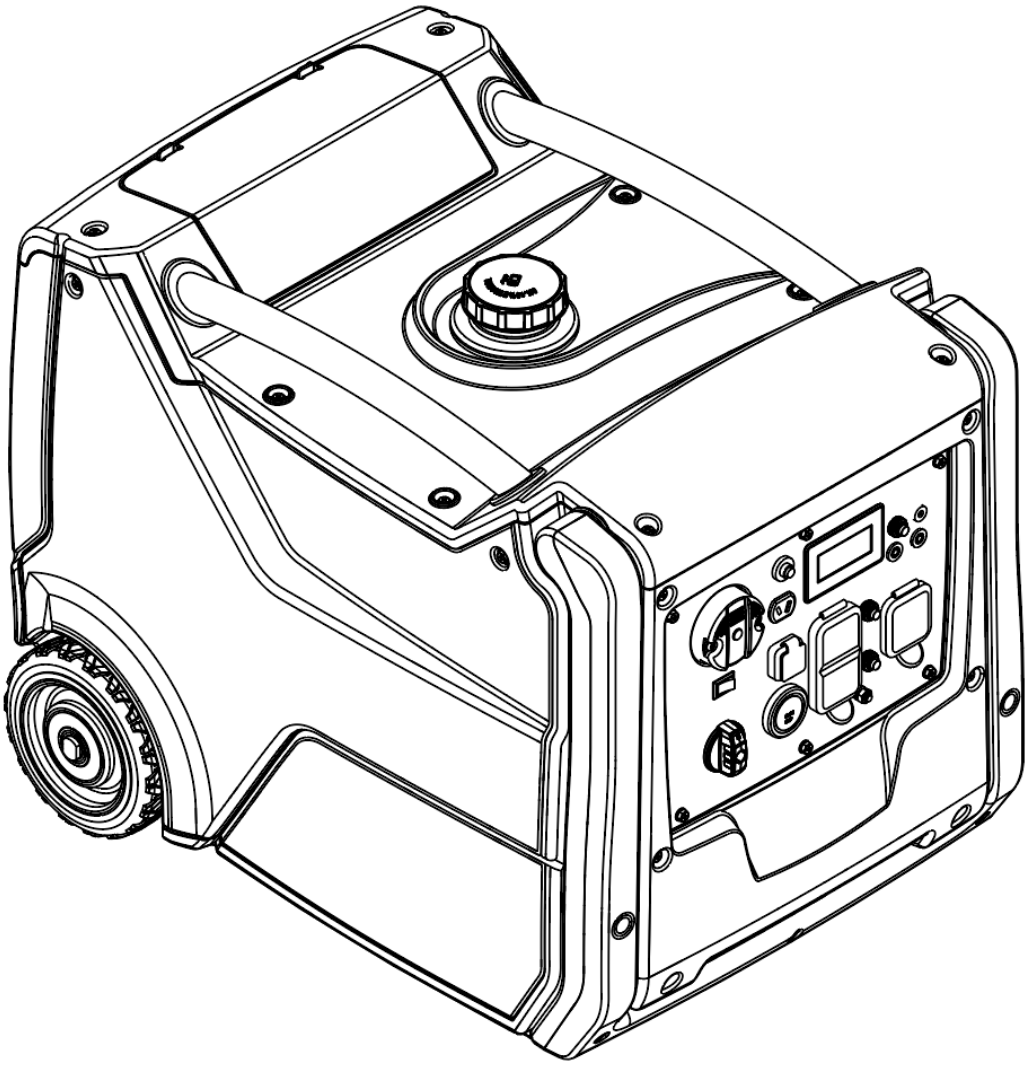
594-8103-00

Service Manual

INV4000 E

Portable Generator



Important Safety Information

Most accidents that involve product operation, maintenance and repair are caused by failure to observe basic safety rules or precautions. An accident can often be avoided by recognizing potentially hazardous situations before an accident occurs. A person must be alert to potential hazards, including human factors that can affect safety. This person should also have the necessary training, skills and tools to perform these functions properly.

Safety precautions and warnings are provided in this manual and on the product. If these hazard warnings are not heeded, bodily injury or death could occur to you or to other persons. The hazards are identified by the “Safety Alert Symbol” ⚠ and followed by a “Signal Word” such as “DANGER”, “WARNING” or “CAUTION”.

Caterpillar cannot anticipate every possible circumstance that might involve a potential hazard. The warnings in this publication and on the product are, therefore, not all inclusive. You must not use this product in any manner different from that considered by this manual without first satisfying yourself that you have considered all safety rules and precautions applicable to the operation of the product in the location of use, including site-specific rules and precautions applicable to the worksite. If a tool, procedure, work method or operating technique that is not specifically recommended by Caterpillar is used, you must satisfy yourself that it is safe for you and for others. You should also ensure that you are authorized to perform this work, and that the product will not be damaged or become unsafe by the operation, lubrication, maintenance or repair procedures that you intend to use.

The information, specifications, and illustrations in this publication are provided on the basis of information that was available at the time that the publication was written. The specifications, torques, pressures, measurements, adjustments, illustrations, and other items can change at any time. These changes can affect the service that is given to the product. Obtain the complete and most current information before you start any job.

In the United States, the maintenance, replacement, or repair of the emission control devices and systems may be performed by any repair establishment or individual of the owner's choosing.

This manual contains safety, operation, and maintenance information. This manual should be stored near the product. Read, study and keep it with the literature and product information.

Consumer Arbitration Clause

The Limited Warranty included in this User Guide contains important legal terms including, but not limited to, a Consumer Arbitration Clause calling for mandatory individual arbitration and waiving the ability to bring a case as a class action. Please review this carefully.

California Proposition 65 Warning

⚠ WARNING

This product and its related accessories can expose you to chemicals including benzene which is known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov. To reduce the risk of these health hazards, avoid inhaling oil and gasoline fumes and engine exhaust. Wash hands after use.

Table of Contents

SAFETY MESSAGES

There may be several specific safety messages on your generator. Please become familiar with all safety messages.

Ensure that all safety messages are legible. Clean the safety messages or replace the safety messages if the words cannot be read or if the illustrations are not visible. Use a cloth, water, and soap to clean the safety messages. Do not use solvents, gasoline, or other harsh chemicals. Solvents, gasoline, or harsh chemicals could loosen the adhesive that secures the safety messages.

Replace any safety message that is damaged or missing. If a safety message is attached to a part of the generator that is replaced, install a new safety message on the replacement part.

Read the Manual

⚠ WARNING

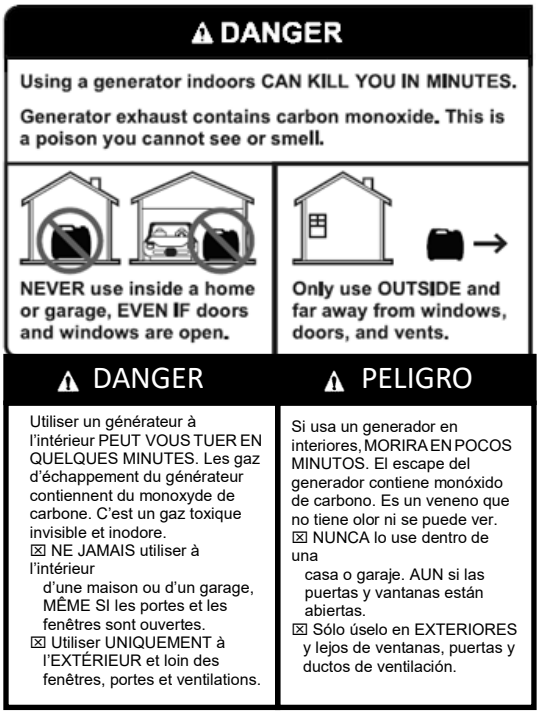
Do not operate or work on this generator unless you have read and understand the instructions and warnings in the Owner's Manual. Failure to follow the instructions or heed the warnings could result in injury or death. Proper care is your responsibility.

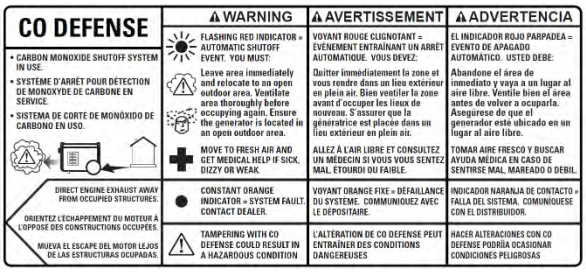
Hot Surface / Do Not Touch / Flammable Material

⚠ WARNING

Hot parts or hot components can cause burns or other personal injury. Do not allow hot parts or components to contact your skin. Use protective clothing or protective equipment to protect your skin. Hot exhaust presents a potential fire hazard. Be sure that nothing flammable is within 1.5 meters of the exhaust.

Carbon Monoxide





Operating a generator indoors can kill you in minutes. Generator exhaust contains carbon monoxide. Carbon monoxide is a poison that you cannot see or smell. Never operate a generator inside a home or garage, even if doors and windows are open. Only operate a generator outdoors and away from windows, doors, and vents. Always direct engine exhaust away from occupied structures. If anyone experiences dizziness, headaches, nausea, or tiredness get to fresh air immediately and seek medical attention. Ventilate the area thoroughly before again occupying it.

The carbon monoxide shutoff system (if equipped) is not a substitute for safe generator operation. Do Not adjust or modify the carbon monoxide shutoff system. Failure to follow instructions can cause the system to malfunction which can result in hazardous conditions.

Electrocution

⚠ DANGER

Shock/Electrocution Hazard: Do not operate this equipment or work on this equipment unless you have read and understand the instructions and warnings in the Owner's Manual. Failure to follow the instructions or heed the warnings will result in serious injury or death.

⚠ WARNING

Operation of this equipment may create sparks that can start fires around dry vegetation. A spark arrestor may be required. The operator should contact local fire agencies for laws or regulations relating to fire prevention requirements.

⚠ WARNING

Electrical backfeed into a utility's distribution system can cause property damage, severe injury, or death.

Electrical backfeed warning. Do not connect generator to a building's electrical system unless using an isolation (transfer) switch installed by a certified, licensed electrician. CA H&S Code 119075 & 119080.

Additional Messages

	**Do not operate in wet conditions**
	**No smoking, no exposed flames, no sparks.**
	**Maintain a minimum distance of 5 feet (1.5 meters) from other objects.**
	**Ensure that the unit is properly grounded.**
	**Earth ground connection**

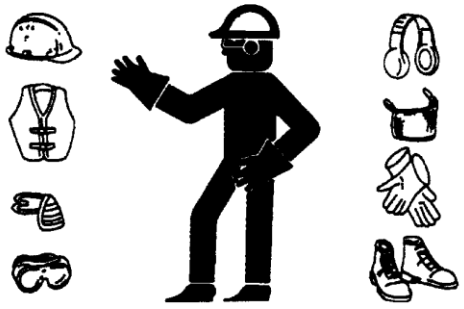
Special Requirements

Electrical equipment, including lines and plug connections should be covered and protected from moisture.

In any generator set installation, the frame of the generator must be connected to an earth ground. A ground terminal is provided.

The INV4000 E has a permanent neutral conductor bonded to the frame.

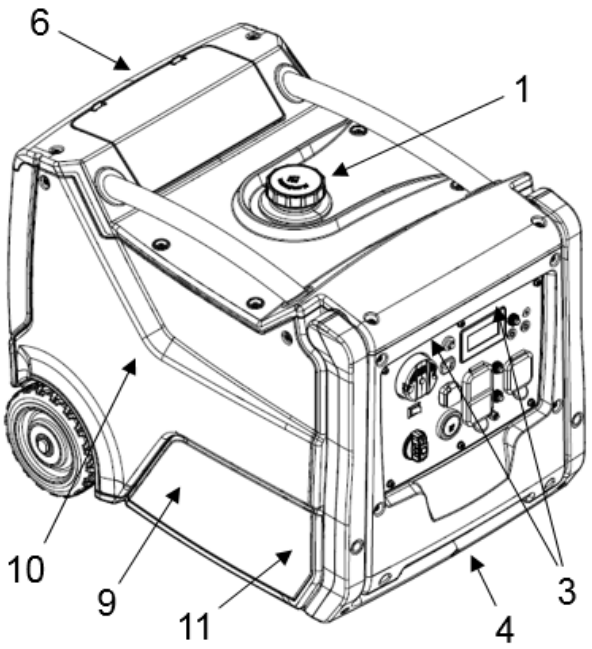
For 120VAC, use extension cords rated for 125V at 20A or greater. Use the shortest extension cord that meets these requirements.

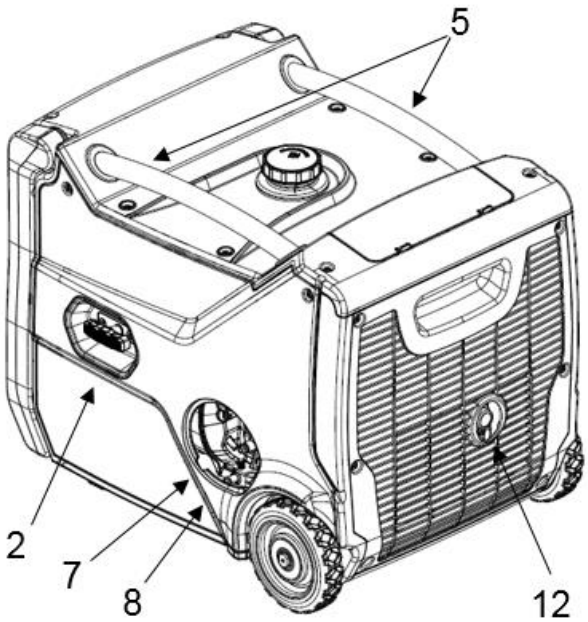


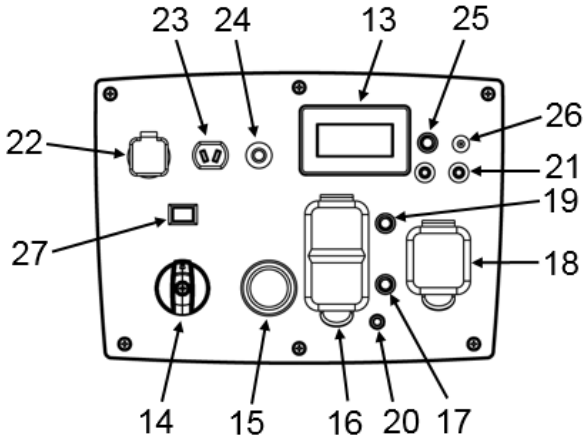
- Wear a hard hat, protective glasses, and other protective equipment, as required.
- When work is performed around an engine that is operating, wear protective devices for ears in order to help prevent hearing damage.
- Do not wear loose clothing or jewelry that can snag on controls or on other engine parts.
- Ensure that all protective guards and all covers are secured in place on the engine.
- Never put maintenance fluids into glass containers. Glass containers can break.
- Use all cleaning solutions with care.

The circuit breakers should match the generator specifications. If the circuit breakers require replacement, they must be replaced with a circuit breaker of the same rating and performance characteristics.

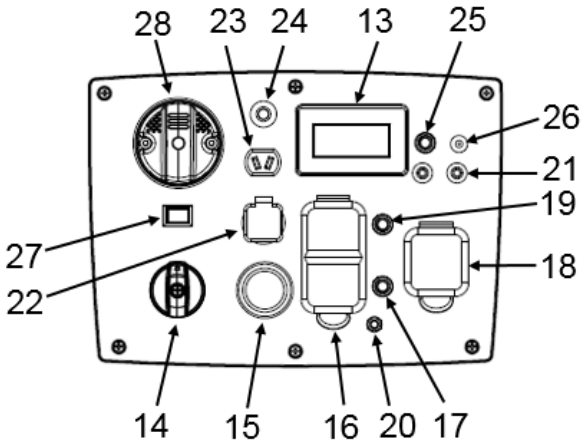
COMPONENT IDENTIFICATION







Panel without CO DEFENSE™

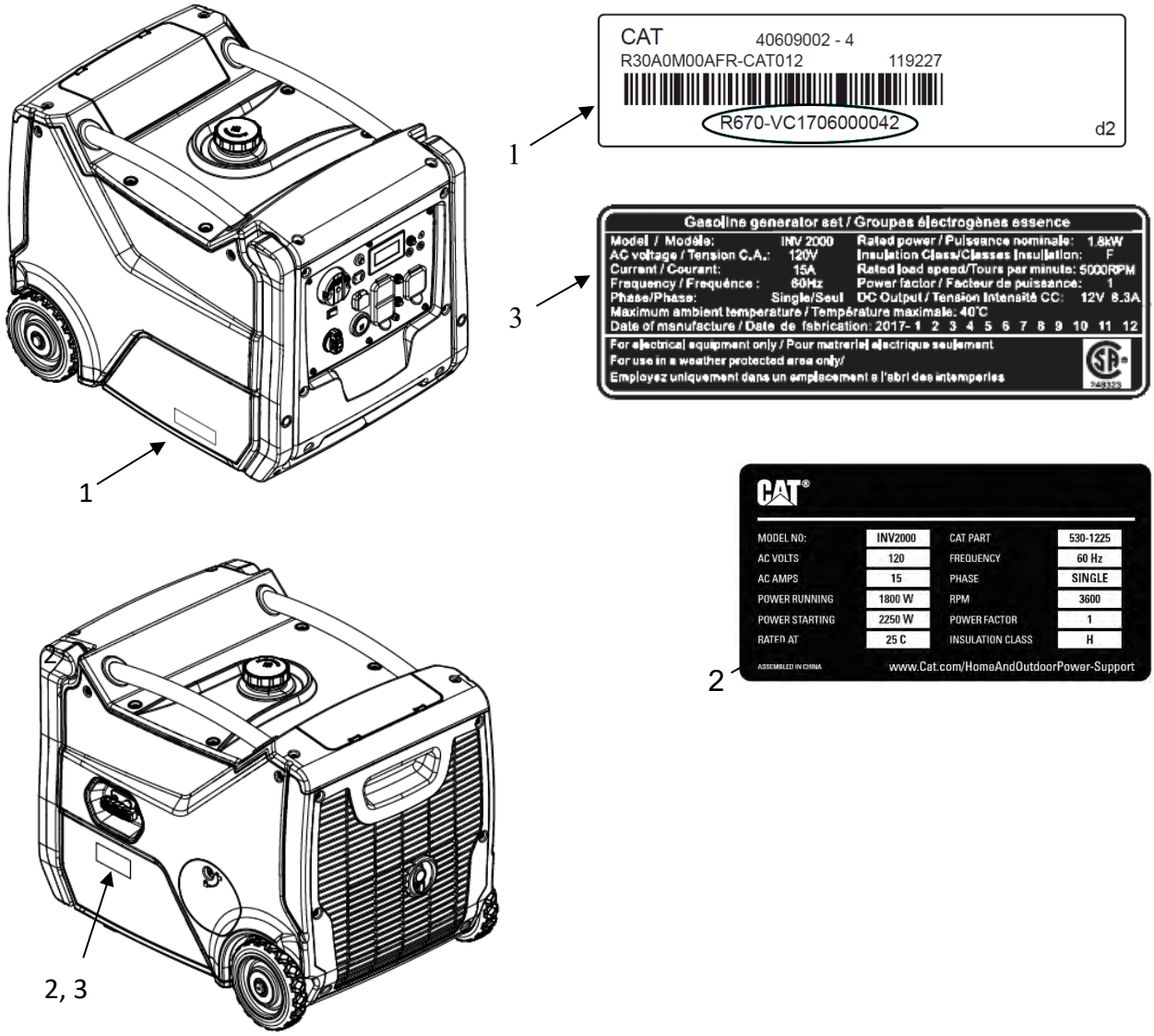


Panel with CO DEFENSE™

1) Fuel Cap
2) Recoil Starter
3) Panel LED Lights
4) Fold-down Handle
5) Carrying Handles
6) Tool Compartment
7) Oil Gauge / Oil Fill*
8) Oil Drain*
9) Air Filter Assembly**
10) Spark plug**
11) Battery**
12) Spark Arrestor
13) LCD Smart Display
14) Generator Switch
15) Electric Starter
16) Receptacle – 120 VAC duplex GFCI
17) AC Circuit Breaker
18) Receptacle – 120 VAC
19) Main AC Circuit Breaker
20) Ground Terminal
21) Parallel Receptacles
22) Receptacle – USB double
23) Receptacle – 12VDC 8.3A
24) DC Circuit Breaker
25) Overload Reset Button
26) Trickle Charger Port
27) Engine Smart Control (ESC) Switch
28) CO DEFENSE™ (If equipped)

*behind service access door
**behind side panel

Engine Type & Serial Number



Cat® portable generators are identified with model numbers, serial numbers, and with performance specification numbers. The model number and performance specifications are located on the ratings plate (2) or the CSA ratings plate (3). The serial number is located on the serial number plate (1).

MAINTENANCE

Regularly Scheduled Maintenance

Included below are the intervals for normal maintenance of the product. The Maintenance and Service Procedures section includes normal maintenance procedures and more detailed service procedures that the typical user may not be able to perform. DO NOT attempt any procedures that you are not qualified to perform.

Ensure that all safety information, warnings, and instructions are read and understood before any operation or any maintenance procedures are performed.

Use service hours or calendar time, WHICH EVER OCCURS FIRST, to determine the correct maintenance intervals.

Stop the engine before servicing. Put the engine in horizontal position and remove the spark plug cap to prevent the engine from starting. Never operate the engine in an unventilated room or other enclosed area.

When Required:
Fuel Tank Cap and Strainer – Clean

Every Use:
Engine Oil Level – Check
Walk-Around Inspection

First 20 Service Hours or 1 Month:
Engine Oil – Change

Every Month:
Generator – Inspect

Every 50 Service Hours or 3 Months:
Spark Arrester – Inspect/Clean/Replace

Every 100 Service Hours or 6 Months:
Engine Oil – Change
Air Filter – Check
Spark Plug – Inspect/Adjust/Replace

Every 300 Service Hours or 1 Year:
Cylinder Head – Clean
Engine Valve Lash – Check

Every 2 Years:
Fuel Line – Check/Replace if necessary

NOTE: Use only genuine Caterpillar parts.

Special Tools

The following tools may be required to perform the service procedures:

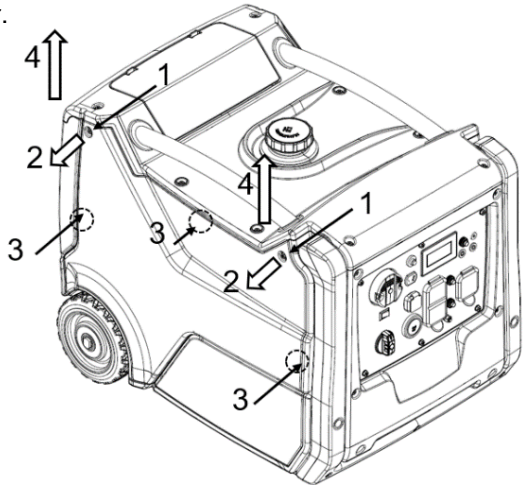
- Bearing driver
- Bearing puller
- Compression gauge
- Float level gauge
- Flywheel driver
- Megohmmeter
- Micrometer
- Multimeter (Volts and Ohms)
- Piston driver
- Piston ring puller
- Ring compressor
- Valve guide driver
- Valve guide reamer
- Valve seat cutter 32°
- Valve seat cutter 45°

MAINTENANCE AND SERVICE PROCEDURES

Air Filter – Check

A dirty air filter will restrict air flow into the carburetor, will cause poor fuel economy, and may damage the engine. To keep the generator in good operating condition, service the air filter regularly. Service more frequently when operating the generator in extremely dusty areas.

Note: Never operate the generator without the air filter in place. Operating the generator without the air filter in place will result in rapid engine wear.



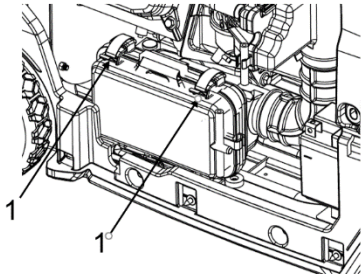
To access the air filter

1. Unscrew the 2 fasteners (1) at the top of the side panel. Note that they are captive fasteners and cannot be removed from the side panel.

2. Pull the captive fasteners in the direction shown (2) to release the top of the side panel.
3. Pull the panel until the hidden fasteners (3) are pulled apart.

Important, stop pulling once the fasteners (3) are pulled apart, otherwise the tabs at the bottom on the side panel could be damaged.

4. To remove the side panel completely, lift off in a vertical direction (4) to release the bottom tabs.



5. To access the air filter foam and paper elements, unclip the 2 fasteners (1).
6. Gently remove the air filter cover. Note, the paper element should be removed with the cover.

Inspect the paper element for cleanliness. If the paper element is dirty, replace it.

Inspect the foam element. If the foam element is dirty, wash the element. If the foam element is damaged, replace it.

Use nonflammable solvent or a mixture of household detergent and warm water to wash the filter. Rinse the filter thoroughly to remove all of the cleaning solution. Replace the filter after the filter has dried. DO NOT oil the foam filter.

Note: Do not wring out the filter. Wringing out the filter may damage the filter.

Use a damp rag to wipe dirt from the case and cover. Install the filter into the housing. Replace the air filter door and side panel in the reverse procedure to removal.

Battery – Test/Replace (If Required)

⚠ DANGER

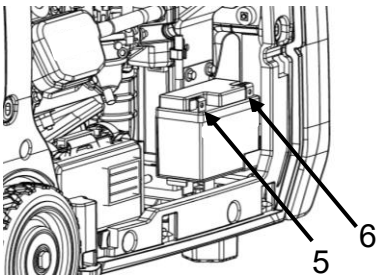
Shock/Electrocution Hazard: Do not operate this equipment or work on this equipment unless you have read and understand the instructions and warnings in the Owner's Manual. Failure to follow the instructions or heed the warnings will result in serious injury or death.

⚠ WARNING

Never disconnect any charging unit circuit or battery circuit cable from the battery when the charging unit is operated. A spark can cause an explosion from the flammable vapor mixture of hydrogen and oxygen that is released from the electrolyte through the battery outlets. Injury to personnel can be the result.

If the battery is unable to turn over the engine, even after charging, check the battery terminals are secure and free from corrosion.

To access the battery follow the Air Filter – Check procedure.



If the battery requires replacement:
1. Disconnect the negative (-) cable **first (6)**.
2. Disconnect the positive (+) cable **second (5)**.
3. Remove the rubber battery strap.

To install the new battery:
1. Connect the positive (+) cable **first**.
2. Connect the negative (-) cable **second**.

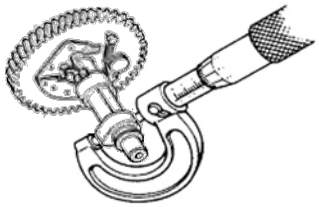
Reattach the side panel in reverse order before use.

NOTE: Use only genuine Caterpillar parts.

CAUTION - DANGER OF EXPLOSION IF BATTERY IS INCORRECTLY REPLACED, REPLACE ONLY WITH THE SAME OR EQUIVALENT TYPE.

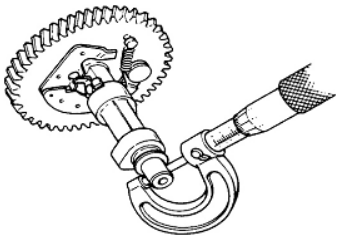
The used battery should be recycled in accordance with local laws.

Camshaft – Inspect/Replace



Inspect the camshaft for damage or abnormal wear. Measure the lift on the camshaft lobes. The acceptable limits for the lift are shown in the table below. If the lift is out of the acceptable range, replace the camshaft.

Model:	Lobe:	Normal Lift:	Minimum Lift:
INV4000E	Intake	27.59mm	27.29mm
	Exhaust	27.56mm	27.26mm

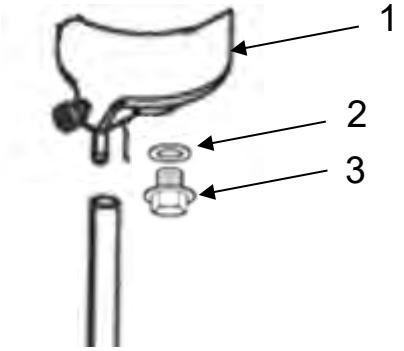


Measure the outside diameter of the camshaft. The acceptable limits for the diameter are shown in the table below. If the diameter is out of the acceptable range, replace the camshaft.

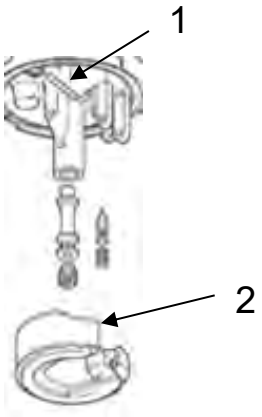
Model:	Normal:
INV4000E	14.166~14.184mm

Carburetor – Inspect/Adjust

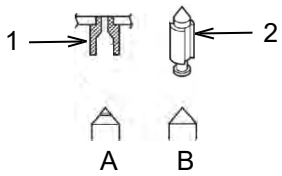
Remove the side panel by following the Air Filter – Check procedure. Use a suitable container to drain the fuel from the hose (attached to the underside of the carburetor) when removing the carburetor. Dispose of the fuel properly. Clean the outside surface of the carburetor before disassembly.



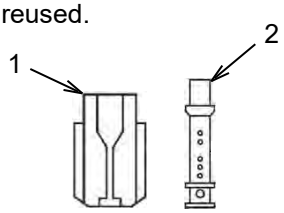
Remove bolt (3) and gasket (2). Carefully remove the float chamber (1), and contain any small parts that may fall out.



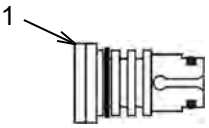
Remove float pin (1), carefully remove float (2) and contain the small parts. Clean the internal parts with carburetor cleaner and compressed air.



Check the float valve seat (1) and float valve (2) for wear. Figure A shows a worn float valve that needs replaced. Figure B shows a float valve that can be reused.



Inspect main fuel jet (1) and main fuel nozzle (2). If worn, replace.



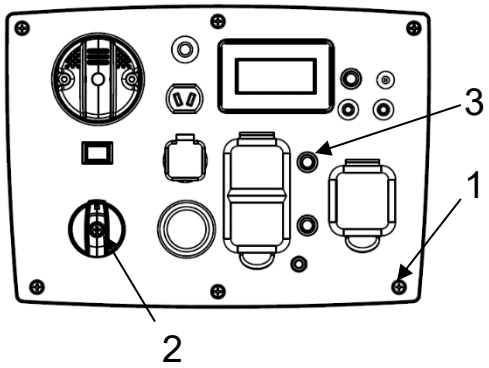
Inspect the idle speed jet (1). Replace if damaged. Apply a light coat of oil to the O-ring seals before reinstalling.

After reinstalling the float, lightly press in with a finger to make sure the float moves freely. Make sure that the float valve is just contacting the valve seat, and the spring is not compressed.

Set the float chamber in place so that the drain hose can be accessed through the service access door. Install gasket and bolt to hold the float chamber in place.

Reinstall the carburetor. After starting the unit, check for leakage.

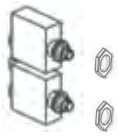
Control Panel – Service



Turn the generator switch to the off position and disconnect the battery.

Remove the six bolts (1). Remove generator switch screw (2) and pull the generator switch forward. Remove the circuit breaker nuts (3) by twisting off. Pull the control panel cover forward and up slowly. Make sure that the cables move freely and are not damaged. Tag the wires to identify them and then disconnect the wiring harnesses. Remove the front cover and place on a surface that will protect the panel from damage.

Circuit Breakers:



Each circuit breaker is held to the panel with a half nut located on the front of the panel. Tag the wires to identify them and then disconnect the circuit breaker. Remove the half nut from the front of the panel then remove the circuit breaker from the rear of the panel.

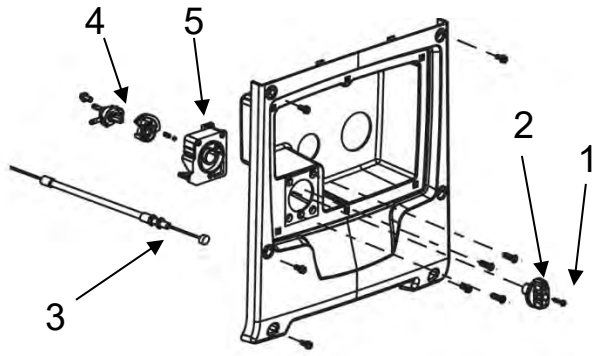
CO System (if equipped):

The CO module is mounted to the front of the control panel using torx screws. There is also a CO controller mounted on the rear.

Display:

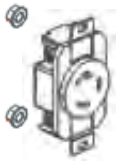
The display is held in place by hot melt glue. Disconnect the display from the wiring harness and remove the glue. Remove the display from the front of the panel.

Generator Switch:



The generator switch is held to the panel with a screw (1). Remove the screw and remove the knob (2) from the front of the panel. The choke cable (3) is attached to the generator switch from the rear of the panel. The fuel valve assembly (4) is attached to the rear of the generator switch with a bolt. Remove the generator switch (5) from the rear of the panel once all is disconnected.

Receptacles and Covers:



Each receptacle is held to the panel with two 7mm nuts. Tag the wires to identify them and then remove the wires from the receptacle. Remove the nuts that hold the receptacle to the panel, and then remove the receptacle from the rear of the panel. The receptacle cover can then be removed from the front of the panel.

CO Module (if equipped) – Replace

Loosen the torx screws and remove the CO module. Disconnect the electrical connector from the rear. Reinstall in reverse order.

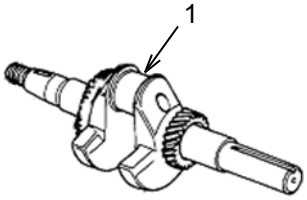
Note: Ensure the CO module is correctly orientated exactly as the CO module removed.

Crankshaft – Inspect/Replace

Inspect the crankshaft oil seal. If the seal is damaged or shows sign of leakage, replace the seal.

Inspect the crankshaft bearings. If the bearing is scored or shows signs of discoloration from

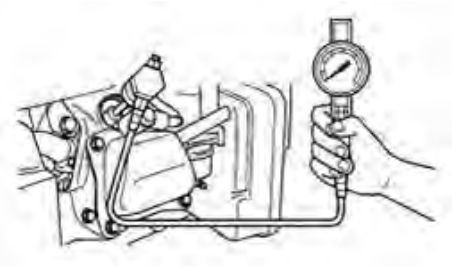
excessive heat, replace the bearing. Coat the bearing with engine oil before installing.



Check the diameter of the crankshaft journal (1). A normal diameter is 30.175-30.185mm. If the diameter is 30.145mm or less, replace the crankshaft.

When installing the crankshaft, insert it into the crankcase until the bearing touches the crankcase without damaging the oil seal.

Cylinder Pressure – Check

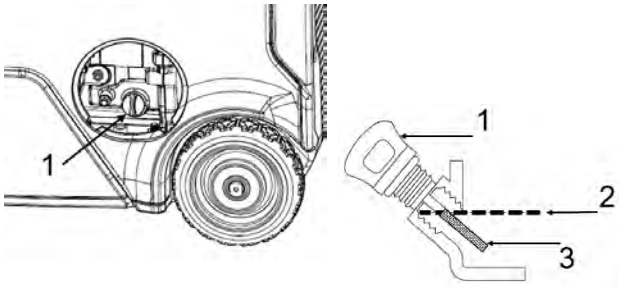


- Use a suitable container to drain the fuel
- Remove the spark plug cap and spark plug.
- Connect the compression gauge as shown above.
- Pull the recoil starter handle several times and note the cylinder pressure.

- If the cylinder pressure is not within 0.45 - 0.69 MPa (65 - 100 psi), refer to the Troubleshooting section.

Engine Oil Level – Check

Always check the engine oil with the generator on a level surface and with the engine stopped.

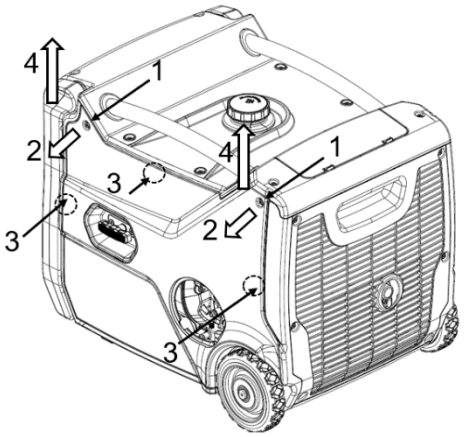


1. Open the service access door and remove the oil level gauge (1) and wipe clean.
2. Check the oil level by re-inserting the oil level gauge (do not screw in tight).
3. If the oil level is low (3), add the recommended engine oil, using the funnel supplied, until the oil level reaches the upper mark (2) on the oil level gauge. Use the chart below to determine which viscosity oil to use.
4. After adding oil, install and tighten the oil level gauge (1) and close the service door.

Recommended Lubricant Viscosities for Ambient Temperature				
Oil Viscosities	°C		°F	
	Min	Max	Min	Max
SAE 0W-40	-40	40	-40	104
SAE 5W-40	-30	50	-22	122
SAE 10W-30	-18	40	0	104
SAE 15W-40	-10	50	14	122

Note: Non-detergent and 2-stroke engine oils will damage the engine and must not be used.

Engine Oil – Change

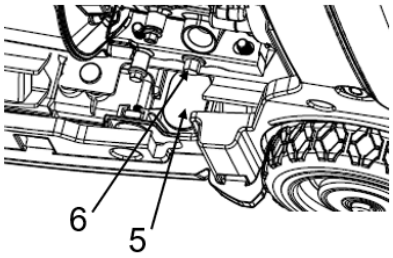


1. Operate the engine until it reaches normal operating temperature. Stop the engine and use a suitable container to collect the used oil.
2. Unscrew the 2 fasteners (1) at the top of the side panel. Note that they are captive fasteners and cannot be removed from the side panel.
3. Pull the captive fasteners in the direction shown (2) to release the top of the side panel.
4. Pull the panel until the hidden fasteners (3) are pulled apart.

Important, stop pulling once the fasteners (3) are pulled apart, otherwise the tabs at the bottom on the side panel could be damaged.

5. To remove the side panel completely, lift off in a vertical direction (4) to release the bottom tabs.

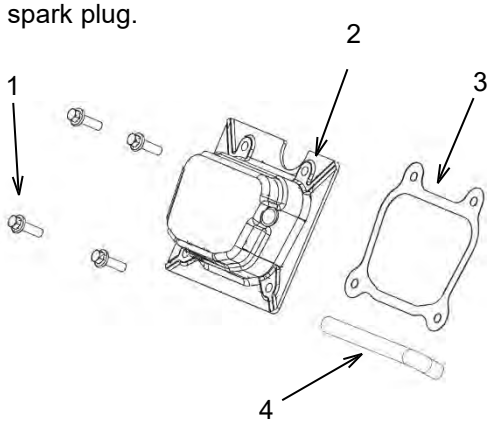
6. The side panel should be set carefully to the side with the recoil cord still attached.



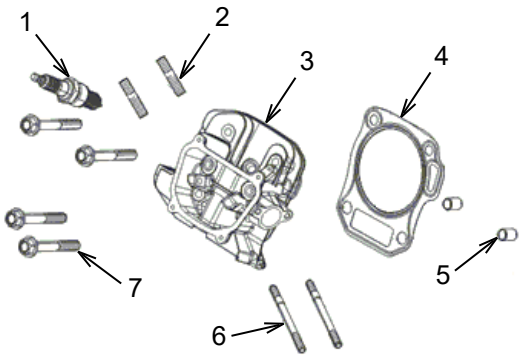
7. Carefully place the generator on wooden blocks to allow an oil drain container to be placed underneath the rubber grommet (5).
8. Remove the rubber grommet (5).
9. Unscrew the oil drain plug (6) and drain all the engine oil into the container.
10. Replace the oil drain plug and rubber grommet.
11. Clean up any excess oil.
12. REFILL the oil, using the funnel (supplied) and check the oil level. Refer to Engine Oil Level – Check.
13. Install and tighten the oil level gauge.
14. Reattach the side panel in reverse order to removal.
15. Dispose of the used oil properly.
16. Start the engine for a brief period and check for leaks.
17. Stop the engine and check the oil level. Add oil if level indicates it is needed. Refer to Engine Oil Level – Check.

Engine Valve – Inspect/Replace

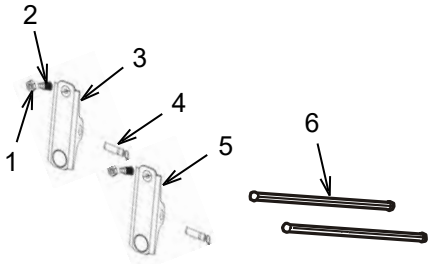
Remove the side panel by following the Air Filter – Check procedure. Remove the spark plug cap and spark plug.



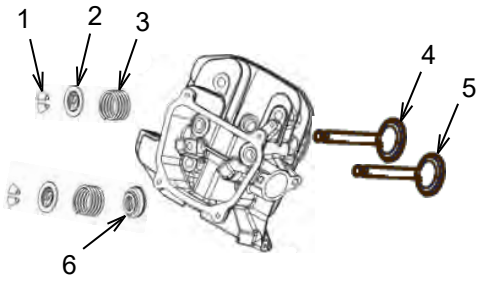
Remove valve cover bolts (1), breather tube (4), valve cover (2), and valve cover gasket (3).



Remove spark plug (1). Remove cylinder head bolts (7), and remove cylinder head (3). Remove cylinder head gasket (4) and discard used gasket. Remove locating pins (5) and set aside. Studs (2) and (6) can remain in the cylinder head for this procedure.



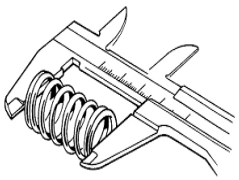
Remove locking nut (1) and adjusting nut (2). Remove pin (4), and remove exhaust valve rocker arm (3). Repeat the process for intake valve rocker arm (5). Check the rocker arms for wear. Replace if damaged. Remove pushrods (6). Inspect the pushrods. Make sure they are straight and not scored. Check the pushrod ends for wear. Replace the pushrods if worn or damaged.



Note: Do not remove the retainers (2) while the head is still on the engine or the valves will drop down into the cylinder.

Remove valve collets (1). Press down on retainer (2) and move it to the side so that the valve stem will pass through the larger hole. Remove valve spring (3) and exhaust valve (4). Repeat the process for the intake valve (5) and intake valve stem oil seal (6).

Valve Springs:



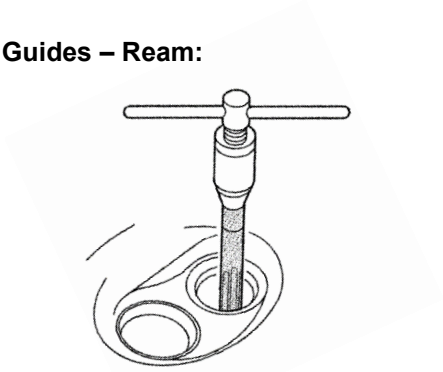
Check the free length of the valve spring. The normal free length is 30.5mm. If the free length is 29.5mm or less, replace the spring.

Model:	Normal:	Minimum:
INV4000E	30.5mm	29.5mm

Valve Guides:

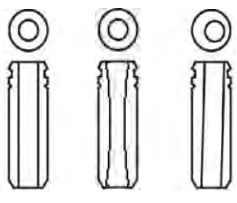
Inspect the valve guides. Make sure that they fit tightly into the cylinder head. Inspect the inner surfaces of the valve guides. The inner surface should be smooth, with no cracking or pitting. If the inner surface is damaged, replace the valve guide.

Valve Guides – Ream:



For best results perform this procedure when the valve guides and cylinder head are at room temperature.

Make sure that the reamer is centered over the valve guide. Coat the reamer and valve guide with cutting oil. Turn the reamer clockwise and work it through the valve guide for the entire length of the reamer. Continue to turn it clockwise as you remove the reamer from the valve guide. Remove any carbon deposits and check the internal diameter of the valve guide. The normal diameter of the valve guide is 5.500-5.512mm. If the internal diameter of the valve guide is 5.560mm or more, either replace the valve guide or install inserts.

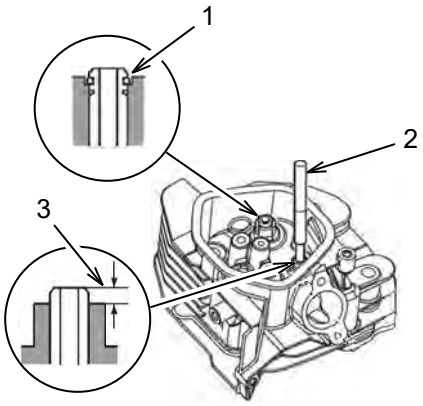


1 2 3

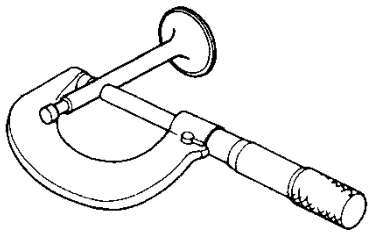
Check the valve guide bore. Insert the valve and make sure that it moves smoothly through the bore without any wobble. Figure 1 shows a good valve guide. Figure 2 shows a valve guide with abnormal wear that would allow the valve to wobble. The valve head could eventually break off and fall into the combustion chamber, damaging the engine. This valve guide must be reamed or replaced. Figure 3 shows a valve guide with a bore that is not centered. This valve guide must be replaced.

Valve Guides – Replace:

Place the new valve guides in the freezer compartment of your refrigerator for one hour. Use a valve guide driver to drive out the old valve guides. Take care that you do not damage the cylinder head while driving out the old valve guides.



Install the new valve guides from the valve spring side of the cylinder head. Use the valve guide driver (2) to drive the exhaust valve guide in until the clip is fully seated (1). Drive the intake valve guide in until the top of the valve guide extends 1mm above the cylinder head (3). After installation check each valve guide for damage. If damaged, repeat the removal and installation process using a new valve guide.



Use a micrometer to measure the outside diameter of the valve stem. Refer to the following table.

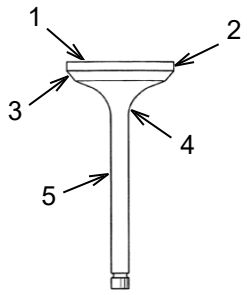
Valve:	Normal:	Minimum:
Intake:	5.468-5.480mm	5.418mm
Exhaust:	5.428-5.440mm	5.378mm

If the diameter of the valve is at or below the minimum, replace the valve.

Subtract the diameter of the valve stem from the internal bore of the valve guide to determine the valve stem-to-guide clearance. If the clearance is more than the maximum shown in the following chart, determine if a new guide or a new valve is the best choice to bring the clearance back into tolerance.

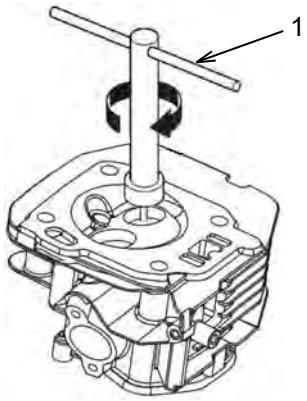
Valve:	Normal:	Maximum:
Intake:	0.020–0.044mm	0.142mm
Exhaust:	0.060–0.084mm	0.182mm

Valves:

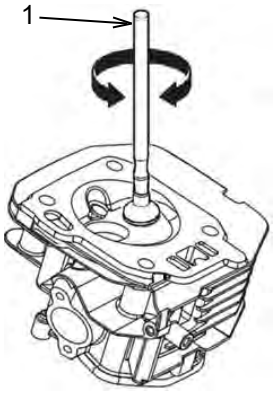


Check the valves for damage. Check the valve head (1), valve margin (2), and valve face (3) for damaged or burnt areas. Check the valve neck (4) for unusual wear. Check the valve stem (5) for wear, scoring, or bends. If any damage is found, replace the valve.

Remove any carbon deposits from the valve seats. Use a runout gauge to measure the concentricity of the seat. Alternatively, apply a light coat of a marking compound to the valve face and insert the valve into the head. Press the valve in firmly and then remove the valve. Check the paint for signs that the valve seat is not concentric. Remove the marking compound from both surfaces.



If the marking compound shows that the valve seat is not concentric, use a 45° valve seat cutter (1) to produce a smooth, concentric seat. Always turn the cutter clockwise. Use both the 45° valve seat cutter and the 32° valve seat cutter to adjust the valve seat so that it contacts the middle of the valve face. The 32° valve seat cutter removes material from the top of the seat. The 45° valve seat cutter removes material from the bottom of the seat. Be sure that when finished the area where the valve contacts the valve seat is from 0.7 to 0.9mm wide. To complete the procedure, make a light pass with the 45° valve seat cutter to remove any burrs that may be on the edge of the seat. When complete, use the marking compound to check for concentricity. Make sure that there is good contact all the way around the valve.

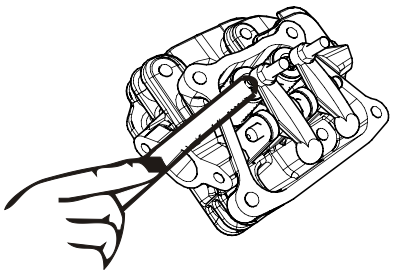


Apply lapping compound to the valve face and insert the valve into the cylinder head. Use a valve lapping tool (1) to finish surfacing the valve and valve seat. Remove any remaining compounds before assembling the cylinder head. Make sure that the pushrods are firmly seated in the lifters. After assembly, follow the Engine Valve Lash – Adjust and the Cylinder Pressure – Check procedures to ensure a proper assembly.

Engine Valve Lash – Adjust

Operating the engine with an improper valve adjustment can reduce engine efficiency. This reduced efficiency could result in excessive fuel usage and/or shortened engine component life.

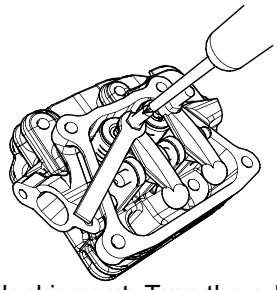
Remove the side panel by following the Air Filter – Check procedure. Remove the spark plug cap, spark plug, valve cover, and valve cover gasket. Lightly pull the recoil starter until the piston is at top dead center.



Measure the valve clearance with a feeler gauge. Refer to the following chart.

Valve Clearance	
Intake	0.05-0.10mm
Exhaust	0.05-0.10mm

If the clearance is outside of the tolerance range, adjust the clearance as follows:



Loosen the locking nut. Turn the adjustment screw clockwise to decrease the gap. Turn the adjustment screw counterclockwise to increase the gap. When the valve clearance is within tolerance, tighten the locking nut. Reinstall the valve cover gasket and valve cover. Check the spark plug washer to ensure proper working condition. If the washer is damaged, replace the washer. Install the spark plug and tighten to 15 Nm. DO NOT overtighten as this may damage the engine. Install the spark plug cap.

Fuel Line and Filter – Replace

Drain the fuel from the fuel tank into an appropriate container. Start the engine and let the engine run out of fuel. Turn the generator switch to the off “0” position.

Remove the side panel by following the Air Filter – Check procedure.

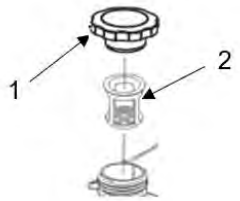
The fuel tank does not need to be removed to replace the fuel line. Move clamps to the center of the fuel line.

Remove the fuel line from the rear of the generator switch and the carburetor.

Remove the fuel filter. Wipe the mounting surface with a clean rag and install a new fuel filter. Tighten the fuel filter.

Inspect the clamps. If the clamps are damaged discard the old clamps and use new clamps. Place two clamps near the center of each new fuel line and install the fuel lines. Position the clamps so that they will hold the fuel line securely in place.

Fuel Tank Cap and Strainer – Clean



Wipe off the fuel cap (1) and surrounding area before removing the fuel cap. Wiping off the fuel cap and surrounding area before removing the fuel cap helps to reduce the amount of contaminants allowed into the fuel system.

If there is a build-up of debris in the fuel strainer (2), remove the strainer and rinse out the strainer. Allow the strainer to dry before installing the strainer.

Generator - Inspect

Once a month start the engine and run the engine until it reaches normal operating temperature (about 10 minutes). Plug in a corded device and turn on the device to ensure that the generator is providing power. Once you have verified that the generator is providing power, turn off the device and unplug it. Then turn the generator off.

Generator - Flash

Under certain conditions the generator can lose the residual magnetism that it needs for excitation. If this has occurred you may be able to charge the excitation field by following these steps:

1. Start the generator set
2. Plug a corded drill into one of the 120VAC receptacles.
3. Press the trigger on the drill, rotate the chuck backwards and then immediately release the trigger.
4. Press the trigger on the drill to see if it works.

You may have to repeat Steps 3 and 4 a few times.

If the generator still does not provide power, refer to the Troubleshooting section in this manual.

High Altitude Kits

At higher altitudes, the standard air-fuel mixture is too rich and will cause decreased performance and increased fuel consumption. A rich mixture will also foul the spark plug and make starting difficult. Operation at higher altitudes for extended periods of time may increase emissions.

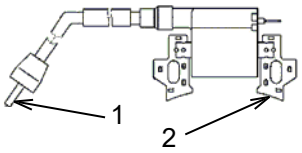
Proper operation can be ensured by installing a high altitude kit when required. An altitude kit consists of a smaller diameter main fuel jet and an adjustment to the pilot screw. Refer to Carburetor – Inspect/Adjust for instructions on replacing the main fuel jet.

Note: At elevations greater than 8000 feet above sea level, the engine may experience decreased performance even with the high altitude kit installed.

Ignition Coil – Test

Ignition coil:

Remove the spark plug cap from the spark plug, taking care to not damage the threads of the spark plug cap.



Measure the resistance of the secondary coil by touching one lead of an Ohmmeter to the spark plug wire (1) and touching the other lead to the metal frame (2). For the INV4000E the resistance should be around 3kΩ. If the resistance is not within the proper range, replace the coil.

Spark plug cap:

Measure the resistance of the sparkplug cap by touching one lead of an Ohmmeter to the wire end of the cap and the other lead to the spark plug end of the cap. For the INV4000E the resistance should be around 5Ω. If the resistance is different, replace the spark plug cap.

Insulation - Test

Use a megohmmeter to check the insulation resistance of the stator winding in the following situations:

- The generator set is removed from storage.
- The generator set is operating in a humid environment.
- The generator set is not protected from the elements.
- The generator set has not been run under load for three months or more.

Winding to Ground:

Connect one of the megohmmeter's terminals to the winding being tested, and the other terminal to ground. When the reading stabilizes the value shown is the winding to ground insulation resistance value. The value should be very high. If the value is not high, or if the value has decreased significantly from the last reading, replace the generator.

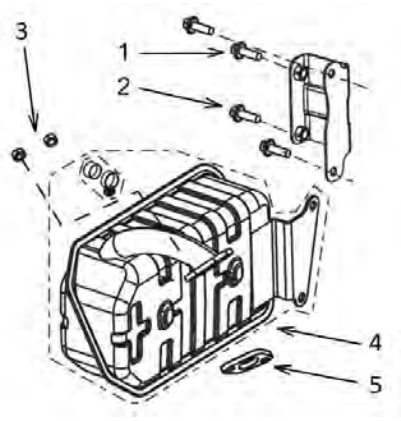
Collector Ring to Ground:

Connect one of the megohmmeter's terminals to one of the copper rings on the collector, and the other terminal to ground. When the reading stabilizes the value shown is the winding to ground insulation resistance value. The value should be very high. If the value is not high, or if the value has decreased significantly from the last reading, replace the generator.

Muffler – Inspect/Replace

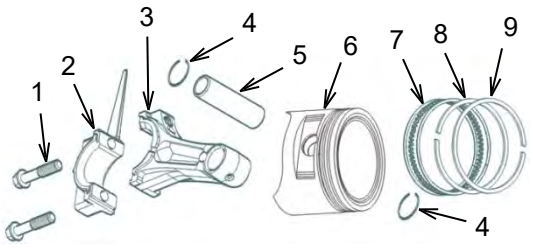
Allow the unit to cool before performing this procedure.

Removal of the end panel and air duct is required to gain access to the muffler.



Remove bolts (1) and (2) to separate the muffler from the bracket. Remove nuts (3) and lift muffler (4) off of the mounting studs. Discard used gasket (5). Removing the cover from the muffler is not recommended. Reinstall in reverse order using a new gasket (5). To service the spark arrestor, refer to Spark Arrestor – Inspect/Clean/Replace.

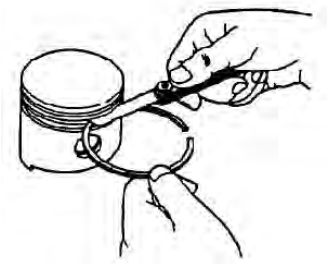
Piston – Inspect/Replace



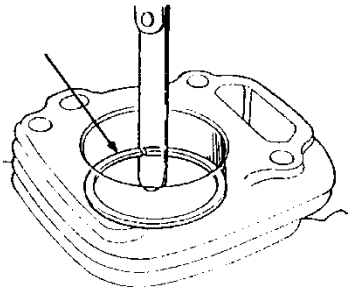
Remove the connecting rod bolts (1) and the rod cap (2). Push the connecting rod and piston out of the block. Remove any carbon deposits. Inspect the cylinder bore. If the cylinder wall is damaged, replace the crankcase. Use a ring puller to remove piston rings (7), (8), and (9). Inspect the rings. Replace if damaged or worn. Remove the piston pin clips (4) and piston pin (5). Measure the piston pin bore inside diameter. Measure the piston pin outside diameter. If the difference is 0.036mm or more, replace the worn part. Inspect the top of the piston (6) for burns and cracks. Inspect the piston ring grooves for damage. If any damage or wear is found, replace the piston. Measure the piston skirt and compare the measurement to the following chart.

Model:	Normal:	Minimum:
INV4000E	69.975-69.985mm	69.925mm

If the measurement is less than the minimum value shown in the chart, replace the piston. Set the piston into the cylinder and measure the clearance between the piston and the cylinder wall by inserting a feeler gauge. If the clearance is 0.13mm or more, replace the piston.



Measure the ring side clearance, as shown. Normal clearance for the INV4000E is between 0.03 – 0.07mm. If the clearance is 0.14mm or more, replace the piston.



Insert the top ring into the cylinder. Measure the end gap of the top ring. Normal values are shown in the chart below. If the end gap is 1.1mm or more, replace the top ring. If the end gap too small, use a fine file to increase the gap. Take care not to leave any sharp edges.

Ring Gap		
Model:	**Top Ring:**	**Second Ring:**
INV4000E	0.55 – 0.808mm	0.6 – 0.858mm

Insert the second ring into the cylinder. Measure the end gap of the second ring. Normal values are shown in the chart below. If the end gap is 1.15mm or more, replace the second ring. If the end gap too small, use a fine file to increase the gap. Take care not to leave any sharp edges.

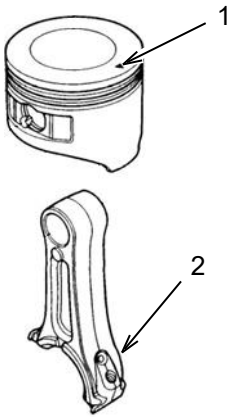
Connecting Rod:

Check the connecting rod. If the connecting rod is bent or cracked, replace the connecting rod. Measure the pin end inside diameter. Install the rod cap and measure the inside diameter of the crank end of the connecting rod. Normal diameters and service limits are shown in the chart below. If the diameter is at or exceeds the maximum value, replace the connecting rod.

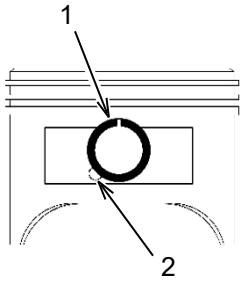
Connecting Rod Ends Inside Diameters		
Pin End:		
Model:	**Normal:**	**Maximum:**
INV4000E	18.011-18.022mm	18.06mm
Crank End:		
INV4000E	30.22-30.23mm	30.27mm

Installation:

The piston head has a triangular mark to aid in assembly.

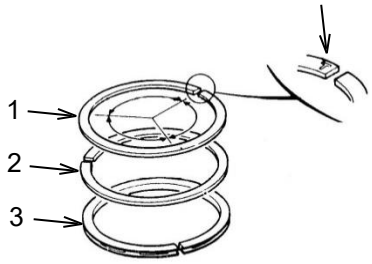


Place the connecting rod into the piston so that the longer side of the rod (2) is aligned with the mark on the piston head (1). Insert the piston pin through one side of the piston, through the connecting rod, and then through the other side of the piston.

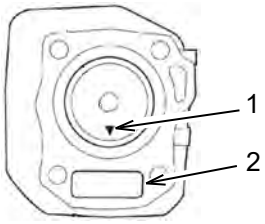


Install the piston pin clip (1) into the groove in the side of the piston. Use long nosed pliers to rotate the clip in. Do not align the gap with the cutout (2). Repeat for the other side.

Rings:



The piston rings have a mark next to the gap. Use a ring puller to install the rings with the mark facing toward the top of the piston. Make sure that you install the rings in the proper grooves, with the oil ring (3) in the lowest groove, the second ring (2) in the middle groove, and the top ring (1) in the groove closest to the head of the piston. The top ring is chrome plated. Make sure that the rings will move freely in the ring groove. Stagger the ring ends so that they are 120° apart, as shown in the drawing.



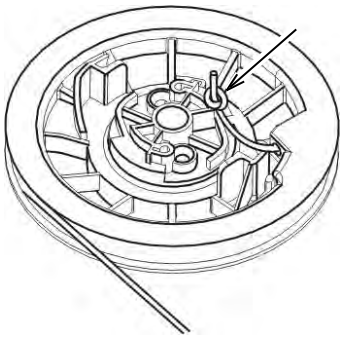
Coat the piston, rings, and cylinder wall with engine oil. Use a ring compressor to push in the rings and insert the piston into the cylinder. Make sure that the mark on the piston head (1) aligns with the lifter mark (2) on the crankcase. Use a piston driver to push the piston out of the ring compressor and into the cylinder.

Install the rod caps and rod cap bolts. Tighten the bolts to 13±1 N·m.

Recoil Starter Spring - Install

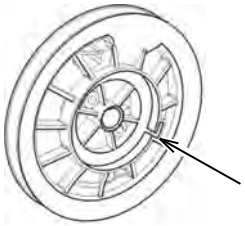
Note: It is recommended that you replace the entire recoil starter assembly.

Inspect the parts. Replace any parts that are damaged or worn.

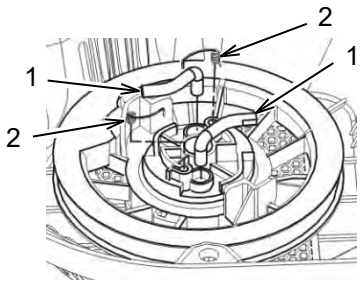


Pass the recoil starter cord through the hole in the recoil starter pulley and make a knot at the rope end as shown above.

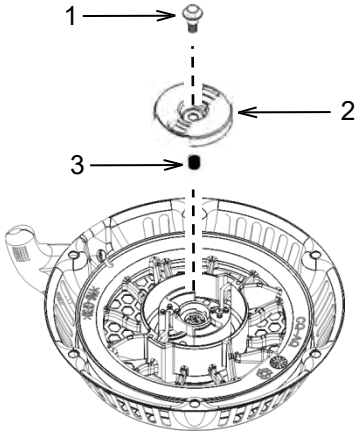
Place the inside hook of the recoil starter spring in the groove of the recoil starter case and set the recoil starter spring into the case. Hold the spring in place.



Place the outside hook of the recoil starter spring in the groove of the recoil starter pulley and hold the pulley in place.



Set the starter drive cams (1) on the recoil starter pulley, and install the return springs (2) on the pulley and hook them on the side of the drive cams.



Install spring (3), drive guide (2), and fixing screw (1). Tighten the fixing screw to 9±1 N·m (6-7 lb ft).

Wrap the cord around the pulley. Pull lightly on the cord and push the end of the cord through the housing. Then push the end of the cord through the handle. Tie a knot in the end of the cord and let the spring pull the handle back to the housing. Pull lightly a few times to make sure the assembly is working properly.

Spark – Check

⚠ DANGER

Shock/Electrocution Hazard: Do not operate this equipment or work on this equipment unless you have read and understand the instructions and warnings in the Owner's Manual. Failure to follow the instructions or heed the warnings will result in serious injury or death.

Make sure that your hands are dry and that you are not electrically grounded.

To reduce the risk of a flash fire, make sure that there is no open fuel in the vicinity. Turn the fuel valve to the off "0" position, and drain the fuel out of the carburetor.

- Remove the spark plug cap and spark plug
- Pull the recoil starter handle to drain the fuel from the cylinder
- Install the spark plug cap onto the spark plug
- Turn the generator switch to the on "I" position.
- Hold the spark plug by the spark plug cap and gently place the threads of the spark plug against the cylinder head as shown above.
- Pull the recoil starter handle and check for a spark.
- If the spark is weak or if there is no spark, refer to Spark Plug – Inspect/Adjust/Replace.
- If the spark plug is not the problem, refer to Ignition Coil – Inspect.

Spark Arrestor - Inspect/Clean/Replace

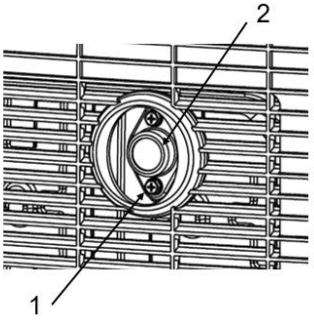
Hot Surface

⚠ WARNING

Hot parts or hot components can cause burns or personal injury. Do not allow hot parts or components to contact your skin. Use protective clothing or protective equipment to protect your skin.

DO NOT perform this maintenance procedure until the muffler has cooled.

This unit has a spark arrestor fitted to the exhaust outlet of the muffler. The spark arrestor should be cleaned with a soft wire brush after every 50 hours or 3 months of use. The spark arrestor should be replaced after every 100 hours of operation or if it becomes damaged.

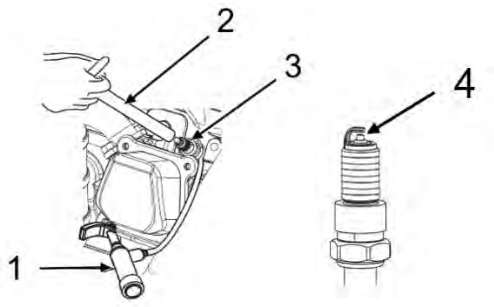


Remove screws (1). Remove spark arrestor (2) Check the spark arrestor for damage. Carefully clean the spark arrestor with a soft wire brush. If the spark arrestor is damaged, replace the spark arrestor.

To install the spark arrestor, align the mounting holes in the spark arrestor with the mounting holes on the muffler. Insert screws (1) and tighten securely.

Spark Plug – Inspect/Adjust/Replace

Refer to the Specifications section of this manual to determine the proper spark plug and spark plug gap for your product.



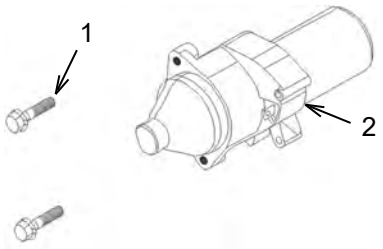
1. DO NOT perform this maintenance procedure with the engine running.
2. Turn the generator switch to the off “O” position.
3. Remove the side panel as per the Air Filter – Check procedure.
4. Remove the spark plug boot (1) by pulling it off the top of the spark plug.
5. Use the plug wrench (2) or a spark plug socket to remove the spark plug (3).
6. Visually check the spark plug to see if it is damaged. If the insulator is cracked, replace the spark plug. If the electrode is damaged, replace the spark plug.
7. Measure the plug gap (4) with a feeler gauge. Adjust the gap as necessary by carefully bending the electrode. Refer to Specifications for the correct gap for your product.
8. Install the spark plug by hand and then tighten to 15 Nm. DO NOT overtighten as this may damage the engine.
9. Re-attach the spark plug boot and side panel.

Starter – Replace (If Required)

Disconnect the negative battery cable from the battery and secure it so that it will not contact the battery.

Drain the fuel tank.

Replacement of the starter motor requires access to the top of the engine. Remove the necessary external panels and fuel tank. Remove the ignition coil and top engine cover.



Remove starter mounting bolts (1) from the end of the crankcase and remove starter (2) from the top of the crankcase. Reinstall in reverse order.

Timing Gear – Inspect/Replace

The engine has two shafts, the camshaft, and the crankshaft. Inspect the gears on each of the shafts. If the gears are worn or any teeth are broken, replace the gear. Check the engagement of the gears. If the gears fit together too loosely the engine will run louder than normal. It is recommended that you replace the gears if the engagement is loose. If you must replace the gears or shafts, replacing them one at a time will lessen the chance of assembling them incorrectly.

The crankshaft and cam shaft both have alignment marks on the gear face. Use these marks to align the gears during assembly. When aligning the marks, make sure that the piston is at the top dead center position.

Walk-Around Inspection

Before starting the engine perform a visual inspection of the unit. Look for:

- Proper oil level
- Proper fuel level
- Good quality fuel
- Fluid leaks
- Loose clamps
- Loose bolts
- Cracked fuel line
- Loose or frayed wiring
- Built up debris

In addition, make sure that:

- The ground terminal is properly connected

STORAGE

When a generator is in storage, air may condense and moisture may appear on the windings. In order to minimize condensation, always store the generator in a dry area. Cover the generator with a protective cover that extends to the ground. The cover should remain loose around the generator to allow proper ventilation.

The generator must not be stored in ambient temperatures greater than 131°F (55°C) as this can damage the CO DEFENSE™ (if equipped).

Wait until the generator has cooled before covering it. NEVER operate the genrator with the cover installed. It could ignite and cause damage.

Storage for 1 to 3 months

Remove any dirt, rust, grease, and oil from the generator. DO NOT use a pressure washer to clean the generator. Inspect the exterior. Make any necessary repairs.

Add fuel stabilizer to the fuel tank to prevent the gasoline from going bad. Start and run the engine for 5 minutes to ensure that the fuel stabilizer has been pulled in to the carburetor. Shut off the engine and allow the engine to cool.

Turn the generator switch to the off “O” position.

Move the generator to the storage place.

Cover the generator.

Storage for more than 3 months

Remove any dirt, rust, grease, and oil from the generator. DO NOT use a pressure washer to clean the generator. Inspect the exterior. Make any necessary repairs.

⚠ WARNING

Gasoline is extremely flammable and is explosive under certain conditions. Drain the fuel in a well-ventilated area with the engine stopped and cool. Never smoke or allow flames or sparks in the area during this procedure.

Remove the fuel cap and carefully turn the generator over to pour the gasoline into an appropriate container. Reinstall the fuel cap, remove any fuel that may have spilled onto the generator, then start and run the engine until the engine stops to allow the fuel to drain from the fuel lines, carburetor, and engine system.

Change the engine oil. Refer to Engine Oil – Change.

Remove the spark plug and pour a small amount of oil into the cylinder. Install the spark plug but do not install the spark plug boot.

Turn the generator switch to the off “O” position.

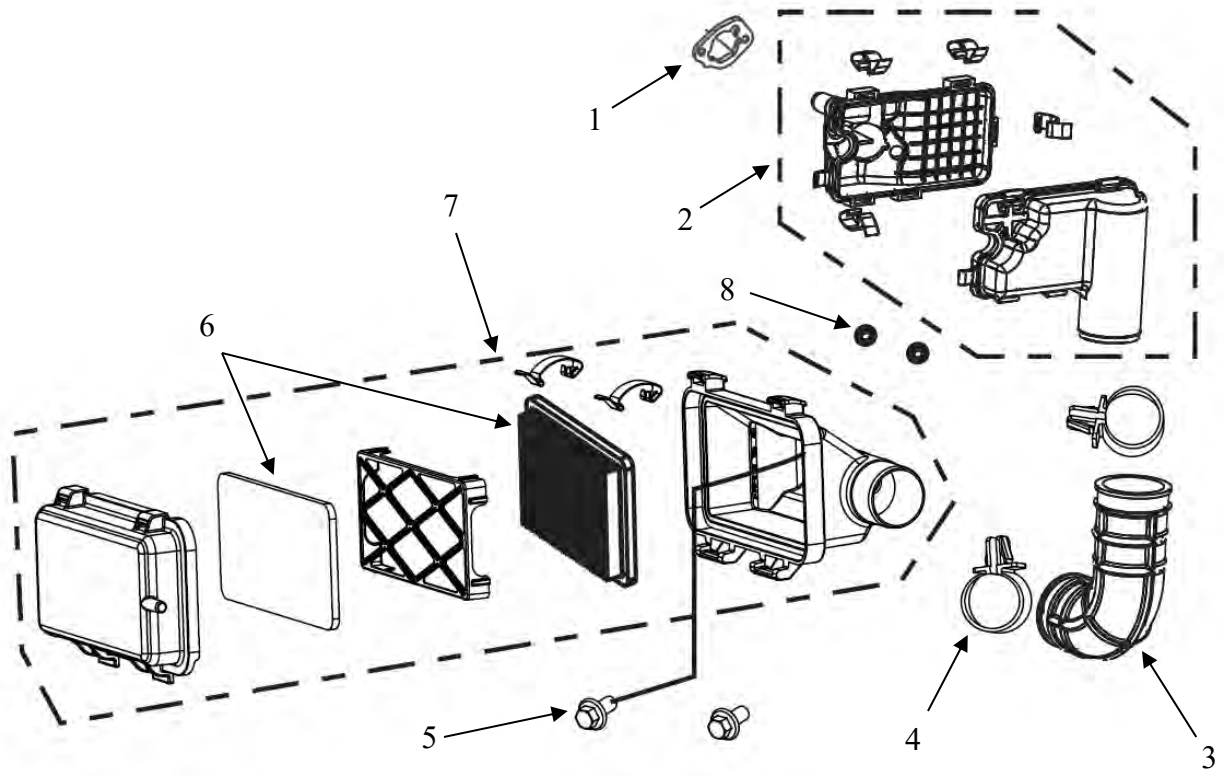
Move the generator to the storage place.

Attach the trickle charger to the port on the control panel and to standard AC power to keep the generator battery fully powered for easy start after storage. Disconnect the battery charger once the battery is fully charged (indicated by a green light on the charger)

Cover the generator.

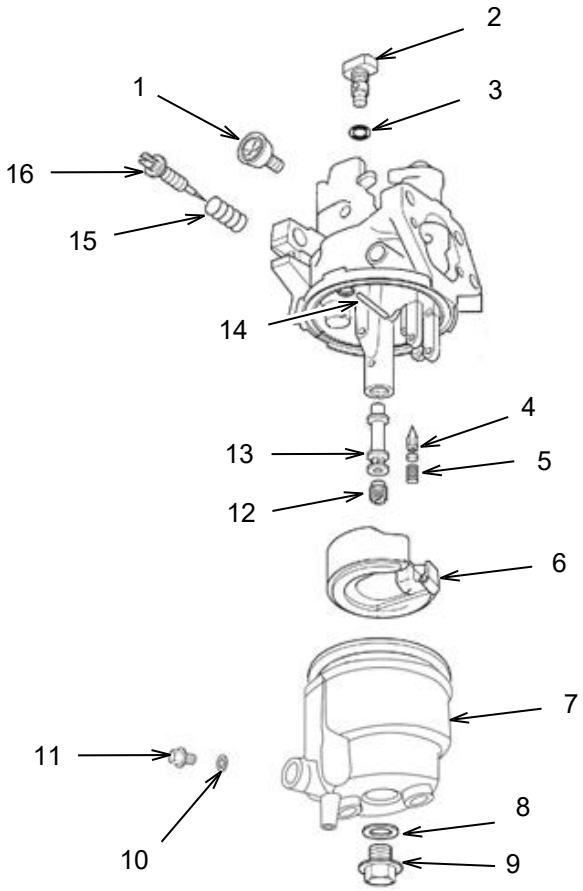
DIAGRAMS

Air Filter Assembly



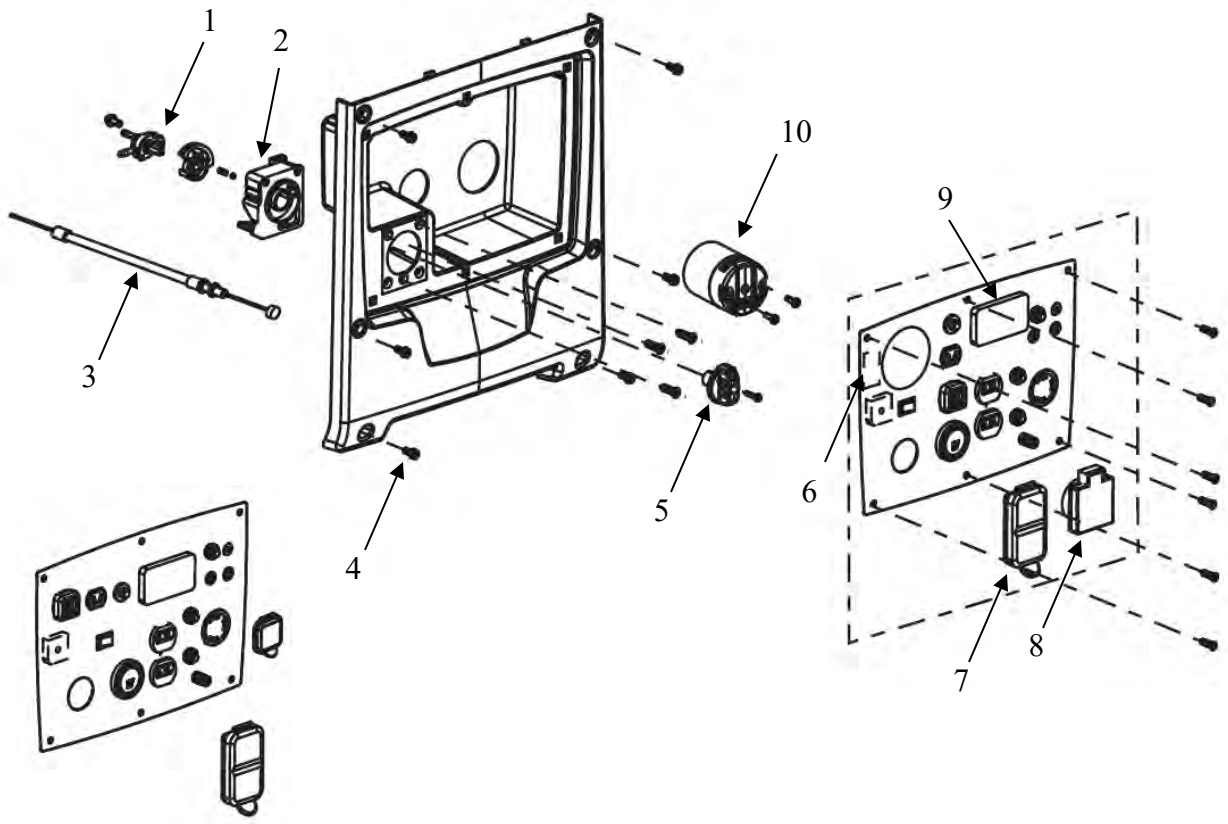
1. Gasket
2. Air filter assembly
3. Intake tube
4. Collar
5. Mounting bolt
6. Filter element
7. Air filter housing group
8. Mounting nut

Carburetor



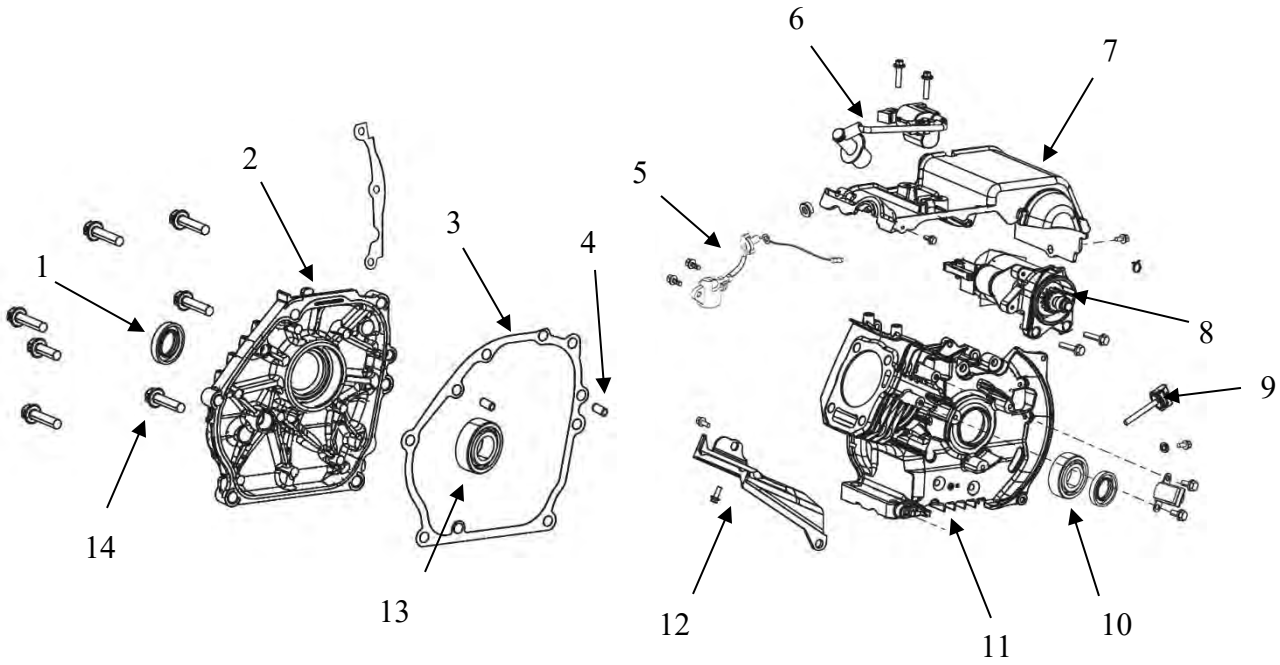
1. Idle speed screw
2. Pilot jet
3. Seal
4. Float valve
5. Float spring
6. Float
7. Float chamber
8. Gasket
9. Bolt
10. Gasket
11. Drain bolt
12. Main jet
13. Nozzle
14. Float pin
15. Spring
16. Pilot screw

Control Panel

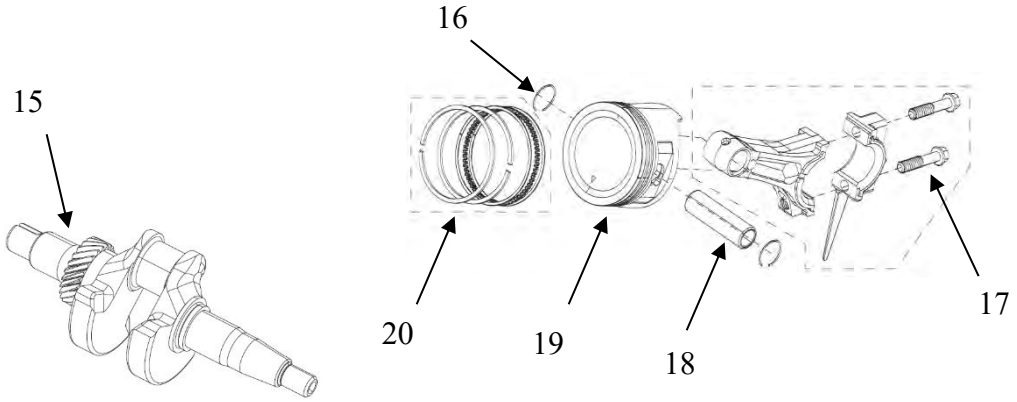


1. Fuel valve
2. Generator switch
3. Choke rod
4. Bolt
5. Generator switch knob*
6. CO Controller (if equipped)
7. Duplex cover
8. Cover
9. LCD smart display
10. CO DEFENSE^{TM} (if equipped)

Crankcase and Piston

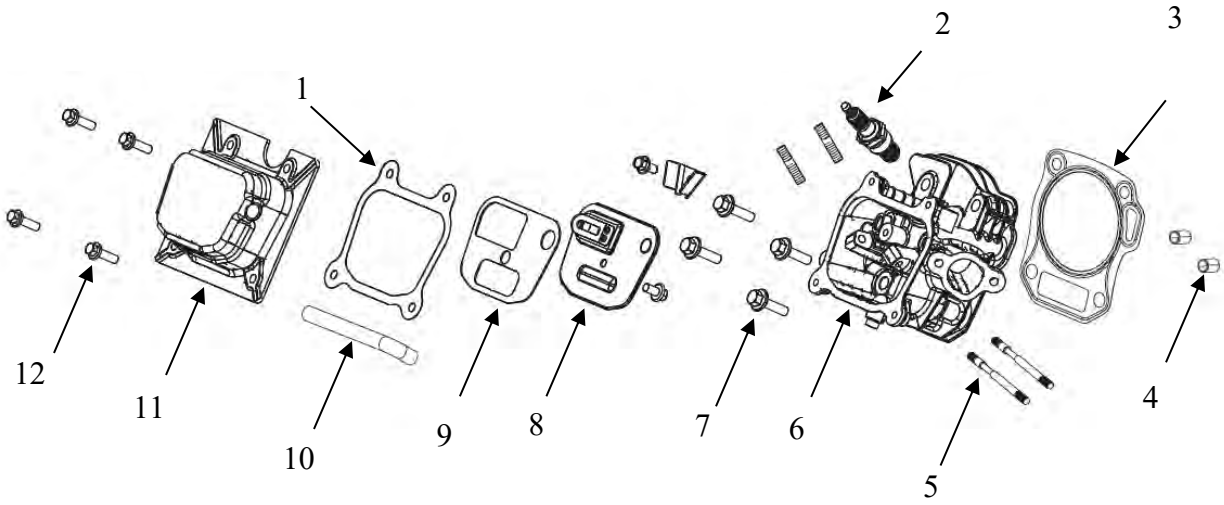


1. Seal
2. Crankcase cover
3. Gasket
4. Locating pin
5. Oil sensor
6. Ignition coil
7. Cover
8. Starting motor
9. Oil level gauge
10. Bearing
11. Crankcase
12. Shield
13. Bearing
14. Bolt

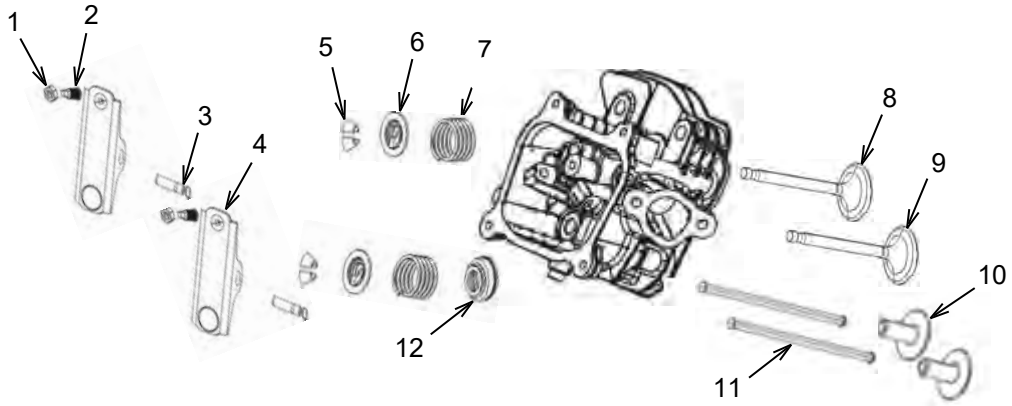


15. Crankshaft
16. Piston pin clip
17. Connecting rod bolt
18. Piston pin
19. Piston
20. Piston ring

Cylinder Head and Valves

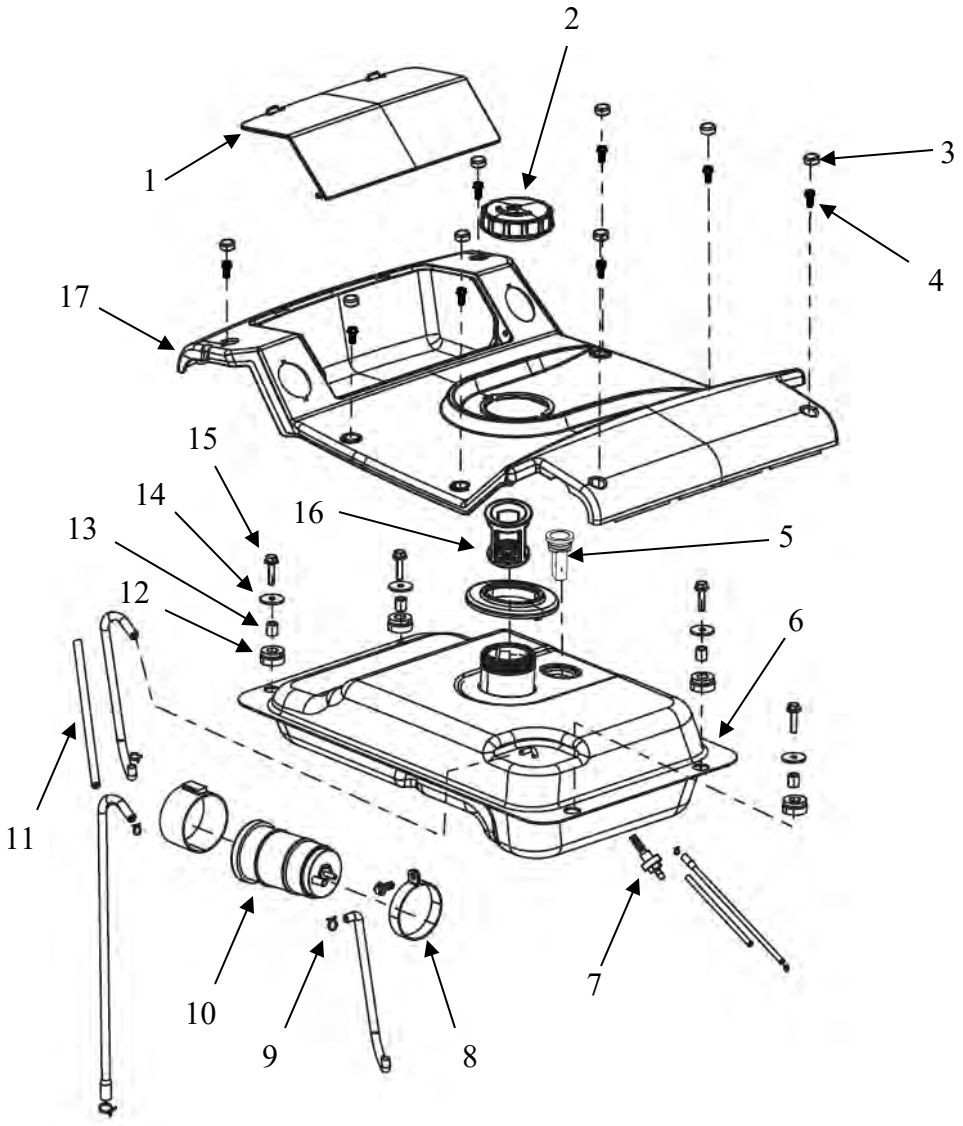


1. Valve cover gasket
2. Spark plug
3. Cylinder head gasket
4. Pin
5. Stud
6. Cylinder head
7. Cylinder head bolt
8. Breather piece
9. Breather gasket
10. Breather tube
11. Valve cover
12. Valve cover bolt



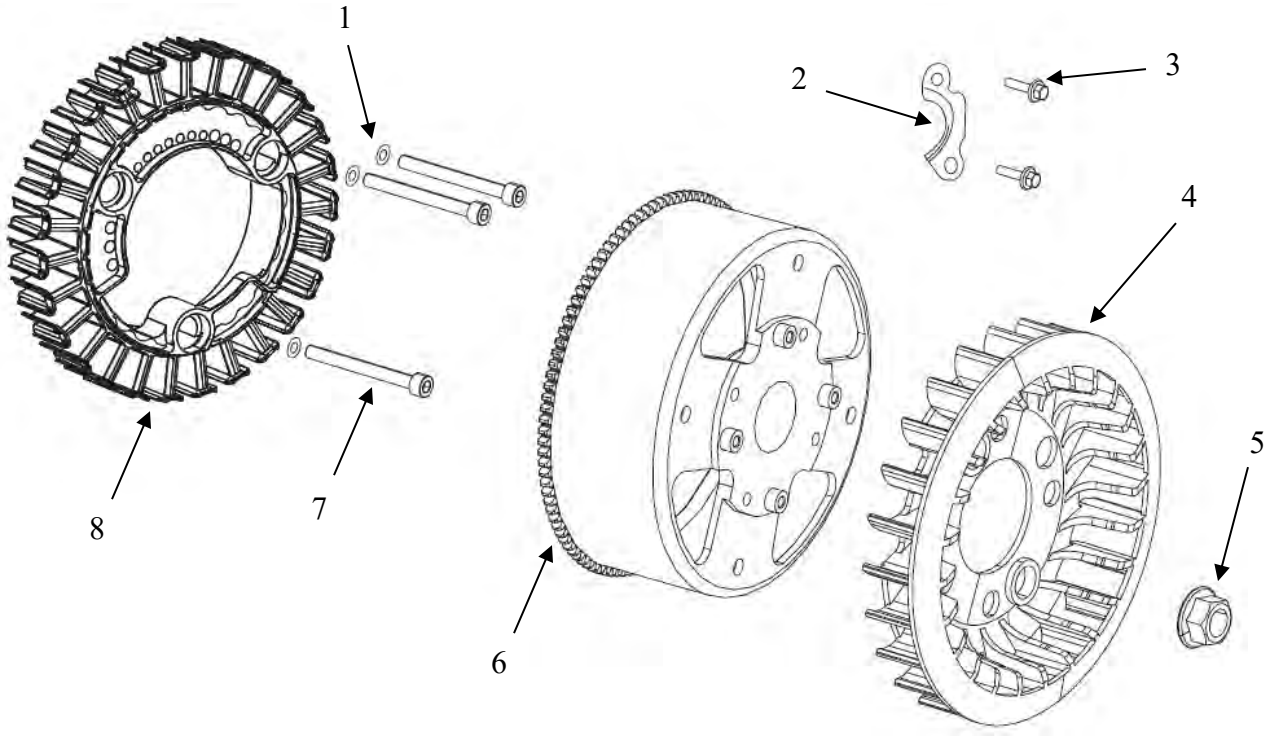
1. Locking nut
2. Adjusting nut
3. Rocker arm pin
4. Rocker arm
5. Valve rotator
6. Retainer
7. Spring
8. Exhaust valve
9. Intake valve
10. Lifter
11. Push rod
12. Retainer

Fuel Tank & Top Panel



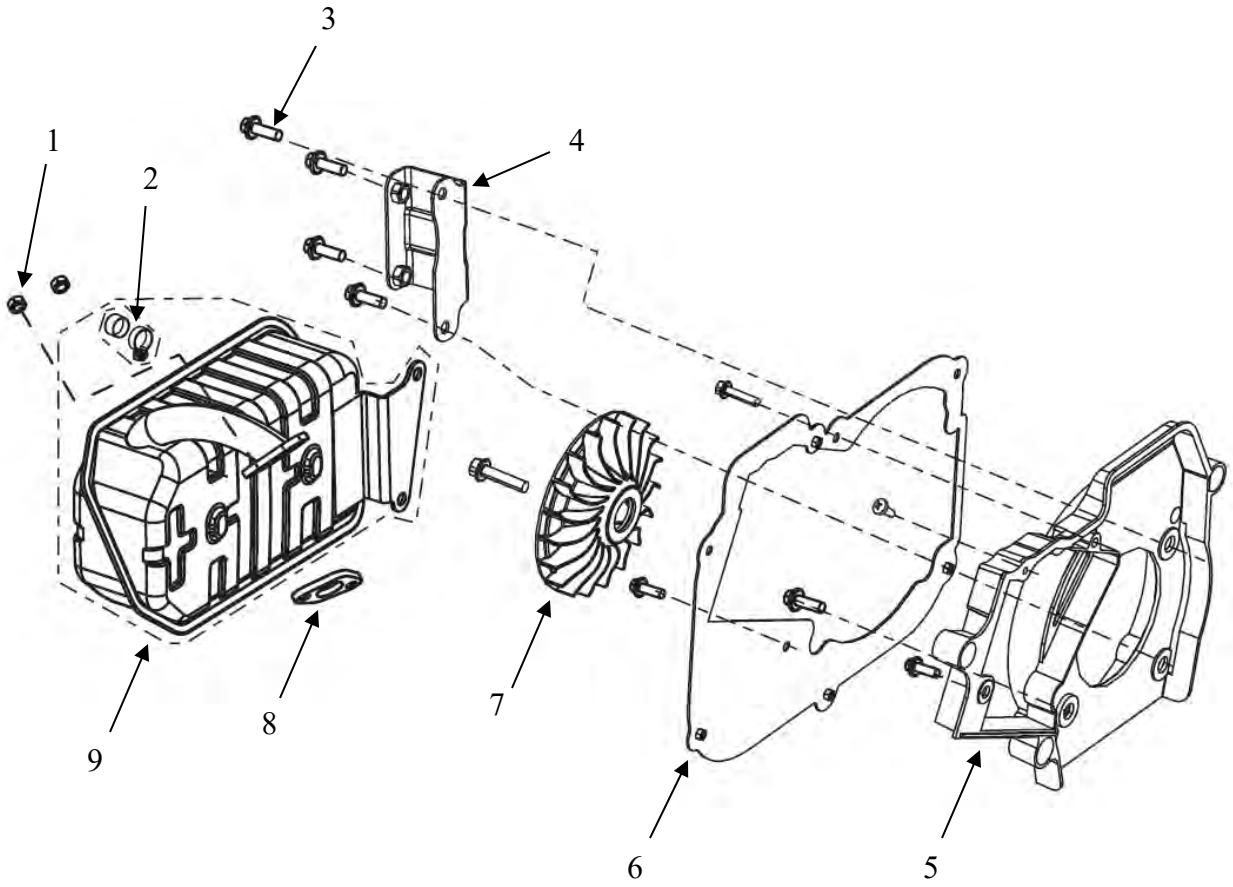
1. Cover
2. Fuel cap
3. Plug
4. Bolt
5. Fuel gauge
6. Fuel tank
7. Fuel filter
8. Evaporator clamp (if equipped)
9. Hose clamp
10. Evaporator (if equipped)
11. Fuel hose
12. Sleeve
13. Bushing
14. Washer
15. Bolt
16. Fuel strainer
17. Fuel tank cover

Alternator



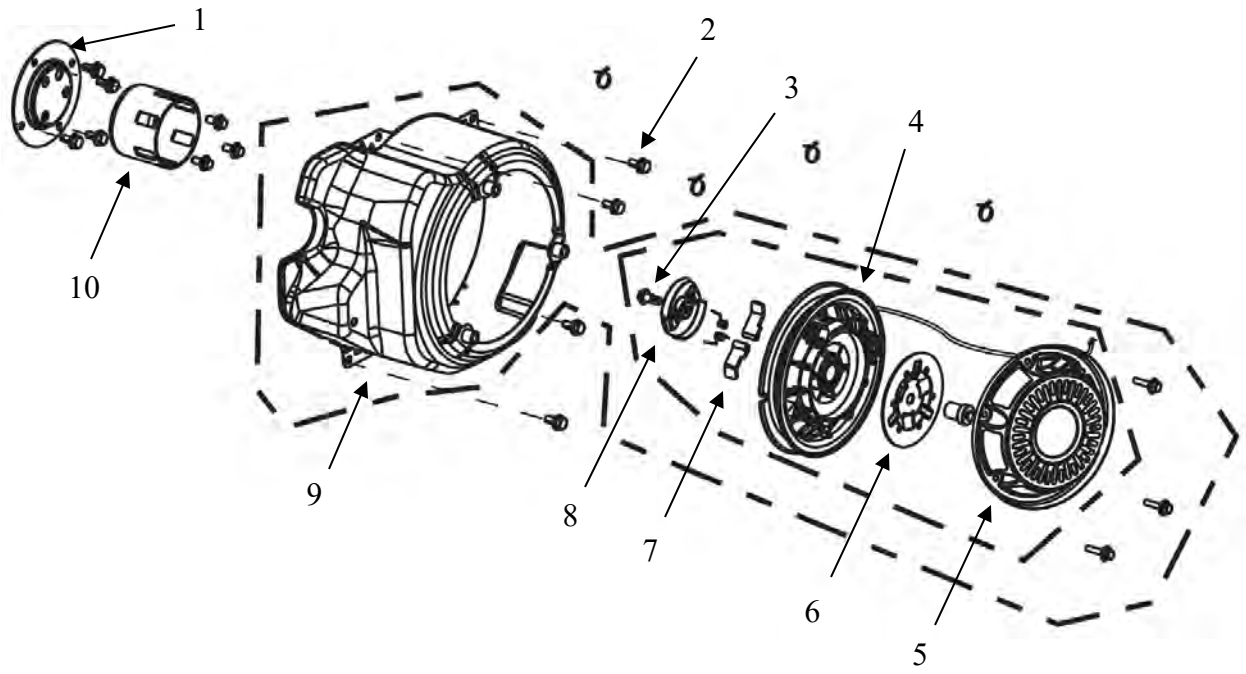
1. Washer
2. Clamp
3. Bolt
4. Impeller
5. Flywheel nut
6. Rotor
7. Bolt
8. Stator

Muffler



1. Nut
2. Spark arrestor
3. Bolt
4. Bracket
5. Shroud
6. Cover
7. Impeller
8. Gasket
9. Muffler assembly

Recoil Starter



1. Starting seat
2. Bolt
3. Locking screw
4. Starter pulley
5. Housing
6. Starter spring
7. Drive cams
8. Drive guide
9. Shroud
10. Starter pulley seat

TROUBLESHOOTING

Issue:	Possible Cause:	Solution:	Check:
Engine Will Not Start	Generator switch in the off “0” position	Turn the generator switch to the correct position.	Start the engine
	Generator inclined	Move generator to a level position	
	Not enough oil in the engine	Check the oil level. If low, add the recommended oil. Refer to Engine Oil Level – Check for the proper oil.	
	Dirty air filter	Check the air filter. Clean or replace as needed.	
	For electric start, start the engine using the recoil starter	If the generator starts, check the battery voltage on the LCD display. If the battery is providing less than 12.4 volts, charge the battery.	
	Oil in the combustion chamber	Remove spark plug, turn generator switch to off “O” position, pull recoil starter four times to remove oil from combustion chamber	
	No fuel	Fill the fuel tank	
	Old or contaminated fuel	Drain and refill if necessary.	
	No fuel at the carburetor	Make sure the generator switch is in the on "I" position.	
		Check the vacuum relief in the fuel cap. If plugged clean the vacuum relief.	
	Not enough fuel to the engine	Make sure the needle valve is closing properly. Clean or replace as needed.	
		Inspect the fuel nozzle. Clean if needed.	
		Inspect the float. If the float is damaged or sticking, repair or replace as needed.	
	Engine flooded	Wait 5 minutes.	
		Remove and clean the spark plug. Suction out fuel or let fuel evaporate before reinstalling spark plug.	
	No spark	Inspect the spark plug. Clean the spark plug, adjust the spark plug gap, or replace the spark plug as necessary.	
		Inspect the spark plug wire. Replace if damaged. Check the resistance. If the resistance is out of tolerance, replace the wire.	
		Inspect the ignition coil. Replace if damaged. Check the resistances. If any of the resistances are out of tolerance, replace the ignition coil.	
		Check the wiring to make sure that none of the wires are shorted to ground.	
	Cylinder pressure	Inspect the cylinder head bolts to make sure they are properly torqued to 40±3 N·m. Tighten if needed.	
		Check the valve clearance and seats. Adjust or repair as needed.	
		Inspect the cylinder head gasket. Replace if damaged.	
		Inspect the cylinder head and cylinder block surfaces for flatness. Repair or replace if out of tolerance.	
		Inspect the piston rings. If the piston rings are worn or broken, replace the piston rings.	
	If the engine still will not start:	Rebuild the engine, replace the engine, or consider replacing the unit.	

Issue:	Possible Cause:	Solution:	Check:
Engine Starts But Runs Rough or Does Not Have Enough Power	Dirty air filter	Check the air filter. Clean or replace as needed	Start the engine. Check if it has power or runs rough
	Generator inclined	Move the generator to a level position	
	Air in fuel line or fuel line clogged	Check the fuel line. Clear or replace as needed.	
	Not enough fuel to the engine	Make sure the needle valve is closing properly. Clean or replace as needed.	
		Inspect the fuel nozzle. Clean if needed.	
		Inspect the float. If the float is damaged or sticking, repair or replace as needed.	
	Engine Smart Control switch on	Turn the Engine Smart Control switch off	
	Carbon built up in combustion chamber	Remove the cylinder head and clean if needed.	
	Cylinder pressure	Check the valve clearance. Refer to the Maintenance Specifications chart for the proper value. Adjust or repair as needed.	
		Inspect the cylinder head gasket. Replace if damaged.	
		Inspect the piston rings. If the piston rings are worn or broken, replace the piston rings.	
	If the engine still has low power:	Rebuild the engine, replace the engine, or consider replacing the unit.	
Engine Shuts Down	Out of fuel	Check the fuel level. Fill the tank if necessary.	Start the engine. Check if it shuts down
	Not enough oil in the engine	Check the oil level. If low, add the recommended oil.	
	Dirty air filter	Clean the air filter.	
	Generator overloaded	Unplug some of the devices.	
	Shut off due to CO accumulation & flashing red indicator	Follow all safety instructions on CO Action Label	
	Shut off due to CO detector system fault & constant orange indicator	Replace CO module	
	If the engine still shuts down:	Rebuild the engine, replace the engine, or consider replacing the unit.	
Engine Making Unusual Sound	Knocking	Check the engine temperature. If the engine is running too hot, refer to the section on overheating.	Start the engine. Check for unusual sound
		Make sure the fuel is good and the proper rating. Drain and refill the fuel tank if necessary.	
		Make sure the flywheel is properly tightened to the crankshaft. Refer to Flywheel – Install for the proper torque.	
		Check the valve clearance. Refer to the Maintenance Specifications chart for the proper value. Adjust or repair as needed.	
		Check for carbon deposits in the cylinder. Clean if needed.	

Issue:	Possible Cause:	Solution:	Check:
		Inspect the piston and piston rings. If the piston or rings are worn or broken, replace the defective part.	
		Inspect the piston pin and piston pin hole. Replace if worn.	
		Inspect the connecting rod ends. Replace if worn.	
		Inspect the main bearing. Replace if worn.	
	If the engine still makes an unusual sound:	Rebuild the engine, replace the engine, or consider replacing the unit	
Engine Overheating	Low Oil	Check the oil. Refill the oil or change the oil as needed.	Start the engine and let it reach operating temperature. Check the temperature.
	Exhaust pipe blocked	Check the exhaust pipe. If the exhaust pipe is blocked, clear the blockage.	
	Debris in cooling fins	Remove the debris.	
	Cylinder or piston or piston ring worn	Inspect cylinder, piston, and piston rings. Replace if needed.	
	Connecting rod deformed	Inspect connecting rod. Replace if needed.	
	If the engine still overheats:	Rebuild the engine, replace the engine, or consider replacing the unit	
Engine Runs, But Generator Provides No Power or Low Power	Generator overloaded, overload light is on	Turn off and unplug all electrical devices, shut down the engine, wait 10-15 minutes and start the engine, connect fewer or lighter electrical loads.	Start the engine and check the output voltage
	Circuit breaker is open	Close the circuit breaker.	
	Bad connection	Stop the engine and check the connections.	
	Defective power cord	Replace the cord.	
	Defective device plugged in	Unplug defective device.	
	Bad inverter control connection or defective inverter control	Check the voltages and connections. Tighten any loose connections. Replace the inverter control.	
	Engine Smart Control switch on	Turn the Engine Smart Control switch off	
	Poor stator or rotor lead contact	Check the contacts. Tighten or replace as needed.	
	Poor panel, meter, or socket contact		
	Magnetic field lost	Flash the generator.	
	Defective winding or winding connection	Check each winding. Check connections to ground. Tighten any loose connections and replace any defective parts.	
	If there is still no power or low power:	Rebuild the generator, replace the generator, or consider replacing the unit.	

APPENDIX

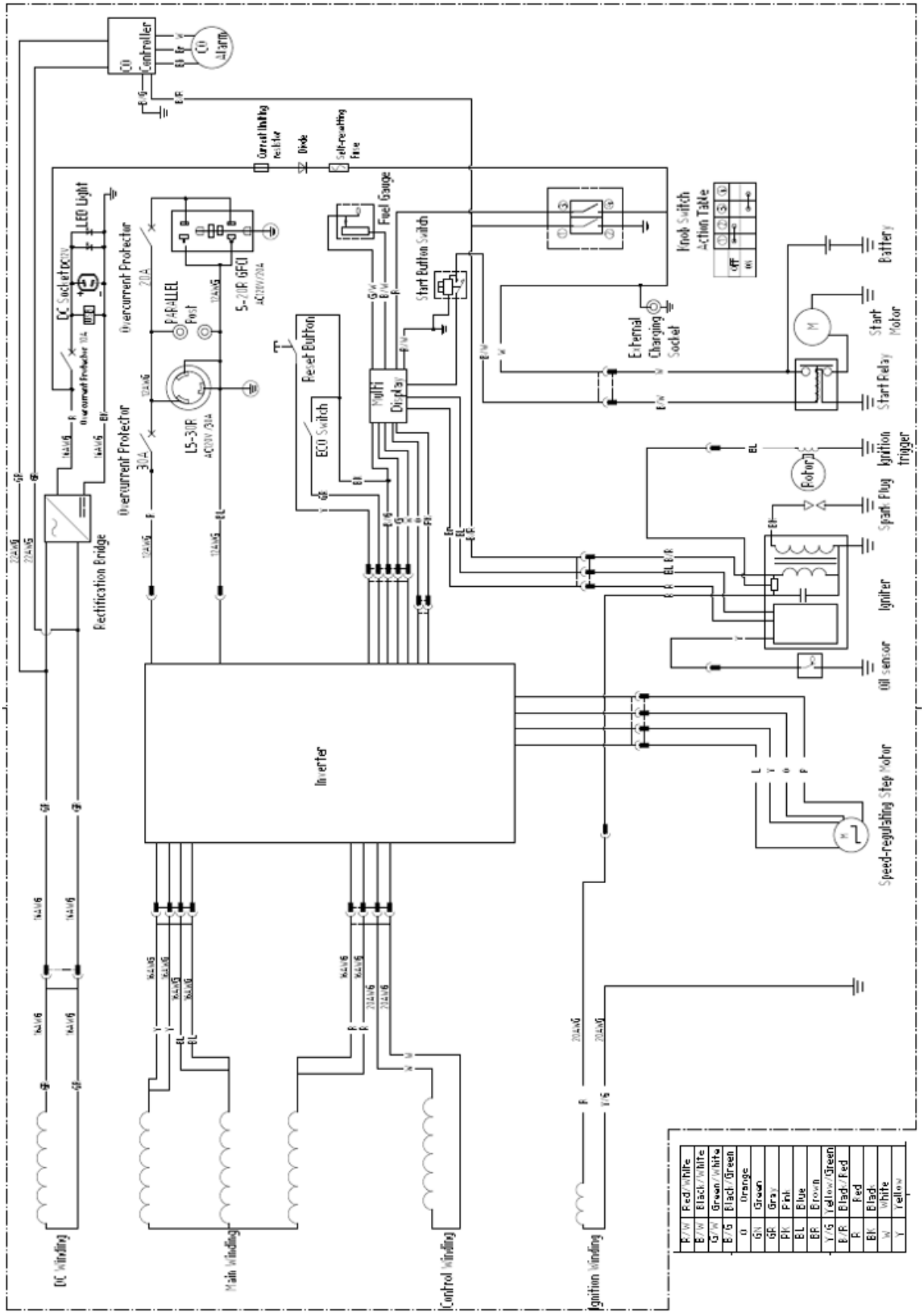
Product Specifications

Engine Type	Single Cylinder, 4-Stroke, Forced Air Cooling
Displacement (cc)	212
Ignition System	Electronic
Spark Plug Gap	.028 - .032 inches (0.7 – 0.8mm)
Fuel Volume	2.1 U.S. gallon (8L)
Fuel Consumption (g/(kW·h)	≤ 395
100% load continuous running time (hr)	4.8
50% load continuous running time (hr)	8.0
Oil Capacity	0.56 quart (0.53L)
Rated Output (DC)	12V 8.3A
Rated Frequency (Hz)	60
Rated Voltage (V)	120
Rated Output Power (kW)	3.2
Surge Output Power (kW)	4.0
Phase	Single
Total Harmonic Distortion	< 3%

Maintenance Specifications

Item	Specification	Service Limit
Maximum speed (no load)	3500 - 3700 rpm	-
Compression (at 600 rpm)	≧0.45MPa	-
Cylinder sleeve I.D.	70.0 – 70.015mm	70.065mm
Piston skirt O.D.	69.975 - 69.985mm	69.925mm
Piston to cylinder clearance	0.015 – 0.04mm	0.13mm
Piston pin bore I.D.	18.002 - 18.008mm	18.018mm
Piston pin O.D.	17.992 – 17.998mm	17.982mm
Pin to pin bore clearance	0.004 – 0. 016mm	0.036mm
Piston ring side clearance	0.03 – 0.07mm	0.14mm
Piston first ring gap	0.55 – 0.808mm	1.108mm
Piston second ring gap	0.60 – 0.858mm	1.158mm
Connecting rod piston end I.D.	18.011 - 18.022mm	18.06mm
Connecting rod crank end I.D.	30.22 – 30.23mm	30.27mm
Oil clearance	0.035 – 0.055mm	0.12mm
Crank end side clearance	0.75 – 1.35mm	1.55mm
Crankshaft pin O.D.	30.175 – 30.185mm	30.145mm
Intake valve clearance	0.05 – 0.10mm	-
Exhaust valve clearance	0.05 – 0.10mm	-
Intake valve stem I.D.	5.468 - 5.480mm	5.418mm
Exhaust valve stem I.D.	5.428 - 5.440mm	5.378mm
Valve guide I.D.	5.500 – 5.512mm	5.560mm
Intake valve stem clearance	0.020 – 0.044mm	0.142mm
Exhaust valve stem clearance	0.060 – 0.084mm	0.182mm
Valve seat width	0.7 – 0.9mm	2.0mm
Valve spring free length	30.5mm	29.5mm
Camshaft intake lobe	27.59mm	27.29mm
Camshaft exhaust lobe	27.56mm	27.26mm
Camshaft journal O.D.	14.166 – 14.184mm	-
Camshaft bracket I.D.	14.200 – 14.218mm	14.248mm
Spark plug gap	0.7 – 0.8mm	-
Spark plug cap resistance	5Ω	-
Secondary ignition coil resistance	3kΩ	-

INV4000 E (CO DEFENSE™ equipped) Electrical Schematic



INV4000 E Electrical Schematic