CHAMPION
GLOBAL POWER EQUIPMENT™-MC

DIAGNOSTIC REPAIR MANUAL

HOME STANDBY GENERATORS

TAKE IT OUTSIDE™
TAKEYOURGENERATOROUTSIDE.COM

1-877-338-0999
or visit **championpowerequipment.com**

SAVE THESE INSTRUCTIONS. This manual contains important safety precautions which should be read and understood before operating the product. Failure to do so could result in serious injury. This manual should remain with the product.

Specifications, descriptions and illustrations in this manual are as accurate as known at the time of publication, but are subject to change without notice.

REV 20221223

Champion Power Equipment, Inc., Santa Fe Springs, CA USA

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SAFETY DEFINITIONS

The purpose of safety symbols is to attract your attention to possible dangers. The safety symbols, and their explanations, deserve your careful attention and understanding. The safety warnings do not by themselves eliminate any danger. The instructions or warnings they give are not substitutes for proper accident prevention measures.

⚠ DANGER

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

⚠ WARNING

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

⚠ CAUTION

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

NOTICE

NOTICE indicates information considered important, but not hazard-related (e.g., messages relating to property damage).

FOR ELECTRICIAN/TECHNICIAN

This HSB Generator must be installed in accordance with current NFPA-37, NFPA 54, NFPA 58 and NFPA-70 standards.

Contact your local electrical inspector or city hall to insure you are aware of all codes and regulations.

Install the equipment in compliance with the National Electric Code (NEC).

For Canada installations, refer to Canadian Electrical Code (CEC).

Contact your natural gas supplier to verify that increased BTU gas demand can be handled with the existing NG meter.

The same should done for LPG fueled generators.

Correct gas pipe length, and size requirements can be found in the HSB Installation Manual.

This generator in the enclosure is designed to be installed outdoors only.

Service and Diagnostics to be performed only by qualified personnel.

Operator's Manual and Installation Manuals for HSB Generator can be downloaded at www.championpowerequipment.com.

INTRODUCTION

The Champion Diagnostic Repair Manual for Home Standby Generators was created to aid in the service and troubleshooting of Champion Home Standby Generators.

Champion Home Standby Generators are designed and engineered in the USA to exacting standards of the North American market. This engine-powered generator meets the Environmental Protection Agency (EPA) Phase 3 emission requirements and is Environment & Climate Change Canada (ECCC) compliant and is certified for safety by cETLus in accordance to UL2200 and CSA22.2 No. 100 for the USA and Canada markets.

CONTACTS

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Disclaimer

This home standby generator is intended exclusively for outdoor installation. This generator will operate using either liquefied petroleum gas (LPG, Propane) or natural gas (NG).

This generator is designed to supply typical home load such as:

- Induction motors – sump pumps, refrigerators, air conditioners, furnaces
- Electronic items – televisions, computer
- Household lighting
- Microwaves

NOTICE

This generator is not intended for use in critical life support applications. Proper sizing of the generator is required to ensure proper operation of appliances. Some appliances require additional wattage to start and must be considered.

INITIAL CHECKS

A routine of initial checks should be implemented whenever an operation issue is suspected or reported.

First Checks: Outside of the enclosure.

– Do a walk around the enclosure

– Check for debris, or objects that could affect the air circulation of the HSB generator

– Check Fuel Shut off valve

  • Is the fuel shut off valve Open or Closed?

– Check External wire conduit are there any bends, or breaks?

  • Are any exposed wire or cable showing?

– Check the Warning LED located between the back-access panel and the engine air inlet louver

  • Is the Warning LED Red light ON or OFF?

Second Checks: Control Panel, Batteries, Engine

– Check Control Panel Modules

Engine Control Module: Document fault codes activated

Engine Control Module: is it set to ATS Position? Is the Green Power Light ON?

ATS Control Module: is it set to ATS Position?

ATS Control Module: is Utility / Generator setting correct for conditions?

Exercise switch set to ON?

Is Circuit Breaker set to ON Position?

Which fuel is being supplied?

NG or LPG?

What is the fuel pressure?

If LPG, were the jets changed?

Were the jets installed properly?

Check Oil

Pull the dipstick and check oil level.

Low oil level can cause low oil pressure switch to open and keep engine from starting.

Check Batteries

Are batteries clean?

Are batteries free of corrosion?

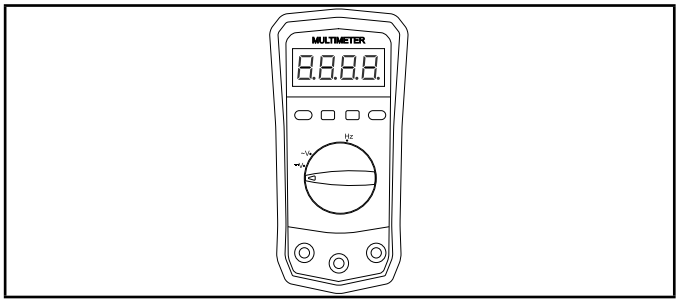
Are battery cables tight?

Fully charged 24 VDC system should be measuring 28 VDC across (2) batteries.

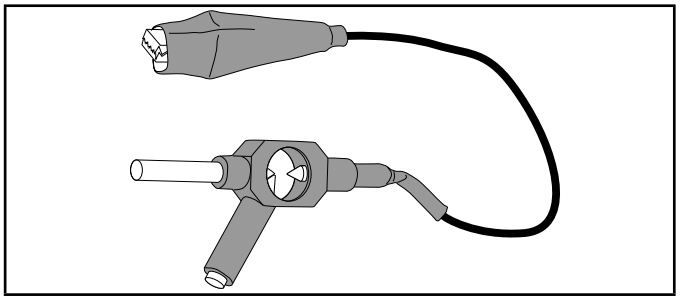
HSB DIAGNOSTIC TOOLS

The following tools will be needed when servicing all Champion Home Standby Generators.

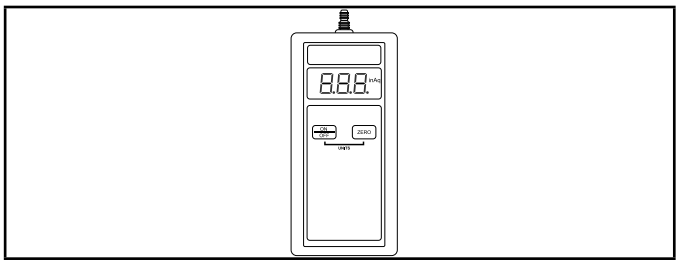
Digital Multimeter – A good quality multimeter that can read VAC, VDC, Hz, and perform continuity checks. The digital multimeter is one of the most important tools in HSB troubleshooting and diagnostics.



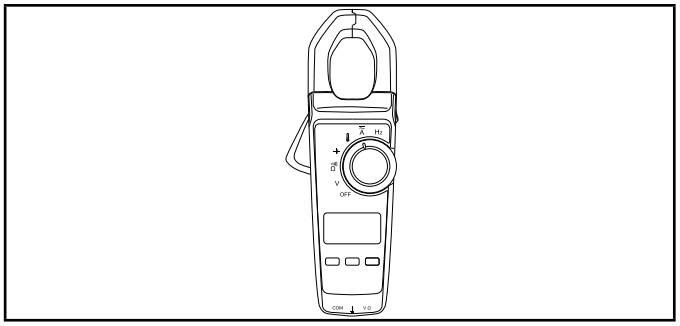
Ignition Spark Tester – Safely test for ignition spark without getting shocked or damaging HSB electronics.



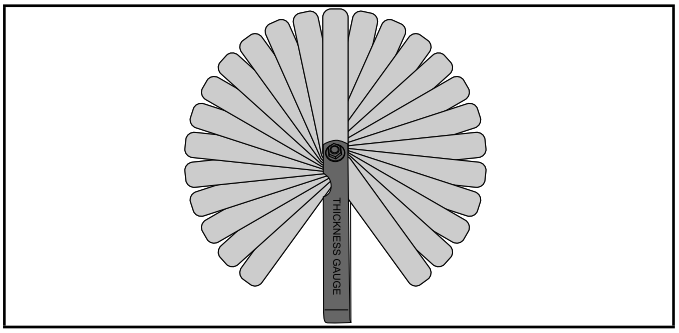
Digital Manometer – Used for measuring LPG, and NG fuel pressure. Fuel pressure is measured in inches of water column (in. – H20).



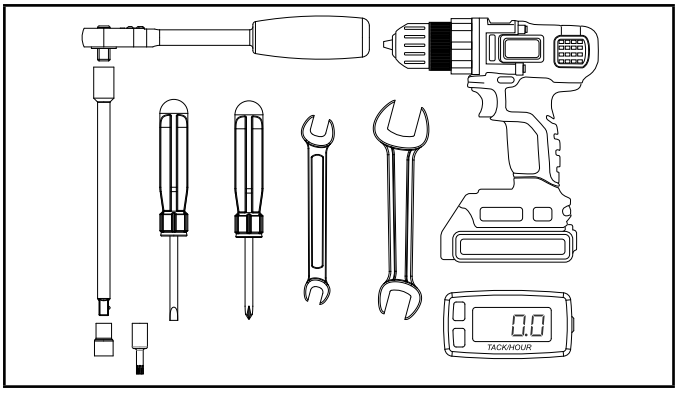
Clamp Meter – The preferred clamp meter can measure both AC and DC current.



Set of Feeler Gauges – Gauge set is used to measure spark plug gap and valve lash clearances. Feeler gauges are also useful for removing main jets from twin cylinder engines.



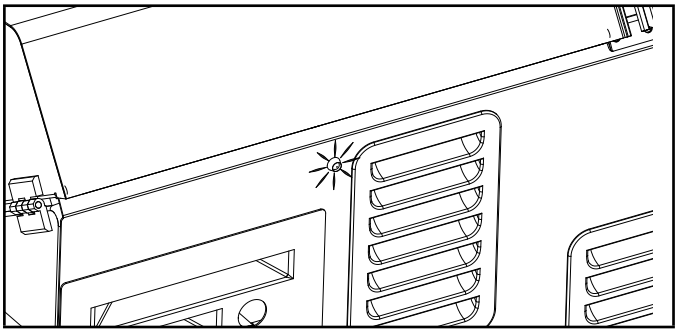
Tools for the Job – A combination of hand tools to perform maintenance and service to all models of HSB Generators and ATS systems.



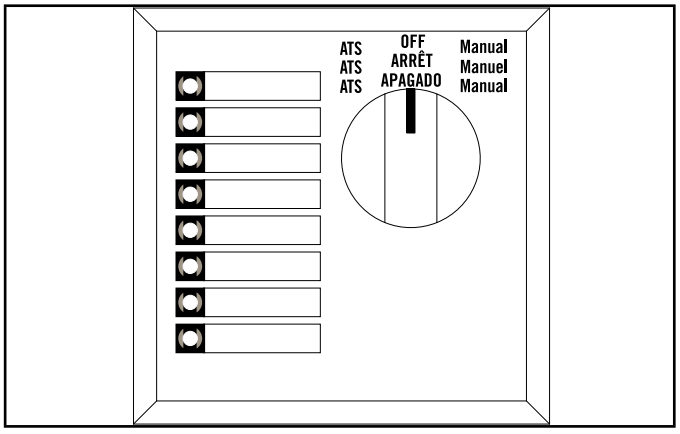
DIAGNOSTIC FAULTS AND CORRECTIVE ACTION

Reset Fault Codes

There's an exterior fault code indicator light located on the back of the enclosure. This should be checked weekly to make sure there are no active fault codes.



The fault code(s) can be reset by placing the Engine Control Module in the OFF position. Wait one minute. This will reset fault LED.



Place switch in Manual position when testing, and ATS position for Standby power mode.

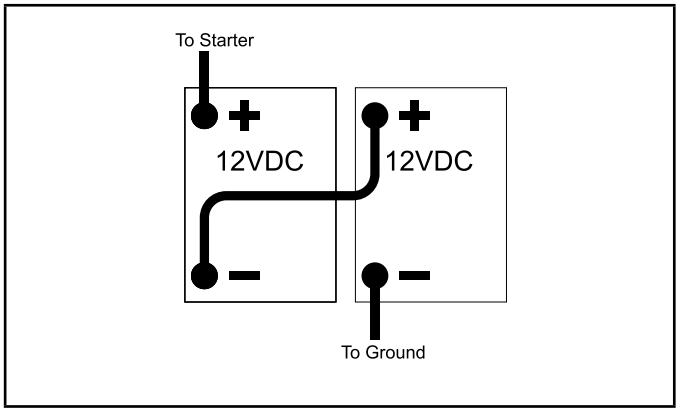
If a fault code(s) re-occurs, it must be addressed.

BATTERIES

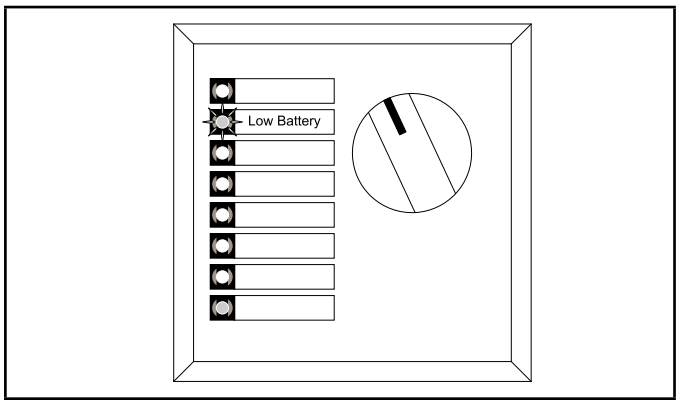
Battery Requirements

Two (2) 12 volt Group U1 batteries with a minimum of 350 CCA each. Battery size: 7 ¾ L × 5 ³⁄₁₆ W × 7 ⁵⁄₁₆ H inches (196mm L × 131mm W × 185mm H). This is based on testing in extreme cold and heat -22° F (-30° C) to 104° F (40° C). Purchase batteries locally. Install positive cable first.

Install a cable from the positive (+) terminal of one battery to the negative (–) terminal of the other battery. Always connect the positive (+) battery cable to the generator first.



Low Battery LED



The yellow LED will be lit if the battery voltage fell below 21.0 volts for at least one minute while the engine was running. If battery voltage rises above 21.1 volts, the LED will turn off. Battery voltage is not monitored when cranking the engine.

Visual Inspection of Batteries

Are batteries dry, clean, and free of corrosion? If not clean the batteries with soapy water; wire brush battery terminals, wire brush battery cable ends.

Check Battery Cables

Are the positive and negative cables tight on battery terminals? If not, tighten cable fasteners.

Abrupt Starting Sequence

A condition where engine starts cranking when battery cables are being installed, and both the Engine Control Module and the ATS module are in the OFF position.

Solution

Replace ATS Module and or Engine Control Module.

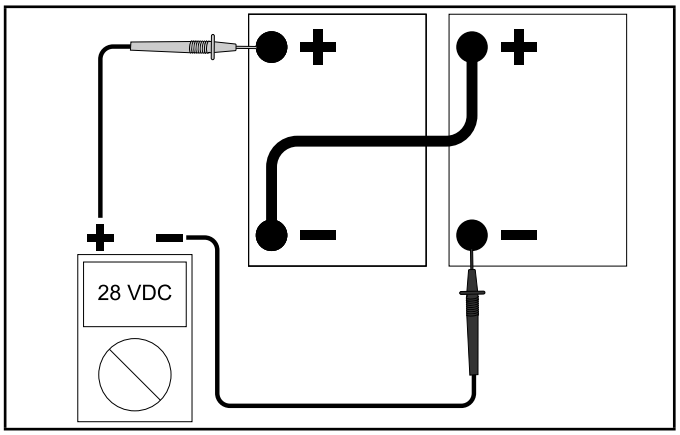
- Remove access panel on back of HSB enclosure
- Unplug Green terminal block from engine control module.
- Install Battery cables.
- If Engine begins to crank, disconnect negative battery cable, and replace damaged ATS Module
- Unplug Green terminal block from ATS control module.
- Reconnect Green terminal block to engine control module.
- Install battery cables
- If Engine begins to crank, disconnect negative battery cable and replace Engine Control module

Battery Test

Voltage DC

Check battery voltage with Voltmeter set to VDC.

Voltmeter readings should be between 26 VDC and 28 VDC. If not, charge the batteries.



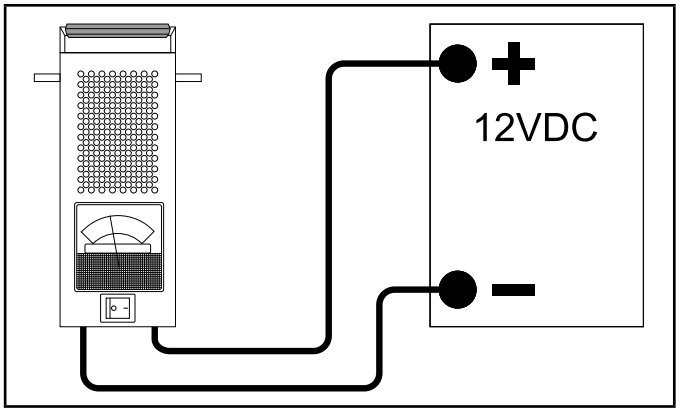
Battery Load Test

Perform battery load test – Load test to be performed on individual 12-volt batteries.

12-volt battery needs to be fully charged.

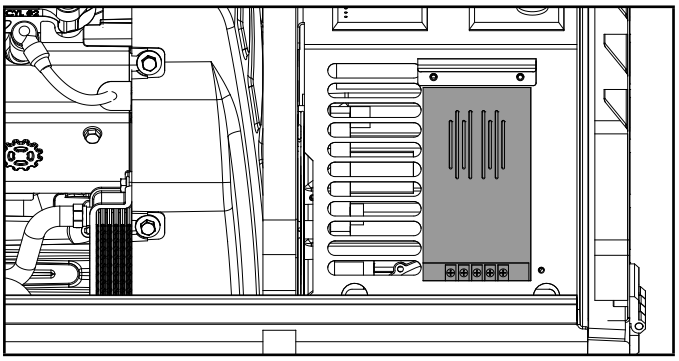
Install battery load tester

- Connect clamps to battery terminals
- Press Load switch – maximum 10 seconds
- Read meter with Load ON
- Replace 12-volt battery if load test fails



BATTERY CHARGER

– Battery charger is located between batteries and control panel.

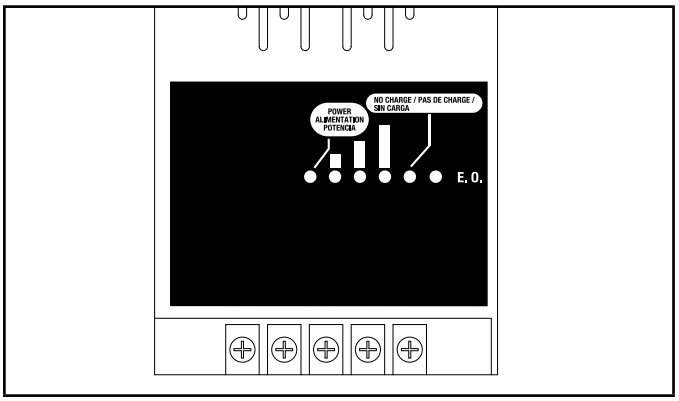


Features

The LEDs on the battery charger indicate the state of the battery's charge level.

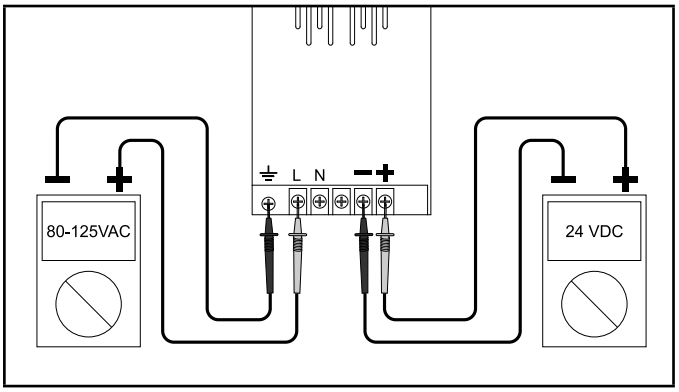
E.O. = Enforced Output

Allows a 3-amp charge of current to GOOD batteries that are in a state of low charge.



Battery charger is powered from utility side of ATS (pin #9) with input of 80-125 VAC.

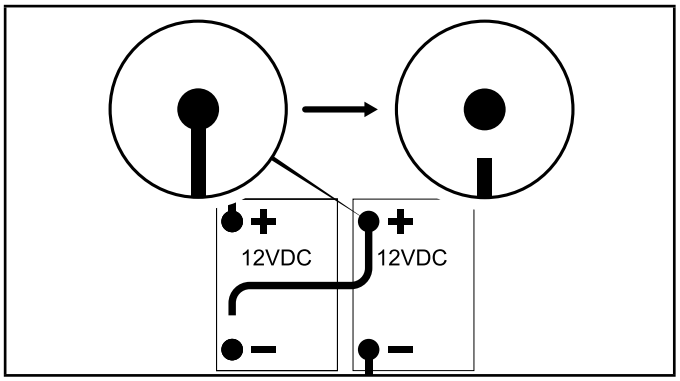
Battery charger output to batteries is listed as 24 VDC with current of 1.6 amps.



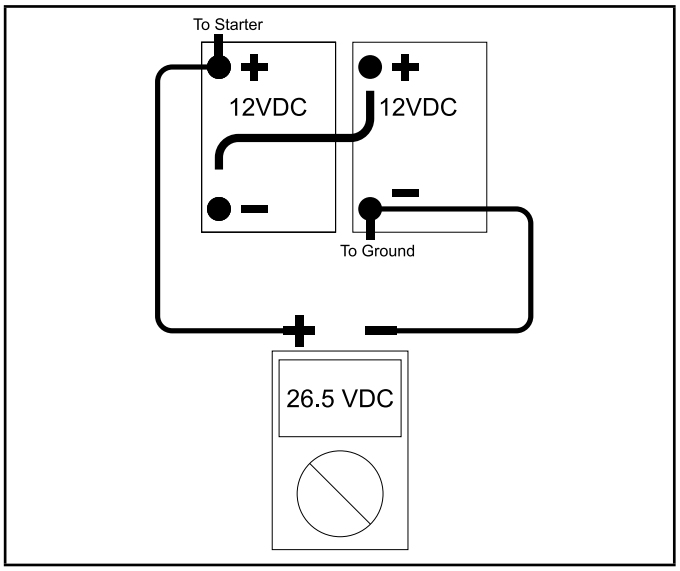
LED meter indicates the state of charge of batteries.

Test Battery Charger Output Voltage

When testing Battery Charger output, the batteries need to be taken out of series. Remove the series cable from batteries. Disconnect the negative side of the battery first. The batteries have been disconnected from the system.



The battery charger is still active. Measure the output voltage at the battery cables. Output voltage can range from 24 VDC to 28 VDC. Document the Battery Charger output voltage. Reconnect the negative battery cable.



Button Marked E.O. on Battery Charger

When Batteries have been taken out of series, and no voltage is shown on the multimeter, press the E.O. Button on the battery charger. If there is still no voltage reading replace the battery charger.

When connecting batteries back into series and the engine control Module (100666) shows no power, press the E.O.button to reset the battery charger. The engine control module will go through aFault LED cycle then the green power LED will be lit.

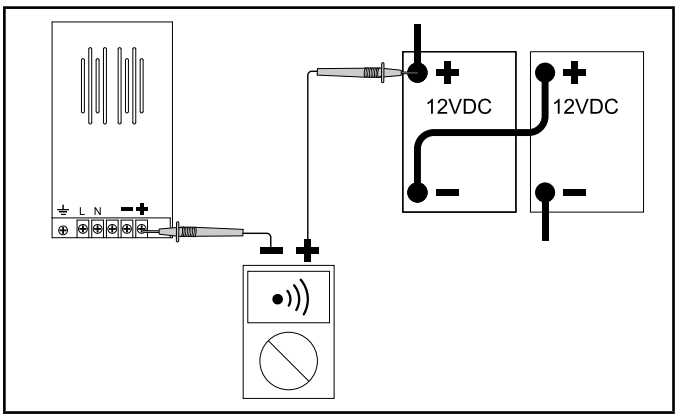
Battery Charger - Models Manufactured Prior to September 2016

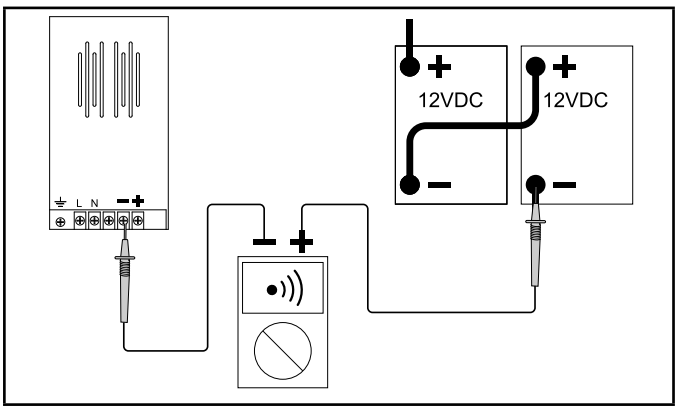
TEST-Continuity

Check continuity between battery cable terminal ends and output connections at battery charger.

Check each cable for continuity.

Diagram illustrates checking continuity on the positive battery cable. Battery Charge wire at positive Cable.





If there is continuity between cable end and battery charger connection, the multimeter will beep. If volt meter does not beep, wire at battery cable connection may have pulled out of connection. Replace the battery charger wire.

Removal and Installation of Battery Charger - All Models

⚠ WARNING

120V at the battery charger. Make sure to disconnect utility power when performing this procedure.

This procedure applies to all HSB Generators where the 24-VDC Battery Charger has been diagnosed as needing replacement.

Before removal of Battery Charger:

HSB Shut down Checklist

To make sure the generator is shut down during maintenance or repair. The following items must be checked:

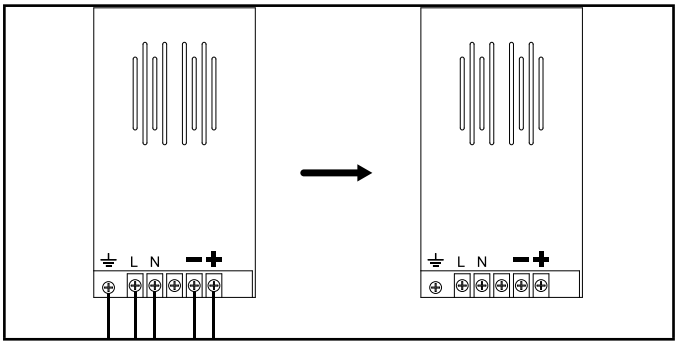
- ☐ Fuel valve is in the CLOSED position.
- ☐ Battery cables are disconnected from batteries. Disconnect the negative side of the battery first.
- ☐ ATS control module (100667) is in the OFF position.
- ☐ Engine control module (100666) is in the OFF.
- ☐ Battery Charger input voltage comes from utility power of the house.
- ☐ Utility power will need to be shut off during Removal and Replacement.

Removal of Battery Charger from HSB Generator

- Battery charger is located between batteries and control panel
- Battery charger is powered from utility side of ATS (pin #9) with input of 80-125 VAC
- Battery charger output to batteries is 24 VDC with current of 1.6 amps
- Remove batteries from HSB enclosure

Wire Connections

- Using a P2 Phillips screw driver, remove the Power wires
- Remove (3) wires on bottom left corner of battery charger
- Ground L and N
- Using a #2 Phillips screw driver, remove the Output wires
- Battery (–) and Battery (+) on bottom right corner of battery charger

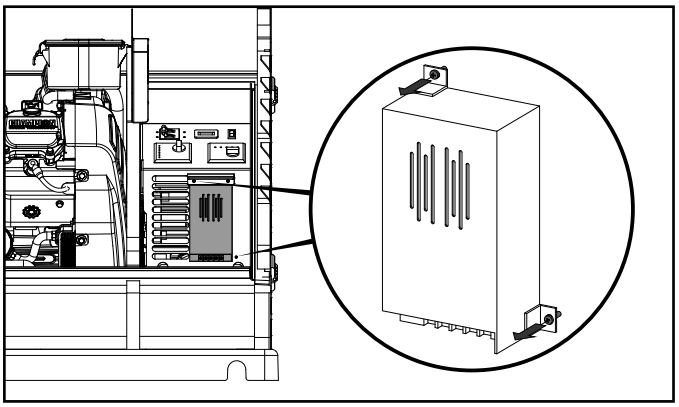


Removal of Battery Charger from HSB Generator – continued

With wiring removed:

– Locate (2) battery charger mounting screws. See following figure

– Using a P2 Phillips Screwdriver, remove the (2) fasteners holding the Battery charger to the lower control panel



Replacement of Battery Charger

– Follow this procedure in reverse order

After Replacement of Battery Charger

HSB Test Mode

– Battery Cables are connected to batteries

– Fuel valve is in the OPEN position

– ATS control module 100667 Switch to OFF position.

– Engine control module 100666 Switch to the OFF position

– When engine control module is switched to Manual position, HSB will start

– HSB circuit breaker in the ON position

– Check power output at Terminal Block #2

– If there is output voltage, move to HSB Ready Checklist

– If not, recheck connections, switches, and grounds

– Consult the HSB Operations Manual

HSB Ready Checklist

☐ ATS control module (100667) is in the AUTO position.

☐ Engine control module (100666) is in the ATS position.

Set Exercise Time

1. The Engine Control Module switch must be in the ATS mode.
2. Decide on the desired day and time to exercise the HSB generator.
3. Press the exercise switch to ON.
4. The HSB generator will start and run for 15 minutes and then shut off.
5. The exercise time is now set.

The HSB generator will begin the next exercise period exactly 168 hours (1 week) from when the exercise switch was pressed to the ON position.

Hz OVER / UNDER

Hz over/ under can be defined as Frequency or Speed which increases over the maximum RPM or Hz setting, and Frequency or Speed which is UNDER the set RPM or Hz setting.

Appliances connected to the generator circuit could be damaged from high or low generator output if the engine is operating outside the preset limits.

Specifications:

Speed setting	3600 RPM
Maximum speed setting	3750 RPM
Frequency	60 Hz
Maximum frequency	62.5 Hz

Hz Over-Speed

Hz Over-Speed is a condition in which an engine is allowed or forced to rotate beyond its design limit. An Over-Speed safety switch senses when engine is in an Over-Speed state and shuts off the ignition and fuel systems.

– The event is documented by fault: “Hz over / under” on the Champion 100666 Engine Control Module

– Over-Speed is caused by governor and throttle misalignment

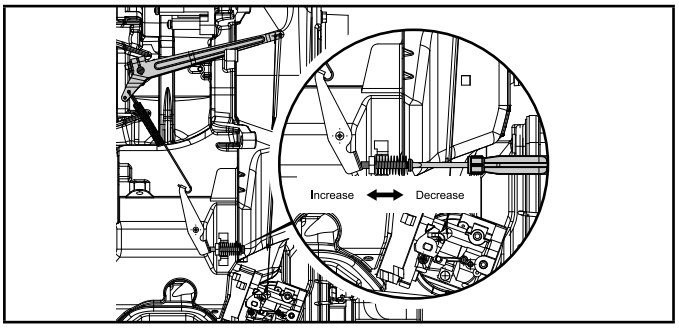
Hz Over-Speed Diagnosis

1. Switch Champion 100666 engine control module to OFF position.
2. Switch Champion 100667 ATS control module to OFF position.
3. Switch exercise to OFF position.
4. Switch Champion 100666 engine control module to manual mode.

5. Engine will start.
6. Listen to engine and or install a Digital Tachometer to record engine RPM.
7. Over speed condition will cause engine to run at a very high RPM, then engine will shut down.

Single Cylinder Speed Frequency Adjustment

Use screw driver for adjustment. Set frequency to: 62-62.5 Hz.



If a speed issue is still present after adjustment, then proceed to *Hz Over/Under Governor Correction.*

⚠ CAUTION

When working on an HSB engine:

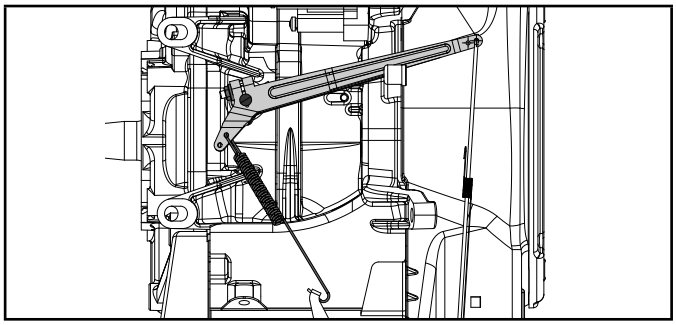
– Shut off fuel valve.
– Switch Champion 100666 engine control module to OFF position.
– Switch Champion 100667 ATS control module to OFF position.

Hz Over/Under Governor Correction – Single Cylinder Engine

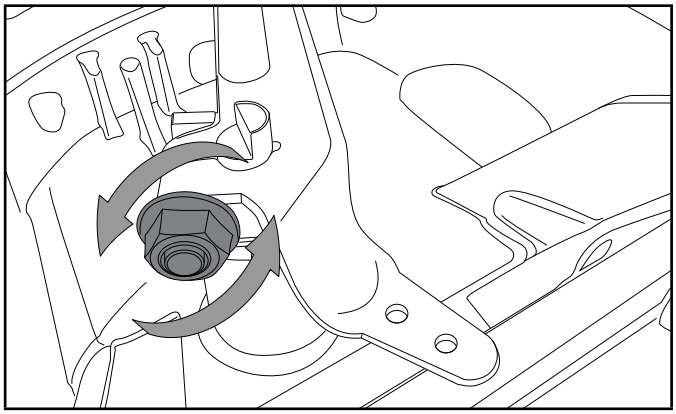
Technical Bulletin Number: 1904-100-50-2 ***Governor Setting for Single Cylinder HSB Generator***.

This bulletin covers the following Champion Power Equipment models: 270cc – 439cc Gasoline Powered Engines, and 8.5kW HSB gaseous fueled engines.

1. Loosen up the pinch bolt at the point where the governor shaft exits the engine. Be sure that the governor arm moves independently from the governor shaft.
2. Once the bolt is loose, rotate governor shaft to counter-clockwise with needle nose vice grips until it stops.



3. Next, push the governor arm in a counter-clockwise position until stops. Then, with pressure applied to both the arm and shaft, pinch the bolt to hold those positions.

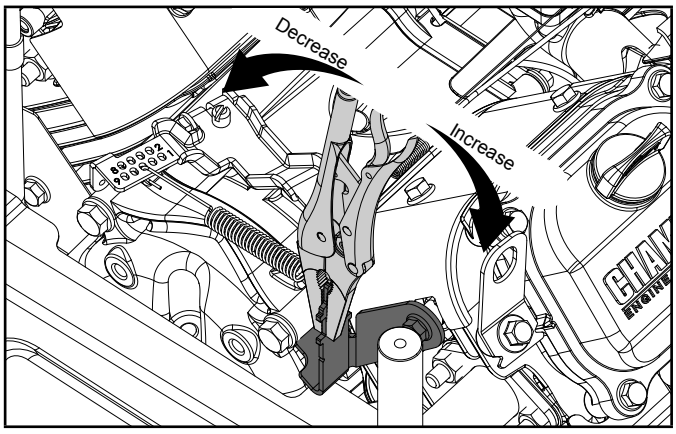


You have now set the governor in its standard setting. Upon needing an increase in RPM to compensate for more load, the governor should now move the throttle rod to add more throttle.

Twin Cylinder Frequency Adjustment

Set engine speed with no electrical load on the generator.

Use long needle nose pliers, or vice grip, to bend the spring anchor on the fixed speed controls.



– To increase engine speed HSNL bend the spring anchor tang on the fixed speed controls away from the governor lever to increase spring tension.

– To decrease engine speed HSNL bend the spring anchor tang on the fixed speed controls toward the governor lever to decrease spring tension.

If a speed issue is still present after adjustment, then proceed to *Hz Over/Under Governor Correction.*

Hz Over/Under Governor Correction – Twin Cylinder Engine

Technical Bulletin Number: 1511-100-50-2. ***Governor Setting for Twin Cylinder HSB Generator***

This bulletin covers the following Champion Power Equipment models (Note: Read instructions completely before performing service):

– All Champion Power Equipment products equipped with a 717cc or 754cc engine

Engine Governor may need to be reset to WOT for following reasons:

– After (300-500 hrs.) of operation, normal duty cycle

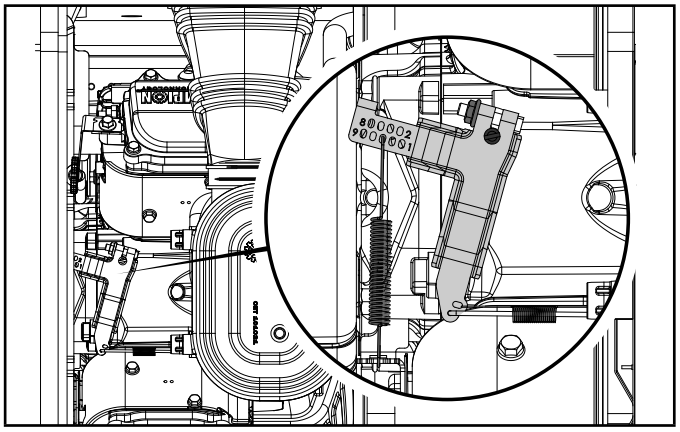
– If carburetor has been removed for cleaning and repositioned

– If the generator is experiencing wide speed droop from 3750 RPM to 3400 RPM

– If the generator is experiencing speed instability /speed hunting

To reset the internal governor flyweights to carburetor throttle WOT position do the following:

1. Remove the main governor spring. If the spring is left on, then the spring force can flex the governor link and cause a setting error and poor droop and stability performance.
2. Loosen the M6 nut that tightens governor lever to governor shaft paddle.
3. Use light 2-finger torque [2-7in-lb (.23-.79 N-m)] on screwdriver to turn governor shaft paddle screw CCW to seat the governor flyweights down at the WOT closed position.
4. Use light 2-finger push on governor lever towards carburetor to seat the carburetor throttle lever up against WOT stop.
5. Tighten the M6 nut to [8 ft-lb(11N-m)]. Be careful not to allow the governor lever to come off stop.
6. Reinstall the main governor spring into hole #5.



Hz Under-Speed

Hz Under-Speed is a condition when the engine is operating at a speed lower than the governor calls for. The condition occurs when generator is out of adjustment or overloaded due to ATS circuit overload, engine component failure, component misalignment, or sub-zero temperatures keeping starting RPM below Under speed fault setting.

– Frequency specs = 60Hz – 62.5 Hz

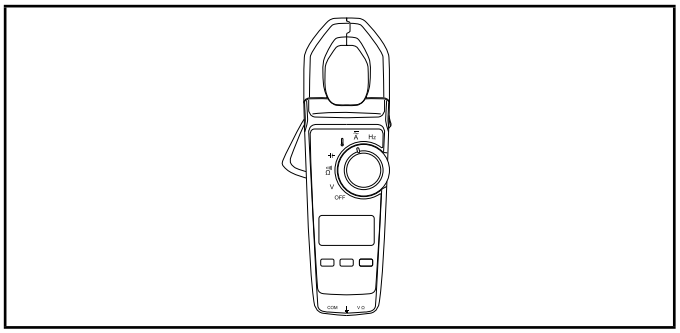
– Under speed Fault activates at 56 Hz

– No voltage or Hz reading

– The event is documented by fault: “Hz over / under” on the Champion 100666 Engine Control Module

Hz Under-Speed Diagnosis

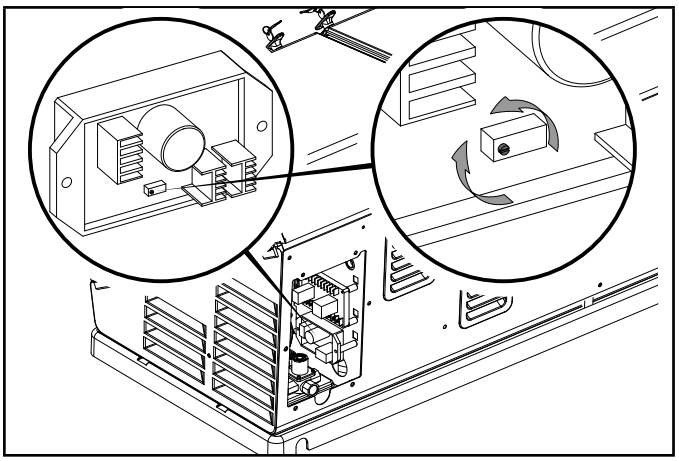
1. Switch Champion 100666 engine control module to OFF position.
2. Switch Champion 100667 ATS control module to OFF position.
3. Switch exercise to OFF position.
4. Install an amp meter to power wire L1 to monitor load if engine does start.
5. Install a Volt / Ohm meter to monitor Frequency.
6. Monitor amp meter during starting and running of HSB generator.



7. Switch Champion 100666 engine control module to manual mode.
8. Engine will begin to crank either normally or slowly.
9. If starting normally go to step 14 if engine shuts down after starting.
10. Listen to engine and measure Hz readings from Multimeter.
11. Monitor Hz or frequency during starting and running of HSB generator.
12. Under speed condition will cause engine to crank very slowly or run as if engine is over loaded.
13. Check starter motor assembly.
14. When engine is running shut off HSB circuit breaker. If speed increases, then Utility power is overloading the generator.
15. Check ATS position and connections.
16. Frequency readings below 56 Hz will cause the under-speed fault to activate.
17. Voltage readings below 230 VAC, check carbon brush assembly, and AVR. Carbon brush test, and AVR adjustment can be found in Engine Under - Power Section

Engine Under-Power

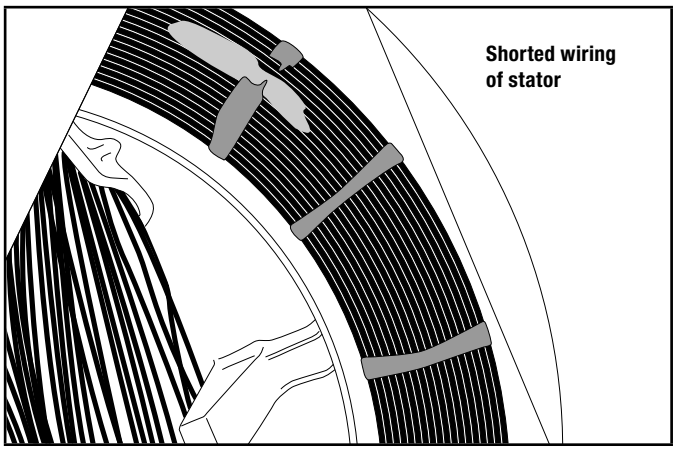
– Low sensing voltage will not allow engine to sense power
– Engine will shut down on Fault Code: Hz OVER/UNDER
– Connect multimeter to L1, and L2
– Measure Volts
– Start Engine
– Voltage should be 240 VAC - if less than 240 VAC make adjustment
– Adjust Voltage - using a small eye glasses screwdriver adjust potentiometer located on AVR to increase, or decrease voltage setting



No Voltage at Terminal 1, Terminal 2

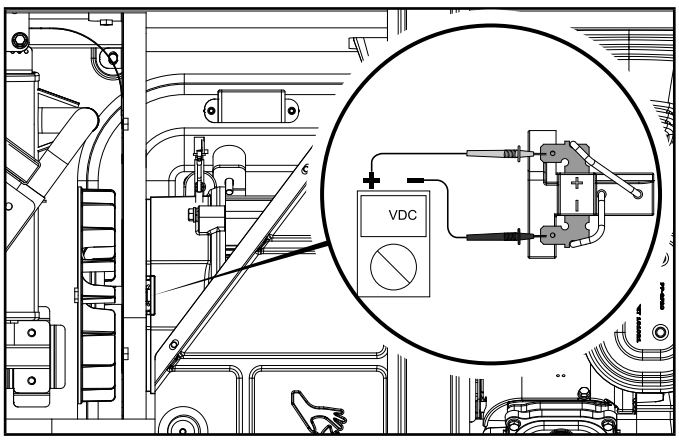
Visually Inspect rotor and stator

– Remove panels, parts, and firewall to visually inspect back of alternator
– With a mirror and flash light inspect rotor and stator for burn marks, corrosion, or broken wiring
– If any damaged is found, contact Champion Power Equipment with results



Check AVR at Alternator Contact Brushes

1. Set multimeter to Volts DC.
2. Connect multimeter to Positive, and Negative terminal wires of contact brushes.
3. Put HSB Generator in manual mode – Carbon Brush reading should be 3-4 VDC when engine is cranking.Carbon Brush reading should be 3-4 VDC when engine is cranking.
4. Carbon Brush readings should be 36 – 37 VDC with engine running at no load.
5. If engine does not start, replace the AVR.



Removal and Installation of Alternator – All Models

⚠ WARNING

Make sure utility power and batteries are disconnected.

It may be necessary to remove exhaust components and firewall to access alternator.

Remove Alternator (Stator)

1. Remove (2) Engine mount nuts located between Alternator supports and rubber motor mounts.
2. Install a 2" × 4" block of wood underneath the front stator housing of alternator to support engine during Stator removal.
3. Make sure block of wood lifts the alternator high enough to remove the End housing support bracket.
4. Remove two nuts on each side of end housing support.
5. Remove end housing support.
6. Remove the stator end housing – 4 fasteners.
7. Tap housing in multiple spots. (This will allow the housing to separate from the rotor bearing).
8. Remove Stator - Slide Stator away from engine and remove.

⚠ CAUTION

Rotor is very heavy.

Remove Alternator (Rotor)

1. Front of rotor is held into engine crankshaft by a press fit connection.
2. Reinstall the rotor fan fastener into the rotor.
3. Position a long pry bar through air inlet housing of front Stator.
4. Position a long brass Drift against the metal end of rotor where it is connected to the engine crankshaft.
5. While prying back on the rotor end, strike the rotor firmly with a hammer and brass drift.
6. Rotor will eventually release from crankshaft.
7. Remove rotor fan fastener.
8. Remove rotor.

⚠ CAUTION

Stator is very heavy.

Engine Overload

A condition where too much load or amps is lugging down the RPM of the engine causing the Hz Over/Under Fault to activate shutting down the HSB Generator. The following categories should be checked when diagnosing Engine Overload.

Check Circuit breaker box - Inspect circuit breakers. ATS branch circuit breaker MUST MATCH the Utility Main Control breakers amp rating to which they will provide power during a utility outage.

Speed

- Governor Adjustment – Follow Governor adjustment procedure described in over speed section
- Speed Adjustment – Engine running at high speed no load adjust frequency to 60-62.5 Hz

Starting System

- Engine cranks slowly
- Bad or corroded connections
- Internal damage to starter motor, or solenoid
- Replace starter motor assembly (V-Twin engine)
- Replace starter solenoid (single cylinder engine)

Check Starter Motor Draw Test

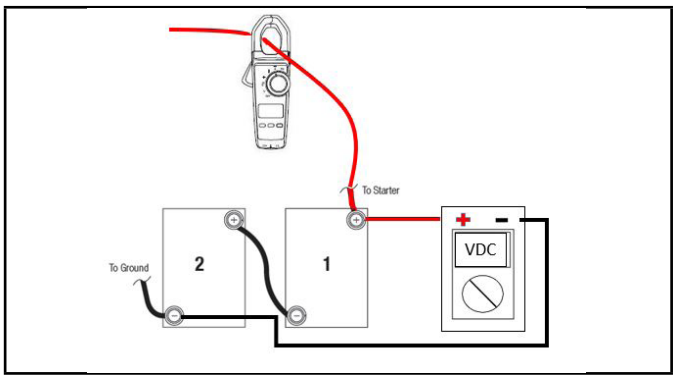
All HSB Models

NOTICE

When testing components, HSB is off line, test in Manual Mode.

Use a clamp-on ammeter/voltage meter for slow start and no start troubleshooting.

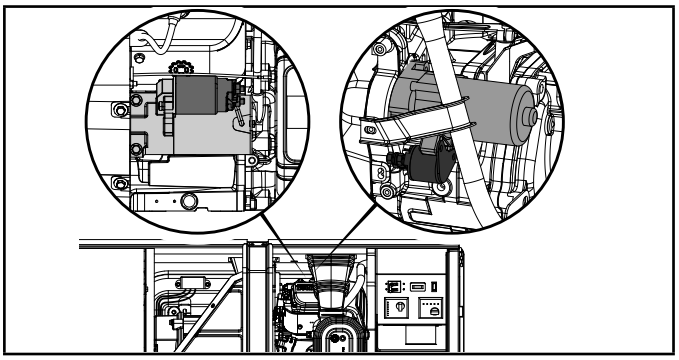
1. Connect the clamp on amp meter.
2. Set clamp on amp meter to DC amps.



3. Set the voltage meter to measure battery voltage (DC volts).
   Voltage at starter solenoid and battery is 28 VDC (Full Charge).
4. Fuel valve is in the OFF position- Non-running tests.

– ATS control module 100667 Switch to OFF position
– Engine control module 100666 Switch to OFF position
– When Engine control module 100666 switched to Manual position there is a 3 second delay then HSB will begin the start cycle

5. During the start cycle, watch the voltage and the amperage at the same time. The voltage should remain at or above 24 VDC while cranking the engine.
6. High current draw and low cranking speed indicates a faulty starter or possible engine problems.
7. If engine operates normally once started, replace the starter motor.



Removal and Installation of Starter Motor Assembly - Twin Cylinder Engine

Technical Bulletin Number 1804-100-10-2 ***Starter Motor Removal and Installation Twin Cylinder Engine HSB Generator.***

When Diagnostics found the following:

– Batteries are fully charged
– Engine Cranks slowly, or will not crank
– Hz Over / Under fault is active
– Starter motor spins but does not engage engine
– Black dust is visible on HSB floor (Base Center) below Starter Motor

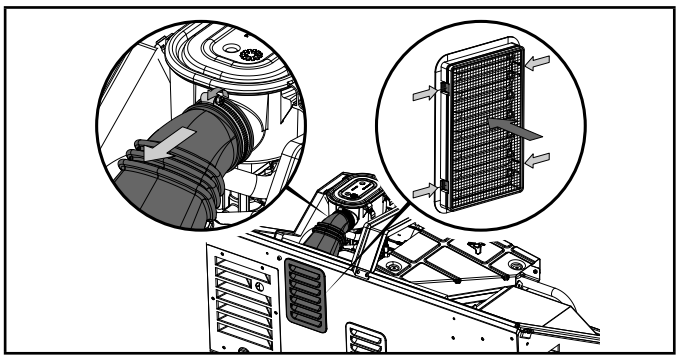
HSB Shut down Checklist

To make sure the generator is shut down during maintenance or repair, the following items must be checked:

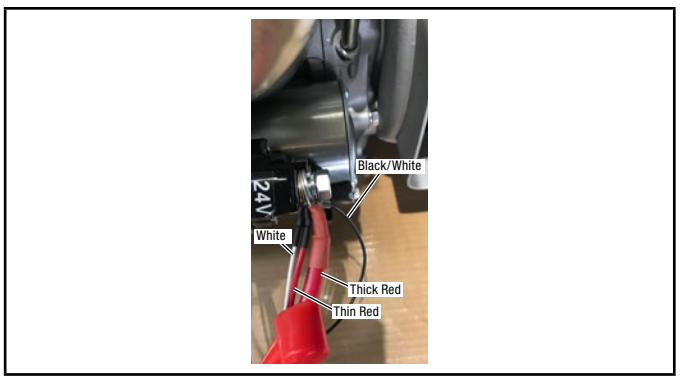
☐ Fuel valve is in the OFF position
☐ Battery cables are disconnected from batteries. Disconnect the negative side of the battery first.
☐ ATS control module is in the OFF position
☐ Engine control module is in the OFF position

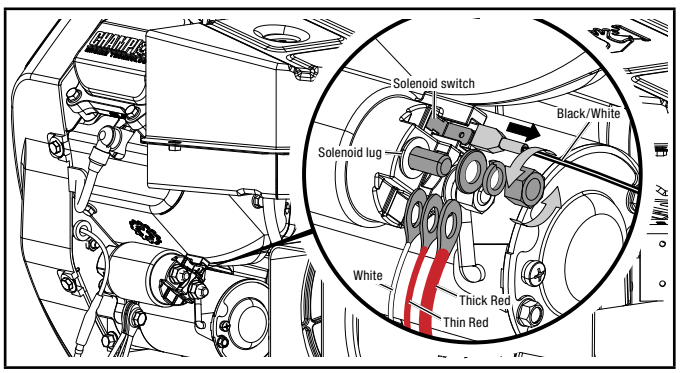
Procedure for Removing Starter Motor

1. Remove Air Inlet Snorkel – Remove band clamp at air box. Remove snorkel by sliding snorkel end away from air box then pulling snorkel free from Louver.
2. Remove Air Inlet Louver. Push (4) mounting clips inward to remove louver from rear panel.
3. Remove Alternator Air Inlet Louver– pull snorkel end away from Louver. Tuck snorkel to side to gain access to starter motor.

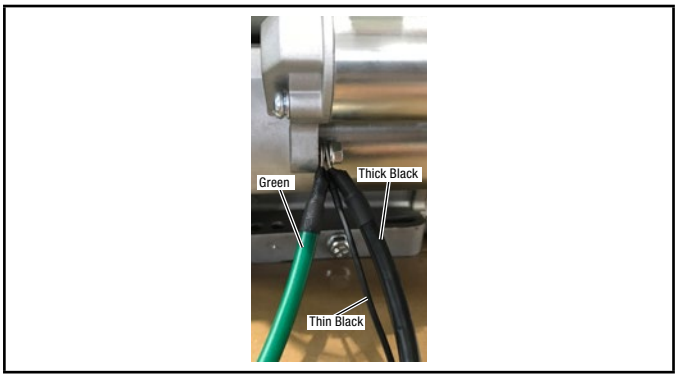


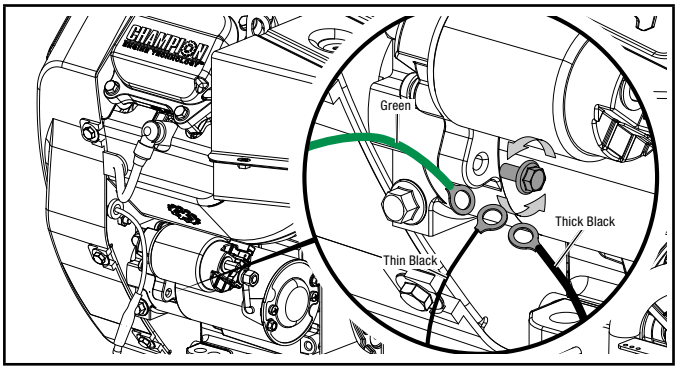
4. Remove wires and cables from Starter Solenoid Lug with 13 mm box wrench. Red Battery cable, White wire, Red Battery Charger wire on models after September of 2016. Remove black/white wire from Starter Solenoid Switch.



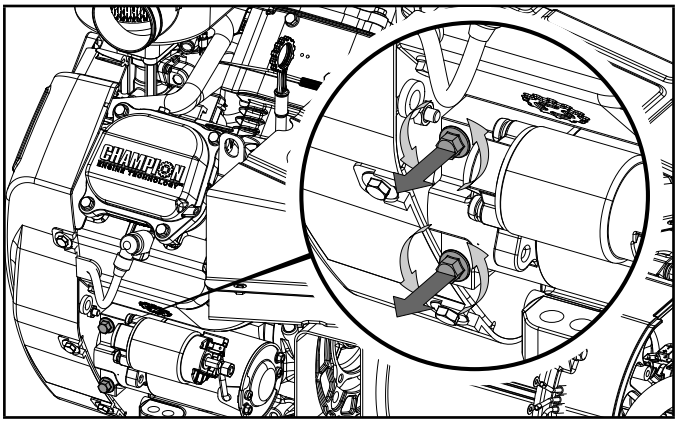


5. Remove ground wires fastened to starter housing with 10 mm socket.



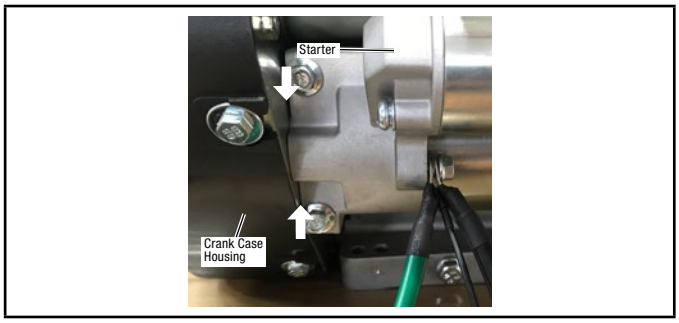


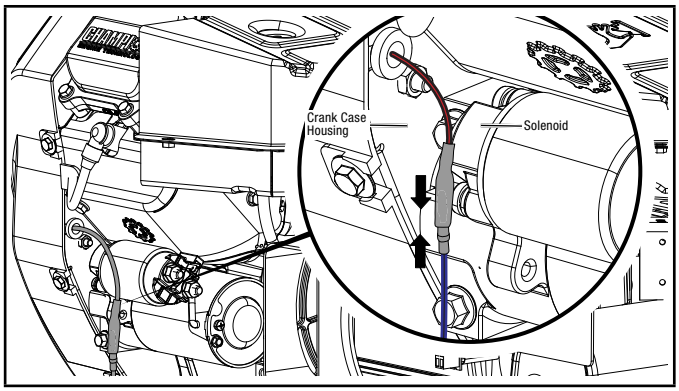
6. Remove two fasteners located at front side of starter motor. Remove with 10mm socket and ratchet.



7. Remove starter Motor Assembly.
8. Reverse procedure for Installation.

9. Upon assembly, do not pinch any wires between the starter and crank case housing.





Removal and Installation of Starter Motor Assembly - Single Cylinder Engine

Technical Bulletin Number 1804-100-10-1 ***Starter motor removal and installation single cylinder engine HSB Generator.***

When Diagnostics found the following:

- Batteries are fully charged
- Engine Cranks slowly, or will not crank
- Hz Over / Under fault is active
- Starter motor spins but does not engage engine
- Black dust is visible on HSB floor (Base Center) below Starter Motor

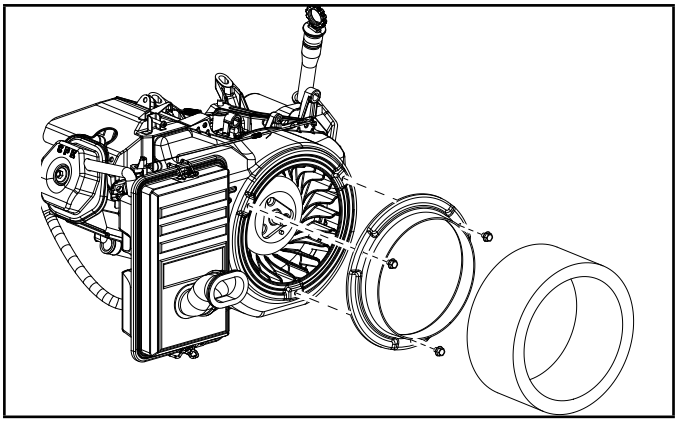
HSB Shut down Checklist

To make sure the generator is shut down during maintenance or repair. The following items must be checked:

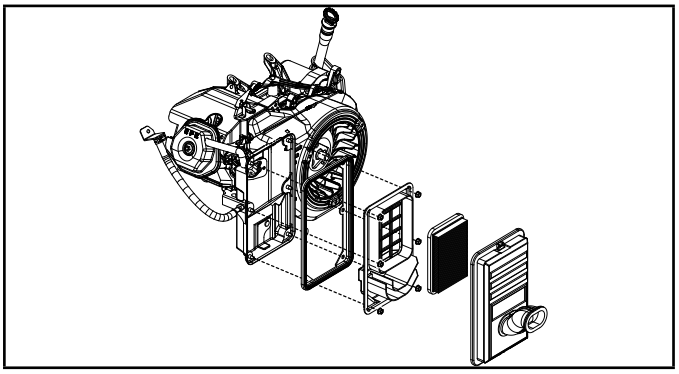
- ☐ Fuel valve is in the OFF position.
- ☐ Battery cables are disconnected from batteries. Disconnect the negative side of the battery first.
- ☐ ATS control module is in the OFF position.
- ☐ Engine control module is in the OFF position.

Procedure for Removing Starter Motor

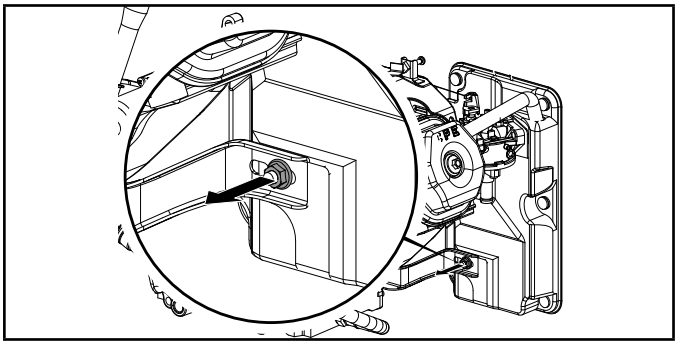
1. Remove Foam ring between firewall and engine fan cover.



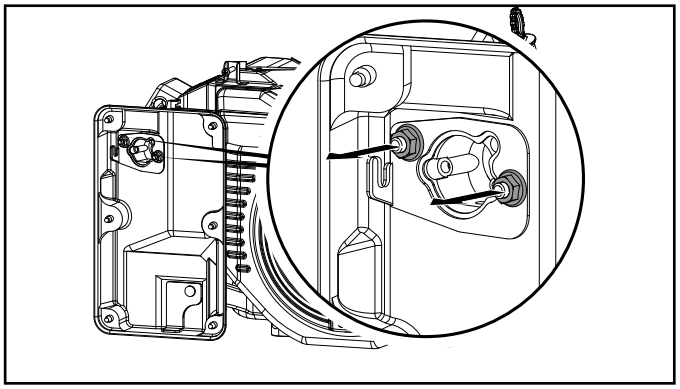
2. Remove air cleaner cover.
3. Remove filter element.



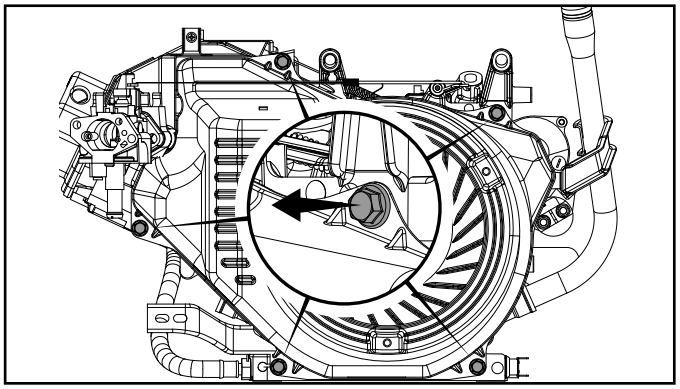
4. Remove Air cleaner separator – 6 nuts – use 8 mm nut driver.
5. Remove air cleaner support nut. Nut location: bottom back side of air cleaner base. Use a 10 mm box wrench.



6. Remove (2) nuts located at Carburetor inlet of air cleaner base . Use a 10 mm socket, 3/8 inch extension, and ratchet. Remove air cleaner base.



7. Remove (5) Fasteners from fan cover. Use a 10 mm socket, 3/8 inch extension, and ratchet. Carefully guide fan cover away from engine.

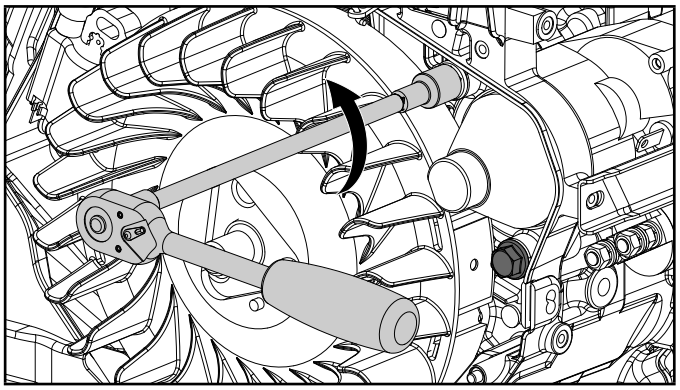


8. Locate (2) fasteners holding Starter motor to engine block.

   8a. Remove Starter motor fasteners.

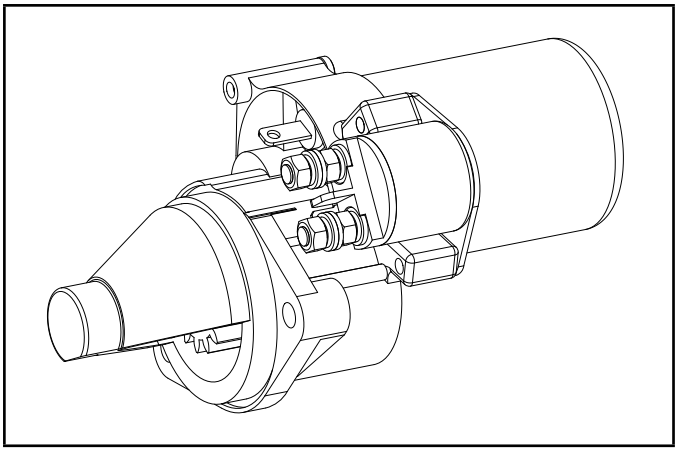
   8b. Use 12mm socket, 3/8-inch extension.

   8c. 3/8-inch ratchet to remove fasteners.



9. Guide starter motor assembly away from engine block.

10. Reverse the procedure for installing starter motor.



After Removal and Installation of Starter Motor Assembly All Models

After repairs are complete perform the following:

HSB Test Mode

- Battery Cables are connected to batteries
- Fuel valve is in the OPEN position
- ATS control module 100667 Switch to OFF position
- Engine control module 100666 Switch to the OFF position
- When Engine Control module is switched to Manual position HSB will start
- HSB circuit breaker in the ON position
- Check power output at Terminal Block #2
- If there is output voltage move to HSB Ready Checklist
- If not recheck connections, switches, and grounds
- Consult the HSB Operations Manual

HSB Ready Checklist

- ☐ ATS control module (100667) is in the AUTO position
- ☐ Engine control module (100666) is in the ATS position

Set the Exercise Time

- The Engine Control Module switch must be in the ATS mode
- Decide on the desired day and time to exercise the HSB generator
- Press the exercise switch to ON
- The HSB generator will start and run for 15 minutes and then shut off
- The exercise time is now set
- The HSB generator will begin the next exercise period exactly 168 hours from when the exercise switch was pressed to the ON position

HIGH ENGINE TEMPERATURE

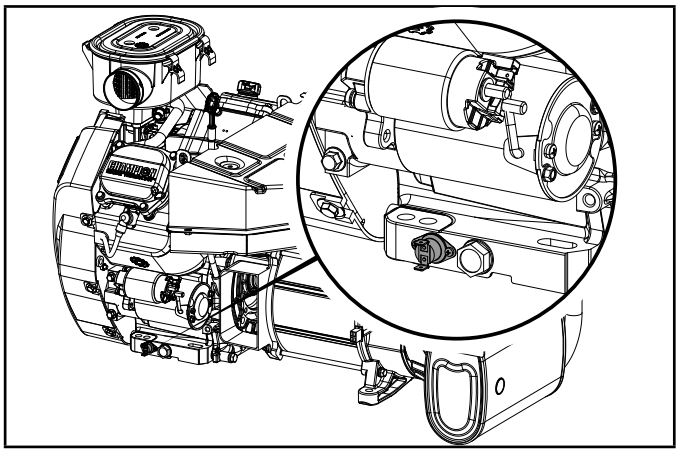
Fault occurs when engine operating temperature exceeds the factory preset limits. If excessive operating temperature is detected, the HSB will shut down and re-start will be disabled. The RED LEDs on the engine control module and enclosure exterior are lit.

This failure could be the result of an excessive load or high ambient temperatures. Should this fault occur do the following;

1. Open the enclosure doors to increase air flow throughout the unit.
2. Reduce / remove load on engine.
3. Check oil level, add oil if required.
4. Inspect the interior and exterior of the enclosure for debris, leaves, etc.
5. Remove debris to increase air flow around and inside the unit.
6. Once the engine temperature falls into the normal operating range, generally 30 minutes, follow the reset procedures in the manuals specific to your model to clear and correct fault.
7. If fault continues to activate test the engine temperature switch.

Temperature Switch

- Is located below starter motor
- Is fastened to engine block with (2) screws
- Has (2) wires connected to each side of switch
- Is normally open
- Designed to close when engine temperature increases above rated switch setting
- Engine shuts down



Test Temperature Switch

- Allow engine to warm up for at least 30 minutes with (2) wires disconnected
- Temperature switch wires can be removed from temperature switch at any time to remove it from the system

– When engine is warmed up. Plug in (2) wires to temperature switch
– If warm engine shuts down after plugging in wires, switch has failed. Replace failed temperature switch as soon as possible
– Check all HSB enclosure louvers for debris or blockage
– Check Engine air inlet grill for debris or blockage
– Check Engine oil cooler for debris or blockage

LOW OIL

Low oil fault occurs when engine control module senses that oil level has dropped below the safe operating level.

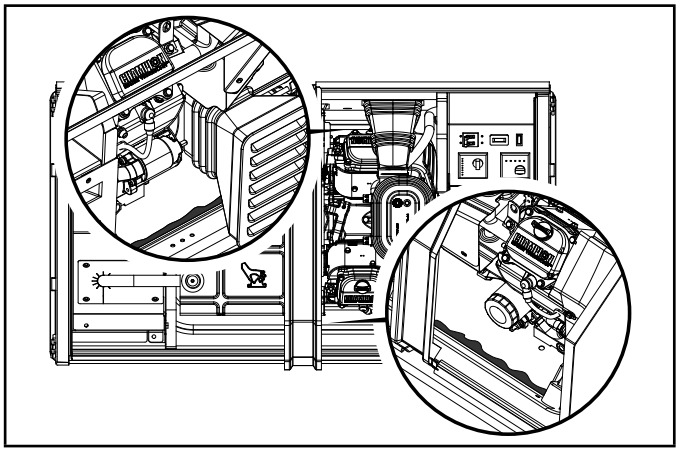
When this happens, the engine will shut down. Should this fault occur do the following;

1. Check the engine oil level before attempting to restart the engine. The engine may start but will immediately shut down until the problem is corrected. If oil level is full go to next step.
2. Check Low oil shut down switch connection. If Connection is secure go to next step.
3. Test low oil shut down switch if steps 1 & 2 are performed, and fault continues to activate.

Oil Leak Identification – All Models

If an oil leak is found check the following:

– Drain Plug – Is it tight
– Oil filter – Is it tight
– Oil cooler Lines – are line clamps tight
– Are cooler lines free of cracks and pin holes
– Replace oil cooler hose if leaks are found
– Crankcase cover – Check the torque on the crankcase cover to reseal gasket. See Torque Specification pages 67 – 68.
– Rocker Cover Gaskets – Look for signs of leakage between Rocker Cover and Cylinder Head
– Replace Rocker Cover Gaskets if needed
– Dip stick and Tube – Make sure dip stick is installed correctly
– If dip stick pulls out of tube during operation shut down HSB Generator
– Call Champion Power Equipment



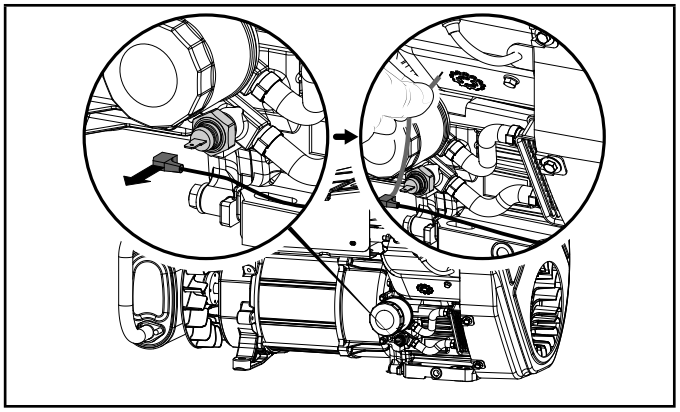
Low Oil Shut Down Switch – Twin Cylinder Engines

Oil Pressure = 36.3 psi to 43.5 psi

Engine control module logic tests pressure circuit for ground (closed position) before start cycle will begin. If switch is grounded, then start cycle will run and engine should start. A few seconds after alternator reaches 58Hz (point of successful start and end of start cycle) the control logic will retest oil pressure circuit and is looking for an open circuit (pressure exceeds oil sender lower limit). If circuit is still grounded (closed position) then system assumes no oil pressure and engine is shut down.

Test: Low Oil Shutdown Switch

– It is possible to manually bypass the switch to check if oil pressure switch has failed
– Remove wire from low oil shutdown switch and hold terminal end onto engine block (grounds circuit)
– If possible attach a jumper wire from terminal end of Low oil shut down wire



– Turn engine control module switch to manual while continuing to hold Shut Down Switch wire terminal on engine block
– When engine is cranking or just beginning to run, remove wire from engine block
– Let engine operate for 20 to 30 seconds

– Re-install the wire to the Low Oil Shutdown Switch
– If engine shuts down, and Low Oil Fault code is activated
– Replace Low Oil Shutdown Switch

NOTICE

As of November 2018 a re-designed switch has been added to all twin cylinder HSB Generators. See Technical Bulletin 191220-100-50-1 for information on testing this low oil switch.

WARNING

Operation of HSB Generator without a functioning Low Oil Pressure Switch can lead to catastrophic failure.

This procedure is only for testing purposes.

Removal and Replacement of Low Oil Shutdown Switch

Before removing Low Oil Shutdown Switch

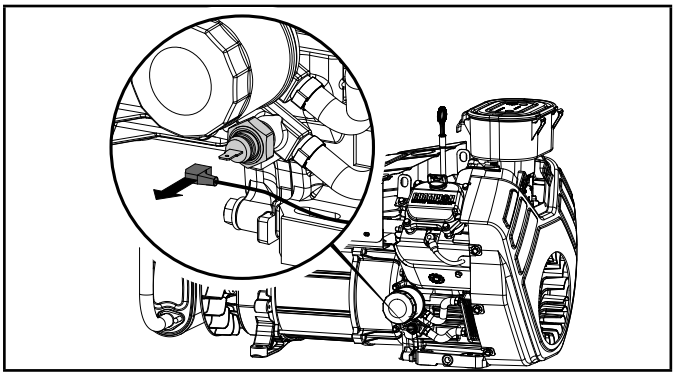
HSB Shutdown Checklist

To make sure the generator is shut down during maintenance or repair. The following items must be checked:

☐ Fuel valve is in the CLOSED position.
☐ Battery cables are disconnected from batteries. Disconnect the negative side of the battery first.
☐ ATS control module (100667) is in the OFF position .
☐ Engine control module (100666) is in the OFF position.

Removal and Replacement

1. Remove yellow wire terminal from Low Oil Shutdown switch.



2. Place an oil catch pan or oil absorbent towel on floor below Low Oil Shutdown Switch.
3. Using a 24 mm deep well socket and ratchet remove the Low Oil Shutdown Switch from oil filter housing.
4. Install the new Low Oil Shutdown Switch.
5. Tighten until snug. Do not over tighten. Over-tightening could lead to cracks at the oil filter adapter.
6. Apply Di electric grease to contacts.

After Removal and Installation of Low Oil Shutdown Switch

HSB Test Mode

– Check engine oil level
– Battery Negative cable connected to battery
– Fuel valve is in the OPEN position
– ATS control module 100667 Switch to OFF position
– Engine control module 100666 Switch to the OFF position
– When Engine Control module is switched to Manual position HSB will start
– Check Low Oil Fault at engine control module
– If engine control module is showing fault re check Low Oil Shut Down Switch, and wire connection
– If engine control module is showing no fault proceed to HSB Ready Check list

HSB Ready Checklist

☐ ATS control module (100667) is in the AUTO position.
☐ Engine control module (100666) is in the ATS position.
☐ HSB circuit breaker in the ON position.

Set Exercise Time

1. The Engine Control Module switch must be in the ATS mode.
2. Decide on the desired day and time to exercise the HSB generator.
3. Press the exercise switch to ON.
4. The HSB generator will start and run for 15 minutes and then shut off.
5. The exercise time is now set.
6. The HSB generator will begin the next exercise period exactly 168 hours from when the exercise switch was pressed to the ON position.

Preventative Maintenance of Low Oil Shutdown Switch – Twin Cylinder Engines

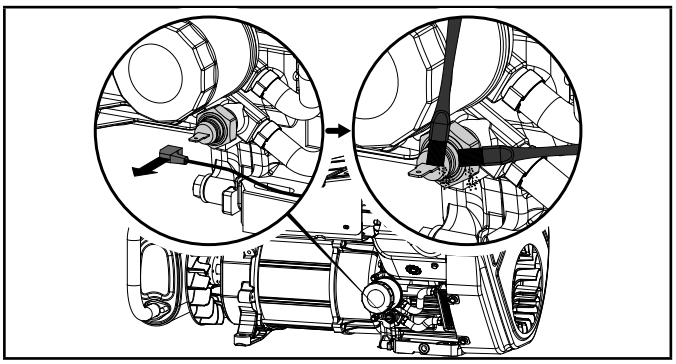
Keep moisture from Low oil shutdown switch pressure spring.

The combination of humidity and salt in some regions can penetrate the sensor tab vent, and the plastic -metal seam of Low Oil Shut-Down switch causing corrosion to the pressure spring inside of the switch.

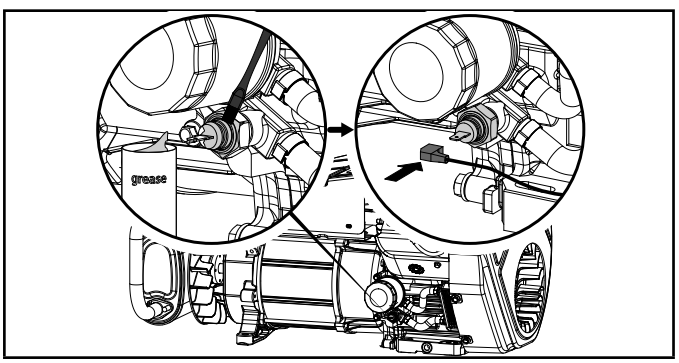
NOTICE

Preventative maintenance is recommended for all HSB Generators.

1. Locate Low Oil Shut-Down Switch.
   1a. Location is to the right of the oil filter next to the Oil Cooler hoses.
2. Clean the Low Oil Shut-Down Switch.
   2a. Remove yellow wire from Low Oil Shut-Down Switch sensor tab.
   2b. Use soapy water and a paint brush to clean all plastic and metal surfaces.
   2c. Work brush into Plastic / Metal seam to remove all dust and dirt.



3. Rinse off Low Oil Shut-Down Switch.
   3a. Use a clean spray bottle full of clean water to rinse off Low Oil Shut-Down Switch.
   3b. Use the fine spray setting to spray plastic - metal seam area.
4. Dry Low Oil Shut-Down Switch.
   4a. Using a clean cloth dry off Low Oil Shut-Down Switch.
   4b. Use compressed air or a hair dryer to blow dry if applicable.
5. Apply grease to Low Oil Shut-Down Switch.
   5a. Use a small brush.
   5b. Work the grease into the plastic - metal seam of switch.
   5c. Brush entire switch and sensor tab with grease.
   5d. Reconnect yellow wire to Low Oil Shut-Down sensor tab.



6. Maintenance Completed.

NOTICE

Recommended grease:

– Dielectric grease

OVER CRANK

Over Crank Fault Code

– Cranking frequency, or Hz needs to be a minimum of 56 Hz for the engine to start and run
– Systems such as ignition, oil, and fuel need to be operational
– Allow the HSB to go through 5 starting cycles

⚠ CAUTION

Turning off the engine control module while performing 5 start cycle will disable fault sensing, and no faults will appear.

– If 5 cycles are completed and over crank fault light comes ON, the engine control module is working properly
– If Not - Look for problems at wire harness, harness connections, and main relay board “Frequency” terminals 13 & 14
– If 5 cycles are completed and over crank fault light is OFF, the engine control module has malfunction

Troubleshooting: Over Crank

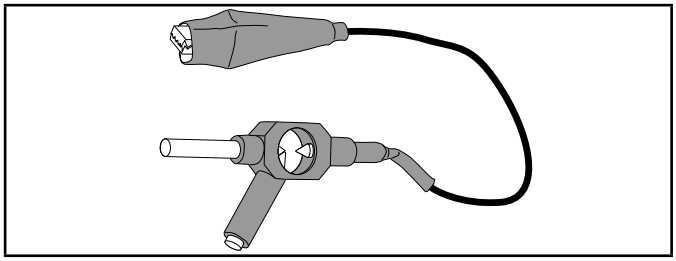
– Engine will not start after 5 starting cycles
– Over crank fault indicator LED is ON

Check for Ignition Spark

⚠ WARNING

Electrical spark is present during this test.

– Remove coil wire from spark plug
– Remove spark plug, and inspect
– Insert an ignition wire spark tester into spark plug boot



– If no spark is visible, the ignition coil has malfunctioned and will need replacement

Check Low Oil Shut down Switch

– Engine control module logic tests pressure circuit for ground (closed position) before start cycle will begin

– See Low Oil Section of Diagnostic manual

Fuel System

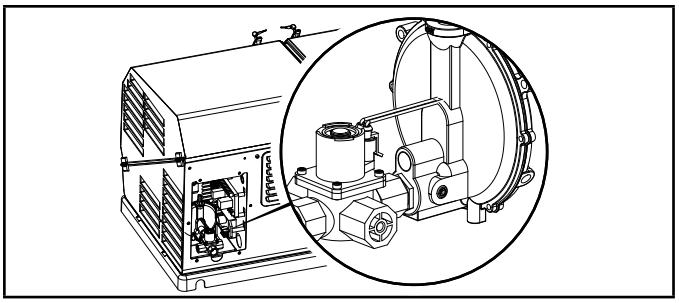
Check Fuel Pressure

1. Check fuel system requirements, and pipe length in the HSB Installation Manual.
2. Is there fuel to the engine?
3. Check fuel shut off valve.
4. Is fuel pressure set correctly?
5. Manometer check: Confirm fuel psi to fuel regulator. Pressure is measured in Inches of H2O.
6. Fuel System Requirements: LPG = 10-12 inch - H2O, NG = 5-7 inch – H2O.

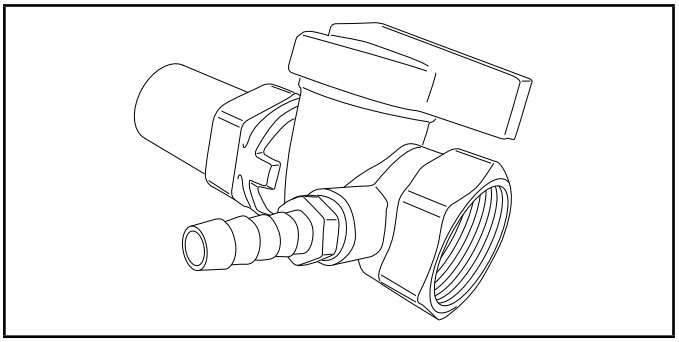
Measure Fuel Pressure: Locations

There are three possible locations to measure fuel pressure on the HSB Generator.

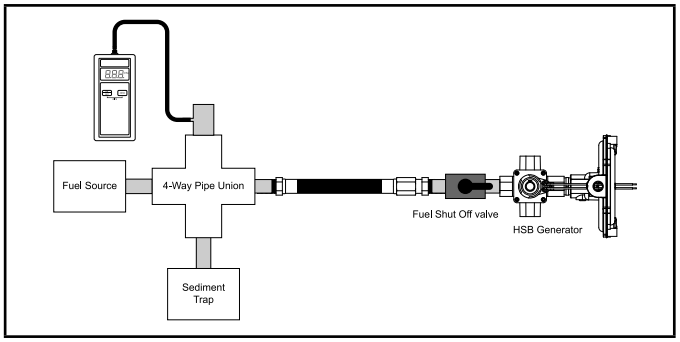
1. Measure at Fuel Regulator – There is an access plug located on the firewall side of fuel regulator. The plug is located where ideal fuel pressure can be measured. This measurement location is very difficult to access.



2. If allowed by National and local codes, install a fuel shut off valve that incorporates an access port to measure fuel pressure



3. Install a 4- way union into Utility fuel piping. Create a manometer access port on the top of the 4- way pipe union. Make sure the flexible fuel hose is installed between the fuel pipe, and the fuel shut off solenoid.



Solenoid Valve, LPG / NG

Solenoid Valve PN 161.134100.00 is a normally closed safety shut-off valve suitable for use with LPG or NG low pressure vapor. Solenoid Valve, LPG / NG is a 12-VDC switch that opens seconds after the starting cycle begins.

Check Voltage: Wiring Circuit - Solenoid Valve, LPG / NG

All HSB Generators utilize a 24 VDC Charging – Starting electrical system.

To allow the 12-VDC Fuel Shut Off Solenoid to operate, a resistor is wired between the Main Relay Board, and the Fuel Shut Off Solenoid positive side.

– There should be 24 VDC at wire, between Main Relay Board and resistor

– There should be 12 VDC at wire, between resistor and Fuel Shut Off Solenoid

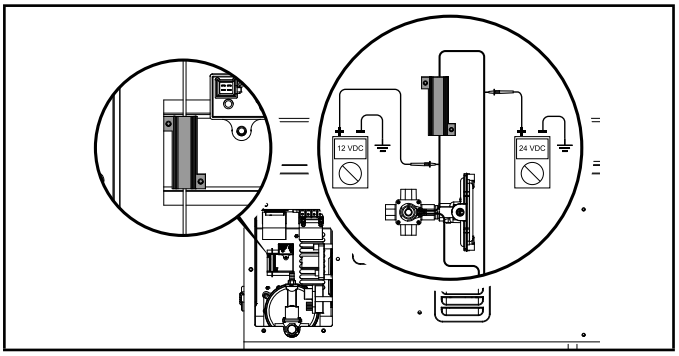
– The resistor reduces voltage by one half

– If there is no voltage between resistor and Fuel Shut Off Solenoid, and 24 VDC before the resistor

– Replace the resistor

– If there is 12 VDC between Resistor and Full Shut off

– Solenoid. Check electrical and mechanical components of the fuel shut off solenoid.



Troubleshooting: 12 VDC at Solenoid Valve, LPG / NG - Engine Will Not Start

Applies to both single cylinder and V-twin HSB Generators using Champion PN 161.134100.00 Solenoid Valve, LPG/NG.

Fault code – Over crank.

Fuel shut off valve should be in the OPEN position.

Fuel Pressure is sufficient: NG = 5-7 in. water column, LPG = 10-12 in. water column.

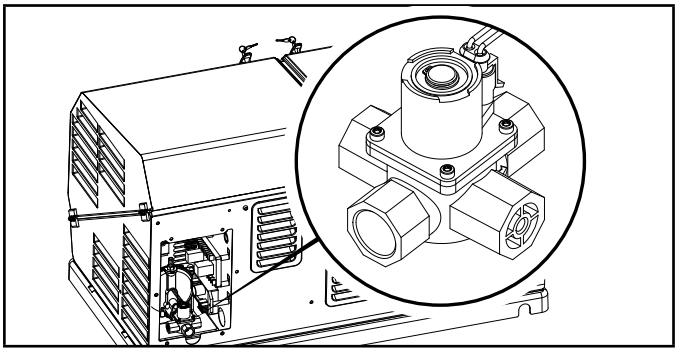
Batteries are fully charged: 28 VDC.

When engine is cranking there is ~ 12 VDC at Fuel Shut Off Solenoid.

Tapping on Solenoid valve with hammer, or Appling heat to Solenoid valve with heat gun allows engine to start.

Cause of Malfunction

Solenoid is being powered, but valve is not responding and there is no fuel flow.



Repair Procedure

Tools Needed

- 3/8 in. Ratchet
- 3/8 in. × 10 mm Socket
- 3/8 in. × 2 in. Extension
- 1/4 in. Ratchet
- 1/4 in. × 2 in. Extension
- 1/4 in. T-20 Torx Socket
- Clean Rag

12 VDC at Fuel Shut Off Solenoid - Engine Will Not Start

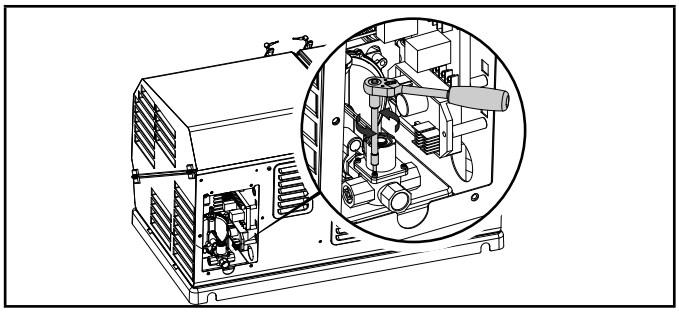
HSB Shut down Checklist

To make sure the generator is shut down during maintenance or repair. The following items must be checked:

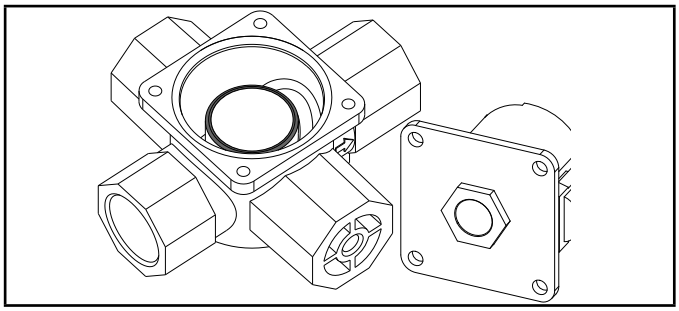
- ☐ Fuel valve is in the CLOSED position.
- ☐ Battery cables are disconnected from batteries. Disconnect the negative side of the battery first.
- ☐ ATS control module (100667) is in the OFF position.
- ☐ Engine control module (100666) is in the OFF position.

Service Solenoid Valve

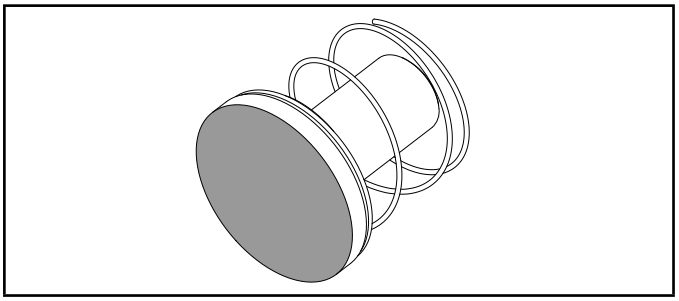
- Remove rear access panel above fuel piping of HSB generator – 10 mm socket
- Locate Fuel Shut Off Solenoid and disconnect wire harness
- Lift black tab and pull out connection terminal end
- Remove (4) Fasteners holding solenoid assembly to the fuel valve housing – TORX – 20 Socket



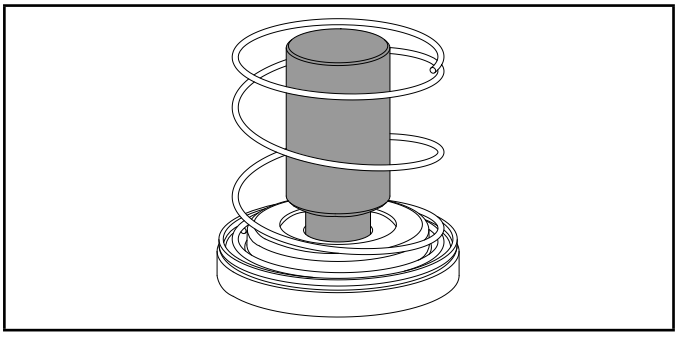
- Remove solenoid, plunger, and spring from fuel valve housing
- Inspect plunger – look for corrosion and excessive grease on rubber contact surface of seal



- If grease is visible on rubber surface, wipe surface clean
- Apply a very light coating of Silicone Grease or Teflon spray coating to rubber surface



– Check for corrosion on plunger shaft



– Contact Champion Power Equipment if corrosion is found
– Replace 161.134100.00 Solenoid Valve if corrosion is found

Reassembly

Place cleaned Plunger and Spring assembly on top of cleaned solenoid valve seat.

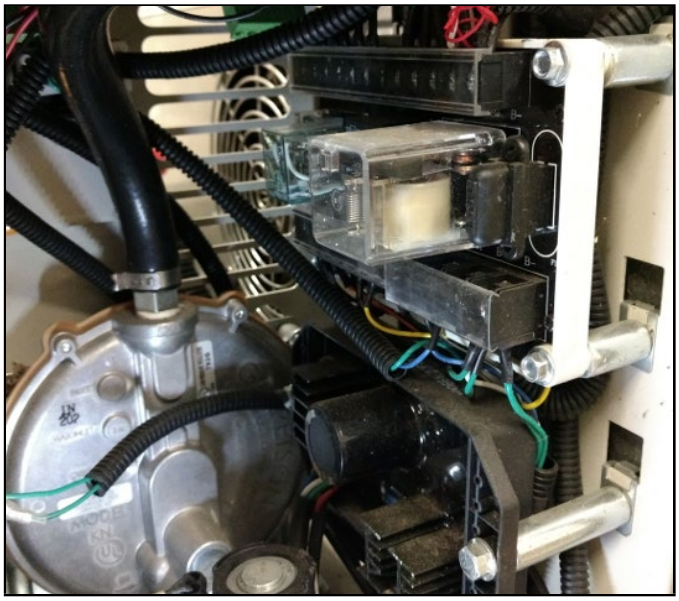
Slide solenoid and mounting plate over plunger assembly and install fasteners - (4) Fasteners use TORX # 20 Socket.

Do not over tighten fasteners. Tighten to 7 Nm (62 in. – lbs.).

Install solenoid wire harness terminal end. End should snap into place.

HSB Starts, Operates Then Shuts Down.

– Check the voltage at the 100417 Main Relay Module mounted on the fire wall next to the fuel shut off solenoid, and above the AVR.



– Measure voltage at terminals marked FUEL. Both the top and bottom terminals marked FUEL should read 24VAC when HSB is operating.

– If voltage is 24VAC on the top Fuel Terminal, and voltage drops, or there is no meter reading after 10 seconds on the bottom Fuel terminal, replace the 100417 Main Relay Board.

HSB Test Mode

– Battery Cables are connected to batteries
– Fuel valve is in the OPEN position
– ATS control module 100667 Switch to OFF position
– Engine control module 100666 Switch to ON position

When switched to ON position HSB will start.

– HSB circuit breaker in the ON position
– Check power output at Terminal Block #2
– If there is output voltage move to HSB Ready Checklist, Page 3
– If not recheck connections, switches, and grounds
– Consult the HSB Operations Manual

HSB Ready Checklist

☐ ATS control module (100667) is in the AUTO position.

☐ Engine control module (100666) is in the ATS position.

Set Exercise Time: Required After Disconnecting Battery

– The Engine Control Module switch must be in the ATS mode

– Decide on the desired day and time to exercise the HSB generator

– Press the exercise switch to ON.

– The HSB generator will start and run for 15 minutes and then shut off

– The exercise time is now set

– The HSB generator will begin the next exercise period exactly 168 hours (one week) from when the exercise switch was pressed to the ON position

ENCLOSURE: ALL MODELS - HSB GENERATOR

Disassembly – Side Covers

Ensure that the ATS and Engine Switches are in the OFF position before performing any disassembly, maintenance or cleaning.

⚠ CAUTION

When removing right side cover assembly, care should be given to Control Panel Wiring and ECU.

– Fuel valve is in the CLOSED position

– ATS control module (100667) is in the OFF position

– Engine control module (100666) is in the OFF position

– Battery cables are disconnected from batteries. Disconnect the negative side of the battery first.

– Remove batteries from enclosure

– Remove fuel hose at fuel shut off solenoid

– If conduit is used for HSB power wires, power wires may have to be disassembled

Home Standby Generator will need to be raised and supported at least 6" off ground or foundation. Removal and Replacement of floor fasteners is required for this procedure.

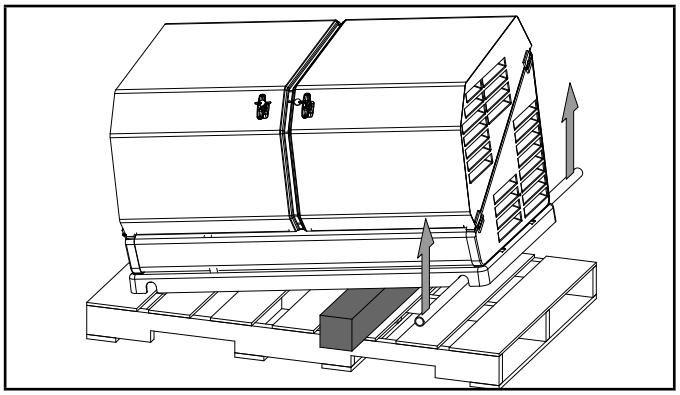
– Remove Lid - Cover assembly. See (Disassembly Lid)

– Remove Cover Assembly

– Slide a long pipe through access holes in plastic pallet

– Requires (2) individuals to lift both ends of pipe to raise HSB off plastic pallet

– Place a 4 in. × 4 in. × 4 ft. wood post underneath HSB enclosure

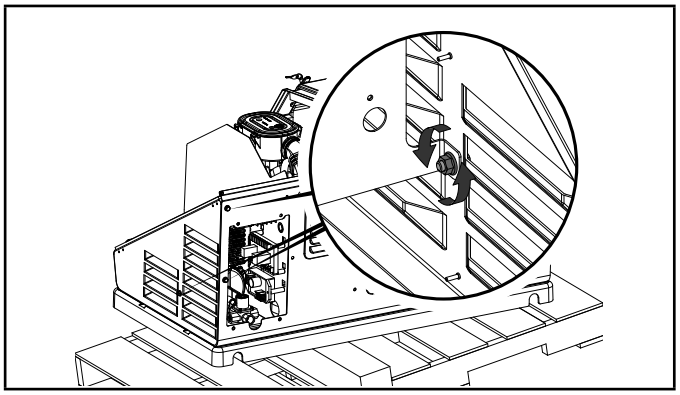


– May need a third individual to slide 4×4 post Underneath plastic pallet

– There should be at least 6 in. of clearance between floor fasteners, plastic pallet, and ground

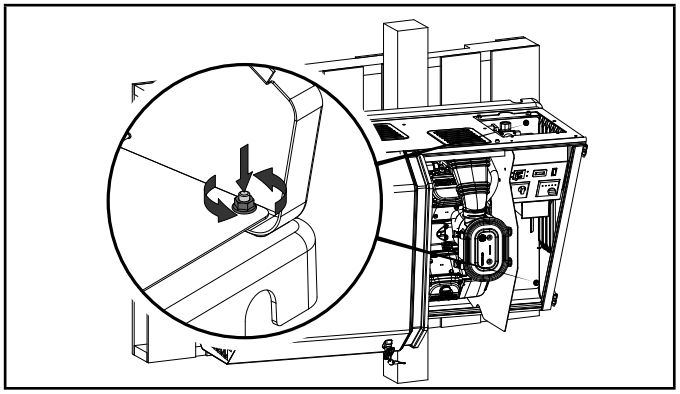
Right Side Cover

– Remove Right side lid (see Disassembly – Lid)



– Remove batteries from enclosure

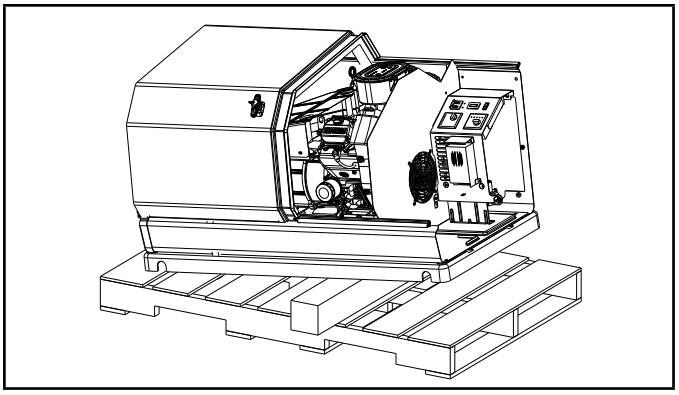
– Remove (2) Floor nuts then tap out fasteners



– Tap fasteners until fasteners fall out of plastic pallet

– Remove (3) fasteners one in middle of cover and two on back side of cover

– Remove panel by sliding out from underneath floor



Left Side Cover

– Remove Left side lid (see Disassembly – Lid)

– Slide a long pipe through access holes in plastic pallet

– Requires (2) individuals to lift both ends of pipe to raise HSB off plastic pallet

– Place a 4 in. × 4 in. × 4 ft. wood post underneath HSB enclosure

– May need a third individual to slide 4 × 4 post underneath plastic pallet

– There should be at least 6 in. of clearance between floor fasteners, plastic pallet, and ground

Thermal Baffle and Muffler Cover

– Remove Thermal baffle - (4) fasteners

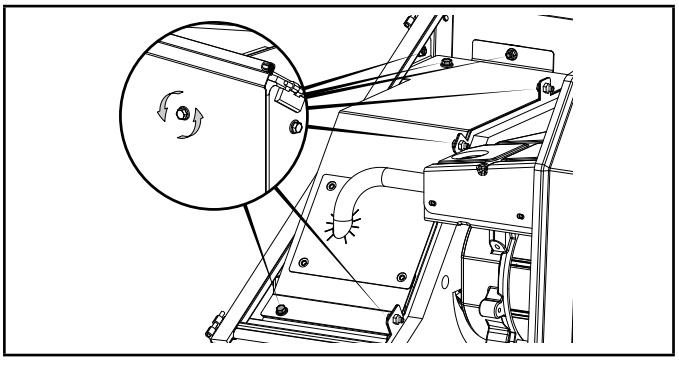
– Stuck Thermal baffle - pry off using a screwdriver

– Remove Muffler cover, Top (7) Fasteners

– (5) Fasteners inside enclosure,

– Fastener on back panel

– Fastener on top part of Left Side Cover



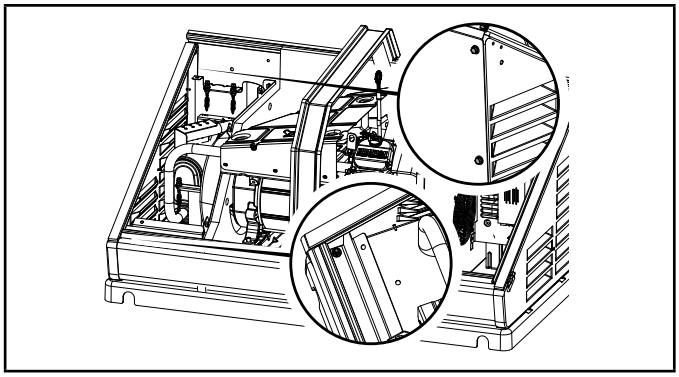
Left Side Cover - Continued

– Remove (1) Floor nut then tap out fastener

– Tap fastener(s) until fastener fall out of plastic pallet

– Remove (2) fasteners on back side of cover

– Remove panel by sliding out from underneath floor



Reassembly of Left, Right Side Covers

– Reverse the above procedures to reinstall Left and right side covers

ENCLOSURE: HSB GENERATOR SINGLE CYLINDER

Firewalls

Disassembly of Firewalls – 8.5 kW HSB

Ensure that the ATS and Engine Switches are in the OFF position before performing any disassembly, maintenance or cleaning.

⚠ CAUTION

When removing right side cover assembly, EXTRA care should be given to Control Panel Wiring and ECU. Follow procedure below.

– Fuel valve is in the CLOSED position

– ATS control module (100667) is in the OFF position

– Engine control module (100666) is in the OFF position

– Battery cables are disconnected from batteries. Disconnect the negative side of the battery first.

– Remove batteries from enclosure

– Remove fuel hose at fuel shut off solenoid

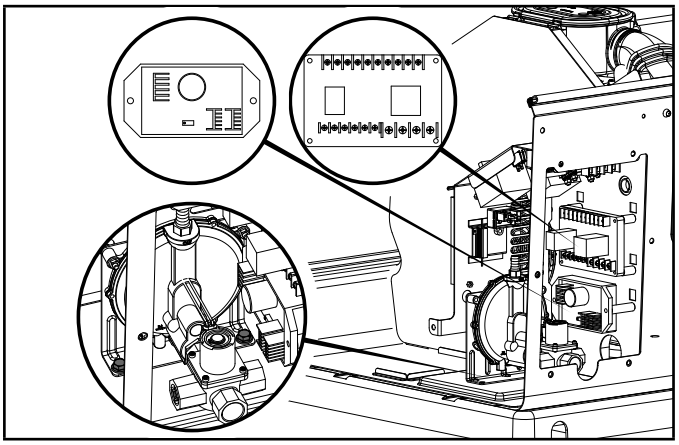
– If conduit is used for HSB power wires, power wires may have to be disassembled

Disassembly of Single Cylinder Firewall - Control Panel - Right Side

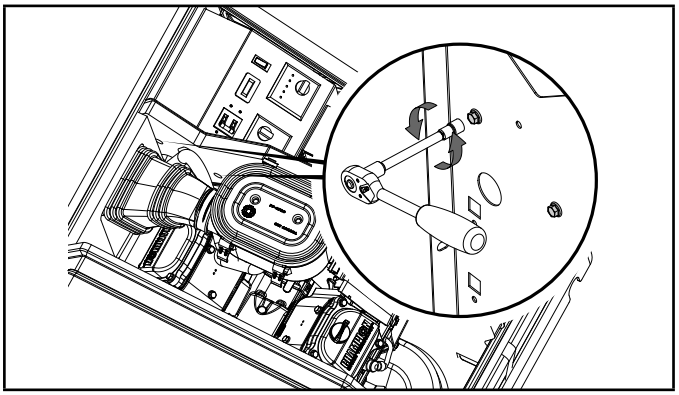
– Right side cover needs to be removed, follow Remove right side cover in the Disassembly – Side Covers section

– Remove batteries from enclosure

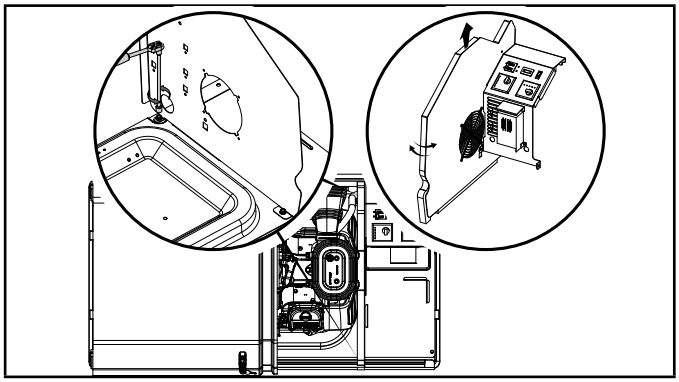
- Disconnect wires and cables that feed through bottom of firewall
- Mark all wire ends with identification
- Pull wire harness into engine compartment
- Disconnect fuel hose from mixer
- Unfasten Regulator bracket from floor
- Mark all wire ends with identification
- Remove regulator –hose assembly
- Unfasten AVR, (2) fasteners
- Unfasten main relay board (4) fasteners



- Remove (2) fasteners located on engine side of Firewall
- Control panel mounting fasteners. Use a 10 mm socket and ratchet



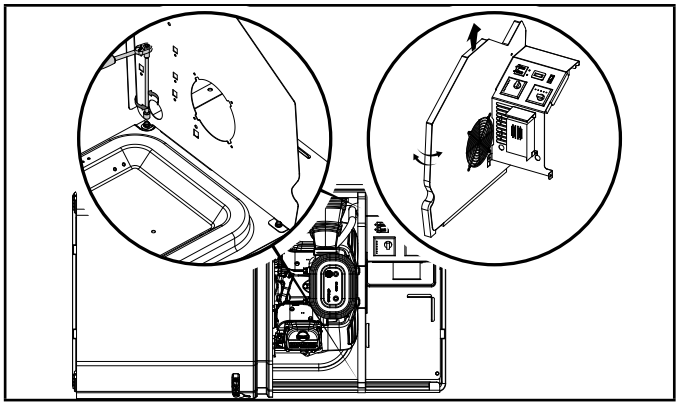
- Remove (2 fasteners mounted on each end of firewall
- Floor mounting fasteners of Firewall
- Use a 12 mm socket, and ratchet with long extension



- Double check to make sure all parts are unfastened from firewall
- Wiggle firewall back and forth to release from HSB enclosure
- Lift firewall to separate from mounting fasteners
- Pivot front of firewall clock wise while moving back of firewall up and away from control panel
- Lift Firewall and remove

Firewall Installation

Repeat the following procedure in reverse order.



Disassembly of Single Cylinder Firewall - Muffler Compartment – Left Side Firewall

NOTICE

Left side firewall most likely will be removed during engine and alternator service or replacement.

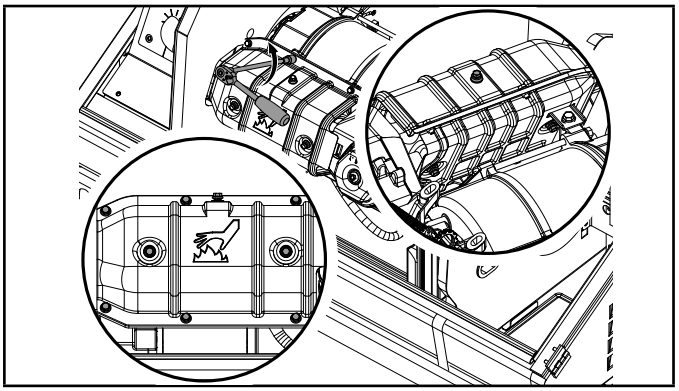
The Left side of the HSB Generator may need to be lifted and supported by a 4×4 wood post, in the event of a floor fastener falling out the bottom of plastic pallet.

Ensure that the ATS and Engine Switches are in the OFF position, fuel shutoff valve in the CLOSED position before performing any disassembly, maintenance or cleaning.

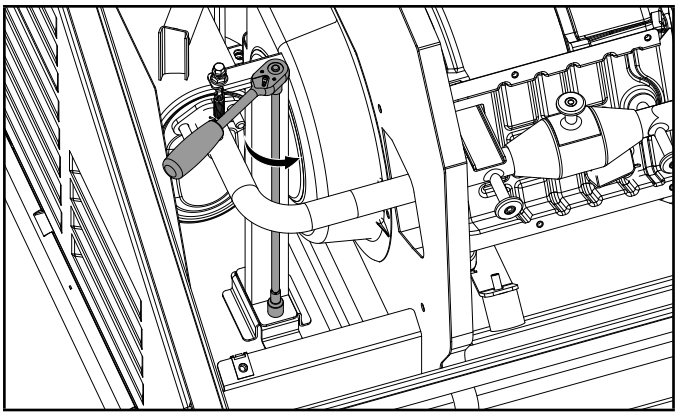
Remove Exhaust system

- Remove heat shield from exhaust pipe use 10 mm socket

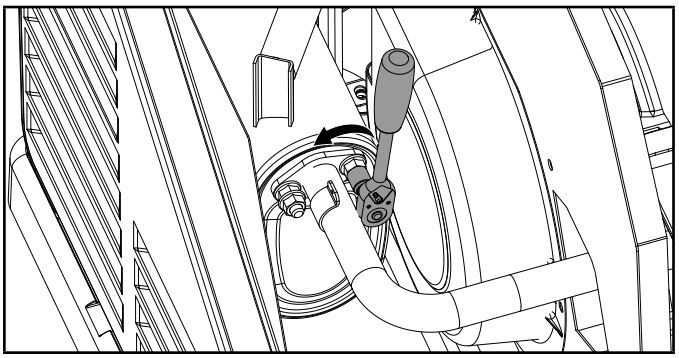
– Remove (2) fastening nuts from exhaust cylinder head connection



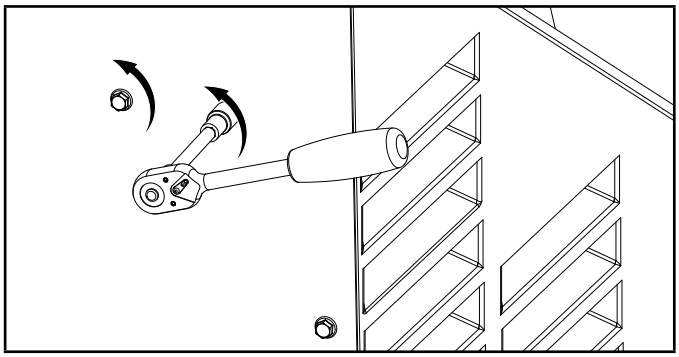
– Use 13 mm socket
– Remove Thermal baffle / gasket from Muffler compartment cover- 4 fasteners
– Use 10 mm wrench and socket
– Remove Muffler compartment cover – 7 fasteners
– Use 10 mm socket
– Remove Exhaust supporter / spring tower mounted on floor of Muffler compartment 2 fasteners



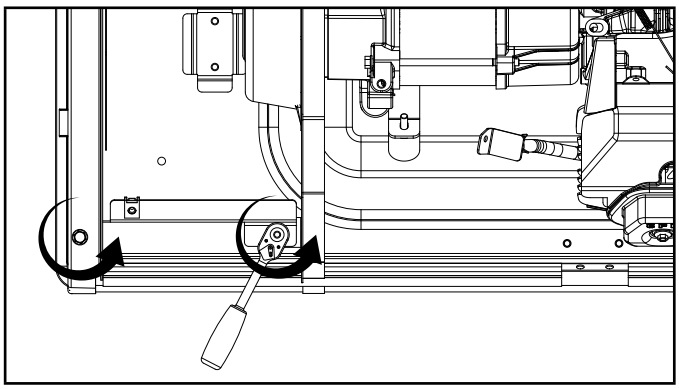
– Use 10 mm socket, long extension, and ratchet
– Remove fasteners at muffler to exhaust pipe connection

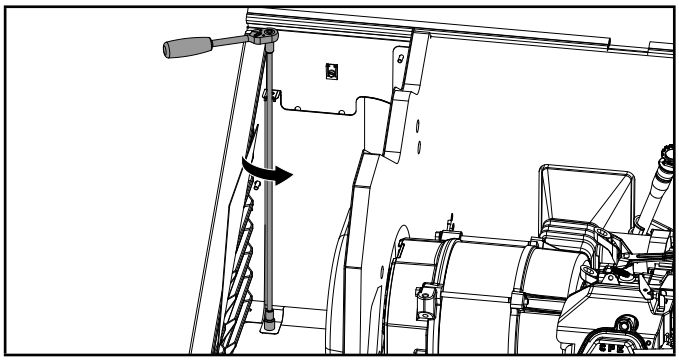


– Remove exhaust pipe by sliding through firewall then out of enclosure
– Use a 14 mm deep well socket
– Let muffler hang from muffler hangers
– On back panel of HSB enclosure remove (2) fasteners – use 10mm socket
– When removing last fastener support muffler hanger with one hand and
– Remove fastener with other hand
– When muffler bracket is free, lift muffler assembly out of HSB enclosure

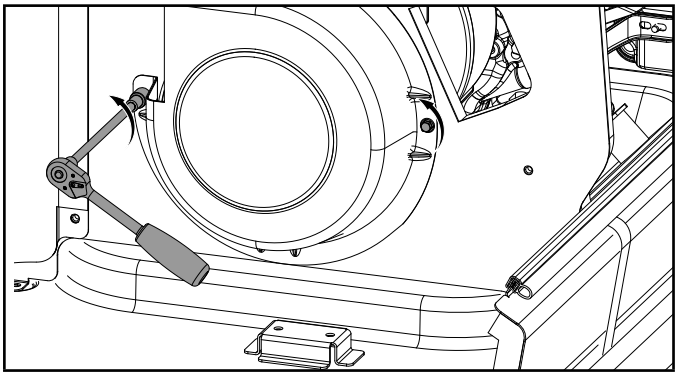


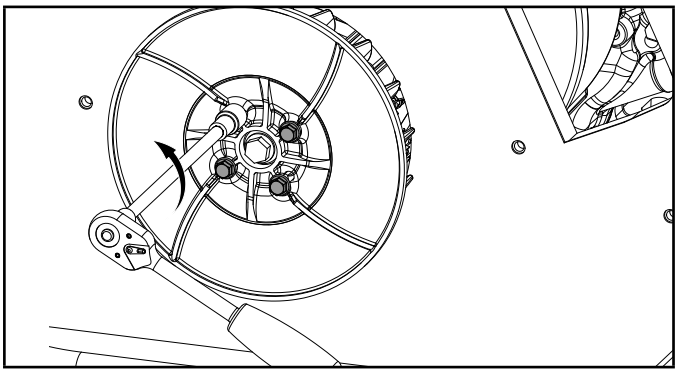
– Remove Muffler cover front
– Remove Muffler cover (back) - Heat shield
– 10 mm socket and 12 mm socket





– Remove Alternator Fan Cover
– Remove Alternator Fan
– 10 mm socket

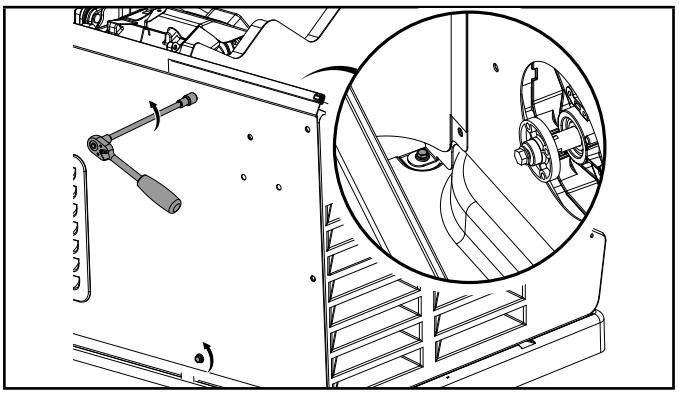




Remove Left Side Firewall

– Remove firewall floor fasteners

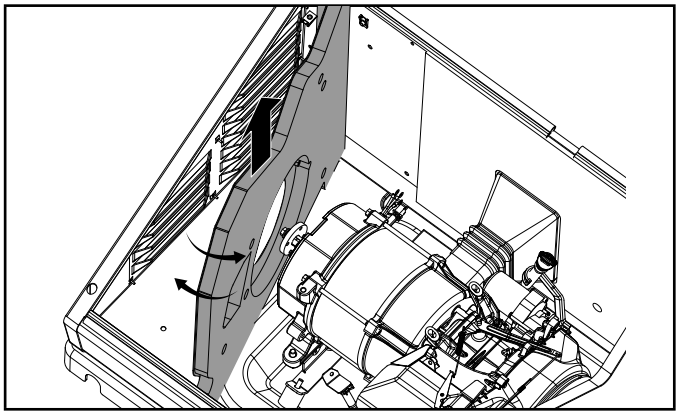
– 10 mm socket, and 12 mm socket



– Double check that all fasteners have been removed

– Lift firewall so bottom hold down brackets are above floor fasteners

– Rotate and tilt firewall so front of firewall is free from front enclosure cover



– Reverse process for Installation of Left Firewall

ENCLOSURE: HSB GENERATOR TWIN CYLINDER

Disassembly of Fire Walls – Twin Cylinder Engine HSB Generator

NOTICE

It's unlikely this firewall will ever need to be removed except for salvaging of parts.

Ensure that the ATS and Engine Switches are in the OFF position before performing any disassembly, maintenance or cleaning.

⚠ CAUTION

When removing right side cover assembly, firewall assembly, EXTRA care should be given to Control Panel Wiring and ECU. Read procedure thoroughly before attempting to remove firewall.

– Fuel valve is in the CLOSED position

– ATS control module (100667) is in the OFF position

– Engine control module (100666) is in the OFF position

– Battery Cables are disconnected from batteries

– Remove batteries from enclosure

– Remove fuel hose at fuel shut off solenoid

– If conduit is used for HSB power wires, power wires may have to be disassembled

Disassembly of Twin Cylinder Firewall - Control Panel – Right Side

Enclosure

– Right side cover needs to be removed, follow Remove right side cover in the Disassembly – Side Covers section

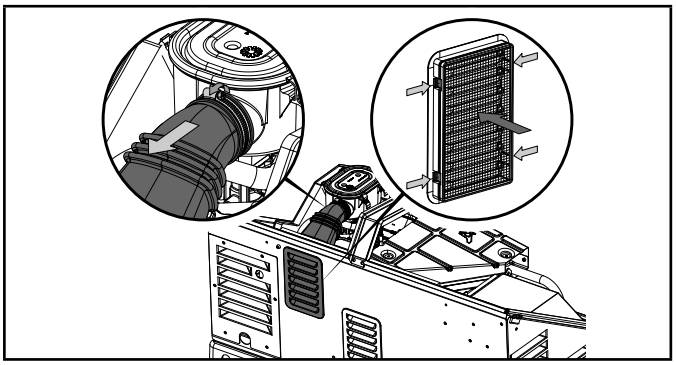
– Remove batteries from enclosure

Engine

– Remove Air Box Rubber Snorkel / pipe (Cylinder #1 side of engine)

– Loosen band clamp

– Pull off air box – pull off louver



Electrical

– Disconnect wires and cables that feed through bottom of firewall

– Mark all wire ends with identification

– Pull wire harness into engine compartment

– Mark all wire ends with identification

– Remove fuel hose clamp from firewall

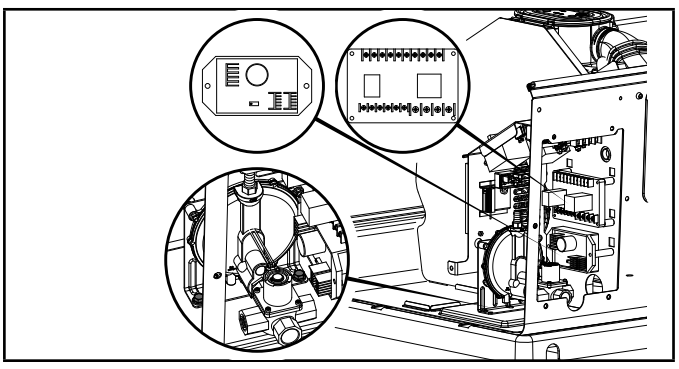
– Disconnect fuel hose from mixer

– Unfasten Regulator bracket from floor

– Remove regulator and hose assembly

– Unfasten AVR, (2) fasteners

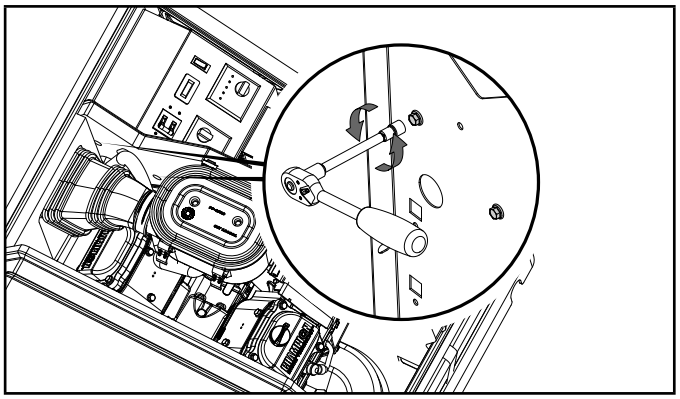
– Unfasten main relay board (4) fasteners



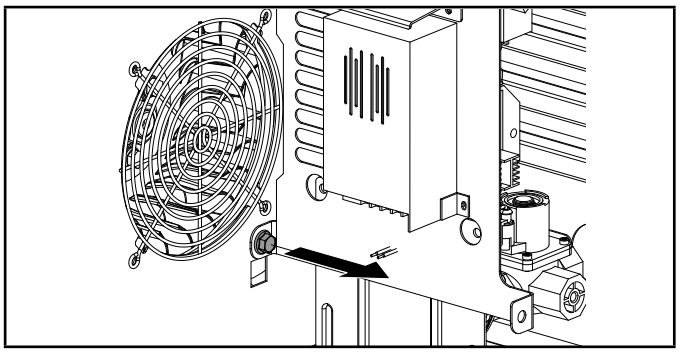
– Remove (1) fastener located on engine side of Firewall

– Control panel mounting fastener

– Use a 10 mm socket and ratchet

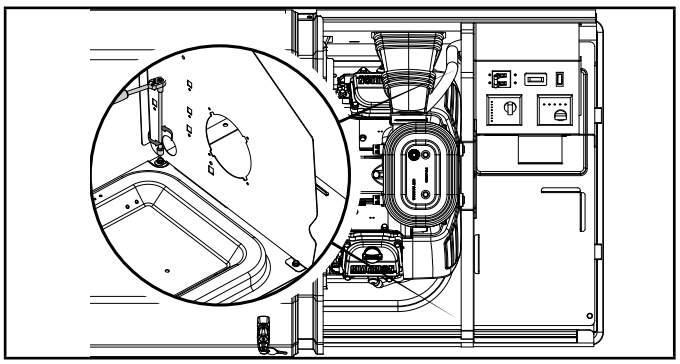


– Remove (1) control panel fastener bottom of firewall near the engine fan grill



– Remove (2) floor fasteners mounted on each end of firewall

– Use a 12 mm socket, and ratchet with long extension



– Double check to make sure all parts are unfastened from firewall

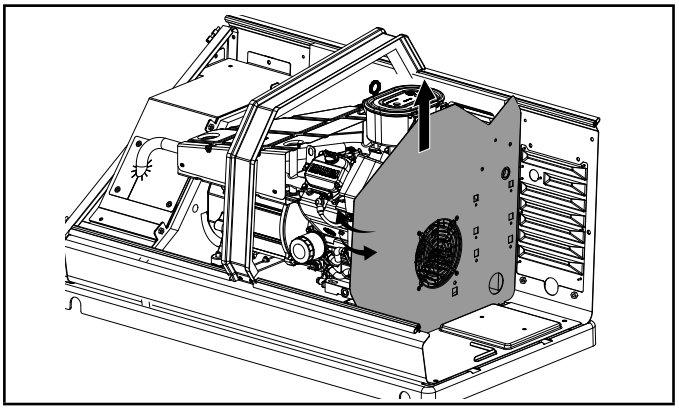
– Wiggle firewall back and forth to release from HSB enclosure

– Lift firewall to separate from mounting fasteners

– Pivot front of firewall counter clock wise

– While moving back of firewall up and away from control panel

– Lift firewall and remove



Firewall Installation

Repeat the following procedure in reverse order.

Disassembly of Twin Cylinder Firewall – Muffler Compartment – Left Side

NOTICE

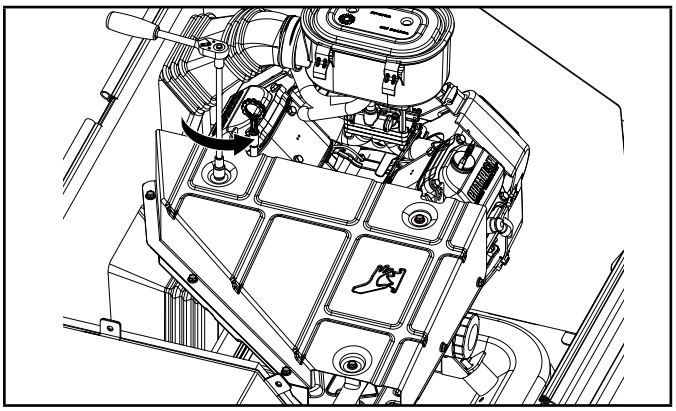
Left side firewall most likely will be removed during engine and alternator service or replacement.

The Left side of the HSB Generator may need to be lifted and supported by a 4×4 wood post, in the event of a floor fastener falling out the bottom of plastic pallet.

Ensure that the ATS and Engine Switches are in the OFF position, fuel shutoff valve in the CLOSED position before performing any disassembly, maintenance or cleaning.

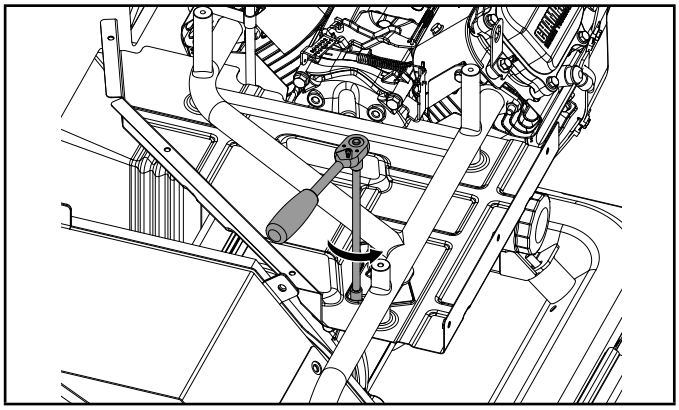
Remove Exhaust system

– Remove Top Heat Shield / Air Guide, from exhaust system – 9 fasteners

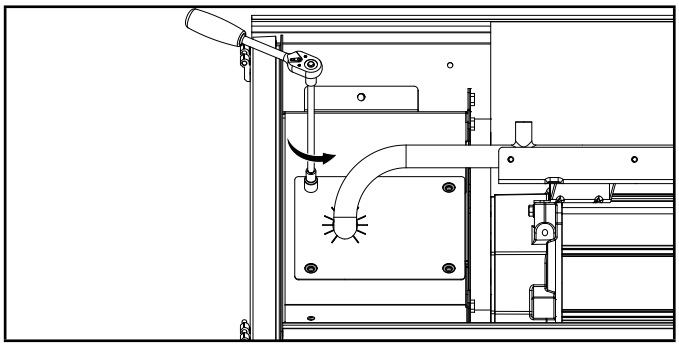


– Remove 4- Fasteners at Cylinder heads (exhaust)

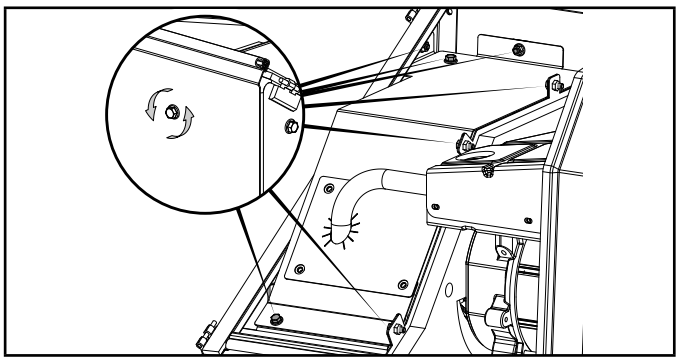
– Remove 1 fastener – Exhaust pipe at top of alternator near muffler firewall



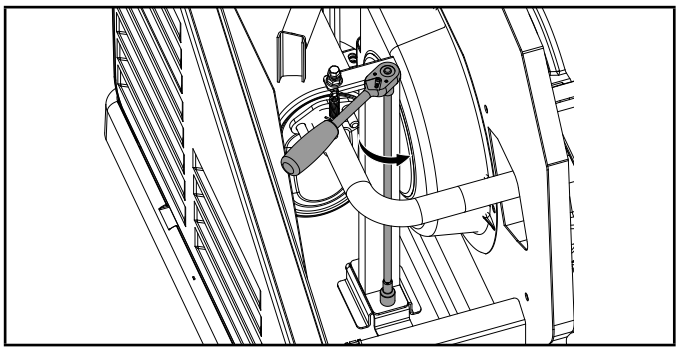
– Remove Thermal baffle / gasket from Muffler compartment cover- 4 fasteners



– Remove Muffler compartment cover – 7 fasteners



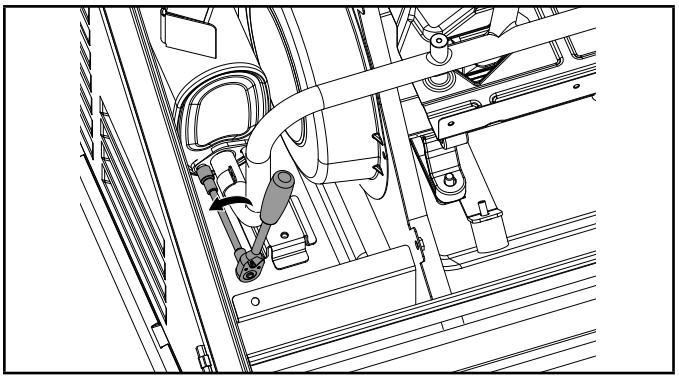
– Remove Exhaust Supporter / spring tower mounted on floor of Muffler compartment – 2 fasteners



– Remove fasteners at muffler to exhaust pipe connection

– Use a 14 mm deep well socket

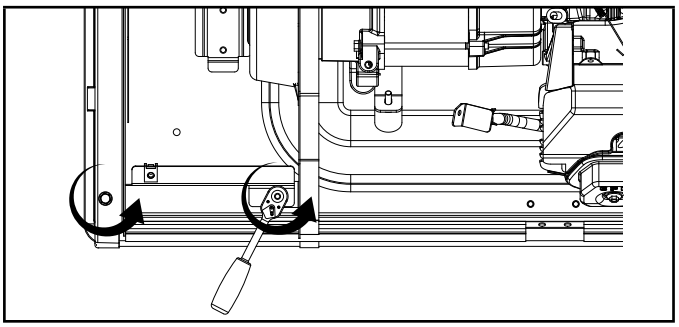
– Separate exhaust pipe from muffler
– Be careful not to damage muffler gasket
– Let muffler hang from muffler hangers



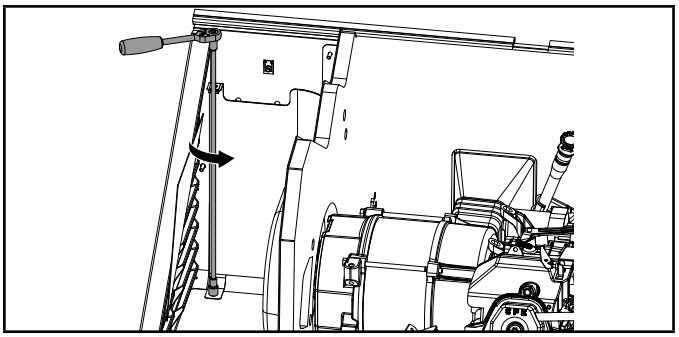
– On back panel of HSB enclosure remove (2) fasteners – use 10mm socket
– When removing last fastener support muffler hanger with one hand
– Remove fastener with other hand
– When muffler bracket is free, lift muffler assembly out of HSB enclosure

Remove Left Firewall

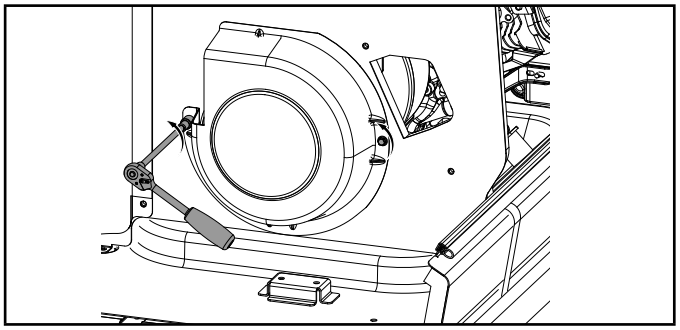
– Remove Muffler cover front



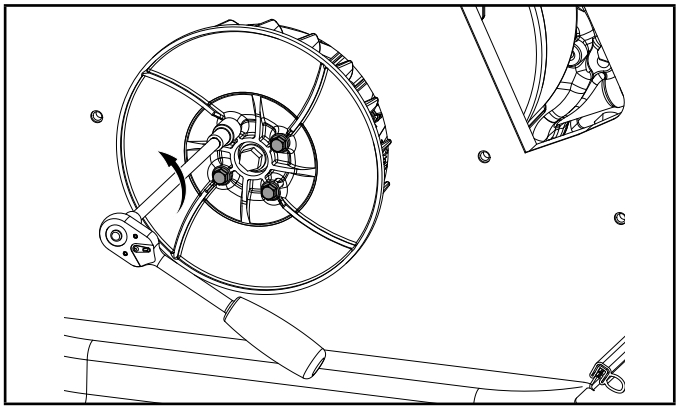
– Remove Muffler cover (back) - Heat shield
– 10 mm socket and 12 mm socket



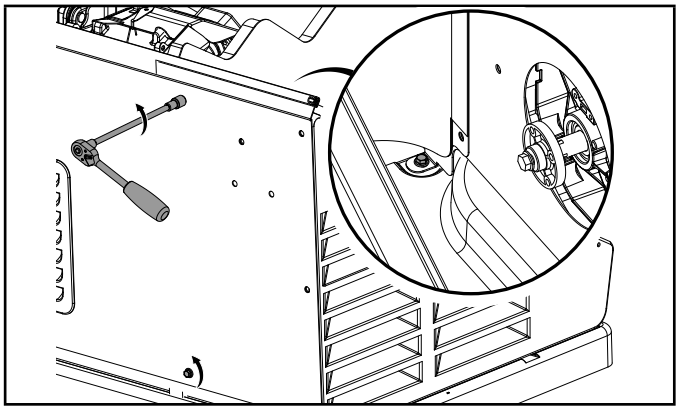
– Remove Alternator Fan Cover



– Remove Alternator Fan
– 10 mm socket

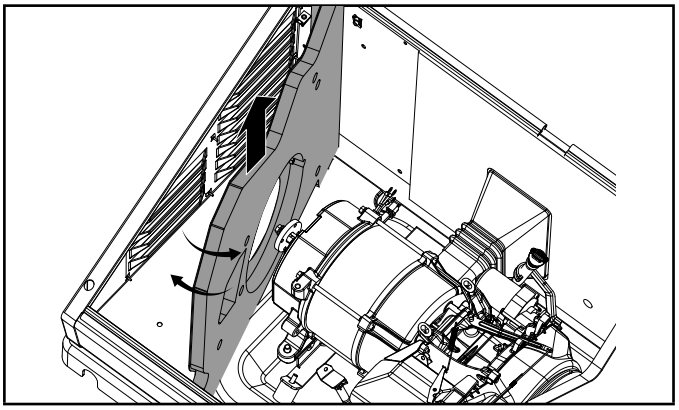


– Remove firewall floor fasteners
– 10 mm socket, and 12 mm socket



Remove Left Firewall

– Double check that all fasteners have been removed
– Lift firewall so bottom hold down brackets are above floor fasteners
– Rotate and tilt firewall so front of firewall is free from front enclosure cover



– Reverse process for Installation of Left Firewall

REMOVAL OF ENGINE AND ALTERNATOR - ALL MODELS

Based on Technical Bulletin Number 1801-100-50-1

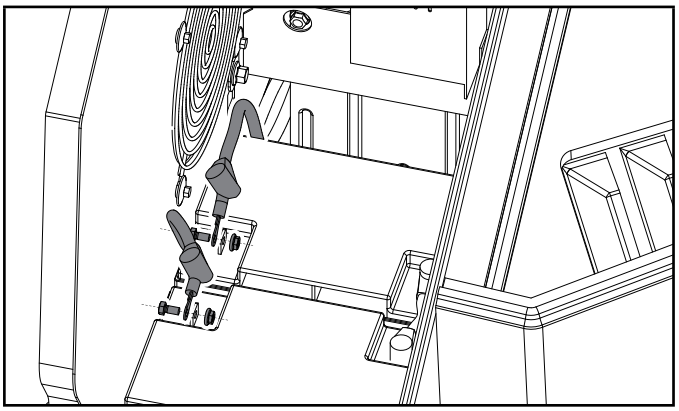
Remove 717cc and 754cc Engine and Alternator from HSB Generator

HSB Shut Down Checklist

To make sure the generator is shut down during maintenance or repair. The following items must be checked:

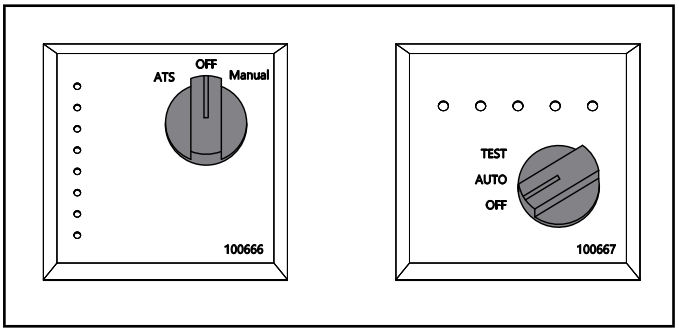
☐ Fuel valve is in the OFF position.

☐ Battery Cables are disconnected from batteries. Disconnect the negative side of the battery first.

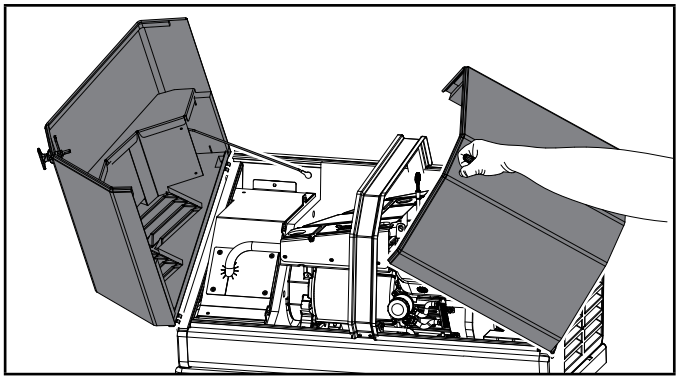


☐ ATS control module is in the OFF position.

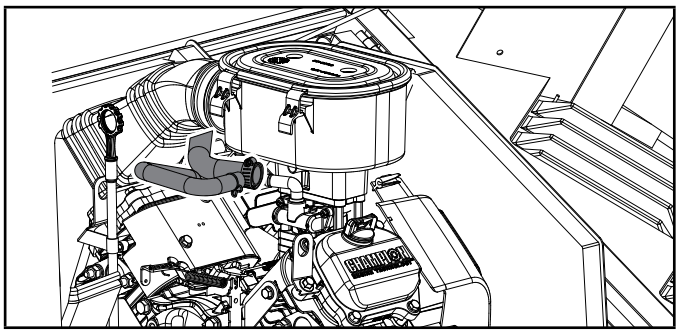
☐ Engine control module is in the OFF position.



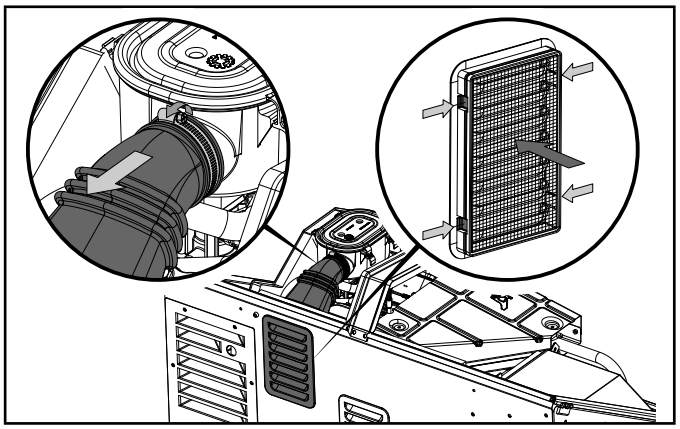
1. Open access doors.



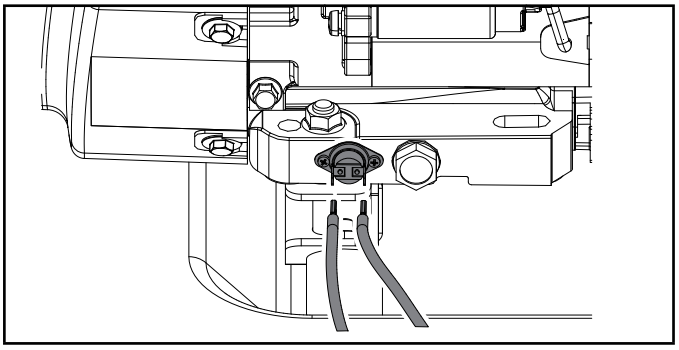
2. Remove fuel hose at mixer.



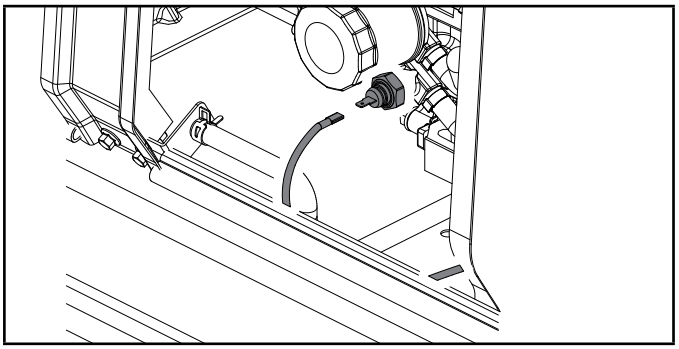
3. Remove Air Box Rubber Snorkel / pipe (Cylinder #1 side of engine) – Loosen band clamp pull off of air box – Then pull off of louver.
4. Remove Rubber Snorkel Louver – Push in (4) tabs on sides of louver and push outwards.



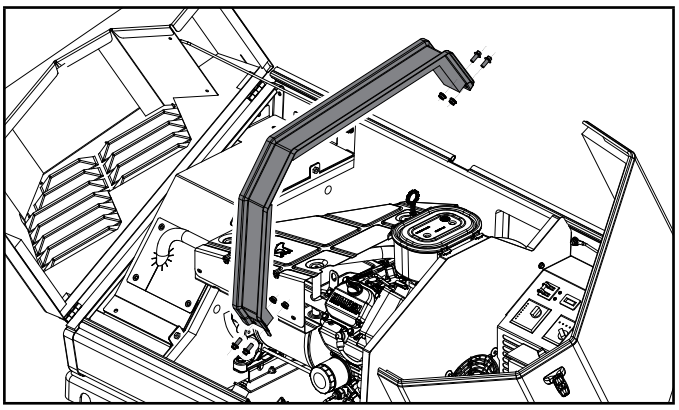
5. Disconnect wires from Thermal Shutdown Switch (Cylinder #1 side of Engine) - Brown wire, Green wire. Brown wire is closest to front firewall.



6. Disconnect Yellow wire from Low Oil Shutdown switch bottom of engine block (Cylinder #2 side of Engine).

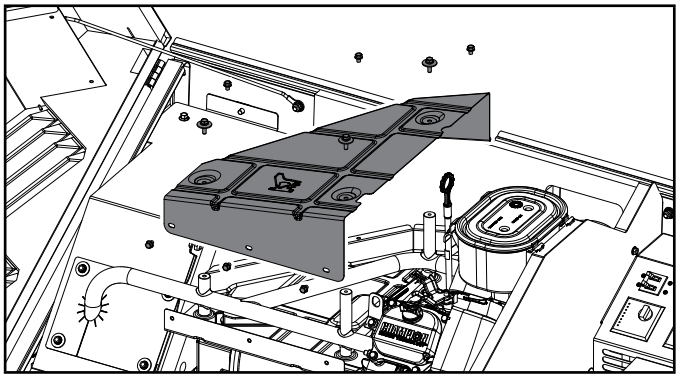


7. Remove lid support / Gutter – Brace in the middle of Home Standby enclosure – 4 bolts/nuts.

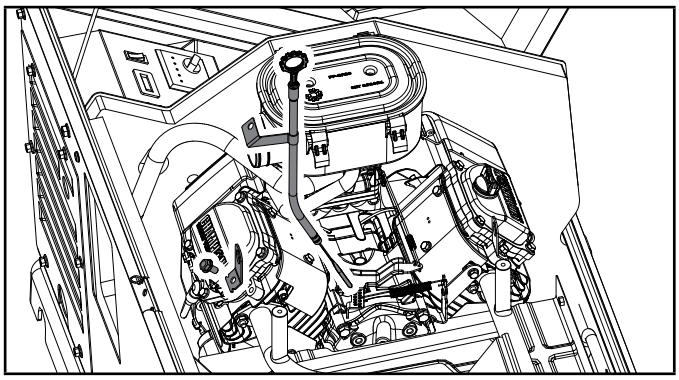


Remove Exhaust System

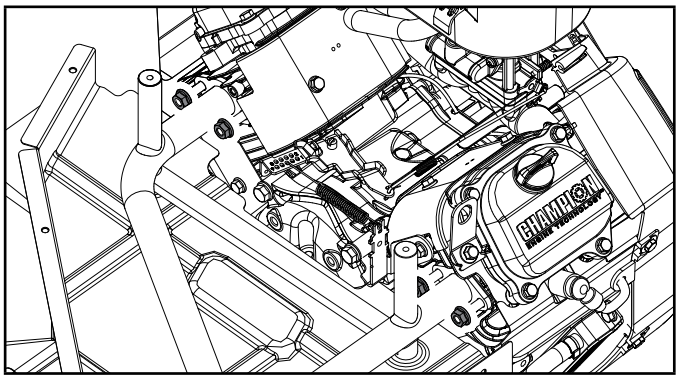
1. Remove lid support / Gutter – Brace in the middle of Home Standby enclosure – 4 bolts/nuts.



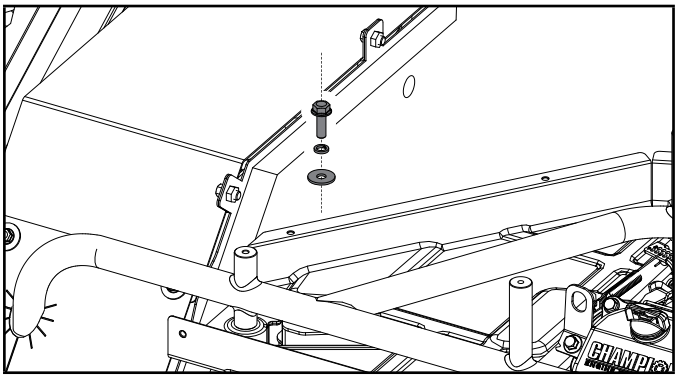
2. Remove bolt holding oil dipstick bracket. Remove dipstick and bracket.



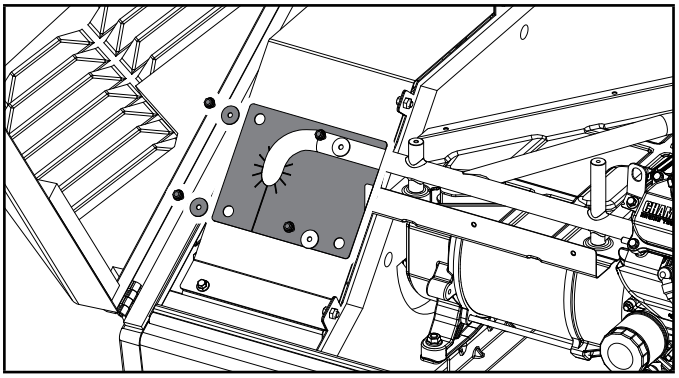
3. Remove 4 nuts from the cylinder heads (exhaust).



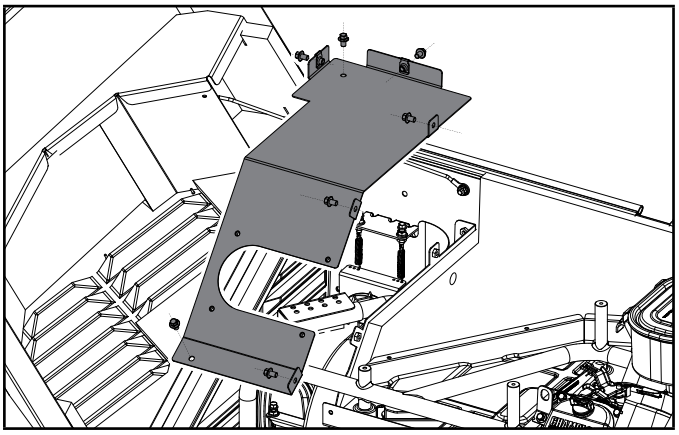
4. Remove 1 bolt, flat and lock washer from the exhaust pipe at top of alternator near muffler firewall.



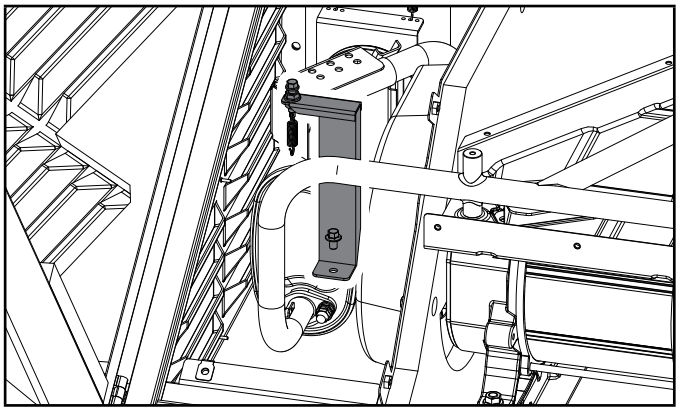
5. Remove Thermal baffle / gasket from Muffler compartment cover - 4 bolts and washers.



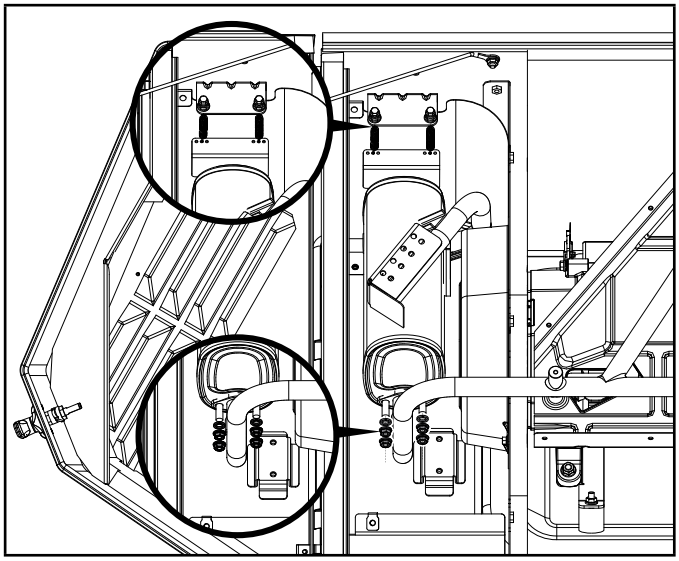
6. Remove Muffler compartment cover – 7 bolts.



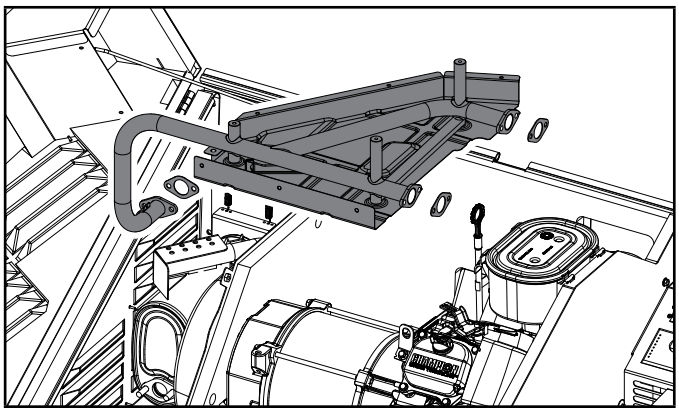
7. Remove Exhaust Supporter / spring tower mounted on floor of Muffler compartment – 2 fasteners.



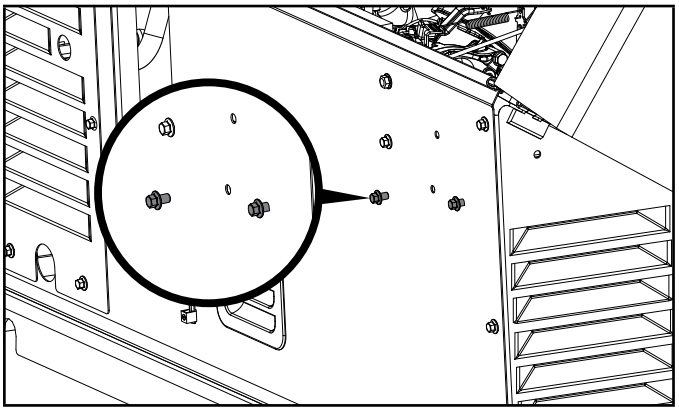
8. Remove fasteners at muffler to exhaust pipe connection. Use a 14 mm deep well socket.
9. Separate exhaust pipe from muffler.
10. Be careful not to damage muffler gasket.
11. Let muffler hang from muffler hangers.



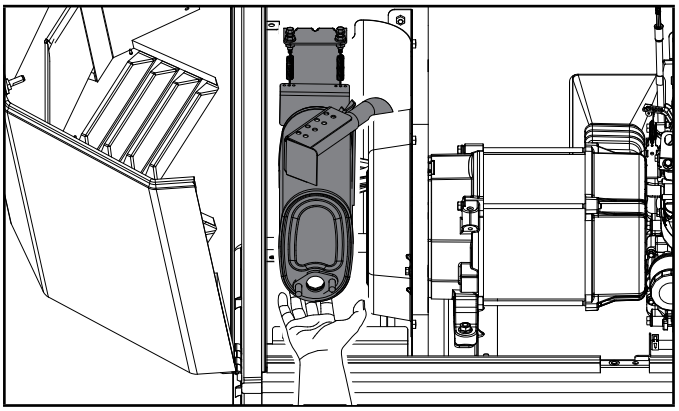
12. Remove exhaust pipe, gaskets and bottom heat shield.



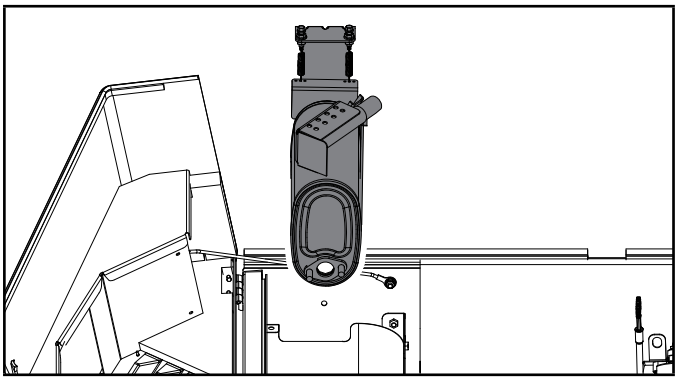
13. On back panel of HSB enclosure remove (2) fasteners – use 10mm socket.



14. When removing last fastener support muffler hanger with one hand.
15. Remove fastener with other hand.

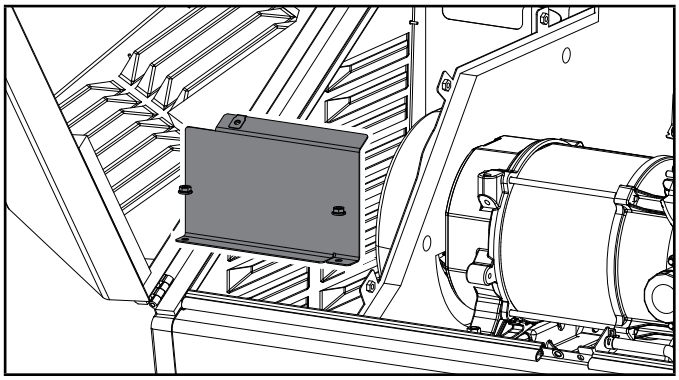


16. When muffler bracket is free, lift muffler assembly out of HSB enclosure.

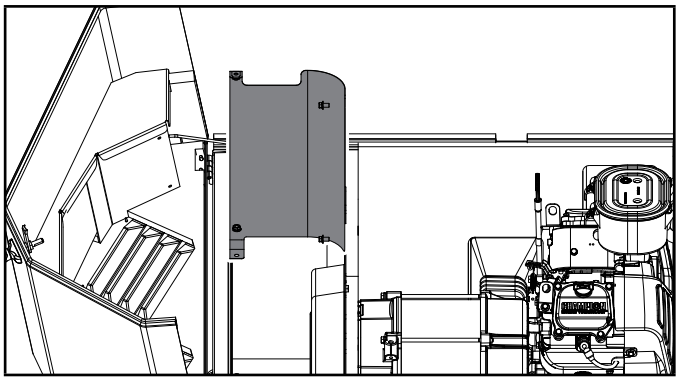


Remove Left Firewall

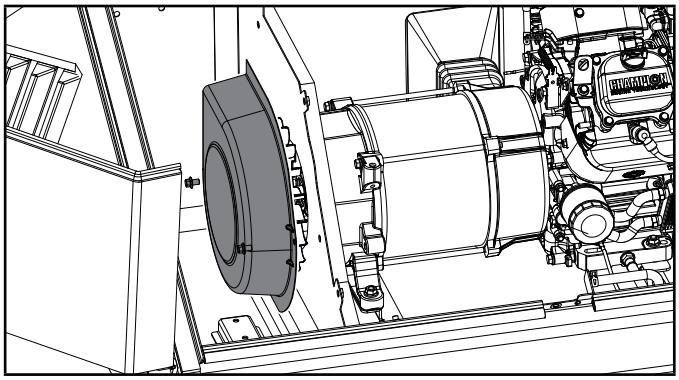
1. Remove Muffler cover front.



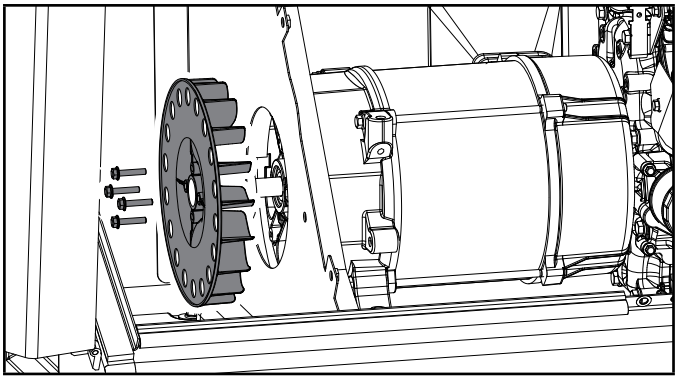
2. Remove Muffler cover (back) - Heat shield. 10 mm socket and 12 mm socket.



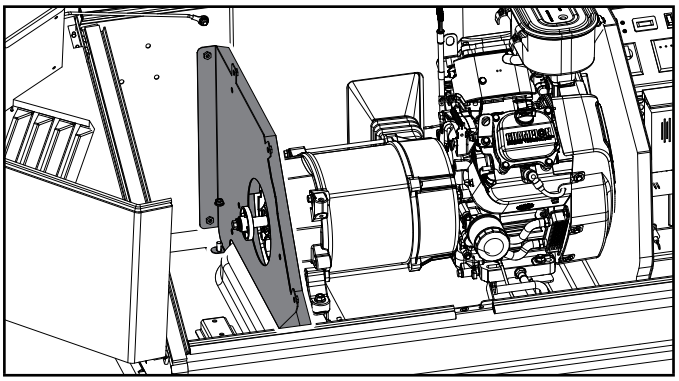
3. Remove Alternator Fan Cover.



4. Remove Alternator Fan bolts and fan. 10 mm socket.

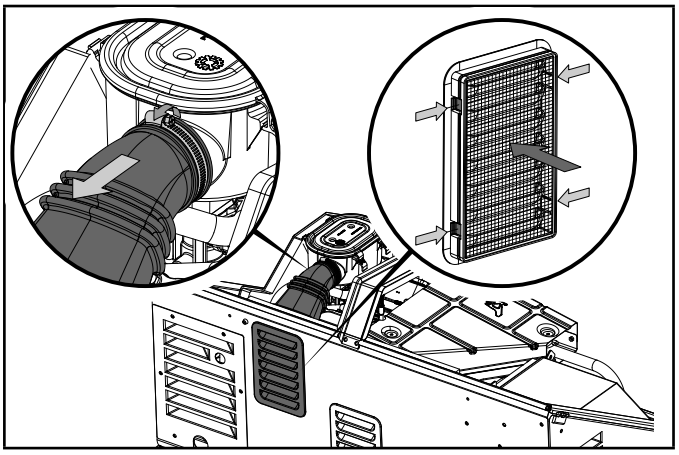


5. Remove firewall floor fasteners. 10 mm socket, and 12 mm socket.

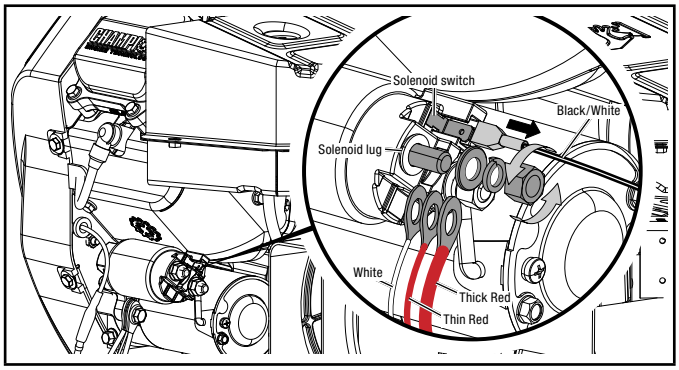


Removing Starter Motor

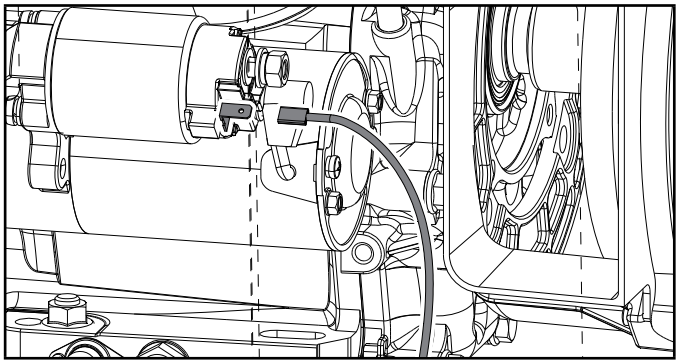
1. Remove Air Inlet Snorkel – Remove band clamp at air box. Remove snorkel by sliding snorkel end away from air box then pulling snorkel free from Louver.
2. Remove Air Inlet Louver. Push (4) mounting clips inward to remove louver from rear panel.
3. Remove Alternator Air Inlet Louver– pull snorkel end away from Louver. Tuck snorkel to side to gain access to starter motor.



4. Remove wires and cables from Starter Solenoid Lug with 13 mm box wrench. Red Battery cable, White wire, Red Battery Charger wire on models after September of 2016.

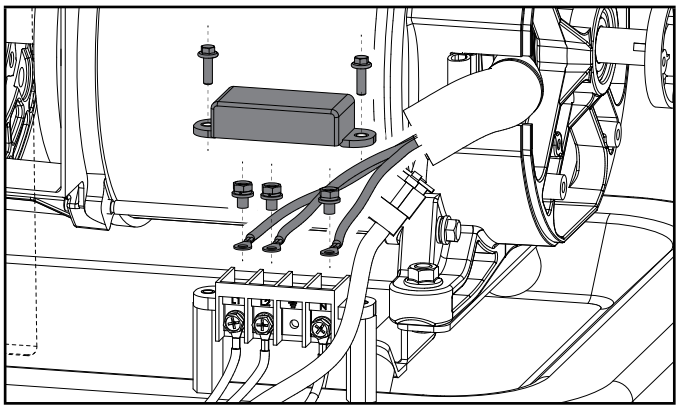


5. Remove black wire from Starter Solenoid Switch.

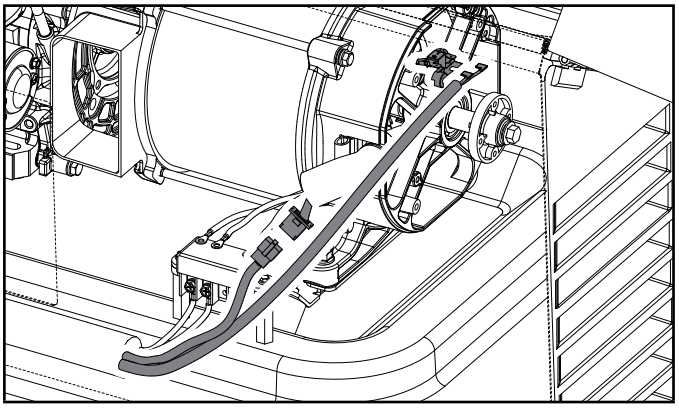


Disconnect Alternator (AVR) Power Wires

1. Disconnect L1, L2, Neutral and ground wires from Terminal block #1 located on floor near back of alternator (Cylinder #1 side of enclosure).

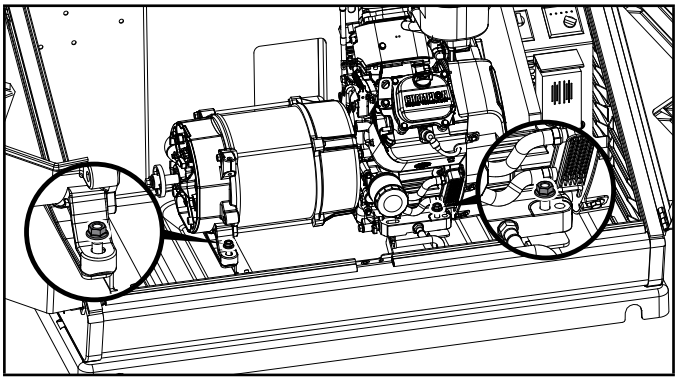


2. Disconnect 4 wire connector at back of alternator (AVR) and the positive and negative wires from the brush assembly.

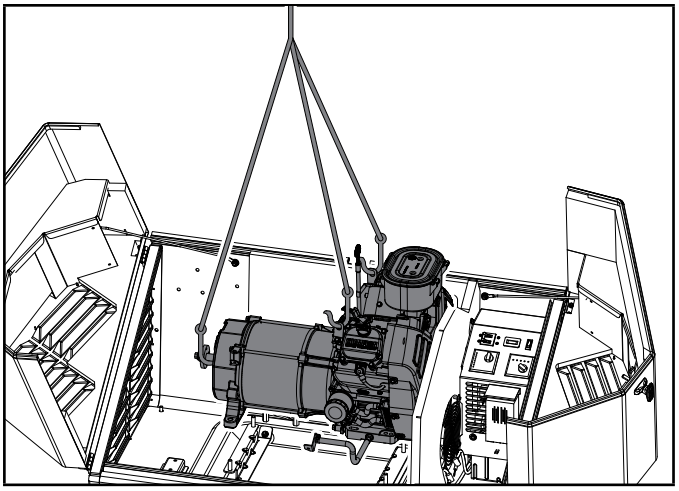


Remove Engine and Alternator

1. Remove (4) Engine mount nuts located between Engine / Alternator supports and rubber motor mounts. 13 mm socket



2. Attach chain sling to lift straps located on each cylinder head.
3. Attach a support sling to back of alternator (Rotor shaft) then around chain sling. Support sling allows engine and alternator to be lifted out relatively level.



4. Begin to lift engine and alternator out of the enclosure.
5. Move the rear firewall to an angled position to allow clearance when lifting out of enclosure.
6. Also check for wires – cables – hoses that may need to be disconnected during the lifting process.
7. When lifting clearance allows guide engine and alternator out of enclosure and place on work area.

ENGINE HEALTH CHECKS AND ADJUSTMENT

Valve Lash

Before working on engine follow HSB Shut Down Checklist.

HSB Shut Down Checklist

To make sure the generator is shut down during maintenance or repair. The following items must be checked:

- ☐ Fuel valve is in the CLOSED position.
- ☐ Battery Cables are disconnected from batteries.
- ☐ ATS control module (100667) is in the OFF position.
- ☐ Engine control module (100666) is in the OFF position.

Tools Needed

- 1/2 in. drive Ratchet, Extension, and 23 mm Socket – Single cylinder engine
- 1/2 in. drive Ratchet, Extension, and 30 mm Socket – Twin cylinder engines
- 1/4 in. drive Ratchet, Extension, and 7 mm Socket
- 3/8 in. drive Ratchet, Extension, and 13 / 16 in. Spark plug Socket
- 3/8 in × 10 mm Socket
- 3/8 in. × 12 mm Socket
- 10 mm Wrench
- 3/16 in. Flat Screwdriver
- Feeler Gauge Set

Find Top Dead Center (TDC)

- Remove batteries from HSB enclosure
- Remove grill from right firewall – 7 mm Socket
- Remove spark plugs from cylinder 1 and cylinder 2
- Insert 24 mm socket 1/2 in. drive Ratchet, Extension over crankshaft nut – Single Cylinder
- Insert 30 mm socket 1/2 in. drive Ratchet, Extension over crankshaft nut – Twin Cylinder
- Place finger over cylinder 1 spark plug hole
- Rotate engine clock wise until pressure can be felt by finger
- Insert 3/16 in. Flat Screwdriver into spark plug hole in cylinder 1

– Rotate engine clock wise - screw driver will rise out of spark plug hole
– When screw driver begins to move downward stop rotation.
– Rotate engine counterclockwise until screw driver reaches a point where no up, or down movement is present
– The piston is now at Top Dead Center

Valve Lash Adjustment: Cylinder #1

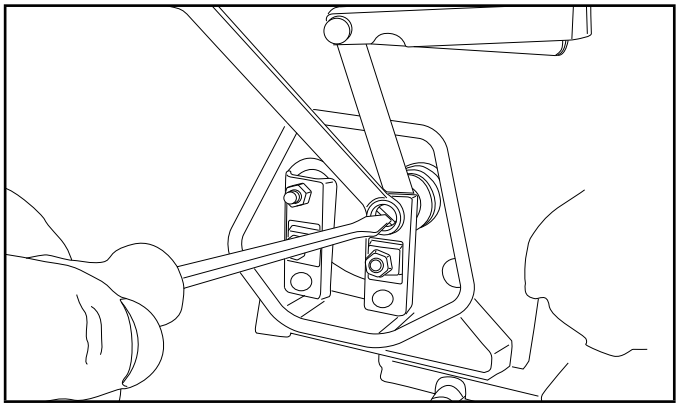
– Single cylinder - Remove cylinder 1 rocker arm cover – 1 fastener, 10 mm socket
– Twin cylinder - Remove cylinder 1 rocker arm cover – 4 fasteners, 10 mm socket
– Inspect gasket of rocker cover – replace if damaged
– Inspect rocker arms – both intake and exhaust rocker arms should have some up and down movement between rocker arm and cylinder head valves
– There should be No tension on Rocker Arms
– If rocker arms are still in tension repeat Find Top Dead Center (TDC)

Valve Lash Specifications:

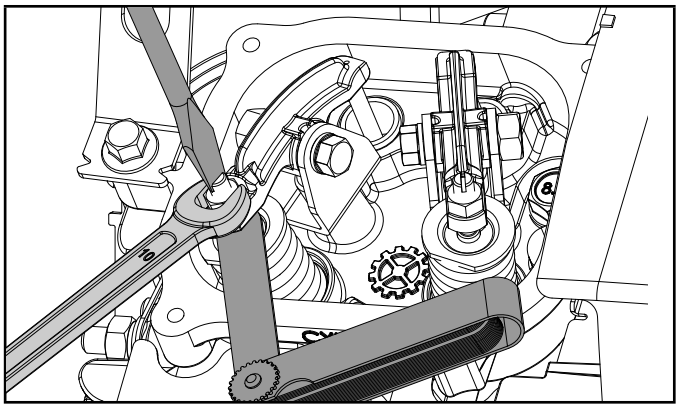
HSB Engine Size	Number of Cylinders	Intake Valve Lash	Exhaust Valve Lash
8.5 kW = 439cc	1	.006 in. +/- .0008 in. (0.15 mm + /- 0.02 mm)	.008 in. +/- .0008 in. (0.20 mm +/- 0.02 mm
11 kW=717 cc 12.5 kW=717 cc	2	.006 in. +/- .0008 in. (0.15 mm + /- 0.02 mm)	.008 in. +/- .0008 in. (0.20 mm +/- 0.02 mm
14 kW=754 cc	2	.006 in. +/- .0008 in. (0.15 mm + /- 0.02 mm)	.008 in. +/- .0008 in. (0.20 mm +/- 0.02 mm

– Using a feeler gauge find the correct gauge thickness to check valve lash
– Thickness is based upon intake valve or exhaust valve lash specification
– Insert gauge in between rocker arm and valve
– There should be a light resistance when moving feeler gauge between Rocker arm and valve
– If lash is too loose or thickness gauge will not fit between rocker arm and valve
– Then the valve lash needs to be adjusted

1. Using a 10 mm wrench loosen the lock nut on end of the Intake side rocker arm.
2. With a 3/16th standard screwdriver, turn screw, (valve adjustment) counter clockwise to allow feeler gauge to be inserted between rocker arm and valve.



3. With feeler gauge in place turn screw (valve adjustment) clockwise, until there is light resistance on feeler gauge.



4. Using a 10mm wrench tighten down jam nut.
5. Double check feeler gauge resistance between rocker arm and valve.
6. Set valve lash on Exhaust valve.
7. Repeat Valve Lash Adjustment Cylinder 1.
8. When intake valve and exhaust valve are set to specifications reassemble rocker arm cover.

Torque fastener/s to the following:

– Single cylinder Rocker Cover Screw = 5.4 Nm (48 in.-lbs.)
– Twin Cylinder Rocker Cover Screws = 10 Nm (7 ft.- lbs.)

Valve Lash Adjustment: Cylinder 2 (Twin Cylinder Engines)

Finding Top Dead Center on Cylinder 2

– Place finger over cylinder 2 spark plug hole
– Rotate engine clock wise until pressure can be felt by finger
– Insert 3/16 in. Flat Screwdriver into the cylinder 1 spark plug hole
– Rotate engine clock wise - screw driver will rise out of spark plug hole
– When screw driver begins to move downward stop rotation

– Rotate engine counterclockwise until screw driver reaches a point where no up, or down movement is present
– The piston is now at Top Dead Center

NOTICE

At this point engine cylinder Leak Down can be checked at Cylinder #2.

See technical bulletin for 439cc, 717cc and 754cc Leak Down test.

Repeat Valve lash adjustment procedure (page 2) for cylinder #2.

Reassembly and Checks

– Install spark plug/s into the engine
– Torque spark plugs to 20-30 N-m (14.8-22.1 ft. -lbs.)
– Install sparkplug wires
– Clean engine air inlet grill before installing
– Install grill to right side firewall – 7 mm Socket
– Install batteries to HSB enclosure
– Clean and inspect battery cables
– Install battery cables
– Check oil level
– Add oil if needed
– Inspect air box filter
– Replace air filter if needed

Leak Down Test

A leak down test is a method of measuring the engine's ability to create and maintain pressure. Compressed air is introduced into the cylinder through the spark plug hole. The difference between introduced pressure and loss of pressure will indicate the condition of the cylinder, head gasket, valves and overall condition of the engine. During the engine valve lash adjustment procedure, is a good opportunity to perform a leak down test.

NOTICE

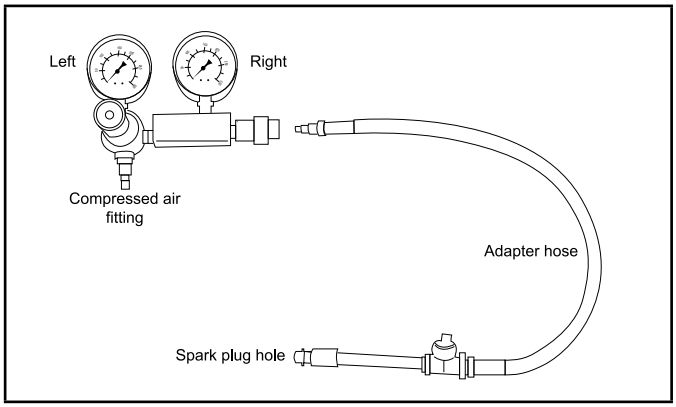
An air compressor capable of 100 psi – 120 psi will be needed to perform this test.

Find Top Dead Center (TDC) 439cc, 717cc, and 754cc

This is also step one for setting valve lash. After checking Leak down, perform valve lash check listed on page "Valve lash adjustment Cylinder #1".

– Remove batteries from HSB enclosure
– Remove grill from right firewall – 7 mm Socket
– Remove spark plugs from cylinder 1 and cylinder 2
– Insert 30 mm socket 1/2 in. drive Ratchet, Extension over crankshaft nut – single cylinder
– Insert 30 mm socket 1/2 in. drive Ratchet, Extension over crankshaft nut – twin cylinder
– Place finger over cylinder 1 spark plug hole
– Rotate engine clock wise until pressure can be felt by finger
– Insert 3/16 in. Flat Screwdriver into spark plug hole in cylinder 1
– Rotate engine clock wise - screw driver will rise out of spark plug hole
– When screw driver begins to move downward stop rotation
– Rotate engine counterclockwise until screw driver reaches a point where no up, or down movement is present
– The piston is now at Top Dead Center

Install Leak Down Tester



– Screw the adapter hose into the spark plug hole just tight enough so it doesn't leak
– Any leakage will give you a false reading
– Do not connect adapter hose to leak down tester at this point
– Install air supply line to air coupler on end of leak down tester
– Make sure left gauge is reading zero psi
– Turn adjusting knob on Leak down tester to set zero
– Couple / Connect adapter hose to leak down tester
– Slowly start adding air to cylinder head

⚠ CAUTION

When introducing pressure into the engine, the engine could suddenly rotate.

Double check. Make sure piston is located at Top Dead Center.

– Adjust the regulator knob on the tester until the left gauge reads exactly 100.0 psi
– Read the Leak down on the right gauge

- Subtract Left gauge reading from the Right gauge reading
- Results: Leak down will be somewhere between 3% - 5% (fresh engine) and 20% - 30% (tired engine)
- Adjust the regulator knob on the tester until the left gauge reads 0 psi
- Disconnect hoses and document the test result. Record all Health check information into a notebook
- Continue to set valve lash if performing the procedure, or reinstall spark plug, and spark plug wire

Compression Test

A compression test is a quick method of measuring how much pressure the piston creates in the cylinder when traveling from bottom dead center (BDC) to top dead center (TDC) with cylinder head valves closed. A compression test can give basic information on the condition of Piston Rings, Cylinder Head, and Cylinder Head Valves.

NOTICE

It is recommended to perform this test on an engine that has been operating for at least 20 minutes before shutting down.

1. ATS control module (100667) is in the OFF position.
2. Engine control module (100666) is in the OFF position.
3. Place fuel shut off valve in the OFF position.
4. Remove spark plugs from cylinder(s).
5. Install threaded end of compression tester into cylinder 1 spark plug hole just tight enough so it doesn't leak.
6. Set Engine control module (100666) to manual mode.
7. HSB will begin starting sequence.
8. After starting sequence ends turn Engine control module (100666) to the OFF position.
9. Record pressure reading from dial indicator.
10. Repeat steps 7-9 a few times to create a sample of readings.

For V-twin engines repeat steps 5-12 on cylinder 2.

Compression Test Readings

New single cylinder engines, new V-twin engine compression test specification = compression greater than 100 psi.

NOTICE

For a cylinder below 60 psi, add 1 teaspoon of engine oil into the spark plug hole and retest. If the reading increase, the piston rings are worn. If no increase in pressure the valves are leaking.

Performing a Leak down Test allows accurate identification of leakage, by listening for the leak when engine is in a non-rotational state.

After Repairs and Adjustments

HSB Test Mode

- Battery Cables are connected to batteries
- Fuel valve is in the OPEN position
- ATS control module 100667 Switch to OFF position
- Engine control module 100666 Switch to ON position
- When switched to ON position HSB will start
- HSB circuit breaker in the ON position
- Check power output at Terminal Block #2
- If there is output voltage move to HSB Ready Checklist
- If not recheck connections, switches, and grounds
- Consult the HSB Operations Manual

HSB Ready Checklist

- ☐ ATS control module (100667) is in the AUTO position
- ☐ Engine control module (100666) is in the ATS position

Set Exercise Time

- The Engine Control Module switch must be in the ATS mode
- Decide on the desired day and time to exercise the HSB generator
- Press the exercise switch to ON
- The HSB generator will start and run for 15 minutes and then shut off
- The exercise time is now set
- The HSB generator will begin the next exercise period exactly 168 hours from when the exercise switch was pressed to the ON position

SPECIFICATIONS

Document Location

For a complete list of Specification, Wiring Diagram, and Exploded View Drawings, consult Champion HSB Installation and Operation Manual, or visit Products, Home Standby, click your model, and download at www.championpowerequipment.com.

Torque: Single Cylinder Engine

Crankcase Cover Bolts	24.4 Nm (216 in.-lbs)
Connecting Rod Bolts	18 Nm (156 in.-lbs)
Rocker Cover Screws	5.4 Nm (48 in.-lbs)
Cylinder Head Bolts	39 Nm (29 ft-lbs) (348 in.lbs)
Intake Manifold Screws	9.5 Nm (84 in.-lbs)
Carburetor to Intake Manifold	9.5 Nm (84 in.-lbs)
Blower Housing	12.2 Nm (108 in.lbs)
Flywheel Nut	115 Nm (85 ft-lbs)
Ignition Coil Bolts	9.5 Nm (84 in.-lbs)
Starter Motor Bolts	24.4 Nm (216 in.-lbs)
Spark Plug	20 – 30 Nm (14.8 – 22.1 ft-lbs) (178 in.lbs – 265 in.lbs)
Air Cleaner box to Carb	9 Nm (84 in.-lbs)
Exhaust pipe nuts	18 Nm (13 ft.-lbs) (156 in.lbs)

Master Mixing Assembly Jets (Carburetor System): Single Cylinder Engine

Idle/low-speed Jet	1.8-2.5 Nm (15.9-22.1 in. lbs)
Main Jet	1.2-1.5 Nm (10.6-13.2 in. lbs)

Torque: Twin Cylinder Engine

Crankcase Cover Bolts	27 Nm (20 lbf-ft)
Connecting Rod Bolts	12 Nm (9 lbf-ft)
Rocker Cover Screws	10 Nm (7 lbf-ft)
Cylinder Head Bolts	40 Nm (29.5 lbf-ft)
Intake Manifold Screws	9.5 Nm (7 lbf-ft)
Carburetor to Intake Manifold	9.5 Nm (7 lbf-ft)
Blower Housing	9 Nm (6.6 lbf-ft)
Flywheel Nut	196 Nm (145 lbf-ft)
Ignition Coil Bolts	9.5 Nm (7 lbf-ft)
Starter Motor Bolts	24.4 Nm (18 lbf-ft)
Spark Plug	18 Nm (13.3 lbf-ft)
Air Cleaner Box to Carb	9 Nm (6.6 lbf-ft)
Exhaust Pipe Nuts	18 Nm (13.3 lbf-ft)

Master Mixing Assembly Jets (Carburetor System): Twin Cylinder Engine

Idle/low-speed Jet	1.9 Nm (1.4 lbf-ft)
Main Jet	3.9 Nm (2.9 lbf-ft)
Fuel Inlet Chamber Screws	2.9 Nm (2.1 lbf-ft)

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