SURFACE VEHICLE RECOMMENDED PRACTICE

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Test Methodology for Evaluating the Chemical Compatibility of Wheel Finishes with Various Chemicals

RATIONALE

The technical report covers technology, products, or processes which are mature and not likely to change in the foreseeable future.

STABILIZED NOTICE

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1. SCOPE

This document proposes methods for the testing and evaluation of aluminum wheel and wheel trim surface finishes for compatibility with various types of tire, wheel and car wash cleaning materials, and other chemicals that might come into contact with these automotive components. It is recognized that each end user of this methodology might seek answers to questions that are unique to his business or situation. Therefore, the procedure is written in a generic sequence that could be strictly followed, repeated, or modified in order to provide the user with the best results. Example decision tree are provided to help the user select a sequence of exposure steps that would best suit his needs, (reference Figures 1, 2).

This procedure should not be utilized if the intent is to evaluate the compatibility of wheel finishes to any flammable products, because those chemistries would require special laboratory safety and handling precautions.

1.1 Purpose

The purpose is to standardize the process and methods for assessing the compatibility of chemicals with wheels and wheel trim used on passenger vehicles.

2. REFERENCES

2.1 Applicable Publications

The following publications form a part of this specification to the extent specified herein. Unless otherwise indicated, the latest version of SAE publications shall apply.

2.1.1 SAE Publication

Available from SAE International, 400 Commonwealth Drive, Warrendale, PA 15096-0001, Tel: 877-606-7323 (inside USA and Canada) or 724-776-4970 (outside USA), www.sae.org.

SAE J2633 Wheel and Wheel Trim Weathering Testing for Paint Coatings

2.1.2 ASTM Publications

Available from ASTM, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org.

ASTM D1735 Standard Practice for Testing Water Resistance of Coatings Using Water Fog

ASTM D 1193 Standard Specification for Reagent Water

3. TEST PROCEDURE

3.1 Test Materials and Equipment

Various liquid tire, wheel, chrome, and whitewall cleaners, as well as other car wash solutions, that can be found in the geographic areas of interest. Various concentrations of ingredients could be evaluated with this procedure. Each test and each test cycle should be initiated with new chemical solutions.

3.1.1 Containers such as polyethylene bottles should be procured to hold the coated panels and the test solutions. These containers must be inert to acids, caustics and petroleum products that could be in the cleaning solutions. The operator should utilize the Material Safety Data Sheets, (MSDS) of each product to determine if the bottles selected for the test will be inert for the test procedure. Make sure that the containers will not be degraded by the solutions prior to container selection. Assure that the containers will be of adequate size to accommodate your test samples and solutions, and for your special handling needs.

3.1.2 While any geometry of sample could be utilized, the recommended sample configuration would be a wrought or cast aluminum or steel panel with the appropriate cleaning, pretreatment, and coating that would simulate production for that candidate finish. The baseline appearance, hardness, and other properties of the panel should be established prior to engaging in a matrix of testing. The baseline properties could be used to determine if there were changes as a result of being exposed to the solutions. Consult with the coating manufacturer to determine the baseline characteristics of the finish.

3.1.3 Finishes that are to be evaluated on the panels should be applied with production-intent cures and thicknesses. Studies could also include minimum and maximum cures and thicknesses. All new coatings should be evaluated in parallel with a currently approved production material, or with a “Dummy panel” with a finish that undergoes the cycles of time and temperature but in a neutral solution, such as water.

3.1.4 The chemistry of the cleaner media should be documented prior to initiation of the procedure to establish the baseline chemistry. The end-of-test cleaner could be compared to the baseline chemistry. Changes might indicate a breakdown in the panel finish.

3.2 Exposure

3.2.1 Document all production intent data relative to coating thickness, cure, and process conditions, finish quality, test media chemistry, etc. After the panels have been coated, allow 72 h `age' before engaging in the next step of the procedure. This is common practice for painted panels to assure that the cross linking has proceeded to a normalized degree of cure.

3.2.2 A preconditioning of 100 °C for 15 minutes is recommended as a means to standardize the moisture content of the finish before beginning the test cycle. It is important to position the panels so that all surfaces can be exposed to this bake. Proceed to the next step as fast as possible, and record the amount of time between steps 3.3.2 and 3.2.3 The time of this step will vary from sample to sample, depending on the size of the matrix to be tested, but the intent is to proceed to the next exposure as soon as the parts cool down enough to handle, to be safely immersed in the test media, and within minutes, not hours.

3.2.3 After the panels have been conditioned, submerge them into the pre-determined concentration of the cleaner solution that is at room temperature. Panels shall be left in the solution for 24 h. The level of cleaner product in the container should be such that not all of the finish is exposed, thereby leaving some “Original” unaffected surface for post-test, and comparisons. An accelerated modification that could be engaged at this point would be to replace step 3.2.3 with step 3.5.1, which would simulate a higher temperature application in the field. 3.2.2 should be followed by step 3.2.4 as soon as this can be done for each panel.

3.2.4 Rinse the panels with water and dry with a cloth. If the panels cannot be cleaned to the original condition, then there was a reaction between the coating and the cleaner, and the test could be ended at this point. If possible, analyze the media for chemical changes, which could indicate that there was a reaction of the coating to the cleaner. If there is no visible degradation and no measurable property changes to the panels or media, such as hardness or roughness of the finish and chemistry of the solution, document the results and proceed with the three accelerated test phases in 3.3. The next step should take place as soon as possible; the amount of time between 3.2.3 and 3.3.1 should be recorded.

3.3 Atmospheres to Accelerate or to Advance the Reactions of the Cleaning Solutions

3.3.1 Heat

While the panel was washed and dried after 3.2.3, it could still contain a significant amount of chemically active sites involving the finish and the cleaning media. Place the panels in an electric oven for 7 days at 49 °C. This step is intended to elevate the temperature, to advance the reactions between the finish and the cleaner media, and to dry the finish. Allow the panels to cool to room temperature, and re-evaluate the finish for appearance and property changes. It there are no changes, proceed to step 3.3.2.

3.3.2 Water Immersion

This step is intended to reactivate the finish and the media, by introducing water back into any damaged areas of the finish that might still be engaged with cleaning media chemistry. Submerge the panels for 24 h in deionized water, (DI) that meets ASTM D 1193, Type 4. DI water is used only to standardize the solution, whereas tap water varies from location to location and is technically, uncontrolled. Dry the panels with a cloth and place them into a humidity chamber per 3.3.3. Time is not of the essence in transferring panels from step 3.3.2 to 3.3.3, although the amount of time to complete this transfer should be recorded. Drying is done to eliminate puddles of the DI water.

3.3.3 100% Relative Humidity

Expose the test panels to the 96 h humidity test per ASTM D 1735. This step causes humidity to permeate into and out of the coating for a prolonged period of time. Unlike the DI water dip, where the water penetrates and could but does not leave the coating, this step causes the humidity to dynamically enter and leave the finish. The dynamics of this step can cause significantly different degrees and types of reactions between the finish and the test media.

3.4 Repeat Steps to Customize the Procedure per Decision Tree

Steps 3.2 and 3.3 should be repeated until the onset of coating degradation, or until a specified result has been achieved. Cycling through these exposure steps can simulate repeated cleaning of a finish by an end user. Cycling through dry and wet conditions can also accelerate reactions that otherwise, would go slower if the reaction were always dry or wet. If at any stage of the testing the operator notices a change in the appearance or properties of the coating, or the appearance or chemistry of the cleaner media, the test could be concluded.

3.5 Optional Atmospheres for Accelerating the Reactions

3.5.1 Heat

Close the jars and place them in a laboratory oven or heated bath for 24 h at 50 °C. This represents an elevated soak temperature compared to the room temperature soak of 3.2.3. Not all users have heated bath chambers. Some heated bath chambers cannot accommodate large test matrices of panels. This step could simulate application where the solutions are heated before they are applied, like in an automatic car wash, or where the solutions are applied to a heated part, like a wheel heated by brake applications.

3.5.2 Ultraviolet

Expose the panels to an accelerated UV test, such as one of those described in SAE J2633. This step could simulate the combined effects of chemical and ultraviolet exposure, over prolonged periods of time and temperature.

3.6 Evaluation Methods

Document the type of degradation observed in the coating system and/or cleaning chemicals for each combination evaluated.

A variety of sequences could be run, depending on the intended outcome. Modifications to this generic specification should be documented in the internal test procedure for the laboratory performing the evaluation. See Figures 1 and 2 for examples.

3.6.1 Finish Evaluation

3.6.1.1 Visual Examination (4-point system)

0 = No observed effect
1 = Slight effect – light hazing, mild staining or color change
2 = Moderate effect – obvious hazing and loss of gloss, obvious staining
3 = Significant effect – complete loss of gloss, major damage or staining

3.6.1.2 Physical Properties if Applicable

Hardness of Finish
Adhesion
Cure
Chemistry

3.6.2 Solution Evaluation

Color
Chemistry

3.7 Test Products

Cleaning products, painted panels and plated panels could be produced by the user or could be obtained by commercial sources. Many of the automatic car wash, chemical suppliers can be found through the International Car Wash Association (ICA). Candidate retail cleaner products can be identified by reviewing the products that are currently on-the-shelf at retail outlets or through the internet.

The Original Equipment Manufacturers (OEM) should be consulted in order to obtain a list of past, current and future wheel finish sources.

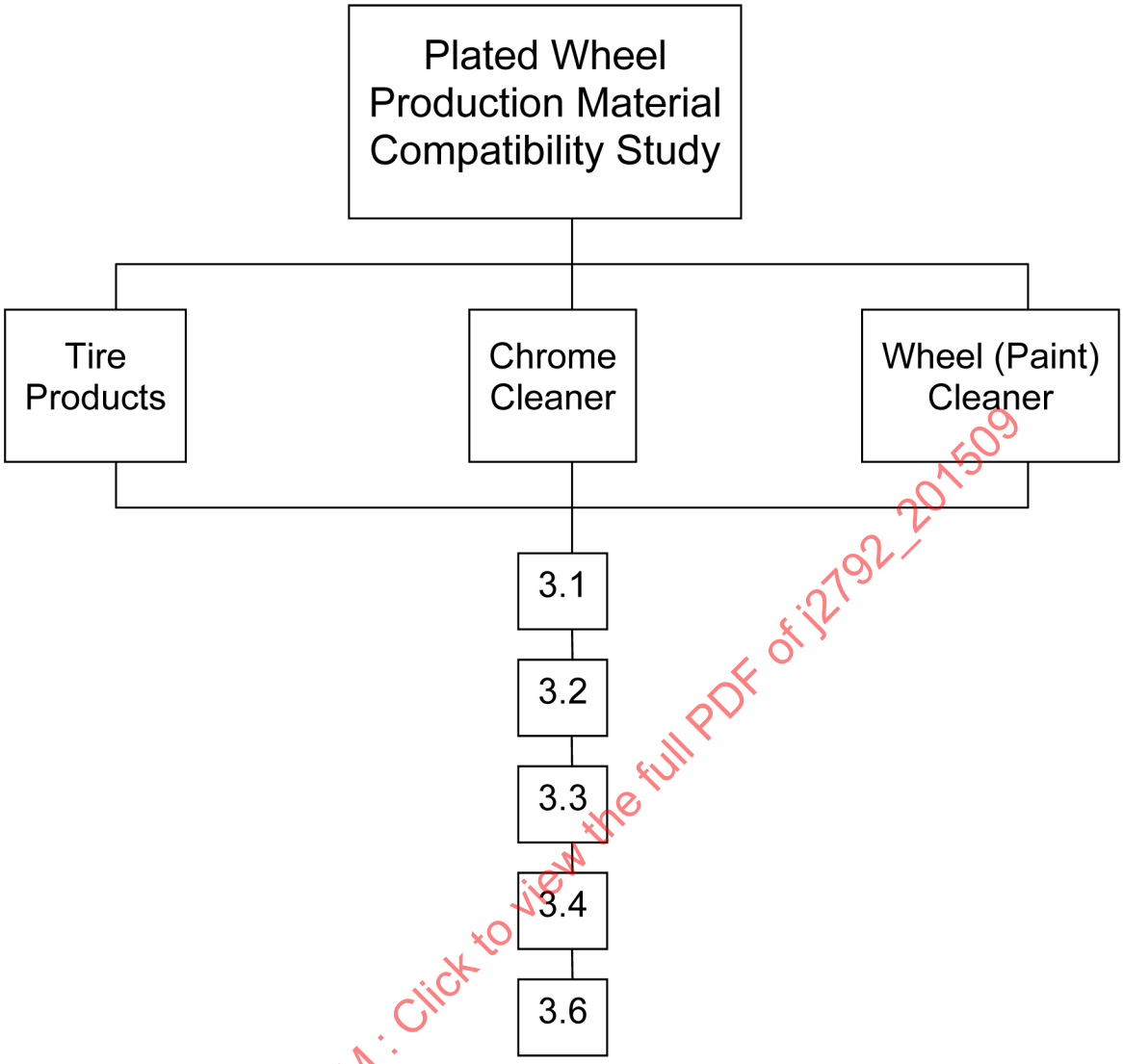

Figure 1 - Example "Decision tree" for evaluating the compatibility of various tire or wheel cleaners with a chrome plated wheel finish