Brake Fluid Testing

Review/UPDATE
Ron Schornstein

Ron is the President of ACUSTRIP Company, Inc. ACUSTRIP was started in 1987 with the vision to provide simple easy to use tests for DIYers and Service Providers to make decisions about their antifreeze coolant service. ACUSTRIP now provides a Complete Health Check Panel for vehicle fluids.

As an entrepreneur with over 30 years of global experience in Finance, Manufacturing, Logistics, Customer Service, Operations, Sales and Project Management, Ron has lead organizations through start up, sales mergers, & acquisitions involving the invention and implementation of new technologies. Ron has donated time to help NeedyMeds (501c3) help uninsured, and indigent patients. Ron has published work on Document Management, Six Sigma, Process Improvement through Teams, Mind Mapping, Patient Assistance, Sample Management and Customer Service. Ron is a MBA, CPIM, ATM, Certified Project Manager, & Six Sigma Black Belt, an Executive Member of ASTM D15,AMRA/MAP & SAE Brake Fluid Committee. Ron is also proud to be a Phi Kappa Psi, and Order of the Arrow Eagle Scout.
Brake Fluid Environment

• The average age of vehicles on the road in the US is 11.4 years.

• As vehicles, fluids and service cycles are changing, regular discussion about brake fluid maintenance is valuable to service providers

• My job today is to facilitate a lively discussion
First, why have a brake fluid testing program?

https://www.youtube.com/watch?v=knK6FqWvl50

• if you are driving and the unthinkable happens and there is brake failure,

What should you do?
Panic?

Our Disaster Recovery Plan Goes Something Like This...

HELP! HELP!

DILBERT
By Scott Adams
Or... Engage a Practiced 7-point plan

1. Stay calm
2. Take your foot off the gas pedal
3. Downshift
4. Put it in neutral
5. If practical, maneuver your car to the right lane, shoulder or exit.
6. Pull over into a safe place
7. Engage the parking brake
At AMRA/MAP

• We plan
  – Evaluate/Inspect
  – Test
  – Agree
  – Document (UICS)
  – Communicate
Review New Brake Fluid Specs

FMVSS 116

• DOT 3, DOT 4 and DOT 5.1, are polyethylene glycol-based fluids
  – hygroscopic and will absorb water from the atmosphere
  – Moisture will reduce boiling point

• DOT 5 is silicone-based
  – Moisture in system will not affect boil point, with severe cold can ice

• (FMVSS116) says nothing about the composition of any fluid, it dictated how the fluid must behave under a variety of specific circumstances.

<table>
<thead>
<tr>
<th>Boiling point ranges</th>
<th>Dry boiling point</th>
<th>Wet boiling point</th>
</tr>
</thead>
<tbody>
<tr>
<td>DOT 3</td>
<td>205 °C (401 °F)</td>
<td>140 °C (284 °F)</td>
</tr>
<tr>
<td>DOT 4</td>
<td>230 °C (446 °F)</td>
<td>155 °C (311 °F)</td>
</tr>
<tr>
<td>DOT 5</td>
<td>260 °C (500 °F)</td>
<td>180 °C (356 °F)</td>
</tr>
<tr>
<td>DOT 5.1</td>
<td>260 °C (500 °F)</td>
<td>180 °C (356 °F)</td>
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</table>
FMVSS-116 Update
Due Nov 2014

SAE Brake Fluid Committee
GM Specification includes (RA)

<table>
<thead>
<tr>
<th>Reserve Alkalinity</th>
<th>30.0 min</th>
<th>See Appendix A</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reserve Alkalinity</td>
<td></td>
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<tr>
<td>After Thermo Oxidation Procedure</td>
<td>50% retention-median 3 tests</td>
<td>See Appendix B</td>
</tr>
<tr>
<td>After Volatization Procedure</td>
<td>50% retention-median 3 tests</td>
<td>See Appendix C</td>
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</table>

The effect of low (RA) has not been shared by GM, and there are no studies available to show the impact of lower than 30 (RA) on In-Service Fluid.

SAE discussions on other aspects of In-Service Brake Fluid is just beginning
Brake Fluid Wisdom

• Brake fluid that contains glycol starts to attract moisture almost as soon as it is put in the car's system and too much moisture can make the brake fluid unsafe. (Low Boil point)

• Brake fluid that has been in the car for a year may contain 2% water.

• Brake fluid that hasn't been replaced in several years may be up to 8% water.

• Never use anything other than approved brake fluid for your car.
Testing
In-Service Brake Fluid Today

• **What is the service?**
  Inspect the brake fluid level, condition, and review Original Equipment Manufacturer`s recommended replacement intervals

• **When/Why is the service recommended?**
  The Motorist Assurance Program (MAP) recommends that brake fluid be tested at OEM recommended brake service intervals to help determine fluid condition(s)

• **How does Brake Fluid Replacement service help?**
  Helps extend the life of brake system components
Typical Testing of In-Service Brake Fluid

• Be Sure the RO is correctly written and approved!

• Park on a level surface
  – It's best to do this when the car is stopped on a level surface, with the engine cold.

• Check Owners manual or Master Cylinder cap to determine which fluid is to be used
  – (Do we know what fluid is in the car?)
Typical Testing of In-Service Fluid (cont)

• **Look for the master cylinder.**
  – On most cars, the master cylinder is located at the back of the engine bay, on the driver's side. There's a reservoir above the cylinder.

• **Check the fluid level in the reservoir.**
  – On most newer cars, the reservoir is transparent, with lines marked "Min" and "Max"; the brake fluid level should fall between these lines. Cars older than the 1980s may have metal reservoirs, requiring you to remove the reservoir cap.
    • (Newer caps screw on and off, while some older caps need to be pried off with a screwdriver.)
Typical Testing of In-Service Fluid (cont)

- Check the brake fluid color?
  
  - Normally, brake fluids are clear or light amber in color. If the fluid looks dark or black, it *may* need to be replaced - further testing is required.
  
  - “Recommendations can not be based solely on the color of the fluid”
Other In-Service Fluid Testing Considerations

• Evaluate the condition of the brake fluid
  – Test for moisture content
  – Evaluate the Boiling Point
  – Evaluate the corrosion protection level
Other In-Service Fluid Testing Considerations (cont)

- Evaluating corrosion protection levels
  - As brake fluid ages, its corrosion inhibitors break down. Check pH level. If the pH is out of specification, Brake Fluid Replacement is required
  - Copper can appear after corrosion has begun. If copper is above 200 ppm, Brake Fluid Replacement is required
  - Fluid additives help protect both rubber and metal brake components. If testing reveals additive depletion or contamination, Brake Fluid Replacement is required.
Typical Testing

Does what we just reviewed match with your organization’s standard inspection and service process?
Testing – Let’s Review
Tests

Moisture
Copper
Additive Depletion
pH
Is Dynamic Testing Necessary?

• Study performed by ABIC Consulting with the following results:
  – FMVSS-116 corrosion test performed with 3% water = **PASS**
  – FMVSS-116 corrosion test with 3% water and a pH of 5.5 = **FAIL**
  – FMVSS-116 corrosion test with 5% water and pH 6.0 for 30 days = **FAIL**
Other Brake Fluid Topics
Brake Fluid Mixing – Cocktails

• DISCUSSION
  – How much was mixed?
  – How important is it?
  – What is the impact on the service interval?
  – Can/should this be tested?
Brake Fluid Cocktails
Are they substitutable?

“Systems designed for a particular type of fluid should continue to be filled with that type of fluid. (especially prior to 2005 when DOT 4 was more widely available)”
Brake fluid Cocktails
Are they substitutable?

• Common impact of mixing fluids is swelling of the rubber components due to introduction of petroleum based products

• Silicone in an older system will generate gelatin, plugging up the system

• What is the impact on service intervals?
Can Brake Fluid be Repaired?

- Additive Depletion Correction?
- pH Correction?
- Moisture Level Correction?
Can Brake Fluid be Repaired?

• Reasons to consider:
  – Already being used for glycol-based coolant
  – Most Brake Fluids are also glycol-based
  – Some products are on the market
Call to Action

• Should MAP include pH as a UICS condition that predicts brake fluid failure as we do with antifreeze (coolant)?

• Should MAP include moisture content as a UICS condition that predicts brake fluid failure?
Call to Action (cont)

• Should MAP consider “Repair or Replacement” of Brake Fluid as a procedure for certain conditions?
• Any other UICS Brake Fluid considerations?
Thank You!

PANEL DISCUSSION and QUESTIONS