SURFACE VEHICLE RECOMMENDED PRACTICE

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Plastic Materials and Coatings for Use In or On Optical Parts Such as Lenses and Reflectors of High-Intensity Discharge Forward Lighting Devices Used in Motor Vehicles

RATIONALE

The forward lighting technology underlying this standard, High-Intesinsity Discharge Forward Lighting - HID or DFL as referred to in this standard, has stabilized and the technology has shifted toward LED.

STABILIZED NOTICE

This document has been declared "Stabilized" by the SAE Lighting Materials Standards Committee and will no longer be subjected to periodic reviews for currency. Users are responsible for verifying references and continued suitability of technical requirements. Newer technology may exist.

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1. SCOPE

This SAE Recommended Practice provides test methods and requirements to evaluate the suitability of plastic optical materials for possible use in discharge forward lighting (DFL) devices in motor vehicles. These materials are typically used for lenses and reflectors.

Separate testing is required for each combination of material, industrial coating, DFL light source, and device focal length. The tests are intended to determine physical and optical characteristics of the materials and coatings. Performance expectations of finished assemblies, including plastic components, are to be based on tests for lighting devices, as specified in SAE Standards and Recommended Practices for motor vehicle lighting equipment. Optical components exposed to weathering should also be subject to SAE J576.

2. REFERENCES

2.1 Applicable Documents

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

2.1.1 SAE Publications

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 J576 Plastic Material or Materials for Use in Optical Parts Such as Lenses and Reflex Reflectors of Motor Vehicle Lighting Devices

SAE J578 Color Specification

SAE J2009 Discharge Forward Lighting System and Subsystems

2.1.2 ASTM Publications

Available from ASTM International, 100 Barr Harbor Drive, P.O. Box C700, West Conshohocken, PA 19428-2959, Tel: 610-832-9585, www.astm.org

ASTM D 1003-00 Standard Test Method for Haze and Luminous Transmittance of Transparent Plastics

ASTM E 308-01 Standard Practice for Computing the Colors of Objects by Using the CIE System

2.1.3 CIE Publication

Available from CIE Central Bureau, Babenbergerstrasse 9/9A, 1010 Vienna, Austria, Tel: +43 1 714 31 87, www.cie.co.at.

CIE 1931 System

2.1.4 ISBN Publication

Available from ACGIH, 6500 Glenway Ave., Bldg. D-7, Cincinnati, OH 45211-4438.

ISBN:0936712-81-3 The Threshold Limit Values for Occupational Exposure to Ultraviolet Radiation Incident Upon Skin or Eye

3. DEFINITIONS

3.1 MATERIAL

A type and grade of plastic, distinguished by its composition, manufacturer's designation (number), and color.

3.2 COATED MATERIAL

A coated material is a material as defined in 3.1 which has a coating applied to the surface of the finished sample to impart some protective properties. Coating identification includes manufacturer's name, formulation designation (number), and recommendations for application.

3.3 APPARATUS

3.3.1 High-intensity Discharge Lamp

A sealed light source that produces light flux by means of an electrical discharge.

3.3.2 Discharge Forward Lighting (DFL) Systems

A lighting system providing forward illumination, comprised of the light discharge source, ballast/ starting system, and interconnecting wiring.

3.3.3 Test Chamber

An aluminum box that provides an alternative to DFL system testing of materials. It is intended to simulate UV intensity and thermal conditions within a DFL device. Refer to Figure 1.

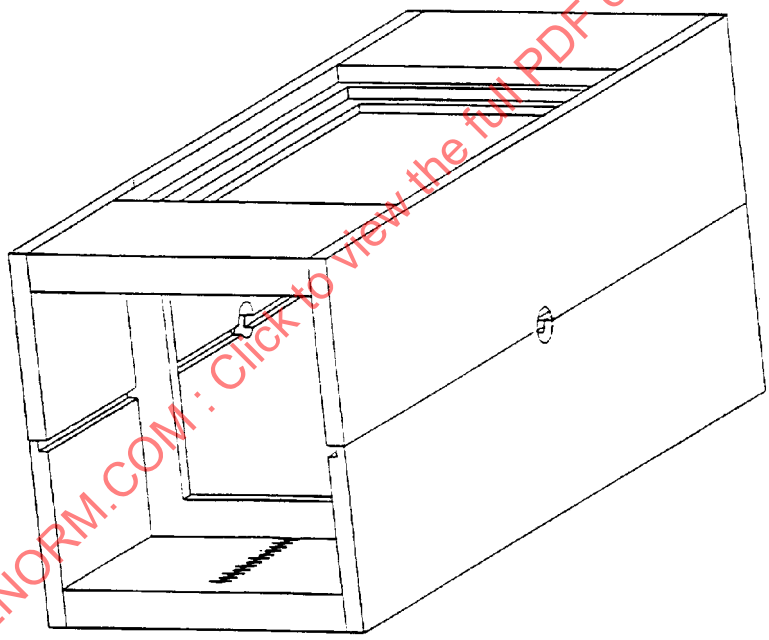

Figure 1 - SAE HID Test Chamber - Assembled - Full Scale

3.3.3.1 Test Chamber Design

The test chamber design is given in Figures 2, 3, 4, and 5. The ability of the chamber to simulate device environments is limited to distances "d" of 44 to 64 mm. It is made of clear anodized 3.2 mm thick aluminum. The assembled test chamber is tight fitting, but not hermetically sealed. The lamp is mounted in compliance with the manufacturer's recommendations and positioned so that the arc discharge coincides with the geometric center of the test chamber. Sample holders are placed a distance "d" from center, on opposite sides of the lamp. The distance "d" determines the UV intensity at the sample. It is nominally twice the focal length of the intended DFL system. There are two sample holders. One sample holder contains Borosilicate glass and the other contains the material to be tested. A 38 mm x 76 mm Borosilicate glass window is built into the top of the test chamber to allow the escape of excess thermal radiation. For d < 50 mm, the window should be covered with an aluminum plate. Thermal equilibrium is reached in an open air environment.

At its discretion, the manufacturer may perform the recommended tests using the actual DFL system rather than the test chamber.

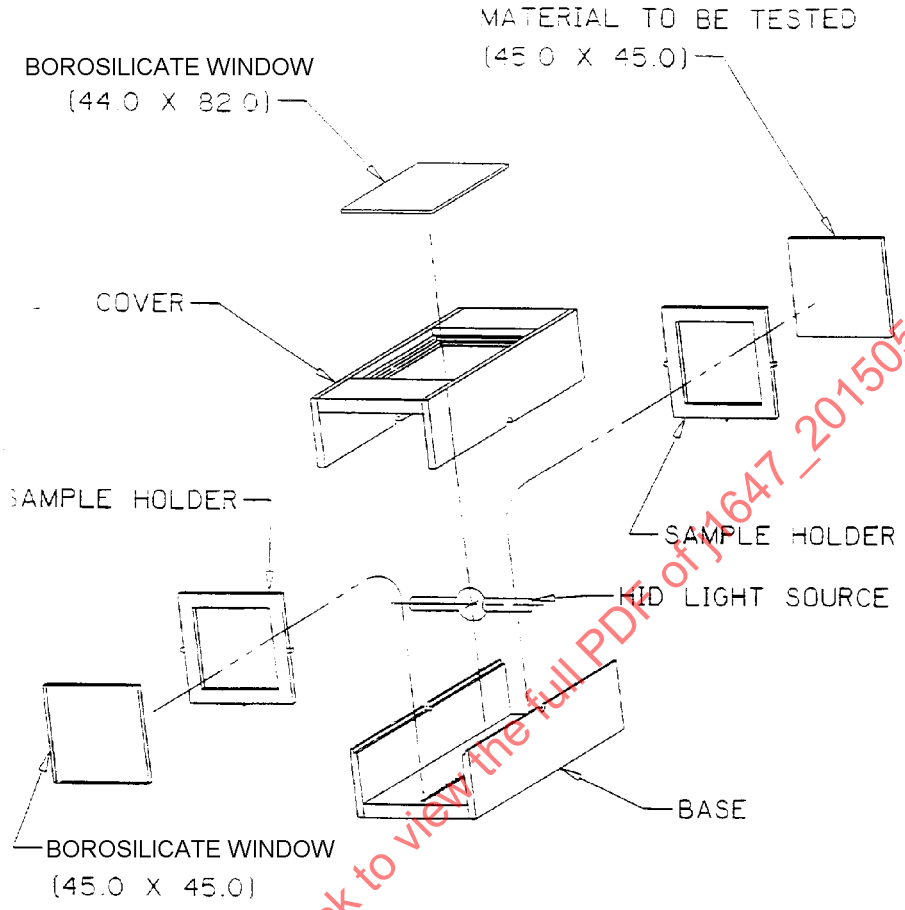

Figure 2 - SAE HID Test Chamber - Perspective - 1/2 Scale

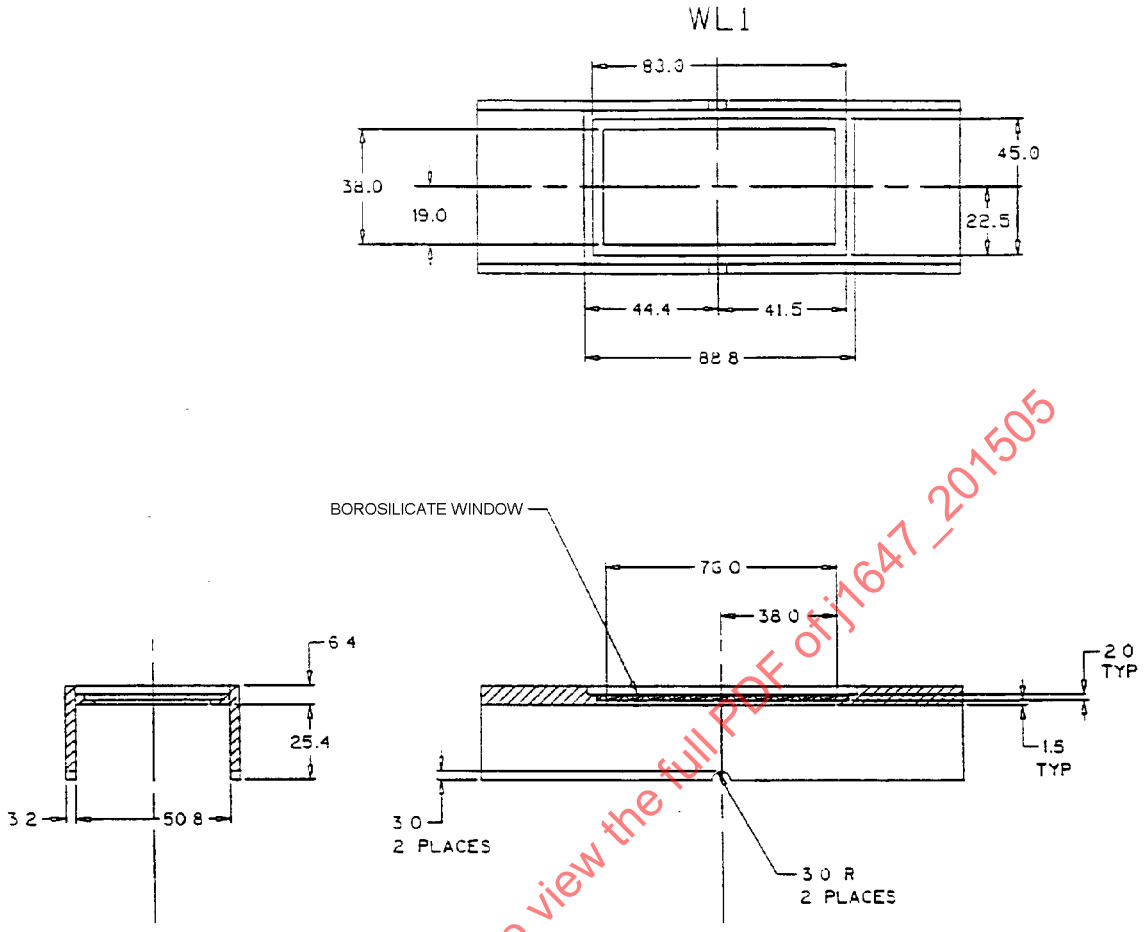

Figure 3 - SAE HID Test Chamber – Cover

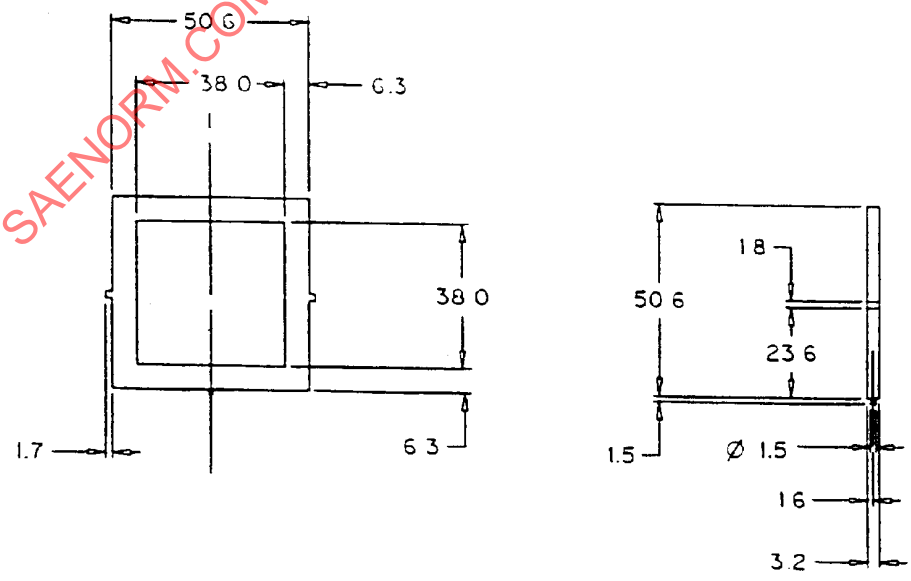

Figure 4 - SAE HID Test Chamber - Sample Holder - 2 Required

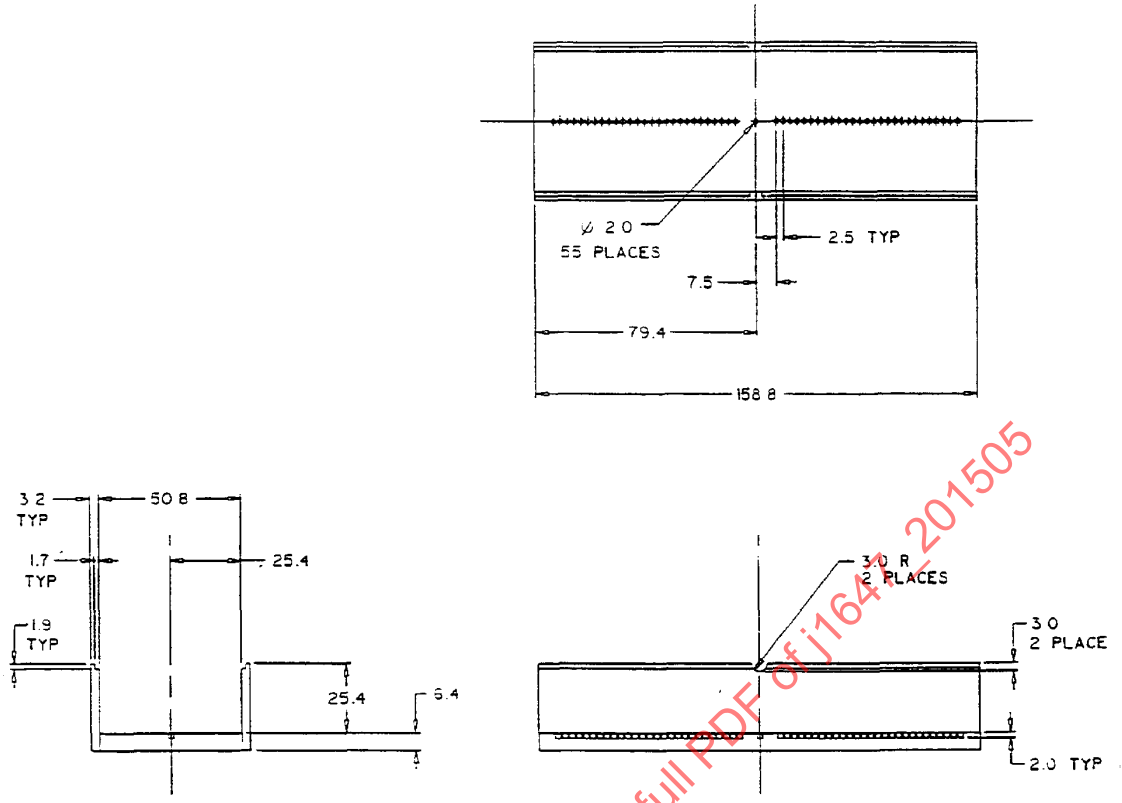

Figure 5 - SAE HID Test Chamber - Base

3.3.3.2 Safety

The threshold limit values for occupational exposure to ultraviolet radiation incident upon skin or eye defined by the American Conference of Governmental Industrial Hygienist should not be exceeded during testing.

The values are found in ISBN:0936712-81-3.

3.4 Surfaces

3.4.1 Exposed Surfaces

Those surfaces of the material, coated or uncoated, exposed to the irradiation of a DFL light source.

3.4.2 Inner Surface

The side of the material, coated or uncoated, closest to the DFL light source.

3.4.3 Outer Surface

The side of the material, coated or uncoated, farthest from the DFL light source.

3.5 Exposure Effects

3.5.1 Color Bleeding

The migration of color out of a plastic part onto the surrounding surface.

3.5.2 Crazing

A network of fine cracks on or beneath the surface of the material with penetration below the surface of the substrate.

3.5.3 Cracking

A separation of adjacent sections of a plastic material with penetration into the specimen.

3.5.4 Haze

The cloudy or turbid appearance of an otherwise transparent specimen caused by light scattered from within the specimen or from its surface.

3.5.5 Delamination

A separation of the layers of a material including coatings.

4. TEST PROCEDURE

4.1 Materials to be Tested

Exposure tests shall be made on each material (as defined in 3.1 and 3.2) used in optical parts employed in DFL motor vehicle lighting devices. Concentrations of polymer components and additives such as plasticizers, lubricants, colorants, weathering stabilizers, and anti-oxidants in plastic materials and/or coatings may be changed without retesting if: the changes are within the limits of composition represented by higher and lower concentrations of these polymer components and additives which have been tested in accordance with Section 4 and found to meet the requirements of Section 5.

4.2 Samples Required

4.2.1 General

Samples of plastic shall be injection molded into polished metal molds to produce test specimens with two flat and parallel faces. Alternative processing techniques may also be used to produce equivalent test specimens. Both inner and outer surfaces shall be prepared as in the intended application.

4.2.2 Number

A minimum of two test samples and one control sample of each material is required, for each thickness to be tested.

4.2.3 Size

Test specimen size shall be 45 mm x 45 mm.

4.2.4 Thickness

The thickness of the sample shall be equal to the minimum thickness of the component in the device. Additionally, the performance limitations of the material can be determined by testing over the thickness range recommended by the manufacturer. Recommended nominal thicknesses are: 1.6 mm, 3.2 mm, 6.4 mm, and 2.3 mm.

4.3 Light Source

A production sample of the DFL light source that will be used in the device, or a representative prototype, shall be used as the light source. The light source used must be new and not operated longer than 10 hours prior to the start of testing.