



Thermal Shock Test for Paint Adhesion

1 Introduction

Note: Nothing in this standard supercedes applicable laws and regulations.

Note: In the event of conflict between the English and domestic language, the English language shall take precedence.

1.1 Purpose. Coated exterior parts are exposed to a variety of environmental conditions. This procedure simulates the thermal shock that an exterior part would experience when a vehicle is cleaned on a cold winter day. Temperature extremes are used to ensure durability of the materials through “worst case” conditions and accelerate the onset of failure in a single test cycle. The purpose of this standard is to determine the resistance to coating adhesion loss of coated surfaces of aluminum, plastic, steel, and other substrates when subjected to a wet steam blast similar to that produced by vehicle wash equipment.

1.2 Applicability. Painted exterior components of vehicle.

2 References

Note: Only the latest approved standards are applicable unless otherwise specified.

2.1 External Standards/Specifications.

ASTM D1193 ISO 2808

2.2 GM Standards/Specifications.

GMW14797 GMW16554

3 Resources

3.1 Facilities.

3.1.1 Calibration. The test facilities and equipment shall be in good working order and shall have a valid calibration label.

3.1.2 Alternatives. Alternative test facilities and equipment may also be used. However, all measuring variables as specified in this standard shall be determined correctly with respect to their physical definition.

3.2 Equipment.

3.2.1 Test Equipment and Material.

3.2.1.1 Scribe Tool. A straight shank tungsten carbide tip, lathe cutting tool or carbide-tipped pencil type tool with tip angle of 60 degrees $\pm$ 15 degrees or equivalent.

3.2.1.2 Razor blade.

3.2.1.3 Water Bath. Water bath at 38 °C $\pm$ 2 °C temperature with 5 ppm maximum dissolved solids as measured utilizing a suitable dissolved solids meter.

3.2.1.4 Freezer capable of maintaining -29 °C $\pm$ 3 °C temperature.

3.2.1.5 Steam Source. A steam generator per the following description, or equivalent, may be used: Model 100 Steam Generator from Atomic Cleaning Systems, 32310 West Eight Mile Road, Farmington Hills, MI 48336; U.S.A., phone (248) 615-4400; <http://www.atomic-cleaning.com/contact.htm>, Milwaukee 1.27 cm ($\frac{1}{2}$ in) globe valve 1151 to 1161, 150 Steam Working Pressure (SWP), 300 Water-Oil-Gas (WOG), is adequate for use in standardization of generator. A retro-fit kit, available from Atomic Cleaning Systems, may be needed to ensure that newer steam generators can meet the parameters required in this specification. Contact Atomic Cleaning Systems for information.

3.2.1.5.1 Input Flow of Water. Input flow of water to be 2.7 L/minute with a deviation less than 5% (3.2.1.5.1.1).

© Copyright 2014 General Motors Company All Rights Reserved

3.2.1.5.1.1 Model 100 Steam Generator. The pumping pressure is directly related to the input flow rate. The pressure needed for the required flow can be determined by measuring the pump pressure and discharge flow rate with the burner off. When the burner is turned on, the required flow rate is obtained by readjusting to the required pump pressure.

3.2.1.5.2 Nozzle Diameter. Diameter of 12.5 mm inner diameter (ID) within 2% and at least 100 mm long.

3.2.1.5.3 Discharge Dynamic Head. Discharge dynamic head pressure must be 37.9 kPa (5.5 psi) within $\pm 5\%$ measured 25 mm from the nozzle using a 4.7 mm ID tube. A non-diverging discharge is required for this test (3.2.1.5.3.1 and 3.2.1.5.3.2 and Figure 1).

3.2.1.5.3.1 This is done by placing the tube midstream 25 mm from the nozzle. The tube size must not be varied because the densities and velocities are not uniform throughout the cross section of the discharge stream.

3.2.1.5.3.2 Adjusting the discharge dynamic head may be required. This must be done in such a way that the input flow rate, as specified in 3.2.1.5.1, is maintained. This is done by adjusting the amount of heat transferred to the water. Increasing the heat will cause the input flow rate to change. It must be readjusted. This operation will result in an increased dynamic pressure. To decrease it, decrease the heat and then adjust the flow (pressure).

3.2.1.6 K Type Thermocouple. For measuring temperature at sample test location.

3.2.1.7 Face Mask. Full face cover safety mask is required when performing this test.

3.2.1.8 Gloves. Gauntlet-type gloves for protection of hands are required.

3.2.1.9 Fixtures. A fixture or rack is needed to hold test sample in place during test, and to hold nozzle in place at specified distance and angle. Fixtures are available through Atomic Cleaning Systems for this purpose but can also be self-created as long as test parameters are met.

3.3 Test Vehicle/Test Piece. Not applicable.

3.4 Test Time. Not applicable.

3.5 Test Required Information. Not applicable.

3.6 Personnel/Skills. Not applicable.

4 Procedure

4.1 Preparation. Not applicable.

4.2 Conditions.

4.2.1 Environmental Conditions. Not applicable.

4.2.2 Test Conditions. Deviations from the requirements of this standard shall have been agreed upon. Such requirements shall be specified on component drawings, test certificates, reports, etc.

4.3 Instructions.

4.3.1 Standardize the steam generator as described in this section.

4.3.1.1 Measure and maintain the input flow at 2.7 L/minute.

4.3.1.1.1 Install a 1.27 cm ($\frac{1}{2}$ in) globe valve in the steam line between coil weld assembly and hose nipple, 0.4 cm ($\frac{5}{32}$ in).

4.3.1.1.2 With burner off, engage pump and adjust globe valve until 2.7 L/minute is obtained.

4.3.1.1.3 Record the tank pressure that is obtained with the 2.7 L/minute flow rate. (This induced back pressure simulates the pressure that steam exerts on the system while the burner is on.) Tank pressure generally needs to be approximately 50 psi (344 kPa) in order to achieve the needed flow rate, dynamic head pressure, and temperature.

4.3.1.2 Measure and maintain the mean dynamic head pressure at 37.9 kPa (5.5 psi). See Figure 1: Measuring the Discharge Dynamic Head Pressure.

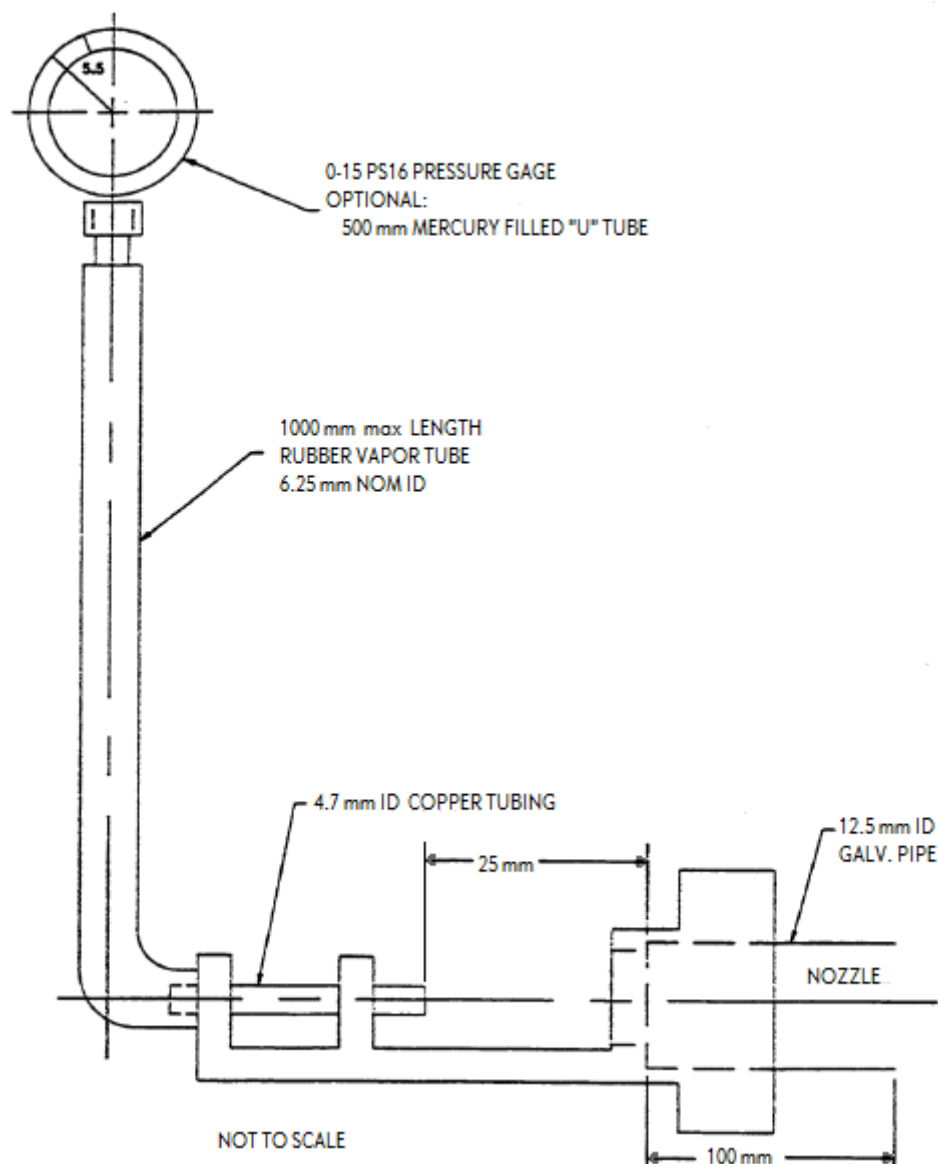


Figure 1: Measuring the Discharge Dynamic Head Pressure

4.3.1.2.1 Open globe valve and turn on the burner.

4.3.1.2.2 Allow tank pressure to stabilize before reading the mean dynamic head.

4.3.1.2.3 Adjustments of the dynamic head pressure are to be made by changing the amount of heat transferred to the water at the burner. (The flow rate, as previously specified, must be maintained.)

4.3.1.2.4 Measure and maintain a temperature of 98 °C to 102 °C of the steam blast at the location of the test site using K type thermocouple. An example of this is shown in Figure 2: Measurement of Steam Blast Temperature.