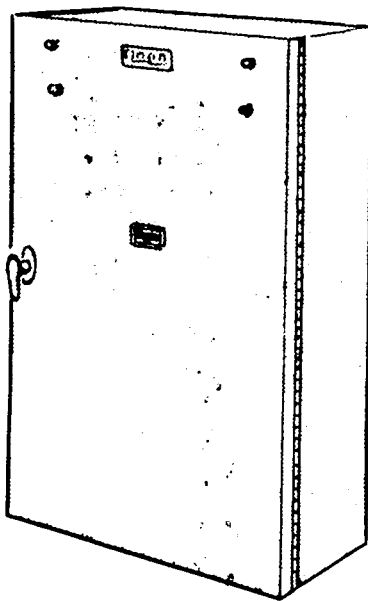


OPERATOR'S MANUAL

FOR
SERIES

LTF - LTG **AUTOMATIC TRANSFER SWITCHES**



FORM NUMBER
913-0032

ISSUE DATE
4-78
Spec 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 Onan uses this symbol throughout this manual to warn of possible serious personal injury.

CAUTION This symbol refers to possible equipment damage.

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

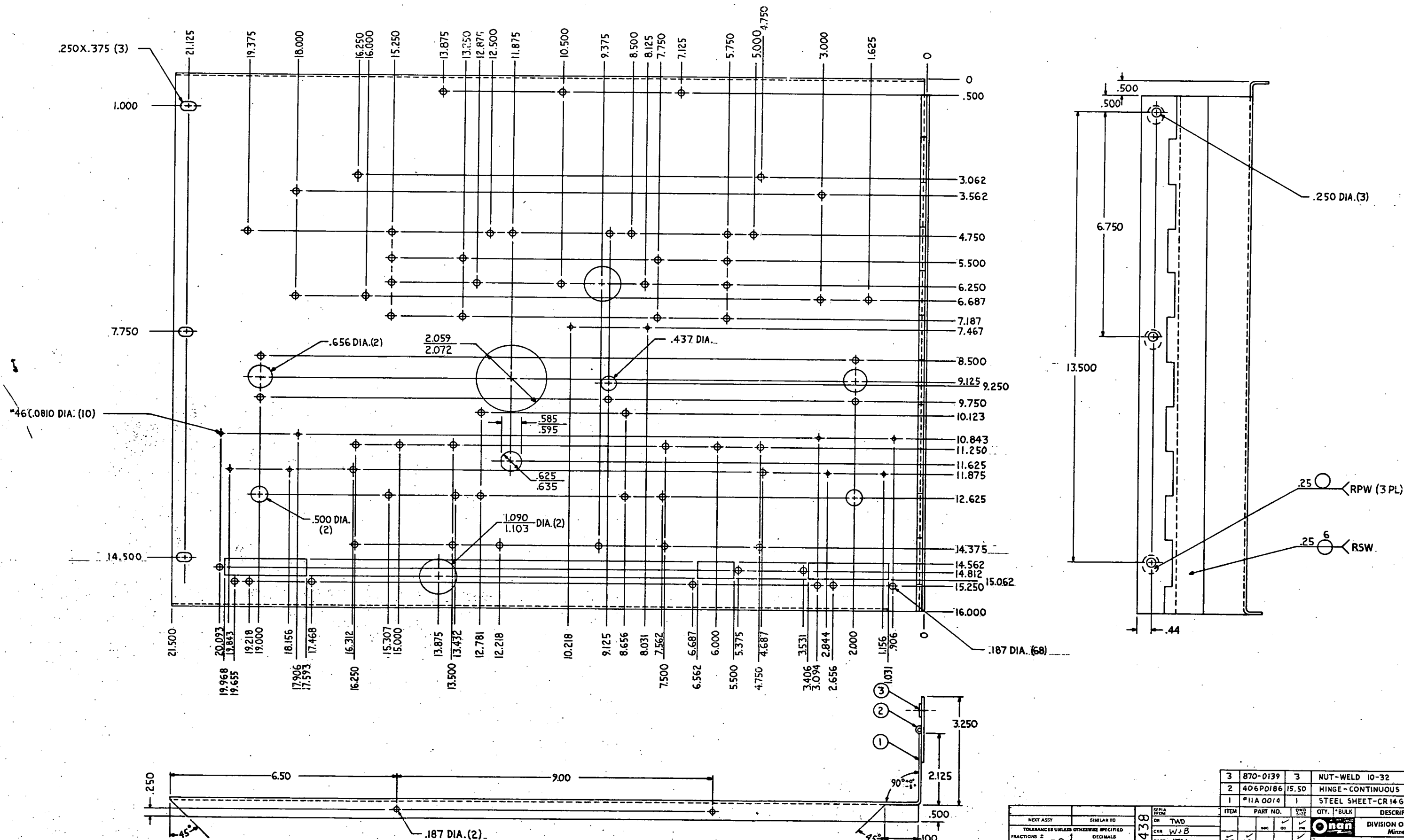
Keep the automatic transfer switch cabinet(s) closed and locked. Make sure authorized personnel only have the cabinet keys.

Always move the operation selector switch on the generator sets to "STOP", disconnect the starting batteries before performing maintenance or adjustments.

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.



NEXT ASSY	SIMILAR TO
TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS $\pm$	DECIMALS
ANGLES... $\pm 5^\circ$	2 PLACE $\pm .03$
HOLES.... $+ .006$ $- .002$	3 PLACE $\pm .010$

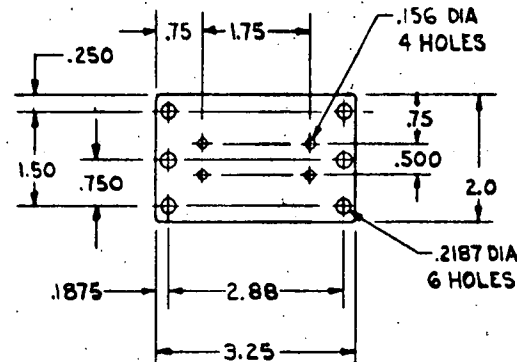
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301-2438	SEPIA FROM
	DR TWD
	CKR W+B
	ENGR JTM
	SAMP REL
	PROD REL 1-20-75 JTM
	PROD

[illegible]

ITEM		PART NO.		QTY.		DESCRIPTION OR MATERIAL	
G	TP	✓ WELD	GD	6	PUR	 DIVISION OF STUDEBAKER CORPORATION Minneapolis, Minnesota	
WCH	WELD	INSF	✓ QC	✓ PO			
DR	CIP	ENG	CRB	CP			
DATE		8-26-71		SC		RELAY-TIME DELAY	
MODEL				PART NO		DWG NO	
GENERAL						307B1149	

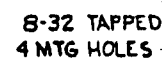
LET	REVISIONS	ZONE	ENG	CKR	DATE



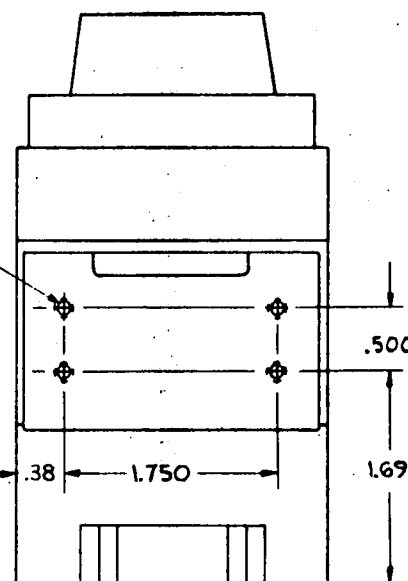
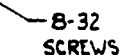
MTG BRKT DETAIL
SCALE: 1=2

SUGGESTED SOURCE OF SUPPLY

VENDOR	VENDOR NO.
AGASTAT ELIZABETH NEW JERSEY	7012L27K



~~SEE NOTE "A"~~



BACK VIEW

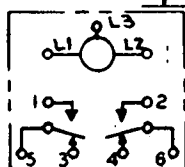
SPECIFICATIONS:

1. COIL VOLTAGE: 208V OR 240V AT 60 HZ, 220V 50 HZ
2. TIMING RANGE: 1 SEC TO 300 SEC DELAY ON PICKUP
3. CONTACT ARRANGEMENT UPDT. SINGLE BREAK

CONTACT RATING:

CONTACT VOLTAGE	MIN. 100,000 OPERATIONS
30 VDC	15.0 AMPS
110 VDC	1.0 AMPS
120 V 60HZ	20.0 AMPS
240 V 60HZ	20.0 AMPS
480 V 60HZ	12.0 AMPS

4. UL LISTED, CSA APPROVED
5 VOLTAGE CODE: TERMINALS L2 & L3 FOR 208V
TERMINALS L1 & L3 FOR 240V



NOTE: "A"
(STAMPED ON TIMER)
CONTACT RATING 240 VAC
1/4 HP - 10 A RES

WIRING DIAGRAM

NEXT ASSEMBLY	SIMILAR TO
TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS $\pm$	DECIMALS
ANGLES $\pm$	2 PLACE $\pm$
	3 PLACE $\pm$

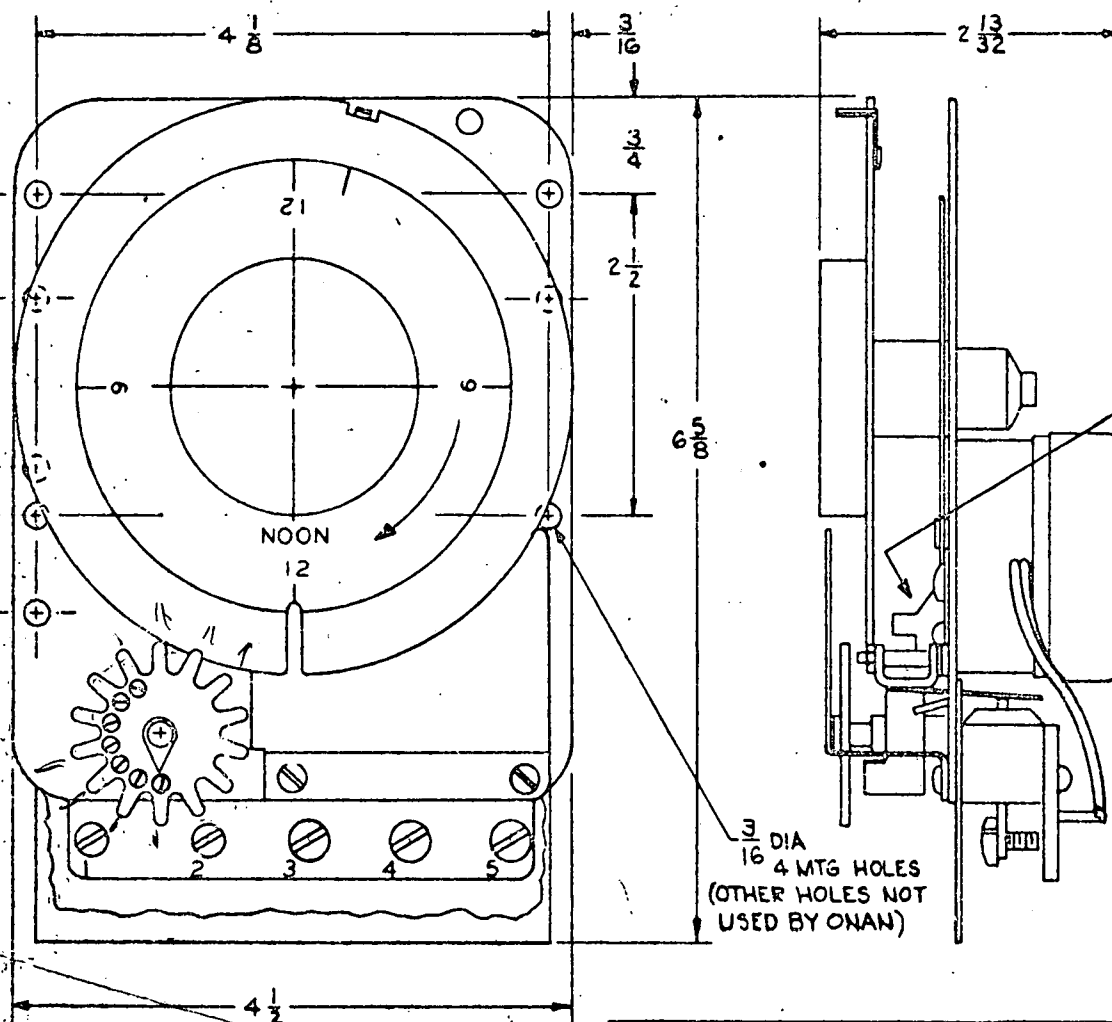
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307B1144

ITEM		PART NO.		QTY.		DESCRIPTION OR MATERIAL	
SA	COST	MSG	TP	RELAY	GD	^G PUR	 DIVISION OF STUDEBAKER CORPORATION Minneapolis, Minnesota
MILL	CRANK	CR	PUNCH	WELD.	INSP	^{OC} PO	
DESIGN APPROVED		DR	EE	ENG	LLL	CER	CP
SAMPLE RELEASE		DATE		2-17-71		SC151	
PROD RELEASE		L.L. 2-23-71		MOORE		PART NO	
SERIA FROM		MASTER		LOAD TRANSFER		DWG NO. 307B1144	

307-1336

REV	REVISIONS	ZONE	ENG	CKR	DATE



MATERIAL:

USE 307-1105 (B) MODIFIED FOR 168 HR
OPERATION BY CONTROL DEPT.

1. BEND TRIP SPRING FLAT AGAINST BASE OF
TIMER SO THAT IT DOES NOT CONTACT SWITCH
LEVER.
2. REMOVE ALL PINS FROM LARGE DIAL
3. INSTALL 7 PINS ON SPOKED WHEEL.
PINS IN: TERMINALS 4 AND 5 ARE CLOSED.
PINS OUT: TERMINALS 3 AND 5 ARE CLOSED.
4. INSTALL EXTRA PINS IN TIME POINTER BRACKET.
5. SWITCH WILL CHANGE POSITION AT APPROXIMATELY
12:30 AM.

SPECIFICATIONS:

COIL - 230 VAC 50Hz

SWITCH - SPDT, 20 AMP AT 125, 250 OR 480 VAC

1/4 AMP AT 250 VDC AND 1/2 AMP AT 125 VDC



WIRING DIAGRAM

307-1316	B
MEET ASSEMBLY	SIMILAR TO
TOLERANCES UNLESS OTHERWISE SPECIFIED	
FRACTIONS ±	DECIMALS ±
ANGLES ±	RADIANS ±
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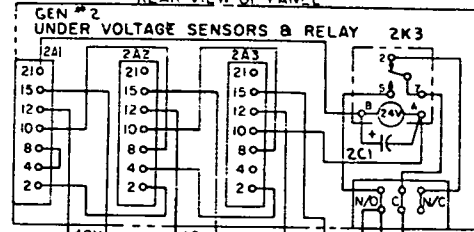
307-1336	ME	SA	COST	MSG	TP	SK	REAR	GO	WJB
	MILL	CRANE	CK	PUNCH	WELD	IMP	CK	WJB	
	DESIGN APPROVED								
	SAMPLE RELEASE								
	PROD RELEASE 3-15-74 JTM								
	SEPA FROM 307-1316/B								

ITEM	PART NO.	QTY.	DESCRIPTION OR MATERIAL
			DIVISION OF STUDER CORPORATION Minneapolis, Minnesota
			SWITCH-TIME
			DWG NO. 307-1336
			DWG STL B

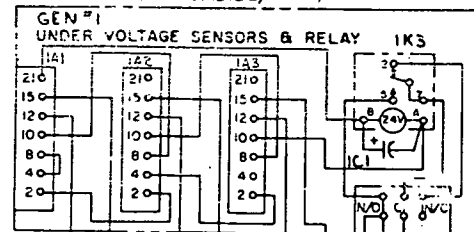
24 hr - 168 hr
running time

NOTE:
SET AT 150 SEC
TIME DELAY ON
PLANT FAILURE
LOCKOUT

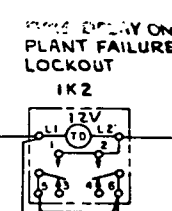
WIRING DIAGRAM
REAR VIEW OF PANEL



(FRONT SIDE)



NOTE:
SET AT 150 SEC
TIME DELAY ON
PLANT FAILURE
LOCKOUT



NOTE:
UNDER VOLTAGE
SENSORS SET AT
PICK-UP 200V
DROP-OUT 180V

GEN NO. 2

GEN NO. 1

168 HOUR
CHANGEOVER
CLOCK
(FRONT SIDE)

START-STOP

START-STOP

RESET

RESET

SELECTOR
SW

AUTO
(CLOSED)

MANUAL
(OPEN)

2S1

2K4

2K5

2K6

2K7

2K8

2K9

2K10

2K11

2K12

2K13

2K14

2K15

2K16

2K17

2K18

2K19

2K20

2K21

2K22

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2K228

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2K230

2K231

2K232

2K233

1. M1 contacts closed — connect ~~ground~~ ^{to energize} 1K5 (start-stop relay) thru 1K4, 1S1, and to B+.

2. 1K5 n.o. contacts close to connect B+ on 1TB1-B+ to 1TB1 remote, and time delay on plant failure relay 1K2 which begins timing.

3. Generator set cranks and starts.

5. Voltage sensors, sense ^{1A1, 1A2, and 1A3} generator voltage and ~~close~~ ^{energize} undervoltage relay 1K3 when voltage reaches pick-up setting.

4. Generator ^{output lights} ~~running~~ indicator lamp lights to indicate unit is running.

6. N.O. 1K3 contacts close to connect generator output to unit failure relay 1K6, ~~and~~ time delay on pick-up relay 1K8, and changeover relay 1K7 (through n.c. 2K8 contacts).

7. ^{unit failure} Relay 1K6 is energized to open its n.c. contacts to remove B+ from time delay on plant failure relay 1K2.

If generator set didn't start or stopped, time delay on plant failure relay 1K2 would energize its n.o. 1K2 contacts to energize plant failure lockout relay 1K4. N.O. 1K4 contacts would open to remove B+ from the remote terminal and relay 1K5, 1K2, and 1K4 ~~de-energize~~. N.C. 1K4 contacts remain open because they are latched ^(failure manual reset). A n.o. set of 1K4 contacts are held closed for the failed alarm circuit.

Normally, time delay on pick-up relay 1K8, ^{would} complete its time delay and close its n.o. 1K8 contacts to energize changeover relay 1K7 if generator set 2 was supplying power to the load and n.c. 2K8 were open,

But for initial start-up, changeover relay 1K7 is energized through 2K8 contacts TDO. ^{n.c.} contacts 1K6 and 1K7 open to insure start-stop relay 2K5 for generator set #2 cannot energize until the clock closes this circuit (generator set #1 fails).

8. Transfer switch coil 1K1 is energized through closed contacts 2K1-1C, n.o. contacts 1K5, and n.o. 1K7 contacts.

9. Transfer switch coil 1K1 closes its main 1K1 contacts to connect generator set #1 to the load. At the same time, it opens its 1K1-1C interlock contacts to prevent transfer switch coil 2K1 from energizing. A mechanical interlock prevents both sides from closing at the same time.
10. Switch 1S2, as the transfer switch closes to connect generator output to ^{and light} "SUPPLYING LOAD" lamp.
11. When change-over time arrives, the changeover clock motor opens its n.c. M1 contacts and closes its n.o. M1 contacts to ^{connect ground to and} energize start-stop relay 2K5 for generator set #2. B+ is connected to 2K5 through n.c. contacts 2K4, switch 2S1, and to terminal 2TB1-B+.
12. Relay 2K5 closes its "2K5" contacts to connect B+ to time delay on plant failure relay 2K2 through closed 2K6 contacts, and connect B+ to the remote terminal on 2TB1. Time delay on plant failure relay 2K2 begins timing.
13. ~~Generator set #2 starts.~~
14. Generator output from generator set #2 lights "RUNNING" lamp 2DS1.
15. Voltage sensors 2A1, 2A2, and 2A3 sense generator voltage and energize undervoltage relay 2K3.
16. ~~Generator running lamp 2DS1 lights to indicate unit is running.~~
16. Relay 2K3 energizes and closes its n.o. 2K3 contacts to connect generator output to unit failure relay 2K6 and time delay on load pick-up relay 2K8. Relay 2K8 begins timing on energization.
17. Unit failure relay 2K6 opens its n.c. 2K6 contacts to remove

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GENERAL INFORMATION

AUTOMATIC TRANSFER SWITCHES

Onan automatic transfer switches are designed to operate with Onan electric generating sets and other Onan related equipment. The automatic transfer switch assures continuous power supply to a load from one of the two generator sets.

Onan standard cabinets meet requirements of the National Electrical Manufacturers Association (NEMA) for a "Type 1" cabinet: general purpose, indoor cabinet.

When contacting a dealer or the factory for information on operation or service of your automatic transfer switch, always furnish the complete model number, specification letter, and serial number as given on the nameplate. This information is needed to identify your automatic transfer switch among the basic and special types manufactured by Onan.

MODEL NUMBER

Following is a typical model number with explanations of the different parts:

Example: LTF30-53/1A

LTF	Onan series automatic transfer switch for 2-wire, 12-volt remote starting for dual generator set operation of prime power installation. LTG indicates a 2-wire, 24-volt remote starting system.
30	Ampere rating.

5	Tens digit 5 designates 50-hertz use only. Number omitted designates 60-hertz use only.
3	Units digit 3 designates voltage, wire and phase: 2 is 240 volt, 3 is 120/240 volt, 1 phase; 4 is 120/208 volt, 4 wire, 3 phase; 4X is 277/480 volt, 4 wire, 3 phase; 5D is 120/240 volt, 4 wire, 3 phase, delta center-tapped; 7 is 220/380 volt, 4 wire, 3 phase; 9X is 347/600 volt, 4 wire, 3 phase.
/	Diagonal separates basic model from specification.
1	Specification number identifies optional equipment. Number 1 designates no options or basic as advertised.
A	Specification letter advances with production modification.

YOUR MANUAL

Since the manual contains the correct information for your automatic transfer switch, keep it handy and refer to it for installation and operation.

Throughout the text, front of the automatic transfer switch is the door side. Left and right are determined when facing the cabinet door.

INSTALLATION

Onan recommends an experienced electrician install the automatic transfer switch, observing all normal safety precautions and local electrical codes. Figure 1 shows a typical installation.

GENERATOR SET

Install the generator set according to the manufacturer's instructions. Make sure the units are serviced for operation before initial start-up. After installation and operation service procedures, check each generator set with its own controls for proper starting, operation, and stopping.

MOUNTING

The automatic transfer switch is normally supplied in a NEMA Type 1 box for indoor mounting, protecting it from excessive heat, moisture, dust and dirt. Mount on a vertical wall, switchboard or other permanent support, whichever is applicable, where it will not be subjected to excessive vibration. Secure it with bolts or screws through the holes provided (Figure 2). Vacuum the cabinet interior to remove dust, chips and filings from mounting.

CAUTION

Extreme care should be exercised 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.

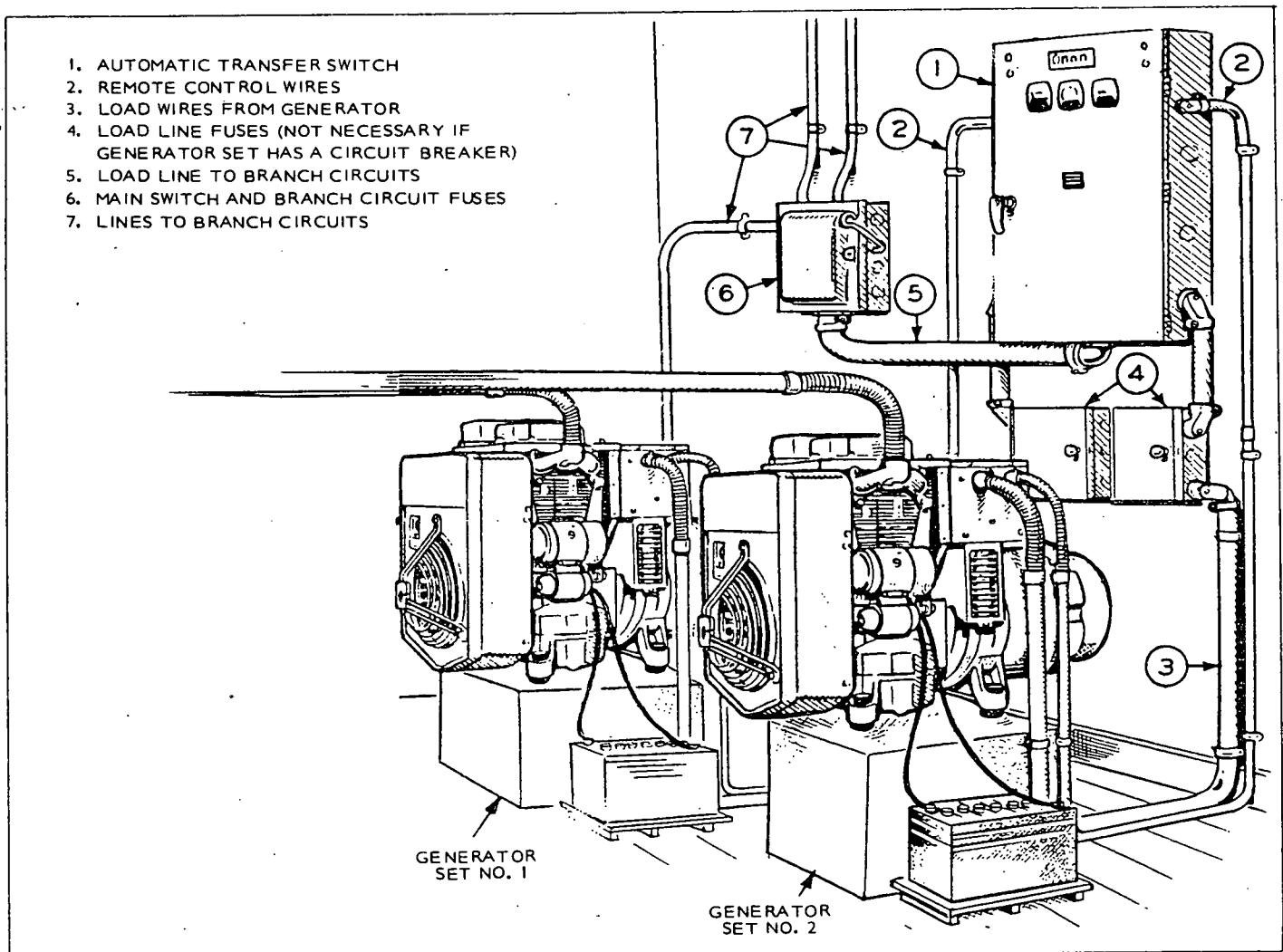
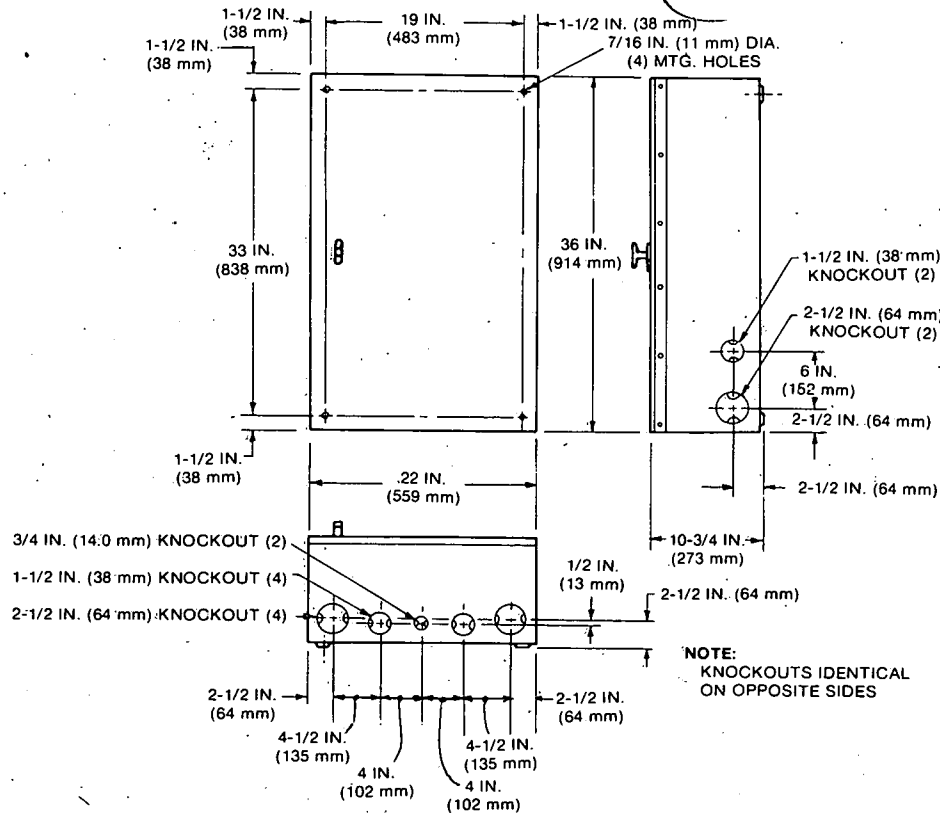


FIGURE 1. TYPICAL INSTALLATION

ONE-DOOR CABINET

(30-60-100-225 AMP)



TWO-DOOR CABINET (400-AMPERE MODEL)

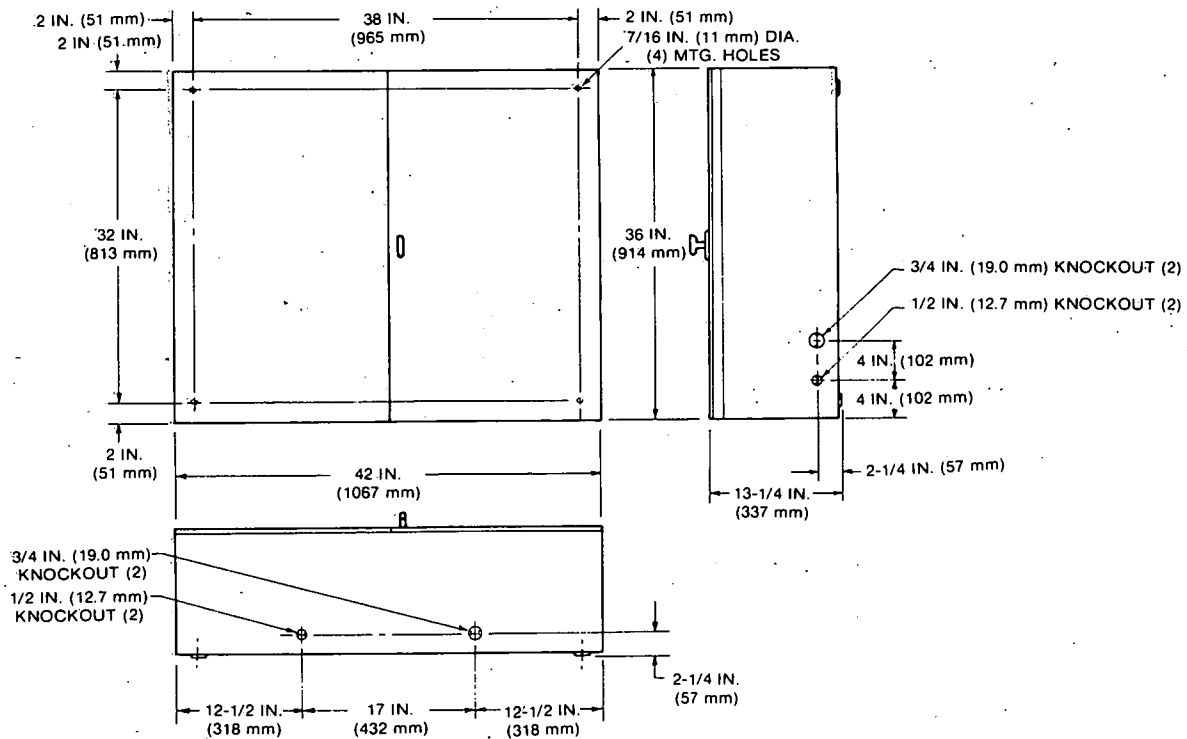


FIGURE 2. CABINET DIMENSIONS

WIRING

Wiring must meet specifications of local electrical codes. Use wires large enough to handle the maximum rated currents. Use conduit for wiring outside the cabinet. If rigid conduit is used between control and generators, install a minimum of two feet (610 mm) of flexible conduit between the rigid conduit and generator set to absorb vibration. Use separate conduit for the control circuit wires.

WARNING

Disconnect batteries when wiring to prevent accidental starting and hazard of serious personal injury.

Generator and Load Connections

AC Color Code:

Hot Wires Black
Ground Wires White

1. Connect all ground wires (Generator 1, Generator 2, and Load) to ground terminal at bottom of the cabinet.
2. Connect generator wires to transfer switch, observing the color code and proper terminal designations (Figure 3). The switch is marked "GEN 1" and "GEN 2." Terminals for each generator connection are marked "A", "B", etc. If more than one voltage is involved, make all connections of equal voltage to terminals with the same letter marking. For example: All 120-volt lines should be connected to terminals marked "A."

3. Connect load lines to that section on transfer switch marked "LOAD." Observe terminal marking for different voltages as stated in previous paragraph.

CONTROL CIRCUIT CONNECTIONS

Control circuit connections are the same for both controls. Two 3-contact terminal blocks marked B+, GND, REMOTE, are located in the control box, one marked for each generator. A similar terminal block is located in each generator set control box. Adhering to the color code, connect wires (using conduit) from each generator set to the proper terminal block in the control box. Use separate conduit from the generator AC output. For most normal installations, #14 wire can be used. Refer to the generator set instruction manual for specific wire sizes if the run is more than 100 feet (30 m).

Control Circuit Color Code: B+ Green
GND White
REMOTE Red

CHECKING PHASE RELATIONS OF THREE-PHASE CONNECTIONS

Phase rotation must be checked and corrected before any load can be added to the generator set. Use the following procedures and use an Onan load-test panel, phase-rotation meter, or three-phase motor.

1. Connect the battery and start generator set 1. See *OPERATION* section for instructions.

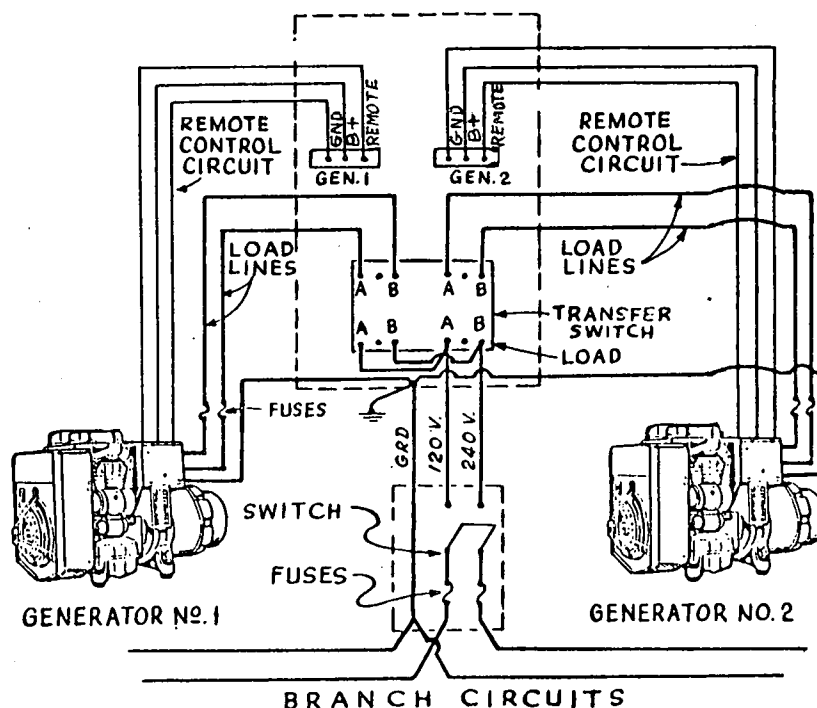


FIGURE 3. LOAD AND CONTROL CIRCUIT CONNECTIONS

2. Check phase rotation.
3. Stop generator set and disconnect starting battery.
4. If phase rotation is incorrect for loads, reverse two generator leads on the transfer switch for this generator set.
5. Repeat procedure for generator set 2.

OPERATION

GENERAL

The automatic transfer switch is designed for use with two remote starting electric generating sets. Figure 4 shows a typical automatic transfer switch. In operation, one generator set runs for a regular period normally 168 hours. At the end of the run cycle, the resting unit is started automatically and warmed up. When the warm-up period is finished, the automatic transfer switch transfers the load and the other generator set shuts down. In case the resting generator set fails to start, cranking is stopped. A warning circuit is then activated and the other unit continues to carry the load indefinitely. If one set stops during operation, the automatic transfer switch starts the other unit and automatically connects to the load without warm-up.

WARNING

Always move the operation selector switch on both generator sets to "STOP" and disconnect the starting batteries before performing maintenance or adjustment procedures. Otherwise, the automatic transfer switch and generator set present a hazard of serious, personal injury.

START-STOP RELAYS

The start-stop relay for each plant controls starting and stopping. In normal operation, it becomes energized when the time clock switches. At the end of the cycle, it de-energizes when the change-over relay for the alternate plant closes. When the start-stop relay energizes, it closes starting connection of the plant remote control and starts the cranking cycle. When it de-energizes, it opens the remote control circuit, stopping the plant. One set of contacts are holding contacts that hold relay in when clock changes over. The remaining contact on the start-stop relay is in series with the change-over relay contacts and contactor coil for the same plant, allowing load change-over only if the start-stop relay is energized (plant running). (FROM OLD LTF-LTG MANUAL) relay is energized (generator set running).

PLANT FAILURE RELAYS

This relay is energized by the closing of the under-voltage sensitive relays which are controlled by the plant output. If the plant output stops or drops below the settings of the under-voltage sensitive relays, the plant failure relay closes the opposite start-stop relay starting the idle plant. The

plant failure lock-out time delay relay energizes the coil in the time delay on plant failure lock-out relay which de-energizes the start-stop relay of the malfunctioning plant.

PLANT GENERATOR SET FAILURE LOCK-OUT TIME DELAY RELAYS

The adjustable time delay relay is energized when the generator set failure relay opens to run a preset length of time after a low voltage condition occurs. When the time delay relay closes, it applies power to the coil in the failure lock-out relay which opens and shuts down the generator set.

PLANT FAILURE LOCK-OUT RELAYS

One lock-out relay for each plant. The relay will open after the failure lock-out time delay relay completes its preset timing interval during a plant malfunction. When the lock-out failure relay energizes one set of contacts open to de-energize the start-stop relay. Another set of contacts close to complete the alarm circuit. The relay once opened must be manually reset by pressing the reset button on the panel.

CHANGE-OVER RELAYS

Two relays control switching of the contactor and are, in turn, controlled by the time delay relays. When the warm up period is ended, the time delay relays energize the change-over relay for the plant that is to take over the load. The relay energizes and switches the contactor. In addition, it breaks the circuit to the start-stop relay for the other plant, stopping that plant.

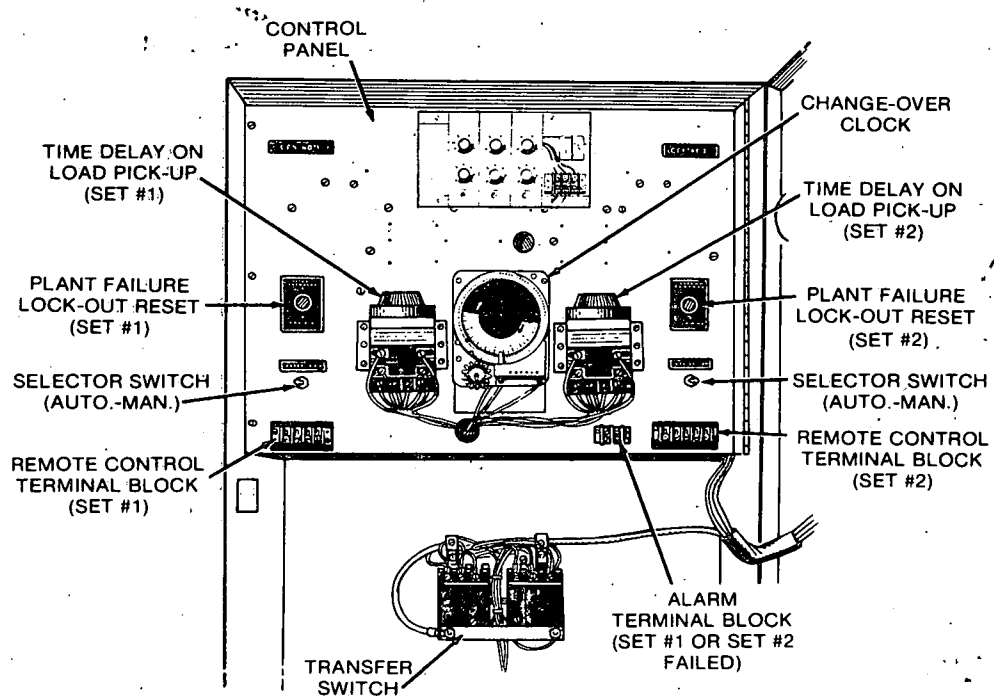
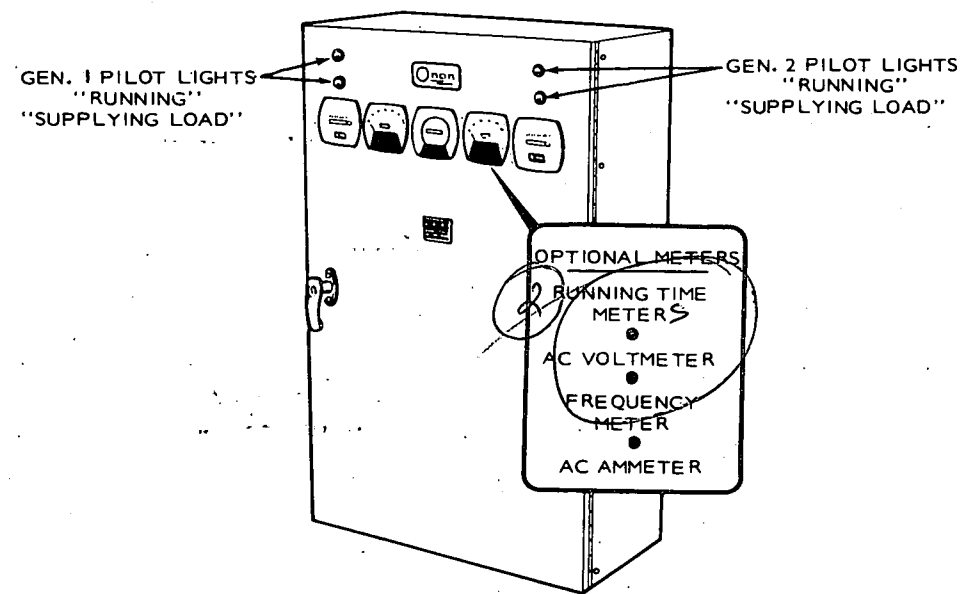
TIME DELAY RELAYS

Two time delay relays are controlled by the voltage sensor relay. These time delay relays are adjustable for a time delay between coil energization and contact operation of from 1 to 300 seconds. At the end of delay, they close the change-over relay of the generator set starting its run cycle and open the other start-stop relay. This time delay allows each generator set to warm up before the load switches. If one generator set stops during its run cycle, both time delay relays are deenergized when the other generator set starts, allowing the transfer switch to transfer the load without a warm-up period.

TRANSFER SWITCH

This unit transfers the load at the end of each cycle. Each transfer switch is rated as shown on the nameplate and contains the proper number of terminals for the rated phase and number of wires. In all cases, the contacts are mechanically and electrically interlocked to prevent switching both generators onto the load at the same time.

all drawings use the word Plant



SOME OPTIONS SHOWN

FIGURE 4. TYPICAL AUTOMATIC TRANSFER SWITCH

ALARM CIRCUIT

Each alarm circuit operates directly from the failure lock-out relay. A single pair of contacts close whenever a generator set won't start (or stops) during normal operation.

CHANGE-OVER CLOCK

The change-over clock is a clock-controlled, single-pole, double-throw switch. It switches at regular intervals of 168 hours (as normally ordered from factory) to energize the start-stop relay for the resting generator positions at about 12:30 a.m. See the **ADJUSTMENTS** section for settings.

THE CLOCK INITIATES CHANGE OF GENERATOR SETS
If not set, rotate the large dial on the change-over clock clockwise until the correct time is aligned with the time pointer.

VOLTAGE SENSORS

The voltage sensors are connected across the AC output of both generator sets. They operate the time delay relays and the generator set failure relays when the voltage is sufficient to close them and automatically start the load change cycle if the voltage drops below a predetermined level. Over-voltage sensing is much the same except it initiates load change-over on abnormally-high voltage.

OVER VOLTAGE IS A OPTION
Both pick-up and drop-out voltage settings are adjustable. Table 1 gives the adjustment ranges in percentages. The pickup adjustment control is always set first, then the drop-out adjustment is set (see **ADJUSTMENTS** section for settings.)

TABLE 1. ADJUSTABLE VOLTAGE SENSING

UNDERVOLTAGE		
VOLTAGE SENSOR	UNIT STARTS (drop-out voltage)	UNIT STOPS (pick-up voltage)
300-0780*	5 to 20% below pick-up voltage setting.	75 to 100% of normal voltage.
OVERVOLTAGE		
VOLTAGE SENSOR	UNIT STARTS (pick-up voltage)	UNIT STOPS (drop-out voltage)
300-0780*	100 to 115% of normal voltage.	2 to 20% below pick-up voltage.

* - Plug-in module, does not include relay or chassis.

AUTOMATIC-MANUAL SELECTOR SWITCHES

Each automatic-manual selector switch on the control panel controls the starting circuit and start-stop relay for its generator set. In the "MANUAL" position, that generator set can be operated from the generator set control but it will not operate the transfer switch to carry the load. In the "AUTOMATIC" position, the LTF or LTG controls generator set operation.

Starting

If both automatic-manual selector switches are set at "MANUAL" and the selector switches on the engine controls are set at "REMOTE" (generator sets not running), move the automatic-manual selector switches to "AUTOMATIC" to start the units. Both generator sets will start but one will shut down when the change-over relay operates to place the load on one generator set.

Moving the automatic-manual switch to "AUTOMATIC" will not start the generator set unless its engine control selector switch is set to "REMOTE" and the generator set is scheduled for load.

Stopping

To stop both the generator sets during operation move both automatic-manual selector switches on the control panel to "MANUAL."

Stopping One Generator Set During Run Cycle to Transfer Load

To transfer the load to the other generator set before a 168-hour period has completed, open the cabinet door. Then turn the small spoked "DAY" wheel of the clock **COUNTERCLOCKWISE** to the opposite generator set. After the time delay on load pick-up, the load is transferred to the generator set just started. The generator set now without load will shut down.

The following procedure can be used to transfer load without a warm-up.

1. Set generator selector switch to "RUN" and start generator set.
2. When set starts, move selector switch in automatic transfer switch for other generator set to "MANUAL." Other generator set will take over load.

ADJUSTMENTS

TIME DELAYS

Load Pick-Up Time Delay

Two Agastat time delay relays are provided, one for each generator set, to delay load pick-up from one generator set to the other. To adjust the time delay, turn its knob clockwise to increase delay time, counterclockwise to decrease delay time. See Figure 5.

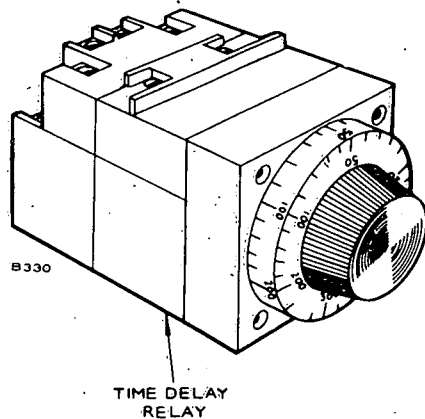


FIGURE 5. LOAD PICK-UP TIME DELAY

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.

Figure 6 shows 300-0780 voltage sensors in sensor chassis.

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

EXAMPLE: For a nominal 208-volt voltage system, a "PICK-UP VOLTAGE" knob reading of 90 is equal to 180.0 volts (90 x 2.0).

Undervoltage Sensor Settings

1. 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

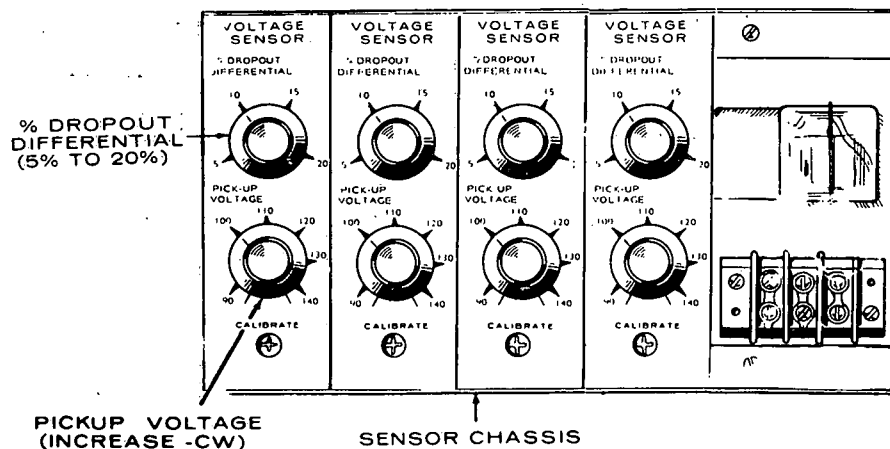


FIGURE 6. 300-0780 VOLTAGE SENSORS IN SENSOR CHASSIS

special equipment which can be damaged by slight voltage changes, a setting which gives pick-up 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.

The drop-out differential is determined by the pick-up setting.

2. 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.

Overvoltage Sensor Settings

1. 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.

The drop-out differential is determined by the pick-up setting.

2. 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.

CHANGE-OVER CLOCK

1. Open cabinet door of control.
2. Move the auto-manual selector switches to manual position, move the generator set operation selector switches to "STOP," and disconnect the starting batteries.

WARNING

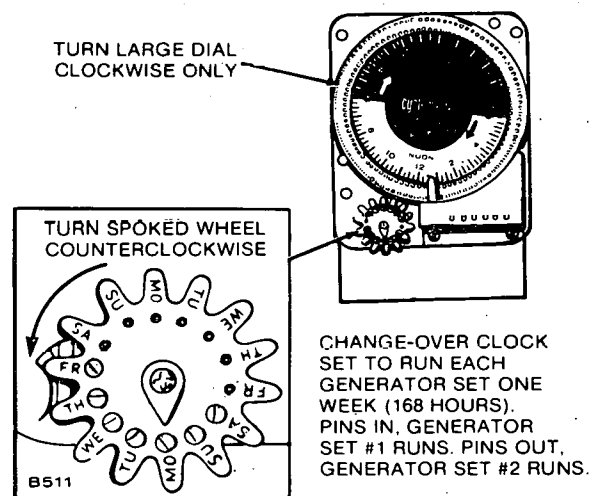
Be sure to disable the generator set during adjustments or maintenance to prevent accidental generator set starting and hazard of serious personal injury.

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 7.
- 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.
5. Turn the small spoked wheel *counterclockwise* until the correct day aligns with the pointer.
6. Connect the starting batteries, move the generator set operation selector switches to "RMT," and move the auto-manual selector switches in the cabinet to the auto position (one generator set should start and assume load).
7. Close the cabinet door.



NOTE: Trip pins are left-hand thread.

FIGURE 7. CHANGE-OVER CLOCK

MAINTENANCE AND REPAIR

When properly installed, the automatic transfer switch requires little attention. In case of faulty operation, the automatic transfer switch may not be at fault. The function charts at the end of this section will aid in the diagnosing of trouble traced to the automatic transfer switch. Always check the following.

1. See that all connections are secure.
2. See that all switches are in their proper positions.
 - a. Automatic transfer control manual-automatic switches must be in automatic position.
 - b. Generator set operation selector switch must be in remote position.
3. Set the switches in the transfer control at *manual* and start each generator set using the set controls. If one will not start, refer to generator set operator's manual.
4. If analysis indicates the control is at fault, check all wiring and components for signs of physical damage, burning, broken wires, etc.
5. Compare the action of the automatic transfer switch under a change in cycle or starting to the control function charts. Replace any component found defective.
6. If generator power is not reaching the load, check the contact points of the transfer switch and the load circuit. The trouble may be in the load circuit, a broken wire, loose connections, blown fuse outside the automatic transfer switch cabinet, defective switch, defective lamp or appliance, a ground on both sides of the load circuit, or, an improper AC load. Repair or replace as needed.

CONTACTS

Contacts should never require cleaning or refacing for the life of the equipment except in unusually dusty or dirty environments. Discoloration of the silver does not affect their efficiency.

CAUTION

Filing the contact face destroys the mating surfaces.

If the contacts ever do become burned or pitted, replace them in the following manner:

1. Remove the plastic hood from the transfer switch.
2. Remove the washers and springs (Figure 8).
3. Lift the contacts from the slide posts.
4. Remove attaching screws from the stationary contacts.

5. Install new contacts (curved silver contact surfaces facing inward).
6. Reassemble the springs and washers.
7. Reinstall the plastic hood.

TRANSFER SWITCH HUM

Alternating current hum has been minimized by the provision of shading coils and by grinding the sealing faces of the magnet assembly. If hum is due to dirt between the sealing faces, clean them with Dowclene EC, Chlorothene Nu, or similar electrical cleaning material. Use medium fine grade emery paper to clean rusted sealing faces. Remove all traces of emery dust.

TRANSFER SWITCH COILS

If a transfer switch coil is grounded or has an open circuit, replace by following appropriate instructions, for a 30 ampere, 60 through 100 ampere, or 200 and 400 ampere transfer switch.

30 Ampere Transfer Switch

Shut off both plants and disconnect batteries before working on the transfer switch.

1. Disconnect transfer switch lead wires and remove switch from cabinet.
2. Remove switch mounting plate and base plates. Disconnect coil lead wires.
3. Remove locking pin and slide coil and stationary magnet from the bottom of the switch. Slide coil from magnet.

1. Disconnect the coil lead wires.
2. Pull off the hairpin-shaped retaining clips holding the control rod and slide out the control rod (use a needle-nose pliers).
3. Slide out the stationary armature and coil assembly.
4. Remove the defective coil from the stationary armature and replace with new coil.

200 and 400 Ampere Transfer Switch

1. Disconnect the coil lead wires.
2. Remove the capscrews mounting the coil and stationary armature to the case **FRAME**.
3. Pull out the assembly.
4. Remove the defective coil from the stationary armature and replace with new coil.

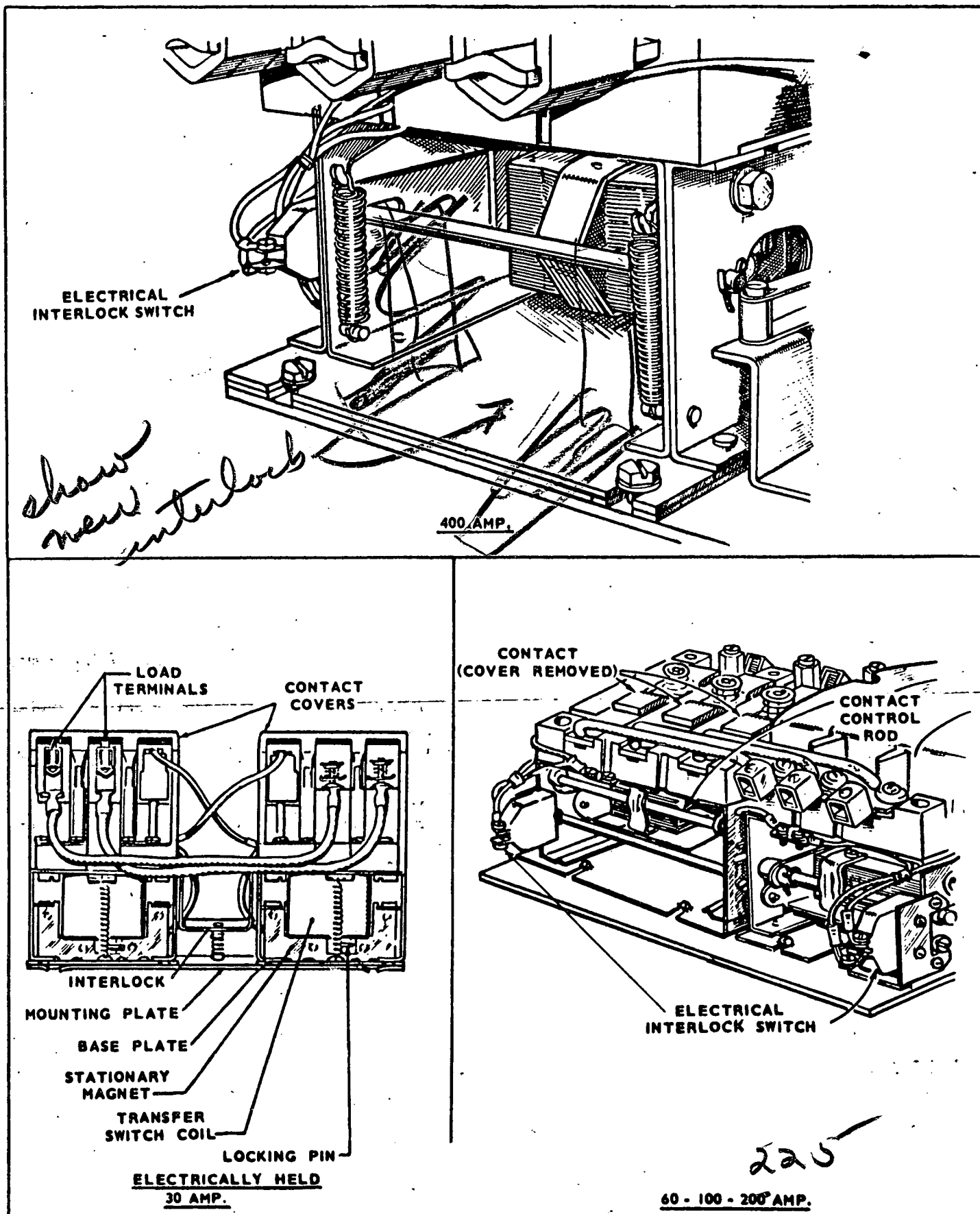


FIGURE 8. TRANSFER SWITCHES

STARTING

Move auto-manual selector switches to manual position and connect batteries.

Turn large dial of change-over clock clockwise to correct time.

Turn small spoked wheel of change-over clock counterclockwise so correct day aligns with pointer.

Move auto-manual selector switch for generator set #1 to AUTO.

Generator set #1 start-stop relay energizes.

Starting circuit for set #1 energizes and engine cranks.

Set #1 starts and builds up speed.

#1 RUNNING lamp lights.

Output voltage builds up and energizes voltage sensor.

Voltage sensor relay closes circuit to time delay on load pick-up relay and generator set failure relay.

Generator set failure relay energizes to open circuit to time delay on generator set failure relay and failure lock-out relay.

After time delay period, time delay on load pick-up closes a circuit to energize change-over relay for set #1.

Circuit opened to start-stop relay of set not programmed for operation.

Change-over relay closes circuit to transfer switch coil.

Transfer switch energizes to close switch contacts, connecting load to generator set #1.

#1 SUPPLYING LOAD lamp lights.

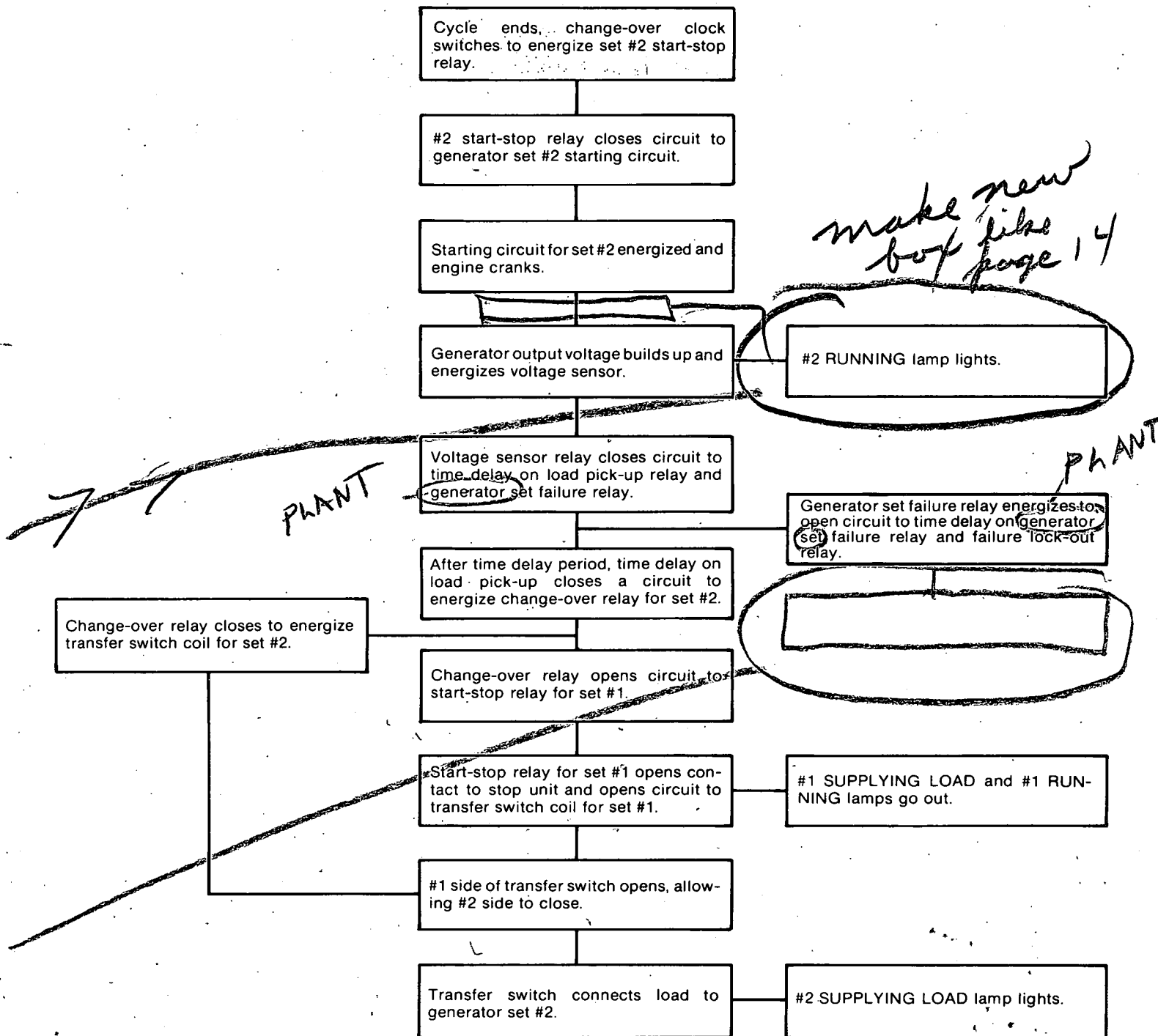
Set auto-manual switch for set #2 to automatic position.

*no Time delay
because of bypass
contacts on T. P. set
#2*

PLANT

PLANT

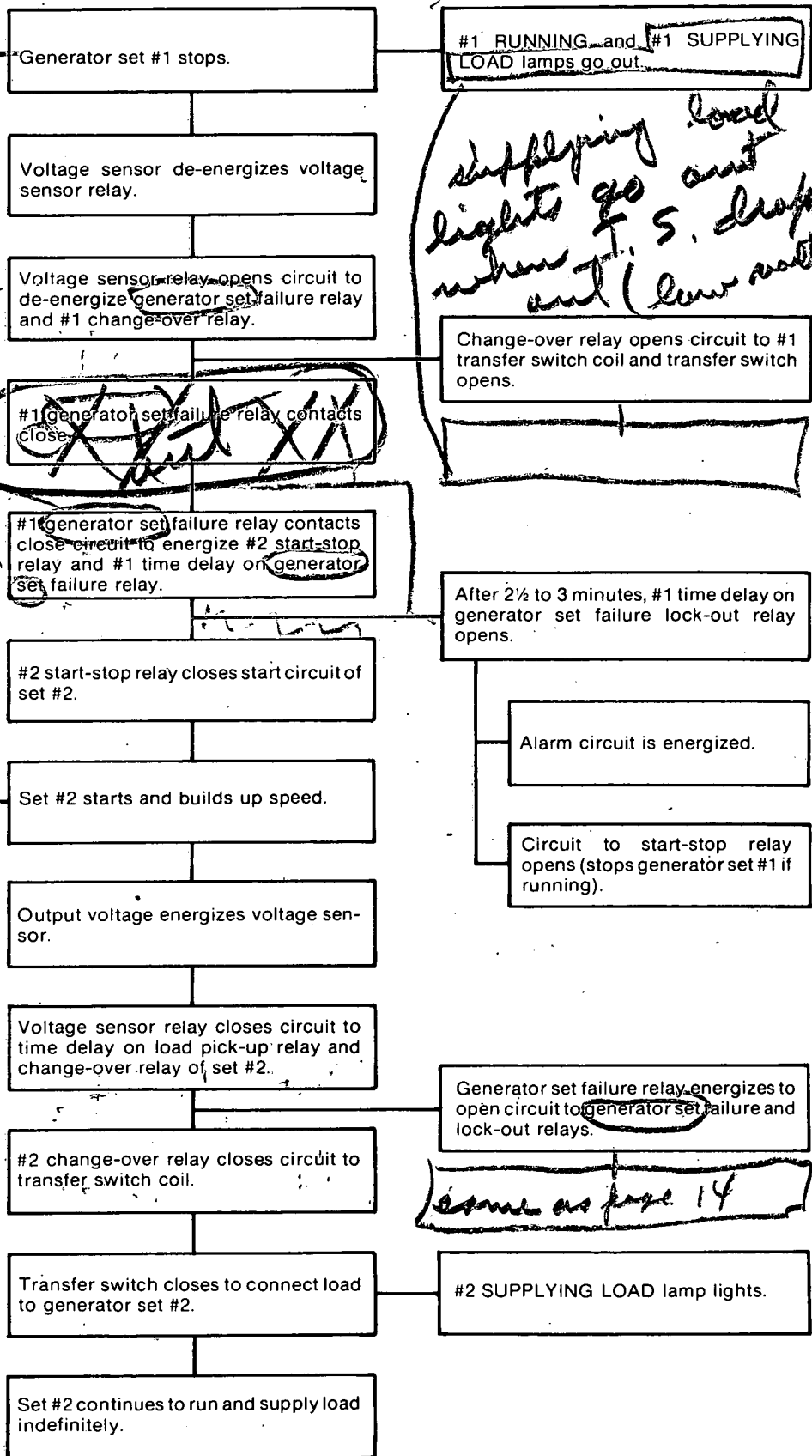
NORMAL CHANGE-OVER CYCLE (Set #1 Running)



GENERATOR SET SUPPLYING LOAD STOPS (or Has Low-Voltage Condition)

TRANSFER SWITCH

PHANT



supplying load lights go out when T.S. drops and (low voltage)

XX

no time delay

same as page 14

PARTS AND SERVICE INFORMATION

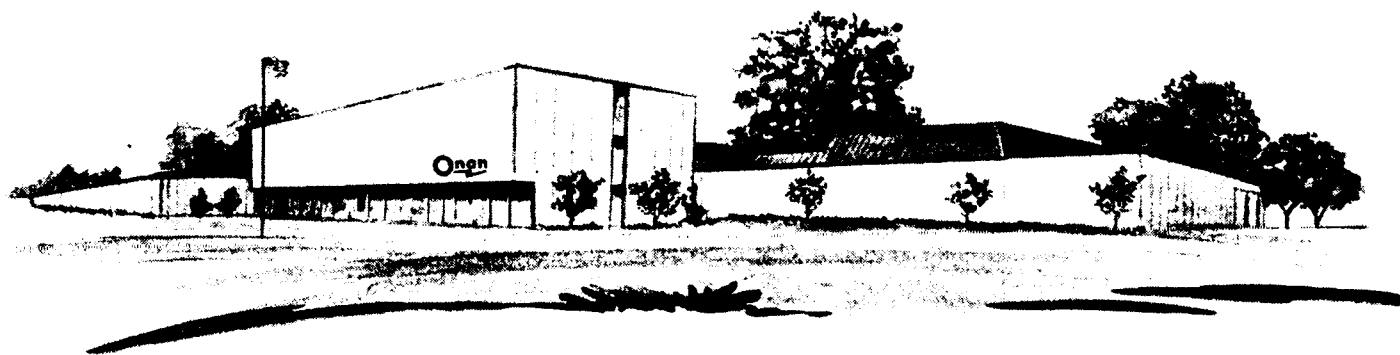
This automatic transfer switch is custom engineered and specially constructed. Optional equipment and special requirements demand particular circuits and components to perform the automatic functions. Because of the individuality of each automatic transfer switch and the variations of circuits and components, a parts list is not printed in this manual.

For these reasons, contact the dealer from whom you purchased this equipment for service and parts.

The wiring diagrams supplied contain a listing and location of parts (excluding hardware and switch parts) and should be kept with this manual.

Remember to give the complete model and serial number when requesting service or parts information.

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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