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GROUP: Cooling

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SUBJECT:

Hydraulic Radiator Cooling Fan System Diagnostic Check Chart Aid

MODELS:

2005 - 2006 (WK / WH) Grand Cherokee

2006 (XK / XH) Commander

SPECIAL TOOLS/EQUIPMENT REQUIRED:

CH9401	StarSCAN® Tool
CH9404	StarSCAN® Vehicle Cable

DISCUSSION:

DESCRIPTION

The 5.7L hydraulic cooling fan is integral to the fan shroud and is located between the radiator and the engine (Fig. 1).

The power steering pump supplies the hydraulic fluid and pressure to rotate the cooling fan blade, while the electrical part of the fan is controlled by the Front Control Module (FCM).

The hydraulic fan drive (motor) consists of the three major following components:

- Steering flow control valve
- Fan control valve
- Two stage G-rotor hydraulic drive

The hydraulic fan and drive is not serviceable, except for the fan motor solenoid. Therefore any failure of the fan blade, hydraulic fan drive (except solenoid) or fan shroud requires replacement of the fan module. Because the fan blade and hydraulic fan drive are matched and balanced as an assembly and servicing either separately would disrupt this balance.

CAUTION: Do not attempt to service the hydraulic cooling fan or fan drive separately, they are serviced as an assembly. Failure to do so may cause severe damage to the hydraulic cooling fan assembly.

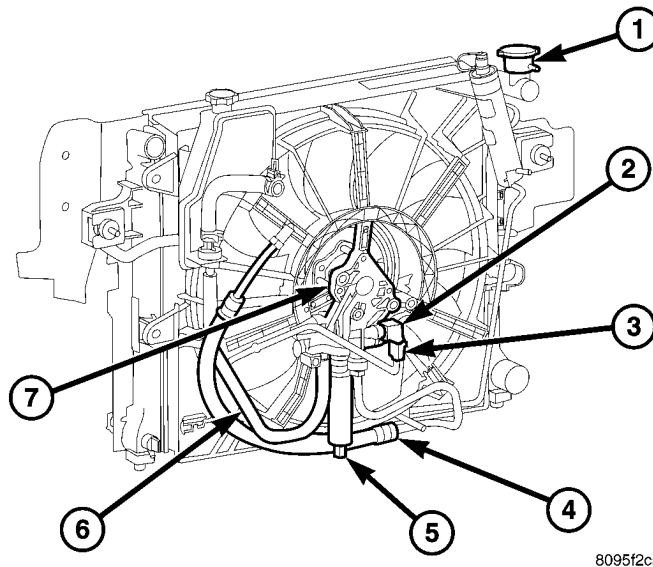


Fig. 1 HYDRAULIC RADIATOR COOLING FAN AND FAN DRIVE - 5.7L

- 1 - RADIATOR
- 2 - HYDRAULIC FAN MOTOR SOLENOID
- 3 - ELECTRICAL CONNECTOR
- 4 - HIGH PRESSURE LINE INPUT - POWER STEERING PUMP TO HYDRAULIC FAN MOTOR
- 5 - HIGH PRESSURE LINE OUTPUT - HYDRAULIC FAN MOTOR TO POWER STEERING GEAR (FILTER SHOWN NOT USED / INSTALLED)
- 6 - LOW PRESSURE RETURN LINE OUTPUT - HYDRAULIC FAN MOTOR TO POWER STEERING RESERVOIR
- 7 - HYDRAULIC FAN MOTOR

OPERATION

The hydraulic radiator cooling fan used on the 5.7L gasoline and 3.0L diesel engines replaces both the electric fan and the engine driven mechanical fan. This provides 5.7L and 3.0L equipped vehicles with heavy trailer towing capability while at the same time reducing unnecessary power drain on both the engine and the vehicles electrical system.

HYDRAULIC FAN STRATEGY

The hydraulic radiator cooling fan is controlled by the Front Control Module (FCM). A Pulse With Modulated (PWM) signal from the FCM controls the fan speed. There are three inputs to the FCM that determine what percentage of fan speed is required by the vehicle. These inputs are:

- Engine Coolant Temperature
- Transmission Oil Temperature
- A/C System Pressure

By monitoring the desired operating parameters for these three inputs, the FCM can determine if cooling airflow is required. If airflow is required, the FCM will slowly speed up the fan until the parameter(s) are under control. Once the temperature or pressure is reduced to within operating parameters the fan will speed up, slow down, or hold its speed to maintain the temperature/pressure requirements.

NOTE: Even if the FCM is not requesting fan on operation, the fan blade will usually spin between 100 and 500 RPM when the vehicle is at idle.

ACTIVATING THE HYDRAULIC FAN WITH THE SCAN TOOL (StarSCAN®)

Under the Engine Systems test heading, there is a subheading. “Hydraulic fan solenoid test”, that has the selections, on/off. Activating the fan with the StarSCAN® will run the fan at 100% duty cycle, which will help troubleshoot any system problems, and also help with the hydraulic system deaeration procedure.

NOTE: Engine must be running to activate the fan with the StarSCAN®.

RADIATOR COOLING FAN HYDRAULIC FLUID PATH

Hydraulic fluid is pumped by the power steering pump through a high pressure delivery line to the fan drive motor. As fluid is diverted through one or both G-rotor stages, rotational motion is created as fluid moves from the high-pressure (inlet) side of the motor to the lower-pressure (high pressure outlet) side. Fluid exiting the drive motor is divided into two paths. In path one, fluid continues through a high pressure delivery line to the vehicle steering gear to provide steering assist. This fluid then exits the steering gear under low pressure and travels through a low pressure line to the power steering fluid cooler to be cooled before being returned back to the power steering fluid reservoir. In path two, excess fluid travels through a low pressure line back to the power steering pump fluid reservoir (Fig. 2).

NOTE: There is a steering flow control valve located in the fan drive motor. This valve operates like the flow control valve found in the typical power steering pump. A failed pump and/or fan drive can produce contamination that may cause the steering flow control valve to stick.

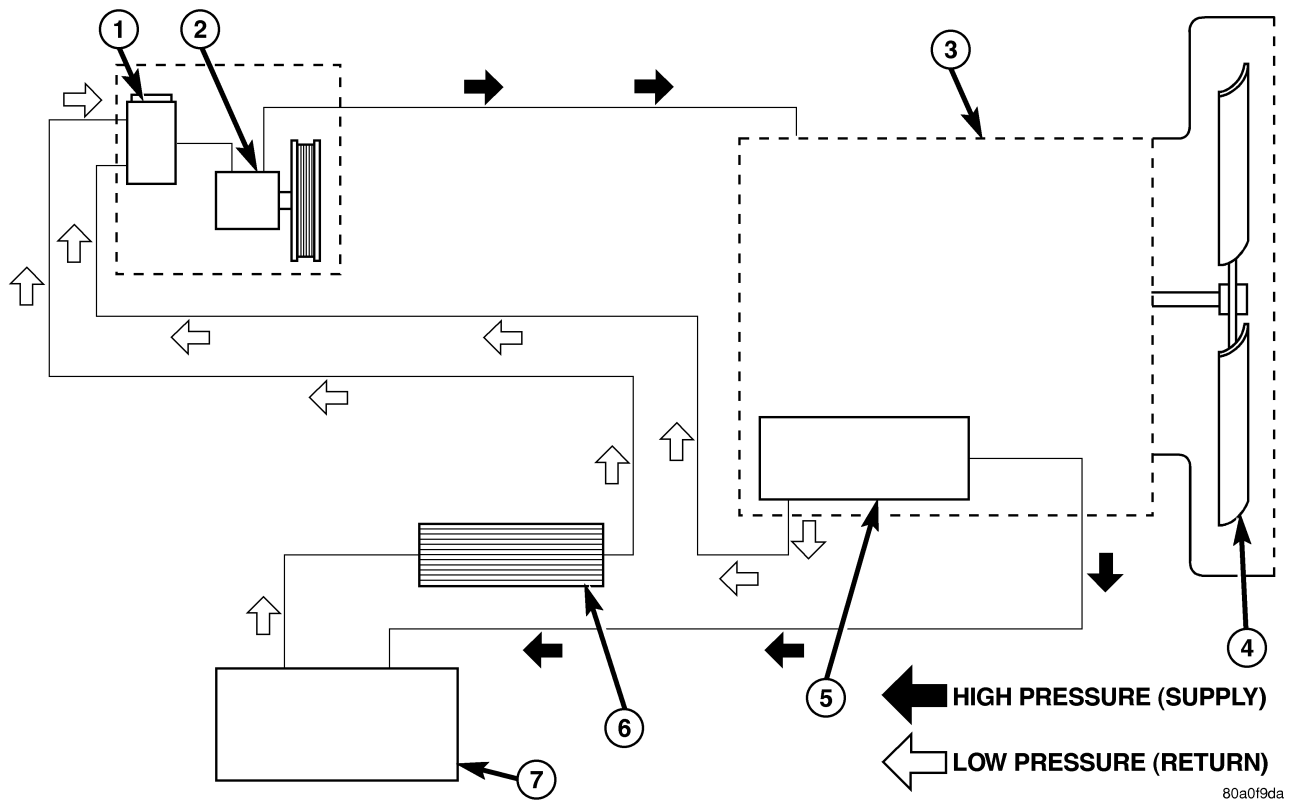


Fig. 2 HYDRAULIC FAN FLUID FLOW CIRCUIT

- 1 - POWER STEERING RESERVOIR
- 2 - POWER STEERING PUMP
- 3 - HYDRAULIC FAN DRIVE ASSEMBLY
- 4 - FAN BLADE
- 5 - HYDRAULIC FAN CONTROL SOLENOID
- 6 - POWER STEERING OIL COOLER
- 7 - STEERING GEAR

DIAGNOSIS:

This diagnostic procedure should be used if the engine overheats or the A/C compressor cycles rapidly.

1. **Non-hydraulic system** - Check for low coolant, faulty thermostat, faulty temperature sensor, etc. - **Is there a Non-hydraulic system problem?**
 - a. Yes >> Repair as necessary.
 - b. No >> Go to [Step #2](#).
2. **Power steering fluid** - Check the power steering fluid level in the reservoir - **Is the fluid in the power steering pump reservoir below the dipstick "Add" mark?**
 - a. Yes >> Check for leaks and repair as required. Fill the reservoir to the proper level and proceed to [Step #3](#).
 - b. No >> Go to [Step #3](#).

CAUTION: Fan blade and/or shroud may have sharp edges!

3. **Radiator cooling fan** - Disconnect and isolate the negative battery cable from the battery. Rotate the fan counterclockwise (as viewed by the driver) using fingertips on the outer fan blade. Move the fan through 7 full rotations and notice the drag torque. - **Does the fan spin freely through all 7 rotations with minimal finger exertion?**
 - a. Yes >> Go to [Step #6](#).
 - b. No >> Go to [Step #4](#).
4. **Does the torque needed to spin the fan significantly change as the fan is rotated?**
 - a. Yes >> Go to [Step #18](#).
 - b. No >> Go to [Step #5](#)
5. **Is it difficult to turn the fan or does it require the effort of more than one finger?**
 - a. Yes >> Go to [Step #18](#)
 - b. No >> Go to [Step #6](#)
6. **Testing the system** - Connect the negative battery cable to the battery. Using the StarSCAN® perform the following tests with the engine running at idle speed. - **Does the fan accelerate when given a 100% duty cycle command?**
 - a. Yes >> Go to [Step #7](#).
 - b. No >> Go to [Step #12](#).
7. **Does the fan decelerate when the duty cycle is changed from 100% to 0%?**
 - a. Yes >> Go to [Step #8](#).
 - b. No >> Go to [Step #18](#).
8. At 0% duty cycle, turn the steering wheel to full left or right stop for up to 5 seconds (to stop fan rotation). - **Does the fan rotate when the steering wheel is returned to center at 0% duty cycle?**
 - a. Yes >> Go to [Step #9](#).
 - b. No >> Go to [Step #10](#).
9. Repeat [Step #8](#), ten times. - **Does the fan always resume rotation after the wheel is returned to center?**
 - a. Yes >> The hydraulic fan motor is OK.
 - b. No >> Go to [Step #10](#).
10. Turn the A/C system on. The ambient temperature or sun load must be high enough to cause the A/C compressor to cycle, this will normally be above 15.6° C / 60° F. With the A/C system operational, the fan speed should increase as the refrigerant pressure rises. If the A/C system does not operate because of low temperature (below 15.6° C / 60° F) or sun load, use the StarSCAN® to step the fan control motor solenoid duty cycle to 100%. - **Does the fan always start soon after the A/C is turned “On” (or the duty cycle is set to 100%)?**
 - a. Yes >> Go to [Step #11](#).
 - b. No >> Go to [Step #18](#).
11. Repeat [Step #10](#), ten times stopping the fan between tests by turning the steering wheel. **Does the fan speed always increases when A/C is turned “On” (100% duty cycle)?**
 - a. Yes >> The hydraulic motor is OK.
 - b. No >> Go to [Step #18](#).
12. **Does pump noise increase indicating that the system pressure is increasing?**
 - a. Yes >> Go to [Step #18](#).
 - b. No >> Go to [Step #13](#).

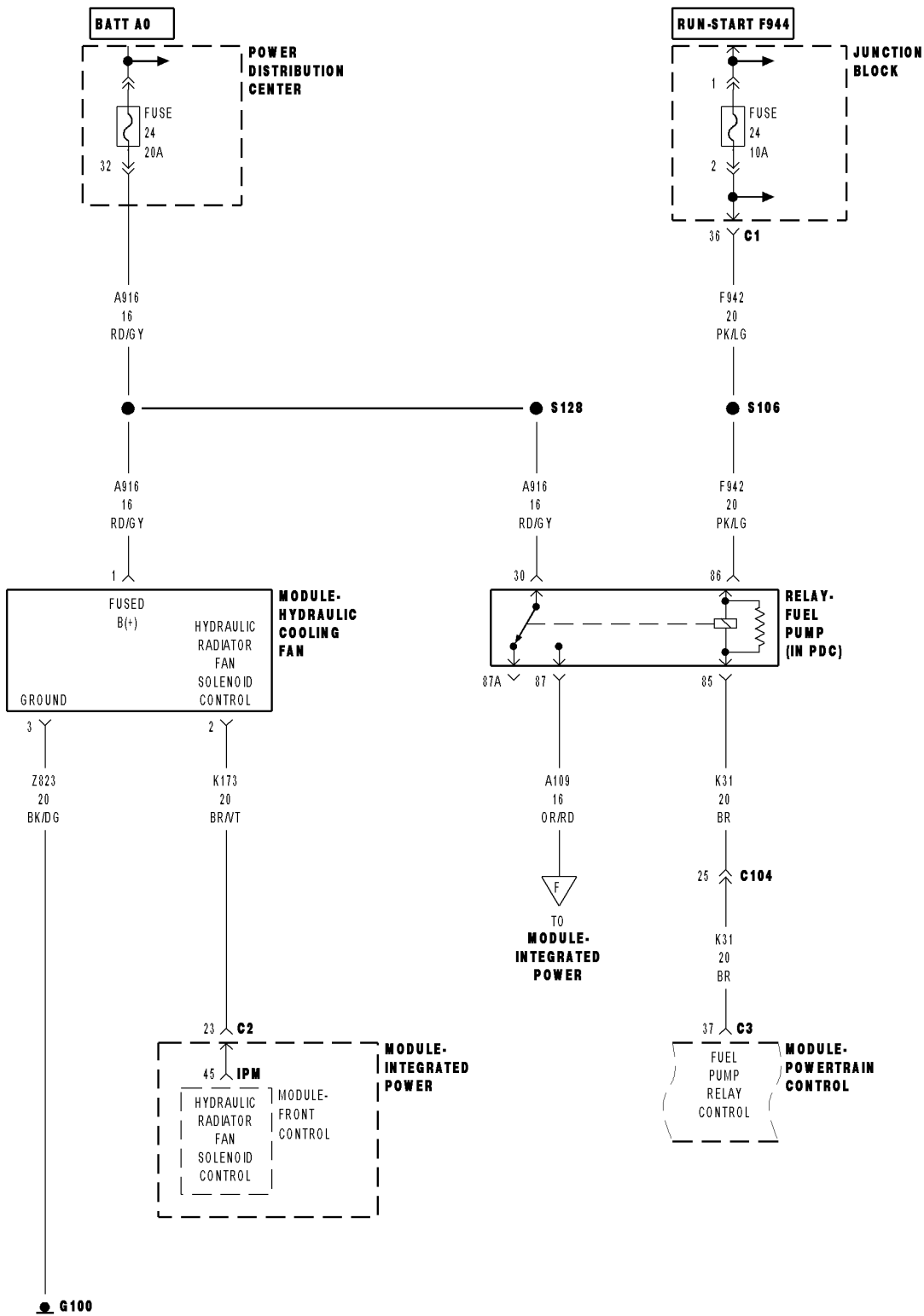


Fig. 3 HYDRAULIC COOLING FAN MODULE CIRCUIT

13. **Electrical testing** - Disconnect the 3 pin connector of the fan motor assembly jumper harness from the vehicle engine compartment wiring harness. Using the connector of the jumper harness for electrical measurements will normally allow easier access than if the connector at the hydraulic motor pressure control valve is used. Measure the resistance between terminal 1 and terminal 2 of the fan motor assembly jumper harness to determine fan motor solenoid resistance. (Fig. 3) - **Is the resistance between 7 and 13 ohms?**
 - a. Yes >> Go to [Step #14](#).
 - b. No >> Go to [Step #17](#).
14. Fabricate a 3 wire jumper harness between the vehicle engine compartment wiring harness and the fan motor assembly jumper harness connector. Insert an ammeter in the K173 BR/VT circuit (Fig. 3). Start the engine and set the duty cycle to 100%. - **Is the current draw on circuit K173, BR/VT, between 0.5 and 1.5 amps?**
 - a. Yes >> Go to [Step #17](#).
 - b. No >> Go to [Step #15](#).
15. Inspect for shorted or broken wires. - **Were any wires shorted or broken?**
 - a. Yes >> Repair as necessary.
 - b. No >> Go to [Step #16](#).
16. Replace the Front Control Module (FCM).
17. Replace the fan control motor solenoid and retest the hydraulic fan motor.
18. Replace the hydraulic fan/motor/shroud assembly.

POLICY:

Reimbursable within the provisions of the warranty using diagnostic labor operations for actual labor time. The Operation Diagnostic labor operations can be located in the 80/90 - Special Services tab in the Labor Operations Manual. Usage of these operations must follow the guidelines outlined in the Global Warranty Administration Manual.