

SMOKING

Look for or check

LIQUID-COOLED ENGINE TROUBLESHOOTING WARNING SIGNS

BLACK SMOKE

GAS Overview: Rich running engine **DIESEL Overview: Timing advanced/** overloaded engine, dirty nozzle or faulty turbocharger.

WHITE SMOKE

GAS Overview: Burning coolant DIESEL Overview: Low combustion temp., lack of fuel, improper fuel, defective nozzle, retarded timing, burning coolant.

BLUE SMOKE

GAS Overview: Burning oil **DIESEL** Overview: Burning oil

AIRFILTER



GAS: Check condition of air filter, replace if in question. Restricted air filter can cause a rich running condition.

Check condition of air filter. replace if in question.

DIESEL: Check condition of air filter, replace if in question. Restricted air filter can cause a high intake vacuum and potentially pull oil from air breather.

OIL LEVEL



Check and maintain proper oil level. Refer to engine owner manual for proper grade and type.

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Check for signs of coolant in engine oil. Additionally do compression and leakdown test on engine.

COOLANT LEVEL



Maintain a 50/50 mix of water and antifreeze. Keep coolant level full.

Pressure test cooling system, follow procedure and values found in repair manual

Maintain a 50/50 mix of water and antifreeze. Keep coolant level full.

Look for signs of oil in coolant if found do compression test and pressure test of cooling system.

FUEL SYSTEM



GAS: Check for proper choke operation. Inspect spark plugs firing end condition to aid in diagnosis

DIESEL: Replace fuel filter, clogged fuel filter, air in fuel lines or restricted flow can cause white smoke.

DIESEL: If fuel primer is getting pulled down during operation, look for blockage in tank, fuel line, shut off valve or filter.

Ensure fuel is of proper grade minimum of 40 cetane

ENGINE TIMING



DIESEL: Black smoke can be caused by advanced timing

DIESEL: White smoke may be an indication of retarded engine timing.

Perform compression and leakdown testing of engine as outlined in repair manual



Perform compression and leakdown testing of engine as outlined in repair manual DIESEL: White smoke may be an indication of low combustion temperature. Check and reset valve cleanances as required. Perform compression test on engine.

The best way to resolve a problem is to identify it by testing. A compression test, leakdown or pressure test is required prior to any engine disassembly.



OVERHEATING

Look for or check

COMMERCIAL POWER

LIQUID-COOLED ENGINE TROUBLESHOOTING WARNING SIGNS



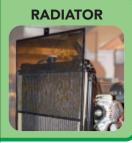
TEMPATURE LIGHT COMES ON



COOLANT TEMPERATURE **GAUGE READS ABOVE** 220° F (105° C) NORMAL RANGE 175°- 220° F (80°-104° C)



COOLANT **OVERFLOW** AT WATER RESERVOIR



Inspect debris guards. Note there may be more than one. See owners manual for engine/equipment

Clean debris from debris guard radiator fins. Check radiator condition, look for leaks or any visible damage or kinked/bulged hoses. Pressure test cooling system if in question.



Inspect belt condition. Look for signs of wear or glazing. Replace if in doubt.

Inspect belt tension/adjust. Loose belt may not allow the water pump to operate properly.

Some applications use electric or hydraulic fans. Consult equipment owners manual.



Check coolant level in radiator and in reservoir. If low, check for signs of leakage.

Inspect coolant condition. Make sure coolant mix is 50/50%. Check for oil in coolant or

coolant in crankcase.

Do a compression and leakdown test if oil is found in coolant or coolant is found in oil.

THERMOSTAT

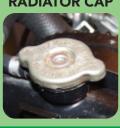


Check thermostat condition. Replace if engine has overheated.

This requires some engine disassembly and draining the cooling system. **Consult Repair Manual**

Thermostat should open between 178°-183° F (81°-84° C). Replace thermostat P/N 825064.

RADIATOR CAP



Check radiator cap for signs of leakage.

Inspect rubber seal under cap for rips and tears. Replace if damaged. Pressure test radiator cap. **Consult Repair Manual**

Cap should hold 11-15 PSI. Replacement cap P/N 820258.

SPECIAL NOTES AND WARNINGS



WARNING: The cooling system is pressurized. **DO NOT** remove the radiator cap while the engine is hot.

Refer to Section 13 Cooling System of the Briggs & Stratton liquid-cooled engine repair manual for specifications and detailed procedures.

IF THE ABOVE STEPS ARE BEYOND YOUR ABILITY, PLEASE CONSULT YOUR LOCAL SERVICE DEALER.

Vanguard 3/LC Engine Compression

Engine Model	Nominal Valve	Minimum Valve
700G	192 psi at 400rpm	142 psi at 400 rpm
950G	200 psi at 400 rpm	150 psi at 400 rpm
954G	215 psi at 400 rpm	155 psi at 400 rpm
700D	498 psi at 300 rpm	384 psi at 300 rpm
850D	512 psi at 300 rpm	384 psi at 300 rpm
950D	526 psi at 300 rpm	384 psi at 300 rpm
950DT/954DT	526 psi at 300 rpm	384 psi at 300 rpm

Checking Compression Pressure on Vanguard 3/LC Diesel Engines:

Cylinder compression testing is a valuable tool that can reveal a great deal about the internal condition of the engine. If components such as pistons, rings, valves, and head gaskets are doing their job, compression readings will be up to specification and consistent across all cylinders. A cylinder that is not within the specified compression reading indicates a problem. If it is decided that the engine must be removed for overhaul or major repair work contact your local Briggs and Stratton Distributor for authorization.

- 1. Engine oil level, air cleaner, starting motor, and battery must be well conditioned.
- 2. Clean the area around the glow plugs before you remove them (compressed air should be used). The idea is to prevent dirt from getting into the cylinders as the compression check is being done.
- 3. Thoroughly warm up the engine (coolant temperature of 176-194F).
- 4. Disconnect fuel solenoid wire harness before starting test.
- 5. Remove all glow plugs. Install (#19443) glow plug gauge adapter firmly into cylinder number one glow plug hole.
- 6. Attach diesel compression gauge (#19555 Diesel compression tester) to glow plug adapter.
- 7. Crank engine until a stable reading is obtained on compression gauge. Record the highest gauge reading obtained.
- 8. Repeat the procedure for the remaining cylinders, document these readings on the Troubleshooting Worksheet and compare to the specifications listed.

Always consult engine operating & maintenance instructions manual and engine repair manual for specific values and procedures.



3/LC ENGINE TROUBLESHOOTING WORKSHEET

Equipment Manufacturer:	Warranty Claim No
Date of Purchase:	Control No.
Customer Name:	Hours Used:
Engine Model:	Dealer Name:
Engine Type:	Dealer Phone:
Engine Code S/N:	Dealer Fax:

C	OMBUSTION		YES/GOOD	NO/BAD	
	Check valve clearance	Adjust			
	Check compression pressure.	Compression test	Cyl.#1	Cyl.#2	Cyl.#3
		FINDINGS >			
	Leakdown test	FINDINGS >	Cyl.#1	Cyl.#2	Cyl.#3

L	UBRICATION		YES/GOOD	NO/BAD	FINDINGS
	Engine oil level	Adjust as required			
	Oil condition	Check viscosity/color			
	Oil pressure	Check oil pressure at 3000 RPM			
	Oil condition	Check for coolant in oil			

F	UEL		YES/GOOD	NO/BAD	FINDINGS
	Sufficient fuel in tank	Fill tank			
	Fuel shut off valve	Open fuel valve			
	Vent plugged	Open vent cap or unplug vent hole			
	Faulty fuel pump/gas	Check pressure & delivery output			
	Improper fuel/stale fuel	Drain, flush tank & refill			
	Contaminated fuel/water dirt	Drain, flush tank & refill			
	Kinked or clogged fuel line	Check fuel flow			
	Fuel solenoid not operational Gas	Clean or replace solenoid, check wire connections, gasket ground			

C	DIESEL		YES/GOOD	NO/BAD	FINDINGS
	Check fuel flow	Does fuel flow from return line			
	Injector	Check pop-off press. & spray pattern			
	Injection Pump	12 Volts to solenoid			
	Glow plugs	Check voltage at glow plugs			
	Fuel filter	White smoke can be caused by clogged fuel filter			

DOLANT		YES/GOOD	NO/BAD	FINDINGS
Engine may not be warming up due to defective thermostat	Replace thermostat			
Coolant level in surge tank	Overflow in surge tank could be result of overheating			
Check alternator belt deflection	Is belt deflection with in spec.?			
Check for leaks	Look for any leaks			
Check level of antifreeze	Radiator should be full			
Pressure test radiator	Pressurize system to 11 psi			
Check radiator cap condition	Pressure test spec 11-15 psi			
Check coolant condition	50/50 mix required			
Check for oil in coolant	May indicate blown head gasket Do compression/leakdown test			
IGINE NOISE		YES/GOOD	NO/BAD	FINDINGS
Check valve clearance	Adjust			
Isolate engine	Remove all PTO drives to isolate engine from equipment			
(HAUST GAS CONDITI	ONS	YES/GOOD	NO/BAD	FINDINGS
Abnormal smell	Check plugs inspect condition.	Cyl.#1	Cyl.#2	Cyl.#3
	Deposits found and color. FINDINGS >			
Possible cause blown head gasl	npression & leak down test. ket, damaged valve or valve seat, ylinder, bent rod. FINDINGS >	Cyl.#1	Cyl.#2	Cyl.#3
	confirm rich running condition, e air filter, timing			
ARK		YES/GOOD	NO/BAD	FINDINGS
Check spark plugs	Replace bad plugs			
Check plugs / inspect condition.	Record gaps, deposits found and color. FINDINGS >	Cyl.#1	Cyl.#2	Cyl.#3
Spark plug lead disconnected	Connect all plug leads			
Check ignition wiring system	Tighten, clean, repair, replace			
Check all connectors	Tighten, clean, repair, replace			
Check ignition coils & leads	Replace bad coil or lead			
Check ignition module	Replace bad module			
RBURETOR		YES/GOOD	NO/BAD	FINDINGS
Choke not operating properly	Adjust or repair			
Dirty air filter	Replace			
Fuel filter dirty	Replace			
Air intake leaks	Check intake systems for any signs of leaks, torque all fasteners			
LE TO HIGH/LOW		YES	NO	Reset to
Idle speed screw				