

ENGINE COOLING FAN

Article Text

1987 Volkswagen Quantum/Quantum Syncro

For Volkswagen Technical Site

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Sunday, March 19, 2000 01:44AM

ARTICLE BEGINNING

1987-88 ENGINE COOLING

Volkswagen Engine Cooling Fans

Cabriolet, Fox, Golf, GTI, Jetta, Scirocco,
Quantum & Vanagon

DESCRIPTION

The basic liquid cooling system consists of a radiator, water pump, thermostat, cooling fan, pressure cap, heater (if equipped), and various connecting hoses and cooling passages in the block and cylinder head. In addition, many cars use a fan clutch (incorporating a thermostatic control) or flexible fan blade. These reduce noise and power requirements at higher engine speeds. Other cars use a 2-speed electric cooling fan.

Some models may use a thermostatic vacuum switch to advance ignition timing in the event of overheating. Most models use a coolant recovery system to prevent loss of anti-freeze.

MAINTENANCE

DRAINING

Remove radiator cap and open heater control valve to maximum heat position. Open drain cocks or remove plugs in bottom of radiator and in engine block. In-line engines usually have one plug or cock, while "V" type engines will have two, one in each bank of cylinders.

CLEANING

A good cleaning compound removes most rust and scale. Follow manufacturer's instructions in the use of cleaner. If considerable rust and scale has to be removed, flushing should be used. Clean radiator air passages by blowing with compressed air from back to front of radiator.

FLUSHING

CAUTION: Some manufacturers use an aluminum and plastic radiator on some models (identified by a note below the filler neck). Material used for cleaning and flushing must be compatible with aluminum, according to manufacturer's recommendations.

1) Back flushing is a very effective means of removing rust and scale from a cooling system. For best results, the radiator, engine and heater core should be flushed separately.

2) To flush radiator, connect flushing gun to water outlet of radiator and disconnect water inlet hose. Use a leadaway hose, connected to radiator inlet, to prevent flooding engine. Use air in

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short bursts only, as this will prevent damage to radiator. Continue flushing until water runs clear.

3) To flush engine, first remove thermostat and replace housing. Connect flushing gun to water outlet of engine. Disconnect heater hoses from engine. Flush using short air bursts until water runs clean. Flush heater core as described for radiator. Make sure heater valve is set to maximum heat position before flushing heater.

REFILLING

Engine should be running while refilling cooling system to prevent air from being trapped in the engine block. After system is full, continue running engine until thermostat is open, then recheck fill level. Do not overfill system.

THERMOSTAT

1) Visually inspect thermostat for corrosion and proper sealing of valve and seat. If satisfactory, suspend thermostat and a thermometer in a container with a 50/50 mixture of anti-freeze and water. See Fig. 1.

2) Do not allow either thermostat or thermometer to touch bottom of container, as this concentration of heat could cause an incorrect reading. Heat water until thermostat just begins to open. Continue to heat water and note temperature when thermostat is completely open.

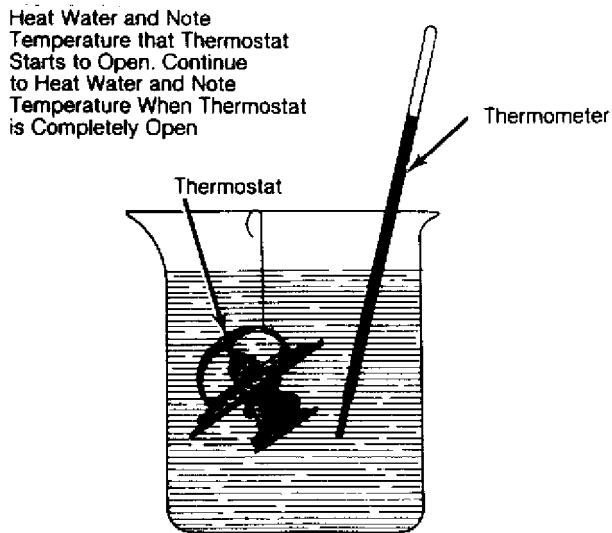


Fig. 1: Testing Thermostat in Anti-Freezer/Water Solution
Support thermometer so it does not touch bottom of container.

3) Read temperature on thermometer. This is the initial opening temperature and should be within specifications. Continue heating water until thermostat is fully open and note temperature. This is the fully opened temperature. If either reading is outside of specifications, replace thermostat, as it is not adjustable.

NOTE: General Motors Imports recommends hanging thermostat in 33% glycol solution at 25°F (4°C) above temperature stamped on

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thermostat. Valve should open. Remove thermostat from solution and place in similar solution at 10 °F (-12°C) below stamped temperature. Valve should close.

PRESSURE TESTING

A pressure testing tool is used to test both radiator cap and complete cooling system. Test as follows, following tool manufacturer's instructions.

Radiator Cap

Visually inspect radiator cap, then dip cap in water and connect to tester. Pump tester to bring pressure to upper limit of cap specifications. If cap fails to hold pressure within specifications, replace cap.

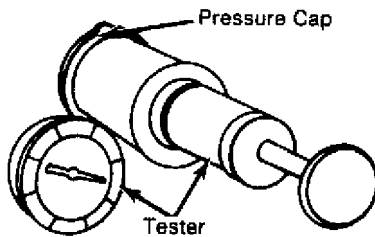


Fig. 2: Testing Radiator Pressure Cap
Wet cap gasket before testing.

Cooling System

1) With engine off, wipe radiator filler neck seat clean. Fill radiator to correct level. Attach tester to radiator and pump until pressure is at upper limit of radiator rating.

2) If pressure drops, inspect for external leaks. If no leaks are apparent, detach tester and run engine until normal operating temperature is obtained. Reattach tester and observe. If pressure builds up immediately, a possible leak exists from a faulty head gasket or crack in head or block.

CAUTION: Pressure may build up quickly. Release any excess pressure or cooling system damage may result.

3) If there is no immediate pressure build up, pump tester to within system pressure range (on radiator cap). Vibration of gauge pointer indicates compression or combustion leak into cooling system. Isolate leak by shorting each spark plug wire to cylinder block. Gauge pointer should stop or decrease vibration when leaking cylinder is shorted.

CAUTION: Do not disconnect spark plug wires while engine is operating, or operate engine with spark plug shorted for more than 1 minute, as catalytic converter may be damaged.

4) Remove engine and transmission (automatic only) oil

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dipsticks and check if water drops appear in oil. If so, a serious internal leak is indicated. If all checks are negative and system holds pressure for 2 minutes, there are no serious leaks in system.

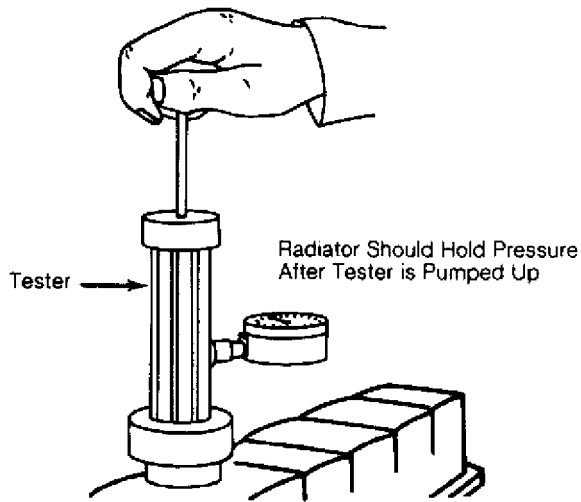


Fig. 3: Pressure Testing Cooling System
Pump up to specified pressure.

ANTI-FREEZE CONCENTRATION

NOTE: On models using aluminum engines or cooling system components, refer to Owners Manual for anti-freeze requirements and recommendations. Aluminum components require a different formulation of anti-freeze to prevent corrosion.

On all cooling systems, test anti-freeze concentration using anti-freeze tester. Tester should have a temperature-compensating feature, as failing to take temperature into consideration could cause an error as large as 30°F (16°C). Follow tester manufacturer's instructions for correct use of tester.

COOLANT RECOVERY SYSTEMS

DESCRIPTION

A coolant recovery system differs from other cooling systems in that an overflow bottle is connected to the radiator overflow hose. Overflow bottle is transparent or translucent to permit checking of coolant level without removing radiator cap. No adjustment or test is required except keeping vent hole or hose clean and checking pressure relief of radiator cap.

OPERATION

As coolant temperature rises and pressure in system exceeds

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pressure relief valve of radiator cap, excess coolant flows into overflow bottle. As engine cools and coolant contracts, vacuum is formed in the system. Vacuum draws coolant, stored in overflow bottle, back into radiator. In a properly maintained cooling system, the only coolant losses will be through evaporation.

Overflow bottle captures and releases coolant according to temperature. (See Fig. 4)

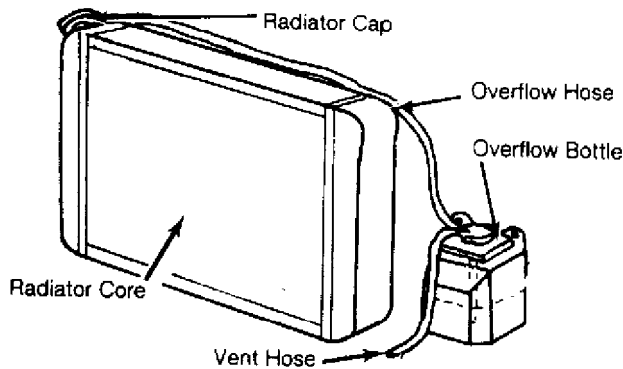


Fig. 4: Typical Coolant Recover System

THERMOSTATICALLY CONTROLLED ELECTRIC FANS

DESCRIPTION

Electrically-driven fans are actuated by thermal relay switches. Thermal switches turn fan motor on when necessary and shut fan motor off when not needed. Air conditioned vehicles are equipped with over-ride switches. These switches turn fan motor on whenever air conditioning system is operating. When system is turned off, fan motor control is returned to thermal relay.

THERMAL SWITCH OPERATION

Operation Temp.

Cut-In Temp.

Stage I 192-201°F (89-94°C)

Stage II 203-212°F (95-100°C)

Cut-Out Temp.

Stage I 178°F (81°C)

Stage II 189°F (87°C)

AAAAAA

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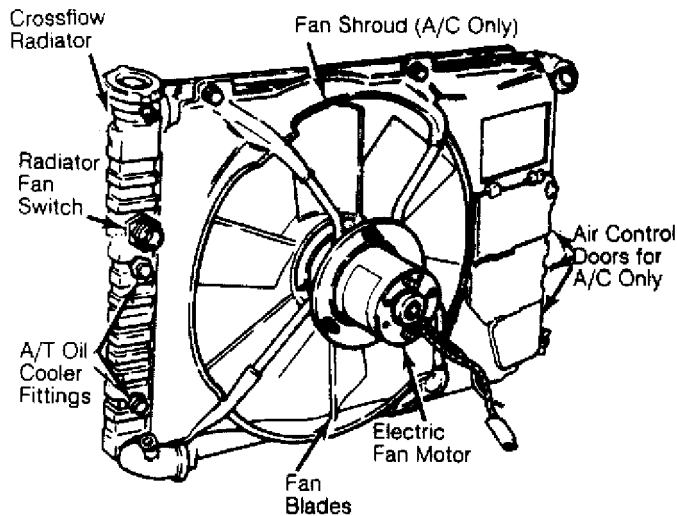


Fig. 5: Typical Thermostatically Controlled Electric Fan

TESTING

Disconnect fan motor wire connector and connect it with 14 gauge wire to a good 12-volt battery. If fan runs, motor is okay. This indicates car battery, thermal switch, radiator fan switch, coolant relay, timer relay, coolant temperature switch, or A/C relay may be defective. If fan motor does not run when connected directly to a good battery, replace fan motor.

VARIABLE SPEED COOLING FANS - FLEX-BLADE FANS

DESCRIPTION

This unit is a flexible blade assembly designed to flex blades as engine RPM increases. As RPM increases, blade pitch decreases, thereby saving power and decreasing noise level. Keep fan belt adjusted to proper tension as necessary.

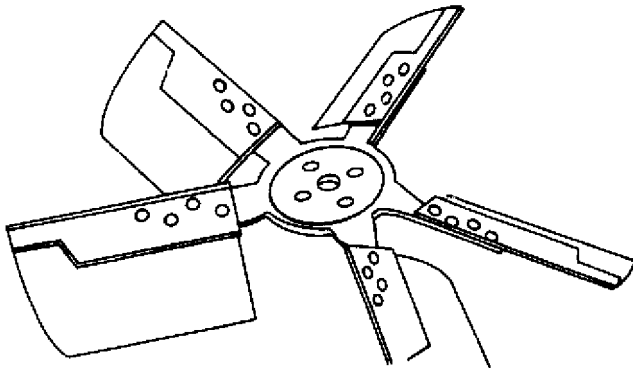


Fig. 6: Flex Blade Fan Assembly

VARIABLE SPEED COOLING FANS CLUTCH WITH THERMOSTATIC CONTROL

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DESCRIPTION

Most air conditioned models use a thermostatically controlled fluid fan and torque control clutch. Thermal control drive is a silicone-filled coupling connecting fan to a fan pulley, and is operated by a control valve. Control valve is operated by a temperature sensitive bi-metallic coil or strip and controls flow of silicone through the clutch.

During periods of operation when radiator discharge air temperature is low, fan clutch speeds are slowed, decreasing load on fan belt. High radiator discharge air temperature causes bi-metallic coil or strip to allow a greater flow of silicone to enter clutch. This increases drag between driven member and driving member resulting in a higher fan speed and increased cooling.

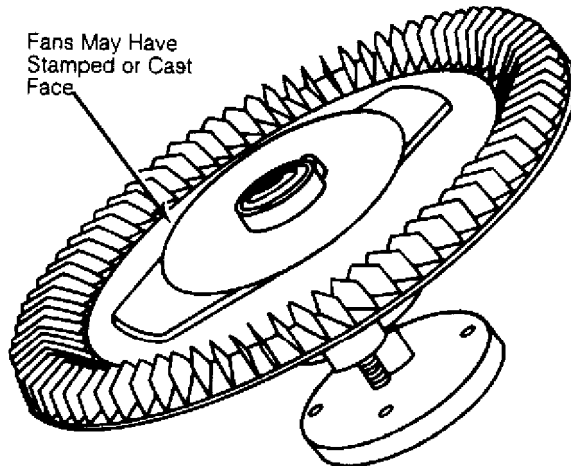


Fig. 7: Thermostatically Controlled Fan Assembly
Shown with stamped face and bi-metallic coil spring.

TESTING

In cases of engine overheating or insufficient air conditioning proceed with following tests:

- 1) Start with a cool engine to ensure complete fan clutch disengagement.
- 2) Cover radiator grille sufficiently to induce high engine temperature.
- 3) Start engine and operate at 2000 RPM. Turn on air conditioning if equipped.
- 4) A fan roar will be noticed when fan clutch engages.

NOTE: It will take approximately 5 to 10 minutes for temperature to become high enough to allow engagement of the fan clutch. While operating engine under these conditions, observe temperature light to prevent overheating. If hot light comes on, remove cover from radiator grille.

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5) When clutch engages, remove radiator grille cover and turn A/C off to assist in engine cooling.

6) After several minutes fan clutch should disengage. This can be determined by a reduction in fan speed and roar. If fan fails to function as described, it should be replaced.

NOTE: To avoid premature cooling system wear, always use the manufacturer's recommended coolant products and coolant mixture ratios.

END OF ARTICLE