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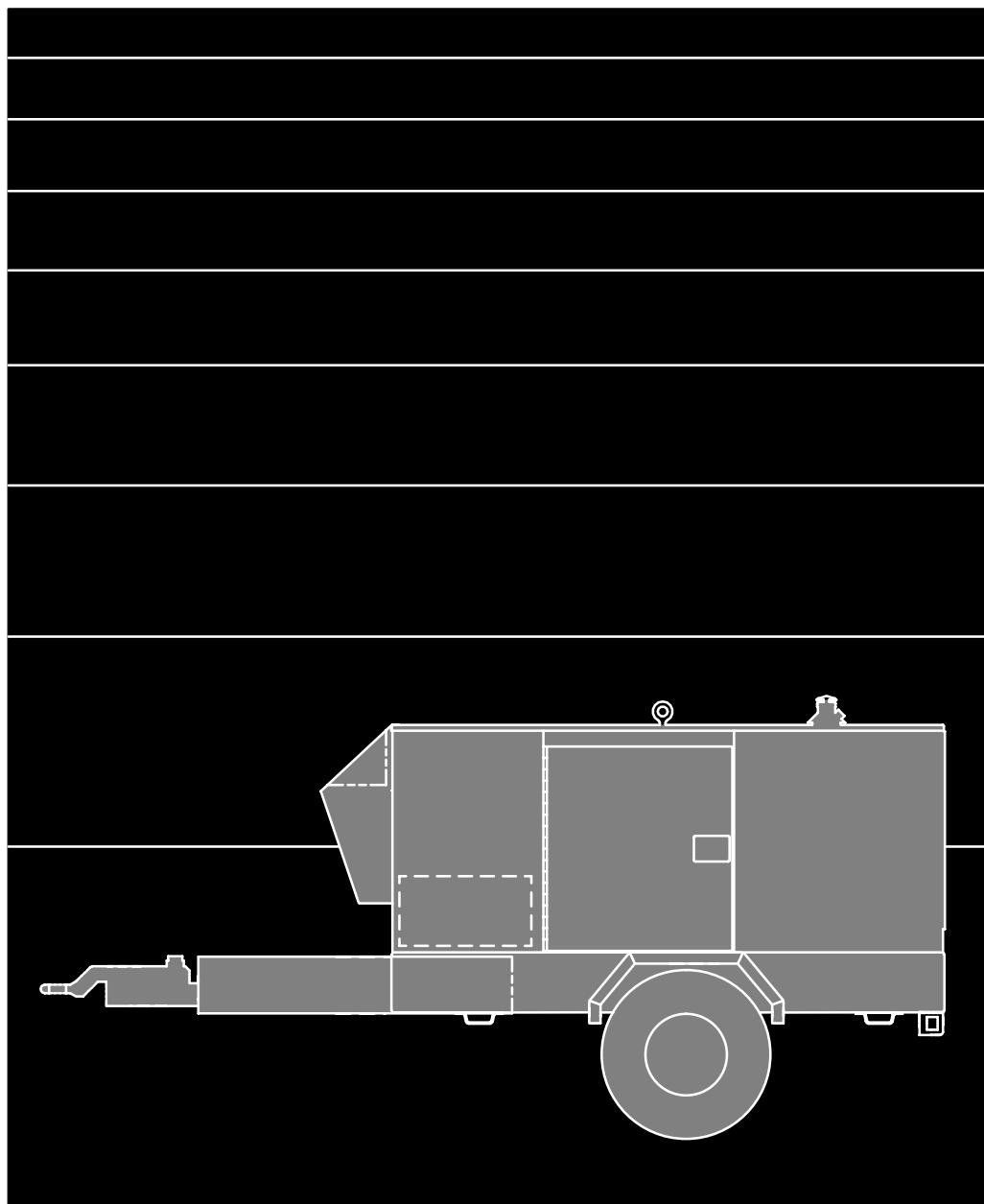
# Operator's Manual

QS 36

QS 50

QS 60

## GENERATOR SETS



Printed U.S.A.

960-0141 11-95

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## California

### Proposition 65 Warning

Diesel engine exhaust and some of its constituents are known to the State of California to cause cancer, birth defects, and other reproductive harm.

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# Safety Precautions

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**Before operating the generator set,** read the Operator's Manual and become familiar with it and the equipment. **Safe and efficient operation can be achieved only if the equipment is properly operated and maintained.** Many accidents are caused by failure to follow fundamental rules and precautions.

The following symbols, found throughout this manual, alert you to potentially dangerous conditions to the operator, service personnel, or the equipment.

**⚠ DANGER** *This symbol 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.*

## FUEL AND FUMES ARE FLAMMABLE

Fire, explosion, and personal injury or death can result from improper practices.

- DO NOT fill fuel tanks while engine is running, unless tanks are outside the engine compartment. Fuel contact with hot engine or exhaust is a potential fire hazard.
- DO NOT permit any flame, cigarette, pilot light, spark, arcing equipment, or other ignition source near the generator set or fuel tank.
- Fuel lines must be adequately secured and free of leaks. Fuel connection at the engine should be made with an approved flexible line. Do not use copper piping on flexible lines as copper will become brittle if continuously vibrated or repeatedly bent.

- Be sure all fuel supplies have a positive shutoff valve.
- Do not smoke while servicing lead acid batteries. Lead acid batteries emit a highly explosive hydrogen gas that can be ignited by electrical arcing or by smoking.

## EXHAUST GASES ARE DEADLY

- Provide an adequate exhaust system to properly expel discharged gases away from enclosed or sheltered areas and areas where individuals are likely to congregate. Visually and audibly inspect the exhaust daily for leaks per the maintenance schedule. Ensure that exhaust manifolds are secured and not warped. Do not use exhaust gases to heat a compartment.
- Be sure the unit is well ventilated.

## MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Keep your hands, clothing, and jewelry away from moving parts.
- Before starting work on the generator set, disconnect starting batteries, negative (-) cable first. This will prevent accidental starting.
- Make sure that fasteners on the generator set are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- Do not wear loose clothing or jewelry in the vicinity of moving parts, or while working on electrical equipment. Loose clothing and jewelry can become caught in moving parts. Jewelry can short out electrical contacts and cause shock or burning.
- If adjustment must be made while the unit is running, use extreme caution around hot manifolds, moving parts, etc.

## **ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH**

- 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 surface to be damp when handling electrical equipment.
- Use extreme caution when working on electrical components. High voltages can cause injury or death. DO NOT tamper with interlocks.
- Follow all applicable state and local electrical codes. Have all electrical installations performed by a qualified licensed electrician. Tag open switches to avoid accidental closure.
- DO NOT CONNECT GENERATOR SET DIRECTLY TO ANY BUILDING ELECTRICAL SYSTEM. Hazardous voltages can flow from the generator set into the utility line. This creates a potential for electrocution or property damage. Connect only through an approved isolation switch or an approved paralleling device.

## **GENERAL SAFETY PRECAUTIONS**

- Coolants under pressure have a higher boiling point than water. DO NOT open a radiator or heat exchanger pressure cap while the engine is running. Allow the generator set to cool and bleed the system pressure first.

- Benzene and lead, found in some gasoline, have been identified by some state and federal agencies as causing cancer or reproductive toxicity. When checking, draining or adding gasoline, take care not to ingest, breathe the fumes, or contact gasoline.
- Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.
- Provide appropriate fire extinguishers and install them in convenient locations. Consult the local fire department for the correct type of extinguisher to use. Do not use foam on electrical fires. Use extinguishers rated ABC by NFPA.
- Make sure that rags are not left on or near the engine.
- Remove all unnecessary grease and oil from the unit. Accumulated grease and oil can cause overheating and engine damage which present a potential fire hazard.
- Keep the generator set and the surrounding area clean and free from obstructions. Remove any debris from the set and keep the floor clean and dry.
- Do not work on this equipment when mentally or physically fatigued, or after consuming any alcohol or drug that makes the operation of equipment unsafe.

**KEEP THIS MANUAL NEAR THE GENSET FOR EASY REFERENCE**

# 1. Introduction

## ABOUT THIS MANUAL

This manual covers operation and maintenance for the Quiet Site generator (genset). Study this manual carefully and comply with each of its warnings and cautions. Using the genset properly and performing regular maintenance can result in longer genset life, better performance, and safer operation.

The Quiet Site genset is designed for temporary or mobile use. Before running the genset, consider these subjects:

**Transporting** - Guidelines for safely moving the genset.

**Positioning** - Space requirements for operation and service.

**Electrical Connections** - Location of electrical connection points for the control and generator.

**Pre-start** - Items and procedures for preparing the genset for operation.

**Startup** - Complete system check to ensure proper installation, satisfactory performance, and safe operation.

This manual does not provide application information for selecting a genset. For engineering data, see the Quiet Site specification and product data sheets.

## SAFETY CONSIDERATIONS

The Quiet Site genset is designed to provide safe and efficient service when properly operated. However, set safety and reliability depend on factors outside the control of the manufacturer.

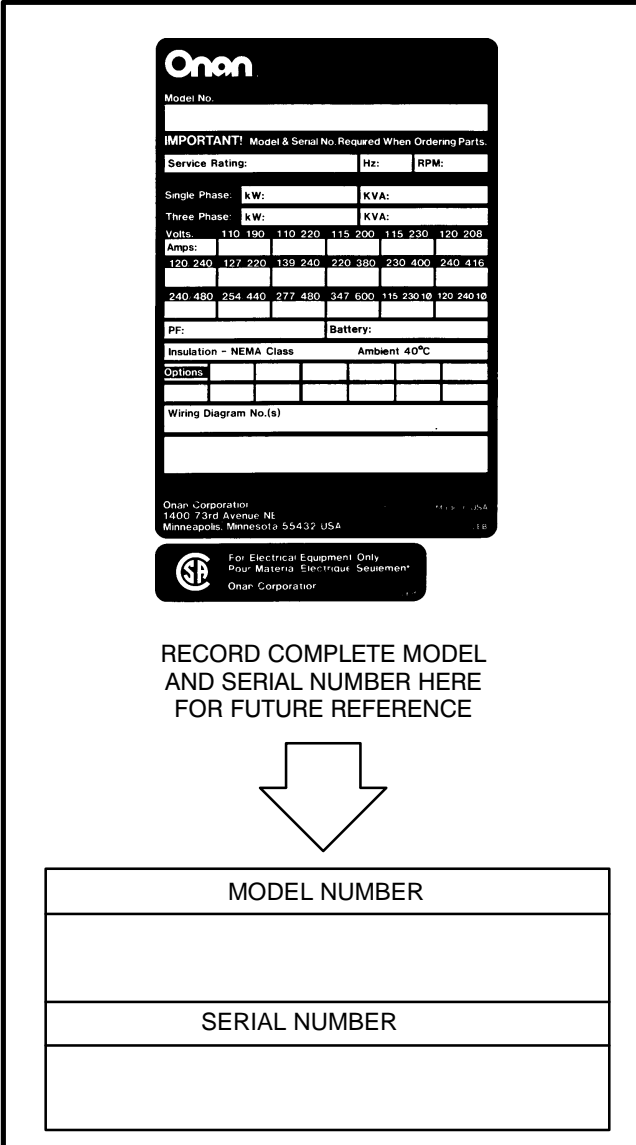
To avoid safety hazards, make all electrical connections to the genset exactly as described in this manual. Electrical systems outside the set must comply with all applicable codes. Be sure to complete all inspections and tests and satisfy all code requirements before operating the genset.

## MODEL IDENTIFICATION

Always use the complete model and serial number when contacting an Onan® dealer or distributor for

parts, service or product information. The model number (which includes the specification number) and the serial number are printed on the nameplate (Figure 1-1).

To make your model and serial number easy to find when you need them, record all of the numbers that appear in the model number and serial number area on your Onan nameplate in the area provided in Figure 1-1. It is important to record every number and letter in order to identify the set correctly.



The figure shows an Onan nameplate with various technical specifications and a corresponding recording area. The nameplate includes fields for Model No., Service Rating (kW, kVA, Hz, RPM), Single Phase and Three Phase ratings, a table of Volts and Amps, PF, Battery, Insulation - NEMA Class, Ambient 40°C, Options, and Wiring Diagram No.(s). Below the nameplate is a large arrow pointing to a recording area with two main sections: MODEL NUMBER and SERIAL NUMBER, each with a large box for recording the information.

Volts:		110 190		110 220		115 200		115 230		120 208	
Amps:											
120 240	127 220	139 240	220 380	230 400	240 416						
240 480	254 440	277 480	347 600	115 230 10	120 240 10						

MODEL NUMBER

SERIAL NUMBER

FIGURE 1-1. NAMEPLATE, QUIET SITE GENERATOR SET

## HOW TO OBTAIN SERVICE

When the generator set requires servicing, contact your nearest dealer or distributor. Factory-trained Parts and Service representatives are ready to handle all your service needs.

If unable to locate a dealer or distributor, consult the Yellow Pages. Typically, our distributors are listed under:

GENERATORS-ELECTRIC,  
ENGINES-GASOLINE OR DIESEL

For the name of your local Cummins/Onan or Onan-only distributor in the United States or Canada, call 1-800-888-ONAN (this automated service utilizes touch-tone phones only). By entering your area code and the first three digits of your local telephone number, you will receive the name and telephone number of the distributor nearest you.

For the name of your local Cummins-only distributor, or if you need more assistance, please call Onan Corporation, 1-612-574-5000, 7:30 AM to 4:00 PM, Central Standard Time, Monday through Friday.

When contacting your distributor, always supply the complete Model Number and Serial Number as shown on the generator set nameplate.

Onan gensets are given a complete running test under a variety of load conditions, and are thoroughly checked before leaving the factory. Examine this unit closely when it arrives, for possible shipping damage. Tighten loose parts, replace missing parts and repair all visible damage before starting the unit.

## SCHEDULING SERVICE

1. Before calling for service, have the following information available:

*The complete Onan product model number and serial number.*

*Date of purchase*

*Nature of the problem*

2. Contact the authorized dealer or distributor nearest you to explain the problem and make an appointment.
3. If you have difficulty in arranging for service or resolving a problem, please contact the dealer coordinator or service manager at the nearest Cummins/Onan distributor for assistance.

### **⚠ WARNING**

**INCORRECT SERVICE OR PARTS REPLACEMENT CAN RESULT IN SEVERE PERSONAL INJURY, DEATH, AND/OR EQUIPMENT DAMAGE. SERVICE PERSONNEL MUST BE QUALIFIED TO PERFORM ELECTRICAL AND/OR MECHANICAL SERVICE.**

### **⚠ CAUTION**

***The Quiet Site units have been designed to operate under certain airflow conditions. During operation, there are areas within the enclosure that normally reach a temperature of 180° to 220° F (82° to 104° C). This operating temperature is typically out of range for any non-standard accessory that may be installed inside of the enclosure. Any electronic components will not withstand these temperatures, so they will degrade and eventually fail. Also, depending on the location of such accessories, there may be an obstruction of airflow, which will upset the cooling system of the genset and lead to engine and generator overheating / failure and / or accessory failure. Onan recommends that no accessories, other than the options listed for Quiet Site, be installed inside of the Quiet Site enclosure.***

***The effects of ducting inlet / outlet airflow, with the exception of operating the unit with the enclosure doors open, have not been quantified. The unit is NOT to be operated with the enclosure doors open. If additional ducting is required for indoor or outdoor application, please contact your Onan dealer or distributor for installation recommendations.***

## 2. Specifications

**TABLE 2-1. STANDARD SERIES SPECIFICATION (30QSGBA, 36QSGBA, 40QSCGA, 50QSGCA)**

MODELS	30 QSGBA	36 QSGBA	40 QSCGA	50 QSGCA
<b>GENERATOR DETAILS</b>				
AC Output:				
Frequency (Hertz)	50	60	50	60
Power:				
– Standby	30kW 38kVA	36kW 45kVA	40kW 50kVA	50kW 63kVA
– Prime	27kW 34kVA	33kW 41kVA	36kW 45kVA	45kW 56kVA
<b>ENGINE</b>				
Cummins Diesel Series	4B3.9	4B3.9	4BT3.9G1	4BT3.9G1
Engine Speed	1500 RPM	1800 RPM	1500 RPM	1800 RPM
Avg. Fuel Consumption #2 Diesel, gph (l/h) at 1/4 load	1.1 (4)	1.5 (6)	1.3 (5)	1.7 (6)
1/2 load	1.5 (6)	2.0 (8)	1.9 (7)	2.3 (9)
3/4 load	1.9 (7)	2.6 (10)	2.6 (10)	3.1 (12)
Full load	2.5 (9)	3.3 (12)	3.2 (12)	4.0 (15)
<b>ELECTRICAL SYSTEM</b>				
Starting Voltage	24 Volts DC	24 Volts DC	24 Volts DC	24 Volts DC
Battery	Two, 12-Volt	Two, 12-Volt	Two, 12-Volt	Two, 12-Volt
<b>CAPACITIES</b>				
Coolant System (gal/l)	4.0 (15)	4.0 (15)	4.0 (15)	4.0 (15)
Oil Capacity (Filter, lines & Crankcase) (qts/l)	12 (11)	12 (11)	12 (11)	12 (11)
Fuel Tank (Trailer)(gal/l)	40 (151)	40 (151)	40 (151)	40 (151)
<b>LUBRICATING SYSTEM</b>				
Oil Type:				
14°F(-10° C) and above	15W40	15W40	15W40	15W40
-10°F(-23° C) to 14°F(-10° C)	10W30	10W30	10W30	10W30
Below -10°F(-23° C)	5W30	5W30	5W30	5W30

**TABLE 2-1. STANDARD SERIES SPECIFICATION (30QSGBA, 36QSGBA, 40QSCGA, 50QSGCA) (Cont'd)**

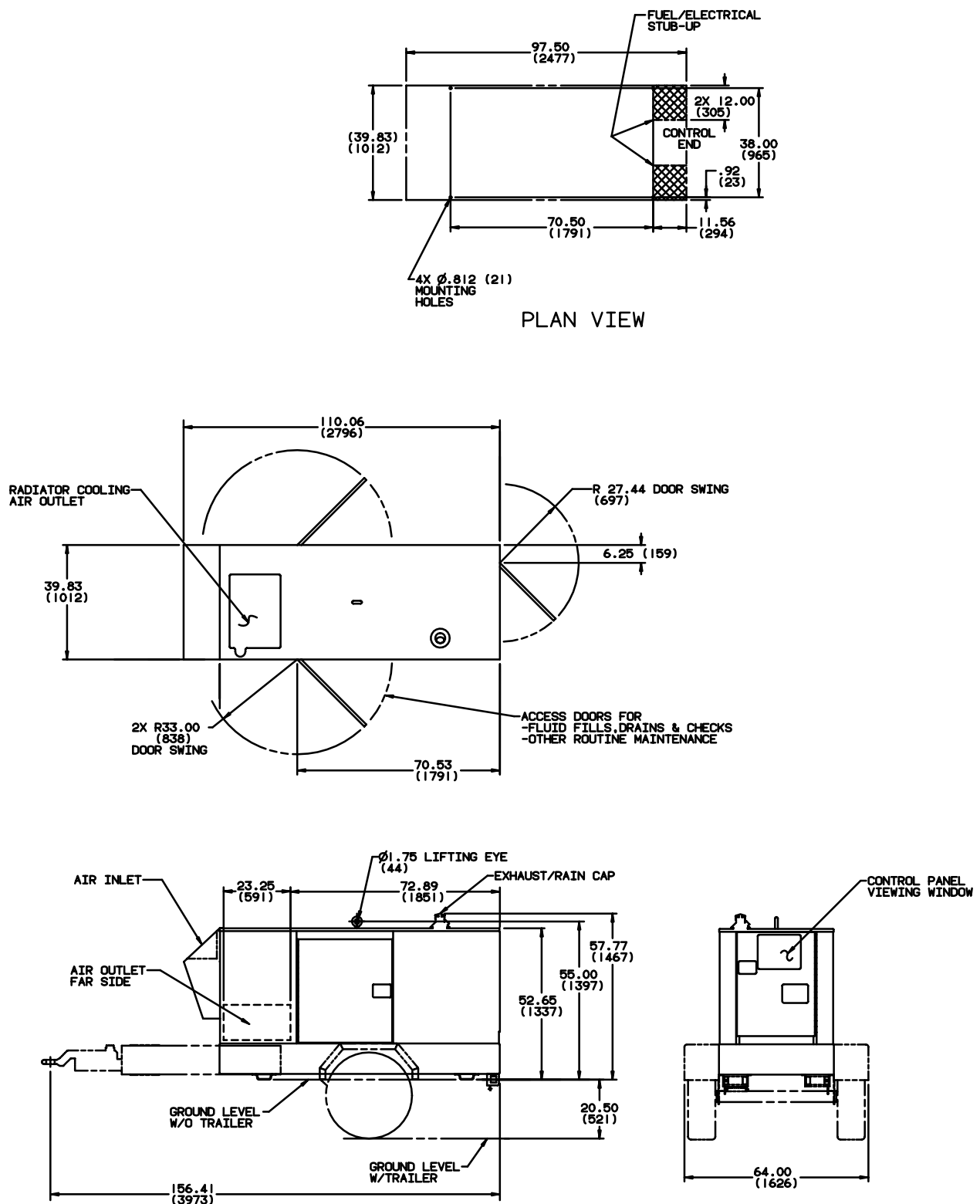
MODELS	30 QSGBA	36 QSGBA	40 QSCGA	50 QSGCA
<b>WEIGHT (Approximate)</b>				
Dry (with oil & coolant):				
Skid-mounted (lbs/kg)	2450 (1112)	2450 (1112)	2560 (1162)	2560 (1162)
Trailer-mounted (lbs/kg)	2960 (1344)	2960 (1344)	3070 (1394)	3070 (1394)
Wet (with oil, coolant & full fuel tank):				
Skid-mounted (lbs/kg)	2505 (1137)	2505 (1137)	2615 (1187)	2615 (1187)
Trailer-mounted (lbs/kg)	3015 (1369)	3015 (1369)	3125 (1419)	3125 (1419)
<b>DIMENSIONS</b>				
Skid-mounted (see Figure 2-1)				
Trailer-mounted (see Figure 2-2)				
<b>TRAILER HITCH</b>				
Ball (inch)	2, 2-1/4, 2-5/16	2, 2-1/4, 2-5/16	2, 2-1/4, 2-5/16	2, 2-1/4, 2-5/16
Lunette eye	Optional	Optional	Optional	Optional
Trailer Hitch	Class IV	Class IV	Class IV	Class IV

**TABLE 2-2. STANDARD SERIES SPECIFICATION (50QSGCB, 60QSGCB)**

MODELS	50 QSGCB	60QSGCB
<b>GENERATOR DETAILS</b>		
AC Output:		
Frequency (Hertz)	50	60
Power:		
– Standby	50kW 63kVA	60kW 75kVA
– Prime	45kW 56kVA	55kW 69kVA
<b>ENGINE</b>		
Cummins Diesel Series	4BT3.9G2	4BT3.9G2
Engine Speed	1500 RPM	1800 RPM
Avg. Fuel Consumption #2 Diesel, gph (l/h) at 1/4 load	1.4 (5)	1.7 (6)
1/2 load	2.1 (8)	2.6 (10)
3/4 load	3.0 (11)	3.6 (14)
Full load	4.0 (15)	4.7 (18)
<b>ELECTRICAL SYSTEM</b>		
Starting Voltage	24 Volts DC	24 Volts DC
Battery	Two, 12-Volt	Two, 12-Volt
<b>CAPACITIES</b>		
Coolant System (gal/l)	4.0 (15)	4.0 (15)
Oil Capacity (Filter, lines & Crankcase) (qts/l)	12 (11)	12 (11)
Fuel Tank (Trailer) (gal/l)	40 (151)	40 (151)
<b>LUBRICATING SYSTEM</b>		
Oil Type:		
14°F(-10° C) and above	15W40	15W40
-10°F(-23° C) to 14°F(-10° C)	10W30	10W30
Below -10°F(-23° C)	5W30	5W30

**TABLE 2-2. STANDARD SERIES SPECIFICATION (50QSGCB, 60QSGCE) (Cont'd)**

<b>MODELS</b>	<b>50 QSGCB</b>	<b>60QSGCB</b>
<b>WEIGHT (Approximate)</b>		
Dry (with oil & coolant):		
Skid-mounted (lbs/kg)	2650 (1203)	2650 (1203)
Trailer-mounted (lbs/kg)	3160 (1435)	3160 (1435)
Wet (with oil, coolant & full fuel tank):		
Skid-mounted (lbs/kg)	2705 (1228)	2705 (1228)
Trailer-mounted (lbs/kg)	3215 (1460)	3215 (1460)
<b>DIMENSIONS</b>		
Skid-mounted (see Figure 2-1)		
Trailer-mounted (see Figure 2-2)		
<b>TRAILER HITCH</b>		
Ball (inch)	2-5/16	2-5/16
Lunette eye	Optional	Optional
Trailer Hitch	Class IV	Class IV



500-2682c

FIGURE 2-1. GENSET DIMENSIONS

# 3. Transporting and Positioning the Genset

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## TRANSPORTING THE GENSET

### Towing Vehicle

The towing vehicle must be a truck or other vehicle that can tow a large trailer. Check the owner's manual for the maximum towing capacity of your vehicle. Section 2 of this manual lists the gross weights of all the Quiet Site models. Consult your distributor if in doubt about the capability of your vehicle.

### Hitch

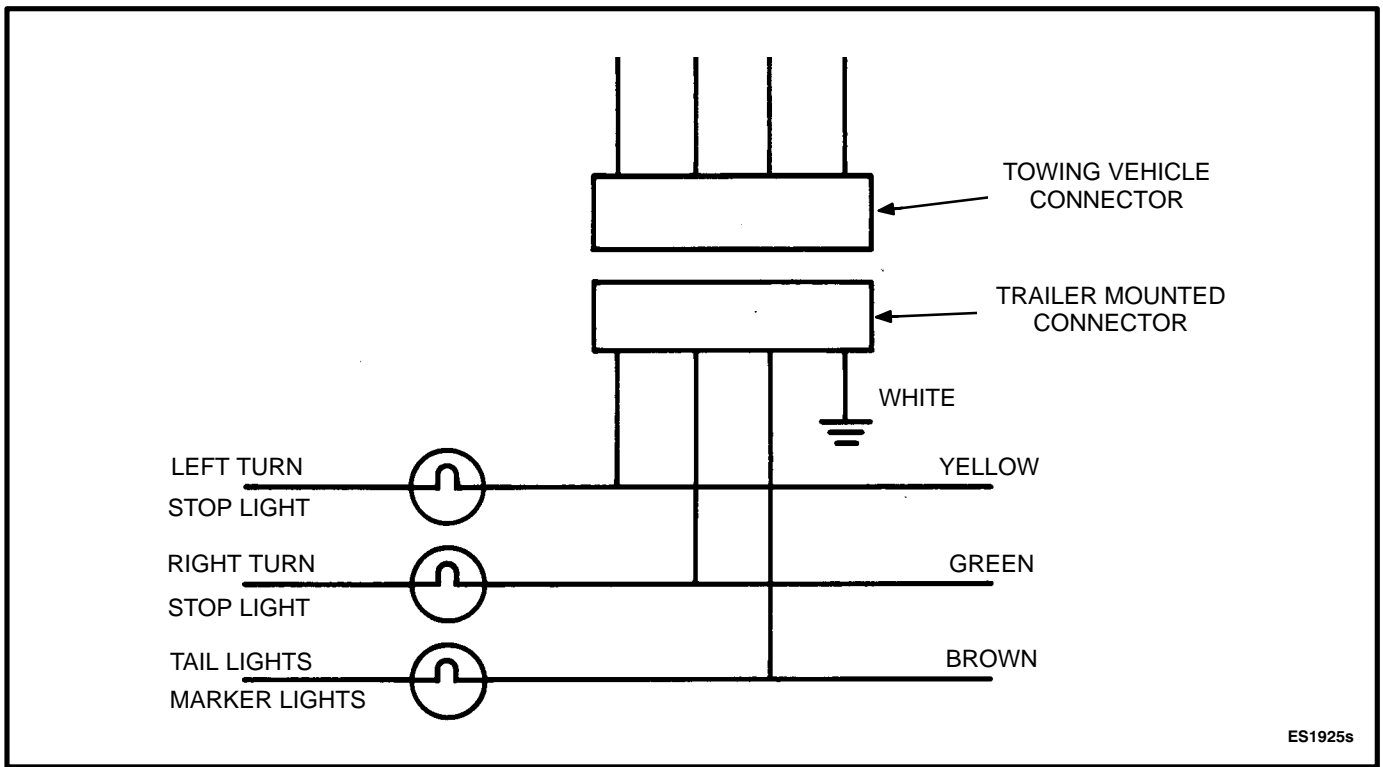
A Class IV trailer hitch must be attached to the vehicle. The hitch may be either the weight-carrying type or the weight-distribution type. Refer to Section 2, *Specifications* for the hitch ball size and genset weight.

The towing capacity of the hitch and ball must be equal or greater than the trailer gross weight. Sway control devices that restrict movement of the trailer tongue cannot be used, because the surge actuator of the trailer braking system must be free to telescope in response to braking requirements.

**⚠WARNING** *Improper towing practices or the use of substandard or incorrectly assembled towing components can lead to equipment damage, severe personal injury or death. Take care to use high-quality components and assemble them correctly when configuring a vehicle for towing. Make certain to follow the component manufacturers' instructions carefully when setting up a towing package.*

### Taillight/Brake Light Connection

A multi-conductor brake/taillight connector is connected through the Quiet Site trailer tongue. Its mating connector is included with the genset, and must be wired into the towing vehicle's electrical system according to the diagram in Figure 3-1.



**FIGURE 3-1. QUIET SITE TRAILER ELECTRICAL CONNECTIONS**

## Towing Vehicle Taillight Wiring

Connect the four-foot trunk connector (3 female, 1 male connection) to the towing vehicle as follows:

1. Make certain that the vehicle lights are OFF.
2. Connect the yellow wire to the left turn signal/stoplight wire in the left rear of the vehicle (truck bed, trunk, etc.) by stripping, soldering and taping the connection, or by using a wire tap device.
3. Connect the green wire to the right turn signal/stop light wire in the same way.
4. Connect the brown wire to the taillight wire.
5. Connect the white (ground) wire to the frame or body of the towing vehicle.

**⚠ CAUTION** *Many flashers for standard turn signals cannot carry the additional electrical load of trailer turn signals. It is possible that a standard-duty flasher may fail under the additional load of the trailer circuit. If normal taillight operation does not occur when the trailer is connected, obtain a heavy duty replacement flasher.*

## Testing Light Circuit

1. Make certain that the white (ground) wire of the vehicle wiring harness is connected to the frame or body of the towing vehicle.
2. Turn on the vehicle headlight switch.
3. With the vehicle headlights in the ON position, the tail lights, side light markers, clearance lamps and identification lamps on the trailer should be lighted.
4. Start the engine of the vehicle and observe the rear lights on the set while someone pushes the brake pedal. The brake lights of the trailer and towing vehicle should light and go out with each application and release of the brake pedal.
5. Move the vehicle turn signal arm into the “left turn” position. The left turn light of the trailer and the towing vehicle should flash at the same time. If the trailer turn signal lights are reversed from those of the towing vehicle, the yellow and green wires of the vehicle connector may have been reversed. Correct this problem by reversing the yellow and green wire connections on the vehicle connector.

**Make certain that the ground wires are firmly attached to the trailer and the towing vehicle.**

## Braking

The Quiet Site genset trailer has a “surge braking” system. When the towing vehicle slows down, the forward movement of the genset pushes against a mechanism in the trailer’s hitch, which actuates a hydraulic braking system on the trailer. A break-away cable is attached between this mechanism and the vehicle; if the towing vehicle and the trailer become accidentally separated due to equipment failure or improper connection of the trailer to the towing vehicle, this breakaway cable will part and the brakes on the trailer will be actuated, stopping the trailer. The Quiet Site trailer braking mechanism is adjusted at the factory to operate correctly.

**Periodically check the brake fluid level in the master cylinder reservoir. Keep the master cylinder reservoir at least half full with DOT-3 hydraulic brake fluid.**

## Attaching the Trailer

This procedure begins with balancing the trailer weight by adjusting the height of the trailer tongue to the height of the hitch on the towing vehicle. Trailer towing will handle best with the trailer properly balanced.

**⚠ WARNING** *A reliable connection must be made between the trailer hitch and the tongue if the trailer is to be towed safely. Do not attempt to tow the trailer if the hitch or ball are damaged. Unsafe towing practices can cause severe personal injury or death if the trailer becomes unhitched.*

1. With the tongue of the trailer positioned at the same height of the towing vehicle hitch, check the weight of the trailer hitch. The trailer hitch weight should be approximately 100 lbs. (45 kg). If hitch weight is not within this limit, adjust the height of the tongue (see Figure 3-2) as follows:
  - A. Remove the four bolts that secure the tongue to the trailer frame.
  - B. To increase trailer hitch weight, position trailer tongue to next higher position and secure the tongue to the frame with the four bolts.
  - C. To decrease trailer hitch weight, position trailer tongue to the next lower position and secure the tongue to the frame with the four bolts.
2. Bring the rear of the towing vehicle up to the trailer hitch, so that the ball is directly under the trailer hitch.

3. Turn the crank on the screwjack to lower the socket of the tongue onto the ball. Remove the pin that holds the trailer screwjack in its vertical position. Move the screwjack into its horizontal storage position and secure it with the pin.
4. **Ball hitch:** Tighten the wheel on the trailer tongue to secure the hitch ball in the tongue socket. Make certain that the ball latch is in the correct position to retain the ball, and that the hand wheel lock is clicking while tightening the hand wheel. (Press down on the hand wheel lock to loosen the hand wheel in order to unhitch the trailer.)

**Lunette eye:** Once the lunette eye is placed over the bottom part of the pintle hook, swing the top portion of the hook down onto the lower part, and secure it with the latch and cotter pin.

5. Connect the safety chains to the hitch using a crossed pattern under the tongue. Attach the safety chains at the specific locations on the hitch provided for this purpose; never attach chains to the ball mount. The safety chains

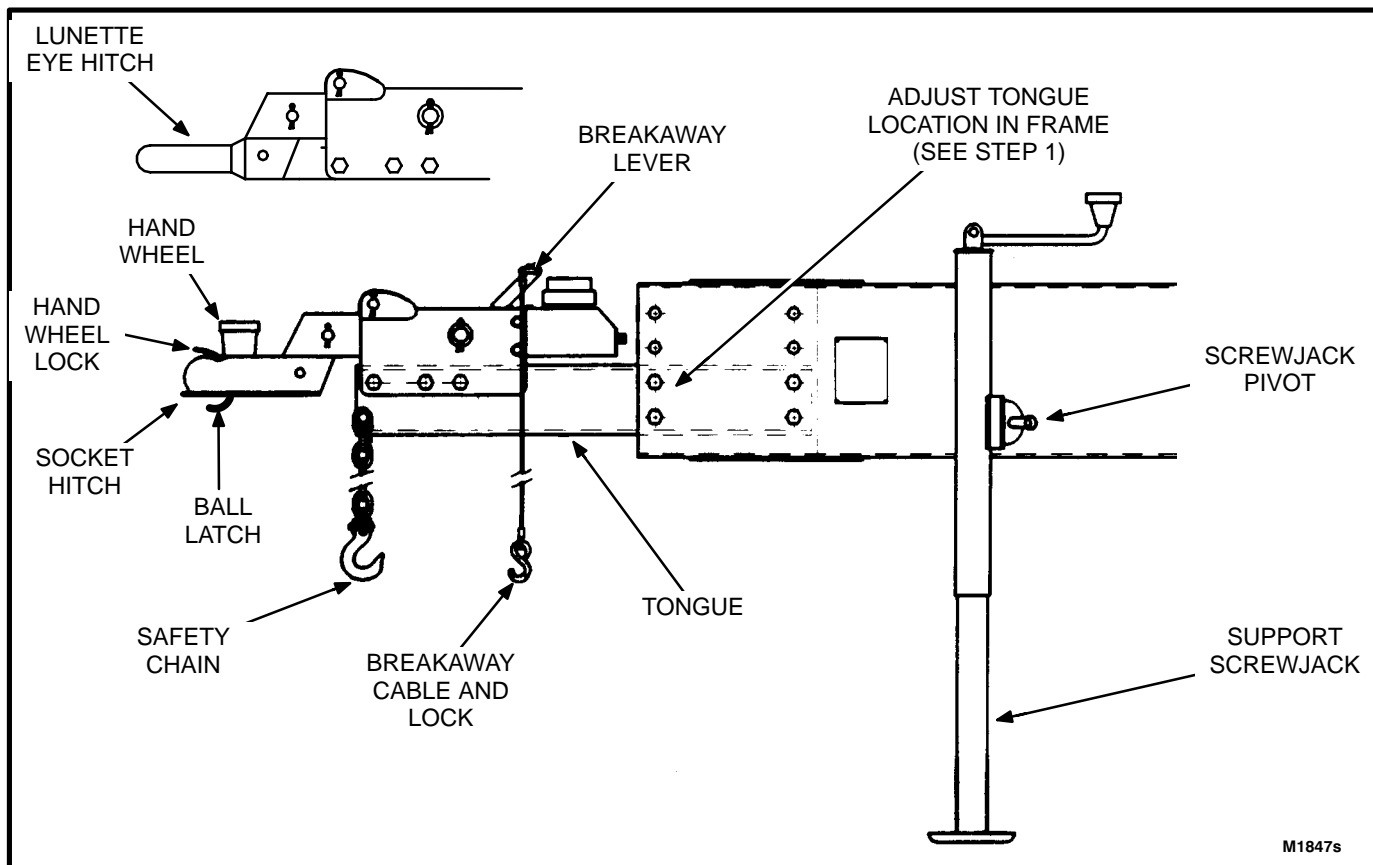
should have some slack to permit sharp turns by the trailer, but should not drag on the roadway.

6. Connect the breakaway S-hook to a secure point on the towing vehicle (one of the safety chain hook locations may be used). Should the breakaway be accidentally applied while unhitching, pry the spring clip out of the notch to release the lever (see Figure 3-2).

**The breakaway system should only operate after both the coupling and safety chains have failed. The breakaway is not a parking brake.**

**⚠ WARNING** *Do not use the breakaway system as a parking brake. Use blocks or chocks to immobilize the genset before operating it. Failure to properly immobilize the set may lead to severe personal injury or death.*

To disconnect the trailer from the towing vehicle, reverse the preceding steps.



**FIGURE 3-2. QUIET SITE TRAILER TONGUE**

## LOCATING AND POSITIONING THE GENSET

**⚠WARNING** *Do not attempt to operate the genset unless it is totally immobile. Failure to securely position the genset may lead to severe personal injury or death.*

### Lifting Eye

The lifting eye at the top of the genset provides a means to hoist the set to the proper location on a particular site, using a hook at the end of a crane or hoist. The gross weight of each of the genset versions is listed in Section 2 of this manual.

### Position

Select a location for the genset that is level and firmly supported, and removed from any nearby fire hazard. Make certain that the genset is stationary, firmly supported, and as level as possible. The genset may be operated on a surface with as much as a fifteen-degree tilt in any direction from the horizontal; however, make certain to select the most level surface available for the set.

Using wheel blocks or chocks, block the wheels of the genset trailer to immobilize it before attempting to operate the genset.

Make certain that all sides of the set are accessible for routine maintenance. Make certain that all air vents and ducts are free of any obstructions.

### Exhaust System

The Quiet Site exhaust is discharged upward, through the roof of the genset's enclosure. Make certain that there is at least 12 inches (305 mm) clearance between exhaust pipes and combustible materials, that all connections are tight, and that the exhaust will not be discharged in the vicinity of air ducts or inlets in areas that are occupied by people.

**⚠WARNING** *Exhaust gas can cause severe personal injury or death. Perform all procedures in accordance with Onan publications to minimize this risk. Do not smoke or allow fire, sparks, arcing equipment or pilot lights in the vicinity while refueling.*

### Mechanical Check

Before operating the genset, check the set over for components that may have become loose or damaged by movement. Repair or replace such parts as required.

## 4. Mechanical Connections

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The genset mechanical system installation consists of the following:

- Check ventilation and exhaust systems
- Check all mechanical connections
- Fill the coolant, lubrication and fuel systems
- Prime the fuel system

### VENTILATION

The genset-mounted radiator with an engine-driven fans is standard on the genset. Air is pulled into the upper front of the genset housing and through the radiator and exits at the front top of the housing. Air is also routed through the engine and generator compartment and exits at the lower right front corner of the housing. Position the genset so that the air intake and exhaust grills are not blocked.

### EXHAUST SYSTEM

Although the Quiet Site uses a self-contained exhaust system, use extreme care in positioning the genset exhaust outlet.

Locate the exhaust outlet away from air inlets to prevent exhaust gases from re-entering an enclosure or room. Exhaust installations are subject to various detrimental conditions such as extreme heat, infrequent operation, and light loads. Regularly inspect the exhaust system both visually and audibly so the entire system remains fume-tight and safe for operation.

**⚠WARNING** *Inhalation of exhaust gases can result in severe personal injury or death. Use extreme care during installation to maintain a tight exhaust system.*

### MECHANICAL CHECK

The genset mechanical system includes fuel, exhaust, ventilation and cooling systems. These systems are self-contained within the genset assembly, making initial setup a relatively simple procedure. However, each of these systems should be checked before every startup. Visually check the genset for loose or damaged components and repair or replace as required.

### COOLANT

Engine coolant is drained before shipment. Before starting, fill the cooling system with the recommended coolant according to Section 9, *Cooling System*.

### LUBRICATION

Engine oil is drained before shipment. Before starting, fill the crankcase with the recommended oil according to Section 9, *Lubrication System*.

### FUEL SYSTEM

In all fuel systems, cleanliness is of the utmost importance. Make every effort to prevent entrance of moisture, dirt or contaminants of any kind.

**⚠WARNING** *Spilled fuel presents the hazard of fire or explosion which can result in severe personal injury or death. Use extreme care when filling the genset fuel tank.*

The Quiet Site engine normally uses ASTM No. 2 Diesel fuel. Fill the fuel tanks with the recommended fuel, and prime the fuel system according to Section 9, *Fuel System*.

## DAY TANK CONTROLLER (OPTIONAL)

The day tank controller option provides the capability of attaching an auxiliary fuel tank to the main (on board) supply tank of the genset. The auxiliary fuel tank enables the genset to operate for an extended number of hours without refueling.

The main fuel tank of the genset is used as a day tank when the day tank controller is installed (see Figure 4-1). The day tank is used to control the flow of fuel between the auxiliary fuel tank and the genset.

The day tank controller includes a float switch and a fuel transfer pump. When the day tank on the genset is emptied, the float switch in the day tank turns on the transfer pump to refill the day tank from the

auxiliary tank. When the day tank is filled, the float switch will turn off the transfer pump, stopping the flow of fuel to the day tank.

## Auxiliary Tank Location

The auxiliary tank must be located near the genset and within the transfer pump lift capability, but below the fuel injection system.

The auxiliary tank top must be below the main tank top to prevent siphoning from the auxiliary tank to the main tank.

**⚠ CAUTION** *Make certain that a minimum level of fuel is present at all times in the onboard tank. If air is present in the fuel lines, the engine fuel pump may be damaged or destroyed.*

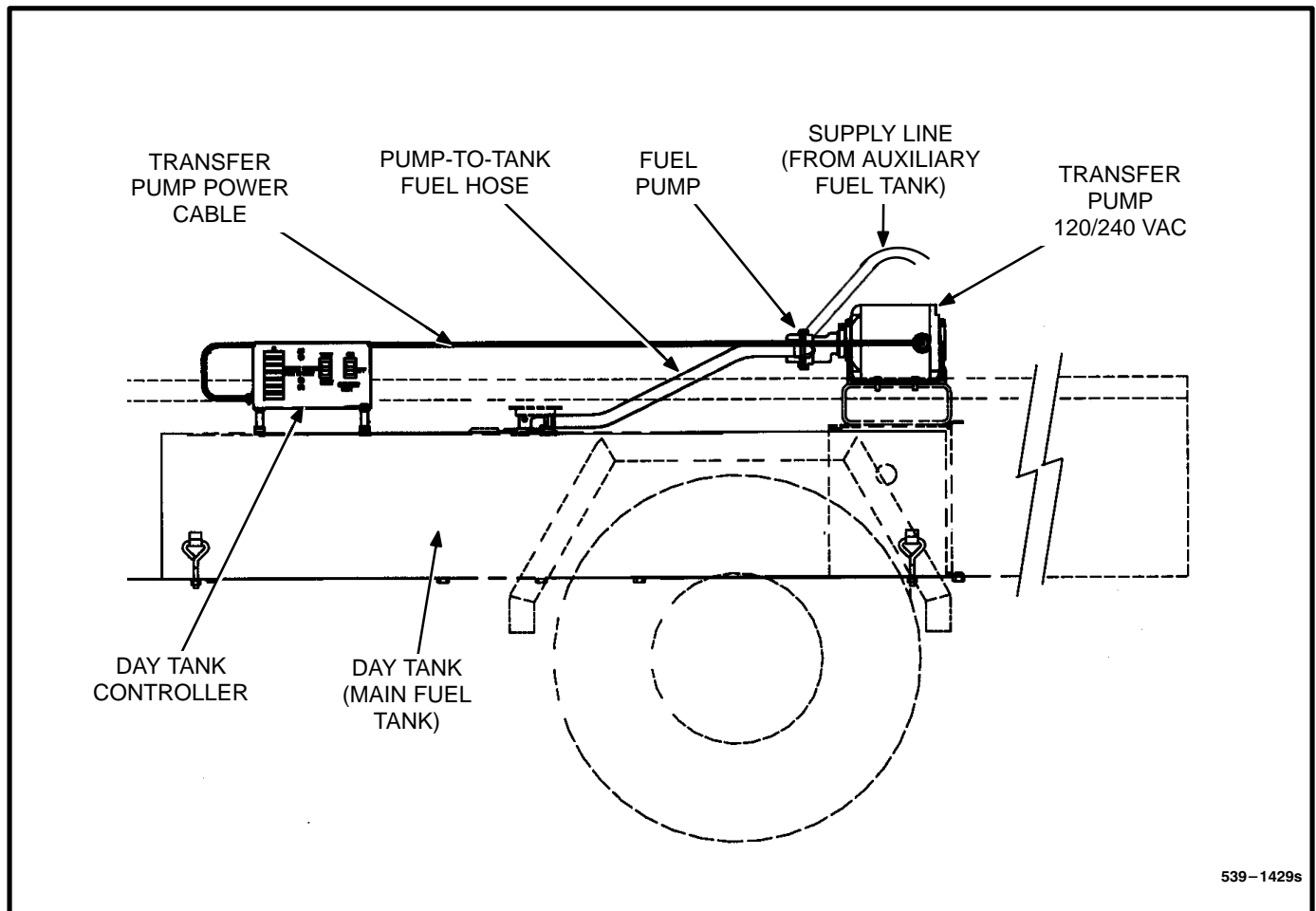


FIGURE 4-1. FUEL TANK CONTROL SYSTEM COMPONENTS

## Auxiliary Tank Connection

The following procedure provides the information to connect the auxiliary fuel tank to the transfer pump inlet. The operator must provide the fuel line that is used between the transfer pump inlet and the auxiliary fuel tank.

**⚠ WARNING** *Generator sets use fuels that are highly flammable and explosive. Faulty installation can lead to leakage and ignition of fuel resulting in severe personal injury, death, and/or property damage. Carefully design and install the fuel system in accordance with all applicable codes.*

1. Pump suction head must not exceed 20 feet, including losses for pipe, valve and fitting friction and derating for altitude. Calculate head losses on the basis of rated pump flow (2 GPM).
2. Use black iron pipe and fittings between the trailer and the auxiliary fuel tank. Use a flexible section of tubing (code approved) between the iron pipe and the inlet of the transfer fuel pump inlet. This tubing should be the same type and size as used between the transfer pump outlet and the day tank.
3. It is recommended that an electric fuel shutoff valve be installed ahead of the pump to maintain pump prime when it is not pumping.  
Terminals TB1-8 and TB1-5 (see Figure 4-3) are available for connection of a 120 or 240 VAC electric fuel shutoff valve rated not more than 0.5 amps. The voltage rating of the valve must correspond with the voltage utilized for the pump (see *Day Tank Controller Power Connection* procedure in this section).

**⚠ CAUTION** *Do not use galvanized fuel lines, fittings or tanks. Condensation in the tank and lines combines with sulfur in the fuel to produce sulfuric acid. The sulfuric acid reacts with the zinc in the galvanized coating and contaminates the fuel.*

*Do not use copper tubing for diesel fuel lines. Diesel fuel polymerizes (thickens) in copper tubing during long periods of standby and will clog the fuel injectors.*

4. Route the fuel line from the auxiliary fuel tank to the transfer pump. It will be necessary to punch, drill or cut a hole in the genset access cover for this fuel line (refer to the Load Cable/Day Tank Fuel Line Access procedure in Section 5).
5. Once the line is run through this hole and secured in place, the hole must be sealed using RTV or equivalent substance for the genset to retain its sound-insulated qualities.
6. Use pipe thread sealant at each fitting.
7. Attach the external fuel line to the transfer pump inlet. Make certain that the fuel line is tightly connected to the fitting on the fuel transfer pump.
8. Read *Day Tank Control System* in Section 6 before operating the pump control. The transfer pump is self priming. The fuel line length will determine the length of time the pump motor must run to prime the system.
9. Run the genset through several pump-on and pump-off cycles to make sure that the day tank installation is working properly. Observe all of the precautions in Section 7, *Operation*. Fix all fuel leaks before placing the genset in service.

## Day Tank Controller Power Connection

Quiet Site gensets with factory-mounted day tank pumps and controllers require that the operator attach power connections to the controller circuit board. AC power to the controller circuit board can be either from the genset or an external source. If the genset is being used in a standby configuration, the day tank controller (see Figure 4-2) should be powered by the emergency bus.

The AC power to the day tank controller can be either 240 VAC or 120 VAC. The factory-mounted day tank controller is shipped in a 240 VAC configuration.

The following procedure provides the information to configure the day tank controller for either 240 VAC or 120 VAC and to attach the AC wires of either voltage level to the day tank controller. See page 11-3 when making connections at the control box terminal board.

**⚠ WARNING** *Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [-] first).*

*Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (-) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (-) cable first, and reconnect it last.*

**⚠ CAUTION** *Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.*

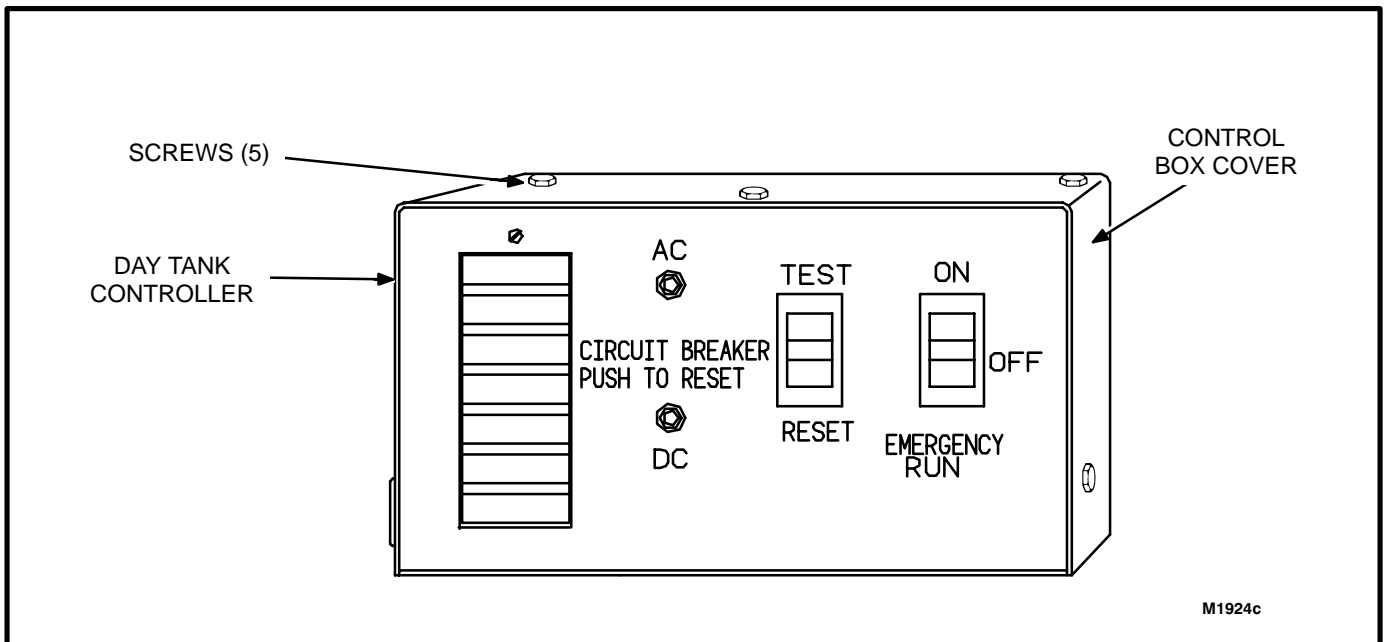


FIGURE 4-2. DAY TANK CONTROLLER

1. Disconnect the battery cables at the battery terminals to prevent accidental starting of the genset. Disconnect the negative (–) cable first.
2. Remove the five screws that secure the control box cover to the control box and remove the control box cover (see Figure 4-2).
3. Check terminal block TB1. Make sure that TB1 is configured for the proper AC input voltage.

To convert the day tank controller from 240 VAC to 120 VAC, perform the following steps.

- A. Remove the two jumpers between terminals **TB1-6** and **TB1-7** in the control box and connect one between terminals **TB1-5** and **TB1-6** and the other between terminals **TB1-7** and **TB1-8**.
- B. Move selector switch **S103** on the control PCB to the up position for 120V.
- C. If the control is equipped with a transformer, remove the two jumpers between terminals **H2** and **H3** and connect one between **H1** and **H3** and the other between **H2** and **H4**.

To convert the day tank controller from 120 VAC to 240 VAC, perform the following steps.

- A. Remove the jumpers between terminals **TB1-5** and **TB1-6**, and **TB1-7** and **TB1-8** in the control box and connect the two jumpers between terminals **TB1-6** and **TB1-7**.
- B. Move selector switch **S103** on the control PCB to the down position for 240V.
- C. If the control is equipped with a transformer, remove the jumpers between terminals **H1** and **H3**, and **H2** and **H4** and connect the two jumpers between **H2** and **H3**.
4. To connect the 120 or 240 VAC input power to the day tank pump and controller, open the circuit clamps on the left side of the day tank control box and pass the conductors through to the inside of the box.

5. In a 120 VAC system, connect positive to **T1**, neutral to **T2**, and earth ground to **T3** on **TB1**.  
In a 240 VAC system, connect line 1 to **T1**, line 2 to **T4**, and earth ground to **T3** on **TB1**.

6. Tighten the clamps to secure the lines.
7. If a two lead wiring harness is provided, the control does not include a power transformer. To provide 24 VDC for the control circuit, connect terminal **TB1-19** to the positive (+) terminal of the 24 V starter motor solenoid and terminal **TB1-20** to the negative (–) terminal.
8. To immediately shut down the engine when the **LO SHUTDOWN** light comes on, connect terminal **TB1-14** to a good grounding point on the engine block and terminal **TB1-15** to terminal **TB2-16** on the engine control monitor board (ECM).
9. Terminals **TB1-10** through **TB1-17** and **TB2-23** through **TB2-27** are available for connections to remote annunciators.
10. Terminal **TB2-22** is available for connection of a grounding signal to activate the blank red light.
11. Terminals **TB1-8** and **TB1-5** are available for connection of a 120 or 240 VAC electric fuel shutoff valve rated not more than 0.5 amps. The voltage rating of the valve must correspond with the voltage utilized for the pump. See Step 13.
12. Install the control box cover and secure it to the control box with the five screws.
13. Attach a tag to the control box indicating the supply voltage.
14. Connect the battery cables to the battery terminals. Connect the positive (+) cable first.

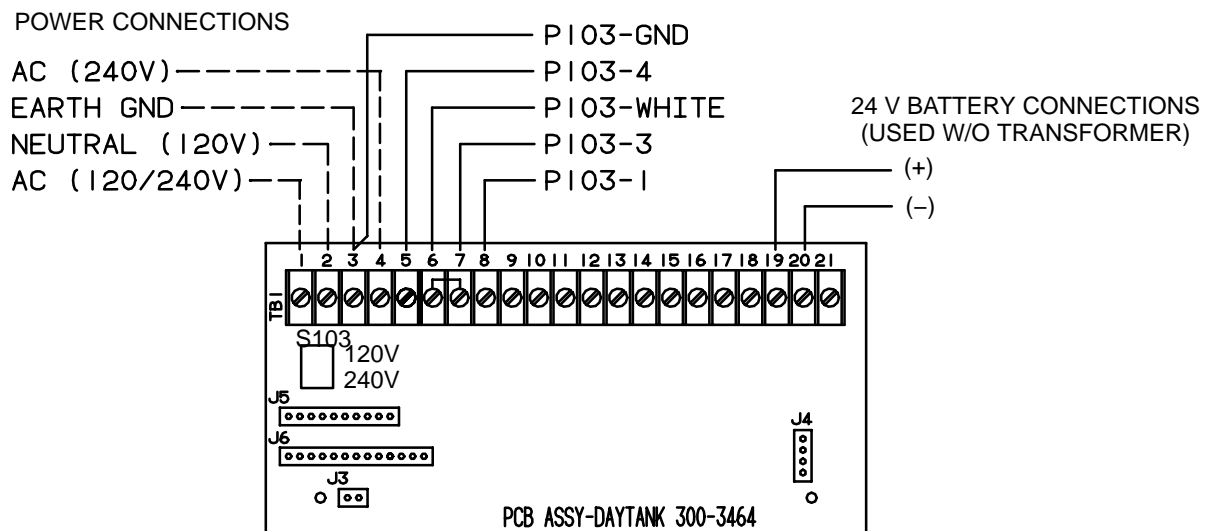


FIGURE 4-3. DAY TANK CONTROLLER TERMINAL CONNECTIONS

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# 5. Electrical Preparation

The following paragraphs contain the procedures that are used to connect the electrical system of the genset.

**⚠WARNING** *Each of the operations described in this section should be done only by persons trained and experienced in electrical maintenance. Improper procedures may result in property damage, bodily injury or death.*

Connecting the genset electrical system involves:

- Installation of transfer switch (standby service only)
- Generator voltage reconnections
- Load connection
- Control wiring
- Battery connection

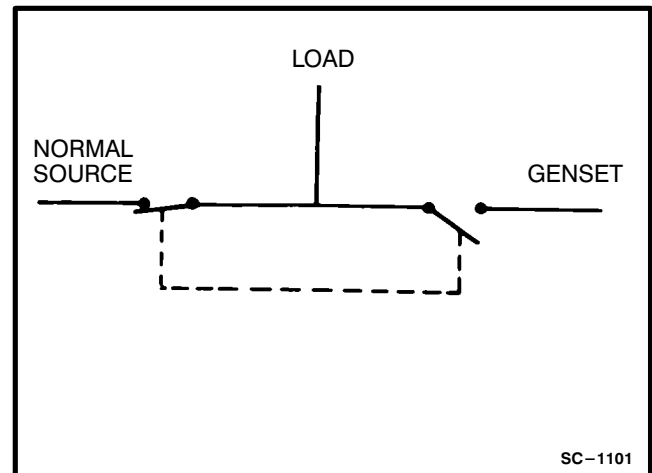
Local regulations often require that wiring connections be made by a licensed electrician, and that the installation be inspected and approved before operation. All connections, wire sizes, materials used, etc. must conform to the requirements of electrical codes in effect at the installation site.

Before starting the genset, verify that all electrical connections are secure, and that all wiring is complete. Replace and secure any access panels that have been removed during installation. Check that the load cables from the genset are properly connected.

**⚠WARNING** *Backfeed to utility system can cause electrocution or property damage. Do not connect to any building electrical system except through an approved device and after building main switch is opened.*

## TRANSFER SWITCH

If the installation is for standby service, a transfer switch must be used for switching the load from the normal power source to the genset (see Figure 5-1). Either a manual or automatic transfer switch may be used. Follow the installation instructions provided with the transfer switch when connecting the load and control wiring.



**FIGURE 5-1. TYPICAL LOAD TRANSFER FUNCTION**

## GENERATOR VOLTAGE RECONNECTIONS

The generator output voltages and maximum current rating are specified on the generator nameplate. Line-to-neutral voltage is always the lower voltage shown on the nameplate. Line-to-line voltage is the higher rating.

Generators have either reconnectable or non-reconnectable outputs. A reconnectable generator may be wired for one of several possible output voltages.

Non-reconnectable generators produce only one specific voltage and cannot normally be wired for a different output. These generators are wired at the factory for a specific voltage, and are not intended for reconnection. The voltage and current rating (amperes) are shown on the nameplate.

**⚠ CAUTION** *Reconnecting factory connected generator sets to lower voltages may reduce set ratings, and also render line circuit breakers too small. Consult with your distributor before performing reconnection for different voltage.*

Reconnectable generators are three phase generators that may be reconnected for the voltages shown in the Reconnection Diagrams (see pages 11-4 and 11-5).

### Genset (Standard) Reconnection

In a standard genset configuration, the generator output (stator) leads T1 through T12 **ARE NOT** connected together when the set is shipped from the factory. When attaching the load cables to this genset, the installer must always check the stator lead connections and perform any necessary reconnect to obtain the voltage desired. Refer to heading *Load Connection to Stator Leads (Standard Genset)* for reconnect procedure.

### Optional Reconnect Switch

Gensets that contain the optional rear panel incorporate a voltage reconnection switch. The voltage reconnection switch allows alternate voltages to be selected from the load panel. The generator output leads are reconfigured by turning the switch, rather than by manually reconnecting the leads. Figure 5-3 illustrates the location of the voltage reconnection switch. Page 11-5 illustrates the output connections of gensets using this switch. Make certain that the set is turned off before reconnecting the output voltage.

**⚠ WARNING** *Electrical shock can cause severe personal injury or death. Make certain that the generator set is disabled by removing the negative (-) cable from the starting battery before reconnecting the generator set either with the switch or manually.*

**⚠ WARNING** *Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [-] first).*

*Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (-) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (-) cable first, and reconnect it last.*

**⚠ CAUTION** *Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.*

## LOAD CONNECTION

**⚠ WARNING** *Backfeed to utility system can cause electrocution or property damage. Do not connect to any building electrical system except through an approved device and after building main switch is opened.*

When connecting loads to the genset, balance the loads so that the current flow from each line terminal (L1, L2 and L3) is roughly the same. This is especially important if both single phase and three phase loads are connected. Any combination of single phase and three phase loading may be used as long as all line currents are roughly the same (within 10 percent of median value) and no line current exceeds the nameplate rating of the generator. Check the current flow from each load cable after connections are made, by observing the control panel ammeter.

Load connections to the genset will vary between the standard genset and the addition of the following options.

- Stator Lead Connection (standard genset load connection)
- Optional Circuit Breaker Box
- Optional Output Terminal Block Load Connection

The following sections provide the procedures to connect the load cables for each of the three genset configurations.

**⚠ CAUTION** *Phase rotation of the genset and utility must be the same. Equipment damage can occur. Check and reconnect as necessary.*

*For all prime power or construction site gensets, check the rotation of every 3-phase motor before loading and reconnect if necessary.*

**⚠ WARNING** *Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [-] first).*

*Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (-) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (-) cable first, and reconnect it last.*

**⚠ CAUTION** *Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.*

### Load Connection to Stator Leads (Standard Genset)

In a standard genset configuration, all load cables are connected to the generator by bolting the load cables directly to the generator leads (T1 through T12).

Use the following procedure to connect the load cables in a standard genset configuration.

**If output terminals are not provided on the set, it will be necessary to punch, drill or cut a hole in the genset housing for the power output cables. Once the cables are run through this hole and secured in place, the hole must be sealed using RTV or an equivalent substance, for the genset to retain its sound-insulated qualities.**

1. Remove the rear housing panel behind the rear door.
2. Bolt the load wires to the appropriate generator lead wires in the output box. See page 11-5 for typical connections.
3. Insulate the connections.

### Load Connection to Optional Output Terminal Block

Using 1/4-20 x 1/2 inch bolts with the correct nuts and washers, bolt the load connection wires directly to the L0, L1, L2 and L3 terminals (see Figure 5-3).

## Optional Circuit Breaker Box Load Connection

**⚠ CAUTION** *Phase rotation of the genset and utility must be the same. Equipment damage can occur. Check and reconnect as necessary.*

***For all prime power or construction site gensets, check the rotation of every 3-phase motor before loading and reconnect if necessary.***

Use the following procedure to connect the load cables to the optional circuit breaker box (see Figure 5-2).

The load cables from the circuit breakers must be brought into the set through an opening made in the housing. An electric drill, pliers, and a sheet-metal nibbler device may be required for this job.

**⚠ WARNING** *Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [-] first).*

***Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (-) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (-) cable first, and reconnect it last.***

**⚠ CAUTION** *Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.*

1. Remove the rear panel assembly from the generator set by removing the 16 lock head flange screws that hold it in place (see Figure 5-2). **Make certain to remove only the screws around the outside edge of the rear panel assembly, rather than the six screws that hold the circuit breaker box. See Figure 5-2.**
2. Cut an opening in either one of the sides, the rear or the bottom of the genset housing to ac-

commodate the load cables. Examine the installation site and consult the outline drawing and installation drawing included with the kit to determine the best area to cut a hole in the housing. Make the smallest possible opening for cables, to allow the least noise to emerge from the set. File off or bend back any sharp edges in the opening, so as not to endanger the insulation on the load cables. Insert and secure the load cables into the set. Once the cables are in place, the hole may be sealed using RTV or silicone sealant.

**⚠ WARNING** *Electrical shock can cause severe personal injury or death. After cutting an opening in the genset housing for electrical cables, make certain to dull or cover any sharp edges. The sharp edges of an opening in the housing can damage electrical insulation, creating a shock hazard. Make certain that the edges of any openings in the housing are smooth, and that the load cables are protected from direct contact with the edges of any openings. Add a grommet or edge strip around the opening to protect the cables.*

3. Access the circuit breaker box by removing the six screws that hold the box mounting brackets to the rear panel assembly.
4. Access the circuit breaker by removing the eight screws that hold the front cover to the circuit breaker box.
5. Cut an opening in the lower box panel to accommodate the load cables. File off or bend back any sharp edges in the opening, so as not to endanger the insulation on the load cables. Add a grommet or edge strip around the opening to protect the load cables.
6. Connect the circuit breaker output to the load. Insert the load cables into the circuit breakers and tighten down the screws.  
Slide insulation sleeving (heat shrink tubing) over all uninsulated connections: using a hot air gun or other implement designed for this purpose, apply heat of 140° F to the connection for three to five seconds for proper shrinkage of the insulation sleeving.
7. Attach the front cover to the circuit breaker box with the eight screws removed in Step 4.

8. Hold the rear panel against the circuit breaker box assembly. Attach the circuit breaker box and brackets to the rear panel with the six screws removed in Step 3. Make certain that the acoustic foam seals the gap between the breaker box and the rear panel.

9. Hold the rear panel assembly in place and attach the rear panel assembly to the genset using the 16 lock head flange screws removed in Step 1.

10. Reconnect the starting battery, negative (-) lead last, to make the set ready for use.

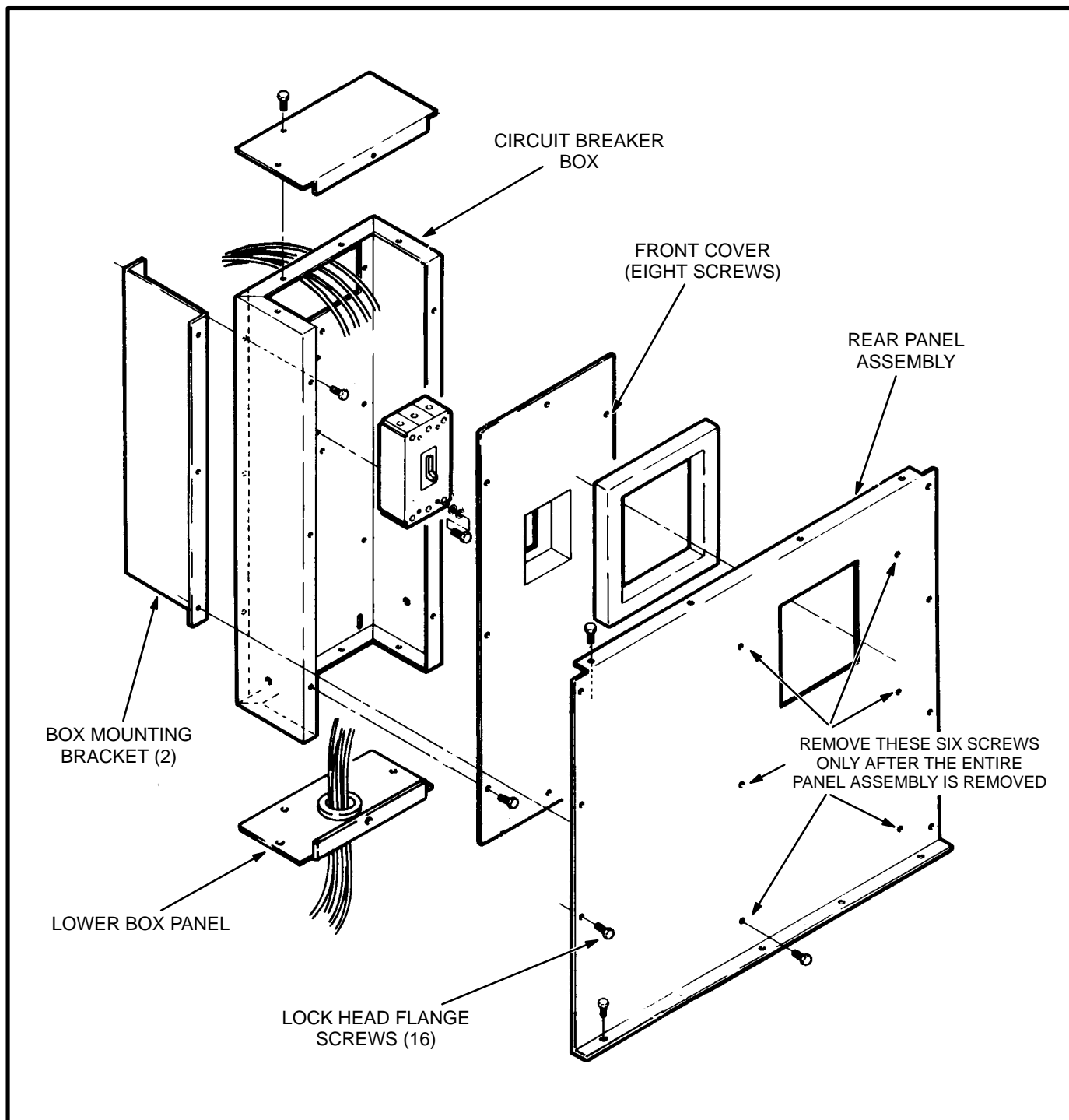


FIGURE 5-2. REAR PANEL ASSEMBLY ATTACHMENT TO GENSET

## POWER DISTRIBUTION PANEL (OPTIONAL)

The power distribution panel (Figure 5-3) has the following features.

- A rotary switch under a lockable cover to select 120/240 VAC single phase, 120/208 VAC three phase or 277/480 VAC three phase output.
- A six-pole line circuit breaker.
- Main output terminals.
- A set of convenience receptacles with individual circuit breakers: one 120 VAC, 20 Amp duplex; one 120 VAC, 20 Amp twist lock; one 240 VAC, 30 Amp twist lock and one 240 VAC, 50 Amp twist lock.

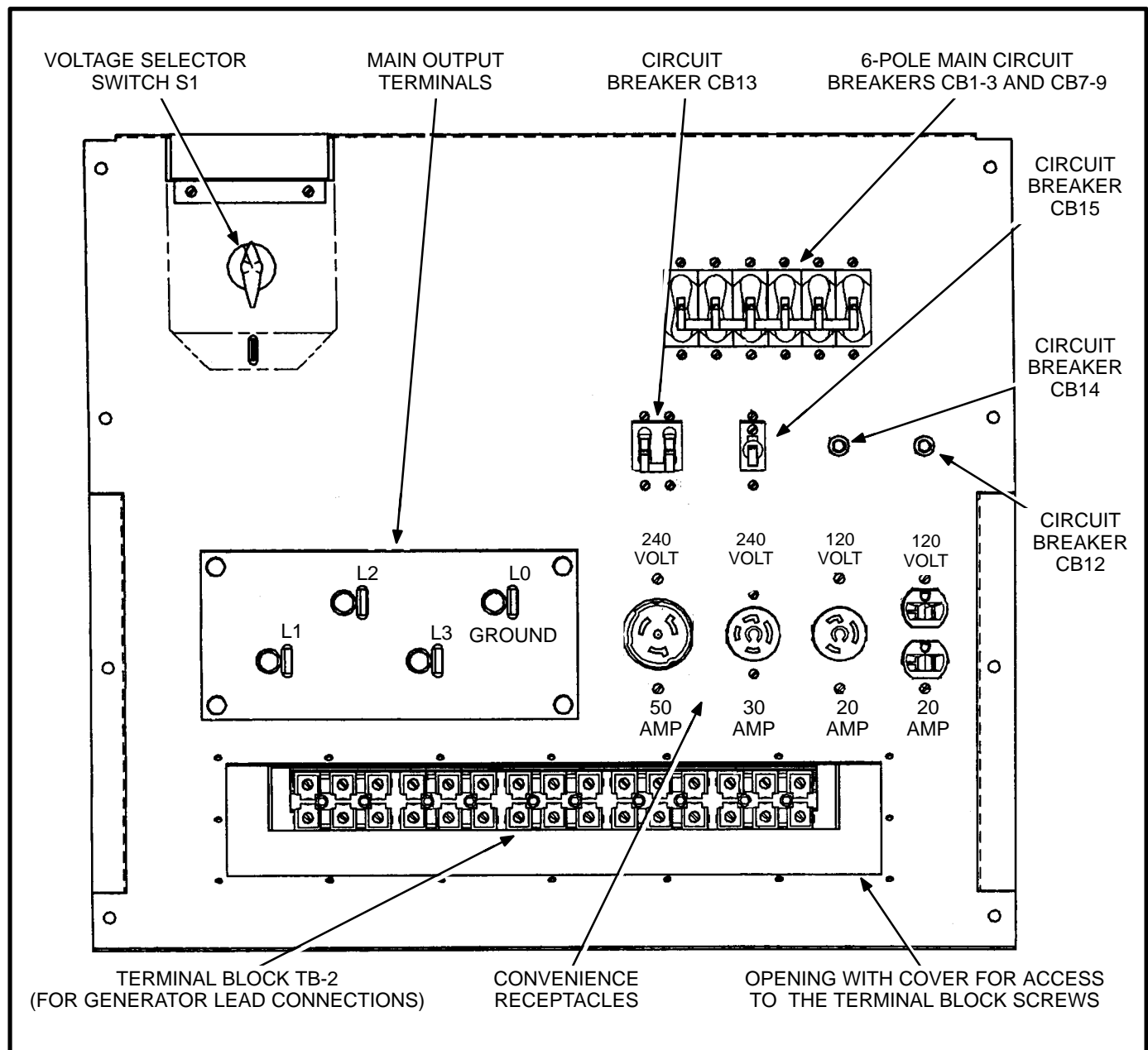


FIGURE 5-3. OPTIONAL POWER DISTRIBUTION PANEL

## GROUNDING

**⚠ WARNING** *Contact with electrical equipment can result in severe personal injury or death. It is extremely important that bonding and equipment grounding be properly done. All metallic parts that could become energized under abnormal conditions must be properly grounded.*

Grounding involves making a conductive connection between the metal parts of the genset (see Figure 5-4) or one of its electrical circuits and the earth. The design and installation of a grounding system is affected by many factors, including the use of multiple transformers, ground fault protection requirements, and the physical location of the generator. Follow the recommendations of the consulting engineer when installing the grounding system.

Typical requirements for bonding and grounding are given in the National Electrical Code, Article 250. All connections, wire sizes, etc. must conform to the requirements of the electrical codes in effect at the installation site.

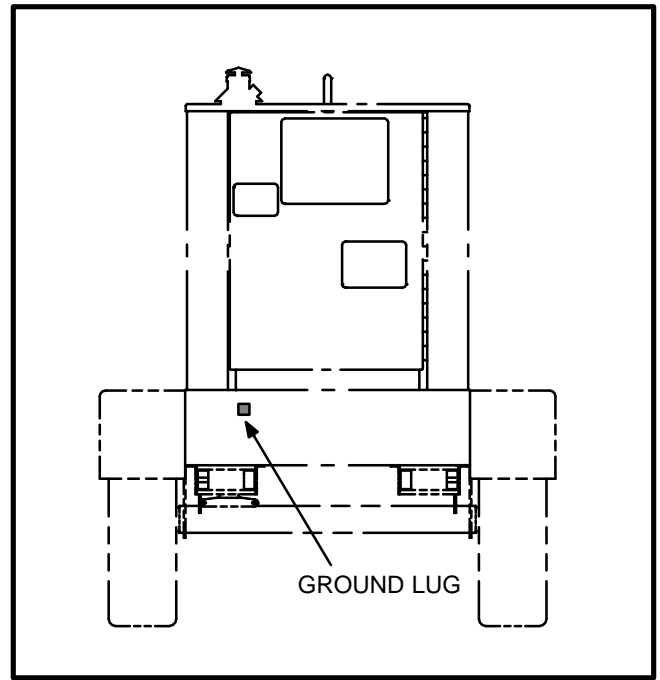


FIGURE 5-4. GENSET GROUND LUG LOCATION

## CONTROL HEATER (OPTIONAL)

A control heater (Figure 5-5) provides a means of humidity/temperature control of the control box interior to protect the components and ensure their effectiveness when the genset is subjected to varying ambient air conditions during extended periods of nonuse. The element is controlled by an adjustable thermostat.

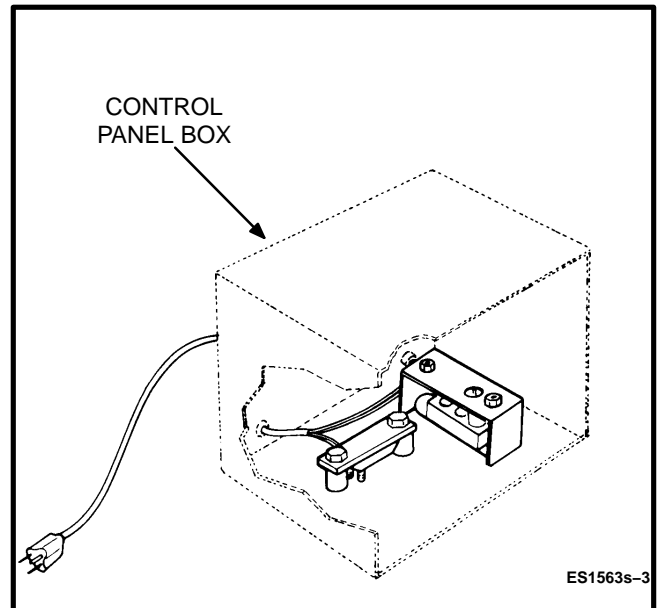


FIGURE 5-5. CONTROL HEATER

## CONTROL WIRING

The genset control panel box (Figure 5-6) provides connection points for remote control and monitor options. These connection points are located on the engine control monitor board (ECM) or the optional auxiliary relay board (ARB). If the optional ARB is installed, all remote connections are attached to this board. Remote connections for both boards are described in the following sections.

If the distance between the genset and the remote station is less than 1000 feet (305 m), use 18 gauge stranded copper wire. If the distance is 1000 to 2000 feet (305 to 610 m), use 16 gauge stranded copper wire. Always run control circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.

### ECM REMOTE CONTROL/MONITOR CONNECTIONS

**⚠ WARNING** High voltages in the control panel box present an electrical shock hazard which can cause severe personal injury or death. Refer to the Safety Precautions page.

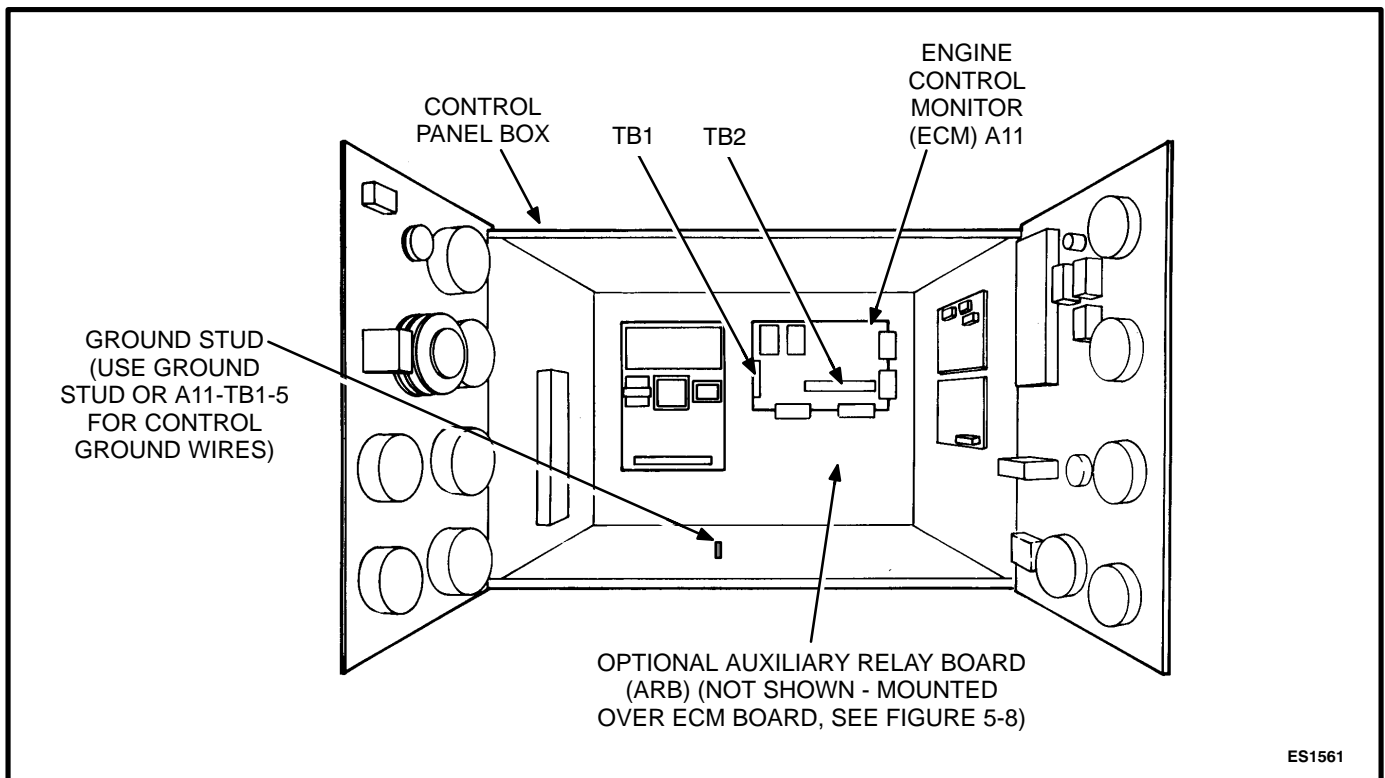
**⚠ CAUTION** Do not install DC control wiring in the same conduit as the AC power. AC voltage-induced currents can create operational problems with electronic solid-state devices.

### Remote Control Connections

Remote control connections are made at the terminal block (TB1) that is located on the engine control monitor board (ECM) (see Figure 5-6). Connect one or more remote switches across the remote terminal and the B+ terminal. See Page 11-6 for typical connections at TB1 of the ECM board.

### Remote Monitor Connections

The optional Detector 12 Control (12 light panel) provides the capability of attaching a remote monitor panel. Connections are made on the terminal block (TB2) located on the ECM board. See Page 11-6 for typical connections at TB2 of the ECM board.



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FIGURE 5-6. REMOTE CONTROL AND REMOTE MONITOR CONNECTIONS

## ARB REMOTE CONTROL/MONITOR CONNECTIONS

**⚠ WARNING** *High voltages in the control panel box present an electrical shock hazard which can cause severe personal injury or death. Refer to the Safety Precautions page.*

**⚠ CAUTION** *Do not install DC control wiring in the same conduit as the AC power. AC voltage-induced currents can create operational problems with electronic solid-state devices.*

The following describes the design/functional criteria for the optional auxiliary relay board (ARB) with a Detector-7 or -12 Genset control. There are two versions of this board; an ARB with or without the additional set of 12 Fault relays (see Figure 5-7).

The board is mounted directly on top of the ECM using standoffs, and having access holes for the fuses located on the ECM.

Page 11-7 provides a detailed diagram of the ARB.

### Terminal Blocks

**TB1** – ARB TB1 and ECM TB1 are identically numbered and provide the same remote control connection points. Note that additional terminals are provided for terminals 5, 7, and 10 of ARB TB1.

**TB2 through TB5** – Connection points for relays K1 through K3. TB2 provides the N/O and N/C connections (three form 'C' contacts for each relay). TB3 through TB5 provide the common connection points (TB3 for K1, TB4 for K2 and TB5 for K3).

**TB6 and TB7** – Connection points for fault relays K4 through K15. Three terminals are provided for each relay, which are labeled COM, N/C, N/O.

### Plug-In Relays (K1, K2, K3)

The ARB can be equipped with one to three 3-pole, double-throw relays. These relays (K1, K2, K3) are field changeable plug-in relays for easy field addition and replacement.

The relay contact ratings are:

- 10 amps at 28 VDC or 120 VAC, 80% PF
- 6 amps at 240 VAC, 80% PF
- 3 amps at 480 VAC, 80% PF

Each relay can be operated as a RUN, COMMON ALARM, or ISOLATED COIL with the changing of a jumper.

### Jumper Positions for Plug-In Relays

Jumpers W1, W2 and W3 perform the same functions for their respective relays, W1 for relay K1, W2 for relay K2, and W3 for relay K3. They can be located in any of 3 positions (A, B, C) independently of each other.

**Jumper Position A (Run):** The relay operates as a Run relay, energizing when SW B+ is applied from the ECM.

**Jumper Position B (Common Alarm):** The relay operates as a Common Alarm relay. The relay energizes any time there is an engine shutdown. This signal is provided from the ECM.

**Jumper Position C (Isolated):** The relay operates as an Isolated relay. The relay coil is energized by a customer applied B+ signal through the terminal block; TB3-1 for relay K1, TB4-1 for relay K2, and TB5-1 for relay K3.

Jumpers W11, W12, and W13 perform the same functions for their respective relays; W11 for relay K1, W12 for relay K2, and W13 for relay K3. They can be located in two different positions (A, B) independently of one another.

**Jumper Position A:** The relay operates isolated from the board. The customer provides the circuit completion through terminal block; TB3 for relay K1, TB4--5 for relay K2, and TB5-5 for relay K3. The customer can operate the relay with switched ground logic or use this relay in the middle of more complex logic circuits if needed.

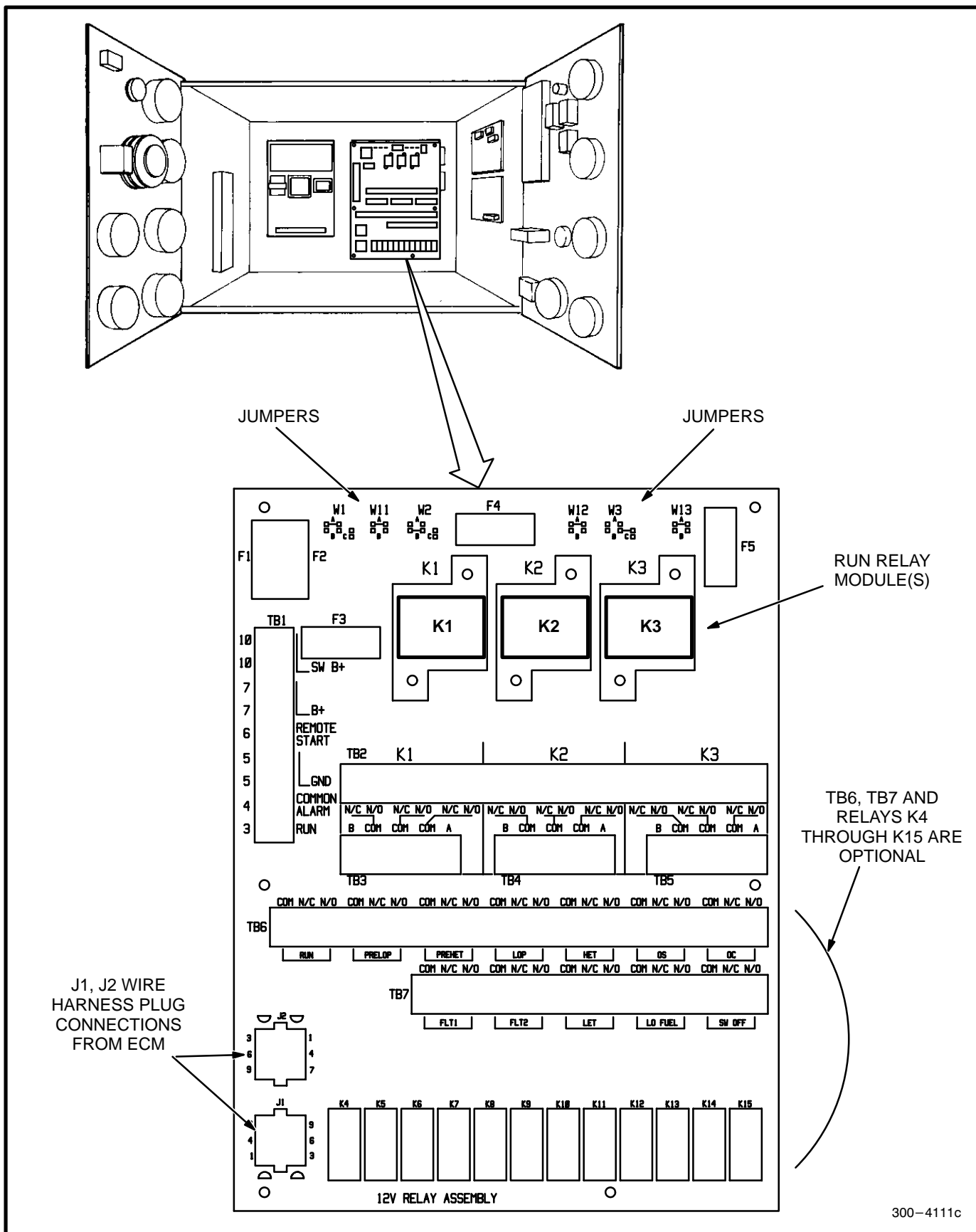
**Jumper Position B:** The relays operate with the coils connected to ground through the board connections. The coil will require a B+ signal to energize with the jumper in this position.

### Fault Relays (K4 through K15)

These optional relay modules are used to operate a remote alarm annunciator that has an independent power source. This allows the use of either AC or DC for alarm drives. The relays are energized through the latching relays on the ECM and provided N/O and N/C contacts for each external alarm connection.

The 12 relays with form 'C' contacts are rated:

- 10 Amp, 120 VAC
- 10 Amp, 30 VDC



**FIGURE 5-7. AUXILIARY RELAY BOARD (ARB)**

## Time-delayed Start/Stop Module

The genset can be equipped with a module to delay starting and stopping when the start and stop signals are received from the remote controller. It is adjustable to delay starts from 1 to 15 seconds to pre-

vent nuisance starts in installations where momentary power interruptions are frequent. It is adjustable to delay stops 1 to 30 minutes to allow the prime source of power time to stabilize. A typical wiring diagram is shown in Figure 5-8.

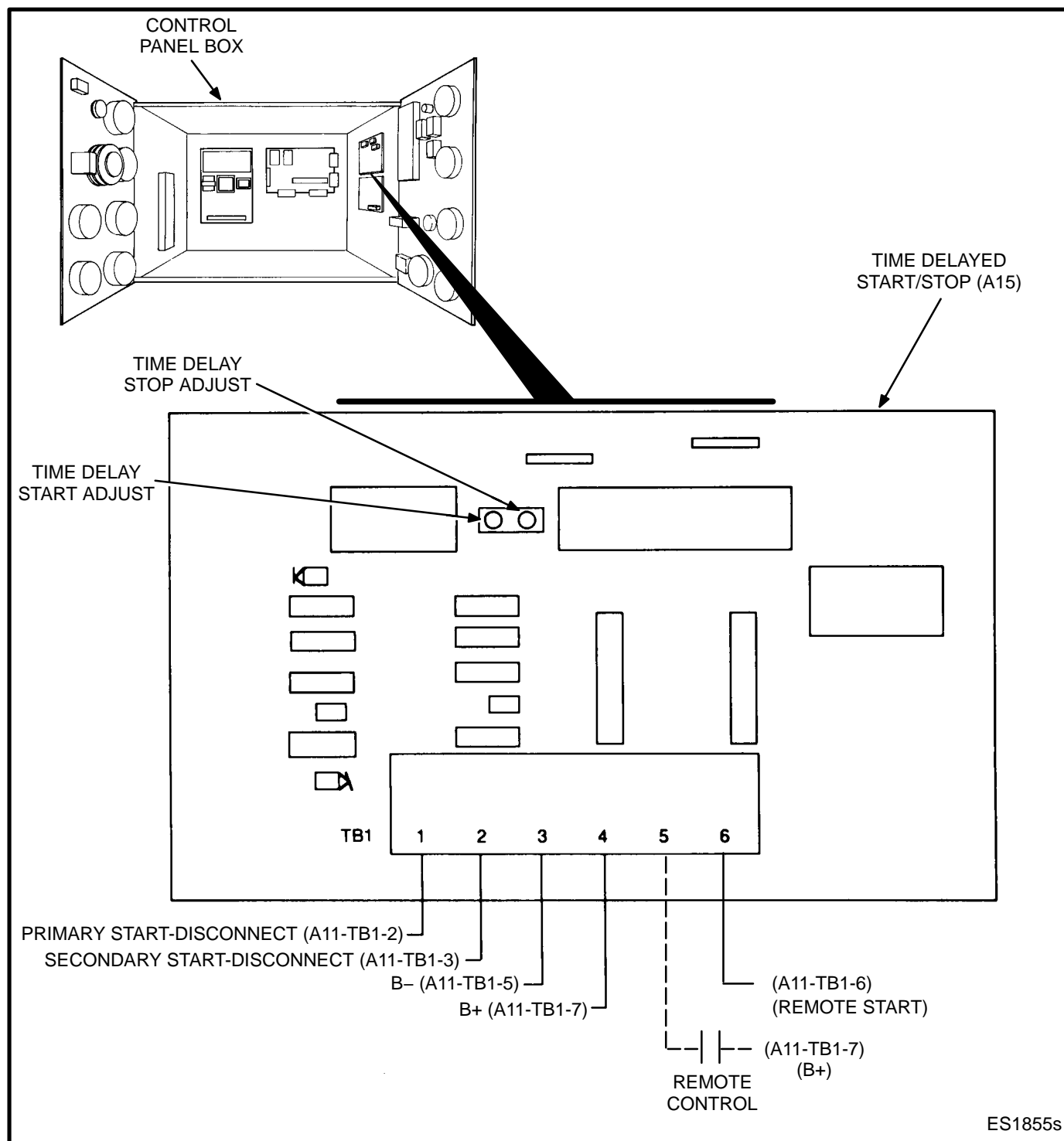


FIGURE 5-8. TIME-DELAYED START/STOP MODULE

## MAIN CIRCUIT BREAKER (OPTIONAL)

Depending on site specifications and applicable code requirements, an optional main circuit breaker (Generator Main Circuit Breaker) may be mounted on the genset rear housing.

### Main Circuit Breaker Remote Connections

Because of the many different types of main circuit breaker that can be used with the genset, the following descriptions will cover all circuit breaker types.

All breakers supplied are thermal and magnetic trip type. Depending on the requirement, the breaker may also include shunt trip and remote alarm connections. Review the following functions/requirements and Figure 5-9.

To access main circuit breaker connections, refer to *Optional Circuit Breaker Box Load Connection* procedure in this section.

- Genset output is connected to the load through the circuit breaker.
- When an overload or short circuit occurs on any one conductor, a common trip bar will disconnect all three conductors.
- The thermal trip action of the breaker is accomplished by bimetal strips. A sustained overcurrent condition will cause a thermal reaction of the bimetal and trip the breaker. Response of the bimetal is proportional to current; high current - fast response, low current - slow response. This action provides a time delay for normal inrush current and temporary overload conditions such as motor starting.

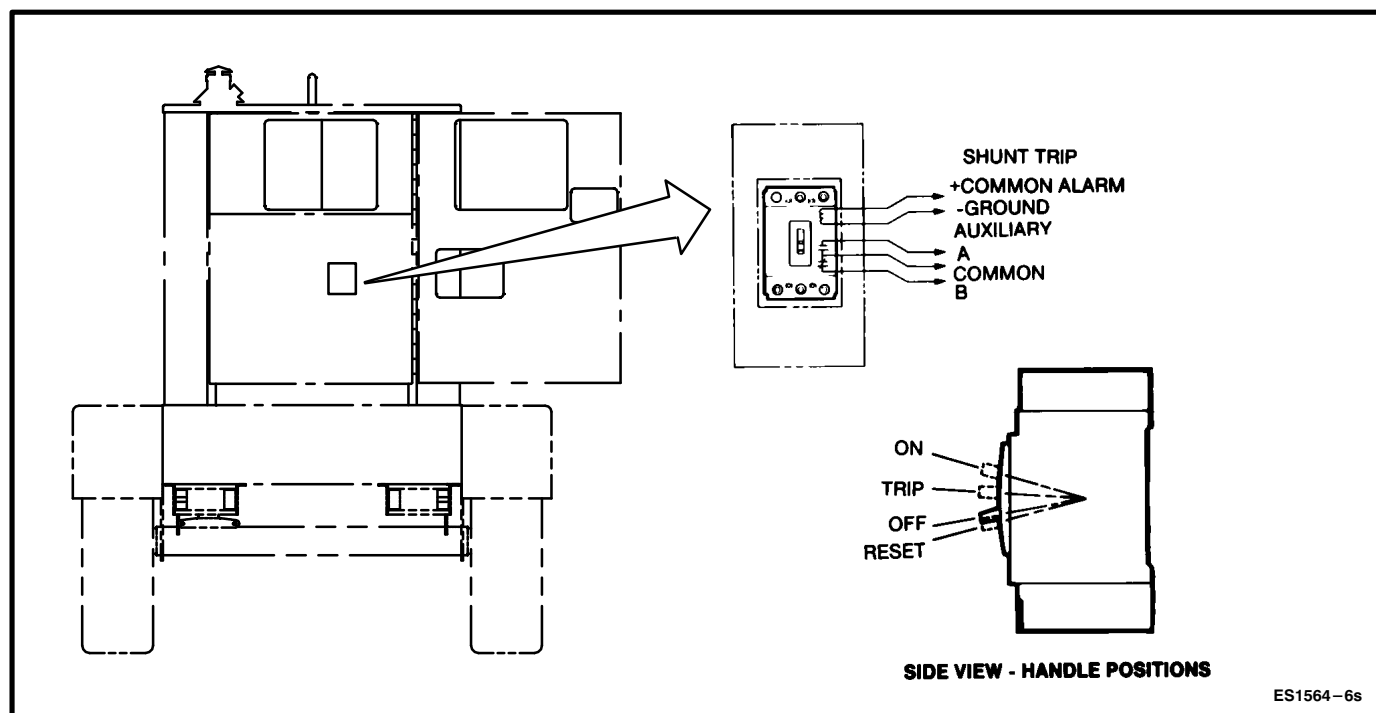


FIGURE 5-9. OPTIONAL MAIN CIRCUIT BREAKER

- The magnetic trip action of the breaker is caused by an electromagnet, which partially surrounds the internal bimetal strips. If a short circuit occurs, the high current through the electromagnet will attract the bimetal armature and trip the breaker. Some breaker models provide front adjustment of the magnetic trip action. These adjustments are normally set at the factory at the high position, but provide for individual conductor settings to suit customer needs.
- The shunt trip mechanism (if equipped) consists of a solenoid tripping device mounted in the breaker with external lead connections for remote signaling. A momentary signal to the solenoid will cause the breaker to trip. (Note that these wires are attached to the optional Pilot Breaker.)

This feature is available in AC or DC voltages, and is normally installed at the factory. The shunt trip mechanism is most often connected to a common fault shutdown circuit of the genset. This quickly disconnects the genset from the load on shutdown, and avoids a reverse power condition.

- Auxiliary contacts (if equipped) are used for local or remote annunciation of the breaker status. They usually have one normally-open and one normally-closed contact (1 form C contact) to comply with the annunciator equipment.

- The trip actuator (if applicable) is for periodic exercise of the breaker, to clean it and maintain its proper operation. Rotating this actuator mechanically simulates overcurrent tripping through actuation of linkages not operated by the On/Off handle.
- Operation of the circuit breaker is determined by site-established procedures. In emergency standby installations, the breaker is often placed to the ON position, and is intended for safety trip actuation in the event of a fault condition. If the breaker trips open, investigate the cause and perform remedial steps per the troubleshooting procedures. To close the breaker, the handle must be placed to the Reset position, then to On.

If the distance between the genset and the remote stations is less than 1000 feet (305 mm), use 18 gauge stranded copper wire. If the distance is 1000 to 2000 feet (305 to 610 m), use 16 gauge stranded copper wire. Always run control circuit wiring in a separate metal conduit from AC power cables to avoid inducing currents that could cause problems within the control.

## BATTERY CONNECTIONS

**⚠ WARNING** *Ignition of explosive battery gases can cause severe personal injury or death. Do not permit any flame, cigarette, pilot light, spark or other ignition source near the battery.*

Starting the unit requires 24-volt battery current. Use two 12-volt batteries for a normal installation. Connect the batteries in series (negative post of first

battery to positive post of second) as shown in Figure 5-10. Normal installation battery cables are included. Increase the cable size if batteries are located remotely from the genset. Service the batteries as necessary. Infrequent unit use (as in emergency standby service) may allow the batteries to self-discharge to the point where they cannot start the unit. If installing an automatic transfer switch that has no built-in charge circuit, connect a special float charger.

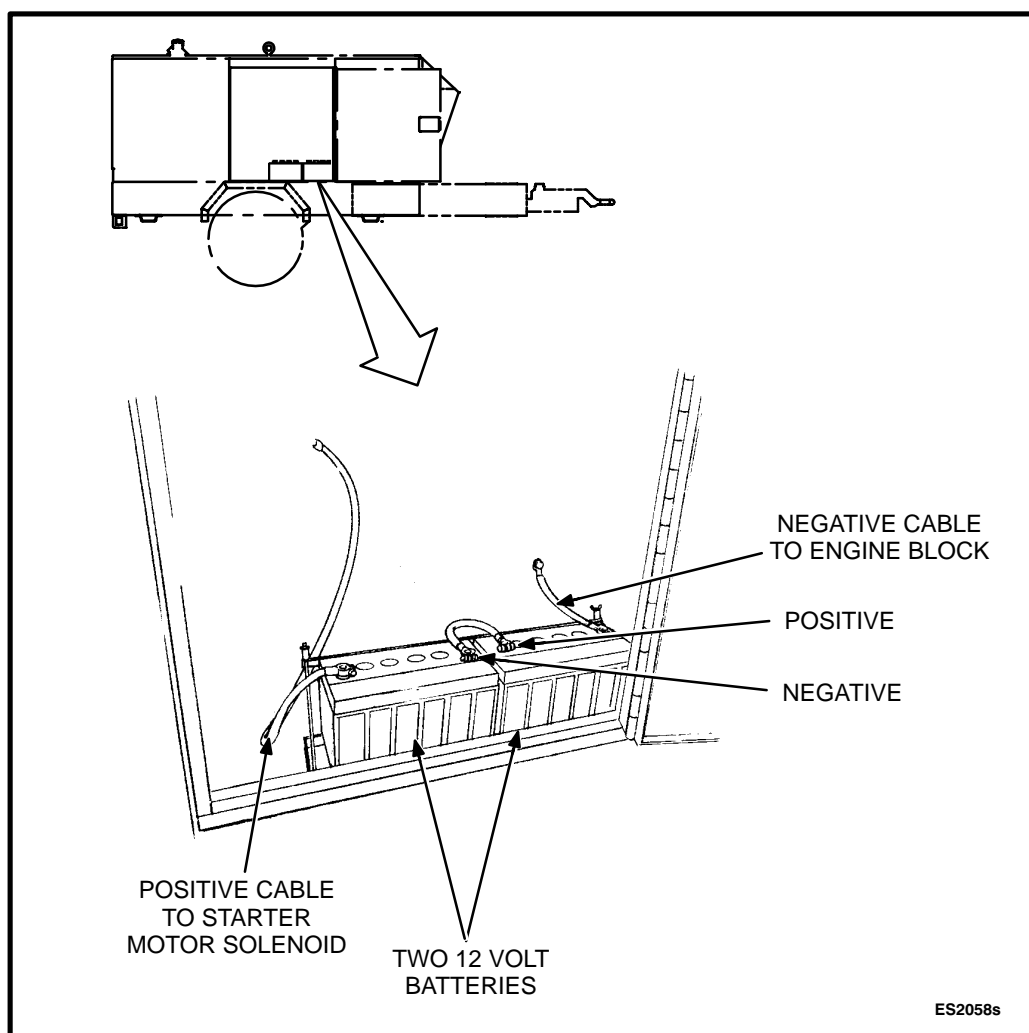


FIGURE 5-10. BATTERY CONNECTIONS

# 6. Control Panel Description

## GENERAL

This section describes the function and operation of the standard and optional generator set instruments and control switches.

The two panels described in this section are the main genset control panel with all options installed, and the control panel of the optional day tank fuel system.

## CONTROL PANEL

The control panel is divided into a DC panel for monitoring the engine, and an AC panel for monitoring the generator. All instruments and control switches are located on the face of the control panel, as illustrated in Figure 6-1.

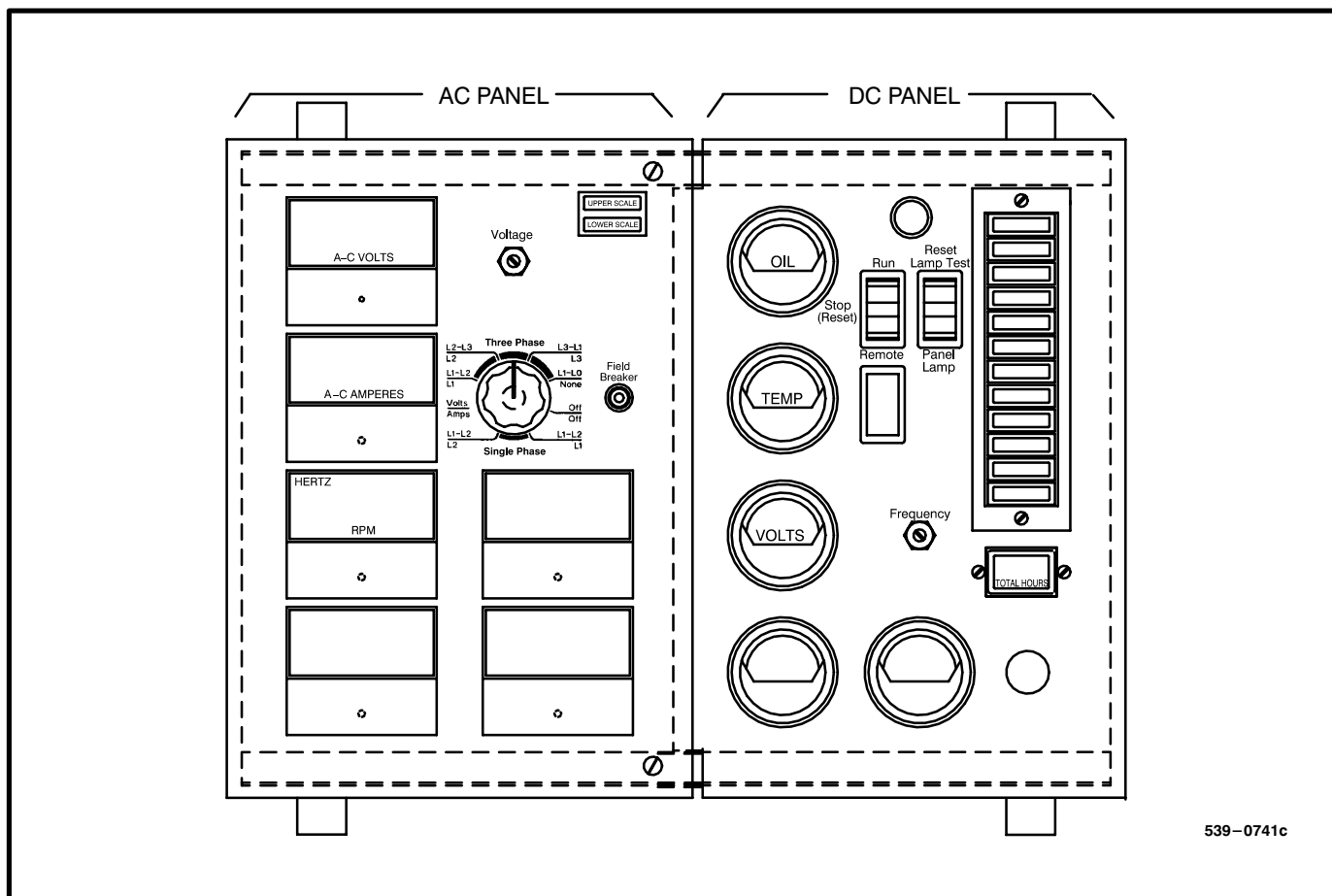


FIGURE 6-1. GENSET CONTROL PANEL

## DC Panel Meters and Controls

Figure 6-2 shows the locations of the meters and controls of the DC panel.

**Panel Lamp:** Illuminates control panel.

**Oil Pressure Gauge:** Indicates pressure of lubricating oil in engine (connected to a sensor unit on the engine).

**Coolant Temperature Gauge:** Indicates temperature of coolant circulating in engine (connected to a sensor unit on the engine).

**DC Voltmeter:** Indicates the battery charging system voltage.

**Run/Stop/Remote Switch:** Starts and stops the unit either locally, or from a remote location connected to the engine control monitor board.

**Running Time Meter:** Registers the total number of hours the unit has run. Use it to keep a record of periodic servicing. Time is cumulative; the meter cannot be reset.

**Reset/Lamp Test/Panel Lamp Switch:** Resets the fault circuit only when the Run/Stop/Remote switch is in the Stop (Reset) position. Tests fault lamps and turns on the control panel lamp.

**Tachometer (optional):** Provides constant monitoring of engine r/min.

**Frequency Adjust Rheostat (Optional):** Used in conjunction with the optional electronic governor to adjust engine speed.

**Oil Temperature Gauge (optional):** Indicates temperature of lubricating oil in engine (connected to a sensor unit on the engine).

**Emergency Stop Pushbutton (optional):** Push-in switch for emergency shutdown of the engine. To reset, pull switch out and move Run/Stop/Remote switch to the Stop position. Then push test switch to Reset/Lamp Test position.

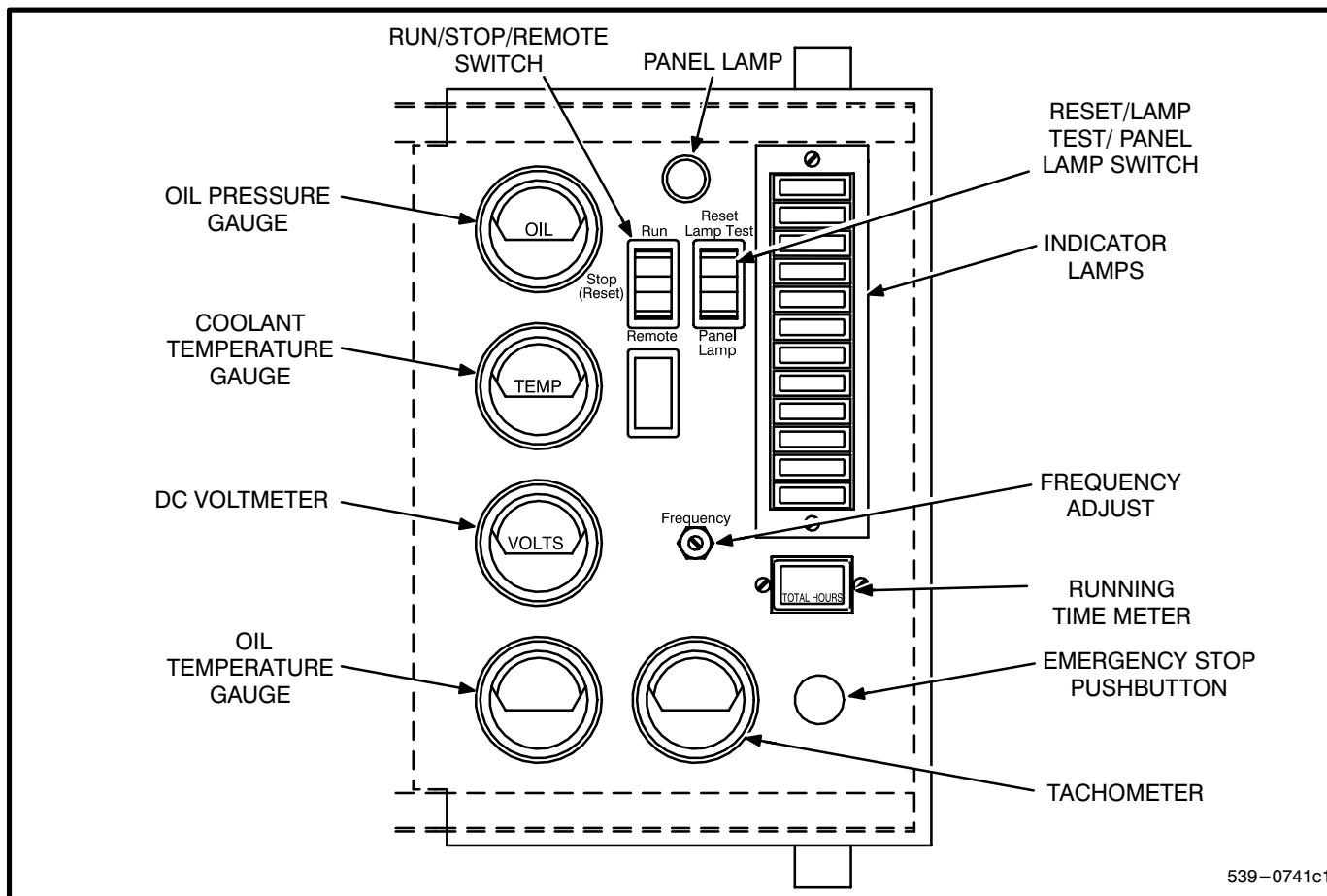


FIGURE 6-2. DC PANEL METERS AND CONTROLS

## DC Panel Indicator Seven-Lamps

Figure 6-3 shows the location of the indicator lamps of the DC panel.

The standard control panel has seven indicator lamps which are:

**RUN** (green) lamp comes on when both starter protection circuits are opened after unit starting.

**PRE LO OIL PRES** (yellow) indicates engine oil pressure is marginally low (20 psi [137kPa]).

**PRE HI ENG TEMP** (yellow) indicates engine temperature is marginally high (above 216°F [102°C]).

**LO OIL PRES** (red) indicates engine has shut down because of critically low oil pressure (14 psi [97kPa]).

**HI ENG TEMP** (red) indicates engine has shut down because of critically high temperature (above 230°F [110°C]). Also is used to indicate low coolant level.

**OVERSPEED** (red) indicates engine has shut down because of excessive speed (60 Hz units at 2100 ±90 r/min, and 50 Hz at 1850 ±50 r/min).

**OVERCRANK** (red) indicates the starter has been locked out because cranking time has exceeded the 75 second limit. The standard cycle cranking allows three 15-second cranking cycles with two 15-second rest periods.

## DC Panel Indicator Twelve-Lamps

The optional twelve-lamp control version includes all features of the seven-lamp version plus the following:

**FAULT 1** (red): an undetected fault. May be factory programmed as a shutdown or non-shutdown, and as a timed or non-timed fault. (Normally set for timed shutdown).

**FAULT 2** (red): Same features as Fault 1 (Normally set for timed shutdown).

**LOW ENG TEMP** (yellow): Engine temperature is marginally low for starting. Indicates inoperative coolant heater.

**LO FUEL** (yellow): Indicates fuel supply is marginally low.

**SWITCH OFF** (flashing red): Indicates generator set is not in automatic start operation mode.

**CAUTION** *Yellow lamps indicate potential problems that could damage the genset. Refer to Troubleshooting in Section 8.*

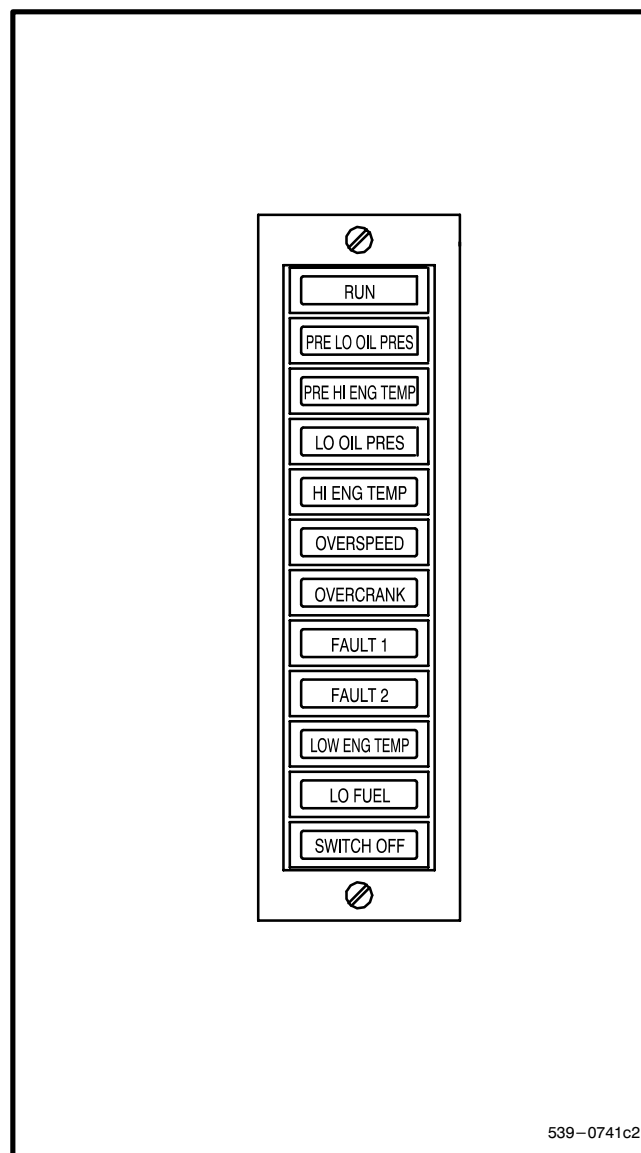


FIGURE 6-3. DC PANEL INDICATORS

## AC Panel

Figure 6-4 shows the location of the meters, controls, and indicator lamps of the AC panel.

**AC Voltmeter:** Dual range instrument indicating AC voltage. Measurement range in use is shown on indicator light.

**AC Ammeter:** Dual range instrument indicates AC generator line current.

**Wattmeter (optional):** Continuously gives reading of the generator output in kilowatts.

**Power Factor Meter (optional):** Indicates percent power factor of AC output.

**Frequency/RPM Meter (optional):** Indicates generator output frequency in hertz and engine speed in revolutions-per-minute (RPM).

**Voltage Adjust Rheostat (optional):** Rheostat providing approximately plus or minus five percent adjustment of the rated output voltage.

**Upper and Lower Scale Indicators (optional):** Indicates which scale to use on the AC voltmeter and ammeter.

**Phase Selector Switch (optional):** Selects the phases of generator output to be measured by AC voltmeter and AC ammeter.

**Engine Pyrometers (optional):** Indicate engine exhaust and inlet air temperatures.

**Field Breaker:** Protects generator exciter and regulator from overheating in the event of certain failure modes.

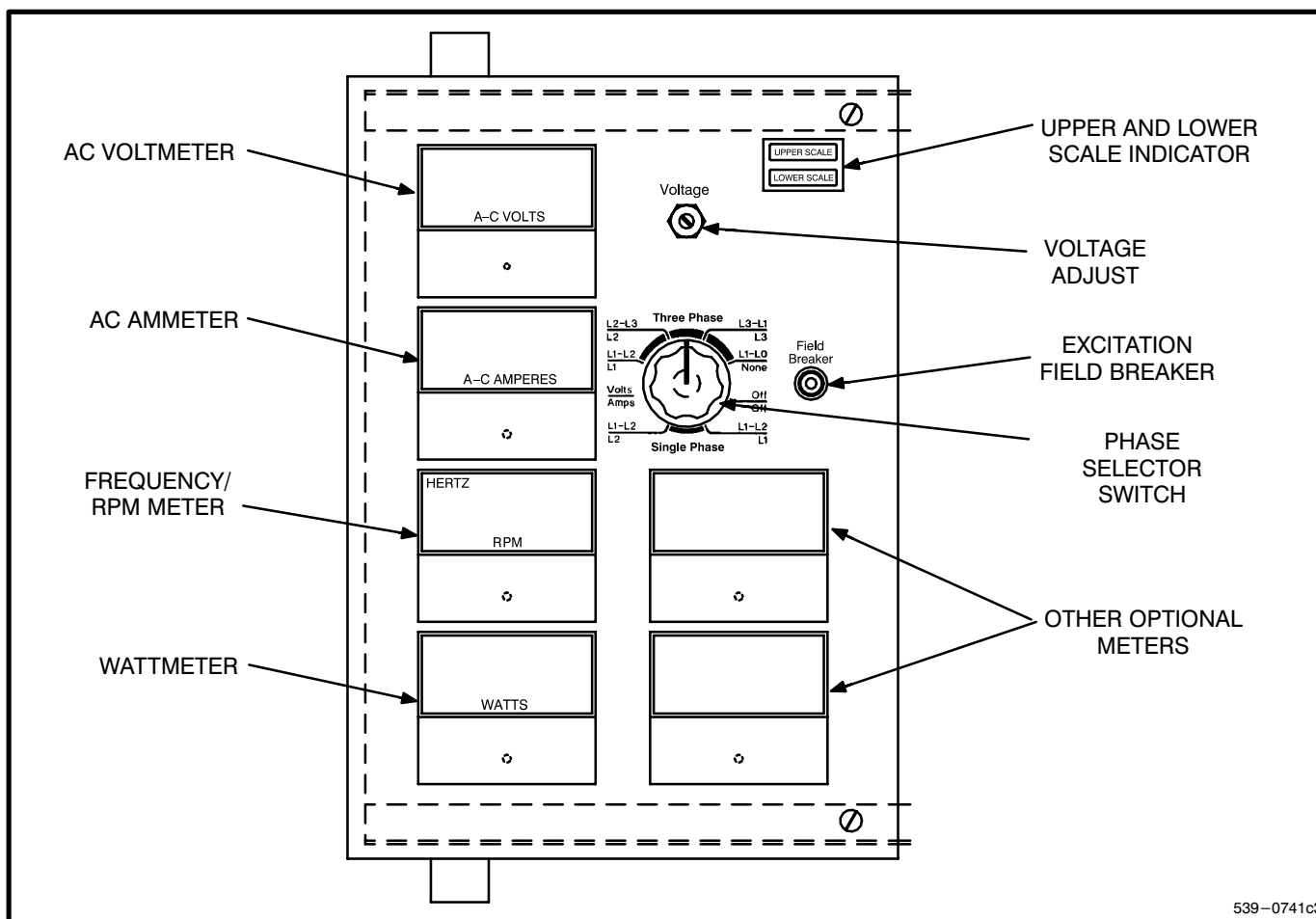


FIGURE 6-4. AC PANEL METERS, CONTROLS, AND INDICATORS

## DAY TANK CONTROL SYSTEM

The day tank control system consists of a skid-mounted fuel tank, fuel pump, float switches, and the automatic control. The control operates the fuel pump to maintain a reservoir of fuel in the day tank, and provides a seven light monitor of the system operation. Figure 6-5 shows the control front panel.

This section explains functions of the control panel lamps, components and operation of the day tank fuel control system. All red color lamps indicate a fault condition.

### Control Panel Switches and Indicators

The following paragraphs describe the operation of the control switches and indicators.

### Indicators:

- **READY** (green): indicates that all the following conditions are met:
  - Control switch is in ON position.
  - If AC power is available for pumping.
  - If DC power is available for internal logic circuits (connections to the engine starting battery might be required).
- **HI FUEL** (red): indicates that the fuel has reached an abnormally high level. It indicates a possible failure of the "pump-off" float switch in the day tank. The lamp can be turned off with the RESET switch after the fuel level drops to normal. The lamp will come back on again during the next pumping cycle if the fault remains.

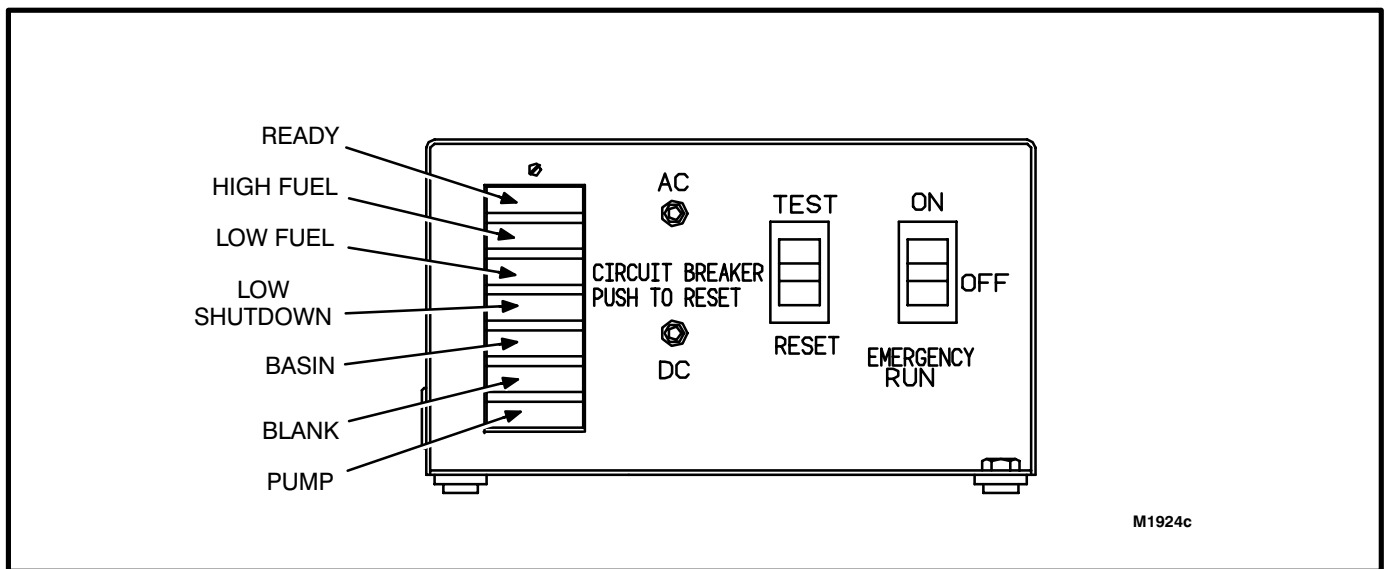


FIGURE 6-5. DAY TANK CONTROL FRONT PANEL

- **LO SHUTDOWN** (red): indicates that the fuel level has dropped to near tank bottom. It indicates a possible empty main fuel tank, fuel line restriction, pump failure, or failure of both the "pump-off" and "low fuel" float switches.

The control should be wired to shut down the genset (optional) as continued operation will allow air to enter the engine injection pump necessitating bleeding to restart the engine. After restoring the tank fuel level, reset circuit with the RESET switch. This switch also restores engine operation if the tank control has been connected to shut down the engine.

**⚠ CAUTION** *Continued operation with a LO FUEL fault can lead to a low fuel shutdown if the low fuel float switch fails.*

- **BASIN** (red): indicates that the fuel has flooded the optional safety basin surrounding the fuel tank. It indicates possible failure of both the "pump-off" and "high fuel" float switches. The basin float switch turns off the fuel pump. The pump cannot function again until the basin is drained of fuel and the circuit is reset with the RESET switch.
- **BLANK** - For customer use.
- **PUMP** (green): indicates that the fuel pump is running. It will come on and go off as fuel is pumped to maintain the day tank level. The lamp does not come on when the EMERGENCY RUN switch is used.

### Switches and Circuit Breakers:

- **ON/OFF/EMERGENCY RUN:** Switches both AC and DC power supplies. The momentary EMERGENCY RUN position allows pump operation if the control fails to operate the pump automatically.
- **TEST/RESET:** Hold the TEST position to test the indicator lamps and pump operating circuits. Replace any lamps that fail to come on. Pressing the RESET position after correcting a

fault condition will restore control operation and turn off the indicator fault lamp. The RESET position also restores engine operation if the fuel control has been connected to shut down the engine.

- **AC and DC CIRCUIT BREAKERS:** Press the breaker reset button to restore control operation if either has tripped.

### Operation

The following steps describes how to operate the day tank controller.

1. Push the control switch to the ON position for automatic operation. The green SYSTEM READY light will come on and the pump will fill the tank if AC power is available for pumping and DC power is available for the internal logic circuits. The level of fuel in the tank will be automatically kept between a set of pump-on and pump-off float switches.

**When filling an empty tank, the red LO SHUTDOWN and LO FUEL lights will come on when the control switch is pushed to the ON position. This is normal. Push the panel RESET switch to turn off the red lights after the tank has been filled.**

**If the SYSTEM READY light does not come on, check for correct AC and DC power connections. See Control Wiring Connections and Fuel Pump Motor wiring Connections in Section 4.**

2. The green PUMP ON light indicates when the pump is running. It will come on and off as fuel is pumped to maintain the proper level in the tank.
3. Push the control switch to the EMERGENCY RUN position (momentary contact) to pump fuel into the tank if the control fails to operate the pump automatically.

**The green PUMP ON light does not come on when the switch is in the EMERGENCY RUN position.**

# 7. Operation

## **⚠ WARNING**

### **EXHAUST GAS IS DEADLY!**

*Exhaust gases contain carbon monoxide, an odorless and colorless gas. Carbon monoxide is poisonous and can cause unconsciousness and death. Symptoms of carbon monoxide poisoning can include:*

- Dizziness
- Nausea
- Headache
- Weakness and Sleepiness
- Throbbing in Temples
- Muscular Twitching
- Vomiting
- Inability to Think Coherently

**IF YOU OR ANYONE ELSE EXPERIENCE ANY OF THESE SYMPTOMS, GET OUT INTO THE FRESH AIR IMMEDIATELY. If symptoms persist, seek medical attention. Shut down the unit and do not operate until it has been inspected and repaired.**

**Protection against carbon monoxide inhalation also includes proper installation and regular, frequent visual and audible inspections of the complete exhaust system.**

## **GENERAL**

This section describes generator set operation, including pre-start checks, starting, running, and stopping the set. Study this entire section carefully before starting the set. Be completely familiar with the set for safe operation.

## **PRE-START CHECKS**

**⚠ WARNING** *Accidental starting of the genset while working on it can cause severe personal injury or death. Prevent accidental starting by placing the RUN/STOP/REMOTE SWITCH to the STOP position.*

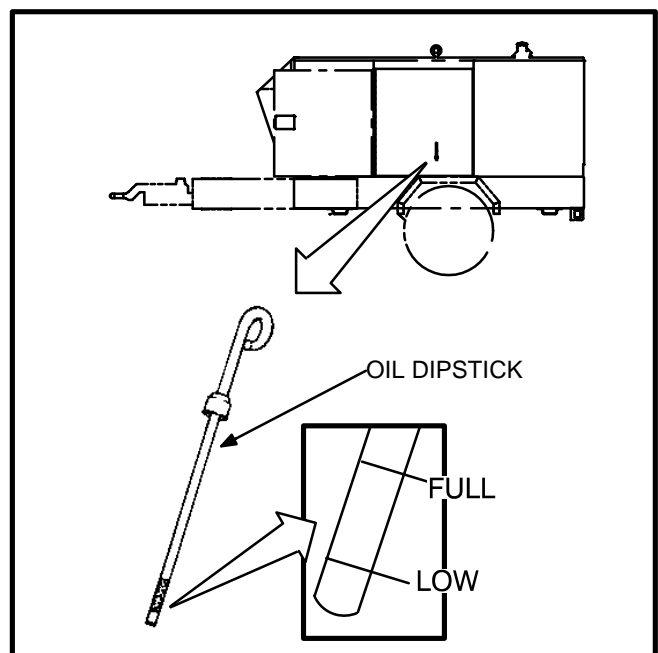
Before starting, be sure the set is ready for operation by making the following checks. Refer to Section 9, *Maintenance* for the correct procedures.

## **Mechanical Checks**

Check for loose belts and fittings, leaking gaskets and hoses, or any signs of mechanical damage. If any problems are found, have them corrected immediately.

## **Lubrication**

Check the engine oil level. Keep the oil level as near as possible to the high mark on the dipstick, without overfilling (see Figure 7-1).



**FIGURE 7-1. OIL LEVEL INDICATOR**

## Coolant

**⚠ CAUTION** *The high engine temperature shutdown system will not operate if the coolant level is too low. The high engine temperature sensor monitors coolant temperature. Loss of coolant will prevent sensor operation and allow the engine to overheat causing severe damage to the engine. Therefore, maintain adequate coolant level for proper operation of the high engine temperature shutdown system.*

The coolant recovery tank should be about two-thirds (2/3) full when the engine is cold. The level will rise as the engine warms up. Note the normal level when the engine is running under load. Add coolant to the recovery tank to replace the normal loss of coolant. Check the entire cooling system for leaks if the level keeps dropping. See Figure 7-2.

**⚠ WARNING** *Contact with hot coolant can result in serious burns. Do not bleed hot pressurized coolant from a closed cooling system.*

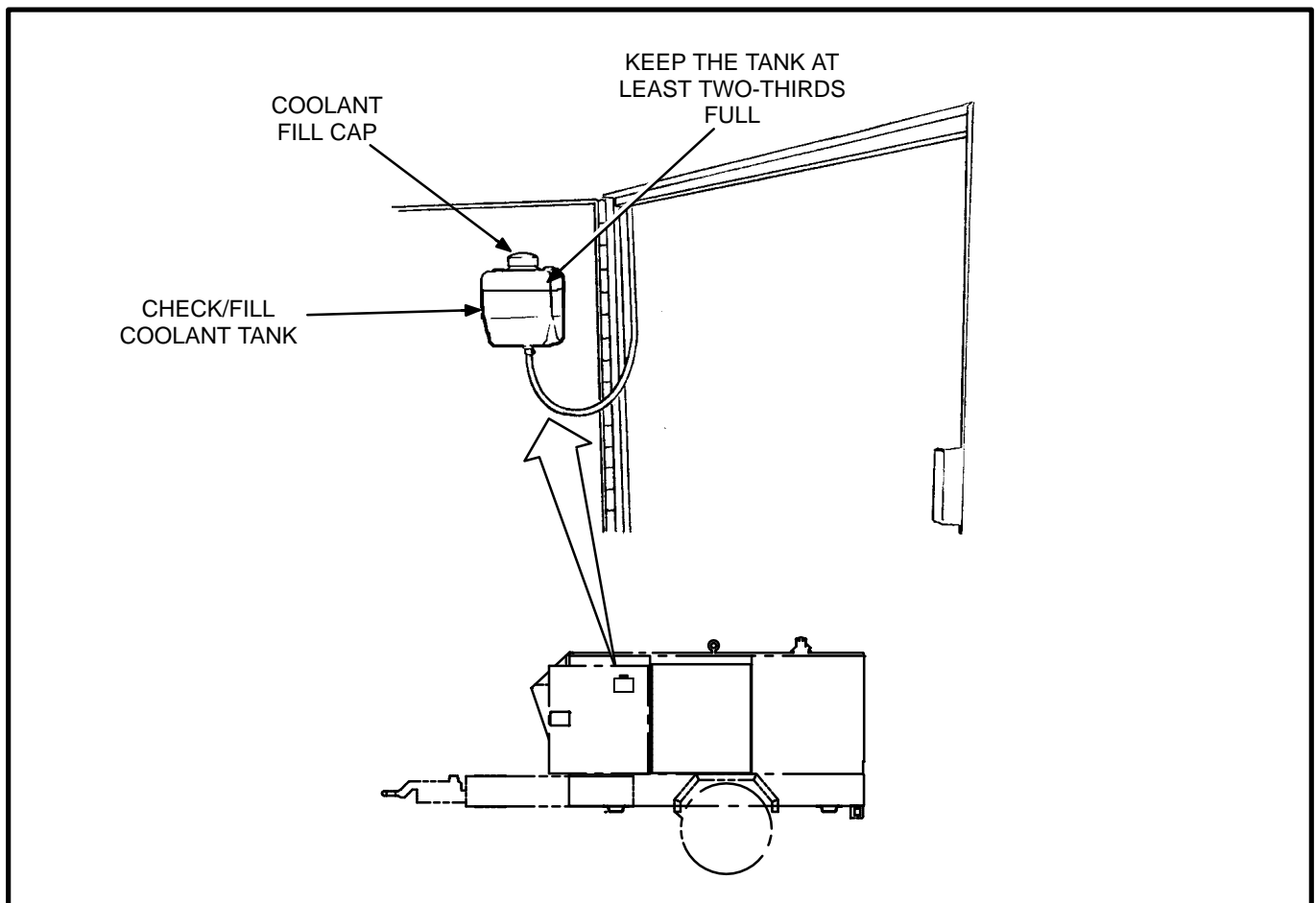


FIGURE 7-2. ENGINE COOLANT LEVEL

## DC Electrical System

With the genset off, check the terminals on the battery (see Figure 7-3) for clean and tight connections. Loose or corroded connections create resistance that can hinder starting. Clean and reconnect the battery cables if loose. Always connect the negative battery cable last.

**⚠ WARNING** *Ignition of explosive battery gases can cause severe personal injury. Do not permit any flame, cigarette, pilot light, spark or other ignition source near the battery.*

**⚠ CAUTION** *Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.*

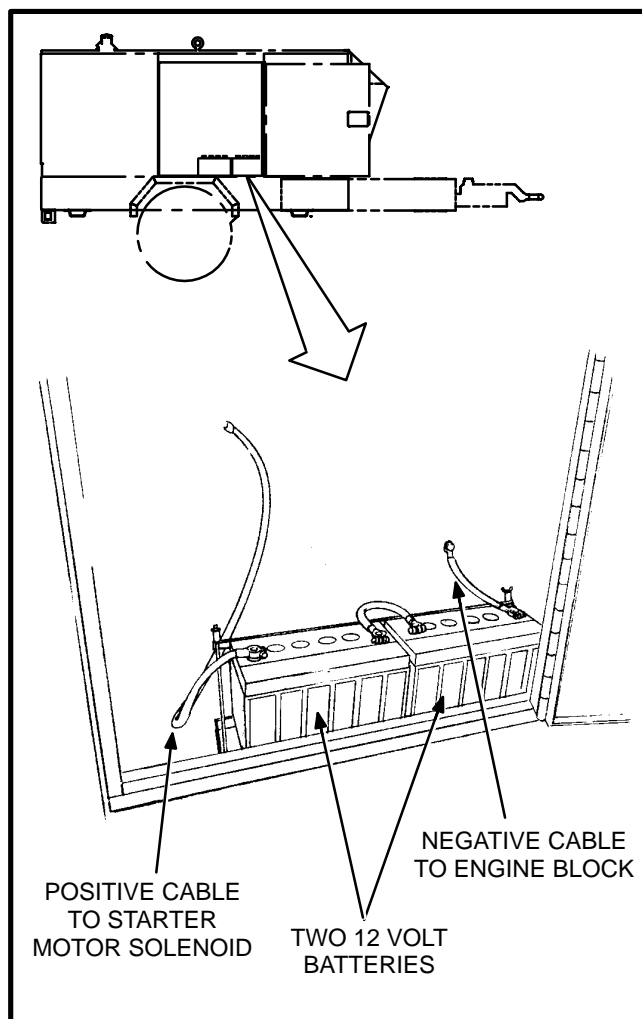
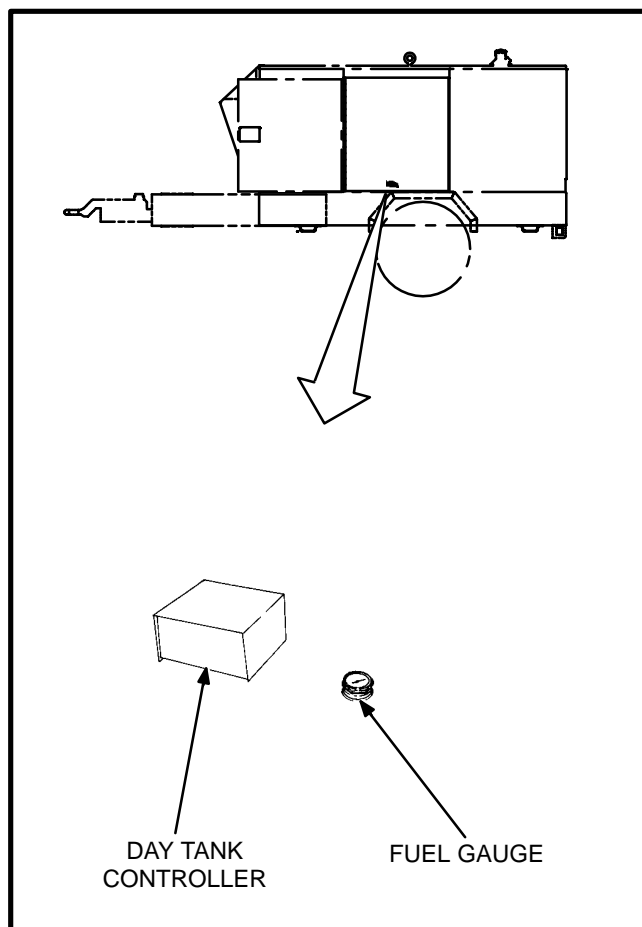


FIGURE 7-3. BATTERY LOCATION

## Fuel

Make sure the fuel tank has sufficient fuel (see Figure 7-4) and that the fuel system is primed. If the genset contains the optional day tank controller, refer to Section 6, *Day Tank Control System* before starting the genset.



**FIGURE 7-4. FUEL GAUGE LOCATION**

## STARTING

The following sections cover the three different methods used to start the generator set.

**⚠ CAUTION** *Phase rotation of the genset and utility must be the same. Equipment damage can occur. Check and reconnect as necessary.*

*For all prime power or construction site gensets, check the rotation of every 3-phase motor before loading and reconnect if necessary.*

### Cold Starting With Loads

In accordance with NFPA 110, Onan recommends installing diesel standby generator sets (life safety systems) equipped with coolant heaters in locations where the minimum ambient temperature is above 40°F (4°C). NFPA also requires that the engine coolant be maintained at a minimum of 90°F (32°C) and for most applications, accept the emergency load in 10 seconds or less. Although most Onan generator sets will start in temperatures down to -25°F (-32°C) when equipped with coolant heaters, it might take some running time to warm the engine up before a load can be applied when ambient temperatures are below 40°F (4°C).

The Low Engine Temperature (LET) lamp on the Onan Detector 12 control is provided to meet the requirements of NFPA 110. The LET sensor alarms when the engine coolant temperature falls below 70°F (21°C). In applications where the ambient temperature falls below 40°F (4°C), the LET may be lit even though the coolant heaters are connected. Under these conditions, although the generator set may start, it may not be able to accept load within 10 seconds. When this condition occurs, check the coolant heaters for proper operation. If the coolant heaters are operating properly, other precautions might be necessary to warm the engine before applying a load.

## Genset Control Panel

Move the Run/Stop/Remote switch on the control panel (Figure 6–5) to the RUN position. This activates the engine control system and the starting system. The starter will begin cranking, and after a few seconds, the engine should start. (If the engine has an ether starting aid system attached, pull its knob to activate the system. The engine should start. Then push in the knob to stop the ether system.) The starter will disconnect when the engine speed reaches 450 to 570 r/min.

If the engine does not start, the starter will disengage after a 75 second limit, and the OVERCRANK indicator will light. The cycle cranking allows three 15-second cranking cycles with two 15-second rest periods.

To clear an overcrank fault, place the Run/Stop/Remote switch in the STOP position and momentarily depress the Reset switch. Wait two minutes for the starter motor to cool, then repeat the starting procedure. If the engine does not run after a second attempt at starting, refer to the Troubleshooting section.

### Starting From Remote Location

Move the Run/Stop/Remote switch on the genset control panel to the REMOTE position. This allows the generator set to be started from a remote switch. Closing the remote switch initiates the starting sequence described in the previous section.

### Automatic Starting

Place the Run/Stop/Remote switch on the genset control panel in the REMOTE position if an automatic transfer switch is used. This allows the transfer switch to start the generator set if a power outage occurs, and stop it when the power returns.

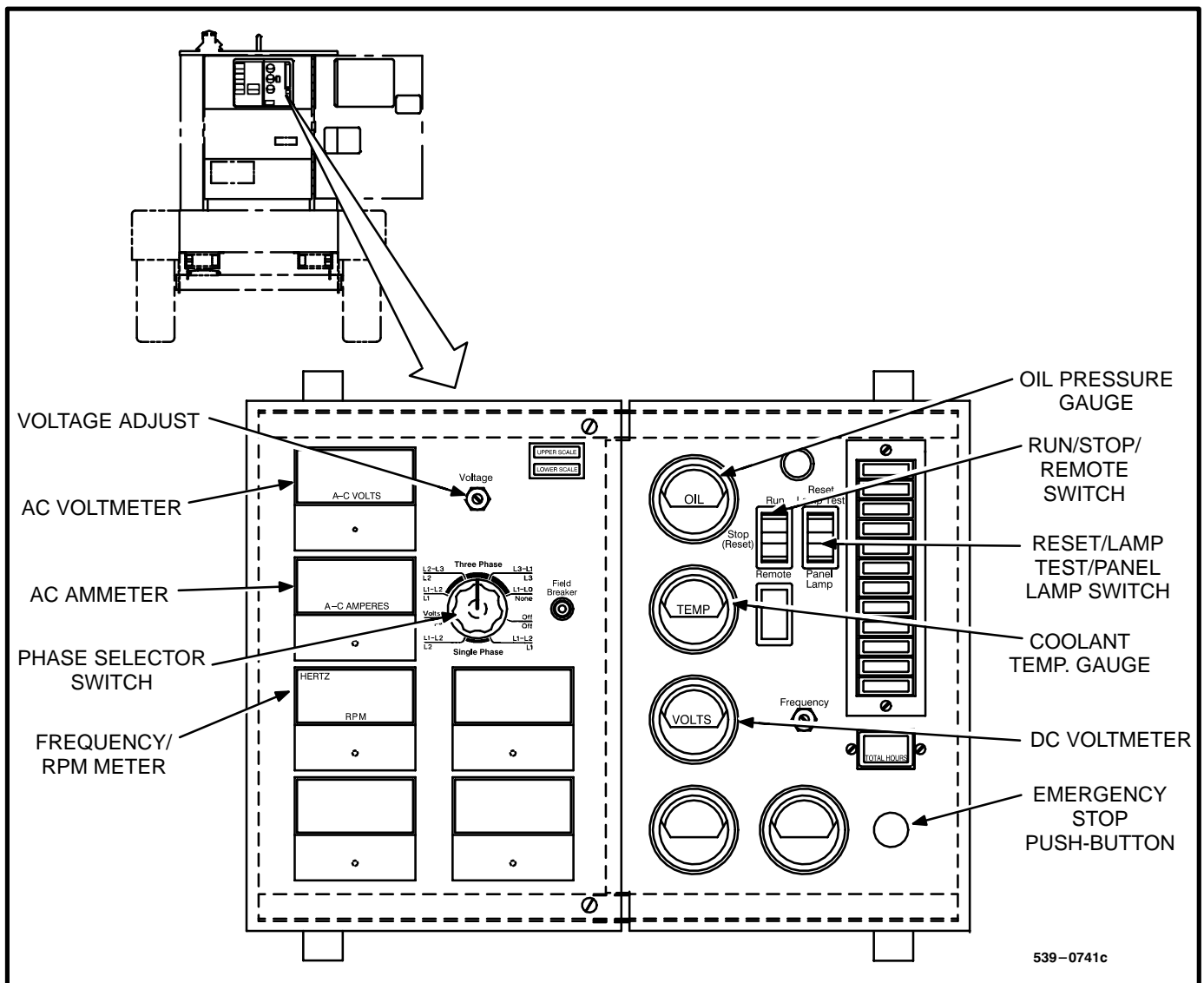


FIGURE 7-5. GENSET CONTROL PANEL

## RUNNING

With the genset running, listen for any unusual noises that may indicate mechanical problems and check the oil pressure frequently. Investigate anything that indicates possible mechanical problems.

Before operating the genset under load, make certain the genset will perform correctly by checking the following areas.

### Exhaust System

**⚠WARNING** *Inhalation of exhaust gases can result in severe personal injury or death. Inspect exhaust system audibly and visually for leaks daily. Repair any leaks immediately.*

Inspect the entire exhaust system including the exhaust manifold, muffler and exhaust pipe. Visually and audibly check for leaks at all connections, welds, gaskets, and joints. Make sure exhaust pipes are not heating surrounding area. If any leaks are detected, have them corrected immediately.

### Fuel System

**⚠WARNING** *Leaking fuel will create a fire hazard that can result in severe personal injury or death if ignited by a spark. If any leaks are detected, have them corrected immediately.*

Inspect the fuel supply lines, filters, and fittings for leaks. Check any flexible sections for cuts, cracks, and abrasions and make sure they are not rubbing against anything that could cause breakage.

### Engine Gauges

Check the following while the genset is operating. Refer to Figure 7-5 for location of engine gauges.

**Oil Pressure Gauge:** The oil pressure should be 35 to 55 psi (241 to 379 kPa) when the engine is at operating temperature.

**Coolant Temperature Gauge:** The coolant temperature should be 170° to 216° F (77° to 102° C) depending on the load and ambient temperature.

**DC Voltmeter:** This is a voltage reference gauge, indicating condition of the batteries and also of battery charging circuit. Gauge should read approximately 24 to 28 volts while genset is running. If reading is high or low, check batteries and the battery charging circuit.

### Generator AC Meters (Optional)

Check the following meters while the genset is operating. Refer to Figure 7-5 for location of the generator AC meters.

**Frequency/RPM Meter:** The generator frequency and engine RPM should be stable and the reading should be the same as the nameplate rating (50 or 60 hz/1500 or 1800 RPM).

The generator frequency is a result of engine speed, which is automatically controlled. If the generator frequency is below specification, contact an authorized service center.

**AC Voltmeter:** Turn the phase selector switch to each line-to-line phase selection shown on the volts scale (L1-L2 on single phase gensets: L1-L2, L2-L3, and L3-L1 on three phase gensets). Read the AC voltmeter using the upper or lower scale as indicated by the scale indicator light. At no load, the line-to-line voltage should be the same as the genset nameplate rating. If the reading is incorrect, refer to the Generator Voltage Adjustment procedure at the end of this section.

**AC Ammeter:** Turn the phase selector switch to each phase selection shown on the amperes scale (L1 and L2 on single phase gensets; L1, L2 and L3 on three phase gensets). Read the ammeter using the upper or lower scale as indicated by the scale indicator light. At no load, the current readings should be zero. With a load applied, each line current should be approximately the same, and no line current should exceed the genset nameplate rating.

## STOPPING

Run the genset at no load for three to five minutes before stopping. This allows the lubricating oil and engine coolant to carry heat away from the combustion chamber and bearings.

**Normal Stop:** If the genset was started at the genset control panel or at a remote control panel, move the Run/Stop/Remote switch or remote starting switch to the STOP position. If the set was started by an automatic transfer switch, the genset will automatically stop about 15 minutes after the normal power source returns.

**Emergency Stop:** An optional emergency stop button is located on the right side of control panel (see Figure 7-5). Push the button in for emergency stop. Note that no fault indicators will light when the emergency button is used. To reset the fault circuitry, pull the emergency stop button out and move the Run/Stop/Remote switch to the Stop position. Then move the test switch to Reset/Lamp Test position.

### Engine Monitor Indicator Lamps

With the genset stopped, hold the Reset/Lamp Test switch in the Test position (see Figure 7-5). All indicator lamps should light. Verify all of the lamps are on and then release the switch. Contact an Onan distributor if any lamps require replacement.

### Mechanical Checks

With the genset stopped, check for loose belts and fittings, leaking gaskets and hoses, or any signs of mechanical damage. If any problems are found, have them corrected immediately.

## BREAK-IN

Drain and replace the crankcase oil after the first 50 hours of operation on new generator sets. Refer to the Maintenance section of this manual for the recommended procedures.

## NO-LOAD OPERATION

Periods of no-load operation should be held to a minimum. If it is necessary to keep the engine running for long periods of time when no electric output is required, best engine performance will be obtained by connecting a "dummy" electrical load. Such a load could consist of a heater element, etc.

## EXERCISE PERIOD

This generator set must be able to go from a cold start to being fully operational in a matter of seconds. This can impose a severe burden on engine parts.

Regular exercising keeps engine parts lubricated, prevents oxidation of electrical contacts and generally helps provide reliable engine starting. Exercise the generator set at least once a week for a minimum of 30 minutes with load so the engine reaches normal operating temperatures.

## HIGH/LOW OPERATING TEMPERATURES

Use a coolant heater if a separate source of power is available. The optional heater available from Onan will help provide reliable starting under adverse weather conditions.

## POWER RATING FACTORS

The generator set power rating applies to sets used in standby applications. The set will operate at the stated rating for the duration of normal utility power interruptions. The rating was established for a standard radiator cooled set running on diesel fuel and operating at an altitude of 300 feet (92 m) with an ambient temperature of 81° F (27° C). For a rating relative to other applications, altitudes, cooling systems, or ambient temperatures, contact an authorized service center.

## GENERATOR VOLTAGE CHECK AND ADJUSTMENT

If the optional AC meters are installed, an external control panel-mounted potentiometer is provided for adjusting the AC output (see Figure 7-5).

Move the Run/Stop/Remote switch on the engine control panel to the Run position. Check the following conditions while the genset is operating.

### Generator Voltage Adjust

This procedure applies to gensets equipped with the AC meter option only. The AC meter option consists of meters, switches and a voltage adjusting potentiometer on the front of the genset control panel.

**⚠ WARNING** *Use extreme caution when working on electrical components. High voltages can cause injury or death. Do not wear damp clothing (particularly wet shoes) or allow skin surface to be damp when handling electrical equipment.*

1. Move the Phase Selector switch to read generator output current and voltage, and perform the following steps:

- A. Insert a screwdriver into the Voltage Adjust potentiometer located on the front of the genset control panel and using a wrench carefully loosen the locking nut.
- B. While observing the voltmeter, slowly turn the screwdriver clockwise to increase voltage or counterclockwise to decrease voltage, and adjust to the rated nameplate voltage.

**If correct voltage cannot be attained through this adjustment, contact an authorized service center for assistance.**

- C. After setting the correct voltage, tighten the locking nut, being careful not to change the adjustment.

2. Move the Phase Selector switch to the OFF position.

## 8. Troubleshooting

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The Quiet Site generator set has sensors that continuously monitor the engine for abnormal conditions, such as low oil pressure or high coolant temperature. If these conditions occur, the engine monitor activates a fault lamp, and may also stop the engine (depending on the condition). If the generator set is stopped for this reason, the operator may be able to restart the set after making adjustments or corrections. This section describes the fault condition system, and suggests troubleshooting procedures.

The standard seven-light control has a single green light to indicate RUN, two amber pre-fault lights and four red fault lights. The optional twelve-light control has a single green light to indicate RUN, four amber lights and seven red fault lights. Both controls also have a terminal connection for an audible alarm, which sounds when a fault occurs.

### SAFETY CONSIDERATIONS

High voltages are present inside the control box and generator output box when the set is running. Do not open the control box or generator output box while the set is running.

**⚠ WARNING** *Contacting high voltage components can cause severe personal injury or death. Keep control and output box covers in place during troubleshooting.*

When troubleshooting a set that is shut down, make certain the generator set cannot be accidentally restarted. Place the Run/Stop/Remote switch in the STOP position and remove the negative battery cable from the set starting battery.

**⚠ WARNING** *Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [-] first).*

*Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (-) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (-) cable first, and reconnect it last.*

**⚠ CAUTION** *Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.*

When a fault lamp turns on during operation, follow the procedures listed below to locate and correct the problem. For any symptom not listed, contact an authorized service center for assistance.

### Resetting the Control

The external alarm and fault lamp may be deactivated by moving the Run/Stop/Remote switch to the Stop position and pressing the Reset/Lamp Test/Panel Lamp switch. Locate the problem and correct it before restarting the set. While pressing the Reset/Lamp Test/Panel Lamp switch, make certain that all lamps light.

### Optional Main Circuit Breaker

The optional Main Circuit Breaker is located on the genset rear load panel cover. If the load exceeds the breaker current rating, the Main Circuit Breaker will open. If the Main Circuit Breaker trips, locate the source of the overload and correct as necessary. Manually reset the breaker to reconnect the load to the generator.

TABLE 8-1. TROUBLESHOOTING

**⚠WARNING** *Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.*

SYMPTOM	CORRECTIVE ACTION
1. Green RUN lamp lights following engine startup.	1. Indicates all engine systems are normal. No corrective action required.
2. PRE HI ENGINE TEMP lamp lights. Engine continues to operate.	2. Indicates engine has begun to overheat and engine temperature has risen to approximately 216° F (102° C). If generator is powering non-critical and critical loads and cannot be shut down, use the following: <ul style="list-style-type: none"> <li>a. Reduce load if possible by turning off non-critical loads.</li> <li>b. Check air inlets and outlets and remove any obstructions to airflow.</li> </ul> If engine can be stopped, follow procedure in step 3.
3. HI ENG TEMP lamp lights. Engine shuts down.	3. Indicates engine has overheated (engine temperature has risen above 230° F [116° C]) or coolant level is low (sets with coolant level sensor). Allow engine to cool down completely before proceeding with the following checks: <ul style="list-style-type: none"> <li>a. Check coolant level and replenish if low. Look for possible coolant leakage points and repair if necessary.</li> <li>b. Check for obstructions to cooling airflow and correct as necessary.</li> <li>c. Check for a slipping or worn fan belt.</li> <li>d. Reset control and restart after locating and correcting problem. Contact an authorized service center if none of the above.</li> </ul>
4. PRE LO OIL PRES lamp lights. Engine continues to operate.	4. Indicates engine oil pressure has dropped to 20 psi (138 kPa). If generator is powering critical loads and cannot be shut down, wait until next shutdown period and then follow step 5 procedure. If engine can be stopped, follow procedure in step 5.
5. LO OIL PRES lamp lights. Engine shuts down. NOTE: See also step 6.	5. Indicates engine oil pressure has dropped to 14 psi (97 kPa). Check oil level, lines and filters. If oil system is OK but oil level is low, replenish. Reset control and restart. Contact an authorized service center if oil pressure is not in the range of 30 to 55 psi (206 to 379 kPa).

TABLE 8-1. TROUBLESHOOTING (cont'd)

**⚠WARNING** *Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.*

SYMPTOM	CORRECTIVE ACTION
<p>6. OVERCRANK lamp lights and engine stops cranking.</p> <p>or</p> <p>Engine runs, shuts down, and LO OIL PRES lamp lights.</p>	<p>6. Indicates possible fuel system problem.</p> <ol style="list-style-type: none"> <li>Check for empty fuel tank, fuel leaks, or plugged fuel lines and correct as required.</li> <li>Check for dirty fuel filter and replace if necessary (see Section 9, <i>Maintenance</i>).</li> <li>Check for dirty or plugged air filter and replace if necessary (see Section 9, <i>Maintenance</i>).</li> <li>Refer to Step 5.</li> <li>Reset the control and restart after correcting the problem. Contact an authorized service center for service if none of the above.</li> </ol>
7. Engine runs and then shuts down, OVERSPEED lamp lights.	7. Indicates engine has exceeded normal operating speed. Contact an authorized service center for service.
*8. SWITCH OFF lamp flashes.	8. Indicates Run/Stop/Remote switch is in the Stop position which will prevent automatic starting if an automatic transfer switch is used. Move the Run/Stop/Remote switch to the Remote position for automatic starting.
*9. LO FUEL lamp lights. Engine continues to run.	9. Indicates diesel fuel supply is running low. Check fuel supply and replenish as required.
*10. LO FUEL lamp lights. Engine shuts down and LO OIL PRES lamp lights.	10. Indicates engine has run out of fuel. Check fuel level and replenish as required.
<p>*11. LO ENG TEMP lamp lights. Set is in standby mode but is not operating.</p> <p>Lamp lights when engine coolant temperature is 70° F (21° C) or lower. Since the lamp goes out after the engine warms up, there should be no cause for alarm even during initial generator set operation.</p> <p>Where the ambient temperature falls below 40° F (4° C), the LET may be lit even though the coolant heaters are connected. The genset may start, but it may not be able to accept load within 10 seconds. See <i>Cold Starting with Loads</i> in Section 6.</p>	<p>11. Indicates engine coolant heater is not operating or is not circulating coolant. Check for the following conditions:</p> <ol style="list-style-type: none"> <li>Coolant heater not connected to power supply. Check for blown fuse or disconnected heater cord and correct as required.</li> <li>Check for low coolant level and replenish if required. Look for possible coolant leakage points and repair as required.</li> <li>Contact an authorized service center if none of the above.</li> </ol>

\*12-Light Panel Only.

TABLE 8-1. TROUBLESHOOTING (cont'd)

**⚠WARNING** *Many troubleshooting procedures present hazards which can result in severe personal injury or death. Only qualified service personnel with knowledge of fuels, electricity, and machinery hazards should perform service procedures. Review safety precautions on inside cover page.*

SYMPTOM	CORRECTIVE ACTION
*12. The FAULT 1 or FAULT 2 fault lamp lights. Engine shuts down immediately, engine runs for several seconds and then shuts down, or engine continues to run.	12. The standard undesignated fault functions are programmed to shut down the set when a fault is sensed. Fault 1 is time delayed while Fault 2 is immediate. The nature of the fault is an optional selection that is determined when the set installation is designed. The undesignated fault functions may also be programmed for non-shutdown or non-time delay. Contact an authorized service center for assistance.
13. Fault lamp lights but no fault exists. Engine gauges show oil pressure, engine temperature, and frequency (speed) are within normal limits.	13. The monitor board or a sensor may be at fault. Contact an authorized service center for service.
14. Engine starts from generator control panel but will not start automatically or from a remote panel. (Note: The Run/Stop/Remote switch must be in the Remote position for automatic or remote starting).	14. Remote circuit breaker is tripped. Reset breaker and restart. Contact an authorized service center if breaker trips after resetting.
15. Engine will not crank.	15. Indicates possible fault with control or starting system. Check for the following conditions: <ul style="list-style-type: none"> <li>a. Emergency stop button may be pushed in. To reset, pull switch out, move the Run/Stop/Remote switch to Stop position and move test switch to Reset/Lamp Test position.</li> <li>b. Fault lamp on. Correct fault and reset control.</li> <li>c. Poor battery cable connections. Clean the battery cable terminals and tighten all connections.</li> <li>d. Discharged or defective battery. Recharge or replace the battery.</li> <li>e. Contact an authorized service center for assistance if none of the above.</li> </ul>
16. No AC output voltage.	16. Field breaker on control panel is tripped. Reset breaker. Contact an authorized service center if voltage buildup causes breaker to trip.
17. Green RUN lamp does not light following engine startup.	17. Indicates possible Start/Disconnect relay failure. Contact an authorized service center for assistance.

\*12-Light Panel Only.

# 9. Maintenance

## GENERAL

Establish a maintenance/service schedule based on the type of application, and on the severity of the environment. The table below lists the recommended service intervals. In extreme operating conditions, reduce the service intervals accordingly. Factors that affect the maintenance schedule include the following:

- Use for continuous duty (prime power)
- Extremes in ambient temperature
- Exposure to elements
- Exposure to salt water
- Exposure to windblown dust or sand

Consult with an authorized service center if the set is subject to extreme operating conditions, and determine a suitable maintenance schedule. Use the running time meter to keep an accurate log of warranty service. Perform all service at the time period indicated, or after the number of operating hours indicated, whichever comes first. Use the following table and the maintenance schedule contained in the engine operation and maintenance manual to determine the required maintenance. Refer to this section and to the engine operation and maintenance manual for procedures.

**TABLE 9-1. MAINTENANCE SCHEDULE**

SERVICE THESE ITEMS	SERVICE TIME				
	Daily or after 8 hours	Weekly or after 50 hours	Monthly or after 100 hours	6 Months or after 200 hours	Yearly or after 400 hours
Inspect genset	x <sup>1</sup>				
Check oil Level	x				
Check coolant Level	x				
Drain water from fuel filter	x <sup>2</sup>				
Check air cleaner (clean if required)		x <sup>2</sup>			
Drain water and sediment from fuel tanks		x <sup>4</sup>			
Exercise standby sets		x <sup>5</sup>			
Check anti-freeze concentration			x		
Check battery level and specific gravity			x		
Drain exhaust condensate trap			x		
Check trailer brake system			x		
Change crankcase oil and filter		See Note 3		x <sup>2</sup>	
Clean generator assembly				x	
Change air cleaner element					x <sup>2</sup>
Change fuel filter					x <sup>2</sup>
Clean cooling system					x
Check fan belt	After 1000 hours <sup>6</sup>				
Check valve lash clearance	After 1000 hours <sup>7</sup>				

1 - Check for oil, fuel, cooling and exhaust system leaks. Check exhaust system audibly and visually with genset running and repair any leaks immediately.

2 - Perform more often in extremely dusty conditions.

3 - Perform after first 50 hours of operation on new sets.

4 - Drain one cup of fuel to remove water and sediment.

5 - Exercise standby sets weekly. Refer to Operation section.

6 - Visually check belt for evidence of slippage.

7 - Contact an authorized service center for service.

**⚠WARNING** *Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [-] first).*

*Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (-) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (-) cable first, and reconnect it last.*

**⚠CAUTION** *Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.*

## GENERATOR SET INSPECTION

During operation, be alert for mechanical problems that could create unsafe or hazardous conditions. Section 7, *Operation* covers the areas that should be frequently inspected for continued safe operation.

## TRAILER BRAKE SYSTEM

The Quiet Site genset trailer has a hydraulic surge braking system. When the brakes are applied in the

tow vehicle, trailer momentum forces the hitch/actuator assembly to telescope into the case assembly, applying force to the master cylinder piston, thus providing hydraulic pressure for braking. A break-away mechanism applies brake pressure in the event of coupling failure.

## Brake Maintenance

1. Keep the master cylinder reservoir at least half full with DOT-3 hydraulic brake fluid.
2. Use a pressure-type brake bleeder if it is necessary to refill and bleed the brake system.
3. There are no adjustments in the brake actuator for stroke length. Readjust the brake shoes to reduce actuator stroke length if it exceeds 1 inch (25 mm). (The length of the roller path on top of the actuator when it is fully extended is the same as stroke length). Brake shoe adjustments are accessible through slots in the back of each drum assembly. Turn the brake drum forward while making shoe adjustments. Back off each shoe 10 clicks from the point where you cannot turn the drum by hand.

**⚠WARNING** *Braking power can diminish, leading to a serious road accident, when actuator stroke length exceeds 1 inch (25mm). Check actuator stroke length regularly and service the brakes if necessary.*

## LUBRICATION SYSTEM

The engine oil was drained from the crankcase before shipment. Before the initial start, the lubrication system must be filled with oil of the recommended classification and viscosity. Refer to Section 2, Specifications, for the lubricating oil capacity.

## Oil Recommendations

Use multigrade lubricating oils with the American Petroleum Institute (API) classification CC/CD, CD/SG or CE/SG. Table 9-2 shows the preferred oil grades for ambient temperatures indicated.

**CC/CD or CD/SG engine oils can be used in areas where CE oil is not yet available, but the oil change interval must be reduced to one half the interval given in the maintenance schedule.**

When selecting oil, pick the grade that has the right viscosity for the lowest temperature expected. Using oil that is too thick can result in a lack of lubrication when the engine is started.

Single-grade oils can be used for short periods until the recommended multigrade oil is obtained.

For further details and discussion of engine lubricating oils, refer to the engine operation and maintenance manual.

## Engine Oil Level

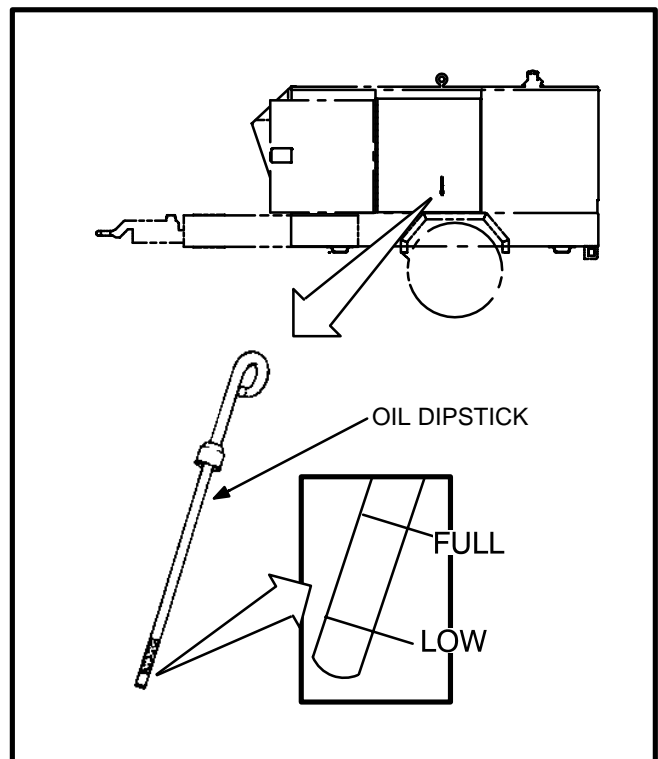
**⚠ CAUTION** *Do not operate the engine with the oil level below the ADD mark or above the FULL mark. Overfilling can cause foaming or aeration of the oil while operation below the ADD mark can cause loss of oil pressure.*

Check the engine oil level during engine shutdown periods at the intervals specified in the Maintenance Table. The oil dipstick and oil fill are located on the side of the engine (Figure 9-1). The dipstick is stamped with FULL and ADD to indicate the level of oil in the crankcase. For accurate readings, shut off the engine and wait approximately 10 minutes before checking the oil level. This allows oil in the upper portion of the engine to drain back into the crankcase.

Keep the oil level as near as possible to the FULL mark on the dipstick. Remove the oil fill cap and add oil of the same quality and brand when necessary.

### TABLE 9-2. OIL VISCOSITY/TEMPERATURE CHART

Oil Grade	Min Temp (°F)	Max Temp (°F)	Min Temp (°C)	Max Temp (°C)
15W-40	14	104	5	40
10W-30	-4	50	-20	10
5W-30	-22	50	-30	10



**FIGURE 9-1. OIL LEVEL INDICATOR**

## Oil and Filter Change

**⚠WARNING** *Hot crankcase oil can cause burns if it is spilled or splashed on skin. Keep fingers and hands clear when removing the oil drain plug and wear protective clothing.*

Change the oil and filter at the intervals recommended in the maintenance table.

Use oil that meets the API classification and viscosity requirements indicated in the previous section.

The engine operation and maintenance manual contains the procedure to drain the oil and replace the oil filter. This manual also specifies the filter type that should be used for this engine model.

When draining the oil, note that the location of the oil drain plug (see Figure 9-2) differs from what is shown in the engine operation and maintenance manual.

To drain the engine oil, perform the following procedure in conjunction with the procedure outlined in the engine operation and maintenance manual.

Place the end of the drain hose in a drain pan and remove the 1/2 inch NPT plug. (Engine oil capacity is listed in the Specifications Section 2.)

After the crankcase is completely drained, install the 1/2 inch NPT plug.

**⚠WARNING** *Used engine oils have been identified by some state or federal agencies as causing cancer or reproductive toxicity. When checking or changing engine oil, take care not to ingest, breathe the fumes, or contact used oil.*

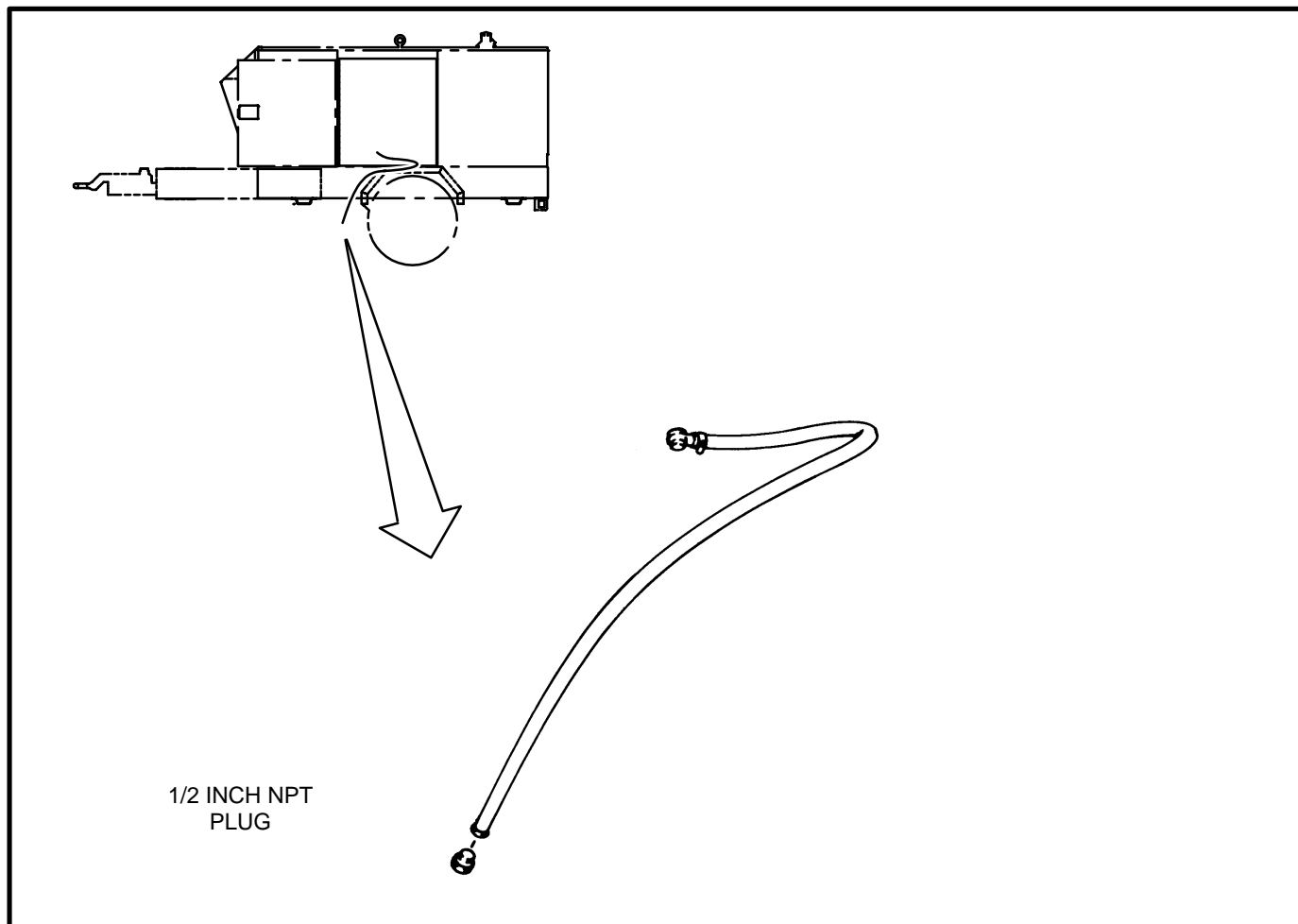


FIGURE 9-2. OIL DRAIN LOCATION

## COOLING SYSTEM

**⚠ WARNING** *Remove the radiator pressure cap slowly after the engine has cooled. The sudden release of pressure from a heated cooling system can result in loss of coolant and possible personal injury from the hot coolant.*

The cooling system on each set is drained prior to shipping and must be refilled before being operated.

### Coolant Requirements

The engine operation and maintenance manual contains the recommended mixture of antifreeze and additives that should be used for this engine model.

### Filling the Cooling System

To fill the cooling system, proceed as follows.

1. Remove the radiator cap and fill coolant to the top of the radiator.
2. Run the engine while watching the coolant level in the radiator. (The level will drop as air escapes from the system.) Add coolant, as necessary, so that the radiator is full when the engine reaches normal operating temperature. Secure the radiator cap.

**⚠ WARNING** *To prevent severe scalding, always let the engine cool down before removing the coolant pressure cap. Turn the cap slowly, and do not open it fully until the pressure has been relieved.*

3. Add coolant to the coolant recovery tank (see Figure 9-4) until it is at least two-thirds (2/3) full. Check the coolant level again after the engine has cooled down and add coolant until the recovery tank is about two-thirds (2/3) full.

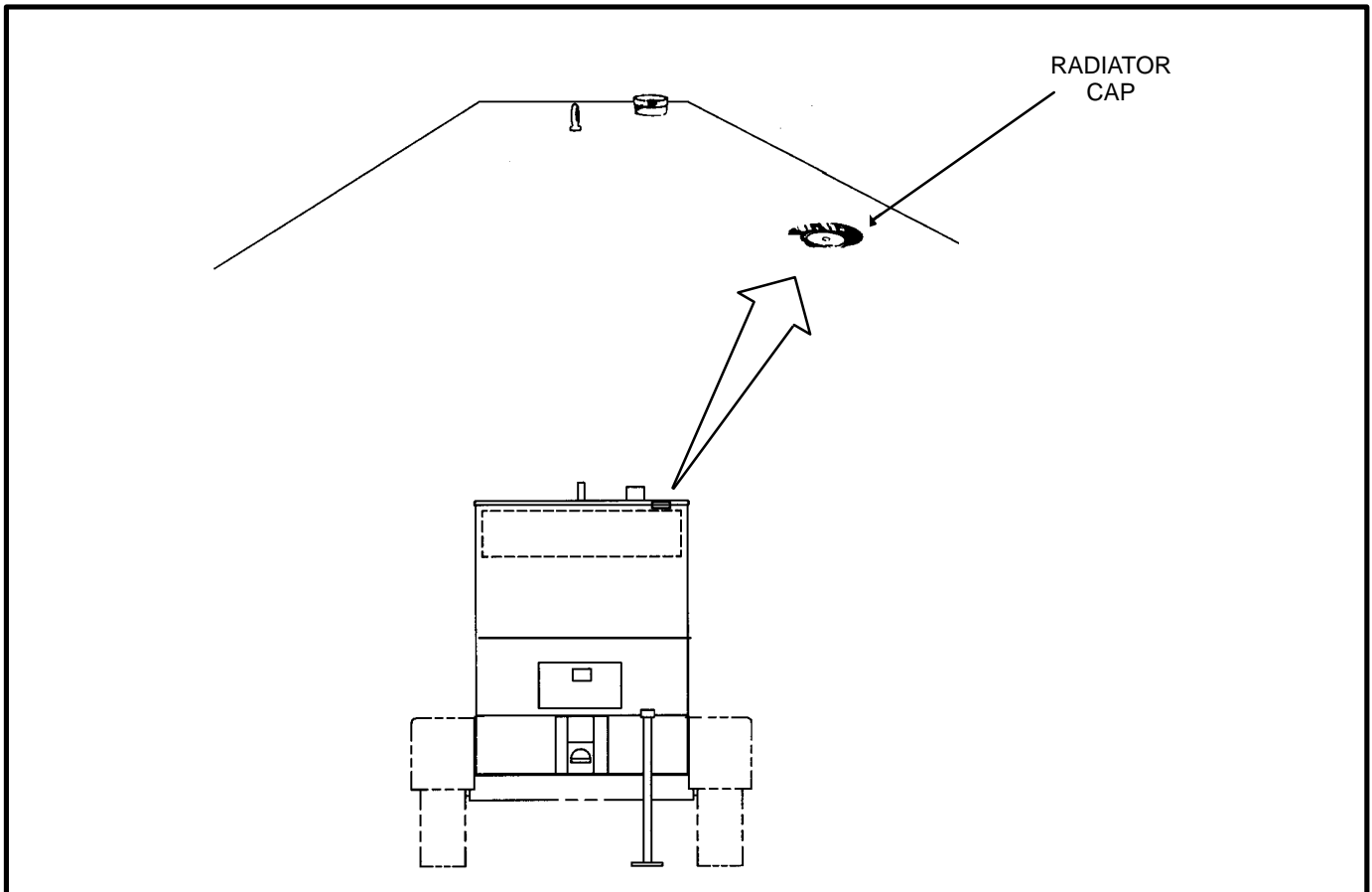


FIGURE 9-3. COOLANT FILL LOCATION

## Coolant Level

Check the coolant level during shutdown periods at the intervals specified in the *Maintenance Schedule*. The coolant recovery tank should be about two-thirds (2/3) full when the engine is cold. The level will rise as the engine warms up. Note the normal level when the engine is running under load. Add coolant to the recovery tank to replace the normal loss of coolant. Check the entire cooling system for leaks if the level keeps dropping. See Figure 9-4.

**⚠ CAUTION** *High Engine Temperature Cutoff will shut down engine in an overheat condition only if coolant level is sufficiently high to physically contact shutdown switch. Loss of coolant will allow engine to overheat without protection of shutdown device, thereby causing severe damage to the engine. It is therefore imperative that adequate engine coolant levels be maintained, to ensure operational integrity of cooling system and engine coolant overheat shutdown protection.*

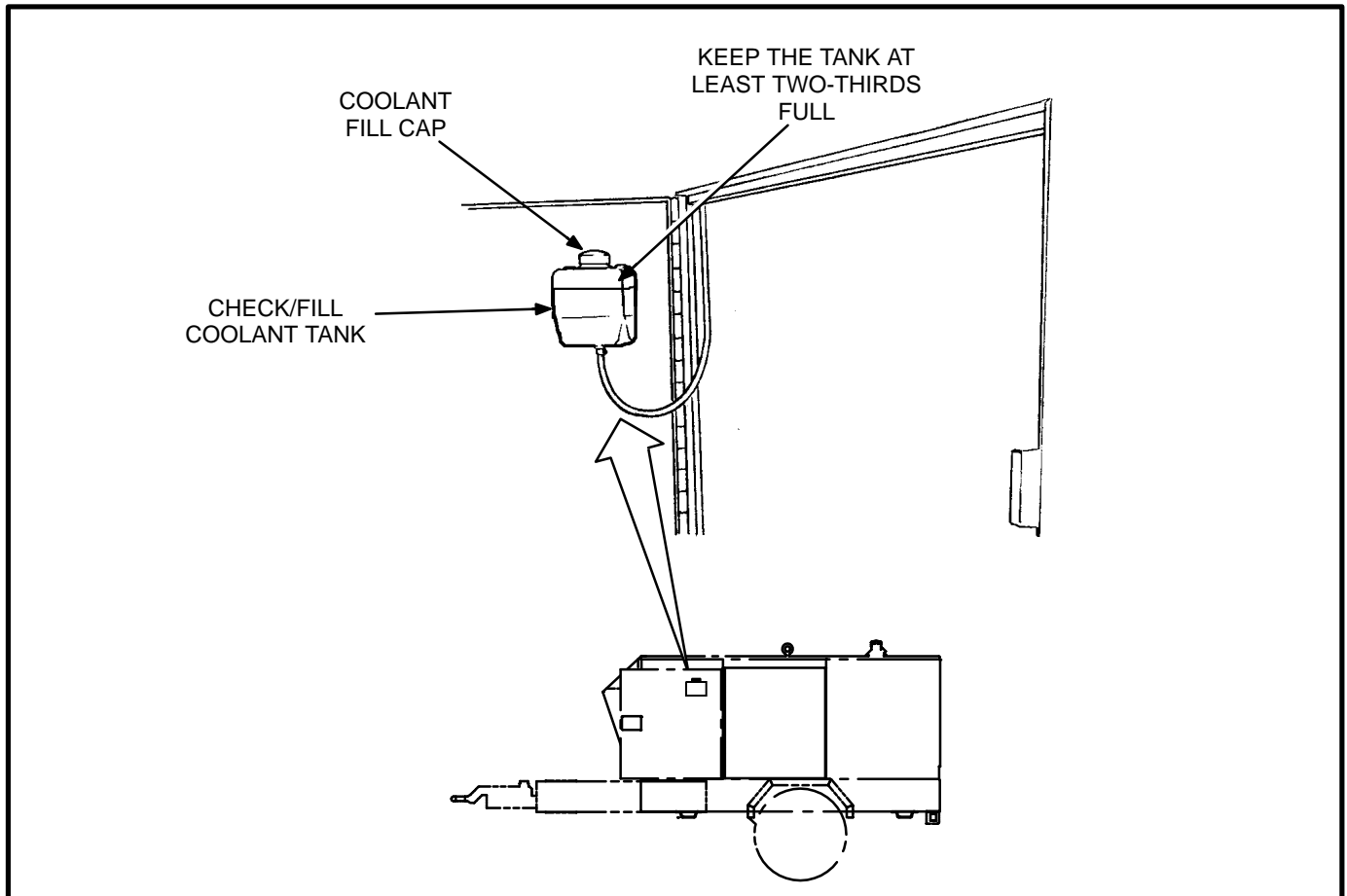


FIGURE 9-4. COOLANT CHECK/FILL TANK

## Flushing and Cleaning

**⚠ CAUTION** *Never pour hot water into a cold engine or cold water into a hot engine. Doing so can crack the head or the cylinder block. Do not operate the unit without water for even a few minutes.*

For efficient generator set operation, drain, flush and refill the cooling system once a year.

The engine operation and maintenance manual contains the recommended chemicals to use for cleaning the cooling system and also the procedure to flush the system.

To drain the system completely, perform the following procedure in conjunction with the procedure outlined in the engine operation and maintenance manual.

Remove the coolant drain hose from the genset housing and place the end of the drain hose in a drain pan. (Cooling system capacity is listed in Section 2, *Specifications*.)

Open the radiator cap (Figure 9-3) and then the cylinder block drain valve located on the engine (see Figure 9-5). Close the cylinder block drain valve after the system is completely drained.

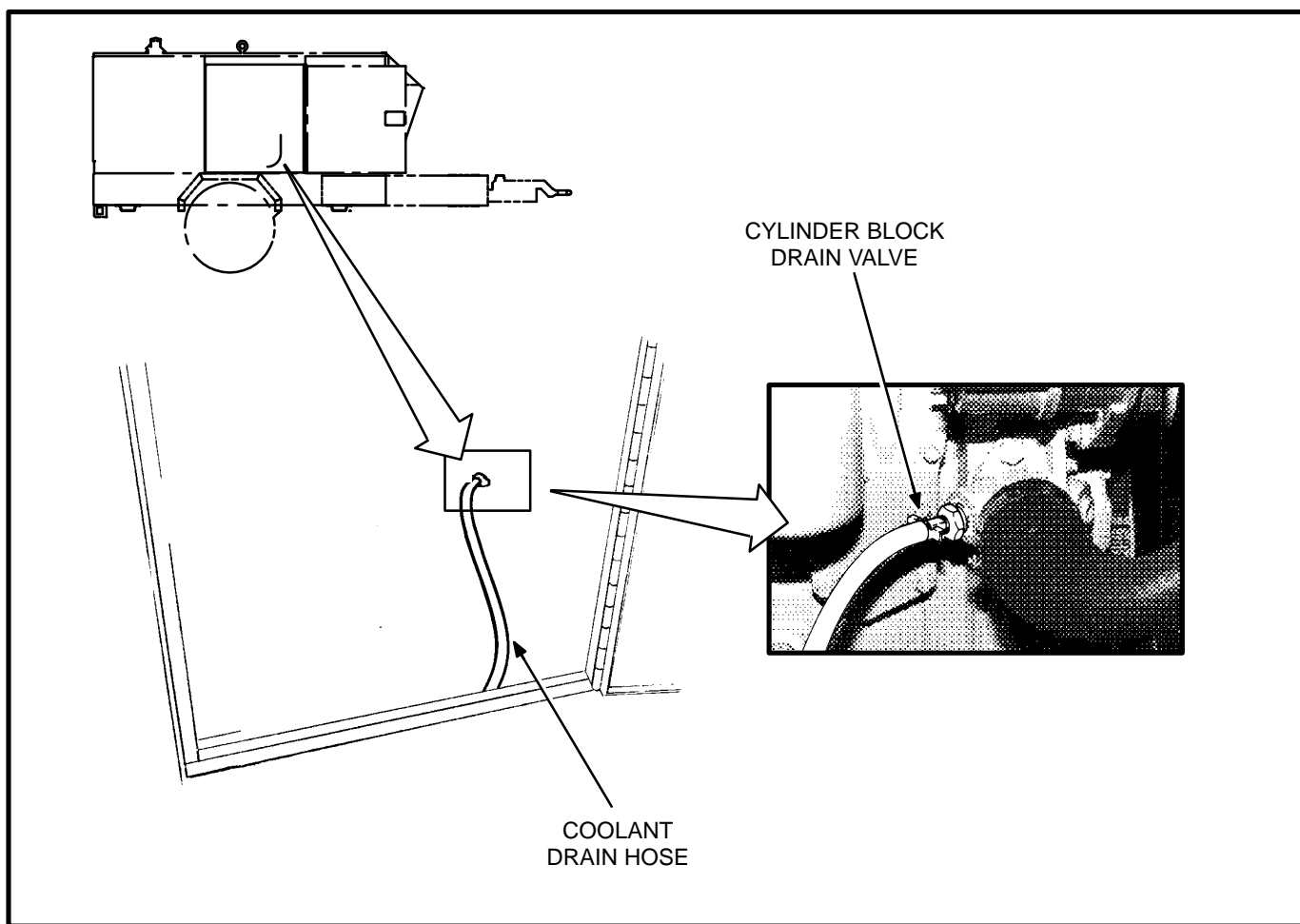


FIGURE 9-5. COOLANT DRAINING

## FUEL SYSTEM

Use only high-quality fuel in this generator set. Fuel quality is important in obtaining dependable performance and satisfactory engine life. Fuel must be clean, completely distilled, well refined, and non-corrosive to fuel system parts.

**⚠ WARNING** *Ignition of fuel can cause severe personal injury or death by fire or explosion. Do not permit any flame, cigarette, spark, pilot light, arcing equipment or other igniter near the fuel system.*

### Fuel Recommendations

Use ASTM 2-D (No. 2 Diesel) or ASTM 1-D (No. 1 Diesel) fuel with a minimum Cetane number of 45. Number 2 diesel fuel gives the best economy and performance under most operating conditions. Use number 1 diesel fuel when ambient temperatures are below 0° C (32° F), or during long periods of light engine load.

The fuel's viscosity must be kept above 1.3 cSt to provide adequate fuel system lubrication.

**Fuels with Cetane numbers higher than 45 may be needed in higher altitudes or when extremely low ambient temperatures are encountered to prevent misfires and resultant excessive smoke.**

Use low-sulfur-content fuel with a cloud point at least 10 degrees below the lowest expected fuel temperature. (Cloud point is the temperature at which wax crystals begin to form in diesel fuel.)

### Fuel Handling Precautions

Take appropriate precautions to prevent the entrance of dirt, water or other contaminants into the fuel system. Filter or strain the fuel as the tank is filled.

**⚠ CAUTION** *Due to the precise tolerances of diesel injection systems, dirt or water in the fuel can cause severe damage to both the injection pump and injector nozzles. Take special precautions to keep the fuel clean and free of water.*

To avoid condensation problems, keep fuel tanks as full as possible. In cold weather, warm fuel returning from the engine heats the fuel in the supply tank. If the fuel level is low, condensation tends to form in the upper portion of the tank. In warm weather, the fuel and the tank will both be warm during the day-time. At night, cool air lowers the temperature of the tank more rapidly than the temperature of the fuel. If the fuel level is low, the upper portion of the tank will cool more rapidly and condensation will tend to form.

Condensation (water) can clog fuel filters as well as causing freezing problems. Also, water mixing with the sulfur in the fuel forms acid which can corrode and damage engine parts.

### Fuel Filters

The filters are spin-off throw-away units. A water drain is situated at the bottom of one filter case. This should be used to drain off moisture either daily or at the end of every exercise period, depending on unit application.

The engine operation and maintenance manual contains the procedure to replace the fuel filters. This manual also specifies the filter type that should be used for this engine model.

### Priming the Fuel System

The fuel system must be primed before initial start-up or after the engine has run out of fuel. To verify and reprime the fuel system, refer to the engine operation and maintenance manual.

## AIR CLEANER

**⚠ CAUTION** *Filters should be handled with care to prevent damage. If the filter does become damaged, install recommended replacement part.*

The filter element should be replaced yearly or sooner if the service indicator button pops up indicating air restriction. See Figure 9-6.

The vacuator valve dumps collected dust automatically.

The following procedure should be followed when replacing the element:

It may be necessary to loosen the air cleaner bands and move the air cleaner to access the element.

1. Remove the air cleaner cover.
2. Remove thumb screw and gasket washer, then remove the element from air cleaner.
3. Wipe out the interior of the air cleaner housing and cover with a clean, damp cloth.
4. Install new element and secure with gasket washer and thumb screw.
5. Install the air cleaner cover and secure.

Inspect all components of the air filtering system including all ducts and hoses. Verify that all connections and clamps are tight and inspect each component for cracks, dents, or other damage. Repair or service as required.

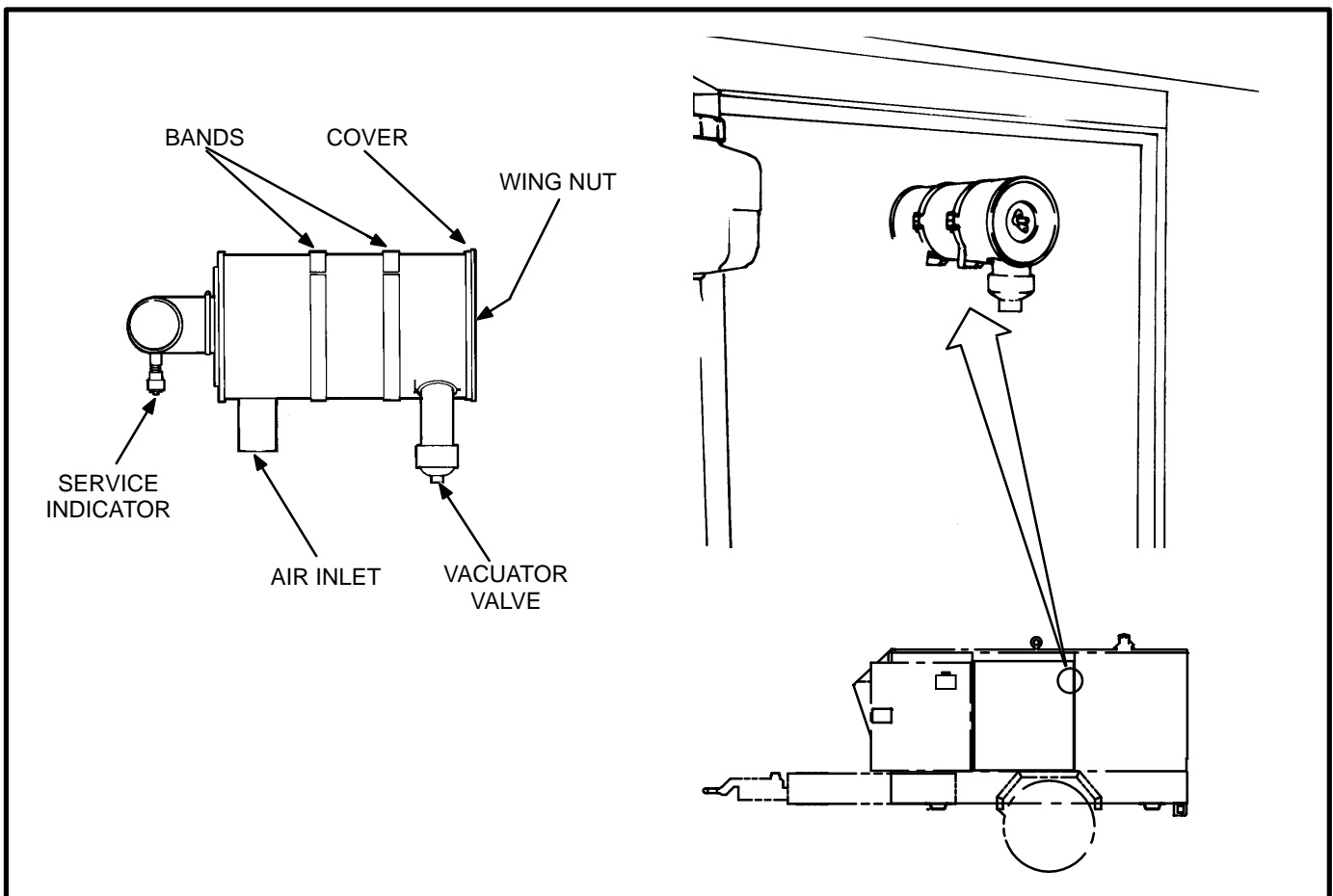


FIGURE 9-6. AIR CLEANER

## FAN BELT

Check the condition of the fan belt at the interval specified in the maintenance table. Inspect the belt for damage (e.g., cracks, torn, missing pieces, etc.). If the fan belt is defective, perform the following procedure to replace the fan belt.

The radiator cooling blower is secured by four bolts to a standoff spacer on the top engine belt pulley. The standoff spacer extends through a hole in the blower compartment bulkhead.

**⚠ WARNING** *Accidental starting of the generator set while working on it can cause severe personal injury or death. Prevent accidental starting by disconnecting the starting battery cables (negative [–] first).*

*Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (–) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (–) cable first, and reconnect it last.*

**⚠ CAUTION** *Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.*

1. Shut down the set and disconnect the batteries (negative [–] cable first) to prevent accidental starting.
2. Go to the front of the set and remove the air inlet screen and box.
3. Remove the air cone.
4. Loosen the four blower hub bolts and withdraw the blower and spacers.
5. Go to the engine compartment and slip the old belt off and the new belt on over the top pulley.
6. Reassemble the blower. Note that the blower wheel, hub cap, the two rubber isolators, and the back plate have eight bolt holes. Line up the four holes in each that match the bolt holes in the spacer. Tighten all four hub bolts by hand and then torque each to 8 ft-lbs (11 N•m).
7. Thread the fan belt through the pulleys in accordance with the engine operation and maintenance manual.
8. Reassemble the air cone, screen and box.

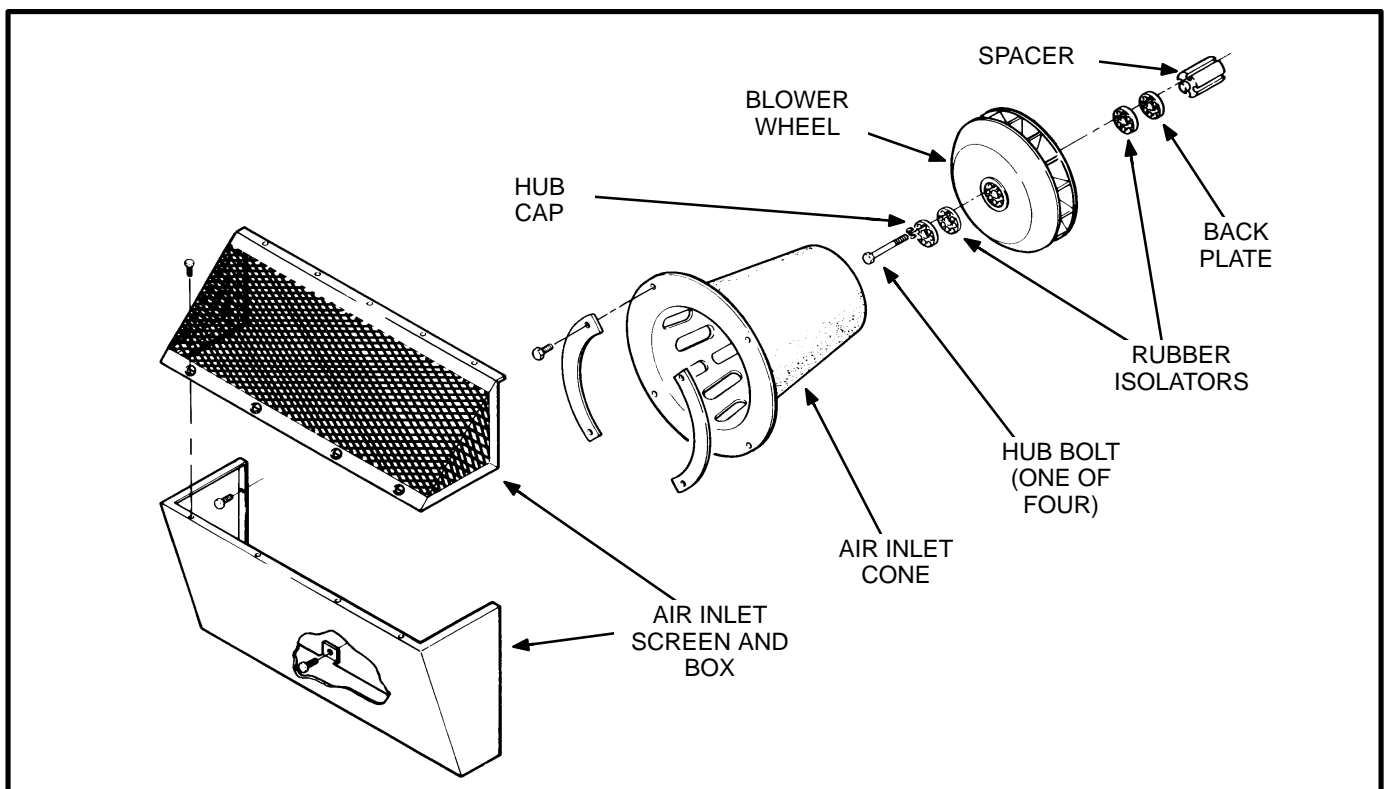


FIGURE 9-7. RADIATOR COOLING BLOWER

## BATTERIES

**⚠ WARNING** *Ignition of explosive battery gases can cause severe personal injury. Do not smoke or allow any source of ignition while servicing batteries.*

Check the condition of the starting battery at the interval specified in the maintenance schedule. To prevent dangerous arcing, always disconnect the negative ground strap from the battery before working on any part of the electrical system or the engine. Disregard the sections on Checking Specific Gravity and Checking Electrolyte Level if using a "maintenance-free" battery.

**⚠ WARNING** *Arcing can ignite the explosive hydrogen gas given off by batteries, causing severe personal injury. Arcing can occur if the negative (-) battery cable is connected and a tool being used to connect or disconnect the positive (+) battery cable accidentally touches the frame or other grounded metal part of the set. To prevent arcing, always remove the negative (-) cable first, and reconnect it last.*

**⚠ CAUTION** *Always disconnect a battery charger from its AC source before disconnecting the battery cables. Otherwise, disconnecting the cables can result in voltage spikes high enough to damage the DC control circuits of the set.*

### Cleaning Batteries

Keep the batteries clean by wiping them with a damp cloth whenever dirt appears excessive.

If corrosion is present around the terminal connections, remove battery cables and wash the terminals with an ammonia solution or a solution consisting of 1/4 pound of baking soda added to 1 quart of water.

Be sure the vent plugs are tight to prevent cleaning solution from entering the cells.

After cleaning, flush the outside of the battery and surrounding areas with clean water.

Keep the battery terminals clean and tight. After making connections, coat the terminals with a light application of petroleum jelly or non-conductive grease to retard corrosion.

### Checking Specific Gravity

Use a battery hydrometer to check the specific gravity of the electrolyte in each battery cell.

Hold the hydrometer vertical and take the reading. Correct the reading by adding four gravity points (0.004) for every ten degrees the electrolyte temperature is above 80° F (27° C). A fully charged battery will have a corrected specific gravity of 1.260. Charge the battery if the reading is below 1.215.

### Checking Electrolyte Level

**⚠ CAUTION** *Do not add water in freezing weather unless the engine will run long enough (two to three hours) to assure a thorough mixing of water and electrolyte.*

Check the level of the electrolyte (acid and water solution) in the batteries at least every 200 hours of operation.

Fill the battery cells to the bottom of the filler neck. If cells are low on water, add distilled water and recharge. If one cell is low, check case for leaks. Keep the battery case clean and dry. An accumulation of moisture will lead to a more rapid discharge and battery failure.

## OUT-OF-SERVICE PROTECTION

The inherent lubricating qualities of No. 2 diesel fuel normally should protect the cylinders of a diesel engine for at least 30 days when the unit is not in service. To protect an engine that will be out of service for more than 30 days, proceed as follows:

1. Exercise the generator set as described in the Operation section until the engine is up to operating temperature.
2. Shut down the engine.
3. Disconnect battery and store in a cool, dry place. Connect battery to a charger every 30 days to maintain it at full charge.
4. Drain the oil base while it is still warm. Refill and attach a warning tag indicating the viscosity of oil used.
5. Service the air cleaner.
6. Check the coolant level and add more coolant if the level is low.
7. Plug the intake and exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
8. Clean and wipe the entire unit. Coat parts susceptible to rust with a light coat of grease or oil.
9. Provide a suitable cover for the entire unit after unit has cooled down.

## RETURNING A UNIT TO SERVICE

1. Remove the cover and all protective wrapping. Remove the plugs from the intake and exhaust outlet.
2. Check the warning tag on the oil base and verify that the oil viscosity is still correct for the existing ambient temperature.
3. Drain and flush the cooling system and refill with the recommended coolant.

**⚠WARNING** *Ignition of explosive battery gases can cause severe personal injury. Do not smoke or allow any ignition source while servicing batteries.*

4. Clean and check the battery. Measure the specific gravity (1.260 at 80° F [27° C]) and verify that the level is at the split ring. If the specific gravity is low, charge until the correct value is obtained. If the level is low, add distilled water and charge until the specific gravity is correct. **DO NOT OVERCHARGE.**
5. Connect the starting battery (negative [-] terminal last).
6. Disconnect the electrical wire from the fuel pump solenoid valve.
7. Rotate the crankshaft, using the starting motor, until oil pressure appears on the gauge, or the warning light goes out.
8. Connect the electrical wire to the fuel pump solenoid valve.
9. Prime the fuel system.
10. Remove all loads before starting the engine.
11. After start, apply load to at least 50 percent of rated capacity.
12. Check all gauges for normal readings. Set is ready for service.

## 10. Maintenance Record

Keep a record of all periodic and unscheduled maintenance. Record the service date and the number of operating hours from the optional hour meter (if equipped).

Refer to the Maintenance Schedule in Section 8 for the time interval between maintenance procedures. Record the name and address of your Onan service center and keep all of your service receipts.

[illegible]

Record the name, address, and phone number of your authorized Onan service center.




# 11. WIRING DIAGRAMS

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## GENERAL

This section consists of the schematic and connection wiring diagrams referenced in the text. The following drawings are included.

- Page 11-3 – Day Tank Pump Control Wiring
- Pages 11-4 and 11-5 – Generator Reconnection Diagrams
- Page 11-6 – Typical Connections At The Engine Control Monitor
- Page 11-7 – Auxiliary Relay Board (ARB) Diagram





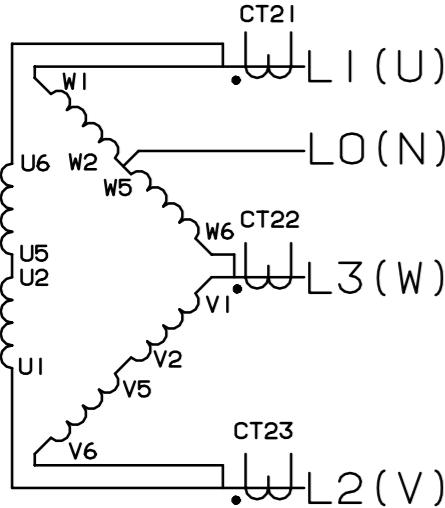
CURRENT TRANSFORMER SECONDARY CONN 1-3

110/220V, 50HZ (R028)  
115/230V, 50HZ (R071)  
120/240V, 60HZ (R106)

110/190V, 50HZ (R004)  
115/200V, 50HZ (R050)  
120/208V, 50;60HZ (R098)  
127/220V, 50;60HZ (R020)

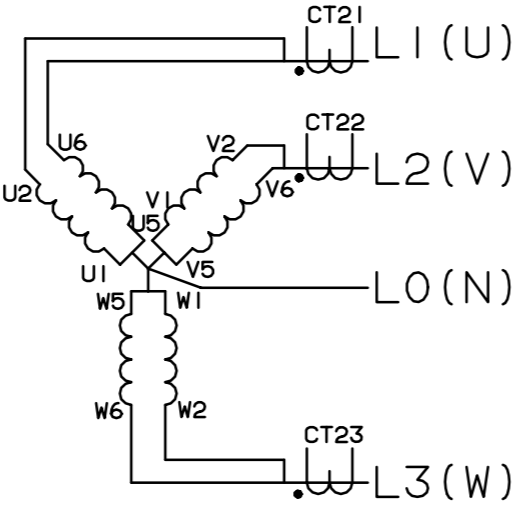
133/230V, 50;60HZ (R057)  
139/240V, 60HZ (R067)

\* RANGE \*  
110-130/220-240 VOLTS



SERIES DELTA  
3 PHASE 4 WIRE

\* RANGE \*  
110-139/190-240 VOLTS



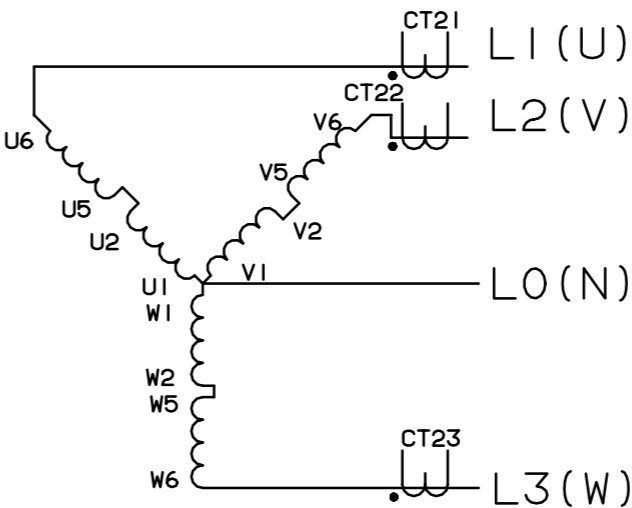
PARALLEL STAR  
3 PHASE 4 WIRE

CURRENT TRANSFORMER SECONDARY CONN 1-2

220/380V, 50; 60HZ (R099)  
260/450V, 50;60HZ (R109)  
240/416V, 50;60HZ (R003)  
255/440V, 50HZ (R023)

200/346V, 50HZ (R068)  
230/400V, 50HZ (R029)  
277/480V, 60 HZ (R002)  
266/460V, 60HZ (R027)

\* RANGE \*  
220-277/380-480 VOLTS

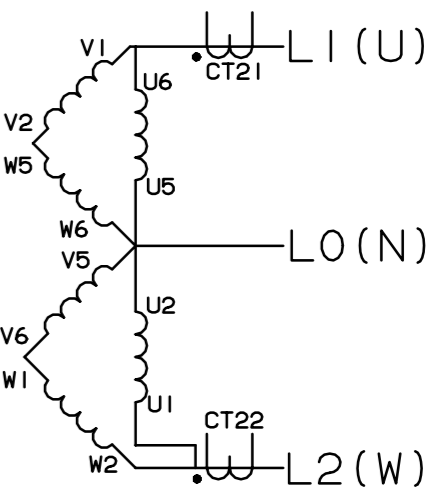


SERIES STAR  
3 PHASE 4 WIRE

CURRENT TRANSFORMER SECONDARY CONN 1-3

100/200V, 50HZ (R054)  
110/220V, 50HZ (R046)  
115/230V, 60HZ (R041)  
120/240V, 60HZ (R104)

\* RANGE \*  
100-120/200-240 VOLTS



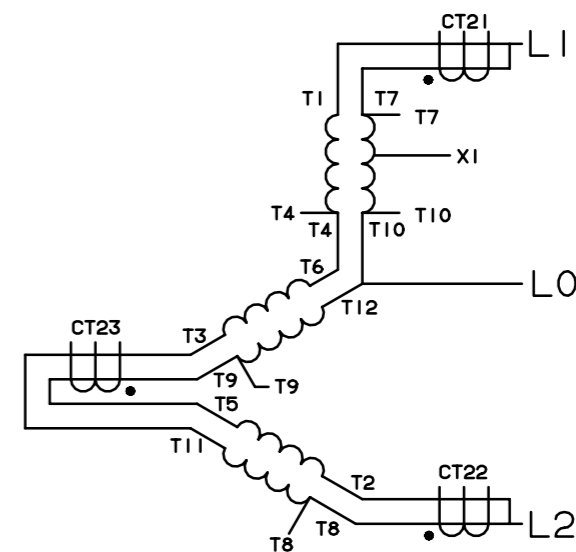
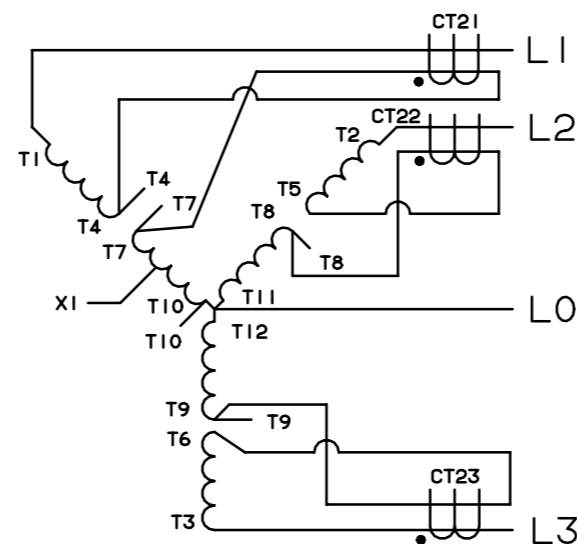
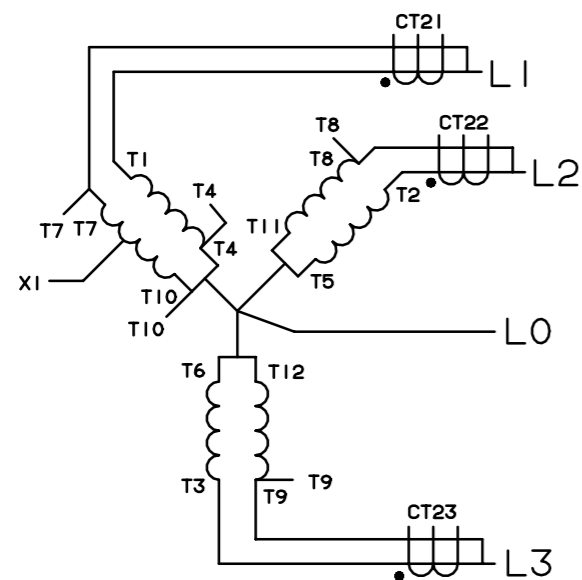
DOUBLE DELTA  
1 PHASE 3 WIRE

CONTROL INPUT				
CONTROL INPUT TB21	SERIES DELTA	PARALLEL STAR	SERIES STAR	DOUBLE DELTA
22	8	8	8	8
23	7	7	7	7
24	4	4	4	4
25	6	6	6	6
26	5	5	5	5
JUMPER	—	—	—	—

NOTES:

1. CURRENT TRANSFORMER SECONDARY MUST BE MANUALLY SELECTED. HIGH VOLTAGE (ABOVE 300 VOLTS) TERMINALS 1 & 2, LOW VOLTAGE BELOW 300 VOLTS USE TERMINALS 1 & 3. TERMINAL #1 IS COMMON.

NO. 625-2251  
REV. B  
MODIFIED



CONT INPUT TB21	
22	T7
23	T8
24	T4
25	T9
26	T10

RECONNECT PANEL TB2	TAP
13	X1
12	T12
11	T11
10	T10
9	T9
8	T8
7	T7
6	T6
5	T5
4	T4
3	T3
2	T2
1	T1

# NOTES:

- SECONDARY CURRENT TRANSFORMER CONN 1-3 FOR ALL APPLICATIONS.

**TB1-10 (SWITCHED B+ OUTPUT)** AUXILIARY POWER SUPPLY FUSED AT 20 AMPS, ENERGIZED WHEN THE START SIGNAL IS APPLIED AND DE-ENERGIZED AT SHUTDOWN (NORMAL AND FAULT)

**TB1-9 (B+ INPUT)** BATTERY POSITIVE (+) CONNECTION

**TB1-8 (START SOLENOID)** OUTPUT TO STARTER SOLENOID FUSED AT 20 AMPS

**TB1-7 (B+ OUTPUT)** AUXILIARY POWER SUPPLY FUSED AT 15 AMPS, AVAILABLE WHEN THE STARTING BATTERIES ARE CONNECTED

**TB1-6 (REMOTE START)** CONNECT TO REMOTE START CONTACT OF THE AUTOMATIC TRANSFER SWITCH. POWER THROUGH **TB1-7 (B+ OUTPUT)** IF FUSED CIRCUIT IS REQUIRED. IF NOT, THROUGH **TB1-9 (B+ INPUT)**

**TB1-5 (GROUND)** REMOTE CONTROL CIRCUIT GROUND POINT

**TB1-4 (COMMON ALARM B+ OUTPUT)** 4 AMP RATED DEVICE MAXIMUM

**TB1-3 (REMOTE RUN LAMP)** GROUND OUTPUT TO LIGHT/RELAY\*

**TB1-2 (AUXILIARY DC DISCONNECT INPUT)** PARALLELS STANDARD DC DISCONNECT CIRCUIT

**TB1-1 (AUXILIARY OVERSPEED INPUT)** GROUND INPUT FROM SENDER

**P1-6 ECM GROUNDING PIN**

**TB2-1 (FAULT 2)** GROUND INPUT FROM SENDER

**TB2-2 (FAULT 2)** GROUND OUTPUT TO LIGHT/RELAY\*

**TB2-3 (FAULT 1)** GROUND INPUT FROM SENDER

**TB2-4 (FAULT 1)** GROUND OUTPUT TO LIGHT/RELAY\*

**TB2-5 (REMOTE RESET)** MOMENTARY CONTACT TO GROUND

**TB2-6 (OVERCRANK FAULT)** GROUND OUTPUT TO LIGHT/RELAY\*

**TB2-7 (OVERSPEED FAULT)** GROUND OUTPUT TO LIGHT/RELAY\*

**TB2-8 (HIGH ENGINE TEMPERATURE FAULT)** GROUND OUTPUT TO LIGHT/RELAY\*

**TB2-9 (LOW OIL PRESSURE FAULT)** GROUND OUTPUT TO LIGHT/RELAY\*

**TB2-10 (PRE-HIGH ENGINE TEMPERATURE WARNING)** GROUND OUTPUT TO LIGHT/RELAY\*

**TB2-11 (PRE-LOW OIL PRESSURE WARNING)** GROUND OUTPUT TO LIGHT/RELAY\*

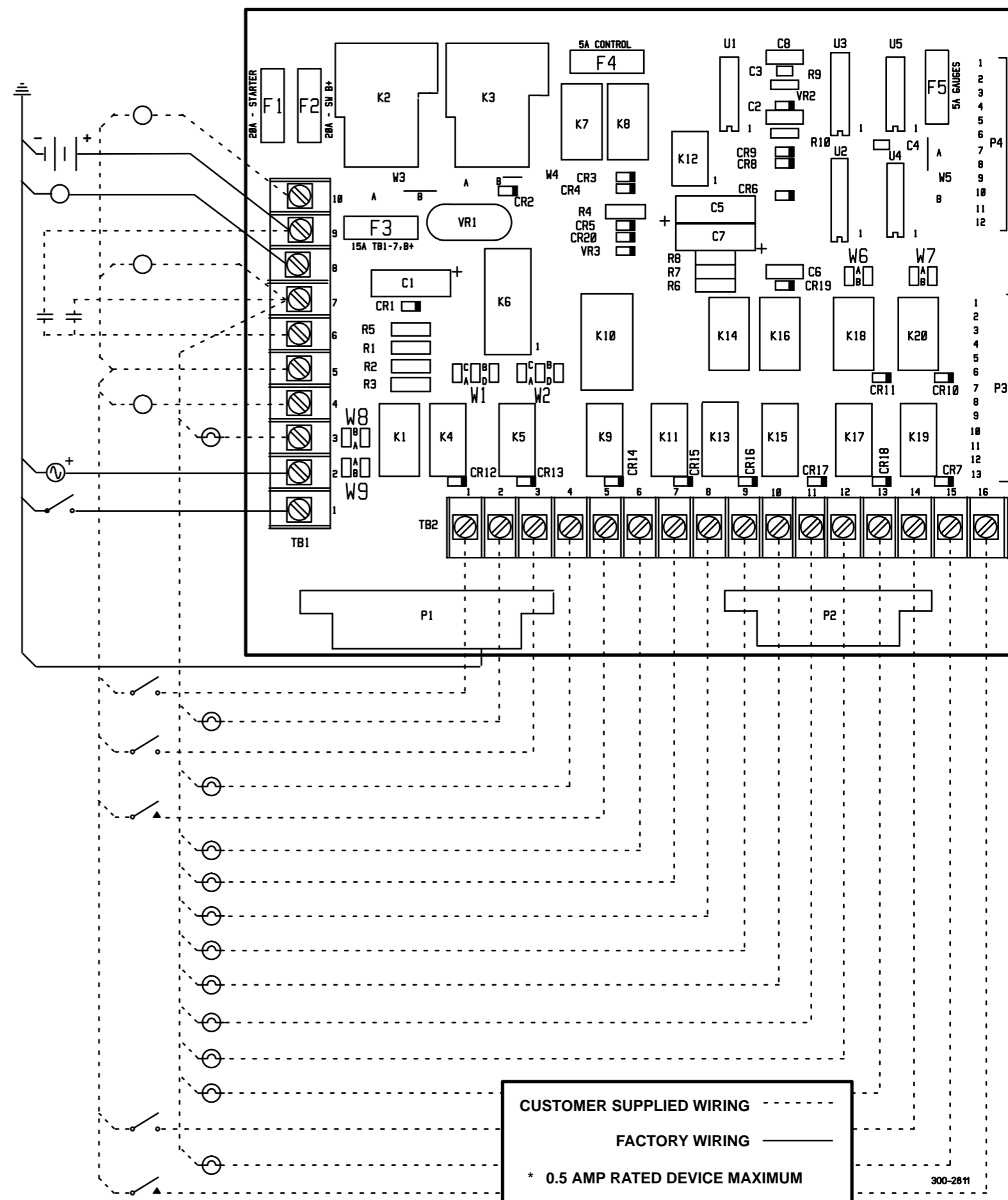
**TB2-12 (SWITCH OFF WARNING)** GROUND OUTPUT TO LIGHT/RELAY\*

**TB2-13 (LOW ENGINE TEMPERATURE WARNING)** GROUND OUTPUT TO LIGHT/RELAY\*

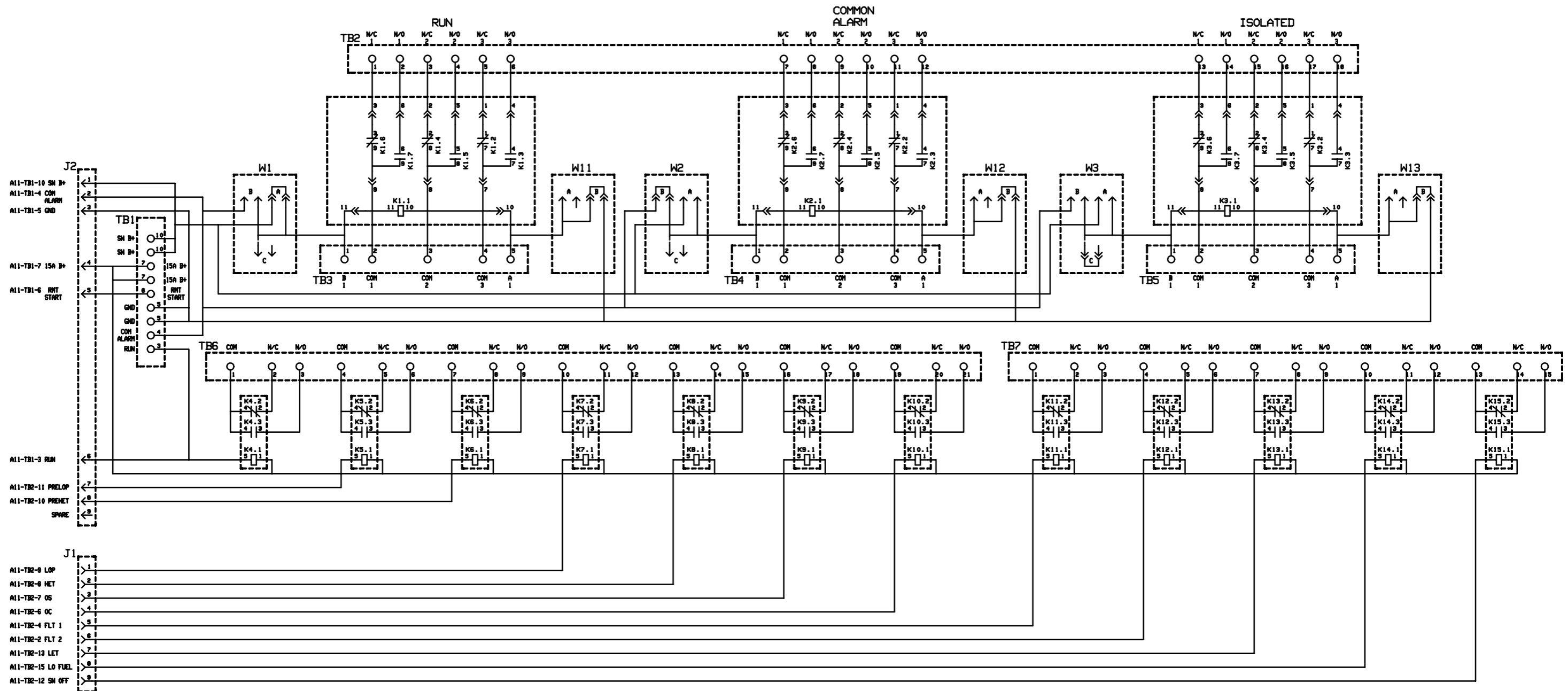
**TB2-14 (LOW FUEL WARNING)** GROUND INPUT FROM SENDER

**TB2-15 (LOW FUEL WARNING)** GROUND OUTPUT TO LIGHT/RELAY\*

**TB2-16 (EMERGENCY SHUT DOWN)** MOMENTARY CONTACT TO GROUND



TYPICAL CUSTOMER CONNECTIONS AT THE ENGINE CONTROL MONITOR (ECM)



AUXILIARY RELAY BOARD DIAGRAM

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