

Cummins **Onan**



Service Manual

Home Standby Generator Set

GSBB (Spec A-B)

GSBC (Spec B)

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1 IMPORTANT SAFETY INSTRUCTIONS

1.1 Save These Instructions

This manual contains important instructions for the generator set that should be followed during installation, operation and maintenance of the generator and batteries.

Thoroughly read the Operator Manual before operating the generator set. Safe operation and top performance can only be obtained when equipment is properly operated and maintained.

The following symbols in this manual alert you to potential hazards to the operator, service person and equipment.

DANGER

Alerts you to an immediate hazard that will result in severe personal injury or death.

WARNING

Alerts you to a hazard or unsafe practice that can result in severe personal injury or death.

CAUTION

Alerts you to a hazard or unsafe practice that can result in personal injury or equipment damage.

1.2 General Precautions

- Keep ABC fire extinguishers handy.
- Make sure all fasteners are secure and torqued properly.
- Keep the generator set and its compartment clean. Do not store any items in the genset compartment.
 - Excess oil, oily rags (etc.) can catch fire.
 - Dirt and gear stowed in the compartment will restrict cooling air flow.
- Before working on the generator set, move the Stop Switch (S2) to the Stop position, disconnect the remote harness (P7) to disable the ATS mounted charger and then remove the negative (-) battery cable to prevent starting.
- Use caution when making adjustments while the generator set is running, hot, moving or when parts are electrically live, as all situations may cause personal injury or death.
- Used engine oil has been identified by some state and federal agencies as causing cancer or reproductive toxicity. Do not ingest, inhale or come into contact with used oil or it's vapors.
- Do not work on the generator set when mentally or physically fatigued or after consuming alcohol or drugs.

1.3 Generator Voltage is Deadly

- Generator output connections must be made by a trained and experienced electrician in accordance with all applicable codes.
- This standby generator set and the public utility may only be connected to the house circuits by means of the automatic transfer switch.
 - Improper connections can lead to electrocution of utility workers and damage to equipment.
- Use caution when working on live electrical equipment. Remove jewelry, make sure clothing and shoes are dry and stand on a dry wooden platform.

1.4 Engine Exhaust is Deadly

- See [What Is Carbon Monoxide Poisoning?](#) to learn the symptoms of Carbon Monoxide poisoning.
- This generator set is for outdoor installation only.
 - It must be located well away from doors, windows, other openings into the house and where the exhaust gases will disperse away from the house.

1.5 Fuel is Flammable and Explosive

- Keep flames, cigarettes, sparks, pilot lights, electrical arc-producing equipment, switches and all other sources of ignition well away from areas where fuel fumes are present and areas sharing ventilation.
- Fuel lines must be secured, free of leaks and separated or shielded from electrical wiring.
- Leaks can lead to explosive accumulations of gas. Prevent leaks and the accumulation of gas.
 - A "rotten egg" smell indicates a possible Natural Gas or Propane leak:
 - Natural Gas rises when released and can accumulate under hoods and inside housings and buildings.
 - Propane sinks when released and can accumulate inside housings and basements and other below-grade spaces.

1.6 Batteries Can Explode

Batteries can explode, causing severe skin and eye burns and can release toxic electrolytes.

- Wear safety glasses.
- Do not smoke.
- Do not dispose of the battery in a fire.
 - The battery is capable of exploding.

- Do not open or mutilate the battery.
 - Released electrolytes have been known to be harmful to the skin and eyes and to be toxic.
- Batteries present the risk to high short circuit current:
 - Remove watches, rings or other metal objects and use tools with insulated handles.
- To prevent arcing when disconnecting the battery:
 - Move the Stop Switch (S2) to the Stop position, disconnect the remote harness (P7) to disable the ATS mounted charger and then remove the negative (-) battery cable to prevent starting.
- To prevent arcing when reconnecting the battery:
 - First, reconnect the positive (+) cable, then the negative (-) cable, and finally reconnect the battery charger.
- When replacing the generator set battery, always replace it with a battery as specified in the [Model Specifications](#) section of this manual.

1.7 Moving Parts Can Cause Severe Personal Injury or Death

- Do not wear loose clothing or jewelry near moving parts such as fans.
- Keep hands away from moving parts.
- Keep guards in place, over fans.

1.8 The Hazards of Carbon Monoxide

Engine-driven generators can produce harmful levels of carbon monoxide that can injure or kill you.

1.8.1 What Is Carbon Monoxide Poisoning?

Carbon Monoxide (CO) is an odorless, colorless, tasteless and non-irritating gas. You cannot see it or smell it. Red blood cells, however, have a greater affinity for CO than for Oxygen. Therefore, exposure even to low levels of CO for a prolonged period can lead to asphyxiation (lack of Oxygen) resulting in death. Mild effects of CO poisoning include eye irritation, dizziness, headaches, fatigue and the inability to think clearly. More extreme symptoms include vomiting, seizures and collapse.

1.8.2 What Are the Special Risks of CO Near the Home?

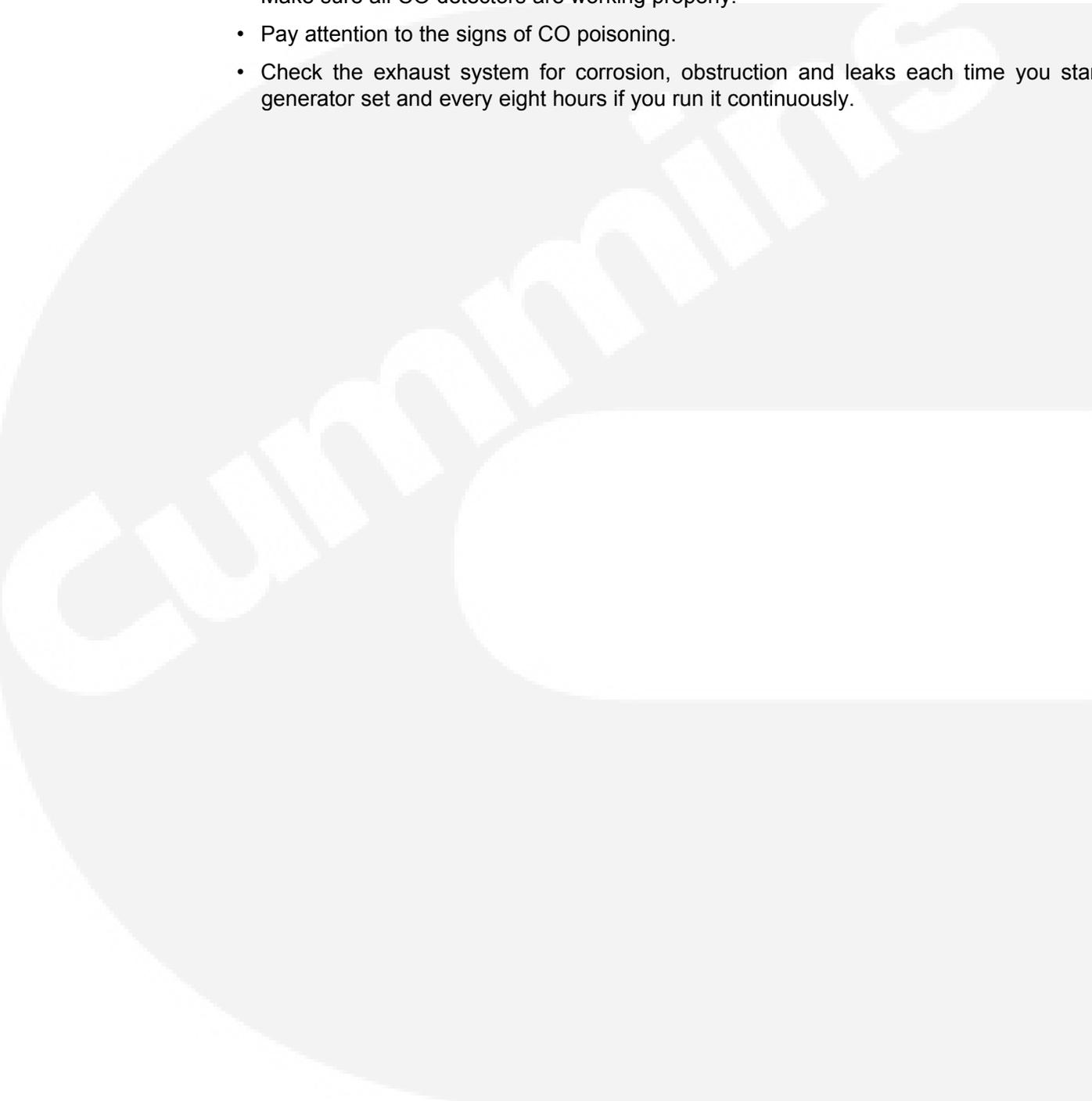
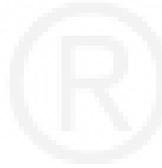
Residents can be exposed to lethal levels of CO when the genset is running. Depending on air temperature and wind, CO can accumulate in or near the home.

To protect yourself and others from the dangers of CO poisoning, it is recommended that reliable and approved CO detector alarms be installed in the home.

⚠ WARNING

Carbon Monoxide (CO) gas can cause nausea, fainting or death.

1.8.3 Only You Can Protect Yourself From CO Poisoning!

- Locate the generator in an area where there are no windows, doors or other access points into the home.
 - Make sure all CO detectors are working properly.
 - Pay attention to the signs of CO poisoning.
 - Check the exhaust system for corrosion, obstruction and leaks each time you start the generator set and every eight hours if you run it continuously.
- 
- 

2 Introduction

This generator set application is intended for stationary emergency use.

Important note for Brazil applications: The manufacturer warns that the installation, operation and maintenance of equipment by the user must fully comply with the Manual's guidelines and current Brazilian laws, including those of the Brazilian Agency of Petroleum, Natural Gas and Fuels (ANP) and the Brazilian Energy Agency (ANEEL).

2.1 About this Manual

This is the Service Manual for the Model GSBB generator set. Read and carefully observe all of the instructions and precautions in this manual.

Refer to the [Maintenance](#) chapter of this manual for instructions and guidelines for performing periodic maintenance. The operator is responsible for generator set maintenance in accordance with the Periodic [Maintenance Schedule](#).

Refer to the [Troubleshooting](#) chapter for steps to be taken to diagnose and correct situations that cause a generator set to shutdown.

WARNING

This generator set is not for life support. It can stop without warning. Children, persons with physical or mental limitations, and pets could suffer personal injury or death. A personal attendant, redundant power or an alarm system must be used if power system operation is critical.

2.2 About the Generator Set

The model GSBB generator set is an engine-powered generator set fueled by Natural Gas or Propane.

See the Specifications section of this manual for specific information about the generator set.

The generator set is intended as a back-up to utility power. Whenever utility power is interrupted, the house electrical loads are automatically switched by the transfer switch from the utility (normal power source) to the generator set (emergency power source). When utility power is restored, the loads are automatically switched back to the utility. To do this, the generator set and transfer switch perform the following functions together:

1. Senses an interruption of utility power.
2. Starts the generator set.
3. Transfers the load to the generator set when operation has stabilized.
4. Senses the return of utility power.
5. Retransfers the load to the utility.
6. Stops the generator set.

A more in-depth illustration of the operation of the generator set and transfer switch can be found in the [Timing Charts](#), located in the Typical Operation chapter of this manual.

2.2.1 Model Specifications

TABLE 1. GSBB AND GSBC MODEL VARIATIONS

Product	Description
20GSBB-6713A\B	60 Hz Warm
20GSBB-6714A\B	60 Hz Cold *
14GSBB-6716A\B	50 Hz (AU/NZ)
20GSBB-6717A\20GSBC-6927B	60 Hz CSA Cold *
* Includes an engine oil heater.	
NOTICE	
See the Cold Weather Specifications Table for recommendations.	

TABLE 2. COLD WEATHER SPECIFICATIONS TABLE

	60 Hz		50 Hz	
	Propane Vapor	Natural Gas	Propane Vapor	Natural Gas
Operating Temperature Range				
Above 32 °F (0 °C) and low humidity	No dryers or starting aids required.			
High humidity	Alternator drying heater recommended.			
Below 20 °F (-7 °C)	Additional oil heater recommended for starting. Factory-installed model available.			
Below 0 °F (-18 °C)	Additional accessory breather shield/shroud required to avoid possible engine damage. See warranty statement.			
Below -10 °F (-23 °C)	Additional accessory battery blanket recommended for starting.			
Below -20 °F (-29 °C)	Not warranted. See warranty statement.			

TABLE 3. GENERATOR SET SPECIFICATIONS TABLE

	60 Hz		50 Hz	
	Propane Vapor	Natural Gas	Propane Vapor	Natural Gas
Dimensions				
Weight (With Oil)	540 lbs (245 kg)			
Size (L x W x H)	48 x 43 x 34.6 in (1219 x 864 x 880 mm)			
Noise	62 dB(A) at 23 ft (7 m) at normal load. (Normal load is equal to the typical household consumption of 3 KW.)			

TABLE 4. FUEL SPECIFICATIONS TABLE (SPEC A AND CANADIAN GSBB SPEC B)

	60 Hz		50 Hz	
	Propane Vapor	Natural Gas	Propane Vapor	Natural Gas
Fueling				
1/2 Load	132,500 Btu/Hr 53 ft ³ /Hr	135,000 Btu/Hr 135 ft ³ /Hr	122,000 Btu/Hr 48 ft ³ /Hr	114,000 Btu/Hr 111 ft ³ /Hr
Full Load	275,000 Btu/Hr 109 ft ³ /Hr	240,000 Btu/Hr 233 ft ³ /Hr	229,000 Btu/Hr 91 ft ³ /Hr	213,000 Btu/Hr 207 ft ³ /Hr
Fuel Pressure (all loads) As measured at genset fuel regulator service port	7-11 inches WC	5-11 inches WC	7-11 inches WC	5-11 inches WC
Tank Size	Contact your local gas company to verify the tank size required for your application.			

TABLE 5. FUEL SPECIFICATIONS TABLE (US GSBB SPEC B AND CANADIAN GSBC SPEC B)

	60 Hz		50 Hz	
	Propane Vapor	Natural Gas	Propane Vapor	Natural Gas
Fueling				
1/2 Load	195,000 Btu/Hr 78 ft ³ /Hr	177,000 Btu/Hr 172 ft ³ /Hr	165,000 Btu/Hr 66 ft ³ /Hr	150,000 Btu/Hr 146 ft ³ /Hr
Full Load	310,000 Btu/Hr 123 ft ³ /Hr	255,000 Btu/Hr 248 ft ³ /Hr	262,500 Btu/Hr 104 ft ³ /Hr	217,000 Btu/Hr 211 ft ³ /Hr
Fuel Pressure (all loads) As measured at genset fuel regulator service port	12-14 inches WC	5-7 inches WC	12-14 inches WC	5-7 inches WC
Tank Size	Contact your local gas company to verify the tank size required for your application.			

TABLE 6. ENGINE SPECIFICATIONS TABLE

	60 Hz		50 Hz	
	Propane Vapor	Natural Gas	Propane Vapor	Natural Gas
Engine	2 Cylinder-V Twin, OHV, Air-Cooled, 4-Stroke, Spark Ignited, 3600 RPM			
Displacement	60.59 in ³ (993 cc)			
Spark Plug Gap	.020 inch (.51 mm)			
Spark Plug Torque	15 ft-lb (20 N-m)			
Intake and Exhaust Cold Valve Lash (Measure at 0.25" (6.35mm) past top dead center)	0.004-0.006 inch (0.10 - 0.15 mm)			
Oil Capacity	Approximately 80 oz (2.3 Liters)			
Oil Recommendation (See Operator Manual)	5W-30 Synthetic Engine Oil			

TABLE 7. GENERATOR SPECIFICATIONS TABLE

	60 Hz		50 Hz	
	Propane Vapor	Natural Gas	Propane Vapor	Natural Gas
Generator	Brush-Type, 2-Pole Rotating Field, Single Bearing			
Power (kVA)	---	---	13.5	13.5
Rated Voltage (V)	120/240	120/240	115/230	115/230
Rated Current (Amps)	162/81.25	144/72	117.4/58.7	117.4/58.7
Phase Type	Single Phase			
Circuit Breaker (Amps)	100	100	60	60
De-rating Guidelines: Maximum wattage or maximum current are subject to and limited by such factors as fuel Btu content, ambient temperature, altitude, engine power and condition, etc. Full rated power is available at 60 °F (15.5 °C) at sea level. De-rate 3.5% for each 1000 ft (304.8 m) above sea level and 3% for each 10 °F (5.5 °C) increase in ambient temperature above 60 °F (15.5 °C). This generator is rated in accordance with UL 2200 (Stationary Engine Generator Assemblies) or CSA C22.2 No. 100-04 (Motors and Generators). The maximum continuous current values that are listed on the generator set nameplate and specification tables occur at the lower limit of acceptable voltage. Maximum current occurs at 108 and 216 volts, 10% below nominal voltage 120/240. The voltage set point of this generator set can be adjusted from the operator panel if desired. Refer to the Operator manual procedure To Adjust the Output Voltage .				

TABLE 8. CONTROL SPECIFICATIONS TABLE

	60 Hz		50 Hz	
	Propane Vapor	Natural Gas	Propane Vapor	Natural Gas
Controller	Integrated Microprocessor-Based Engine, Generator, Transfer Switch Controller			

TABLE 9. DC SYSTEM SPECIFICATIONS TABLE

	60 Hz		50 Hz	
	Propane Vapor	Natural Gas	Propane Vapor	Natural Gas
DC System				
Nominal Battery Voltage	12 Volts DC			
Battery Group	26 R			
Battery Type	Maintenance Free			
Minimum Cold Crank Amps	545			

2.3 Generator Set Nameplate

WARNING

Improper service or replacement of parts can lead to severe personal injury or death and to damage to equipment and property. Service personnel must be qualified to perform electrical and mechanical service.

⚠ CAUTION

Unauthorized modifications or replacement of fuel, exhaust, air intake or speed control system components that affect engine emissions are prohibited by law in the State of California.

Model, Spec and Serial Numbers: Be ready to provide the model, spec and serial numbers on the generator set nameplate when contacting Cummins Onan for information, parts and service.

Record these numbers so that they are easy to find when needed. Each character in these numbers is significant for obtaining the right parts listed in the Parts Catalog. Genuine Cummins Onan replacement parts are recommended for best results.

My Generator Set Information	
Model	
Spec	
Serial Number	

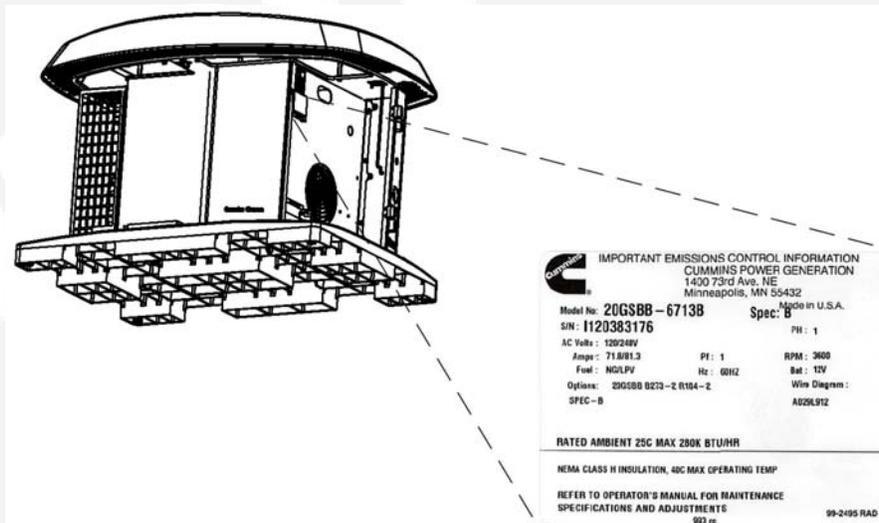
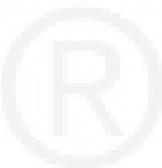


FIGURE 1. NAMEPLATE



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3 Maintenance

3.1 Periodic Maintenance Schedule

Periodic maintenance is essential for top generator set performance. Use the Maintenance Frequency table as a guide for normal periodic maintenance.

- In hot and dusty environments some maintenance procedures should be performed more frequently, as indicated by the footnotes in the table.
- Maintenance, replacement or repair of emission control devices and systems may be performed by any engine repair establishment or individual.
 - Warranty work **MUST** be completed by an authorized Cummins dealer.

⚠ WARNING
<i>Accidental or remote starting of the generator set can cause severe personal injury or death. Before working on the generator set, move the switch (S2) to the Stop position, disconnect the remote harness (P7) to disable the ATS mounted charger and remove the negative (-) battery cable from the battery to prevent starting.</i>

TABLE 10. MAINTENANCE FREQUENCY

Maintenance Task	Maintenance Frequency				
	First Startup	Daily or Every 24 Hours	Every 3 Months or 100 Hours	Every 250 Hours	Every 400 Hours
Check Engine Oil Level		X _{2, 5}			
Change Engine Oil and Oil Filter	After first 8 hours		X ₁		
Adjust Engine Valve Clearance	After first 50 hours ₄		X ₄		
Replace Engine Air Filter					X ₁
Clean and Check Starting Battery				X	
Replace Spark Plugs and Wires					X ₃
Clean Engine Cooling Fins					X ₃
Complete System Test			X ₆		

1. Perform more often when operating in dusty conditions.
2. Perform more often when operating in high temperature conditions.
3. Perform sooner if engine performance deteriorates.
4. Must be performed by a qualified mechanic (authorized Cummins Onan dealer).
5. Check daily during power outages, or monthly without power outages.
6. See automatic transfer switch manual for testing of load transfer.

3.2 Cleaning the Housing Top

The top surface of the generator set housing can be damaged by pressure washing or solvents and other cleaning agents. Only use soap and water or an "all citrus degreaser" to clean the top.

3.3 Exercising the Generator Set

NOTICE

Audible engine RPM variation may be heard while there is no load applied. This is normal and does not affect genset performance.

Exercising the generator set drives off moisture, re-lubricates the engine and removes oxides from electrical contacts. The result is better starting, more reliable operation and longer engine life.

The generator set exerciser is capable of automatically starting the generator set and letting it run for 20 minutes, once every 28 days, or more often, if desired.

Refer to the [Exercise Settings](#) section of this manual for more information on setting up the exerciser.

3.4 Complete System Test

A complete system test is recommended to verify that the electrical system is working properly. Testing the system once every three months is required to make sure the transfer switch will transfer the load to the generator set, should there be a utility power failure. For more information, see the automatic transfer switch Operator Manual.

To initiate a complete system test:

1. Switch the main utility disconnect from the ON to the OFF position.
2. Make sure the following occurs:
 - a. The generator control starts the generator set.
 - b. After the generator set starts and stabilizes, the load is transferred from the utility to the generator set.
3. Switch the main utility disconnect from the OFF to the ON position.
4. Make sure the following occurs:
 - a. After a time delay, the load is transferred back to the utility.
 - b. Once the transfer switch is connected to utility power, after a time delay, the generator set stops.

NOTICE

If the test fails, call an authorized Cummins dealer to perform the testing.

3.5 Engine Oil Maintenance

3.5.1 Recommended Engine Oil

Check the oil level prior to starting the generator set to verify that the oil level is between the FULL and ADD marks.

- The generator set is shipped with engine oil
 - 5W-30 synthetic engine oil is recommended

3.5.2 Checking Engine Oil Level

WARNING

State and federal agencies have determined that contact with used engine oil can cause cancer or reproductive toxicity. Avoid skin contact and breathing of vapors. Use rubber gloves and wash exposed skin. Accidental or remote starting of the generator set can cause severe personal injury or death. Disconnect the negative (-) battery cable and place the control switch in its OFF position before starting work.

1. Pull out the dip stick and wipe it clean
2. Reinsert the dip stick
3. Remove the dipstick one final time and check the oil level

NOTICE

The engine oil level indicated on the dipstick should be between the FULL and ADD marks.

4. Reinsert the dipstick

If the engine oil level check shows excessive or insufficient levels of oil (oil level line above the FULL mark or below the ADD mark), oil must be drained or added. Refer to the following sections ([Drain Oil](#) or [Add Oil](#) - as needed) for instructions and guidelines for draining and adding oil.

3.5.3 Add or Drain Oil

CAUTION

Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the FULL and ADD marks on the dipstick.

3.5.3.1 Drain Oil

If the oil level is found to be excessive (see [Checking Engine Oil Level](#)), oil must be drained from the engine.

1. Attach one end of the drain hose (shipped loose with the genset) to the oil drain valve
2. Place the other end of the drain hose into an appropriate container.

Refer to local/state regulations to determine the appropriate container for used oil.

3. Open the oil drain valve to release oil from the engine into the appropriate container.
4. Re-check the engine oil level ([Checking Engine Oil Level](#))
Based on the results, add or drain oil.
5. When a sufficient amount of oil has been drained from the system:
 - a. Close the oil drain valve
 - b. Remove the drain hose
 - c. Wipe the oil drain valve clean
 - d. Dispose of the used oil in accordance with local/state regulations.

3.5.3.2 Add Oil

If the oil level is found to be insufficient (see [Checking Engine Oil Level](#)), oil must be added.

1. Add the appropriate amount of oil, based on the engine oil level check performed beforehand.
2. Re-check the engine oil level (see [Checking Engine Oil Level](#)).
Based on the results, add or drain oil.
3. Clean up and dispose of any oil in accordance with local/state regulations.

3.5.4 Changing Engine Oil and Oil Filter

Refer to the [Periodic Maintenance Schedule](#) for scheduled engine oil changes and to the control panel for the oil filter part number. Change oil more often in hot and dusty environments.

1. Run the generator set until warm, shut down and place pan under the end of the oil drain hose attached to the drain valve.
2. Make sure the oil drain hose is connected to the oil drain valve and open the drain valve. Reclose the valve when oil stops draining.
3. Spin off the oil filter canister and clean the filter mounting surface on the engine block. Remove the old gasket if it remains.
4. Make sure the gasket is in place on the new filter and apply a thin film of clean oil to the gasket. Spin the new filter on until the gasket just touches the block. Turn it an additional 1/2 to 3/4 turn. Do not over tighten.
5. Refill with 67 oz (2 liters) of oil.

⚠ CAUTION

Too much oil can cause high oil consumption. Too little oil can cause severe engine damage. Keep the oil level between the Full and Add marks.

6. Start and run for 30 seconds.
7. Shut the engine off and wait 5 minutes.
8. Add more oil slowly, to bring the oil level to the FULL mark on the dipstick.
9. Dispose of the used oil and oil filter according to local environmental regulations.

3.6 Replacing the Air Filter Element

⚠ WARNING

Before working on the generator set, move the Switch (S2) to the Stop Position, disconnect the remote harness (P7) to disable the ATS mounted charger, and remove the negative (-) battery cable from the battery to prevent starting.

Refer to the [Periodic Maintenance Table](#) for scheduled air filter replacements. Replace it more often in dusty environments.

To change the filter element:

1. Remove the outer and inner cover and reassemble with a new air filter element.
2. Make sure the outer cover is seated before tightening its wing nut.

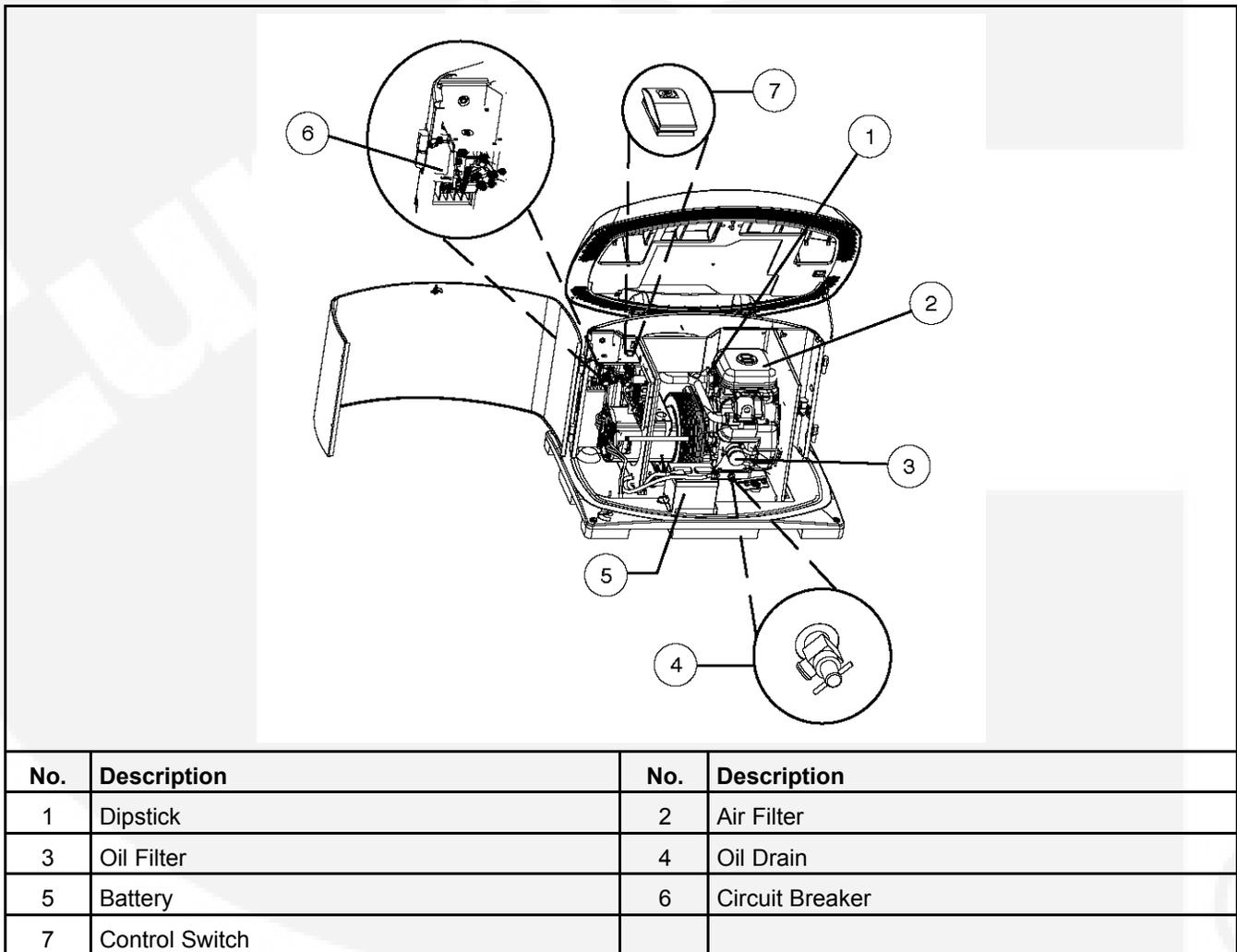


FIGURE 2. MAINTENANCE POINTS

3.7 Battery Maintenance

⚠ WARNING

Arcing at battery terminals or in light switches or other equipment, and flames or sparks, can ignite battery gas causing severe personal injury—Ventilate battery area before working on or near battery—Wear safety glasses—Do not smoke—Switch work light ON or OFF away from battery—Stop the generator set—Disconnect the negative (-) battery cable first and reconnect it last.

⚠ WARNING

Before working on the generator set, move the Switch (S2) to the Stop Position, disconnect the remote harness (P7) to disable the ATS mounted charger, and remove the negative (-) battery cable from the battery to prevent starting.

Refer to the [Periodic Maintenance Table](#) for scheduled battery maintenance, and follow the battery manufacturer's instructions. Have the battery charger in the transfer switch replaced if the battery keeps running down.

Always:

1. Keep the battery case and terminals clean and dry and the terminals tight.
2. Remove battery cables with a battery terminal puller. Torque threaded stud battery terminals as recommended by the battery manufacturer.
3. Make sure which terminal is positive (+) and which is negative (-) before making battery connections, always removing the negative (-) cable first and reconnecting it last to reduce arcing.

NOTICE

If the battery needs to be replaced, be sure that the replacement battery specs match those found in the [Specifications Table](#) in this manual.

3.8 Spark Plugs

⚠ WARNING

Before working on the generator set, move the Switch (S2) to the Stop Position, disconnect the remote harness (P7) to disable the ATS mounted charger, and remove the negative (-) battery cable from the battery to prevent starting.

Set the genset control to the Off position before checking the spark plugs.

Refer to the [Periodic Maintenance Table](#) for scheduled spark plug replacement.

The genset has two spark plugs: one on each side of the engine. The spark plugs must be in good condition for proper engine starting and performance. A spark plug that fouls frequently or has heavy soot deposits indicates the need for engine service.

To prevent cross threading a spark plug, always thread it in by hand until it seats. Torque the spark plug to 15 lb-ft (20 N-m).

Return the genset control to Auto when finished performing maintenance.

3.9 Accessory Heater Kits

⚠ WARNING

Electrical connections must be made by a trained and experienced electrician. Improper installation can lead to electrocution and damage to property. Automatic startup of the generator set during installation can cause severe personal injury or death. Push the control switch Off and disconnect the negative (-) cable from the battery to keep the generator set from starting.

An optional thermostatically controlled battery heater is available for more reliable starting in ambient temperatures down to -20 °F (-28.8 °C). The heater wraps around the battery. The heater cord is connected in the 120V junction box.

An optional thermostatically controlled oil and alternator heater assembly is also available for more reliable generator starting at low ambient temperatures. The heater cord is connected in the 120V junction box.

TABLE 11. HEATER KITS AND PARTS

Part Description	Model/Part Number (included in product unless otherwise noted)
Heater Assembly (Spec A and Canadian GSBB Spec B)	20GSBB-6714A
Heater Assembly (US GSBB Spec B and Canadian GSBC Spec B)	20GSBB-6714B, 20GSBC-6727B, 15GSBB-6720B
Harness, Interface (Spec A and Canadian GSBB Spec B)	A030B021
Harness, Interface (US GSBB Spec B and Canadian GSBC Spec B)	A041U952
Harness, Heater (Oil Heater) (Spec A and Canadian GSBB Spec B)	A030B021
Harness, Heater (Alternator Heater) (Spec A and Canadian GSBB Spec B)	A030B021
Harness, Heater (Alternator Heater) (US GSBB Spec B and Canadian GSBC Spec B)	Accessory Only
Battery Heater Kit	Accessory Only
Breather Shroud	Accessory Only

3.10 Maintenance Record

Record all periodic and unscheduled maintenance and service. See the [Periodic Maintenance Schedule](#) for a list of scheduled maintenance frequency.

4 Service

⚠ WARNING

Some Generator Set service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform Generator Set service.

⚠ WARNING

Accidental or remote starting of the generator set can cause severe personal injury or death. Disconnect the negative (-) battery cable and place the control switch in its OFF position before starting work. Hazardous Voltage. Before starting work disconnect the source that supplies 120 V for the generator set accessory heaters and GFCI outlet

⚠ WARNING

Gaseous fuels are flammable and explosive and can cause severe personal injury or death. Do not smoke if you smell gas or are near fuel tanks or fuel-burning equipment or are in an area sharing ventilation with such equipment. Keep flames, sparks, pilot lights, electrical arcs and arc-producing equipment and all other sources of ignition well away. Keep a type ABC fire extinguisher handy.

4.1 Placing the Generator Set Back in Service

Before leaving the site, if the generator set is ready to be placed in service, set the control switch to the REMOTE position to provide automatic standby power.

NOTICE

If the generator set is not in Remote mode, the generator set control goes to sleep and needs to be reconfigured each time it wakes up.

If the control board is replaced, it will be necessary to configure the replacement control board.

NOTICE

Before placing the genset back in service, review the [Startup and Configuration](#) chapter of this manual.

4.2 Transfer Switch

⚠ WARNING

Interconnecting the generator set and the public utility can lead to the electrocution of personnel working on the utility lines, damage to equipment and fire. An approved switching device must be used to prevent interconnections.

For information regarding servicing the transfer switch, see the manual that was shipped with your transfer switch.

4.3 Engine

This generator set is powered by a Briggs & Stratton Vanguard M61 Engine.

Engine	Part Number
Spec A and Canadian GSBB Spec B	A026L548
US GSBB Spec B and Canadian GSBC Spec B	A040R203

For engine-specific service, refer to the Engine Service Manual.

4.4 Engine - Generator Assembly

4.4.1 Engine - Alternator Removal

1. Shut down the generator set and disconnect all power from the house to the generator set.

⚠ WARNING

Hazardous Voltage. Before starting work disconnect the source that supplies 120 V for the generator set accessory heaters and GFCI outlet

2. Turn off the fuel supply.
3. Remove the negative (–) cable from the battery.

⚠ WARNING

Accidental or remote starting can cause severe personal injury or death. Disconnect the negative (–) cable at the battery to prevent the engine from starting before installing the kit.

4. Disconnect the battery charger from the transfer switch by disconnecting connector P7.

⚠ WARNING

Even though the battery is disconnected, the wires may still be live from the battery charger in the transfer switch (trickle charger).

5. Remove the roof, service doors, finger guards and panels as necessary.
6. Disconnect all fuel and electrical lines and muffler from the engine and alternator.
7. Secure a hoist to the two lifting eyes on the engine and either strap around the alternator or use the labeled lifting points to achieve a 4-point lift on the engine-alternator assembly.

NOTICE

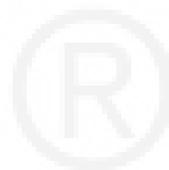
Only the engine and alternator may be lifted using the four lifting points, the rest of the generator set must be lifted utilizing the pockets under the skid.

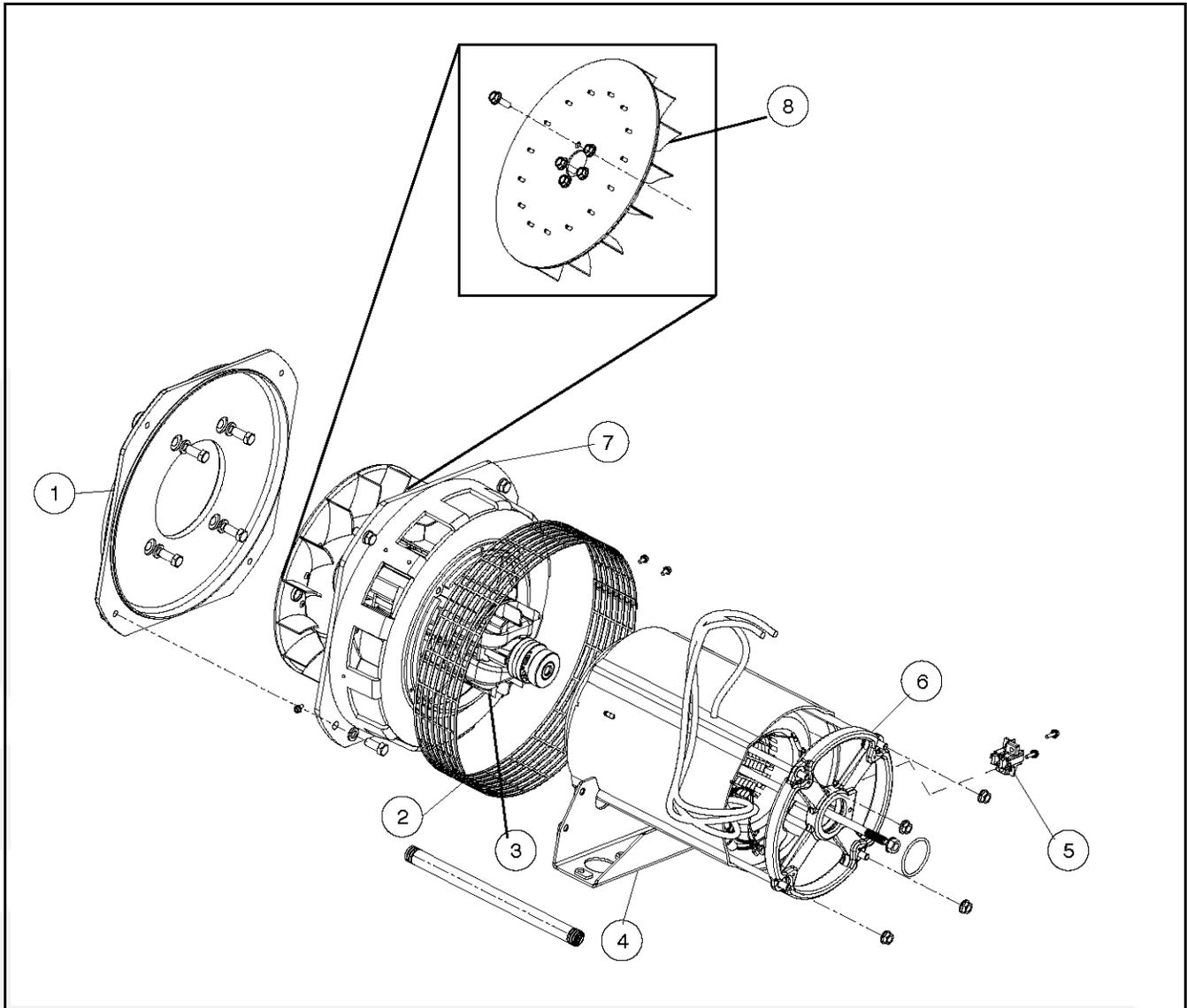
8. Remove the nuts that secure the four vibration isolators to the engine or generator.
9. Lift the engine-alternator assembly away as a unit for service.

4.4.2 Engine-Alternator Installation

Reference the image below for installation of the engine-alternator assembly.

See the [Testing The Fuel System for Leaks](#) section of this manual for appropriate fuel testing methods.





No.	Description
1	Fan housing
2	Fan guard
3	Wound armature
4	Generator stator
5	Alternator brush block
6	Generator end bell
7	Alternator adapter
8	Alternator fan

FIGURE 3. ALTERNATOR ASSEMBLY

4.5 Fuel System Components Testing

⚠ WARNING

Fuel systems must be installed by qualified service technicians. Improper installation presents hazards of fire and improper operation, resulting in severe personal injury or property damage.

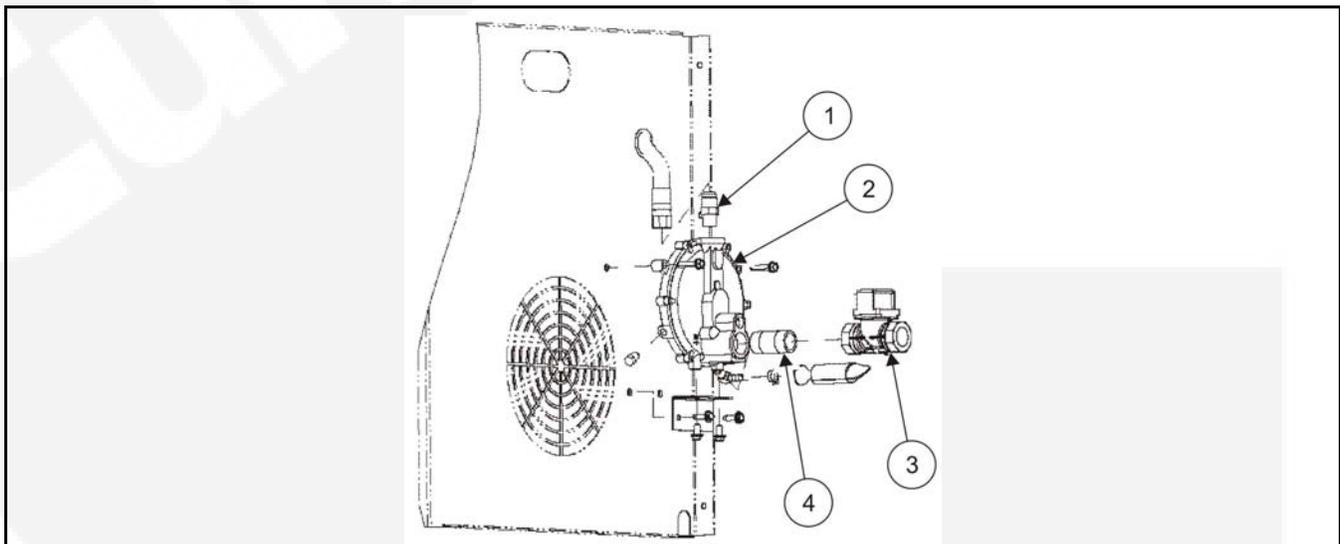
⚠ WARNING

Gaseous fuels are flammable and explosive and can cause severe personal injury or death. Do not smoke if you smell gas or are near fuel tanks or fuel-burning equipment or are in an area sharing ventilation with such equipment. Keep flames, sparks, pilot lights, electrical arcs and arc-producing equipment and all other sources of ignition well away. Keep a type ABC fire extinguisher handy.

⚠ CAUTION

Unauthorized modifications or replacement of fuel, exhaust, air intake or speed control system components that affect engine emissions are prohibited by law in the State of California.

The following image illustrates the fuel system components. The gas demand regulator meters fuel to the engine gas-air mixer. It is usually not the cause of fuel system problems. All other possible fuel system problems should first be checked out.



No.	Description	No.	Description
1	Hose Adapter	3	Solenoid
2	Fuel Regulator	4	Nipple Fitting

Note: The test port (thread size 3/8 NPT) is located on the back side of this image.

FIGURE 4. FUEL SYSTEM COMPONENTS (SPEC A AND CANADIAN GSBB SPEC B)

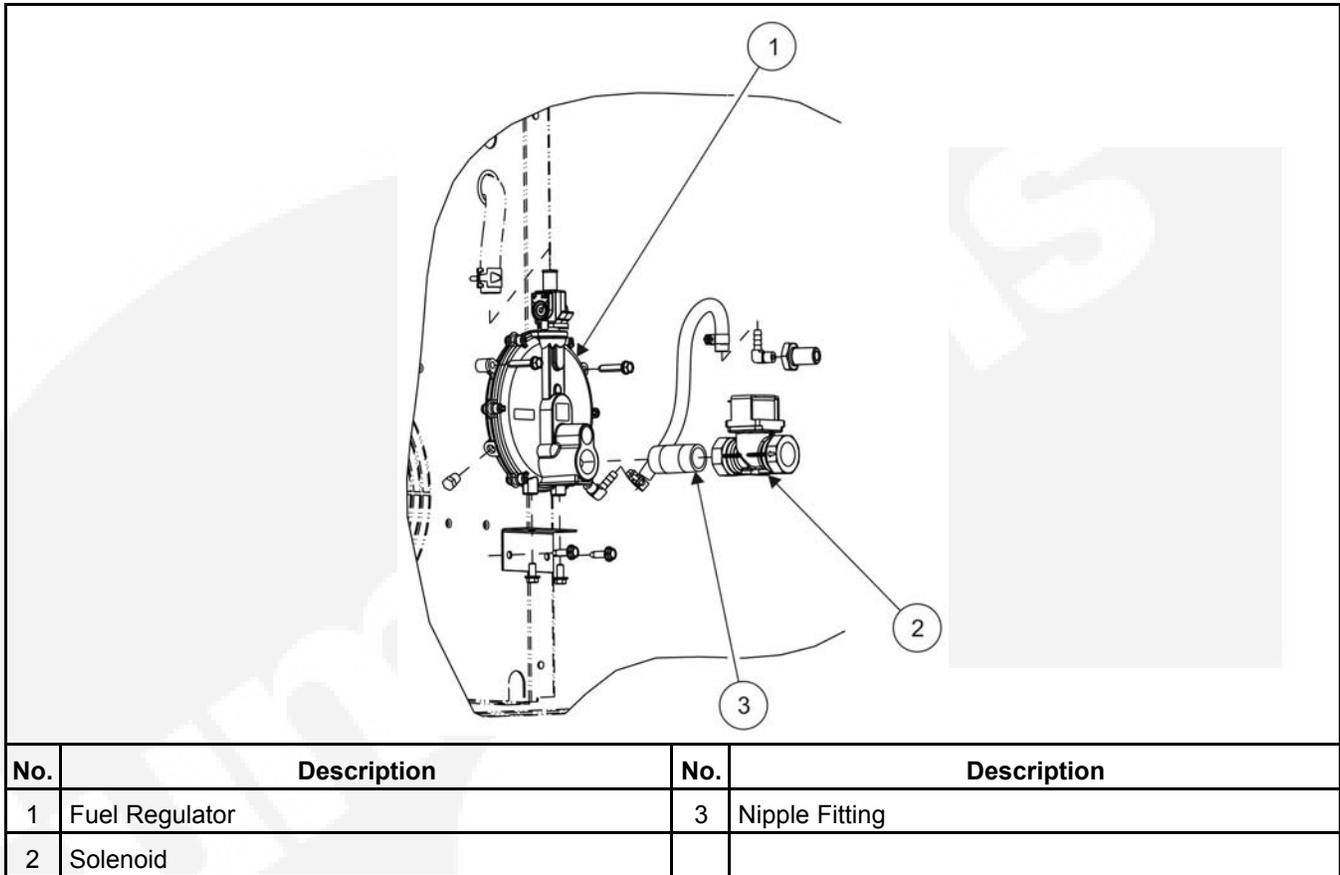


FIGURE 5. FUEL SYSTEM COMPONENTS (US GSBB SPEC B AND CANADIAN GSBC SPEC B)

4.5.1 Fuel Pressure

⚠ WARNING

High gas supply pressure can cause gas leaks which can lead to fire and severe personal injury or death. Gas supply pressure must be adjusted to specifications by trained and experienced personnel.

Satisfactory performance requires that the propane vapor be supplied at the appropriate WC (water column). See the [Specifications](#) section of this manual.

When measuring supply pressure, the most accurate reading would be on the input side of the demand regulator.

4.5.2 Gas-Air Mixer

Gas-Air Mixer: When reinstalling the gas-air mixer make sure to assemble the components in the appropriate order, with three new flange gaskets. Torque the flange bolts to 13 ft-lbs (17.5 N-m).

4.5.3 Governor Actuator

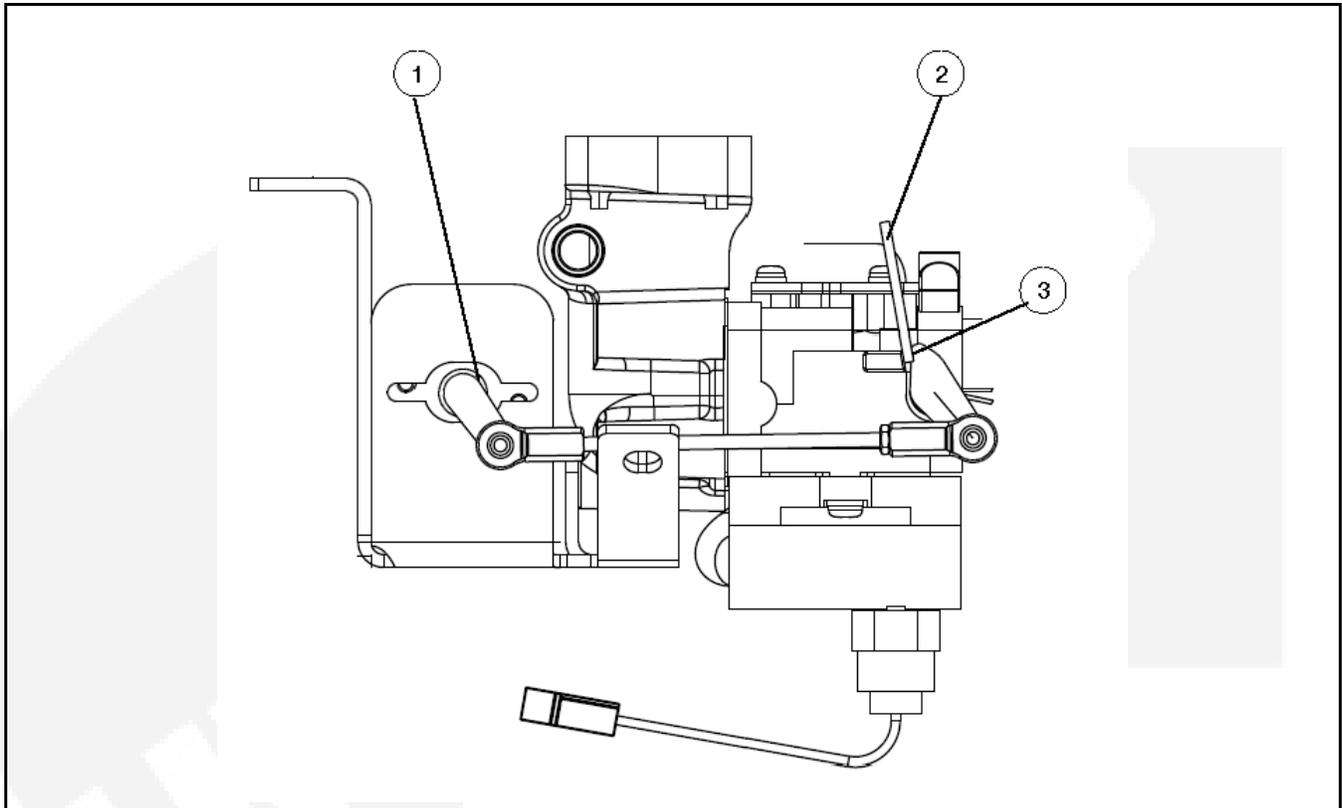
Governor Actuator Testing: Disconnect the two actuator leads and apply 12 VDC. Replace the actuator if the actuator arm does not move smoothly and without binding to the wide open throttle position (rotation of approximately 35 degrees).

Governor Actuator Replacement:

NOTICE

It is beneficial to remove the air cleaner including the base for this procedure and to place a clean rag in the "V" between the cylinders to catch any small fasteners that may drop.

1. Mount the actuator on its bracket with the lever pointing down (approximately 8 o'clock). Do not tighten the screws at this time.
2. Connect one end of the ball end throttle link to the mixer arm, using a washer on both faces of the arm and one end to the actuator lever, tightening both screws to 6 in/lb-f.
3. Hold a 3/32" diameter rod (a drill bit works well) at the wide open throttle slot. Pushing the governor actuator arm counter-clockwise to wide-open the throttle, slide the actuator in its slots until the throttle lever just touches the rod. Tighten the two actuator mounting screws to 6 in/lb-f.
4. When the linkage assembly is released, the throttle lever arm should rest against the low idle screw.
5. Push the link to check that the throttle arm can open fully to the 3/32" diameter rod and touch the low idle screw. If not, readjust the position of the actuator. The throttle should open fully and close fully.



No.	Description
1	Rotate arm counter-clockwise to fully open slide until the lever just touches the rod. Tighten the fasteners.
2	3/32" rod
3	Lever just touches the rod

FIGURE 6. GOVERNOR ACTUATOR - OPEN

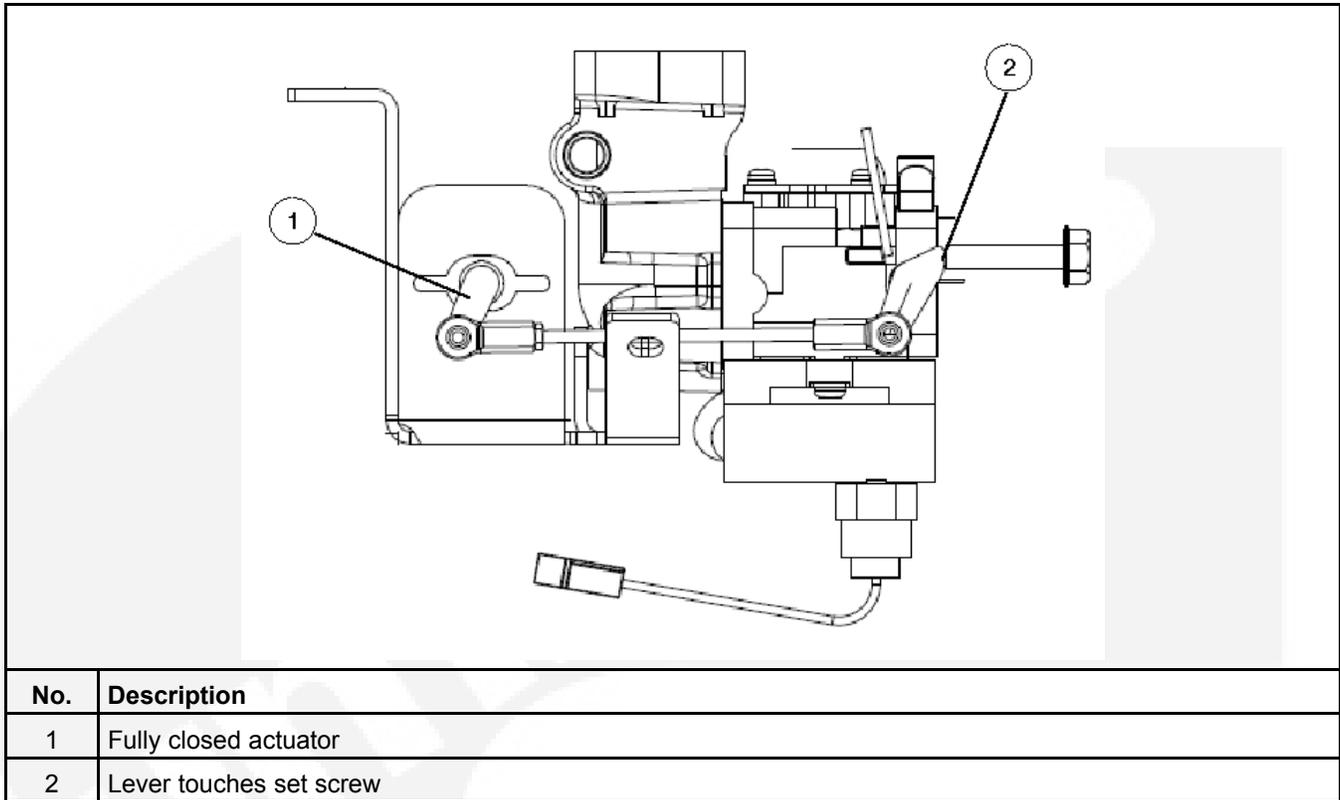


FIGURE 7. GOVERNOR ACTUATOR - CLOSED

4.5.4 Governor Linkage Adjustment (50 Hz LP Only)

NOTICE

It is beneficial to remove the air cleaner including the base for this procedure and to place a clean rag in the "V" between the cylinders to catch any small fasteners that may drop.

Due to inconsistencies in fuels, operating temperatures and engine variation, it may be necessary to adjust the linkage in order to achieve the proper no load frequency (primarily in 50 Hertz LP applications).

1. Loosen the fasteners that hold the actuator.
2. Slide the actuator to its furthest point away from the butterfly.
3. Tighten both fasteners to 6 in-lb-f.

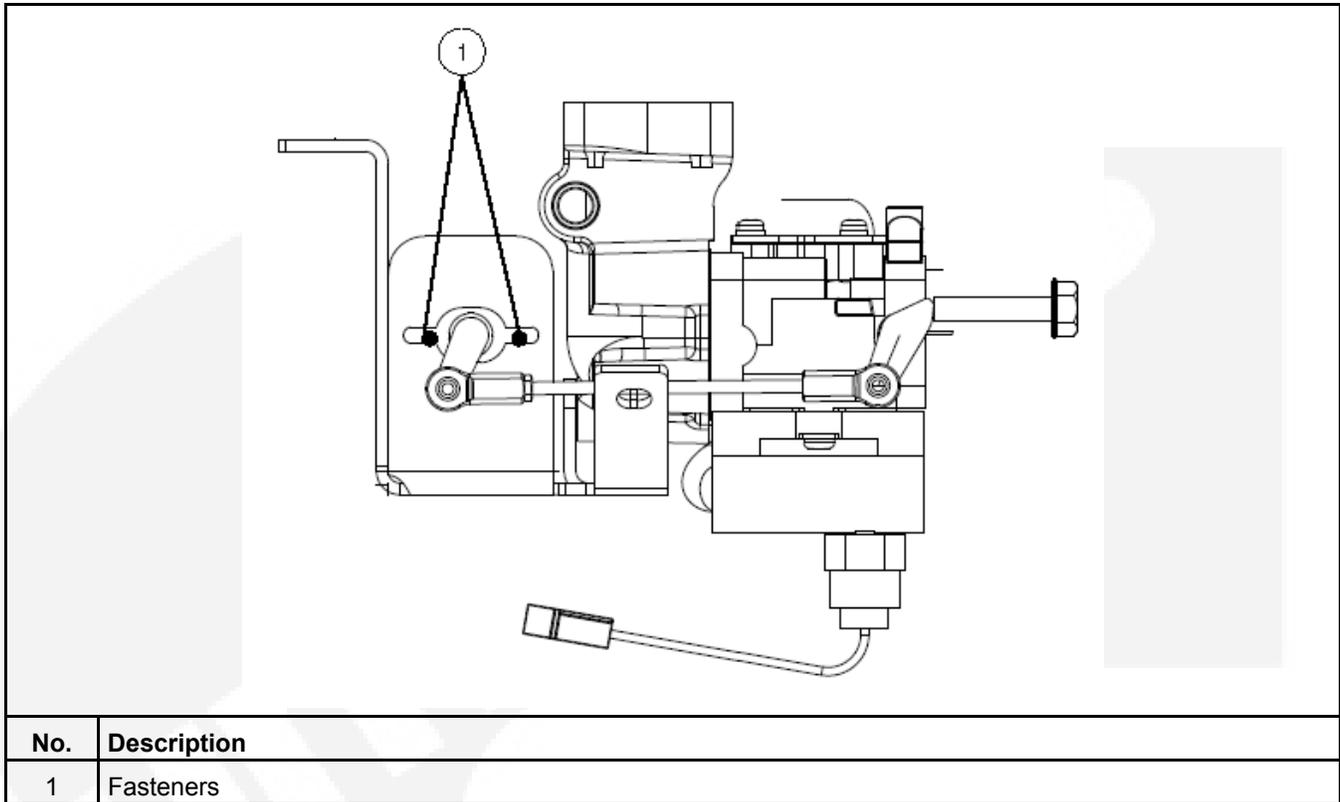


FIGURE 8. GOVERNOR ACTUATOR - FASTENERS

4.5.5 Gas Demand Regulator

Conduct a lock-off pressure test as follows before replacing a demand regulator. Replace the demand regulator only if lock-off pressure is not within the range of 0.20–0.35 inches (5.1–8.9 mm) WC (Spec A and Canadian GSBB Spec B) or 0.075 ± 0.025 inches (19 ± 6.35 mm) WC (US GSBB Spec B and Canadian GSBC Spec B).

Lock-Off Pressure Test: Lock-off pressure is determined by pressurizing the back (vent) side of the regulator diaphragm to simulate gas-air mixer venturi vacuum. Conduct the test as follows:

1. Connect the regulator inlet to a source of air pressure regulated to 11 inches (28 cm) WC.
2. Disconnect the hose from the engine gas-air mixer at the regulator outlet. The soap bubble will be placed on the hose barb at the regulator.
3. "T" in two hoses to the end of the regulator vent hose (3/8 inch I. D.). Use one hose to measure pressure by connecting it to an inclined manometer that reads 0–2 inches (0–50 mm) WC and the other to provide the test pressure.
4. Attach a soap bubble to the hose barb at the regulator outlet. While reading the pressure indicated by a manometer and watching the soap bubble, blow lightly into the hose being used to pressurize the regulator. Regulator lock-off pressure is the minimum pressure that will cause air to flow through the regulator, as indicated by the expanding soap bubble. (At first the soap bubble may expand due to diaphragm movement but will stop expanding if air is not flowing through the regulator.)

NOTICE

Make sure the diaphragm is in a vertical plane (as in the genset) when performing a bench test, otherwise the weight of the diaphragm will cause erroneous readings of lock-off pressure.

Vent Hose: Make sure to reconnect the regulator vent hose to the vent insect screen as required.

4.5.6 Fuel Solenoid

Test for Leakage: If there is a smell of gas when the genset is not running, or any other reason to suspect that the valve is leaking, connect the inlet of the valve to a source of air pressure regulated to not more than 14 inches WC (35 cm) and disconnect the outlet hose. Replace the solenoid if it leaks. Use a soap bubble to check for leakage.

Test for Operation: Disconnect the solenoid from the generator set wiring harness and connect it to a 12 volt battery while the source of air pressure is still connected. Replace the solenoid if it does not open.

First Start: Upon the first connection of the fuel, especially in LP systems, it is possible for a spike of pressure greater than the operating strength of the fuel solenoid to pass through the main regulator and to lock the solenoid into an inoperable position. This issue can be reduced by using a two-stage regulator at the tank.

If the situation occurs:

1. Close the main valve at the tank and vent the fuel from the line at the tank.
2. Start the crank cycle at the genset and then turn on the fuel at the tank while the engine is cranking.

NOTICE

Multiple crank attempts may be required to purge the fuel line, depending on the length of the run.

4.5.7 Low Gas Pressure Switch (If Equipped)

Disconnect the pressure switch from the generator set wiring harness and check for electrical continuity across its terminals while connected to a source of air pressure regulated to not more than 14 inches WC (35 cm). Replace the switch if it does not close when air pressure is applied or open when pressure is released.

4.5.8 Testing the Fuel System for Leaks

⚠ WARNING

Fuel presents the hazard of explosion or fire which can result in severe personal injury or death. Do not smoke or allow any flame, spark, pilot light, arc-producing equipment, switch or other ignition sources around fuel or fuel components.

Before operating the generator set, test the fuel system for leaks.

- Energize the fuel solenoid from a separate 12-volt DC source before testing the fuel system

NOTICE

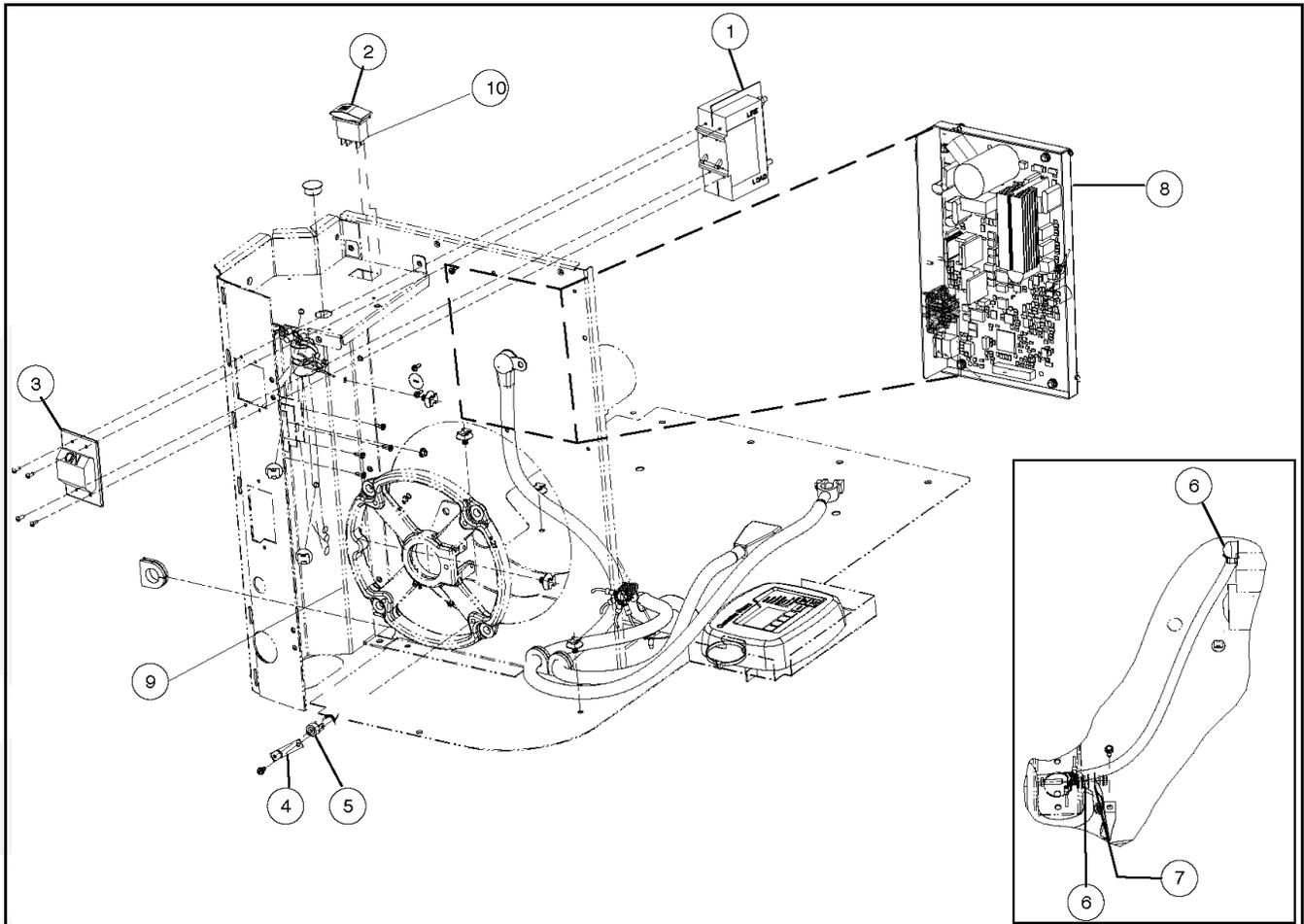
Testing for gas leaks with a flame can cause a fire or explosion that can lead to severe personal injury or death. Use approved methods only.

After assembly, and before initial operation, all fuel system connections, hose valves, regulators and fittings must be tested and proven free of leaks using a soap-and-water (or equivalent) solution while the system is under gas or air pressure of at least 1.5 times the supply pressure or 3 psi (20.7 kPa) minimum.

- Apply the soap-and-water solution to all fuel system connections, hose valves, regulators and fittings.
 - When the system is running, bubbles will form where air/pressure is leaking from the system.

Other approved methods of detecting leaks can be used if appropriate. **DO NOT** use a flame to test for gas leaks.

4.6 Control



No.	Description
1	Circuit breaker
2	Rocker switch
3	Insulation boot
4	Sensor bracket
5	Temperature switch
6	Battery lead
7	Electrical strap
8	Control card
9	Engine harness
10	Single pole dual relay

FIGURE 9. CONTROL COMPONENTS

4.6.1 Generator Control

General: The generator control is an integrated microcontroller-based engine, generator and transfer switch control. It provides all the control, monitoring and diagnostic functions required to operate a standby generator set.

Transfer Switch Control: When a transfer switch without a built-in controller is used, all transfer and retransfer signals come from the generator control. Transfer times are pre-set and not adjustable. Power transfer from the utility to the genset is set at five seconds. Retransfer to the utility is set for ten minutes. After retransfer, there is a generator cool down period of ten minutes.

Connections: All DC control connections to the control are through connector J1. Utility sense and control connections are through connector P7. Optional Ethernet connections are through a Cat 5 Ethernet cable connector. Refer to the appropriate wiring diagrams and wiring harness drawings.

Mounting: The control is mounted on the left inner panel, under the finger guard. The finger guard and control panel each have 4 screws for mounting.

Configuration: Perform [Generator Set Configuration](#) when replacing the control board.

Software Updates: To update the control software:

1. Disconnect the harness to the in-home display at J4 before updating the control software. Refer to the appropriate wiring diagrams for more information.
2. Connect the InPower Onan service tool harness (PN 0338-4840) to remote connector J5.
3. Hold the stop button to wake up the control.
4. Connect InPower Onan and update the software.
5. Disconnect the service tool harness and reconnect the in-home display to J4.

4.6.2 START/STOP Switch S2

Unsnap the connector from the back of the switch for access to its terminals. Replace the switch if it does not:

- close across terminals 2 and 3 when the switch is held in the Start position
- close across terminals 1 and 2 when held in the Stop position
- the status indicator light does not light when 12 VDC is connected across terminals 7 (-) and 8 (+)

4.6.3 Line Circuit Breaker CB1/CB2

Disconnect all wiring and check electrical continuity across the terminals of each circuit breaker. Replace a circuit breaker that does not reset or that does not close or open as the handle is turned ON and OFF.

4.6.4 Current Transformers CT1/CT2

The current transformers are tied to the line side of the circuit breakers with polarity dot toward the generator.

4.6.5 Alternator Temperature Switch

The alternator temperature switch contacts are normally closed. The switch contacts open at $170\text{ }^{\circ}\text{F} \pm 5^{\circ}$.

4.7 Generator

4.7.1 Operation

This is a single-bearing, two-pole, revolving field generator with brushes and slip rings. Output voltage is regulated by the generator set control.

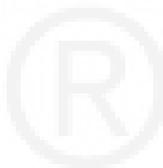
Stator: The stator consists of steel laminations with two sets of windings in the lamination slots. The main windings (L1-L2, Neutral) power the connected loads and the quadrature windings (Q1-Q2) supply power for the generator field.

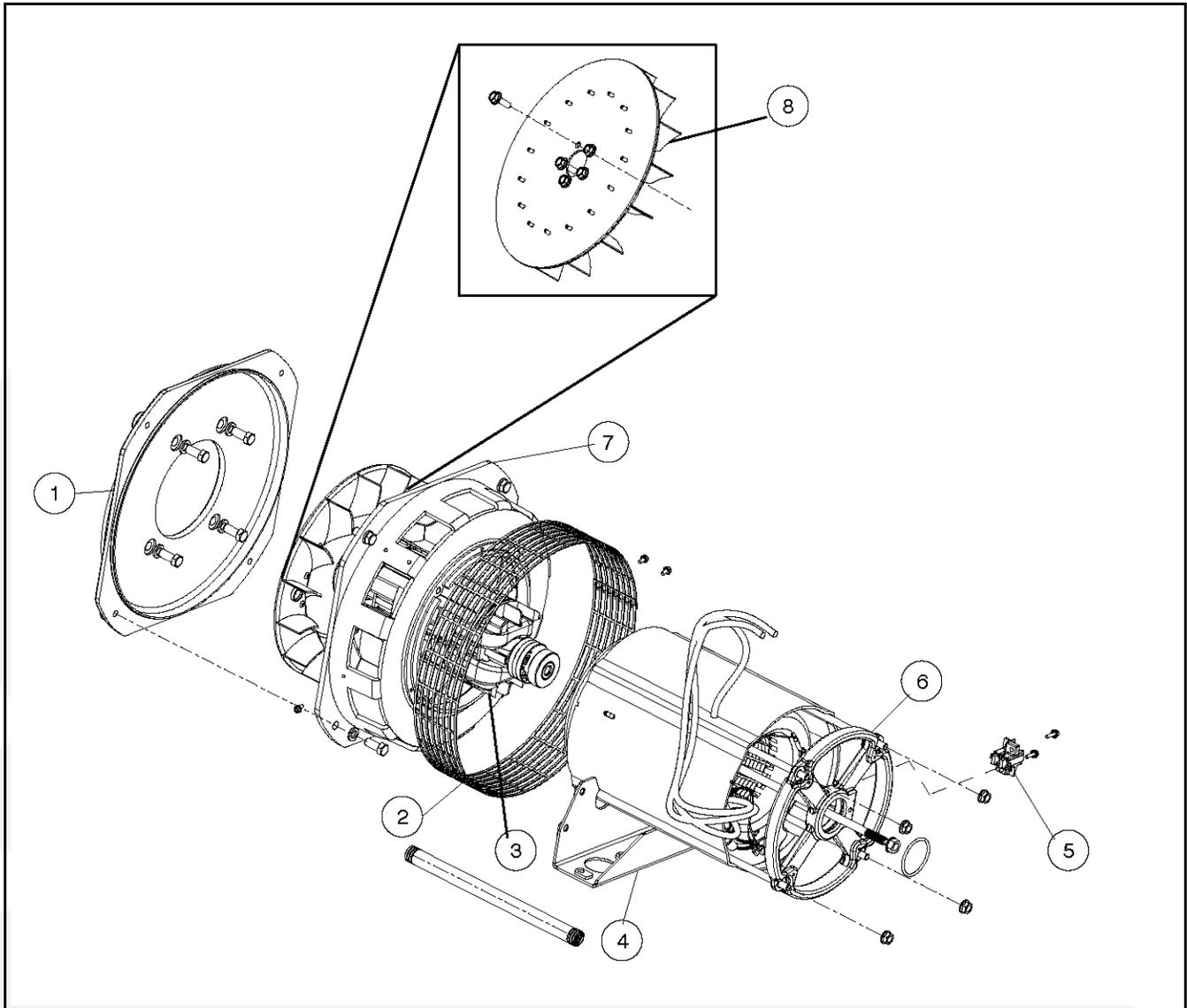
See [Testing the Generator](#).

Rotor: The rotor consists of a shaft with steel laminations wrapped with field windings. A molded slip ring assembly is pressed on to supply field current to the rotor windings through the brush block assembly. The rotor shaft is supported in the end bell by a sealed ball bearing. The rotor is centered on and driven by the taper on the end of the engine crankshaft.

Brush Block: Field current passes through the brush block which has two spring-loaded carbon brushes that make contact with the rotor slip rings.

Voltage Regulator: The generator set control maintains constant output voltage under varying load conditions by varying field current. Power for field excitation is supplied by the quadrature winding (Q1-Q2).





No.	Description
1	Fan housing
2	Fan guard
3	Wound armature
4	Generator stator
5	Alternator brush block
6	Generator end bell
7	Alternator adapter
8	Alternator fan

FIGURE 10. GENERATOR (ALTERNATOR)

4.8 Alternator Temperature Switch

The alternator temperature switch contacts are normally closed. The switch contacts open at 170 °F ± 5°.

4.9 Brush Block/Slip Ring Service

Disconnect the field leads from the brush block (F1, F2), remove the two mounting screw and withdraw the brush block from the generator end bell. Replace the brush block assembly if either brush is shorter than 7/16 inch (11 mm), binds in the brush block or is damaged in any way.

Remove the brush block and inspect the slip rings for grooves, pits, or other damage. Use a Scotch Brite pad or commutator stone to remove light wear or corrosion.

4.10 Stator Service

Removal:

1. Remove roof, service doors, finger guards and panels as necessary.

NOTICE

The back panel must be removed to remove the stator.

2. Remove the engine-generator assembly.
3. Remove the brush block.

⚠ CAUTION

The brushes can be damaged if the brush block is not removed before removing the end bell.

4. Remove the nuts and lock washers on the four stator through studs.
5. Remove the end bell.
6. Pull the stator straight out and away from the engine, leaving the rotor and through studs in place, taking care not to damage rotor or stator windings.

Reassembly: Reassembly is the reverse of removal. Re-lubricate the bearing bore in the end bell with molybdenum disulfide paste or equivalent and make sure the O-ring is placed in the bearing bore. Torque the nuts on the through studs to 31 ft-lbs (42 N-m).

4.11 Rotor Service

Removal:

1. Remove roof, service doors, finger guards and panels as necessary.

NOTICE

The back panel must be removed to remove the rotor.

2. Remove the stator and stator through studs.
3. Remove the nut and flat washer on the rotor through stud and remove the through stud. (Use two nuts locked together at the end of the rotor through stud to loosen and remove the stud from the crankshaft.)
4. Thread in a rotor removal rod (shortened rotor through stud or 7/16-14 UNC-2A threaded rod) and turn it with a screwdriver until it bottoms in the crankshaft. Thread in and tighten a 9/16-12 UNC-2B bolt against the rod until the rotor breaks loose from the crankshaft.

Reassembly: Reassembly is the reverse of removal. Torque the nut on the through stud to 49 ft-lbs (67 N-m). If it is necessary to reinstall the engine-generator adaptor, torque the four mounting bolts to 49 ft-lbs (67 N-m).

4.12 Testing the Generator

Rotor Winding Continuity: Test the rotor for grounded, open and shorted windings using an ohmmeter. First test at the brush block terminals. If the resistance is high, remove the brush block and test directly on the slip rings. Replace the brush block if a high resistance is due to the brushes.

Rotor Ground Resistance Test: Set the ohmmeter to the highest resistance scale, or use a megger. Touch one test probe to the rotor shaft and the other to one of the slip rings. Refer to the Rotor and Stator Resistance Tests table for resistance values and any corrective action.

Rotor Winding Resistance: Touch the slip rings with the meter test probes. Refer to the Rotor and Stator Resistance Tests table for resistance values and any corrective action.

Main Winding to Quad Winding: Test for short between main windings and quad windings.

Stator Ground Resistance Test: Set the ohmmeter to the highest resistance scale, or use a megger. Set the ohmmeter to the highest resistance scale and then touch one test probe to the stack and, in turn, the other to each stator lead. Refer to the Rotor and Stator Resistance Tests table for measurement values.

Stator Winding Resistance: Use a meter (Wheatstone Bridge) having a precision down to 0.001 ohms to measure stator winding resistance values as shown in the Rotor and Stator Resistance Tests table.

Stator Winding for Grounds: With an ohmmeter, measure each winding to the stator laminations to check for bad insulation. Refer to the Rotor and Stator Resistance Tests table for measurement values.

TABLE 12. ROTOR AND STATOR RESISTANCE TESTS

Tests	Measurement Values
Rotor Ground Resistance	Reading > 1 megohm (one million ohms) on megger, or infinity on an ohmmeter
Rotor Winding Resistance F1 to F2 (at 75° F - room temperature)	27.59 ohms ± 10%.
Main Winding to Quad Winding	Open (infinity) for any winding
Stator Ground Resistance	Reading > 1 megohm (one million ohms) on megger, or infinity on an ohmmeter.
Stator Winding Resistance (at 75° F - room temperature):	
L1 to N	0.094 ohms ± 10%

Tests	Measurement Values
L2 to N	0.094 ohms \pm 10%
L1 to L2	(Equal to sum of L1 to N and L2 to N) \pm 1%
Q1 to Q2	1.11 ohms \pm 10%
L1 and N to Q1 and Q2	Infinity
L2 and N to Q1 and Q2	Infinity
L1 to Gnd L2 to Gnd	Infinity Infinity
L1 and N to laminations	Infinity
L2 and N to laminations	Infinity
Q1-Q2 to laminations	Infinity
*If a stator or rotor fails the initial test, repeat the test to check the validity of the initial measurement before replacing the stator or the rotor.	

This generator is rated in accordance with UL 2200 (Stationary Engine Generator Assemblies) or CSA C22.2 No. 100-04 (Motors and Generators). The maximum continuous current values that are listed on the generator set nameplate and specification tables occur at the lower limit of acceptable voltage. Maximum current occurs at 108 and 216 volts. The voltage set point of this generator set can be adjusted from the operator panel if desired.

The operator panel allows the service voltage to be changed to 7.5% below the nominal 240 volt set point. The entire 10% voltage adjustment is not allowed by the end user in order to ensure that the utilization voltage is not too low at the end devices. Additional voltage drop across the supply conductors may cause risk of damage or improper function of the devices if the voltage at the genset is set too low.

Derating Guidelines: Maximum wattage or maximum current are subject to and limited by such factors as fuel Btu content, ambient temperature, altitude, engine power and condition, etc. Full rated power is available at 60 °F (15.5 °C) at sea level. Derate 3.5% for each 1000 ft (304.8 m) above sea level and 3% for each 10 °F (5.5 °C) increase in ambient temperature above 60 °F (15.5 °C).

Example Derate Calculation:

Customer location is at 2000 ft (x m) elevation and the ambient air temperature is 90 °F (x °C).

De-rate for Elevation:

$$2000 \div 1000 = 2$$

$$2 \times 3.5\% = 7\% \text{ de-rate for elevation}$$

De-rate for Temperature:

$$90^\circ - 60^\circ = 30^\circ$$

$$30^\circ \div 10^\circ = 3$$

$$3 \times 3\% = 9\% \text{ de-rate for temperature}$$

Total De-rate:

$$9\% + 7\% = 16\% \text{ total de-rate \%}$$

$$\text{Amp} \times (\text{total de-rate} \div 100) = \text{de-rate in amps}$$

$$73.2 \times (16 \div 100) = 11.7 \text{ amps}$$

Expected output will be 73.2 amp - 11.7 amp = 61.5 amp

To verify generator set performance:

1. Follow de-rate guidelines above and determine % reduction in generator set output due to temperature and elevation. See example calculation.
2. While the generator set is running, determine the output voltage at the customer connection block TB2.
3. Use the table below to find the expected current value for the measured voltage and apply the de-rate calculated in step 1.
4. Measure current at the customer connection wires at TB2.
5. Turn on household devices or increase the load setting of the load bank until the current is equal to the de-rated current calculated in step 3. Approximate load bank setting required to achieve the expected amperage output can be estimated by multiplying the expected amperage output by the voltage measured in step 2.

TABLE 13. EXPECTED CURRENT VALUE FOR MEASURED VOLTAGE

Generator Voltage at TB2	Minimum Amps Available Before Derate LP	Minimum Amps Available Before Derate NG	Generator Voltage at TB2	Minimum Amps Available Before Derate NG
252	69.7	61.5	241.5	55.9
249.6	70.4	62.1	239.2	56.4
247.2	71	62.7	236.9	57
244.8	71.7	63.4	234.6	57.5
242.4	72.4	64	232.3	58.1
240	73.2	64.6	230	58.7
237.6	73.9	65.3	227.7	59.3
235.2	74.7	65.9	225.4	59.9
232.8	75.4	66.6	223.1	60.5
230.4	76.2	67.3	220.8	61.1
228	77	68	218.5	61.8
225.6	77.8	68.7	216.2	62.4
223.2	78.7	69.5	213.9	63.1
*220.8	79.5	70.2	*211.6	63.8
*218.4	80.4	71	*209.3	64.5
*216	81.3	71.8	*207	65.2

*These voltage settings are not allowed by the generator control.

5 Operation

5.1 In-Home Operator Panel

The operator panel must be hard-wired to the generator set in order for the generator system to operate.

NOTICE

The in-home operator panel and Internet/Email interface can be used simultaneously

The operator panel consists of two UTILITY status lamps, three GENERATOR status lamps, three action buttons and an LCD display screen with four navigation buttons.

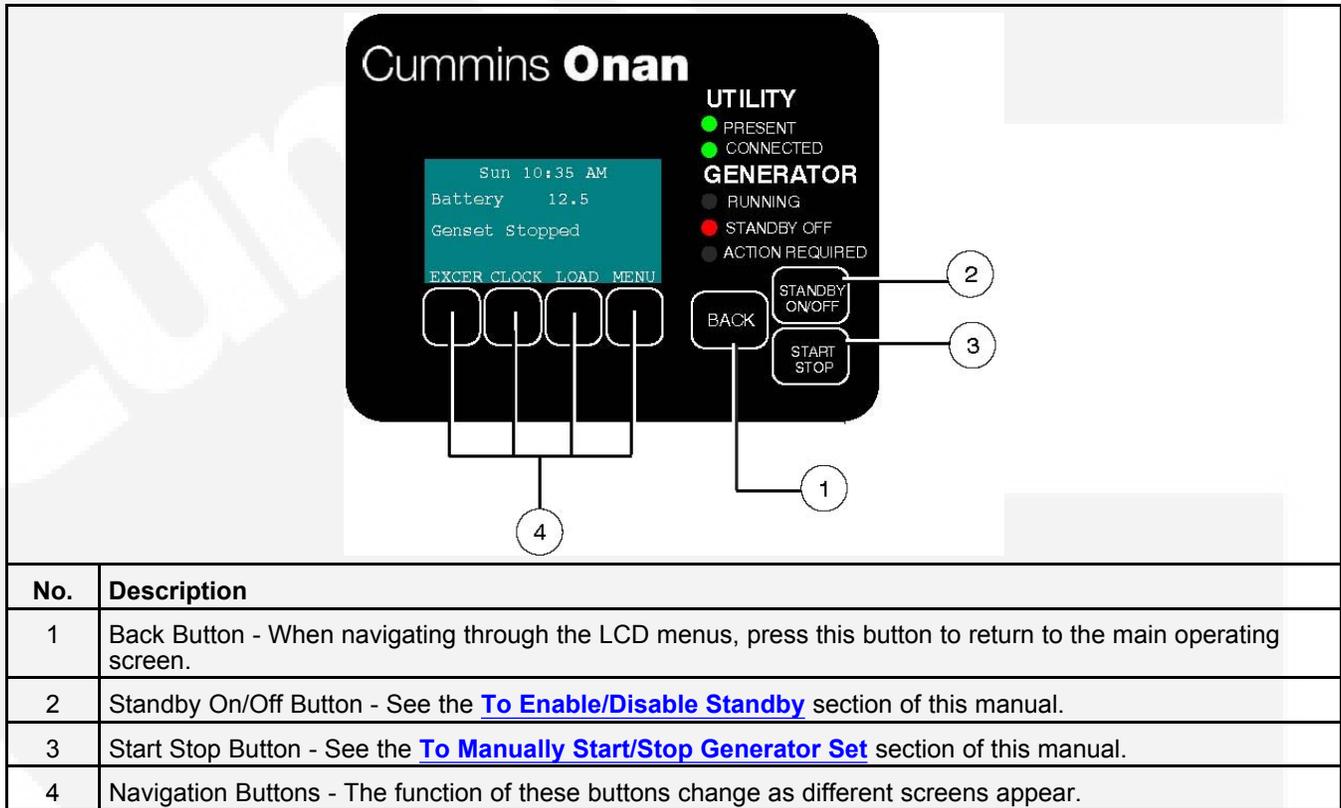


FIGURE 11. IN-HOME OPERATOR PANEL

5.1.1 BACK Button

When navigating through the LCD menus, press the **BACK** button to return to the main operating screen.

5.1.2 Standby ON/OFF Button

See [To Enable/Disable Standby](#).

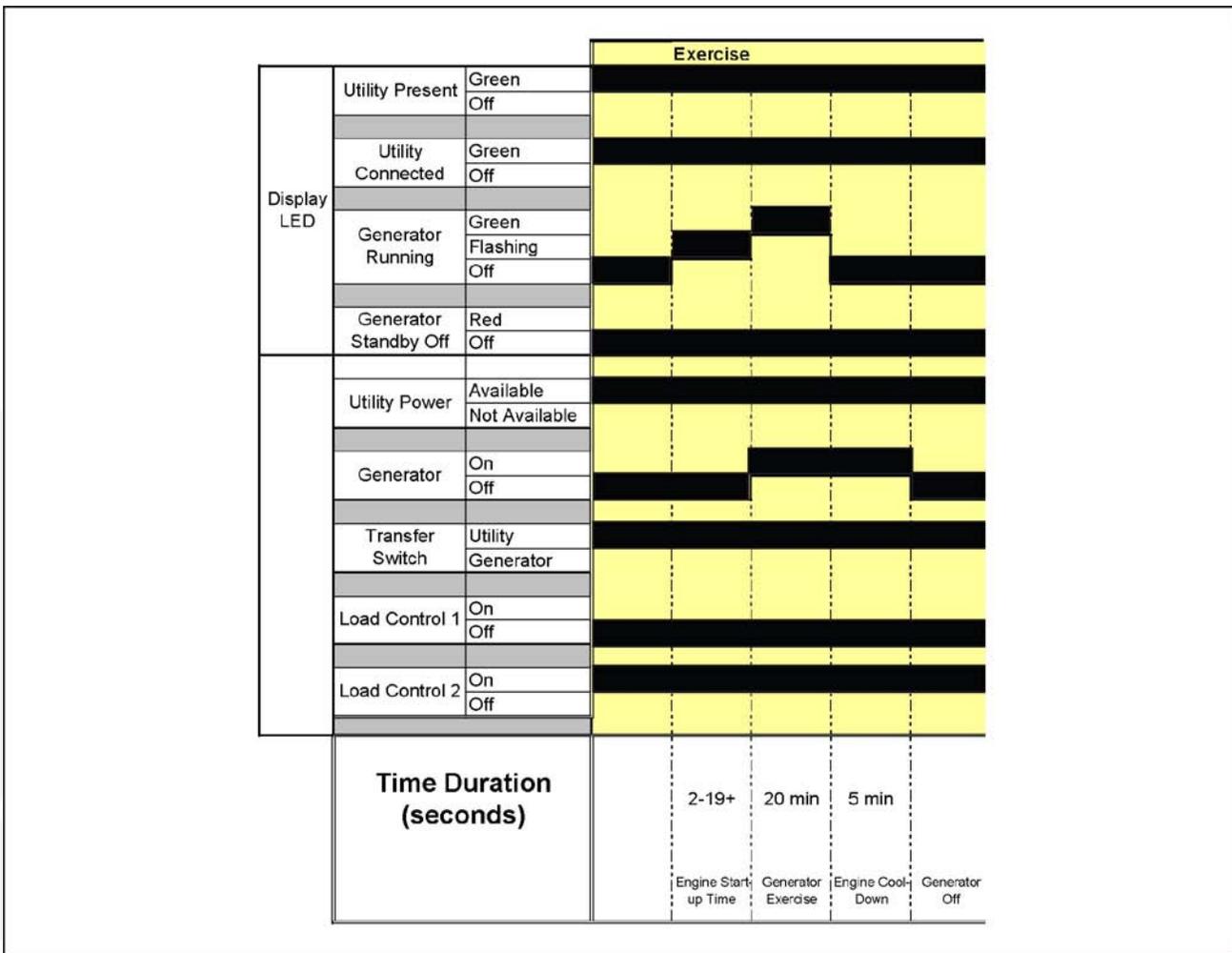


FIGURE 13. EXERCISE TIMING DIAGRAM

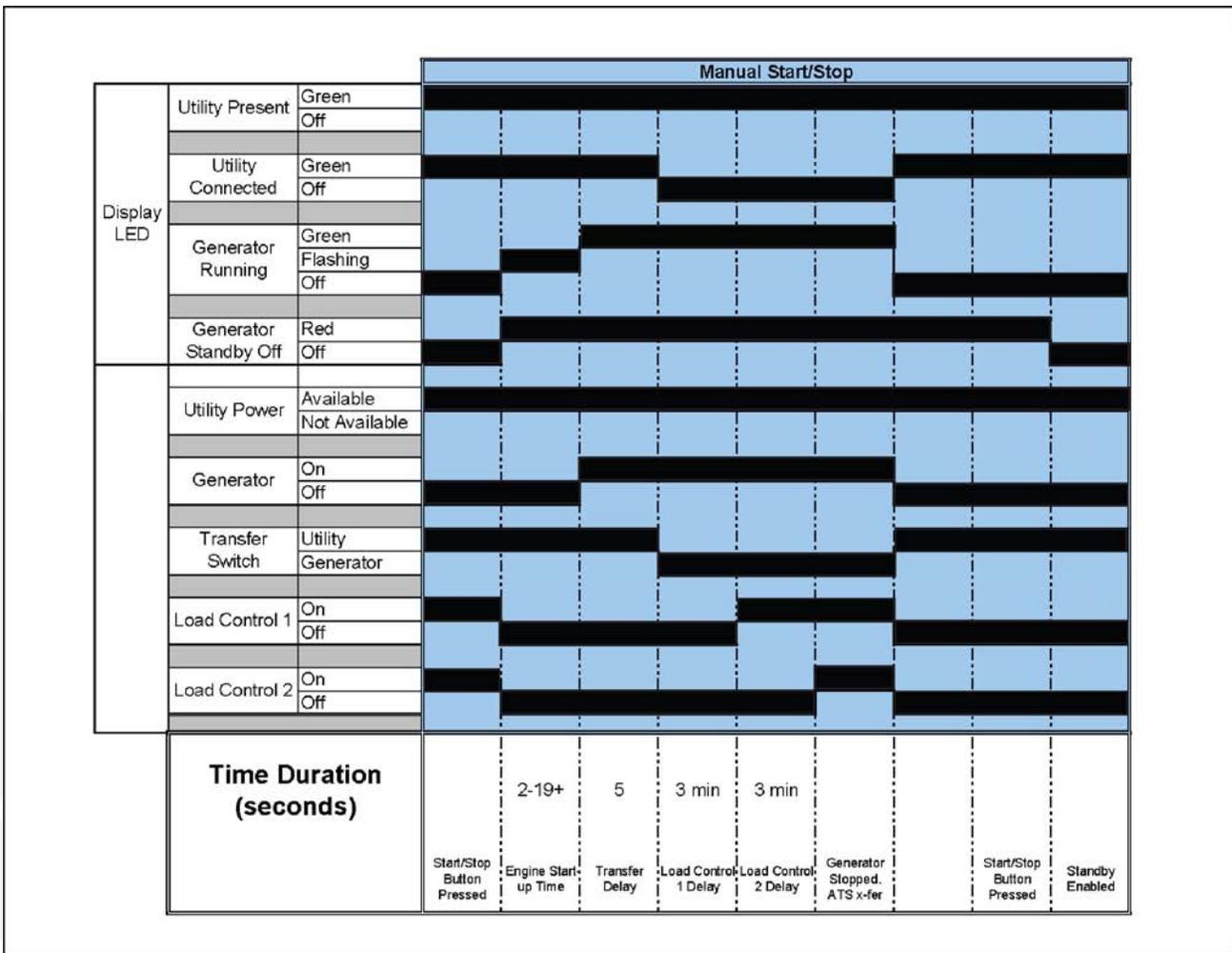


FIGURE 14. MANUAL START/STOP TIMING DIAGRAM

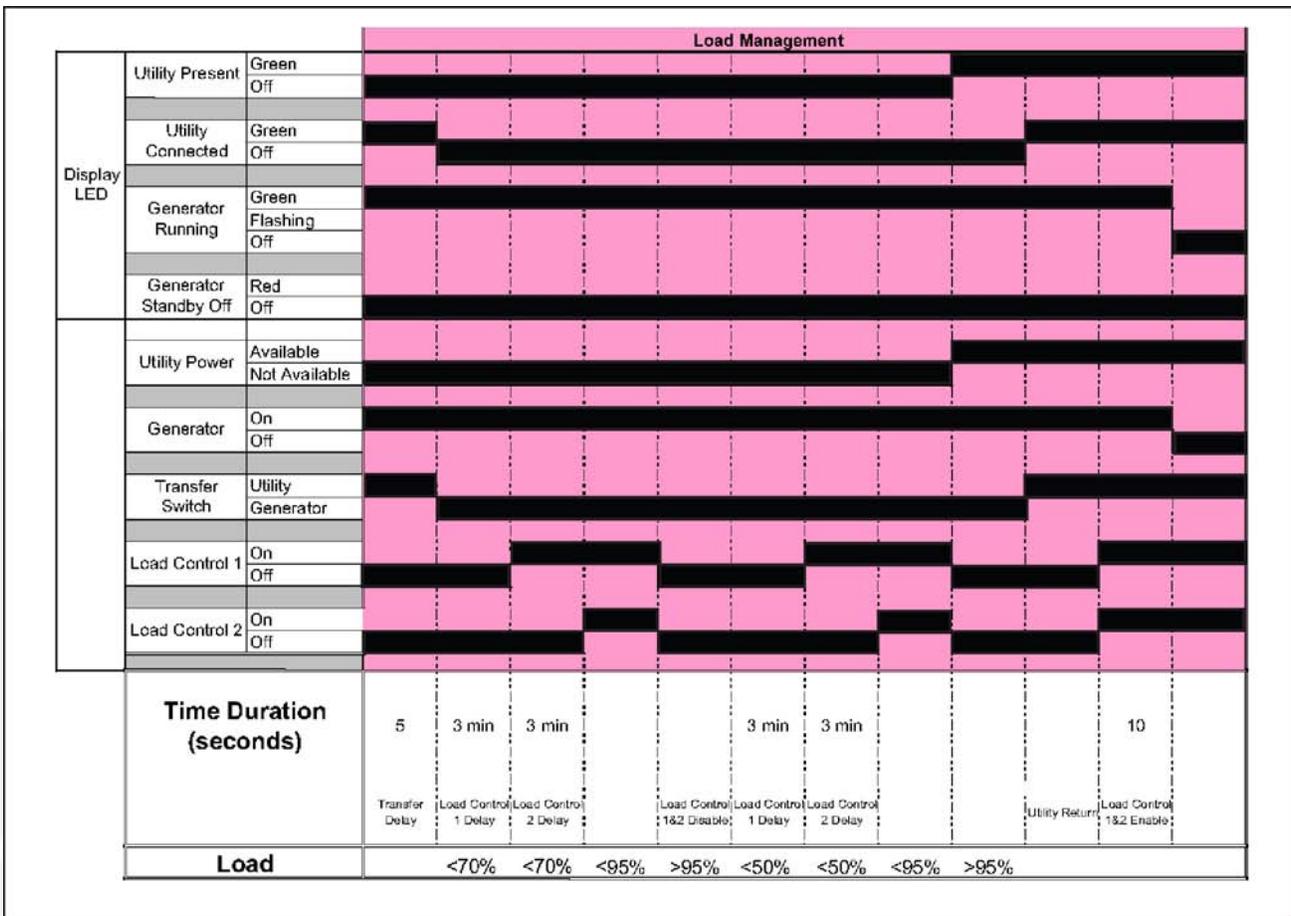


FIGURE 15. LOAD MANAGEMENT TIMING DIAGRAM

5.2.1 Normal Operation: Utility Power Available and Connected

As long as utility power is available and connected, both of the green UTILITY lamps (PRESENT and CONNECTED) will stay on and the LCD screen will indicate "Genset Stopped".

If the red GENERATOR STANDBY OFF light is on, the generator set will not start up automatically if utility power is interrupted. See the [To Enable/Disable Standby](#) section of this manual to enable STANDBY so that the generator set will automatically supply power if utility power is interrupted.

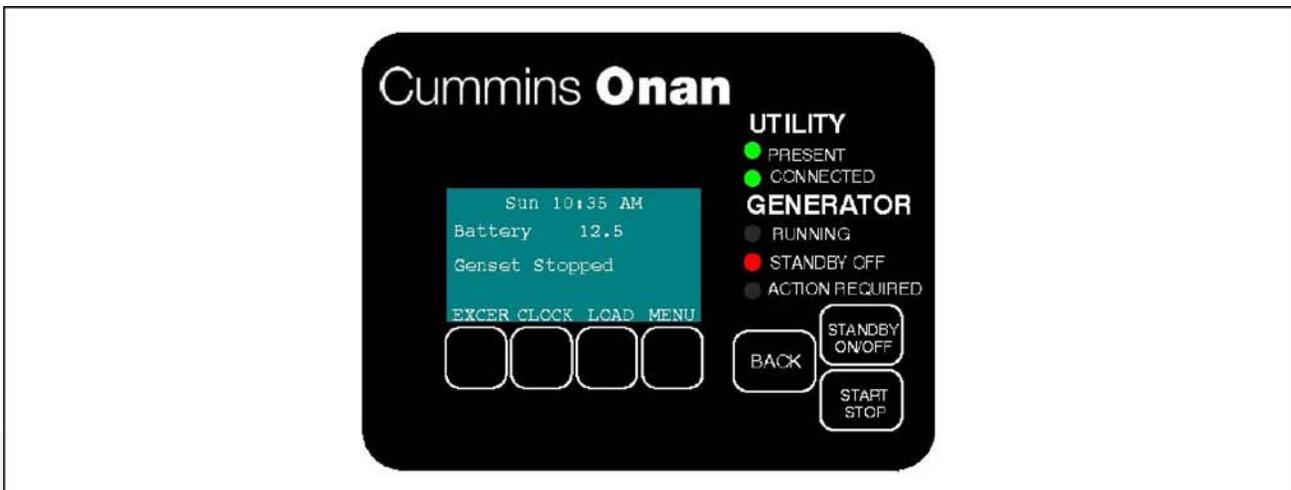


FIGURE 16. UTILITY PRESENT AND CONNECTED—STANDBY OFF LAMP ON

5.2.2 Emergency Operation: Utility Power Interrupted

If utility power is interrupted,

1. The green UTILITY PRESENT lamp will go out
2. The generator set will start automatically and the green GENERATOR RUNNING lamp will turn on.
3. The UTILITY CONNECTED light will go out when the generator set is connected to supply power.

The LCD screen will provide a visual indication of "Genset Load" (bar graphs). The bar graphs indicate how much of the available power is being used in each supply line (L1 and L2).

If the red ACTION REQUIRED light comes on, either the generator shut down or periodic maintenance has come due. The LCD screen will indicate what maintenance is due or which fault occurred.

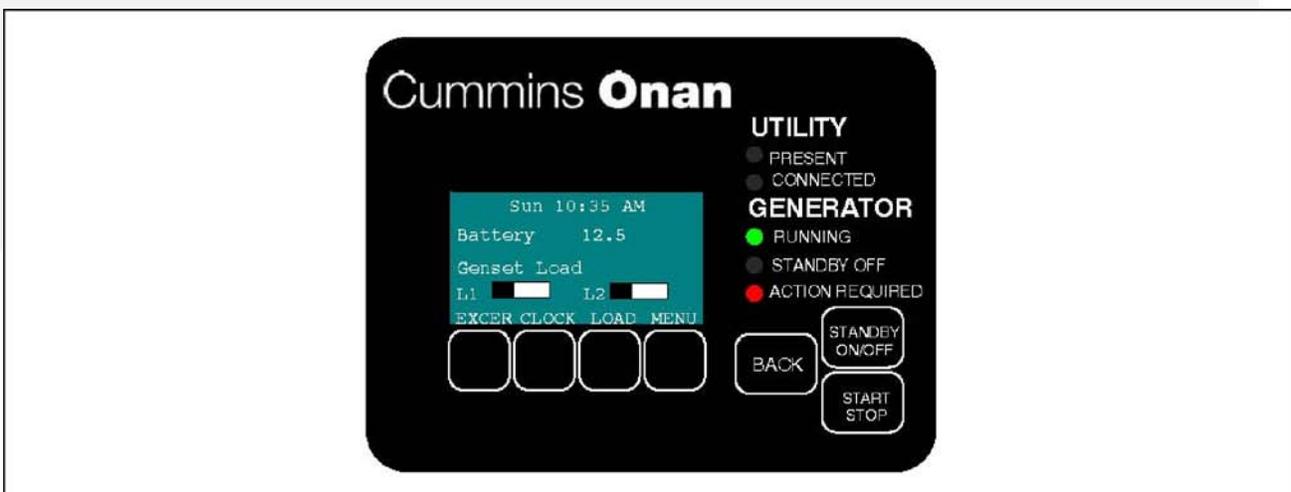


FIGURE 17. GENERATOR SET RUNNING—ACTION REQUIRED LAMP ON

5.3 To Enable/Disable Standby

Normally, you should not have to disable generator set STANDBY.

- STANDBY should always be enabled (ON) except during maintenance/service.
- STANDBY will have to be re-enabled (STANDBY OFF light on) if the generator set is started or stopped manually (normally a maintenance/service function) or a fault shutdown has occurred.

⚠ CAUTION

When STANDBY is disabled the generator set will NOT automatically start to supply power if utility power is interrupted.

To enable or disable generator set standby:

1. Press the STANDBY ON/OFF button on the operator panel, which takes you to the Standby ON/OFF screen.
2. Press the up or down arrow button to select ON or OFF.
3. **To enable STANDBY** select ON and press the BACK button. The STANDBY OFF lamp will go out and the display will state: "Standby ready enabled by user."
4. **To disable STANDBY** select OFF and press the BACK button. The STANDBY OFF lamp will come on and the display will state: "Standby ready disabled by user."

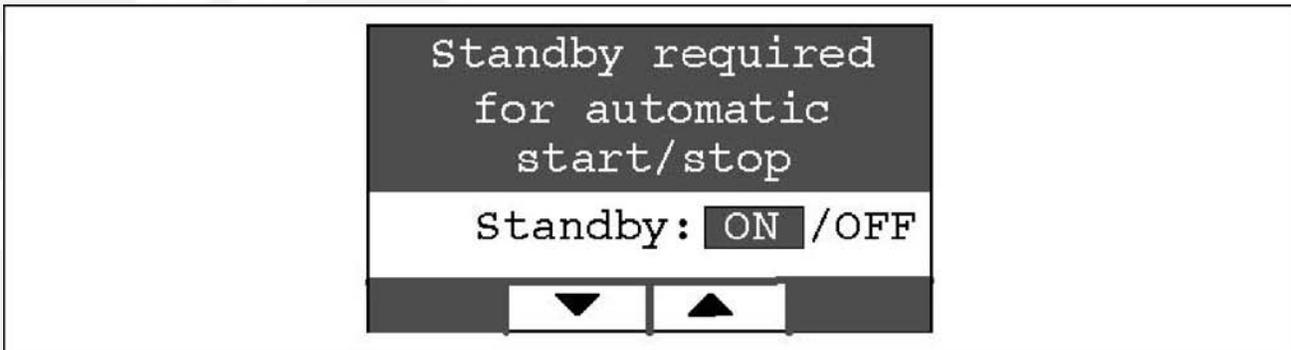


FIGURE 18. ENABLE/DISABLE STANDBY SCREEN

5.4 To Manually Start/Stop Generator Set

Normally, only the maintenance/service technician has to manually start and stop the generator set.

- Starting the generator set will result in the generator powering the house loads.

⚠ CAUTION

Manually starting or stopping the generator set disables generator set STANDBY. The generator set will not automatically start to supply power if utility power is interrupted.

Manually start and stop the generator set once every 3 months to test that these functions are working properly.

To manually start or stop the generator set:

1. Press the START STOP button on the operator panel, which takes you to the Genset START/STOP screen.
 - The screen will display "Genset Stopped" or "Genset Running," as appropriate.
2. Press START to manually start the generator set and connect it to supply power to the house. The STANDBY OFF lamp will come on and the display will state: "Genset started manually (Standby Ready Disabled)."
3. Press STOP to manually stop the generator set and disconnect it. The STANDBY OFF lamp will come on and the display will state: "Genset stopped manually (Standby Ready Disabled)."

NOTICE

To start the generator set without connecting loads pick Exercise Now on the Exerciser Clock screen.

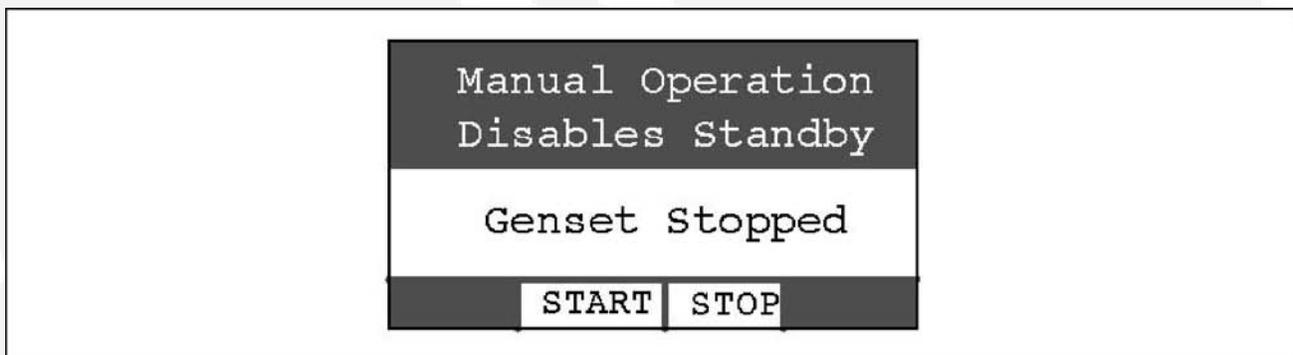


FIGURE 19. GENSET START/STOP SCREEN

5.5 Fault, Maintenance and New Event Screens

Various warning and event screens may appear on the operator panel during Normal or Emergency Operation.

5.5.1 Fault Screen

If a generator set shutdown fault occurs, a FAULT warning appears with the following information:

- Brief description of the warning or fault
- The two-digit Fault Code Number
- The time of occurrence of the fault

Press the BACK button to reset the fault and return to the home screen.

See the [Fault Log](#) section of this manual to review the log of the last 5 faults.

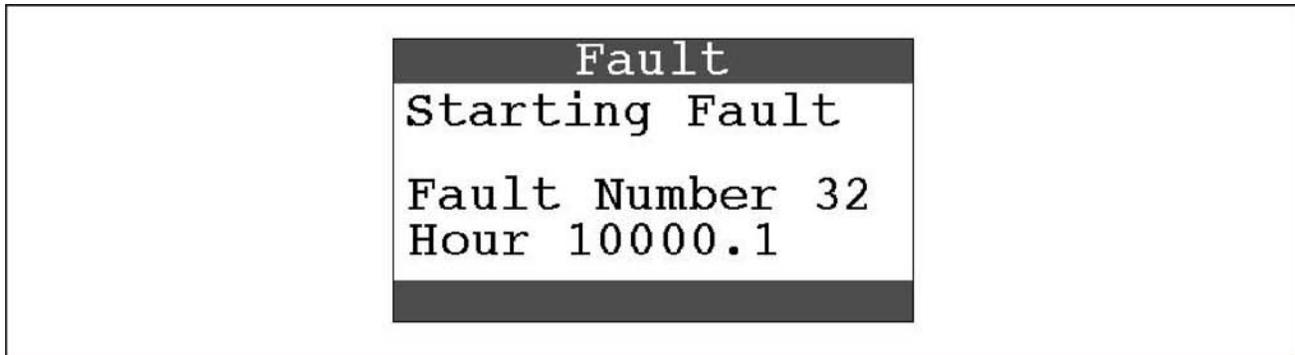


FIGURE 20. TYPICAL FAULT SCREEN

5.5.2 Maintenance Due Screen

A Maintenance Due screen appears when a scheduled maintenance operation is due.

- The warning does not time out.
- Perform the maintenance.

Press the BACK button to return to the home screen.

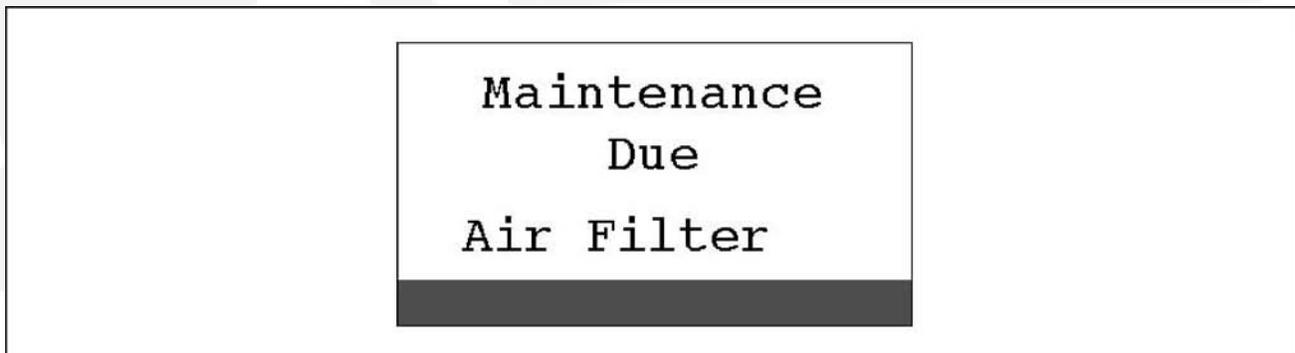


FIGURE 21. TYPICAL MAINTENANCE DUE SCREEN

5.5.3 New Event Screen

A New Event screen appears whenever system status changes, such as when there is an interruption of utility power. The screen provides a brief description of the event along with the time and date of the event.

- The message does not time out, unless superseded by a new event.
- Press the BACK button to return to the home screen.

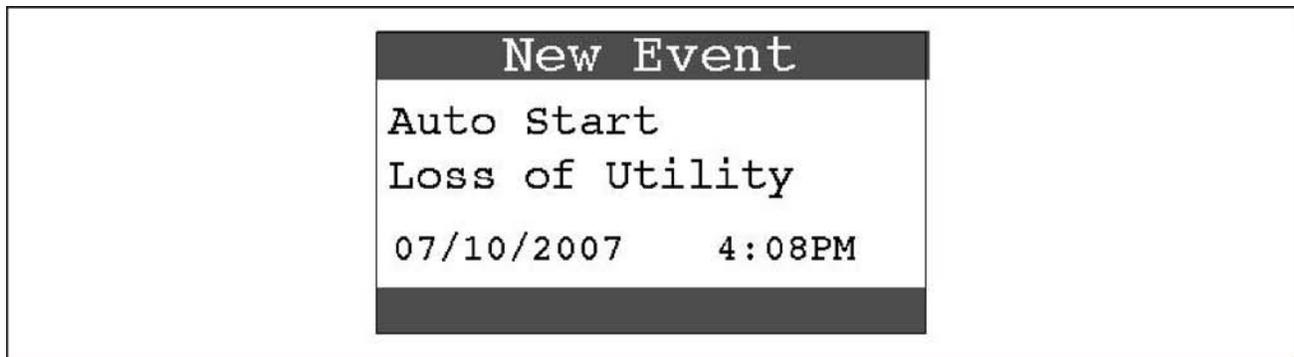


FIGURE 22. TYPICAL NEW EVENT SCREEN

5.6 Genset Status

To check generator set output voltage and frequency and the total numbers of hours run:

1. Press the MENU button on the home screen.
2. Press the up or down arrow button on the menu screen to select Genset Status.
3. Press the ENTER button on the menu screen and note the values displayed on the Genset Status screen.
4. Press the BACK button to return to the home screen.

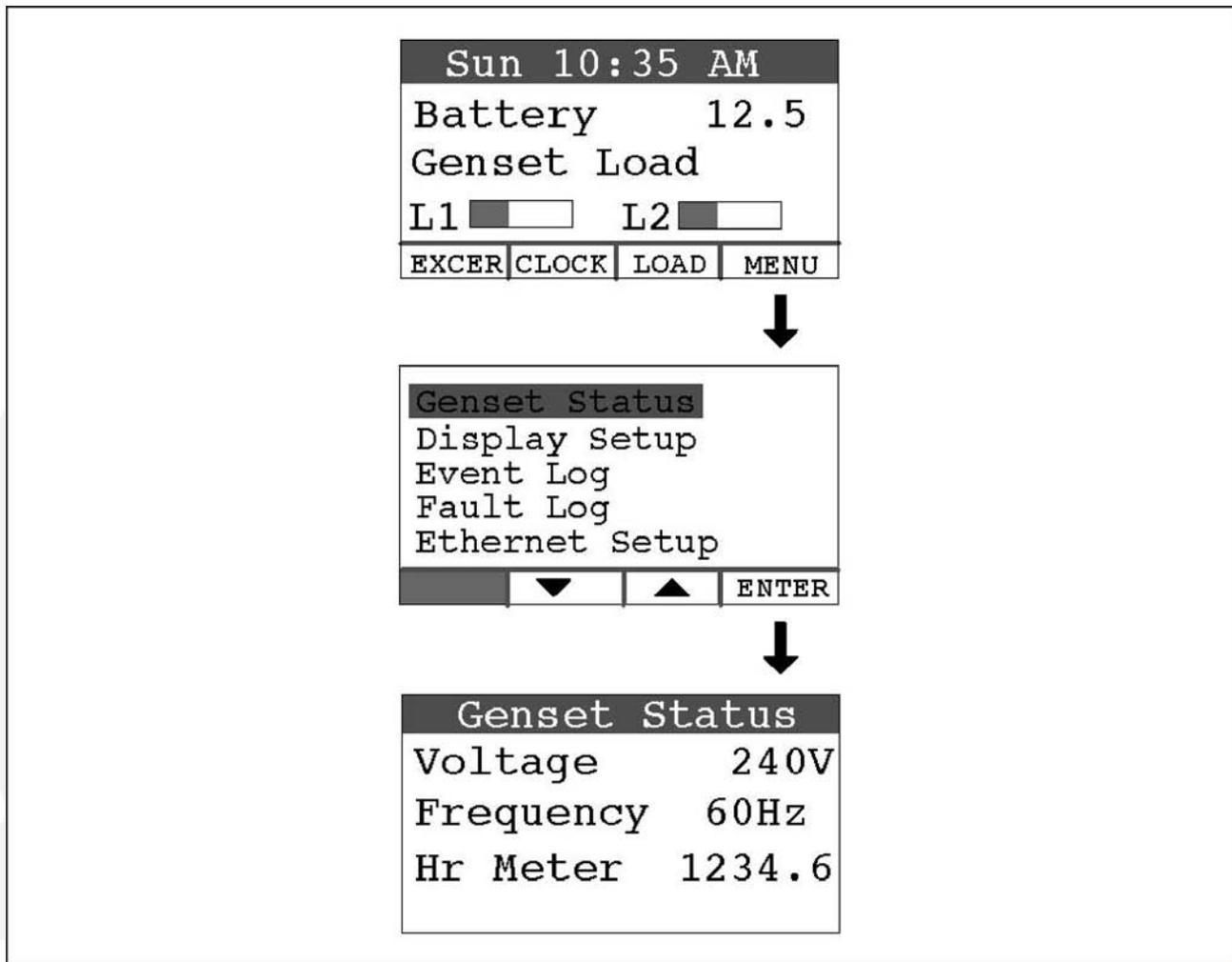


FIGURE 23. GENERATOR SET STATUS SCREEN

5.7 Display Setup and Software Info

5.7.1 Brightness and Contrast

To change the Brightness and Contrast of the display screen:

1. Press the MENU button on the home screen.
2. Press the up or down arrow button on the menu screen to select Display Setup.
3. Press the ENTER button on the menu screen.
4. Press the NEXT button to select Brightness or Contrast.
5. Press the increase or decrease arrow button to increase or decrease brightness.
6. Change Contrast the same way as Brightness.
7. Press the BACK button to save the settings and return to the home screen.

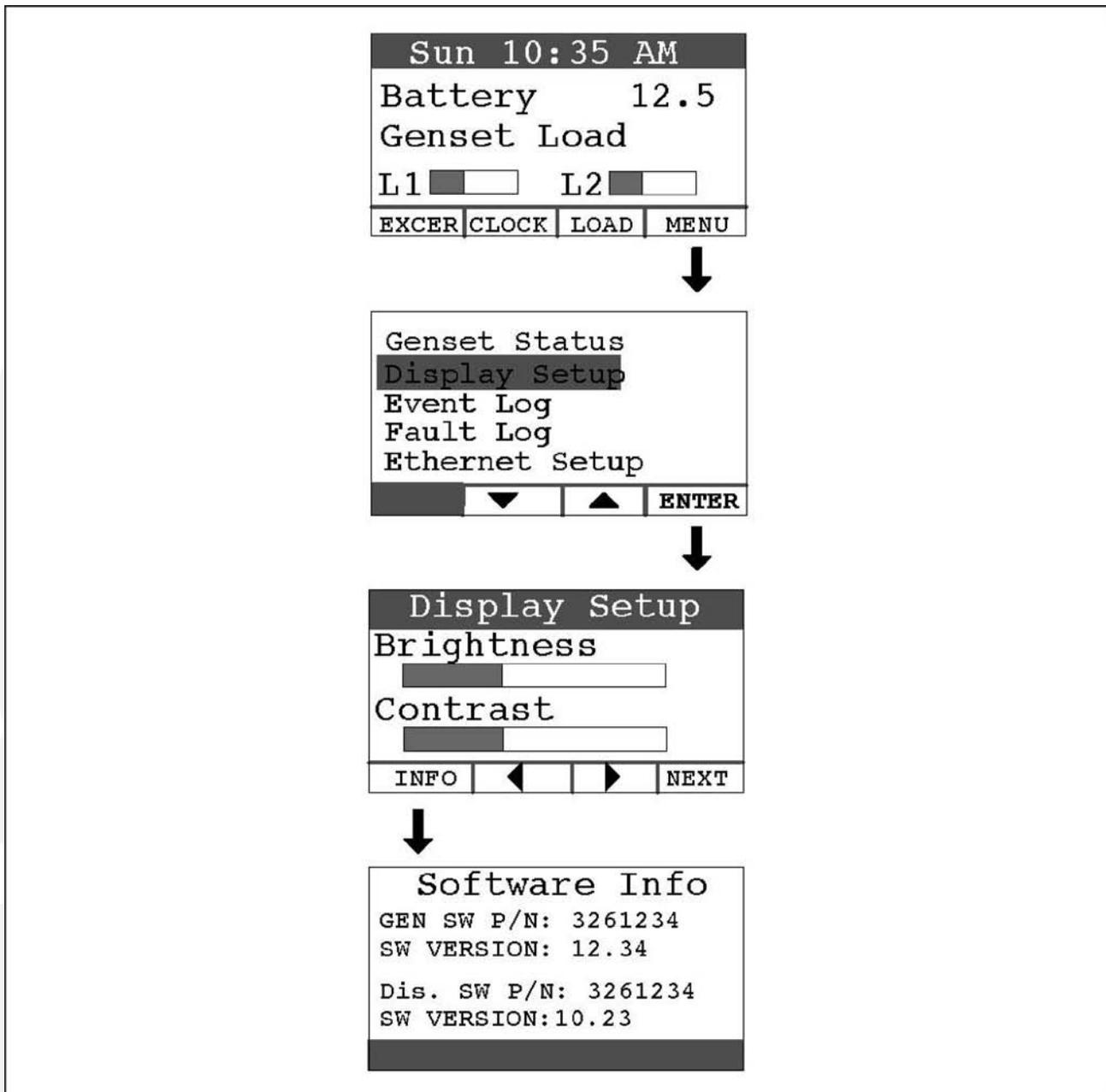


FIGURE 24. DISPLAY SETUP AND SOFTWARE INFO SCREENS

5.7.2 Software Info

To check on the generator set and display software:

1. Press the MENU button on the home screen.
2. Press the up or down arrow button on the menu screen to select Display Setup.
3. Press the ENTER button on the menu screen.
4. Press the INFO button on the Display Setup screen and note the values displayed on the Software Info screen.
5. Press the BACK button to return to the home screen.

5.8 Event Log

5.8.1 To Check Log of Last 20 Events

1. Press the MENU button on the home screen.
2. Press the up or down arrow button on the menu screen to select Event Log.
3. Press the ENTER button on the menu screen.
4. Scroll through the event log with the up and down double-arrow buttons. Each screen provides a brief description of the event along with the time and date of the event.
5. Press the BACK button to return to the home screen.

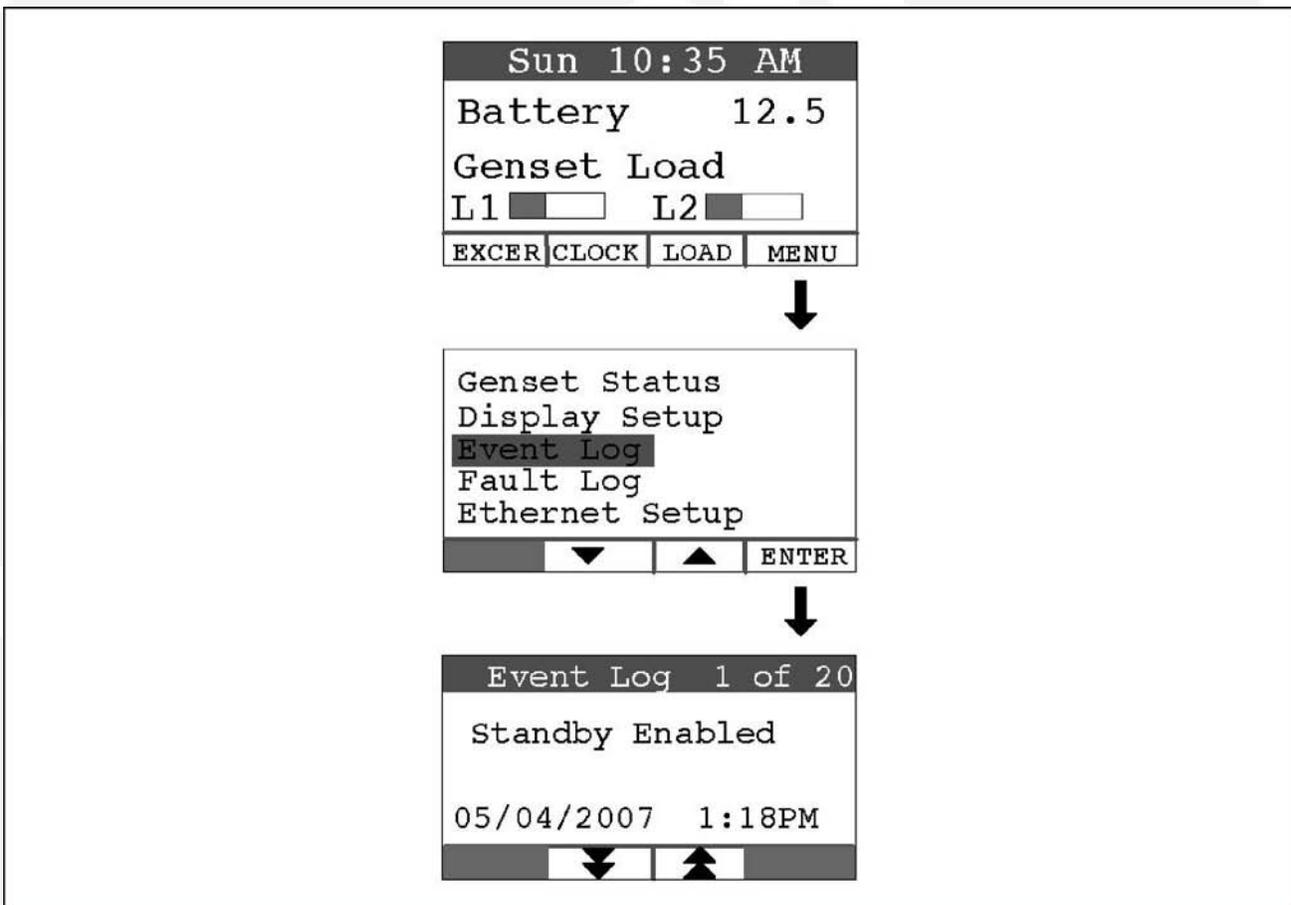


FIGURE 25. EVENT LOG SCREEN

5.8.2 List of Recordable Events

- "Genset started manually (Standby Ready Disabled)"
- "Genset stopped manually (Standby Ready Disabled)"
- "Genset exercise started"
- "Genset exercise completed"
- "Genset started due to loss of utility"

- "Genset stopped with return of utility"
- "Switch on genset moved to remote position"
- "Switch on genset moved to run position"
- "Switch on genset moved to off position"
- "Standby ready disabled by user"
- "Standby ready enabled by user"
- "Utility lost - not in Standby Ready"
- "Utility returned - not in Standby Ready"
- "Maintenance reminder - Change oil and check valve lash"
- "Maintenance reminder - Change oil & filter, air filter, adjust valve lash, clean and check battery & engine cooling fins"
- "Genset fault - (Fault description appended)"
- "Genset warning - Transfer Switch Signal Failure"
- "Genset warning - Transfer Switch Failed to Transfer to Utility"
- "Genset warning - Low Battery or Battery Charger Failure"

5.9 Fault Log

To check the log of the last 5 faults:

1. Press the MENU button on the home screen.
2. Press the up or down arrow button on the menu screen to select Fault Log.
3. Press the ENTER button on the menu screen.
4. Scroll through the fault log with the up and down double-arrow buttons. Each screen provides a brief description of the fault, the fault code number and the time and date of the fault.
5. Press the BACK button to return to the home screen

NOTICE

If there are no faults recorded, the "No Stored Faults" screen will appear.

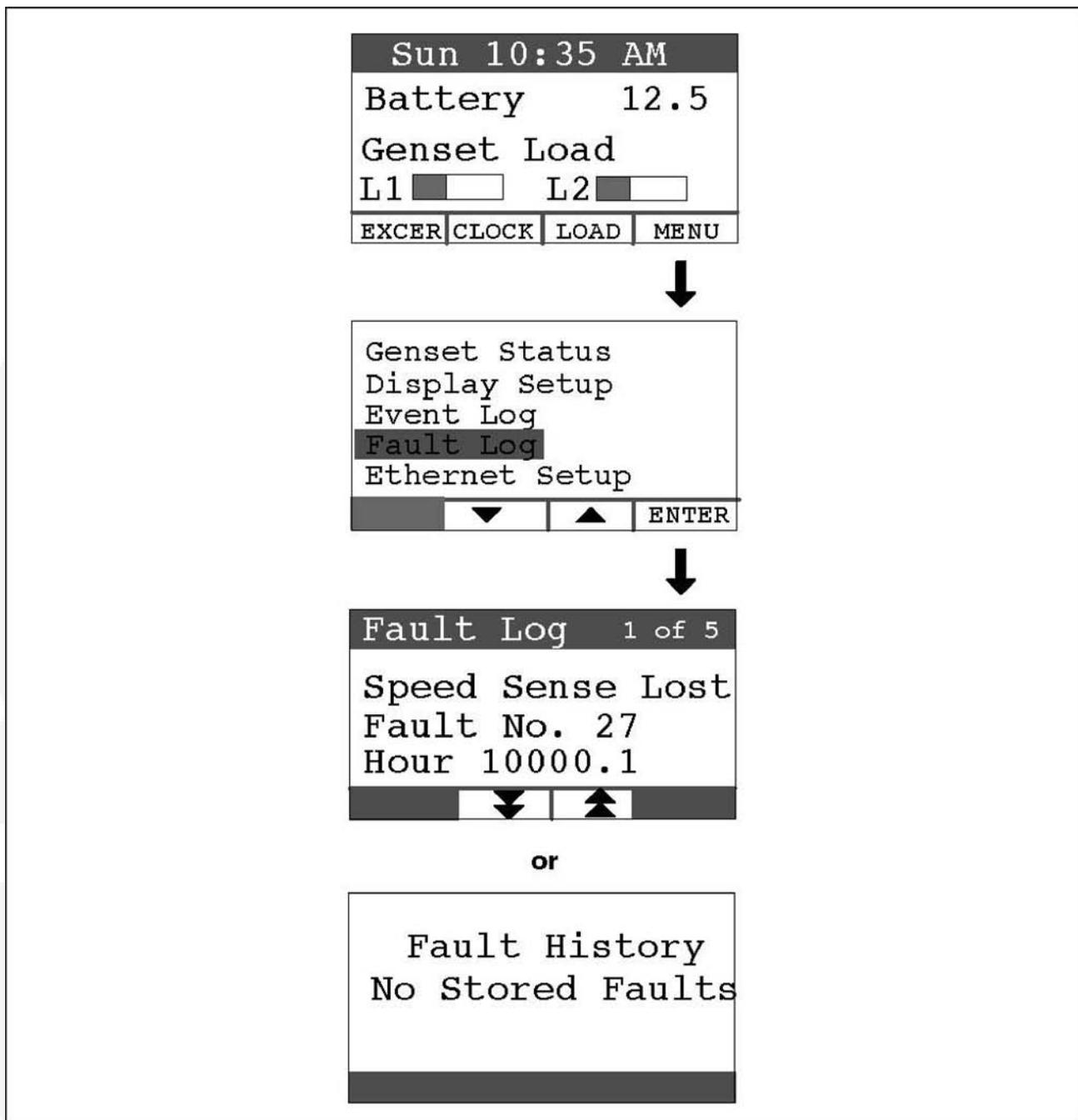


FIGURE 26. FAULT LOG SCREEN

5.10 Ethernet Settings

This feature allows for in-home or remote access to your generator set through a web page.

- On this web page, you can:
 - start or stop your generator set
 - adjust the exerciser day and time

- determine if utility power is available
- view the last 20 events/faults on the generator set

This feature is useful for homeowners who travel or have a second home and want to be able to remotely interface with their generator set. This feature can also help to reduce troubleshooting time and service calls when the service technician has access to the same web page.

Use of the Ethernet is not required if you do not use web access. To set up your generator set for web access, complete installation instructions.

NOTICE

Ethernet setup must be done at the generator set location. It cannot be done via the web from a different location. An available Ethernet port and a high-speed Internet are required for functionality.

To reset the Internet and email interface IP address and password:

1. Press the MENU button on the home screen.
2. Press the up or down arrow button on the menu screen to select Ethernet Setup.
3. Press the ENTER button on the menu screen.
4. Press the NEXT button to select the field to change.
5. **To Reset Password** - If you have forgotten your password, select the Reset Password field and press an up or down arrow. The password will be reset to "cummins". Press the BACK button to go back to the home screen.
6. **IP Address** - If DHCP is ON (factory setting), the modem/router will assign the generator set IP Address displayed here. This is the address you enter in your internet browser address bar. The address assigned to the generator set may change over time. If, for example, the modem/router is unplugged, it will probably re-assign new addresses to all of the devices in the home that it serves. If the IP Address you have been using does not work any longer, copy down the new address and enter it on the browser page.
7. **DHCP ON/OFF** - DHCP leaves the factory ON. If more advanced features are desired, the modem/router probably can be configured for DHCP to be OFF. Refer to the [Generator Set Network Setup Guide](#) regarding the permanent generator set IP Address to assign.
8. **Manually Enter IP Address—DHCP OFF** - If DHCP is OFF, it will be necessary to manually enter the IP Address, which consists of four three-digit numbers. To enter a number, select the hundreds, tens or units field in each three digit number field by pressing the NEXT and PREV buttons. Push the up or down arrow to increase or decrease the number in the selected field. Numbers in the units fields will increase by one, in the tens fields by ten and in the hundreds field by one hundred. Refer to the [Generator Set Network Setup Guide](#) to make sure setup is complete.

NOTICE

If utilizing a remote internet access to the generator set, it is recommended that a UPS battery backup be connected to your router and/or modem.

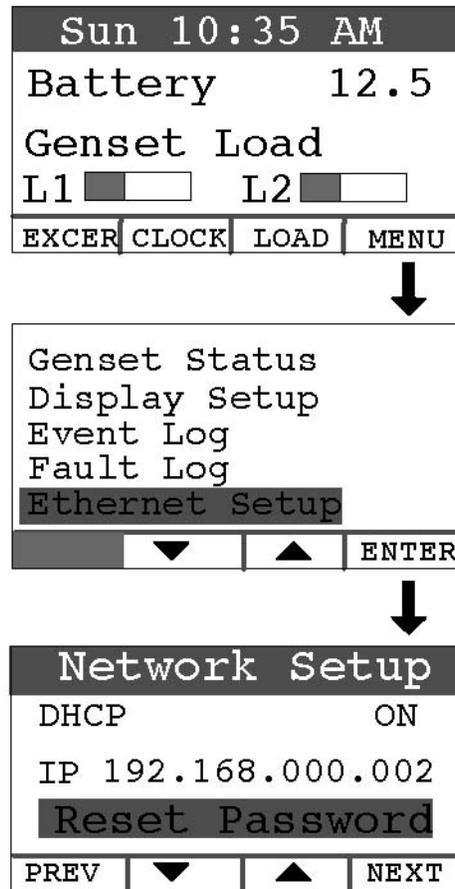


FIGURE 27. NETWORK SETUP SCREEN

5.11 Exercise Settings

To set the generator set exercise schedule:

1. Press the EXCER button on the home screen.
2. Press the NEXT button on the Exerciser Clock screen to select the field to change.
3. Press the up or down arrow button to increase or decrease the frequency of exercise and the day of the week and time of day for exercise.

Frequency selections are:

Weekly

Bimonthly

Monthly

Never

4. Press the BACK button to save the settings and return to the home screen.
5. If you want to exercise the generator set now, select Exercise Now, and press either the up or down arrow.

NOTICE

Scheduled or prompted exercise does not transfer the house loads to the generator set.

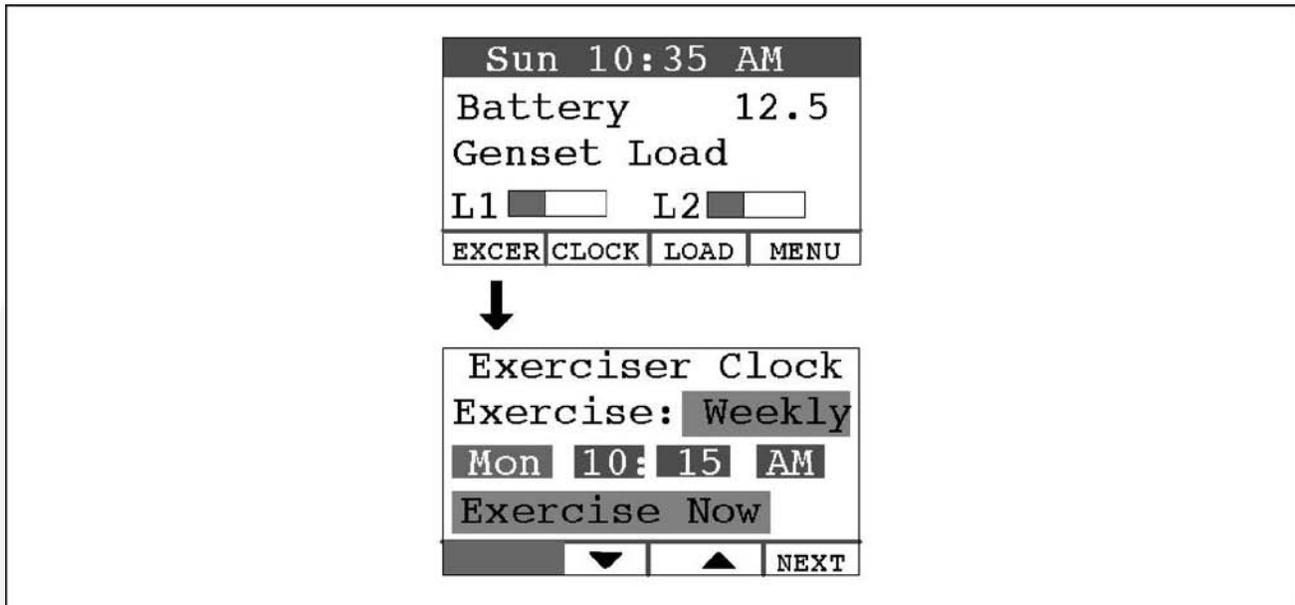


FIGURE 28. EXERCISE CLOCK SCREEN

5.12 Time Setup

To set up the generator set clock for the current date and time:

1. Press the CLOCK button on the home screen.
2. Press the NEXT button on the Time Setup screen to select the field to change.
3. Press the up or down arrow button to increase or decrease or change the date or time.
4. Press the BACK button to save the settings and return to the home screen.

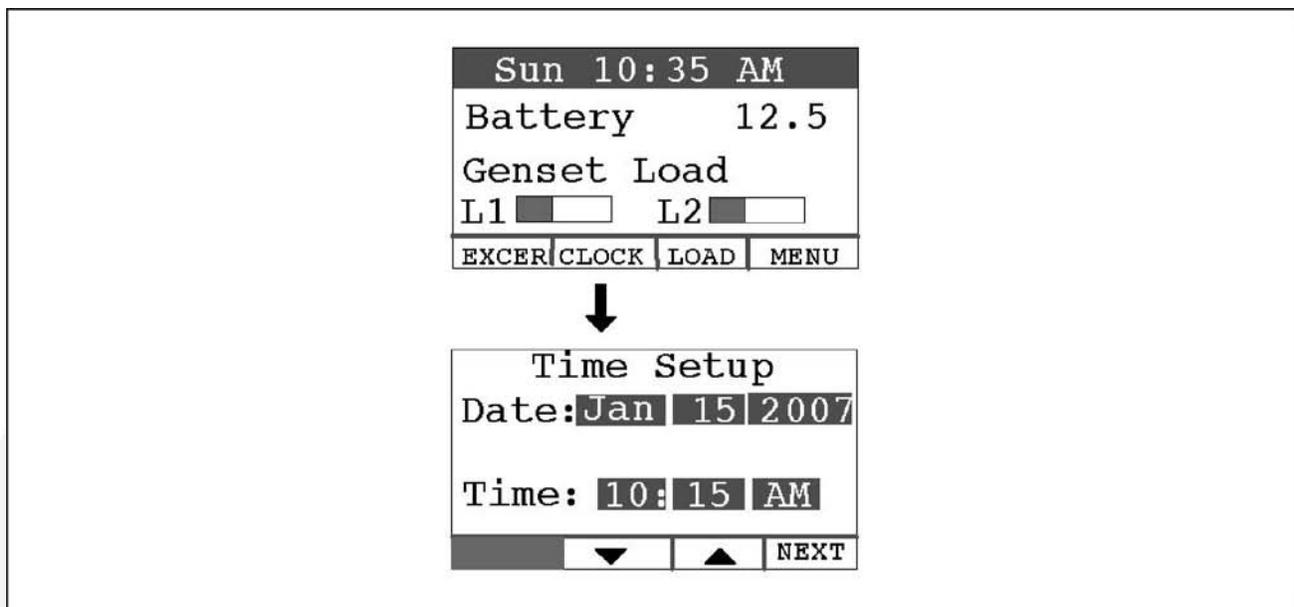


FIGURE 29. TIME SETUP SCREEN

5.13 Load Management

The generator set may have been set up at installation to connect and disconnect certain large loads, such as air conditioners, to manage the total load so as not to overload the generator set. This requires the installation of relays to the load management signals which allow for the disconnection of loads. Load management can be set to operate in [automatic](#) or [manual](#) mode.

Whether in automatic or manual mode, there is a delayed start. Load 1 is enabled three minutes after the generator set is connected to the house loads, and Load 2 is enabled six minutes after the generator set is connected to the house loads.

5.13.1 Automatic Load Management

When set to automatic mode, the user takes no action and can only view which loads are connected. Three minutes after the generator starts, the load that is connected to genset load L1 is connected. After a delay of three more minutes, the load that is connected to genset load L2 is connected. If the connection of loads L1 and L2 exceeds 95% of the generator's load capacity, they are disconnected by the generator. Following another three minute delay, the control reconnects both loads following the same connection sequence used in the first attempt (three minutes apart). If generator load capacity is exceeded again, both loads are disconnected and no further reconnection is tried.

To select automatic load management and view whether the selected loads are connected while the generator set is running:

1. Press the LOAD button on the home screen.
2. Press the up or down arrow button to select Automatic.
3. Note which loads are connected or disconnected.
4. Press the BACK button to return to the home screen.

Adjust percent load to match the de-rate.

5.13.2 Manual Load Management

⚠ CAUTION

To reduce unnecessary loss of service, it is highly recommended that manual load management be undertaken only by an authorized Cummins Onan dealer.

When set to manual mode, the user is able to view, connect, and disconnect loads. If the connection of loads L1 and L2 exceeds generator capacity, the AC circuit breaker trips.

To select manual load management when the generator is running:

1. Press the LOAD button on the home screen.
2. Press the up or down arrow button to select Manual.
3. Note which loads are connected or disconnected.
4. Press the double-down arrow button to go the load connect/disconnect screen.
5. Connect or disconnect Load 1 or Load 2 as necessary by pressing either button under Load 1 or Load 2.
6. Press the BACK button to save the setting and return to the home screen.

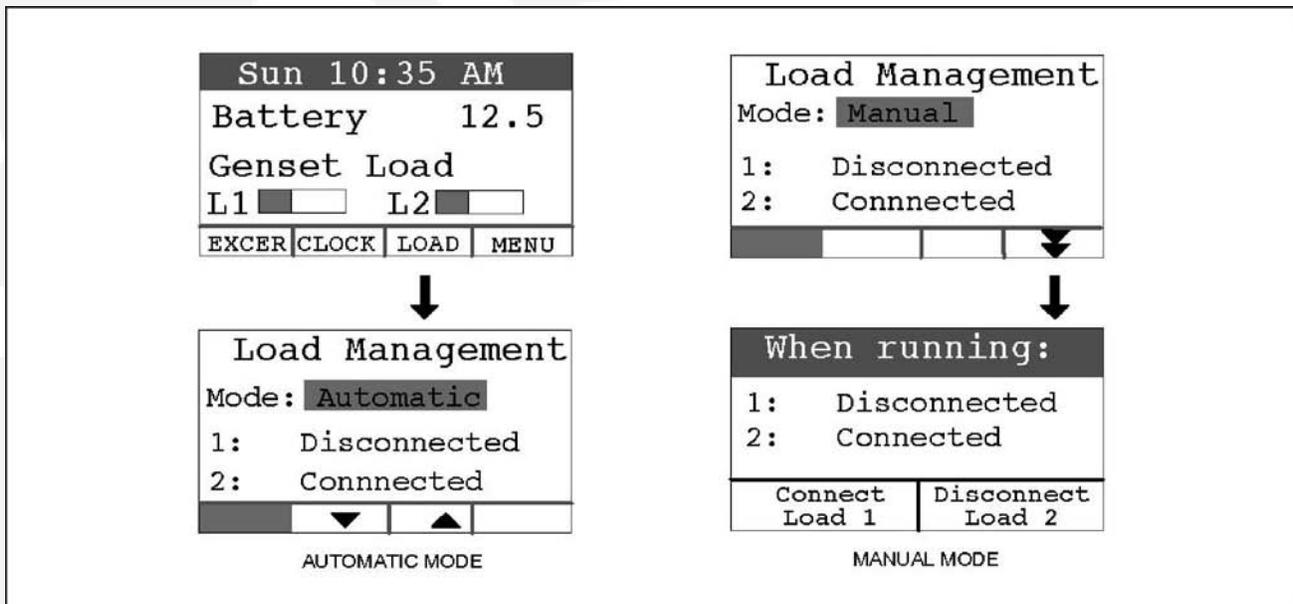


FIGURE 30. LOAD MANAGEMENT SCREEN

6 Startup and Configuration

6.1 Pre-startup Inspection

Before starting the genset inspect the installation and check off each of the following questions if it can be answered "YES". If a question cannot be checked off, review the appropriate section in the manual.

- Can the top, maintenance and service access doors be swung fully open for operation, maintenance and service?
- Are the cooling air inlet and outlet openings free of obstructions?
- Have the AC output connections been made properly?
- Has the transfer switch been installed properly to prevent connecting the generator set to the utility?
- Has a properly sized battery been installed?
- Are all fuel connections tight?
- Is fuel supply pressure correct?
- Are electrical and fuel lines properly separated?
- Does engine exhaust disperse away from buildings?
- Have all fuel connections been checked for leaks?
- Is the fuel supply pressure to the inlet of the generator set appropriately set for the fuel being used?
- Does the installation meet all applicable local, state, and federal codes?
- Is the fuel regulator vent screen free of obstructions?
- Is the manual fuel selector set to proper fuel?

6.2 Startup

When all installation requirements have been met, connect the battery cables to the battery, positive (+) cable first.

⚠ WARNING

Automatic startup of the generator set during installation can cause severe personal injury or death. Push the control switch OFF and disconnect the negative (-) cable from the battery to keep the generator set from starting.

Read through the Operator's Manual and perform the maintenance and pre-start checks instructed. The genset is shipped from the factory with the proper level of engine oil, but should be checked before the genset is started. Start and operate the genset, following all the instructions and precautions in the Operator Manual.

Perform [Generator Set Configuration](#).

NOTICE

Before leaving the site, if the genset is ready to be placed in service, set the control switch to the REMOTE position to provide automatic standby power.

6.3 Generator Set Configuration

The operator panel has a menu with four generator set/transfer switch parameters that must be configured for the installation.

To configure the generator set:

1. Press the MENU button on the home screen.
2. Press and hold the blank (far left, solid black) button on the menu screen for at least 5 seconds to go to the Config Menu.
3. Press the up or down arrow button on the Config Menu screen to select Generator Config.
4. Press Enter on the Config Menu to go to the Generator Config screen.
5. Press the NEXT button on the Generator Config Menu screen to select the Config, Frequency or Rating field.
6. Press the up or down arrow button to increase or decrease the configuration parameter.
 - a. Config: Select appropriate configuration (depending on model and fuel) from the table shown below.
 - b. Frequency: Select 60 Hz or 50 Hz.
 - c. Rating: Rating will be filled in, based on the configuration selected. This value can be lowered in order to correctly de-rate for high altitude or hot climates. (Selecting the correct Amps value will also allow the correct genset load to be displayed on the Operator Panel.
 - d. Press the BACK button to save the setting and return to the home screen.

TABLE 14. CONFIGURATIONS, BASED ON MODEL AND FUEL TYPE

Model (Spec)	Fuel	Configuration
GSBB Spec A and Canadian GSBB Spec B	Natural Gas	14
GSBB Spec A and Canadian GSBB Spec B	Propane	15
US GSBB Spec B and Canadian GSBC Spec B	Natural Gas	18
US GSBB Spec B and Canadian GSBC Spec B	Propane	19

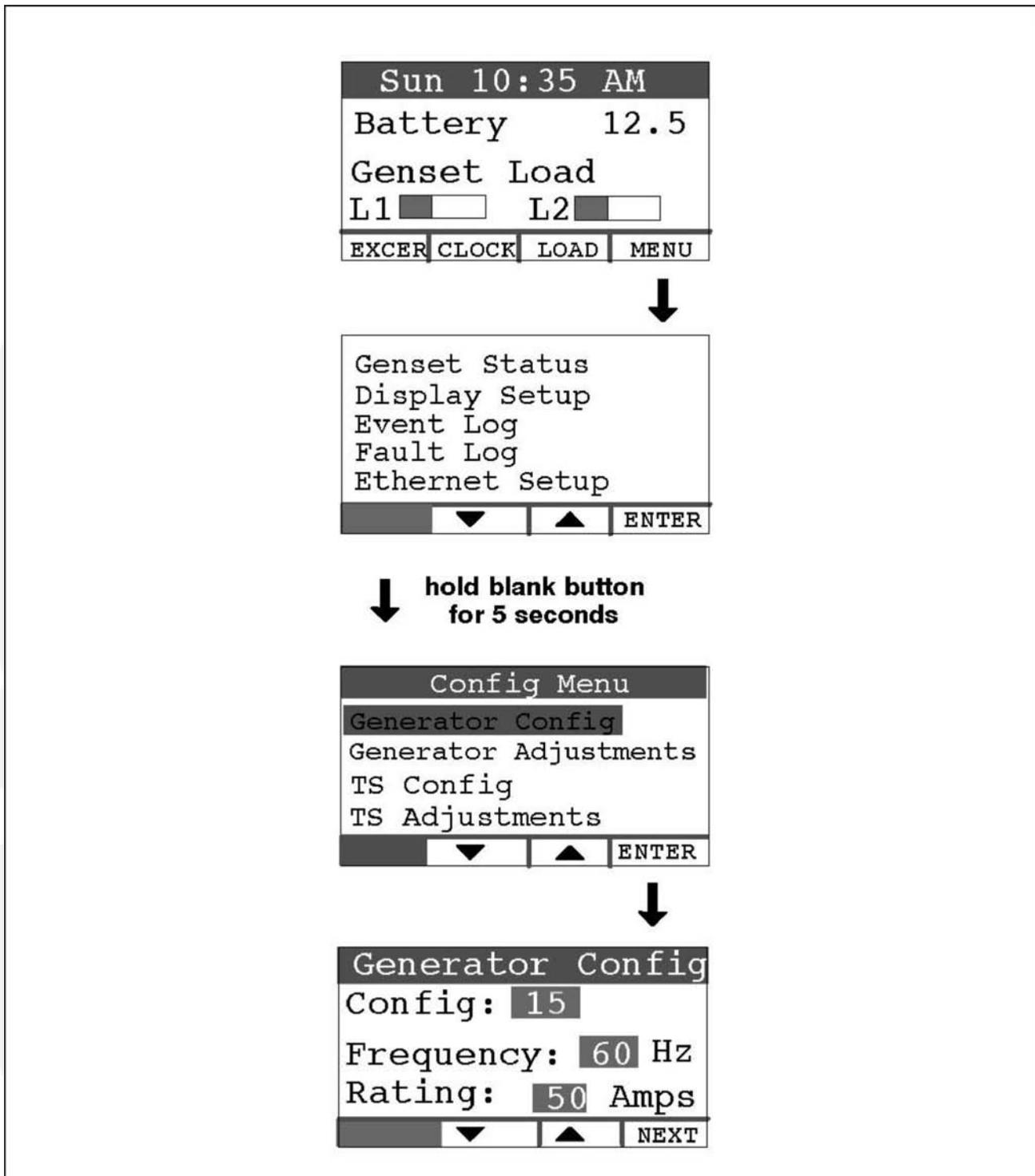


FIGURE 31. GENERATOR CONFIGURATION

6.4 Generator Adjustments

6.4.1 To Adjust the Output Voltage

Use the following procedure:

1. Connect an accurate AC volt meter across L1 and L2 while the generator set is running.
2. With Output Volts selected on the Adjustments Menu screen, press the up or down arrow button to adjust the voltage to the desired setting
3. The control allows an adjustment of 240 VAC \pm 7% (17 VAC).
4. Press the BACK button to save the settings and return to the home screen.

6.4.2 To Calibrate the Display Meter

Use the following procedure:

1. Connect an accurate AC volt meter across L1 and L2 while the generator set is running.
2. Press the NEXT button to select the Display Cal field (screen not shown).
3. Press the up or down arrow to adjust the voltage reading on the screen until it matches the meter reading.
4. Press the BACK button to save the settings and return to the home screen.

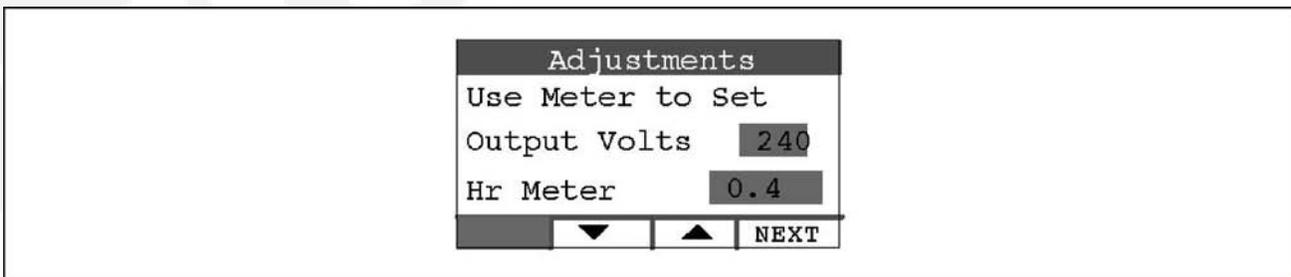


FIGURE 32. ADJUSTMENT MENU SCREEN

6.5 Transfer Switch Configuration

To configure the generator set for the transfer switch being used:

1. Press the MENU button on the home screen.
2. Press and hold the blank button on the menu screen for at least 5 seconds to go to the Config Menu.
3. Press the up or down arrow button on the Config Menu screen to select TS Config.
4. Press Enter on the Config Menu to go to the Transfer Switch screen.
5. Press the up or down arrow button to select between two choices: "RSS100-6868 and RSS200-6869" or "RSS100-6634 and RSS200-6635," which must match the model number of the transfer switch being used.

NOTICE

For non-Cummins Onan transfer switches, select RSS100-6634 and RSS100-6635.

6. Press the BACK button to save the setting and return to the home screen.

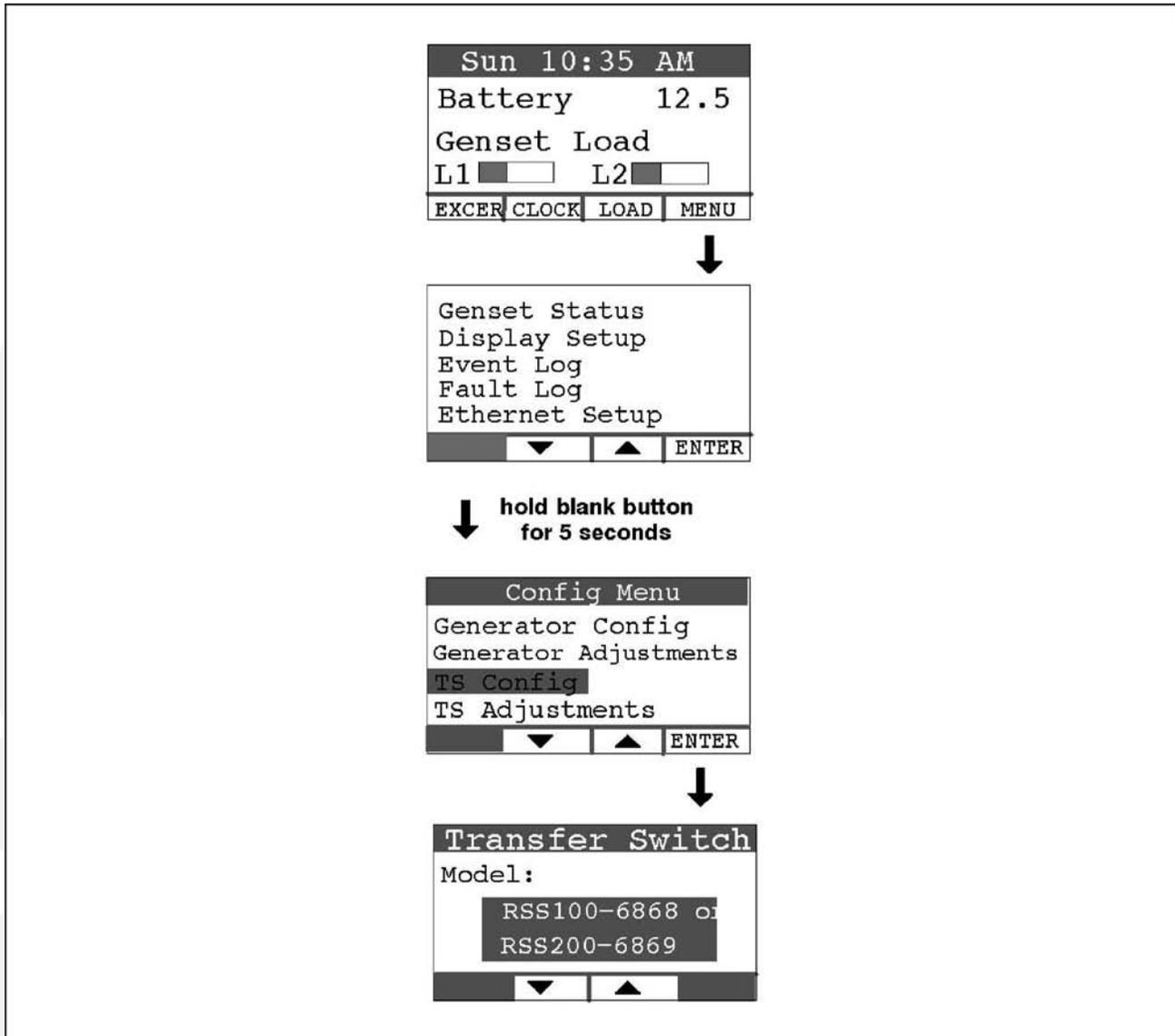


FIGURE 33. TRANSFER SWITCH CONFIGURATION

6.6 Transfer Switch Parameter Adjustments

Model RSS100-6634 and RSS200-6635 Transfer Switches: Refer to Transfer Switch Installation Manual 962-0620 to set the parameters inside the transfer switch.

Model RSS100-6868 and RSS200-6869 Transfer Switches: To make transfer switch parameter adjustments:

1. Press the MENU button on the home screen.
2. Press and hold the blank button on the menu screen for at least 5 seconds to go to the Config Menu.
3. Press the up or down arrow button on the Config Menu screen to select TS Adjustments.

4. Press Enter on the Config Menu to go to the Transfer Switch screen.
5. Press the NEXT button on the Generator Config Menu screen to select the Pickup, Dropout or Nominal field.
6. **To set Nominal** - Press the up or down double-arrow button to increase or decrease the nominal utility voltage parameter to match actual (Present) utility voltage. The Pickup and Dropout parameters are percentages of the nominal voltage parameter.
7. **To set Pickup**- Press the up or down double-arrow button to increase or decrease the minimum utility voltage to which the transfer switch will connect. Default is 90% of nominal. It can be increased to 95% of nominal.
8. **To set Dropout**- Press the up or down double-arrow button to increase or decrease the minimum utility voltage at which the transfer switch will disconnect. Default is 85% of nominal. It can be decreased to 80/75/70% of nominal.
9. Press the BACK button to save the setting and return to the home screen.

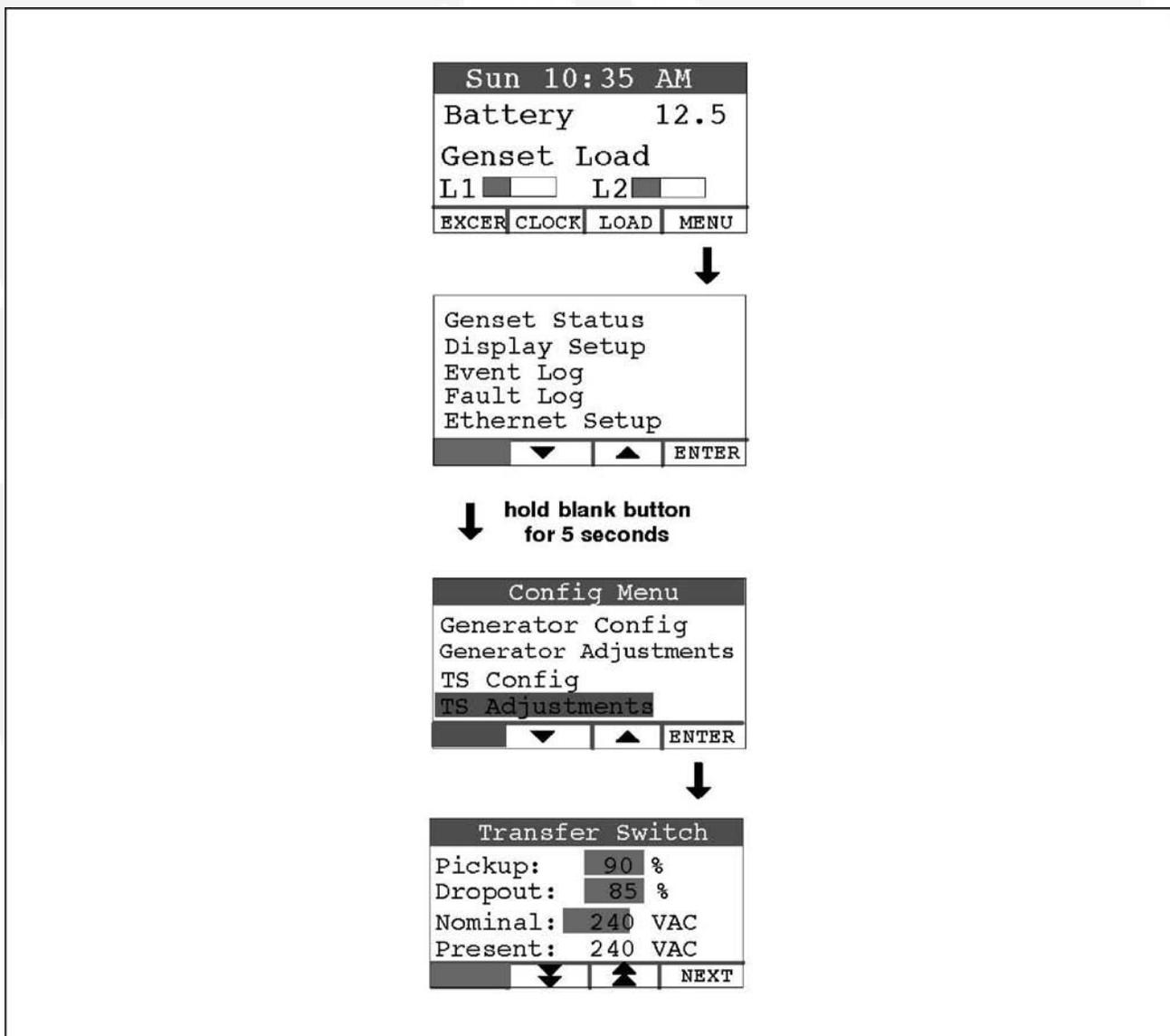


FIGURE 34. TRANSFER SWITCH ADJUSTMENTS

7 Optional Internet/Email Interface Descriptions

7.1 Introduction

This feature allows for in-home or remote access to your generator set through a web page.

NOTICE

An Internet browser (i.e., Internet Explorer) is required for this option.

On this web page, you can start or stop the generator set, adjust the exerciser day and time, determine if utility power is available and view the last 20 events/faults on the generator set.

This feature is useful for homeowners who travel or have a second home and want to be able to remotely interface with their generator set. This feature can also help to reduce troubleshooting time and service calls when the service technician has access to the same web page.

Use of the Ethernet is not required if you do not use web access. To set up your generator set for web access, complete installation instructions are included in the Network Setup Guide instruction sheet, included with your generator set literature package.

The Internet/Email Interface can make the same fault, maintenance and event notices available to you and to your generator set service contract agency with appropriate Internet Service and email account.

NOTICE

Technical support for setup and troubleshooting of the hardware used for in-home network access to the generator set is available through the selling Cummins Onan dealer/distributor.

The owner may be required to contact their ISP and/or email provider for technical support of the email notification feature setup and troubleshooting.

Due to the variations in network equipment, network configurations and ISPs, the owner is responsible for acquiring the needed support/service from a qualified network specialist to properly and securely set up the owner's network for remote monitoring of the generator set.

Cummins Onan does not provide technical support for setup and troubleshooting of the owner's network and email service.

7.2 Screen Descriptions

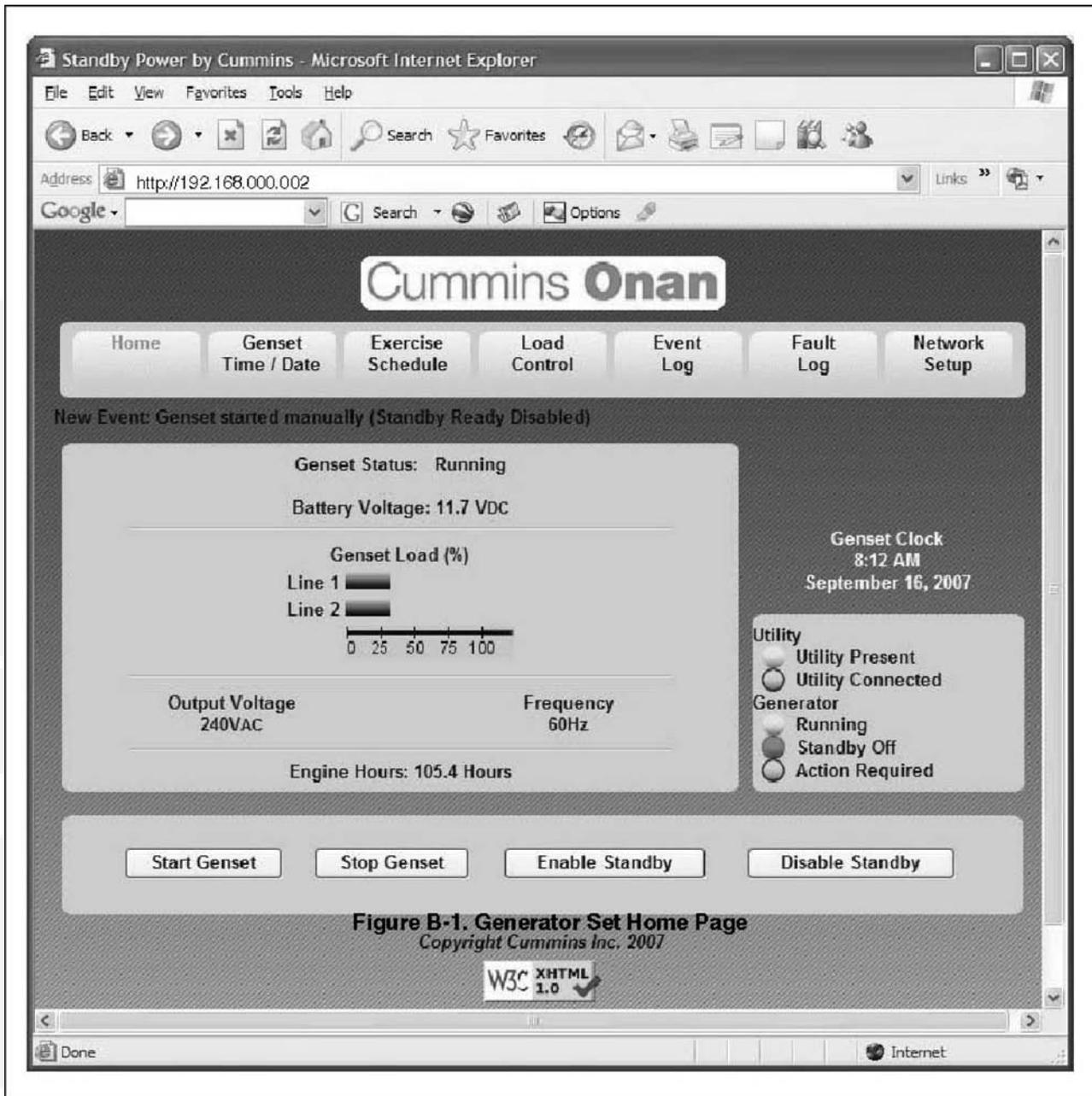


FIGURE 35. HOME PAGE

7.2.1 Setting Time and Date

Select the Genset Time/Date Tab on the Home Screen to set the time and date for the generator set control.

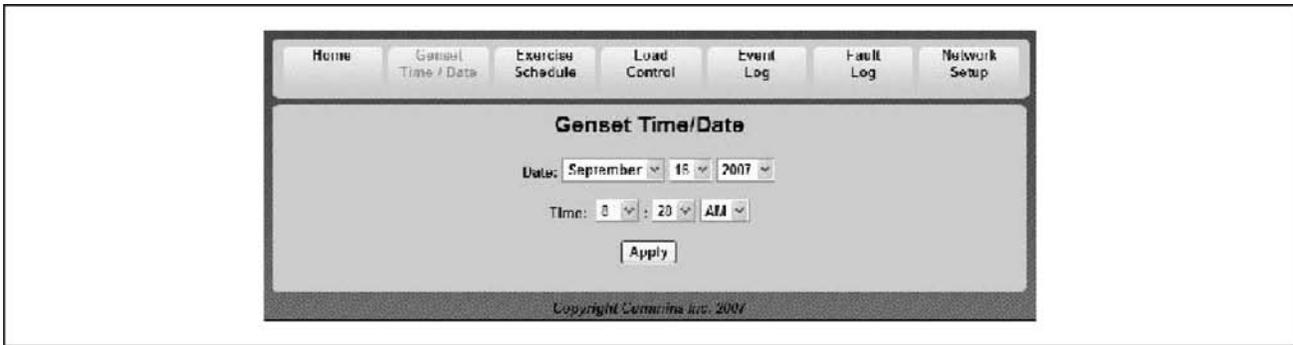


FIGURE 36. SET GENSET TIME AND DATE

7.2.2 Set Exercise Schedule

Select the Exercise Schedule Tab on the Home Screen to set the generator set exercise schedule.

NOTICE

The generator set will exercise on the first scheduled day for which it is programmed. After that it exercises on that day at the scheduled interval. For example, if the generator set is scheduled on a Wednesday for Saturdays with a monthly interval, the generator set starts on the next available Saturday. After that it exercises on Saturdays one month apart.



FIGURE 37. SET EXERCISE SCHEDULE

7.2.3 Load Control (Management)

Select the Load Control Tab on the Home Screen to enable Automatic or Manual Load Control. In Automatic mode, the user can only view which loads are connected. In Manual mode, the user can view loads and also connect or disconnect them. See [Load Management](#) for details.

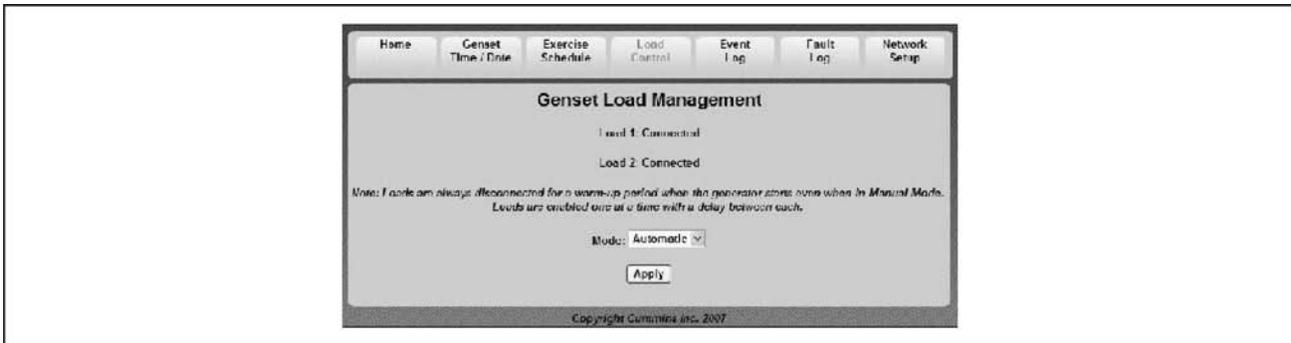


FIGURE 38. GENSET LOAD MANAGEMENT

7.2.4 Event Log

Select the Event Log Tab on the Home Screen to review the last 20 events. See the Event Log screen capture below for a list of all of the recordable events.



FIGURE 39. EVENT LOG

7.2.5 Fault Log

Select the Fault Log Tab on the Home Screen to review the last 5 faults.



FIGURE 40. FAULT LOG

7.2.6 Network Setup Screen Descriptions

An owner-custom password can be defined in the Network Setup screen shown below. The user will be prompted to enter the User Name and Password to access this screen.

The Network Setup Parameters screen allows dynamic addresses to be changed to static addresses. This screen allows the user to configure the static address for the in-home network. See the Network Setup Parameters screen shown below.

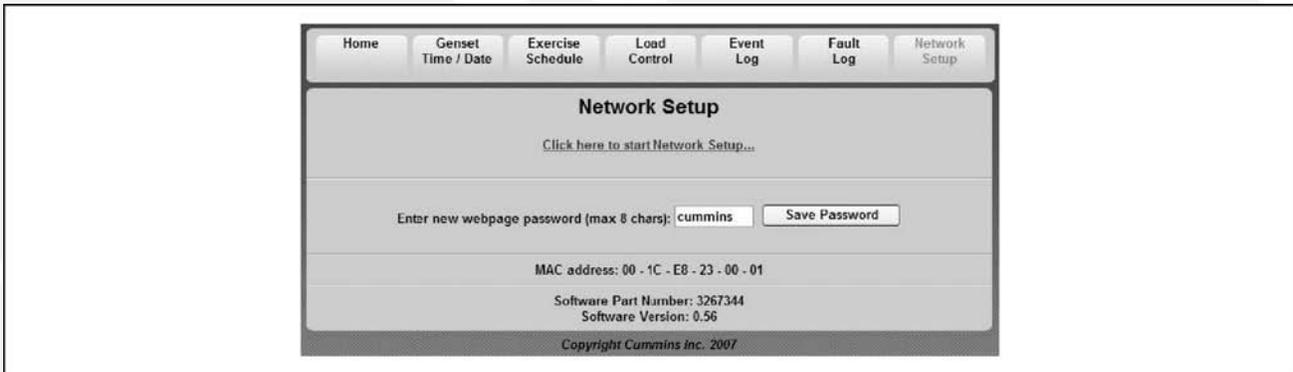


FIGURE 41. NETWORK SETUP SCREEN

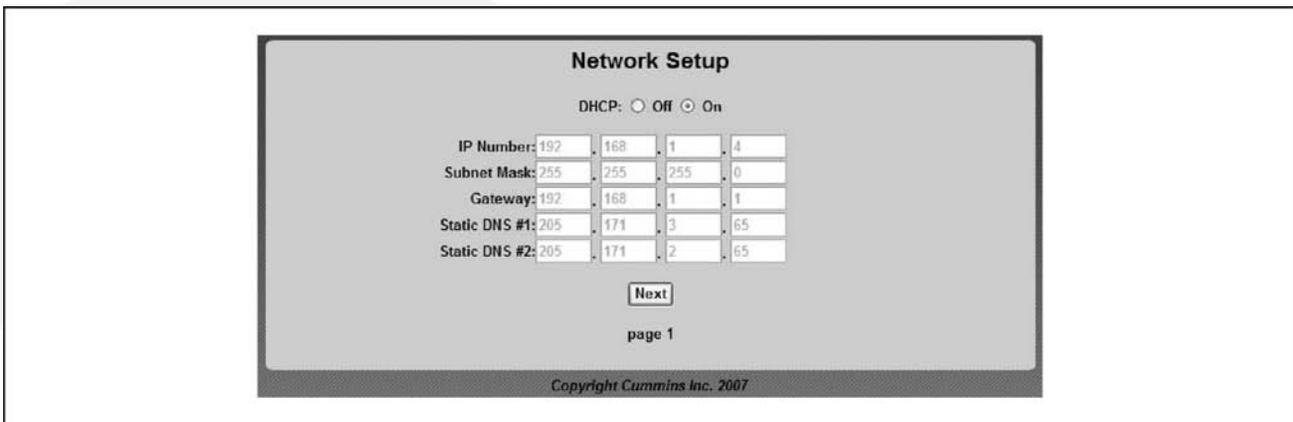


FIGURE 42. NETWORK SETUP PARAMETERS

7.2.7 Email Setup Screen Descriptions

The user must determine what events will trigger an email notification of the event:

- Never
- All Events

- Maintenance and Attention Required or Attention Required Only

This screen is also used to set up e-mail configuration.

The user may enter up to three email addresses for receiving notifications of the home-standby generator set status. See the Email Addresses figure below.

FIGURE 43. EMAIL SETUP PARAMETERS

FIGURE 44. EMAIL ADDRESSES

7.2.8 Saving Changes

After the email addresses are added and Done is selected, this screen will appear, verifying that all changes have been saved.

FIGURE 45. SAVE SCREEN

8 Optional Internet/Email Interface Setup

8.1 Network Connectivity Options

Network connectivity includes in-home Network access to the generator set, e-mail notification, and remote access to the generator set.

8.2 Material/Cable Routing

Route the category 5 Ethernet cable from the generator in the same conduit as the control lines and display cable (for in-home mounted displays) to the transfer switch and into the house. Ensure the cable is long enough to reach the network router. Attach the cable end connectors at each end.

8.3 Network Information Needed For Setup

The following sections will help with gathering information required for a successful installation.

8.3.1 Network Router

The following information is needed to configure the generator set with a static IP address.

- Router User Name: _____
- Router Password: _____
- Available Static IP Address: _____

8.3.2 Email/Internet Service Provider (ISP)

This information is used when configuring email notifications. The internet service provider (ISP) may need to be contacted for this information.

NOTICE

If these items cannot be verified or provided, email communication and/or remote Internet access may not work. If the service provider will not verify or provide the installer with this information, it is the responsibility of the customer to provide this information.

Email Account Provider (May Be ISP): _____

Email Account Provider Contact Number: _____

Email Provider Allows SMTP Communications Via Port: ____

Email Provider Supports Authenticated and Unauthenticated Email: Yes/No (circle one)

NOTICE

Some email accounts will not accept unauthenticated emails and will not work with the system. Ensure the email account and SMTP port accept non-SSL and TLS connections.

Email Server Static IP Address: _____

Email Server Name (SMTP): _____

(Example: smtp.hughes.net)

Email Account User Name: _____

(Example: include@emailprovider.com)

Email Account Password: _____

Email Notification Preferences

Email Address 1: _____

Email Address 2: _____

Email Address 3: _____

NOTICE

The ISP may take several days to establish the IP address and an additional service cost may be incurred.

8.4 In-Home Network Access to the Generator Set

1. Connect a category 5 (Ethernet) cable from the generator set control board to the modem/router. Make sure the modem/router has sufficient ports available for connections for both the generator set and the computer connections.

NOTICE

The router will assign an IP address to the generator set control.

2. Write down the IP Address (shown on the Network Setup screen below) on the generator set's in-home operator panel.

IP Address _____

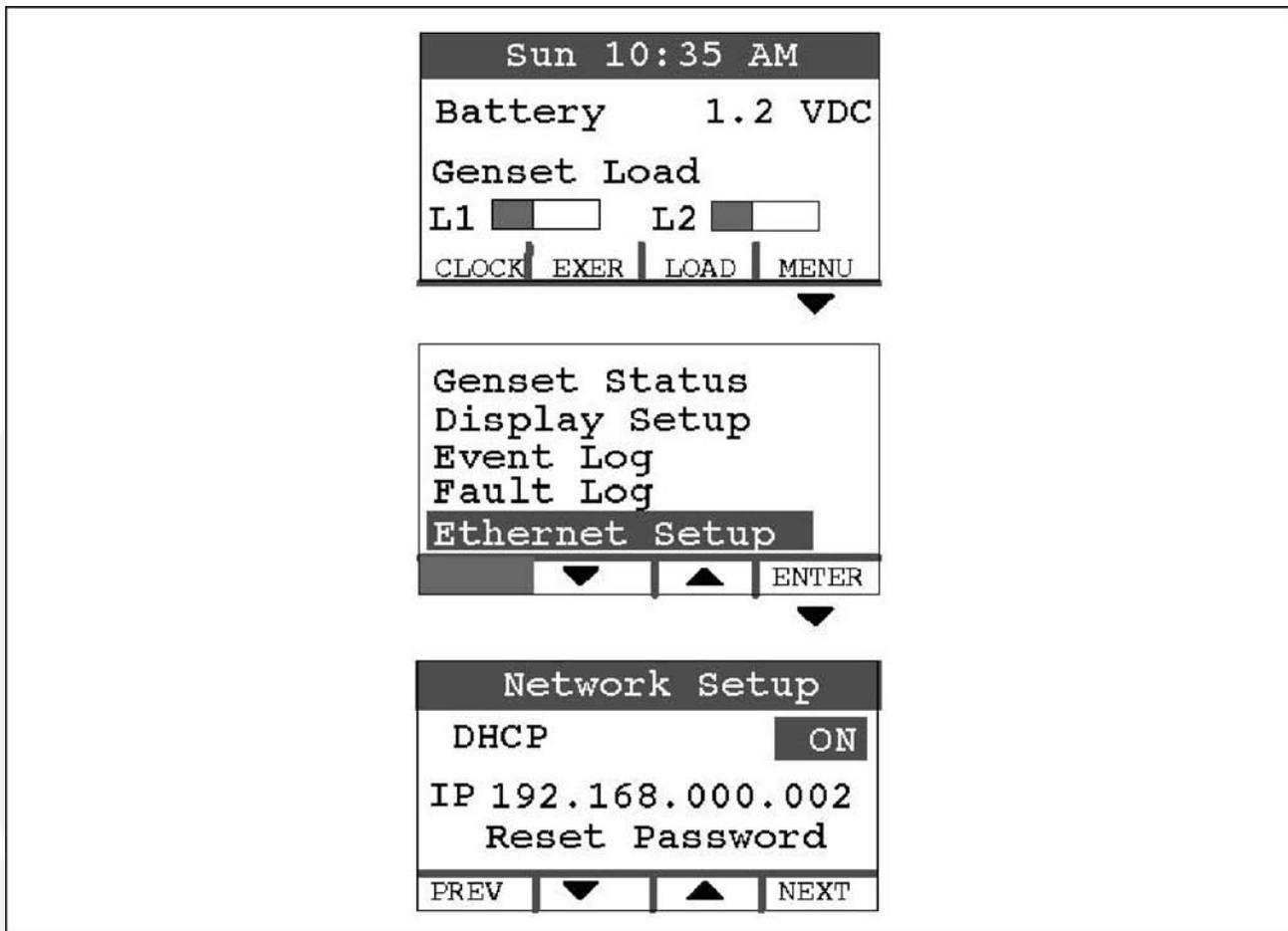


FIGURE 46. NETWORK SETUP SCREEN ON THE IN-HOME OPERATOR PANEL

NOTICE

Leave the DHCP (Dynamic Host Configuration Protocol) on, as it assigns a dynamic IP address to your internet connection.

3. Type the IP address in the address bar of the web browser of a computer established on the same in-home network as the generator set. The computer's web browser will display the generator set's web page.
4. Enter the User Name and Password. The default User Name and Password is as follows.

User Name: admin

Password: cummins
5. To change your password, click the **Network Setup** tab. Enter a new password, and click **Save Password**.

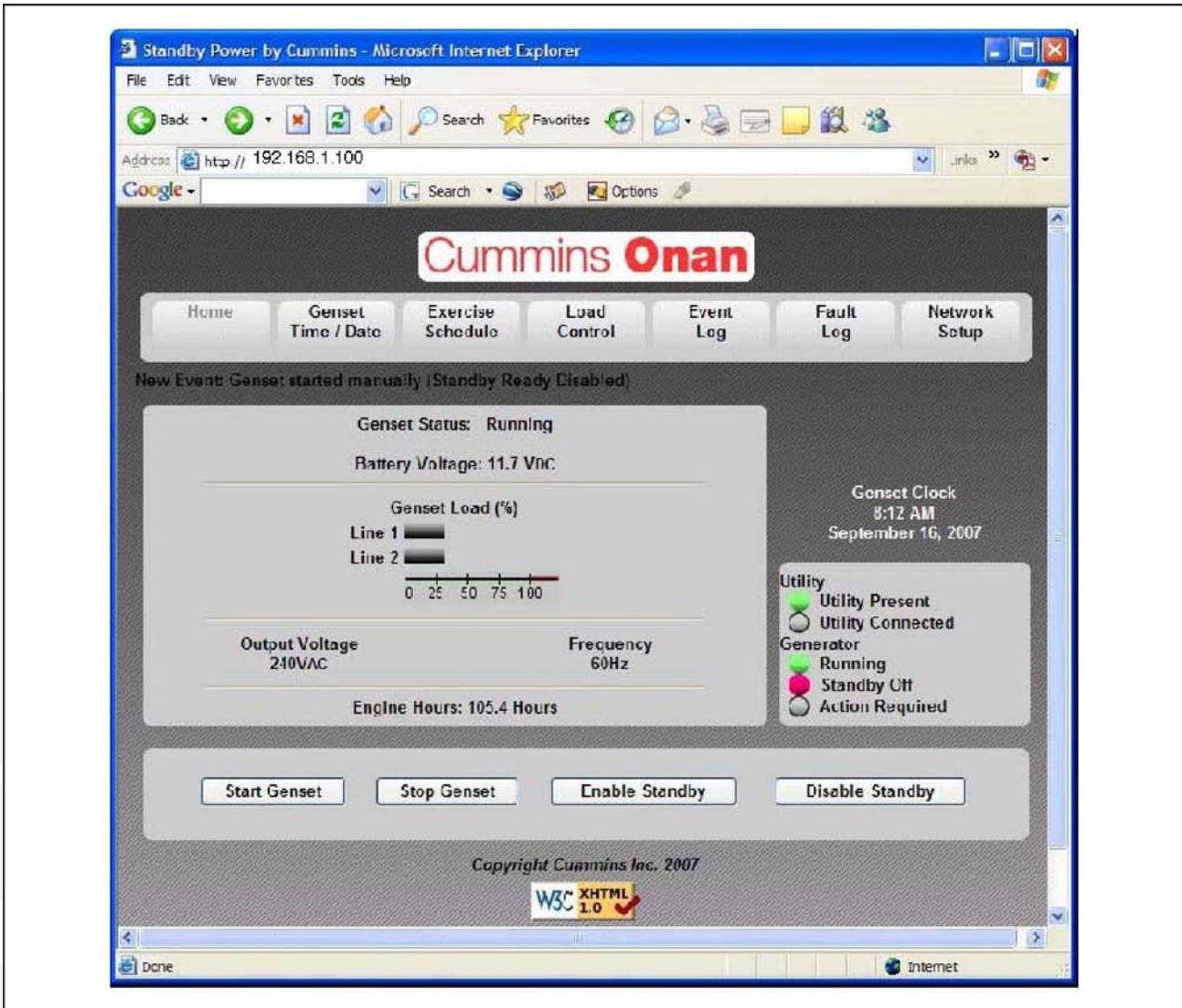


FIGURE 47. GENERATOR SET HOME PAGE

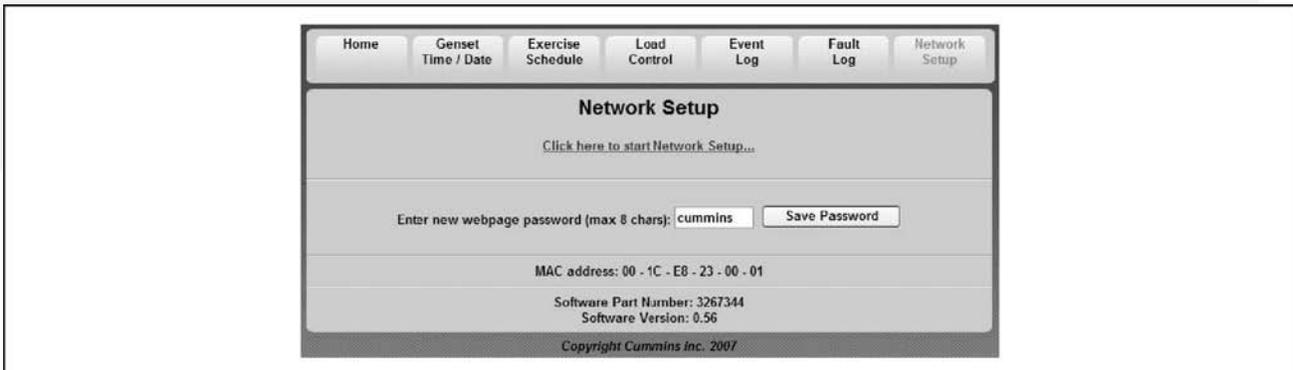


FIGURE 48. NETWORK SETUP SCREEN

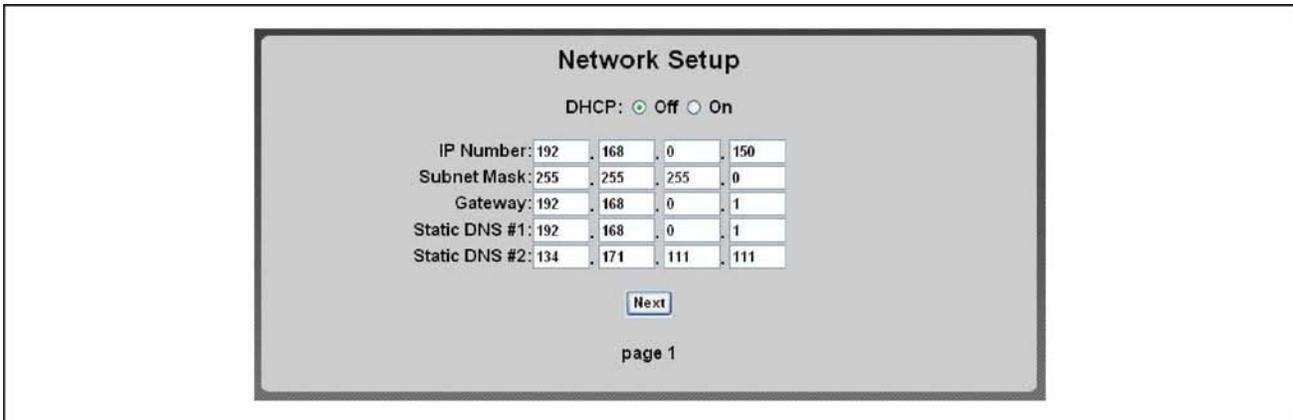


FIGURE 49. NETWORK SETUP (PAGE 1)

8.5 Setting Up Internet Access and E-mail Alerts

1. Set up the in-home computer access to the generator set. See [Section 8.4](#).

NOTICE

For the following steps, refer to the figures below.



FIGURE 50. NETWORK SETUP SCREEN

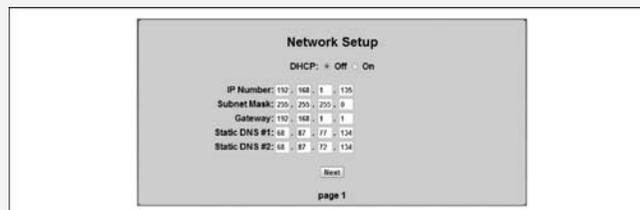


FIGURE 51. NETWORK SETUP PAGE 1

The screenshot shows a web interface for 'Network Setup' with a sub-section for 'Email Setup'. The 'Alert Level' is set to 'Maintenance and Attention Required'. Under 'Outgoing Server (SMTP)', there are four input fields: 'SMTP Port Number (0-65535): 25', 'Server Name (max 42 chars): smtp.mail.yahoo.com', 'User Name (max 48 chars): stealth_genset@yahoo.com', and 'Password (max 16 chars):'. A 'Next' button is at the bottom, and the page is labeled 'page 2'.

FIGURE 52. NETWORK SETUP PAGE 2

The screenshot shows a web interface for 'Network Setup' with a sub-section for 'Destination Email Addresses (max 48 chars each)'. There are three input fields: 'Address #1: stealth_genset@yahoo.com', 'Address #2: jacob.mirah@cummins.com', and 'Address #3: jacob.mirah@gmail.com'. A 'Done' button is at the bottom, and the page is labeled 'page 3'.

FIGURE 53. NETWORK SETUP PAGE 3

2. Click **Network Setup** on the home page.
3. Click **Click here to start Network Setup**.
4. Click **Off** to turn off the generator set DHCP.

NOTICE

Skip step 5 is a unique IP address was already provided by the router.

5. In the **IP Number** field, enter a unique in-home network address for the generator set by changing the field of IP address number to a number between 001 and 256 (one that is not in use by another device on the same network).
6. The **Subnet Mask**, **Static DNS #1 and #2**, and **Gateway** numbers establish the connections between the modem/router and the generator set and do not need to be changed.
7. Press **Next** to continue to the e-mail setup screen.
8. Select the **Alert Level** to choose the type of e-mail message that the customer would like to receive.
9. Enter the SMTP **Port Number** provided by your ISP or e-mail service provider.
10. Enter your e-mail **Server Name**.

NOTICE

An e-mail server name may be obtained from the customer's ISP or e-mail service provider (example: smtp.cummins).

11. Enter the **User Name** and **Password** for the provided e-mail server.

12. Click **Next** to enter the destination e-mail addresses.
13. Enter up to three different e-mail addresses which will receive generator set e-mail alerts.

E-mail Address 1: _____

E-mail Address 2: _____

E-mail Address 3: _____

14. Press **Done** to complete the e-mail confirmation.

NOTICE

If the IP address was changed in step 5, type the new address into the Internet browser's address bar in order to return to the home screen.

15. To complete the remote viewing process, see [Section 8.6](#) and [Section 8.7](#).



FIGURE 54. NETWORK SETUP SCREEN

8.6 Port Forwarding

NOTICE

Opening ports in a firewall can pose network security risks. The following instructions require forwarding port 80.

1. Access the customer's modem/router user manual.
2. Using the operator manual, determine how to gain access to the modem/router's setup screen.
3. Locate the port forwarding section of the modem/router's setup menu.
4. Configure port 80 to be forwarded to the IP address created in [Section 8.5](#).

NOTICE

To maintain connections to all devices connected to the modem/router, do not turn off the modem/router DHCP.

5. To complete the remote viewing process, see [Section 8.7](#).

8.7 Remote Viewing IP Options Static IP

1. Acquire a static IP address.

NOTICE

Acquiring a static IP may incur additional service charges from your ISP.

2. Use the provided static IP address to access the generator set webpage from any location with Internet access.

8.8 Dynamic IP Monitoring

NOTICE

If a static IP address has been authorized from your ISP, the following steps are not required. Some services may require software to be installed on a home computer.

1. Determine the home network's public/external IP address using an online tool (such as, www.whatismyip.com).
2. Locate a dynamic IP host online and register for services.

NOTICE

Online dynamic hosting service can often be provided at no cost.

3. Configure the modem/router to update the dynamic IP host each time its external/public IP address changes.

NOTICE

Instructions for completing the above step should be provided by the dynamic IP monitoring host and the router user manual.

4. Use the URL provided by the dynamic IP host service to access the generator set webpage from any location with Internet access.

8.9 Email Setup Parameters

8.9.1 Outgoing Server (SMTP) Settings

Ask your Internet Service Provider (ISP) and/or e-mail provider for the Server Name, User Name and Password to enter.

Server Name: _____

User Name: _____

Password: _____

NOTICE

An Email account capable of SMTP authentication via port 25 is required. The User Name must include the domain name. Example: `username@domainname`

8.9.2 Email Addresses

You may enter up to three Email addresses to whom to send generator set status and event messages.



FIGURE 55. NETWORK SETUP SCREEN

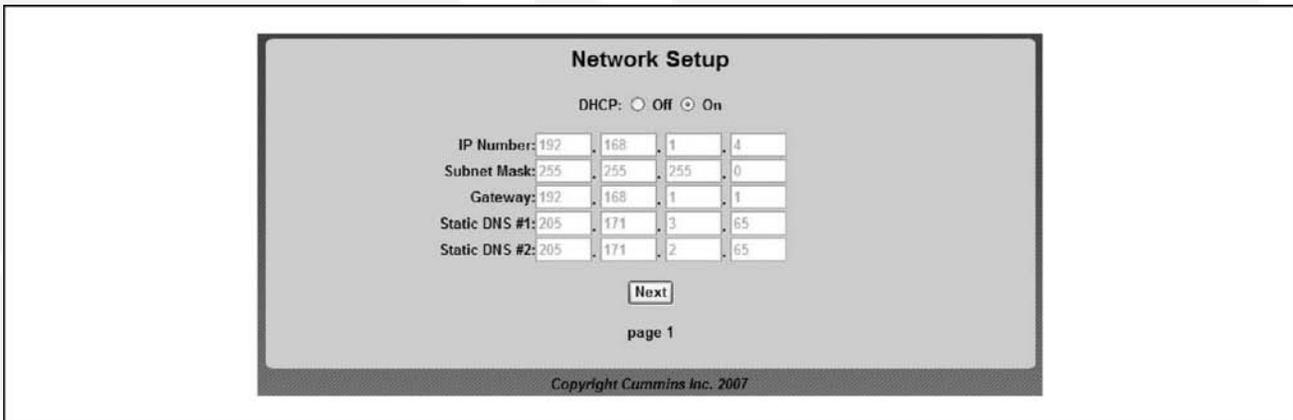


FIGURE 56. NETWORK SETUP PARAMETERS

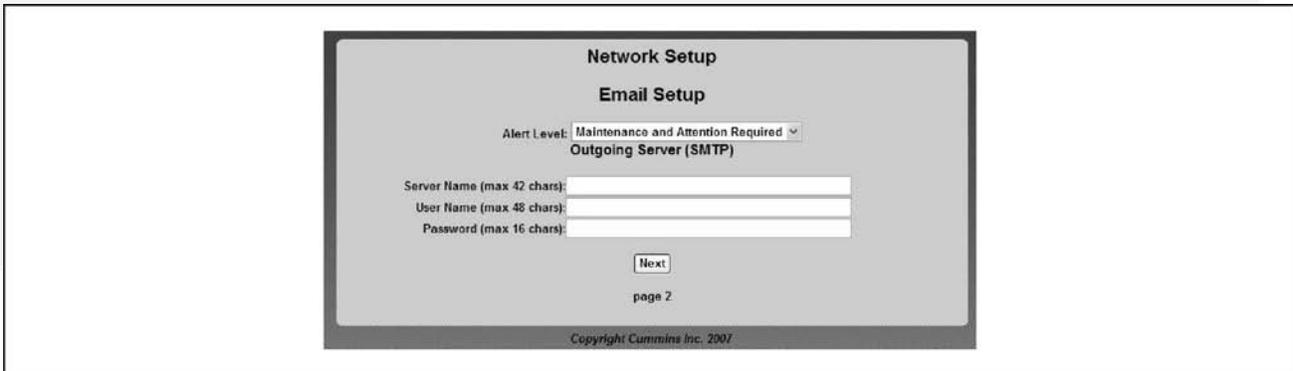


FIGURE 57. EMAIL SETUP PARAMETERS

Network Setup

Destination Email Addresses (max 48 chars each)

Address #1:

Address #2:

Address #3:

Done

page 3

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FIGURE 58. EMAIL ADDRESSES

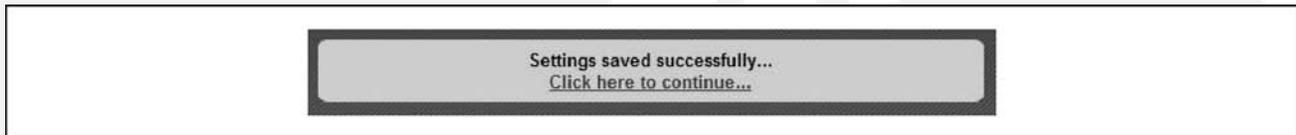


FIGURE 59. RETURN TO HOME PAGE

8.10 Remote Internet Access to the Generator Set

See the network connection information, provided in Appendix A of this manual. Be sure to read through the procedure and collect all needed information before attempting this procedure.

⚠ WARNING

Opening ports in your firewall can pose network security risks. The following instructions require forwarding port 80.

NOTICE

It is highly recommended that a professional computer and network support specialist be hired to complete this part of the setup for proper connections and proper firewall protection to the in-home network.

1. Follow the modem and router setup instructions to forward port 80 to the IP address that was previously assigned to the generator set. Typically, this is done on a Port Forwarding or Virtual Server setup screen.

NOTICE

To maintain connections to all devices connected to the modem/router, do not turn off modem/router DHCP.

NOTICE

If the router is capable of being set up as a switch, plug the input from the modem into one of the open router outputs instead of accomplishing this step.

2. To access the generator set's web page on any computer or wireless device not connected to the same modem/router as the generator set, type in the owner's public IP address and enter the user name and password.
3. To access the generator set's web page on any computer or wireless device connected to the same modem/router as the generator set, type in the unique in-home network address of the generator set and enter the username and password.

8.11 Help Hotline

1-800-888-6626 option 1

Technical support for setup and troubleshooting of the hardware used for in-home network access to the generator set is available through the selling Cummins Onan dealer/distributor.

The owner may be required to contact their ISP and/or email provider for technical support of the e-mail notification feature setup and troubleshooting.

Due to the variations in network equipment, network configurations and ISPs, the owner is responsible for acquiring the needed support/service from a qualified network specialist to properly and securely set up the owner's network for remote monitoring of the generator set.

Cummins Onan does not provide technical support for setup and troubleshooting of the owner's network and email service.

- If you can't remember your password, reset it to "cummins" by selecting **Reset Password** on the Network Setup screen on the in-home Operator Panel and pressing the up or down arrow.
- The customer's public IP Address must be a static IP Address. If the customer's public IP Address is dynamic, the customer must either obtain a static IP Address from their service provider or set up a domain name that manages the dynamic IP Address.

8.12 Frequently Asked Questions

Question: Do I need a router?

Answer: Yes, a router or switch is required to allow for the connection of more than one device (computer, generator set, etc.) with each other and the Internet.

- Typically, your Internet modem also serves as a router.
- If you have an available Ethernet connection on your router-enabled modem, you may not need to add an additional router.

Question: Do I need a modem?

Answer: A modem is required if you want to utilize the email and remote Internet access features of the generator set.

- Only one modem is required.
- If you already have an Internet connection, you have a modem.

Question: What is an IP Address?

Answer: An IP Address, or Internet Protocol Address, is a unique address that devices such as a computer or your home generator set use to communicate with each other, both on your in-home network (LAN network) or with the World Wide Web.

Question: What is the difference between Static and Dynamic IP Addresses?

Answer:

Dynamic IP Address - On your in-home network, the router (with DHCP enabled) will assign a dynamic IP Address to all devices (computer, home generator set, etc.) connected to the router. As devices are added and removed from the router, the devices are automatically updated with new IP Addresses. This means that your computer and generator set IP Addresses will not always be the same unless static IP Addresses are assigned.

Static IP Address - A static IP Address is an unique address that is permanently assigned to a device. On the World Wide Web, your typical ISP (Internet Service Provider) assigns a dynamic IP Address to your Internet connection. This is the IP Address you type into your Internet browser to access your generator set from the World Wide Web. A static IP Address is required for you to establish a constant address you can always access from the World Wide Web. Contact your ISP to set up a static IP Address for your Internet connection.

Question: What is DHCP?

Answer: DCHP, or Dynamic Host Configuration Protocol, automatically assigns IP Addresses, subnet masks, and gateways to devices, allowing them to communicate with each other.

- Your router and generator set are equipped with DHCP.
- Default is for DHCP to be on.

Question: What is a UPS device and why is it recommended?

Answer: A UPS (Uninterruptible Power Supply) device is battery backup to keep devices such as computers and modems powered during short-term power outages.

- We recommend that the modem/router be powered through a UPS device to ensure that your generator set is able to send emails and be remotely accessed at all times.
- For example, if your generator set shuts down during a utility power outage, the generator set can still send you an email letting you know that the power has failed and that the generator set shut down.

Question: When do I need to use a Static IP Address?

Answer: Static IP addresses are required if you plan to access your generator set remotely via the Internet.

Question: I used the IP Addresses shown on the front of this guide, but why was I not able to access the generator set?

Answer: The IP Addresses shown in this guide are only examples and are not likely to be the ones that will work on your network setup.

Question: The IP Address consists of four numbers ranging from 0 to 255 which are separated by dots; 179.168.052.094, for example. Are leading zeros necessary?

Answer: No, the IP Address, 192.168.0.1, for example, is equivalent to 192.168.000.001. The address can be entered either way.

Question: How do I get my IP Number, Subnet Mask and Gateway?

Answer:

On a PC:

1. Disable the PC's wireless function.

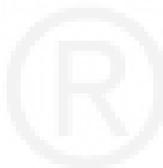
2. Establish an Ethernet connection between the computer and generator set via a common modem.
3. On the computer, Click **Start>Run**.
4. On the run menu that appears type "**cmd** " and click OK.
5. Type "**ipconfig** " on the DOS window that appears.

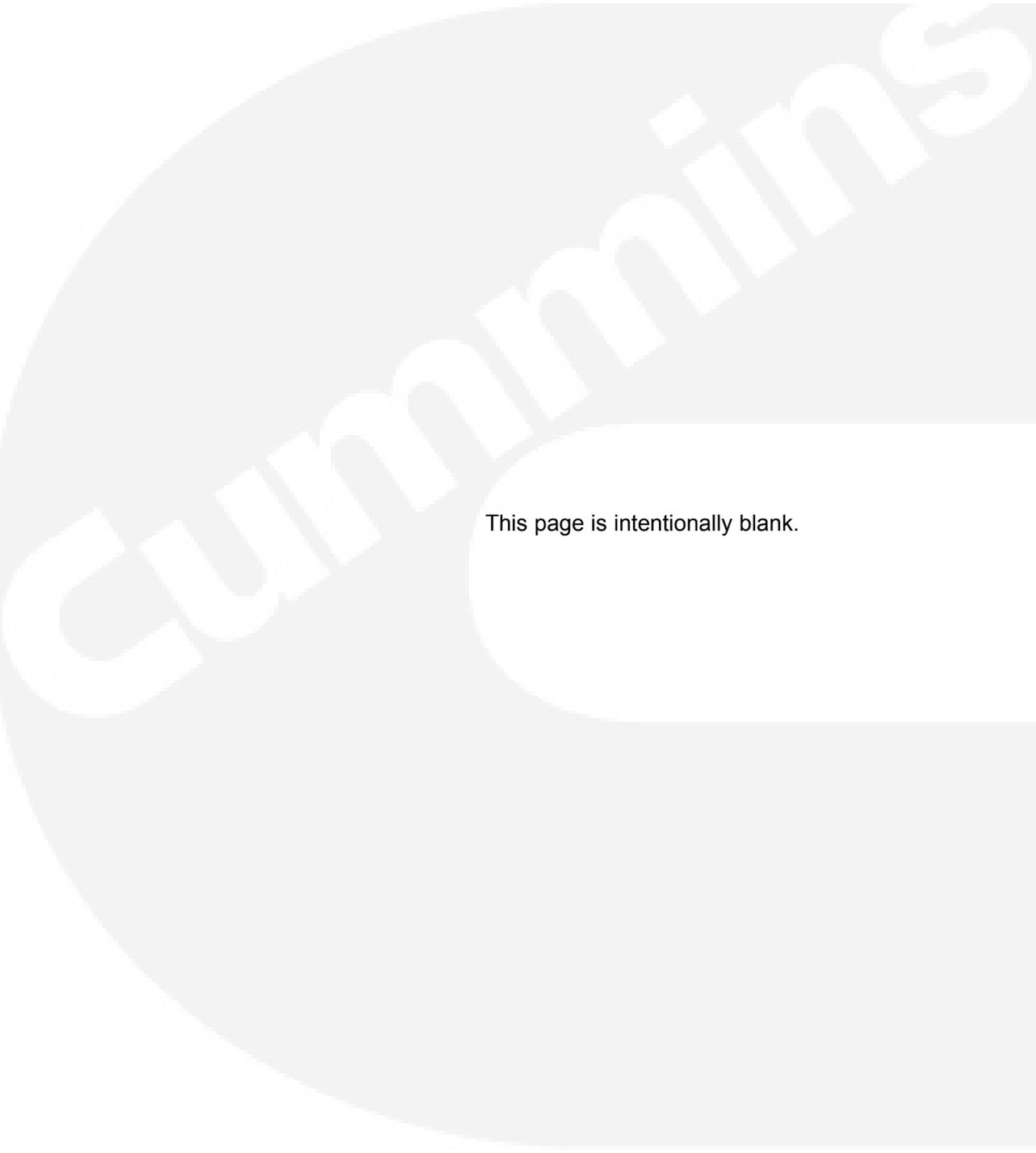
Question: Why do I need two IP Addresses to access my generator set?

Answer: You can access your generator set from two networks, your in-home or local network, and from the World Wide Web, thus requiring two addresses.

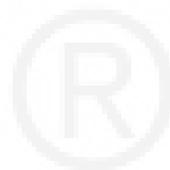
- Your local IP Address is different from your World Wide Web IP Address.
 - From your in-home network you use the generator set's Static IP Address.
 - From the World Wide Web you first need to access your modem, which is accomplished by typing in the Static IP Address of your Internet connection.

Your modem will then automatically forward you to your generator set on the local network.





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9 Troubleshooting

By regularly performing the following periodic maintenance and guidelines, you greatly reduce the chances of a genset shutdown.

- Maintain an appropriate oil level
- Keep battery connections clean and tight
- Do not overload the generator set
- Keep the air inlet and outlet openings clear

9.1 Troubleshooting With the In-Home Operator Panel

If a fault shutdown occurs the ACTION REQUIRED lamp on the in-home Operator Panel will come on and the LCD screen will display the a description of the Fault, the Fault Number, and the hour in total generator set running time when the Fault occurred.

The shutdown codes are listed below in numerical order along with step-by-step corrective actions.

9.2 Troubleshooting with the Flashing Indicator Light

The status indicator light on the Control Switch inside the generator set flashes the diagnostic fault code when a fault shutdown occurs. For a single-digit fault code (2 or 4), the light will flash 2 or 4 times and after a short pause will repeat.

For a two-digit fault code the light will flash the tens digit, pause and flash the units digit and repeat after a longer pause. Fault 36 would be flashed as follows:

flash-flash-flash—*pause* —flash-flash-flash-flash-flash-flash—*long pause* —repeat

NOTICE

For fault history, go to the in-home Operator Panel.

9.3 Fault Code Blinking

At fault shutdown, the status indicator light will repeatedly blink sets of 1, 2, 3 or 4 blinks.

- **One blink** indicates shutdown due to high engine temperature.
- **Two blinks** indicate shutdown due to a loss of engine oil pressure.
- **Three blinks** indicate a service fault. Press **Stop** once to cause the two-digit, second-level shutdown code to blink. (Pressing **Stop** again will stop the blinking.) The two-digit code consists of 1, 2, 3, 4 or 5 blinks, a brief pause, and then 1 to 9 blinks. The first set of blinks represents the tens digit and the second set of blinks the units digit of the shutdown code number.
- **Four blinks** indicate that cranking time exceeded 35 seconds.

- *Fault Code Nos. 1, 2, 3, and 4 are first level faults. Pay close attention to the pause sequence to avoid interpreting first level faults as second-level Fault Codes Nos. 11, 22, 33 or 44.*
- *To avoid the possibility of anyone misinterpreting Code Nos. 3 and 4 as Code Nos. 33 and 44, the latter have not been assigned faults.*

9.4 Restoring Fault Code Blinking

The fault code stops blinking after five minutes. Press **Stop** three times within three seconds to restore fault code blinking.

NOTICE

The last fault logged will blink even though the condition that caused the shutdown may have been corrected.

⚠ WARNING

Some Generator Set service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform Generator Set service.

9.5 Generator Set Starts or Stops Without Command - No Fault Code

Logic: To start or stop - control receives ground at start or stop input on control, DC voltage drops below 8V and controller de-energizes (shuts down in sleep mode)

Possible Causes: Low battery voltage, shorted harness connection, faulty start/stop switch, "Standby Ready" is enabled, faulty or incorrect spark plugs.

Diagnosis and Repair:

1. Check last fault and record.
2. Measure battery voltage at battery and generator set.
3. Inspect battery connections and cables for cleanliness, tightness and damage: clean, tighten and repair connections and cables as necessary.
4. Check electrolyte level and hydrometer reading in maintenance type batteries: replace electrolyte and recharge or replace battery as necessary.
5. Disconnect generator set control J1 connector. Verify that the J1 pins are fully inserted and inspect pin condition, using one of the processes listed below. Then insert, repair or replace pins as necessary.

Pin Inspection Processes (use one of the following to inspect the pins):

Use the test points of the tester tool #420-0603

Use a mating pin connector

Use a pin gauge the same size (.045") as the mating control connector pin

Use any suitable device that will not damage the inside contact wipers of the pin socket

6. Reconnect J1 connector and test run generator set for symptom: repair or replace pins in connector as necessary.
7. Measure battery voltage at generator set while attempting to start from local or remote switch: recharge or replace battery if voltage drops below 8 VDC, test and service generator set battery charger.
8. Measure battery voltage and check for voltage increase while generator set is running.
9. Measure for continuity change across start/stop switch between neutral and start position and neutral and stop position at switches and at connector J1: reconnect or repair connections, replace switches as necessary.
10. Measure for continuity from start and stop inputs to ground at switches and at connector J1: Repair or replace damaged harness.
11. Determine if "Standby Ready" is enabled (Control will command start and stop based on its own settings): disable "Standby Ready" or explain "Standby Ready" function to customer.
12. Verify the condition of the spark plugs and whether they are Cummins Onan branded plug(s). Non-resistive type plugs sold through non-Cummins Onan channels can cause this condition. Replace the spark plug(s) if questionable or of non-Cummins Onan origin. Please see field flash for more information.

9.6 No Response - Status Indicator Light Dead

Logic: To start - the control receives ground via the start/stop switch to start or stop input on control

Possible Causes: Low/No battery voltage, poor battery connection, faulty battery, open harness connection, faulty start/stop switch, faulty LED, F3 fuse open

Diagnosis and Repair:

1. Measure the battery voltage at the battery, at the generator set, and at connector J1: reconnect, clean, repair, and replace connections as necessary.
2. Measure battery voltage at the generator set while attempting to start or prime from the local or remote switch: recharge or replace the battery if voltage drops below 8 VDC, test and service the generator set battery charger if so equipped, increase battery cable size or run parallel cables.
3. Check F3 fuse for open circuit.
4. Measure for continuity change across start/stop switch between neutral and start position and neutral and stop position at switches and at connector J1: reconnect or repair connections; replace switches as necessary.
5. Test switches LED by energizing with 12 VDC: replace switches as necessary.
6. Disconnect the generator set control J1 connector. Verify that the J1 pins are fully inserted and inspect pin condition, using one of the processes listed below. Then insert, repair, or replace pins as necessary.

Pin Inspection Processes (use one of the following to inspect the pins):

- Use the test points of the tester tool #420-0603
- Use a mating pin connector
- Use a pin gauge the same size (.045") as the mating control connector pin

- Use any suitable device that will not damage the inside contact wipers of the pin socket
7. Reconnect the J1 connector and test run the generator set for start operation.

9.7 Starting Battery Runs Down

Logic: Low/No battery voltage

Possible Causes: Marginal battery connections, battery, charging system, excessive cranking

Diagnosis and Repair:

1. Measure battery voltage at the battery and the generator set.
2. Inspect battery connections and cables for cleanliness, tightness, and damage: clean, tighten, and repair connections and cables as necessary.
3. Check electrolyte level and hydrometer reading in maintenance type batteries: replace electrolyte and recharge or replace the battery as necessary.
4. Verify the battery charger is on and check operation.
5. Measure battery voltage and check for voltage increase while the generator set is running.
6. Check last fault and record: troubleshoot as necessary.
7. Disconnect the generator set control J1 connector. Verify that the J1 pins are fully inserted and inspect pin condition, using one of the processes listed below. Then insert, repair, or replace pins as necessary.

Pin Inspection Processes (use one of the following to inspect the pins):

- Use the test points of the tester tool #420-0603
 - Use a mating pin connector
 - Use a pin gauge the same size (.045") as the mating control connector pin
 - Use any suitable device that will not damage the inside contact wipers of the pin socket
8. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
 9. Measure for continuity change across the start/stop switch between the neutral and stop position at the switches and the J1 connector: replace switches as necessary or disconnect the external stop device if so equipped.
 10. Measure for voltage at the fuel solenoid while the generator set is not running.

9.8 Starter Engages - Disengages

Logic: Cranking voltage dips below 8 VDC: microprocessor aborts start attempt

Possible Causes: Battery connections, battery, charging system, start/stop switches, engine compression, faulty or incorrect spark plugs.

Diagnosis and Repair:

1. Measure battery voltage at the battery and the generator set.

2. Inspect the battery connections and cables for cleanliness, tightness, and damage: clean, tighten, and repair connections and cables as necessary.
3. Check electrolyte level and hydrometer reading in maintenance type batteries: replace electrolyte and recharge or replace the battery as necessary.
4. Disconnect the generator set control J1 connector. Verify that the J1 pins are fully inserted and inspect pin condition, using one of the processes listed below. Then insert, repair, or replace pins as necessary.

Pin Inspection Processes (use one of the following to inspect the pins):

- Use the test points of the tester tool #420-0603
 - Use a mating pin connector
 - Use a pin gauge the same size (.045") as the mating control connector pin
 - Use any suitable device that will not damage the inside contact wipers of the pin socket
5. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
 6. Measure battery voltage at the generator set while attempting to start from a local or remote switch: recharge or replace the battery if voltage drops below 8 VDC, test and service the generator set battery charger if so equipped, increase the battery cable size or run parallel cables.
 7. Verify the condition of the spark plugs and whether they are Cummins Onan branded plugs. Non-resistive type plugs sold through non-Cummins Onan channels can cause this condition. Replace the spark plug(s) if questionable or of non-Cummins Onan origin.
 8. Measure battery voltage and check for voltage increase while the generator set is running.

9.9 No AC Power - Generator Set Running, Status LED On Steady or Flashing Rapidly

Logic: Circuit Breakers have tripped due to overload or short.

Possible Causes: Circuit breakers, customer loads

Diagnosis and Repair:

1. Status light on - Measure AC output at generator set circuit breaker: reset or turn on the generator set circuit breaker; diagnose faulty loads as necessary.

9.10 Generator Set Cranks But Does Not Start - No Fault Code

Logic: Fault codes are based on time lapse between events

Possible Causes: Faulty or incorrect spark plugs, low battery output, low fuel pressure

Diagnosis and Repair:

1. Check and record last fault code.
2. Measure battery voltage at the battery and the generator set.

3. Inspect the battery connections and cables for cleanliness, tightness, and damage: clean, tighten, and repair connections and cables as necessary.
4. Check electrolyte level and hydrometer reading in maintenance type batteries: replace electrolyte and recharge or replace the battery as necessary.
5. Check the fuel supply pressure coming into the generator regulator and ensure it is within specification.
6. Verify the condition of the spark plugs and whether they are Cummins Onan branded plug(s). Non-resistive type plugs sold through non-Cummins Onan channels can cause this condition. Replace the spark plug(s) if questionable or of non-Cummins Onan origin.

9.11 Genset Warning - Transfer Switch Failed to Transfer Back to Utility When Utility is Restored - No Fault Code

Logic: The control does not sense the grounded, utility switch-position wire.

Possible Causes: Transfer switch is faulty, or wire is disconnected or broken.

Diagnosis and Repair:

1. Fix wire connection.
2. Replace a broken wire.
3. Replace a faulty transfer switch.

9.12 Low Oil Pressure Fault - Fault Code 2

Logic: Continuous ground (≥ 3 seconds) at control for oil pressure input. The switch opens with pressure.

Possible Causes: Low/high oil level, faulty switch, faulty oil pressure relief valve, faulty oil pump

Diagnosis and Repair:

1. Verify that Last Fault is FC 2: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure oil level: add or drain oil as necessary.
3. Disconnect the generator set control J1 connector. Verify that the J1 pins are fully inserted and inspect pin condition, using one of the processes listed below. Then insert, repair, or replace pins as necessary.

Pin Inspection Processes (use one of the following to inspect the pins):

- Use the test points of the tester tool #420-0603
 - Use a mating pin connector
 - Use a pin gauge the same size (.045") as the mating control connector pin
 - Use any suitable device that will not damage the inside contact wipers of the pin socket
4. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.

5. Measure continuity change across the start/stop switch between rest and under simulated pressure: replace the switch as necessary.
6. Measure continuity between ground and J1-6: repair or replace the harness as necessary.
7. Measure oil pressure with a mechanical gauge: repair or replace the relief valve and oil pump as necessary.

9.13 Service Check Fault - Fault Code 3

Logic: Single-Digit Fault to indicate shutdown due to a Two-Digit Fault

Possible Causes: Any Two-Digit Fault Code

Diagnosis and Repair:

1. Verify that Last Fault is FC 3: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. While LED is flashing three times press stop once (1 second duration): trouble shoot Two-Digit Fault Code.
3. You can read the fault code from the in-home Operator Panel if access is granted.

9.14 Overcrank - Fault Code 4

Logic: Controller unable to sense generator set quad frequency after cycle crank (30 seconds of cranking / 30 seconds between each crank attempt for a total of 3 crank attempts) and Low Fuel Pressure switch is closed (pressure switch circuit open = low pressure).

Possible Causes: Faulty switch, faulty external start command, fuel supply, air fuel mixture, exhaust system, wire connections, starter, ignition system

Diagnosis and Repair:

1. Verify that Last Fault is FC 4: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure for continuity change across the start/stop switch between the neutral and start position at the switches and the J1 connector: replace switches as necessary or disconnect the external start device if so equipped.
3. Disconnect the generator set control J1 connector, verify the J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use a mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace pins as necessary.
4. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
5. Verify engine rotation manually: repair engine damage as necessary.
6. Measure DC voltage at the starter during start attempt: repair wire connections, replace the start solenoid and starter as necessary.
7. Check air filter cleanliness; replace the air filter as necessary.

8. Check for blocked or damaged exhaust system: repair or replace exhaust components as necessary.
9. **Propane Models**
 - a. When ambient temperatures are less than 40°F vapor – withdrawal Propane tanks should be at least half full to provide proper vaporization rate.
 - b. Propane having more than 2.5 percent Butane will not vaporize in ambients at less than 32°F; use HD-5 grade Propane.
 - c. Run the generator set on shop fuel supply; verify tank level and fuel line condition.
10. Measure steady DC voltage at the fuel solenoid while the generator set is running; repair wiring as necessary.
11. Verify clear vent hose.
12. Check the generator set fuel lines for damage: replace the fuel line as required.
13. Measure the fuel supply and regulator lock-off pressures.
14. Check the governor, actuator, linkage, and spring for debris, damage, and looseness: readjust and repair as necessary.
15. Verify that the spark plug cables are secure on the spark plugs: reconnect or replace as necessary.
16. Inspect the ignition kill lead (J1-12) in the harness and at connector J1: repair or replace the lead, terminal, or pins as necessary.
17. Measure the spark plug gap: set the gap or replace the spark plugs as necessary.
18. Verify the ignition spark condition.
19. Inspect the spark plug leads, kill lead terminals at magnetos, and measure magneto air gap: replace the terminals, set the gap, or replace the magnetos as necessary.
20. Measure field, quadrature, and main winding resistance: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
21. Measure field, quadrature, and main winding resistance to ground: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
22. Measure field, quadrature, and main winding resistance to each other: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
23. Check the alignment of the brushes to the slip rings.

9.15 Overvoltage - Fault Code 12

Logic: Instantaneous Fault - AC voltage S1-S2 greater than 300 VAC Delayed Fault - AC voltage line-to-line greater than 278 VAC, but less than 150 VAC for 3 continuous seconds.

Possible Causes: Generator set loads, wire connections, windings

Diagnosis & Repair:

1. Verify that Last Fault is FC 12: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure and verify AC voltage at the customer connection block and at pins J1-34 and J1-35.

3. Measure and verify AC frequency while changing engine rpm to determine if frequency response matches engine rpm response.
4. Cycle loads to determine if a particular load causes fault: diagnose faulty load as necessary.
5. Verify balanced loads in 120/240 VAC applications: balance loads within 10 percent line-to-line as required.
6. Remove connector J1 from the control and re-install, and try to start the generator set: inspect, repair, or replace the J1 connector pins as necessary.
7. Measure field, quadrature, and main winding resistance: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
8. Measure field, quadrature, and main winding resistance to ground: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
9. Measure field, quadrature, and main winding resistance to each other: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
10. Check the alignment of the brushes to the slip rings.

9.16 Undervoltage - Fault Code 13

Logic: AC voltage 240 line-to-line less than 216 VAC for 5 continuous seconds

Possible Causes: generator set loads, wire connections, windings

Diagnosis & Repair:

1. Verify that the Last Fault is FC 13: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure and verify AC voltage at the customer connection block and at pins J1-34 and J1-35.
3. Measure and verify AC frequency while changing engine rpm to determine if frequency response matches engine rpm response.
4. Cycle loads to determine if a particular load will cause fault: diagnose faulty load as necessary.
5. Verify balanced loads in 120/240 VAC applications: balance loads within 10 percent line-to-line as required.
6. Remove connector J1 from the control and re-install it, and try to start the generator set: inspect, repair, or replace J1 connector pins as necessary.
7. Measure field, quadrature and main winding resistance: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
8. Measure field, quadrature, and main winding resistance to ground: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
9. Measure field, quadrature, and main winding resistance to each other: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
10. Check brush alignment:
 - a. Inspect brush wear on the slip rings and verify brush misalignment is toward the windings.

- b. If misalignment is toward the bearing, the cause is not from this tolerance issue and is likely the result of the end bell not being seated properly during assembly. Inspect for cause and repair as necessary.

9.17 Overfrequency - Fault Code 14

Logic: Instantaneous Fault - Frequency greater than 72Hz Delayed Fault - Frequency greater than 66Hz, but less than 72Hz, for 6 continuous seconds

NOTICE

This fault code is for both the 50 Hz and 60 Hz models.

Possible Causes: Generator set loads, engine governor function, fuel supply, air fuel mixture, exhaust system, choke, demand regulator, carburetor, generator windings, wire connections

Diagnosis & Repair:

1. Verify that the Last Fault is FC 14: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure AC current while running the generator set with loads: identify faulty or short cycling loads.
3. Measure generator set load capability with load bank (de-rate for altitude and temperature as necessary).
4. Measure AC frequency while running.
5. Measure AC frequency while changing engine rpm to determine if frequency response matches engine rpm response.
6. Disconnect the generator set control J1 connector, verify the J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace pins as necessary.
7. Reconnect J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
8. Check all grounds and neutral leads for looseness at the battery and the generator set; run the generator set on a separate battery: tighten or replace terminals and leads as necessary.
9. Check for air filter cleanliness; replace air filter as necessary.
10. Check for blocked or damaged exhaust system: repair or replace exhaust components as necessary.
11. **Propane Models**
 - a. When ambient temperatures are less than 40°F vapor – withdrawal Propane tanks should be at least half full to provide proper vaporization rate.

- b. Propane having more than 2.5 percent Butane will not vaporize in ambients at less than 32°F; use HD-5 grade Propane.
 - c. Run the generator set on shop fuel supply; verify the tank level and fuel line condition.
12. Measure steady DC voltage at the fuel solenoid while the generator set is running; repair wiring as necessary.
13. Verify clear vent hose.
14. Check the generator set fuel lines for damage: replace the fuel line as required.
15. Measure fuel supply and regulator lock off pressures.
16. Check the governor, actuator, linkage, and spring for debris, damage, and looseness: readjust and repair as necessary.
17. Measure field, quadrature, and main winding resistance: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
18. Measure field, quadrature and main winding resistance to ground: clean slip rings, replace brushes, repair harness and replace rotor or stator as necessary.
19. Measure field, quadrature, and main winding resistance to each other: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
20. Check brush alignment:

Inspect brush wear on the slip rings and verify brush misalignment is toward the windings. If misalignment is toward the bearing, the cause is not from this tolerance issue and is likely the result of the end bell not being seated properly during assembly. Inspect for cause and repair as necessary.
21. Verify that spark plug cables are secure on spark plugs: reconnect or replace as necessary.
22. Inspect ignition kill lead (J1-12) in harness and at connector J1: repair or replace lead, terminal or pins as necessary.
23. Measure spark plug gap: set the gap or replace the spark plugs as necessary.
24. Verify ignition spark condition.
25. Inspect the spark plug leads, kill lead terminals at magnetos, and measure magneto air gap: replace the terminals, set the gap, or replace magnetos as necessary.

9.18 Underfrequency - Fault Code 15

Logic: Frequency less than 54 Hz (for the 60 Hz model) or 45 Hz (for the 50 Hz model) for 8 continuous seconds.

Possible Causes: Generator set loads, engine governor function, fuel supply, air fuel mixture, exhaust system, choke, demand regulator, carburetor, generator windings, ignition, wire connections

Diagnosis & Repair:

1. Verify that the Last Fault is FC 15: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure AC current while running the generator set with loads: identify faulty or short cycling loads.

3. Measure generator set load capability with shop load bank (de-rate for altitude and temperature as necessary).
4. Measure AC frequency while running.
5. Measure AC frequency while changing engine rpm to determine if frequency response matches engine rpm response.
6. Disconnect the generator set control J1 connector, verify the J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use a mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace the pins as necessary.
7. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
8. Check air filter cleanliness; replace the air filter as necessary.
9. Check for blocked or damaged exhaust system: repair or replace exhaust components as necessary.
10. **Propane Models**
 - a. When ambient temperatures are less than 40°F vapor-withdrawal, Propane tanks should be at least half full to provide proper vaporization rate.
 - b. Propane having more than 2.5 percent Butane will not vaporize in ambients at less than 32°F; use HD-5 grade Propane.
 - c. Run the generator set on shop fuel supply; verify the tank level and fuel line condition.
11. Measure steady DC voltage at fuel solenoid while the generator set is running; repair wiring as necessary.
12. Verify clear vent hose.
13. Check the generator set fuel lines for damage: replace fuel line as required.
14. Measure the fuel supply and regulator lock off pressures.
15. Check the governor, actuator, linkage, and spring for debris, damage, and looseness: readjust and repair as necessary.
16. Measure field, quadrature, and main winding resistance: clean the slip rings, replace the brushes, repair the harness, and the replace rotor or stator as necessary.
17. Measure field, quadrature, and main winding resistance to ground: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
18. Measure field, quadrature, and main winding resistance to each other: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
19. Check brush alignment:

Inspect brush wear on the slip rings and verify brush misalignment is toward the windings. If misalignment is toward the bearing, the cause is not from this tolerance issue and likely the result of the end bell not being seated properly during assembly. Inspect for cause and repair as necessary.

20. Verify that the spark plug cables are secure on the spark plugs: reconnect or replace as necessary.
21. Inspect ignition kill lead (J1-12) in the harness and at connector J1: repair or replace the lead, terminal, or pins as necessary.
22. Measure the spark plug gap: set the gap or replace the spark plugs as necessary.
23. Verify ignition spark condition.
24. Inspect the spark plug leads, kill lead terminals at magnetos, and measure magneto air gap: replace the terminals, set the gap, or replace the magnetos as necessary.
25. Measure temperature of the air intake and temperature rise across the generator set; remove blockage or prevent air recirculation.

9.19 Governor Actuator Shutdown- Fault Code 19

Logic: Controller sensed governor actuator circuit open or shorted.

Possible Causes: Wire connections, governor actuator

Diagnosis & Repair:

1. Verify that the Last Fault is FC 19: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure and verify governor actuator resistance. Replace as necessary.
3. Measure and verify governor wiring to the control. Replace or repair as necessary.
4. Disconnect the generator set control J1 connector, verify the J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use a mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace the pins as necessary.
5. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.

9.20 Governor Actuator Overload - Fault Code 22

Logic: Maximum governor output (PWM) for 10 continuous seconds while fuel pressure switch open and current at 100%

Possible Causes: Generator set loads, wire connections, fuel supply, air fuel mixture, exhaust system, governor actuator, ignition system

Diagnosis & Repair:

1. Verify that the Last Fault is FC 22: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure AC current while running the generator set with loads: identify faulty or short cycling loads or reduce loads as necessary.

3. Measure the generator set load capability with a shop load bank (de-rate for altitude and temperature as necessary).
4. Measure AC frequency and droop while the generator set is running.
5. Measure AC frequency while changing engine rpm to determine if frequency response matches engine rpm response.
6. Disconnect the generator set control J1 connector, verify J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use a mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace pins as necessary.
7. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
8. Check air filter cleanliness; replace the air filter as necessary.
9. Measure steady DC voltage at the fuel solenoid while the generator set is running; repair wiring as necessary.
10. **Propane Models**
 - a. When ambient temperatures are less than 40°F vapor – withdrawal Propane tanks should be at least half full to provide proper vaporization rate.
 - b. Propane having more than 2.5 percent Butane will not vaporize in ambients at less than 32°F; use HD-5 grade Propane.
 - c. Run generator set on shop fuel supply; verify tank level and fuel line condition.
11. Verify clear vent hose.
12. Check the generator set fuel lines for damage: replace the fuel line as required.
13. Measure the regulator lock off pressure.
14. Check the intake manifold and gaskets for air leaks: tighten fasteners and replace the gaskets and manifold as necessary.
15. Check for a blocked or damaged exhaust system: repair or replace the exhaust components as necessary.
16. Verify actuator function by applying DC voltage to the terminals: replace the actuator as necessary.
17. Check the carburetor for binding; inspect the spring for dirt and debris: clean the spring, replace the carburetor as necessary.
18. Verify that spark plug cables are secure on the spark plugs: reconnect or replace as necessary.
19. Inspect the ignition kill lead (J1-12) in the harness and at connector J1: repair or replace the lead, terminal, or pins as necessary.
20. Measure spark plug gap: set gap or replace spark plugs as necessary.
21. Verify ignition spark condition.

22. Inspect the spark plug leads, kill lead terminals at magnetos, and measure the magneto air gap: replace the terminals, set the gap, or replace the magnetos as necessary.

9.21 Voltage Sense Lost - Fault Code 27

Logic: generator set frequency is greater than 40 Hz and voltage sensed less than 5 VAC on one or both lines. (The control senses if one line is lost or disconnected).

Possible Causes: generator set loads, generator windings, ignition, wire connections,

Diagnosis & Repair:

1. Verify that the Last Fault is FC 27: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure AC voltage.
3. Disconnect the generator set control J1 connector, verify the J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use a mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace pins as necessary.
4. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
5. Measure field, quadrature, and main winding resistance: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
6. Measure field, quadrature, and main winding resistance to ground: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
7. Measure field, quadrature, and main winding resistance to each other: clean the slip rings, replace the brushes, repair the harness, and replace the rotor or stator as necessary.
8. Check brush alignment.
9. Verify that the spark plug cables are secure on the spark plugs: reconnect or replace as necessary.
10. Inspect the ignition kill lead (J1-12) in the harness and at connector J1: repair or replace the lead, the terminal, or the pins as necessary.
11. Measure the spark plug gap: set the gap or replace the spark plugs as necessary.
12. Verify ignition spark condition.
13. Inspect the spark plug leads, kill lead terminals at magnetos, and measure the magneto air gap: replace the terminals, set the gap, or replace the magnetos as necessary.
14. Measure temperature of the air intake and temperature rise across the generator set; remove blockage or prevent air recirculation.

9.22 High Battery Voltage - Fault Code 29

Logic: DC voltage to controller greater than 19 VDC.

Possible Causes: Incorrect battery configuration, wire damage, faulty charger, control

Diagnosis & Repair:

1. Verify that the Last Fault is FC 29: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure DC voltage at the battery, at the generator set, and at connector J1: reconnect the battery or repair wiring as necessary.
3. Measure DC voltage with the battery charger on: reduce the boost charge rate or diagnose the faulty charger as necessary.
4. Disconnect the generator set control J1 connector, verify that the J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace pins as necessary.
5. Reconnect the J1 connector and test run the generator set for fault occurrence.

9.23 Low Cranking Speed Sense - Fault Code 32

Logic: Quadrature frequency less than 1Hz (Engine RPM less than 180) for 3 continuous seconds after pressing start

Possible Causes: Starter, engine components, air intake system, exhaust system, generator windings, wire connections, battery, battery connections, oil viscosity

Diagnosis & Repair:

1. Verify that the Last Fault is FC 32: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure battery voltage at the battery and the generator set: recharge or replace the battery as necessary.
3. Verify engine rotation manually: repair engine damage as necessary.
4. Verify generator rotation manually: repair generator damage as necessary.
5. Disconnect the generator set control J1 connector, verify that the J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use a mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace pins as necessary.
6. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
7. Measure DC voltage at the starter during a start attempt: repair wire connections, replace the start solenoid and starter as necessary.

8. Check air filter cleanliness; replace the air filter as necessary.
9. Check for a blocked or damaged exhaust system: repair or replace exhaust components as necessary.
10. Measure AC frequency while changing engine rpm to determine if frequency response matches engine rpm response.
11. **Propane Models**
 - a. When ambient temperatures are less than 40°F vapor – withdrawal Propane tanks should be at least half full to provide proper vaporization rate.
 - b. Propane having more than 2.5 percent Butane will not vaporize in ambients at less than 32°F; use HD-5 grade Propane.
 - c. Run the generator set on shop fuel supply; verify tank level and fuel line condition.
12. Measure steady DC voltage at the fuel solenoid while the generator set is running; repair wiring as necessary.
13. Verify clear vent hose.
14. Check the generator set fuel lines for damage: replace fuel line as required.
15. Measure fuel supply and regulator lock off pressures.
16. Check the governor, actuator, linkage, and spring for debris, damage, and looseness: readjust and repair as necessary.
17. Verify that the spark plug cables are secure on the spark plugs: reconnect or replace as necessary.
18. Inspect the ignition kill lead (J1-12) in the harness and at connector J1: repair or replace the lead, terminal, or pins as necessary.
19. Measure the spark plug gap: set the gap or replace the spark plugs as necessary.
20. Verify ignition spark condition.
21. Inspect the spark plug leads, kill lead terminals at magnetos, and measure the magneto air gap: replace the terminals, set the gap, or replace the magnetos as necessary.
22. Measure the temperature of the air intake and temperature rise across the generator set; remove blockage or prevent air recirculation.

9.24 Control Card Failure - Fault Code 35

Logic: EEPROM (programming variables) error during self test

Possible Causes: Faulty program

Diagnosis & Solution:

1. Verify that the Last Fault is FC 35: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Replace the control.

9.25 Generator Set Stopped Without Fault Condition - Fault Code 36

Logic: RPM less than 500 and Sense Voltage S1-S2 at 0 VAC while fuel pressure switch open and no other fault condition occurred

Possible Causes: Fuel supply, air fuel mixture, exhaust system, choke, demand regulator, carburetor, generator windings, ignition, wire connections

Diagnosis & Repair:

1. Verify that the Last Fault is FC 36: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Verify engine rotation manually: repair engine damage as necessary.
3. Verify generator rotation manually: repair generator damage as necessary.
4. Disconnect the generator set control J1 connector, verify that the J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use a mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace pins as necessary.
5. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
6. Check the air filter for cleanliness; replace air filter as necessary.
7. Check for a blocked or damaged exhaust system: repair or replace exhaust components as necessary.
8. Measure the generator set load capability with a shop load bank.
9. Measure AC frequency while changing engine rpm to determine if frequency response matches engine rpm response.
10. **Propane Models**
 - a. When ambient temperatures are less than 40°F vapor – withdrawal Propane tanks should be at least half full to provide proper vaporization rate.
 - b. Propane having more than 2.5 percent Butane will not vaporize in ambients at less than 32°F; use HD-5 grade Propane.
 - c. Run the generator set on shop fuel supply; verify the tank level and fuel line condition.
11. Measure steady DC voltage at the fuel solenoid while the generator set is running; repair wiring as necessary.
12. Verify clear vent hose.
13. Check the generator set fuel lines for damage: replace fuel lines as required.
14. Measure the fuel supply and regulator lock off pressures.
15. Check the governor, actuator, linkage, and spring for debris, damage, and looseness: readjust and repair as necessary.

16. Verify that the spark plug cables are secure on the spark plugs: reconnect or replace as necessary.
17. Inspect ignition kill lead (J1-12) in harness and at connector J1: repair or replace the lead, terminal, or pins as necessary.
18. Measure the spark plug gap: set the gap or replace the spark plugs as necessary.
19. Verify ignition spark condition.
20. Inspect the spark plug lead, kill lead terminals at magnetos, and measure the magneto air gap: replace the terminals, set the gap, or replace the magnetos as necessary.
21. Measure temperature of the air intake and temperature rise across the generator set; remove blockage or prevent air recirculation.

9.26 Invalid Set Configuration - Fault Code 37

Logic: Generator set control configuration does not meet any valid configuration.

Possible Causes: Generator set configuration, control

Diagnosis & Repair:

1. Verify that the Last Fault is FC 37: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Using the remote display, reset and save the generator set configuration.
3. If the generator set configuration is correct and the fault will not clear, replace the control.

9.27 Processor Fault - Fault Code 43

Logic: RAM (programming variables) error during self test

Possible Causes: Faulty program

Diagnosis & Solution:

1. Verify that the Last Fault is FC 43: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Disconnect battery power to the generator set control, wait 30 seconds, and reconnect the battery. Power up control and verify if fault code returns.
3. Replace the control.

9.28 Speed Sense Fault - Fault Code 45

Logic: While running quadrature frequency dropped to 0 Hz for 1 continuous second

Possible Causes: Loads, generator windings, wire connections

Diagnosis & Repair:

1. Verify that the Last Fault is FC 45: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure quadrature winding resistance at stator leads (J1-2 and J1-3) and at the J1 connector.

3. Disconnect the generator set control J1 connector, verify that the J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use a mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket.
 - Insert, repair, or replace pins as necessary.
4. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
5. Measure AC current while running the generator set with loads: identify faulty or short cycling loads.
6. Measure generator set load capability with a shop load bank (de-rate for altitude and temperature as necessary).
7. Measure generator set frequency and droop while running.
8. Measure AC frequency while changing the engine rpm to determine if the frequency response matches engine rpm response: repair the damaged generator drive system as necessary.

9.29 Generator Set Overload - Fault Code 46

Logic: Current is at or above operational design limit and approaching fault declaration: 13, 15, 22, or 36.

Possible Causes: Loads, wire connections, windings,

Diagnosis & Repair:

1. Verify that the Last Fault is FC 46: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Measure AC current and voltage while running the generator set with loads: identify faulty or short cycling loads or reduce loads as necessary.
3. Measure the generator set load capability with a shop load bank (de-rate for altitude and temperature as necessary).
4. Disconnect the generator set control J1 connector, verify that the J1 pins are fully inserted, and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket.
 - Insert, repair, or replace pins as necessary.
5. Reconnect the J1 connector and test run the generator set for fault occurrence: repair or replace pins in the connector as necessary.
6. Check the air filter for cleanliness; replace the air filter as necessary.
7. Measure steady DC voltage at the fuel solenoid while the generator set is running; repair wiring as necessary.

8. Verify clear vent hose.
9. Run the generator set on shop fuel supply; verify the tank level and fuel line condition.
10. Check the generator set fuel lines for damage: replace the fuel lines as required.
11. Measure regulator lock off pressure.
12. Check the intake manifold and gaskets for air leaks: tighten the fasteners and replace the gaskets and manifold as necessary.
13. Check for a blocked or damaged exhaust system: repair or replace exhaust components as necessary.
14. Verify actuator function by applying DC voltage to the terminals: replace the actuator as necessary.
15. Check the carburetor for binding; inspect the spring for dirt and debris: clean the spring; replace the carburetor as necessary.
16. Verify that the spark plug cables are secure on the spark plugs: reconnect or replace as necessary.
17. Inspect ignition kill lead (J1-12) in the harness and at connector J1: repair or replace the lead, terminal, or pins as necessary.
18. Measure the spark plug gap: set the gap or replace the spark plugs as necessary.
19. Verify ignition spark condition.
20. Inspect the spark plug leads, kill lead terminals at magnetos, and measure the magneto air gap: replace the terminals, set the gap, or replace the magnetos as necessary.

9.30 Alternator Over Temp - Fault Code 76

Logic: Temperature at alternator is too high (switch at 170 °F).

Possible Causes: Wire connections, faulty temperature sensor, faulty DC fan, blocked intake or exhaust openings

Diagnosis & Solution:

1. Verify that the Last Fault is FC 76: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Verify the generator set enclosure is fully closed and latched during operation to promote proper air flow.
3. Verify the generator set enclosure for clear intake and exhaust openings.
4. Verify the temperature at the customer connection terminal block within the generator set.
5. Disconnect the generator set control J1 connector, verify that the J1 pins are fully inserted and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use a mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace pins as necessary

6. Verify the temperature sensor resistance. Replace as necessary.
7. Measure the temperature sensor wiring (J1-33) for continuity. Repair or replace as necessary.
8. Visually inspect the alternator fan for missing or damaged fins. Replace the fan if necessary.

9.31 Low Fuel Pressure - Fault Code 78

Logic: Controller sensed fuel pressure switch open and approaching fault declaration: 14, 15, 22 or 36.

Possible Causes: Wire connections, fuel system, fuel pressure switch,

Diagnosis & Solution:

1. Verify that the Last Fault is FC 78: Yes, continue diagnosis; No, troubleshoot actual last fault.
2. Verify the fuel supply and regulator lock off pressures.
3. Measure steady DC voltage at the fuel solenoid while the generator set is running; repair wiring as necessary.
4. Verify the fuel lines are not kinked or broken/cracked.
5. Run the generator set on shop fuel supply; verify the tank level and fuel line condition.
6. Check the generator set fuel lines for damage: replace the fuel line as required.
7. Check for fuel pressure switch continuity to ground while the generator set is running.
8. Check for fuel pressure switch continuity across its terminals while fuel system pressure is applied.
9. Check the fuel pressure switch wiring for an open circuit.
10. Disconnect the generator set control J1 connector, verify that the J1 pins are fully inserted and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use a mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace pins as necessary.

9.32 Failure To Transfer To Generator Set - Fault Code 79

NOTICE

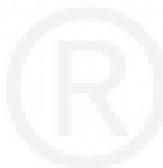
Only with 6634 and 6635 (to be performed by a Cummins Technician only)
Only with 6868 and 6869

Logic: Controller commanded transfer switch to standby position but standby position feedback not received after the 5 second transfer time delay.

Possible Causes: Wire connections, faulty positional switch, faulty transfer switch component(s)

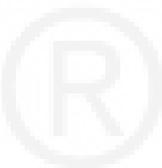
Diagnosis & Solution:

1. Verify that the main AC circuit breaker on generator set is to "On".
2. Verify that the Last Fault is FC 79: Yes, continue diagnosis; No, troubleshoot actual last fault.
3. Manually start an exercise session and verify the transfer switch position during the exercise.
4. Disable the generator by placing the generator local start switch in the "Off" position.
5. Manually operate the transfer switch via lever to the generator position; check for generator position switch continuity to ground at the transfer switch.
6. Check for continuity from the transfer terminal block position (TB4-6) to the generator position terminal (J2-5).
7. Check for a ground signal at the generator position terminal (J2-5) at the control connector; repair wiring as necessary.
8. Disconnect the generator set control J1 connector, verify that the J1 pins are fully inserted and inspect pin condition using the steps below:
 - Use the test points of the tester tool #420-0603
 - Use mating pin connector, a pin gauge of the same size (.045") as the mating control connector pin, or any suitable device that will not damage the inside contact wipers of the pin socket
 - Insert, repair, or replace pins as necessary.





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10 Communication Troubleshooting

10.1 In-Home Network Access to Generator Set Troubleshooting

⚠ WARNING

Some generator set service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform generator set service.

Possible Causes: Bad connections or bad communications

Corrective Actions:

1. Check connections.
 - a. Verify that the Ethernet cable is plugged into the generator set control and the router.
 - b. Verify that the computer that is attempting to access the generator set is connected to the same router as the generator set via an Ethernet cable (on the same local area network).
 - c. Verify that the wireless card on the computer is turned off.
 - d. Check to see if both ends of the Ethernet cable are assembled and crimped as described in the installation instructions. If not, reassemble and crimp as described in the installation instructions.
 - e. Verify that the Ethernet cable connections between the generator set and the router are solid and correct.
 - f. Proceed to "Check communications."
2. Check communications.
 - a. If the router is also connected to an incoming connection from an ISP, check to see if you can access a standard web page with the computer connected to the same router as the generator set. If not, contact your router manufacturer for troubleshooting information.
 - b. Check to see if the green and orange lights are illuminated at the Ethernet connection port on the generator set control board. If the lights are not illuminated, this indicates that no information is being transmitted or received. Test the cable by disconnecting the Ethernet cable from the generator control board and connecting it to the computer (swap the cable with the existing Ethernet cable). With the router connected to the ISP, check to see if you can access a standard web page.
 - a. If you can access a standard web page, call Cummins Support at 1-800-888-6626 and select option 1.
 - b. If you cannot access a standard web page, go to the "Check connections" step above.
 - c. Check to see if the correct generator IP address has been entered. If not, enter the correct IP address in the address bar of the web browser. Be sure to not enter "www" or other text prior to the IP address.

- d. If none of the above troubleshooting techniques help, call Cummins Support at 1-800-888-6626 and select option 1.

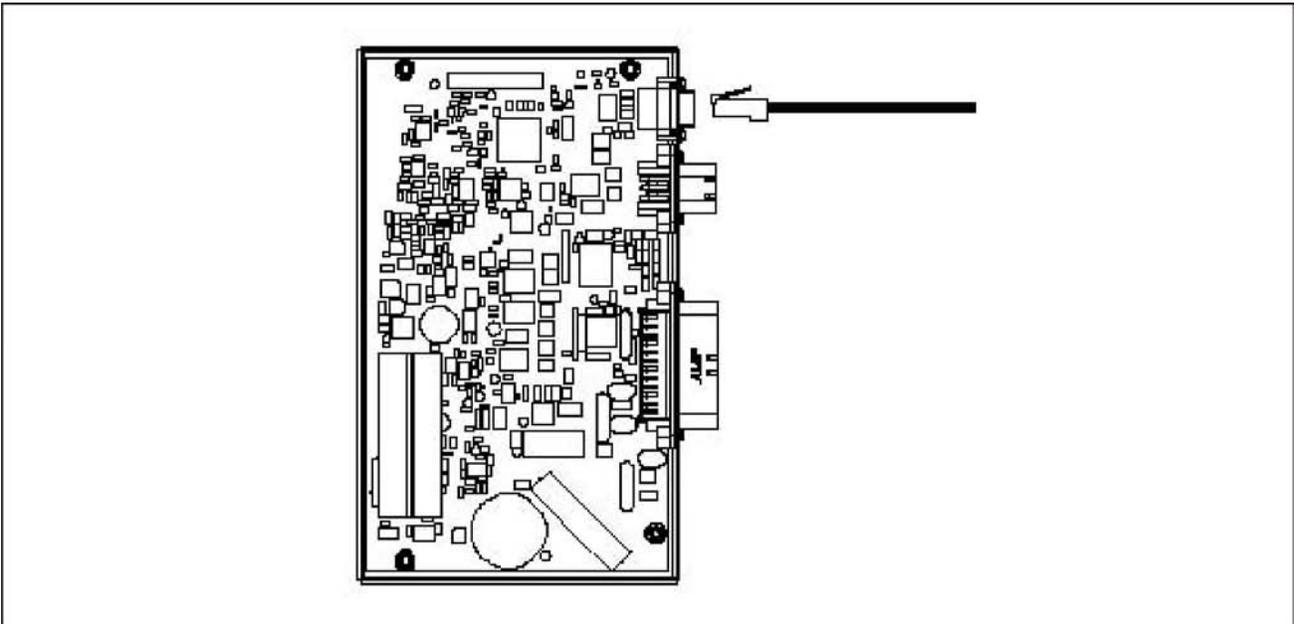


FIGURE 60. NETWORK CONNECTIONS (CONTROL BOARD AND ETHERNET CONNECTION)

10.2 Remote Internet Access to Generator Set Troubleshooting

⚠ WARNING

Some generator set service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform generator set service.

Possible Causes: Improper setup, no high-speed internet connection, public IP address is not active or properly set up, incorrect IP address is entered, computer is connected to the same router or network as the generator set, or the internet connection is faulty.

Corrective Actions:

1. Check to see if you are able to access the generator set with your in-home computer.
If not, refer to the [In-Home Network Access Troubleshooting](#) procedures.
2. Verify that you followed the network setup procedures.
Refer to the [Network Setup Guide](#).
3. Verify that you are using a high-speed internet connection.
4. Verify that the public IP address is active and set up properly with the ISP (Internet Service Provider). If necessary, contact the ISP to verify your setup.*
5. Verify that the correct public IP address is entered into the web browser of the computer (i.e. xxx.xxx.xxx.xxx).

6. Verify that the computer is not connected to the same router or local area network as the generator set. If it is on the same network, you will be able to access the generator set using the local network IP address configured on the generator set. The computer used for internet access must be connected to a different internet connection than the generator set.
7. Check to see if you can access a standard web page from a computer. If not, contact the ISP to troubleshoot the internet connection.
8. Verify all settings, as described in the Network Setup Guide.
9. If the previous steps do not correct the problem, contact a computer network specialist to diagnose.
 - * To verify your IP address, access "whatismyipaddress.com" from the browser of a computer connected to the internet and on the same network as the generator set. This web page displays your current IP address which should match the IP address assigned to you by your ISP.

10.3 Email Alert Troubleshooting

WARNING

Some Generator Set service procedures present hazards that can result in severe personal injury or death. Only trained and experienced service personnel with knowledge of fuels, electricity, and machinery hazards should perform Generator Set service.

Possible Causes: An improper setup, the alert level is not set to "all events," emails cannot be received, the outgoing email address is not included in your contact list, the email account is not capable of using plain SMTP for the outgoing SMTP server setup, the domain name is not included in the user name filed of the Network Setup screen, or the DNS #1 and #2 values are incorrect on the Network Setup screen.

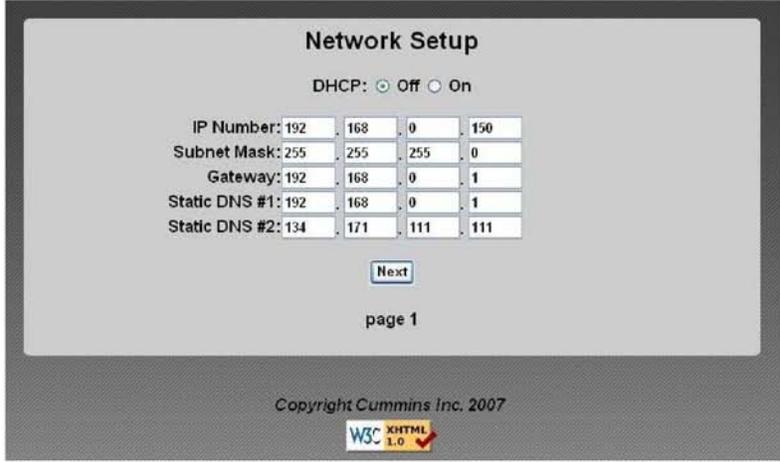
Corrective Actions:

1. Check to see if you are able to access the generator set with your in-home computer. If not, refer to [In-Home Computer Access Troubleshooting](#).
2. Verify that you followed the network setup instructions. Refer to the [Network Setup Guide](#).
3. Verify that the alert level is set to All Events.
 - a. To verify that your generator set can send emails, select Disable Standby and wait several minutes to verify that you did receive an email.
 - b. Select Enable Standby and wait a few more minutes to verify that you did receive a second email.
4. Send an email to the destination email address and check to see if you received this email. If not, contact your email service provider or your ISP (Internet service provider) to diagnose.
5. Check to see if the destination email accounts have spam filtering.
 - a. If spam filtering is present, add the outgoing email address to your contact list.
 - b. If spam filtering is not present, proceed to step 6.

6. Ensure that the SMTP server in use is capable of distributing non SSL certified emails. If the SMTP server is not capable of sending non SSL certified emails or the status is unknown, please contact your ISP technical support for information.
7. Verify that the domain name is included in the user name field of the Network Setup screen (i.e. username@domainname).**
8. Verify with your ISP that the Static DNS (Domain Name Server) #1 and #2 are correct.
9. If the previous steps do not correct the problem, contact a computer network specialist to diagnose.

** "No authentication" is possible on some systems by leaving the username and password fields blank.

IMPORTANT NOTE: Changes are not saved unless you navigate through all three Network Setup screens and click on "Done". The message "Settings Saved Successfully" is then displayed.



Network Setup

DHCP: Off On

IP Number:	192	168	0	150
Subnet Mask:	255	255	255	0
Gateway:	192	168	0	1
Static DNS #1:	192	168	0	1
Static DNS #2:	134	171	111	111

page 1

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FIGURE 61. NETWORK SETUP - PAGE 1

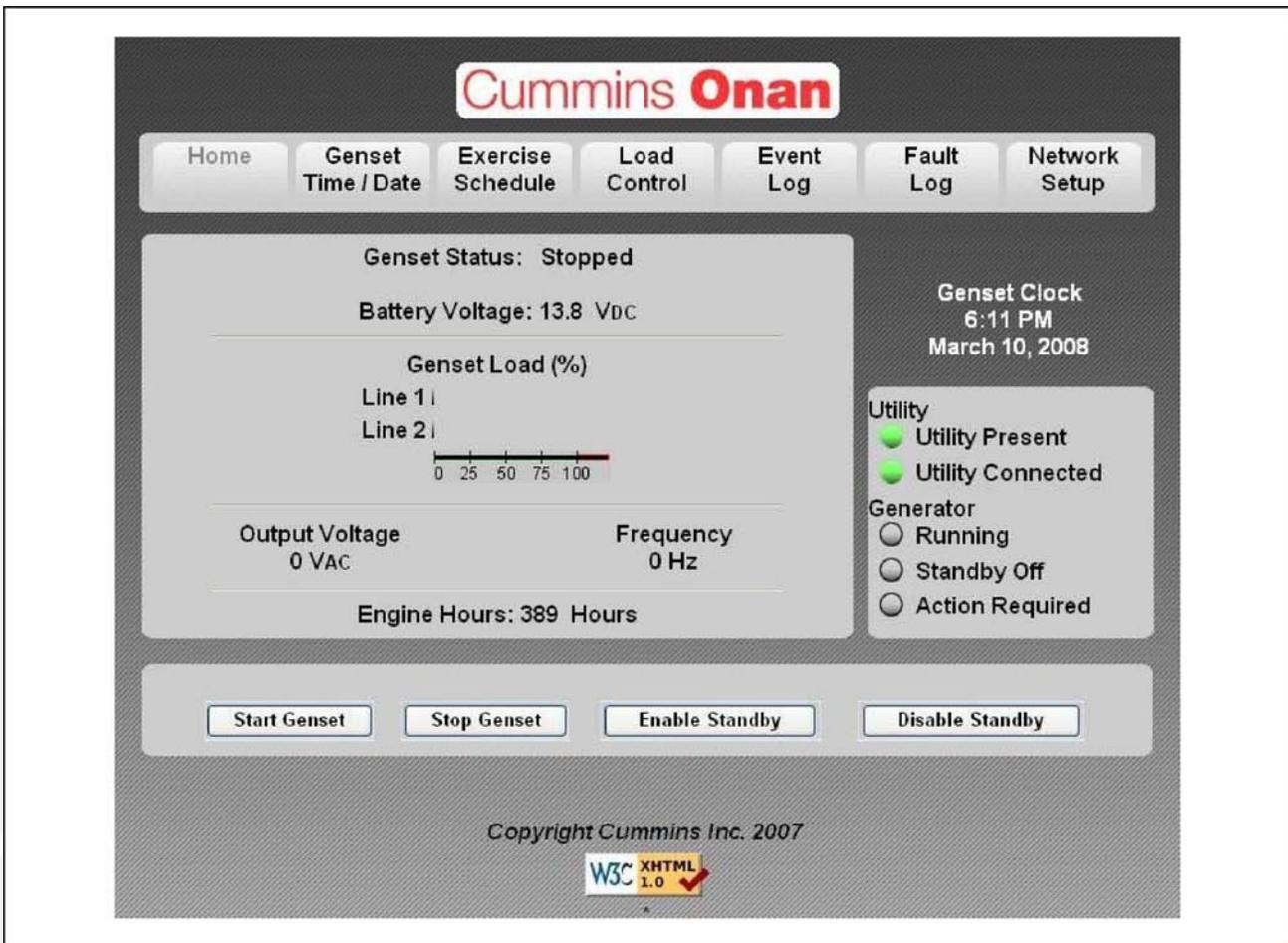


FIGURE 62. GENERATOR SET HOME PAGE

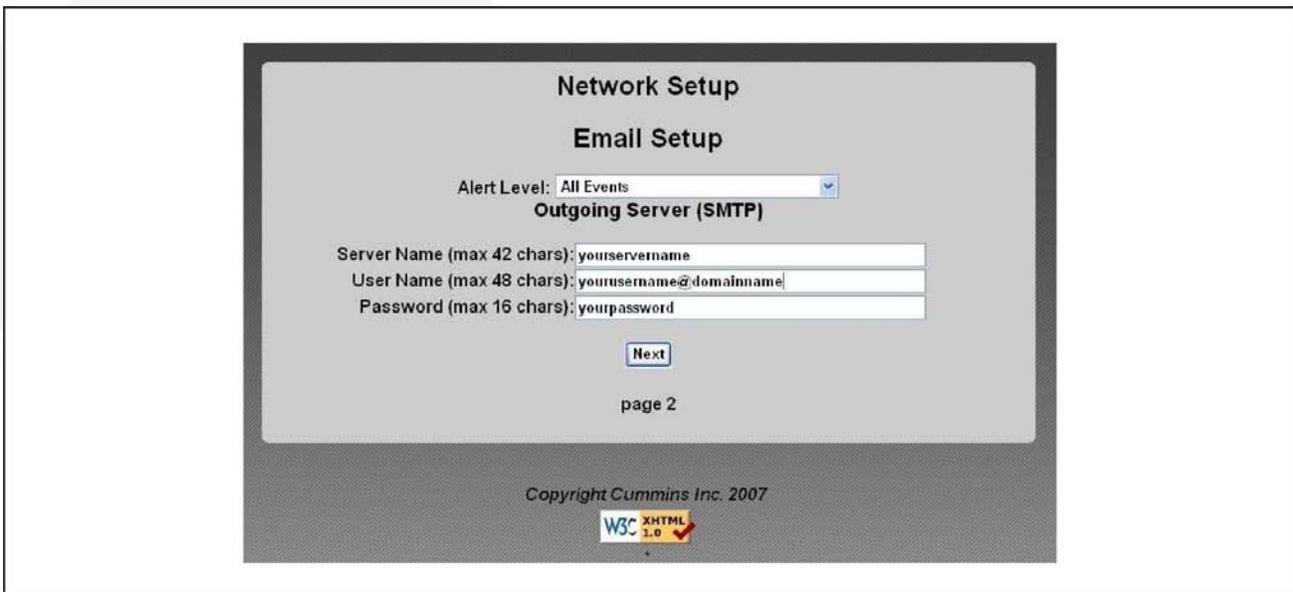


FIGURE 63. NETWORK SETUP - PAGE 2

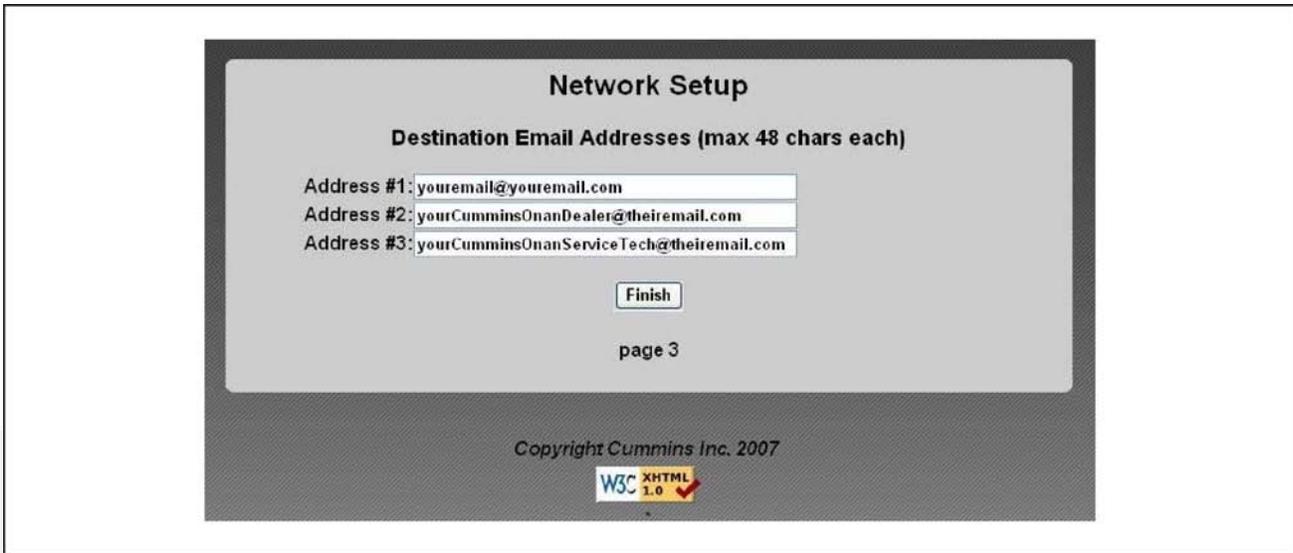


FIGURE 64. NETWORK SETUP - PAGE 3

Appendix A. Outline and System Drawings

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Wiring connections to the Ethernet RJ-45 plug are shown in the Ethernet RJ-45 Connector Wiring illustration. Utilize an appropriate Ethernet stripping and crimping tool for these connections.

FIGURE 65. ETHERNET CONNECTIONS (OPTIONAL)

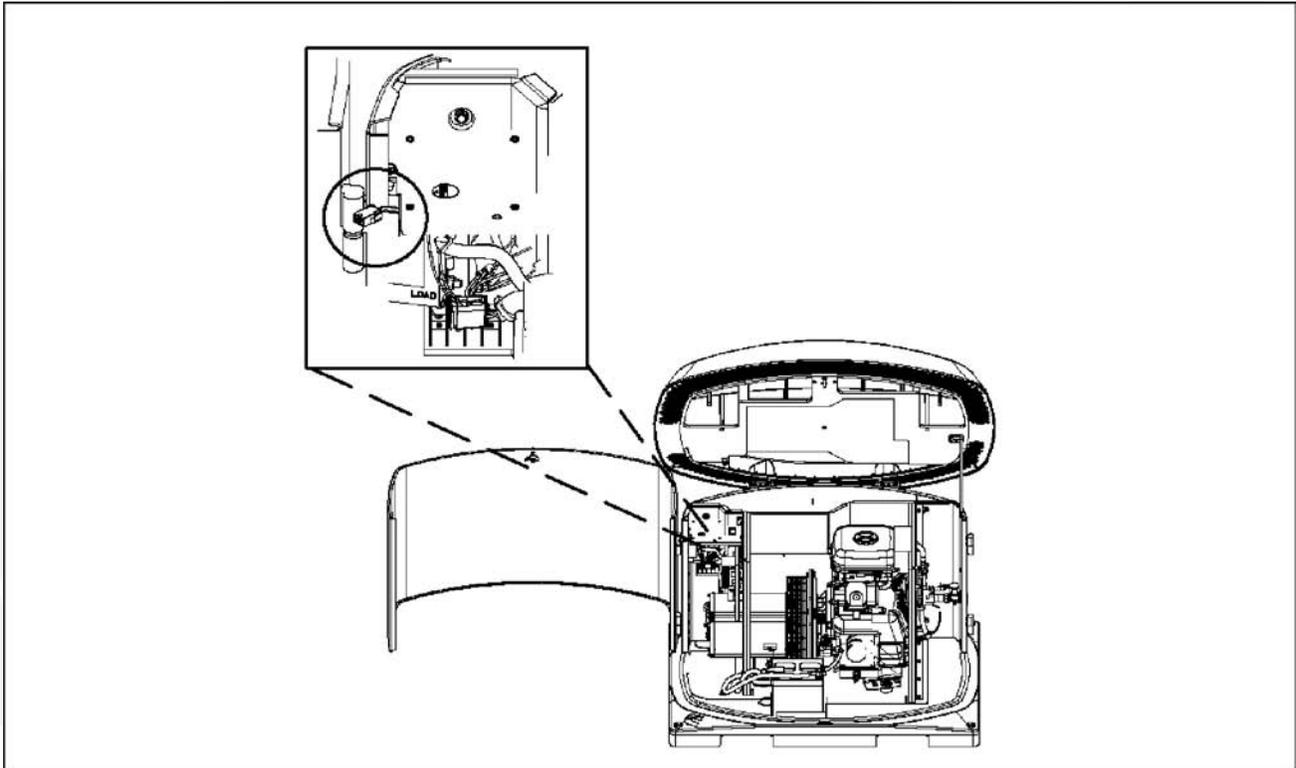


FIGURE 66. ETHERNET CONNECTOR

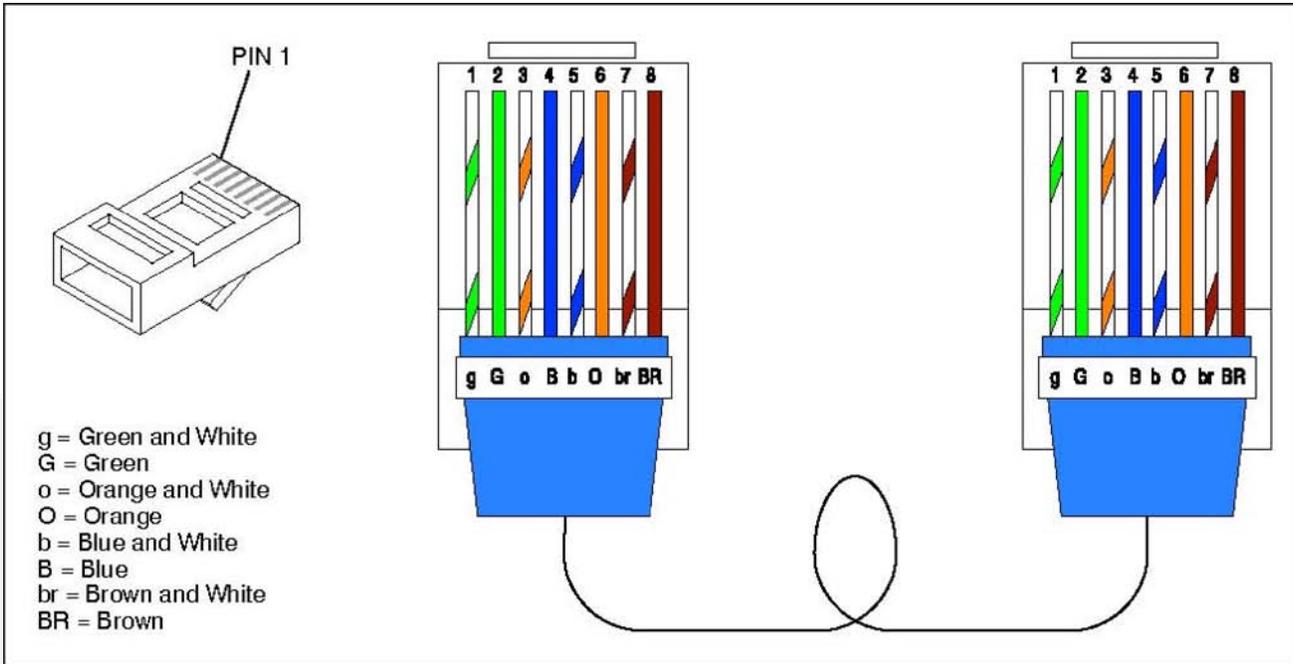


FIGURE 67. ETHERNET RJ-45 CONNECTOR WIRING

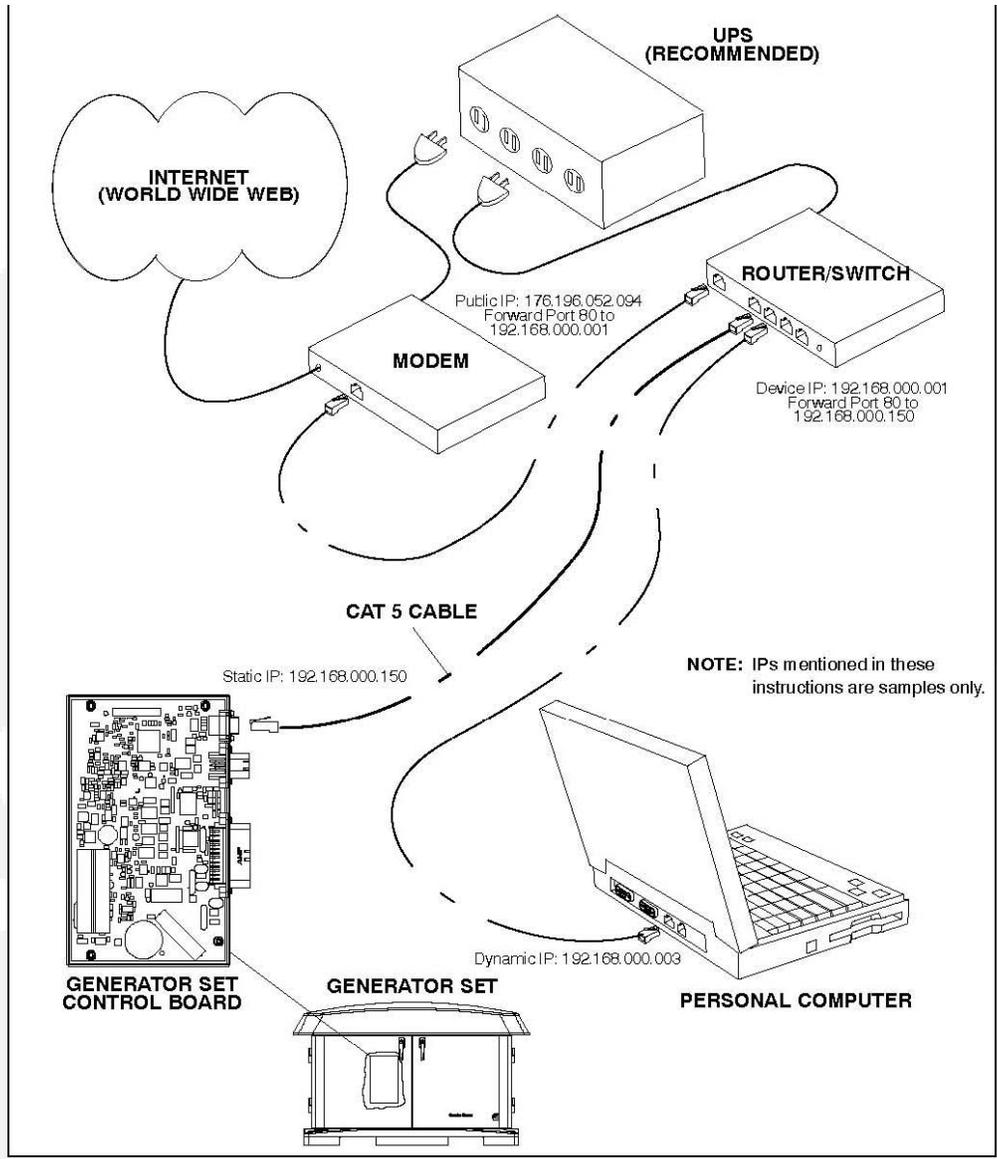
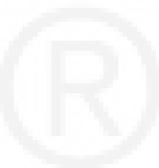
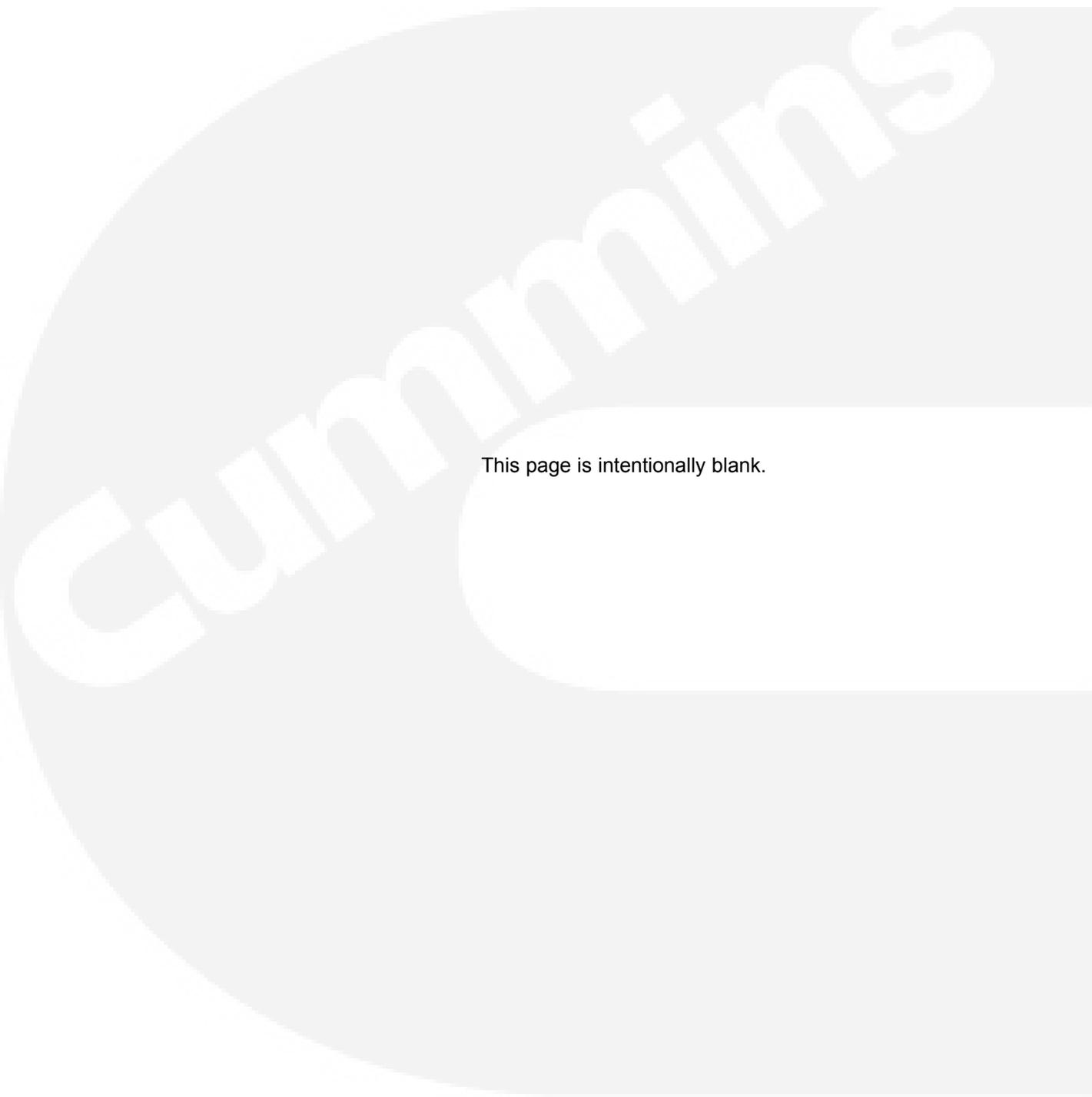


FIGURE 68. NETWORK CONNECTIONS

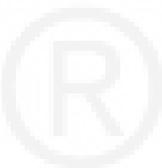


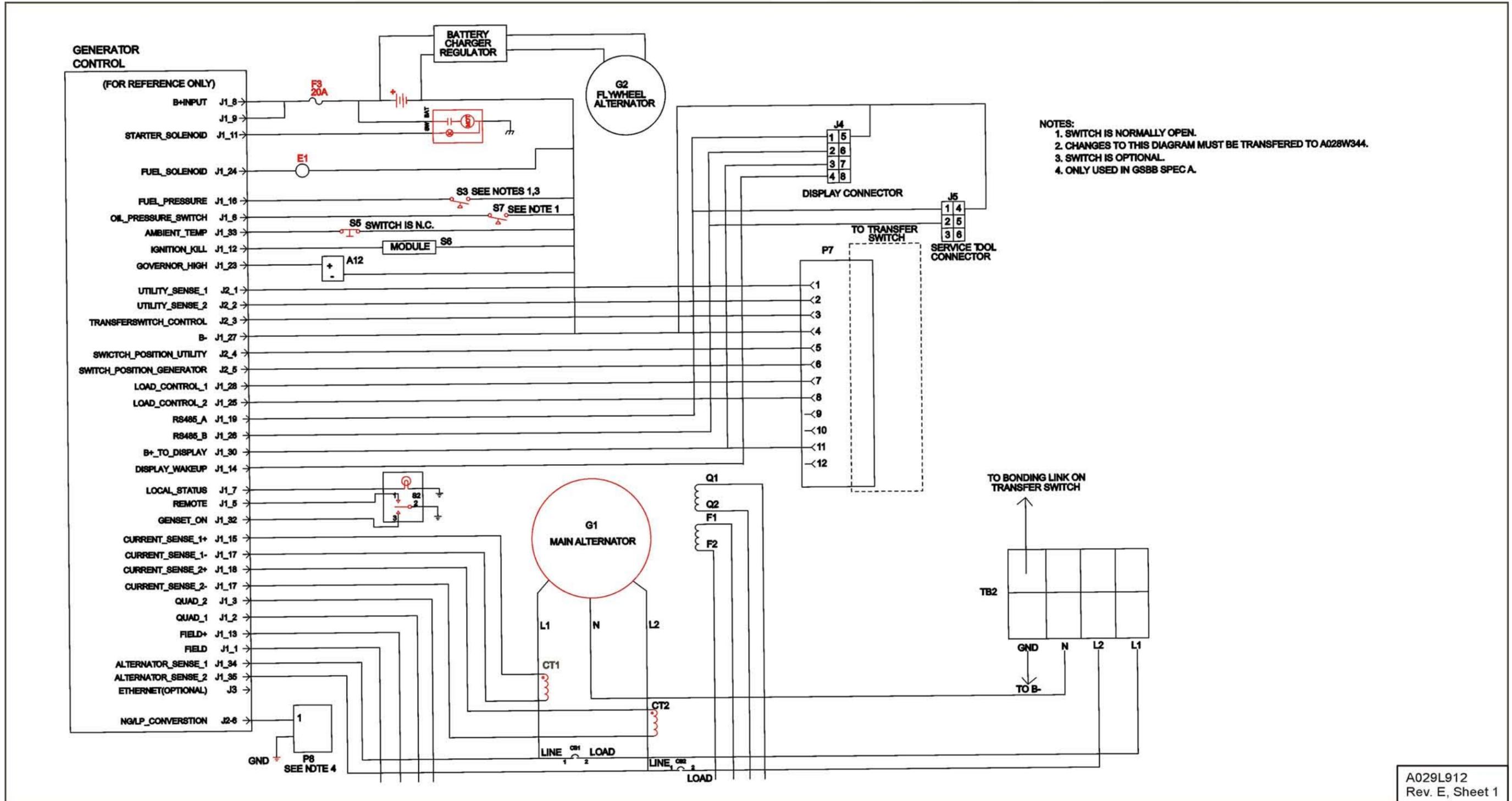
FIGURE 69. MANUAL FUEL SELECTION VALVE





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A029L912
Rev. E, Sheet 1

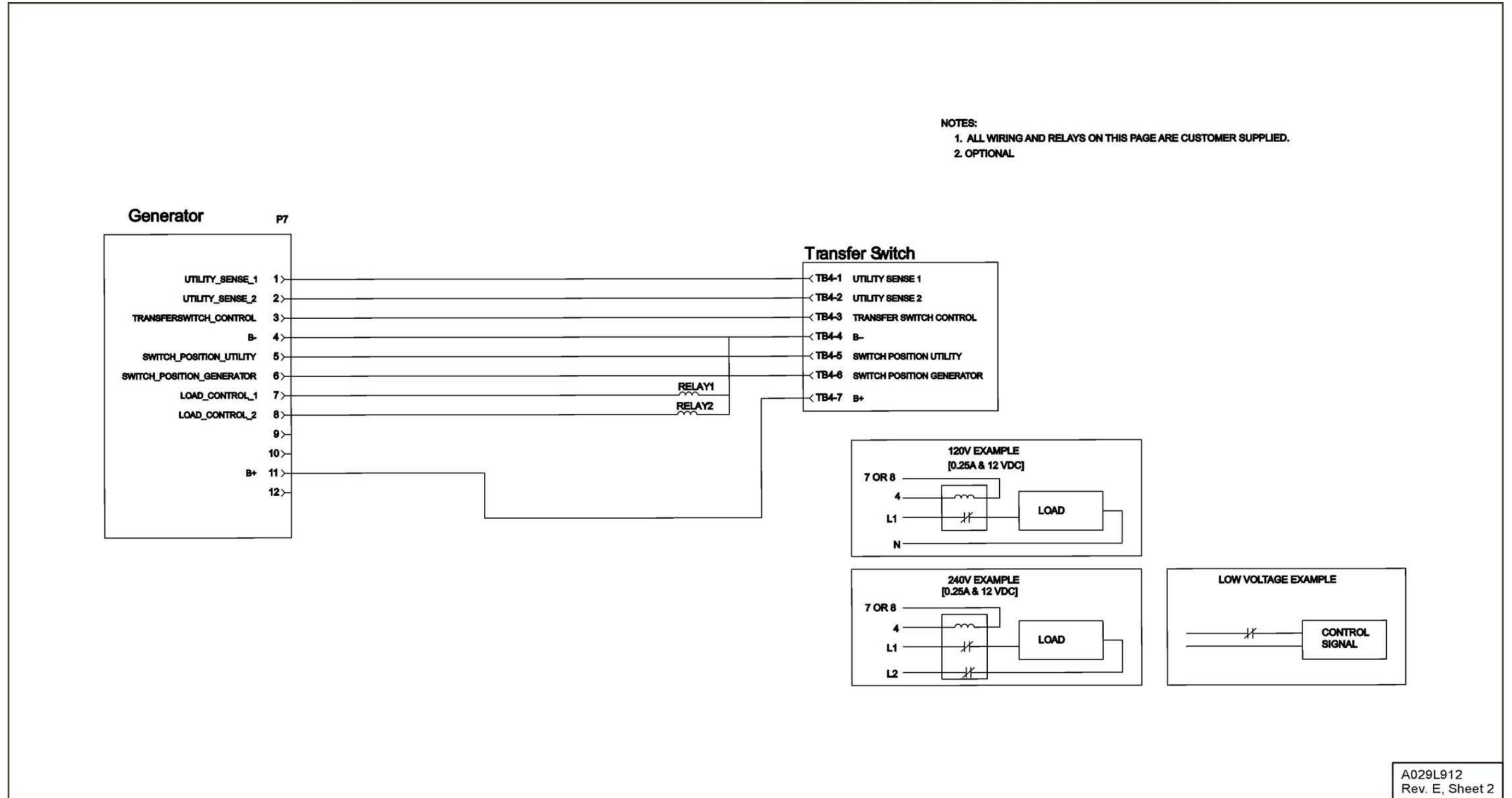
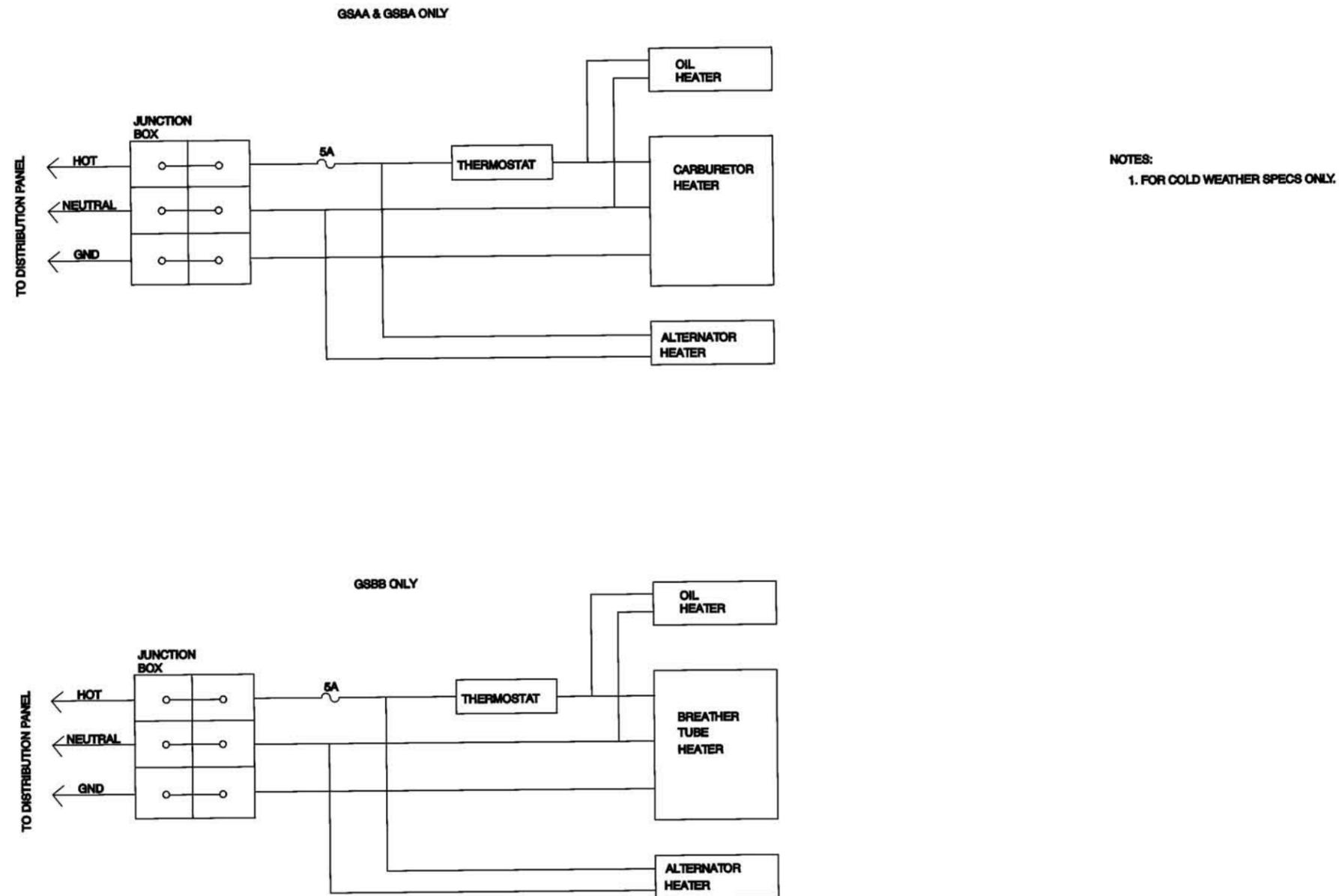
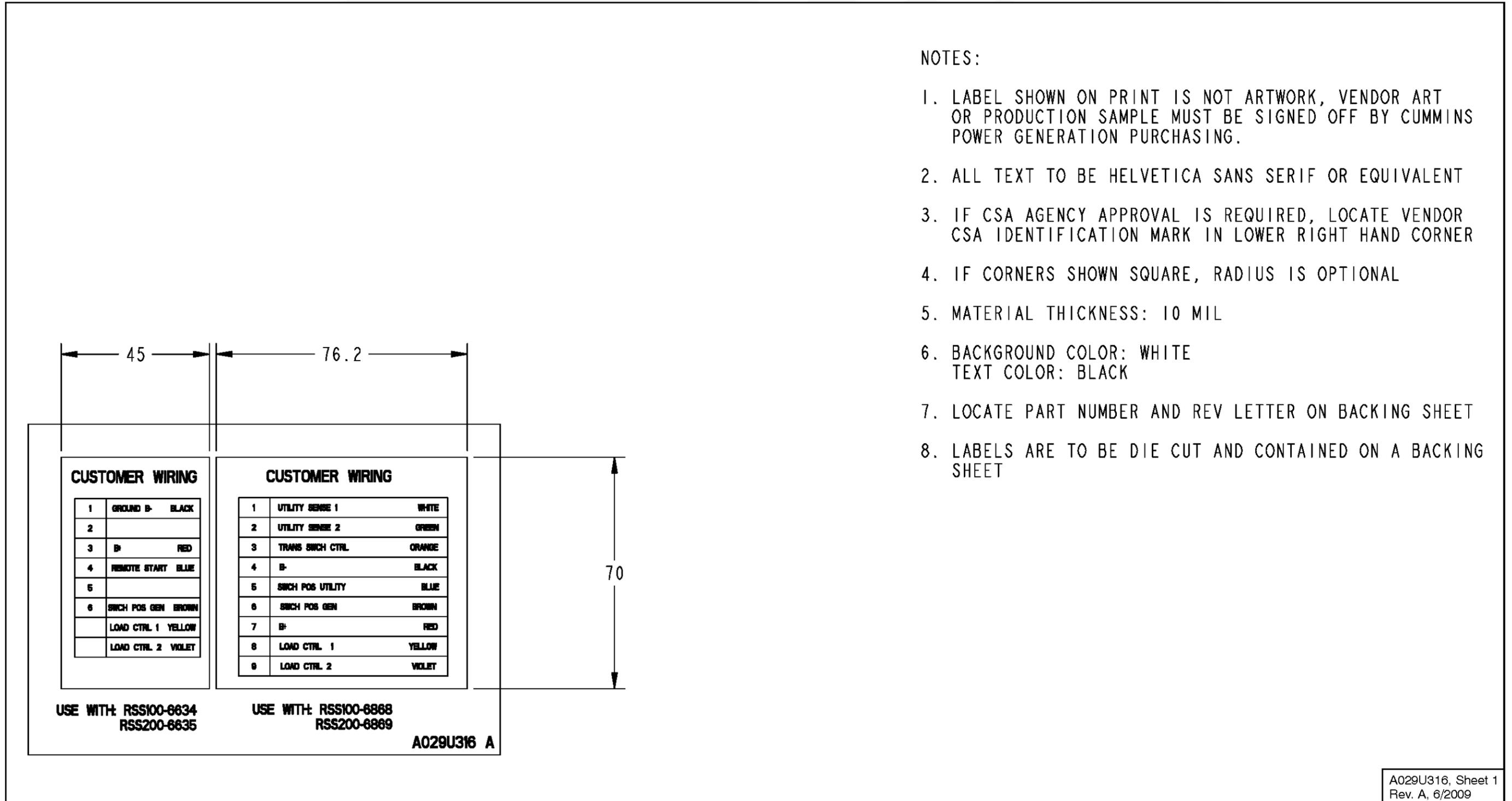


FIGURE 71. WIRING DIAGRAM (SHEET 2 OF 3)



A029L912
Rev. E, Sheet 3

FIGURE 72. WIRING DIAGRAM (SHEET 3 OF 3)



NOTES:

1. LABEL SHOWN ON PRINT IS NOT ARTWORK, VENDOR ART OR PRODUCTION SAMPLE MUST BE SIGNED OFF BY CUMMINS POWER GENERATION PURCHASING.
2. ALL TEXT TO BE HELVETICA SANS SERIF OR EQUIVALENT
3. IF CSA AGENCY APPROVAL IS REQUIRED, LOCATE VENDOR CSA IDENTIFICATION MARK IN LOWER RIGHT HAND CORNER
4. IF CORNERS SHOWN SQUARE, RADIUS IS OPTIONAL
5. MATERIAL THICKNESS: 10 MIL
6. BACKGROUND COLOR: WHITE
TEXT COLOR: BLACK
7. LOCATE PART NUMBER AND REV LETTER ON BACKING SHEET
8. LABELS ARE TO BE DIE CUT AND CONTAINED ON A BACKING SHEET

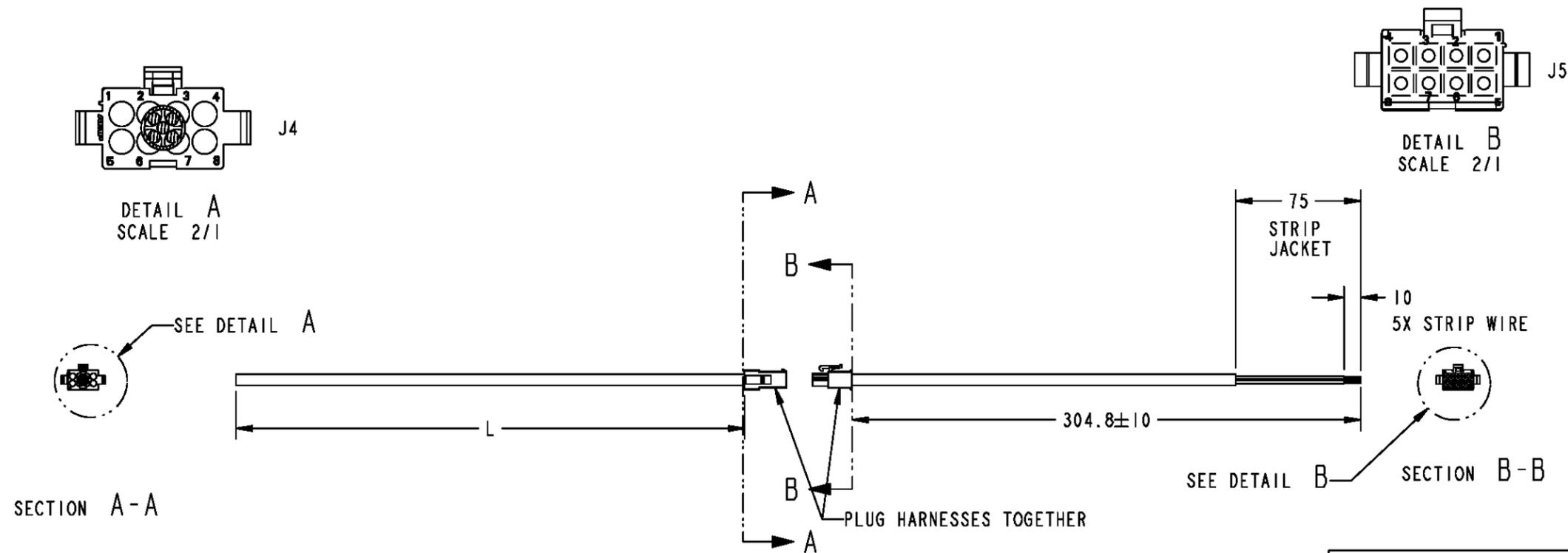
A029U316, Sheet 1
Rev. A, 6/2009

FIGURE 73. HARNESS LABEL

WIRE	FROM	PIN	WIRE COLOR	FUNCTION (REF)
W1	J4-1	0323-2449	ORANGE	RS485A
W2	J4-2	0323-2449	WHITE	RS485B
W3	J4-3	0323-2449	RED	B+
W4	J4-4	0323-2449	BLACK	B-
W5	J4-5	0323-2449	GREEN	DISPLAY WAKEUP
W6	J5-1	0323-2063	ORANGE	RS485A
W7	J5-2	0323-2063	WHITE	RS485B
W8	J5-3	0323-2063	RED	B+
W9	J5-4	0323-2063	BLACK	B-
W10	J5-5	0323-2063	GREEN	DISPLAY WAKEUP

NOTE:

- HARNESS MUST BE PROCURED FROM A SUPPLIER QUALIFIED AS A UL RECOGNIZED HARNESS MANUFACTURER (CATEGORY ZPFW2). PACKAGING OR PARTS TO BE MARKED IN ACCORDANCE WITH REQUIREMENTS SPECIFIED BY SUPPLIERS UL PROGRAM.



TABULATION	
PART NUMBER	L
A029U306	1 FT
A029U308	50 FT
A029U310	100 FT
A029U311	200 FT

A029U307, Sheet 1
Rev. A, 7/2009

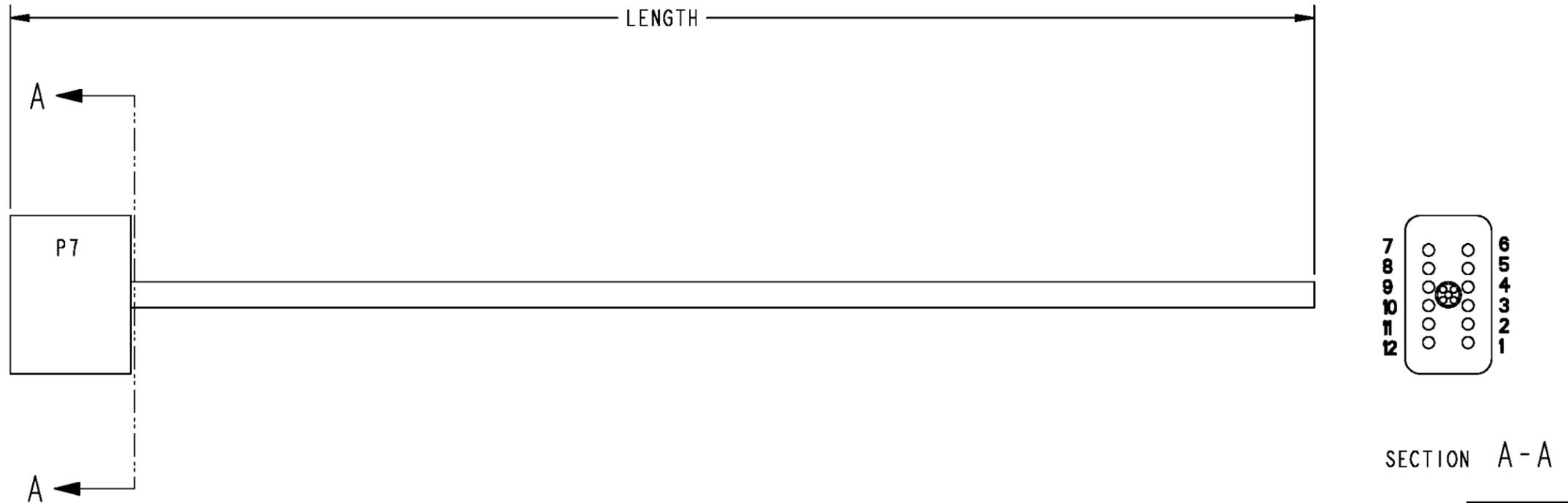
FIGURE 74. WIRING HARNESS CONNECTIONS (SHEET 1 OF 4)

WIRE	FROM	PIN	WIRE COLOR	FUNCTION (REF)
W1	P7-1	0323-149	WHITE	UTILITY SENSE 1
W2	P7-2	0323-149	GREEN	UTILITY SENSE 2
W3	P7-3	0323-149	ORANGE	TRANSFER SWITCH CONTROL
W4	P7-4	0323-149	BLACK	B-
W5	P7-5	0323-149	BLUE	UTILITY SWITCH POSITION
W6	P7-6	0323-149	BROWN	GENERATOR SWITCH POSITION
W7	P7-7	0323-149	YELLOW	LOAD CONTROL 1
W8	P7-8	0323-149	VIOLET	LOAD CONTROL 2
W9	P7-11	0323-149	RED	B+

NOTES:

1. HARNESES TO BE INDIVIDUALLY PACKAGED AND INCLUDE F/N 5 (LABEL, INFORMATION)
2. HARNESS MUST BE PROCURED FROM A SUPPLIER QUALIFIED AS A UL RECOGNIZED HARNESS MANUFACTURER (CATEGORY ZPFW2). PACKAGING OR PARTS TO BE MARKED IN ACCORDANCE WITH REQUIREMENTS SPECIFIED BY SUPPLIERS UL PROGRAM.

TABULATION	
PART NUMBER	LENGTH
A029U298	1 FT
A029U302	50 FT
A029U303	100 FT
A029U304	200 FT



A029U299, Sheet 1
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FIGURE 75. WIRING HARNESS CONNECTIONS (SHEET 2 OF 4)

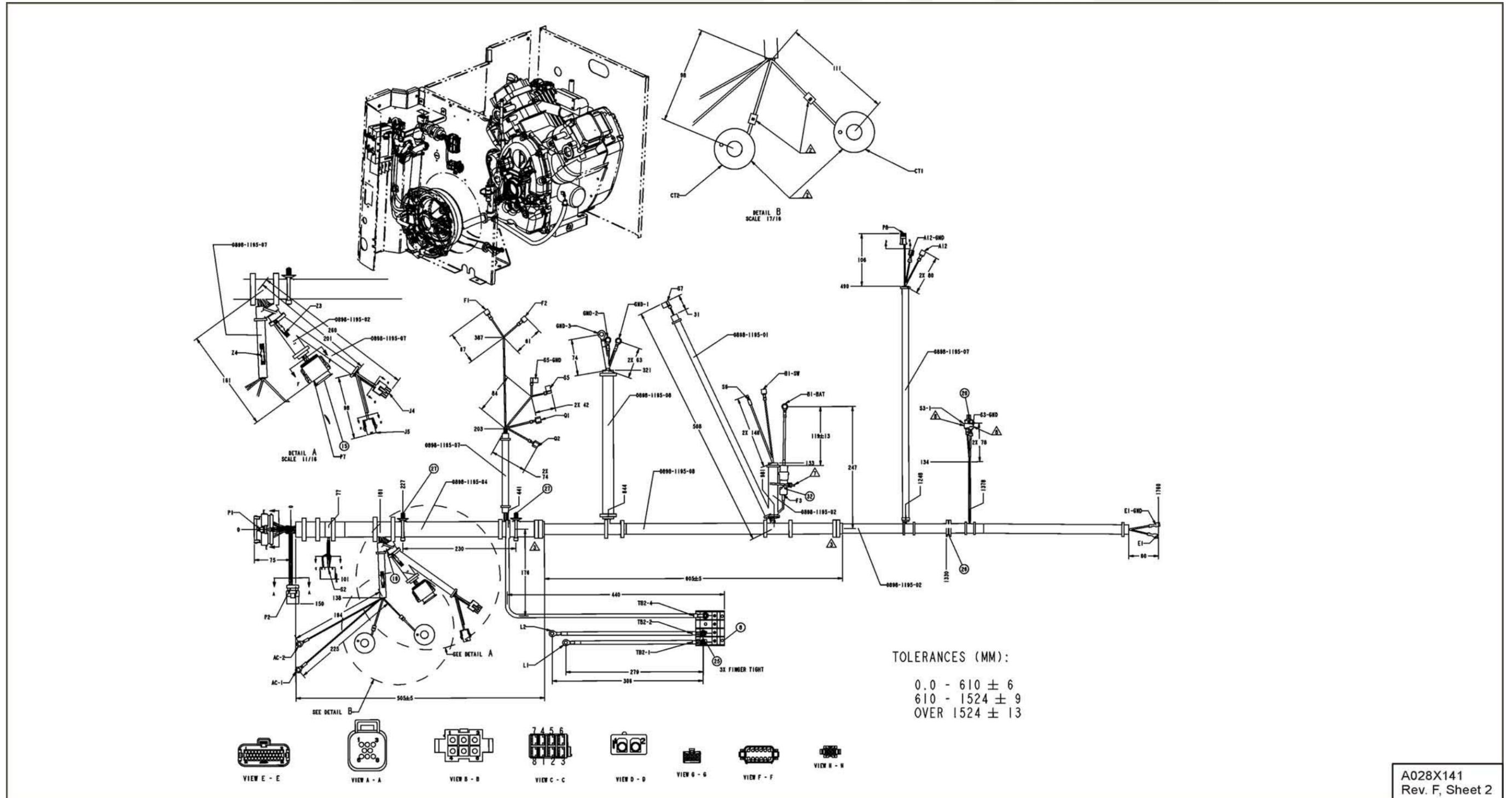
TO/FROM WIRE LIST					
WIRE NAME	FROM	TERMINAL	TO	TERMINAL	WIRE
W01	P1-1	0323-1014-01	F2-1	SEE_REF_DES	0334_0757
W02	P1-2	0323-1014-01	Q1-1	SEE_REF_DES	0334_0757
W03	P1-3	0323-1014-01	Q2-1	SEE_REF_DES	0334_0757
W04	P2-5	0323-1014-01	P7-6	0323-1492	0334_0757
W05	P1-5	0323-1014-01	S2-1	0332-2928	0334_0756
W06	P1-6	0323-1014-01	S7-1	SEE_REF_DES	0334_0756
W07	P1-7	0323-1014-01	S2-8	0332-2928	0334_0756
W08	P1-8	0323-1014-01	F3-2	SEE_REF_DES	0334_0758
W09	P2-1	0323-1014-01	P7-1	0323-1492	0334_0757
W11	P1-12	0323-1014-01	S6-1	SEE_REF_DES	0334_0758
W12	P1-13	0323-1014-01	F1-1	SEE_REF_DES	0334_0757
W15	P1-16	0323-1014-01	S3-1-1	SEE_REF_DES	0334_0756
W20	J4-1	0323-2063	Z1-2	6mm_STRIP	0334_0756
W22	J4-4	0323-2063	P1-14	0323-1014-01	0334_0757
W23	P1-23	0323-1014-01	A12-1	SEE_REF_DES	0334_0756
W24	P1-24	0323-1014-01	E1-1	SEE_REF_DES	0334_0756
W25	P1-25	0323-1014-01	P7-8	0323-1492	0334_0757
W27	J4-2	0323-2063	Z2-2	6mm_STRIP	0334_0756
W29	P1-28	0323-1014-01	P7-7	0323-1492	0334_0757
W30	P1-30	0323-1014-01	Z3-2	6mm_STRIP	0334_0756
W31	J4-3	0323-2063	Z3-2	6mm_STRIP	0334_0756
W32	Z3-1	6mm_STRIP	P7-11	0323-1492	0334_0757
W33	P1-33	0323-1014-01	S5-1	SEE_REF_DES	0334_0756
W34	P1-32	0323-1014-01	S2-3	0332-2928	0334_0756
W35	P1-34	0323-1014-01	AC-1-1	SEE_REF_DES	0334_0756
W36	P1-35	0323-1014-01	AC-2-1	SEE_REF_DES	0334_0756
W37	S3-GND-1	SEE_REF_DES	E1-GND-1	SEE_REF_DES	0334_0757
W38	S3-GND-1	SEE_REF_DES	GND-1-1	SEE_REF_DES	0334_0757
W39	S5-GND-1	SEE_REF_DES	GND-1-1	SEE_REF_DES	0334_0757
W40	A12-GND-1	SEE_REF_DES	GND-1-1	SEE_REF_DES	0334_0756
W41	S2-2	0332-2928	S2-7	0332-2928	0334_0756
W42	S2-2	0332-2928	GND-2-1	SEE_REF_DES	0334_0757
W43	P7-4	0323-1492	GND-2-1	SEE_REF_DES	0334_0757
W44	P1-27	0323-1014-01	GND-2-1	SEE_REF_DES	0334_0757
W45	J4-5	0323-2063	Z5-2	6mm_STRIP	0334_0757
W46	P2-2	0323-1014-01	P7-2	0323-1492	0334_0757
W47	P2-3	0323-1014-01	P7-3	0323-1492	0334_0757
W48	P2-4	0323-1014-01	P7-5	0323-1492	0334_0757
W49	L1-1	SEE_REF_DES	TB2-1-1	SEE_REF_DES	0334_1212
W50	L2-1	SEE_REF_DES	TB2-2-1	SEE_REF_DES	0334_1212
W51	TB2-4-1	SEE_REF_DES	GND-3-1	SEE_REF_DES	0334_1212
W53	CT1-2	SEE_NOTE_1	P1-15	0323-1014-01	0334_0757
W54	CT1-1	SEE_NOTE_1	Z4-2	6mm_STRIP	0334_0757
W55	CT2-1	SEE_NOTE_1	Z4-2	6mm_STRIP	0334_0757
W56	CT2-2	SEE_NOTE_1	P1-18	0323-1014-01	0334_0757
W57	Z4-1	6mm_STRIP	P1-17	0323-1014-01	0334_0757
W58	P1-8	0323-1014-01	F3-2	SEE_REF_DES	0334_0758
W59	P2-6	0323-1014-01	P8-2	0323-0488	0334_0756
W60	P8-1	0323-0488	A12-GND-1	SEE_REF_DES	0334_0756
W61	F3-1	SEE_REF_DES	B1-BAT-1	SEE_REF_DES	0334_0759
W63	P1-11	0323-1014-01	B1-SW-1	SEE_REF_DES	0334_0757
W64	Z1-2	6mm_STRIP	J5-1	0323-2449	0334_0757
W65	Z1-1	6mm_STRIP	P1-19	0323-1014-01	0334_0757
W66	Z2-2	6mm_STRIP	J5-2	0323-2449	0334_0757
W67	Z2-1	6mm_STRIP	P1-26	0323-1014-01	0334_0757
W68	Z5-2	6mm_STRIP	J5-4	0323-2449	0334_0757
W69	Z5-1	6mm_STRIP	GND-2-1	SEE_REF_DES	0334_0757

CONNECTORS AND TERMINALS				
REF_DES	PART NUMBER	DESCRIPTION	GOES TO (DESC)	GOES TO (PART)
A12	0332.1993	TERMINAL-RECEPTICAL	ACTUATOR, GOVERNOR	1/4 X .03 TAB
A12-GND	0332.4045	TERMINAL-RECEPTICAL		
AC-1	0332.0004	TERMINAL-RING		
AC-2	0332.0004	TERMINAL-RING		
B1-BAT	0332.1194	TERMINAL-RING	STARTER	5/16 STUD
B1-SW	0332.1993	TERMINAL-RECEPTICAL	STARTER	1/4 X .03 TAB
CT1	A028X144	TRANSFORMER, CURRENT		
CT2	A028X144	TRANSFORMER, CURRENT		
E1	A008Z612	TERMINAL, RECEPTICAL	FUEL SHUTOFF	.187 X .02 RCPT
E1-GND	A008Z612	TERMINAL, RECEPTICAL	FUEL SHUTOFF	.187 X .02 RCPT
F1	0332.1992	TERMINAL-RECEPTICAL	BRUSH BLOCK	1/4 X .03 TAB
F2	0332.1992	TERMINAL-RECEPTICAL	BRUSH BLOCK	1/4 X .03 TAB
F3	0321.0371	HOLDER-FUSE		
GND-1	0332.1194	TERMINAL-RING	ALTERNATOR FOOT	5/16 STUD
GND-2	0332.1194	TERMINAL-RING	ALTERNATOR FOOT	5/16 STUD
GND-3	0332.1302	TERMINAL		
J4	0323.2011	CONNECTOR, PLUG		
J5	0323.2644	CONNECTOR, PLUG		
L1	0332.2748	TERMINAL		
L2	0332.2748	TERMINAL		
P1	0323.1019_01	CONNECTOR-PLUG		
P2	0323.2516	CONNECTOR-PLUG		
P7	0323.1582	CONNECTOR, PLUG		
P8	A028X409	CONNECTOR, PLUG		
Q1	0332.2430	TERMINAL-BLADE	QUAD WINDING	1/4 .03 RCPT
Q2	0332.2430	TERMINAL-BLADE	QUAD WINDING	1/4 .03 RCPT
S2	0308.1019	CONNECTOR-SWITCH		
S3-1	0332.1992	TERMINAL-RECEPTICAL		
S3-GND	0332.4041	TERMINAL-RECEPTICAL		
S5	0332.2571	TERMINAL-RCPT		
S5-GND	0332.2571	TERMINAL-RCPT		
S6	0323.2517	CONNECTOR, RECEPTICAL	STARTER	
S7	0332.2571	TERMINAL-RCPT		
TB2-1	0332-0913	TERMINAL		
TB2-2	0332-0913	TERMINAL		
TB2-4	0332-0913	TERMINAL		
Z3	0332.3058	SPLICE-BUTT		
Z4	0332.3058	SPLICE-BUTT		

- NOTES:
- THIS PART IS MANUFACTURER SOURCE CONTROLLED.
 - COMPONENTS CT1 AND CT2 ARE PART OF ASSEMBLY A028X144. ADJUST LEAD LENGTHS AS REQUIRED. APPLY UL RECOGNIZED VINYL SELF LAMINATING LABEL SYSTEM TO CT1 AND CT2 LEADS.
 - OVERLAP BUNDLE ENDS A MINIMUM OF 25MM. APPLY (2) WIRE TIES TO THE OVERLAP.
 - HARNESS MUST BE PROCURED FROM A SUPPLIER QUALIFIED AS A UL RECOGNIZED HARNESS MANUFACTURER (CATEGORY ZPFW2). PACKAGING OR PARTS TO BE MARKED IN ACCORDANCE WITH REQUIREMENTS SPECIFIED BY SUPPLIER'S UL PROGRAM.
 - IF A VALUE OF 0 (ZERO) IS USED IN THE BILL OF MATERIAL, THE QUANTITY OF THE AFFECTED ITEMS SHALL BE DERIVED FROM THE DRAWING REQUIREMENTS.
 - WIRE TIES SHALL BE PLACED AT ALL TUBE ENDS AND AT BOTH SIDES OF BREAK OUTS. WIRE TIES SHALL BE PLACED ALONG TUBE EVERY 100MM MAX.
 - ALL BREAK OUTS SHALL EXIT FROM THE TUBING SLIT REGARDLESS WHICH SIDE THEY APPEAR IN THE GRAPHICS.
 - TIE WRAP FUSE TO HARNESS WITH ITEM 0332-3088.
 - TIE BACK AND SECURE LEAD INTO CONVOLUTED TUBING.

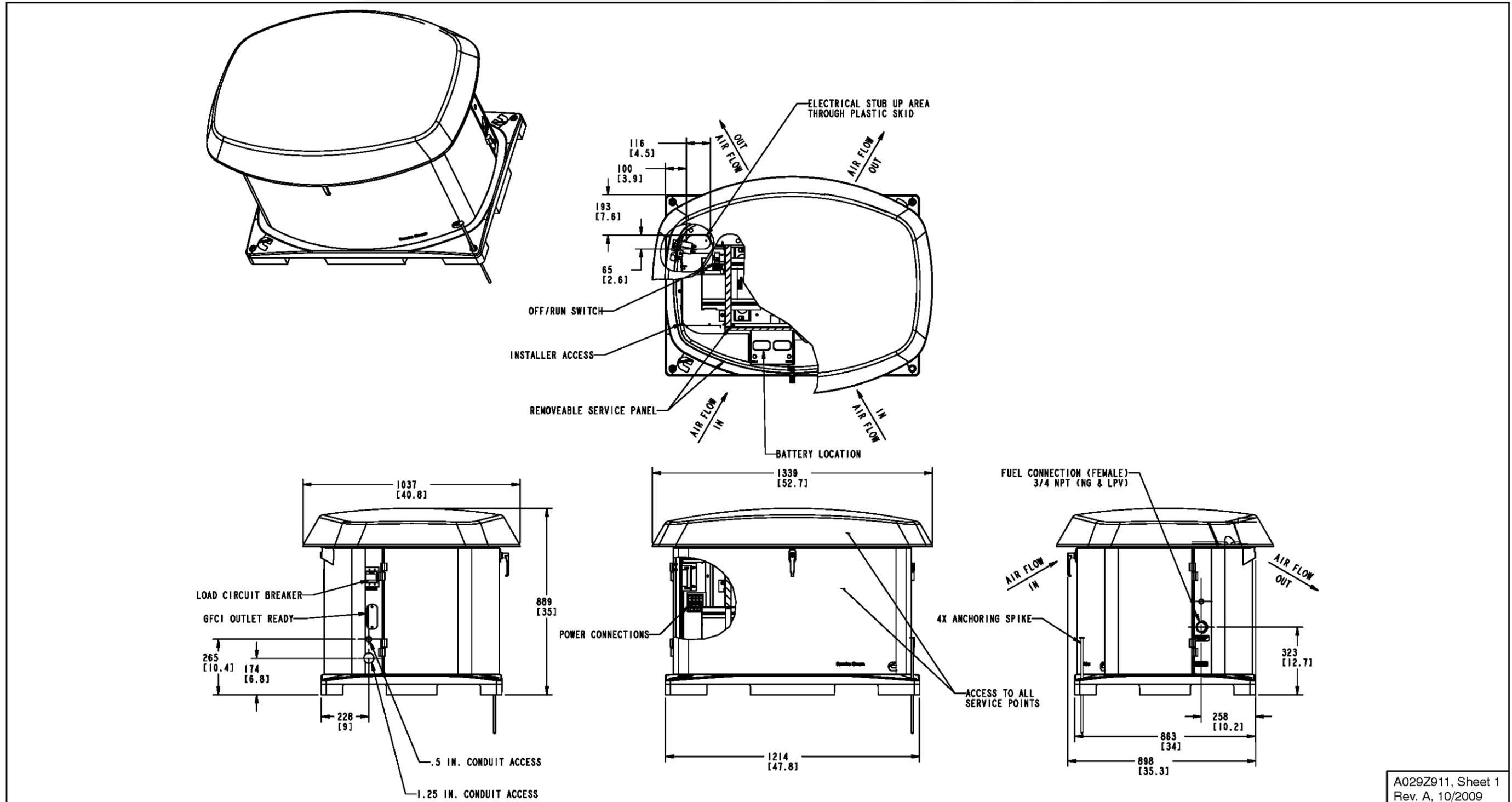
A028X141
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FIGURE 76. WIRING HARNESS CONNECTIONS (SHEET 3 OF 4)



A028X141
 Rev. F, Sheet 2

FIGURE 77. WIRING HARNESS CONNECTIONS (SHEET 4 OF 4)

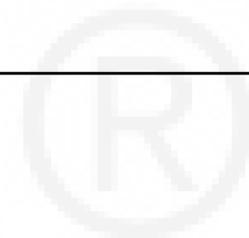


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FIGURE 78. OUTLINE DRAWING



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