Q-SUN

Q-SUN Xe-2
Xenon Test Chambers

MANUAL

For Serial Numbers:

XX-XXXXX-79-X2HE

XX-XXXXX-79-X2HSE

XX-XXXXX-79-X2HBSE

Q-LAB

Revision Date

05 Nov 2020

Table of Contents

1. Specifications, Classifications, Symbols (Oct 2020)

Specifications, Classifications

- The recommended ambient operating temperature and relative humidity (RH) for the Q-SUN® Xe-2 tester is 23 ± 5 °C and 50 ± 25% RH.
- The maximum ambient operating temperature and humidity is 40 °C and 80% relative humidity.
- Temperatures outside the recommended range may cause chamber temperature and/or humidity faults.
- Transportation and Storage Temperature: -40 °C to 80 °C.
- Installation Category: Category II for transient over-voltages.
- Pollution Control: Pollution Degree 2.
- Sound Pressure Level: Sound Pressure Level does not exceed 75 dBA.
- Altitude: 2000 meters or less.
- Operation: Continuous Rating.
- Supply Connection: Permanently connected or plug/socket connection (industrial type per IEC 6309 or twist lock type in North America).
- External Disconnect: Required for all connections.
- External Over-Current Protection: Must be rated for not more than 40 A (USA, Canada) or 64 A (Europe).

Symbols

Electrical Shock Hazard

Hot Surfaces Hazard

Attention

Finger/Hand Crushing Hazard

Local waste & recycling regulations per the WEEE Directive 2002/96/EC on Waste Electrical and Electronic Equipment

2. Safety Information

Q-Lab accepts no responsibility for the consequences if the user fails to comply with the instructions in this operating manual. Q-Lab will accept responsibility for defective parts or components only if the machinery was defective at the time that the tester was shipped.

- This manual does not claim to address potential safety issues, if any, associated with the use of this product.
- It is the responsibility of the user of this manual to establish appropriate safety and health practices, and to determine the applicability of regulatory limitations prior to use.
- If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment safety devices may be impaired.
- The Q-SUN meets the European Low Voltage Directive 2014/35/EU and complies with the requirements of EN 61010-1: 2010 (Third Edition), “Safety of Electrical Equipment for Measurement, Control and Laboratory Use”.
- The Q-SUN meets the European Electromagnetic Directive 2014/30/EC and complies with the requirements of EN 55011:2007 Radiated and Conducted Emissions – class A.
- Use only parts that have been supplied or recommended by Q-Lab.

2.1 Heat and Electrical Shock Hazards (Nov 2020)

Warning Labels

- **Warning:** If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.
- Doors (Figure 2.1a) provide access to tester interior spaces containing heat generating and/or electrical components.
- Warning labels indicate heat and electric shock hazards inside the Q-SUN tester (Figure 2.1a and Figure 2.1b).

Figure 2.1a: Tester access door locations.

Figure 2.1b: Hot surface and shock hazard warning labels.

Inside the Lamp Door

- **IMPORTANT:** Always shut off the Xe-2 power switch before opening the lamp door.
- The Xe-2 high voltage xenon lamp is located under the lamp door on top of the machine.
- For safety, a tool (slotted screw driver) must be used to open the door (Figure 2.1c).
- Figure 2.1d shows safety labeling and electrical components.
- An interlock switch (Figure 2.1d) turns off lamp power when the lamp door is opened.
- The xenon lamp is very hot. Wait 15 minutes after stopping the machine to remove the lamp (see Section 16.1).

Figure 2.1c: Lamp door located on top of the Xe-2 cabinet.

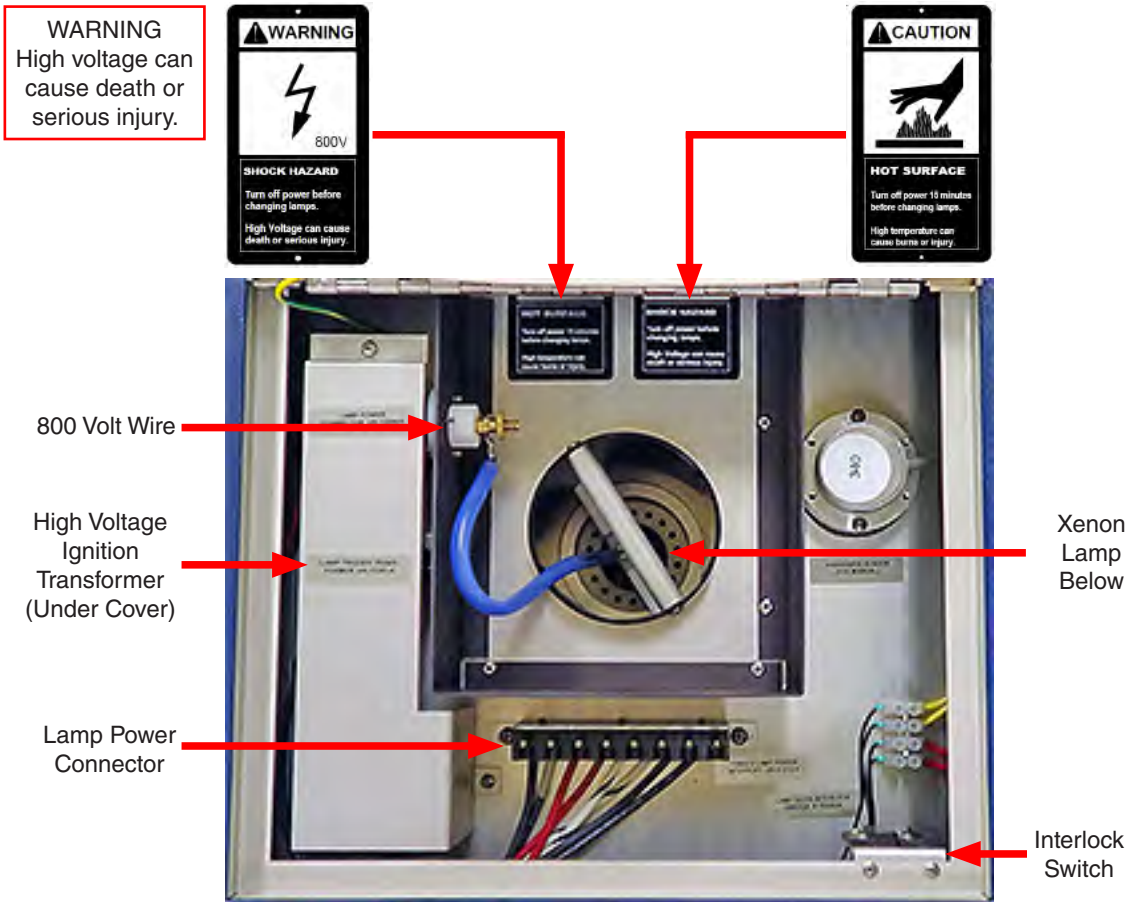


Figure 2.1d: Inside the lamp door.

Inside the Chamber Door

- Items located in the test chamber, including specimens and holders, can be very hot.
- Let the test chamber cool before opening the chamber door.

Figure 2.1e: Opening chamber door.

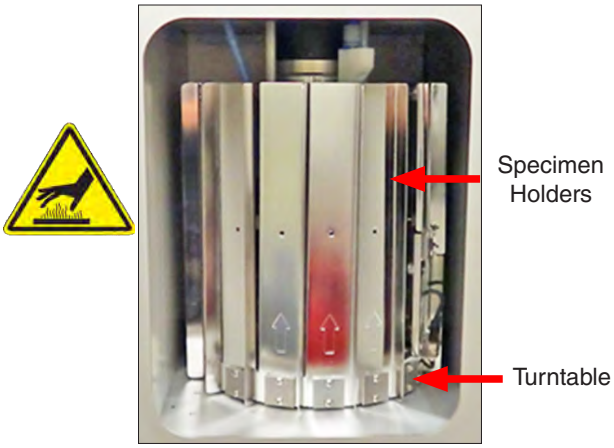


Figure 2.1f: Test chamber interior showing specimen holders on turntable.

Inside the Side Doors

- For safety, a tool (slotted screw driver) must be used to open these doors.
- Electrical and heat generating components and safety labels are located throughout.

Figure 2.1g: Inside Left Door

Figure 2.1h: Inside Right Door

2.2 Ultraviolet and Infrared Hazards (Nov 2020)

Chamber Door

- The Xe-2 xenon lamp can cause severe sunburn, eye inflammation, and damage to your vision.
- Touch the stop icon on the Status Screen (Figure 2.2a) before opening the chamber door (see Section 11.2 for more information on the Status Screen).
- An interlock switch (Figure 2.2b) shuts off power to the lamp when the test chamber door is opened.

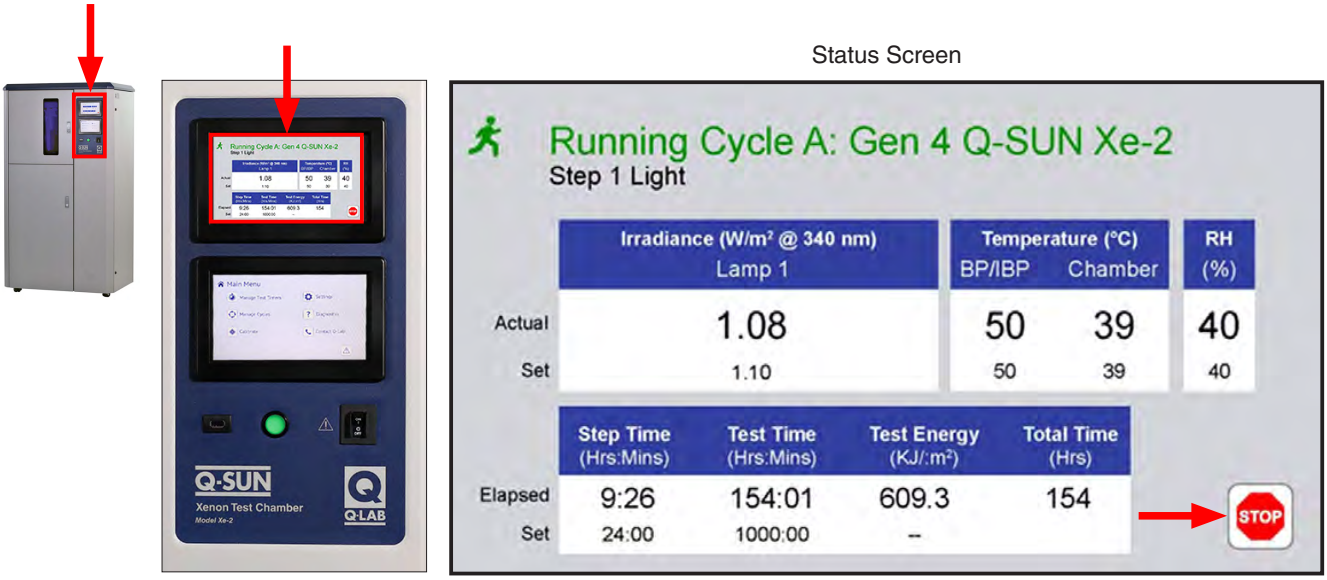


Figure 2.2a: Stop icon on the Status Screen.

Figure 2.2b: Test chamber door opened to show interlock switch location.

3. General Description (Nov 2020)

The LX-5085-TM Q-SUN Xe-2 Technical Manual provides information on the installation, operation, and maintenance of Q-SUN Xe-2 test chambers.

Overview

- The Q-SUN Xe-2 is equipped with an air-cooled xenon arc lamp to test the lightfastness of textiles as well as many other materials.
- The Xe-2 is designed to meet ISO 105-B02, ISO 105-B04, AATCC Test Method 16, and many other test methods.
- All Xe-2 testers have a rotating specimen rack and provide precise control of critical test parameters including irradiance level, black panel temperature, chamber air temperature, and relative humidity.
- The Xe-2 can be configured using one of a number of different optical filter types. (see Section 7.2).
- Front water spray (Xe-2-HSE) and front water spray with back spray (Xe-2-HBSE) options are available (see Section 10).
- All Q-SUN Xe-2 models are “E” models that feature enhanced performance, including dual touchscreen control and longer lamp life or higher irradiance capability.

Q-SUN Xe-2 Models Description

- This manual covers the Q-SUN Xe-2 models shown here:

Model	Configuration
Xe-2-HE	H: Humidity Control
Xe-2-HSE	S: Front Spray
Xe-2-HBSE	BS: Back Spray (in addition to Front Spray)

Disposal

- When disposing of the Q-SUN Xe-2, please follow your local regulations.
- This equipment must be properly disposed of at end-of-life by means of an authorized waste management system.

4. Operating Environment

The Tester Must Be Located in a Suitable Environment

- All Q-Lab test chambers are sophisticated scientific instruments.
- All tester models must be operated in a suitable controlled environment (Section 4.1).
- Operating the tester in an unsuitable environment (Section 4.2) will void the warranty.

4.1 Suitable Environments (May 2020)

Ambient Laboratory Temperature and Humidity

- The recommended ambient operating temperature and relative humidity (RH) for Q-SUN testers is 23 ± 5 °C and 50 ± 25% RH.
- Operating outside the recommended range (or in rare cases, even within it), certain standards or test cycle conditions may not be achievable.
- Operating outside the recommended range can result in the tester producing chamber temperature and/or humidity faults.
- Never operate your tester in lab temperatures >40 °C or >80% RH.
- Consult with Q-Lab for more specific information about achievable chamber temperature/humidity values based upon various ambient lab conditions.

Physical Environment

- A room that is dry, clean, and free of dust, particles, gases, or salt fog.
- A room with an HVAC (heating/ventilation/air-conditioning) system.
- A location away from windows or HVAC vents.
- A location that provides the necessary minimum clearances as specified in Section 5.2.

4.2 Unsuitable Environments (Mar 2019)

Salt Fog or Other Airborne Contamination

- Operating the tester in an unsuitable environment will void the warranty.
- Do Not install Q-SUN testers in a room with Q-FOG or any other corrosion chambers (Figure 4.2a).
- Do Not locate Q-SUN testers in a room with machines or processes that generate dust, particles, vapors, gases, etc (Figure 4.2b)

Figure 4.2a: Do Not Install Xe-2 Testers in a Room with Corrosion Chambers

Figure 4.2b: Do Not Locate Tester in Room with Airborne Dust, Particles or Gases

Uncontrolled Temperature and Humidity

- Do not operate the tester in a room with uncontrolled temperature and humidity (Figure 4.2b).
- Do not locate tester near sources of cold or hot air (Figure 4.2d).

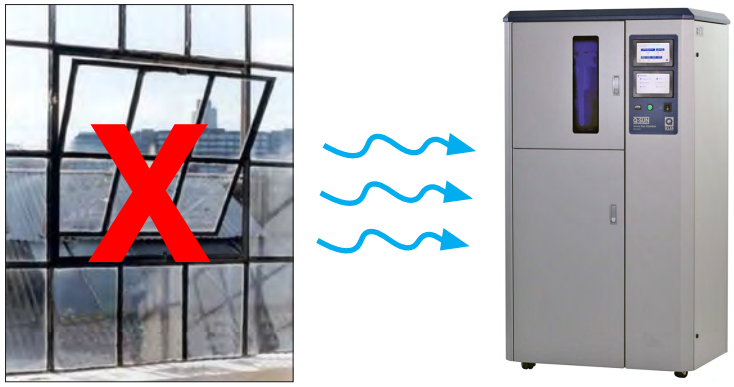


Figure 4.2c: Do Not Locate Testers Near Open Windows

Figure 4.2d: Keep Tester Away from Sources of Hot or Cold Air

Other Unsuitable Environments

- **Outdoors:** Rain and dust will corrode or short out electrical components.
- **Metal Dust / Metal Chips:** Do not locate the tester near metal cutting machines or metal grinding machines. Conductive metal dust or metal chips in the air will damage electronic components.
- **Carbon Fibers:** Do not operate the tester where carbon fibers or carbon reinforced plastic are being cut. The conductive carbon fibers will damage electronic components.
- **Conductive Pigments:** Do not operate the tester where carbon black or other conductive pigment dust is in the air. The conductive dust will damage electronic components.
- **Other Corrosive Gases:** Do not expose the tester to acid fog, SO_2 gas, or other corrosive gases.
- **Excessive Voltage:** The electrical supply to the tester must be no more than 10% higher than the voltage listed on the nameplate.
- **Low Voltage:** Recurring “brown-outs” or voltages less than 90% of the rated voltage will damage electrical components.
- **Water Leaks from Ceiling:** Water leaking onto the tester will damage electrical components.

For further detail on laboratory environment requirements, please contact Q-Lab Repair and Tester Support. See Section 20 for contact information.

5. Set Up

5.1 Uncrating (Feb 2020)

- Q-SUN Xe-2 testers are shipped in one of two types of crates (Figure 5.1a and Figure 5.1b).
- Labels on the crate indicate the location of the instructions to be opened first (Figure 5.1c).
- Instructions for uncrating and setting up the tester are located in the envelope shown in Figure 5.1d.

Carefully read these instructions before uncrating the tester. Follow all local, OSHA, EHS, and other applicable equipment handling safety requirements, recommendations, and practices.

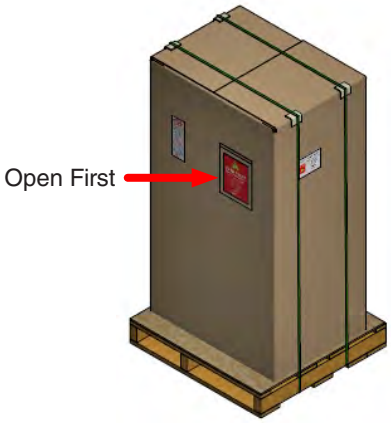


Figure 5.1a: This Crate has a Carton Banded to a Wooden Skid.

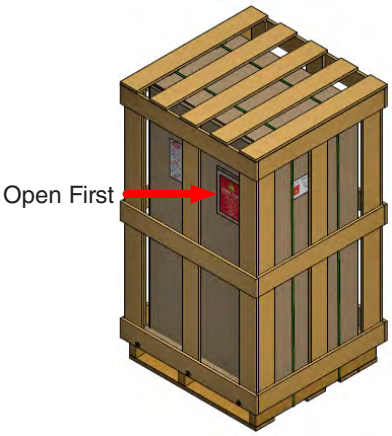


Figure 5.1b: This Crate has a Wooden Frame Surrounding the Carton.

Figure 5.1c: Labels on the crate indicate the envelope to be opened first.

Figure 5.1d: Open this envelope for important uncrating instructions.

Weights

	Crate with Carton Only	Crate with Carton and Wooden Frame
Shipping Weight (Approximate):	182 kg (402 lb)	227 kg (500 lb)
Machine Weight:	172 kg (379 lb)	172 kg (379 lb)

Tools Required

Medium Phillips Screwdriver (Crate with Wooden Frame Only)		Flat Blade Screwdriver
Pry Bar (Crate with Wooden Frame Only)	Ratchet and 15 mm (9/16”) Socket	Small Ladder or Step Stool
Band Cutter	Utility Knife	Fork Lift*

*A fork lift or other mechanical lifting device is recommended for use in moving the crated tester to the installation location, and to lift the frame in one piece from the crate with wooden frame.

1. Uncrating instructions are located in this envelope. Remove and read the instructions.

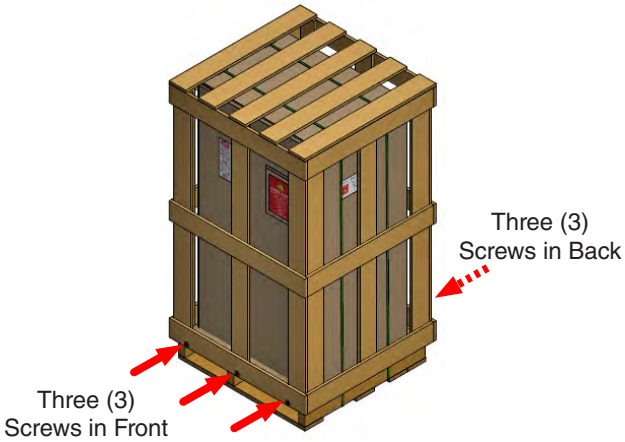

Crate with Carton and Wooden Frame

Go To Step 3.

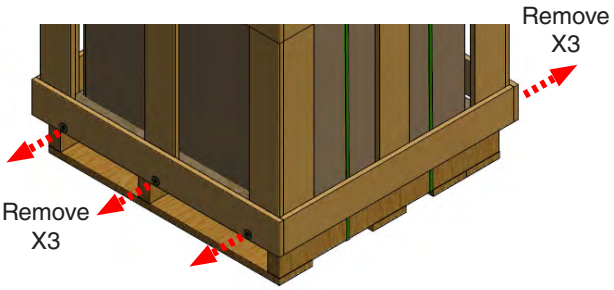

Crate with Carton Only

Go To Step 6.

2. For crate with wooden frame continue with Step 3. For crate with carton only, go to Step 7.

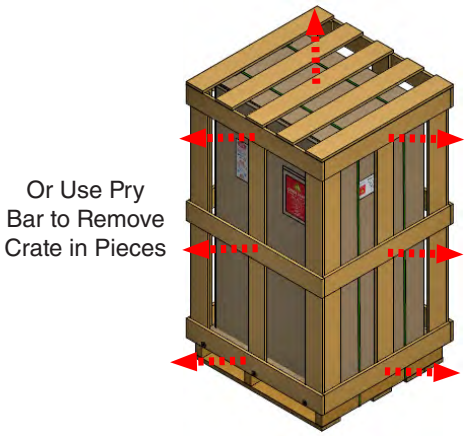


3. Locate the six (6) Phillips screws in the bottom front and back horizontal boards.

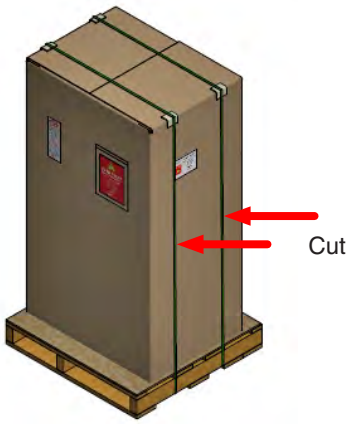


4. Remove all six (6) screws.

5. If a fork lift is available, use it to carefully lift the wooden frame up and off of the tester.

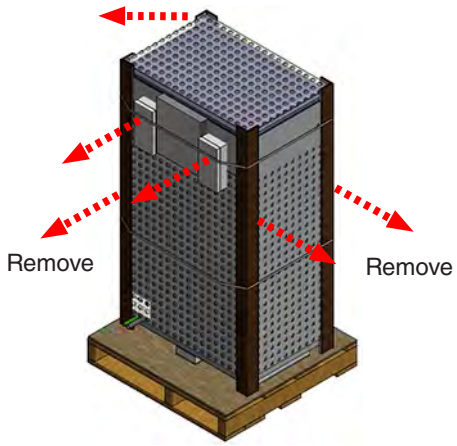


6. If a fork lift is not available, use a pry bar to carefully remove the horizontal and vertical wooden pieces off of the tester.

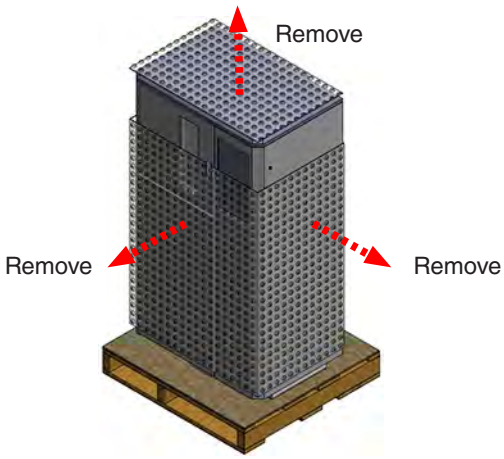


7. Cut the bands holding the carton to the skid. Remove the bands.

8. Carefully lift the carton up and off of the tester.

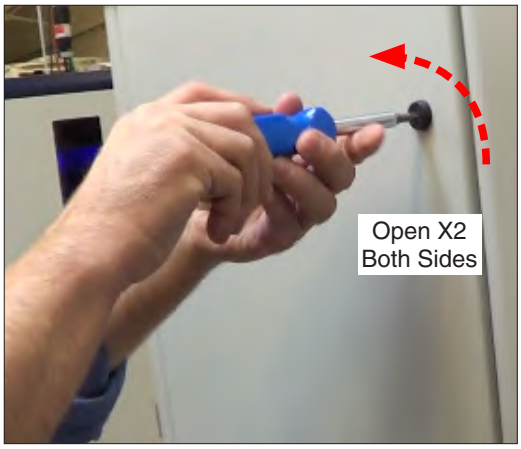


9. Remove all plastic wrap, four (4) cardboard corner posts, and foam blocks.



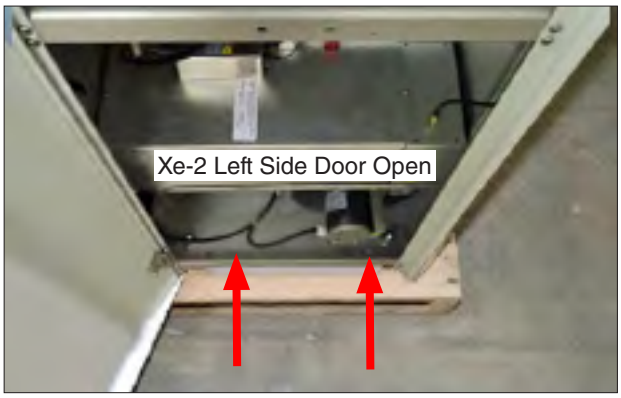
10. Remove all bubble wrap from around the tester.

11. Locate two (2) latches on the left side door and two (2) latches on the right side door of the tester.

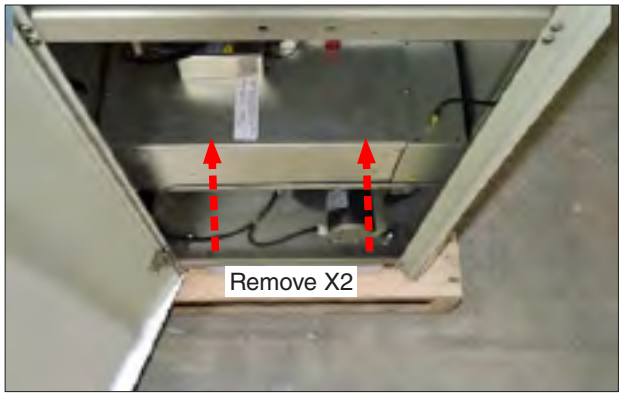


12. Open two (2) latches on the left side door and two (2) latches on the right side door of the tester.

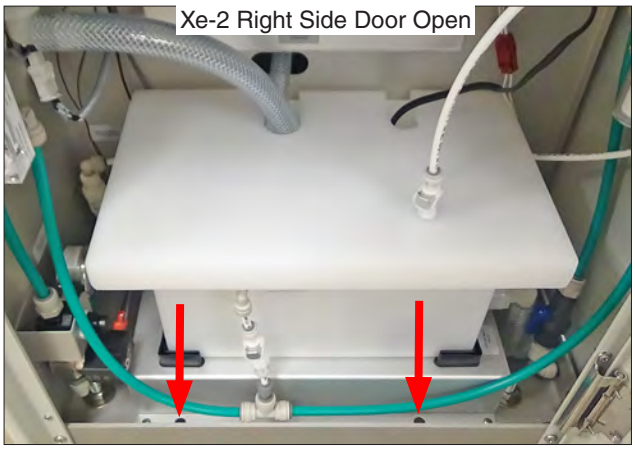
13. Open the left side door and the right side door of the tester.



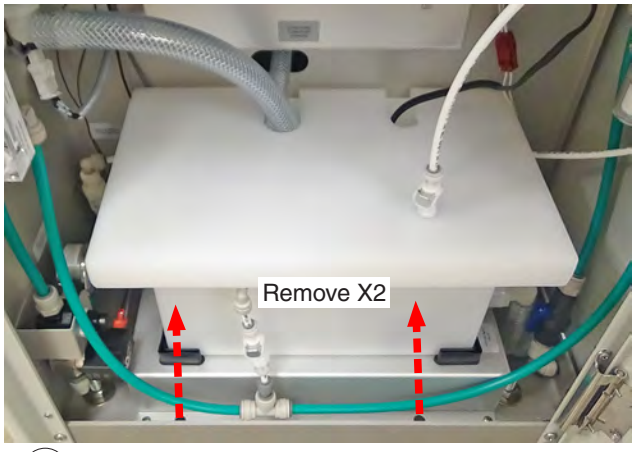
14. Locate the two (2) nuts and bolts holding the tester to the skid on the bottom left side.



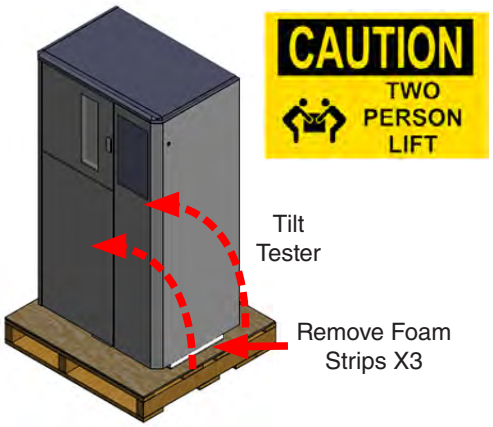
15. Remove the two (2) nuts and bolts holding the tester to the skid on the left side.



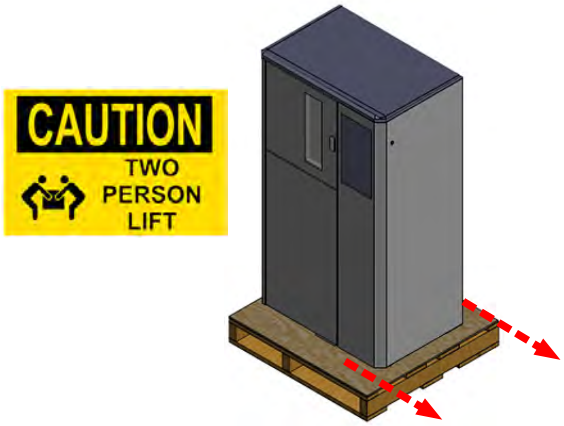
16. Locate the two (2) nuts and bolts holding the tester to the skid on the bottom right side.



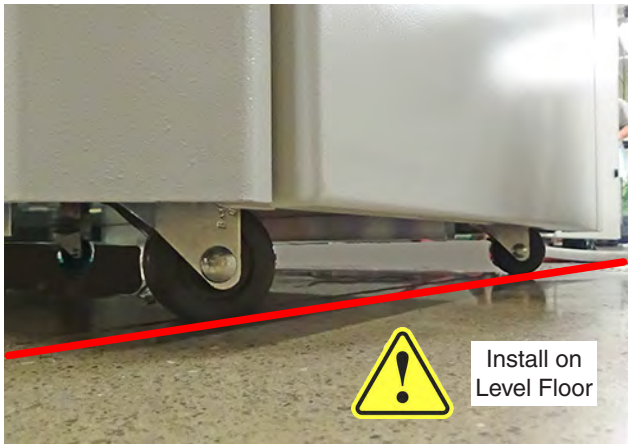
17. Remove the two (2) nuts and bolts holding the tester to the skid on the right side.



18. At least two people are needed to move the Xe-2. Carefully tilt the tester and remove the three foam strips under the tester.



19. The Xe-2 is equipped with casters. Carefully roll the tester off the skid.



20. Make sure the tester is installed on a level floor.

Optional Lift Kit

IMPORTANT: The casters must be removed if an optional Q-SUN lift kit is installed (see Section 15.3).

21. Remove any adhesive tape and accessory boxes from the inside and outside of the tester.

5.2 Dimensions and Space Requirements (Mar 2019)

- The Q-SUN Xe-2 uses room air for cooling.
- The tester does not require its own vent hood or ducting. Do not attach to a powered vent.
- The Q-SUN Xe-2 exhausts about 1800 W into the room.
- Allow adequate space around the tester for air flow and to access tester components (Figure 5.2).

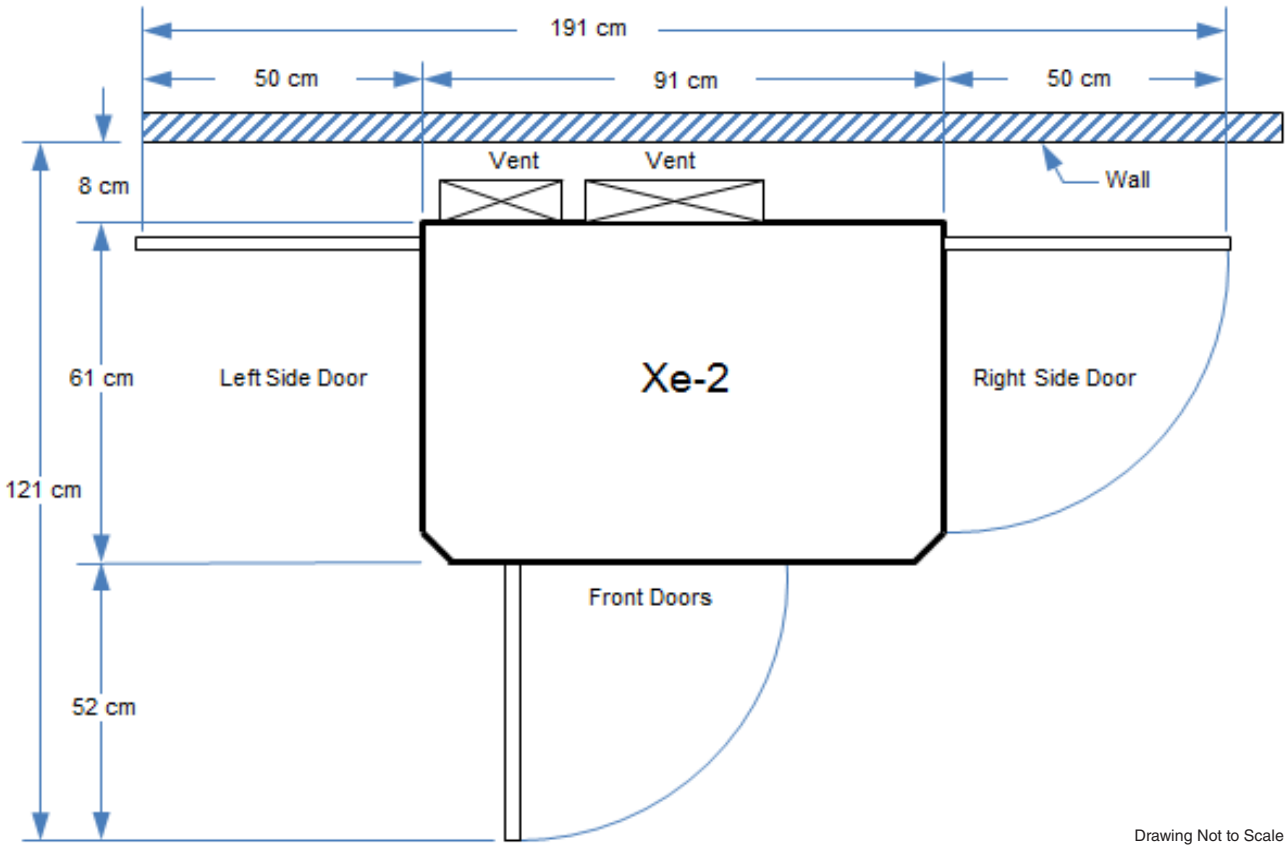


Figure 5.2: Floor space required.

5.3 Electrical (Oct 2020)

- The Q-SUN Xe-2 comes in 208 V single phase or 230 V single phase.
- The voltage is specified when the tester is ordered.
- The input voltage and current rating are shown on the nameplate at the rear of the tester (Figure 5.3a).
- The voltage supplied to the machine must be within ±10% of the voltage rating.
- The circuit must be capable of supplying the rated current.
- A power cord is supplied with the tester. A connector (plug) is not supplied.
- A qualified electrician should make all electrical connections.

Voltage:	230 V or 208 V (as stated on nameplate) ± 10% - single phase
Current:	23 A at 230 V, 24 A at 208 V
Frequency:	50 or 60 Hz
Supply Connection:	Permanently connected or plug/socket connection (industrial type per IEC 6309 or twist lock type in North America).
External Disconnect:	Required for all installations
External Over-Current: Protection:	Must be rated for not more than 32 amps

In locations where electrical power sources demonstrate voltage instability, excessive EMI or RFI, short duration or long duration transients, an additional Line Conditioner, Automatic Voltage Regulator, Uninterruptable Power Supply (UPS) or other electrical filtering/conditioning equipment may be necessary to ensure reliable operation of the tester.

- Such devices need to be designed to respond to out-of-range conditions in less than **10 milliseconds** and maintain operation for the duration of the out-of-range condition.
- Devices such as servo-motor controlled Voltage Regulators do not respond quickly enough to prevent damage to the tester in over-voltage situations and **should not be used** (Figure 5.3b).

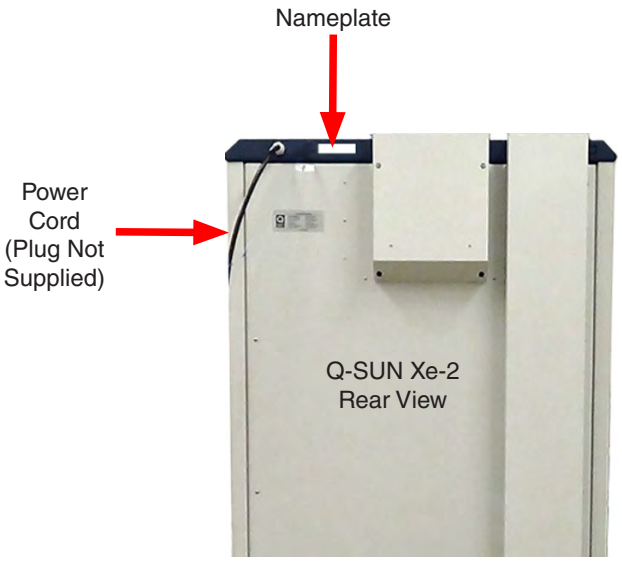


Figure 5.3a: Power cord and nameplate location.

Figure 5.3b: Do not use servo voltage regulator.

5.4 Water (Feb 2020)

Overview

- Purified water must be supplied to all Q-SUN Xe-2 testers.
- Water is used by the humidifier to produce humidity.
- Water is also used to spray on the test specimens in Xe-2 models with water spray.
- Q-SUN models with water spray require much higher water purity than those with a humidifier and no water spray.
- Reverse osmosis / deionized (RO/DI) water is **required**.
- The Q-SUN tester warranty is voided if water purity conditions are not met.

Specifications

System (Model)	Inlet Pressure	Flow Setting	Resistivity	Conductivity	Silica	Total Dissolved Solids	pH
Front Spray (Xe-2-HSE)	30-80 psi (207-522 kPa)	0.5L/min	> 5 M ohm•cm	< 0.2 µS/cm	< 0.1 ppm	< 0.1 ppm	6-8
Front and Back Spray (Xe-2-HBSE)		5 psi	> 5 M ohm•cm	< 0.2 µS/cm	< 0.1 ppm	< 0.1 ppm	6-8
Humidifier (Xe-2-HE)	3-80 psi (21-552 kpa)	1.0 L/hr	> 200 k ohm•cm	< 5.0 µS/cm	Not Important	< 2.5 ppm	6-8

NOTE: Average Daily Volume is dependent on individual test cycles. See Section 10.

Figure 5.4a: Q-SUN Xe-2 water purity requirements.

Reverse Osmosis / Deionization System

The reverse osmosis / deionized (RO/DI) water system described on the next page produces water pure enough for spray systems. **This type of RO/DI system is required for water spray in Xe-2 testers.**

Use Type I, not Type II anion in the mixed bed tanks of the DI system.

The Strong Base **Type I** Anion resin in the mixed bed tanks is the most important part of these systems to prevent water spotting. This is because strong base Type I anion resin is the only resin that can effectively remove suspended silica. **Suspended silica is the major cause of specimen spotting.** Type I anion is much better at removing suspended silica than Type II. Unfortunately, Type II is the most common anion. So be sure to insist that your water purification supplier installs Type I, not Type II. The cost for Type I anion is about the same as Type II.

Type I anion is only necessary in the mixed bed "polishing" stages of the deionization (Figure 5.4b, Stage E), not in the initial "rough" purification stages.

Flush out the water supply line prior to connecting to the Xe-2 tester.

- Figure 5.4b below shows an effective Reverse Osmosis / Deionized Water System with Anion Type I Resin for spray water silica removal.
- For information on water purification systems, contact the Life Science business of Merck KGaA, Darmstadt, Germany. The Life Science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the USA and Canada.

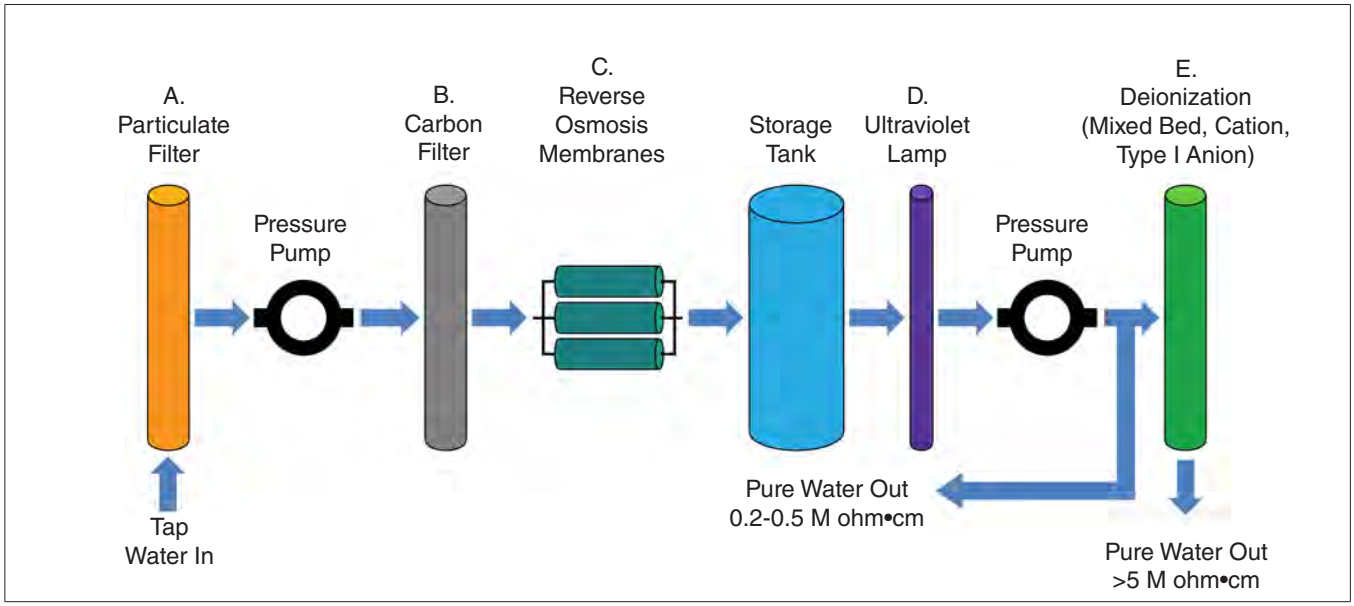


Figure 5.4b: Reverse Osmosis / Deionized Water System.

- Additional RO/DI system information is shown below.

Stage	Purpose	Outgoing Purity	Notes
A. Particulate Filter	Remove small particles		Replace once per year
B. Carbon Filter	Remove chlorine		Replace once or twice per year
C. R/O Membranes	Remove dissolved solids, colloidal silica, organic and biological contaminates	0.2-0.5 M ohm•cm	Rough purification stage
D. Ultraviolet Lamp	Disinfect water		Rough purification stage
E. Mixed Bed Tank	Final polishing to remove positively and negatively charged ions	> 5 M ohm•cm	Final polished water purity

Supply Connection

Purified water is required.

- The water supply connection is made at the lower rear of the tester (Figure 5.4c).
- The Xe-2 is supplied with 3/8" (9.5 mm) and 10 mm water supply fittings in kit XR-11358-K (Figure 5.4d).
- A water supply tube is not supplied with the tester.
- Example water supply connections are shown in Figure 5.4e through Figure 5.4h.

Figure 5.4c: Water supply connection.

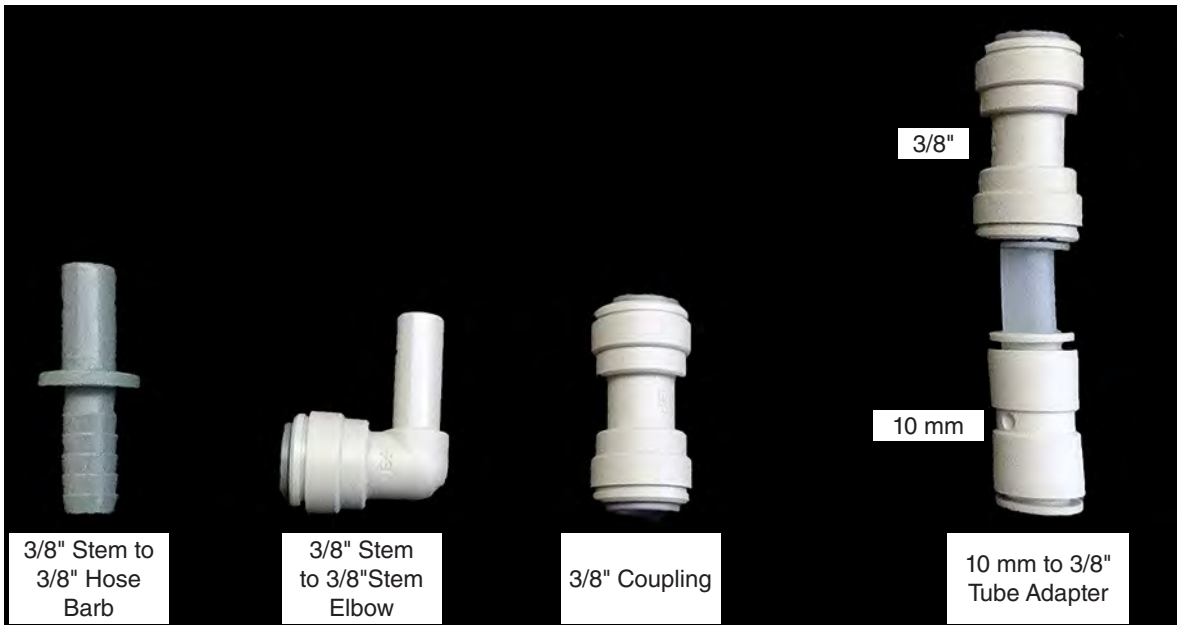


Figure 5.4d: Suppled water inlet fittings.

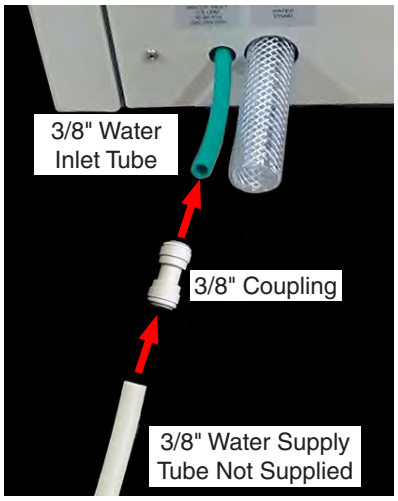


Figure 5.4e: Water supply connections - Configuration 1.

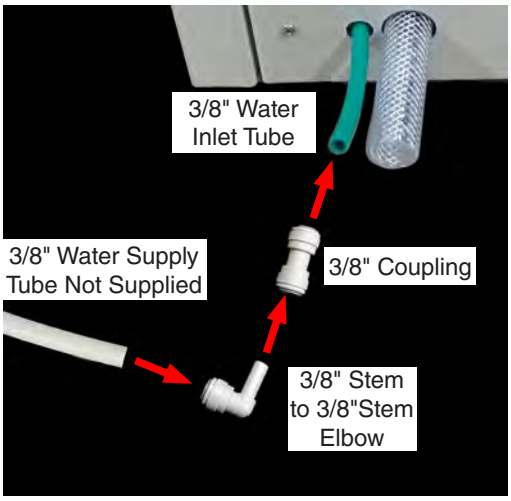


Figure 5.4f: Water supply connections - Configuration 2.

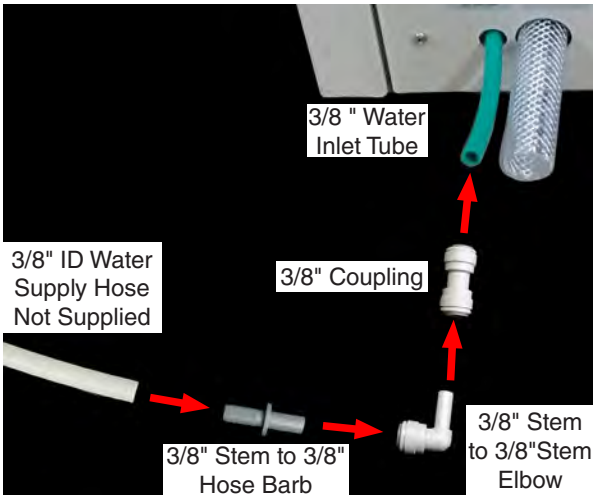


Figure 5.4g: Water supply connections - Configuration 3.

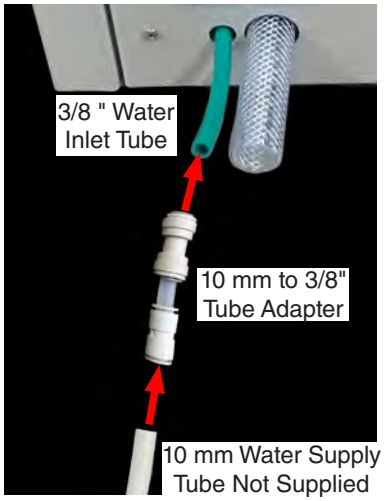


Figure 5.4h: Water supply connections - Configuration 4.

Inside Plumbing

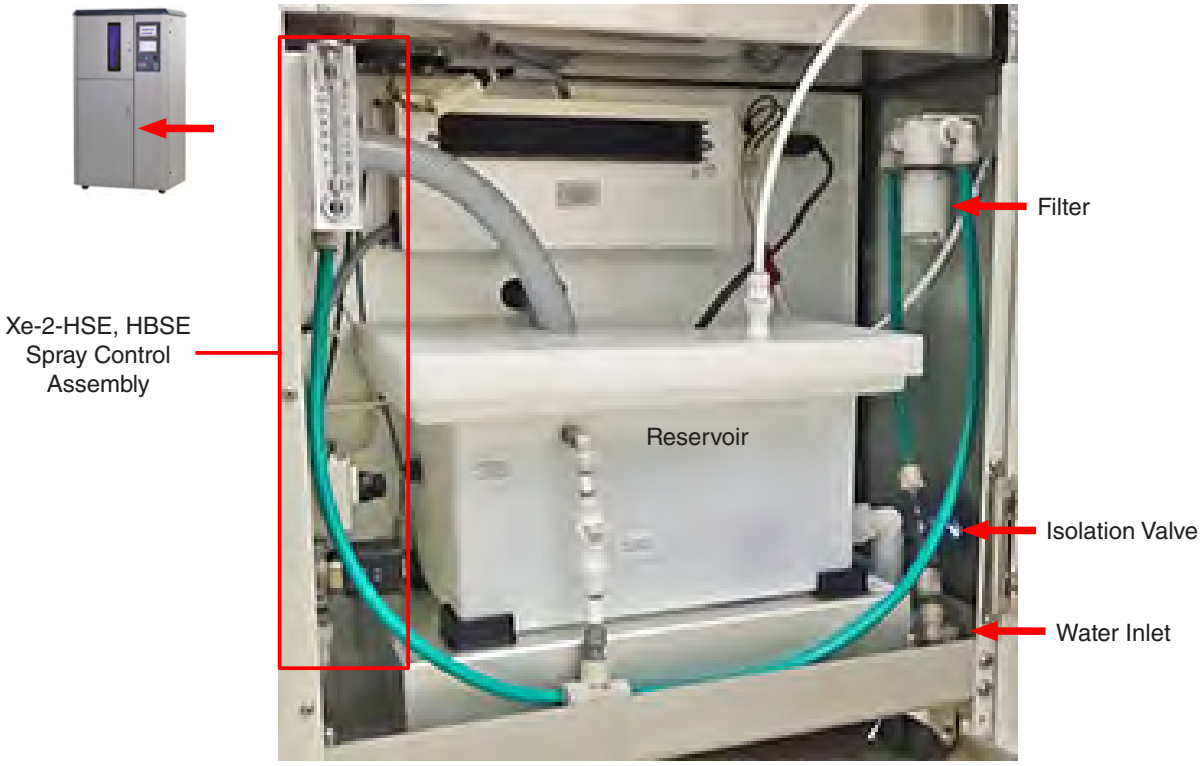


Figure 5.4i: Lower access door opened to show water supply plumbing.

Drain Connections

- A water drain connection must be made on all Xe-2 testers.
- The drain connections are made at the lower rear of the unit (Figure 5.4j).
- The Xe-2 is supplied with 3/4" (19 mm) connector fittings and 16.5 feet (5 m) of 3/4" (19 mm) drain hose in kit XR-11358-K (Figure 5.4k).
- Example water drain connections are shown in Figure 5.4l and Figure 5.4m.

Figure 5.4j: Water drain connection.

Figure 5.4k: Supplied water drain hose and fittings.

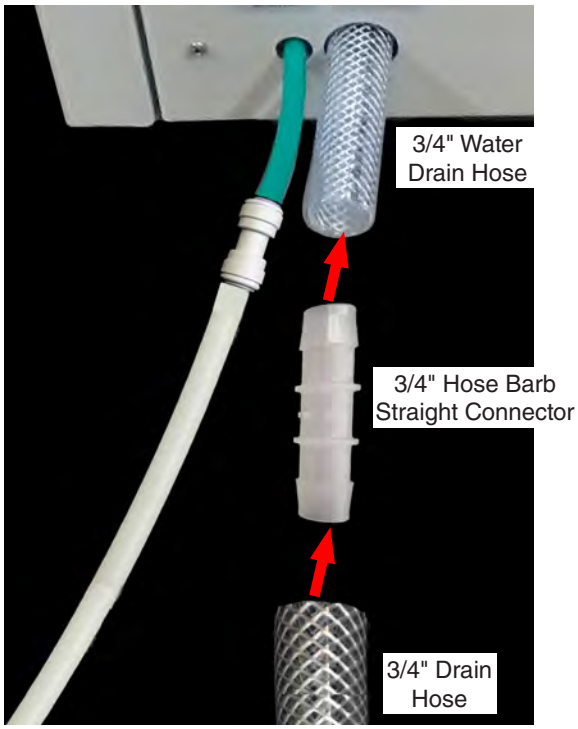


Figure 5.4l: Water drain connections - Configuration 1.

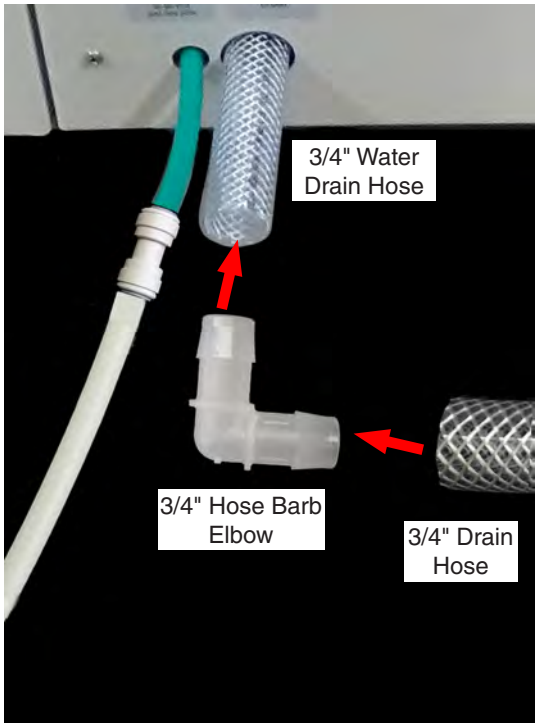


Figure 5.4m: Water drain connections - Configuration 2.

Raised Drain Connections

- If the tester drain hose must rise more than 100 mm (4.0") above the floor at any point before reaching a drain, a pump is needed or the tester must be elevated.
- An optional drain pump kit is available (see Section 15.2) to pump drain water over obstacles or to an elevated drain.
- Alternatively, an optional lift kit can be used to raise the entire tester up off of the floor (see Section 15.3).
- Do not use concrete blocks, pallets, bricks, or other means to raise the tester to achieve proper drainage.
- Contact Q-Lab Repair and Tester Support with any questions about tester drainage requirements.

6. Specimen Rotation

6.1 Turntable (Nov 2020)

- In Q-SUN Xe-2 testers, specimens are mounted on a turntable that rotates around the xenon lamp.
- The specimens face toward the lamp and are exposed to the xenon light (see Section 7) as the turntable rotates.
- The turntable rotation speed is 2.5 rpm @ 50 Hz and 3.0 rpm @ 60 Hz
- Specimens are mounted in holders (Figure 6.1).
- The holders are inserted into the mounting blocks on the turntable.
- See Section 12.3 for more information on specimen mounting.

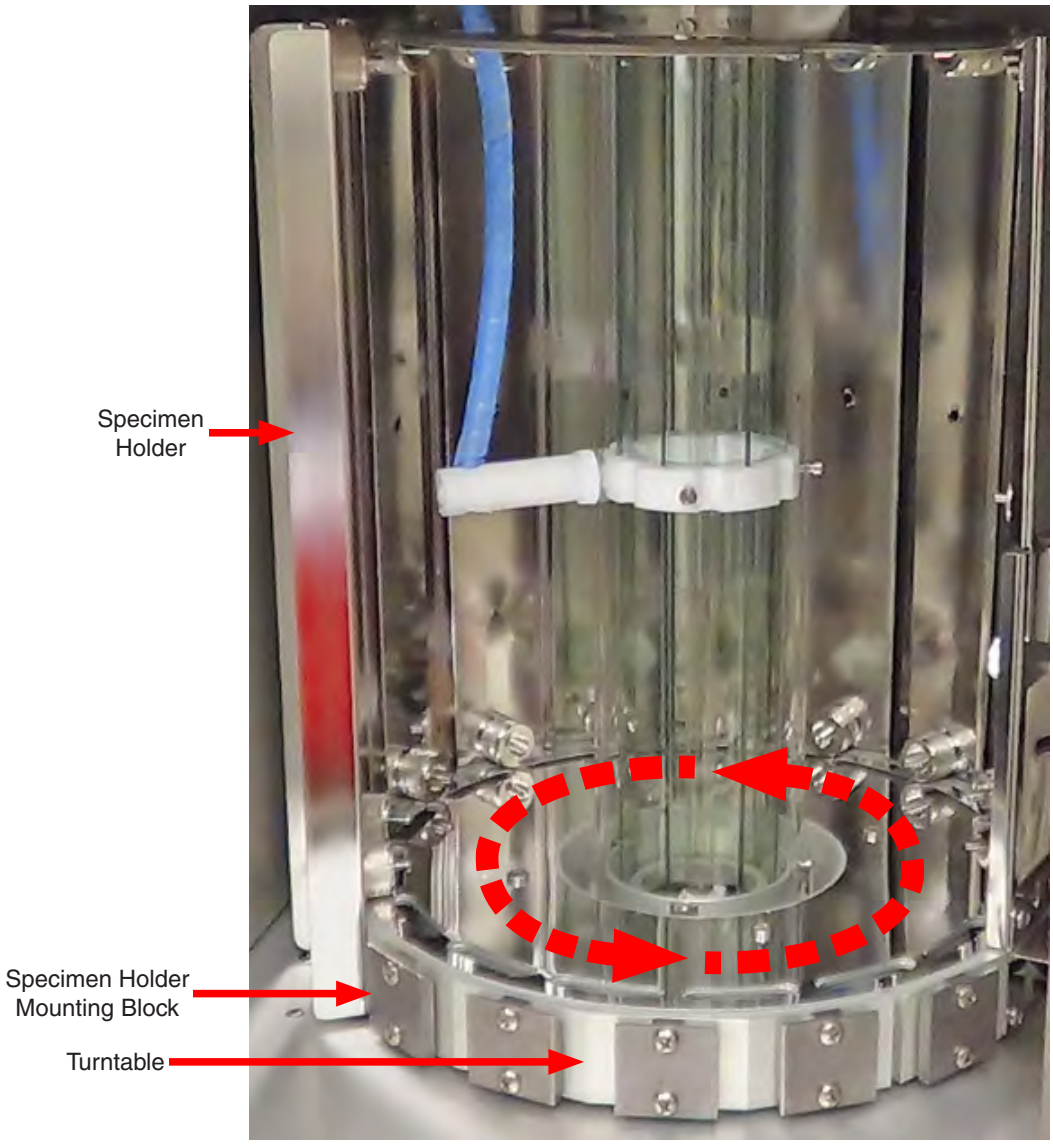


Figure 6.1: Specimen holder and turntable showing rotation (some holders removed).

6.2 Drive System (Oct 2020)

- The turntable is supported by a retaining bearing on the floor of the test chamber (Figure 6.2a).
- The drive sprocket engages the turntable drive pins to rotate the turntable (Figure 6.2b).

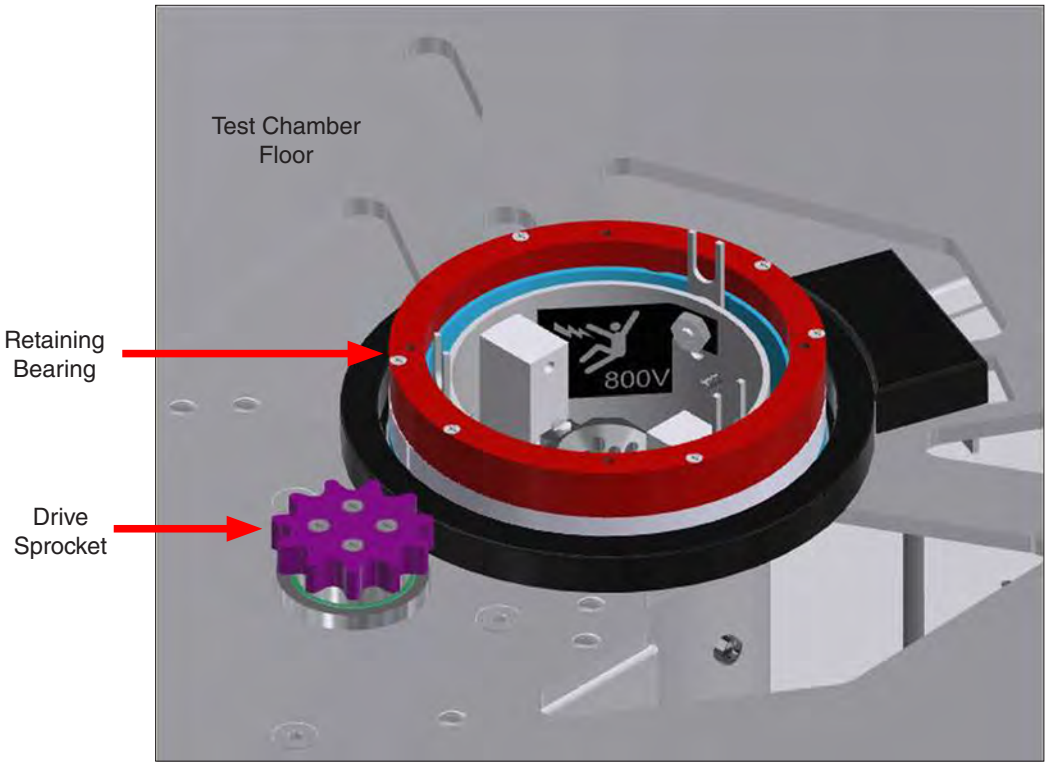


Figure 6.2a: Schematic showing turntable drive sprocket and retaining bearing (turntable removed).

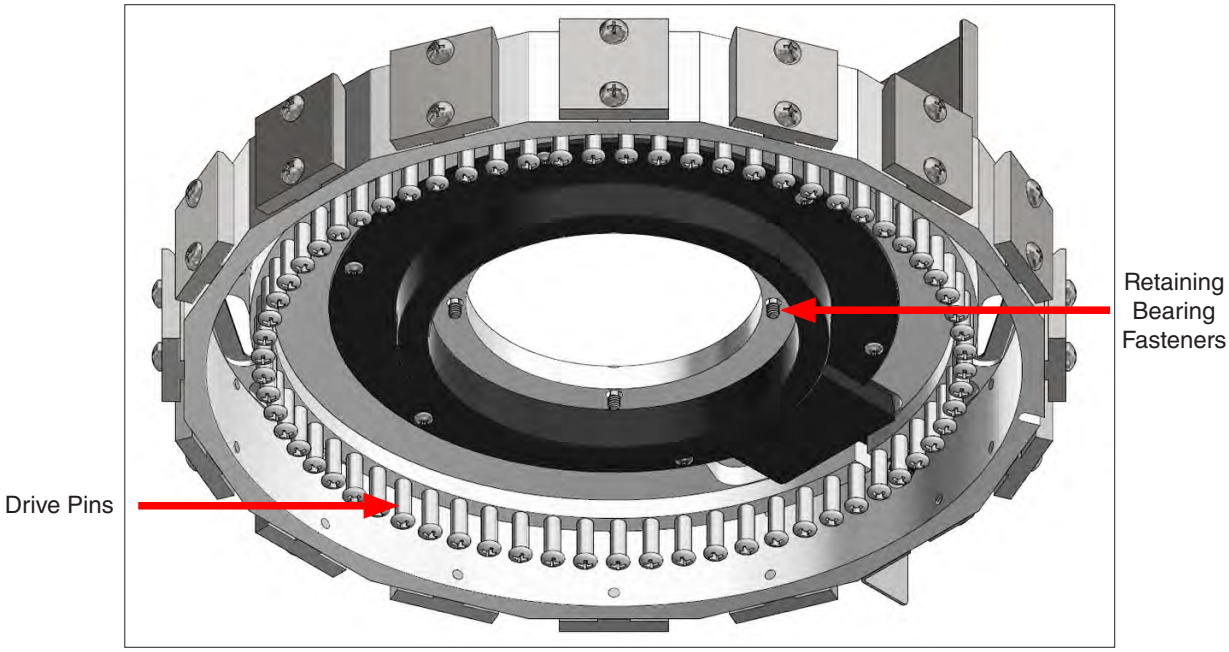


Figure 6.2b: Turntable bottom view showing drive pins and retaining bearing fasteners.

6.3 Turntable Motor Components and Rotation Sensor (Oct 2020)

- The turntable is driven by a motor located below the test chamber floor (Figure 6.3).
- The rotation sensor detects turntable movement (Figure 6.3).
- A notification is displayed on the tester main menu if the turntable is not moving as expected (see Section 17).

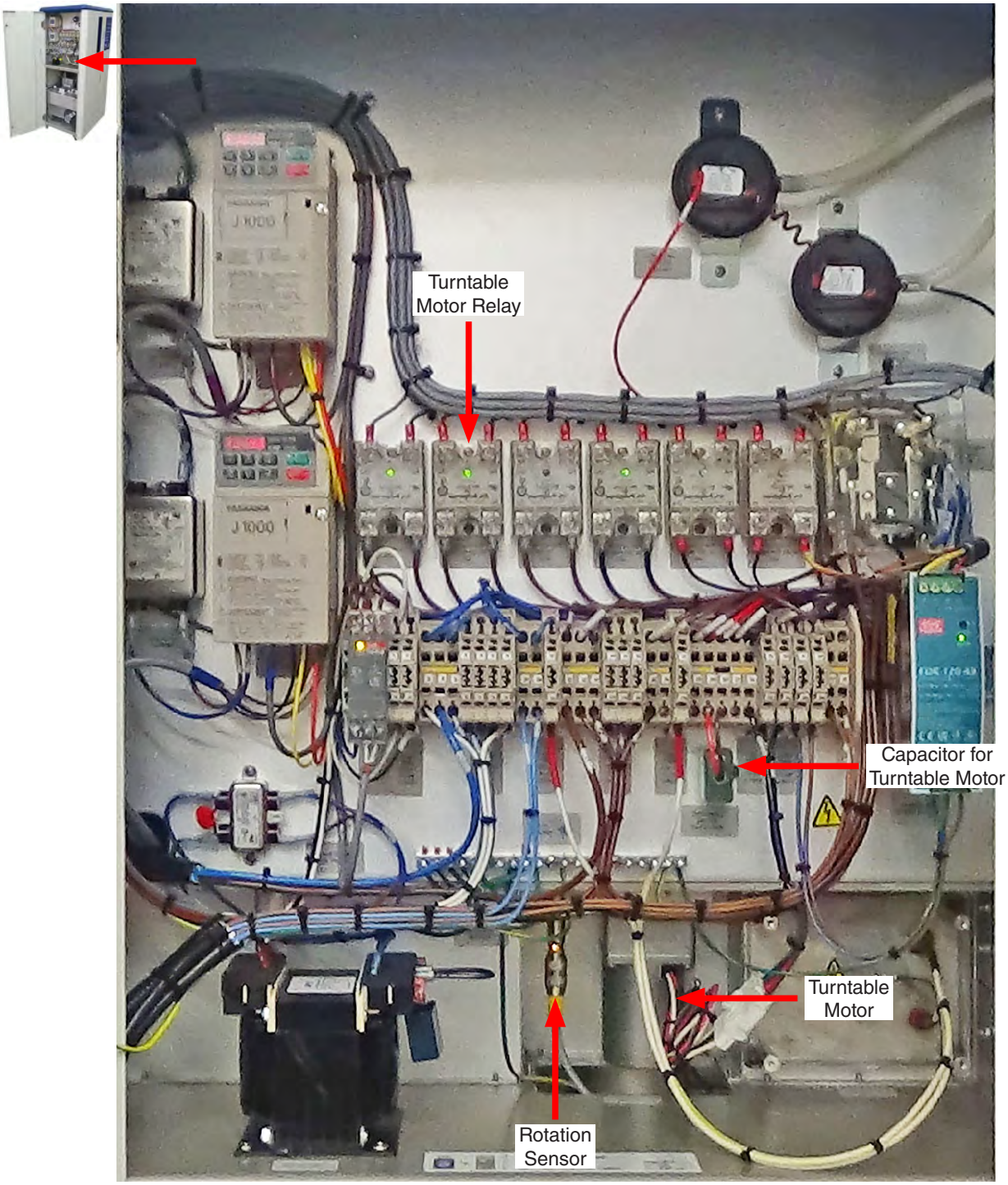


Figure 6.3: Left side access door open showing turntable motor components and rotation sensor.

7. Xenon Light System

7.1 Lamp (Oct 2020)

- Q-SUN Xe-2 testers use a xenon lamp (Figure 7.1a) to reproduce the damaging effects of sunlight.
- Read Section 2.2 on safety before operating the lamp.
- The xenon lamp is installed inside the optical filter assembly, or lantern (Figure 7.1b). See Section 7.2.
- See Section 16.1 for lamp replacement instructions.
- The lamp generates significant heat and is cooled by an air circulation system (see Section 7.3).
- An irradiance control system monitors and adjusts the light emitted by the xenon lamp (see Section 7.4).

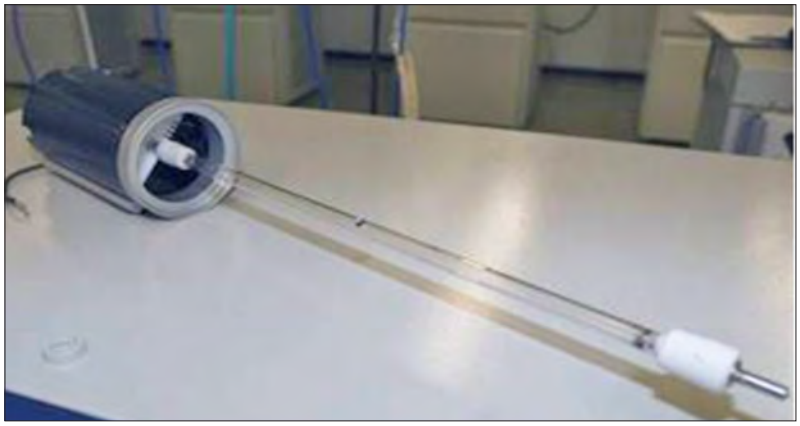


Figure 7.1a: Xenon lamp.

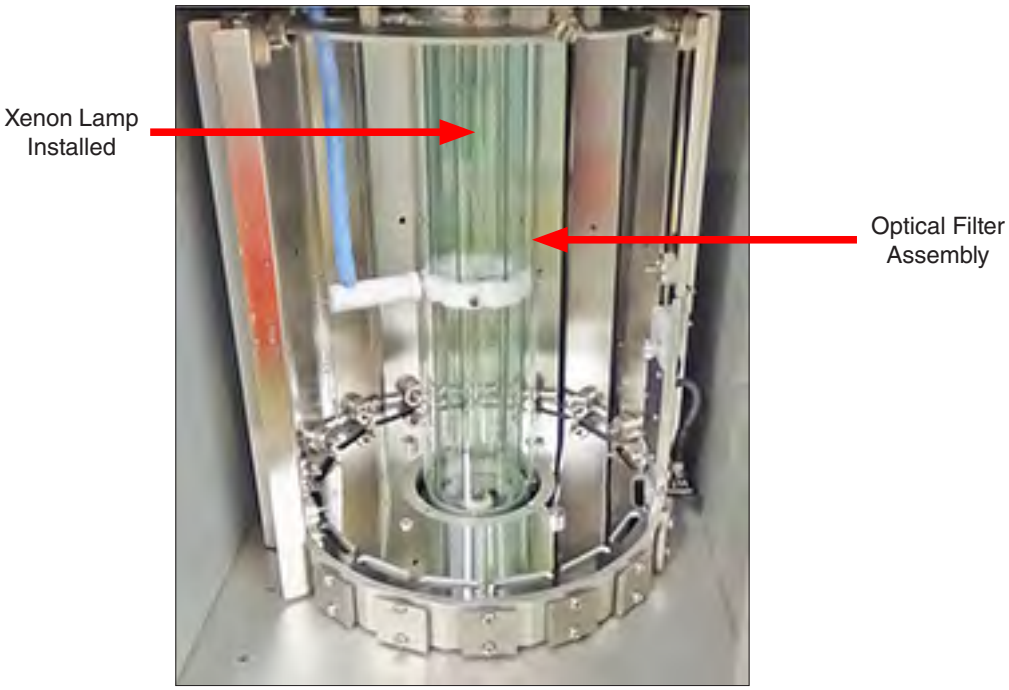


Figure 7.1b: Xenon lamp installed inside the optical filter assembly.

7.2 UV Optical Filters (Nov 2020)

Overview

- 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. Optical filters are used to attenuate the short wavelength light.
- The optical filter system (lantern) consists of an outer glass cylinder and two rows of 7 flat optical filters arranged in a circle inside the cylinder (Figure 7.2b).
- Rings at the top, middle, and bottom retain the flat filters.
- A label at the top of the lantern identifies the filter type (Figure 7.2b).
- To see the filter label, open the chamber door, remove several of the specimen holders, and look at the top of the lantern.
- Consult Q-Lab Technical Bulletin *LX-5060 A Choice of Filters for Q-SUN Xenon Test Chambers* for more information on choice of filter for your application.
- See Section 16.2 for optical filter maintenance information.

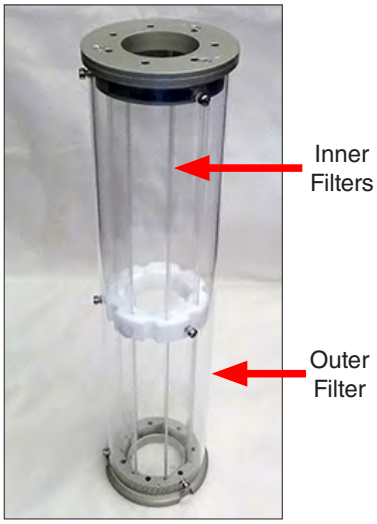


Figure 7.2a: Optical filter assembly (lantern).

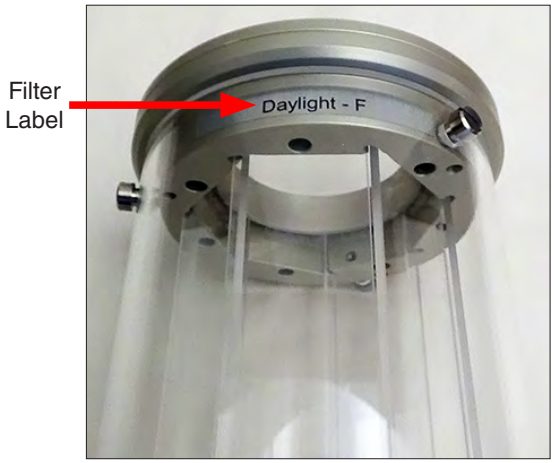


Figure 7.2b: Optical filter identification label.

Available Optical Filters

- See Figure 7.2c and Figure 7.2d for spectral power distributions of available optical filters.

Filter Type	Description
DAYLIGHT-Q (quartz outer cylinder)	Noon summer sunlight.
DAYLIGHT-F (quartz outer cylinder)	Noon summer sunlight, with an even more realistic match to the solar spectrum (matches ASTM D7869).
DAYLIGHT-B/B (quartz outer cylinder)	Matches the spectrum of revolving drum machines with borosilicate inner and outer filters. Transmits short wave UV that is not found in natural sunlight (harsher UV).
WINDOW-Q (borosilicate outer cylinder)	Noon summer sunlight through window glass.
WINDOW-B/SL (borosilicate outer cylinder)	Matches the spectrum of revolving drum machines with borosilicate inner and soda lime outer filters. For AATCC specifications that call for window glass filters.
WINDOW-IR (borosilicate outer cylinder)	Similar to Window-Q with reduced IR transmission (heat absorbing filter). **Window-IR filters absorb infrared energy, and therefore get very hot during use. Never use a Window-IR filter with a water spray cycle (and no known standards require it). Water inadvertently sprayed onto hot filters can lead to cracking.**
WINDOW-B04 (borosilicate outer cylinder)	Required for ISO 105-B04, consists of 12 Window-IR filters and 2 Window-B/SL filters.
WINDOW-SF5 (borosilicate outer cylinder)	Spectrum specified in Ford BO 116-01 test method.
EXTENDED UV-Q/B (quartz outer cylinder)	More UV than natural sunlight, for SAE J2412 and J2527 tests.

Spectral Power Distributions (also called Spectral Irradiance)

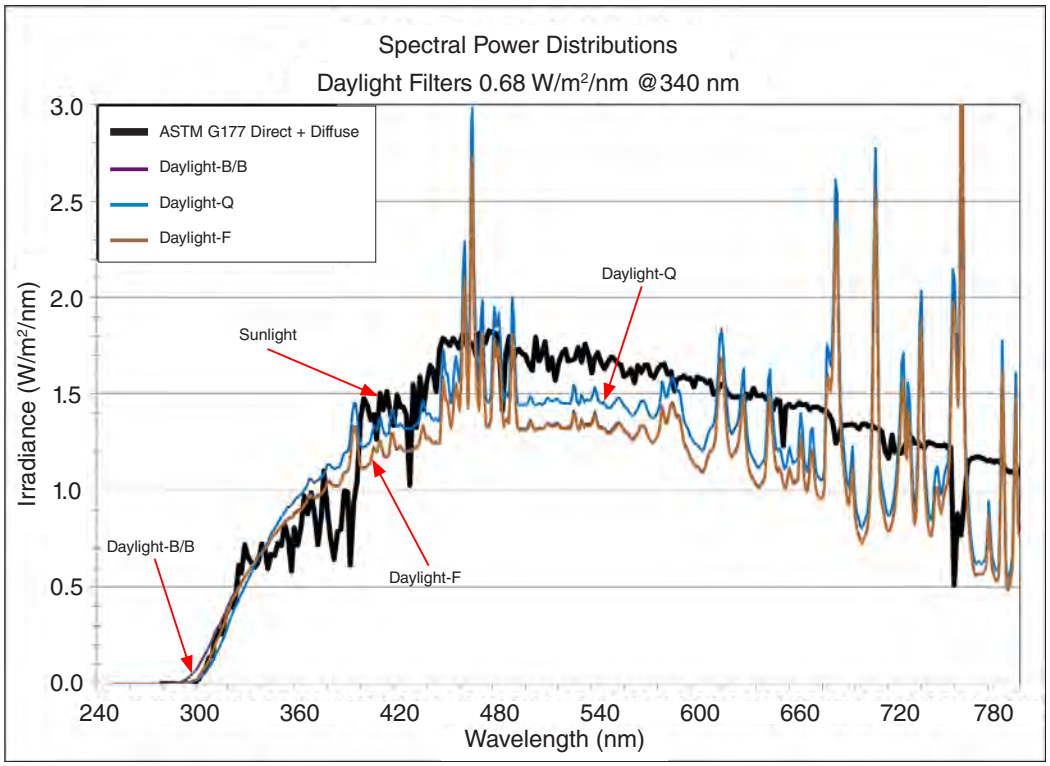


Figure 7.2c: Spectral power distributions of Daylight filters from 250-800 nm.

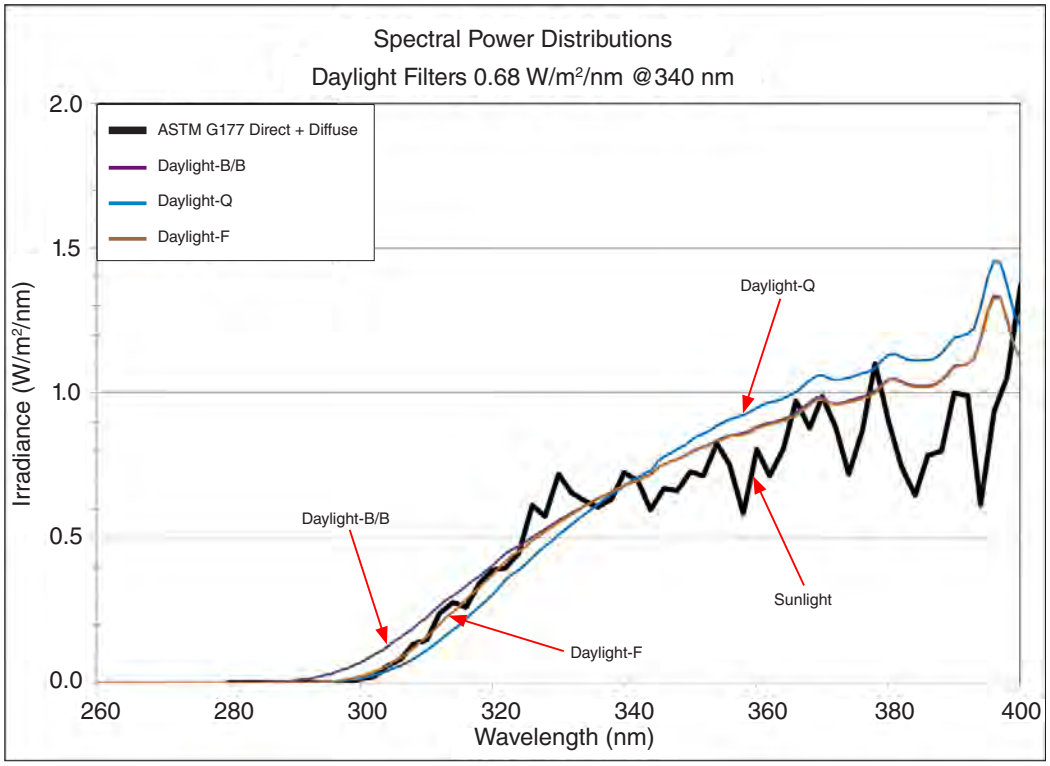


Figure 7.2d: Spectral power distributions of Daylight filters from 260-400 nm.

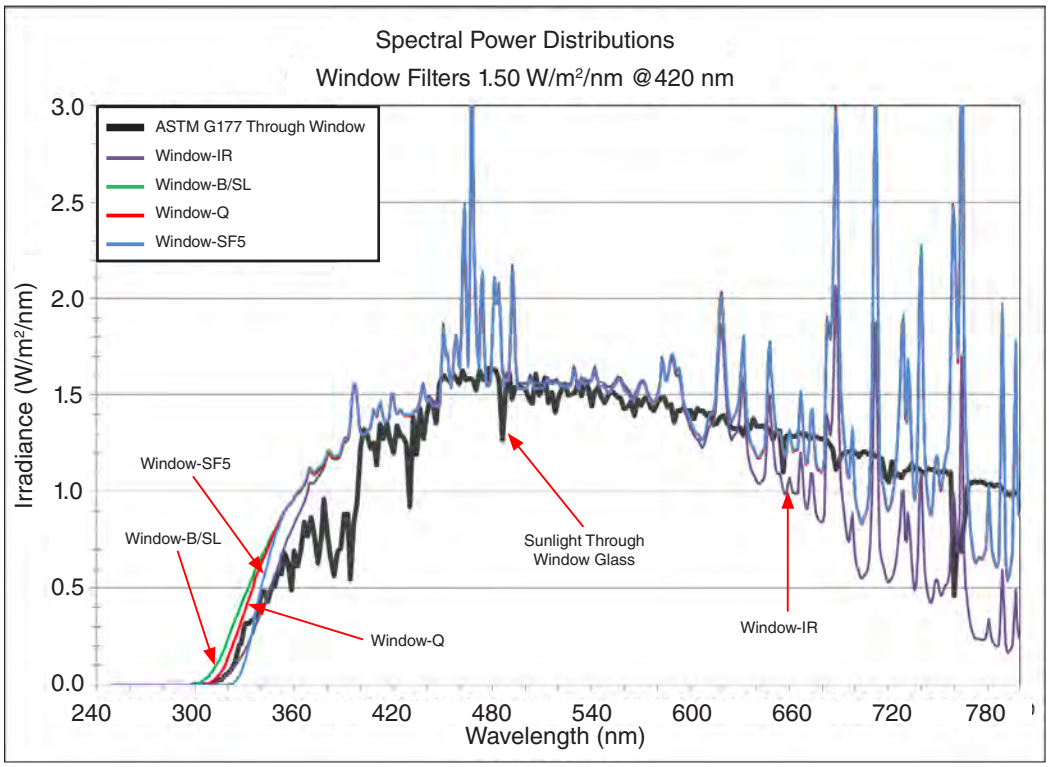


Figure 7.2a: Spectral power distributions of Window filters from 250-800 nm.

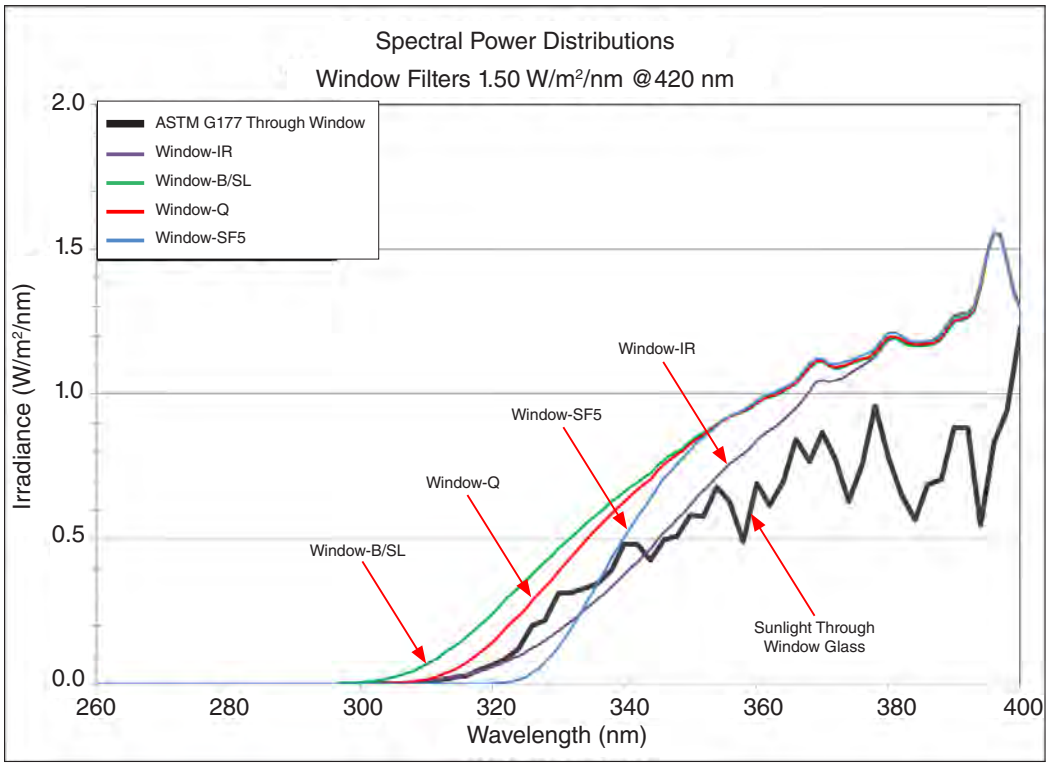


Figure 7.2b: Spectral power distributions of Window filters from 260-400 nm.

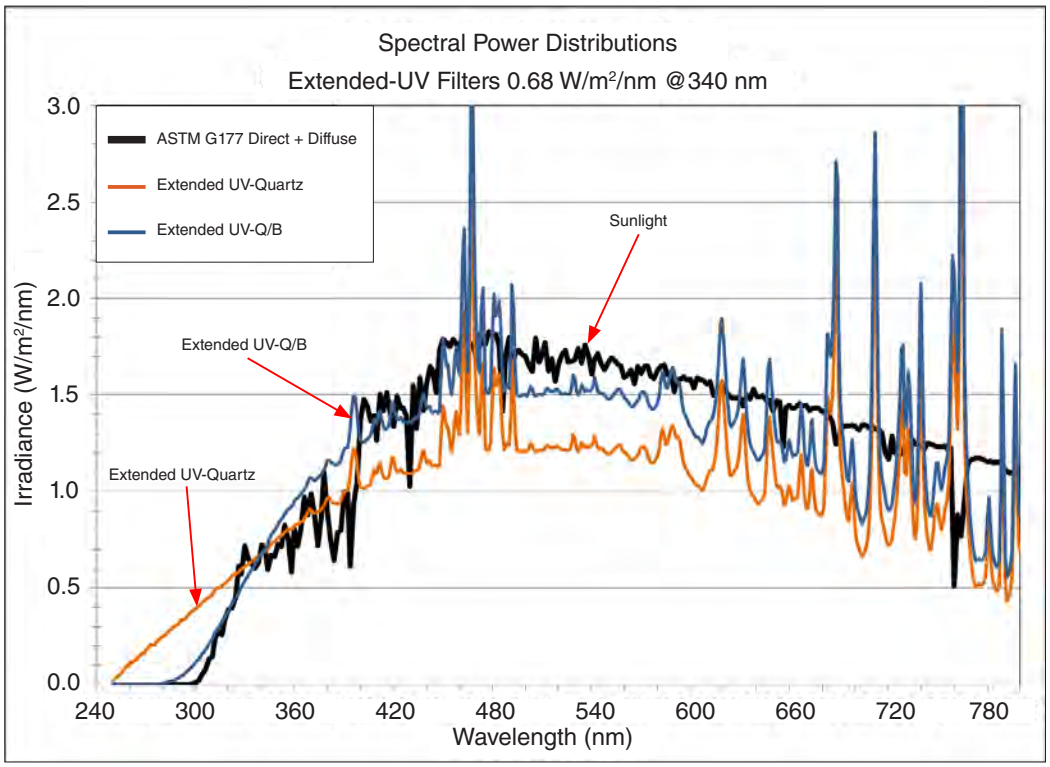


Figure 7.2c: Spectral power distributions of Extended-UV Filters from 250-800 nm.

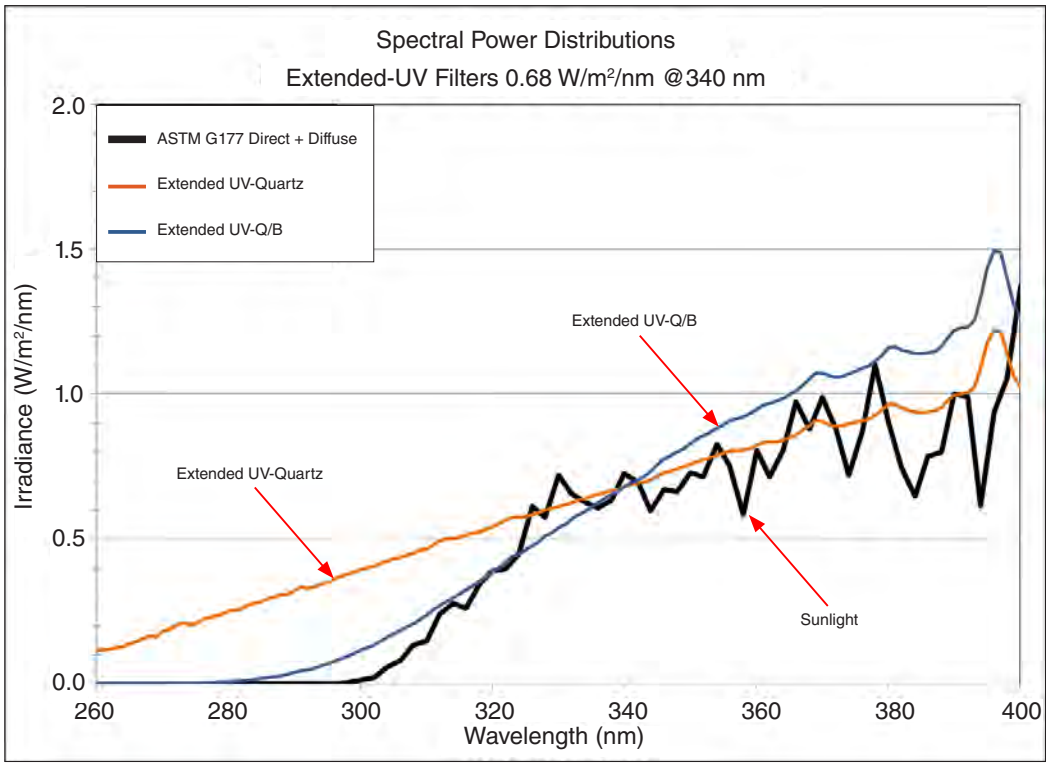


Figure 7.2d: Spectral power distributions of Extended-UV Filters from 260-400 nm.

7.3 Lamp Cooling System (Nov 2020)

- A system of air filters, ducts, and blowers circulates room air through the tester to cool heat-generating components including the ballast and the xenon lamp (Figure 7.3).

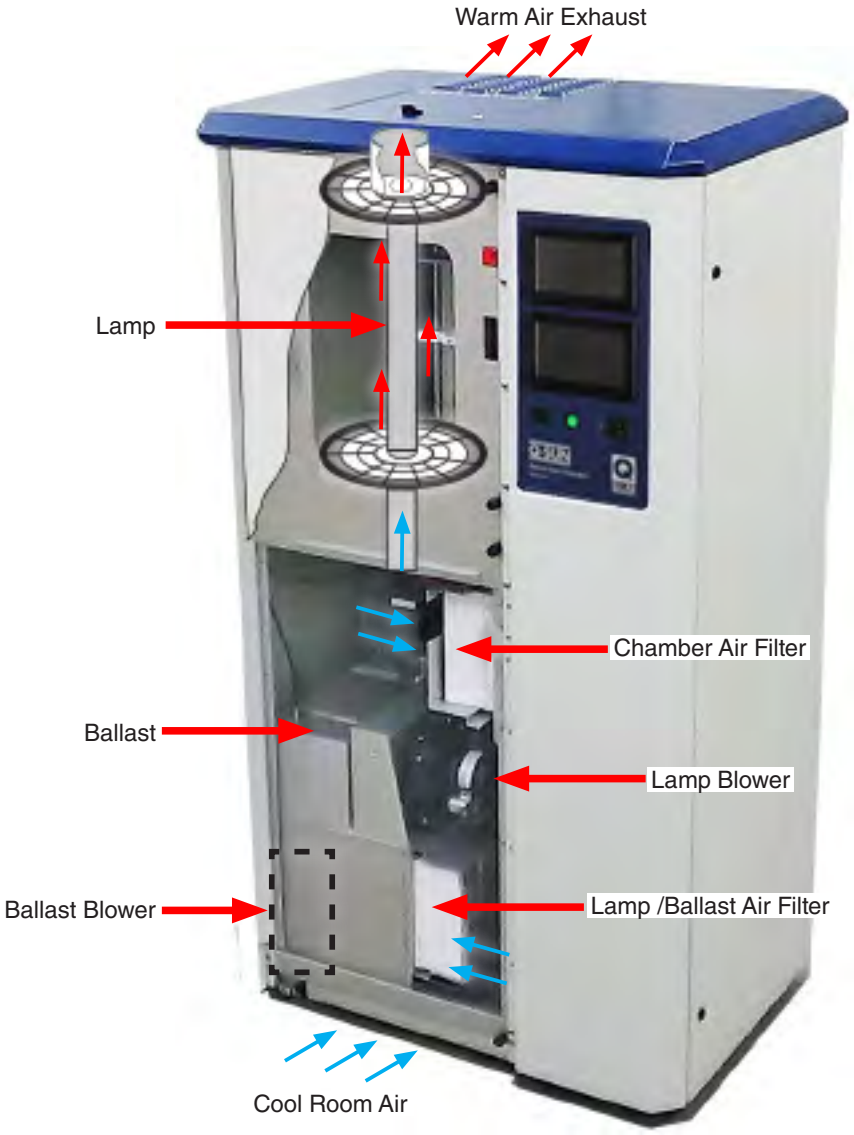


Figure 7.3: Lamp cooling system schematic.

7.4 Irradiance Sensors (Oct 2020)

- Three (3) irradiance sensor types are available:

Description	Part Number
340 nm Sensor	X-7515-K
420 nm Sensor	X-7522-K
TUV Sensor	X-7523-K

- The installed sensor type is displayed on the tester Status Screen (see Figure 7.4a).
- The irradiance sensor is located at the top of the tester and is accessed through the lamp door (see Figure 7.4b).
- Most common test methods specify the type of irradiance sensor needed to conduct the test (see Section 12.2).
- See Section 18 for sensor replacement part information.
- See Section 13.1 for calibration instructions.

NOTE: Contact Q-Lab Repair and Tester Support if irradiance instability occurs when changing the irradiance sensor type.

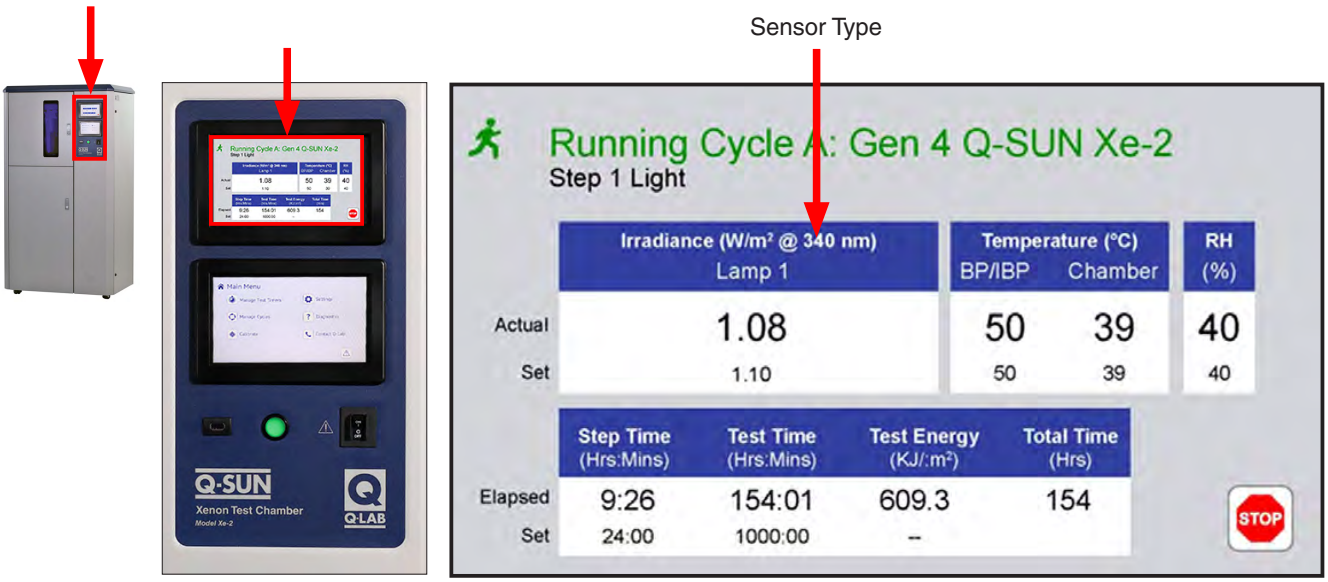


Figure 7.4a: Sensor type shown on Status Screen.

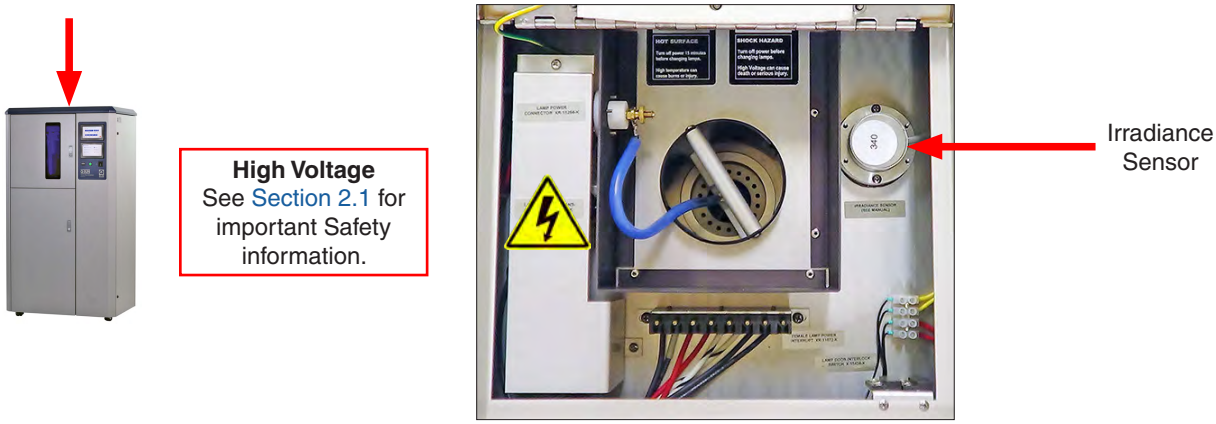


Figure 7.4b: Irradiance sensor location.

7.5 Irradiance Control System (Nov 2020)

- All Q-SUN Xe-2 models use a system that includes an irradiance sensor, main controller, relay, and ballast to control lamp irradiance. (Figure 7.4b, Figure 7.5a, Figure 7.5b).
- The UV sensor measures light intensity and sends information to the main controller.
- The main controller regulates the power to the ballast that drives the lamp to maintain the irradiance set point.
- See *LX-5085-SO Q-SUN Xe-2 System Overviews* for detailed information on the irradiance control system.

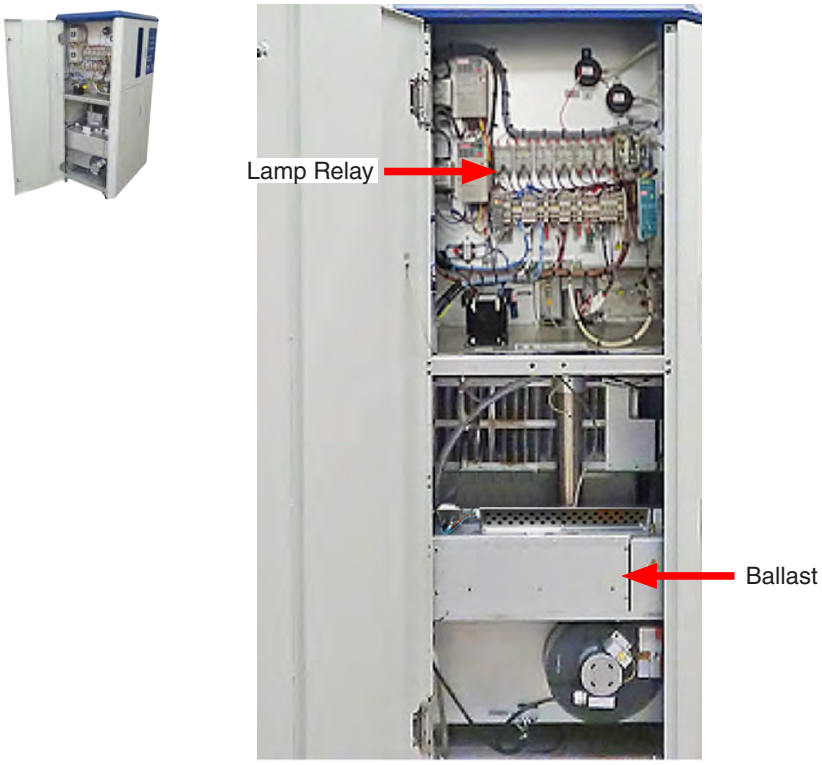


Figure 7.5a: Left side door open showing lamp power supply (ballast)

Figure 7.5b: Right side door open showing main controller.

8. Temperature Control Systems

8.1 Black Panel Temperature Sensor (Nov 2020)

- The Q-SUN measures the temperature of a black panel sensor to control specimen temperature.
- The actual black panel temperature (along with the temperature set point) is displayed on the tester Status Screen (see Section 11).
- Two types of black panel sensors are available (Figure 8.1a).
- They produce very different test temperatures, even with the same controller temperature setting.

IMPORTANT: If you run a standard test method (see Section 12) be sure to use the type of black panel that is specified in your standard.

				
ASTM Designation:	***Uninsulated*** Black Panel (BP)		***Insulated*** Black Panel (IBP)	
ISO Designation:	Black ***Panel***		Black ***Standard***	
Construction:	Black Painted Stainless Steel		Black Painted Stainless Steel with Plastic Insulating Backing	

Figure 8.1a: Black panel temperature sensors.

- White panel temperature sensors are also available but are far less common than black panel temperature sensors (see Section 8.2).

- The panel temperature sensor mounts on the turntable (Figure 8.1b) using a special holder (see Section 12.3).
- The sensor connects to a contactless data transmission system located under the turntable (Figure 8.1c through Figure 8.1e).
- The panel temperature data is monitored by the main controller to maintain the panel temperature set point.

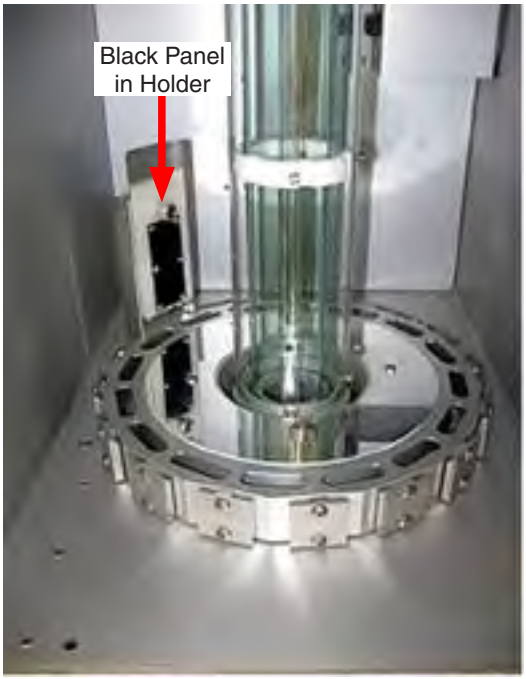


Figure 8.1b: Black panel mounted on turntable (specimen holders removed).

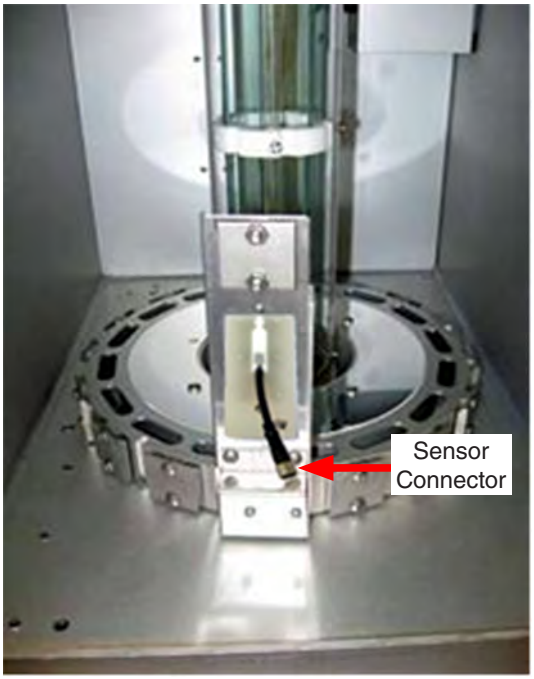


Figure 8.1c: Panel temperature sensor connector (disconnected).

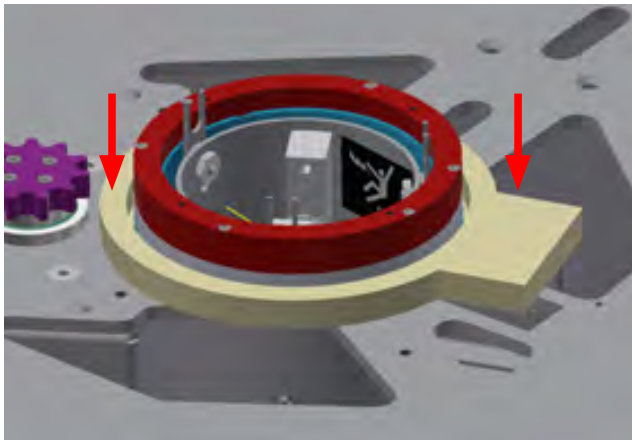


Figure 8.1d: Schematic showing primary contactless panel temperature data link (mounted on test chamber floor).

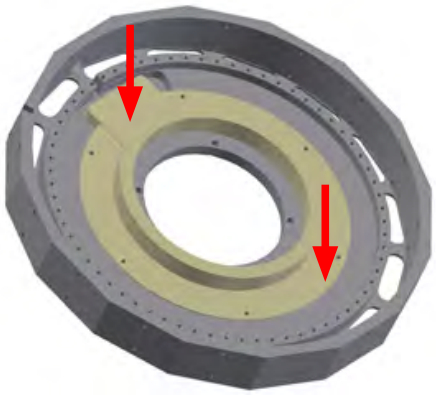


Figure 8.1e: Secondary contactless panel temperature data link (mounted on bottom of turntable).

8.2 White Panel Temperature Sensor (Mar 2019)

- The white panel temperature sensor for the Xe-2 is similar to the black panel but uses a different temperature sensor and connector (Figure 8.2a).
- The white panel and transmitter mount on a special sample holder that is placed next to the black panel on the Xe-2 turntable (Figure 8.2b).
- The white panel transmits data wirelessly to a receiver outside of the test chamber that displays the white panel temperature (Figure 8.2c).
- Except where noted, references in this manual to black panel temperature sensors also apply to white panel temperature sensors.
- See *XR-11803-L Q-SUN White Panel Installation* for detailed information on installing and operating white panel temperature sensors (contact Q-Lab Repair and Tester Support for more information).

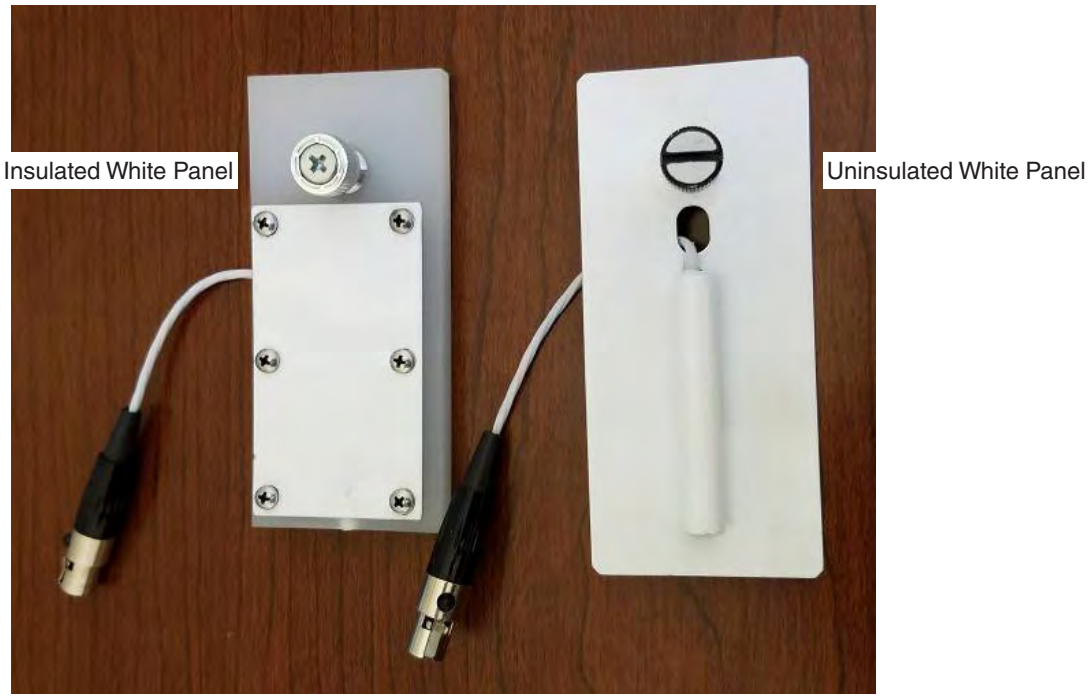


Figure 8.2a: White panel temperature sensors.

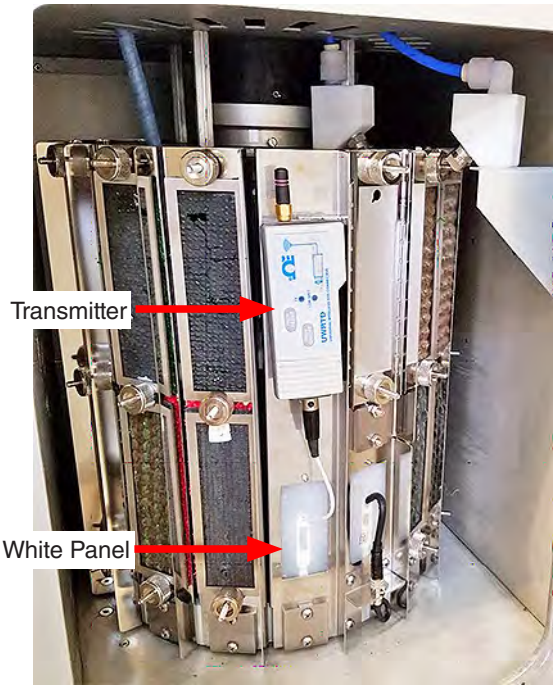


Figure 8.2b: White panel and transmitter mounted on turntable.

Figure 8.2c: White panel data receiver.

8.3 Chamber Air Temperature Sensor (Oct 2020)

- The Q-SUN Xe-2 includes a chamber air temperature (CAT) sensor in addition to the panel temperature sensor.
- The CAT sensor is located at the right rear of the test chamber (Figure 8.3a).
- The CAT sensor and the relative humidity (RH) sensor are in the same housing (Figure 8.3b).
- The actual chamber air temperature (along with the temperature set point) is displayed on the tester Status Screen (see Section 11).

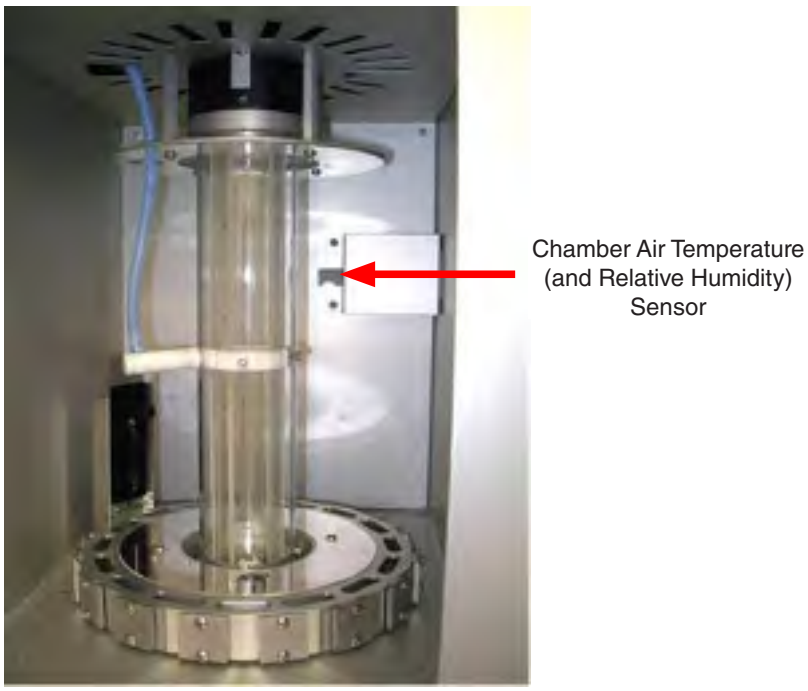


Figure 8.3a: Chamber air temperature sensor mounting location.

Figure 8.3b: Chamber air temperature (and relative humidity) sensor.

8.5 Laboratory Temperature Sensor (Nov 2020)

- The Xe-2 is equipped with a laboratory temperature sensor.
- If the Q-SUN shuts down due to a black panel or chamber air temperature fault, the lab temperature at the time of the fault will be displayed on the Notifications Screen (see Section 11.8) as an aid to troubleshooting.

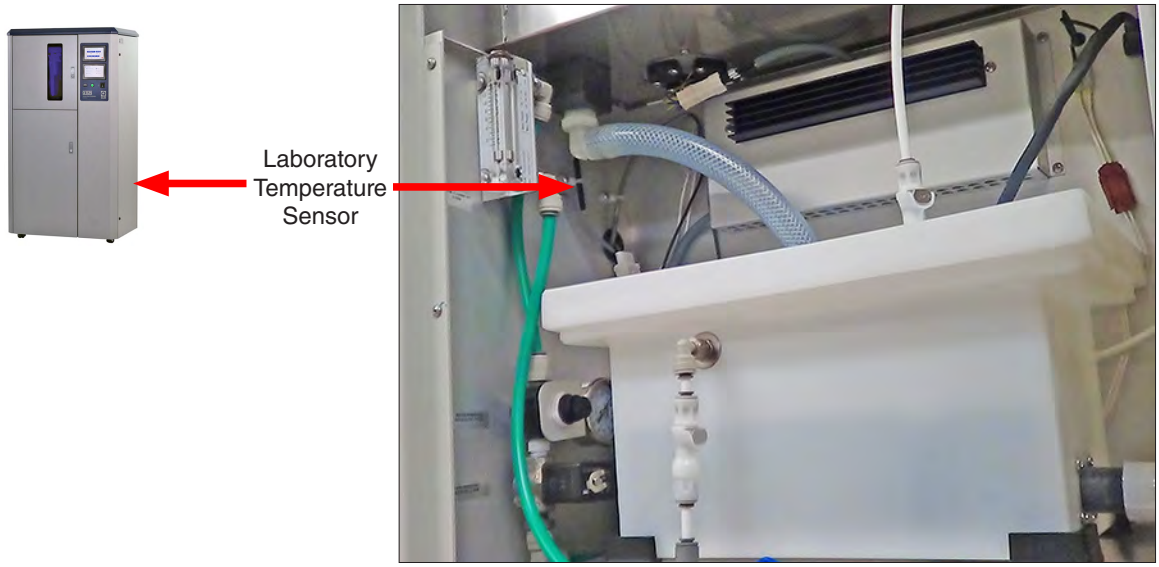


Figure 8.5: Xe-2 right side door open showing lab temperature sensor.

8.6 Chamber Air Temperature Control (Nov 2020)

- Air is circulated through the Xe-2 to provide test chamber cooling and heating (Figure 8.6a).
- The air temperature is controlled using variable speed blower systems and an air heater (Figure 8.6b and Figure 8.6c).
- Both blowers (recirculating and fresh air) work simultaneously and the air heater turns on and off (for both) as necessary to maintain the chamber air temperature at set point.
- To lower chamber temperature, fresh room (ambient) air is circulated into the chamber.
- To raise chamber temperature, chamber air is recirculated and the air heater is activated.
- See *LX-5085-SO Q-SUN Xe-2 System Overviews* for more information.

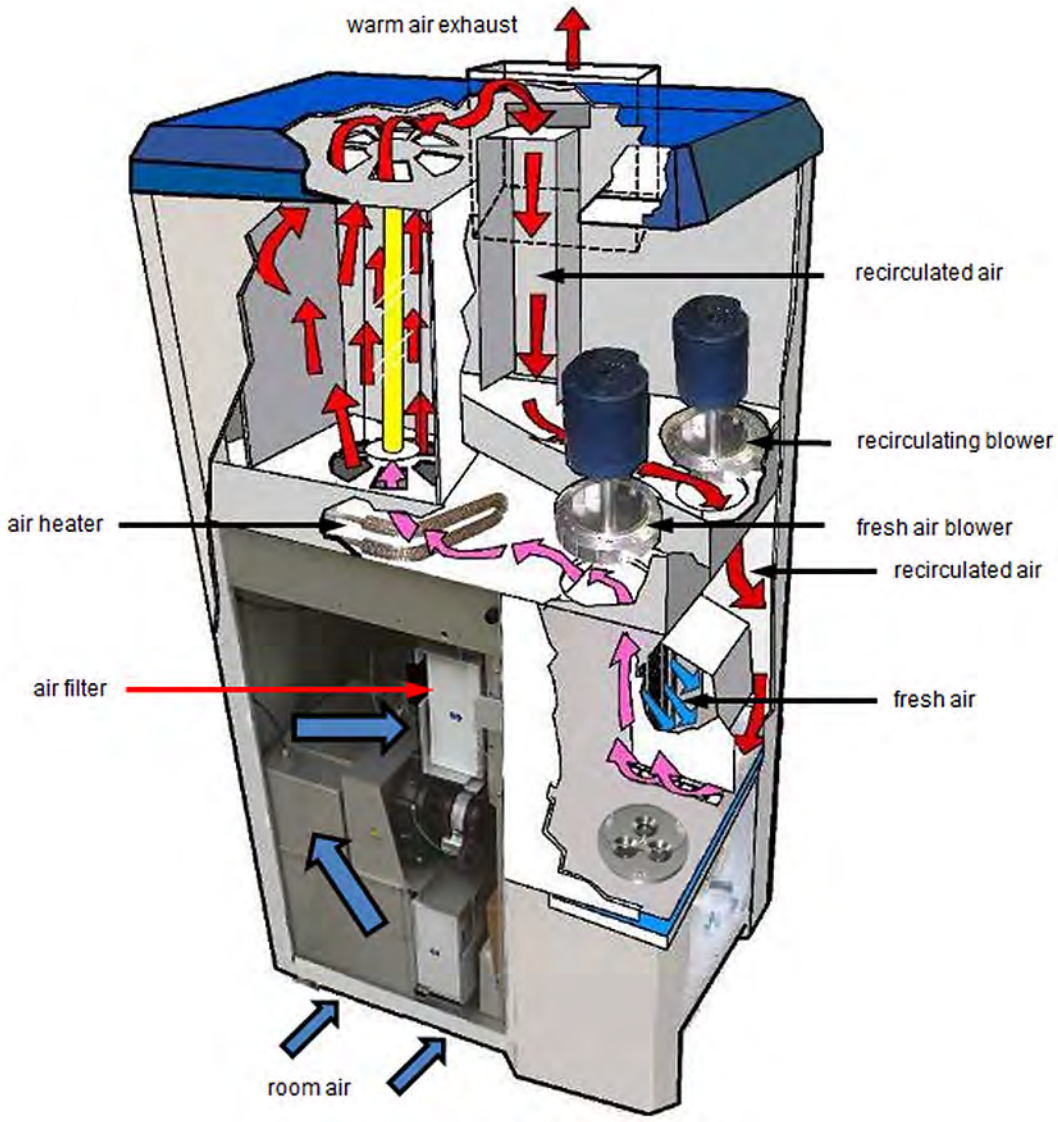


Figure 8.6a: Schematic showing the temperature control and air flow.

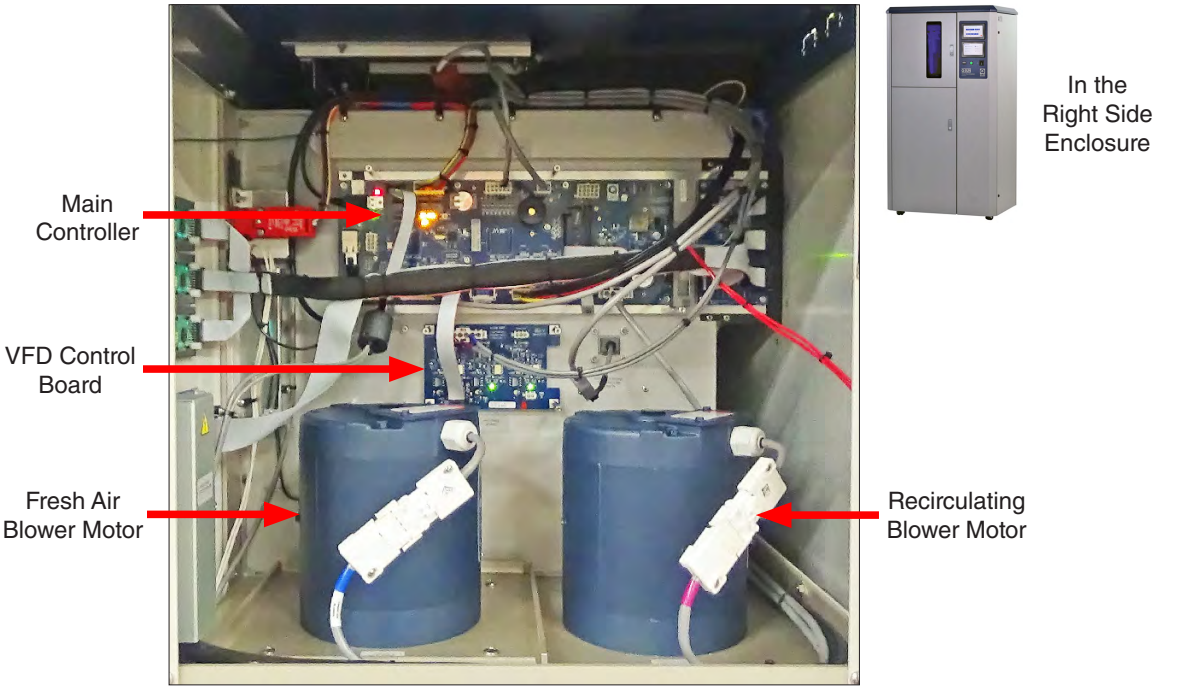


Figure 8.6b: Air circulation components including the main controller Variable Frequency Drive (VFD) control board and blower motors.

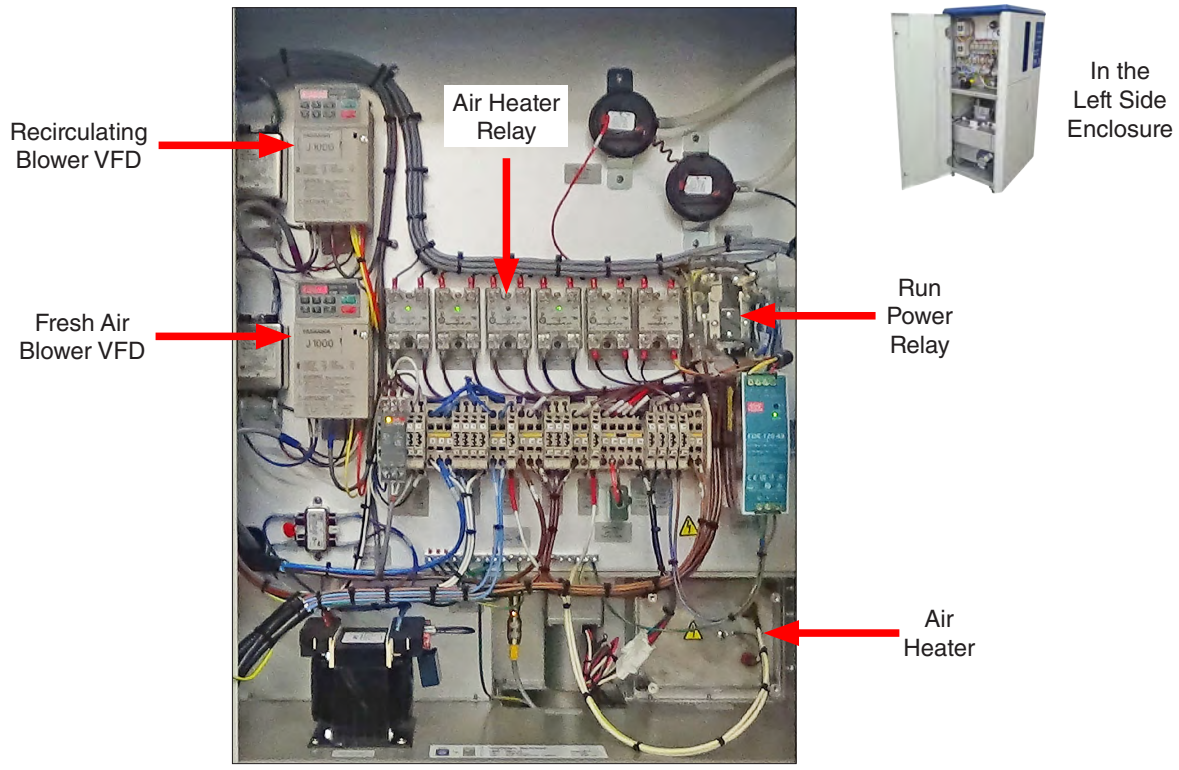


Figure 8.6c: Air circulation components including variable frequency drives, relays, and the air heater.

9. Relative Humidity System

9.1 Humidifier (Nov 2020)

- All Q-SUN Xe-2 testers are equipped with a controlled relative humidity (RH) system (Figure 9.1).
- The humidifier is an ultrasonic disc humidifier that produces droplets of water about 1 micron in diameter.
- The humidifier disc is located in the bottom of the humidifier water pan.
- The disc contains three (3) nebulizers that generate ultrasonic waves.
- The water pan is filled constantly from a pump inside the circulation reservoir.
- The level in the chamber pan is maintained by an overflow stem, which flows back down to the reservoir.

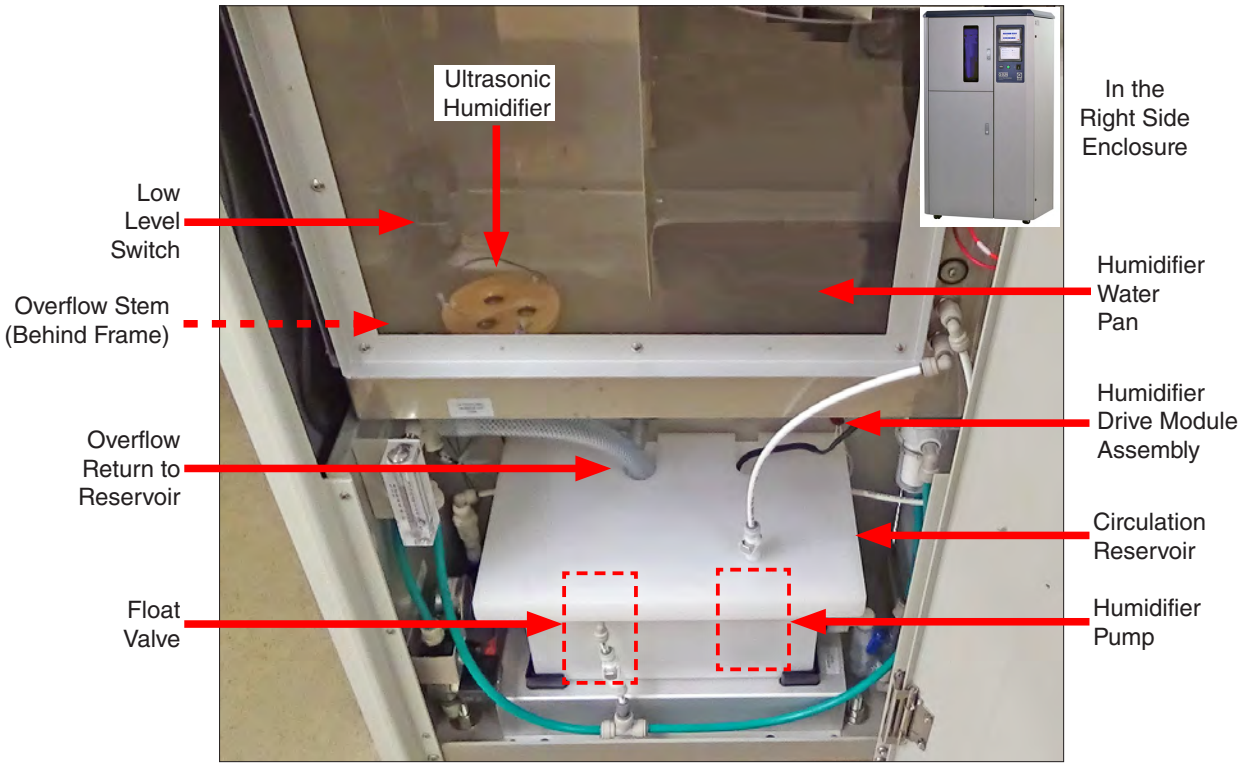


Figure 9.1: Humidifier System

9.2 Relative Humidity Sensor (Nov 2020)

- The Q-SUN Xe-2 includes a Relative Humidity (RH) sensor.
- The RH sensor is located at the right rear of the test chamber (Figure 9.2a).
- The RH sensor and the chamber air temperature sensor are in the same housing (Figure 9.2b).
- The actual RH (along with the RH set point) is displayed on the tester Status Screen (see Section 11).

Figure 9.2a: Relative humidity sensor mounting location.

Figure 9.2b: Relative humidity and chamber air temperature sensor.

9.3 Humidity Control System (Nov 2020)

- The humidity control system includes the main controller, driver module, and the humidity sensor (Figure 9.3a and Figure 9.3b).
- See LX-5085-SO Q-SUN Xe-2 System Overviews for more information.

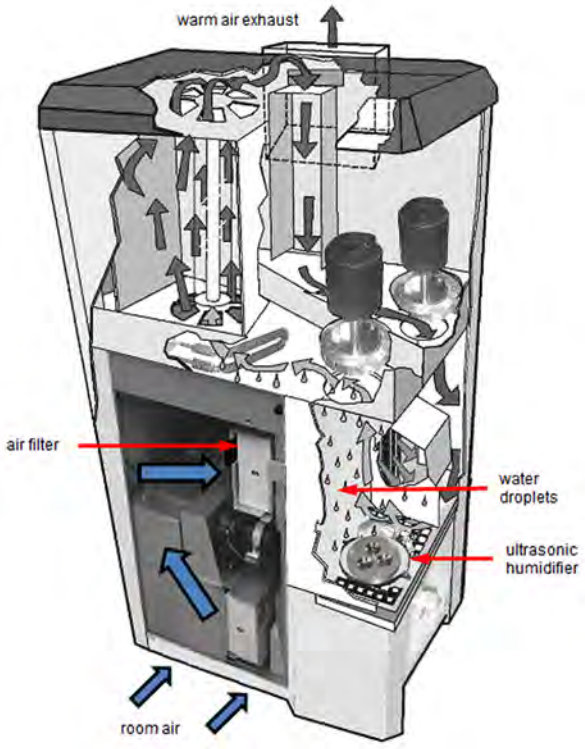


Figure 9.3a: Humidity control system.

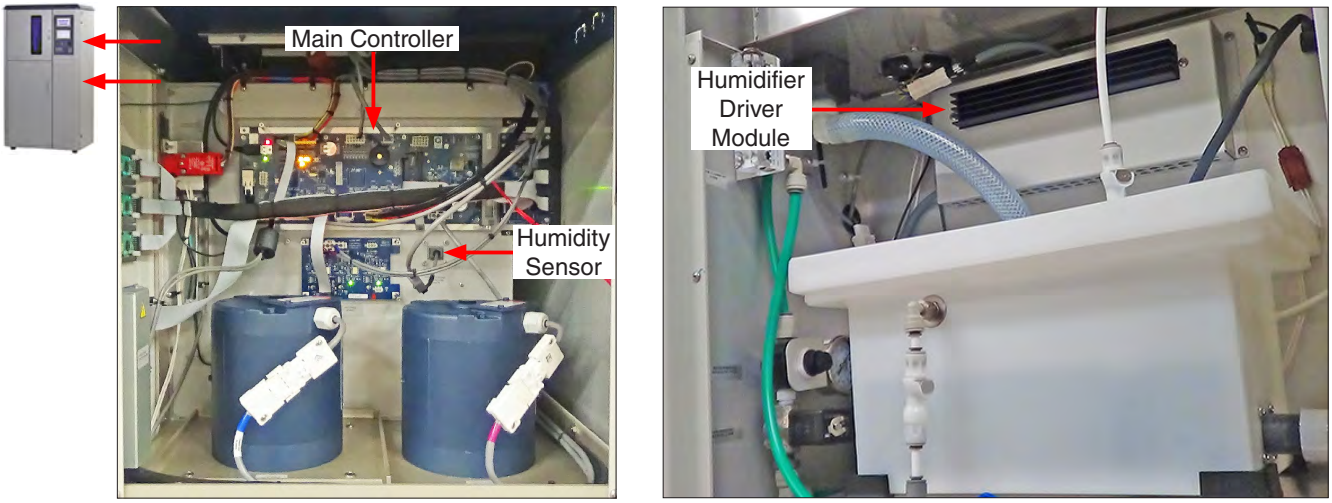


Figure 9.3b: Humidity control components.

10. Water Spray Systems

- Two (2) water spray systems are optionally available for the Xe-2 tester.
  - The Xe-2-HSE model has one system to spray water on the front of the specimens that face toward the lamp during a *Light + Spray* or a *Dark + Spray* step.
  - The Xe-2-HBSE model has an additional back spray system to spray water on the back as well as on the front of the specimens. The Xe-2-HBSE has *Light + Spray Front*, *Dark + Spray Front*, and *Dark + Spray Front + Back* functions.
- A spray control assembly (part number X-11452-K) is used to control the water flow to the nozzles.
- See *LX-5085-SO Q-SUN Xe-2 System Overviews* for detailed spray system information and diagrams.

10.1 Front Spray, Model Xe-2-HSE (Nov 2020)

- The Xe-2-HSE has one spray nozzle located near the top of the chamber (Figure 10.1a and Figure 10.1b).
- The nozzle sprays the entire height of the specimen holder.
- The front (side facing the lantern) of each specimen gets sprayed as the turntable rotates.
- A spray control assembly (Figure 10.1c) includes a pressure regulator that controls the flow of water to the nozzle.
- Use the pressure regulator to set the flow rate (visible on the flow meter) to 0.5 liters/minute when the spray is on.

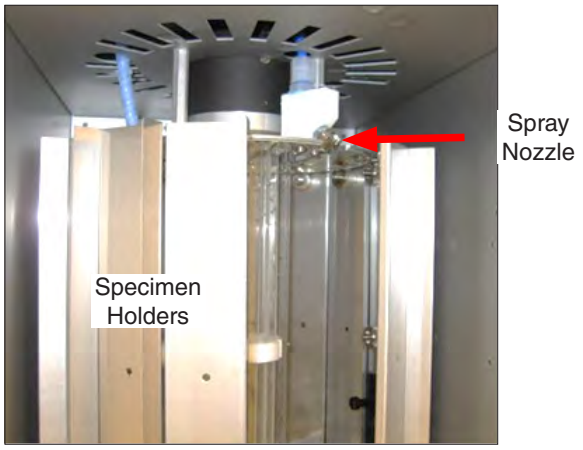


Figure 10.1a: Front spray nozzle location.

Figure 10.1b: Front spray nozzle detail.

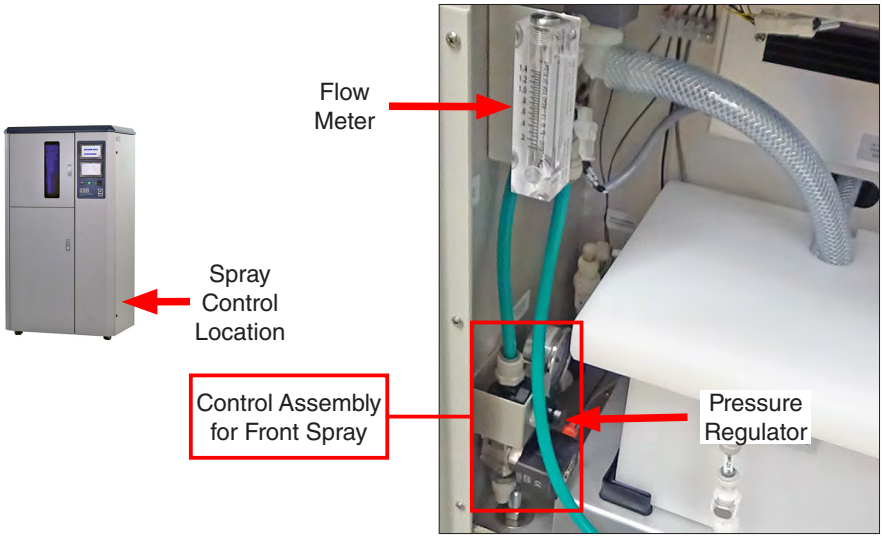


Figure 10.1c: Xe-2 right side door open to show front spray control.

10.2 Back Spray, Model Xe-2-HBSE (Nov 2020)

- The back spray option enables the Xe-2 to perform the SAE J2527 standard (see Section 12).
- In addition to the front spray nozzle, the Xe-2-HBSE has a second nozzle located near the top of the chamber (Figure 10.2a).
- During a *Dark+Spray Front+Back* in addition to front spray the back spray nozzle sprays the back of the specimens.
- Back Spray operates only during *Dark + Spray Front + Back* steps.
- Back Spray will not operate during a *Light + Spray Front* step.
- The nozzles spray the entire height of the specimen holder.
- The front and back of each specimen gets sprayed as the turntable rotates. **NOTE:** Open back specimen holders must be used to spray the back side of the specimens (see Section 12.3).
- The back spray has a separate assembly to control the flow of water (Figure 10.2b).
- Use the front spray pressure regulator to set the flow rate (visible on the flow meter) to 0.5 liters/minute when the spray is on (see Section 10.1).
- Use the back spray pressure regulator to set the pressure to 5 psi on the pressure guage when the spray is on.

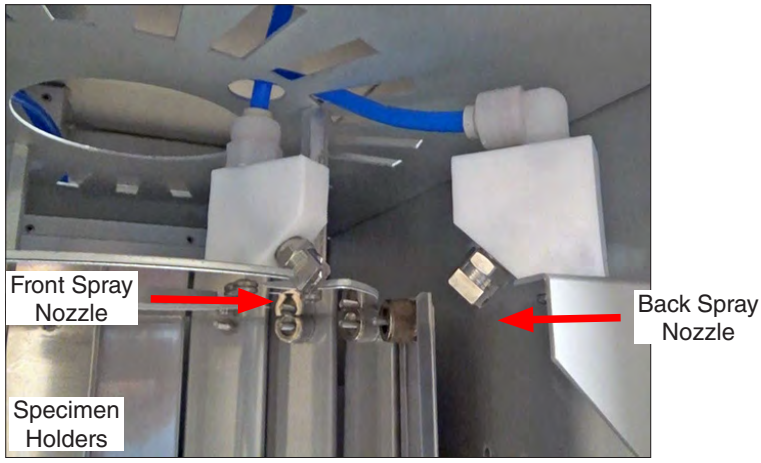


Figure 10.2a: Xe-2-HBSE Back spray nozzle location.

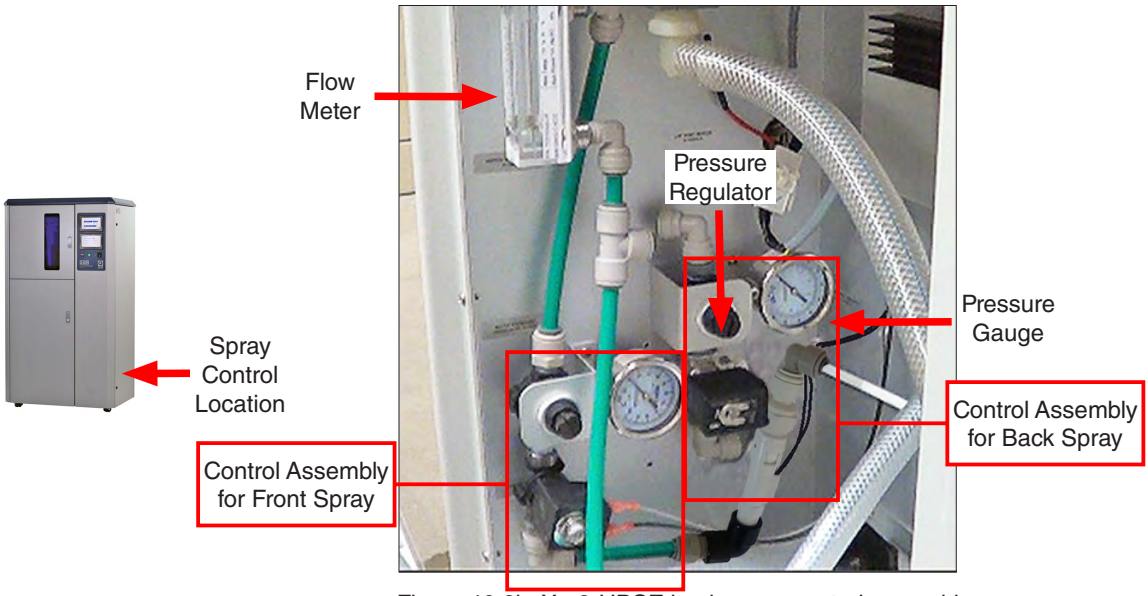


Figure 10.2b: Xe-2-HBSE back spray control assembly.

11. Main Controller Operation

11.1 Overview (Oct 2020)

Purpose

- The Q-SUN main controller controls all functions of the tester.
- Interactive software allows easy programming using dual, full-color touch-screen displays.
- One or more common test cycles have been pre-programmed. Custom test cycles can be easily created.
- The main controller continuously displays all test status conditions and monitors for errors. The main controller will automatically stop a test if an error is detected.
- New software revisions can easily be downloaded and installed.
- System configuration and performance data can be exported to assist in troubleshooting.

Display screens

- Two touch-screen monitors mounted on the Q-SUN control panel are used to control tester operation and the display of test status (Figure 11.1a).
- The Status Screen is on the top and the Menu Screen is on the bottom.
- The Status Screen (Figure 11.1b) displays tester current running conditions.
- The Menu Screen (Figure 11.1c) is the main interface for operator control of the tester, including settings, programming, and calibration.
- The screens are activated when the tester is powered on.
- After an interval of inactivity, the screens will automatically deactivate. Just tap a screen to reactivate (Figure 11.1d).
- The touch-screens should be cleaned with a soft cloth and alcohol. Do not use water to clean the screens.
- The screens can be operated using a stylus. Many operators prefer using a stylus with the touch-screens.
- A large LED indicator (Figure 11.1a), below the menu screen and visible from a distance, changes colors to indicate current operational status of the test.

Figure 11.1a: Touch-screens and LED location.

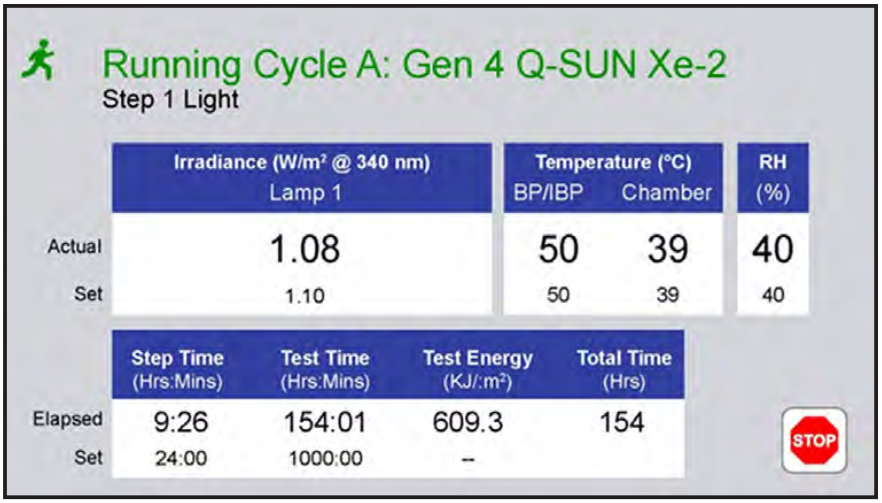


Figure 11.1b: Status Screen displaying typical operating conditions.

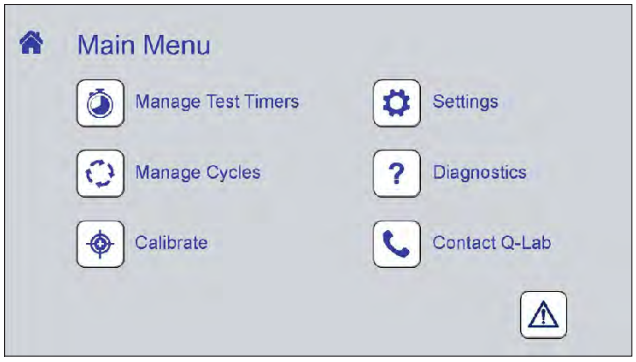


Figure 11.1c: Menu screen displaying the main menu.

Figure 11.1d: Touch either screen to activate.

11.2 Status Screen (Oct 2020)

- The Status Screen (Figure 11.2a) displays:
  - The status icon and state that indicates the overall status of the tester (see Overall Test Status).
  - The cycle identification and the name of the test being run.
  - The current test step number and type of step.
  - Actual irradiance and set point irradiance values.
  - Actual temperature and set point temperature of the panel and chamber air temperature sensors.
  - Actual relative humidity (RH) and set point RH values.
  - Elapsed and set step time and test time.
  - Tester total operation time.
  - Touch RUN / STOP button to run or to stop the test.
  - When the test is stopped and the test chamber door is opened the Manual Rotate button is displayed (Figure 11.2b). Touch this button to rotate the turntable for mounting or removing test specimens.

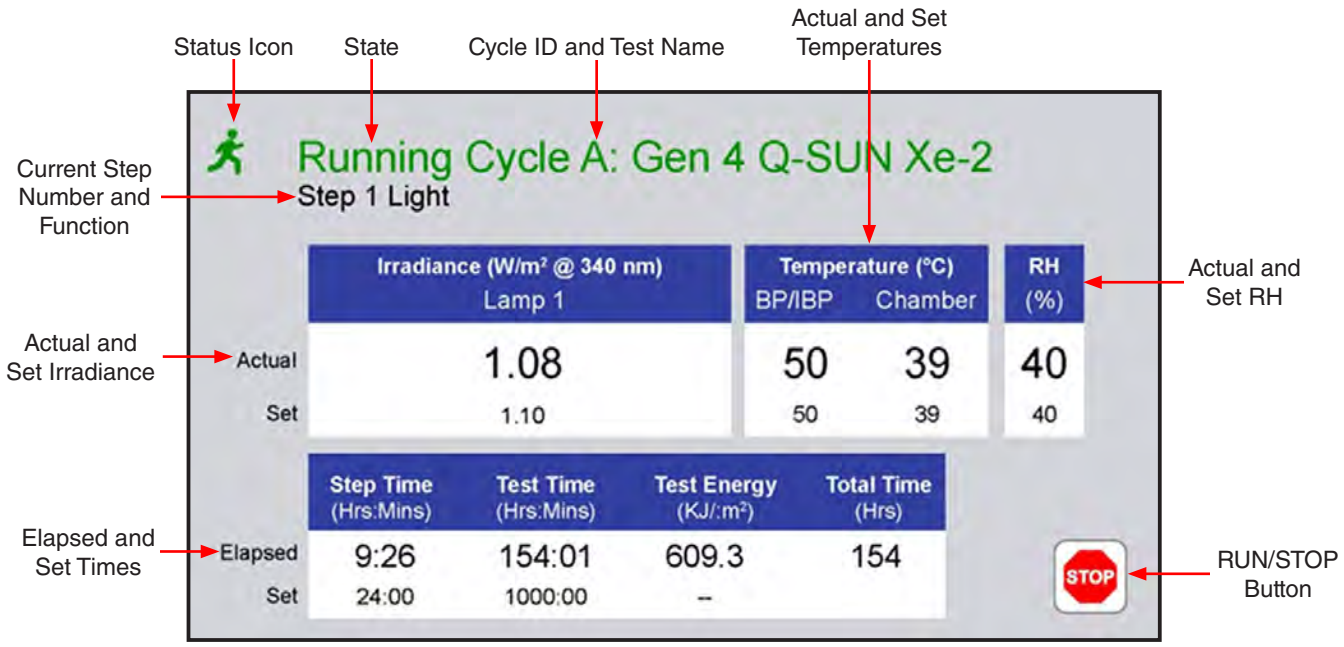


Figure 11.2a: Status Screen display elements.

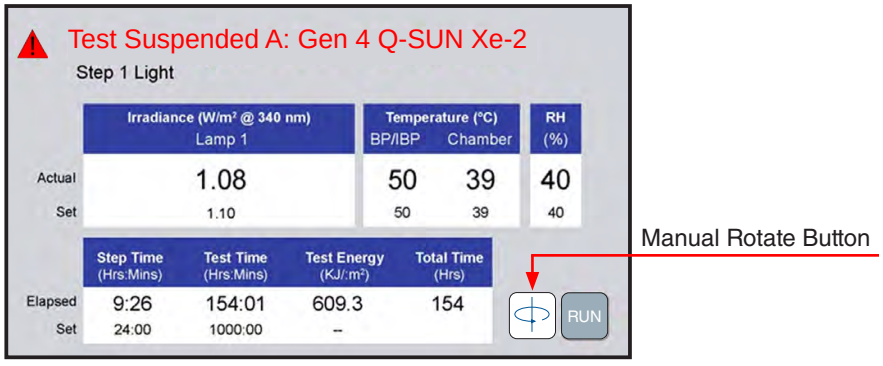


Figure 11.2b: Manual Rotate button.

Overall Test Status

- A colored icon and title at the top of the screen indicate the overall status of the test (Figure 11.2c, Figure 11.2d).
- Icons in the lower right corner of the screen can be used to stop or run the test.
- The title also shows the test cycle letter and the name of the test cycle.
- The LED status indicator changes color corresponding to the icon and title status.
- The table below summarizes all status conditions.

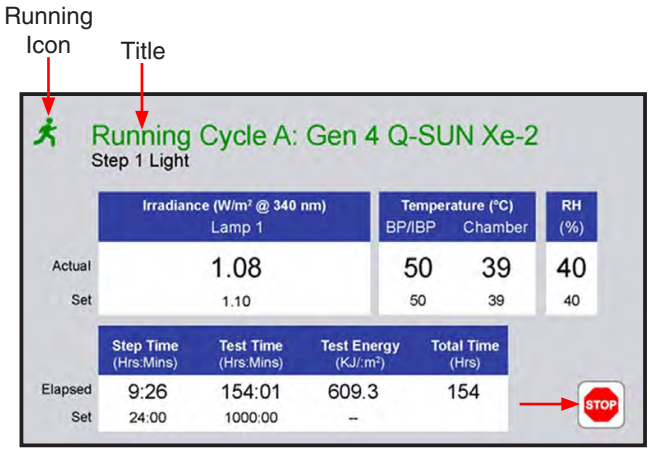


Figure 11.2c: Status icon and title when test running.

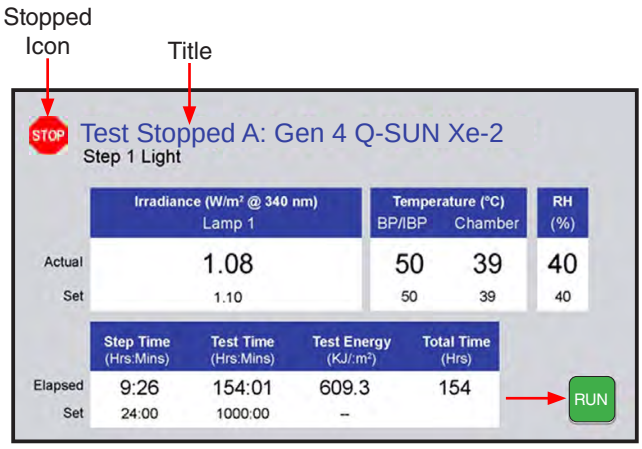


Figure 11.2d: Status icon and title when test stopped.

Icon	Title (color)	LED (color, condition)	Status
	Running Cycle (Green)	(Green, Static)	Test running normally, no active notifications.
	Test Completed (Blue)	(Blue, Flashing)	Test completed.
	Running Cycle (Green)	(Yellow, Flashing)	Test running, one or more notifications.
	Test Stopped (Blue)	(White, Static)	Power on, stopped, no active notifications (standby).
	Test Suspended (Red)	(Red, Flashing)	Error, test stopped. Check Notifications on the menu screen.
Does not affect the icon.	Does not affect the title.	(Magenta, Static)	Software Install or VSC transfer using USB port.

11.3 Main Menu Screen (Oct 2020)

- The Main Menu is the home display for the menu screen (Figure 10.3).
- The Main Menu screen provides access to all other operator controls for the tester.
- The Main Menu displays icons to access these functions:
  - Notifications (Section 11.4)
  - Manage Test Timers (Section 11.5)
  - Manage Cycles (Section 11.6)
  - Calibration (Section 13)
  - Settings (Section 11.7)
  - Diagnostics (Section 11.8)
  - Contact Q-Lab (Section 11.9)

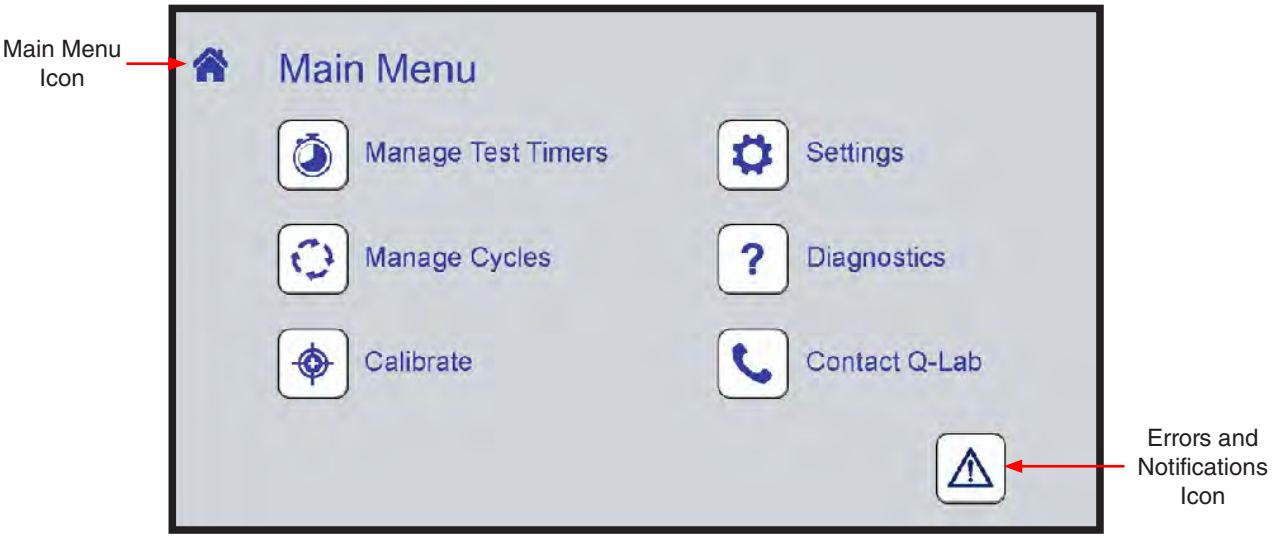


Figure 11.3a: Main Menu screen.

11.4 Notifications (Oct 2020)

- Notifications provide useful diagnostic information for technicians and repair personnel.
- Notifications show significant tester events and errors that occurred in the recent past.
- Up to 50 notifications are automatically stored by the Q-SUN main controller.
- On the Main Menu screen, touch the notification icon to display the Notifications Screen (Figure 11.4a).
- The type, information icon, identification code (ex. M49), and name are displayed for each notification (Figure 11.4b).
- "Active" and "Cleared" notifications are listed separately, in chronological order, most recent at the top of the list (Figure 11.4c, Figure 11.4d).
- Color-coded attention icons indicate the type of notification (Figure 11.4e).
  - A red triangle indicates an error occurred that stopped the test.
  - A yellow triangle indicates an event that did not stop the test, such as a maintenance reminder.
  - A blue triangle indicates the successful completion of a test.
- Touch the notification information icon to display details (Figure 11.4f through Figure 11.4j).
- See Section 11.4 for a complete list of notifications.

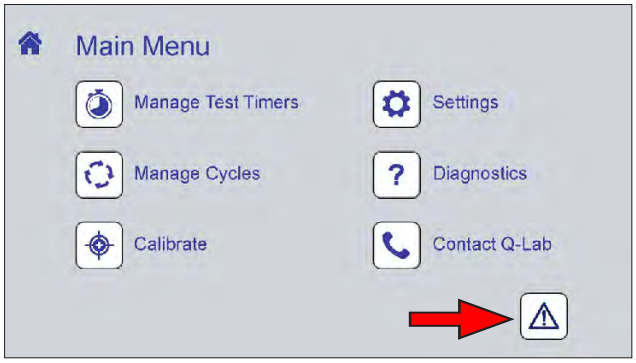


Figure 11.4a: The notifications icon. Icon color changes depending on notification status.

Figure 11.4b: The Notifications Screen lists notification information.

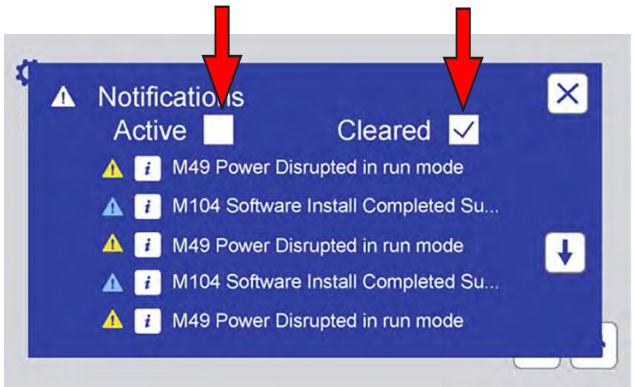


Figure 11.4c: Touch the Active or Cleared check box to view active or cleared notifications.

Figure 11.4d: Touch the scroll button(s) to move down or up the notification list.

Figure 11.4e: Color coded icons show notification type.

Figure 11.4f: Touch the information icon to display notification details.

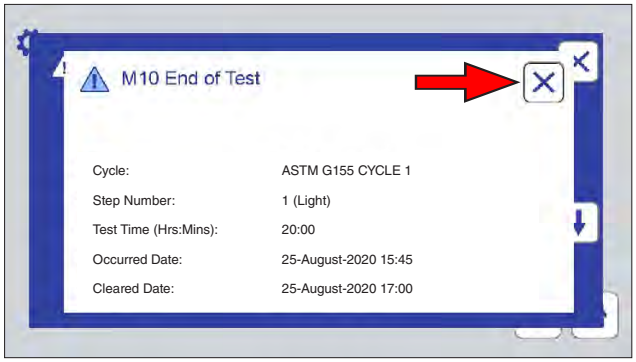


Figure 11.4g: Notification details. Touch the Close icon to return to the Notifications Screen.

Figure 11.4h: If the alarm is active, touch the yellow mute icon to silence. When the notification has been resolved, touch the icon to the left of the notification to clear it.

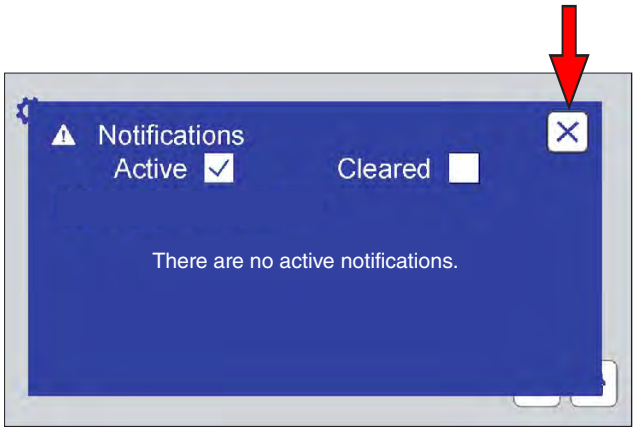


Figure 11.4i: Touch the Notification Screen close icon to re-display the main menu.

Code	Message	Condition & Recommended Action
M1	CHAMBER DOOR IS OPEN	If the chamber door is closed and the M1 error message appears, the chamber door interlock is defective or needs adjustment.
M2	LAMP DOOR IS OPEN	If the lamp door is closed and the M2 error message appears, the lamp door interlock is defective or needs adjustment.
M10	END OF TEST	Appears at the end of a test if you have chosen the MESSAGE ONLY action in your program. There will be no alarm, and the machine will continue to run. The user must shut off the machine manually.
M11	END OF TEST	Appears at the end of a test if you have chosen the ALARM action in your program. The alarm will sound, but the machine will continue to run. The user must shut off the machine manually.
M12	END OF TEST SHUTDOWN	Appears at the end of your test if you have chosen the STOP action in your program. There will be no alarm. The machine will shut off automatically.
M13	END OF TEST SHUTDOWN	Appears at the end of a test if you have chosen the STOP + ALARM action in your program. The alarm will sound. The machine will shut off automatically.
M14	TIME TO REPLACE LAMP	1500 Light Hours have elapsed since this message appeared previously.
M15	TIME FOR ROUTINE SERVICE - SEE MANUAL	2000 Operation Hours have elapsed since this message appeared previously. Refer to Section 13 of this manual for preventative maintenance information.

Figure 11.4j: A complete list of notifications and their meaning is given in Section 11.8.

11.5 Manage Test Timers (Oct 2020)

- On the Main Menu screen touch the Manage Test Timers icon to display the Manage Test Timers screen (Figure 11.5a).
- The Manage Test Timers screen provides three functions:

1. Specify what action the tester should perform at the end of a test (Figure 11.5b and Figure 11.5c).
   - o Stop
   - o Message only
   - o Alarm only
   - o Stop and alarm
   - o None
2. Set test duration units (Figure 11.5d through Figure 11.5f).
   - o Hours and minutes
   - o kJ/m^2
3. Set the elapsed time and/or duration in the selected units for the current test (Figure 11.5g through Figure 11.5i).

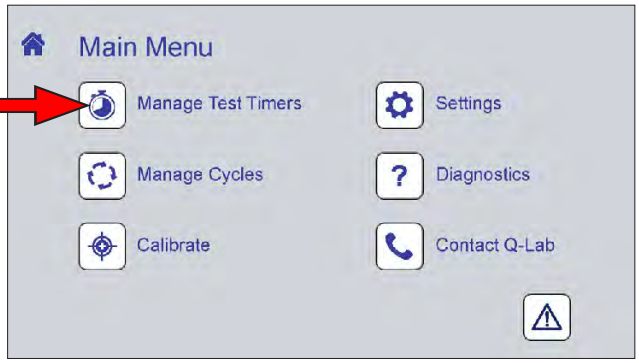


Figure 11.5a: Manage Test Timers icon.

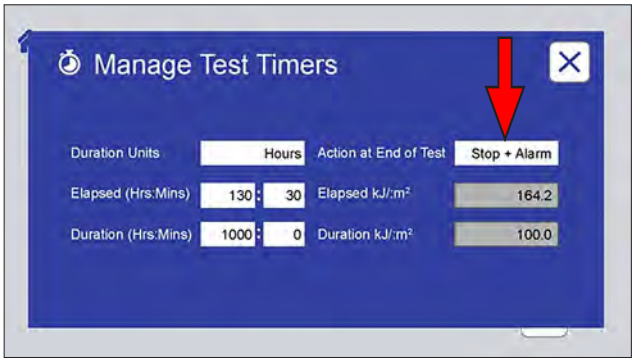


Figure 11.5b: Manage Test Timers screen. Touch the Action at End of Test text box to specify the action.

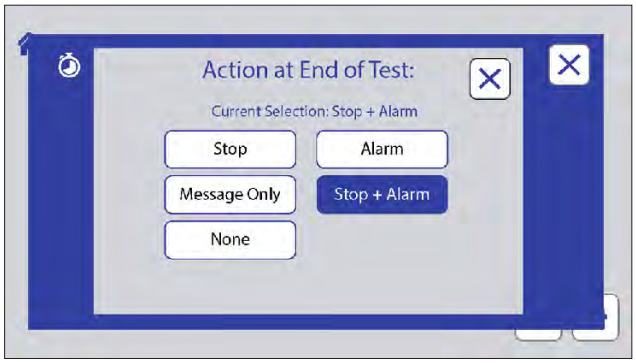


Figure 11.5c: Action at End of Test screen. Touch an action button to select that action.

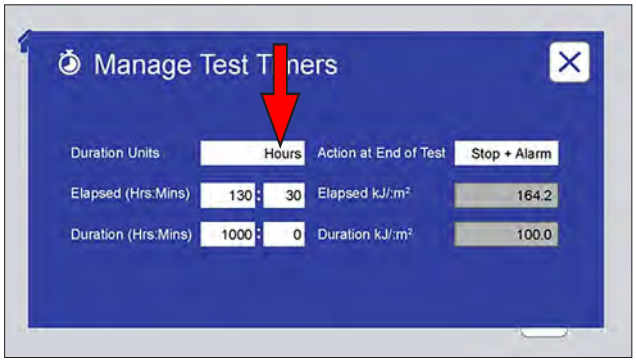


Figure 11.5d: Touch the Duration Units text box to set the test duration units in hours or in energy (kJ/m^2).

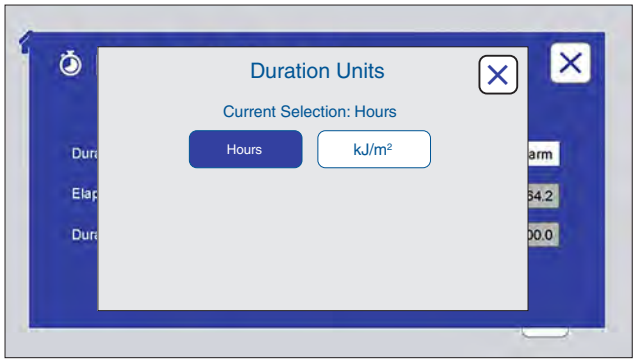


Figure 11.5e: Touch the Hours or kJ/m² text boxes to select the duration units.

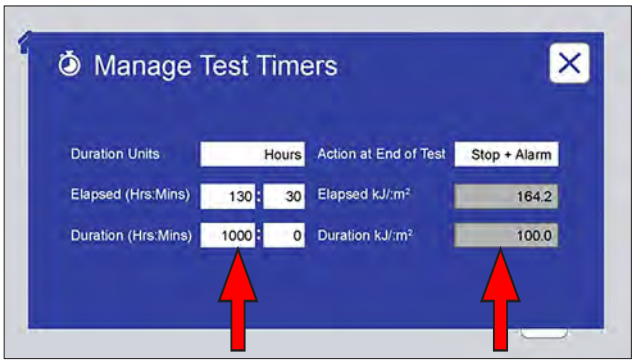


Figure 11.5f: The value text boxes for the selected duration unit are enabled. The text boxes for the unselected duration unit are disabled (grayed out).

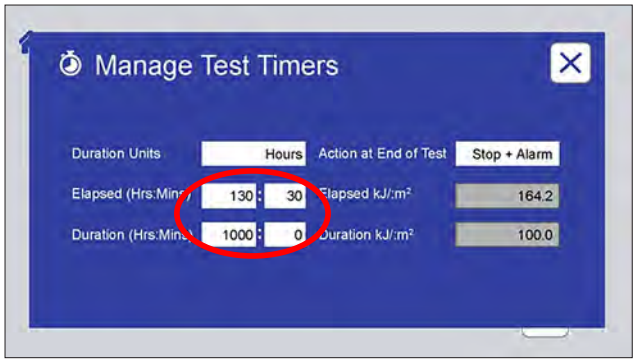


Figure 11.5g: Touch the enabled text box(s) to enter the new values.

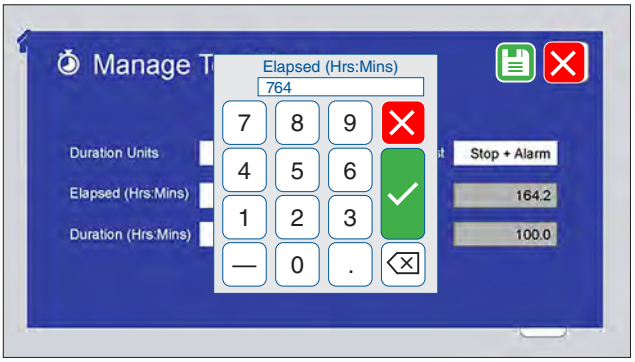


Figure 11.5h: Enter the new values using the numeric keypad. Touch the check mark to accept, or the X to cancel changes.

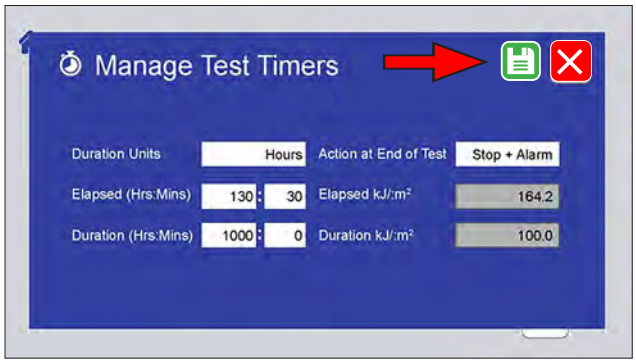


Figure 11.5i: If any changes have been made, touch the save changes icon or the cancel changes icon to re-display the Main Menu screen.

11.6 Manage Cycles (Oct 2020)

- On the Main Menu screen touch the Manage Cycles icon (Figure 11.6.1a) to display the Manage Cycles screen.
- The Manage Cycles screen is displayed showing the active test cycle and the steps in the cycle, with the currently executing step indicated (Figure 11.6.1b).
- Each cycle is stored with an alphanumeric (A through J) identification tab (Figure 11.6.1b).
  - Touch a tab to select a cycle.
    - The cycle name (ex. ASTM G155) along with step number, function, irradiance and temperature set points, and time are shown for each step in the cycle.
- Each lettered cycle tab provides controls to:
  - Delete a cycle (Figure 11.6.2a through Figure 11.6.2c).
    - An actively running cycle cannot be deleted.
    - Deleting an inactive cycle will create a blank cycle with only a final step.
  - Lock a cycle to prevent unauthorized changes (Figure 11.6.3a through Figure 11.6.3e).
  - Add, edit, or delete steps in a cycle (Figure 11.6.4a through Figure 11.6.6d).
  - Create a new cycle (Figure 11.6.7a through Figure 11.6.7e).
  - Run a cycle from any of its steps (Figure 11.6.8a through Figure 11.6.8d).
- Pre-programmed test cycles cannot be modified. They can, however, be deleted.
- The Q-SUN main controller can store ten (10) test cycles.
- A test cycle can consist of up to twenty-five (25) steps.

11.6.1 Select a Cycle

Figure 11.6.1a: Manage Cycles icon.

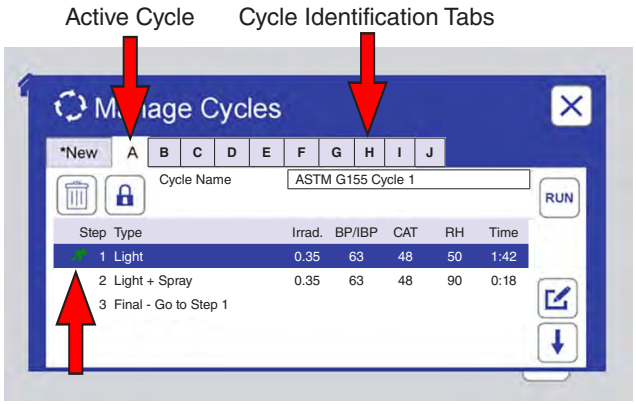


Figure 11.6.1b: Manage Cycles screen. The active cycle is displayed. The currently running step is indicated. From here you can run that cycle, or perform other actions as in the next sections.

11.6.2 Delete a Cycle

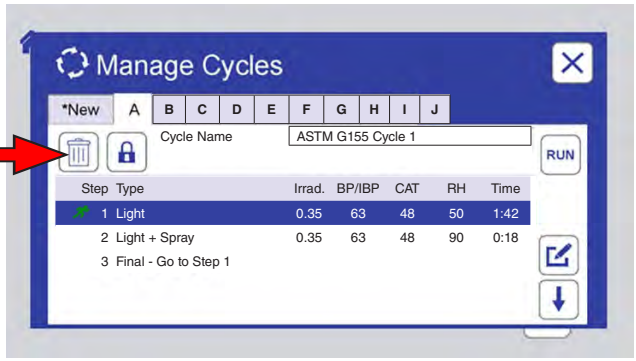


Figure 11.6.2a: Touch the delete icon to delete the selected cycle.

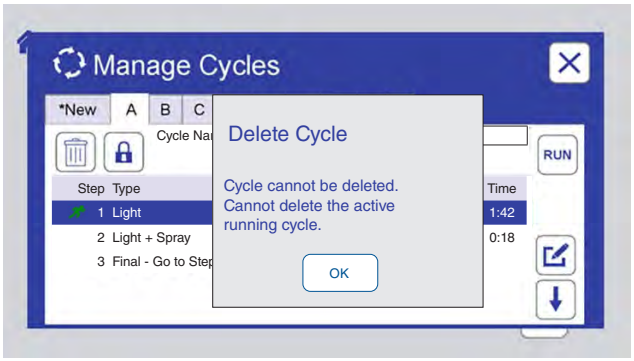


Figure 11.6.2b: The active running cycle cannot be deleted. Touch OK to clear message.

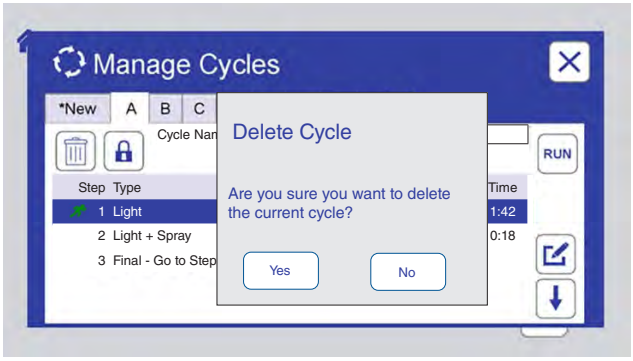


Figure 11.6.2c: To delete an inactive cycle, the operator is prompted for verification. Touch No to cancel delete. Touch Yes to create a blank cycle.

11.6.3 Lock a Cycle

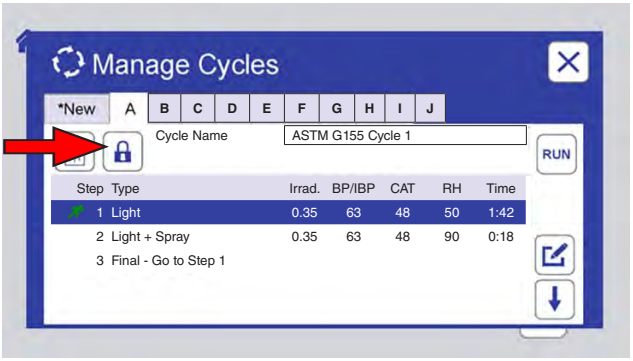


Figure 11.6.3a: Touch the lock icon to lock the cycle. **NOTE:** Pre-programmed test cycles are locked by Q-Lab.

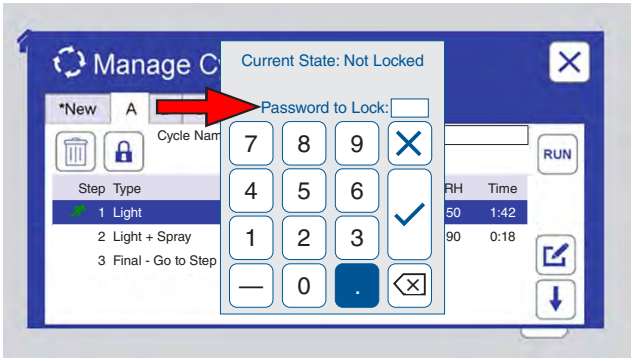


Figure 11.6.3b: The numeric keypad is displayed. A password must be entered to lock the cycle.

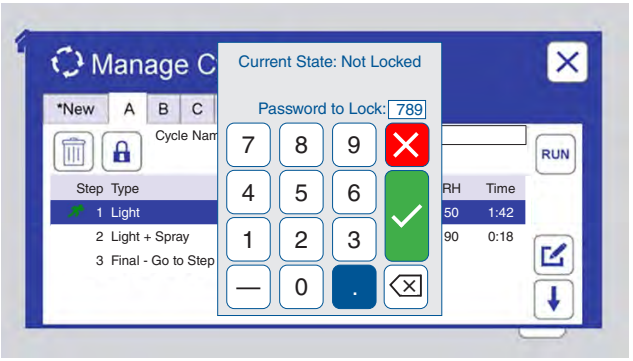


Figure 11.6.3c: Enter the numeric password. Touch the check mark button to save, or the X button to cancel setting the password.

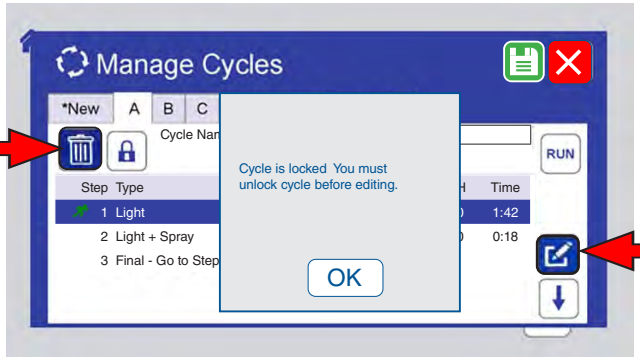


Figure 11.6.3d: This message is displayed if a delete or edit icon is touched on a locked cycle.

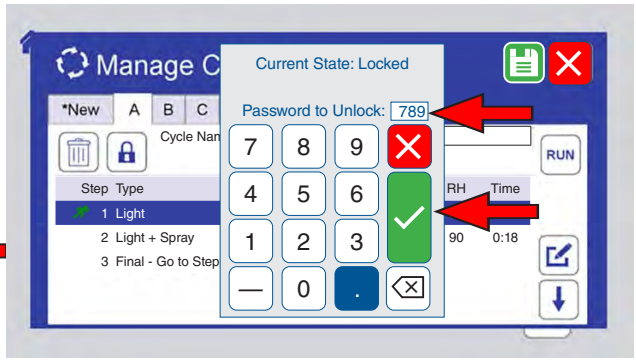


Figure 11.6.3e: To unlock a cycle, touch the lock icon, enter the password, then touch the check mark button.

11.6.4 Add a Step to a Cycle

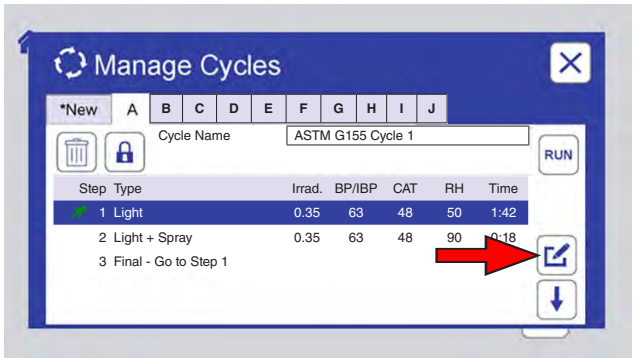


Figure 11.6.4a: For any cycle, a new step can be added before or after an existing step. Select the existing step then touch the Edit icon.

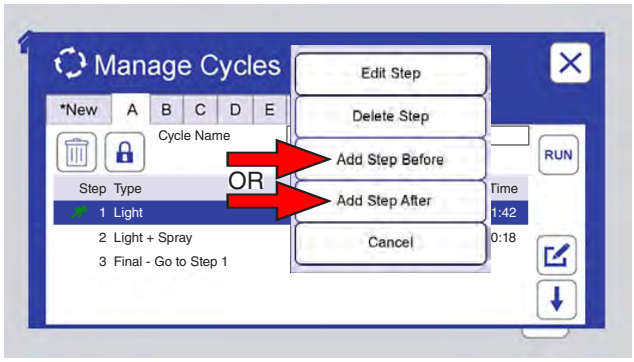


Figure 11.6.4b: The step revision control is displayed. Touch Add Step Before or Add Step After.

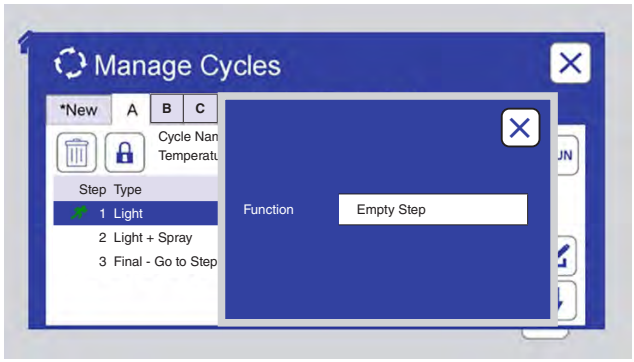


Figure 11.6.4c: Touch the function text box to select a function.

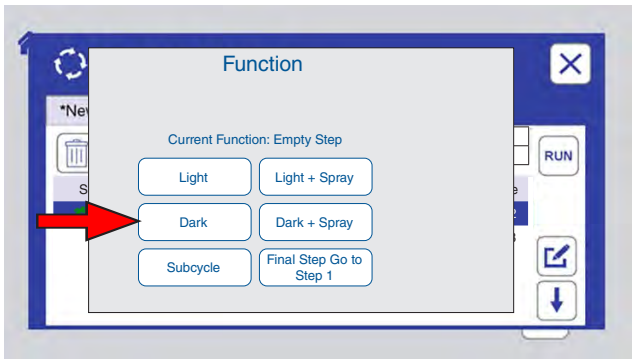


Figure 11.6.4d: Touch the desired function. Additional functions may be available depending on model (see Section 10).

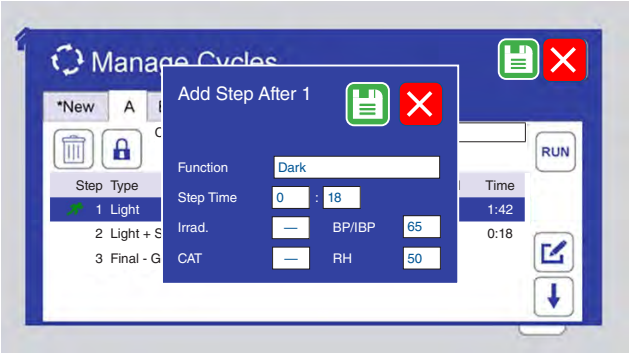


Figure 11.6.4e: Step values must be entered. Touch the Step Time (Hrs:Mins), Irrad(iance), and BP/IBP text boxes to select.

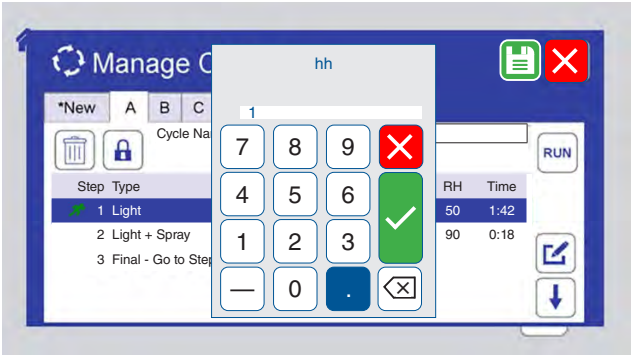


Figure 11.6.4f: Use the numeric keypad to enter the values for each parameter. Touch the check mark button to accept those values or the X button to cancel.

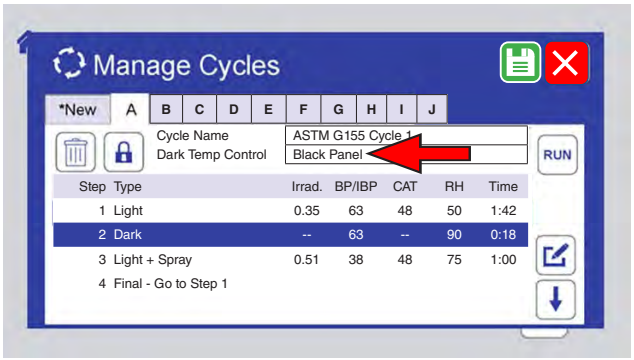


Figure 11.6.4g: Touch the Dark Temp Control box to select whether temperature in a dark step is controlled by BPT or CAT.

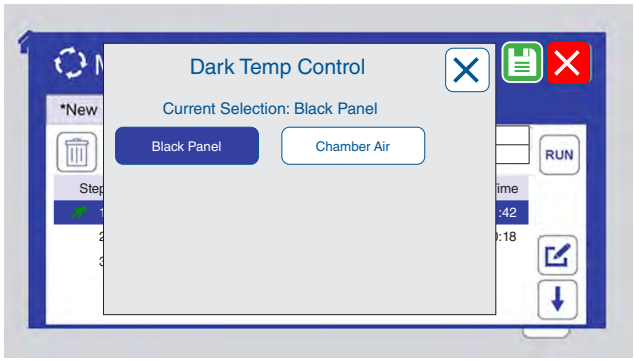


Figure 11.6.4h: Touch the Black Panel or the Chamber Air button to select that sensor for temperature control.

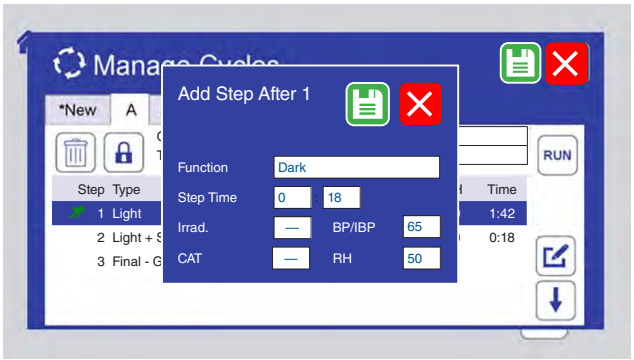


Figure 11.6.4i: The new step values are displayed. Touch the save icon to save the new step.

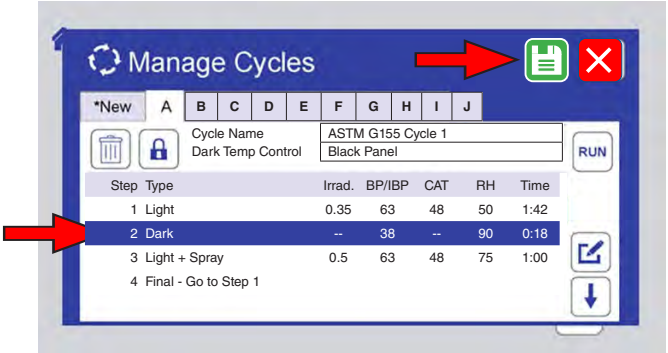


Figure 11.6.4j: The new step is shown for the cycle. Touch the save icon to save the modified cycle.

11.6.5 Edit a Step

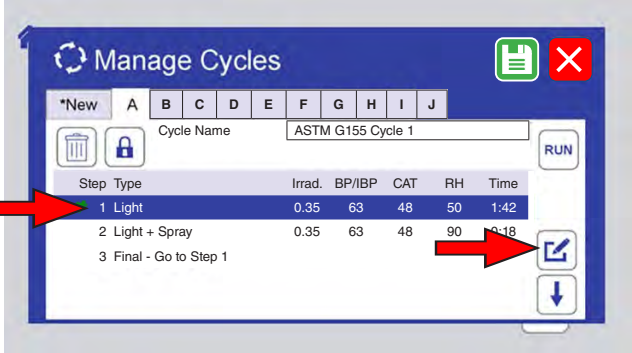


Figure 11.6.5a: To edit a step, touch the cycle ID tab, touch the step to select, then touch the pencil icon.

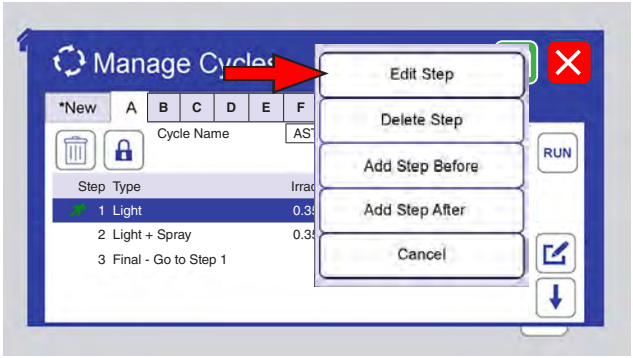


Figure 11.6.5b: Touch the Edit Step button.

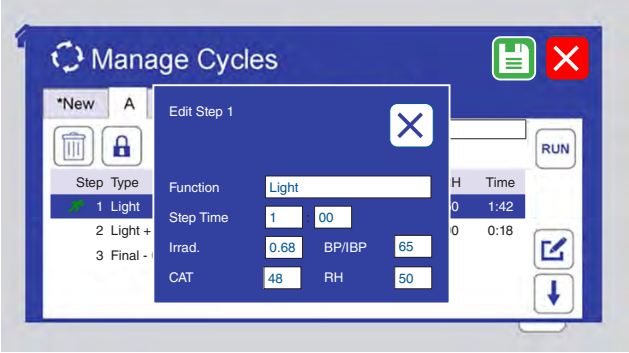


Figure 11.6.5c: Touch the Function, Step Time, Irradiance, BP/IBP, CAT, or RH text boxes to select.

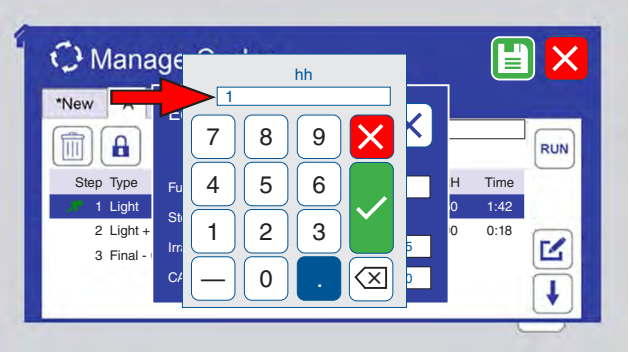


Figure 11.6.5d: Use the numeric keypad to enter the new values for the selected step. Touch the check mark button to accept those values or the X button to cancel.

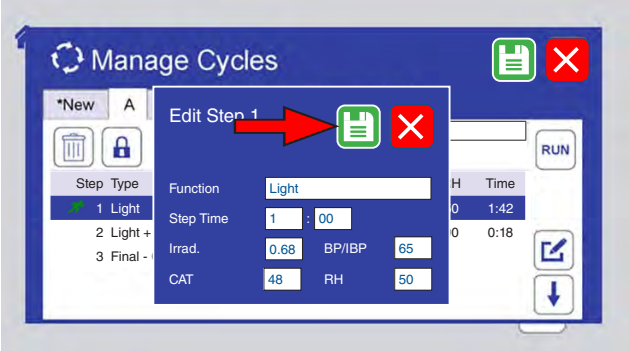


Figure 11.6.5e: Touch the save icon to save the edited step.

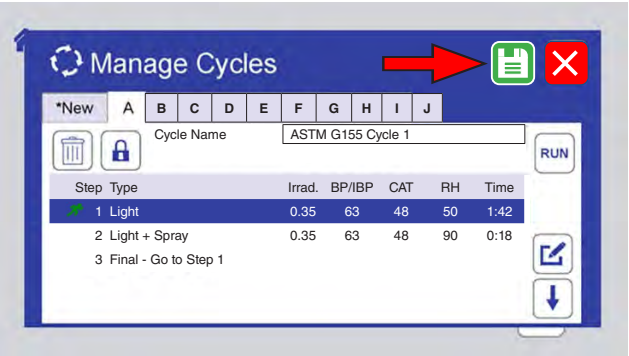


Figure 11.6.5f: The edited step is shown for the cycle. Touch the save icon to save the edited cycle.
NOTE: pre-programmed test cycles cannot be edited.

11.6.6 Delete a Step

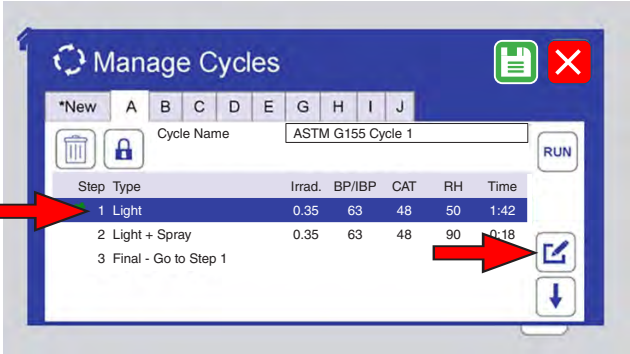


Figure 11.6.6a: To delete a step, touch the cycle ID tab, touch the step to delete, then touch the pencil icon.

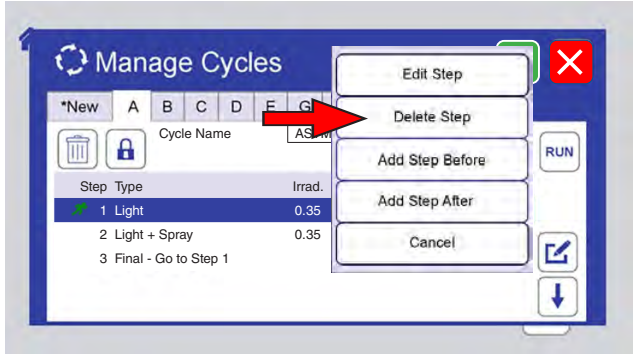


Figure 11.6.6b: Select Delete Step.

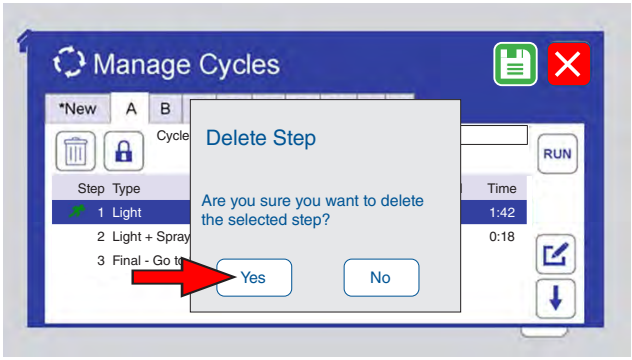


Figure 11.6.6c: Touch the Yes button to delete the step or touch No to cancel the delete.

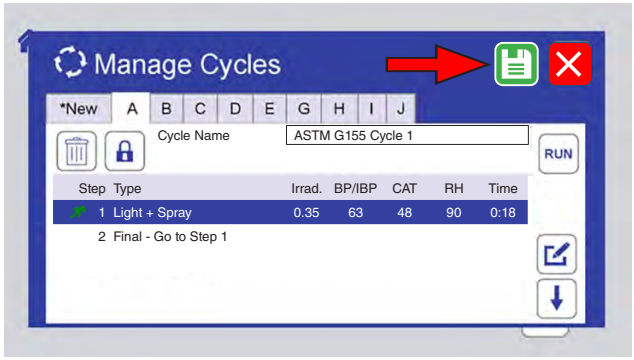


Figure 11.6.6d: Touch the save icon to save the edited cycle.

11.6.7 Create a New Cycle

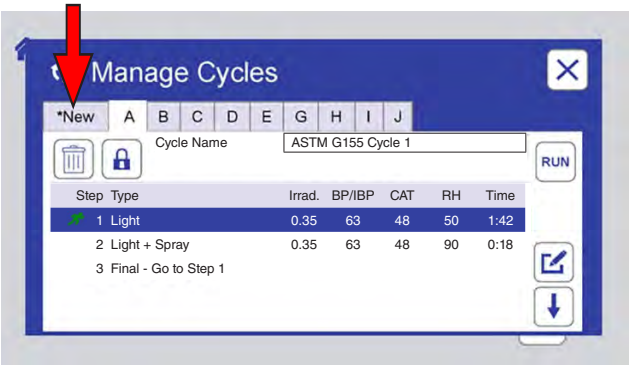


Figure 11.6.7a: To create a new cycle, touch the *New tab.

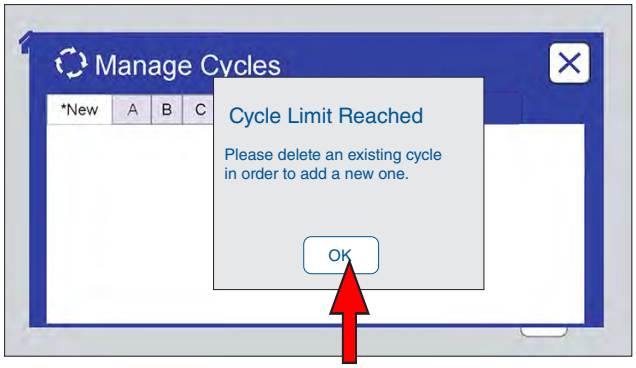


Figure 11.6.7b: If all available cycles are programmed, this message is displayed Touch OK.

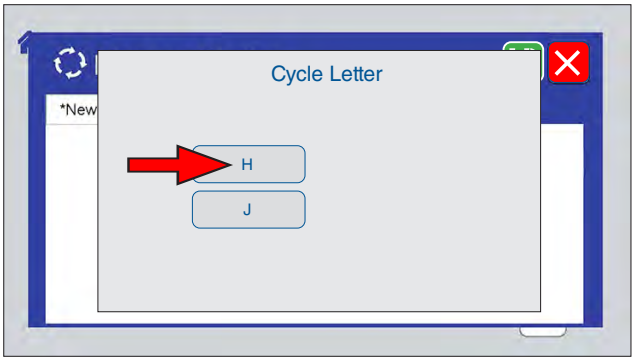


Figure 11.6.7c: If there are open cycles, the available cycle letters are displayed. Touch a letter to program that cycle.

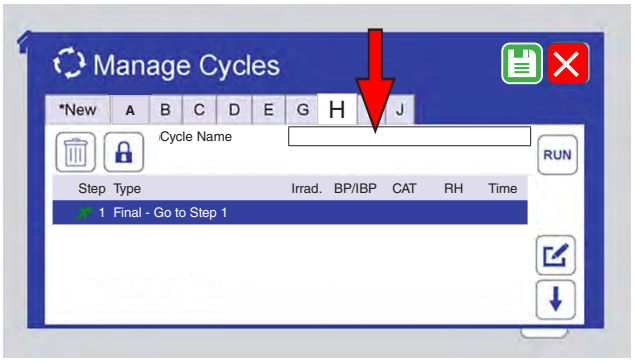


Figure 11.6.7d: An empty cycle is created with only a final step. Enter a name for the new cycle.

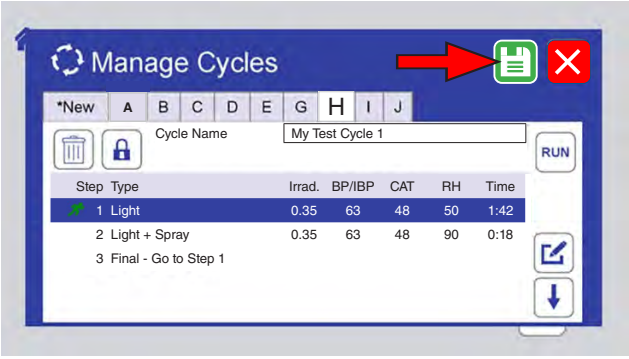


Figure 11.6.7e: Follow Figure 11.6.4a through Figure 11.6.4j to add steps and save the new cycle.

11.6.8 Run From Step

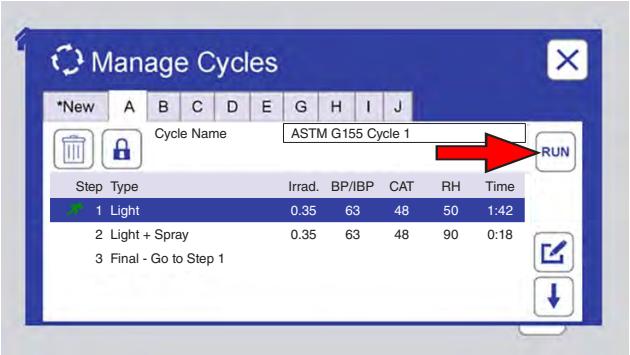


Figure 11.6.8a: A cycle can be run from a specified time in one of its steps. Select the step, then touch the Run icon.

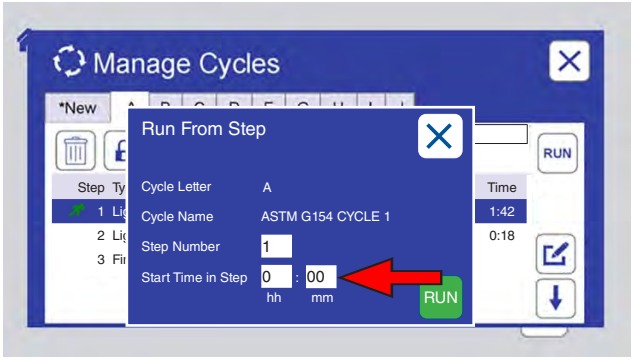


Figure 11.6.8b: Touch the start time hh (hours) text box or the mm (minutes) text box to set the time. Start time can be set to 0 to start at the beginning of the step

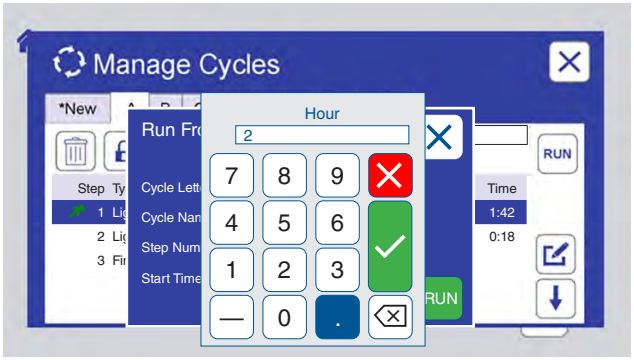


Figure 11.6.8c: Use the numeric kepad to set the time. Touch the check mark button to accept those values or the X button to cancel.

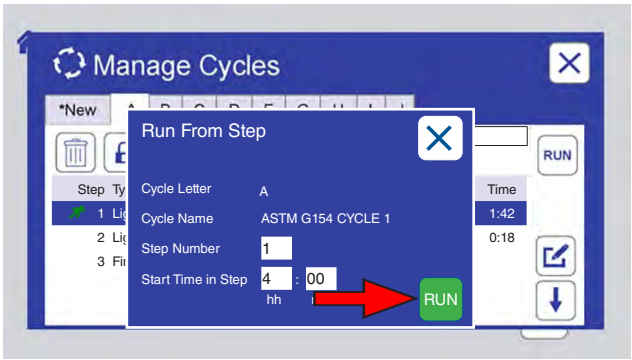


Figure 11.6.8d: Touch the Run icon to run the step from the time entered.

11.7 Settings (Nov 2020)

- On the Main Menu screen touch the Settings icon (Figure 11.7a) to display the Settings screen.
- The Settings screen displays user-selectable machine parameters (Figure 11.7b)
  - Volume (Figure 11.7c and Figure 11.7d).
    - Alarm
    - Touch
  - Display Options (Figure 11.7e through Figure 11.7h)
    - Status Screen Brightness
    - Main Menu Screen Brightness
    - Sleep Time
  - Language (Figure 11.7i through Figure 11.7l), available are:
    - English, French, Spanish, German, Italian, Chinese, Japanese, Korean
  - Date/Time (Figure 11.7m through Figure 11.7p).
  - Ethernet (Figure 11.7q through Figure 11.7t).
  - Machine Configuration (Figure 11.7u through Figure 11.7w). Contact Q-Lab Repair and Tester Support for more information on using this setting.
- The Q-SUN can be operated using just one screen.
  - In the event of the failure of either screen, the controller will automatically reconfigure to use just the functioning screen to maintain full operation of the tester. This will be indicated by error message M900 on the failed screen and the appropriate error message M901 or M902 on the remaining screen. (see Section 17.2).
  - A button appears in the upper right corner of the screen to toggle the remaining screen between Main Menu and Status displays (see Figure 11.7x through Figure 11.7aa).

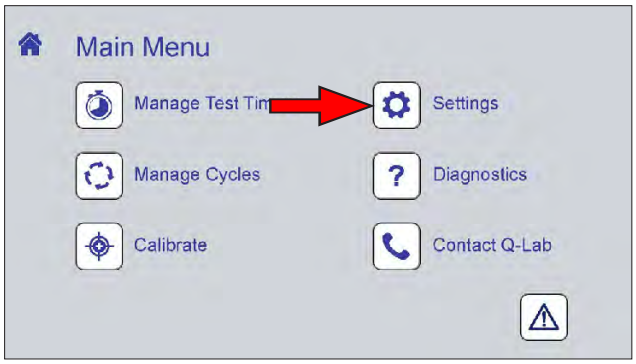


Figure 11.7a: Touch the Settings icon on the Main Menu screen to display settings controls.

Settings

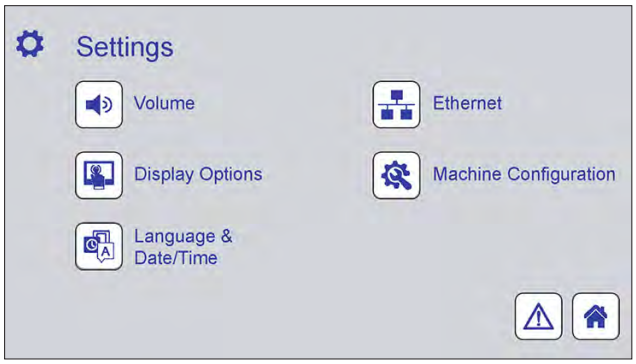


Figure 11.7b: Settings screen. Touch any icon to display controls for that function. The Notification Screen (Section 11.4) and the home screen can also be displayed.

Volume

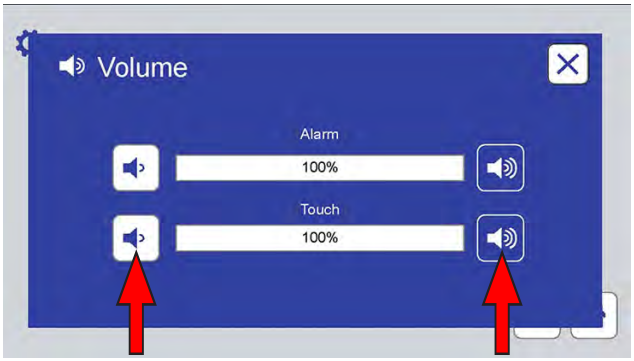


Figure 11.7c: The Volume screen provides controls to set volume (0 to 100) for machine alarms and for the screen touch indicator. Touch a volume icon to adjust.

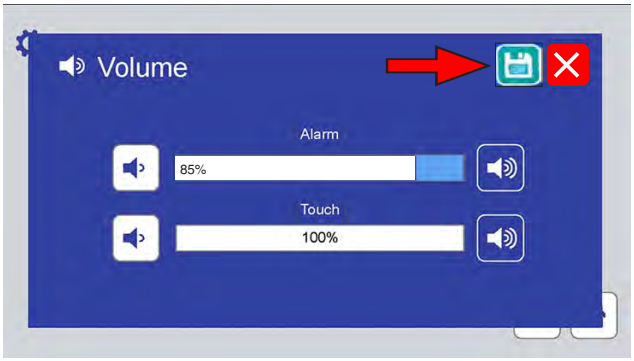


Figure 11.7d: If a volume is changed, touch the save icon to save the new volume level.

Display Options

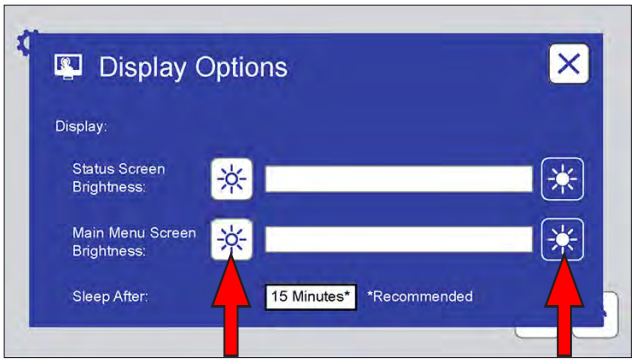


Figure 11.7e: The Display Options screen provides controls to adjust the brightness of the status and menu screens. Touch a brightness icon to adjust.

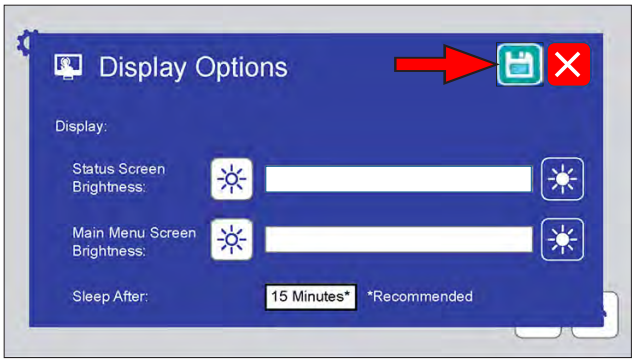


Figure 11.7f: If a brightness is changed, touch the save icon to save the new brightness level.

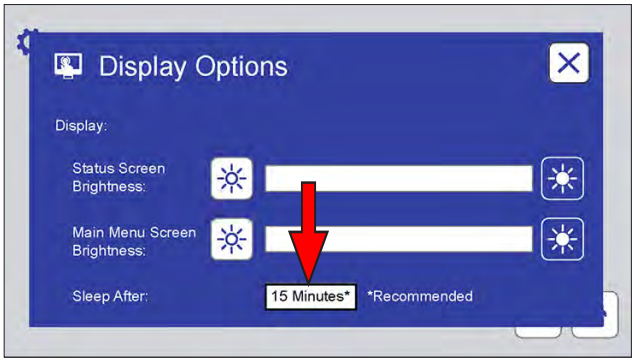


Figure 11.7g: The Display Options screen can also be used to adjust the inactive time that elapses before the screens “go to sleep” (i.e. deactivate). 15 minutes is recommended.

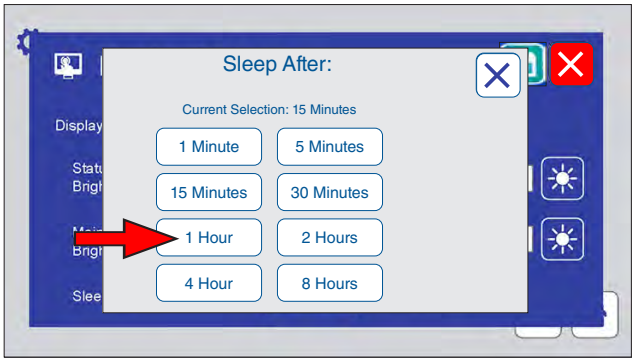


Figure 11.7h: Touch a time button to change the time before screens go to sleep. If changed, touch the save icon to save the new time.

Language

Figure 11.7i: This screen displays controls to select the control interface language.

Figure 11.7j: Touch the language text box to display the possible display languages.

Figure 11.7k: Touch the text box for the desired language.

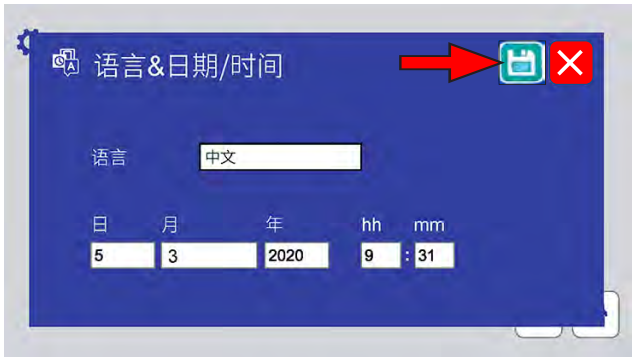


Figure 11.7l: All text on both screens will be in the selected language. Touch the save icon to save the selection.

Date/Time

Figure 11.7m: This screen displays controls to set the date and time. Touch a text box to set Day, Month, Year, hh (hour) or mm (minute). hh display is always 24 hour time.

Figure 11.7n: The numeric keypad is used to set Day, Year, hh, and mm. Enter the number, then touch the check mark button.

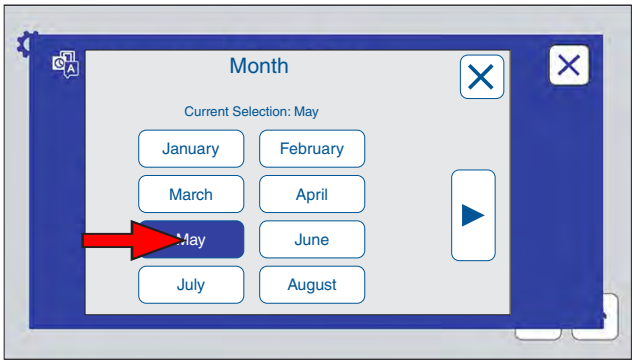


Figure 11.7o: Touch the month button to select the month on this display. Touch the right arrow button to display the remaining months.

Figure 11.7p: Touch the save icon to save any changes to the Language & Date/Time.

Ethernet

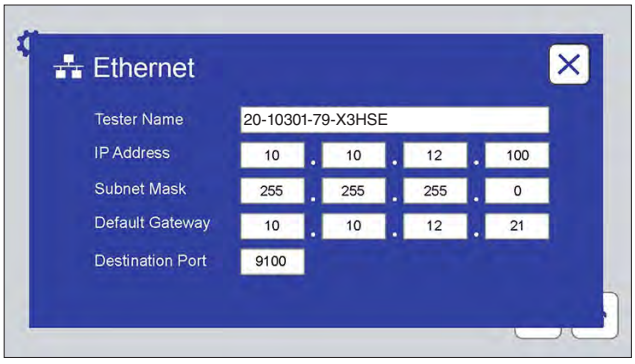


Figure 11.7q: This screen displays and provides text boxes to enter ethernet connection parameters.

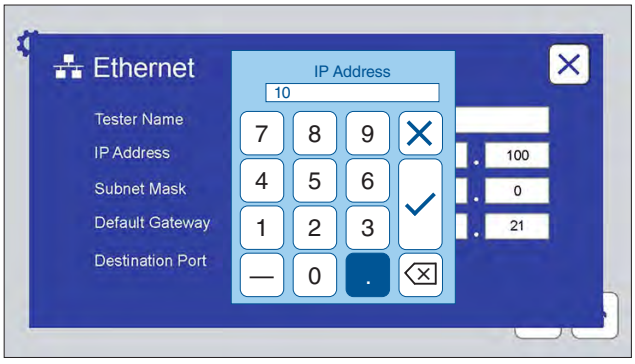


Figure 11.7r: Touch any text box to use the numeric keypad to input the parameter.

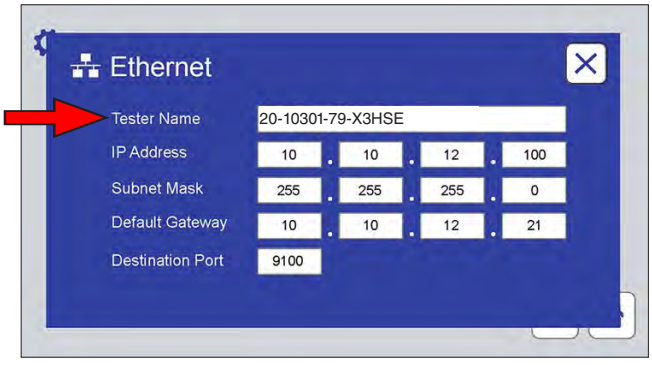


Figure 11.7s: Additionally, this screen has the name of the tester as it would appear on a network, if using the VIRTUAL STRIPCHART network version.

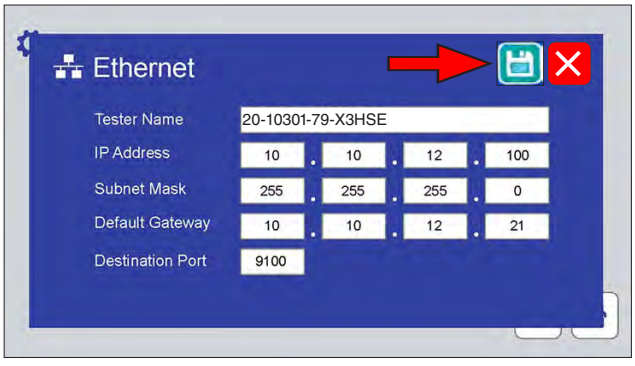


Figure 11.7t: Touch the save icon to save any changes to Ethernet parameters.

Machine Configuration

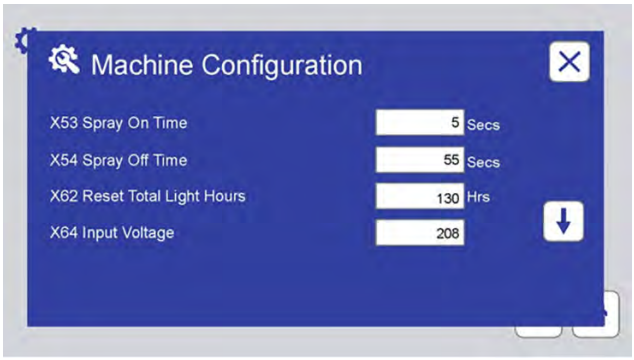


Figure 11.7u: Machine Configuration includes several customizable parameters. Contact Q-Lab Repair with questions about parameters. Touch the down arrow to display additional parameters.

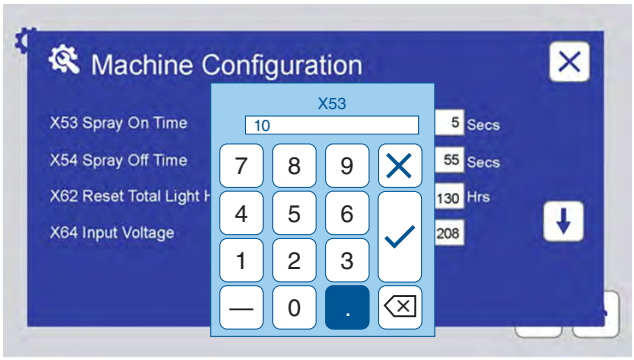


Figure 11.7v: Touch the parameter text box to use the numeric keypad to enter a value. Contact Q-Lab Repair and Tester Support (Section 20) for more information.

No.	Name	Unit	Range	Description
X53	Spray On Time	Secs		This sets the spray on time during Spray steps
X54	Spray Off Time	Secs		This sets the spray off time during Spray steps
X62	Reset Total Light Hours	Hrs	0-999,999	This allows the user to reset the total light hours timer. The timer only runs if the lamps are on.
X64	Input Voltage		208 or 230	This identifies the input voltage for the machine.
X104	Lamp Change Interval	Hrs	0-20,000	This is the length of time between “M14 Time to Replace Lamp” reminders.
X105	Routine Service Interval	Hrs	0-5,000	This is the time interval between “M15 Perform Routine Service” reminders.
X125	Reset Routine Service	Hrs	1-900	This sets the time until the next “M15 Perform Routine Service” reminder.
X167	Reset RH Sensor Time XXX Days	Days	Yes/No	This sets the RH sensor time (days) after replacing the RH sensor.
X185	Serial Number Year		##	Two-digit year of tester manufacture from serial number
X186	Serial Number Unique ID		#####	Five-digit unique tester ID from serial number
X187	Serial Number Series		###	Two- or three-digit tester series from serial number

Figure 11.7w: Complete list of accessible parameters.

Single Screen Mode

- In the event that one screen fails or loses communication with the main controller, the Q-SUN Xe-2 can be operated in Single Screen Mode.
- Single Screen Mode means that both Main Menu and Status Screen information can be shown on one physical display screen.
- If one of the display screens fails the Xe-2 main controller will enter Single Screen Mode as shown in Figure 11.7x.
- Figure 11.7y through Figure 11.7aa illustrate how to toggle between Main Menu and the Status Screen displays.
- The full range of tester status and cycle operation functionality is available in Single Screen Mode.
- Replacement display screen kits (TEB-105016-K) are available.
- Contact Q-Lab Repair and Tester Support for more information.

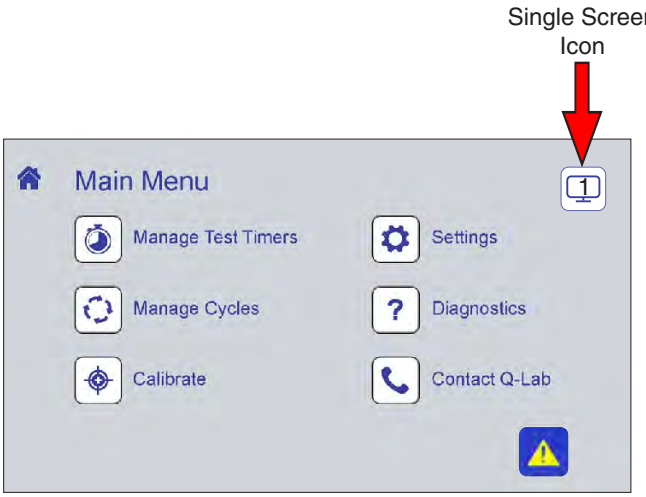


Figure 11.7x: Main Menu in Single Screen Mode showing the single screen icon. Touch the single screen icon.

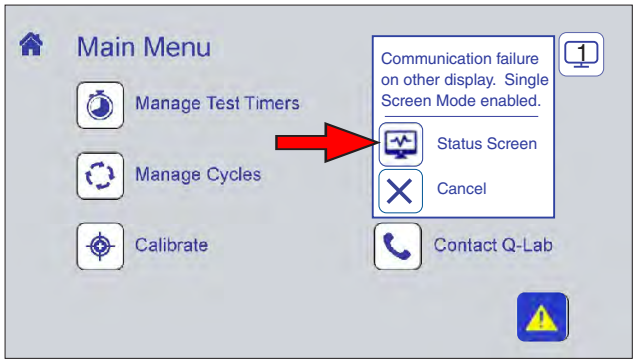


Figure 11.7y: Touch the Status Screen icon to display the Status Screen.

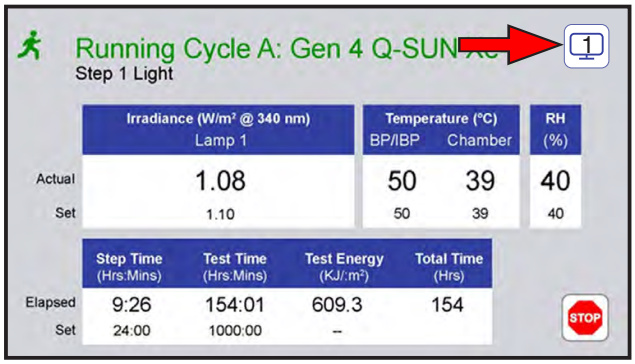


Figure 11.7z: Status Screen in Single Screen Mode. Touch the single screen icon.

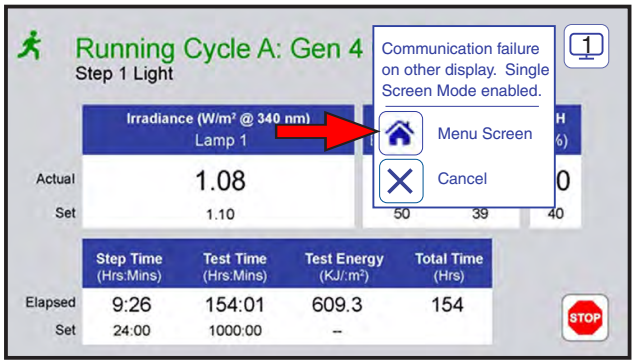


Figure 11.7aa: Touch the Main Menu icon to display the Menu Screen.

11.8 Diagnostics (Nov 2020)

- Diagnostics are a list of tester current operating conditions.
- Diagnostics are an important tool to assist in troubleshooting tester conditions.
- On the Main Menu screen, touch the Diagnostics icon (Figure 11.8a) to display the Diagnostics screen (Figure 11.8b).
- Press the UP or DOWN arrows to scroll through the diagnostics.
- There are no editable values on these screens.
- Checking the diagnostic information will not interrupt the test cycle in any way.
- See Figure 11.8c for a complete list of Diagnostics.

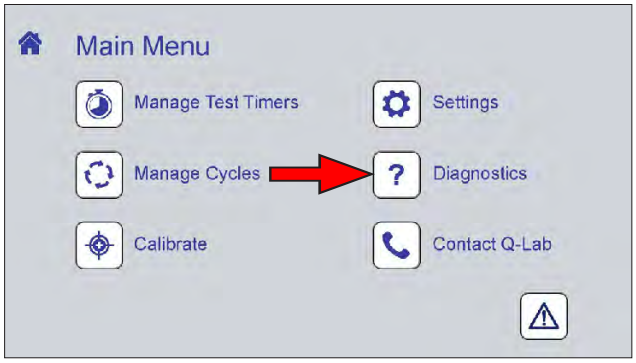


Figure 11.8a: Touch the Diagnostics icon on the Main Menu screen to display diagnostic information.

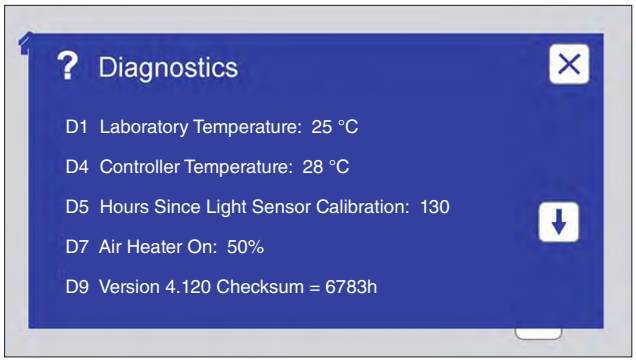


Figure 11.8b: The Diagnostics screen displays current machine operating conditions.

No.	Diagnostic Name	Diagnostic Description
D1	Laboratory Temperature= XXX°C	This shows the current lab temperature.
D4	Controller Temperature= XXX°C	This shows the current temperature of the controller.
D5	Hours Since Light Sensor Cal XXXX	This shows the current value of the lamp change timer. When this timer exceeds the light sensor calibration interval, an M31 *Calibrate Light Sensors* alarm occurs. The M31 notification is reset when the light sensor is recalibrated.
D7	Air Heater On= XXX%	This shows the air heater output. As the chamber temperature nears the temperature set point, the air heater output is reduced.
D9	Version 4.XXX CHECKSUM= XXXXh	This shows the software version and checksum. The checksum can be used by the software programmer to determine if there is a compiling error.
D10	Lamp Output: XXX%	This shows the lamp output for the lamp in light steps.
D12	Auxiliary Panel Temperature= XXX°C	This shows the current temperature of a white panel temperature sensor, when in use.
D14	Total Lamp Hours Elapsed= XXXXXX	This shows the total time that the lamps have been on.
D15	Humidifier On = XXX%	This shows the output power to the humidifier.
D17	Recirculating Air Blower On = XXX%	This shows the relative output power to the recirculating air blower.
D18	Fresh Air Blower On = XXX%	This shows the relative output power to the fresh air blower.
D19	Lamp Hours: 1=XXXX	This shows the current value of each lamp change timer. When the lamp timer reaches a set value (3000 hours by default), the M14 *Time to Replace Lamp* will be triggered.
D20	Hours Since Routine Service XXXXX	This shows the number of hours since the M15 *Perform Routine Service* alarm was last cleared.
D24	Serial Number	Displays the tester's serial number as input either at Q-Lab or during a TEB replacement or Reset operation.
D25	MAC Address	Displays the media access control (MAC) address for the tester.
D26	Total Energy Elapsed	Displays the light energy delivered by the tester over its lifetime.
D27	Cal Factor	Displays the calibration factor being applied for the current optical filter selection.

Figure 11.8c: Complete list of diagnostic numbers, names, and descriptions.

11.9 Contact Q-Lab (Oct 2020)

- Touch the Contact Q-Lab icon on the Menu Screen (Figure 11.9a).
- The Contact Q-Lab screen (Figure 11.9b) displays the link to Q-Lab Repair and Tester Support on q-lab.com.

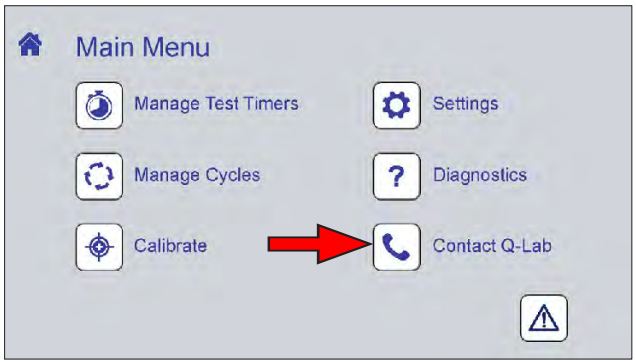


Figure 11.9a: Touch the Contact icon on the Main Menu screen to display Q-Lab contact information.

Contact Q-Lab

Figure 11.9b: Scan the code on this screen for Q-Lab contact information.

12. Running a Test

- Common test cycles that can be pre-programmed into the Q-SUN are shown in Section 12.1.
- Guidelines for selecting test parameters and choosing settings for custom cycles are given in Section 12.2.

12.1 Common Test Cycles (Nov 2020)

- Listed below are some of the common test methods that can be run in the Q-SUN Xe-2 tester.
- Visit Q-Portal Standards Search for an extensive listing of test methods that can be run in Q-SUN testers.

AATCC Test Method 16 Option 3 (2004) - Colorfastness to Light

Models: Xe-2-HE, Xe-2-HSE, Xe-2-HBSE

Optical Filters: Window-B/SL UV Sensor: 420 nm Black Panel: Uninsulated

Water Consumption: less than 24 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	30	1.10	63	43	24:00
2	FINAL STEP – GO TO STEP 1					

ASTM D7869 (2013) - Standard Practice for Xenon Arc Exposure Test with Enhanced Light and Water Exposure for Transportation Coatings

Models: Xe-2-HSE, Xe-2-HBSE

Optical Filters: Daylight-F UV Sensor: 340 nm Black Panel: Uninsulated

Water Consumption: 263 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Dark + Spray Front	95			40	4:00
2	Light	50	0.40	50	42	0:30
3	Light	50	0.80	70	50	4:30
4	Light	50	0.40	50	42	0:30
5	Dark + Spray Front	95			40	2:30
6	Subcycle Repeat Steps 7-10 4×					
7	Dark + Spray Front	95			40	0:30
8	Light	50	0.40	50	42	0:20
9	Light	50	0.80	70	50	2:00
10	Dark	50			40	0:10
11	FINAL STEP – GO TO STEP 1					

ASTM G155 (2013) - Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

Models: Xe-2-HSE, Xe-2-HBSE

Optical Filters: Daylight-Q, Daylight-B/B UV Sensor: 340 nm Black Panel: Uninsulated

Water Consumption: 116 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light		0.35	63	43*	1:42
2	Light + Spray Front		0.35	63*	43*	0:18
3	FINAL STEP – GO TO STEP 1					

* Indicates no value specified in the test method but a value is programmed into the tester

ISO 105-B02 Cycle A1 (2013) - Textiles -- Tests for colour fastness -- Part B02: Colour fastness to artificial light: Xenon arc fading lamp test

Models: Xe-2-HE, Xe-2-HSE, Xe-2-HBSE

Optical Filters: Window-IR UV Sensor: TUV Black Panel: Insulated

Water Consumption: less than 24 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	40	42	47	39*	24:00
2	FINAL STEP – GO TO STEP 1					

* Indicates no value specified in the test method but a value is programmed into the tester

ISO 105-B04 Condition 1 (1994) - Textiles -- Tests for colour fastness -- Part B04: Colour fastness to artificial weathering: Xenon arc fading lamp test

Models: Xe-2-HSE, Xe-2-HBSE

Optical Filters: Window-B04 UV Sensor: TUV Black Panel: Insulated

Water Consumption: 32 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light + Spray Front		42	50	38*	0:01
2	Light		42	50*	38*	0:29
3	FINAL STEP – GO TO STEP 1					

* Indicates no value specified in the test method but a value is programmed into the tester

ISO 4892-2 Cycle 1 (2013) - Plastics -- Methods of exposure to laboratory light sources -- Part 2: Xenon-arc lamps

Models: Xe-2-HSE, Xe-2-HBSE

Optical Filters: Daylight-Q, Daylight-B/B UV Sensor: 340 nm Black Panel: Insulated

Water Consumption: 116 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	50	0.51	65	38	1:42
2	Light + Spray Front		0.51	60*		0.18
3	FINAL STEP – GO TO STEP 1					

* Indicates no value specified in the test method but a value is programmed into the tester

ISO 4892-2 Cycle 3 (2013) - Plastics -- Methods of exposure to laboratory light sources -- Part 2: Xenon-arc lamps

Models: Xe-2-HE, Xe-2-HSE, Xe-2-HBSE

Optical Filters: Window-B/SL, Window-Q UV Sensor: 420 nm Black Panel: Insulated

Water Consumption: less than 24 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	20	1.10	100	65	24:00
2	Final Step - Go To Step 1					

ISO 4892-2 Cycle 5 (2013) - Plastics -- Methods of exposure to laboratory light sources -- Part 2: Xenon-arc lamps

Models: Xe-2-HE, Xe-2-HSE, Xe-2-HBSE

Optical Filters: Window-Q, Window-B/SL UV Sensor: 420 nm Black Panel: Uninsulated

Water Consumption: less than 24 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	50	1.10	63	38	24:00
2	FINAL STEP – GO TO STEP 1					

ISO 4892-2 Cycle 7 - Plastics – Methods of exposure to laboratory light sources -- Part 2: Xenon-arc lamps

Models: Xe-2-HE, Xe-2-HSE, Xe-2-HBSE

Optical Filters: Window-Q, Window-B/SL UV Sensor: 420 nm Black Panel: Insulated

Water Consumption: less than 24 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	50	1.10	65	38	24:00
2	FINAL STEP – GO TO STEP 1					

ISO 11341 Cycle A Method 1 (2004) - Paints and varnishes -- Artificial weathering and exposure to artificial radiation -- Exposure to filtered xenon-arc radiation

Models: Xe-2-HSE, Xe-2-HBSE

Optical Filters: Daylight-Q, Daylight-B/B UV Sensor: 340 nm Black Panel: Insulated

Water Consumption: 116 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	50	0.51	65	38	1:42
2	Light + Spray Front		0.51	65*	38*	0.18
3	FINAL STEP – GO TO STEP 1					

* Indicates no value specified in the test method but a value is programmed into the tester

ISO 11341 Cycle C Method 1 (2004) - Paints and varnishes -- Artificial weathering and exposure to artificial radiation -- Exposure to filtered xenon-arc radiation

Models: Xe-2-HE, Xe-2-HSE, Xe-2-HBSE

Optical Filters: Daylight-Q, Daylight-B/B UV Sensor: 340 nm Black Panel: Insulated

Water Consumption: less than 24 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	50	0.51	65	38	24:00
2	FINAL STEP – GO TO STEP 1					

ISO 11341 Cycle C Method 2 (2004) - Paints and varnishes -- Artificial weathering and exposure to artificial radiation -- Exposure to filtered xenon-arc radiation

Models: Xe-2-HE, Xe-2-HSE, Xe-2-HBSE

Optical Filters: Window-Q, Window-B/SL UV Sensor: 420 nm Black Panel: Insulated

Water Consumption: less than 24 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	50	1.10	65	38	24:00
2	FINAL STEP – GO TO STEP 1					

SAE J2412 (2015) - Accelerated Exposure of Automotive Interior Trim Components Using a Controlled Irradiance Xenon-Arc Apparatus

Models: Xe-2-HE, Xe-2-HSE, Xe-2-HBSE

Optical Filters: Extended UV-Q/B UV Sensor: 340 nm Black Panel: Uninsulated

Water Consumption: less than 24 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	50	0.55	89	62	3:48
2	Dark				38	1:00
3	Final Step - Go to Step 1					

SAE J2527 (2017) - Performance Based Standard for Accelerated Exposure of Automotive Exterior Materials Using a Controlled Irradiance Xenon-Arc Apparatus

Models: Xe-2-HBSE

Optical Filters: Extended UV-Q/B, Daylight-Q, Daylight-B/B UV Sensor: 340 nm Black Panel: Uninsulated

Water Consumption: 304 L/day

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Dark + Spray Front + Back	95			38	1:00
2	Light	50	0.55	70	47	0:40
3	Light + Spray Front	50	0.55	70	47	0:20
4	Light	50	0.55	70	47	1:00
5	FINAL STEP – GO TO STEP 1					

12.2 Selecting Test Parameters (Nov 2020)

Optical Filters

- Q-SUN optical filters are very durable and all filters maintain the required spectrum indefinitely, lasting for years under normal use with proper maintenance (except Window-IR, see Section 16.3).
- The application or test standard dictates which filter to use.
- See the table below for the allowable irradiance set points and the charts on the following pages for allowable black panel, chamber air temperature and relative humidity.

	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)
Daylight-F	0.80 (0.95)	1.50 (1.75)	75 (85)
Daylight-Q	0.68 (0.80)		
Extended UV (-Q/B)			
Daylight-B/B	0.51 (0.61)[D]		55 (65)
Window (-Q, -B/SL)	0.55 (0.65)		70 (80)
Window (-SF5, -IR, -B04)	—		42 (62)

Notes:

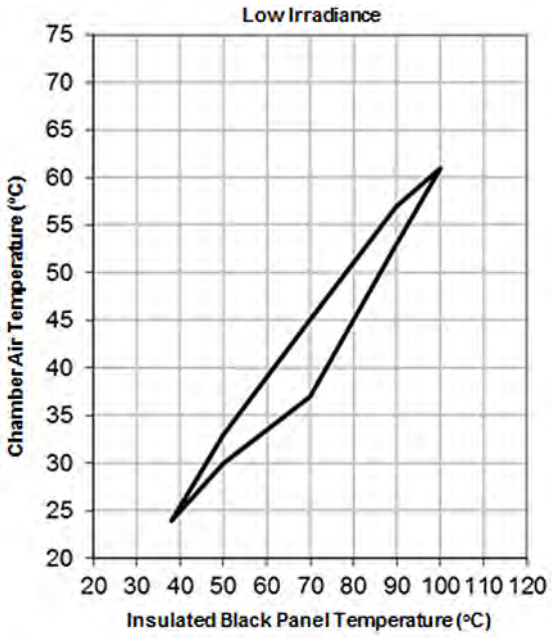
A: Minimum irradiance 0.25 @340 nm, 0.45 @420 nm, and 20 @TUV.

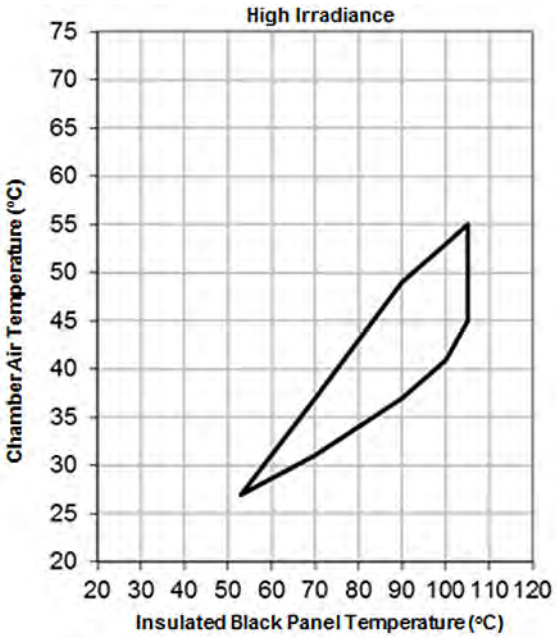
B: Typical irradiance that can be obtained by using the X-1800+ or X-1850+ lamp with a lamp life of 3000 hours.

C: Maximum irradiance that can be obtained by using the X-1800+ or X-1850+ lamp with a lamp life of 1000 hours.

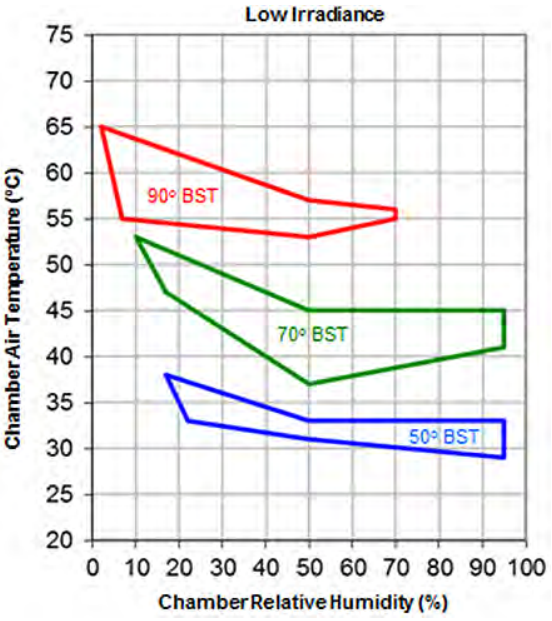
D: In addition to the standard 1,000 and 3,000 hour warranties for Maximum and Typical irradiance values shown, Q-Lab will also guarantee 2000 hours at 0.55 W/m²/nm.

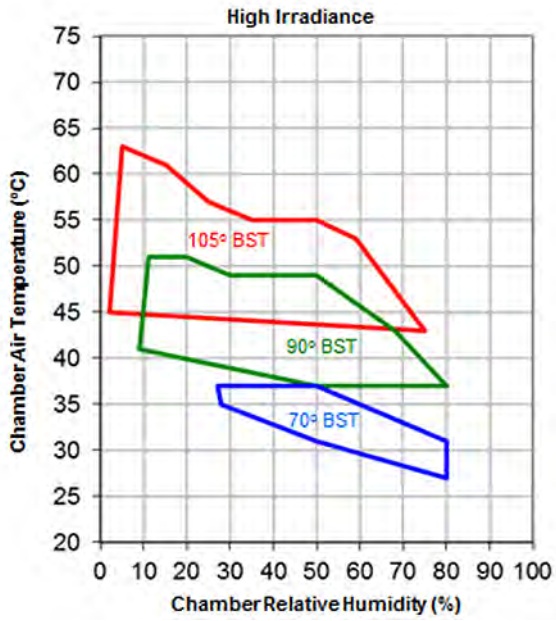
Insulated Black Panel (Black Standard) Temperature vs. Chamber Air Temperature (at 50% RH)





Chamber Relative Humidity vs. Chamber Air Temperature for Several Insulated Black Panel (Black Standard) Temperatures





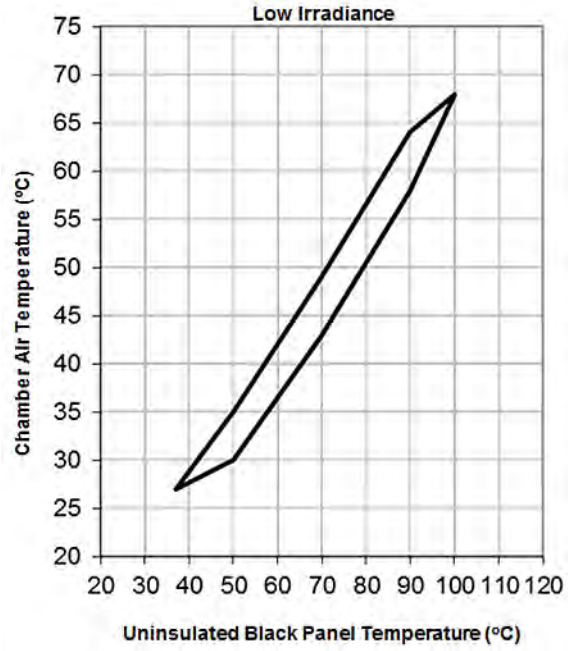
IRRADIANCE / UV FILTER
0.35 W/m² at 340 nm / Daylight-Q
or 0.74 W/m² at 420 nm / Window-Q

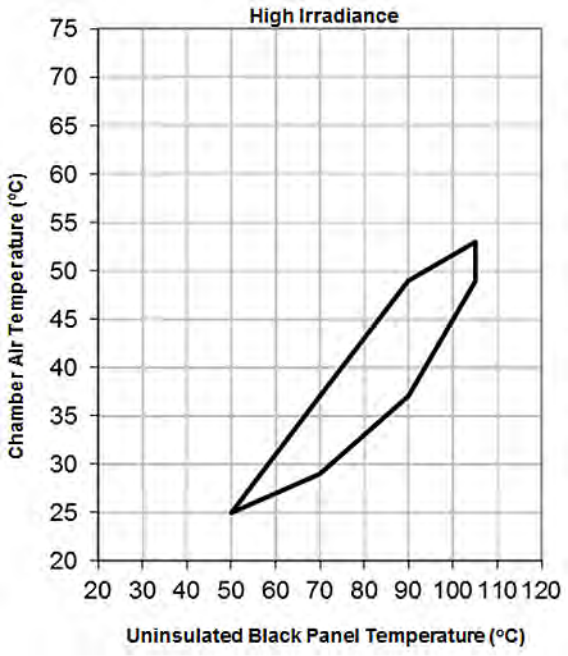
IRRADIANCE / UV FILTER
0.68 W/m² at 340 nm / Daylight-Q
or 1.44 W/m² at 420 nm / Window-Q

TEST CONDITIONS: Room Temperature 23 °C, Room RH 40%

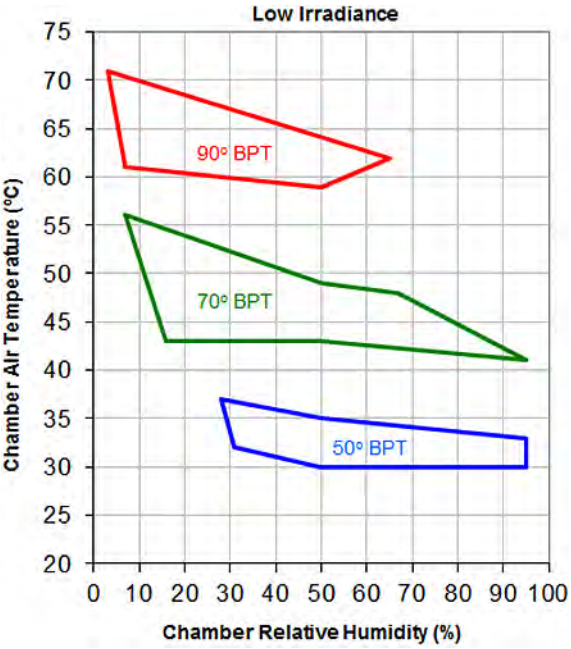
CAUTION: This data was obtained from one machine under the conditions listed. The boundaries shown in this graph should be considered typical but we do not guarantee all machines will operate at these limits.

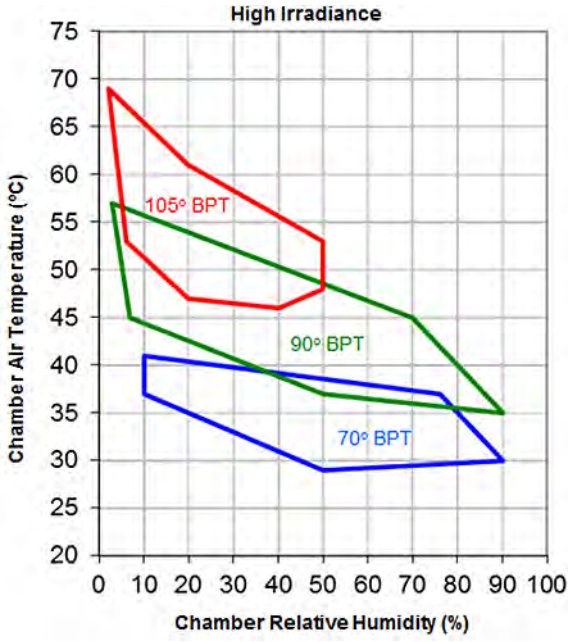
Uninsulated Black Panel Temperature vs. Chamber Air Temperature (at 50% RH)





Chamber Relative Humidity vs. Chamber Air Temperature for Several Uninsulated Black Panel Temperatures





IRRADIANCE / UV FILTER
0.35 W/m² at 340 nm / Daylight-Q
or 0.74 W/m² at 420 nm / Window-Q

IRRADIANCE / UV FILTER
0.68 W/m² at 340 nm / Daylight-Q
or 1.44 W/m² at 420 nm / Window-Q

TEST CONDITIONS: Room Temperature 23 °C, Room RH 40%

CAUTION: This data was obtained from one machine under the conditions listed. The boundaries shown in this graph should be considered typical but we do not guarantee all machines will operate at these limits.

12.3 Mounting Test Specimens (Feb 2020)

- The Q-SUN Xe-2 has fifteen (15) full-size specimen holders (Figure 12.3a).
- One additional holder is half size because the black panel is mounted below it.
- The turntable can be rotated by hand in either direction or by pressing the rotate button on the Status Screen.
- Slide the holders down into the specimen holder keepers to mount on the turntable.
- Slide the holders up out of the holder to remove (Figure 12.3b)
- All sixteen (16) specimen holders must be mounted during a test for optimal air flow through the test chamber.
- Both open back and solid back specimen holders are available.

NOTE: Always use open back specimen holders unless specimens require additional rigidity (e.g., textiles, etc.).

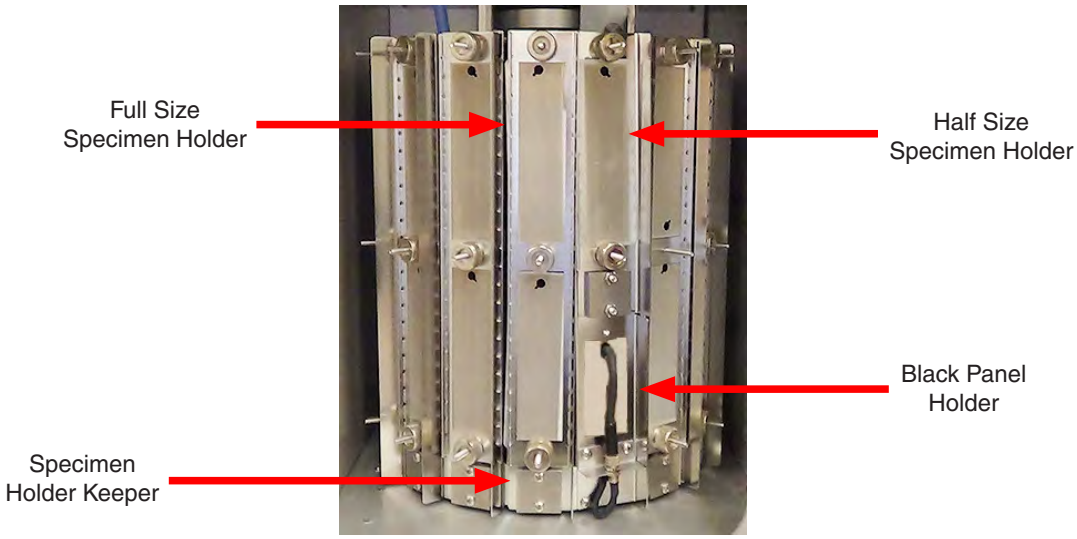


Figure 12.3a: Specimen holders mounted on the turntable.

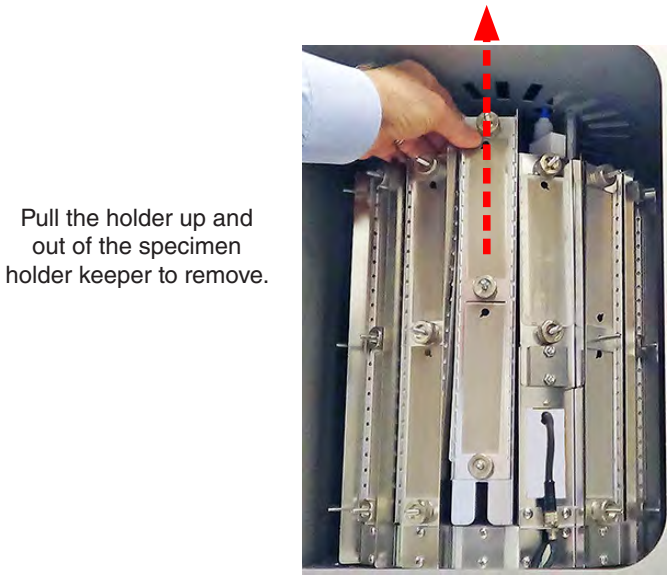


Figure 12.3b: Removing a specimen holder.

Open Back Specimen Holders

- Open back specimen holders are available with two windows (Figure 12.3c) and three windows (Figure 12.3e).
- Specimens up to 18 mm thick are mounted from the rear in open back holders.
- The open rear plate allows specimen labels to be visible when the specimens are mounted on the Xe-2 turntable.
- The open front plate maintains the surfaces of thick specimens the correct distance from the lamp.

NOTE: The aluminum panels included with open back holders should only be used when no specimens are mounted in the holder.

Two Window

- The XR-11448-K kit includes 15 full-size two-window open back holders and 1 half size holder.
- Full size holds two 45 mm × 132 mm specimens. Half size holds one 45 mm × 132 mm specimen.

Three Window

- The XR-11824-K kit includes 15 full-size three-window open back holders and 1 half size holder.
- Full size holds three 45 mm × 89 mm specimens. Half size holds one 45 mm × 132 mm specimen.

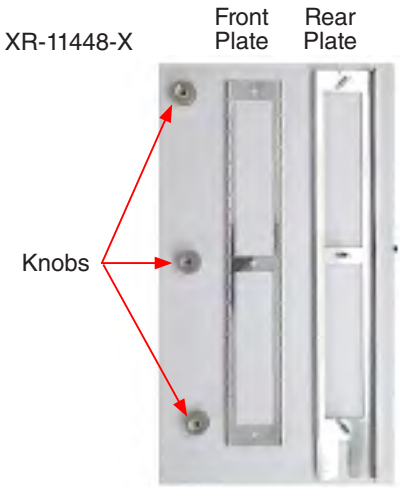


Figure 12.3c: Two window holder components.

Figure 12.3d: Two window holder assembled.

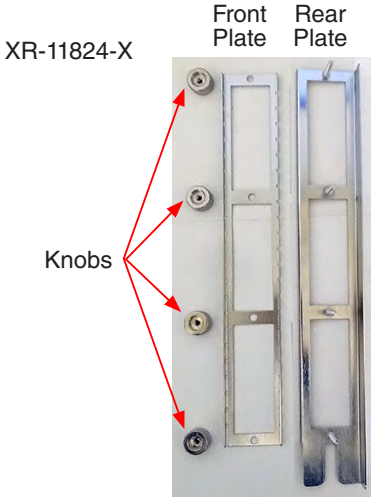


Figure 12.3e: Three window holder components.

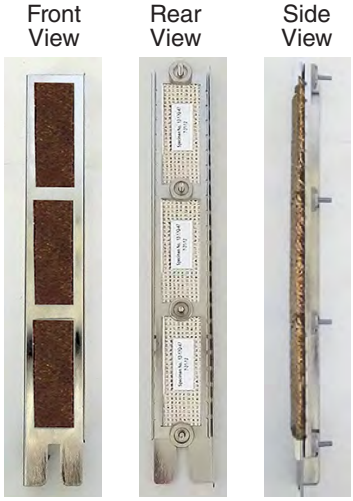


Figure 12.3f: Three window holder assembled.

Solid Back Specimen Holders

- Specimens up to 12 mm thick are mounted on the side facing the lamp using thumb nuts (Figure 12.3g through Figure 12.3i).

Figure 12.3g: Solid back specimen holder.

- Textile specimens are stapled to 275 mm × 45 mm card stock or 132 mm × 45 mm for the mini holder.

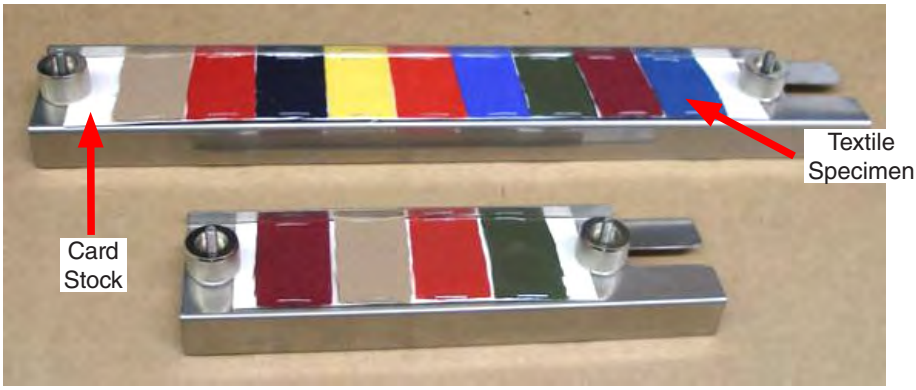


Figure 12.3h: Textile specimens stapled to card stock.

- Kit XR-11291-K is available to divide the full size specimen holders in half so that two 132 mm × 45 mm specimens can be attached to each holder.

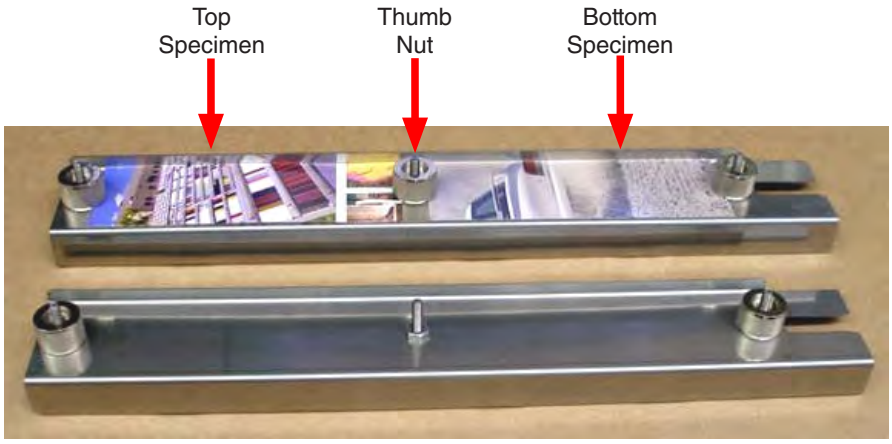


Figure 12.3i: Center nut added for mounting shorter specimens.

Blue Wool Specimen Holder for ISO 105-B04

ISO 105-B04 requires a blue wool reference material to be mounted behind a piece of glass to keep it from getting wet from the water spray. The holder (XR-11368-K) shown in Figure 12.3j is designed to do this. It mounts above the black panel holder and includes a 1/3 and 2/3 mask.

Front   Back

Figure 12.3j: ISO 105-B04 blue wool holder.

Masks for Solid Back Holders

The AATCC (paper) masks come in a kit (XR-11229-K, Figure 12.3k) of 100 pieces. Center thumb nut kit XR-11291-K and metal picture frame kit XR-11315-K are also required.

Figure 12.3k: AATCC textile mask.

ISO 105-B02 (Metal) Masks for Method 1

The ISO 105-B02 method 1 masks (Figure 12.3l) come in a kit (XR-11168-K) which includes 15 full size pieces of the 1/3 mask, 15 pieces of the 2/3 mask, and one each of the 1/3 and 2/3 masks for the half size holder. This is enough to fill the entire chamber with both the 1/3 and 2/3 masks.

The ISO 105-B02 Method 1 masks also come in a kit (XR-11316-K) which includes 31 pieces of the short 1/3 mask, and 31 pieces of the short 2/3 mask. This is enough to fill the entire chamber with both the 1/3 and 2/3 masks when the center thumb nut kit XR-11291-K is used.

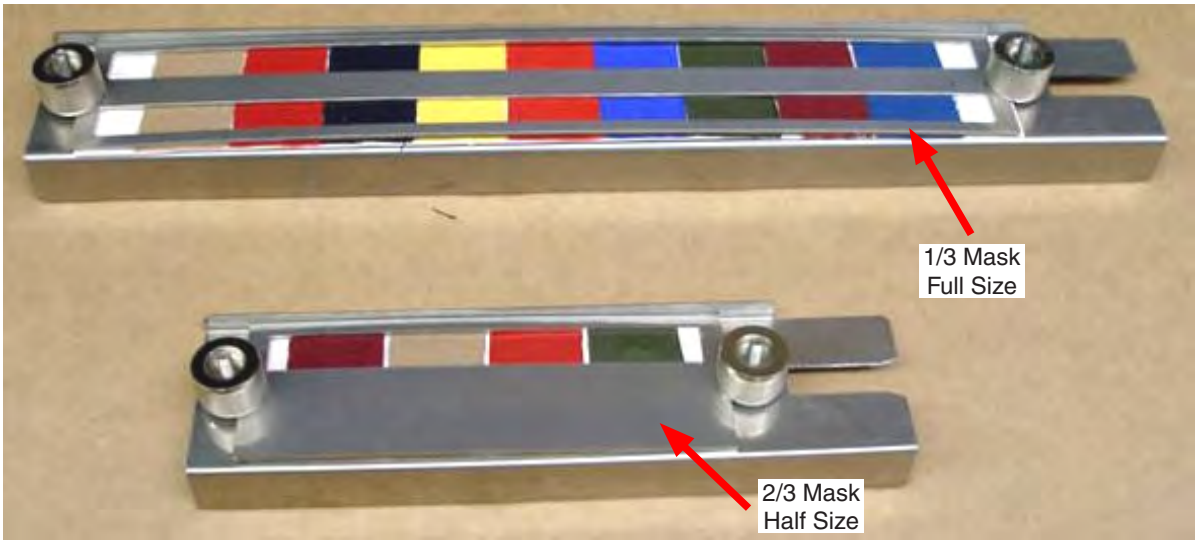


Figure 12.3l: : ISO 105-B02 Method 1 textile mask.

ISO 105-B02 (Metal) Masks for Method 2

The ISO 105-B02 Method 2 masks come in a kit (XR-11369-K) which includes 15 full size pieces of the 1/4 mask, 15 pieces of the 1/2 mask, 15 pieces of the 3/4 mask and one each of the 1/4, 1/2, and 3/4 masks for the half size holder. This is enough to fill the entire chamber with 1/4, 1/2, and 3/4 masks.

The ISO 105-B02 Method 2 masks also come in a kit (XR-11376-K) which includes 31 pieces of the short 1/4, 1/2, and 3/4 masks. This is enough to fill the entire chamber with 1/4, 1/2, and 3/4 masks when the center thumb nut kit XR-11291-K is used.

Picture Frame (Metal) Mask

Picture frame masks (Figure 12.3m) hold textile or paper specimens securely in place. They come in a kit (XR-11168-K) which includes 15 full size pieces and one short piece. This is enough to fill the entire chamber.

The picture frame masks also come in a kit (XR-11315-K) which includes 31 pieces of the short mask. This is enough to fill the entire chamber when the center thumb nut kit XR-11291-K is used.

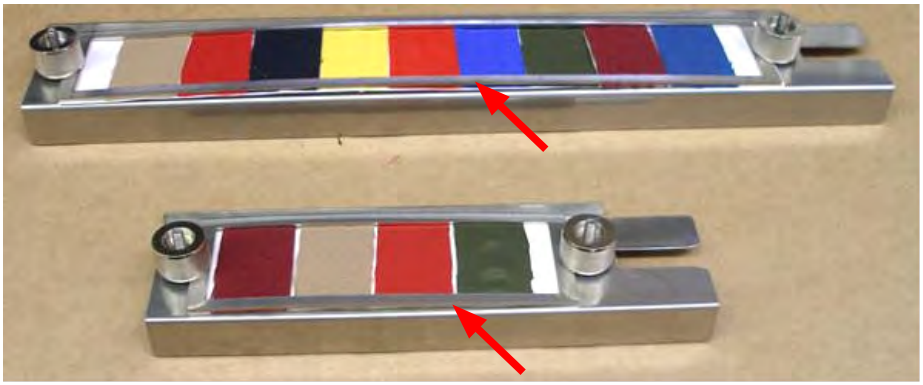


Figure 12.3m: Picture frame mask.

13. Calibration

- Q-SUN Xe-2 irradiance sensor is calibrated with the UC20 Smart Sensor (see Section 13.1).
- The black panel temperature sensor is calibrated with a UC202 Smart Sensor.
- The humidity / chamber air temperature sensor replacement is described in Section 13.4.
- The table below lists the Q-SUN Xe-2 sensors that require periodic re-calibration or replacement.
- Please contact Q-Lab for more information (Section 20).

Sensor	Calibration Frequency	Calibration instrument
Irradiance	500 hours[1]	UC20 Smart Sensor
Black Panel Temperature	6 months[2]	UC202 Smart Sensor
Humidity / Chamber Air Temperature	12 months	None required, dispose of old sensor and replace with new sensor

[1] Or calibrate whenever the lamp, UV optical filter, irradiance sensor, or test cycle conditions are changed.
[2] Or calibrate whenever the lamp, UV optical filter, the black panel sensor, or test cycle conditions are changed.

13.1 Irradiance Calibration (Nov 2020)

Smart Sensors

- Irradiance is calibrated with a UC20/340, UC20/420, UC20/LUX, or UC20/TUV Smart Sensor (Figure 13.1a through Figure 13.1d).
  - The UC20/LUX Smart Sensor is identical to the UC20/420 except that illuminance can also be displayed and calibrated in units of Lux. The UC20/LUX Smart Sensor requires a 420 nm sensor in the tester.
  - The UC20/340 Smart Sensor cannot be used with Window-IR or Window-SF5, nor Window-B04 filters.
  - Smart Sensors are labeled and color coded for identification.
  - The UC20 Smart Sensor must match the type of sensor (340 nm, 420 nm, Lux, or TUV) installed in the tester.
- Smart Sensors are calibrated at Q-Lab and the calibration information is stored in the Smart Sensor.
  - Calibration information is shown on the sensor calibration certificate and on a Smart Sensor case label (Figure 13.1f and Figure 13.1g).
  - Calibration information can also be displayed on the Xe-2 Menu Screen when the Smart Sensor is connected (Figure 13.1h).
- The UC20 Smart Sensor will give a notification on-screen when plugged-in if calibration is due in the next 90 days or overdue.
  - Upon calibration expiration, Smart Sensors should be discarded and replaced with an inexpensive new sensor. See the Replacement Parts List, Section 18
  - Optionally, Smart Sensors can be returned to Q-Lab for recalibration. Contact Q-Lab Repair and Tester Support for more information.
- Clean the Smart Sensor face with alcohol and a soft cloth before calibrating irradiance (Figure 12.1e).
- Store the Smart Sensor in its case when not in use to avoid any contamination.

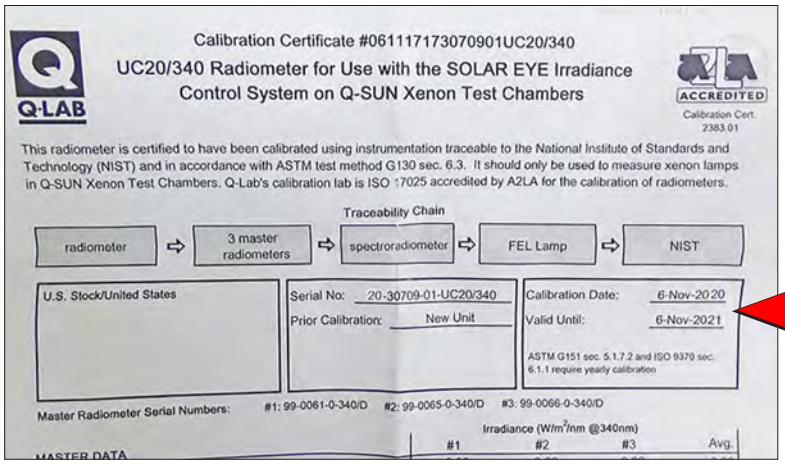
Figure 13.1a: UC20/340 Smart Sensor (Green Label)

Figure 13.1b: UC20/420 Smart Sensor (Red Label)

Figure 13.1c: UC20/LUX Smart Sensor (Brown Label)

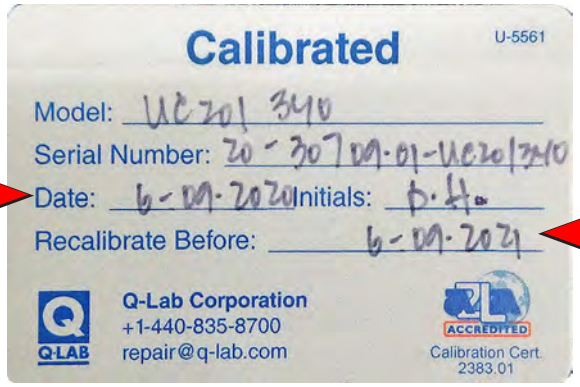
Figure 13.1d: UC20/TUV Smart Sensor (Gray Label)

Figure 13.1e: Clean the sensor face with alcohol and a soft cloth.



Sensor Calibration and Expiration Dates

Figure 13.1f: UC20/340 calibration certificate.



Sensor Calibration Date

Calibration Expiration Date

Figure 13.1g: Smart Sensor calibration label on case.

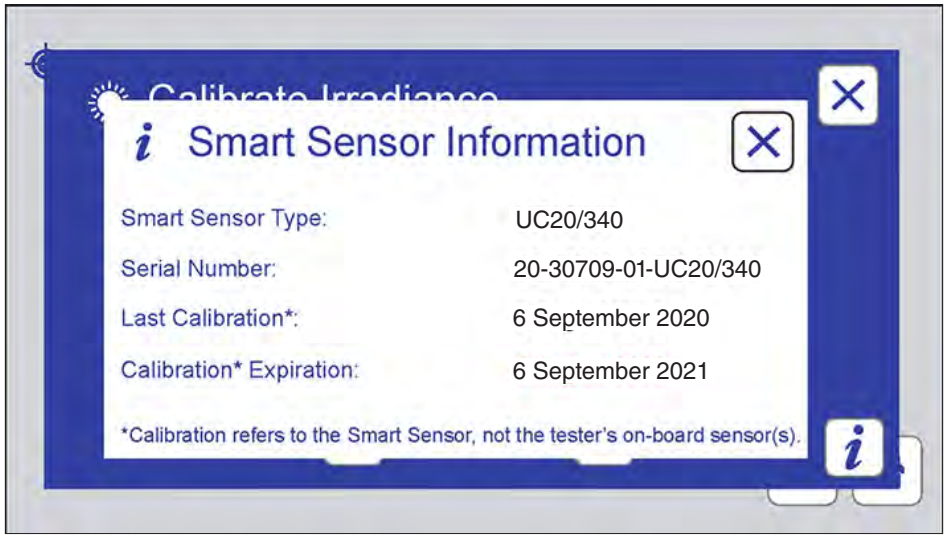
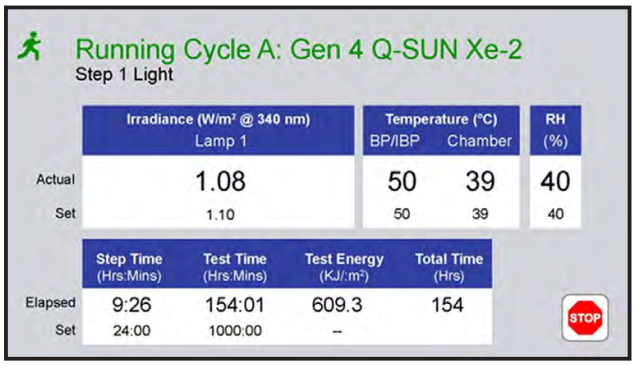


Figure 13.1h: Smart Sensor (UC20/340 shown) information displayed on Xe-2 Menu Screen.

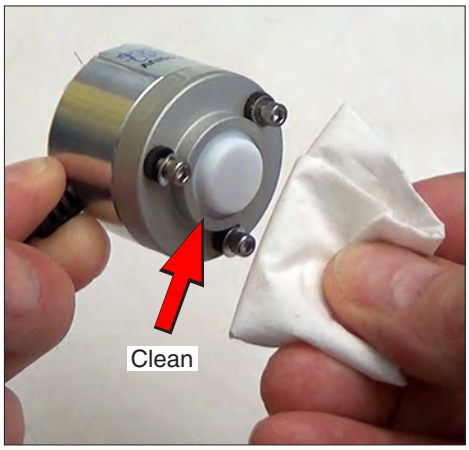
Irradiance Calibration Procedure

- Calibrate the Q-SUN Xe-2 in a light cycle and at normal operating temperature and irradiance.
- Calibrate with test specimens in place.
- Irradiance calibration should always be done before black panel calibration.
- Irradiance calibration instructions for UC20/340, UC20/420, and UC20/TUV Smart Sensors are given below.
- For UC20/LUX Smart Sensor calibration instructions, contact Q-Lab Repair and Tester Support.



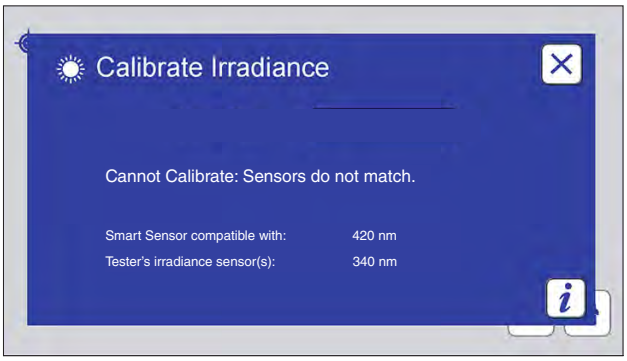
1. Run the Xe-2 in a Light Step (see Section 11.6). Make sure the black panel temperature and the irradiance are at the normal operating set points.

2. Remove the UC20 Smart Sensor from the case.

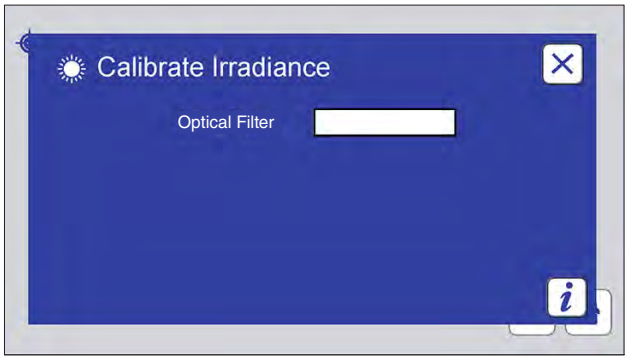


3. Clean the sensor face with alcohol and a soft cloth.

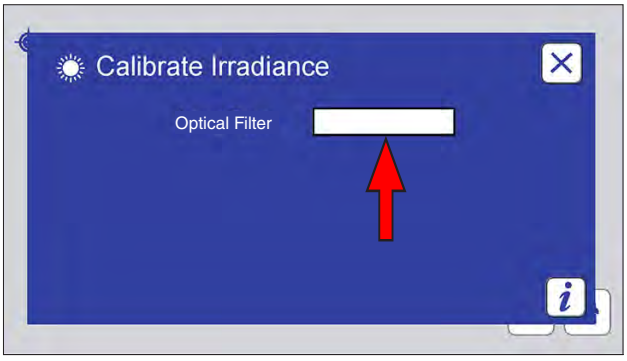
4. Plug the Smart Sensor into the USB connector on the Xe-2 control panel.



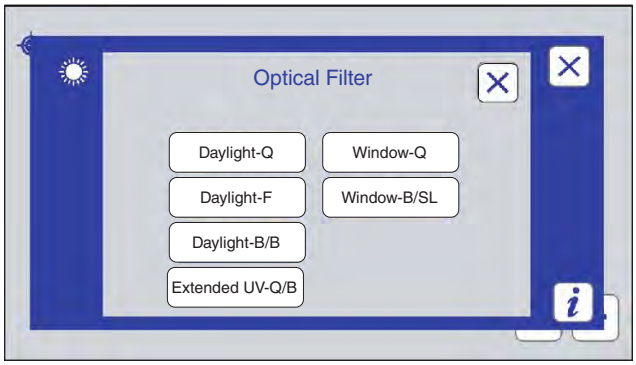
5. If the Smart Sensor does not match the Xe-2 irradiance sensor this message is displayed. Connect the Smart Sensor that matches the Xe-2 irradiance sensor.



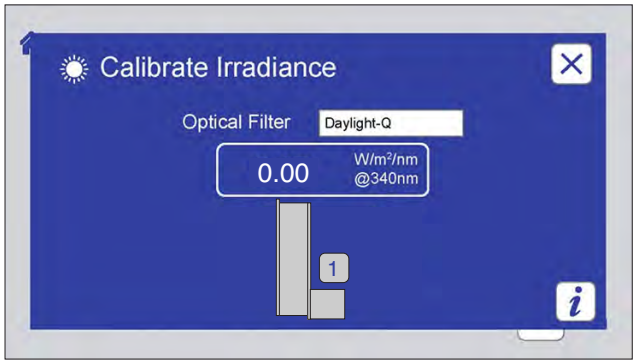
6. For testers with 340 nm or TUV sensors, this Calibrate Irradiance screen with a box to select the optical filter is displayed. For testers with a 420 nm sensor, go to Step 12.



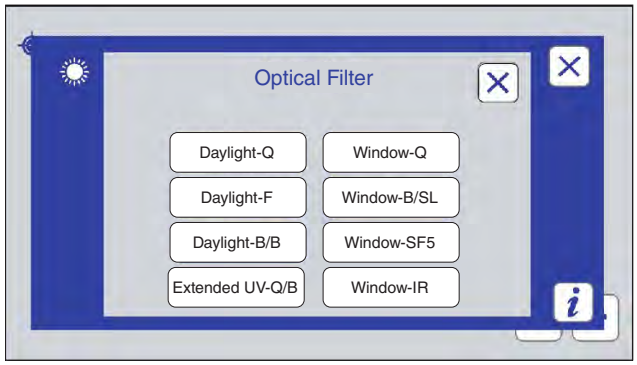
7. Touch the Optical Filter text box. For 340 nm sensors continue with Step 8. For TUV sensors go to Step 10.



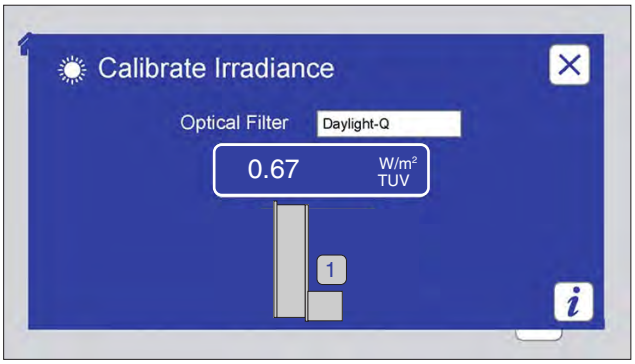
8. The Optical Filter screen for 340 nm sensors. Touch the optical filter button that matches the optical filters installed in the tester.



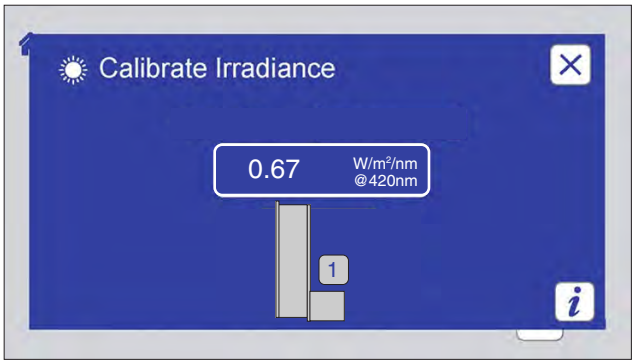
9. For testers with a 340 nm sensor, this screen is displayed. Go to Step 13.



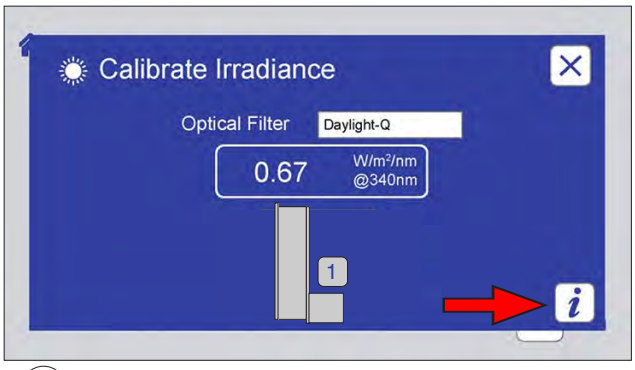
10. The Optical Filter screen for TUV sensors. Touch the optical filter button that matches the optical filters installed in the tester.



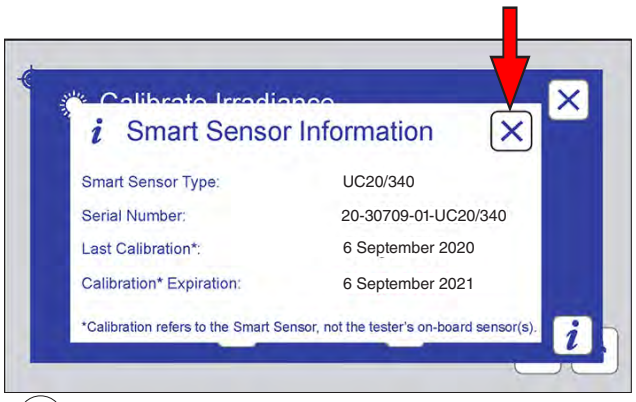
11. For testers with a TUV sensor, this screen is displayed. Go to Step 13.



12. For testers with a 420 nm sensor, this screen is displayed.

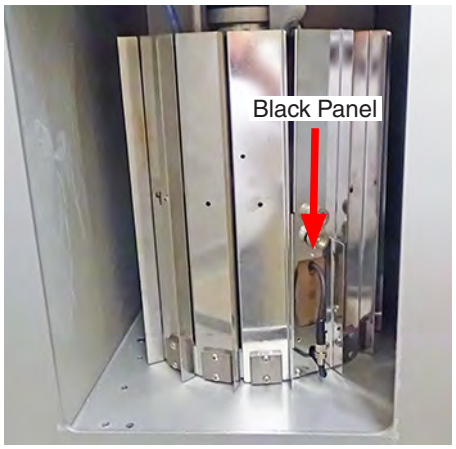


13. **Optional:** to display the Smart Sensor calibration information, touch the information icon.



14. The Smart Sensor information screen is displayed (UC20/340 shown). Touch the close icon to close the information screen.

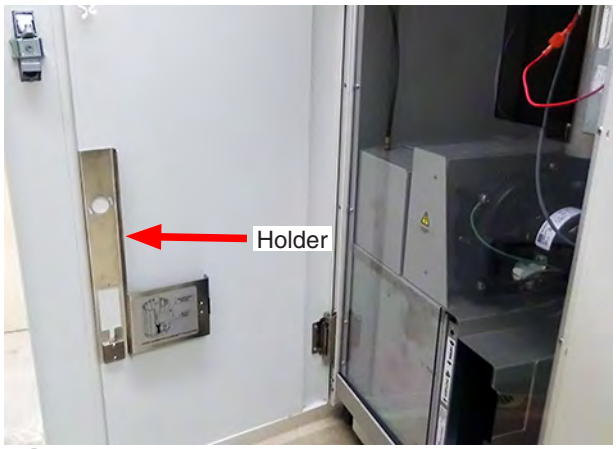
15. Open the test chamber door.



16. Rotate the turntable so that the black panel is positioned approximately as shown.

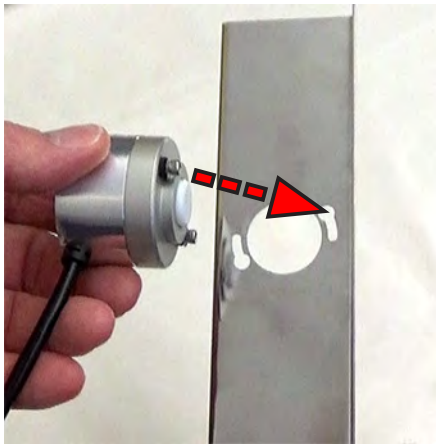
17. Remove the one specimen holder to the left of the black panel

18. Open the tester lower front door.



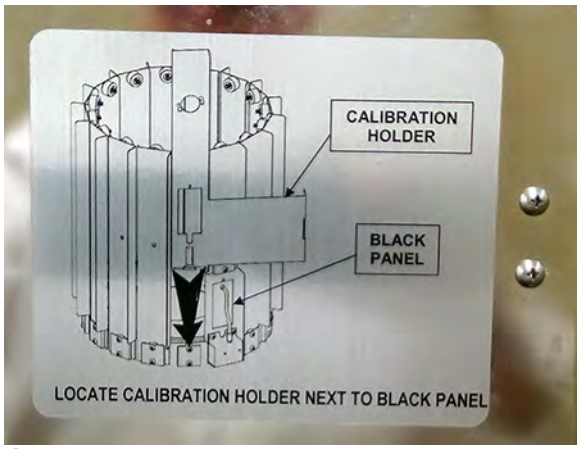
19. Locate the calibration sensor holder on the inside of the door.

20. Remove the holder.

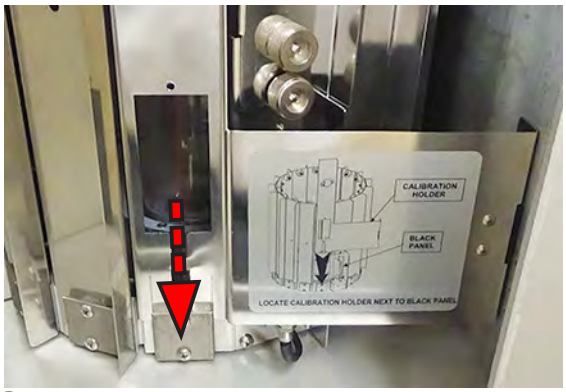


21. Align the pins in the UC20 Smart Sensor with the holes in the holder.

22. Insert the UC20 Smart Sensor into the holder. Twist the sensor to lock into position.



23. The holder label shows how to mount the holder on the turntable.



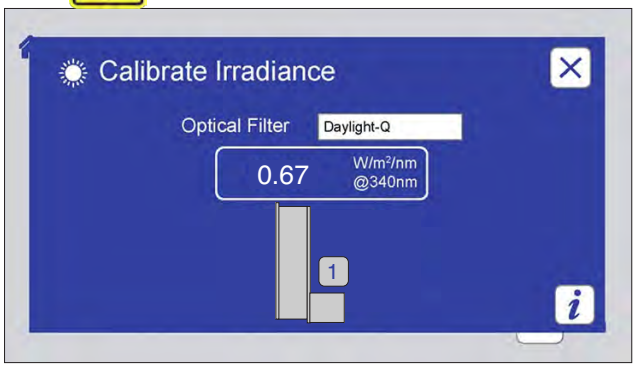
24. Insert the holder into the turntable specimen holder fixture as shown. If necessary use the Manual Rotate button on the Status screen to rotate the turntable (see Figure 11.2b).

▶ Properly installed holder with UC20 Smart Sensor.

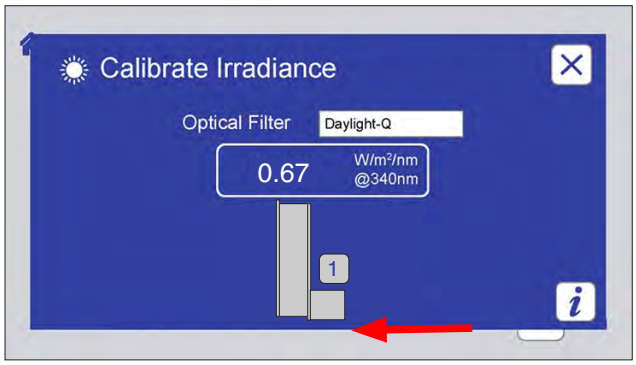
25. Close the test chamber door.

26. Keep the sensor cord away from the door latch.

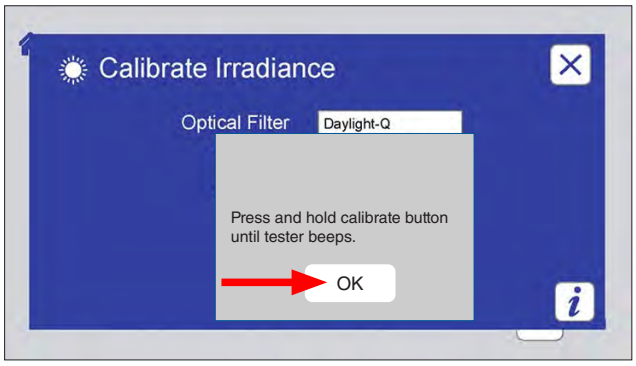
Wait for the irradiance to stabilize.



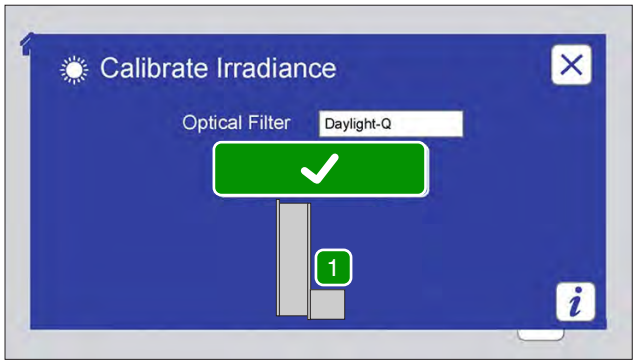
27. Wait a few minutes to allow the irradiance and temperature to stabilize at the set points (340 nm sensor shown).



28. Press and hold the channel 1 button until the tester beeps.



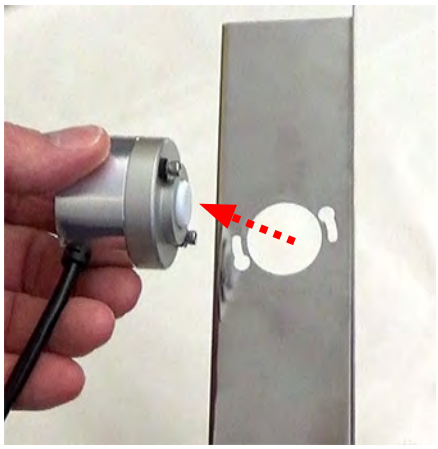
29. If the button is not pressed long enough, this message is displayed. Touch the OK button to close the message. Press and hold the channel 1 button again until the tester beeps.



30. The channel button turns green and a check mark is displayed indicating successful calibration.

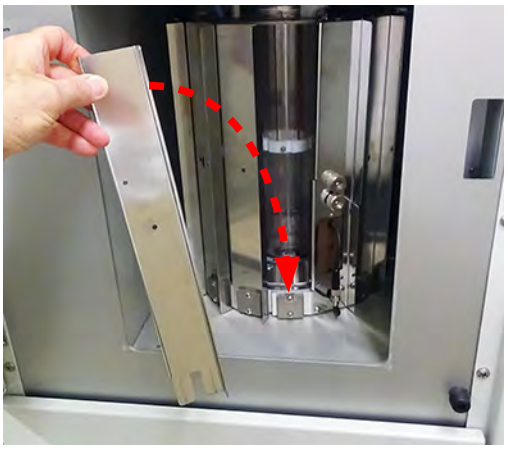
31. Disconnect the Smart Sensor from the Xe-2 control panel.

32. Remove the holder with UC20 Smart Sensor from the test chamber.



33. Remove the UC20 Smart Sensor from the holder.

34. Replace the holder in the bracket on the lower door. Close the door.



35. Replace the specimen holder removed in Step 17 on the turntable.

36. Close the test chamber door. Close the latch.

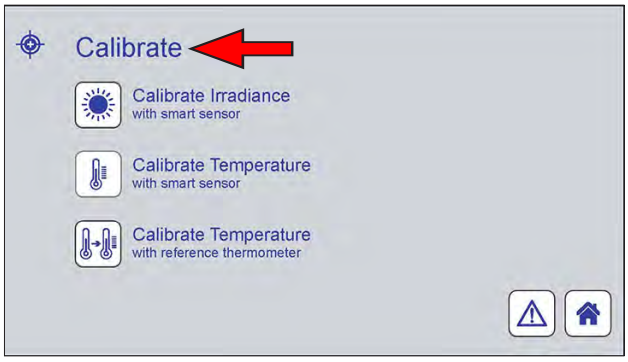
37. Replace the UC20 Smart Sensor in the case.

- Calibration must be completed in less than 5 minutes.
- If you are unable to complete the procedure in this time frame due to interruption, remove the Smart Sensor from the calibration port, wait 5 minutes, and repeat the calibration procedure.

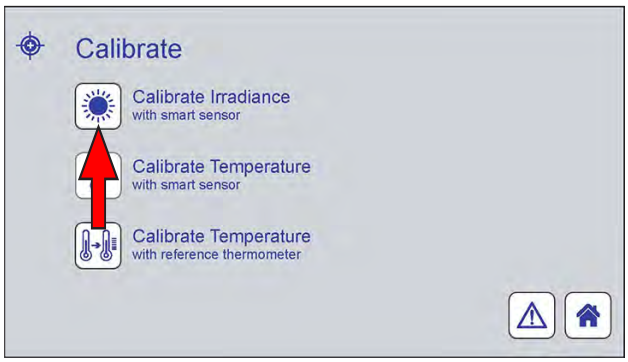
Access Calibrate Functions Through the Main Menu

- The calibrate screens can also be accessed through the Main Menu.

▶ Calibrate functions can also be accessed by touching the calibrate icon on the Xe-2 main menu screen.



▶ The Calibrate screen is displayed.



▶ Touch the Calibrate Irradiance icon.

13.2 Black Panel Temperature Sensor (Oct 2020)

Overview

- For accurate temperature readings, calibrate the black panel temperature sensor every six months in accordance with ASTM E220.
- The black panel temperature sensor should also be recalibrated whenever the panel temperature sensor, optical filters, UV sensor, or test cycle conditions are changed.
- A UC202/BP or UC202/IBP Temperature Smart Sensor is used to calibrate the panel temperature sensor.
- The UC202 Temperature Smart Sensor must match the type of panel temperature sensor in the Q-SUN.
  - Use the UC202/BP with uninsulated black panel (also known as "black panel"), Figure 13.2a.
  - Use the UC202/IBP with insulated black panel (also known as "black standard"), Figure 13.2b.

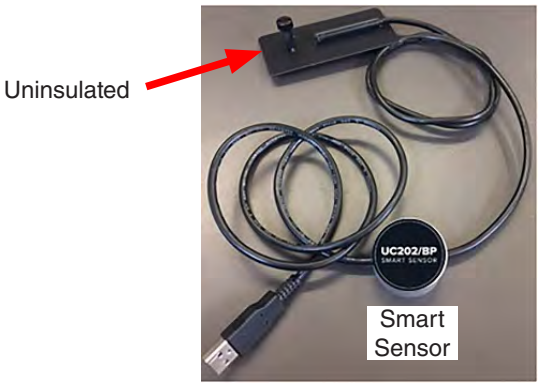


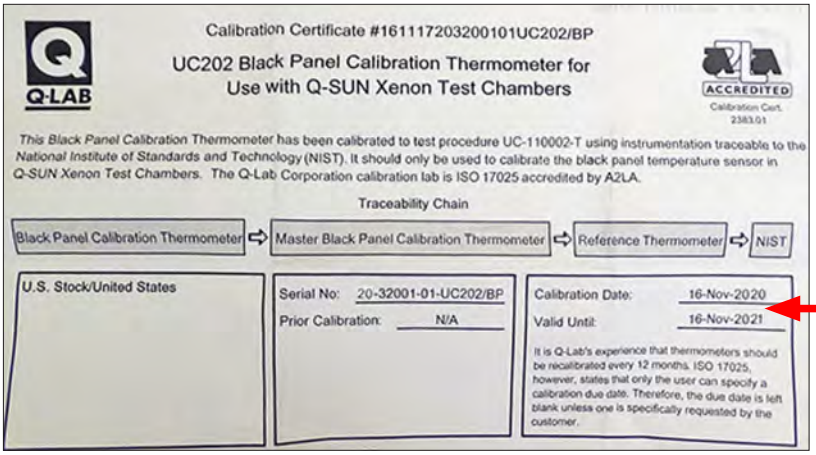
Figure 13.2a: UC202/BP Temperature Smart Sensor with Uninsulated Black Panel (Black Panel)

Figure 13.2b: UC202/IBP Temperature Smart Sensor with Insulated Black Panel (Black Standard)

- Smart Sensors are calibrated at Q-Lab and the calibration information is stored in the Smart Sensor.
  - Calibration information is shown on the sensor calibration certificate and on a Smart Sensor case label (Figure 13.2c and Figure 13.2d).
  - Calibration information can also be displayed on the Xe-2 menu screen when the Smart Sensor is connected (Figure 13.2e).
- The UC202 Smart Sensor will give a notification on-screen when plugged-in if calibration is due in the next 90 days or overdue.
  - Upon calibration expiration, Smart Sensors should be discarded and replaced with an inexpensive new sensor. See the Replacement Parts List, Section 18.
  - Optionally, Smart Sensors can be returned to Q-Lab for recalibration. Contact Q-Lab Repair and Tester Support for more information.
- Store the Smart Sensor in its case when not in use to avoid any contamination.

For Testers Equipped with a White Panel Temperature Sensor

- Calibration is done in hot water, not with a UC202.
- If the white panel is installed with a black panel it is not calibrated directly. The D12 Auxiliary Panel Temperature diagnostic value (D12) is used to calculate the white panel temperature offset. See Section 11.8 for more information.



Sensor Calibration and Expiration Dates

Figure 13.2c: UC202 Calibration Certificate

Sensor Calibration and Expiration Dates

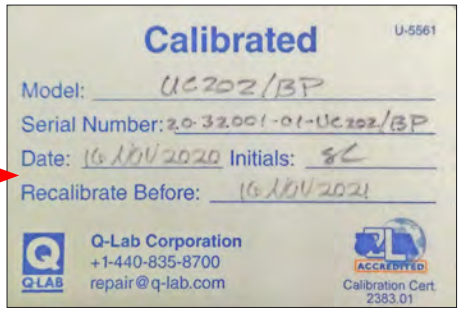


Figure 13.2d: UC202 Temperature Smart Sensor Calibration Label on Case

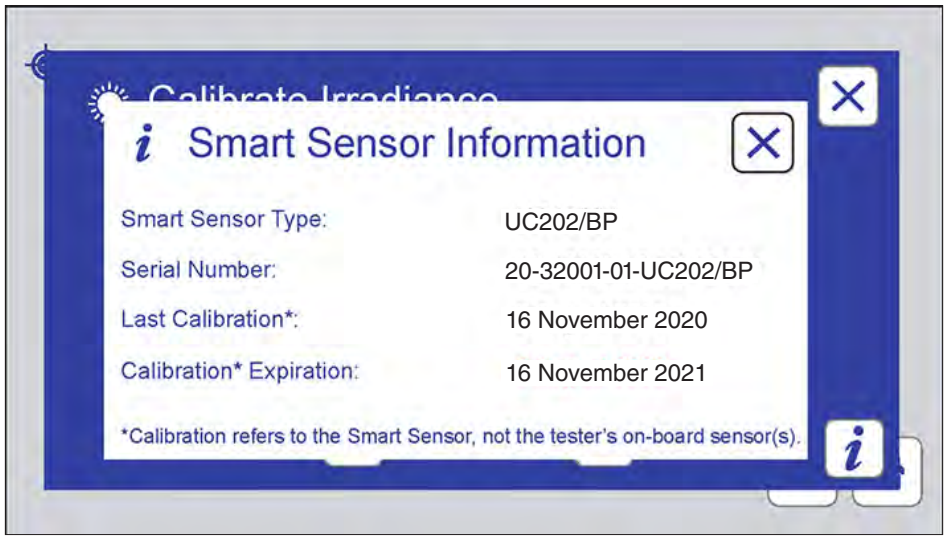
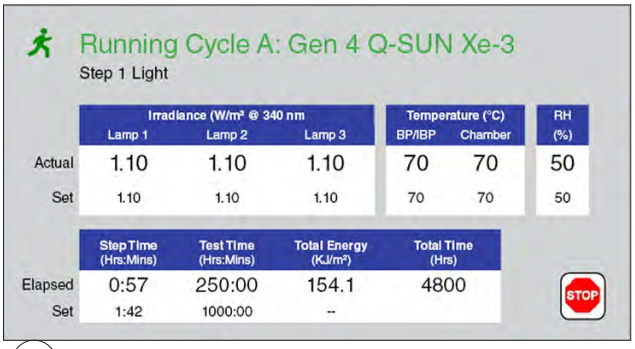


Figure 13.2e: Smart Sensor information displayed on Xe-2 menu screen.

Procedure

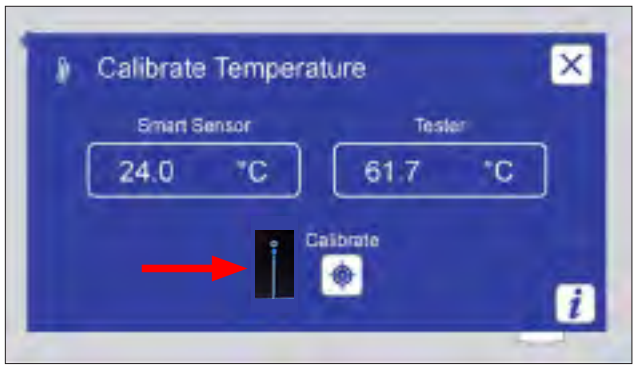
- The Q-SUN panel temperature sensor and UC202 Smart Sensor should be mounted the same way the Q-SUN panel temperature sensor will be mounted during testing.
  - o If the Q-SUN panel temperature sensor will be attached to the specimen tray during testing, it should be calibrated that way.
  - o If the Q-SUN panel temperature sensor will to be mounted in a specimen holder during testing, it should be mounted in a specimen holder for calibration.
- Special UC202/BP black panel and UC202/IBP insulated black panel holders are available in specimen holder kit X-10113-K.



1. Run the Xe-2 in a Light Step (see Section 11). Make sure the black panel temperature and the irradiance are at the normal operating set points.

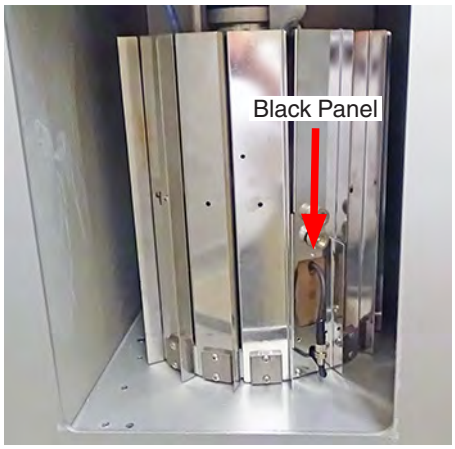
2. Remove the UC202 Temperature Smart Sensor from the case. UC202/BP shown.

3. Plug the UC202 Smart Sensor into the USB connector on the Xe-2 control panel.

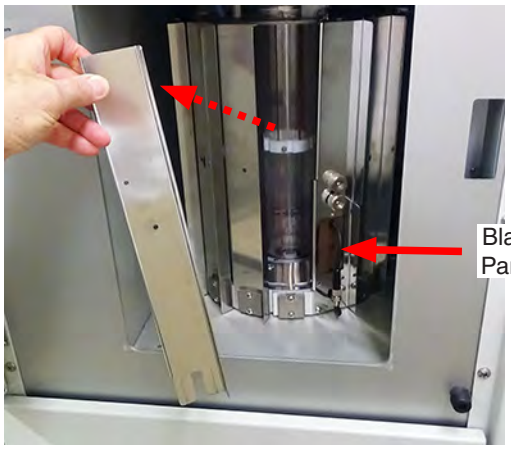


▶ The calibrate temperature screen is displayed. The Smart Sensor type (BP or IBP) is recognized by the tester. UC202/BP in this example.

4. Open the test chamber door.

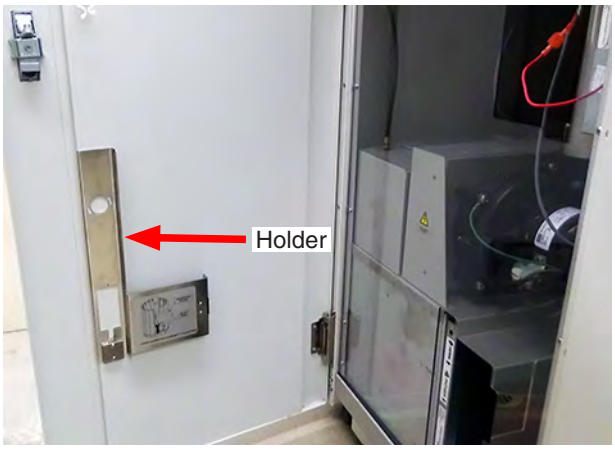


5. Rotate the turntable so that the black panel is positioned approximately as shown.



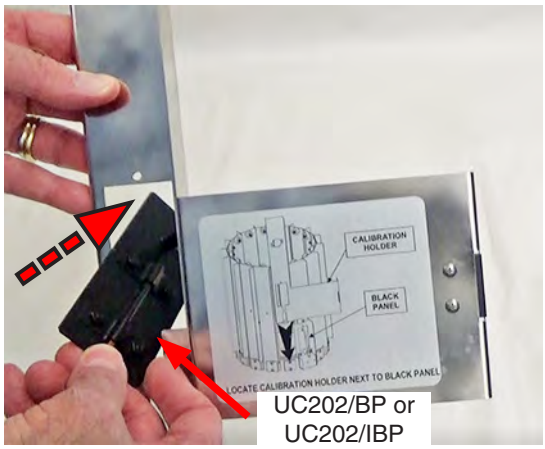
6. Remove the one specimen holder to the left of the black panel. Set aside.

7. Open the tester lower front door.

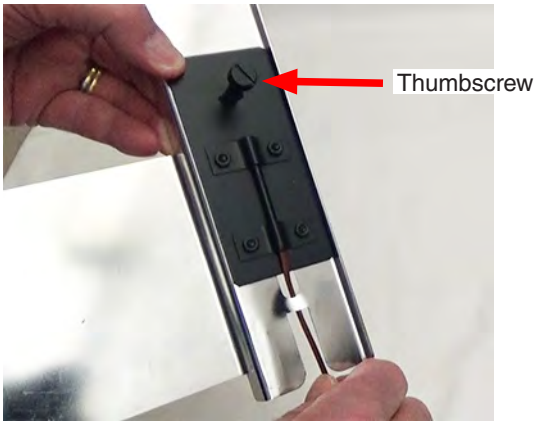


8. Locate the calibration sensor holder on the inside of the door.

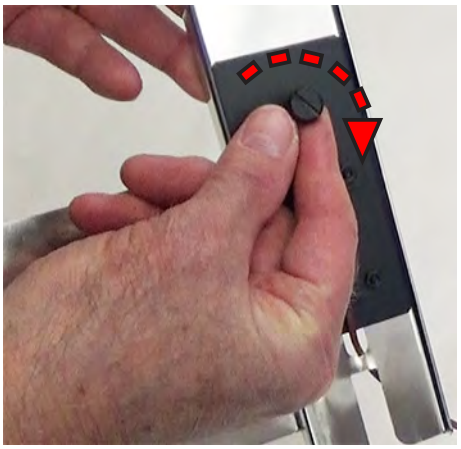
9. Remove the holder.



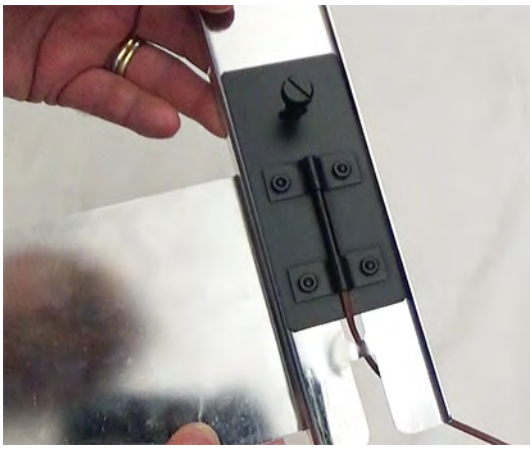
10. From the side of the holder with the label, insert the black panel through the large opening.



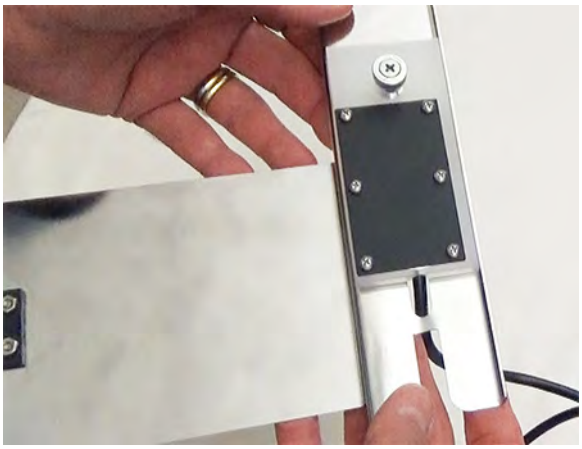
11. From the opposite side of the holder, turn the black panel so that the thumbscrew faces away from the holder.



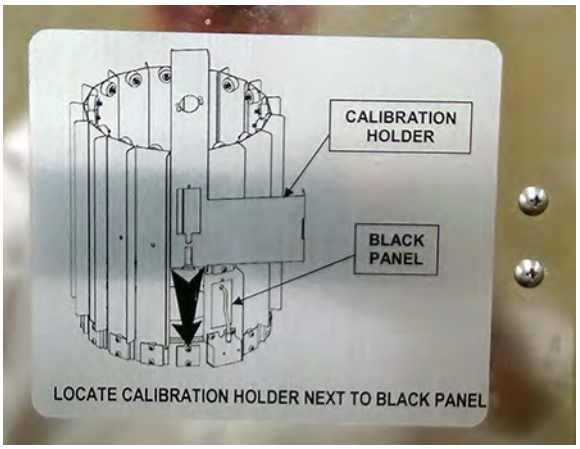
12. Align the thumbscrew with the tapped hole in the holder. Tighten the thumbscrew.



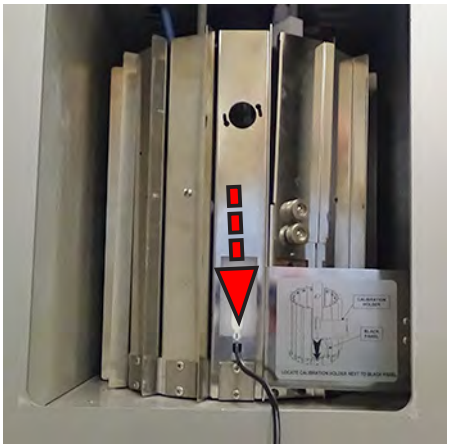
13. Black panel correctly mounted in the holder.



▶ Insulated black panel correctly mounted in the holder.



14. The holder label shows how to mount the holder on the turntable.

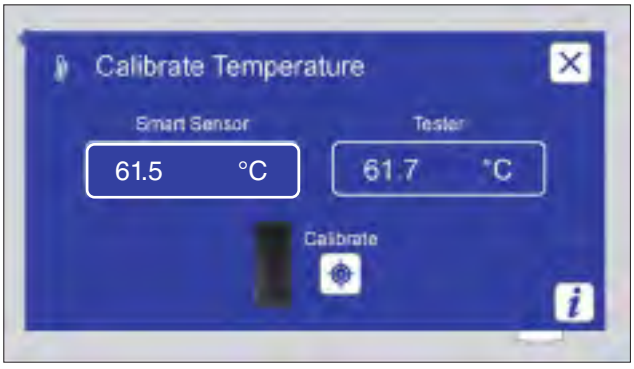


15. Insert the holder into the turntable specimen holder fixture as shown.

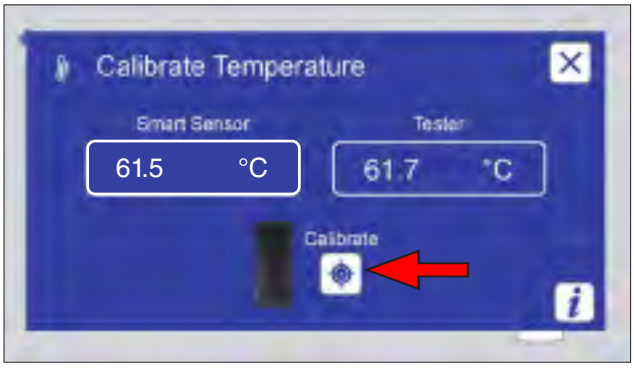
16. Close the test chamber door.

17. Keep the sensor cord away from the door latch. Allow the Q-SUN to stabilize at the irradiance and temperature set points.

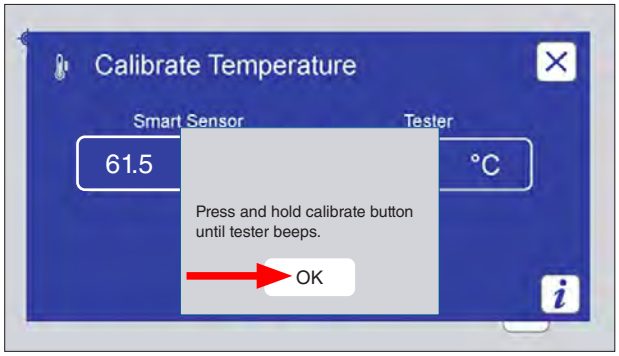
18. IMPORTANT: Keep this circular housing out of the test chamber.



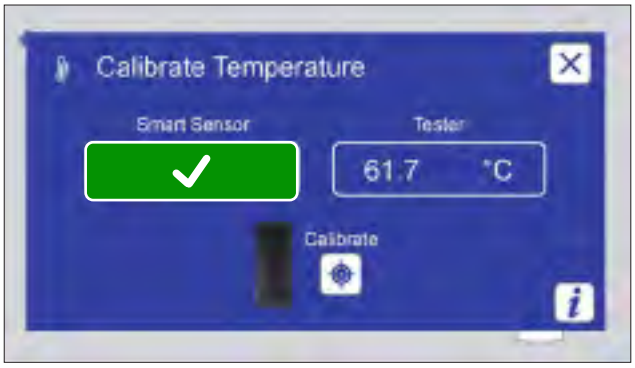
19. ⚠ Wait a few seconds to allow the sensors temperature to stabilize.



20. Press and hold the calibration button until the tester beeps.

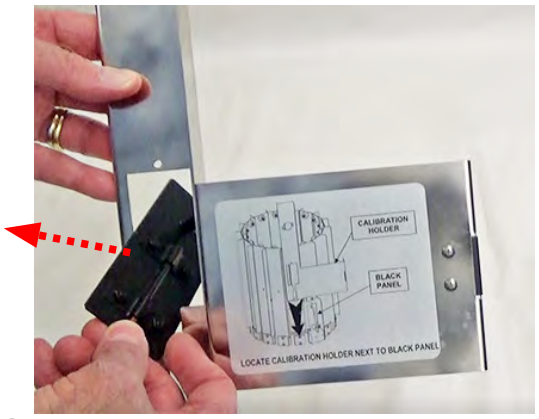


21. If the button is not pressed long enough, this message is displayed. Touch the OK button to close the message. Press and hold the calibrate button again until the tester beeps.



22. The Smart Sensor button turns green with a check mark indicating successful black panel temperature sensor calibration.

23. Disconnect the UC202 Smart Sensor from the Xe-2 control panel.



24. Remove the holder with the UC202 Smart Sensor from the test chamber. Remove the Smart Sensor from the holder.

25. Replace the specimen holder removed in Step 6. Close the test chamber door.

26. Replace the UC202 Smart Sensor in the case.

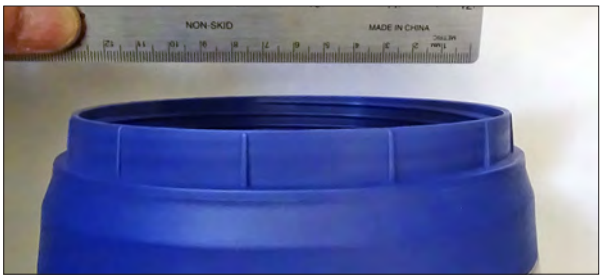
13.3 White Panel Temperature Offset (Oct 2020)

- The white panel is not calibrated the same way as a black panel in the Q-SUN Xe-2. The calibration is comparison to a reference thermometer. It is not possible to adjust the white panel's output.
- An offset value must be manually calculated to correlate the white panel temperature with a calibrated reference thermometer temperature.
- To find the offset, the white panel and a reference thermometer are placed in a container of hot water.
- The temperature reading of the white panel (as displayed on the transceiver) and the reading on the reference thermometer display are compared. The difference in the temperatures is the white panel temperature offset.
- The offset value is added to (or subtracted from) the displayed white panel temperature to give the adjusted white panel temperature.
- The adjusted white panel temperature should be used in place of the temperature displayed on the transceiver.
- Follow the steps below to find the white panel temperature offset.
- The following steps show an insulated white panel. Find the temperature offset of an uninsulated white panel in exactly the same way.

1. Follow the steps below to determine the white panel temperature offset.

2. A reference thermometer and insulated water container are needed.

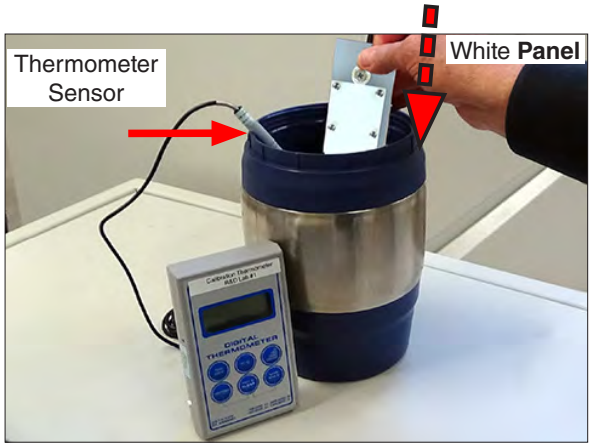
5.5 cm
Minimum



3. **IMPORTANT:** The opening of the insulated container must be at least 5.5 cm wide to insert the white panel.

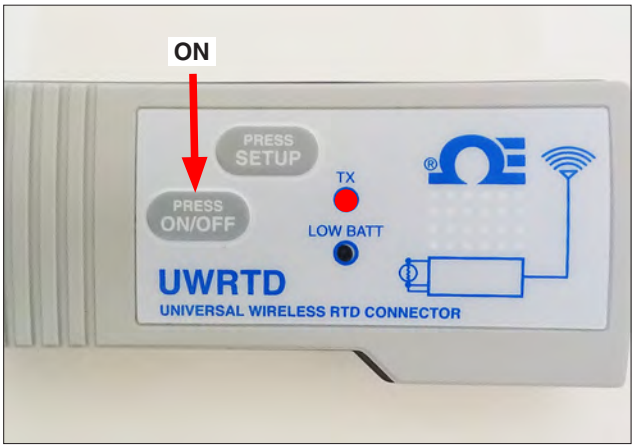
4. Fill the insulated container with water of approximately the highest temperature called for in the test cycle.

5. Remove the white panel and the transmitter from the holder.



6. Place the white panel and the calibrated reference thermometer sensor in the insulated container. DO NOT allow the transmitter to get wet.

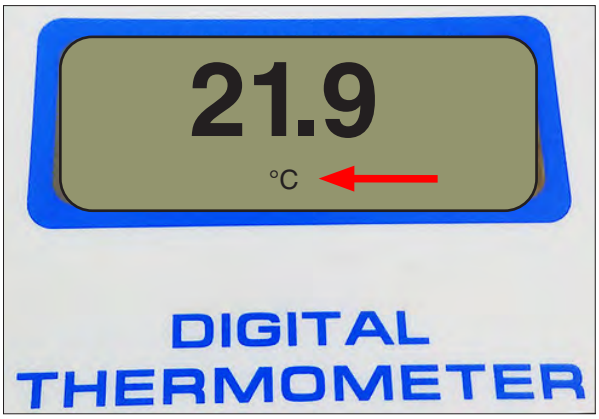
7. Turn the reference thermometer **ON**.



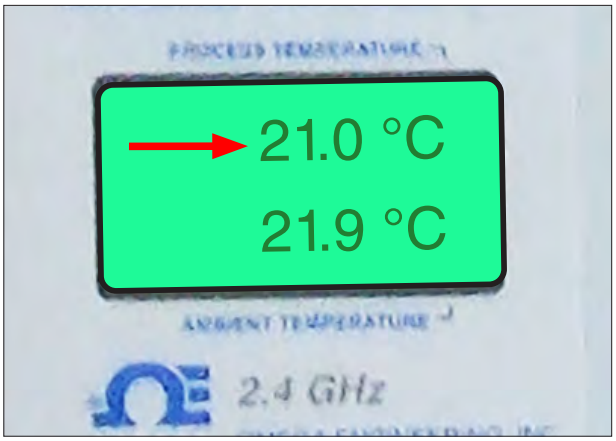
8. Turn the transmitter **ON**.

Wait

9. Wait five (5) minutes for the temperatures to stabilize.



10. Read the temperature on the reference thermometer display. Set the temperature scale (Celsius recommended) to match the transceiver.



11. Read the Process Temperature on the white panel transceiver display.

Calculate the white panel temperature offset

Reference Thermometer Temperature:	21.9 °C
White Panel Transceiver Temperature:	21.0 °C
White Panel Temperature Offset:	0.9 °C

NOTE: If the white panel temperature is greater than the reference temperature, the offset will be negative.

12. Calculate the white panel temperature offset. Example calculation shown here.

13. Remove the white panel and the reference sensor from the container.

14. Dry the white panel. Replace the white panel and transmitter on the holder.

15. Reinstall the white panel holder in the test chamber.

16. Close and latch the test chamber door.

- White panel offset calculation is complete.
- Run test cycles as normal with the tester.
- Remember to apply the white panel temperature offset to all white panel temperature values.
- The offset is always “added” to the value you read on the transceiver. A positive offset means that the white panel reading is lower than its actual temperature; a negative offset means that the white panel reading is higher than its actual temperature.

13.4 Relative Humidity / Chamber Air Temperature Sensor Replacement (Nov 2020)

- This sensor is designed to be replaced once a year. It cannot be recalibrated.
- The replacement sensor part number is X-10415-K. See Section 18 for more information.

1. Open the test chamber door.
2. Remove the specimen holders from the turntable.
3. Locate the RH/chamber air temperature sensor at the right rear of the chamber (Figure 13.4a).
4. Remove the sensor from the mounting bracket (Figure 13.4b).
5. Disconnect the sensor from the cable (Figure 13.4c).
6. Install the new sensor (Figure 13.4d).

Figure 13.4a: RH/Chamber Air Temperature Sensor at the right rear of the test chamber.

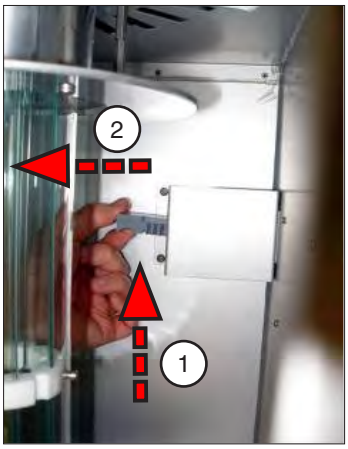
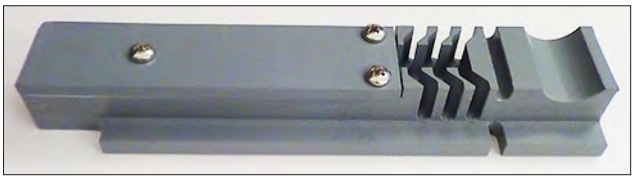


Figure 13.4b: Carefully reach behind the lantern. Lift the sensor up and then pull to the left.

Figure 13.4c: Push the release lever on the connector to disconnect the sensor from the cable. Discard the old sensor.



Part Number X-10415-K

Figure 13.4d: Install a new X-10415-K RH & Chamber Air Temperature Sensor. See Section 18.

14. Data Storage and Transfer

14.1 Ethernet Communications (Oct 2020)

- The Q-SUN main controller has the capability to transfer data via Ethernet.
- A Ethernet port is located at the top left corner at the rear of the tester (Figure 14.1).
- Q-Lab can supply a VIRTUAL STRIPCHART (VSC) program that runs on a PC.
  Contact Q-Lab Repair and Tester Support for more information.
- The strip chart program will be able to set up communications, request data groups, and save and display that data.

Figure 14.1: Ethernet port located at the top left corner at the rear of the tester.

14.2 Secure Digital (SD) Card (Oct 2020)

- All tester information, i.e. timers, expert parameters, error messages, setpoints, actuals, test cycles, and other system configuration information is written to an SD card every minute.
- The operating parameters can be viewed by the customer or by Q-Lab Repair and Tester Support (see Section 20) using the export features later in this section.
- If the main controller fails, the SD card can be transferred to a new controller and all tester information will be preserved. The user does not have to reenter the serial number and date/time, test cycles, expert parameters, or timer values.
- The information on the SD Card can also be copied and emailed to Q-Lab Repair and Tester Support.
- That information can be copied to another SD Card so the original tester's configuration can be "cloned" by Q-Lab Repair and Tester Support for analysis.

14.3 Export Diagnostics (Nov 2020)

- The Export Diagnostics function transfers the full set of VSC parameters.
- These include the most recent two weeks (tester time) of data, recorded every minute as a .vsc file.
- The complete system configuration is also transferred in this operation.
- This includes tester operational information like timers, expert parameters, setpoints, actuals, heater and blower percentages, calibration factors, test cycles, and error messages.
- A USB flash drive is used to export diagnostic parameters (Figure 14.3a)
- Connect the USB drive to the USB port on the Q-SUN control panel (Figure 14.3b).
- The USB Options screen will be displayed (Figure 14.3c).
- Touch the Export Diagnostics button to begin the export process (Figure 14.3d and Figure 14.3e).
- Transfer the USB drive to a computer (Figure 14.3f).
- The exported files (Figure 14.3g) can be uploaded to the Q-Portal Asset Center where customers can view basic operational data (Figure 14.3h and Figure 14.3i) and Q-Lab personnel can view extended operational data.

Figure 14.3a: USB drive needed to export diagnostics.

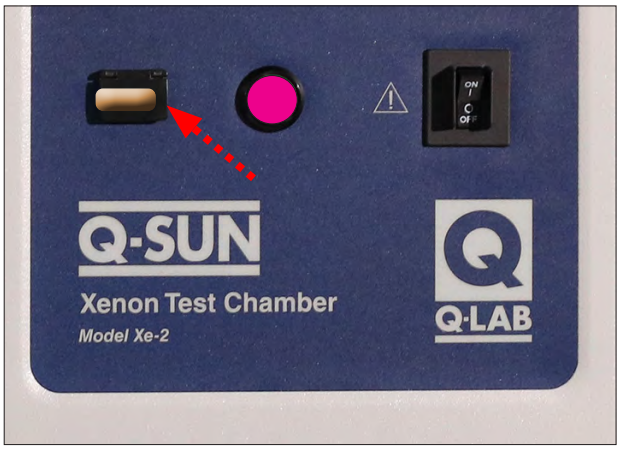


Figure 14.3b: Connect the drive to the USB port on the Q-SUN control panel.

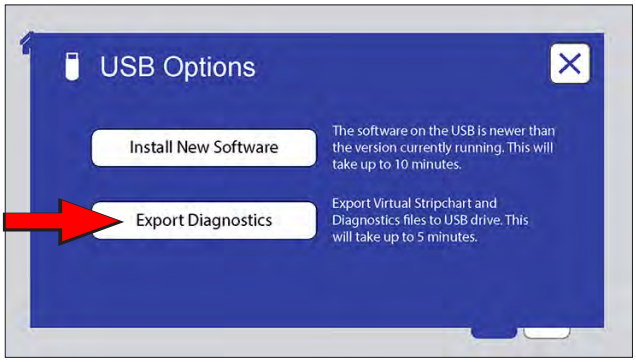


Figure 14.3c: USB Options screen showing the Export Diagnostics button.

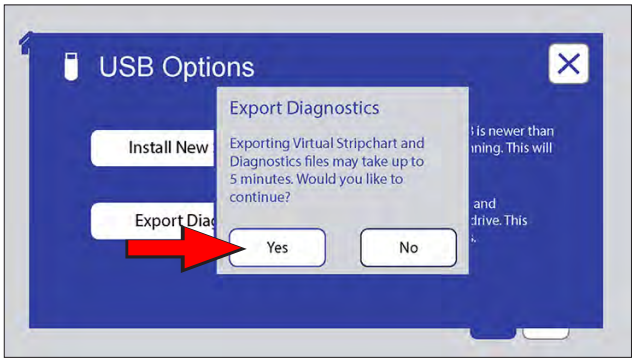


Figure 14.3d: Touch Export Diagnostics then the Yes button to begin export.

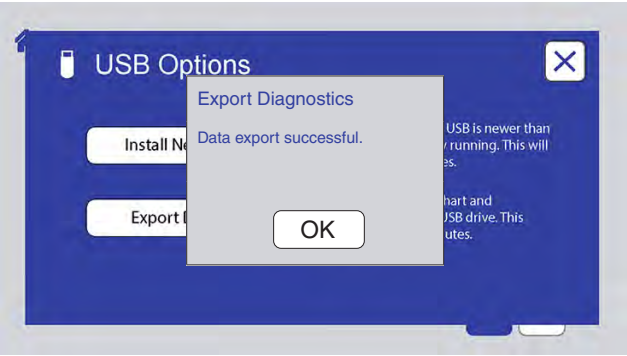


Figure 14.3e: When the Export Diagnostics data transfer is complete, this message is displayed. Touch OK.

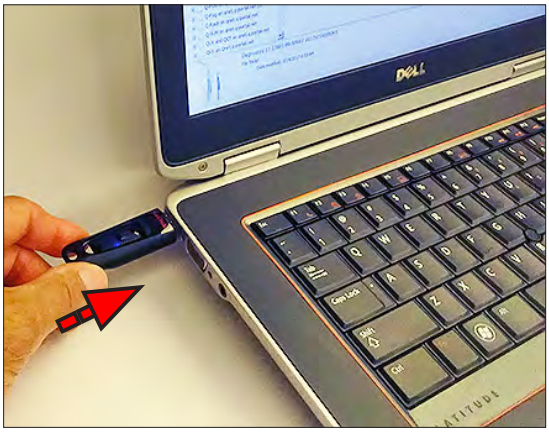
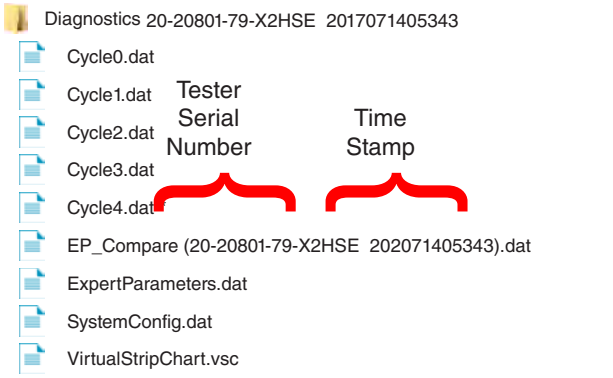


Figure 14.3f: Insert the USB drive into a computer to display the list of files



* The number of Cycle files will vary depending on tester configuration.

Figure 14.3g: The USB drive will have a folder with the diagnostic data files exported from the tester.

IMPORTANT NOTE: All files except EP_Compare are readable only by the tester. Do not try to open the other files on a PC.

- The .vsc file is the most important file because it contains the actual tester operational data.
- See Section 14.4 or contact Q-Lab Repair and Tester Support for instructions on importing .vsc files to the Q-Portal Asset Center for analysis.

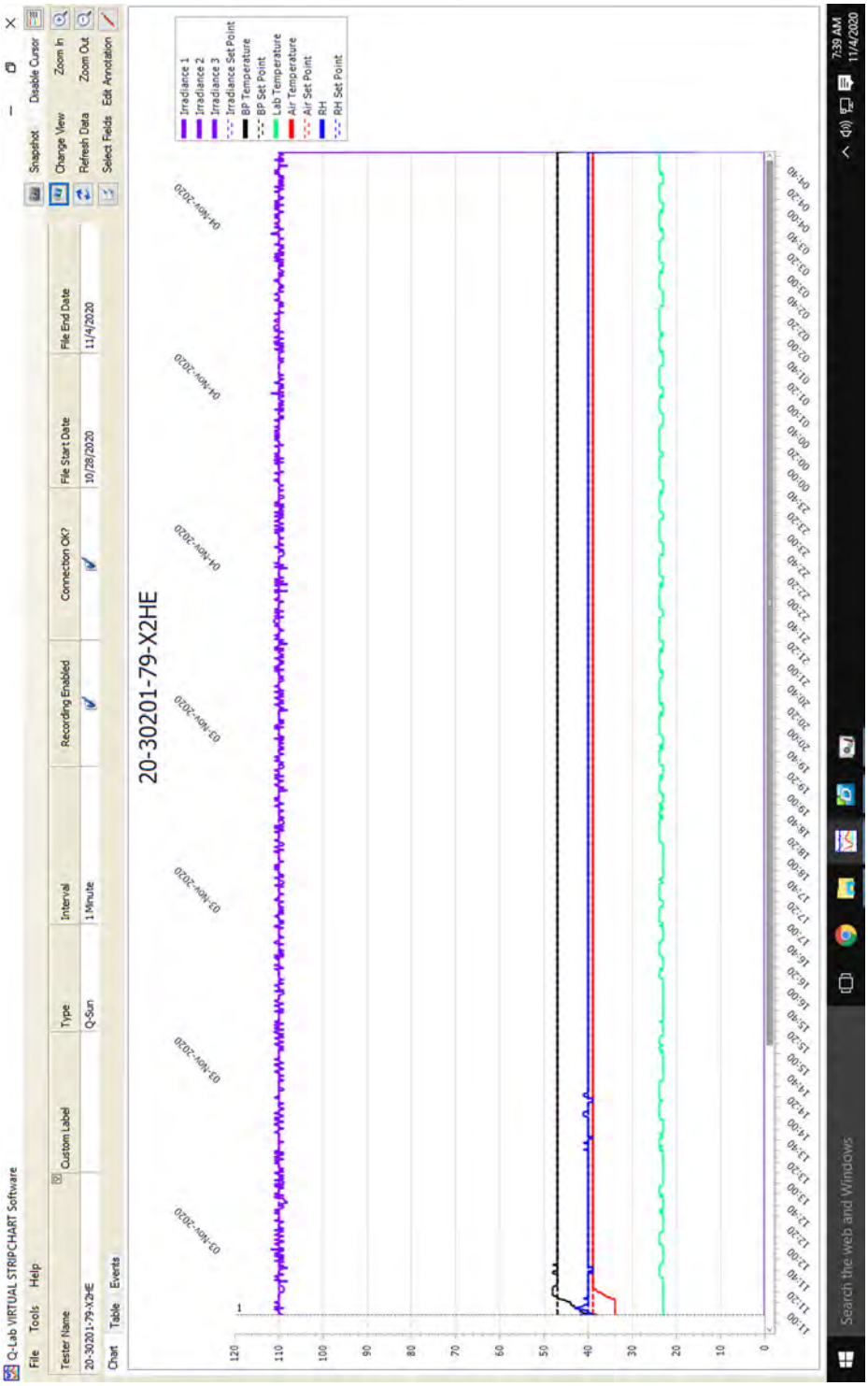


Figure 14.3h: VIRTUAL STRIPCHART chart view.

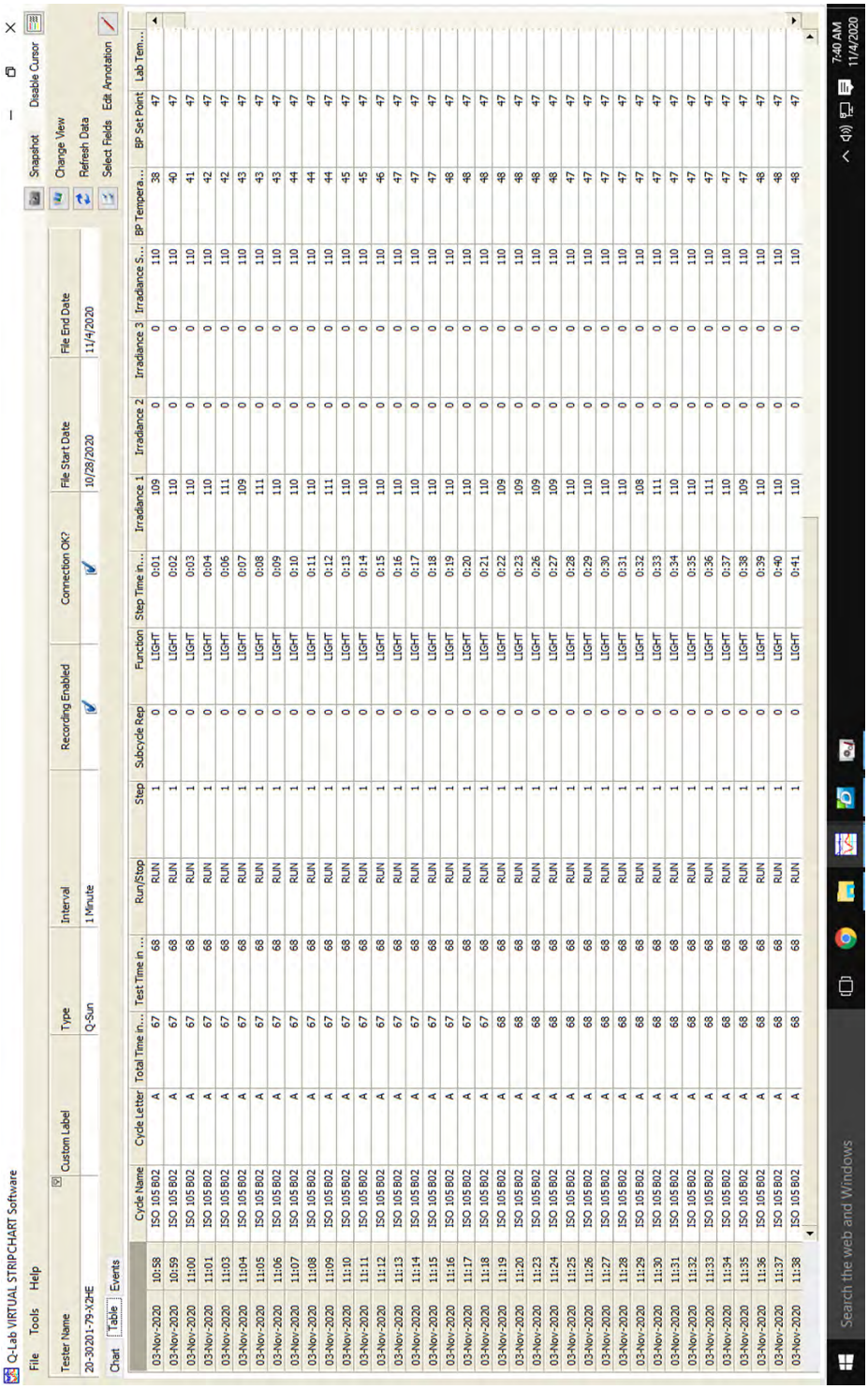


Figure 14.3i: VIRTUAL STRIPCHART table view.

14.4 Import VIRTUAL STRIPCHART Data (Aug 2020)

- At the Q-Lab Q-Portal Asset Center, customers can register their Q-SUN Xe-2 testers.
- Once a tester is registered, customers can access important information relating to the tester as well as view, customize, export, and create .pdf files of their virtual stripchart data .
- The .vsc files must first be downloaded using the Export Diagnostics function (see Section 14.3). Contact Q-Lab Repair and Tester Support (Section 20) for more information.

15. Options

15.1 Water Repurification System (Nov 2020)

- Q-Lab offers an optional water repurification system (part number X-10897-K) for the Q-SUN to conserve water (Figure 15.1).
- This system re-circulates and re-purifies the spray water instead of letting it go down the drain.
- This can save over 50 liters of purified water per day.

The repurification system is not a primary purification system. It is a repurification system. You still must supply purified water to the Q-SUN. Purified water is required for proper operation. The Q-SUN tester **warranty is voided** if this condition is not met.

- During a spray step the pump turns on and draws water out of the reservoir.
- The water first goes through a repurification cartridge to remove any contaminants.
- It is then sprayed on the test specimens and drains back into the reservoir.
- A float valve automatically adds water to the reservoir to replenish water lost to evaporation – NO MANUAL FILLING IS NEEDED.
- A built in water purity monitor should be checked once a month.
- The repurification cartridge should be changed when the Total Dissolved Solids exceed 1 ppm.
- When the Q-SUN is supplied with pure water the repurification cartridge should last several years.

NOTE: The water repurification system requires a drain. If needed, a lift kit (see Section 15.3) can be used to raise the water repurification system to the correct drainage height.

Figure 15.1: Q-SUN Xe-2 with water repurification system.

15.2 Drain Pump (Mar 2019)

- Drain pumps (Figure 15.2) are optionally available for Q-SUN Xe-2 models.
- A pump is needed if the tester drain tube must rise more than 100 mm (4.0") above the floor before reaching a drain.
- The drain pump kit includes the pump, 30 m (100') of hose and various fittings.
- The drain pump maximum lift is 5.8 m (19 ft).

Drain Pumps

Part Number	Description
X-6955-K	Drain Pump Kit, 120 volt
X-6956-K	Drain Pump Kit, 230 volt

Figure 15.2: Drain pump.

15.3 Lift Kit (Feb 2020)

- If the laboratory drain is above floor level, or the drain hose from the tester has to rise over an obstruction before it reaches a floor drain, an optional lift kit (part number X-15416-K) can be used to raise the entire tester up to enable proper drainage.
- The lift kit includes four (4) square aluminum risers (Figure 15.3a) and necessary hardware.
- A leveling foot comes installed on each riser.
- The Xe-2 casters are removed and the risers are installed in the same locations, raising the tester by 11 cm (4.25").
- **IMPORTANT:** Casters can not be used with the lift kit.
- Do not use concrete blocks, pallets, bricks, or other means to raise the tester to achieve proper drainage.
- A lift kit can also be used to raise a water repurification system (see Section 15.1) to the correct drainage height.
- Contact Q-Lab Repair and Tester Support with any questions about tester drainage requirements.

Figure 15.3a: Lift Kit includes four (4) risers.

Figure 15.3b: Riser installed.

15.4 Water Inlet Pump (Mar 2020)

- A water inlet pump (Figure 15.4) is optionally available for Q-SUN Xe-2 installations that do not have sufficient water pressure.
- The pump will boost low pressure or draw water from a reservoir.
- The pump operates automatically and supplies water to the Q-SUN on demand.

Figure 15.4: Water inlet pump assembly X-10730-K.

16. Maintenance

16.1 Lamp Maintenance (Nov 2020)

- The xenon lamp is replaced every 3000 hours to maintain a consistent spectral power distribution.
- If the lamp is less than 3000 hours old and the irradiance does not reach the set point, the lamp may need to be replaced.
- As the lamp ages, it operates at a higher power and produces more heat in the chamber.
- If a test requires a low chamber temperature and the Q-SUN cannot maintain that low temperature the lamp may need to be replaced.
- To display the lamp age:
  - On the Xe-2 Main Menu screen touch the Diagnostics icon.
  - Scroll to Diagnostic D19 Lamp Hours (see Section 11.8).

Always power OFF the tester and disconnect the main power before performing any maintenance in the lamp area.

The lamp is hot. Press **STOP**. Shut off power to the machine. Wait 15 minutes for lamps to cool. Turn the external disconnection switch off. Always re-calibrate the system after changing lamps.

1. While standing on a stool or ladder, open the lamp door on top of the Q-SUN tester.
2. Loosen the lamp power thumb nut (Figure 16.1a).
3. Remove the power wire.

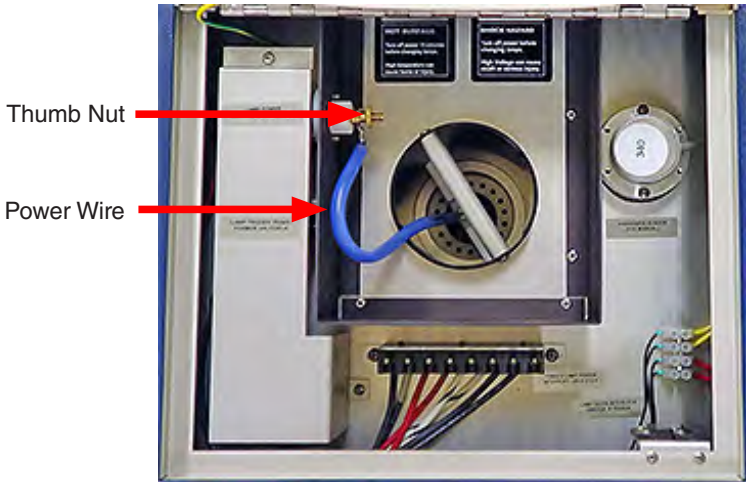
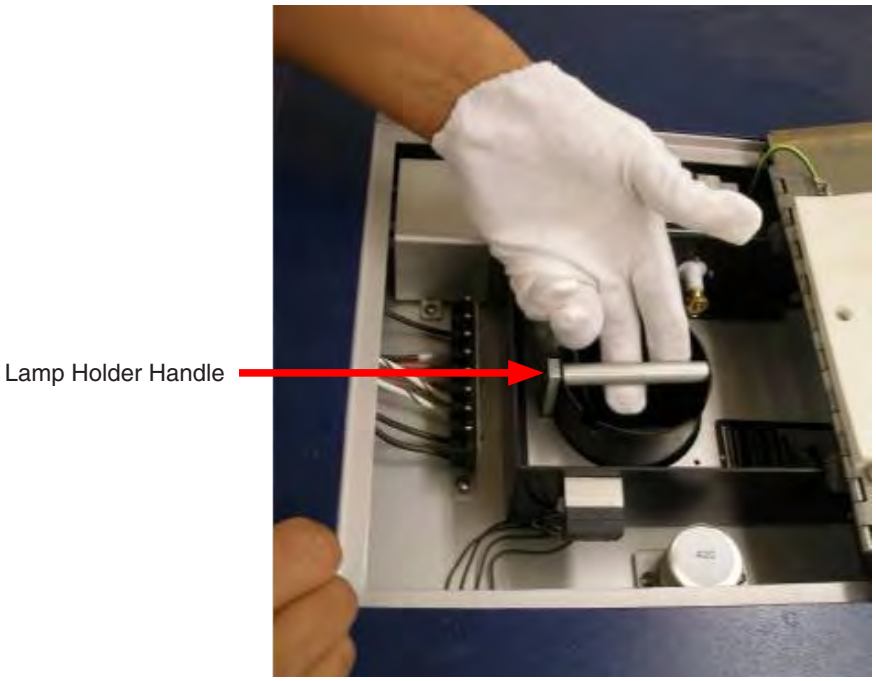


Figure 16.1a: Xe-2 top view with lamp door open.

4. Carefully pull straight up on the handle to remove the lamp and holder from the tester (Figure 16.1b and Figure 16.1c). If the lamp does not come out with the holder, then reach down and carefully pull up on the lamp itself.



Always wear gloves when handling the xenon lamp.

Figure 16.1b: Carefully pull up on the lamp handle.

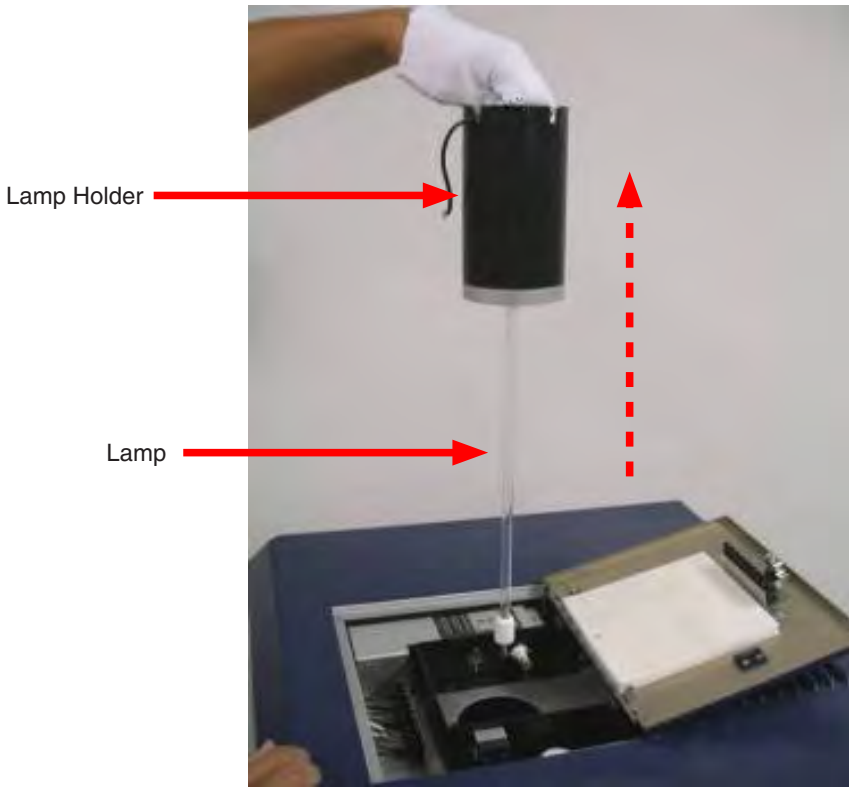


Figure 16.1c: Pull the lamp straight up to remove from the tester.

5. While wearing the glove supplied with the lamp, remove the old lamp from the lamp holder (Figure 16.1d).
6. Carefully remove the new lamp from the packaging (Figure 16.1e).
7. Slide the new lamp into the connector in the lamp holder (Figure 16.1f).

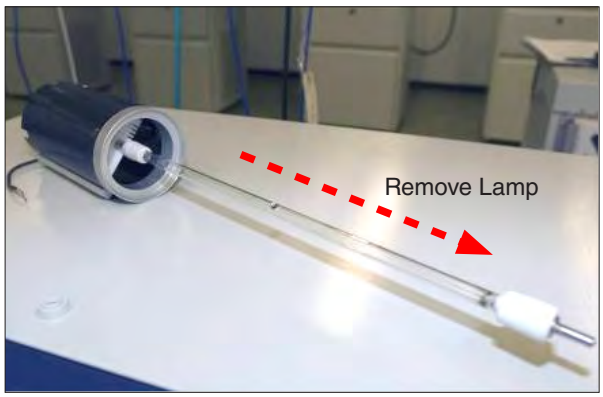


Figure 16.1d: Remove old lamp from holder.

IMPORTANT: If the lamp is touched by bare skin it must be cleaned using the alcohol pad supplied with the lamp.

Figure 16.1e: Remove new lamp from packaging. Wear the glove.

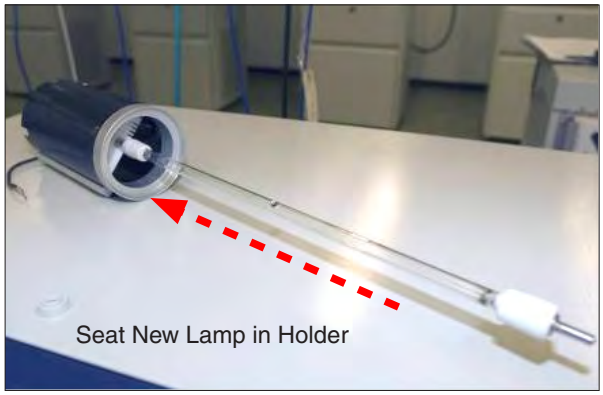


Figure 16.1f: Carefully slide the new lamp into the holder.

8. Open the chamber door and remove several specimen holders (Figure 16.1g).
9. Insert the lamp down through the lantern (Figure 16.1h). Be careful to guide the lamp past the trigger wire in the middle of the lantern.
10. Position the lamp so that the bottom lines up with the bottom connector.

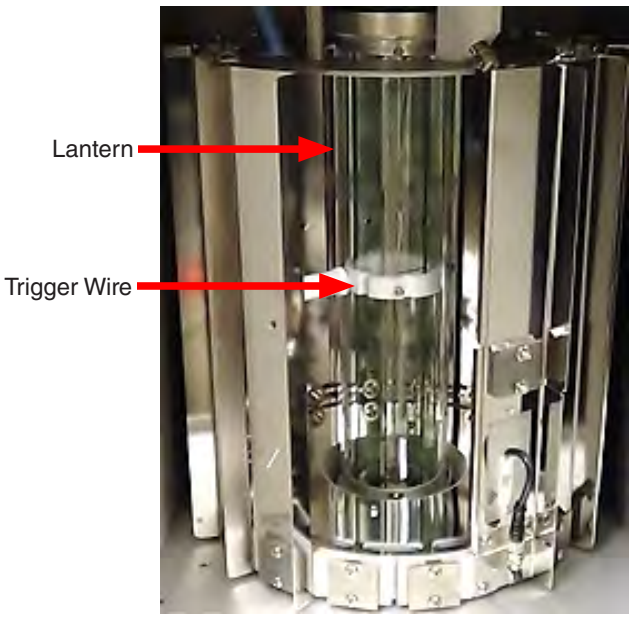


Figure 16.1g: Remove specimen holders to view the filter lantern. Locate the trigger wire.

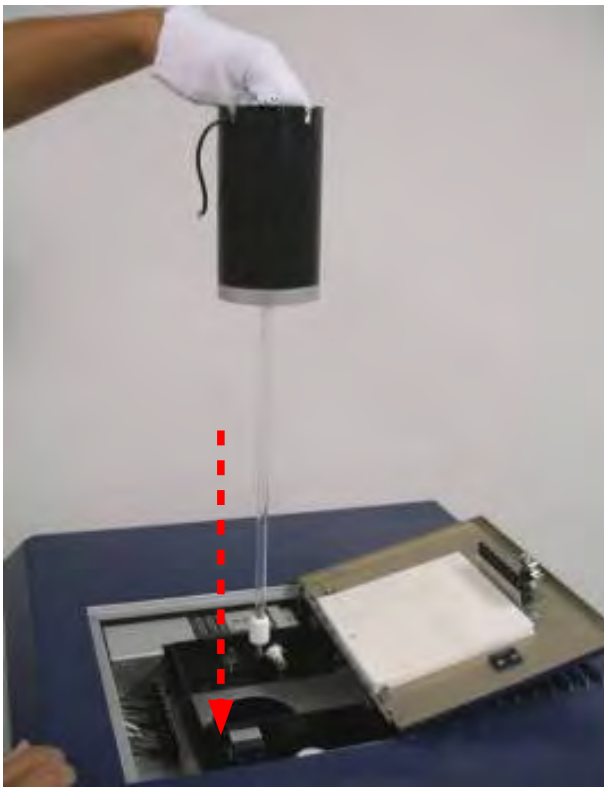


Figure 16.1h: Carefully lower lamp into the tester.

11. Gently push down on the lamp holder to seat the lamp in the bottom connector (Figure 16.1i). There should be slight resistance when doing this. If more than slight force is necessary, the lamp pin is probably not lined up with the connector, or the lamp holder is not lined up with the lantern.
12. Reconnect the lamp power wire (Figure 16.1l).

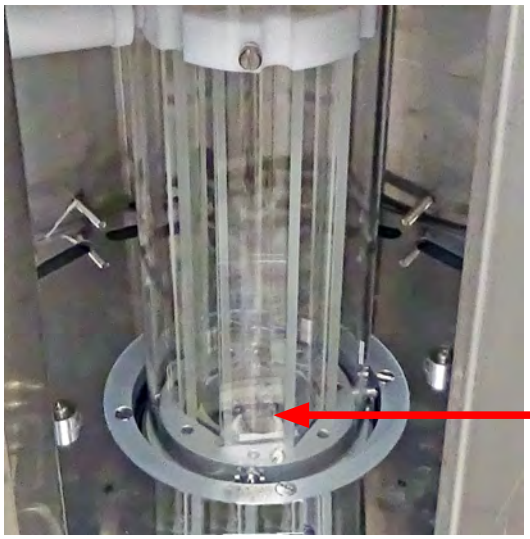


Figure 16.1i: Lamp bottom connector.

When the lamp is properly installed there should be no gap between the lamp holder and the top of the lantern. See Figure 16.1j and Figure 16.1k.

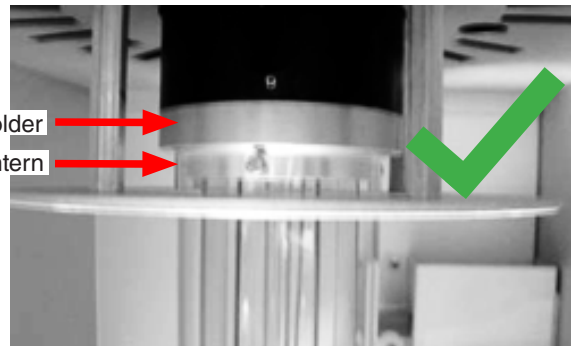


Figure 16.1j: Lamp properly installed.

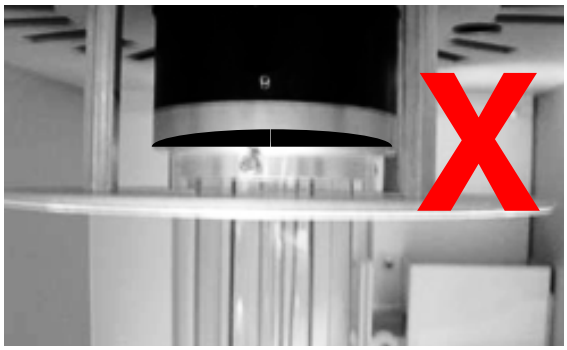


Figure 16.1k: Lamp **NOT** properly installed.

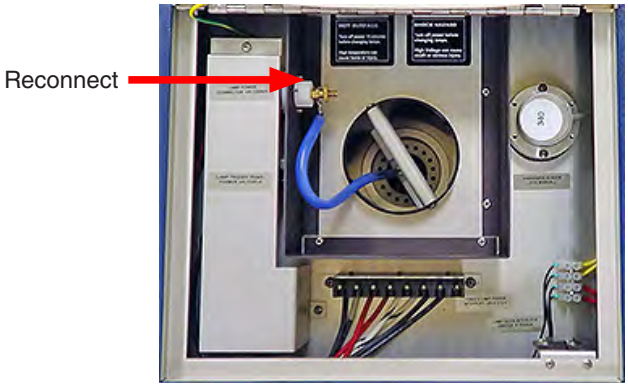


Figure 16.1l: Reconnect the power wire. Tighten the nut.

Recalibrate the irradiance sensor (see Section 13.1 for instructions).

16.2 Optical Filter Assembly Maintenance (Nov 2020)

- The UV optical filter assembly (lantern) should be inspected regularly for deposits on the UV filters and the outer cylinder.
- Deposits will block some of the light from getting to the specimens.

16.2.1 Inspection

1. First remove the lamp as described in Section 16.1.
2. Remove all specimen holders from the turntable.
3. Unscrew the trigger wire from the lantern. Lift the lantern about 25 mm and tilt the bottom of the lantern towards the chamber door. (Figure 16.2.1a).
4. Once the bottom of the lantern is clear of the turntable, lower the lantern through the top reflector and remove from the tester (Figure 16.2.1b).
5. Look for any haze or cloudy buildup on the UV filters and cylinder.
6. If UV filters and/or cylinder are hazy or cloudy, they must be cleaned (see Section 16.2.2).

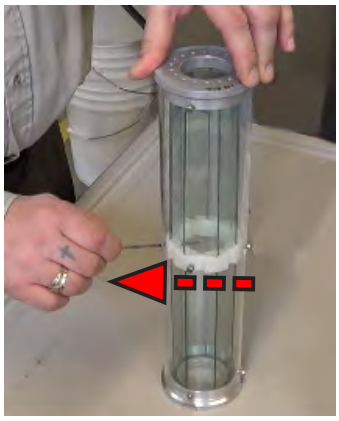
Figure 16.2.1a: Remove trigger wire from lantern.

Figure 16.2.1b: Remove lantern.

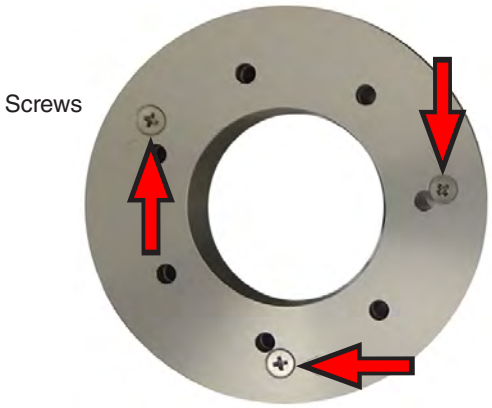
16.2.2 Cleaning

- To clean the optical filters, first the lantern must be disassembled.
- Next the individual filter segments and the lantern cylinder are cleaned.
- Finally, the lantern is reassembled and reinstallled in the test chamber.

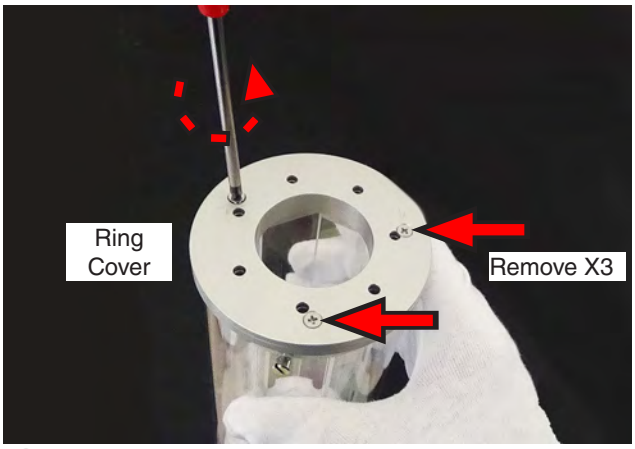
Disassembly



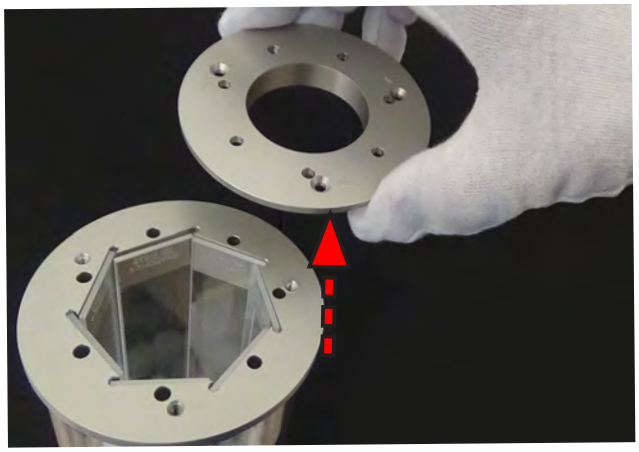
1. Place lantern on flat surface. Remove the trigger wire from the lantern. Set aside.



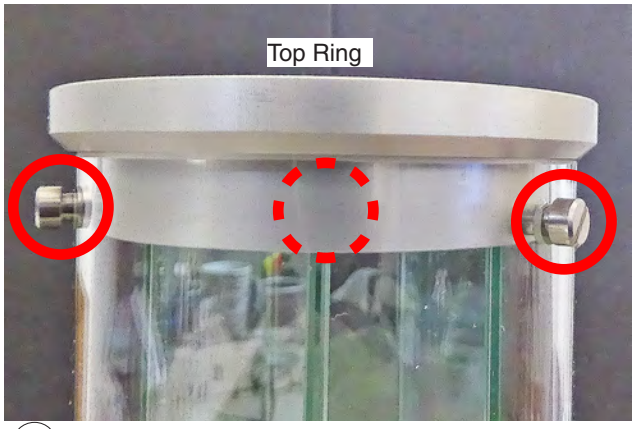
2. Locate the three (3) screws in the lantern top ring.



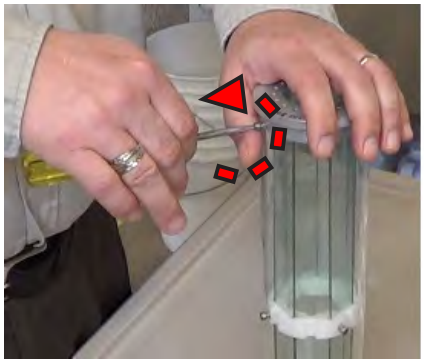
3. Use a Phillips screwdriver to remove three screws in the lantern ring cover. Save the screws.



4. Remove the ring cover from the lantern. Set aside.

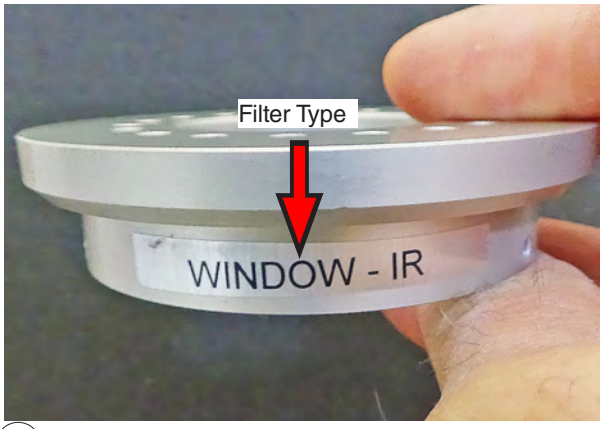


5. Locate the three (3) top ring screws on the side of the lantern. **NOTE:** This type lantern has no ring covers.



6. Use a flat blade screwdriver to remove three screws in the lantern ring. Save the screws.

7. Remove the ring from lantern. Set aside.



8. Locate the filter type label on the lantern top ring. **NOTE: the** filter type is also etched on each filter segment.

Filter Type

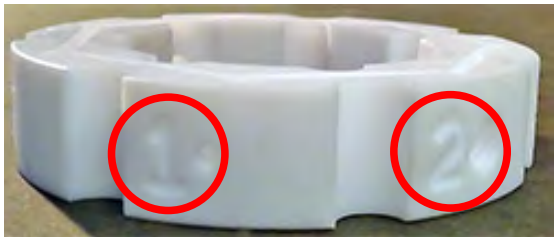
- Extended UV-Q/B
- Daylight-B/B
- Daylight-Q
- Daylight-F
- Window-B/SL
- Window-Q
- Window-SF5

9. For lanterns with filter types listed here, remove the filter segments from the lantern. Set aside. Go to Step 14.

Filter Type

- Window-IR
- Window-B04

10. For lanterns with filter types listed here, the filter segments must be removed and replaced in the lantern in exactly the same order. Go to Step 11.



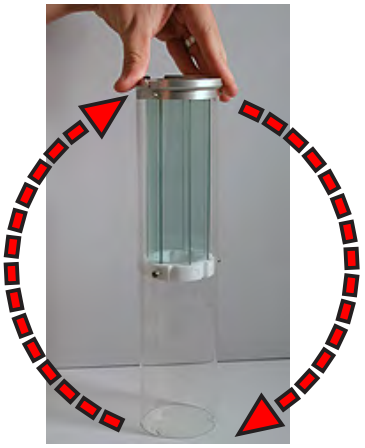
Numbers on Center Ring

11. The center ring in these lanterns have the numbers 1 through 7 to identify the filter segment order.

12. Remove filter segments in numerical order beginning with number 1. Keep the filter segments in order before and after cleaning.

Top Filter Segments in Order on Numbered Paper

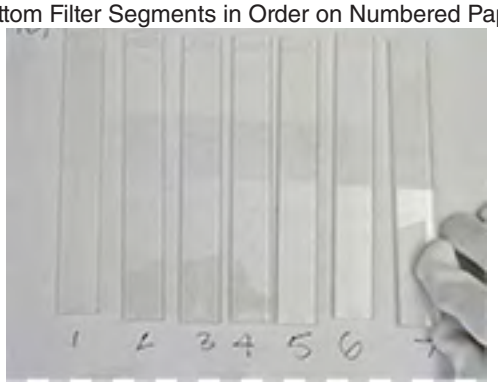
13. To easily keep filter segments in order, place and number the segments (Top 1 - 7) on a piece of paper or cardboard.



14. Flip the lantern over.

15. Remove the bottom seven (7) filter segments from the lantern.

Bottom Filter Segments in Order on Numbered Paper



16. For Window-IR/ Window-B04 filters, keep filter segments in order, place and number the segments (Bottom 1 - 7) on a piece of paper or cardboard.

Lantern Cylinder

Clean Can 2.75" (69 mm) diameter maximum

17. Use a clean, oil-free spray can (or similar) to support the lantern glass cylinder.

Center Ring

18. Place the lantern cylinder over the can. Seat center ring on the top of the can.

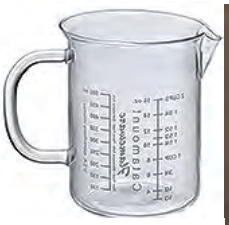
Remove

19. Use a flat blade screwdriver to remove three (3) screws in lantern center ring. Save the screws.

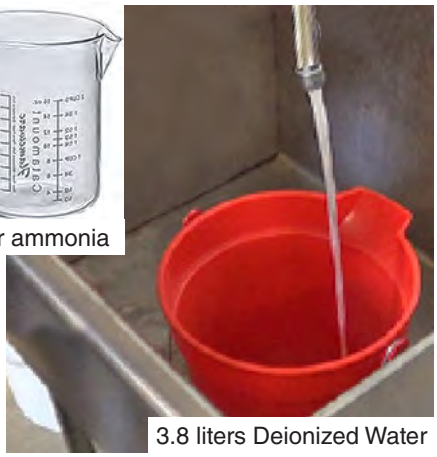
20. Remove the lantern cylinder from the can. Set aside.

21. Save the center ring.

Cleaning

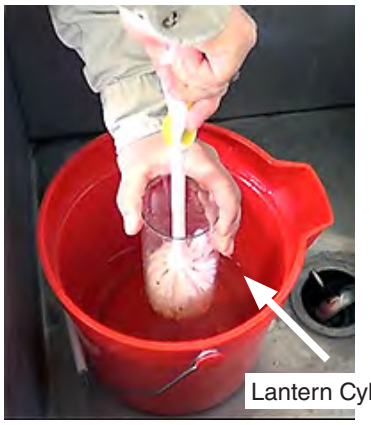


0.25 liter ammonia



3.8 liters Deionized Water

22. Mix one cup (.25 liter) ammonia with one gallon (3.8 liters) deionized water.



Lantern Cylinder

23. Clean the lantern cylinder inside with a clean brush and the ammonia solution.

Lantern Cylinder

24. Use a clean sponge to wipe the outside of the lantern cylinder.

Deionized Water

25. Rinse lantern cylinder inside and outside with clean deionized water.

Do not touch clean cylinder with bare hands.

26. Dry lantern cylinder inside and outside with a clean paper towel. Set lantern cylinder aside.

- For lanterns with Window-IR and Window- B04 filters, clean filters in numerical order.
- Keep filters in order after cleaning.

Filter Segment

27. Clean all filter segments with the sponge and the ammonia solution.

28. Rinse filter segments with deionized water.

29. Dry filter segments with clean paper towels. **IMPORTANT**: Hold filters at edges.

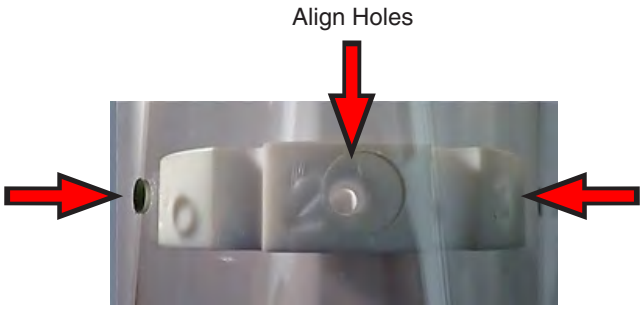
Do not touch clean filter segments with bare hands.

30. **IMPORTANT:** For lanterns with Window-IR and Window-B04 filters, keep filters in order after cleaning.

Reassembly

31. Lower clean lantern cylinder over the can. Handle cylinder with clean gloves. Do not touch clean cylinder with bare hands.

32. Lower center ring into cylinder onto can. For lanterns with Window-IR and Window-B04 filters, make sure numbers on center ring are right side up.



33. Make sure that small holes in the cylinder align with holes in the center ring as shown above.

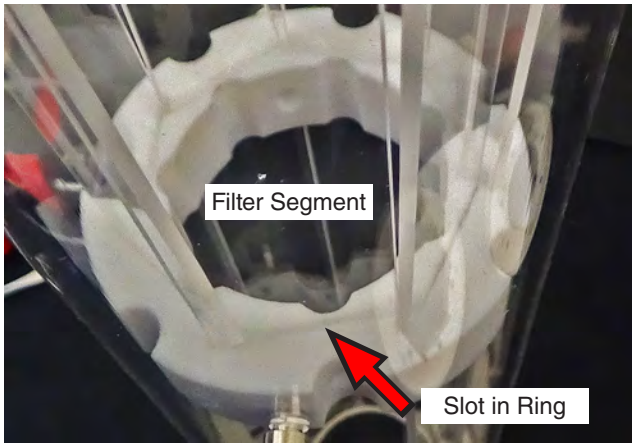
34. Insert three (3) screws removed in Step 19 through small cylinder holes into the center ring.

35. Tighten the three (3) screws in center ring. Tighten to stop. **DO NOT** over tighten screws.

36. Remove the lantern cylinder from the can.

- Do not touch clean filter segments with bare hands.
- For Window-IR and Window -B04 filters. Reinstall filter segments in same order and center ring position from which they were removed.

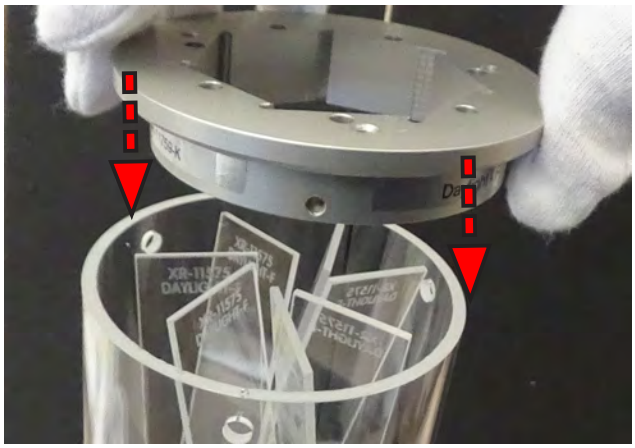
37. Reinstall seven (7) top half filter segments into center ring.



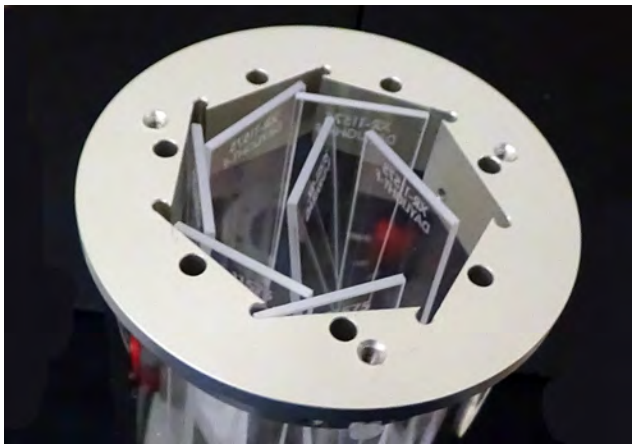
38. Seat the filter segments into slots in the center ring.

39. The part number etched in the filter segments should be at the top of the cylinder as shown here.

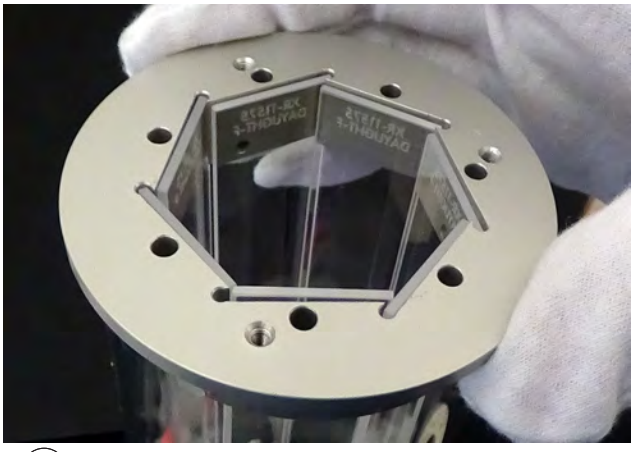
40. Push all the filter segments toward the center of the cylinder as shown.



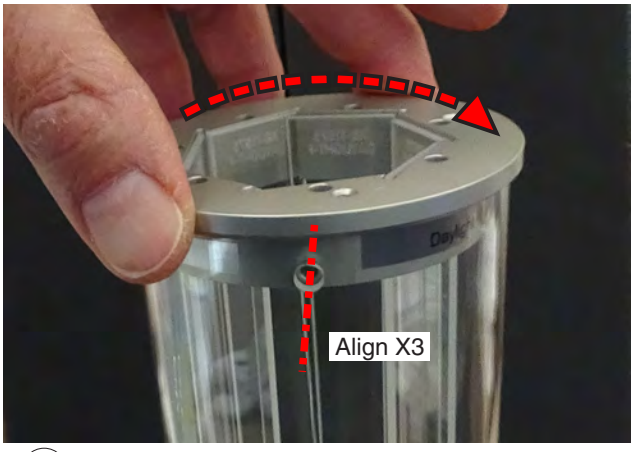
41. Place top ring on cylinder, keeping all filter segments inside the bottom rim of the ring.



42. Use a small screwdriver to carefully position all filter segments inside the ring.

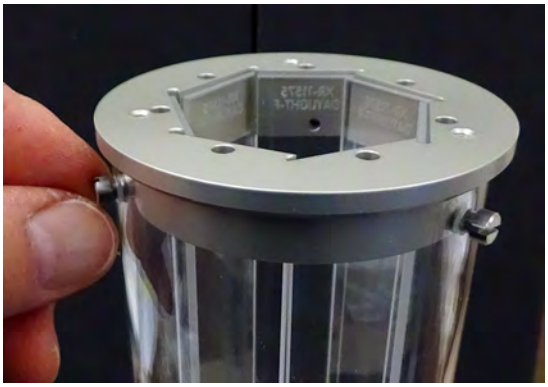


43. Carefully position filter segments into the slots in the ring.

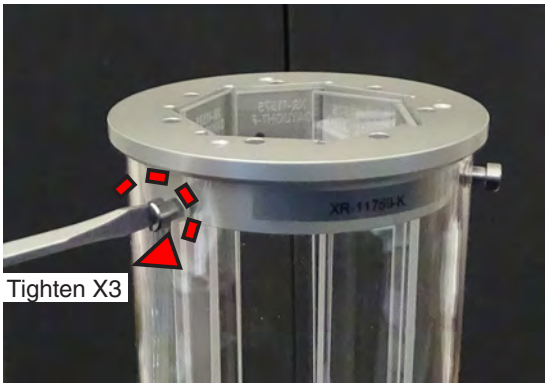


44. Slowly rotate the ring clockwise to align holes with holes in the cylinder, and filter segments in the slots.

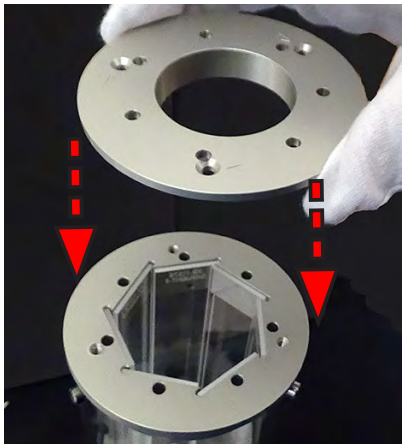
Insert



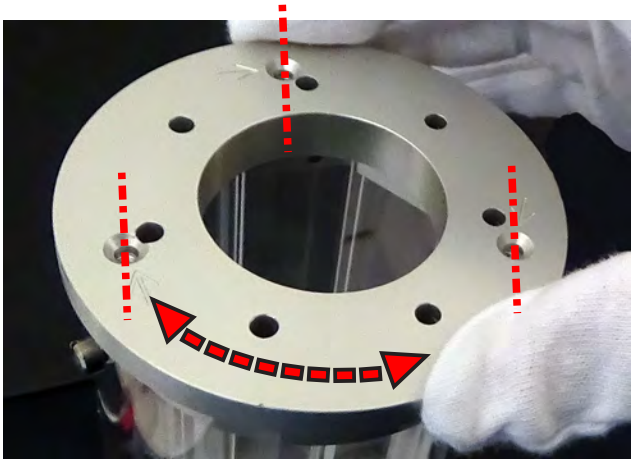
45. Insert three screws into the ring. Start the thread.



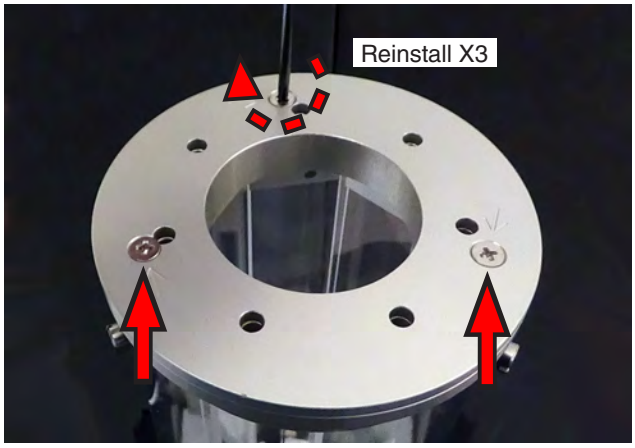
46. Tighten the three (3) screws in the ring. Tighten to stop. **DO NOT** over-tighten screws.



47. Place ring cover on top of ring.



48. Rotate cover to align the countersunk holes in the cover with the tapped holes in the ring.

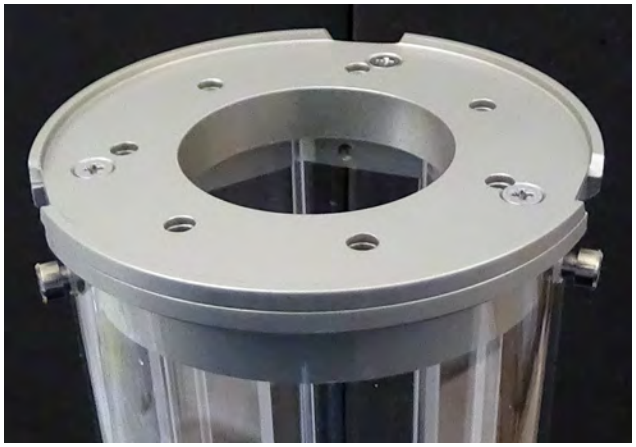


49. Reinstall the three (3) screws.

50. Flip the lantern over.

- Do not touch clean filter segments with bare hands.
- For Window-IR and Window -B04 filters. Reinstall filter segments in same order and center ring position from which they were removed.

51. Reinstall seven (7) bottom half filter segments into center ring.

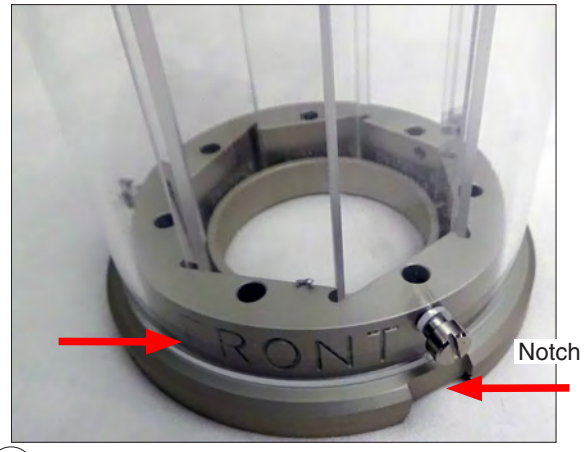


52. Repeat Step 38 through Step 49 to reinstall the lantern bottom ring and cover.

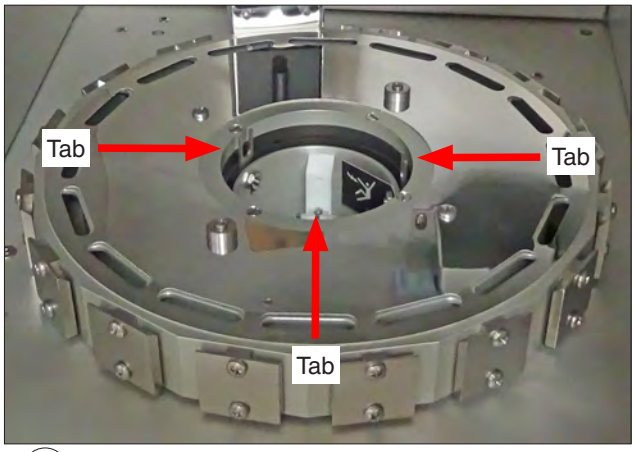
53. Reinstall the trigger wire in the center ring.

- Use a glove.
- Do not touch clean cylinder with bare hands.

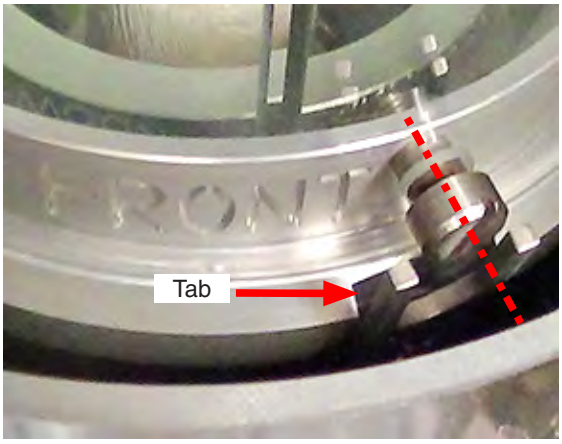
54. Reinstall clean lantern in the Q-SUN test chamber. Use a glove to hold lantern.



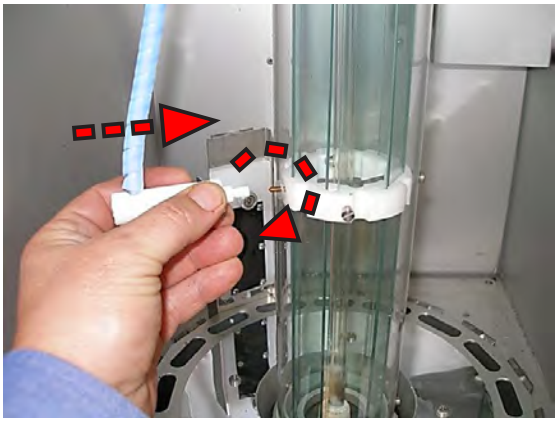
58. The word **FRONT** on the bottom ring of the lantern must face the front of the chamber



59. Notches in the lantern must line up with the tabs in the center of the turntable.



55. Align screws and notches in bottom ring with tabs on the turntable.

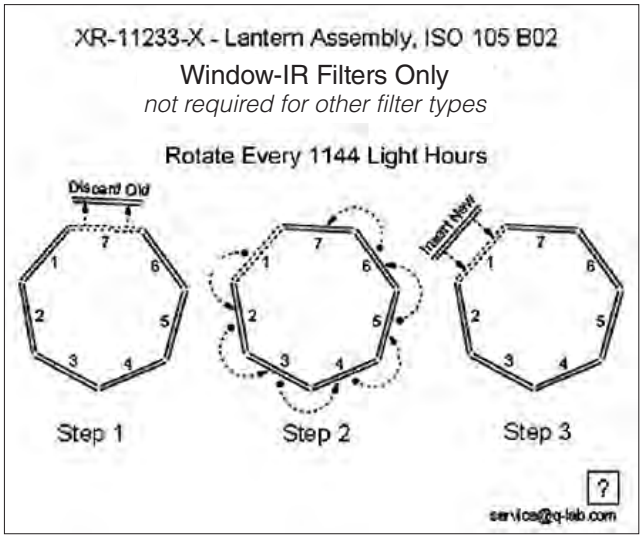


56. Reconnect lamp trigger wire. Tighten the connector.

57. Reinstall the lamp. See Section 16.1 for lamp installation instructions.

16.3 Window-IR Filter Rotation (Nov 2020)

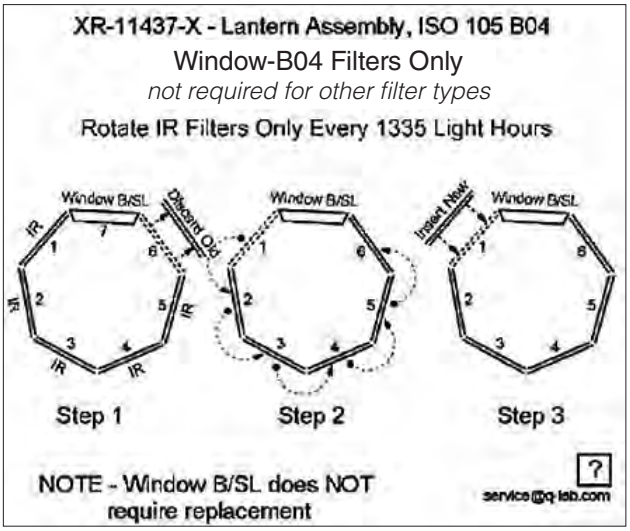
- The spectral transmission of Window-IR filters changes as they age.
- Therefore, for consistent results over time, they should be rotated as shown in the diagrams below.
- This is only necessary with Window-IR filters.
- Window-IR filters are used either as the sole optical filter in a lantern, or as part of the Window-B04 lantern along with Window-B/SL filters.
- In the Window-B04 lantern, only the Window-IR segments need to be replaced, not the Window-B/SL.



Step 1: Discard the top and bottom filter in position 7.

Step 2: Rotate the other filters as shown.

Step 3: Install a new filter in the top and bottom of position 1.



Step 1: Discard the top and bottom filter in position 6.

Step 2: Rotate the other filters as shown.

Step 3: Install a new filter in the top and bottom of position 1.

NOTE: The Window – B/SL filter in position 7 is not rotated.

16.4 Lamp Reflector Cleaning (Oct 2020)

- The reflector at the top and bottom of the lamp (Figure 16.4) should be cleaned with a soft lint-free cloth moistened with alcohol every time the outer cylinder is cleaned.

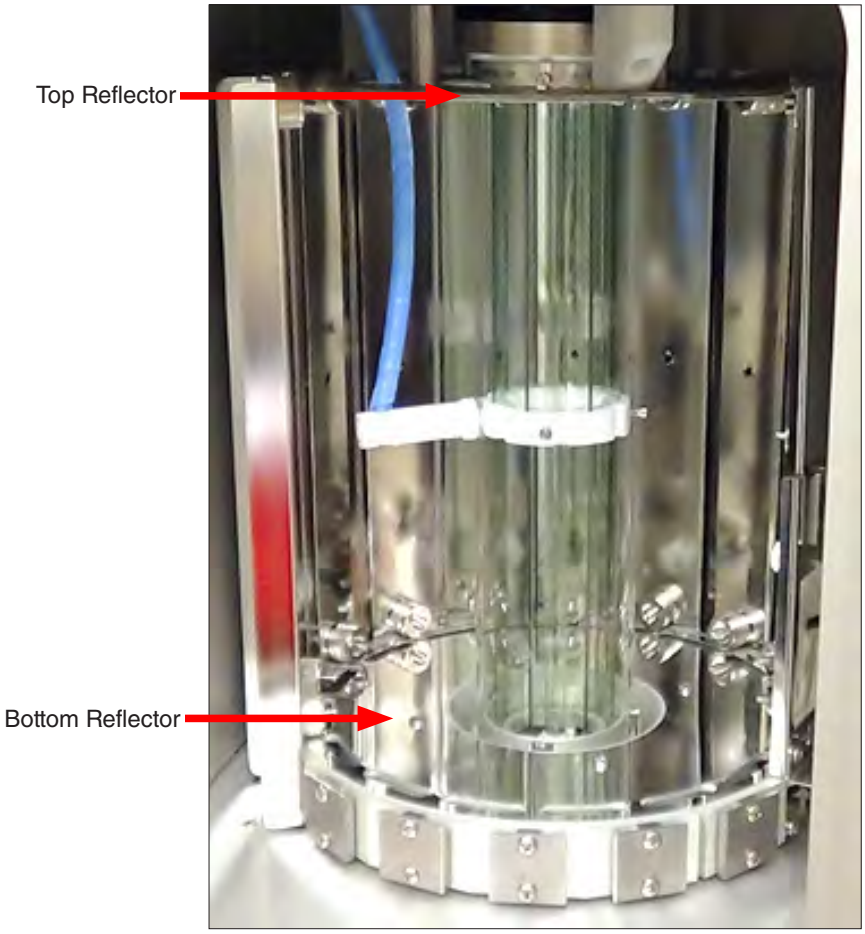


Figure 16.4: Lamp reflector cleaning.

16.5 Air Filter Cleaning (Nov 2020)

- Remove and inspect the two air filters every month. Inspect more frequently if the Xe-2 is run in a dusty environment.
- Filters are located behind the lower front door.
- If the tester is equipped with disposable air filters, replace as necessary
- If the tester is equipped with washable filters, see the following pages for washing instructions.

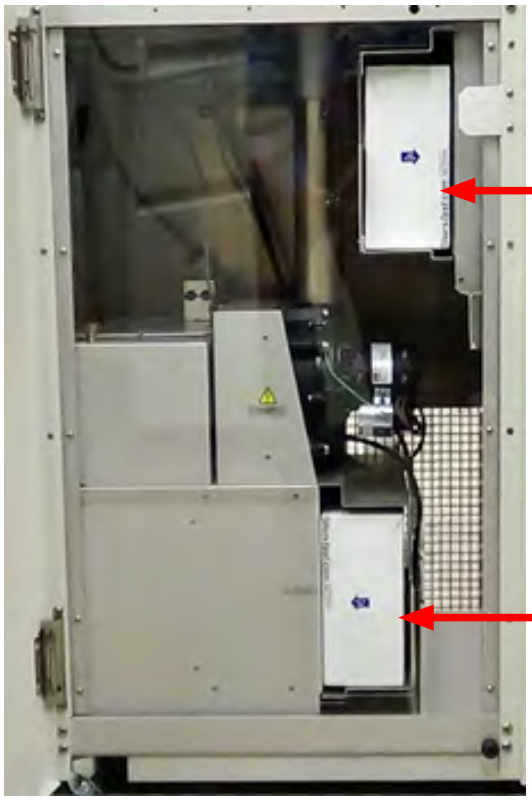


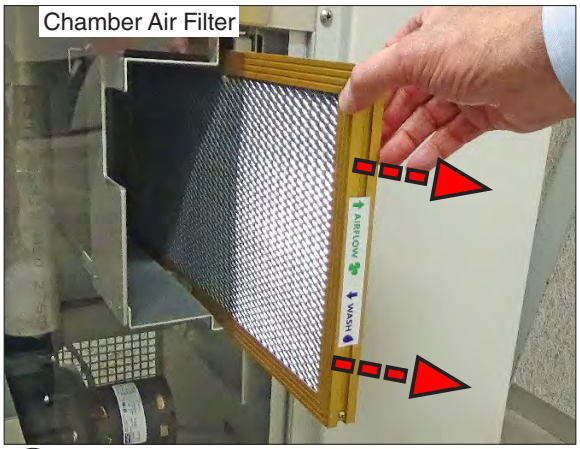
Figure 16.5a: Air filter locations.

XR-11515 Disposable Air Filter

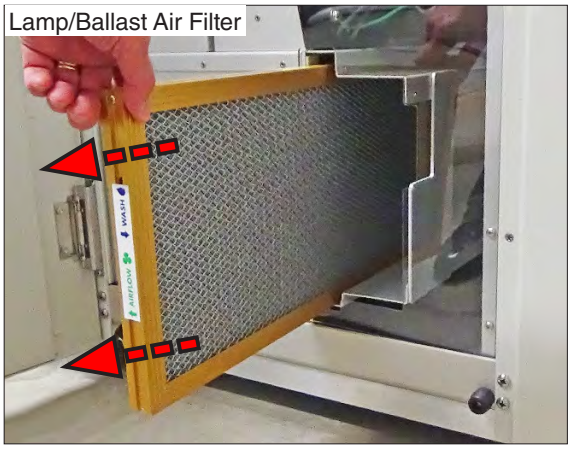
XR-11514-K Washable Air Filter

Figure 16.5b: Air filters.

NOTE: The same filter is used for both the chamber air and the lamp/ballast air.



1. Open the Xe-2 lower front door. Remove the chamber air filter from the tester.



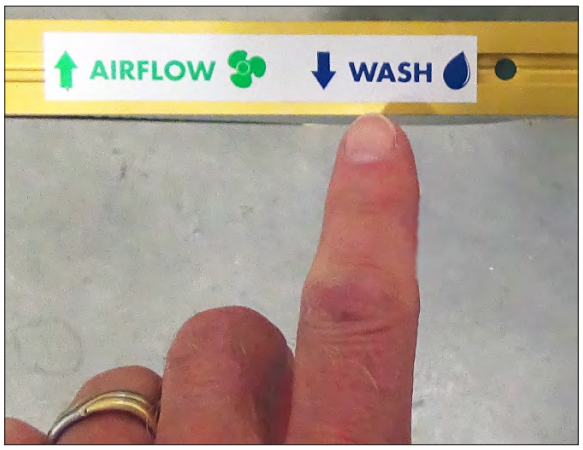
2. Open the Xe-2 lower front door. Remove the lamp/ ballast air filter from the tester.

Less Than 3 Years Old - Wash

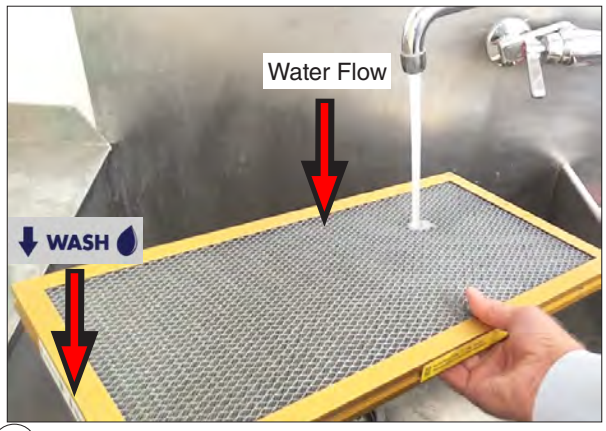
3. If the date on the filter label is less than 3 years older than the current date, the filter can be washed and reinstalled. See Step 5 through Step 11.

More Than 3 Years Old - Discard

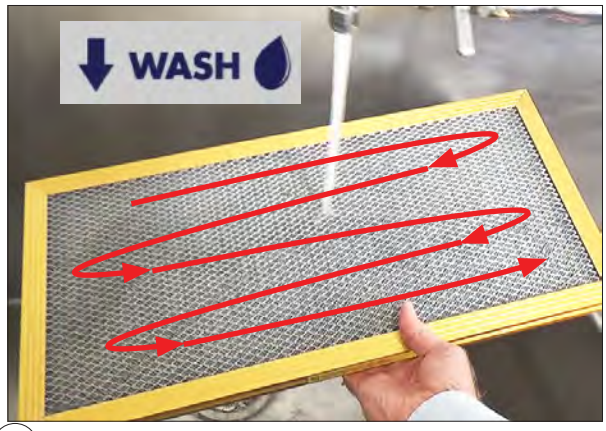
4. If the date is more than 3 years older than the current date, discard the filter. Replace with XR-11514-K (see Section 18).



5. Locate **WASH** label on edge of filter.

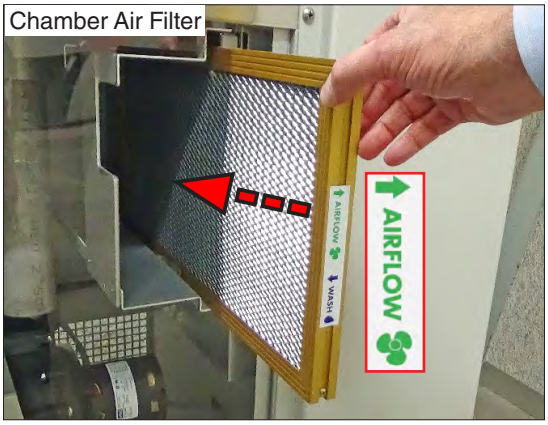


6. Hold filter under **CLEAN** running water. **IMPORTANT:** Water flow MUST BE in direction of **WASH** arrow.

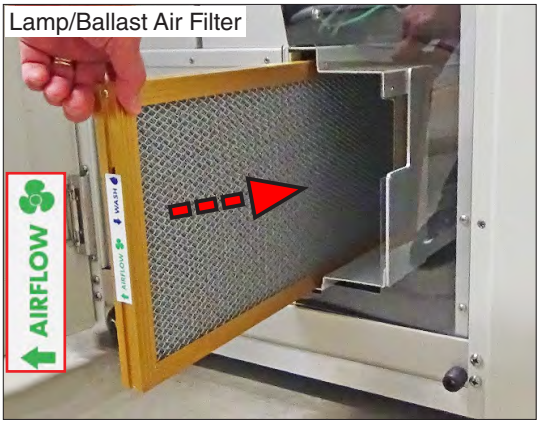


7. Wash all of filter. **NOTE:** If rinsing with water does not remove dirt, use an electrostatic air filter cleaner spray.

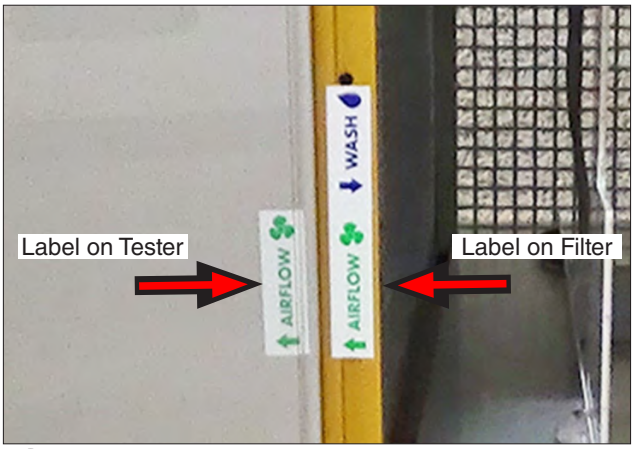
8. Allow water to drain from the air filter before reinstalling.



9. Reinstall the chamber air filter.
IMPORTANT: Make sure arrows on the airflow labels are in direction shown.



10. Reinstall the lamp/ballast air filter.
IMPORTANT: Make sure arrows on the airflow labels are in direction shown.



11. Make sure the air flow label on the filters matches the air flow labels on the tester.

16.6 Humidifier Water Pan Cleaning (Oct 2020)

The humidifier water pan should be inspected and cleaned every 6 months to remove bacteria.

If it requires cleaning:

1. Unplug the power cord
2. Shut off the water supply to the Q-SUN tester.
3. Remove the screws that mount the clear cover.
4. Remove the water shields.
5. Make sure the drain hose is properly connected.
6. Pull the overflow stem straight up to drain the water pan.
7. Remove the three wing nuts that hold the humidifier disk in place.
8. Remove the disk.
9. Clean the water pan with alcohol or a mild detergent, and flush with clean water.

Figure 16.6a: Humidifier Cover

Figure 16.6b: Humidifier Water Pan

16.7 Humidifier Reservoir Cleaning (Oct 2020)

The humidifier reservoir and pump should be inspected and cleaned every 6 months. Before cleaning, unplug the power cord and shut off the water supply to the Q-SUN tester.

1. Disconnect the water pan supply tube.
2. Disconnect the pump power cord.
3. Remove the reservoir cover to access the pump under the cover
4. Pull the overflow stem straight up to drain the reservoir.

- See *Service Instructions XR-11578-L* for detailed humidifier reservoir cleaning instructions. Contact Q-Lab Repair and Tester Support for more information.

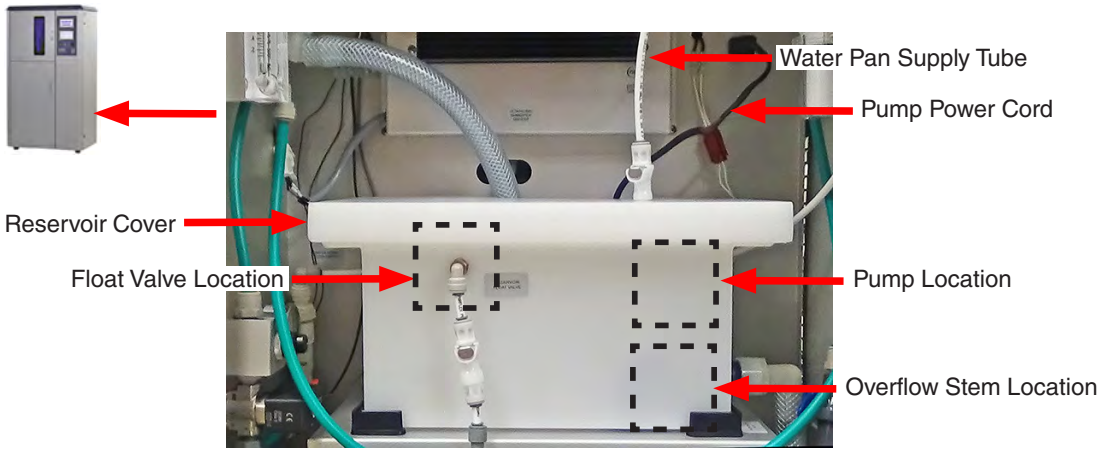


Figure 16.7a: Humidifier Reservoir

16.8 Spray Nozzle (Oct 2020)

- In Xe-2-HSE and Xe-2-HBSE models the spray nozzle(s) should be checked regularly to insure that the spray water is flowing properly.
- Open the chamber door during a spray step (it will continue to spray for one minute).
- Remove several specimen holders to the left of the front spray nozzle but leave the specimen holder directly in front of the front spray nozzle in place.
- Check to make sure the water spray covers the entire height on the *inside* (facing the lantern) of the specimen holder.
- If the water spray does not cover the entire height, replace the front spray nozzle (part number XR-11330-K).

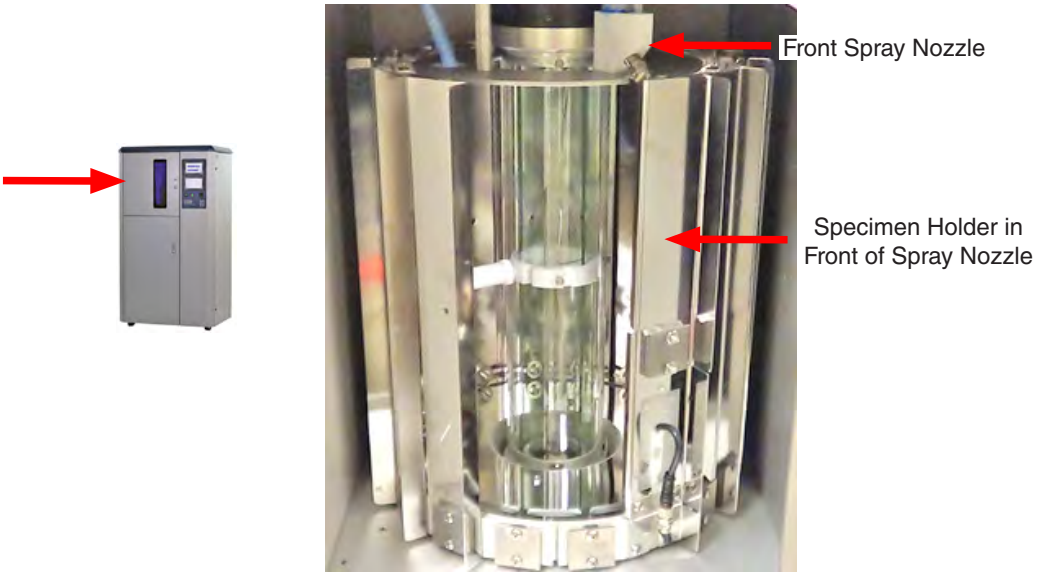


Figure 16.8a: Check front spray nozzle in Xe-2-HSE and Xe-2-HBSE testers.

- For Xe-2-HBSE models make sure the water spray covers the entire height on the *outside* of the specimen holder.
- If the water spray does not cover the entire height, replace the back spray nozzle (part number XR-11330-K).

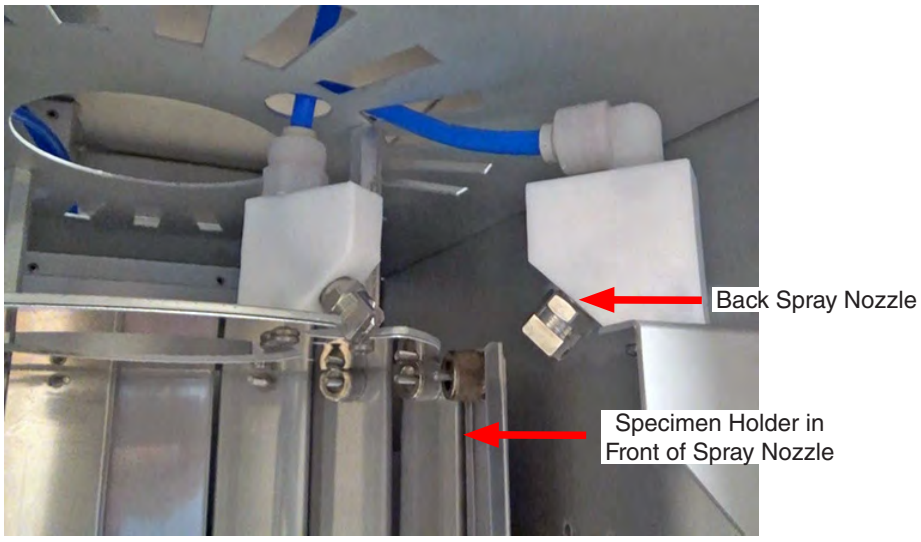
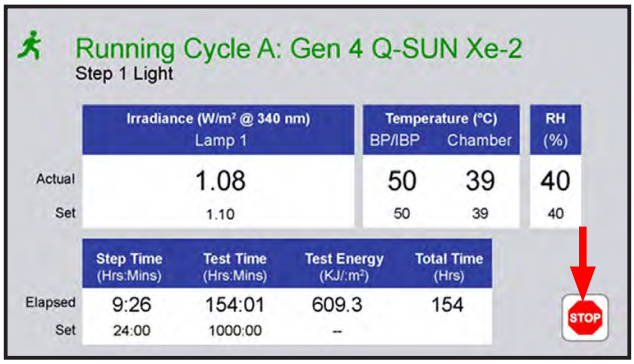


Figure 16.8b: Check back spray nozzle in Xe-2-HBSE only.

16.9 Water Filter Check (Nov 2020)

- Every six months, check the water filter and replace it if dirty.
- Follow the steps below to check and install the filter.

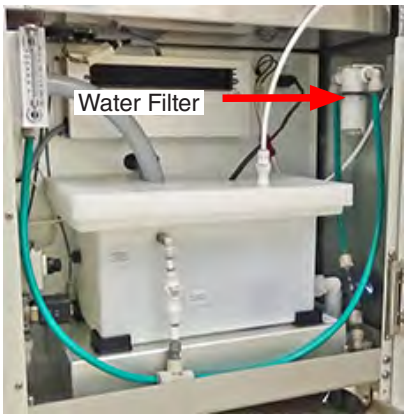


1. Touch the STOP icon on the Status Screen.

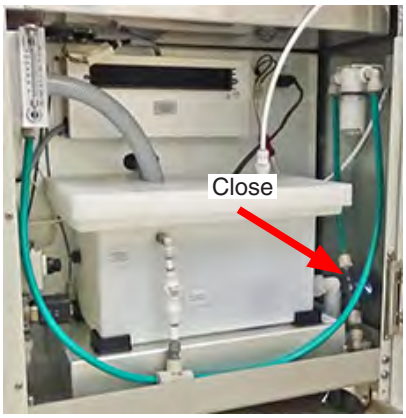
2. Tester power **OFF**.

3. Use a flat blade screwdriver to open the latches on the right side door.

4. Open the right side door.



5. Locate the water filter inside the Xe-2 enclosure.

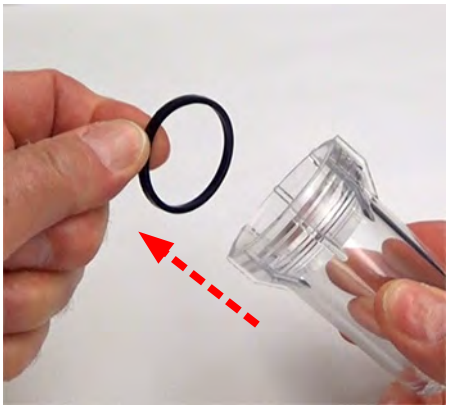


6. Close the water shut off valve.

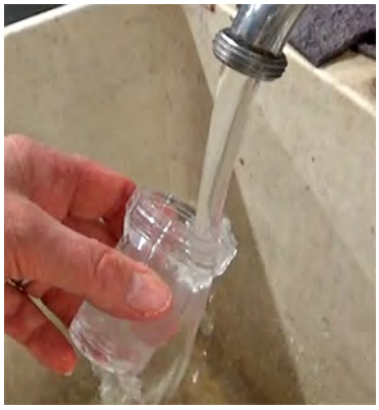
7. Unscrew the filter housing.

8. Remove the filter housing from the filter cap.

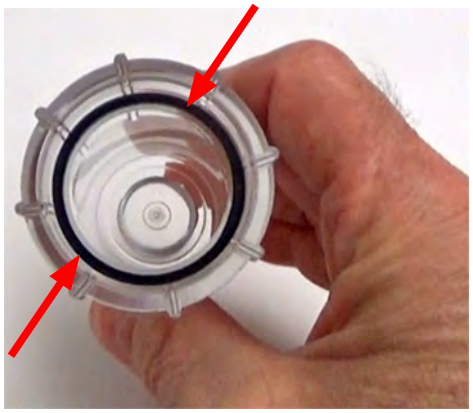
9. Remove the old filter from the filter cap. If the filter is dirty it should be replaced. Discard the old filter. If not dirty, just reinstall.



10. Remove the gasket from the filter housing. Wipe the gasket clean.



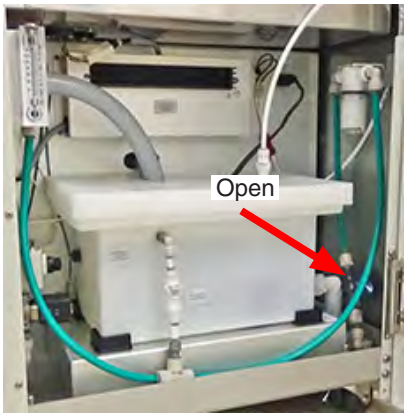
11. Clean the inside of the filter housing. Clean the gasket groove.



12. Replace the gasket in the filter housing.

13. Install a new filter (Part Number F-8066.5) in the filter cap.

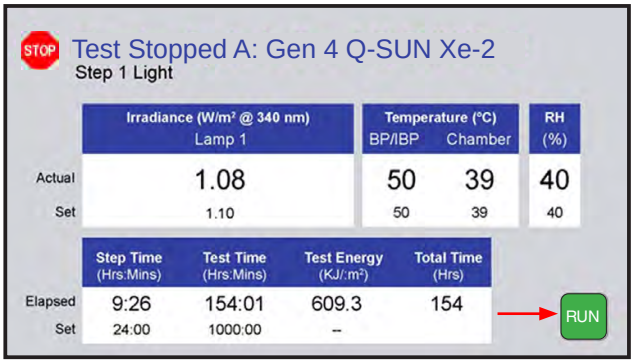
14. Reinstall the filter housing on the cap. Do Not Over-Tighten.



15. Open the water valve. Allow filter housing to fill with water.

16. Close and latch the right side door.

17. Tester power **ON**.



18. Press **RUN** on the tester Status Screen.

16.10 Software Updates (Oct 2020)

- Q-Lab periodically updates the software that runs the Q-SUN to improve tester performance.
- Q-Lab recommends that customers check www.q-lab.com/software for new software versions every year to determine if any mandatory software updates have been released and should be installed.
- The files required to perform software updates can only be obtained by contacting Q-Lab.

Software Version and Tester Serial Number

- The currently-installed Q-SUN software version number and tester serial number are required to determine if a software update needs to be performed.
- The Q-SUN serial number and the software version are listed in the diagnostics screen accessed from the controller main menu.
- See Section 11.8 for instructions to display the tester serial number (diagnostic D24) and software version (diagnostic D9). The serial number can also be found on the nameplate attached to the rear of the Xe-2 cabinet.

Software Types

- Once you have the tester serial number and software version number, visit www.q-lab.com/software.
- The most recent versions of Q-SUN software will be listed and identified as either **Required**, **Recommended,** or **Optional**.
  - **Required** updates must be installed immediately, as they address issues that may strongly affect tester performance and/or pose a safety concern.
    - If a Required software version is more recent than the version currently installed on the Q-SUN (see previous section), that software needs to be installed.
    - More recent software versions are indicated by a higher version number (e.g. 4.110 and 4.200 would both be more recent than 4.100).
  - **Recommended** updates should be installed as soon as possible, as they offer a significant improvement and/or make an important correction.
  - **Optional** updates should not be installed unless Q-Lab personnel have directed you to do so.

Software Update Process

- The appropriate software update file can be obtained either by contacting Q-Lab Repair directly or by filling out the web-based form on www.q-lab.com/software.
- Q-Lab Repair and Tester Support personnel will contact you to discuss your situation and, when applicable, provide you with necessary software files and instructions to perform an update.
- Copy the software files (file format must be .ff4) to the root directory of a USB flash drive (Figure 16.10a).
- Connect the drive to the tester USB port on the control panel (Figure 16.10b).
- If a valid software file is on the USB drive, the controller will determine if that version is newer, the same as, or older than the software installed on the tester.
- On the USB Options screen, the software button label will reflect the relative software version (Figure 16.10c).
  - *Install New Software* means the software version on the USB drive is newer than the version on the tester
  - *Install Current Software* means the software version on the USB drive is the same as the version on the tester.
  - *Install Older Software* means the software version on the USB drive is older than the version on the tester.
- Touch the software install button to begin the software update process.
- Touch OK to confirm software installation (Figure 16.10d).
- If at any time during the software upgrade process a problem occurs with the USB drive or the data storage card on the main controller board, an error message will be displayed on the tester control panel.
- See Section 20 for Q-Lab Repair and Tester Support contact information.

Figure 16.10a: Copy the software files from Q-Lab to a USB drive.

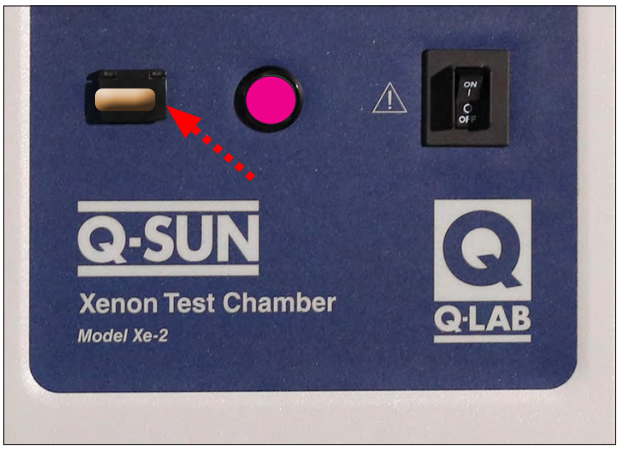


Figure 16.10b: Connect the drive to the USB port on the Q-SUN control panel.

Figure 16.10c: The USB Options screen displays the software installation button.

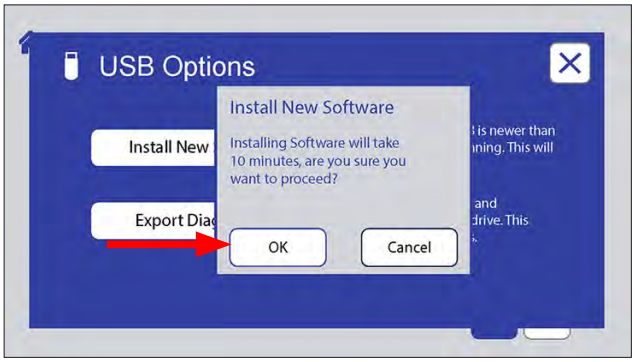


Figure 16.10d: Touch OK to proceed with software installation.

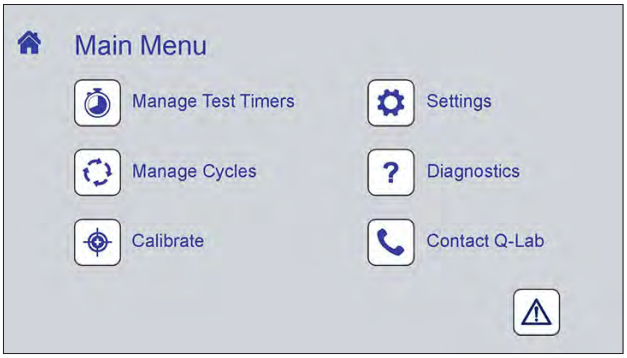


Figure 16.10e: After software installation, the tester will restart automatically. Following that restart, the tester can be operated normally.

17. Troubleshooting and Repair

- The Q-SUN Xe-2 is designed so that the user can make virtually all repairs.
- Only use replacement parts that have been supplied or recommended by Q-Lab.

17.1 Controller Will Not Start (Nov 2014)

- See that the power cord is connected and the circuit breaker is on.
- Check the main power switch on the Q-SUN Xe-2.
- Check the fuses on the main terminal strip.
- Check for 24VAC on the output of the transformer going to the controller.
- If the controller still does not start, replace it. See Section 20 for Q-Lab Repair and Tester Support contact information.

17.2 Notifications (Oct 2020)

Conditions & Recommended Actions

- Notifications provide normal operating information and messages indicating that there is a problem.
- The problem may be that the test parameters chosen cannot be attained.
- The table below provides information on the complete list of Notifications.

IMPORTANT WARNING

The “recommended actions” shown below will sometimes instruct the technician to work in areas inside of the Xe-2 that allow exposure to high voltage and hot surfaces. Only a qualified technician should perform work on the Xe-2 electrical system.

Code	Message	Condition & Recommended Action
M1	Chamber Door is Open	Chamber door is open.
M2	Lamp Door is Open	The lamp door is open. If the lamp door is closed, check lamp door interlock.
M3	Waring, Chamber Door Interlock Error	If chamber door switches 1 and 2 do not agree. One interlock is defective or needs adjustment.
M10	End of Test	MESSAGE ONLY program step. The user must shut off the machine manually.
M11	End of Test	ALARM program step. Alarm sounds but the machine will continue to run.
M12	End of Test Shutdown	Appears at the end of your test if you have chosen the STOP action in your program. The machine will shut down.
M13	End of Test Shutdown	STOP + ALARM action in your program. The machine will shut down.
M14	Time to Replace Lamp	3000 Lamp operation hours have elapsed.
M15	Time for Routine Service	2000 Machine operation Hours have elapsed. Refer to Section 16 of this manual for preventative maintenance information.
M16	Black Panel Temp Too Hot XXX °C	Black panel temperature is 3 or more degrees higher than the setpoint for 55 minutes. 1. The black panel setpoint is too low for the chamber air temperature setpoint. 2. The recirculated air blower (or drive) is bad. 3. The fresh air blower (or drive) is bad.
M17	Black Panel Temp Too Cold XXX °C	Black panel temperature is 3 or more degrees lower than the setpoint for 55 minutes. 1. The black panel setpoint is too high for the chamber air temperature setpoint. 2. The recirculated air blower (or drive) is bad. 3. The fresh air blower drive is bad.
M18	Chamber Air Temp Too Hot XXX °C	Chamber air temperature is 3 or more degrees higher than the setpoint for 55 minutes. 1. The setpoint is too low for the lab temperature. 2. The air heater relay is bad (failed on). 3. The fresh air blower (or drive) is bad. 4. The recirculated air blower drive is bad.

Code	Message	Condition & Recommended Action
M19	Chamber Air Temp Too Cold XXX °C	Chamber air temperature is 3 or more degrees lower than the setpoint for 55 minutes. 1. The setpoint is too high for the lab temperature. 2. The air heater relay is bad (failed off). 3. The air heater is bad. 4. The fresh air blower drive is bad. 5. The recirculated air blower (or drive) is bad.
M24	Lab Temp at Time of Alarm XXX °C	An informational notification that accompanies one or more stopping errors. This may be useful for diagnosis as lab temperature can be the cause of a chamber temperature or humidity fault.
M25	Controller Too Hot XX °C	The controller temperature is higher than the maximum allowable temperature. Move the Q-SUN into an air-conditioned room.
M26	Lamp/Ballast Blower Failure	1. The blower is bad. 2. The blower relay is bad. 3. The airflow switch is bad.
M27	Lamp/Ballast Blower On: Should be Off	1. The blower relay is bad. 2. The airflow switch is bad.
M30	Replace Battery	The controller's battery voltage is too low. Replace the battery. **CAUTION:** Dispose of the old Lithium battery according to local regulations and ordinances.
M31	Calibrate Light Sensors	The lamps have been on for 500 hours. Recalibrate the sensors.
M33	Wrong Radiometer: Should be UC20/340	The radiometer being used is a 420 nm or TUV type, but the Q-SUN has 340 nm sensors installed. Use a UC20/340 radiometer.
M34	Wrong Radiometer: Should be UC20/420	The radiometer being used is a 340 nm or TUV type, but the Q-SUN has 420 nm sensors installed. Use a UC20/420 radiometer.
M35	Wrong Radiometer: Should be UC20/TUV	The radiometer being used is a 340 or 420 nm type, but the Q-SUN has TUV sensors installed. Use a UC20/TUV radiometer.
M43	Water Spray Off: Should be On	The Q-SUN is running a spray step, but the spray is off. Possible causes are: 1. The water supply is turned off. 2. The solenoid valve is bad. 3. The flow switch is bad.
M44	Water Spray On: Should be Off	The Q-SUN is NOT running a spray step, but the spray is on. Possible causes are: 1. The solenoid valve is bad. 2. The flow switch is bad.
M46	Nebulizer Water Level Too Low	Water level in humidifier water pan is too low. Check water supply system. See Section 5.4.

Code	Message	Condition & Recommended Action
M49	Power Disrupted	This message indicates power was off and then came back on during a **RUN** step. The message appears if power goes out for any reason, including if the user turns power OFF when the tester is in RUN mode. Always press STOP before powering the Q-SUN off to prevent the M49 message from being displayed when the Q-SUN is powered back on.
M50	Chamber Humidity Too High XX%	The chamber humidity is 5% or more above set point.
M51	Chamber Humidity Too Low XX%	The chamber humidity is 5% or more below set point.
M52	Black Panel Temp Runaway XXX °C	The black panel temperature is more than 10 °C too hot for 1 minute 1. The black panel set point is too low for the chamber air temperature set point. 2. The recirculated air blower (or drive) is bad. 3. The fresh air blower (or drive) is bad.
M53	Chamber Air temp Runaway XXX °C	The chamber air temperature is more than 10 °C too hot for 1 minute 1. The set point is too low for the lab temperature. 2. The air heater relay is bad (failed on). 3. The fresh air blower (or drive) is bad. 4. The recirculated air blower drive is bad.
M56	Blower Controller Fault	1. Input voltage fluctuations. 2. Room temperature is too high. 3. Motor has failed. 4. Blower controller fault.
M58	Turntable Turning: Should be Stopped	Turntable relay is defective.
M59	Turntable Stopped: Should be Turning	1. Turntable rotation sensor needs adjustment or is defective. 2. Turntable relay is defective. 3. Turntable gear motor is defective. 4. Chamber door Interlock is defective.
M60	Low Irradiance: Change Lamp	The irradiance of a lamp channel is 5% below set point. Replace the lamp and recalibrate.
M61	Lamp Out	The irradiance is 30% below the set point. 1. The lamp burned out. 2. The ballast is bad. 3. The lamp relay is bad. 4. The trigger finger is bad.
M63	Irradiance Too High	The irradiance is 5% above the set point. 1. The dimming cable from the ballast and the controller is not properly connected. 2. The ballast is bad.
M64	Lamp On: Should be Off	The Q-SUN is in a dark cycle, but the controller senses the irradiance is above 0.05 W/m^2. Replace the lamp relay.
M65	AC Voltage Out of Range	Indicates that there may be a ballast shutdown due to low voltage. Check power supply to Xe-2.
M67	Lamp Relay Stuck On	The irradiance is above 0.05 W/m^2 during the “Relay Check.” 1. The lamp relay is defective. 2. Replace the lamp relay.

Code	Message	Condition & Recommended Action
M68	Run relay Stuck On	The irradiance is above 0.05 W/m² during the “Relay Check.” 1. The run power relay is defective. 2. Replace the run power relay.
M70	Black Panel temp Sensor Fail XXX °C	The Black Panel Temperature is less than 3 °C or greater than 180 °C. 1. Make sure connector is firmly seated. 2. Replace the Black Panel Temperature sensor.
M71	Black Panel Temp Disrupted XXX°C	The signal from the black panel temperature sensor is being disrupted.
M72	Air Temp Sensor Fail	The Air Temperature is less than 3 °C. 1. Make sure connector is firmly seated. 2. Replace the Air Temperature Sensor.
M74	Lab Temperature Sensor Fail	The Lab Temperature is less than 3 °C. 1. Make sure connector is firmly seated. 2. Replace the Lab Temperature Sensor.
M77	RH Sensor Fail	The RH sensor is reading less than 3%. 1. Make sure connector is firmly seated. 2. Replace the RH Sensor.
M79	Max Calibration Time Exceeded	Calibration time is limited to two hours. If calibration is incomplete, restart the Xe-2 and complete calibration in less than two hours.
M80	Flash Memory Failure	Checksum test on program failed. Contact Q-Lab Repair and Tester Support.
M81	Flash Data Corrupt	Parameter and setup data corrupted. Contact Q-Lab Repair and Tester Support.
M82	RAM Corrupted, RAM Reloaded	Error in RAM data. Data is reloaded from flash. Contact Q-Lab Repair and Tester Support.
M90	Time to Replace RH Sensor	The RH sensor needs replaced. See Section 9.2.
M101	SD Card Missing	The SD card on the main controller board is missing or not seated properly. Contact Q-Lab Repair.
M103	System Auto Reboot	The Q-SUN has restarted itself in order to avoid a potential problem in operation. Please contact Q-Lab Repair.
M104	Software Install Completed Successfully	Software has been installed without issue
M900	Status Screen Communications Failure	Communication lost between main controller and Status Screen. Tester will enter single-screen mode.
M901	Menu Screen Communications Failure	Communication lost between main controller and Menu Screen. Tester will enter single-screen mode.
M902	Main Controller Communications Failure	Message that appears on a screen that has experienced M900 or M901

17.3 Lamp (Nov 2014)

Lamp Will Not Start

- Trigger wire is not in good contact with lamp.
- Burned out lamp, try another lamp.
- Faulty Trigger/Transformer Assembly, replace assembly. See Section 18 for replacement parts.
- Faulty ballast.
- Faulty ballast auxiliary module.
- Faulty lamp relay.

Lamp Flickers During Operation

- Trigger wire is not in good contact with lamp.
- Faulty trigger/transformer assembly, replace assembly. See Section 18 for replacement parts.
- Reverse lamp - the trigger wire may not be making good contact with the lamp in the original position (see Section 16.1).
- Faulty lamp, try another lamp.

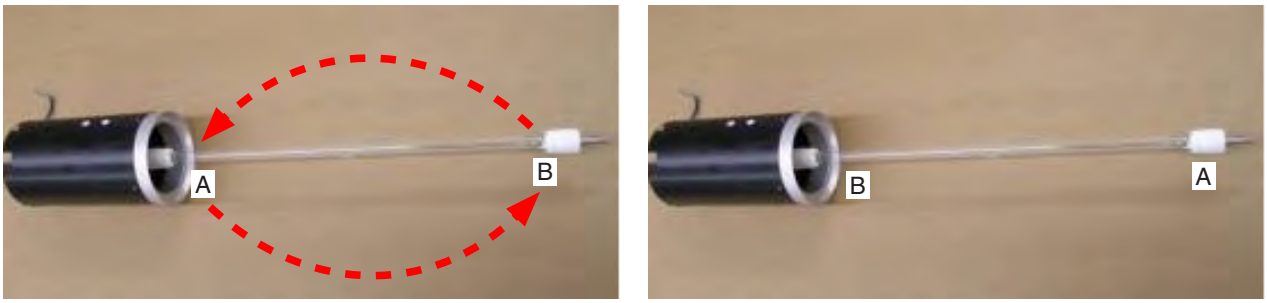


Figure 17.3a: Reversing the Lamp

17.4 Humidifier and Water Level (Nov 2020)

RH Symptom	Probable Cause(s)
RH Too Low	1. Water supply valve is turned off 2. Water pressure is less than 3 psi 3. Clogged pump intake (inside reservoir) 4. Clogged float valve (inside reservoir) 5. Float valve needs adjustment (inside reservoir) 6. Q-SUN out of level (tilted toward rear) 7. Bad Pump 8. Setpoint is outside permissible range 9. Humidifier wiring connections bad 10. Humidifier drive board bad
RH Too High	1. Humidifier Drive Board Bad 2. Setpoint is outside permissible range 3. Tester is not level

Water Level Symptom	Probable Cause(s)
Low	1. Water supply valve is turned off 2. Water pressure is less than 3 psi 3. Clogged pump intake (inside reservoir) 4. Clogged float valve (inside reservoir) 5. Float valve needs adjustment (inside reservoir) 6. Q-SUN out of level (tilted toward rear) 7. Bad Pump 8. Overflow stem not properly seated
High	1. Overflow stem is blocked

Reservoir Symptom	Probable Cause(s)
Low	1. Water supply valve is turned off 2. Water pressure is less than 3 psi 3. Clogged float valve (inside reservoir) 4. Float valve needs adjustment (inside reservoir) 5. Q-SUN out of level (tilted toward rear) 6. Bad Pump
High	1. Float valve needs adjustment 2. Float valve bad 3. Overflow stem not properly seated

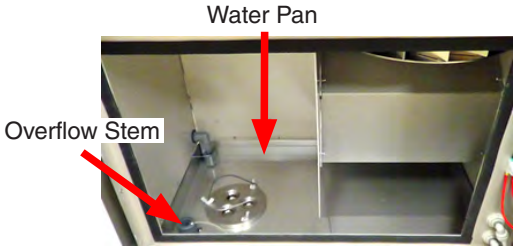


Figure 17.4a: Humidifier Water Pan

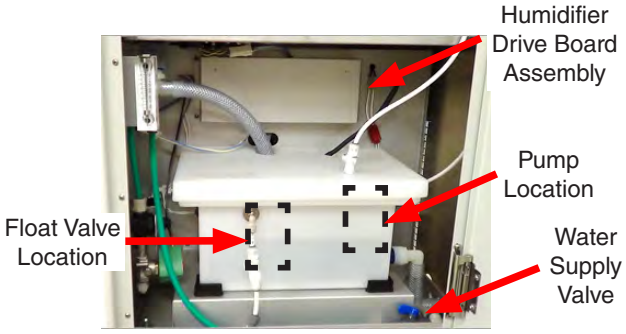


Figure 17.4b: Humidifier Water Reservoir

17.5 Spray Water Flow (Nov 2020)

During a *Spray Front* step, the water flow rate should be 0.5 liter/min.

If the flow rate is not 0.5 liter/min. adjust the pressure regulator.

If you cannot obtain 0.5 liter/min. check the following.

Flow rate too low:

- Water supply shut off
- Water pressure too low
- Clogged nozzle
- Bad solenoid
- Bad pressure regulator

Flow rate too high:

- Bad pressure regulator