



# A Choice of Filters for Q-SUN Xenon Test Chambers

There are three general categories of filters which can be used in the Q-SUN<sup>®</sup> xenon test chamber. The choice of filter depends upon the material tested and its end-use application. Within each general category, there may be several different types of filters. Each filter is a flat piece of specialty glass specifically designed to have a particular transmission.

Because the radiation from an unfiltered xenon arc contains too much short-wave UV to allow useful correlation to natural exposures on the earth's surface, Q-SUN testers employ various types of optical filters to reduce unwanted radiation and achieve an appropriate spectrum. For most of the filter types used, the greatest effect is on the short wavelength portion of the spectrum. Because the damaging effects of UV are inversely proportional to wavelength (i.e., shorter wavelengths = more damaging), it is critical that the cut-on wavelength match the service environment. Nominal cut-on wavelengths are shown below for each filter type.

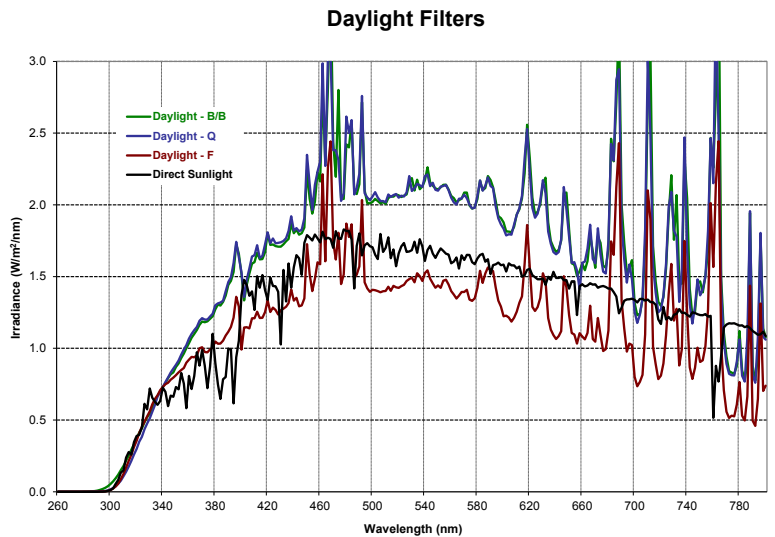
## Daylight Filters

Q-SUN daylight filters produce spectra approximately equivalent to direct sunlight and conform to the spectral requirements of ISO 4892, ISO 11341, ASTM G155, SAE J1960, and SAE J2527. They are recommended for testing materials that are intended for outdoor use.

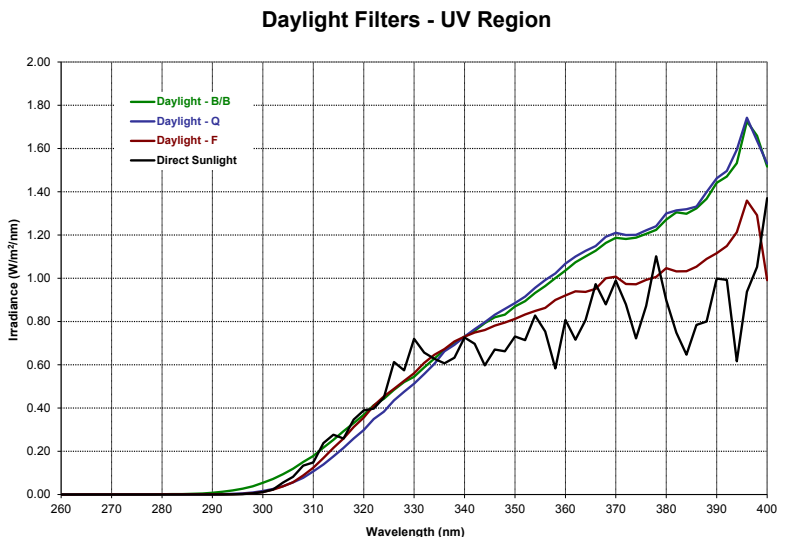
**Daylight - Q.** With a nominal cut-on of 295 nm, *Daylight - Q* provides an accurate spectral match with direct sunlight. This filter is often recommended for the best correlation between Q-SUN xenon and natural outdoor exposures.

**Daylight - B/B.** With a nominal cut-on at 290 nm, *Daylight - B/B* is recommended when correlation to certain rotating-drum style xenon testers is desired.

**Daylight - F.** With a nominal cut-on of 295 nm, *Daylight - F* also provides an accurate spectral match with direct sunlight, particularly in the short-wave UV region. Developed within the automotive industry, this specialty filter has become adopted in some automotive and test standards (e.g. ASTM D7869).



Q-SUN daylight filters compared to direct sunlight.



For the best correlation to direct sunlight, *Daylight - Q* filters are recommended.

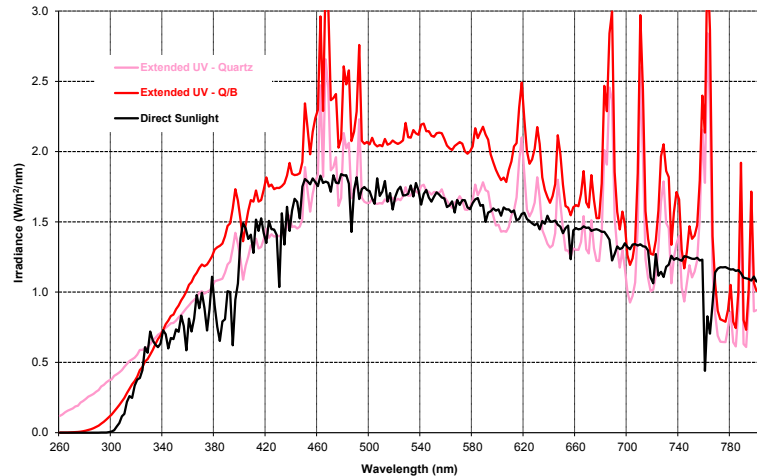
## Extended UV Filters

Q-SUN extended UV filters allow significant excess UV below the cut-on of natural sunlight at the earth's surface. Extended UV filters are often used to produce faster degradation than daylight filters. They may also be used to reproduce extraterrestrial spectra for aerospace applications.

**Extended UV - Q/B.** This filter has a nominal cut-on at 275 nm. For many materials it will produce faster degradation than daylight filters. This filter may be required for certain automotive test methods including SAE J1960, SAE J1885, SAE J2412 and SAE J2527. It is described in ASTM G155.

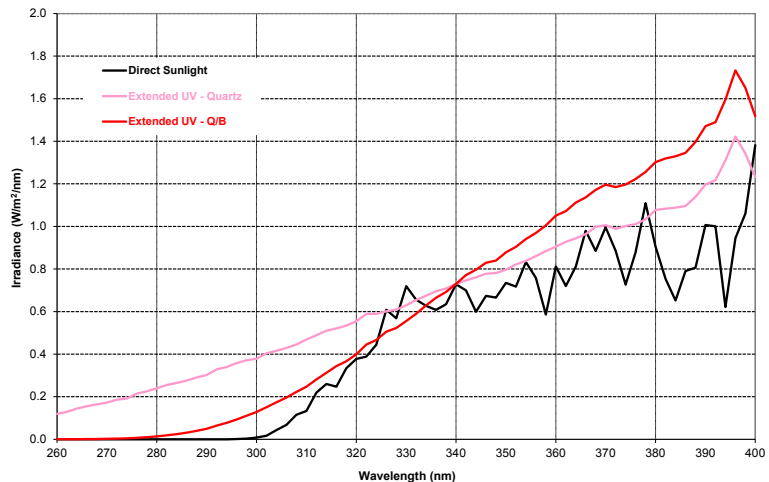
**Extended UV - Quartz.** Certain special applications require a spectrum with aggressive, very short-wave UV to produce an extraterrestrial exposure condition. The quartz filter has a nominal cut-on at 250 nm. Because of its extreme short wave UV cut-on, this filter does not meet the definitional requirements for an "extended UV filter" as defined in SAE or ASTM.

Extended UV Filters



For some materials, extended UV filters may produce faster degradation.

Extended UV Filters - UV Region



Certain automotive test methods call for the spectrum produced by the Extended UV - Q/B filter.

## Technical Notes

**Sunlight Data.** As used in this document, the terms "sunlight" and "direct sunlight" refer to sunlight as defined by using the input variables from ASTM G177 in version 2.9.2 of the SMARTS2 model and is approximately equivalent to noon, midsummer sunlight in the northern hemisphere. The term "sunlight through window glass" refers to a calculated value where direct sunlight data from CIE Table 4 is multiplied by the transmission of 1/8 inch glass of the type commonly used in North America.

**Q-SUN Data.** The data shown in the graphs for Q-SUN filters was measured at the specimen plane in a Q-SUN xenon test chamber. Data for the daylight and extended UV Filters was normalized to 0.73 W/m<sup>2</sup>/nm @ 340 nm to provide a benchmark comparison with noon midsummer sunlight. Data for the window glass filters was normalized to 1.20 W/m<sup>2</sup>/nm @ 420 nm to correspond with the calculated CIE/window glass data.

**Cut-On.** For purposes of this document, the "nominal cut-on wavelength" is defined as 0.2% of the irradiance at 420 nm, rounded to the nearest 5 nm.

## Window Glass Filters

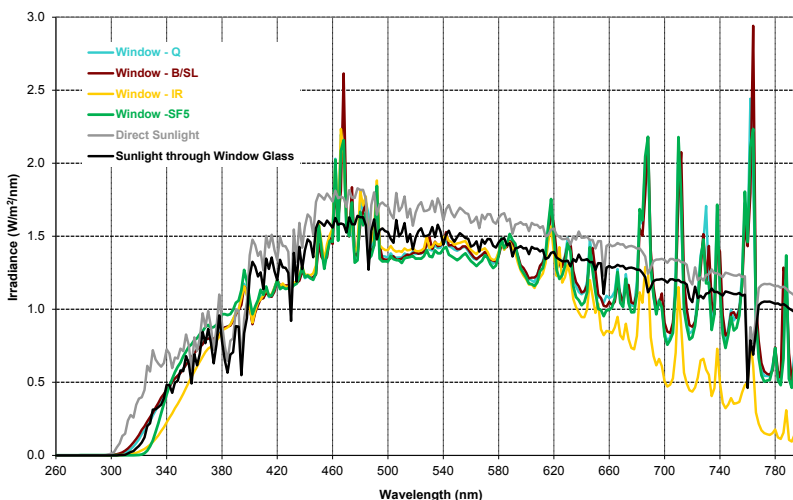
Intended for testing materials that are used indoors, window glass filters produce spectra equivalent to sunlight coming through the window. However, there is no single “standard window glass.” Because transmission varies due to thickness, chemical composition, etc., several window glass filters have been developed.

The spectrum produced by the Q-SUN window glass filter also covers most of the wavelengths that would be found from the many artificial light sources used indoors (cool white fluorescent, etc.), so it is appropriate for most indoor applications. For more information on how the spectrum of window glass filtered xenon compares to indoor light sources, see Q-Lab Technical Bulletin LX-5026.

**Window - Q.** This filter is equivalent to direct sunlight coming through a piece of single-strength, single-pane glass of the type most widely used in North America. This filter meets the requirements for window glass filters in ASTM and most ISO test methods. *Window - Q* has a nominal cut-on of 310 nm.

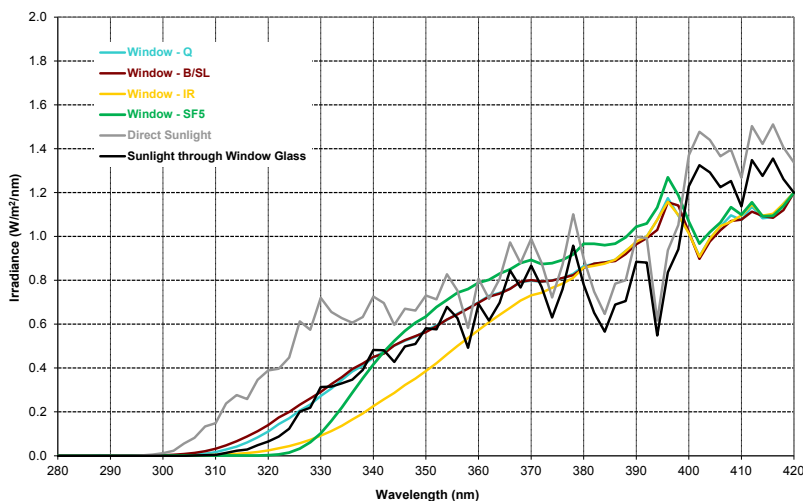
**Window - B/SL.** This filter is slightly more transmissive and produces a spectrum with slightly more short-wave UV. *Window - B/SL* has a nominal cut-on of 300 nm. This filter meets the requirements for window glass filters in ASTM, ISO and AATCC test methods, including AATCC TM 16-3.

## Window Filters



A variety of window glass filters are available to reproduce the spectrum of sunlight that has been filtered by different types of glass.

## Window Filters - UV Region



The spectrum produced by the *Window - Q* filters meet the requirements of ASTM and most ISO test methods.

**Window - IR.** Infrared (IR) filters produce a similar short wavelength cut-on as other window glass filters, but also reduce the amount of long wavelength visible and IR energy that reaches the test specimen. This filter meets certain test specifications that call for “heat reducing filters” (ISO 105 B02). The IR filter has a nominal cut-on of 320 nm.

**Window - SF5.** This filter is specified for certain automotive interior tests (such as Ford) that require a so-called “335 nm long pass filter.” Despite this OEM-designated description, the nominal cut-on for this filter is 325 nm. It is designed to simulate automotive interior conditions.

## Filter Application Table

Filter Name	Nominal Cut-On	Recommended Use
Daylight - Q	295 nm	Best for correlation with outdoor exposures
Daylight - B/B	290 nm	Best for correlation to some rotating-drum style testers
Daylight - F	295 nm	Accurate match to the short-wave UV portion of sunlight Used in some ASTM and automotive test standards
Extended UV - Q/B	275 nm	Used for some automotive test methods
Extended UV - Quartz	250 nm	Very aggressive, very short-wave UV, extraterrestrial spectrum
Window - Q	310 nm	Sunlight North American window glass Meets most ISO & ASTM requirements for Window Glass Filters
Window - B/SL	300 nm	Recommended for AATCC procedures like TM 16-3 Meets most ISO & ASTM requirements for Window Glass Filters
Window - IR	320 nm	Reduced heat for lower exposure temperatures Recommended for ISO 105 B02 "European Conditions" Does not meet the requirements for most ISO & ASTM Window Glass Filters
Window - SF5	325 nm	Used for some automotive interior tests (e.g. Ford)

### For more information about any of the above test methods, please contact:

**AATCC**, PO Box 12215 Research Triangle Park, NC 27709 USA

Phone: 919-549-8141; Fax: 919-549-8933; [www.aatcc.org](http://www.aatcc.org)

**ASTM International**, 100 Barr Harbor Drive, PO Box C700, West Conshohocken, PA, 19428-2959 USA

Phone: 610-832-9585; Fax: 610-832-9555; [www.astm.org](http://www.astm.org)

**ISO**, 1 rue de Varembé, Case postale 56 CH-1211 Geneva 20, Switzerland

Phone: +41 22 749 01 11; Fax: +41 22 733 34 30; [www.iso.org](http://www.iso.org)

**SAE**, 400 Commonwealth Drive, Warrendale, PA 15096-0001 USA

Phone: 724-776-4841; Fax: 724-776-0790; [www.sae.org](http://www.sae.org)

**Q-Lab Corporation**

[www.q-lab.com](http://www.q-lab.com)



**Q-Lab Headquarters**  
Westlake, OH USA  
Tel: +1-440-835-8700  
[info@q-lab.com](mailto:info@q-lab.com)

**Q-Lab Florida**  
Homestead, FL USA  
Tel: +1-305-245-5600  
[q-lab@q-lab.com](mailto:q-lab@q-lab.com)

**Q-Lab Europe, Ltd.**  
Bolton, England  
Tel: +44-1204-861616  
[info.eu@q-lab.com](mailto:info.eu@q-lab.com)

**Q-Lab Arizona**  
Buckeye, AZ USA  
Tel: +1-623-386-5140  
[q-lab@q-lab.com](mailto:q-lab@q-lab.com)

**Q-Lab Deutschland GmbH**  
Saarbrücken, Germany  
Tel: +49-681-857470  
[vertrieb@q-lab.com](mailto:vertrieb@q-lab.com)

**Q-Lab China** 中国代表处  
Shanghai, China 中国上海  
电话: +86-21-5879-7970  
[info.cn@q-lab.com](mailto:info.cn@q-lab.com)