From CAT Service Manual SEBR 0541-03

COOLING SYSTEM

Above Normal Heating

Probable Cause(s)

1. Low Coolant Level
2. Bad Temperature Gauge
3. Dirty Radiator
4. Loose Belt(s)
5. Bad Hose(s)
6. Shunt Line Restriction
7. Shutters Not Opening Correctly
8. Bad Water Temperature Regulators
9. Bad Water Pump
10. Air in Cooling System
11. Wrong Fan, Fan or Shroud Not in Correct Position
12. Radiator Too small
13. Not Enough Air Flow Through Radiator Because of Restriction in Engine Compartment
14. High Outside Temperature

Above Normal Heating (Cont.)

Probable Cause(s)

15. Operation at High Altitude
16. Engine Used in a Lug Condition
17. Air Inlet Restriction
18. Exhaust Restriction
19. Fuel Injection Timing Not Correct
20. Transmission Problems

Below Normal Heating

Probable Cause(s)

21. Long Idle Periods
22. Very Light Load
23. Bad Water Temperature Regulator(s) and/or Vent Valve

Cooling System

Above Normal Heating

Recommended Procedure

1. Low Coolant Level . . . If the coolant level is too low, not enough coolant will go through the engine and radiator. This lack of coolant will not take enough heat from the engine and there will not be enough flow of coolant through the radiator to release the heat into the cooling air. Low coolant level is caused by leaks or wrong filling of the radiator. With the engine cool, be sure that coolant can be seen at the low end of the fill neck on the radiator top tank.

2. Bad Temperature Gauge . . . A temperature gauge which does not work correctly will not show the correct temperature. If the temperature gauge shows that the coolant temperature is too hot but other conditions are normal, either install a gauge you know is good or check the cooling system with the 8T0470 Thermistor Thermometer Group.

3. Dirty Radiator . . . Check the radiator for debris between the fins of the radiator core which prevents free air flow through the radiator core. Check the radiator for debris, dirt, or deposits on the inside of the radiator core which prevents free flow of coolant through the radiator.

4. Loose Belt(s) . . . Loose fan belts will cause a reduction in air flow. Tighten the belts according to V-Belt Tension Chart that is shown in Specification section of this Service Manual.

5. Bad Hose(s) . . . Bad hoses with leaks can normally be seen. Hoses that have no visual leaks can "collapse" (pull together) during operation and cause a restriction in the flow of coolant. Hoses become soft and/or get cracks after a period of time. Hoses must be changed after 50,000 miles or a year of use. The inside of a hose can deterioriate, and the loose particles of the hose can cause a restriction in the flow of coolant.

6. Shunt Line Restriction . . . A restriction of the shunt line from the radiator top tank to the engine water pump inlet, or a shunt line not installed correctly, will cause a reduction in water pump efficiency. The result will be low coolant flow and overheating.

7. Shutters Not Opening Correctly . . . Check the opening temperature of the shutters. The shutters must be completely closed at a temperature below the fully open temperature of the water temperature regulators.

8. Bad Water Temperature Regulator(s) . . . A regulator that does not open, or only opens part of the way, can cause above normal heating. To test the thermostats, see the Testing and Adjusting section of this Service Manual.

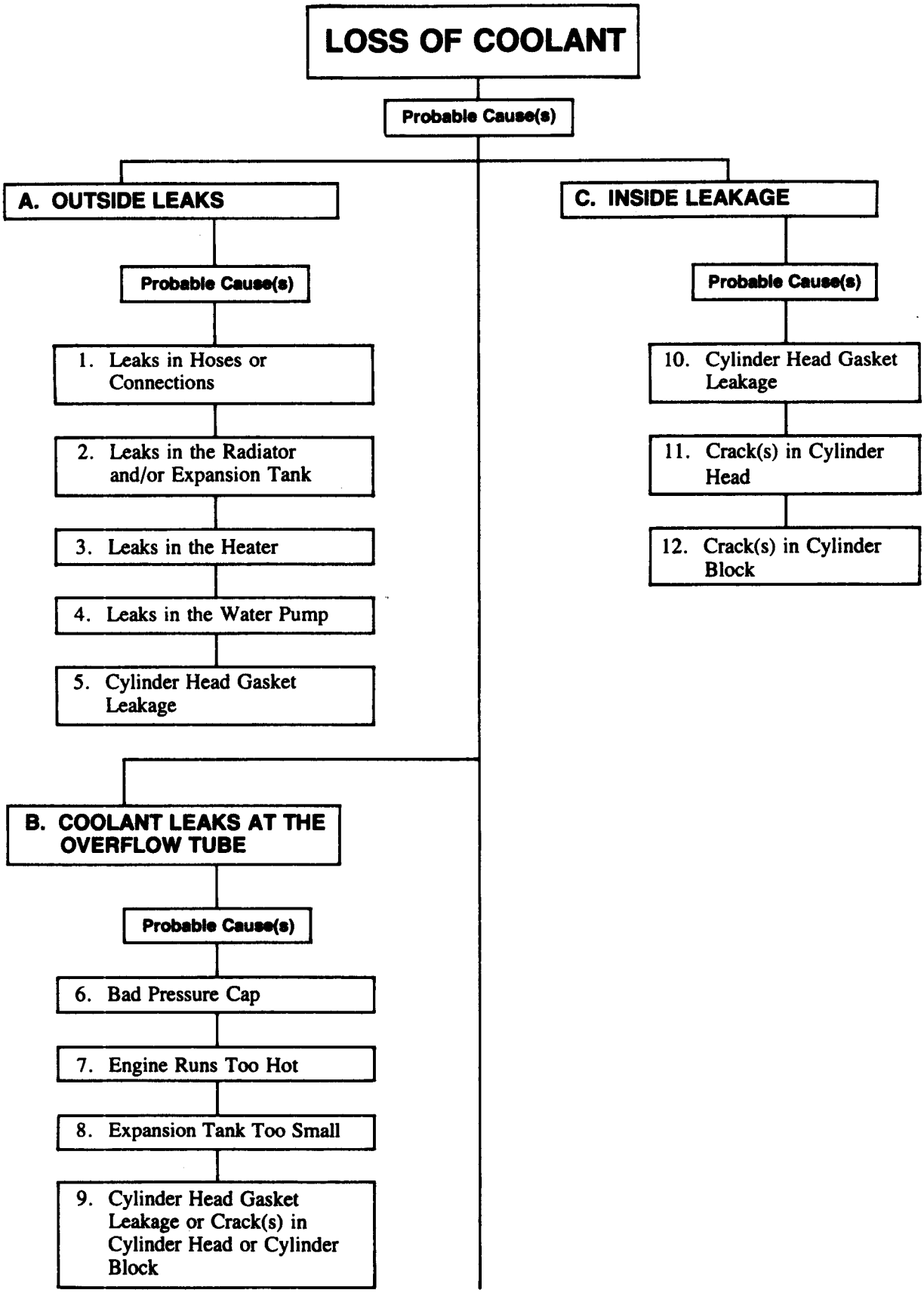
9. Bad Water Pump . . . A water pump with a loose or damaged impeller does not pump enough coolant for correct engine cooling. Remove the water pump and check for damage to the impeller. If the impeller has no damage, check the impeller clearance. The clearance between the impeller and the housing is 0.28 to 0.84 mm (.011 to .033 in).

10. Air in Cooling System . . . Air can get into the cooling system in different ways. The most common causes are not filling the cooling system correctly, and combustion gas leaking into the system. Combustion gas can get into the system through inside cracks or bad cylinder head gaskets. Air in the cooling system causes a reduction in coolant flow and bubbles in the coolant. Air bubbles hold coolant away from engine parts, preventing heat flow.

Air in the cooling system can be found by the Bottle Test. The equipment needed to make this test is a one pint bottle, a bucket of water and a hose which will fit the end of the overflow pipe of the radiator.

Before testing, make sure the cooling system is filled correctly. Use a wire to hold the relief valve in the radiator cap open. Install the radiator cap and tighten it. Put the hose over the end of the overflow pipe.

Start the engine and operate it at high idle rpm for a minimum of five minutes after the engine is at normal operating temperature. Use a cover on the radiator core to keep the engine at operating temperature. After five or more minutes at operating temperature, place the loose end of the hose in the bottle filled with water. Put the bottle in the bucket of water with the top down. If the water gets out of the bottle in less than forty seconds, there is too much exhaust gas leakage into the cooling system. Find the cause of the air or gas getting into the cooling system and correct as necessary.


LOSS OF COOLANT
Probable Cause(s)
A. OUTSIDE LEAKS
Probable Cause(s)
1. Leaks in Hoses or Connections
2. Leaks in the Radiator and/or Expansion Tank
3. Leaks in the Heater
4. Leaks in the Water Pump
5. Cylinder Head Gasket Leakage
B. COOLANT LEAKS AT THE OVERFLOW TUBE
Probable Cause(s)
6. Bad Pressure Cap
7. Engine Runs Too Hot
8. Expansion Tank Too Small
9. Cylinder Head Gasket Leakage or Crack(s) in Cylinder Head or Cylinder Block
C. INSIDE LEAKAGE
Probable Cause(s)
10. Cylinder Head Gasket Leakage
11. Crack(s) in Cylinder Head
12. Crack(s) in Cylinder Block

Loss of Coolant

Recommended Procedure

A. Outside Leaks

1. Leaks in Hoses or Connections . . . Check all hoses and connections for visual signs of leakage. If no leaks are seen, look for damage to hoses or loose clamps.

2. Leaks in the Radiator and/or Expansion Tank . . . Put pressure to the radiator and/or expansion tank with the 9S8140 Cooling System Pressurizing Pump Group and check for leaks.

3. Leaks in the Heater . . . Put pressure to the cooling system with the 9S8140 Cooling System pressurizing Pump Group and check the heater for leaks.

4. Leaks in the Water Pump . . . Check the water pump for leaks before starting the engine, then start the engine and look for leaks. If there are leaks at the water pump, repair or install a new water pump.

5. Cylinder Head Gasket Leakage . . . Look for leaks along the surface of the cylinder head gasket. If you see leaks, install a new head gasket.

B. Coolant Leaks at the Overflow Tube

6. Bad Pressure Cap or Relief Valve . . . Check the sealing surfaces of the pressure cap and the radiator to be sure the cap is sealing correctly. Check the opening pressure and sealing ability of the pressure cap or relief valve with the 9S8140 Cooling System Pressurizing Pump Group.

7. Engine Runs Too Hot . . . If coolant temperature is too high, pressure will be high enough to move the cap off of the sealing surface in the radiator and cause coolant loss through the overflow tube. See "Above Normal Heating" in COOLING SYSTEM Chart.

8. Expansion Tank Too Small or Installed Wrong . . . The expansion tank can be either a part of the radiator or it can be installed separately from the radiator. The expansion tank must be large enough to hold the expansion of the coolant as it gets warm or has sudden changes in pressure. Make sure the expansion tank is installed correctly, and the size is according to the recommendations of the Truck Manufacturer.

9. Cylinder Head Gasket Leakage, or Crack(s) in Cylinder Head or Cylinder Block . . . Remove the radiator cap and with the engine running look for air bubbles in the coolant. Bubbles in the coolant are a sign of probable leakage at the head gasket. With the engine not running, check each cylinder with the cylinder leakage tester. Special Instruction, Form No. GMG00694 gives the test procedure. If you see air bubbles in the coolant during this test, there is a leak of combustion gas into the cooling system. Remove the cylinder heads from the engine. Check cylinder heads, cylinder walls and head gasket surface of the cylinder block for cracks. When installing heads, use new head gasket.

C. Inside Leakage

10. Cylinder Head Gasket Leakage . . . If the cylinder head gasket leaks between a water passage and an opening into the crankcase, coolant will get into the crankcase.

11. Crack(s) in Cylinder Head . . . Crack(s) in the upper surface of the cylinder head, or an area between a water passage and an opening into the crankcase, can allow coolant to get into the crankcase.

12. Crack(s) in Cylinder Block . . . Crack(s) in the cylinder block between a water passage and the crankcase will let coolant get into the crankcase.