BRIGGS & STRATTON
SERVICE & TROUBLESHOOTING MANUAL
STANDBY GENERATOR SYSTEM
FOREWORD

This manual was written to assist engine technicians and service personnel with the repair and maintenance procedures for standby generators. It assumes that persons using this manual have been properly trained in and are familiar with the servicing procedures for these products, including the proper use of required tools and safety equipment and the application of appropriate safety practices. Persons untrained or unfamiliar with these procedures or products should not attempt to perform such work.

Proper maintenance and repair is important to safe, reliable operation of all standby generators. The troubleshooting, testing, maintenance, and repair procedures described in this manual are appropriate for the generators described herein. Alternative methods or procedures may pose risk to personal safety and the safety and/or reliability of the standby generator and are not endorsed or recommended by Briggs & Stratton.

All information, illustrations, and specifications contained in this manual were based on the data available at the time of publication. Briggs & Stratton Corporation reserves the right to change, alter, or otherwise improve the product or the product manuals at any time without prior notice.

This printed copy may be out of date. Go to The Power Portal for the most up-to-date information and manual revision.

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Important Safety Instructions

SAVE THESE INSTRUCTIONS - This manual contains important instructions that should be followed during installation and servicing of the generator and batteries.

Safety Symbols and Meanings

![Explosion](image)

![Fire](image)

![Electrical Shock](image)

![Toxic Fumes](image)

![Rotating Parts](image)

![Hot Surface](image)

![Auto Start](image)

![Explosive Pressure](image)

![Chemical Burn](image)

![Lift Hazard](image)

![Read Manual](image)

⚠️ The safety alert symbol indicates a potential personal injury hazard. A signal word (DANGER, WARNING, or CAUTION) is used with the alert symbol to designate a degree or level of hazard seriousness. A safety symbol may be used to represent the type of hazard. The signal word NOTICE is used to address practices not related to personal injury.

⚠️ **DANGER** indicates a hazard which, if not avoided, will result in death or serious injury.

⚠️ **WARNING** indicates a hazard which, if not avoided, could result in death or serious injury.

⚠️ **CAUTION** indicates a hazard which, if not avoided, could result in minor or moderate injury.

**NOTICE** addresses practices not related to personal injury. The manufacturer cannot possibly anticipate every possible circumstance that might involve a hazard. The warnings in this manual, and the tags and decals affixed to the unit are, therefore, not all-inclusive. If you use a procedure, work method or operating technique that the manufacturer does not specifically recommend, you must satisfy yourself that it is safe for you and others. You must also make sure that the procedure, work method or operating technique that you choose does not render the generator system unsafe.

**WARNING** Running engine gives off carbon monoxide, an odorless, colorless, poison gas.

Breathing carbon monoxide could result in death, serious injury, headache, fatigue, dizziness, vomiting, confusion, seizures, nausea or fainting.

- Operate this product ONLY outdoors in an area that will not accumulate deadly exhaust gas.
- Keep exhaust gas away from any windows, doors, ventilation intakes, soffit vents, crawl spaces, open garage doors or other openings that can allow exhaust gas to enter inside or be drawn into a potentially occupied building or structure.
- Carbon monoxide detector(s) MUST be installed and maintained indoors according to the manufacturer’s instructions/recommendations. Smoke alarms cannot detect carbon monoxide gas.

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

**WARNING** Certain components in this product and related accessories contain chemicals known to the State of California to cause cancer, birth defects, or other reproductive harm. Wash hands after handling.

**WARNING** Storage batteries give off explosive hydrogen gas during recharging. Slightest spark will ignite hydrogen and cause explosion, resulting in death and/or serious injury. Battery electrolyte fluid contains acid and is extremely caustic. Contact with battery contents could cause severe chemical burns. A battery presents a risk of electrical shock and high short circuit current.

- DO NOT dispose of battery in a fire. Recycle battery.
- DO NOT allow any open flame, spark, heat, or lit cigarette during and for several minutes after charging a battery.
- DO NOT open or mutilate the battery.
- Wear protective goggles, rubber apron, rubber boots and rubber gloves.
- Remove watches, rings, or other metal objects.
- Use tools having insulated handles.
**WARNING** Propane and Natural Gas are extremely flammable and explosive, which could cause burns, fire or explosion resulting in death and/or serious injury.

- Install the fuel supply system according to NFPA 37 and other applicable fuel-gas codes.
- Before placing the generator into service, the fuel system lines must be properly purged and leak tested.
- After the generator is installed, you should inspect the fuel system periodically.
- NO leakage is permitted.
- DO NOT operate engine if smell of fuel is present or other explosive conditions exist.
- DO NOT smoke around the generator. Wipe up any oil spills immediately. Ensure that no combustible materials are left in the generator compartment. Keep the area near the generator clean and free of debris.

**WARNING** Hazardous Voltage - Contact with power lines could cause electric shock or burns, resulting in death or serious injury. Lifting Hazard / Heavy Object - Could result in serious injury.

- If lifting or hoisting equipment is used, DO NOT contact any power lines.
- DO NOT lift or move generator without assistance.
- Use lifting pipes as described in Lifting the Generator.
- DO NOT lift unit by roof as damage to generator will occur.

**WARNING** Generator produces hazardous voltage.

- Failure to properly ground generator could result in electrocution.
- Failure to isolate generator from utility power could result in death or serious injury to electric utility workers due to backfeed of electrical energy.

- When using generator for backup power, notify utility company.
- DO NOT touch bare wires or bare receptacles.
- DO NOT use generator with electrical cords which are worn, frayed, bare or otherwise damaged.
- DO NOT handle generator or electrical cords while standing in water, while barefoot, or while hands or feet are wet.
- If you must work around a unit while it is operating, stand on an insulated dry surface to reduce the risk of a shock hazard.
- DO NOT allow unqualified persons or children to operate or service generator.
- In case of an accident caused by electrical shock, immediately shut down the source of electrical power and contact the local authorities. Avoid direct contact with the victim.

- Despite the safe design of the generator, operating this equipment imprudently, neglecting its maintenance or being careless could cause possible injury or death.
- Remain alert at all times while working on this equipment. Never work on the equipment when you are physically or mentally fatigued.
- Before performing any maintenance on the generator, disconnect the battery cable indicated by a NEGATIVE, NEG or (-) first. When finished, reconnect that cable last.
- After your system is installed, the generator may crank and start without warning any time there is a power failure. To prevent possible injury, always set the generator's system switch to OFF, remove the service disconnect from the disconnect box AND remove the 15 Amp fuse BEFORE working on the equipment.
**WARNING** Starter and other rotating parts could entangle hands, hair, clothing, or accessories resulting in serious injury.

- NEVER operate generator without protective housings, covers, or guards in place.
- DO NOT wear loose clothing, jewelry or anything that could be caught in the starter or other rotating parts.
- Tie up long hair and remove jewelry.
- Before servicing, remove 15 Amp fuse from control panel and disconnect Negative (NEG or -) battery cable.

**CAUTION** Installing the 15A fuse could cause the engine to start at any time without warning resulting in minor or moderate injury.

- Observe that the 15 Amp fuse has been removed from the control panel for shipping.
- DO NOT install this fuse until all plumbing and wiring has been completed and inspected.

**CAUTION** Excessively high operating speeds could result in minor injury and/or equipment damage. Excessively low speeds impose a heavy load on generator.

- DO NOT tamper with governed speed. Generator supplies correct rated frequency and voltage when running at governed speed.
- DO NOT modify generator in any way.

**NOTICE** Improper treatment of generator could damage it and shorten its life.

- Use generator only for intended uses.
- If you have questions about intended use, contact your authorized dealer.
- Operate generator only on level surfaces.
- Adequate, unobstructed flow of cooling and ventilating air is critical to correct generator operation.
- The access panels/doors must be installed whenever the unit is running.
- DO NOT expose generator to excessive moisture, dust, dirt, or corrosive vapors.
- Remain alert at all times while working on this equipment. Never work on the equipment when you are physically or mentally fatigued.
- DO NOT start engine with air cleaner or air cleaner cover removed.
- DO NOT insert any objects through cooling slots.
- DO NOT use the generator or any of its parts as a step. Stepping on the unit could cause stress and break parts. This may result in dangerous operating conditions from leaking exhaust gases, fuel leakage, oil leakage, etc.
- If connected devices overheat, turn them off and disconnect them from generator.

Shut off generator and contact an authorized dealer if:
- electrical output is lost;
- equipment sparks, smokes, or emits flames;
- unit vibrates excessively;
- unit makes unusual noises.
SECTION 1 - Safety, Maintenance and Adjustments
Equipment Description

This product is only for use as an optional generator system which provides an alternate source of electric power and to serve loads such as heating, refrigeration systems, and communication systems that, when stopped during any power outage, could cause discomfort or inconvenience.

NOTICE  This product does NOT qualify for either an emergency standby or legally required standby system as defined by NFPA 70 (NEC).

- Emergency generator systems are intended to automatically supply illumination, power, or both, to designated areas and equipment in the event of failure of the normal supply. Emergency systems may also provide power for such functions as ventilation where essential to maintain life, where current interruption of the normal supply would produce serious life safety or health hazards.

- Legally Required standby generator systems are intended to automatically supply power to selected loads in the event of failure of the normal source which could create hazards or hamper rescue or firefighting operations.

Every effort has been made to ensure that information in this manual is accurate and current. However, we reserve the right to change, alter, or otherwise improve the product and this document at any time without prior notice.

Only current licensed electrical and plumbing professionals should attempt home generator system installations. Installations must strictly comply with all applicable codes, industry standards, laws and regulations.
Generator Location

The actual physical location of your generator has a direct affect on:

1. The amount of plumbing required to fuel your generator.
2. The amount of wiring required to control and connect your generator.

Specific location guidelines are discussed in the installation manual. Acquaint yourself with that information and confer with your installer. Be sure to ask how your site might affect installation costs and compliance with local codes and standards.

- Install generator outdoors in an area that will not accumulate deadly exhaust gas.
- DO NOT install generator where exhaust gas could accumulate and enter inside or be drawn into a potentially occupied building or structure.
- By law it is required in many states to have a Carbon Monoxide (CO) detector in operating condition in your home. Carbon monoxide detector(s) (A) MUST be installed and maintained indoors according to the manufacturer’s instructions/recommendations. A CO monitor is an electronic device that detects hazardous levels of CO. When there is a buildup of CO, the monitor will alert the occupants by flashing visual indicator light and alarm. Smoke alarms cannot detect CO gas.

**WARNING**

Running engine gives off carbon monoxide, an odorless, colorless, poison gas. Breathing carbon monoxide could result in death, serious injury, headache, fatigue, dizziness, vomiting, confusion, seizures, nausea or fainting.

- Operate this product ONLY outdoors in an area that will not accumulate deadly exhaust gas.
- Keep exhaust gas away from any windows, doors, ventilation intakes, soffit vents, crawl spaces, open garage doors or other openings that can allow exhaust gas to enter inside or be drawn into a potentially occupied building or structure.
- Carbon monoxide detector(s) MUST be installed and maintained indoors according to the manufacturer’s instructions/recommendations. Smoke alarms cannot detect carbon monoxide gas.

**WARNING**

Exhaust heat/gases could ignite combustibles or structures resulting in death and/or serious injury.

- Exhaust outlet side of weatherproof enclosure must have at least 5 ft. (1.5 m) minimum clearance from any structure, shrubs, trees, or any kind of vegetation.
- Standby generator weatherproof enclosure must be at least 5 ft. (1.5 m) from windows, doors, any wall opening, shrubs or vegetation over 12 in. (30.5 cm) in height.
- Standby generator weatherproof enclosure must have a minimum of 5 ft. (1.5 m) overhead clearance from any structure, overhang or trees.
- DO NOT place weatherproof enclosure under a deck or other type of structure that may confine airflow.
- USE ONLY flexible fuel line provided. Connect provided fuel line to generator. DO NOT use with or substitute any other flexible fuel line.
- Smoke detector(s) MUST be installed and maintained indoors according to the manufacturer’s instructions/recommendations. Carbon monoxide alarms cannot detect smoke.
- DO NOT place weatherproof enclosure in manner other than shown in illustrations.

- Ensure exhaust gas is kept away from any windows, doors, ventilation intakes, soffit vents, crawl spaces, open garage doors or other openings that can allow exhaust gas to enter inside or be drawn into a potentially occupied building or structure. Your neighbor’s home may be exposed to the engine exhaust from your standby generator and must be considered when installing your standby generator.
- Wind and air currents should be taken into consideration when positioning generator.

See the installation manual for full details on safe generator location.
Other General Location Guidelines

- Place the standby generator in a prepared location that is flat and has provisions for water drainage.
- Install the standby generator in a location where sump pump discharge, rain gutter downspouts, roof run-off, landscape irrigation, or water sprinklers will not flood the unit or spray the enclosure and enter any air inlet or outlet openings.
- Install the standby generator where it will not affect or obstruct and services including covered, concealed and underground, such as telephone, electric, fuel (natural gas/ LPG vapor), irrigation, air conditioning, cable, septic, sewer, well and so forth.
- Install the standby generator where leaves, grass, snow, etc. will not obstruct air inlet and outlet openings. If prevailing winds will cause blowing or drifting, you may need to construct a windbreak to protect the unit.

Lifting the Generator

⚠️ WARNING Hazardous Voltage - Contact with power lines could cause electric shock or burns, resulting in death or serious injury.
Lifting Hazard / Heavy Object - Could result in serious injury.
- If lifting or hoisting equipment is used, DO NOT contact any power lines.
- DO NOT lift or move generator without assistance.
- Use lifting pipes as described in Lifting the Generator.
- DO NOT lift unit by roof as damage to generator will occur.

The generator weighs more than 500 pounds (227 kg). Proper tools, equipment and qualified personnel should be used in all phases of handling and moving the generator.

Two 60” lengths (minimum) schedule 40 nominal ¾” steel pipe (A), supplied by the installer, are required to lift the generator manually. Insert pipes through the lifting holes (B) located near the unit's base.

You may also lift the unit using a “hook and hoist” method attached to the lifting pipes, provided that you use a spreader bar to ensure that the chains or cables DO NOT touch the generator’s roof or cabinet.
Access Ports

The generator is equipped with an enclosure that has several access panels, as shown.

The access panels and the components located behind them are listed below:

A - Roof (Control Panel, air filter, oil dipstick, and circuit breaker)
B - Front Access Panel (oil drain and oil filter)
C - Battery Panel (battery and generator data label)
D - Rear Access Panel (fuel regulator, fuel selector, and engine starter)
E - Control Panel Cover (field wiring and control wires)

Each generator is shipped with a set of identical keys. These keys fit in the lock on the front removable panel. The roof must be unlocked in order for it to open.
To open roof:
1. Insert key into lock (A) of front panel. Gently push down on roof above the lock to aid in turning the key. Turn key one quarter turn clockwise.
2. Lift roof to the open position.

To remove front panel:
1. Remove the two bolts (B) that secure the panel to the unit.
2. Lift panel to remove from unit.

To secure front panel:
1. Place panel in unit.
2. Secure the panel with two bolts.

To remove rear panel:
1. Ensure the roof is in the open position.
2. Remove the two bolts (C) that secure the panel to the unit.
3. Lift panel to remove from unit.

To secure rear panel:
1. Slide panel into place on unit.
2. Secure the panel with two bolts.

To remove battery panel:
1. Ensure the roof is in the open position.
2. Remove the two bolts (D) that secure the panel to the unit.
3. Lift up on panel and remove.

To secure battery panel:
1. Place panel in unit.
2. Secure the panel with two bolts.
Fuel Conversion

The engine of your generator system has the capability to run on natural gas (NG) or on liquefied petroleum (LP) vapor. To convert to either fuel, follow these steps:

**NOTICE** Units are set to NG at the factory.

1. Insert key into lock of front panel. Gently push down on roof above the lock to aid in turning the key. Turn key one quarter turn clockwise.
2. Lift roof to the open position.
3. Press the control board **OFF** button.
4. Remove 15 Amp fuse from control panel.
5. Remove the rear panel.
6. Locate the fuel selector valve (A), located on top of the fuel regulator (B). Using a 5 mm Allen wrench, turn the selector valve to either LP or NG.

**NOTICE** Do Not overtighten the fuel selector switch or move the selection arrow (C) past the fuel type.

8. Reinstall the rear panel.
9. Reinstall 15 Amp fuse in control panel.
10. Press the control board **AUTO** button.
Generator Components
15kW - 20kW Generator (Front View)

Generator is shown with roof and access covers removed for clarity.

A - Lifting Holes — Provided at each corner for lifting generator.

B - Alternator — An electrical machine that generates alternating current

C - Muffler — High-performance muffler lowers engine noise to comply with most residential codes.

D - Circuit Breaker — Protects the system from shorts and other over-current conditions.

E - Control Board — Used for generator operation control, menu start-up, and informational display functions.

F - Air Cleaner — Uses a dry type filter element to protect engine by filtering dust and debris out of intake air.

G - Engine Label (on valve cover) — Identifies engine model and type

H - Spark Plug — A device in the cylinder head of the engine that ignites the fuel mixture by means of an electric spark.

J - Oil Filter — Filters engine oil to prolong generator life.

K - Battery (installer supplied) — 12 Volt DC, lead acid, automotive style battery provides power to start the engine.

L - Oil Heater Port/ Oil Drain Hose Port — Provided to allow an optional heating element to be installed. Provided to facilitate oil changing.

M - Generator Data Label — Identifies generator model number and serial number. Located inside battery access compartment.
Generator Components
15kW - 20kW Generator (Back View)

Generator is shown with roof and access covers removed for clarity.

A - Lifting Holes — Provided at each corner for lifting generator.

B - Fuel Solenoid — Automatically opens and closes to supply fuel to the unit when needed.

C - Fuel Regulator — Controls fuel flow to engine for proper operation.

D - Fuel Selector Valve — Used to select proper fuel type (LP or NG).

E - Spark Plug — A device in the cylinder head of the engine that ignites the fuel mixture by means of an electric spark.

F - Oil Fill Cap — Location for adding oil to engine.

G - Electrical Field Wiring Inlet — Wires to and from generator are centered in this location.

H - Air Cleaner — Uses a dry type filter element to protect engine by filtering dust and debris out of intake air.

J - Engine Oil Dipstick — Allows user to check engine oil level easily.

K - Oil Heater Port — Provided to allow an optional heating element to be installed to warm engine oil to promote easy starting in cold climates.
A - Menu/Programming Navigation Buttons — See Menu section for details

B - USB Port — Authorized Dealer Service Use Only

C - Generator Operation Control Buttons —
   • "AUTO" Normal operating position. Press and hold button to put unit into Automatic mode. If a utility power outage is sensed, the system will start the generator. When utility power is restored, auto lets the engine stabilize internal temperatures, shuts off the generator, and waits for the next utility outage.
   • "OFF" Turns off running generator, prevents unit from starting, and resets any detected faults.
   • "MANUAL" Used to manually start the generator.
   
   "AUTO" LED — LED will light when unit is placed into Auto mode. LED will blink if exercise cycle is not set or set to OFF.

D - 15 Amp Fuse — Protects the home generator DC control circuits. If the fuse has ‘blown’ (melted open) or was removed, the engine cannot crank or start. Replace the fuse using only an identical ATO 15A fuse. One spare fuse is supplied with the unit.

E - Cover — This protective cover must be opened to access the fuse and the USB port.

F - Digital Display — Displays generator mode, menu options, service codes, and service engine indicators.
System Connectors

Low Voltage connections to signal fault contacts, transfer switch communication and auxiliary 12VDC power are made via a field connection terminal block in control board area. Compare this illustration with your generator to familiarize yourself with the location of these connections.

A - Two Pin Terminal Block — Used to connect utility 240 VAC from fuse block in ATS to the control board. Connect only one wire per terminal.

B - Fault Contacts — Use NO, COM and NC to hook up a siren, light, etc. to alert you in case of a fault. Contacts reverse state (NO goes to NC and vice versa) upon a fault condition.

C - Transfer Switch Communication (TxRx and TxRx GND) — Connect to transfer switch control board for communication interface using 18AWG copper twisted pair wire.

D - +LED and GND Connection — Not required for wireless monitor included with unit. Available for optional hardwired remote system status panel accessory, #6144.

E - Eight Pin Terminal Block — Used to connect signal wires to the control board. Connect only one wire per terminal.

F - Power Connection (Line 1 and Line 2) — Power connection to transfer switch.

G - Neutral and Ground Connection — Connect to transfer switch neutral and ground

- For power output connection (Line 1, Line 2, Neutral, and Ground), refer to the following table:

<table>
<thead>
<tr>
<th>Power output connections minimum 300V, 75°C</th>
<th>15 kW</th>
<th>16 kW</th>
<th>17 kW</th>
<th>20 kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>6AWG Copper</td>
<td>6AWG Copper</td>
<td>4AWG Copper</td>
<td>4AWG Copper</td>
<td></td>
</tr>
<tr>
<td>4AWG Aluminum</td>
<td>4AWG Aluminum</td>
<td>3AWG Aluminum</td>
<td>2AWG Aluminum</td>
<td></td>
</tr>
</tbody>
</table>


- For utility circuit connection (Utility A and Utility B) use #14 AWG minimum 300 volt wire.
- For transfer switch communication use #18 AWG twisted pair conductors, no greater than 200 ft in length, 300 volt wire.
- When connecting to the terminal block, fasten only one wire to each connector screw.
- Torque terminal block screws to 4.4 in-lb (0.49 Newton meter).
- Torque circuit breaker connections to 45 in-lb (5 Newton meter).
Menu

The following chart shows the icons for the buttons that control the system control panel.

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="icon.png" alt="OK" /></td>
<td><strong>MENU</strong> ENTER THE MENU (VIEW SETTINGS) PRESS TO CONFIRM SELECTION WHEN PROGRAMMING.</td>
</tr>
<tr>
<td><img src="icon.png" alt="X" /></td>
<td><strong>ESCAPE (EXIT)</strong> RETURN TO LAST MENU ITEM</td>
</tr>
<tr>
<td><img src="icon.png" alt="&gt;" /></td>
<td><strong>RIGHT ARROW</strong> TOGGLE THROUGH MENU OPTIONS SETTING SYSTEM PARAMETERS</td>
</tr>
<tr>
<td><img src="icon.png" alt="&lt;" /></td>
<td><strong>LEFT ARROW</strong> TOGGLE THROUGH MENU OPTIONS SETTING SYSTEM PARAMETERS</td>
</tr>
<tr>
<td><img src="icon.png" alt="i" /></td>
<td><strong>MANUAL MODE</strong> USED TO MANUALLY START THE GENERATOR. PRESS AND HOLD BUTTON TO START THE GENERATOR.</td>
</tr>
<tr>
<td><img src="icon.png" alt="O" /></td>
<td><strong>OFF</strong> TURNS OFF RUNNING GENERATOR, PREVENTS UNIT FROM STARTING, AND RESETS ANY DETECTED FAULTS.</td>
</tr>
<tr>
<td><img src="icon.png" alt="R" /></td>
<td><strong>AUTOMATIC MODE</strong> NORMAL OPERATING POSITION. PRESS AND HOLD BUTTON TO PUT UNIT INTO AUTOMATIC MODE. IF A UTILITY POWER OUTAGE IS SENSED, THE SYSTEM WILL START THE GENERATOR. WHEN UTILITY POWER IS RESTORED, AUTO LETS THE ENGINE STABILIZE INTERNAL TEMPERATURES, SHUTS OFF THE GENERATOR, AND WAITS FOR THE NEXT UTILITY POWER OUTAGE.</td>
</tr>
</tbody>
</table>

The following chart describes key sequences for accessing different programming modes;

| ![<](icon.png) ![>](icon.png) | **GENERAL SET-UP** PRESS AND HOLD [ARROW LEFT AND ARROW RIGHT] FOR THREE SECONDS TO ENTER THE PROGRAM MODE. |
| ![<](icon.png) ![X](icon.png) ![>](icon.png) | **ADVANCED SETTINGS** PRESS AND HOLD [ARROW LEFT, ARROW RIGHT AND ESC] FOR THREE SECONDS TO ENTER THE ADVANCED SETTINGS MODE. |
| ![OK](icon.png) ![X](icon.png) | **WIRELESS LINK MODE** PRESS AND HOLD [MENU AND ESC] FOR THREE SECONDS TO ENTER THE WIRELESS LINKING MODE. |
General Set Up Screen

For general set up, press and hold the left arrow and right arrow for 3 seconds. Follow the prompts as outlined below.

NOTE: Date and Time were set at the factory and stored in the control panel memory. The Exercise Cycle was also set at the factory. The default exercise cycle occurs on Tuesdays, at 2:00 P.M. Central Standard Time. To update or change these settings, follow the steps below.

IF DURING PROGRAMMING NO BUTTONS ARE PRESSED FOR 30 SECONDS, THE CONTROL PANEL WILL AUTOMATICALLY EXIT THE PROGRAM MODE.
Control Panel Prompts

Automatic Mode
In Automatic Mode, the display screen will display via scrolling text:
- GENERATOR READY - if the unit is in standby and utility power is present.
- GENERATOR ON - if the unit is running and utility power is not present.
- SERVICE CODE - if a system fault has been detected.

General System Parameters
To view general system parameters, press the MENU button. The following will scroll across the digital display and then move to the next item:
- Run time
- Date
- Time
- Exercise Cycle date and start time
The user can press the LEFT ARROW or RIGHT ARROW at any time to move to the next item. The user can press ESCAPE to go back to GENERATOR READY. If no user inputs are made for 10 seconds after all the items have been displayed, the control board will reset to GENERATOR READY.
Advanced Settings Screen

Advanced setting parameters are preset at the factory for a typical installation. To view Advanced Settings items and/or to change items, follow the instructions listed below.

**NOTICE** Advanced settings are critical to the operation of the unit. Careful consideration should be taken when working in the Advanced Settings menu. Exercise caution when selecting and verifying parameters for the generator and region where the generator is being operated. Confirm all settings before operating the generator for the first time.

For advanced menu items, press and hold the left arrow, right arrow, and escape key for 3 seconds. Follow the prompts as outlined below.

**NOTICE** In the Advanced Setting menu, a three button access code (left arrow, right arrow, and escape key) must be pressed once to enter the menu and again to change any setting. After each confirmation of a setting, the selection will display solid for 2 seconds before moving to the next program item.
**Fuel Consumption**

Estimated fuel supply requirements at half and full load for natural gas and LP vapor fuels are shown below.

**Power Decrease at High Altitude or High Temperature**

Air density is less at high altitudes, resulting in less available engine power. Specifically, engine power will decrease 3.5% for each 1,000 feet (300 meters) above sea level and 1% for each 10°F (5.6°C) above 77°F (25°C). Make sure you and your installer consider these factors when determining total generator load.

### LP Vapor (Propane)

<table>
<thead>
<tr>
<th>Load</th>
<th>20kW</th>
<th>17kW</th>
<th>16kW</th>
<th>15kW</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cu Ft/Hr</td>
<td>135</td>
<td>118</td>
<td>113</td>
<td>109</td>
</tr>
<tr>
<td>Gal/Hr (liquid)</td>
<td>3.75</td>
<td>3.28</td>
<td>3.14</td>
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<td>295000</td>
<td>282500</td>
<td>272500</td>
</tr>
<tr>
<td>Cu Ft/Hr</td>
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<td>99</td>
<td>96</td>
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<td>Gal/Hr (liquid)</td>
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<td>Gal/Hr (liquid)</td>
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<td>Gal/Hr (liquid)</td>
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<td>BTU/Hr</td>
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</table>

### Natural Gas

<table>
<thead>
<tr>
<th>Load</th>
<th>20 kW (18 kW)</th>
<th>17 kW (14.4 kW)</th>
<th>16 kW (14.4 kW)</th>
<th>15 kW (13.5 kW)</th>
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<tbody>
<tr>
<td>Cu Ft/ Hr</td>
<td>260</td>
<td>248</td>
<td>244</td>
<td>240</td>
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<td>BTU / Hr</td>
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<tr>
<td>Cu Ft/ Hr</td>
<td>240</td>
<td>218</td>
<td>212</td>
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<td>BTU / Hr</td>
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<td>218000</td>
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<td>Cu Ft/ Hr</td>
<td>187</td>
<td>170</td>
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<td>Cu Ft/ Hr</td>
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<td>125</td>
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<td>BTU / Hr</td>
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<tr>
<td>Cu Ft/ Hr</td>
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<td>99</td>
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<tr>
<td>BTU / Hr</td>
<td>99000</td>
<td>99000</td>
<td>99000</td>
<td>99000</td>
</tr>
</tbody>
</table>
Generator AC Connection System
A single-phase, three-wire AC connection system is used in the home generator. The stator assembly consists of a pair of stationary windings with two leads brought out of each winding. The junction of leads 22 and 33 forms the neutral lead, as shown schematically and as a wiring diagram. A complete schematic and wiring diagram can be found later in this manual.

**NOTICE** Neutral is not bonded to ground at generator.

**NOTICE** Generator must be used with only an UL approved transfer switch that is compatible with the generator.

Automatic Operation Sequence
The generator’s control board constantly monitors utility voltage. Should utility voltage drop below a preset level, the control board will signal the engine to crank and start. When utility voltage is restored above a preset voltage level, the engine is signaled to shut down.

The actual system operation is not adjustable and is sequenced by sensors and timers on the control board, as follows:

**Utility Voltage Dropout Sensor**
- This sensor monitors utility source voltage.
- If utility source voltage drops below about 70 percent of the nominal supply voltage, the sensor energizes a 3 second timer. The timer is used to “sense” brown-outs.
- Once the timer has expired, the engine will crank and start.

**Utility Voltage Pickup Sensor**
This sensor monitors utility power voltage. When utility voltage is restored above 80 percent of the nominal source voltage, a time delay starts timing and the engine will go to engine cool-down.

**Engine Cool-down Timer**
When utility power is sensed and the load transfers to the utility source, the engine will go into a cool down period as described below:
- If the generator has run for MORE than 5 minutes, once the utility transfer occurs, the engine will continue to run for about 1 minute before shutting down.
- If the generator has run for LESS than 5 minutes, once the utility transfer occurs, the engine will continue to run until 5 minutes has elapsed before shutting down.
Setting Exercise Timer
The generator is equipped with an exercise timer. During the exercise period, the unit runs for approximately 20 minutes and then shuts down. Electrical load transfer DOES NOT occur during the exercise cycle (unless an utility power outage occurs).

The generator will only enter the exercise cycle if the unit is in the AUTO mode and this exact procedure is followed.

**NOTICE** During the weekly exercise cycle, the generator will run for 20 minutes, but it will not supply power to the home. During the exercise cycle, the in-home monitor will continue blinking the GENERATOR READY green LED.

If you want to change the day and time the unit exercises again, simply perform the procedure again.

To turn off the generator exercise cycle, go to the OFF selection within the day of the week menu and press OK. The display will then scroll: EXERCISE CYCLE OFF.

To set the exercise timer:

**NOTICE** The generator is set with a default exercise cycle setting of Tuesday at 2:00 P.M, Central Time. To change the cycle setting, proceed to the following steps:

1. Choose the day and time you want your generator to exercise.
2. Press and hold the left arrow and right arrow simultaneously for 3 seconds to enter the General Set-Up program mode. See General Set-Up flow chart in Menu Section.
3. Verify and/or set the time and date on the unit.
4. Go to the SET EXERCISE prompt and hit the “OK” button.

**NOTICE** Items will flash until they are selected.

- **SELECT DAY:** Use the left or right arrow to toggle through the days of the week. Once the day is selected, hit the “OK” button.
- **SELECT HOUR:** Use the left or right arrow to toggle between 1 and 12. Choose the hour of the day you want the generator to exercise then hit the “OK” button.
- **SELECT MINUTE:** Use the left or right arrow to toggle between 00 and 59. Choose the minute of the day you want the generator to exercise then hit the “OK” button.
- **SELECT AM/PM:** Use the left or right arrow to toggle between AM and PM. Once chosen, hit the “OK” button.

Maintenance

**WARNING** Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

Servicing the System
Before performing any generator maintenance, always perform the following steps:

1. Set generator’s circuit breaker to its OFF position.
2. Press and hold the control board OFF button.
3. Remove 15 Amp fuse from control board.
4. **Utility voltage is present at generator control board.** Disconnect power before servicing control board by removing the fuses from the transfer switch.
5. After all servicing has been completed, replace fuses in transfer switch, replace 15 Amp fuse in control board, set circuit breaker ON and press and hold control board AUTO button.

The generator’s warranty does not cover items that have been subjected to operator abuse or negligence. To receive full value from the warranty, the operator must maintain the generator as instructed in this manual.

Some adjustments will need to be made periodically to properly maintain your generator.

All service and adjustments should be made at least once each season. Follow the requirements in the Maintenance Schedule chart.

Generator maintenance consists of keeping the unit clean. Operate the unit in an environment where it will not be exposed to excessive dust, dirt, moisture or any corrosive vapors. Cooling air louvers on the enclosure must not become clogged with snow, leaves, or any other foreign material. To prevent generator damage caused by overheating, keep the enclosure cooling inlets and outlets clean and unobstructed at all times.

Check the cleanliness of the unit frequently and clean when dust, dirt, oil, moisture or other foreign substances are visible on its exterior/interior surface. Inspect the air inlet and outlet openings inside and outside the enclosure to ensure air flow is not blocked.

DO NOT use direct spray from a garden hose to clean generator. Water can enter the engine and generator and cause problems.

**NOTICE** Improper treatment of generator could damage it and shorten its life.

- DO NOT expose generator to excessive moisture, dust, dirt, or corrosive vapors.
- DO NOT insert any objects through cooling slots.
Clean the generator as follows:
1. Press and hold the control board OFF button.
2. Remove 15 Amp fuse from control board.
3. Clean generator as desired.
   • Use a damp cloth to wipe exterior surfaces clean.
   • Use a soft, bristle brush to loosen caked on dirt, etc.
   • Use a vacuum cleaner to pick up loose dirt and debris.
   • Use low pressure air (not to exceed 25 psi) to blow away dirt. Inspect cooling air slots and openings on the generator. These openings must be kept clean and unobstructed.
4. Reinstall 15 Amp fuse in control board.
5. Press and hold the control board AUTO button.

Maintenance Schedule
Follow the hourly or calendar intervals of operation, whichever occurs first.

<table>
<thead>
<tr>
<th>Time / Frequency</th>
<th>Task</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>First 5 Hours</strong></td>
<td>Change Engine Oil</td>
</tr>
<tr>
<td></td>
<td>Clean Debris</td>
</tr>
<tr>
<td>Every 8 Hours or Daily</td>
<td>Check Engine Oil Level</td>
</tr>
<tr>
<td></td>
<td>Change Air Filter</td>
</tr>
<tr>
<td></td>
<td>Change Engine Oil and Filter</td>
</tr>
<tr>
<td></td>
<td>Replace Spark Plugs</td>
</tr>
<tr>
<td></td>
<td>Check Valve Clearance</td>
</tr>
<tr>
<td>Every 100 Hours or Annually</td>
<td>Check Circuit Breaker Torques</td>
</tr>
<tr>
<td></td>
<td>Annually</td>
</tr>
<tr>
<td></td>
<td>Clean Oil Cooler Fins</td>
</tr>
<tr>
<td></td>
<td>Test System Operation (Simulate a Power Outage)</td>
</tr>
</tbody>
</table>

Battery
**NOTICE** Failure to disconnect negative battery cable could result in equipment failure.
• DO NOT attempt to jump start the generator.
• Damage to equipment resulting from failure to follow this instruction will void engine and generator warranty.

Servicing of batteries is to be performed or supervised by personnel knowledgeable of batteries and the required precautions. Keep unauthorized personnel away from batteries.

Servicing the Battery

| WARNING | Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling. |

If it is necessary to service the battery, proceed as follows:
1. Press and hold the control board OFF button.
2. Remove 15 Amp fuse from control panel.
3. Service or replace battery as required. See Battery in Final Installation Considerations in the installation manual for specific battery needed.
4. Connect red battery cable to battery positive terminal (indicated by POSITIVE, POS, or (+)).
5. Connect black negative battery cable to negative battery terminal (indicated by NEGATIVE, NEG, or (-)).
6. Ensure hardware on both positive and negative battery terminals is secure.
7. Reinstall 15 Amp fuse in control panel.
8. Press and hold the control board AUTO button.

Charging the Battery
If it is necessary to charge the battery, proceed as follows:
1. Press and hold the control board OFF button.
2. Remove 15 Amp fuse from control board.
3. Disconnect negative battery cable from negative battery terminal (indicated by NEGATIVE, NEG, or (-)).
4. Charge battery with battery charger at 2 Amps until battery holds 12 Volts. DO NOT exceed 13.7 volts when charging.

**NOTICE** DO NOT use a battery booster to quick charge a low battery.
5. After charging, connect negative battery cable to negative battery terminal (indicated by NEGATIVE, NEG, or (-)).
6. Ensure hardware on both positive and negative battery terminals is secure.
7. Reinstall 15 Amp fuse in control board.
8. Press and hold the control board AUTO button.
**Electronic Governor**

The engine electronic governor system allows for improved control and increased generator performance compared to mechanically governed systems. The result is smooth steady-state operation without the “hunting” common to some mechanical governors. The system also reduces speed variations under engine loading and unloading and significantly reduces frequency fluctuation experienced when the engine is under higher loads.

The electronic governor system is composed of a stepper motor (B), stepper motor throttle control linkages (C), and throttle side linkages (A). The control board contains a digital controller that processes engine speed information and sends appropriate commands to the stepper motor to control the position of the engine throttle.

Since the electronic governing system controls the engine throttle demand based upon generator load, the following service codes and/or conditions may be related to an electronic governing system issue:

- Engine Does Not Start
- Over Speed
- Under Frequency
- Unstable No Load Engine Control

While trouble shooting any of these conditions, a verification of the electronic governor system can be initiated through the control panel – advanced menu options – Electronic Governor Check. Refer to page 21 of this manual for Advanced Menu Operation.

**Electronic Governing Check:**

The generator has an electronic governing check feature that will turn on the stepper motor and move the throttle linkage clockwise and counterclockwise within the throttle limits. The test will rotate the stepper motor and move the throttle arm between the wide open throttle and dead idle limits 4 times with a 2 second delay between each throttle sweep. This will allow visual verification that the stepper motor is functioning properly and the control linkages are connected. The engine will not attempt to start during this test. If the stepper motor does not move, or if a linkage binds, then service may be required. Ensure push rod between stepper motor and throttle arm maintains sufficient clearance to the bulkhead during operation. Clearance can be increased by gently compressing the bulkhead material at the stepper motor link pass through slot.

**NOTICE** If stepper motor does not move, please make sure the stepper motor connector is attached.
Engine Maintenance

Adjust Valve Lash
1. Valve lash adjustment must be performed on a COLD engine.
2. Remove both spark plugs to ease manual rotation of engine crankshaft.
3. Access to rotate the engine by hand is available by removing the engine intake screen in the battery compartment such that the crankshaft nut is accessible. Care must be taken when reassembling this screen using the self tapping screws as over-torquing will strip out the partition material.
4. Set the No. 1 cylinder at ¼" (6mm) past Top Dead Center (TDC) on the compression stroke.
5. Using a feeler gage (A), measure the valve clearance.
6. The proper valve clearance is .005" (0.13mm) for both the intake and exhaust.
7. Adjust the clearance by loosening the lock nut (B), then turn the adjusting screw (C).
8. Once the clearance is properly set, hold the adjusting screw while torquing the lock nut to 70 in-lbs (8Nm).
9. Repeat for cylinder No. 2.

Fuel System Inspection and Maintenance

Natural Gas/Propane Fuel System
The fuel system installed on this engine has been designed to various standards to ensure performance and reliability. To ensure compliance to these standards, follow the recommended maintenance schedule contained in this section.

NOTICE The fuel system components have been specifically designed and calibrated to meet the fuel system requirements of the engine. If a fuel system component fails to operate or develops a leak, it should be repaired or replaced with the OEM recommended replacement parts.

Pressure Regulator Maintenance and Inspection
- Check for any fuel leaks at the inlet and outlet fittings.
- Check for any fuel leaks in the regulator body.
- Check to ensure the regulator is securely mounted and the mounting bolts are tight.
- Check the regulator for external damage.

Venturi/Throttle Control Device Maintenance and Inspection

NOTICE A dirty air cleaner may significantly alter the venturi performance.
- Leaks at all fittings.
- Ensure the venturi and throttle body are securely mounted.
- Inspect air cleaner element according to the recommended maintenance schedule found in this section.
- Inspect air inlet hose connection and clamp. Inspect hose for cracking, splitting, or chaffing. Replace if any of these conditions exist.
- Check fuel line for cracking, splitting, or chaffing. Replace if any of these conditions exist.
- Check for leaks at the throttle body and intake manifold.
Exhaust System Maintenance and Inspection

When inspecting the exhaust system, check the following:

- Inspect exhaust manifold at the cylinder head for leaks and that all retaining bolts and shields (if used) are in place.
- Inspect muffler for exhaust leaks. Repair as necessary.

Service Spark Plugs

Changing the spark plugs will help your engine to start easier and run better.

1. Clean area around spark plugs.
2. Remove and inspect spark plugs.
3. Check electrode gap with wire feeler gauge and reset spark plug gap to recommended gap if necessary (see Specifications).
4. Replace spark plugs if electrodes are pitted, burned or porcelain is cracked. Use the recommended replacement spark plugs. See Specifications.
5. Install spark plugs and tighten to 180 in/lbs (20Nm).

Engine Oil

⚠️ CAUTION Avoid prolonged or repeated skin contact with used motor oil.
- Used motor oil has been shown to cause skin cancer in certain laboratory animals.
- Thoroughly wash exposed areas with soap and water.

NOTICE Any attempt to crank or start the engine before it has been properly serviced with the recommended oil will result in equipment failure.
- Refer to the Maintenance section.
- Damage to equipment resulting from failure to follow this instruction will void engine and generator warranty.

This engine is filled with synthetic oil (API SJ/CF 5W-30). This allows from system operation in the widest range of temperature and climate conditions.

We recommend the use of Briggs & Stratton Warranty Certified oils for best performance. Other high-quality detergent oils are acceptable if classified for service SF, SG, SH, SJ or higher. DO NOT use special additives.

Changing Engine Oil

KEEP OUT OF REACH OF CHILDREN. DON'T POLLUTE. CONSERVE RESOURCES. RETURN USED OIL TO COLLECTION CENTERS.

Checking/Adding Engine Oil

1. Gain access to the dipstick on the engine.
2. Clean the oil fill area of any debris.
3. Remove the dipstick and wipe with a clean cloth.
4. Fully insert dipstick into oil fill.
5. Remove dipstick and check oil level. Verify oil is a FULL mark (top hole) on dipstick.
6. If needed, slowly pour recommended oil into oil fill opening. DO NOT overfill. After adding oil, wait one minute and recheck oil level.

NOTICE Overfilling with oil could cause the engine not to start, or hard starting.
- DO NOT overfill.
- If over the FULL mark on dipstick, drain oil to reduce oil level to FULL mark on dipstick.
7. Replace and tighten oil dipstick.
Change oil while the engine is still warm from running, as described in the operator's manual.

1. Set control board system switch to OFF.
2. Remove 15 Amp fuse from control panel.
3. Place oil drain hose into an approved container.
4. Remove brass fitting from end of drain hose and drain oil into an approved container.
5. When oil has drained, replace brass fitting on hose.
6. Add oil if not changing oil filter, See Checking/Adding Engine Oil.

**Changing Oil Filter**

1. Place an approved container under oil filter.
2. Remove oil filter and dispose of properly.
3. Before installing a new oil filter, lightly lubricate the oil filter gasket with fresh, clean oil.
4. Install the oil filter by hand until the gasket contacts the oil filter adapter, then tighten the oil filter ½ to ¾ turn.
5. Add oil as described in Checking/Adding Engine Oil.
6. Remove container from under oil filter and clean up any spilled oil.
7. Start and run engine. As engine warms up, check for oil leaks.
8. Stop engine, wait for oil to settle, check oil level and add if necessary as described in Checking/Adding Engine Oil.

**NOTICE** Any attempt to crank or start the engine before it has been properly serviced with the recommended oil will result in equipment failure.

DO NOT attempt to crank or start the engine before it has been properly serviced with the recommended oil. This may result in engine failure.

Damage to equipment resulting from failure to follow this instruction will void engine and generator warranty.

---

**Service Air Cleaner**

Your engine will not run properly and may be damaged if you run it with a dirty air cleaner. Clean or replace more often if operating under dusty or dirty conditions.

To service the air cleaner, follow these steps:

1. Remove the knob (A) and the cover (B). Remove the nut (C) and the retainer (D).
2. Remove air filter (E).
3. To loosen debris, gently tap air cleaner on a hard surface. If air cleaner is excessively dirty, replace with a new air cleaner.
4. Install the air filter and secure with retainer and nut.
5. Install the cover and secure with knob.

**NOTICE** Replacement parts must be the same and installed in the same position as the original parts. The filter must be UL listed.
WARNING If engine overspeeds rapidly without governor control reducing the throttle after 3600 RPM is attained, be prepared to pull the 15 Amp fuse rapidly in the control panel to prevent damage to various generator components.
Control Panel
The control panel contains all the logic circuits, operator controls, and system displays necessary to operate, program, and protect the generator. The control panel interprets and monitors electrical inputs from all related circuits throughout the standby operation. Before replacing the control panel, all other circuits must be tested to ensure proper operation. When a failure has been traced to the control panel, it must be replaced as a complete assembly.

240VAC utility power is delivered from the fuses in the transfer switch to the 2-pin terminal strip in the electrical box. The control panel uses internal circuits to rectify the utility voltage to 12VDC. The 240VAC utility power is also used to power the optional battery warmer and optional oil warmers.

Functions of the Control Panel:
- Battery Trickle Charge
- Set Exercise Timer (Set Exercise)
- Manual Start (Manual Over-Ride)
- Sensing Utility Voltage
- Automatic Start, in the event of utility failure
- Automatic Engine Cool-Down Timer
- Service Code Detection with Automatic Shutdown
- Service Code Digital Display
- Hour Meter

Power During Control Panel Fault Conditions
When the generator system experiences a service code, the automatic transfer switch automatically defaults to utility power when present. This ensures that all circuits in the home will have power until the service code is corrected.

How to Access the Control Panel
The control panel circuit board is mounted behind the control panel face.
1. Open and/or remove the system control panel door.
2. Set generator’s circuit breaker to its OFF position.
3. Press and hold the control board OFF button.
4. Remove 15 Amp fuse from control board.
5. Utility voltage is present at the generator control board. Disconnect power before servicing control board by turning off utility and removing the fuses from the transfer switch.
6. Remove three screws that secure control box cover to enclosure to expose unit’s circuit breaker.
7. Remove the four control panel screws, then carefully remove and tilt down the panel to expose the control board.
The control panel is connected to its various circuits through connectors that are mounted directly to the board, shown tilted down.

- **J3**: 8-pin connector
- **J5**: 2-pin connector connected to fuses in transfer switch
- **J6**: 8-pin connector used for optional generator features
- **J4** and **J7**: Used for optional battery and engine warmers
- **J8** and **J9**: Sense 240VAC from the generator

The functions of the 8-pin connector (J3) are shown below:

<table>
<thead>
<tr>
<th>PIN</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>Vacant</td>
</tr>
<tr>
<td>7</td>
<td>Vacant</td>
</tr>
<tr>
<td>6</td>
<td>Oil Pressure (Wire #85)</td>
</tr>
<tr>
<td>5</td>
<td>Oil Temperature (Wire #95)</td>
</tr>
<tr>
<td>4</td>
<td>Fuel Solenoid (Wire #14)</td>
</tr>
<tr>
<td>3</td>
<td>Start Circuit (Wire #56)</td>
</tr>
<tr>
<td>2</td>
<td>Ground (Wire #0)</td>
</tr>
<tr>
<td>1</td>
<td>Battery Trickle Charge (Wire #13)</td>
</tr>
</tbody>
</table>
Accessing the Automatic Voltage Regulator

The Automatic Voltage Regulator (AVR) is mounted in the control box under the control board. The voltage regulator acts to increase or decrease voltage to the rotor windings based on the demands of the load connected to the generator. The increase or decrease in voltage through the rotor results in a proportional increase or decrease in the rotor's magnetic field strength, which is what induces (AC) current in the power windings of the stator.

The operating sequence for this type of voltage regulator is as follows:

1. Battery voltage is applied to the rotor at generator startup to establish the magnetic field via wires #56 and #0 connected to the AVR at terminals #56 and #0. The battery voltage along with the residual magnetism starts the power generation process.

2. The rotor turns at 3600RPMs.

3. Excitation winding output is delivered through wires #2 and #6 to the voltage regulator at excitation terminals #2 and #6.

4. The voltage regulator converts the (AC) excitation winding output to (DC) and delivers the (DC) output to the rotor to Pin #4 of the AVR, brush, and slip ring. It then moves throughout the rotor winding, back to the AVR Pin #1. The (DC) output from the voltage regulator to the rotor is based on the voltage signals received from sensing wires #11A and #44A.

5. Voltage from the 240VAC stator power windings are available through wires #11A and #44A to the circuit breaker.

6. 240VAC and frequency signals are delivered from the stator winding via wires #11A and #44A, to the voltage regulator at sensing terminals #11A and #44A. If for any reason sensing or frequency is lost, the voltage regulator will turn off.

WARNING: Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.
Service Code Detection System

The generator may have to run for long periods of time with no operator present. For that reason, the system is equipped with sensors that automatically shut down the generator in the event of potentially damaging conditions, such as low oil pressure, high temperature, over speed, and other conditions.

The generator’s control board shows service code descriptions scrolling across the digital display. The service code descriptions are listed below:

1. Low Battery Voltage
2. Low Oil Pressure
3. Under Voltage / Over Voltage
4. Engine Does Not Start
5. Low Frequency
6. Engine Overspeed
7. High Oil Temperature
8. Transfer Switch Fault
9. Over Voltage
10. Reserved
11. Reserved
12. Battery Charge Circuit
13. Reserved
14. No Wireless Communication
15. Reserved
16. Generator Sense Failure

- Codes 1-8 will scroll the appropriate service code and blink an LED sequence.
- Codes 9-16 will scroll the appropriate service code.

Reset Service Code Detection System

The operator must reset the service code detection system anytime that a service code is displayed. To do so, press and hold the control board OFF button until the display does not scroll the service codes. Then press and hold the control board OFF button for at least 7 seconds. Once the display turns off, leave it off for at least 30 seconds. Remedy the code condition, then return the home generator to service by pressing and holding the control board AUTO button and installing the 15 Amp fuse (if removed).

If the service code is not corrected, the unit will return to Auto Shutdown and the same service code indication(s) will be displayed.

If more than one service code exists, the control panel will display the codes sequentially.

**NOTICE** Not all service codes will result in unit shutdown.
LOW BATTERY VOLTAGE OR BATTERY CHARGE CIRCUIT

Test #1
Check Battery*

OK? YES

Test #2
Measure Trickle Charge Voltage at Battery

Charge / Replace Battery

Charge / Replace Battery

Test #3
Check Utility Voltage Input

Voltage OK? YES END

240VAC? YES

Test #4
Measure Trickle Charge Voltage at control panel

Greater than 13V? NO

Replace control panel

NO

YES

Check and Repair Fuses, Wiring, and Connections in the ATS

Repair Wiring and/or Connections between control panel and Battery

*Before starting Test #1, ensure that all fuses are installed and are functioning properly
This service code is indicated by Low Battery Voltage or Battery Charge Circuit scrolling across the digital display and the LED will blink repeatedly one time with a pause. This condition occurs if the battery voltage drops below the preset value.

The trickle charge circuit is a float-type charger. When utility voltage is present, the trickle charge circuit in the control panel will maintain the voltage of a fully charged battery. A completely discharged battery will not be capable of powering the digital display. The causes for a low or discharged battery may be:

- Blown fuses in the transfer switch
- Blown fuse in the generator control panel
- Failed battery
- Parasitic drain on the battery
- Failed trickle charger

The circuit functions and test/repair procedures for these conditions are outlined below.

**TEST 1 - Check Battery**

1. Press control panel OFF button.
2. Remove the 15 Amp fuse.
3. Remove fuses from transfer switch.
5. Disconnect the negative (-) battery cable.
6. Disconnect the positive (+) battery cable.
7. Using the approved procedure for your battery tester, check the battery state-of-charge.
   - If the battery is discharged, connect to an appropriate battery charger. Follow manufacturer’s recommendations for the charging the battery.
   - If battery replacement is required, the replacement must be a 12VDC, correctly sized battery. Refer to the installation manual for complete battery information.
8. Reinstall transfer switch fuses.
   - Once battery state-of-charge is satisfactory, proceed to TEST 2 - Check Trickle Charge Voltage at Battery.

**TEST 2 - Check Trickle Charge Voltage at Battery**

There are two methods of testing the battery charge circuit:

- Measure charging current from the battery charge circuit.
- Measure the battery charger output voltage.

Either one can be used, or they can be used in conjunction with each other to confirm a diagnosis.

**Measuring Charging Current**

1. Verify that utility power is present at the generator.
2. Measure the voltage across the battery terminals. Proceed to next step if the battery voltage is less than 13.0V. If the voltage is greater than 13.0V, proceed to TEST 4.

3. Set the clamp meter to measure DC current and place on Wire #13.
   - If no current is measured, proceed to TEST 4.
   - If current is measured, clear fault condition and place control panel in Auto mode.

**TEST 3 - CHECK UTILITY VOLTAGE INPUT**

1. Set the meter to measure AC volts. Referring to the figure below, test for approximately 240 VAC between terminals J7 and J4. If 240 VAC is not present:
   - Remove connector J5 and inspect for 240 VAC between Pin #1 and #2 of connector J5.
   - Inspect and correct the wiring between connector J5 and the transfer switch.
2. Set the meter to measure DC volts. Inspect voltage at connector J3 between Wire #13 and #0. (Inspection to be performed with the connector connected to the control board and test leads inserted into the rear of the connector).
   - If a minimum of 13 VDC is found present at connector J3, but absent at the battery cable/lead terminations, inspect and correct the wire harness between the control board and the battery.
3. If the proceeding steps are not successful in restoring function of the battery charge circuit, the control panel must be replaced.
4. Reinstall the transfer switch fuses.
5. Clear applicable fault codes.
6. Return the generator to standby service

**AT CONTROL PANEL**

**Measuring Battery Charger Output**

1. Set control panel system switch to OFF.
2. Remove the 15 Amp fuse.
3. Inspect the fuse to see if blown.
   - If fuse is good, proceed to Step 4.
   - A blown fuse indicates a short in the circuit. Repair any short and replace fuse before proceeding to Step 4.
4. Disconnect the negative (-) battery cable. Leave positive (+) battery cable connected to the battery.
5. Set the meter to measure DC voltage. Connect positive (+) meter test lead to positive (+) battery terminal.
6. Connect negative (-) meter test lead to negative (-) battery cable.
   - If approximately 13.0 VDC is measured, the test is complete.
   - If battery charge circuit voltage is low, proceed to Step 7.
7. Remove the transfer switch fuses.
8. Remove the generator control panel allowing access to the 5 Amp, 240 VAC canister style fuse located on the rear of the control board. If the fuse is blown, replace with a fuse of identical type and rating and recheck the battery charge circuit.
9. Replace the transfer switch fuses.

**NOTICE** Ensure that the rear of the removed control
LOW OIL PRESSURE

The panel cannot short to ground as the control panel will be energized.

Test #1
Measure for Short-to-Ground on Wire #85

- Shorted?
  - YES: Repair / Replace Wire #85
  - NO: Test #2

Test #2
Check Oil Pressure Switch

- Does LOP Switch Open?
  - YES: Replace System Control Board
  - NO: Test #3

Test #3
Measure Engine Oil Pressure

- Within Spec?
  - YES: Replace Oil Pressure Switch
  - NO: Repair / Replace Engine as Required

Fault Detected?

YES: Reset Fault Code

NO: Reset Fault Code

Start Unit

END
Low Oil Pressure
This service code is indicated by Low Oil Pressure scrolling across the digital display and the remote LED will repeatedly flash twice with a pause. The unit is equipped with an Low Oil Pressure (LOP) switch that uses normally closed contacts held open by engine oil pressure during operation. Should oil pressure drop below the 8 - 10 psi range, the switch contacts close and the engine will shut down. This completes a circuit to ground on Wire #85 and the control panel shuts the engine down.

Correcting Low Oil Pressure
1. Fix any obvious leaks and, if necessary, add the recommended oil to the FULL mark on the dipstick.
2. Reset the service code detection system. See Resetting the Service Code Detection System.
3. Return the standby generator to service by pressing and holding the control board AUTO button and installing the 15 Amp fuse (if removed).

If the low oil pressure condition is not corrected, the unit will return to Auto Shutdown and the same service code indication(s) will be displayed. Proceed to TEST 1 - Measure for Short-to-Ground.

TEST 1 - Measure for Short-to-Ground
1. Press control panel OFF button.
2. Remove the 15 Amp fuse.
3. Remove fuses from transfer switch.
4. Remove screws to gain access to the control panel board.
5. Disconnect the 8-pin connector (J3) from the control panel.
6. Disconnect Wire #85 from the LOP switch.
7. Measure for short-to-ground between Wire #85 and engine block.
   • If no short is detected, proceed to TEST 2 - Check Oil Pressure Switch.
   • If a short is detected, proceed with Steps 8-14.
8. Repair or replace wiring, as necessary, then retest.
9. Reconnect Wire #85 to the LOP switch.
10. Reconnect the 8-pin connector to the control panel.
11. Reinstall the system control panel cover.
12. Reinstall the 15 Amp fuse and transfer switch fuses.
13. Set control panel system switch to ON.
15. Return the standby generator to service by pressing and holding the control board AUTO button.

TEST 2 - Check Oil Pressure Switch
1. With the LOP switch installed and Wire #85 removed, press and hold the control board MANUAL button to start the unit.
2. Check the switch with a continuity tester. The switch contacts should be open (no continuity).

**NOTICE** The switch may be tested separately using a hand/vacuum pump (can apply vacuum or pressure).
• If the switch contacts are open when the engine is running, and wire #85 is not shorted to ground and the unit shuts down, replace the control panel.
• If the switch contacts remain closed, proceed to TEST 3 - Check Engine Oil Pressure.

TEST 3 - Check Engine Oil Pressure
1. Remove the oil pressure switch and install a technician supplied oil pressure gauge.
2. Press and hold the control board MANUAL button to start the unit.
3. Pressure reading on gauge should be 10-50 PSI (0.7-3.5 Bar).
   • If oil pressure is normal and oil switch did not open in Test 2, replace the oil switch and repeat Test 2.
   • If oil pressure is low, see VANGUARD Twin Cylinder OHV Repair Manual (#272144) to troubleshoot the source of the problem.
UNDER VOLTAGE / OVER VOLTAGE

TEST #1
Remove Generator from Load-Side and run in Manual Mode

Voltage Reading within Specification?

YES → END

NO → Test #2
Measure Circuit Breaker (CB) Generator -Side Voltage

240VAC? ±10%?

YES → Test #3
Measure Continuity at Control Panel Sensing Wires

NO → END

YES → Replace control panel

Output OK?

YES → END

NO → Replace Open Wires J8 & J9 Between CB Output and control panel

Output OK?

YES → END

NO → Replace Voltage Regulator

OK?

YES

NO → Output OK?

YES

NO → END

Test #4
Check Alternator

END

WARNING If engine overspeeds rapidly without governor control reducing the throttle after 3600 RPM is attained, be prepared to pull the 15 Amp fuse rapidly in the control panel to prevent damage to various generator components.

TEST #2
Measure Circuit Breaker (CB) Generator -Side Voltage

END

Test #3
Measure Continuity at Control Panel Sensing Wires

Replace control panel

Output OK?

YES → END

NO → Replace Open Wires J8 & J9 Between CB Output and control panel

Output OK?

YES → END

NO → Replace Voltage Regulator

OK?

YES

NO → Output OK?

YES

NO → END

Test #4
Check Alternator

END

WARNING If engine overspeeds rapidly without governor control reducing the throttle after 3600 RPM is attained, be prepared to pull the 15 Amp fuse rapidly in the control panel to prevent damage to various generator components.

END
Under Voltage
The under voltage shutdown feature is designed to protect the generator and its loads from an output voltage that is too low. Sensed at #11 (E1) and #12 (E2) - Between generator breaker and control panel. This service code is indicated by Under Voltage scrolling across the digital display and the remote LED will flash repeatedly three times with a pause.

Under voltage may be caused by:
• All generator circuit breaker lugs on circuit breaker not tight. Ensure lugs are tightened to 45 in-lbs.
• A generator that is overloaded
• A restriction in the fuel flow
• A broken or disconnected signal lead from generator breaker to control panel (#11/E1 and/or #12/E2)
• Diminished engine power
• A failed alternator
• Open wiring
• A failed AVR

TEST 1 - Remove Generator from Load-Side and Run in Manual Mode
1. Ensure the circuit breaker is OFF or OPEN.
2. Press and hold the MANUAL button to start the generator.
3. Check and note the control panel display of output voltage, output frequency, and battery voltage. Verify values are 240VAC±10%, 57 - 62.5 Hz and at 12-14 VDC battery charging.
• If values are not within specifications, proceed to TEST 2 - Measure Circuit Breaker Generator-Side Voltage.
4. Turn Circuit breaker to ON or CLOSED position.
• If a fault occurs, then troubleshoot field wiring to automatic transfer switch for short condition.

TEST 2 - Measure Circuit Breaker Generator-Side Voltage
1. Ensure the circuit breaker is OFF or OPEN.
2. Start the generator and measure for 240VAC±10% on the generator-side of the circuit breaker. If reading is correct proceed to Step 4

NOTICE The operation of the electronic governor depends on voltage output to maintain the speed of the engine. If there is no voltage, the engine may overspeed and mechanical operation of the throttle may be required to prevent overspeeding the engine.

If this is required, disconnect throttle linkage and wire harness from control panel or control box and manually open to full throttle to start (pull throttle linkage away from engine). Once started, push in to maintain a 3600 RPM speed (57 - 62.5 Hz). Verify HZ on Control Panel display and with a meter. If correct proceed to Step 4
• If specified voltage on the generator side of the breaker is NOT present, proceed to TEST 4 - Check Alternator.
3. If there is voltage on the generator side of the breaker, but none on the load-side, manually cycle the circuit breaker and retest. If there is still no voltage on the load-side, replace the circuit breaker.
4. Proceed to TEST 3 - MEASURE CONTINUITY AT CONTROL PANEL SENSING WIRES.

TEST 3 - Measure Continuity at Control Panel Sensing Wires
NOTICE Use care when obtaining measurements on wires. It is possible to short terminals to control panel electrical components.
1. Ensure the circuit breaker is OFF or OPEN and the generator is OFF.
2. Ensure Utility power circuit breaker is OFF at the Transfer Switch.
3. Disconnect the sensing wires #11/E1 and #12/E2 from the generator circuit breaker.
4. Open the control panel and disconnect #11/E1 and #12/E2 from pins J8 and J9 on the control panel.
5. Measure continuity on each wire. If a reading of infinity (OL) is discovered (open), replace the wire accordingly.
• If the sensing wires provide an ohm reading OTHER than infinity- replace the control panel.
• If, after replacing the Control Panel, a fault is still present, proceed to TEST 4 - CHECK ALTERNATOR.

TEST 4 - Check Alternator
There are two methods of testing the alternator windings:
1. Measuring the rotor resistance and comparing to the specifications.
2. Bypassing the Automatic Voltage Regulator (AVR).
They can be used in conjunction with each other to confirm a diagnosis.
Measure Winding Resistance

Prior to measuring resistance, perform the following steps:
1. Press and hold the control panel OFF button.
2. Remove the 15 Amp fuse.
3. Remove fuses from transfer switch.
4. Remove screws to gain access to the circuit breaker and neutral connection at the generator.
5. Disconnect the power wires #11 and #44 from the circuit breaker.
6. Disconnect wires #22 from the neutral lug.
7. Disconnect all the wires from the voltage regulator.

Test Stator AC Power Windings

1. Set meter to measure Ohms.
2. Connect the test leads to stator wires #11 and #22.
3. Measure the resistance and compare it to the nominal resistance to the specifications listed in the “SPECIFICATIONS” section (page 70).
4. Connect the test leads to stator wires #22 and #44.
5. Measure the resistance and compare it to the nominal resistance listed in the “SPECIFICATIONS” section (page 70).
   - A reading within the specifications listed is acceptable.
   - A reading of infinity (O.L.) or high resistance indicates an opening in the power winding. Replace the stator.
   - A low reading indicates a shorted stator winding. Replace the stator.
6. Connect one meter test lead to a proper ground on the engine or alternator. Connect the other test lead to the stator power windings. (Test each: Wire #11 and Wire #44)
   - A reading of infinity (O.L.) should be measured.
   - A reading other than infinity indicates a stator winding is shorted to ground. Replace the stator.

Test Stator Excitation Winding

The excitation wires are numbered #2 and #6. The excitation wires were disconnected from the voltage regulator earlier in Measuring Winding Resistance.
1. Set meter to measure Ohms.
2. Connect the test leads to the stator excitation wires #2 and #6.
3. Measure the resistance and compare it to the specifications listed in the “SPECIFICATIONS” section (page 70).
   - A reading within the specifications listed is acceptable.
   - A reading of infinity or high resistance indicates an opening in the excitation winding. Replace the stator.
   - A low reading indicates a shorted stator winding. Replace the stator.
4. Connect one test lead to a stator power wire #11 or #44. Connect the other test lead to one of the excitation wires (#2 or #6).
   - A reading of infinity should be measured.
   - A reading other than infinity indicates a power winding shorted to an excitation winding. Replace the stator.

Check Rotor Resistance Through the Brush Wires

In an effort to eliminate the need to disassemble the engine/alternator assembly, the rotor resistance can be measured through the brush wires. This may not provide conclusive results. Resistance measured through the brush wires #1 and #4 will likely result in a slightly higher reading than the specifications listed in the “SPECIFICATIONS” section (page 70). If a measurement is not within 10% of specifications listed in the “SPECIFICATIONS” section (page 70), a rotor amperage test must be performed. To check the rotor resistance:
1. Set meter to measure Ohms.
2. Connect the test leads to the brush wires.
3. Measure the rotor resistance. Compare it to the nominal resistance from the specifications listed in the “SPECIFICATIONS” section (page 70).
   - A reading of infinity or a very high resistance indicates an open circuit or a partially open condition in the rotor windings. Before replacing the rotor, proceed to Bypass the Automatic Voltage Regulator (AVR).
   - A very low resistance indicates a shorted rotor. Replace the rotor. Before replacing the rotor, proceed to Bypass the Automatic Voltage Regulator (AVR).
   - If resistance is within specifications, proceed to Step 4.
4. Connect one test lead to a proper metal ground on the engine or alternator and the other test lead to either brush wire.
   - A reading other than infinity indicates a rotor winding shorted to the rotor shaft. Replace the rotor. *
Bypass the Automatic Voltage Regulator (AVR)

Bypassing the AVR will test all wiring and windings within the alternator without disassembly of the generator. There are two AC Voltage checks and one DC Amperage test to be performed. The exact readings may vary depending on ambient temperature, battery voltage, meter calibration, etc. This test requires a fully charged 12V battery.

An open winding in the rotor could cause lowered voltage readings during these tests. Check and record all the voltage readings first, then check and record the amperage draw on the rotor.

1. Press control panel OFF button.
2. Remove the 15 Amp fuse.
3. Switch the generator circuit breaker OFF.
4. Disconnect all wires from the AVR.
5. Set meter to measure AC voltage. Connect one test lead to Wire #2 and the other lead to Wire #6.
6. Connect a jumper wire from battery positive (+) to one brush wire #4.
   • NOTE: Install a low amperage fuse (not provided) in line to protect the rotor from an inadvertent short from the battery.
   • Connect a jumper from battery negative (-) to the other brush wire #1.
7. Reinstall the 15 Amp fuse.
8. Manually start the unit and measure AC voltage across Wire #2 and Wire #6. A minimum of 60VAC should be measured.
9. Press control panel OFF button.
10. Connect one test lead to Wire #11A and the other lead to Wire #44A.
11. Manually start the unit and measure AC voltage across Wire #11A and Wire #44A. 100VAC minimum should be measured.

There is one DC Amperage test to perform. The exact amperage readings may vary depending on ambient temperature, battery voltage, meter calibration, etc.

1. Set meter to measure DC Amperage.
2. Connect the meter in series between battery positive (+) and brush wire #4.
   • NOTE: Install a low amperage fuse (not provided) in line to protect the rotor from an inadvertent short from the battery.
   Refer to the operation/instruction manual for the meter you are using for correct test lead locations and meter settings.
3. Connect a jumper wire in series between the 12V battery negative (-) and the other brush wire #1.
4. Measure the amperage draw first with the engine off. Then, manually start the unit and measure DC Amperage. Reading should always be .6 - .75Amps, whether the engine is off or running.
5. Disconnect the battery from the jumpers.
6. Restore wiring connections to the circuit breaker and the AVR.
7. Analyze test results as follows:
   • If all readings are within the spec, the alternator is good and the voltage regulator is suspect.
   • If amperage reading is within the range, and one or more of the voltage readings are low, the stator is suspect.
   • High amperage indicates a short in the rotor. Verify battery voltage, wiring, and connections. Repair as necessary, then retest. If the reading is still high, replace the rotor.
   • Low or no amperage indicates an open circuit in the rotor. Verify the meter’s fuse is good and check the battery voltage, wiring and connections. Repair as necessary, then retest. If reading is still low, replace the rotor.
Use this flowchart if engine cranks but does not start.
Whenever the unit is directed to start (Manual or Auto), the control panel delivers 12VDC from Pin #3, Wire #56 to the starter contactor for 10 seconds. If there is a no-start condition, it pauses for 10 seconds and it will continue for 6 starting attempts.

During the starting attempt, the control panel also delivers 12 VDC from Pin #4, Wire #14 to the fuel solenoid and monitors wires for a minimum voltage signal. The signal indicates that the engine has started and delivery of voltage to the starter contactor is discontinued.

This service code is indicated by Engine Does Not Start scrolling across the digital display and the remote LED will flash repeatedly four times with a pause.

A no-start condition may be caused by:
- No or low alternator output voltage
- Inadequate fuel supply
- Incorrect fuel selector setting
- Fuel solenoid not opening
- Fuel supply discrepancies
- Starter motor damaged
- Loose electronic governor connection
- Starter motor connections loose
- Engine component damage
- Clogged engine air filter
- Worn or fouled spark plugs
- Damaged wiring or loose connections
- Clogged atmospheric vent on regulator

Troubleshooting Engine No-Start Conditions
1. Start the standby generator by pressing and holding the manual start button.

The engine will either crank and not start, or it may not crank at all. Use TESTS 1-6 for starting problems and TEST 7-10 for cranking problems.

Starting Problems
If the engine starts but shuts down and Engine Does Not Start scrolls across the digital display, the condition is caused by no voltage or frequency on the control panel. A short circuit in the main breaker or wiring could be the cause. Use Under Voltage or Over Voltage troubleshooting for this condition.

TEST 1 - Visually Inspect Generator
1. Open roof and remove panels to the unit.
2. Remove the 15 Amp fuse from the control panel, then inspect for any obvious broken or corroded electrical connections.
3. Remove the screws to gain access to the control panel board. See How to Access the Control Panel Board.
4. Visually inspect the condition of all wiring, connectors, and terminals associated with the following components:
   - Oil Pressure and Oil Temperature
   - Spark plug Lead (Remove the lead and ensure the plug is tight)
   - Starter Contactor
   - Fuel Solenoid
   - Generator and Engine Grounds
   - Starter Motor
   - All component connections
   - The control panel connections and each of their wires
5. Repair or replace any damaged wiring or terminal connections.
6. Reset the service code detection system. See Resetting the Service Code Detection System.
7. Press and hold the manual start button to start unit.
8. If there are no obvious electrical faults, and the problem persists, proceed to TEST 2 - Fuel Delivery System.

TEST 2 - Check Fuel Delivery System
1. Ensure that adequate fuel supply is available to operate the system.
2. Verify that the main fuel supply valve and any in-line fuel valves are open.
3. Correct any fuel supply problems.
4. Press and hold the system switch to start the unit.
5. If the unit still does not start, proceed to TEST 3 - Check Fuel Supply Pressure.
TEST 3 - Check Fuel Supply Pressure

1. Turn **OFF** fuel valve supplying fuel to generator.
2. Remove test port plug. The installer supplied test port should have been installed with the fuel supply system during the original installation process.

**NOTICE** If no port is available in the fuel line to validate fuel pressure, proceed to TEST 4 - Check Fuel Solenoid, items #5 through #7, to use the test port in the fuel regulator to review fuel supply pressure.

3. Install Briggs & Stratton Manometer #19495, in fuel supply line, as close to the generator as possible, to verify that the specified fuel pressure is available to the fuel solenoid.
4. Turn **ON** manual fuel valve.
5. Measure generator inlet fuel pressure. Fuel pressure should measure 11-14 in. wc (LP) or 5-7 in. wc (NG) with all gas appliances turned on and operating.

- If the proper fuel pressure is not present, repair or replace the fuel delivery system, then retest the fuel pressure as described above.

**NOTICE** Positive fuel pressure is required while attempting to start the generator and typically no more than a 1-2” W.C. drop should be seen between specified static fuel pressure and starting fuel pressure.

- If fuel pressure is acceptable, proceed to TEST 4 - Check Fuel Solenoid.

TEST 4 - Check Fuel Solenoid and Thermal Fuses

1. Set meter to read DC Volts.
2. Connect positive (+) test lead to Wire #14, at fuel solenoid.
3. Connect negative (-) test lead to ground.
4. Measure DC Volts at fuel solenoid while the engine is cranking. No voltage will be present when the system pauses between cranks. When the solenoid activates, an audible click can be heard at the solenoid. This is an indication that the solenoid is opening properly.

- If no voltage is present, proceed to Step 8.
- If voltage in present at the fuel solenoid, proceed to Step 5.
5. Remove the pipe plug in the regulator test port and install Briggs & Stratton Manometer #19495.
6. Ensure the fuel supply valves are **ON**.
7. Using a jumper wire, connect 12VDC to Wire #14 at the fuel solenoid. Fuel pressure should measure 11-14 in. wc (LP) or 5-7 in. wc (NG).

- If the proper fuel pressure is not present, repair or replace the fuel delivery system, then retest the fuel pressure as described above.
- If no fuel pressure in measured, replace the fuel solenoid.
- If fuel pressure is measured within specifications, the solenoid is good. Proceed to TEST 5 - Check Fuel Regulator.
8. Set meter to read resistance.
9. Check thermal fuse to ground connection by measuring the impedance from Wire #14 and fuel solenoid to ground.
10. Connect positive (+) meter test lead to Wire #14 at fuel solenoid.
11. Connect negative (-) meter lead to ground.
12. Measure resistance. The resistance should be less than 30 Ohms.

- If it does not, proceed to Step 13.
13. Set meter to read DC volts.
14. Remove the screws to gain access to the control panel.
15. Connect positive (+) meter test lead to Pin #4, Wire #14.
16. Connect negative (-) meter lead to ground.
17. Measure DC volts while cranking.

- If no voltage is measured at the control panel, replace the control panel.
- If voltage is measured at the control panel, but not at the solenoid, repair or replace the wiring between the control panel board and the fuel solenoid (Wire #14).

**TEST 5 - Check Fuel Regulator**

The fuel regulator has two atmospheric vent holes that balance diaphragm pressures.

1. Install a 1/8 NPT barbed fitting into one hole. Attach a 2 foot length of hose to the fitting.
2. Plug the other vent hole, then gently blow into the hose.

When the fuel solenoid is energized (open) with battery voltage, this gentle pressure will allow fuel to pass through the regulator and will be indicated on the manometer as a decrease in pressure.

- If no fuel flow is detected, replace the fuel regulator.
- If fuel flow is detected, proceed to TEST 6 - Check Spark.
TEST 6 - Check Spark

1. With spark plugs installed, attach Briggs & Stratton Ignition Tester #19368 to each spark plug lead. Connect the other end of the tester to a good engine ground.
   • If spark jumps the tester gap the ignition armature is working correctly, proceed to Step 2.
   • If spark does not jump the gap, the ignition armature is not functioning. See VANGUARD TWIN CYLINDER OHV Repair Manual #272144 to troubleshoot the ignition system.

2. If the engine runs, but misses under load, test the ignition by installing Briggs & Stratton Ignition Tester #19368 to a spark plug lead and each spark plug.

3. Press and hold control panel system switch to start unit.
   • If spark jumps the tester gap, the ignition system is functioning properly. The color of the spark is not important.
   • If there is no spark during the test, but there was spark during Step 2, replace the spark plug and test again. If still no spark, see VANGUARD TWIN CYLINDER OHV Repair Manual #272144 for further troubleshooting.
   • Repeat this test on the other cylinder to test for proper spark of both plugs.
The engine will either crank and it will not start, or it may not crank at all. Use this flowchart if engine does not crank.
Cranking Problems

TEST 7 - Check Battery Components

⚠️ WARNING Battery posts, terminals and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands after handling.

1. Check the condition and electrical integrity of the battery and all wires, connectors, and cables throughout the unit. Some areas for particular focus are:
   - Battery state of charge
   - Battery connections
   - Generator grounds, wiring, and connections
   - Starter contactor
2. Inspect the 15 Amp fuse. Replace if necessary. If the fuse is replaced, reset the service code detection system. See Resetting the Service code Detection System.
3. Remove the screws to gain access to the control panel board. See How to Access Control Panel Board.
4. Make sure all the wires and connections are securely attached to the back of the control panel board.
5. Check the unit grounding cables and connections.
6. If electrical components are OK, proceed to TEST 8 - Check Starter Contactor Signal.

TEST 8 - Check Starter Relay Signal

1. Press and hold control panel OFF button.
2. Reset the service code detection system. See Resetting the Service code Detection System.
3. Gain access to the starter relay located near the starter.
4. Connect the positive (+) test lead of the meter to Wire #56 and the relay terminal. Connect the negative (-) test lead to of the meter to ground.
5. Start the standby generator by pressing and holding the control board MANUAL button.
6. While the engine start cycle is in progress, the voltage reading should be above 9.6VDC. Remember that the control panel only delivers 12VDC to the starter contactor for 10 seconds then pauses.
   - If voltage is present, but the starter won’t engage, proceed to TEST 10 - Check Starter Solenoid Connection.
   - If no voltage is present, remove wire #56 to the relay terminal and repeat steps 4-6 measuring voltage at the wire.
   - If no voltage is still present, the proceed to Test 9 - Check Control Panel Board Output.

TEST 9 - Check Control Panel Board Output

1. During the crank cycle, measure the DC Voltage between Pin #3, Wire #56, and ground at Pin #2, Wire #0.
   - If no voltage is measured at the control board, replace the control panel.
   - Reset the exercise timer. See Resetting the Exercise Timer.
   - If voltage is measured, repair or replace wiring between the control panel and the starter contactor.
2. Measure the voltage at the starter motor. The reading should be above 9.6VDC between the starter terminal and ground while cranking.

TEST 10 - Check Starter Solenoid Connection

1. Verify battery voltage at the positive lug located on the starter.
2. Verify battery voltage at starter relay wire #13.
   - Wire #13 may be labeled as #99 on some units.
   - If no voltage is present, repair or replace wiring between starter and battery and/or starter and relay.
3. During crank cycle, measure DC voltage at solenoid control wire lug and ground.
   - If no voltage is present, repair or replace wiring between relay and solenoid and/or replace starter relay.
   - If voltage is present but the starter does not engage, proceed to TEST 11 - Check Starter Motor.

TEST 11 - Check Starter Motor

Refer to VANGUARD Twin Cylinder OHV Repair Manual #272144 for procedure to check the condition of the engine starter motor.
LOW FREQUENCY / ENGINE OVERSPEED

Test #1
Check No-Load Frequency

Within Specs?

YES

Test #2
Check Full-Load Frequency

Within Specs?

YES

Test #3
Measure Frequency at Control Panel

Within Specs?

YES

YES

Generator shuts down on low frequency?

YES

Replace control panel

NO

Repair/Replace wiring

NO

Perform Tests #2 and #3 in Engine Does Not Start Section

Inspect and Test Stepper Motor and linkages

NO

Perform Alternator tests in Under Voltage section. Use Test #3

YES

END
This feature protects devices connected to the transfer switch by shutting the generator down if the engine runs slower than 55 Hz for three seconds. This service code is indicated by Low Frequency scrolling across the digital display and the remote LED will flash repeatedly five times with a pause. This condition may be caused by:
- A failed engine component
- A problem with the electronic governor system
- Excessive loads on the generator
- A restricted air filter
- A problem in the generator sense wiring
- Problem with the fuel delivery system
- Engine that is producing insufficient power
- A problem in the control panel

**TEST 1 - Check No-Load Frequency**

For the following procedures, we recommend the use of Briggs & Stratton Digital Tach and Hour Meter #19389.

**Generator frequency specification is 58.5-61.5 Hz (3600±100 RPM)**

1. Remove the screws to gain access to the main circuit breaker.
2. Reset the service code detection system. See Resetting the Service code Detection System.
3. Switch the generator circuit breaker is OFF or open.
4. Start the standby generator by pressing and holding the control board MANUAL button.
5. Measure frequency at the generator side of circuit breaker.
   - If frequency at no-load is correct, proceed to TEST 2 - Check Full-Load Frequency.
   - If measured frequency is not correct, perform alternator tests per Under Voltage Section. Repair or replace alternator as indicated.

**TEST 2 - Check Full-Load Frequency**

Perform the following test under full electrical loads with all gaseous fuel appliances turned on and operating.

**Generator frequency specification is 58.5-61.5 Hz (3600±100 RPM)**

1. Remove the screws to gain access to the main circuit breaker.
2. Reset the service code detection system. See Resetting the Service code Detection System.
3. Switch the generator circuit breaker is ON or closed.
4. Start the standby generator by pressing and holding the control board MANUAL button.
5. Measure frequency at the generator side of circuit breaker after ATS has transferred the load.
   - If the frequency is correct, restore utility power then proceed to TEST 3 - Measure Frequency Control Panel.
   - If measured frequency is not correct, perform alternator tests per Under Voltage Section. Repair or replace alternator as indicated.

**TEST 3 - Measure Frequency at Control Panel**

1. With the unit running unloaded, measure the frequency at J8 and J9 at the control panel pins.
   - If the frequency is not correct, repair or replace the wiring between the circuit breaker and #E1 and #E2 at the control panel. Then re-test the frequency at #E1 and #E2.
   - If the frequency is correct but the generator continues to shut down for low frequency and the alternator tests “good,” replace the control panel board.

The control panel monitors generator output frequency. If the generator output frequency increases to 65Hz - 70Hz, the control panel waits three seconds before shutting the unit down. Should the frequency exceed 70Hz, the control panel will shut down the generator immediately. This service code is indicated by Engine Overspeed scrolling across the digital display.

**NOTICE** The stepper motor must be mounted in the center of the mounting slots that secure the motor to the generator. If linkage is binding, correct binding or increase clearance between bulkhead slot and linkage to make sure linkage is free. Repeat Step 5. If linkage is OK, proceed to TEST 3 - Measure Frequency at Control Panel.
ENGINE OVERSPEED

This feature protects devices connected to the transfer switch by shutting the generator down if the engine runs slower than 65 Hz for three seconds or longer, or if it exceeds 70 Hz.

This service code is indicated by Engine Overspeed scrolling across the digital display and the remote LED will flash repeatedly five times with a pause.

This condition may be caused by:
- A failed engine component
- A problem with the electronic governor system
- A problem in the generator sense wiring
- Problem with the fuel delivery system
- A problem in the control panel
- Binding of the control throttle linkage
- An uncalibrated stepper motor position
- Short circuit in starter or rotor winding
- Problem with the AVR

⚠️ WARNING If engine overspeeds rapidly without governor control reducing the throttle after 3600 RPM is attained, be prepared to pull the 15 Amp fuse rapidly in the control panel to prevent damage to various generator components.

TEST 1 - Check No-Load Frequency

For the following procedures, we recommend the use of Briggs & Stratton Digital Tach and Hour Meter #19389.

Generator frequency specification is 58.5-61.5 Hz (3600±100 RPM)

1. Remove the screws to gain access to the main circuit breaker.
2. Reset the service code detection system. See Resetting the Service code Detection System.
3. Switch the generator circuit breaker is OFF or open.
4. Start the standby generator by pressing and holding the control board MANUAL button.
5. Measure frequency at the generator side of circuit breaker.
   - If frequency at no-load is correct, proceed to TEST 2 - Check Full-Load Frequency.
   - If measured frequency is not correct, perform alternator tests per Under Voltage Section. Repair or replace alternator as indicated.

TEST 2 - Check Full-Load Frequency

Perform the following test under full electrical loads with all gaseous fuel appliances turned on and operating.

Generator frequency specification is 58.5-61.5 Hz (3600±100 RPM)

1. Remove the screws to gain access to the main circuit breaker.
2. Reset the service code detection system. See Resetting the Service code Detection System.
3. Switch the generator circuit breaker is ON.
4. Start the standby generator by pressing and holding the control board MANUAL button.
5. Measure frequency at the generator side of circuit breaker.
   - If the frequency is correct, restore utility power then proceed to TEST 3 - Measure Frequency Control Panel.
   - If measured frequency is not correct, perform alternator tests per Under Voltage Section. Repair or replace alternator as indicated.

TEST 3 - Measure Frequency at Control Panel

1. With the unit running unloaded, measure the frequency at J8 and J9 at the control panel pins.
   - If no voltage or frequency is present, proceed to Troubleshooting the AVR and then validating the alternator windings.

NOTICE The stepper motor must be mounted in the center of the mounting slots that secure the motor to the generator. If linkage is binding, correct binding or increase clearance between bulkhead and linkage to make sure linkage is free. Repeat Step 5. If linkage is OK, proceed to TEST 3 - Measure Frequency at Control Panel.
HIGH OIL TEMPERATURE

*Check and correct oil level and blocked air passages. Ensure all enclosure panels are in place before performing Test #1

Test #1
Check Oil Temperature Switch (OTS)*

- Shorted?
  - YES: Replace OTS. Reset Fault Detection. Start Unit.
  - NO: OK? YES → END

- OK?
  - YES → END
  - NO: Replace control panel

Test #2
- Check Wire #95
- Check Oil Switch Ground Wire
- Check Control Panel Ground Wire at J3 PIN #2

- Shorted?
  - YES: Repair / Replace Affected Wires
  - NO: OK? YES → END
  - NO: Replace control panel

- OK?
  - YES → END
  - NO: Reset Fault Detection. Start Unit
The contacts of the Over-Temperature Switch (OTS) are normally open. If the engine temperature exceeds approximately 320°F (160°C), the switch closes and the engine shuts down.

This service code is indicated by High Temperature scrolling across and the remote LED will flash repeatedly seven times with a pause.

- Common causes for high oil temperature include:
  - Low oil level
  - Running the unit with an access door removed
  - Obstructed air inlet or exhaust port
  - Debris in the engine compartment
  - Running unit with roof open

Inspect for and correct these conditions before checking the OTS. Once the problem is corrected, reset the service code detection system. See Resetting the Service code Detection System.

**TEST 1 - Check Over Temperature Switch**

1. Press and hold the control panel OFF button.
2. Remove the 15 Amp fuse.
3. Locate the Over-Temperature Switch (OTS) located by the oil drain hose near the starter motor.
4. With the engine cold, check for continuity between switch terminals.
   - No continuity should be measured with the engine cold or at normal operating temperature,
   - If continuity, replace the OTS.

**TEST 2 - Check Wire #95**

1. Gain access to the control panel. See How to Access the Control Panel Board.
2. Disconnect the 8-pin connector (J3) from the control panel board and disconnect Wire #95 from the OTS.
3. Measure for short-to-ground between Wire #95 and the engine block.
   - If a short-to-ground is present, repair or replace the wiring as necessary.
   - If no short-to-ground is present, replace the control panel.
TRANSFER SWITCH FAULT

A transfer switch fault indicates an open circuit within the switch, which can occur:
- At the fuse(s)
- In the contactor coils
- In the limit switches
- In the factory wiring

Because an open circuit can occur in variable places, generator symptoms may vary. A visual inspection is generally sufficient to determine the source.

*The most likely cause of this service code is a blown fuse in the transfer switch or incorrect setting of dipswitches.*

This service code is indicated by *Transfer Switch Service Code* scrolling across the digital display (if transfer switch is equipped with service code detection).
- The service code will display if a code occurs while the unit is stopped and set in **AUTO** mode.
- The service code will not display if a code occurs while the unit is running in Exercise, Manual, or Utility mode.
- The unit will not shut down if a code occurs while the unit is delivering standby power. But the service code will display when power transfer back to the utility and the generator has stopped running.

**Setting Dipswitches**

Dipswitches are used to adjust control board operation based on generator capacity. DPSW1 and DPSW2 switches are set to correspond to total system kW rating. Dipswitch DPSW1 (A) has units of 1,000 watts; Dipswitch DPSW2 (B) has units of 10,000 watts.

**NOTICE** Use extreme caution when setting dipswitches or damage to control board will result.
- Use a pencil or small piece of plastic to set the dipswitch.
- NEVER use a screwdriver or any type of metal object to set dipswitches.

Set dipswitches with utility and generator power removed from the transfer switch to ensure proper control system operation. If dipswitches are set when power is present at transfer switch, a power reset needs to be performed before the new dipswitch settings will take effect. Power reset is when all power is removed from the transfer switch and then reintroduced after 30 seconds. The “On” position for the dipswitches is the switch number ON THE TRANSFER SWITCH CONTROL BOARD, not on the switch. For example, for an 18,000 watt generator, set DPSW2 dipswitch 10 to “On” position. Set DPSW1 dipswitch 8 to “On” position. 10,000 plus 8000 equals 18,000 watts. Set only one switch to “On” position on DPSW1 and DPSW2.

- If generator is installed in an area regularly subjected to temperatures below 40°F (4°C), select a 50 second warm up time by moving jumper JP2 (C) installed on transfer switch control board from ‘20’ position to ‘50’ position.
- Set the DPSW1 (A) and DPSW2 (B) dipswitches on the transfer switch control board to match the kW rating of the standby generator, as described in Setting Dipswitches.

Refer to following chart for proper switch selection(s).

<table>
<thead>
<tr>
<th>kW Rating of Generator</th>
<th>DPSW #1 “ON” Position</th>
<th>DPSW #2 “ON” Position</th>
</tr>
</thead>
<tbody>
<tr>
<td>7kW</td>
<td>7</td>
<td>0</td>
</tr>
<tr>
<td>8kW</td>
<td>8</td>
<td>0</td>
</tr>
<tr>
<td>9kW</td>
<td>9</td>
<td>0</td>
</tr>
<tr>
<td>10kW*</td>
<td>0</td>
<td>10</td>
</tr>
<tr>
<td>11kW*</td>
<td>1</td>
<td>10</td>
</tr>
<tr>
<td>12kW</td>
<td>2</td>
<td>10</td>
</tr>
<tr>
<td>13kW*</td>
<td>3</td>
<td>10</td>
</tr>
<tr>
<td>14kW</td>
<td>4</td>
<td>10</td>
</tr>
<tr>
<td>15kW</td>
<td>5</td>
<td>10</td>
</tr>
<tr>
<td>16kW</td>
<td>6</td>
<td>10</td>
</tr>
<tr>
<td>17kW</td>
<td>7</td>
<td>10</td>
</tr>
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<td>18kW</td>
<td>8</td>
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<tr>
<td>19kW</td>
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<tr>
<td>50kW</td>
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<td>50</td>
</tr>
<tr>
<td>60kW</td>
<td>0</td>
<td>60</td>
</tr>
</tbody>
</table>

* For generators with a rating that includes 500 Watts, round down to next lowest rating (example: 13.5 kW set to 13kW)
Intentionally Left Blank
TEST #1
Reset Control Panel

Does Code Return? NO

Is a wireless monitor used? NO
Replace Control Panel

YES

TEST #2
Turn off Wireless Monitor

Does Code Return? YES
Replace Control Panel

NO

TEST #3
Test and Relink Wireless Monitor

Correct number of connected wireless devices? YES

NO
Inspect and Verify Antenna Cable Assembly

Perform second relinking test? NO

YES
Replace Wireless Monitor

END
This service code is indicated by Battery Charge Circuit scrolling across the digital display and the LED will blink repeatedly one time with a pause. This condition occurs if the battery voltage drops below the preset value.

The trickle charge circuit is a float-type charger. When utility voltage is present, the trickle charge circuit in the control panel will maintain the voltage of a fully charged battery. A completely discharged battery will not be capable of powering the digital display. The causes for a low or discharged battery may be:

• Blown fuses in the transfer switch
• Blown fuse in the generator control panel
• Failed battery
• Parasitic drain on the battery
• Failed trickle charger

The circuit functions and test/repair procedures for these conditions are outlined below.

TEST 1 - Check Battery
1. Press control panel OFF button.
2. Remove the 15 Amp fuse.
3. Remove fuses from transfer switch.
4. Inspect removed fuses from transfer switch for continuity. A blown fuse indicates a short in the circuit. Repair and short and replace fuse before proceeding.
5. Disconnect the negative (-) battery cable.
6. Connect the negative (-) battery cable.
7. Using the approved procedure for your battery tester, check the battery state-of-charge.
   • If the battery is discharged, connect to an appropriate battery charger. Set the charger at 2 Amps until a full charge is indicated. DO NOT exceed the 2 Amp charge rate.
   • If battery replacement is required, the replacement must be a 12VDC, correctly sized battery. Refer to the installation manual for complete battery information.
8. Reinstall transfer switch fuses.
   • Once battery state-of-charge is satisfactory, proceed to TEST 2 - Check Trickle Charge Voltage at Battery.

TEST 2 - Check Trickle Charge Voltage at Battery
Testing of the trickle charge may be performed with a DC Amp Clamp used at Wire #13. (Approximately 1 Amp).

OR
1. Set control panel system switch to OFF.
2. Remove the 15 Amp fuse.
3. Inspect the fuse to see if blown.
   • If fuse is good, proceed to Step 4.
   • A blown fuse indicates a short in the circuit. Repair any short and replace fuse before proceeding to Step 4.
4. Disconnect the negative (-) battery cable. Leave positive (+) battery cable connected to the battery.
5. Set the meter to measure DC voltage. Connect positive (+) meter test lead to positive (+) battery terminal.
6. Connect negative (-) meter test lead to negative (-) battery cable.
   • If approximately 13.0 VDC is measured, proceed to Step 7.
   • If battery voltage is low, proceed to Step 7 under Check Battery.
7. Remove the transfer switch fuses.
8. Remove the generator control panel allowing access to the 5 Amp, 240 VAC canister style fuse located on the rear of the control board. If the fuse is blown, replace with a fuse of identical type and rating and recheck the battery charge circuit.
9. Replace the transfer switch fuses. Ensure that the rear of the removed control panel cannot short to ground as the control panel will be energized.
10. Set the meter to measure AC volts. Test for approximately 240 VAC between terminals J7 and J4. If 240 VAC is not present:
    • Remove connector J5 and inspect for 240 VAC between Pin #1 and #2 of connector J5.
    • Inspect and correct the wiring between connector J5 and the transfer switch.
11. Set the meter to measure DC volts. Inspect voltage at connector J3 between Wire #13 and #0. (Inspection to be performed with the connector connected to the control board and test leads inserted into the rear of the connector).
    • If a minimum of 13 VDC is found present at connector J3, but absent at the battery cable/lead terminations, inspect and correct the wire harness between the control board and the battery.
12. If the proceeding steps are not successful in restoring function of the battery charge circuit, the control panel must be replaced.
13. Reinstall the 15 Amp control board fuse and the transfer switch fuses.
15. Return the generator to standby service.
SECTION 3 - UNIT DISASSEMBLY
Open roof
1. Insert key into lock (A) of front panel. Gently push down on roof above the lock to aid in turning the key. Turn key one quarter turn clockwise.

2. Lift roof to the open position.

Disconnect Gas Springs from Roof
1. Hold left hand gas spring upper nut with a wrench or socket. Loosen and remove upper gas spring shoulder bolt using an Allen wrench (C).

2. Compress left hand gas spring and tuck behind flange (D) as shown.

3. Repeat for right hand gas spring.


Remove Roof
1. Hold left hand roof hinge nut with wrench or socket. Loosen and remove roof hinge shoulder bolt using an Allen wrench (E).

2. Repeat for right hand roof hinge.

3. Lift the roof from the unit and set aside.

Remove front panel
1. Remove the two bolts (B) that secure the panel to the unit.

2. Lift panel to remove from unit.

Remove rear panel
1. Remove the two bolts (F) that secure the panel to the unit.

2. Lift panel to remove from unit.

Remove battery panel
1. Remove the two bolts (G) that secure the panel to the unit.

2. Lift up on panel and remove.

Remove Battery
1. Disconnect the negative battery cable.

2. Disconnect the positive battery cable.

3. Remove battery and set aside.
Disconnect the Alternator Wiring
1. Remove the three mounting screws that secure the control panel cover. Remove cover and set aside.
2. Remove the four mounting screws that secure the control panel to the electrical box.
3. Disconnect the generator side wiring from the circuit breaker.
4. Disconnect Wire #22 from the neutral lug and the ground wire from the ground lug.
5. Remove wires #44A, 11A, 2 and 6 from the AVR.
6. Disconnect wire harness, then gather wire and push them through the grommet.
7. Gather the disconnected wires and gently feed them out of the bottom of the control box.

Remove Left Hand Enclosure Panel
1. Using a socket and extensions as required, remove the three screws (A) that secure the left hand roof support to the base.
2. Remove the screw (B) securing the left hand shear brace to the base.
3. Remove the screws (C) securing the rear horizontal brace from the upper portion of the left hand and right hand roof supports. Remove the rear horizontal brace and set aside.
4. Remove the screws (D) securing the fore/aft strap to the left hand panel. Remove the strap and set aside.

NOTE Removal of this strap allows the left hand panel to be flexed open, thus allowing it to clear the alternator intake and the exhaust ducting.
5. Remove the left hand panel front screw (E). Remove the left hand panel and related from the unit and set aside.

Disconnect Engine Wiring and Fuel Hose
1. Disconnect battery ground cable from engine block.
2. Disconnect the wire from the oil pressure switch.
3. Disconnect the wires from the temperature sensor.
4. Disconnect the wire from the oil warmer(s) (if equipped).
5. Disconnect the wires from the starter motor.
6. Disconnect clevis at stepper motor arm by unsnapping clevis from push rod. Push rod may then be disconnected from clevis and stepper motor arm.
7. Disconnect fuel supply hose from mixer, plug hose and mixer inlet.
Remove Muffler Box

1. Using socket and extensions as required, remove the five screws that secure the muffler box to the base.
2. Remove the muffler box from the unit and set aside.

**NOTICE** Care should be taken when removing the muffler box from the unit.

- The muffler box should be moved slightly up to clear the alternator intake ducting, then may be pulled toward the left side of the unit such that the muffler clears the muffler box.

3. Remove the clips that secure the rear of the alternator inlet duct. Remove and set aside.

4. Remove the four shoulder bolts that secure the formed portion of the alternator inlet duct. Remove the formed portion of the duct and set aside.
Engine and Alternator Removal

1. Remove the alternator intake ducting.
2. Remove the four stator bolts (A).
3. Remove the two bolts that connect the alternator to the crankcase.
4. Remove the brushes (B) and brush wiring from the alternator.
5. Tap loose and remove the Rear Bearing Carrier (C) from the alternator.
6. Remove rear plastic alternator outlet duct.
7. Using crankshaft to provide countervailing torque, loosen the rotor bolt. Do Not remove the rotor bolt.
8. Prop the alternator to engine adapter casting up slightly on a wooden block. This provides clearance for the alternator stator to slide out and off the rotor.
9. Tap, pry and slide the stator off the unit.

NOTICE The stator weighs approximately 110 lbs.

10. While supporting and pulling the rotor with one hand, strike the rotor assembly, on the steel laminations, with a plastic, dead-blow hammer until it separates from the engine shaft.
11. Remove the rotor through-bolt the rest of the way and remove the rotor.
12. Disconnect remaining wiring and hoses from engine as applicable.
13. Remove the remaining two engine mount bolts.
14. Using the hoisting tabs on the engine cylinder heads, lift engine off unit.

NOTICE Use caution to ensure the stepper motor throttle link is not damaged during removal.

15. Installation is in reverse of removal.
SECTION 4 - GENERATOR SPECIFICATIONS
# SPECIFICATIONS

| RATED MAXIMUM LOAD CURRENT (LP) AT 240 VOLTS | 83.3 AMPS |
| RATED AC VOLTAGE                           | 240 VOLTS |
| RATED FREQUENCY                            | 60 Hz     |
| PHASE                                      | SINGLE PHASE |
| RATED TEMPERATURE                          | 77°F (25°C) |
| NORMAL OPERATING RANGE                     | -20°F to 104°F (-28.8°C to 40°C). |
| LP FUEL SUPPLY PRESSURE                    | 11 - 14 IN. W.C. |
| NG FUEL SUPPLY PRESSURE                    | 5 - 7 IN. W.C |

## RESISTANCE VALUES

| ROTOR                                      | 19.4 - 23.7 Ohm |
| 17kW and below:                           | 16.2 - 23.5 Ohm |
| 20kW:                                      |                 |
| POWER WINDING                              |                 |
| 17kW and below:                           | 11-22 or 22-44: 0.06 - 0.07 Ohm |
| 20kW:                                      | 11-22 or 22-44: 0.05 - 0.06 Ohm |
| EXCITATION WINDING                         |                 |
| 17kW and below:                           | 0.99 - 1.15 Ohm |
| 20kW                                       | 0.77 - 0.94 Ohm |

## FASTENER TORQUE VALUES

| ALTERNATOR ADAPTER TO ENGINE              | 25-33 LB-FT (Nm) |
| ROTOR BOLT TO CRANKSHAFT                  | 30-40 LB-FT (Nm) |
| BRUSHES TO REAR BEARING CARRIER          | 50 LB-IN (7Nm)  |
| STATOR BOLT                                | 168 - 240 LB-IN (Nm) |
| NEGATIVE BATTERY CABLE TO ENGINE          | 80 LB-IN (9Nm)  |
| MUFFLER TO CYLINDER HEAD                  | 180 - 265 LB-IN (Nm) |
| ALTERNATOR OUTLET DUCT TO CASTING         | 15 - 25 LB-IN (Nm) |
| ENGINE / ALTERNATOR VIBRATION MOUNTS      | 150 - 200 LB-IN (Nm) |
| GROUND STAR                               | 40 - 100 LB-IN (Nm) |
| STARTER LEAD                              | 25 - 50 LB-IN (Nm) |