BRIGGS & STRATTON®

COMMERCIAL POWER

SMOKING

Look for or check

LIQUID-COOLED ENGINE TROUBLESHOOTING WARNING SIGNS

BLACK SMOKE	WHITE SMOKE	BLUE SMOKE
GAS Overview: Rich running engine DIESEL Overview: Timing advanced/ overloaded engine, dirty nozzle or faulty turbocharger.	GAS Overview: Burning coolant DIESEL Overview: Low combustion temp., lack of fuel, improper fuel, defective nozzle, retarded timing, burning coolant.	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.	Check and maintain proper oil level. Refer to engine owner manual for proper grade and type.	Check and maintain proper oil level. Refer to engine owner manual for proper grade and type. Check for signs of coolant in engine oil. Additionally do compression and leak-down 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
COMPRESSION 	Perform compression and leakdown testing of engine as outlined in repair manual	DIESEL: White smoke may be an indication of low combus-tion 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.

Always consult engine owners manual and repair manual for specific values and procedures. www.briggsandstratton.com or www.briggsnetwork.com

BRIGGS & STRATTON®
COMMERCIAL POWER

OVERHEATING

Look for or check

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

RADIATOR 	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.
FAN BELT 	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.
COOLANT LEVEL 	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.

Always consult engine owners manual and repair manual for specific values and procedures. www.briggsandstratton.com or www.briggsnetwork.com

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.
www.briggsandstratton.com
www.briggsnetwork.com

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:** _____

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

LUBRICATION		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			

FUEL		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			

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			

COOLANT		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			

ENGINE NOISE		YES/GOOD	NO/BAD	FINDINGS
Check valve clearance	Adjust			
Isolate engine	Remove all PTO drives to isolate engine from equipment			

EXHAUST GAS CONDITIONS		YES/GOOD	NO/BAD	FINDINGS
Abnormal smell	Check plugs inspect condition. Deposits found and color. FINDINGS >	Cyl.#1	Cyl.#2	Cyl.#3
Smoke blue/gray - oil: Compression & leak down test. Possible cause blown head gasket, damaged valve or valve seat, damaged piston ring, worn cylinder, bent rod. FINDINGS >		Cyl.#1	Cyl.#2	Cyl.#3
Smoke black: Check plugs to confirm rich running condition, inspect/replace air filter, timing				

SPARK		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			

CARBURETOR		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			

IDLE TO HIGH/LOW		YES	NO	Reset to
Idle speed screw not set correct	Re-adjust idle speed screw			