AMECA

AMECA List of Diffusing Plastic Materials

October 30, 2026



List of

Diffusing Plastics Used on Motor Vehicles

October 30, 2026 Edition

Automotive Manufacturers Equipment Compliance Agency, Inc.
1025 Connecticut Avenue, NW Suite #1000
Washington DC 20036

www.ameca.org

1. STATUS

The following materials have been accepted by the Automotive Manufacturers Equipment Compliance Agency as meeting the weathering test procedures and critera for cracking, crazing, color, and delamination of FMVSS 108. The materials do not meet 108 haze requirements. 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.

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. DISTRIBUTION

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

4. 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

5. NOTE ON COLOR

The colors listed have been determined to be in compliance with SAE J-578 using the ASTM E 308-66 method in thicknesses 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 can 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.**

6. NOTE ON INNER LENS COLOR

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

7. 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.

8. 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.

9. Note on Inner Lens Testing

Currently SAE 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 bracket test every color combination (light/dark) you want to use—red, blue, amber, etc. The light/dark colors must be in the same color space.
2) You must bracket test molecular weight (heavy/light) 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) For more information, please see SAE Paper: http://papers.sae.org/2004-01-0800

Inner lens materils will be listed as a system. Both the inner lens and outer lens material/color will be listed *together.* If you only test a limited range of lens colors, thicknesses or materials that is how they will be listed.

10. 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 company'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 company'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 company's own material. Each separate material stands alone for weathering performance unless bracketed by materials of higher and lower concentrations or molecular weights.

Q4) How many thicknesses to I have to test?
A) SAE 576: 1.6 ± 0.25 mm, 2.3 ± 0.25 mm, 3.2 ± 0.25 mm, and 6.4 ± 0.25 mm.

Q5) Even if it's for a coating?
A) Yes.

Q6) Do materials have to meet the color requirements before testing?
A) Yes: Samples for the thicknesses specified by the manufacturer must conform to the applicable color test requirement of this standard prior to testing. If no special thicknesses apply, then all 4 used by SAE J576 must comply.

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

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

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

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

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MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Asahi Kasei Corporation www.asahi-kasei.co.jp	80N	Polymethyl Methacrylate	KML1069 KML1070 KML1071 KML1090 KML1091 NS00165 NS00178	White White White White White Clear Clear

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



Covestro Deutschland AG (Europe)
Covestro LLC (America)
Covestro (Hong Kong) Limited (Asia Pacific)
www.covestro.com

Diffusive Film Product Grades Protected Applications Only		Polycarbonate	White

Makrofol® LM228 in 300/500 micron thickness
Makrofol® LM243 in 150/500 micron thickness
Makrofol® DE14 in 175/500 micron thickness
Makrofol® DE62 in 175/500 micron thickness
Makrofol® DE72 in 175/500 micron thickness
Makrofol® LM302 in 175/500 micron thickness
Makrofol® UV503 14 250 / 500 micron thickness,

Makrofol® Films were tested behind coated Makrolon AL2447 and uncoated Roehm PMMA 8N.



Covestro Deutschland AG (Europe)
Covestro LLC (America)
Covestro (Hong Kong) Limited (Asia Pacific)
www.covestro.com

Makrolon® 2405	Polycarbonate	021471	White
Makrolon® 2407	Protected Applications Only	021531	White
Makrolon® LED2245	Approved Color Codes	021532	White
Makrolon® LED2247		021533	White
		021688	White
Makrolon® LED2245DQ	Polycarbonate	028335	White
	Protected Applications Only	029335	White
	Approved Color Codes		
Makrolon® LED2245EL	Polycarbonate	021754	White
	Edge-Lighting Product Grades	021760	White
	Protected Applications Only	021767	White
		021769	White

Note: Makrolon® LED2245EL may not be used as a reflex reflector.
Makrolon® LED2245EL is considered a diffused material above 3.2 mm when behind PMMA, and above 6.4 mm when behind polycarbonate.

Note: All Covestro inner lens products are tested behind clear coated 2.3mm Makrolon AL 2647

Makrolon 2407 in diffusive colors listed is protected by Makrolon®AL2647 with Momentive Performance Materials Inc. PHC587.

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

Coating in Alphabetical Order and Corresponding Manufacturer

PHC587: See Momentive Performance Materials, Inc.

Coating Manufacturer in Alphabetical Order

Information on PHC 587C hard coat may be obtained by writing to the following:

Momentive Performance Materials GmbH
Building V7
51368 Lverkusen
Germany

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

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Evonik Operations Gmbh	VESTAMID LX9012 T8	Polyamide	---	Diffusion

www.evonik.com

Note: VESTAMID LX9012 T8 is only listed in 1.0, 1.6 and 3.2mm thicknesses.

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
LX MMA CORP.	HI835MS	Polymethyl	ID59	Diffusion
	IH830C	Methacrylate	ID68	Diffusion
www.lxmma.com	IH830HR		ID69	Diffusion
			ID88	Diffusion
Formery LGMMA Corproation			ID178	Diffusion
			ID188	Diffusion
			ID193	Diffusion
			ID195	Diffusion
			ID198	Diffusion
			ID1558	Diffusion
			ID1559	Diffusion

Color ID59 is available on HI835MS from 1.6 mm to 3.2 mm only
Color ID59 is available on IH830C from 1.6 mm to 3.2mm only
Color ID88 is available on HI835MS from 1.6 mm to 3.2 mm only
Color ID88 is available on IH830C from 1.6 mm to 3.2 mm only

Material HI835MS is available in colors ID68, ID178, ID188, ID193, ID195 ID198, ID1558, and ID1559 in all thicknesses
Material IH830C is available in colors ID1559 in all thicknesses
Material IH830C is available with colors ID68, ID178, ID188, ID193, ID195 ID198, and ID1558 in 3.2 mm only
Material IH830HR is not available in Color ID193 in any thickness

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Mitsubishi Chemical Corporation	DURABIO D7342DR www.m-chemical.co.jp	Aliphatic Polycarbonate	06D075	Diffusive

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
MOCOM Compounds GmbH & Co. KG www.mocom.eu	Alcom PC 740/4 UV	Polycarbonate	CC1320-08LG	Clear/ light scattering
			CC1321-08LG	Clear/ light scattering
			CC1322-08LG	Clear/ light scattering
			CC1323-08LG	Clear/ light scattering
			RD1123-05 LD	Red, diffusive
	Alcom LG PC 1000 UV		14094 CC1323-08	Clear/ light scattering

Note:
All Mocom inner lens products are tested behind clear 2.0 mm Makrolon GP 099 coated with protective Momentive Performance Materials Inc. PHC 587.

RÖHM TRADITIONALLY INNOVATIVE Roehm America LLC Röhm GmbH Roehm Chemical (Shanghai) Co., Ltd www.roehm.com www.acrylite-polymers.com www.Plexiglas.de	PMMA ACRYLITE®/ PLEXIGLAS® **Softlight**	8N zk3BR zk4BR zk5BR zk6BR AG100	df20 df21 df22 df23	**Clear** -- 0 1 9V913 **Neutral** 543A
	PMMA ACRYLITE®/ PLEXIGLAS® **Softlight**	8N AG100	df42 df43 df44 df46 df47	**Yellow** 13025 23085 1V400 2V404
	PMMA ACRYLITE®/ PLEXIGLAS® **Softlight**	8N AG100	df92 df93 df95 df97 df98 df99	**Amber** 23340 23095 23335 13115 23105 2V401
				Red 3V137 3V136 3V126 3V125 33661 33681 33780(901) 33721 33711 ~~33701~~ 33691 3V401 3V402 3V403 3V408
				Green 65122 65542
				Gray 7V274 7V275 7V273 7V271 7V272 7V270 7V269 7V268 7V265 7V205 7V336 7V337 7V338 7V244 75451 77670

Note: 7V336, 7V338 and 7V337 are listed from 1.6 to 3.2 mm only

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Sumitomo Chemical Co., Ltd. www.sumitomo-chem.co.jp Note: Color 4912 is listed in from 2.3 mm to 6.4 mm only	SUMIPEX® F10	Polymethyl Methacrylate	011 4912 4999	White Red Red
Sumitomo Chemical Asia PTE Ltd. http://sumitomo-chem.com.sg Note: Color 4912 is listed in from 2.3 mm to 6.4 mm only	SUMIPEX® F10	Polymethyl Methacrylate	011 4912 4999	White Red Red
Sumitomo Chemical Europe S.A./N.V. www.sumitomo-chem.be Note: Color 4912 is listed in from 2.3 mm to 6.4 mm only	SUMIPEX®® F10	Polymethyl Methacrylate	011 4912 4999	White Red Red

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
Teijin Limited	PANLITE ML-2200 PANLITE ML-2205	Polycarbonate		Clear

www.teijin.co.jp

Note: Only 1.6mm thickness was tested.

MFR.	TRADE NAME AND FLOW FORMULATION	TYPE OF RESIN	NUMBER	COLOR
	ALTUGLAS™(Or PLEXIGLAS™)	Polymethyl		Colorless/Clear
	ALTUGLAS™ R-Life	Methacrylate	58102	White
	PLEXIGLAS™ R-Life		58200	White
	V045		58235	White
	V825		66080	White
Trinseo Inc.	V825 CR50		68177	White
Altuglas Division	V920T		616	Red
Altuglas S.r.l. (Italy)	DR		756	Red
Trinseo Korea Ltd.	Diffuse 81		18242	Red
Altuglas Division	Diffuse 101		883	Amber
www.trinseo.com	Diffuse 301		937	Amber
www.plexiglas.com	Diffuse 302			
www.altuglas.com	Diffuse 502			
	MI7			

V920T is only available in color 68177 white.

PLEXIGLAS™ or ALTUGLAS™ Frosted V045 is only in white 68177

Note: Red 756 is only listed for the thickness 0.177 inches and thicker.
Note: Amber 937 is only listed for thickness 0.125 inches and thinner.

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Appendix A: AMECA Accredited Laboratory Information

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.atlas-mts.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.atlas-mts.com

Q-Lab Arizona Test Services
21212 W Patton Rd.
Wittmann, AZ 85361
Tel: (623) 386-5140
FAX: (623) 386-5143
Website: www.q-lab.com

Q-Lab Florida Test Services and
1005 S.W. 18th Avenue, P.O.
Box 349490
Homestead, Florida 33034
Tel: (305) 245-5600
FAX: (305) 245-5656
Website: www.q-lab.com

Appendix B: Supplemental Lab Information

ATLAS
MATERIAL TESTING SOLUTIONS

ACCELERATING YOUR EXPERTISE

Helping You Put Your Products To The Test



THE GLOBAL LEADER IN PRODUCT DURABILITY, PERFORMANCE & WEATHERING TESTING INSTRUMENTS & SERVICES

AMETEK
MEASUREMENT & CALIBRATION TECHNOLOGIES

Instruments

Accelerated Weathering ❖ Corrosion ❖ Flammability ❖ Solar Environmental ❖ Technical Lighting

Ci Series Weather-Ometers



Atlas' flagship accelerated weathering instruments offer superior performance, innovative features, and large capacity.

- Water-cooled xenon arc lamps and advanced filter technology deliver the best simulation of natural sunlight
- Best-in-class uniformity for irradiance, temperature, relative humidity and spray
- Intuitive touch screen controls
- Custom testing capabilities

SUNTEST® Family



The most widely used flatbed xenon test chambers available in tabletop or free standing models to meet lower testing capacity needs. Features include:

- Optical light filters to simulate indoor/outdoor sunlight
- A variety of accessories ideal for testing realistic end-use conditions
- Best-in-class flatbed irradiance and temperature uniformity

Xenotest® Instruments



These premium air-cooled accelerated weathering instruments offer an array of options to meet virtually all global weathering and lightfastness testing requirements.

- Designed with state-of-the-art controls
- On-rack radio-controlled sensor technology for superior monitoring of light and temperature
- High water and power efficiency

UVTest



An economical fluorescent/UV weathering test instrument for product screening at lower operating costs.

- Simple touch screen operation and control in several languages
- Patented irradiance calibration safety access ports
- Remote Ethernet data acquisition application
- Recirculating spray water option

Corrosion Cabinets



The most sophisticated and versatile corrosion and salt fog cabinets available. Capable of replicating automatic cycling between several environmental conditions to reduce the need to move or otherwise handle test specimens.

- Design maximizes testing volume
- Large solution reservoir
- Optional features allow for simulation of several environmental conditions

Flammability Chambers



Atlas flammability chambers offer unmatched accuracy, repeatability and safety when determining the burn rates and resistance of various materials.

- All chambers are easy to install and operate
- Specimen holders available to accommodate a variety of material types
- Chambers are available for appliance, aircraft and automotive applications

Solar Simulation Systems



Atlas Custom Systems designs and builds custom solar simulation systems such as walk-in chambers or full-scale test facilities. These full scale test facilities use a series of highly coordinated metal halide lights to provide uniform radiant energy to meet the demanding testing needs of many industries.

Solar Environmental Chambers



A group of integrated, easy-to-use test chambers for various solar and environmental applications. These instruments combine environmental simulation with metal halide lighting technology and are ideal for testing medium to large sized automotive, plastics, electronics and 3D components, finished products as well as PV modules.

Technical Lighting Systems



Atlas/KHS technical lighting systems are designed for high-speed photography and video. These systems are ideal for crash testing and other safety experiments, custom designed to match the complex illumination requirements of various test configurations. Available with conventional HMI light sources or the latest LED technology, these lighting systems offer an array of solutions for analytical testing of high speed events.

Our mission is to help our customers worldwide provide the most reliable and durable product solutions through our combined experience and expertise in weathering instruments and testing, custom capabilities, consulting and global support.

Services

Natural & Accelerated Weathering Testing ❖ Evaluations ❖ Consulting ❖ Technical Support ❖ Client Education

Natural Weathering Services



Atlas offers outdoor weathering sites worldwide to ensure factors from a variety of climates can be tested.

- Static Exposure Testing
- Sun Tracking Exposure Testing
- EMMAQUA® Accelerated Outdoor Testing
- Ultra-Accelerated Weathering Testing
- Automotive Exposure Testing (Samples, Components, Complete Vehicles)

Accelerated Laboratory Weathering Services



Atlas Weathering Services Group operates one of the largest networks of ISO/IEC 17025 accredited accelerated weathering testing laboratories in the world. Our indoor exposure labs offer artificial accelerated weathering tests and a variety of other environmental test programs, all designed to accurately simulate true end-use conditions and meet global weathering standards.

Evaluation Services



Atlas offers a wide range of evaluation and measurement services for your specimens during and after the weathering process.

- Instrumental Color/Gloss Measurements
- Visual Evaluations
- Photography/IR Imaging
- Emittance
- Spectral Transmittance/Reflectance
- Solar Reflectance Index
- Additional Optical Property Measurements

Consulting Solutions



Atlas Consulting Solutions offers design and implementation of environmental durability testing methods, programs, and strategies. Our international group of weathering experts help you achieve your objectives through all stages of the value chain from materials to components, systems to end-use products.

Worldwide Technical Support



Proper maintenance is critical in order for your instrument to operate at peak performance. Atlas' AMECARE Performance Services Program ensures that your instrument will operate optimally at all times. Benefits include:

- Preventative maintenance inspections
- Scheduled ISO accredited calibrations (where available)
- Detailed service reports with professional assessment of key components

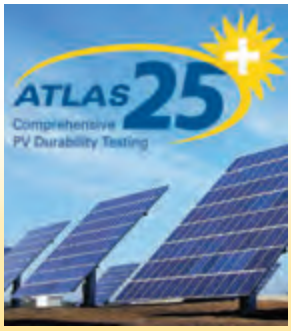
Client Education & Training



Atlas offers an array of resources designed to advance your weathering education and provide you with the knowledge you need to successfully meet your testing requirements. Events include:

- Seminars
- Workshops
- Webcasts
- In-House Programs
- Technical Conferences

Solar Industry Solutions



Atlas offers a complete portfolio of testing services to evaluate the performance, durability and reliability of solar cells, modules, complete arrays, concentrated solar power products and solar thermal collectors. Atlas also offers its proprietary Atlas 25+® long-term durability testing program for solar modules.

ATLAS
MATERIAL TESTING SOLUTIONS

Ultra-Accelerated EMMA®









AMETEK®
MEASUREMENT & CALIBRATION
TECHNOLOGIES

THE BENEFITS OF ULTRA-ACCELERATED TESTING

What is the Ultra-Accelerated EMMA®?

The Ultra-Accelerated EMMA (UA-EMMA) is Atlas' latest advancement in natural exposure testing. This new outdoor testing device delivers approximately 10-12 years of equivalent radiation exposure as would be received in a standard outdoor testing rack in South Florida in a single year.

The system achieves this accelerated exposure through a patented "cool mirror" technology that has very high reflectance in the UV and near visible wavelength ranges while attenuating reflectance in the longer wavelength visible and IR portions of the solar spectrum.

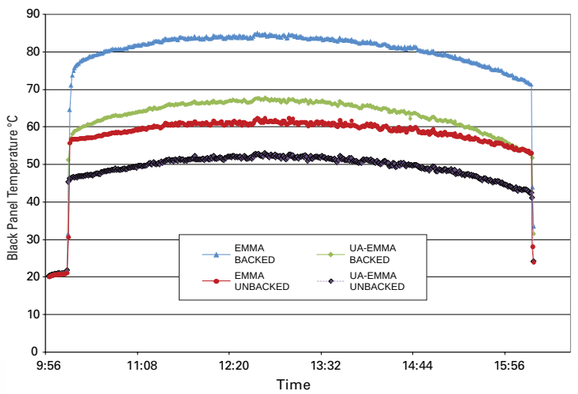


What are the Advantages?

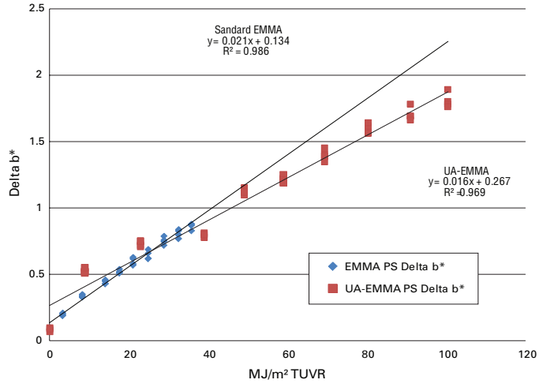
The new UA-EMMA system allows for greatly accelerated testing while fulfilling three critical testing requirements:

- Exposes many different types of materials to ultra-high UV irradiance
- Maintains high fidelity to the natural solar UV spectrum
- Keeps specimens at acceptable exposure temperatures

Black Panel Temperature Performance
UA-EMMA vs. Standard EMMA Data



Comparison of Polystyrene (PS) Reference Material in Standard EMMA and UA-EMMA by UV Radiant Exposure



Ideal Materials for UA-EMMA® Testing

- Materials that require a long service life
- Transparent and glazed materials
- Temperature sensitive materials such as PVC
- Coatings applied to metal panels
- Materials that perform well in EMMA or EMMAQUA exposure testing

EMMAQUA® Weathering Standards

The table below lists selected standards for EMMAQUA exposure. For details, refer to the individual standards. Test methods which are proprietary to individual companies and which also specify Fresnel-based exposure methods are not listed here.

EMMAQUA STANDARD	SCOPE	COUNTRY
ISO 877-3	Plastics	International
ASTM D3841	Glass-fiber reinforced polyester	USA
ASTM D4141	Coatings	USA
ASTM D4364	Plastics	USA
ASTM D5722	Coated hardboard	USA
ASTM E1596	PV modules	USA
ASTM G90	Non-metallic materials	USA
SAE J576	Optical automotive plastics	USA
SAE J1961	Automotive exterior	USA
SAE-AMS-T-22085	Preservation sealing tape	USA
JIS Z2381	General	Japan

Applications

- Adhesives
- Agricultural Films
- Automotive Exteriors
- Building Materials
- Elastomers
- Glass (Architectural & Automotive)
- Packaging
- Paints & Coatings
- Plastics
- Roofing
- Sealants



1958



The first EMMAQUA® device, constructed with a wooden frame and sheet metal skin, is patented, manufactured and placed into service.

1969

Atlas' DSET Laboratories relocates from Phoenix to New River, Arizona. The EMMAQUA device is redesigned with a steel framework and more efficient spray delivery system.



1986



EMMAQUA+®, the next generation of accelerated weathering devices, is introduced. Advancements include individual cycle programming, black panel temperature control, and altazimuth solar tracking for more efficient delivery of full-spectrum solar energy.

1999

The MQ3K is launched, utilizing state-of-the-art technology in computer-controlled cycle programming, more accurate altazimuth solar tracking, one-touch start/stop, error sensing feedback and the most-specular mirrors available.



2004



Atlas introduces four patented suites of Temperature-Controlled EMMAQUA. (Static, Night, Dynamic Temperature and Variable Irradiance Control). This breakthrough allows for the testing of materials that are sensitive to thermal buildup.

2014

Atlas introduces the UA-EMMA, the latest advancement in outdoor accelerated testing. This device couples the EMMA platform with a new patented mirror system, optimizing real-world correlation.





Global Support, Weathering Exposure Sites & Laboratories

■ Corporate Offices

Chicago, Illinois USA ■ Linsengericht, Germany ■ Shanghai, China ■ São Paulo, Brazil
Élancourt, France ■ Mörfelden-Walldorf, Germany ■ Bangalore, India ■ Leicester, United Kingdom

● Outdoor Exposure Sites & Laboratories

Miami, Florida USA • Phoenix, Arizona USA • Sanary, France • Chicago, Illinois USA• Duisburg, Germany • Leicester, United Kingdom
Hoek van Holland, The Netherlands • Chennai, India • Prescott, Arizona USA • Loveland, Colorado USA • Medina, Ohio USA
Keys, Florida USA • Jacksonville, Florida USA • Alberta, Michigan USA • Hainan, China • Guangzhou, China
Seosan, Korea • Miyakojima, Okinawa, Japan • Choshi, Japan • Kirishima, Japan
Singapore • Melbourne, Australia • Townsville, Australia • Novorossiysk, Russia
Gelendzhik, Russia • Moscow, Russia

▲ Local Sales & Service Support

To contact your local Atlas Sales representative please visit http://atlas-mts.com/contact/local-representatives/

For general inquiries please contact us at atlas.info@ametek.com

www.atlas-mts.com

Specifications and features of products and services are subject to change without notice.

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Q-Lab Test Services

- Florida & Arizona Outdoor Exposures
- Accelerated Laboratory Testing
- Evaluations

Q-LAB

Weathering & Outdoor Climatic Testing

If you're concerned about your product's appearance or functional performance in the outdoor environment, you're not alone. Sunlight, heat, and moisture cause billions of dollars in product damage every year. A proper weathering testing program can help you anticipate and prevent a variety of potential product failures, meet durability specifications, and preserve your reputation for quality.

Will your product last outdoors? Don't guess when you can test!



















WHY TEST?

Reliable weathering and corrosion data can help you:

- Avoid unexpected product failures
- Make the best material selection decisions
- Validate new or less-expensive materials or additives
- Improve your competitive advantage
- Warranty your product's lifetime with confidence

Natural outdoor weathering and corrosion testing give the most realistic prediction of product performance. Accelerated testing, available both outdoors and in the laboratory, gives faster results but with some uncertainty about its accuracy. Many companies combine both approaches to ensure reliable results in the shortest time possible.

WHY CHOOSE Q-LAB?

Experienced and Reliable

Q-Lab provides the highest-quality weathering testing services. Our first natural weathering site opened in 1959. Today, our scientists and engineers participate and offer leadership in ISO, ASTM, IEC, GB, and numerous other professional organizations in creating standardized test methods and procedures.

Instant Credibility

When Q-Lab does your testing, the results have instant credibility with your customers and colleagues. Q-Lab conducts all exposure tests and evaluations in accordance with appropriate test methods from ASTM, ISO, BSI, DIN, JIS, SAE, GB, and other recognized organizations and is accredited by AMECA and AAMA.

Cost-Effective

Q-Lab's state-of-the-art test services are available at a surprisingly affordable price. In many cases, it is less costly to test with Q-Lab than to set up and run tests yourself.

Best Test Sites, Best Technology

South Florida and Arizona, where Q-Lab does most of its outdoor testing, have been recognized for over a century as harsh climates for product testing. If your products perform well in these benchmark locations, they will perform well just about anywhere. Q-Lab uses the most trusted accelerated weathering and corrosion technologies, used by thousands of companies in dozens of industries.

Natural Outdoor Testing

Location is everything. About one hundred years ago, companies in the paint and automotive industries realized that environmental conditions in South Florida and the Arizona desert were the harshest on their products. Several companies operated their own test sites in these locations, and they used what they learned to make their products durable enough to ensure generations of satisfied customers. Today, much of this testing has been consolidated at Q-Lab's sites in Florida and Arizona. Companies around the globe trust Q-Lab to perform their outdoor product testing.

FLORIDA

The subtropical climate of the Miami area has the perfect year-round combination of abundant sunlight, warm temperatures, and plentiful water. Sunshine during the summer months in Miami is quite similar to that of northern temperate regions. However, in the winter the difference is dramatic. The key point is that it is the same sun—just more of it, and for a longer duration each year. The same holds true for temperature, rainfall, dew, and humidity.

The result of this perfect combination of environmental factors is that exposures at Q-Lab Florida are accelerated compared to temperate climates. One year of Florida sunshine can produce the same weathering effects on materials as several years of weathering in most major markets around the world. Specimens that can withstand the sunlight, heat, and water in south Florida can be expected to be durable in most locations around the world.

SOUTH FLORIDA IS PERFECT FOR TESTING:

- Sunlight (UV) stability
- Moisture sensitivity
- Mildew/mold resistance
- Surface erosion
- High-temperature resistance
- Thermal shock response
- Corrosion behavior
- Moisture ingress
- Acid rain resistance



THE GLOBAL BENCHMARK
Q-Lab Florida has more specimens on test than any other outdoor weathering facility in the world.



DESERT TESTING
Arizona features even hotter temperatures and higher levels of sunlight than Florida.

ARIZONA

Arizona's desert climate is characterized by intense sunlight, very high temperatures, minimal rainfall, and very low humidity. Arizona desert exposures provide a different – in some ways harsher – exposure environment than Florida subtropical tests. Compared with Florida, Arizona is much hotter and receives about 15-20% more annual total solar and UV energy. Arizona experiences large day to night temperature variations, about 17 °C (31 °F) on average. Arizona receives little annual rainfall and has low atmospheric moisture overall. Specimens tested in the Arizona desert can be expected to have superior resistance to sunshine and elevated temperatures.

ARIZONA DESERT IS PERFECT FOR TESTING:

- Sunlight (UV) stability
- Heat aging effects
- Thermal expansion stress resistance
- Heat deflection and distortion
- Material durability in low humidity environments

OHIO

Northeast Ohio has a Northern Temperate climate, meaning it experiences four true seasons during the year. Outdoor specimens are subject to a range of exposures to UV light, temperature, and water, including regular freeze/thaw cycles during the winter.

Although Northeast Ohio testing will generally not attain the acceleration of natural outdoor testing in Florida or Arizona, it does deliver conditions experienced by much of the population of the United States and the rest of the world.

Some industries include a benchmark Northern Temperate climate in their certification programs, in addition to Florida and Arizona, to ensure a fully comprehensive program for natural weathering. Ohio is ideal for meeting these requirements.





Accelerated Laboratory Testing

Q-Lab offers a full range of accelerated laboratory weathering and corrosion testing services at our fully-equipped facilities in Florida and Germany. Q-Lab can perform most testing that utilizes xenon arc, fluorescent UV, salt spray, or cyclic corrosion chambers. Contract testing at Q-Lab is an ideal solution for companies that:

> Have a short-term need for testing but aren't ready to invest in facilities and equipment

> Need additional testing capacity that the in-house lab can't accommodate

> Have a special project with a new test cycle that can't be performed in-house

> Need third-party verification of test results

STANDARD & CUSTOM EXPOSURES

Tests and evaluations are performed to appropriate ASTM, ISO, EN, DIN, JIS, SAE, GB, AATCC, or other standard procedures.

Visit **Q-Lab.com/standards** or contact Q-Lab to discuss a particular standard.

We can also perform custom exposures to meet your individual testing needs. **More on page 13.**

TWO LABS, ONE STANDARD OF QUALITY

> Homestead, Florida USA
> Saarbrücken, Germany

Both locations follow the ISO 17025 accredited Quality System, ensuring the best care for your projects.



Homestead, Florida USA



Saarbrücken, Germany



RAPID RESULTS
Xenon arc test chambers are used to test colorants in paints and plastics.

TYPES OF ACCELERATED TESTS



XENON ARC WEATHERING

For weathering tests that require full sunlight simulation, the **Q-SUN** xenon arc weathering chamber can perform a variety of methods from the automotive, textile, building material, paint, plastics, personal care, or other industries. Xenon arc instruments are usually the best choice for applications where color change is the primary failure mode of concern.



FLUORESCENT UV WEATHERING

When changes to physical properties of polymeric materials are the concern, the **QUV** accelerated weathering tester is an effective tool for comparative testing. Fluorescent UV lamps match the most damaging portion of the sunlight spectrum (UVA and UVB), reproduce degradation from germidical treatments (UVC), or simulate indoor environments (Cool White).



SALT SPRAY/ CYCLIC CORROSION

Q-FOG cyclic corrosion chambers can perform any test from simple salt spray to tests with precise control of RH and moisture transitions, which is required by most OEM automotive standards. In addition, certain models can also perform demanding modern test protocols like CASS and JASO M609.

Q-TRAC Natural Sunlight Concentrator Testing

Faster test, natural environment. Accelerated outdoor materials testing using a Q-TRAC natural sunlight concentrator delivers the benefits of testing in a natural outdoor environment while at the same time amplifying the sunlight and heat delivered to specimens. This testing is especially useful for highly-durable materials with long expected lifetimes.

SUPER-FAST RESULTS FROM NATURAL SUNLIGHT

The Q-TRAC delivers the same amount of damaging ultraviolet energy in just one year as specimens would experience in five years of Florida sunlight. Like other accelerated tests, sunlight concentrator testing allows products to be brought to market faster, but the Q-TRAC uses natural sunlight to reduce further the risk of generating erroneous test results. In this way, the Q-TRAC delivers dual benefits – the realism of natural exposures and the speed of accelerated laboratory tests.

Q-TRAC IS PERFECT FOR TESTING:

- Roofing
- Coil coatings
- Fluoropolymers
- Geosynthetics
- Powder coatings
- Building materials
- Industrial coatings
- Hardboard coatings

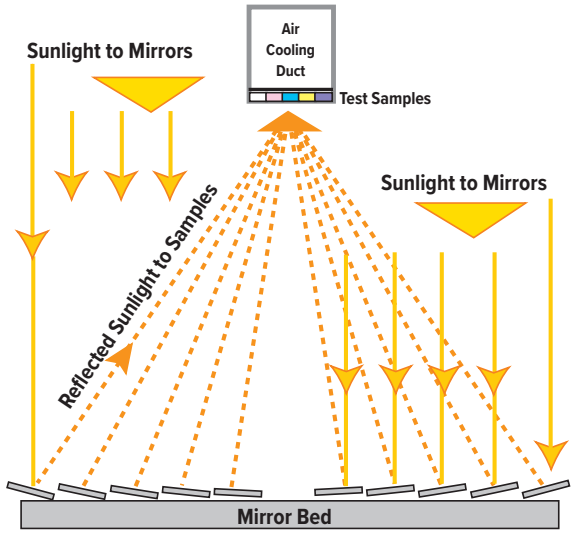
ONLY IN ARIZONA

Q-TRAC testing requires a high proportion of direct beam sunlight and low cloud cover that exists only in very dry environments.



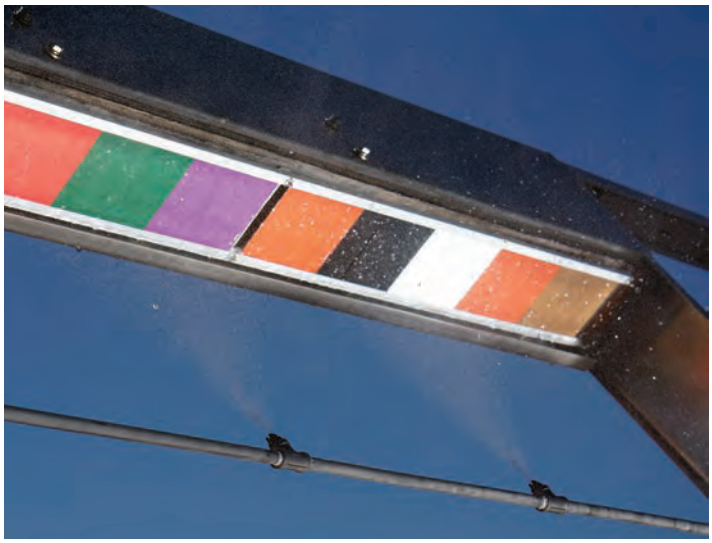
ENHANCED SUNLIGHT WITH CONCENTRATING MIRRORS

The Q-TRAC system uses an array of 10 flat mirrors to reflect and concentrate natural sunlight onto the test specimens. It further maximizes the exposure by automatically tracking the sun throughout the day in both azimuth (horizontal) and elevation (vertical).



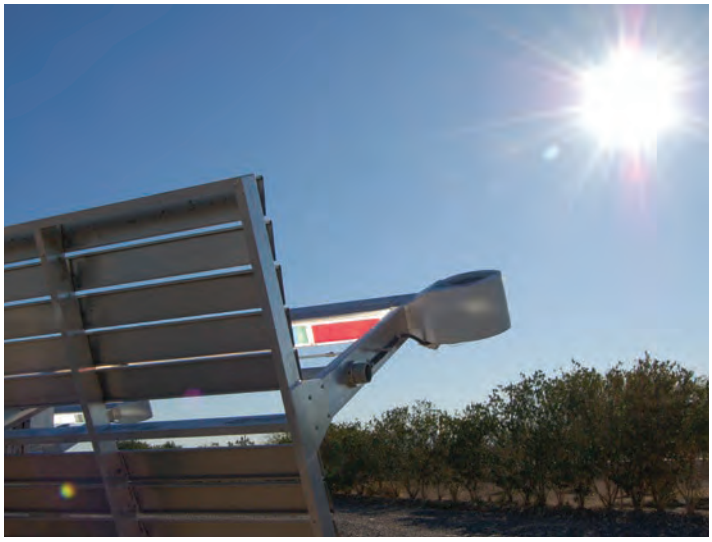
Q-TRAC WATER SPRAY & SPECIAL APPLICATIONS

Water spray during the night time can simulate the time of wetness experienced in Florida, and during the day it can simulate thermal shock associated with rain bursts. During night-time wetting, specimens are oriented facing upward to give increased wetness and realism compared to original natural sunlight concentrator testing. Q-Lab also offers temperature-controlled Q-TRAC testing for more heat-sensitive specimens.



Several standardized cycles—including desert, freeze/thaw, and spray are available to test different materials and end-use application. Standards include:

- ASTM G90
- ASTM D4141
- ASTM D4364
- ASTM D5105
- ASTM D5722
- SAE J1961
- SAE J576
- ISO 877-3
- AAMA 623, 624 and 625



Automotive Interior Testing

Accelerated testing to simulate behind-glass environments. Interior components in automobiles and other behind-glass environments can experience higher temperatures than materials in service outdoors. AIM box testing delivers high temperatures in combination with natural sunlight behind window glass for fast, realistic testing.

AIM BOX

An Automotive Interior Materials (AIM) box is an under-glass enclosure that simulates the sunlight and heat found inside an automobile. Although this technology was developed for the automotive industry, it can be very effective for many applications where glass-filtered sunlight and heat are important stressors, such as building window assemblies and electrical enclosures.

Key test standards for AIM box testing include GMW 14873, GMW 16717, GMW 3417, GM 2617M, GM 3619M, GM 7454M, GM 7455M, GM 9538P, Ford DVM 0020, and ASTM G201.

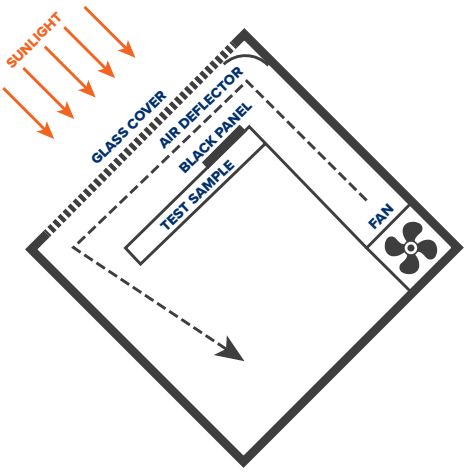
DEGRADATION MODES PRODUCED IN AIM BOX TESTING:

- Color change
- Cracking
- Peeling
- Oxidation
- Heat deflection
- Tackiness

REALISTIC SIMULATION

Testing automotive interiors can be different from testing other materials because air temperatures inside a vehicle can far exceed the temperature outside it. Materials can reach 100 °C or more in warmer climates. Furthermore, the light that reaches internal components is filtered by automotive glass, making it different from natural outdoor sunlight.

The AIM box uses tempered glass - clear or laminated - to simulate the sunlight spectrum experienced inside a car. In addition, a black panel thermometer continuously monitors the environment inside the box. A cooling fan and curtain are used to ensure that specimens are maintained at precise and realistic temperatures.





HIGH TEMPERATURE TESTING
Automotive instrument and dashboard panels are commonly tested in AIM boxes.

ACCELERATION

The AIM box in Arizona can perform precision azimuth tracking of the sun throughout the day. This boosts the total amount of solar radiation reaching the specimens for faster results without sacrificing accuracy.

TRUE AIM BOX

To increase the total amount of solar radiation exposure, Q-Lab's proprietary new TRUE (Tracking Reflecting Ultra Exposure) AIM box uses highly reflective mirrors and dual-axis tracking (azimuth and elevation) to focus more sunlight into the box interior. This technique approximately doubles the total sunlight received every day.



Standard Outdoor Exposures

True benchmarking via standardized testing. Natural outdoor testing according to international test standards gives improved consistency of results from test to test. Having a library of outdoor test data according to recognized test standards gives the best estimate for a product's service life and serves as an excellent basis for comparison to accelerated laboratory testing.

DIRECT EXPOSURE (ASTM G7, ASTM D1435)

Specimens can be securely mounted at a variety of angles for direct exposure to the sun. Various backing techniques are available to simulate the thermal environment of the specimen's intended service application. Plywood backing raises temperatures, while open- or mesh-backed specimens receive maximum natural air flow for cooler temperatures.



UNDER GLASS (ASTM G24, ISO 877-2)

These exposures are used to test interior-use materials, such as textiles and printing inks. Specimens are behind 3 mm window glass which will filter out short-wavelength (UVB) light. Exposures are typically at a 45° or 5° angle from horizontal.



BLACK BOX (ASTM D4141, GMW 14873)

These tests reproduce conditions found on the horizontal surfaces of a vehicle, including higher temperatures and longer wet times. Under glass black box exposures are used to test automotive interior materials or other applications that experience similar conditions.

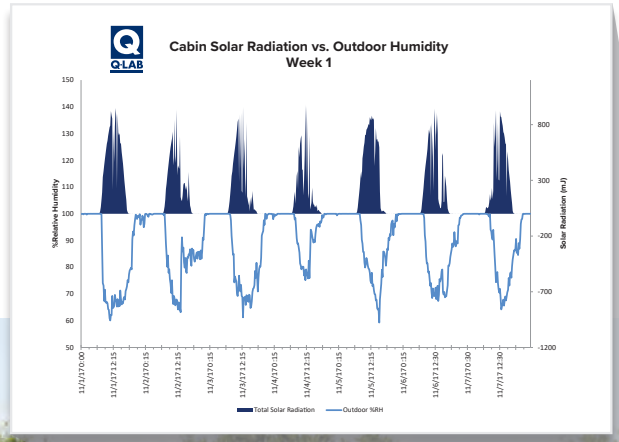


Other standard outdoor exposure test methods are available, including salt-accelerated, outdoor acid etch, and mildew-enhanced weathering.

Custom Tests & Special Projects

If you need a specialized test for a component, assembly, or complete product, Q-Lab can customize a test program to identify any problem areas quickly. Do you need to measure the temperature profile of multiple areas of your product throughout the day? Or design a test that accurately simulates your product's end use? Whatever your need, our experts can design a customized test solution to fit your budget.





Outdoor weathering testing in a replicated end use environment, like the shed shown above, can demonstrate interactions between components and give a more realistic representation of outdoor product durability.

DETAILED DATA ACQUISITION

Q-Lab can instrument your product to capture the data most important to you, and we always take care to protect confidentiality.

Evaluations & Physical Testing

Exposing your products or materials is only half of the equation. Measuring how they degrade over time is the other half. Q-Lab's engineers and technicians are worldwide experts at identifying and quantifying how your materials change when exposed to weathering or corrosion tests. We have many tools at our disposal to tell you nearly everything you need to know about your product's performance.

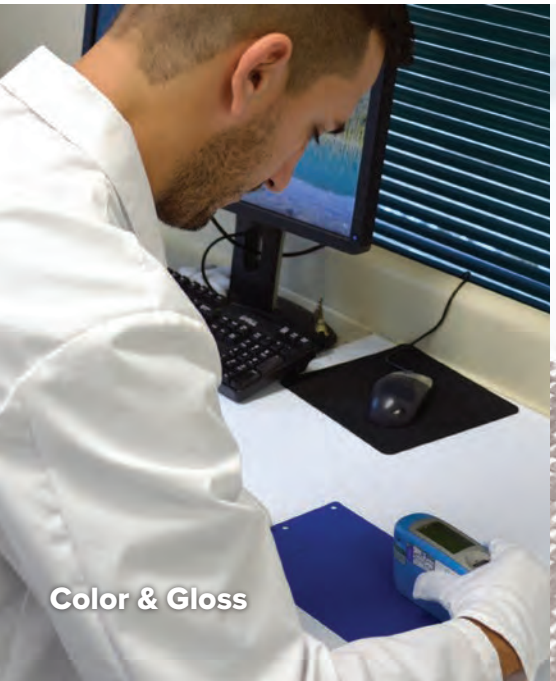
VISUAL EVALUATIONS

Visual evaluations detail all defects observed, such as cracking/checking, blistering, chalking, dirt retention, flaking, mildew growth, surface rust, or color change, according to standardized rating scales.

Q-Lab technicians are highly trained and experienced experts in the field of evaluation techniques and reporting scales. Many are actively involved in the organizations that create and maintain the standards relied upon by labs around the world.

COLOR & GLOSS MEASUREMENTS

Instrumental measurements of appearance and surface characteristics include gloss, distinctness of image, and color. These are used in place of or in addition to visual ratings, and are required by many standards. The science of color and appearance measurement can be very complex, and Q-Lab's experts can guide you through your options to ensure you get the correct data for your needs.


Color & Gloss


Mechanical


Photography



VISUAL EVALUATIONS

All visual ratings are made under standard lighting conditions to provide accurate, repeatable results.

MECHANICAL TESTS

Mechanical tests on physical properties are necessary for many products and materials. They include:

- Drop impact
- Pencil hardness
- Tape adhesion
- Mandrel bend & elongation
- Tensile strength & elongation
- Shear & peel adhesion
- Gravelometer stone chip impact
- Taber abrasion

PHOTOGRAPHY & SPECIAL HANDLING

A complete test program often includes other special services or handling. Common services include washing, polishing, scribing, and specimen weighing. Q-Lab can also photograph weathering and corrosion changes, which requires special lighting skills and equipment.



Q-LAB

OUR GLOBAL NETWORK

We are committed to provide world-class technical, sales, and repair support in each of the over 60 countries in which we operate. Visit **Q-Lab.com/support** for contact information specific to your location and inquiry type.

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