



**STAGNANT COOLANT TEST FOR ALUMINUM AND FLUORINE
AND ITS EFFECT ON ALUMINUM CORROSION UNDER HEAT REJECTING CONDITIONS**

Application

This method is used to 1) prepare a soluble solution of aluminum and fluorine in engine coolant under stagnant conditions and 2) measure the effect of this solution on the corrosion of aluminum under heat rejecting conditions using ASTM D4340.

Equipment Required

1. Oven: capable of 90C, holding automotive heat exchangers and vented to the outside
2. Rubber plugs: size and number depends on the heat exchanger (all openings to be plugged)
3. Aluminum foil pieces
4. Screw clamps: size and number depends on the heat exchanger (intent is to keep the plugs in place)
5. Bin: large enough to hold the heat exchangers, to capture any lost coolant
6. Glass graduated cylinder with glass or Teflon stopper: 1000 ml
7. Refractometer
8. Glass stirring rod
9. Fresh/unused coolant concentrate
10. Aluminum engine cooling system component with the exception of the engine and water pump.
Example is the heat exchanger with known internal fluxing as part of the controlled atmosphere brazing process (e.g. Nocolok potassiumaluminofluorinate flux).
Note: More than 1 heat exchanger may be required for stagnation testing because the volume of coolant required for post-stagnation testing is 1.25L)
 - Report of the internal volume of the heat exchanger
 - Report of the internal surface area of the heat exchanger
11. De-ionized or distilled water
12. Plastic samples bottles: 2 X 250ml, and 1 X 1L
13. Full face shield, gloves, and other required safety equipment
14. Equipment required to perform ASTM D4340

Date	Action	Revisions
2010 08 10	Revised	See Summary of Revisions
2010 03 16	Activated	



Procedure

1. Mix 500 ml of fresh coolant concentrate with 500 ml de-ionized or distilled water in graduated cylinder to achieve 50/50 +/- 2% concentration (coolant added first, water on top). Install glass stopper and mix coolant and water for 20 seconds, back and forth action.
2. Verify concentration 48 to 52% with refractometer (use glass stirring rod to put drops of mixture).
3. Mix coolant and water as in step 1 until there is enough coolant for:
 - 1L pre-test baseline coolant for ASTM D4340 testing;
 - 250ml coolant samples for pre-test (baseline) coolant analysis;
 - Filling aluminum component(s) to obtain 1.25L post-test coolant.
4. Fill aluminum component(s) with 50/50 coolant / de-ionized water mixture,;
5. Repeat steps 1-4 until heat exchanger is nearly full (allow some room for coolant expansion in the oven);
6. Plug heat exchanger with rubber plugs, cover with foil and install screw clamps over foil;
7. Put heat exchanger into 90C oven for 2 weeks, and monitor every few days to make sure there is not a large loss of coolant (more than 10% of volume);
8. Take 250ml coolant sample post-test. Use refractometer to get post-test coolant concentration;
9. Provide 250 ml coolant samples (pre- and post-test) to PTI Cooling Product Engineering (for informational purposes only);
10. Provide 1L pre-test and ~1L post-test coolant samples to PTI Cooling Product Engineering for testing per ASTM D4340 (Standard test method for corrosion of cast aluminum in engine coolant under heat rejection conditions);
11. Remove remainder of coolant from the heat exchanger(s). Retain heat exchanger(s) and coolant remains for 60 days.
12. Final report to include – Results of ASTM D4340 for pre-test coolant and post-test coolant per ASTM D4340. Aluminum corrosion rate greater than 1.0 mg/cm²/wk is unacceptable.

Note:

Chemicals, materials, parts, and equipment referenced in this document must be used and handled properly. Each party is responsible for determining proper use and handling in its facilities.

Summary of Revisions:

- Changed radiator to aluminum heat exchanger; changed heat exchanger to aluminum component in cooling system except engine and water pump
- Added details about Controlled atmosphere brazing Nocolock flux
- Added ASTM D4340 of pre-test coolant
- Added internal surface volume of heat exchanger and internal coolant volume of heat exchanger
- Added coolant analysis "for informational purposes only"