

How to run SAE J2412 and J2527

如何正确运行SAE J2412和J2527

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Overview 主题

- Defining Expectations 应该做哪种测试
- SAE Accelerated Exposure in Xenon-Arc Apparatus
- 使用氙灯设备运行SAE加速曝晒
- SAE J2412 & SAE J2527
 - Interpretation of test conditions 试验条件的解读
 - Setting up Q-SUN xenon-arc test chamber Q-SUN的设置
 - Specimen preparation and mounting 试样的准备与安装
 - Running the test 运行试验
 - Evaluating and reporting 试样评估和试验报告

What Kind of Test Should I Run?

应该做哪种测试?

Accelerated Test Type 加速测试类型	Result 结果	Test Time 测试时间	Results compared to 结果与什么相比
Quality Control 质量控制	Pass / fail 合格 / 不合格	<ul style="list-style-type: none"> • Defined 确定的 • Short 时间短 	Material specification 材料规格
Qualification / validation 鉴定 / 验证	Pass / fail 合格 / 不合格	<ul style="list-style-type: none"> • Defined 确定的 • Medium-long 中长 	Reference material or specification 参考材料或规范
Correlative 相关性	Rank-ordered data 排序数据	<ul style="list-style-type: none"> • Open-ended 不确定 • Medium 时间中等 	Natural exposure (Benchmark site) 自然曝晒
Predictive 预估	Service life Acceleration factor 使用寿命 加速系数	<ul style="list-style-type: none"> • Open-ended 不确定 • Long 时间长 	Natural exposure (Service environment) 自然曝晒 (使用环境)

What Kind of Test Should I Run?

应该做哪种测试?

Accelerated Test Type 加速测试类型	Result 结果	Test Time 测试时间	Results compared to 结果与什么相比
Quality Control 质量控制	Pass / fail 合格 / 不合格	<ul style="list-style-type: none"> • Defined 确定的 • Short 时间短 	Material specification 材料规格
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Predictive 预估	Service life Acceleration factor 使用寿命 加速系数	<ul style="list-style-type: none"> • Open-ended 不确定 • Long 时间长 	Natural exposure (Service environment) 自然曝晒 (使用环境)

Evolution of Standards 标准的演变

1st Generation Xenon Automotive Testing 第一代氙灯汽车测试标准

- Introduced in the late 80's as SAE J1885 and SAE J1960.
- 在上世纪80年代末，标准号为SAE J1885和SAE J1960
- Initially were hardware-based, requiring water-cooled xenon lamps, but current revisions are performance-based which allow a multitude of chamber designs to satisfy the standards as long as conditions are met.
- 最初是硬件标准，要求水冷氙灯，现在是以性能为基础的标准
- When first introduced, these standards provided the best methods in screening and qualifying of materials
- 这些标准一经提出，就为材料的筛选和鉴定提供了最好的方法
- SAE J1960 at the time 当时的SAE J1960
 - Correlated well to outdoor testing of coatings developed at the beginning of the clear-coat / base-coat era 与户外测试有很好的相关性

How to run laboratory test...

如何运行实验室测试...

- Interpretation of test conditions
- 试验条件解读
- Setting up Q-SUN xenon-arc test chamber
- Q-SUN氙灯试验箱的设置
- Specimen preparation and mounting
- 试样准备和安装
- Running the test 运行试验
- Evaluating and reporting 试样评估和试验报告

Forces of Weathering 老化因素

- Sunlight 光
 - Light source 光源
 - Optical filter 光过滤片
 - Irradiance Control point and setting
 - 辐照度控制点和设置
- Heat 热
 - Black Panel or Insulated Black Panel
 - 黑板温度计还是黑标温度计
 - Chamber Air Temperature 箱体空气温度
- Moisture 水
 - Relative Humidity 相对湿度
 - Spray 水喷淋





SAE J2412

Accelerated Exposure of Automotive Interior Trim
Components Using a Controlled Irradiance Xenon-Arc
Apparatus

使用控制辐照度氙灯设备对汽车内饰件进行加速曝晒

Xenon-Arc Light Source 氙灯光源

SAE J2412

- Conveniently, the light source, xenon-arc, is mentioned directly in the title. 标准名称中直接提到了氙灯
- In case there are any doubts, additional notes are included in the standard, giving users clear instruction:
- 标准中还增加了注释，给用户明确说明：

§ 5.2 The apparatus employed utilizes a xenon-arc lamp(s) as the source of radiation...

§ 5.2 设备使用氙灯作为辐射源

§ 5.2.1 A more complete description of the apparatus can be found in ASTM G151 and ASTM G155

§ 5.2.1 ASTM G151 和 ASTM G155 中提供了更完整的设备说明

Optical Filter Requirements 光过滤片

SAE J2412

- SAE J2412 specifies an **Extended UV** optical filter, resulting in a relatively harsh spectrum. SAE J2412规定紫外延展过滤片
- The device manufacturer has responsibility to ensure a particular filter satisfies the standard.
- 设备制造商有责任确保特定过滤片符合标准

§ 5.1 The equipment manufacturer is responsible for the approval of the equipment and for providing the proof of compliance of the critical test parameters, including the different spectral power distributions (SPD)...

§ 6.1.3 Fit the xenon-arc burner with an Extended UV Filter to provide a spectral power distribution (SPD) indicated in Appendix A, Table A1 and Figure A1.

Appendix A, Figure A1

SAE J2412

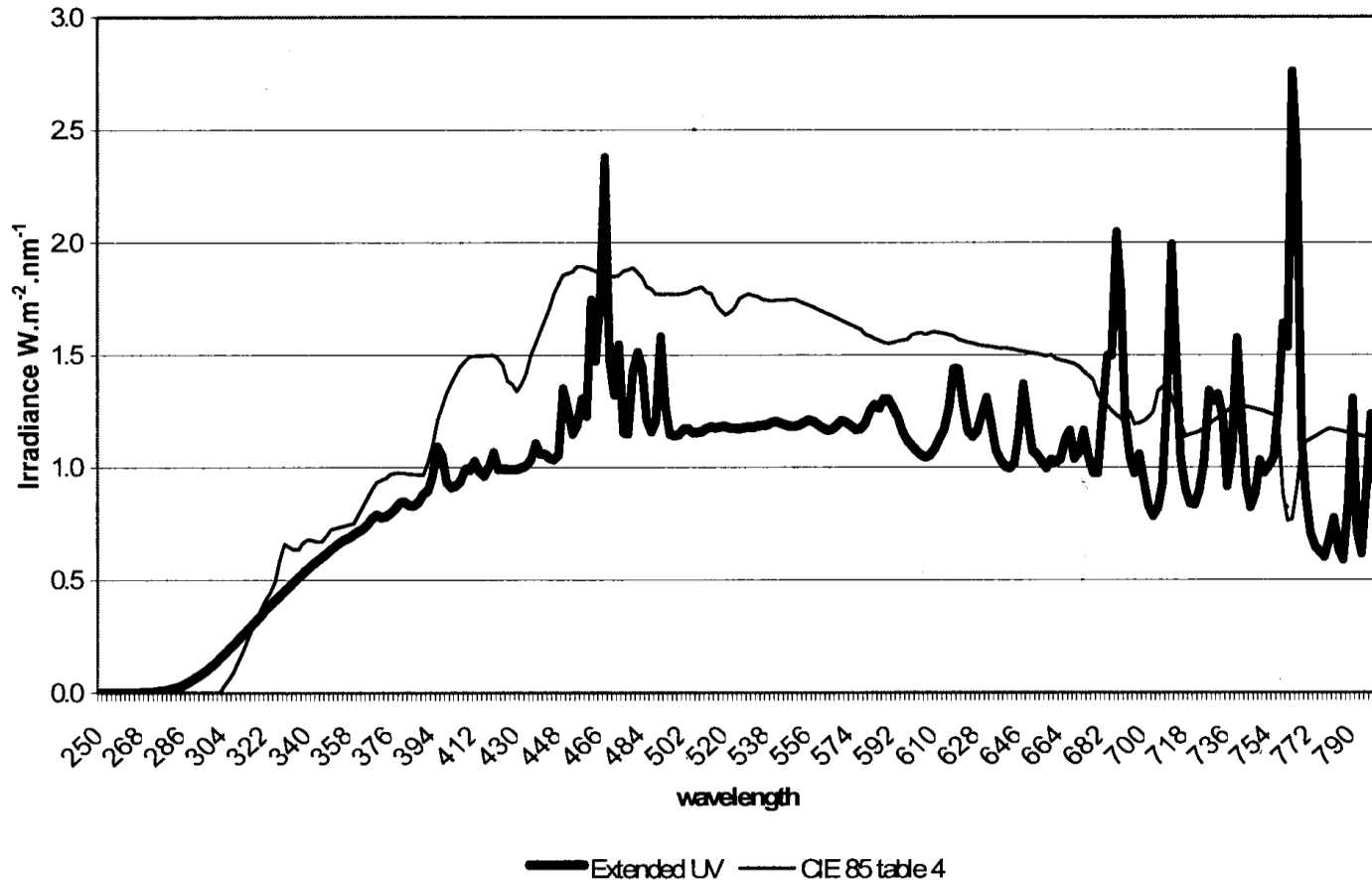
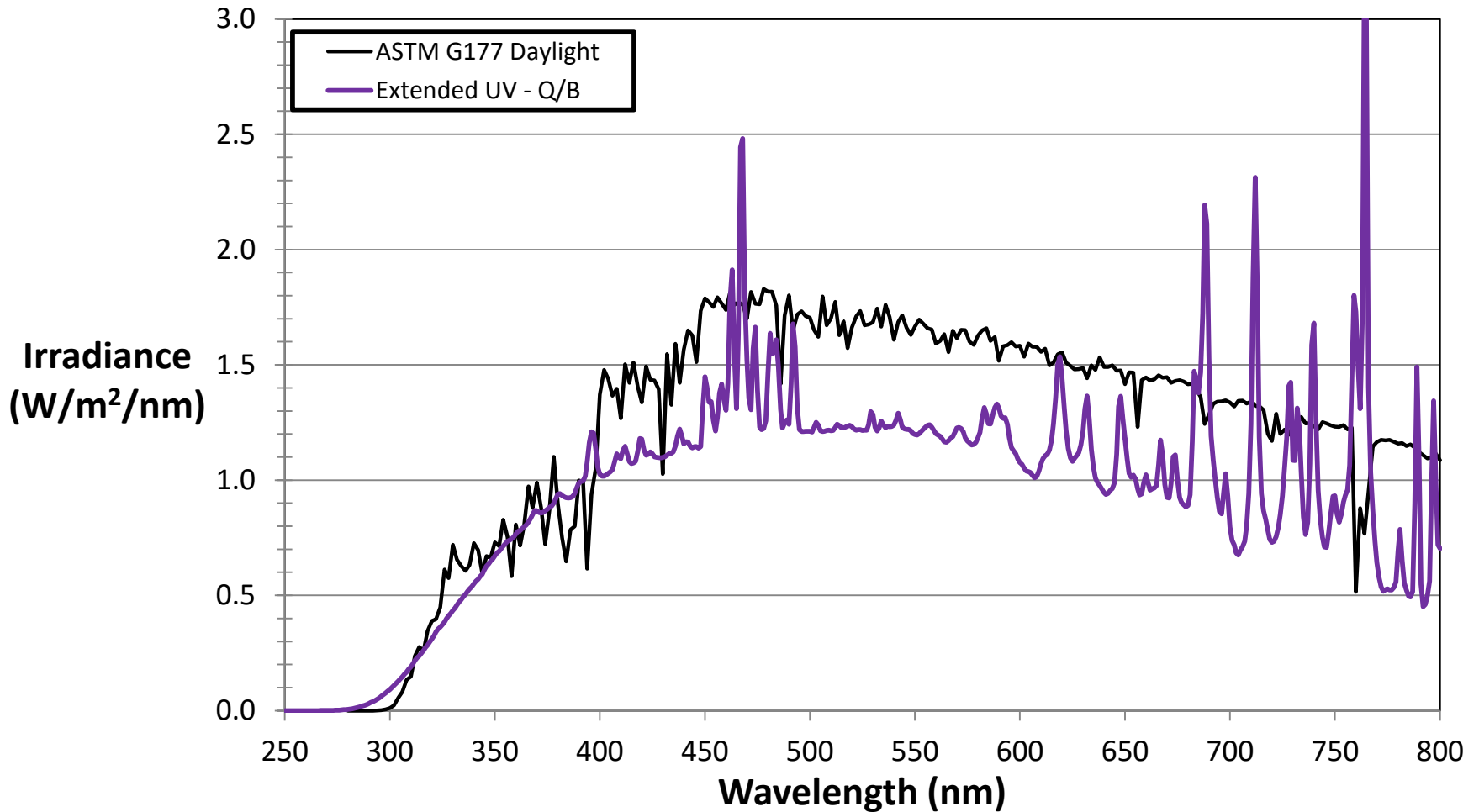


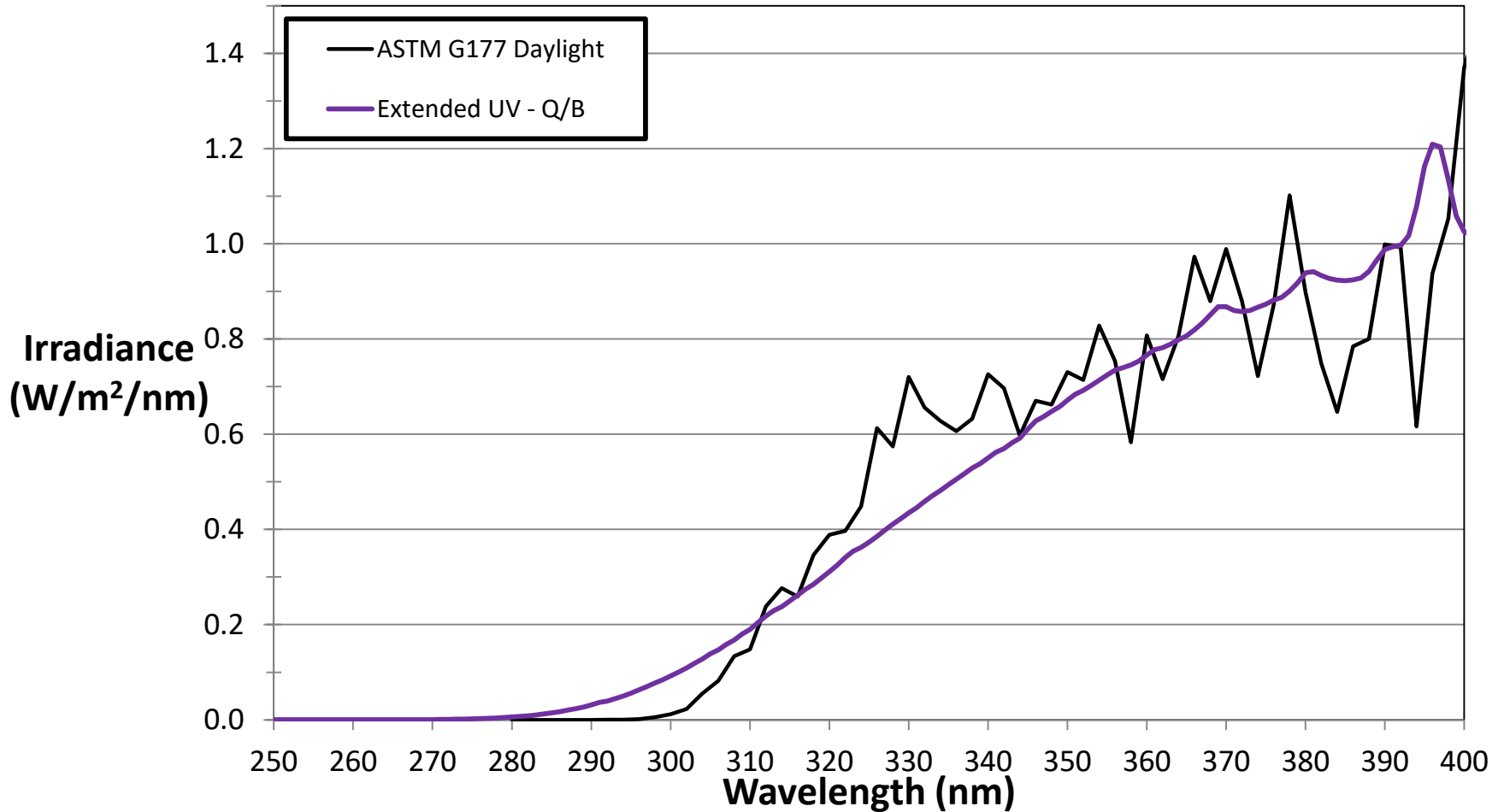
Figure A1 – Extended UV filter vs. sunlight spectral power distribution (SPD)

Xenon Arc with Extended UV-Q/B

UV and Visible Light

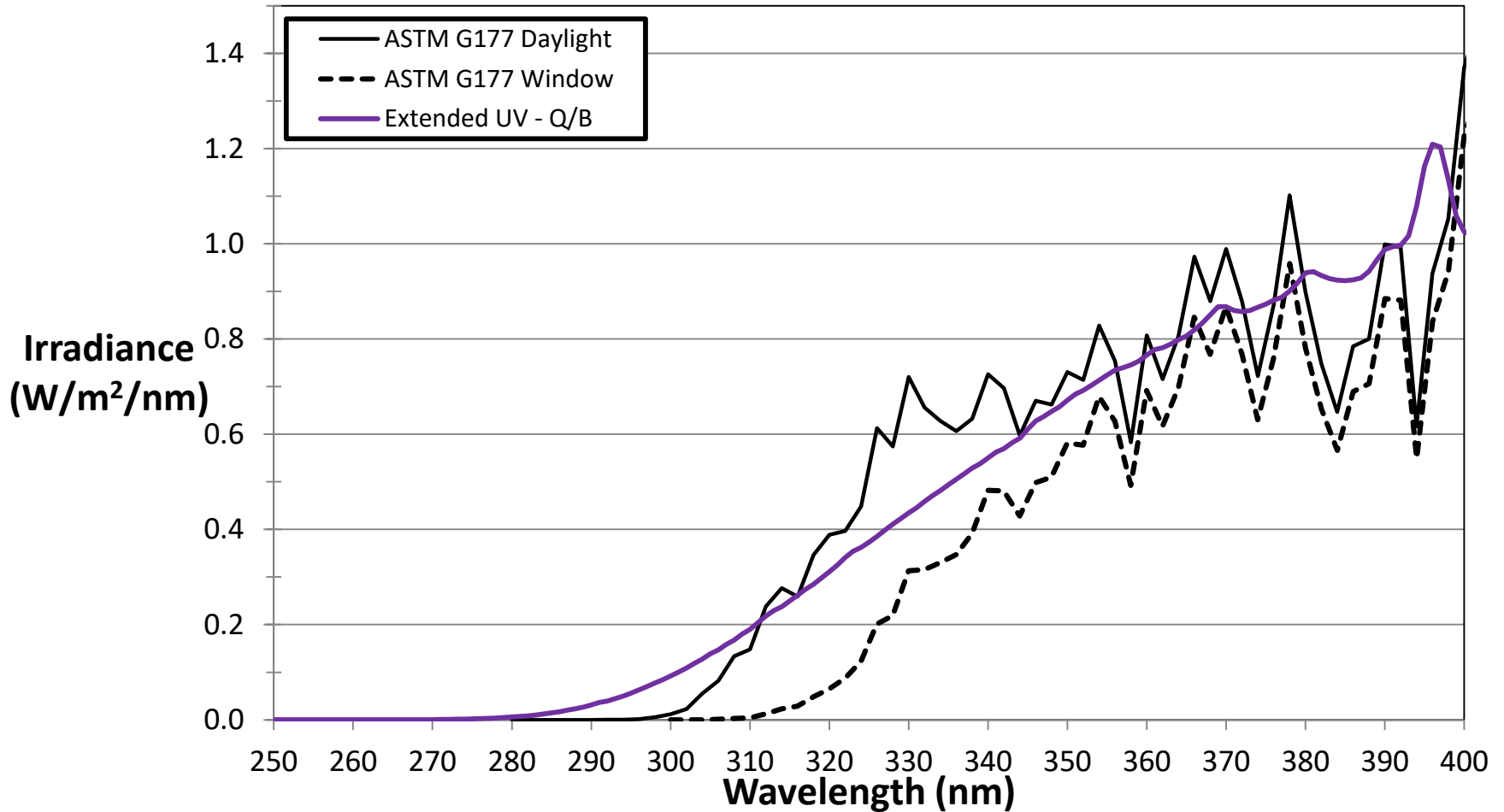


Xenon Arc with Extended UV-Q/B UV Light



Xenon Arc with Extended UV-Q/B

UV Light



Spectral Requirements Table

SAE J2412

Table A1 (Part 1) - Irradiance in W/m² based on 81 SPD's for Xenon-Arcs with extended UV filters normalized to exactly 0.55 W.m⁻² at 340 nm

The spectral charts shown are a great visual representation of the optical filter intent, but the real requirement is given in *Table A1*.

bandpass	average	standard deviation	min	max
250-260	0.00	0.00	0.00	0.02
261-270	0.00	0.00	0.00	0.03
271-280	0.04	0.02	0.01	0.10
281-290	0.22	0.08	0.09	0.42
291-300	0.73	0.16	0.36	1.16
301-310	1.60	0.20	1.04	2.19
311-320	2.72	0.19	2.13	3.26
321-330	3.91	0.14	3.48	4.29
331-340	5.06	0.04	4.95	5.18
341-350	6.10	0.10	5.91	6.33
351-360	7.06	0.22	6.48	7.67
361-370	7.97	0.33	7.19	8.83
371-380	8.65	0.48	7.55	9.77
381-390	9.17	0.59	7.99	10.57
391-400	10.67	0.70	9.17	13.29
300-400	63.10	1.97	58.30	68.17

Irradiance, Panel Temperature, Chamber Air Temperature & RH

- All four parameters are to be controlled automatically in SAE J2412

§ 5.2 The instrument shall have the means to automatically control irradiance, Black Panel temperature, chamber temperature and relative humidity.

Narrowband 340 nm Irradiance

SAE J2412

Note 1: 0.55 Wm⁻²nm⁻¹ at 340 nm is the historic preferred irradiance for this test.. Equipment monitoring a broad band rather than the narrow band will have different target values than those listed in Table 1

Table 1 - Target values at control panel sensor

Controls	Dark Cycle		Light Cycle	
	Target	Tolerance	Target	Tolerance
Automatic Irradiance	None		Contractual Agreement (See Note 1)	$\pm 0.02 \text{ Wm}^2 \text{ nm}^{-1}$
Black Panel Temperature	38 °C	$\pm 2.5 \text{ °C}$	89 °C	$\pm 2.5 \text{ °C}$
Dry Bulb Temperature	38 °C	$\pm 3 \text{ °C}$	62 °C	$\pm 2 \text{ °C}$
Relative Humidity	95%	$\pm 10\%$	50%	$\pm 10\%$
Radiant Exposure	Not applicable		Contractual Agreement	
Cycle Duration	1 hour (See Note 2)	$\pm 6 \text{ minutes}$	3.8 hours (See Note 2)	$\pm 6 \text{ minutes}$

Black Panel Temperature Sensor

SAE J2412

§ 5.3 *The apparatus shall have an uninsulated black panel thermometer as described in ASTM G151*

Table 1 - Target values at control panel sensor

Controls	Dark Cycle		Light Cycle	
	Target	Tolerance	Target	Tolerance
Automatic Irradiance	None		Contractual Agreement (See Note 1)	$\pm 0.02 \text{ Wm}^2 \text{ nm}^{-1}$
Black Panel Temperature	38 °C	$\pm 2.5 \text{ °C}$	89 °C	$\pm 2.5 \text{ °C}$
Dry Bulb Temperature	38 °C	$\pm 3 \text{ °C}$	62 °C	$\pm 2 \text{ °C}$
Relative Humidity	95%	$\pm 10\%$	50%	$\pm 10\%$
Radiant Exposure	Not applicable		Contractual Agreement	
Cycle Duration	1 hour (See Note 2)	$\pm 6 \text{ minutes}$	3.8 hours (See Note 2)	$\pm 6 \text{ minutes}$

Air Temperature and Relative Humidity

SAE J2412

§ 5.2 *The instrument shall have the means to automatically control irradiance, Black Panel temperature, chamber temperature and relative humidity.*

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Controls	Dark Cycle		Light Cycle	
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Dry Bulb Temperature	38 °C	$\pm 3 \text{ °C}$	62 °C	$\pm 2 \text{ °C}$
Relative Humidity	95%	$\pm 10\%$	50%	$\pm 10\%$
Radiant Exposure	Not applicable		Contractual Agreement	
Cycle Duration	1 hour (See Note 2)	$\pm 6 \text{ minutes}$	3.8 hours (See Note 2)	$\pm 6 \text{ minutes}$

Cycle Duration

SAE J2412

Note 2: Other cycle times may be used upon contractual agreement, if, for example, an irradiance different than the specified default value is specified

Table 1 - Target values at control panel sensor

Controls	Dark Cycle		Light Cycle	
	Target	Tolerance	Target	Tolerance
Automatic Irradiance	None		Contractual Agreement (See Note 1)	$\pm 0.02 \text{ Wm}^2 \text{ nm}^{-1}$
Black Panel Temperature	38 °C	$\pm 2.5 \text{ °C}$	89 °C	$\pm 2.5 \text{ °C}$
Dry Bulb Temperature	38 °C	$\pm 3 \text{ °C}$	62 °C	$\pm 2 \text{ °C}$
Relative Humidity	95%	$\pm 10\%$	50%	$\pm 10\%$
Radiant Exposure	Not applicable		Contractual Agreement	
Cycle Duration	1 hour (See Note 2)	$\pm 6 \text{ minutes}$	3.8 hours (See Note 2)	$\pm 6 \text{ minutes}$



SAE J2527

Performance Based Standard for Accelerated Exposure of
Automotive Exterior Materials Using a Controlled
Irradiance Xenon-Arc Apparatus

使用控制辐照度氙灯设备对汽车外饰材料进行加速曝
晒的以性能为基础的标准

Xenon-Arc Light Source

SAE J2527

- As with SAE J2412, the title of J2527 includes the light source directly in the title
- Additional criteria give users instruction:
 - § 5.2 The apparatus utilizes a xenon-arc lamp(s) as the source of radiation.*
 - § 5.2.1 A more detailed description of the apparatus can be found in ASTM G151 and ASTM G155*

Optical Filter Requirements

SAE J2527

- SAE J2527 allows for either Extended-UV optical filters or Daylight filters to be used for exposure.

§ 6.3 Fit the xenon-arc lamp with the appropriate optical filters to meet the intended spectral power distribution (SPD). The filters shall provide an SPD that falls within the respective ranges shown in Tables C1 or C2 in Appendix C. Refer to Figure C1 or C2 in Appendix C for representative spectral power distributions.

Appendix C, Figure C2

SAE J2527

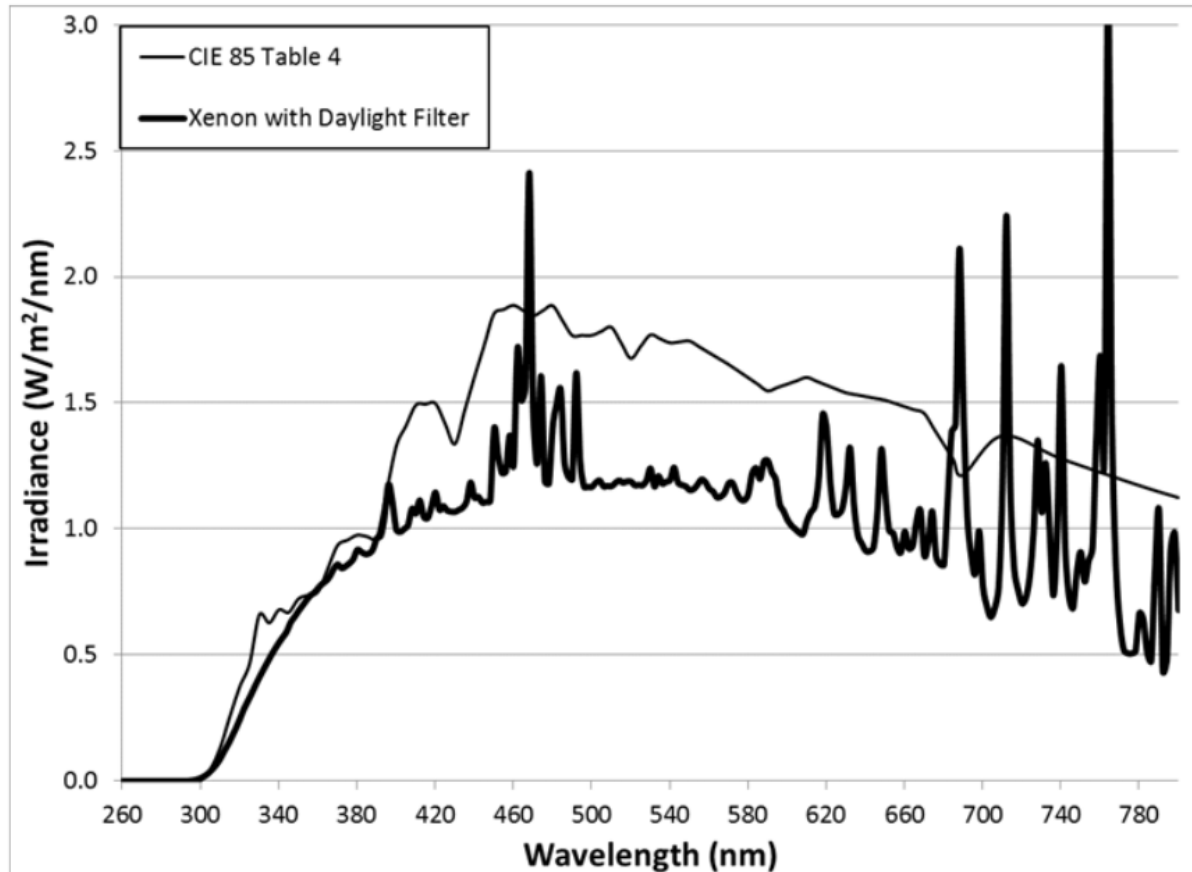
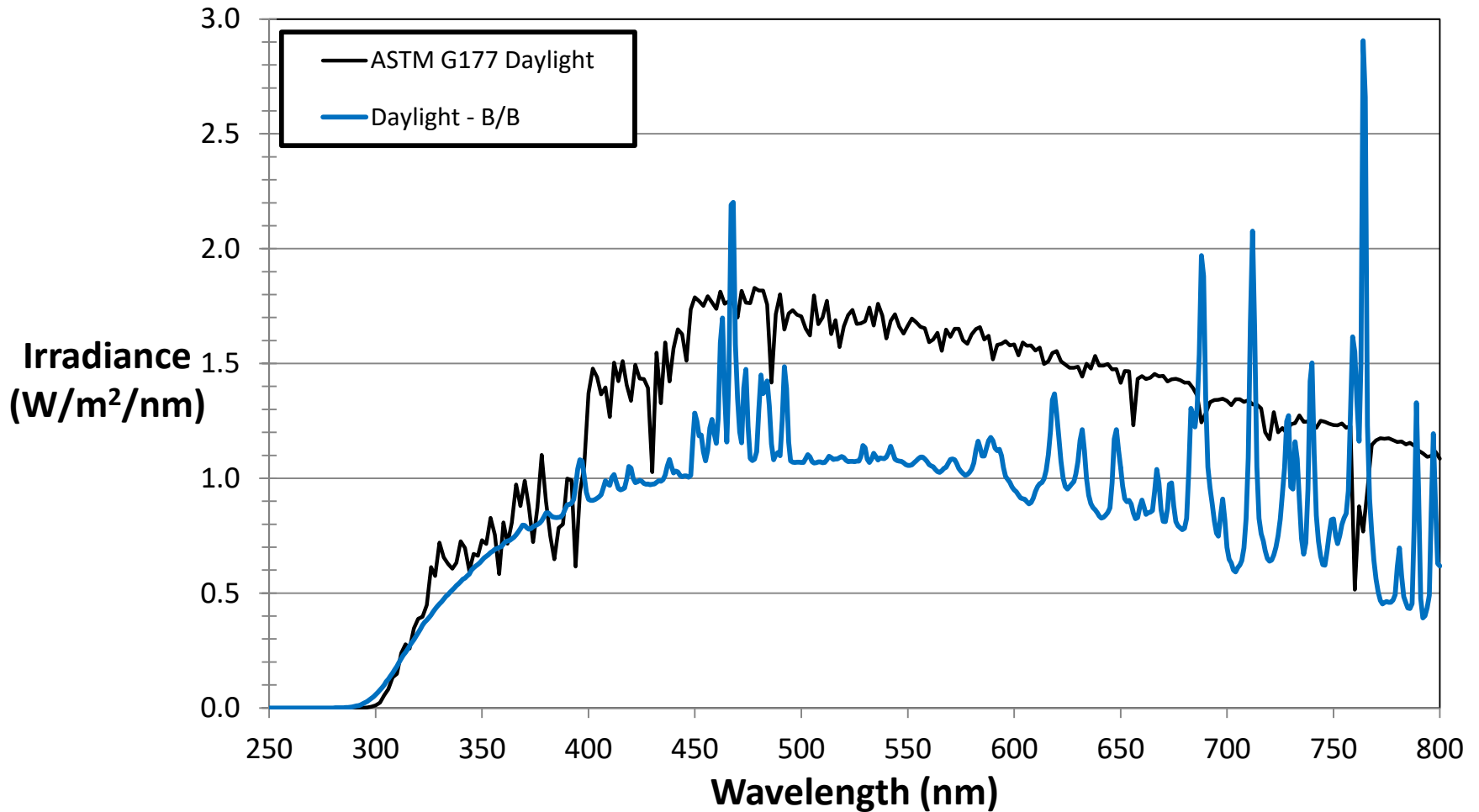


Figure C2 – Example of daylight filter vs. sunlight spectral power distribution

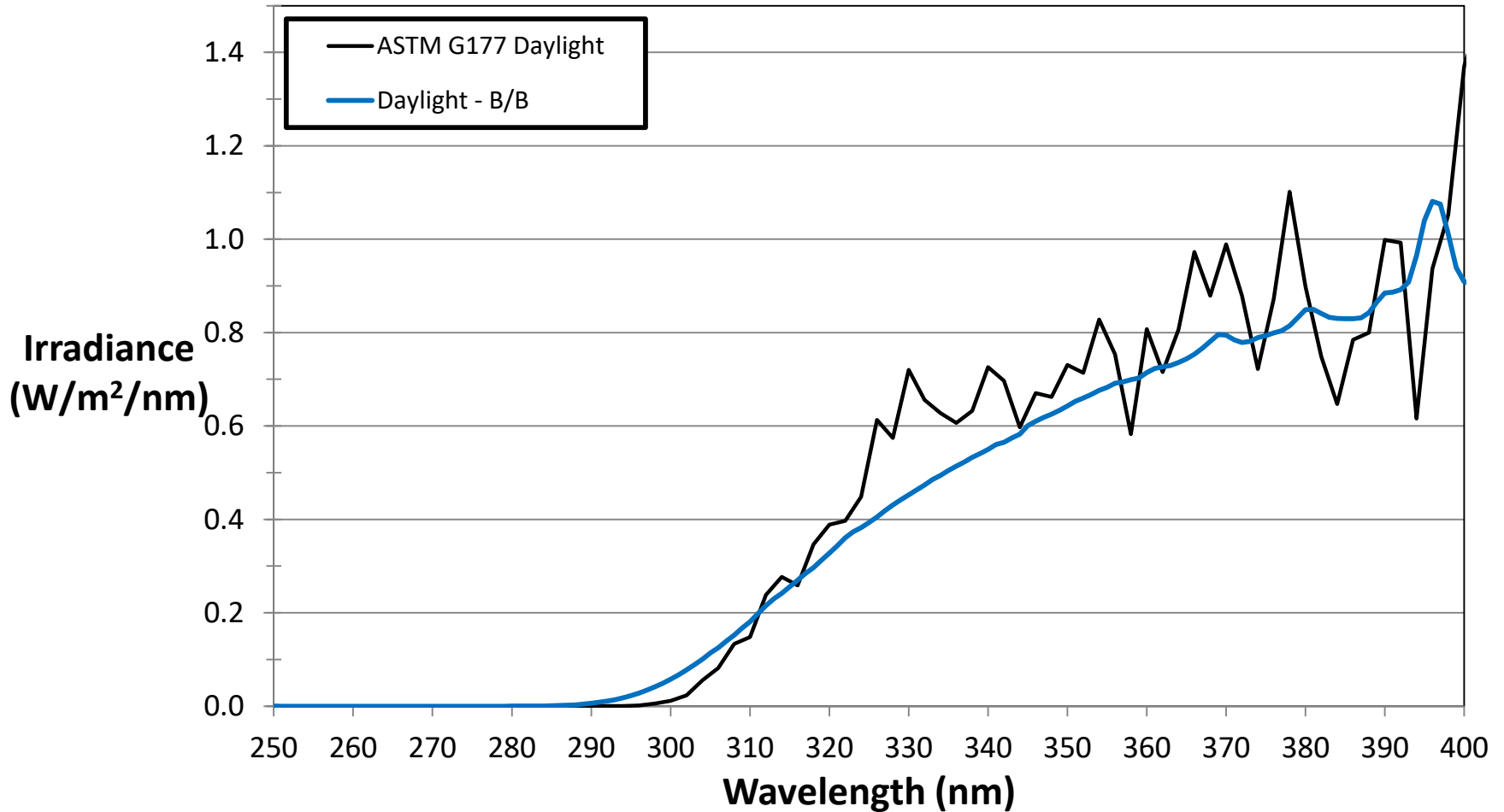
Xenon Arc with Daylight-B/B Filters

UV and Visible Light

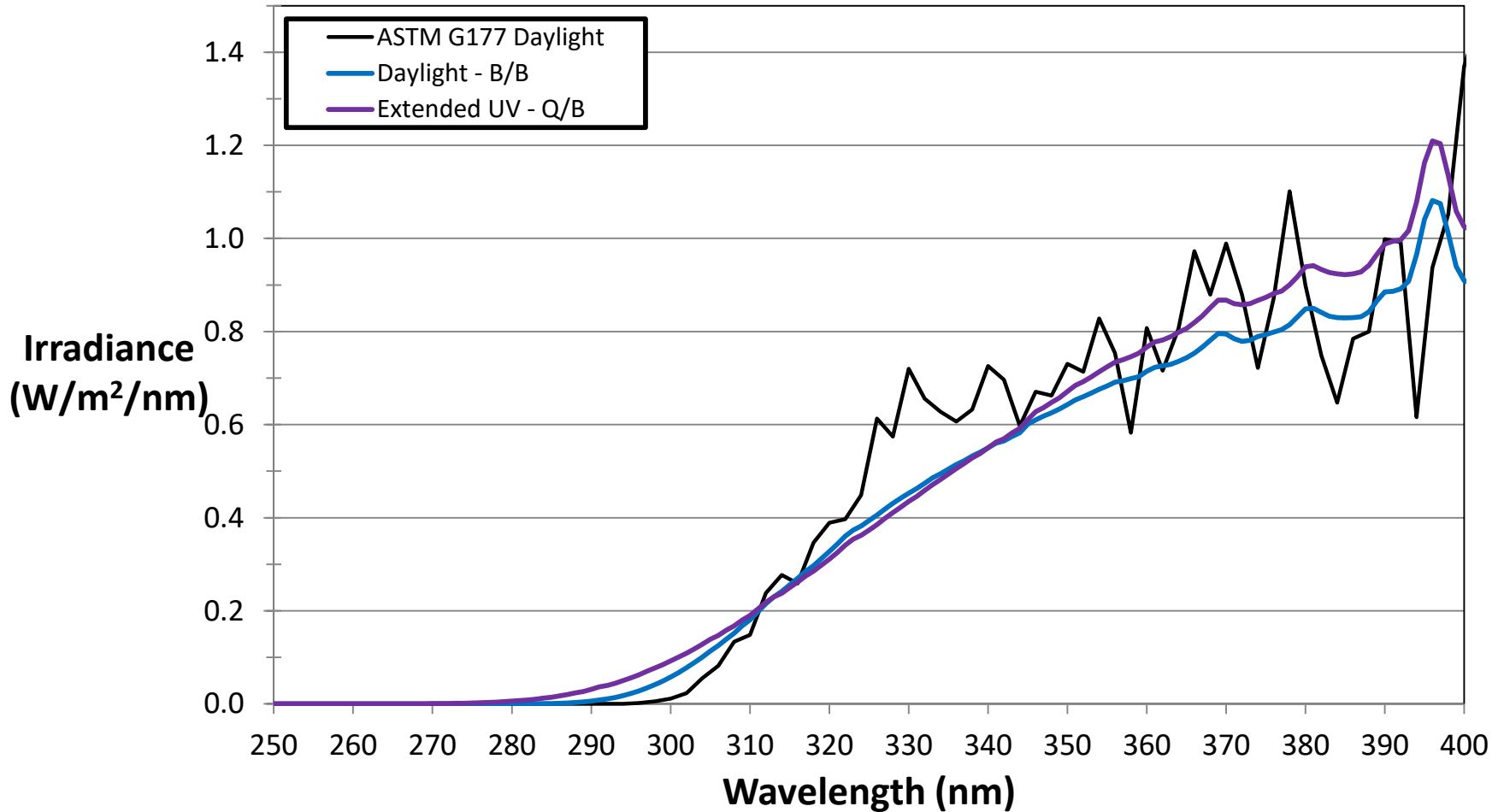


Xenon Arc with Daylight-B/B Filters

UV Light



Xenon Arc Extended UV-Q/B, Daylight-B/B Filters



Spectral Requirements Table

SAE J2527

Table C2 - Daylight filters

Irradiance in W/m² based on 111 SPD'S for Xenon-Arcs with Daylight Filters Normalized to Exactly 0.55 Wm⁻²nm⁻¹ at 340 NM

Bandpass	Mean	Std. Dev	Min	Max	Lower 95%	Upper 95%
250-260	0.00	0.00	0.00	0.00	0.00	0.00
261-270	0.00	0.00	0.00	0.00	0.00	0.00
271-280	0.00	0.00	0.00	0.01	0.00	0.00
281-290	0.02	0.02	0.00	0.11	0.00	0.06
291-300	0.19	0.10	0.03	0.55	0.00	0.38
301-310	0.77	0.21	0.32	1.46	0.35	1.18
311-320	1.91	0.21	1.31	2.68	1.49	2.33
321-330	3.39	0.13	2.96	3.97	3.12	3.65
331-340	4.92	0.06	4.68	5.11	4.80	5.03
341-350	6.24	0.09	5.80	6.40	6.06	6.43
351-360	7.40	0.22	6.66	7.82	6.97	7.84
361-370	8.58	0.41	7.56	9.82	7.76	9.39
371-380	9.25	0.60	8.09	11.36	8.04	10.45
381-390	9.92	0.89	8.39	13.71	8.15	11.69
391-400	11.88	1.44	9.64	18.57	8.99	14.76
300-400	64.31	3.57	57.79	78.96	57.16	71.45

The spectral requirements for SAE J2527 are given in Appendix C.

- **Table C1** details Extended UV Filters – for historical matching
- **Table C2** details Daylight Filters – recommended for more realistic test.

Irradiance, Panel Temperature, Chamber Air Temperature & RH

- All four parameters are to be controlled automatically in SAE J2527

§ 5.2 The apparatus shall have the means to simultaneously and automatically control irradiance, black panel temperature, relative humidity, and chamber temperature.

Narrowband 340 nm Irradiance

SAE J2527

** 0.55 W·m⁻²·nm⁻¹ at 340 nm is the historic preferred irradiance for this test. An apparatus that monitors irradiance using a broadband rather than a narrowband will have a different value*

Table 2 - Target values at control panel sensor

Controls	Dark+Spray Step 1		Light Step 2,3,4	
	Target	Operational Fluctuation	Target	Operational Fluctuation
Automatic irradiance	None		0.55 Wm ⁻² nm ⁻¹ at 340 nm *	
Black panel temp.	None		70 °C	± 3 °C
Chamber air temp. (Dry bulb)	38 °C	Not Applicable	47 °C	± 3 °C
Relative humidity	95%	Not Applicable	50%	± 10%
Radiant exposure	None		See applicable specification	

Black Panel Temperature Sensor

SAE J2527

§ 5.3 The apparatus shall have an un-insulated black panel thermometer as described in ASTM G151 unless otherwise agreed upon by contractual parties.

Table 2 - Target values at control panel sensor

Controls	Dark+Spray Step 1		Light Step 2,3,4	
	Target	Operational Fluctuation	Target	Operational Fluctuation
Automatic irradiance	None		0.55 Wm ⁻² nm ⁻¹ at 340 nm *	
Black panel temp.	None		70 °C	± 3 °C
Chamber air temp. (Dry bulb)	38 °C	Not Applicable	47 °C	± 3 °C
Relative humidity	95%	Not Applicable	50%	± 10%
Radiant exposure	None		See applicable specification	

Air Temperature and Relative Humidity

SAE J2527

§ 5.2 *The apparatus shall have the means to simultaneously and automatically control irradiance, black panel temperature, relative humidity, and chamber temperature.*

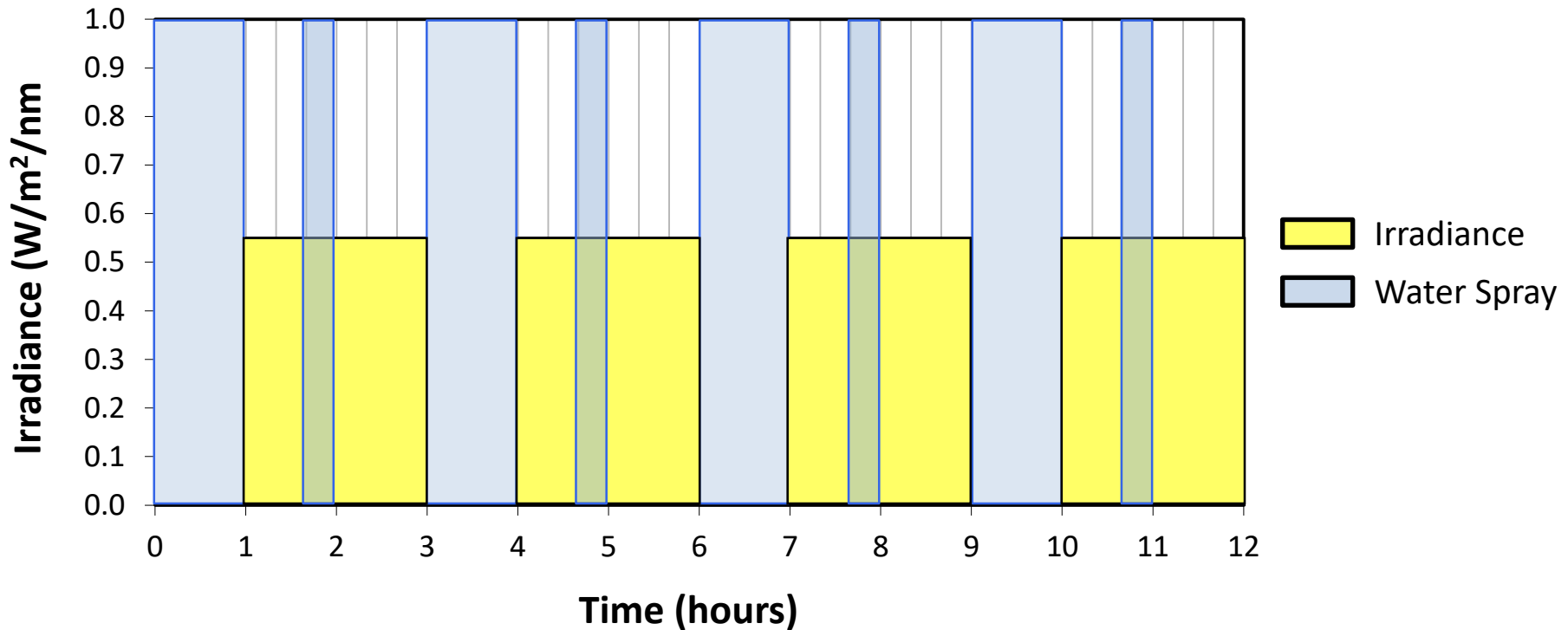
Table 2 - Target values at control panel sensor

Controls	Dark+Spray Step 1		Light Step 2,3,4	
	Target	Operational Fluctuation	Target	Operational Fluctuation
Automatic irradiance	None		0.55 Wm ⁻² nm ⁻¹ at 340 nm *	
Black panel temp.	None		70 °C	± 3 °C
Chamber air temp. (Dry bulb)	38 °C	Not Applicable	47 °C	± 3 °C
Relative humidity	95%	Not Applicable	50%	± 10%
Radiant exposure	None		See applicable specification	

Cycle Duration

SAE J2527

§ 6.4 Choose the program cycle which provides 120 minutes of light and 60 minutes of dark in the following cycle: 60 minutes of dark with both back and front spray, 40 minutes of light followed by 20 minutes of light and front specimen spray, followed by 60 minutes of light, and repeating. The test sequence shall follow the condition set up in Table 1



Additional Requirements

SAE J2412 & SAE J2527

- Specimen Repositioning
 - SAE J2412 & SAE J2527 § 5.4.1
- DI Water Supply (< 1 ppm solids and < 0.2 ppm silica)
 - SAE J2412 § 6.1.1
 - SAE J2527 § 6.2
- Test duration to be reported by total radiant exposure (kJ/m²/nm)
 - SAE J2412 & SAE J2527 § 9.2.6

How to run laboratory test...

- Interpretation of test conditions
- **Setting up Q-SUN xenon-arc test chamber**
- Specimen preparation and mounting
- Running the test
- Evaluating and reporting

How to Program SAE J2412 in Q-SUN?

- Q-SUN Xe-2 or Xe-3
- Extended UV-Q/B Filter
- Narrowband 340 nm Sensor
- Uninsulated Black Panel

Step	Function	Relative Humidity	Irradiance	Black Panel Temp	Chamber Air Temp	Step Time (hh:mm)
1	Light	50 %	0.55 W/m ² /nm	89 °C	62 °C	3:48
2	Dark	95 %			38 °C	1:00

How to Program SAE J2527 in Q-SUN?

- Q-SUN Xe-2HBS or Xe-3HBS (or any other –BS configuration)
- Extended UV-Q/B Filter -or- Daylight-BB Filter
- Narrowband 340 nm Sensor
- Uninsulated Black Panel

Step	Function	Relative Humidity	Irradiance	Black Panel Temp	Chamber Air Temp	Step Time (hh:mm)
1	Dark + Spray Front + Back	95 %			38 °C	1:00
2	Light	50 %	0.55 W/m ² /nm	70 °C	47 °C	0:40
3	Light + Spray	50 %	0.55 W/m ² /nm	70 °C	47 °C	0:20
4	Light	50 %	0.55 W/m ² /nm	70 °C	47 °C	1:00

Chamber Sensor Calibration

Sensor	Device
Irradiance	CR20/340QB CR20/340BB (SAE J2527 only) UC20/340
Panel	CT202/BP UC202/BP
Chamber Air Temperature Relative Humidity	Chamber Air Temperature / Relative Humidity Sensor



UC20/340 Smart Sensor



UC202/BP Smart Sensor

How to run laboratory test...

- Interpretation of test conditions
- Setting up Q-SUN xenon-arc test chamber
- **Specimen preparation and mounting**
- Running the test
- Evaluating and reporting

Mesh Tray in Q-SUN Xe-3

- In order for water delivery during SAE J2527's back spray, a mesh tray is required in an Xe-3HBS.
- The mesh tray may be used for SAE J2412 in order to meet the non-mandatory polystyrene tolerance.
- The mesh tray is not applicable to the Xe-2; open back specimen holders should be used.



Xe-3 Mesh Tray

Specimen Preparation

- SAE J2412 & SAE J2527 Specimen Preparation and Conditioning

§ 7.1 Prepare the specimens to be exposed to fit the specimen holder being used. Refer to ASTM G 147 for conditioning and handling of specimens.
- SAE J2412 Back textiles with cardboard

§ 7.3 Interiors textiles (body cloth, carpet, vinyl coated fabrics, etc.) shall always be backed with white cardboard. In all cases the white cardboard shall be the size of the specimen holder to eliminate any gaps.
- SAE J2412 Fill unused slots and gaps with cardboard

§ 7.4 Fill all unused slots with an inert non-reflective material (e.g., white cardboard panels) to maintain desired air flow.



Textile Specimens
on cardstock in Xe-2 holder

How to run laboratory test...

- Interpretation of test conditions
- Setting up Q-SUN xenon-arc test chamber
- Specimen preparation and mounting
- **Running the test**
- Evaluating and reporting

Specimen Repositioning

- Ensures best repeatability and reproducibility
- Perform at least 4 times per test



Matching Polystyrene Tolerance

- Instrumental Color Measurement (reflectance mode)
 - includes the specular component
 - CIELAB, D65 illuminant, 10° observer
- Back with white calibration tile
 - Do not back with paper as may include optical brighteners
- Mount polystyrene in specimen holder
- Mesh Tray
- Place chip close or directly next to the black panel
(参见SAE J2412 D.2.3.3和SAE J2527 B.2.3.3)

Matching Polystyrene Tolerance

- PS板背面无需垫铝片
 - 如果试样尺寸适合安装在样品架上，则PS板，黑板温度计和试样都安装在样品架上，背面用卡环固定，且PS板和黑板温度计安装在同一个样品架上
 - 如果试样尺寸不适合安装在样品架上，则PS板，黑板温度计和试样都直接放置在网格托盘上
- 其它位置全部用样品架（带铝片）或直接用铝片填充

Polystyrene Exposure



Polystyrene Chip Location



Polystyrene Before and After Exposure

Polystyrene Lot 9 Specification (non-mandatory)

Radiant Dosage (kJ/m ² ·nm @ 340 nm)	95% Tolerance Interval for Reflectance Δb^* , SAE J1885 and J2412 Extended UV Filter		
	Low	Target	High
37.6			
75.2	1.30	2.40	3.50
112.8	1.78	3.03	4.29
150.4	2.26	3.66	5.07
188.0	2.74	4.30	5.86
225.6	3.21	4.93	6.64
263.2	3.69	5.56	7.43
300.8	4.17	6.19	8.21
338.4	4.65	6.83	9.00
376.0	5.13	7.46	9.79
413.6	5.61	8.09	10.57
451.2	6.09	8.72	11.36
488.8	6.56	9.35	12.14
526.4	7.04	9.99	12.93
564.0	7.52	10.62	13.71
601.6	8.00	11.25	14.50

Automotive Materials Association Round Robin Study on PS Lot 9 SAE J2412 Exposure

Polystyrene Lot 9 Specification (non-mandatory)

SAE J2527 - Polystyrene Lot 9 Reference Material Specifications (Sept 2017)

Radiant Dosage (kJ/m ² ·nm @340 nm)	95% Tolerance Interval for Reflectance Δb^* , SAE J1960 and J2527 Table C1 Spectra Extended UV Filter			95% Tolerance Interval for Reflectance Δb^* , SAE J2527 Table C2 Spectra Daylight Filter		
	Low	Target	High	Low	Target	High
	31.6					
63.2	0.40	1.20	2.00	0.50	1.00	1.50
94.8	0.69	1.57	2.45	0.71	1.29	1.86
126.4	0.99	1.94	2.89	0.93	1.57	2.21
158.0	1.28	2.31	3.34	1.14	1.86	2.57
189.6	1.57	2.68	3.79	1.36	2.14	2.93
221.2	1.86	3.05	4.23	1.57	2.43	3.29
252.8	2.16	3.42	4.68	1.79	2.71	3.64
284.4	2.45	3.79	5.13	2.00	3.00	4.00
316.0	2.74	4.16	5.57	2.21	3.29	4.36
347.6	3.04	4.53	6.02	2.43	3.57	4.71
379.2	3.33	4.90	6.46	2.64	3.86	5.07
410.8	3.62	5.27	6.91	2.86	4.14	5.43
442.4	3.91	5.64	7.36	3.07	4.43	5.79
474.0	4.21	6.01	7.80	3.29	4.71	6.14
505.6	4.50	6.38	8.25	3.50	5.00	6.50

Automotive Materials Association Round Robin Study on PS Lot 9 SAE J2527 Exposure

Periodic Calibration and Lamp Replacement

- Irradiance Calibration
 - 500 hrs
- Temperature Calibration
 - 6 months
- Lamp replacement
 - 1500 hrs
 - Or 3000 hrs with new *E* model configuration

How to run laboratory test...

- Interpretation of test conditions
- Setting up Q-SUN xenon-arc test chamber
- Specimen preparation and mounting
- Running the test
- Evaluating and reporting

Evaluating and Reporting

- Visual Assessment
- Grey Scale Fade
- Instrumental Color Assessment
- Gloss retention
- Blistering
- Adhesion
- Duration to be reported as radiant exposure ($\text{kJ}/\text{m}^2/\text{nm}$)

Conclusion

- These two standards have been instrumental in the development of material reliability and performance. The majority of the performance of these standards is for Qualification and Validation.
- Though new standards have better correlation to service environment or more accurate representation of light exposure, the standards are still very popular, with many manufacturers and automotive suppliers still performing.
- The Q-SUN Xe-2 and Xe-3 are both qualified to run either standard with the proper configuration and setup.

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