COOLING SYSTEM CHECKS

Coolant Concerns Beyond the Freeze Protection

When performing engine maintenance, the coolant is seldom considered. While the freeze factor is usually the first consideration at the start of winter, few consider the corrosive inhibitors and lubricants that become depleted, promoting water pump failure. In addition, the accumulation of engine and radiator deposits can affect engine cooling.

Coolant exchangers are highly recommended by most vehicle manufacturers. These devices reduce the amount of waste involved compared to the traditional flush and fill procedure. The exchanger eliminates hazardous chemicals from being dumped and contaminating the ground water. The exchange and transfusion type devices add new coolant while pushing the old, contaminated coolant from the system. The drain and fill method only removes 50% of the coolant, resulting in an improper coolant concentration. The mixture of antifreeze to water may be less than the required 50/50 mix, resulting in insufficient levels of corrosion inhibitors, vital lubricants, and freeze protection. The coolant exchange procedure eliminates trapped air in the system, where a typical drain and fill method may require one hundred miles of driving to purge all the air from the system.

MINERALS PROMOTE DEPOSITS

When filling a cooling system, it is imperative that tap or well water is not used, as hard minerals are likely present. Minerals may result in an accumulation of deposits, which can affect the water pump seal, resulting in leakage. The cooling system should be filled with a 50/50 pre-diluted mixture of coolant or a concentrated coolant diluted with distilled water. Top-offs should be done with a 50/50 mixture.

Some of the newer engines feature a water pump equipped with a seal that is lubricated by the coolant. A weep chamber in the pump housing allows the coolant to collect and evaporate. Often, the exterior of the pump will display evidence of staining, as some vapor escapes past the vent hole, staining the pump housing. Minor staining should be considered a normal condition and not require a water pump replacement. Wetness or an accumulation of wet coolant residue will require a water pump replacement.

ELECTROLYSIS

Repeated radiator or heater core failures may be due to an electrical problem referred to as electrolysis. This condition occurs when electrical current flows through the coolant, resulting in a deterioration of the metal. Light weight metals, ungrounded plastic radiator tanks and the abundance of electrical systems and accessories have made this condition a common occurrence. Electrical accessories that are not properly grounded may result in the electrical current seeking ground through the coolant. When this occurs, the coolant becomes electrically charged and becomes an electrolyte, consuming soft metals such as the radiator or heater core. The condition can be recognized by a white, black, or green crusty deposit forming around the solder joints and eventually resulting in coolant leakage. Pinholes may also occur in the heater core or radiator. While a poor engine component ground, such as a starter motor, may result in a defective radiator or heater core in a matter of a few weeks, an improperly grounded electrical accessory may take months to destroy the same components.

Testing for electrolysis can be performed with a digital voltmeter set on the 12-volt DC scale. The negative lead of the voltmeter should be attached to the negative post of the battery. The positive lead of the voltmeter should be placed in the coolant, being careful not to make contact with the filler neck or radiator core. Two readings should be taken, one with the engine off and the other with the engine running at 2,000 RPM with all electrical accessories on. A voltage reading in excess of 0.3 volts confirms electrical leakage into the coolant. When this condition is present, perform a complete coolant exchange and retest. If the condition is still present, a thorough ground inspection of the electrical system and components must be performed. This can be achieved by individually turning off the electrical accessories, while observing the voltmeter. When the voltage drops below 0.1 volts, you have identified the problem circuit. Pulling

fuses while observing the voltmeter will assist in locating the problem circuit. To isolate the circuit feeding off a fused circuit will require a wiring diagram to determine what circuits are getting power from that fuse. Look at the add-on electrical accessories first, as that is usually where the poor ground returns are identified.

COOLANT LEAKS ON FORD F150 V6-3.5L W/TURBOCHARGERS

Two turbochargers can spell twice the trouble when Ford's 3.5L EcoBoost exhibits the odor of coolant leakage. If it is your personal vehicle, you will be lucky if the leakage is due to a defective radiator or coolant hose. If you are unlucky, the leakage will be coming from a coolant feed or return line on one or both turbochargers. This is a labor-intensive repair, and you'd better check the repair procedure and labor hours for a given year model before quoting the job to a customer. If not, you may have to absorb some labor hours. For example:

2013-2014 F150 3.5L

Coolant Feed	Coolant Return
Left Side 2.0 Hours	Left Side 4.4 Hours
Right Side 1.7 Hours	Right Side 6.7 Hours

2015 F150 3.5L

Coolant Feed	Coolant Return
Left Side 3.5 Hours	Left Side 1.5 Hours
Right Side 4.4 Hours	Right Side 1.5 Hours

The labor hours required to make the repairs can vary based on the year model of the vehicle. Do your research before giving your customer a quote.

We have had reports of technicians removing the body from the chassis to make the turbo coolant line repairs/replacement. We are not recommending that procedure, as we have not tried it.

CYLINDER HEAD COOLANT/OIL LEAKAGE

Customer complaints of an illuminated MIL/Check Engine Light accompanied by multiple misfire codes may be the result of coolant or oil leakage into the spark plug tubes. Vehicles affected are illustrated in GM Service Bulletin #21-NA-147. Year makes and models illustrated in the bulletin vary from 2010-2024 equipped with 3.0L and 3.6L engines.

The technician should determine if the coolant or oil is coming from the spark plug tubes and not entering from above. If the diagnosis determines that a spark plug tube is the source of the leakage, the cylinder head, ignition coil and spark plug should be replaced. The leakage is the result of porous spots in the cylinder head, created during manufacturing. The tubes are permanently sealed and are not replaceable.

OIL CONTAMINATED COOLANT

GM advises that certain 3.0L and 3.6L engines may require an engine replacement due to oil contaminated coolant. GM Service Bulletin PIP5257E illustrates the year makes and models that may encounter the oil contaminated symptoms.

The contamination may be due to leakage from the main oil gallery to a water jacket due to a thin wall casting or block porosity.

GM recommends the following test procedure to isolate the cause of the leakage:

1) If equipped with an oil cooler it should be tested for leakage into the coolant through the radiator.

2) When checking the cooler, use a higher pressure (100 PSI) on the oil side of the cooler. The average engine oil pressure is over 60 PSI, and the coolant pressure is 16 PSI.

3) If the cooler tests good or if the vehicle is not equipped with an oil cooler, the engine and all rubber coolant hoses will require replacement.

4) The radiator and heater core must be flushed or replaced if necessary. If the vehicle is equipped with a rear heater core it must be flushed and the hoses replaced.

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