Q-SUN Xenon Arc Testers Operation and Maintenance

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Q-Lab

View Recorded Presentation

Q-Lab's Operator Training Series

Today is the first of a three-part webinar series on basic operation of our weathering and corrosion testers

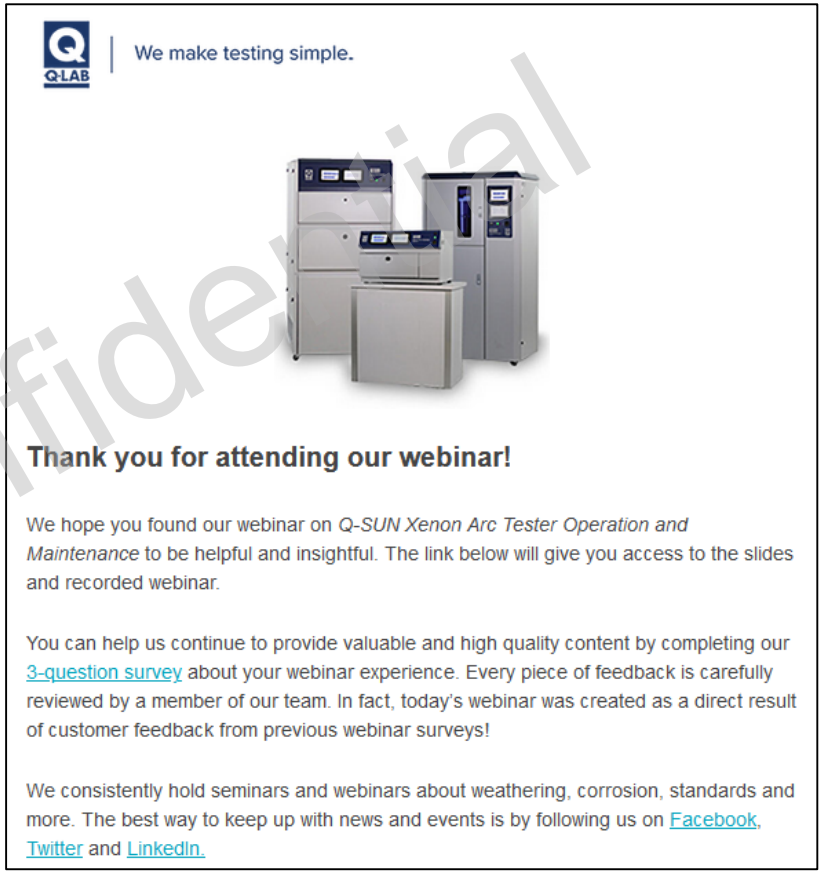
All upcoming and archived webinars can be accessed at:
q-lab.com/webinars

Date	Topic
06 Oct	QUV
13 Oct	Q-SUN
20 Oct	Q-FOG

Administrative Notes

You'll receive a follow-up email from info@email.q-lab.com with links to a survey, registration for future webinars, and to download the slides

Use the **Q&A feature in Zoom** to ask us questions today!



We make testing simple.

Thank you for attending our webinar!

We hope you found our webinar on *Q-SUN Xenon Arc Tester Operation and Maintenance* to be helpful and insightful. The link below will give you access to the slides and recorded webinar.

You can help us continue to provide valuable and high quality content by completing our 3-question survey about your webinar experience. Every piece of feedback is carefully reviewed by a member of our team. In fact, today's webinar was created as a direct result of customer feedback from previous webinar surveys!

We consistently hold seminars and webinars about weathering, corrosion, standards and more. The best way to keep up with news and events is by following us on Facebook, Twitter and LinkedIn.

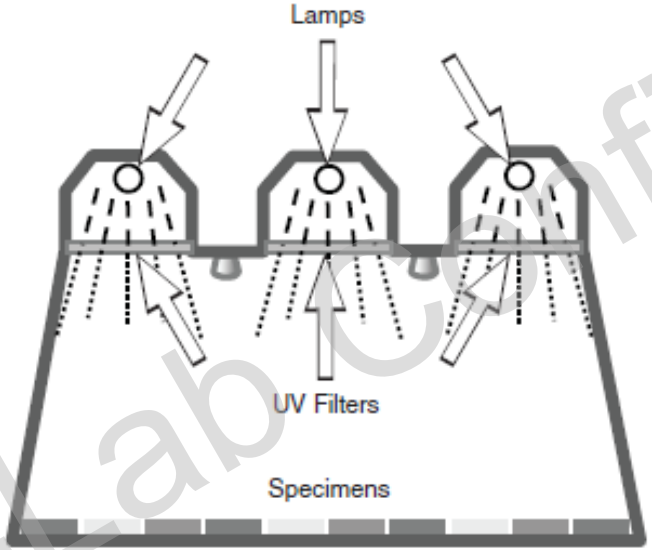
Q-SUN Xenon Arc Models

Simulate light (outdoor direct sunlight, indoor filtered light); heat (elevated temperature), and water (humidity and water spray)

Q-SUN Topics

- Safety
- Features and Functions
- Running a Test
- Calibration
- Maintenance

Xenon Lamps



Xenon Lamps give off UV light and should not be viewed directly

Interlocks stop tester when door opened

Interlock Switches

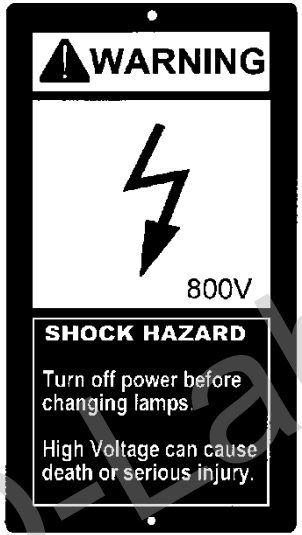
Xe-1

Xe-2
(overhead view)

Xe-3

Q-SUN Hazards

Electrical Shock



Hot Surface

Topics

- Safety
- Features and Functions
- Running a Test
- Calibration
- Maintenance

Q-SUN Overview (Flat Array)

1) User interface
2) USB port for data transfer
3) Xenon lamps with irradiance control
4) Optical filters
5) Water spray
6) Onboard irradiance sensors
7) Black Panel Temp sensor
8) Specimen holders
9) Relative Humidity/CAT sensor

Q-SUN Overview (Rotating Rack)

1) User interface
2) USB port for data transfer
3) Xenon lamps with irradiance control
4) Optical filters
5) Water spray
6) Onboard irradiance sensors
7) Black Panel Temp sensor
8) Specimen holders
9) Relative Humidity/CAT sensor

Q-SUN Optional Features

Q-SUN Model/ Configuration		Q-SUN Tester Features					
		Gen 4 + High Irrad (-E)[4]	Humidity Control (-H)	Chamber Air Chiller (-C)	Water Spray (-S)	Back Spray (-BS)	Dual Spray (-DS)
Xe-1	Xe-1-B[3]						
	Xe-1-BCE	●		●			
	Xe-1-SE	●			●		
	Xe-1-SCE	●		●	●		
	Xe-1-WE	●			●[5]		
Xe-2	Xe-2-HE	●	●				
	Xe-2-HSE	●	●		●		
	Xe-2-HBSE	●	●		●	●	
Xe-3	Xe-3-H[3]		●				
	Xe-3-HCE	●	●	●			
	Xe-3-HSE	●	●		●		
	Xe-3-HSCE	●	●	●	●		
	Xe-3-HBSE	●	●		●	●	
	Xe-3-HBSCE	●	●	●	●	●	
	Xe-3-HDSE	●	●		●		●
	Xe-3-HDSCE	●	●	●	●		●
	Xe-3-HDSBSE	●	●		●	●	●
	Xe-3-HDSBSCE	●	●	●	●	●	●

Q-SUN Light Delivery

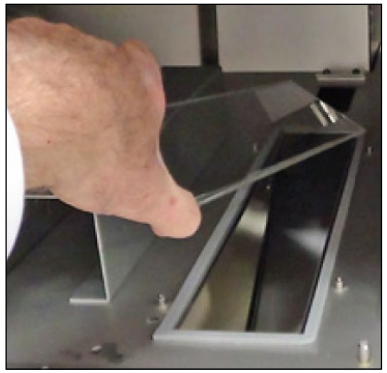
Xenon arc lamps

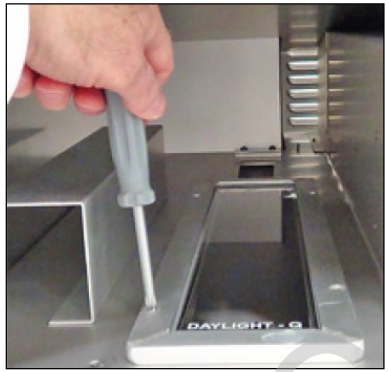
Optical filters

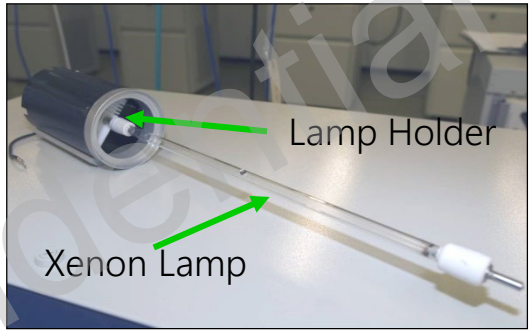
Xe-2 lantern

Xe-1 / Xe-3 flat filter

Optical Filters and Lamps





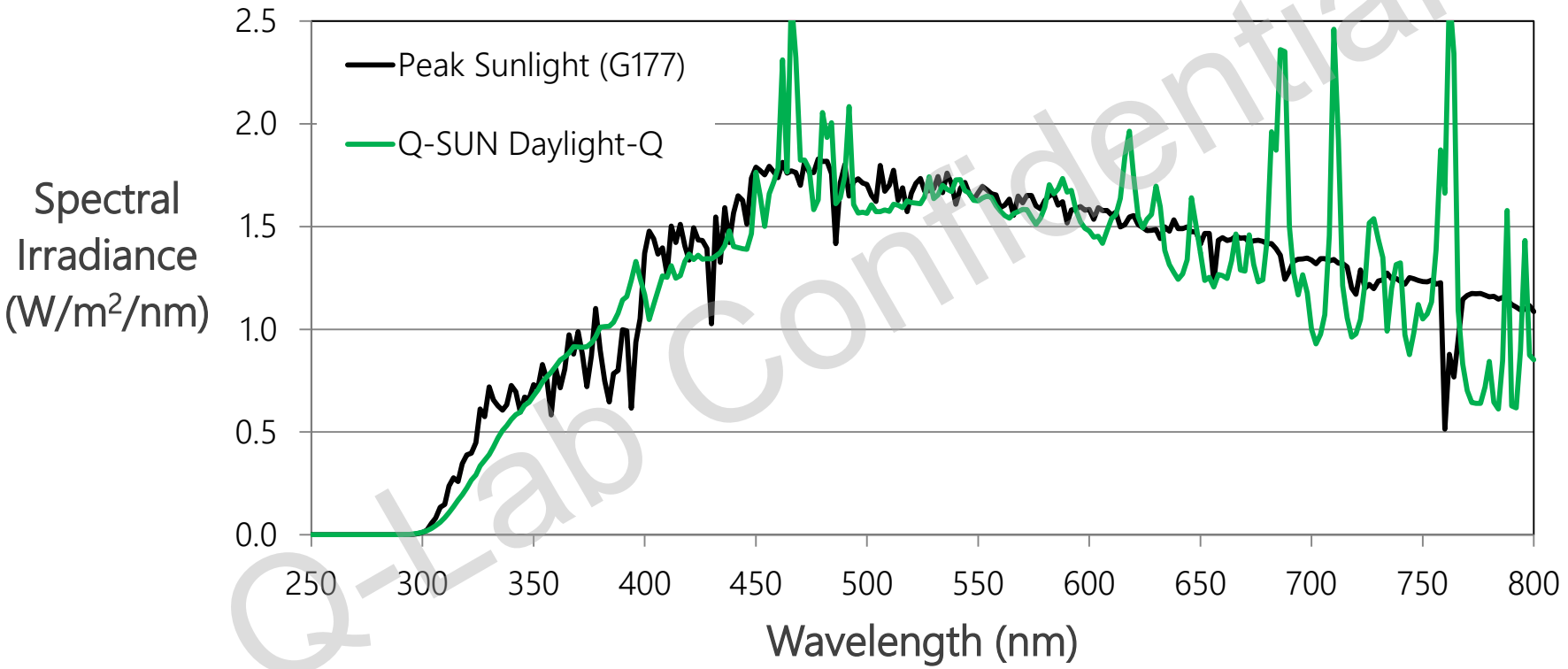


Xe-1
and
Xe-3

Xe-2

Filter
Lantern

Xenon Arc Spectrum

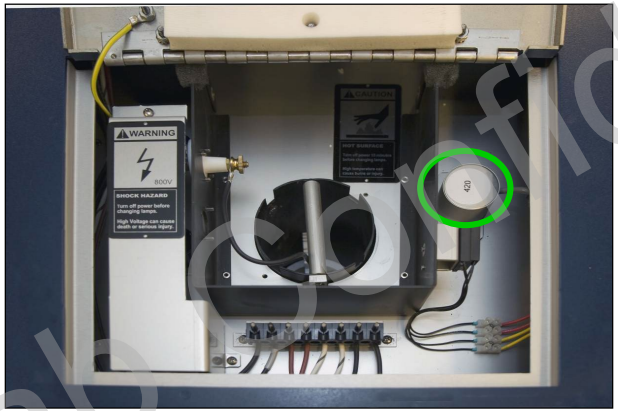


SOLAR EYE Irradiance Control System

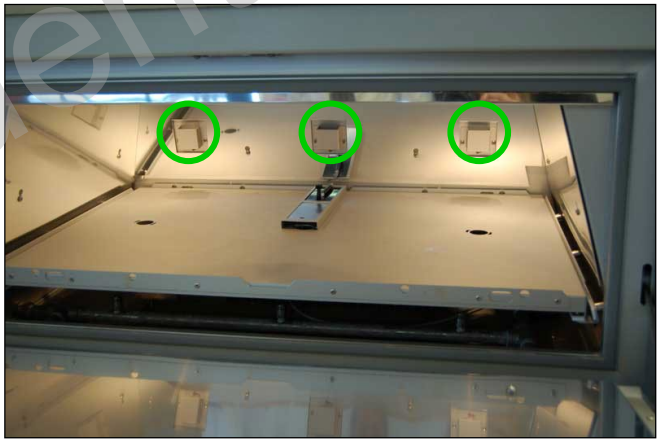
- SOLAR EYE Irradiance Control maintains the same light output at all times
- Ballasts control lamp output
- Allows for excellent repeatability and reproducibility

Onboard Irradiance Sensors

Xe-1



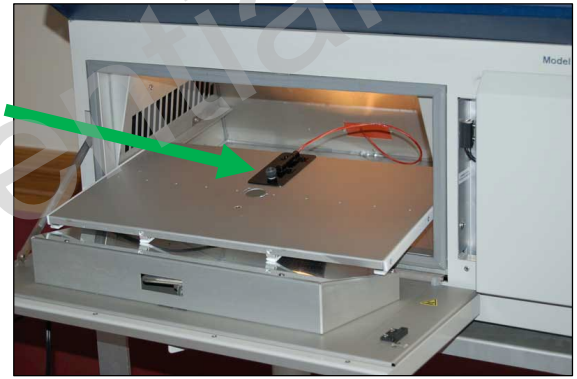
Xe-2
(overhead)



Xe-3

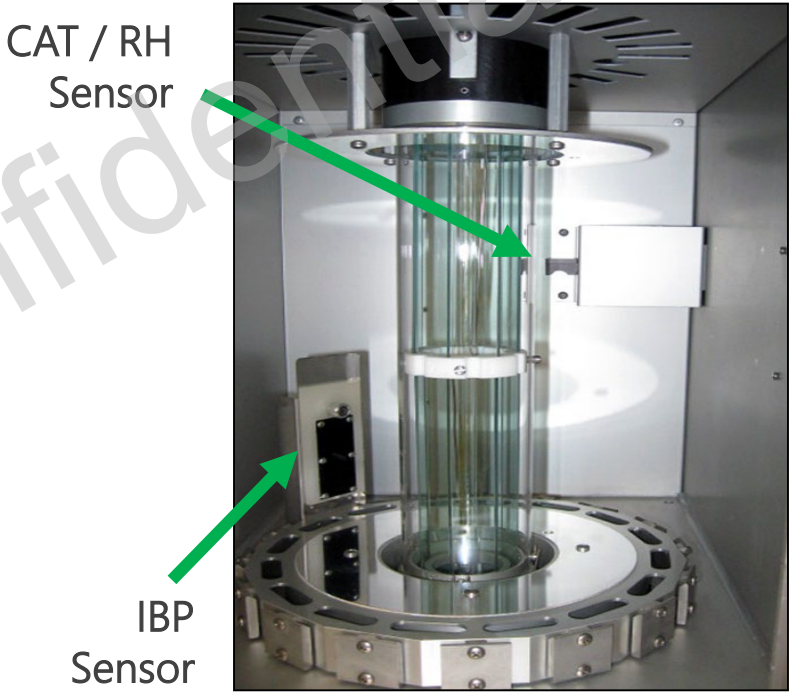
Xe-1 Onboard Temperature Sensors

- Xe-1 Black Panel (BP) or Insulated Black Panel (IBP) Thermometer
- Optional Chamber Air Thermometer (CAT) in Xe-1
- Tester can control temperature by BP or CAT; the other is simply monitored



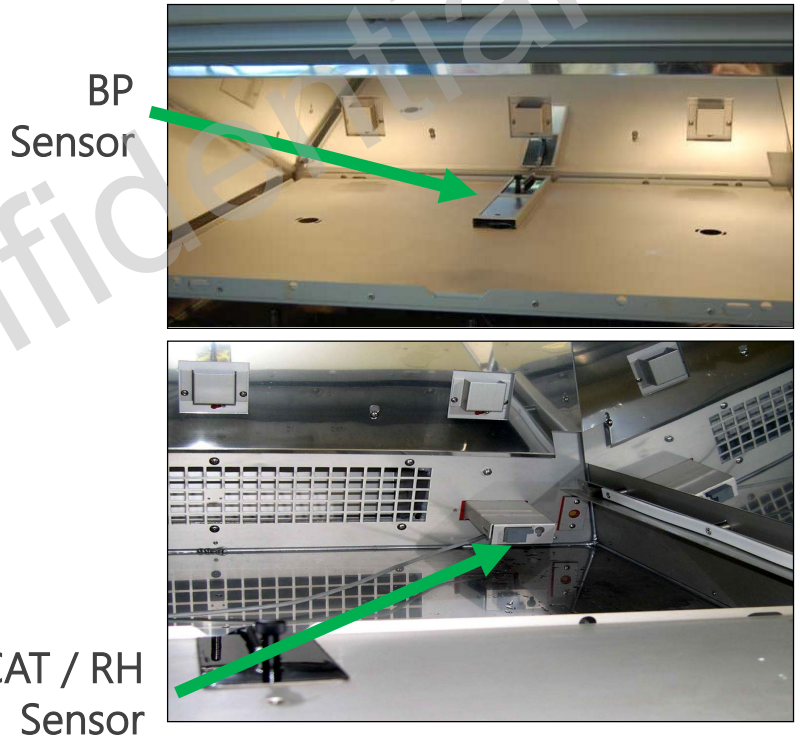
Xe-2 Onboard Temperature & RH Sensors

- Xe-2 Black Panel (BP) or Insulated Black Panel (IBP) Thermometer
- One sensor monitors Chamber Air Temperature and Relative Humidity (CAT/RH Sensor), standard in Xe-2
- Tester simultaneously controls BP, CAT, & RH.

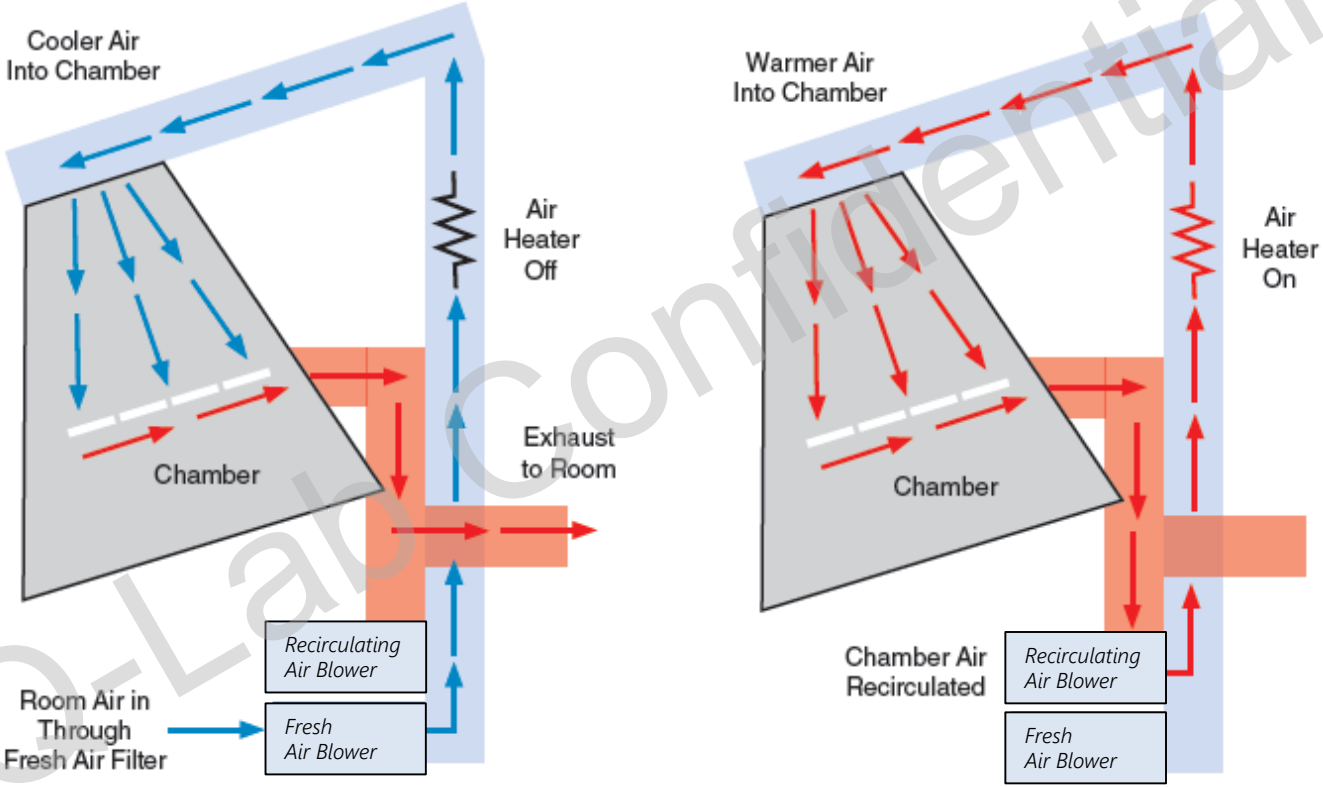


Xe-3 Onboard Temperature & RH Sensors

- Xe-3 Black Panel (BP) or Insulated Black Panel (IBP) Thermometer
- One sensor monitors Chamber Air Temperature and Relative Humidity (CAT/RH Sensor), standard in Xe-3
- Tester simultaneously controls BP, CAT, & RH.



Temperature Control



Optional Chiller (Xe-1 / Xe-3)

Reduces minimum BPT by:

~10 °C (Xe-3)

~20 °C (Xe-1)

Q-SUN Water Delivery

- Water Spray (optional)
  - Front
  - Back (Xe-2 / Xe-3)
  - Dual (Auxiliary) (Xe-3)
  - Immersion (Xe-1)
- Relative Humidity control (Xe-2 / Xe-3)

Q-SUN Water Quality

- Purified (RO/DI) water is **required**
- Spray water requires even higher purity and also low silica
- Q-Lab follows ASTM G151 recommendations

Water Delivery	Resistivity (Ω·cm)	Conductivity (µS/cm)	Silica (ppm)	Total Dissolved Solids (ppm)	pH
Spray	> 5 M	< 0.2	< 0.1	< 0.1	6-8
Humidity	> 200 k	< 5.0	No requirement	< 2.5	6-8

Spray Systems (Optional)

Front (Top)

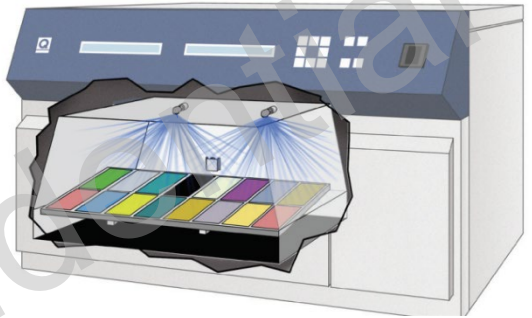
Back (Bottom)

Xe-1 / Xe-3 Water Spray System

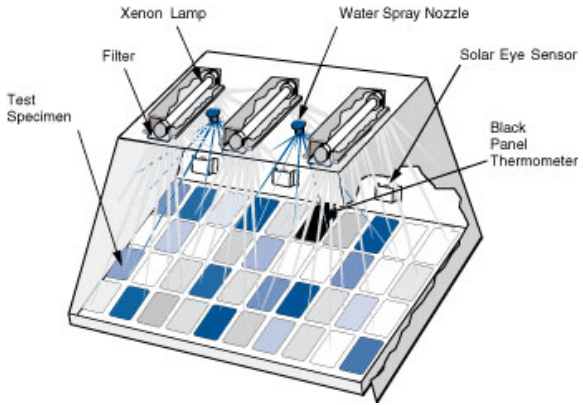
- Features
  - Pulse Rate Control
  - Automatic Fault Detector

- Two nozzles, used for:
  - Mist
  - Thermal Shock
  - Erosion

Xe-1



Xe-3



Xe-2 Water Spray System

- Features
  - Pulse Rate Control
  - Automatic Fault Detector
- One nozzle, used for:
  - Mist
  - Thermal Shock
- Second Nozzle for optional Back Spray

Specialized

Xe-1 Immersion

Xe-3 Dual Spray

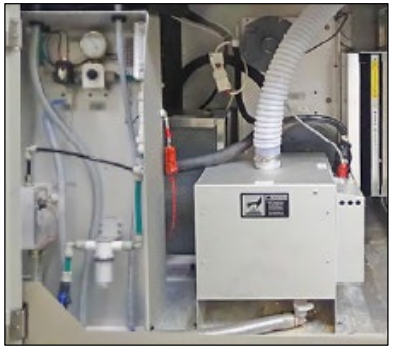
Relative Humidity Control (Xe-2 / Xe-3)

- Feedback Loop System
- RH/CAT Sensor

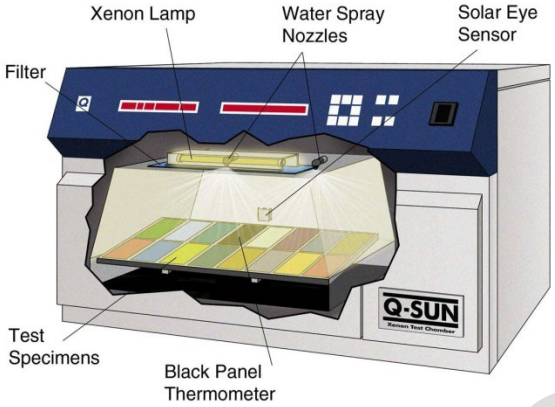
- Main Controller
- Humidity Generator
  - Nebulizer in Xe-2
  - Boiler in Xe-3

Xe-2

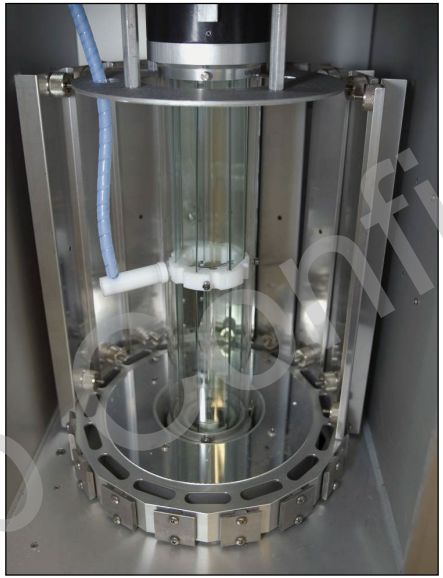
Xe-3



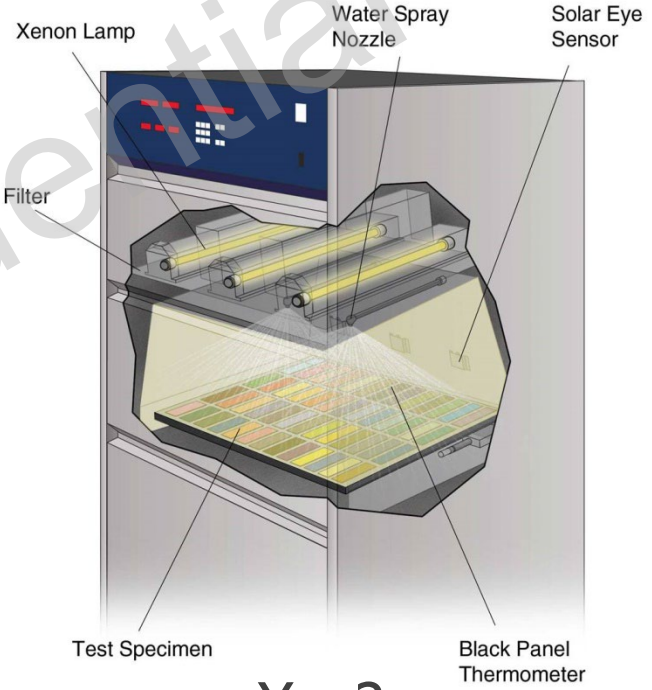
Q-SUN Specimen Exposure Areas



Xe-1



Xe-2



Xe-3

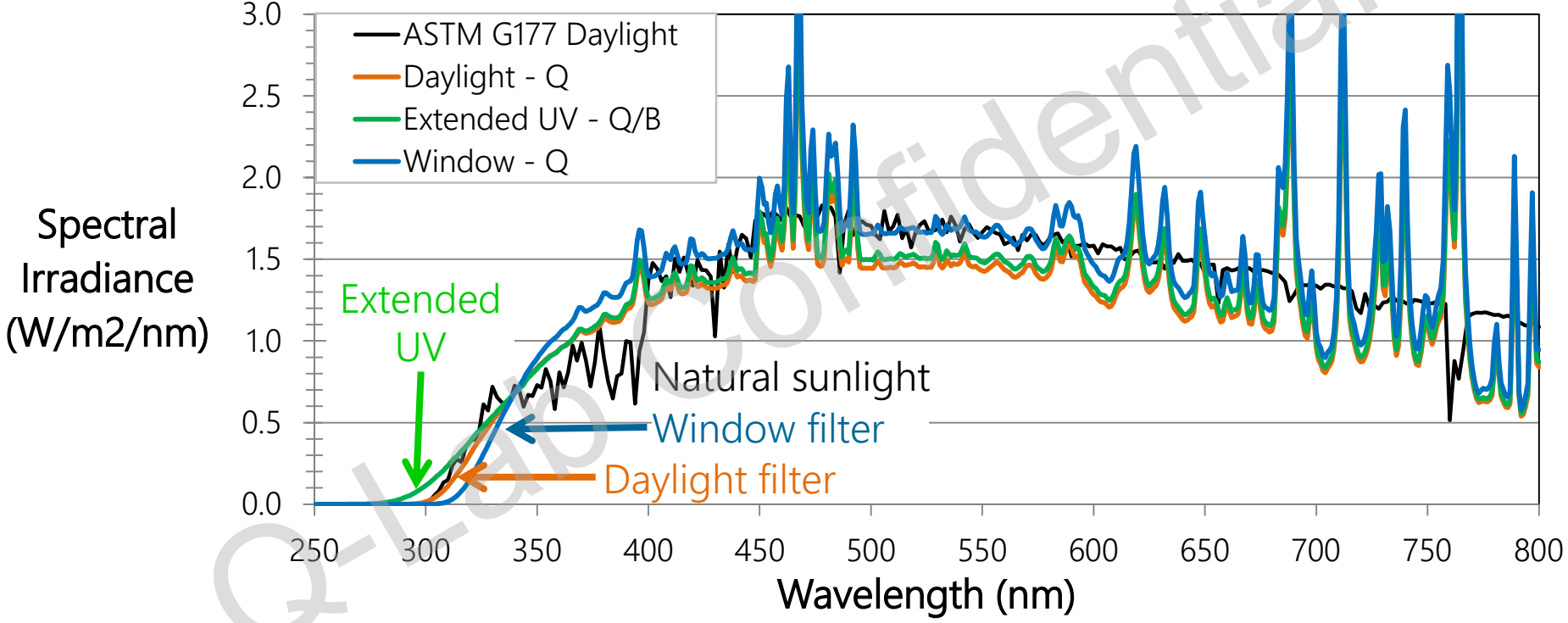
Q-SUN Topics

- Safety
- Functions of the Tester
- Running a Test
- Calibration
- Maintenance

Step 1: Select an Optical Filter

- Check your test method
  - Almost all test methods describe the filter type
- If you don't test to a specific method:
  - Outdoor applications: Daylight - Q
  - Indoor applications: Window - Q

Q-SUN Optical Filters



Step 2: Select Irradiance Settings

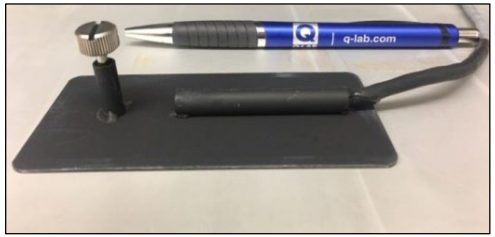
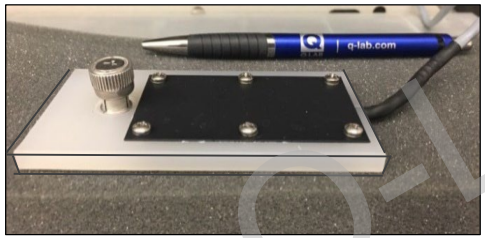
- 340 nm Control Point
  - For outdoor service environments
- 420 nm Control Point
  - For indoor service environments
- TUV Control Point
  - 300-400 nm (wideband, general service environments)
  - Typically used for European standards

Select Irradiance Values

	Xe-1 & Xe-3 Irradiance Values Typical (& Maximum)[A,B,C]			Xe-2 Irradiance Values Typical (& Maximum)[A,B,C]		
	W/m²/nm @340 nm	W/m²/nm @420 nm	W/m² @TUV (300-400 nm)	W/m²/nm @340 nm	W/m²/nm @420 nm	W/m² @TUV (300-400 nm)
Daylight-F	0.80 (1.30)	1.50 (2.40)	75 (125)	0.80 (0.95)	1.50 (1.70)	75 (85)
Daylight Q	0.68 (1.10)			0.68 (0.80)		
Extended UV (-Q/B, -Quartz[D])						
Daylight-B/B				0.51 (0.61)[E]		55 (65)
Window (-Q, -B/SL)	0.55 (0.85)		70 (108)	0.55 (0.65)		70 (80)
Window (-SF5, -IR, -B04[F])	-		42 (68)	-		42 (62)

Achievable irradiance values vary by optical filter, tester type, and control point

Step 3: Select Black Panel Type

Panel	Construction	ASTM Designation	ISO Designation	Temp Range (°C)
	Black painted stainless steel	Uninsulated Black Panel	Black Panel	45-110
	Black painted stainless steel mounted on 0.6 cm white PVDF	Insulated Black Panel	Black Standard	50-120

Black Panel Temperature Control

- BP/IBP is typically mounted in holder (sometimes directly on tray)
- Irradiance, color, and thickness all affect specimen temperature

Step 4: Programming

- Light
- Dark
- Light + Spray
- Dark + Spray
- Dark + Spray Front and Back
- Dual Spray
- Light + Dual Spray
- Light + Immersion
- Dark + Immersion

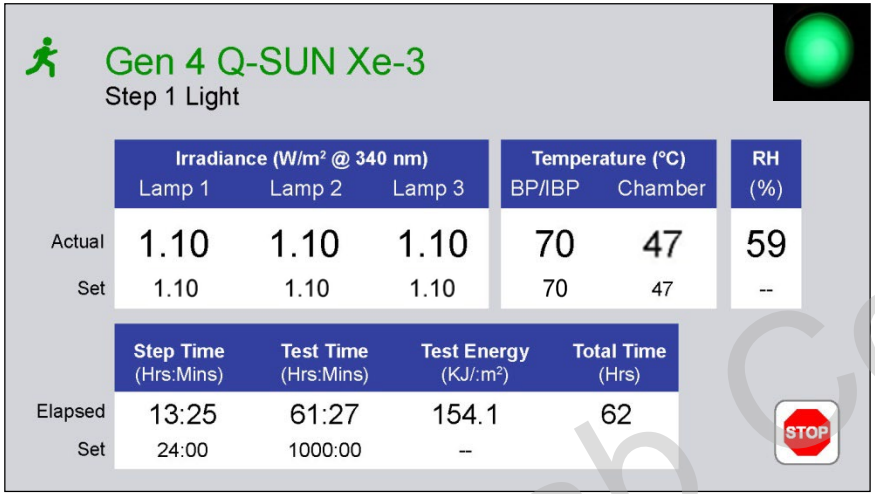
Q-SUN Front Control Panel

Dual, Full-Color Touchscreen Displays

USB

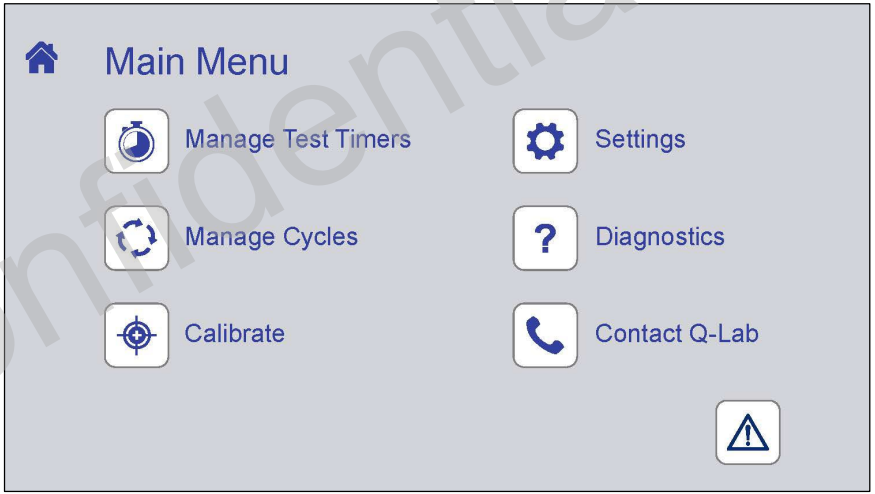
LED Status Indicator

Status and Menu Screens



Status screen

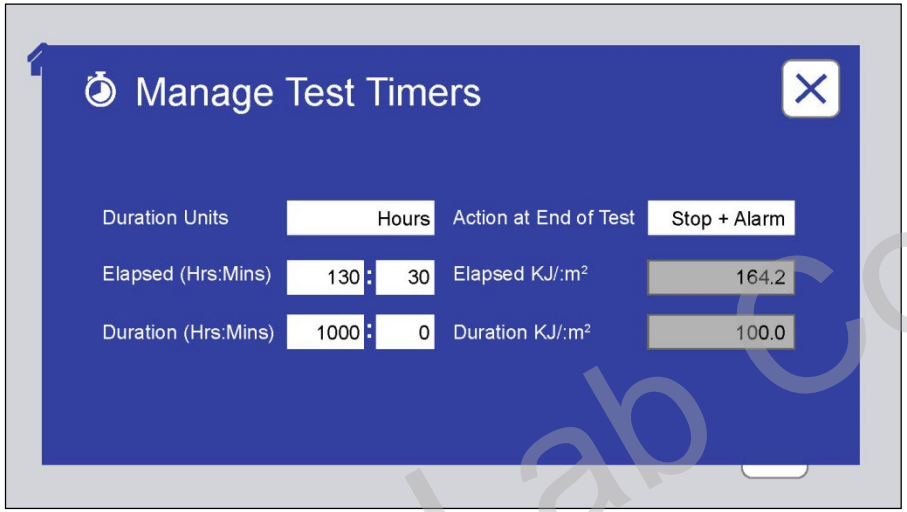
Setpoint and actual controls
Test timers



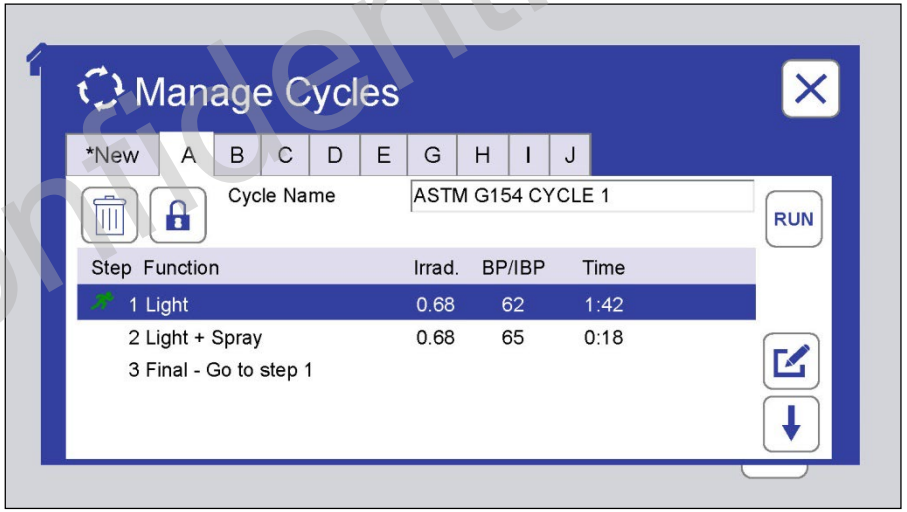
Menu screen

Cycle management
Calibration
Settings

Programming Tests



Test Duration



Managing Cycles

Step 5: Calibration

More on this later!

Step 6: Specimen Mounting

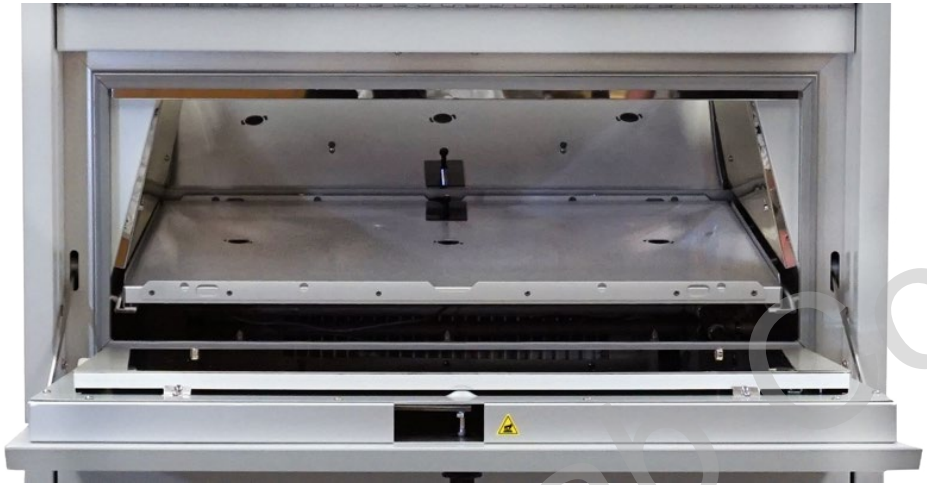
- Specimen Capacity
  - Xe-1: 17 (51 × 102 mm)
  - Xe-2: 31 (45 × 132 mm)
  - Xe-3: 55 (51 × 102 mm)
- Type of holder
  - Open-Backed (thick, rigid specimens)
  - Solid-Backed (flexible specimens)
  - Three-dimensional
- Specimen Tray
  - Solid
  - Mesh (open)
- Masking
  - Commonly used in textile testing

Specimen Holders Xe-1 / Xe-3

Panel Holders

3D Specimen Holders

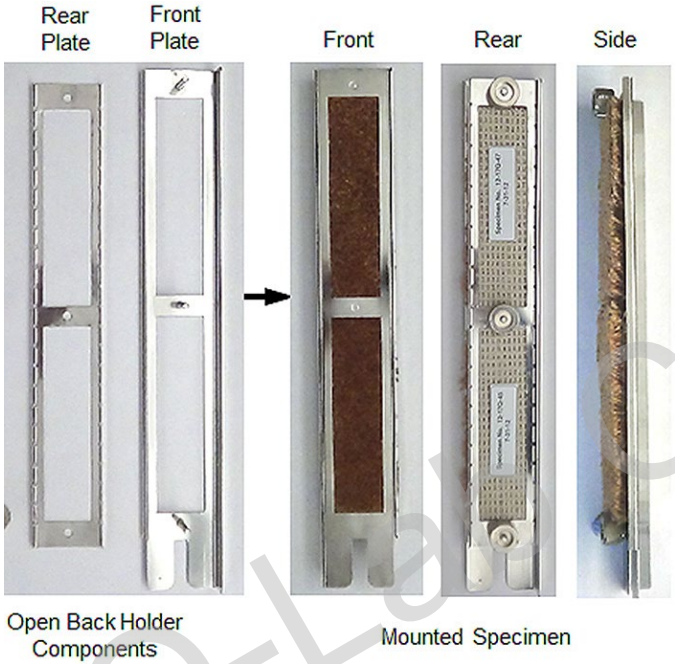
Specimen Mounting Trays Xe-3



Solid Tray

Open Mesh Tray

Q-SUN Xe-2 Specimen Holders

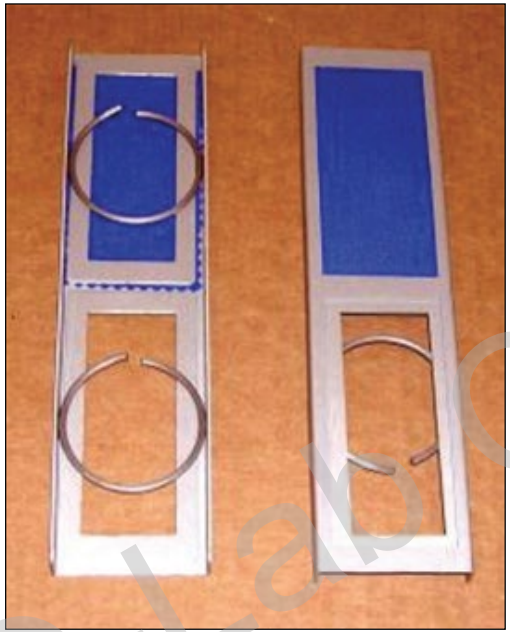


Open-backed

Close-backed

Textile masks

Mounting Flexible Specimens



Textiles

Thin Films

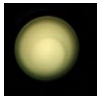
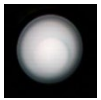
Step 7: Running the Test

- Specimen Repositioning
- Tester status and monitoring
- Data Logging via VIRTUAL STRIPCHART (optional)
- Calibration

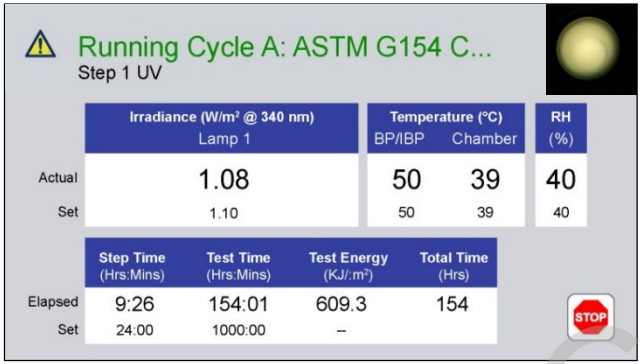
Specimen Repositioning

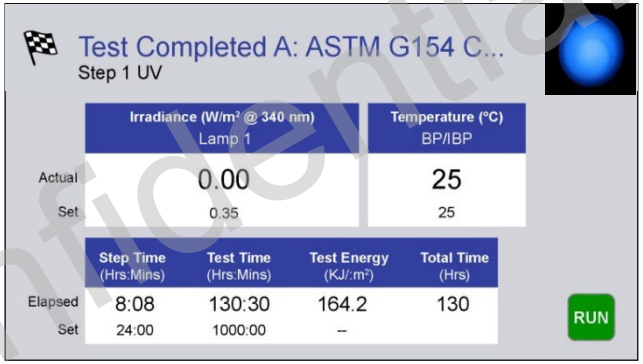
- Ensures best repeatability and reproducibility
- Perform at least 4 times per test (weekly for long tests)
- Important for both rotating rack and flat array testers

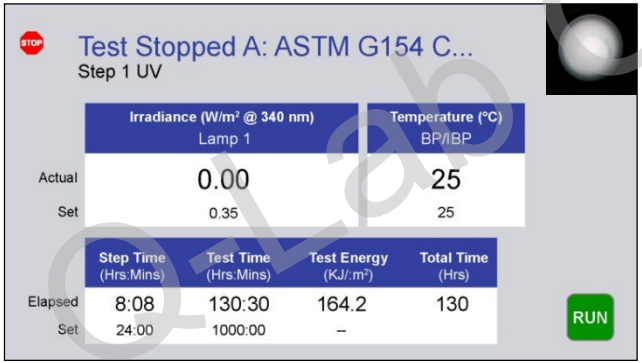
LED Status Indicator

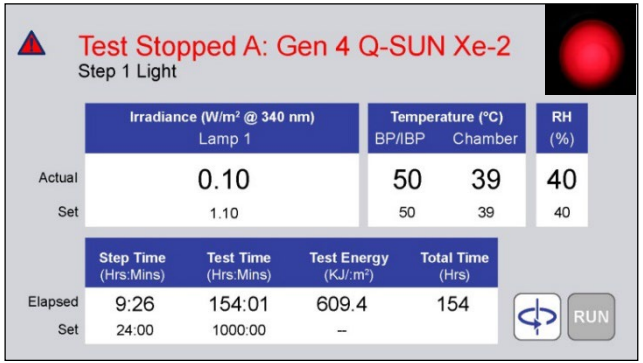
Color	Appearance	Meaning
Red 	*Flashing*	Error, test stopped
Yellow 	*Flashing*	Notification, test still running
White 	Static	Power on, stopped, no active error
Green 	Static	Test running, no active error
Blue 	*Flashing*	Test completed
Magenta 	*Flashing*	Software install or VSC transfer

Tester Status

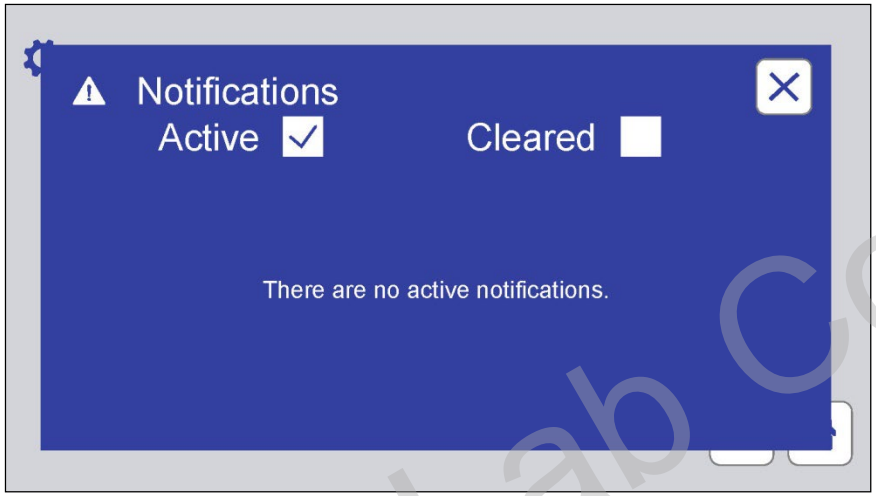


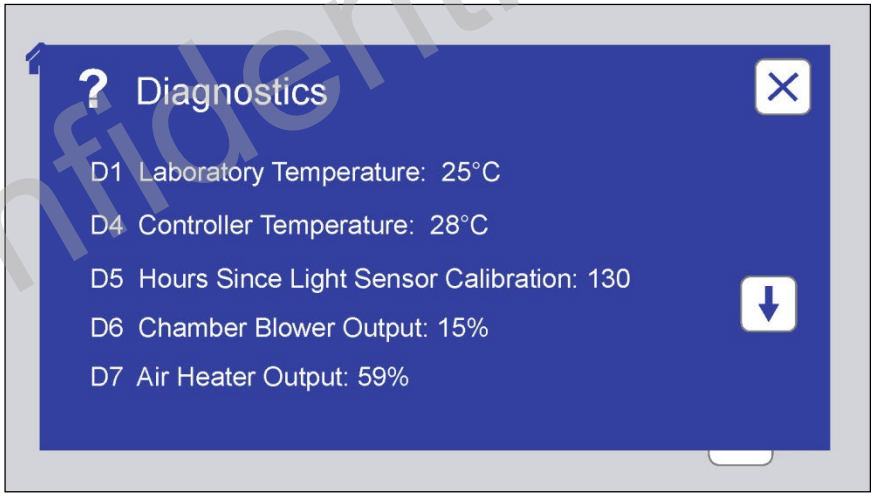






Notifications and Diagnostics





Q-SUN Topics

- Safety
- Functions of the Tester
- Running a Test
- Calibration
- Maintenance

Q-SUN Calibration

- Irradiance sensor
  - Every 500 light hours
- Black Panel temp sensor
  - Every 6 months
- Chamber air temp sensor
  - Every 12 months

- Calibration best practices
  - Calibrate whenever test conditions are changed
  - Calibrate at operating conditions
  - Always calibrate the lamps before calibrating the Black Panel

Q-SUN Smart Sensor Options

UC20/340

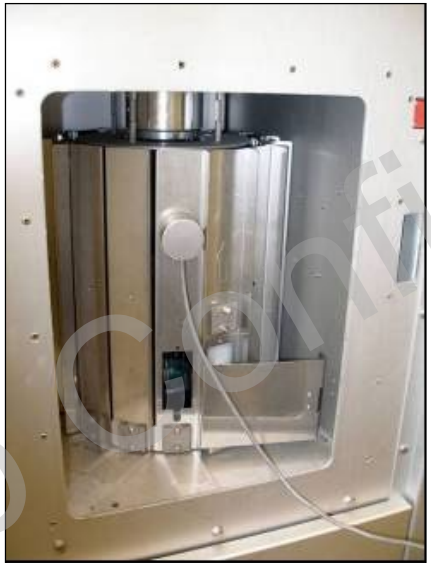
UC202/BP

UC202/IBP

Description	Name	Color Code	Used For
Irradiance Smart Sensor	UC20/340		Calibration Radiometer for 340nm on board sensor
	UC20/420		Calibration Radiometer for 420nm on board sensor
	UC20/TUV		Calibration Radiometer for TUV on board sensor
	UC20/LUX		Calibration Radiometer for LUX on board sensor
Temperature Smart Sensor	UC202/BP		Calibration of onboard Black Panel sensor
	UC202/IBP		Calibration of onboard Insulated Black Panel sensor

Irradiance Calibration Ports

Xe-1

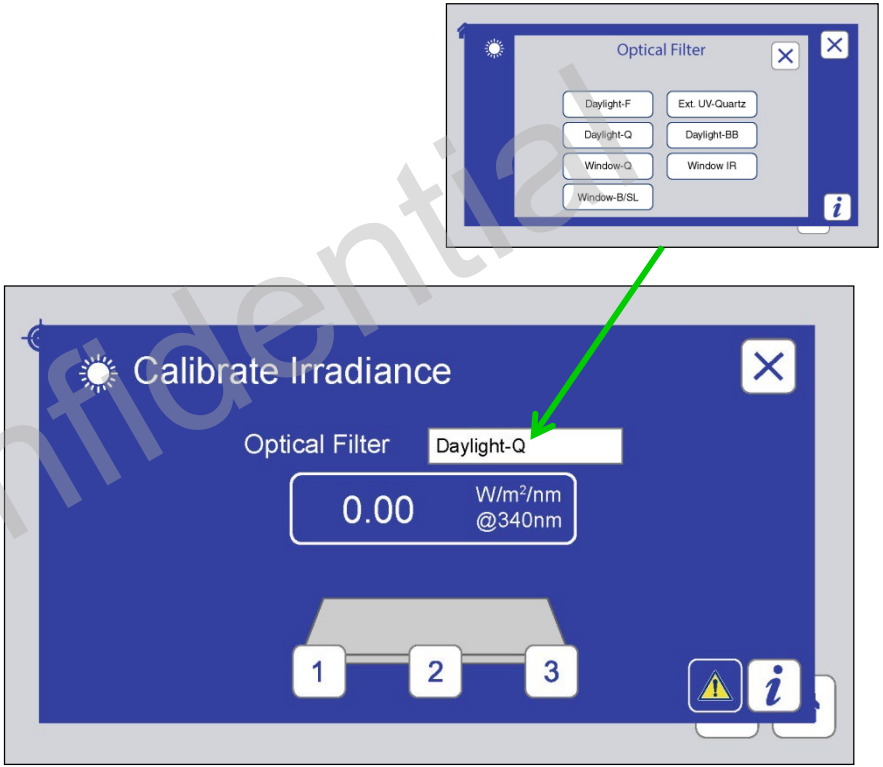


Xe-2

Xe-3

Irradiance Calibration

Plug Smart Sensor directly into tester USB port



Select optical filter and *Calibrate*

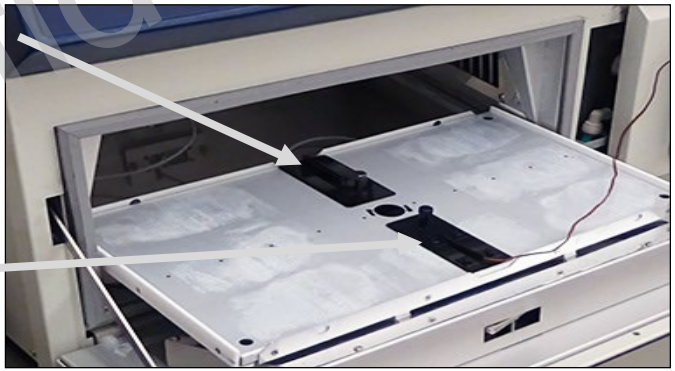
Black Panel Temp Sensor Calibration

Tester black panels and calibrated black panel are placed adjacent to each other in the chamber

Onboard Sensor in Panel Holder

Onboard Black Panel

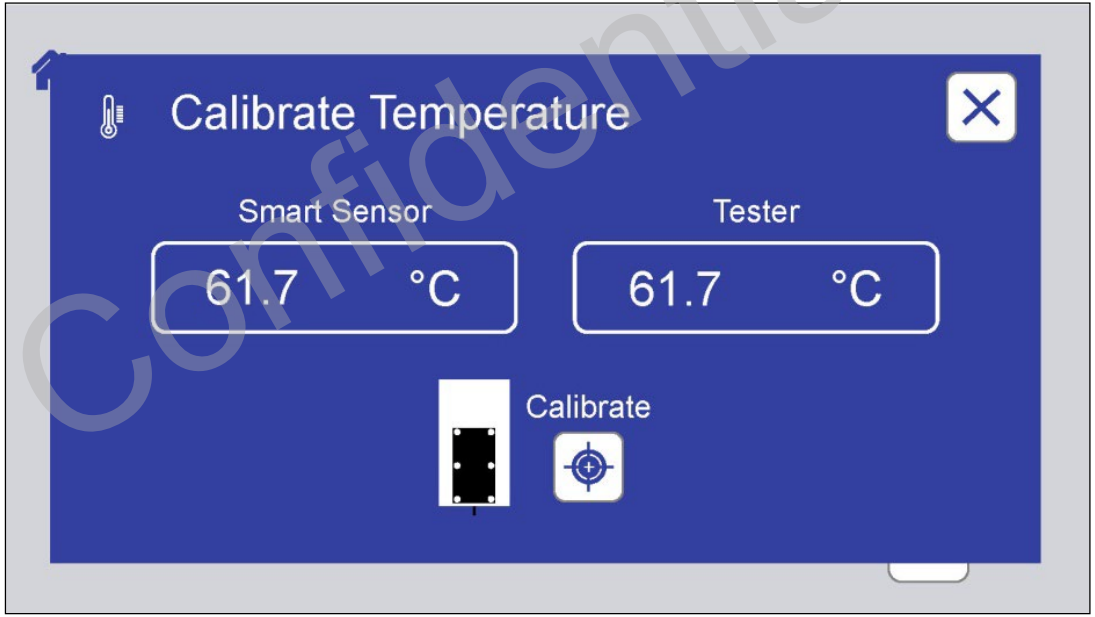
Calibration Black Panel



Onboard Sensor on Tray

Black Panel Thermometer Calibration

Let temperature stabilize and press *Calibrate*



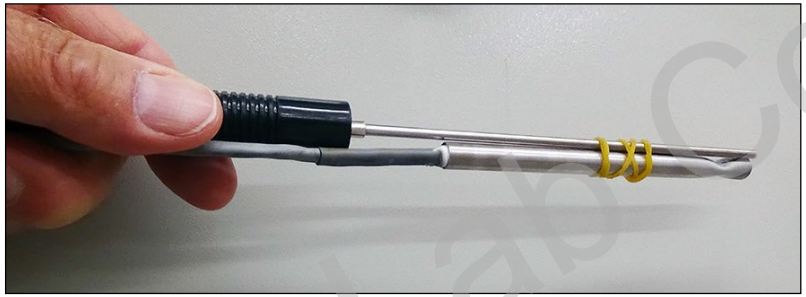
RH/CAT Sensor Annual Replacement

Xe-2

Xe-3

Xe-1 Chamber Air Temp Sensor Calibration

Using an independent reference device, calibrate the chamber air temperature in hot water bath



Yearly Reference Device Calibration

Irradiance & Black Panel Calibration Devices

- UC20 Irradiance Smart Sensors (replace/recalibrate)
- UC202 Temperature Smart Sensors (replace/recalibrate)

Chamber Air Temp / RH sensor (replace)

Q-SUN Topics

- Safety
- Functions of the Tester
- Running a Test
- Calibration
- Maintenance

Xenon Lamp Replacement Schedule

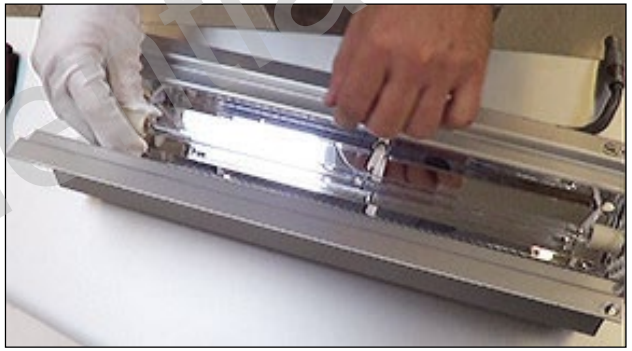
- Xenon lamps need to be replaced because they “age” (spectral shift to less UV)
- Q-SUN Optical Filters do not age

Q-SUN tester	Irradiance	Warranted Lamp Life (hrs)
Legacy	Typical	1500
Q-SUN “E” Model	Typical	3000
Q-SUN “E” Model	Maximum	1000

Q-SUN Xe-1 / Xe-3 Lamp Replacement

(1) Remove lamp housing from tester

(2) Remove lamp and clean housing

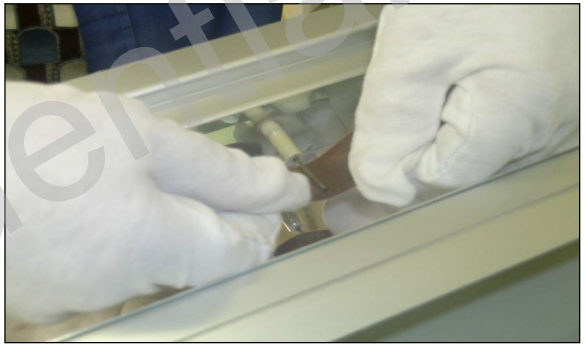


(3) Clean UV filters

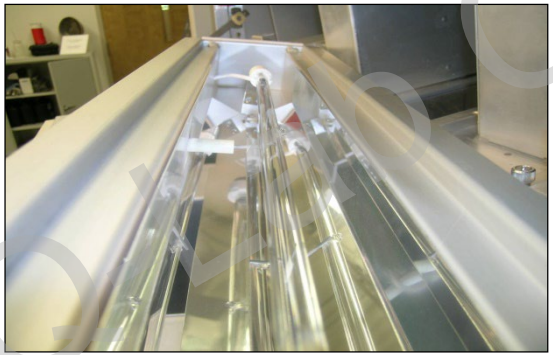
Q-SUN Xe-1 / Xe-3 Lamp Replacement

(4) Replace lamp

(5) Verify trigger finger contact



(6) Final lamp check



(7) Install replacement lamp

Q-SUN Xe-2 Lamp Replacement

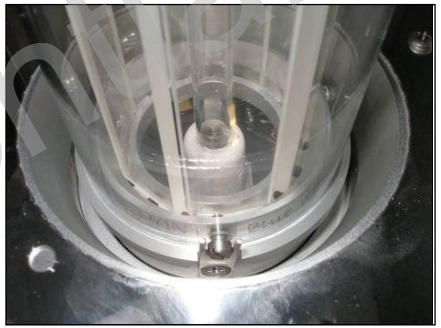
(1) Remove old lamp

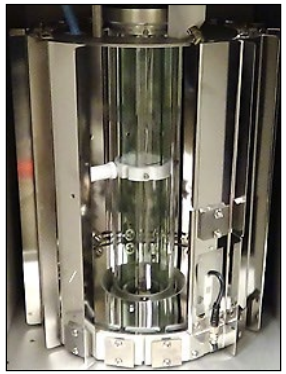
(2) Remove and clean filter lantern with ammonia

Q-SUN Xe-2 Lamp Replacement

(3) Install replacement lamp

(4) Verify trigger finger contact





Routine Maintenance

- Clean / Replace Air Filters (Monthly)
- Clean Humidifier
- Inspect Water Filter
- Clean Spray Nozzles
- Inspect Chamber Wall Reflectors

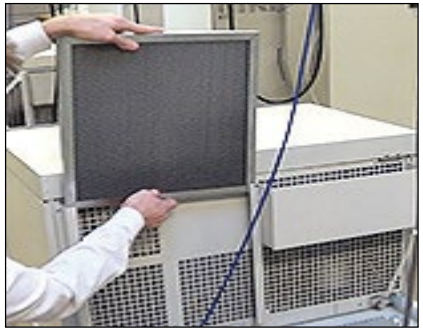
Every
6 months

Clean or Replace Air Filters

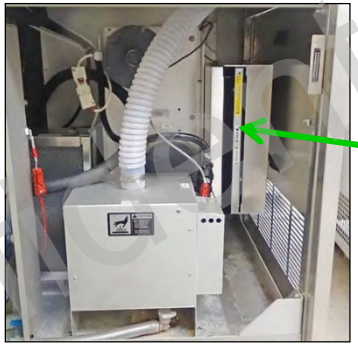
Disposable

Washable (Preferred)

Clean or Replace Air Filters

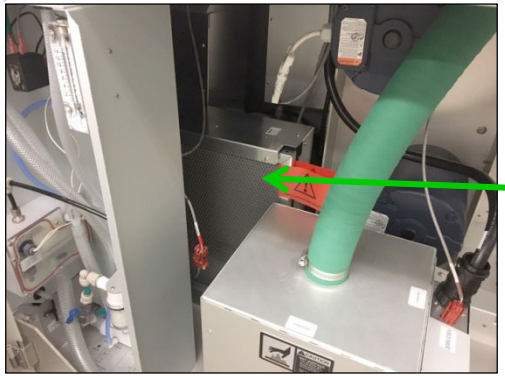


Xe-1 Air Filter



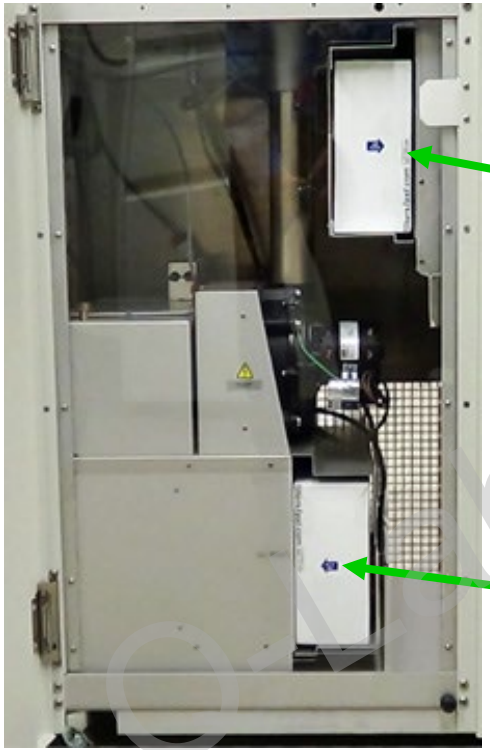
Xe-3
Chamber
Air Filter

Chiller Air Filter

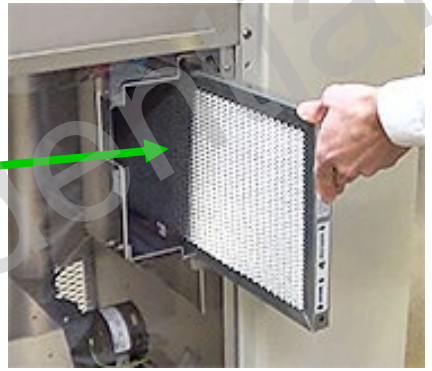


Xe-3
Ballast
Blower
Air Filter

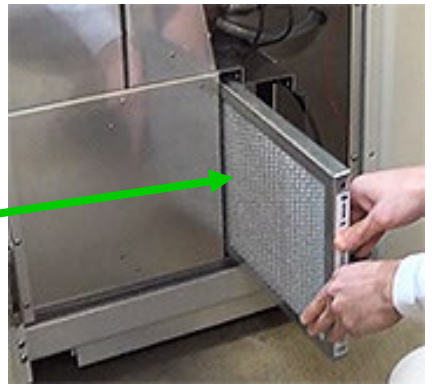
Clean or Replace Air Filters



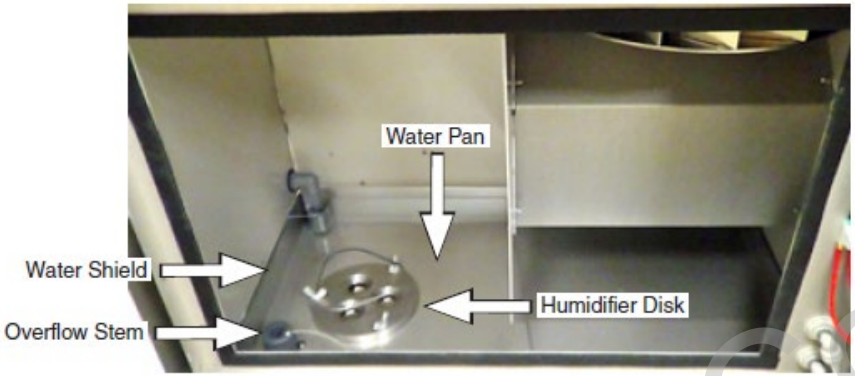
Xe-2
Chamber
Air Filter



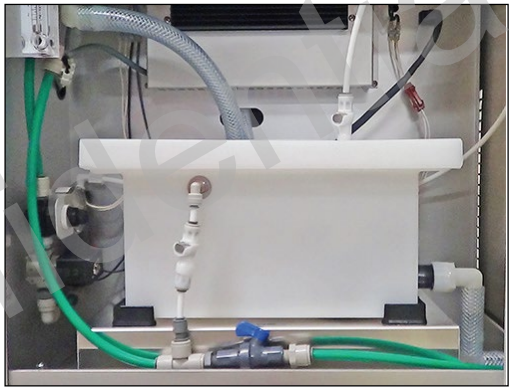
Xe-2 Lamp
Cooling
Air Filter



Clean Xe-2 Humidifier



Water pan

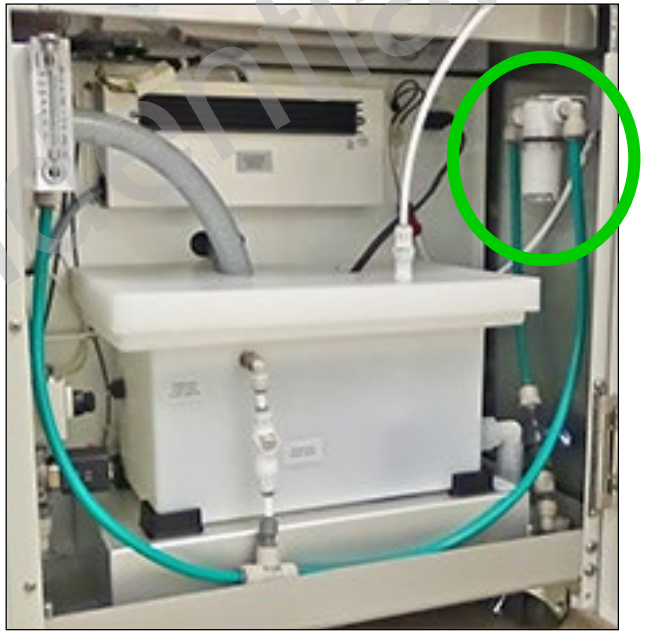


Reservoir

- Disassemble humidifier water pan and reservoir
- Clean with alcohol or mild detergent

Inspect Water Filter

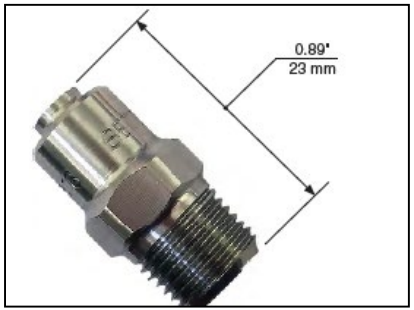
Xe-3



Xe-2

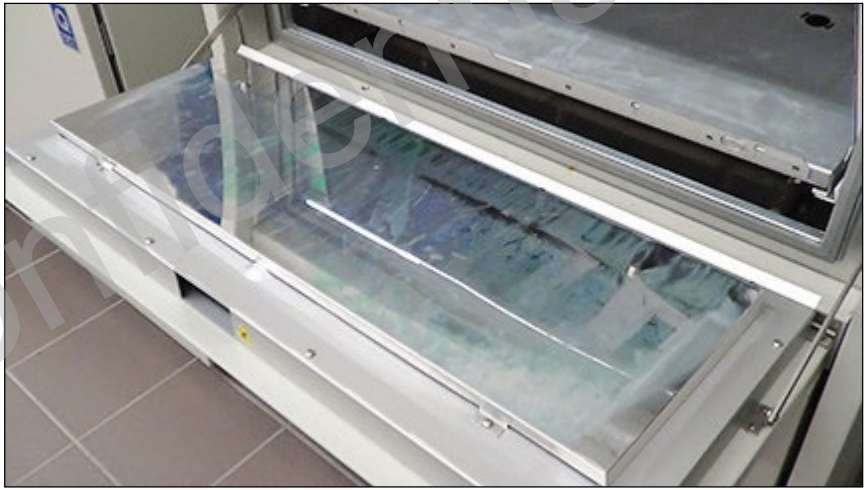
Clean Spray Nozzles

- Remove and disassemble for cleaning
- Clean in ultra-sonic cleaner or …
- Clean with anti-scaling cleaner (to remove calcium and magnesium deposits) or…
- Thorough washing and rinsing in detergent



Inspect Chamber Reflectors

Clean - OK



Cloudy - Replace

Clean slip ring track (Xe-2)

- Wipe down with scouring pads
- Clean with isopropyl alcohol

Q-SUN Xe-2 now has a contactless system for BP Temp Sensor

Field Calibration Audits, Tester Commissioning, and Customer Education

- This presentation was a condensed version of our Q-SUN operator training. Typical training includes hands-on sessions and further in-depth review of tester components not covered here
- Q-Lab Repair team offers tester audits and field calibrations, in addition to their on-site repair visits and troubleshooting services.
- Q-Lab offers customized training plans that can be catered to each customer's demand and may include *Tester Commissioning* as well as *Weathering 101* and *Atmospheric Corrosion* education
- Contact info@q-lab.com or Repair@q-lab.com for more info

Thank you for your attention!
Questions?

Send your inquiry to:
info@q-lab.com