

2014 ENGINE

Engine Cooling System - Compass & Patriot

DESCRIPTION

GAS ENGINE

The cooling system regulates engine operating temperature. It allows the engine to reach normal operating temperature as quickly as possible. It also maintains normal operating temperature and prevents overheating.

The cooling system also provides a means of heating the passenger compartment. The cooling system is pressurized and uses a centrifugal water pump to circulate coolant throughout the system. A separate and remotely mounted, coolant bottle is used.

The cooling system consists of:

- Radiator
- Coolant
- Cooling Fan(s)
- Water pump
- Thermostat
- Hoses and clamps
- Coolant pressure bottle/overflow system

OPERATION

GAS ENGINE

The primary purpose of a cooling system is to maintain engine temperature in a range that will provide satisfactory engine performance and emission levels under all expected driving conditions. It also provides hot water (coolant) for heater performance and cooling for automatic transmission oil. It does this by transferring heat from engine metal to coolant, moving this heated coolant to the radiator, and then transferring this heat to the ambient air.

- When the engine is cold and both the primary and secondary thermostats are closed. The coolant will circulate through the engine, heater system, and the

bypass. The cooling system has no flow through the radiator

- As the engine warms up, the primary thermostat will start to open at 77 °C (170 °F). Coolant will start to flow through the radiator and the internal transmission cooler. The primary thermostat will fully open at 95 °C (203 °F).
- The secondary thermostat will start to open at 95 °C (203 °F). This will increase the coolant flow through the cylinder block and cylinder head and the radiator. The secondary thermostat will fully open at 104 °C (220 °F).
- **TURBOCHARGED ENGINE ONLY:** the turbocharged engine has a single thermostat that starts to open at 90.5 °C (195 °F) and is fully open at 100 °C (212 °F). This is done to reduce resistance and increase flow.

DIESEL

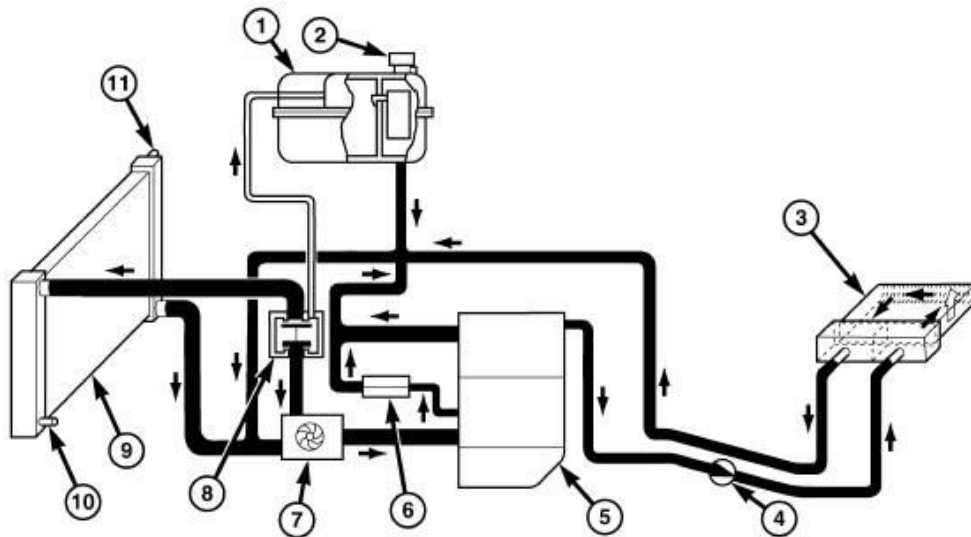


Fig. 1: Cooling System Flow
Courtesy of CHRYSLER GROUP, LLC

- 1 - COOLANT RECOVERY PRESSURE CONTAINER
- 2 - PRESSURE CAP
- 3 - HEATER CORE
- 4 - AUXILIARY HEATER
- 5 - ENGINE
- 6 - OIL COOLER
- 7 - WATER PUMP
- 8 - THERMOSTAT HOUSING
- 9 - RADIATOR

10 - COOLANT DRAIN VALVE**11 - SERVICE FILL VENT VALVE**

The water pump draws coolant from the radiator and delivers it to the engine block. The coolant travels through the engine block into the cylinder head. Coolant exits the engine at the thermostat. If the coolant temperature is less than 87°C (189°F) the thermostat directs all of the coolant back to the water pump. If the coolant temperature is between 87°C (189°F) and 102°C (216°F) the thermostat is in the mix mode and directs the coolant to the radiator and the water pump. If the coolant is greater than 102°C (216°F), the thermostat directs all of the coolant to the radiator.

The thermostat also feeds excess coolant and bleeds air from the system through a hose leading to the coolant reservoir. The reservoir returns coolant to the inlet side of the water pump. A port and hose at the rear of the engine block provides coolant to the heater core. This coolant is returned to the engine at the intake side of the water pump.

The oil cooler receives coolant directly from the engine block. A hose returns this coolant to the inlet side of the water pump.

DIAGNOSIS AND TESTING

AERATION

If coolant level drops below a certain point, aeration will occur drawing air into the water pump resulting in the following:

- High reading shown on the temperature gauge.
- Loss of coolant flow through the heater core.
- Corrosion in the cooling system.
- Transmission oil will become hotter (automatic transmission equipped vehicles).
- Water pump seal may run dry, increasing the risk of premature seal failure.
- Combustion gas leaks into the coolant can also cause the above problems.

DEAERATION

As air is removed from the cooling system, it gathers in the coolant recovery

container. This pressure is released into the atmosphere through the pressure valve located in the radiator pressure cap when pressure reaches 96 - 124 kPa (14 - 18 psi). This air is replaced with coolant from the coolant recovery container.

NOTE: Deaeration does not occur at engine idle, higher engine speeds are required. Normal driving will deaerate cooling system.

To effectively deaerate the system, multiple thermal cycles of the system may be required.

FLOW CHECK

WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

To determine whether coolant is flowing through the cooling system, use one of the following procedures:

- If engine is cold, idle engine until normal operating temperature is reached. Then feel the upper radiator hose. If it is hot, coolant is circulating.
- Remove pressure cap when engine is cold, remove small amount of coolant. Idle engine until thermostat opens, you should observe coolant flow while looking down the filler neck. Once flow is detected install the pressure cap.

LEAK TESTING

WARNING: If vehicle has been run recently, wait 15 minutes before removing pressure cap. Place a shop towel over the cap, and without pushing down, rotate it counterclockwise to the first stop. Allow fluids to escape through the overflow tube. When the system stops pushing coolant and steam into the coolant recovery container and pressure drops, push down on the cap and remove it completely. Squeezing the radiator inlet hose with a shop towel (to check pressure) before and after turning

to the first stop is recommended.

With engine not running, wipe the coolant filler neck sealing seat clean. The radiator should be full.

Attach Tool (special tool #7700, Tester, Cooling System) or equivalent cooling system pressure tester to the coolant filler neck. Apply 104 kPa (15 psi) pressure. If the pressure drops more than 13 kPa (2 psi) in 2 minutes inspect all points for external leaks.

All hoses, radiator and heater, should be moved while at 104 kPa (15 psi) since some leaks occur while driving due to engine movement, etc.

If there are no external leaks after the gauge dial shows a drop in pressure, detach the tester. Start engine and run the engine to normal operating temperature in order to open the thermostat and allow the coolant to expand. Reattach the tester. If the needle on the dial fluctuates, it indicates a combustion leak and is usually a head gasket leak.

WARNING: With tool in place pressure builds up fast. Any excessive amount of pressure built up by continuous engine operation must be released to a safe pressure point. never permit pressure to exceed 138 kPa (20 psi).

If the needle on the dial does not fluctuate, race the engine a few times. If an abnormal amount of coolant or steam is emitted from the tailpipe, it may indicate a damaged head gasket, cracked engine block or cylinder head.

There may be internal leaks which can be determined by removing the oil dipstick. If water globules appear intermixed with the oil, it will indicate an internal leak in the engine. If there is an internal leak, the engine must be disassembled for repair.

COOLING SYSTEM

CONDITION	POSSIBLE CAUSE	CORRECTION
TEMPERATURE GAUGE READS LOW	1. Diagnostic Trouble Code (DTC) has been set indicating a stuck	1. Replace thermostat, if necessary. If a (DTC) has not been set, the

	open engine thermostat.	problem may be with the temperature gauge.
	2. Engine Coolant Temperature Sensor.	2. Check connector at Engine Coolant Temperature Sensor. Repair as necessary.
	3. Inoperative temperature gauge.	3. Check gauge operation. Refer to DIAGNOSIS AND TESTING .
	4. Coolant level low during cold ambient temperature, accompanied by poor heater performance.	4. Check coolant level in the coolant recovery/reserve container and the radiator. Inspect the system for leaks. Repair as necessary. Refer to WARNINGS in LEAK TESTING before removing pressure cap.
TEMPERATURE GAUGE READS HIGH OR ENGINE COOLANT WARNING LAMP ILLUMINATES. COOLANT MAY OR MAY NOT BE LOST FROM SYSTEM.	1. Trailer being towed, a steep hill being climbed, vehicle being operated in slow moving traffic, or engine idling during high ambient (outside) temperatures with air conditioning on. High altitudes could also cause these conditions.	1. This may be a temporary condition and repair is not necessary. Turn off the air conditioning and drive the vehicle without any of the previous conditions. Observe the temperature gauge. The gauge should return to the normal range. If the gauge does not return to the normal range, determine the cause of the overheating and repair.

2. Inoperative temperature gauge.	2. Check gauge operation. Refer to <u>DIAGNOSIS AND TESTING</u> .
3. Is temperature warning lamp (if equipped) illuminating unnecessarily?	3. Check warning lamp operation. Refer to <u>DIAGNOSIS AND TESTING</u> .
4. Coolant low in recovery/reserve bottle and radiator?	4. Check for coolant leaks and repair as necessary.
5. Pressure cap not installed tightly. If cap is loose, boiling point of coolant will be lowered. Also refer to the following step 6.	5. Tighten cap.
6. Poor seals at pressure cap.	6. (a) Check condition of cap and cap seals. Refer to <u>CAP, RADIATOR, DIAGNOSIS AND TESTING</u> . Replace cap if necessary.
	(b) Check condition of filler neck. If neck is warped or damaged, replace neck.
7. Coolant level low in radiator, but not in coolant recovery/reserve bottle. This indicates the radiator is not drawing coolant from	7. (a) Check condition of pressure cap and cap seals. Replace cap if necessary.
	(b) Check condition of filler neck. Replace if damaged.

the coolant recovery/reserve bottle as the engine cools. As the engine cools, a vacuum is formed inside the cooling system. If the pressure cap seals are defective, or the cooling system has a leak, a vacuum cannot be formed.	(c) Check condition of hose from filler neck to coolant container. It should be tight at both ends without any kinks or tears. Replace hose as necessary.
	(d) Check coolant recovery/reserve bottle and hose for blockage. Repair as necessary.
8. Freeze point of coolant not correct. Mixture ratio may be too rich.	8. Check coolant concentration. Refer to <u>COOLANT, DIAGNOSIS AND TESTING</u> . Adjust glycol-to-water ratio as required.
9. Coolant not flowing through system.	9. Check for coolant flow at filler neck with some coolant removed, engine warm, and thermostat open. Coolant should be observed flowing through filler neck. If flow is not observed, determine reason for lack of flow and repair as necessary.
10. Radiator air seals missing or improperly installed.	10. Inspect air seals. Correct as necessary.
11. Radiator or A/C condenser fins are dirty or clogged.	11. Clean obstruction from fins.
12. Radiator core is	12. Replace or clean

	plugged or corroded.	radiator.
	13. Fuel or ignition system problems.	13. Refer to the appropriate Powertrain Diagnostic Procedure information.
	14. Dragging Brakes.	14. Inspect brake system and repair as necessary. Refer to <u>DIAGNOSIS AND TESTING</u> .
	15. Bug screen or other aftermarket accessory is being used causing reduced air flow.	15. Remove bug screen or accessory.
	16. Thermostat partially or completely closed.	16. Check thermostat operation and replace as necessary. Refer to <u>THERMOSTAT, DIAGNOSIS AND TESTING</u> .
	17. Cooling fan not operating properly.	17. Check electric fan operation and repair as necessary.
	18. Cylinder head gasket leaking.	18. Check cylinder head gasket for leaks. Refer to <u>DIAGNOSIS AND TESTING</u> .
	19. Heater core leaking.	19. Check heater core for leaks.
TEMPERATURE GAUGE READING IS INCONSISTENT (FLUCTUATES, CYCLES OR IS ERRATIC)	1. The gauge may cycle up and down. This is due to the cycling of the electric radiator fan.	1. A normal condition. No correction is necessary. If gauge cycling is the hot zone, check electric fan operation and repair as necessary.

2. During cold weather operation with the heater blower in the high position, the gauge reading may drop slightly.	2. A normal condition. No correction is necessary.
3. Temperature gauge or Engine Coolant Temperature Sensor is defective or shorted.	3. Check gauge operation. Refer to <u>DIAGNOSIS AND TESTING</u> .
4. Gauge reading rises when vehicle is brought to a stop after heavy use (engine still running).	4. A normal condition. No correction is necessary. The gauge should return to normal range after vehicle is driven.
5. Gauge reading high after restarting a warmed-up (hot) engine.	5. A normal condition. No correction is necessary. The gauge should return to normal range after a few minutes of engine operation.
6. Coolant level low in radiator (air will build up in the cooling system causing the thermostat to open late).	6. Check and correct coolant leaks.
7. Cylinder head gasket leaking allowing exhaust gas to enter cooling system. This will cause thermostat to open late.	7. (a) Check for cylinder head gasket leaks using Tool C-3685-A Block Leak Tester or the equivalent. Repair as necessary. (b) Check for coolant in

		the engine oil. Inspect for white steam emitting from exhaust system. Repair as necessary.
	8. Water pump impeller loose on shaft.	8. Check water pump and replace as necessary.
	9. Air leak on the suction side of water pump allows air to build up in cooling system. This will cause the thermostat to open late.	9. Locate leak and repair as necessary.
PRESSURE CAP IS BLOWING OFF STEAM AND/OR COOLANT FLOWING INTO RECOVERY BOTTLE. TEMPERATURE GAUGE READING MAY BE ABOVE NORMAL, BUT NOT HIGH. COOLANT LEVEL MAY BE HIGH IN RECOVERY BOTTLE.	1. Pressure relief valve in pressure cap is defective.	1. Check condition of pressure cap and seals. Refer to <u>CAP, RADIATOR, DIAGNOSIS AND TESTING</u> . Replace as necessary.
COOLANT LOSS TO THE GROUND WITHOUT PRESSURE CAP BLOWOFF. GAUGE IS READING HIGH OR HOT.	1. Coolant leaks in radiator, cooling system hoses, water pump or engine.	1. Pressure test cooling system and repair as necessary.
DETONATION OR PRE-IGNITION (NOT CAUSED BY IGNITION SYSTEM). GAUGE MAY OR MAY NOT BE READING HIGH.	1. Engine overheating.	1. Check reason for overheating and repair as necessary.
	2. Freeze point of	2. Check the freeze

	coolant not correct.	point of the coolant. Refer to <u>COOLANT, DIAGNOSIS AND TESTING</u> . Adjust glycol-to-water ratio as required.
HOSE OR HOSES COLLAPSE WHEN ENGINE IS COOLING	1. Vacuum created in cooling system on engine cool-down is not being relieved through coolant recovery/reserve system.	1. (a) Pressure cap relief valve stuck. Refer to <u>CAP, RADIATOR, DIAGNOSIS AND TESTING</u> . Replace as necessary.
		(b) Hose between coolant recovery/reserve bottle and outlet connector is kinked. Repair as necessary.
		(c) Vent at coolant recovery/reserve bottle is plugged. Clean vent and repair as necessary.
		(d) Recovery/reserve bottle is internally blocked or plugged. Check for blockage and repair as necessary.
RADIATOR FAN OPERATES ALL THE TIME	1. Malfunctioning electrical component or circuit.	1. Refer to appropriate Powertrain Diagnostic Procedures information. Repair as necessary.
	2. Check for low coolant level.	2. Repair as necessary.
RADIATOR FAN WILL NOT OPERATE, GAUGE	1. Fan motor defective.	1. Refer to appropriate Powertrain Diagnostic

READING HIGH OR HOT		Procedures information for operation of the scan tool. Repair as necessary.
	2. Fan relay, powertrain control module (PCM) or engine coolant temperature sensor defective.	2. Refer to appropriate Powertrain Diagnostic Procedures information for operation of the scan tool. Repair as necessary.
	3. Blown fuse in power distribution center (PDC).	3. Determine cause for blown fuse and repair as necessary.
NOISY FAN	1. Fan blade loose.	1. Replace radiator fan assembly.
	2. Fan blade striking a surrounding object.	2. Locate point of fan blade contact and repair as necessary.
	3. Air obstructions at radiator or A/C condenser.	3. Remove obstructions and/or clean debris from radiator and/or A/C condenser.
	4. Electric fan motor defective.	4. Replace radiator fan assembly.
INADEQUATE AIR CONDITIONER PERFORMANCE (COOLING SYSTEM SUSPECTED)	1. Electric radiator fan not operating when A/C is on.	1. Refer to appropriate Powertrain Diagnostic Procedures information for operation of the scan tool. Repair as necessary.
	2. Radiator and/or air conditioning condenser is restricted, obstructed or dirty.	2. Remove restriction and/or clean as necessary.
	3. Radiator air seals missing or improperly	3. Inspect air seals. Repair as necessary.

	installed.	
	4. Engine is overheating (heat may be transferred from radiator to A/C condenser). High underhood temperature due to engine overheating may also transfer heat to A/C components.	4. Correct overheating condition. Refer to <u>DIAGNOSIS AND TESTING</u> .
INADEQUATE HEATER PERFORMANCE	1. Has a diagnostic trouble code (DTC) been set?	1. Refer to appropriate Powertrain Diagnostic Procedures information.
	2. Coolant level low.	2. Check cooling system for leaks. Repair as necessary.
	3. Obstructions in heater hose fittings at engine.	3. Remove heater hoses at both ends and check for obstructions. Repair as necessary.
	4. Heater hose kinked.	4. Locate kinked area and repair as necessary.
	5. Water pump is not pumping coolant to heater core. When the engine is fully warmed up, both heater hoses should be hot to the touch.	5. Refer to <u>PUMP, WATER, DIAGNOSIS AND TESTING</u> . Repair as necessary.
HEAT ODOR	1. Various heat shields are used at certain components. One or more of these shields may be missing.	1. Locate missing shields and replace or repair as necessary.

	2. Is temperature gauge reading above the normal range?	2. Refer to the previous TEMPERATURE GAUGE READS HIGH in these Diagnostic Charts. Repair as necessary.
	3. Is cooling fan operating correctly?	3. Repair as necessary.
	4. Has undercoating been applied to any unnecessary component.	4. Clean undercoating as necessary.
	5. Engine may be running rich causing the catalytic converter to overheat.	5. Refer to appropriate Powertrain Diagnostic Procedures information for operation of the scan tool. Repair as necessary.
POOR DRIVEABILITY (THERMOSTAT POSSIBLY STUCK OPEN). GAUGE MAY BE READING LOW	1. Has a diagnostic trouble code (DTC) been set?	1. Refer to the appropriate Powertrain Diagnostic Procedure information for checking a DTC related to the thermostat.
STEAM IS COMING FROM FRONT OF VEHICLE NEAR GRILLE AREA WHEN WEATHER IS WET, ENGINE IS WARMED UP, RUNNING, AND VEHICLE IS STATIONARY. TEMPERATURE GAUGE IS IN NORMAL RANGE.	1. During wet weather, moisture (snow, ice or rain condensation) on the radiator will evaporate when the thermostat opens. This opening allows heated water into the radiator. When the moisture contacts the hot radiator, steam may be emitted. This usually occurs in cold	1. Occasional steam emitting from this area is normal. No repair is necessary.

	weather with no fan or airflow to blow it away.	
COOLANT COLOR	1. Coolant color is not necessarily an indication of adequate corrosion or temperature protection. Do not rely on coolant color for determining condition of coolant.	1. Check the freeze point of the coolant. Refer to COOLANT, DIAGNOSIS AND TESTING . Adjust the glycol-to-water ratio as required.
COOLANT LEVEL CHANGES IN COOLANT RECOVERY/RESERVE BOTTLE	1. Level changes are to be expected as coolant volume fluctuates with engine temperature. If the level in the bottle was between the FULL HOT and ADD marks at normal engine operating temperature, the level should return to within that range after operation at elevated temperatures.	1. A normal condition. No repair is necessary.

STANDARD PROCEDURE

COOLANT LEVEL CHECK

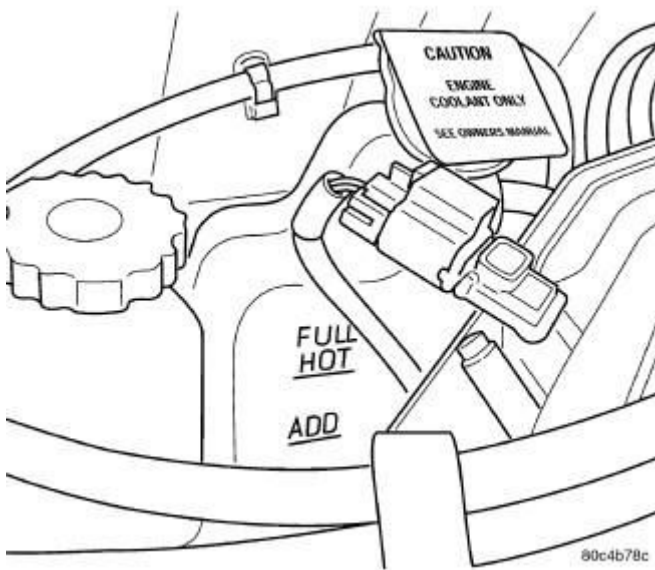


Fig. 2: Coolant Level

Courtesy of CHRYSLER GROUP, LLC

NOTE: Do not remove pressure cap for routine coolant level inspections.

The coolant recovery/reserve system provides a quick visual method for determining the coolant level without removing the pressure cap. Simply observe, with the engine idling and warmed up to normal operating temperature, that the level of the coolant in the recovery/reserve bottle is between the FULL HOT and ADD marks.

COOLING SYSTEM DRAINING

WARNING: Do not open the radiator draincock with the system hot and under pressure. Serious burns from coolant can occur.

NOTE: Drain, flush, and fill the cooling system at the mileage or time intervals specified in the **MAINTENANCE SCHEDULE**. Refer to **MAINTENANCE SCHEDULES, DESCRIPTION**. If the solution is dirty, rusty, or contains a considerable amount of sediment; clean and flush with a reliable cooling system cleaner. Care should be taken in disposing of the used engine coolant from your vehicle. Check governmental regulations for disposal of used

engine coolant.

1. Position a clean collecting container under draincock location.
2. Without removing the pressure cap and with system not under pressure, turn draincock counterclockwise to open.
3. The coolant reserve bottle should empty first, then remove the pressure cap.
4. If coolant reserve bottle does not empty first:
 - a. Check condition of the pressure cap and cap seals.
 - b. Check for kinked or torn overflow hose from filler neck to reserve bottle.
5. Allow cooling system to drain completely.

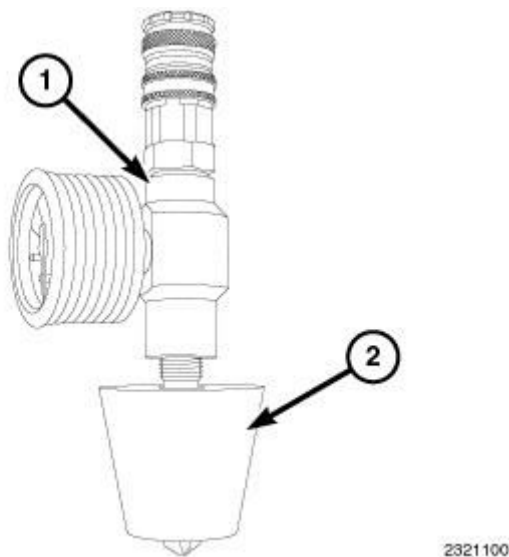
STANDARD PROCEDURE - COOLANT AIR EVACUATION

Fig. 3: Pressurized Air Operated Vacuum Generator
Courtesy of CHRYSLER GROUP, LLC

Evacuating or purging air from the cooling system involves the use of a pressurized air operated vacuum generator. The vacuum created allows for a quick and complete coolant refilling while removing any airlocks present in the system components.

NOTE: To avoid damage to the cooling system, ensure that no component would be susceptible to damage when a vacuum is drawn on the system.

WARNING: ANTIFREEZE IS AN ETHYLENE GLYCOL BASE COOLANT AND IS HARMFUL IF SWALLOWED OR INHALED. IF SWALLOWED, DRINK TWO GLASSES OF WATER AND INDUCE VOMITING. IF INHALED, MOVE TO FRESH AIR AREA. SEEK MEDICAL ATTENTION IMMEDIATELY. DO NOT STORE IN OPEN OR UNMARKED CONTAINERS. WASH SKIN AND CLOTHING THOROUGHLY AFTER COMING IN CONTACT WITH ETHYLENE GLYCOL. KEEP OUT OF REACH OF CHILDREN. DISPOSE OF GLYCOL BASED COOLANT PROPERLY. CONTACT YOUR DEALER OR GOVERNMENT AGENCY FOR LOCATION OF COLLECTION CENTER IN YOUR AREA. DO NOT OPEN A COOLING SYSTEM WHEN THE ENGINE IS AT OPERATING TEMPERATURE OR HOT UNDER PRESSURE; PERSONAL INJURY CAN RESULT. AVOID RADIATOR COOLING FAN WHEN ENGINE COMPARTMENT RELATED SERVICE IS PERFORMED; PERSONAL INJURY CAN RESULT.

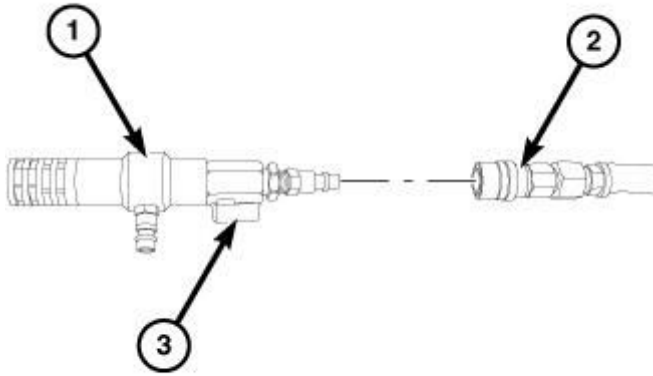
WARNING: WEAR APPROPRIATE EYE AND HAND PROTECTION WHEN PERFORMING THIS PROCEDURE.

NOTE: The service area where this procedure is performed should have a minimum shop air requirement of 80 PSI (5.5 bar) and should be equipped with an air dryer system.

NOTE: For best results, the radiator should be empty. The vehicle's heater control should be set to the heat position (ignition may need to be turned to the on position but do not start the motor).

1. Refer to the Chrysler Pentastar Service Equipment (Chrysler PSE) Coolant Refiller #85-15-0650 or equivalent tool's operating manual for specific assembly steps.

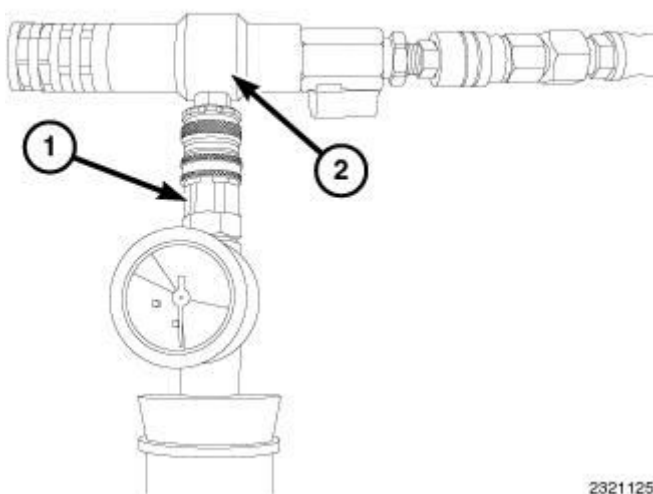
2. Choose an appropriate adapter cone that will fit the vehicle's radiator filler neck or reservoir tank.
3. Attach the adapter cone (2) to the vacuum gauge (1).



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Fig. 4: Vacuum Generator/Venturi Ball Valve
Courtesy of CHRYSLER GROUP, LLC

4. Make sure the vacuum generator/venturi ball valve (3) is closed and attach an airline hose (2) (minimum shop air requirement of 80 PSI/5.5 bar) to the vacuum generator/venturi (1).
5. Position the adaptor cone/vacuum gauge assembly into the radiator filler neck or reservoir tank. Ensure that the adapter cone is sealed properly.



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Fig. 5: Vacuum Generator/Venturi
Courtesy of CHRYSLER GROUP, LLC

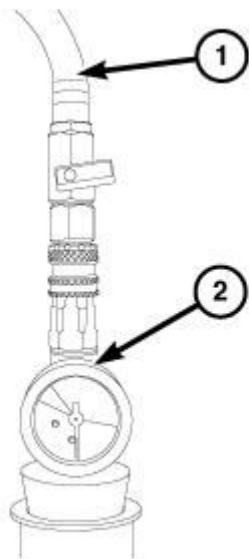
6. Connect the vacuum generator/venturi (2) to the positioned adaptor cone/vacuum gauge assembly (1).
7. Open the vacuum generator/venturi ball valve.

NOTE: Do not bump or move the assembly as it may result in loss of vacuum. Some radiator overflow hoses may need to be clamped off to obtain vacuum.

8. Let the system run until the vacuum gauge shows a good vacuum through the cooling system. Refer to the tool's operating manual for appropriate pressure readings.

NOTE: If a strong vacuum is being created in the system, it is normal to see the radiator hoses to collapse.

9. Close the vacuum generator/venturi ball valve.



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Fig. 6: Vacuum Generator/Venturi And Air Line
Courtesy of CHRYSLER GROUP, LLC

10. Disconnect the vacuum generator/venturi and airline from the adaptor cone/vacuum gauge assembly.
11. Wait approximately 20 seconds, if the pressure readings do not move, the system has no leaks. If the pressure readings move, a leak could be present in the system and the cooling system should be checked for leaks and the procedure should be repeated.

12. Place the tool's suction hose into the coolant's container.

NOTE: Ensure there is a sufficient amount of coolant, mixed to the required strength/protection level available for use. For best results and to assist the refilling procedure, place the coolant container at the same height as the radiator filler neck. Always draw more coolant than required. If the coolant level is too low, it will pull air into the cooling system which could result in airlocks in the system.

13. Connect the tool's suction hose (1) to the adaptor cone/vacuum gauge assembly (2).

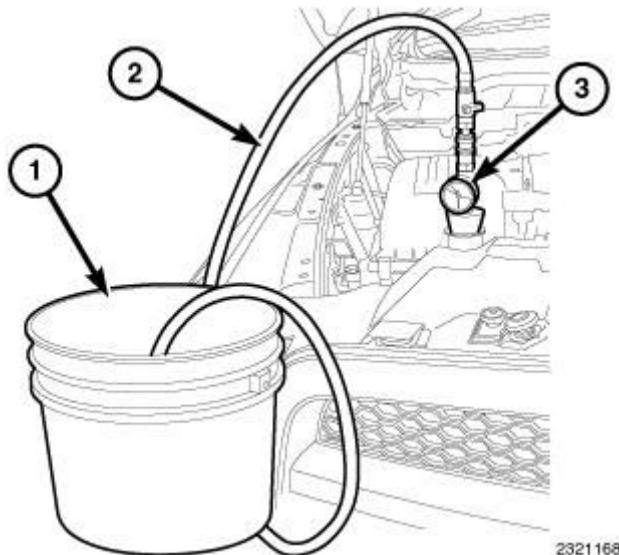


Fig. 7: Suction Hose Ball Valve
Courtesy of CHRYSLER GROUP, LLC

NOTE: View typical

14. Open the suction hose's ball valve to begin refilling the cooling system.
15. When the vacuum gauge reads zero, the system is filled.

NOTE: On some remote pressurized tanks, it is recommended to stop filling when the proper level is reached.

16. Close the suction hose's ball valve and remove the suction hose from the

adaptor cone/vacuum gauge assembly.

17. Remove the adaptor cone/vacuum gauge assembly from the radiator filler neck or reservoir tank.
18. With heater control unit in the HEAT position, operate engine with container cap in place.
19. After engine has reached normal operating temperature, shut engine off and allow it to cool. When engine is cooling down, coolant will be drawn into the radiator from the pressure container.
20. Add coolant to the recovery bottle/container as necessary. **Only add coolant to the container when the engine is cold. Coolant level in a warm engine will be higher due to thermal expansion.** Add necessary coolant to raise container level to the COLD MINIMUM mark after each cool down period.
21. Once the appropriate coolant level is achieved, attach the radiator cap or reservoir tank cap.

CLEANING/REVERSE FLUSHING

CLEANING

Drain the cooling system and refill with water. Run the engine with the radiator cap installed until the upper radiator hose is hot. Stop the engine and drain the water from system. If the water is dirty, fill the system with water, run the engine and drain the system. Repeat this procedure until the water drains clean.

REVERSE FLUSHING

Reverse flushing of the cooling system is the forcing of water through the cooling system. This is done using air pressure in the opposite direction of normal coolant flow. It is usually only necessary with very dirty systems with evidence of partial plugging.

REVERSE FLUSHING RADIATOR

Disconnect the radiator hoses from the radiator inlet and outlet. Attach a section of the radiator hose to the radiator bottom outlet fitting and insert the flushing gun. Connect a water supply hose and air supply hose to the flushing gun.

CAUTION: Internal radiator pressure must not exceed 138 kPa (20 psi) as damage to radiator may result.

Allow the radiator to fill with water. When the radiator is filled, apply air in short blasts. Allow the radiator to refill between blasts. Continue this reverse flushing until clean water flows out through the rear of the radiator cooling tube passages.

REVERSE FLUSHING ENGINE

Drain the cooling system. Remove the thermostat housing and thermostat. Install the thermostat housing. Disconnect the radiator upper hose from the radiator and attach the flushing gun to the hose. Disconnect the radiator lower hose from the water pump and attach a lead-away hose to the water pump inlet fitting.

CAUTION: On vehicles equipped with a heater water control valve, be sure the heater control valve is closed (heat off). This will prevent coolant flow with scale and other deposits from entering the heater core.

Connect the water supply hose and air supply hose to flushing gun. Allow the engine to fill with water. When the engine is filled, apply air in short blasts, allowing the system to fill between air blasts. Continue until clean water flows through the lead away hose.

Remove the lead away hose, flushing gun, water supply hose and air supply hose. Remove the thermostat housing and install the thermostat. Install the thermostat housing with a replacement gasket. Refer to Thermostat Replacement. Refer to appropriate procedures in this service information. Connect the radiator hoses. Refill the cooling system with the correct antifreeze/water mixture. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, DESCRIPTION** . Refer to Refilling the Cooling System. Refer to **STANDARD PROCEDURE**.

CHEMICAL CLEANING

In some instances, use a radiator cleaner (Mopar® Radiator Kleen or equivalent) before flushing. This will soften scale and other deposits and aid flushing operation.

CAUTION: Follow manufacturers instructions when using these products.

SPECIFICATIONS

SPECIFICATIONS

2014 Jeep Patriot Limited

2014 ENGINE Engine Cooling System - Compass & Patriot

DESCRIPTION	SPECIFICATIONS	
	METRIC	US
2.0L Engine*	6.8L	7.2 qts.
2.4L Engine*	6.8L	7.2 qts.
2.2L Diesel Engine*	9.5L	10.0 qts.
*(Includes heater and coolant recovery bottle filled to MAX level.)		

TORQUE

DESCRIPTION	N.m	Ft. Lbs.	In. Lbs.
Bolts, A/C Condenser to Radiator	5	-	44
Bolt, Automatic Belt Tensioner Pulley - Gas Engine	24	18	-
Bolt Automatic Belt Tension Assembly	54	40	-
Bolts, Charge Air Cooler to Radiator (Turbo Equipped)	5	-	44
Bolt, Coolant Recovery Bottle	4	-	35
Bolts, Coolant Adapter	18	13	-
Bolts, Inlet Housing to Coolant Adapter	11	8	97
Screw, Bypass Valve to Radiator	5	-	44
Screw, Bypass Tube to EGR Cooler	10	7	89
Screw, Transmission Cooler to Radiator	5	-	44
Engine Coolant Temperature Sensor	17	13	-
Pivot Bolt, Generator Mounting	54	40	-
Locking Nut, Generator Mounting	54	40	-
Screws, Transmission Cooler to Radiator	8	-	71
Bolts, Water Pump to Engine Block	24	18	-
EGR Cooler to Exhaust Manifold Tube Nuts	20	15	-
EGR Cooler to Exhaust Manifold Tube Bolts	20	15	-
EGR to EGR Valve Tube Bolts	20	15	-
Bolts, Water Pump Inlet Tube to Water Pump Housing - Gas Engine	24	18	-
Bolts, Water Pump to Water Pump Adapter	22	16	-

2014 Jeep Patriot Limited

2014 ENGINE Engine Cooling System - Compass & Patriot

- Gas Engine

Bolts, Water Pump Pulley to Water Pump -
Gas Engine

9

-

80

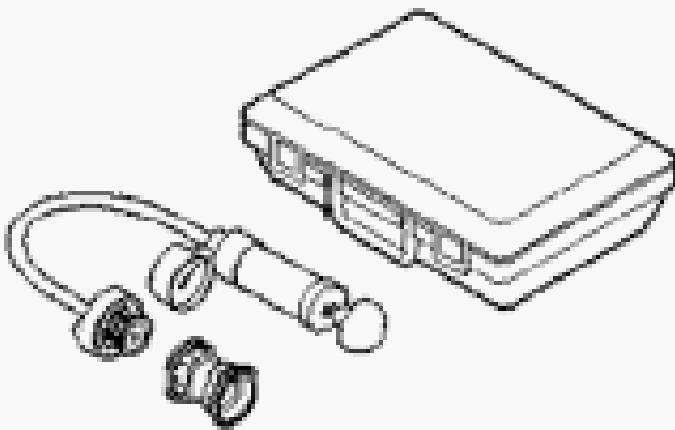
INSPECTION

INSPECTION

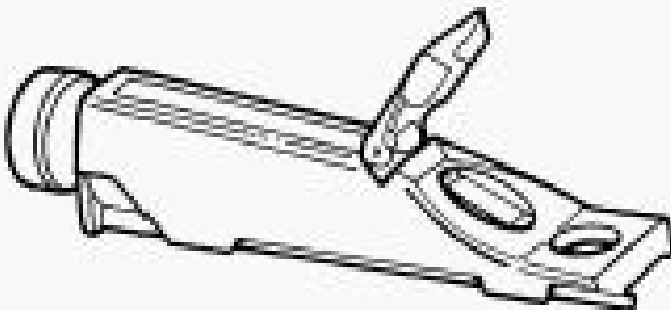
After performing a cleaning/flush procedure, inspect all hoses, clamps and connections for deterioration and leaks. Inspect radiator and heater core for leaks.

SPECIAL TOOLS

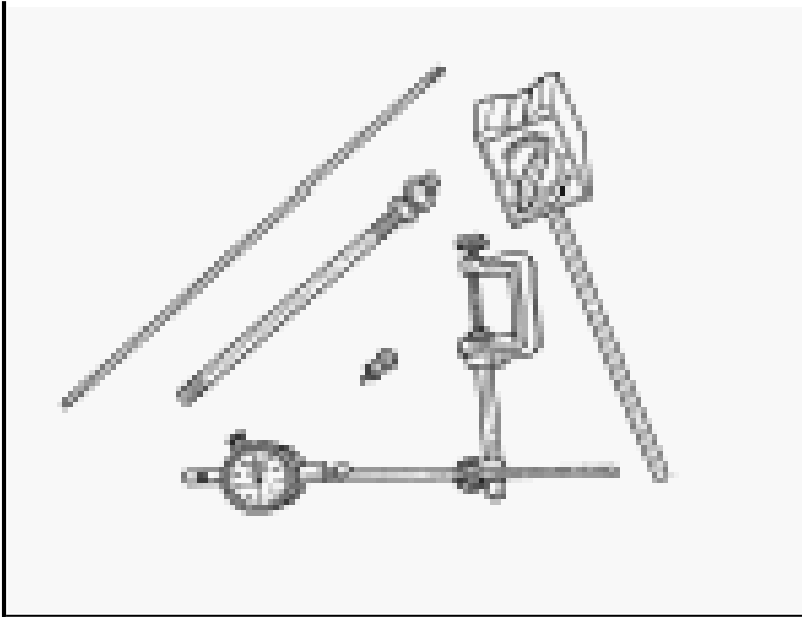
SPECIAL TOOLS



7700 - Tester, Cooling
System
(Originally Shipped In Kit
Number(s) 7700-A.)



8286 - Refractometer



8875A - Disconnect,
Transmission Cooler Line
(Originally Shipped In Kit
Number(s) 9202, 9328,
9328-CAN, 9329, 9516,
9575.)

ACCESSORY DRIVE

BELT, SERPENTINE

DESCRIPTION

GAS ENGINE

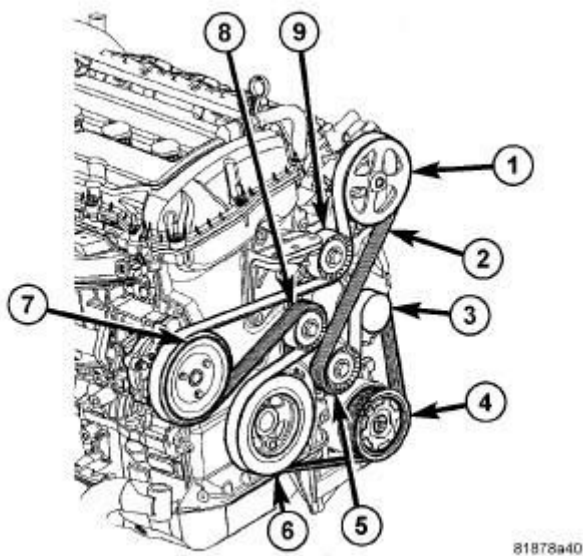


Fig. 8: Accessory Drive Belt - World Engine
Courtesy of CHRYSLER GROUP, LLC

The accessory drive belt (2) is a serpentine type belt that is driven by the crankshaft pulley (6).

The belt drives the A/C compressor, generator (3), power steering pump (1) and water pump (7). Belt tension is maintained by an automatic belt tensioner (8).

DIESEL ENGINE

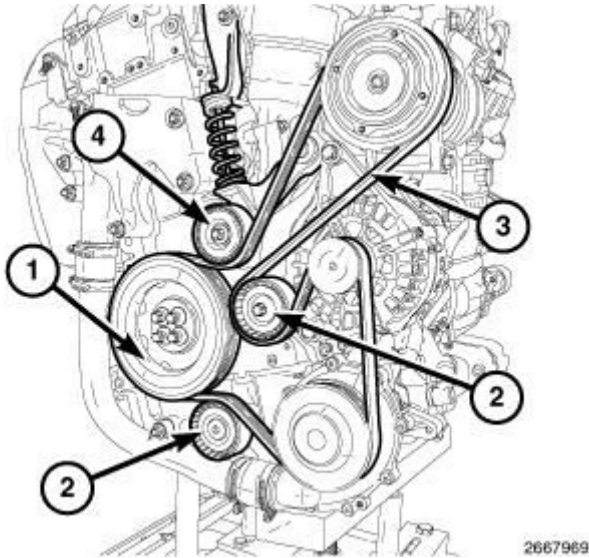


Fig. 9: Identifying Main Drive Belt
Courtesy of CHRYSLER GROUP, LLC

The accessory drive belt on the 2.2L Diesel engine is of the serpentine style. This belt is used to drive the generator, power steering pump, and the A/C compressor.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ACCESSORY DRIVE BELT

ACCESSORY DRIVE BELT DIAGNOSIS CHART

CONDITION	POSSIBLE CAUSES	CORRECTION
RIB CHUNKING (One or more ribs has separated from belt body)	1. Foreign objects imbedded in pulley grooves.	1. Remove foreign objects from pulley grooves. Replace belt.
	2. Installation damage	2. Replace belt
RIB OR BELT WEAR	1. Pulley misaligned	1. Align pulley(s)
	2. Abrasive environment	2. Clean pulley(s). Replace belt if necessary
	3. Rusted pulley(s)	3. Clean rust from pulley (s)
	4. Sharp or jagged	4. Replace pulley. Inspect

2014 Jeep Patriot Limited

2014 ENGINE Engine Cooling System - Compass & Patriot

	pulley groove tips	belt.
	5. Belt rubber deteriorated	5. Replace belt
BELT SLIPS	1. Belt slipping because of insufficient tension	1. Inspect/Replace tensioner if necessary
	2. Belt or pulley exposed to substance that has reduced friction (belt dressing, oil, ethylene glycol)	2. Replace belt and clean pulleys
	3. Driven component bearing failure (seizure)	3. Replace component or bearing
	4. Belt glazed or hardened from heat and excessive slippage	4. Replace belt.
LONGITUDINAL BELT CRACKING	1. Belt has mistracked from pulley groove	1. Replace belt
	2. Pulley groove tip has worn away rubber to tensile member	2. Replace belt
GROOVE JUMPING (Belt does not maintain correct position on pulley)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Pulley(s) not within design tolerance	2. Replace pulley(s)
	3. Foreign object(s) in grooves	3. Remove foreign objects from grooves
	4. Pulley misalignment	4. Align component
	5. Belt cordline is broken	5. Replace belt
BELT BROKEN (Note: Identify and correct problem before new belt is installed)	1. Incorrect belt tension	1. Replace Inspect/Replace tensioner if necessary
	2. Tensile member	2. Replace belt

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2014 ENGINE Engine Cooling System - Compass & Patriot

	damaged during belt installation	
	3. Severe misalignment	3. Align pulley(s)
	4. Bracket, pulley, or bearing failure	4. Replace defective component and belt
NOISE (Objectionable squeal, squeak, or rumble is heard or felt while drive belt is in operation)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Bearing noise	2. Locate and repair
	3. Belt misalignment	3. Align belt/pulley(s)
	4. Belt to pulley mismatch	4. Install correct belt
	5. Driven component induced vibration	5. Locate defective driven component and repair
	6. System resonant frequency induced vibration	6. Vary belt tension within specifications
TENSION SHEETING FABRIC FAILURE (Woven fabric on outside, circumference of belt has cracked or separated from body of belt)	1. Tension sheeting contacting stationary object	1. Correct rubbing condition
	2. Excessive heat causing woven fabric to age	2. Replace belt
	3. Tension sheeting splice has fractured	3. Replace belt
CORD EDGE FAILURE (Tensile member exposed at edges of belt or separated from belt body)	1. Incorrect belt tension	1. Inspect/Replace tensioner if necessary
	2. Belt contacting stationary object	2. Replace belt
	3. Pulley(s) out of tolerance	3. Replace pulley
	4. Insufficient adhesion between tensile member and rubber matrix	4. Replace belt

VISUAL DIAGNOSIS

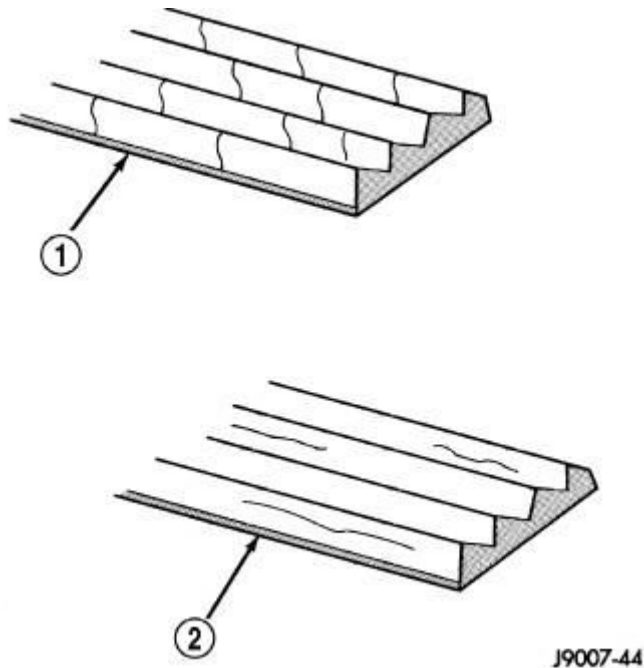


Fig. 10: Belt Wear Patterns
Courtesy of CHRYSLER GROUP, LLC

- | |
|--|
| 1 - NORMAL CRACKS ON BELT
2 - NOT NORMAL CRACKS ON BELT |
|--|

When diagnosing serpentine accessory drive belts, small cracks that run across the ribbed surface of the belt from rib to rib (1), are considered normal. These are not a reason to replace the belt. However, cracks running along a rib (not across) (2) are **not** normal. Any belt with cracks running along a rib must be replaced. Also replace the belt if it has excessive wear, frayed cords or severe glazing.

Refer to **ACCESSORY DRIVE BELT DIAGNOSIS CHART** for further belt diagnosis.

NOISE DIAGNOSIS

Noises generated by the accessory drive belt are most noticeable at idle. Before replacing a belt to resolve a noise condition, inspect all of the accessory drive pulleys for contamination, alignment, glazing, or excessive end play.

REMOVAL

GAS ENGINE

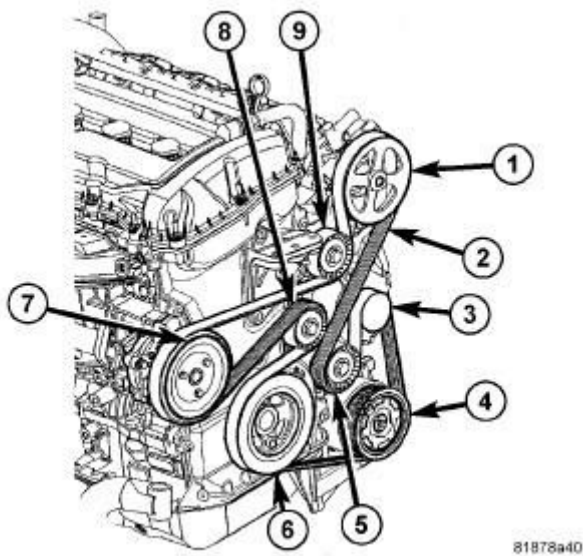


Fig. 11: Accessory Drive Belt - World Engine
Courtesy of CHRYSLER GROUP, LLC

1. Using a wrench, rotate accessory drive belt tensioner (8) counterclockwise until accessory drive belt (2) can be removed from pulleys (5 and 9).
2. Remove accessory drive belt (2).

DIESEL

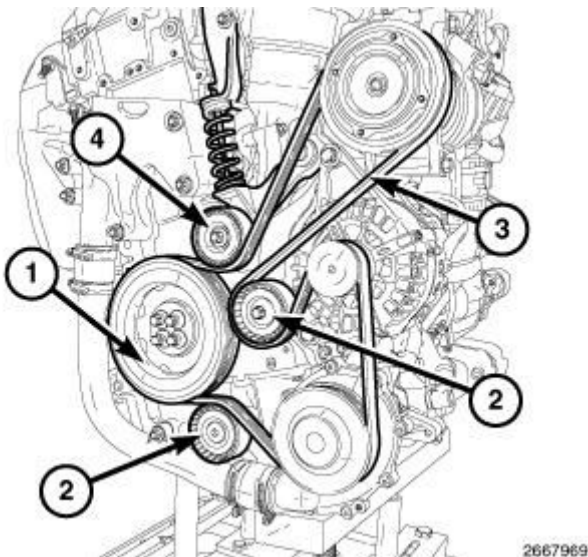


Fig. 12: Identifying Main Drive Belt
Courtesy of CHRYSLER GROUP, LLC

1. Raise and support the vehicle.

CAUTION: Do not let the tensioner arm snap back to the

freearm position, severe damage may occur to the tensioner.

2. Using a wrench, rotate the belt tensioner (4) until the belt (3) can be removed from the pulleys (1, 2). Gently, release spring tension on tensioner (4).
3. Remove the accessory drive belt (3).

INSTALLATION

GAS ENGINE

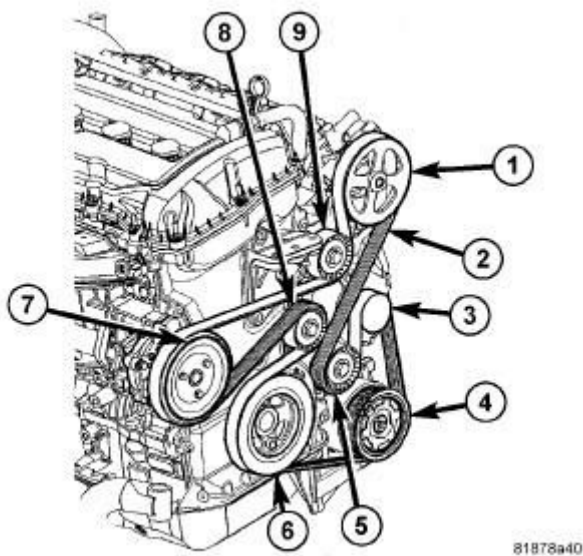


Fig. 13: Accessory Drive Belt - World Engine
Courtesy of CHRYSLER GROUP, LLC

NOTE: When installing drive belt on the pulleys, make sure that belt is properly routed and all V-grooves make proper contact with pulley grooves.

1. Install the accessory drive belt (2) around all the pulleys except for the generator pulley (3).
2. Using a wrench, rotate accessory drive belt tensioner (8) counterclockwise until accessory drive belt (2) can be installed on the generator pulley (3). Release spring tension onto accessory drive belt (2).

DIESEL

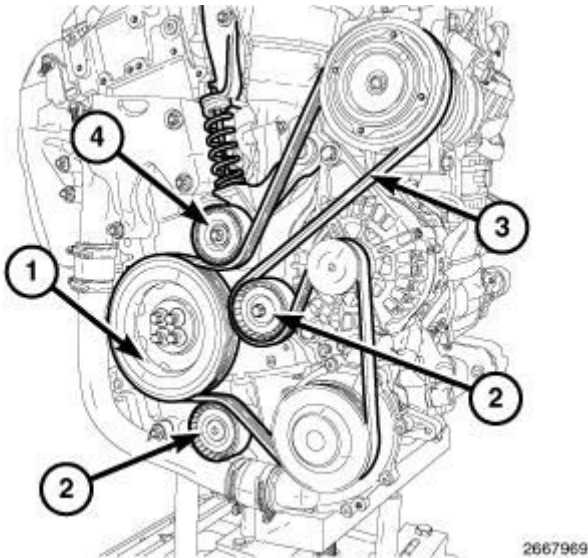


Fig. 14: Identifying Main Drive Belt
Courtesy of CHRYSLER GROUP, LLC

NOTE: When installing accessory drive belt, be sure belt is routed around all accessories correctly.

1. Install belt over all pulleys except for the power steering pump pulley.

CAUTION: Do not let the tensioner arm snap back to the freearm position, severe damage may occur to the tensioner.

2. Using a wrench, rotate belt tensioner (4) clockwise until belt can be installed onto power steering pump pulley. Release spring tension onto belt.
3. Lower vehicle from hoist.

PULLEY, IDLER

REMOVAL

REMOVAL

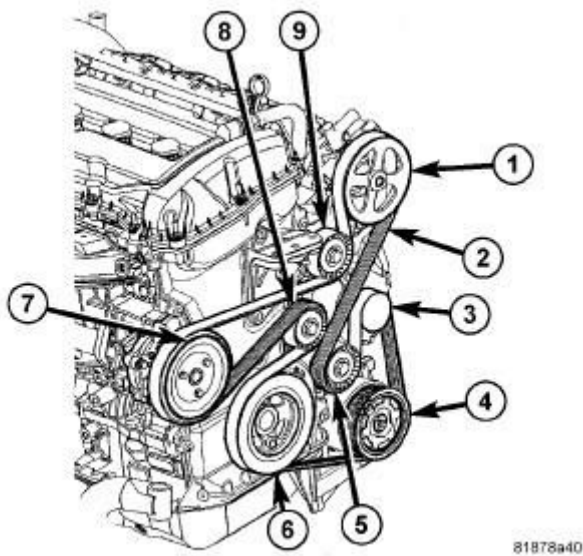


Fig. 15: Accessory Drive Belt - World Engine
Courtesy of CHRYSLER GROUP, LLC

1. Raise vehicle on hoist.
2. Remove belt splash shield.
3. Remove accessory drive belt (2). Refer to **BELT, SERPENTINE, REMOVAL**.
4. Remove idler pulley mounting bolt. Remove idler pulley (5 or 9).

DIESEL ENGINE

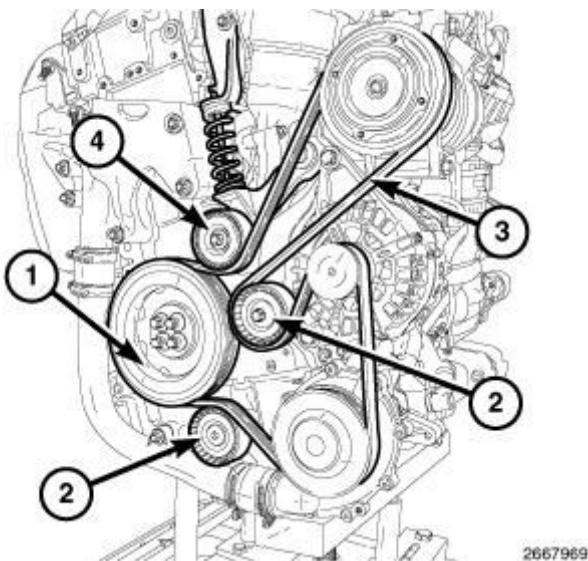


Fig. 16: Identifying Main Drive Belt
Courtesy of CHRYSLER GROUP, LLC

1. Remove the accessory drive belt (3). Refer to **BELT, SERPENTINE, REMOVAL**.
2. From under the vehicle, remove the idler pulley mounting bolt. Remove idler pulley (2).

INSTALLATION

INSTALLATION

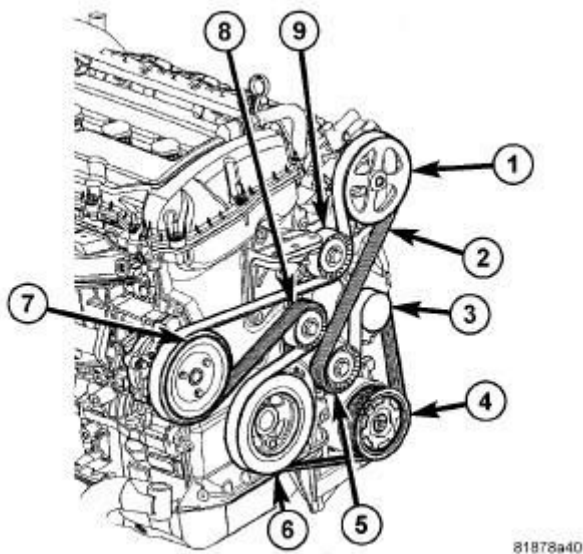


Fig. 17: Accessory Drive Belt - World Engine
Courtesy of CHRYSLER GROUP, LLC

1. Position pulley (5 or 9) in mounting position. Install idler pulley mounting bolt. Tighten bolt to 48 N.m (35 ft. lbs.).
2. Install accessory drive belt (2). Refer to **BELT, SERPENTINE, INSTALLATION**.
3. Install belt splash shield.
4. Lower vehicle.

DIESEL ENGINE

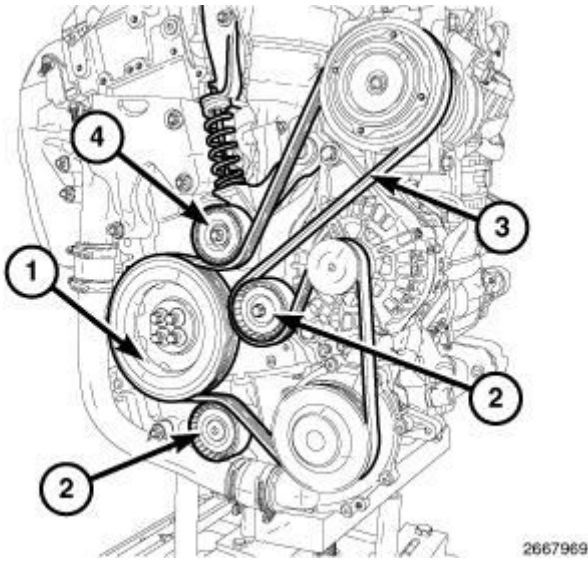


Fig. 18: Identifying Main Drive Belt
Courtesy of CHRYSLER GROUP, LLC

1. Remove the accessory drive belt (3). Refer to **BELT, SERPENTINE, REMOVAL**.
2. From under the vehicle, remove the idler pulley mounting bolt. Remove idler pulley (2).

TENSIONER, BELT

DESCRIPTION

DESCRIPTION

The automatic belt tensioner maintains proper tension on the accessory drive belt. The tensioner pulley can be serviced separately.

REMOVAL

GAS ENGINE

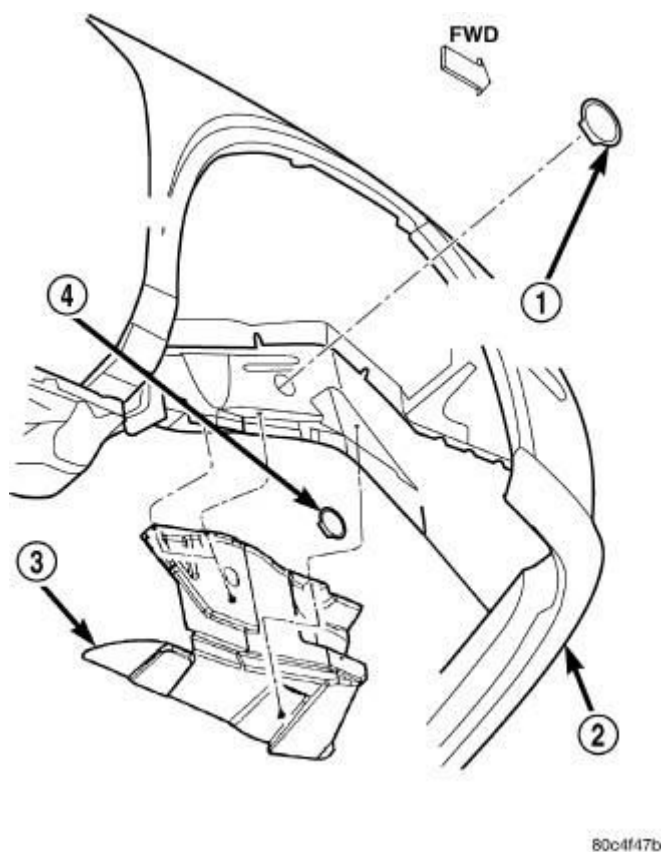


Fig. 19: Splash Shield
Courtesy of CHRYSLER GROUP, LLC

1. Raise vehicle on hoist.
2. Remove belt splash shield (3).

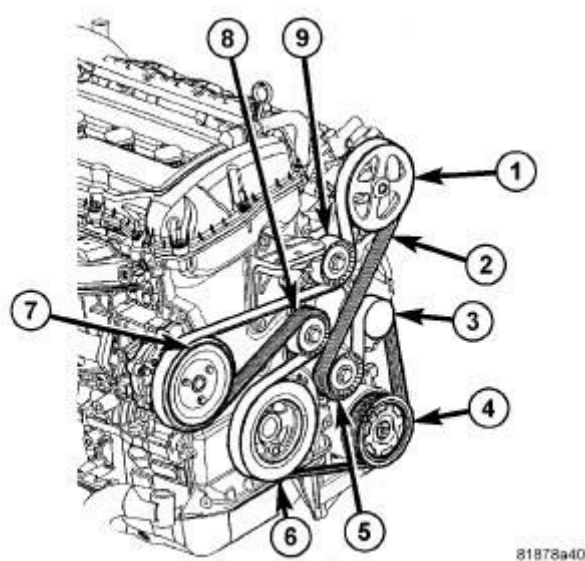
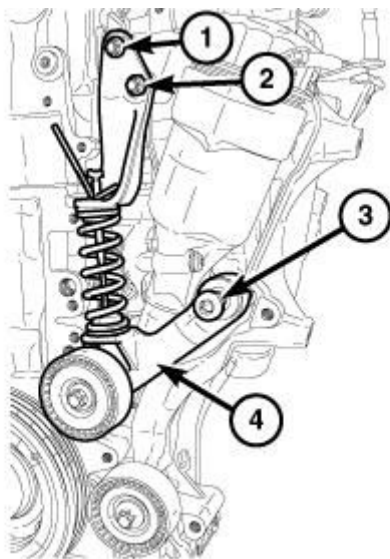


Fig. 20: Accessory Drive Belt - World Engine
Courtesy of CHRYSLER GROUP, LLC

- 1 - POWER STEERING PUMP
- 2 - ACCESSORY DRIVE BELT
- 3 - GENERATOR
- 4 - CRANKSHAFT PULLEY
- 5 - LOWER IDLER PULLEY
- 6 - CRANKSHAFT PULLEY
- 7 - WATER PUMP PULLEY
- 8 - ACCESSORY DRIVE BELT TENSIONER
- 9 - UPPER IDLER PULLEY

3. Remove accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL**.
4. Remove accessory drive belt tensioner mounting bolt. Remove accessory drive belt tensioner (8).

DIESEL ENGINE



2734304

Fig. 21: Tensioner Bracket Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Remove the accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL**.
2. Lower the vehicle.
3. Remove the tensioner bracket mounting bolts (1, 2 3).
4. Raise and support the vehicle.
5. Remove the tensioner assembly (4) from underneath the vehicle.

6. If idler pulley is to be replaced, remove pulley from tensioner (4).

ACCESSORY CARRIER BRACKET REMOVAL - DIESEL ENGINE

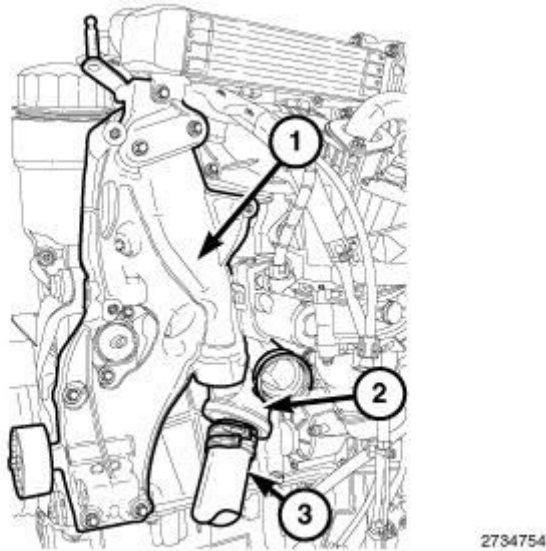


Fig. 22: Identifying Thermostat Housing & Accessory Carrier Bracket
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the negative battery cable.
2. Remove the water/power steering/vacuum pump assembly. Refer to **PUMP, WATER, REMOVAL**.
3. Lower the vehicle.
4. Remove the coolant recovery bottle. Refer to **BOTTLE, COOLANT RECOVERY, REMOVAL**.
5. Remove the charge air cooler.
6. Remove the A/C condenser. Refer to **CONDENSER, A/C, REMOVAL** .
7. Remove the A/C compressor. Refer to **COMPRESSOR, A/C, REMOVAL** .
8. Remove the generator. Refer to **GENERATOR, REMOVAL** .
9. Remove the EGR cooler. Refer to **COOLER, EGR, REMOVAL**.
10. Remove the accessory drive belt tensioner. Refer to **TENSIONER, BELT, REMOVAL**.
11. Remove the coolant bypass hose from the thermostat housing (2).
12. Remove the radiator hose (3) from the thermostat housing (2).
13. Remove the thermostat housing mounting bolts.

14. Remove the accessory drive bracket mounting bolts.
15. Remove the accessory drive bracket (1).
16. If necessary, separate the thermostat (2) from the accessory drive bracket (1).

INSTALLATION

GAS ENGINE

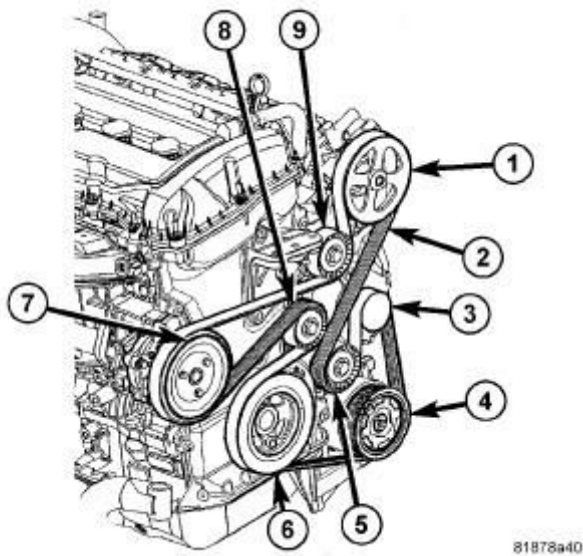


Fig. 23: Accessory Drive Belt - World Engine
Courtesy of CHRYSLER GROUP, LLC

1. Position accessory drive belt tensioner (8) and install mounting bolt (1). Tighten bolt (1) to 24 N.m (212 in. lbs.).
2. Install accessory drive belt (2). Refer to **BELT, SERPENTINE, INSTALLATION**.

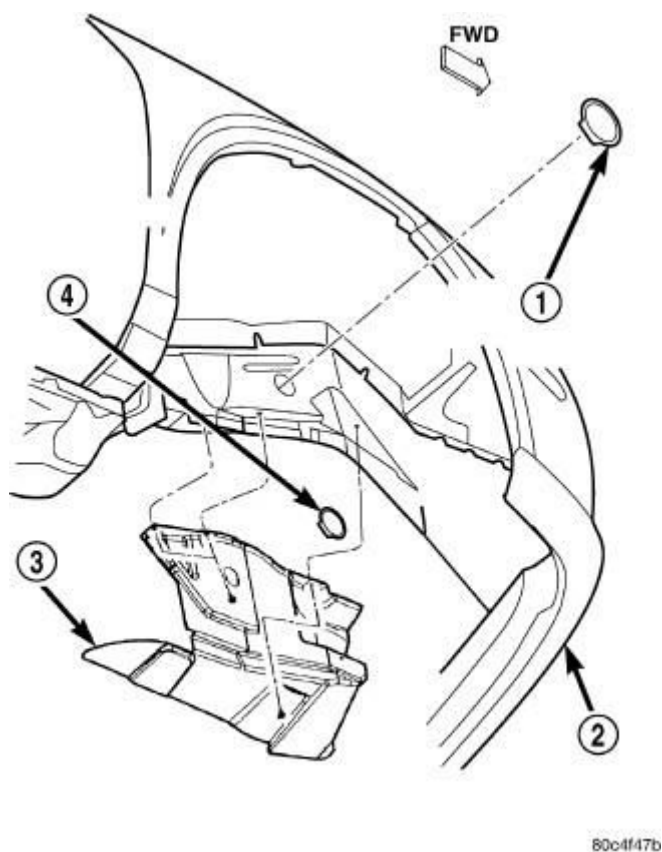


Fig. 24: Splash Shield

Courtesy of CHRYSLER GROUP, LLC

3. Install belt splash shield (3).
4. Lower vehicle.

DIESEL ENGINE

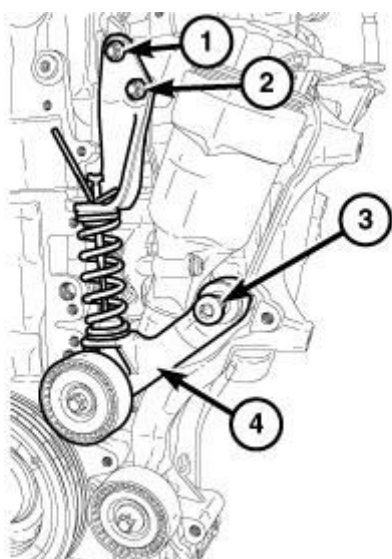
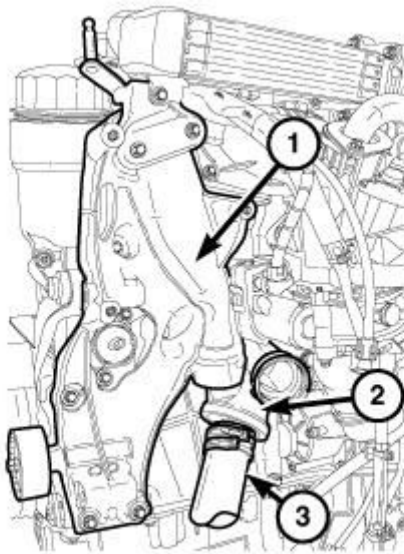


Fig. 25: Tensioner Bracket Mounting Bolts

Courtesy of CHRYSLER GROUP, LLC

1. Install tensioner pulley and bolt, if removed. Tighten bolt to 25 N.m (18 ft. lbs.).
2. From underneath the vehicle, position the belt tensioner assembly (4) onto the engine.
3. Install the lower bolt (3) into the accessory drive bracket to assist in holding the tensioner assembly (4) in place. Hand tighten the bolt.
4. Lower the vehicle.
5. Install the upper belt tensioner bolts (1, 2) to the accessory drive bracket. Tighten the bolts to 20 N.m (15 ft. lbs.).
6. Tighten the lower belt tensioner bolt to 45 N.m (33 ft. lbs.).
7. Install the accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION**.

ACCESSORY DRIVE BRACKET INSTALLATION - DIESEL ENGINE

2734754

Fig. 26: Identifying Thermostat Housing & Accessory Carrier Bracket
Courtesy of CHRYSLER GROUP, LLC

1. If necessary, install the thermostat (2) to the accessory drive bracket (1).
2. Position the accessory drive bracket (1) to the engine.
3. Install the accessory drive bracket mounting bolts. Tighten the bolts to 9 N.m (80 in. lbs.).
4. Install the thermostat housing mounting bolts. Tighten the bolts to 9 N.m (80

in. lbs.).

5. Install the radiator hose (3) to the thermostat housing (2).
6. Install the coolant bypass hose to the thermostat housing (2).
7. Install the accessory drive belt tensioner. Refer to **TENSIONER, BELT, INSTALLATION**.
8. Install the EGR cooler. Refer to **COOLER, EGR, INSTALLATION**.
9. Install the generator. Refer to **GENERATOR, INSTALLATION**.
10. Install the A/C compressor. Refer to **COMPRESSOR, A/C, INSTALLATION**.
11. Install the A/C condenser. Refer to **CONDENSER, A/C, INSTALLATION**.
12. Install the charge air cooler.
13. Install the coolant recovery bottle. Refer to **BOTTLE, COOLANT RECOVERY, INSTALLATION**.
14. Install the water/power steering/vacuum pump assembly. Refer to **PUMP, WATER, INSTALLATION**.
15. Install the negative battery cable.

ENGINE

BOTTLE, COOLANT RECOVERY

DESCRIPTION

GAS ENGINE

The coolant recovery system consists of a coolant recovery container mounted to the RH inner wheel housing, a vent hose for the coolant recovery container, a hose connecting the container to the radiator neck, and a pressure cap.

DIESEL ENGINE

The coolant recovery system consists of a coolant recovery container mounted to the RH inner wheel housing, a vent hose for the coolant recovery container, a hose connecting the container to the radiator neck, and a pressure cap.

OPERATION

GAS ENGINE

The system works in conjunction with the cooling system pressure cap to utilize thermal expansion and contraction of the coolant to keep the coolant free of trapped air. The system provides space for expansion and contraction. Also, the system provides a convenient and safe method for checking and adjusting the coolant level at atmospheric pressure without removing the pressure cap. It also provides some reserve coolant to compensate for minor leaks and evaporation or boiling losses.

DIESEL ENGINE

The location of the container allows any air or vapor exceeding the pressure/vent cap rating to escape through the cap. Coolant flows through the container at all times during engine operation whether the engine is cold or at normal operating temperature. The coolant container is equipped with a pressure/vent cap. For more information. Refer to **CAP, RADIATOR, DESCRIPTION**.

REMOVAL

GAS ENGINE

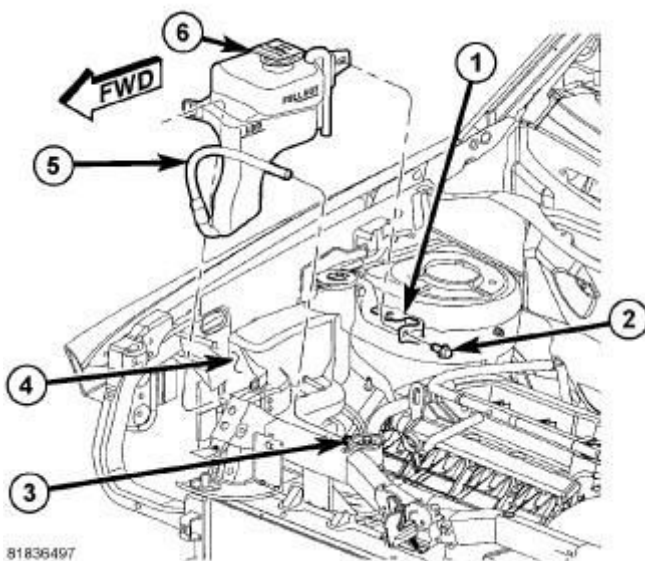


Fig. 27: Coolant Recovery Container
Courtesy of CHRYSLER GROUP, LLC

- 1 - MOUNTING BRACKET
- 2 - BOLT
- 3 - RADIATOR HOSE TEE
- 4 - WASHER RESERVOIR

5 - HOSE

6 - COOLANT RECOVERY CONTAINER

1. Partially drain cooling system using the draincock only. Refer to **STANDARD PROCEDURE**. Drain system below level of the coolant recovery pressure container.
2. Remove the return hose (5) from the upper radiator hose tee (3).
3. Remove the coolant recovery bottle mount bolt (2) from the mounting bracket (1).
4. Disengage the coolant recovery container (6) from the washer reservoir bottle (4).
5. Remove the coolant recovery container (6).

DIESEL ENGINE

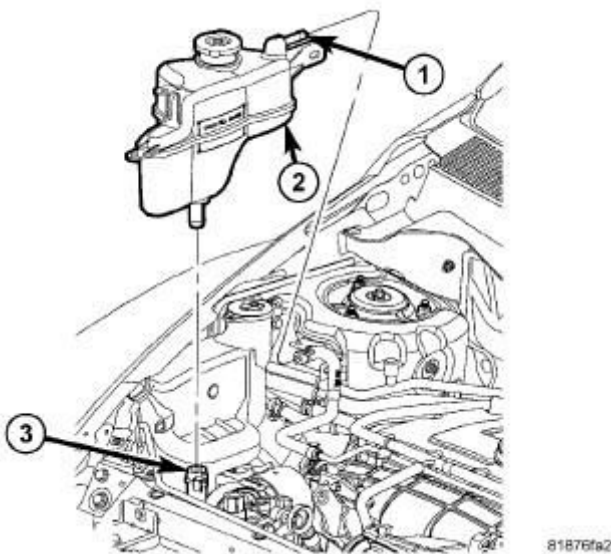


Fig. 28: Coolant Container - Diesel Engine
Courtesy of CHRYSLER GROUP, LLC

1 - RETURN FITTING

2 - PRESSURE CONTAINER

3 - COOLANT HOSE

1. Partially drain the cooling system using the draincock only. Refer to **STANDARD PROCEDURE**. Drain the system below the level of the coolant recovery pressure container (2).

2. Disconnect the return hose at the coolant recovery pressure container (2).
3. Remove the coolant recovery pressure container bolts.
4. Lift container up and disconnect the coolant hose (3) from the bottom of the pressure container (2).
5. Remove the pressure container (2) from engine compartment.

INSTALLATION

GAS ENGINE

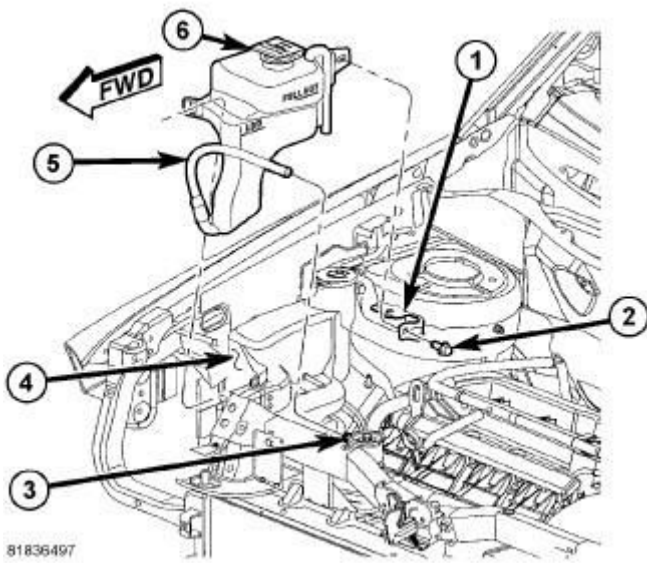


Fig. 29: Coolant Recovery Container
Courtesy of CHRYSLER GROUP, LLC

- | |
|--------------------------------|
| 1 - MOUNTING BRACKET |
| 2 - BOLT |
| 3 - RADIATOR HOSE TEE |
| 4 - WASHER RESERVOIR |
| 5 - HOSE |
| 6 - COOLANT RECOVERY CONTAINER |

1. Position the coolant recovery container (6) into the washer fluid reservoir (4).
2. Install the coolant recovery container mounting bolt (2). Tighten the mounting bolt to 4 N.m (35 in. lbs.).
3. Connect the hose (5) at the upper radiator tee (3).

4. Fill coolant recovery container to proper level. Refer to **STANDARD PROCEDURE**.

DIESEL ENGINE

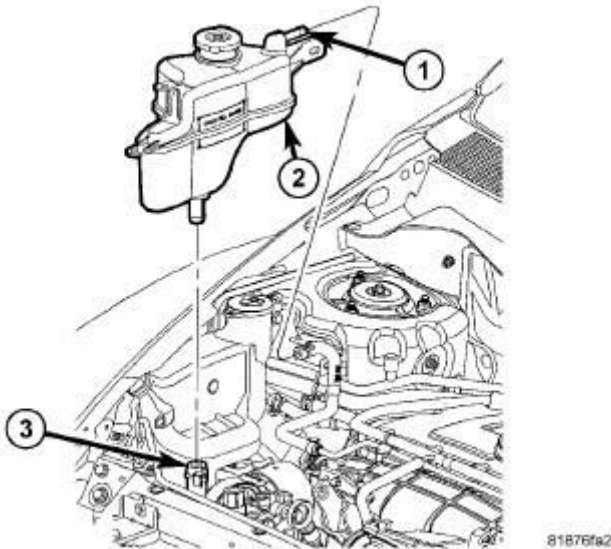


Fig. 30: Coolant Container - Diesel Engine
Courtesy of CHRYSLER GROUP, LLC

- | |
|---|
| <p>1 - RETURN FITTING
2 - PRESSURE CONTAINER
3 - COOLANT HOSE</p> |
|---|

1. Lower the pressure container (2) into the engine compartment and connect the coolant hose (3) at bottom of the pressure container (2).
2. Position the pressure container (2) and install the mounting bolts. Tighten the mounting bolts to 4 N.m (35 lbs. in.).
3. Connect the coolant return hose to the coolant recovery container (2).
4. Refill the cooling system. Refer to **STANDARD PROCEDURE**.

CAP, RADIATOR

DESCRIPTION

GAS ENGINE

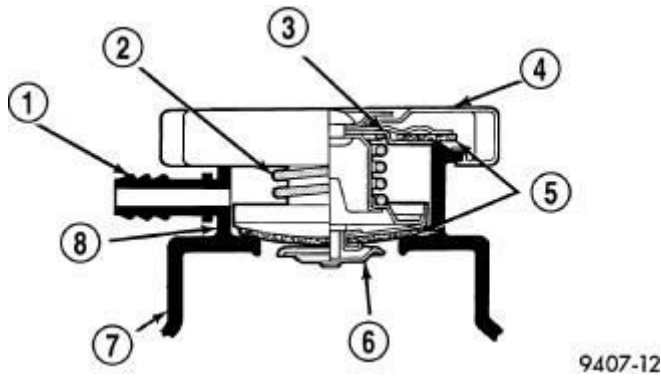


Fig. 31: Cooling System Pressure Cap
Courtesy of CHRYSLER GROUP, LLC

- 1 - OVERFLOW NIPPLE
- 2 - MAIN SPRING
- 3 - GASKET RETAINER
- 4 - STAINLESS-STEEL SWIVEL TOP
- 5 - RUBBER SEALS
- 6 - VENT VALVE
- 7 - RADIATOR
- 8 - FILLER NECK

The cooling system is equipped with a pressure cap that releases built up pressure, maintaining a range of 97-124 kPa (14-18 psi).

There is also a vent valve (6) in the center of the cap. This valve also opens when coolant is cooling and contracting, allowing coolant to return to radiator from coolant recovery container by vacuum through connecting hose. **If valve is stuck shut, the radiator hoses will be collapsed on cool down. Clean the vent valve to ensure proper sealing when boiling point is reached.**

DIESEL ENGINE

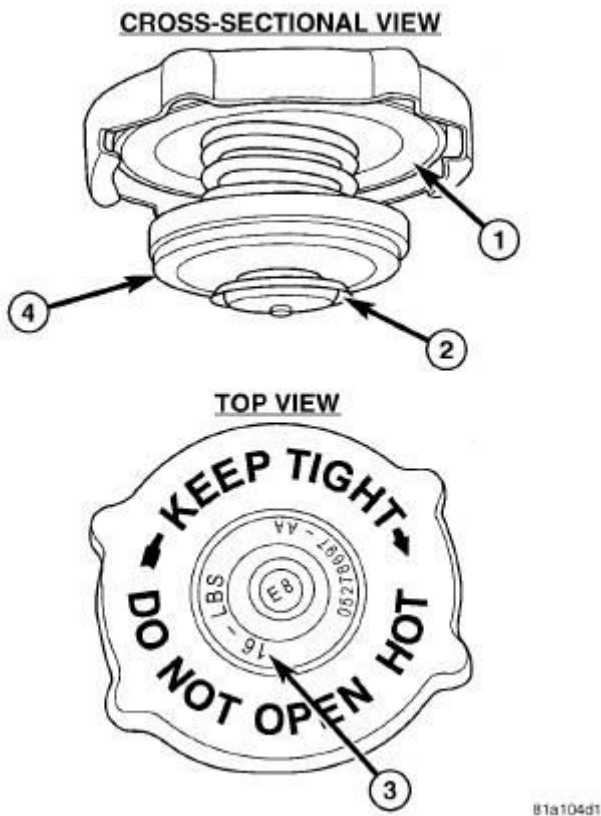


Fig. 32: Radiator Pressure Cap
Courtesy of CHRYSLER GROUP, LLC

- 1 - NECK SEAL
- 2 - VACUUM VENT
- 3 - PRESSURE RATING
- 4 - PRESSURE VALVE

All vehicles are equipped with a pressure cap. This cap releases pressure at some point within approximately 110 kPa (16 psi). The pressure relief point (in pounds) is engraved on top of the cap.

The cooling system will operate at pressures slightly above atmospheric pressure. This results in a higher coolant boiling point allowing increased radiator cooling capacity. The cap contains a spring-loaded pressure relief valve. This valve opens when system pressure reaches the release range of approximately 110 kPa (16 psi).

A rubber gasket seals the radiator filler neck. This is done to maintain vacuum during coolant cool-down and to prevent leakage when system is under pressure.

DIAGNOSIS AND TESTING

PRESSURE TESTING

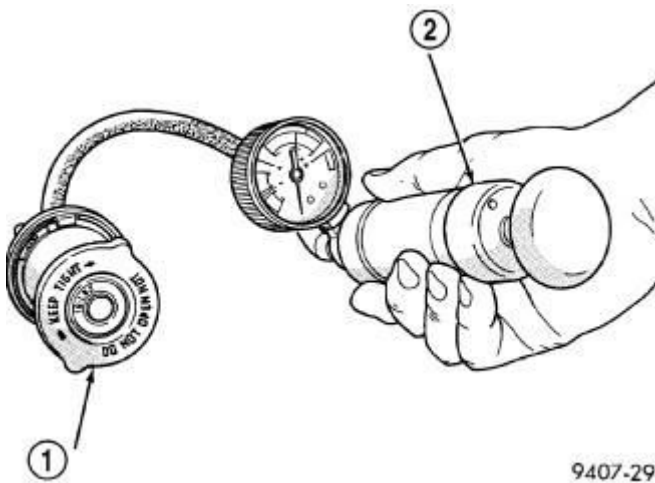


Fig. 33: Pressure Testing Radiator Cap
Courtesy of CHRYSLER GROUP, LLC

- 1 - PRESSURE CAP
- 2 - PRESSURE TESTER

Dip the pressure cap in water. Clean any deposits off the vent valve or its seat and apply cap to end of the Pressure Cap Test Adaptor that is included with the Cooling System Tester (special tool #7700, Tester, Cooling System). Working the plunger, bring the pressure to 104 kPa (15 psi) on the gauge. If the pressure cap fails to hold pressure of at least 97 kPa (14 psi), replace the pressure cap.

CAUTION: The Cooling System Tester Tool is very sensitive to small air leaks that will not cause cooling system problems. A pressure cap that does not have a history of coolant loss should not be replaced just because it leaks slowly when tested with this tool. Add water to the tool. Turn tool upside down and recheck pressure cap to confirm that cap is bad.

If the pressure cap tests properly while positioned on Cooling System Tester (special tool #7700, Tester, Cooling System), but will not hold pressure or vacuum when positioned on the filler neck. Inspect the filler neck and cap top gasket for irregularities that may prevent the cap from sealing properly.

PRESSURE RELIEF TESTING

WARNING: If vehicle has been run recently, wait 15 minutes before removing cap. Place a shop towel over the cap, and without pushing down, rotate it counterclockwise to the first stop. Allow fluids to escape through the overflow tube. When the system stops pushing coolant and steam into the coolant recovery container and pressure drops, push down on the cap and remove it completely. Squeezing the radiator inlet hose with a shop towel (to check pressure) before and after turning to the first stop is recommended.

WARNING: The warning words "DO NOT OPEN HOT" on the pressure cap is a safety precaution. When hot, the cooling system builds up pressure. To prevent scalding or other injury, the pressure cap should not be removed while the system is hot and/or under pressure.

The pressure cap upper gasket to filler neck seal can be checked by removing the overflow hose at the radiator filler neck overflow nipple. Attach the radiator pressure tester to the **filler neck overflow nipple**, and pump air into the system. The pressure cap upper gasket should relieve pressure at 69-124 kPa (10-18 psi), and hold pressure at 55 kPa (8 psi) minimum.

There is no need to remove the pressure cap at any time **except** for the following purposes:

- Check and adjust coolant freeze point
- Refill system with new coolant
- Conducting service procedures
- Checking for leaks

INSPECTION

INSPECTION

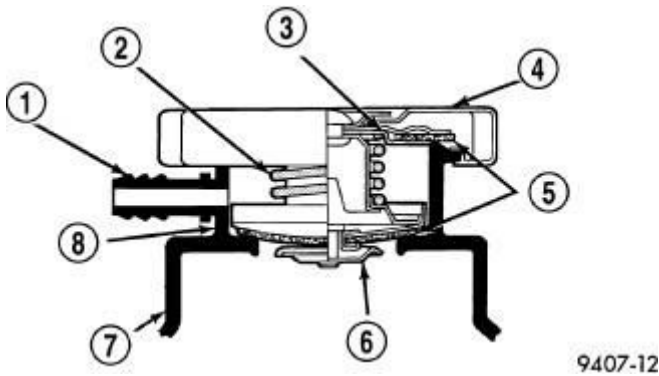


Fig. 34: Cooling System Pressure Cap
Courtesy of CHRYSLER GROUP, LLC

- 1 - OVERFLOW NIPPLE
- 2 - MAIN SPRING
- 3 - GASKET RETAINER
- 4 - STAINLESS-STEEL SWIVEL TOP
- 5 - RUBBER SEALS
- 6 - VENT VALVE
- 7 - THERMOSTAT HOUSING/ENGINE OUTLET CONNECTOR
- 8 - FILLER NECK

Hold the cap in your hand, **top side up**. The vent valve (6) at the bottom of the cap should not open. If the valve opens, replace the cap. If the rubber seal (5) has swollen, preventing the valve from opening, replace the cap.

Hold the cleaned cap in your hand, **upside down**. If any light can be seen between vent valve (6) and the rubber seal (5), replace the cap.

A replacement cap must be of the type designed for a full pressure coolant systems. This design ensures coolant return to the radiator.

COOLANT

DESCRIPTION

DESCRIPTION

GAS ENGINES

WARNING: Antifreeze is an ethylene-glycol base coolant and is harmful if swallowed or inhaled. If swallowed, drink two glasses of water and induce vomiting. If

inhaled, move to fresh air area. Seek medical attention immediately. Do not store in open or unmarked containers. Wash skin and clothing thoroughly after coming in contact with ethylene-glycol. Keep out of reach of children. Dispose of glycol base coolant properly, contact your dealer or government agency for location of collection center in your area. Do not open a cooling system when the engine is at operating temperature or hot under pressure, personal injury can result. Avoid radiator cooling fan when engine compartment related service is performed, personal injury can result.

CAUTION: Mixing of engine coolant (antifreeze) other than specified Organic Additive Technology (OAT) engine coolant (antifreeze), may result in engine damage and may decrease corrosion protection. Organic Additive Technology (OAT) engine coolant is different and should not be mixed with Hybrid Organic Additive Technology (HOAT) engine coolant (antifreeze). If a non-OAT engine coolant (antifreeze) is introduced into the cooling system in an emergency, it should be replaced with the specified engine coolant (antifreeze) as soon as possible.



A multimedia supplement to the instructions contained in this article is available. To view the multimedia example of the condition described go to;
<http://www.youtube.com/user/Mitchell1Tips>
then type, "A00610914.vid1" into the "Search Channel" box.

To find the coolant needed. Refer to **CAPACITIES AND RECOMMENDED FLUIDS, SPECIFICATIONS** .

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, or the equivalent ethylene-glycol base coolant with organic corrosion inhibitors (called OAT, for Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% ethylene-glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

DIESEL ENGINES

WARNING: Antifreeze is an ethylene glycol based coolant and is harmful if swallowed or inhaled. If swallowed, drink two glasses of water and induce vomiting. If inhaled, move to fresh air area. Seek medical attention immediately. Do not store in open or unmarked containers. Wash skin and clothing thoroughly after coming in contact with ethylene glycol. Keep out of reach of children. Dispose of glycol based coolant properly, contact your government agency for location of collection center in your area. Do not open a cooling system when the engine is at operating temperature or hot under pressure, personal injury can result. Avoid radiator cooling fan when engine compartment related service is performed, personal injury can result.

CAUTION: Use of Propylene Glycol based coolants is not recommended, as they provide less freeze protection and less boiling protection.

The cooling system is designed around the coolant. The coolant must accept heat from engine metal, in the cylinder head area near the exhaust valves and engine

block. Then coolant carries the heat to the radiator where the tube/fin radiator can transfer the heat to the air.

The use of aluminum cylinder blocks, cylinder heads, and water pumps requires special corrosion protection. Mopar® Antifreeze/Coolant, 5 Year/100, 000 Mile Formula (MS-9769), or the equivalent ethylene glycol based coolant with hybrid organic corrosion inhibitors (called HOAT, for Hybrid Organic Additive Technology) is recommended. This coolant offers the best engine cooling without corrosion when mixed with 50% Ethylene Glycol and 50% distilled water to obtain a freeze point of -37°C (-35°F). If it loses color or becomes contaminated, drain, flush, and replace with fresh properly mixed coolant solution.

The green coolant **MUST NOT BE MIXED** with the orange or magenta coolants. When replacing coolant the complete system flush must be performed before using the replacement coolant.

CAUTION: Mopar® Antifreeze/Coolant, 5 Year/100, 000 Mile Formula (MS-9769) may not be mixed with any other type of antifreeze. Doing so will reduce the corrosion protection and may result in premature water pump seal failure. If non-HOAT coolant is introduced into the cooling system in an emergency, it should be replaced with the specified coolant as soon as possible.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - COOLANT CONCENTRATION TESTING

Coolant concentration should be checked when any additional coolant was added to system or after a coolant drain, flush and refill. The coolant mixture offers optimum engine cooling and protection against corrosion when mixed to a freeze point of -37°C (-34°F) to -46°C (-50°F). The use of a hydrometer or a refractometer can be used to test coolant concentration.

A hydrometer will test the amount of glycol in a mixture by measuring the specific gravity of the mixture. The higher the concentration of ethylene glycol, the larger the number of balls that will float, and higher the freeze protection (up to a maximum of 60% by volume glycol).

A refractometer Tool (special tool #8286, Refractometer) will test the amount of glycol in a coolant mixture by measuring the amount a beam of light bends as it passes through the fluid. Refer to **SPECIAL TOOLS**.

Some coolant manufactures use other types of glycols into their coolant formulations. Propylene glycol is the most common new coolant. However, propylene glycol based coolants do not provide the same freezing protection and corrosion protection and is not recommended.

CAUTION: Do not mix types of coolant. Corrosion protection will be severely reduced.

COOLER, EGR

DESCRIPTION

DESCRIPTION

The EGR cooler cools recirculated exhaust gasses to reduce combustion temperature which results in less NOx gases.

REMOVAL

REMOVAL

1. Disconnect the negative battery cable.
2. Remove engine cover.
3. Drain cooling system. Refer to **STANDARD PROCEDURE**.

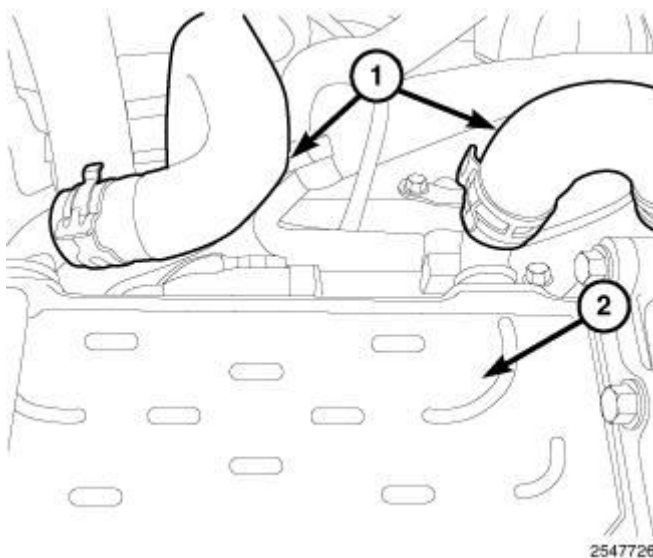


Fig. 35: Identifying Coolant Hoses & EGR Cooler

Courtesy of CHRYSLER GROUP, LLC

4. Disconnect coolant hoses (1) from the EGR cooler (2).

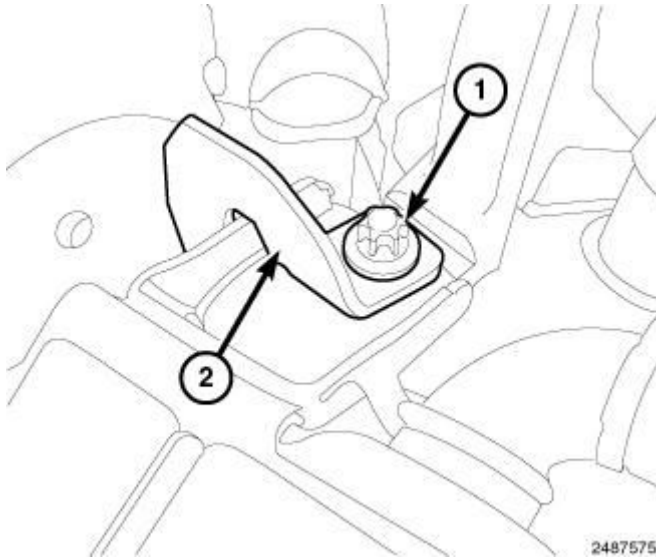


Fig. 36: Upper EGR Cooler Bolt & Bracket
Courtesy of CHRYSLER GROUP, LLC

5. Remove the upper EGR cooler bolt (1) and bracket (2).

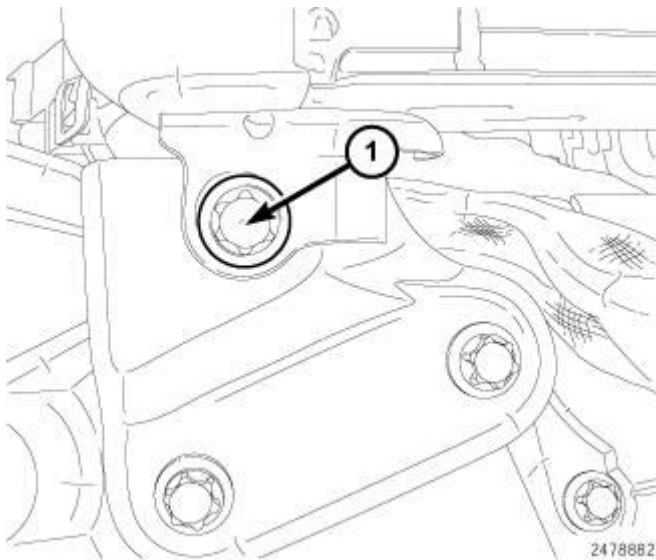


Fig. 37: Lower EGR Cooler Bolt
Courtesy of CHRYSLER GROUP, LLC

6. Remove the A/C wiring connector bracket and position aside.
7. Remove the lower EGR cooler bolt (1).

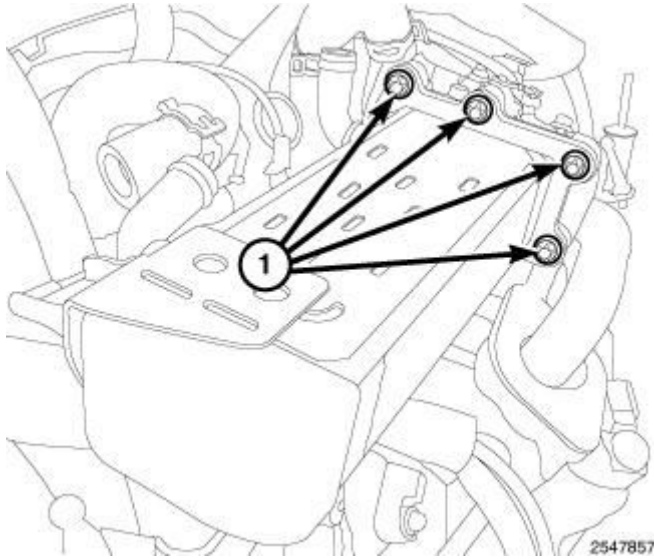


Fig. 38: EGR Cooler & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Two bolts hidden under cooler.

8. Remove six bolts (1) and the EGR cooler (2).

INSTALLATION

INSTALLATION

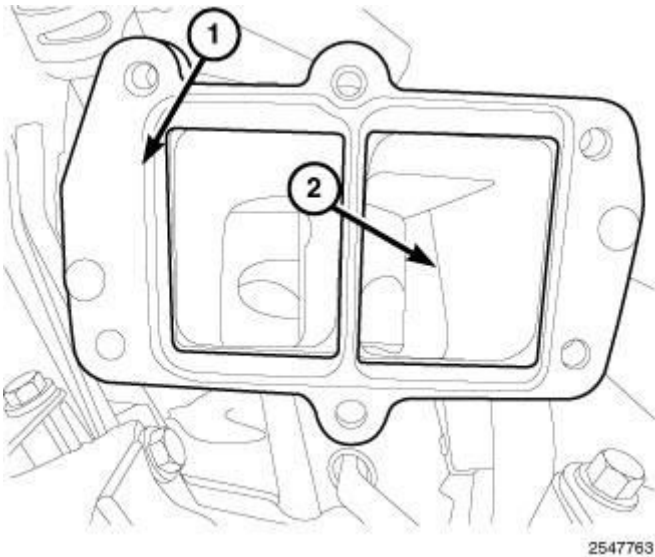


Fig. 39: EGR Body & Gasket
Courtesy of CHRYSLER GROUP, LLC

1. Clean all gasket mating surfaces.
2. Install a new gasket (1) onto the EGR body (2).

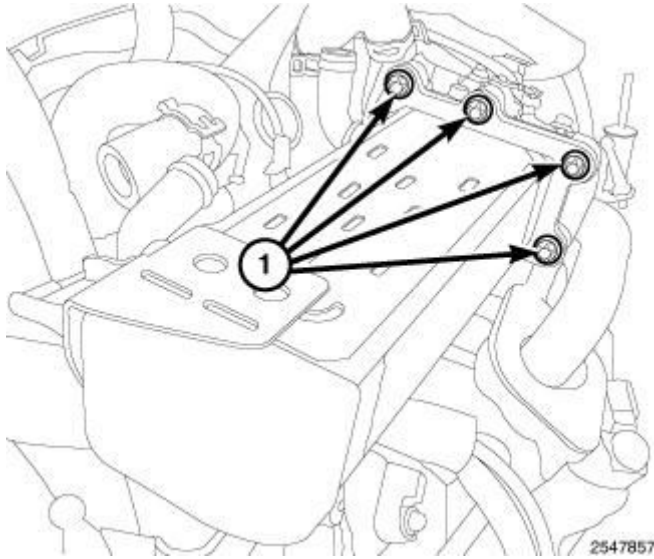


Fig. 40: EGR Cooler & Bolts
Courtesy of CHRYSLER GROUP, LLC

3. Install EGR cooler. Tighten bolts (1) to 9 N.m (80 in. lbs.).

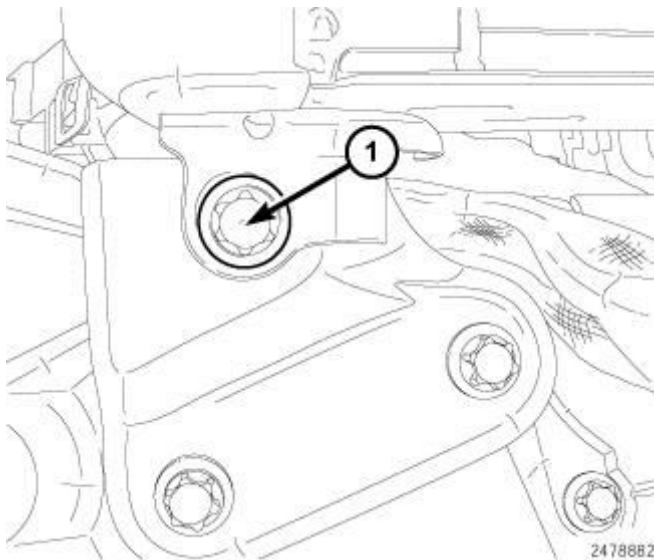


Fig. 41: Lower EGR Cooler Bolt
Courtesy of CHRYSLER GROUP, LLC

4. Install the lower EGR cooler bolt (1). Tighten to 9 N.m (80 in. lbs.).
5. Install the A/C connector mounting bracket.

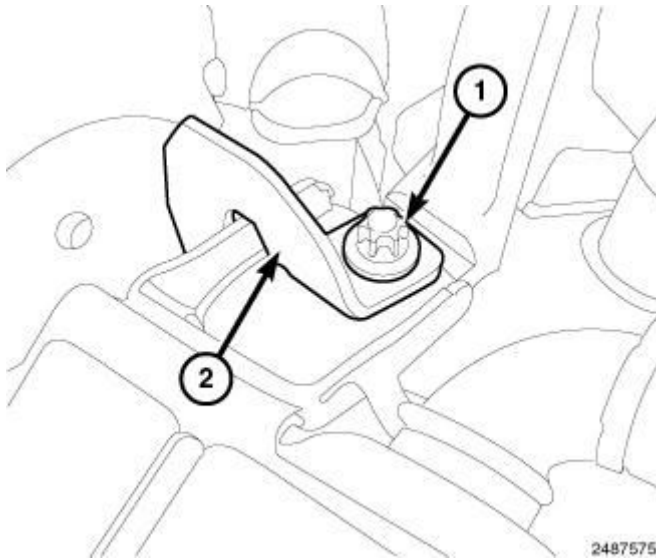


Fig. 42: Upper EGR Cooler Bolt & Bracket
Courtesy of CHRYSLER GROUP, LLC

6. Install the upper EGR cooler bolt. Tighten bolt to 9 N.m (80 in. lbs.).

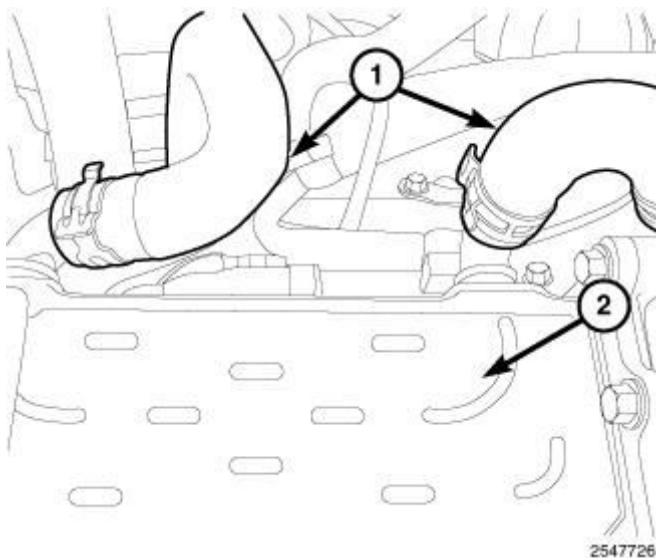


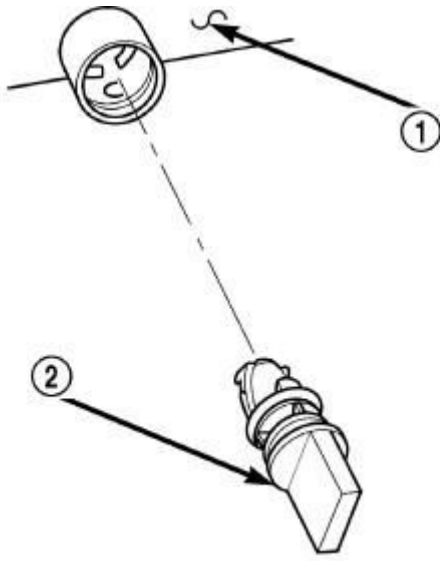
Fig. 43: Identifying Coolant Hoses & EGR Cooler
Courtesy of CHRYSLER GROUP, LLC

7. Connect coolant hoses (1) to the EGR cooler (2).
8. Fill cooling system. Refer to **STANDARD PROCEDURE**.
9. Install engine cover.
10. Connect the negative battery cable.

DRAINCOCK, RADIATOR

REMOVAL

REMOVAL



80c414e9

Fig. 44: Draincock

Courtesy of CHRYSLER GROUP, LLC

1 - RADIATOR TANK

2 - DRAINCOCK

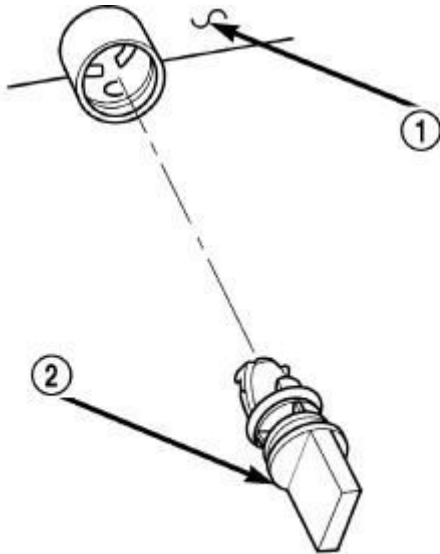
CAUTION: Use of pliers on draincock is not recommended.
Damage may occur to radiator or draincock.

NOTE: It is not necessary to remove draincock during a routine coolant drain.

1. Remove the front passenger side wheel. Refer to **REMOVAL** .
2. Remove the front passenger side splash shield assembly from the wheelhouse. Refer to **SHIELD, SPLASH, FRONT WHEELHOUSE, REMOVAL** .
3. Drain the cooling system. Refer to **STANDARD PROCEDURE**.
4. Open the draincock (2) by turning it counterclockwise until it stops.
5. Turn the draincock (2) back (clockwise) 1/8 turn.
6. Pull the draincock (2) from the radiator tank (1).

INSTALLATION

INSTALLATION

**Fig. 45: Draincock**

Courtesy of CHRYSLER GROUP, LLC

1 - RADIATOR TANK

2 - DRAINCOCK

1. Align draincock stem to radiator tank opening.
2. Push draincock (2) into the radiator tank opening.
3. Tighten the draincock (2) by turning clockwise until it stops.
4. Fill the cooling system. Refer to **STANDARD PROCEDURE**.
5. Install front passenger side splash shield assembly to the wheelhouse area. Refer to **SHIELD, SPLASH, FRONT WHEELHOUSE, INSTALLATION N**.
6. Install the front passenger side wheel. Refer to **INSTALLATION** .

FAN, COOLING

DESCRIPTION

DESCRIPTION

The radiator cooling fans are dual-speed electric motor driven fans. The radiator fan assembly includes two electric motors, two five blade fans, and a support shroud that is attached to the radiator. The radiator fans are serviced as an assembly.

OPERATION

GAS ENGINE

Radiator fan operation is controlled by the Totally Integrated Power Module (TIPM), with inputs from the engine coolant temperature sensor, continuously variable transmission (CVT) oil temperature, and A/C head pressure. The (TIPM) turns on the fan through either the high or low speed fan relay. The PCM provides a ground to the relay's control circuit. The fan relays are located in the (TIPM). Refer to the label beneath the (TIPM) cover for location of fan relays.

If the cooling fan is inoperative or a Diagnostic Trouble Code (DTC) related to fan control has been set, for diagnostic procedures, refer to **DTC INDEX** .

DIESEL ENGINE

Radiator fan operation is controlled by the Powertrain Control Module (PCM) with inputs from the temperature of the coolant, which is sensed by the coolant temperature sensor, and vehicle speed which is measured by the vehicle speed sensor. The PCM turns on the fan through either the high or low speed fan relay. The PCM provides a ground to the relay's control circuit. The fan relays are located on the back of the fan shroud.

If the cooling fan is inoperative or a Diagnostic Trouble Code (DTC) related to fan control has been set, for diagnostic procedures. Refer to **DTC INDEX** .

REMOVAL

COOLING FAN - REMOVAL

WARNING: Do not open the radiator draincock with the system hot and under pressure because serious burns from coolant can occur.

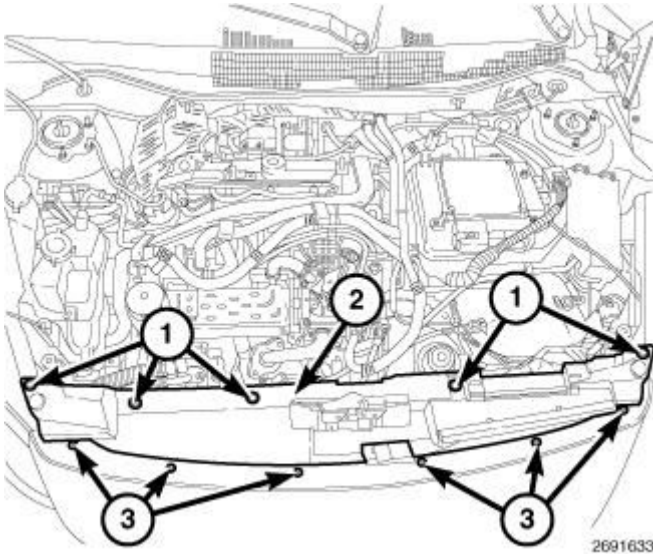


Fig. 46: Upper Radiator Closure Panel
Courtesy of CHRYSLER GROUP, LLC

1. Remove the air intake duct.
2. Disconnect negative cable from battery.
3. Drain the coolant just below the upper radiator hose.
4. Remove the upper radiator closure panel (2). Refer to **PANEL, CLOSURE, UPPER, REMOVAL** .
5. Remove the hood latch cable.

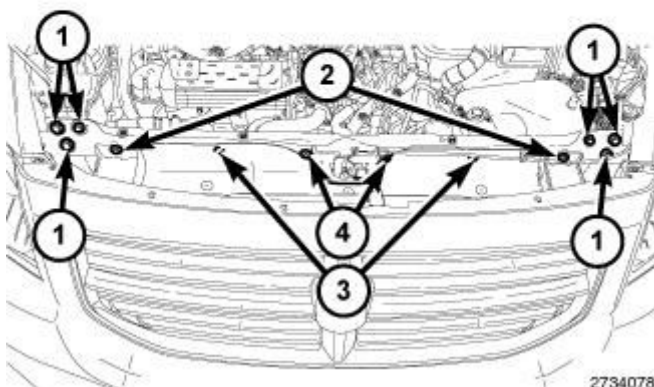


Fig. 47: Upper Core Support Seal Push Pins & Radiator Core Support Bolts
Courtesy of CHRYSLER GROUP, LLC

6. Remove the upper core support seal push pins (3).

7. Remove radiator core support bolts (1).

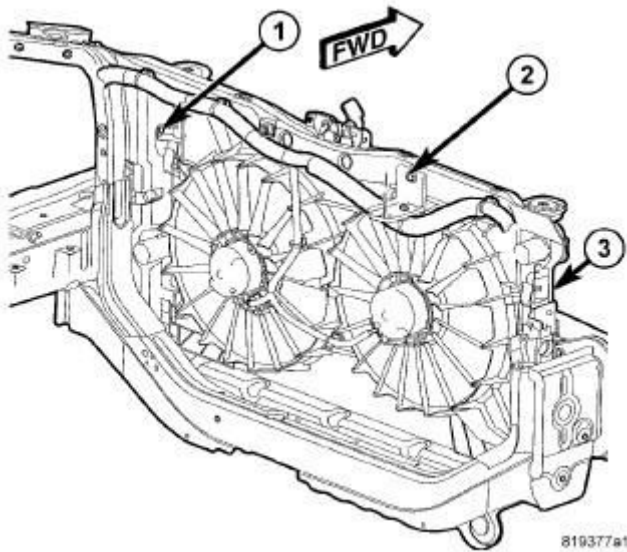


Fig. 48: Radiator Fan Assembly
Courtesy of CHRYSLER GROUP, LLC

8. Remove the upper radiator hose support bracket (2).
9. Remove the upper radiator hose from the radiator and position aside.
10. Remove the wiring harness from the fan shroud.
11. Disconnect radiator fan electrical connectors.
12. Remove radiator fan module (1) by lifting up from the engine compartment.

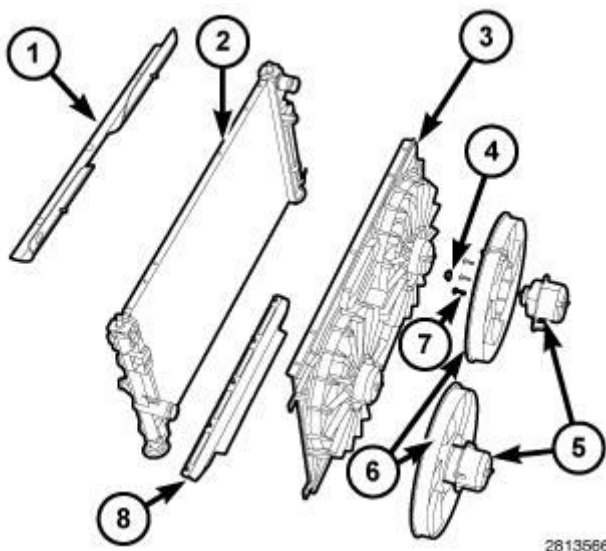


Fig. 49: Lower, Fan Blade Retaining Nut & Fan Motor
Courtesy of CHRYSLER GROUP, LLC

13. Remove the lower (8) shroud seal.
14. Remove the fan blade retaining nut (4) from the fan motor.
15. Remove the fan motor (5) assembly from the shroud.

DIESEL 2.2L - REMOVAL

WARNING: Do not open the radiator draincock with the system hot and under pressure because serious burns from coolant can occur.

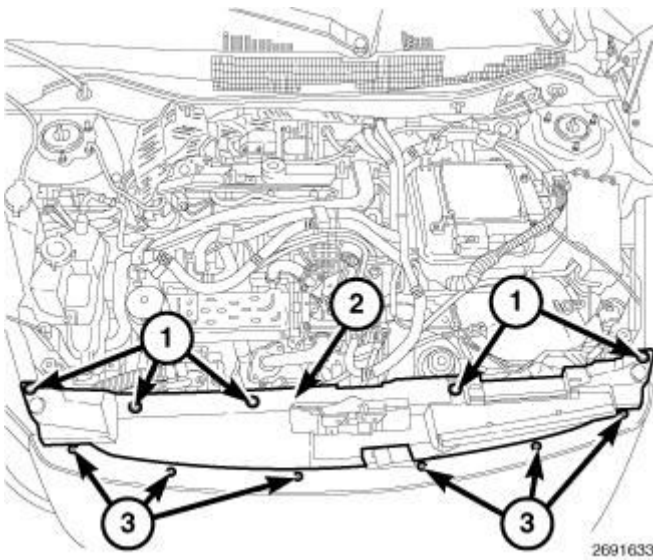


Fig. 50: Upper Radiator Closure Panel
Courtesy of CHRYSLER GROUP, LLC

1. Remove the air intake duct.
2. Disconnect the negative battery cable.
3. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .
4. Remove belly pan bolts.
5. Drain cooling system below upper radiator hose level.
6. Close off cooling system when the desired level is reached.
7. Install the belly pan.
8. Lower the vehicle.
9. Remove the upper radiator closure panel (2). Refer to **PANEL, CLOSURE, UPPER, REMOVAL** .
10. Remove the hood latch cable.

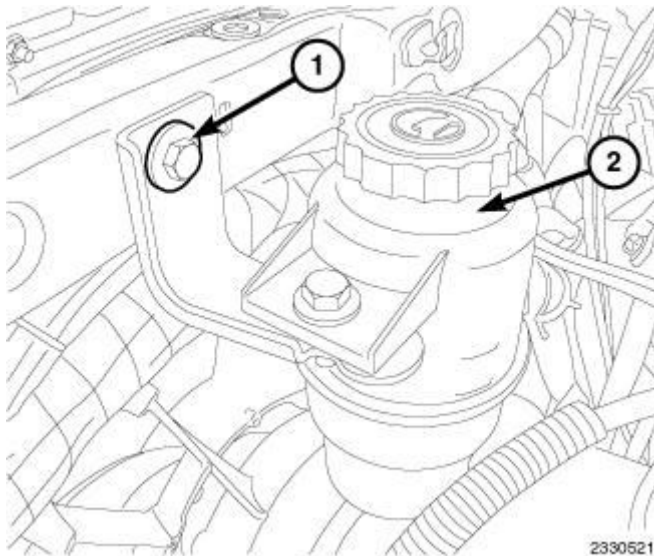


Fig. 51: Power Steering Fluid Reservoir & Mounting Bolt
Courtesy of CHRYSLER GROUP, LLC

11. Remove the power steering fluid reservoir (2) mounting bolt (1) and position aside.

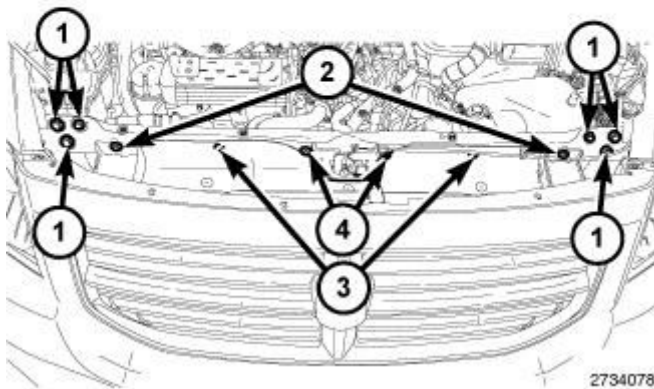


Fig. 52: Upper Core Support Seal Push Pins & Radiator Core Support Bolts
Courtesy of CHRYSLER GROUP, LLC

12. Remove the upper core support seal push pins (3).
13. Remove radiator core support bolts (1).

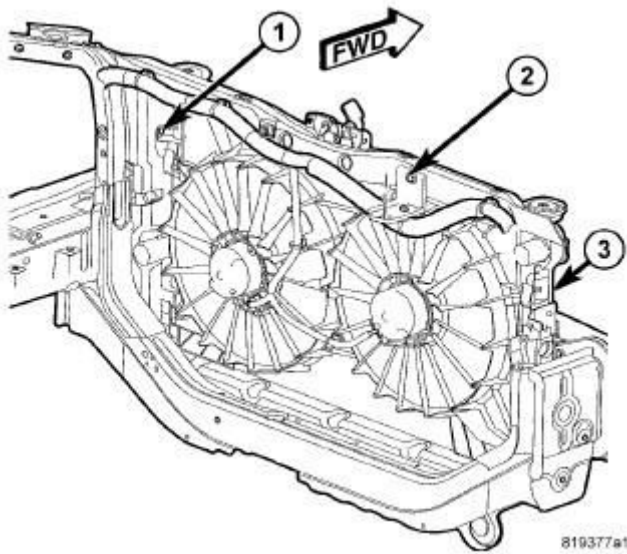


Fig. 53: Radiator Fan Assembly
Courtesy of CHRYSLER GROUP, LLC

14. Disconnect upper radiator hose from radiator.
15. Remove the wiring harness from the fan shroud.
16. Disconnect radiator fan wire harness connectors.
17. Remove radiator fan module (1) by lifting up from the engine compartment.

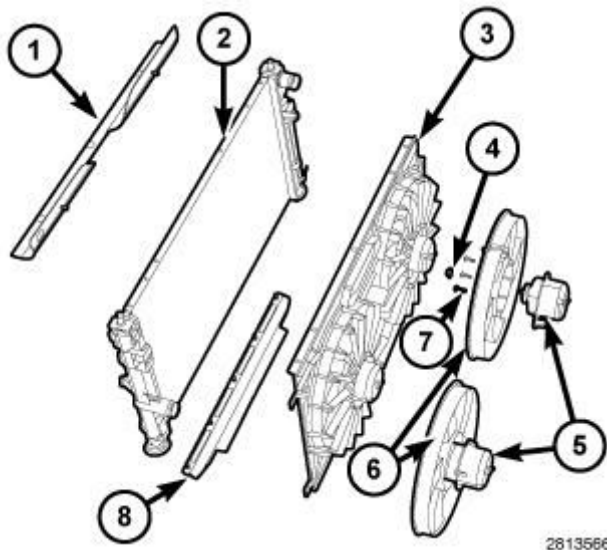


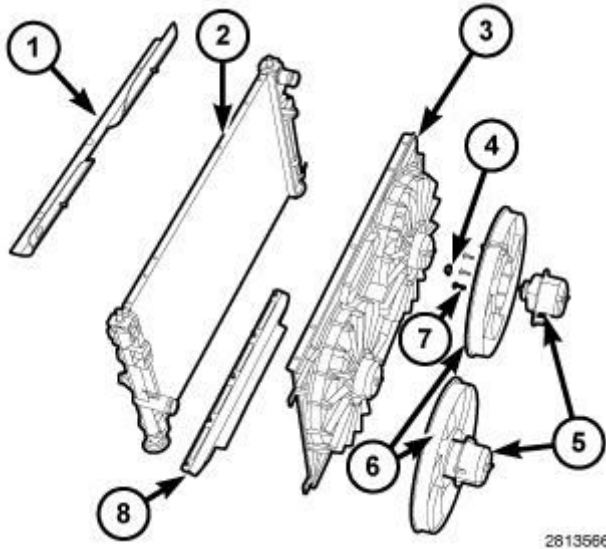
Fig. 54: Lower, Fan Blade Retaining Nut & Fan Motor
Courtesy of CHRYSLER GROUP, LLC

18. Remove the lower (8) shroud seal.
19. Remove the fan blade retaining nut (4) from the fan motor.

20. Remove the fan motor (5) assembly from the shroud.

INSTALLATION

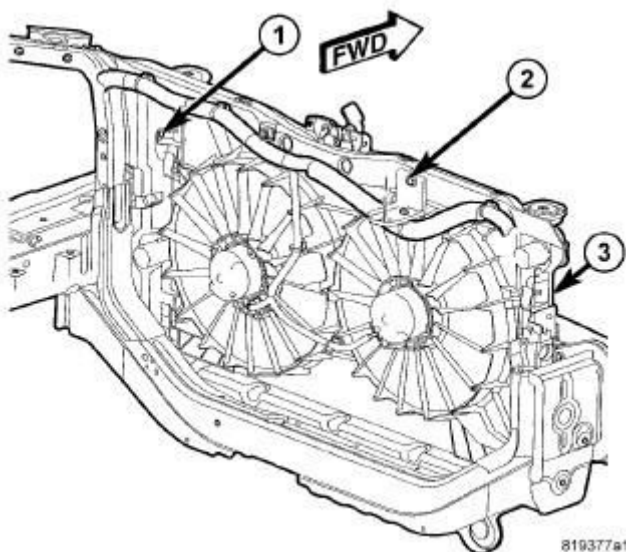
COOLING FAN - INSTALLATION



2813566

Fig. 55: Lower, Fan Blade Retaining Nut & Fan Motor
Courtesy of CHRYSLER GROUP, LLC

1. Install the fan motor (5) onto shroud (3).
2. Install the fan (6) onto the motor.
3. Install the lower (8) shroud seal.



819377a1

Fig. 56: Radiator Fan Assembly
Courtesy of CHRYSLER GROUP, LLC

4. Install radiator fan module (1).
5. Connect the electrical connectors.
6. Install the wiring harness mounting retainers into fan shroud.
7. Install the upper radiator hose support bracket (2).
8. Install upper radiator hose to the radiator.

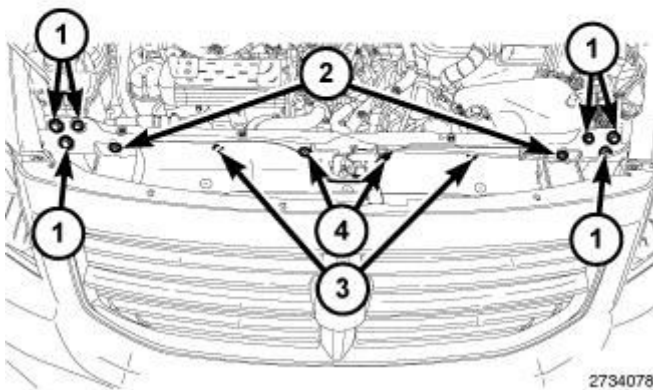


Fig. 57: Upper Core Support Seal Push Pins & Radiator Core Support Bolts

Courtesy of CHRYSLER GROUP, LLC

9. Install the upper radiator core support. Tighten outer bolts (1) to 23 N.m (17 ft. lbs.). Tighten the inner support bolts to 8 N.m (6 ft. lbs.).
10. Install the hood latch cable.
11. Install the core support seal (3).

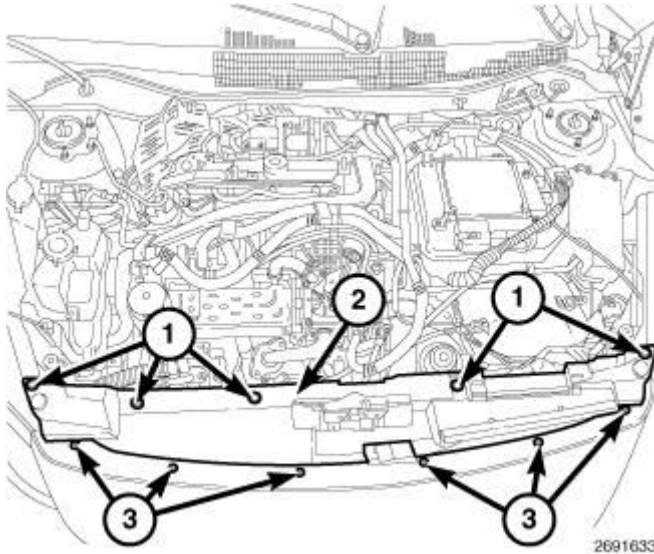


Fig. 58: Upper Radiator Closure Panel
Courtesy of CHRYSLER GROUP, LLC

12. Install radiator closure panel (2). Refer to **PANEL, CLOSURE, UPPER, INSTALLATION**.
13. Connect the negative battery cable.
14. Fill the coolant to the proper level.
15. Run vehicle. Check for proper fan operation and coolant level.
16. Install the air intake duct.

DIESEL 2.2L - INSTALLATION

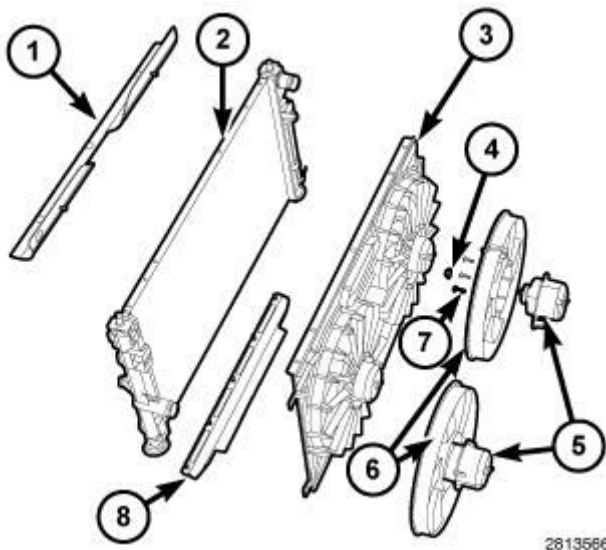


Fig. 59: Lower, Fan Blade Retaining Nut & Fan Motor
Courtesy of CHRYSLER GROUP, LLC

1. Install the fan motor (5) onto shroud (3).
2. Install the fan (6) onto the motor (5).
3. Install the lower shroud seal (8).

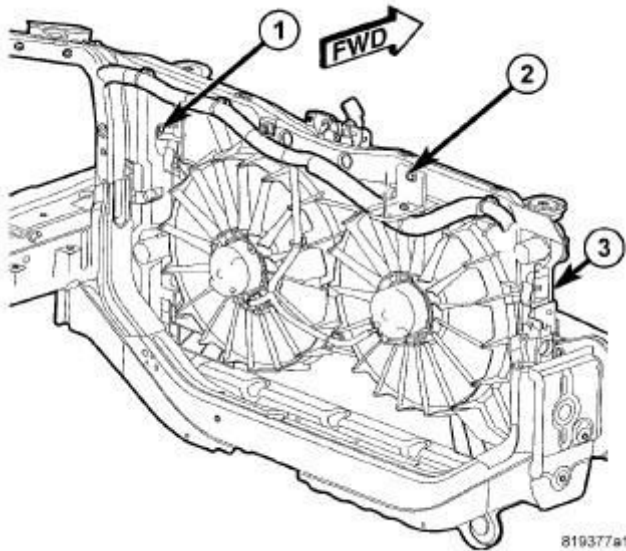


Fig. 60: Radiator Fan Assembly
Courtesy of CHRYSLER GROUP, LLC

4. Install the radiator fan module (1).
5. Connect the radiator fan wire harness connectors.
6. Install upper radiator hose.
7. Install the wiring harness mounting retainers into fan shroud.

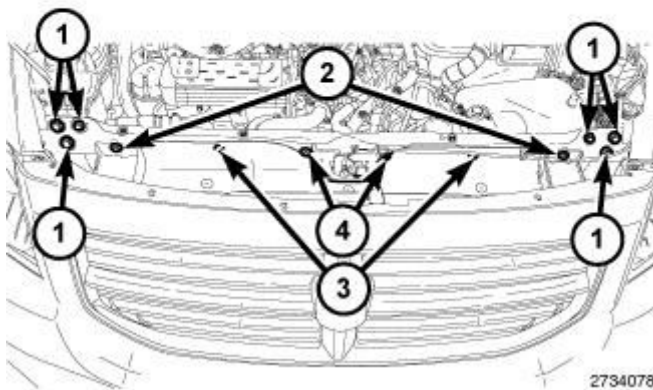


Fig. 61: Upper Core Support Seal Push Pins & Radiator Core Support

Bolts**Courtesy of CHRYSLER GROUP, LLC**

8. Install the upper radiator core support. Tighten outer bolts (1) to 23 N.m (17 ft. lbs.). Tighten the inner support bolts (1) to 8 N.m (6 ft. lbs.).
9. Install the hood latch cable.
10. Install the core support seal (3).

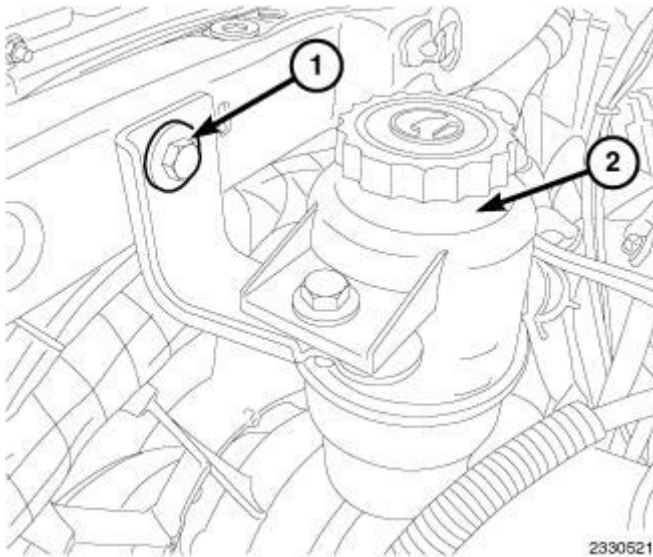


Fig. 62: Power Steering Fluid Reservoir & Mounting Bolt
Courtesy of CHRYSLER GROUP, LLC

11. Install the power steering reservoir (2). Tighten bolt (1) to 12 N.m (9 in. lbs.).

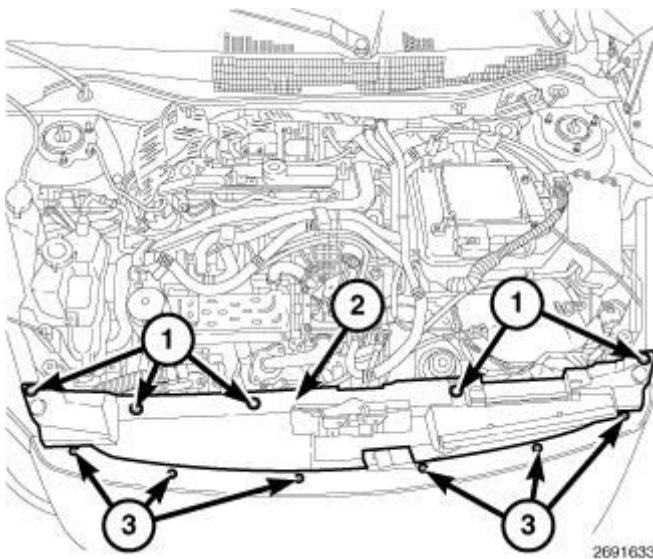


Fig. 63: Upper Radiator Closure Panel

Courtesy of CHRYSLER GROUP, LLC

12. Install radiator closure panel (2). Refer to **PANEL, CLOSURE, UPPER, INSTALLATION**.
13. Top coolant off. Refer to **STANDARD PROCEDURE**.

HEATER, ENGINE BLOCK

DESCRIPTION

DESCRIPTION

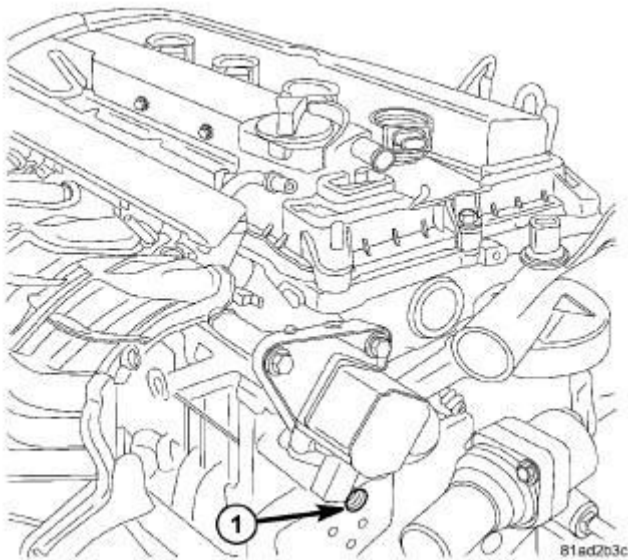


Fig. 64: Block Heater - Gas Engine
Courtesy of CHRYSLER GROUP, LLC

- | |
|------------|
| 1 - Item_1 |
| 2 - Item_2 |

The cartridge type block heater is mounted in a bore at the rear of the block under the coolant adapter. The block heater does not directly contact coolant. It heats the aluminum block.

The heater is powered by 110 Volt AC through a power cord and connector.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE BLOCK HEATER TESTING

If unit does not operate, trouble can be in either the power cord or the heater

element. Test power cord for continuity with a 110-volt voltmeter or 110-volt test light; test heater element continuity with an ohmmeter or 12-volt test light.

REMOVAL

REMOVAL

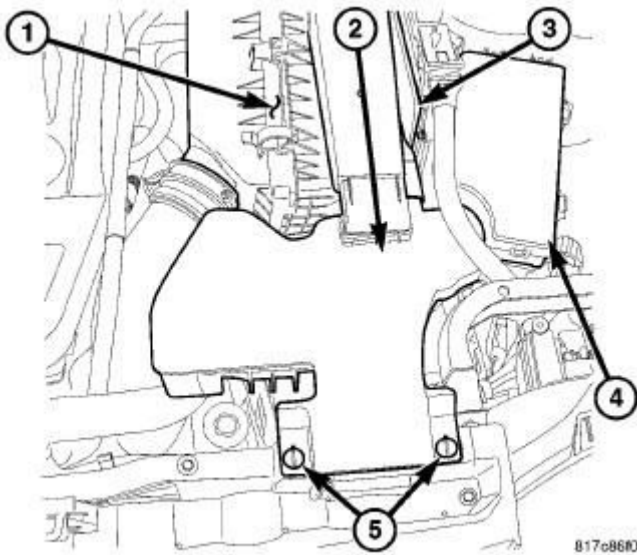


Fig. 65: Air Cleaner Inlet
Courtesy of CHRYSLER GROUP, LLC

1. Remove engine cover.
2. Remove air cleaner inlet.

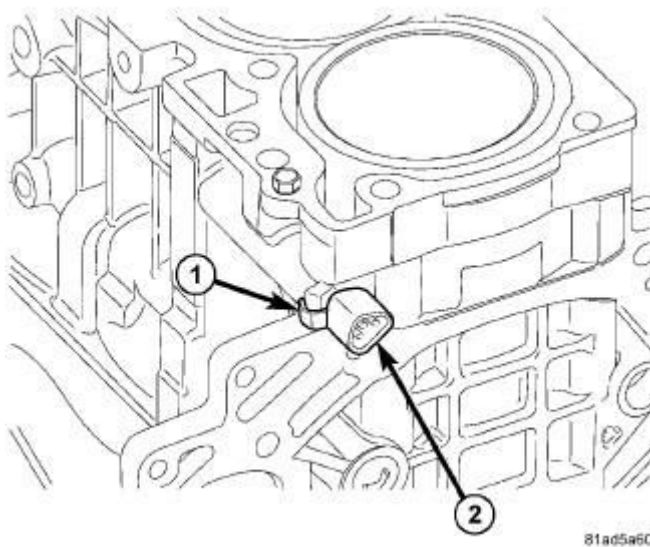


Fig. 66: Block Heater 2.0/2.4l Engine

Courtesy of CHRYSLER GROUP, LLC

- 1 - RETAINING CLIP
- 2 - BLOCK HEATER

3. Detach power cord plug from heater.
4. Remove retaining clip (1). Remove block heater assembly (2).

INSTALLATION

INSTALLATION

1. Thoroughly clean bore hole.
2. Insert block heater assembly into bore.
3. Install retaining clip.
4. Connect power cord to block heater.

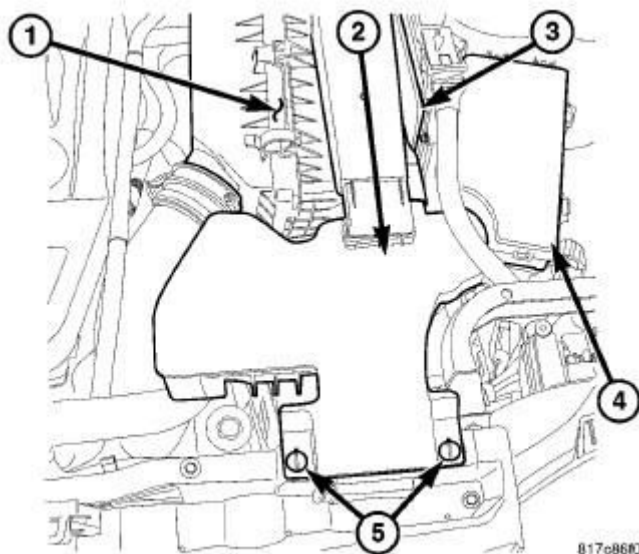


Fig. 67: Air Cleaner Inlet
Courtesy of CHRYSLER GROUP, LLC

5. Install air intake inlet.
6. Install engine cover.

PUMP, WATER

DESCRIPTION

GAS ENGINE

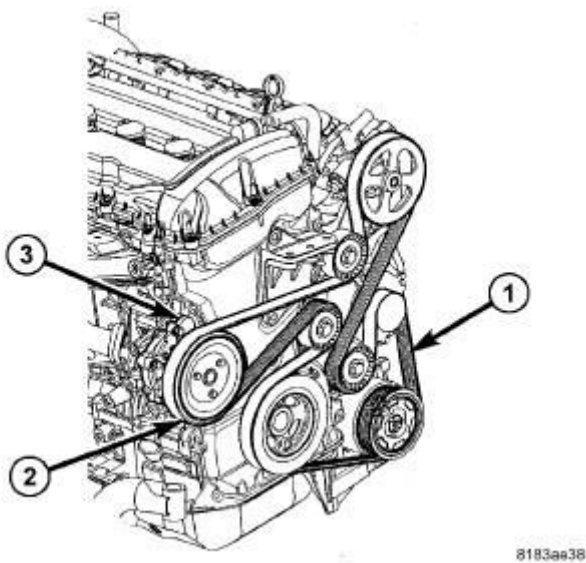


Fig. 68: Water Pump - World Engine
Courtesy of CHRYSLER GROUP, LLC

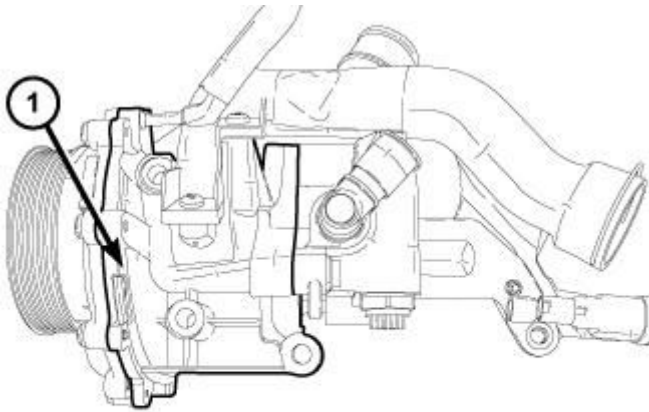
- | |
|---|
| 1 - ACCESSORY DRIVE BELT
2 - WATER PUMP PULLEY
3 - WATER PUMP |
|---|

The water pump (3) on the world engine is attached to the water pump adapter on the front of the cylinder block.

The water pump is driven by the accessory drive belt. The water pump is connected to the water plenum by the return tube.

Turbocharger equipped engines use a smaller diameter water pump pulley than the naturally aspirated engine. This allows increased coolant flow without pump cavitation.

DIESEL ENGINE



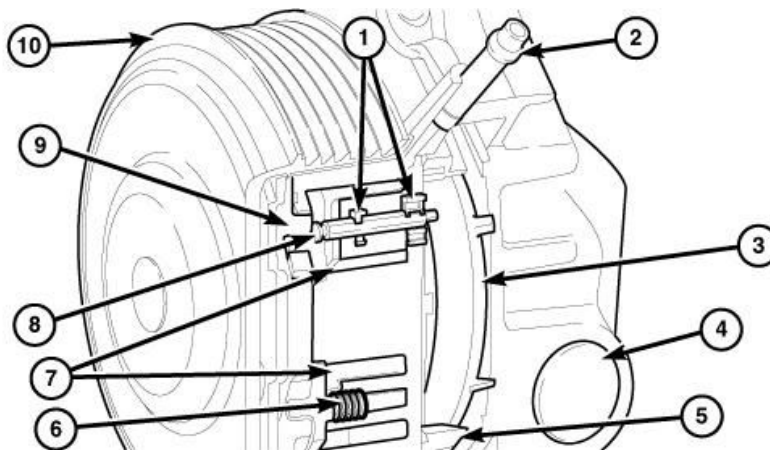
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Fig. 69: Water/Power Steering Pump
Courtesy of CHRYSLER GROUP, LLC

The combination water/power steering pump (1) on this vehicle is attached to the lower corner of the cylinder block on the left hand side.

The water/power steering pump (1) cannot be disassembled or serviced separately.

The water/power steering pump (1) is driven by the accessory drive's serpentine belt.



2902707

Fig. 70: Water Pump Components
Courtesy of CHRYSLER GROUP, LLC

- | |
|--|
| 1-CONTROL ROD SEALS
2-VACUUM SUPPLY FITTING
3-IMPELLER |
|--|

4-COOLANT RETURN 5-REGULATING VALVE 6-RETURN SPRINGS 7-EVACUATION ROOMS 8-CONTROL RODS 9-POWER DIAPHRAGM 10-WATER PUMP PULLEY

The water pump is turned on or off by vacuum. The Powertrain Control Module (PCM) actuates a switchover valve that turns vacuum supply to the water pump piston. A piston slides back and forth covering and uncovering a port used for coolant flow.

The controlling of the coolant flow helps manage temperature throughout the cooling system.

The water pump can be shut off if the following conditions exist:

- Engine speed is not achieved
- The fuel injection quantity is not achieved
- Intake air temperature is not reached
- Coolant temperature is not reached
- The A/C control unit does not request the heating mode

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - WATER PUMP

A quick flow test to determine if the water pump is working effectively is to check heater system for proper operation. A defective pump will not provide an adequate flow of heated coolant through the system.

WARNING: DO NOT REMOVE THE COOLING SYSTEM PRESSURE CAP WITH THE SYSTEM HOT AND UNDER PRESSURE BECAUSE SERIOUS BURNS FROM COOLANT CAN OCCUR.

Another flow test to help determine water pump operation is as follows:

1. Remove cooling system pressure cap.
2. Remove a small amount of coolant from the system.
3. Start the engine and warm up until thermostat opens.
4. With the thermostat open and coolant level low, visually inspect for coolant flow. If flow is present, the water pump is pumping coolant through the system.

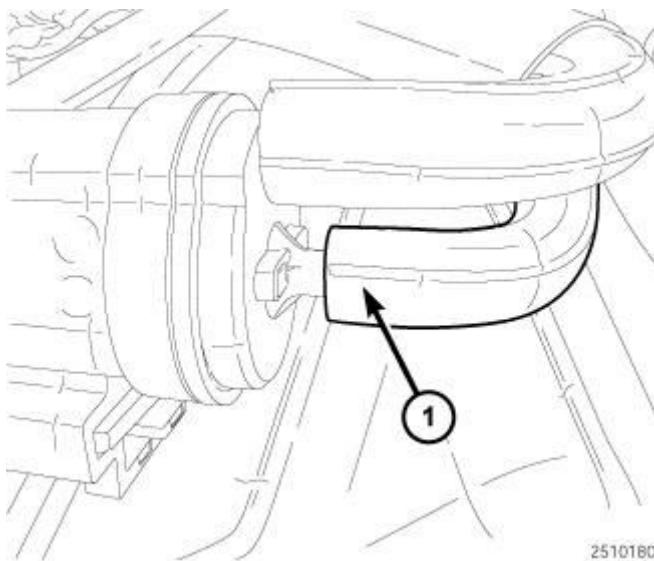
WATER PUMP TESTING - OM 651

Fig. 71: Water Pump Valve
Courtesy of CHRYSLER GROUP, LLC

1. A water pump slide valve test is used to ensure valve movement and proper flow from the water pump. The water pump valve is controlled by a switch that receives a signal from the Powertrain Control Module (PCM). When the switch is turned on, vacuum is supplied to the water pump that actuates a valve that controls the flow of coolant on or off. Using a vacuum pump on the port located on the water pump. When vacuum is applied, the piston should be heard by means of a clunk. It is possible to see movement of the valve through the weep holes located around the housing of the pump. A return spring will slowly return the valve.

Once the water pump is verified of proper operation. The vacuum supply can be checked by means of a vacuum gauge installed on the supply line before and after the switch. This will verify if the vacuum pump or if the switch is working properly. Vacuum should be 18 inches HG (609 millibars).

Once vacuum has been verified. While manually applying and releasing vacuum. Perform the **WATER PUMP** test.

REMOVAL

GAS ENGINE

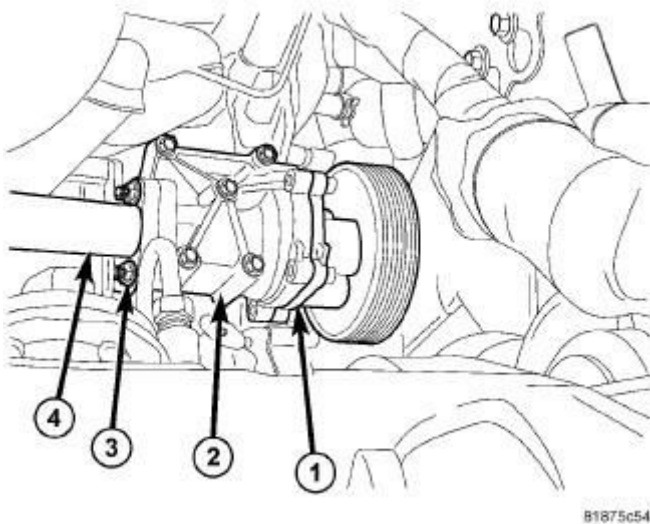


Fig. 72: Water Pump - Gas Engine
Courtesy of CHRYSLER GROUP, LLC

- | |
|---|
| <ul style="list-style-type: none">1 - WATER PUMP2 - MOUNTING BOLT3 - WATER INLET TUBE NUTS4 - INLET WATER TUBE |
|---|

1. Remove the accessory drive belt. Refer to **BELT, SERPENTINE, REMOVAL**.
2. Raise vehicle. Refer to **HOISTING, STANDARD PROCEDURE**.
3. Remove accessory drive belt splash shield.
4. Drain cooling system. Refer to **STANDARD PROCEDURE**.
5. Remove screws attaching water pump pulley (1). Remove pulley (1).
6. Remove water pump mounting bolts (2).
7. Remove water pump (3).

DIESEL

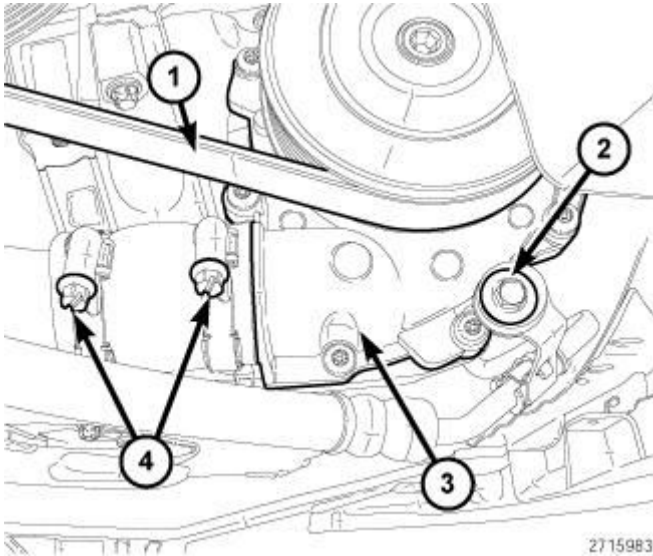


Fig. 73: Power Steering Pressure Line Retaining Bracket Bolt
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Drain the power steering fluid.
3. Raise and support the vehicle.

NOTE: **Drain the fluid in a clean container, free of debris.**
 Save the fluid for re-use.

4. Drain the cooling system. Refer to **STANDARD PROCEDURE**.
5. Remove the accessory drive belt (1). Refer to **BELT, SERPENTINE, REMOVAL**.
6. Loosen the band clamps (4) and disconnect the coolant return hose from the water pump (3).
7. Remove the power steering line retaining bracket bolt (2).

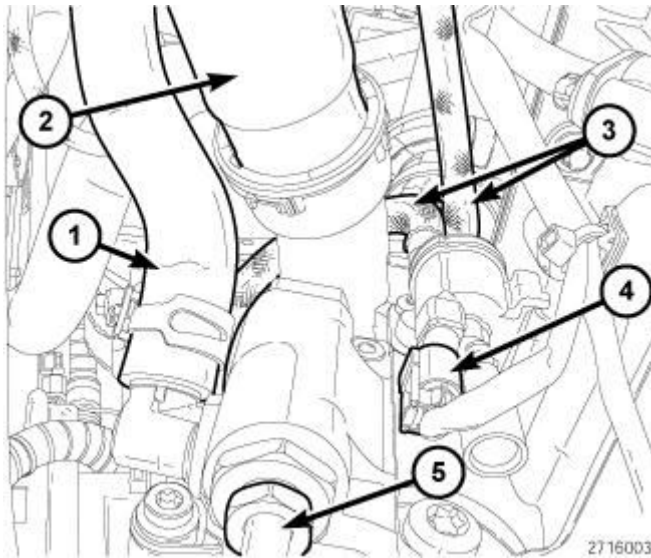


Fig. 74: Vacuum Lines, Coolant Inlet Hose, Power Steering Pump Supply Hose & Vacuum Switch Connector
Courtesy of CHRYSLER GROUP, LLC

8. Remove the coolant inlet hose (2) at the pump.
9. Remove the thermostat bypass hose at the pump.
10. Remove the power steering pump supply hose (1) at the pump.
11. Remove the power steering vacuum lines (3).
12. Disconnect the electronically controlled vacuum switch connector (4).

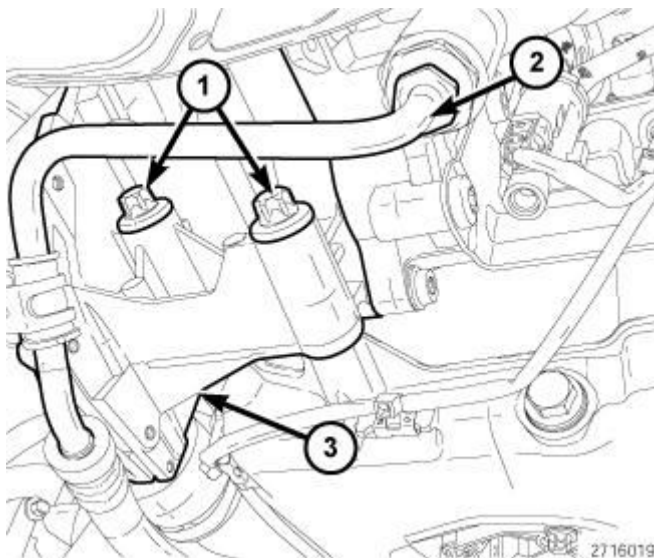
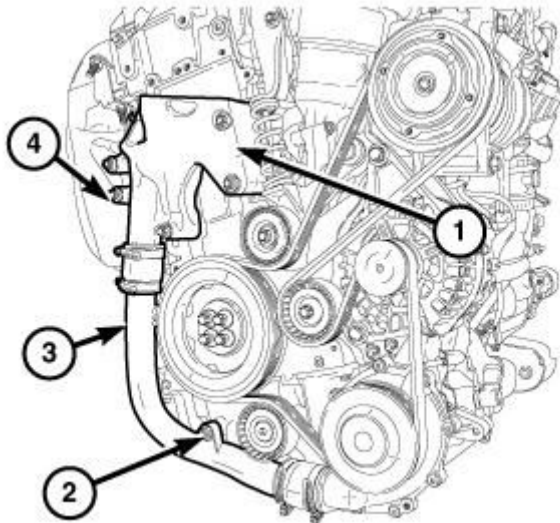


Fig. 75: Pressure Line At Pump
Courtesy of CHRYSLER GROUP, LLC

13. Remove the power steering pressure line (2).

14. Remove the water/power steering pump support bracket bolt.
15. Remove the water/power steering pump mounting bolts (1).
16. Remove the water/power steering pump (3).

DIESEL COOLING MANIFOLD



2739698

Fig. 76: Identifying Cooling Manifold, Engine Block Bolt, Coolant Return Hose & Cooling Manifold Mounting Bolts
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect and isolate the negative battery cable.
2. Raise and support the vehicle.
3. If equipped, remove the belly pan.

NOTE: Drain the fluid in a clean container, free of debris. Save the fluid for re-use.

4. Drain the cooling system. Refer to **STANDARD PROCEDURE**.
5. Remove the coolant return hose to engine block bolt (2).
6. Loosen the band clamps and disconnect the coolant return hose from the water pump.
7. Loosen the band clamps and disconnect the coolant return hose from the cooling manifold (1).
8. Remove the coolant return hose.
9. Lower the vehicle.

10. Support the engine from underneath.
11. Remove the coolant recovery bottle. Refer to **BOTTLE, COOLANT RECOVERY, REMOVAL**.
12. Remove the right side engine mount. Refer to **INSULATOR, ENGINE MOUNT, RIGHT, REMOVAL**.
13. Raise the engine slightly on the right side enough to gain clearance to the cooling manifold mounting bolts (4).
14. Remove bolts (4) the cooling manifold (1).
15. Remove and discard gasket.

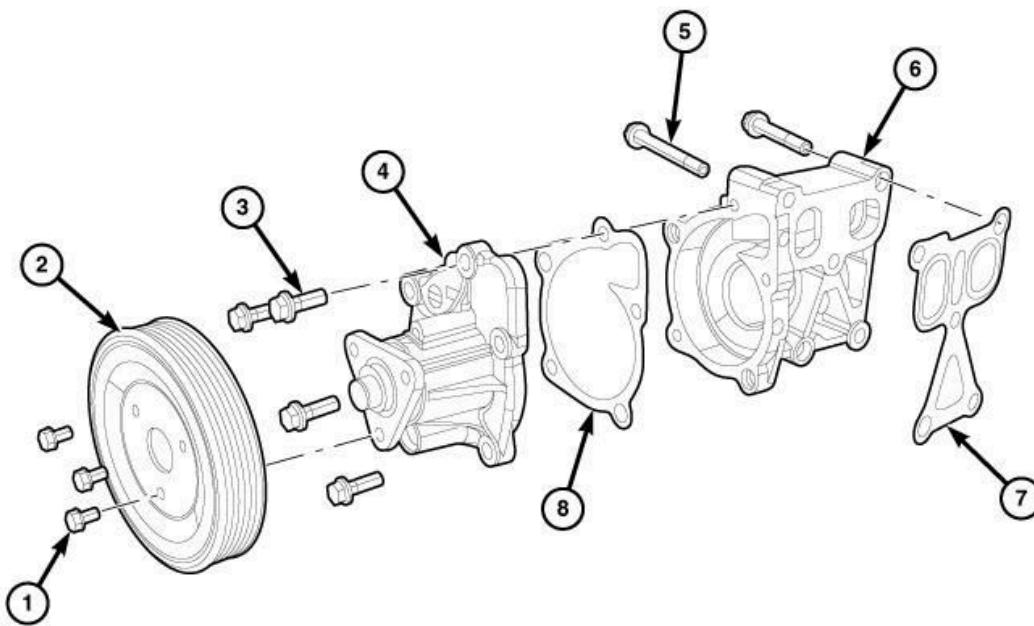
DISASSEMBLY**DISASSEMBLY**

Fig. 77: Water Pump Pulley, Adapter And Gasket
Courtesy of CHRYSLER GROUP, LLC

1. Remove the water pump assembly from the vehicle. Refer to **PUMP, WATER, REMOVAL**.
2. Discard the water pump outlet gasket (7).
3. Remove the three bolts (1) attaching the water pump pulley (2) to the water pump (4).

4. Remove the water pump pulley (2).
5. Remove the five bolts (3) attaching the water pump (4) to the water pump adapter (6).
6. Remove and discard the gasket (8).
7. Remove the water pump (4) and inspect carefully for any damage. Refer to **PUMP, WATER, INSPECTION**.

INSPECTION

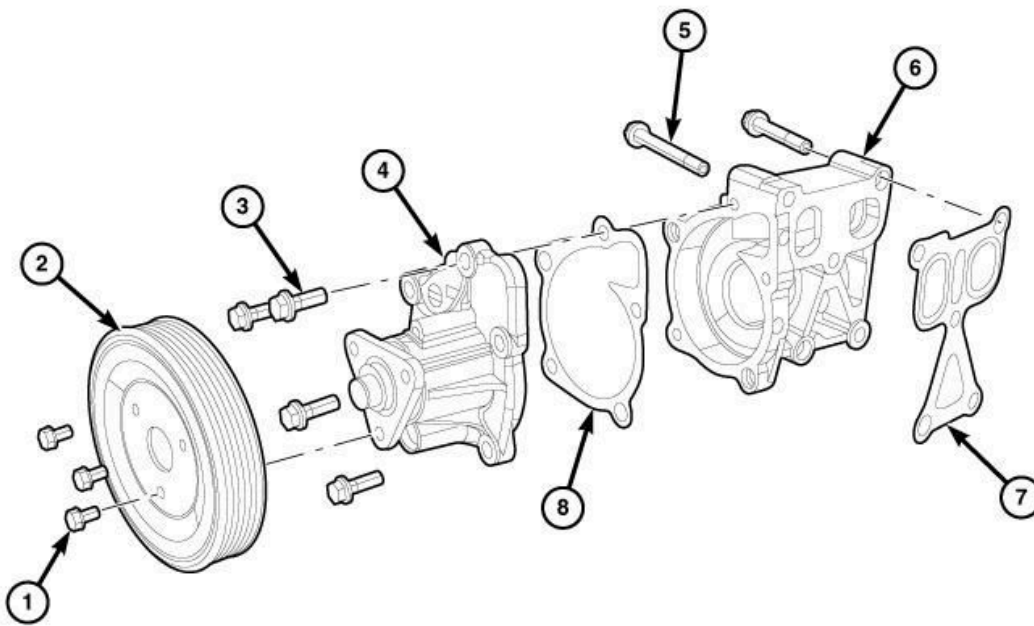
WATER PUMP

Replace water pump body assembly if it has any of these defects:

- Cracks or damage on the body.
- Coolant leaks from the shaft seal, evident by wet coolant traces on the pump body.
- Loose or rough turning bearing.
- Impeller rubs either the pump body or the engine block.
- Impeller loose or damaged.
- Sprocket or sprocket flange loose or damaged.

ASSEMBLY

ASSEMBLY



2109355

Fig. 78: Water Pump Pulley, Adapter And Gasket
Courtesy of CHRYSLER GROUP, LLC

1. Thoroughly clean all gasket mating surfaces before assembling.
2. Inspect water pump and components for any damage. Refer to **PUMP, WATER, INSPECTION**.
3. Using bolts (3), install the water pump (4) and gasket (8) to the water pump adapter (6). Tighten the bolts (3) to 22 N.m (16 lbs. ft.)
4. Using bolts (1), install the water pump pulley (2) to the water pump (4). Tighten the bolts (1) to 9 N.m (80 lbs. in.)
5. Using bolts (5), install the water pump assembly and gasket to the engine block. Tighten the bolts to 24 N.m (18 lbs. ft.). Refer to **PUMP, WATER, INSTALLATION**.
6. Start the engine and check for leaks. Refer to **DIAGNOSIS AND TESTING**.

INSTALLATION

GAS ENGINE

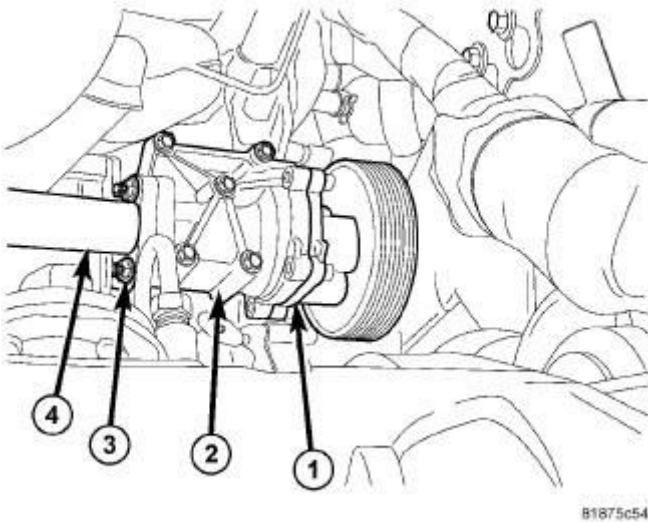


Fig. 79: Water Pump - Gas Engine
Courtesy of CHRYSLER GROUP, LLC

- | |
|--|
| <p>1 - WATER PUMP
2 - MOUNTING BOLT
3 - WATER INLET TUBE NUTS
4 - INLET WATER TUBE</p> |
|--|

1. Position water pump assembly (1) and gasket onto cylinder block.
2. Position water inlet tube (4) and gasket onto water pump (1).
3. Install mounting bolts (2). Tighten bolts to 24 N.m (18 ft. lbs.).
4. Install drive belt splash shield.
5. Lower vehicle.
6. Install accessory drive belt. Refer to **BELT, SERPENTINE, INSTALLATION**.
7. Evacuate air and refill cooling system. Refer to **STANDARD PROCEDURE**.
8. Check cooling system for leaks. Refer to **DIAGNOSIS AND TESTING**.

DIESEL

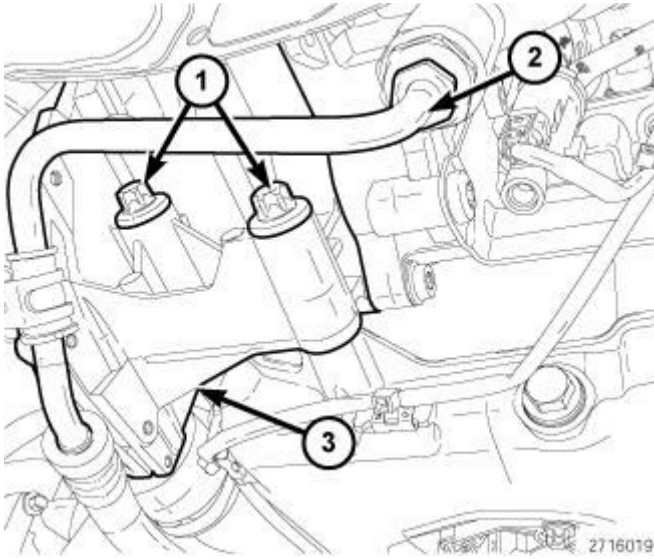


Fig. 80: Pressure Line At Pump
Courtesy of CHRYSLER GROUP, LLC

1. Position the water/power steering pump (3) onto the engine block while guiding the thermostat bypass hose onto pump assembly.
2. Install the water/power steering pump mounting bolts (1). Tighten the bolts (1) to 20 N.m (15 ft. lbs.).
3. Install the water/power steering support bracket bolt. Tighten the bolt to 12 N.m (9 ft. lbs.).
4. Install the power steering pressure line (2). Tighten the nut to 32 N.m (24 ft. lbs.).

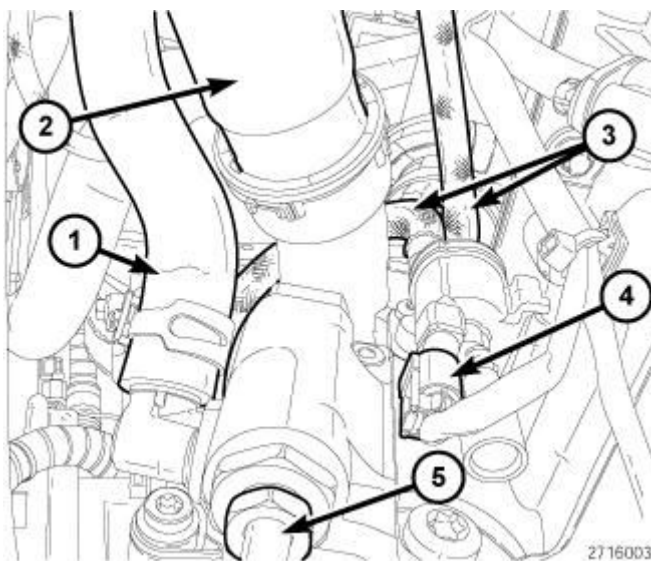


Fig. 81: Vacuum Lines, Coolant Inlet Hose, Power Steering Pump Supply Hose & Vacuum Switch Connector
Courtesy of CHRYSLER GROUP, LLC

5. Connect the electronically controlled vacuum switch connector (4).
6. Connect the vacuum lines (3) to the electronically controlled vacuum switch.
7. Connect the coolant inlet hose (2) at the pump.
8. Connect the power steering pump supply hose (1) at the pump.

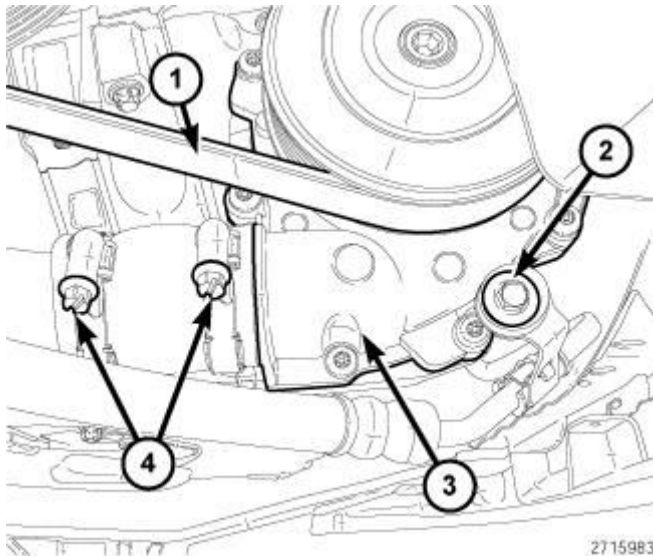
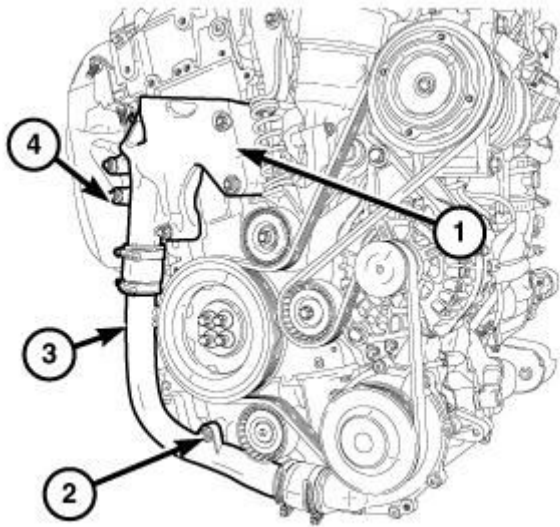


Fig. 82: Power Steering Pressure Line Retaining Bracket Bolt
Courtesy of CHRYSLER GROUP, LLC

9. Connect the power steering pressure line retaining bracket bolt (2). Tighten the bolt to 12 N.m (9 ft. lbs.).
10. Connect the coolant return hose to the water pump (3). Tighten the band clamps (4) to 1.7 N.m (15 in. lbs.).
11. Install accessory drive belt (1). Refer to **BELT, SERPENTINE, INSTALLATION**.
12. Lower the vehicle.
13. Evacuate air and refill cooling system. Refer to **STANDARD PROCEDURE**.
14. Fill and bleed the power steering system. Refer to **STANDARD PROCEDURE**.
15. Connect the negative battery cable.
16. Check cooling system for leaks. Refer to **DIAGNOSIS AND TESTING**.
17. Check the power steering system for leaks.



2739698

Fig. 83: Identifying Cooling Manifold, Engine Block Bolt, Coolant Return Hose & Cooling Manifold Mounting Bolts

Courtesy of CHRYSLER GROUP, LLC

1. Using a new gasket, install the cooling manifold (1). Tighten bolts (4) to 25 N.m (18 ft. lbs.).
2. Lower the engine.
3. Install the right side engine mount. Refer to **INSULATOR, ENGINE MOUNT, RIGHT, INSTALLATION** .
4. Install the coolant recovery bottle. Refer to **BOTTLE, COOLANT RECOVERY, INSTALLATION**.
5. Remove the support from underneath.
6. Lower the vehicle.
7. Install the coolant return hose.
8. Connect the coolant return hose to the cooling manifold (1) and tighten the band clamps.
9. Connect the coolant return hose to the water pump and tighten band clamps.
10. Install the coolant return hose to engine block bolt and securely tighten.
11. Raise and support the vehicle.
12. If equipped, install the belly pan.
13. Lower the vehicle.
14. Evacuate air and refill cooling system. Refer to **STANDARD PROCEDURE**.
15. Connect the negative battery cable.

16. Check cooling system for leaks. Refer to **DIAGNOSIS AND TESTING**.

RADIATOR, ENGINE COOLING

DESCRIPTION

DESCRIPTION

The radiator is a cross-flow type (horizontal tubes) with design features that provide greater strength, as well as sufficient heat transfer capabilities to keep the engine coolant within operating temperatures.

The radiator has an aluminum core with plastic tanks. Although stronger than brass, plastic tanks are subject to damage by impact. Always handle radiator with care.

OPERATION

OPERATION

The radiator functions as a heat exchanger, using air flow across the exterior of the radiator tubes. This heat is then transferred from the coolant and into the passing air.

REMOVAL

GAS ENGINE

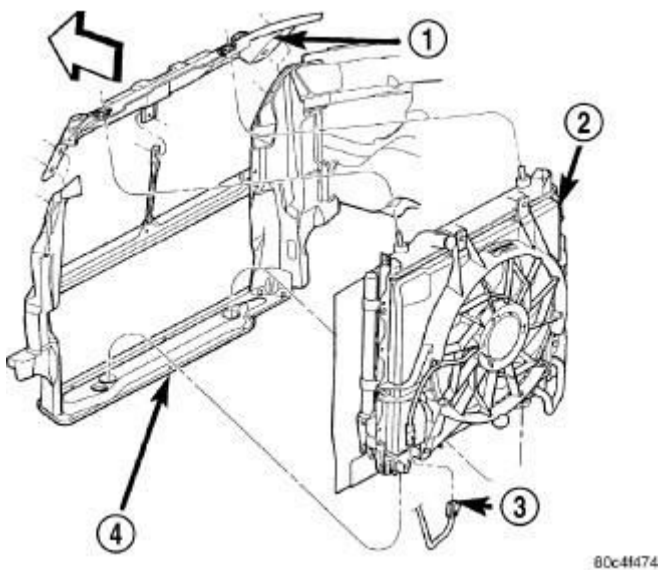


Fig. 84: Cooling Module Assembly
Courtesy of CHRYSLER GROUP, LLC

- 1 - UPPER RADIATOR CLOSURE PANEL
- 2 - COOLING MODULE
- 3 - RADIATOR FAN CONNECTOR
- 4 - LOWER RADIATOR CROSSMEMBER

WARNING: Do not open the radiator draincock with the system hot and under pressure because serious burns from coolant can occur.

1. Drain cooling system. Refer to STANDARD PROCEDURE.
2. Remove radiator fan. Refer to FAN, COOLING, REMOVAL.
3. Disconnect lower radiator hose.
4. Remove fasteners attaching AC condenser to radiator. Reposition AC condenser.
5. Remove radiator assembly by lifting it up from the engine compartment. **Care should be taken not to damage the cooling fins and tubes during removal.**

DIESEL

WARNING: Do not open the radiator draincock with the system hot and under pressure because serious burns from coolant can occur.

NOTE: It is not necessary to discharge the air conditioning system to remove the radiator.

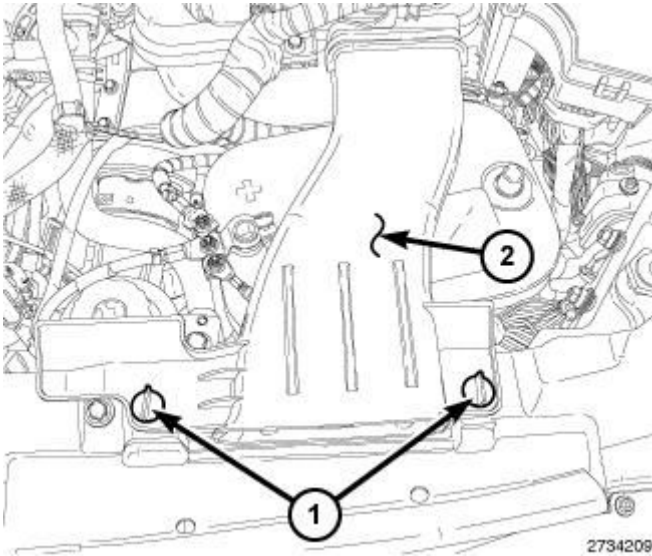


Fig. 85: Identifying Air Inlet Tube
Courtesy of CHRYSLER GROUP, LLC

1. Remove air intake duct (2).
2. Disconnect the negative battery cable.
3. Remove engine cover.
4. Raise and support the vehicle. Refer to **HOISTING, STANDARD PROCEDURE** .

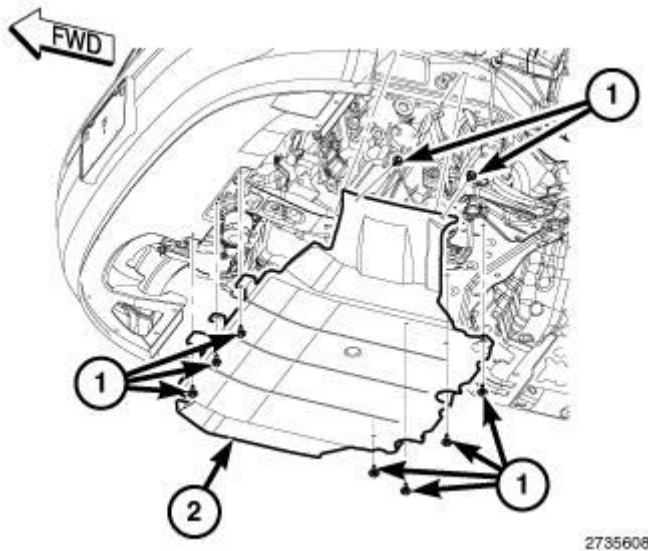


Fig. 86: Belly Pan & Bolts
Courtesy of CHRYSLER GROUP, LLC

NOTE: Belly pan removal is necessary for draining the cooling system.

5. Remove lower belly pan (2).
6. Drain cooling system. Refer to **STANDARD PROCEDURE**.

NOTE: Removal of the lower radiator hose can only be accessed from the top of vehicle when the cooling fan module has been removed.

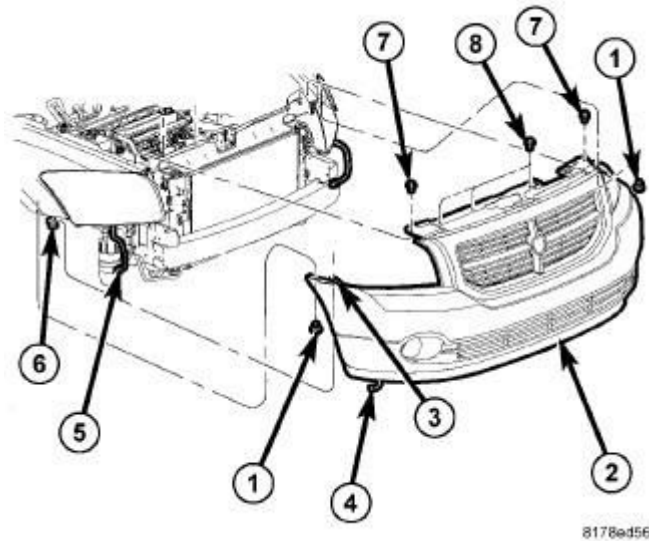


Fig. 87: Front Bumper Fascia Components
Courtesy of CHRYSLER GROUP, LLC

7. Partially lower the vehicle.
8. Remove the front wheel and tires.
9. Remove the inner splash shields.
10. Remove the front bumper fascia/grille (2) assembly. Refer to **FASCIA, FRONT, REMOVAL**.

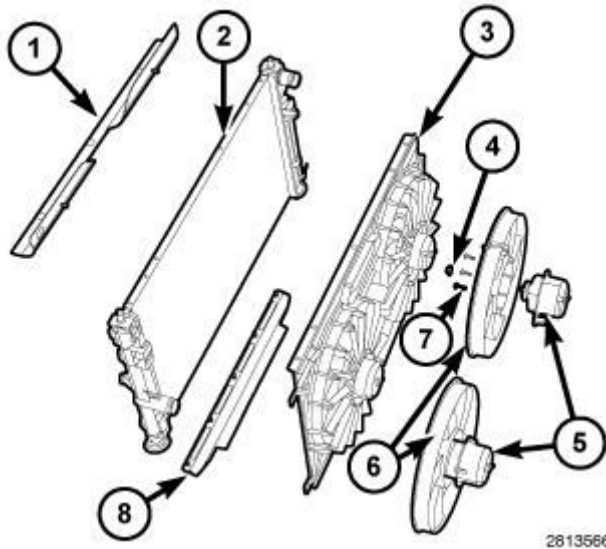


Fig. 88: Lower, Fan Blade Retaining Nut & Fan Motor
Courtesy of CHRYSLER GROUP, LLC

11. Lower the vehicle.
12. Remove radiator fan module assembly (8). Refer to **FAN, COOLING, REMOVAL**.
13. Disconnect the lower radiator hose.

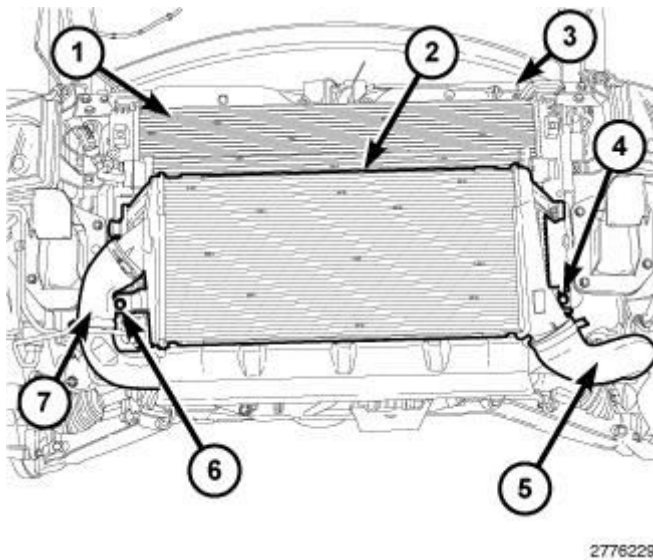


Fig. 89: Radiator, Charge Air Cooler, Hose & Fasteners
Courtesy of CHRYSLER GROUP, LLC

14. Disconnect the charge air hoses (5, 7) from the charge air cooler (2).
15. Remove the bolts (4, 6) and the charge air cooler from the radiator (3).
16. Remove remaining fasteners attaching A/C condenser (1) to radiator.
Position A/C condenser aside.

17. Lift the radiator up and out of engine compartment.

INSPECTION

INSPECTION

Inspect the radiator tanks for cracks, broken or missing fittings also inspect the joint where the tanks seam up to the radiator core for signs of leakage and/or deteriorating seals.

Inspect radiator core for corroded, bent or missing cooling fins. Inspect the core for bent or damaged cooling tubes.

INSTALLATION

GAS ENGINE

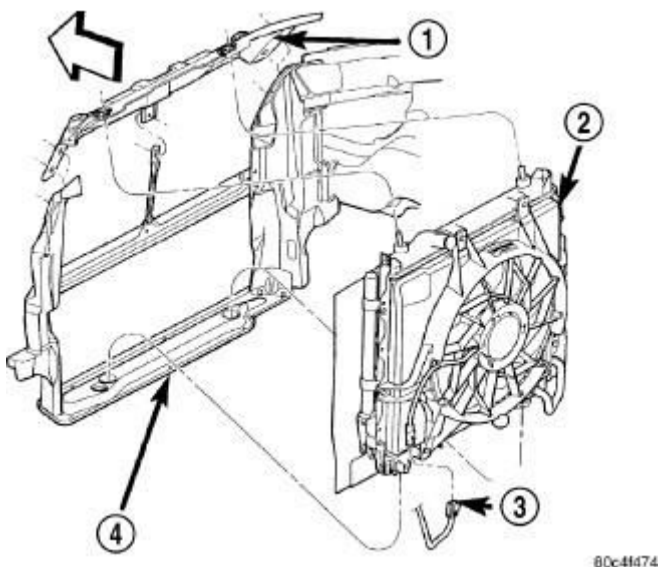


Fig. 90: Cooling Module Assembly
Courtesy of CHRYSLER GROUP, LLC

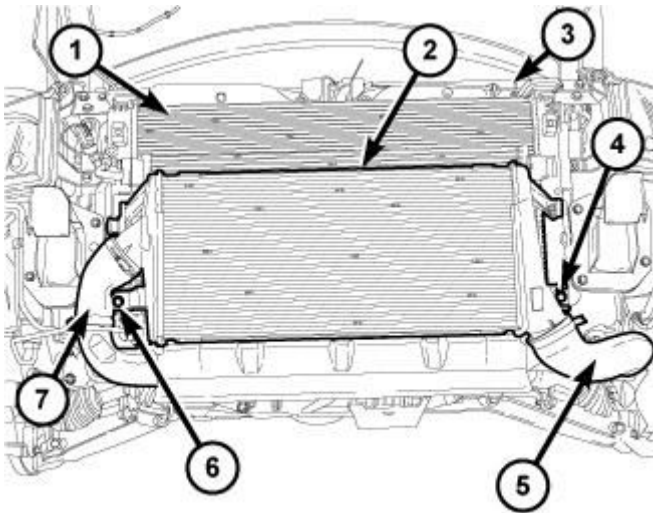
- 1 - UPPER RADIATOR CLOSURE PANEL
- 2 - COOLING MODULE
- 3 - RADIATOR FAN CONNECTOR
- 4 - LOWER RADIATOR CROSSMEMBER

1. Install the lower air seal to radiator.
2. Position radiator into mounting position.
3. Position A/C condenser against radiator. Hand start fasteners.

4. Install radiator fan/shroud assembly. Hand start fasteners.
5. Tighten all condenser fasteners to 8 N.m (70 in. lbs.).
6. Tighten all radiator fan fasteners to 6 N.m (55 in. lbs.).
7. Install fasteners attaching transmission oil cooler to radiator. Tighten fasteners to 8 N.m (70 in. lbs.).
8. Raise vehicle on hoist.
9. Connect the lower air seal to the side air seals.
10. Connect lower radiator hose. Align the hose and position the clamp so it will not interfere with engine components.
11. Connect the radiator fan electrical connector.
12. Connect the power steering hoses.
13. Close radiator draincock.
14. Lower vehicle.
15. Connect upper radiator hose. Align the hose and position the clamp to prevent interference with the engine or hood.
16. Install upper radiator closure panel and center brace Refer to **PANEL, CLOSURE, UPPER, INSTALLATION** .
17. Install grille.
18. Install battery tray and battery.
19. Connect positive battery cable. Connect negative battery cable.
20. Install air cleaner housing assembly.
21. Fill cooling system with coolant. Refer to **STANDARD PROCEDURE**.
22. Operate engine until it reaches normal operating temperature. Check cooling system for correct fluid level.

DIESEL

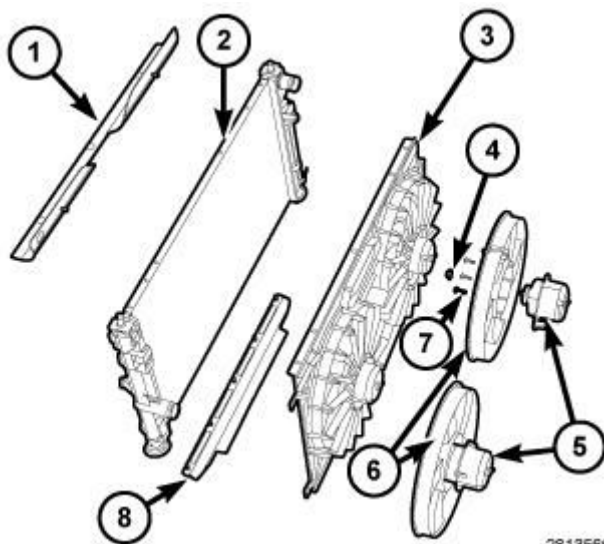
NOTE: **Care must be taken not to damage the radiator cooling fins and tubes during installation.**



2776229

Fig. 91: Radiator, Charge Air Cooler, Hose & Fasteners
 Courtesy of CHRYSLER GROUP, LLC

1. Lower radiator (1) into mounting position.
2. Install the A/C condenser onto radiator mounts.
3. Position charge air cooler to radiator. Tighten bolts (4, 6) to 8 N.m (70 in. lbs.).
4. Connect charge air cooler hoses (5, 7).



2813566

Fig. 92: Lower, Fan Blade Retaining Nut & Fan Motor
 Courtesy of CHRYSLER GROUP, LLC

5. Install the lower radiator hose. Align the hose and position the clamp so it will not interfere with engine components.
6. Install radiator cooling module (8). Refer to **FAN. COOLING.**

INSTALLATION.

7. Raise the vehicle.

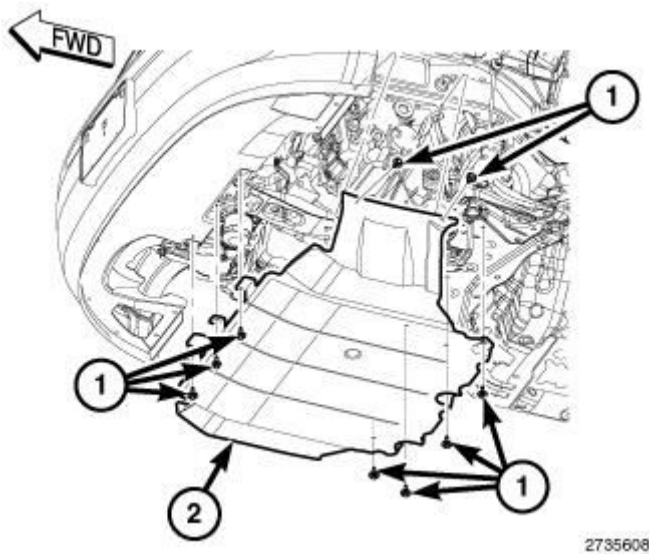


Fig. 93: Belly Pan & Bolts
Courtesy of CHRYSLER GROUP, LLC

8. Install the lower belly pan (2).
9. Partially lower the vehicle.

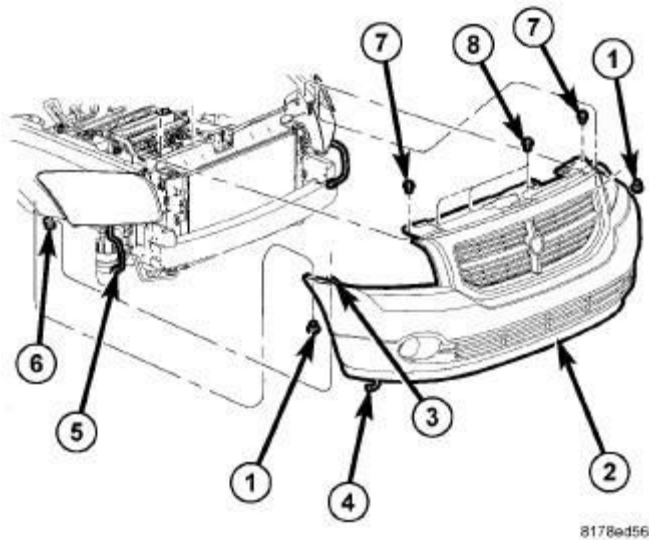


Fig. 94: Front Bumper Fascia Components
Courtesy of CHRYSLER GROUP, LLC

10. Install the front bumper/grille fascia (2). Refer to **FASCIA, FRONT, INSTALLATION** .

11. Install inner well splash shields.
12. Install the front tires. Refer to **INSTALLATION**.
13. Lower the vehicle.

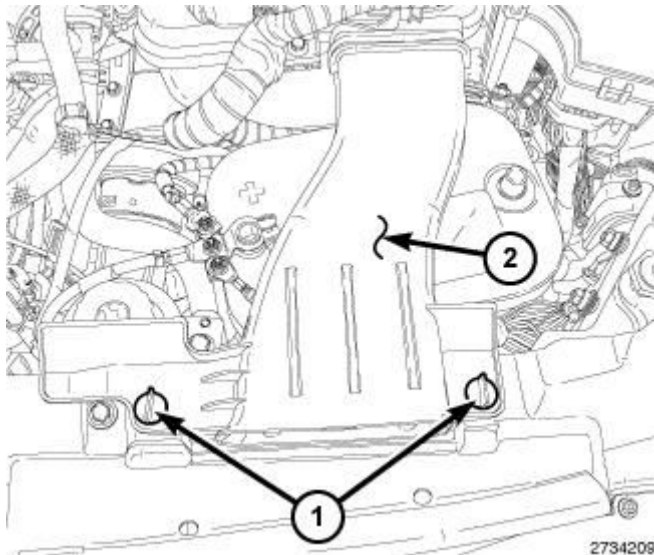


Fig. 95: Identifying Air Inlet Tube
Courtesy of CHRYSLER GROUP, LLC

14. Fill cooling system with appropriate coolant. Refer to **STANDARD PROCEDURE**.
15. Connect the negative battery cable.
16. Install engine cover.
17. Install air cleaner intake duct (2).
18. Operate engine until it reaches normal operating temperature. Check cooling system for correct fluid level.

SENSOR, COOLANT TEMPERATURE

DESCRIPTION

DESCRIPTION

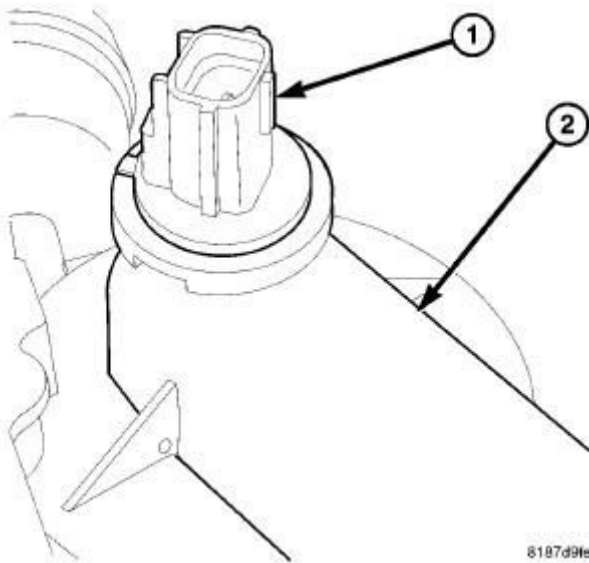


Fig. 96: ECT - World Engine - Coolant Adapter
Courtesy of CHRYSLER GROUP, LLC

- | |
|---------------------|
| 1 - ETC |
| 2 - COOLANT ADAPTER |

There are two engine coolant sensors (ECT). One ECT (1) is located in the coolant adapter and one is (ECT) sensor (1) threads into the cylinder block. New sensors have sealant applied to the threads.

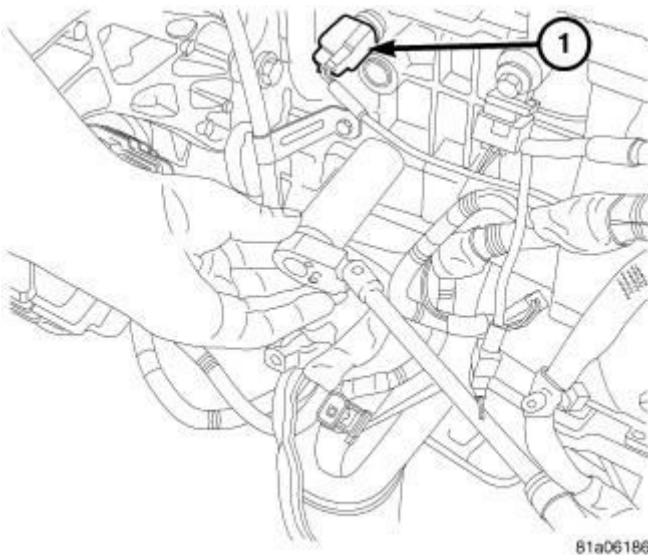


Fig. 97: ECT Sensor
Courtesy of CHRYSLER GROUP, LLC

- | |
|---------|
| 1 - ECT |
|---------|

The ECT Sensor is a Negative Thermal Coefficient (NTC) Sensor. The resistance of the ECT Sensor changes as coolant temperature changes. This results in different input voltages to the PCM. The PCM also uses the ECT Sensor input to operate the radiator cooling fan(s), and send a message over the PCI bus to the instrument cluster for temperature gauge operation.

DIESEL ENGINE

The Engine Coolant Temperature (ECT) sensor is used to sense engine coolant temperature. The sensor protrudes into an engine water jacket. The ECT sensor is located on the top of the thermostat housing.

The ECT sensor is a two-wire Negative Thermal Coefficient (NTC) sensor. Meaning, as engine coolant temperature increases, resistance (voltage) in the sensor decreases. As temperature decreases, resistance (voltage) in the sensor increases.

OPERATION**OPERATION**

The ECT sensor provides an input to the PCM. As temperature increases, resistance of the sensor decreases. As coolant temperature varies, the ECT sensor resistance changes resulting in a different voltage value at the PCM ECT sensor signal circuit. The ECT sensor provides input for various PCM operations. The PCM uses the input to control air-fuel mixture, timing, and radiator fan on/off times.

REMOVAL**GAS ENGINE****COOLANT ADAPTER MOUNTED**

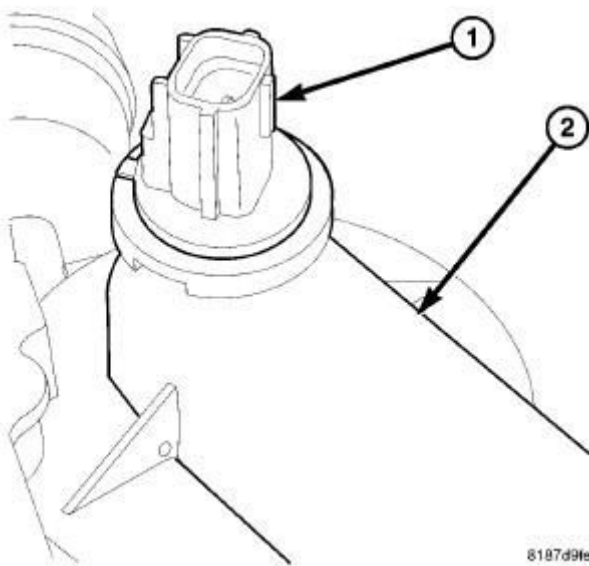


Fig. 98: ECT - World Engine - Coolant Adapter
Courtesy of CHRYSLER GROUP, LLC

1 - ETC

2 - COOLANT ADAPTER

1. Disconnect negative battery cable.
2. Partially drain cooling system below level of ECT Sensor (1). Refer to **STANDARD PROCEDURE**.
3. Disconnect ECT Sensor electrical connector.
4. Remove ECT Sensor (1) By pressing the locking tab down and turning the sensor counterclockwise.

DIESEL ENGINE

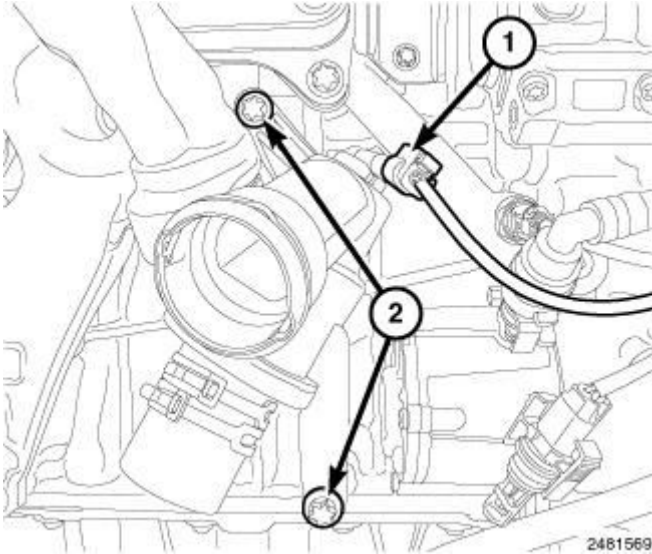


Fig. 99: Identifying Thermostat Heater Connector & Upper Thermostat Housing Bolt

Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the negative battery cable.
2. Remove the thermostat housing. Refer to **THERMOSTAT, REMOVAL**.
3. Remove retaining clip and the coolant temperature sensor (1).
4. Remove and discard the O-ring seal.

INSTALLATION

GAS ENGINE

COOLANT ADAPTER MOUNTED

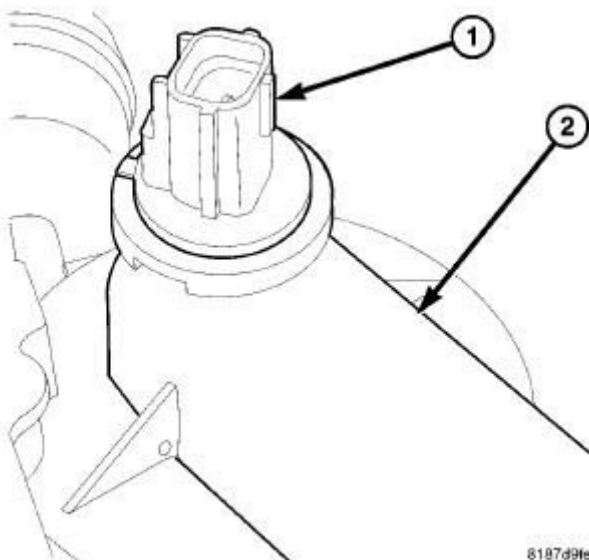
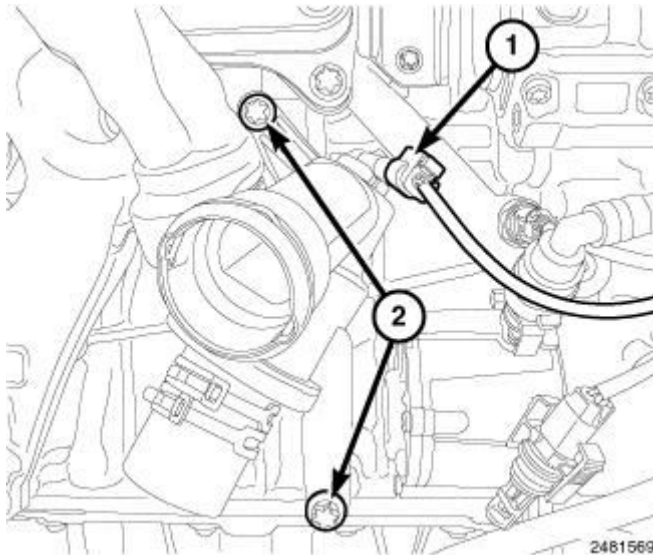


Fig. 100: ECT - World Engine - Coolant Adapter
Courtesy of CHRYSLER GROUP, LLC

- | |
|--------------------------------|
| 1 - ETC
2 - COOLANT ADAPTER |
|--------------------------------|

1. Lubricate the ECT sensor O-ring with coolant.
2. Install the ECT Sensor (1). Make sure the coolant sensor is locked in place.
3. Connect the ECT Sensor electrical connector.
4. Fill the cooling system. Refer to **STANDARD PROCEDURE**.
5. Connect the negative battery cable.

DIESEL ENGINE



**Fig. 101: Identifying Thermostat Heater Connector & Upper
Thermostat Housing Bolt**
Courtesy of CHRYSLER GROUP, LLC

- 1.
2. Clean the O-ring sealing surfaces.
3. Using a new O-ring seal, install coolant temperature sensor (1) and retaining clip.
4. Install the thermostat housing. Refer to **THERMOSTAT, INSTALLATION**.
5. Connect the negative battery cable.
6. Start engine and inspect for leaks.

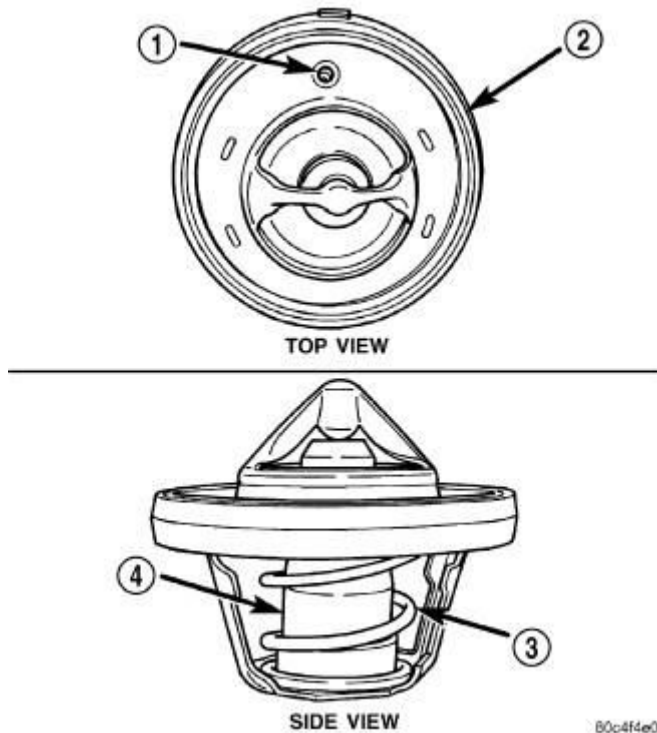
THERMOSTAT**DESCRIPTION****DESCRIPTION**

Fig. 102: Thermostat
Courtesy of CHRYSLER GROUP, LLC

- 1 - AIR BLEED
- 2 - SEAL
- 3 - RETURN SPRING
- 4 - PELLET CHAMBER

The primary thermostat is located on the front of the water plenum in the thermostat housing/coolant inlet. The thermostat has an air bleed vent located on its flange. The air bleed vent (1) and the locator dimple on thermostat seal provide for proper positioning of thermostat in inlet housing.

The secondary thermostat is located in the cylinder head under the water plenum.

OPERATION**OPERATION**

When the Engine is cold and both the primary and secondary thermostats are closed. The coolant will circulate through the engine, heater system, and the bypass. The cooling system has no flow through the radiator

As the engine warms up, the primary thermostat will start to open at 82 °C (179 °F). Coolant will start to flow through the radiator oil cooler and transmission cooler. Coolant will flow through the transmission oil cooler only when the primary thermostat is fully open. The primary thermostat will fully open at 95 °C (203 °F).

The secondary thermostat will start to open at 95 °C (203 °F). This will increase the coolant flow through the cylinder block and cylinder head and the radiator. The secondary thermostat will fully open at 110 °C (230 °F).

If the thermostat is stuck open or allows coolant leakage through it, the engine will not operate at the proper temperature for obtaining engine fuel efficiency, performance and emissions levels. If this condition occurs, a diagnostic trouble code will be set and a MIL light will be turned on. Refer to the appropriate Powertrain Diagnostic Procedures information for further information and diagnostics provided.

DIAGNOSIS AND TESTING

DIAGNOSIS AND TESTING - ENGINE COOLANT THERMOSTAT

The thermostat is operated by a wax filled chamber (pellet) which is sealed. When heated coolant reaches a predetermined temperature the wax pellet expands enough to overcome the closing spring and water pump pressure, which forces the valve to open. Coolant leakage into the pellet will cause a thermostat to fail open. Do not attempt to free up a thermostat with a screwdriver.

Thermostat diagnostics is included in Totally Integrated Power Module's (TIPM) programming for on-board diagnosis. The malfunction indicator light (MIL) will illuminate and a diagnostic trouble code (DTC) will be set when an "open too soon" condition occurs. Do not change a thermostat for lack of heater performance or temperature gauge position, unless a DTC is present. For other probable causes. Refer to **DIAGNOSIS AND TESTING**. Thermostat failing shut is the normal long term mode of failure, and normally, only on high mileage vehicles. The temperature gauge will indicate this.

REMOVAL

PRIMARY THERMOSTAT - GAS ENGINE

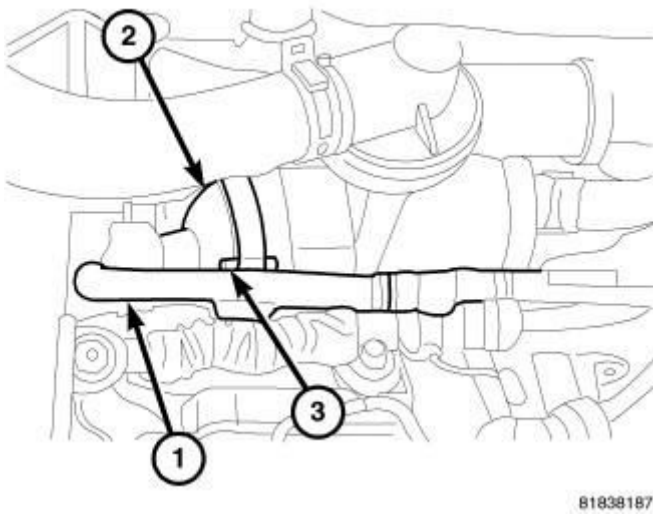


Fig. 103: Primary Thermostat
Courtesy of CHRYSLER GROUP, LLC

- 1 - COOLANT HOSE
- 2 - INLET HOUSING
- 3 - BOLT

1. Partially drain THE cooling system. Refer to **STANDARD PROCEDURE**.
2. Remove THE air filter housing Refer to **STANDARD PROCEDURE**.
3. Disconnect the coolant hose (1) from the inlet housing (2).
4. Remove inlet housing bolts (3).
5. Remove the thermostat assembly, and clean the sealing surfaces.

SECONDARY THERMOSTAT - GAS ENGINE

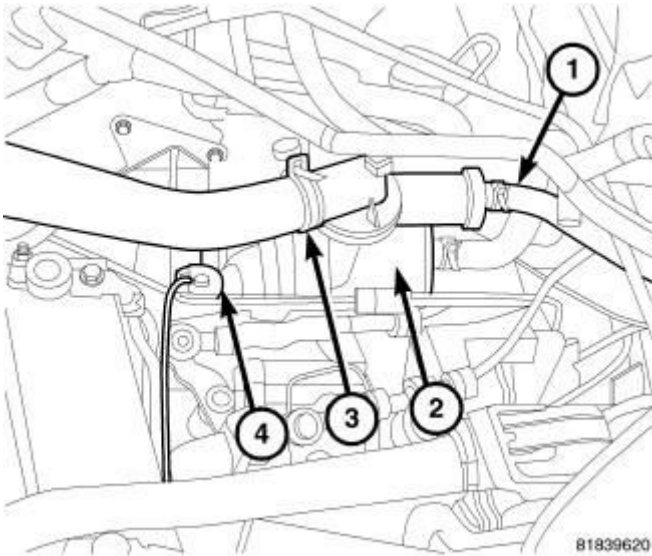


Fig. 104: Secondary Thermostat
Courtesy of CHRYSLER GROUP, LLC

- | |
|---|
| <p>1 - COOLANT HOSE (REAR)</p> <p>2 - COOLANT ADAPTER</p> <p>3 - RADIATOR HOSE</p> <p>4 - RADIATOR HOSE (FRONT)</p> |
|---|

1. Partially drain cooling system. Refer to **STANDARD PROCEDURE**.
2. Remove the air filter housing. Refer to **2.0L BODY, AIR CLEANER, REMOVAL** or **2.4L BODY, AIR CLEANER, REMOVAL**.
3. Disconnect coolant hoses (1) from rear of the coolant adapter (2).
4. Remove the radiator hose (3).
5. Remove the radiator hose (4) from the front of the coolant adapter (2).
6. Remove the coolant adapter mounting bolts.
7. Carefully slide the coolant adapter off the water pump inlet tube and remove the coolant adapter (2) and the secondary thermostat.

DIESEL ENGINE

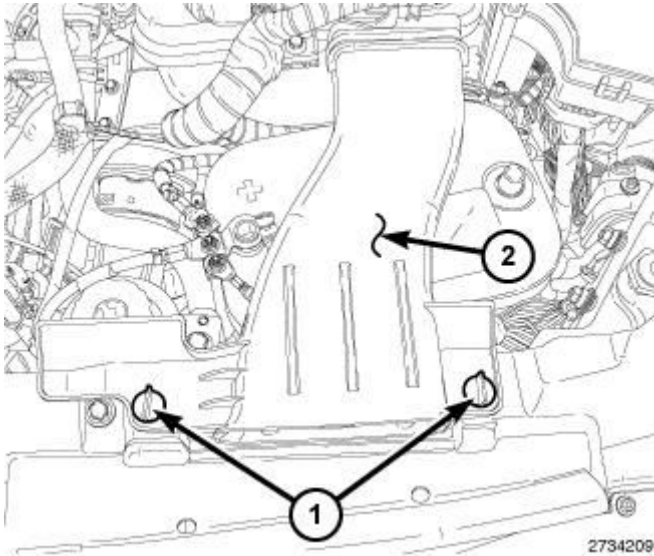


Fig. 105: Identifying Air Inlet Tube
Courtesy of CHRYSLER GROUP, LLC

1. Disconnect the negative battery cable.
2. Remove the air intake duct (2).
3. Siphon the power steering fluid from the reservoir.
4. Remove the fan module assembly. Refer to **FAN, COOLING, REMOVAL**.

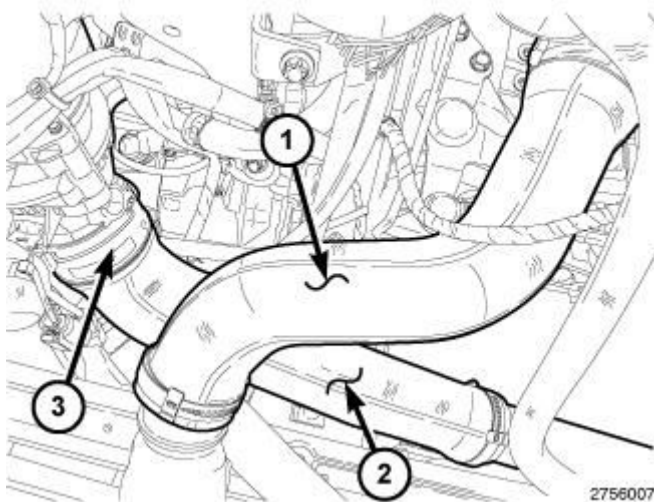


Fig. 106: Identifying Front Upper & Lower Air Charge Hose
Courtesy of CHRYSLER GROUP, LLC

5. Remove the front upper air charge hose (1).
6. Remove the front lower air charge hose (2) to the EGR throttle control housing.

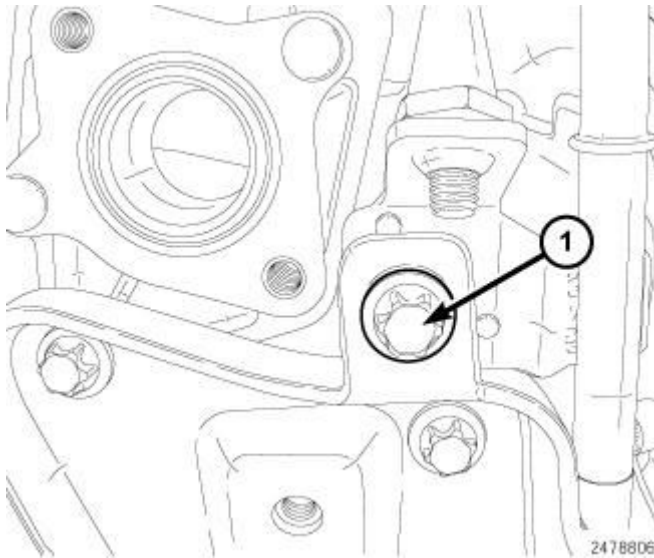


Fig. 107: Vacuum Tube Bolt
Courtesy of CHRYSLER GROUP, LLC

7. Remove the brake booster vacuum line support bracket (1).

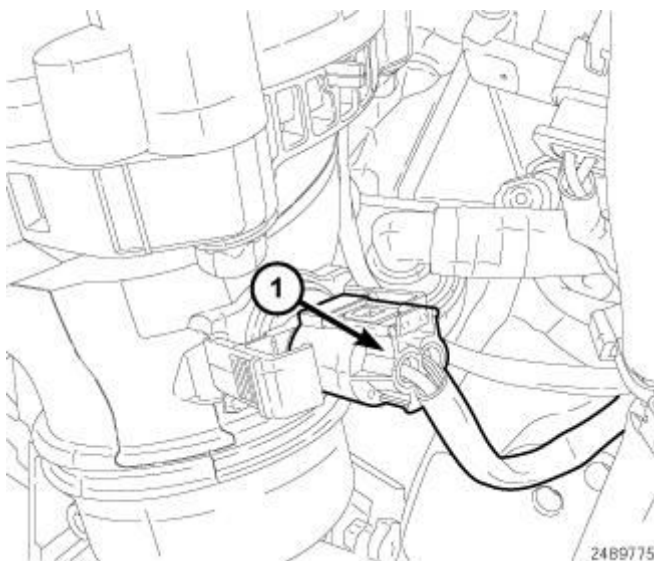


Fig. 108: Identifying Charge Air Temperature Sensor Connectors
Courtesy of CHRYSLER GROUP, LLC

8. Disconnect the wire harness connector to the EGR air flow control valve and charge air temperature sensor (1).
9. Loosen the lower hose clamp from the thermostat housing to the combination water/power steering pump.

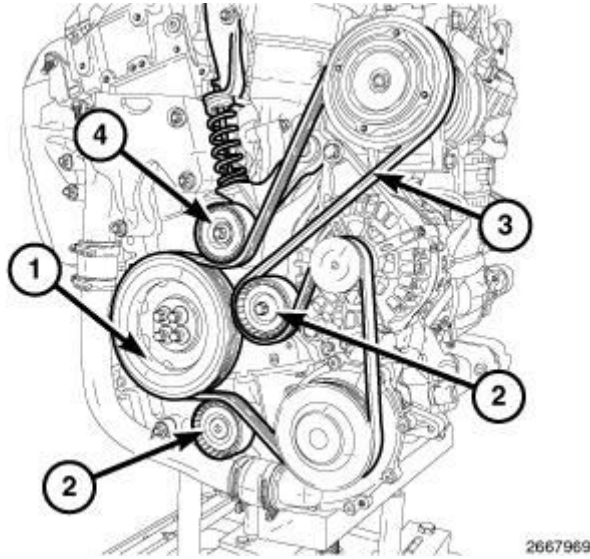


Fig. 109: Identifying Main Drive Belt
Courtesy of CHRYSLER GROUP, LLC

10. Raise the vehicle.
11. Remove main drive belt (3). Refer to **BELT, SERPENTINE, REMOVAL**.

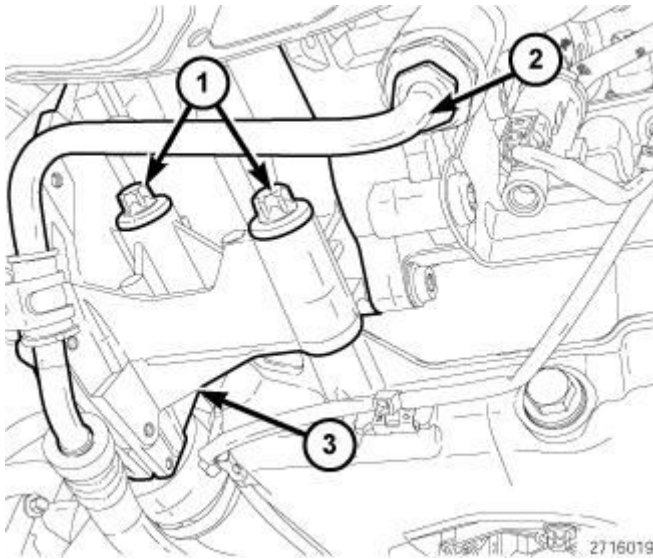


Fig. 110: Pressure Line At Pump
Courtesy of CHRYSLER GROUP, LLC

12. Remove the water/power steering pump assembly. Refer to **PUMP, WATER, REMOVAL**.

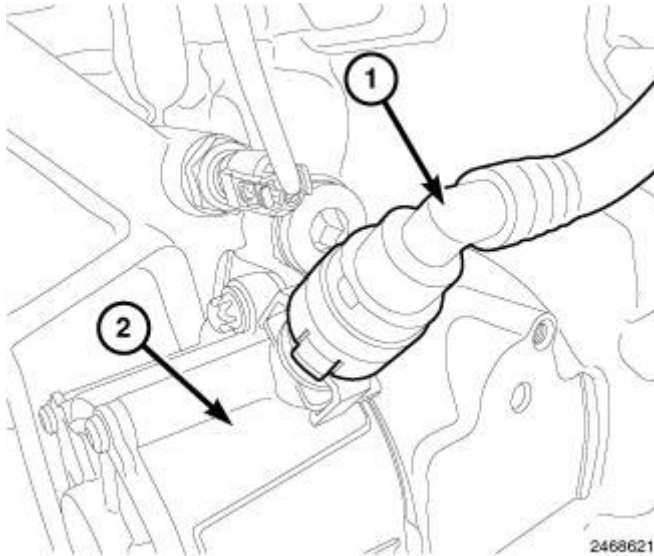


Fig. 111: Vacuum Hose At Vacuum Pump
Courtesy of CHRYSLER GROUP, LLC

13. Remove the brake booster vacuum line check valve (1) from the vacuum pump.

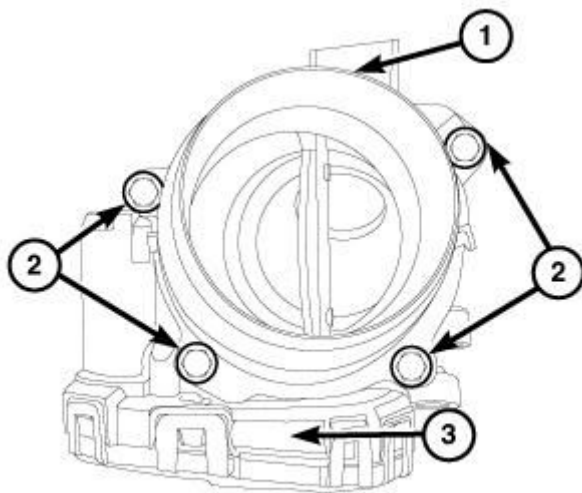


Fig. 112: EGR Air Flow Control Valve & Bolts
Courtesy of CHRYSLER GROUP, LLC

14. Remove the four mounting screws (2) from the EGR throttle control (3) to the mixing tank.
15. Position the inlet nozzle (1) aside, to be removed from the top side of vehicle.
16. Remove the EGR throttle control assembly (3).

NOTE: The thermostat must be replaced with the housing. Trying to remove the thermostat from the housing will damage the housing and the thermostat.

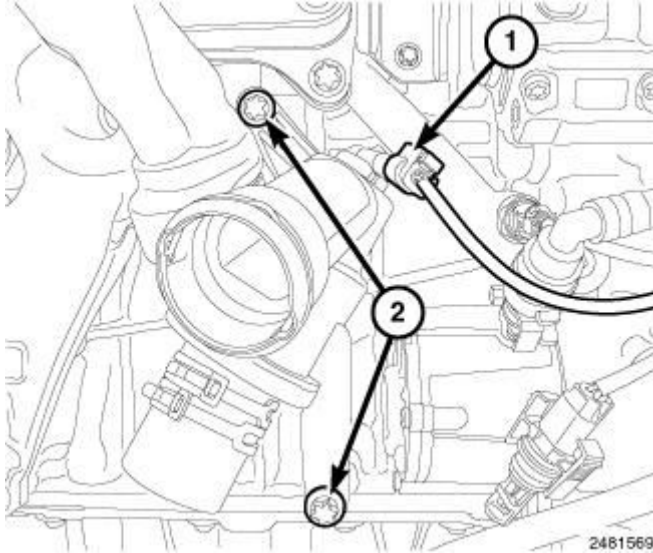


Fig. 113: Identifying Thermostat Heater Connector & Upper Thermostat Housing Bolt
Courtesy of CHRYSLER GROUP, LLC

17. Remove the lower thermostat housing mounting bolt (2).
18. Lower vehicle.
19. Remove the intake nozzle.
20. Disconnect the thermostat heater connector (1).
21. Remove the upper thermostat housing bolt (2).
22. Remove the thermostat housing by moving the housing in a side to side motion.

INSTALLATION

PRIMARY THERMOSTAT - GAS ENGINE

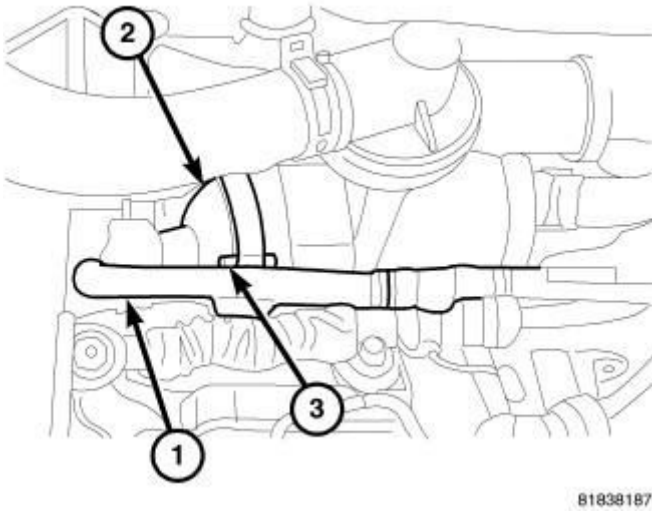


Fig. 114: Primary Thermostat
Courtesy of CHRYSLER GROUP, LLC

1 - COOLANT HOSE
2 - INLET HOUSING
3 - BOLT

1. Position thermostat into the water plenum, aligning air bleed with the location notch on inlet housing (2).
2. Install inlet housing (2) onto coolant adapter. Tighten bolts to 9 N.m (79 in. lbs.).
3. Connect coolant hose (1).
4. Install air filter housing.
5. Fill cooling system. Refer to **STANDARD PROCEDURE**.

SECONDARY THERMOSTAT - GAS ENGINE

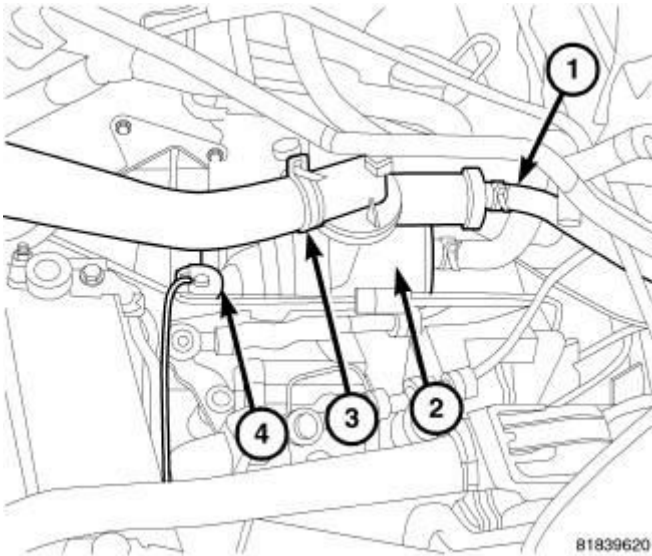


Fig. 115: Secondary Thermostat
Courtesy of CHRYSLER GROUP, LLC

- | |
|--|
| <p>1 - COOLANT HOSE (REAR)
2 - COOLANT ADAPTER
3 - RADIATOR HOSE
4 - RADIATOR HOSE (FRONT)</p> |
|--|

1. Position the thermostat into the cylinder head.
2. Inspect the water pump inlet tube O-rings for damage before installing the tube in the coolant adapter. Replace O-ring as necessary.
3. Lubricate the O-rings with soapy water.
4. Position the coolant adapter on the water pump inlet tube and the cylinder head.
5. Install the coolant adapter mounting bolts. Tighten the bolts to 18 N.m (159 in. lbs.).
6. Connect the front coolant hose (1).
7. Connect the two rear coolant hoses (1).
8. Connect the radiator hose (3).
9. Install the air filter housing Refer to **2.0L BODY, AIR CLEANER, INSTALLATION** or **2.4L BODY, AIR CLEANER, INSTALLATION** .
10. Fill the cooling system. Refer to **STANDARD PROCEDURE**.

DIESEL ENGINE

NOTE: Use coolant on the seals of the thermostat housing so the seals won't become damaged and to help aid in installation.

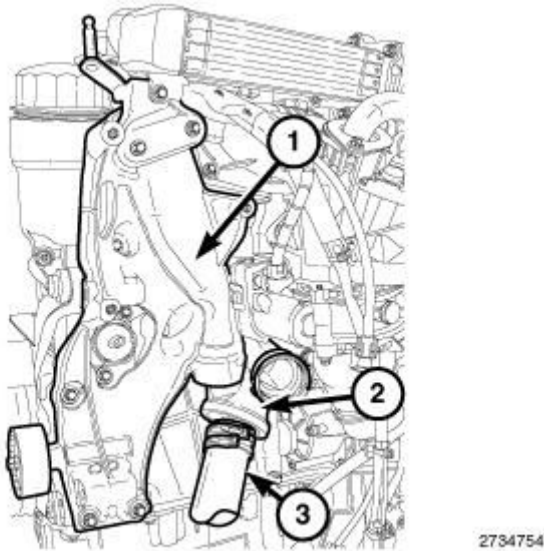


Fig. 116: Identifying Thermostat Housing & Accessory Carrier Bracket
Courtesy of CHRYSLER GROUP, LLC

1. Install the thermostat housing (2) into the accessory carrier bracket (1) by using hand pressure and twisting motion to seat the housing into place.

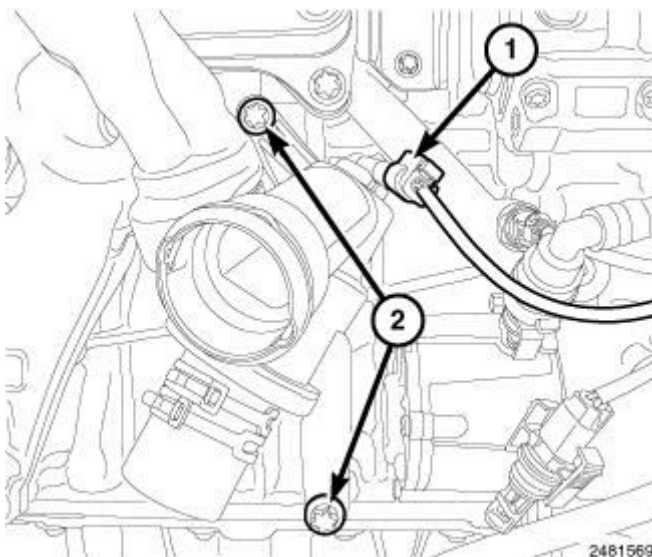
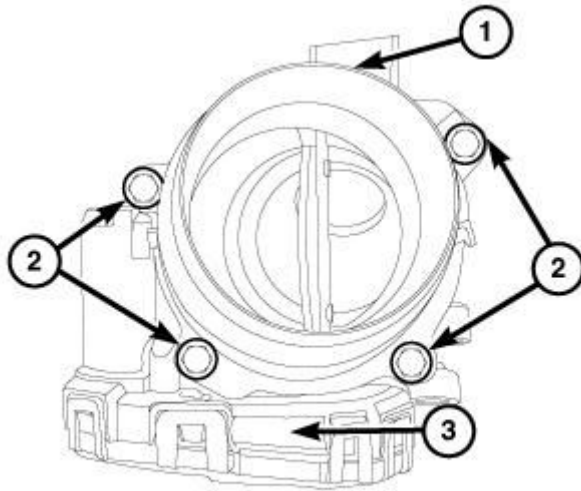


Fig. 117: Identifying Thermostat Heater Connector & Upper Thermostat Housing Bolt
Courtesy of CHRYSLER GROUP, LLC

2. Install the two thermostat housing mounting bolts (2). Tighten the bolts to 9

N.m (80 in. lbs.).

3. Connect the thermostat heater connector (1).



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Fig. 118: EGR Air Flow Control Valve & Bolts
Courtesy of CHRYSLER GROUP, LLC

4. Install the EGR (3) and the inlet nozzle (1). Install two bolts (2) to support nozzle and EGR in place. Do not tighten.
5. Raise vehicle.
6. Install all mounting screws (2) for the EGR throttle control housing and the inlet nozzle, to the mixing tank. Tighten bolts (2) to 9 N.m (80 in. lbs.).
7. Install the brake booster check valve vacuum line at the pump.

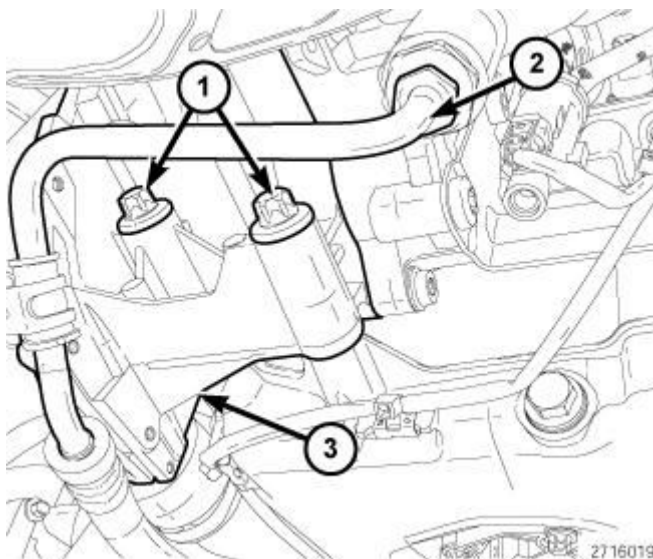


Fig. 119: Pressure Line At Pump
Courtesy of CHRYSLER GROUP, LLC

8. Install the water/power steering pump assembly. Refer to **PUMP, WATER, INSTALLATION**.

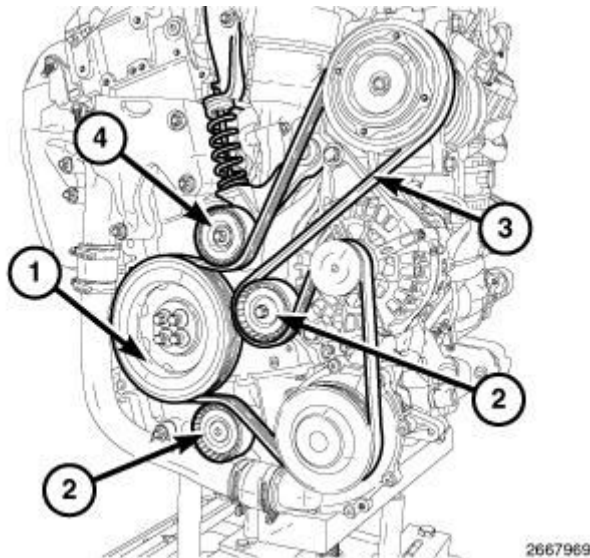


Fig. 120: Identifying Main Drive Belt
Courtesy of CHRYSLER GROUP, LLC

9. Install the main drive belt (3).

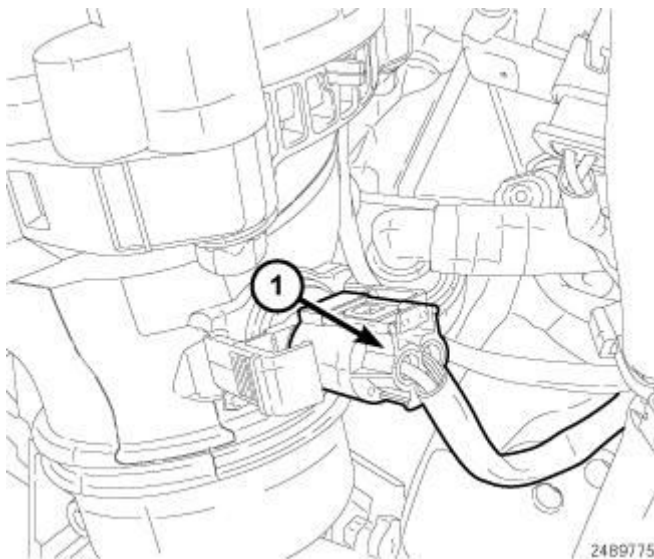


Fig. 121: Identifying Charge Air Temperature Sensor Connectors
Courtesy of CHRYSLER GROUP, LLC

10. Lower vehicle.
11. Install lower thermostat housing hose clamp onto combination water/power steering pump.
12. Connect the EGR throttle control and charge air temperature sensor

connectors (1).

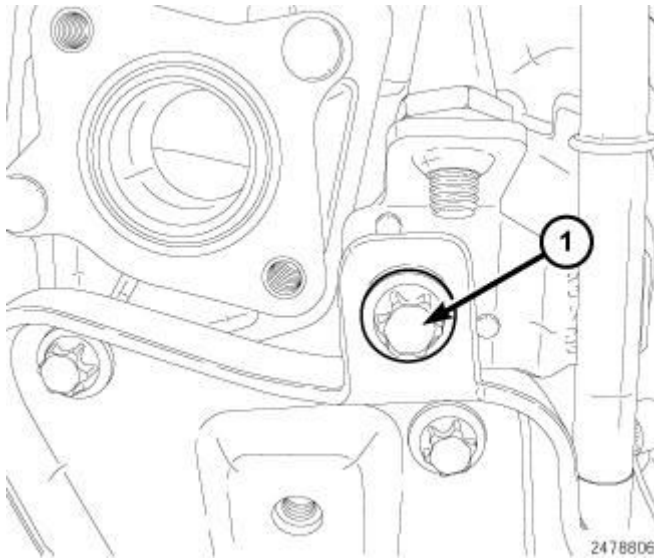


Fig. 122: Vacuum Tube Bolt
Courtesy of CHRYSLER GROUP, LLC

13. Install the upper brake booster vacuum line bracket bolt (1).

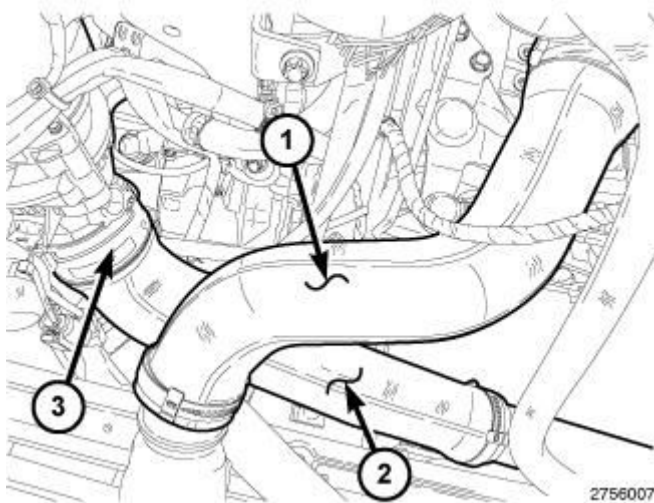


Fig. 123: Identifying Front Upper & Lower Air Charge Hose
Courtesy of CHRYSLER GROUP, LLC

14. Install the front lower air charge hose (2). Tighten hose clamps to 2 N.m (18 in. lbs.).
15. Install the front upper air charge hose (1). Tighten hose clamps to 2 N.m (18 in. lbs.).
16. Install the fan module assembly. Refer to **FAN, COOLING,**

INSTALLATION.

17. Add coolant. Refer to **STANDARD PROCEDURE**.
18. Add power steering fluid. Refer to **STANDARD PROCEDURE**.
19. Connect the negative battery cable.
20. Run engine to operating temperature and check for leaks.

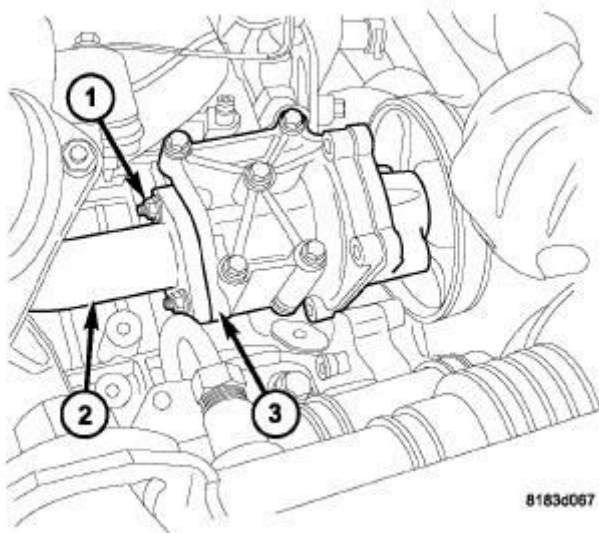
TUBE, WATER INLET, GAS ENGINE**REMOVAL****REMOVAL**

Fig. 124: Water Pump Inlet Tube - Gas Engine
Courtesy of CHRYSLER GROUP, LLC

- | |
|--|
| <p>1 - NUTS
2 - WATER PUMP INLET TUBE
3 - WATER PUMP HOUSING</p> |
|--|

The water pump inlet tube (2) connects the water pump to the coolant adapter. This tube is sealed by an O-ring and held in place by fasteners to the water pump housing.

1. Drain cooling system. Refer to **STANDARD PROCEDURE**.
2. Remove the coolant adapter and secondary thermostat. Refer to **THERMOSTAT, REMOVAL**.

3. Raise and support vehicle.
4. Remove inlet tube mounting nuts (1).
5. Remove inlet tube (2).

INSTALLATION

INSTALLATION

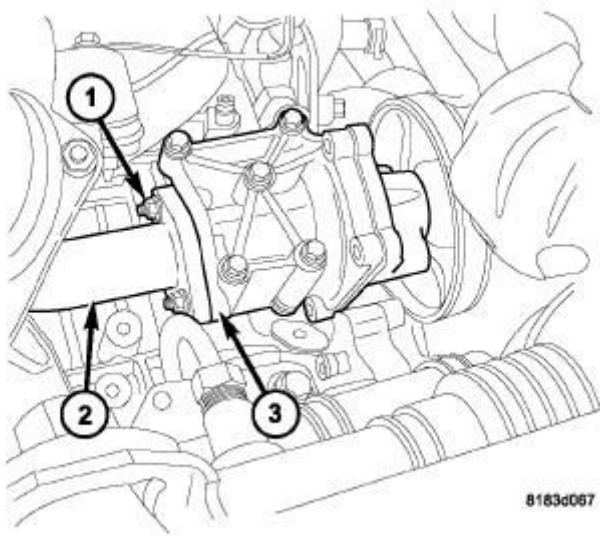


Fig. 125: Water Pump Inlet Tube - Gas Engine
Courtesy of CHRYSLER GROUP, LLC

- | |
|---------------------------|
| 1 - NUTS |
| 2 - WATER PUMP INLET TUBE |
| 3 - WATER PUMP HOUSING |

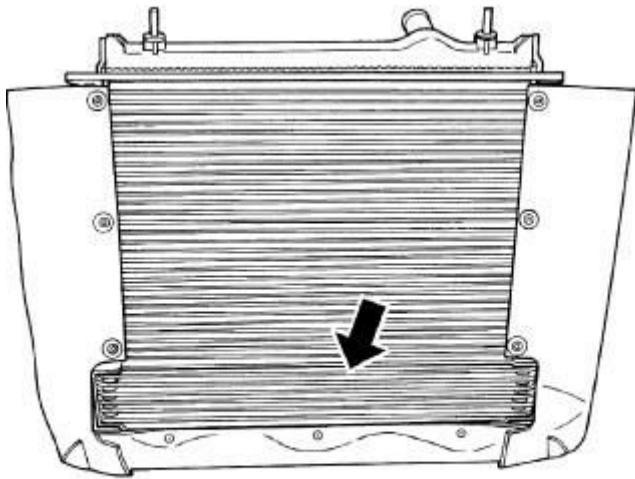
1. Inspect the O-ring for damage before installing the tube. Replace O-ring as necessary.
2. Lubricate O-rings with soapy water.
3. Install new water inlet gasket between tube and water pump housing (2).
4. Position water pump inlet tube (3) on water pump housing (2). Hand tighten nuts to aide in tube alignment.
5. Install secondary thermostat and coolant adapter. Refer to **THERMOSTAT, INSTALLATION**.
6. Tighten coolant tube nuts (1) to 24 N.m (212 in. lbs.).
7. Fill cooling system. Refer to **STANDARD PROCEDURE**.

TRANSMISSION

COOLER, TRANSMISSION OIL

DESCRIPTION

DESCRIPTION



80c41482

Fig. 126: Automatic Transmission Oil Cooler
Courtesy of CHRYSLER GROUP, LLC

The automatic transmission cooler is located in the front of the radiator and behind the front fascia and is combined with the A/C condenser. The transmission cooler is a heat exchanger that allows heat in the transmission fluid to be transferred to the air passing over the cooler fins.

The Transmission oil cooler/A/C condenser assembly is equipped with quick connect fitting for the transmission oil cooler lines.

REMOVAL

REMOVAL

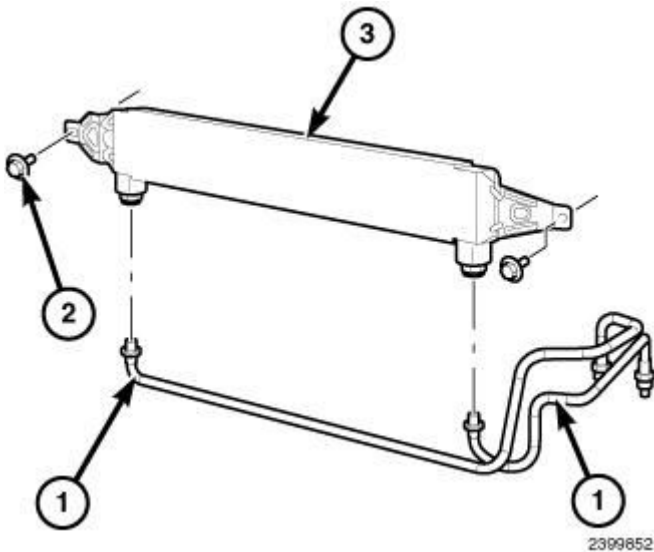


Fig. 127: Transmission Cooler Lines And Transmission Oil Cooler
Courtesy of CHRYSLER GROUP, LLC

1. On models equipped with A/C, refer to the A/C Condenser removal procedures. Refer to **CONDENSER, A/C, REMOVAL** .
2. On non A/C equipped models, lift the vehicle and remove the lower closeout panel.
3. Using Tool (special tool #8875A, Disconnect, Transmission Cooler Line) disconnect the transmission cooler lines (1) from the transmission oil cooler (3). Refer to **TUBES AND HOSES, TRANSMISSION OIL COOLER, STANDARD PROCEDURE**.
4. Remove the transmission oil cooler mounting bolts (2).
5. Remove the transmission oil cooler (3).

CLEANING

CLEANING

Check the external cooler for debris on the cooling fin surfaces. Clean as necessary.

INSPECTION

INSPECTION

Inspect all hoses, tubes, clamps and connections for leaks, cracks, or damage. Replace as necessary. Use only approved transmission oil cooler hoses that are molded to fit the space available.

Inspect external coolers for leaks, loose mounts, or damage. Replace as necessary.

INSTALLATION

INSTALLATION

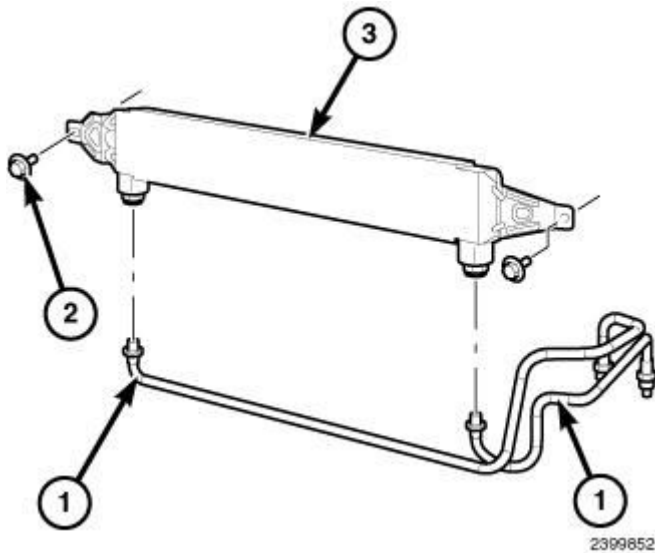


Fig. 128: Transmission Cooler Lines And Transmission Oil Cooler
Courtesy of CHRYSLER GROUP, LLC

1. On models equipped with A/C, refer to the A/C Condenser installation procedure. Refer to **CONDENSER, A/C, INSTALLATION** .
2. On non A/C equipped models, position the transmission oil cooler (3) to the radiator.
3. Install the transmission oil cooler mounting bolts (2). Tighten the bolts to 8 N.m (70 in. lbs.).
4. Connect the transmission cooler lines to the transmission oil cooler (1). Refer to **TUBES AND HOSES, TRANSMISSION OIL COOLER, STANDARD PROCEDURE**.
5. Install the lower closeout panel.
6. Lower the vehicle.
7. Start engine and check transmission fluid level. Adjust level as necessary.

TUBES AND HOSES, TRANSMISSION OIL COOLER

STANDARD PROCEDURE

STANDARD PROCEDURE - QUICK CONNECT FITTING DISASSEMBLY/ASSEMBLY

DISCONNECT

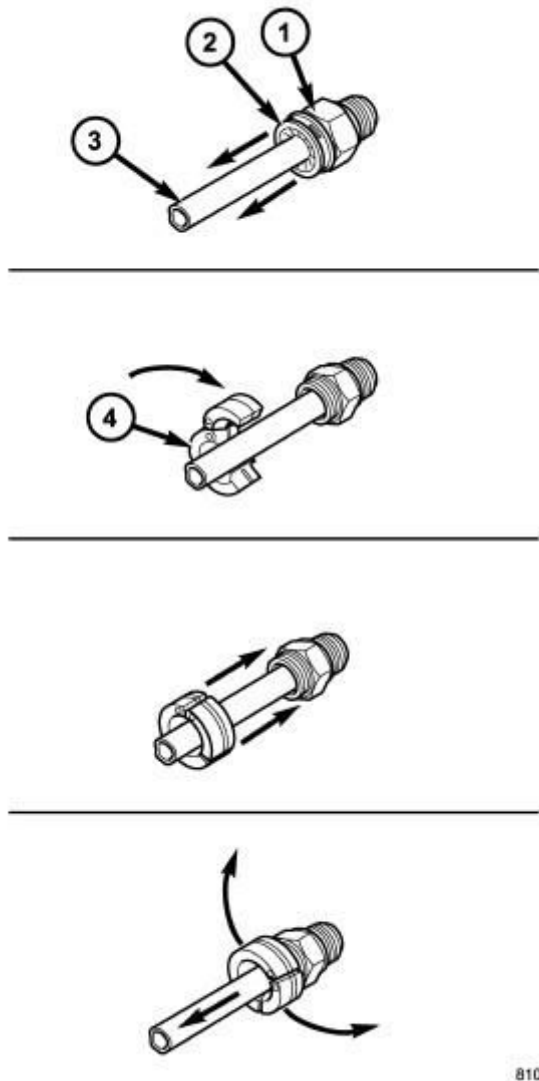


Fig. 129: Oil Cooler Line Quick Connect Fitting - Disassembly
Courtesy of CHRYSLER GROUP, LLC

1 - QUICK CONNECT FITTING

2 - DUST CAP

3 - OIL COOLER LINE

4 - SPECIAL TOOL 8875A for 3/8" Line or 9546 for 1/2" Line.

1. Remove dust cap by pulling it straight back off of quick connect fitting
2. Place disconnect Special Tool (special tool #8875A, Disconnect, Transmission Cooler Line) onto a 3/8 inch transmission cooler lines or

Special Tool (special tool #9546, Disconnect Tool) onto a 1/2 inch transmission cooler lines with the fingers of the tool facing the quick connect fitting.

3. Slide disconnect tool down the transmission line and engage the fingers of the tool into the retaining clip. When properly engaged in the clip, the tool will fit flush against the quick connect fitting.
4. Rotate the disconnect tool 60° to expand the retaining clip.
5. While holding the disconnect tool against the quick connect fitting, pull back on the transmission cooler line to remove.

CONNECT

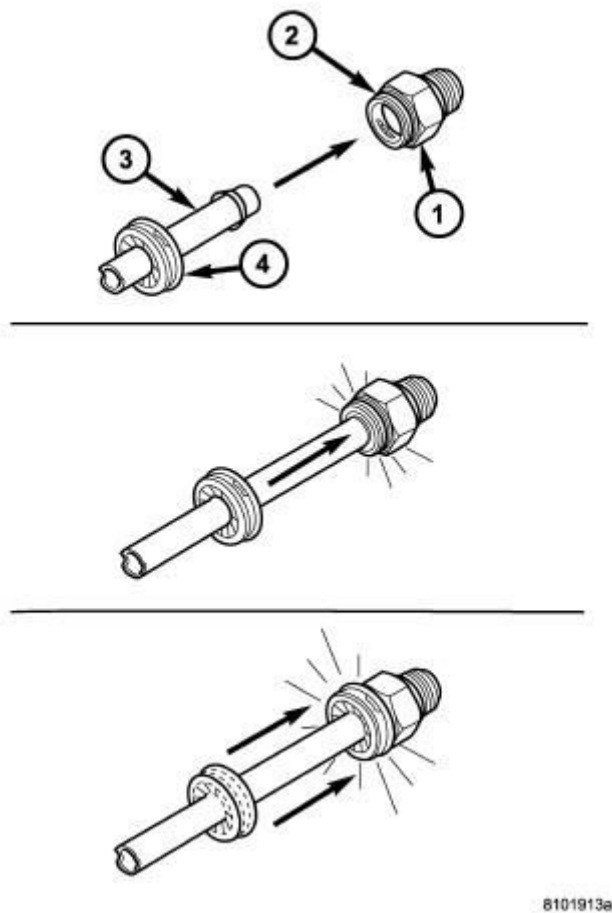


Fig. 130: Oil Cooler Line Quick Connect Fitting - Assembly
Courtesy of CHRYSLER GROUP, LLC

1 - QUICK CONNECT FITTING

2 - CLIP

3 - OIL COOLER LINE

4 - DUST CAP

1. If removed, install the quick connect fitting into the transmission oil cooler or the transmission. Tighten the fitting to 15 N.m (132 in. lbs.).
2. Align the cooler line (3) with the quick connect fitting while pushing straight into the fitting.
3. Push in on the transmission cooler line until a click is heard or felt.
4. Slide the dust cap (4) down the transmission cooler line and snap it over the quick connect fitting until it is fully seated and rotates freely. The dust cap will only snap over the quick connect fitting when the transmission cooler line is properly installed.

NOTE: If the dust cap will not snap into place, repeat step 2.