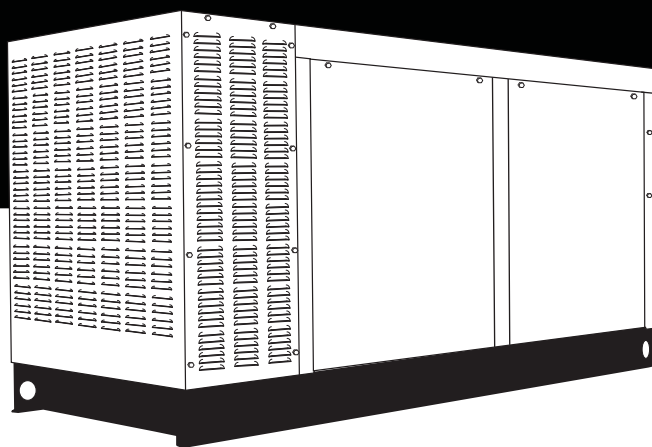


Serial Number

2.4L
Industrial
25kW Models
EPA Certified

STATIONARY EMERGENCY GENERATOR OWNER'S MANUAL



A new standard of reliability

— ⚠ **CAUTION** ⚠ —

ONLY QUALIFIED ELECTRICIANS OR CONTRACTORS SHOULD ATTEMPT INSTALLATION!
DEADLY EXHAUST FUMES. OUTDOOR INSTALLATION ONLY!

This manual should remain with the unit.

SECTION	PAGE
INTRODUCTION	1-1
Read this Manual Thoroughly.....	1-1
Operation and Maintenance.....	1-1
How to Obtain Service.....	1-1
SAFETY RULES	1-2
IDENTIFICATION RECORD	2-1
Data Label.....	2-1
EQUIPMENT DESCRIPTION	3-1
Equipment Description.....	3-1
Engine Oil Recommendations.....	3-1
Coolant Recommendations.....	3-1
ENGINE PROTECTIVE DEVICES	4-1
Engine Protective Devices.....	4-1
Coolant Temperature Sensing.....	4-1
Low Coolant Level.....	4-1
Oil Pressure Sensing.....	4-1
Overcrank Shutdown.....	4-1
Overspeed Shutdown.....	4-1
RPM Sensor Loss Shutdown.....	4-1
DC Fuse.....	4-1
FUEL SYSTEMS	5-1
Fuel Requirements.....	5-1
Natural Gas Fuel System.....	5-1
Propane Vapor Withdrawal Fuel System.....	5-1
LP Liquid Fuel System.....	5-1
SPECIFICATIONS	6-1
Stationary Emergency Generator.....	6-1
Engine.....	6-1
Cooling System.....	6-1
Fuel System.....	6-1
Electrical System.....	6-1
Cold Weather Kit.....	6-2
Reconfiguring the Fuel System.....	6-2
Fuel System.....	6-2
Wire Harness.....	6-3
Ignition Control Module.....	6-3
Ignition Description.....	6-3
Ignition Shutdown on Loss of Flywheel or Cam/Distributor Signals.....	6-3
Diagnostic Blink Patterns (Ignition Red LED).....	6-4
GENERAL INFORMATION	7-1
Alternator AC Lead Connections.....	7-1
Four-lead, Single-phase Stator.....	7-1
Alternator Power Winding Connections.....	7-1
3-phase Alternators.....	7-1
3-phase Alternators ("Delta" Configuration).....	7-2
INSTALLATION	8-1
Installation.....	8-1
Preparation Before Start-up.....	8-1
Transfer Switch.....	8-1
Fuel System.....	8-1
Generator Set Lubrication.....	8-1
Prior to Initial Start-up.....	8-1
Engine Coolant.....	8-1
Belt Tension.....	8-1
Electrical System.....	8-1
Initial Inspection for Genset Start-up.....	8-1
Start-up Checklist.....	8-2
Preparation for Start-up.....	8-2
OPERATION	9-1
Stationary Emergency Generator Control and Operation.....	9-1
Operating Unit with Manual Transfer Switch.....	9-1
Engine Start-up and Transfer.....	9-1
Retransfer and Shutdown.....	9-1
Operating Unit with Automatic Transfer Switch.....	9-1
MAINTENANCE	10-1
Maintenance Performed by Service Dealers/Contractors.....	10-1
Every Three Months.....	10-1
Once Every Six Months.....	10-1
Once Annually.....	10-1
First 30 Operating Hours.....	10-1
First 100 Operating Hours.....	10-1
Every 500 Operating Hours.....	10-1
Cooling System.....	10-1
Overload Protection for Engine DC Electrical System.....	10-1
Checking Fluid Levels.....	10-1
Check Engine Oil.....	10-1
Battery Fluid.....	10-2
Engine Coolant.....	10-2
Maintenance Owner/Operator Can Perform.....	10-2
Check Engine Oil Level.....	10-2
Check Battery.....	10-2
Exercise System.....	10-2
Inspect Cooling System.....	10-2
Check Engine Coolant Level.....	10-2
Perform Visual Inspection.....	10-2
Inspect Exhaust System.....	10-2
Check Fan Belt.....	10-2
Inspect Engine Governor.....	10-2
Changing Engine Oil.....	10-2
Changing the Engine Air Cleaner.....	10-3
Spark Plugs.....	10-3
Coolant Change.....	10-3
Miscellaneous Maintenance.....	10-3
Cleaning the Stationary Emergency Generator.....	10-3
Battery.....	10-4
Battery Maintenance.....	10-4
Battery Replacement.....	10-4
Repair Parts.....	10-4
SERVICE SCHEDULE	11-1
TROUBLESHOOTING	12-1
Troubleshooting Guide.....	12-1
EMISSIONS WARRANTY	13-1
NOTES	



 **SAVE THESE INSTRUCTIONS** – 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. 

INTRODUCTION

Thank you for purchasing this model of the stationary emergency generator product line.

Every effort was expended to make sure that the information and instructions in this manual were both accurate and current at the time the manual was written. However, the manufacturer reserves the right to change, alter or otherwise improve this product(s) at any time without prior notice.

◆ READ THIS MANUAL THOROUGHLY

If any portion of this manual is not understood, contact the nearest Service Dealer for starting, operating and servicing procedures.

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

— **DANGER** —

After this heading, read instructions that, if not strictly complied with, will result in serious personal injury, including death, or property damage.

— **WARNING** —

After this heading, read instructions that, if not strictly complied with, may result in personal injury or property damage.

— **CAUTION** —

After this heading, read instructions that, if not strictly complied with, could result in damage to equipment and/or property.

NOTE:

After this heading, read explanatory statements that require special emphasis.

These safety warnings cannot eliminate the hazards that they indicate. Common sense and strict compliance with the special instructions while performing the service are essential to preventing accidents.

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 of others.**

 **This symbol points out potential explosion hazard.**

 **This symbol points out potential fire hazard.**

 **This symbol points out potential electrical shock hazard.**

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 instructing other users to properly start and operate the unit. This prepares them if they need to operate the equipment in an emergency.

For safety reasons, the manufacturer recommends that this equipment be installed, serviced and repaired by a 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.

◆ OPERATION AND MAINTENANCE

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 a 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 ensure a minimum number of problems and keep operating expenses at a minimum. See a Service Dealer for service aids and accessories.

Operating instructions presented in this manual assume that the generator electric system has been installed by a Service Dealer or other competent, qualified contractor. Installation of this equipment is not a "do-it-yourself" project.

◆ HOW TO OBTAIN SERVICE

When the generator requires servicing or repairs, simply contact a Service Dealer for assistance. Service technicians are factory-trained and are capable of handling all service needs.

When contacting a Service Dealer about parts and service, always supply the complete model number of the unit as given on the front cover of this manual or on the DATA LABEL affixed to the unit.



Standby Emergency Generator Important Safety Instructions



WARNING:



The engine exhaust from this product contains chemicals known to the state of California to cause cancer, birth defects or other reproductive harm.



WARNING:



This product contains or emits chemicals known to the state of California to cause cancer, birth defects or other reproductive harm.

Study these SAFETY RULES carefully before installing, 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 a procedure, work method or operating technique is used that 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 this equipment imprudently, neglecting its maintenance or being careless can cause possible injury or death. Permit only responsible and capable persons to install, operate or maintain this equipment.



Potentially lethal voltages are generated by these machines. Ensure all steps are taken to render the machine safe before attempting to work on the generator.



Parts of the generator are rotating and/or hot during operation. Exercise care near running generators.



GENERAL HAZARDS

- For safety reasons, the manufacturer recommends that this equipment be installed, serviced and repaired by a 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 always comply with applicable codes, standards, laws and regulations. Adhere strictly to local, state and national electrical and building codes. Comply with regulations the Occupational Safety and Health Administration (OSHA) has established. 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 gas, which can be DEADLY. This dangerous gas, if breathed in sufficient concentrations, can cause unconsciousness or even death. For that reason, adequate ventilation must be provided. This should be considered prior to installing the generator. The unit should be positioned to direct exhaust gasses safely away from any building where people, animals, etc., will not be harmed. Any exhaust stacks that ship loose with the unit must be installed properly per the manufacturer's instruction, and 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.
- 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 all worn, damaged or defective parts using only factory-approved parts.
- Before performing any maintenance on the generator, disconnect its battery cables to prevent accidental start-up. Disconnect the cable from the battery post indicated by a NEGATIVE, NEG or (–) first. Reconnect that 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.



Standby Emergency Generator Important Safety Instructions



ELECTRICAL HAZARDS

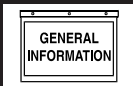
- All stationary emergency generators covered by this manual produce dangerous electrical voltages and can cause fatal electrical shock. Utility power delivers extremely high and dangerous voltages to the transfer switch as well as the generator. Avoid contact with bare wires, terminals, connections, etc., on the generator as well as the transfer switch, if applicable. Ensure all appropriate covers, guards and barriers are in place before operating the generator. If work must be done around an operating unit, stand on an insulated, dry surface to reduce 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 personnel 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 National Electrical Code (NEC) requires the frame and external electrically conductive parts of the generator to be connected to an approved earth ground. This grounding will help prevent dangerous electrical shock that might be caused by a ground fault condition in the generator or by static electricity. Never disconnect the ground wire.
- 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 source. 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.
- Stationary emergency 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 start-up 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 causing injury.

FIRE HAZARDS

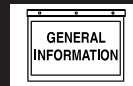
- Keep a fire extinguisher near the generator at all times. Do NOT use any carbon tetra-chloride type extinguisher. Its fumes are toxic, and the liquid can deteriorate wiring insulation. Keep the extinguisher properly charged and be familiar with its use. If there are any questions pertaining to fire extinguishers, consult the local fire department.

EXPLOSION HAZARDS

- Properly ventilate any room or building housing the generator to prevent build-up 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.
- These generators may operate using one of several types of fuels. 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.
- Diesel fuels are highly FLAMMABLE. Gaseous fluids such as natural gas and liquid propane (LP) gas are extremely EXPLOSIVE. Natural gas is lighter than air, and LP gas is heavier than air; install leak detectors accordingly.



Stationary Emergency Generator General Information



IDENTIFICATION RECORD

◆ DATA LABEL

Every generator set has a DATA LABEL that contains important information pertinent to the generator. The data label, which can be found attached to the generator's lower connection box, lists the unit's serial number and its rated voltage, amps, wattage capacity, phase, frequency, rpm, power factor, production date, etc.

NOTE:

For actual information related to this particular model, please refer to the Manual Drawing Listing located at the end of this manual, or to the data label affixed to the unit.

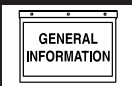
★ *Stationary Emergency Generator Model and Serial Number*

This number is the key to numerous engineering and manufacturing details pertaining to your unit. Always supply this number when requesting service, ordering parts or seeking information.

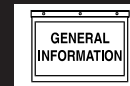
Data Label

MODEL			
PROD DATE		SERIAL	
KW	KVA	PHASE	HERTZ
VOLT	AMP	PWR FACT	ALT RPM
ENG RPM	TYPE CODE		
ALT SUBTRANS REACTANCE		ALT TRANS REACTANCE	
CLASS ☐ ROTOR ☐ STATOR WINDING INS AT 25°C AMB			
MODEL NO (CAT/CUST NO)		SERIAL NO	

0G2110 REV C



Stationary Emergency Generator Equipment Description



EQUIPMENT DESCRIPTION

This equipment is a revolving field, alternating current Stationary Emergency Generator. It is powered by a gaseous fueled engine operating at 1800 rpm for 4-pole direct drive units, 3600 rpm for 2-pole direct drive units and 2300 - 3000 rpm for quiet drive gear units. See the Specifications section for exact numbers. The unit comes complete with a sound attenuated enclosure, internally mounted muffler, control console, mainline circuit breaker, battery charger, and protective alarms as explained in the following paragraph.

All AC connections, including the power leads from the alternator, 120 volt battery charger input and control connections to the transfer switch are available in the main connection box.

The Stationary Emergency Generator incorporates the following alternator features:

- Rotor and Stator insulation class is rated as defined by NEMA MG1-32.6, NEMA MG1-1.66. The generator is self ventilated and drip-proof constructed. Refer to the Specifications section or the data label for the class ratings.
- The voltage waveform deviation, total harmonic content of the AC waveform and telephone influence factor have been evaluated and are acceptable according to NEMA MG1-32.

ENGINE OIL RECOMMENDATIONS

The unit has been filled with 5W-20 engine oil at the factory. Use a high-quality detergent oil classified "For Service SJ or SH." Detergent oils keep the engine cleaner and reduce carbon deposits. When changing the engine oil, be sure to use 5W-30 engine oil.



- Any attempt to crank or start the engine before it has been properly serviced with the recommended oil may result in an engine failure.**

NOTE:

For temperatures below 32° F, it is strongly recommended to use the optional Cold Weather Start Kit (part number listed in the Specification Section). The oil grade for temperatures below 32° F is 5W-30 synthetic oil.

COOLANT RECOMMENDATIONS

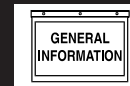
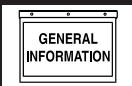
Use a mixture of half low silicate ethylene glycol base anti-freeze and deionized water. Cooling system capacity is listed in the specifications. Use only deionized water and only low silicate anti-freeze. If desired, add a high quality rust inhibitor to the recommended coolant mixture. When adding coolant, always add the recommended 50-50 mixture.



- Do not use any chromate base rust inhibitor with ethylene glycol base anti-freeze or chromium hydroxide ("green slime") forms and will cause overheating. Engines that have been operated with a chromate base rust inhibitor must be chemically cleaned before adding ethylene glycol base anti-freeze. Using any high silicate anti-freeze boosters or additives will also cause overheating. The manufacturer also recommends that any soluble oil inhibitor is NOT used for this equipment.**



- Do not remove the radiator pressure cap while the engine is hot or 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 taste of antifreeze even though it is poisonous to them.**



ENGINE PROTECTIVE DEVICES

The Stationary Emergency Generator may be required to operate for long periods of time without an operator on hand to monitor such engine conditions as coolant temperature, oil pressure or rpm. For that reason, the engine has several devices designed to protect it against potentially damaging conditions by automatically shutting down the unit when the oil pressure is too low, the coolant temperature is too high, the coolant level is too low, or the engine is running too fast.

NOTE:

Engine protective switches and sensors are mentioned here for the reader's convenience. Also refer to the applicable control panel manual for additional automatic engine shutdown information.

◆ COOLANT TEMPERATURE SENSING

An analog Water Temperature Sender (WTS) is located in the engine's cooling system. This sender is connected to the panel and allows the panel to monitor and display the temperature of the coolant system.

The WTS is a resistive device whose resistance changes based on coolant temperature. The resistance of the sender results in a voltage being developed across the sender. As the Coolant temperature increases, the resistance will decrease, causing the voltage to decrease. This changing voltage is converted to 4-20mA signal by a signal conditioner module. The corresponding 4-20mA signal is read by the control panel and displayed as the coolant temperature.

The control panel will monitor and display the coolant temperature anytime the DC input to the control panel is present.

If the temperature exceeds approximately 140° C (284° F), the engine shutdown will be initiated. The generator will automatically restart and the display will reset once the temperature has returned to an operating level.

◆ LOW COOLANT LEVEL

A Low Coolant Level (LCL) sensor is placed in the generators coolant system. This sensor allows the panel to detect a Low Coolant Level condition.

The LCL is a resistive device whose resistance changes rapidly based on the presence or absence of coolant.

The resistance of the LCL results in a voltage being developed across the LCL. This voltage changes as the resistance changes. This changing voltage is converted to 4-20mA signal by a signal conditioner module. The corresponding 4-20mA signal is read by the control panel and displayed as the low coolant level.

If the level of the engine coolant drops below the level of the low coolant level sensor, the engine shutdown will be initiated.

◆ OIL PRESSURE SENSING

An analog Oil Pressure Sender (OPS) is used for monitoring the engine oil pressure. This sender allows the control panel to measure and display the Engine oil pressure.

The OPS is a resistive device, whose resistance changes based on engine oil pressure. The resistance of the sender results in a voltage being developed across the sender. As the oil pressure increases, the resistance will decrease, causing the voltage to decrease. This changing voltage is converted to 4-20mA signal by a signal conditioner module. The corresponding 4-20mA signal is read by the control panel and displayed as the oil pressure.

The control panel will monitor and display oil pressure anytime the DC input to the control panel is present.

Should the oil pressure drop below the 8 psi range, the engine shutdown is initiated. The unit should not be restarted until oil is added. Turn the AUTO/OFF/MANUAL switch to the OFF position, then back to AUTO to restart.

◆ OVERCRANK SHUTDOWN

When the control panel receives a start signal, it initiates the programmed starting sequence. The start sequence consists of the number of crank attempts, the length of each crank attempt, and the rest time between each crank attempt. If the engine has not started by the end of the final crank attempt, an Overcrank alarm is generated, the control panel will sound the alarm and display the message "Failed to start".

◆ OVERSPEED SHUTDOWN

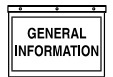
A speed circuit controls engine cranking, start-up, operation and shutdown. Engine speed signals are delivered to the circuit board whenever the unit is running. Should the engine over speed above a safe, preset value, the circuit board initiates an automatic engine shutdown. Contact the nearest Authorized Dealer if this failure occurs.

◆ RPM SENSOR LOSS SHUTDOWN

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

◆ DC FUSE

This fuse is located inside of the control panel. It protects the panel wiring and components from damaging overload. Always remove this fuse before commencing work on the generator. The unit will not start or crank if the fuse is blown. Replace the fuse with one of the same size, type, and rating. (See the exploded views and parts lists at the end of this manual for replacement part number.)



Stationary Emergency Generator Specifications



SPECIFICATIONS

◆ STATIONARY EMERGENCY GENERATOR

Type.....Synchronous
Rotor Insulation.....Class F
Stator Insulation.....Class H
Total Harmonic Distortion.....<5%
Telephone Interference Factor (TIF)< 50
Alternator Output Leads 3-phase6-wire
BearingsSealed Ball
CouplingFlexible Disc
Load Capacity (Standby Rating)25kW*

* NOTE: Generator rating and performance in accordance with ISO8528-5, BS5514, SAE J1349, ISO3046 and DIN 6271 Standards. KW rating is based on LPG fuel and may derate with natural gas.

Excitation System	Direct
Generator Output Voltage/kW - 60 Hz	<u>kW</u> <u>Amp</u> <u>CB Size</u>
120/240V, 1-phase, 1.0 pf	25 104 125
120/208V, 3-phase, 0.8 pf	25 87 100
277/480V, 3-phase, 0.8 pf	25 38 40
Generator Locked Rotor KVA Available @ Voltage Dip of 35%	
Single-phase.....	50 KVA
208V, 3-phase	70 KVA
480V, 3-phase	70 KVA

◆ ENGINE

MakeMitsubishi
ModelIn Line
Cylinders and Arrangement.....4
Displacement.....2.4 Liter
Bore.....3.41 in.
Stroke.....3.94 in.
Compression Ratio.....9.5-to-1
Air Intake System.....Naturally Aspirated
Valve Seats.....Hardened
Lifter Type.....Hydraulic

Engine Parameters

Rated Synchronous RPM60 Hz, 1800
Gross HP at rated kW60 Hz, 40

Exhaust System

Exhaust Flow at Rated Output 60 Hz.....130 cfm
Exhaust Temperature at Rated Output.....900° F

Combustion Air Requirements (Natural Gas)

Flow at rated power, 60 Hz.....70 cfm

Governor

Type.....Electronic
Frequency Regulation.....Isochronous
Steady State Regulation± 0.25%

Engine Lubrication System

Type of Oil PumpGear
Oil FilterFull Flow Spin-on, Cartridge
Crankcase Oil Capacity4 U.S. qts.

◆ COOLING SYSTEM

Type.....Pressurized Closed Recovery
Water Pump.....Belt Driven
Fan Speed.....1000 rpm
Fan Diameter.....22 inches
Fan Mode.....Puller
Air Flow (inlet air including alternator and
combustion air)1600 ft³/min.
Coolant Capacity.....(3.0 U.S. gal.)
Heat Rejection to Coolant.....106,900 Btu/h
Maximum Operating Air Temp. on Radiator.....60° C (150° F)
Maximum Ambient Temperature50° C (140° F)

◆ FUEL SYSTEM

Type of FuelNatural Gas, Propane Vapor
Carburetor.....Down Draft
Secondary Fuel Regulator.....Standard
Fuel Shut-off Solenoid.....Standard
Operating Fuel Pressure5 in. - 14 in. Water Column

Fuel Consumption - ft³/hr (Natural Gas/LPV)

<i>Exercise</i>	<i>25%</i>	<i>50%</i>	<i>75%</i>	<i>100%</i>
<i>Cycle</i>	<i>Load</i>	<i>Load</i>	<i>Load</i>	<i>Load</i>
42/16	107/41	204/77	293/111	375/142

◆ ELECTRICAL SYSTEM

Battery Charge Alternator12V, 30 Amp
Static Battery Charger2 Amp
Recommended Battery.....Group 26, 525CCA
System Voltage.....12 Volts

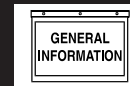
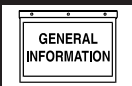
Voltage Regulator

Type.....Electronic
SensingSingle-phase
Regulation.....± 1%
Features.....V/F Adjustable, Adjustable
Voltage and Gain LED Indicators

Power Adjustment for Ambient Conditions

Temperature Deration
3% for every 10° C above °C25
1.65% for every 10° above °F77
Altitude Deration
1% for every 100 m above m.....183
3% for every 1000 ft. above ft.600

Controller.....H-100



FUEL SYSTEM

◆ FUEL REQUIREMENTS

The Stationary Emergency Generator may be equipped with one of the following fuel systems:

- Natural gas fuel system
- Propane vapor (PV) fuel system
- Liquid propane (LP) fuel system

The Manual Drawing Listing that is affixed to the unit includes the "Identification Code," which may be used to identify the type of fuel system installed on the unit.

Recommended fuels should have a Btu content of at least 1,000 Btu's per cubic foot for natural gas; or at least 2,520 Btu's per cubic foot for LP gas. Ask the fuel supplier for the Btu content of the fuel.

Required fuel pressure for **natural gas is 5 inches to 14 inches water column (0.18 to 0.5 psi); and for liquid propane, 5 inches to 14 inches of water column (0.18 to 0.5 psi).**

NOTE:

Any piping used to connect the generator to the fuel supply should be of adequate size to ensure the fuel pressure NEVER drops below five inches water column for natural gas or 5 inches water column for propane vapor for all load ranges. The fuel supply piping shall be sized according to the installation manual using the fuel consumption requirements identified in the Specifications section of the Owner's Manual.

NOTE:

It is the responsibility of the installer to make sure that only the correct recommended fuel is supplied to the generator fuel system. Thereafter, the owner/operator must make certain that only the proper fuel is supplied.

◆ NATURAL GAS FUEL SYSTEM

Natural gas is supplied in its vapor state. In most cases, the gas distribution company provides piping from the main gas distribution line to the standby generator site. The following information applies to natural gas fuel systems.

- Gas pressure in a building is usually regulated by national, state and local codes.
- To reduce gas pressure to a safe level before the gas enters a building, a primary regulator is needed. The natural gas supplier may or may not supply such a regulator.
- It is the responsibility of the gas supplier to make sure sufficient gas pressure is available to operate the primary regulator.
- Gas pressure at the inlet to the fuel shutoff solenoid should not exceed approximately 14 inches water column (0.5 psi).

◆ PROPANE VAPOR WITHDRAWAL FUEL SYSTEM

This type of 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. The vapor withdrawal system is generally best suited for smaller engines that require less fuel. The installer should be aware of the following:

- When ambient temperatures are low and engine fuel consumption is high, the vapor withdrawal system may not function efficiently.
- Ambient temperatures around the supply tank must be high enough to sustain adequate vaporization, or the system will not deliver the needed fuel volume.
- In addition to the cooling effects of ambient air, the vaporization process itself provides an additional cooling effect.

◆ LP LIQUID FUEL SYSTEM

LP is supplied as a liquid in pressure tanks. It is usually made up of propane, butane, or a mixture of the two gases. Propane tends to vaporize readily even at temperatures as low as -20° F (-29° C). However, butane reverts to its liquid state when temperatures drop below 32° F (0° C).

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 generally 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.

RECONFIGURING THE FUEL SYSTEM

NOTE:

All models are configured to run on natural gas from the factory.

Before the generator can be operated using a LP fuel source, the fuel system, wire harness, and ignition control module must be reconfigured. The steps to reconfigure the generator from a natural gas (NG) to a liquidified petroleum (LP) fuel source are as follows:

◆ FUEL SYSTEM

1. Turn the main gas supply off and disconnect the battery. The battery may be reconnected after the wire harness has been reconfigured.
2. Remove the carburetor fuel hose from the outlet port of the demand regulator (see Figure 6.2).
3. Loosen the spring clamp on the start line hose and remove it from the brass hose fitting.
4. Remove the black pipe assembly from the outlet port of the demand regulator (Figure 6.2).
5. Remove the pipe plug.
6. Move NG jet from Port 2 to Port 1 and LP jet from Port 1 to Port 2.
7. Install the pipe plug. Apply pipe sealant compound to threads before installation.

NOTE:

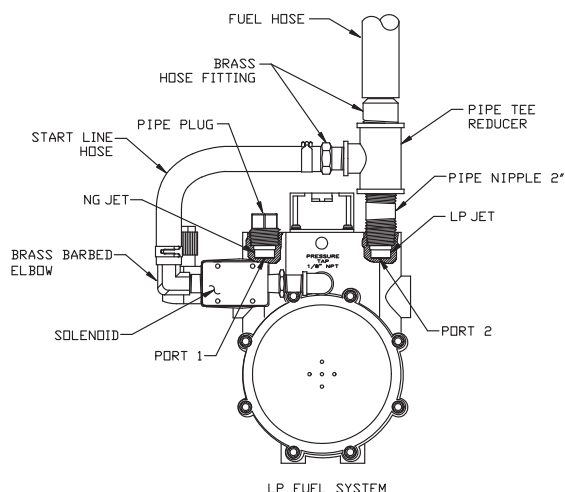
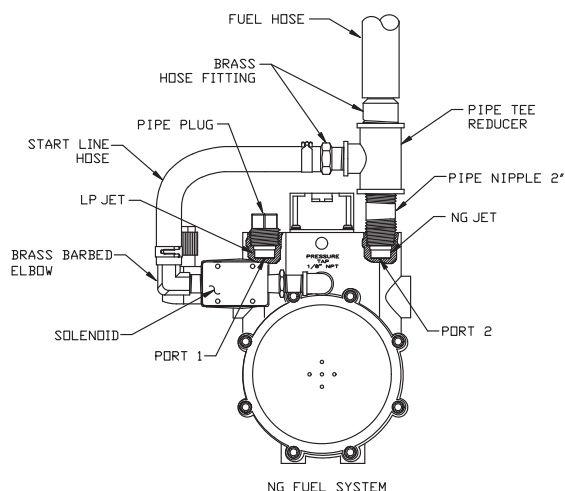
The jet sizes are stamped on the individual jets. The larger jet size is used for running on NG.

8. Install the previously removed black pipe onto the outlet port of the demand regulator. Use pipe sealant on the pipe threads.
9. Reverse steps 1-3 in this procedure to reactivate the demand regulator.
10. Follow the instructions in the Wire Harness section.
11. Follow the instructions in the Ignition Control Modules section.



⚠ Serious injury or damage may occur if not configured properly. Please consult an Authorized Dealer with any questions.

Figure 6.2 — Reconfigure the Fuel System



◆ WIRE HARNESS

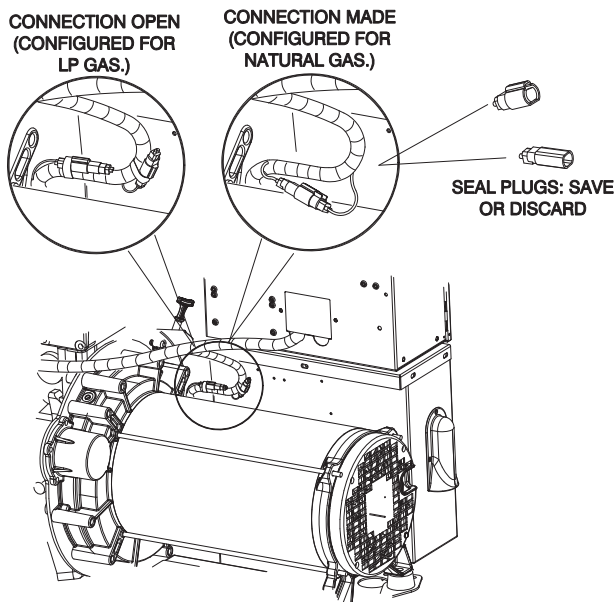
A fuel select connector is located in the wire harness behind the control panel (Figure 6.3).

Engine timing for Natural Gas (NG) Fuel is selected when this connection is MADE (i.e. the two connector halves are plugged together).

Engine timing for LP Fuel is selected when this connection is LEFT OPEN. When this connector is left open, the plugs should be installed in these connectors to prevent moisture from entering the harness connectors.



⚠ Whenever the Generator's Fuel Regulator is converted from one Fuel type to the other, make sure to configure the Fuel Select Connector for the correct Fuel type.

Figure 6.3 — Fuel Select Connector

◆ IGNITION CONTROL MODULE

The ignition control module must be without power for at least one (1) minute before the new settings will take effect. If the battery hasn't already been disconnected, do so at this time for at least one (1) minute.

IGNITION DESCRIPTION

When this ignition is used on a 2.4L engine, a mag pick-up sensor and 164 tooth flywheel are used to determine engine timing. A CAM sensor establishes the location of flywheel tooth number one.

Nominal 2.4L Engine Timing versus Engine Speed:

<u>RPM</u>	<u>LP Timing (BTDC)</u>	<u>NG Timing</u>
1800 rpm	21 degrees	30 degrees

◆ IGNITION SHUTDOWN ON LOSS OF FLYWHEEL OR CAM/DISTRIBUTOR SIGNALS

The ignition will stop firing the coils immediately following the loss of the flywheel signal. The ignition will stop firing the coils approximately three (3) seconds following the loss of the cam signal.

◆ DIAGNOSTIC BLINK PATTERNS (IGNITION RED LED)

The diagnostic LED is located on the back of the ignition control module, near one of the module mounting bases. It will be necessary to remove the module from the panel, and turn over, to view the LED.

- Normal Operation: LED flashes at a 0.5 second ON and a 0.5 second OFF rate.

LED Fault Code with Priority as shown;

- No Crank Signal: LED blinks 2 times, is OFF for 3.0 seconds and then repeats
- No CAM Signal: LED blinks 3 times, is OFF for 3.0 seconds and then repeats

Only one fault is displayed at a time. If multiple faults exist then the highest priority fault must be resolved prior to a lower priority fault being displayed.

The diagnostic blink patterns provide flywheel and CAM sensor diagnostics only during cranking following the initial power-up of the ignition. The Generator must have been in the OFF mode for 60 seconds prior to cranking for the flywheel and CAM sensor diagnostics to be valid (i.e. diagnostics are not valid during a re-crank). The LED fault code blink pattern, if present, is displayed for 60 seconds and then the ignition will power itself down.

NOTE:

The ignition cover does not need to be removed to see the LED.

ALTERNATOR AC LEAD CONNECTIONS

See "Voltage Codes". This Stationary Emergency Generator may be rated at any one of three voltages, either single-phase or three-phase. The electrical wires in the unit's AC connection (lower) panel should be installed according to the number of leads and the voltage/phase required for the application. If there are any questions regarding lead connection, refer to the wiring diagrams at the back of this manual.

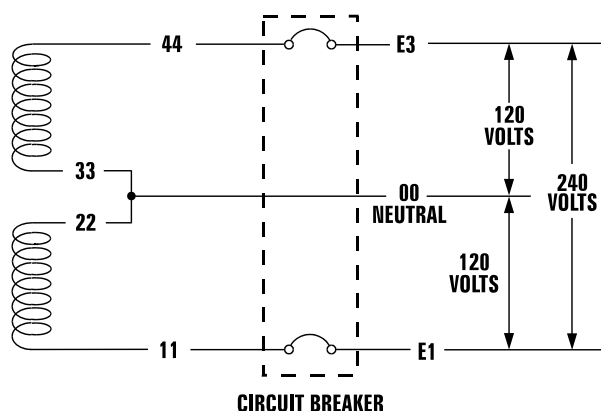
Voltage codes apply to the type of stator assembly installed on a particular generator.

◆ FOUR-LEAD, SINGLE-PHASE STATOR

Four-lead alternators (see Figure 7.1) are designed to supply electrical loads with voltage code "A" (240V, 1-phase, 60 Hz). Electrical power is produced in the stator power windings. These windings were connected at the factory to the main circuit breaker as shown in Figure 7.1.

The rated voltage between each circuit breaker terminal is 240V. The rated voltage between each circuit breaker terminal and the neutral point 00 is 120V.

Figure 7.1 — Four-lead, Single-phase Stator



ALTERNATOR POWER WINDING CONNECTIONS

◆ 3-PHASE ALTERNATORS

The Stationary Emergency Generator is designed to supply 3-phase electrical loads. Electric power is produced in the alternator power windings. These windings were connected at the factory to the main circuit breaker with a "Y" configuration as shown in Figures 7.2, 7.3 and 7.4.

The rated voltage between circuit breaker terminals E1-E2, E1-E3 and E2-E3 is 480V, 208V or 600V depending on the model.

The rated voltage between each circuit breaker terminal and the neutral point 00 is 277V, 120V, or 346V depending on the model.

Figure 7.2 — Stator Power Winding Connections - 3-phase, 277/480V (6 Lead)

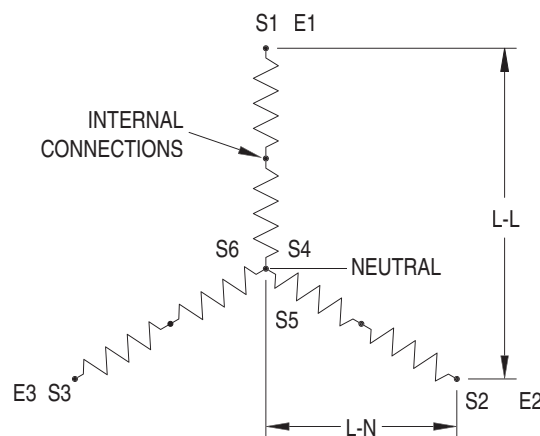


Figure 7.3 — Stator Power Winding Connections - 3-phase, 120/208V (6 Lead)

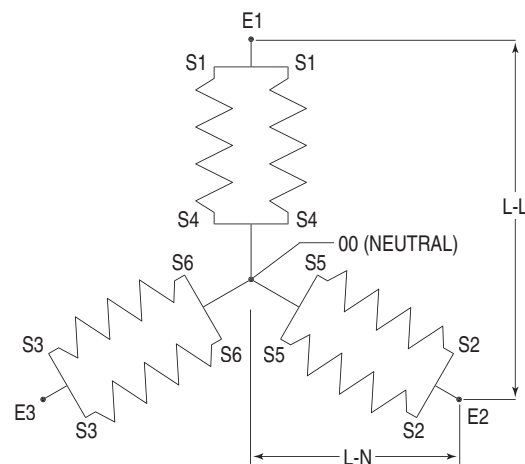
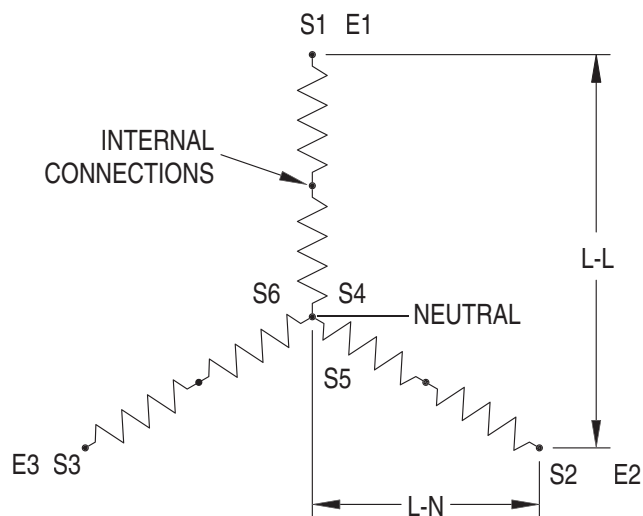


Figure 7.4 — Stator Power Winding Connections - 3-phase, 346/600V (6 Lead)



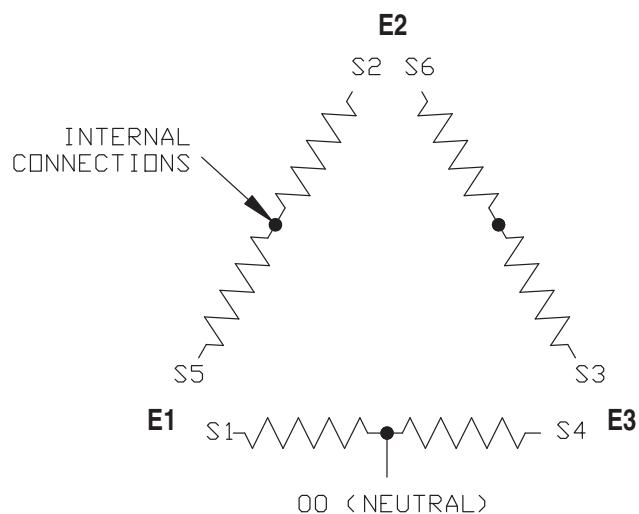
◆ 3-PHASE ALTERNATORS ("DELTA" CONFIGURATION)

The Stationary Emergency Generator is designed to supply 3-phase electrical loads. Electric power is produced in the alternator power windings. These windings were connected at the factory to the main circuit breaker with a "Delta" configuration as shown in Figures 7.5.

The rated voltage between circuit breaker terminals E1-E2, E1-E3 and E2-E3 is 240V.

The rated voltage between E1 or E3 and the neutral point 00 is 120V.

Figure 7.5 — Stator Power Winding Connections - 3-phase, 120/240V (6 Lead)





INSTALLATION

Refer to the separate "Installation Guide" supplied with the unit.

For safety reasons, the manufacturer recommends that this equipment be installed, serviced and repaired by a 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.

PREPARATION BEFORE START-UP

The instructions in this section assume that the Stationary Emergency Generator has been properly installed, serviced, tested, adjusted and otherwise prepared for use by a competent, qualified installation contractor. Be sure to read the "Safety Rules", as well as all other safety information in this manual, before attempting to operate this (and related) equipment.

Before starting the generator for the first time, the installer must complete the following procedures. For follow-up maintenance information and/or service intervals, please refer to the "Maintenance" section and the "Service Schedule".

◆ TRANSFER SWITCH

If this generator is used to supply power to any electrical system normally powered by an electric utility, the National Electrical Code requires that a transfer switch be installed. The transfer switch prevents electrical backfeed between two different electrical systems. (For additional information, see the applicable transfer switch manual for this unit.) The transfer switch, as well as the generator and other electrical components, must be properly located and mounted in strict compliance with applicable codes, standards and regulations.

◆ FUEL SYSTEM

Make sure the fuel supply system to the generator (a) delivers the correct fuel at the correct pressure and (b) is properly purged and leak tested according to code. No fuel leakage is permitted. See "Specifications" for more information.

◆ GENERATOR SET LUBRICATION

Check the engine crankcase oil level before operating and add oil to the proper level – the dipstick "FULL" mark. Never operate the engine with the oil level below the dipstick "ADD" mark. See "Specifications" and "Engine Oil Recommendations".

Check the oil level in the generator gearbox (if so equipped) prior to initial use and at the intervals indicated by the "Service Schedule." The recommended oil is SAE 90 gear lubricant.

NOTE:

This engine is shipped from the manufacturer with "break-in" oil. This oil should be changed after 30 hours of operation.

◆ PRIOR TO INITIAL START-UP



⚠ Prior to initially starting the generator, it must be properly prepared for use. Any attempt to crank or start the engine before it has been properly serviced with the recommended types and quantities of engine fluids (oil, coolant, fuel, etc.) may result in an engine failure.

◆ ENGINE COOLANT

Have the engine cooling system properly filled with the recommended coolant mixture. Check the system for leaks and other problems. See "Specifications" and "Coolant" sections.

◆ BELT TENSION

Check the engine-fan belt tension and condition prior to placing the unit into service and at recommended intervals. Belt tension is correct when a force of approximately 22 pounds (10 kg), applied midway between pulleys, deflects the belt about 3/8- to 5/8-inch (10 to 16 mm).

◆ ELECTRICAL SYSTEM

Make sure the generator is properly connected to an approved earth ground.

Make sure the generator battery is fully charged, properly installed and interconnected, and ready for use.

NOTE:

Battery charger must be connected to 120 VAC, 15 amp circuit to operate.

Check to ensure that there are no loose electrical connections. Restrain any loose wires to keep them clear of any moving generator set components.

INITIAL INSPECTION FOR GENSET STARTUP

Inspect for the following.

- Freight Damage.
- Manuals present.
- Fluid Levels (Oil, coolant, battery, Gear Drive).
- Correct fuel piping.
- Correct muffler installation for external applications (open units only).
- Adequate air flow, clearances and ventilation per installation drawings and applicable codes.
- Correct AC and DC wire size, connections and grounding. Control and communication wiring to/from the transfer switch must be run in a separate conduit from the AC power leads.
- **Battery charger connection to 120 VAC.**
- Communication wires connected between transfer switch and generator (HTS only).
- Unit secured to pad.



START-UP CHECKLIST



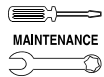
WARNING

Before working on the Stationary Emergency Generator, ensure the following:

- The AUTO/OFF/MANUAL switch is in the OFF position.
- The 120VAC supply to the battery charger is switched OFF.

◆ PREPARATION FOR START-UP

- Ensure that the 120VAC circuit breaker to the battery charger is open.
- Remove the fuse from the the control panel. Open the front door of the control box and remove the 15 Amp ATO fuse in the lower left-hand corner of the control box.
- Connect the battery cables to the battery. Attach negative battery cable last.
- Close the 120VAC circuit breaker to the battery charger.
- Measure the voltage at the battery before and after the charger is turned on.
- Verify all AC electrical connections are tight at the circuit breaker and transfer switch.
- Visually inspect entire area looking for loose paper, plastic wrappings, leaves, etc.
- Check all hoses clamps fittings for leaks or damage.
- Check all electrical plugs throughout the generator. Ensure each plug is seated correctly and fully inserted into its receptacle.
- Verify the AUTO/OFF/MANUAL switch is in OFF position.
- Open the valve to the engine fuel line.
- Bleed the fuel system of air. (necessary for long fuel lines).
- Open the generator main line circuit breaker.
- Connect a manometer to the gas line and record the static pressure. It must be as listed in the Specifications.
- Insert the fuse into the control panel.
- Move the AUTO/OFF/MANUAL switch to the manual position. The engine should now crank and start.
- Check voltage at the generator terminals.
- For 3-phase units, check phase rotation at the transfer switch terminals. The generator phase rotation must match the utility phase rotation.
- Check for coolant, fuel, oil, and exhaust leaks.
- Close the generators main line circuit breaker.
- Turn the generator set off.
- Connect the UTILITY supply to the transfer switch.
- Set the AUTO/OFF/MANUAL switch to AUTO.
- Disconnect utility power before the transfer switch.
Engine should start, transfer to load.
Run at least 15 minutes on generator power. Make certain all 3-phase loads are functioning correctly (correct phase rotation).
- Reconnect Utility power
Transfer switch will transfer back to Utility and engine will shut down within the given time parameters set up for the specific transfer switch and controller.
- Install all covers, access plates and door panels.
- Put the Owners Manual in a safe and accessible place.
- Make certain the AUTO/OFF/MANUAL switch is in the AUTO position.



MAINTENANCE PERFORMED BY SERVICE DEALERS/CONTRACTORS

⚠ WARNING ⚠

⚠ Before working on the Stationary Emergency Generator, ensure the following:

- The AUTO/OFF/MANUAL switch is in the OFF position.
- The 15A fuse has been removed from the control box.
- The 120VAC supply to the battery charger is switched OFF.

◆ EVERY THREE MONTHS

1. Check battery condition.
2. Inspect and test fuel system.
3. Check transfer switch.
4. Inspect exhaust system.
5. Check engine ignition system.
6. Check fan belts.

◆ ONCE EVERY SIX MONTHS

1. Test Engine Safety Devices (low oil pressure, low coolant level, high coolant temperature).

◆ ONCE ANNUALLY

1. Test engine governor; adjust or repair, if needed.
2. Clean, inspect generator.
3. Flush cooling system.
4. Clean/re-gap spark plugs or replace as necessary.

◆ FIRST 30 OPERATING HOURS

1. Change engine "break-in" oil and filter.

◆ FIRST 100 OPERATING HOURS

1. Change engine oil and oil filter. After initial change, service engine oil and filter at 100 operating hours or six months, whichever comes first.
2. Retorque intake and exhaust manifold.

◆ EVERY 500 OPERATING HOURS

1. Service air cleaner.
2. Check starter.
3. Check engine DC alternator.

COOLING SYSTEM

Air intake and outlet openings in the generator compartment must be open and unobstructed for continued proper operation. This includes such obstructions as high grass, weeds, brush, leaves and snow.

Without sufficient cooling and ventilating air flow, the engine/generator quickly overheats, which causes it to shut down. (See the installation diagram.)

⚠ WARNING ⚠

⚠ The exhaust system parts from this product get extremely hot and remains hot after shutdown. High grass, weeds, brush, leaves, etc. must remain clear of the exhaust. Such materials may ignite and burn from the heat of the exhaust system.

OVERLOAD PROTECTION FOR ENGINE DC ELECTRICAL SYSTEM

Engine cranking, start up and running are controlled by a solid state Engine Controller circuit board. Battery voltage is delivered to that circuit board via a 15 amp fuse. These overcurrent protection devices will open if the circuit is overloaded.

⚠ CAUTION ⚠

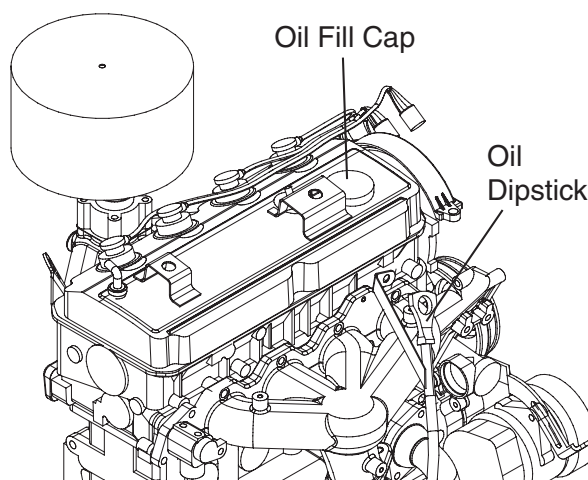
⚠ If a circuit breaker opens or a fuse element melts, find the cause of the overload before resetting the circuit breaker or replacing the fuse.

CHECKING FLUID LEVELS

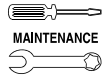
◆ CHECK ENGINE OIL

Check engine crankcase oil level (Figure 10.1) at least every 20 hours of operation, or prior to use.

Figure 10.1 - Oil Dipstick and Oil Fill Cap



- Remove oil dipstick and wipe dry with a clean, lint-free cloth.
- Install oil dipstick, then remove again.
- Oil should be between FULL and ADD marks.
- If oil level is below the dipstick ADD mark, remove oil fill cap. Add the recommended oil to bring oil level up to the FULL mark. DO NOT FILL ABOVE THE "FULL" MARK. See "Engine Oil Recommendations" for recommended oils.



Stationary Emergency Generator Maintenance



◆ BATTERY FLUID

Check battery electrolyte fluid based on the Maintenance Schedule. Fluid should cover separators in all battery cells. If fluid level is low, add distilled water to cover tops of separators. **DO NOT USE TAP WATER IN BATTERY.**

◆ ENGINE COOLANT

Check coolant level in coolant recovery bottle. See Specifications.

- Add recommended coolant mixture as necessary.
- Periodically remove radiator pressure cap (only when engine has cooled down) to make sure the coolant recovery system is functioning properly. Coolant should be at bottom of radiator filler neck. If coolant level is low, inspect gasket in radiator pressure cap. Replace cap, if necessary. To have pressure cap tested, contact a Service Dealer. Inspect cooling system and coolant recovery system for leaks.

MAINTENANCE OWNER/ OPERATOR CAN PERFORM

— ⚠ WARNING ⚠ —

⚠ Before working on the generator, ensure the following:

- The AUTO/OFF/MANUAL switch is in the OFF position.
- The 15A fuse has been removed from the control box.
- The 120VAC supply to the battery charger is switched OFF.

◆ CHECK ENGINE OIL LEVEL

Refer to “Checking Fluid Levels”.

◆ CHECK BATTERY

- See “Checking Fluid Levels”.
- Check battery cables for condition, tightness, corrosion or damage. Clean, tighten or replace as necessary.

◆ EXERCISE SYSTEM

Start the Stationary Emergency Generator engine at least once every seven days and let it run at least 20 minutes. For more detailed exercise information, see the respective sections in the Control Panel Technical Manual that is supplied with the unit.

◆ INSPECT COOLING SYSTEM

- Inspect engine cooling system. See “Maintenance Schedule”.
- Check hoses for damage, deterioration, leaks, etc. Correct any discrepancies found.
- Check hose clamps for tightness.

◆ CHECK ENGINE COOLANT LEVEL

See “Checking Fluid Levels”.

◆ PERFORM VISUAL INSPECTION

Complete a thorough visual inspection of the entire engine-generator monthly. Look for obvious damage, loose, missing or corroded nuts, bolts and other fasteners. Look for fuel, oil or coolant leaks.

◆ INSPECT EXHAUST SYSTEM

Inspect the exhaust system at least once every three months. Check all exhaust system pipes, mufflers, clamps, etc. for condition, tightness, leaks, security, damage.

◆ CHECK FAN BELT

- Inspect fan belts every three months. Replace any damaged, deteriorated, worn or otherwise defective belt.
- Check fan belt tension. Thumb pressure, exerted midway between pulleys, should deflect about 3/8 to 5/8 of an inch. Adjust belt tension as required.
- Check fan belt alignment.

◆ INSPECT ENGINE GOVERNOR

Visually inspect electronic governor.

— ⚠ DANGER ⚠ —

⚠ Do not attempt to adjust the governor. Only qualified service facilities should adjust the governor. Excessively high operating speeds are dangerous and increase the risk of personal injury. Low speeds impose a heavy load on the engine when adequate engine power is not available and may shorten engine life. Correct rated frequency and voltage are supplied only at the proper governed speed. Some connected electrical load devices may be damaged by incorrect frequency and/or voltage. Only qualified service technicians should adjust the governed speed.

◆ CHANGING ENGINE OIL

— ⚠ CAUTION ⚠ —

⚠ Hot oil may cause burns. Allow engine to cool before draining oil. Avoid prolonged or repeated skin exposure with used oil. Thoroughly wash exposed areas with soap.

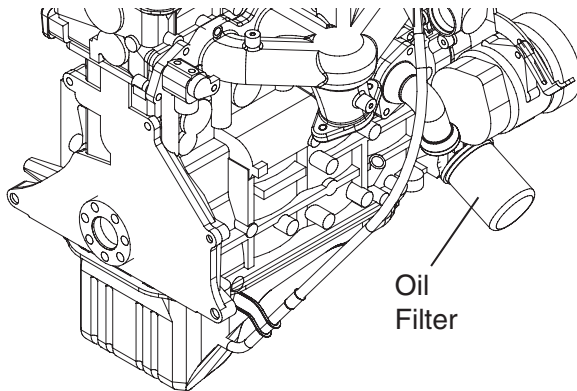
Refer to maintenance performed by service facilities for engine oil and filter change frequencies.

Drain the oil while the engine is still warm from running. This means warm up the engine, shut it down and drain immediately as follows:

1. Remove OIL DRAIN HOSE from its retaining clip.
2. Loosen and remove OIL DRAIN HOSE CAP. Drain oil completely into suitable container.
3. When all oil has drained, install and tighten OIL DRAIN HOSE CAP, and re-install into its retaining clip.
4. Turn OIL FILTER (Figure 10.2) counterclockwise and remove. Properly dispose of old filter.



Figure 10.2 – Oil Filter



5. Apply light coating of new engine oil to seal of new oil filter.-Install FILTER and tighten by hand only. DO NOT OVER TIGHTEN.
6. Remove OIL FILL CAP and add recommended oil. Crankcase oil capacity is listed in the "Specifications" section.



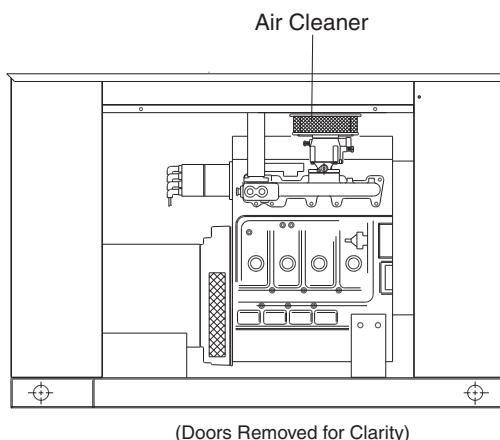
⚠ After refilling the crankcase with oil, always check oil level on dipstick. NEVER OPERATE ENGINE WITH OIL BELOW THE DIPSTICK "ADD" MARK.

7. Start engine and check for oil leaks.
8. Shut OFF engine and wait 10 minutes for the oil to settle down into the oil pan. Recheck oil level on dipstick. DO NOT fill above the dipstick "FULL" mark.
9. Dispose of used oil at a proper collection center.

◆ CHANGING THE ENGINE AIR CLEANER

To replace the engine air cleaner, remove the air cleaner cover and replace the air filter making sure it is positioned properly before reattaching the cover (Figure 10.3).

Figure 10.3 – Engine Air Cleaner



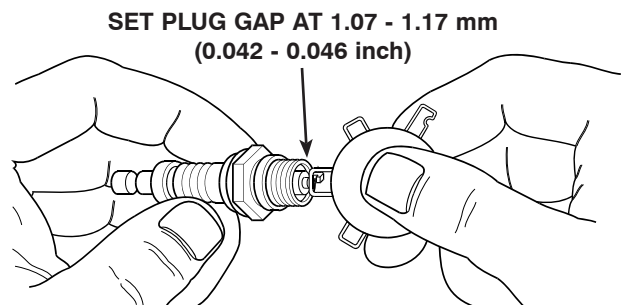
See the "Service Schedule," for air cleaner maintenance.

◆ SPARK PLUGS

Reset the spark plug gap or replace the spark plugs as necessary (Figure 10.4).

1. Clean the area around the base of the spark plugs to keep dirt and debris out of the engine. Clean by scraping or washing using a wire brush and commercial solvent. Do not blast the spark plugs to clean.
2. Remove the spark plugs and check the condition. Replace the spark plugs if worn or if reuse is questionable. See the "Service Schedule" section for recommended inspection.
3. Check the spark plug gap using a wire feeler gauge. Adjust the gap to 1.07-1.17 mm (0.042-0.046 inch) by carefully bending the ground electrode (Figure 10.4).

Figure 10.4 – Setting the Spark Plug Gap



◆ COOLANT CHANGE

Every year, have a service facility drain, flush and refill the cooling system. See "Specifications" for cooling system recommendations.

MISCELLANEOUS MAINTENANCE

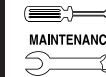
◆ CLEANING THE STATIONARY EMERGENCY GENERATOR

Keep the generator as clean and as dry as possible. Dirt and moisture that accumulates on internal generator windings have an adverse effect on insulation resistance.

Periodically clean generator exterior surfaces. A soft brush may be used to loosen caked on dirt. Use a vacuum system or dry, low pressure air to remove any accumulations of dirt. The generator is housed inside an all-weather enclosure, clean the enclosure with a soft, damp cloth or sponge and water.

Once each year have the generator cleaned and inspected by a Service Dealer. That dealer will use dry, low pressure air to clean internal windings. Parts inside the control console should be cleaned and inspected at this time as well.

Finally, have the insulation resistance of stator and rotor windings checked. If insulation resistances are excessively low, the generator may require drying.



◆ BATTERY

All lead-acid storage batteries discharge when not in use. Refer to specific instructions and warnings that accompany the battery. If such information is not available, observe the following precautions when handling a battery:

- DO NOT use jumper cables and a booster battery to crank or start the generator engine.
- DO NOT recharge a weak battery while it is installed in the generator. Remove battery from generator and recharge in a well-ventilated area, away from fuel vapors, sparks, heat or flames.
- Battery electrolyte fluid is an extremely caustic sulfuric solution that can cause severe burns. DO NOT permit fluid to contact eyes, skin, clothing, painted surfaces, wiring insulation, etc. If any battery fluid is spilled, flush the affected area with clear water immediately.
- Always wear safety glasses, rubber apron and gloves when handling a battery.
- Batteries give off explosive hydrogen gas while charging. The gas can form an explosive mixture around the battery for several hours after charging. Any spark, heat or flames can ignite the gas and cause an explosion which can shatter the battery, causing blindness or other serious injury.

◆ BATTERY MAINTENANCE

The battery should be inspected per the "Scheduled Maintenance" section. The following procedure should be followed for inspection:

1. Inspect the battery posts and cables for tightness and corrosion. Tighten and clean as necessary.
2. Check the battery fluid level of unsealed batteries and, if necessary, fill with DISTILLED WATER ONLY. DO NOT USE TAP WATER IN BATTERIES.
3. Have the state of charge and condition checked. This should be done with an automotive-type battery hydrometer.



DANGER

- ▲ **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. Such 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 corrosive 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 use any jumper cables or booster battery to crank and start the generator engine. If the battery has completely discharged, remove it from the generator for recharging.**



WARNING

- ▲ **Be sure the AUTO/OFF/MANUAL switch is set to 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 120VAC power supply to the battery is turned OFF, or sparking may occur at the battery posts as the cables are attached and cause an explosion.**

◆ BATTERY REPLACEMENT

NOTE:

Unit DOES NOT include battery.

When supplying or replacing the battery, the recommended number and type of battery is listed in the Specifications Section.

NOTE:

The BCI number should be located directly on the battery.



Stationary Emergency Generator Service Schedule



SERVICE SCHEDULE

22 KW - 150 KW GASEOUS STATIONARY EMERGENCY GENERATOR

The following is a recommended maintenance schedule for Gaseous Stationary Emergency Generator sets from 22kW to 150 kW in size. The established intervals in the schedule are the maximum recommended when the unit is used in an average service application. They will need to be decreased (performed more frequently) if the unit is used in a severe application. Use calendar time, from the previous maintenance interval to determine the next required maintenance interval.

Service Maintenance Interval Information:

The various service maintenance intervals are designated by interval numbers as follows:

- 1 An early inspection of the generator set to insure it is ready to operate when required and to identify any potential problem areas.



This inspection may be performed by the end user providing the following safety steps are taken to prevent the engine from starting automatically without warning:

To prevent injury, perform the following steps in the order indicated before starting any maintenance:

- Disable the generator set from starting and/or connecting to the load by setting the control panel Auto/Off/Manual switch to the "OFF" position.
- Remove the 15 amp control panel fuse.
- Turn off the battery charger.*
- Remove the negative battery cable.



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

Following all maintenance, reverse these steps to insure the unit is returned to standby setup for normal operation when required.

- 2 A wear-in service inspection of the generator set to insure it is ready to operate and carry the load when required, and to identify any potential problem areas.

*Performed **ONLY ONCE** following the first three months or the first 30 hours of operation after purchase of the unit.*

This inspection contains some maintenance tasks which require special tools, equipment, and/or knowledge to accomplish and should be performed only by a Service Dealer.

- 3 An operational inspection of the generator set to insure it is ready to operate and carry the load when required, and to identify any potential problem areas.

Performed semi-annually or following each 50 hours of operation of the unit.

This inspection contains some maintenance tasks which require special tools, equipment, and/or knowledge to accomplish and should be performed only by a Service Dealer.

- 4 A mid-level inspection of the generator set to insure it is ready to operate and carry the load when required, and to identify any potential problem areas.

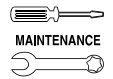
Performed annually or following each 100 hours of operation of the unit.

This inspection contains some maintenance tasks which require special tools, equipment, and/or knowledge to accomplish and should be performed only by a Service Dealer.

- 5 A comprehensive inspection of the generator set to insure it is properly serviced and ready to operate and carry the load when required, and to identify any potential problem areas.

Performed annually or following each 250 hours of operation of the unit.

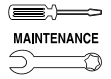
This inspection contains some maintenance tasks which require special tools, equipment, and/or knowledge to accomplish and should be performed only by a Service Dealer.



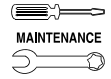
Stationary Emergency Generator Service Schedule



Maintenance Tasks	Level 1		Level 2		Level 3		Level 4		Level 5	
	Recom- mended to be done monthly/ 10 hrs.	Task Comp. (Date- Initials)	Required to be done 3 months/ Break-in 30 hrs.	Task Comp. (Date- Initials)	Required to be done Semi- annually/ 50 hrs.	Task Comp. (Date- Initials)	Required to be done Annually/ 100 hrs.	Task Comp. (Date- Initials)	Required to be done Bi- annually/ 250 hrs.	Task Comp. (Date- Initials)
1. Disable the unit from operating per the first page warning.										
2. Check the engine oil level. Adjust as necessary.										
3. Check the engine coolant level. Adjust as necessary.										
4. Check the engine coolant thermal protection level. Correct as necessary.										
5. Check the natural gas delivery system for leaks and correct pressure on gas engine driven units. Tighten connections as necessary.										
6. Check the air inlets and outlets for debris. Clean as necessary.										
7. Check the battery electrolyte level and specific gravity if accessible. Adjust as necessary.										
8. Check the battery posts, cables, and charger for loose connections, corrosion, and proper operation. Correct as necessary.										
9. Check the unit wiring for loose connections, corrosion, and damage. Correct as necessary.										

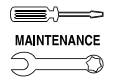


Stationary Emergency Generator Service Schedule



Maintenance Tasks	Level 1		Level 2		Level 3		Level 4		Level 5	
	Recom- mended to be done monthly/ 10 hrs.	Task Comp. (Date- Initials)	Required to be done 3 months/ Break-in 30 hrs.	Task Comp. (Date- Initials)	Required to be done Semi- annually/ 50 hrs.	Task Comp. (Date- Initials)	Required to be done Annually/ 100 hrs.	Task Comp. (Date- Initials)	Required to be done Bi- annually/ 250 hrs.	Task Comp. (Date- Initials)
10. Check the engine accessory drive belts and fan coupling device if equipped for correct tension, wear, weather cracking, and damage. Replace as necessary.										
11. Check the engine valve clearance/lash. Adjust as necessary.**										
12. Visually inspect the unit looking for leaks, wear or damage, loose connections or components, and corrosion. Correct as necessary.										
13. Test the engine and transfer switch safety devices. Correct and/or adjust as necessary.										
14. Initiate an automatic start and transfer of the unit to site load and exercise it for at least 1 hour looking for leaks, loose connections or components, and abnormal operating conditions. Correct as necessary.										
15. Replace the engine accessory drive belts.										
16. Check gearbox oil level (if equipped).										
17. Change gearbox oil (if equipped).										

** Not required for engines equipped with hydraulic lifters. See the "Specification" section for lifter type.



Stationary Emergency Generator Service Schedule



Maintenance Tasks	Level 1 Recom- mended to be done monthly/ 10 hrs.	Task Comp. (Date- Initials)	Level 2 Required to be done 3 months/ Break-in 30 hrs.	Task Comp. (Date- Initials)	Level 3 Required to be done Semi- annually/ 50 hrs.	Task Comp. (Date- Initials)	Level 4 Required to be done Annually/ 100 hrs.	Task Comp. (Date- Initials)	Level5 Required to be done Bi- annually/ 250 hrs.	Task Comp. (Date- Initials)
18. Start and exercise the unit at full rated load (use a load bank if the site load is not enough) for at least 2 hours looking for leaks, loose connections or components, and abnormal operating conditions. Correct as necessary.										
19. Perform an engine oil analysis (send a sample to a lab for results). Change the engine oil and filters if the analysis results indicate this is required.										
20. Change the engine oil.										
21. Replace the engine oil filter(s).										
22. Replace engine spark plugs. Clean and re-gap or replace as necessary.										
23. Replace the engine air filter(s).										
24. Perform a 5 minute no-load operational run of the unit looking for any post service problems.										
25. Return the unit to standby setup for operation when required.										



Stationary Emergency Generator Troubleshooting



TROUBLESHOOTING GUIDE

PROBLEM	CAUSE	CORRECTION
Engine won't crank.	15 amp fuse blown. - Loose or corroded or defective battery cables. - Defective starter contactor. - Defective starter motor. - Dead or Defective Battery. 5 amp fuse blown.	- Replace fuse. - Tighten, clean or replace battery cables as necessary. - Replace contactor.* - Replace starter motor.* - Remove, change or replace battery. - Replace fuse.*
Engine cranks but won't start	- Out of fuel. - Fuel solenoid (FS) is defective - Open Wire #14A from Engine Control circuit board. - Spark plugs defective. - Door on tank not closed.	- Replenish fuel. - Replace solenoid.* - Reconnect wire. - Clean, regap or replace plugs. - Close door on tank.
Engine starts hard, runs rough.	- Flame arrestor (air cleaner) plugged or damaged. - Plugged fuel line. - Defective spark plugs. - Fuel pressure incorrect.	- Clean or replace as needed. - Unclog fuel line. - Clean, regap or replace plugs. - Confirm fuel pressure to regulator is as recommended in SPECIFICATIONS.
Engine starts then shuts down.	- Engine oil level is low. - Engine is overheated. - Defective Low Oil Pressure Switch - Defective Coolant Temperature Switch - Defective Control Module circuit board. - Coolant Level is Low. - Defective Low Coolant Level Switch	- Check oil and add oil as needed. - Check cooling system for leaks. - Replace switch.* - Replace switch.* - Replace board.* - Repair leak - Add coolant. - Replace Switch.*
AUTO/OFF/MANUAL Switch at OFF, engine continues to run	- Defective AUTO/OFF/MANUAL switch - Open/disconnected wire #15A between AUTO/OFF/MANUAL switch and Control Module circuit board. - Defective Control Module circuit board	- Replace switch.* - Reconnect/close wire. - Replace board.*
No AC output from generator.	- Check main line circuit breaker. - Check circuit breaker & fuses. - Transfer switch set to NORMAL position - Generator internal failure. - Thermal circuit breaker open.	- Reset to ON or CLOSED. - Reset and replace, if necessary. - Set to GENERATOR position. * - Auto-reset - Wait 5 min. and attempt restart.

***Contact the nearest Authorized Dealer for assistance.**



United States Environmental Protection Agency Warranty Statement Warranty Rights, Obligations and Coverage

The United States Environmental Protection Agency (EPA) and Generac Power Systems, Inc. (Generac), are pleased to explain the Emission Control System Warranty on your new stationary emergency engine. If during the warranty period, any emission control system or component on your engine is found defective in materials or workmanship Generac will repair your engine at no cost to you for diagnosis, replacement parts and labor provided it be done by an Authorized Warranty Service Facility. Your emission control system may include parts such as the fuel metering, ignition, and exhaust systems and other related emission related components listed below. Generac will warrant the emissions control systems on your 2009 and later model year engines provided there has been no abuse, neglect, unapproved modification or improper maintenance of your engine. For engines less than 130 HP the warranty period is two years from the date of sale to the ultimate purchaser. For engines greater than or equal to 130 HP the warranty period is three year from the date of the engine being placed into service.

Purchaser's/Owner's Warranty Responsibilities

As the engine purchaser/owner you are responsible for the following. 1.) The engine must be installed and configured in accordance to the installation specifications. 2.) The completion of all maintenance requirements listed in your Owner's Manual. 3.) Any engine setting adjustment must be done in accordance and consistent with the instructions in the Owner's Manual. 4.) Any emission control system or component must be maintained and operated appropriately in order to ensure proper operation of the engine and control system to minimize emissions at all times.

Generac may deny any, or all Emission Control System Warranty coverage or responsibility of the engine, or an emission control system or component on your engine thereof, if it has failed due to abuse, neglect, unapproved modification or improper maintenance, or the use of counterfeit and/or 'gray market' parts not made, supplied or approved by Generac. Warranty service/scheduled maintenance can be arranged by contacting your selling dealer or an Authorized Warranty Service dealer. The purchaser/owner shall be responsible for any expenses or other charges incurred for service calls and/or transportation of the product to/from the inspection or repair facilities. The purchaser/owner shall be responsible for any and/or all damages or losses incurred while the engine is being transported/shipped for inspection or warranty repairs.

Emission Related Parts Include the Following (if so equipped)

- | | |
|---|--|
| 1) Fuel Metering System | 3) Ignition System including |
| 1.1) Gasoline Carburetor assembly and internal components | a) Spark plug, b) Ignition module, |
| a) Fuel filter, b) Carburetor, c) Fuel Pump | c) ignition coil, d) Spark plug wire |
| 1.2) Carburetion assembly and its components | 4) Exhaust system |
| a) Fuel controller, b) Carburetor and its gaskets, | a) Catalyst assembly, b) Exhaust manifold, |
| c) Mixer and its gaskets, d) Primary gas regulator | c) Muffler, d) Exhaust pipe, e) Muffler gasket |
| e) Liquid vaporizer | 5) Crankcase Breather Assembly including |
| 1.3) Fuel Regulator | a) Breather connection tube, b) PCV valve |
| 2) Air Induction System including | 6) Oxygen Sensor |
| a) Intake pipe/manifold, b) Air cleaner | 7) Diagnostic Emission-Control System |



United States Environmental Protection Agency Compliance Requirements

Purchaser's/Owner's Recordkeeping Responsibilities

The United States Environmental Protection Agency (EPA) and Generac Power Systems, Inc. (Generac), are pleased to explain your recordkeeping requirements for compliance with Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines as listed in the Electronic Code of Federal Regulations Title 40 Part 60. As the engine purchaser/owner who operates and maintains their certified emergency stationary engine and emission control system according to applicable emission related guidelines as specified in this Owner's Manual you are required to meet the following notification and recordkeeping requirements to demonstrate compliance. 1.) Maintain documentation that the engine is certified to meet emission standards. 2.) Recordkeeping of maintenance conducted. 3.) Recordkeeping of the provision allowing natural gas engines to operate using propane for a maximum of 100 hours per year as an alternate fuel solely during emergency operations provided the engine is not certified to operate on propane. 4.) Meet all compliance notifications submitted to the purchaser/owner and maintain all supporting documentation. 5.) Recordkeeping of hours of operation, including what classified the operation as emergency and how many hours are spent for non-emergency operation. For emergency engines greater than or equal to 130 HP, recordkeeping of hours of operation begins January 1, 2011. For emergency engines less than 130 HP, recordkeeping of hours of operation begins January 1, 2009; Engines are equipped with non-resettable hour meters to facilitate recordkeeping.

Specific Air Quality Management or Air Pollution Control Districts may have different and additional record keeping/ reporting requirements. Your permit to construct and/or operate the engine may be contingent upon compliance with those requirements. Check with your local Air Quality Management or Air Pollution Control District for specific requirements.

Emergency stationary internal combustion engines (ICE) may be operated for the purpose of maintenance checks and readiness testing, provided that the tests are recommended by Federal, State or local government, Generac, or the insurance company associated with the engine. Maintenance checks and readiness testing of such units is limited to 100 hours per year. There is no time limit on the use of emergency stationary ICE in emergency situations. The purchaser/owner may petition the Administrator for approval of additional hours to be used for maintenance checks and readiness testing, but a petition is not required if the owner maintains records indicating that Federal, State, or local standards require maintenance and testing of emergency ICE beyond 100 hours per year. Emergency stationary ICE may operate up to 50 hours per year in non-emergency situations, but those 50 hours are counted towards the 100 hours per year provided for maintenance and testing. The 50 hours per year for non-emergency situations cannot be used for peak shaving or to generate income for a facility to supply power to an electric grid or otherwise supply power as part of a financial arrangement with another entity. For purchaser/owner of emergency engines, any operation other than emergency operation, maintenance and testing, and operation in non-emergency situations for 50 hours per year, as permitted in this section is prohibited.

If you operate and maintain your certified emergency stationary SI internal combustion engine and emissions control systems in accordance with the specifications and guidelines in the Owner's Manual, EPA will not require engine performance testing. If not, your engine will be considered non-certified and you must demonstrate compliance according to Subpart JJJJ – Standards of Performance for Stationary Spark Ignition Internal Combustion Engines as listed in the Electronic Code of Federal Regulations Title 40 Part 60.

Emission-Related Installation Instructions

Your certified emergency stationary engine has pre-set emission control systems or components that require no adjustment. Inspection and replacement of an emissions related component is required to be done in accordance with the requirements cited in the United States Environmental Protection Agency Warranty Statement or can be arranged by contacting your selling dealer or an Authorized Warranty Service dealer. Failing to follow these instructions when installing a certified engine in a piece of nonroad equipment violates federal law 40 CFR 1068.105 (b), subject to fines or penalties as described in the Clean Air Act.

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Stationary Emergency Generator Notes

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