

4.0 SPITFIRE TROUBLESHOOTING

SECTION I. ENGINE

1.0. Will not turn over

1.1. **There is a loose or corroded battery terminal.** Clean and tighten the battery terminal connections.

1.2. **The battery is dead.** Recharge or replace the battery. Test the charging system. Repair if necessary. *WARNING: Do not attempt to jump-start this machine from a running vehicle. The amperage output from an automobile will damage the charging system of the truckmount.*

1.3. **The fuseable link protector for the main power supply has blown.** Inspect the wiring thoroughly to locate shorted or damaged wires.

1.4. **The vacuum blower has seized.** Attempt to turn the engine by hand. If it will not turn, refer to Vacuum section III, 5.0.

1.5. **The ignition switch is defective.** Test to see if there is 12 volts to the switch. If there is, but there is not 12 volts going from the switch, replace the switch.

1.6. **There is a problem with the starter solenoid.** If there is 12 volts at the battery connection and at the key switch connection with the key in the start position but there is not 12 volts on the starter connection of the solenoid, replace the solenoid.

1.7. **The starter motor is defective.** Check to see if the engine can be turned over by hand. If it can, and if there is 12 volts from the starter solenoid to the starter, replace the starter.

1.8. **There is a mechanical problem with the engine.** If the engine can be turned over by hand and the vacuum blower is not locked up, refer the engine to a qualified service technician to determine the cause of the problem.

2.0. Turns over but will not start. There *is no spark.*

(Note: To check for spark, use the following procedure. Remove a spark plug from the engine. Attach the lead wire back onto the plug. Ground the threaded part of the spark plug to an unpainted engine surface. While holding the plug and wire assembly by the insulated wire, crank the engine over by turning the ignition switch to the "start" position. You should observe a blue spark between the two electrodes of the spark plug.)

2.1. **Recovery tank is full.** Empty the tank.

2.2. **Recovery tank float is defective.** Disconnect float. If engine starts, replace the float.

2.3. **The mix tank is empty.** Check to make sure water source is activated. If it is, refer to High-Pressure section III, 5.0.

2.4. **The low-water switch in the mix tank is faulty.** Check for 12 volts at the red / white wire on the relay under the switches at the lower left front of the machine. If 12 volts is not present, check the system back to the ignition switch to locate the problem. Repair as necessary.

2.4.1. If 12 volts *is* present at the relay, remove the white wire from the relay and try to start the machine. If it starts, check the ground wire from the mix tank float switch. This wire is grounded to the machine frame below the mix tank. Remove and clean the wire connector and attempt to start the machine.

2.4.2. If cleaning the ground wire does not correct the problem, replace the low water switch in the mix tank.

2.5. **The oil pressure switch is preventing the engine from starting.** Check the engine oil level. If it is low, add oil to the proper level. If the engine still will not start, disconnect the oil pressure switch. If the engine starts with the oil pressure switch disconnected, replace the oil pressure switch.

2.5.1. **Note:** It is important to use only Briggs oil filters. Even though an after-market filter may fit, the internal by-pass system may not be compatible with the Briggs engine resulting in low oil pressure.

2.6. **The high temperature switch has shut the engine down.** Observe the temperature gauge. If the reading is above the normal operating range (230° or above), allow the machine to cool down. If it will still not start, disconnect the high temp switch. If the machine then starts, replace the switch.

2.6.1. If the machine starts after it has cooled down, refer to the Heating System section III, 1.0.

2.7. **The spark plugs are faulty.** Remove and inspect. Replace as necessary.

2.8. **The engine ignition system is malfunctioning.** Refer to a qualified engine service technician for inspection.

3.0. Turns over but will not start. There *is* spark.

3.1. **Fuel is not reaching the carburetor inlet.** Check the fuel pump. If the pump is working, inspect the fuel lines between the fuel source and the carburetor. Repair or replace any faulty parts as necessary.

3.1.1. If the pump is not working, check for 12 volts and a ground at the pump.

3.1.2. If 12 volts is not present at the pump, check the wiring to the pump, including the fuse. Repair or replace as necessary. Note: If the fuse has blown, carefully inspect the wiring for a shorted or damaged wire. Repair immediately.

3.1.3. If 12 volts is present at the pump and the ground is good, replace the pump.

3.2. **The carb solenoid is malfunctioning.** Test for 12 volts at solenoid. If 12 volts is present, replace the solenoid.

3.3. **The engine is flooded.** Wait for a few minutes and attempt to start with the choke open. Note: If the engine has been flooded, it may be necessary to remove and clean the spark plugs.

3.4. **The spark plugs are dirty or worn.** Inspect and replace if necessary.

3.5. **There is a mechanical problem with the engine.** Have engine inspected by a qualified engine service technician.

4.0. Starts then dies immediately

4.1. **The oil pressure switch is activated.** Check engine oil for proper level. If oil level is okay, disconnect switch. If the engine starts, replace the switch.

4.1.1. **Note:** It is important to use only Briggs oil filters. Even though an after-market filter may fit, the internal by-pass system may not be compatible with the Briggs engine resulting in low oil pressure.

5.0. Will not come up to normal operating RPM

5.1. **Throttle linkage is out of adjustment.** Inspect for broken or loose linkage. Repair or replace as necessary and adjust to proper RPM. Note: It is important to use an accurate tachometer to adjust engine speed to 3000 RPM while it is under a vacuum load of between 10"hg and 14"hg. Too high or too low will cause severe damage to machine components.

5.2. **There is excessive load on the engine due to the blower-to-recovery tank hose becoming delaminated.** Remove and inspect the inside of the hose. Replace as necessary.

5.3. **There is excessive back-pressure on the engine or blower exhaust.** Check for clogged blower heat exchanger.

6.0. Runs rough at medium or high speed

6.1. **One or both spark plugs are defective.** Remove and inspect spark plugs. Replace as necessary.

6.2. **A spark plug wire is loose at the spark plug or has been damaged.** Inspect wire. Replace wire and coil as necessary.

6.3. **Low compression on one or both cylinders.** Check compression. If low, check valve adjustment. If incorrect, adjust to proper specs. This operation should be performed by a qualified service technician.

6.3.1. If adjustment is okay, there is a possibility of burned valves, burned head gasket or worn cylinders. Refer to qualified engine service technician.

6.4. **Poor spark on one or both cylinders.** Refer to qualified engine service technician.

6.5. **Inadequate fuel supply to the carburetor.** Test the fuel volume at the carburetor by removing the fuel line from the carburetor inlet and placing the line in a metal container with a minimum of 16 oz capacity. Turn on the ignition switch to operate the fuel pump. The fuel flow volume should be 12 oz / minute. Check for clogged filter or obstructed fuel line. Also check to make sure the fuel pump is mounted vertically and is close to the fuel source. Repair as necessary.

7.0. Runs rich (Black smoke)

7.1. **Dirty air filter.** Inspect and replace as necessary.

7.2. **Choke is partially closed.** Inspect and adjust or repair as necessary.

7.3. **Excessive fuel to carburetor.** Insure that fuel pump is proper PSI rating. A fuel pump with a psi rating in excess of that of the pump supplied with the machine could overpower the inlet valve in the carburetor, causing excessive fuel to be supplied to the carburetor.

7.3.1. There is dirt in the carburetor, causing the carburetor inlet valve to be held open. Refer to qualified engine service technician.

8.0. Engine overheats

8.1. **Poor ventilation in vehicle.** All cargo area doors must be open for proper ventilation. Roof vents are strongly recommended for machines that are operated in hot climates. Any item that might restrict air flow to the machine such as other equipment or a solid divider should be moved or modified to permit proper air flow.

8.2. **Low engine oil level.** Check oil level and replenish as necessary.

8.3. **Engine RPM too high.** Check RPM with an accurate tachometer. Adjust as necessary to 3000 RPM.

8.4. **Restricted engine or blower exhaust.** Disassemble exhaust components to locate restriction. Repair as necessary.

SECTION II. VACUUM SYSTEM

1.0. Weak vacuum at wand. Gauge reads normal (10" to 12" with hoses & wand attached)

1.1. **Clogged hoses or wand tube.** Disconnect hoses and check carefully for an obstruction.

1.2. **Excessive length of hoses connected to machine.** Make sure machine is rated for the conditions under which it is being operated.

2.0. Vacuum gauge will not come up to 12" hg

2.1. **There is an air leak somewhere in the vacuum system.** Check vacuum relief valve for proper adjustment. Carefully check all vacuum hoses for a cut or break. Check recovery tank lid gasket. Make sure recovery tank drain valve is fully closed.

2.2. **Vacuum blower is turning too slowly.** Check engine RPM. Adjust as necessary to 3000 RPM.

2.3. **The vacuum gauge is defective.** Test gauge and replace as necessary.

3.0. Vacuum gauge reads too high with no hoses attached

3.1. **Filter in recovery tank is clogged.** Remove and clean or replace as necessary.

3.2. **Hose from vacuum blower to recovery tank is delaminated internally.** Inspect and replace as necessary.

4.0. Noisy vacuum blower

4.1. **Vacuum blower is low on oil.** Inspect oil level and replenish as necessary. Note: Running vacuum blower low on oil can cause severe mechanical damage. If this situation occurs, it should be inspected by a qualified service technician.

4.2. **There is internal damage to the blower.** Refer to qualified service technician.

5.0. Vacuum blower is locked and will not turn

5.1. **The machine has been unused for a period on time and the blower was not properly lubricated when it was shut down, causing rust to build up on internal surfaces.** Spray penetrating oil into blower inlet and let sit for at least one hour. Then *very carefully* use pipe wrench on outer diameter of pulley on blower shaft and attempt to free up blower. *Do not use wrench directly on blower shaft.* If unable to free up blower in this manner, refer it to a qualified service technician.

5.2. **There is internal damage to the blower.** Refer to qualified service technician.

SECTION III. HIGH PRESSURE SYSTEM

1.0. Will not come up to normal cleaning pressure

- 1.1. **Pressure adjusting valve is defective or dirty.** Disassemble valve. Repair or replace if necessary.
- 1.2. **Worn seals or valves in pump.** Test pump output volume directly from pump at normal operating RPM. If volume is below manufacturers specifications, replace seals and inspect for defective valves.
- 1.3. **Pump RPM is too low.** Check engine RPM and adjust as necessary to 3000 RPM. Check for loose pump belt. Adjust tension as necessary.
- 1.4. **High temperature dump solenoid is activated.** Refer to Heating System section.
- 1.5. **Primary system control orifice is missing, worn or loose.** Remove filter and inspect orifice. Tighten or replace as necessary.

2.0. No pressure reading on PSI gauge

- 2.1. **No water in mix tank.** Refer to section 5.0.
- 2.2. **Pump switch is not turned on. (*Diverter models only*)** Turn on switch.
- 2.3. **Pump belt is broken.** Replace belt.
- 2.4. **Pump clutch is not activated. (*Diverter models only*)** There is *no* water in water box. Refer to section 5.0.
- 2.5. **Pump clutch is not activated. (*Diverter models only*)** There *is* water in the water box. Check for 12 volts at clutch. If 12 volts is present, replace clutch.
 - 2.5.1. If 12 volts is *not* present at clutch, check for 12 volts at pump clutch rocker switch and pump clutch micro-switch. If 12 volts is not being transferred through either of these switches replace the switch as necessary.
 - 2.5.2. If 12 volts *is* being transferred through these switches, check the low water switch in water box.
 - 2.5.3. If low water switch has no continuity when float is up, replace the switch. If switch is good, replace the low water relay.

3.0. PSI gauge reads normal; low pressure from wand

3.1. **There is a restriction in the cleaning tool.** Inspect tool jet and clean or replace as necessary. Inspect any filters in the cleaning tool and clean or replace as necessary.

3.2. **There is a defective quick connect in the system.** Inspect each quick connect and replace as necessary.

3.3. **There is a restriction in one of the solution hoses.** Remove quick connects and inspect hoses. Clean or replace as necessary.

3.4. **There are hard water deposits restricting the system between the exhaust heat exchanger and the high-pressure solution connection at the front of the machine.** Descale the machine. If this doesn't solve the problem, disassemble this portion of the system to locate the restriction.

4.0. Pressure pulsation

4.1. **Water in the water-box is too hot and is approaching boiling point.** Check temperature of water in the water-box. If it is too high, refer to Heating System section IV.

4.2. **There is an air leak between the water box outlet and the pump inlet.** Physically check all hoses and fittings for cuts, breaks, cracks or tightness. Repair as necessary.

4.3. **One of the intake or outlet valves in the high pressure pump is defective or is being held open by debris.** Remove each valve and inspect for correct operation.

5.0. Mix Tank empty or fills slowly

5.1. **There is a restriction in the water supply system.** Inspect the supply system from the source through the mix tank solenoid valve. Look for kinks, clogs or restricted filters.

5.2. **One or both water inlet float switches in the mix tank are defective.** Check both switches for continuity. Replace as necessary.

5.3. **Preheater is restricted with scale buildup.** Test water flow through preheater. If it is inadequate, descale entire system.

5.3.1. If descaling does not restore water flow, bypass preheater and re-test water flow. If adequate water flow is delivered to mix tank with preheater bypassed, replace the preheater.

6.0. Mix Tank overflows

6.1. **There is debris caught in the mix tank solenoid valve.** Disassemble valve and repair or replace as necessary.

6.2. **One or both water inlet float switches in the mix tank are defective.** Check both switches for continuity. Replace as necessary.

SECTION IV. HEATING SYSTEM

1.0. Machine overheats and shuts down

1.1. **The controlled orifice or filter screen is restricted with hard water scale and chemical build-up.** Remove and inspect. Clean or replace as necessary.

1.2. **The high-pressure recirculating loop is restricted with hard water scale and chemical build-up.** Inspect hoses and fittings from stainless steel heat exchanger through filter and orifice back to pressure regulator. Clean or replace as necessary.

1.3. **The high-pressure dump solenoid is restricted.** Inspect solenoid and the hose that delivers water to it. Clean or replace as necessary.

1.4. **The diverter valve is stuck or is out of adjustment.** Manually operate and observe diverter valve (make sure exhaust system is cool) to determine if the movement of the valve is restricted. Repair or adjust as necessary.

1.5. **The high-pressure dump solenoid is not functioning.** Check for 12 volts at the solenoid. If 12 volts *is* present, replace the solenoid.

1.5.1. If 12 volts *is not* present at the solenoid, check for 12 volts at the thermostat. If 12 volts *is not* present at thermostat, check the wiring that supplies power to the thermostat. Repair as necessary.

1.5.2. If 12 volts *is* present at the thermostat, replace the thermostat.

2.0. Unable to achieve normal cleaning solution temperature

2.1. **Engine RPM is too low.** Check RPM with accurate tachometer and adjust as necessary to 3000 RPM.

2.2. **System is in Divert mode.** Change to cleaning mode. (*Diverter model only*)

2.3. **Temperature control knob is turned down.** Adjust to higher setting.

2.4. **Diverter valve is not closing completely.** Inspect diverter valve for proper operation. Adjust linkage as necessary. (*Diverter model only*)

2.5. **Cleaning solution flow is too great.** Measure flow at cleaning tool.

2.5.1. Cleaning tool jet is too large or worn out. Inspect jet. Replace if necessary.

2.4.2. Cleaning solution pressure is too high. Adjust pressure to normal. Inspect pressure gauge for accurate reading.

2.6. **Heat exchangers have hard water scale build up internally.** Descale system.

SECTION V. CHEMICAL SYSTEM

1.0. Inadequate or no chemical flow

1.1. **Filter on feed line in chemical jug is clogged.** Inspect and clean.

1.2. **Check valve on feed line in chemical jug is stuck.** Inspect and repair or replace.

1.3. **Feed line from chemical jug is loose, pinched or cut.** Inspect and repair.

1.4. **The ball indicator in the flow meter is stuck.** Tap gently on the flow meter or use low (5# to 10#) air pressure in the chemical feed line to free the ball indicator.

1.5. **The venturi in the mix tank solenoid valve is restricted.** Remove venturi and clean or replace as necessary.

1.6. **There is inadequate water flow to the mix tank.** Refer to High Pressure section III, 5.0.

3.0. Solution jug fills with water

3.1. **The check valve in the chemical feed line is faulty.** Inspect and clean or replace as necessary.

SECTION VI. MISCELLANEOUS

1.0. Water from exhaust

1.1. **The recovery tank has been filled with foam or overfilled with water.** Remove recovery tank lid and inspect. If full, drain tank then inspect high-level shutoff switch for proper operation. Clean or replace switch as necessary.

1.1.1. If foam is observed in recovery tank, use defoamer on carpet being cleaned.

1.2. **Condensation.** This will be more pronounced in cool weather and humid climates. Observe how long this condition persists after starting machine. If it is only until the machine warms up, it is normal.

1.3. **A heat exchanger is leaking.** Inspect heat exchangers. Repair or replace as necessary.

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