Cummins Onan

Operator's Manual

QS14
QS20
QS28
GENERATOR SETS

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Safety Precautions

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 and explosion 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, 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. Visually and audibly inspect the exhaust daily for leaks per the maintenance schedule. Ensure that exhaust manifolds are secure 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.
- 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.

Important Safety Precautions

Read and observe these safety precautions when using or working on electric generators, engines and related equipment. Also read and follow the literature provided with the equipment.

Proper operation and maintenance are critical to performance and safety. Electricity, fuel, exhaust, moving parts and batteries present hazards that can cause severe personal injury or death.

FUEL, ENGINE OIL, AND FUMES ARE FLAMMABLE AND TOXIC

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

- Used engine oil, and benzene and lead, found in some gasoline, have been identified by government agencies as causing cancer or reproductive toxicity. When checking, draining or adding fuel or oil, do not ingest, breathe the fumes, or contact gasoline or used oil.
- Do not fill tanks with engine running. Do not smoke around the area. Wipe up oil or fuel spills. Do not leave rags in engine compartment or on equipment. Keep this and surrounding area clean.
- Inspect fuel system before each operation and periodically while running.
- Equip fuel supply with a positive fuel shutoff.
- Do not store or transport equipment with fuel in tank.
- Keep an ABC–rated fire extinguisher available near equipment and adjacent areas for use on all types of fires except alcohol.
- Unless provided with equipment or noted otherwise in installation manual, fuel lines must be copper or steel, secured, free of leaks and separated or shielded from electrical wiring.
- Use approved, non-conductive flexible fuel hose for fuel connections. Do not use copper tubing as a flexible connection. It will work–harden and break.

EXHAUST GAS IS DEADLY

- Engine exhaust contains carbon monoxide (CO), an odorless, invisible, poisonous gas. Learn the symptoms of CO poisoning.
- Never sleep in a vessel, vehicle, or room with a genset or engine running unless the area is equipped with an operating CO detector with an audible alarm.
- Each time the engine or genset is started, or at least every day, thoroughly inspect the exhaust system. Shut down the unit and repair leaks immediately.
- Warning: Engine exhaust is known to the State of California to cause cancer, birth defects and other reproductive harm.

Make sure exhaust is properly ventilated.

- Vessel bilge must have an operating power exhaust.
- Vehicle exhaust system must extend beyond vehicle perimeter and not near windows, doors or vents.
- Do not use engine or genset cooling air to heat an area.
- Do not operate engine/genset in enclosed area without ample fresh air ventilation.
- Expel exhaust away from enclosed, sheltered, or occupied areas.
- Make sure exhaust system components are securely fastened and not warped.

MOVING PARTS CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not remove any guards or covers with the equipment running.
- Keep hands, clothing, hair, and jewelry away from moving parts.
- Before performing any maintenance, disconnect battery (negative [–] cable first) to prevent accidental starting.
- Make sure fasteners and joints are secure. Tighten supports and clamps, keep guards in position over fans, drive belts, etc.
- If adjustments must be made while equipment is running, use extreme caution around hot manifolds and moving parts, etc. Wear safety glasses and protective clothing.

BATTERY GAS IS EXPLOSIVE

- Wear safety glasses and do not smoke while servicing batteries.
- Always disconnect battery negative (–) lead first and reconnect it last. Make sure you connect battery correctly. A direct short across battery terminals can cause an explosion. Do not smoke while servicing batteries. Hydrogen gas given off during charging is explosive.
- Do not disconnect or connect battery cables if fuel vapors are present. Ventilate the area thoroughly.

DO NOT OPERATE IN FLAMMABLE AND EXPLOSIVE ENVIRONMENTS

Flammable vapor can be ignited by equipment operation or cause a diesel engine to overspeed and become difficult to stop, resulting in possible fire, explosion, severe personal injury and death. **Do not operate diesel equipment where a flammable vapor environment can be created by fuel spill, leak, etc., unless equipped with an automatic safety device to block the air intake and stop the engine.**

HOT COOLANT CAN CAUSE SEVERE PERSONAL INJURY

- Hot coolant is under pressure. Do not loosen the coolant pressure cap while the engine is hot. Let the engine cool before opening the pressure cap.

ELECTRICAL SHOCK CAN CAUSE SEVERE PERSONAL INJURY OR DEATH

- Do not service control panel or engine with unit running. High voltages are present. Work that must be done while unit is running should be done only by qualified service personnel.
- Do not connect the generator set to the public utility or to any other electrical power system. Electrocution can occur at a remote site where line or equipment repairs are being made. An approved transfer switch must be used if more than one power source is connected.
- Disconnect starting battery (negative [–] cable first) before removing protective shields or touching electrical equipment. Use insulative mats placed on dry wood platforms. Do not wear jewelry, damp clothing or allow skin surface to be damp when handling electrical equipment.
- Use insulated tools. 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.
- With transfer switches, keep cabinet closed and locked. Only authorized personnel should have cabinet or operational keys. Due to serious shock hazard from high voltages within cabinet, all service and adjustments must be performed by an electrician or authorized service representative.

If the cabinet must be opened for any reason:

1. Move genset operation switch or Stop/Auto/Handcrank switch (whichever applies) to Stop.
2. Disconnect genset batteries (negative [–] lead first).
3. Remove AC power to automatic transfer switch. If instructions require otherwise, use extreme caution due to shock hazard.

MEDIUM VOLTAGE GENERATOR SETS (601V TO 15kV)

- Medium voltage acts differently than low voltage. Special equipment and training are required to work on or around medium voltage equipment. Operation and maintenance must be done only by persons trained and qualified to work on such devices. Improper use or procedures will result in severe personal injury or death.
- Do not work on energized equipment. Unauthorized personnel must not be permitted near energized equipment. Induced voltage remains even after equipment is disconnected from the power source. Plan maintenance with authorized personnel so equipment can be de-energized and safely grounded.

GENERAL SAFETY PRECAUTIONS

- Do not work on equipment when mentally or physically fatigued or after consuming alcohol or drugs.
- Carefully follow all applicable local, state and federal codes.
- Never step on equipment (as when entering or leaving the engine compartment). It can stress and break unit components, possibly resulting in dangerous operating conditions from leaking fuel, leaking exhaust fumes, etc.
- Keep equipment and area clean. Oil, grease, dirt, or stowed gear can cause fire or damage equipment by restricting airflow.
- Equipment owners and operators are solely responsible for operating equipment safely. Contact your authorized Onan/Cummins dealer or distributor for more information.

KEEP THIS DOCUMENT NEAR EQUIPMENT FOR EASY REFERENCE.

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Section 1. Introduction

ABOUT THIS MANUAL

This manual provides general information for operating and maintaining the Quiet Site generator set. Study this manual carefully, and observe all warnings and cautions. Using the generator set properly and following a regular maintenance schedule will contribute to longer unit life, better performance, and safer operation.

The Quiet Site series of generator sets is normally intended for temporary or mobile use: the set is not usually installed in a permanent, fixed position. It is necessary to consider certain factors to set up and operate the generator set safely and effectively. These include the following:

Transporting - Guidelines for safely moving the generator set.

Positioning - Space requirements for normal operation and service.

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

Prestart - Items and procedures needed to prepare generator set for operation.

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

This manual does not provide application information for selecting a generator set. For engineering data specific to the generator set, refer to the Quiet Site specification and product data sheets.

Safety Considerations

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

To avoid safety hazards, make all electrical connections to the generator set exactly as specified in this manual. All systems external to the generator must comply with all applicable codes. Make certain to complete all inspections and tests and satisfy all code requirements before operating the generator set.

HOW TO OBTAIN SERVICE

When the generator set requires service, contact an authorized service center for assistance. Factory-trained parts and service representatives are ready to handle all your service needs.

When contacting a distributor, supply the complete model number and serial number as shown on the nameplate (Figure 1-1).

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

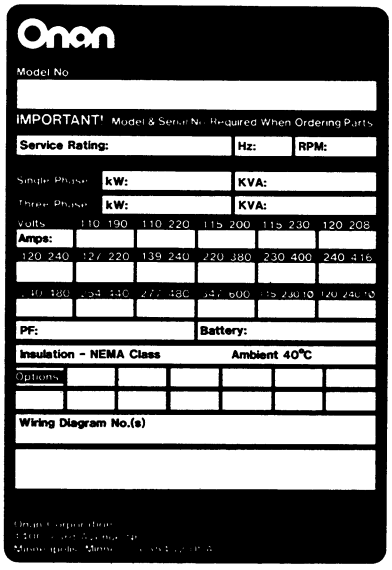


FIGURE 1-1. NAMEPLATE, QUIET SITE GENERATOR SET

Section 2. Specifications

14QSA3

Hertz (RPM)	60 (1800)
Horsepower (kW)	24 (18)
Piston speed fpm (m/s)	1088 (5.53)
Radiator cooling air cfm (m^3/min)	4000 (113.3)
Heat discharged at radiator outlet BTU/min (MJ/min)	1240 (1.3)
Coolant flow gpm (L/min)	24 (91)
Combustion requirement air - cfm (m^3/min)	44 (1.2)
Generator cooling cfm (m^3/min)	270 (7.6)
Heat discharged at compartment outlet BTU/min (MJ/min)	480 (0.5)
Average fuel consumption #2 Diesel, gph (l/h) at 1/4 load	0.5 (2)
1/2 load	0.8 (3)
3/4 load	1.2 (5)
Full load	1.6 (6)
Motor starting 3-phase, kW	14
kVA	52
Voltage regulation (no load to full load)	±2%
Power factor	0.8
Insulation	Class F
Sound level, full load, at 7 meters	63 dB(A)

10QSA3

Hertz (RPM)	50 (1500)
Horsepower (kW)	18 (13)
Piston speed fpm (m/s)	907 (4.61)
Radiator cooling air cfm (m^3/min)	3300 (93.5)
Heat discharged at radiator outlet BTU/min (MJ/min)	1020 (1.1)
Coolant flow gpm (L/min)	20 (76)
Combustion requirement air - cfm (m^3/min)	38 (1-1)
Generator cooling cfm (m^3/min)	225 (6.4)
Heat discharged at compartment outlet BTU/min (MJ/min)	380 (0.4)
Average fuel consumption #2 Diesel, gph (l/h) at 1/4 load	0.4 (2)
1/2 load	0.7 (3)
3/4 load	0.9 (3)
Full load	1.3 (5)
Motor starting 3-phase, kW	11
kVA	43
Voltage regulation (no load to full load)	±5%
Power factor	0.8
Insulation	Class F
Sound level, full load, at 7 meters	63 dB(A)

14QSA3/10QSA3 Engine

Make/model ..... Cummins 3A1.7-GS/GC
Design ..... 4 cycle, water-cooled, swirl-design combustion chamber
Starting system/voltage ..... Electric, 12 V battery
Displacement ..... 1.72 liters (104.96 cubic inches)
Number of cylinders 3
Fuel tank capacity ..... 25 gallons (94.64 l)
Coolant ..... 10.7 quarts (10.12 l)
Oil capacity ..... 6 quarts (5.68 l)

14QSA3/10QSA3 Dimensions

Trailer-mounted sets:
Length ..... 138.4 inches (351.54 cm)
Width ..... 64.0 inches (162.56 cm)
Height ..... 72.6 inches (184.4 cm) to roof of enclosure
78.25 inches (198.76 cm) to top of exhaust pipe
Approximate weight (without fuel) ..... 2346 pounds (1064.13 kg)

Skid-mounted sets:
Length ..... 92.0 inches (233.68 cm)
Width ..... 40.0 inches (101.6 cm)
Height ..... 52.75 inches (133.99 cm) to roof of enclosure
57.75 inches (146.69 cm) to top of exhaust pipe
Approximate weight (without fuel) ..... 2076 pounds (941.66 kg)

Standard Voltage Selections:

14QSA3: 60 hz, 1800 rpm, reconnectible broad-range

3-Phase		Single Phase
120/208 V, 49A	220/380 V, 27A	120/240 V, 47 A
127/220 V, 46 A	240/416 V, 24 A	
139/240 V, 42 A	254/440 V, 23 A	
120/240 V, 42 A	277/480 V, 21 A	

10QSA3: 50 Hz, 1500 rpm, reconnectible broad-range

3-Phase		Single Phase
110/190 V, 38 A	127/220 V, 33A	110/220 V, 38 A
115/200 V, 36 A	220/380 V, 19 A	115/230 V, 36 A
120/208 V, 35 A	230/400 V, 18 A	120/240 V, 35 A
110/220 V, 33 A	240/416 V, 17 A	
115/230 V, 31 A	254/440 V, 16 A	

20QSA4

Hertz (RPM)	60 (1800)
Horsepower (kW)	33 (25)
Piston speed fpm (m/s)	1086 (5.53)
Radiator cooling air cfm (m^3/min)	4000 (113.3)
Heat discharged at radiator outlet BTU/min (MJ/min)	1450 (1.5)
Coolant flow gpm (L/min)	40 (151)
Combustion requirement air - cfm (m^3/min)	59 (1.7)
Generator cooling cfm (m^3/min)	275 (7.8)
Heat discharged at compartment outlet BTU/min (MJ/min)	700 (0.7)
Average fuel consumption #2 Diesel, gph (l/h) at 1/4 load	0.8 (3)
1/2 load	1.2 (5)
3/4 load	1.6 (6)
Full load	2.1 (8)
Motor starting 3-phase, kW	21
kVA	108
Voltage regulation (no load to full load)	±2%
Power factor	0.8
Insulation	Class F
Sound level, full load, at 7 meter	64 dB(A)

16QSA4

Hertz (RPM)	50 (1500)
Horsepower (kW)	27 (20)
Piston Speed fpm (m/s)	905 (4.61)
Radiator cooling air cfm (m^3/min)	3300 (93.5)
Heat discharged at radiator outlet BTU/min (MJ/min)	1280 (1.4)
Coolant flow gpm (L/min)	33 (125)
Combustion requirement air - cfm (m^3/min)	48 (1.4)
Generator cooling cfm (m^3/min)	230 (6.5)
Heat discharged at compartment outlet BTU/min (MJ/min)	510 (0.5)
Average fuel consumption #2 Diesel, gph (l/h) at 1/4 load	0.6 (2)
1/2 load	1.0 (4)
3/4 load	1.3 (5)
Full load	1.7 (6)
Motor starting 3-phase, kW	17
kVA	48
Voltage regulation (no load to full load)	±5%
Power factor	0.8
Insulation	Class F
Sound level, full load, at 7 meters	63 dB(A)

20QSA4/16QSA4 Engine

Make/model ..... Cummins 4A2.3-GS/GC1
Design ..... 4-cycle, water-cooled, swirl-design combustion chamber
Starting system/voltage ..... Electric, 12 V battery
Displacement ..... 2.29 liters (139.74 cubic inches)
Number of cylinders 4
Fuel tank capacity ..... 25 gallons (98.42 l)
Coolant ..... 11.9 quarts (11.26 l)
Oil capacity ..... 6 quarts (5.68 l)

20QSA4/16QSA4 Dimensions

Trailer-mounted sets:
Length ..... 138.4 inches (351.54 cm)
Width ..... 64 inches (162.56 cm)
Height ..... 72.6 inches (184.4 cm) to roof of enclosure
78.25 inches (198.76 cm) to top of exhaust pipe
Approximate weight (without fuel) ..... 2430 pounds (1102.43 kg)

Skid-mounted sets:
Length ..... 81.5 inches (207.01 cm)
Width ..... 40 inches (101.6 cm)
Height ..... 52.75 inches (133.99 cm) to roof of enclosure
57.75 inches (146.69 cm) to top of exhaust pipe
Approximate weight (without fuel) ..... 2160 pounds (979.76 kg)

Standard Voltage Selections:

20QSA4: 60 hz, 1800 rpm, reconnectible broad range

3-phase		Single Phase
120/208 V, 69 A	220/380 V, 38 A	120/240 V, 69 A
127/220 V, 66 A	240/416 V, 35 A	
139/240 V, 60 A	254/440 V, 33 A	
120/240 V, 60 A	277/480 V, 30 A	

16QSA4: 50 hz, 1500 rpm, reconnectible broad range

3-phase		Single Phase
110/190 V, 61 A	127/220 V, 53 A	110/220 V, 61 A
115/200 V, 58 A	220/380 V, 30 A	115/230 V, 58 A
120/208 V, 56 A	230/400 V, 29 A	120/240 V, 56 A
110/220 V, 52 A	240/416 V, 28 A	
115/230 V, 50 A	254/440 V, 26 A	

28QSA6

Hertz (RPM)	60 (1800)
Horsepower (kW)	50 (37)
Piston speed fpm (m/s)	1088 (5.53)
Radiator cooling air cfm (m^3/min)	5350 (151.5)
Heat discharged at radiator outlet BTU/min (MJ/min)	2200 (2.3)
Coolant flow gpm (L/min)	41 (155)
Combustion requirement air - cfm (m^3/min)	90 (2.5)
Generator cooling cfm (m^3/min)	240 (6.8)
Heat discharged at compartment outlet BTU/min (MJ/min)	1185 (1.3)
Average fuel consumption #2 Diesel, gph (l/h) at 1/4 load	1.2 (5)
1/2 load	1.8 (7)
3/4 load	2.4 (9)
Full load	3.1 (12)
Motor starting 3-phase, kW	30
kVA	134
Voltage regulation (no load to full load)	±2%
Power factor	0.8
Insulation	Class F
Sound level, full load, at 7 meters	66 dB(A)

24QSA6

Hertz (RPM)	50 (1500)
Horsepower (kW)	41 (30)
Piston speed fpm (m/s)	907 (4.61)
Radiator cooling air cfm (m^3/min)	4460 (126.3)
Heat discharged at radiator outlet BTU/min (MJ/min)	1920 (2.0)
Coolant flow gpm (L/min)	34 (129)
Combustion requirement air - cfm (m^3/min)	75 (2.1)
Generator cooling cfm (m^3/min)	200 (5.7)
Heat discharged at compartment outlet BTU/min (MJ/min)	760 (0.8)
Average fuel consumption #2 Diesel, gph (l/h) at 1/4 load	0.9 (3)
1/2 load	1.5 (6)
3/4 load	2.0 (8)
Full load	2.6 (10)
Motor starting 3-phase, kW	24
kVA	112
Voltage regulation (no load to full load)	±5%
Power factor	0.8
Insulation	Class F
Sound level, full load, at 7 meters	66 dB(A)

28QSA6/24QSA6 Engine

Make/model ..... Cummins 6A3.4-GS/GC2
Design ..... 4-cycle, water-cooled, swirl-design combustion chamber
Starting system/voltage ..... Electric, 12 V battery
Displacement ..... 3.43 liters (209.31 cubic inches)
Number of cylinders 6
Fuel tank capacity ..... 40 gallons (151.42)
Coolant ..... 3.13 gallons (11.84 l)
Oil capacity ..... 9 quarts (8.52 l)

28QSA6/24QSA6 Dimensions

Trailer-mounted sets:
Length ..... 156.4 inches (397.26 cm)
Width ..... 64 inches (162.56 cm)
Height ..... 72.6 inches (184.4 cm) to roof of enclosure
78.25 inches (198.76 cm) to top of exhaust pipe
Approximate weight (without fuel) ..... 2785 pounds (1263.26 kg)

Skid-mounted sets:
Length ..... 110.06 inches (279.56 cm)
Width ..... 40 inches (101.6 cm)
Height ..... 52.75 inches (133.99 cm) to roof of enclosure
57.75 inches (146.69 cm) to top of exhaust pipe
Approximate weight (without fuel) ..... 2515 pounds (1140.78 kg)

Standard Voltage Selections:

28QSA6: 60 hz, 1800 rpm, reconnectible broad range

3-phase		Single Phase
120/208 V, 97 A	220/380 V, 53 A	120/240 V, 97 A
127/220 V, 92 A	240/416 V, 49 A	
129/240 V, 84 A	254/440 V, 46 A	
120/240 V, 84 A	277/480 V, 42 A	

24QSA6: 50 hz, 1500 rpm, reconnectible broad range

3-phase		Single Phase
110/190 V, 91 A	127/220 V, 79 A	110/220 V, 91 A
115/200 V, 87 A	220/380 V, 46 A	115/230 V, 87 A
120/208 V, 83 A	230/400 V, 43 A	120/240 V, 83 A
110/220 V, 79 A	240/416 V, 42 A	
115/230 V, 75 A	254/440 V, 39 A	

Section 3. Transporting and Positioning the Generator Set

TRANSPORTING THE GENERATOR SET

Towing Vehicle

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

Hitch

A Class II trailer hitch with a standard 2" ball, or a standard pintle hook must be attached to the towing vehicle. The hitch must be able to support the generator set tongue weight (150 lbs. maximum). The hitch may be either the weight-carrying type or the weight-distribution type.

The towing capacity of the hitch and ball must be equal to or greater than the trailer gross weight. This figure may be found in Section 2 of this manual. Sway control devices that restrict operation of the actuator 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 generator set, and must be wired into the towing vehicle's electrical system according to the diagram, Figure 3-1.

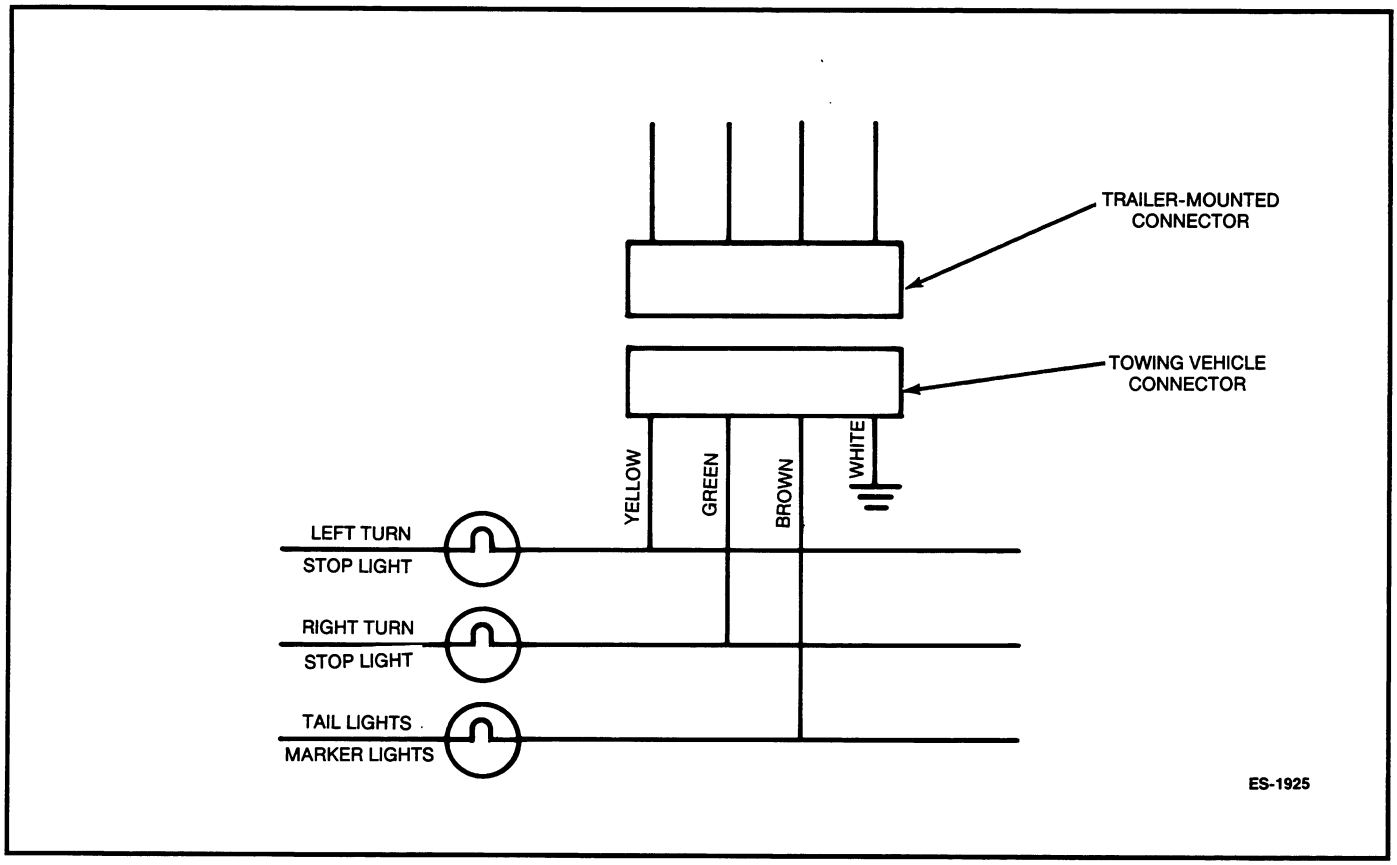


FIGURE 3-1. QUIET SITE TRAILER ELECTRICAL CONNECTIONS

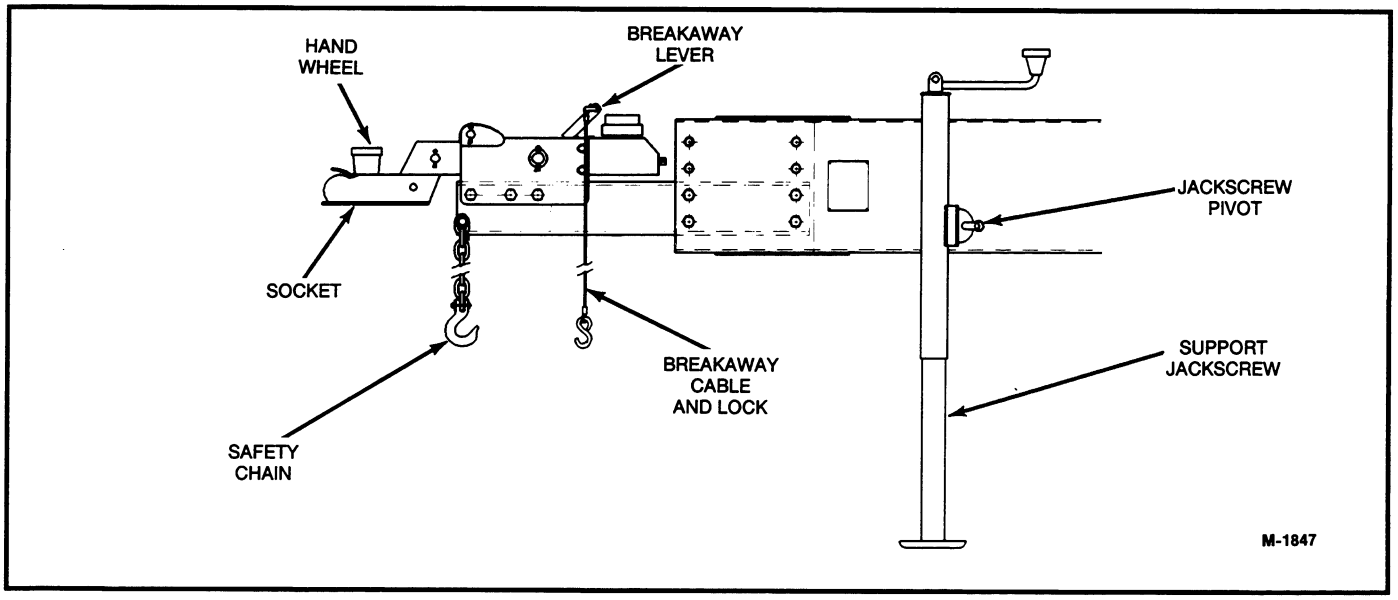


FIGURE 3-2. QUIET SITE TRAILER TONGUE

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/stop light 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 manner.
4. Connect the brown wire to the tail light 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. 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 have someone depress the brake pedal. The brake lights of the trailer and towing vehicle should light and go out simultaneously 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 simultaneously. If the trailer turn signal lights are reversed from those of the towing vehicle, it is probable that the yellow and green wires of the vehicle connector 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 generator set trailer has a "surge braking" system. When the towing vehicle slows down, the forward movement of the generator set pushes against a mechanism in the trailer's hitch, which actuates a hydraulic braking system on the trailer. A breakaway 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 to operate correctly at the factory. If trailer braking problems are encountered, consult an authorized distributor.

Attaching the Trailer

This procedure begins with the trailer tongue jacked up on its supportive jackscrew (see Figure 3-2).

1. Bring the rear of the towing vehicle up to the trailer hitch, so that the ball is directly under the tongue (or the lunette eye is directly over the bottom portion of the pintle hook).
2. Turn the crank on the jackscrew to lower the socket of the tongue onto the ball or the hook. Remove the pin that holds the trailer jackscrew in its vertical position. Move the jackscrew into its horizontal storage position and secure it with the pin.
3. 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. (Depress the lock to loosen the hand wheel in order to unhitch the trailer.)

   (Lunette eye) Once the lunete 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.

⚠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.***

4. 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 or pintle hook. The safety chains should have some slack to permit sharp turns by the trailer, but should not drag on the roadway.

5. 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 generator set 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.

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

LOCATING AND POSITIONING THE GENERATOR SET

Lifting Eye

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

Position

Select a location for the generator set that is level and firmly supported, and removed from any nearby fire hazard. Make certain that the generator set is stationary, firmly supported, and as level as possible. The generator set 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 generator set trailer to immobilize it before attempting to operate the generator set.

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 generator set'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 produce severe personal injury or death. Perform all procedures in accordance with Onan publications to minimize this risk.***

Mechanical Check

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

Section 4. Mechanical and Electrical Preparation

Before starting the generator set the first time, be sure it is serviced and ready for operation, and that the electrical output is connected correctly. After making certain that the generator set is secure and stable (see Section 3 of this manual), perform the following steps:

- Check ventilation and exhaust systems
- Check all mechanical connections
- Fill the coolant, lubrication and fuel systems
- Prime the fuel system
- Connect the generator set electrical output

VENTILATION

A set-mounted radiator with engine-driven fan is standard on the generator set. Air flows through the radiator and the engine end of the housing, then exits at the lower right front corner of the housing. Position the generator set air inlets so that dust, dirt and debris are not drawn into the set.

EXHAUST SYSTEM

Although the Quiet Site uses a self-contained exhaust system, use extreme care in positioning the set 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 generator set mechanical system includes fuel, exhaust, ventilation and cooling systems. These systems are self-contained within the generator set assembly, making initial setup a relatively simple procedure. However, each of these systems should be checked before every startup. Visually check the generator set 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. See Section 8, Maintenance, in this manual for more information.

LUBRICATION

Engine oil is drained before shipment. Before starting, fill the crankcase with the recommended oil. Refer to Section 8, Maintenance, in this manual for the procedure.

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 generator set 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 as described in Section 8, Maintenance.

Day Tank Controller (optional)

A day tank is a fuel transfer tank which is used in situations where a larger, auxiliary fuel tank is necessary. The day tank controller option may be used to control fuel flow from such a tank. See Figure 4-1.

The day tank controller includes a float switch and a fuel transfer pump. When the main tank on the set is emptied, the float switch in the main tank turns on the transfer pump. The pump draws fuel from the auxiliary tank, the hose conveys the fuel to the generator set's main fuel tank, and the float switch turns the pump off when the main tank is filled.

If the day tank controller is used, it will be necessary to punch, drill or cut a hole in the generator set housing for a fuel line. Once the line is run through this hole and secured in place, the hole must be sealed using RTV or an equivalent substance, for the generator set to retain its sound-insulated qualities.

Supply Tank Lower Than Engine: With this installation, the auxiliary tank is installed near the generator set 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. Provide an overflow line to the auxiliary tank in case the float switch fails to shut off the fuel transfer pump.

⚠WARNING ***Spilled fuel presents the hazard of fire or explosion which can result in severe personal injury or death. Provide an overflow line to the supply tank from the day tank.***

Supply Tank Higher Than Engine: Use fuel line at least as large as the fuel pump inlet. Include a shutoff solenoid in the fuel line between the auxiliary tank and the main tank. It stops fuel flow when the generator set is turned off.

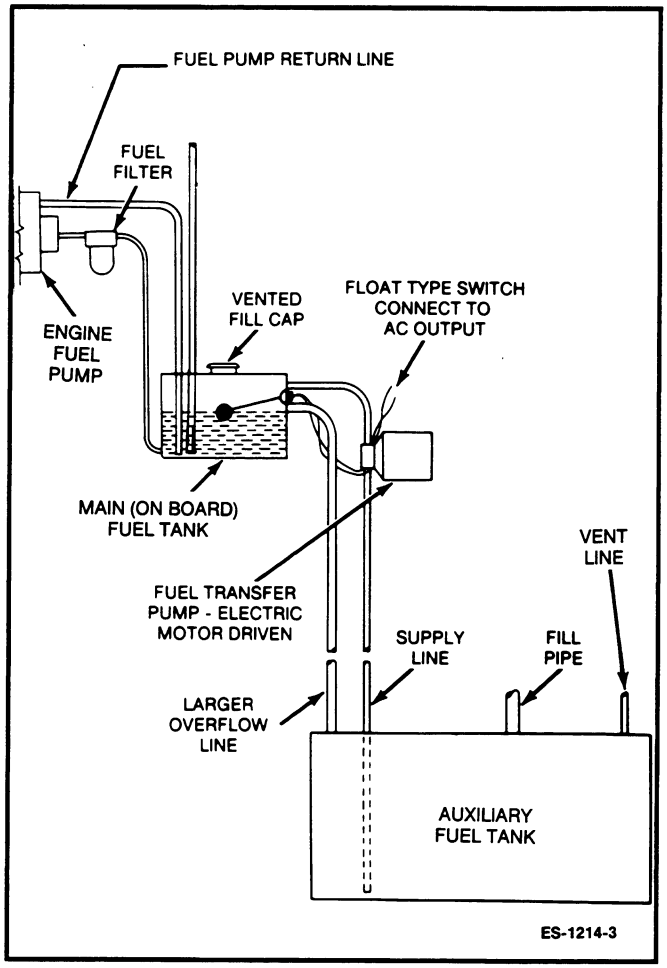


FIGURE 4-1. DAY TANK CONTROLLER

Engine Fuel Connections

Identification tags are attached to the fuel supply line and fuel return line connections by the factory. Flexible lines for connecting between the engine and the stationary fuel line are supplied with this option.

AC WIRING

General

Connecting the generator set electrical system involves connecting the load, installing the control wiring, and connecting the battery. Connect the battery last to avoid accidental starting of the unit during installation.

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 set, 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 generator set are properly connected.

An optional rear panel provides a voltage reconnection switch, terminals for load connection, and output circuit breakers. These features are discussed separately below. Figure 4-2 illustrates this panel.

⚠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.***

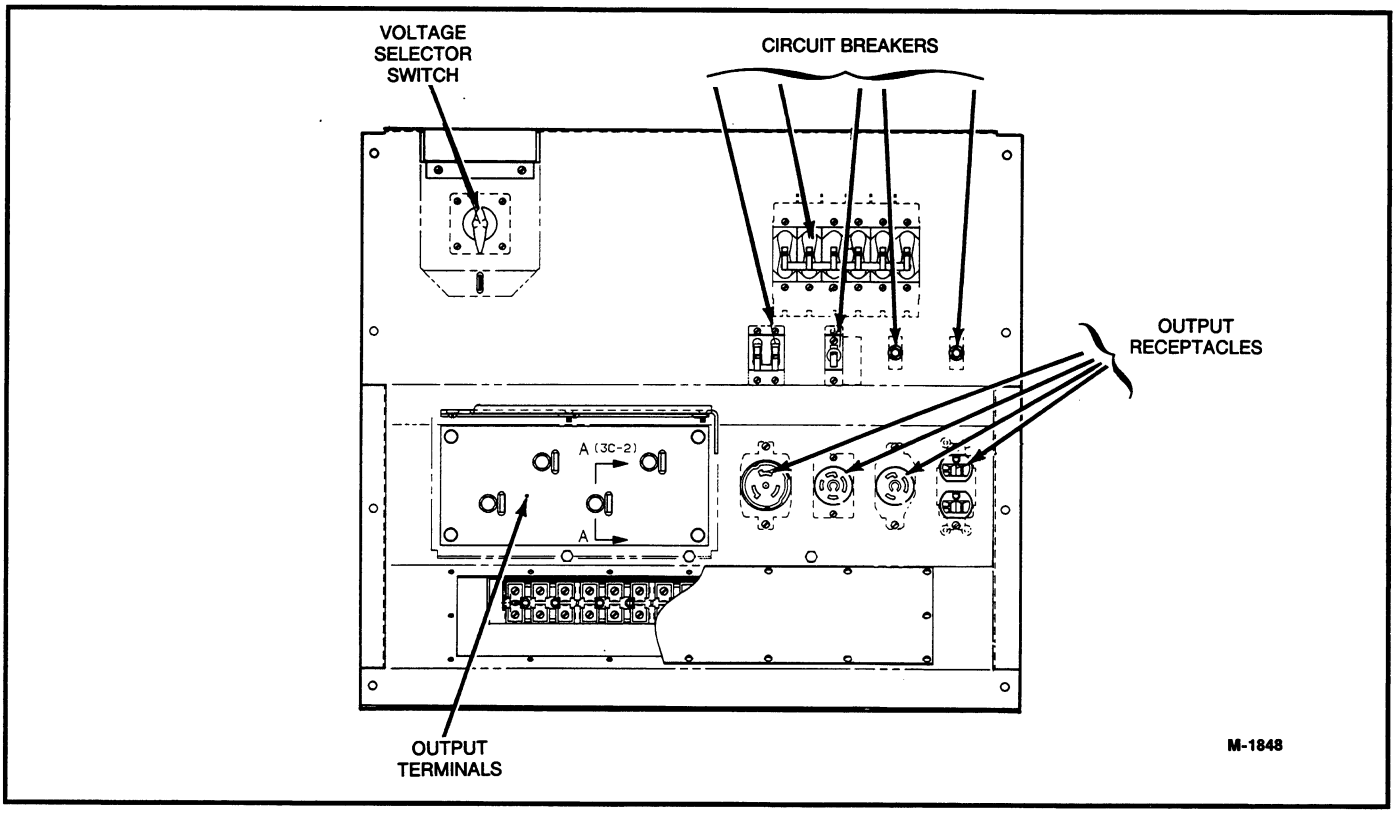


FIGURE 4-2. OPTIONAL REAR PANEL

If the installation is for standby service, a transfer switch must be used for switching the load from the normal power source to the generator set (see Figure 4-3). 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.

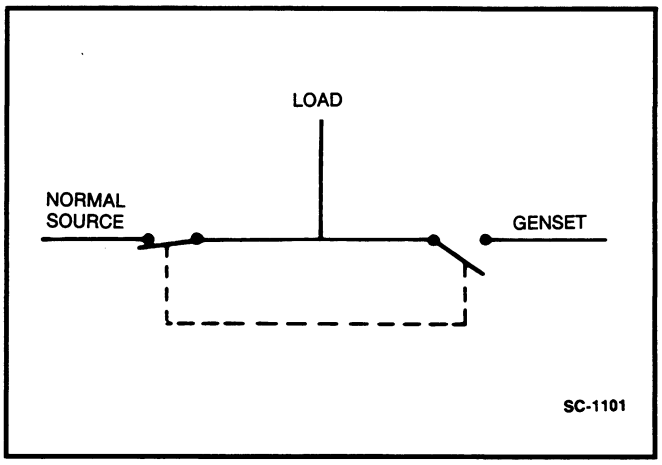


FIGURE 4-3. LOAD TRANSFER SWITCH (TYPICAL FUNCTION)

Output Connection

Generator Voltage Connections: 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 reconnectible or non-reconnectible outputs. A reconnectible generator may be wired for one of several possible output voltages. Non-reconnectible generators produce only one specific voltage, and cannot normally be wired for a different output. The following sections explain the connection procedure for each voltage code.

Non-Reconnectible Generators (Voltage Codes E, F and H): 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.

Reconnectible Generators (Voltage Codes L and Z): Generators with codes L (for 60 hz) and Z (for 50 hz) are three phase generators that may be reconnected for the voltages shown in Figure 4-4. Refer to the set nameplate for the current rating (amperes).

If the generator set incorporates the voltage reconnect switch, refer to Figure 4-5 for generator voltage reconnections.

⚠WARNING ***Use extreme caution when working on electrical components. High voltages can cause 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.***

Load Connection

If output terminals are not provided on the set, it will be necessary to punch, drill or cut a hole in the generator set 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 generator set to retain its sound-insulated qualities.

Generator sets without output terminal block: Load connection wires on the 12-lead generators ARE NOT connected together when the set is shipped from the factory. These 12 wires are labeled T1 through T12 and must be connected correctly before making load connections. Proceed as follows:

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 according to Figure 4-4 or Figure 4-5 for required voltage.
3. Insulate the connections.

Generator sets with optional output terminal block: Using 3/8" bolts with the correct nuts and washers, bolt the load connection wires directly to the L0, L1, L2 and L3 terminals (see Figure 4-2).

When installing sets with the optional AC ammeter, the generator output leads must be routed through a current transformer for proper meter operation (see Figure 4-6). The transformers are identified CT21, CT22, and CT23 (three phase only) on the wiring diagram and electrical schematics. Refer to Figure 4-4 to identify the output leads that must be routed through each transformer. Use a cable tie to secure the loose transformer to the generator output leads.

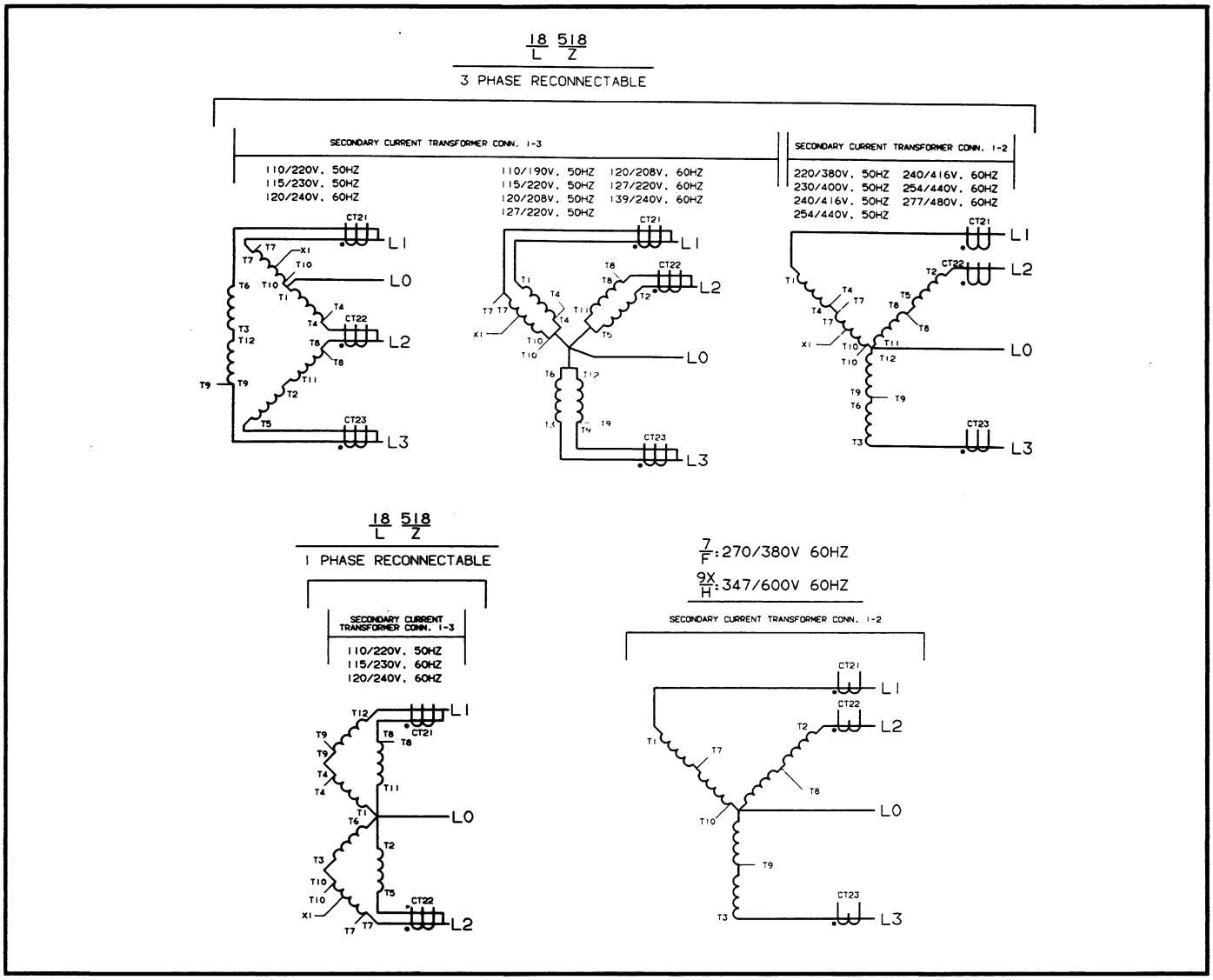
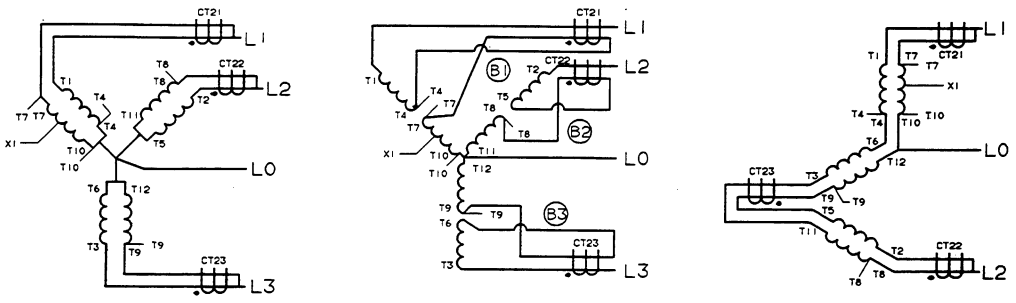


FIGURE 4-4. GENERATOR VOLTAGE RECONNECTIONS



120/208 VAC 3Ø | 227/480 VAC 3Ø | 120/240 VAC 1Ø

FIGURE 4-5. GENERATOR VOLTAGE CONNECTIONS WITH VOLTAGE RECONNECT SWITCH

Voltage Reconnection Switch (Optional)

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 4-2 illustrates the location of the voltage reconnection switch. Figure 4-5 illustrates the output connections of generator sets using this switch.

⚠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.***

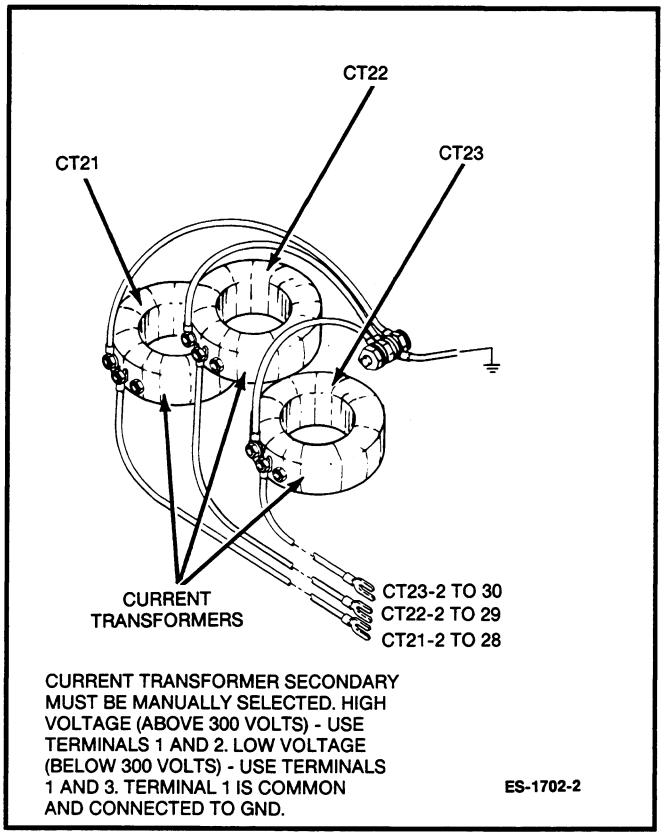


FIGURE 4-6. CURRENT TRANSFORMERS

Load Balancing

When connecting load to the generator set, balance the loads so the current flow from each line terminal (L1, L2 and L3) is roughly the same. This is especially important if both single- and three-phase loads are connected. Any combination of single- 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 line after connections are made, by observing the control panel ammeter.

Grounding

Grounding involves making a conductive connection between the metal parts of the generator set 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.

⚠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.***

Control Heater (Optional)

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

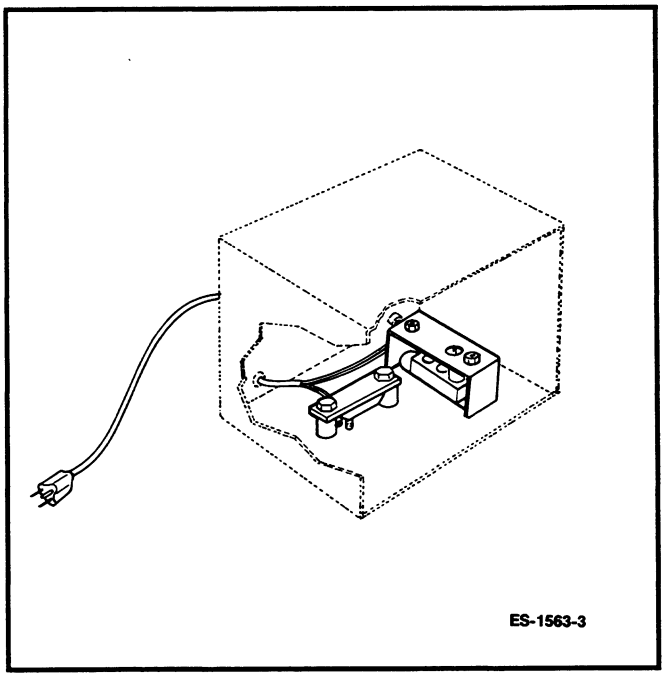


FIGURE 4-7. CONTROL HEATER

DC WIRING

Remote Control Connections

Provision is made inside the control box for addition of optional remote starting and alarm systems. Connections are made on the terminal block (TB1) located on the engine monitor circuit board (A11). Connect one or more remote switches across the remote terminal and the B+ terminal (see Figure 4-8).

If the distance between the generator set 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 conduit from AC power cables to avoid inducing currents that could cause problems within the control.

Remote Monitor Connections

Provision is made inside the control box to add optional remote monitoring to these generator sets employing optional Detector 12 Control (12 light panel). Connections are made on the terminal block (TB2) located on the engine monitor circuit board (A11).

⚠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.***

Battery Connection

The Quiet Site uses one 12 volt battery, connected as shown in Figure 4-9. Connect battery positive before connecting battery negative to prevent arcing.

Service the battery as necessary. Infrequent set use (as in emergency standby service) may allow the battery to self-discharge to the point where it cannot start the set. If an automatic transfer switch is installed that has no built-in charge circuit, connect a separate trickle charger.

⚠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.***

VOLTAGE RECONNECTION/ CIRCUIT BREAKER/ OUTPUT TERMINAL PANEL

An optional back panel assembly provides a voltage reconnection switch, a circuit breaker panel, and load output terminals and receptacles. (The voltage reconnection switch and output terminals are discussed earlier in this section.) Figure 4-2 illustrates this panel.

Circuit Breaker Panel

Depending on site specifications and applicable code requirements, an optional circuit breaker panel may be mounted on the generator set rear housing.

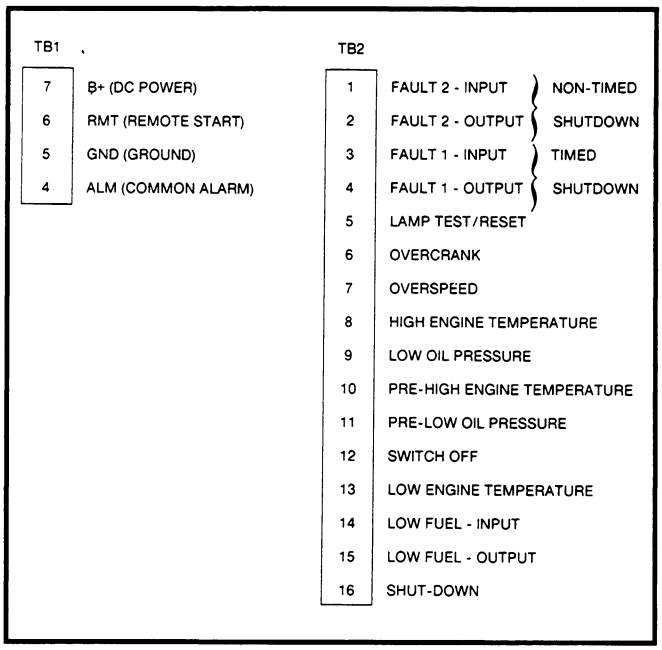


FIGURE 4-8. REMOTE CONNECTIONS

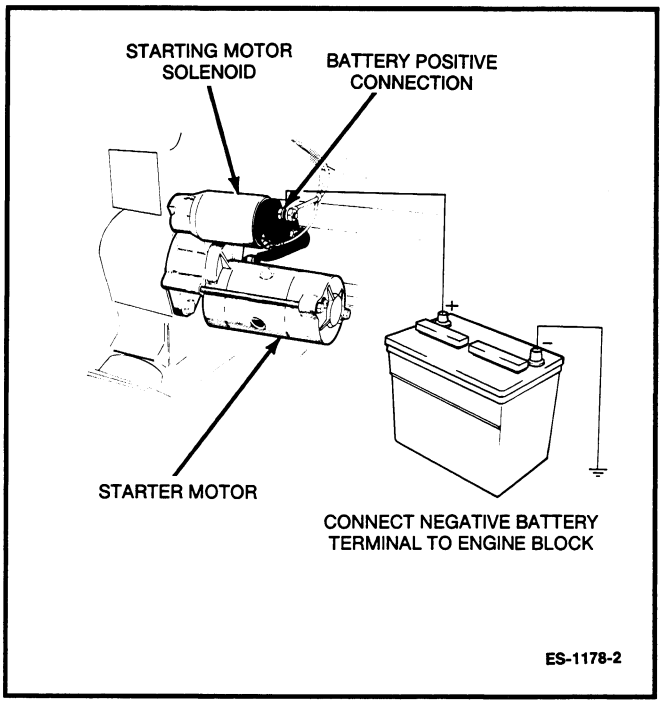


FIGURE 4-9. BATTERY CONNECTIONS

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 4-10.

- Generator set 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 or 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.
- 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. 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 generator set. This quickly disconnects the set 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 generator set 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 conduit from AC power cables to avoid inducing currents that could cause problems within the control.

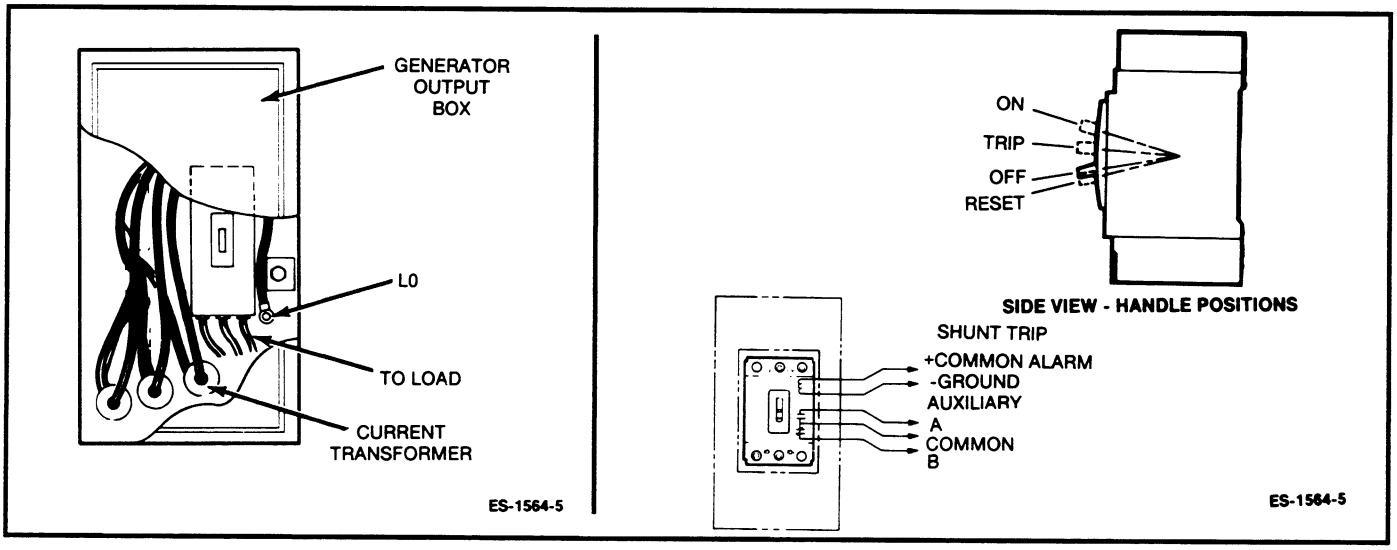


FIGURE 4-10. TYPICAL GENERATOR-MOUNTED CIRCUIT BREAKER

INTERFACE RELAY MODULES

If the installation includes a remote control panel having alarm circuits powered by a separate AC or DC source, Module A13 (7 relays) and Module A14 (5 relays) may be provided to interface with the ECM (A11) circuits. Typical wiring diagrams are shown in Figure 4-11.

TIME-DELAYED START/STOP MODULE

This module contains adjustable potentiometers for time-delayed start (1 to 15 seconds), and time-delayed stop (1 to 15 minutes). Time delay adjustment is done by turning the appropriate potentiometer clockwise to increase or counterclockwise to decrease the time delay. Set the time delay start per site requirements, and the time delay stop for approximately 3 to 5 minutes. A typical wiring diagram is shown in Figure 4-12.

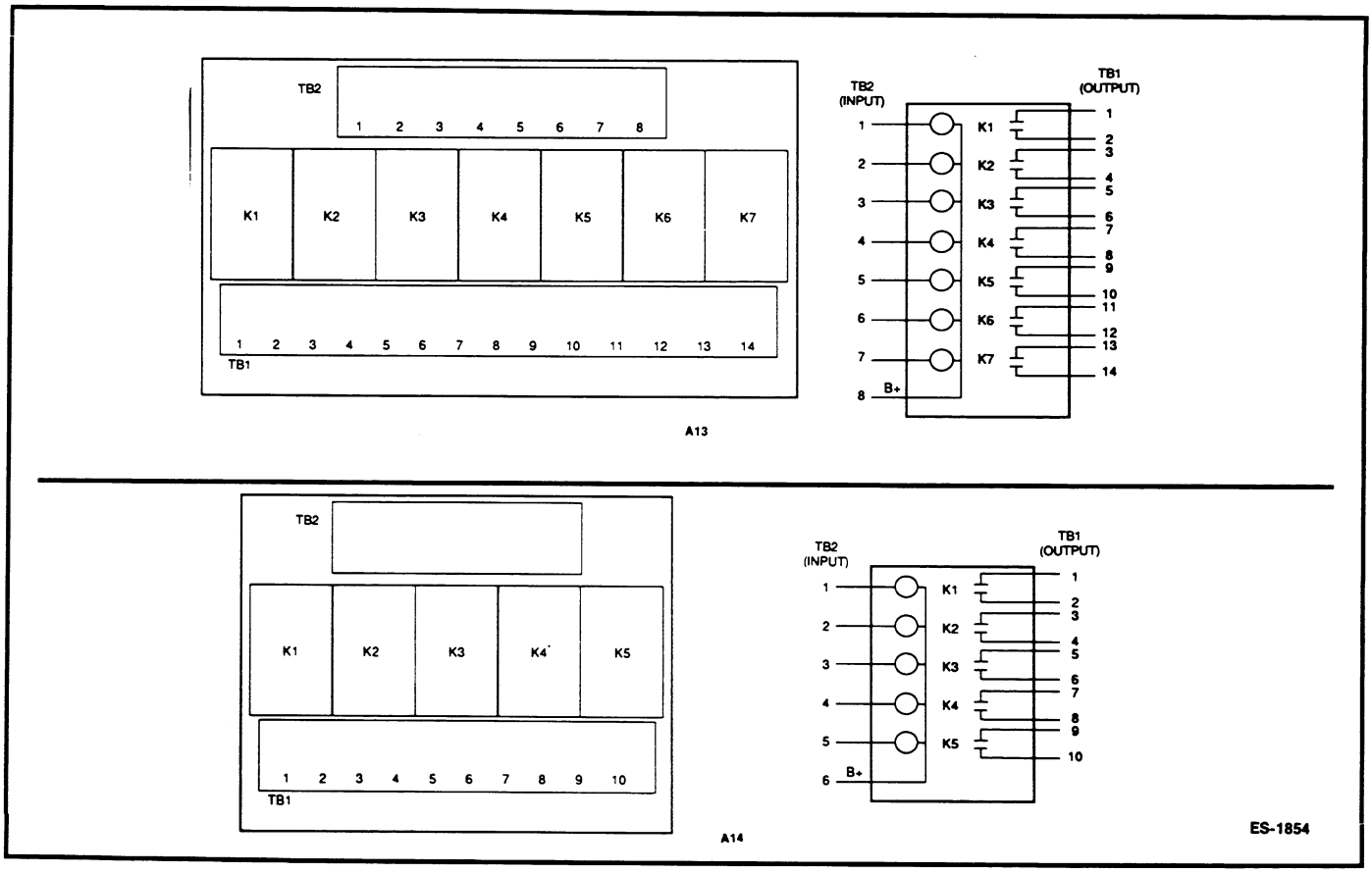


FIGURE 4-11. INTERFACE RELAY MODULES

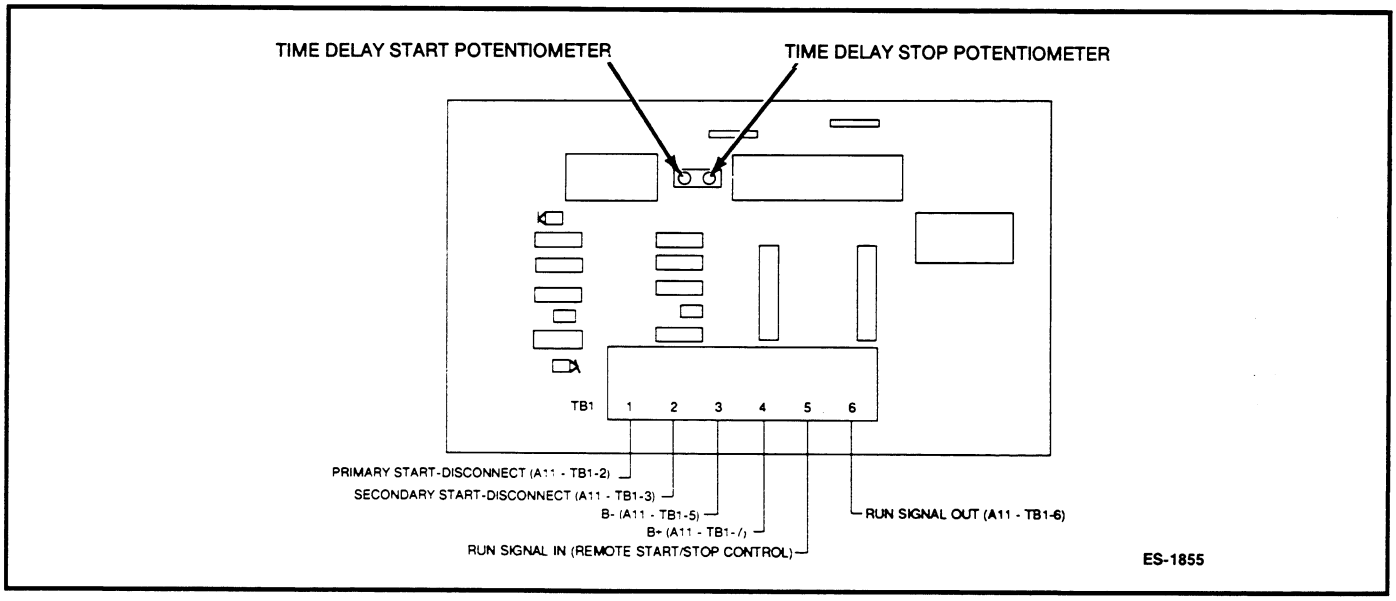


FIGURE 4-12. TIME-DELAYED START/STOP MODULE

Section 5. Initial Start and Checks

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

STARTING

Press the Preheat switch for 10 seconds (if applicable). Move the Run/Stop/Remote switch on the engine control panel to the RUN position. The starter should crank the engine and the engine should start within a few seconds. (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 system.) If after a few seconds of cranking the engine fails to start or starts, runs and then stops and the fault lamp lights, refer to the troubleshooting charts in Section 7 of this manual.

ENGINE GAUGES

Check the following while the generator set is operating.

Oil Pressure Gauge

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

Water Temperature Gauge

The water temperature should be 170° to 220° F (77° to 104° 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. The gauge should read approximately 12 to 14 volts while set is running. If reading is high or low, check batteries and the battery charger circuit.

AC METERS (IF EQUIPPED)

Note the AC instruments on the control panel. The frequency meter and voltmeter should indicate rated nameplate frequency and voltage. Turn the control panel Voltage Adjust control to reach the nameplate voltage. Use the Phase Selector Switch to read each of the line-to-line voltages.

If the generator set does not have control instruments or a Voltage Adjust control on the front panel, proceed to the Generator Voltage Checks section of this manual.

Check the following while the generator set is operating.

Frequency Meter

The generator frequency should be stable and the reading should be the same as the nameplate rating (50 or 60 hz).

AC Voltmeter

Turn the phase selector switch to each line-to-line phase selection shown on the volts scale (L1-L2 on single phase sets: L1-L2, L2-L3, and L3-L1 on three phase sets). 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 set nameplate rating.

AC Ammeter

Turn the phase selector switch to each phase selection shown on the amperes scale (L1 and L2 on single phase sets; L1, L2 and L3 on three phase sets). 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 set nameplate rating.

ENGINE MONITOR INDICATOR LAMPS

Move the Run/Stop/Remote switch on the engine panel to the Stop position. Hold the Reset/Lamp Test switch in the Test position. 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.

GENERATOR VOLTAGE CHECKS

Generator voltage checks consist of two possible which depend on generator set meters (Detector AC Option).

The generator voltage may be adjusted within 5% of the rated nameplate voltage through either an external control panel-mounted potentiometer or an internal voltage regulator-mounted potentiometer. The internal potentiometer also adjusts the range of the external potentiometer.

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

Generator Voltage Adjust (Detector AC Option)

This procedure pertains to generator sets equipped with Detector AC option only. The AC option consists of meters, switches and a voltage adjusting R21 potentiometer on the control front panel.

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

   A. Insert a screwdriver into the Voltage Adjust R21 potentiometer located on the front of the generator set control 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, proceed to Voltage Regulator Adjustment procedure.

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

2. Move Phase Selector switch to the Off position.

Voltage Regulator Adjustment

This procedure pertains to generator sets equipped with Detector AC option only. The procedure performs the adjustment range centering of voltage adjust R21 potentiometer located on the control front panel.

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

   A. Insert a screwdriver into the Voltage Adjust R21 potentiometer located on the front of the generator set control and using a wrench carefully loosen the locking nut.

   B. Turn screwdriver to set adjustment screw to the mid-position and retighten locking nut being careful not to change the adjustment.

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

   C. Open control panel doors, locate VRAS-1 (rear wall) and refer to Figure 5-1 to locate R32 potentiometer.

   D. While observing the voltmeter, insert a screwdriver into R32 potentiometer and slowly turn to increase or decrease voltage until adjusted to the rated nameplate voltage.

2. Close control panel doors and move Phase Selector switch to the Off position.

Generator Voltage Adjust (Without Detector AC Option)

This procedure pertains to the voltage adjustments of a generator set that does not have the Detector AC option. It applies to any voltage (shown in Figure 4-2) except series wye connections.

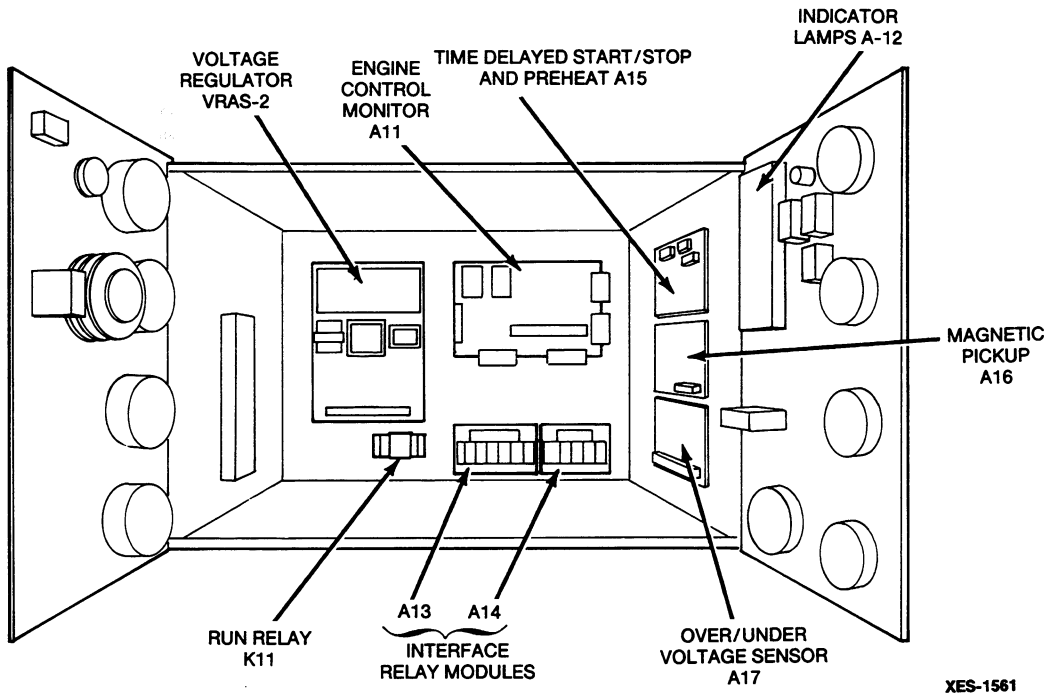
⚠WARNING ***High voltages in the control present an electrical shock hazard which can cause severe personal injury or death. Refer to Safety Precautions page.***

1. Open control panel doors, locate VRAS-2 (rear wall), and refer to Figure 5-1 to locate terminal board TB1 and R32 potentiometer.

2. Connect a voltmeter to VRAS-2 terminal board TB1-2 and TB1-3 terminals (Figure 5-1).

3. While observing the voltmeter, insert a screwdriver into R32 potentiometer and slowly turn to increase or decrease voltage until adjusted to the rated nameplate voltage.

4. Disconnect voltmeter from TB1 and close control panel doors.



VOLTAGE REGULATOR VRAS-2

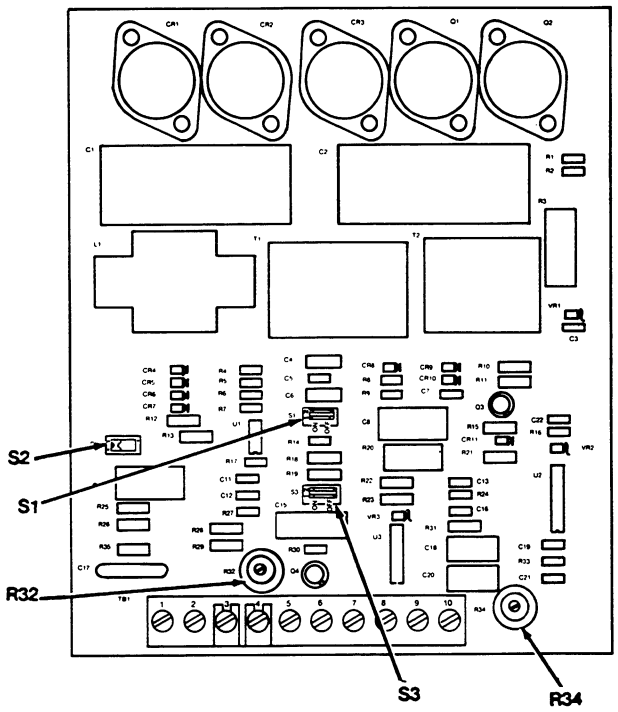


FIGURE 5-1. VOLTAGE REGULATOR LOCATION/ADJUSTMENTS

FREQUENCY CHECK

The generator frequency is a result of engine speed, which is automatically controlled. If generator frequency is below specification contact an Onan distributor.

EXHAUST SYSTEM

With the generator set operating, 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 including the exhaust manifold, muffler and exhaust pipe. If any leaks are detected, have them corrected immediately.

⚠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.***

FUEL SYSTEM

With the generator set operating, 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.

⚠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.***

DC ELECTRICAL SYSTEM

With the generator set off, check the terminals on the battery 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.***

COOLING SYSTEM

When the engine is first started, monitor the coolant level by observing the check-fill coolant tank inside the housing door. As trapped air is expelled from the system, the coolant level will drop and additional coolant should be added, to the level specified on the tank. Replace the check-fill coolant tank lid when the coolant level is stable.

⚠WARNING ***Contact with hot coolant can result in severe burns. Allow cooling system to cool before releasing pressure and removing the radiator cap.***

MECHANICAL ADJUSTMENTS

With the generator set 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.

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

Section 6. Operation

GENERAL

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

PRESTART CHECKS

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

Lubrication

Check the engine oil level. Keep the oil level as near as possible to the high mark on the dipstick, without overfilling.

Coolant

Check the engine coolant level by observing the level in the check/fill tank. Do not check coolant while the engine is hot.

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

Fuel

Make sure the fuel tanks have sufficient fuel and that the fuel system is primed. See the *Maintenance* section for the recommended fuel.

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.

⚠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 includes proper installation and regular, frequent visual and audible inspections of the complete exhaust system.

1-P/EM

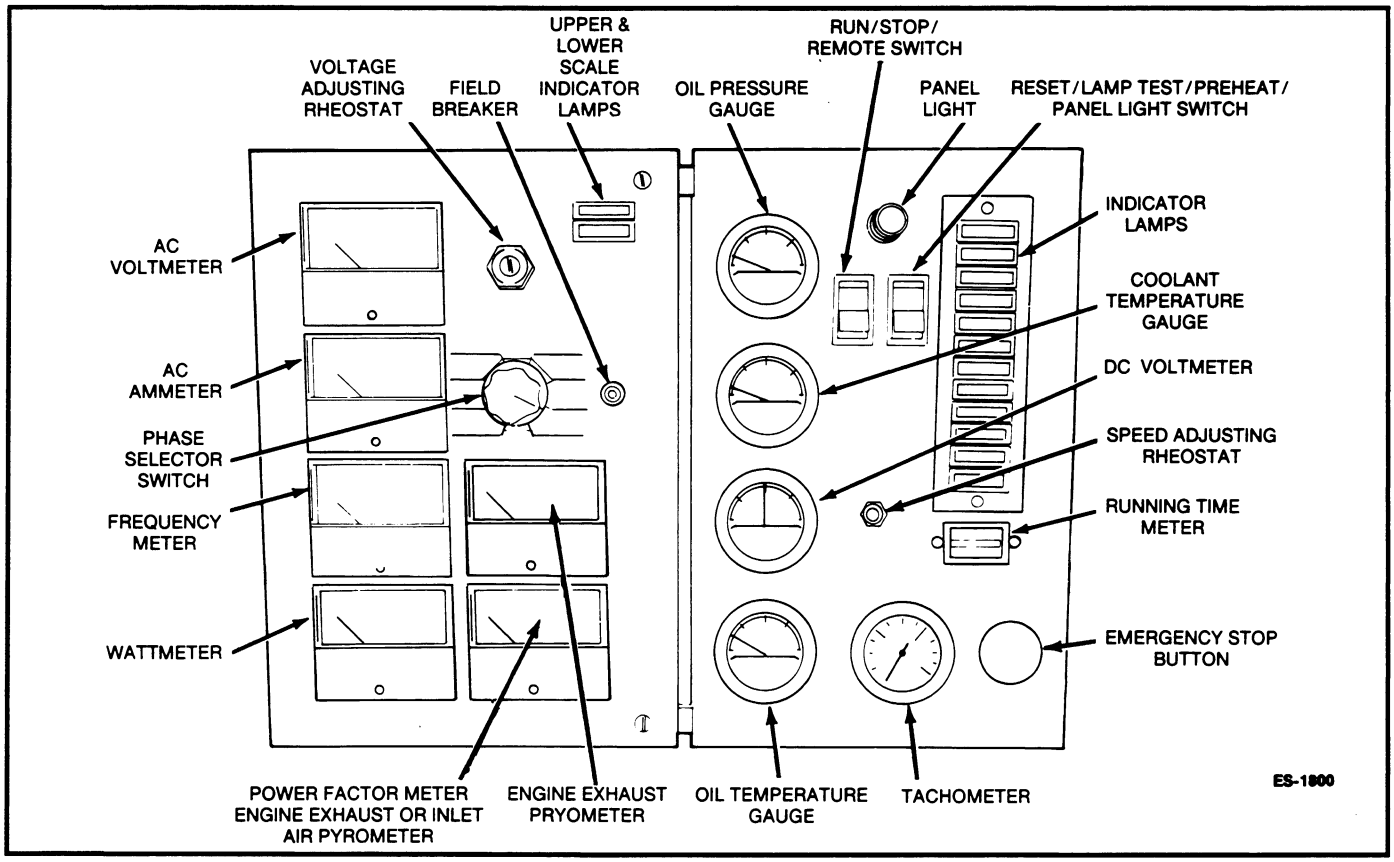


FIGURE 6-1. CONTROL PANEL

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/Preheat/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. Also manually operates the engine preheat.

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

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

Emergency Stop Button (optional): Push-in switch for emergency shutdown of the generator set.

Indicator Lamps: The standard control panel has seven indicator lamps which are:

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

PRE LO OIL PRES (yellow) indicates engine oil pressure is marginally low.

PRE HI ENG TEMP (yellow) indicates engine temperature is marginally high.

LO PRES (red) indicates engine has shut down because of critically low oil pressure.

HI ENG TEMP (red) indicates engine has shut down because of critically high temperature.

OVERSPEED (red) indicates engine has shut down because of excessive speed.

OVERCRANK (red) indicates the starter has been locked out because of excessive cranking time.

⚠CAUTION ***Yellow lamps indicate potential problems that could damage the genset. Refer to Troubleshooting, Section 7 in this manual.***

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.

Frequency Meter: Indicates generator output frequency in hertz. It can be used to check engine speed (each hertz equals 30 r/m).

Voltage Adjusting Rheostat: Rheostat providing approximately plus or minus five percent adjustment of the rated output voltage.

Upper and Lower Scale Indicator Lamps: Indicates which scale to use on the AC voltmeter and ammeter.

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

Wattmeter (Optional): Provides continuous reading of the generator output in kilowatts.

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

CONTROL PANEL INTERIOR

Generator AC Voltage Regulator

The solid-state regulator (VRAS-2) maintains AC output voltage from the generator at a predetermined level regardless of load. Voltage is regulated ± 2% from no load to full load. Random voltage variation is ± 1% for constant loads.

Engine Control Module

A circuit board assembly holds electronic and relay components of the engine monitoring circuit. The wiring harness connects sensors on the engine (Figure 6-2) to plug connectors on the board. The control module protects the genset as follows:

Overcrank: Limits engine cranking to 75 seconds. If the engine fails to start, the module lights a fault lamp and opens the cranking circuit. On the 12-lamp control (optional), the cycle cranking option allows three 15-second cranking cycles with two 15-second rest periods.

Overspeed: Shuts down the engine immediately and lights a fault lamp if overspeed occurs. The sensor switch is mounted in the end bell on the generator shaft. It is factory-adjusted to shut down 60 hertz units at 2100 ± 90 r/min, 50 hertz units at 1850 ± 50 r/min.

Low Oil Pressure: Shuts down the engine immediately and lights a fault lamp if oil pressure drops below 14 psi (97 kPa). The fault is time-delayed 10 seconds following starter disconnect, and inhibited during cranking. The delay allows oil pressure to rise to normal before the electronic control module monitors this system.

A pre-low oil pressure sensor and lamp provides an alarm that oil pressure is marginally low, 20 psi (137 kPa) or less. Find and correct the cause as soon as possible.

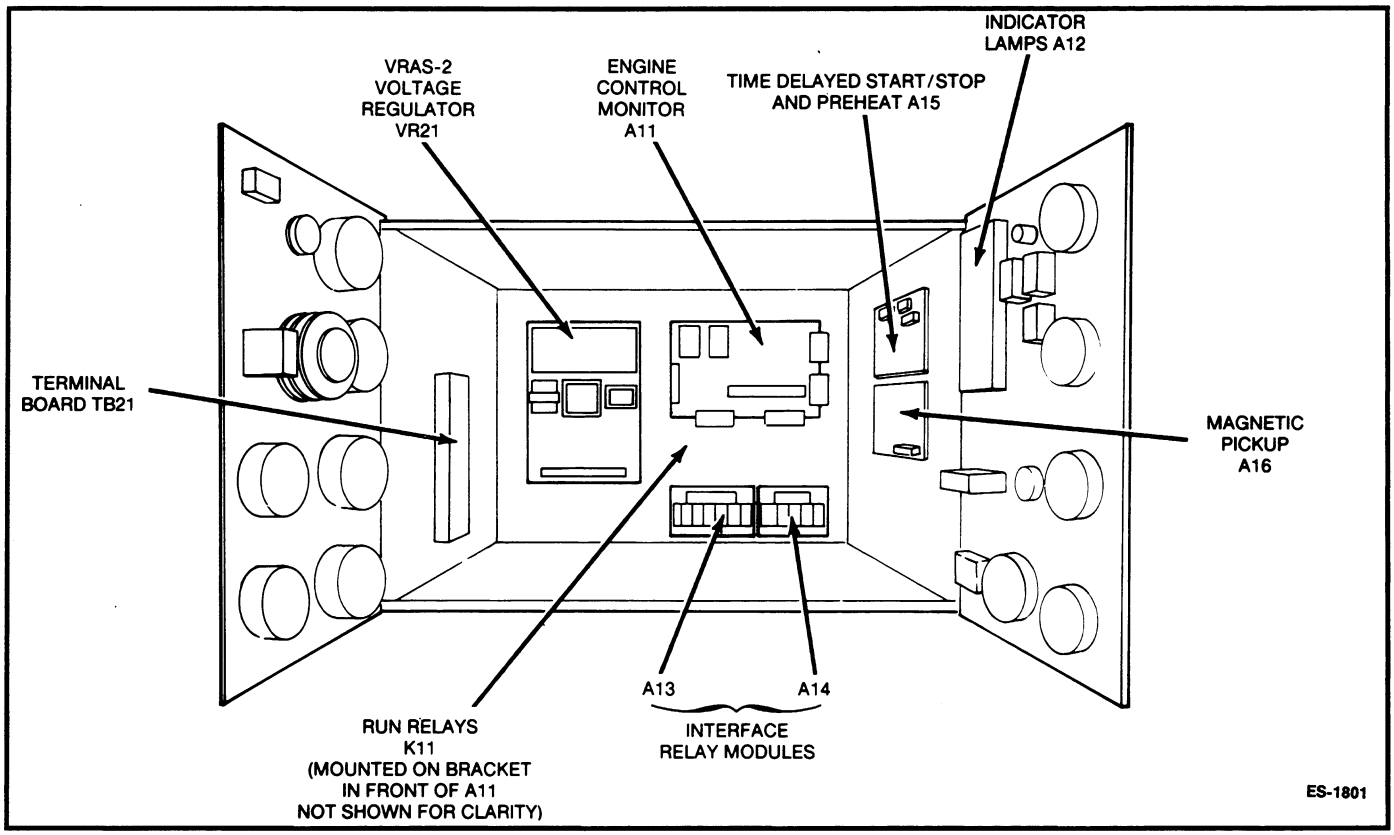


FIGURE 6-2. CONTROL PANEL INTERIOR

High Engine Temperature: Shuts down the engine immediately and lights a fault lamp if coolant temperature rises above 222°F (106°C). The fault is time-delayed about 10 seconds after starter disconnect, and inhibited during cranking. This delay allows the coolant enough time to circulate and return the water jacket to a normal temperature before the electronic control module checks this system.

A pre-high engine temperature sensor and lamp provides an alarm that engine temperature is marginally high, 202°F (94°C). Find and correct the cause as soon as possible.

⚠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.***

Low Coolant Level Shutdown (Optional): A solid state switch shuts down the engine if coolant level falls too low. It also turns on the high engine temperature fault lamp.

STARTING

The following sections cover the three different methods used to start the generator set. Review Section 4 of this manual, Mechanical and Electrical Preparation.

Starting at Control Panel

Press the Preheat switch (if applicable) for no more than 10 seconds before starting. Move the Run-Stop-Remote switch on the DC panel (Figure 6-1) 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 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 specified period, and the control will indicate an overcrank fault. Generator sets with the standard overcrank control will crank continuously for as long as 75 seconds before the starter is disengaged. Generator sets with the cycle cranking option will crank for 15 seconds, then stop for 15 seconds until 3 cycles are completed. 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 generator set DC 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 generator set DC 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.

STOPPING

Before Stopping

Run the generator set 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.

To Stop

If the set was started at the set 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 set will automatically stop about 15 minutes after the normal power source returns.

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 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.

Section 7. Troubleshooting

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 at the generator output when the set is running. Do not open the control box or generator output area while the set is running.

⚠WARNING ***Contacting high voltage components can cause serious 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 during troubleshooting can cause severe personal injury or death. Disable the generator set before troubleshooting.***

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 Onan distributor 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/Preheat switch. Locate the problem and make the necessary corrections before restarting the set. While pressing the Reset/Lamp Test/Preheat switch, make certain that all lamps light.

Line Circuit Breaker (Optional)

The optional line circuit breaker mounts at the generator rear housing panel. If the load exceeds the generator current rating, the line circuit breaker will open, preventing the generator from being overloaded. If the 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 7-1. 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 start-up.	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 202°F (94°C). If generator is powering non-critical and critical loads and cannot be shut down, use the following: a. Reduce load if possible by turning off non-critical loads. b. Check air inlets and outlets and remove any obstructions to airflow. 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 222°F/106°C) or coolant level is low (sets with coolant level sensor). Allow engine to cool down completely before proceeding with the following checks: a. Check coolant level and replenish if low. Look for possible coolant leakage points and repair if necessary. b. Check for obstructions to cooling airflow and correct as necessary. c. Check for a slipping fan belt and tighten if loose. d. Reset control and restart after locating and correcting problem. Contact an authorized service center if none of the above.
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 procedures 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 okay 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 7-1. TROUBLESHOOTING (Continued)

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

SYMPTOM	CORRECTIVE ACTION
6. OVERCRANK lamp lights and engine stops cranking. or Engine runs, shuts down, and LO OIL PRES lamp lights.	6. Indicates possible fuel system problem. a. Check for empty fuel tank, fuel leaks, or plugged fuel lines and correct as required. b. Check for dirty fuel filter and replace if necessary (see MAINTENANCE section). c. Check for dirty or plugged air filter and replace if necessary (see MAINTENANCE section). d. Refer to Step 5. e. Reset the control and restart after correcting the problem. Contact an authorized service center for service if none of the above.
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.
*11. LO ENG TEMP lamp lights. Set is in standby mode but is not operating. (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.)	11. Indicates engine coolant heater is not operating or is not circulating coolant. Check for the following conditions: a. Coolant heater not connected to power supply. Check for blown fuse or disconnected heater cord and correct as required. b. Check for low coolant level and replenish if required. Look for possible coolant leakage points and repair as required. c. Contact an authorized service center if none of the above.

*12-Light Panel Only.

TABLE 7-1. TROUBLESHOOTING (Continued)

⚠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 timed 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.
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: a. Fault lamp on. Correct fault and reset control. b. Poor battery cable connections. Clean the battery cable terminals and tighten all connections. c. Discharged or defective battery. Recharge or replace the battery. d. Contact an authorized service center for assistance if none of the above.
16. No AC output voltage.	16. Field breaker is tripped. Reset breaker. Contact an authorized service center if voltage build up causes breaker to trip.
17. Green RUN lamp does not light following engine start-up.	17. Indicates possible Start/Disconnect relay failure. Contact an authorized service center for assistance.

* - 12-Light Panel Only.

Section 8. Maintenance

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 conditons, 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 to determine the maintenance required, then refer to the following sections for the service procedures.

⚠WARNING ***Accidental starting of the set can cause severe personal injury or death. Disconnect the battery cables (ground cable first) when repairs are made to the engine, controls, or generator.***

TABLE 8-1. MAINTENANCE SCHEDULE

MAINTENANCE CHECKS	SERVICE TIME				
	Daily or after 8 hours	Weekly or after 50 hours	Monthly or after 100 hours	6 Months or after 200 hours	12 Months or after 400 hours
Inspect Generator Set	X[1]				
Check Oil Level	X				
Check Fan Belt	X				
Check Coolant Level	X				
Check Coolant Heater (if equipped)	X				
Check Air Cleaner		X[2]			
Check Battery Charging System		X			
Drain Water and Sediment from Fuel Tanks		X[6]			
Exercise Standby Sets		See Note 8			
Check Anti-freeze Concentration			X		
Check Fuel Level			X		
Change Crankcase Oil and Filter		See Note 3		X[2,3,4]	
Check Battery Condition				X	
Clean Generator Assembly				X	
Change Air Cleaner Element					X
Change Fuel Filter					X[2,5]
Check Valve Lash Clearance		See Note 3			X[3,7]

1 - Check for oil, fuel, cooling, and exhaust system leaks. Check exhaust system audibly and visually with set running. Shut unit down 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 - Perform every 200 hours or 6 months, whichever comes first.
5 - Perform every 400 hours or 12 months, whichever comes first.
6 - Drain 1 cup or more of fuel to remove water and sediment.
7 - Contact an authorized service center for service.
8 - Exercise standby sets weekly. Refer to Operation section.

GENERATOR SET INSPECTION

During operation, be alert for mechanical problems that could create unsafe or hazardous conditions. These sections cover areas that should be frequently inspected for continued safe operation.

Engine Gauges

Check the following while the generator set is operating.

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

Water Temperature Gauge: The water temperature should be in the range of 170° to 220°F (77° to 111°C) depending on the load and ambient temperature.

Battery Charge Rate DC Voltmeter: Indicates the battery charging system voltage.

AC Meters

Frequency Meter: The generator frequency should be stable and the reading should be the same as the nameplate rating: 50 or 60 hz.

AC Voltmeter: Turn the phase selector switch to each line-to-line phase selection shown on the volts scale (L1-L2 on single phase sets: L1-L2, L2-L3, and L3-L1 on three phase sets). Read the AC voltmeter using the upper or lower scale as indicated by the scale indicator light.

AC Ammeter: Turn the phase selector switch to each phase selection shown on the Amps scale (L1 and L2 on single phase sets: L1, L2 and L3 on three phase sets). 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 about the same, and no line current should exceed the set nameplate rating.

Engine Monitor Indicator Lights

Hold the Reset/Lamp Test/Preheat switch in the Test position. All indicator lamps (except Run) should light. Verify that all the bulbs are on, then release the switch. Replace any bulbs that are burned out.

Exhaust System

With the generator set operating, 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. Also make sure that exhaust pipes are not heating surrounding areas excessively. If any leaks are detected, have them corrected immediately.

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

Fuel System

With the generator set operating, inspect the fuel supply lines, return lines, filters, and fittings for leaks. Check any flexible sections for cuts, cracks and abrasions and make sure they do not rub against anything that could cause breakage.

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

DC Electrical System

With the generator set stopped, check the battery terminals for clean and tight connections. Loose or corroded connections create resistance which can hinder starting. Clean and reconnect the battery cables if loose. Always connect the negative battery cable last to reduce the possibility of arcing.

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

Mechanical

With the generator set stopped, check for loose belts and fittings, leaking gaskets and hoses, or any signs of mechanical damage. If any problems are found, correct them immediately. With the set running, listen for any unusual noises that may indicate mechanical problems, and check the oil pressure frequently. Investigate anything that indicates possible mechanical problems.

LUBRICATION SYSTEM

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.

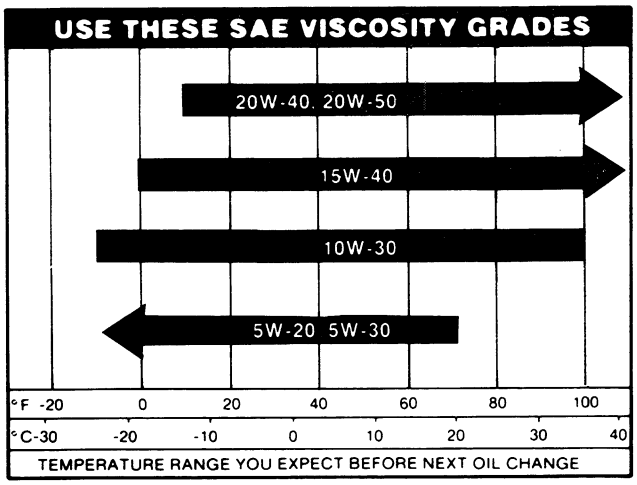
Oil Recommendations

Use multigrade lubricating oils with the American Petroleum Institute (API) classification CD/SF or CE/SF. Table 8-2 shows preferred oil grades for ambient temperatures indicated.

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.

TABLE 8-2.



Oil Filter Change: Spin off oil filter and discard it. Thoroughly clean filter mounting surface. Apply a thin film of oil to filter gasket and install new element. Spin element on by hand until gasket just touches mounting pad, then turn an additional 1/4 to 1/2 turn. Do not overtighten.

With oil in crankcase, start engine and check for leaks around filter element. Retighten only as much as necessary to eliminate leaks, but do not overtighten.

Engine Oil Level

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 (see Figure 8-1). 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.

⚠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.***

Oil and Filter

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.

Engine Oil Change: Run engine until thoroughly warm before draining oil. Stop the engine, place a pan under the drain outlet and remove the oil drain plug or open the drain valve. After the oil is completely drained, replace the drain plug or close the drain valve. Refill with oil of the correct API classification and appropriate SAE viscosity grade for the temperature conditions.

⚠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.***

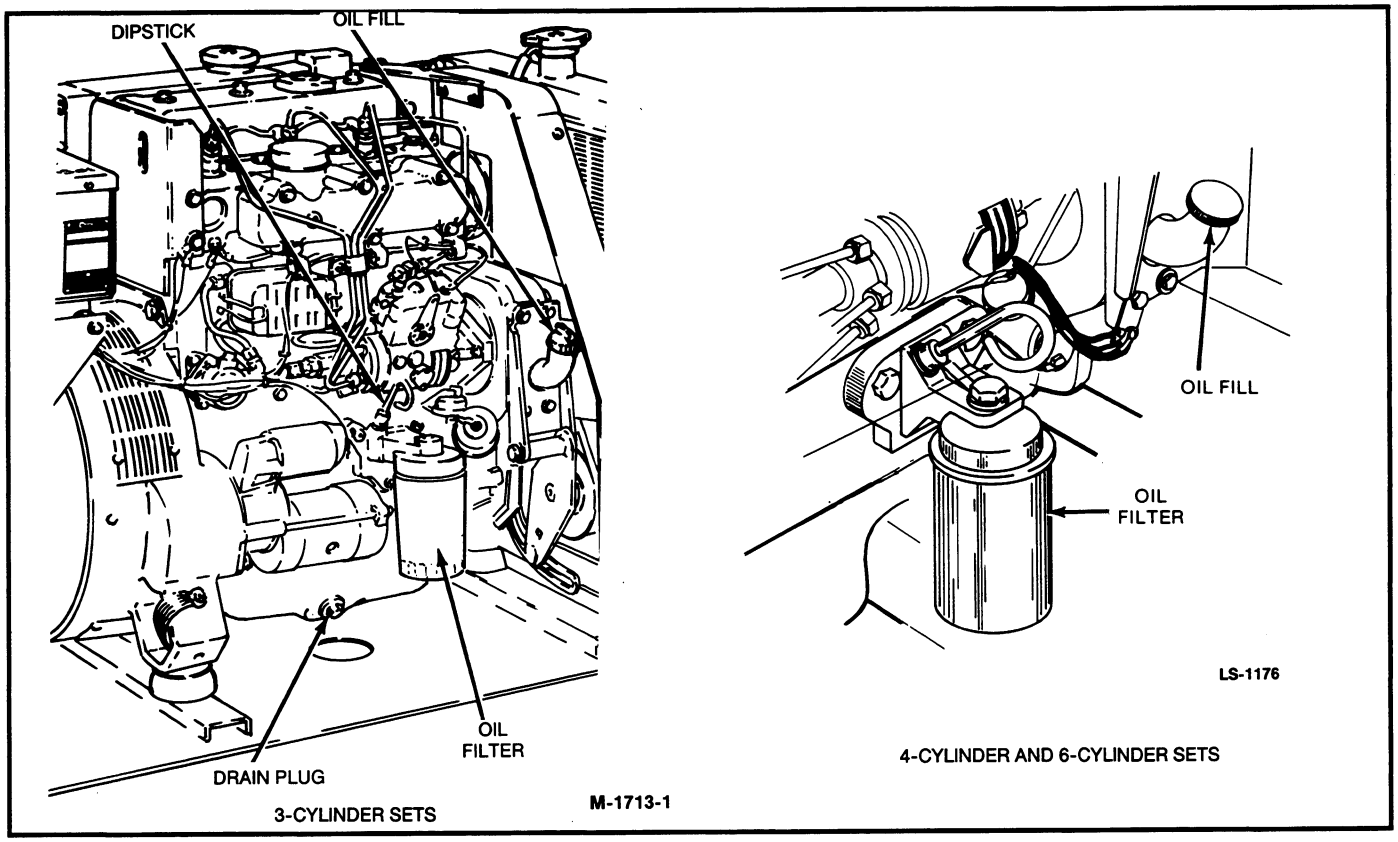


FIGURE 8-4. ENGINE OIL

COOLING SYSTEM

The cooling system on each set is drained prior to shipping and must be refilled before being operated. Cooling system capacity is listed in the Specifications section.

Coolant Requirements

A satisfactory engine coolant inhibits corrosion and protects against freezing. A solution of ethylene glycol ("permanent") antifreeze and water is recommended for normal operation and storage periods. Choose an anti-freeze that contains a rust and corrosion inhibitor, but does not contain a stop-leak additive.

The water used for engine coolant should be clean, low in mineral content, and free of corrosive chemicals such as chloride, sulphate, or acid. Use soft water whenever available. Well water often contains lime and other minerals, which may eventually clog the radiator core and reduce the cooling efficiency.

Be sure that the anti-freeze will protect the cooling system during the coldest winter weather. Use a 50/50 mixture of anti-freeze and clean water for adequate corrosion protection.

Filling the Cooling System

Verify that all drain cocks are closed and all hose clamps are secure. Remove the radiator pressure cap and slowly fill the radiator with the recommended coolant. Limit the fill rate to 3 gallons/minute to allow the engine block to fill completely with coolant. Remove the cap of the coolant check/fill tank and fill the tank to the specified level.

⚠CAUTION ***Exceeding the recommended fill rate can cause incomplete filling of the engine block which can result in possible engine damage during warm-up. Always follow the recommended fill procedure. When the engine is started, monitor the coolant level. As trapped air is expelled from the system, the coolant level will drop in both the radiator and the coolant check/fill tank. Refill the coolant check/fill tank and replace its cap when the coolant level is stable.***

Coolant Level

Check the coolant level during shutdown periods at the intervals specified in the Maintenance Table. Add coolant to the check/fill tank to the specified level.

⚠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.***

⚠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.***

Flushing and Cleaning

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

To drain the system completely, the radiator drain and the cylinder block drain located on the right side of the engine must be opened.

Chemical Cleaning: Clean the cooling system thoroughly if rust and scale have collected on the engine water jacket or in the radiator. Rust and scale slow down heat absorption and can block the coolant flow. Use a radiator cleaning compound according to the manufacturer's instructions.

Flushing: After cleaning or before filling the system with new coolant, drain the block, radiator and coolant check/fill tank and fill with clean water. Operate the set for 10 minutes, then drain the system completely. Refill with the recommended coolant.

⚠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.***

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 serious 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.

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 daytime. 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 sulphur in the fuel forms acid which can corrode and damage engine parts.

Priming the Fuel System

The fuel system must be primed before initial startup or after the engine has run out of fuel.

Low Pressure Fuel System: The transfer pump, fuel filter and injection pump housing comprise the low pressure fuel system. Use the following procedure to remove trapped air from the system.

1. Check fuel level in fuel tank and open shutoff valve.
2. Loosen the fuel filter-to-injection pump line at the injection pump fuel inlet fitting (Figure 8-2).
3. Actuate the priming level (Figure 8-3) on the side of the transfer pump until fuel flows from the fitting.

   If the camshaft transfer pump lobe is up, turn the engine one revolution to permit hand priming.
4. Tighten the fuel line at the injection pump inlet.

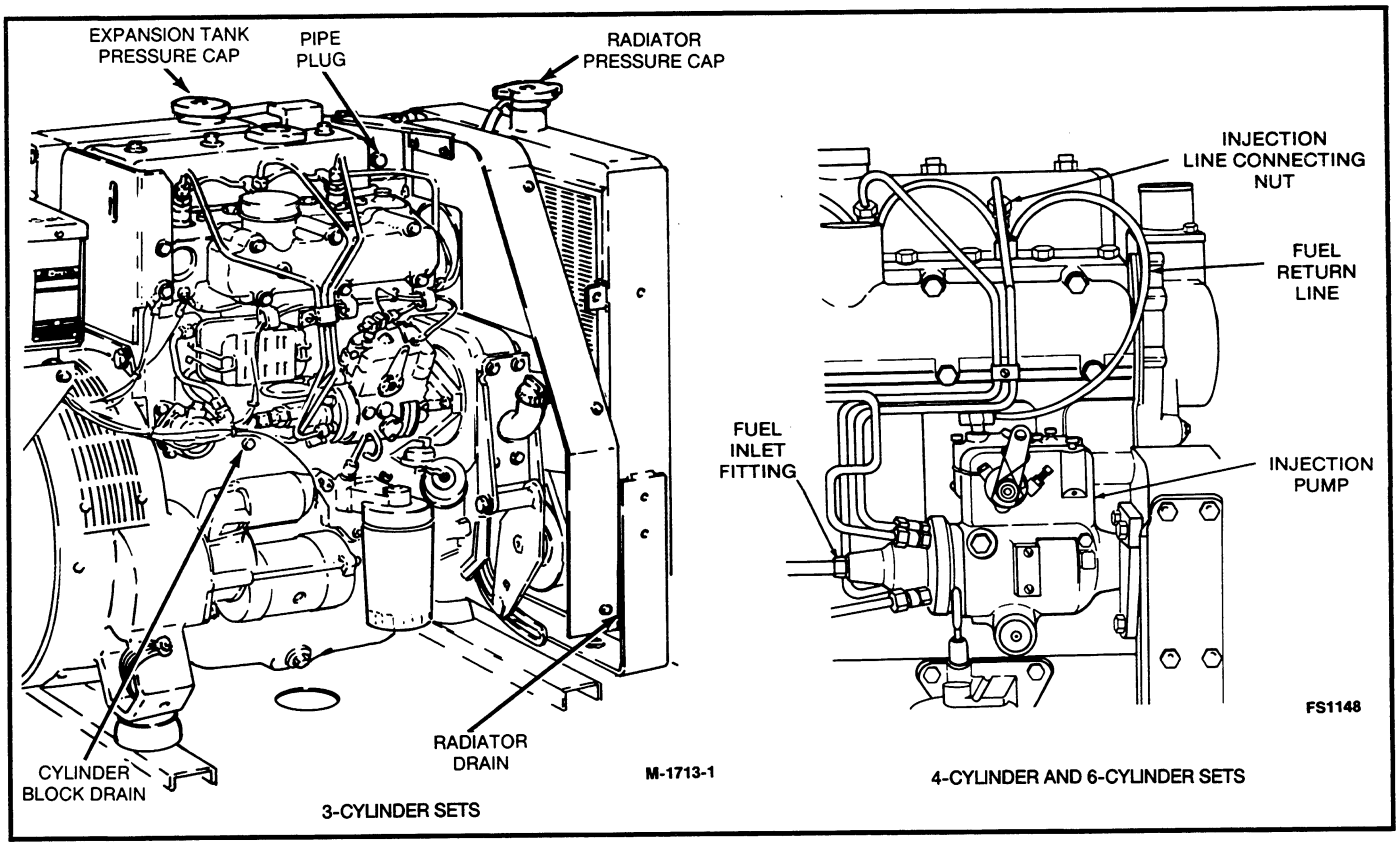


FIGURE 8-2. INJECTION PUMP

High Pressure Fuel System: The injection pump, fuel injection lines and fuel injectors comprise the high pressure fuel system. This part of the system is usually self-priming since any trapped air is usually forced out through the injection nozzles. However, if the engine is out of fuel, has been shut down for an extended period, or has had its injection lines removed, it may be necessary to prime. Use the following procedures:

1. Loosen the fuel injection line connecting nut (Figure 8-2) attaching each line to its corresponding nozzle holder.
2. Energize the starting motor by placing the Run/Stop/Remote switch in the Run position.
3. After 30 seconds, place the Run/Stop/Remote switch in the Stop position, then pause for two minutes to cool the starter motor.
4. Discontinue priming when fuel flows from the end of all high-pressure fuel injection lines. Tighten connection nuts and torque to 18 ft-lbs (24 n•m).

⚠WARNING ***Keep hands away from spray. The discharge pressure can penetrate the skin and can cause blood poisoning or a serious skin infection.***

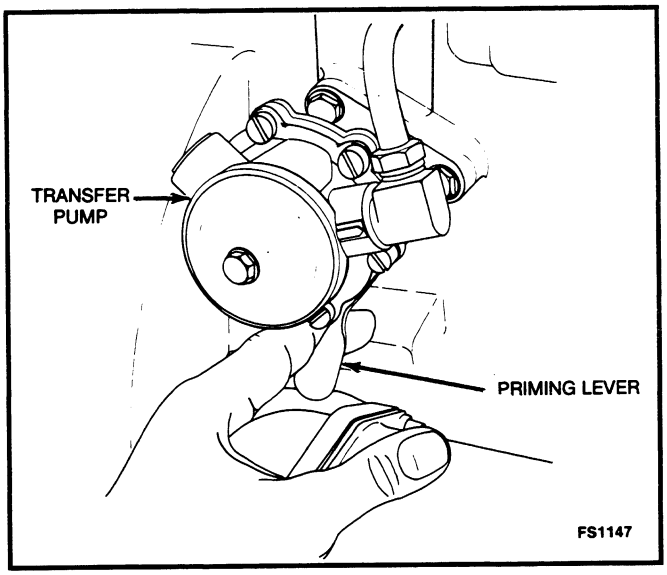


FIGURE 8-3. FUEL TRANSFER PUMP

Fuel Filter

The combination primary and secondary fuel filter is a disposable type. Any dirt that passes through the primary section is trapped by the secondary section. This prevents dirt from entering the fuel injection pump.

The filter replacement interval will vary according to the fuel quality and cleanliness. Using the wrong fuel or dirty fuel will shorten the service life of the filter.

Refer to the Periodic Maintenance Schedule for the recommended filter change interval. However, if the engine shows signs of fuel starvation (reduced power or surging), change the fuel filter. Use the following procedures to replace.

1. Close fuel tank shutoff valve.
2. Clean all dirt from around filter, filter base and surrounding area.
3. Remove filter retaining clip or clips from fuel filter (see Figure 8-4).
4. Remove old filter and dispose of it properly.

⚠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.***

5. Install new fuel filter and prime fuel system.

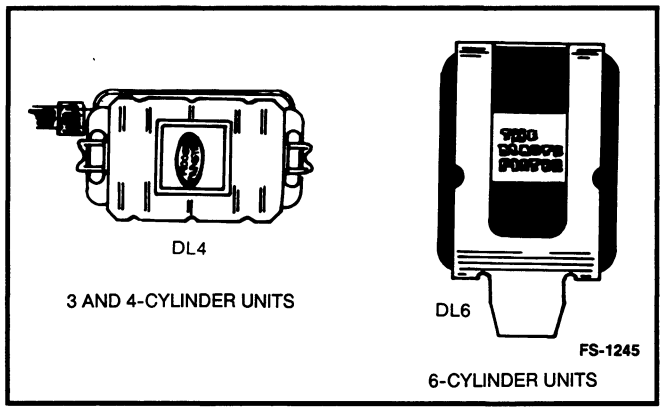


FIGURE 8-4. FUEL FILTERS

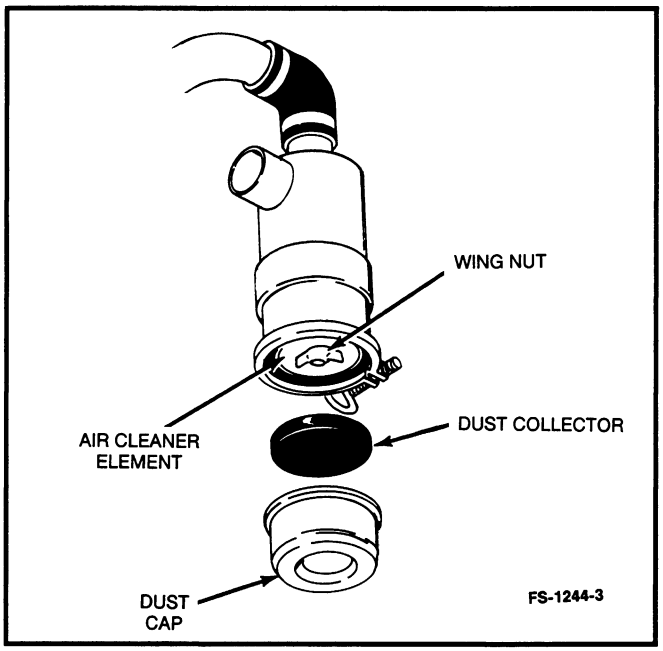


FIGURE 8-5. AIR CLEANER

AIR CLEANER

A heavy duty air cleaner is standard on the Quiet Site. It uses a heavy duty element that can be either replaced, or cleaned and reused. Use the following procedures to service:

1. Remove the dust cap (see Figure 8-5).
2. Clean dust and debris from the rubber dust collector in the dust cap.
3. Remove the wing nut and the air filter element.

4. Clean the element by directing dry, clean low pressure air up and down the pleats on the inside of the element. If the element is extremely dirty, it can be washed by soaking in a mild detergent and water. Soak for 15 minutes and then rinse thoroughly with clean water.

5. Air dry the element for a minimum of 24 hours. Do not dry with compressed air or at temperatures greater than 150°F (66°C).

6. Reassemble the filter assembly.

⚠CAUTION ***Do not reuse the element more than twice. Replace if element has even the slightest hole, to prevent engine damage from dirt.***

Fan Belt

To adjust, loosen alternator bolt that passes through elongated slot in mounting bracket. Slide alternator until a fan belt tension of 60 lbs. (267 n•m) is obtained. Tighten alternator mounting bolt to lock alternator in place. Check tension and repeat if necessary. See Figure 8-6.

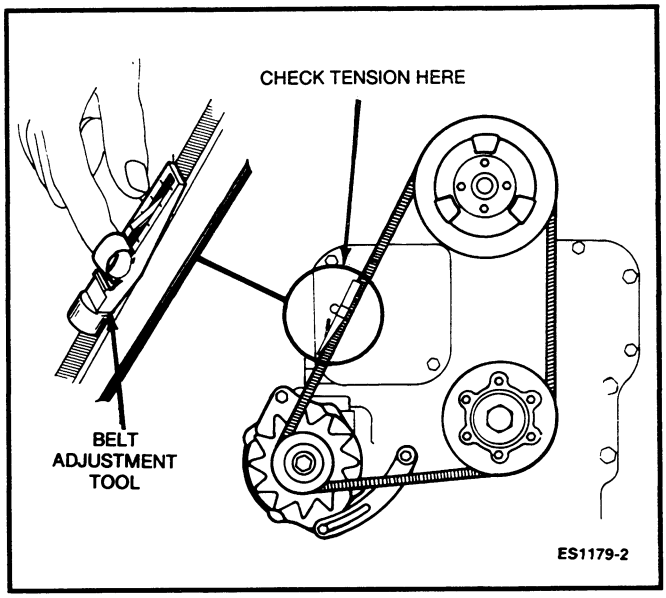


FIGURE 8-6. FAN BELT ADJUSTMENT

VALVE CLEARANCE

Correct valve clearance is very important in diesel engine performance because of the high compression developed in the cylinders. Incorrect valve clearance will cause loss of compression, misfiring, noise and may eventually lead to damaged engine components. At the interval recommended in Table 8-1, contact an authorized service center.

BATTERY

Check the condition of the starting battery at the interval specified in the Periodic 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 ***Ignition of explosive battery gases can cause severe personal injury. Do not smoke or allow any source of ignition while servicing batteries.***

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 ¼ 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 five 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

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.

⚠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.***

AC GENERATOR

There are no brushes, brush springs or collector rings on the Quite Site generator. For this reason, it requires very little servicing. Periodic inspections, coinciding with engine oil changes, will provide good performance.

Remove the generator set rear housing panel and inspect the rotating rectifier assembly to make sure the diodes (see Figure 8-7) are free of dust, dirt and grease. Excessive foreign matter on these diodes and heat sinks will cause the diodes to overheat and will result in their failure. Blow out the assembly periodically with filtered low pressure air.

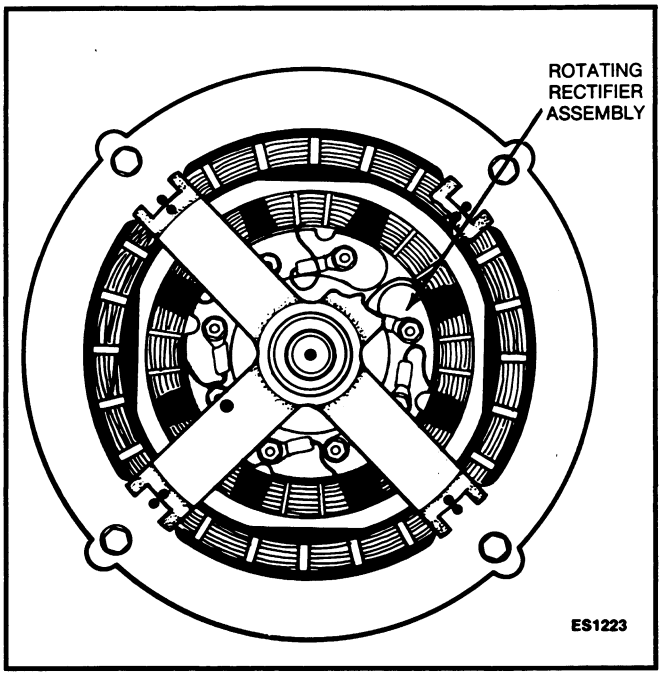


FIGURE 8-7. GENERATOR END VIEW

⚠CAUTION ***Excessive foreign matter on diodes and heat sinks will cause overheating and possible failure.***

Generator Bearing

Inspect the bearing for evidence of outer case rotation every 1000 hours of running.

If the generator set is used for prime power, replace the bearing every 10,000 hours or two years. If the set is used for standby power, replace the bearing every five years. Deterioration of the bearing grease due to oxidation makes this replacement necessary.

If the generator requires major repair or servicing, contact an authorized service center.

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 and drain the oil base while it is still warm. Refill and attach a warning tag indicating the viscosity of oil used.
3. Service the air cleaner.
4. Check the coolant level and add more coolant if the level is low.
5. Plug the exhaust outlets to prevent entrance of moisture, bugs, dirt, etc.
6. Clean and wipe the entire unit. Coat parts susceptible to rust with a light coat of grease or oil.
7. Disconnect battery and store in a cool dry place. Connect battery to a charger every 30 days to maintain it at full charge.
8. 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 plug from the 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. 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.

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

4. Drain and flush the cooling system and refill with the recommended coolant.
5. Prime the fuel system.
6. Connect the starting battery (ground terminal last).
7. Remove all loads before starting the engine.
8. After start, apply load to at least 50 percent of rated capacity.
9. Check all gauges for normal readings. Set is ready for service.

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