Technical Training Tip of the Month – June 2006

Coolant Neglect is One of the Leading Causes of Cooling System Breakdowns

By Grant Wolter

The subject of coolant service often comes up with the change of seasons, whether it be in the cold of winter or the heat of summer. This happens to coincide with manufacturers' recommendations that the engine cooling system be checked every six months. To keep cooling systems in adequate operating condition, it is necessary to check the level, strength and condition of the coolant on a regular basis and to replace or recycle the coolant before the protective additives are completely depleted.

<u>COMMON COOLING SYSTEM CHECKS:</u>

- Coolant level and condition
    - Coolant "strength" as checked with a coolant hydrometer
    - Acidity checks
    - Visual inspection of the color of the coolant as an indicator of type and condition
        - *Reminder:* visual checks alone are not an adequate check of coolant condition
- Check the radiator for build up of debris and blockage of airflow
- Visual inspection of the inside of the radiator for deposits looking in through the filler neck
- Check hoses for surface contamination, soft spots, cuts, leaks, chafing, and proper routing that avoids kinks and contact with moving parts
- Inspect water pump bearings/bushings for looseness and signs of leakage
- Engine operating temperature
    - Using a scan tool or thermometer after engine warm up
- Radiator cap pressure tests
    - Maintaining rated pressure is essential for proper boil-over protection
- Check cooling fan operation
    - Mechanical type
        - Drive belt condition and tension
        - Fan clutch operation
        - Fan blade condition
    - Electric type
        - Motor operation
        - Turn-on, turn-off temperature
        - Fan blade condition

<u>COOLANT INSPECTION AND MAINTENANCE:</u>

Coolant hydrometer should indicate a temp of -34° F

- Reading is an indication of the coolant's freezing point
    - A freezing point of -34° F indicates a proper 50/50 mixture
- Readings below -34° F indicate too high of a concentration of coolant to water
    - A mixture of 60/40 coolant and water is sometimes recommended for vehicle operation below -5° F ambient temperature. This yields a freezing point of about -50° F
        - Sometimes called a "winter mix"
        - Should be changed back to 50/50 in warmer climates
- Coolant must have the right amount of water and antifreeze to provide adequate freezing *and* boil-over protection
- A 50/50 mix
    - Provides the maximum range of freezing to boil-over protection
    - Ensures proper coolant additive concentrations
    - Ensures proper coolant viscosity/flow
    - Ensures the best balance of coolant corrosion protection and lubrication properties vs. heat transfer
    - Is not simply the ideal mixture, it is the correct mixture

- Purified, de-ionized water is required for mixing with coolant
    - Tap water introduces contaminates into the coolant which cause acidity and internal component deposits
- 50/50 premix coolants are recommended for topping off the coolant level since they assure a proper mixture is maintained
    - The water used by the coolant manufacturers in the mix is properly de-ionized and free of contaminants

Coolant acidity should be checked

- Acidity indicates contamination and/or breakdown even before the coolant turns muddy
- Can be checked with litmus paper or "coolant pH tester"
    - Coolant should have a slightly alkali pH (pH = 8.5-10.5)
    - Coolant with a pH of less than 7.0 is *acidic,* and should be changed
- A check of voltage between the metal radiator (or engine block) and the coolant at radiator the fill neck, can be used as an indirect check of coolant acidity
    - Stick one voltmeter probe right into the coolant, and the other voltmeter probe on a metal part of the radiator
    - Voltage reading must be below **0.4** volts (less than **400**mV)

Coolant color indicates type and condition

- Cloudy, brown, or muddy coolant indicates contamination and/or breakdown
- Colors of green, orange, yellow are generally used to indicate the type of coolant
    - There is no "standardized" specification for the properties of each color of coolant
        - Each manufacturer specs their own fluids
    - Use of the "wrong" coolant in an engine usually has no short term noticeable effects, but long term durability of the engine and it's gaskets and seals can be dramatically affected
        - Use of coolants that are known to meet the manufacturer's specifications for a particular engine is strongly recommended
    - Green color is generally the most common type
        - Typical change interval is 2 years or 36,000 miles
    - Orange is most commonly used to indicate Organic Acid Technology (OAT) long-life coolant
        - Typical change interval is 5 years 100,000 miles
    - Yellow is commonly used to indicate next generation long-life coolant
        - Typical change interval is 5 years 100,000 miles
        - Ford's yellow coolant also contains a diesel coolant additive for resistance to cavitation erosion
- Mixing of different types of coolant is not recommended due to the possibility the incompatibility of the additives
    - Mixing of the current colors of coolant usually results in a brown color, which, by default, indicates contaminated coolant

Only ethylene glycol based coolants are currently approved by manufacturers

- So called "green" *propylene* glycol based coolants are not approved by manufacturers at this time (green as in; environmentally "green", not the color green)

A number of states and localities require that coolant contain a "bittering agent". "Bitterized" coolants simply contain an additive that makes the coolant taste bad

- Coolant normally has a "sweet" taste
- Ethylene Glycol is a deadly poison, particularly for small animals
- The bittering agent has no effect on the coolant's other properties
- Legally required use of "bitterized" coolants, or addition of a bittering agent is currently being implemented by most states

Diesel engine coolant additives are a regular maintenance item for most diesel engines

- Additives are usually required to be added at least once in between the normal coolant change interval
- The additives are critical in preventing cylinder wall cavitation erosion on diesel engines
- Some coolants already contain a diesel additive

No one coolant has been proven to work on all vehicles due to the complexity of cooling system metallurgy, gaskets and other sealing system technologies. Therefore, it is important to refer to the manufacturer's recommendations. Preventative maintenance cannot prevent all problems from occurring. Service of the coolant and cooling system components on a regularly scheduled preventive maintenance program will limit the likelihood of damaging the more expensive parts.

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