

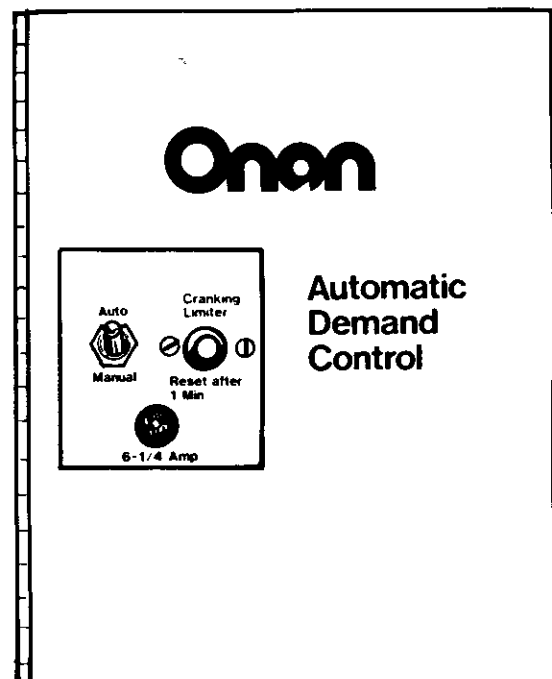
Onan

Service Manual

HA

Control

Automatic Load Demand Control
(Spec D) B+ Switching Controls



907-0501

7-86

Printed in U.S.A.

Safety Precautions

Before performing maintenance or service on your HA controlled generator set system, read all related manuals and become thoroughly familiar with your system components. Safe and efficient operation can be achieved only if the equipment is properly operated and maintained. Many accidents are caused by failure to follow simple and fundamental rules or precautions.

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

⚠ DANGER *This symbol if used warns of immediate hazards which will result in severe personal injury or death.*

⚠ WARNING *This symbol refers to a hazard or unsafe practice which can result in severe personal injury or death.*

⚠ CAUTION *This symbol refers to a hazard or unsafe practice which can result in personal injury or product or property damage.*

This controller has components with high AC voltages which present potential hazards that can result in severe personal injury or death. For this reason, service personnel should periodically review the following safety precautions and also the safety precautions listed in other equipment manuals.

- During normal operation, keep the controller cabinet closed.
- When performing service or maintenance to your system components, tag the controller with a warning sign to inform others not to operate.
- Before performing maintenance or making adjustments, move the controller switch to MANUAL position and the generator set switch to STOP position. Then disconnect generator set starting batteries to prevent an accidental start-up.
- If adjustment must be made while the system is operating, use extreme caution due to the danger of electrical shock hazards, hot manifolds, moving parts, etc.
- Jewelry is a good conductor of electricity and should be removed when working on the electrical equipment.
- Remove electric power before removing protective shields or touching electrical equipment. Use rubber insulative mats placed on dry wood platforms over floors that are metal or concrete when around electrical equipment. Do not wear damp clothing (particularly wet shoes) or allow skin surfaces to be damp when handling electrical equipment.
- Except for allowable adjustments, do not tamper with, alter, or otherwise try to bypass interlock control circuits of your generator set system. Non-prescribed control modifications present potentially hazardous conditions that can result in severe personal injury or equipment damage.
- Follow all state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches.
- Keep your generator set system equipment and their surrounding areas clean and free from obstructions. Remove any debris and keep the area clean and dry.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult your local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguisher rated ABC by NFPA.
- Do not work on equipment when mentally or physically fatigued.
- Onan suggests copying and posting these suggestions in potential hazard areas of the vessel. Most important, exercise caution and use common sense.

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Section 1. General Information

ABOUT THIS MANUAL

This manual provides service information for the Onan marine model 7.5 and 15.0 kW rated HA Automatic Demand Controls.

The specific HA controller models covered in this manual are for 3-wire, B+ switching, 12-volt, remote-starting of 120- and 120/240-volt, single-phase, negative-ground, marine generator set installations. The installation of this type of controller must always comply with all applicable codes and standards. Refer to the installation section of your generator set Operator's Manual for further information.

Study all manuals supplied with your generator set carefully and observe all warnings and cautions. Knowing your generator set, using it properly, and following a regular maintenance schedule will result in longer unit life, better performance, and safer operation.

If the HA controller requires servicing beyond the scope of information given in this manual, contact an Onan distributor or dealer for assistance. Always supply the complete model number and serial number as shown on the Onan nameplate mounted on the controller. Refer to Figure 1-1.

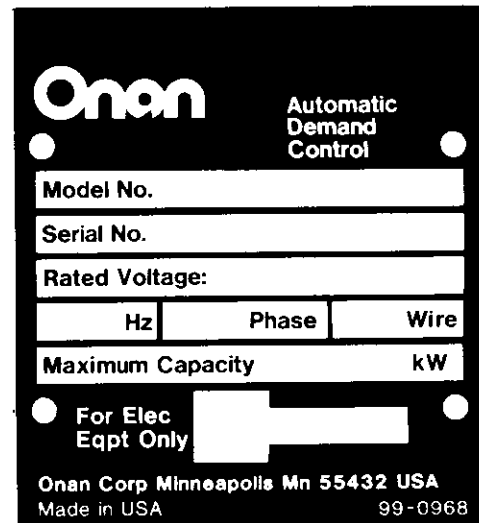
Also provide model and serial numbers of your generator set. This information is necessary in order for parts and service personnel to properly respond to your needs.

CAUTION *Incorrect installation, service, or replacement of parts can result in severe personal injury and/or equipment damage. Service personnel must be qualified to perform electrical and mechanical service.*

MODEL NUMBER SYSTEM

7.5 HA - 23/24 D

- 7.5** Watt Rating - 7.5 designates 7,500 watts, 15.0 designates 15,000 watts.
- HA** Series - Designates Onan Automatic Demand Control.
- 23** **2** Code Number - No number designates 60 Hz; Number 5 designates 50 Hz; Number 2 designates 50 or 60 Hz control.
- 3** Code Number - Designates voltage, wire and phase. Note: 1 = 120 volts, 1 phase; 2 = 240 volts, 1 phase; 3 = 120/240 volts, 1 phase.
- /24** Code Number - These code numbers (24 or 25) identifies the control as B+ switching type, and also the time delay of generator set starting. Number 24 is for 5-minute delayed starting during bilge blower operation. Number 25 is for bilge blower operation delay plus 20-second preheat delay for diesel engine glow-plugs.
- D** Specification Letter - Advances with production modification.



The nameplate is a black rectangular label with white text and fields. At the top left is the 'Onan' logo. To its right, 'Automatic Demand Control' is printed. Below the logo, there are four horizontal white bars for 'Model No.', 'Serial No.', 'Rated Voltage:', and 'Maximum Capacity kW'. Under 'Rated Voltage:', there are three small boxes labeled 'Hz', 'Phase', and 'Wire'. Below these is a box for 'For Elec Eqpt Only' with a blank space next to it. At the bottom, it says 'Onan Corp Minneapolis Mn 55432 USA' and 'Made in USA' with the number '99-0968' on the right.

Onan			Automatic Demand Control		
Model No.					
Serial No.					
Rated Voltage:					
Hz		Phase		Wire	
Maximum Capacity					kW
For Elec Eqpt Only					
Onan Corp Minneapolis Mn 55432 USA					
Made in USA				99-0968	

FIGURE 1-1. ONAN NAMEPLATE



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Section 2. Operation Description

GENERAL

The HA automatic demand control provides automatic starting of a generator set when a load (lighting, motor, or other electrical device) is switched on. When the electrical load is removed, it automatically stops the generator set. It is designed to operate an Onan generator set as the only power source, not as a standby unit during commercial power outages.

NORMAL OPERATION

When the generator set is not running, the DC starting battery is connected across the line (in place of AC voltage). When a load is connected across the line (when a light is turned on for example), the small amount of current flowing through the 120-volt bulb (from the battery) operates a sensitive relay to the generator set start circuit. When the generator set starts and reaches full speed, the line contactor disconnects the battery from the line and connects the output of the generator set to the line (load).

The generator set will continue to run if engine AC current flows through the load from the generator set. In general, a 40-watt load keeps a 120-volt generator set running (100 watts for a 240-volt generator set). When all loads are removed from the line, the HA control will automatically shut down the generator set and return all control components to original position.

The HA automatic demand control requires little attention, but if difficulties arise, use the operation description, service information, and troubleshooting chart to diagnose and locate the trouble. Review the following Circuit Descriptions to fully understand how the controller operates.

CIRCUIT DESCRIPTIONS

Control components differ slightly between 120-volt, 2-wire AC and 120/240-volt, 3-wire AC model controllers. The load sensor control board A1 (300-0740) of 120-volt models includes the start-run relay (A1K1) as an integral part of the printed circuit board. The start-run relay K9 of 120/240-volt models is mounted and wired apart from the load sensor control board A1 (300-0747). Therefore depending on controller model, your troubleshooting procedures and replacement parts may differ. The following circuit descriptions are for reference only, and only reflect 120/240-volt, 3-wire AC controllers. Refer to Section 4, Wiring Diagrams for wiring diagram/schematic specific to your application.

Pilot Circuit

The pilot circuit initiates generator crank and start when there is a demand for electric power (Figure 2-1). If an AC load is connected to the generator set, DC current from the B+ terminal flows through auto-manual switch S1 (in Auto position), rectifier A1CR1, one-half the start-run relay coil K9 (terminals 8-1), fuse A1F1, normally-closed K2 contacts, and the AC load to common ground and battery to energize the start-stop relay K9.

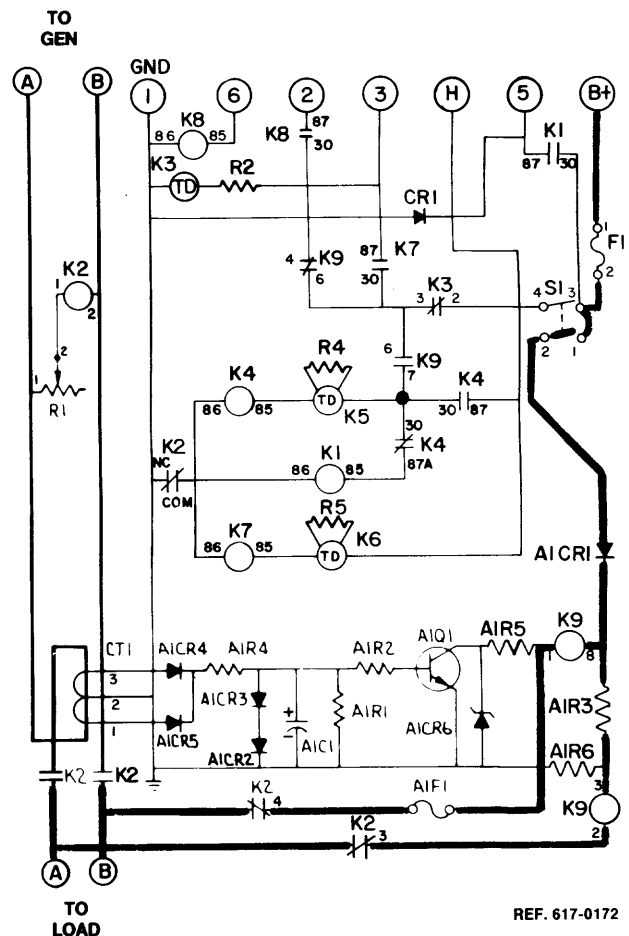


FIGURE 2-1. PILOT CIRCUIT

REF. 617-0172

Bilge Blower Circuit

When start-stop relay K9 energizes to close its normally-open contacts (6-7), it completes a circuit from S1 (3-4), through the normally-closed contacts of K3 (2-3), the closed contacts of K9 (6-7), and the normally-closed K4 contacts (30-87A), to energize the coil of bilge blower relay K1 (85-86). Energizing K1 relay, closes its normally-open contacts (30-87) completing a circuit to TB1-5 for operation of the bilge blower. See Figure 2-2.

The closed contacts of K9 (6-7) also completes a circuit to energize K5 relay. Relay K5 provides a five-minute delay (before energizing cranking relay K4) while the bilge blower operates to expel vapors from the bilge.

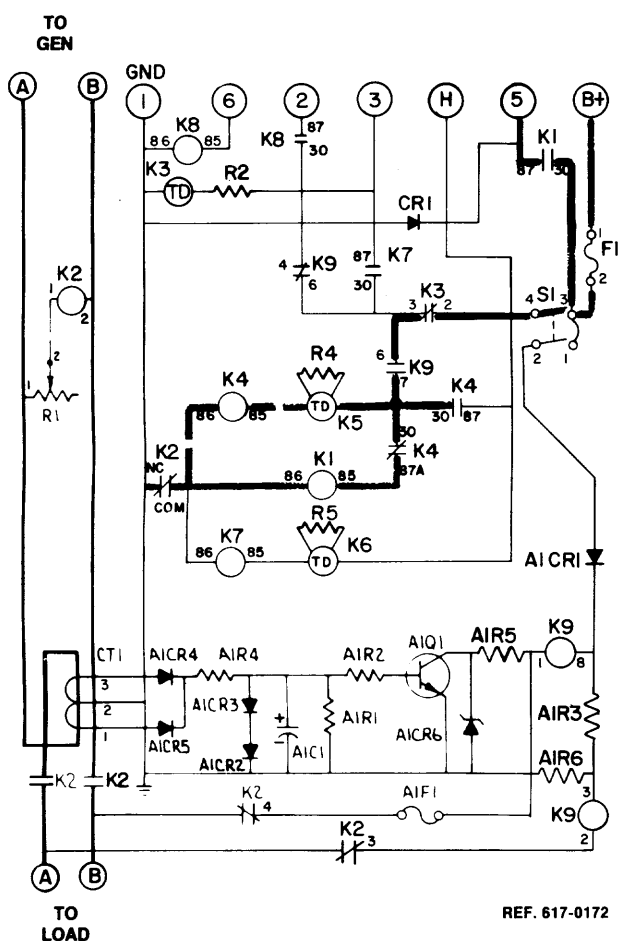


FIGURE 2-2. BILGE BLOWER CIRCUIT

Cranking Circuit (Without Glow Plug Preheat)

At the end of the five-minute K5 time delay, K4 relay will energize and close its normally-open contacts (30-87) to complete a circuit to TB1-3. TB1-3 connects to the generator start circuit. See Figure 2-3.

If the generator set does not start within 45 to 90 seconds, the heat produced by the element in cranking limiter K3 will cause it to open. The normally-closed K3 contacts (2-3) will open and de-energize the start circuit.

Wait at least one minute before resetting K3 cranking limiter. This time allows the material in the breaker to solidify and hold the contacts closed so cranking can resume.

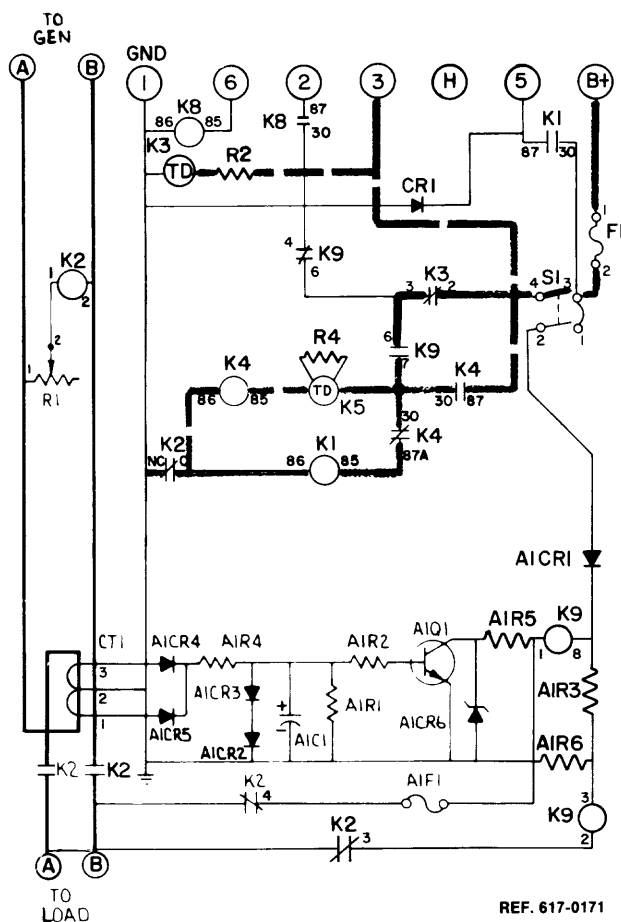


FIGURE 2-3. CRANKING CIRCUIT (WITHOUT GLOW-PLUG PREHEAT)

Cranking Circuit (With Glow Plug Preheat)

At the end of the five-minute K5 delay, K4 relay will energize to open its normally closed contacts (30-87A) to relay K1 to stop bilge blower operation, and close its normally-open contacts (30-87) to energize the engine glow-plugs and preheat time delay relay K6. After the twenty-second K6 time delay, start relay K7 will energize. With K7 relay energized, its normally-open contacts (30-87) will close to complete a circuit to TB1-3. TB1-3 connects to the generator start circuit. See Figure 2-4.

If the generator set does not start within 45 to 90 seconds, the heat produced by the element in cranking limiter K3 will cause it to open. The normally-closed K3 contacts (2-3) will open and de-energize the start circuit.

Wait at least one minute before resetting K3 cranking limiter. This time allows the material in the breaker to solidify and hold the contacts closed so cranking can resume.

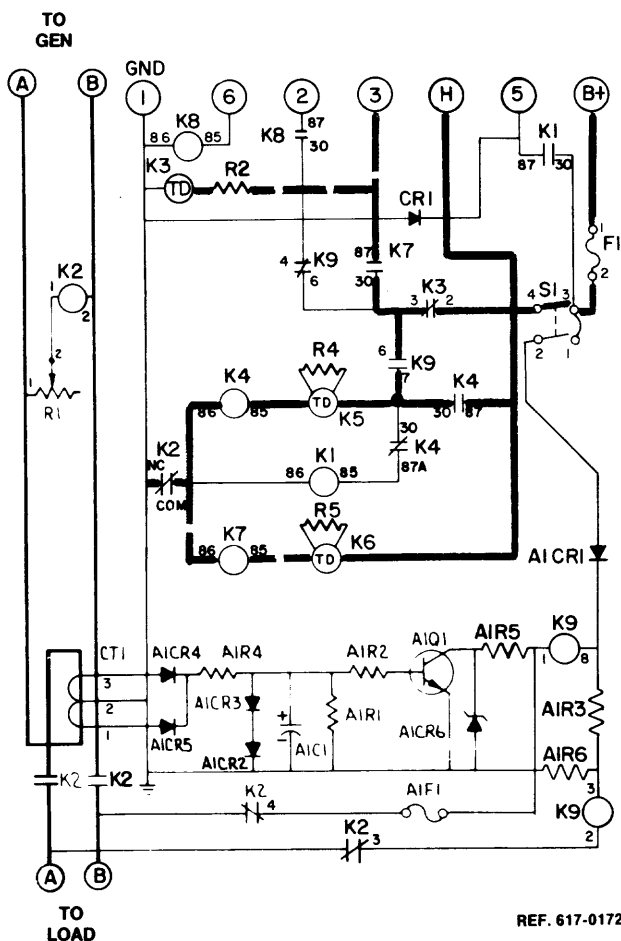


FIGURE 2-4. CRANKING CIRCUIT
(WITH GLOW-PLUG PREHEAT)

Generator Run Circuit

When the engine starts and the generator AC voltage builds up to approximately 105 volts on 120-volt units or approximately 210 volts on 240-volt units, line contactor K2 is energized. Resistor R1 adjusts the line contactor pick-up voltage. When contactor K2 is energized, it opens its normally-closed control contacts (4 and 3) to disconnect the control from load lines, and closes its normally-open line contacts to supply power to the load. See Figure 2-5.

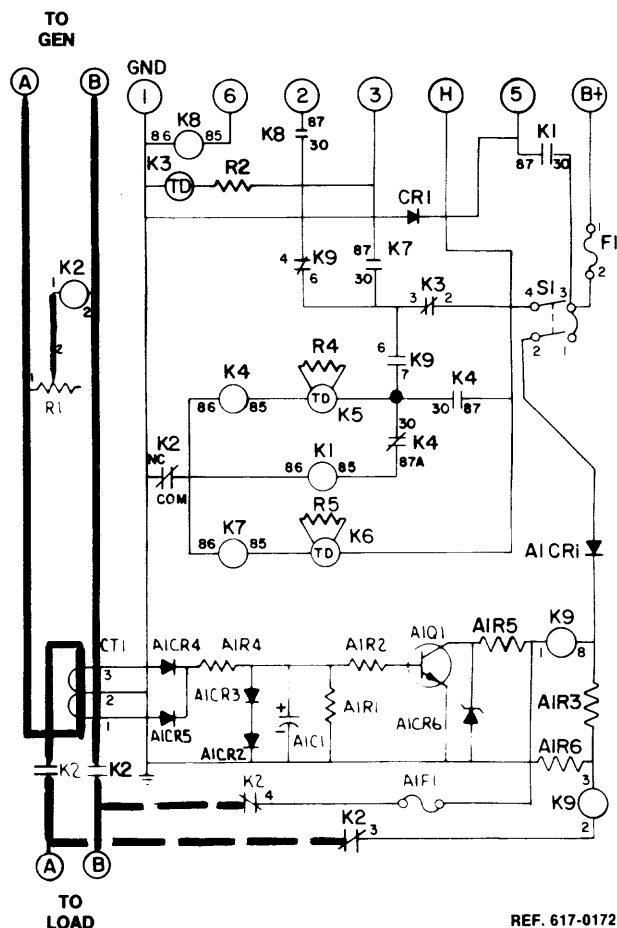
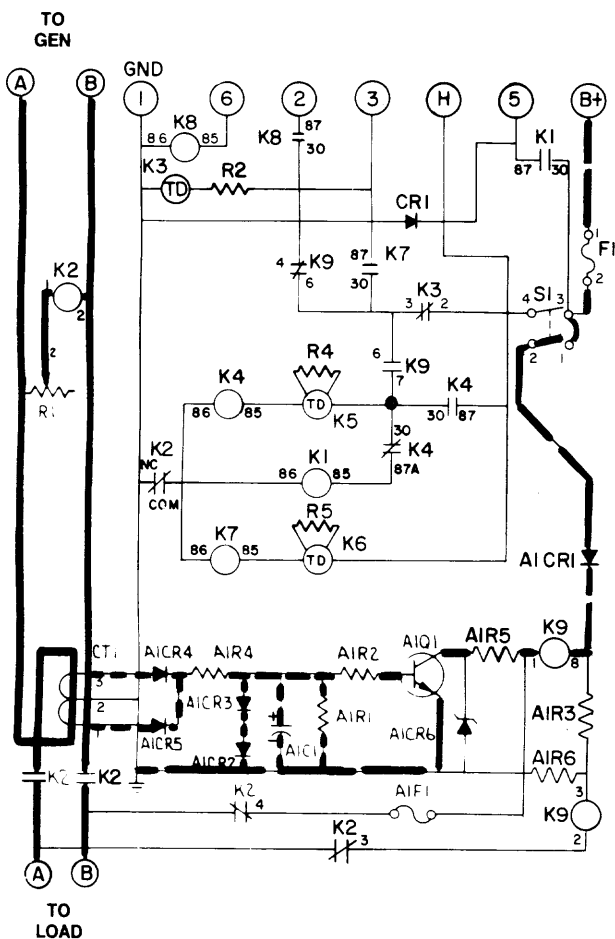


FIGURE 2-5. GENERATOR RUN CIRCUIT

Power Circuit

When contactor K2 energizes (see Figure 2-6), the pilot circuit interlock contacts (terminals 3 and 4) open just before the power contacts close. This prevents application of generator voltage to the low voltage control circuit. The normally closed common contacts in the generator start disconnect circuit will open to break the circuit to TB1-3.

Load current passing through current transformer CT1 induces a small AC output to load sensor control board A1. Load sensor control board A1 circuitry turns on transistor A1Q1, which provides a ground for start-run relay K9. DC current flows from B+ through auto-manual switch S1, rectifier A1CR1, start-stop relay K9 coil (1-8), and the transistor to ground. The relay K9 remains energized as long as a load is connected keeping normally-closed K9 contacts (4-6) open to prevent generator set shutdown.



REF. 617-0172

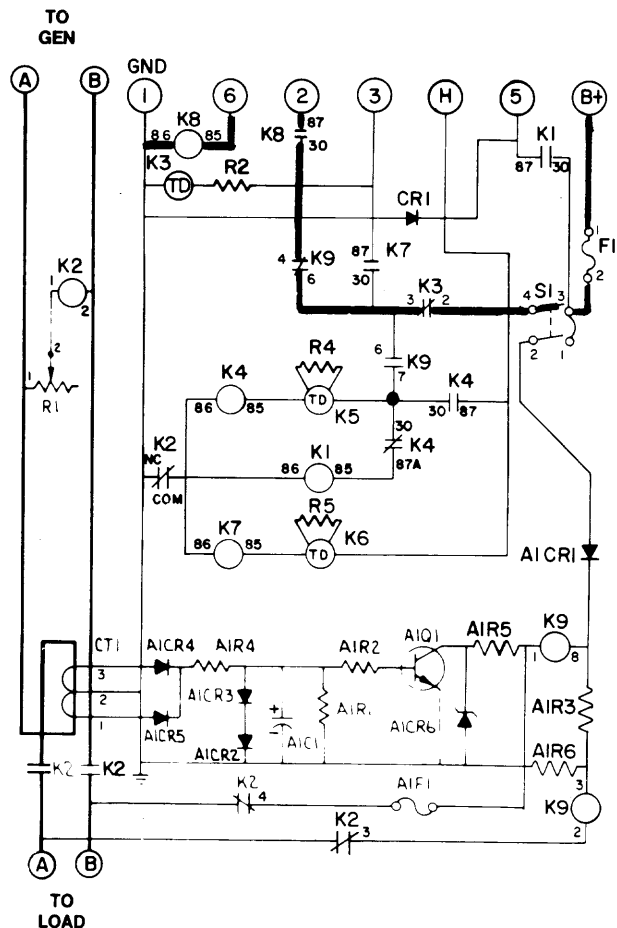
FIGURE 2-6. POWER CIRCUIT

Stop Circuit

During generator set operation, DC current is supplied from the generator set controls to TB1-6 of the controller to energize relay K8. With relay K8 energized, its normally-open contacts in series to TB1-2 are closed. See Figure 2-7.

When the AC load is removed, there is no current flow through transformer CT1 and transistor A1Q1 switches off. The start-run relay K9 is de-energized and its normally-closed contacts (6-4) close.

When K9 normally-closed contacts (6-4) close, a circuit is completed from TB1-B+. DC current is then supplied through S1 (3-4), K3 (2-3), K9 (6-4), K8 (30-87) to TB1-2 to provide a switched B+ signal to the generator stop controls. When the generator set shuts down, contactor K2 and all control relays return to their normal de-energized position.



REF. 617-0172

FIGURE 2-7. STOP CIRCUIT

COMPONENT DESCRIPTIONS

Cabinet Exterior

Auto-Manual Switch (S1): For normal operation, keep the auto-manual switch (see Figure 2-8) in the Auto position. Whenever you do not want automatic starting or you want to service the generator set, set the switch at Manual. In the Manual position, the generator set will start only from its start-stop switch.

Cranking Limiter (K3): The cranking limiter is a safety device to control the maximum cranking time. If the engine will not start after cranking 45 to 90 seconds, the breaker opens, removing battery voltage from the generator start circuit to TB1-3. Push the button to reset position after allowing to cool for one minute.

The limiter can be tested by checking continuity of the heater and checking for heating during a starting cycle. To test circuit breaking, disconnect the generator set from TB1-3 and apply a load. The start-run relay K9 should operate immediately. After any start-time delay of bilge blower and glow plugs (if equipped), the cranking limiter should heat. After 45 to 90 seconds, the limiter should open. Resistor R2, in series with K3, is located under the flip-open panel, toward left side of control box.

Battery B+ DC Current Supply Fuse (F1): This 6-1/4 ampere fuse is for short circuit protection during start and run of bilge blower and generator set.

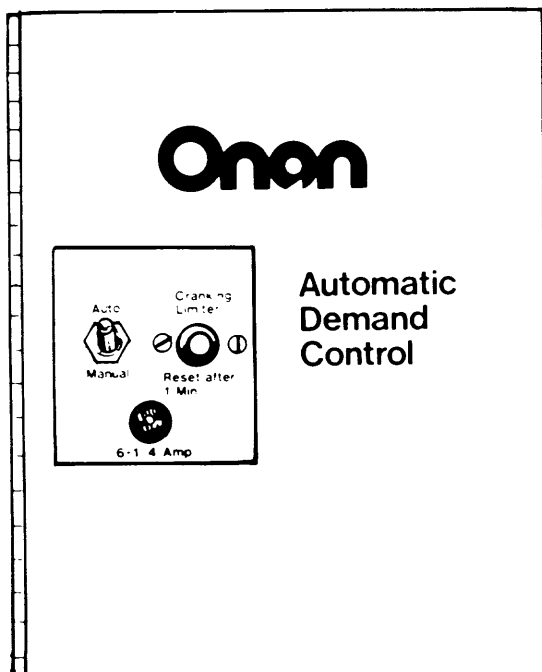


FIGURE 2-8. CABINET EXTERIOR

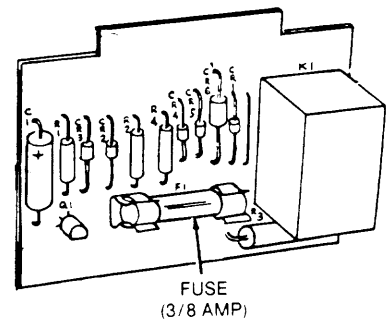
Cabinet Interior

Load Sensor Control (A1): This printed circuit board control is located inside the flip-open control panel. See Figures 2-9 and 2-10.

During generator set operation, board A1 receives its operating current from current transformer CT1. AC current from CT1 to board A1 keeps transistor A1Q1 turned on, which in turn provides a ground path for start-run relay K9. DC current from B+ terminal will then keep K9 relay energized, until load is removed and current flow through CT1 stops.

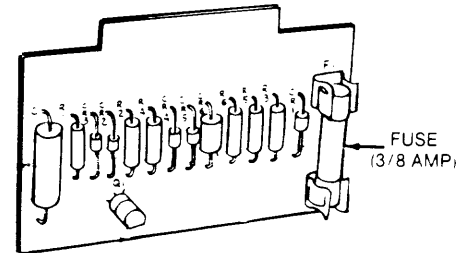
Other than the 3/8 ampere fuse (A1F1) there are no serviceable components on board A1. Refer to Troubleshooting section for further information. Replace if found defective.

FOR 120 VOLT MODELS
(300-0740)



ES-1661

FOR 120/240 VOLT MODELS
(300-0747)



ES-1661-1

FIGURE 2-9 LOAD SENSOR CONTROL PRINTED CIRCUIT BOARDS

Current Transformer (CT1): The current transformer senses AC load current flow. Load current through the transformer produces a small AC output to the load sensor board A1. See Figure 2-10.

If the transformer is believed defective, perform continuity check at A1/J1 (pins 7,8, and 9). Replace the current transformer if continuity does not exist through windings.

Line Contactor (K2): The line contactor connects the generator AC output to the load after generator voltage builds up. It has auxiliary contacts to disconnect the pilot and cranking circuits after the generator set starts. Both the contacts and coil of the contactor are replaceable.

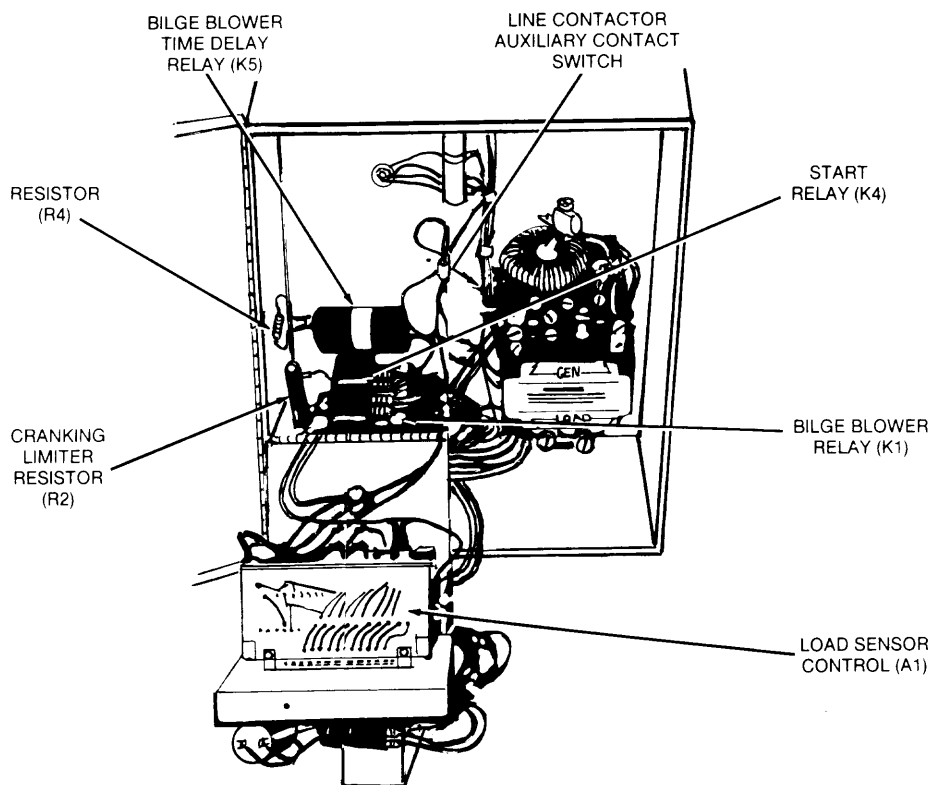
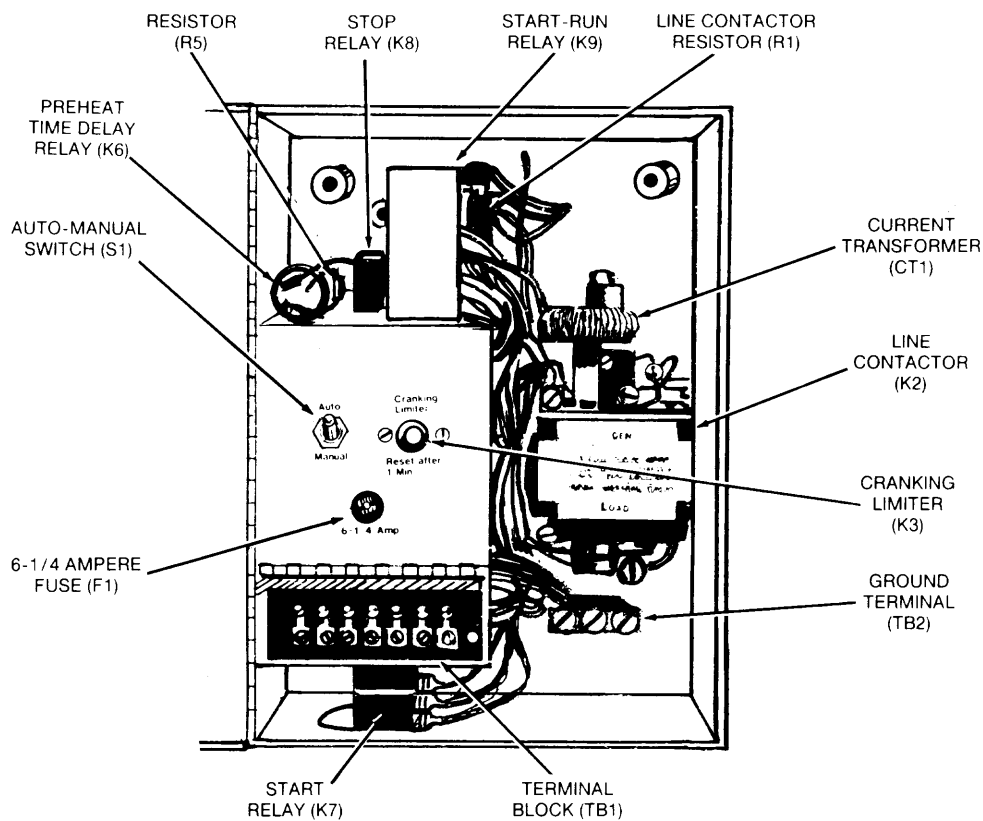


FIGURE 2-10. CABINET INTERIOR
(7.5 HA 120/240-VOLT SHOWN)

ES-1660

If the contact points become dirty, badly burned or pitted, disassemble and clean or replace them as follows (see Figure 2-11):

1. Remove plastic hood.
2. Remove spring and washer from each contact guide post.
3. Lift contacts from guide post. Curved silver contact surfaces face inward when replacing.
4. Take out stationary contacts by removing screws holding them to the plastic body.

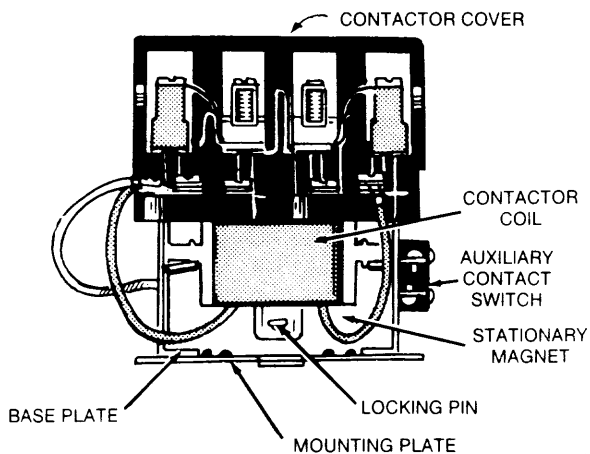
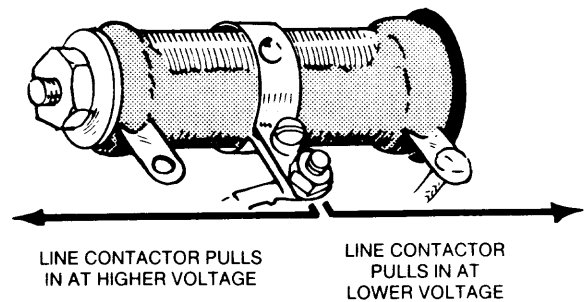


FIGURE 2-11. HA LINE CONTACTOR (K2)

Mounted on the back side of contactor K2 is an auxiliary contact switch, where relays K1, K4, and K7 (if equipped) number 86 coil leads are attached to the normally closed contact terminal. Upon successful generator start and voltage build-up to energize the coil of K2, this auxiliary contact switch will open the K1, K4 and K7 relay circuits, which prevents accidental bilge blower, generator set starter, and glow-plug operation after generator set is running.

Resistor R1 provides adjustability of contactor K2 pull-in voltage. Resistor R1 is factory set to pull in when generator voltage reaches 102 to 108 volts for a 120-volt load (204 to 216 volts on 240-volt load). Do not adjust this resistor unless the line contactor will not pull in when the generator set starts, or if it pulls in at too low a voltage causing the generator set to cycle. See Figure 2-12.



ES-1662-1

FIGURE 2-12. LINE CONTACTOR ADJUSTMENT (R1)

Start-Run Relay (K9): This relay initiates generator start commands when a load is imposed to the line. It is held energized during generator set operation. And, it initiates generator set shutdown when load is removed from the line. Relay K9 is mounted on top of the flip-open control panel. Refer to Troubleshooting section for further information.

Bilge Blower Relay (K1): This relay is energized immediately upon load demand and closure of normally-open contacts of relay K9. When energized, relay K1 closes its normally-open contacts to initiate bilge blower operation. Relay K1 is located under the flip-open control panel.

Time Delayed Generator Set Starting Relays (K5 and K4, and K6 and K7 if equipped): Time delay relay K5 (with resistor R4) provides the five-minute time delay before energizing relay K4. On units without glow-plug preheat, generator set cranking will be initiated immediately. Units with glow-plug preheat will be delayed an additional twenty seconds, after time delay relay K6 (with resistor R5) times out to energize relay K7.

Relay K5 and K4 are located under the flip-open control panel, toward the back of the control box. Relay K6 is mounted on top of the flip-open control panel, and K7 on the base of the control box.

Generator Stop Relay (K8): This relay is energized during generator set operation through TB1-6. When energized, it closes its normally-open contacts to TB1-2, in order that a switched B+ generator stop command can be initiated to the generator set when load is removed and start-run relay K9 is de-energized. The K8 relay is located on top of the flip-open control panel.



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Section 3. Troubleshooting

GENERAL

Study the detailed circuit and component descriptions in the Operation Description section and also all troubleshooting information in your generator set manual. Having a thorough understanding of controller/generator set operation will aid in more effective and timely troubleshooting and repair should a fault condition occur. Also refer to Normal Automatic Operation Sequence and appropriate wiring diagram.

If a problem is evident, refer to the following procedures and select the list most appropriate to the fault condition. Perform the checks in order given.

⚠ CAUTION

Incorrect installation, service, or replacement of parts can result in severe personal injury and/or equipment damage. Service personnel must be qualified to perform electrical and mechanical component installation.

NORMAL AUTOMATIC OPERATION SEQUENCE

LOAD IS APPLIED TO LOAD LEADS A/B.

ENERGIZES (with switch S1 at Auto position)

K9 Start-Run Relay

ENERGIZES

K1 Bilge Blower Relay

K5 Cranking Time Delay Relay (five minutes, for Bilge Blower operation)

ENERGIZES

K4 Relay to Engine Start Circuit at TB1-3 (for units without glow-plug preheat)

OR

K6 Preheat Time Delay Relay (twenty-seconds, for units with glow-plugs)

ENERGIZES

K7 Engine Start Relay

ENERGIZES

Engine Start Circuit at TB1-3

DE-ENERGIZES

K1 Bilge Blower Relay

GENERATOR SET STARTS

Conditions: Generator set ready for operation (no maintenance being performed, adequate fuel supply, etc.), and K3 Cranking Limiter Relay remained closed.

ENERGIZES

K8 Engine Stop Relay (contacts close in engine stop circuit to TB1-2)

K2 Contactor Coil

Normally-closed control contacts (4 and 3) and auxiliary switch contacts open immediately before K2 line contacts close. With K2 line contacts closed, generator power is supplied to load.

ENERGIZES

CT1 Current Transformer to power Load Sensor A1. With continued power to Load Sensor A1, Start-Run Relay K9 is kept energized.

LOAD IS REMOVED FROM LOAD LEADS A/B

DE-ENERGIZES

CT1 Current Transformer power supply to Load Sensor.

DE-ENERGIZES

K9 Start-Run Relay

De-energizing K9 relay, closes its normally-closed contacts (6-4) in the engine stop circuit to TB1-2, and provides a switched B+ command to the generator set from TB1-2.

GENERATOR SET STOPS

DE-ENERGIZES

K2 Contactor Coil

K8 Engine Stop Interlock Relay

All control components of the HA controller are now at automatic operation readiness.

TYPICAL PROBLEMS

BILGE BLOWER DOES NOT OPERATE WHEN LOAD IS CONNECTED.

1. Check switch positions. Auto-Manual switch S1 should be at Auto position, and bilge blower controls at proper automatic start position.
2. Battery terminals may be incorrect. Should have negative ground only.
3. Check that cranking limiter relay K3 is at reset position. Depress pushbutton to reset.
4. Check 6-1/4 ampere fuse. If open, check for short circuit. Remedy and replace fuse.
5. Place Auto-Manual switch S1 to Manual position. Check fuse on load sensor printed circuit board and replace if open. Make sure incoming wires from generator aren't connected to the load side of the contactor.

⚠ WARNING

High AC voltages present the hazard of severe personal injury or death. Be sure to disconnect the starting batteries to prevent accidental starting during service procedures.

⚠ CAUTION

Incorrect installation, service, or replacement of parts can result in severe personal injury and/or equipment damage. Service personnel must be qualified to perform electrical and mechanical component installation.

6. With a hydrometer, check battery specific gravity.

⚠ WARNING

Batteries present the hazard of explosion which can result in severe personal injury. Do not smoke or allow any arc-producing devices around the battery area.

7. Check load circuits. Disconnect load wires from control and substitute another load (such as a 100-watt lamp). Reconnect battery cables and check for battery voltage at control TB1-B+ terminal. Place Auto-Manual switch S1 to Auto position. If generator set starts with this load, check for problem in load circuits.
8. Jumper a wire from terminal TB1-B+ to terminal TB1-5. If bilge blower does not operate, problem is in bilge blower or its circuitry.

Bilge blower operates: Perform the following checks.

- A. Check security of wiring connections between switch S1 and relay K1 terminal 30.
- B. Check for battery voltage at relay K9 terminal 8. If voltage is absent, load sensor diode A1CR1 is probably defective. Replace load sensor board A1.
- C. Check for battery voltage at load sensor fuse A1F1. If voltage is absent, start-run relay K9 is defective. Replace relay K9.
- D. If K9 relay is energized, check for battery voltage at bilge blower relay K1 terminals 85 and 86. If voltage is absent at terminal 85, check for voltage at relay K4 terminal 87A. Relay K4 normally-closed contacts (30-87A) may be stuck open. Replace relay K4.

If voltage is present at K1-85, check security of wiring connections and mounting of K2 auxiliary contact switch. Repair or replace as necessary. Replace relay K1.

AUTOMATIC DEMAND CONTROL WILL NOT START GENERATOR SET WITH LOAD

1. Battery terminals may be incorrect. Should have negative ground only.
2. Check cranking limiter relay K3. If tripped, push reset button after waiting one minute. Before restarting, check for cause.
3. Check 6-1/4 ampere fuse. If open, check for short circuit. Remedy and replace fuse.
4. Check if bilge is operating. If it is, wait until the end of bilge blower operation to see if unit starts.

If bilge blower does not operate when load is connected, see *Bilge Blower Does Not Operate When Load is Connected*.

5. If bilge blower doesn't stop after approximately five minutes, check for voltage at relay K4 terminals 85 and 86. If voltage is present, replace relay K4. If voltage is absent, replace time delay relay K5 and resistor assembly R4.

6. For HA controllers with time delay preheat, engine cranking is delayed an additional twenty seconds after bilge blower operation. If engine doesn't crank after approximately twenty seconds, check for voltage at relay K7 terminals 85 and 86. If voltage is present, replace relay K7. If voltage is absent, replace time delay relay K6 and resistor assembly R5.
7. Check generator set operation without automatic demand control. Disconnect demand control from generator set. Start generator set with set controls. If unit doesn't operate properly, reconnect demand control and refer to the generator set operator's manual or service manual.
8. Jumper cranking limiter relay terminal 3 to TB1-3, then remove jumper. Remove quickly if unit starts.

⚠ WARNING

Before performing this test, make sure the bilge blower has operated. Otherwise, any gas accumulations could ignite, resulting in fire and explosion.

9. Remove the load, stop the generator set, and disconnect battery ground cable. With an ohmmeter, check for continuity across contactor K2 normally-closed contacts (terminals 3 and 4).

GENERATOR SET STARTS BUT DOES NOT ASSUME LOAD

1. Check generator output voltage. See generator set operator's manual.
2. Check the automatic control contactor coil. If malfunctioning, see Line Contactor (K2) resistor R1 adjustment in section 2. Check pull-in voltage and change setting (if necessary) of adjustable resistor R1 for proper contactor pull-in.

GENERATOR SET STARTS BUT STOPS WHEN LINE CONTACTOR PULLS IN

1. Move Auto-Manual switch to Manual position. Start generator set at unit controls by placing the switch to Start position. Controller contactor should close and supply power to load.
2. Place HA control Auto-Manual switch to Auto position. If generator set stops, review the following:
 - A. Remove start-run relay K9 and perform a continuity check between pins 1 and 8 to check resistance of holding coil. Reading should be 500 ohms $\pm 10\%$. Replace relay if defective.
 - B. Perform continuity check of current transformer lead connections at A1/J1 (pins 7,8 and 9).
 - C. Replace load sensor board A1.
3. Generator set repeatedly over-cranks and trips cranking limiter K3. Check fuel level and standpipe depth in tank.

GENERATOR SET WILL NOT STOP WHEN LOAD IS REMOVED

1. Confirm that all loads are removed.
2. Cranking limiter K3 normally-closed contacts are open. Depress reset pushbutton.
3. Check for B+ voltage at stop relay K8 terminals 30, 87 and 85. If voltage is present at terminal 30, but not at 87, relay K8 is possibly defective. Check voltage at TB1-6. If voltage is absent, check all related wiring from generator set to TB1-6. If voltage is present at TB1-6 and K8 terminal 85, relay K8 is defective or terminal 86 wire is disconnected from relay or ground.
4. Put Auto-Manual switch to Manual position and stop generator set by placing the unit switch to Stop position. Remedy as necessary by correcting wiring or replacing relay K8.



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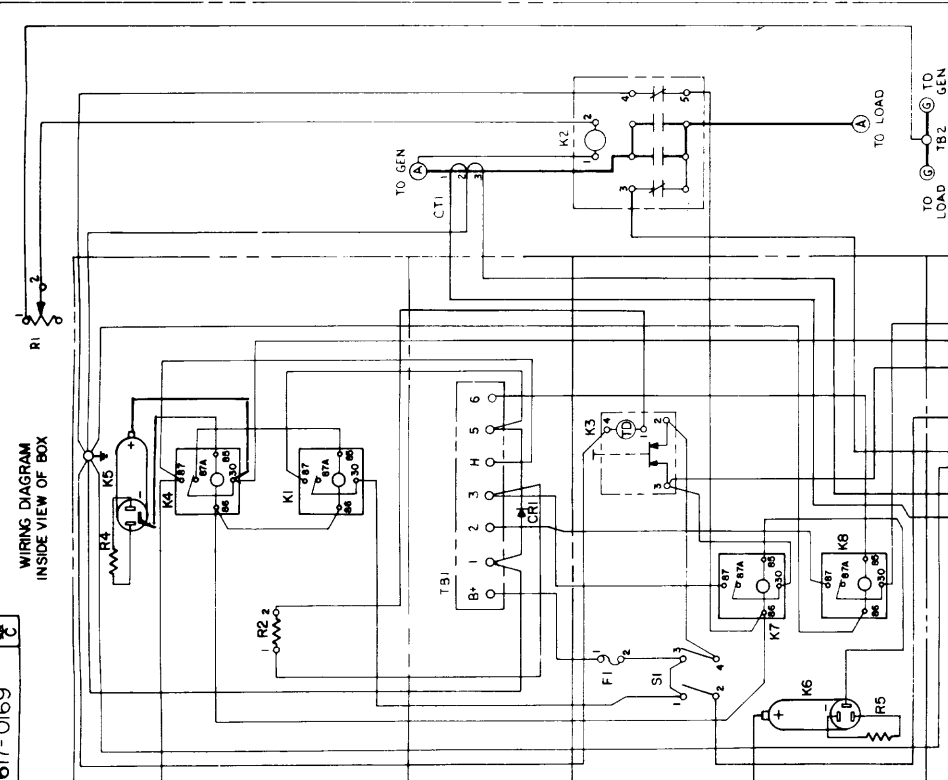
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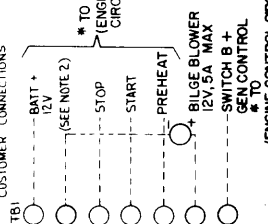
Section 4. Wiring Diagrams

MODEL	DRAWING NUMBER	PAGE
7.5HA-21/25D	612-0169	4-2
7.5HA-21/24D	617-0170	4-3
7.5HA-23/24D	617-0171	4-4
7.5HA-23/25D	617-0172	4-5
15.0HA-23/24D	617-0173	4-6
15.0HA-23/25D	617-0174	4-7

WIRING DIAGRAM
INSIDE VIEW OF BOX



CUSTOMER CONNECTIONS



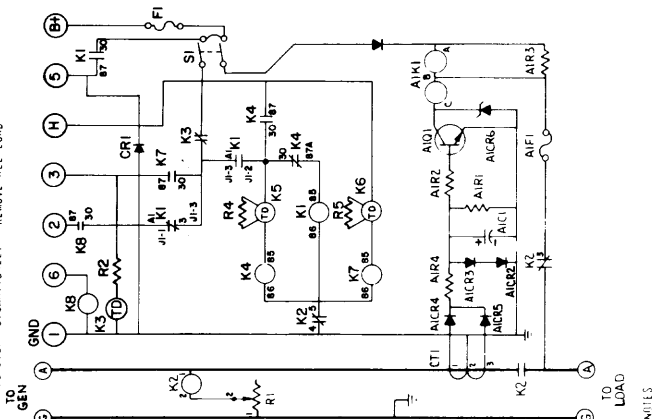
NOTE:

LESS OTHERWISE NOTED ALL
ELEMENTS ARE SHOWN IN THE
ENERGIZED POSITION

SCHEMATIC

OPERATE WITH NEGATIVE GROUND ONLY
TO START AUTOMATICALLY - APPLY LOAD
LOAD FOR 120V, INCANDESCENT LAMP OF 40W OR HEATER
OF 475W MIN (35-OHMS)

TO STOP AUTOMATICALLY - REMOVE ALL LOAD



U.S.

- 1 OPERATE WITH NEGATIVE GROUND ONLY
- 2 IT IS NOT NECESSARY TO CONNECT TERMINAL 1 TO GEN BECAUSE GENERATOR AND CONTROL ARE CONNECTED THRU THE AC GROUND LEAD

3 CAUTION IF GEN IS CONNECTED TO LOAD TERMINALS

OF CONTACTOR K2. THE AC OUTPUT VOLTAGE WILL BLOW

THE PROTECTIVE FLUSE

A MOUNT SWITCH WITH FINISHING NUT ON THE FRONT PANEL

2. The second group of authors (e.g., Berman and Meese, 1999; Fildes et al., 2000; Makridakis, 2000; Makridakis and Hibon, 2000; Makridakis and Hibon, 2001; Makridakis et al., 2001; Makridakis and Hibon, 2002; Makridakis et al., 2002; Makridakis and Hibon, 2003; Makridakis et al., 2003; Makridakis and Hibon, 2004; Makridakis et al., 2004; Makridakis and Hibon, 2005; Makridakis et al., 2005; Makridakis and Hibon, 2006; Makridakis et al., 2006; Makridakis and Hibon, 2007; Makridakis et al., 2007; Makridakis and Hibon, 2008; Makridakis et al., 2008; Makridakis and Hibon, 2009; Makridakis et al., 2009; Makridakis and Hibon, 2010; Makridakis et al., 2010; Makridakis and Hibon, 2011; Makridakis et al., 2011; Makridakis and Hibon, 2012; Makridakis et al., 2012; Makridakis and Hibon, 2013; Makridakis et al., 2013; Makridakis and Hibon, 2014; Makridakis et al., 2014; Makridakis and Hibon, 2015; Makridakis et al., 2015; Makridakis and Hibon, 2016; Makridakis et al., 2016; Makridakis and Hibon, 2017; Makridakis et al., 2017; Makridakis and Hibon, 2018; Makridakis et al., 2018; Makridakis and Hibon, 2019; Makridakis et al., 2019; Makridakis and Hibon, 2020; Makridakis et al., 2020; Makridakis and Hibon, 2021; Makridakis et al., 2021; Makridakis and Hibon, 2022; Makridakis et al., 2022; Makridakis and Hibon, 2023; Makridakis et al., 2023; Makridakis and Hibon, 2024; Makridakis et al., 2024; Makridakis and Hibon, 2025; Makridakis et al., 2025) have shown that the performance of the statistical models is generally poor, especially in the long-term forecast horizon.

5 HYPOT TEST: WITH 1500V FOR ONE SECOND, FROM K2-A

10 G

35-

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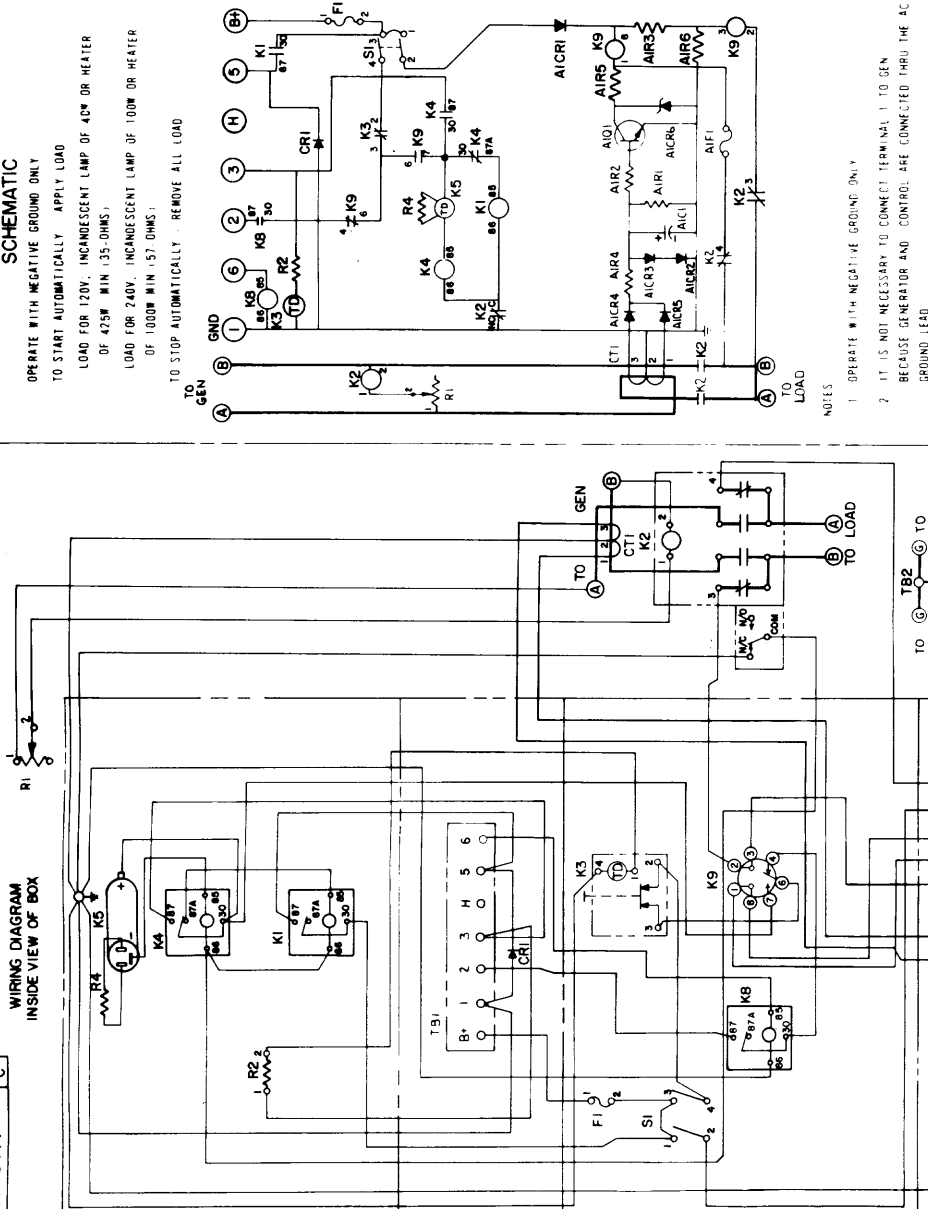
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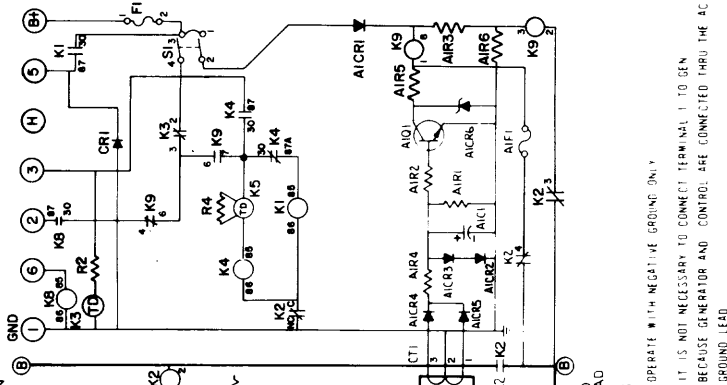
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617-0171

WIRING DIAGRAM
INSIDE VIEW OF BOX

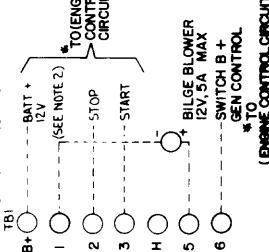
SCHEMATIC

OPERATE WITH NEGATIVE GROUND ONLY
TO START AUTOMATICALLY APPLY LOAD
LOAD FOR 120V. INCANDESCENT LAMP OF 40W OR HEATER
OF 475W MIN. (35 OHMS)
LOAD FOR 240V. INCANDESCENT LAMP OF 100W OR HEATER
OF 1000W MIN. (57 OHMS)
TO STOP AUTOMATICALLY REMOVE ALL LOAD
TO GEN



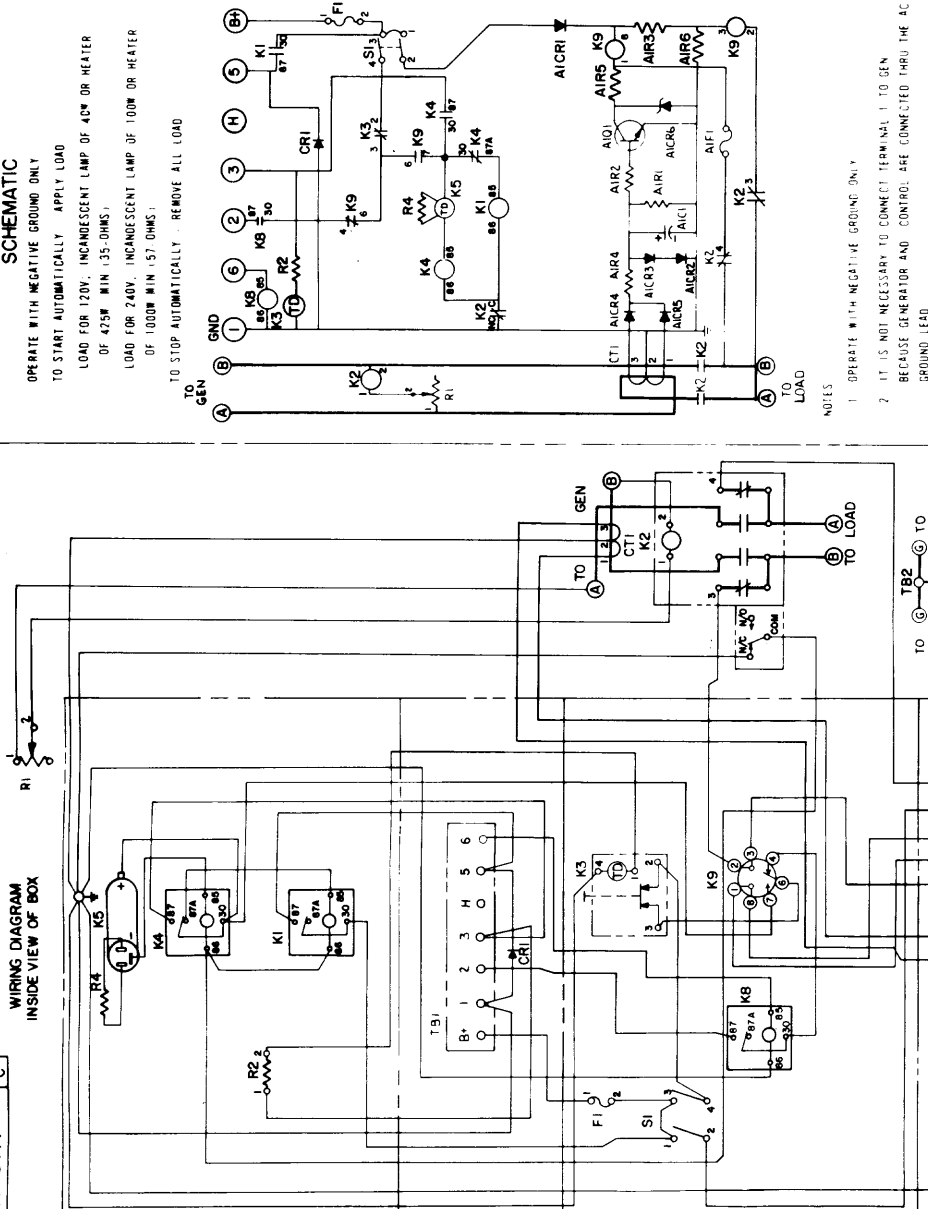
NOTES
1. OPERATE WITH NEGATIVE GROUND ONLY
2. IT IS NOT NECESSARY TO CONNECT TERMINAL 1 TO GEN
BECAUSE GENERATOR AND CONTROL ARE CONNECTED THRU THE AC
GROUND LEAD
3. CAUTION IF GEN IS CONNECTED TO LOAD TERMINALS
OF CONTACTOR K2 THE AC OUTPUT VOLTAGE WILL BLOW
THE PROTECTIVE FUSE.
4. MOUNT SWITCH WITH FINISHING NUT ON THE FRONT PANEL
5. HYPOT TEST WITH 1500V FOR ONE SECOND FROM K2 A
TO GEN-TB2 BEFORE RHY IS CONNECTED TO IT

CUSTOMER CONNECTIONS



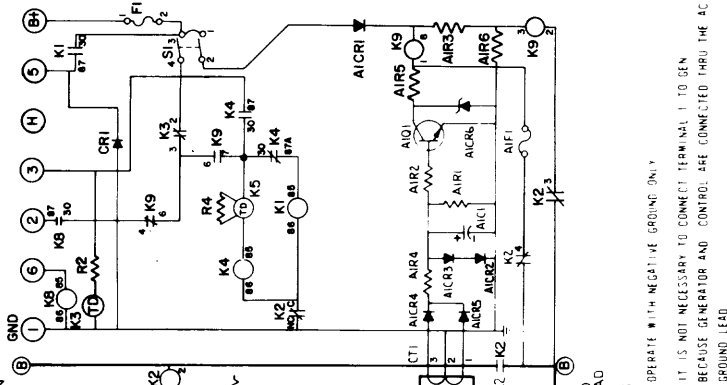
NOTE:
UNLESS OTHERWISE NOTED ALL
COMPONENTS ARE SHOWN IN THE
DE-ENERGIZED POSITION
(ENGINE CONTROL CIRCUIT)

617-0171

WIRING DIAGRAM
INSIDE VIEW OF BOX

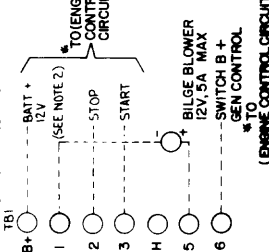
SCHEMATIC

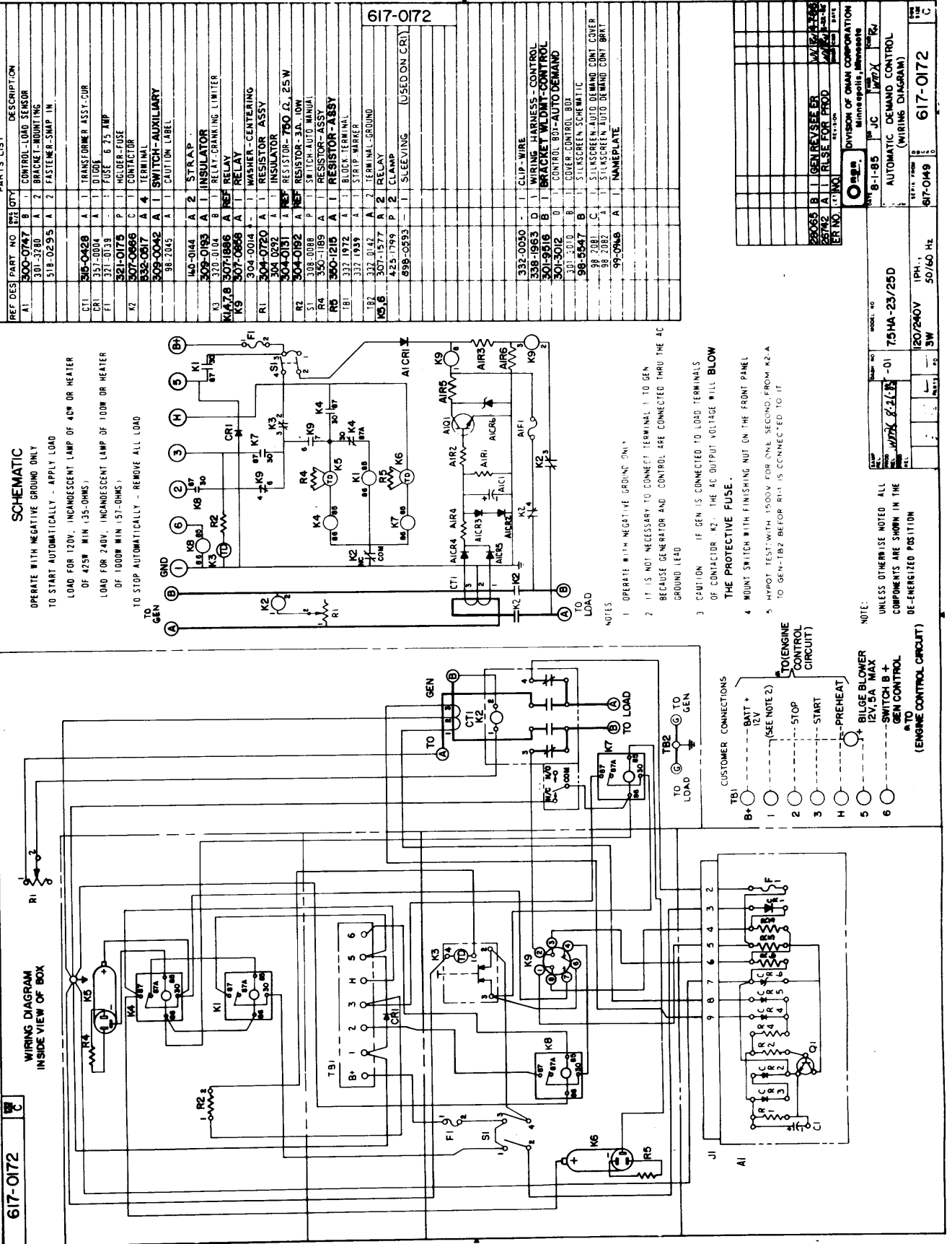
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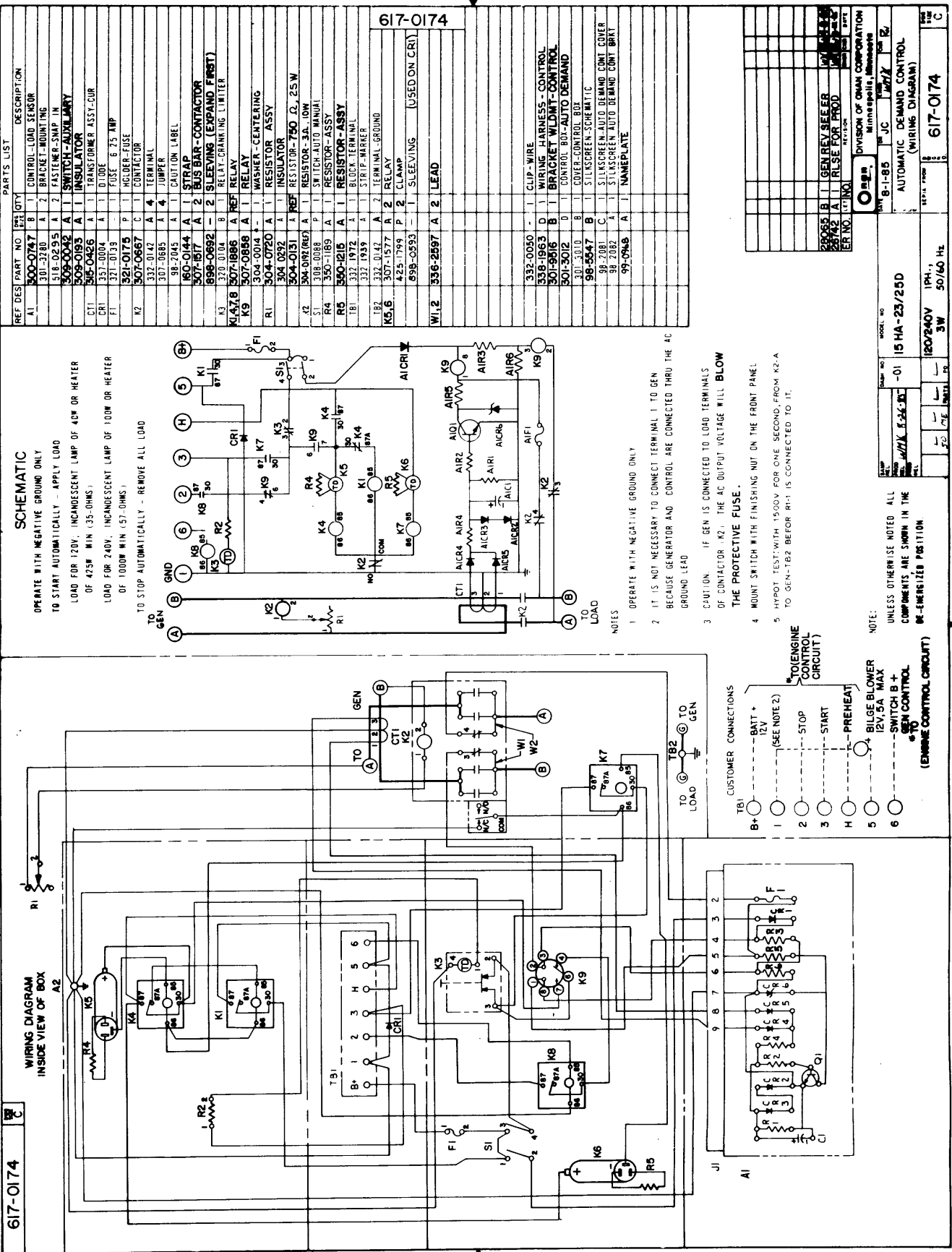


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CUSTOMER CONNECTIONS









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