Owner's Manual

For

Automatic Standby Generator

20 kW Synergy™

⚠ DANGER!

⚠ **NOT INTENDED FOR USE IN CRITICAL LIFE SUPPORT APPLICATIONS.**

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

⚠ **DEADLY EXHAUST FUMES! OUTDOOR INSTALLATION ONLY!**

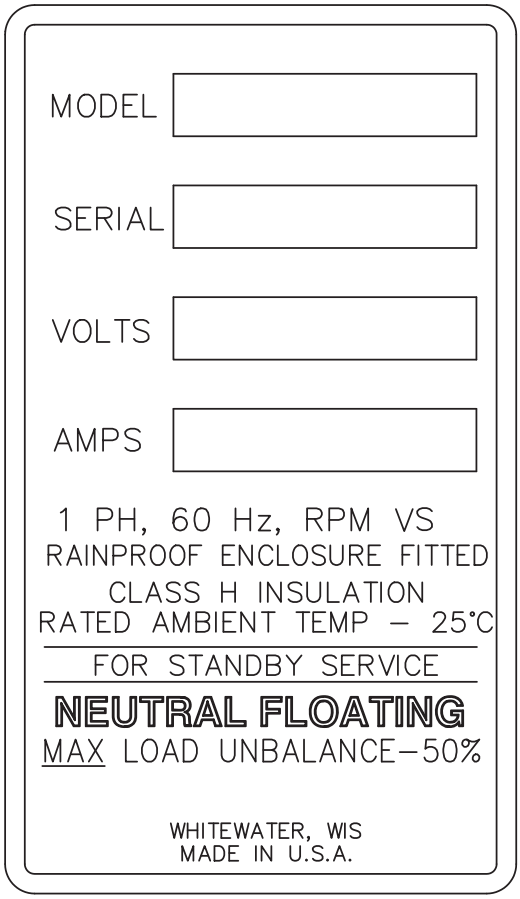
This manual should remain with the unit.

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

Para español , visita: http://www.generac.com/service-support/product-support-lookup

Pour le français, visiter : http://www.generac.com/service-support/product-support-lookup

Use this page to record important information about your generator set.



Record the information found on your unit data label on this page for quick and easy reference. The label is affixed to the inside partition left of the control pad. For directions on how to open the lid and remove the front panel, see Section 3 Operation. The Unit Identification label provides the following information:

- Model Number
- Serial Number
- Control Board Part Number
- Voltage Rating of the unit
- Maximum Current Rating of the unit (AMPS)

When contacting an independent Authorized Service Dealer about parts and service, always supply the complete model number and serial number of the unit.

Operation and Maintenance: Proper maintenance and care of the generator ensures a minimum number of problems and keeps operating expenses at a minimum. It is the operator's responsibility to perform all safety checks, to make sure that all maintenance for safe operation is performed promptly, and to have the equipment checked periodically by an independent Authorized Service Dealer. Normal maintenance, service and replacement of parts are the responsibility of the owner/operator and, as such, are not considered defects in materials or workmanship within the terms of the warranty. Individual operating habits and usage may contribute to the need for additional maintenance or service.

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

To find your Local Independent AUTHORIZED SERVICE DEALER

INDEPENDENT AUTHORIZED SERVICE DEALER LOCATION

To locate the nearest INDEPENDENT AUTHORIZED SERVICE DEALER, please call this number:

1-800-333-1322

or, visit the dealer locator at:

www.generac.com/Service/Dealer Locator/

⚠WARNING

California Proposition 65. Engine exhaust and some of its constituents are known to the state of California to cause cancer, birth defects, and other reproductive harm. (000004)

⚠WARNING

California Proposition 65. This product contains or emits chemicals known to the state of California to cause cancer, birth defects, and other reproductive harm. (000005)

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Section 1 Safety

1.1 — Introduction

Thank you for purchasing this compact, high performance, variable speed, air-cooled, engine-driven stationary automatic standby generator set. Every effort was made to make sure that the information and instructions in this manual were both accurate and current at the time the manual was written. However, the manufacturer reserves the right to change, alter or otherwise improve this product or manual at any time without prior notice.

This generator is designed to automatically supply electrical power to operate critical loads during a utility power failure. This unit is factory installed in an all-weather metal enclosure and **is intended exclusively for outdoor installation**. This generator will operate using either vapor withdrawn liquid propane (LP) or natural gas (NG).

NOTE: When properly sized, this generator is suitable for supplying typical residential loads such as Induction Motors (sump pumps, refrigerators, air conditioners, furnaces, etc.), Electronic Components (computer, monitor, TV, etc.), Lighting Loads and Microwaves.

READ THIS MANUAL THOROUGHLY: The operator is responsible for proper and safe use of this equipment. The manufacturer strongly recommends that the operator read and thoroughly understand the instructions and contents of this owner's manual before attempting to use the equipment. If any portion of this publication is not understood, contact the nearest Authorized Service Dealer for starting, operating and servicing procedures.

SAVE THESE INSTRUCTIONS: The manufacturer suggests that this manual and the rules for safe operation be copied and posted near the unit's installation site. Safety should be stressed to all operators and potential operators of this equipment.

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

⚠DANGER

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

(000001)

⚠WARNING

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

(000002)

⚠CAUTION

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

(000003)

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

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

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

This symbol points out a potential Explosion Hazard.

This symbol points out a potential Fire Hazard.

This symbol points out a potential Electrical Shock Hazard.

These “Safety Alerts” cannot eliminate the hazards that they signal. Strict compliance with these special instructions, plus common sense are major accident prevention measures.

1.2 — General Safety

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

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

⚠ DANGER!

Despite the safe design of this generator, operating this equipment imprudently, neglecting its maintenance or being careless can cause possible injury or death. Permit only responsible and capable persons to install, operate and maintain this equipment.

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

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

The installation of this generator must always comply with applicable codes, standards, laws and regulations.

A running generator gives off DEADLY carbon monoxide, an odorless, colorless, poisonous gas. Breathing carbon monoxide can cause dizziness, throbbing temples, nausea, muscular twitching, headache, vomiting, weakness, sleepiness, inability to think clearly, fainting, unconsciousness or even death.

⚠ CAUTION!

The control panel for this unit is intended to be operated by qualified service personnel only.

1.3 — General Safety Hazards

- For safety reasons, this equipment should only be installed, serviced and repaired by a Service Dealer or other competent, qualified electrician or installation technician who is familiar with applicable codes, standards, regulations and product Installation Manual guidelines. The operator also must comply with all such codes, standards, regulations and product Installation Manual guidelines.

- The engine exhaust fumes contain carbon monoxide, which can be DEADLY. This dangerous gas, if breathed in sufficient concentrations, can cause unconsciousness or even death. DO NOT alter or add to the exhaust system or do anything that might render the system unsafe or in noncompliance with applicable codes and standards.
- Install a carbon monoxide alarm indoors, according to manufacturer's instructions/recommendations.
- Adequate, unobstructed flow of cooling and ventilating air is critical for correct generator operation. Do not alter the installation or permit even partial blockage of ventilation provisions, as this can seriously affect safe operation of the generator. **The generator MUST be installed and operated outdoors only.**
- Keep hands, feet, clothing, etc. away from drive belts, fans, and other moving or hot parts. Never remove any drive belt or fan guard while the unit is operating.
- When working on this equipment, remain alert at all times. Never work on the equipment when physically or mentally fatigued.
- Inspect the generator regularly, and contact the nearest Dealer for parts needing repair or replacement.
- Before performing any maintenance on the generator, remove the control panel fuse and disconnect the Negative (—) battery cable to prevent accidental startup. When disconnecting battery cables always remove the NEGATIVE (NEG or "—") cable first, then remove the POSITVE (POS, or "+") cable. When reconnecting the cables, connect the POSITIVE cable first, and the NEGATIVE cable last.
- Never use the generator or any of its parts as a step. Stepping on the unit can stress and break parts, and may result in dangerous operating conditions from leaking exhaust gases, fuel leakage, oil leakage, etc.

1.4 — Exhaust Hazards

- Generator engine exhaust contains DEADLY carbon monoxide, an odorless, colorless, poisonous gas. Breathing carbon monoxide can cause dizziness, throbbing temples, nausea, muscular twitching, headache, vomiting, weakness, sleepiness, inability to think clearly, fainting, unconsciousness or even death. If any carbon monoxide poisoning symptom is experienced, move into fresh air and immediately seek medical attention.
- This generator is designed for OUTDOOR installation ONLY. Never operate the generator inside any garage or other enclosed space.

1.5 — Electrical Hazards

- All generators covered by this manual produce dangerous electrical voltages that can cause fatal electrical shock. Utility power delivers extremely high and dangerous voltages to the transfer switch, as does the standby generator when it is in operation. Avoid contact with bare wires, terminals, connections, etc. while the unit is running. Ensure all appropriate covers, guards and barriers are in place, secured and/or locked before operating the generator. If work must be done around an operating unit, stand on an insulated, dry surface to reduce potential shock hazard.
- Do not handle any kind of electrical device while standing in water, while barefoot, or while hands or feet are wet. DANGEROUS ELECTRICAL SHOCK MAY RESULT.
- This is an Automatic Standby Generator, the generator may crank and start at any time when utility is lost. When this occurs, load circuits are transferred to the STANDBY (generator) power source. To prevent injury, before working on this generator (for inspection, service or maintenance), always put the generator into the OFF mode and remove the 7.5 Amp fuse from the generator control panel.
- In case of accident caused by electric shock, immediately shut down the source of electrical power. If this is not possible, attempt to free the victim from the live conductor. AVOID DIRECT CONTACT WITH THE VICTIM. Use a nonconducting implement, such as a dry rope or board, to free the victim from the live conductor. If the victim is unconscious, apply first aid and get immediate medical help.
- Never wear jewelry when working on this equipment. Jewelry can conduct electricity resulting in electric shock, or may get caught in moving components resulting in injury.

1.6 — Fire Hazards

- For fire safety, the generator must be installed and maintained properly. Installation MUST always comply with applicable codes, standards, laws, regulations and product Installation Manual guidelines. Adhere strictly to local, state, and national electrical and building codes. Comply with regulations the Occupational Safety and

Health Administration (OSHA) has established. Also, ensure that the generator is installed in accordance with the manufacturer's instructions and recommendations. Following proper installation, do nothing that might alter a safe installation and render the unit in noncompliance with the aforementioned codes, standards, laws and regulations.

- Keep a fire extinguisher near the generator at all times. Extinguishers rated "ABC" by the National Fire Protection Association are appropriate for use on the standby generator. Keep the extinguisher properly charged and be familiar with its use. Consult the local fire department with any questions pertaining to fire extinguishers.

1.7 — Explosion Hazards

- Do not smoke around the generator. Wipe up any fuel or oil spills immediately. Ensure that no combustible materials are left in the generator compartment, or on or near the generator as FIRE or EXPLOSION may result. Keep the area surrounding the generator clean and free from debris.
- Gaseous fluids such as natural gas and liquid propane (LP) gas are extremely EXPLOSIVE. Install the fuel supply system according to applicable fuel-gas codes. Before placing the home standby electric system into service, fuel system lines must be properly purged and leak tested according to applicable code. After installation, inspect the fuel system periodically for leaks. No leakage can be permitted.

⚠ WARNING!

If this generator is used to power electrical load circuits normally powered by a utility power source, it is required by code to install a transfer switch. The transfer switch must effectively isolate the electrical system from the utility distribution system when the generator is operating (NEC 702). Failure to isolate an electrical system by such means will result in damage to the generator and also may result in injury or death to utility power workers due to backfeed of electrical energy.

Section 2 General Information

2.1 — Synergy Operating Principle

2.1.1— Benefits

The Synergy 20 kW generator brings exciting new technology to the Home Standby generator product. The generator is significantly more fuel efficient than constant speed generators at normal loads, provides premium power quality, and is significantly quieter while operating at exercise and normal loads.

- Exceptionally quiet exercise at 57 dB
- Quieter operation - 3 dB with improved tonal qualities at exercise and under normal loads
- Cleanest Standby power available with 1.5 THD
- Significant fuel savings: more fuel efficient under normal loads
- Lower operating speed at 2700 rpm at low loads
- Tuned Helmhortz resonator and muffler to further lower sound levels
- Variable Speed / Constant Frequency operation

2.1.2— Start Up

When the generator starts up, the engine ramps up to 3600 RPM to produce maximum power. This ensures that there is sufficient power to carry the load when the transfer switch operates. The engine RPM then gradually ramps down to a speed appropriate for the attached load.

For example, if there is no load, the engine ramps down to approximately 2700 RPM. The time it takes to ramp down to 2700 RPM is approximately 4-5 minutes. Since the ramp rate is linear, less time would be required for it to ramp down to only 3400 RPM.

During startup, as the engine ramps up to 3600 RPM, the Automatic Voltage Regulator (AVR) electronics performs a self test (before transfer) involving an overall system check of the unit. If a fault is detected, the unit shuts down and displays an alarm.

2.1.3— Normal Running

The engine operates between 2700 RPM - 3600 RPM depending on the attached load. When the load increases or decreases, the speed increases or decreases accordingly.

2.1.4— Small Load Changes

The system is designed to maintain the current engine speed for small load changes. Larger load changes result in a change in engine speed to appropriately handle the load.

2.1.5— Large Load (Not Overload)

The engine always runs at a speed appropriate for the attached load. When a large load is applied, the fast Loadshed signal is activated. All loads attached to the Loadshed controller in the transfer switch are dropped and the engine speed immediately increases to 3600 RPM. Five seconds later, the Loadshed signal is deactivated and Loads 3 and 4 are sequenced back on, spaced 15 seconds apart. Loads 1 and 2, which are designed for air conditioners, are sequenced back on after 5 minutes.

The engine speed remains at 3600 RPM for a programmable time (20 minutes default) and then ramps down to the speed appropriate for the attached load. The programmable time can be changed by the dealer to prevent annoying ramps up and down in engine speed if large loads turn on and off frequently.

2.1.6— Overload

If a load is sensed that is too large for the engine, that load will be locked out for a period of 30 minutes. If the load is not connected through a fast Loadshed enabled controller and module, then the generator shuts down with an “Overload” alarm.

2.1.7— Low Speed Exercise

Low speed exercise operates at 1950 RPM for five minutes. The output voltage and frequency will not be at the rated voltage and frequency during exercise.

2.1.8— Normal Exercise

Normal exercise is at 3600 RPM at normal voltage and frequency levels for 5 minutes.

2.1.9— Automatic Voltage Regulator (AVR) Cooling Fans

The system is equipped with two fans to cool the AVR electronics. The primary fan is powered by AC during operation. The secondary fan is powered by 12V DC through the controller. The fans are monitored during operation and if a failure occurs, an alarm is displayed.

The secondary fan continues to operate for up to **one hour** after the generator is shut down. Proper cooling must occur before removing battery connections for maintenance or other service activity.

⚠ CAUTION!

⚠ **If utility is present, the secondary 12V DC fan continues to operate for up to one hour after the generator is shut down (even if the 7.5 amp ATO fuse is removed). To avoid hand injury, always exercise caution when working near the AVR fan housing.**

NOTE: The AVR cooling air inlet includes a filter. Verify the filter is installed and properly seated at time the unit is installed. Check the filter at regular maintenance intervals to verify proper airflow.

2.2 — The Generator

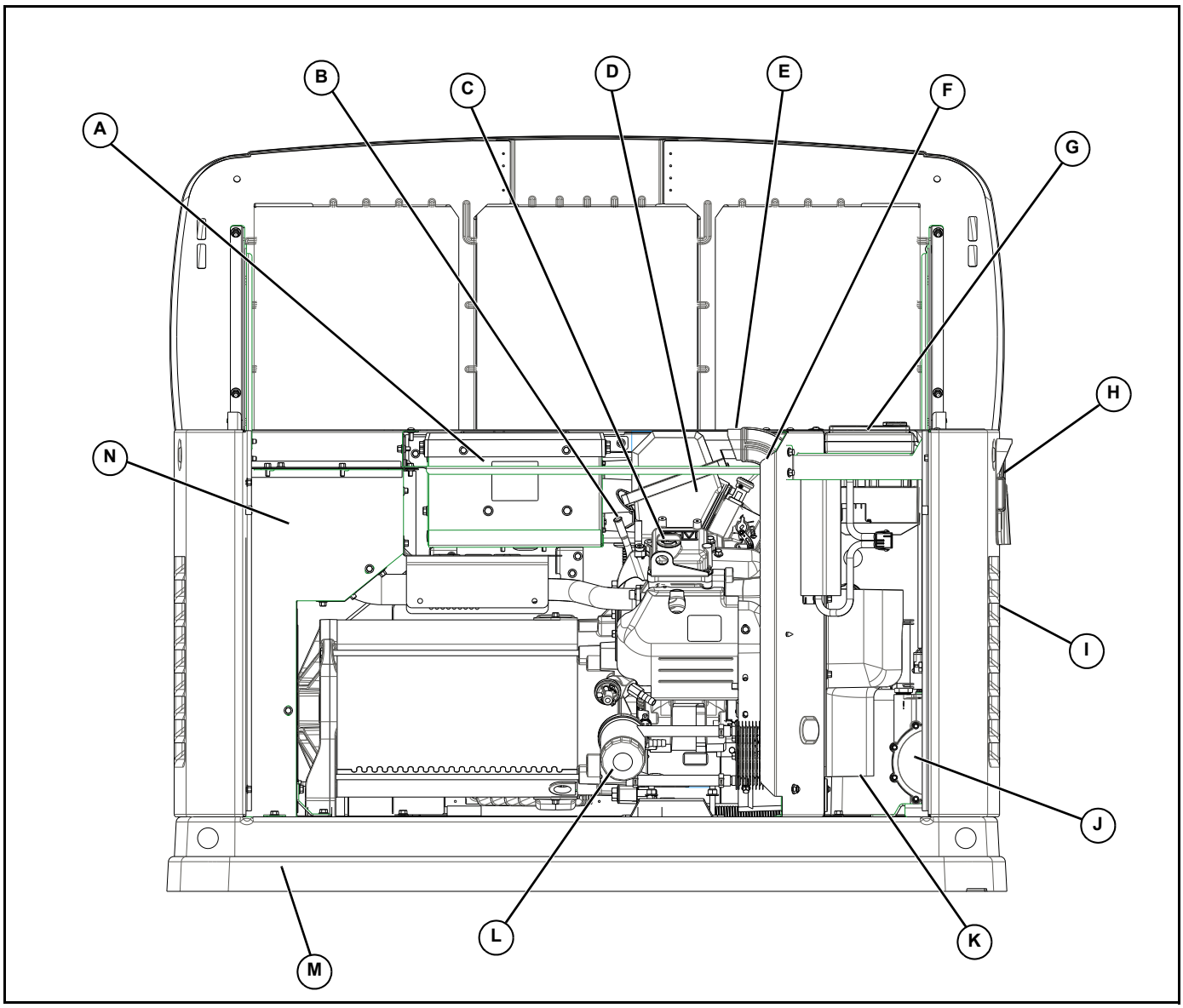

Figure 2-1. Component Locations

A.	Automatic Voltage Regulator (AVR)	H.	Circuit Breakers
B.	Oil Dipstick	I.	Fuel Inlet (Back)
C.	Oil Fill Cap	J.	Fuel Regulator
D.	Engine Air Filter	K.	Battery Compartment
E.	AVR Air Filter	L.	Oil Filter
F.	Data Label	M.	Composite Base
G.	Control Pad	N.	Exhaust Enclosure

2.3 — Protection Systems

The owner/operator is alerted to Alarm and/or Warning conditions via the control pad LCD screen. All Alarm conditions cause the generator to shut down. The Warning messages alert the operator to conditions that do not disable the unit, require immediate correction, or result in shut down.

Some of the possible Alarm/Warning messages are listed below.

NOTE: For Synergy specific alarms, see Subsection 5.3 — Synergy Troubleshooting.

2.3.1— Alarms

- High Temperature
- Low Oil Pressure
- Overcrank
- Overspeed
- Underspeed
- RPM Sensor Loss
- Wiring Error
- Overvoltage
- Undervoltage
- Fuse Problem
- Overload
- Stepper Overcurrent

2.3.2— Warnings

- Charger Warning
- Charger Missing AC
- Low Battery
- Exercise Set Error
- USB Warning
- Download Failure

The above list is not all inclusive. For more information about alarms, see Section 5 Troubleshooting.

NOTE: A WARNING alerts the operator to a condition that must be addressed, but does not shut down the generator. An ALARM shuts down the generator to protect the unit from damage. In the event of an alarm, the owner may clear the alarm and restart the generator. If the alarm occurs again, contact your independent servicing dealer.

2.4 — Emission Information

The U.S. Environmental Protection Agency (EPA) requires that this generator comply with exhaust emission standards. This generator is certified to meet the applicable EPA emission levels, and is certified for use as a stationary engine for standby power generation. Any other use may be a violation of federal and/or local laws. To ensure that the engine complies with applicable emission standards for the duration of its service life, it is important to perform the maintenance tasks described in Subsection 4.3 — Service Maintenance Schedule. This generator is certified to operate on Liquid Propane Vapor fuel or pipeline Natural Gas.

The Emission Control System code is EM (Engine Modification). The Emission Control System on this generator may consist of the following components:

- Air Induction System
  - Intake Pipe / Manifold
  - Air Cleaner
- Fuel Metering System
  - Carburetor / Mixer Assembly
  - Fuel Regulator
- Ignition System
  - Spark Plug
  - Ignition Module
- Exhaust System
  - Exhaust Manifold
  - Muffler

2.5 — Specifications

2.5.1— Generator

Model	20 kW Synergy
Rated Voltage	240
Rated Maximum Load Current (Amps) at 240 Volts (LP)*	83.3
Main Circuit Breaker	90 Amp
Phase	1
Rated AC Frequency	60 Hz
Battery Requirement	Group 26R, 12 Volts and 525 CCA Minimum (Generac Part No. 0H3421S)
Unit Weight in Lbs. (kilos)	509 (231)
Enclosure	Aluminum
Normal Operating Range	This unit is tested in accordance to UL 2200 standards with an operating temperature of -20º F (-29º C) to 122º F (50º C). For areas where temperatures fall below 32º F (0º C) a cold weather kit is required. When operated above 77º F (25º C) there may be a decrease in engine power. Please reference the engine specifications section.
These generators are rated in accordance with UL 2200, Safety Standard for Stationary Engine Generator Assemblies, and CSA-C22.2 No. 100-04 Standard for Motors and Generators. * Natural Gas ratings will depend on specific fuel Btu/joules content. Typical derates are between 10-20% off the LP gas rating.	

2.5.2— Engine

Model	20 kW Synergy
Type of Engine	GT-999
Number of Cylinders	2
Displacement	999 cc
Cylinder Block	Aluminum w/Cast Iron Sleeve
Recommended Spark Plug	RC12YC
Spark Plug Gap	1.02 mm (0.040 in)
Starter	12 VDC
Oil Capacity Including Filter	Approx. 1.9 Qt/1.8 L
Recommended Oil Filter	Part #070185E
Recommended Air Filter	Part #0J8478
Engine power is subject to and limited by such factors as fuel Btu/joules content, ambient temperature and altitude. Engine power decreases about 3.5 percent for each 1,000 feet (304.8 meters) above sea level, and also will decrease about 1 percent for each 6º C (10º F) above 15º C (60º F) ambient temperature.	

The specification sheet for this generator was included in the documentation provided with the unit at the time of purchase. For additional copies, consult your local Authorized Independent Service Dealer.

2.5.3— Fuel Requirements

The engine has been fitted with a dual fuel carburetion system. The unit will run on natural gas or LP gas (vapor), but it has been factory set to run on natural gas. The fuel system is configured for the selected fuel source during installation.

Recommended fuels should have a btu content of at least 1,000 Btus per cubic foot (37.26 megajoules per cubic meter) for natural gas, or at least 2,500 Btus per cubic foot (93.15 megajoules per cubic meter) for LP gas (vapor). If converting to LP gas from natural gas, a minimum LP tank size of 250 gallons (946 liters) is recommended. See the Installation Manual for complete procedures and details.

⚠ DANGER!

Gaseous fuels such as natural gas and liquid propane gas are highly explosive. Any spark can ignite such fuels and cause an explosion. No leakage of fuel is permitted. Natural gas, which is lighter than air, tends to collect in high areas. LP gas is heavier than air and tends to settle in low areas.

2.5.4— Battery Requirements

Group 26R, 12V, minimum 525CCA (Generac Part No. 0H3421S).

For proper battery maintenance, see Subsection 4.6.1— Check Battery Condition/Fluid Level.

2.5.5— Battery Charger

The battery charger is integrated into the control system. It operates as a “Smart Charger,” which ensures output charging levels are safe and continuously optimized to promote maximum battery life.

2.5.6— Engine Oil Requirements

For correct engine oil type, see Subsection 4.5.3.1— Engine Oil Recommendations.

2.6 — Accessories

See Table 2-1. The following accessories are available.

Table 2-1. Accessories

Accessory	Description
Cold Weather Kit	Required in areas where temperatures fall below 32 º F (0 º C).
Scheduled Maintenance Kit	Includes all pieces necessary to perform maintenance on the generator along with oil recommendations.
Auxiliary Transfer Switch Lockout	Enables any of the transfer switches to completely lock out one large electrical load by tying into its control system.
Fascia Skirt Wrap	Standard on all 22 kW units. Available for all current production air-cooled units that don't include it. It snaps together, around the base and mounting pad of the generator, to provide a smoothing, contoured look as well as rodent/insect protection. Requires use of the mounting pad shipped with the generator.
Mobile Link™	Provides a personalized web portal that displays the generator’s status, maintenance schedule, event history and much more. This portal is accessible via computer, tablet or smart phone. Sends emails and/or text notifications the moment there is any change in the generator’s status. Notification settings can be customized to what type of alert is sent and how often. For more information, visit www.standbystatus.com.
Wireless Local Monitor	Completely wireless and battery powered, the Wireless Local Monitor provides you with instant status without ever leaving the house. Status lights (red, yellow and green) alert owners when the generator needs attention. Magnetic backing permits refrigerator mounting and gives a 600 foot line of sight communication.

Table 2-1. Accessories (Continued)

Accessory	Description
Power Management Module (PMM) Starter Kit	Includes one module with transformer. The transformer, which is mounted inside the ATS enclosure, interfaces with the OPCB to generate the 24 Vac signal needed for control of the contactor (Load 1 on the OPCB).
Power Management Module (PMM)	Includes one module only. To achieve full system functionality, a total of three kits are required to allow control of the three remaining contactors (Loads 2/3/4 on the OPCB).
Touch-Up Paint Kit	Very important to maintain the look and integrity of the generator enclosure. This kit includes touch-up paint and instructions.
Extended Warranty Coverage	Extend your generator's warranty coverage by purchasing the 5 year extended warranty coverage. Covers 5 years of both parts and labor. Extended coverage can be purchased within 12 months of the end-users purchase date. This extended coverage is applicable to registered units and end-user proof of purchase must be available upon request. Available for Generac ®, Guardian ® and Centurion ® products. Not available for Corepower™ and EcoGen products or all international purchases.

Contact an independent authorized Dealer for additional information on accessories.

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3.1 — Control Pad

⚠ WARNING!

⚠ **The control pad is intended for use by qualified service personnel only.**

See Figure 3-1. The control pad is located under the lid of the enclosure. The lid is secured by two locks, one on each side of the enclosure. For best results, press down on the lid directly above the side lock, and while holding the lid down, use key to unlock the latch. Repeat step on opposite side of enclosure. Always unlock both the left and right side locks before attempting to lift the lid.

NOTE: The lid may appear stuck if pressure is not applied as described. Always verify that the side locks are unlocked before pulling up on lid.

To remove the front access panel, lift it straight up to disengage side hooks, and then outward away from unit.

When closing the unit, remember to lock both left and right side locks.

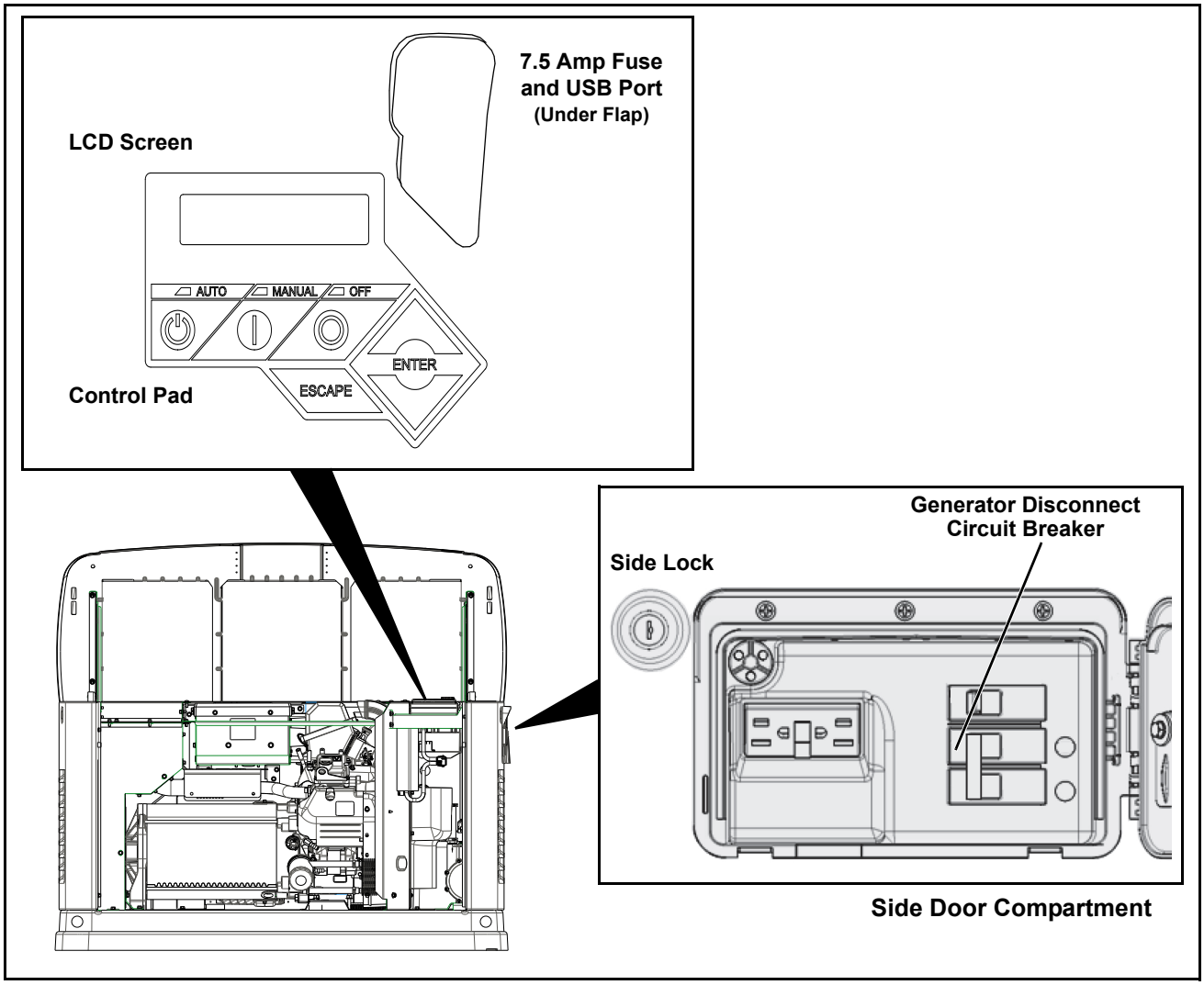

Figure 3-1. Control Pad and Side Door Compartment

⚠ WARNING!

With the control pad set to AUTO, the engine may crank and start at any time without warning. Such automatic starting occurs during the programmed exercise cycle or when utility power source voltage drops below the configured level. To prevent possible injury that might occur during sudden starts, always set the control pad to OFF and remove the 7.5 amp fuse before working on or around the generator or transfer switch. For added security, place a DO NOT OPERATE tag or placard at both the control pad and transfer switch.

NOTE: Never run the generator with any access panel removed.

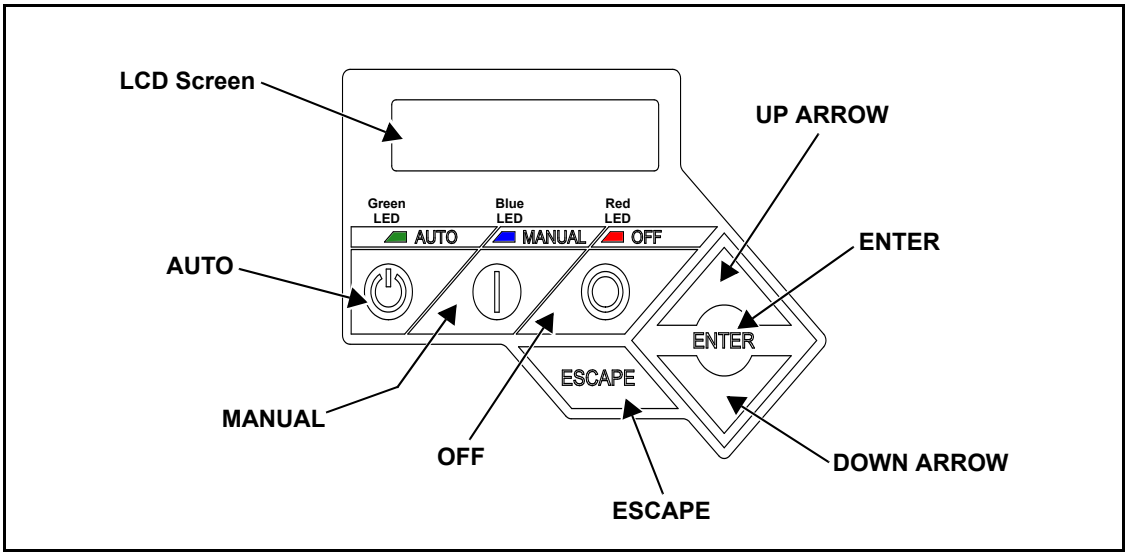

Figure 3-2. Control Pad and LCD Screen

3.2 — Auto/Manual/Off

Feature	Description
AUTO	Press to activate fully automatic operation. Green LED illuminates to confirm that system is in AUTO mode. Transfer to standby power occurs if utility power fails. Exercise timer functionality is enabled, if set.
MANUAL	Press to crank and start engine. Blue LED illuminates to confirm that system is in MANUAL mode. Transfer to standby power occurs if utility power fails. Exercise timer functionality is disabled.
OFF	Press to shut down engine, if running. Red LED illuminates to confirm that system is in OFF mode. Transfer to standby power does not occur if utility power fails. Exercise timer functionality is disabled.

3.3 — Menu Navigation

Feature	Description
System Menus	
HOME Screen	The system returns to the Home screen if the control pad is not used for five minutes. The screen normally displays a Status message, such as Ready to Run (Auto mode) or Switched to OFF (Off mode), and the total Hours of Protection. If an active alarm/warning condition occurs, the associated Alarm/Warning message is displayed. To clear the Alarm/Warning message, press OFF on the control pad followed by ENTER. In the event of multiple Alarms/Warnings, the next message is then displayed. The highest priority alarm is always displayed first.
MAIN MENU	Enables the operator to navigate the software using UP ARROW, DOWN ARROW, ENTER and ESCAPE. The Main Menu can be accessed from any sub menu by consecutively pressing ESCAPE. Each time ESCAPE is pressed, the preceding menu is displayed. The Main Menu is reached when the System, Date/Time, Battery, and Sub Menus are displayed.
Navigation	
ESCAPE	Used to abort a routine or back up to the preceding menu.
ENTER	Used to make a selection or save an entry.
UP ARROW **DOWN ARROW**	Used to move forward or backward from menu to menu or to scroll forward or backward (increment or decrement) through available selections.
NOTE: Pressing the control pad illuminates the backlight for 30 seconds. The backlight also illuminates for 30 seconds whenever an active Alarm/Warning message is displayed.	

3.4 — Change Time and Date

To change the time and date after activation, see the Navigation Menu in Figure 3-3. If power is lost (battery is disconnected/reconnected, 7.5 amp control pad fuse is removed/installed, etc.), the display automatically prompts the user for the Time and Date. All other information is retained in memory.

3.5 — Programmable Timers

3.5.1— Dealer Programmable

NOTE: A dealer pass code is required.

3.5.1.1—High Run Speed Timer

A programmable high run speed timer is provided. The timer controls the length of time the generator runs at maximum speed after application of a large load (such as an air conditioner). The time can be increased to prevent the potential cycling of engine RPM as loads turn on and off. For example, if the timer is currently set to **ten** minutes, and the normal AC cycling time is 15 minutes, increasing the timer to 20 minutes would prevent the engine speed from ramping up and down every ten minutes between AC cycles (even though fuel consumption would increase).

3.5.1.2—Start-Up Delay Timer

A programmable line interrupt delay (or Start-Up Delay) timer is provided. When utility voltage fails (falls below 65% of nominal), the start-up delay timer is started. If the voltage rises above the Utility Volts Low threshold, the timer is reset. If the utility voltage remains below the threshold during the duration of the timer, the unit cranks and starts.

NOTE: The factory default setting is five seconds, but is adjustable from 2 to 1500 seconds.

3.5.2— User Programmable

3.5.2.1—Exercise Time

A programmable exercise time is provided. In the AUTO mode, the engine starts and runs at the programmed interval, either weekly, bi-weekly (the default), or monthly, at the time and day specified. During the exercise cycle, the unit runs approximately **five** minutes and then shuts down. Transfer of loads to the generator does not occur unless utility power fails. For more information, see Subsection 3.12 —Setting the Exercise Timer.

3.6 — USB Port for Firmware Updates

A USB port is located beneath the rubber flap adjacent to the control pad, and is provided for firmware updates. Firmware updates must be performed by an Independent Authorized Service Dealer.

NOTE: The USB port is intended for use with a USB thumb drive only. The USB port is not intended for charging devices such as phones or laptops. Do not connect any consumer electronics to the USB port.

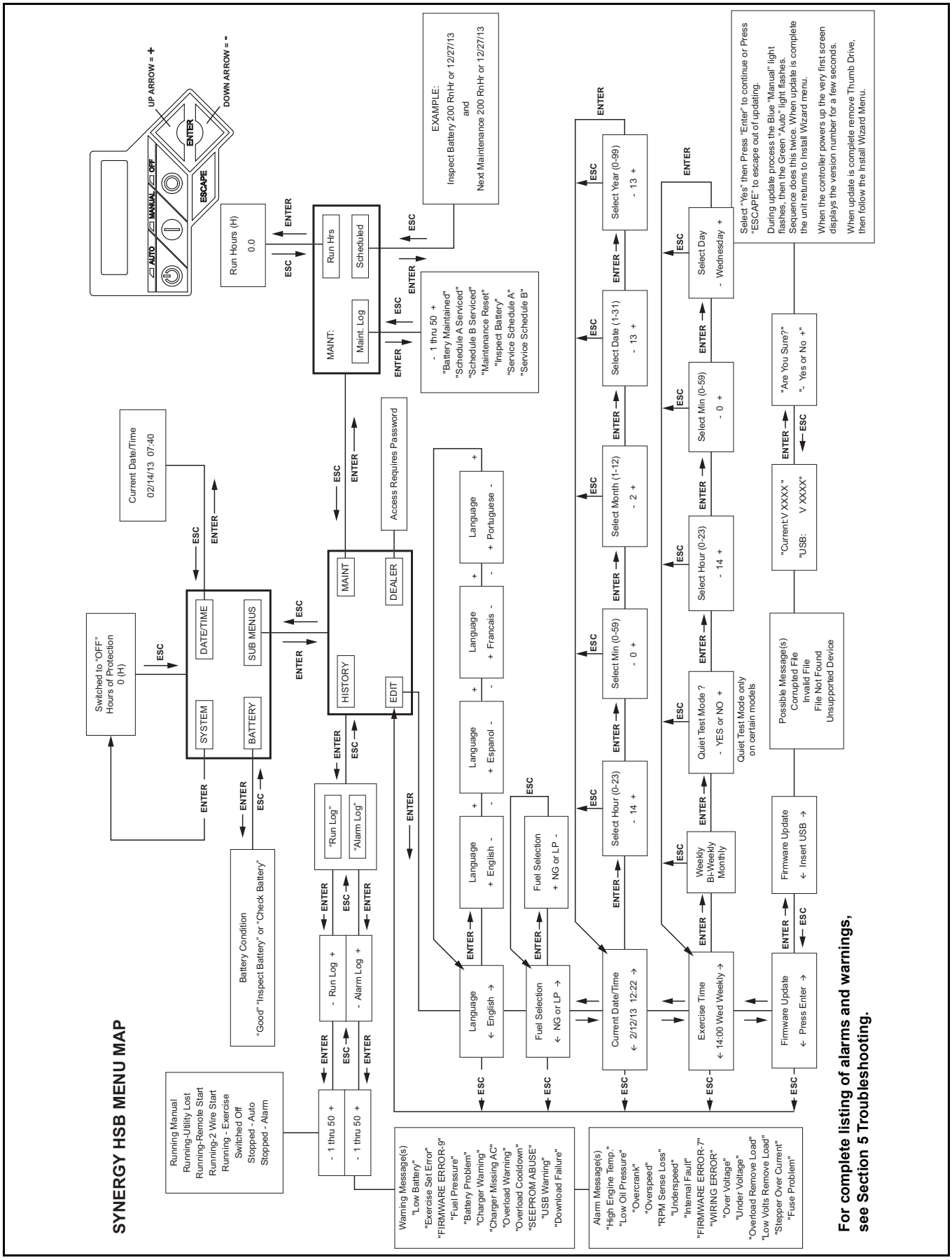

Figure 3-3. Navigation Menu

3.7 — Transfer Switch Automatic Operation

In AUTO, the generator starts automatically when utility source voltage drops below the preset level. Once the unit starts, loads are transferred to the standby power source.

To select automatic operation:

1. Verify that the transfer switch main contacts are set to the UTILITY position (loads connected to the utility power source).
2. Verify that normal UTILITY power source voltage is available to transfer switch terminal lugs N1 and N2.
3. Move the Generator Disconnect Circuit Breaker switch under the side door to the ON (Closed) position.
4. Press AUTO on the control pad. A green LED illuminates to confirm that the system is in the AUTO mode.

3.7.1— Automatic Sequence of Operation

3.7.1.1—Utility Failure

If the control pad is set to AUTO when the utility power fails (falls below 65% of nominal, dealer programmable), a **five** second Start-Up Delay timer is started (dealer programmable). If utility power is still absent when the time expires, the engine cranks and starts.

Once started, a **five** second engine Warm-Up Delay timer starts. When the time has elapsed, the load is transferred to the generator. If utility power is restored (above 80% of nominal, dealer programmable) between the time the engine is first started and expiration of the warm-up time, the system completes the start cycle and then runs through its normal cool-down cycle while the load remains on the utility source.

3.7.1.2—Cranking

The cyclic cranking is controlled as follows:

Sixteen (16) seconds crank, seven (7) seconds rest, sixteen (16) seconds crank, seven (7) seconds rest; this sequence is repeated for a total of five (5) crank cycles.

3.7.1.3—Load Transfer

With the generator running, the transfer of load is dependent upon the operating mode as follows:

<table>
<tr><td rowspan="3">AUTO</td><td>• Starts and runs if utility power fails (falls below 65% of nominal) for five consecutive seconds (adjustable).
• Starts a five second engine warm-up timer.
• Does not execute transfer if utility power returns before expiration of warm-up timer (but finishes the warm-up and cool-down cycles).
• Transfers back to utility once utility power returns (above 80% of nominal) for fifteen consecutive seconds.
• Only shuts down if OFF is pressed on the control pad or an alarm shutdown occurs.
• Once utility power returns, starts a one minute cool-down cycle before it shuts down.</td></tr>
<tr><td>EXERCISE</td></tr>
<tr><td>• Only works in the AUTO mode when the generator is NOT running.
• Does not exercise if generator is already running in AUTO or MANUAL modes.
• During exercise cycle, transfers only if utility power fails for ten consecutive seconds.</td></tr>
<tr><td>MANUAL</td><td>• Engine cranks and runs even if utility power is present, but does not transfer to generator.
• Transfers to generator if utility fails (falls below 65% of nominal) for ten consecutive seconds.
• Transfers back to utility when utility returns for fifteen consecutive seconds. The engine continues to run until AUTO or OFF is pressed.</td></tr>
</table>

3.7.2— Load Shed Functionality

The Synergy product Transfer Switch includes an Overload Prevention Control Board (OPCB) to shed critical loads.

The OPCB, commonly referred to as the Load Shed Board, has “Fast Load Shed” capability, which effectively prevents large loads from stalling the engine. **ALL LOADS GREATER THAN 10 kW OR 2 HP (MOTORS) MUST BE CONNECTED TO THE OPCB. If natural gas is the selected fuel type, then all loads greater than 9kW must be connected to the OPCB.** Examples of a large load are a 3T air conditioner, 3 HP well pump, 3 HP sump pump, etc.

When the generator senses the application of a large load (greater than 10 kW or 2HP) while the engine is at low speed, the load is instantly shed (within milliseconds) and the engine is instructed to run at 3600 RPM. This action prevents stalling of the engine. The loads are then reapplied when the engine is back up to speed. Normal loads take about **six** seconds. Large loads, such as an air conditioner, have specially designated connections on the OPCB, and are only reapplied after **five** minutes (to protect the air conditioner motor).

See the Transfer Switch Owner’s Manual for a complete description.

3.8 — Transfer Switch Manual Operation

⚠ DANGER!

DO NOT attempt to activate the transfer switch manually until all power voltage supplies to the switch have been completely turned off. Failure to turn off all power voltage supplies may result in extremely hazardous and possibly fatal electrical shock.

Prior to automatic operation, manually exercise the transfer switch to verify that there is no binding or interference with proper operation of the mechanism. Manual operation of the transfer switch is required if automatic operation fails.

IMPORTANT NOTE: Always use the applicable transfer switch owner's manual for actual manual transfer switch operation instructions. The information presented here describes a typical V-style transfer switch, which is not used for three phase applications.

3.8.1— Transfer to Generator Power

When utility power fails, manually transfer to standby power and start the generator as follows:

1. Press OFF on the control pad.
2. Move the Generator Disconnect Circuit Breaker switch to the OFF (Open) position.
3. Turn off the utility power supply to the transfer switch using the means provided (such as a utility main line circuit breaker).
4. Use the manual transfer handle inside the transfer switch to move the main contacts to the STANDBY position (loads connected to the standby power source).
5. Press MANUAL on the control pad. The engine cranks and starts.
6. Allow the engine to run for 20 seconds to bring it up to normal operating speed.
7. Move the Generator Disconnect Circuit Breaker switch to the ON (Closed) position.

3.8.2— Transfer Back to Utility Power

When utility power is restored, manually transfer back to utility power and shut down the generator as follows:

NOTE: Verify that utility voltage has returned and is at the proper value.

1. Move the Generator Disconnect Circuit Breaker switch to the OFF (Open) position.
2. Allow the engine to run for **one** minute at no-load to cool down the unit.
3. Press OFF on the control pad to shut down the engine.
4. Verify that utility power supply to the transfer switch is turned off.
5. Use the manual transfer handle inside the transfer switch to move the main contacts to the UTILITY position (loads connected to the utility power source).

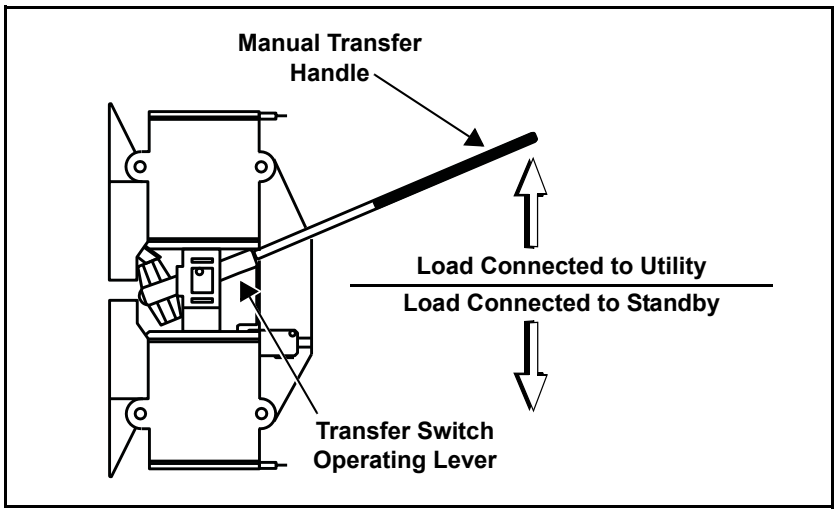

Figure 3-4. Manual Transfer Switch Operation (Typical)

6. Turn on the utility power supply to the transfer switch using the means provided.
7. Press AUTO on the control pad. A green LED illuminates to confirm that the system is in the AUTO mode.

3.9 — Removal From Service During Utility Outages

If, during prolonged utility outages, the user wishes to remove the unit from service to conserve fuel, reduce run hours, or to perform maintenance tasks, then complete the steps listed below.

IMPORTANT NOTE: Failure to abide by this procedure can result in equipment damage.

To remove the generator from service while running in AUTO and online, proceed as follows:

1. Turn the main utility disconnect to OFF (Open).
2. Move the Generator Disconnect Circuit Breaker switch to the OFF (Open) position.
3. Allow unit to cool for **one** minute.
4. Press OFF on the control pad to shut down the engine.

NOTE: If the generator is to remain off for more than an hour with utility power NOT PRESENT, wait one hour for the internal fans to cool it down.

5. Pull up rubber flap covering fuse holder and remove 7.5 amp fuse to prevent discharge of the starting battery.

To return the generator to service, proceed as follows:

1. Pull up rubber flap covering fuse holder and install 7.5 amp fuse.
2. Follow Install Wizard and enter information as required.
3. Press AUTO on the control pad. A green LED illuminates to confirm that the system is in the AUTO mode. Allow the generator to start and run for 20 seconds.
4. Move the Generator Disconnect Circuit Breaker switch to the ON (Closed) position.
5. Turn the main utility disconnect to ON (Closed).

3.10 — Side Door Compartment

Check local codes for side door locking requirements. A hasp is provided, so that the side door can be secured with a customer supplied padlock if necessary.

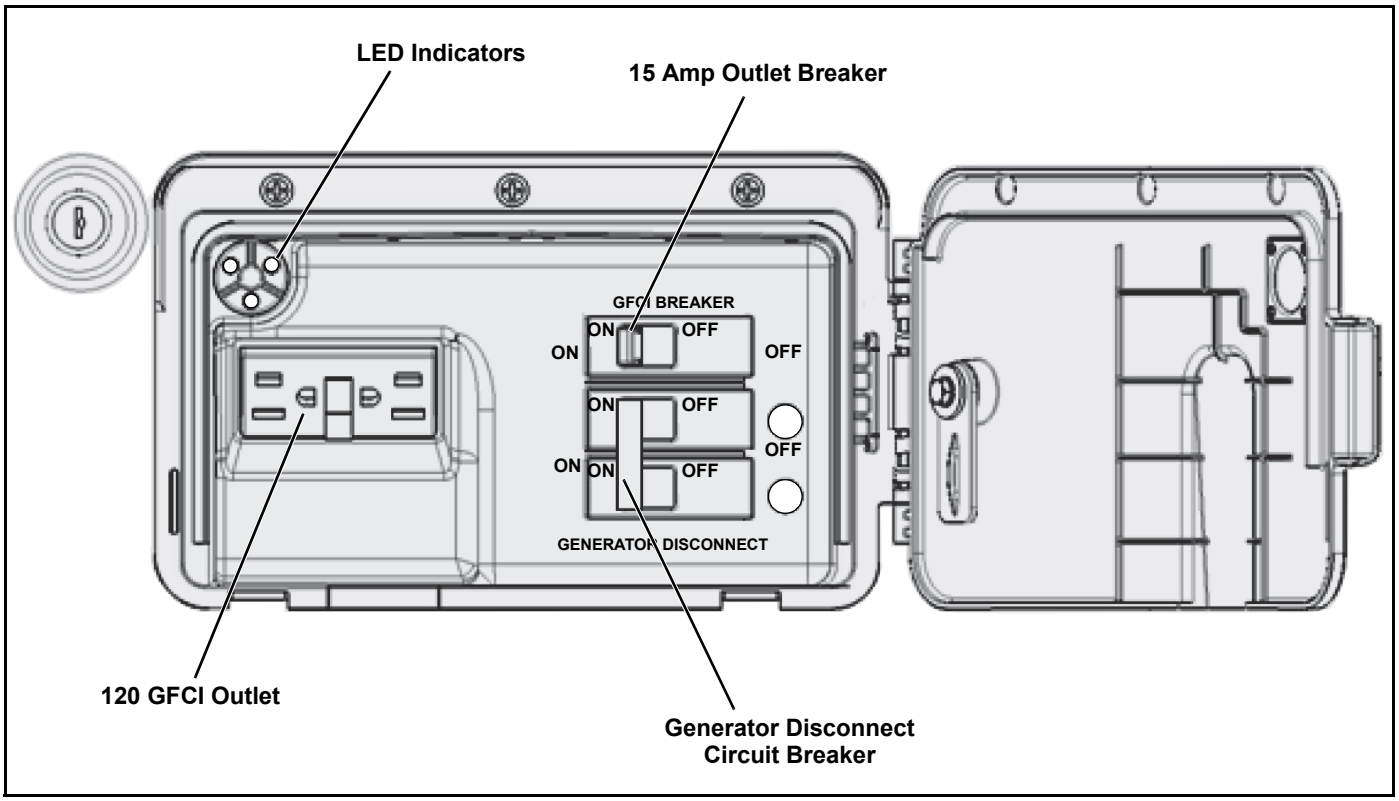

Figure 3-5. Open Side Door Compartment

3.10.1— LED Indicators

- Green Ready LED: Illuminates when utility power is present and the control pad is set to AUTO. Also indicates when the generator is running.
- Red Alarm LED: Illuminates when the control pad is set to OFF or a fault is detected. Contact your authorized servicing dealer if necessary.
- Yellow Maintenance LED: Indicates that maintenance is required.

3.10.2— 120V GFCI Outlet/15 Amp Breaker

Some units are equipped with an external 15 amp, 120 volt GFCI convenience outlet located in the side door compartment.

When the generator is running, in the absence of utility power, this outlet may also be used to power items outside the home such as lights or power tools. This outlet may also be used when utility power is present by running the generator in manual mode.

This outlet does not provide power if the generator is not running. **DO NOT USE THIS OUTLET WHEN THE GENERATOR IS IN EXERCISE MODE.** This outlet is protected by a 15 Amp circuit breaker located in the side door compartment.

3.11 — Battery Charger

NOTE: The battery charger is integrated into the control module.

The battery charger operates as a “Smart Charger” that ensures:

- Output is continually optimized to promote maximum battery life.
- Charging levels are safe.

NOTE: A warning is displayed on the LCD screen when the battery needs service.

3.12 — Setting the Exercise Timer

This generator is equipped with a configurable exercise timer. The first of two settings specifies the Day/Time of the exercise. Once set, the generator will start and exercise on the day of the week and at the time of day specified. During the exercise period, the unit runs for approximately **five** minutes, and then shuts down. The second setting establishes exercise frequency, and can be set to WEEKLY, BIWEEKLY (the default), or MONTHLY. If monthly is selected, the date of the month must be entered. Transfer of loads to the generator does not occur during the exercise cycle unless utility power is lost.

IF THE INSTALLER TESTS THE GENERATOR PRIOR TO INSTALLATION, PRESS **ENTER** ON THE CONTROL PAD TO SKIP EXERCISE TIMER SETUP.

The exercise information and programming options is shown in Table 3-1.

Figure 3-6 illustrates the engine speed profile during a typical low speed exercise cycle. While providing the necessary periodic exercise, the lower RPM reduces fuel consumption, engine wear, and noise.

NOTE: The exercise feature operates only when the generator is in the AUTO mode and the Exercise Timer is properly set. The current date/time must be reset every time the T1 circuit is shut down, the 12 volt battery is disconnected, the 7.5 amp fuse is removed, and/or the battery charger is disconnected (control pad has no power and LCD screen is blank).

Table 3-1. Generator Exercise Characteristics

Model	20 kW Synergy
Low Speed Exercise	1950 rpm
Exercise Frequency Options	Weekly/Bi-WeeklyMonthly
Exercise Time Length	5 minutes

Figure 3-6. Low Speed Exercise Profile - 20 kW Synergy

Section 4 Maintenance

4.1 — Maintenance

NOTE: Proper maintenance is necessary for safe operation and is crucial to the life of the generator. Genuine Generac parts MUST be used to ensure warranty coverage

NOTE: Since most maintenance alerts occur at the same time (two or four year intervals), only one will appear at any one time. Clearing one will cause the next active alert to be displayed.

4.2 — Maintenance Kits

To maintain the warranty, genuine Generac replacement parts MUST be used, including Generac oil kits (which include both an oil filter and an air filter). Generac oil kits can be obtained through an Authorized Dealer or purchased on-line. To purchase on-line, access the maintenance kits page through **www.generac.com**. Follow the prompts to enter delivery information and complete the purchase.

All Generac oil kits meet minimum American Petroleum Institute (API) Service Class SJ, SL, or better. Use no special additives. Select the appropriate viscosity oil grade according to the expected operating temperature. Synthetic oil also can be used in the appropriate weight as standard.

4.3 — Service Maintenance Schedule

NOTE: Use only Genuine Generac parts to ensure warranty coverage.

⚠WARNING!

All generator service must be performed by a qualified service person only.

It is important to perform all maintenance at the interval specified in the Service Maintenance Schedule. This ensures safe and proper operation, as well as compliance with applicable emissions standards. Critical emissions maintenance must be performed for the Emissions Warranty to remain valid. Service and repairs may be performed by any qualified service technician or repair shop.

The LCD screen prompts the user when it is time to perform the Schedule A or Schedule B maintenance tasks. When performing Schedule B maintenance, first perform all tasks listed under Schedule A maintenance.

Observe the maintenance tasks and intervals shown in Table 4-1.

IMPORTANT NOTE: The secondary 12V DC fan continues to operate for up to one hour after the generator is shut down. Proper cooling must occur before removing battery connections for maintenance or other service activity.

⚠CAUTION!

If utility is present, the secondary 12V DC fan continues to operate for up to one hour after the generator is shut down (even if the 7.5 amp ATO fuse is removed). To avoid hand injury, always exercise caution when working near the AVR fan housing.

Table 4-1. Service Maintenance Schedule

Service	Daily If Running Continuously or Before Each Use	Every Year	Schedule A Every Two Years or 200 Hours	Schedule B Every Four Years or 400 Hours
Check Enclosure Louvers for Dirt and Debris	O			
Check Lines and Connections for Fuel or Oil Leaks	O			
Check Engine Oil Level	O			
Check Battery Condition, Electrolyte Level, and State of Charge		O	O	O
Replace AVR Filter *			O	O
Replace Engine Oil and Oil Filter **			O	O
Replace Engine Air Filter				O
Replace/Gap Spark Plugs				O
Inspect/Adjust Valve Clearance ***				O

Contact the nearest independent Authorized Service Dealer for assistance if necessary.

* Replace AVR filter more frequently if operating in dusty conditions.

** Change engine oil and filter after the first 25 hours of operation. In cold weather conditions (ambient below 40° F/ 4.4° C), or if unit is operated continuously in hot weather conditions (ambient above 85° F / 29.4° C), change engine oil and filter every year or 100 hours of operation.

*** Check/adjust valve clearance after the first 25 hours of operation.

4.4 — Remove From Service

To ensure safety, follow the steps below prior to inspection, maintenance or service.

1. Unlock left and right side locks. Open lid.

NOTE: For best results, press down on lid directly above each side lock, and while holding the lid down, use key to unlock latches.

2. Press OFF on the control pad. A red LED illuminates to confirm that the system is in the OFF mode.
3. Move the Generator Disconnect Circuit Breaker switch to the OFF (Open) position.
4. If the generator has been running, allow one hour to elapse for unit to cool down and fans to stop running.
5. Pull up rubber flap covering fuse holder and remove 7.5 amp fuse.
6. Remove T1 fuse from transfer switch.

4.5 — Daily Maintenance (If Running Continuously)

4.5.1— Check Enclosure Louvers

1. Verify that intake and exhaust louvers and openings are clean and unobstructed.
2. Wipe exterior surfaces clean using a damp cloth.
3. Loosen dirt, oil, etc. with a soft bristle brush.
4. Remove loose dirt and debris using a vacuum cleaner, or low pressure compressed air (not exceeding 25 psi).

NOTE: Periodically wash and wax enclosure using automotive type products. Frequent washing is recommended in salt water/coastal areas.

4.5.2— Check Lines and Connections

Perform a general inspection as follows:

- Check Fuel Lines and Connections for Leaks
- Check Oil Lines and Connections for Leaks

4.5.3— Check Engine Oil Level

1. Remove dipstick and wipe with a clean cloth. See A of Figure 4-1.
2. Completely insert the dipstick and then remove it.

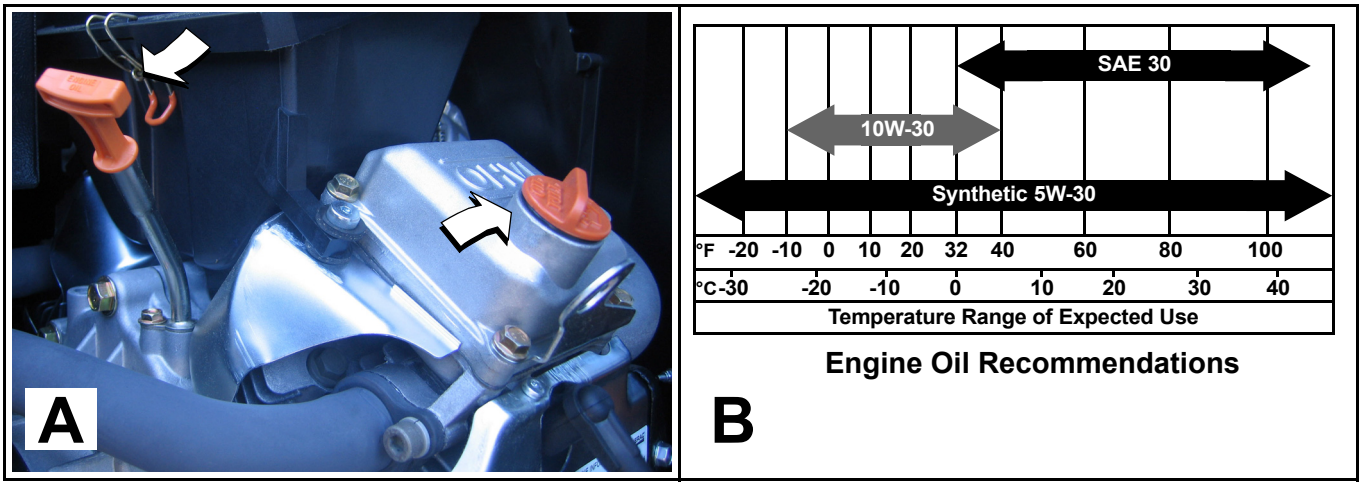

Figure 4-1. Check Engine Oil Level

3. Verify that the oil level is at or near the FULL mark.
4. If necessary, remove the oil fill cap and slowly add the recommended type of oil until the level is at the FULL mark. **DO NOT OVERFILL**. See B of Figure 4-1.
5. Install dipstick and oil fill cap.

⚠CAUTION!

⚠ **Never operate the engine with the oil level below the ADD mark on the dipstick. Doing so could damage the engine.**

⚠ **Hot oil may cause burns. Avoid prolonged or repeated skin exposure with used oil. Thoroughly wash exposed areas with soap.**

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

4.5.3.1— Engine Oil Recommendations

All oil should meet minimum American Petroleum Institute (API) Service Class SJ, SL or better. Use no special additives.

See B of Figure 4-1. Select the oil viscosity grade according to the expected operating temperature.

- Above 32° F (0° C), use SAE 30
- Between 40° F and -10° F (4° C and -23° C), use 10W-30
- For all temperature ranges, use Synthetic 5W-30

4.6 — Schedule A Maintenance

NOTE: Perform Schedule A maintenance every two years or after 200 hours of service, whichever comes first.

4.6.1— Check Battery Condition/Fluid Level

4.6.1.1— Check Condition and Clean

1. Remove front access panel.
2. Verify that top of battery is clean and dry. Dirt and electrolyte on top of the battery can cause battery to self-discharge. Clean battery top with a solution of baking soda (sodium bicarbonate) and water (5 teaspoons baking soda per quart or liter of water). When solution stops bubbling, rinse off the battery with clean water.
3. Clean cable clamps and battery terminals using a wire brush or sandpaper to remove any oxidation.
4. Inspect battery screws, clamps and cables for breakage, loose connections and corrosion. Tighten and clean as necessary.
5. Check the battery posts for melting or damage caused by over tightening.
6. Inspect battery for discoloration, raised top or a warped or distorted case, which might indicate that the battery has been frozen, overheated or overcharged.
7. Inspect the battery case for cracks or leaks.
8. Check the battery fluid level of unsealed batteries. See Subsection 4.6.1.2—Check Fluid Level.
9. Check the battery state of charge. See Subsection 4.6.1.3—Check State of Charge.
10. Replace battery if damaged or unable to hold a charge. See Subsection 4.6.1.4—Battery Replacement.

4.6.1.2— Check Fluid Level

Check the fluid level of unsealed batteries. If necessary, fill with distilled water only. DO NOT use tap water.

4.6.1.3— Check State of Charge

Check the state of charge using a Digital Multimeter. Recharge and retest if state of charge is below manufacturer's recommendations. Replace battery if necessary.

4.6.1.4— Battery Replacement

Removal

⚠ CAUTION!

Always disconnect the negative battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in serious injury.

1. Remove battery negative cable (black) from battery negative (-) terminal.
2. Remove battery positive cable (red) from battery positive (+) terminal.
3. Remove battery from battery tray.

Installation

1. Install battery onto battery tray.

⚠ CAUTION!

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in serious injury.

2. Install battery positive cable (red) to battery positive (+) terminal.
3. Install battery negative cable (black) to battery negative (-) terminal.

4.6.2— Replace AVR Filter

⚠CAUTION!

If utility is present, the secondary 12V DC fan continues to operate for up to one hour after the generator is shut down (even if the 7.5 amp ATO fuse is removed). To avoid hand injury, always exercise caution when working near the AVR fan housing.

⚠CAUTION!

The AVR remains charged for up to three minutes after power down. To avoid potential electrical shock, allow five minutes to elapse before removing AVR filter housing.

1. Remove screw to release AVR filter housing from back panel. See A of Figure 4-2.
2. Remove AVR filter housing.
3. Grasp rubber lifting strap and remove filter from filter housing. Discard filter. See B of Figure 4-2.
4. Install **new** filter, so that edge is positioned inboard of two tabs on filter housing.
5. Install AVR filter housing so the bottom drops into the slots, ensuring that the rubber boot is completely around the fan opening. Install screw to fasten AVR filter housing to back panel and torque to 50-96 **in-lbs** (6-11 Nm).

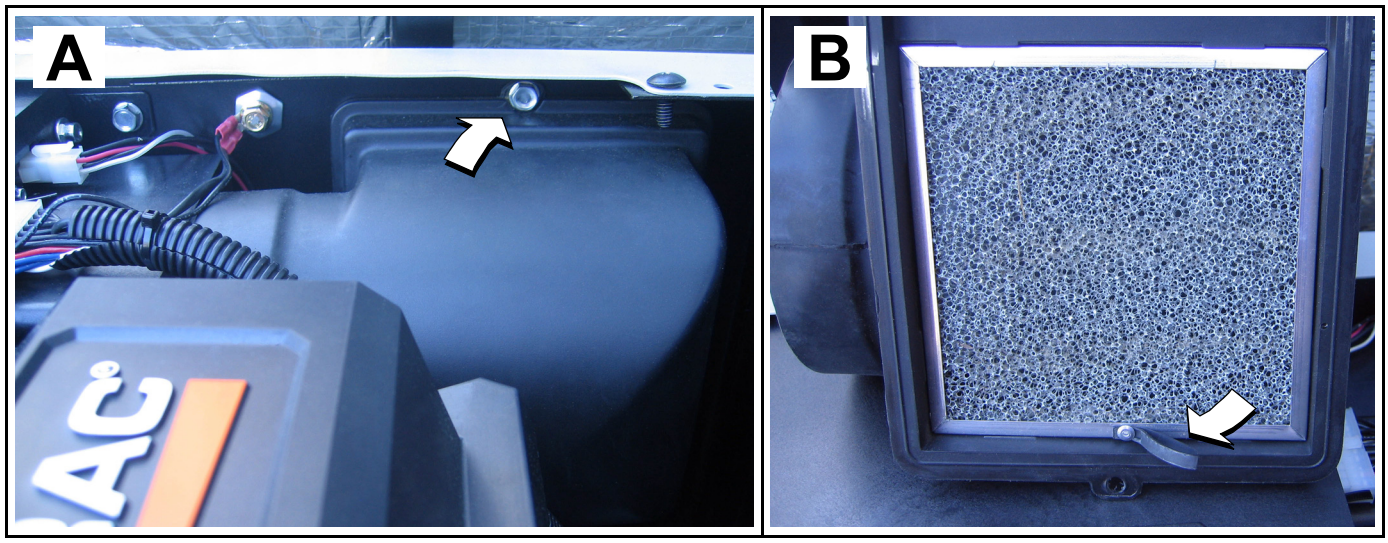

Figure 4-2. Replace AVR Filter

4.6.3— Replace Engine Oil and Oil Filter

1. Remove oil drain hose from holding clamp.
2. Remove drain plug from oil drain hose. See A of Figure 4-3.
3. Drain oil into a suitable container.
4. Install drain plug onto end of oil drain hose.
5. Install oil drain hose into holding clamp.
6. Rotate oil filter counterclockwise to remove from oil filter adapter. See B of Figure 4-3.
7. Apply a light coat of clean engine oil to gasket of **new** oil filter.
8. Install oil filter by hand until gasket just contacts oil filter adapter. Tighten oil filter an additional 3/4 to one full turn.
9. Remove oil fill cap and fill engine with the recommended oil. See Figure 4-1.
10. Install oil fill cap.
11. Return unit to service. See Subsection 4.8 —Return to Service.

12. Press MANUAL on the control pad to start the engine. A blue LED illuminates to confirm that the system is in the MANUAL mode.
13. Allow the engine to run for a few minutes. Check for leaks while the engine is running.
14. Press OFF on the control pad to shut the engine down. A red LED illuminates to confirm that the system is in the OFF mode.
15. Remove dipstick and wipe with a clean cloth.
16. Completely insert the dipstick and then remove it.
17. Verify that the oil level is at or near the FULL mark.
18. If necessary, remove the oil fill cap and slowly add oil until the level is at the FULL mark. **DO NOT OVERFILL**.
19. Install dipstick and oil fill cap.

NOTE: Dispose of used engine oil and oil filter at a proper collection center.

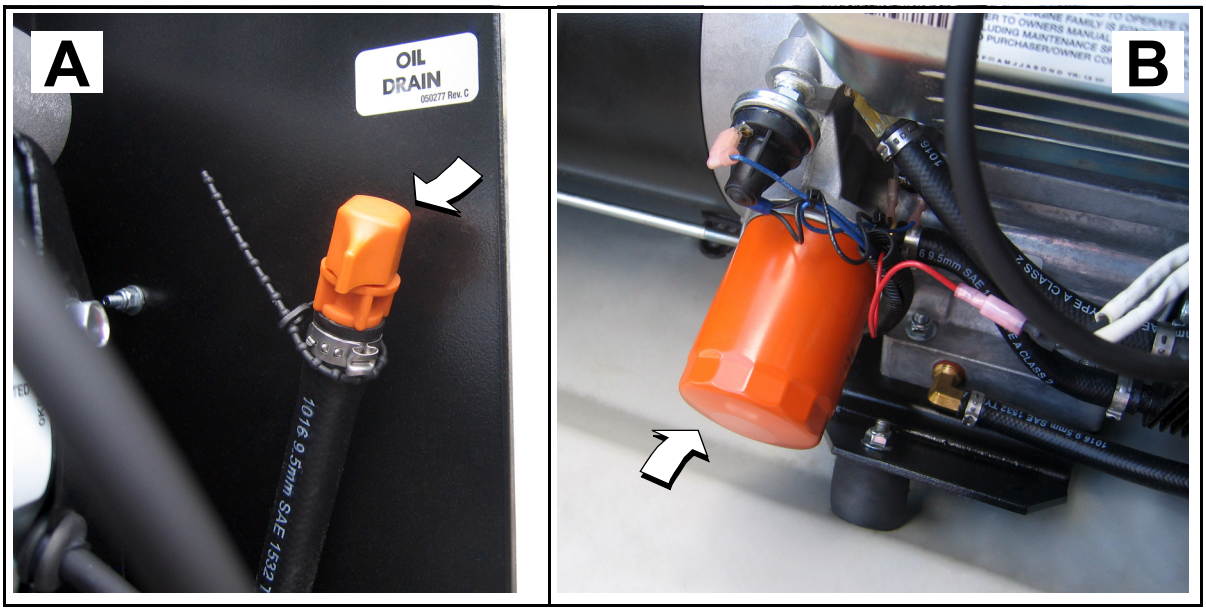

Figure 4-3. Oil Drain and Filter Location

4.7 — Schedule B Maintenance

NOTE: Perform Schedule B maintenance every four years or after 400 hours of service, whichever comes first. Before proceeding below, first perform all tasks listed under Schedule A Maintenance.

4.7.1— Replace Engine Air Filter

1. Remove unit from service. See Subsection 4.4 —Remove From Service.
2. Disengage cover clip and remove air cleaner cover. See A of Figure 4-4.
3. Remove air filter and discard.
4. Thoroughly clean the air cleaner cover and housing of dust and dirt.
5. Install **new** air filter. See B of Figure 4-4.
6. Install air cleaner cover and engage cover clip.

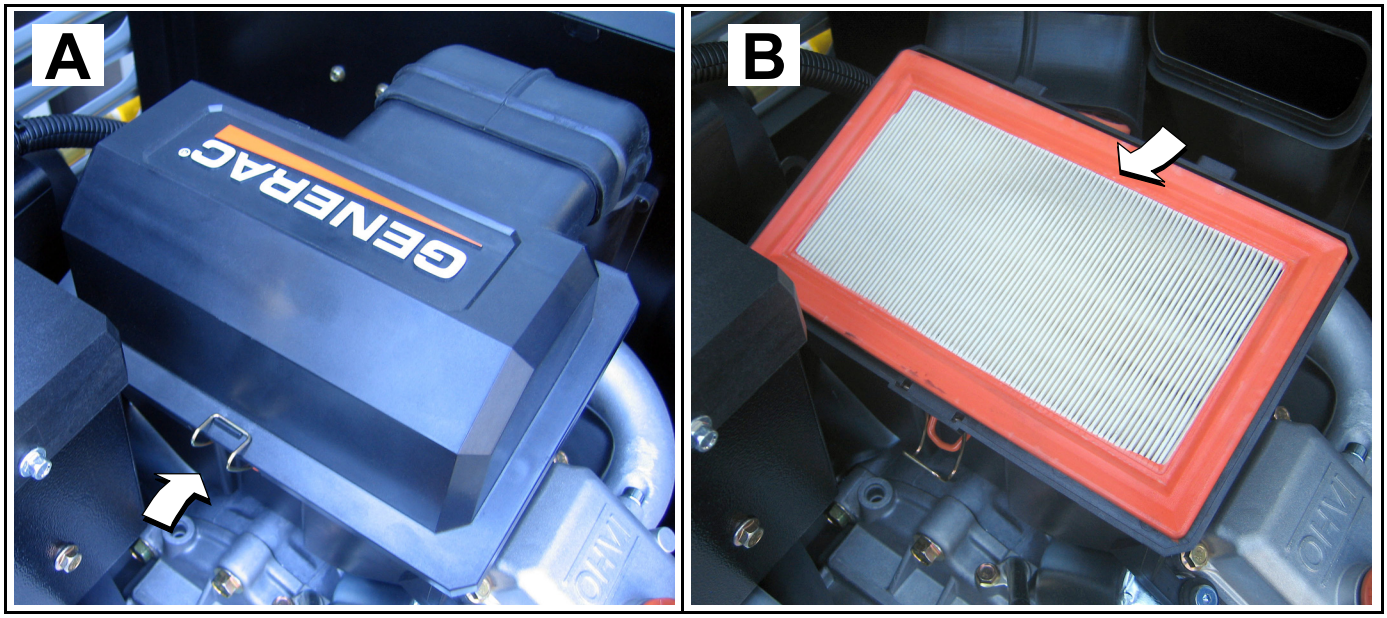

Figure 4-4. Replace Engine Air Filter

4.7.2— Clean/Gap/Replace Spark Plugs

Clean, gap or replace spark plugs as follows:

⚠ DANGER!

Never disconnect a spark plug with the engine running. Doing so will result in an electric shock that could result in death or serious injury.

⚠ CAUTION!

If utility is present, the secondary 12V DC fan continues to operate for up to one hour after the generator is shut down (even if the 7.5 amp ATO fuse is removed). To avoid hand injury, always exercise caution when working near the AVR fan housing.

⚠ CAUTION!

The AVR remains charged for up to three minutes after power down. To avoid potential electrical shock, allow five minutes to elapse before removing AVR filter housing.

1. Remove screw to release AVR filter housing from back panel. Remove AVR filter housing.
2. Remove spark plug cables from spark plug terminals.

NOTE: When disconnecting spark plug cable from spark plug terminal, always grasp and pull on the boot at the terminal end of the cable. Pulling on cable portion can result in parts damage.

3. Thoroughly clean area around spark plugs.
4. Remove spark plugs from cylinder head using a 5/8 inch spark plug socket.

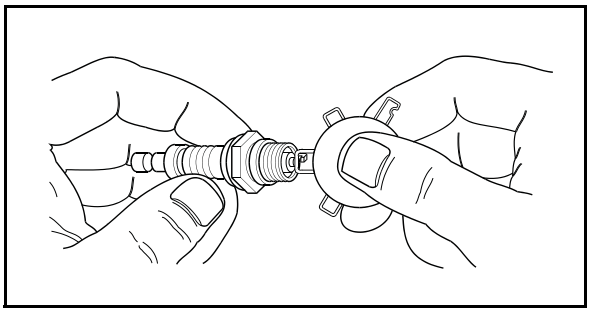

Figure 4-5. Adjust Spark Plug Gap

5. Check condition of threads in cylinder head and on spark plugs. If necessary, soften deposits with penetrating oil and clean out with a thread chaser.
6. Clean spark plugs using a wire brush and commercial solvent. Do not blast spark plugs. Use **new** spark plugs if necessary.
7. See Figure 4-5. Check spark plug gap using a wire feeler gauge. Adjust gap by carefully bending ground electrode to the dimensions in Section 2.5.2 - ENGINE.
8. Finger tighten spark plugs into cylinder head, and then using a spark plug socket, tighten to 15-18 ft-lbs (20-25 Nm).
9. Install spark plug cables onto spark plug terminals.
10. Install AVR filter housing. Install screw to fasten AVR filter housing to back panel and torque to 50-96 **in-lbs** (6-11 Nm).

4.7.3— Check/Adjust Valve Clearance

IMPORTANT: If uncomfortable performing this procedure or the proper tools are not available, contact the nearest independent Authorized Service Dealer for assistance. This procedure is a very important to ensure maximum engine service life.

4.7.3.1— Check Valve Clearance

1. Verify that engine is at ambient air temperature.

⚠ CAUTION!

The AVR remains charged for up to three minutes after power down. To avoid potential electric shock, allow five minutes to elapse before removing AVR filter housing.

2. Remove screw to release AVR filter housing from back panel. Remove AVR filter housing. See A of Figure 4-2.
3. Depress external latch to disconnect 4-pin connector from AVR.
4. Remove three screws to release AVR fan from AVR. See Figure 4-6.
5. Remove spark plug cables from spark plug terminals.

NOTE: When disconnecting spark plug cable from spark plug terminal, always grasp and pull on the boot at the terminal end of the cable. Pulling on cable portion can result in parts damage.

6. Thoroughly clean area around spark plugs.
7. Remove spark plugs from cylinder head using a 5/8 inch spark plug socket.
8. Remove four screws to release valve cover.

9. Move piston to Top Dead Center (TDC) of compression stroke (both valves closed). Proceed as follows:
   a. Remove intake screen at front of engine to gain access to flywheel nut.
   b. Place large socket and socket wrench on flywheel nut and rotate engine in a clockwise direction while watching piston through spark plug hole.

NOTE: Piston is at TDC when it is at the highest point of travel.

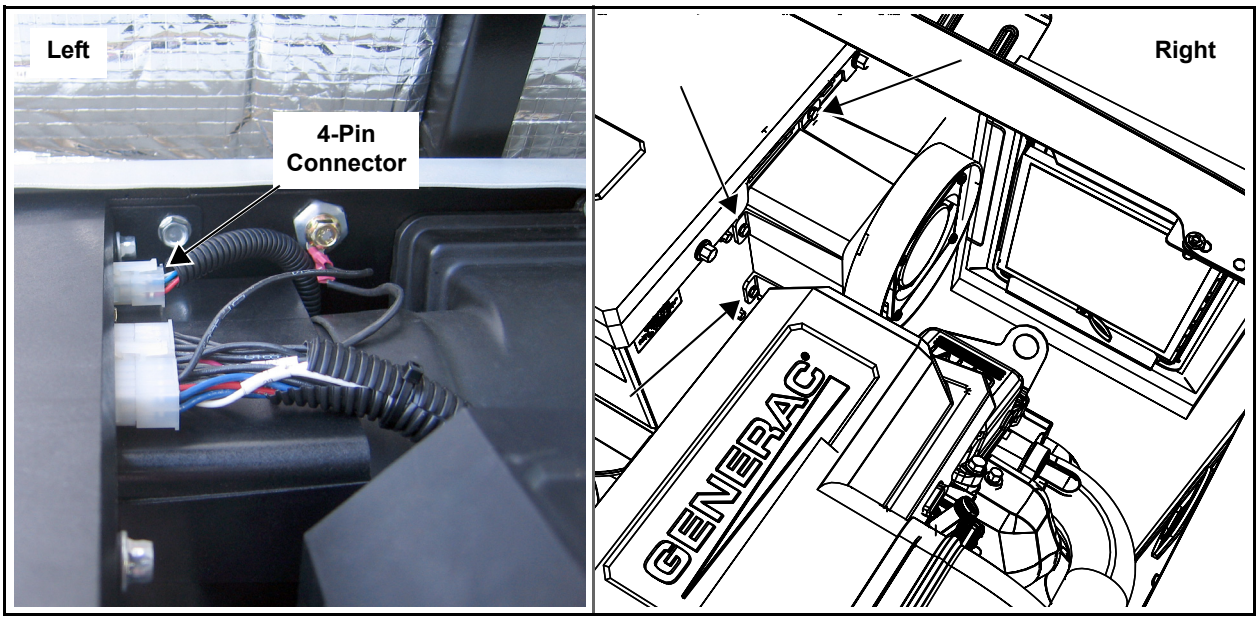

Figure 4-6. Remove AVR Fan Connector and Screws

10. Insert a 0.002 - 0.004 inch (0.05 - 0.1mm) feeler gauge between rocker arm and valve stem. Clearance is correct when a slight drag is felt while sliding feeler gauge back and forth. Verify that clearances are within the following specification:
    - Intake and Exhaust: 0.002 - 0.004 inch (0.05 - 0.1mm)
11. Proceed as follows:
    a. If valve clearance adjustment is required, see Subsection 4.7.3.2— Adjust Valve Clearance.
    b. If valve clearance is within specification, see steps 5-12 under Subsection 4.7.3.2— Adjust Valve Clearance.

4.7.3.2— Adjust Valve Clearance

1. Loosen rocker arm jam nut. Use an Allen wrench to turn the pivot ball stud, while also checking clearance between rocker arm and valve stem with the feeler gauge.

NOTE: Hold the rocker arm jam nut in place as the pivot ball stud is turned.

2. When the correct valve clearance is obtained, hold the pivot ball stud in place with the Allen wrench and tighten rocker arm jam nut until snug.
3. Using a torque wrench, tighten jam nut to 174 **in-lbs** (20 N-m).
4. Recheck valve clearance to verify that it did not change during tightening of the jam nut.
5. Install **new** valve cover gasket.
6. Start four screws to install valve cover.
7. Verify that valve cover gasket is properly positioned, and then alternately tighten screws to 6-9 ft-lbs (8-12 Nm) using a crosswise pattern
8. Finger tighten spark plugs into cylinder head, and then using a spark plug socket, tighten to 15-18 ft-lbs (20-25 Nm).
9. Install spark plug cables onto spark plug terminals.

10. Install the AVR fan.

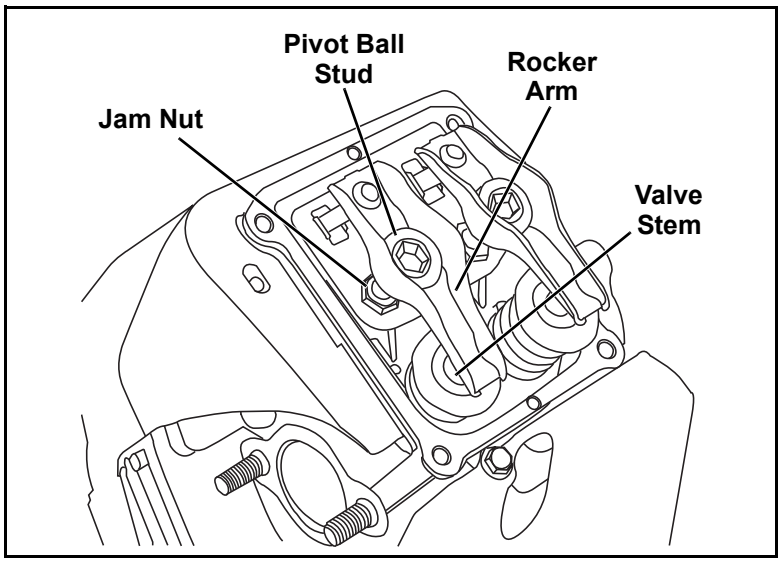

Figure 4-7. Check/Adjust Valve Clearance

11. Connect 4-pin connector to AVR. Press pin and socket halves together until external latch engages.
12. Install AVR filter housing so the bottom drops into the slots and ensuring that the rubber boot is completely around the fan opening. Install screw to fasten AVR filter housing to back panel and torque to 50-96 **in-lbs** (6-11 Nm).

4.8 — Return to Service

1. Install front access panel.
2. Install T1 fuse in transfer switch.
3. Pull up rubber flap covering fuse holder and install 7.5 amp fuse.
4. Follow Install Wizard instructions using LCD screen and control pad.
5. Move the Generator Disconnect Circuit Breaker switch to the ON (Closed) position.
6. Press AUTO on the control pad. A green LED illuminates to confirm that the system is in the AUTO mode.
7. Close lid. Lock left and right side locks.

4.9 — Attention After Submersion

If the generator has been submerged in water, it MUST NOT be started and operated. Following any submersion in water, have a Dealer thoroughly clean, dry, and inspect the generator. If the structure (home) has been flooded, it should be inspected by a certified electrician to ensure there won't be any electrical problems during generator operation or when utility power is returned.

4.10 — Corrosion Protection

Periodically wash and wax the enclosure using automotive type products. Frequent washing is recommended in salt water/coastal areas. Spray engine linkages with a light oil such as WD-40.

4.11 — Out of Service Procedure

If the generator cannot be exercised every seven days and will be out of service longer than 90 days, prepare the generator for storage.

4.11.1— Remove For Storage

1. Press MANUAL on the control pad to start the engine. A blue LED illuminates to confirm that the system is in the MANUAL mode.

2. Allow the unit to warm up for a few minutes.
3. Press OFF on the control pad to stop the engine. A red LED illuminates to confirm that the system is in the OFF mode.
4. While the engine is still warm, completely drain engine oil and refill the crankcase with oil. See Subsection 4.6.3—Replace Engine Oil and Oil Filter.
5. Press MANUAL on the control pad to start the engine. A blue LED illuminates to confirm that the system is in the MANUAL mode.
6. Close the fuel shutoff valve in the fuel supply line and allow the unit to shut down.
7. Verify that engine oil level is at or near the FULL mark. Remove the oil fill cap and slowly add the recommended type of oil, if necessary. **DO NOT OVERFILL**.
8. Set the Generator Disconnect Circuit Breaker switch to the OFF (Open) position.
9. Turn off the utility power to the transfer switch.
10. Pull up rubber flap covering fuse holder and remove 7.5 amp fuse.

⚠ CAUTION!

Always disconnect the negative battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in serious injury.

11. Remove battery negative cable (black) from battery negative (-) terminal.
12. Remove battery positive cable (red) from battery positive (+) terminal.
13. Remove battery charger AC input T1/Neutral cable (with white sleeve).
14. Attach tag to engine indicating the viscosity and classification of the oil added to the crankcase.
15. Remove spark plugs. Spray a fogging agent into the spark plug holes. Reinstall spark plugs. For more information, see Subsection 4.7.2—Clean/Gap/Replace Spark Plugs.
16. Remove battery and store in a cool, dry room on a wooden board. Never store the battery on a concrete or earthen floor.
17. Clean and wipe down the entire generator. See Subsection 4.5.1—Check Enclosure Louvers.

4.11.2— Return To Service After Storage

To return the unit to service after storage:

1. Verify that utility power is turned off.
2. Check tag on engine indicating the viscosity and classification of the oil added to the crankcase. If necessary, drain and refill crankcase with the proper oil. See Subsection 4.6.3—Replace Engine Oil and Oil Filter.
3. Check the fluid level of unsealed batteries. If necessary, fill with distilled water only. DO NOT use tap water. Check the state of charge using a Digital Multimeter. Recharge and retest if state of charge is below manufacturer's recommendations. Replace battery if necessary.
4. Clean and wipe down the entire generator. See Subsection 4.5.1—Check Enclosure Louvers.
5. Pull up rubber flap covering fuse holder and remove 7.5 amp fuse.
6. Install battery onto battery tray.

⚠ CAUTION!

Always connect the positive battery cable first. If the positive cable should contact ground with the negative cable installed, the resulting sparks may cause a battery explosion which could result in serious injury.

7. Install battery positive cable (red) to battery positive (+) terminal.
8. Install battery negative cable (black) to battery negative (-) terminal.
9. Reconnect the battery charger AC input T1/Neutral cable (with white sleeve).
10. Open the fuel shutoff valve.

11. Pull up rubber flap covering fuse holder and install 7.5 amp fuse.
12. Follow Install Wizard instructions using LCD screen and control pad.
13. Press MANUAL on the control pad to start the engine. A blue LED illuminates to confirm that the system is in the MANUAL mode.
14. Allow the unit to warm up for a few minutes.
15. Press OFF on the control pad to stop the engine. A red LED illuminates to confirm that the system is in the OFF mode.
16. Turn on the utility power to the transfer switch.
17. Move the Generator Disconnect Circuit Breaker switch to the ON (Closed) position.
18. Press AUTO on the control pad to stop the engine. A green LED illuminates to confirm that the system is in the AUTO mode.

The generator is ready for service.

NOTE: When a battery is dead or has been disconnected, the exercise timer and current date and time must be reset.

5.1 — Engine Troubleshooting

Table 5-1. Engine Diagnostics

Problem	Cause	Correction
Engine will not crank.	1) Fuse blown. 2) Loose, corroded or defective battery cables. 3) Defective starter contact. 4) Defective starter motor. 5) Dead Battery.	1) Correct short circuit condition by replacing 7.5 Amp fuse. 2) Tighten, clean or replace as necessary.* 3) Tighten, clean or replace as necessary.* 4) Tighten, clean or replace as necessary.* 5) Charge or replace battery.
Engine cranks but will not start.	1) Out of fuel. 2) Defective fuel solenoid (FS). 3) Defective spark plug(s). 4) Valve clearance needs adjustment.	1) Replenish fuel / Turn on fuel valve. 2) * 3) Clean, re-gap or replace plug(s). 4) Adjust valve clearance.
Engine starts hard and runs rough.	1) Air cleaner plugged or damaged. 2) Defective spark plug(s). 3) Fuel regulator not set. 4) Fuel pressure incorrect. 5) Fuel selector in wrong position.	1) Check / replace air cleaner. 2) Clean, re-gap or replace plug(s). 3) Set fuel regulator. 4) Confirm fuel pressure to regulator is 10-12” water column (19-22mm mercury) for LP, and 3.5 - 7” water column (9-13mm mercury) for natural gas. 5) Move selector to correct position.
Generator is set to OFF, but the engine continues to run.	1) Control board wired incorrectly. 2) Defective control board.	1) Repair wiring or replace control board.* 2) Replace control board.
No AC output from generator.	1) Main line circuit breaker is in the OFF (or OPEN) position. 2) Generator internal failure.	1) Reset circuit breaker to ON (or CLOSED). 2) *
No transfer to standby after utility source failure.	1) Defective transfer switch coil. 2) Defective transfer relay. 3) Transfer relay circuit open. 4) Defective control logic board.	1) * 2) * 3) * 4) *
Unit consumes large amounts of oil.	1) Engine over filled with oil. 2) Engine breather defective. 3) Improper type or viscosity of oil. 4) Damaged gasket, seal or hose.	1) Adjust oil to proper level. 2) * 3) See “Engine Oil Recommendations.” 4) Check for oil leaks.
* Contact an Authorized Independent Service Dealer for assistance.		

5.2 — Generator Troubleshooting

Table 5-2. Generator Diagnostics

Active Alarm	LED	Problem	Things to Check	Solution
NONE	GREEN	Unit running in AUTO but no power in house.	Check Generator Disconnect circuit breaker.	Contact servicing dealer if Generator Disconnect circuit breaker is in the ON position.
HIGH TEMPERATURE	RED	Unit shuts down during operation.	Check the LEDs/Screen for alarms.	Check ventilation around the intake, exhaust and rear of generator. Contact serving dealer if no obstruction is found.
OVERLOAD REMOVE LOAD	RED	Unit shuts down during operation.	Check the LEDs/Screen for alarms.	Clear alarm and remove household loads from the generator. Put back in AUTO and restart.
RPM SENSE LOSS	RED	Unit was running and shuts down, attempts to restart.	Check the LEDs/Screen for alarms.	Clear alarm and remove household loads from the generator. Put back in AUTO and restart. If problem returns, contact servicing dealer to investigate possible fuel issue.
NOT ACTIVATED	NONE	Unit will not start in AUTO with utility loss.	See if screen says unit not activated.	Refer to activation section in Owner's Manual.
None	GREEN	Unit will not start in AUTO with utility loss.	Check screen for start delay countdown.	If the start up delay is greater than expected, contact servicing dealer to adjust from 2 to 1500 seconds.
LOW OIL PRESSURE	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Check oil level. Add oil per Owner's Manual. Contact servicing dealer if oil level is correct.
RPM SENSE LOSS	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Clear alarm. Navigate to the BATTERY MENU on the control pad LCD. Contact servicing dealer if battery is GOOD. Replace battery If CHECK BATTERY is displayed.
OVERCRANK	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Check fuel line shutoff valve is in the ON position. Clear alarm. Attempt to start the unit in MANUAL. If it does not start or starts and runs rough, contact servicing dealer.
LOW VOLTS REMOVE LOAD	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Clear alarm and remove household loads from the generator. Set back to AUTO and restart.
FUSE PROBLEM	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Check ATO 7.5 Amp fuse. Replace with same type fuse if bad. Contact servicing dealer if fuse is good.
OVERSPEED	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Contact servicing dealer.
UNDER VOLTAGE	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Contact servicing dealer.
UNDERSPEED	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Contact servicing dealer.

Table 5-2. Generator Diagnostics (Continued)

Active Alarm	LED	Problem	Things to Check	Solution
STEPPER OVERCUR-RENT	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Contact servicing dealer.
MISWIRE	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Contact servicing dealer.
OVERVOLTAGE	RED	Unit will not start in AUTO with utility loss.	Check the LEDs/Screen for alarms.	Contact servicing dealer.
LOW BATTERY	YELLOW	Yellow LED illuminated in any state.	Check screen for additional information.	Clear alarm. Navigate to the BATTERY MENU on the control pad LCD. Contact servicing dealer if battery is GOOD. Replace battery If CHECK BATTERY is displayed.
BATTERY PROBLEM	YELLOW	Yellow LED illuminated in any state.	Check screen for additional information.	Contact servicing dealer.
CHARGER WARNING	YELLOW	Yellow LED illuminated in any state.	Check screen for additional information.	Contact servicing dealer
SERVICE A	YELLOW	Yellow LED illuminated in any state.	Check screen for additional information.	Perform SCHEDULE A maintenance. Press ENTER to clear.
SERVICE B	YELLOW	Yellow LED illuminated in any state.	Check screen for additional information.	Perform SCHEDULE B maintenance. Press ENTER to clear.
Inspect Battery	YELLOW	Yellow LED illuminated in any state.	Check screen for additional information.	Inspect battery. Press ENTER to clear.

5.3 — Synergy Troubleshooting

Table 5-3. Synergy Diagnostics

Ecode/Active Alarm	LED	Problem	Things to Check	Possible Causes/Solution
1048 VSCF Overload	RED	Unit shuts down during operation.	Check the LEDs/Screen for alarms.	Alternator, AVR or wiring is damaged. Contact servicing dealer.
1049 VSCF Overload	RED	Unit shuts down during operation.	Check the LEDs/Screen for alarms.	Generator output is shorted or severely overloaded. Identify and clear the overload, and then restart.
1051 VSCF High Battery	YELLOW	Yellow LED illuminated in any state.	Check the LEDs/Screen for alarms.	Voltage supply to the AVR is high. If an external battery charger is in use, contact installing dealer to correct installation. If an external battery charger is NOT in use, contact servicing dealer.
1052 VSCF DC Overvoltage	RED	Unit shuts down during operation.	Check the LEDs/Screen for alarms.	Probable causes are: 1) The generator was temporarily overloaded. 2) The output was temporarily shorted. Try to restart the unit.
1053 VSCF Gate Fault	RED	Unit shuts down during operation or starting.	Check the LEDs/Screen for alarms.	AVR is damaged. Contact servicing dealer.
1054 VSCF IGBT Overtemp.	RED	Unit shuts down during operation or starting.	Check the LEDs/Screen for alarms.	Probable causes are: 1) Replace AVR filter. Inspect fan. 2) Intake or exhaust air path is blocked. Check intake and exhaust. 3) The BIG fan is not running (only runs when the engine is running). KEEP FINGERS AWAY FROM FAN HOUSING- PERSONAL INJURY CAN OCCUR IF FAN IS RUNNING. Contact servicing dealer. 4) Air leak in AVR enclosure. Contact servicing dealer. 5) Engine running too hot. Inspect air intake and exhaust. 6) Ambient temperature has risen above 60º F. Derate the generator output per specifications.
1055 VSCF Phase Error	RED	Unit shuts down during starting.	Check the LEDs/Screen for alarms.	An incorrect voltage and frequency has been detected during starting. Probable causes are: 1) Alternator damage. Contact servicing dealer. 2) Generator has started into a severe load. Manually operate transfer switch back to utility position and try to restart unit. If problem persists, remove load and attempt to restart unit again. 3) The engine may not be reaching its prescribed speed. Proceed as follows: • Verify stepper motor is moving and linkage is free. • Verify stepper motor is plugged in. • Verify gas pressure is within specified limits.
1056 VSCF Undervoltage	RED	Unit shuts down during operation or starting.	Check the LEDs/Screen for alarms.	The generator output voltage is too low. Probable causes are: 1) The load is too large. Remove load and attempt to restart unit. 2) Alternator or AVR damage. Contact servicing dealer.

Table 5-3. Synergy Diagnostics (Continued)

Ecode/Active Alarm	LED	Problem	Things to Check	Possible Causes/Solution
1057 VSCF Overvoltage	RED	Unit shuts down during operation or starting.	Check the LEDs/Screen for alarms.	Probable causes are: 1) The generator has been overloaded. Remove load and attempt to restart unit. 2) Generator has started into a severe load. Manually operate transfer switch back to utility position and try to restart unit. If problem persists, remove load and attempt to restart unit again.
1058 VSCF DC Undervoltage	RED	Unit shuts down during operation or starting.	Check the LEDs/Screen for alarms.	The DPE winding supplies this voltage. 1) Alternator damage. Contact servicing dealer.
1059 VSCF Field Loss	RED	Unit shuts down during starting.	Check the LEDs/Screen for alarms.	Unit detects no output voltage while starting. 1) Alternator damage. Contact servicing dealer.
1061 VSCF Field Loss	RED	Unit shuts down during operation.	Check the LEDs/Screen for alarms.	Unit detects loss of output voltage while running. 1) Alternator damage. Contact servicing dealer.
1060 Big Fan Failure	RED	Unit shuts down during operation.	Check the LEDs/Screen for alarms.	This alarm occurs when the AVR electronics temperature exceeds 70 C. Possible causes are: 1) AVR filter faulty. Replace AVR filter. 2) Intake or exhaust air path is blocked. Check intake and exhaust. 3) The BIG fan is not running (only runs when the engine is running). **KEEP FINGERS AWAY FROM FAN HOUSING- PERSONAL INJURY CAN OCCUR IF FAN IS RUNNING.** Contact servicing dealer. 4) Air leak in AVR enclosure. Contact servicing dealer. 5) Engine running too hot. Inspect air intake and exhaust. 6) Ambient temperature has risen above 60º F. Derate the generator output per specifications. If message is displayed when generator is stopped, also check SMALL fan. Small fan RUNS for 60 minutes after generator is stopped and keeps electronics cool during heat soak.
1065 Overfrequency	RED	Unit shuts down during operation.	Check the LEDs/Screen for alarms.	Probable causes are: 1) Overload. Remove load and attempt to restart unit. 2) RPM sensor has failed. Contact servicing dealer. 3) Stepper motor problem. Contact servicing dealer.
1066 VSCF Speed mismatch	RED	Unit shuts down during Operation or starting.	Check the LEDs/Screen for alarms.	1) Fuel problem (pressure loss). Check fuel supply and attempt to restart unit. 2) A large load is not wired through the Loadshed module. Contact installing dealer to correct installation. 3) Large overload. Remove load and attempt to restart unit. 4) Throttle or engine problem. Contact servicing dealer.
1070 Small fan failure	YELLOW	“Small fan failure” is displayed. If unit was running in AUTO and utility returns, it will continue to run for one hour to cool electronics without fan.	Check the LEDs/Screen for alarms.	Small fan current incorrect. Probable causes are: 1) Fan wiring or mechanical problem. Contact servicing dealer. 2) Air path is blocked. Check AVR filter. **KEEP FINGERS AWAY FROM FAN HOUSING- PERSONAL INJURY CAN OCCUR IF FAN IS RUNNING.**

5.4 — Load Shed Troubleshooting

Table 5-4. Load Shed Diagnostics

Symptom	Possible Causes
Generator stalls when large load is supplied.	1) Total load is too big for the generator and fuel type. Contact installing dealer to correct installation. 2) A large load is not wired through the Loadshed module. Contact installing dealer to correct installation.
Large loads keep getting shed and locked out (load LED goes out for 30 minutes).	Total load is too big for generator. Contact installing dealer to correct installation.
Output voltage is low/high.	Voltage calibration incorrect. Contact servicing dealer.
Generator does not pull full power.	Current calibration incorrect. Contact servicing dealer.

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Generac Power Systems, Inc.
S45 W29290 Hwy. 59
Waukesha, WI 53189
1-888-GENERAC (1-888-436-3722)
generac.com