

# Weathering & Light Stability

## A Testing Summary Guide

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**Weathering** causes millions of dollars of product damage every year. Damage includes color change, gloss loss, strength loss, cracking, peeling, chalking and oxidation. The main causes of weathering are sunlight (especially UV), high temperatures, and moisture in the form of rain, dew and high humidity. In addition, there are often synergistic effects between sunlight and moisture. Materials resistant to light alone and moisture alone may fail when subject to light and moisture in combination.

**Indoor Light Stability** is often critical for products and materials exposed to sunlight filtered through window glass, or whose service life exposes them to bright indoor lighting.

## Which approach is best for you?

Q-Lab has a range of products and services to answer your weathering or light stability questions. Unfortunately there is no single testing technique that is perfect for all materials and applications. The approach you choose depends on what you need to accomplish, your time frame, your budget and the material you are testing. Each technique has inherent strengths and weaknesses and users must educate themselves to make an informed choice.

**Outdoor Weathering in Florida or Arizona** is the world standard for sunlight and moisture. It allows the most realistic prediction of product performance. However, exposure tests can take years to complete.

**The Q-TRAC® Natural Sunlight Concentrator** intensifies natural sunlight on test specimens, providing fast, natural results. However, it is subject to seasonal variations in weather and high temperatures.

**The QUV® Weathering Tester** is fast and economical. Fluorescent UV lamps provide the best simulation of solar UV. However, the QUV lacks the longer wavelengths necessary for testing certain materials.

**The Q-SUN® Xenon Test Chamber** reproduces the full spectrum of sunlight, including UV, visible and infrared. It is especially useful for testing dyes, pigments, textiles, inks and indoor materials. However, xenon arcs are inherently less stable than fluorescent lamps and water spray is less realistic than the QUV tester's condensation cycle.

**Laboratory Test Services** are ideal when you are not prepared to purchase your own tester or have capacity limitations. Q-Lab Weathering Research Service can perform QUV and Q-SUN exposures for you.



**Knowing the weatherability of your product is too important to leave to chance. Q-Lab's products and testing services include natural outdoor and accelerated techniques to best test the light stability and weatherability of your products.**

**Recommendations.** Predicting the future is always difficult, but knowing how long your product will last outdoors is too important to leave to chance. Because no laboratory test can replicate all of the things that can occur outdoors, we believe that all testing programs should be based on natural exposures in both Florida and Arizona. These exposures are remarkably inexpensive. We also recommend that you perform at least one accelerated test, on the QUV, Q-SUN or Q-TRAC testers. The accelerated test you choose should be optimized for the material and the end-use application. This combined approach allows you to proceed with confidence. The natural outdoor exposures provide a solid baseline, while the accelerated tests give fast data on new developments.

## Outdoor Weathering in Florida & Arizona

In today's international marketplace, few companies sell into a strictly local market. However, due to differences in climate, product performance may vary greatly from place to place. Scientists often use "Florida Weathering" and "Arizona Weathering" as international benchmarks for durability testing because these locations typically produce faster degradation than exposures in more temperate climates.



**Resistance to sunlight and moisture is a fundamental measure of a product's durability.**

**Florida Weathering.** Florida has high intensity sunlight, high year-round temperatures, abundant rainfall and high humidity. This harsh climate is ideal for testing exterior durability. It is especially useful for moisture sensitive materials like coatings, building materials and many plastics. Florida is also excellent for testing mildew resistance.

**Arizona Weathering.** The Arizona desert provides another benchmark for durability. Products are exposed to brutal, yet realistic conditions: high UV, very high temperatures, large daily temperature fluctuations and low moisture. Arizona receives about 20% more sunlight than Florida; maximum air temperatures are commonly 10°F hotter. For many materials, this harsh environment produces even faster degradation than Florida. Particularly affected are color and gloss of coatings, heat aging and physical properties of plastics, coatings on plastics, lightfastness and tensile strength of textiles.



**Q-Lab conducts weathering exposures on panels, parts, components and assemblies.**

### **Remarkably Inexpensive.**

A typical outdoor exposure program is less than \$500/year/location. And that includes all the necessary evaluation procedures like gloss and color measurements, visual evaluations, etc.

### **Natural Weathering Advantage**

- Instant Credibility
- Real World Exposure Results
- Accredited, Third-Party Test Results

## Q-TRAC Natural Sunlight Concentrator

**Accelerated NATURAL Weathering.** If you need fast answers, but don't want to use laboratory devices that only simulate sunlight, the Q-TRAC Natural Sunlight Concentrator is your answer. The Q-TRAC concentrator is an accelerated natural weathering tester that gives fast, realistic results using natural sunlight. The Q-TRAC unit is an outdoor exposure device that automatically tracks the sun from morning to night. At the same time, it uses a series of 10 mirrors to reflect high intensity, full spectrum, natural sunlight and concentrate it onto your test specimens. This follow-the-sun, solar concentrating system maximizes the amount of sunlight exposure that your test specimen receives.



**Correlation studies indicate that the Q-TRAC sunlight concentrator is particularly useful for coil coatings, powder coatings, architectural coatings, and certain plastics.**

**Fast Answers to Your Weathering Questions.** In one year on a Q-TRAC concentrator, your specimens receive as much sunlight as 5 years in Florida. Actual degradation rates may vary with the material.

**Q-TRAC Sunlight Concentrators Are Easy to Use.** You simply send us the test specimens. We do all the mounting, color or gloss measurements, visual evaluations, etc. You receive evaluations at the predetermined intervals. Nothing could be easier.

### **The Q-TRAC Sunlight Concentrator Advantage**

- Full Spectrum Natural Sunlight
- Fast Results (5x Florida Sunlight)
- Easy to Use Test Service

# Q-SUN Xenon Test Chambers

**Full Spectrum Sunlight Simulation.** The Q-SUN chambers test materials for photostability by exposing them to UV, visible and IR light. It uses filtered xenon arc light for the ultimate correlation to the full spectrum of sunlight. Daylight Filters are used to simulate direct sunlight exposure. Window-Glass Filters are used to reproduce a sunlight-through-glass spectrum for indoor photostability tests.

A Q-SUN tester is especially useful for testing color change and lightfastness of pigments, dyes and inks. For materials that are temperature-sensitive, a chiller can be added to allow exposures at room temperature conditions.

**The Most Realistic Xenon.** Where moisture is an issue, some Q-SUN units can be operated as a weathering tester by the addition of water spray. The Q-SUN Xe-1 and Xe-3 chambers' near horizontal specimen mounting system allows moisture to remain on the surface of the specimen for an extended time and mimics the natural service condition of many exposure environments. A second spray can be added to simulate special conditions like acid rain.

**Versatile Specimen Mounting.** The flat specimen mounting system of the Q-SUN Xe-1 and Xe-3 chambers easily accommodates three-dimensional parts, components and products, like bottles and test tubes.

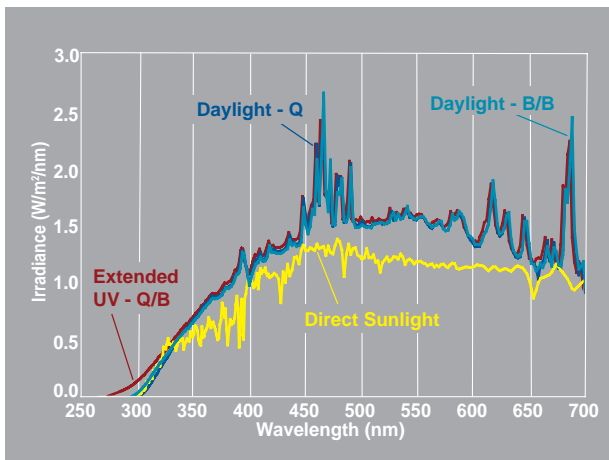
**Now You Can Afford to do Xenon Testing.** If you have been putting off buying a xenon tester because of high prices, it's time to look again. The Q-SUN chambers' low purchase price and low lamp prices are a breakthrough in the price/performance equation.

## The Q-SUN Xenon Test Chamber Advantage

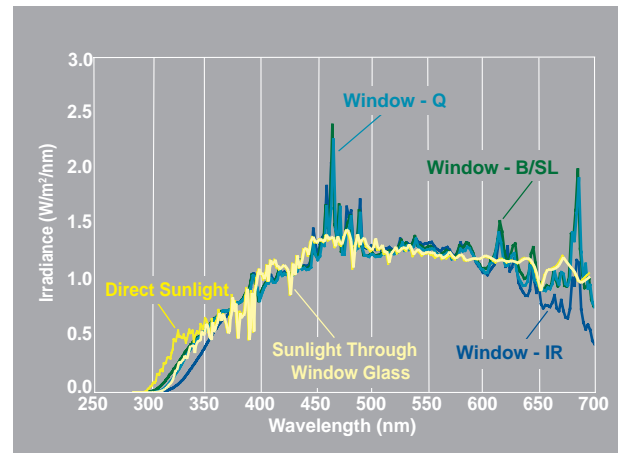
- Full Spectrum Xenon Arc Light
- Most Realistic Moisture Attack
- 3-D Specimen Mounting in Xe models



A variety of Q-SUN models offer all the flexibility and features you need in a xenon arc tester. Three dimensional products are easily accommodated on the flat specimen tray of both Q-SUN Xe-1 and Xe-3 xenon chambers. The Q-SUN B02 chamber is specifically designed with a rotating rack for ISO 105 B02 textile lightfastness testing.



**Daylight Filters** are used to test outdoor products. **Extended UV Filters** may be used to accelerate the degradation of some products.



**Window Glass Filters** are used to test indoor products. **IR Filters** are used to test textiles and heat sensitive products.

# QUV Weathering Testers

In a few days or weeks the QUV weathering tester can reproduce the damage which occurs over months or years outdoors. The QUV unit is cost effective, easy to install, easy to use, and practically maintenance free. Three models are available to cover a range of testing needs and budgets.

**UV & Sunlight Simulation.** UV is responsible for most of the sunlight damage to durable materials exposed outdoors. The QUV tester uses fluorescent UV lamps because they are significantly more stable than other lamps and allow more reproducible test results. For physical properties degradation, fluorescent UV lamps are the best way to simulate the damaging effects of sunlight. The UVA-340 lamp is the best available simulation of short wavelength sunlight. It is especially useful for comparing the performance of different types of polymers and stabilizers and is the best QUV lamp for correlation studies.

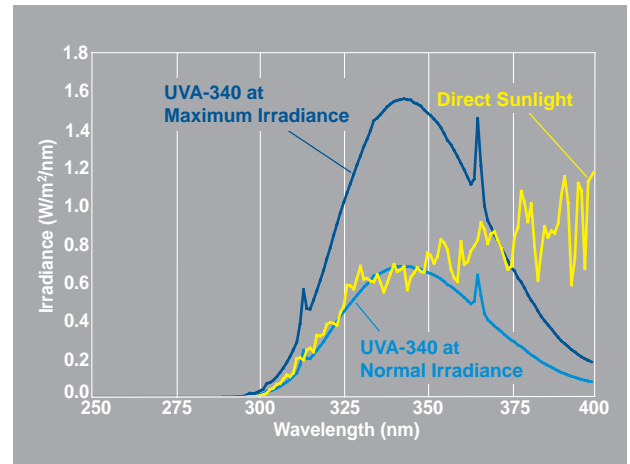
**Moisture Simulation.** The QUV simulates the effects of rain and dew by subjecting specimens to condensing humidity for a rigorous, highly realistic moisture exposure. Thermal shock and erosion can be simulated with the addition of water spray.



The QUV tester is the world's most widely used weathering tester. The QUV machine reproduces the damage caused by sunlight, rain and dew. It can give you fast answers for R&D, quality control, material certification and predictions of durability.

## The QUV Weathering Tester Advantage

- Best Available Simulation of Sunlight UV
- Fast, Low Cost, Easy to Operate
- Virtually Maintenance Free



**UVA-340 lamps** are the best reproduction of short-wave UV sunlight. **SOLAR EYE® Irradiance Control** can increase the irradiance and accelerate testing.

# Laboratory Test Service

**Q-Lab Weathering Research Service.** Let us do the testing for you. Q-Lab has a fully equipped accelerated weathering laboratory offering a wide range of exposure services including QUV accelerated weathering testers and Q-SUN xenon test chambers. A multitude of evaluation services are also available.

## Fast, Hassle-Free Data.

When Q-Lab does the testing, you don't have to deal with all the details of testing. You don't have to purchase, install, operate, calibrate and maintain the instruments. All you have to do is send in the test specimens. With Q-Lab you buy the test results, not the tester.



Our experienced, friendly staff at Q-Lab can perform all light stability and weathering tests for you.

## Q-Lab Accelerated Lab Advantage

- Fast, Hassle-Free Results
- Accredited to ISO 17025
- Low Cost

# Weathering & Light Stability Testing Options

The table below summarizes the strengths and weaknesses of the most common techniques for testing weathering and photostability. Of necessity, this table is an over-simplification and contains many generalizations. For more detailed advice on your testing program, call Q-Lab.

<b>Legend:</b>	...	Very good
	..	Good
	•	May be useful
	x	Not recommended
	—	Not applicable

		Outdoor Exposures			Lab Testers	
		Q-Lab Florida	Q-Lab Arizona	Q-TRAC <sup>(1)</sup>	QUV <sup>(2)</sup>	Q-SUN <sup>(2)</sup>
<b>Sunlight</b>	Full Spectrum (UV, Visible, IR)	...	...	..	X	..
	Short Wave UV Spectrum (295-360 nm)	...	...	..	...	..
	Spectral Stability - UV	•	•	•	...	..
	Spectral Stability - Visible Light	•	•	•	—	..
<b>Temperature</b>	High Temperature	..	...	...	...	...
	Daily Temperature Swings	..	...	...	•	•
	Temperature Control	—	—	•	...	...
	Thermal Shock (from rain/spray)	..	X	..	...	...
<b>Moisture</b>	Rain & Dew	...	X	•	...	•
	Erosion (from rain/spray)	..	X	•	...	..
<b>General Characteristics</b>	Fast Results	•	•	..	...	..
	Ease of Use	...	...	...	...	..
	Low Price	...	...	•	...	..
	Low Operating Cost	—	—	—	...	..
<b>Products &amp; Applications</b>	Coatings, Color	...	...	...	..	...
	Coatings, Physical Properties	...	...	..	...	..
	Coatings, Architectural/Industrial	...	...	..	...	..
	Coatings, Automotive	...	...	•	..	..
	Coatings, Coil	...	...	..	..	•
	Dyes	...	...	•	•	...
	Inks	...	...	•	•	...
	Pigments	...	...	..	..	...
	Plastics, Color	...	...	•	..	...
	Plastics, Physical Properties	...	...	•	...	..
	Roofing	...	...	...	...	...
	Sealants	...	...	•	..	..
	Textiles, Fading	...	...	•	•	...
	Textiles, Physical Properties	...	...	..	..	..
	Pharmaceuticals/Cosmetics	...	...	X	X	...

Footnotes: (1) Exposure services available at Q-Lab Arizona.

(2) Table is based on customer-owned equipment. Lab test services are available at Q-Lab Florida.

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