Bayer MaterialScience

Bayer Polycarbonates Business Unit

Successful

<u>Product – Color – Coatings</u>

Combinations

For Vehicle Lighting Optical Devices

Automotive Lighting Segment

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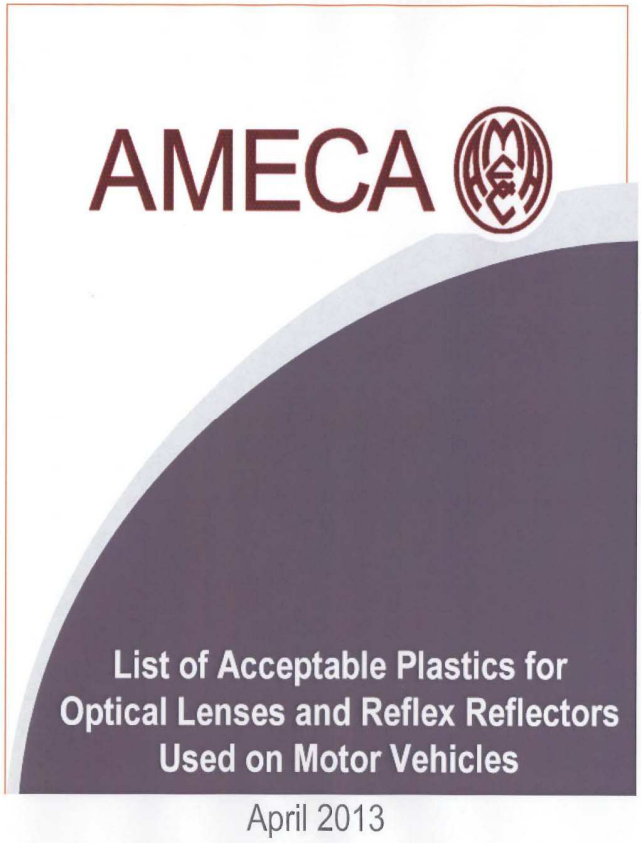

AMECA

List of

Acceptable Plastics for

Optical Lenses and Reflex Reflectors

Used on Motor Vehicles

April 2013 Edition

Automotive Manufacturers Equipment Compliance Agency, Inc.
1025 Connecticut Avenue, NW Suite #1012
Washington DC 20036

www.ameca.org

1. STATUS

The following materials have been accepted by the Automotive Manufacturers Equipment Compliance Agency as meeting the 3-year weathering test of SAE J576 (as amended in 49 CFR 571.108 S5.1.2) for plastics used in optical lenses and reflectors used on motor vehicles. No evaluation has been made as to the suitability of individual materials for particular automotive uses, or to the manufacturing methods.

You must contact the resin or coating manufacturer to determine the best material for your application.

Every plastics resin manufacturer has specialized products for different applications, processing conditions, manufacturing equipment, light sources and final use.

Please contact the manufacturer directly for more information.

The device manufacturers must ensure that the lenses molded from acceptable materials meet the color and plastic stability test requirements for each individual device.

2. LISTING

The material is listed by the manufacturer's name, trade name and flow formulation, type of resin, color number and color.

3. MATERIAL COATINGS AND HAZE

When these materials are used for state/provincial regulated lighting device lenses, the applicable state/provincial regulations shall be met.

Criteria: Reflex reflectors shall meet the haze requirements of SAE J576, paragraph 4.2.3 (under 7%).
Other forward lighting: 30 % see 49 CFR 571.108 S5.1.2 (b)

Background: Reflex reflectors go through three layers of plastic (outer lens, internal reflection in the reflector and the outer lens again). Consequently, the haze requirements for lenses incorporating a reflex reflector must be less than 7%. If a lens does NOT incorporate a reflex it can have up to 30% haze.

The Code "#" denotes material which must be coated to pass the 7% haze requirement. This material does **not** need to be coated to meet the 30% haze requirement.

The Code "Q" denotes a coated material that must be coated to pass the 7% haze requirement. No information is given on uncoated performance.

The Code "$" denotes a coated material with haze values between 7% and 30%. No information is given on uncoated performance.

The Code “@” denotes a coated material with haze values between 7% and 30%. This material is unusable when uncoated.

The Code "!" denotes a material that does not require a coating to be used as an inner lens when protected by an outer lens designated by Code "#“. These materials have been tested *together* as a *system* and together they will meet FMVSS 108.

4. DISTRIBUTION

This list is updated and distributed free on a monthly basis. Any revised or pre-release editions may be obtained by contacting AMECA.

5. DEFINITIONS

Coating -- Material applied to surface of the lens to improve some aspect of performance.

Coated materials-- a material which has a coating applied to the surface of the finished sample to impart some protective properties. Coating identification means a mark of the manufacturer's name, formulation designation number, and recommendations for application.

Color bleeding -- the migration of color out of a plastic part onto the surrounding surface.

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

Crazing -- a network of apparent fine cracks on or beneath the surface of materials.

Delamination -- a separation of the layers of a material including coatings.

Hard Coat -- 1) Coating which is cured by UV radiation.
2) Coating which provides additional resistance to abrasion or scratching which may be cured by thermally or by UV radiation. May contribute to long term durability of material.

NOTE: Both definitions are being used--please verify the intended performance when discussing hard coats.

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

UV-protective Coat -- Coating designed to provide additional protection from the sun's electromagnetic radiation, particularly those wavelengths in the UV bandwidth. Often used on polycarbonate substrates to improve weathering performance. Polycarbonates must be coated for use in or in front of reflex reflectors.

Reflex reflectors-- devices used on vehicles to give an indication to approaching drivers using reflected light from the lamps of the approaching vehicle.

Substrate -- Base material to which all other performance enhancing materials are added.

UV radiation -- Short wavelength, high energy radiation emitted by the sun or other object (HID lamp). Wave lengths between 10 and 380 nm.

HID Lamp -- High Intensity Discharge Lamp. Lamps produce light by the use of a stabilized arc. Lamps can produce significant UV radiation which may require special materials. See SAE J-1647

6. NOTE ON COLOR

The colors listed have been determined to be in compliance with SAE J-578 using the ASTM E 308-66 method required by FMVSS 108 or in thicknesss specified by the resin manufacturer (SAE J576 S4.1).

NOT EVERY COLOR LISTED WILL MEET SAE J-578 COORDINATES FOR YOUR *INTENDED* THICKNESS

NOT EVERY MATERIAL IN EVERY COLOR WILL MEET J578 WITH LED OR ILLUMINANT C LIGHTSOURCES

CHECK WITH THE RESIN MANUFACTURER'S COLOR SPECIALIST

The ASTM E 308-66 method uses an illuminant A light source energized to 2856k. ***If you use anything other than an incandescent light source at 2856k you MUST verify that the resulting color meets the specifications of SAE J-578 for your intended thickness.*** **Halogen light sources at 3200k, illuminant C (strobe) and LED light sources will dramatically alter the color output. In addition, some light sources do not emit color or luminous flux uniformly. Measurements should be made to verify that the emitted light using your intended lightsource meets the specifications of J-578 throughout its photometric range.**

7. NOTE ON INNER LENS COLOR

Combinations of inner and outer lenses with various colors may not perform predictably. Output will vary markedly with different light sources. Check with the resin manufacturer's color specialist when making selections

8. NOTE ON "EQUIVALENT" FORMULATIONS.

Many companies have distributed manufacturing facilities, cooperative agreements or joint ventures. In order to list a facility or another company the company which has done the three year weathering testing must send documentation stating that the materials, processes and end products are equivalent between itself and the new applicant. Due to industry complaints, the List of Acceptable Plastics has revised the listing to more accurately reflect the test data from various parent companies. ***In addition, if the joint venture is terminated or the manufacturing facility is sold, the subsidiary or joint company must be able to provide weathering test data on its own. A company can no longer rely on the parent company data and processes if they have no relationship to the parent company who conducted the original testing.***

9. NOTE ON SAE J-576 FORMATTING

In 2003 SAE reformatted J576 JUL91. Section 2 "References" was split into two sections, Section 2, References and Section 3 Definitions. Please check the formatting used during communication and verify you are referring to the same edition.

10. NOTE ON SUBMITTING FOR ADDITIONAL COLORS

If you plan to add an additional color number to your listing, please list the existing colors which have undergone the three year weathering that are a greater and lesser concentration. The colors listed MUST be in the same color space. See SAE J576, JUL91 Section 4.1

11. Note on FMVSS 108 Rewrite published December 4, 2007.

We are including both the 2007 edition of FMVSS 108 for plastics and the rewritten version. There are some significant differences. Including specifying additional thicknesses, color requirements before and after testing and others. If you have any issues with the proposed changes, please write to the address below.

U.S. Department of Transportation
NHTSA Correspondence Unit
1200 New Jersey Avenue, SE, Room W41-306
Washington, D.C. 20590

11. Note on Inner Lens Testing

Currently the DOT has issued no guidelines for inner lenses. If and when they do, they will be the requirements that everyone must follow. In the meantime, we would recommend for following guidelines for inner lens test setup.

1) You must test every color combination you want to use—red, blue, amber, etc.
2) You must test every molecular weight for both outer lens and inner lens.
3) The test setup—airspace, ventilation, should duplicate as close as possible the conditions in an inner automotive lens including factors such as ventilation, spacing between inner and outer lens and coatings.
4) In our opinion, the thinnest lens may be used as the outer lens as that would be the worst case scenario.
5) For more information, please see SAE Paper: http://papers.sae.org/2004-01-0800

12. Special Note on the definition of "Protected Inner Lens" and/or "Protected Applications"

Protected Inner Lenses or Protected Applications for polycarbonate lenses refers to an outer lens which has a UV absorbing capabilities. NOT physical protection but UV protection.

Frequently Asked Questions

Q1) If someone else has weathered a polycarbonate/PMMA material, do I have to weather my polycarbonate/PMMA material?

A) Yes, every company's material stands independently from what another company has done. Each coating, pigment and additive must be tested with each companiy's own material. Each separate material stands alone for weathering performance unless bracketed by materials of higher and lower concentrations or molecular weights.

Q2) If someone else has weathered a pigment with another plastic do I have to weather the pigment with my plastic?

A) Yes, every company's material stands independently from what another company has done. Each coating, pigment and additive must be tested with each companiy's own material. Each separate material stands alone for weathering performance unless bracketed by materials of higher and lower concentrations or molecular weights.

Q3) If someone else has weathered a coating do I have to weather my material with that coating?

A) Yes, every company's material stands independently from what another company has done. Each coating, pigment and additive must be tested with each companiy's own material. Each separate material stands alone for weathering performance unless bracketed by materials of higher and lower concentrations or molecular weights.

Q4) Testing laboratories typically use a 1-10 numbering scale according to ASTM D660 to indicate the degree of crazing, cracking or delamination associated with weathering. What numberical value from ASTM D660 is acceptable for listing?

A) FMVSS 108 does not refer to any numerical values from ASTM D660. The numerical values are done by the test laboratory for manufacture convenience. FMVSS 108 Section 5.1.2 (a) refers to SAE J-576 which says:

> SAE J576 Section 5.2.4 APPEARANCE—The exposed samples when compared with the unexposed controls shall not show physical changes affecting performance such as color bleeding, delamination, crazing, or cracking.

In addition, the rewrite of FMVSS 108 states:

> S14.4.2.2.4.2 After completion of the outdoor exposure test materials used for headlamp lenses must show no deterioration.
>
> S14.4.2.2.4.3 After completion of the outdoor exposure test all materials, when compared with the unexposed control samples, must not show physical changes affecting performance such as color bleeding, delamination, crazing, or cracking. ***Additionally materials used for***

reflex reflectors and lenses used in front of reflex reflectors must not show surface deterioration or dimensional changes.

Your tested samples must not show any changes affecting performance. The only value which shows no change is a numerical value of 10.

Q5) How many thicknesses to I have to test?

A) FMVSS 108 Rewrite: S14.4.2.1.3 Samples must be furnished in thicknesses of 1.6 ± 0.25 mm, 2.3 ± 0.25 mm, 3.2 ± 0.25 mm, and 6.4 ± 0.25 mm.

Q6) Even if it's for a coating?

A) Yes.

Q7) Do materials have to meet the color requirements before testing?

A) Yes: S14.4.2.1.4 All samples must conform to the applicable color test requirement of this standard prior to testing.

Q8) What about the plastics used in non-FMVSS applications such as emergency vehicle lighting which also require three year weathering?

A) Yes, those can be listed with non-standard colors as long as they are NOT used on FMVSS 108 lighting devices.

Testing outline. Note, we also recommend you send DOUBLE samples to prevent any errors.

- 3 Thicknesses (4 if rewrite is approved)
  - For each colour
  - For each coating
  - For each molecular weight (MW)
- For example:
  - 3 thickness samples of dark red, uncoated, Lowest MW
  - 3 thickness samples of light red, uncoated, Lowest MW
  - 3 thickness samples of dark red, uncoated, Highest MW
  - 3 thickness samples of light red, uncoated, Highest MW

  - 3 thickness samples of dark red, coating 1, Lowest MW
  - 3 thickness samples of light red, coating 1, Lowest MW
  - 3 thickness samples of dark red, coating 1, Highest MW
  - 3 thickness samples of light red, coating 1, Highest MW

  - Now repeat for clear, yellow, blue, coating 2 & coating 3

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Bayer MaterialScience AG (Europe)		HIGH-HEAT	550042	Clear Q
www.bayermaterialscience.com		POLYCARBONATE	551022	Clear Q
	APEC 1603		550674	Clear Q
	APEC 1703		350054	Red Q
	APEC 1803		350056	Red Q
	APEC 1897 Clear only		350335	Red Q
	(coated)		250337	Yellow Q
			250322	Yellow Q
			250339	Yellow Q

Coated Bayer MaterialScience AG (Europe) Apec plastics may only be treated with the following acceptable coatings applied to the molded lens.

Coating in Alphabetical Order and Corresponding Manufacturer

Acryking F-328, Acryking K-101, Acryking PH-220, Acryking PH-328: See Mitsubishi Rayon Co., Ltd.

FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3: See Fujikura Kasei Co., Ltd.

LS123: See NB Coatings

PHC 587C: Momentive Performance Materials Inc.

Stanley SH-41: See Stanley Electric

UVHC3000, UVHC3000K1, UVHC3000K-Z: Momentive Performance Materials Inc.

UVT200V1, UVT200V2, UVT200V3, UVT200V5, UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7 and UVT610V8: See Red Spot

V88VC31: See Sherwin-Williams

Coating Manufacturer in Alphabetical Order

Information on Acryking F-328, Acryking K-101, Acryking PH-220, and Acryking PH-328 coatings may be obtained by writing to the following address:

Mitsubishi Rayon Co., Ltd.
1-1 Marunouchi
1-Chome,
Chiyoda -Ku
Tokyo 100-8253, Japan
www.mrc.co.jp

NOTE: Acryking K-101 is NOT suitable for use with or in front of a reflex reflector

(Coating information continuted on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3 coatings may be obtained by writing:

Fujikura Kasei Co., Ltd.
6-15 Shibakeon 2-Chome Minato-Ku
Tokyo, 105-0011, Japan
www.fkkasei.co.jp

NOTE: FUJIHARD HH2551U series is only suitable for use on APEC 1803 and APEC 1987
NOTE: FUJIHARD HH2551U series data was submitted by Fujikura Kasei

Information on UVHC3000, UVHC3000K1, UVHC3000K-Z, PHC 587C hard coat may be obtained by writing to the following address:

Momentive Performance Materials GmbH
Building V7
51368 Lverkusen
Germany

Momentive Performance Materials Inc.
260 Hudson River Road
Waterford, NY 12118
www.momentive.com

NOTE: UVHC3000 is only acceptable for use on Apec 1603
NOTE: UVHC3000K1, UVHC3000K-Z only APEC 1703 and APEC 1803
NOTE: UVHC3000K1, UVHC3000K-Z, PHC 587C submitted by Momentive Performance Materials Inc.

Information on UVT200V1, UVT200V2, UVT200V3, UVT200V5, UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7 and UVT610V8 coatings may be obtained by writing to the following address:

Red Spot Paint & Varnish Co., Inc.
P.O. Box 418
Evansville, IN 47703-0418
www.redspot.com

NOTE: UVT200 tested on clear samples only.
NOTE: UVT610V tested on clear APEC 1803
NOTE: All UVT test data submitted by Red Spot.

Information on LS123 coating hard coat may be obtained by writing to the following address:

NB Coatings, Inc.
North American Headquarters
2701 E. 170th Street
Lansing, IL 60438
http://www.nbcoatings.com/
1-800-323-3224

Information on Permaclear V88VC31 coating may be obtained by writing to the following address:

Sherwin-Williams Automotive Finishes Corp.
388 Robins Drive
Troy, MI 48083
www.sherwin-automotive.com

(Coating information continuted on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on SH-41 hard coat may be obtained by writing to the following address:

Stanley Electric Co., Ltd.
2-9-13, Nakameguro, Meguro-KU
Tokyo 153, Japan
www.stanley.co.jp

NOTE: Stanley SH-41 is only acceptable for use on Apec 1803

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Bayer MaterialScience AG (Europe)		POLYCARBONATE	550012	Clear #
www.bayermaterialscience.com			550391	Clear #
	MAKROLON 2407		550392	Clear #
	MAKROLON 2607		550394	Clear #
	MAKROLON 2807		550395	Clear #
	MAKROLON 3103		550396	Clear #
	MAKROLON AL2247 Protected Applications Only		550660	Clear #
	MAKROLON AL2447		550674	Clear #
	MAKROLON AL2447 MAS165		551013	Clear #
	MAKROLON AL2647 MAS331		551070	Clear #
	MAKROLON AL2647		551104	Clear #
	MAKROLON AL2847		751303	Clear #
	MAKROLON AL3147		350391	Red #
	MAKROLON LED2045 Color 000000 Protected Applications Only		350392	Red #
	MAKROLON LED2245 Color 000000 Protected Applications Only		350393	Red #
	(coated or uncoated)		350394	Red #
			357866	Red #
			250210	Yellow #
			250337	Yellow #
			250391	Yellow #
			250392	Yellow #
			250393	Yellow #
			256866	Yellow #
			256909	Yellow #
			250395	Yellow #
			558889	Blue #
			750390	Gray #
			750391	Gray #
			750392	Gray #

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Coated Bayer MaterialScience AG (Europe) Makrolon and Makrolon AL plastics may only be treated with the following acceptable coatings applied to the molded lens.

Note: Colors 550674 and 751303 are available on AL2647 only
Color 551013 is available on AL2447 only

Coating in Alphabetical Order and Corresponding Manufacturer

ACRIPLEX 100PSR/100SR: See RöhM GmbH & Co. KG

Acryking F-328, Acryking K-101, Acryking K-103, Acryking PH-220, Acryking PH-328, Acryking PH-700 Acryking PH-710 and Acryking PH-720: See Mitsubishi Rayon Co., Ltd.

FUJIHARD 2540U, FUJIHARD 2540U-1, FUJIHARD 2540U-2: See Fujikura Kasei Co., Ltd.

FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3: See Fujikura Kasei Co., Ltd.

FUJIHARD HH2561U-6, FUJIHARD HH2561U-7, FUJIHARD HH2561U-8, FUJIHARD HH2561U-9: See Fujikura Kasei Co., Ltd.

(Coating information continuted on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

FUJIHARD 2570U, FUJIHARD 2570U-1, FUJIHARD 2570U-2: See Fujikura Kasei Co., Ltd.

KUV-1000, KUV-4000, KUV-5000, KUV-6000: See KCC Corporation

LHP100/LHC100: See Momentive Performance Materials, Inc.

LS123: See NB Coatings

Permaclear IV: See Sherwin Williams

PHC587, PHC 587C hard coat: See Momentive Performance Materials, Inc.

SH-41, SH-50 and SH-51 hard coats: See Stanley Electric

SHP300/SHC3000, SHP401/AS4000, SHP401/SHC4002, SHP470/AS4700: See Momentive Performance Materials Inc

UVHC3000, UHVC3000K, UHVC3000K1, and UHVC3000K-Z hard coats: See Momentive Performance Materials Inc.

UVT200V1, UVT200V2, UVT200V3, UVT200V5 coatings: See Red Spot

UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7, and UVT610V8 coatings: See Red Spot

V88VC31 coatings: See Sherwin Williams

Coating Manufacturer by Alphabetical Order

Information on KUV-1000, KUV-4000, KUV-5000, KUV-6000 coatings may be obtained by writing:

KCC Corporation
83 Mabook-Dong, Giheung-Gu, Yongin-Si
Gyunggi-Do, South Korea
www.kccworld.co.kr.

NOTE: KUV-1000 was tested on 6.4mm lens thickness only
Information on KUV-1000, KUV-4000, KUV-5000, KUV-6000 was submitted by KCC Corporation
KUV-4000, KUV-5000, KUV-6000 tested on AL2447 and AL2647 clear only.

(Coating information continuted on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on FUJIHARD 2540U, FUJIHARD 2540U-1, FUJIHARD 2540U-2, FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3, FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3, FUJIHARD HH2561U-6, FUJIHARD HH2561U-7, FUJIHARD HH2561U-8, FUJIHARD HH2561U-9, FUJIHARD 2570U, FUJIHARD 2570U-1, FUJIHARD 2570U-2 coatings may be obtained by writing:

Fujikura Kasei Co., Ltd.
6-15 Shibakeon 2-Chome Minato-Ku
Tokyo, 105-0011, Japan
www.fkkasei.co.jp

NOTE: FUJIHARD HH2540U-series, FUJIHARD HH2551U-series, FUJIHARD HH2561U-series, FUJIHARD HH2570U-series is only for use on clear MAKROLON AL2447 and MAKROLON 2647
NOTE: FUJIHARD HH2541U-series, FUJIHARD HH2551U-series, FUJIHARD HH2561U-series,FUJIHARD HH2570U-series data was submitted by Fujikura Kasei

Information on Mitsubishi Rayon Acryking F-328, Acryking K-101, Acryking K-103, Acryking PH-220, Acryking PH-328, Acryking PH-700, Acryking PH-710 and Acryking PH-720 may be obtained by writing to the following address:

Mitsubishi Rayon Co., Ltd.
1-1 Marunouchi
1-Chome,
Chiyoda -Ku
Tokyo 100-8253, Japan
www.mrc.co.jp

NOTE: Acryking K-101 is NOT suitable for use with or in front of a reflex reflector
NOTE: Acryking PH-710 and Acryking PH-720 test data was submitted by Mitsubishi Rayon
NOTE: Acryking PH-710 and Acryking PH-720 was tested on clear AL-2447 only

Information on LHP100/LHC100, SHP300/SHC3000, SHP401/AS4000, SHP401/SHC4002, SHP470/AS4700, PHC587, PHC 587C, UVHC3000, UVHC3000K, UVHC3000K1 and UVHC3000K-Z hard coats may be obtained by writing to the following address:

Momentive Performance Materials GmbH
Building V7
51368 Lverkusen
Germany

Momentive Performance Materials Inc.
260 Hudson River Road
Waterford, NY 12118
www.momentive.com

NOTE: Momentive Performance Materials Inc. SHP3000/SHC3000 is NOT suitable for use with or in front of a reflex reflector

NOTE: UVHC3000K test data submitted by Momentive Performance Materials, Inc.
NOTE: UVHC3000K1, UVHC3000K-Z, PHC 587C submitted by Momentive Performance Materials Inc.

(Coating information continuted on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on LS123 coating hard coats may be obtained by writing to the following address:

NB Coatings, Inc.
North American Headquarters
2701 E. 170th Street
Lansing, IL 60438
http://www.nbcoatings.com/

Information on Red Spot UVT200V1, UVT200V2, UVT200V3, UVT200V5, UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7, and UVT610V8 coatings may be obtained by writing to the following address:

Red Spot Paint & Varnish Co., Inc.
P.O. Box 418
Evansville, IN 47703-0418
www.redspot.com

NOTE: All UVT test data submitted by Red Spot.

Information on ACRIPLEX 100PSR/100SR hard coat may be obtained by writing to the following address:

RöhM GmbH & Co. KG
Krischenalle
64293 Darmstadt, Germany
www.Röhm.com

Information on Permaclear IV and V88VC31 coatings may be obtained by writing to the following address:

Sherwin-Williams Automotive Finishes Corp.
388 Robins Drive
Troy, MI 48083
www.sherwin-automotive.com

Information on SH-41, SH-50 and SH-51 hard coats may be obtained by writing to the following address:

Stanley Electric Co., Ltd.
2-9-13, Nakameguro, Meguro-KU
Tokyo 153, Japan
www.stanley.co.jp

Note: Stanley SH-51 submitted by Stanley Electric
Note: Stanley SH-51 only tested on clear MAKROLON AL2447 and AL2647.

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Bayer MaterialScience LLC (America)		HIGH-HEAT	550042	Clear Q
www.bayermaterialsciencenafta.com		POLYCARBONATE	551022	Clear Q
	APEC 1603		550674	Clear Q
	APEC 1703		350054	Red Q
	APEC 1803		350056	Red Q
	APEC 1897 Clear only		350335	Red Q
	(coated)		350340	Red Q
			250196	Yellow Q
			250322	Yellow Q
			250337	Yellow Q
			250339	Yellow Q
			256866	Yellow Q

Note: 250337 is for APEC 1803 only

Coated Bayer MaterialScience LLC (America) Apec plastics may only be treated with the following acceptable coatings listed below when applied to the molded lens:

Coating in Alphabetical Order and Corresponding Manufacturer

Acryking F-328, Acryking K-101, Acryking PH-220, Acryking PH-328: See Mittsubishi Rayon Co., Ltd.

FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3: See Fujikura Kasei Co., Ltd.

LS123: See NB Coatings, Inc.

PHC587C: See Momentive Performance Materials Inc.

SH-41: See Stanley Electric

UVT200V1, UVT200V2, UVT200V3, UVT200V5, UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7 and UVT610V8: See Red Spot

UVHC3000, UVHC3000K1, UVHC3000K-Z: See Momentive Performance Materials Inc.

V88VC31: See Sherwin Williams

Coating Manufacturer in Alphabetical Order

Information on FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3 coatings may be obtained by writing:

Fujikura Kasei Co., Ltd.
6-15 Shibakeon 2-Chome Minato-Ku
Tokyo, 105-0011, Japan
www.fkkasei.co.jp

NOTE: FUJIHARD HH2551U series is only suitable for use on APEC 1803 and APEC 1897
NOTE: FUJIHARD HH2551U series data was submitted by Fujikura Kasei

(Coating information continuted on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on Acryking F-328, Acryking K-101, Acryking PH-220, and Acryking PH-328 coatings may be obtained by writing to the following address:

Mitsubishi Rayon Co., Ltd.
1-1 Marunouchi
1-Chome,
Chiyoda -Ku
Tokyo 100-8253, Japan
www.mrc.co.jp

NOTE: Acryking K-101 is NOT suitable for use with or in front of a reflex reflector

Information on UVHC3000, UVHC3000K1, UVHC3000K-Z and PHC587C hard coat may be obtained by writing to the following address:

Momentive Performance Materials GmbH
Building V7
51368 Lverkusen
Germany

Momentive Performance Materials Inc.
260 Hudson River Road
Waterford, NY 12118
www.momentive.com

NOTE: UVHC3000 is only acceptable for use on Apec 1603
NOTE: UVHC3000K1, UVHC3000K-Z and PHC587C only for use on APEC 1803
NOTE: UVHC3000K1, UVHC3000K-Z and PHC587C data submitted by Momentive Performance Materials Inc.

Information on LS123 coating hard coat may be obtained by writing to the following address:

NB Coatings, Inc.
North American Headquarters
2701 E. 170th Street
Lansing, IL 60438
http://www.nbcoatings.com/
1-800-323-3224

Information on Red Spot UVT200V1, UVT200V2, UVT200V3, UVT200V5, UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7 and UVT610V8 coatings may be obtained by writing to the following address:

Red Spot Paint & Varnish Co., Inc.
P.O. Box 418
Evansville, IN 47703-0418
www.redspot.com

NOTE: UVT610V tested on clear APEC 1803 only
NOTE: UVT200 tested on clear samples only.
NOTE: All UVT test data submitted by Red Spot.

Information on V88VC31 coating may be obtained by writing to the following address:

Sherwin-Williams Automotive Finishes Corp.
388 Robins Drive
Troy, MI 48083
www.sherwin-automotive.com

(Coating information continuted on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on SH-41 hard coat may be obtained by writing to the following address:

Stanley Electric Co., Ltd.
2-9-13, Nakameguro, Meguro-KU
Tokyo 153, Japan
www.stanley.co.jp

NOTE: Stanley SH-41 is only acceptable for use on Apec 1803

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Bayer MaterialScience LLC (America)		POLYCARBONATE	550012	Clear #
www.bayermaterialsciencenafta.com			550396	Clear #
	(MAKROLON AL2247 PROTECTED APPLICATIONS ONLY)		550660	Clear #
	MAKROLON AL2447		550674	Clear #
	MAKROLON AL2447 MAS165		551013	Clear #
	MAKROLON AL2647 MAS331		551066	Clear #
	MAKROLON AL2647		551067	Clear #
	MAKROLON AL2847		551068	Clear #
	MAKROLON AL3147		551069	Clear #
	MAKROLON LED2045 Color 000000 Protected Applications Only		551070	Clear #
	MAKROLON LED2245 Color 000000 Protected Applications Only		551104	Clear #
	(coated or uncoated)		751303	Clear #
			357866	Red #
			357867	Red #
			357868	Red #
			357869	Red #
			357915	Red #
			250210	Yellow #
			250332	Yellow #
			250337	Yellow #
			256811	Yellow #
			256847	Yellow #
			256858	Yellow #
			256861	Yellow #
			256866	Yellow #
			256867	Yellow #
			256868	Yellow #
			256869	Yellow #
			256894	Yellow #
			256896	Yellow #
			256908	Yellow #
			256909	Yellow #
			250200	Yellow #
			558889	Blue #
			558920	Blue #
			752723	Gray #
			752960	Gray #
			752969	Gray #
			752970	Gray #

Coated Bayer MaterialScience LLC (America) Makrolon AL plastics may only be treated with the following acceptable coatings applied to the molded lens:

Note: Colors 250337, 550674 and 751303 are available on AL2647 only
Color 551013 is available on AL2447 only

Coating in Alphabetical Order and Corresponding Manufacturer

Acryking F-328, Acryking K-101, Acryking K-103, Acryking PH-220, Acryking PH-328, Acryking PH-700 Acryking PH-710 and Acryking PH-720: See Mitsubishi Rayon Co., Ltd.

ACRIPLEX 100PSR/100SR hard coats: See RöhM GmbH & Co. KG

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

(Coating information continuted on the next page)

FUJIHARD 2540U, FUJIHARD 2540U-1, FUJIHARD 2540U-2: See Fujikura Kasei Co., Ltd.

FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3: See Fujikura Kasei Co., Ltd.

FUJIHARD HH2561U-6, FUJIHARD HH2561U-7, FUJIHARD HH2561U-8, FUJIHARD HH2561U-9: See Fujikura Kasei Co., Ltd.

FUJIHARD 2570U, FUJIHARD 2570U-1, FUJIHARD 2570U-2: See Fujikura Kasei Co., Ltd.

KUV-1000, KUV-4000, KUV-5000, KUV-6000: See KCC corporation

LHP100/LHC100: See Momentive Performance Materials Inc.

LS123: See NB Coatings, Inc.

Permaclear IV: See Sherwin Williams

PHC587 and PHC587C hard coat: See Momentive Performance Materials, Inc.

SHP300/SHC3000, SHP401/AS4000, SHP401/SHC4002, SHP470/AS4700: Momentive Performance Materials Inc.

SH-41, SH-50 and SH-51: See Stanley Electric Co., Ltd.

UVHC3000, UVHC3000K, UVHC3000K1, UVHC3000K-Z: See Momentive Performance Materials Inc.

UVT200V1, UVT200V2, UVT200V3 and UVT200V5: See Red Spot

UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7, and UVT610V8: See Red Spot

V88VC31: See Sherwin Williams

Coating Manufacturer in Alphabetical Order

Information on FUJIHARD 2540U, FUJIHARD 2540U-1, FUJIHARD 2540U-2, FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3, FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3, FUJIHARD HH2561U-6, FUJIHARD HH2561U-7, FUJIHARD HH2561U-8, FUJIHARD HH2561U-9, FUJIHARD 2570U, FUJIHARD 2570U-1, FUJIHARD 2570U-2 coatings may be obtained by writing:

Fujikura Kasei Co., Ltd.
6-15 Shibakeon 2-Chome Minato-Ku
Tokyo, 105-0011, Japan
www.fkkasei.co.jp

NOTE: FUJIHARD HH2540U-series, FUJIHARD HH2551U-series, FUJIHARD HH2561U-series, FUJIHARD HH2570U-series is only for use on clear MAKROLON AL2447 and MAKROLON 2647

NOTE: FUJIHARD HH2541U-series, FUJIHARD HH2551U-series, FUJIHARD HH2561U-series, FUJIHARD HH2570U-series data was submitted by Fujikura Kasei

(Coating information continuted on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on KUV-1000, KUV-4000, KUV-5000, KUV-6000 coatings may be obtained by writing:

KCC Corporation
83 Mabook-Dong, Giheung-Gu, Yongin-Si
Gyunggi-Do, South Korea
www.kccworld.co.kr.

NOTE: KUV-1000 was tested on 6.4mm lens thickness only
Information on KUV-1000, KUV-4000, KUV-5000, KUV-6000 was submitted by KCC Corporation
KUV-4000, KUV-5000, KUV-6000 tested on AL2447 and AL2647 clear only.

Information on Mitsubishi Rayon Acryking F-328, Acryking K-101, Acryking K-103, Acryking PH-220, Acryking PH-328, Acryking PH-700, Acryking PH-710 and Acryking PH-720 may be obtained by writing to the following address:

Mitsubishi Rayon Co., Ltd.
1-1 Marunouchi
1-Chome,
Chiyoda -Ku
Tokyo 100-8253, Japan
www.mrc.co.jp

NOTE: Acryking K-101 is NOT suitable for use with or in front of a reflex reflector
NOTE: Acryking PH-710 and Acryking PH-720 test data was submitted by Mitsubishi Rayon
NOTE: Acryking PH-710 and Acryking PH-720 was tested on clear AL-2447 only

Information on LHP100/LHC100, SHP300/SHC3000, SHP401/AS4000, SHP401/SHC4002, SHP470/AS4700, PHC587, PHC587C, UVHC3000, UVHC3000K, UVHC3000K1 and UVHC3000K-Z and hard coats may be obtained by writing to the following address:

Momentive Performance Materials GmbH
Building V7
51368 Lverkusen
Germany

Momentive Performance Materials Inc.
260 Hudson River Road
Waterford, NY 12118
www.momentive.com

NOTE: Momentive Performance Materials Inc. SHP3000/SHC3000 is NOT suitable for use with or in front of a reflex reflector
NOTE: UVHC3000K test data submitted by Momentive Performance Materials, Inc.
NOTE: UVHC3000K1, UVHC3000K-Z and PHC587C test data submitted by Momentive Performance Materials Inc.

Information on LS123 coating hard coat may be obtained by writing to the following address:

NB Coatings, Inc.
North American Headquarters
2701 E. 170th Street
Lansing, IL 60438
http://www.nbcoatings.com/

(Coating information continued on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on Red Spot UVT200V1, UVT200V2, UVT200V3, UVT200V5, UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7, and UVT610V8 coatings may be obtained by writing to the following address:

Red Spot Paint & Varnish Co., Inc.
P.O. Box 418
Evansville, IN 47703-0418
www.redspot.com

NOTE: All UVT test data submitted by Red Spot.

Information on ACRIPLEX 100PSR/100SR hard coat may be obtained by writing to the following address:

RöhM GmbH & Co. KG
Krischenalle
64293 Darmstadt, Germany
www.Röhm.com

Information on Permaclear IV and V88VC31 coatings may be obtained by writing to the following address:

Sherwin-Williams Automotive Finishes Corp.
388 Robins Drive
Troy, MI 48083
www.sherwin-automotive.com

Information on SH-41, SH-50 and SH-51 hard coats may be obtained by writing to the following address:

Stanley Electric Co., Ltd.
2-9-13, Nakameguro, Meguro-KU
Tokyo 153, Japan
www.stanley.co.jp

Note: Stanley SH-51 submitted by Stanley Electric
Note: Stanley SH-51 only tested on clear MAKROLON AL2447 and AL2647

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Bayer MaterialScience Ltd. (Asia Pacific)		HIGH-HEAT	550042	Clear Q
www.bayermaterialscience.com		POLYCARBONATE	551022	Clear Q
	APEC 1603		550674	Clear Q
	APEC 1703		350054	Red Q
	APEC 1803		350056	Red Q
	APEC 1897 Clear only		350335	Red Q
	(coated)		350340	Red Q
			250196	Yellow Q
			250322	Yellow Q
			250337	Yellow Q
			250339	Yellow Q
			256866	Yellow Q

Note: Color 250337 is for APEC 1803 only

Coated Bayer MaterialScience Ltd. (Asia Pacific) Apec plastics may only be treated with the following acceptable coatings applied to the molded lens:

Coating in Alphabetical Order and Corresponding Manufacturer

Acryking F-328, Acryking K-101, Acryking PH-220, Acryking PH-328: See Mittsubishi Rayon Co., Ltd.

FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3: See Fujikura Kasei Co., Ltd.

LS123: See NB Coatings, Inc.

PHC587C: See Momentive Performance Materials Inc.

SH-41: See Stanley Electric Co., Ltd.

V88VC31: See Sherwin Williams

UVT200V1, UVT200V2, UVT200V3, UVT200V5, UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7 and UVT610V8: See Red Spot

UVHC3000, UVHC3000K1, and UVHC3000K-Z: See Momentive Performance Materials Inc.

(Coating information continued on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Coating Manufacturer in Alphabetical Order

Information on FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3 coatings may be obtained by writing:

Fujikura Kasei Co., Ltd.
6-15 Shibakeon 2-Chome Minato-Ku
Tokyo, 105-0011, Japan
www.fkkasei.co.jp

NOTE: FUJIHARD HH2551U series is only suitable for use on APEC 1803 and APEC 1897
NOTE: FUJIHARD HH2551U series data was submitted by Fujikura Kasei

Information on Acryking F-328, Acryking K-101, Acryking PH-220, and Acryking PH-328 coatings may be obtained by writing to the following address:

Mitsubishi Rayon Co., Ltd.
1-1 Marunouchi
1-Chome,
Chiyoda -Ku
Tokyo 100-8253, Japan
www.mrc.co.jp

NOTE: Acryking K-101 is NOT suitable for use with or in front of a reflex reflector

Information on PHC587C, UVHC3000, UVHC3000K1, and UVHC3000K-Z hard coat may be obtained by writing to the following address:

Momentive Performance Materials GmbH
Building V7
51368 Lverkusen
Germany

Momentive Performance Materials Inc.
260 Hudson River Road
Waterford, NY 12118
www.momentive.com

NOTE: UVHC3000 is only acceptable for use on Apec 1603
NOTE: PHC578C, UVHC3000K1, and UVHC3000K-Z is only acceptable for use on Apec 1703 and Apec 1803
NOTE: PHC578C, UVHC3000K1, and UVHC3000K-Z data is submitted via Momentive Performance Materials

Information on LS123 coating hard coat may be obtained by writing to the following address:

NB Coatings, Inc.
North American Headquarters
2701 E. 170th Street
Lansing, IL 60438
http://www.nbcoatings.com/

(Coating information continued on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on Red Spot UVT200V1, UVT200V2, UVT200V3, UVT200V5, UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7 and UVT610V8 coatings may be obtained by writing to the following address:

Red Spot Paint & Varnish Co., Inc.
P.O. Box 418
Evansville, IN 47703-0418
www.redspot.com

NOTE: UVT200 tested on clear samples only.
NOTE: UVT610V tested on clear APEC 1803 only.
NOTE: All UVT test data submitted by Red Spot.

Information on V88VC31 coating may be obtained by writing to the following address:

Sherwin-Williams Automotive Finishes Corp.
388 Robins Drive
Troy, MI 48083
www.sherwin-automotive.com

Information on SH-41 hard coat may be obtained by writing to the following address:

Stanley Electric Co., Ltd.
2-9-13, Nakameguro, Meguro-KU
Tokyo 153, Japan
www.stanley.co.jp
NOTE: Stanley SH-41 is only acceptable for use on Apec 1803

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Bayer MaterialScience Ltd. (Asia Pacific)		POLYCARBONATE	550012	Clear #
www.bayermaterialscience.com			550660	Clear #
	MAKROLON AL2447		550674	Clear #
	MAKROLON AL2447 MAS165		551013	Clear #
	MAKROLON AL2647 MAS331		551066	Clear #
	MAKROLON AL2647		551067	Clear #
	MAKROLON LED2045 Color 000000	Protected Applications Only	551068	Clear #
	MAKROLON LED2245 Color 000000	Protected Applications Only	551069	Clear #
	(coated or uncoated)		551070	Clear #
			550396	Clear #
			551104	Clear #
			751303	Clear #
			357866	Red #
			357867	Red #
			357868	Red #
			357869	Red #
			357915	Red #
			250210	Yellow #
			256811	Yellow #
			250337	Yellow #
			256847	Yellow #
			256858	Yellow #
			256861	Yellow #
			256866	Yellow #
			256867	Yellow #
			256868	Yellow #
			256869	Yellow #
			256894	Yellow #
			256896	Yellow #
			256908	Yellow #
			256909	Yellow #
			250200	Yellow #
			558889	Blue #
			558920	Blue #
			752723	Gray #
			752960	Gray #
			752969	Gray #
			752970	Gray #

Coated Bayer MaterialScience Ltd. (Asia Pacific) Makrolon AL plastics may only be treated with the following acceptable coatings applied to the molded lens.

Note: Colors 250337, 550674 and 751303 are available on AL2647 only
Color 551013 is available on AL2447 only

Coating in Alphabetical Order and Corresponding Manufacturer

ACRIPLEX 100PSR/100SR: See RöhM GmbH & Co. KG

Acryking F-328, Acryking K-101, Acrykng K-103, Acryking PH-220, Acryking PH-328, Acryking PH-700, Acryking PH-710 and Acryking PH-720: See Mitsubishi Rayon Co., Ltd.

(Coating information continued on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

FUJIHARD 2540U, FUJIHARD 2540U-1, FUJIHARD 2540U-2: See Fujikura Kasei Co., Ltd.

FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3: See Fujikura Kasei Co., Ltd.

FUJIHARD HH2561U-6, FUJIHARD HH2561U-7, FUJIHARD HH2561U-8, FUJIHARD HH2561U-9: See Fujikura Kasei Co., Ltd.

FUJIHARD 2570U, FUJIHARD 2570U-1, FUJIHARD 2570U-2: See Fujikura Kasei Co., Ltd.

KUV-1000, KUV-4000, KUV-5000, KUV-6000: See KCC Corporation

LHP100/LHC100: See Momentive Performance Materials Inc.

LS123: See NB Coatings Inc.

Permaclear IV: See Sherwin Williams

PHC587 and PHC587C: See Momentive Performance Materials Inc

SH-41, SH-50 and SH-51: See Stanley Electric Co., Ltd.

SHP300/SHC3000, SHP401/AS4000, SHP401/SHC4002, SHP470/AS4700: See Momentive Performance Materials

UVHC3000, UVHC3000K, UVHC3000K1 and UVHC3000K-Z: See Momentive Performance Materials

UVT200V1, UVT200V2, UVT200V3 and UVT200V5: See Red Spot

UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7, and UVT610V8 hard coats: See Red Spot

V88VC31: See Sherwin Williams

Coating Manufacturer in Alphabetical Order

Information on FUJIHARD 2540U, FUJIHARD 2540U-1, FUJIHARD 2540U-2, FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3, FUJIHARD HH2551U, FUJIHARD HH2551U-1, FUJIHARD HH2551U-2, FUJIHARD HH2551U-3, FUJIHARD HH2561U-6, FUJIHARD HH2561U-7, FUJIHARD HH2561U-8, FUJIHARD HH2561U-9, FUJIHARD 2570U, FUJIHARD 2570U-1, FUJIHARD 2570U-2 coatings may be obtained by writing:

Fujikura Kasei Co., Ltd.
6-15 Shibakeon 2-Chome Minato-Ku
Tokyo, 105-0011, Japan
www.fkkasei.co.jp

NOTE: FUJIHARD HH2540U-series, FUJIHARD HH2551U-series, FUJIHARD HH2561U-series, FUJIHARD HH2570U-series is only for use on clear MAKROLON AL2447 and MAKROLON 2647

NOTE: FUJIHARD HH2541U-series, FUJIHARD HH2551U-series, FUJIHARD HH2561U-series, FUJIHARD HH2570U-series data was submitted by Fujikura Kasei

(Coating information continued on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on KUV-1000, KUV-4000, KUV-5000, KUV-6000 coatings may be obtained by writing:

KCC Corporation
83 Mabook-Dong, Giheung-Gu, Yongin-Si
Gyunggi-Do, South Korea
www.kccworld.co.kr.

NOTE: KUV-1000 was tested on 6.4mm lens thickness only
Information on KUV-1000, KUV-4000, KUV-5000, KUV-6000 was submitted by KCC Corporation
KUV-4000, KUV-5000, KUV-6000 tested on AL2447 and AL2647 clear only.

Information on Mitsubishi Rayon Acryking F-328, Acryking K-101, Acryking K-103, Acryking PH-220, Acryking PH-328, Acryking PH-700, Acryking PH-710 and Acryking PH-720 may be obtained by writing to the following address:

Mitsubishi Rayon Co., Ltd.
1-1 Marunouchi
1-Chome,
Chiyoda -Ku
Tokyo 100-8253, Japan
www.mrc.co.jp

NOTE: Acryking K-101 is NOT suitable for use with or in front of a reflex reflector
NOTE: Acryking PH-710 and Acryking PH-720 test data was submitted by Mitsubishi Rayon
NOTE: Acryking PH-710 and Acryking PH-720 was tested on clear AL-2447 only

Information on LHP100/LHC100, SHP300/SHC3000, SHP401/AS4000, SHP401/SHC4002, SHP470/AS4700, PHC587, PHC587C, UVHC3000, UVHC3000K, UVHC3000K1, and UVHC3000K-Z hard coats may be obtained by writing to the following address:

Momentive Performance Materials GmbH
Building V7
51368 Lverkusen
Germany

Momentive Performance Materials Inc.
260 Hudson River Road
Waterford, NY 12118
www.momentive.com

NOTE: Momentive Performance Materials Inc. SHP3000/SHC3000 is NOT suitable for use with or in front of a reflex reflector

NOTE: UVHC3000K, UVHC3000K1, UVHC3000K-Z and PHC587C test data submitted by Momentive Performance Materials, Inc.

Information on LS123 coating hard coats may be obtained by writing to the following address:

NB Coatings Inc.
2701 East 170TH Street
Lansing, IL 60438
http://www.nbcoatings.com/

(Coating information continued on the next page)

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR

Information on Red Spot UVT200V1, UVT200V2, UVT200V3, UVT200V5, UVT610V1, UVT610V2, UVT610V3, UVT610V4, UVT610V5, UVT610V6, UVT610V7, and UVT610V8 coatings may be obtained by writing to the following address:

Red Spot Paint & Varnish Co., Inc.
P.O. Box 418
Evansville, IN 47703-0418
www.redspot.com

NOTE: All UVT test data submitted by Red Spot.

Information on ACRIPLEX 100PSR/100SR hard coat may be obtained by writing to the following address:

RöhM GmbH & Co. KG
Krischenalle
64293 Darmstadt, Germany
www.Röhm.com

Information on Permaclear IV and V88VC31 coatings may be obtained by writing to the following address:

Sherwin-Williams Automotive Finishes Corp.
388 Robins Drive
Troy, MI 48083
www.sherwin-automotive.com

Information on SH-41, SH-50 and SH-51 hard coats may be obtained by writing to the following address:

Stanley Electric Co., Ltd.
2-9-13, Nakameguro, Meguro-KU
Tokyo 153, Japan
www.stanley.co.jp

Note: Stanley SH-51 submitted by Stanley Electric
Note: Stanley SH-51 only tested on clear MAKROLON AL2447 and AL2647

Arizona Desert Testing
21212 West Patton Road
Wittman, Arizona 85361
Tel: (623) 388-9500
FAX: (623) 388-9007
Website: www.aztest.com

Atlas Weathering Services Group
DSET Laboratories
45601 N. 47th Avenue
Phoenix, Arizona 85027-7042
Tel: (623) 465-7356; (800) 255-DSET
FAX: (623) 465-9409
Website: www.atlaswsg.com

Atlas Weathering Services Group
South Florida Test Services
Everglades Division
16100 S.W. 216th Street
Miami, Florida 33170
Tel: (305) 245-3659
FAX: (305) 245-9122
Website: www.atlaswsg.com

Q-LAB Weathering Research Service
24742 West Durango Street
Buckeye, Arizona 85326
Tel: (623) 386-5140
FAX: (623) 386-5143
Website: www.q-panel.com

Q-LAB Weathering Research Service
1005 S.W. 18th Avenue,
P.O. Box 349490
Homestead, Florida 33034
Tel: (305) 245-5600
FAX: (305) 245-5656
Website: www.q-panel.com

S5.1.2 Plastic materials used for optical parts such as lenses and reflectors shall conform to SAE Recommended Practice J576 JUL91, except that:

(a) Plastic lenses (other than those incorporating reflex reflectors) used for inner lenses or those covered by another material and not exposed directly to sunlight shall meet the requirements of paragraphs 3.3 and 4.2 of SAE J576 JUL91 when covered by the outer lens or other material;

(b) After the outdoor exposure test, the haze and loss of surface luster of plastic materials (other than those incorporating reflex reflectors) used for outer lenses shall not be greater than 30 percent haze as measured by ASTM D 1003–92, *Haze and Luminous Transmittance of Transparent Plastic;*

(c) After the outdoor exposure test, plastic materials used for reflex reflectors and for lenses used in front of reflex reflectors shall not show surface deterioration, crazing, dimensional changes, color bleeding, delamination, loss of surface luster, or haze that exceeds 7 percent as measured under ASTM D 1003–92.

(d) The thickness of the test specimens specified in paragraph 3.2.2 of SAE J576 JUL91 may vary by as much as ±0.25 mm.

(e) After exposure to the heat test as specified in subparagraph (f) of this paragraph, and after cooling to room ambient temperature, a test specimen shall show no change in shape and general appearance discernable to the naked eye when compared with an unexposed specimen. The trichromatic coefficients of the samples shall conform to the requirements of SAE J578c, *Color Specification for Electric Signal Lighting Devices,* May 1977.

(f) Two samples of each thickness of each plastic material are used in the heat test. Each sample is supported at the bottom, with at least 51 mm. of the sample above the support, in the vertical position in such a manner that, on each side, the minimum uninterrupted area of exposed surface is not less than 3225 sq. mm. The samples are placed for two hours in a circulating air oven at 79 ±3 degrees C.

(g) All outdoor exposure tests shall be 3 years in duration, whether the material is exposed or protected. Accelerated weathering procedures are not permitted.

Excerpts from Section 14 from FMVSS 108

S14.1.2 *Plastic optical materials.* All plastic materials used for optical parts such as lenses and reflectors on lamps or reflective devices required or allowed by this standard must conform to the material test requirements of S14.4.2.

S14.1.3 All coatings used on optical materials must have added to their formulations an optical brightener, whose presince is detectable by ultraviolet light, to aid in testing for their presince. Other equivalent industry accepted methods may be used as an alternative

S14.4.2 Plastic optical materials tests. Accelerated weathering procedures are not permitted.

S14.4.2.1 Samples.

S14.4.2.1.1 Samples of materials shall be injection molded into polished metal molds to produce test specimens with two flat and parallel faces. Alternative techniques may be used to produce equivalent specimens.

S14.4.2.1.2 Test specimens shape may vary, but each exposed surface must contain a minimum uninterrupted area of 32 sq cm.

S14.4.2.1.3 Samples must be furnished in thicknesses of 1.6 ± 0.25 mm, 2.3 ± 0.25 mm, 3.2 ± 0.25 mm, and 6.4 ± 0.25 mm.

S14.4.2.1.4 All samples must conform to the applicable color test requirement of this standard prior to testing.

S14.4.2.1.5 A control sample, kept properly protected from influences which may change its appearance and properties of each thickness, must be retained.

S14.4.2.2 Outdoor exposure test.

S14.4.2.2.1 Outdoor exposure tests of 3 years in duration must be made on samples of all materials, including coated and uncoated versions, used for optical parts of devices covered by this standard. Tests are to be conducted in Florida and Arizona.

S14.4.2.2.2 Concentrations of polymer components and additives used in plastic materials may be changed without outdoor exposure testing provided the changes are within the limits of composition represinted by higher and lower concentrations of these polymer components and additives previously tested to this section and found to meet its requirements.

S14.4.2.2.3 Procedure.

S14.4.2.2.3.1 One sample of each thickness of each material must be mounted at each exposure site so that at least a minimum uninterrupted area of 32 sq cm of the exposed upper surface of the sample is at an angle of 45° to the horizontal facing south. The sample must be mounted in the open no closer than 30 cm (11.8 in) to its background.

S14.4.2.2.3.2 During the exposure time the samples must be cleaned once every three months by washing with mild soap or detergent and water, and then rinsing with distilled water. Rubbing must be avoided.

S14.4.2.2.4 Performance requirements. Plastic lenses, other than those incorporating reflex reflectors, used for inner lenses or those covered by another material and not exposed directly to sunlight must meet the optical material test requirements when covered by the outer lens or other material.

S14.4.2.2.4.1 After completion of the outdoor exposure test the haze and loss of surface luster as measured by ASTM 1003–92, Haze and Luminous Transmittance of Transparent Plastic, (incorporated by reference, see 571.108 S5.2 of this title) must not be greater than:

(a) 30% for materials used for outer lenses, other than those incorporating reflex reflectors;

(b) 7% for materials used for reflex reflectors and lenses used in front of reflex reflectors.

S14.4.2.2.4.2 After completion of the outdoor exposure test materials used for headlamp lenses must show no deterioration.

S14.4.2.2.4.3 After completion of the outdoor exposure test all materials, when compared with the unexposed control samples, must not show physical changes affecting performance such as color bleeding, delamination, crazing, or cracking. Additionally materials used for reflex reflectors and lenses used in front of reflex reflectors must not show surface deterioration or dimensional changes.

S14.4.2.2.4.4 After completion of the outdoor exposure test all materials, when compared with the unexposed control samples, must not have their luminous transmittance accordance with ASTM E 308–66 (1973), Spectrophotmetry and

Description of Color in CIE 1931 System (incorporated by reference, see 571.108 S5.2 of this title) using CIE Illuminant A (2856K).

S14.4.2.2.4.5 After completion of the outdoor exposure test all materials must conform to the color test of this standard in the range of thickness stated by the material manufacturer.

S14.4.2.3 Heat test.

S14.4.2.3.1 Procedure. Two samples of each thickness of each material must be supported at the bottom, with at least 51 mm of the sample above the support, in the vertical position in such a manner that, on each side, the minimum uninterrupted area of exposed surface is not less than 3225 sq mm. The samples are placed in a circulating air oven at 79 ± 3 °C for two hours.

S14.4.2.3.2 Performance requirements. After completion of the heat exposure and cooling to room ambient temperature, a test specimen must show no change in shape and general appearance discernable to the naked eye when compared with an unexposed specimen and continue to conform to the applicable color test requirement of this standard.