

GENERATOR MOUNTED CONTROL PANEL

(TYPE 4 — CHANGE LEVEL 9 THRU 11)

INTRODUCTION

The uses of the generator mounted control panel are:

To help control the electric power made by the generator set.

To monitor (check) the operation of the generator set.

To help protect the generator set from damage caused by low oil pressure, high coolant temperature, overspeed and overcrank.

To help with the transfer of electrical load to and from the generator set.

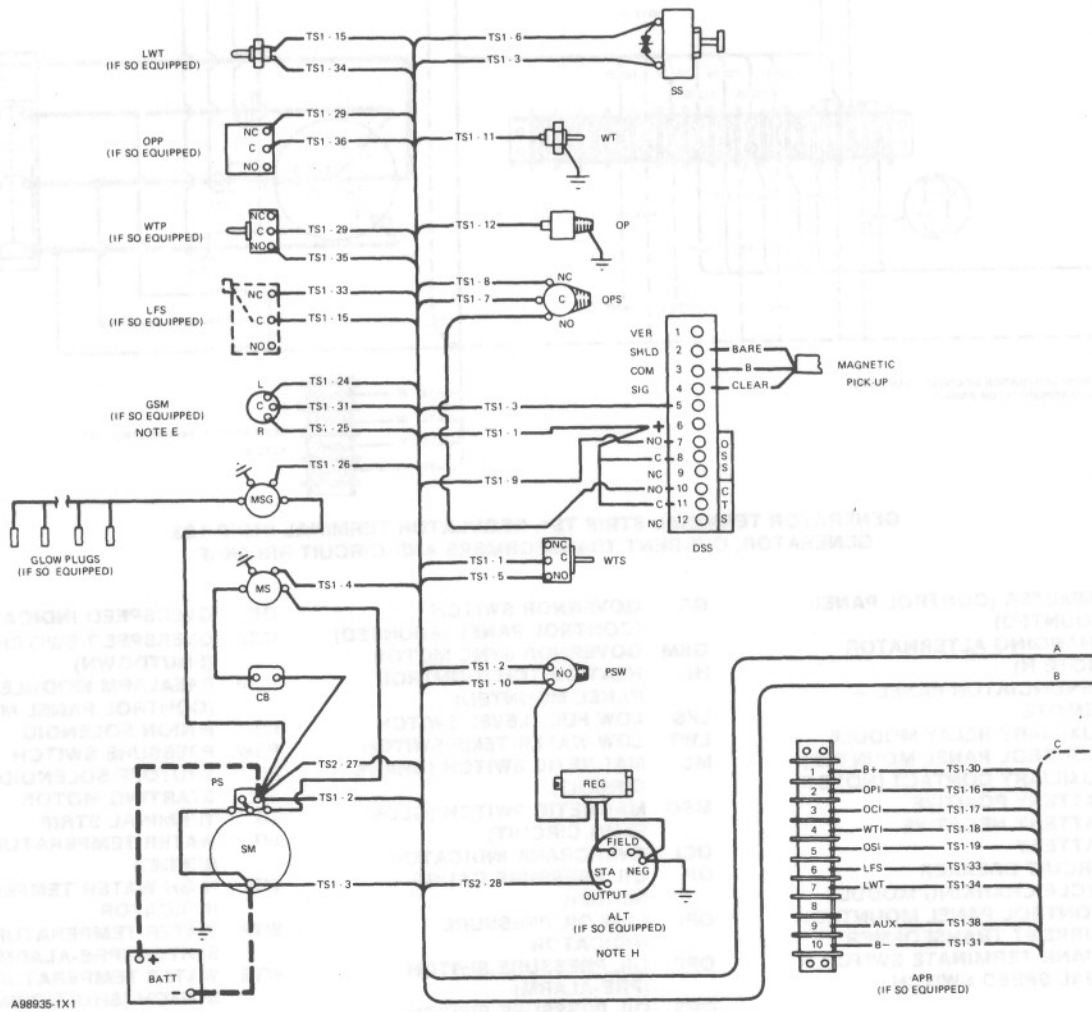
To help parallel two or more units onto the same bus.

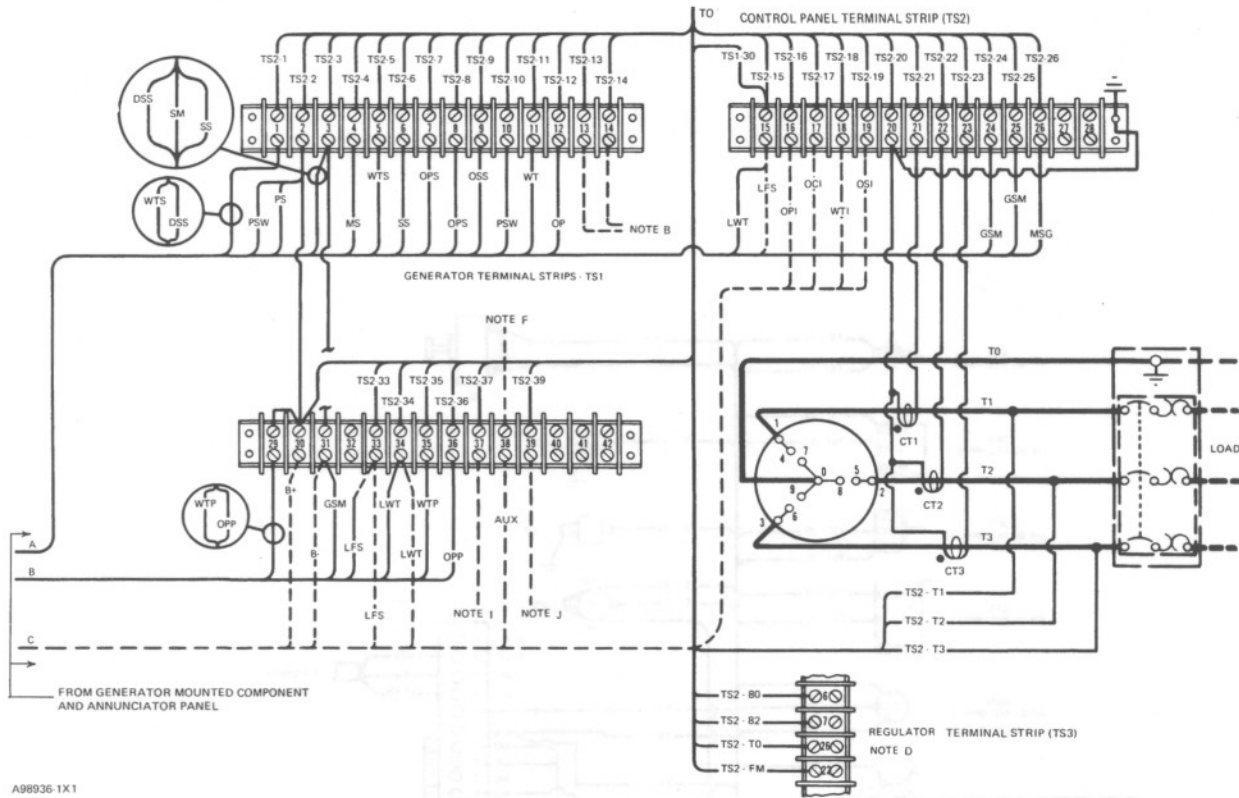
IDENTIFICATION

The location of the control panel is on the top of the regulator housing. This panel has a place for a heat switch and prealarm module. The shutdown indicators are relay lamp type. The control panel has either a 12 or 13 place model number on the panel nameplate. The model number gives an indication of the control panel component part numbers. Make reference to the Parts Book, GENERATOR MOUNTED CONTROL PANEL, Form No. SEBP1068. The last digit (or two digits) of the model number is the change level to which the panel was built.

WIRING

See the pages that follow for wiring diagrams, schematics and photographs for identification.

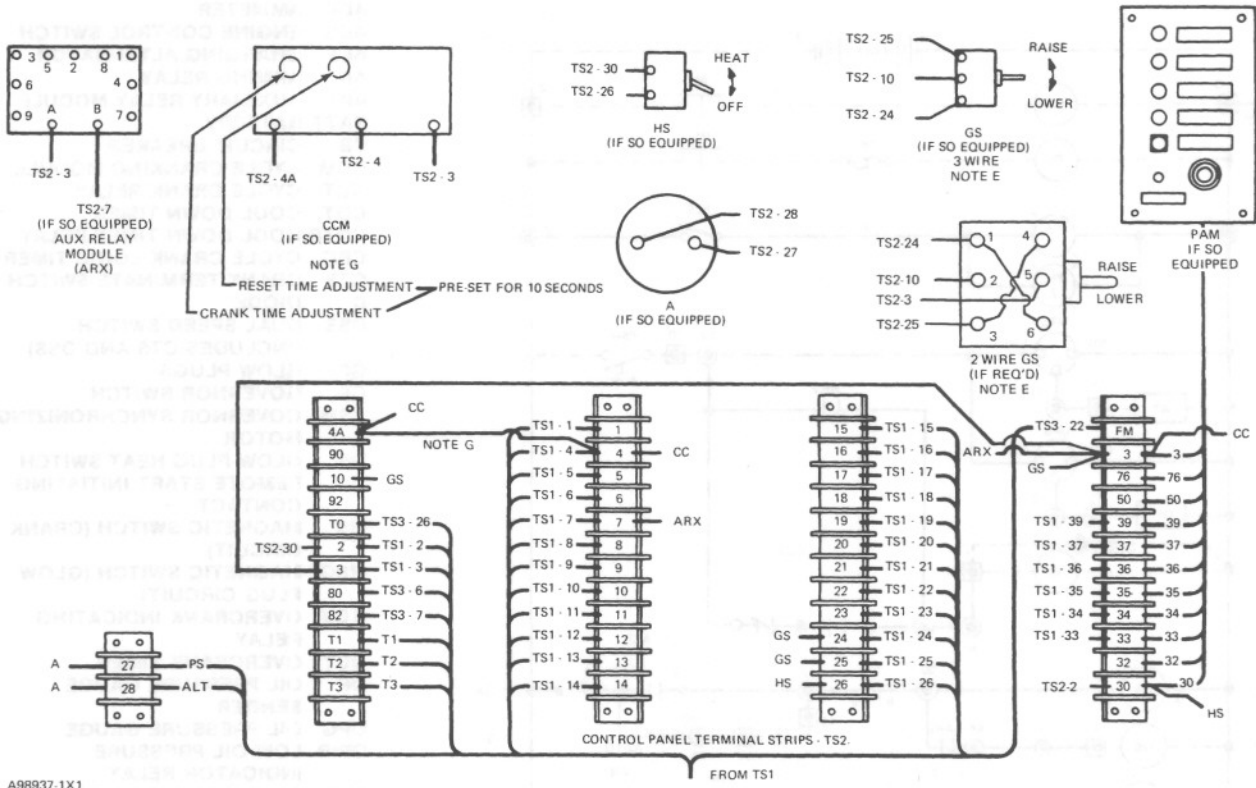




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GENERATOR TERMINAL STRIP TS1, REGULATOR TERMINAL STRIP TS3.
GENERATOR, CURRENT TRANSFORMERS AND CIRCUIT BREAKER

- | | | |
|---|---|---|
| <p>A AMMETER (CONTROL PANEL MOUNTED)</p> <p>ALT CHARGING ALTERNATOR (NOTE H)</p> <p>APR ANNUNCIATOR PANEL — REMOTE</p> <p>ARX AUXILIARY RELAY MODULE (CONTROL PANEL MOUNTED)</p> <p>AUX AUXILIARY CONTACT (NOTE F)</p> <p>B+ BATTERY POSITIVE</p> <p>B- BATTERY NEGATIVE</p> <p>BATT BATTERY</p> <p>CB CIRCUIT BREAKER</p> <p>CCM CYCLE CRANKING MODULE (CONTROL PANEL MOUNTED)</p> <p>CT CURRENT TRANSFORMER</p> <p>CTS CRANK TERMINATE SWITCH</p> <p>DSS DUAL SPEED SWITCH</p> | <p>GS GOVERNOR SWITCH (CONTROL PANEL MOUNTED)</p> <p>GSM GOVERNOR SYNC MOTOR</p> <p>HS HEAT SWITCH (CONTROL PANEL MOUNTED)</p> <p>LFS LOW FUEL LEVEL SWITCH</p> <p>LWT LOW WATER TEMP SWITCH</p> <p>MS MAGNETIC SWITCH (CRANK CIRCUIT)</p> <p>MSG MAGNETIC SWITCH (GLOW PLUG CIRCUIT)</p> <p>OPI OVERCRANK INDICATOR</p> <p>OP OIL PRESSURE GAUGE SENDER</p> <p>OPI LOW OIL PRESSURE INDICATOR</p> <p>OPP OIL PRESSURE SWITCH (PRE-ALARM)</p> <p>OPS OIL PRESSURE SWITCH (SHUTDOWN)</p> | <p>OSI OVERSPEED INDICATOR</p> <p>OSS OVERSPEED SWITCH (SHUTDOWN)</p> <p>PAM PREALARM MODULE (CONTROL PANEL MOUNTED)</p> <p>PS PINION SOLENOID</p> <p>PSW PRESSURE SWITCH</p> <p>SS SHUTOFF SOLENOID</p> <p>SM STARTING MOTOR</p> <p>TS TERMINAL STRIP</p> <p>WT WATER TEMPERATURE GAGE SENDER</p> <p>WT1 HIGH WATER TEMPERATURE INDICATOR</p> <p>WTP WATER TEMPERATURE SWITCH (PRE-ALARM)</p> <p>WTS WATER TEMPERATURE SWITCH (SHUTDOWN)</p> |
|---|---|---|



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CONTROL PANEL COMPONENTS (PARTIAL) AND CONTROL PANEL TERMINAL STRIP TS2

NOTE A: Wire and cable shown dotted to be furnished by customer.

NOTE B: To be wired to engine starting contact (N.O.) in auto transfer switch by customer.

NOTE C: Each wire on terminal strip is identified on each end — corresponding to terminal strip number.

NOTE D: Remove yellow wire and insulate from terminal 7 at TS3 before connecting wire from TS2.

NOTE E: Use 3 wire diagram with sodine 3 wire synchronizing motor. Use 2 wire diagram with 2 wire permanent magnet motor.

NOTE F: To be wired to auxiliary contact (N.O.) on emergency side of transfer switch. Req'd only when optional generator set annunciator panel (remote) is provided. (generating indication).

NOTE G: Red jumper wire from TS2-4A to TS2-4 must be removed when cycle cranking module is used.

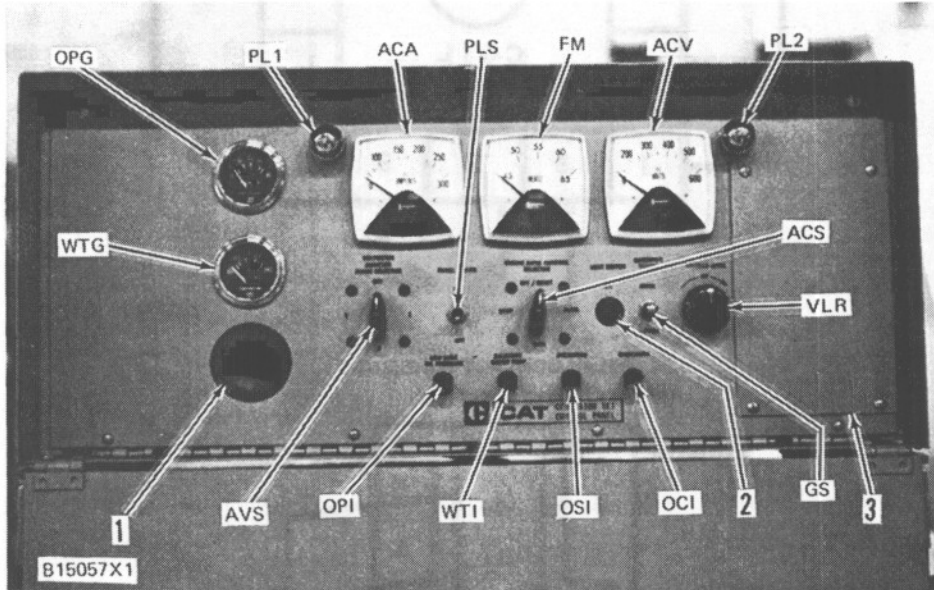
NOTE H: Do not operate alternator without a battery connected in the system. Do not polarize alternator. Do not operate alternator simultaneously with a DC generator to charge a common battery.

NOTE I: Provides 24 volts for remote low oil pressure (pre-alarm) (OPP) indication when pre-alarm module is used.

NOTE J: Provides 24V for customer provided remote shutdown and pre-alarm indicator when pre-alarm module is used.

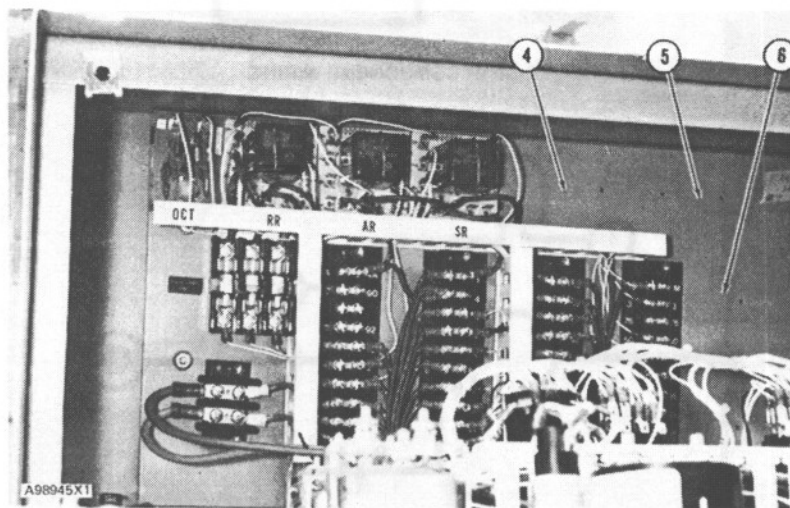
COMPONENTS

NOTE: For specifications on components located on the engine, make reference to the ENGINE SERVICE MANUAL.



CONTROL PANEL (TYPE 4 — CHANGE LEVEL 9 THRU 11)

- | | | | | | |
|-----|---------------------------------|-------|-----------------------------|-----|---|
| ACA | Alternating current ammeter | FM | Frequency meter | VLR | Voltage level rheostat |
| ACS | Engine control switch | PL1,2 | Panel lamps | 1. | Button (Direct current ammeter DCA) |
| ACV | Alternating current voltmeter | PLS | Panel lamp switch | 2. | Button (heat switch HS, if so equipped) |
| AVS | Ammeter/voltage selector switch | OCI | Overcrank indicator | 3. | Panel (prealarm module PAM, if so equipped) |
| | | OPG | Oil pressure gauge | | |
| | | OPI | Oil pressure indicator | | |
| | | OSI | Overspeed indicator | | |
| | | WTG | Water temperature gauge | | |
| | | WTI | Water temperature indicator | | |



INSIDE CONTROL PANEL
(TYPE 4 — CHANGE LEVEL 9 THRU 11)

4. Location for CDT (cool down timer, if so equipped). 5. Location for AUX (auxiliary relay, if so equipped). 6. Location for CCM (cycle crank module, if so equipped).

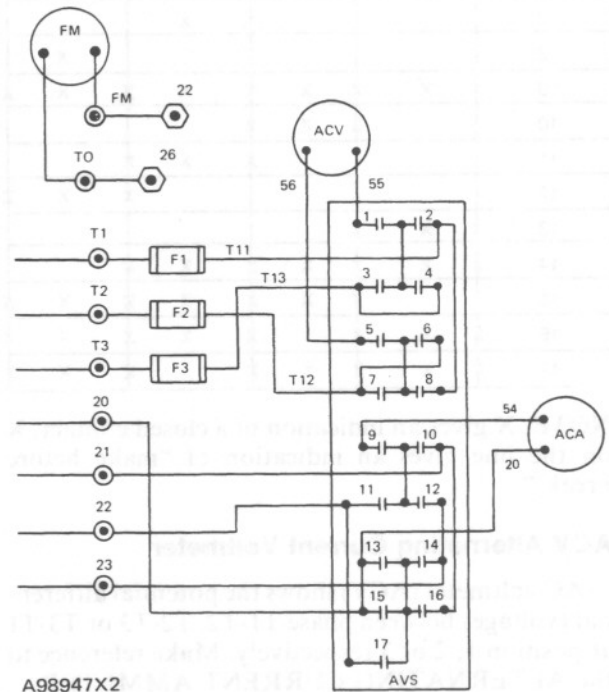
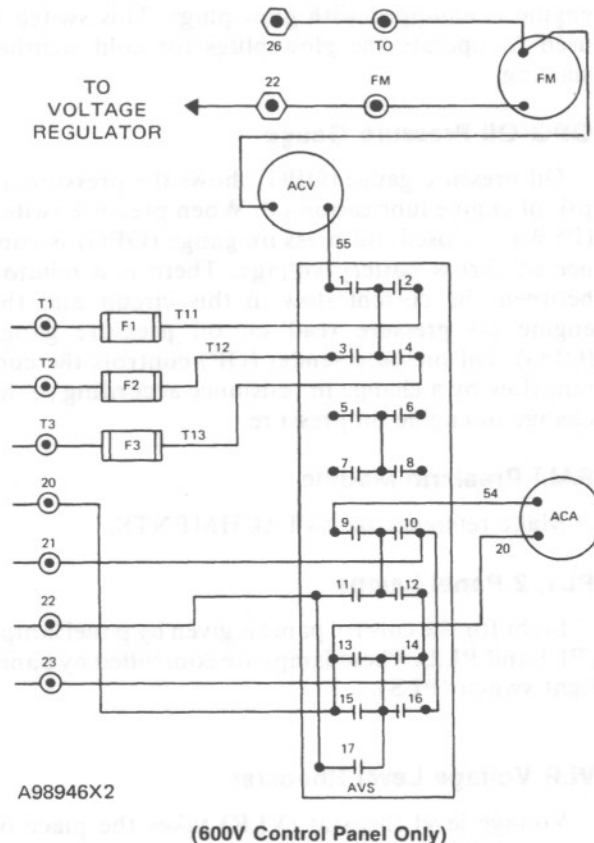
ACA Alternating Current Ammeter

AC ammeter (ACA) gives an indication, in amperes, of the current from each phase of the generator to the load. Ammeter/voltmeter selector switch (AVS) is used to connect the ammeter to the current transformer on phase T1, T2 or T3; see Contact Chart. Ammeters normally have an input range from 0 to 5 amperes. Current transformer (CT1, CT2 or CT3) causes a reduction of the actual line current, in its respective phase lead, to a level within the input range of the ammeter. The ammeter is calibrated (has marks) to give an indication of the actual current flow in one phase load of the generator.

NOTE: Several methods have been used to connect control panel instruments. The recommended method is shown in the diagrams.

CONTACT CHART FOR AVS				
PHASES				
CONTACT	OFF	1 (T1)	2 (T2)	3 (T3)
1	X	X	X	X
2		X		
3			X	
4				X
5	X	X	X	X
6		X		
7			X	
8				X
9	X	X	X	X
10		X	X	
11			X	X
12				X
13	X	X		
14	X	X	X	X
15		X	X	X
16	X	X	X	X
17	X	X	X	X

NOTE: X gives an indication of a closed contact, X on the line gives an indication of "make before break."



AMMETER/VOLTMETER SELECTOR SWITCH (AVS) WIRING DIAGRAMS

- ACA Alternating current ammeter
- ACV Alternating current voltmeter
- F1,2,3 Fuses
- FM Frequency meter

- ⊙ Terminal point on TS2 in control panel
- ⊙ Terminal Point on TS3 part of voltage regulator

ACS Engine Control Switch

Engine control switch (ACS) controls the engine start and stop systems. To start the engine, move the switch to the MANUAL position. To stop the engine move the switch to the STOP or OFF/RESET position. For standby application (engine starts when remote initiating contact I closes), move the switch to the AUTO position. To start after engine shutdown caused by high water temperature, low oil pressure or overspeed, turn switch to STOP position and correct fault. Then move switch to OFF/RESET position. Engine can now be started in MANUAL or AUTO position. For more information on the operation of this switch, make reference to the AUTOMATIC START/STOP SYSTEM.

CONTACT CHART FOR ACS				
CONTACT	OFF- RESET	AUTO	MAN	STOP
1	X	X	X	X
2		X		
3			X	
4				X
5	X	X	X	X
6		X		
7			X	
8				X
9	X	X	X	X
10		X	X	
11			X	X
12				X
13	X	X		
14	X	X	X	X
15		X	X	X
16	X	X	X	X
17	X	X	X	X

NOTE: X gives an indication of a closed contact, X on the line gives an indication of "make before break."

ACV Alternating Current Voltmeter

AC voltmeter (ACV) shows the potential differential (voltage) between phase T1-T2, T2-T3 or T3-T1 at position 1, 2 or 3 respectively. Make reference to the ALTERNATING CURRENT AMMETER.

DCA Direct Current Ammeter

DC Ammeter (DCA) is used in place of button (1) when the ammeter is ordered. This ammeter shows the amount of DC current in amperes, that flows in the alternator circuit (if so equipped).

FM Frequency Meter

Frequency meter (FM) shows the hertz (cycles per second) of the electricity made when the generator set is in operation. There is a direct relation between the frequency of the electricity and the rpm of the generator set; see formula.

$$\text{frequency (hertz)} = \frac{\text{number of poles} \times \text{rpm}}{120}$$

GS Governor Switch

Governor switch (GS) is used when the engine is equipped with a remote control synchronizing motor for the governor. Engine speed is controlled with this switch.

HS Heat Switch

Heat switch (HS) is in place of button (2) when the engine is equipped with glow plugs. This switch is used to operate the glow plugs for cold weather starting.

OPG Oil Pressure Gauge

Oil pressure gauge (OPG) shows the pressure, in psi, of engine lubrication oil. When pressure switch (PSW) is closed, oil pressure gauge (OPG) is connected across battery voltage. There is a relation between the current flow in this circuit and the engine oil pressure read on oil pressure gauge (OPG). Oil pressure sender (OP) controls the current flow by a change in resistance according to the change in engine oil pressure.

PAM Prealarm Module

Make reference to ATTACHMENTS.

PL1, 2 Panel Lamps

Light for the control panel is given by panel lamps (PL1 and PL2). These lamps are controlled by panel light switch (PLS).

VLR Voltage Level Rheostat

Voltage level rheostat (VLR) takes the place of voltage level rheostat (R2) on the generator regulator assembly. It is used to adjust the voltage output of the generator.

NOTE: Make reference to OPERATION OF GENERATOR; REGULATOR ADJUSTMENT. On generators equipped with a generator mounted control panel, the yellow wire from voltage level rheostat (R2) to terminal (7) on the regulator terminal strip is disconnected at terminal (7).

AUTOMATIC START/STOP SYSTEM

Introduction

The automatic start/stop system is normally used for standby operation. That is, without an operator. The generator set must start, pick up the load, operate the load, and stop after the load is removed. An automatic transfer switch controls the transfer of load to and from the generator set. When normal (commercial) power has a failure, initiating contactor (I), part of the automatic transfer switch, closes. This will begin the automatic start sequence. When the engine starts, the control panel instruments will show voltage and frequency. The automatic transfer switch will transfer the load to the generator set when voltage and frequency reach approximately rated value. When normal power returns, the automatic transfer switch will transfer the load back to normal power. Initiating contactor (I) will open. This will begin the automatic stop sequence. The generator set will also stop automatically if the engine has a failure.

NOTE: For specifications on components located on the engine, make reference to the ENGINE SERVICE MANUAL.

Automatic Start

With engine control switch (ACS) in the AUTO position, contacts (10) and (9) are closed. When commercial (normal) power has a failure, remote start initiating contact (I) closes. This makes a complete circuit from battery (BATT) to energize run relay (RR) and magnetic switch (MS).

When run relay (RR) is energized, contacts (RR2) open and contacts (RR1) close. (RR2) open prevents current flow to shutoff solenoid (SS) through pressure switch (PSW). (RR1) closed energizes dual speed switch (DSS) and overcrank timer (OCT).

When dual speed switch (DSS) is energized, a magnetic pickup relays engine rpm to the switch. The dual speed switch has a crank terminate (CTS) circuit and an overspeed (OSS) circuit.

When overcrank timer (OCT) is energized, a timer will start. After the engine cranks for approximately 30 seconds the timer will stop. (OCT) contacts will close. Make reference to ENGINE DOES NOT START.

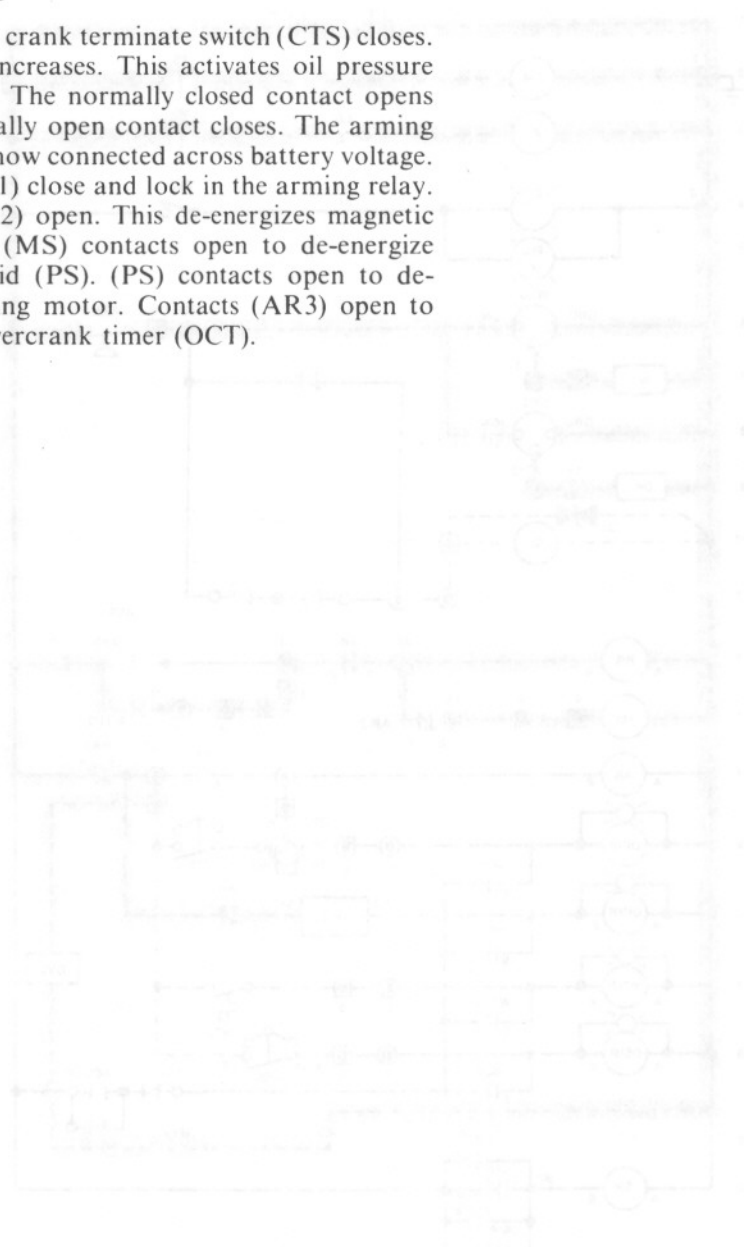
When magnetic switch (MS) is energized, (MS) contacts close and pinion solenoid (PS) is energized. This causes (PS) contacts to close, starting motor (SM) will crank the engine. (PSW) will close. This energizes water temperature gauge (WTG) and oil pressure gauge (OPG).

Manual Start

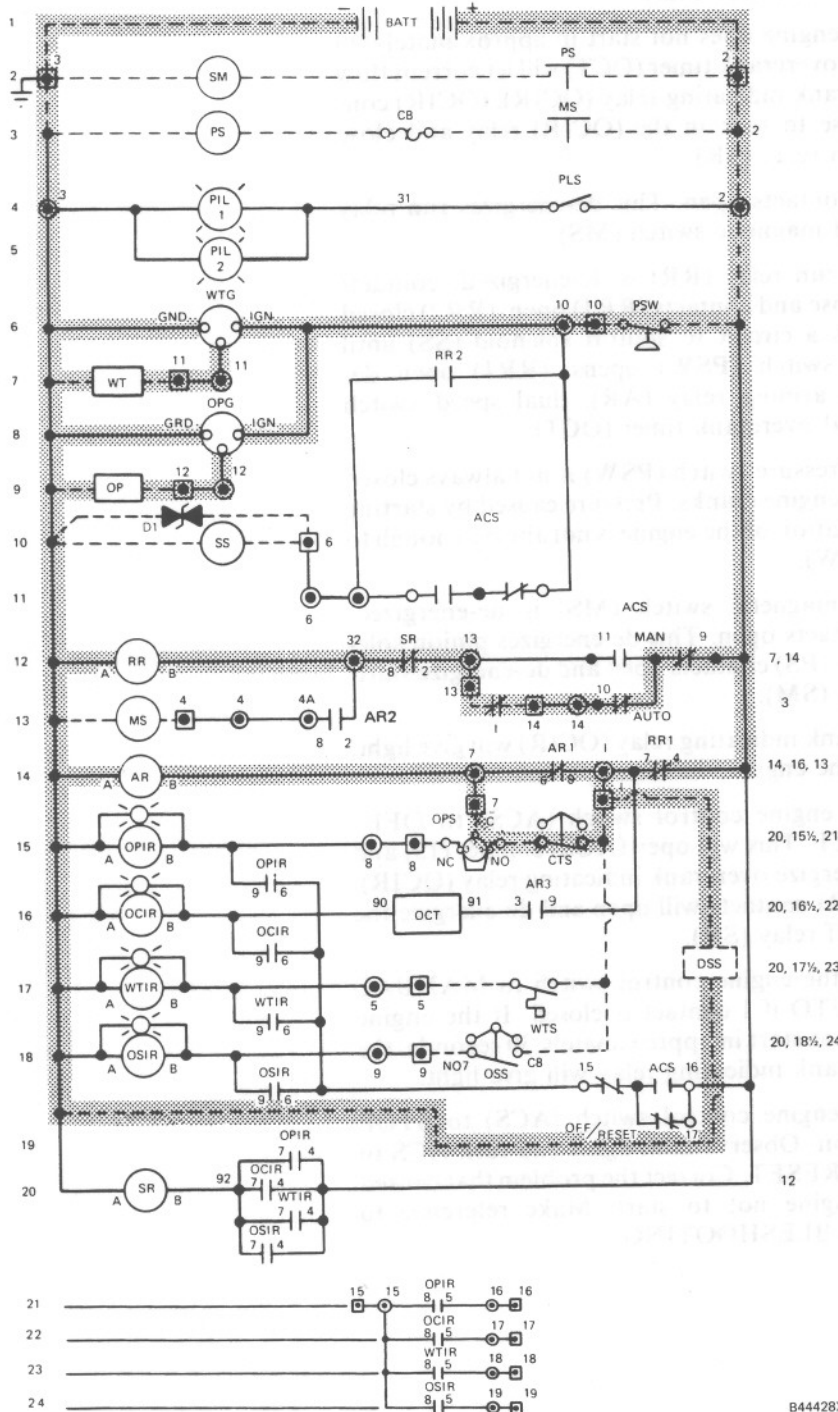
The current flow for manual start is similar to automatic start except engine control switch (ACS) is turned to the MAN position. Contact (10) is open and contact (11) is closed. It is not necessary for remote start indicating contact (I) to close. Run relay (RR) and magnetic switch (MS) will energize as soon as contact (11) is closed.

Engine Starts

At 600 rpm, crank terminate switch (CTS) closes. Oil pressure increases. This activates oil pressure switch (OPS). The normally closed contact opens and the normally open contact closes. The arming relay (AR) is now connected across battery voltage. Contacts (AR1) close and lock in the arming relay. Contacts (AR2) open. This de-energizes magnetic switch (MS). (MS) contacts open to de-energize pinion solenoid (PS). (PS) contacts open to de-energize starting motor. Contacts (AR3) open to de-energize overcrank timer (OCT).



CONTROL PANEL
AUTOMATIC STOPPER - SAE 30 CHASSIS



- ADC AMMETER
 - ACS ENGINE CONTROL SWITCH
 - ALT CHARGING ALTERNATOR
 - AR ARMING RELAY
 - ARX AUXILIARY RELAY MODULE
 - BATT BATTERY
 - CB CIRCUIT BREAKER
 - CCM CYCLE CRANKING MODULE
 - CCT CYCLE CRANK RELAY
 - CDT COOL DOWN TIMER
 - CDTR COOL DOWN TIMER RELAY
 - CRC CYCLE CRANK LOGIC TIMER
 - CTS CRANK TERMINATE SWITCH
 - D DIODE
 - DSS DUAL SPEED SWITCH (INCLUDES CTS AND OSS)
 - GP GLOW PLUGS
 - GS GOVERNOR SWITCH
 - GSM GOVERNOR SYNCHRONIZING MOTOR
 - HS GLOW PLUG HEAT SWITCH
 - I REMOTE START INITIATING CONTACT
 - MS MAGNETIC SWITCH (CRANK CIRCUIT)
 - MSG MAGNETIC SWITCH (GLOW PLUG CIRCUIT)
 - OCIR OVERCRANK INDICATING RELAY
 - OCT OVERCRANK TIMER
 - OP OIL PRESSURE GAUGE SENDER
 - OPG OIL PRESSURE GAUGE
 - OPIR LOW OIL PRESSURE INDICATOR RELAY
 - OPS OIL PRESSURE SWITCH
 - OSIR OVERSPEED INDICATING RELAY
 - OSS OVERSPEED SWITCH
 - PIL PANEL ILLUMINATION LAMP
 - PLS PANEL LAMP SWITCH
 - PS PINION SOLENOID
 - PSW PRESSURE SWITCH
 - RR RUN RELAY
 - SS SHUT-OFF SOLENOID
 - SM STARTING MOTOR
 - SR SHUTDOWN RELAY
 - WT WATER TEMPERATURE GAUGE SENDER
 - WTG WATER TEMPERATURE GAUGE
 - WTIR HIGH WATER TEMPERATURE INDICATING RELAY
 - WTS WATER TEMPERATURE SWITCH
- TERMINAL STRIP POINT (CONTROL PANEL)
 TERMINAL STRIP POINT (GENERATOR TERMINAL BOX)

CONTROL PANEL
AUTOMATIC POSITION—ENGINE STARTS

Engine Does Not Start

If the engine does not start in approximately 30 seconds, overcrank timer (OCT) will let current flow to overcrank indicating relay (OCIR). (OCIR) contacts close to lock in the (OCIR) relay and close shutdown relay (SR).

(SR) contacts open. This de-energizes run relay (RR) and magnetic switch (MS).

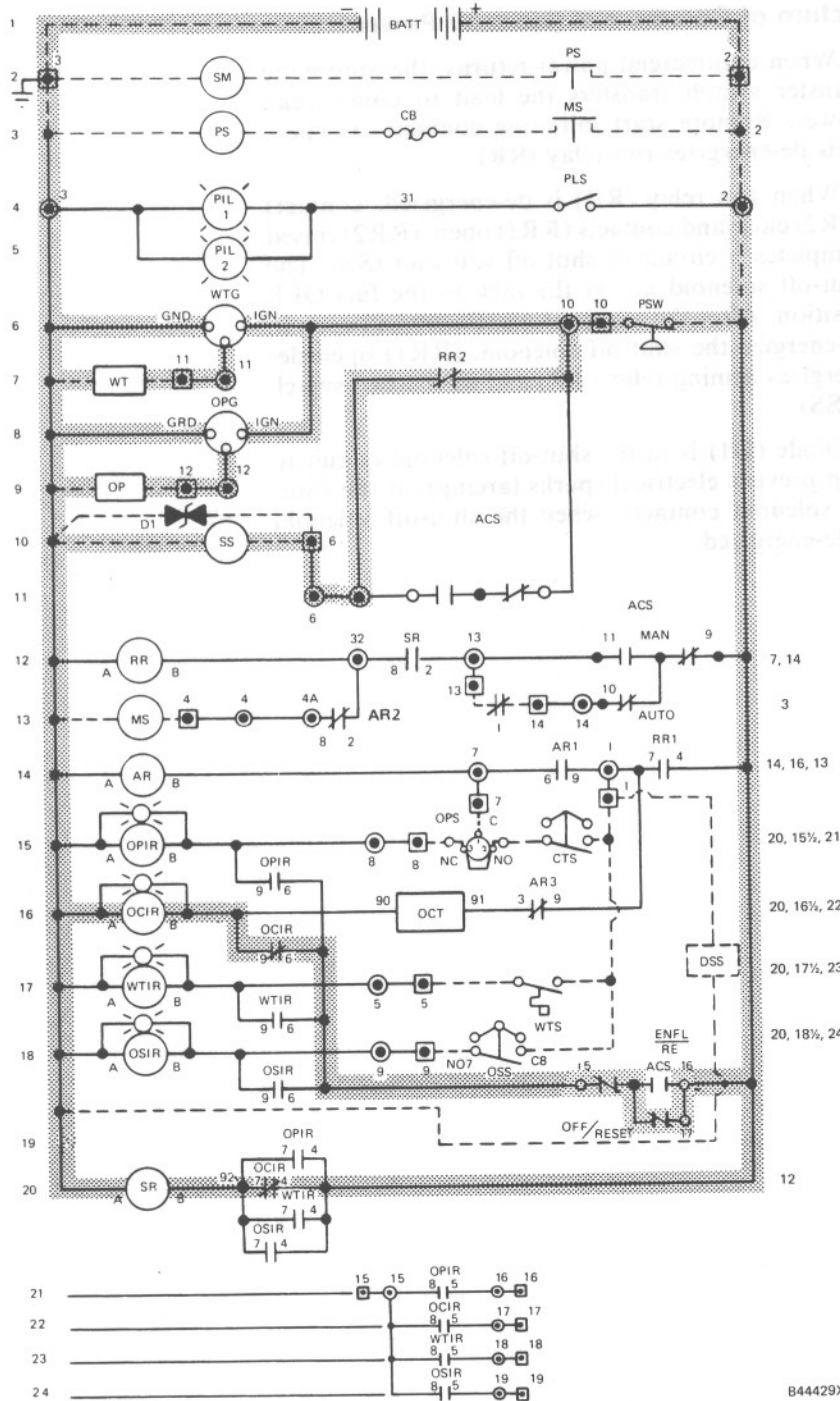
When run relay (RR) is de-energized, contacts (RR2) close and contacts (RR1) open. (RR2) closed completes a circuit to shutoff solenoid (SS) until pressure switch (PSW) opens. (RR1) open de-energizes arming relay (AR), dual speed switch (DSS) and overcrank timer (OCT).

NOTE: Pressure switch (PSW) is not always closed when the engine cranks. Pressure caused by starting motor rotation of the engine is not always enough to close (PSW).

When magnetic switch (MS) is de-energized, (MS) contacts open. This de-energizes pinion solenoid (PS). (PS) contacts open and de-energize starting motor (SM).

Overcrank indicating relay (OCIR) will give light. To start the engine, do the steps that follow:

1. Turn engine control switch (ACS) to OFF/RESET. This will open (ACS) contact (15) and de-energize overcrank indicating relay (OCIR). (OCIR) contacts will open and de-energize the shutoff relay (SR).
2. Turn the engine control switch to MANUAL or AUTO if I contact is closed. If the engine does not start in approximately 30 seconds, the overcrank indicating relay will give light.
3. Turn engine control switch (ACS) to STOP position. Observe fault lights and turn ACS to OFF/RESET. Correct the problem that caused the engine not to start. Make reference to TROUBLESHOOTING.



- ADC AMMETER
 - ACS ENGINE CONTROL SWITCH
 - ALT CHARGING ALTERNATOR
 - AR ARMING RELAY
 - ARX AUXILIARY RELAY MODULE
 - BATT BATTERY
 - CB CIRCUIT BREAKER
 - CCM CYCLE CRANKING MODULE
 - CCT CYCLE CRANK RELAY
 - CDT COOL DOWN TIMER
 - CDTR COOL DOWN TIMER RELAY
 - CRC CYCLE LOGIC TIMER
 - CTS CRANK TERMINATE SWITCH
 - D DIODE
 - DSS DUAL SPEED SWITCH (INCLUDES CTS AND OSS)
 - GP GLOW PLUGS
 - GS GOVERNOR SWITCH
 - GSM GOVERNOR SYNCHRONIZING MOTOR
 - HS GLOW PLUG HEAT SWITCH
 - I REMOTE START INITIATING CONTACT
 - MS MAGNETIC SWITCH (CRANK CIRCUIT)
 - MSG MAGNETIC SWITCH (GLOW PLUG CIRCUIT)
 - OCIR OVERCRANK INDICATING RELAY
 - OCT OVERCRANK TIMER
 - OP OIL PRESSURE GAUGE SENDER
 - OPG OIL PRESSURE GAUGE
 - OPIR LOW OIL PRESSURE INDICATOR RELAY
 - OPS OIL PRESSURE SWITCH
 - OSIR OVERSPEED INDICATOR RELAY
 - OSS OVERSPEED SWITCH
 - PIL PANEL ILLUMINATION LAMP
 - PLS PANEL LAMP SWITCH
 - PS PINION SOLENOID
 - PSW PRESSURE SWITCH
 - RR RUN RELAY
 - SS SHUT-OFF SOLENOID
 - SM STARTING MOTOR
 - SR SHUTDOWN RELAY
 - WT WATER TEMPERATURE GAUGE SENDER
 - WTG WATER TEMPERATURE GAUGE
 - WTIR HIGH WATER TEMPERATURE INDICATING RELAY
 - WTS WATER TEMPERATURE SWITCH
-
- TERMINAL STRIP POINT (CONTROL PANEL)
 - TERMINAL STRIP POINT (GENERATOR TERMINAL BOX)

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CONTROL PANEL
AUTOMATIC POSITION—ENGINE DOES NOT START

Return of Commercial (Normal) Power

When commercial power returns, the automatic transfer switch transfers the load to commercial power. Remote start initiating contacts (I) open. This de-energizes run relay (RR).

When run relay (RR) is de-energized, contacts (RR2) close and contacts (RR1) open. (RR2) closed completes a circuit to shut-off solenoid (SS). The shut-off solenoid moves the rack to the fuel OFF position. After the engine stops (PSW) will open to de-energize the shut-off solenoid. (RR1) open de-energizes arming relay (AR) and dual speed switch (DSS).

Diode (D1) is in the shut-off solenoid circuit to help prevent electrical sparks (arcing), at the shut-off solenoid contacts, when the shut-off solenoid is de-energized.

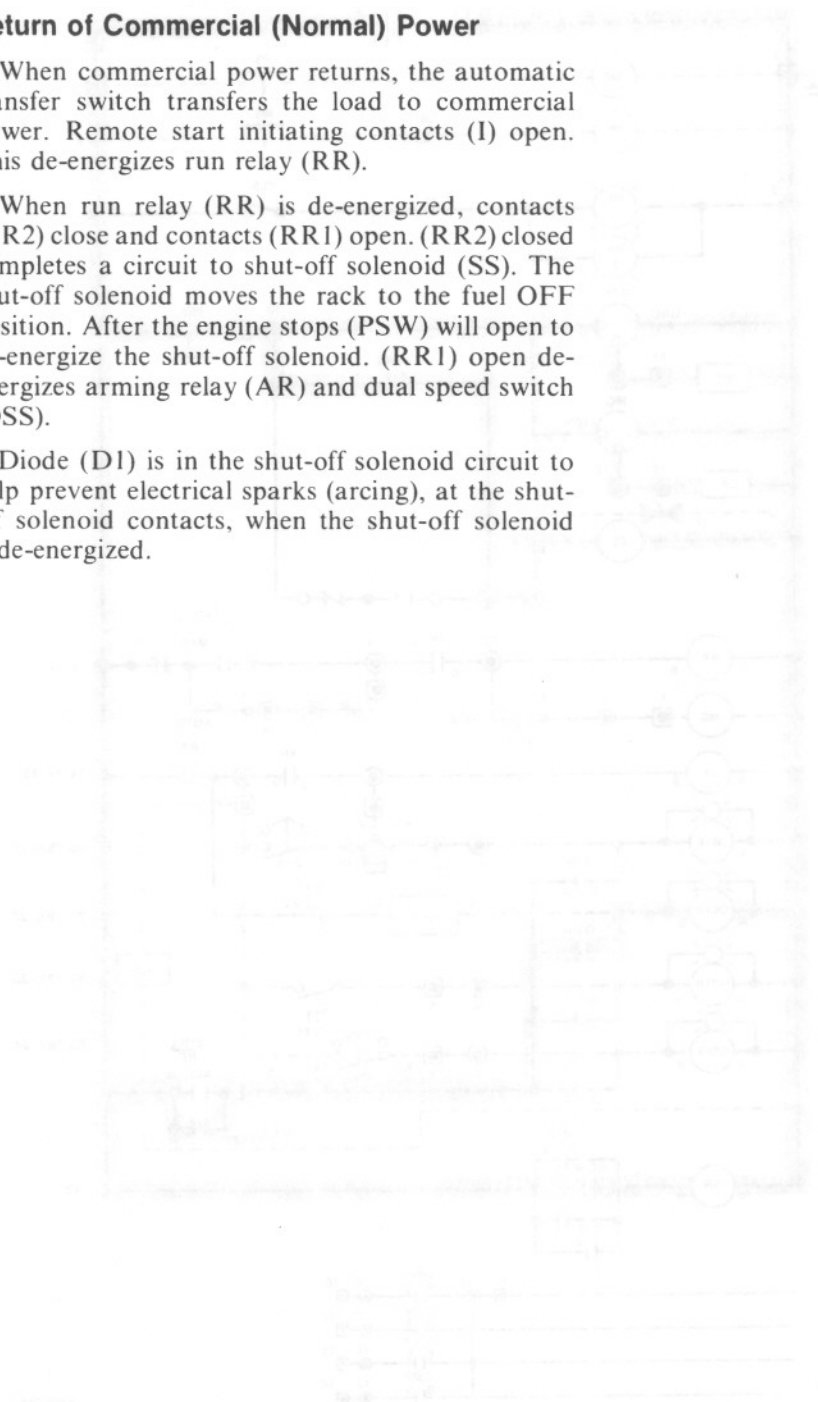


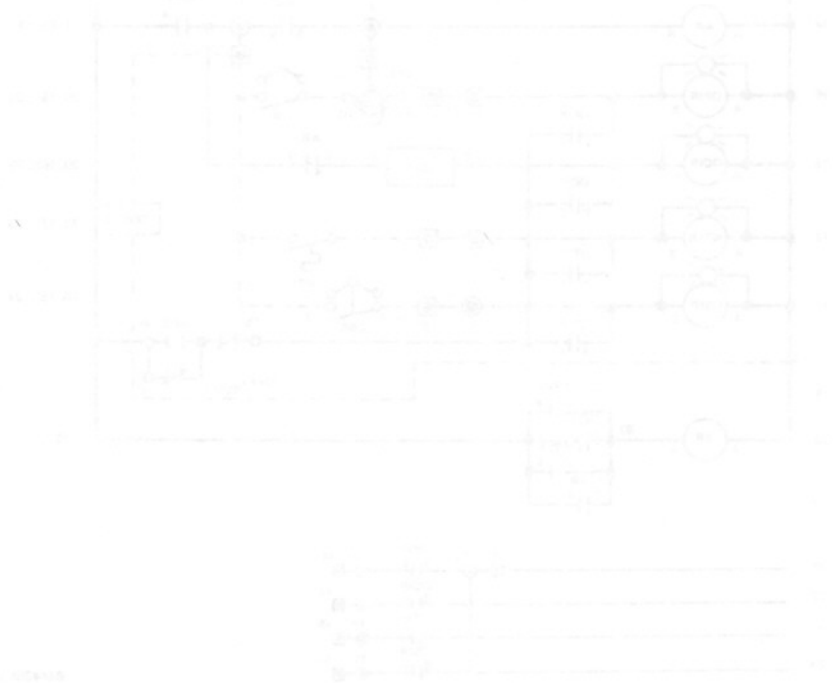
Diagram description: AUTOMATIC STOP-ENGINE DOES NOT START

Manual Shutdown

When engine control switch (ACS) is turned to the STOP position or OFF/RESET position, contacts (10 and 11) are open. With contacts (10 and 11) open, the run relay (RR) de-energizes. In addition, the STOP position closes contacts (5 and 8). This provides another path to the shutoff solenoid (SS).

When run relay (RR) is de-energized, contact (RR2) closes and contact (RR1) opens. With (RR2) closed, it completes a circuit to the shut-off solenoid (SS). If the STOP position is used, closed contact (RR2) completes a parallel circuit to shutoff solenoid (SS). (This parallel circuit is necessary to stop the engine when the engine control switch is in the AUTO or MAN position.) After the engine stops, (PSW) will open to de-energize the shutoff solenoid. With contact (RR1) open, the arming relay (AR) and the dual speed switch (DSS) are de-energized.

Diode D1 helps prevent electrical sparks (arcing) at the contacts in the shutoff solenoid circuit when the shutoff solenoid is de-energized.



CONTROL PANEL - AUTOMATIC SHUTDOWN

Shutdown Caused by Engine Failure

The packaged generator set has shutdown sensors, shutdown indicators and shutdown circuit for the conditions that follow.

1. Low oil pressure
2. High water temperature
3. Overspeed
4. Overcrank

For information about overcrank shutdown, make reference to ENGINE DOES NOT START.

Conditions (1, 2 or 3) will energize its respective indicating relay. The number (2) contacts of the respective relay will close to energize shut-off relay (SR). The number (1) contacts of the respective relay will close to lock in the relay.

When shutdown relay (SR) is energized, (SR) contacts open. This de-energizes run relay (RR). Contacts (RR2) close and contacts (RR1) open. (RR2) closed completes a circuit to shut-off solenoid (SS) until pressure switch (PSW) opens. (RR1) open de-energizes arming relay (AR) and dual speed switch (DSS).

Diode (D1) helps prevent electrical sparks (arcing) at the contacts in the shut-off solenoid circuit, when the shut-off solenoid is de-energized.

Indicating relay for the fault condition will give light. To start the engine, do the steps that follow.

1. Turn engine control switch (ACS) to OFF or STOP.

NOTE: For start up when (OCIR) indicating relay gives light, make reference to ENGINE DOES NOT START.

2. Correct the problem that caused the engine to shutdown.
3. Rotate ACS to OFF/RESET position. This de-energizes the indicating relay. The indicating relay contacts will open and de-energize the shutdown relay (SR).

NOTE: Reset oil pressure or overspeed switch if necessary. The system is ready to start if engine control switch (ACS) is turned to MAN or AUTO.

