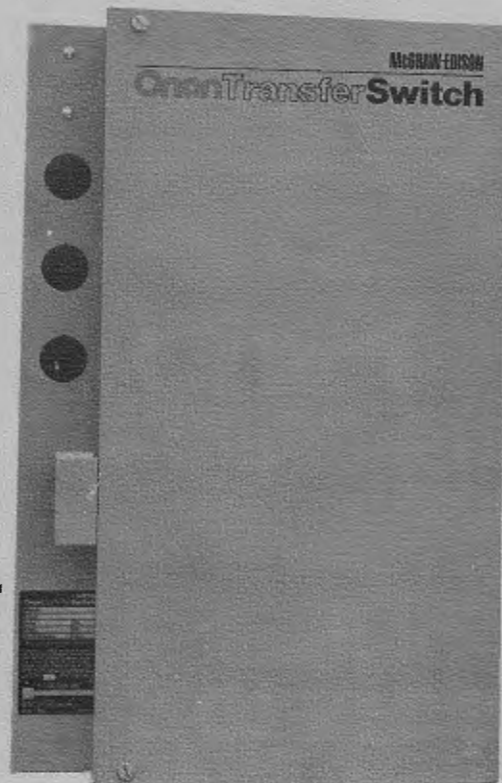




Service Manual LT/26K Transfer Switch

Starting Spec F

**Utility-to-GenSet
Automatic Control**



Safety Precaution

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 *This symbol is used throughout the text to warn of possible serious personal injury or death.*

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

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

Use rubber insulative mats placed on dry wood platforms over floors that 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 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.

WARNING

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

Table of Contents

TITLE	PAGE
SAFETY PRECAUTIONS	Inside Cover
GENERAL INFORMATION	2
Onan Service Manual	2
Model Number System	2
OPERATION DESCRIPTION	4
Normal Operation	4
Power Outage	5
Generator Set Starting Circuits	5
Restoration of Commercial Power	6
Simulation of Power Outage	7
Voltage Sensors	7
Time Delays	7
Auxiliary Contacts	8
Exerciser Clock	8
Battery Charger	9
ADJUSTMENTS	16
Control Relays	16
Exerciser Clock	17
Battery Charger	17
TRANSFER SWITCH ASSEMBLY	18
Replacing Auxiliary Switch	18
Replacing Main Contacts	19
Replacing Closing Coil	20
Replacing Mechanical Latch	20
TROUBLESHOOTING	22
TB1 Terminal Board	22
J1 Connector	25
J2 Connector	25
K11 Interposing Relay	25
Typical Problems	25

General Information

ONAN SERVICE MANUAL

This manual contains circuit descriptions of the transfer switch, modifications, adjustments, and troubleshooting procedures. Whenever troubleshooting or planning a repair, remember the transfer switch, generator set and commercial power are all interdependent. Decide which is the problem and then repair using necessary and normal safety precautions.

MODEL NUMBER SYSTEM

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

LT	B	C	A	60	-	4X	U	/	260	01	F
1	2	3	4	5		6	7		8	9	10

1. Series Identification

2. Transfer Switch Type

A = 2 Pole, Elec. Held

B = 3 Pole, Elec. Held

F = 2 Pole, Mech. Held Line Side

G = 3 Pole, Mech. Held Line Side

K = 2 Pole, Mech. Held Both Sides

L = 3 Pole, Mech. Held Both Sides

3. Basic Application

C = GenSet Standby to Utility 2-Wire Start

E = GenSet Standby to Utility 3-Wire Start

4. Enclosure

A = NEMA 1

C = Open Construction

5. Continuous Ampere Rating

30 or 60

6. Voltage Code

60 Hz

1 = 120V, 1Ø, 3-wire

3 = 120/240V, 1Ø, 3-wire

4 = 120/208V, 3Ø, 4-wire

4X = 277/480V, 3Ø, 4-wire

5D = 120/240V, 3Ø, 4-wire

7 = 220/380V, 3Ø, 4-wire

7X = 240/416V, 3Ø, 4-wire

8 = 127/220V, 3Ø, 4-wire

9X = 347/600V, 3Ø, 4-wire

Voltage code with prefix "5" indicates 50 hertz (e.g. 53 indicates 50 hertz, 120/240 volts, 1-phase, 3-wire).

7. Agency Certification

U = UL Listed

C = CSA Approved

N = No formal Agency Approval of Complete Assembly

8. Control Group Code

See page 3.

9. Meter-Lamp Group Code

See page 3.

10. Specification Letter

Advances with production modification.

8. CONTROL GROUP CODES

CONTROL GROUP FEATURES	CONTROL GROUP CODE					
	260	261	262	263	264	265
Phase Loss Relay	X	X	X	X	X	X
Generator Pickup Relay	X	X	X	X	X	X
Time Delay Retransfer		X	X	X	X	X
Time Delay Start			X	X	X	X
Time Delay Stop				X	X	X
Time Delay Transfer					X	X
Adjustable Voltage Sensing, Line Side						X

9. METER-LAMP GROUP CODES

CONTROL GROUP FEATURES	METER-LAMP CODE						
	00	01	02	03	04	05	06
None	X						
Normal & Emergency Lights		X	X	X	X	X	X
AC Voltmeter			X	X			X
AC Ammeter				X			X
Running Time Meter				X	X	X	
Frequency Meter				X		X	X

Operation Description

The following operation description is intended only as an aid in understanding and servicing of the automatic transfer switch. For example, if after using the Troubleshooting section, follow a particular part of the operation description to understand why or how such a problem occurred.

The service manual descriptions apply to typical models and might not directly relate to the model being serviced. Wiring diagrams referenced in the operation description appear at the end of this section. Note each one has three parts: a pictorial wiring diagram, a schematic, and a parts description reference. The wiring diagrams were selected because they show most available options.

NORMAL OPERATION

Under normal operation, the commercial power line is connected to the Load terminals by the transfer switch contacts K1. Refer to WD (wiring diagram) 619-6288. Contacts K1 are shown closed because they are mechanically held. Contact operation differs only in how they are held in position - either electrically or mechanically.

When commercial power is first applied, voltage sensor relay K6 energizes and completes the circuit to relay coils K3, K4, K5 and K7. See Figure 1. Relay K7 energizes immediately, and if the commercial (Normal) line contacts are not closed, the K1 closing coil (CC) is energized.

Once the transfer switch is picked up by the Normal line side, it is mechanically held in that position and the closing coil de-energized by opening of the K1 cutout switch. The cutout switch is activated by the mechanical interlock.

Relay K6 can be either a voltage sensor with an adjustable dropout 5% lower than the pick up voltage, or a phase loss sensor when the voltage feeding the relay coil drops below the relay holding voltage (about 30 to 50 percent of coil rating).

Relay K3 can be a time delay or regular relay depending upon its setting. When energized it opens the contacts connected across terminal strip TB1-3 and TB1-4, and prevents automatic starting of the generator set.

Relay K4 and K5 functions are described in the Power Outage section.

The K11 interposing relay is used in transfer switches when voltage ratings are over 240 VAC. It provides a disconnect function for the K1 closing coil because the control relays are rated only at 240 VAC. See Figures 1 and 9.

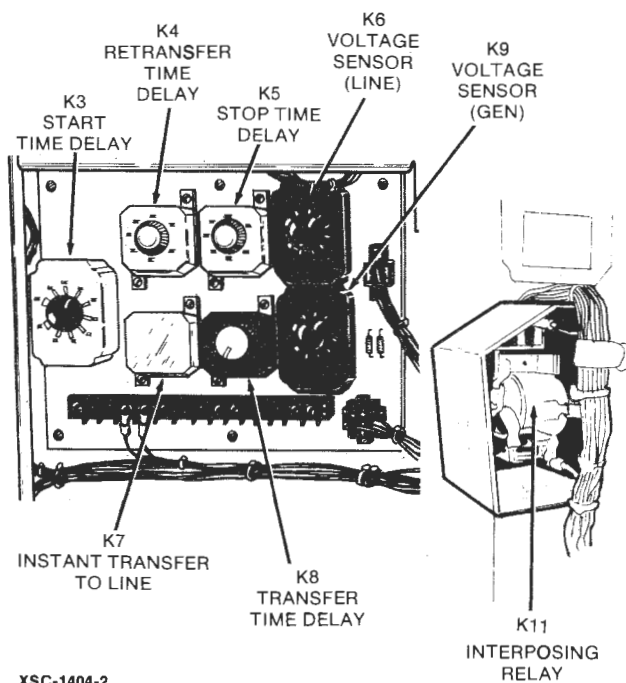


FIGURE 1. CONTROL PC BOARD AND RELAYS

POWER OUTAGE

When a commercial power outage occurs, or the voltage drops 5 percent lower than the setting of relay K6, K6 opens the circuit feeding relays. If the control is not equipped with a K6 relay, the loss of normal voltage is detected only when the voltage drops below the timer coils holding voltage.

Relay K3 when de-energized closes a contact between TB1-3 and TB1-4. The closing and opening of this contact controls starting and stopping of the generator set.

Relay K9 is the generator voltage sensor with an adjustable pickup range of 80 to 90 percent, and a fixed dropout of 5 percent below the pickup point. Relay K9 energizes and connects generator voltage to K8 (time delay transfer relay). Relay K8 is adjustable and can be a time delay or a regular relay. When K8 energizes, its N/O (normally open) contacts close to complete the circuit for the K1-KC (trip coil). The trip coil closes K1-IC (interlock contact) and completes the circuit through K2-CC (closing coil). With the closing of the K2 contacts, the generator set is connected to the load.

GENERATOR SET STARTING CIRCUITS

Sending start and stop signals to the generator set is a basic function of the transfer switch. The starting circuit function of the transfer switch must be compatible with that in the generator set control. The LT/26K transfer switch has either two-wire or three-wire starting circuits described as follows.

Two-Wire Starting

In a two-wire starting circuit, battery voltage (B+) is reconnected by K3 to the remote (RMT) terminal. See Figures 1 and 2. When commercial power fails or falls below the holding voltage of voltage sensor relay K6, it de-energizes. This removes power from K3; and after any time delay, K3 closes the contact between TB1-3 and TB1-4 (B+ and RMT terminals) to initiate generator set starting. The exerciser clock N/O contact is in series with the K3 contact and provides the ground path through switch S3.

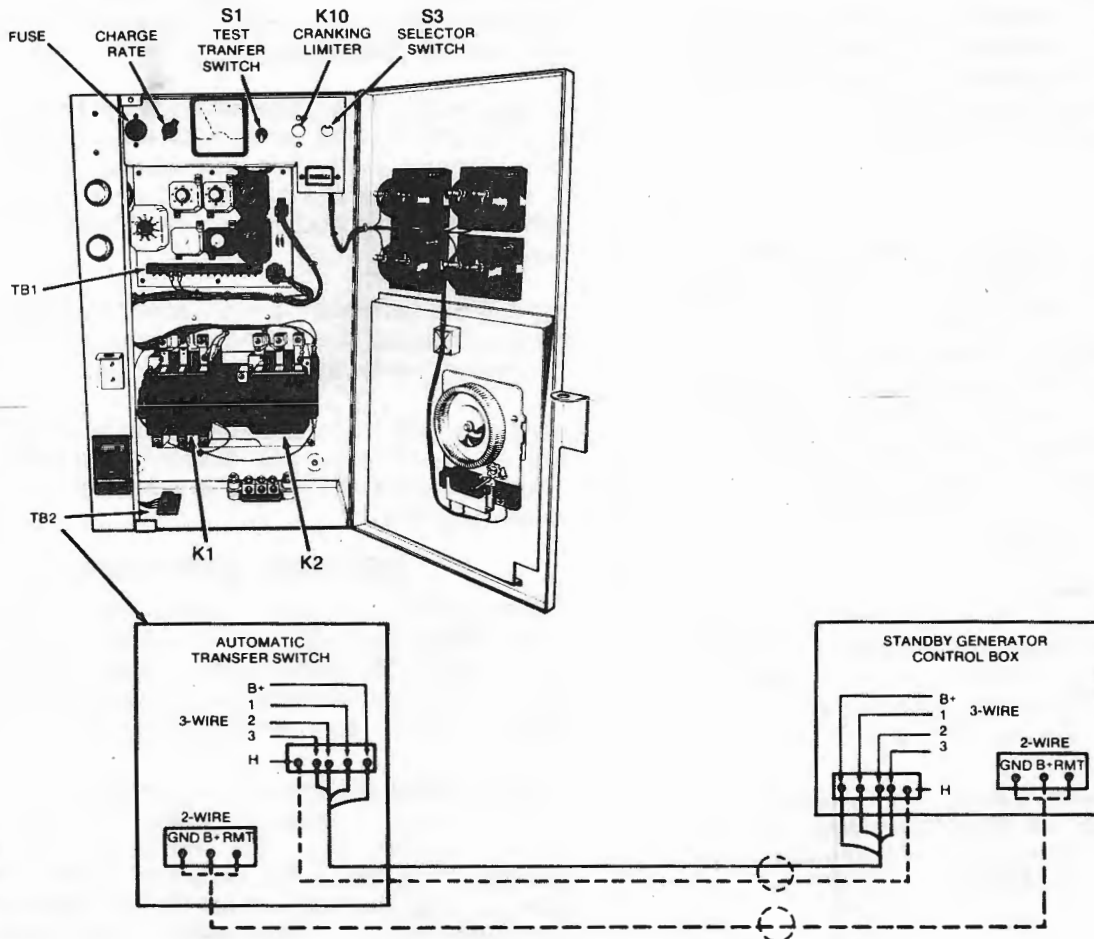


FIGURE 2. CONTROL PANEL AND GENERATOR SET REMOTE WIRING CONNECTIONS

ES-1418

Three-Wire Starting

In a three-wire starting circuit, ground is switched instead of battery voltage. A selector switch S3, described in a following paragraph, is required to be in the Auto position for proper operation. See Figure 2.

When commercial power fails, relay K6 energizes and removes power from K3. After any time delay setting (0.1 to 10 seconds) the K3-TDC (time delay close) contacts close and K3-TDO (time delay open) contacts open. The K3-TDC (contacts connect ground to TB2-3 and signals the generator set to start. The K3-TDO contact is closed when Normal power is available and keeps the generator from starting.

Between terminals TB1-13 and TB1-14 are the generator voltage sensor relay contacts K9. When the sensor detects proper generator voltage, the contacts open and remove ground from relay cranking limiter coil K10. If ground is not removed within 60 seconds, K10 will time out and remove the start signal from the generator set. The cranking limiter K10 is used only with three-wire starting and is described below.

Cranking Limiter

The cranking limiter relay used only on three-wire starting systems is referenced K10 (Figure 2). The limiter is energized when the engine begins to crank. If the engine fails to start within one minute, a heating element in the limiter relay opens the cranking circuit. The limiter must be manually reset.

Selector Switch

This switch (referenced S3) is the operation selector switch used only for three-wire starting systems. The three positions of the switch function are as follows:

Auto: This is the normal operation position. It allows the LT/26K transfer switch to start the generator set and assume load if a power outage occurs. The position connects ground to TB1-3 (through the optional M2 exerciser clock contact) and the automatic start/stop function controlled by the K3-TDC contact.

Hand Crank: This position is used for generator set maintenance. It prevents the transfer switch from starting the generator set and allows starting and stopping only at the generator set control. The Hand Crank position does not connect ground to either TB1-3 or TB1-5.

Stop: This position is used when servicing the generator set. It shuts down the generator set and prevents it from starting by connecting ground to terminal TB1-5 (and TB2-2).

RESTORATION OF COMMERCIAL POWER

When the commercial (Normal) line voltage returns, voltage sensor relay K6 will detect proper line voltage and close the contacts between TB1-1 and TB1-2. This energizes relay K4 (Time Delay Retransfer), and after timing out, energizes K7 (Instant Transfer to Line). The closing of K7 contact energizes K2-TC (trip coil) through the closed K2 interlock contact.

When the K2 trip coil energizes, the opposite K2 interlock contact closes. This completes the circuit to K1-CC (closing coil) through the closed K1 cutout switch. The transfer switch now switches the load back to the commercial (normal) power source.

The generator set is still running but will be stopped when relay K5 (Time Delay Stopping) times out and energizes K3.

SIMULATION OF POWER OUTAGE

To ensure the equipment is ready to perform, the operator should monthly simulate a power outage. The Onan LT/26K Transfer Switch has a Test Transfer Switch (S1) on the inside panel to provide this function. See Figures 2 and 7.

S1 has two positions, Normal and Test. In the Normal position, the transfer switch is set for automatic operation. When placed in the Test position, a start signal is sent to the generator set. The generator set will start and assume load as long as the switch is in this position.

Moving the switch to Normal causes load transfer to the commercial (Normal) power source after K4 relay retransfer time delay expires.

A remote Test Transfer Switch or added area protection equipment would be connected to TB1-11 and TB1-12. If used, the jumper is removed from across these terminals.

VOLTAGE SENSORS

Voltage sensors allow the transfer switch to react to a fixed voltage point (95 percent of pick-up point) and to an adjustable pickup voltage (optional for three-phase sensor). Adjustable single-phase voltage sensing is standard equipment for the generator output.

If the commercial (Normal) line voltage falls to the K6 drop-out point, it de-energizes and opens K3 (Time Delay Starting) relay. K3 signals starting of the generator set. When the generator voltage reaches pickup value of voltage sensor K9, transfer of load will take place after any time delay of K8 (Time Delay Transfer).

When the commercial line voltage returns and reaches the K6 pickup voltage, the relay closes and initiates load retransfer after any time delays. For troubleshooting, relay K6 can be bypassed by placing a jumper between TB1 terminals 1 and 2.

TIME DELAYS

All time delay relays are mounted on a PC board except the optional preheat relay which is mounted on the door above the exerciser clock. See Figures 1 and 2. The time delay functions of relays K3, K4, K5 and K8 are optional. The following is a brief functional description of each. Refer to the Adjustments section for proper setting procedure.

Start Time Delay K3

This is a brief time delay relay (adjustable from 0.1 to 10 seconds) preventing generator set starting from short duration power interruptions. If the interruption exceeds the delay setting of K3, it signals the generator set to start. The circuit function of K3 is described in the section titled "Generator Set Starting Circuits".

Stop Time Delay K5

This relay begins timing when the load is retransferred to the commercial (Normal) power source. At the end of delay (adjustable from 3 to 300 seconds),

the K5 contact closes and energizes K3 which stops the generator set. For troubleshooting, relay K5 can be bypassed by adding a jumper between TB1-7 and TB1-8.

Transfer Time Delay K8

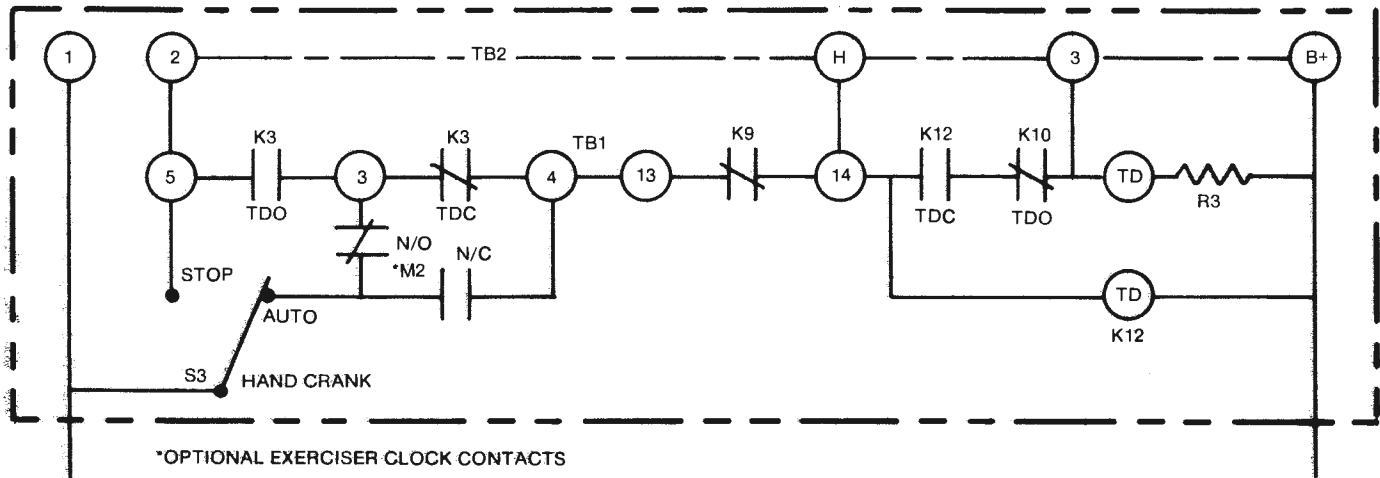
This relay starts timing when the generator voltage satisfies the K9 generator voltage sensor. This brief time delay (adjustable from 0.3 to 30 seconds), allows the generator set to stabilize before load is applied.

Retransfer Time Delay K4

This time delay starts the moment commercial (Normal) line voltage returns and K6 is satisfied. After the delay (adjustable from 2 to 30 minutes), K4 contacts close and energize the instant transfer to line relay K7. For troubleshooting, relay K4 can be bypassed by adding a jumper between TB1-9 and TB1-10.

Preheat Relay (Kit Option K12)

This relay is mounted inside the cabinet door as shown in Figure 2. This relay delay allows 3-wire start preheat function prior to starting and is adjustable from 0.6 to 60 seconds. Figure 3 is a schematic showing K12 circuit connections.



ES 1525

FIGURE 3. SCHEMATIC/WIRING DIAGRAM

AUXILIARY CONTACTS (OPTIONAL)

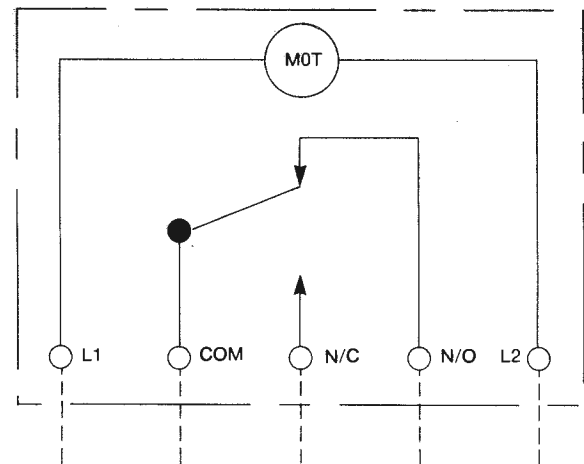
A switch with one normally open and normally closed contact can be added to the Normal and Emergency side of the transfer switch. They are used for external alarm or control circuitry and have a rating of 10 amperes at 480 VAC. Wiring is terminated at the auxiliary switch.

EXERCISER CLOCK (OPTIONAL)

The exerciser clock is set by the factory to provide one-half hour of exercise each week. Onan recommends that the generator set be operated for 30 minutes each week to remove moisture and to keep a film of lubricating oil on the engine parts.

Exercising for one long period is better than several short periods. The normal exercise period is from 12:00 to 12:30 p.m. on Saturdays. If this schedule is not satisfactory, the exerciser program may be changed using the procedure in the Adjustments section.

The contacts in the exerciser clock are basically a single-pole double-throw switch as shown in Figure 4. When the clock switch is activated, the N/C contact closes and sends a start signal (ground) to the generator set via TB1-4. See Figure 3. Transfer switches without an exerciser clock have a jumper between Selector Switch S3-3 and TB1-3.



ES-1538

FIGURE 4. EXERCISER SCHEMATIC

Transfer switches rated at 480 or 600 volts AC use a step-down transformer to furnish 120 volts AC to the clock motor. See Figure 5. The transformer primary has an additional tap and allows it to be used for either voltage. It is located inside the cabinet behind the nameplate as shown.

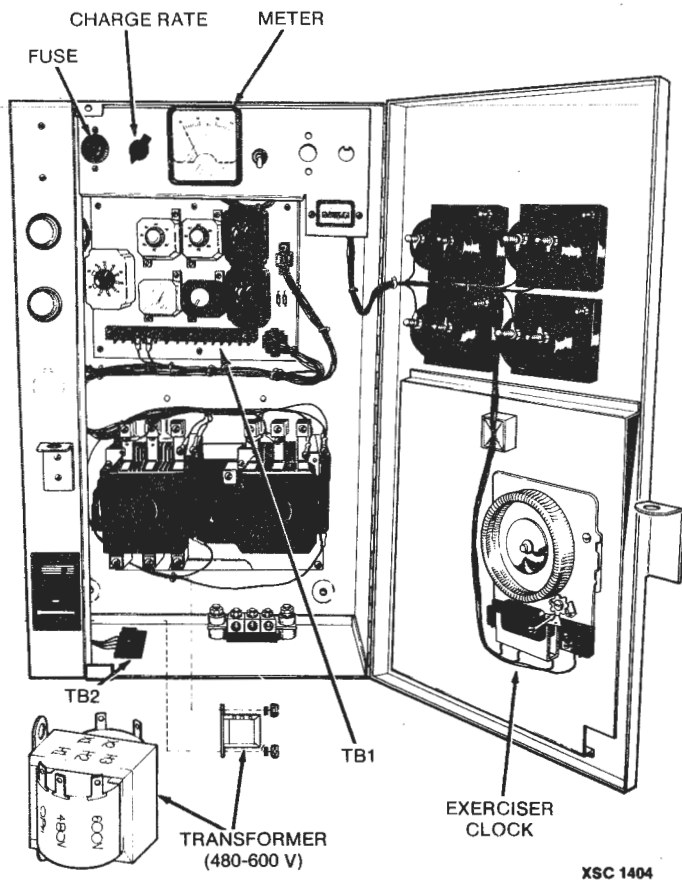
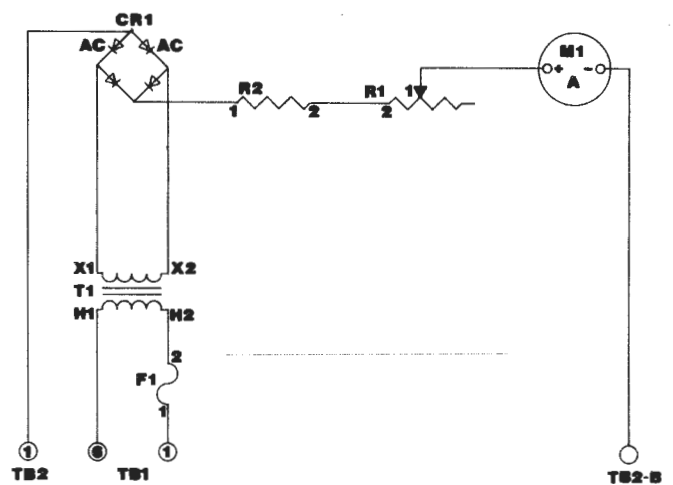


FIGURE 5. EXERCISER CLOCK AND CHARGER

BATTERY CHARGER (OPTIONAL)

A trickle battery charger is available for 12-volt battery systems. A knob on the panel allows adjustment of the charge rate from 5 to 300 milliamperes. It also has an ammeter and a fuse for circuit protection as shown in Figure 5.

A schematic diagram of the charger is shown in Figure 6. AC power connections are at TB1 terminals 1 and 6; DC output connections are at TB2 terminals 1 and B+.

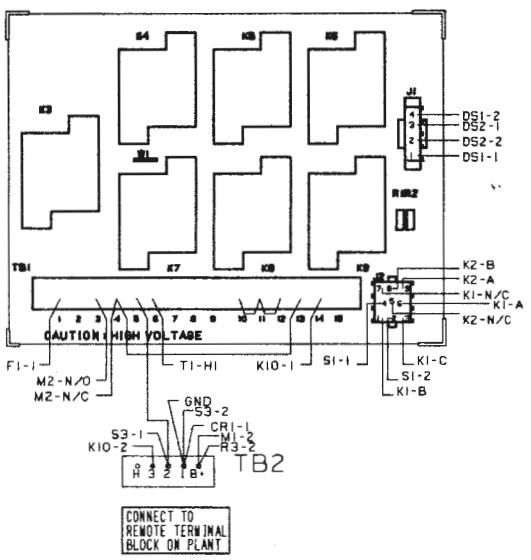
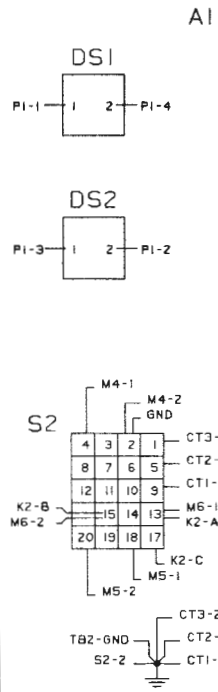
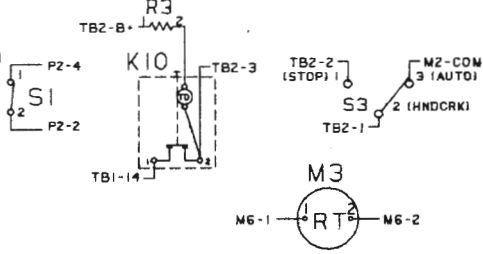
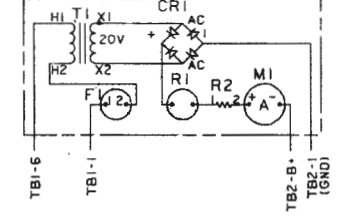


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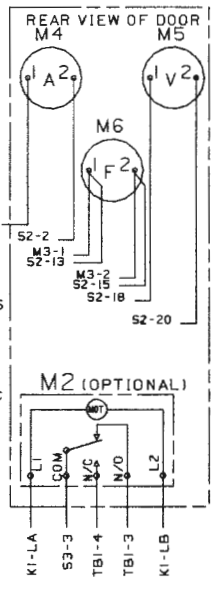
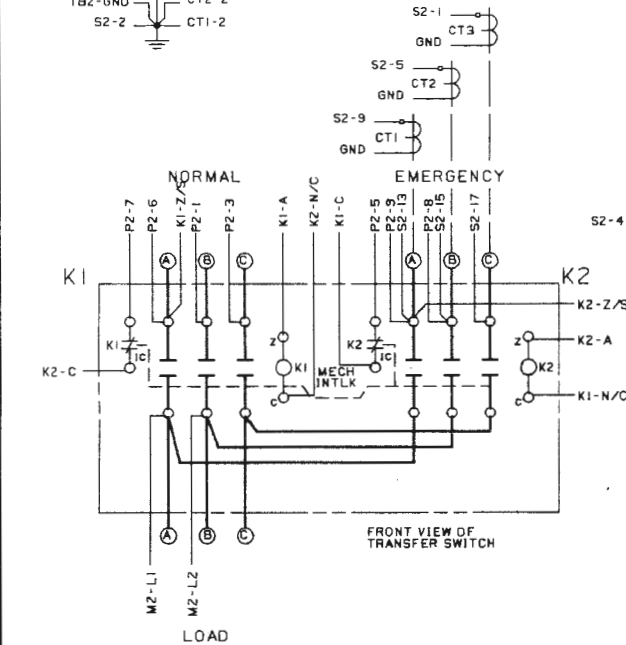
FIGURE 6. BATTERY CHARGER SCHEMATIC

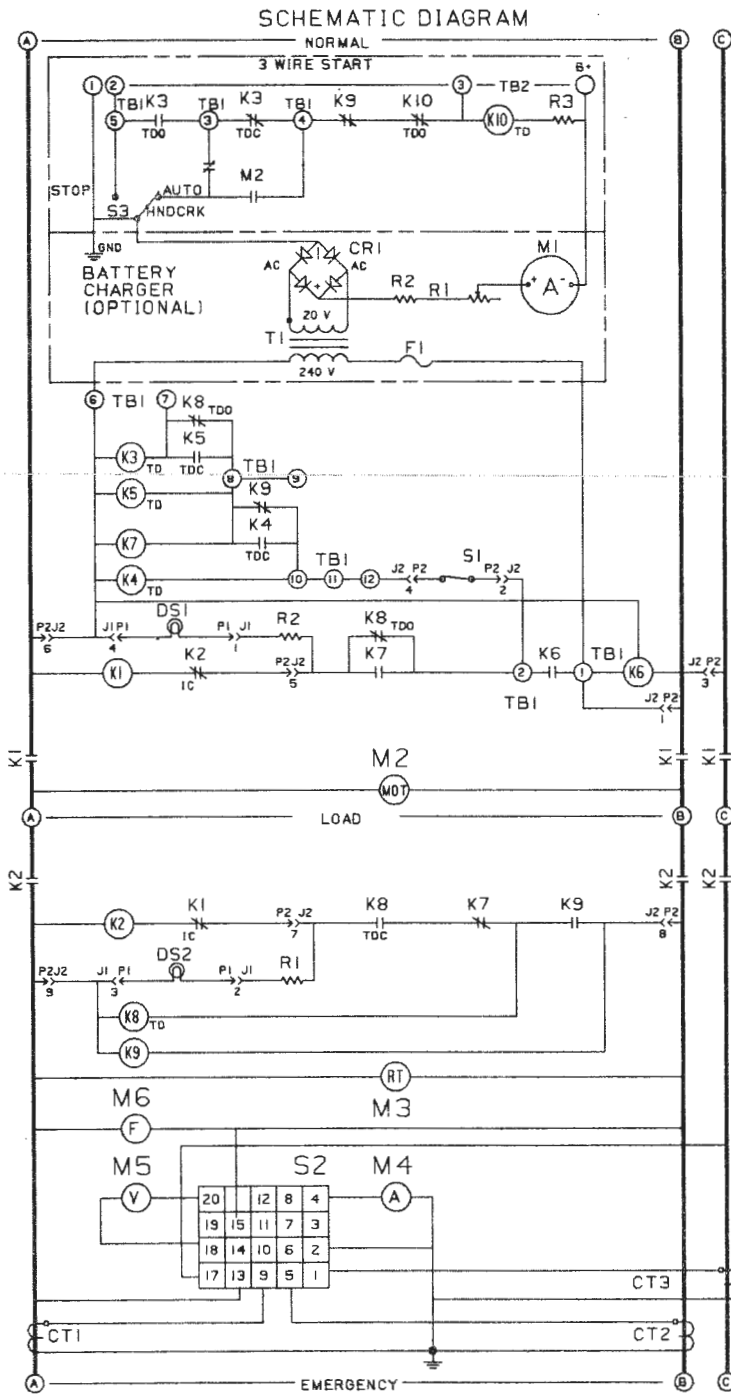
619-6227 C

A2 BATTERY CHARGER (OPTIONAL)



- NOTES:
- 3 WIRE STARTING
ALL COILS OPERATE ON 208-240 VAC EXCEPT K10
 - TRANSFER SWITCH ELECTRICALLY HELD BOTH SIDES
IC - INTERLOCK CONTACT
 - UNLESS OTHERWISE NOTED, ALL COMPONENTS ARE SHOWN IN DE-ENERGIZED POSITION
 - AFTER TEST OR EXERCISE WITH LOAD PLANT WILL RUN FOR DURATION OF TIME DELAYS
 - WHEN REMOVING J2 PLUG, SELECTOR SW ON PLANT OR L.T. MUST BE IN "STOP" POSITION OR GEN WILL RUN AND GEN SIDE OF PANEL WILL BE ENERGIZED
 - INSTALL JUMPERS AS FOLLOWS ON A1:
TB1-10 TO TB1-11
TB1-11 TO TB1-12
 - TO ADD AREA PROTECTION EQUIPMENT OR REMOVE TEST SWITCH, REMOVE JUMPER BETWEEN TB1-11 AND TB1-12





PARTS LIST		
REF DES	QTY	DESCRIPTION
A1	1	PCB ASSY-XFR SW CONT
A2	1	BATTERY CHARGER (OPTIONAL)
CT1,2,3	3	TRANSFORMER-CURRENT -01,-03
	3	TRANSFORMER-CURRENT -02,-04
DS1	1	LAMP-HOUSING (WHITE)
	1	NAMEPLATE-NORMAL (DS1)
DS2	1	LAMP-HOUSING (YELLOW)
	1	NAMEPLATE-EMERGENCY (DS2)
	2	LAMP-NEON
K1,K2	1	TRANSFER SWITCH (30A) -01 (208V)
	1	TRANSFER SWITCH (60A) -02 (208V)
	1	TRANSFER SWITCH (30A) -03 (240V)
	1	TRANSFER SWITCH (60A) -04 (240V)
K3	1	RELAY-TIME DELAY STARTING
		.1 TO 10 SEC ON DE-ENERGIZATION
K4	1	RELAY-TIME DELAY RETRANSFER
		2 TO 30 MIN ON ENERGIZATION
K5	1	RELAY-TIME DELAY
		STOPPING AFTER RETRANSFER
		3 TO 300 SEC ON ENERGIZATION
K6	1	RELAY-VOLTAGE SENSOR
		3 PHASE LINE SIDE
K7	1	RELAY-INSTANT TRANSFER TO LINE
K8	1	RELAY-TIME DELAY TRANSFER
		.3 TO 30 SEC ON ENERGIZATION
K9	1	RELAY-VOLTAGE SENSOR
		1 PHASE GEN SIDE
K10	1	RELAY-CRANKING LIMITER
M2	1	CLOCK-PLANT EXERCISER(OPT)
M3	1	METER-TIME TOTALIZING
M4	1	AMMETER-AC (0-40) -01,-04
	1	AMMETER-AC (0-75) -02,-04
M5	1	VOLTMETER-AC 0-300V
M6	1	METER-FREQUENCY 55-65HZ
R3	1	RESISTOR,3 OHM,10 WATT
S1	1	SWITCH-TEST TRANSFER
S2	1	SWITCH-ROTARY (VOLT & AMP)
	1	BRACKET ASSY-SSCRN
S3	1	SWITCH-SELECTOR
TB2	REF	TERMINAL BLOCK
	1	MARKER STRIP

619-6227 C

22,749	PROD RLSE				
ER NO.	LTR	REVISION	ENR	CKR	DATE

DASH NO	MODEL NO	DASH NO	MODEL NO
-01	LTBEA30-4U/26503F	-03	LTBEA30-5DU/26503F
-02	LTBEA60-4U/26503F	-04	LTBEA60-5DU/26503F

Onan ONAN CORPORATION
MINNEAPOLIS, MINNESOTA

DATE 8-9-83 DR MRD ENGR JTM CKR JZ

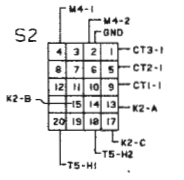
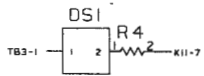
TITLE
WD-AUTOMATIC XFR SW

SIMILAR TO DWG NO. SHT DWG SIZE
619-6152 619-6227 OF C

FIGURE 8. SCHEMATIC DIAGRAM, THREE-PHASE, 3-WIRE START, WITH OPTIONS

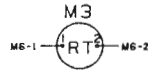
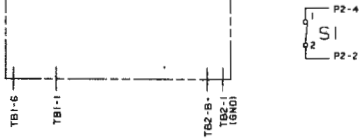
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LEFT FRONT SIDE OF BOX
INSIDE VIEW

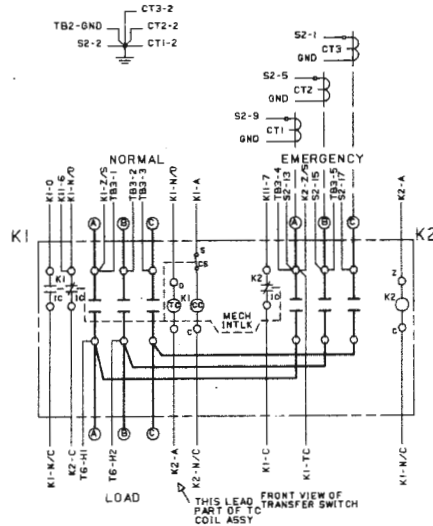
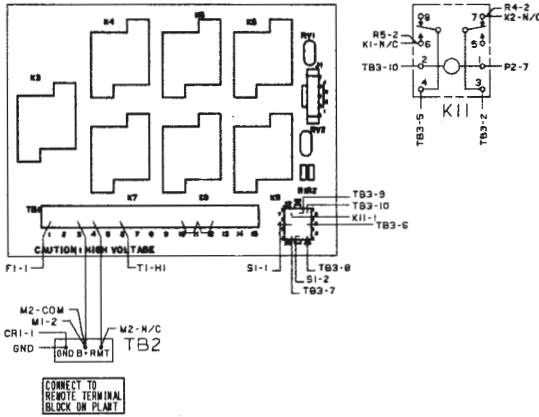


INSIDE OF BOX

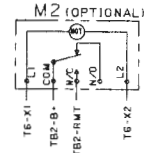
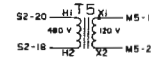
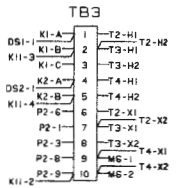
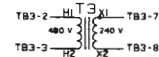
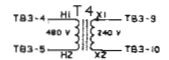
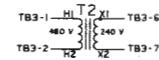
A2 BATTERY CHARGER (OPTIONAL)



A1



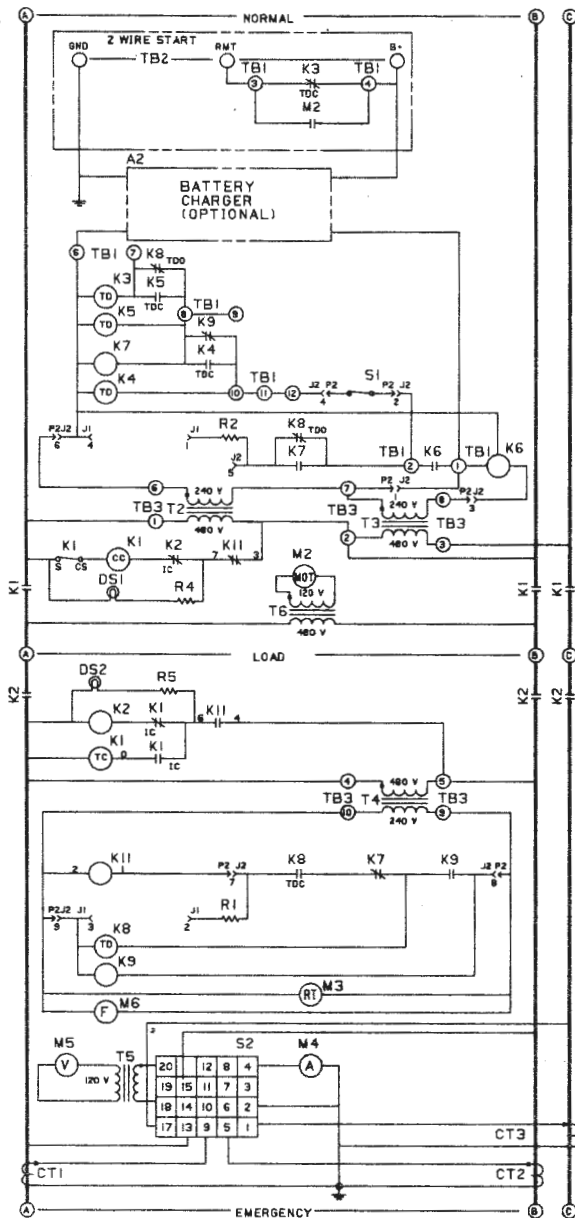
INSIDE VIEW OF DOOR



NOTES:

- 2 WIRE STARTING
ALL COILS OPERATE ON 240 VAC
EXCEPT X1, K2
- TRANSFER SWITCH MECHANICALLY
HELD LINE SIDE
IC - INTERLOCK CONTACT
TC - TRIP COIL
CS - CUTOFF SWITCH
CC - CLOSING COIL
- UNLESS OTHERWISE NOTED, ALL COMPONENTS
ARE SHOWN IN DE-ENERGIZED POSITION
- AFTER TEST OR EXERCISE WITH LOAD
PLANT WILL RUN FOR DURATION OF
TIME DELAYS
- WHEN REMOVING J2 PLUG, SELECTOR SW
ON PLANT OR L.T. MUST BE IN "STOP"
POSITION OR GEN WILL RUN AND GEN
SIDE OF PANEL WILL BE ENERGIZED
- INSTALL JUMPERS AS FOLLOWS ON A1:
TB1-10 TO TB1-11
TB1-11 TO TB1-12
- TO ADD AREA PROTECTION EQUIPMENT
OR REMOTE TEST SWITCH, REMOVE
JUMPER BETWEEN TB1-11 AND TB1-12

SCHEMATIC DIAGRAM



REF	DES	QTY	DESCRIPTION
A1		1	PCB ASSY-XFR SW CONT
A2		1	BATTERY CHARGER (OPTIONAL)
CT1,2,3		3	TRANSFORMER-CURRENT -01
		3	TRANSFORMER-CURRENT -02
DS1		1	LAMP-HOUSING (WHITE)
		1	NAMEPLATE-NORMAL (DS1)
DS2		1	LAMP-HOUSING (YELLOW)
		1	NAMEPLATE-EMERGENCY (DS2)
		2	LAMP-NEON
K1,K2		1	TRANSFER SWITCH (30A) -01
		1	TRANSFER SWITCH (60A) -02
		1	LATCH-MECHANICAL
K3		1	RELAY-TIME DELAY STARTING
		1	J1 TO 10 SEC ON DE-ENERGIZATION
K4		1	RELAY-TIME DELAY RETRANSFER
		2	TO 30 MIN ON ENERGIZATION
K5		1	RELAY-TIME DELAY
		1	STOPPING AFTER RETRANSFER
		3	TO 300 SEC ON ENERGIZATION
K6		1	RELAY-VOLTAGE SENSOR
		3	PHASE LINE SIDE
K7		1	RELAY-INSTANT TRANSFER TO LINE
K8		1	RELAY-TIME DELAY TRANSFER
		3	TO 30 SEC ON ENERGIZATION
K9		1	RELAY-VOLTAGE SENSOR
		1	PHASE GEN SIDE
K11		1	RELAY-INTERPOSING
		1	COVER-RELAY
M2		1	CLOCK-PLANT EXERCISER(OPT)
M3		1	METER-TIME TOTALIZING
M4		1	AMMETER-AC (0-40) -01
		1	AMMETER-AC (0-75) -02
M5		1	VOLTMETER-AC 0-480V
M6		1	METER-FREQUENCY 55-65HZ
R4,5		2	RESISTOR ASSY
S1		1	SWITCH-TEST TRANSFER
S2		1	SWITCH-ROTARY (VOLT & AMP)
		1	BRACKET ASSY-SSCRN
T2,4		2	TRANSFORMER
T3		1	TRANSFORMER
T5		1	TRANSFORMER
T6		1	TRANSFORMER-CLOCK (OPT)
TB2		1	TERMINAL BLOCK
		1	MARKER STRIP
TB3		1	REF TERMINAL BLOCK

ER NO.	LTN NO.	REVISION	ENGR	CHKR	DATE
24,298	D	1	ADD 301-89791 (COVER-RELAY)	JM	6-4-84
23,834	C	1	K7 WAS 307-2296	JM	6-2-84
23,648	B	1	M5 WAS 302-1711 (B)	JM	6-1-84
23,036	A		SUPDS5-C DWD, SAME NO W/CHGS, DATED 5-23-83		

SAMP REL	DASH NO	MODEL NO	DATE	BY	CHKD	DATE
PROD REL	-01	LTGCA30-4XU/26503F	10-24-83	WRD	JTM	GJC
PROD REL	-02	LTGCA60-4XU/26503F				
PROD REL						
		277/480V, 3PH, 4W, 60HZ	SIMILAR TO	DATE	SHT	DATE
			619-6104	619-6119	05	10

FIGURE 9. SCHEMATIC DIAGRAM, THREE-PHASE, 2-WIRE START, WITH OPTIONS

Adjustments

This section provides information for making adjustments to the time delays, exerciser clock and battery charger. Some adjustments require that AC power be applied to the transfer switch. Use extreme caution to avoid contact of exposed terminals within the cabinet since they present a shock hazard.

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

CONTROL RELAYS

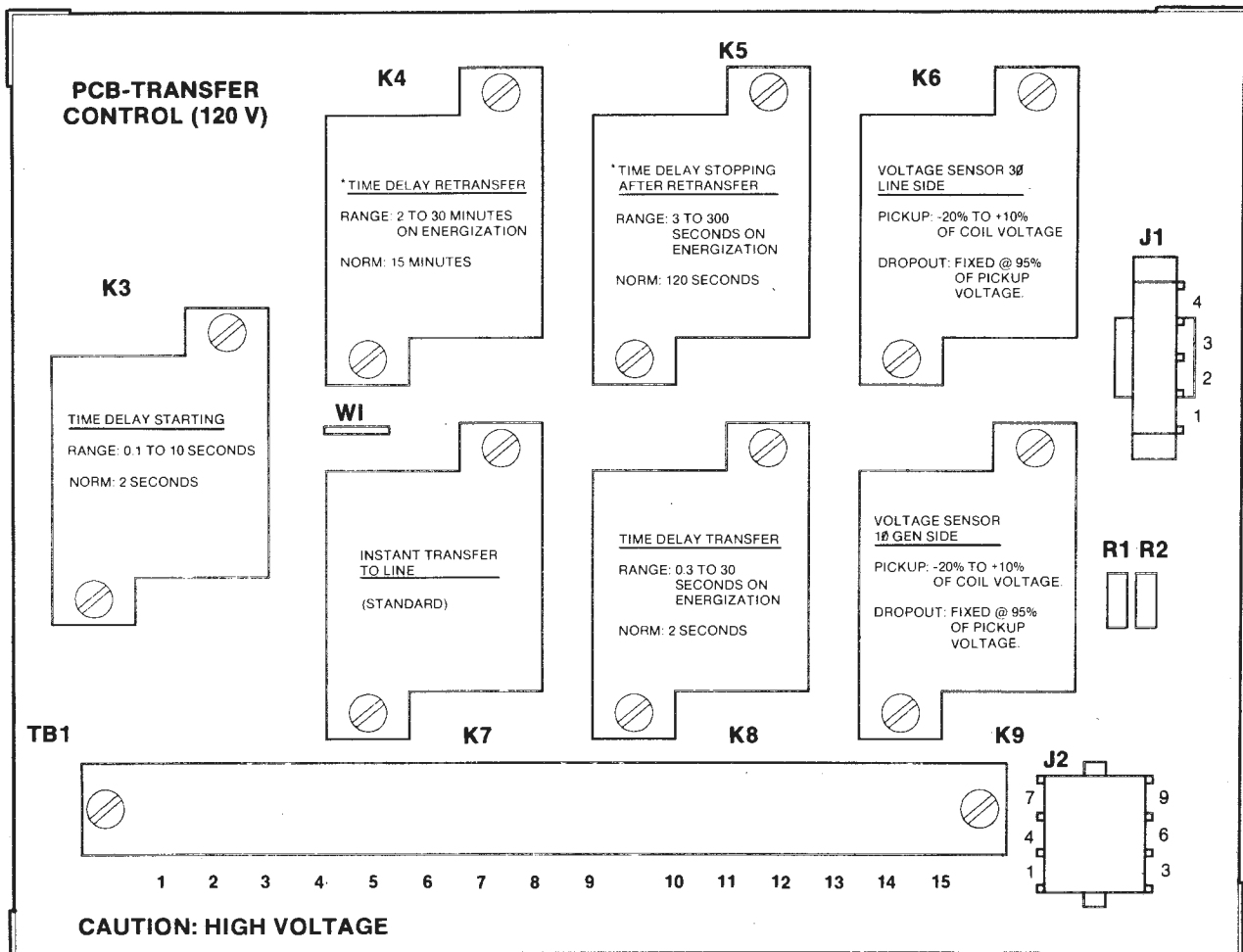
The relay function and location on the control printed circuit board is shown in Figure 10. Relays K4 and K5 are optional. The time delay functions of relays K3, K4, K5, K8 and the pickup adjustment of K6 are other options.

The range and normal (Norm) settings are listed for the adjustable relays. When adjustment is necessary, use the following procedure.

1. Relays K3, K4, K5 and K8 are adjusted by turning a control knob on top of the relay. The control knob pointer is referenced to scale divisions on the relay representing percentages of the range (0 to 100 percent).

For example: K5 has a range of 3 to 300 seconds and the pointer is set on the 4th (40 percent) scale division. Thus 40 percent of 300 seconds equals 120 seconds, the approximate normal setting for this relay.

2. Voltage sensor relays K6 and K9 have the same range of pickup adjustment (-20% to +10% of coil voltage). The relay dial voltage references are different for the single-phase and three-phase relays. Refer to Table 1 for the approximate voltage settings.



*OPTIONAL RELAYS

FIGURE 10. RELAY FUNCTION AND ADJUSTMENT

SC-1407

CAUTION Do not set voltage sensor above rating of transfer switch or sensor will not operate. Haphazard adjustment might result in abnormal operation of the transfer switch.

TABLE 1.
VOLTAGE SENSOR PICK-UP SETTINGS

DIAL SETTING	APPROXIMATE AC PICK-UP VOLTAGE	
	Single-Phase	Three-Phase
1	190	178
2	202	189
3	215	200
4	225	210
5	233	220
6	241	230
7	251	240
8	264	250
9	274	260
10	284	268

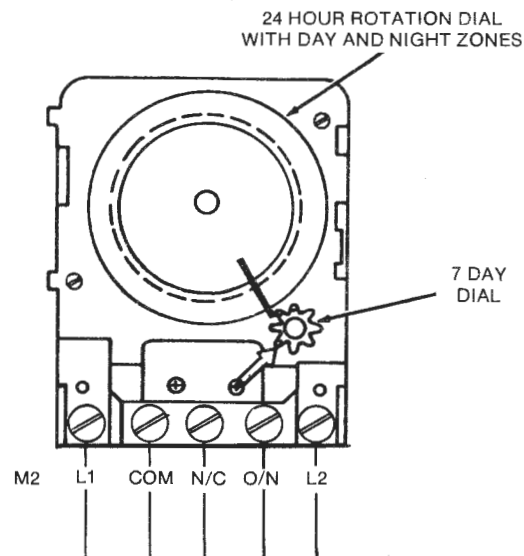
EXERCISER CLOCK

The exerciser clock initiates generator set starting and exercising without load at preset intervals. The large dial divides the 24-hour day into 15-minute intervals. A smaller spoked dial divides the week into one-day segments. See Figure 11.

Before setting clock, place S3 Selector Switch in the Stop position. This will prevent inadvertent starting of the generator set while setting the clock.

The screw is removed from the 7-spoke day wheel corresponding to the day of exercise. Set wheel until day of week is opposite the metal arrow screwed to the nameplate. If setting is being made later than 2:00 a.m., turn wheel clockwise until present day of week is opposite arrow. Between midnight and 2:00 a.m., setting must be made to day just ended at midnight.

Return S3 Selector Switch to the Auto position.



SC 1437

FIGURE 11. SETTING OF EXERCISER

BATTERY CHARGER

Battery charger operation is checked by opening the cabinet door and observing the milliammeter operation. Check the fuse on the battery charger panel. Replace if necessary with the same type ampere size fuse.

As a starting point, set Charger Rate control for about 100 milliamperes. The correct setting will vary with application and battery size. Final setting can only be determined by testing battery with a hydrometer often for several weeks. The specific gravity of a fully charged battery should be at 77°F (25°C).

Transfer Switch Assembly

Series LT/26K transfer switches are two or three pole. The contact assemblies make and break the current flow to the load. The transfer switch is electrically and mechanically interlocked to prevent simultaneous closing to both power sources.

When closed to either Normal or Emergency power source, the contacts are either mechanically or electrically held depending upon chosen options. Mechanically held contacts are held closed by a latch that disconnects the pull-in coil. This eliminates hum during normal operation.

This section covers the service procedures for components of the transfer switch assembly. The following sections cover the removal and replacement of serviceable components.

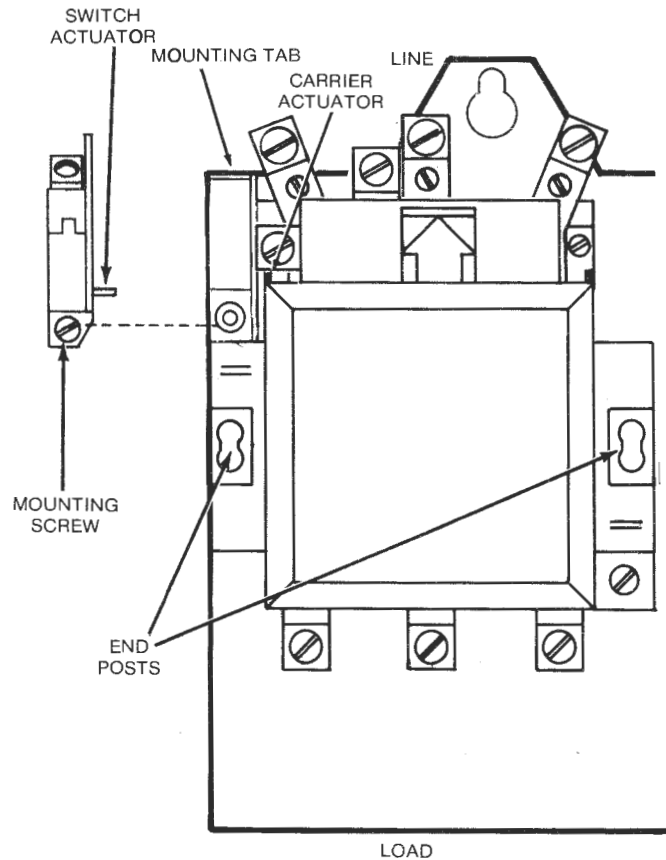
REPLACING AUXILIARY SWITCH

WARNING

The transfer switch presents a shock hazard that might cause serious personal injury or death unless all AC power is removed. Be sure to disconnect the generator set starting battery and remove the normal AC power before attempting service.

An optional auxiliary switch may be fitted to the Normal and Emergency side of the transfer switch as shown in Figure 12. The auxiliary switch is secured to the transfer switch by a single mounting screw.

If an ohmmeter check indicates a faulty switch, first remove the mounting screw and switch. Then install new switch and transfer leads from old switch to the new one to prevent wiring error. When mounting, be sure bottom of switch is properly engaged in the mounting tab and that the switch actuator is inserted under the carrier actuator. Tighten mounting screw.



ES-1539-1

FIGURE 12. INSTALLING AUXILIARY SWITCH

Before restoring power to the transfer switch, manually operate the movable contact carrier assembly to assure free movement (push on contact carrier end posts). On mechanical held switches, slide the latch manual release button in direction of arrow to open contactor.

REPLACING MAIN CONTACTS

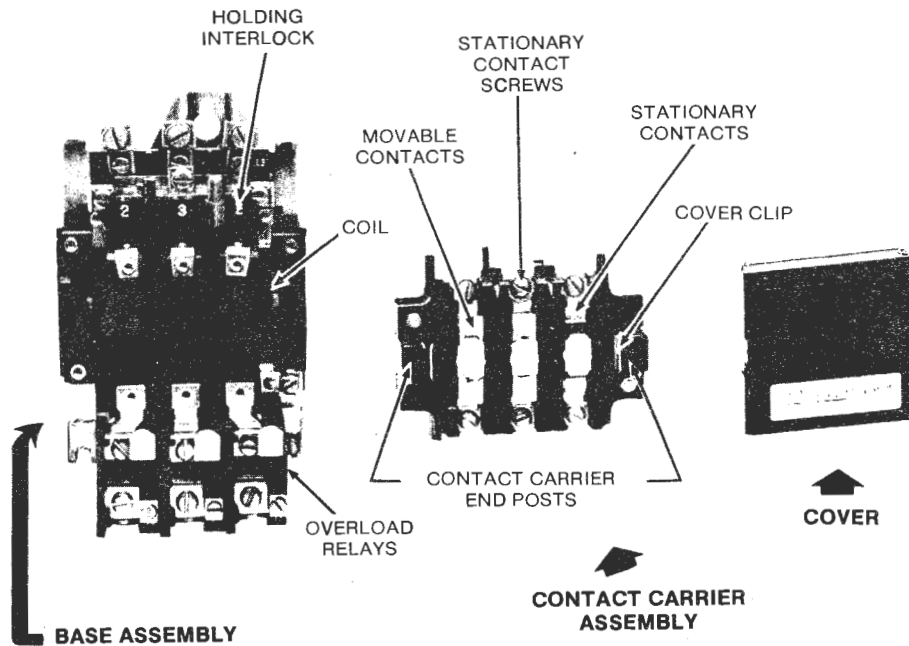
WARNING *The transfer switch presents a shock hazard that might cause serious personal injury or death unless all AC power is removed. Be sure to disconnect the generator set starting battery and remove the normal AC power before attempting service.*

Inspection of the main contacts is done by pushing the cover clips outward and removing the contact cover. See Figure 13. All portions of contacts are now visible. It is not necessary to remove contact carrier assembly shown in Figure 13 to replace main contacts. If contacts need replacement, use the following procedure.

1. Lift spring-loaded contact retainers upward and pull out movable contacts.
2. Loosen stationary contact screws and lift out contacts.

3. Install new stationary contacts and tighten contact screws.
4. Install new movable contacts under retainers.
5. Install cover and secure with cover clips.
6. Manually operate the movable contact carrier assembly to assure free movement (push on contact carrier end posts). On mechanical held switches, slide the latch manual release button in direction of arrow to open contactor.

CAUTION *The transfer switch cannot function correctly unless properly assembled. Be sure all stationary contact screws are tightened, cover and cover clips are in place before power is restored.*



ES-1540

FIGURE 13. TRANSFER SWITCH DISASSEMBLY

REPLACING CLOSING COIL

WARNING *The transfer switch presents a shock hazard that might cause serious personal injury or death unless all AC power is removed. Be sure to disconnect the generator set starting battery and remove the normal AC power before attempting service.*

The closing coil is located under the contact carrier assembly. See Figure 13. To gain access to the coil, either for testing or replacement, use the following procedure. Reference the resistance readings in Table 2 for testing with an ohmmeter.

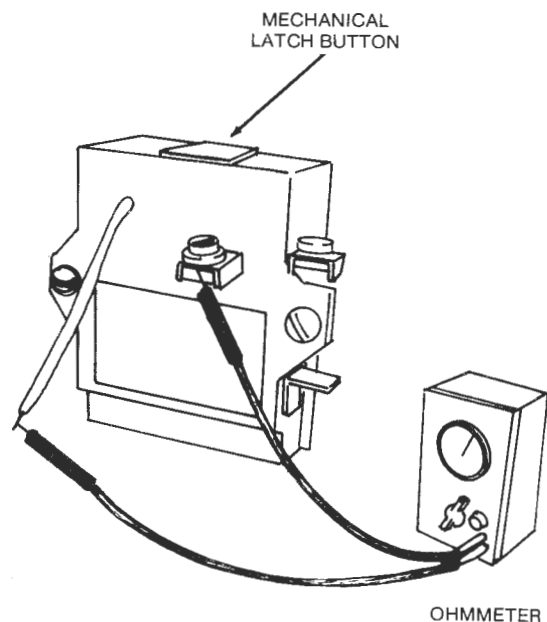
1. Remove mechanical latch (if used) by backing out two mounting screws.
2. Push the cover clips outward and remove the contactor cover.
3. Loosen all stationary contact screws. Pull out contact carrier assembly. All contacts and screws will remain captive to the assembly if it is not turned over.
4. Remove coil by grasping the tabs at each end and lifting straight up.
5. Insert coil with the tabs up and coil contacts against wipers.
6. Place carrier assembly in position and tighten stationary contact screws.
7. Install mechanical latch (if used) and top cover. Secure cover with the cover clips.
8. Manually operate the movable contact carrier assembly to assure free movement (push on contact carrier end posts). On mechanically held switches, slide the latch manual release button in direction of arrow to open contactor.

CAUTION *The transfer switch cannot function correctly until properly assembled. Be sure all stationary contact screws are tightened, cover and cover clips are in place before power is restored.*

REPLACING MECHANICAL LATCH (IF USED)

WARNING *The transfer switch presents a shock hazard that might cause serious injury or death unless all AC power is removed. Be sure to disconnect the generator set starting battery and remove the normal AC power before attempting service.*

The mechanical latch and coil assembly is located above the main body of the transfer switch. See Figure 14. The latch is most commonly used on the line (Normal) contactor. It allows the line closing coil to be de-energized, reducing hum, vibration, and extended coil life expectancy.



ES-1537

FIGURE 14. TESTING MECHANICAL LATCH TRIP COIL

TABLE 2. CLOSING COIL RESISTANCE IN OHMS
@ 77°F (25°C) ±10% (2 & 3 POLE SWITCHES)

VOLTAGE/FREQUENCY	30 AMPERE	60 AMPERE
110V. 50 Hz, 120V. 60 Hz	36.5	19.5
208/220V. 60 Hz	135	68
208/220V. 50 Hz, 240V. 60 Hz	146	78
440V. 60 Hz	545	282
440V. 50 Hz, 480V. 60 Hz	595	320
550V. 50 Hz, 600V. 60 Hz	930	514
120V. 50 Hz	40	25.8
240V. 50 Hz	160	107
480V. 50 Hz	655	440
600V. 50 Hz	1020	703

Trip coil resistance readings are listed in Table 3 and are measured from the trip coil lead to the terminal shown in Figure 14. The mechanical latch is removed from the transfer switch by backing out two mounting screws.

After assembling the latch to the transfer switch, manually operate the movable contact carrier assembly to assure free movement (push on contact carrier end posts). Slide the latch manual release button in direction of arrow to open contactor.

CAUTION *The transfer switch cannot function correctly unless properly assembled. Be sure all stationary contact screws are tightened, cover and cover clips are in place before power is restored.*

**TABLE 3. TRIP COIL RESISTANCE IN OHMS
@ 77°F (25°C) ±10% (30-60 AMP)**

VOLTAGE, 50/60 Hz	RESISTANCE
110	39.2
208/220	110
277	248
480	648
600	1020
240	160

Troubleshooting

Troubleshooting/servicing of the LT/26K transfer switch requires service personnel to have a current schematic diagram for the specific unit being serviced. This is necessary due to the numerous control group options, voltage codes and adders that may appear in one transfer switch and not another.

This troubleshooting procedure will use one typical schematic diagram as shown in Figure 15. When troubleshooting other units using different options and adders, apply similar approach or logic to the circuits.

If a problem is evident, check the more logical or more easily accessible components first. For example: generator set does not start on power outage -check manual starting at the engine control first. The

problem could simply be a bad battery or battery connection.

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

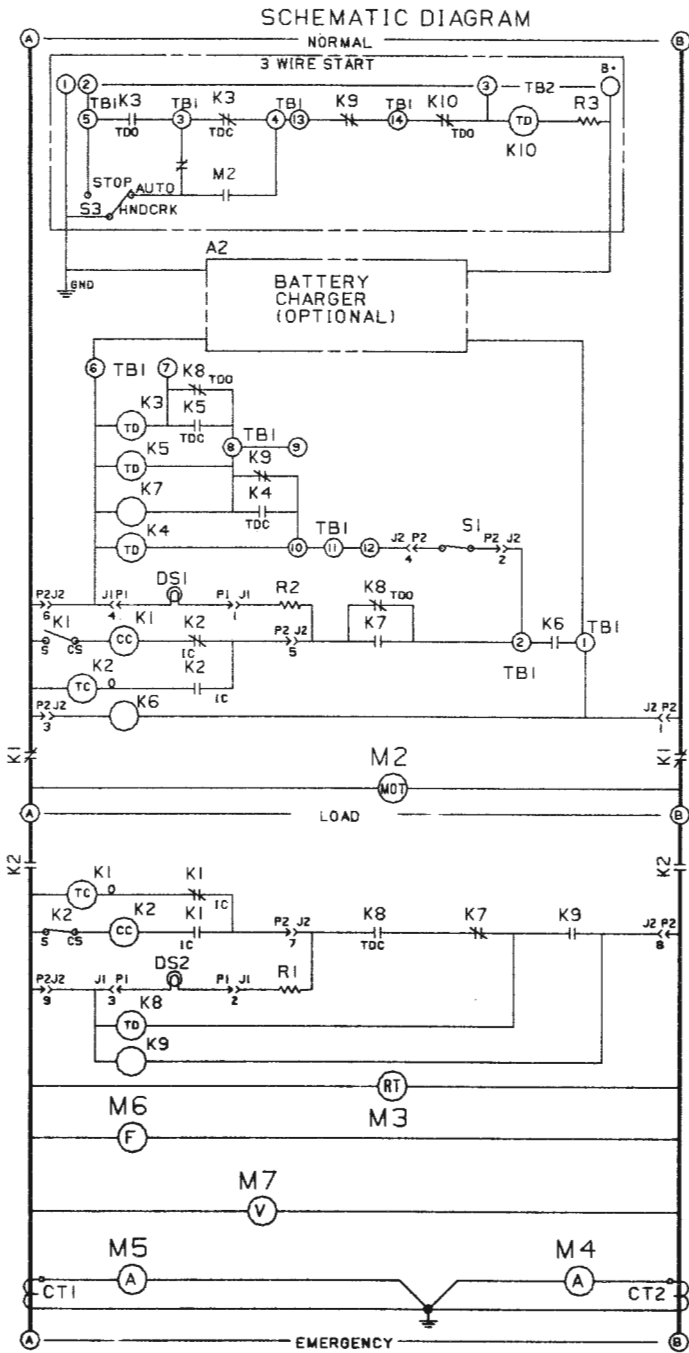
TB1 TERMINAL BOARD

Within the transfer switch cabinet, the TB1 terminal board can furnish a handy reference or test point when troubleshooting. The first part of this section will list the terminals, which circuit or components are connected there, and the voltage present when load is connected to the Normal source. All voltages and terminals apply to the schematic diagrams shown in Figures 15 and 16.

**TABLE 4. TB1 TERMINAL CONNECTIONS
(APPLIES ONLY TO FIGURE 15)**

TB1 TERMINAL	CONNECTION	*TERMINAL VOLTAGE
1	Normal Line "B", Jack J2-1, K6 coil and contact, optional battery charger.	240 VAC to TB1-6 (Normal line "A")
2	Contact of relays K6, K7 and K8; Jack J2-2.	240 VAC to TB1-6 (Normal line "A")
3	Relay K3 common contacts, exerciser clock M2 N/C (normally closed) contact.	0 VDC to gnd.
4	K3 N/C contact, M2 N/O (normally open) contact, jumper to TB1-13.	0 VDC to gnd.
5	K3 N/O contact, S3 stop terminal, TB2-2	0 VDC to gnd.
6	Normal line "A", J2-6, J1-4, relay coils K3, K4, K5, K7, optional battery charger.	240 VAC to TB1-6 (Normal line "B")
7	Voltage to energize K3; K8 N/C contact, K5 N/O contact.	240 VAC to TB1-6 (Normal line "A")
8,9	Voltage to energize K5 and K7; K8 and K9 contacts, K4 and K5 contact. Note: Terminals 7 and 8 are jumpered whenever relay K5 function is not required.	240 VAC to TB1-6 (Normal line "A")
10	Voltage to energize K4, K7, K5 and K3; K4 N/O contact, K9 N/C contact, jumper to TB1 terminals 11 and 12. Note: Terminals 9 and 10 are jumpered whenever relay K4 function is not required.	240 VAC to TB1-6 (Normal line "A")
11	Jumper always between TB1-10 and TB1-11 except when a special exerciser field modification is installed.	240 VAC to TB1-6 (Normal line "A")
12	Jack J2-4. Jumper always between TB1-11 and TB1-12. May be removed to install Area Protection or a remote Test Switch.	240 VAC to TB1-6 (Normal line "A")
13	Jumper to TB1-4; K9 N/C contact.	Battery B+ to ground
14	Common to N/C contact of K9 and K10.	Battery B+ to ground
15	N/O contact of K9.	-

*AC voltages may be different for voltage options other than shown in Figure 15.
DC voltages may be different for 2-wire start systems

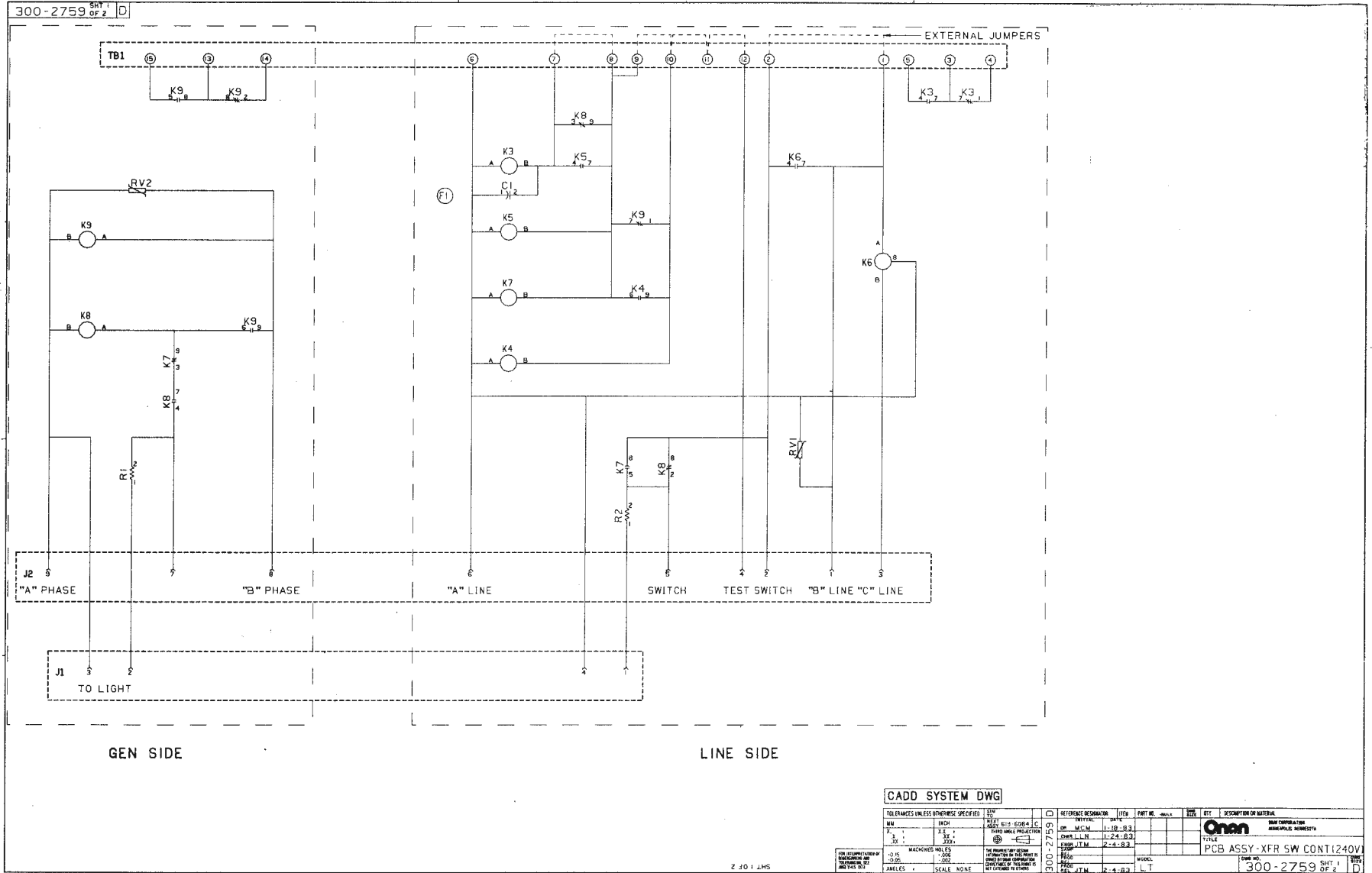


PARTS LIST		
REF	DESQTY	DESCRIPTION
A1	1	PCB ASSY -XFR SW CONT
A2	1	BATTERY CHARGER (OPTIONAL)
CT1,2	2	TRANSFORMER -CURRENT -01
	2	TRANSFORMER -CURRENT -02
DS1	1	LAMP-HOUSING (WHITE)
	1	NAMEPLATE-NORMAL (DS1)
DS2	1	LAMP-HOUSING (YELLOW)
	1	NAMEPLATE-EMERGENCY (DS2)
	2	LAMP-NEON
K1,K2	1	TRANSFER SWITCH (30A) -01
	1	TRANSFER SWITCH (60A) -02
	2	LATCH-MECHANICAL
K3	1	RELAY-TIME DELAY STARTING
		.1 TO 10 SEC ON DE-ENERGIZATION
K4	1	RELAY-TIME DELAY RETRANSFER
		2 TO 30 MIN ON ENERGIZATION
K5	1	RELAY-TIME DELAY
		STOPPING AFTER RETRANSFER
		3 TO 300 SEC ON ENERGIZATION
K6	1	RELAY-VOLTAGE SENSOR
		1 PHASE LINE SIDE
K7	1	RELAY-INSTANT TRANSFER TO LINE
K8	1	RELAY-TIME DELAY TRANSFER
		.3 TO 30 SEC ON ENERGIZATION
K9	1	RELAY-VOLTAGE SENSOR
		1 PHASE GEN SIDE
K10	1	RELAY-CRANKING LIMITER
M2	1	CLOCK-PLANT EXERCISER(OPT)
M3	1	METER-TIME TOTALIZING
M4,5	2	AMMETER-AC (0-40) -01
	2	AMMETER-AC (0-75) -02
M7	1	VOLTMETER-AC 0-300V
M6	1	METER-FREQUENCY 55-65HZ
R3	1	RESISTOR,3 OHM,10 WATT
S1	1	SWITCH-TEST TRANSFER
S3	1	SWITCH-SELECTOR
TB2	REF	TERMINAL BLOCK

FIGURE.15. TYPICAL SCHEMATIC DIAGRAM, SINGLE PHASE, 3-WIRE START

300-2759 SHT 1 OF 2 D

FIGURE 16. PRINTED CIRCUIT BOARD SCHEMATIC



CADD SYSTEM DWG

TOLERANCES UNLESS OTHERWISE SPECIFIED		DIMENSIONS UNLESS OTHERWISE SPECIFIED		REFERENCE DESIGNATION		PART NO.		REV.		QTY.		DESCRIPTION OF MATERIAL	
MM	INCH	FRAC	DEC	OP	M.C.M.	1-18-83							Onan
±	±	±	±	OP	M.C.M.	1-24-83							PCB ASSY-XFR SW CONT(240V)
±	±	±	±	OP	M.C.M.	2-4-83							300-2759 SHT 1 OF 2
MACHINED HOLES		THE NUMBER OF HOLES		MATERIAL		SCALE		DATE		BY		CHKD	
±.05		UNLESS OTHERWISE SPECIFIED		PCB		NONE		1-18-83		LT		300-2759 SHT 1 OF 2	
±.02		UNLESS OTHERWISE SPECIFIED		PCB		NONE		1-18-83		LT		300-2759 SHT 1 OF 2	
±.01		UNLESS OTHERWISE SPECIFIED		PCB		NONE		1-18-83		LT		300-2759 SHT 1 OF 2	
±.005		UNLESS OTHERWISE SPECIFIED		PCB		NONE		1-18-83		LT		300-2759 SHT 1 OF 2	
±.002		UNLESS OTHERWISE SPECIFIED		PCB		NONE		1-18-83		LT		300-2759 SHT 1 OF 2	
±.001		UNLESS OTHERWISE SPECIFIED		PCB		NONE		1-18-83		LT		300-2759 SHT 1 OF 2	

300-2759 D

J1 CONNECTOR

This connector is used on 120 and 240 VAC models to connect the Normal and Emergency lights to the main relay circuit board (Figure 17). These lights indicate voltage is available to energize the transfer switch coils.

- J1-1 and J1-4 are the connectors for the Normal light DS1.
- J1-2 and J1-3 are the connectors for the Emergency light DS2.

J2 CONNECTOR

The line (Normal) power and the generator (Emergency) power are applied to the main relay board by this connector (Figure 17). The output voltage to energize the transfer switch coils on both line and generator side are also run through this connector.

- J2-1 "B" phase line (Normal) input.
- J2-2 & J2-4 Panel TEST TRANSFER SWITCH.
- J2-3 "C" phase Normal line input.
- J2-5 Output to transfer switch Normal line side.
- J2-6 "A" phase (Normal) line input.
- J2-7 Output to transfer switch Emergency generator side.
- J2-8 "B" phase Emergency generator input.
- J2-9 "A" phase Emergency generator input.

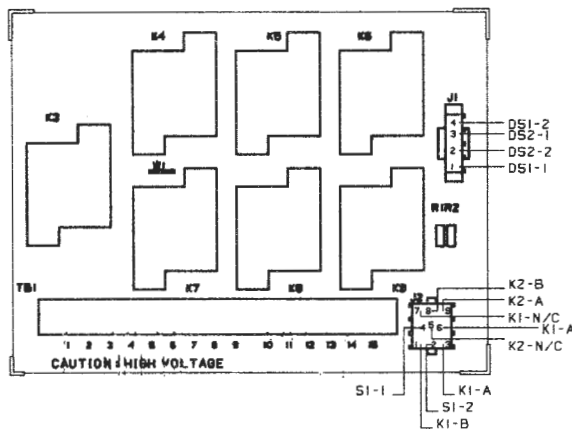


FIGURE 17. J1 AND J2 CONNECTOR TERMINALS

K11 INTERPOSING RELAY

The interposing relay is used in transfer switches when voltage ratings are over 240 VAC. Figure 1 shows the relay location. If the relay is defective, the transfer switch will not transfer load to the generator set. The relay coil resistance reading should be 1200 ohms $\pm 15\%$.

TYPICAL PROBLEMS

This section lists some common problems that might occur with an installation and the areas to look for possible malfunction.

Power Outage Occurs, But Generator Set Does Not Start

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

1. Check for overcrank condition by observing Cranking Limiter button on panel inside the transfer switch cabinet (3-wire start only).
2. Onan water-cooled generator sets (two-wire starting only): Selector switch on the generator set control panel must be in the REMOTE position.
3. Check generator set. Start with start-stop controls on generator set. If it does not crank, check starting batteries. If it cranks but does not start, check fuel supply.

WARNING Ignition of explosive battery gases might cause severe personal injury. Do not smoke while servicing.

WARNING Ignition of fuel might cause serious personal injury or death by fire or explosion. Do not permit any flame, cigarette, or other igniter near the fuel system.

4. Check relays on transfer switch printed circuit board as follows: K3, K9, K10.

When Generator Set is Started Manually, Transfer Switch Transfers Load (Normal Line On)

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

Check K4 Time Delay Retransfer relay - the coil may be defective.

Generator Set Starts But Does Not Assume Load

1. Check output voltage of the emergency power source by observing voltmeter of generator set or optional voltmeter on the transfer switch.
2. If DS2 does not light, check for misadjusted or defective voltage sensor K9, time delay relay K8 and relay K7 (units rated over 240 VAC-also check K11 interposing relay). If DS2 lights, check K1 trip coil, K2 closing coil and K2 cut-out switch.

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

No Transfer of Load From Generator Set to Normal Power

1. The K4 retransfer time delay might not have expired. Wait a few moments. This function can be bypassed by placing a jumper between TB1-9 and TB1-10.
2. Stop the generator set with its start-stop switch. When the generator set stops, the transfer switch should transfer load to the normal power source if voltage is normal.
3. If DS1 does not light, check for misadjusted or defective:
 - Voltage Sensor relay K6
 - Time Delay Retransfer relay K4
 - Instant Transfer to Line relay K7
 - Connector J2

If DS1 lights, check:

- K2 trip coil
- K1 closing coil
- K1 cutout switch

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

Generator Set Continues to Run After Re-transfer of Load to Normal Power

Check Time Delay Stopping relay K5 and Time Delay Starting relay K3. The Time Delay Stopping relay can be bypassed by placing a jumper between TB1-7 and TB1-8.

Generator Set Starts During Normal Power Service

1. Two-wire starting (Onan water-cooled generator sets): Selector switch on the set control panel must be in REMOTE position.

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

2. Check Test Transfer Switch inside transfer switch cabinet to make sure it is set at NORMAL position.
3. Check exerciser clock (if equipped) to see if it is scheduled for exercise.
4. Momentary voltage dips might cause voltage sensor K6 to initiate generator set starting. Voltage sensing settings on K6 might have to be changed.

Generator Set Does Not Exercise (If Equipped with Exerciser)

1. Two-wire starting only (Onan water-cooled generator sets): Selector switch on the set control panel must be in REMOTE position.

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

2. Check exerciser to see if it is set correctly and is running.
3. Check generator set. Start with start-stop control on generator set. If it does not crank, check the starting batteries. If it cranks but does not start, check the fuel supply.
4. Check switch operation on Exerciser M2. Check relays K3, K9 and K10.

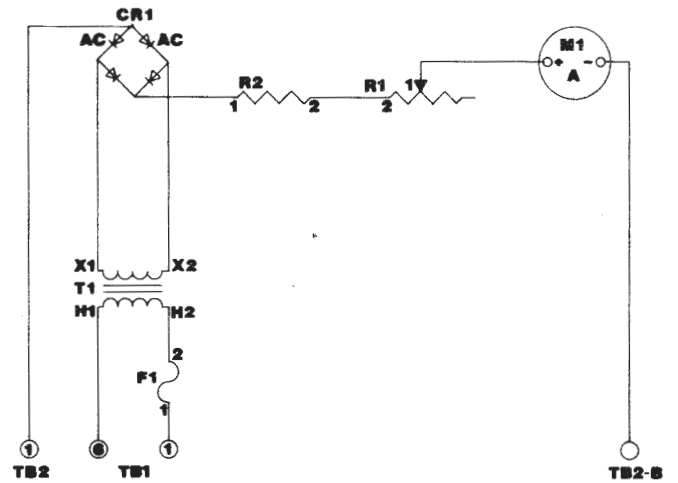
Battery Charger Fails to Charge (If Equipped)

WARNING Ignition explosive battery gases might cause severe personal injury. Do not smoke while servicing.

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

Troubleshoot the charging circuit using the schematic diagram Figure 18. Input AC voltage can be checked across TB1 terminals 1 and 6; output DC voltage across TB2 terminals 1 and B+.

Check battery for defect.



ES 1463

FIGURE 18. BATTERY CHARGER SCHEMATIC

