

Testing water used for flushing systems can prevent premature engine failure

Even the best cooling system maintenance practices will fail if the source water you're using to flush the system doesn't meet engine manufacturer and ASTM specifications. Today's pre-mixed coolants take much of the guesswork out using a proper source water, but when mixing your own coolant formulations or flushing your systems with water from an on-site source, analysis is highly recommended to make sure the water meets specifications.

RECOMMENDED SCALING PROPERTY LEVELS

| Scaling Properties | Definition | Specification or Recommended Levels |
|---------------------------|---|--|
| Total Hardness | The sum of calcium and magnesium in a water - hardness forms scale | 170 ppm or less (ASTM) |
| Iron | Immediately forms scale providing food for iron bacteria - the biological end product of the iron bacteria food cycle being sulfur-type acids | 0.5 ppm or less |
| Silica | Combines with calcium to form silicate scale - scale formed will be hard and highly insulating | 30 ppm or less |
| Sulfate | Combines with calcium and magnesium to form scale or converts to sulfuric acid | 100 ppm or less (ASTM) |

DEPOSIT CHARACTERISTICS

Carbonate

A carbonate deposit is usually granular and can be very porous. The crystals of calcium carbonate are large, but will usually be matted together with finely divided particles of other materials so that the scale looks dense and uniform. A carbonate deposit can be identified by dropping it into an acid solution. Bubbles of carbon dioxide will effervesce from the scale.

Sulfate

A sulfate deposit is much harder and denser than a carbonate deposit because the crystal structure is smaller. A sulfate deposit is brittle, does not pulverize easily and will not effervesce when dropped into an acid solution.

Silica

A high silica deposit is very hard, highly insulating and resembles porcelain. The crystals of silica are extremely small, forming a very dense, impenetrable scale. This scale is very brittle, very difficult to pulverize and not soluble in hydrochloric acid.

Iron

Iron deposits, from corrosion products or iron contamination in the make-up water, are very dark in color. They are usually magnetic and soluble in hot acid.

RECOMMENDED ACID PITTING PROPERTY LEVELS

| Acid Pitting Compound | Definition | Specification or Recommended Level |
|-------------------------------|---|------------------------------------|
| Chloride | Forms salt or hydrochloric acid to pit metal | 40 ppm or less (ASTM) |
| Sulfate | Under acidic conditions, can form sulfuric acid | 100 ppm or less (ASTM) |
| pH | Measures a water's acidity or alkalinity | 5.5 - 9.0 (ASTM) |
| Total Dissolved Solids | Solids indicate the level of contaminants present in the water. Excessive dissolved solids can cause a coolant to foam. | 340 ppm or less (ASTM) |

ADDITIONAL WATER PROPERTIES TO CONSIDER

Free Carbon Dioxide – 60 ppm or less

Phenolphthalein Alkalinity – water's natural alkalinity

Methyl Orange Alkalinity – water natural reserve or ability to neutralize acid - although other properties in the water may cause variance, less than 20-30 ppm is recommended

Higher – water will release cavitating carbon dioxide gas and forms carbonic acid that will pit metal

Lower – at increased temperatures, water becomes acidic, causing pitting

Specific Conductance – the natural resistance of the water against galvanic electrical current between the engine and cooling system; 500 micromhos or less is recommended.