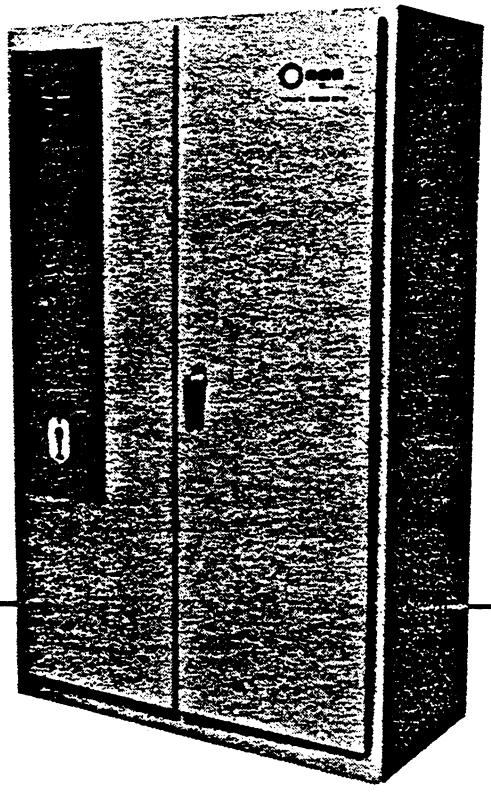
Onan

Operator's Manual

OT

Switch



GenSet-to-GenSet
Automatic Control

962-0105
100-280A Spec C
400-1000A Spec B
7-80
Printed in U.S.A.

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.

TABLE OF CONTENTS

All information, illustrations and specifications contained in this manual are based on the latest product information available at the time of publication. Onan reserves the right to make changes at any time without notice.

GENERAL INFORMATION

INTRODUCTION

Read the OT operator's manual thoroughly before attempting any operation or adjustment procedure. It contains the information necessary for correct operation procedures. You can promote safety largely by learning correct procedures, taking precautions, and by using "common sense." The manual includes adjustments and troubleshooting sections.

TRANSFER SWITCH APPLICATION

This OT series transfer switch enables two generator sets to provide a prime power source system, each running at controlled, alternate times (system often referred to either as a plant-to-plant or prime power system). The OT includes a time switch which is normally set to run one generator set for a week and then run the other generator set for a week, etc. Figure 1 shows designated Generator Set #1 connected to load.

Prime power is used in this manual to mean that the two generator sets provide total power for the installation (no outside power source). These systems are usually used in remote areas where utility power source is either unavailable or it would require a relatively expensive utility connection.

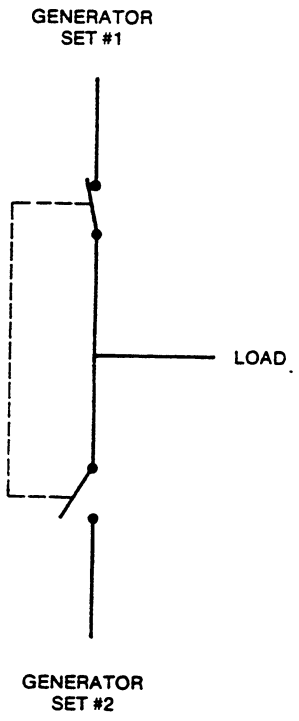


FIGURE 1. SERIES OT TRANSFER SWITCH

INSTALLATION

MOUNTING

Have an experienced electrician install the OT transfer switch according to 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.

Latch and Latch Pin Adjustment
If the control accessory panel will not close after mounting because the latch is above or below the latch pin, perform the following.

1. Open the OT cabinet door.
2. Remove the twist-lock disconnect plug from the receptacle.
3. Completely open the control accessory panel.
4. Loosen the latch pin and move the latch pin up or down in the slot as necessary (Figure 2). Then tighten.
5. Close the control accessory panel. If more adjustment is necessary, repeat procedure.

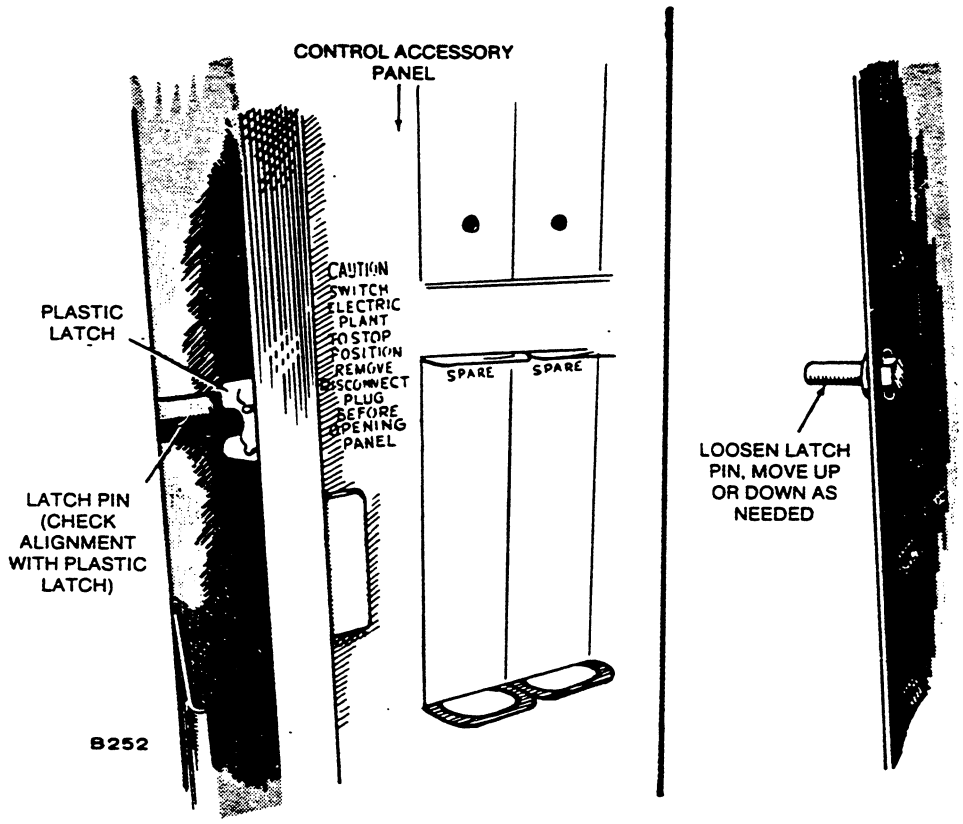


FIGURE 2. ADJUSTMENT OF LATCH PIN

WIRING

Before wiring is started, make sure the generator sets are serviced for operation and test each generator set from its own controls. Then stop and disable the generator sets including removing the starting batteries.

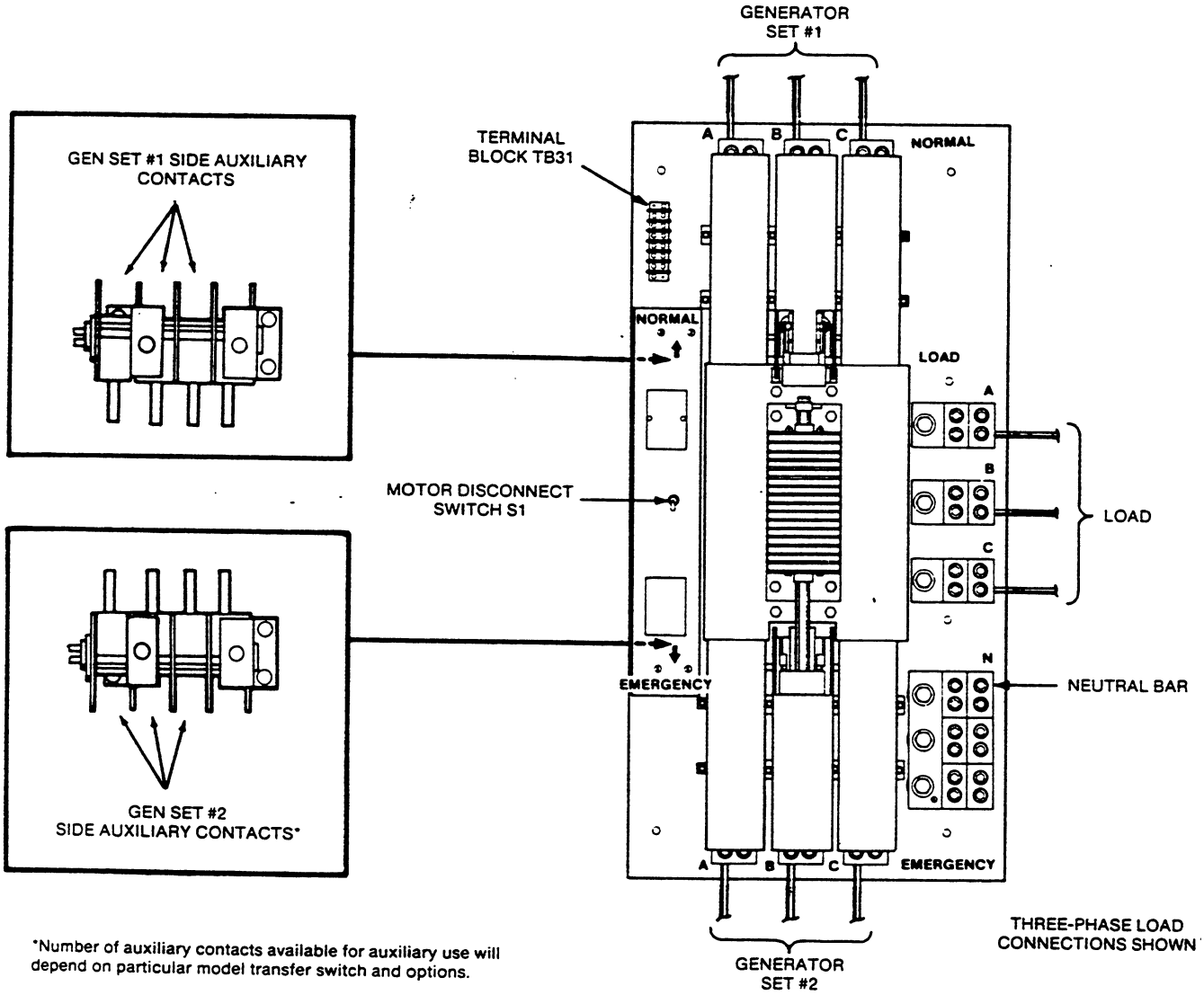
WARNING **Failure to disable the generator sets before wiring procedures are performed could result in a serious shock hazard.**

If using rigid conduit between the generator sets and the OT transfer switch, install at least 2 feet (610 mm) of flexible conduit between the rigid conduit and generator set to absorb vibration. Run control circuit wiring in separate conduit from the AC wiring, otherwise induced currents could cause operational problems within the OT.

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.**

Generator Set and Load Connections

1. Connect wires of sufficient size to carry rated current from the load and generator sets directly to the transfer switch terminals which are marked A and B for single-phase switches, and A, B, and C for three-phase switches. Phases of the generator sets and loads for three-phase systems must match. Figure 3 shows a three-phase transfer switch.



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

FIGURE 3. SINGLE ACTUATOR TRANSFER SWITCH

Generator Set #1 wires connect to the NORMAL designated terminals on top of the transfer switch, and Generator Set #2 wires connect to the EMERGENCY terminals on the lower part of the transfer switch. Table 1 lists transfer switch wire capacities.

On some larger OT transfer switch cabinets, you can remove the bottom panel from the front of the cabinet for easing wire connections.

2. If needed, the neutral bar provides for connection of the neutral wires (Figure 3).

Control Circuit Connections

1. Connect the low voltage DC remote control wires from the generator sets. Two-wire starting for Onan radiator-cooled generator sets use three terminals, B+, GND (ground), and RMT (remote). Three-wire starting for Onan air-cooled generator sets use four terminals, B+, 1, 2, and 3. Use number 16 wire for up to 100 feet or 31 metres with a maximum of 0.5 ohm per line.

2. If a preheat time delay is used for a three-wire start diesel generator set, connect a wire from terminal TB1-H in the OT cabinet to terminal H on the generator set. Use number 16 wire for up to 100 feet or 31 metres with a maximum of 0.5 ohm per line.

Auxiliary Connections

1. Auxiliary contacts are located on the transfer switch for external alarm or circuitry. To gain access to the contacts, remove the cover which houses the transfer switch motor disconnect switch. Figure 3 shows the locations. 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.

2. Another set of auxiliary contacts connect to terminal block TB6-1 and -9 to operate a remote alarm for a generator set failure condition. The alarm would be energized by an engine overcrank condition or certain generator failure conditions. The contacts have ratings of 10 amperes at 28 VDC/120 VAC, 6 amperes at 240 VAC, and 3 amperes at 480 VAC, all 0.8 power factor.

CLEANING OF CABINET

After completing the installation and wiring, clean the cabinet interior. If available, use a vacuum to remove dust, chips, and filings from mounting and wiring.

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.

CHECKOUT PROCEDURES AFTER INSTALLATION

After installing the generator set and OT transfer switch, check the various automatic transfer switch functions. Move the operation selector switches to STOP, on generator sets for two-wire starting or in OT cabinet for three-wire starting. Then check these items in the order presented.

Time Switch
The time switch is factory set to run each generator set for one week periods. If you want other time intervals, change using the instructions from the *ADJUSTMENTS* section. Set the time switch to the correct day and time using the following

1. Turn the *large dial clockwise* only until the correct time aligns with the pointer.
2. Turn the small *spoked wheel counterclockwise* only so that the pins in the wheel are on the bottom and that the correct day aligns with the pointer. The part of the spoked wheel without pins should be on top. (With pins in, Generator Set #1 runs; with pins out, Generator Set #2 runs.)

Check Switch Positions
Check to make sure the operation selector switches are still in the STOP positions, and move the test transfer switch in the OT cabinet to the center position.

Test Overcrank Function

1. *Two-Wire Starting*
   a. Disconnect the positive lead from the starter of one generator set and tape lead so it can not touch metal frame.
   b. Connect the starting batteries for the same generator set.
   c. Move the operation selector switch on the generator set control panel to REMOTE. The GEN FAILURE lamp on the OT should light at the end of the crank period for this generator set (usually factory set for 75± 15 seconds).
   d. Move the operation selector switch back to STOP.
   e. Reconnect the positive lead to the starter.
   f. Push the PUSH TO RESET button on the two-to-three wire converter module for that generator set. The GEN FAILURE lamp should go out.

   See generator set operator's manual for instructions on resetting cranking limiter on engine control (if necessary).

   g. Repeat procedure for other generator set.

2. *Three-Wire Starting*
   a. Disconnect the positive start lead from the start solenoid or starter of one generator set and tape lead so it can not touch metal frame.
   b. Connect the starting batteries for the same generator set.
   c. Move the operation selector switch in the cabinet for the same generator set to NORMAL (switch is on two-to-three wire converter module). The overcrank lamp should light at the end of the crank period for this generator set, usually 75 ± 15 seconds in addition to the 2 to 3 seconds for the time delay on start.
   d. Move the operation selector switch back to STOP.
   e. Reconnect the positive lead to the starter or start solenoid.
   f. Push the PUSH TO RESET button on the two-to-three wire converter module for that generator set. The overcrank lamp should go out.
   g. Repeat procedure for other generator set.

Starting Test

1. *Two-Wire Starting*
   a. Move the operation selector switch on Generator Set #1 to REMOTE. It should start and assume the load. The NO. 1 RUNNING lamp and NO. 1 LOADED lamp should both light.
   b. Move the operation selector switch on Generator Set #2 to RUN. It should start but not take over the load. The NO. 2 RUNNING lamp should light.
   c. Note meters and general operating conditions. If okay, move the operation selector switch on Generator Set #2 to REMOTE (should shut down), and proceed to *Test Transfer With Load.*

2. *Three-Wire Starting*
   a. Move the operation selector switch in the OT cabinet for Generator Set #1 to NORMAL. Generator Set #1 should start and take over the load. The NO. 1 RUNNING lamp and NO. 1 LOADED lamp should both light.
   b. Move the operation selector switch in the OT cabinet for Generator Set #2 to HAND CRANK. Then start Generator Set #2 from its engine control panel. The NO. 2 RUNNING lamp on the OT should light.

c. Note meters and general operating conditions. If okay, move the operation selector switch on Generator Set #2 to NORMAL (should shut down) and proceed to *Test Transfer With Load.*

Test Transfer With Load

1. With Generator Set #1 carrying load, move the test transfer switch on the control accessory panel to the TEST GEN 1 (down) position. Generator Set #2 should start after the time delay on start and take over the load (no time delay on transfer). Note indicator lamps on the OT meter-lamp panel. Generator Set #1 will not shut down.
2. Turn the small spoked wheel on the time switch counterclockwise so that the pins in the wheel are on the top (bottom should not have pins). Generator Set #1 should shut down after the time delay on stop.
3. Move the test transfer switch to the NORMAL (middle) position. Generator Set #2 is now in the operation mode.
4. Move the test transfer switch to the TEST GEN 2 (up) position. Generator Set #1 should start after the time delay on start and take over load after the time delay on retransfer. Generator Set #2 will not shut down.
5. Turn the small spoked wheel on the time switch counterclociwise so that the pins are on the bottom and correct day aligns with pointer. Generator Set #2 should shut down after the time delay on stop.
6. Move the test transfer switch to NORMAL (center).
7. Generator Set #1 and the OT are now in the normal operating mode. Generator Set #1 will run until the time switch changes over to the other generator set. You can leave them in this sequence or change them as outlined in the *OPERATION* section.

DESCRIPTION

CABINET

The cabinet that contains a Series OT transfer switch depends upon the environment or service conditions of the application. Onan offers several cabinet constructions. The most common are a NEMA #1 enclosure and an open construction, with other constructions possible.

A NEMA #1 cabinet is an enclosure that is used for indoor environments in which no hazardous service conditions exists. This cabinet provides protection against accidental contact with the enclosed equipment. The current capacity of the transfer switch determines the cabinet size.

Open construction is the Series OT transfer switch without a cabinet. Provisions for mounting the transfer switch components allow placement in a location or cabinet of the customer's choice. Open construction may be used whenever an enclosure is not required or an enclosure is needed that meets special requirements.

TRANSFER SWITCH

The transfer switch does the work of opening and closing the contacts that transfer the load between Generator Set #1 and Generator Set #2. The transfer switch is a pair of multipole, single throw, electromechanical switches, that are mechanically interlocked to prevent simultaneous closing to both power sources. Onan Series OT transfer switches are available with current ratings of 100, 150, 225, 280, 400, 600, 800 and 1000 amperes at rated voltage. The principal parts of the transfer switch are the contact assemblies and the linear actuator.

The contact assemblies actually make and break the current flow. When closed to either Generator Set #1 or Generator Set #2 power source, these contacts are mechanically held. A mechanical interlock prevents the contact assemblies from closing to both power sources at the same time.

The linear actuator moves the contact assemblies from the Generator Set #1 power source to the Generator Set #2 power source and back again as required. The linear actuator is a linear induction motor that acts upon an actuator rod, which moves the contact assemblies. Operation of the linear actuator is electrical and is initiated automatically with automatic transfer switches. Manual operation of the transfer switch is possible by applying direct manpower to the transfer switch handles. Refer to manual operation in the *OPERATION* chapter.

Motor Disconnect Switch:
The motor disconnect switch opens and closes the power lead to the linear actuator. The switch has two positions; UP for automatic operation and DOWN for manual operation. The motor disconnect switch is located on the auxiliary contact cover as in Figure 3.

Switching Poles
Series OT transfer switches are multipole switches. A multipole switch is one that opens and closes more than one current path, or pole, with a common switching means. Series OT transfer switches are available with the following switching pole combinations:

1. 2 pole, with a neutral block.
2. 3 pole, with a neutral block.

Programmed Transition
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 Generator Set #1 power source nor to the Generator Set #2 power source. This feature allows residual voltages in a motor load to decay to an acceptable level before transition is completed. The length of time that the transfer switch is in the midposition can be adjusted from 0.5 to 5 seconds. The proper adjustment is a function of the motor and its connected load. See the *ADJUSTMENTS* section.

Auxiliary Contacts
Auxiliary contacts are provided on both the Generator Set #1 and Generator Set #2 side of the transfer switch. They are located as in Figures 3 and 4, and are actuated by the operation of the transfer switch during transfer and retransfer. The auxiliary contact current ratings are: 25 amps at 125, 250, or 480 VAC; 1 horsepower at 125 VAC; 2 horsepower at 250 or 480 VAC; and a pilot duty rating of 750 VA at 277 VAC maximum.

METER-LAMP PANEL

Located on the left side of the transfer switch, the meter-lamp panel supports indicating lamps that can be read without opening the cabinet door(s). Figure 4 illustrates a meter-lamp panel.

One set of lamps, NO. 1 RUNNING and NO. 2 RUNNING, indicate if the generator sets are running.

Another set of lamps, No. 1 LOADED and NO. 2 LOADED, light to show which generator set is connected to the load. If a generator set overcrank or failure condition occurs, the respective GEN FAILURE lamp lights to indicate that engine cranking has discontinued operation.

CONTROL ACCESSORY PANEL

The control accessory panel in Series OT automatic transfer switches executes the supervisory functions of sensing, timing, logic, and others. The majority of these functions are executed by solid-state, plug-in modules on the control accessory panel which is located directly behind the cabinet locking door (Figure 4). The remaining supervisory functions are provided by control switches and a timer switch. The solid-state modules may include voltage sensing modules, timing modules, and a control voltage module.

The control accessory panel can be swung open to allow access to the transfer switch. Before opening the control accessory panel: 1) Move the operation selector switches to STOP, located on the control panel for three-wire starting or on engine controls for two-wire starting; and 2) Remove the starting battery ground cables.

WARNING **You can use the control panel disconnect plug to remove Generator Set #1 power from the control accessory panel. However, it will not disconnect Generator Set #2 power from the control panel. For these reasons, to de-energize the control accessory panel with one generator set operating, you must: 1) Have Generator Set #1 connected to the load, 2) Disable Generator Set #2 by moving its operation selector switch to STOP and disconnecting its starting batteries, and 3) Remove the control disconnect plug from the receptacle. Note that the rest of the automatic transfer switch still has components with high voltages.**

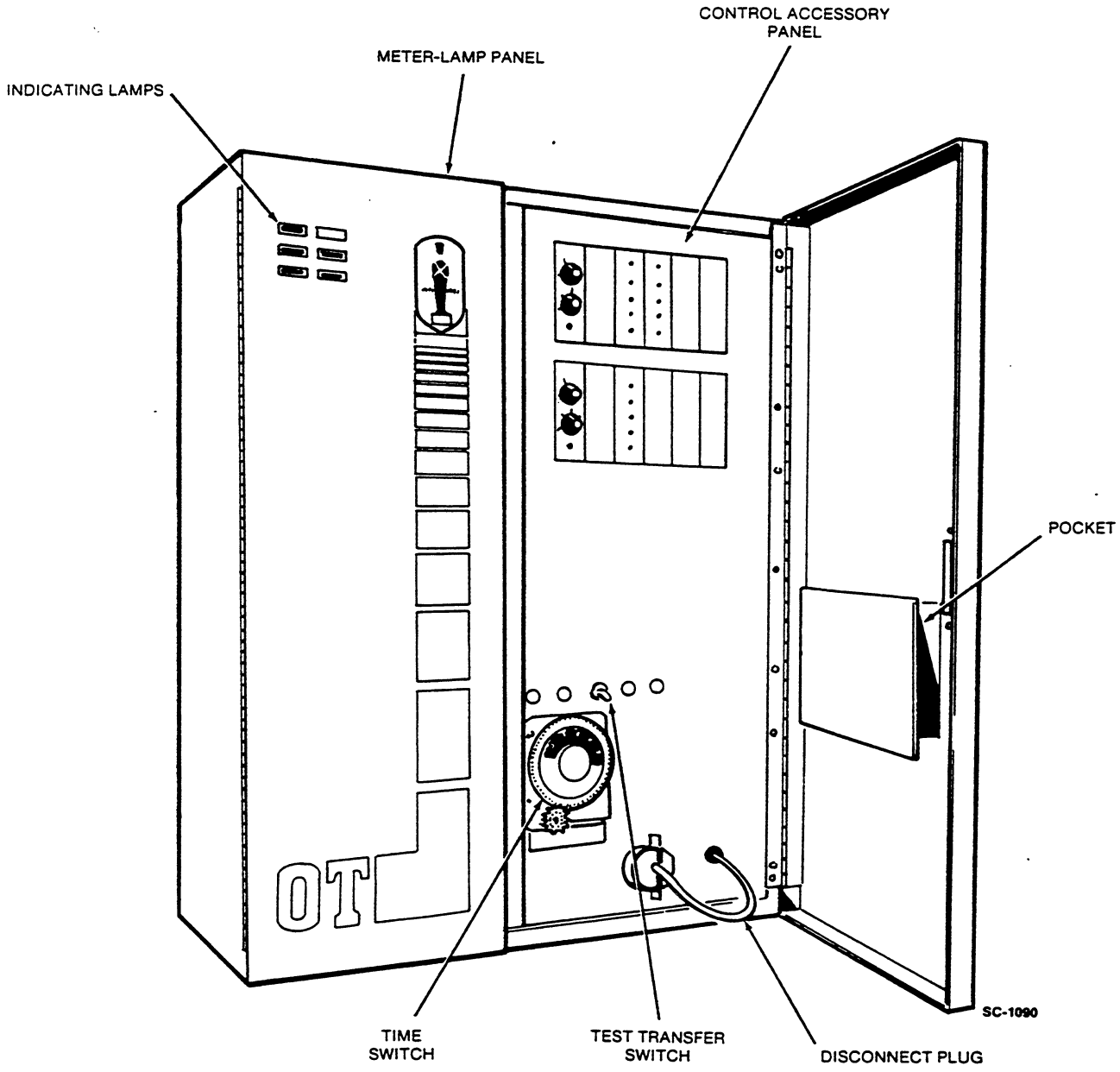


FIGURE 4. OT AUTOMATIC TRANSFER SWITCH

All the following modules used in automatic transfer switches are listed after the number position they occupy in the control accessory panel. Note that some positions list more than one module. If the automatic transfer switch has a frequency sensor for the generator sets, one sensor module will occupy module position 2 and one will occupy module position 8. If the OT does not use these modules, positions 2 and 8 will be filled with blank modules.

Position	Module
1	Undervoltage Sensor - Generator Set #1
2	Blank or Frequency Sensor - Generator Set #1
3	Start-Stop Time Delay - Generator Set #1
4	Transfer-Retransfer Time Delay
5	2 to 3 Wire Converter - Generator Set #1
6	Blank - Generator Set #1
7	Undervoltage Sensor - Generator Set #2
8	Blank or Frequency Sensor - Generator Set #2
9	Start-Stop Time Delay - Generator Set #2
10	12V Voltage Module - 12V start control, or 24 to 12 V voltage module for 24V start control
11	2 to 3 Wire Converter - Generator Set #2
12	Blank - Generator Set #2

AC Voltage Sensors

Two solid-state voltage sensor modules, illustrated in Figure 5, monitor the voltage of both generator set outputs. Generator set power supplies may be monitored for both undervoltage and overvoltage conditions, requiring four voltage sensors.

Voltage sensor modules have two adjustments. One adjustment sets the pickup voltage. The pickup voltage scale is graduated from 90 to 140 volts, based on a nominal 120 volt system. For other voltage systems, the scale must be corrected using the multiplying factor given in Table 2.

TABLE 2. VOLTAGE MULTIPLYING FACTORS

VOLTAGE	MULTIPLYING FACTOR
120	1.0
208	1.73
240	2.0
480	4.0
600	5.0

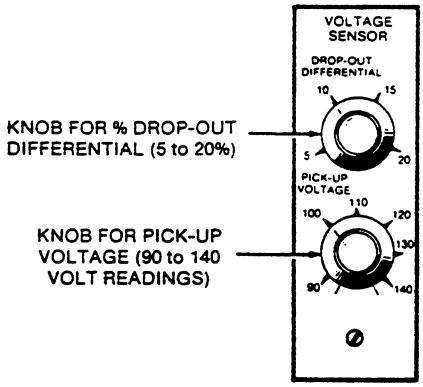


FIGURE 5. VOLTAGE SENSOR

The second adjustment is the dropout differential. The dropout differential is a percentage, adjustable from 5 to 20%, of the pickup voltage. The dropout differential is subtracted from the pickup voltage to arrive at the dropout voltage. The dropout voltage is always lower than the pickup voltage by the dropout differential.

Voltage Sensors. Generator set output can be sensed for undervoltage and overvoltage using voltage sensor modules. When an undervoltage or overvoltage condition exists, as defined by the pickup voltage setting and dropout differential, the voltage sensor module initiates the start signal sequence for the idle generator set. When the original source voltage returns to normal, the voltage sensor modules initiate load transfer back to the original generator set and initiate the stop signal sequence for the other generator set. Table 3 gives the range of adjustment and function of voltage sensors in both undervoltage and overvoltage applications.

TABLE 3. VOLTAGE SENSING

UNDERVOLTAGE SENSING	
Secondary Generator Set Starts* (drop-out voltage)	**Secondary Generator Set Stops* (pick-up voltage)**
5 to 20% below pick-up voltage setting	75 to 100% of normal voltage
OVERVOLTAGE SENSING	
Secondary Generator Set Starts* (pick-up voltage)	**Secondary Generator Set Stops* (drop-out voltage)**
101 to 116% of normal voltage	5 to 20% below pick-up voltage

*Secondary generator set means the idle generator set in contrast to the primary generator set that normally would be scheduled to carry load.

Timing Modules
The supervisory functions of the control accessory panel may include several adjustable time delays before or after an event. The solid-state modules that provide timing functions may include: the Transfer-Retransfer module, the Start-Stop module, and Preheat module. Table 4 gives the duration of the time delays and the factory settings.

Start-Stop Module. The solid-state start-stop module provides adjustable time delays before the electric generating set is allowed to start or stop. The start time delay begins upon interruption of the other power source or upon signal of the time switch. If the duration of the power interruption exceeds the start time delay (Table 4), the start signal is sent to the electric generating set. The purpose of the start time delay is to prevent the generator set from starting when power interruptions of very short duration occur. The stop time delay begins timing when the load is retransferred to the other power source. At the end of the stop time delay, the stop signal is sent to the generator set. The purpose of this time delay is to allow the generator set to cool down while running at no load.

Transfer-Retransfer Module. The solid-state transfer-retransfer module provides adjustable time delays before the events of transfer and retransfer are allowed to occur (Table 4). The transfer time delay begins at the moment that the Generator Set #2 output voltage reaches the pickup voltage setting of the generator voltage sensor. At the end of the transfer delay, the transfer switch is allowed to operate, transferring the load to the Generator Set #2 power source. The purpose of the very brief transfer delay is to allow the electric generating set to stabilize before the load is applied.

The retransfer time delay operation is very similar to the transfer time delay operation. However, it delays transfer of the load from Generator Set #2 to the Generator Set #1 power source.

Preheat Module. The solid-state preheat time delay module may be used with three-wire starting diesel engines to provide a preheat function. The preheat module prevents the engine starter motor from engaging until the adjustable preheat time delay is complete.

Starting Circuits
One of the basic supervisory functions of an automatic transfer switch is to send start and stop signals to the electric generating set. The starting circuit function requires the automatic transfer switch to be compatible with the starting circuit of the electric generating set. The starting circuits available in Series OT automatic transfer switches are: two-wire, twelve volts; two-wire, twenty-four volts; and three-wire, twelve volts.

Two-Wire Starting Circuits. Although the logic is much more involved, the operation of a two-wire starting circuit can be thought of as a simple single pole, single throw switch. A closed switch signals the electric generating set to start and run. An open switch signals the electric generating set to stop. The starting battery of the electric generating set provides the operating voltage. Accordingly, the OT Series of automatic transfer switches includes twelve and twenty-four volt models with two-wire starting circuits.

Three-Wire Starting Circuits. The end result of the three-wire starting circuit logic is similiar to a single-pole double throw switch. A common is closed to one side to send a start signal. The common is closed to the opposite side to send a stop signal. See *Two to Three-Wire Converter Module.*

TABLE 4. ADJUSTABLE TIME DELAYS

TIME DELAY	TIME RANGE	FACTORY SETTING (if any)
Starting	0.1 to 15 sec. 0.5 to 615 sec.*	2.5 sec. —
Transfer, Retransfer	0.1 to 10 min. 0.5 to 30 min.	5 min. 5 min.
Stopping	0.1 to 10 min.	5.0 min.
Preheat	5 to 90 sec.	60 sec.

*Programmable start-stop timer.

Control Voltage Module
A solid-state control voltage module supplies components of the control accessory group with their voltage requirements. There are two possible control voltage modules. Both use the engine starting battery as a source. If the battery is twelve volts, the module will be twelve volts. If the starting battery is twenty-four volts, the module will convert twenty-four to twelve volts.

Two To Three-Wire Converter Module
This solid-state module is used to convert a two-wire starting control accessory group into a three-wire starting control accessory group. The major features of the two to three-wire converter are: an operation selector switch, the cranking limiter, and the reset button. See Figure 6. It is also in the control accessory panel for two-wire start generator sets, but the operation selector switch on the module has no function for these models.

Operation Selector Switch. The operation selector switch controls the operation of the three-wire starting electric generating set only. The operation selector switch has three positions: STOP, HAND CRANK, and NORMAL.

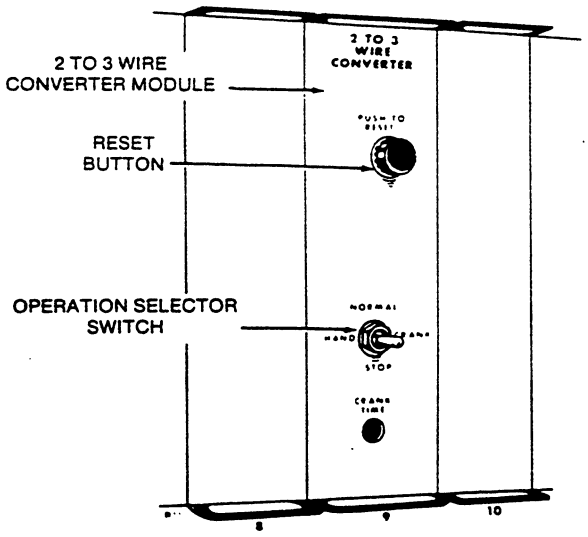


FIGURE 6. 2 TO 3 WIRE CONVERTER MODULE

WARNING **The operation selector switch on the two to three wire converter has no function for two-wire start generator sets. For this reason, always use the operation selector switch on the engine control to disable these generator sets for servicing (always disconnect starting batteries too). Otherwise, accidental generator set starting presents a hazard of serious personal injury.**

STOP: Shuts down the generator set and prevents it from starting. Use this position when servicing the generator set.

HAND CRANK: Prevents the automatic transfer switch from starting the generator set but allows starting and stopping at the generator set. Use this position for generator set maintenance.

NORMAL: Allows the generator set to start and assume the load upon a signal from the automatic transfer switch. This is the normal operating position.

Cranking Limiter. The cranking limiter is a protective circuit that limits the time the engine starter motor is engaged. If the electric generating set doesn't start within the adjustable time limit, the cranking limiter opens the starting circuit disengaging the engine starter motor. The GEN FAILURE indicating lamp will light and a set of alarm contacts for remote alarm or signal will close.

In addition, certain generator set functions of two-wire start generator sets will also cause the protective circuit to open and stop engine cranking.

Reset Button. When the cranking limiter opens the starting circuit or an alarm condition shuts down the generator set within an adjustable time limit, you can reset the module by pressing the reset button after correcting the problem.

Time Switch
The time switch initiates the starting of generator sets for the preset times. It is a clock-controlled, single-pole, double-throw switch that switches at intervals of 168 hours as normally ordered from the factory. The time switch initiates change of the generator sets at about 12:30 a.m. See the *ADJUSTMENTS* section for settings.

Test Switch
The test switch on the control accessory panel is a three-position, double-pole, double-throw switch. It can be positioned to simulate a power interruption of the operating generator set and initiate starting of the idle generator set. The second generator set after reaching rated speed and voltage assumes the load. The switch has a center position for normal operation and two test positions, one for each generator set.

OPERATION

This section has two main divisions, one for automatic transfer switch operation and one for manual transfer switch operation. The automatic transfer switch part includes the normal OT operating mode (automatic generator set starting, load transfer, etc.) and procedures that can be performed in this mode. Manual transfer switch operation means manual operation of the transfer switch itself by some qualified personnel.

AUTOMATIC TRANSFER SWITCH OPERATION

The OT series automatic transfer switch is set for automatic operation by setting the switches on the control accessory panel to the described positions. It is assumed the time switch already was set after installation was completed. If it does require settings, see the *ADJUSTMENTS* section. You can change operation from one generator set to the other before the time switch has completed its operation interval as noted. Procedures to test operations are also given under automatic transfer switch operation.

Switch Positions for Two-Wire Control

Test Transfer Switch — NORMAL (center postion)
Motor Disconnect Switch — UP

Switch Positions for Three-Wire Control

Test Transfer Switch — NORMAL (center position)
Operation Selector Switch — NORMAL
Motor Disconnect Switch — UP

Manually Initiating Change of Generator Sets
To transfer the load to the other generator set before the operation interval is over, open the cabinet door. Then turn the small spoked wheel COUNTER-CLOCKWISE to the opposite generator set. After the start and transfer time delays complete, the load should transfer to the generator set just started. The generator set now without load will shut down after the stop time delay.

Test Operation
If Generator Set #1 is carrying load and you want to test Generator Set #2, move the test transfer switch to TEST GEN 1. Generator Set #2 should start and assume load from the other generator set without a transfer time delay. Generator Set #1 will not shut down unless you do with the operator selector switch.

If Generator Set #2 is carrying load and you want to test Generator Set #1, move the test transfer switch to TEST GEN 2. Generator Set #1 should start and assume load after the retransfer time delay. Generator Set #2 will not shut down unless you do so with the operation selector switch.

To return operation to the original generator set, move the test transfer switch to the NORMAL (center) position.

MANUAL TRANSFER SWITCH 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.**

When the motor disconnect switch is moved from manual to automatic operation, the automatic transfer switch will return to the active power source on operation cycle by the timer switch. The operator must put the transfer switch in its preferred position, manually, before moving the motor disconnect switch to automatic operation position.

WARNING **The rapid movement of the manual operator handles may cause personal injury. An automatic transfer switch must be placed in its preferred position, manually, before moving the motor disconnect switch to automatic operation.**

225-280 Ampere Transfer Switches

1. Move the motor disconnect switch to the DOWN, manual operation position.
2. Pull either manual operator handle in the desired direction; down for Generator Set #2, up for Generator Set #1.
3. Return the transfer switch to its preferred position.
4. Return the motor disconnect switch to the UP, automatic operation position.

100-150, 400-1000, and Programmed Transition 225-280 Ampere Transfer Switches

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

   Retransfer, from Generator Set #2 power to the Generator Set #1 power source:
   c. Pull the lower manual operator handle up.
   d. Push the upper manual operator handle up.
3. Return the transfer switch to its preferred position.
4. Return the motor disconnect switch to the UP, automatic operation position.

ADJUSTMENTS

TIME DELAYS

Start-Stop Time Delay
The factory has adjusted the start-stop time delay for a delay on starting of 2 to 3 seconds and a delay on stopping of 4.5 to 5 minutes. Use the following procedure to change the delay times. If you do not want to interrupt the load during this procedure, adjust the start-stop time delay for the idle generator set only.

1. Open the OT cabinet door.
2. If you do not want load transfer during this procedure, perform the following:
   a. Move the operation selector switch for the idle generator set to STOP.
   b. Move the transfer switch motor disconnect switch down. If this requires opening the control accessory panel, first remove the twist-lock disconnect plug. Then reclose the control panel and reconnect the plug.

WARNING **Use great care if opening control accessory panel since some components on rear of panel might be energized and present a serious shock hazard. Note other components of OT are still energized.**

3. Move the operation selector switch for the idle generator set back to NORMAL for three-wire starting or REMOTE for two-wire starting, whichever applies.
4. Move the test transfer switch to the down or up position, whichever position will start the idle generator set.
5. With a watch with a second hand, measure the time until the generator set starts cranking.
6. Insert a small screwdriver through "START" hole in front panel of start-stop time delay module. Turn potentiometer clockwise to increase start time delay or counterclockwise to decrease start time delay. Make adjustments in small increments.
7. Move the test switch back to the center position.
8. Measure the time until the generator set shuts down.
9. Turn the "STOP" potentiometer with the small screwdriver clockwise to increase the stop time delay or counterclockwise to decrease the stop time delay.
10. Repeat procedure until you obtain desired time delays.
11. If load was transferred for procedure, proceed directly to Step 12. Otherwise, perform the following:
    a. Move the operation selector switch for idle generator set to STOP.
    b. Move the transfer switch motor disconnect switch to up position.
    c. Move the operation selector switch for the idle generator set to NORMAL for three-wire starting or REMOTE for two-wire starting, whichever applies.
12. Close the cabinet door.

Optional Start-Stop Time Delay
For a time delay change of the programmable timer, pull out the time delay module from the control panel and change the switch settings on the side of the printed circuit board for the desired times. Table 5 lists the switch positions for the available time delays. Figure 7 shows the module as viewed from the switch (right) side.

Example: For a start time delay of 2.4 seconds, close switches 1,2, and 3, and open switch 4. For a 345-second time delay on stopping, close switches 5, 7, and 8, and open switch 6.

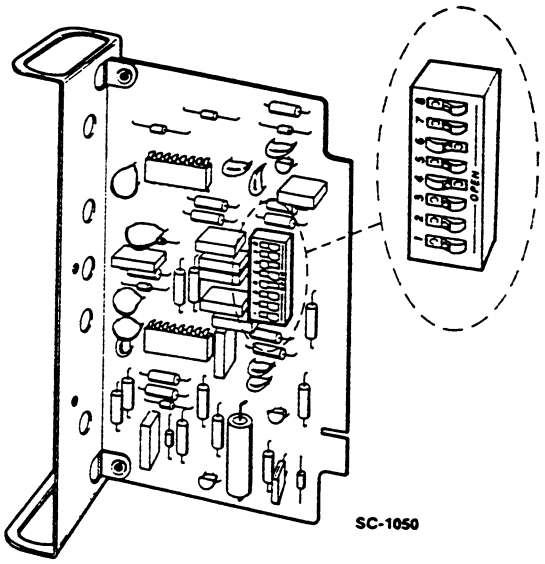


FIGURE 7. OPTIONAL, PROGRAMMABLE START-STOP MODULE

Transfer-Retransfer Time Delay
To change the delay time of the transfer-retransfer time delay, perform the following and refer to Figure 8. Note there will be a load transfer with this procedure.

1. Open the OT cabinet.
2. Move the test transfer switch up or down, whichever position will start the idle generator set.

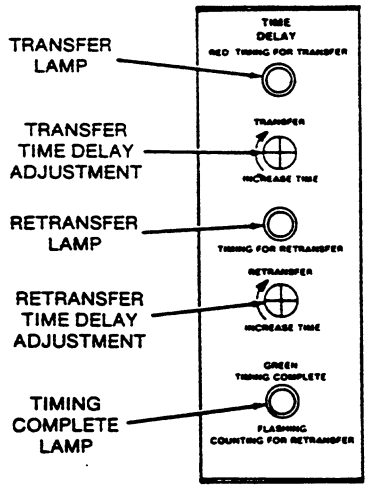


FIGURE 8. TRANSFER-RETRANSFER TIME DELAY

3. With a watch with a second hand, measure the time the red transfer LED on the time delay module remains lit. The red LED will turn off after the time delay is complete. If the time delay is correct or time you desire, proceed to Step 5. Otherwise, proceed to Step 4.
4. Insert a small screwdriver through the "TRANSFER" opening in the front panel of the transfer-retransfer time delay module. Turn clockwise in small increments to increase the time delay, counterclockwise to decrease the time delay.
5. Move the test transfer switch to the center position.
6. With a stopwatch or watch with a second hand, count the number of flashes the bottom green LED makes in 60 seconds (Onan suggests counting for 60 seconds—shorter intervals would give less accuracy for determining time delays). Once retransfer timing is complete, the retransfer LED will turn off and green LED will remain on for the duration of the generator set stop delay. The following list gives the correlation of pulses to time delays.

Pulses/60 sec	Time Delay (min)
50	5
25	10
17	15
13	20
10	25
8	30

If time delay is correct or time you want, proceed to Step 9. Otherwise, proceed to Step 7.

7. Insert a small screwdriver through the "RETRANSFER" opening in the front panel of the transfer-retransfer time delay module. Turn clockwise in small increments to increase the time delay, counterclockwise to decrease the time delay.
8. Repeat procedure until you obtain desired time delays.
9. Close the cabinet.

TABLE 5. PROGRAMMABLE TIME DELAY

PROGRAMMABLE START — STOP TIMER

c = SWITCH CLOSED
o = SWITCH OPEN

SWITCH POSITIONS				
1	2	3	4	TO START
5	6	7	8	TO STOP
				TIME
o	o	c	o	0.5 sec
o	o	o	c	1.0 sec
c	o	c	o	1.4 sec
c	c	c	o	2.4 sec
c	o	o	c	5.5 sec
o	o	o	o	7.9 sec
c	c	o	c	9.6 sec
c	o	o	o	43 sec
o	o	c	c	62 sec
c	c	o	o	76 sec
c	o	c	c	345 sec
c	c	c	c	615 sec

TIME TOL ± 20%

Preheat Time Delay

The preheat time delay for diesel generator sets with three-wire starting is adjustable from 5 to 60 seconds. To change the delay time, follow these instructions.

1. Open the OT cabinet.
2. If you do not want load transfer for this adjustment, perform the following.
   a. Move the operation selector switch for the idle generator set to STOP.
   b. Move the transfer switch motor disconnect switch down. If this requires opening the control accessory panel, first remove the twist-lock disconnect plug. Close the panel and reconnect the plug afterwards.

WARNING **Use great care if opening control accessory panel since some components on rear of panel might be energized and present a serious shock hazard. Note other components of OT are still energized.**

c. Move the operation selector switch for the idle generator set back to NORMAL for three-wire starting or to REMOTE for two-wire starting, whichever applies.

3. Move the test transfer switch down or up, whichever position will start the idle generator set.
4. With a watch with a second hand, measure the time the small lamp on the preheat time delay module lights before engine cranking.
5. Move the test transfer switch back to the center position.
6. If time delay for preheat is set as desired, proceed to Step 9. Otherwise, proceed to Step 7.
7. Insert a small screwdriver through the "PREHEAT" opening in the front panel of the preheat time delay module. Turn potentiometer clockwise to increase the delay time, counterclockwise to decrease delay. Make adjustments in small increments.
8. Repeat procedure until you have desired preheat time.
9. If load was transferred for procedure, proceed to Step 10. Otherwise, follow these steps.

   a. Move the operation selector switch for the idle generator set to STOP.
   b. Move the transfer switch motor disconnect switch to the up position.
   c. Move the operation selector switch to NORMAL for three-wire starting or to REMOTE for two-wire starting.

10. Close the cabinet.

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 operation selector switches to STOP (on control accessory panel in cabinet for three-wire starting, on engine control panels for two-wire starting) and disconnect both generator set starting batteries.

WARNING **Be sure to move the operation selector switches to STOP and disconnect starting batteries before attempting adjustments. Otherwise, the automatic transfer switch presents a serious shock hazard.**

3. With automatic transfer switches, remove the twist-lock disconnect plug and open the control accessory panel.
4. Locate the time delay relay (shown in Figure 9) 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. With automatic transfer switches, close the control accessory panel and reconnect the twist-lock disconnect plug.
7. Reconnect the generator set starting batteries.

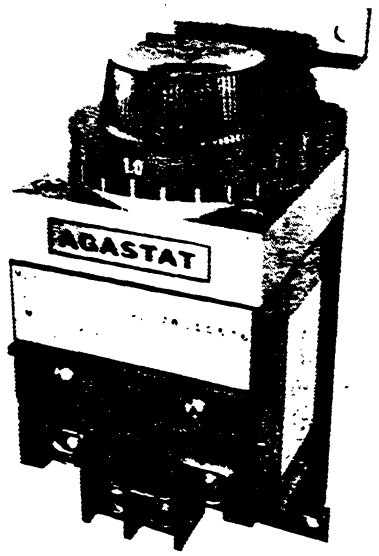


FIGURE 9. PROGRAMMED TRANSITION TIME DELAY RELAY

8. Move the operation selector switches to NORMAL (in cabinet for three-wire starting) or REMOTE (on engine control panels for two-wire starting), whichever applies.
9. Close the OT transfer switch cabinet door.

OVERCRANK TIME ADJUSTMENT

Overcrank settings are made at the factory for approximately 75 ± 10 seconds cranking. To adjust perform the following.

1. Remove the positive lead from the idle generator set's start solenoid or starter.
2. Open cabinet door of automatic transfer switch.
3. Move test transfer switch to down or up position, whichever starts idle generator set. Overcrank lamp on automatic transfer switch should light at end of crank period. Measure the crank time with a stop watch or watch with a second hand.
4. To change the time, insert a small screwdriver through the "CRANK TIME" hole in the front of the 2 to 3 wire converter module. Turn clockwise to increase the cranking time or counterclockwise to decrease the cranking time. Make adjustments in small increments.
5. Move test transfer switch to center position.
6. Push the PUSH TO RESET button on the 2 to 3 wire converter module.
7. Repeat procedure until you obtain the desired cranking time.
8. Close and lock cabinet door.
9. Reconnect positive lead to generator set's starter or start solenoid.

TIME SWITCH ADJUSTMENT

If you want to change the change-over interval durations for the generator sets, use the following steps. Onan recommends shutting down both generator sets during the procedure.

1. Open the OT cabinet.
2. Move the operation selector switches to STOP, located in OT cabinet for three-wire starting or on generator set control panels for two-wire starting, and disconnect starting batteries.
3. Install a trip pin *(left-hand thread)* in the small spoked wheel for the days you want Generator Set #1 to operate (pins out, Generator Set #2 will operate).

   a. For 168-hour (7-day) operation of one generator set and then 168-hour operation of the other generator set, install 7 trip pins in consecutive positions in the small spoked wheel. See Figure 10.

   b. For 24-hour (1-day) operation of one generator set and then 24-hour operation of the other generator set, install a trip pin in every alternate day in the small spoked wheel.

   Store unused pins in the time pointer bracket.

4. Rotate the large dial *clockwise* until the correct time is aligned with the time pointer.

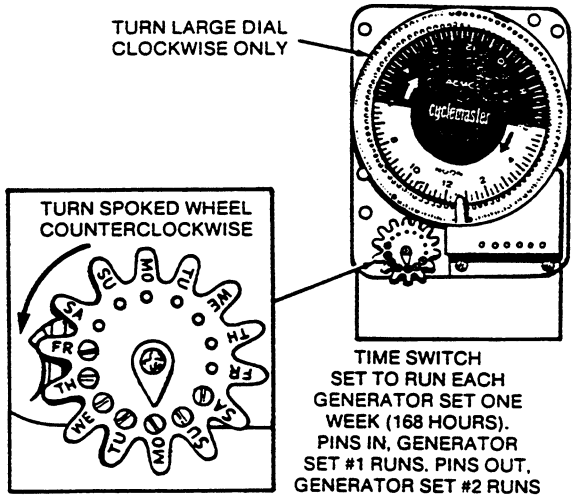


FIGURE 10. TIME SWITCH SETTINGS

5. Turn the small spoked wheel *counterclockwise* until the correct day aligns with the pointer.
6. Connect the starting batteries, and move the operation selector switches to REMOTE for two-wire starting or to NORMAL for three-wire starting (one generator set should start and assume load).
7. Close cabinet.

AC VOLTAGE SENSORS

Voltage sensors can be used for either undervoltage or overvoltage sensing of either generator power supplies. Range of the settings for both types of solid state sensors is for a nominal 120-volt system. For higher voltage systems, the "PICK-UP VOLTAGE" knob readings are multiplied by the following multiplying factor.

VOLTAGE	MULTIPLYING FACTOR
120	1.0
208	1.73
240	2.0
480	4.0
600	5.0

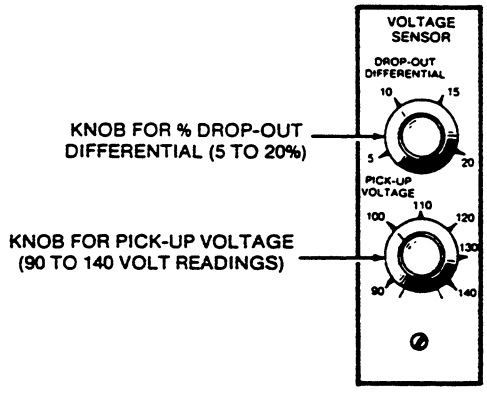


FIGURE 11. VOLTAGE SENSOR

Undervoltage Sensor Settings

Use the following steps for setting undervoltage sensors. Your settings, however, might vary considerably from the example shown due to your particular application requirements. Use settings which give load protection and yet will avoid "nuisance" load transfers.

1. Open the cabinet door.
2. Move the operation selector switches to STOP, on engine controls for two-wire starting, or in cabinet for three-wire starting.
3. Turn the "PICK-UP VOLTAGE" knob to the desired pick-up voltage (voltage at which load is transferred from generator set on rest cycle to generator set on duty cycle). Unless you have special equipment which can be damaged by slight voltage changes, a setting which gives pickup at 90 percent of the nominal voltage is usually satisfactory. For example, 90 percent of 120 volts (for a 120-volt system) gives 108 volts for the knob setting.
4. Turn the "% DROP-OUT DIFFERENTIAL" knob to the desired percent deviation below the pick-up voltage. This setting is the voltage at which the load is transferred from generator set on duty cycle to the generator set on rest cycle. A setting of 15 percent is often satisfactory. For example, 15 percent of 108 volts (pick-up voltage from Step 1) is 16 volts. The drop-out voltage is then pick-up voltage minus the differential voltage, 108 - 16 = 92 volts.
5. Move the operation selector switches to REMOTE for two-wire starting (on engine controls) or to NORMAL for three-wire starting (in OT cabinet), whichever applies.

Overvoltage Sensor Settings

Use the following steps for setting overvoltage sensors. Your settings, however, might vary considerably from the example shown due to your particular application requirements. Use settings which give load protection and yet will avoid "nuisance" load transfers.

1. Open the cabinet door.
2. Move the operation selector switches to STOP, on engine controls for two-wire starting, or in cabinet for three-wire starting.
3. Turn the "PICK-UP VOLTAGE" knob to the desired pick-up voltage (voltage at which load is transferred from generator set on duty cycle to the generator set on rest cycle). Unless you have special equipment which can be damaged by slight voltage changes, a setting which gives 113 percent of the nominal voltage is usually satisfactory. For example, 113 percent of 120 volts (for a 120-volt system) gives 135 volts for the knob setting.
4. Turn the "% DROP-OUT DIFFERENTIAL" knob to the desired deviation below the pick-up voltage. This setting is the voltage at which the load is transferred from the generator set on rest cycle to generator set on duty cycle. A setting of 5 percent is often satisfactory. For example, 5 percent of 135 volts (pick-up voltage from Step 1) is approximately 7 volts. The drop-out voltage is then pick-up voltage minus the differential voltage, 135 - 7 = 128 volts.
5. Move the operation selector switches to REMOTE for two-wire starting (on engine controls) or to NORMAL for three-wire starting (in OT cabinet), whichever applies.
6. Close the cabinet door.

TROUBLESHOOTING

GENERATOR SET SCHEDULED FOR DUTY CYCLE DOES NOT START

1. Check settings on time switch in OT cabinet.
2. Check for a generator set overcrank condition.
3. Check positon of operation selector switch. It should be set at REMOTE for two-wire starting (on engine control) or at NORMAL for three-wire starting (in OT cabinet).
4. Check generator set. Start with start-stop switch on generator set. If it does not crank, check starting batteries. If it cranks but does not start, check fuel supply. Refer to generator set manual.

GENERATOR SET SCHEDULED FOR DUTY CYCLE STARTS BUT DOES NOT ASSUME LOAD

1. Check to make sure the transfer-retransfer time delay has completed.
2. Check generator output voltage to make sure it is above the voltage setting.
3. Check to make sure the control panel disconnect plug is inserted completely into the receptacle.
4. Check undervoltage sensor pickup voltage setting. It should have a setting in most cases of 100 volts (200 for 240-volt system).
5. Check position of transfer switch motor disconnect switch (should be up).

GENERATOR SET STARTS WHEN NOT SCHEDULED

1. Check positions of operation selector switches. They should be at REMOTE for two-wire starting (on generator sets) or at NORMAL for three-wire starting (in OT cabinet).
2. Check test switch position on control accessory panel. It should be in center position.
3. Check to make sure the control panel disconnect plug is inserted completely into receptacle.
4. Check voltage sensor settings. If settings are okay, starting may be due to momentary voltage dips of the other generator set. You may have to reduce the pickup voltage setting slightly.

GENERATOR SET CONTINUES TO RUN AFTER COMPLETING DUTY CYCLE

1. Check position of operation selector switch. It should be at REMOTE for two-wire starting (on engine control) or at NORMAL for three-wire starting (in OT cabinet).
2. Check to make sure the stop time delay has completed. The start-stop time delay may be defective. Stop generator set with the start-stop switch.

PARTS AND SERVICE INFORMATION

This Series OT transfer switch is custom engineered and specially constructed. Because of the individuality of each automatic 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 should be kept with your instruction manual in the "pocket" inside the cabinet.

Any shipments made are complete unless the packing list indicates items are backordered. 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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