Operator’s Manual

Inverter Generator

GPi 3200 / GPSi 3200
GPi 4300 / GPSi 4300

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Manufacturer

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Original instructions

This Operator's Manual presents the original instructions. The original language of this Operator's Manual is American English.

Foreword

SAVE THESE INSTRUCTIONS—This manual contains important instructions for the machine models listed below. These instructions must be followed during installation and maintenance of the generator (and battery, if equipped).

Machines covered in this manual

Machine	Item Number
GPi 3200	0620781, 0620779
GPSi 3200	0620780, 0620936
GPi 4300	0620782, 0620784
GPSi 4300	0620783, 0620937

Machine documentation

- Keep a copy of the Operator's Manual with the machine at all times.
- Use the separate Parts Book supplied with the machine to order replacement parts.
- If you are missing either of these documents, please contact Wacker Neuson Corporation to order a replacement or visit www.wackerneuson.com.
- When ordering parts or requesting service information, be prepared to provide the machine model number, item number, revision number, and serial number.

Expectations for information in this manual

- This manual provides information and procedures to safely operate and maintain the above Wacker Neuson model(s). For your own safety and to reduce the risk of injury, carefully read, understand, and observe all instructions described in this manual.
- Wacker Neuson Corporation expressly reserves the right to make technical modifications, even without notice, which improve the performance or safety standards of its machines.
- The information contained in this manual is based on machines manufactured up until the time of publication. Wacker Neuson Corporation reserves the right to change any portion of this information without notice.

CALIFORNIA Proposition 65 Warning

Engine exhaust, some of its constituents, and certain vehicle components, contain or emit chemicals known to the State of California to cause cancer and birth defects or other reproductive harm.

Laws pertaining to spark arresters

NOTICE: State Health Safety Codes and Public Resources Codes specify that in certain locations spark arresters be used on internal combustion engines that use hydrocarbon fuels. A spark arrester is a device designed to prevent accidental discharge of sparks or flames from the engine exhaust. Spark arresters are qualified and rated by the United States Forest Service for this purpose. In order to comply with local laws regarding spark arresters, consult the engine distributor or the local Health and Safety Administrator.

Foreword

Manufacturer's approval

This manual contains references to *approved* parts, attachments, and modifications. The following definitions apply:

- **Approved parts or attachments** are those either manufactured or provided by Wacker Neuson.
- **Approved modifications** are those performed by an authorized Wacker Neuson service center according to written instructions published by Wacker Neuson.
- **Unapproved parts, attachments, and modifications** are those that do not meet the approved criteria.

Unapproved parts, attachments, or modifications may have the following consequences:

- Serious injury hazards to the operator and persons in the work area
- Permanent damage to the machine which will not be covered under warranty

Contact your Wacker Neuson dealer immediately if you have questions about approved or unapproved parts, attachments, or modifications.

1 Safety Information

1.1 Signal Words Found in this Manual

This manual contains DANGER, WARNING, CAUTION, *NOTICE,* and NOTE signal words which must be followed to reduce the possibility of personal injury, damage to the equipment, or improper service.

This is the safety alert symbol. It is used to alert you to potential personal hazards.

- ▶ Obey all safety messages that follow this symbol.

DANGER

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

- ▶ To avoid death or serious injury from this type of hazard, obey all safety messages that follow this signal word.

WARNING

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

- ▶ To avoid possible death or serious injury from this type of hazard, obey all safety messages that follow this signal word.

CAUTION!

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

- ▶ To avoid possible minor or moderate injury from this type of hazard, obey all safety messages that follow this signal word.

NOTICE: Used without the safety alert symbol, NOTICE indicates a situation which, if not avoided, could result in property damage.

Note: *A Note contains additional information important to a procedure.*

1.2 Machine Description and Intended Use

This machine is a portable electric power source. The Wacker Neuson Inverter Generator consists of a gasoline engine, a fuel tank, and an electric alternator and inverter. Controls and receptacles are provided on a control panel mounted on the side of the machine. As the engine runs, the generator converts mechanical energy into AC power and DC power. The operator connects loads to the AC power receptacles or DC terminals.

This machine is intended for the purpose of supplying electrical power to connected loads. Refer to the product specifications for the output voltage and frequency of this generator, and for the maximum output power limit of this generator.

This machine has been designed and built strictly for the intended use described above. Using the machine for any other purpose could permanently damage the machine or seriously injure the operator or other persons in the area. Machine damage caused by misuse is not covered under warranty.

The following practices are some examples of misuse:

- Connecting a load that has voltage and frequency requirements that are incompatible with the generator output
- Overloading the generator with a load that draws excessive power during either continuous running or start-up
- Operating the generator in a manner that is inconsistent with all federal, state and local codes and regulations.
- Using the machine as a ladder, support, or work surface
- Using the machine to carry or transport passengers or equipment
- Operating the machine outside of factory specifications
- Operating the machine in a manner inconsistent with all warnings found on the machine and in the Operator’s Manual

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This machine has been designed and built in accordance with the latest global safety standards. It has been carefully engineered to eliminate hazards as far as practicable and to increase operator safety through protective guards and labeling. However, some risks may remain even after protective measures have been taken. They are called residual risks. On this machine, they may include exposure to:

- Heat, noise, exhaust, and carbon monoxide from the engine
- Fire hazards from improper refueling techniques
- Fuel and its fumes
- Electric shock and arc flash
- Personal injury from improper lifting techniques

To protect yourself and others, make sure you thoroughly read and understand the safety information presented in this manual before operating the machine.

1.3 Safety Guidelines for Operating the Machine

DANGER

Carbon monoxide. Using a generator indoors CAN KILL YOU IN MINUTES. Generator exhaust contains carbon monoxide (CO). This is a poison you cannot see or smell. If you can smell the generator exhaust, you are breathing CO. But even if you cannot smell the exhaust, you could be breathing CO.

- NEVER use a generator inside homes, garages, crawlspaces, or other partly enclosed areas. Deadly levels of carbon monoxide can build up in these areas. Using a fan or opening windows and doors does NOT supply enough fresh air.
- ONLY use a generator outside and far away from windows, doors, and vents. These openings can pull in generator exhaust.
- Even when you use a generator correctly, CO may leak into the home. ALWAYS use a battery-powered or battery-backup CO alarm in the home.
- If you start to feel sick, dizzy, or weak after the generator has been running, move to fresh air RIGHT AWAY. See a doctor. You could have carbon monoxide poison.

WARNING

Machines operated improperly or by untrained personnel can be hazardous.

- Read the operating instructions contained in both this Operator's Manual and the engine operator's manual.
- Familiarize yourself with the location and proper use of all controls.
- Inexperienced operators should receive instruction from someone familiar with the machine before being allowed to operate it.

Operator qualifications

Only trained personnel are permitted to start, operate, and shut down the machine. They also must meet the following qualifications:

- have received instruction on how to properly use the machine
- are familiar with required safety devices

The machine must not be accessed or operated by:

- children
- people impaired by alcohol or drugs

Personal Protective Equipment (PPE)

Wear the following Personal Protective Equipment (PPE) while operating this machine:

- Close-fitting work clothes that do not hinder movement
- Safety glasses with side shields
- Hearing protection
- Safety-toed footwear

Before starting the machine

Before starting this machine:

- Follow starting and stopping instructions described in this manual. Know how to operate and stop the generator before starting it.
- Do not start a machine in need of repair.

- Make sure the machine is on a firm, level surface and will not tip, roll, slide, or fall while operating.
- Remove all tools, cords, and other loose items from the generator before starting it.

Electrical safety

To increase electrical safety while operating this machine:

- Do not operate the generator, or tools attached to the generator, with wet hands.
- Do not use worn electrical cords. Severe electrical shock and equipment damage may result.
- Do not operate generator in standing water.
- Make certain the machine is well-grounded and securely fastened to a good earthen ground per national and local regulations.
- Do not overload the generator. The total amperage of the tools and equipment attached to the generator must not exceed the load rating of the generator.

WARNING

Backfeed from the generator into the public power distribution system can seriously injure or kill utility workers!

- ▶ Improper connection of generator to a building's electrical system can allow electrical current from the generator to backfeed into utility lines. This may result in electrocution of utility workers, fire, or explosion.
- ▶ Connections to a building's electrical system must be made by a qualified electrician and comply with all applicable laws and electrical codes.
- ▶ If connected to a building's electrical system, the generator must meet the power, voltage, and frequency requirements of the equipment in the building.

Generator vibration

Generators vibrate in normal use. During and after the use of the generator, inspect the generator as well as extension cords and power supply cords connected to it for damage from vibration.

- Have damaged items repaired or replaced as necessary.
- Do not use plugs or or cords that show signs of damage such as broken or cracked insulation or damaged blades.

Operating safety

To increase operating safety while running this machine:

- Do not operate the generator when open containers of fuel, paint, or other flammable liquids are in the vicinity of the generator.
- Do not place flammable material or liquids near the generator.
- Do not operate the machine indoors.
- Do not touch the hot engine, exhaust, or generator components. Burns will result.

Always do the following:

- Wear hearing protection when operating equipment.
- Keep the machine at least one meter (three feet) away from structures, buildings, and other equipment during use.
- Keep the area immediately surrounding and underneath the machine clean, neat, and free of debris and combustible materials. Make sure that the area overhead is clear of debris that could fall onto or into the machine or exhaust compartment.

Storing the machine

Store the machine properly when it is not being used. The machine should be stored in a clean, dry location out of the reach of children.

1.4 Operator Safety While Using Internal Combustion Engines

WARNING
Internal combustion engines present special hazards during operation and fueling. Failure to follow the warnings and safety standards could result in severe injury or death.

- ▶ Read and follow the warning instructions in the engine owner's manual and the safety guidelines below.

DANGER
Carbon monoxide. Using a generator indoors CAN KILL YOU IN MINUTES. Generator exhaust contains carbon monoxide (CO). This is a poison you cannot see or smell. If you can smell the generator exhaust, you are breathing CO. But even if you cannot smell the exhaust, you could be breathing CO.

Refueling safety

When refueling the engine:

- Do not smoke.
- Do not refuel if the generator is sitting in a truck fitted with a plastic bed liner. Static electricity can ignite the fuel or fuel vapors.
- Do not refuel a hot or running engine.
- Do not refuel the engine near an open flame.

When refueling the engine, always:

- Refill the fuel tank in a well-ventilated area.
- Replace the fuel tank cap after refueling.

Operating safety

When operating the generator:

- Check the fuel lines and the fuel tank for leaks and cracks before starting the engine.
- Do not run the machine if fuel leaks are present or the fuel lines are loose.
- Do not run the engine near open flames.
- Do not start the engine if fuel has spilled or a fuel odor is present. Move the generator away from the spill and wipe the generator dry before starting.
- Do not smoke while operating the machine.

1.5 Guidelines for Service Safety

WARNING
A poorly maintained machine can be a personal injury hazard.
- ▶ Follow the Periodic Maintenance schedule in this Operator's Manual.
- ▶ Repair or replace any damaged or defective components immediately.

Personal Protective Equipment (PPE)

Wear the following Personal Protective Equipment (PPE) while servicing or maintaining this machine:
- Close-fitting work clothes that do not hinder movement
- Safety glasses with side shields
- Hearing protection
- Safety-toed footwear

In addition, before servicing or maintaining the machine:
- Tie back long hair.
- Remove all jewelry (including rings).

Prerequisites

Before servicing this machine:
- Stop the engine.
- If the engine has an electric starter, disconnect the negative terminal on the battery.
- Attach a "DO NOT START" sign to the machine. This will notify everyone that the machine is being serviced and will reduce the chance of someone inadvertently trying to start the machine.

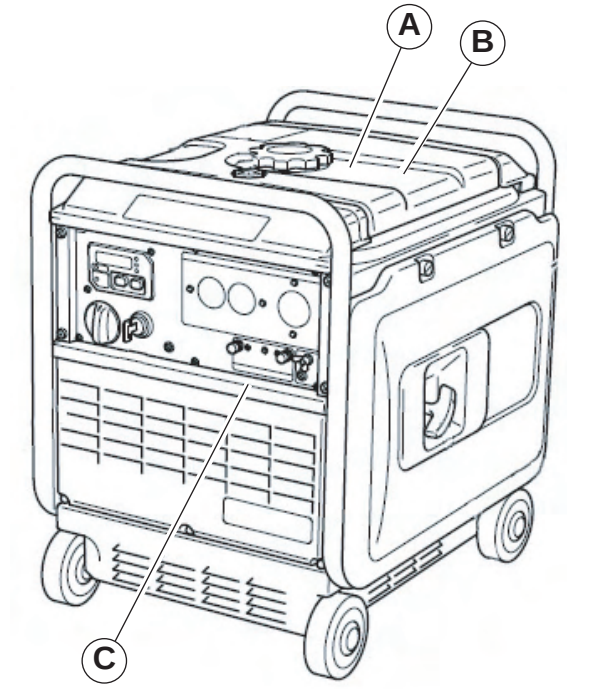
Ground connection
- The generator must be connected to a good earthen ground for proper operating safety!
- Ground the generator in accordance with the standards defined in national, state, and local regulations.

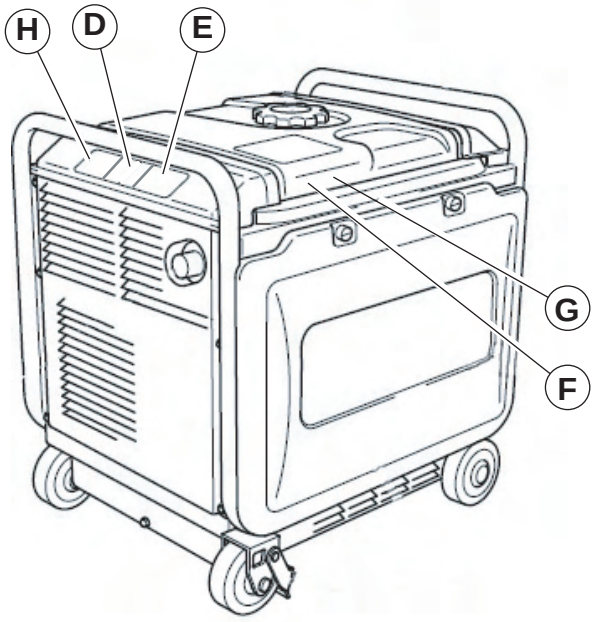
Personal injury avoidance
- Let the engine and muffler cool before transporting or servicing the machine.
- Do not service the machine if your clothing or skin is wet.
- Do not allow untrained personnel to service this machine. Only trained electrical technicians should be allowed to service the electrical components of this machine.

Service safety
- Do not modify the machine without the express written approval of the manufacturer.
- Do not allow water to accumulate around the base of the machine. If water is present, move the machine and allow the machine to dry before servicing.

Replacing parts and labels
- Replace worn or damaged components.
- Use only spare parts recommended by Wacker Neuson.
- Keep the fuel lines in serviceable condition. Leaking fuel and fumes are extremely explosive!
- Replace all missing and hard-to-read labels. Labels provide important operating instructions and warn of dangers and hazards.
- Check all external fasteners at regular intervals.

1.6 Label Locations

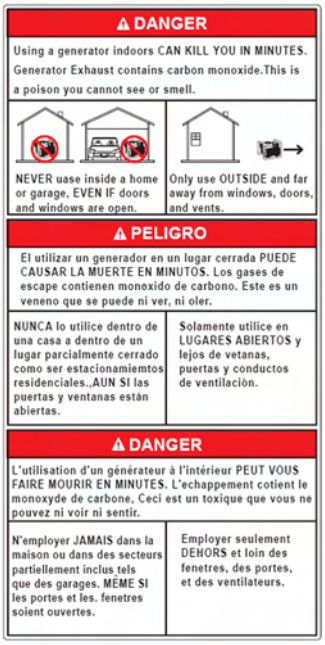
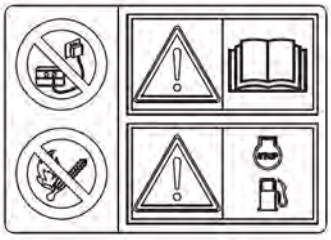
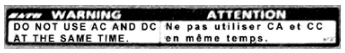


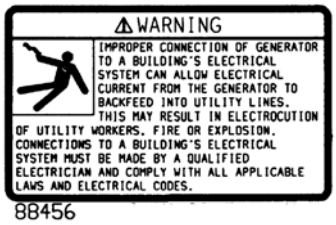


1.7 Machine Labels

Wacker Neuson machines use international pictorial labels where needed. These labels are described below.

1.8 Safety and Warning Labels

Ref.	Label	Meaning
A		DANGER Using a generator indoors CAN KILL YOU IN MINUTES. Generator exhaust contains carbon monoxide. This is a poison you cannot see or smell. NEVER use inside a home or garage, EVEN IF doors and windows are open. Only use OUTSIDE and far away from windows, doors, and vents.
B		Do not connect the generator to a household or commercial power source. Keep open flames and sparks away from the generator. Attention! Read the Operator's Manual before operating this machine. Attention! Stop the engine before refueling.
C		WARNING Do not use AC and DC at the same time.

Ref.	Label	Meaning
D		WARNING ■ To reduce the risk of injury, user must read and understand instruction manual. ■ Exhaust gas contains poisonous carbon monoxide. ■ Do not use in poorly ventilated area. ■ The operator may suffer severe elecrtric shock. ■ Do not touch with wet hands. ■ The operator may suffer burns. ■ Do not touch hot muffler. ■ Potential danger of explosion or fire. ■ Stop engine during fuel supply. Keep flammable things away. ■ Be careful not to spill fuel during refueling. ■ Use unleaded gasoline only. ■ Keep open flames away from the generator. ■ Do not operate in rain or snow. ■ Do not connect to a household circuit.
E		WARNING Hot surface! Do not touch. DANGER Risk of carbon monoxide poisoning. Keep a safe distance away from the machine.
F		This equipment **does not** meet California EVP emission regulations for small off-road engines.
G		**WARNING** Improper connection of the generator to a building's electrical system can allow electrical current from the generator to backfeed into utility lines. This may result in electrocution of utility workers, fire, or explosion. Connections to a building's electrical system must be made by a qualified electrician and comply with all applicable laws and electrical codes.

Ref.	Label	Meaning
H		A nameplate listing the model number, item number, revision number, and serial number is attached to each unit. Please record the information found on this nameplate so it will be available should the nameplate become lost or damaged. When ordering parts or requesting service information, you will always be asked to specify the model number, item number, revision number, and serial number of the unit.

2 Operation

DANGER
Carbon monoxide. Using a generator indoors CAN KILL YOU IN MINUTES. Generator exhaust contains carbon monoxide (CO). This is a poison you cannot see or smell. If you can smell the generator exhaust, you are breathing CO. But even if you cannot smell the exhaust, you could be breathing CO.

- NEVER use a generator inside homes, garages, crawlspaces, or other partly enclosed areas. Deadly levels of carbon monoxide can build up in these areas. Using a fan or opening windows and doors does NOT supply enough fresh air.
- ONLY use a generator outside and far away from windows, doors, and vents. These openings can pull in generator exhaust.
- Even when you use a generator correctly, CO may leak into the home. ALWAYS use a battery-powered or battery-backup CO alarm in the home.
- If you start to feel sick, dizzy, or weak after the generator has been running, move to fresh air RIGHT AWAY. See a doctor. You could have carbon monoxide poison.

2.1 Overview

Generator application

This generator is an exceptionally quiet and compact machine designed to provide single phase power for construction, commercial, and residential applications. State-of-the-art inverter technology ensures a consistent flow of clean and stable power suitable for operating not only tools, but also delicate electronic equipment.

Safety notices

- Do not exceed the power output of the generator. Damage to tools or generator can occur. Refer to *Technical Data*.
- When using the generator as a stand-by or substitute power supply, make sure the voltage and phase rotation of the line connections match those of the main lines. Failure to match phase rotation and voltage may cause equipment connected to the generator to operate incorrectly! This could create unsafe operating conditions.
- Do not exceed the rated current limit of any receptacle.

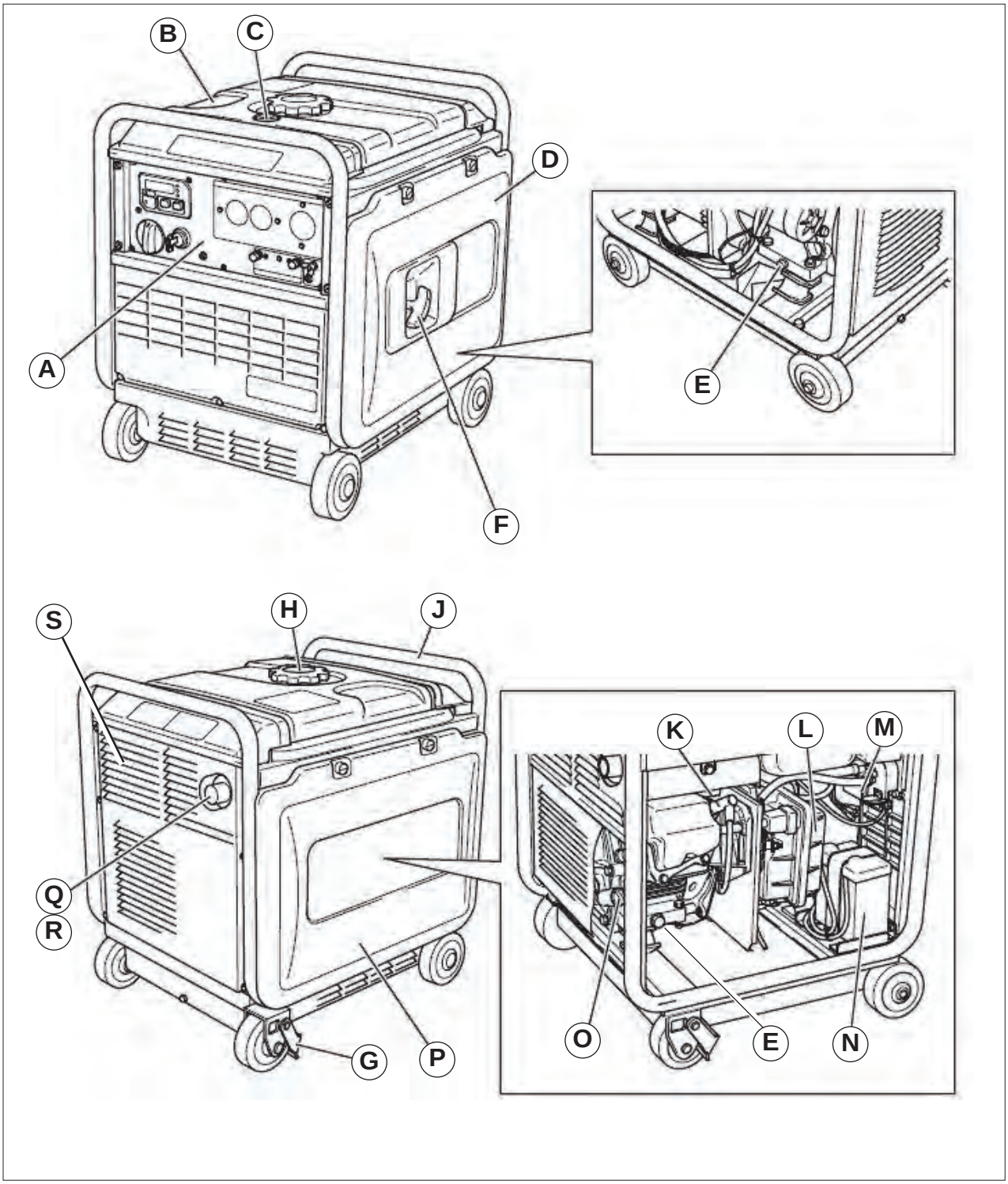
2.2 Preparing the Machine for First Use

Preparing for first use

To prepare your machine for first use:

1. Make sure all loose packaging materials have been removed from the machine.
2. Check the machine and its components for damage. If there is visible damage, do not operate the machine! Contact your Wacker Neuson dealer immediately for assistance.
3. Take inventory of all items included with the machine and verify that all loose components and fasteners are accounted for.
4. Attach component parts not already attached.
5. Add fluids as needed and applicable, including fuel, engine oil, and battery acid.
6. Move the machine to its operating location.

2.3 Features and Components



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Ref.	Description	Ref.	Description
A	Control panel	**K**	Spark plug cap
B	Fuel tank	**L**	Air cleaner
C	Fuel gauge	**M**	Fuel strainer
D	Right side panel (if equipped)	**N**	Battery (if equipped)
E	Oil drain plug	**O**	Oil filler / gauge
F	Recoil starter	**P**	Left side panel (if equipped)
G	Wheel brake (if equipped)	**Q**	Exhaust outlet
H	Fuel tank cap	**R**	Spark arrester
J	Frame	**S**	Rear cover

2.4 Lifting and Transporting

Lifting the Machine

This generator, while compact, is heavy enough to cause injury if proper lifting techniques are not used. Observe the following guidelines when lifting the generator.

- Do not attempt to lift and carry the generator unassisted. Use appropriate lifting equipment such as slings, chains, hooks, ramps, or jacks.
- Make sure lifting equipment is attached securely and has enough weight-bearing capacity to lift or hold the generator safely.
- Remain aware of the location of other people nearby when lifting the generator.

Transporting the Machine

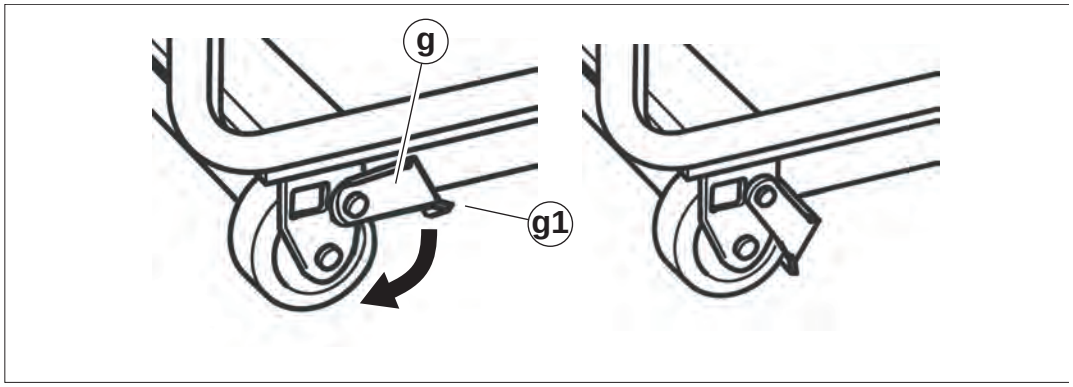
Observe the following guidelines when transporting the generator to and from the job site.

- Allow the engine to cool before transporting the generator.
- Drain the fuel tank.
- Close the fuel valve.
- Ensure that the generator is securely strapped down in the transport vehicle to prevent it from sliding or tipping.
- Do not refuel the generator in or on the transport vehicle. Move the generator to its operating location and then fill the fuel tank.

2.5 Wheel Brakes (if equipped)

Description

The two rear wheels on your generator (if equipped) feature spring-operated brakes **(g)** . These brakes help to prevent the generator from unintentional movement. Lock both rear wheels after the generator has been placed in its operating position.



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Locking and unlocking the wheels

- To lock the wheel, press the brake tab **(g1)** until the brake snaps in place against the wheel.
- To unlock the wheel, lift the brake tab.

2.6 Installation

Locating the generator

Follow the practices below when choosing an appropriate location for the generator.

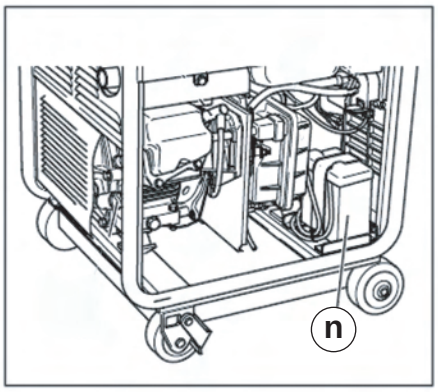
- Place the generator in an area where it will not be exposed to rain, snow, or direct sunlight.
- Position the generator on firm, level ground so that it will not slide or shift.
- Position the engine exhaust away from areas where people may be present.
- The surrounding area must be free from water and moisture. All components must be protected from excessive moisture.

NOTICE: The generator has a built-in forced air cooling system, and may become overheated if it is enclosed. Therefore, do not enclose the generator or cover it with a box.

2.7 Connecting and Maintaining the Battery

Location and description

An automotive-style battery **(n)** is installed on the machine. The battery is located next to the air cleaner.



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WARNING
Explosion hazard. Batteries can emit explosive hydrogen gas.
- ▶ Keep all sparks and flames away from the battery.
- ▶ Do not short-circuit battery posts.

WARNING
Battery fluid is poisonous and corrosive.
- ▶ In the event of ingestion or contact with skin or eyes, seek medical attention immediately.

Battery connections

To connect the battery:
- Connect the positive (+) battery cable to the battery.
- Connect the negative (-) battery cable to the battery.

To disconnect the battery:
- Stop the engine.
- Place all electrical switches in the OFF position.
- Disconnect the negative (-) battery cable from the battery.
- Disconnect the positive (+) battery cable from the battery.

Maintaining the battery

- Follow the battery manufacturer’s maintenance recommendations.
- Keep battery terminals clean and connections tight.
- When necessary, tighten the cables and grease the cable clamps with petroleum jelly.
- Maintain the battery at full charge to improve cold weather starting.

Precautions

Observe the following precautions to prevent serious damage to the electrical system.

- Do not disconnect the battery while the machine is running.
- Do not attempt to run the machine without a battery.
- Do not attempt to jump-start the machine.
- In the event that the machine has a discharged battery, either replace the battery with a fully charged battery or charge the battery using an appropriate battery charger. See *Technical Data* for the equivalent battery specification.
- Dispose of waste batteries in accordance with local environmental regulations.

2.8 Use of Extension Cords

When a long extension cord is used to connect an appliance or tool to the generator, a voltage loss occurs—the longer the cord, the greater the voltage loss. This results in less voltage being supplied to the appliance or tool and increases the amount of current draw or reduces performance. A heavier cord with a larger wire size will reduce the voltage loss.

WARNING
Electric shock hazard. Damaged extension cords can cause electrical shock, resulting in serious injury or death. DO NOT use worn, bare, or frayed cords.

▶ Replace damaged cords immediately.

Use the chart below as a guide for selecting proper cable size.

Current	Load in Watts		Maximum Cable Length in Feet			
(Amps)	120V	240V	#10	#12	#14	#16
2.5	300	600	1000.	600	375	250
5	600	1200	500	300	200	125
7.5	900	1800	350	200	125	100
10	1200	2400	250	150	100	-
15	1800	3600	150	100	65	-
20	2400	4800	125	75	50	-

Use only extension cords rated for outdoor use and equipped with a third-wire ground.

NOTICE: Operating equipment at low voltage can cause it to overheat.

2.9 Power Requirements

Application

This generator is designed to operate single-phase, 60 Hz equipment running at 120 VAC. It also provides DC power strictly intended for charging 12V automotive style batteries.

Check the nameplate or label provided on tools and equipment to make sure their power requirements are met by the power output of the generator. If the wattage is not given for a particular tool or piece of equipment, contact the tool manufacturer for wattage requirements.

NOTICE: Do not exceed the continuous rated output of the generator. Damage to tools or generator can occur. See *Technical Data*.

About power requirements

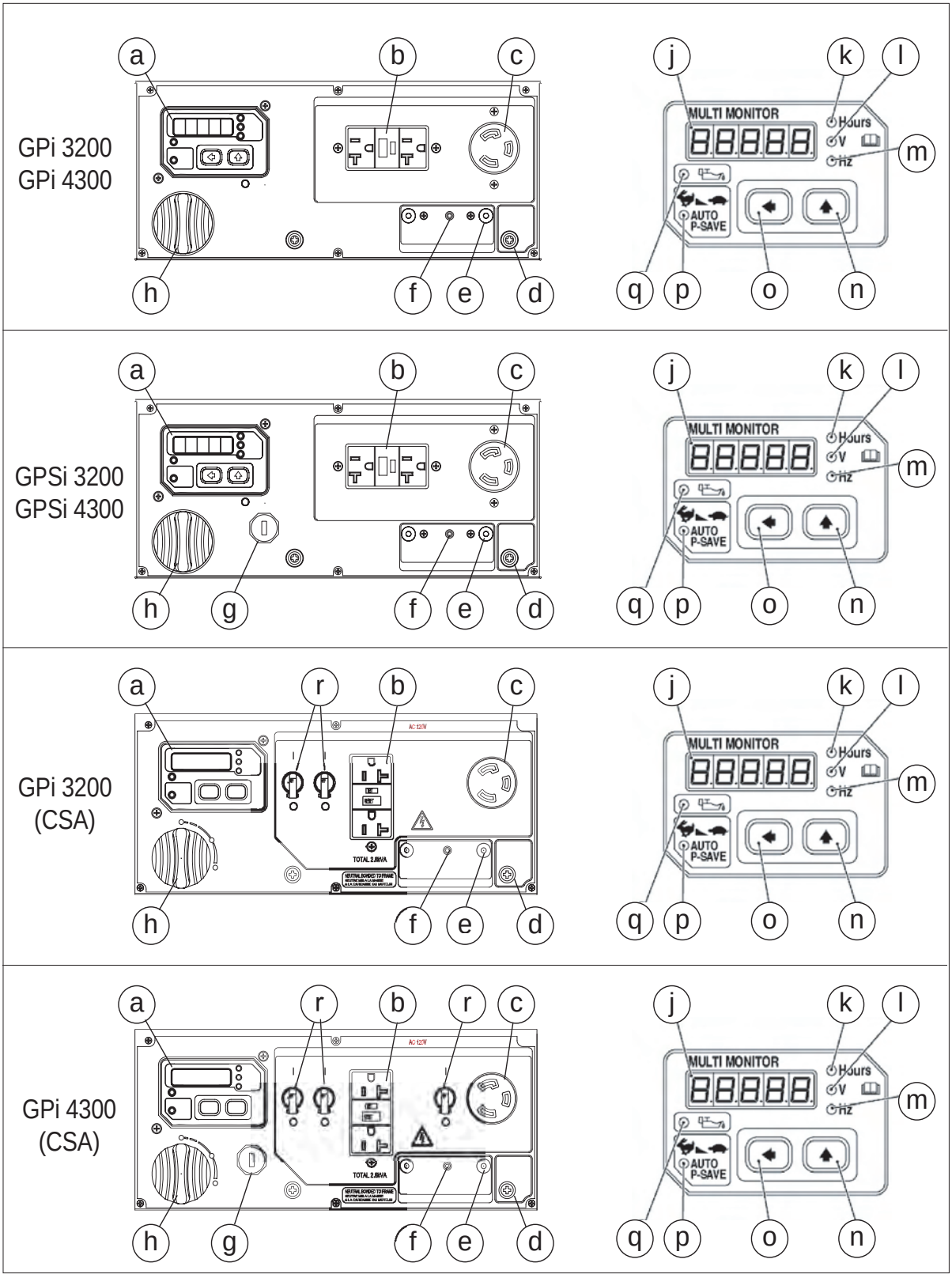
Some pieces of equipment and tools require a surge of current when starting. This means that the amount of power needed to initially start the equipment is larger than the power required to keep it running. The generator must be capable of supplying this "surge" current. Other equipment may require more power than is actually stated on its nameplate.

Approximate starting power requirements

The information in the following chart is offered only as a general guideline to help you determine power requirements for different types of equipment. Contact your nearest Wacker Neuson dealer, or the manufacturer or dealer of the tool or equipment, with questions regarding power requirements.

Equipment type	Wattage needed to start	Comments
■ Incandescent lights ■ Appliances such as irons and hot plates	Same wattage as is stated on their nameplates	These have resistive-type heating elements.
■ Fluorescent and mercury lamps	1.2–2 times their stated wattage	
■ Electrical motors ■ Certain electrical tools	Depends on motor type and use	
■ Most electrical tools	1.2–3 times their stated wattage	
■ Submersible pumps ■ Air compressors	3–5 times their stated wattage	
■ Other equipment	Calculate by multiplying its voltage and amperage requirements	Volts x Amps = Watts

2.10 Control Panel



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Ref.	Description	Ref.	Description
a	Multi monitor	k	Operation hour indicator light
b	AC receptacles, 20A	l	Voltage indicator light
c	AC receptacle, 30A	m	Frequency indicator light
d	Ground lug	n	LED display changeover switch
e	DC terminals	o	Auto-power saving switch
f	DC circuit breaker	p	Auto-power saving indicator
g	Key switch	q	Engine oil level warning indicator light
h	Engine switch	r	AC circuit breaker
j	LCD		

Multi monitor (a)

The multi monitor **(a)** displays the status of various machine functions while the generator is operating.

AC receptacles (b, c)

AC power is supplied through two 20A receptacles **(b)** and a 30A twist-lock receptacle **(c)**. Use only grounded, three-leg electrical plugs when connecting AC equipment to the machine.

Ground lug (d)

The ground lug **(d)** is the terminal for grounding the generator. See topic *Ground Lug* for more information.

DC terminals (e)

The generator provides DC power for charging batteries. The red terminal is positive (+); the black terminal is negative (-). See topic *Using DC Power*.

DC circuit breaker (f)

The DC circuit breaker **(f)** shuts off the electrical current when the current exceeds its limit, or a malfunction occurs in a piece of equipment connected to the generator.

- The DC circuit breaker has activated when the button pops out.
- To reset the DC circuit breaker, press the button.

Key switch (g)

The key switch **(g)** is used to start and stop the engine. See topic *Starting the Generator (Electric Start)*.

Engine switch (h)

The engine switch **(h)** controls the function of the choke and the fuel valve. There are three positions:

Symbol	Meaning	Description
	Choke valve is closed	Turn the switch to this position when starting a cold engine.
	Normal operating position	Turn the switch to this position after the engine starts. **Note:** *A warm engine can be started with the switch in this position.*
	Fuel valve is closed	Turn the switch to this position to stop the engine.

LCD (j)

The LCD **(j)** displays machine operating status such as voltage, frequency, and operating hours. The LCD also displays **O_Lod** when the generator is in an overload condition.

LCD changeover switch (n) and indicator lights

The green LCD changeover switch **(n)** allows the operator to cycle through the various machine status modes described above.

- Operating hours are displayed when the machine starts. The red operator hour indicator light **(k)** illuminates.
- Pressing the LCD changeover switch after starting changes the LCD display to voltage. The red voltage indicator light **(l)** illuminates.
- Pressing the LCD changeover swiitch a second time changes the LCD display to frequency. The red frequency indicator light **(m)** illuminates.
- Pressing the LCD changeover switch a third time changes the LCD display back to operating hours. The red operator hour indicator light **(k)** illuminates.

Auto-power saving switch (o) and indicator light

When pressed, the red auto-power saving switch **(o)** activates the auto-power saving function. The green auto-power saving indicator light **(p)** illuminates.

Engine oil level warning indicator light (q)

When the engine oil level falls below the specified operating level, the indicator light **(q)** illuminates and the engine stops. The oil level is detected by an internal oil sensor.

AC circuit breakers (r)

An AC circuit breaker **(r)** shuts off the electrical current when the current exceeds its limit, or a malfunction occurs in a piece of equipment connected to the generator.

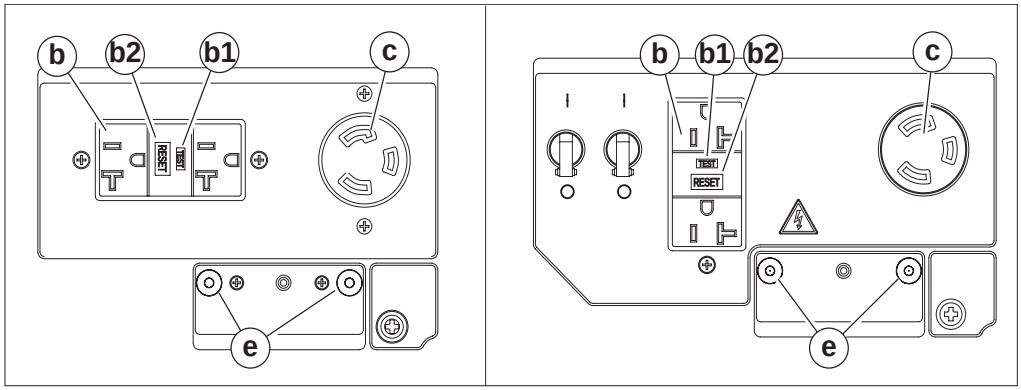
- An AC circuit breaker has activated when the toggle switch moves to the OFF position.
- To reset an AC circuit breaker, move the toggle switch to the ON position.

2.11 Customer Connections

Description

The generator is equipped with:

- one 120V 20A duplex receptacle **(b)** with a ground fault circuit interrupt (GFI)
- one 120V 30A twist-lock receptacle **(c)**
- one pair of DC terminals **(e)** exclusively intended for charging 12V automotive-style batteries. See *Using DC Power* for more information.



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Testing GFI operation

The GFI cuts power to the receptacle when a ground fault occurs to a piece of equipment attached to the generator. Follow the procedure below to test the GFI for proper operation every time the generator is used.

1. Disconnect all equipment from the generator.
2. Start the generator.
3. Push the black TEST button **(b1)** on the receptacle. Pushing the TEST button in cuts power to the receptacle and causes the red RESET button **(b2)** to pop out.

NOTICE: If the RESET button does not pop out, the GFI is not working. Do not operate the generator until the problem can be corrected.

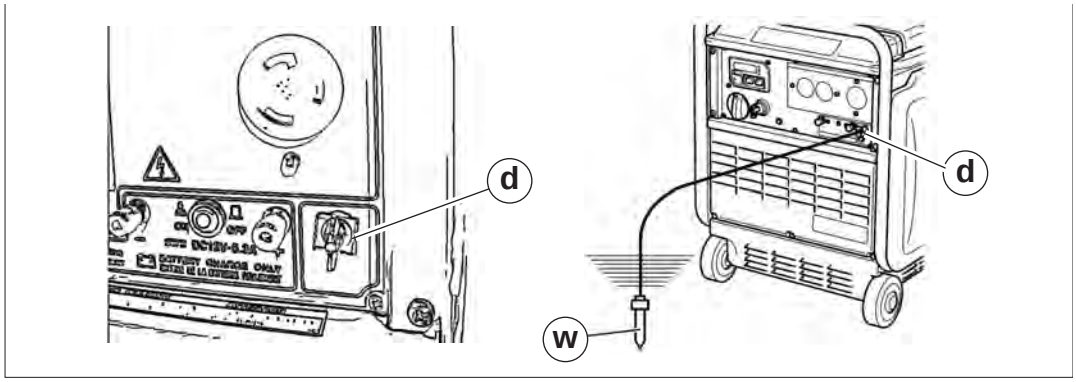
4. Push the RESET button to restore power to the receptacle.

If the RESET button pops out during operation, stop the generator and check the equipment attached to the generator for defects.

2.12 Grounding the Generator

Location

The ground lug **(d)** is located to the right of the DC terminals.



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Function

This ground connection is used for electrically grounding the generator when necessary to comply with the National Electrical Code and other federal, state, and local regulations. For grounding requirements in your area, consult with a qualified electrician, electrical inspector, or local agency having jurisdiction over electrical compliance.

- If the generator is used at a construction site, there may be additional regulations which must be observed.
- In some areas, generators are required to be registered with local utility companies.

Connection

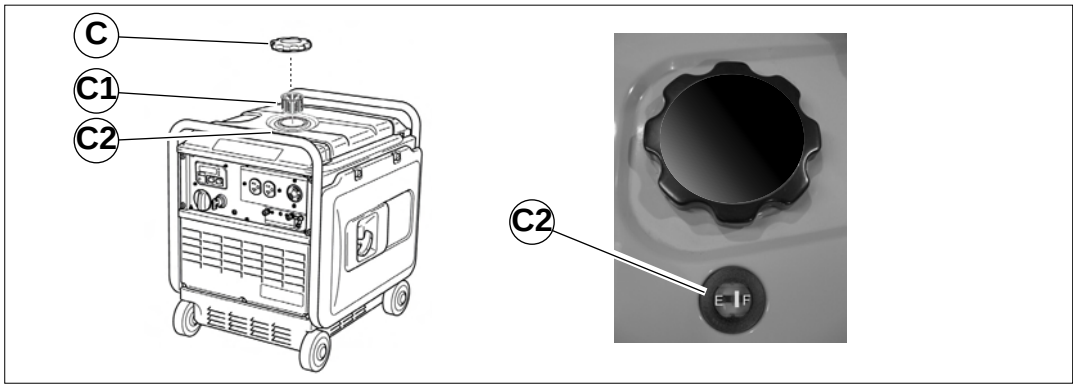
Connect the ground lug to a good earthen ground for proper operating safety in compliance with NEC and local standards. The following options may be used:

- Connect the ground lug to a grounding spike **(w)** and drive the grounding spike into the earth.
- Connect the ground lug to an existing grounded conductor.

2.13 Fueling the Machine

Fuel filler cap

The fuel filler cap **(C)** is located on top of the fuel tank. Turn the fuel filler cap counter-clockwise to open; clockwise to close.



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WARNING

Fire/burn hazards. Gasoline is flammable and can ignite or explode.

- ▶ Keep all open flames, sparks, and cigarettes away from the machine while refueling.
- ▶ Do not refuel if the generator is sitting in a truck fitted with a plastic bed liner. Static electricity can ignite the fuel or fuel vapors.
- ▶ Do not refuel when the engine is running or hot.

Filling the fuel tank

Follow the guidelines below when filling the fuel tank.

- Turn the engine switch **(h)** to STOP before refueling.
- Refuel only with clean, fresh unleaded gasoline.
- Add fuel through the fuel filter **(C1)**, making sure that dirt or water do not enter the fuel tank.
- Fill only until the fuel level reaches the “F” mark on the fuel level gauge **(C2)**. Do not overfill!
- Close the fuel filler cap tightly and clean up spilled fuel before operating the machine.

Using gasoline / ethanol blends

This portable generator is not for use with gasoline / ethanol blends with over 15% ethanol.

2.14 Before Starting

DANGER

Carbon monoxide. Using a generator indoors CAN KILL YOU IN MINUTES. Generator exhaust contains carbon monoxide (CO). This is a poison you cannot see or smell. If you can smell the generator exhaust, you are breathing CO. But even if you cannot smell the exhaust, you could be breathing CO.

Explanation

Before putting the generator into service, review each item on the following checklist. It is important to make sure that the machine is set up properly to reduce the possibility of malfunction.

WARNING

Personal injury hazard. Failure to follow the listed procedures may cause injury to personnel or damage to the generator.

- ▶ Make sure that all persons setting up the generator are certified or fully trained on the installation and operation of the generator.

Before starting the generator:

Exterior checks

- check for damage that may have occurred during towing or travel to the jobsite
- check for fuel leaks
- check for loose or missing fasteners
- make sure the exhaust pipe is not clogged with debris
- make sure that the generator is level
- make sure the generator is not resting on against any adjacent wiring
- make sure that the generator air vents are not blocked
- make sure that the generator is grounded to a good earthen ground per local regulations and NEC standards

Internal and pre-operation checks

- check engine oil and fuel levels—fill as required
- determine voltage needs
- review and follow safety instructions found in the front of this Operator's Manual

2.15 Starting the Generator (S Models)

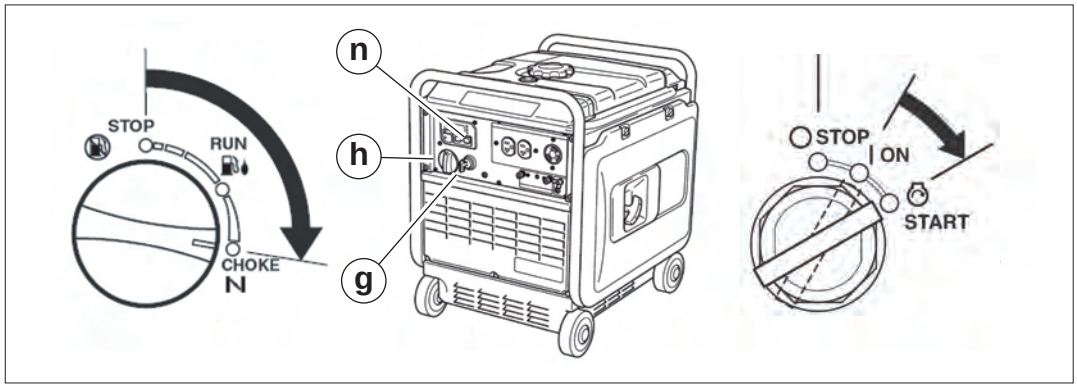
CAUTION
Personal injury or machine damage hazards. Starting the generator with equipment attached can damage the generator or the equipment. Unexpected equipment start-up can cause personal injury.

- ▶ Disconnect all equpment from the generator before starting it.

Starting procedure

Follow the procedure below to start the machine.

1. Turn the engine switch **(h)** to the CHOKE position (or the RUN position if the engine is warm or the ambient temperature is high).



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2. Insert the starting key into the key switch **(g)**.
3. Turn the starting key clockwise to the “I” (ON) position, then farther to the START position. The engine will start.

NOTICE: To avoid machine damage, do not engage the starter motor continuously for more than five seconds. If the engine fails to start, return the starting key to the ON position, wait approximately 10 seconds, and then try again.

Do not turn the key switch to the START position when the engine is running.

4. If you started the engine with the engine switch in the CHOKE position, allow the engine to run for 20–30 seconds and then turn the engine switch to the RUN position.
5. Use the LED changeover switch **(n)** to switch to display voltage on the LCD. A reading of 120V indicates that the generator is operating properly.

Troubleshooting

- If the engine does not start after several attempts, repeat the starting procedure with the engine switch turned to the RUN position.
- Try starting the machine manually. See *Starting the Generator (Manual Start Models).*
- If the engine still does not start, refer to the *Troubleshooting* chapter.

2.16 Starting the Generator (Manual Start Models)

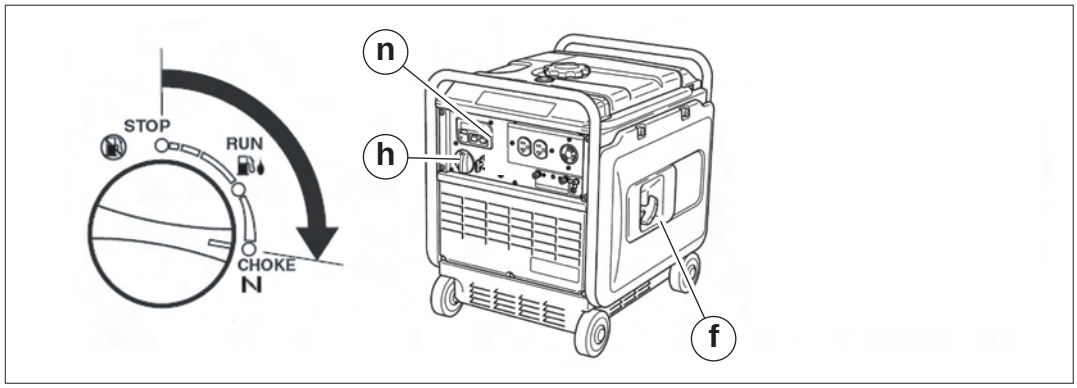
CAUTION
Personal injury or machine damage hazards. Starting the generator with equipment attached can damage the generator or the equipment. Unexpected equipment start-up can cause personal injury.

- ▶ Disconnect all equpment from the generator before starting it.

Starting procedure

Follow the procedure below to start the machine.

1. Turn the engine switch **(h)** to the CHOKE position (or the RUN position if the engine is warm or the ambient temperature is high).



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2. Pull the recoil starter **(f)** slowly until you feel resistance.
3. After you feel resistance, return the recoil starter to its original position and pull quickly. The engine will start.
4. If you started the engine with the engine switch in the CHOKE position, allow the engine to run for 20–30 seconds and then turn the engine switch to the RUN position.
5. Use the LED changeover switch **(n)** to switch to display voltage on the LCD. A reading of 120V indicates that the generator is operating properly.

Troubleshooting

If the engine does not start after several attempts, repeat the starting procedure with the engine switch turned to the RUN position. If the engine still does not start, refer to the *Troubleshooting* chapter.

2.17 Using AC Power

Prerequisites

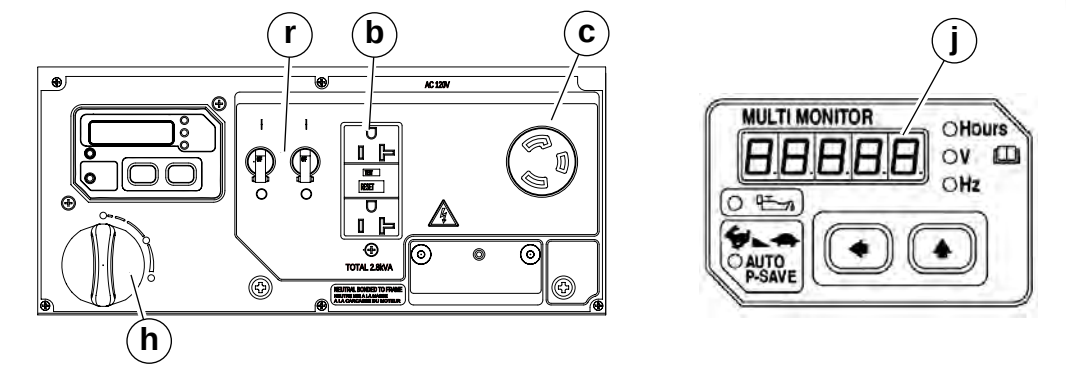
- Verify that the engine is operating.
- Verify that the voltage displayed on the LCD **(j)** is approximately 120V.
- Turn off the equipment to be connected to the generator.
- Confirm that the equipment to be connected to the generator does not exceed the maximum rated power output and specifed amperage.

WARNING
Electric shock hazard. Failure to properly ground the generator could lead to electrical sparks, especially if the connected electrical equipment is grounded.

▶ Make sure the generator is properly grounded. See *Grounding the Generator*.

Engine switch position

Leave the engine switch **(h)** in the RUN position while the machine is operating.



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Connecting equipment

1. Insert the equipment plug into the 20A GFI receptacle **(b)** or the 30A twist-lock receptacle **(c)**.

Note: *To use the 30A twist-lock receptacle, insert the plug into the receptacle and turn it clockwise to the LOCK position.*

2. Turn on the power switch for the equipment.

Overload fault

Excessive current draw on the generator will cause an overload fault. When this fault occurs, AC power is cut off and **O_Lod** displays on the LCD.

To clear an overload fault, stop the engine immediately and remedy the overload condition. Then re-start the engine.

Circuit breaker activation

If equipped, your machine's circuit breakers **(r)** shut off the electrical current when the current exceeds its limit. Circuit breakers also activate if a malfunction occurs in a piece of equipment connected to the generator.

- Reset circuit breakers by returning the toggle switches to the ON position.
- Stop the machine and identify the cause if a circuit breaker activates repeatedly.

Disconnecting equipment

1. Turn off the power switch for the equipment.
2. Remove the plug from the 20A GFI receptacle or the 30A twist-lock receptacle.

Note: *To remove the plug from the 30A twist-lock receptacle, first turn the plug counter-clockwise to unlock it.*

2.18 Using DC Power

Overview

The DC terminals **(e)** are to be used only for charging 12V batteries. Maximum available power is 12V–8.3A (100W).

WARNING
Risk of machine damage and electric shock.
- ▶ Do not use AC power and DC power at the same time.

Prerequisites

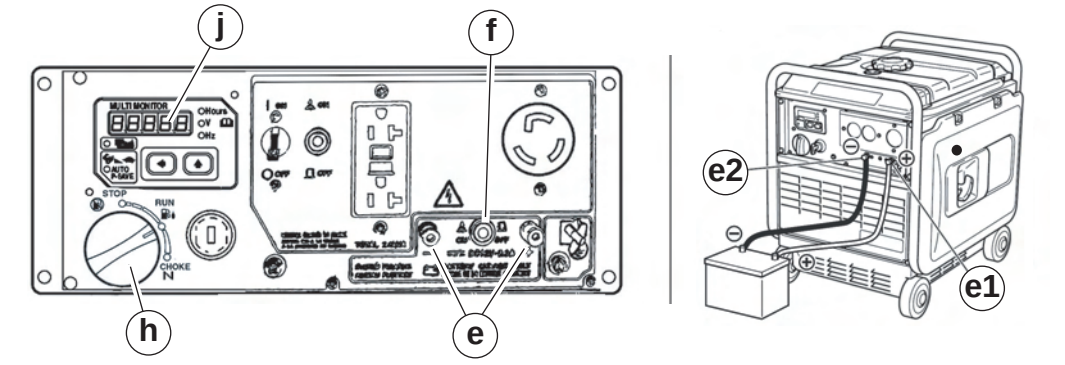
- Verify that the engine is operating.
- Verify that the voltage displayed on the LCD **(j)** is approximately 120V.
- Verify that nothing is connected to the AC outlets.
- Make sure that the charging cables to be used are rated for 12V and the maximum CCA rating of the battery.

WARNING
Personal injury hazard. Battery acid is corrosive to metallic surfaces and harmful to human skin.
- ▶ Wear protective clothing, goggles and gloves when working near batteries.
- ▶ If battery acid contacts the skin or eyes, rinse immediately with clear water and seek immediate medical attention.

WARNING
Explosion hazard. Explosive hydrogen gas is discharged through battery vent holes during the charging process.
- ▶ Do not use open flames or smoke near batteries.
- ▶ Do not place metallic objects on or near the battery terminals. Metallic objects in contact with both poles of the battery will generate extreme heat and potentially ignite explosive battery gases.

Engine switch position

Leave the engine switch **(h)** in the RUN position while the generator is operating.



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Connecting and charging a battery

Follow the procedure below to connect and charge a battery.

1. Connect the positive terminal **(e1)** (red) on the generator to the positive (+) battery terminal.
2. Connect the negative terminal **(e2)** (black) on the generator to the negative (-) battery terminal.
3. Charge the battery for the recommended length of time prescribed by the battery manufacturer.

Disconnecting the battery

When the battery is fully charged:

1. Disconnect the cable from the negative (-) terminals of the battery and the generator.
2. Disconnect the cable from the positive (+) terminals of the battery and the generator.

If the DC circuit breaker activates

The DC circuit breaker **(f)** may activate while a battery is charging. This may occur for either of the following reasons:

- Defective battery—check the battery before replacing the DC breaker
- Excessive current draw from a large capacity battery or a totally discharged battery—use an AC battery charger to charge the battery instead of the generator.

2.19 Stopping the Generator

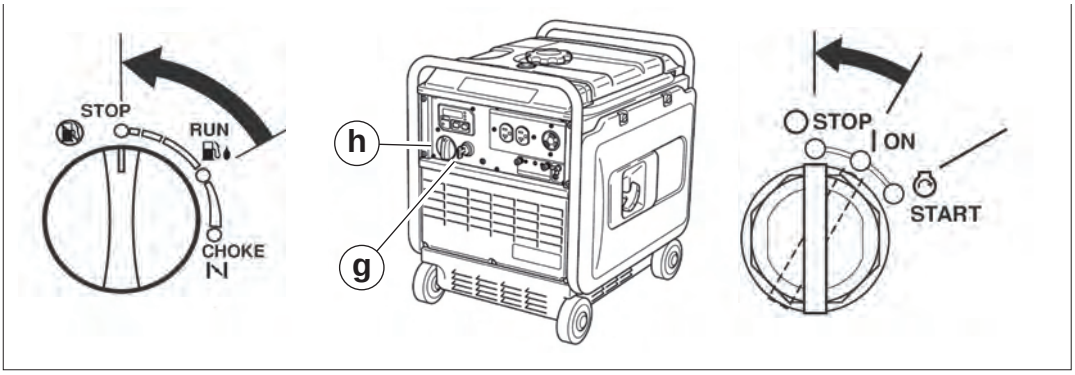
Before stopping

Inform other personnel on the jobsite that power is being turned off. Make sure that the power shutdown will not create any hazards by turning off devices such as pumps, heaters, or lights that may need to be kept on.

Stopping procedure

To stop the generator:

1. Switch off and disconnect all equipment from the generator.
2. Allow the generator to run at no load for approximately 3 minutes.
3. Turn the engine switch **(h)** to the STOP position.



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4. (Electric start models only): Turn the key switch **(g)** to the “O” (STOP) position.

2.20 Emergency Shutdown Procedure

Procedure

If a breakdown or accident occurs while the machine is operating, follow the procedure below:

1. Stop the engine.
2. Turn off the fuel supply.
3. Disconnect tools from the machine.
4. Allow the machine to cool.
5. Contact the rental yard or machine owner for further instructions.

3 Maintenance

3.1 Periodic Maintenance Schedule

The table below lists basic machine and engine maintenance. Tasks designated with check marks may be performed by the operator. Tasks designated with square bullet points require special training and equipment.

Refer to the engine owner's manual for additional information.

	Every 8 hours (daily)	Every 50 hours (weekly)	Every 100 hours (biweekly)	Every 200 hours (monthly)	Every 500 hours	Every 1000 hours
Clean generator enclosure	✓					
Check for loose or missing fasteners	✓					
Check engine oil level and refill as needed	✓					
Check AC receptacles for dirt or blockage; test GFI	✓					
Check DC terminals for damage or dirt	✓					
Check engine switch and multi monitor for proper operation	✓					
Clean spark plug		■				
Clean air cleaner		■				
Change engine oil[1]			■			
Clean spark arrester			■			
Replace air cleaner element				■		
Clean fuel strainer				■		
Clean and adjust spark plug and electrodes				■		
Replace spark plug					■	
Remove carbon from cylinder head[2]					■	
Check and adjust valve clearance[2]					■	
Clean and adjust carburetor[2]					■	
Clean and replace carbon brushes					■	
Replace fuel lines[3]						■
Overhaul engine[2]						■
Check generator rotor						■
Check generator stator						■
Replace engine mount						■

1 Perform initial oil change after first 20 hours of operation.
2 Refer to the engine service manual or consult an authorized Wacker Neuson service center
3 Replace yearly

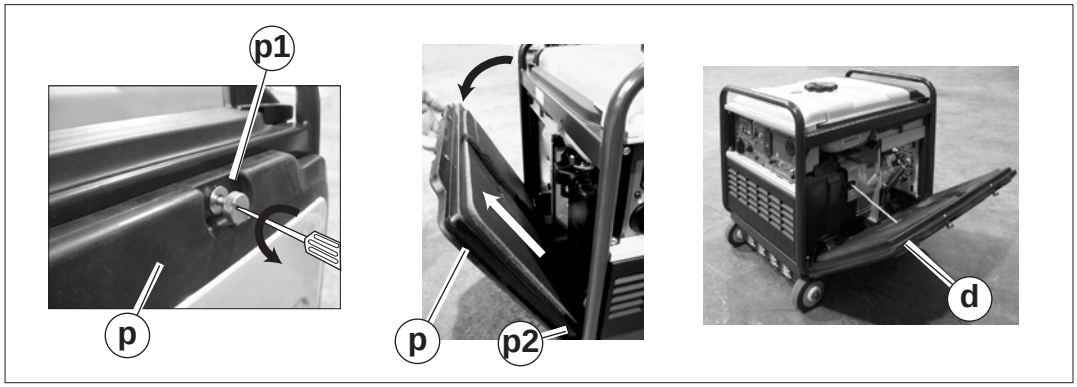
3.2 Detaching the Side Panels (S Models)

Description

Electric start machines are equipped with two sound attenuation panels. The panels remain in place during normal operation. The left side panel **(p)** must be detached and removed to perform routine maintenance.

Removing the left side panel

Follow the procedure below to detach and remove the left side panel.



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1. Using a flat bladed screwdriver, loosen the two mounting screws **(p1)** at the top of the panel.

Note: *It is not necessary to completely remove the mounting screws. Loosen them only until the screws spin freely.*

2. The bottom edge of the panel rests in a metal channel **(p2)**. Grasp the rubber seal at the top edge of the panel and pull the panel away from the generator body.
3. Remove the panel by lifting it out of the channel in the direction of the white arrow.

Detaching the right side panel

The right side panel **(d)** cannot easily be removed from the generator because of the recoil starter. However, the right side panel can be detached if necessary by following steps 1 and 2 above.

Re-attach the panels when maintenance work is complete.

3.3 Checking the Engine Oil

When

Check engine oil daily before starting the engine, or more than 5 minutes after stopping the engine.

Prerequisites

- Engine is stopped
- Machine is on a level surface
- Fresh oil is available (see *Technical Data* for type and quantity)

WARNING

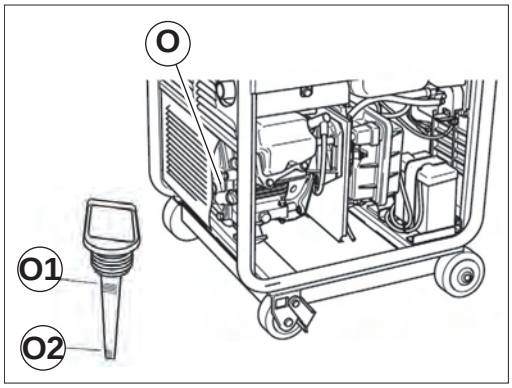
Burn hazard. The engine and exhaust pipe become extremely hot during operation.

► Stop the engine and allow the machine to cool before checking the engine oil.

Procedure

Follow the procedure below to check the engine oil level.

1. The oil filler cap **(O)** with level gauge is located at the rear of the machine below the engine exhaust pipe.



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2. Unscrew and remove the oil filler cap from the oil fill port.
3. Wipe the level gauge clean and insert it into the oil fill port.
4. Remove the level gauge from the oil fill port and check the oil level. The oil level should fall between the upper and lower marks **(O1, O2)**.
5. If the oil level is too low, add oil until the level reaches the upper mark **(O1)**.
6. Re-install the oil filler cap and tighten it securely.

Note: *Change the oil if it appears dark, dirty, or contaminated. See "Changing the Engine Oil."*

3.4 Cleaning the Air Cleaner

When Clean the air cleaner every 50 hours of operation.

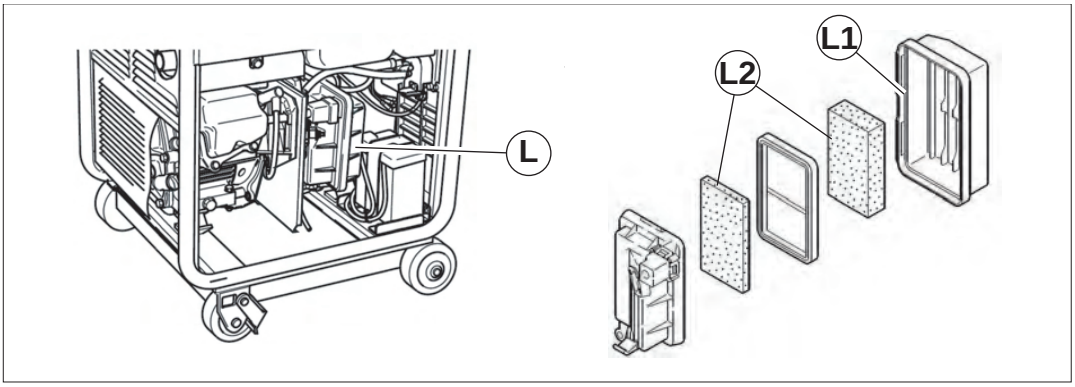
Prerequisite Engine is stopped and cool to the touch

Description The air cleaner assembly consists of two urethane forms housed inside the air cleaner body. A clean air cleaner prevents dirt from entering and damaging the engine.

WARNING
Burn hazard. The engine and exhaust pipe become extremely hot during operation.

- ▶ Stop the engine and allow the machine to cool before cleaning the air cleaner.

Procedure Follow the procedure below to clean the air cleaner.



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1. The air cleaner assembly **(L)** is located on the right side of the machine behind the control panel. Unhook and remove the air cleaner body cover **(L1).**
2. Remove the urethane forms **(L2)** from the air cleaner body.
3. Rinse the urethane forms with clean water. Squeeze out excess water (do not twist) and dry the urethane forms thoroughly.
4. Wipe the inside of the air cleaner body with a clean, dry cloth.
5. Re-install the urethane forms inside the air cleaner body.
6. Re-install the air cleaner body cover.

3.5 Cleaning and Checking the Spark Plug

When

Clean the spark plug and check the electrode gap every 200 hours of operation (monthly).

Prerequisite

Engine is stopped and cool to the touch

WARNING

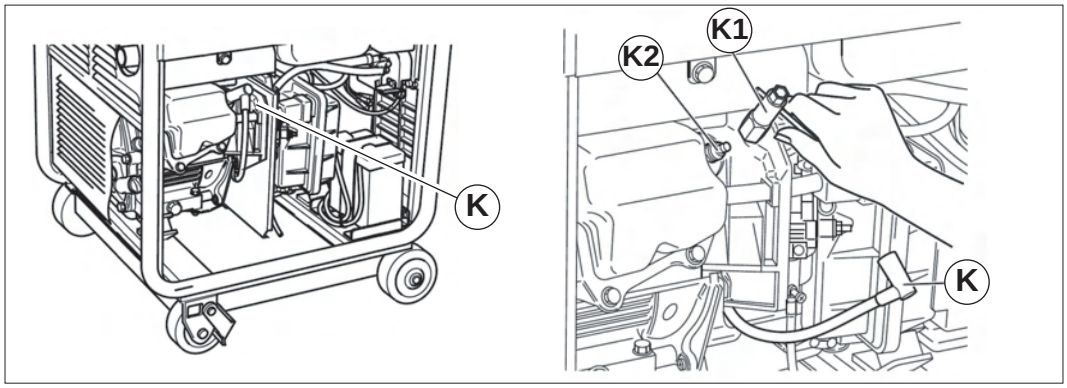
Burn hazard. Engine and exhaust pipe become extremely hot during operation.

- ▶ Stop the engine and allow the machine to cool before cleaning and adjusting the spark plug.

Removing and cleaning the spark plug

Follow the procedure below to remove and clean the spark plug.

1. The spark plug cap **(K)** is located on the side of the engine behind the air cleaner.



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2. Disconnect the spark plug cap from the spark plug **(K2)**.
3. Using the provided spark plug wrench **(K1)**, unscrew and remove the spark plug.
4. If the electrode is covered with carbon deposits, use a wire brush or spark plug cleaner to remove the carbon.

NOTICE: If the spark plug is cracked or damaged, replace it. See *Technical Data*.

Checking the electrode gap

5. The electrode gap should measure between 0.6 to 0.7 mm (0.024 to 0.028 in.). Adjust the gap if necessary.

Re-installing the spark plug

6. Re-install the spark plug and tighten it securely.

NOTICE: A loose spark plug can become very hot and may cause engine damage. Make sure that the spark plug is properly seated and tightened.

7. Re-connect the spark plug cap.

3.6 Changing the Engine Oil

When

Change the engine oil after the first 20 hours of operation, and every 50 hours thereafter.

Prerequisites

- Engine is stopped, but still warm
- Machine is on a level surface
- Fresh engine oil (see engine operator's manual)
- Plastic cloth and a container of sufficient volume to collect drained oil

Note: *Collect, store and dispose of drained oil in accordance with current environmental protection regulations.*

WARNING

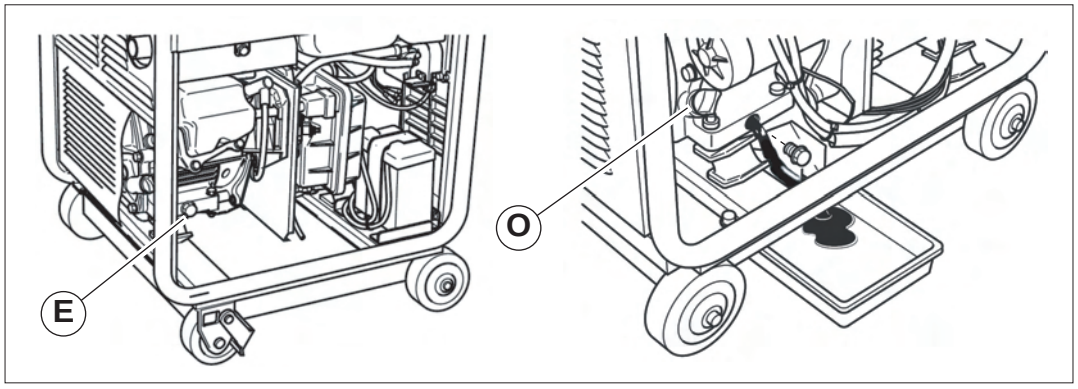
Burn hazard. Engine and exhaust pipe become extremely hot during operation.

▶ Stop the engine and allow the machine to cool before changing the engine oil.

Changing the engine oil

Follow the procedure below to change the engine oil

1. Place a plastic cloth and a collection container beneath the machine.
2. Unscrew and remove the oil filler cap **(O)** from the oil fill port.



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3. The oil drain plug **(E)** is located at the base of the engine. Unscrew and remove the oil drain plug. Drain the oil into a suitable container.
4. Re-install the oil drain plug.
5. Add new engine oil to the upper line of the level gauge on the oil filler cap. When the proper oil level is reached, re-install the oil filler cap. See *Checking the Engine Oil.*

3.7 Cleaning the Spark Arrester

When Clean the spark arrester after every 100 hours of operation.

Prerequisite Engine is stopped and cool to the touch

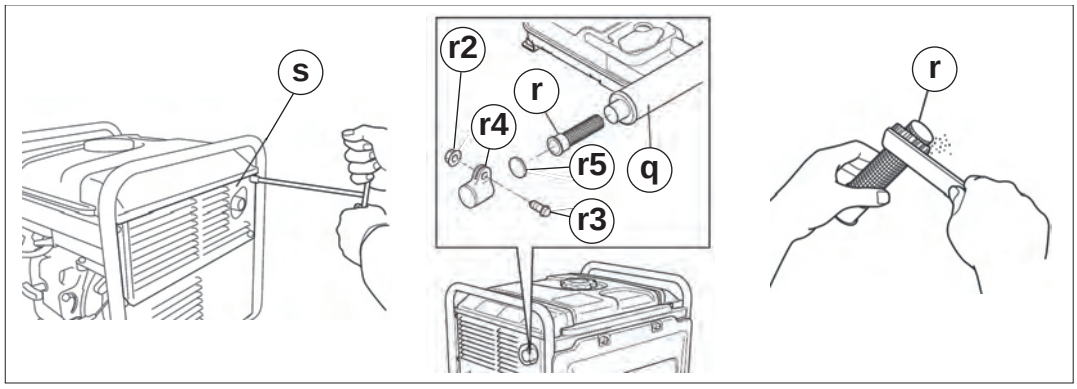
Description The spark arrester is a cylindrical metal element fastened inside the exhaust outlet. If the spark arrester is not cleaned regularly, it will become clogged with carbon deposits and impair engine performance.

- Engine exhaust gases will not flow.
- Engine output will be reduced.
- More fuel will be consumed.
- Starting will become difficult.

CAUTION
Personal injury hazards. The spark arrester screen is made of stiff metal wire. Sharp wire ends can puncture or cut skin. Carbon dust can get into eyes.

▶ Wear protective gloves and eye protection when cleaning the spark arrester.

Procedure Follow the procedure below to clean the spark arrester.



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1. Remove the four flange bolts from the rear cover **(s)**, and remove the rear cover.
2. Remove the nut **(r2)** and screw **(r3)** from the tail screen cover **(r4)**, and remove the tail screen cover.
3. Remove the tail screen **(r5)** and spark arrester **(r)** from the exhaust outlet **(q)**.
4. Use a stiff brush to remove carbon deposits from the spark arrester screen.

NOTICE: Avoid damaging the spark arrester screen during the cleaning process.

5. Inspect the spark arrester screen for holes or cracks. If the screen is damaged, replace it.
6. Re-insert the spark arrester screen into the exhaust outlet.
7. Re-install the tail screen and tail screen cover, and fasten with the nut and screw.
8. Replace the rear cover and re-install the flange bolts.

3.8 Cleaning the Fuel Strainer

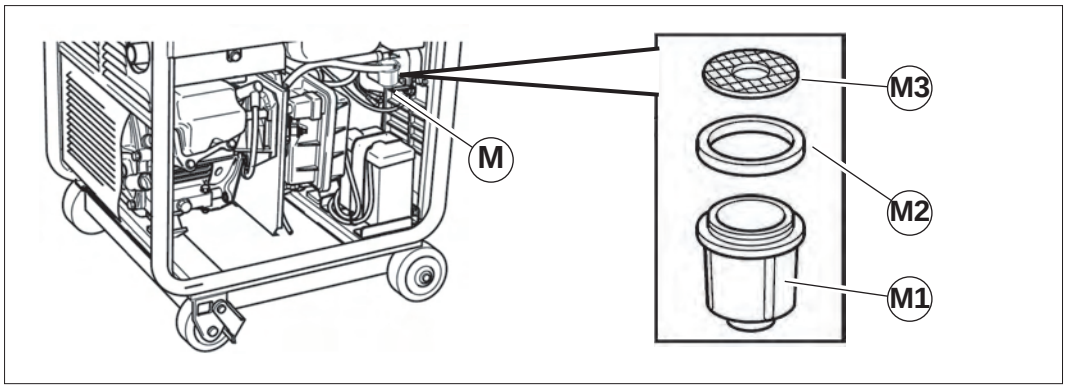
When Clean the fuel strainer monthly, or after every 200 hours of operation.

Prerequisite Engine is stopped and cool to the touch.

Description The fuel strainer **(M)** removes dirt and water from the fuel before it enters the carburetor. Water and sediment collect in the fuel strainer cup **(M1)**.

WARNING
Fire/burn hazards. Gasoline is flammable and can ignite or explode.
- ▶ Keep all open flames, sparks, and cigarettes away from the machine while cleaning the fuel strainer.
- ▶ Do not clean the fuel strainer while the engine is running or hot.

Procedure Follow the procedure below to clean the fuel strainer.



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1. Using a wrench, remove the fuel strainer cup, gasket **(M2)**, and screen **(M3)** from the generator.
2. Empty collected water and sediment from the fuel strainer cup.
3. Using a clean dry cloth, wipe any remaining water and sediment from the screen, the gasket, and the inside of the fuel strainer cup.
4. Re-assemble and re-install the fuel strainer. Tighten securely to prevent fuel leaks.

3.9 Storing the Generator

When

Follow the procedures described below if you intend to take your generator out of service and store it for at least six months.

Tasks

The following tasks must be performed in order to prepare the generator for storage:

1. Drain fuel from the fuel tank.
2. Drain fuel from the carburetor.
3. Change the engine oil.
4. Check for loose or missing fasteners; tighten or replace as needed.
5. Clean the machine.
6. Store the machine.

Prerequisites

- Engine is stopped and cool to the touch
- Machine is on a level surface
- Fresh engine oil (see engine operator's manual)
- Clean, dry shop cloths
- Plastic cloth and containers of sufficient volume to collect drained fuel and oil

Note: *Collect, store and dispose of drained fuel and oil in accordance with current environmental protection regulations.*

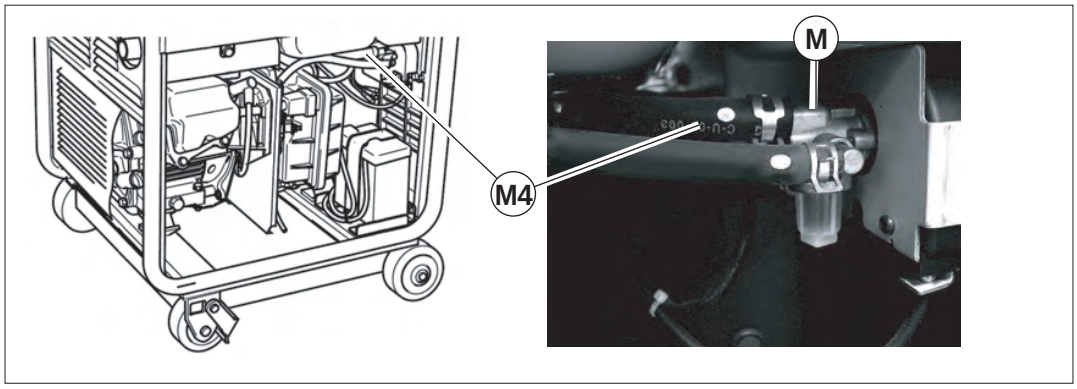
WARNING

Fire/burn hazards. Gasoline is flammable and can ignite or explode.

- ▶ Keep all open flames, sparks, and cigarettes away from the machine while draining the fuel tank and carburetor.
- ▶ Do not drain fuel while the engine is running or hot.

Draining the fuel tank

Follow the procedure below to drain the fuel tank.



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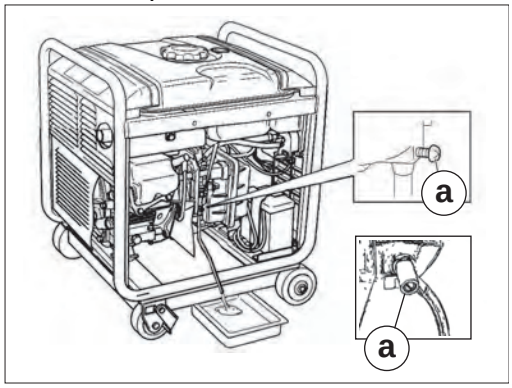
1. Place a plastic cloth and a collection container beneath the machine.
2. Locate the fuel line **(M4)**. Pinch the fuel line with locking pliers or a hose pincher and disconnect it from the fuel strainer **(M)**.
3. Open the fuel line and drain fuel into the collection container.

4. Reconnect the fuel line to the fuel strainer.
5. Dispose of drained fuel.

Draining the carburetor

6. Place a plastic cloth and a collection container beneath the machine.



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7. Locate the fuel drain screw **(a).** The screw is either recessed or exposed depending on your machine model.
8. Unscrew and remove the fuel drain screw. Fuel will drain from the attached plastic tube.
9. Collect and dispose of drained fuel.
10. Re-install the fuel drain screw.

Change the engine oil

See *Changing the Engine Oil.*

Check fasteners

Check the machine for loose or missing fasteners. Tighten or replace as needed.

Clean the machine

11. Using a clean, dry shop cloth, wipe the outside of the machine thoroughly to remove dust and contaminants.
12. Spray the machine with a protectant such as Armor-All®.

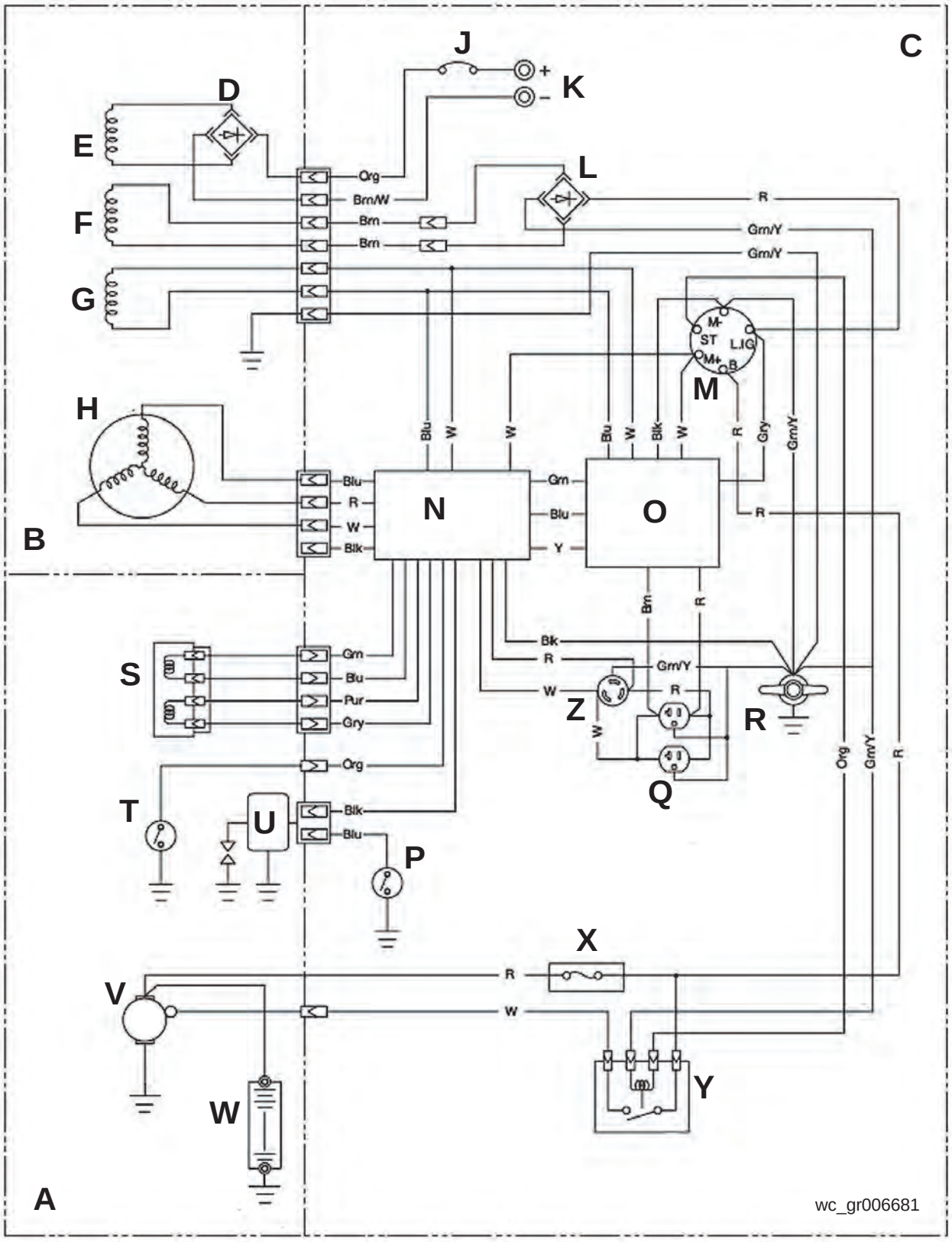
NOTICE: Do not use water to clean the machine! Water is corrosive and can permanently damage the machine and operating electronics.

Store the machine

13. Store the machine in a well-ventilated, low humidity area.

4 Schematics

4.1 Electrical Schematic (S Models, non-CSA)

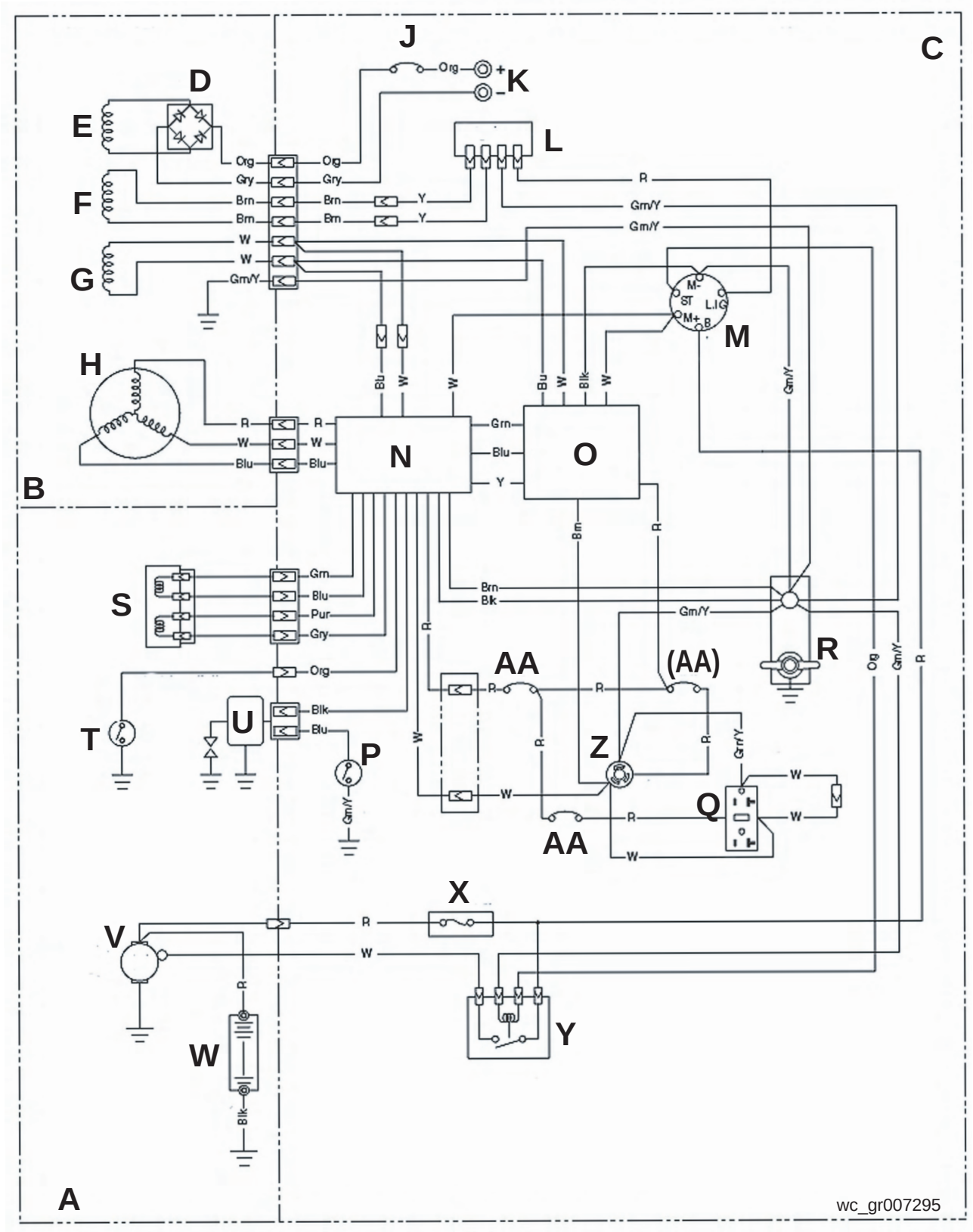


4.2 Electrical Schematic Components (S Models, non-CSA)

	Component		Component
A	Engine	**O**	Monitor control unit
B	Generator	**P**	Engine switch
C	Control panel	**Q**	AC receptacle, 120V 20A
D	Diode rectifier	**R**	Ground terminal
E	Coil (1)	**S**	Stepping motor
F	Coil (2)	**T**	Oil level sensor
G	Coil (3)	**U**	Ignition coil
H	Main coil	**V**	Starting motor
J	DC circuit breaker	**W**	Battery
K	DC output terminal	**X**	Fuse, 10A
L	Diode rectifier	**Y**	Relay
M	Key switch	**Z**	AC receptacle, 120V 30A
N	Inverter and engine control unit	**AA**	Circuit breaker

Wire Colors					
Blk	Black	Brn	Brown	Org	Orange
Blk/W	Black/White	Brn/W	Brown/White	Gry	Gray
Blu	Blue	Grn	Green	R	Red
LBlu	Pink	Grn/W	Green/White	W	White
Y	Yellow	W/Blk	White/Black	Grn/Y	Green/Yellow
Pur	Purple				

4.3 Electrical Schematic (CSA)

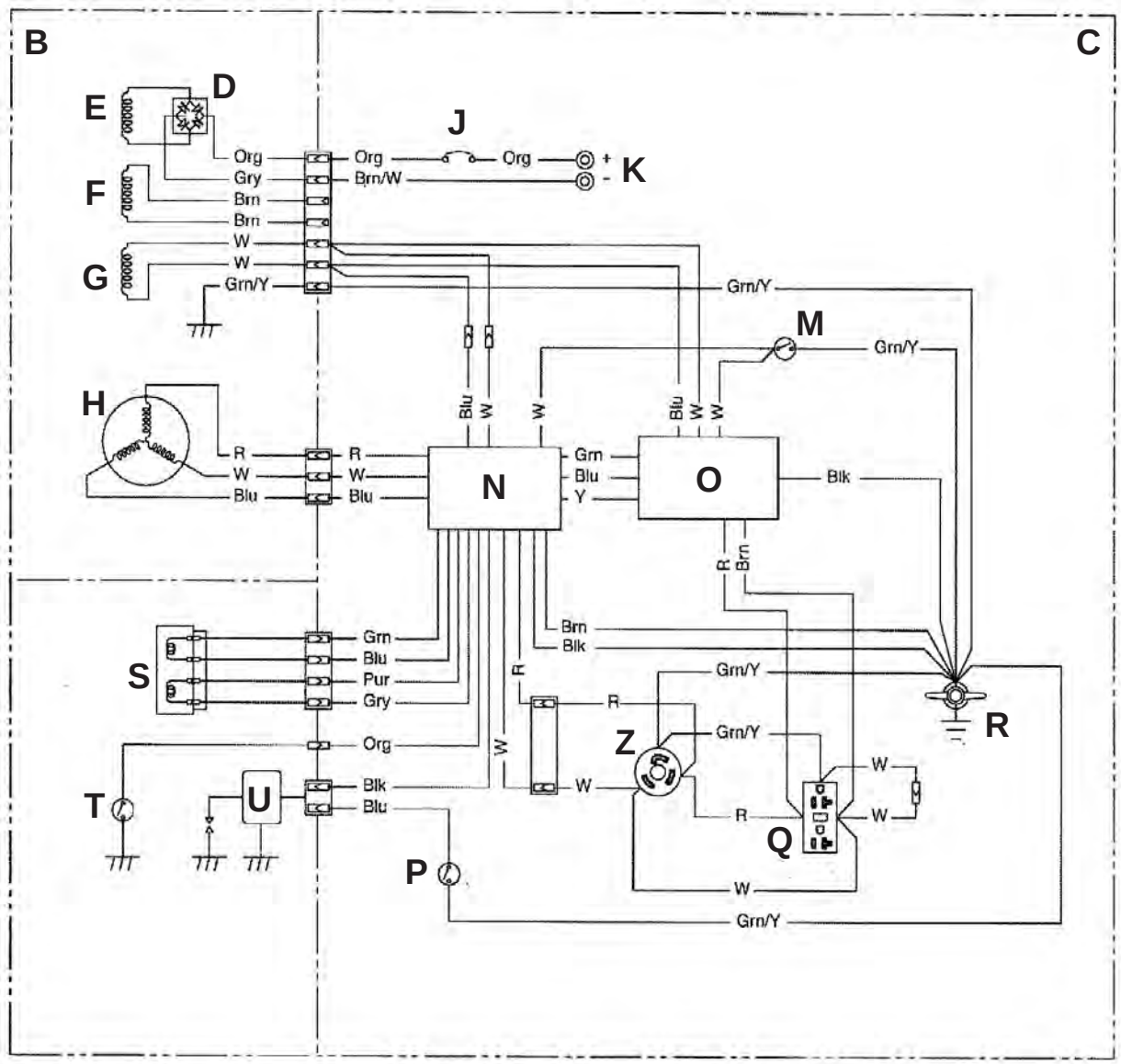


4.4 Electrical Schematic Components (CSA)

	Component		Component
A	Engine	**O**	Monitor control unit
B	Generator	**P**	Engine switch
C	Control panel	**Q**	AC receptacle, 120V 20A
D	Diode rectifier	**R**	Ground terminal
E	Coil (1)	**S**	Stepping motor
F	Coil (2)	**T**	Oil level sensor
G	Coil (3)	**U**	Ignition coil
H	Main coil	**V**	Starting motor
J	DC circuit breaker	**W**	Battery
K	DC output terminal	**X**	Fuse, 10A
L	Diode rectifier	**Y**	Relay
M	Key switch	**Z**	AC receptacle, 120V 30A
N	Inverter and engine control unit	**AA**	Circuit breaker

Wire Colors					
Blk	Black	Brn	Brown	Org	Orange
Blk/W	Black/White	Brn/W	Brown/White	Gry	Gray
Blu	Blue	Grn	Green	R	Red
LBlu	Pink	Grn/W	Green/White	W	White
Y	Yellow	W/Blk	White/Black	Grn/Y	Green/Yellow
Pur	Purple				

4.5 Electrical Schematic (Manual Start Models, non-CSA)



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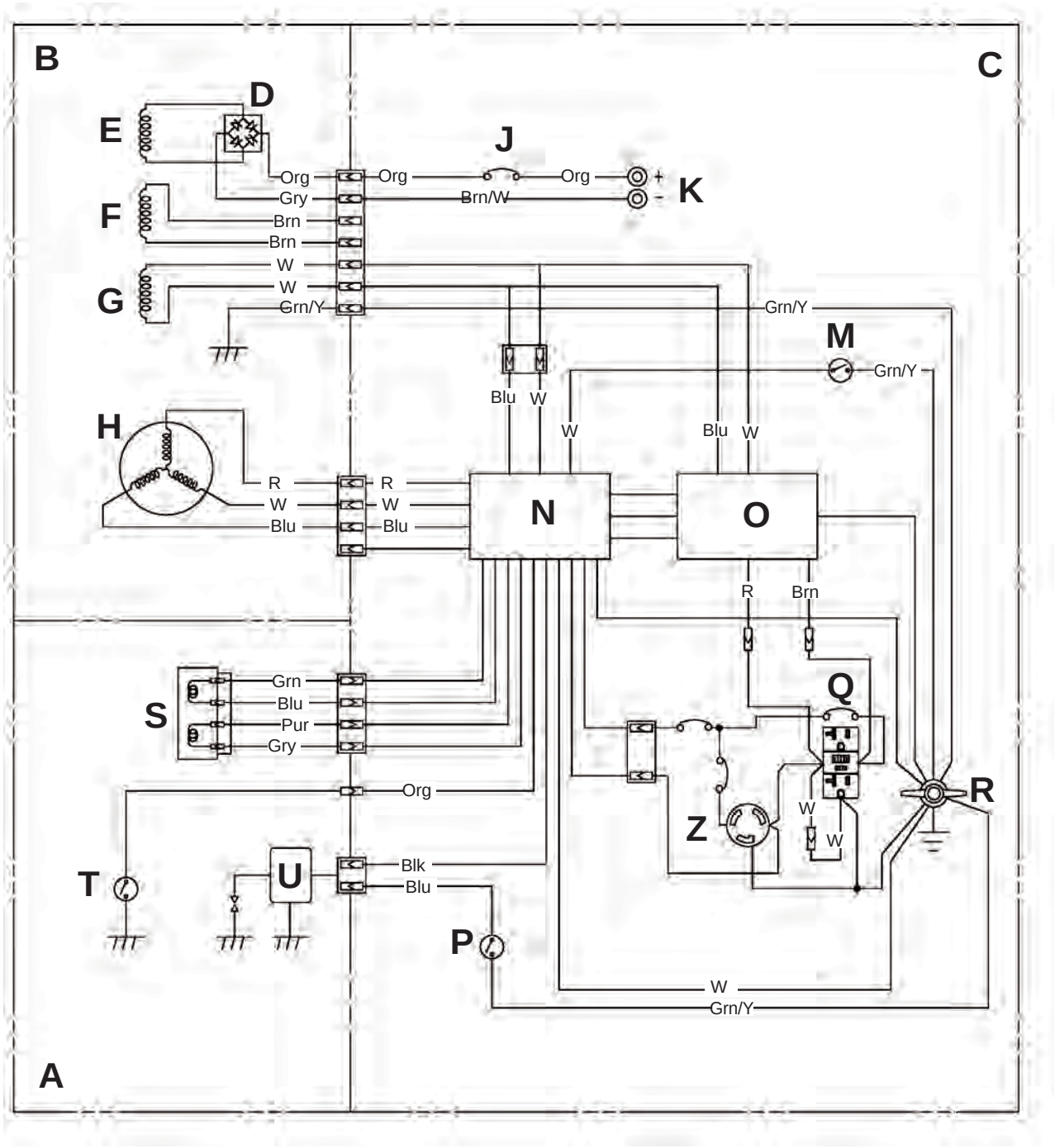
4.6 Electrical Schematic Components (Manual Start Models, non-CSA)

	Component		Component
A	Engine	**K**	DC output terminal
B	Generator	**M**	Micro switch
C	Control panel	**N**	Inverter and engine control unit
D	Diode rectifier	**O**	Monitor control unit
E	Coil (1)	**P**	Engine switch
F	Coil (2)	**Q**	AC receptacle, 120V 20A
G	Coil (3)	**R**	Ground terminal
H	Main coil	**U**	Ignition coil
J	DC circuit breaker	**Z**	AC receptacle, 120V 30A

Wire Colors					
Blk	Black	Brn	Brown	Org	Orange
Blk/W	Black/White	Brn/W	Brown/White	Gry	Gray
Blu	Blue	Grn	Green	R	Red
LBlu	Pink	Grn/W	Green/White	W	White
Y	Yellow	W/Blk	White/Black	Grn/Y	Green/Yellow
Pur	Purple				

4.7 Electrical Schematic (Manual Start Models, CSA)



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4.8 Electrical Schematic Components (Manual Start Models, CSA)

	Component		Component
A	Engine	**K**	DC output terminal
B	Generator	**M**	Micro switch
C	Control panel	**N**	Inverter and engine control unit
D	Diode rectifier	**O**	Monitor control unit
E	Coil (1)	**P**	Engine switch
F	Coil (2)	**Q**	AC receptacle, 120V 20A
G	Coil (3)	**R**	Ground terminal
H	Main coil	**U**	Ignition coil
J	DC circuit breaker	**Z**	AC receptacle, 120V 30A

Wire Colors					
Blk	Black	Brn	Brown	Org	Orange
Blk/W	Black/White	Brn/W	Brown/White	Gry	Gray
Blu	Blue	Grn	Green	R	Red
LBlu	Pink	Grn/W	Green/White	W	White
Y	Yellow	W/Blk	White/Black	Grn/Y	Green/Yellow
Pur	Purple				

5 Basic Troubleshooting

Problem	Cause	Remedy
Engine is difficult to start	1. Fuel is contaminated 2. Spark plug gap setting is incorrect	1. Clean fuel filter and fuel tank. Remove water, dirt, and other impurities. 2. Check and adjust spark plug gap clearance if necessary.
Engine does not start	1. Engine switch in wrong position 2. No fuel 3. Equipment is connected to the generator 4. Loose spark plug cap 5. Fouled spark plug 6. Low engine oil	1. Turn engine switch to CHOKE position. 2. Refill fuel tank. 3. Switch off equipment and disconnect from the generator. 4. Push spark plug cap firmly onto spark plug. 5. Remove spark plug and clean electrode. 6. Add engine oil.
Engine power output is low	1. Air cleaner is dirty 2. Engine is overheated	1. Clean air cleaner. 2. Consult engine owner's manual.
Engine stops	1. Engine malfunction 2. Fuel tank is empty	1. Consult engine owner's manual. 2. Refill fuel tank.
No electricity is generated at receptacle	1. Overload fault (red overload indicator light illuminates) 2. DC circuit breaker is OFF 3. GFI has activated 4. Loose connection at AC receptacle or DC terminals 5. Engine was started after equipment was connected	1. Stop engine and check equipment and/or generator for overloading. 2. Press the DC circuit breaker to ON position after checking equipment for normal operation. 3. Press the RESET button on the AC receptacle after checking equipment for normal operation. 4. Tighten connection. 5. Switch off equipment and disconnect from the generator. Reconnect after re-starting engine.

6 Technical Data

6.1 Engine

Engine Power Rating
Engine power rating per ISO/TR 14396. Actual power output may vary due to conditions of specific use.

Model		GPi 3200	GPSi 3200	GPi 4300	GPSi 4300
Engine					
Engine make		Robin			
Engine model		EX21		EX27	
Number of cylinders		1			
Displacement	cm^3 (in^3)	211 (12.87)		265 (16.17)	
Operating speed	rpm	2800–3600		2800–3700	
Max. rated power @ rated speed	kW (hp)	4.8 (6.4) @ 3600 rpm		6.3 (8.2) @ 3600 rpm	
Engine oil type		4-stroke API SE, SG, SH, or SJ SAE 10W-30 or 10W-40			
Engine oil capacity	L (qt.)	0.6 (0.63)		1.0 (1.06)	
Starting system		Manual	Manual and Electric	Manual	Manual and Electric
Spark plug	type	NGK BR -6HS or equivalent			
Battery	type	12V-6A-h or larger		12V-12A-h or larger	
		Yuasa	YTX7L-BS	Yuasa	YB12AL-A2
		GS	GTX7L-BS	GS	GM12AZ-3A-2 CB12AL-A
		Interstate	YTX7L-BS	Interstate	YB12AL-A
		GNB	7L-BS	GNB	12AL-A
		Sears	44024	Sears	44052
Fuel type	type	Unleaded gasoline			
Fuel tank capacity	L (gal)	13 (3.4)	14 (3.7)		16 (4.2)
Fuel consumption @ continuous load	L (gal)/hr.	1.7 (0.45)		2.4 (0.64)	
Running time @ continuous load	hours	7.6	8.2	5.8	6.7

6.2 Generator Data

Machine		GPi 3200	GPSi 3200	GPi 4300	GPSi 4300
Machine					
Generator type		Multi-pole revolving field inverter			
Generator speed	rpm	2800–3600		2800–3700	
Rated AC voltage	V	120			
Rated frequency	Hz	60			
Rated AC current	A	23.3		31.7	
Continuous AC output	W	2800		3800	
Rated power factor		1.0			
Rated DC voltage	V	12			
Rated DC current	A	8.3			
Safety device type		Current breaker			
Grounding system		Neutral ground (Neutral bonded to frame)			
AC connections		(1) NEMA 50-2R (1) NEMA 50-3R			
DC connection		Screw-on terminals (+ / -)			
Maximum ambient temperature rating	°C (°F)	40 (104)			
Length	mm (in.)	487 (19.2)	537 (21.1)	523 (20.6)	580 (22.8)
Width	mm (in.)	432 (17.0)	482 (19.0)	477 (18.8)	527 (20.8)
Height	mm (in.)	475 (18.7)	583 (23.0)	507 (19.9)	618 (24.3)
Dry weight	kg (lb)	38 (83.8)	65 (143.3)	45 (99.2)	80 (176.4)

Engine Emission Warranty Information and Statement

⚠ WARNING: ⚠

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

NOTICE

FEDERAL EMISSION COMPONENT DEFECT WARRANTY and CALIFORNIA EMISSION CONTROL WARRANTY are applicable to only those engines/ generators complied with EPA (Environmental Protection Agency) and CARB (California Air Resources Board) emission regulations in the U.S.A.

NOTICE

To the engines/generators exported to and used in the countries other than the U.S.A., warranty service shall be performed by the distributor in each country in accordance with the standard Robin engine/generator warranty policy as applicable.

AIR INDEX

To show compliance with California emission regulations, a hangtag has been provided displaying the Air Index level and durability period of this engine.

The Air Index level defines how clean an engine's exhaust is over a period of time. A bar graph scaled from "0" (most clean) to "10" (least clean) is used to show an engine's Air Index level. A lower Air Index level represents cleaner exhaust from an engine.

The period of time (in hours) that the Air Index level is measured is known as the durability period. Depending on the size of the engine, a selection of time periods can be used to measure the Air Index level (see below).

Descriptive Term		Applicable to Emissions Durability Period
Moderate	-	50 hours (engine from 0 to 80 cc)
		125 hours (engine greater than 80 cc)
Intermediate	-	125 hours (engine from 0 to 80 cc)
		250 hours (engine greater than 80 cc)
Extended	-	300 hours (engine from 0 to 80 cc)
		500 hours (engine greater than 80 cc)

Notice : This hangtag must remain on this engine or piece of equipment, and only be removed by the ultimate purchaser before operation.

FEDERAL EMISSIONS COMPONENT DEFECT WARRANTY

EMISSIONS COMPONENT DEFECT WARRANTY COVERAGE – This emission warranty is applicable in all States, except the state of California.

Fuji Heavy Industries Ltd. and Robin America Inc., Wood Dale Illinois, (herein "ROBIN AMERICA") warrant(s) to the initial retail purchaser and each subsequent owner, that this Nonroad engine (herein "engine") has been designed, built, and equipped to conform at the time of initial sale to all applicable regulations of the U.S.
Environmental Protection Agency (EPA), and that the engine is free of defects in materials and workmanship which would cause this engine to fail to conform with EPA regulations during its warranty period.

For the components listed under PARTS COVERED, the service dealer authorized by ROBIN AMERICA will, at no cost to you, make the necessary diagnosis, repair, or replacement necessary to ensure that the engine complies with applicable U.S. EPA regulations.

EMISSISON COMPONENT DEFECT WARRANTY PERIOD

The warranty period for this engine begins on the date of sale to the initial purchaser and continues for a period of two years.

PARTS COVERED

Listed below are the parts covered by the Emission Components Defect Warranty. Some of the parts listed below may require scheduled maintenance and are warranted up to the first scheduled replacement point for that part.

(1) Fuel Metering System
- (i) Carburetor and internal parts (and/or pressure regulator or fuel injection system).
- (ii) Air/fuel ratio feedback and control system, if applicable.
- (iii) Cold start enrichment system, if applicable.
- (iv) Regulator assy (gaseous fuel, if applicable)

(2) Air Induction System
- (i) Intake manifold, if applicable
- (ii) Air filter.

(3) Ignition System
- (i) Spark plugs.
- (ii) Magneto or electronic ignition system.
- (iii) Spark advance/retard system, if applicable.

(4) Exhaust manifold, if applicable

(5) Miscellaneous Items Used in Above Systems
- (i) Electronic controls, if applicable
- (ii) Hoses, belts, connectors, and assemblies.
- (iii) Filter lock assy (gaseous fuel, if applicable)

OBTAINING WARRANTY SERVICE

To obtain warranty service, take your engine to the nearest authorized Robin America service dealer . Bring your sales receipts indicating date of purchase for this engine. The service dealer authorized by ROBIN AMERICA will perform the necessary repairs or adjustments within a reasonable amount of time and furnish you with a copy of the repair order. All parts and accessories replaced under this warranty become the property of ROBIN AMERICA.

WHAT IS NOT COVERED

*Conditions resulting from tampering, misuse, improper adjustment (unless they were made by the service dealer authorized by ROBIN AMERICA during a warranty repair), alteration, accident, failure to use the recommended fuel and oil, or not performing required maintenance services.

*The replacement parts used for required maintenance services.

*Consequential damages such as loss of time, inconvenience, loss of use of the engine or equipment, etc.

*Diagnosis and inspection charges that do not result in warranty-eligible service being performed.

*Any non-authorized replacement part, or malfunction of authorized parts due to use of non-authorized parts.

OWNER'S WARRANTY RESPONSIBILITIES

As the engine owner, you are responsible for the performance of the required maintenance listed in your owner's manual. ROBIN AMERICA recommends that you retain all receipts covering maintenance on your engine, but ROBIN AMERICA cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

As the engine owner, you should however be aware that ROBIN AMERICA may deny warranty coverage if your engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

You are responsible for presenting your engine to the nearest service dealer authorized by ROBIN AMERICA when a problem exists.

If you have any questions regarding your warranty rights and responsibilities, you should contact the Robin America customer service department at 1-630-350-8200 for the information.

THINGS YOU SHOULD KNOW ABOUT THE EMISSION CONTROL SYSTEM WARRANTY MAINTENANCE AND REPAIRS

You are responsible for the proper maintenance of the engine.
You should keep all receipts and maintenance records covering the performance of regular maintenance in the event questions arise. These receipts and maintenance records should be transferred to each subsequent owner of the engine. ROBIN AMERICA reserves the right to deny warranty coverage if the engine has not been properly maintained. Warranty claims will not be denied, however, solely because of the lack of required maintenance or failure to keep maintenance records.

MAINTENANCE, REPLACEMENT OR REPAIR OF EMISSION CONTROL DEVICES AND SYSTEMS MAY BE PERFORMED BY ANY REPAIR ESTABLISHMENT OR INDIVIDUAL;
HOWEVER, WARRANTY REPAIRS MUST BE PERFORMED BY A SERVICE DEALER AUTHORIZED BY ROBIN AMERICA. THE USE OF PARTS THAT ARE NOT EQUIVALENT IN PERFORMANCE AND DURABILITY TO AUTHORIZED PARTS MAY IMPAIR THE EFFECTIVENESS OF THE EMISSION CONTROL SYSTEM AND MAY HAVE A BEARING ON THE OUTCOME OF A WARRANTY CLAIM.

If other than the parts authorized by ROBIN AMERICA are used for maintenance replacements or for the repair of components affecting emission control, you should assure yourself that such parts are warranted by their manufacturer to be equivalent to the parts authorized by ROBIN AMERICA in their performance and durability.

HOW TO MAKE A CLAIM

All repair qualifying under this limited warranty must be performed by a service dealer authorized by ROBIN AMERICA. In the event that any emission-related part is found to be defective during the warranty period, you shall notify Robin America customer service department at 1-630-350-8200 and you will be advised of the appropriate warranty service dealer or service providers where the warranty repair can be performed.

CALIFORNIA EMISSION CONTROL WARRANTY STATEMENT
YOUR WARRANTY RIGHTS AND OBLIGATIONS

The California Air Resources Board and Fuji Heavy Industries Ltd. (herein “FUJI”) are pleased to explain the emission control system warranty on your 2005 and later Small Off-Road engine (herein "engine"). In California, new engine must be designed, built and equipped to meet the State's stringent anti-smog standards. FUJI must warrant the emission control system on your engine for the periods of time described below, provided there has been no abuse, neglect or improper maintenance of your engine. Your emission control system may include parts such as the carburetor or fuel-injection system, and the ignition system. Also included may be hoses, belts, connectors and other emission-related assemblies. Where a warrantable condition exists, FUJI will repair your engine at no cost to you including diagnosis, parts and labor.

MANUFACTURER'S WARRANTY COVERAGE:

The 2005 and later engines are warranted for two (2) years. If any emission related part on your engine is defective, the part will be repaired or replaced by FUJI.

OWNER'S WARRANTY RESPONSIBILITIES :

-As the engine owner, you are responsible for the performance of the required maintenance listed in your Owner's Manual. FUJI recommends that you retain all receipts covering maintenance on your engine, but FUJI cannot deny warranty solely for the lack of receipts or for your failure to ensure the performance of all scheduled maintenance.

-As the engine owner, you should ,however, be aware that FUJI may deny you warranty coverage if your engine or a part has failed due to abuse, neglect, improper maintenance or unapproved modifications.

-You are responsible for presenting your engine to a service dealer or warranty station authorized by ROBIN AMERICA Inc. 940 Lively Blvd., Wood Dale, IL 60191 (herein ROBIN AMERICA) as soon as a problem exists. The warranty repairs should be completed in a reasonable amount of time, not to exceed 30 days.

If you have any questions regarding your warranty rights and responsibilities, you should contact the Robin America Inc. Customer Service Department at 1-630-350-8200

LIMITED WARRANTY
on Emission Control Systems
– California Only –

FUJI warrants to the owner of the 2005 and later engine that the engine 1)has been designed, built and equipped so as to conform at the time of manufacture with the applicable regulations of the California Air Resources Board, and (2) is free from defects in materials and workmanship that could cause it to fail to conform with those regulations as may be applicablein the terms and conditions stated below.

A. COMMENCEMENT DATE

The warranty period begins on the date the engine is delivered to a first retail purchaser.

B. LENGTH OF COVERAGE

FUJI warrants to a first retail purchaser and each subsequent purchaser that the engine is free from defects in materials and workmanship that cause the failure of a warranted emission-related part for a period of two (2) years after the date of delivery to the first retail purchaser.

C. WHAT IS COVERED:

1. REPAIR OR REPLACEMENT PARTS
   Repairs and replacement of any warranted part will be performed at no charge to you by an authorized service dealer or a warranty station. You may contact the Robin America Inc. Customer Service Department at 1-630-350-8200 to obtain the name of the nearest appropriate location where your warranty repairs are performed.
2. WARRANTY PERIOD
   This warranty continues for a period of two (2) years and applies only to the repair, replacement or adjustment of the component parts that are not scheduled for replacement as required maintenance. Further, component parts which are scheduled only for regular inspection to the effect of "repair or replace as necessary" are warranted for the warranty period. Any warranted part which is scheduled for replacement as required maintenance is warranted for the period of time up to the first scheduled replacement point for that part.
3. DIAGNOSIS
   You will not be charged for diagnostic labor that leads to the determination that a warranted part is defective, if the diagnostic work is performed at an authorized service dealer or warranty station.
4. DAMAGES
   If a warranted part failed causing damage to other engine components, consult an warranty station.

D. WHAT IS NOT COVERED

1. This limited warranty does not cover any part which malfunctions, fails or is damaged due to failure to follow the maintenance and operating instructions set forth in the 2005 and later Owner's Manual including:
   (1) improper maintenance of any warranted parts
   (2) improper installation, adjustment or repair of the engine or of any warranted part unless performed by an authorized service dealer
   (3) failure to follow recommendations on fuel use contained in the 2005 and later Owner's Manual
   (4) repairs performed outside of the authorized warranty service dealers
   (5) use of parts which are not authorized by FUJI.
2. Add-on or modified parts
   This warranty does not cover any part that malfunctions, fails or is damaged due to alterations by changing, adding to or removing parts from the engine.
3. Expenses incurred by processing warranty claims
   FUJI, any authorized service dealer and warranty station shall not be liable for any loss of use of the engine, for any alternative usage, for any damage to goods, loss of time or inconvenience.

E. HOW TO FILE A CLAIM

All repairs qualifying under this Limited Warranty must be performed by a dealer who sold you the engine or warranty station authorized by ROBIN AMERICA. In the event that any emission-related part is found to be defective during the warranty period, you must notify the Robin America Inc. Customer Service Department at 1-630-350-8200 and you will be advised of the appropriate warranty service facilities where the warranty repair is to be performed.

F. WHERE TO OBTAIN WARRANTY SERVICE

It is recommended that warranty service be performed by the authorized dealer who sold you the engine, although warranty service will be performed by any authorized service dealers or warranty stations anywhere in the United States.

When warranty repair is needed, the engine must be brought to an authorized service dealer or warranty station's place of business during normal business hours. In all cases, a reasonable time, not to exceed 30 days, must be allowed for the warranty repair to be completed after the engine is received by the authorized service dealer or warranty station.

G. MAINTENANCE, REPLACEMENT AND REPAIR OF EMISSION-RELATED PARTS

Only warranted engine replacement parts approved by FUJI should be used in the performance of any warranty maintenance or repairs on emission-related parts. If other than authorized parts are used for maintenance, replacement or repair of components affecting emission control, you should assure yourself that such parts are warranted by their manufacturer to be equivalent to authorized parts in performance and durability. FUJI ,however, assumes no liability under this warranty with respect to parts other than authorized parts. The use of non-authorized replacement parts does not invalidate the warranty on other components unless the non-authorized parts cause damage to warranted parts.

H. PARTS COVERED UNDER THE CALIFORNIA EMISSIONS WARRANTY

(1) Fuel Metering System
- (i) Carburetor and internal parts (and/or pressure regulator or fuel injection system).
- (ii) Air/fuel ratio feedback and control system, if applicable.
- (iii) Cold start enrichment system, if applicable.
- (iv) Regulator assy (gaseous fuel, if applicable)

(2) Air Induction System
- (i) Intake manifold, if applicable
- (ii) Air filter.

(3) Ignition System
- (i) Spark plugs.
- (ii) Magneto or electronic ignition system.
- (iii) Spark advance/retard system, if applicable.

(4) Exhaust manifold, if applicable

(5) Miscellaneous Items Used in Above Systems
- (i) Electronic controls, if applicable
- (ii) Hoses, belts, connectors, and assemblies.
- (iii) Filter lock assy (gaseous fuel, if applicable)

I. MAINTENANCE STATEMENTS

It is your responsibility to have all scheduled inspection and maintenance services performed at the times recommended in the 2005 and later Owner's Manual and to retain proof that inspection and maintenance services are performed at the times when recommended. FUJI will not deny a warranty claim solely because you have no record of maintenance; however, FUJI may deny a warranty claim if your failure to perform required maintenance resulted in the failure of warranted part. The proof which you maintain should be given to each subsequent owner of the engine. You are responsible for performing the scheduled maintenance described below based on the procedures specified in the 2005 and later Owner's Manual. The scheduled maintenance below is based on a normal engine operating schedule.

PROCEDURE	INTERVAL
1) Change engine oil	: Initial 20 hours and every 100 hours afterward
2) Clean air cleaner (element)	: Every 50 hours
3) Replace air cleaner element	: Every 200 hours
4) Clean and adjust spark plug and electrodes	: Every 200 hours

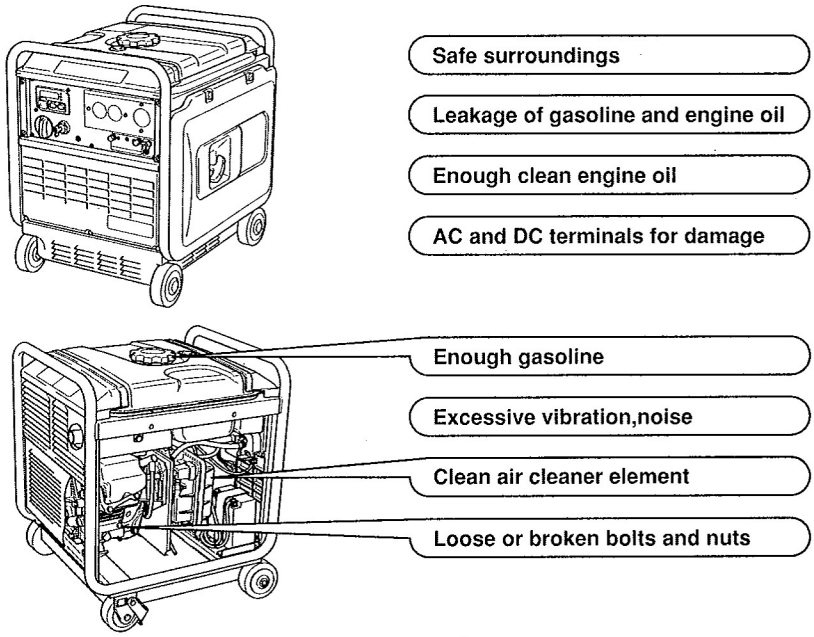
Note: More frequent maintenance may be necessary under dusty, dirty or severe conditions.

MAINTENANCE

MAINTENANCE, REPLACEMENT OR REPAIR OF THE EMISSION CONTROL DEVICES AND SYSTEMS MAY BE PERFORMED BY ANY NONROAD ENGINE REPAIR ESTABLISHMENT OR INDIVIDUAL.

DAILY INSPECTION

Before running the generator, check the following service items:



PERIODIC MAINTENANCE

Periodic maintenance is vital to safe and efficient operation of your generator.
Check the table below for periodic maintenance intervals.
IT IS ALSO NECESSARY FOR THE USER OF THIS GENERATOR TO CONDUCT THE MAINTENANCE AND ADJUSTMENTS ON THE EMISSION-RELATED PARTS LISTED BELOW TO KEEP THE EMISSION CONTROL SYSTEM EFFECTIVE.

The emission control system consists of the following parts :

(1) Carburetor and internal parts
(2) Cold start enrichment system, if applicable
(3) Intake manifold, if applicable
(4) Air cleaner elements
(5) Spark plug
(6) Magneto or electronic ignition system
(7) Spark advance/retard system, if applicable
(8) Exhaust manifold, if applicable
(9) Hoses, belts, connectors, and assemblies

The maintenance schedule indicated in the table is based on the normal generator operation. Should the generator be operated in extremely dusty condition or in heavier loading condition, the maintenance intervals must be shortened depending on the contamination of oil, clogging of filter elements, wear of parts, and so on.

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