

OLYMPIAN™

Owner's Manual
For
Gaseous Fueled Industrial Generators
25 kW - 300 kW

⚠ DANGER!



**ONLY QUALIFIED ELECTRICIANS OR
CONTRACTORS SHOULD ATTEMPT
INSTALLATION!**



DEADLY EXHAUST FUMES!

This manual should remain with the unit.

**This manual must be used in conjunction
with the appropriate installation manual.**

 WARNING

CANCER AND REPRODUCTIVE HARM

www.P65Warnings.ca.gov

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Section 1 Safety

1.1 — Introduction

Every effort was expended to ensure that the information and instructions in this manual were both accurate and current at the time it was released. However, the manufacturer reserves the right to change, alter, or otherwise improve this product at any time without prior notice.

Read this manual thoroughly. If any portion is not understood, contact the nearest Authorized Service Dealer for starting, operating, and servicing procedures. The operator is responsible for proper and safe use of the equipment. The manufacturer strongly recommends that the operator read this Owner's Manual and thoroughly understand all instructions before using this equipment. The manufacturer also strongly recommends having an Authorized Service Dealer provide instruction to any designated operators in the safe inspection, starting, operating, and stopping of this unit.

1.1.1— Installation, Operation, and Maintenance

Installation and initial startup of this equipment is not a “do-it-yourself” project. This generator set must be installed by an Authorized Service Dealer or other competent, qualified contractor. The initial startup must be performed and documented by a factory Authorized Service Dealer. A factory Authorized Service Dealer can also provide the necessary training for authorized operators. It is the operator's responsibility to perform all safety checks, to make sure that all maintenance for safe operation is performed promptly, and to have the equipment checked periodically by an Authorized Service Dealer. Normal maintenance service and replacement of parts are the responsibility of the owner/operator and, as such, are not considered defects in materials or workmanship within the terms of the warranty. Individual operating habits and usage contribute to the need for maintenance service.

Proper maintenance and care of the generator will ensure a minimum number of problems and keep operating expenses at a minimum. See an Authorized Service Dealer for service aids and accessories.

1.1.2— How to Obtain Service

NOTE: Use this page to record important information about the generator set.

Each generator set has a DATA LABEL containing important information about the unit.

When contacting an Authorized Service Dealer about parts and/or service, always supply the complete model number and serial number of the unit as given on the data label. For quick and easy reference, copy the information printed on the Data Label located on the generator onto the sample label printed here. See Figure 1-1.

GENERATOR UNIT

GEN MODEL:
MODEL:
SERIAL:
ALTERNATE
PROD DATE:
COUNTRY OF ORIGIN:

GENERATOR DATA

KW	KVA	HZ	PF
UPSIZE	ALT	KW	KVA
VOLT		/	AMP
ENG	RPM	ALT	RPM
BREAKER	KW	AMP	
X"D		X"D	
ROTOR	STATOR	CLASS	
WINDINGS @	AMBIENT	TEMP	
		MANUF. LOC.	

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Figure 1-1. Data Label (Sample)

1.2 — Safety Rules

Throughout this publication, and on tags and decals affixed to the generator, DANGER, WARNING, CAUTION, and NOTE boxes are used to alert personnel to special instructions about a particular operation that may be hazardous if performed incorrectly or carelessly. Observe them carefully. They indicate:

DANGER!

INDICATES A HAZARDOUS SITUATION OR ACTION WHICH, IF NOT AVOIDED, WILL RESULT IN DEATH OR SERIOUS INJURY.

WARNING!

Indicates a hazardous situation or action which, if not avoided, could result in death or serious injury.

CAUTION!

Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

NOTE: Notes provide additional information important to an operation or procedure.

Four commonly used safety symbols accompany the DANGER, WARNING and CAUTION blocks. The type of information each indicates is as follows:



This symbol points out important Safety Information that, if not followed, could endanger personal safety and/or property.



This symbol points out a potential Explosion Hazard.



This symbol points out a potential Fire Hazard.



This symbol points out a potential Electrical Shock Hazard.

WARNING!



SAVE THESE INSTRUCTIONS. This manual contains important instructions that should be followed during operation and maintenance of the generator and batteries. The manufacturer suggests that these rules for safe operation be copied and posted in potential hazard areas. Safety should be stressed to all operators, potential operators, and service and repair technicians for this equipment.

Study these Safety Rules carefully before operating or servicing this equipment. Become familiar with this Owner's Manual and with the unit. The generator can operate safely, efficiently, and reliably only if it is properly installed, operated, and maintained. Many accidents are caused by failing to follow simple and fundamental rules or precautions.

The manufacturer cannot anticipate every possible circumstance that might involve a hazard. The warnings in this manual, and on tags and decals affixed to the unit are, therefore, not all-inclusive. If using a procedure, work method, or operating technique the manufacturer does not specifically recommend, ensure that it is safe for others. Also make sure the procedure, work method, or operating technique utilized does not render the generator unsafe.

DANGER!

- Despite the safe design of this generator, operating the equipment imprudently, neglecting its maintenance, or being careless can cause possible injury or death. Permit only responsible and capable persons to install, operate, and maintain this equipment.
- Parts of the generator are rotating and/or hot during operation. Exercise care near running generators.
- The installation must always comply with applicable codes, standards, laws and regulations.

- If the generator is used to power electrical load circuits normally powered by a utility power source, installation of a transfer switch is required. The transfer switch must effectively isolate the electrical system from the utility distribution system when the generator is operating. Failure to isolate an electrical system by such means will result in damage to the generator and also may result in injury or death to utility power workers due to backfeed of electrical energy.
- Potentially lethal voltages are generated by this equipment. Ensure all steps are taken to make the unit safe before attempting any work on the generator.

1.3 — General Hazards

- For safety reasons, the manufacturer recommends that this equipment be installed, serviced, and repaired by an Authorized Service Dealer or other competent, qualified electrician or installation technician who is familiar with applicable codes, standards, and regulations. The operator also must comply with all such codes, standards, and regulations.
- Installation, operation, servicing, and repair of this (and related) equipment must comply with all applicable codes, standards, laws, and regulatory requirements. Also, ensure that the generator is installed, operated, and serviced in accordance with the manufacturer's instructions and recommendations. Following installation, do nothing that might render the unit unsafe or in noncompliance with the aforementioned codes, standards, laws, and regulations.
- The engine exhaust fumes contain carbon monoxide, which can be DEADLY. This dangerous gas, if breathed in sufficient concentrations, can cause unconsciousness or even death. For this reason, adequate ventilation must be provided. Exhaust gases must be piped safely away from any building or enclosure that houses the generator to an area where people, animals, etc. will not be harmed. This exhaust system must be installed properly, in strict compliance with applicable codes and standards.
- Keep hands, feet, clothing, etc. away from drive belts, fans, and other moving or hot parts. Never remove any drive belt or fan guard while the unit is operating. Ensure that all guards, covers, and protective devices removed during maintenance or service are reinstalled.
- Adequate, unobstructed flow of cooling and ventilating air is critical in any room or building housing the generator to prevent buildup of explosive gases and to ensure correct generator operation. Do not alter the installation or permit even partial blockage of ventilation provisions, as this can seriously affect safe operation of the generator.
- Keep the area around the generator clean and uncluttered. Remove any materials that could become hazardous.
- When working on this equipment, remain alert at all times. Never work on the equipment when physically or mentally fatigued.
- Inspect the generator regularly, and promptly repair or replace any worn, damaged, or defective parts using only factory approved parts.
- Before performing any maintenance on the generator, disconnect the battery cables to prevent accidental startup. Disconnect the cable from the battery post indicated by a NEGATIVE, NEG, or (–) first, then remove the POSITIVE, POS, or (+) cable. When reconnecting the cables, connect the POSITIVE cable first, the NEGATIVE cable last.
- Never use the generator or any of its parts as a step. Stepping on the unit can stress and break parts, and may result in dangerous operating conditions from leaking exhaust gases, fuel leakage, oil leakage, etc.

1.4 — Electrical Hazards

- All generators covered by this manual produce dangerous electrical voltages and can cause fatal electrical shock. Utility power delivers extremely high and dangerous voltages to the transfer switch as well as the stationary emergency generator when it is in operation. Avoid contact with bare wires, terminals, connections, etc. on the generator as well as the transfer switch, if applicable. Ensure all appropriate covers, guards, and barriers are in place, secured and/or locked before operating the generator. If work must be done around an operating unit, stand on an insulated, dry surface to reduce potential shock hazard.
- Do not handle any kind of electrical device while standing in water, while barefoot, or while hands or feet are wet. DANGEROUS ELECTRICAL SHOCK MAY RESULT.

- If people must stand on metal or concrete while installing, operating, servicing, adjusting, or repairing this equipment, place insulative mats over a dry wooden platform. Work on the equipment only while standing on such insulative mats.
- The generator must be grounded in accordance with all code and regulatory requirements.
- Wire gauge sizes of electrical wiring, cables, and cord sets must be adequate to handle the maximum electrical current (ampacity) to which they will be subjected.
- Before installing or servicing this (and related) equipment, make sure that all power voltage supplies are positively turned off at their sources. Failure to do so will result in hazardous and possibly fatal electrical shock.
- Connecting this unit to an electrical system normally supplied by an electric utility shall be by means of a transfer switch so as to isolate the generator electric system from the electric utility distribution system when the generator is operating. Failure to isolate the two electric system power sources from each other by such means will result in damage to the generator and may also result in injury or death to utility power workers due to backfeed of electrical energy.
- Generators installed with an automatic transfer switch will crank and start automatically when NORMAL (UTILITY) source voltage is removed or is below an acceptable preset level. To prevent such automatic startup and possible injury to personnel, disable the generator's automatic start circuit (battery cables, etc.) before working on or around the unit. Then place a "DO NOT OPERATE" tag on the generator control panel and on the transfer switch.
- In case of accident caused by electric shock, immediately shut down the source of electrical power. If this is not possible, attempt to free the victim from the live conductor. AVOID DIRECT CONTACT WITH THE VICTIM. Use a nonconducting implement, such as a dry rope or board, to free the victim from the live conductor. If the victim is unconscious, apply first aid and get immediate medical help.
- Never wear jewelry when working on this equipment. Jewelry can conduct electricity resulting in electric shock, or may get caught in moving components resulting in injury.

1.5 — Fire Hazards

- Keep a fire extinguisher near the generator at all times. DO NOT use any carbon tetra-chloride type extinguisher. Its fumes are toxic, and the liquid can deteriorate wiring insulation. Keep the extinguisher properly charged and be familiar with its use. If there are any questions pertaining to fire extinguishers, consult the local fire department.
- All fuel types are potentially FLAMMABLE and/or EXPLOSIVE and should be handled with care.

1.6 — Explosion Hazards

- Properly ventilate any room or building housing the generator to prevent buildup of explosive gas.
- Do not smoke around the generator. Wipe up any fuel or oil spills immediately. Ensure that no combustible materials are left in the generator compartment, or on or near the generator, as FIRE or EXPLOSION may result. Keep the area surrounding the generator clean and free from debris.
- All fuel types are potentially FLAMMABLE and/or EXPLOSIVE and should be handled with care. Comply with all laws regulating the storage and handling of fuels. Inspect the unit's fuel system frequently and correct any leaks immediately. Fuel supply lines must be properly installed, purged, and leak tested according to applicable fuel-gas codes before placing this equipment into service.

Section 2 General Information

2.1 — Unit Identification

2.1.1— Data Label

Each generator set has a DATA LABEL containing important information about the generator. The data label lists the unit serial number, rated voltage, amps, wattage capacity, etc.

NOTE: The figure below is a generic representation only. For actual information on your particular model, refer to the data label(s) affixed to your unit.

2.1.2— Model Identification Code

The model identification code gives important information about the generator set. For example, if the code is:

SG 0100 A G03 6.8 N 23 H B Y Y 3

Then the generator would have the attributes shown in bold below:

SG	Stationary gaseous generator.	
0100	Rated output is 100,000 watts (100kW).	
A	Voltage code (see Subsection 2.1.3).	
G03	Indicates engine MFG (for manufacturer's use).	
6.8	Engine is 6.8 liter.	
N	Natural Gas fuel system.	
	L	LP Liquid Withdrawal fuel system.
	V	LP Vapor Withdrawal fuel system.
	R	Dual fuel system with LP liquid as secondary.
	P	Dual fuel system with LP Vapor as secondary.
23	2,300 Engine rpm rating (15 = 1500 rpm, 18 = 1,800 rpm, etc.) NOTE: Engines operating above 1,500 or 1,800 rpm use a gearbox to reduce the engine rpm to the desired alternator rotor rpm of 1,500 rpm (50 Hz operation) or 1,800 rpm (60 Hz operation).	
H	Unit has optional "H" control panel.	
B	Brushless excitation.	
	P	Permanent magnet excitation.
Y	Standard enclosure equipped.	
	N	No enclosure — suitable for indoor installation.
	S	Level 1 sound attenuation.
	L	Level 2 sound attenuation.
Y	Exhaust muffler mounted.	
	N	Exhaust muffler not provided.
	L	Exhaust muffler shipped loose with unit.
3	Emission designation (for factory use).	

GENERATOR UNIT

GEN MODEL:
MODEL: SG0100AG036.8N23HBYY3
SERIAL: 
ALTERNATE
PROD DATE:
COUNTRY OF ORIGIN:

GENERATOR DATA

KW	KVA	HZ	PF
UPSIZ	ALT	KW	KVA
VOLT	/	AMP	
ENG RPM		ALT RPM	
BREAKER	KW	AMP	
X"D		X"D	

ROTOR	STATOR	CLASS
WINDINGS @	AMBIENT	TEMP
		MANUF. LOC.

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Sample

2.1.3— Voltage Code

The letter following the kilowatt rating in the model identification code is the voltage code. The voltage code indicates the following:

Code	Description
A	120/240 volts, single-phase, four-lead, 60 Hz
D	120/240 volts, single- and three-phase, 12-lead, 60 Hz
G	120/208 volts, three-phase, 12-lead, 60 Hz Broad Range
H	231/400 volts, three-phase, 12-lead, 60 Hz Broad Range
J	120/240 volts, three-phase, 12-lead, 60 Hz Broad Range
K	277/480 volts, three-phase, 12-lead, 60 Hz Broad Range
L	346/600 volts, three-phase, six-lead, 60 Hz
M	110/220 volts, single-phase, four-lead, 50 hz
N	115/200 volts, three-phase, 12-lead, 50 Hz Broad Range
P	100/200 volts, three-phase, 12-lead, 50 Hz Broad Range
R	231/400 volts, three-phase, 12-lead, 50 Hz Broad Range
S	277/480 volts, three-phase, six-lead, 50 Hz

NOTE: The current North America Product “LTA/LG” 12-lead units can be field converted to a different voltage. However, this process is done by the dealer and it is a “Dealer’s Business Decision” to do so. The Service Parts Team assists the dealer in identifying any “Part Changes” required and our Application Support Team provides the dealer with a New H100 xml file for the new voltage rating.

2.2 — Equipment Description

This equipment is a revolving field, alternating current type generator set. The generator is designed to supply electrical power for the operation of compatible electrical loads when the utility power supply is not available or has dropped to an unacceptable level.

The generator’s revolving field is directly connected to and driven by an engine by means of flexible discs or a gearbox. Generators with a four-pole rotor are driven at a rated speed of 1,800 rpm to supply a frequency of 60 Hertz. Four-pole rotors operating at 50 Hertz are driven at 1,500 rpm.

Refer to the data label affixed to the unit for rated AC voltage, wattage, amperage, number of phases, etc. See Subsection 2.1.2 for an explanation of how to identify the unit’s features.

2.2.1— Standard Generator Features

The generator incorporates the following features:

- The rotor insulation system is Class “H” rated, and the stator insulation is Class “H” rated as defined by NEMA MG1-22.4 and NEMA MG1-1.65.
- The generator is self-ventilated and drip-proof constructed.
- The voltage waveform deviation, total harmonic content of the AC waveform and “telephone influence factor” have been evaluated and are acceptable according to NEMA MG1-22.
- All prototype tested models have passed three-phase symmetrical short circuit test to ensure system protection and reliability.

2.2.2— Generator and Load Compatibility

The generator must be fully compatible with the rated voltage, phase, and frequency of the connected electrical loads. The generator, connected electrical devices, or both, can be damaged if voltage, phase, and frequency are not compatible.

NOTE: This manual assumes that the generator set has been properly selected, installed and interconnected by a competent, qualified electrician or installation contractor. Once the installation is complete, do nothing that may result in non-compatibility between the generator and connected electrical loads.

2.2.3— Single-Phase “A” or “M” Code Units

The following statement applies to single-phase units with an “A” or “M” code alternator:

The generator is suitable for supplying typical residential loads, such as induction motors (sump pumps, refrigerators, air conditioners, furnaces, etc.), electronic components (TV, computer, monitor, etc.), lighting loads, and microwaves.

2.2.4— Three-Phase Load Imbalance Limits

For three-phase units the maximum load imbalance between phases can not exceed 25% of rated load (current).

2.2.5— Ambient Condition Derate

The maximum ambient temperature for the generator is indicated on the unit data label. Derate values for ambient temperature in excess of that indicated on the data label, as well as altitude, may apply depending on the engine and kW rating of the unit. Consult an Authorized Service Dealer for any derate values applicable to this specific generator at its installed location.

2.3 — Engine/Generator Protective Devices

The generator set may be required to operate for long periods of time without an operator on hand to monitor conditions such as coolant temperature, oil pressure, voltage, frequency, etc. For this reason, the generator set has numerous sensors to provide the control panel with the information it needs to protect both the engine and generator. The control panel is designed to shut down the engine if potentially damaging conditions occur. These conditions can include low oil pressure, high coolant temperature, low coolant level, engine overspeed, over or under voltage, over or under frequency, etc. These settings are configured at the factory and can be changed/adjusted by an Authorized Service Technician if required.

NOTE: Engine/generator protective devices are only mentioned here for the owner/operator’s general information. For details, consult the applicable control panel technical manual. The list below is not all inclusive.

2.3.1— Coolant Temperature Sensor

The control panel automatically shuts down the engine if the engine coolant temperature rises above a safe level.

2.3.2— Low Coolant Level Sensor

Should the engine coolant level drop below the level of the low coolant temperature sensor, it is possible for the engine to overheat without automatic shutdown. To prevent such overheating, the engine has a low coolant level sensor. If the level of engine coolant drops below the level of the low coolant level sensor, the control panel will shut the engine down.

2.3.3— Oil Pressure Sensor

This sensor monitors engine oil pressure. If oil pressure drops below a safe level, the control system automatically shuts down the engine.

2.3.4— Overspeed Shutdown

A speed circuit controls engine cranking, startup, operation, and shutdown. Engine speed signals are delivered to the control panel whenever the unit is running. Should the engine overspeed above a safe, preset value, the control panel initiates an automatic engine shutdown.

2.3.5— Overcrank Shutdown

After a pre-specified duration of cranking, this function ends the cranking if the engine has failed to start. The default settings are:

- The unit will attempt to start (crank) three times.
- Each crank cycle lasts either 10 or 15 seconds, followed by a five second rest (to cool the starter).
- After three starting attempts the unit will shutdown.

2.3.6— RPM Sensor Loss Shutdown

If the speed signal to the control panel is lost, engine shutdown will occur.

2.3.7— Low Fuel Pressure Warning

- Some gaseous units are equipped with a low fuel pressure warning switch which will trigger a Warning alarm if the fuel pressure drops below a minimum setting.

2.4 — DC Fuses

Located inside the front panel, the fuses protect the control panel wiring and components from damaging overload. For fuse location and identification, see Figure 3-4.

2.5 — Fuel System

This generator set is equipped with one of the following fuel systems:

- Natural Gas (NG) fuel system
- LP gas vapor withdrawal fuel system (LPV)
- LP gas liquid withdrawal fuel system (LPL)
- Dual fuel system: Natural Gas (primary fuel source), LP gas vapor (secondary fuel source)
- Dual fuel system: Natural Gas (primary fuel source), LP gas liquid (secondary fuel source)

2.5.1— Natural Gas Fuel System

Natural gas is supplied by a local utility in its vapor state through in ground piping.

2.5.2— LP Fuel System

LP is supplied as a liquid in pressurized tanks. It is usually made up of propane, butane, or a mixture of both gases.

2.5.2.1—LP Vapor Withdrawal Fuel System

Utilizes the vapors formed above the liquid fuel in the supply tank. Approximately 10 to 20 percent of the tank capacity is needed for fuel expansion from the liquid to the vapor state.

2.5.2.2—LP Liquid Withdrawal Fuel System

LP in a liquid withdrawal system must be converted to its gaseous state before it is introduced into the engine carburetor. A vaporizer converter is used to accomplish this. In such a converter, heated engine coolant is ported through the converter to provide the necessary heat for conversion of the fuel from a liquid to a gaseous state.

NOTE: Units with LP gas liquid withdrawal systems incorporate a block heater as standard equipment. The heater is powered by the utility power source during non-operating periods to provide heated coolant to aid in the fuel vaporization process.

2.5.2.3—Dual Fuel: NG/LP Fuel System

Some applications require the use of a “dual-fuel” system. This type of fuel system allows the generator to run on either natural gas (primary) or LP vapor or liquid (secondary). In the event that the primary source (utility supplied) becomes unavailable, the unit automatically switches to the secondary source. It can do so while in operation or while not operating.

2.6 — Specifications

2.6.1— Generator

Refer to the data plate on the generator for rated watts, amperes, frequency, voltage, phase, and other important information.

2.6.2— Engine Oil Recommendations

The engine has been filled with factory engine oil of a grade recommended by the engine supplier as follows:

- Gaseous Engines: 6.8L displacement or smaller - SAE 5W-20; Displacement larger than 6.8L - SAE 40.
- Gaseous Engines: 9.0L displacement - SAE 15W-40.

The manufacturer recommends an initial oil and filter change after the first 50 hours (or first 3 months) of service operation. Use a high quality detergent oil with an appropriate classification and viscosity for the engine type and ambient temperature conditions. Consult your Authorized Servicing Dealer for oil recommendations. Synthetic oils meeting the same service category and viscosity requirements for the application may be used.

- Recommended API Service Category for gaseous engines: SJ, SL, SM, or SN.

2.6.3— Coolant

Use only deionized or distilled water and Ethylene glycol antifreeze (Propylene glycol can also be used but do not mix with Ethylene glycol). When adding coolant, always add the recommended 50-50 mixture.

⚠ DANGER!



- **DO NOT remove the radiator pressure cap while the engine is hot. Serious burns from boiling liquid or steam could result.**
- **Ethylene glycol base antifreeze is poisonous. Do not use mouth-to-siphon coolant from the radiator, recovery bottle, or any container. Wash hands thoroughly after handling. Never store used antifreeze in an open container because animals are attracted to the smell and the taste of antifreeze even though it is poisonous.**



Do not use any chromate base rust inhibitor with propylene glycol base antifreeze. Using any high silicate antifreeze boosters or additives also will cause overheating. The manufacturer also recommends that any soluble oil inhibitor is NOT USED for this equipment.

2.6.4— Gearbox Lubrication (If Equipped)

Use only SAE 90 gear oil with the correct proportion of Lucas Heavy Duty Oil Stabilizer. See the Maintenance section for more information.

2.7 — Starting Aids (If Equipped)

One or more of the following starting aids may be provided to ensure quicker, easier starts under varying climactic conditions.

- Engine coolant heater
- Engine oil heater
- Battery warmer

These aids are powered by a normal (utility) power source during non-operating periods.

2.7.1— Engine Coolant Heater

Heats the engine coolant when the unit is not operating. This action keeps the engine warm even in cold weather, helping to ensure quicker starts. Powered by a circuit normally fed by the utility power supply.

2.7.2— Engine Oil Sump Heater

Keeps the oil in the sump heated to allow easier starting and faster engine warm-up. Powered by a circuit normally fed by the utility power supply.

2.7.3— Battery Warmer

Keeps the battery warm so it can provide full cranking current when starting in cold conditions. Powered by a circuit normally fed by the utility power supply.

Section 3 *Operation*

3.1 — Generator Control and Operation

The operation of this generator set should only be performed by an “Authorized Operator,” that is, someone who has been properly trained by an Authorized Service Dealer. Contact your local Authorized Service Dealer for assistance in training Authorized Operators.

The following instructions assume that the generator has been properly installed, serviced, tested, adjusted, and otherwise prepared for use by a competent, qualified installation contractor and Authorized Service Dealer. Carefully read the Safety Rules and any other safety information before attempting to operate this (and related) equipment.

3.1.1— Grounding the Generator

Ground the generator set in accordance with all codes and regulatory requirements.

⚠ DANGER!



DO NOT connect the ground wire to any pipe that carries a flammable or explosive substance as FIRE or EXPLOSION may result.

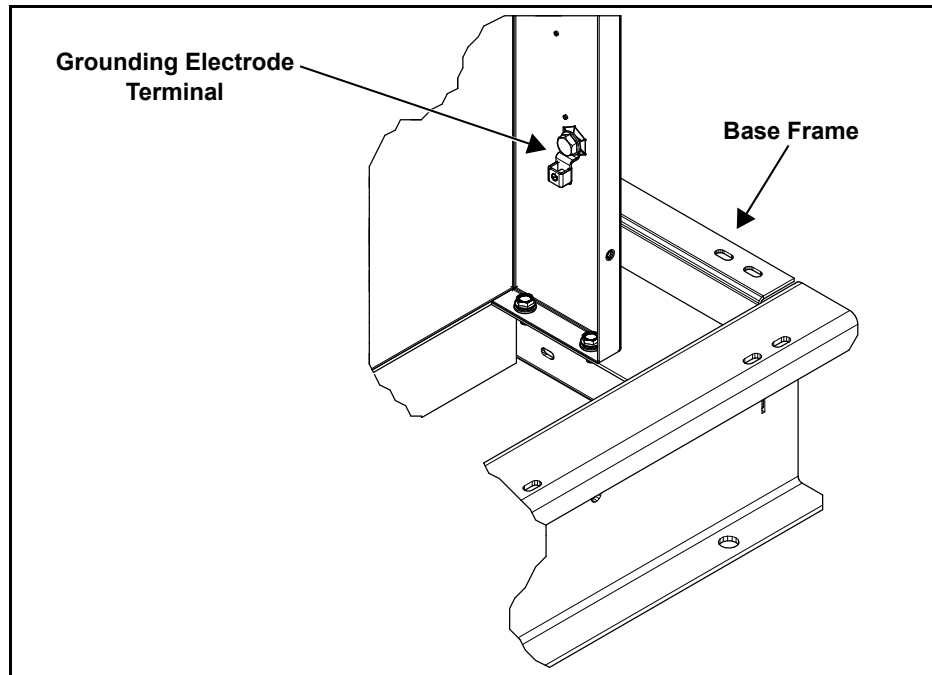


Figure 3-1. Grounding Electrode Terminal (Typical)

3.1.2— Generator AC Neutral Connections

Grounding is recommended only at one point in the system. Consult local building codes for proper neutral grounding requirements.

3.1.3— Initial Startup

The initial startup of the generator set must be performed and documented by an Authorized Service Dealer.

3.2 — H-100 Panel Interface

The H-100 Panel Interface mounted on the generator allows the operator to monitor, and if necessary, manually start the generator.

3.2.1— Emergency Stop Button

The red Emergency Stop Button is the top button on the right side of the panel. Pressing the button while the unit is running will immediately shut the generator down. To restart the unit, the Emergency Stop Button must be manually reset, the Key Switch turned to the “OFF” position, and then turned to either the “AUTO” or “MAN” position, depending on the desired mode of operation.

3.2.2— Common Alarm Horn

Directly below the Emergency Stop Button is a Common Alarm Horn. The “Common Alarm and Digital Output Function #1” are activated whenever a fault condition is set for “Alarm” and if the fault is “Active.” The Common Alarm will not activate on “Warnings” or “DTC” fault conditions. Pressing the “ENTER” button on the key pad will acknowledge the alarm and silence the horn. The manufacturer recommends that the local service dealer be notified of any alarm condition in order for qualified service personnel to assess and correct the situation.



Figure 3-2. H-100 Control Panel Interface

3.2.3— Key Switch

A manual three-position Key Switch is located beneath the Common Alarm Horn. The positions are:

- **AUTO:** The generator will automatically start when a properly connected automatic transfer switch senses a loss or reduction of available utility power.
- **OFF:** Immediately shuts down the generator and/or prevents it from starting automatically.
- **MAN:** Immediately starts the generator.

3.2.4— Left Display Window

The Left Display Window can be configured to display different menus. See the H-100 Operations Manual for more information. Normally, the following information is displayed:

- Volts
- Amps
- Frequency
- Hertz
- Kilowatts

3.2.5— Right Display Window

The Right Display Window displays:

- Alarm information
- HOME menu: basic engine menu information, such as oil pressure, oil temperature, water temperature, battery voltage
- MENU: main menu navigation screen

Alarms	Left Display
Engine	Generator
Status	Diagnostic
Service	Exercise/HTS

Figure 3-3. Right Display Window (Press MENU)

3.2.6— Arrow Keys Pad

The key pad contains four arrow keys, a HOME key, a MENU key, and an ENTER key. Two LEDs are also present, one labeled NOT IN AUTO and the other ALARM.

Use the arrow keys to navigate through the menus displayed in the Display Windows. For example, when the HOME key is pressed, the HOME menu is displayed in the Right Display Window. When a flashing cursor appears within a line of the text, move the cursor up, down, left, or right by pressing the corresponding arrow key.

The NOT IN AUTO LED flashes once each second when the Key Switch is moved to the OFF or MAN positions.

During normal operation when no alarms are present, the ALARM LED flashes for one second every 30 seconds (approximate) to indicate that the panel is operational. When an active alarm condition is detected, the ALARM LED flashes once each second. The LED remains ON if the alarm condition is acknowledged, but still active.

3.2.7— Fuse Block

The fuse block is located inside the control panel at the back lower left corner. The 10 amp fuse in the F2 slot is the control panel fuse.

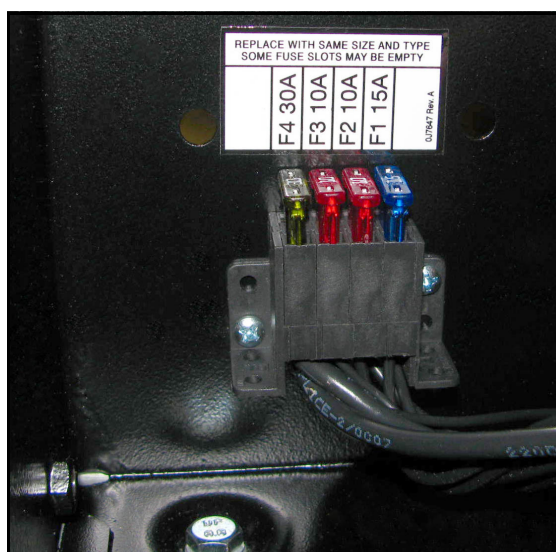


Figure 3-4. Panel Fuse Block

NOTE: Some units will NOT have a fuse in the F4 slot.

3.3 — Additional Components

3.3.1— Main Line Circuit Breaker

A Main Line Circuit Breaker (MLCB) is located on the face of the High Voltage Customer Connections panel, typically situated to the right of the H-100 Control Panel. The MLCB serves as the means of disconnect at the generator, to disconnect it from the Transfer Switch.

3.3.2— Automatic Transfer Switch

A typical automatic transfer switch monitors utility voltage and when that voltage falls outside of specific parameters, it will initiate the generator start command. As long as the generator control is in the AUTO position, it responds to the automatic transfer switch start command.

For information about any connected automatic transfer switch, consult the applicable transfer switch owner's manual.

DANGER!



Connecting this generator to an electrical system normally supplied by an electric utility shall be by means of a transfer switch (either fully automatic or manual), so as to isolate the electric system from the utility distribution system when the generator is operating. Failure to isolate the electric system by these means will result in damage to the generator and may also result in injury or death to utility workers due to backfeed of electrical energy.

3.3.3— Automatic Battery Charger

One of the following types of battery chargers may be provided:

- 2.5-amp
- 10-amp

The 2.5-amp charger is 12 VDC only. The 10-amp charger is available either as a 12 VDC or 24 VDC, as appropriate for the engine's DC system voltage.

Both chargers are fully automatic float types and are fully fuse protected (input and output). They have automatic current limiting to reduce risk of overcharging, and have automatic maintenance of charge voltage. Therefore, they can be connected to the batteries continuously.

The chargers require the connection of a charged battery in order to turn on. The battery provides boost voltage for the charger, so a completely dead battery will not allow the charger to operate. The boost required is approximately 9 to 11 volts for a 12 VDC system, and 18 to 22 volts for a 24 VDC system. Replace the battery if it is below the boost voltage.

3.3.4— Engine Coolant Heater (If Equipped)

Heats the engine coolant when the unit is not operating. This action keeps the engine warm even in cold weather, helping to ensure quicker starts. Powered by a circuit normally fed by the utility power supply.

3.3.5— Engine Oil Sump Heater (If Equipped)

Keeps the oil in the sump heated to allow easier starting and faster engine warm-up. Powered by a circuit normally fed by the utility power supply.

3.3.6— Battery Warmer (If Equipped)

Keeps the battery warm so it can provide full cranking current when starting in cold conditions. Powered by a circuit normally fed by the utility power supply.

3.4 — Alarm Response Procedures

The generator is protected by factory set alarms and warnings. The alarms and warnings alert the owner/operator of a fault condition that requires attention and action to keep the generator operating in an efficient and safe running order.

3.4.1— Alarm Types

When any alarm is triggered, the Common Alarm Horn sounds, the Alarm LED flashes, and the Alarm Page in the Right Display Window becomes active.

NOTE: Not all faults can be corrected and cleared by the owner/operator. Some Warnings and most Alarm conditions must be safely cleared by a qualified dealer or trained technician.

3.4.1.1—Warnings

Warnings are the lowest level alarm, and are generated to alert the operator that an operating condition has changed and may require action or inspection. Warnings clear once they are no longer active.

3.4.1.2—Non-Shutdown Alarms

Non-shutdown alarms are more urgent than warnings, and indicate a system parameter which is approaching or has exceeded a safe operating limit. Non-shutdown alarms require some form of action, such as inspection, close monitoring, etc. These types of alarms clear when they are no longer active and have been acknowledged.

3.4.1.3—Shutdown Alarms

Shutdown Alarms protect the generator from damage and indicate a system fault that if continued without immediate inspection or correction would result in damage to the unit. Shutdown Alarms are cleared only after the key switch has been placed in the OFF position and they are no longer active.

3.4.2— Alarm Display Window

Three system warning and alarm pages can be displayed in the Right Display Window. Each page is capable of displaying three warnings and/or alarms. If there are more than nine total warnings/alarms, only the most recent are displayed. All warnings and alarms remain in the list until they are cleared.

- Warnings clear when they are no longer active.
- Alarms clear when they have been acknowledged and the alarm condition has been corrected.
- Shutdown alarms clear only after they have been acknowledged, the alarm condition has been corrected, the Key Switch has been cycled from the “AUTO” to the “OFF” position, and the alarm is no longer active.

Any active warning or alarm condition will sound the Common Alarm Horn, and the Right Display Window immediately changes to the first alarm page.

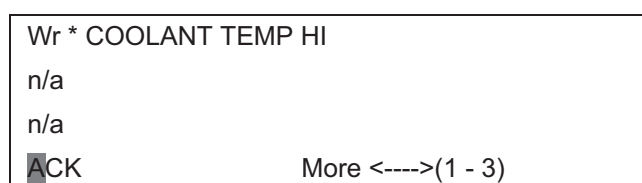


Figure 3-5. System Alarm Warning Page

See Figure 3-5. The alarm page display indicates the following:

Wr	=	Warning (Al = Alarm, SD = Shutdown alarm).
*	=	Indicates the alarm has not been acknowledged.
COOLANT TEMP HI	=	Indicates the fault condition. (Hi = tripped by being above the threshold; Lo = tripped by being below the threshold).
n/a	=	Indicates that no additional alarms or warnings exist and that these lines are vacant.
Cursor flashes on the "A" in "ACK"	=	Press the ENTER key to acknowledge the alarm. The horn stops and the asterisk (*) is removed from the display.
More <--->(1-3)	=	Indicates that as many as three pages of alarm information may be available.

3.4.3— General Fault Response Procedure

1. Press the ENTER key to acknowledge the fault, silence the alarm horn, and switch the ALARM LED from flashing to ON.
2. Carefully read each line of the Alarm Warning Page to determine what fault condition is present. If there is more than one fault, the most recent is listed first.
3. Press the MENU key to display the main menu navigation screen.
4. Depending on the fault condition, use the arrow keys to toggle to the corresponding area and press the ENTER key.
5. Observe the information displayed for the affected area.
6. Determine corrective action necessary.
7. When the fault condition is cleared, the ALARM LED will turn off.

3.5 — Operating the Unit with an Automatic Transfer Switch

If the generator has been installed along with an automatic transfer switch, the engine may be started and stopped automatically or manually.

NOTE: Refer to the applicable manual for any transfer switch being used and note the dangers during operation.

Normal operation is the generator in "Automatic" working with an automatic transfer switch. When the transfer switch senses a utility failure or loss it will provide a start command to the generator, the generator will automatically start and the transfer switch will transfer power to the load from utility to generator (emergency). It is important that both the generator and any connected automatic transfer switch(es) be properly connected and in "Automatic" mode for normal operation to work.

3.6 — Operating the Unit with a Manual Transfer Switch

If the generator was installed in conjunction with a transfer switch capable of manual operation only, or when an automatic transfer switch has failed and can only be transferred manually, the following procedure applies. A manually operated transfer switch is one that will not provide automatic startup.

⚠ DANGER!



DO NOT attempt to operate a manual transfer switch, or an automatic transfer switch in the manual mode, until all power supplies (utility and generator) to the transfer switch have been positively turned OFF, or extremely dangerous, and possibly lethal, electrical shock can result.

Transfer switch enclosure doors should be kept closed and locked. Only authorized personnel should be allowed access to the transfer switch interior. Extremely high and dangerous voltages are present in the transfer switch.

3.6.1— Manual Engine Startup and Transfer

If the unit is equipped with a control panel other than the H-100, refer to the applicable documentation for that panel. For additional and specific information about any transfer switch connected to the generator, refer to the applicable transfer switch manual as well.

In order to manually transfer load from the utility source to the generator (emergency source):

1. With the generator OFF, and the generator Main Line Circuit Breaker in the OFF (OPEN) position, turn OFF or disconnect the utility power circuit to the transfer switch, using the means provided (such as the utility source main line circuit breaker or other means of disconnect).
2. Set the transfer handle to its EMERGENCY (STANDBY/GENERATOR) position with load circuits connected to the emergency (generator) power supply.
3. Set the generator's main line circuit breaker to its OFF (OPEN) position.
4. Start the generator.
5. Allow the engine to stabilize and warm up.
6. Check all applicable instrument and gauge readings. When certain that all readings are correct, set the emergency generator's Main Line Circuit Breaker to its ON (CLOSED) position.
7. Load circuits are now powered by the stationary emergency generator.

3.6.2— Re-Transfer and Shutdown

To manually transfer the load back to the utility power source and shut down the generator:

1. Set the stationary emergency generator's main line circuit breaker to its OFF (OPEN) position.
2. Make sure utility power to the transfer switch is OFF (open the utility disconnect).
3. Manually move the transfer switch handle to its UTILITY (NORMAL) position, i.e., load circuits connected to the utility.
4. Turn ON the utility power supply to the transfer switch using the means provided (such as the utility power source main line circuit breaker).
5. Allow the generator to run at no-load for five to ten minutes to stabilize internal temperatures.
6. Shut down the generator.

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Section 4 Maintenance

4.1 — Maintenance Schedule

Periodic inspection, service, and maintenance of this unit is critical in ensuring its reliable operation. The following is the manufacturer's recommended maintenance schedule. The established intervals are the maximum required when the unit is used in typical standby service applications (approximately 200 hours per year). The maintenance items will need to be performed more frequently if the unit is used in severe applications (such as long duration outages, very high or very low ambient conditions, or extremely dirty/dusty environments). Use the unit hour meter or calendar time, whichever occurs first, from the previous maintenance interval to determine the next required maintenance interval. Note that some checks are based on hours of operation.

There may be times when the generator must operate continuously for long periods of time (for example, extended utility outages). During such extended operational periods some items will require more frequent checking (based on hours). Use the "Extended Run-Time Maintenance Checks" recommendation for such periods of operation.

Be sure to follow all applicable safety and caution statements found in the unit operating manual or engine service/maintenance manual before performing any maintenance checks or service.

This maintenance schedule reflects the minimum tasks that need to be accomplished to ensure that the unit remains operational. A repair shop or person of the owner's choosing may maintain, replace, or repair emissions-control devices and systems. Some maintenance that is non-emissions related may be performed by an authorized operator and other maintenance must be performed by an Authorized/Qualified Service Dealer Technician.

NOTE: An authorized operator is one who has been trained by a Manufacturer Authorized Service Dealer in the proper operation and inspection of this standby generator set.

4.1.1— Service Maintenance Intervals

Extended Run-Time Maintenance Checks: Daily checks which must be performed when the unit is operated continuously for extended periods of time. These checks and routine monthly checks can be performed by an authorized operator.

NOTE: For units equipped with a gearbox, the gearbox oil should be checked monthly or every 100 hours of operation.

- 1A. A **one-time** post installation, initial operation, service inspection of the generator set to ensure it is ready to operate, transfer to, and carry the load when required, and to identify any potential problem areas. *Performed ONLY ONCE following the first three months or the first 50 hours of operation after installation/startup of the unit and requires approximately 2.5 hours per unit to complete.*

The various service maintenance intervals are designated by interval numbers:

1. A frequent, periodic inspection of the generator set to ensure it is ready to operate when required and to identify any potential problem areas. *Performed monthly, or every 24 hours (interrupted) of operation of the unit, and requires approximately 0.5 hours per unit to complete.*
2. An operational service inspection of the generator set to ensure it is ready to operate and carry the load when required, and to identify any potential problem areas. *Performed semi-annually (6 months) or every 100 hours of operation of the unit and requires approximately 1.5 hours per unit to complete.*
3. A mid-level service inspection of the generator set to ensure it is ready to operate and carry the load when required, and to identify any potential problem areas. *Performed annually or every 200 hours of operation of the unit and requires approximately 6.0 hours per unit to complete.*
4. A comprehensive service inspection of the generator set to ensure it is properly serviced and ready to operate and carry the load when required, and to identify any potential problem areas. *Performed biannually (every 24 months or 500 hours) and requires approximately 8.0 hours per unit to complete.*

NOTE: Maintenance levels 2, 3, and 4 require the use of the applicable engine service manual and must be performed by a qualified service technician.

4.1.2— Maintenance Schedule

The following pages contain the maintenance schedule describing the checks/tasks which need to be accomplished at each designated maintenance interval. Some maintenance level tasks are combined. For example, if the 6 month tasks are due, both the monthly and the 6 month task should be completed at the same time. Similarly, when the annual tasks are due, the monthly and semi-annual tasks should also be completed. There is space on the sheets for recording the date and signature of the person completing the task, as well as recording the engine hours and other pertinent information. At the bottom of each sheet, space is also provided to record any fluids added, parts replaced or corrective action taken. All of this recorded information provides a detailed maintenance history of the unit. This maintenance history may be required for warranty validation purposes, and is a good idea to maintain throughout the lifetime of the unit. It is recommended by the manufacturer that service procedures beyond the normal monthly checks be performed by an Authorized Service Dealer.

4.1.3— Notes and Maintenance Item Explanations

Maintenance Item	Description
Oil and Oil Filter	Change oil and filter shortly after start up or commissioning of the unit. The recommendation is that this be done after the first 50 hours of operation or after the first three months of service. Perform oil and filter changes every 200 hours (or yearly) thereafter. If an oil analysis program is used (annually), the acceptable oil change interval can be extended to 500 hours or every 2 years, based on the results of the analysis.
Gearbox Oil (If Equipped)	Change gearbox oil every 2 years or 600 hours of operation. Check gearbox oil level monthly or every 100 hours of operation.
Coolant Quality	Check coolant annually for proper thermal protection levels. Drain, flush, and refill the cooling system with fresh coolant every 2 years regardless of operating hours.
Flexible Hoses	Change coolant, fuel (gaseous supply hoses from regulator to mixer), oil, charge air cooling, and block heater hoses, flexible joints, etc.) every 2 years regardless of operating hours.
Accessory drive belts	Replace accessory drive belts every 2 years regardless of operating hours. If necessary, check and replace automatic tensioner (if used).
Magnetic Pickup(s) mounted on flywheel housing	Remove, clean, inspect, and reset magnetic pickups to the correct operational output voltage every 2 years.
Crank and/or Cam Pickup for ignition system	Visually inspect (outside) for cleanliness and tightness.

NOTE: Certain applications may require more frequent maintenance checks and more frequent operation under load.

NOTE: This schedule does not reflect all of the possible requirements of an individual engine manufacturer service schedule, particularly if the unit is used in other than a standby power application.

NOTE: For more information about service schedules and support for your application, please consult your local Authorized Service Dealer.

Authorized Operator Maintenance Tasks. Perform steps 1 through 8 and 11 every 24 continuous operating hours. These checks require approximately 0.5 hours per unit.		Task Completed Date/Initials
1. Before shutting the unit down, perform a thorough visual inspection for leaks, loose components or connections, excessive apparent wear or damage. Any discrepancies noted should be further inspected and corrected while the unit is shut down.		
2. Shut the unit down per the procedure in the owner's manual.		
3. Check the engine oil level. The level should be between the low and full markings on the dipstick. Adjust as necessary.		
4. Check the engine coolant level. Make sure the level in the coolant catch tank is between the cold and hot level markings. Adjust as necessary. Use only a 50/50 mixture of appropriate coolant.		
5. Visually inspect the engine accessory drive belts and fan coupling device (if equipped) for correct tension and any signs of abrasion, wear, deterioration or damage. Correct as necessary.		
6. Visually inspect all hoses and connections (exhaust, intake, coolant, block heater, fuel lines and filters, oil filters, etc) for leaks, tightness, signs of deterioration, wear, or damage. Correct as necessary.		
7. Check the air inlets and outlets (enclosure or building vents) for debris or blockage. Correct as necessary.		
8. Visually inspect the fuel supply system for signs of leaks or damage. Correct as necessary.		
9. Gearbox Equipped Only: Check the gearbox oil level every 100 operating hours. Adjust as necessary.		
10. Weekly When Operating: Check the battery electrolyte level (if accessible). Adjust as necessary (add only distilled or deionized water to replenish battery cells).		
11. Return the unit to operational condition and restart. Check unit voltage and frequency. Visually inspect the unit for leaks, loose connections or components. Place the unit back in service.		
Date Inspection Completed: _____ Unit Hour-Meter Reading: _____		
Technician/Authorized Operator Signature signifying inspection complete: _____		
Record any oil or coolant added and notes about any discrepancies found and corrective action taken.		

One Time at 50 Hours / 3 Months. These maintenance tasks must be performed by a trained/qualified service technician. Comply with all safety notices contained in the Owner's Manual. Some of these tasks require the use of the applicable engine service manual.

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Owner's Manual for Gaseous Fueled Industrial Generators

Authorized Operator Maintenance Tasks Requires approximately 0.5 hours per unit.	Task Completed Date/Initials
1. Disable the unit from operating per the instructions in the owner's manual.	
2. Check the engine oil level. The level should be between the low and full markings on the dipstick. Adjust as necessary.	
3. Gearbox Equipped Only: Check the gearbox oil level. Adjust as necessary.	
4. Check the engine coolant level. Make sure the level in the coolant catch tank is between the cold and hot level markings. Adjust as necessary. Use only a 50/50 mixture of appropriate coolant.	
5. Check the battery electrolyte level (if accessible). Adjust as necessary (add only distilled or deionized water to replenish battery cells).	
6. Check the battery terminal posts, connections, cables and charger connections, and battery hold-downs for signs of corrosion, looseness, etc. Remove, clean and tighten connections as necessary.	
7. Check operation and condition of the battery charger. Check operation and condition of optional block heater, oil sump heater, and battery warmer (if equipped). Correct discrepancies as necessary.	
8. Check the air inlets and outlets (enclosure or building vents) for debris or blockage. Correct as necessary.	
9. Visually inspect the fuel supply system for signs of leaks or damage. Correct as necessary.	
10. Perform a 5 minute, no-load operational test of the unit. Check unit voltage and frequency. Visually inspect the unit for leaks, wear, damage, loose connections or components, and corrosion. Correct as necessary. Voltage: Frequency:	
11. If the control has alarm and/or event or run logs, record the alarm and event logs to a history file for the unit.	
12. Return the unit to operational condition.	
Date Inspection Completed: Unit Hour-Meter Reading:	
Technician/Authorized Operator Signature signifying inspection complete:	
Record any oil or coolant added and notes about any discrepancies found and corrective action taken.	

These maintenance tasks must be performed by a trained/qualified service technician. Perform these tasks every 6 months or every 100 hours of operation. Perform these tasks in addition to the regularly scheduled Monthly maintenance tasks. Comply with all safety notices contained in the Owner's Manual. Some of the tasks will require the use of the applicable engine service manual.

Qualified Service Technician Maintenance Tasks Requires approximately 2.0 hours per unit.		Task Completed Date/Initials
1.	Disable the unit from operating per the procedure found in the owner's manual.	
2.	Check the engine accessory drive belts and fan coupling device (if equipped) for correct tension, wear, abrasion, deterioration, or damage. Correct as necessary.	
3.	Check all hoses, piping, and connections (intake, exhaust, coolant, block heater, fuel and filters, oil lines and filters) for tightness, leaks, deterioration or damage. Correct as necessary.	
4.	Load test the battery or test electrolyte levels (specific gravity) with a hydrometer.	
5.	Return the unit to operational condition and test. Place the unit in automatic and open the service disconnect to force the unit to start and transfer to the load. Exercise the unit against the load for 15 minutes, visually inspecting for leaks, loose connections or components, and any abnormal operating conditions. Record the unit voltage and frequency while running. Restore utility power and monitor transfer to utility, cool-down and shutdown. Correct any discrepancies. Voltage: Frequency: kW: kVA:	
6.	If the control has alarm and/or event or run logs, record the alarm and event logs to a history file for the unit.	
7.	Return the unit to operational condition.	
Date Inspection Completed:		Unit Hour-Meter Reading:
Technician/Authorized Operator signature signifying inspection complete:		
Record any oil or coolant added and notes about any discrepancies found and corrective action taken.		

Qualified Service Technician Maintenance Tasks Requires approximately 6.0 hours per unit.		Task Completed Date/Initials
1.	Disable the unit from operating per the procedure found in the owner's manual. Some of the following tasks will require the use of the applicable engine service manual.	
2.	Gearbox Equipped Only: Change the gearbox oil. Can be extended to 600 hours.	
3.	Replace the engine air filter(s).	
4.	Replace the spark plugs. Gap per the engine specifications.	
5.	Replace the engine accessory drive belts. Inspect and lubricate (if required) the belt tensioning device (if equipped) and replace if necessary.	
6.	Drain and flush the cooling system. Refill with fresh coolant of appropriate type (50/50 mixture).	
7.	Replace all flexible hoses: Coolant hoses including the block heater hoses and vaporizer hoses (if equipped); charge air system connection hoses/joints/couplings, and any flexible fuel or oil lines.	
8.	Remove, clean, inspect, reinstall and reset to correct voltage level the flywheel magnetic pickup(s) (if equipped).	
9.	Return the unit to operational condition and test. Place the unit in automatic and open the service disconnect to force the unit to start and transfer to the load. Use an appropriate load bank to supplement load to full rated load (100% kW at rated kVA) if possible. Exercise the unit against the load for 2 hours (120 minutes). Visually inspect for leaks, loose connections or components, and any abnormal operating conditions. Record the unit voltage, frequency, kW and kVA while running. Remove the load bank load, restore utility power and monitor transfer to utility, cool-down and shutdown. Correct any discrepancies. Voltage: Frequency: kW: kVA:	
10.	If control has alarm and/or event or run logs, record the alarm and event logs to a history file.	
11.	Return the unit to operational condition and place back in automatic operation.	
Date Inspection Completed:		Unit Hour-Meter Reading:
Technician/Authorized Operator signature signifying inspection complete:		
Record any oil or coolant added and notes about any discrepancies found and corrective action taken.		

4.8 — Disabling a Generator for Maintenance

⚠ CAUTION!



There are two conditions when maintenance checks may have to be performed on the unit:

1. When the unit is in standby mode (automatic) and NOT running. To disable the unit from starting in this condition, in order to perform maintenance checks or service, follow the steps in 4.2.1.
2. **When the unit is running and providing power to the load. To shut down the unit safely, without damaging loads or the generator, follow the steps for shutting down a unit while in operation. Before shutting down an operating unit for maintenance, always make sure that personnel are warned that the power will be shut down temporarily, so that equipment that might be damaged can be properly turned off or placed in standby.**

4.8.1— To Disable the Generator From Starting

To prevent injury, BEFORE performing any maintenance, disable the generator set from starting and/or connecting to the load:

1. Set the control panel AUTO/OFF/MANUAL switch to the OFF position.
2. Remove the control panel fuse (F2-10A fuse).
3. Turn off power to the battery charger (remove battery charger ATC style fuse or open the battery charger circuit breaker located in the load control panel).
4. Disconnect the negative battery cable.

NOTE: The battery charger must be turned off BEFORE disconnecting the battery cable to prevent an over-current condition from burning out sensitive control panel components and circuits.

NOTE: Following any maintenance, reverse these steps to insure the unit is returned to standby setup for normal operation.

4.8.2— Shutdown and Restart an Operating Generator

If the unit is operating and required checks must be performed:

1. Ensure that power to the load can be interrupted (warn any equipment users that there will be a temporary power disruption). There may be other procedures that must be done before shutting a unit down, depending on application.
2. Open the generator Main Line Circuit Breaker (MLCB).
3. Allow the unit to cool down (running at no-load) for approximately 5 minutes to prevent damage to critical engine components.
4. Set the control panel AUTO/OFF/MANUAL switch to the OFF position. There may be safety tag-outs or lockouts required at this point, depending on application.
5. Perform the necessary maintenance checks or tasks (based on the hourly requirements).
6. When all checks have been completed and any discrepancies corrected, set the control panel AUTO/OFF/MANUAL switch to the AUTO position.
7. When the generator is running, and all engine/generator parameters (voltage, frequency, coolant temp, oil pressure, etc.) have been verified as correct, close the generator Main Line Circuit Breaker (MLCB). The unit will accept and carry the load.
8. Make a last visual inspection of the generator set to make sure it is operating properly.

4.9 — Maintenance Tasks

4.9.1— Visually Inspect Unit

Perform a visual inspection of the unit periodically. If problems are found contact your local authorized service dealer. Look for the following:

- Any debris, trash, grass or weed growth, which would obstruct the flow of cooling air into and out of the unit ventilation louvers.
- Visually inspect hoses and hose connections for signs of leakage. This includes all coolant hoses, fuel hoses, exhaust system connections, intake system connections, etc. Also look at the engine block and gearbox (if equipped) for signs of fluid leakage.
- Visually inspect the engine accessory drive belts for evidence of obvious wear, fraying or deterioration, and obvious looseness. A “squealing” sound heard during starting and running could indicate a loose belt.

4.9.2— Check Engine Fluids

The following checks can be performed by a trained authorized operator. Observe all safety precautions outlined in the “Safety” section.

4.9.2.1—Check Engine Oil Level

An authorized operator should check the levels of engine oil and engine coolant monthly (or every 24 hours of operation). The oil level should be maintained between the “FULL” and “ADD” marks on the engine dipstick. Recommended fluids are listed in Subsection 2.6.2.

To check the engine oil:

1. Locate the engine oil dipstick.
2. The most accurate oil level readings are measured when the engine is cold. If the engine was running, wait at least 10 minutes before proceeding.
3. Remove the dipstick and wipe it dry with a clean, lint free cloth.
4. Slowly insert the clean dipstick into the tube. Visually confirm that the dipstick is fully seated in the dipstick tube. A visual inspection is required because some dipsticks will require more effort than others to fully seat.
5. After 10 seconds remove the dipstick.
6. Look at the oil level on both sides of the dipstick. The lower of the two readings will be the correct oil level measurement.
7. Add oil (if necessary) to adjust the level. After adding or changing the oil, the engine should run for one minute before checking the oil level. Remember to wait 10 minutes to allow the engine to cool and oil to fully drain into the oil pan.

Typical causes of inaccurate oil level readings:

- Reading the high level of the dipstick.
- Reading the dipstick before the oil fully drains into the oil pan.
- Inserting and removing the dipstick too quickly.
- The dipstick is not fully seated in the dipstick tube.

4.9.2.2—Check Coolant Level

⚠ DANGER!

- **DO NOT** remove the radiator pressure cap while the engine is hot. Serious burns from boiling liquid or steam could result.
- Add coolant only to the expansion tank when the engine is cool (not at operating temperature).
- Ethylene glycol base antifreeze is poisonous. Do not use mouth-to-siphon coolant from the radiator, recovery bottle, or any container. Wash hands thoroughly after handling. Never store used antifreeze in an open container because animals are attracted to the smell and the taste of antifreeze even though it is poisonous.



Do not use any chromate base rust inhibitor with propylene glycol base antifreeze. Using any high silicate anti-freeze boosters or additives also will cause overheating. The manufacturer also recommends that any soluble oil inhibitor is NOT USED for this equipment.

Visually check the coolant expansion tank and make sure the coolant level is between the “Cold” and “Hot” level markings. To add coolant to the system add it to the expansion tank when the engine is cool (not at operating temperature, not running). Add only a 50/50 mixture of the correct antifreeze and distilled or deionized water to the coolant system.

4.9.2.3—Check/Change Gearbox Oil (If Equipped)

Check monthly, or every 100 hours of operation. Biannually (or every 600 hours), an authorized service technician should completely drain and refill the gearbox.

Gear oil used is 80W-90. Lucas Heavy Duty Oil Stabilizer should be added as follows by Fluid volume:

- 390 Gearbox - Approximately 32 oz. total. 26 oz. gear oil and 6 oz. Lucas Heavy Duty Oil Stabilizer.
- 520 Gearbox - Approximately 55 oz. total. 44 oz. gear oil and 11 oz. Lucas Heavy Duty Oil Stabilizer.

To Check Gearbox Oil Level:

1. Disable the generator from starting.
2. Remove the oil level check plug. See Figure 4-1.
3. The oil level should be at the bottom edge of the oil level check plug hole.
4. To add oil, remove the oil filler/vent cap, and fill through the vent line.
5. Replace the vent cap and oil level check plug and tighten.

NOTE: Do NOT overfill the gearbox. If too much fluid is added let the excess drain from the level check plug hole and collect it in a suitable container or with rags.

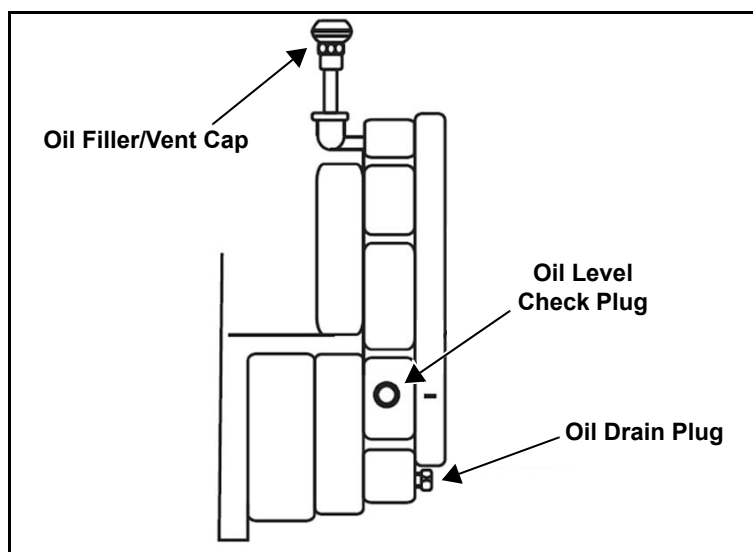


Figure 4-1. Gearbox Oil Servicing Points

To change the gearbox oil:

1. Disable the generator from starting.
2. Remove the oil drain plug and drain the oil into an appropriate container. Properly dispose of or recycle the oil.
3. Reinstall the oil drain plug.
4. To add oil to the gearbox, remove the oil level check plug and oil filler/vent cap.
5. Add the recommended oil/stabilizer mix until it just starts to flow from the oil level check plug opening.
6. Install and tighten the oil filler/vent cap and oil level check plug.

Return the generator to operating condition. Start the unit and check for leaks.

4.9.3— Battery Inspection

⚠ DANGER!



Stationary emergency generators installed with automatic transfer switches will crank and start automatically when NORMAL (UTILITY) source voltage is removed or is below an acceptable preset level. To prevent automatic startup and possible injury to personnel, do not connect battery cables until NORMAL source voltage at the transfer switch is correct and the system is ready to be placed into operation.



Storage batteries give off EXPLOSIVE hydrogen gas. This gas can form an explosive mixture around the battery for several hours after charging. The slightest spark can ignite the gas and cause an explosion. An explosion can shatter the battery and cause blindness or other injury. Any area that houses a storage battery must be properly ventilated. Do not allow smoking, open flame, sparks, or any spark producing tools or equipment near the battery.



Battery electrolyte fluid is an extremely caustic sulfuric acid solution that can cause severe burns. Do not permit fluid to contact eyes, skin, clothing, painted surfaces, etc. Wear protective goggles, protective clothing and gloves when handling a battery. If fluid is spilled, flush the affected area immediately with clear water.



DO NOT dispose of the battery in a fire. The battery is capable of exploding.



DO NOT open or mutilate the battery. Released electrolyte can be toxic and harmful to the skin and eyes.



The battery represents a risk of high short circuit current. When working on the battery, always remove watches, rings, or other metal objects, and only use tools that have insulated handles.

An authorized operator should inspect the engine battery system monthly. At this time, the battery fluid level should be checked and distilled water added if needed. Battery cables and connections also should be inspected for cleanliness and corrosion.

Once every six months, an Authorized Service Technician should inspect the battery system. At this time the battery condition and state of charge should be checked using a battery hydrometer. The battery should be recharged or replaced as required.



Servicing of the battery is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries. Observe the following precautions when working on batteries:

- Remove the 10A F2 fuse from the generator control panel.
- Remove watches, rings, or other metal objects.
- Use tools with insulated handles.
- Wear rubber gloves and boots.
- Do not lay tools or metal parts on top of the battery.

- Disconnect the charging source prior to connecting or disconnecting battery terminals. Remove the battery charger fuse (ATC style fuse, 5 amp on the 2.5 charger and 15 amp on the 10A charger).
- Wear full eye protection and protective clothing.
- Where electrolyte contacts the skin, wash it off immediately with water.
- Where electrolyte contacts the eyes, flush thoroughly and immediately with water and seek medical attention.
- Spilled electrolyte is to be washed down with an acid neutralizing agent. A common practice is to use a solution of 1 pound (500 grams) bicarbonate of soda to 1 gallon (4 liters) of water. The bicarbonate of soda solution is to be added until the evidence of reaction (foaming) has ceased. The resulting liquid is to be flushed with water.



Lead-acid batteries present a risk of fire because they generate hydrogen gas.

- DO NOT SMOKE when near the battery.
- DO NOT cause flame or spark in battery area.
- Discharge static electricity from the body before touching the battery by first touching a grounded metal surface.



Be sure the AUTO/OFF/MANUAL switch is set in the OFF position before connecting the battery cables. If the switch is set to AUTO or MANUAL, the generator can crank and start as soon as the battery cables are connected.



Be sure the utility power supply to the battery charger is turned OFF and the 10A and 15A fuses are removed from the generator control panel and the ATC style fuse removed from the battery charger, or sparking may occur at the battery posts as the cables are attached and cause an explosion.

NOTE: A negative ground system is used. Battery connections are shown on the wiring diagrams. Make sure the battery is correctly connected and terminals are tight. Observe battery polarity when connecting the battery to the generator set.

4.9.4— Battery Installation and Replacement

When required, the battery must be replaced with one of equivalent size, voltage, and CCA (cold crank amp capacity). Consult the Unit Specification Sheet or contact the local Authorized Service Dealer for proper battery sizing.

A new battery must be filled with the proper electrolyte and be fully charged before installing.

Preliminary Instructions

1. Set the AUTO/OFF/MANUAL switch on the generator control panel to OFF.
2. Turn off utility power supply to the battery charger circuit.
3. Remove the 10A fuse from the generator control panel.
4. Remove the ATC style fuse from the battery charger.

Battery cables are connected to the generator connection points at the factory. Connect the cables to the battery posts as shown in Figure 4-2.

12VDC System

1. Connect the red battery cable from the starter contactor to the positive (POS or +) battery post.
2. Connect the black battery cable to the frame ground to the negative (NEG or -) battery post.

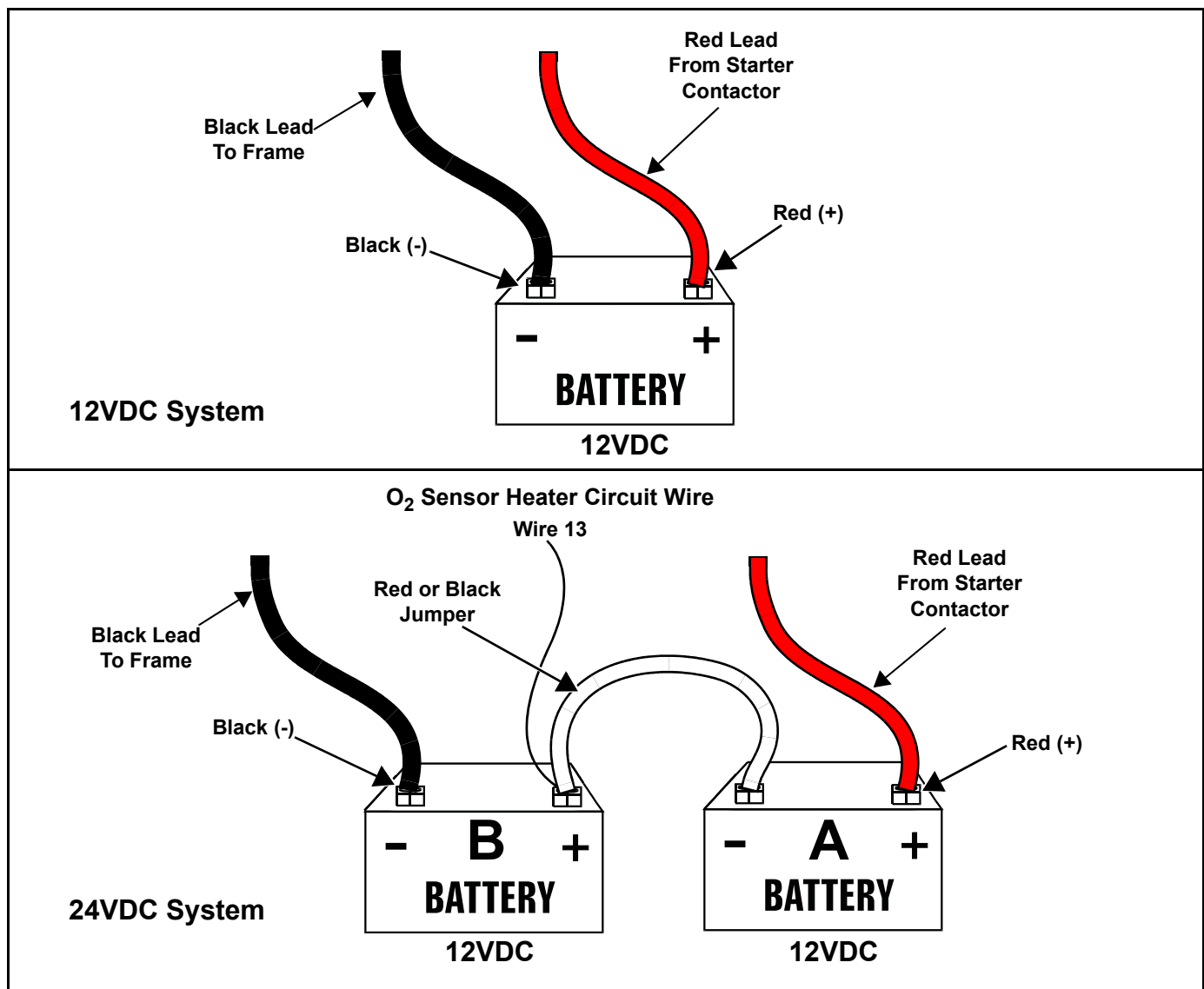


Figure 4-2. Battery Cable Connections

24VDC System

1. Connect the red battery cable from the starter contactor to the positive (POS or +) post of battery A.
2. Connect the black battery cable to the frame ground to the negative (NEG or -) post of battery B.

NOTE: On 24V gaseous units, center tap the wire for the oxygen sensor heater circuit (Wire 13) between the batteries as shown in Figure 4-2.

3. Connect either a black or red jumper cable from the negative (NEG or -) post of battery A to the positive (POS or +) post of battery B.

Final Instructions

1. Install the ATC style fuse in the battery charger.
2. Install the 10A fuse in the generator control panel.
3. Turn on the utility power supply to the battery charger circuit.
4. If the unit was previously operational, turn the AUTO/OFF/MANUAL switch on the generator control panel to AUTO.



Damage will result if the battery connections are made in reverse.

4.9.5— Other Maintenance Checks

The following inspections should be performed by a qualified/authorized service technician, or a properly trained authorized operator. These maintenance items require a high level of experience and skill to evaluate and correct.

- Inspect engine accessory drive belts
- Inspect hoses and connections
- Inspect fuel supply system
- Inspect exhaust system

4.10 — Maintenance and Repair Parts

All non-emissions related service maintenance or repairs should be completed by an authorized service technician to maintain the warranty status of a unit. Emissions related maintenance and repairs may be performed by a person or repair shop of the owner's choosing.

