TECHNICAL MANUAL LX-5080-TM

Q-SUN

Q-SUN Xe-3
Xenon Test Chambers

For Serial Numbers:

XX-XXXXX-81-X3HCE
XX-XXXXX-81-X3HSE
XX-XXXXX-81-X3HSCE
XX-XXXXX-81-X3HBSE
XX-XXXXX-81-X3HDSE
XX-XXXXX-81-X3HBSCE
XX-XXXXX-81-X3HDSCE
XX-XXXXX-81-X3HDSBSE
XX-XXXXX-81-X3HDSBSCE

Q-LAB

Revision Date

31 Mar 2022

Table of Contents

1. Specifications, Classifications, Symbols (Feb 2015)

Specifications, Classifications

- The recommended ambient operating temperature and relative humidity (RH) for the Q-SUN 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 (Dec 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.
- Warning labels indicate heat and electric shock hazards inside the Q-SUN tester.

Figure 2.1a: Hot Surface Warning Label

Figure 2.1b: Shock Hazard Warning Label

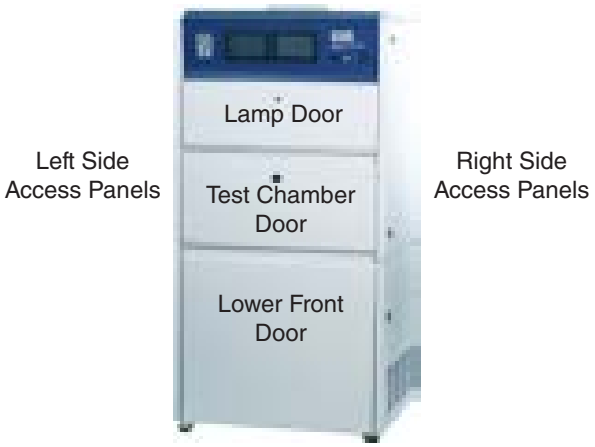


Figure 2.1c: Tester door and access panel locations.

All Q-SUN models are equipped with an interlock switch (Figure 2.1d) that turns off the xenon lamps when the lamp access door is opened.

Figure 2.1d: Lamp Door Interlock Switch Location

CAUTION: The vapor hose and the humidifier are hot.

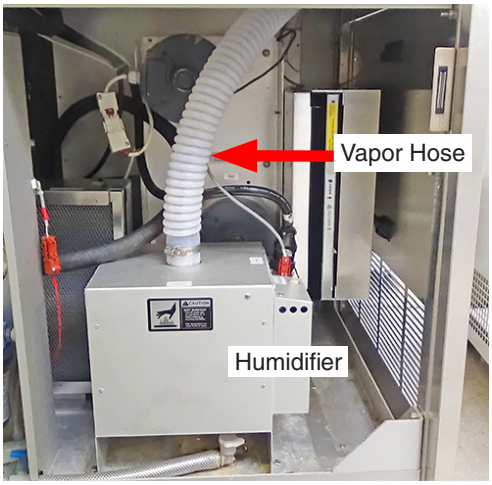


Figure 2.1e: Humidifier Inside Lower Front Door

Figure 2.1f: Humidifier Hot Surface Label

2.2 Ultraviolet and Infrared Hazards (Mar 2019)

The Q-SUN lamps produce UV light that can cause severe sunburn, eye inflammation, and damage to your vision. Do not defeat the switch that turns off lamps when the chamber door is open.

Figure 2.2 below shows the location of the chamber door interlock switch inside the right side top access panel.

NOTE: The right side top access panel is connected to the tester by a ground wire tether. When removing the access panel it is not necessary to disconnect the wire. The ground wire is long enough to set the access panel on the ground in front of the tester.

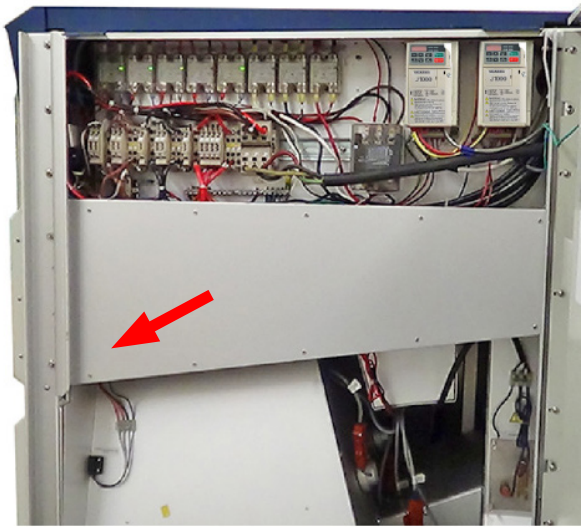


Figure 2.2: Chamber door interlock location (right side top access panel removed).

2.3 Dual Spray System (Oct 2020)

Overview

- Q-SUN Xe-3 models equipped with dual spray (DS) have a separate assembly, which includes the fluid reservoir and an enclosure housing an electrically operated pump system (Figure 2.3).

Electrical Shock Hazards

- Because the Dual Spray system is electrically operated, care should always be exercised when working on or around the equipment, particularly if the floor is wet.
- The enclosure below the reservoir houses the system pump and other components, and should only be opened by trained service technicians.

Fluid Hazards

- The fluid being introduced into the Q-SUN by the Dual Spray system is determined by the customer's application and fluid specifications are beyond the scope of this manual.
- Fluids that may be corrosive, acidic and/or toxic may be introduced into the Dual Spray system.
- Follow all local, OSHA, EHS, and other applicable material handling safety requirements, recommendations, and practices when mixing, refilling, and disposing of these fluids.
- The Dual Spray reservoir and all containers used in conjunction with fluid storage should be properly labeled.
- Some fluids which may be used in the reservoir of the Dual Spray system can become contaminated with fungus, bacteria, or other organisms.
- Depending on the fluid used, frequent checks and cleaning of Dual Spray components may be required (see Section 15.5).
- Consideration should be given to mixing small batches of liquid frequently rather than large amounts that could become contaminated before use.

Figure 2.3: Dual Spray reservoir and pump system enclosure.

3. General Description (Oct 2020)

The LX-5080-TM Q-SUN Xe-3 Technical Manual provides information on the installation, operation, and maintenance of Q-SUN Xe-3 test chambers.

Overview

- Q-SUN Xe-3 test chambers are laboratory simulators of the effects of indoor and outdoor light stability and weathering. All Q-SUN Xe-3 testers feature light, heat, and relative humidity control.
- Three spray system options are available on Q-SUN Xe-3 testers (see Section 9).
  - The front spray option (Xe-3 "S" models) delivers pure water spray to the top (front) of test specimens to simulate outdoor dew and rain.
  - The back spray (Xe-3 "BS" model) sprays the bottom (back) surface of specimens as well.
  - Testers with dual spray (Xe-3 "DS" models) can spray a second liquid onto the top (front) of the specimens.
- The Q-SUN chiller option (Xe-3 "C" models) allows testing at reduced temperatures by combining an air chilling system with a Q-SUN Xe-3 to reduce the temperature of the air entering the test chamber (see Section 7).
- This Technical Manual covers Q-SUN Xe-3 "E" models that feature enhanced performance, including dual touchscreen control and longer lamp life or higher irradiance capability.
- For the basic non-"E" Q-SUN Xe-3-H tester, see *LX-5080-B-TM Q-SUN Xe-3-H Technical Manual*.

Q-SUN Xe-3 Models Description

Model	**Configuration**
Xe-3-HSE	S: Water Spray
Xe-3-HCE	C: Chiller
Xe-3-HSCE	Chiller + Spray
Xe-3-HBSE	BS: Back Spray
Xe-3-HDSE	DS: Dual Spray
Xe-3-HBSCE	Back Spray + Chiller
Xe-3-HDSCE	Dual Spray + Chiller
Xe-3-HDSBSE	Dual Spray + Back Spray
Xe-3-HDSBSCE	Dual Spray + Back Spray + Chiller

Partial List of Standard Test Methods Met by Q-SUN Xe-3 Xenon Test Chambers

- Listed below are several widely used standards that can be performed with Q-SUN Xe-3 testers.
- For an extensive list of standards Q-SUN testers can perform see *LX-5054 Standards Met by Q-SUN Testers*.

ASTM C1442 – Conducting Tests on Sealants Using Artificial Weathering Apparatus

ASTM D1248 – Polyethylene Plastic Extrusion Materials for Wire and Cable

ASTM D2565 – Xenon Arc – Plastics for Outdoor Applications

ASTM D3424 – Lightfastness of Printed Material

ASTM D3451 – Testing Coating Powders

ASTM D3794 – Testing Coil Coatings

ASTM D4101 – Polypropylene Plastic Injection and Extrusion Materials

ASTM D4303 – Lightfastness of Artists' Pigments

ASTM D4459 – Xenon Arc – Plastics for Indoor Applications

ASTM D4798 – Xenon Arc – Bituminous Materials

ASTM D5010 – Testing Printing Inks & Related Materials

ASTM D5071 – Xenon Arc – Exposure of Photodegradable Plastics

ASTM D7869 – Xenon Arc – Transportation Coatings

ASTM G151 – General Guidelines for Exposure of Nonmetallic Materials

ASTM G155 – Xenon Arc – Test Apparatus for Exposure of Nonmetallic Materials

ISO 11341 – Paints – Xenon Arc

ISO 4892-2 – Plastics – Methods of Exposure to Laboratory Light Sources – Part 2: Xenon-Arc Sources

DIN 53 387 – Artificial weathering and aging of plastics and elastomers by exposure to filtered xenon arc radiation (Cycles A & E)

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.

NOTE: Some images in this section show "E" models Xe-3 testers. Except where noted, all information is exactly the same for non-"E" (Xe-3-H) testers.

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 5.7.

4.2 Unsuitable Environments (May 2020)

Salt Fog or Other Airborne Contamination

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

Figure 4.2a: Do not install testers in a room with corrosion chambers.

Figure 4.2b: Do not locate testers in a 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 4.2c).
- 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 19 for contact information.

5. Setup

5.1 Xe-3 Uncrating (Dec 2020)

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

- Q-SUN Xe-3 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.

NOTE: Some images in this section show "E" models Xe-3 testers. Except where noted, all information is exactly the same for non-"E" (Xe-3-H) testers.

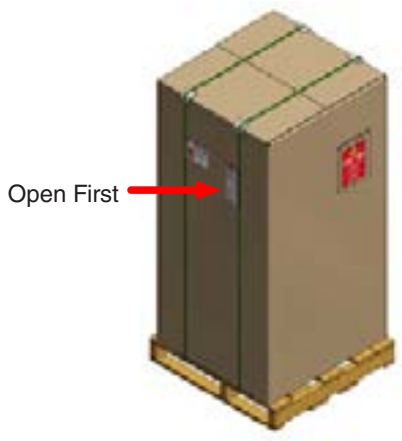


Figure 5.1a: This Crate has a Carton Banded to a Wooden Skid.

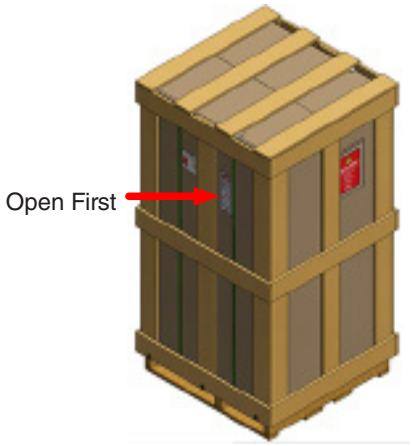


Figure 5.1b: This Crate has a Wooden Frame Surrounding the Carton.

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

Shipping Weight (Approximate)	Main Unit
On Skid With Wooden Crate	363 kg (800 lbs)
On Skid With Carton Only	318 kg (700 lbs)
Tester Weight*	190-233 kg (420-512 lbs)

* Weight varies based on installed options.

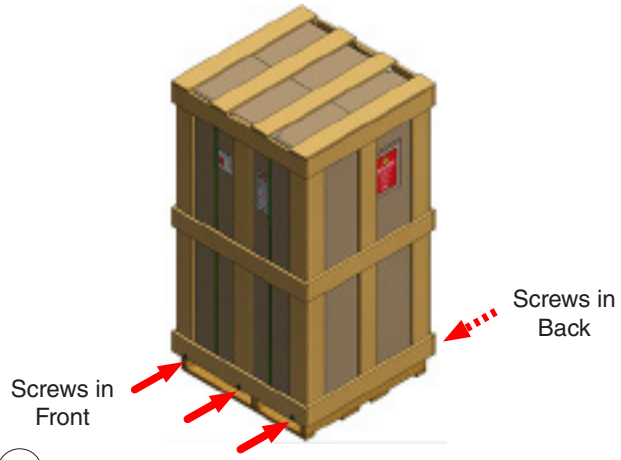
Tools Required

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

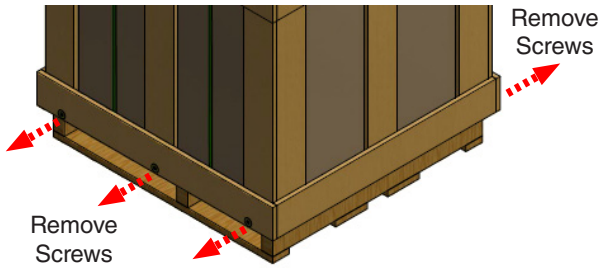
*A fork lift or other mechanical lifting device is recommended for use in moving the crated tester to the installation location, and to lift the frame in one piece from the crate with wooden frame.

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

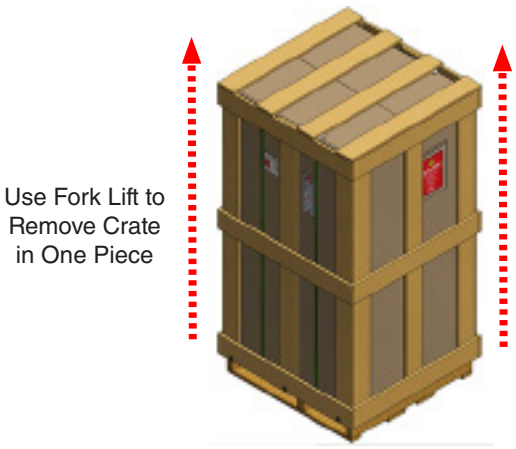
2. For crate with wooden frame continue with Step 3. For crate with carton only, go to Step 7.



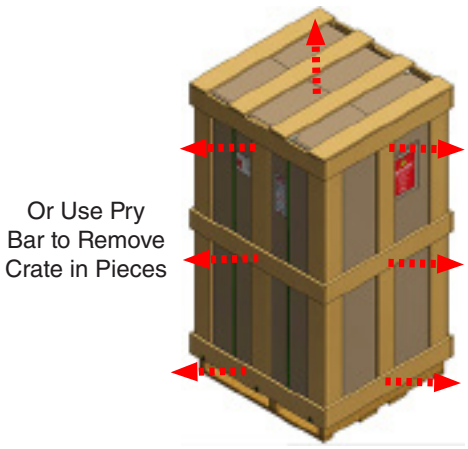
3. Locate the Phillips screws in the bottom front and back horizontal boards.



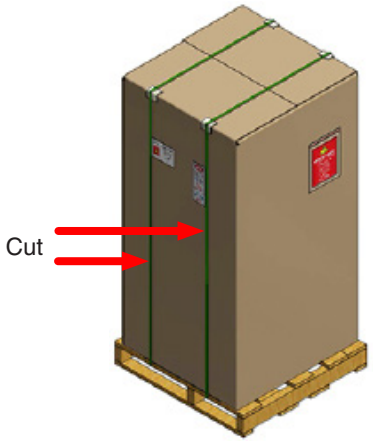
4. Remove all screws.



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

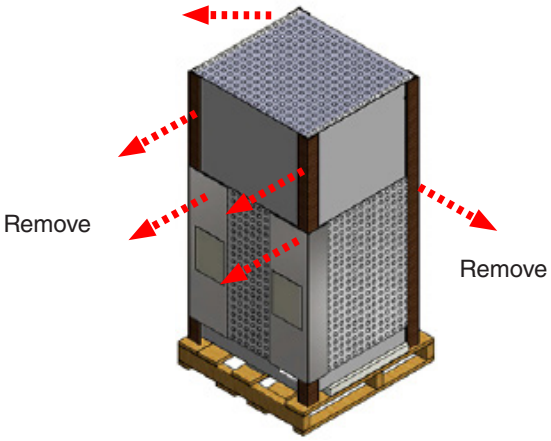


6. If a fork lift is not available, use a pry bar to carefully remove the horizontal and vertical wooden pieces off of the tester.

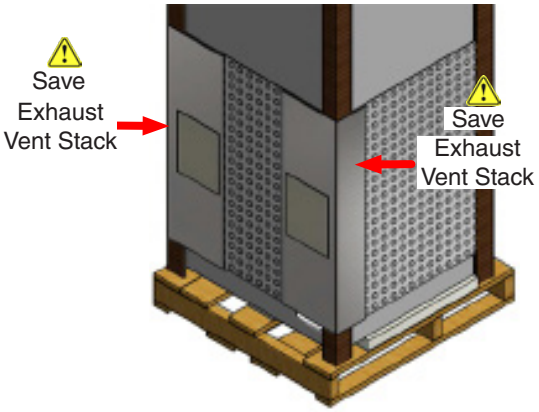


7. Cut the bands holding the carton to the skid. Remove the bands.

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

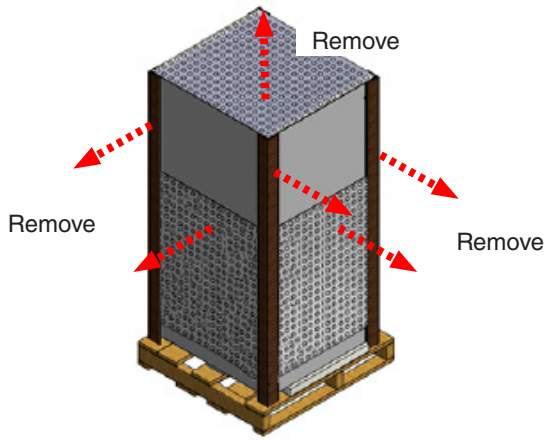


9. Remove all plastic wrap from around the tester.



10. Locate the two (2) exhaust vent stack pieces taped to the rear corners of the tester marked “Do Not Throw Away”. These pieces must be saved.

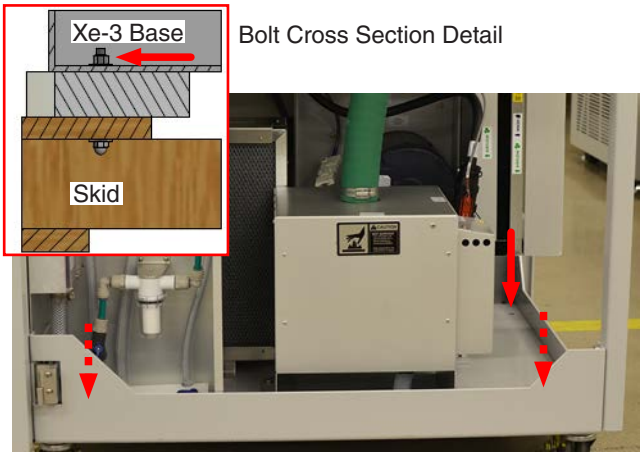
11. Remove the exhaust vent stack pieces (X-6971) and set aside.



12. Remove the four (4) corner protectors and all bubble wrap and tape from around the tester.

13. Locate the two (2) latches in the right side lower access panel.

14. Open the latches and remove the access panel. Open the lower front door.



Bolt Cross Section Detail

15. Locate three (3) bolts in the base of the tester that secure the tester to the skid. Remove the bolts.

At least two people are needed to remove the Q-SUN from the skid.

16. Remove the tester from the skid.

a. Begin by tilting the Q-SUN and removing the three foam strips under the bottom of the unit.

b. “Walk” the Q-SUN off the skid in the direction parallel to the boards of the skid.

c. Slide the Q-SUN into place and adjust the leveling feet so the unit is level.

d. Remove adhesive tape from various parts on the inside and outside of the unit.

17. Remove the tester from the skid.

18. Open and remove all parts from separate cartons shipped with tester.

5.2 Chiller Uncrating (Apr 2021)

- For Q-SUN Xe-3 models with chiller (C), follow the instructions in this section to uncrate the chiller unit.
- Carefully read these instructions before uncrating the chiller.
- The tables below list chiller weights and tools needed for uncrating.
- Chillers are shipped in two types of crates (Figure 5.2.a and Figure 5.2.b).

Weights

Shipping Weight (Approximate)	
On Skid With Wooden Crate	182 kg (400 lbs)
On Skid With Carton Only	136 kg (300 lbs)
Chiller Weight	123 kg (270 lbs)

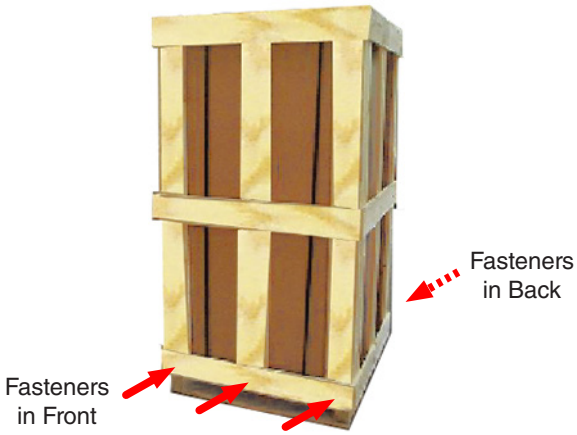
Tools Required

Phillips Screwdriver (Wooden Crate Only)	Flat Blade Screwdriver
Pry Bar (Wooden Crate Only)	Ratchet and 15 mm (9/16”) Socket
Band Cutter	Utility Knife
Fork Lift*	
*A fork lift or other mechanical lifting device is recommended for use in moving the crated chiller to the installation location, and to lift the wooden frame in one piece from the crate with wooden frame.	

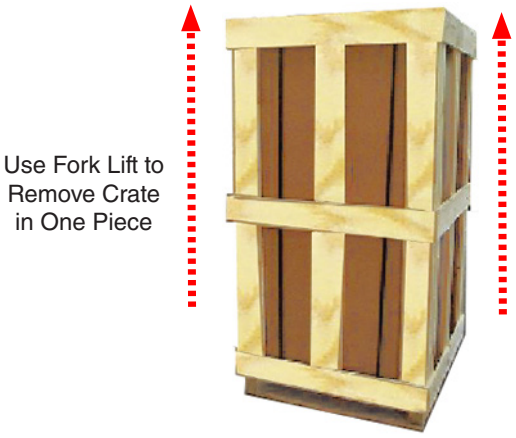
Figure 5.2.a: This Crate has a Carton Banded to a Wooden Skid.

Figure 5.2.b: This Crate has a Wooden Frame Surrounding the Carton.

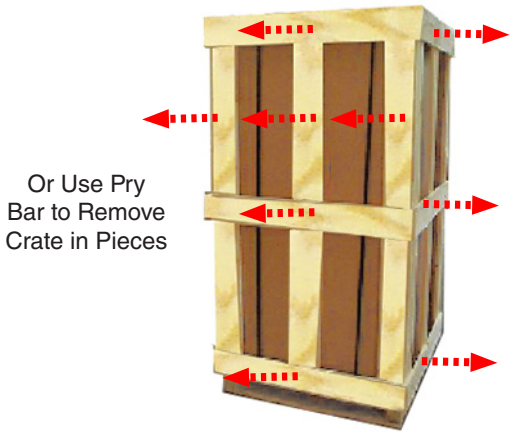
1. For crate with wooden frame continue with Step 2. For crate with carton only, go to Step 5.



2. Remove the fasteners in the bottom front and back horizontal boards.



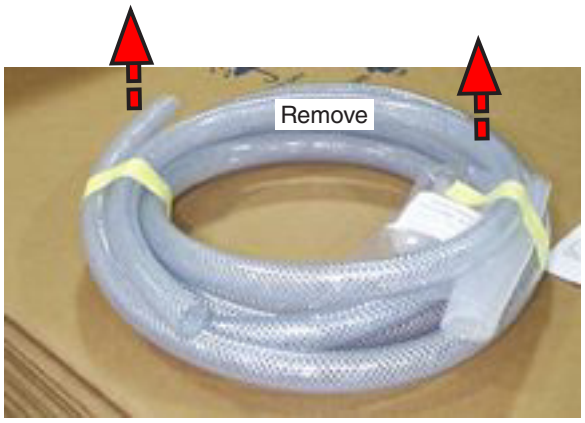
3. If a fork lift is available, use it to carefully lift the wooden frame up and off the carton in one piece.



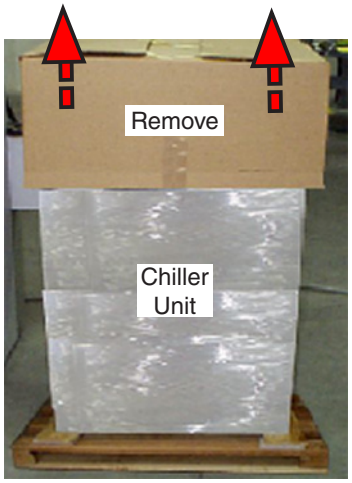
4. If a fork lift is not available, use a pry bar to carefully remove the horizontal and vertical wooden pieces off the carton..

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

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



7. Remove the hose and bag of fittings from the top of the inner carton. Set aside.



8. Remove the inner carton from on top of the main chiller unit. Set aside.

9. Open the carton. Remove the duct assembly pieces and the bag of screws.

Contents of Carton:

X-6916-X CHILLER Q-SUN DUCT ASSEMBLY

X-6951-X CHILLER TRANSITION DUCT ASSEMBLY

X-6964-X CHILLER DUCT ASSEMBLY

U-5150 1/4" PHILLIPS SCREWS (14)

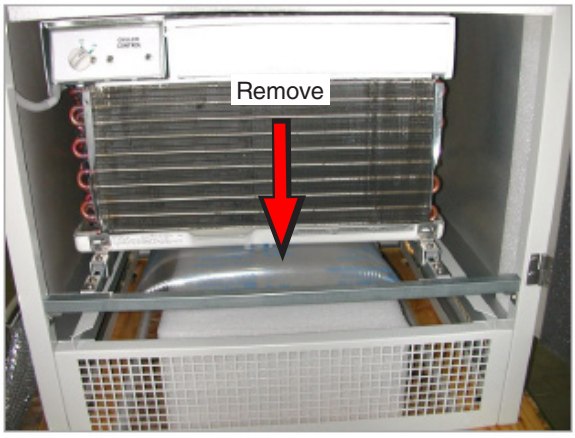
10. Contents of the carton are listed above. Unwrap all and set aside.

11. Remove the plastic wrap from the chiller unit.

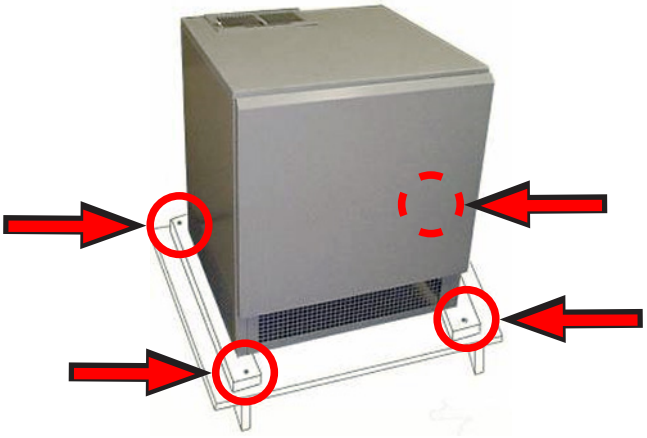
12. Remove the air filter at the side of the carton. Set aside.

13. Remove any remaining plastic wrap from the chiller unit.

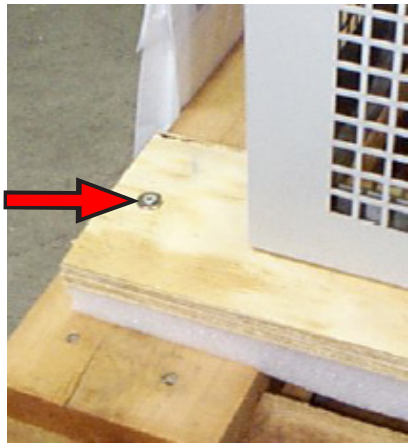
14. Open the chiller front access door.



15. Remove the air bag from the chiller. Close the access door.



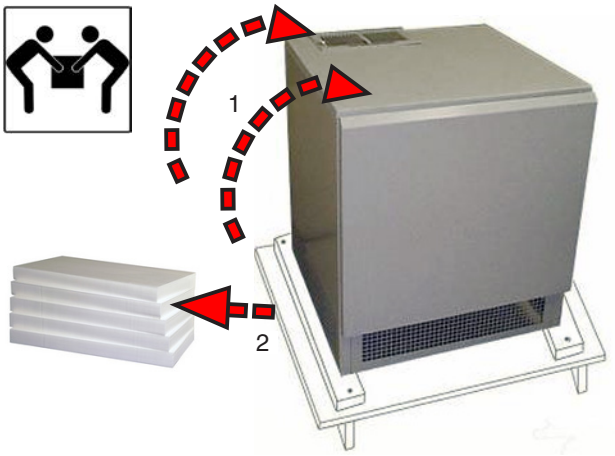
16. Locate the four (4) screws that secure the wooden runners under the chiller to the skid



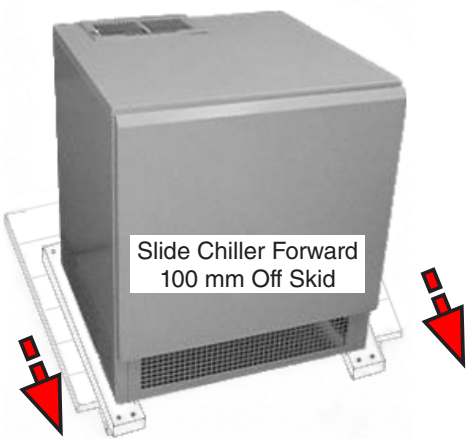
17. Remove the four (4) screws.

At least two people are needed to remove the chiller from the skid.

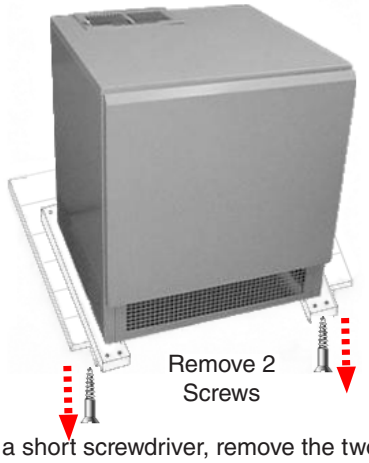
18. Follow Steps 19 through 26 to remove the chiller from the skid.



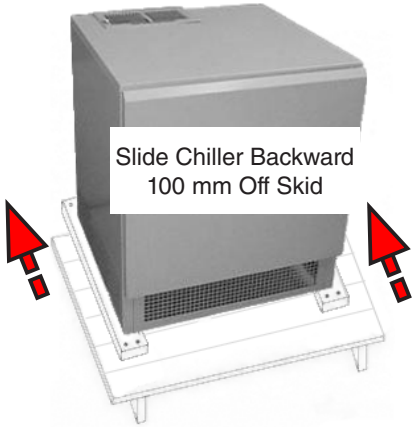
19. Two persons tilt the chiller. Pull the foam pieces out from under the bottom of the unit. Discard foam.



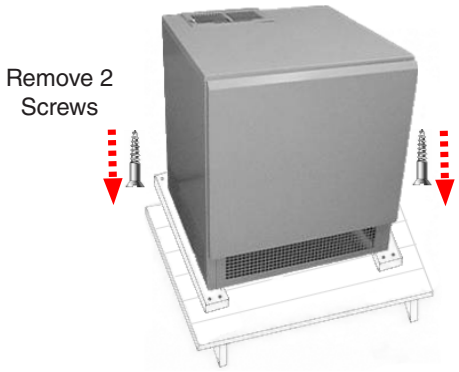
20. Partially slide the unit off the skid in the direction parallel to the boards of the skid, so that the unit overhangs the skid by about 100 mm (4").



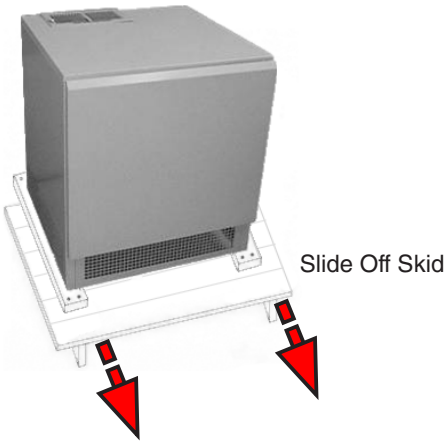
21. With a short screwdriver, remove the two (2) screws from the bottom of each wooden runner that secures the runner to the chiller.



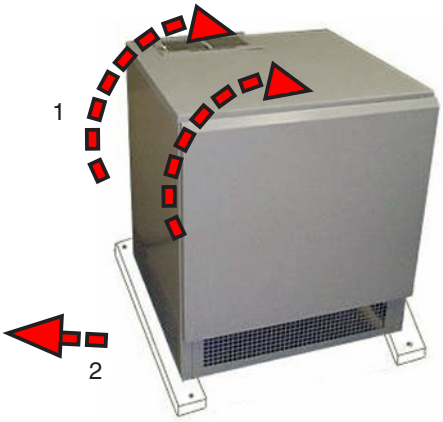
22. Slide the unit the opposite way, until it overhangs the skid about 100 mm (4").



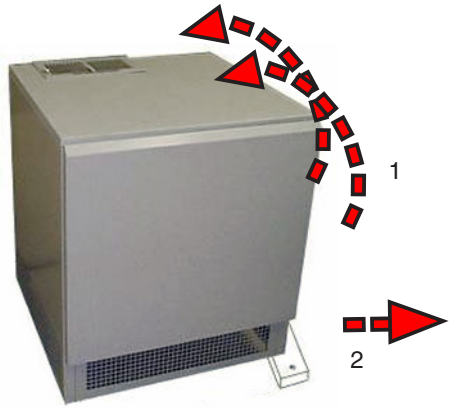
23. With a short screwdriver, remove the two (2) screws from the bottom of each wooden runner that secures the runner to the chiller.



24. Slowly slide the unit (and runners) off the skid onto the floor.

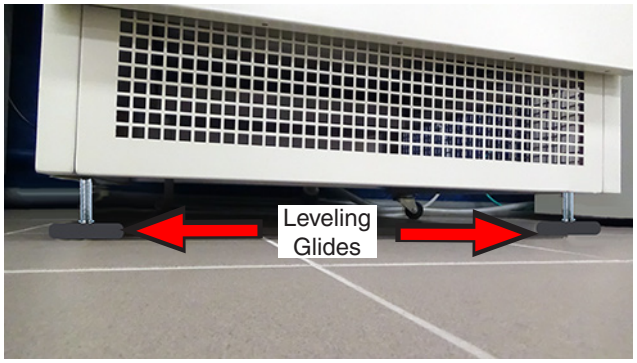


25. Tilt up one side of the chiller and remove the runner. Discard runner.



26. Tilt up the other side of the chiller and remove the other runner. Discard runner.

27. Slide the unit into position, at the right side of the installed Xe-3. Space must be available to access the front and rear of the chiller. See Section 3.2.

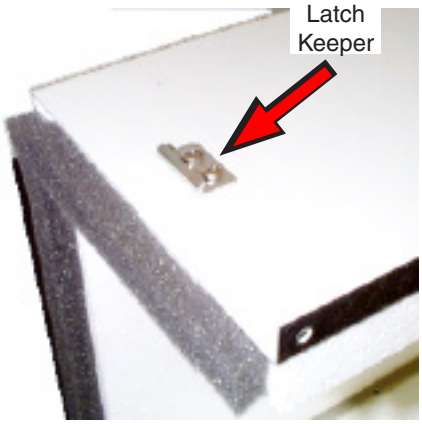


28. If the chiller is moved, do not hit floor drain, cracks, etc, as the adjustable leveling glides may be damaged.

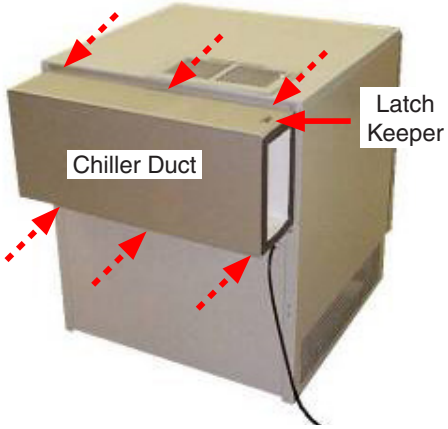
5.3 Chiller Assembly (Apr 2021)

- If the Q-SUN tester does not have the chiller option go to Section 5.4.
- Using six of the enclosed #6 screws, attach the Chiller Duct to the rear of the chiller (Step 3 through Step 4) with the latch keeper in position as shown.
- Using two #6 screws, loosely attach the Q-SUN duct to the rear panel of the Q-SUN (Step 5 through Step 7).
- Remove the tester right side lower access panel.
- Remove the chiller shroud in front of the air filter (two screws at top and two screws at bottom of shroud, Step 8).
- From insdie the tester, using two #6 screws, attach the duct to the machine's right rear upright (Step 9). Tighten the four screws in the Q-SUN duct.
- Reinstall the chiller shroud (Step 10).
- Using four #6 screws, attach the transition duct to the Q-SUN duct as shown in Step 11 and Step 12.
- Follow Step 13 through Step 21 to complete chiller assembly.

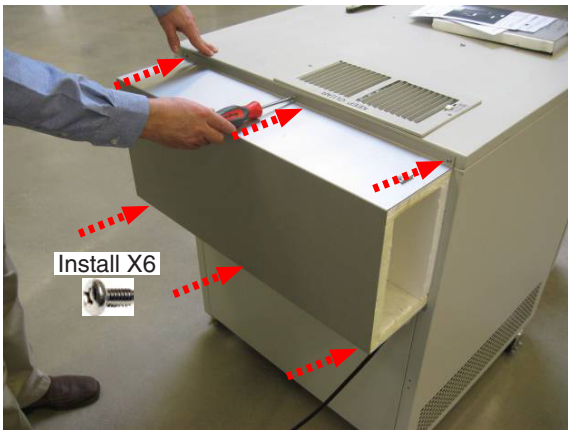
1. Locate the chiller duct assembly (X-6964-X).



2. Notice the latch keeper located on the top of the duct.

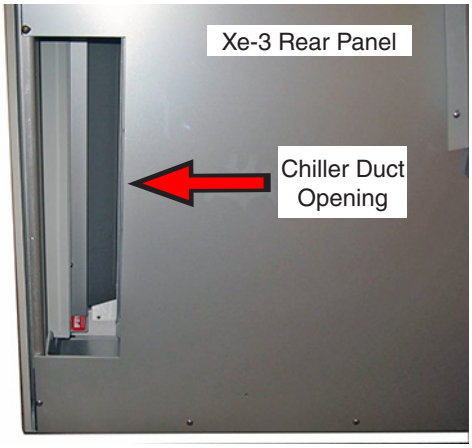


3. Six (6) screw locations to attach the chiller duct to the rear of the chiller.



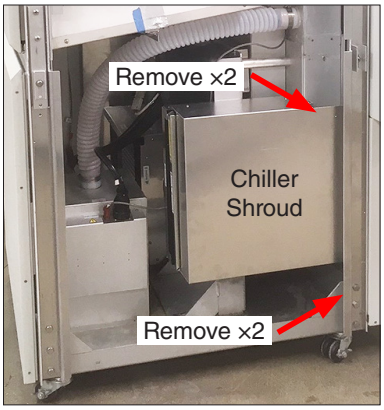
4. Attach the chiller duct assembly to the rear of the chiller using six (6) Phillips screws (U-5150).

5. Locate the chiller Q-SUN duct assembly (6916-X).

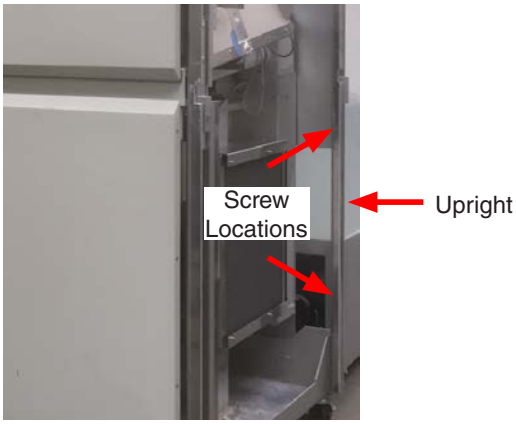


6. Locate the chiller duct opening at the lower left rear of the Xe-3 rear panel.

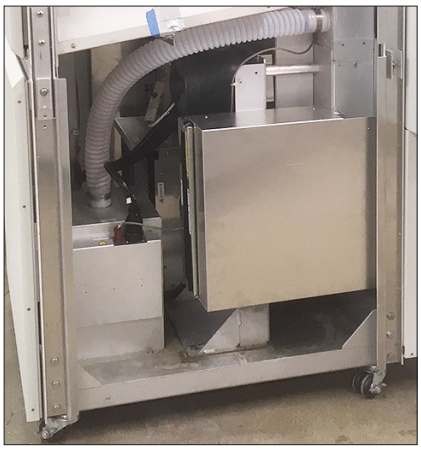
7. Using two (2) Phillips screws, loosely attach the Q-SUN duct over the Xe-3 chiller duct opening.



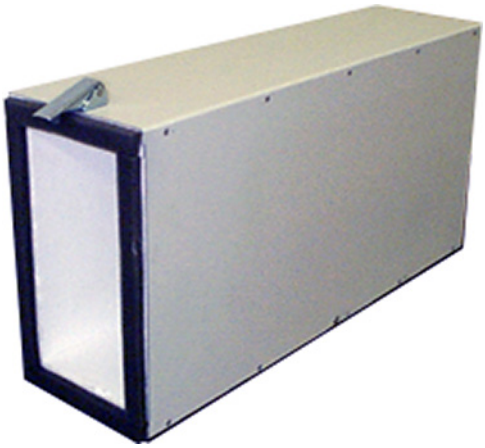
8. Remove the tester right side lower access panel. Remove the chiller shroud in front of the air filter (two screws at top and two screws at bottom of shroud). Save the screws and shroud.



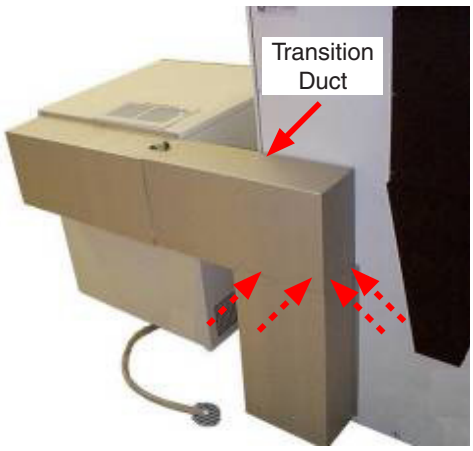
9. From inside the tester, use two #6 screws to attach the Q-SUN duct to the machine's right rear upright. Tighten the four screws in the Q-SUN duct.



10. Reinstall the chiller shroud.

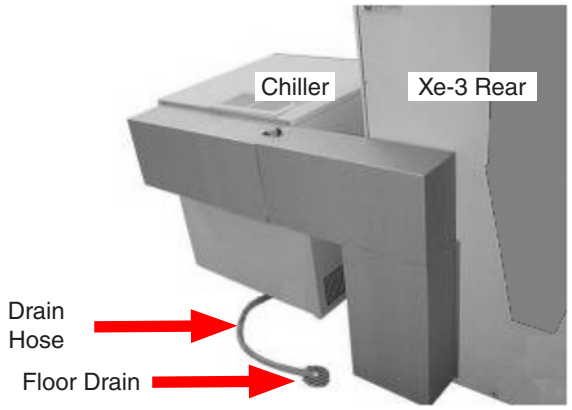


11. Locate the transition duct (X-6951-X).



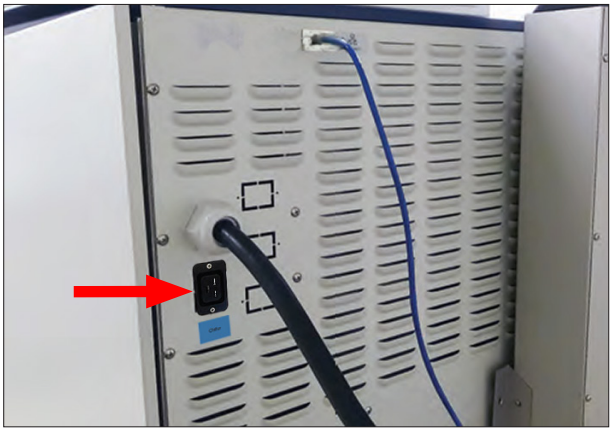
12. Four (4) screw locations to attach the transition duct to the Q-SUN duct.

13. Move the chiller to the installation location beside the tester.

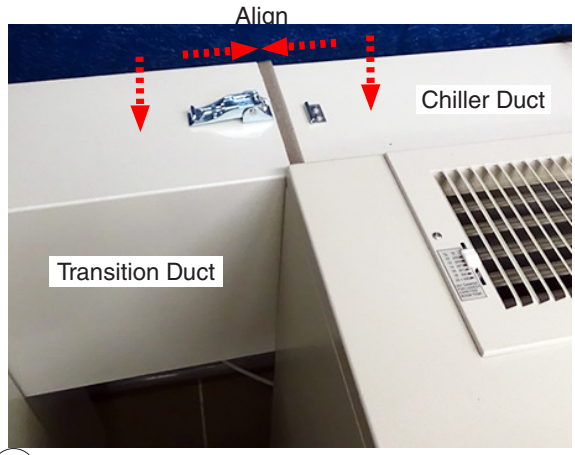


14. Locate the 1/2" drain hose at the bottom rear of the chiller cabinet. Make sure the end of the hose is over or in the drain.

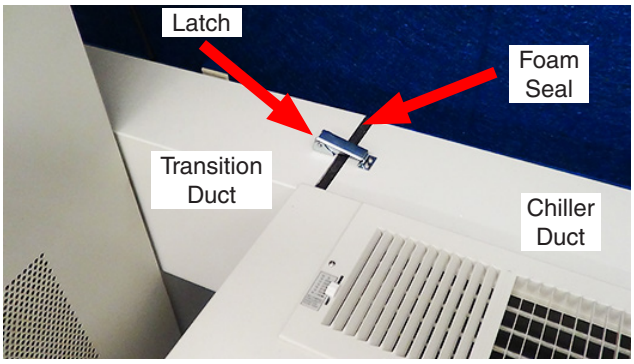
15. Locate the chiller power connector.



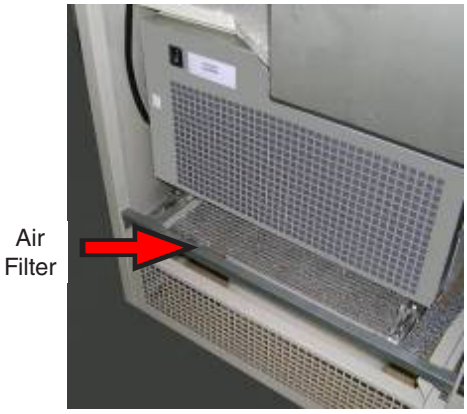
16. Connect the chiller power cord to the chiller power outlet at the rear of the tester.



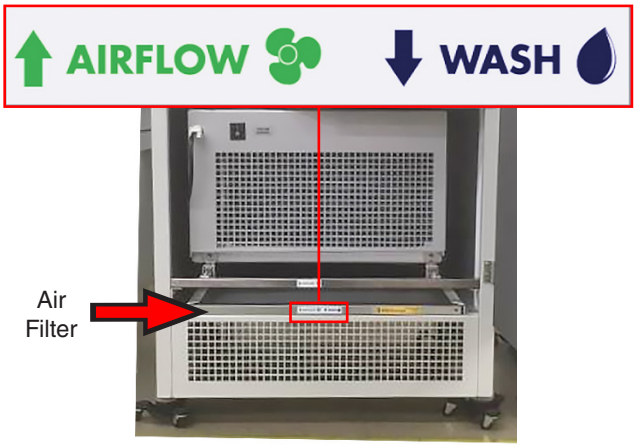
17. Position the chiller so that the chiller duct aligns vertically and horizontally with the transition duct. If needed adjust the chiller leveling glides.



18. Push the ducts together. Make sure the foam seal is in place. Latch the ducts together.



19. Open the chiller front access door. Locate the air filter.



20. Make sure the air flow arrow on the edge of the air filter frame points up.

21. Close the chiller access door.

To Complete Chiller Installation see:

Section 5.7 through Section 5.10

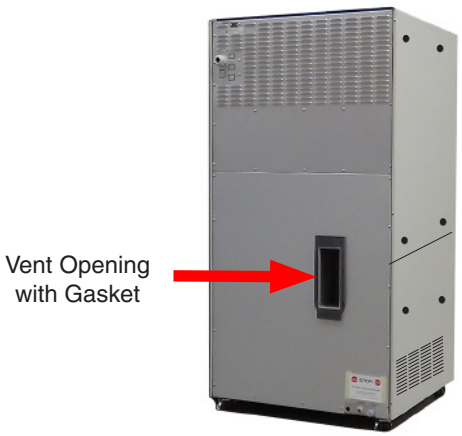
22. Go to the Sections listed above to complete installation of the chiller.

5.4 Xe-3 Exhaust Vent Assembly (Dec 2020)

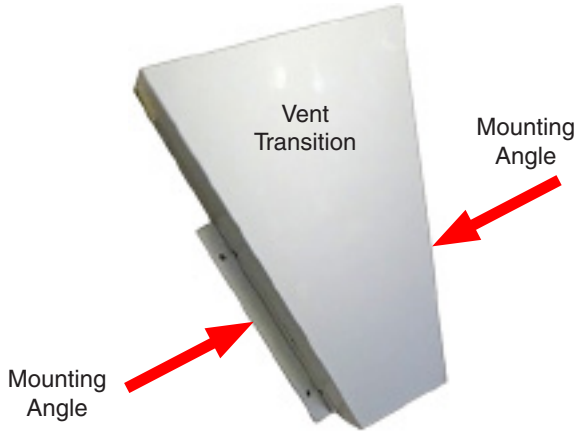
An exhaust vent must be installed on all Xe-3 testers. Parts of the vent assembly are shipped in a separate carton. The vent extension stack pieces are taped to the corners of the tester as shown in Section 5.1, Step 10.

Exhaust Vent Parts

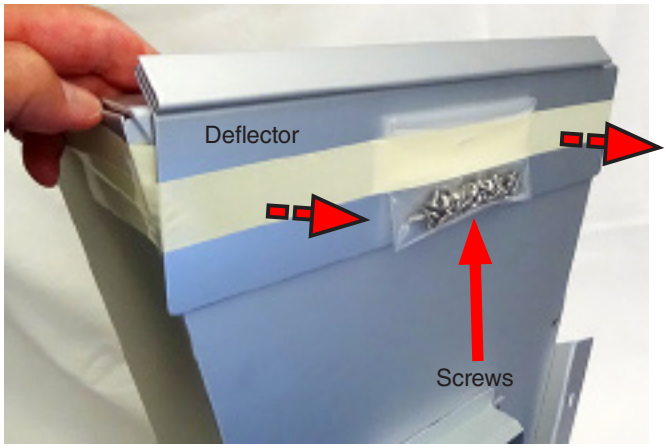
Part No.	Description	Quantity
X-6970-X	Exhaust Vent Transition	1
X-6971	Exhaust Vent Extension Stack	2
X-6974	Exhaust Deflector	1
X-6973	Exhaust Mounting Angle	2
U-5120	8-18 × 3/8" Phillips Pan Head Sheet Metal Screw	18



1. Locate the vent opening in the rear panel of the tester.

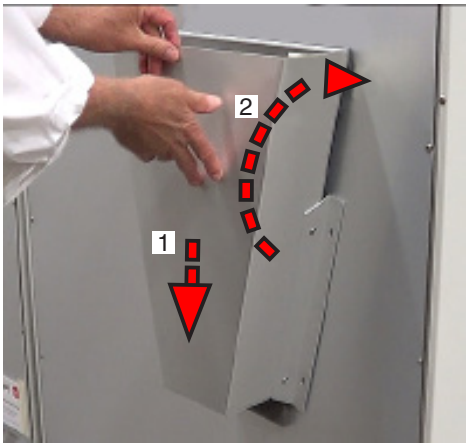


2. Locate the exhaust vent transition (X-6970-X) with two (2) mounting angles attached.



3. Remove the deflector and bag of screws from the rear side of the vent transition.

4. Insert the bottom of the exhaust vent transition into the vent opening.



7. While pushing downward, rotate the top of the vent transition into the vent opening

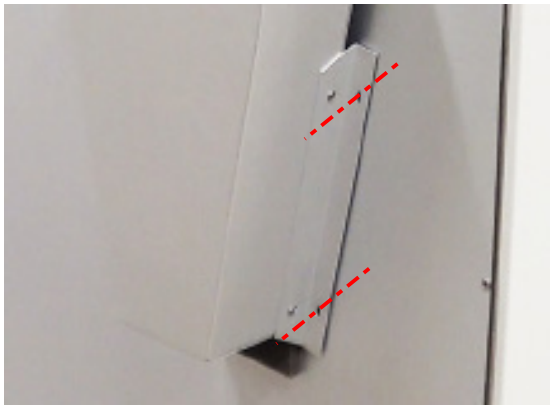
a. Use downward pressure on the vent transition to clear the vent opening gasket and avoid tearing it.

b. The mounting angles will fit against the back panel when the vent transition is fully in place.

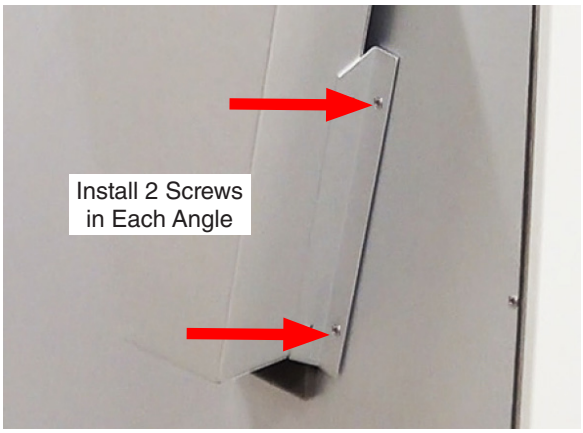
c. With the vent transition in place reach down inside and run your fingers along the edges to make sure that the vent gasket was not moved from its original position.

d. If the gasket moved out of position, remove the vent transition, the reposition the gasket and reinstall the vent transition.

5. Make sure the vent opening gasket did not move.

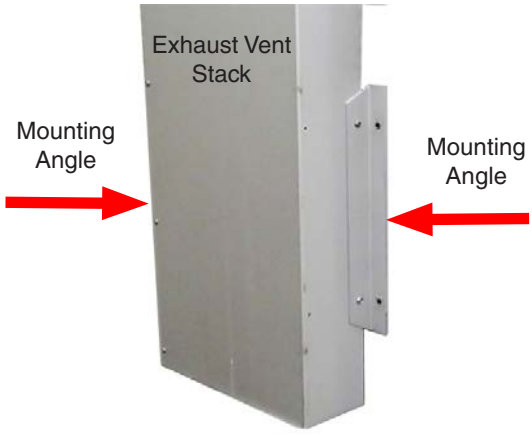


6. Align the holes in the mounting angles on both sides of the transition with the holes in the rear panel.

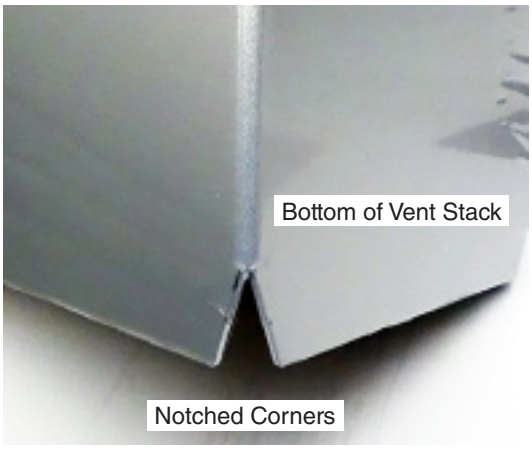


8. Fasten the mounting angles to the rear panel using four (4) screws from the bag removed in Step 3.

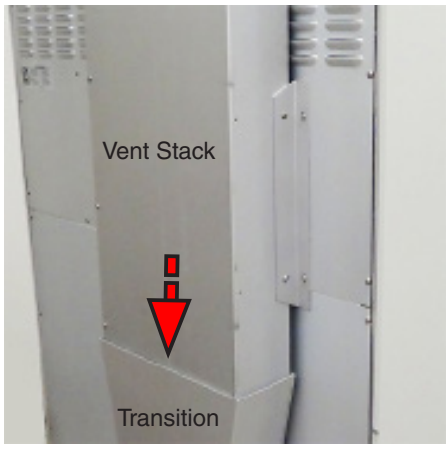
9. Assemble the two (2) exhaust vent stack pieces (X-6971) as shown using screws from the bag.



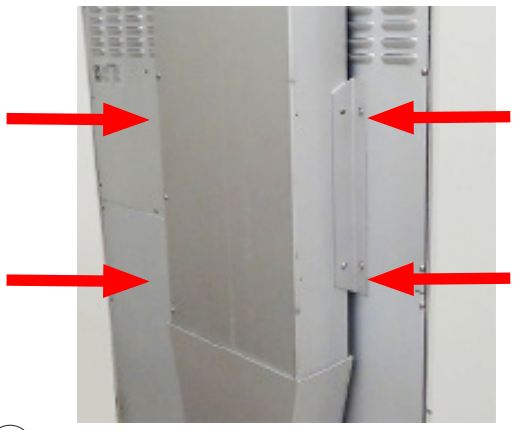
10. Attach a mounting angle (X-6973) to each side of the exhaust vent stack using screws from the bag.



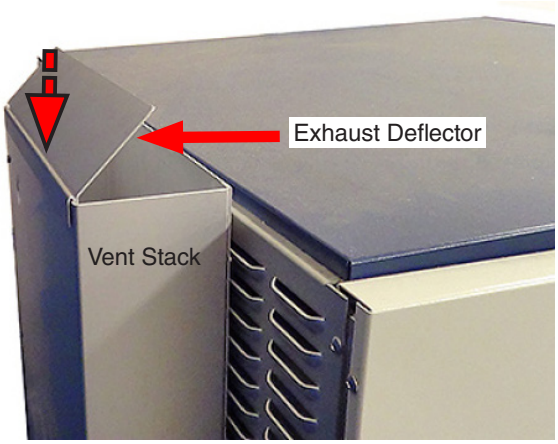
11. Orient the vent stack with the notched corners at the bottom.



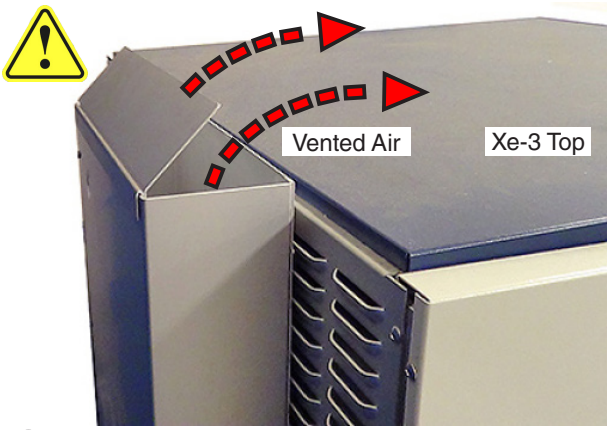
12. Insert the end of the vent stack with the notched corners down into the opening of the vent transition.



13. Attach the mounting angles on both sides of the vent stack to the Xe-3 rear panel using screws from the bag.



14. Attach the exhaust deflector (X-6974) to the top of the vent stack.



15. The exhaust deflector should point so that the vented air is blown over the top of the Xe-3 and away from a wall behind the tester.

16. Completed exhaust vent assembly.

5.5 Back Spray Set Up (Oct 2020)

For Q-SUN Xe-3 models with back spray (BS), follow the instructions in Section 5.1 and Section 5.4 to uncrate the Xe-3 and assemble the Xe-3 exhaust vent. Follow the instructions below to place the Back Spray manifold in the operational position.

- Open the Xe-3 test chamber door and remove the adhesive tape from the specimen tray.
- Slide the open back specimen tray forward, resting it on the chamber door (Figure 5.5a).
- Remove the adhesive tape that secured the Back-Spray manifold in position during shipping.
- Slide the manifold forward until it contacts the front of the chamber below the chamber door (Figure 5.5b [1]).
- Then slide the manifold left until it contacts the left side of the chamber (Figure 5.5b [2]).
- The manifold is now in the correct operational position.
- See Section 9 for more information on spray systems.

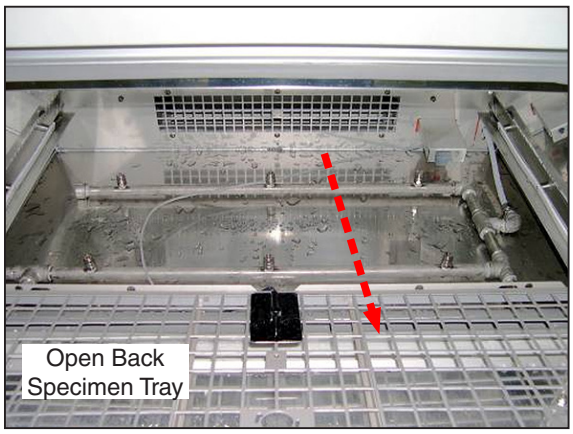


Figure 5.5a: Remove Tape. Slide the open back specimen tray all the way forward.

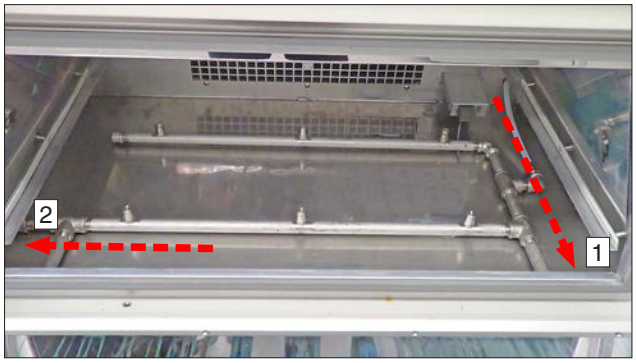


Figure 5.5b: Remove tape. Slide the manifold forward, then to the left.

5.6 Dual Spray Uncrating and Assembly (Dec 2020)

For Q-SUN Xe-3 models with Dual Spray (DS), follow the instructions in Section 5.1 and Section 5.4 to uncrate the Xe-3 and assemble the Xe-3 exhaust vent. Follow the instructions below to uncrate and assemble the Dual Spray system.

Uncrating

- The Dual Spray system is shipped in one of two types of crates (Figure 5.6a and Figure 5.6b).
- If the crate has a wooden frame, carefully remove the fasteners and frame boards.
- Cut the straps that hold the fiberboard carton to the skid. Lift off the carton.
- Cut the straps that hold the Dual Spray cart to the skid (Figure 5.6c).
- Remove the four side panels and hardware from inside the reservoir.
- At least two people are needed to remove the Dual Spray system from the skid.
- DO NOT attempt to lift the Dual Spray assembly alone.
- Lift the entire cart and reservoir assembly straight up so that the cart wheels clear the skid.
- Move the entire Dual Spray assembly off the skid onto the floor (Figure 5.6d).
- See Section 9 for more information on spray systems.

Figure 5.6a: This Crate has a Carton Banded to a Wooden Skid.

Figure 5.6b: This Crate has a Wooden Frame Surrounding the Carton.

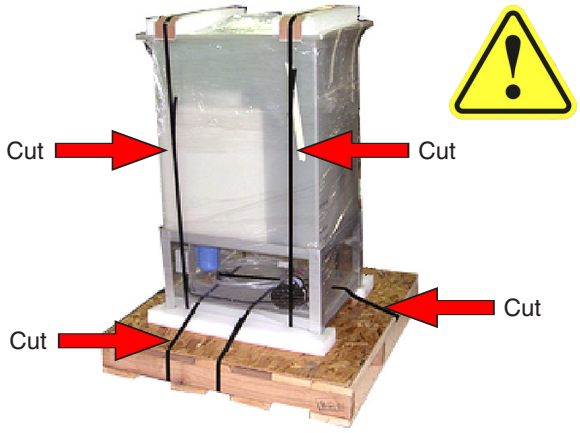


Figure 5.6c: Cut straps. Remove packing material. Remove hardware.

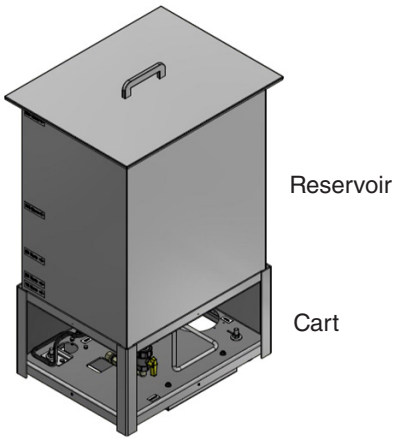


Figure 5.6d: Remove Dual Spray assembly from the skid.

Assembly

1. Carefully unwrap the two (2) cart side panels (X-10081), the cart front panel (X-10082), and the cart rear panel (X-10083).
2. The two (2) cart side panels mount on the sides of the cart (Figure 5.6e).
   - Install the panels by hooking the long flange under the bottom edge of the lower shelf on the cart
   - Then pull the panel up until the short flange hooks over the top edge of the upper shelf
3. Install the rear panel with the electrical and fluid connection openings on the rear of the cart (Figure 5.6f).
4. Install the front panel (Figure 5.6g).
5. Connect the Dual Spray power cord (X-10088-X) to the connector at the rear of the cart (Figure 5.6i).
6. Connect the other end of the power cord to the outlet labeled “Dual Spray” on the Xe-3 rear panel (Figure 5.6j).
7. Connect the tubing (X-10063) into the quick-disconnect fitting at the rear of the cart.
8. Connect the other end of the tubing to the similar fitting on the lower left rear of the Xe-3, labeled “Dual Spray System Fluid Inlet”.
9. If this is being fitted to an existing Q-SUN tester, see Installation Instructions *X-10050-L, Q-SUN Dual Spray Retrofit*.

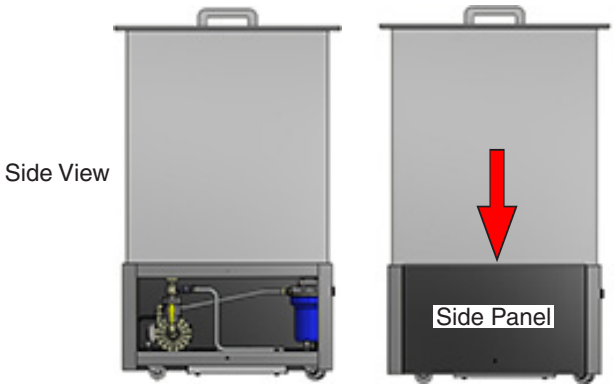


Figure 5.6e: Install one (1) side panel on each side of cart.

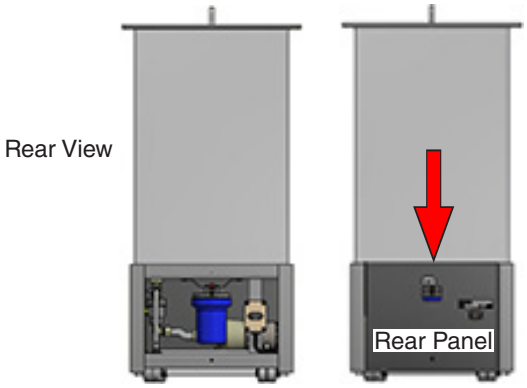


Figure 5.6f: Install rear panel. Openings in panel fit over fluid and electrical connections.

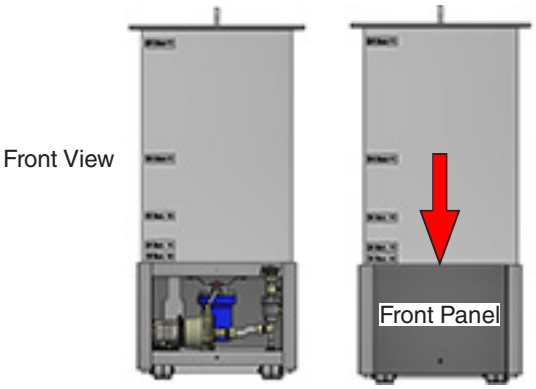


Figure 5.6g: Install front panel.

Figure 5.6h: Position the Dual Spray assembly next to Xe-3 as shown.

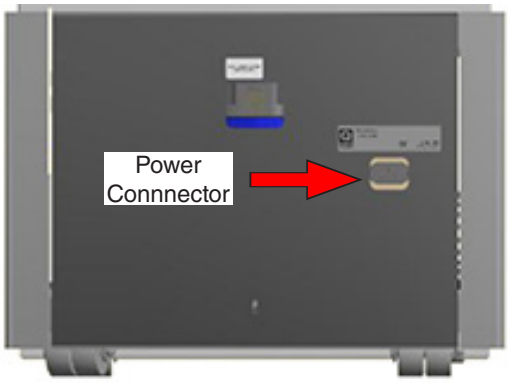


Figure 5.6i: Connect power cord at rear of cart.

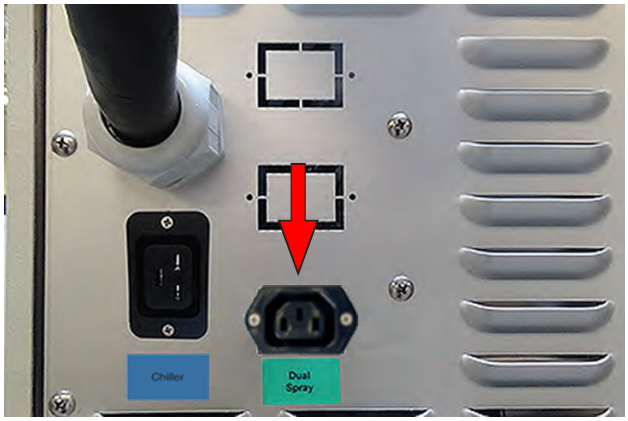


Figure 5.6j: Dual Spray power connector location on Xe-3 rear panel.

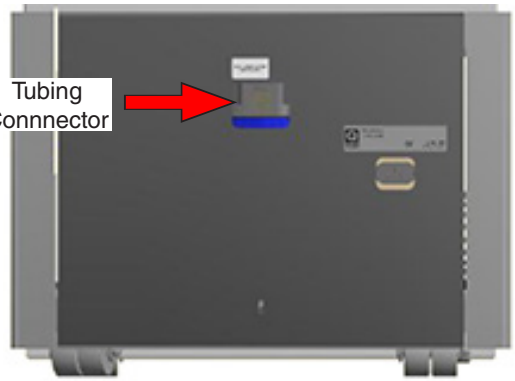


Figure 5.6k: Connect tubing at rear of cart.

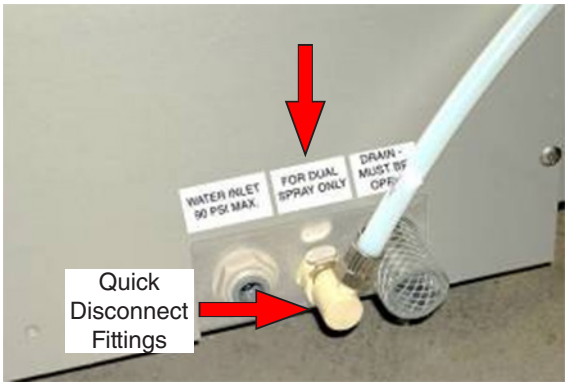


Figure 5.6l: Dual Spray fluid inlet location on lower left of the Xe-3 rear panel with quick disconnect fittings.

5.7 Dimensions and Space Requirements (Mar 2020)

All Xe-3 Models

- The Xe-3 should be positioned as shown in Figure 5.7a below.
- This position will allow sufficient room to operate the unit, gain access to service areas, and allow proper ventilation through the air intake and exhaust vents.

Q-SUN Xe-3 Dimensions

External Dimensions with Leveling Glides (W × H × D)	91 cm × 178 cm × 99 cm (36" × 70" × 39")
External Dimensions with Casters (W × H × D)	91 cm × 183 cm × 99 cm (36" x 72" × 39")

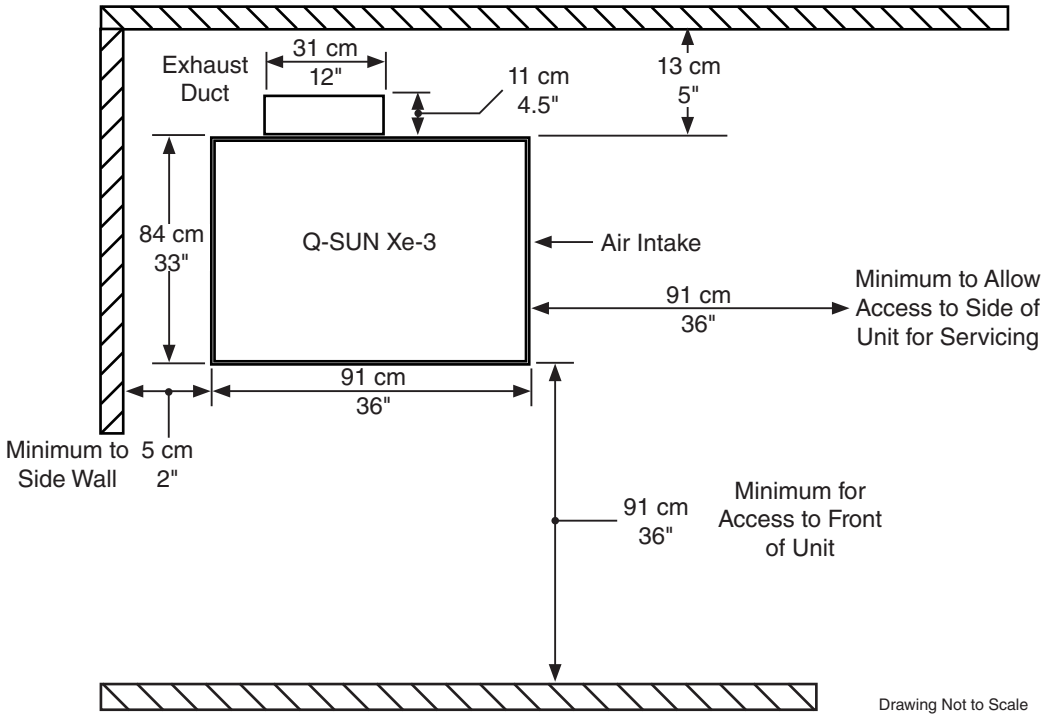


Figure 5.7a: Xe-3 placement without chiller.

Xe-3 with Chiller

- An Xe-3 with Chiller should be positioned as shown in Figure 5.7b below.
- This position will allow sufficient room to operate the unit, gain access to service areas, and allow proper ventilation through the air intake and exhaust vents.

NOTE: To remove the Xe-3 right side access panels the chiller duct may need to be unlatched and the chiller moved away from the Xe-3.

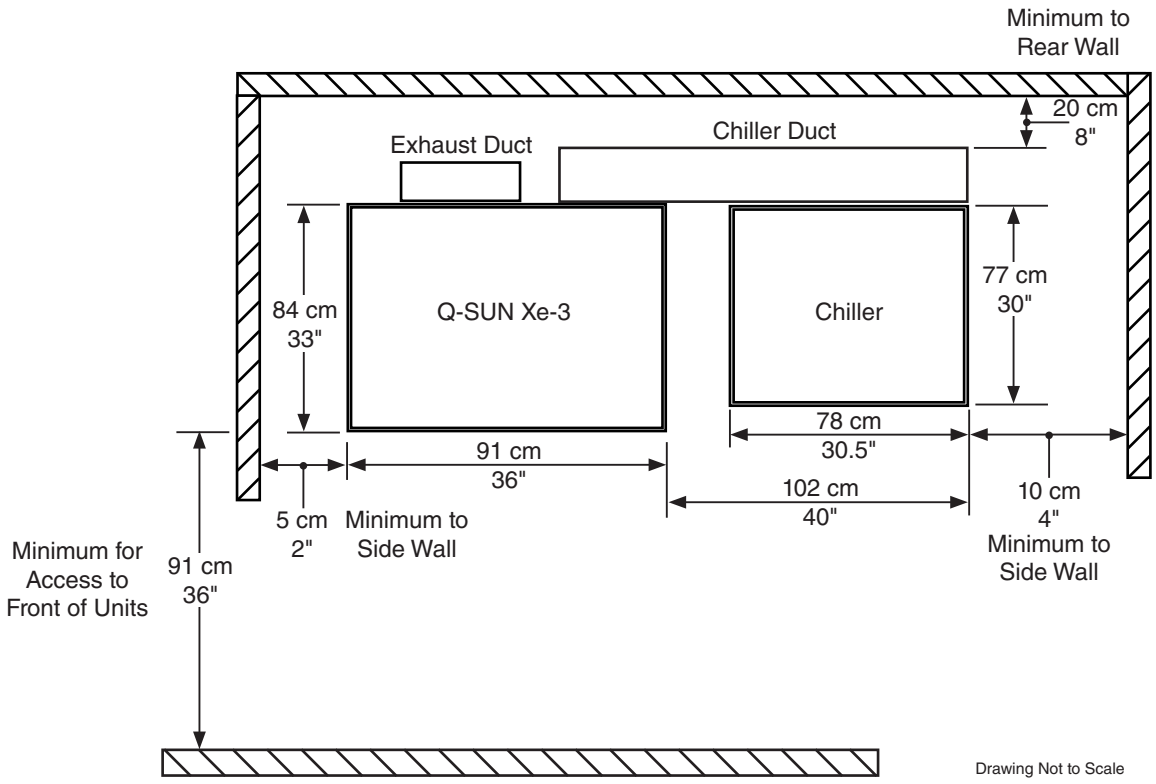


Figure 5.7b: Q-SUN Xe-3 placement with chiller.

Xe-3 with Dual Spray

- The Dual Spray system includes a cart/reservoir assembly with a footprint of approximately 76 × 61 cm (30 × 24").
- The system is powered by connection to the Xe-3 with an 2.5 m (98") power cord.
- The Dual Spray system is equipped with casters and is commonly positioned at the left side of the Xe-3 main cabinet.

5.8 Electrical (Apr 2021)

- All Q-SUN Xe-3 models come in 208 V, 230 V, and 400 V three-phase versions.
- 208V, 230V, or 400V is specified when the machine is ordered.
- The electrical requirements for Xe-3 testers are shown in Figure 5.8a below.
- Each tester has a nameplate attached to the rear of the unit which shows electrical requirements (Figure 5.8b).
- The voltage supplied to the machine must be within ±10% of the voltage rating of the machine and the circuit must be capable of supplying the rated current.

Power Cord Not Supplied

- The power cord connection between the facility main power suppy and the Q-SUN main power electrical panel **IS NOT** with Q-SUN Xe-3 testers.
- The user must provide the electrical hardware and connections.
- A qualified electrician should make all electrical connections to the Q-SUN Xe-3 tester.
- A hole is provided at the top rear of the machine so that a conduit fitting can be attached and the wires inserted inside the machine to the electrical panel behind the right side top access panel (Figure 5.8c).

  NOTE: The right side top access panel is connected to the tester by a ground wire tether. When removing the access panel it is not necessary to disconnect the wire. The ground wire is long enough to set the access panel on the floor in front of the tester.
- For 208 V or 230 V machines, four wires are required; three current carrying conductors and an earth ground (Figure 5.8d).
- For 400 V machines, five wires are required; four current carrying conductors and an earth ground (Figure 5.8e).

Electrical Requirements

Voltage:	All Models	208 V or 230 V or 400 V ± 10% - three phase
Current:	Xe-3-HSE/HBSE/HDSE/HDSBSE	39 A @ 208 V, 39 A @ 230 V, 26 A @ 400 V
	Xe-3-HCE/HSCE/HBSCE/HDSCE/HDSBSCE	44 A @ 208 V, 44 A @ 230 V, 26 A @ 400 V
Frequency:	All Models	50 or 60 Hz
Installation:	Rated as Installation (Over voltage) Category II for transient over voltages.	

Figure 5.8a: Electrical requirements.

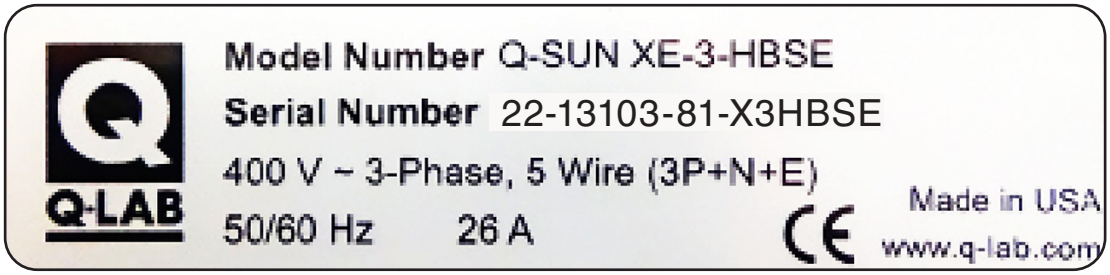


Figure 5.8b: Xe-3 Serial number nameplate shows electrical requirements.

Figure 5.8c: Remove upper right side access panel to see the electrical panel.

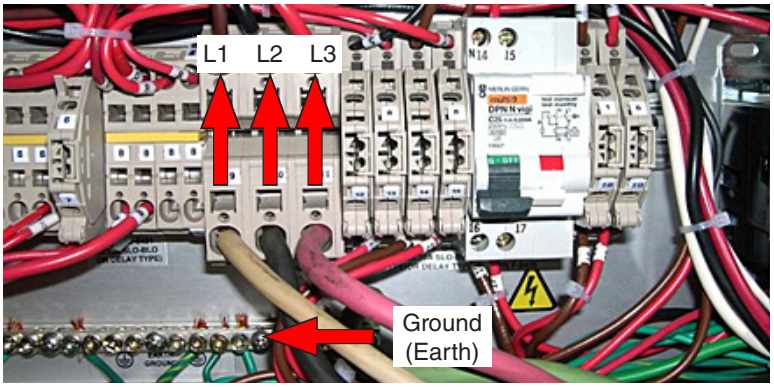


Figure 5.8d: Electrical input connections for 208 V and 230 V testers.

IMPORTANT: The neutral wire must be connected AND it must be connected to the terminal shown.

Be sure the neutral wire and one of the phase wires are not reversed.

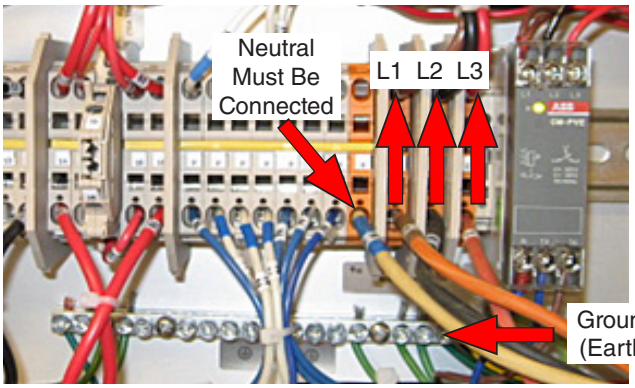


Figure 5.8e: Electrical input connections for 400 V testers.

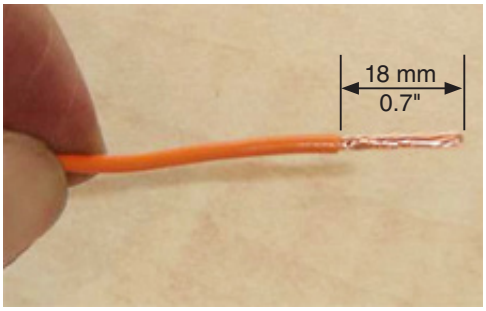


Figure 5.8f: Strip all wires 18 mm (0.7") before connecting.

To connect wires use a 5 mm screwdriver
to open the terminal tension clamps.

Figure 5.8g: 5 mm screwdriver.

Chiller

- If the Xe-3 is equipped with a chiller (C models), the chiller gets power from an outlet on the Xe-3 rear panel (Figure 5.8h).

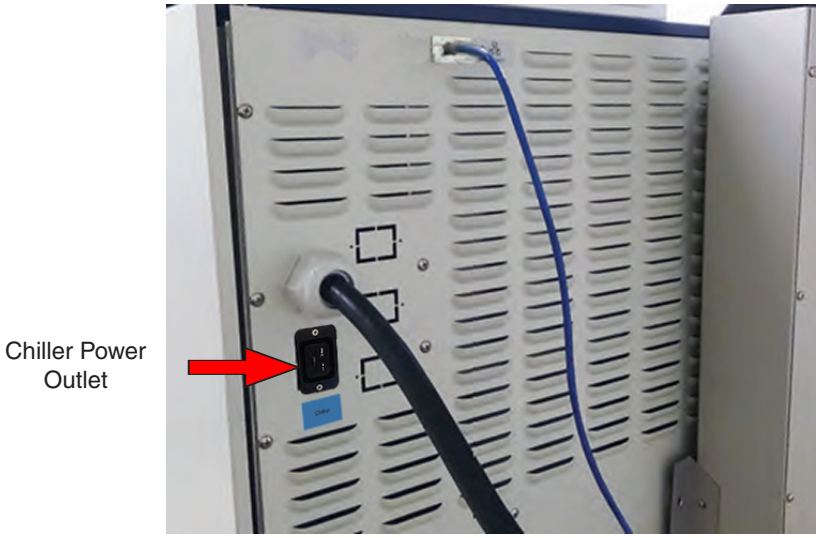


Figure 5.8h: Power outlet for chiller on Xe-3 rear panel.

Back Spray

- Xe-3 models equipped with a Back Spray (BS) system have no additional power requirements.

Dual Spray

- The power cord for the Dual Spray (DS) system connects to an outlet labeled “Dual Spray” on the Xe-3 rear panel (see Figure 5.6j). No additional power connections are required.

NOTE: The number and placement of power outlets on the rear of the Xe-3 varies depending on installed options.

5.9 Water (Sep 2020)

Overview

- Purified water must be supplied to all Q-SUN Xe-3 testers.
- Water is used by the humidifier to produce humidity.
- Water is also used to spray on the test specimens in Xe-3 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

Spray System (Model)	Inlet Pressure	Flow Setting	Average Daily Volume	Resistivity	Conductivity	Silica	Total Dissolved Solids	pH
Front Spray* ("S" models)	30-90 psi (207-620 kPa)	1.4 liter/min	0.16 liter/minute × spray time***	>5M ohm•cm	<0.2 µS/cm	<0.1 ppm	<0.1 ppm	6-8
Front and Back Spray* ("B" models)		15 psi**	0.65 liter/minute × spray time***					
Humidifier (non-"S" models)	10-90 psi (69-620 kPa)	0.1 liter/min	44 liters/day	> 200k ohm•cm	<5.0 µS/cm	Not Important	<2.5 ppm	6-8

* A minimum of 30 psi is needed continuously during spray steps to ensure all specimens are exposed to water spray uniformly. Failure to maintain adequate pressure for the duration of a spray step will cause the tester to produce a fault and interrupt the test.

**15 psi is the flow setting for the Back Spray only.

*** Average daily volume during a spray step is based on a spray on time of 10 seconds and a spray off time of 50 seconds. Adjusting the spray on/off time will change the average daily volume.

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-3 testers.**

Important: Use Type I, not Type II anion in the mixed bed tanks of the RO/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. Note that Type I anion is only necessary in the mixed bed "polishing" stages of the deionization, not in the initial "rough" purification stages.

- Figure 5.9a 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.

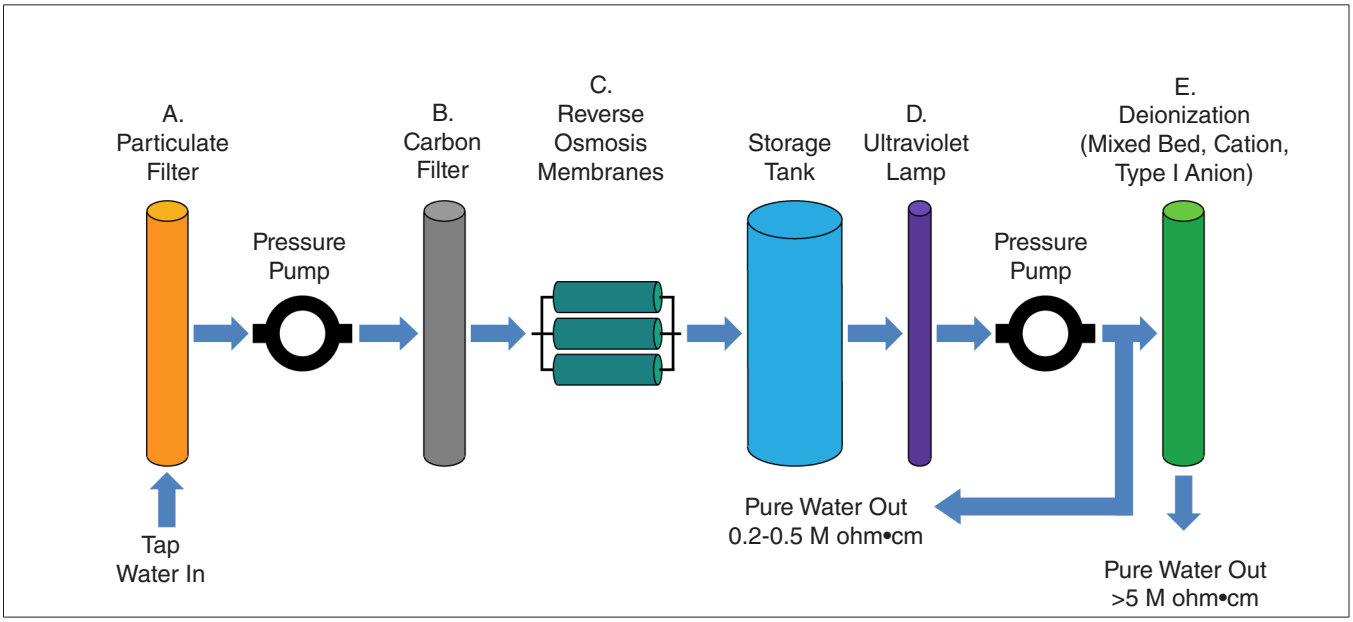


Figure 5.9a: Reverse Osmosis / Deionized Water System.

- 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

Connections

- The water supply and drain connections are made at the lower rear of the tester (Figure 5.9b).
- The Q-SUN tester is supplied with kit X-7654-K (Figure 5.9b) which includes water inlet and drain fittings to meet various connection configurations (Figure 5.9d through Figure 5.9g).
- A 10 mm water fitting adapter (U-40817-X) for connecting the tester to a 10 mm inlet water supply is also supplied (Figure 5.9c).
- The water inlet hose is not supplied with the tester. Drain hose is supplied with the tester.

Note: Connect water supply and allow 20 minutes for the humidifier tank to fill before powering on the tester.

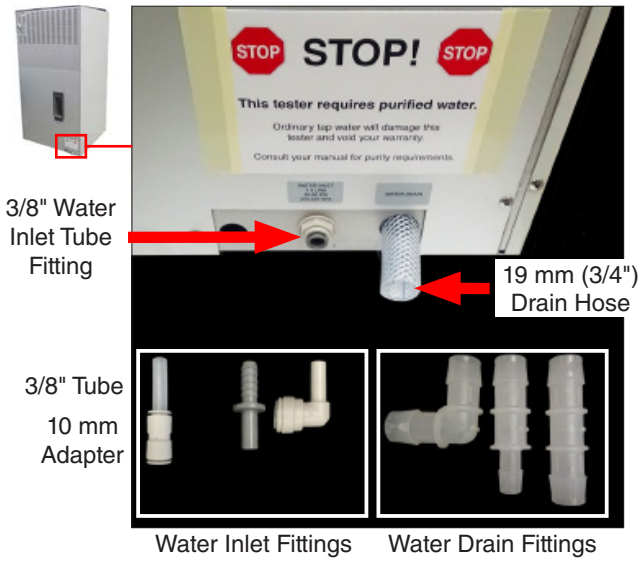


Figure 5.9b: Supplied water inlet and drain fittings.

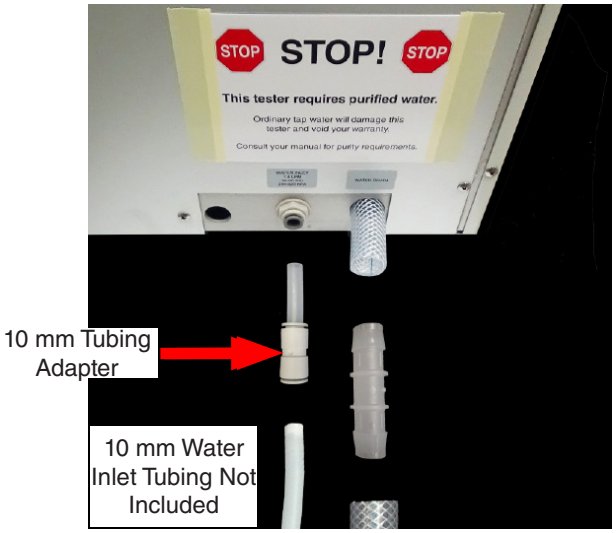


Figure 5.9c: Connect to 10 mm inlet water supply.

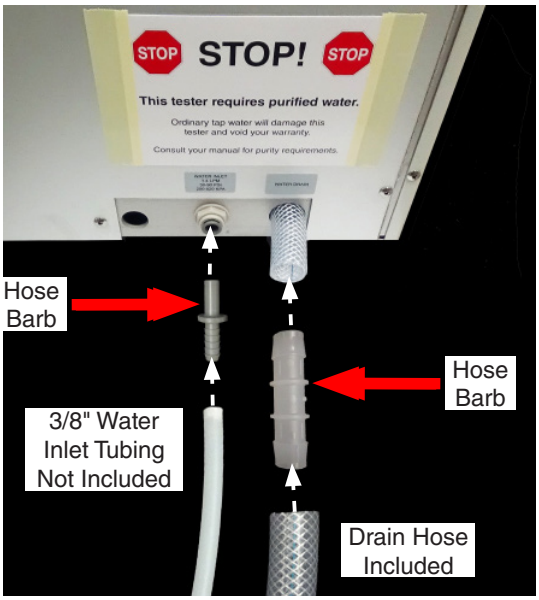


Figure 5.9d: Configuration 1.

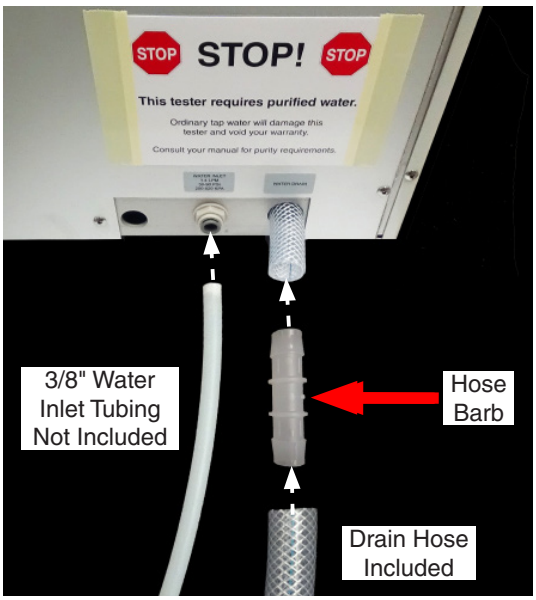


Figure 5.9e: Configuration 2.

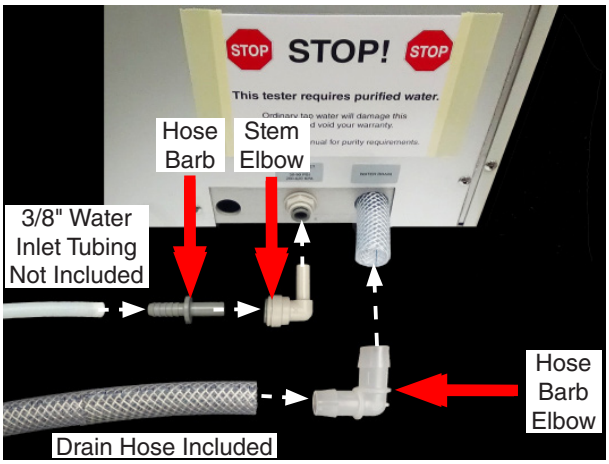


Figure 5.9f: Configuration 3.

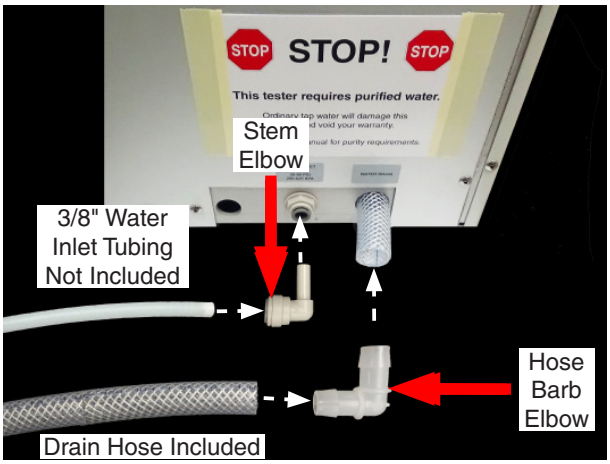


Figure 5.9g: Configuration 4.

To disconnect inlet hose barb or elbow, push in on the dark gray gripper ring on the inlet connector.

Figure 5.9h: Disconnect hose barb or elbow.

Raised Drain

- The drain tube must lie flat on the floor. 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 14.1) 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 14.2).
- 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.

Chiller

- The chiller does not require an input water supply.
- A drain connection must be made to drain water that condenses on the chiller evaporator coil.
- The drain connection is made at the lower rear of the chiller (Figure 5.9i).
- The chiller has a short piece of 1.3 cm (1/2") drain hose exiting below the rear panel.
- A 1.3 cm (1/2") × 2 cm (3/4") reducer is included in the drain kit to allow the chiller drain to be connected to the 2 cm (3/4") drain hose that is supplied in the drain kit.

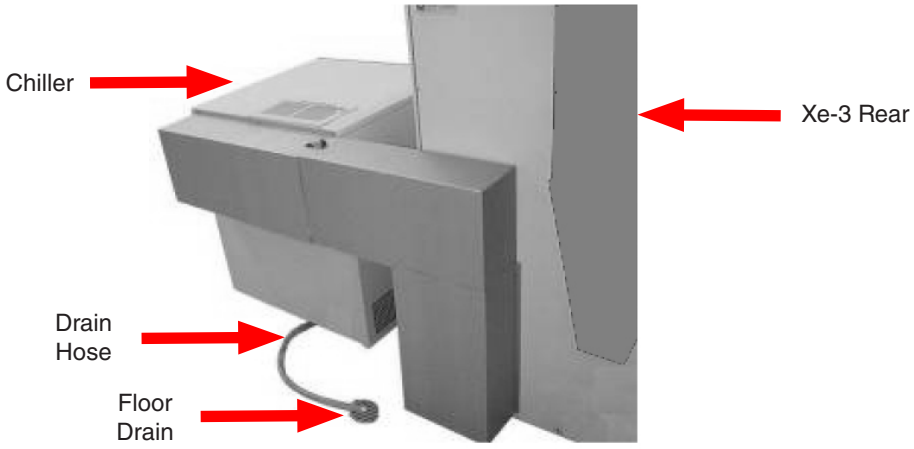


Figure 5.9i: Chiller drain hose routed to floor drain.

Back Spray

- Xe-3 models equipped with a Back Spray (BS) system have no additional water connection requirements

Dual Spray

- The Dual Spray system has a fluid drain hose at the bottom of the reservoir (Figure 5.9j).
- The reservoir drain valve and hose are accessed by removing one of the Dual Spray cart side panels.
- Make sure the drain hose is extended to an approprate fluid disposal drain before opening the drain valve.
- Opening the ball valve allows fluid from the reservoir to be pumped to the spray nozzles in the Xe-3 test chamber.
- See Section 2.3 for important information regarding potential fluid hazards.

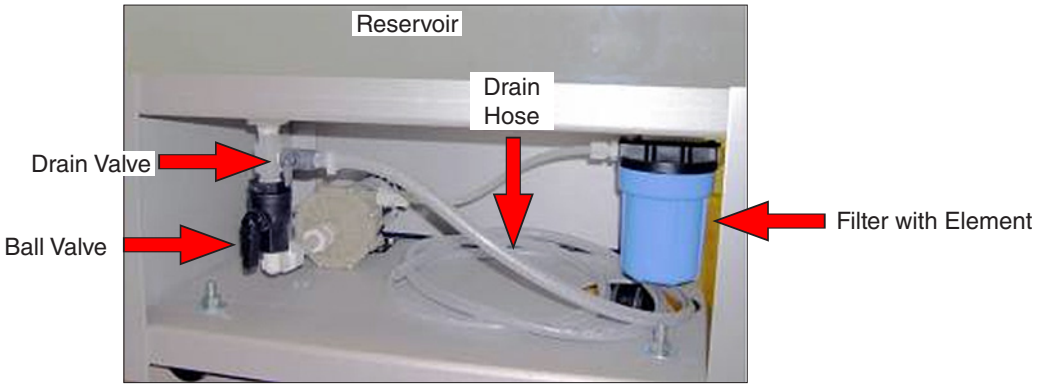


Figure 5.9j: Cart side panel removed to access Dual Spray drain valve and drain hose.

5.10 Venting (Dec 2020)

Xe-3

- The Q-SUN Xe-3 releases warm, moist exhaust air directly into the room.
- Xe-3 testers without chiller produce 5400 watts (18425 BTU/hr) of room heat.
- Xe-3 testers with chiller produce 6600 watts (22520 BTU/hr) of room heat.
- The Xe-3 humidifier exhausts approximately 6.0 liters (13.2 pounds) per hour of water vapor into the room.
- A dehumidifier may be required to prevent condensation from forming in the room.
- The recommended ambient operating temperature and relative humidity (RH) for the Xe-3 tester is 23 ± 5 °C and 50 ± 25% RH. See Section 4 for more important information on recommended tester operating conditions.
- The air conditioning and ventilation required to maintain the recommended ambient operating temperature and humidity should take into account the Q-SUN heat and water vapor exhaust.

The Xe-3 air intake and exhaust vents must not be obstructed. Keep filters clean.

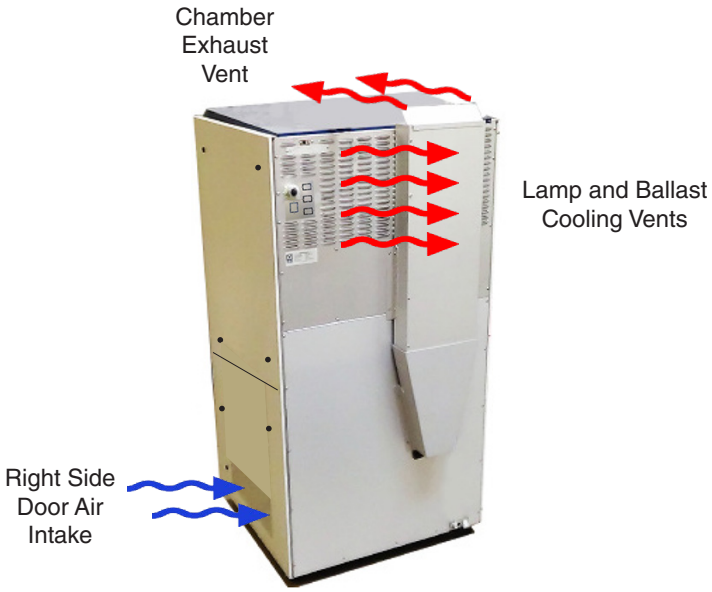


Figure 5.10a: Q-SUN Xe-3 Rear View Showing Air Intake and Exhaust Vent Locations

Contact Q-Lab Repair and Tester Support for venting options.

Chiller

The chiller air intake and exhaust vents must not be obstructed. Keep filters clean.

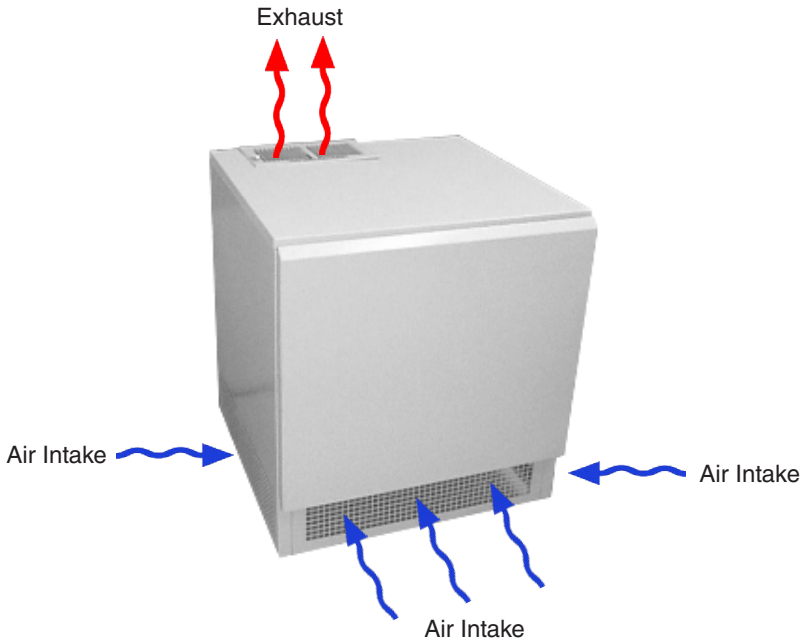


Figure 5.10b: Chiller Air Intake and Exhaust Vent Locations

Back Spray

- Xe-3 models equipped with a Back Spray (BS) system have no additional venting requirements.

Dual Spray

- Xe-3 models equipped with a Dual Spray (DS) system have no additional venting requirements.

6. Xenon Light System

6.1 Xenon Lamps and Specimen Geometry (Nov 2014)

Q-SUN testers use xenon lamps to reproduce the damaging effects of sunlight. Read Section 2 on safety before operating the xenon lamps.

Figure 6.1a: Q-SUN Xenon lamp.

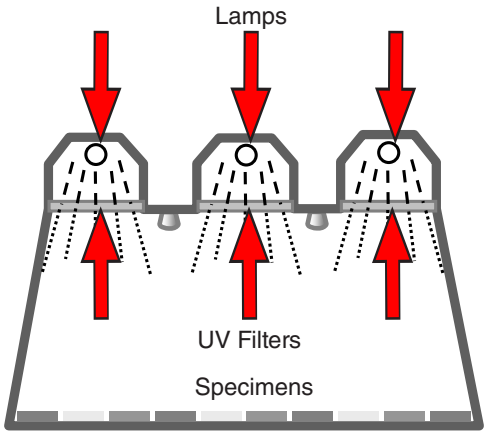


Figure 6.1b: Lamp and specimen geometry.

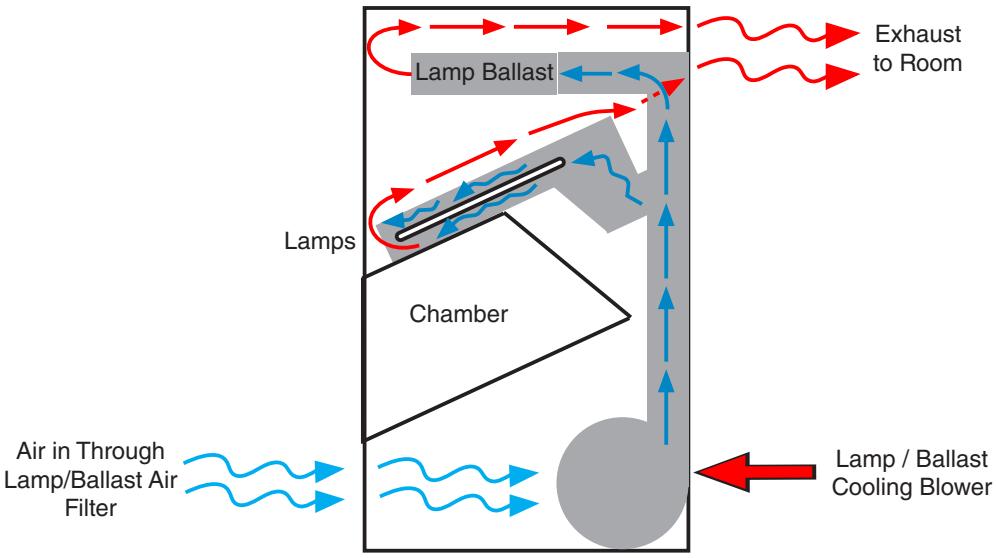


Figure 6.1c: Lamp cooling airflow schematic right side view.

6.2 SOLAR EYE Irradiance Control System (Oct 2014)

All Q-SUN Xe-3 models use 3 UV sensors, ballasts, and lamps. The UV sensor measures light intensity and sends information to the controller.

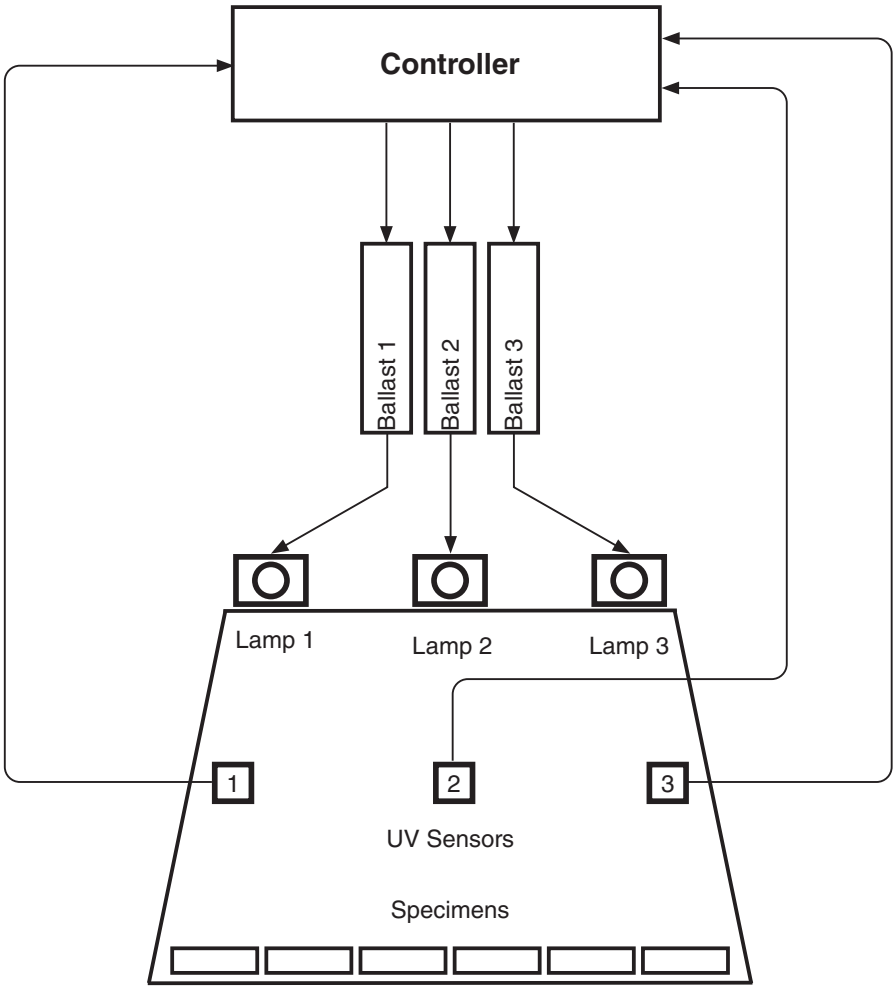


FIGURE 6.2: SOLAR EYE® Feedback Loop System

6.3 Irradiance Sensors (Sep 2020)

- Three (3) irradiance sensor types are available:

Sensor Type	Part Number
340 nm	X-7515-K
420 nm	X-7522-K
TUV (Total UV, 300-400 nm)	X-7523-K

  - The irradiance sensors are attached to the rear chamber wall (Figure 6.3a).
  - The installed sensor type is displayed on the tester control panel Status Screen (Figure 6.3b).
  - Most common test methods specify the type of irradiance sensor needed to conduct the test (see Section 11.1).
  - The irradiance control system must be re-calibrated whenever the sensor is changed. See Section 12.1 for calibration instructions.
  - See Section 17 for sensor replacement part information.

NOTE: Contact Q-Lab Repair and Tester Support if irradiance stability issues occur when changing the irradiance sensor type. See Section 19 for Q-Lab contact information.

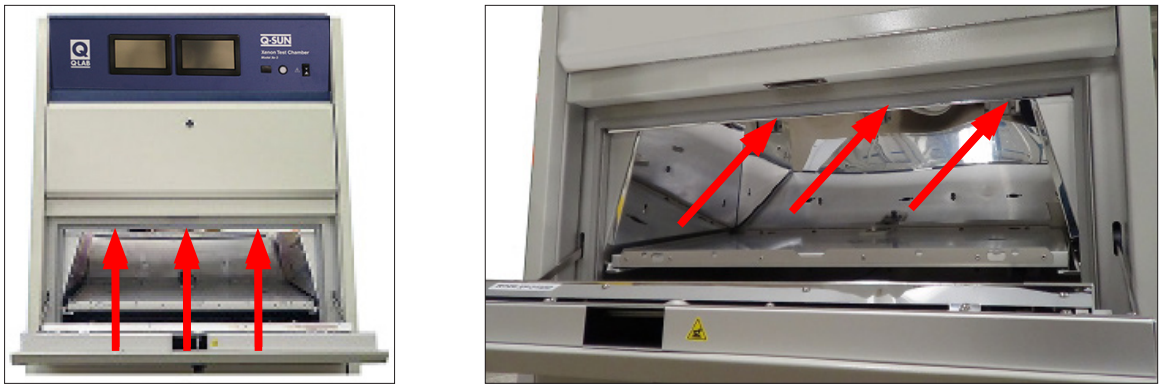


Figure 6.3a: Irradiance sensor locations.

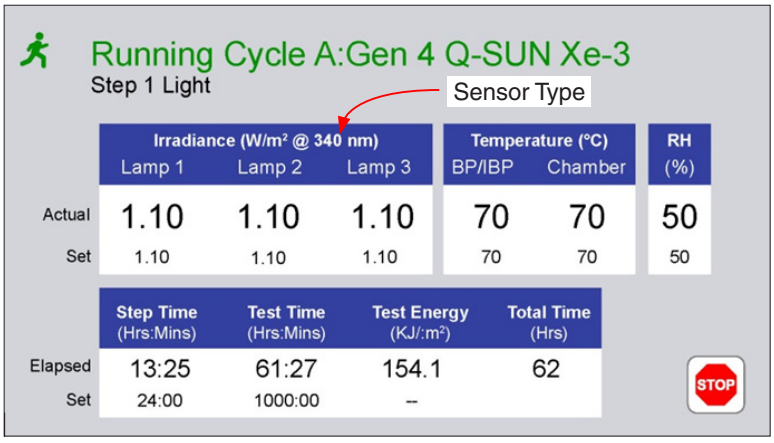


Figure 6.3b: Sensor type shown on Xe-3 Status display.

6.4 UV Optical Filters (Mar 2022)

- 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.
- The filter type name is etched on the filters for easy identification (see Figure 6.4a).
- See Section 17 for optical filter part numbers
- 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 for Section 11.3 information on changing optical filters.

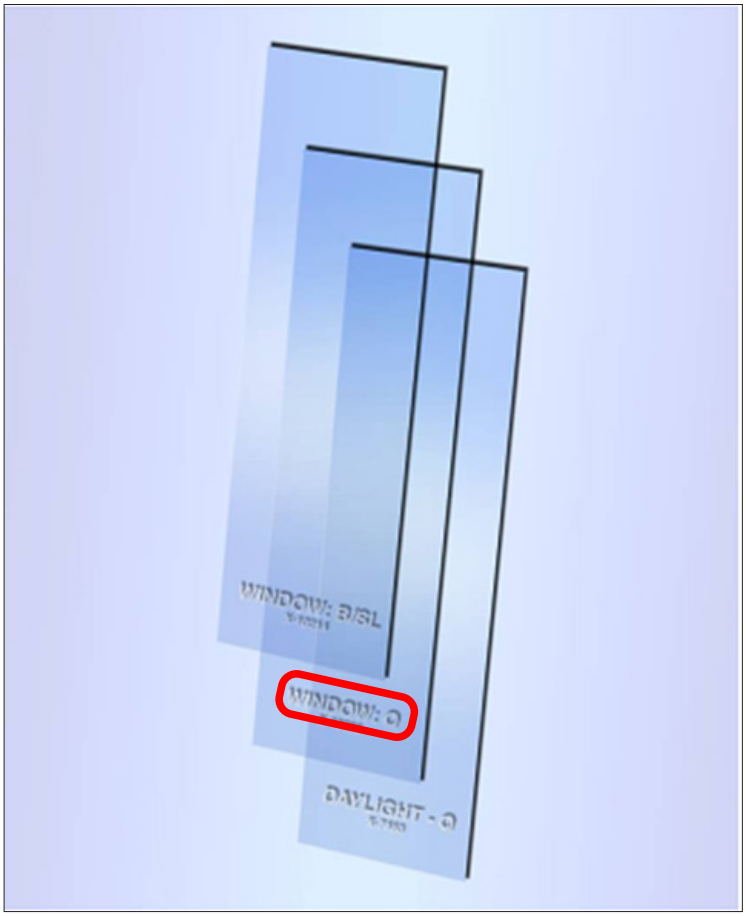


Figure 6.4a: Q-SUN Xe-3 UV filters are labeled with filter type.

Available Optical Filters

- Optical filters are divided into three broad classes: Daylight, Window, and Extended-UV. These are described at length in *Technical Bulletin LX-5060 A Choice of Filters for Q-SUN Xenon Test Chambers*.
- Q-SUN optical filters are listed in the table below.
- See Figure 6.4b through Figure 6.4h for spectral power distributions of the optical filters.

Filter Type	Description
Daylight-Q	Noon summer sunlight. Meets ASTM and ISO General and Type I spectral irradiance requirements.
Daylight-F	Noon summer sunlight, with an even more realistic match to the solar spectrum (matches ASTM D7869). Meets ASTM and ISO General and Type I spectral irradiance requirements.
Daylight-B/B	Matches the spectrum of rotating rack machines with borosilicate inner and outer filters. Transmits shortwave UV that is not found in natural sunlight (harsher UV). Meets ASTM and ISO General and Type II spectral irradiance requirements.
Window-Q	Noon summer sunlight through window glass.
Window-B/SL	Matches the spectrum of rotating rack machines with borosilicate inner and soda lime outer filters. For AATCC specifications that call for window glass filters.
Window-IR	Similar to Window-Q, but 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 (note that no known standards require it). Water inadvertently sprayed onto hot filters can lead to cracking.**
Window-SF5	Spectrum specified in the Ford BO 116-01 test method.
Extended UV-Quartz	Extremely harsh short wavelength UV.
Extended UV-Q/B	More UV than natural sunlight, for SAE J2412 and J2527 tests.
UV Blocking	Blocks all UV light. Used in combination with a Daylight or Window filter to meet ICH guidelines. Contact Q-Lab abd request *Service Instruction X-10521-L ICH Guidelines Test Protocol for Q-SUN Xenon Arc Test Chambers* for more information (see Figure 6.4h).

Daylight Optical Filters

- Popular test standards have very broad "General Classification" spectral requirements for daylight optical filters.
- To help distinguish daylight optical filter characteristics, test standards ASTM G155, ISO 4892-2, and ISO 16474-2 now include two sub-classifications for daylight optical filter spectral requirements:
  - Type I and Type II
  - These sub-classifications provide more precise specifications of light spectra in accelerated weathering tests to help users of the standards make more informed decisions about test parameters.
- All Q-Lab daylight optical filters meet the General Classification spectral requirements.
- The Daylight-Q and Daylight-F optical filters also meet the Type I classification, and closely match natural sunlight.
- The Daylight-B/B optical filter meets the Type II classification and matches historical filters that allow more shortwave UV light than natural sunlight.
- Contact Q-Lab for detailed daylight optical filter spectral classification information.

Spectral Power Distributions (also called Spectral Irradiance)

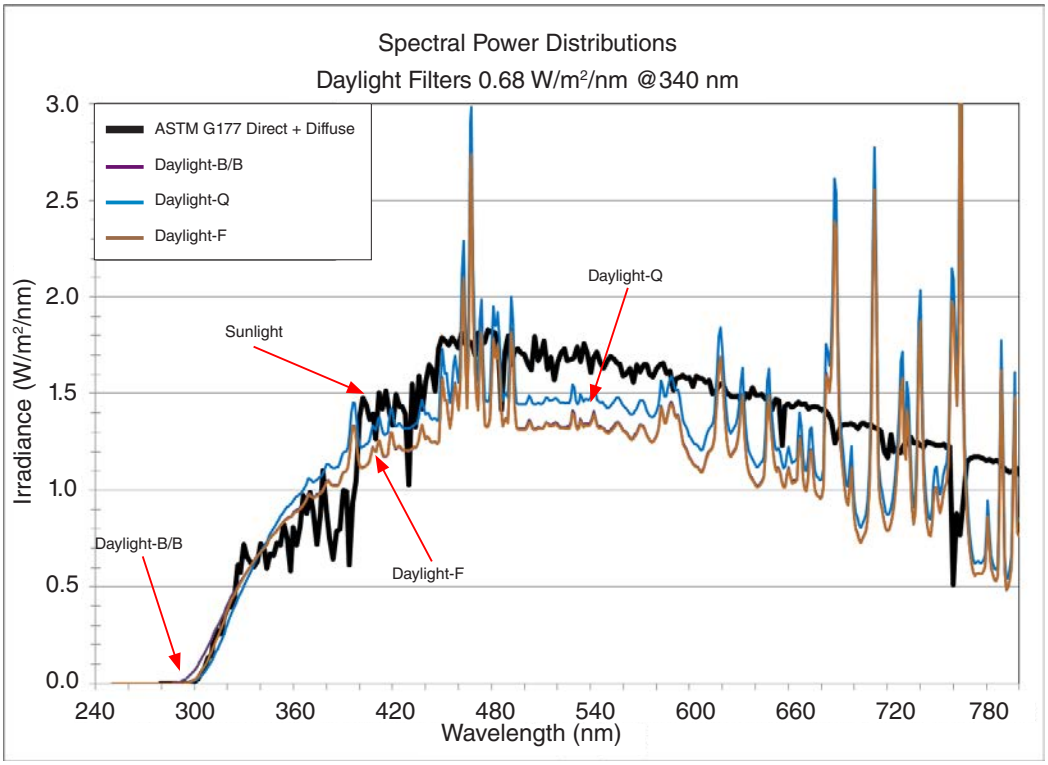


Figure 6.4b: Spectral power distributions of Daylight filters from 250-800 nm.

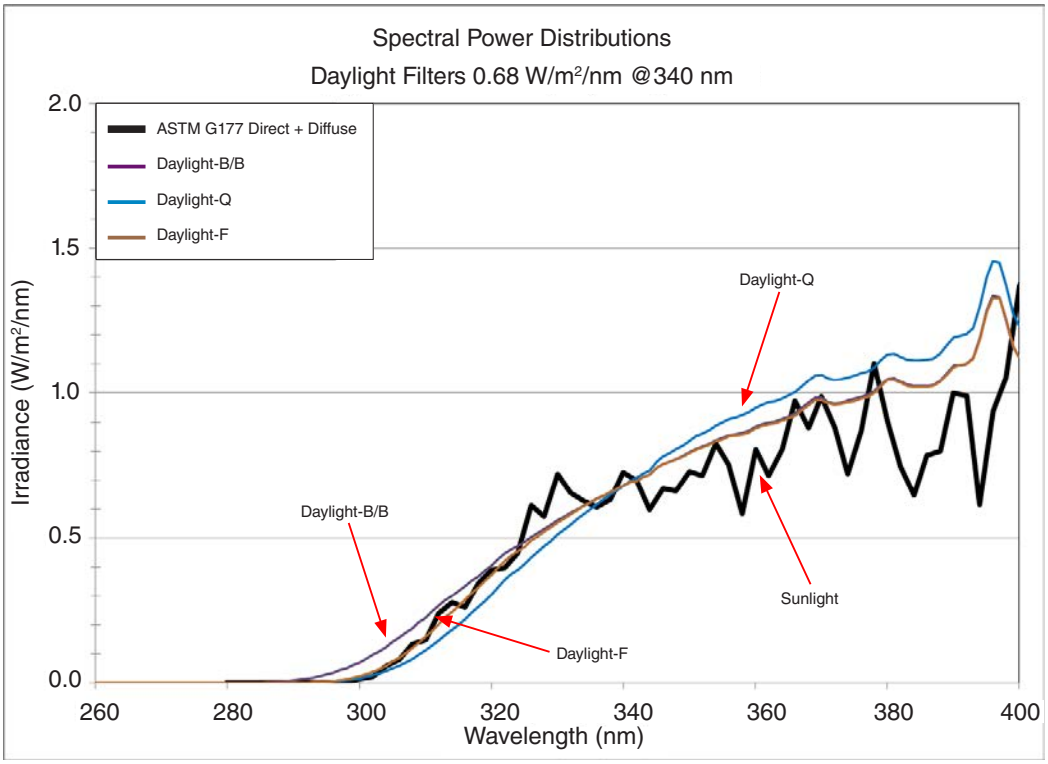


Figure 6.4c: Spectral power distributions of Daylight filters from 260-400 nm.

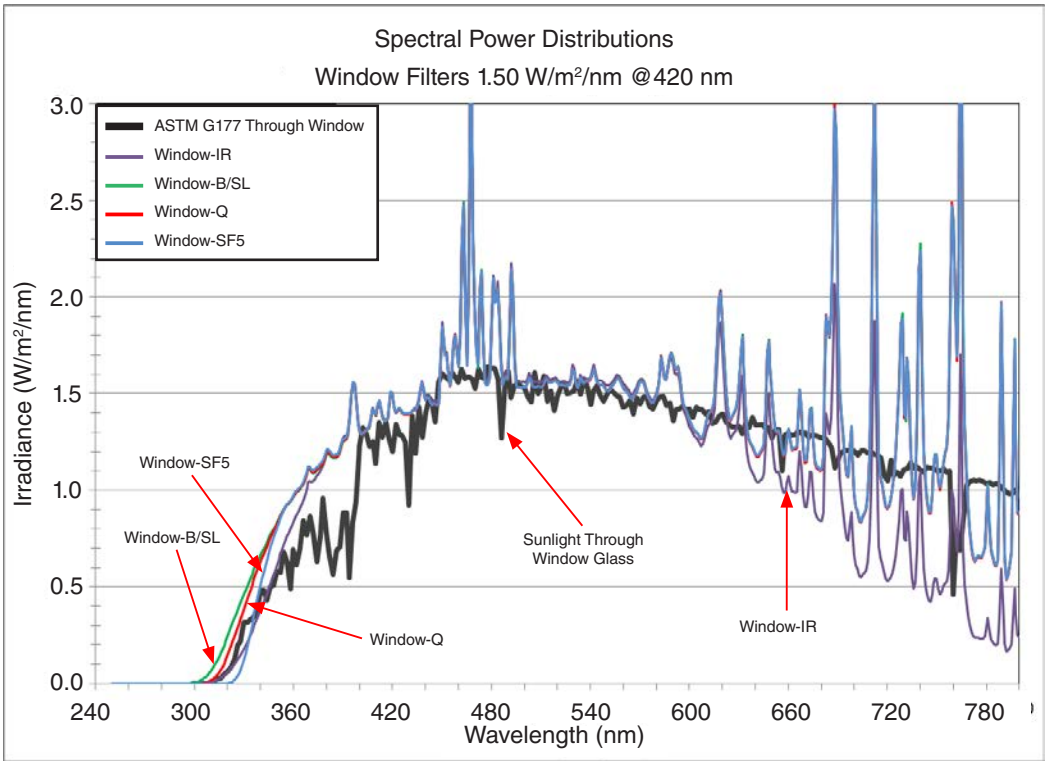


Figure 6.4d: Spectral power distributions of Window filters from 250-800 nm.

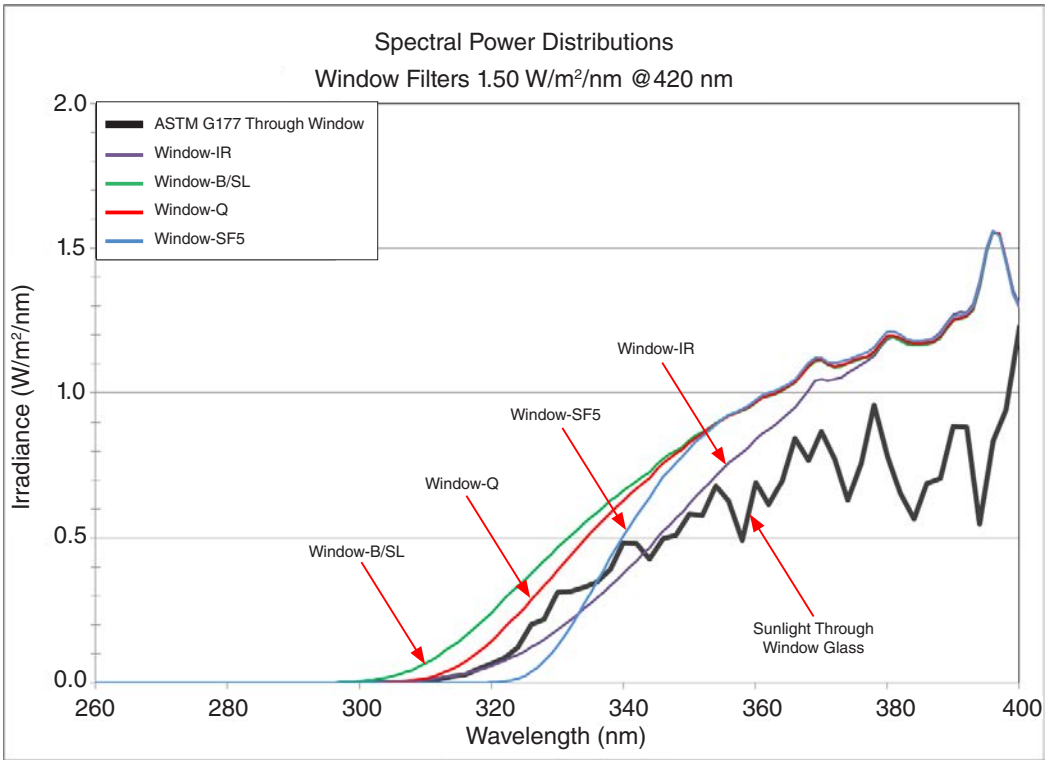


Figure 6.4e: Spectral power distributions of Window filters from 260-400 nm.

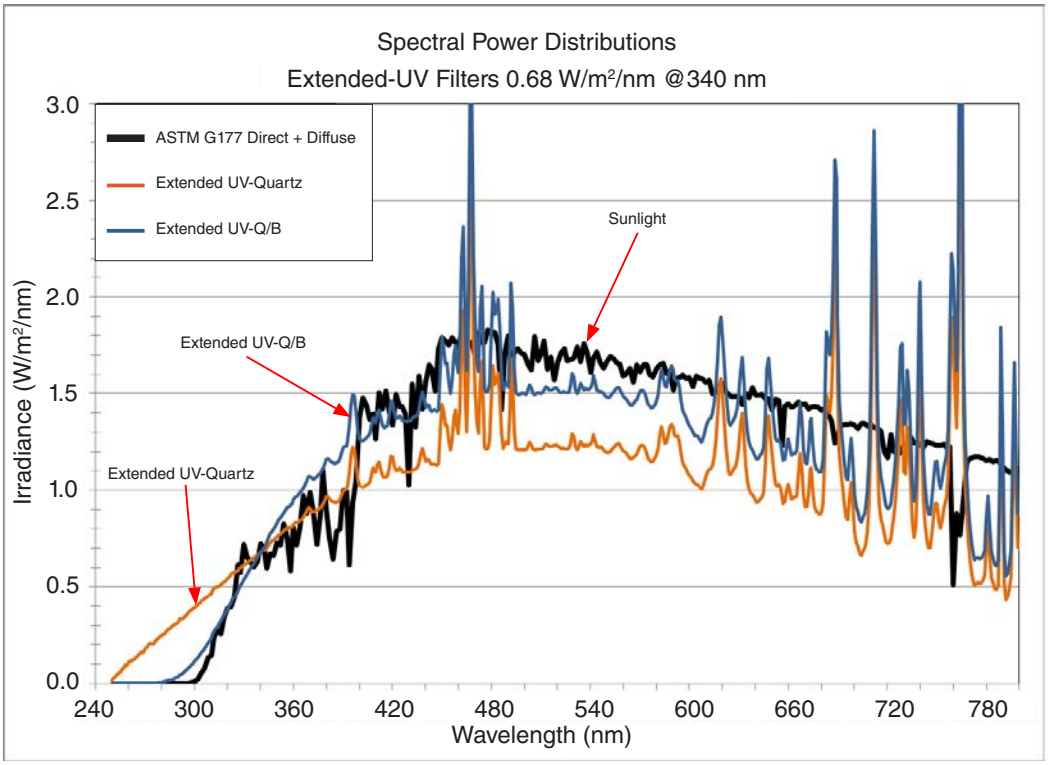


Figure 6.4f: Spectral power distributions of Extended-UV Filters from 250-800 nm.

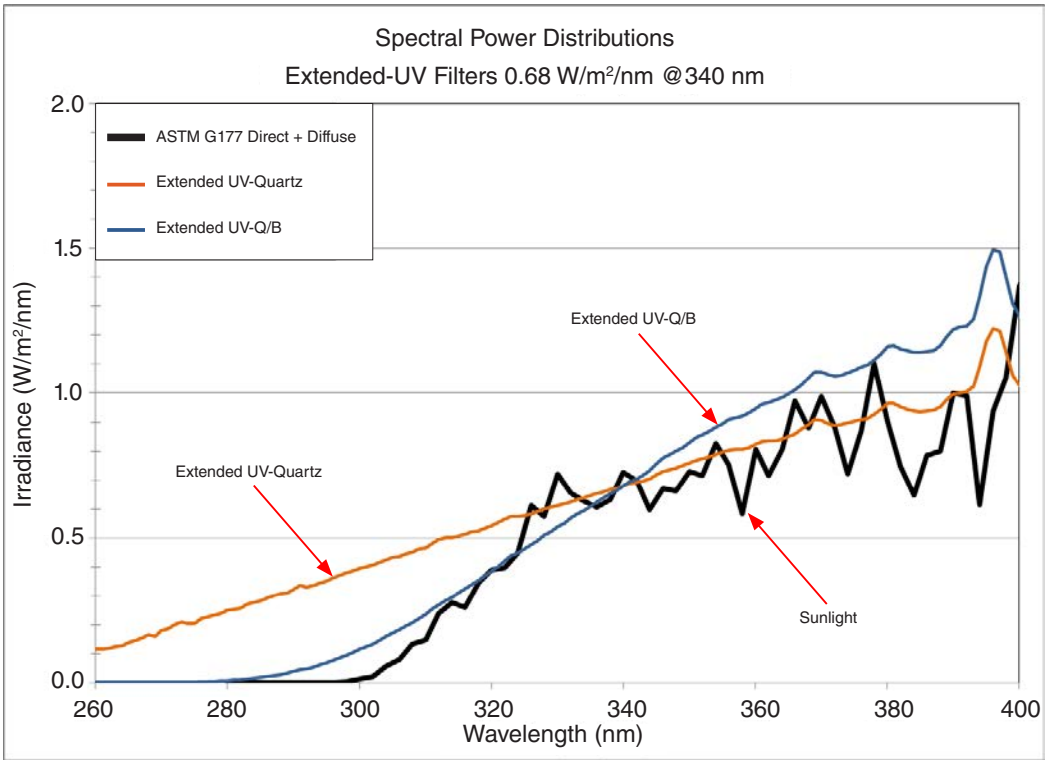


Figure 6.4g: Spectral power distributions of Extended-UV Filters from 260-400 nm.

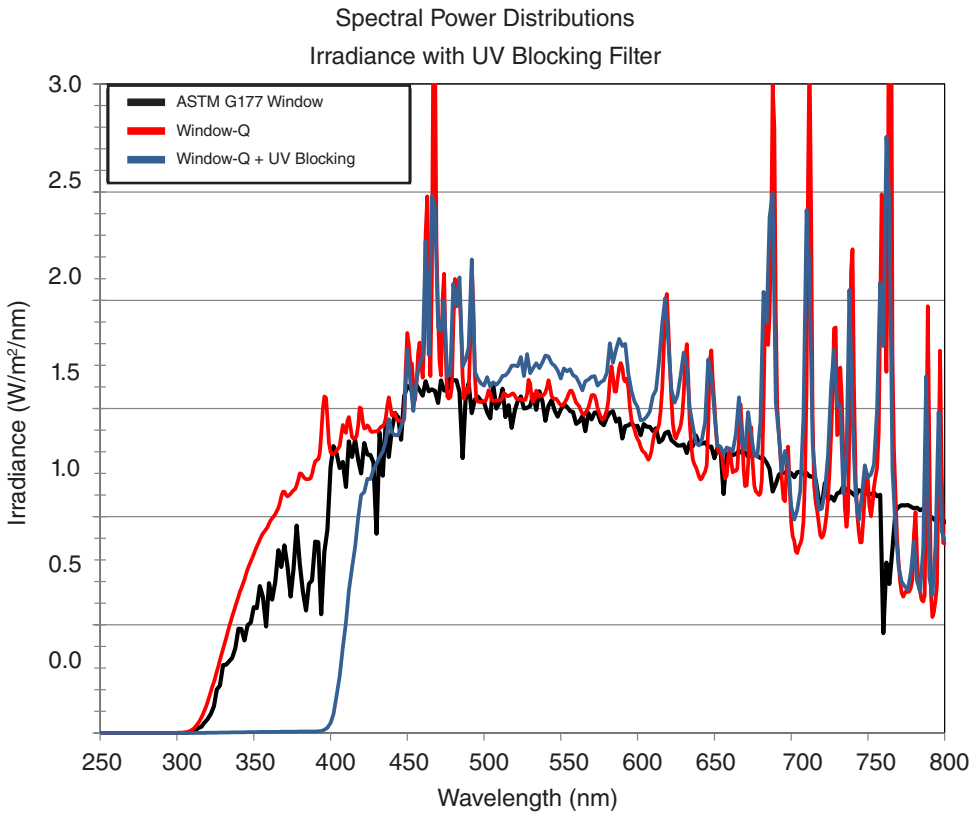


Figure 6.4h: Spectral power distributions for a Q-SUN with Window-Q filters (red) and Window-Q plus UV blocking filters (blue), plus the ASTM G177 reference Window glass spectrum (black line). **NOTE:** The Window-Q is set to 1.50 W/m²/nm @420 nm but the UV blocking filter is shown at 1.00 W/m²/nm @420 nm to best match the visible and IR to Window-Q.

7. Temperature Control Systems

7.1 Panel Temperature Sensors (Oct 2020)

Overview

- Xe-3 testers use a temperature sensor to control operating temperature during a test.
- The far more common black-painted sensors (Figure 7.1a and Figure 7.1b), as well as white-painted sensors (Figure 7.1d and Figure 7.1e) are available.
- Both the black and the white sensors can be uninsulated or insulated.
- ASTM and ISO designations vary for uninsulated and insulated black panels (Figure 7.1c).
- Uninsuated and unsulated sensors produce very different test temperatures (the insulated black panel will produce cooler temperatures) for the same controller temperature setting.
- The panel temperature sensor can be attached to the specimen tray or preferably be mounted in a 2"×4" specimen holder.
- When running a standard test method, be sure to use the type of panel temperature sensor specified in the standard.

Black Panel Temperature Sensor

- The Q-SUN controls the temperature of a black panel sensor attached to the specimen tray.
- Two types of black panel sensors are available (See Figures below).
- They produce very different test temperatures (the insulated black panel will produce cooler temperatures), even with the same controller temperature setting.
- If you run a standard test method, be sure to use the type of black panel that is specified in your standard.

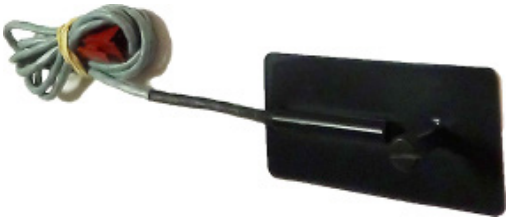


Figure 7.1a: Uninsulated Black Panel.

Figure 7.1b: Insulated Black Panel.

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

Figure 7.1c: ASTM vs. ISO designations for black panel temperature sensors.

White Panel Temperature Sensor

- White panel temperature sensors are identical to the black panels except painted white.
- Uninsulated and insulated white panels are available (Figure 7.1d and Figure 7.1e).
- A white panel can replace the black panel, or a white panel can be added to the tester with the black panel.
- Except where noted, references in this manual to black panel temperature sensors also apply to white panel temperature sensors.
- See *X-15351-L Q-SUN Xe-3 White Panel Installation* for detailed information on installing and operating white panel temperature sensors.

Figure 7.1d: Uninsulated White Panel.

Figure 7.1e: Insulated White Panel.

Sensor Location

- Securely mount the black panel sensor to the specimen tray (Figure 7.1f).
- Do not allow specimens to touch, cover or shade the black panel. See Section 11.4.

Figure 7.1f: Proper location of the panel temperature sensor.

7.2 Chamber Air Temperature Sensor (Oct 2020)

- The Q-SUN Xe-3 includes a chamber air temperature (CAT) sensor in addition to the panel temperature sensor.
- The chamber air temperature sensor is located at the right rear of the test chamber. (Figure 7.2a)
- The chamber air temperature sensor and the relative humidity (RH) sensor are in the same housing (see Section 12.4).

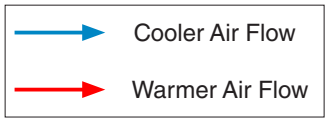
Figure 7.2a: Chamber air temperature sensor location.

7.3 Chamber Air Temperature Control (Oct 2020)

Non-Chiller Models

- The chamber temperature is controlled using variable speed blowers and an air heater.
- Both blowers (recirculting 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 ambient air is circulated into the chamber (Figure 7.3a).
- To raise chamber temperature, chamber air is recirculated and the air heater is activated (Figure 7.3b).

Note: Spray steps temporarily disturb temperature control and reduce temperature.



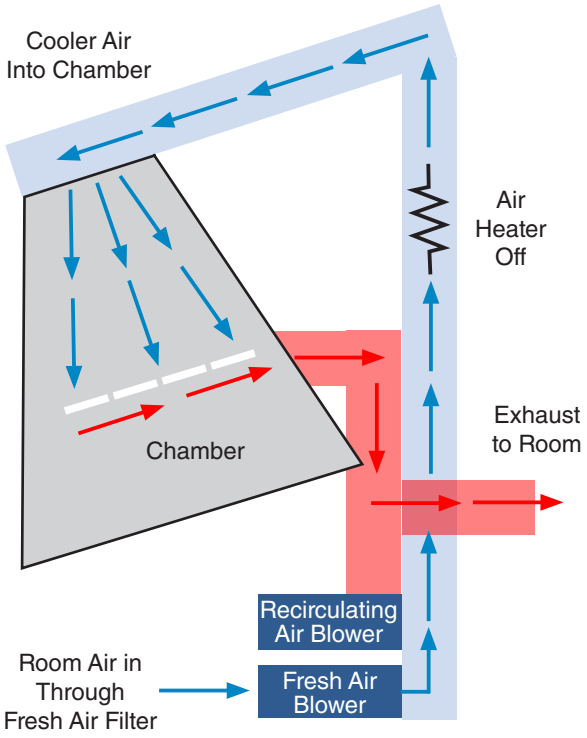


Figure 7.3a: Schematic showing air flow for chamber temperature cooling.

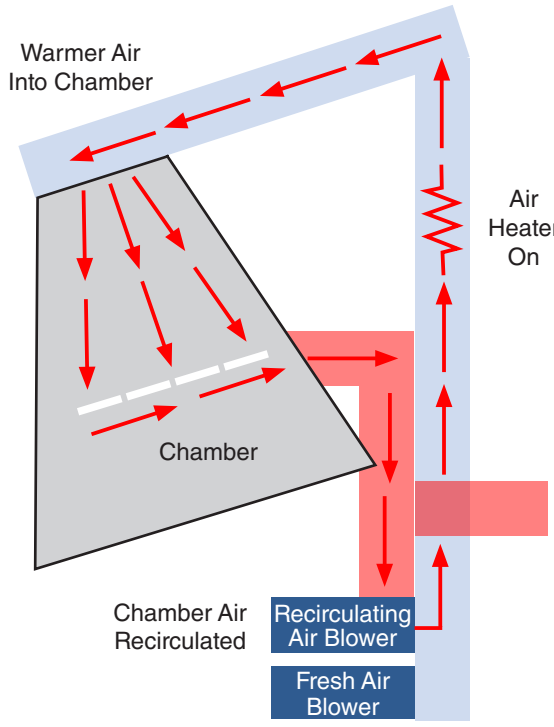


Figure 7.3b: Schematic showing air flow for chamber temperature heating.

Chiller Models

Temperature control in Xe-3 models with chiller operates similarly to non-chiller models except as noted here:

- The chiller achieves lower chamber temperatures by cooling the air that is drawn in by the fresh air blower.
- The fresh air intake in the Xe-3 is blocked so that the air suppplied to the fresh air blower is the cooled air from the chiller (Figure 7.3c).
- This air is typically cooled approximately 15 °C, so significant reductions in chamber temperatures are possible.

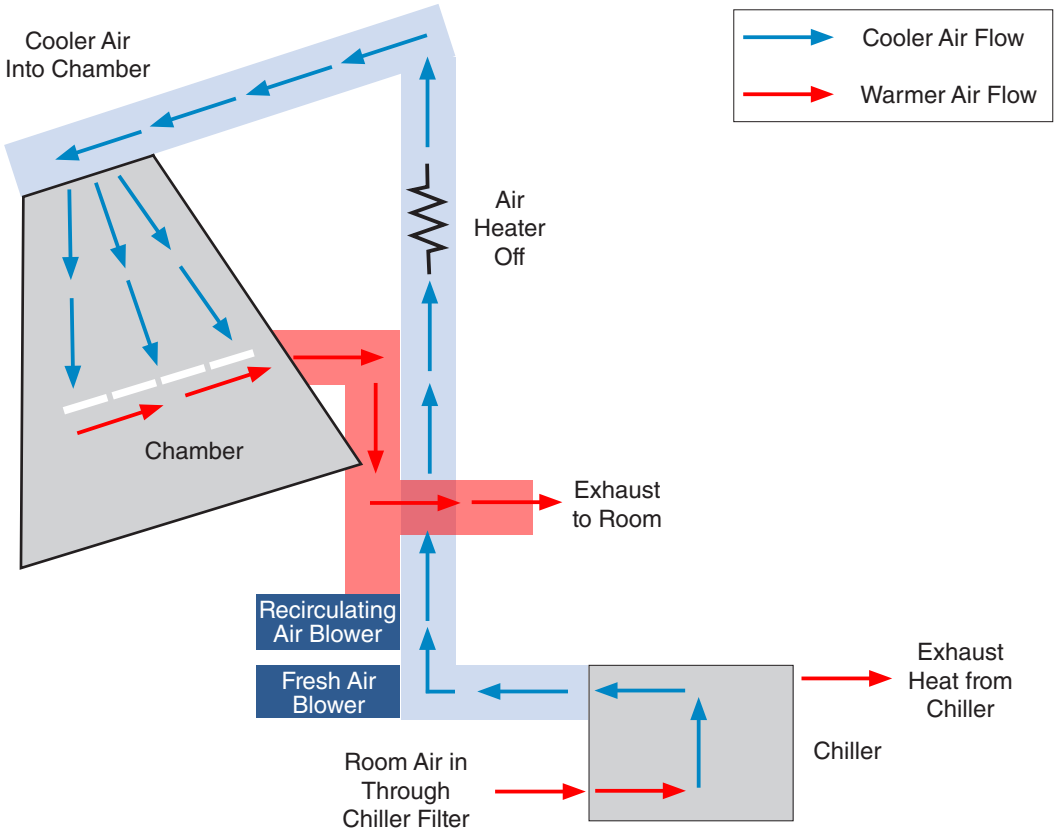


Figure 7.3c: Schematic showing air flow for chamber temperature cooling with chiller.

- The chiller cools the test chamber by providing room air that has been cooled (if the chiller is on) into the Q-SUN test chamber.
- The chamber air temperature is automatically controlled by turning the chiller on or off, by varying the amount of chilled air mixed with air recirculated from the chamber, and by heating the air, if necessary.
- The black panel temperature is automatically controlled by varying the speeds of both blowers, thus providing greater or less airflow to cool the black panel.
- The Q-SUN controller determines if the chiller is needed during each step of the test program, based on the type of step, the temperature set point, and the lab temperature (see Section 10).
- The chiller power switch on the front of the cooling unit inside the chiller cabinet (Figure 7.3d) must remain in the ON position.

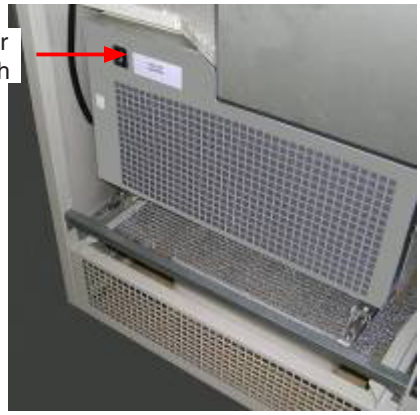


Figure 7.3d: Chiller power switch location.

Damper

- With most chiller systems, when the room temperature drops below about 20 °C (68 °F), the temperature of the cooling coil on the chiller can get below freezing.
- Since significant quantities of water are condensed on this coil, ice can form, which then freezes and degrades the performance of the unit (and can ultimately ruin the chiller).
- The chiller includes a manually-operated damper (Figure 7.3e).
- The damper position must be set to the lowest temperature expected in the room where the Q-SUN is operating.
  - Using the graduations on the damper as a guide, the damper louvers should be fully open if the room is 20 °C (68 °F) or warmer to allow maximum cooling efficiency.
  - The damper should be partially closed in a cool (20 °C / 68 °F or less) room to recirculate some of the exhausted heat. This increases the air temperature going through the cooling coil, reducing the danger of freeze-up.
- Use the graduations on the side of the damper (Figure 7.3f) as a guide to adjusting the damper levels.

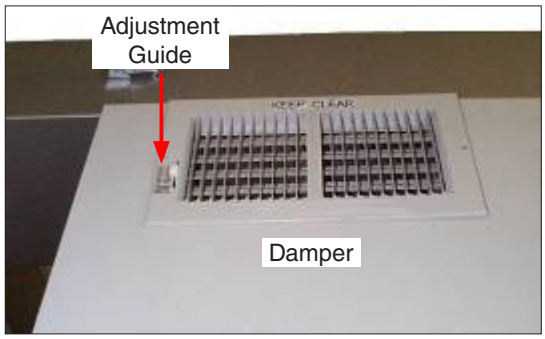


Figure 7.3e: Damper located on top of chiller cabinet.

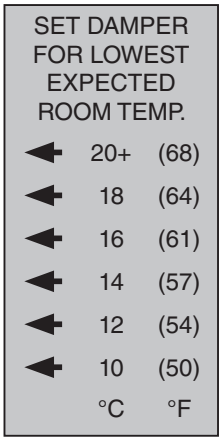


Figure 7.3f: Damper adjustment guide.

8. Relative Humidity System

8.1 Humidifer (Mar 2022)

- All Q-SUN Xe-3 models are equipped with a controlled relative humidity (RH) system.
- Humidity control system components can be accessed through the lower front door and the lower right side access panel (Figure 8a and Figure 8b).
- The humidity sensor is under the specimen tray.
- Water level in the humidifier is maintained by a float valve in the water feed box.
- See Section 15.6 for humidifier maintenance information.

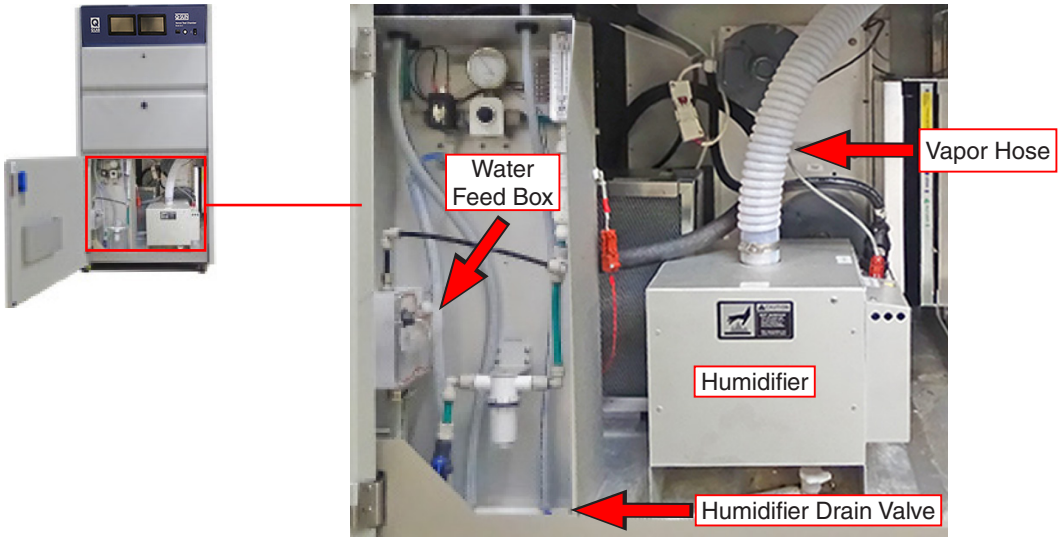


Figure 8a: Open lower front door to access humidity system components.

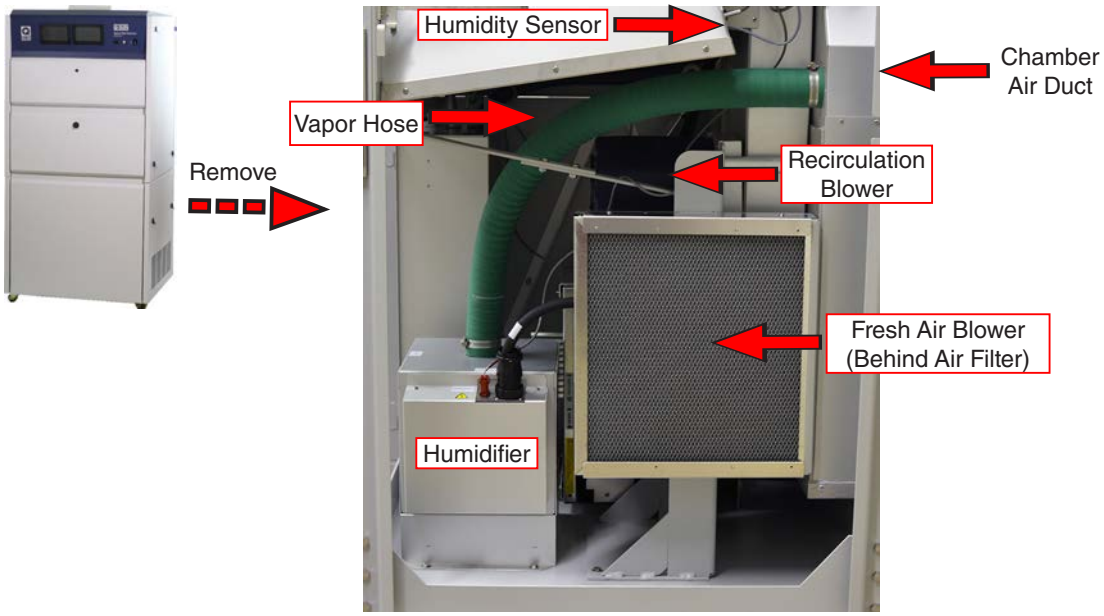


Figure 8b: Remove lower right side panel to access humidity system components.

8.2 Relative Humidity Sensor (Mar 2022)

- The Q-SUN Xe-3 includes a RH sensor.
- The RH sensor is located under the specimen tray (Figure 8.2a).
- The RH sensor and the chamber air temperature sensor are in the same housing (Figure 8.2b).
- This sensor is designed to be replaced once a year. It cannot be recalibrated (see Section 12.4).
- The actual RH (along with the RH set point) is displayed on the tester Status Screen (see Section 10.2).

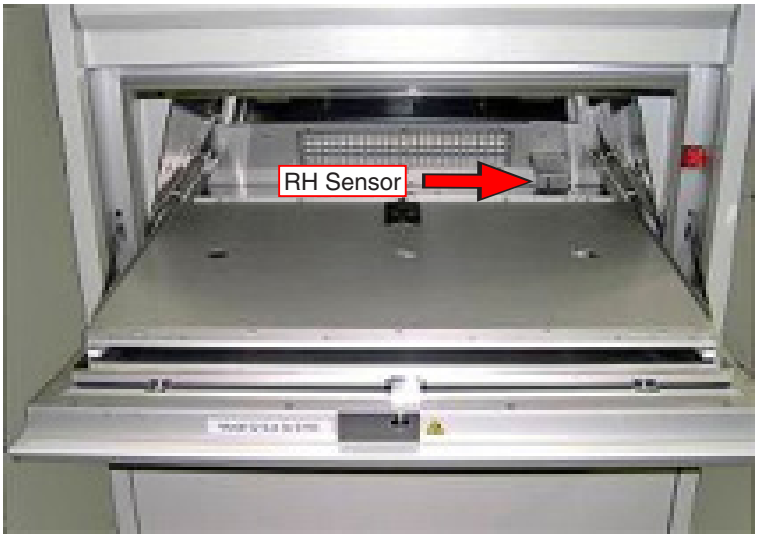


Figure 8.2a: Xe-3 test chamber, specimen tray pulled out to show RH sensor.

Figure 8.2b: RH (and chamber air temperature) sensor.

9. Fluid Spray Systems

- Three spray system options are available on Q-SUN Xe-3 testers.
  - o Q-SUN Xe-3 testers with the "S" water spray model designation simulate outdoor moisture with water spay. during a *Spray* step.
  - o Q-SUN Xe-3 testers with the "BS" water back spray model designation can spray the bottom (back) surface of the specimens with water spay only during a *Dark + Spray Front + Back* step.
  - o Q-SUN Xe-3 with the "DS" dual spray model designation can spray a second liquid onto the top (front) of the specimens during an *Auxiliary Spray* or *Light + Aux* Spray step, in addition to the standard "S" top (front) water spray.
- See *LX-5080-SO Q-SUN Xe-3 System Overviews* for detailed spray system information and diagrams.

Important: Very high purity water is required for spray systems. See Section 5.9 for water purity requirements.

9.1 Front Spray (Dec 2020)

- Q-SUN Xe-3 front spray (S) models have two water spray nozzles (Figure 9.1a and Figure 9.1b).
- The front spray control system consists of a shut-off valve, water filter, flow switch, pressure regulator, pressure gauge, flow meter, and solenoid valve (Figure 9.1c).

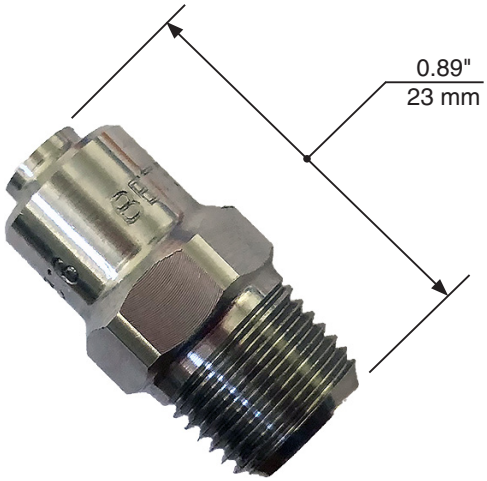


Figure 9.1a: Spray nozzle.

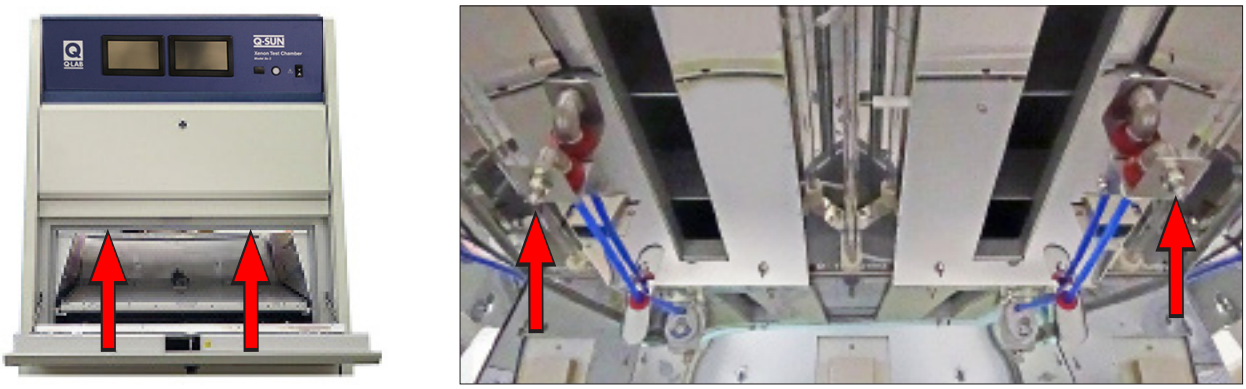


Figure 9.1b: Front spray nozzles on test chamber ceiling.

- Use the pressure regulator to set flow rate when spray is on. Recommended flow setting is 1.4 liter per minute.
- During normal operation, the front spray pressure gauge (Figure 9.1c) should read approximately 20 psi (138 kPa).
- For back spray models, the back spray pressure gauge (not shown) should read approximately 15 psi (103 kPa).
- The spray pulse rates can be changed (see Section 10.7).
- These spray pulses are adequate to keep test specimens wet during the entire spray step (they do not dry off during the spray off period) and water is conserved.
- Contact the Q-Lab Repair and Technical Support Department for more information on setting spray pulse rates.

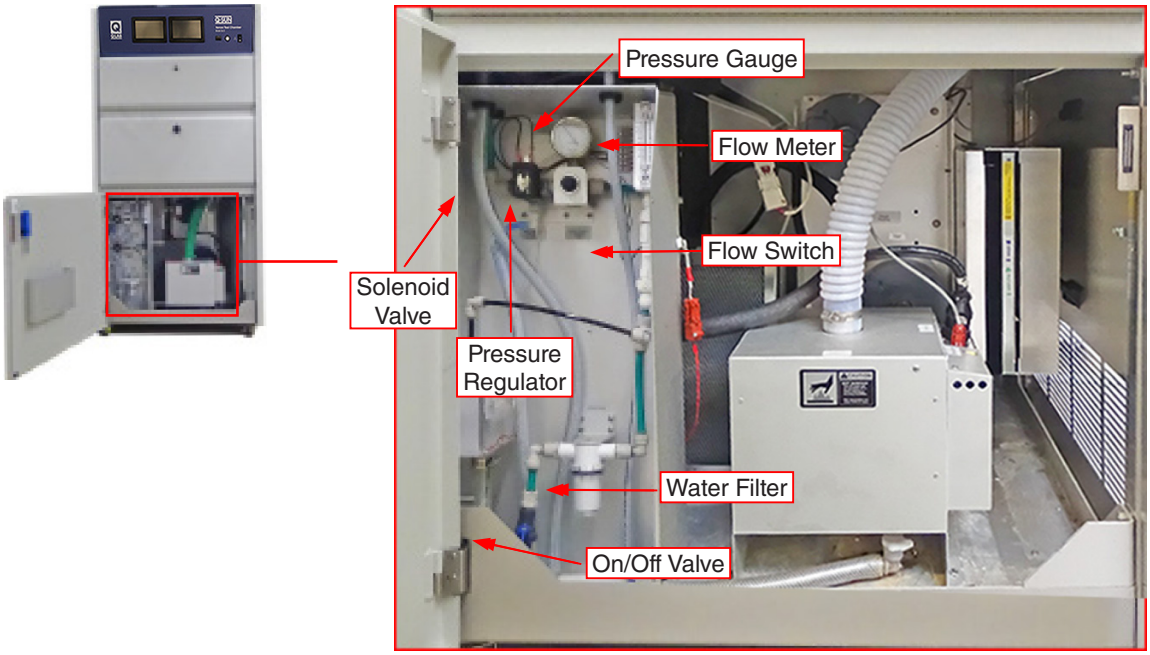


Figure 9.1c: Plumbing Box Inside Lower Front Door

NOTE: When replacing or cleaning the nozzles, remove the nozzle and bracket assembly from the top of the test chamber first, then use the appropriate tools to remove the nozzle from the elbow. Use care to avoid damaging the tubing when removing the nozzle. See Section 15.6 for nozzle maintenance information.

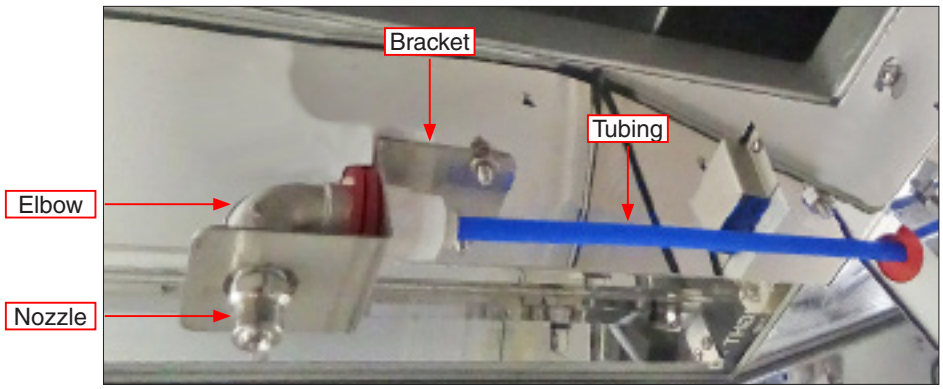


Figure 9.1d: Nozzle and Bracket Assembly Mounted on Chamber Ceiling

9.2 Back Spray (Oct 2020)

- An Xe-3 equipped with Back Spray can spray water on the bottom (back) surface of the specimens.
- The Back Spray function allows testing to those specifications that require back spray during a dark step in the test cycle, notably SAE J2527.
- During a *DARK+SPRAY FRONT+BACK* step, in addition to the standard front (top) spray, six nozzles (Figure 9.2a) spray the bottom (back) surface of the specimens through an open-back (mesh) specimen tray.
- Back Spray operates only during *DARK+SPRAY FRONT+BACK* steps.
- Back Spray will not operate during a *LIGHT+SPRAY FRONT* step.
- The Back Spray control system is located in the plumbing box (Figure 9.2b).
- If the back-spray is desired, verify that the Ball Valve is turned ON (Figure 9.2c) and program the step using the tester Main Menu (see Section 10).
- If Back Spray is not needed, program the step to *DARK+SPRAY FRONT*.

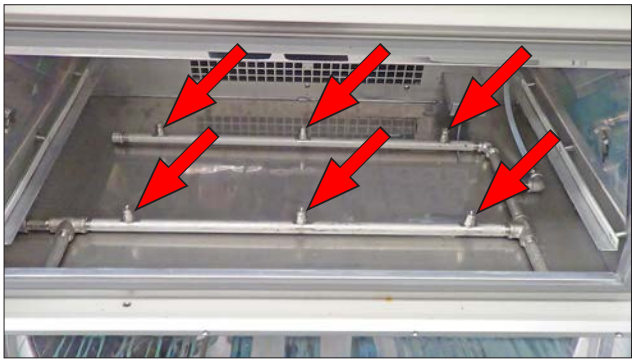


Figure 9.2a: Back Spray nozzles on bottom of Xe-3 test chamber (specimen tray removed).

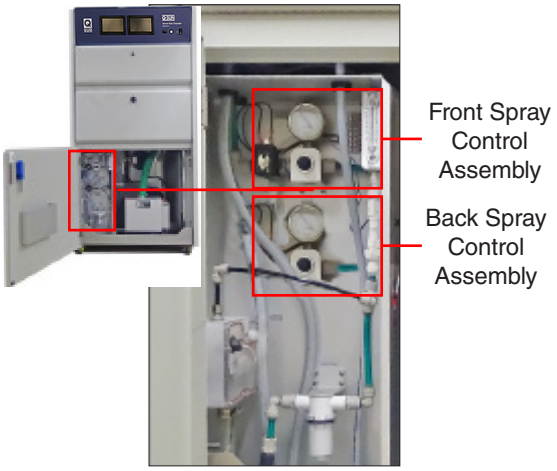


Figure 9.2b: The Back Spray control assembly is located in the plumbing box below the Front Spray controls.

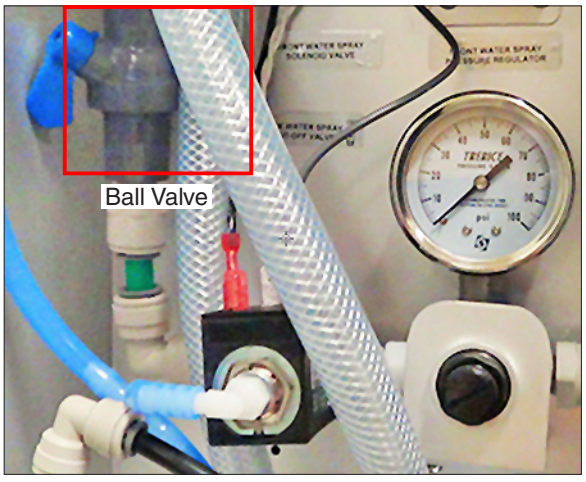


Figure 9.2c: Ball Valve and Back Spray Control Assembly Components

9.3 Dual Spray (Oct 2020)

Overview

- An Xe-3 equipped with the Dual Spray system can spray a second liquid onto the top (front) of the specimens during an *AUXILIARY* or *AUXILIARY+LIGHT* step, in addition to the standard front water spray.
- The Dual Spray function allows considerable flexibility in the development of tests for materials which are subjected to multiple liquids in their end use.
- Examples of such materials are:
  - Automotive paints and exterior plastics, to determine the combined effects of acid and “neutral” rain, or acid rain and dew.
  - Fingernail polish, with soapy water and pure water.

Xe-3 Dual Spray models must not have a Water Repurification System installed. Drainage must go directly to waste and cannot be reused. Using a repurification system will result in adding the solution to the repurification reservoir, contaminating purified water and compromising tester components.

Dual Spray System Components

- The Dual Spray system includes:
  - Fluid reservoir (Figure 9.3a).
  - Cart Assembly with pump, filter, drain, and plumbing
  - Two (2) additional spray nozzles at the top of the Xe-3 test chamber (Figure 9.3b).
  - Power cable, tubing and hardware to connect the Dual Spray system to the Xe-3
- Whenever the Q-SUN test program includes an *AUXILIARY* step, fluid is pumped from the reservoir through the filter and tubing to the nozzles in the Xe-3 test chamber.
- The flow rate is approximately 1 liter per minute, but is somewhat influenced by the viscosity and density of the liquid.

Figure 9.3a: Dual Spray cart and reservoir.

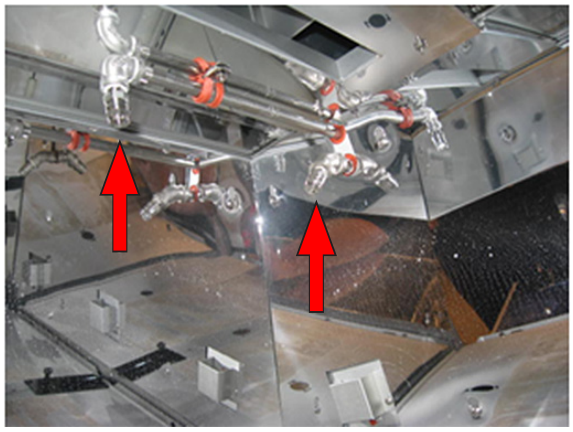


Figure 9.3b: Two (2) Dual Spray nozzles located at the top of the test chamber.

Fluid Requirements

- The Dual Spray system can pump a range of liquids, but they must be compatible with materials used in the construction of the Dual Spray system listed here:
  - Polypropylene
  - Stainless steel, type 316
  - Viton seals
- Additionally, the liquid must be compatible with materials used in the construction of the Xe-3 tester listed here:
  - Anodized aluminum
  - Stainless steel, type 316.
  - Silicone seals
  - Polypropylene and PVC drain tubing

Attempting to pump fluids incompatible with these materials could severely damage the equipment, voiding the warranty, and could cause bodily harm.

Operation

- The Dual Spray system operates only during *Auxiliary* and *Light+Auxiliary* steps.
- If Dual Spray step is desired for a specific test cycle follow the instructions below:

1. Add the desired liquid to the reservoir (the cart may be rolled to another area easily by first disconnecting the power cord and the plumbing via the quick-connect fitting).
2. Verify the Dual Spray cart power cord is plugged into both the cart and the Q-SUN outlet marked “Dual Spray” (see Section 5.6).
3. Verify the tubing connecting the Dual Spray cart to the Q-SUN tester is fully inserted at both ends.
4. Verify that the open mesh specimen tray (X-7035-X) is in place in the test chamber (Figure 9.3c).
   NOTE: a closed back specimen tray cannot be used.
5. A horizontal specimen tray insert (X-10080-X) has been provided so the Dual Spray liquid will pool and not run off the specimens. If pooling is needed, place the horizontal specimen tray on top of the open mesh tray (Figure 9.3d).
   NOTE: Use a leveling instrument to verify that the horizontal specimen tray is actually level. If it is not level, the four leveling pads (or casters) that support the tester can be adjusted to level the Xe-3 tester.
6. Program an *Auxiliary* or *Light+Auxiliary* step at the desired point in the test cycle, for the desired length of time (see Section 10) for programming instructions.
7. Run the test cycle.

- During the *Auxiliary* or *Light+Auxiliary* step, the pump on the Dual Spray cart will operate, spraying the liquid onto the top (front) of the specimens.
- All other functions of the machine will cease (there will be no temperature or humidity control, etc.).
- At the conclusion of the *Auxiliary* or *Light+Auxiliary* step the liquid will drain off the specimens.
- The rate at which the specimens dry can have an effect on some materials.
- To speed specimen drying, program a low humidity in the following step or to slow drying, program a high humidity (see Section 10).
- Similarly, low temperature setpoints will slow drying and high ones will speed drying.
- Some experimentation may be needed to establish setpoints that are appropriate for the materials being tested and also within the functional limits of the Q-SUN tester. See Section 10 for more information on Xe-3 operational ranges.

Figure 9.3c: Open back specimen tray.

Figure 9.3d: Horizontal specimen tray - positioned on top of open back specimen tray.

IMPORTANT: When running the ASTM D7356 acid etch test method:

- Normally during Front Spray steps (not Dual Spray) the spray is pulsed ON and OFF to conserve water.
- When running the ASTM D7356 acid etch test method, Front Spray during the one minute *DARK+SPRAY FRONT* steps should be continuous (not pulsed).
- See the Machine Configuration in Section 10.7 for information on setting Front Spray ON and OFF times.

10. Main Controller Operation

10.1 Overview (Sep 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.
- Many common test cycles have been pre-programmed. Custom test cycles can be easily created.
- The main controller continuously displays all test status conditions and continuously 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 10.1a).
- The Status Screen is on the left and the Menu Screen is on the right (Figure 10.1b, Figure 10.1c)
- The Status Screen displays tester current running conditions.
- The Menu Screen 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 10.1d).
- 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, to the right of the menu screen and visible from a distance, changes colors to indicate current operational status of the test.

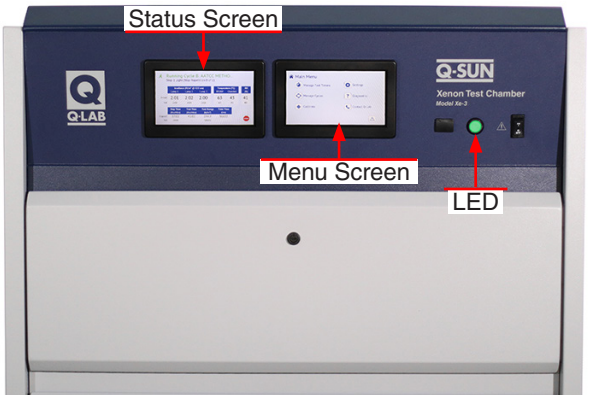


Figure 10.1a: Touch-screens and LED location.

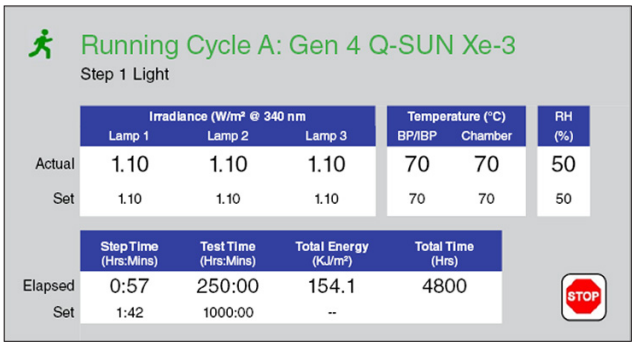


Figure 10.1b: Status screen displaying typical operating conditions.

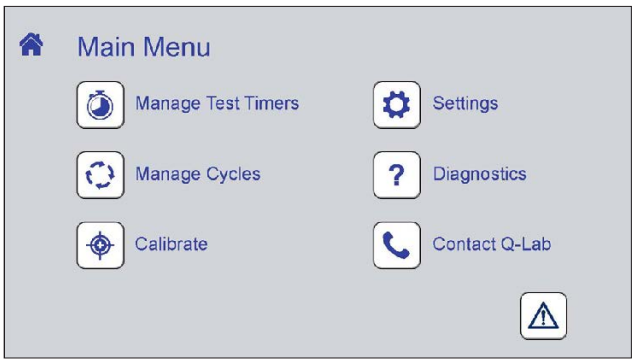


Figure 10.1c: Menu screen displaying the main menu.

Figure 10.1d: Touch to activate.

10.2 Status Screen (Sep 2020)

- The Status Screen (Figure 10.2a) 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 temperature sensor.
  - Elapsed and set step time and test time.
  - Tester total operation time.
  - RUN / STOP button. This button is the only operator control interface on the status screen.

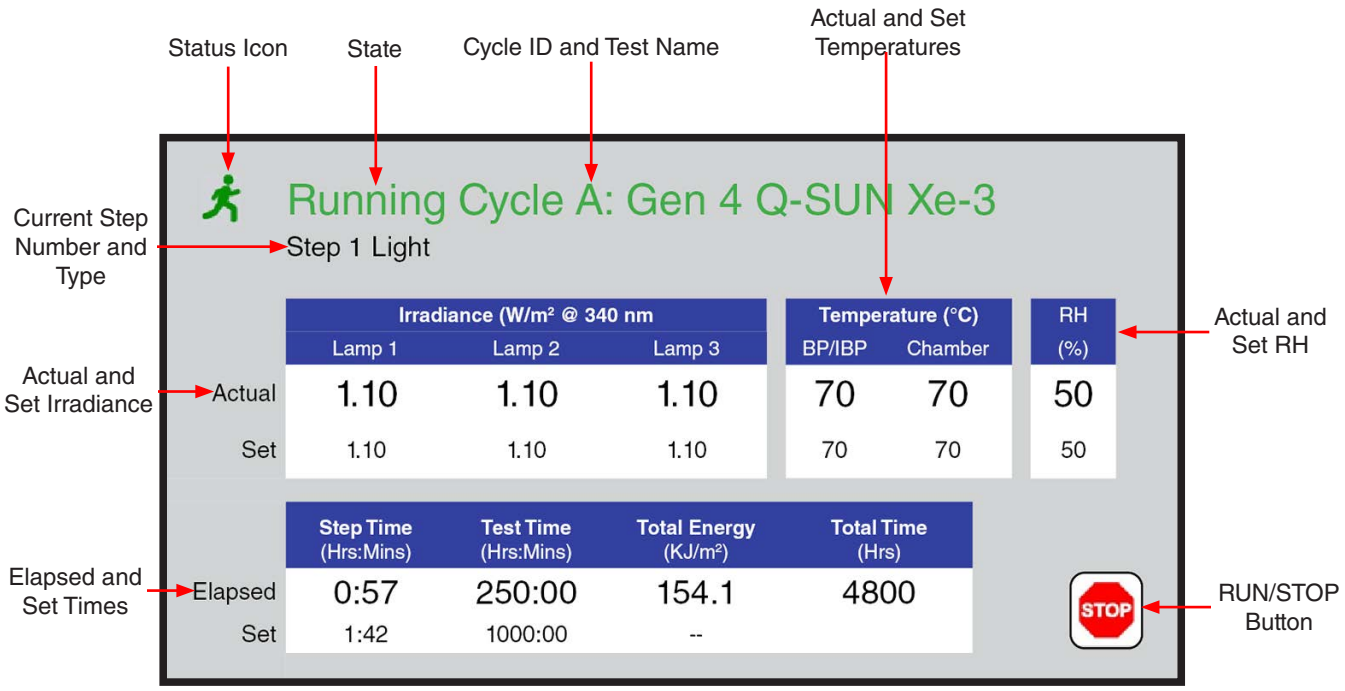


Figure 10.2a: Status screen components.

Overall Test Status

- A colored icon and title at the top of the screen indicate the overall status of the test (Figure 10.2b, Figure 10.2c).
- 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.

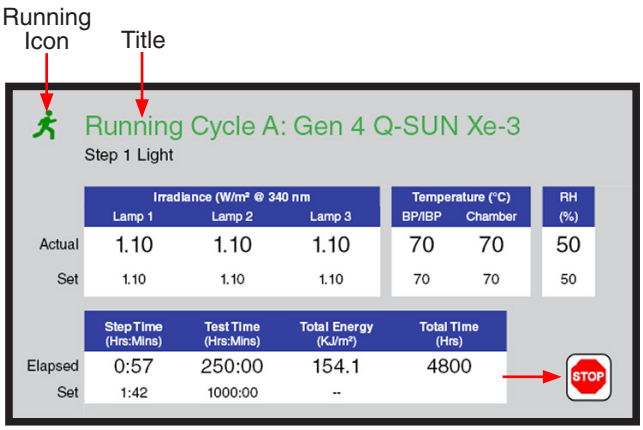


Figure 10.2b: Status icon and title when test running.

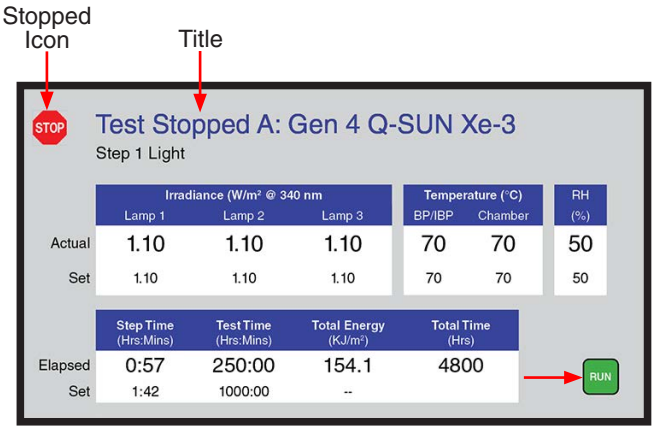
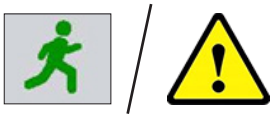


Figure 10.2c: Status icon and title when test stopped.

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.

10.3 Main Menu Screen (Aug 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 10.4)
  - Manage Test Timers (Section 10.5)
  - Manage Cycles (Section 10.6)
  - Calibration (Section 12)
  - Settings (Section 10.7)
  - Diagnostics (Section 10.8)
  - Contact Q-Lab (Section 10.9)

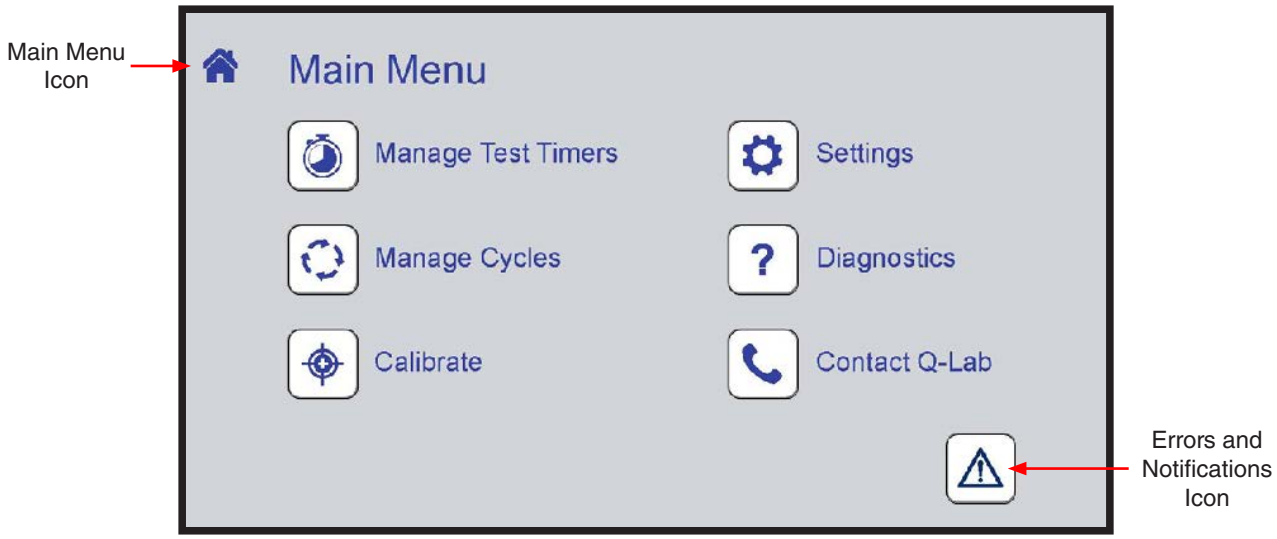


Figure 10.3: Main Menu screen.

10.4 Notifications (Sep 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 10.4a).
- The type, information icon, identification code (ex. M49), and name are displayed for each notification (Figure 10.4b).
- "Active" and "Cleared" notifications are listed separately, in chronological order, most recent at the top of the list (Figure 10.4c, Figure 10.4d).
- Color-coded attention icons indicate the type of notification (Figure 10.4e).
  - o A red triangle indicates an error occurred that stopped the test.
  - o A yellow triangle indicates an event that did not stop the test, such as a maintenance reminder.
  - o A blue triangle indicates the successful completion of a test.
- Touch the notification information icon to display details (Figure 10.4f through Figure 10.4j).
- See Section 16.2 for a complete list of notifications.

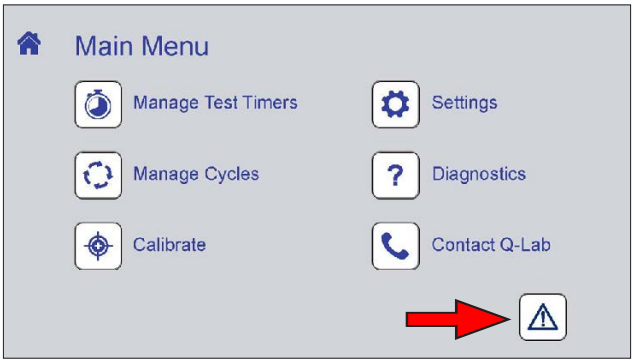


Figure 10.4a: The notifications icon. Icon color changes depending on notification status.

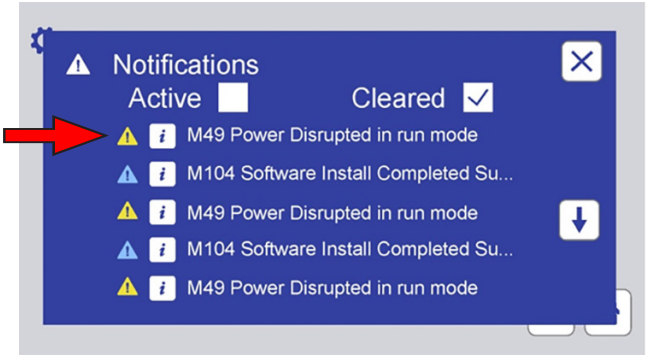


Figure 10.4b: The Notifications Screen lists notification information.

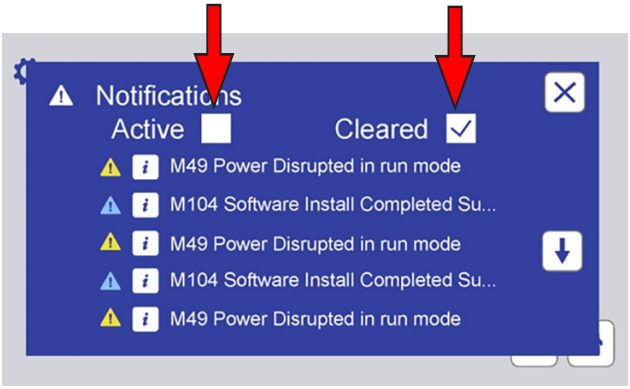


Figure 10.4c: Touch the Active or Cleared check box to view active or cleared notifications.

Figure 10.4d: Touch the scroll button(s) to move down or up the notification list.

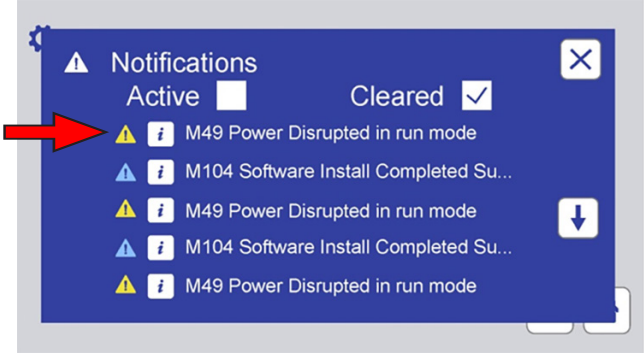


Figure 10.4e: Color coded icons show notification type.

Figure 10.4f: Touch the information icon to display notification details.

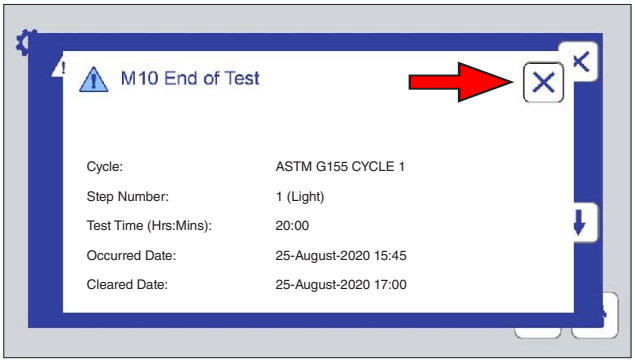


Figure 10.4g: Notification details. Touch the Close icon to return to the Notifications Screen.

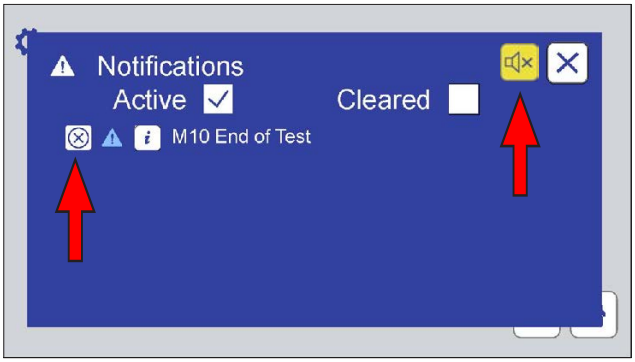


Figure 10.4h: If the alarm is active, touch the yellow mute icon to silence. When the notification has been resolved, touch the icon to the left of the notification to clear it.

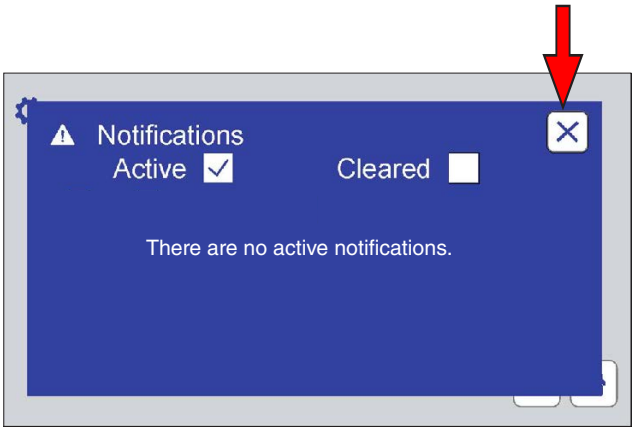


Figure 10.4i: Touch the Notification Screen close icon to re-display the main menu.

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 10.4j: A complete list of notifications and their meaning is given in Section 16.2.

10.5 Manage Test Timers (Sep 2020)

- On the Main Menu screen touch the Manage Test Timers icon to display the Manage Test Timers screen (Figure 10.5a).
- The Manage Test Timers screen provides three functions:
  1. Specify what action the tester should perform at the end of a test (Figure 10.5b and Figure 10.5c).
     - o Stop
     - o Message only
     - o Alarm only
     - o Stop and alarm
     - o None
  2. Set test duration units (Figure 10.5d through Figure 10.5f).
     - o Hours and minutes
     - o kJ/m²
  3. Set the elapsed and/or duration in the selected units for the current test (Figure 10.5g through Figure 10.5i).

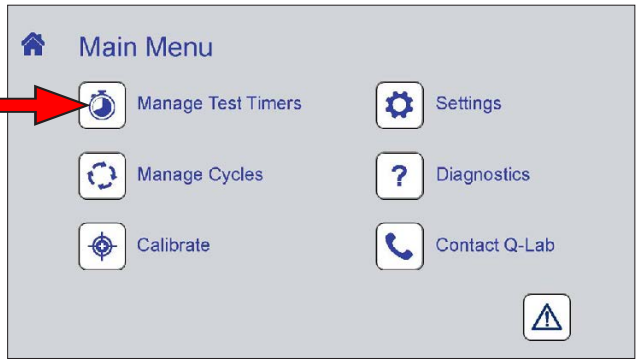


Figure 10.5a: Manage Test Timers icon.

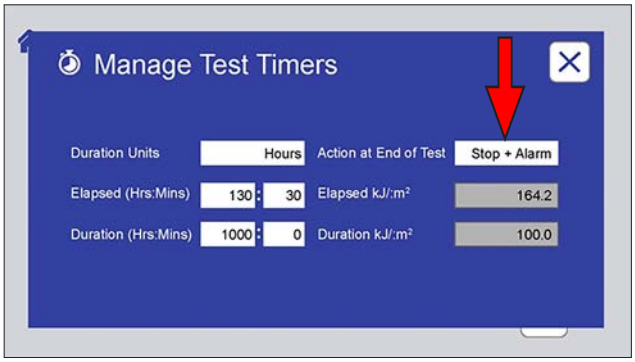


Figure 10.5b: Manage Test Timers screen. Touch the Action at End of Test text box to specify the action.

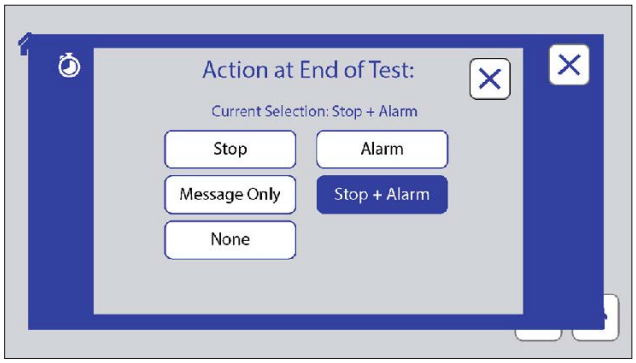


Figure 10.5c: Action at End of Test screen. Touch an action button to select that action.

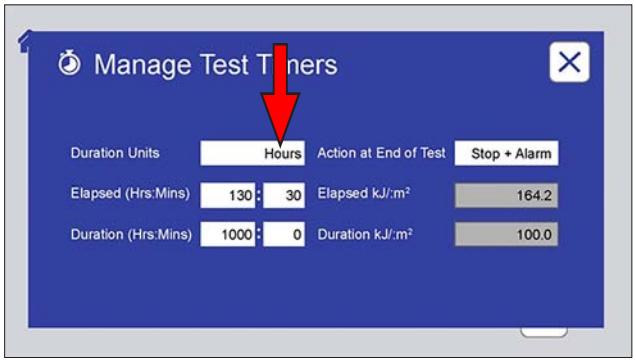


Figure 10.5d: Touch the Duration Units text box to set the test duration units in hours or in energy (kJ/m²).

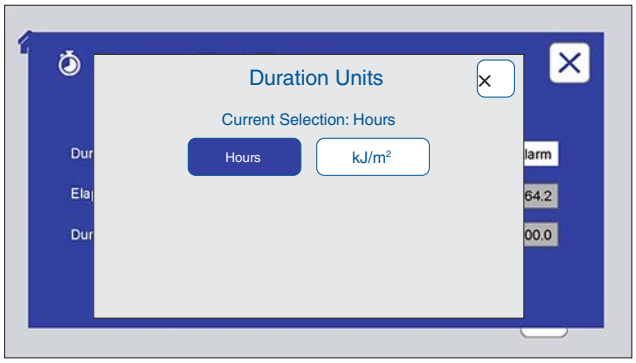


Figure 10.5e: Touch the Hours or kJ/m² text boxes to select the duration units.

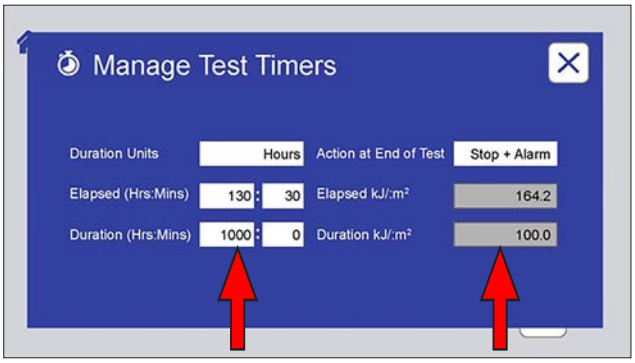


Figure 10.5f: The value text boxes for the selected duration unit are enabled. The text boxes for the unselected duration unit are disabled (grayed out).

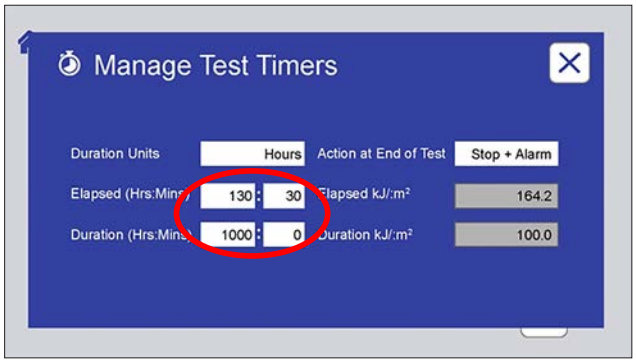


Figure 10.5g: Touch the enabled text box(s) to enter the new values.

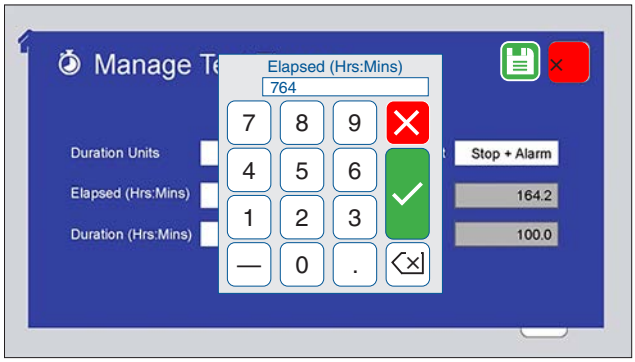


Figure 10.5h: Enter the new values using the numeric keypad. Touch the check mark to accept, or the X to cancel changes.

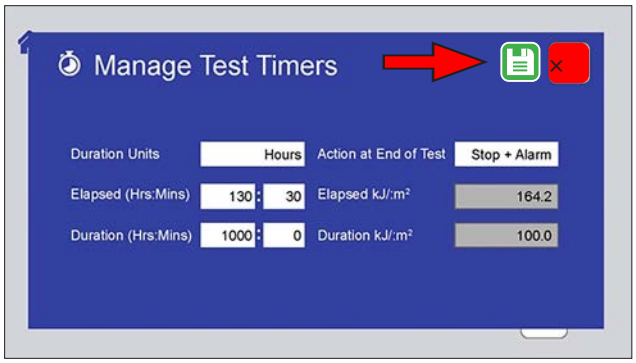


Figure 10.5i: If any changes have been made, touch the save changes icon or the cancel changes icon to re-display the Main Menu screen.

10.6 Manage Cycles (Nov 2020)

- On the Main Menu screen touch the Manage Cycles icon (Figure 10.6.1.a) 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 10.6.1.b).
- Each cycle is stored with an alphanumeric (A through J) identification tab (Figure 10.6.1.b).
  - o 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:
  - o Delete a cycle (Figure 10.6.2.a through Figure 10.6.2.c).
    - An actively running cycle cannot be deleted.
    - Deleting an inactive cycle will create a blank cycle with only a final step.
  - o Lock a cycle to prevent unauthorized changes (Figure 10.6.3.a through Figure 10.6.3.e).
  - o Add, edit, or delete steps in a cycle (Figure 10.6.4.a through Figure 10.6.6.d). Pre-programmed test cycles cannot be edited (they can be deleted).
  - o Create a new cycle (Figure 10.6.7.a through Figure 10.6.7.e).
  - o Run a cycle from any of its steps (Figure 10.6.8.a through Figure 10.6.8.d).
- 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.

10.6.1 Select a Cycle

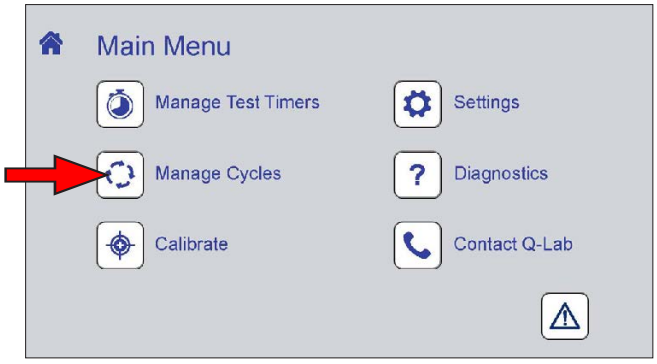


Figure 10.6.1.a: Manage Cycles icon.

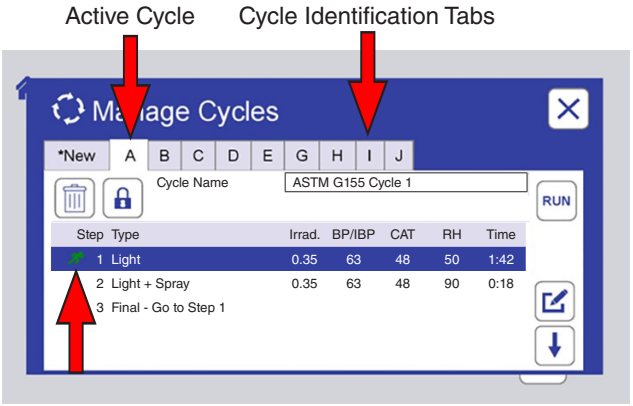


Figure 10.6.1.b: Manage Cycles screen. The active cycle is displayed. The currently running step is indicated. From here you can run that cycle, or perform other actions as in the next sections.

10.6.2 Delete a Cycle

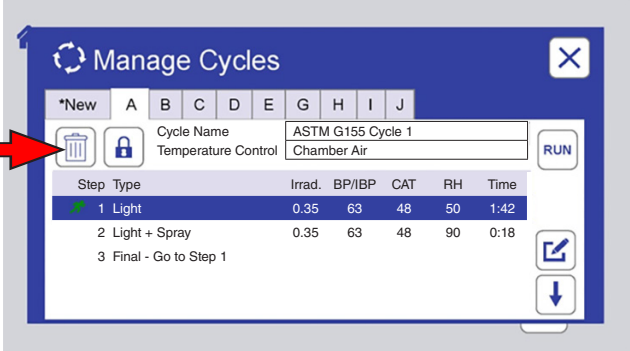


Figure 10.6.2.a: Touch the delete icon to delete the selected cycle.

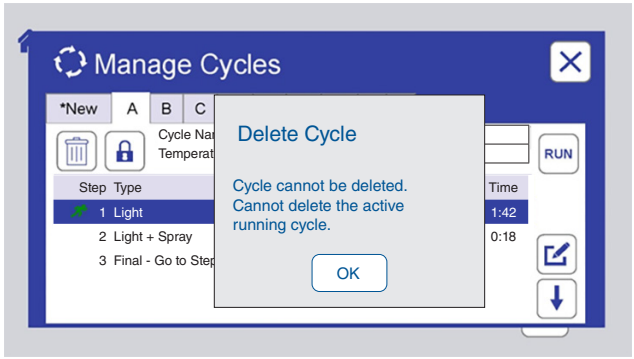


Figure 10.6.2.b: The active running cycle cannot be deleted. Touch OK to clear message.

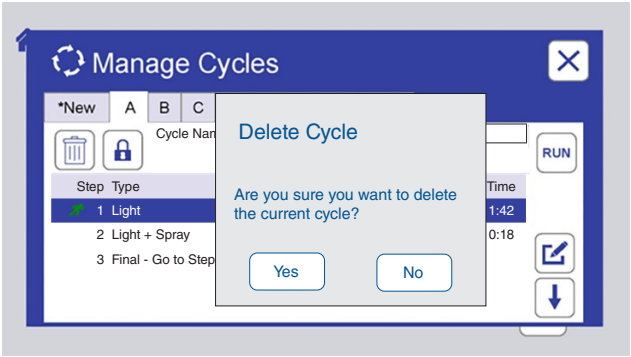


Figure 10.6.2.c: To delete an inactive cycle, the operator is prompted for verification. Touch No to cancel delete. Touch Yes to create a blank cycle.

10.6.3 Lock a Cycle

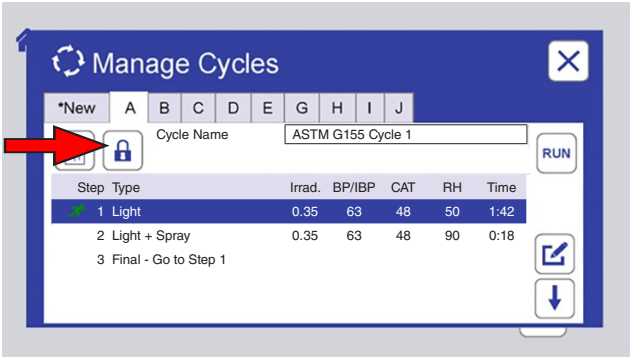


Figure 10.6.3.a: Touch the lock icon to lock the cycle.
NOTE: Pre-programmed test cycles are locked by Q-Lab.

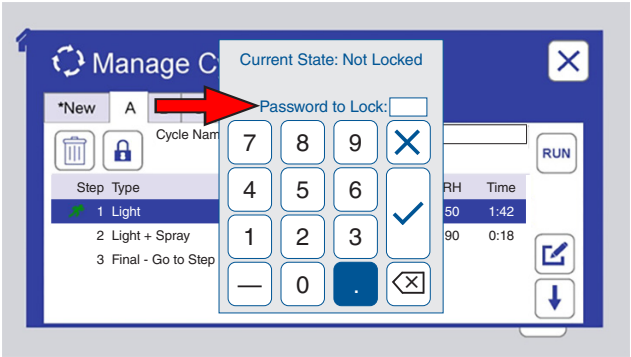


Figure 10.6.3.b: The numeric keypad is displayed. A password must be entered to lock the cycle.

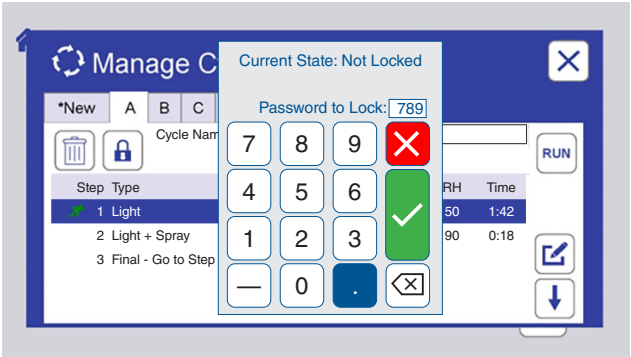


Figure 10.6.3.c: Enter the numeric password. Touch the check mark button to save, or the X button to cancel setting the password.

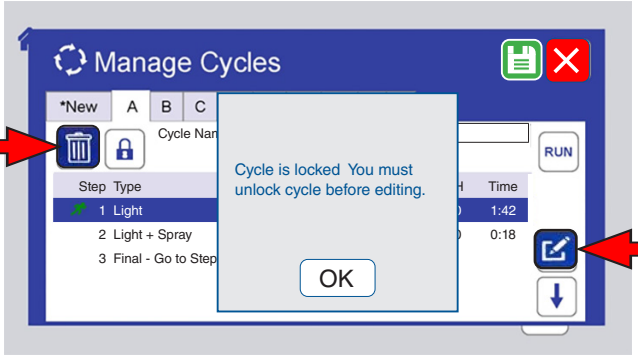


Figure 10.6.3.d: This message is displayed if a delete or edit icon is touched on a locked cycle.

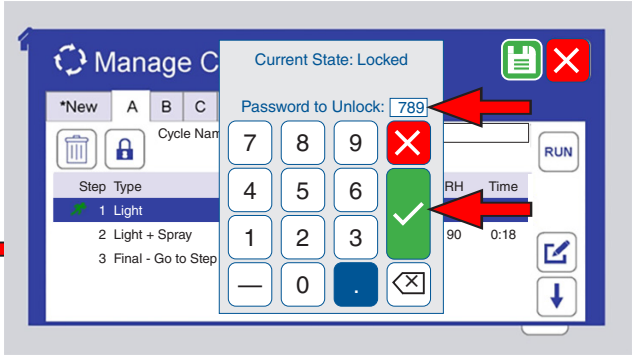


Figure 10.6.3.e: To unlock a cycle, touch the lock icon, enter the password, then touch the check mark button.

10.6.4 Add a Step to a Cycle

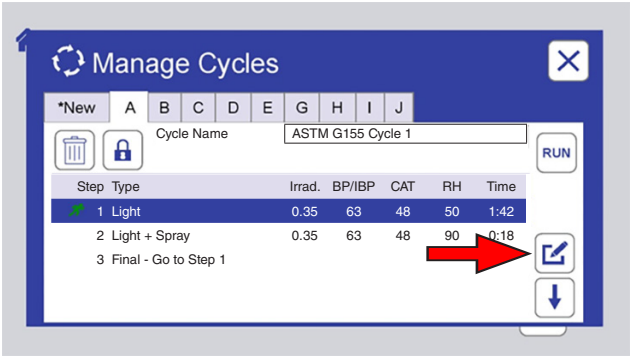


Figure 10.6.4.a: For any cycle, a new step can be added before or after an existing step. Select the existing step then touch the Edit icon.

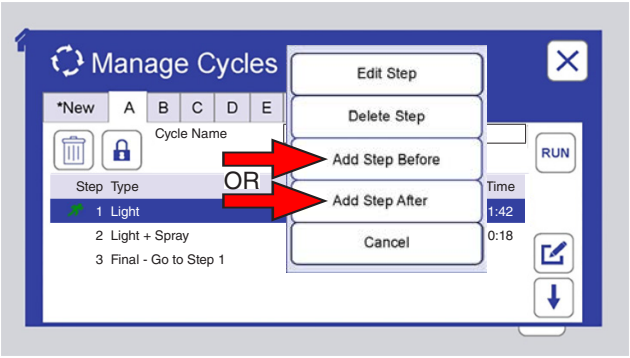


Figure 10.6.4.b: The step revision control is displayed. Touch Add Step Before or Add Step After.

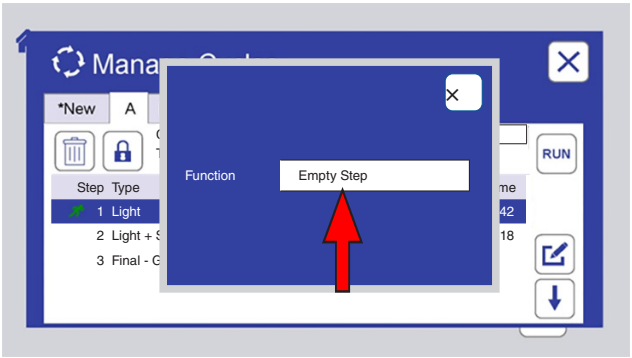


Figure 10.6.4.c: Touch the function text box to select a function.

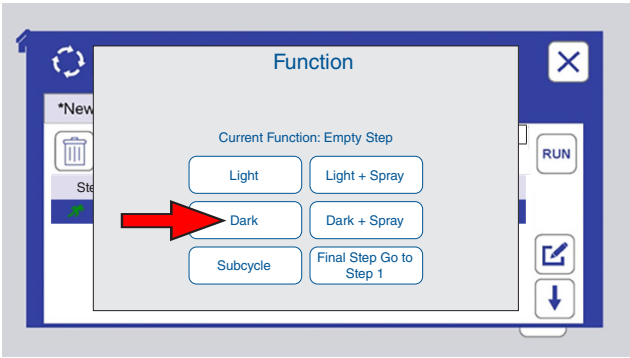


Figure 10.6.4.d: Touch the desired function. Additional functions may be available depending on model (see Section 9).

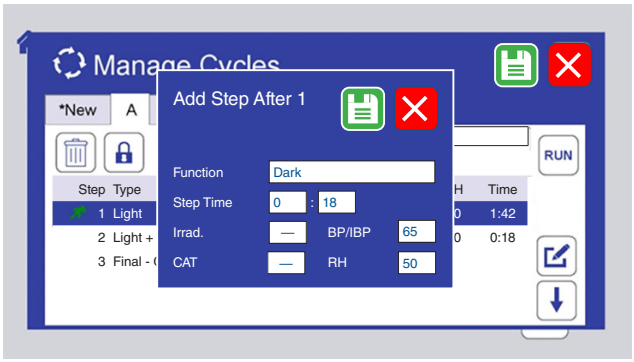


Figure 10.6.4.e: Step values must be entered. Touch the Step Time (Hrs:Mins), Irrad(iance), and BP/IBP text boxes to select.

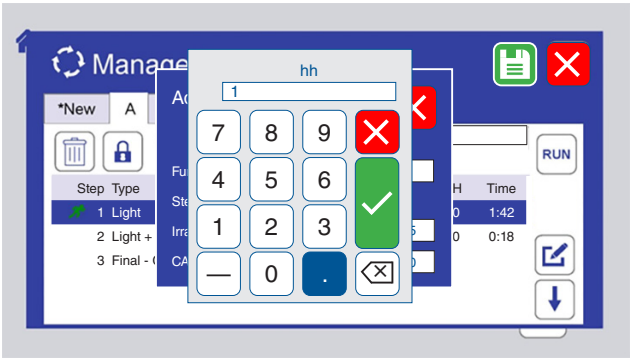


Figure 10.6.4.f: Use the numeric keypad to enter the values for each parameter. Touch the check mark button to accept those values or the X button to cancel.

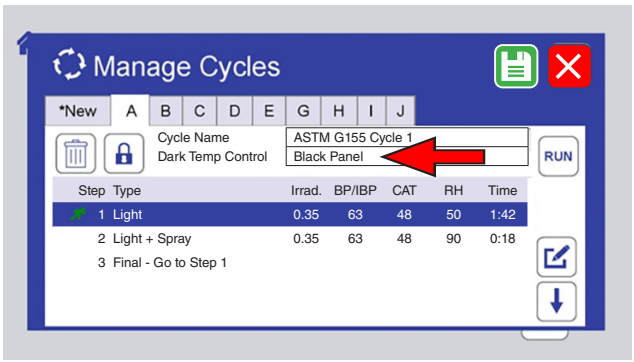


Figure 10.6.4.g: Touch the Dark Temp Control box to select whether temperature in a dark step is controlled by BPT or CAT.

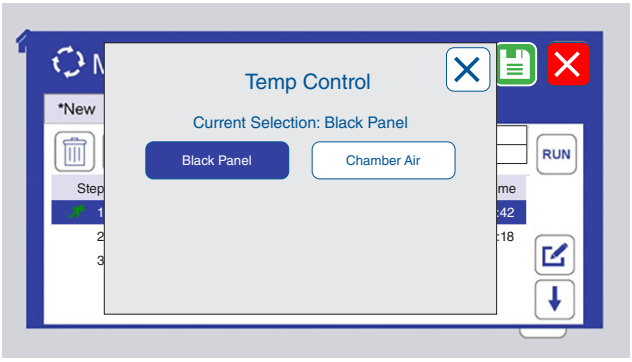


Figure 10.6.4.h: Touch the Black Panel or the Chamber Air button to select that sensor for temperature control.

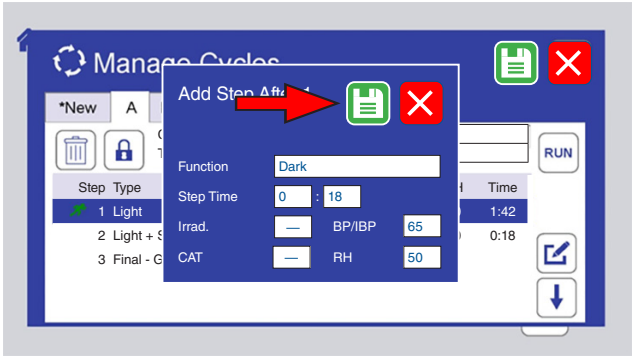


Figure 10.6.4.i: The new step values are displayed. Touch the save icon to save the new step.

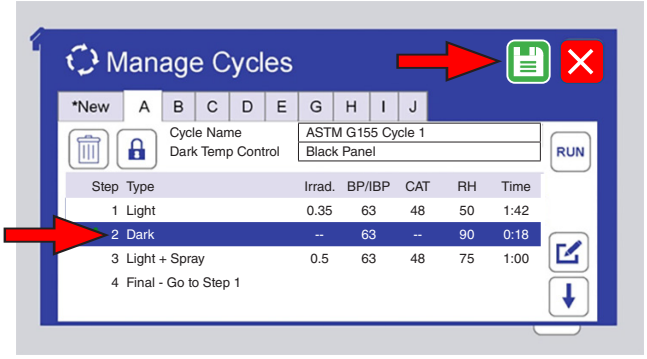


Figure 10.6.4.j: The new step is shown for the cycle. Touch the save icon to save the modified cycle.

10.6.5 Edit a Step

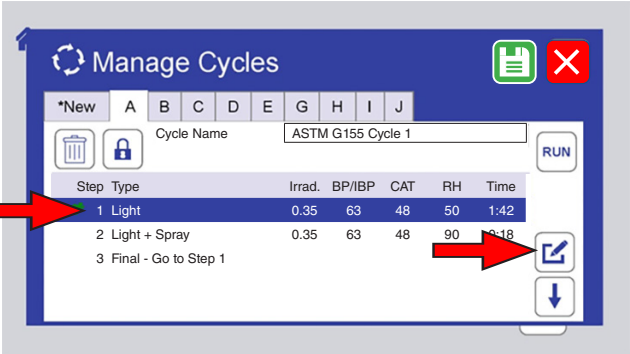


Figure 10.6.5.a: To edit a step, touch the cycle ID tab, touch the step to select, then touch the pencil icon.

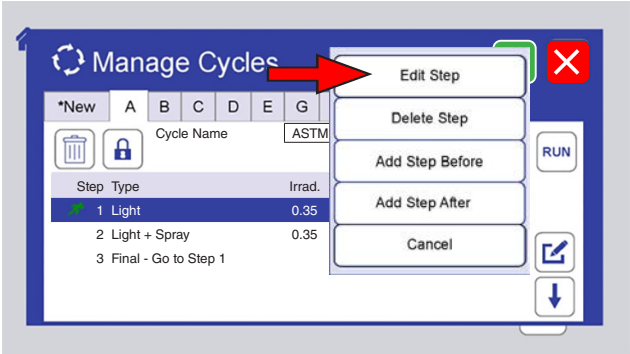


Figure 10.6.5.b: Touch the Edit Step button.

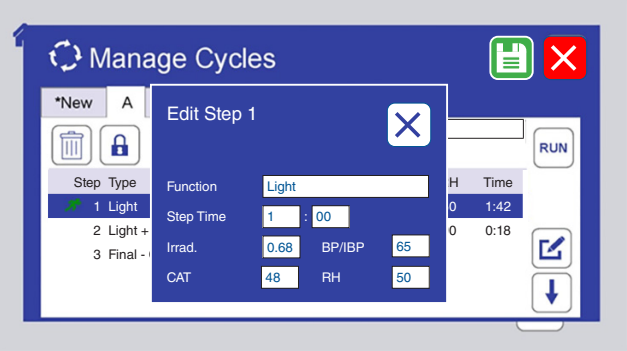


Figure 10.6.5.c: Touch the Function, Step Time, Irradiance, BP/IBP, CAT, or RH text boxes to select.

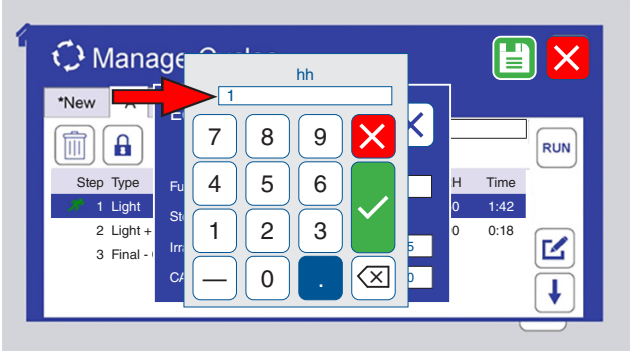


Figure 10.6.5.d: Use the numeric keypad to enter the new values for the selected step. Touch the check mark button to accept those values or the X button to cancel.

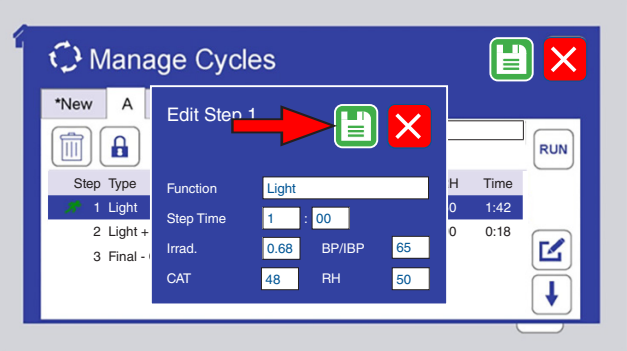


Figure 10.6.5.e: Touch the save icon to save the edited step.

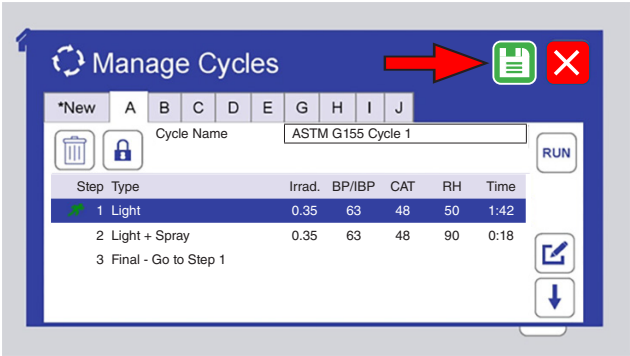


Figure 10.6.5.f: The edited step is shown for the cycle. Touch the save icon to save the edited cycle.
NOTE: pre-programmed test cycles cannot be edited.

10.6.6 Delete a Step

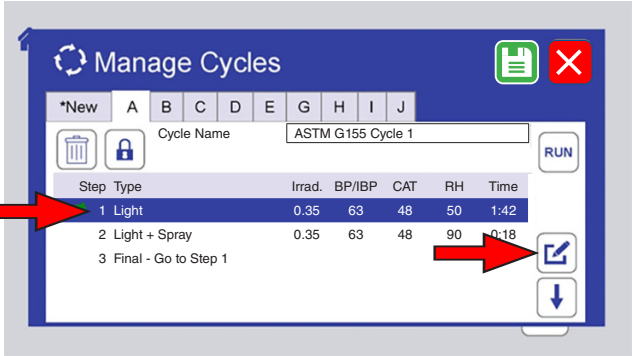


Figure 10.6.6.a: To delete a step, touch the cycle ID tab, touch the step to delete, then touch the pencil icon.

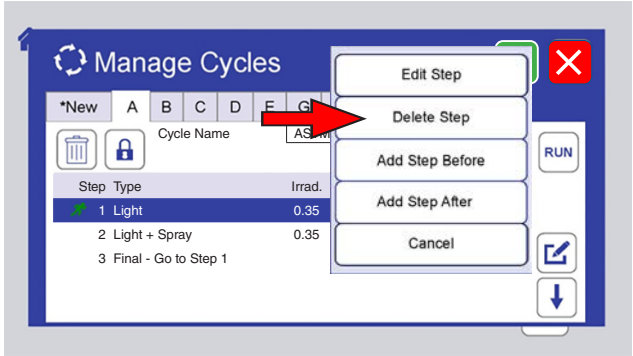


Figure 10.6.6.b: Select Delete Step.

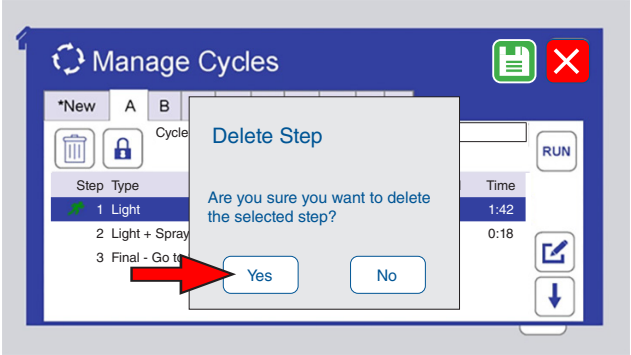


Figure 10.6.6.c: Touch the Yes button to delete the step or touch No to cancel the delete.

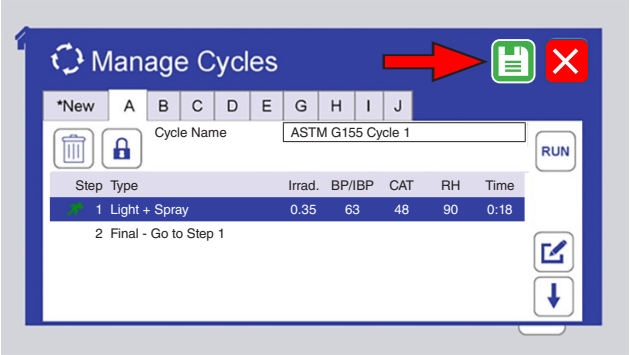


Figure 10.6.6.d: Touch the save icon to save the edited cycle.

10.6.7 Create a New Cycle

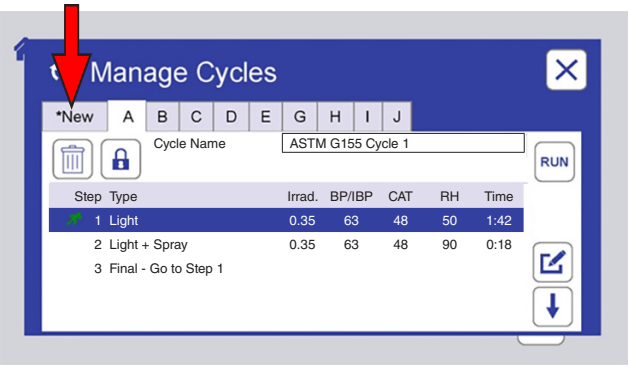


Figure 10.6.7.a: To create a new cycle, touch the *New tab.

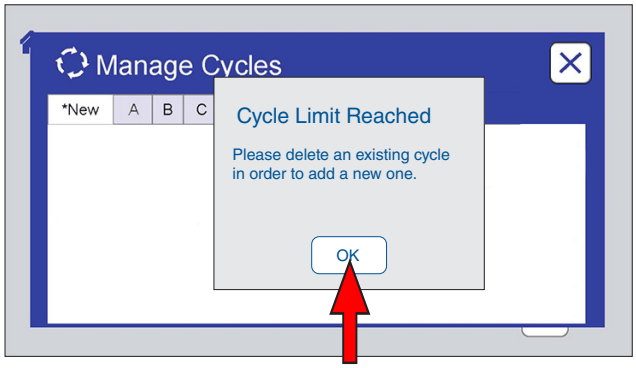


Figure 10.6.7.b: If all available cycles are programmed, this message is displayed Touch OK.

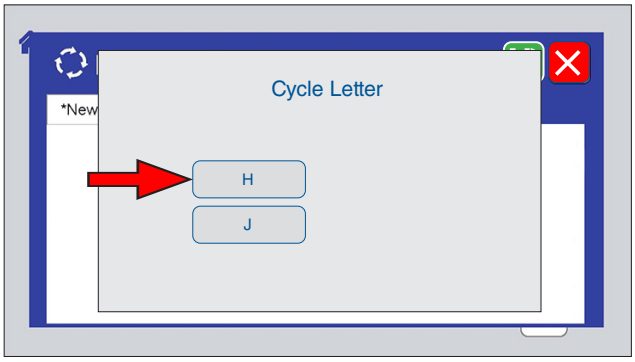


Figure 10.6.7.c: If there are open cycles, the available cycle letters are displayed. Touch a letter to program that cycle.

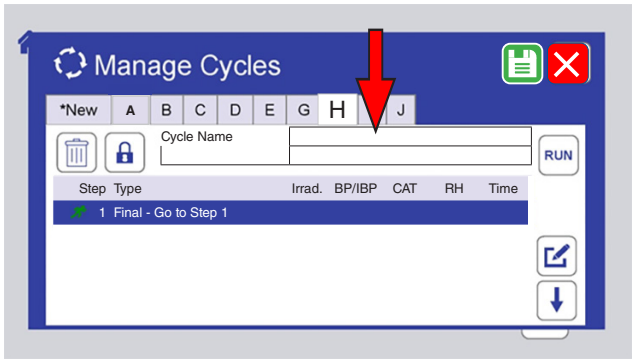


Figure 10.6.7.d: An empty cycle is created with only a final step. Enter a name for the new cycle.

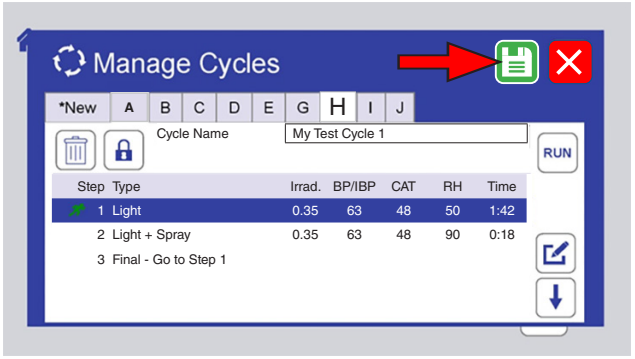


Figure 10.6.7.e: Follow Figure 10.6.4a through Figure 10.6.4j to add steps and save the new cycle.

10.6.8 Run From Step

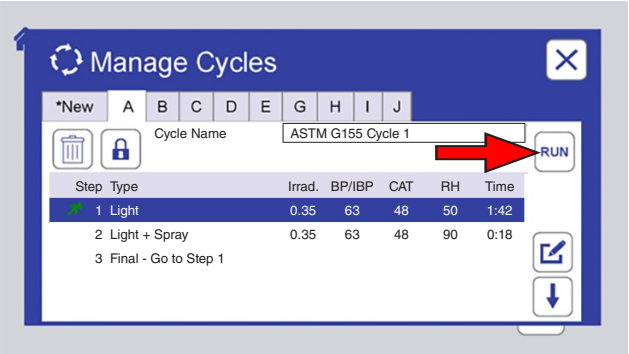


Figure 10.6.8.a: A cycle can be run from a specified time in one of its steps. Select the step, then touch the Run icon.

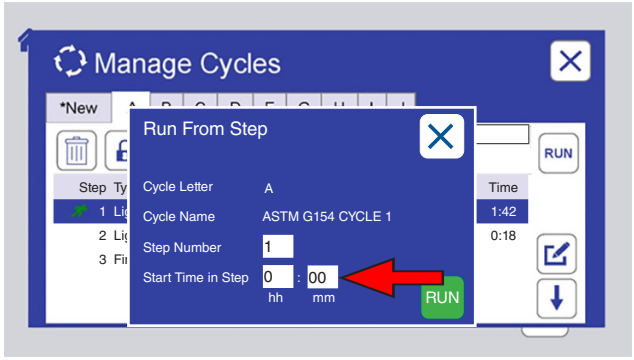


Figure 10.6.8.b: Touch the start time hh (hours) text box or the mm (minutes) text box to set the time. Start time can be set to 0 to start at the beginning of the step

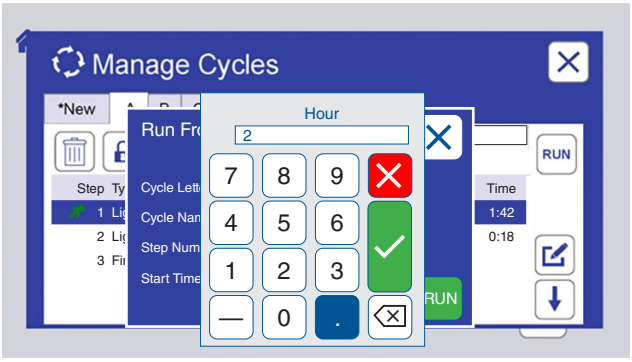


Figure 10.6.8.c: Use the numeric keypad to set the time. Touch the check mark button to accept those values or the X button to cancel.

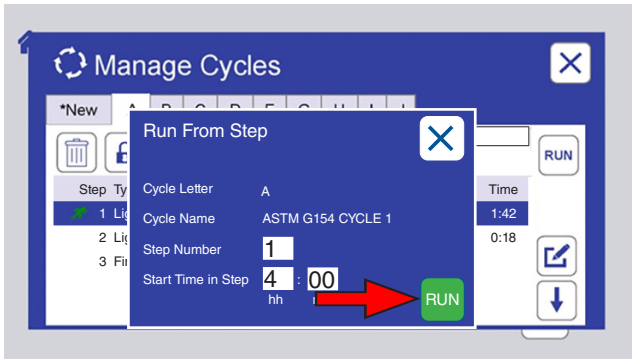


Figure 10.6.8.d: Touch the Run icon to run the step from the time entered.

10.7 Settings (Mar 2022)

- On the Main Menu screen touch the Settings icon (Figure 10.7a) to display the Settings screen.
- The Settings screen displays user-selectable machine parameters (Figure 10.7b)
  - o Volume (Figure 10.7c and Figure 10.7d).
    - Alarm
    - Touch
  - o Display Options (Figure 10.7e through Figure 10.7h)
    - Status Screen Brightness
    - Main Menu Screen Brightness
    - Sleep Time
  - o Language (Figure 10.7i through Figure 10.7l). Controls can be displayed in any of seventeen (17) different languages:
    - English, French, Spanish, German, Italian, Chinese, Japanese, Korean, Czech, Dutch, Polish, Portuguese, Russian, Swedish, Thai, Turkish, and Vietnamese
  - o English, French, Spanish, German, Italian, Chinese, Japanese, Korean
  - o Date/Time (Figure 10.7m through Figure 10.7p).
  - o Ethernet (Figure 10.7q through Figure 10.7t).
  - o Machine Configuration (Figure 10.7u and Figure 10.7v). Contact Q-Lab Repair and Tester Support for more information on using this setting.
- The Q-SUN can be operated using just one screen.
  - o 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 16.2).
  - o A button appears in the upper right corner of the screen to toggle the remaining screen between Main Menu and Status displays (see Figure 10.7x through Figure 10.7aa).

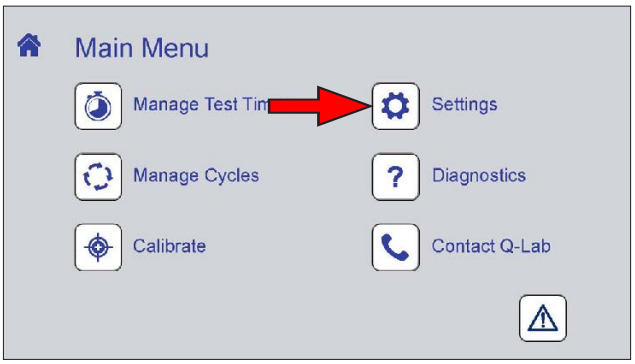


Figure 10.7a: Touch the Settings icon on the Main Menu screen to display settings controls.

Settings

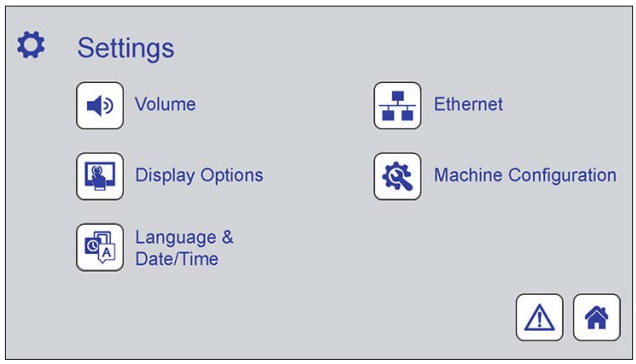


Figure 10.7b: Settings screen. Touch any icon to display controls for that function. The notification screen (Section 10.4) and the home screen can also be displayed.

Volume

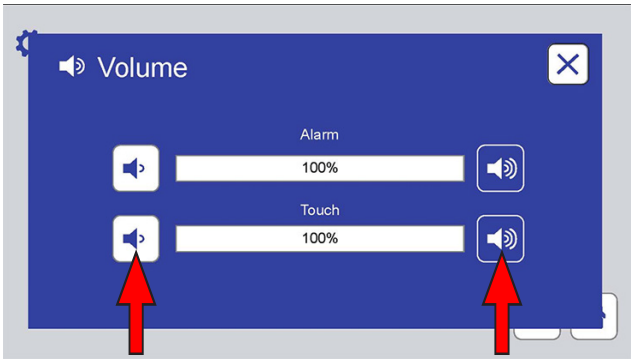


Figure 10.7c: The Volume screen provides controls to set volume (0 to 100) for machine alarms and for the screen touch indicator. Touch a volume icon to adjust.

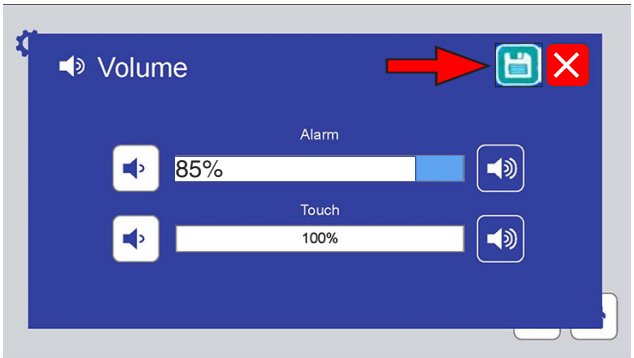


Figure 10.7d: If a volume is changed, touch the save icon to save the new volume level.

Display Options

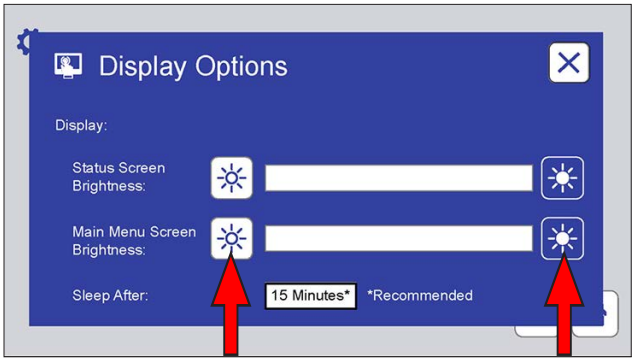


Figure 10.7e: The Display Options screen provides controls to adjust the brightness of the status and menu screens. Touch a brightness icon to adjust.

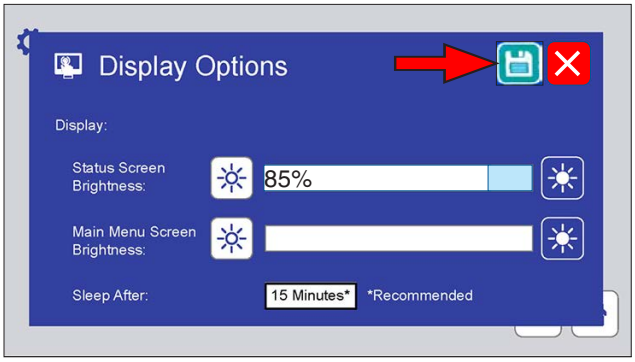


Figure 10.7f: If a brightness is changed, touch the save icon to save the new brightness level.

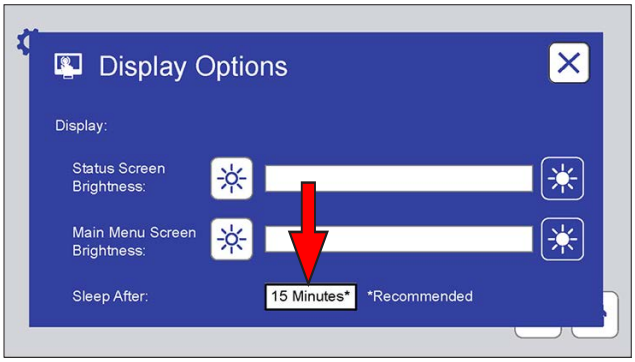


Figure 10.7g: The Display Options screen can also be used to adjust the inactive time that elapses before the screens “go to sleep” (i.e. deactivate). 15 minutes is recommended.

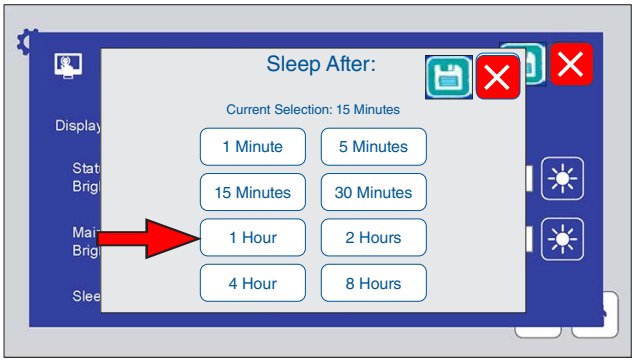


Figure 10.7h: Touch a time button to change the time before screens go to sleep. If changed, touch the save icon to save the new time.

Language

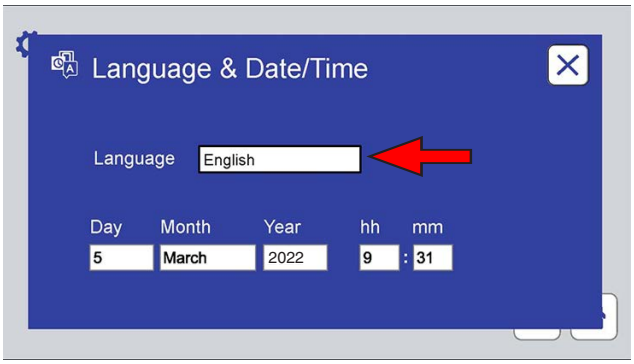


Figure 10.7i: This screen displays controls to select one of seventeen control interface languages.

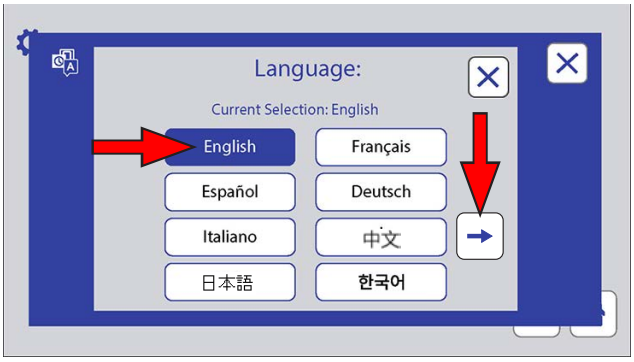


Figure 10.7j: Touch the language text box to select the control display language. Touch the Arrow icon to display additional available languages.

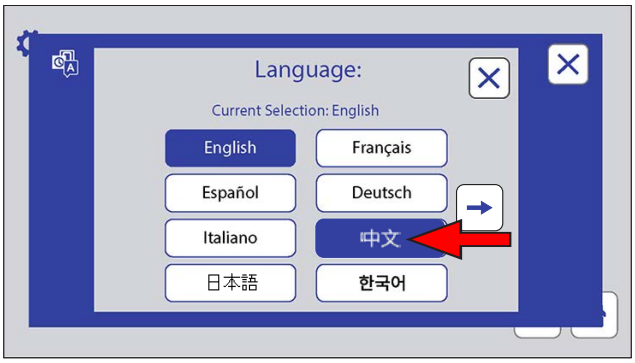


Figure 10.7k: Touch the text box for the desired language.

Figure 10.7l: All text on both screens will be in the selected language. Touch the save icon to save the selection.

Date/Time

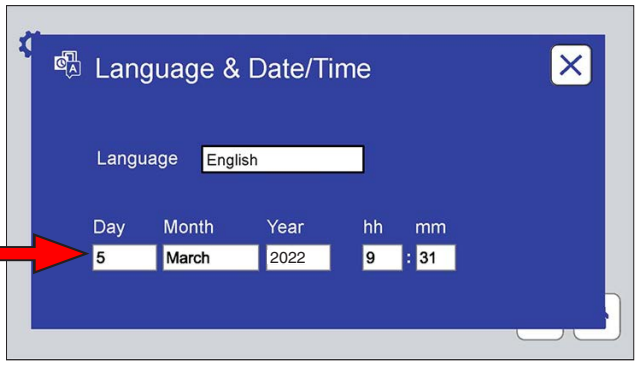


Figure 10.7m: This screen displays controls to set the date and time. Touch a text box to set Day, Month, Year, hh (hour) or mm (minute). hh display is always 24 hour time.

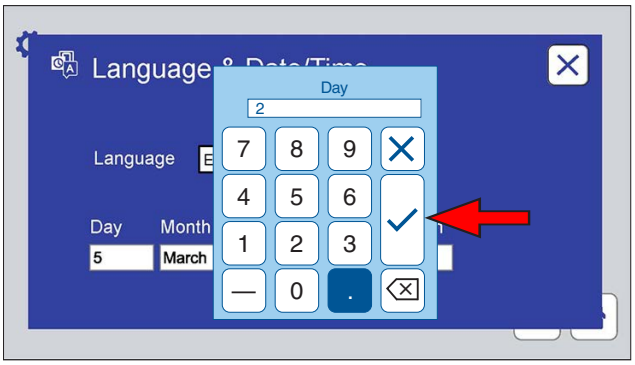


Figure 10.7n: The numeric keypad is used to set Day, Year, hh, and mm. Enter the number, then touch the check mark button.

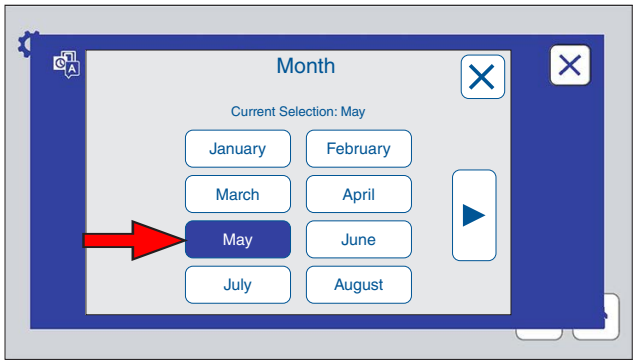


Figure 10.7o: Touch the month button to select the month on this display. Touch the right arrow button to display the remaining months.

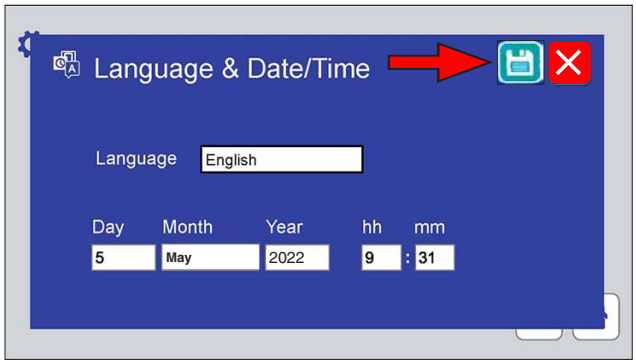


Figure 10.7p: Touch the save icon to save any changes to the Language & Date/Time.

Ethernet

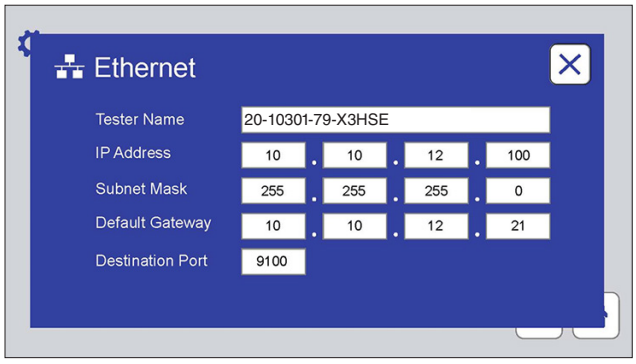


Figure 10.7q: This screen displays and provides text boxes to enter ethernet connection parameters.

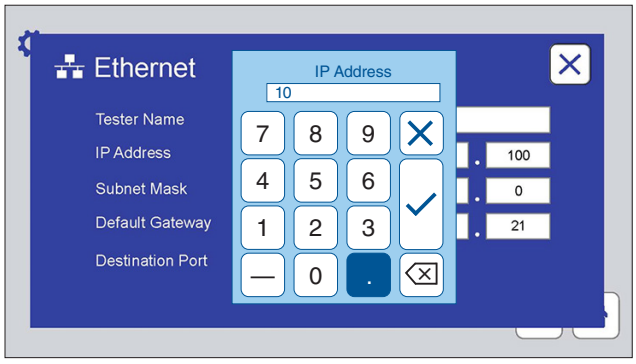


Figure 10.7r: Touch any text box to use the numeric keypad to input the parameter.

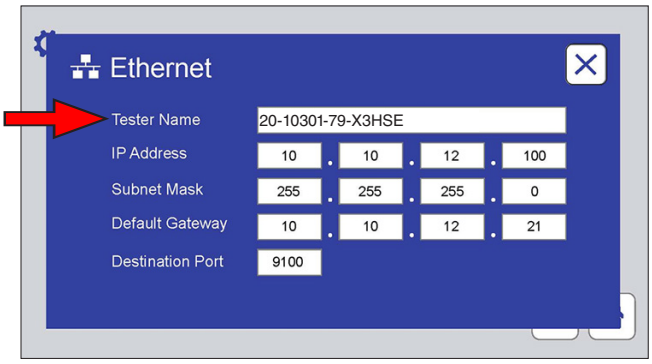


Figure 10.7s: Additionally, this screen has the name of the tester as it would appear on a network, if using the VIRTUAL STRIPCHART network version.

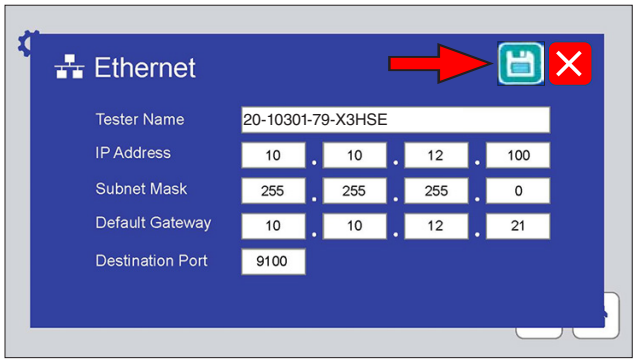


Figure 10.7t: Touch the save icon to save any changes to Ethernet parameters.

Machine Configuration

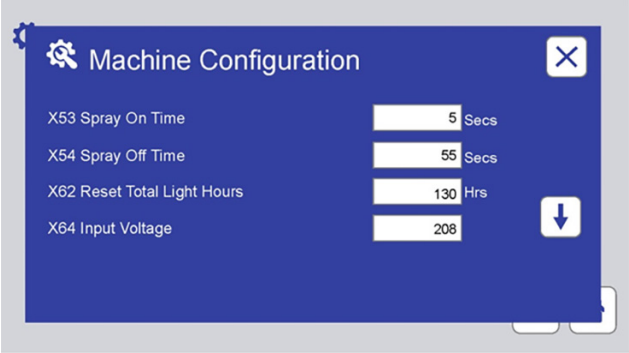


Figure 10.7u: Machine Configuration includes several customizable parameters. Contact Q-Lab Repair with questions about parameters. Touch the down arrow to display additional parameters.

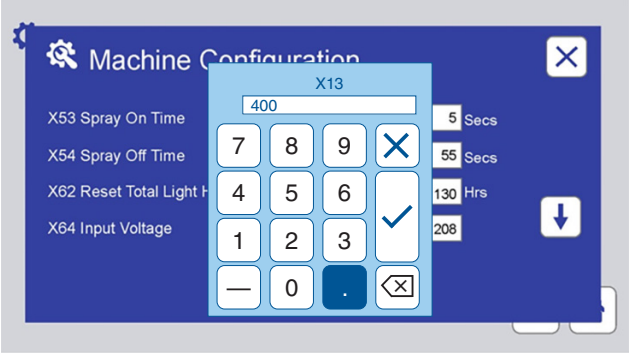


Figure 10.7v: Touch the parameter text box to use the numeric keypad to enter a value. Contact Q-Lab Repair and Tester Support (Section 19) for more information.

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. The maximum duty cycle of the boiler heater is adjusted based on X64.
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 10.7w: 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-3 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-3 main controller will enter Single Screen Mode as shown in Figure 10.7x.
- Figure 10.7y through Figure 10.7aa 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.

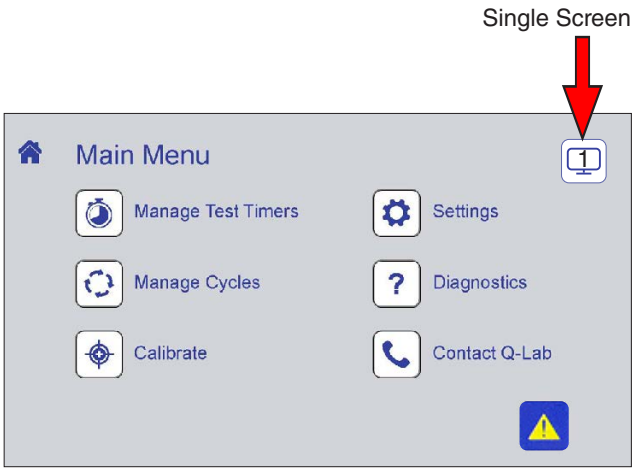


Figure 10.7x: Main Menu in Single Screen Mode showing the single screen icon. Touch the single screen icon.

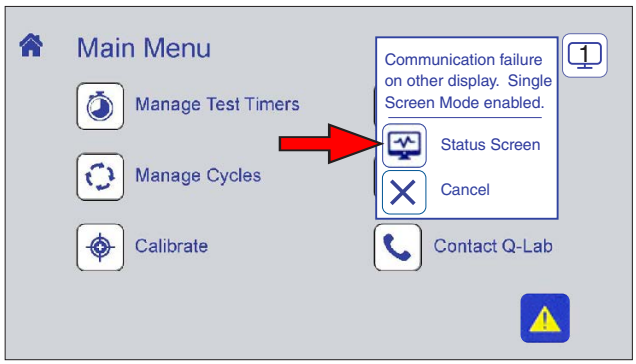


Figure 10.7y: Touch the Status Screen icon to display the Status Screen.

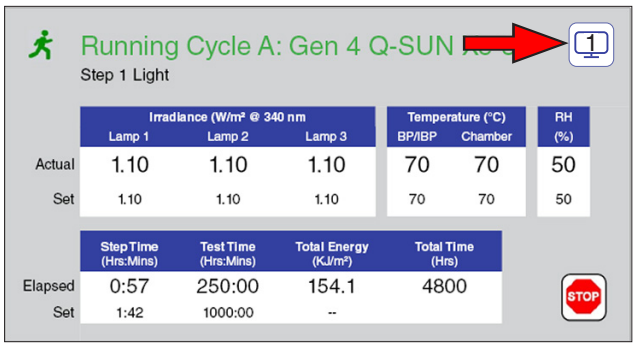


Figure 10.7z: Status Screen in Single Screen Mode. Touch the single screen icon.

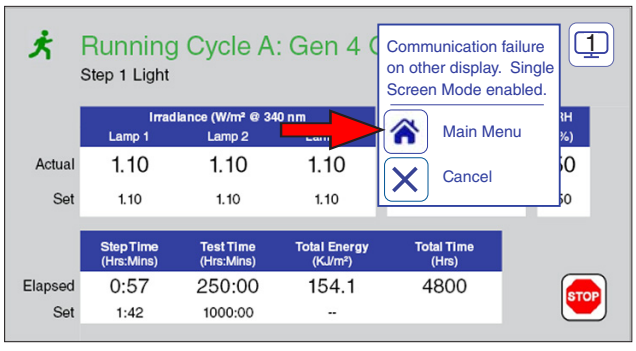


Figure 10.7aa: Touch the Main Menu icon to display the Main Menu.

10.8 Diagnostics (Mar 2022)

- 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 10.8a) to display the Diagnostics screen (Figure 10.8b).
- 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 10.8c for a complete list of Diagnostics.

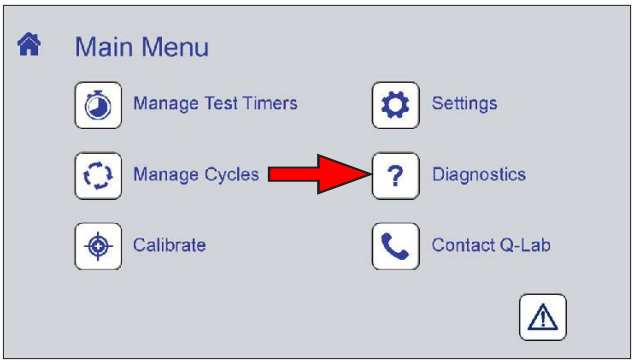


Figure 10.8a: Touch the Diagnostics icon on the Main Menu screen to display diagnostic information.

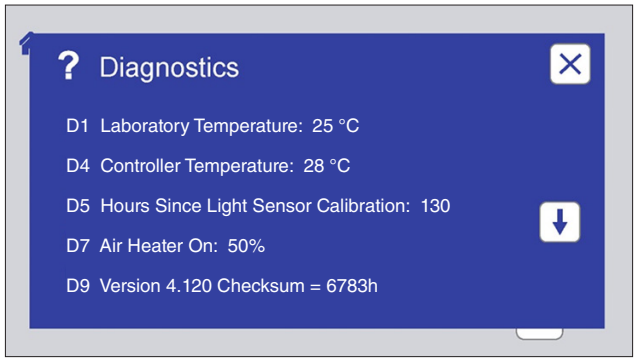


Figure 10.8b: The Diagnostics screen displays current machine operating conditions.

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 all light channels are 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: 1=XXX% 2=XXX% 3=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
D16	Humidifier Temperature = XXX°C	This shows the humidifier temperature.
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 2=XXXX 3=XXXX	This shows the current value of each lamp change timer. When a 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.
D22	Chiller On/Off	This shows whether the chiller output is on or off.
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 deliverd by the tester over its lifetime.
D27	UV Cal Factor	Displays the calibration factor being applied for the current optical filter selection.

Figure 10.8c: Complete list of diagnostic numbers, names, and descriptions.

10.9 Contact Q-Lab (Sep 2020)

- Touch the Contact Q-Lab icon on the Menu Screen (Figure 10.9a).
- The Contact Q-Lab screen (Figure 10.9b) displays the link to Q-Lab Repair and Tester Support on q-lab.com.

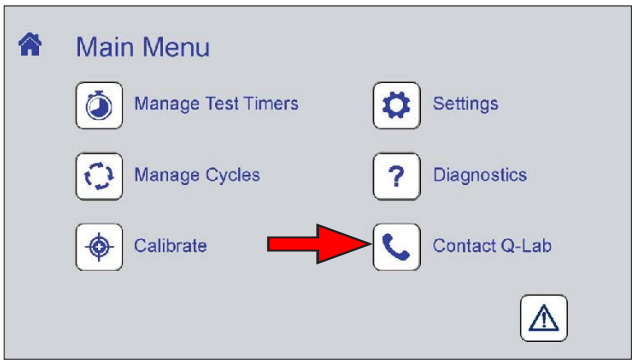


Figure 10.9a: Touch the Contact icon on the Main Menu screen to display Q-Lab contact information.

Figure 10.9b: Scan the code on this screen for Q-Lab contact information.

11. Running a Test

- Tests can be run using standard test cycles pre-programmed into the tester, or custom cycles can be constructed.
- Common test cycles that can be pre-programmed into the Q-SUN are shown in Section 11.1.
- Guidelines for selecting test parameters and choosing settings for custom cycles are given in Section 11.2.
- For instructions on modifying cycles or creating custom cycles see Section 10.6.
- Instructions for changing optical filters are given in Section 11.3.
- Various methods for mounting test specimens are illustrated in Section 11.4.
- Recommendations for repositioning test specimens are provided in Section 11.5.

11.1 Common Test Cycles (Dec 2020)

- These test cycles are just a few representative examples of the wide array of standards published by national and international standards organizations, trade associations, and manufacturers.
- All Q-SUN xenon testers are pre-programmed with test cycle(s) specified by the user.
- For any questions regarding the setup, programming, and performance of test cycles, contact Q-Lab.

AATCC TM16, Table 1 Option 3
Colorfastness to Light

Models: All

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

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
3	Final Step Go To Step 1					

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

Models: All Spray

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

Spray: 15 seconds on, 25 seconds off

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Dark + Spray	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	95			40	2:30
6	Subcycle Repeat Steps 7-10 4×					
7	Dark + Spray	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					

* Q-Lab does not recommend running this test without a Daylight-F filter. In addition to spectral differences, the environmental aspects of the cycle will not be achieved properly with another type of filter.

ASTM G155 Table X3.1, Cycle 1 (also known as the 102/18 cycle)
Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

Models: All Spray

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

Spray: 10 seconds on, 50 seconds off

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light		0.35	63		1:42
2	Light + Spray		0.35	63*		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.

ASTM G155 Table X3.1, Cycle 6
Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

Models: All

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

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	35	1.10	63	43*	3:48
2	Dark	90			43*	1:00
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, Exposure Cycle A1
Textiles -- Tests for colour fastness -- Part B02: Colour fastness to artificial light: Xenon arc fading lamp test

Models: All

Optical Filters: Window-IR UV Sensor: 420 nm Black Panel: Insulated

Step	Function	RH (%)	Irradiance (W/m²/nm)	Black Panel Temp. (°C)	Chamber Air Temp. (°C)	Step Time (hh:mm)
1	Light	40	1.10	47	39*	24:00
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 A, Method 1
Paints and varnishes - Artificial weathering and exposure to artificial radiation - Exposure to filtered xenon-arc radiation

Models: All Spray

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

Spray: 10 seconds on, 50 seconds off

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	50	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 4892-2,Cycle 1 (also known as the 102/18 cycle)
Plastics -- Methods of Exposure to Laboratory Light Sources -- Part 2: Xenon-arc Lamps

Models: All Spray

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

Spray: 10 seconds on, 50 seconds off

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		0.51	65*		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.

SAE J2412
Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials

Models: All

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

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	95			38	1:00
3	Final Step - Go To Step 1					

SAE J2527 **Performance Based Standard for Accelerated Exposure of Automotive Exterior Materials Using a Controlled Irradiance Xenon-Arc Apparatus**						
Models: All Back Spray						
Optical Filters: Extended UV-Q/B, Daylight-B/B			UV Sensor: 340 nm		Black Panel: Uninsulated	
Spray: 10 seconds on, 50 seconds off						
Step	Function	RH (%)	Irradiance ($W/m^2/nm$)	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					

Prevent Condensation On Specimens At Start Up

- When the Q-SUN is started in a “Dark” step, water may condense on the test specimens as warm humidified air strikes the cool, room-temperature specimens.
- This can be a problem for specimens that should not get wet, such as paper or pharmaceuticals.
- It might not be a problem for specimens already exposed to water spray, such as many paints and plastics.
- To prevent condensation, always start the tester on a “Light” step.
- The radiant heat from the lamps will warm up the specimens rapidly to prevent condensation.

Test Duration

- Test duration depends on the test material and the application:
  - Air-dry alkyd paints may require only 250 hours (10 days).
  - Some coil coatings may require 2,000 hours (12 weeks) or more.
  - Roofing materials are commonly exposed for up to 5,000 hours.
  - Plastics may be tested for hundreds to thousands of hours, depending upon the end use application.
  - Textile fading tests commonly take only a few days.
- Consult material specification sheets whenever appropriate.

11.2 Selecting Test Parameters (Mar 2022)

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 15.4).
- The application or test standard dictates which filter to use.
- See *LX-5046-Q-SUN Specification Bulletin* for the most recent Q-SUN lamp irradiance ranges and warranty information.

	Xe-3 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 (1.30)	1.50 (2.40)	75 (125)
Daylight-Q	0.68 (1.10)		
Extended UV (-Q/B, -Quartz)			
Daylight-B/B			
Window (-Q, -B/SL)	0.55 (0.85)		70 (108)
Window (-SF5, -IR)	—		42 (68)
UV Blocking	—	Contact Q-Lab Repair and Tester Support [D]	

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+ lamp with a lamp life of 3000 hours.
C: Maximum irradiance that can be obtained by using the X-1800+ lamp with a lamp life of 1000 hours.
D: Tests with UV Blocking optical filters, including the ICH Guidelines test, are often calibrated and programmed in units of Lux.

- The approximate intensity of noon summer sunlight at 340 nm is 0.68 W/m^2.

Calibrate the Q-SUN onboard UV sensors whenever irradiance set point, lamps, UV sensors, or UV filters are changed.

Black Panel Temperature Range

- The table below shows black panel temperature range when lab temperature is 23 °C.
- Higher or lower lab temperatures will change the temperature control range.

NOTE: Black panel temperatures shown in this section do not apply to white panel temperature sensors. Contact Q-Lab Repair and Tester Support for more information.

	Uninsulated		Insulated	
Irradiance (W/m² @ 340 nm with Daylight-Q filter)	0.35	0.68	0.35	0.68
Irradiance (W/m² @ 420 nm with Window-Q filter)	0.74	1.44	0.74	1.44
Temperature Range without Chiller	**42-100 °C**	**52-115 °C**	**50-107 °C**	**57-120 °C**
Temperature Range with Chiller	**31-100 °C**	**44-115 °C**	**38-107 °C**	**48-120 °C**

Relative Humidity

The maximum RH that can be achieved depends on the irradiance, black panel temperature, and chamber air temperature.

- Min and max black panel (BP/IBP), insulated black panel (IBP/BST), chamber air temperatures, and relative humidity capabilities are dependent on ambient lab conditions.
- Interdependencies between these parameters limit achievable operating conditions in the tester.

Chamber Air Temperature

Chamber air temperature can be set during light steps.

Xe-3 Models without Chiller

- Figures Figure 11.2a and Figure 11.2b show the chamber air temperature ranges for non-chiller Xe-3 models.

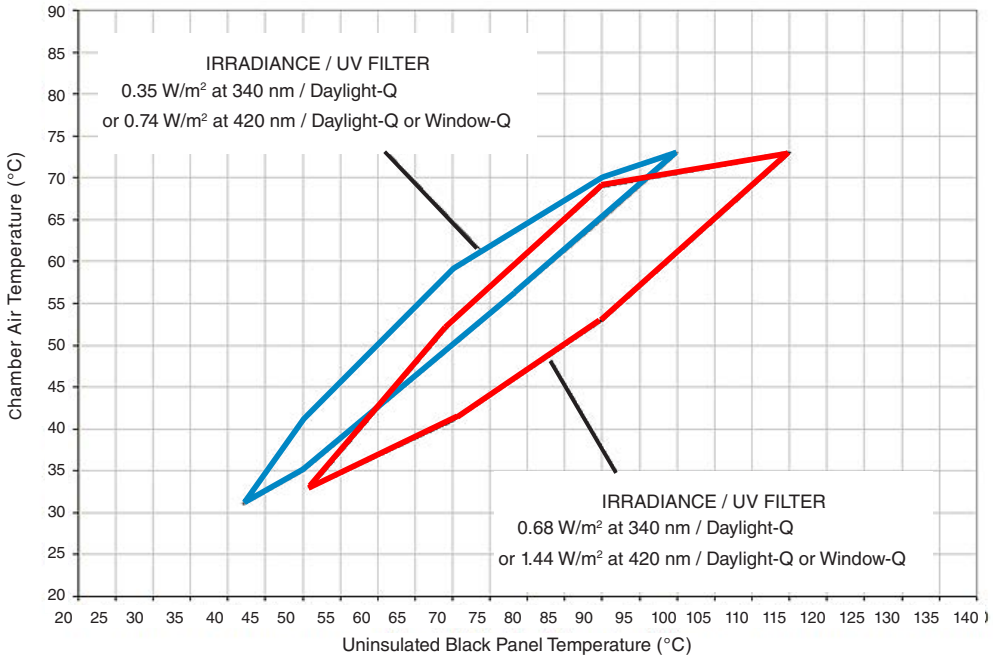


Figure 11.2a: **Uninsulated** Black Panel vs. chamber air temperature at 50% relative humidity and 23 °C Lab temperature.

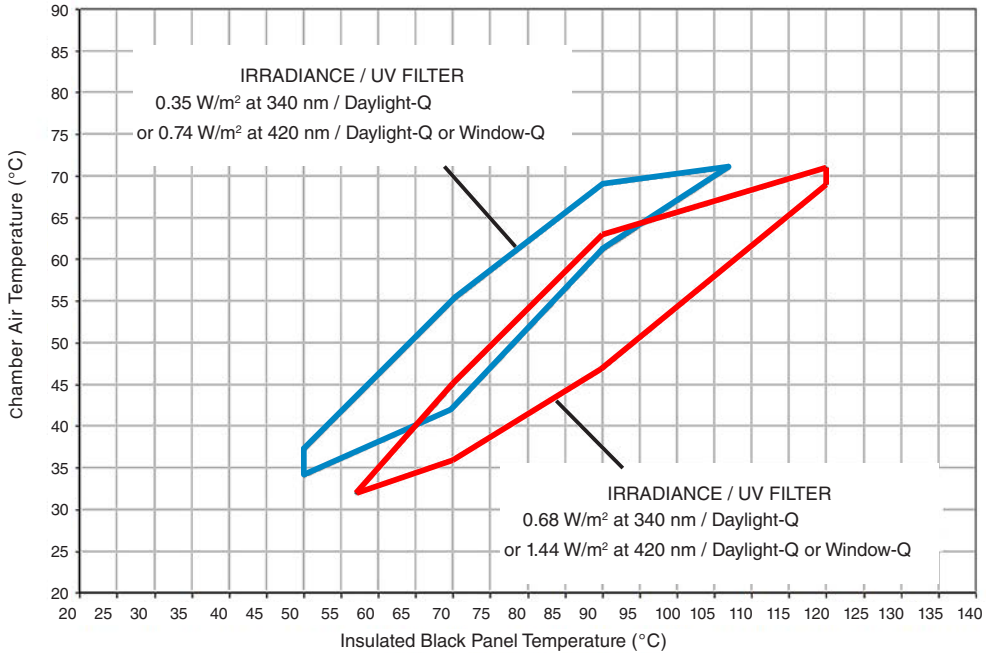


Figure 11.2b: I**nsulated** Black Panel vs. chamber air temperature at 50% relative humidity and 23 °C lab temperature.

Xe-3 Models with Chiller

- Figures Figure 11.2c and Figure 11.2d show the chamber air temperature ranges for Xe-3 models with chiller.

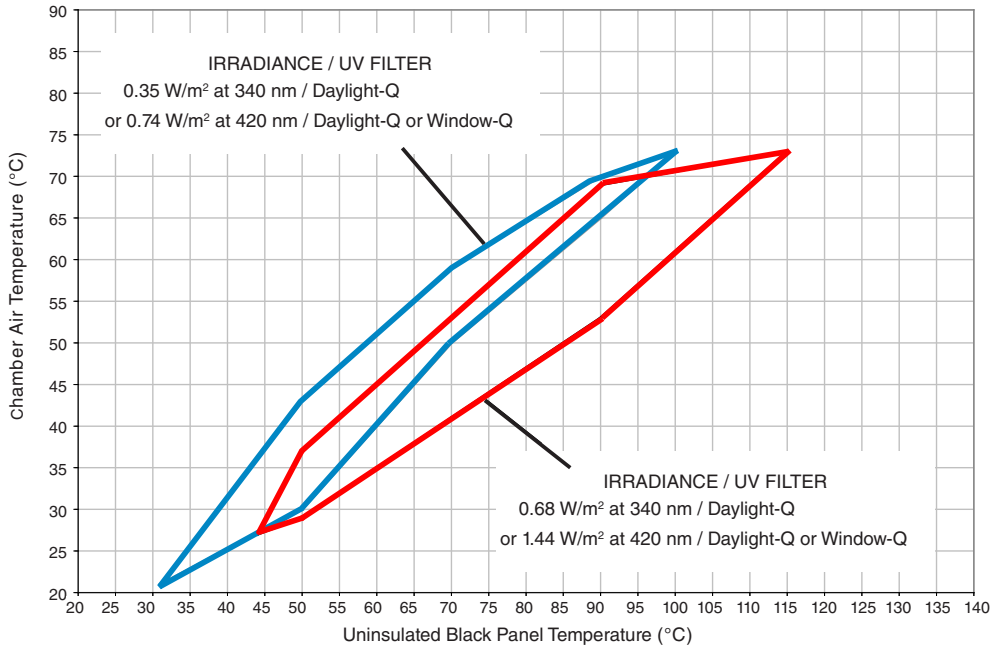


Figure 11.2c: **Uninsulated** Black Panel vs. chamber air temperature at 50% relative humidity and 23 °C Lab temperature.

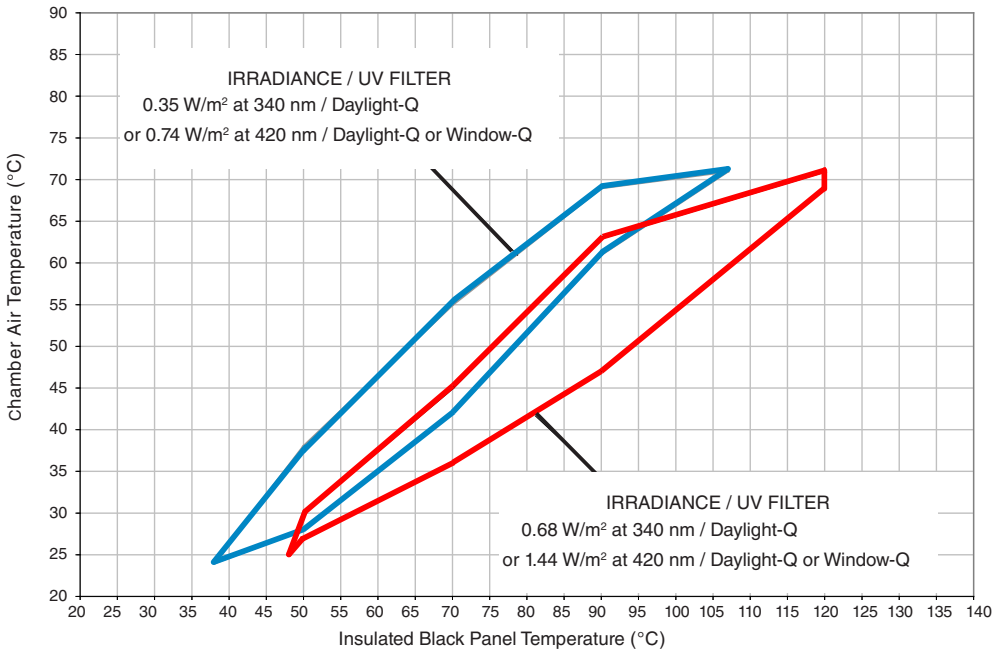


Figure 11.2d: I**nsulated** Black Panel vs. chamber air temperature at 50% relative humidity and 23 °C lab temperature.

11.3 Changing UV Optical Filters (Sep 2020)

- Q-SUN Xe-3 testers must have a glass UV optical filter (Section 6.4) installed below each of the three lamps.
- The glass filter protects the operator from high lamp voltage and also protects the lamp from accidental damage.
- The Q-SUN is shipped with filters as ordered (see Section 17 for part numbers). They are easily replaced.

The Q-SUN must be powered **OFF** and the main power supply disconnected before changing the optical filters.

- Remove the lamp housing (Figure 11.3b) as described in Section 15.1 to access the filter
- To change UV filters, remove the four screws that secure the frame and gently remove the frame (Figure 11.3c).
- The UV filter can now be lifted out and replaced (Figure 11.3d).
- Contact Q-Lab and request *Service Instruction X-7460-L Q-SUN UV Filter Installation* for optical filter installation details.
- The filter type name is etched into the filter surface for positive identification (Figure 11.3e).
- Optical filters should be cleaned before installing and at regular intervals (see Section 15.3).

Never operate the Q-SUN tester without a UV optical filter below each lamp.

Figure 11.3a: Open the lamp door.

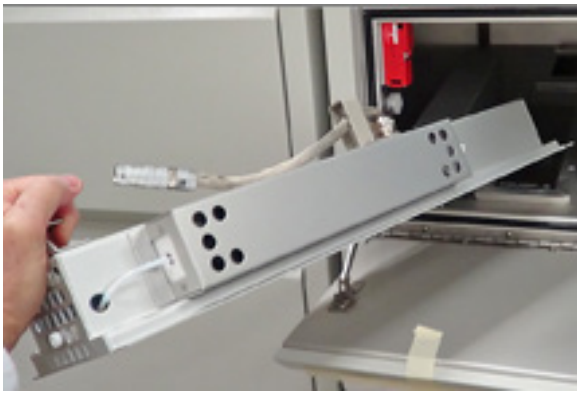


Figure 11.3b: Remove the lamp housing.

Figure 11.3c: Unscrew the UV optical filter frame.

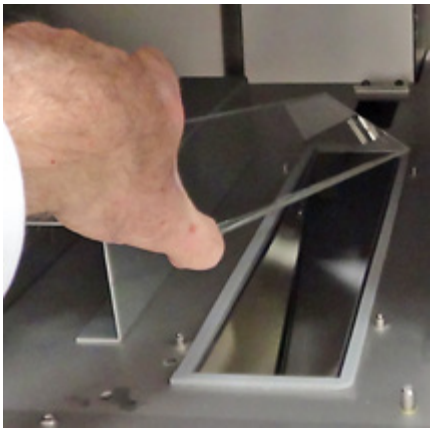


Figure 11.3d: Remove the UV optical filter.

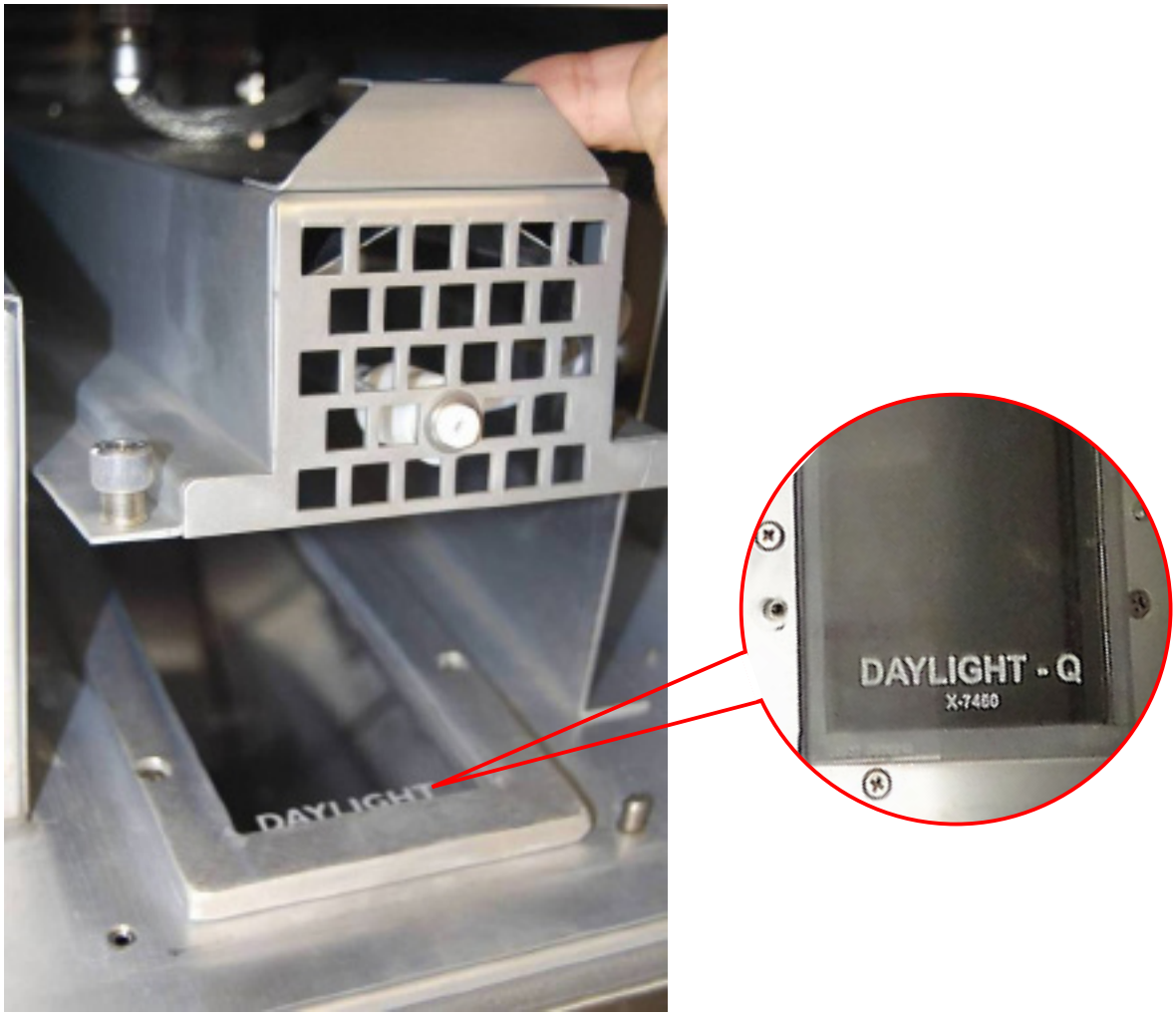


Figure 11.3e: Optical filter type etched into filter.

11.4 Mounting Test Specimens (Sep 2017)

Caution: Do not cover or shadow the black panel with specimens (Figure 11.4a and Figure 11.4b).

- Covering the black panel with specimens or shadow lowers its temperature and can cause the heater to stay on too long, overheating the specimens.
- Mount three-dimensional specimens far enough away from the black panel to avoid casting a shadow on it.
- Flat specimens and three-dimensional items are placed directly on the tray (Figure 11.4c).
- High air flow through the chamber makes it necessary to secure lightweight specimens.

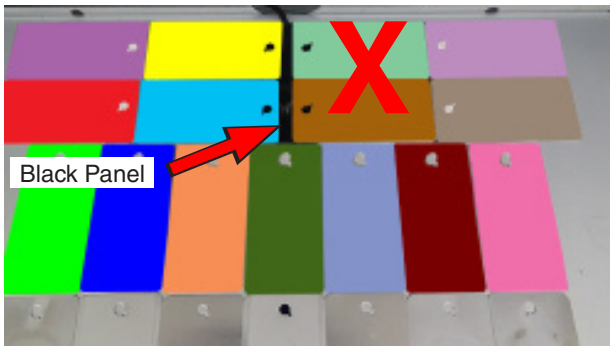


Figure 11.4a: Do not cover black panel.

Figure 11.4b: Black panel must be uncovered.

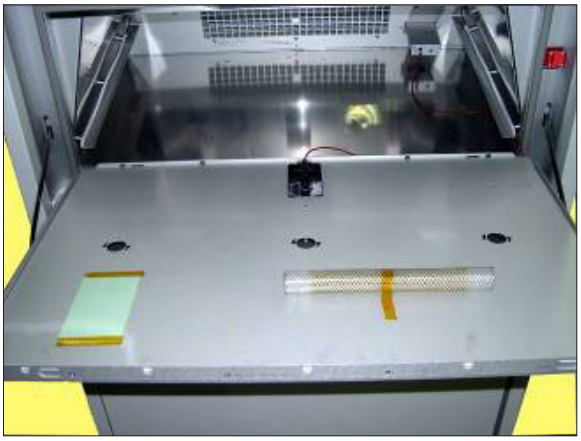


Figure 11.4c: Specimens secured to tray.

Solid and Open Back Specimen Trays

- A solid back tray (Figure 11.4d) partially insulates the back side of the specimens and causes some specimens to run hotter than when mounted on the open back tray (Figure 11.4e).
- The solid tray is chosen for most applications.

Figure 11.4d: Solid back specimen tray.

Figure 11.4e: Open back specimen tray.

- When using the open back tray, all spaces not filled with test specimens must be filled in for proper air flow (Figure 11.4f and Figure 11.4f).
- Otherwise, the air will flow through the tray and will not flow uniformly over the test specimens.
- The open back tray is required for test SAE J2527 (performance based version of SAE J1960) or SAE J2412 (performance based version of SAE J1885).
- See Section 9.3 for additional information on using the open back specimen tray when running Dual Spray steps.

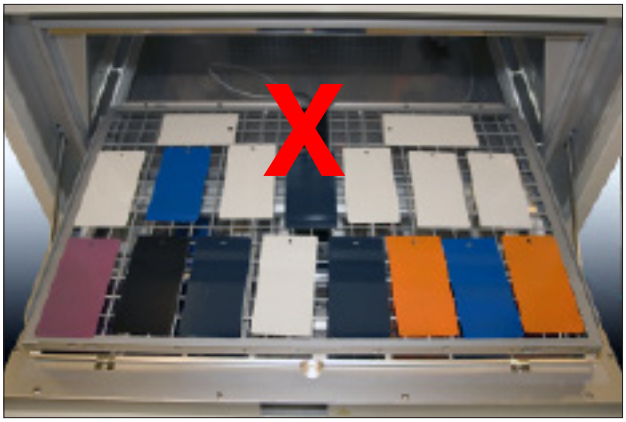


Figure 11.4f: Gaps between specimens on the open back tray affect cooling air flow.

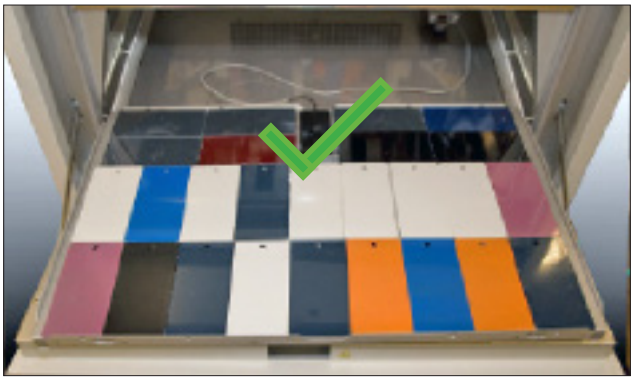


Figure 11.4g: Fill in gaps between specimens on the open back tray for proper cooling air flow.

Panel Holders

- Panel holder assemblies are available to hold flat, 50×100 mm, 75×150 mm, 100×150 mm, and 100×200 mm specimens.
- The panel holder assemblies come with blank Q-PANEL® test panels and retaining rings.

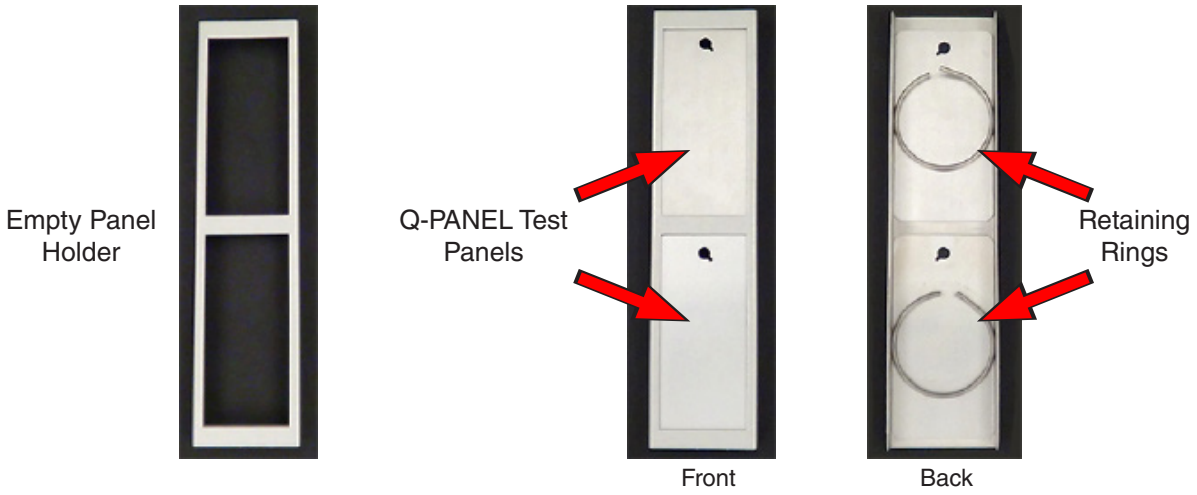


Figure 11.4h: Panel holder assembly.

Figure 11.4i: Panel holder kit (Part Number X-10114-K) with (26) panel holders holding (51) 50×100 mm specimens and the black panel.

Figure 11.4j: Panel holder kit (Part Number X-10260-K) with (10) panel holders holding (20) 75×150 mm specimens and (2) 50×100 mm panel holders.

Figure 11.4k: Panel holder kit (Part Number X-10261-K) with (8) panel holders holding (16) 100×150 mm specimens and (2) 50×100 mm panel holders.

Figure 11.4l: Panel holder kit (Part Number X-10262-K) with (6) panel holders holding (12) 100×200 mm specimens and (2) 50×100 mm panel holders.

Mounting an Insulated Black Panel When Using Panel Holders

- When using panel holders and an insulated black panel (IBP), the IBP should be mounted on a special holder shown below (Figure 11.4m and Figure 11.4o).
- These special holders are included in the specimen holder kits.
- The second IBP holder is used when calibrating with the UC202/IBP (Figure 11.4p).
- A single panel holder assembly for mounting (1) 50×100 mm specimen next to the IBP is also included in the specimen holder kits (Figure 11.4n).

Figure 11.4m: Insulated black panel holders.

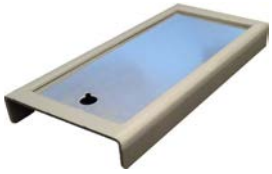


Figure 11.4n: Single panel holder assembly.

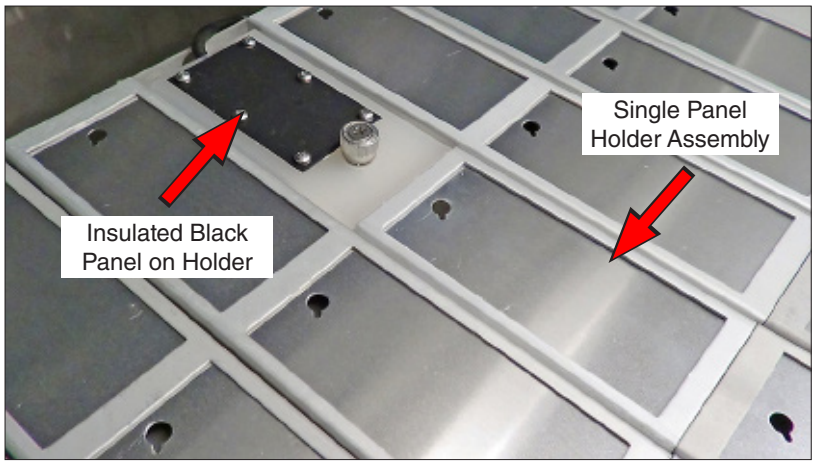


Figure 11.4o: Insulated black panel mounted on special holder and single panel holder with (1) 50×100 mm specimen.

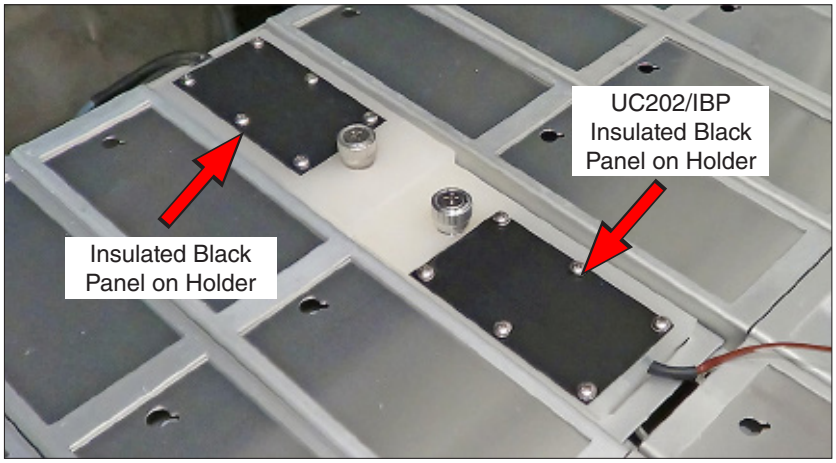


Figure 11.4p: Insulated black panel and UC202/IBP insulated black panel mounted on special holders.

Mounting an Uninsulated Black Panel When Using Panel Holders

- When using panel holders and an uninsulated black panel (BP), the BP should be mounted on a standard 50×100 mm panel holder (Figure 11.4q and Figure 11.4r).
- Use a retaining ring to hold the BP in place.
- Fill the panel holder with a 50×100 mm specimen (Figure 11.4r).
- When calibrating the BP, mount the UC202/BP in the same 50×100 mm holder and hold in place with a retaining ring (Figure 11.4s).

Figure 11.4q: Standard 50×100 mm Panel Holder

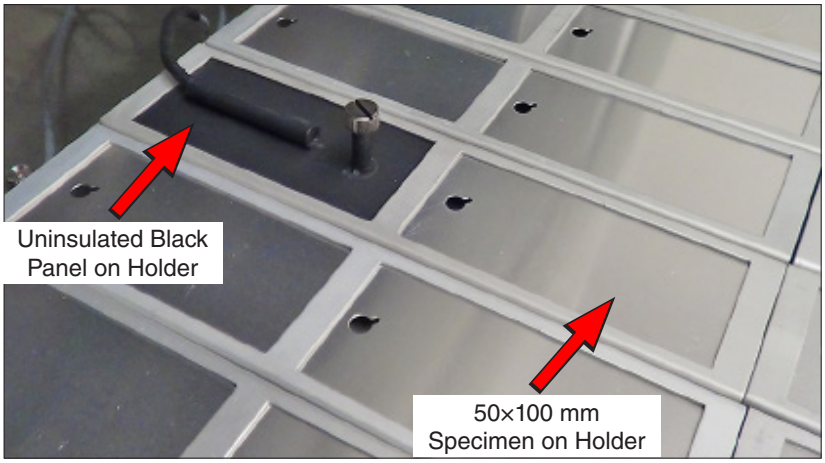


Figure 11.4r: Uninsulated Black Panel and (1) 50×100 mm Specimen Mounted on Standard 50×100 mm Holder

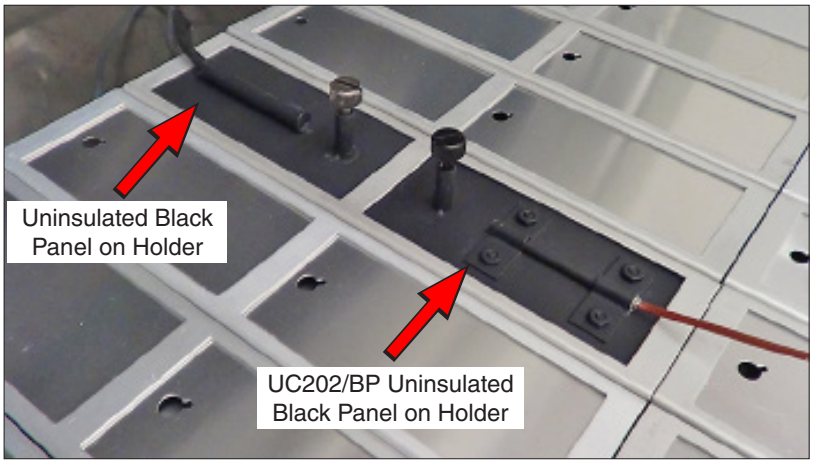


Figure 11.4s: Uninsulated Black Panel and UC202/BP Uninsulated Black Panel Mounted on Standard 50×100 mm Holder

Mounting Thin Films and Textile Specimens

- To mount thin films or textile specimens without a panel backing (so the specimen can “breathe”), a special textile/thin film panel holder is available.
- The textile/thin film holder (Part Number X-10255-X) is shown in Figure 11.4t through Figure 11.4w.
- Notice that the solid backing panel is replaced with a backing panel that is open in the center.

Figure 11.4t: Thin film placed on panel holder.

Figure 11.4u: Thin film mounted in panel holder.

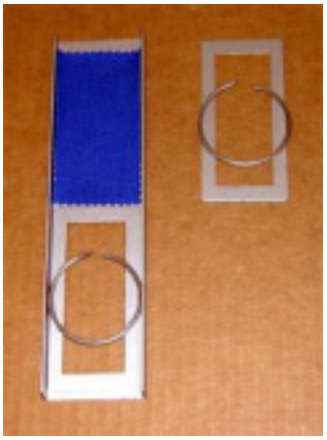


Figure 11.4v: Textile specimen placed on textile/thin film holder.

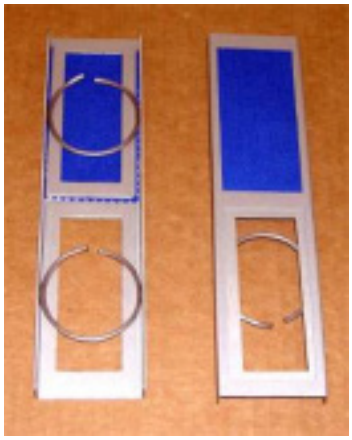


Figure 11.4w: Textile specimen mounted in textile/thin film holder.

Textile Masks

- The textile mask (Part Number X-10264-K) mounts in the 50×100 mm panel holder (Figure 11.4x and Figure 11.4y).
- A specimen can be placed in the Q-SUN for 4 days but a portion of the specimen can be exposed to the light for only 1 day, another portion for 2 days, another portion for 3 days, and another portion for 4 days by removing a different section of the mask each day.
- Textile masks of the type described in ISO 105 B02 are also available.
- 1/3 and 2/3 masks as well as 1/4, 1/2 and 3/4 masks are available (Figure 11.4z).

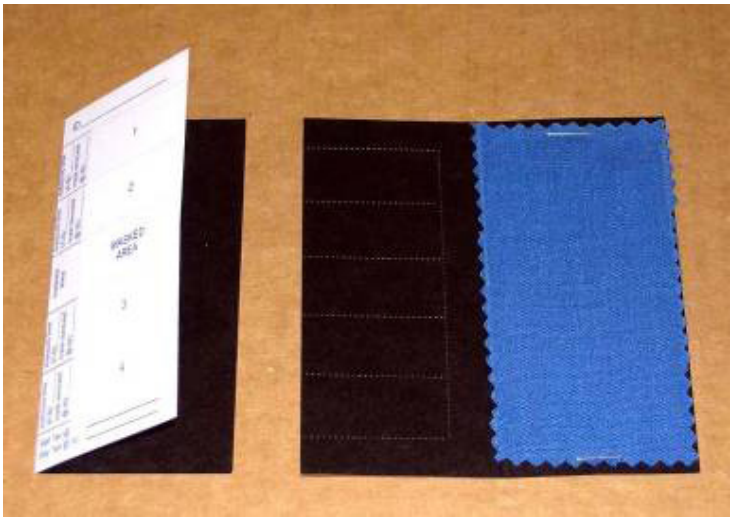


Figure 11.4x: Textile mask with specimen stapled inside.

Figure 11.4y: Textile mask mounted in panel holder with one section of the mask removed.

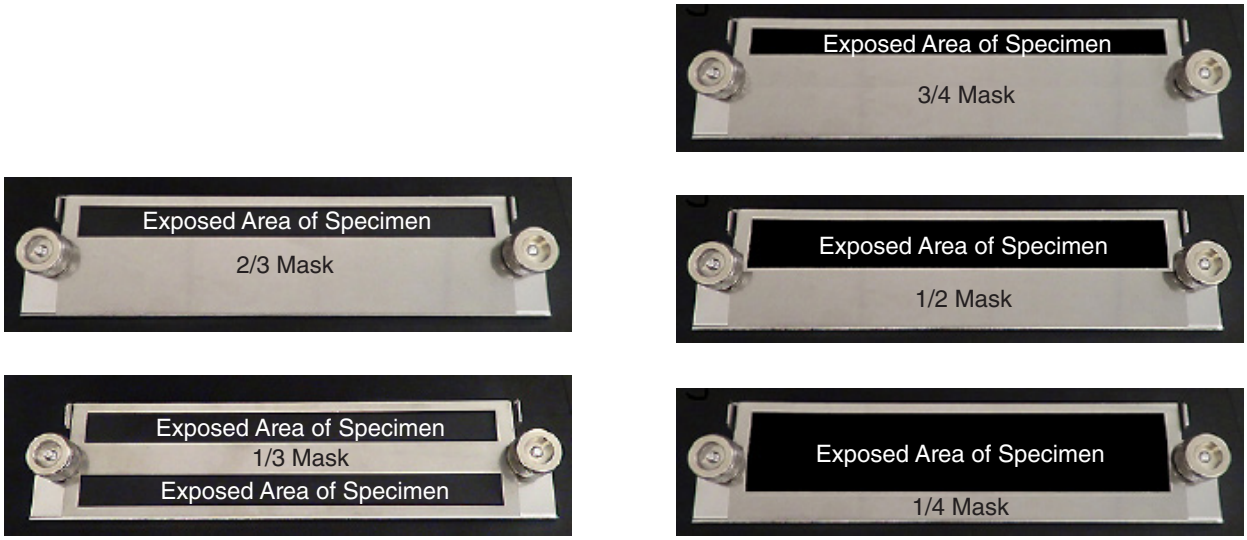


Figure 11.4z: ISO 105-B02 type textile masks.

Standard Reference Materials

- Standard reference materials should be placed just in front of the black panel.
- Figure 11.4aa and Figure 11.4ab show the recommended placement of reference materials in the test chamber.
- These materials are available from Q-Lab. See Section 17 for a listing of available materials.

Figure 11.4aa: Reference material position on specimen tray.

Figure 11.4ab: Reference material position on specimen tray (with panel holders).

3D Specimens

- The graph in shows the relationship between distance from the specimen tray and irradiance.
- **Note:** Specimens mounted above the plane receive higher irradiance.

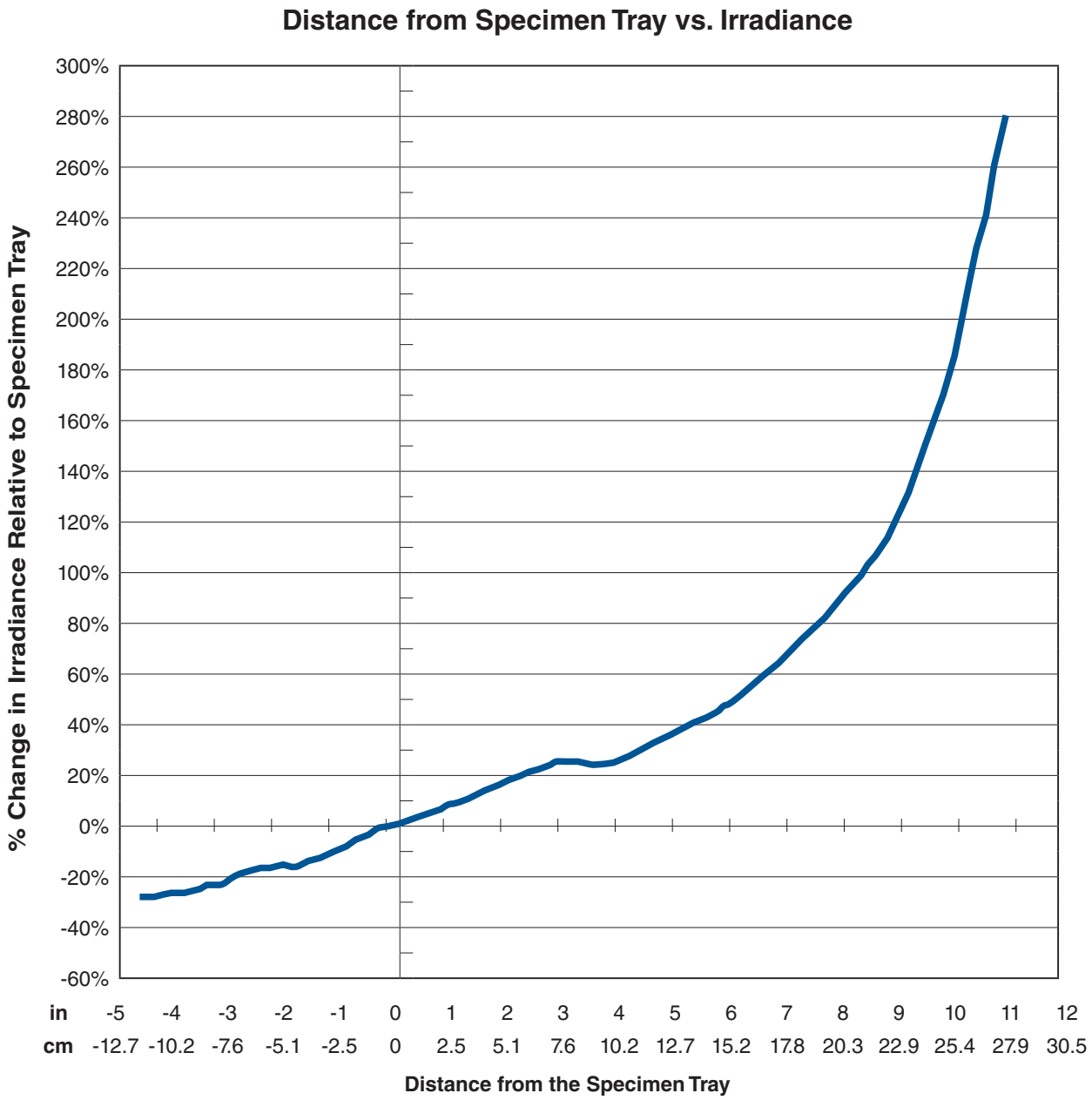


Figure 11.4ac: Distance from specimen tray vs. irradiance.

11.5 Repositioning Test Specimens (Nov 2014)

Regular repositioning of the test specimens is recommended to obtain uniform exposures.

- Specimens to be tested for 2000 hours (12 weeks) should be repositioned weekly.
- Specimens to be tested for 100 hours should be repositioned daily.
- A suggested repositioning plan is shown in Figure 11.5.

Figure 11.5: Specimen repositioning.

To Reposition Specimens:

Step 1. Remove two panel holders from front left corner.

Step 2. Move front row to left.

Step 3. Move two panel holders from back right corner to front row right corner.

Step 4. Move back row to right.

Step 5. Place two panels holders removed in **Step 1** in the opening on the left of the back row.

12. Calibration

- Q-SUN Xe-3 irradiance sensors are calibrated with the UC20 Smart Sensor (see Section 12.1).
- The panel temperature sensor is calibrated with a UC202 Smart Sensor.
- The humidity / chamber air temperature sensor replacement is described in Section 12.4.
- The table below lists the Q-SUN Xe-3 sensors which require periodic re-calibration or replacement.
- Please contact Q-Lab for more information (Section 19).

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

12.1 Irradiance Calibration (Mar 2022)

Smart Sensors

- Irradiance is calibrated with a UC20/340, UC20/420, UC20/LUX, or UC20/TUV Smart Sensor (Figure 12.1a throughFigure 12.1d).
  - 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 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 12.1f andFigure 12.1g).
  - Calibration information can also be displayed on the Xe-3 Menu Screen when the Smart Sensor is connected (Figure 12.1h).
- 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 17.
  - 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 99% isopropyl 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 12.1a: UC20/340 Smart Sensor (Green Label)

Figure 12.1b: UC20/420 Smart Sensor (Red Label)

Figure 12.1c: UC20/LUX Smart Sensor (Brown Label)

Figure 12.1d: UC20/TUV Smart Sensor (Gray Label)

Figure 12.1e: Clean the sensor face with 99% isopropyl alcohol and a soft cloth.

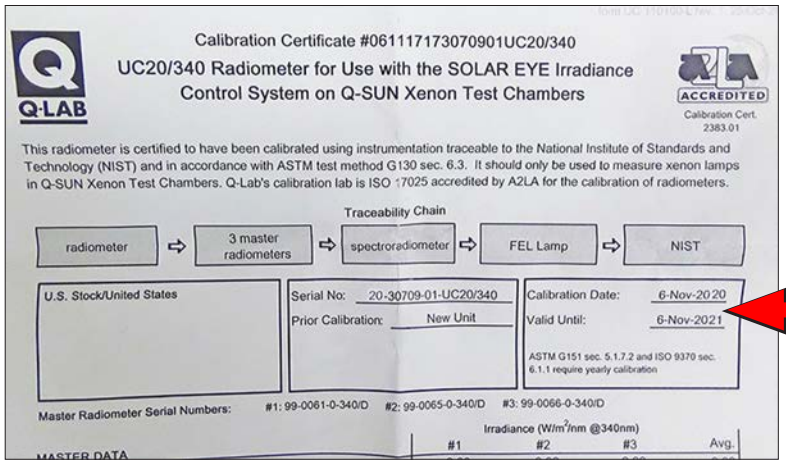


Figure 12.1f: UC20/340 calibration certificate.

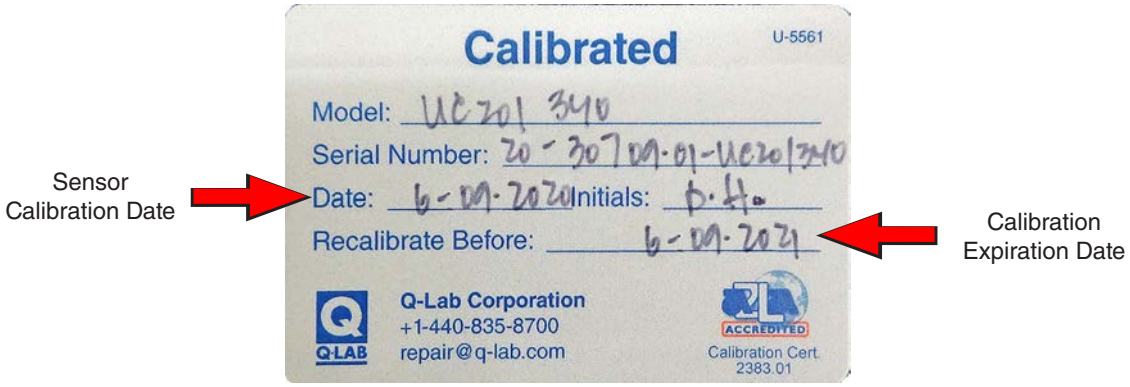


Figure 12.1g: Smart Sensor calibration label on case.

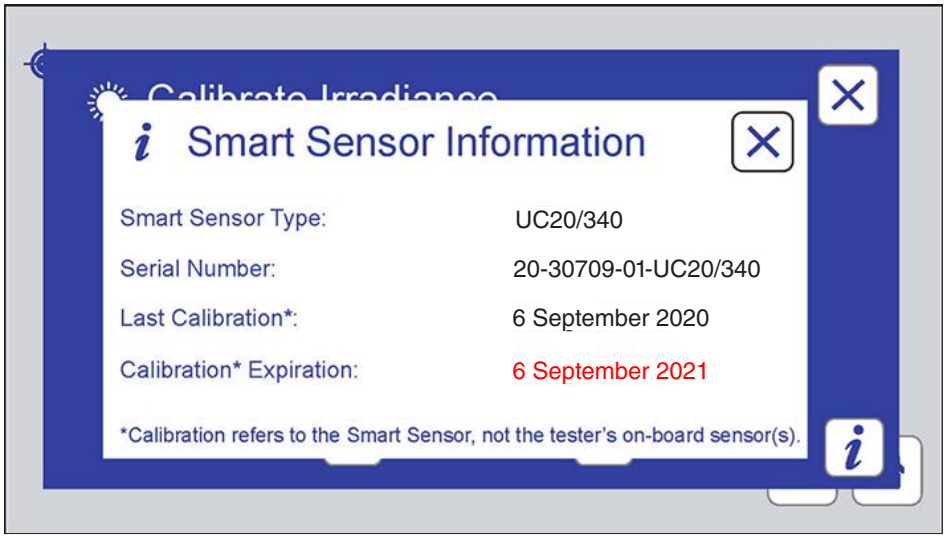
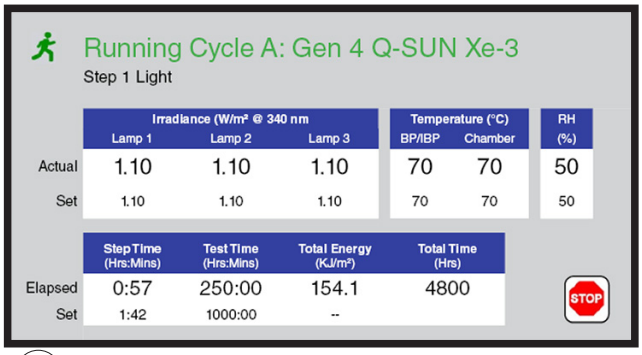


Figure 12.1h: Smart Sensor information displayed on Xe-3 Menu Screen.

Irradiance Calibration Procedure

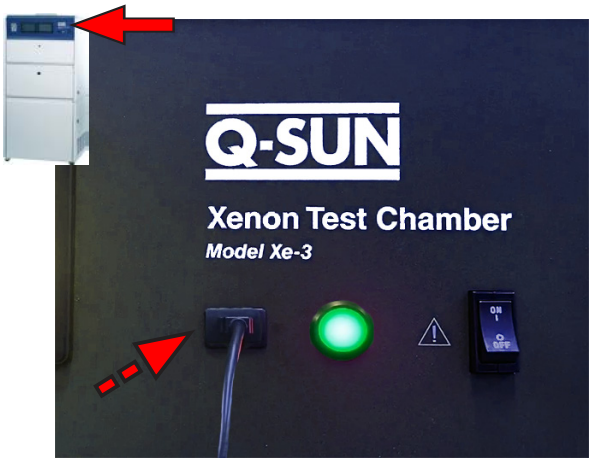
- The calibration instructions are listed in the steps below.
- Calibrate the Q-SUN Xe-3 in a light cycle and at normal operating temperature and irradiance.
- Calibrate with test specimens in place.
- Irradiance calibration should always be done before black panel temperature calibration.



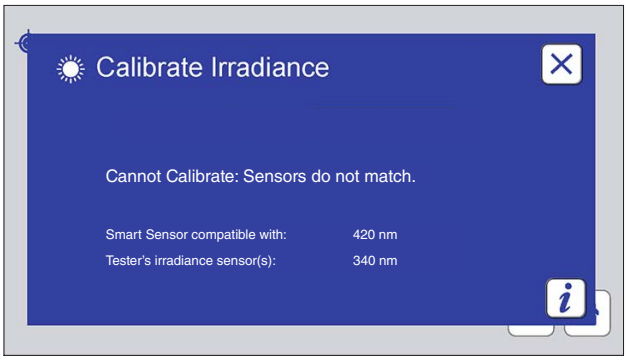
1. Run the Xe-3 in a Light Step (see Section 10). Make sure the black panel temperature and the irradiance are at the normal operating set points.

2. Remove the UC20 Smart Sensor from the case.

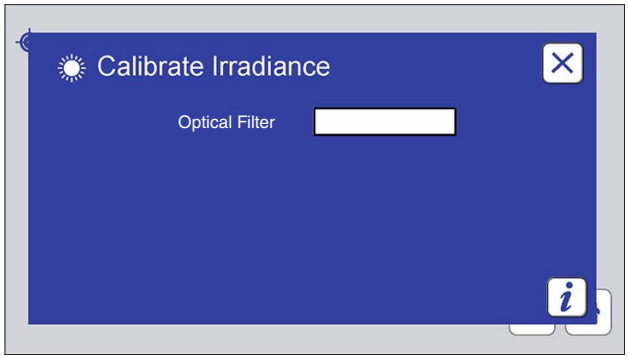
3. Clean the sensor face with 99% isopropyl alcohol and a soft cloth.



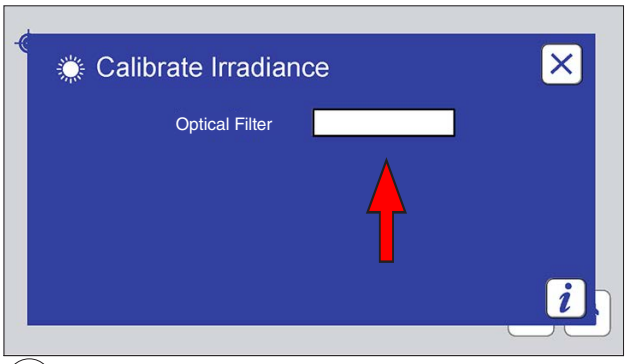
4. Plug the Smart Sensor into the USB connector on the Xe-3 control panel.



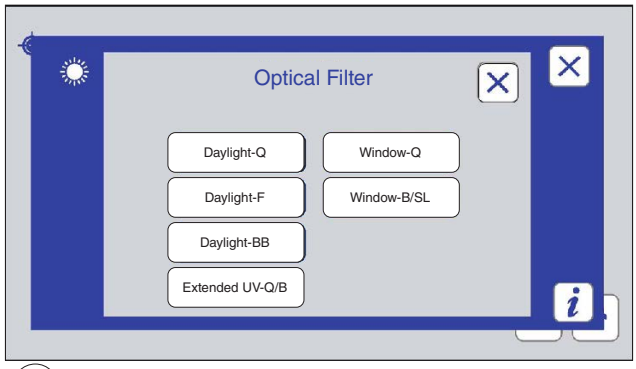
5. If the Smart Sensor does not match the Xe-3 irradiance sensor this message is displayed. Connect the Smart Sensor that matches the Xe-3 irradiance sensor.



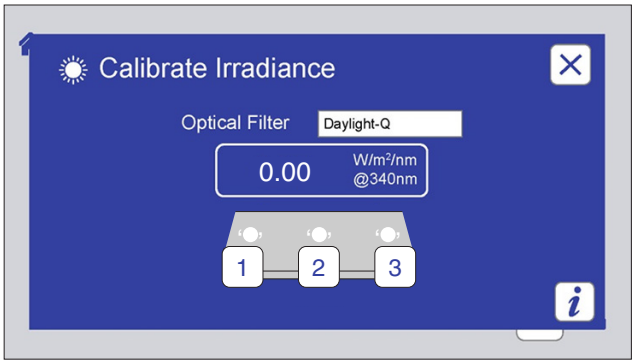
6. For testers with 340 nm or TUV sensors, this Calibrate Irradiance screen with a box to select the optical filter is displayed. For testers with a 420 nm sensor, go to Step 12.



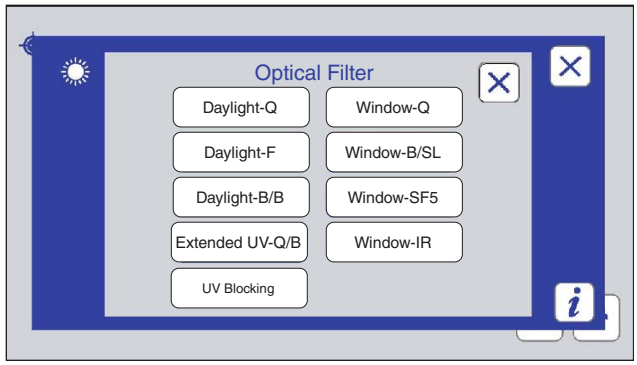
7. Touch the Optical Filter text box. For 340 nm sensors continue with Step 8. For TUV sensors go to Step 10.



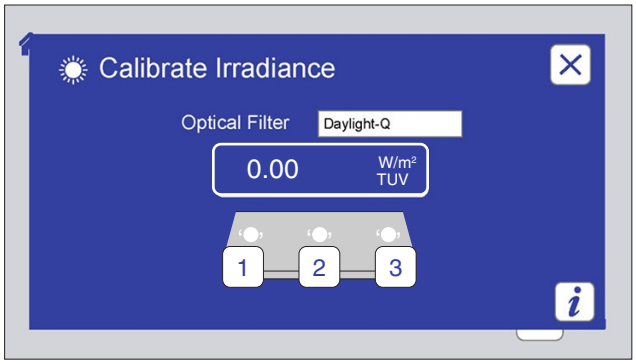
8. The Optical Filter screen for 340 nm sensors. Touch the optical filter button that matches the optical filters installed in the tester.



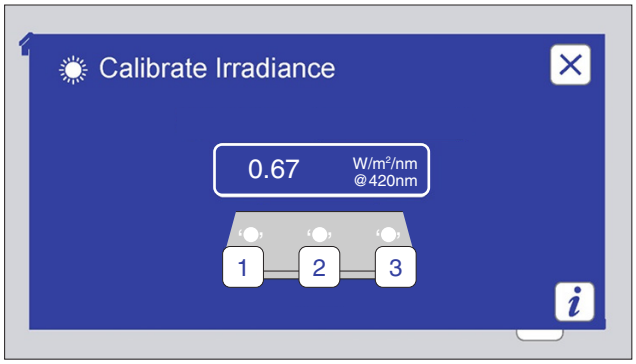
9. For testers with a 340 nm sensor, this screen is displayed. Go to Step 13.



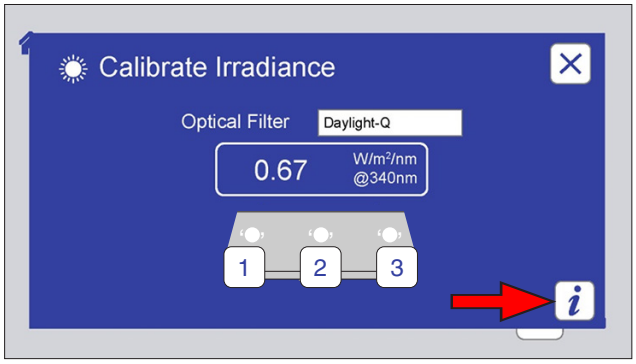
10. The Optical Filter screen for TUV sensors. Touch the optical filter button that matches the optical filters installed in the tester.



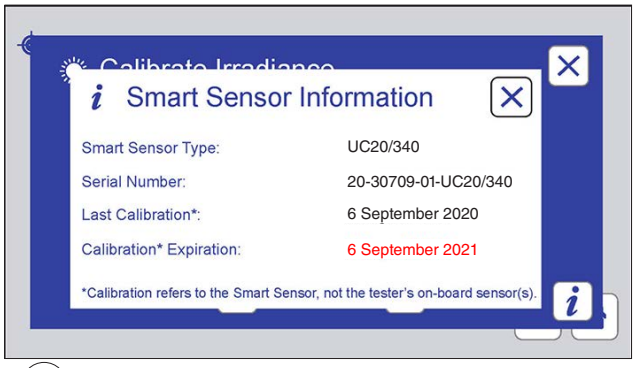
11. For testers with a TUV sensor, this screen is displayed. Go to Step 13.



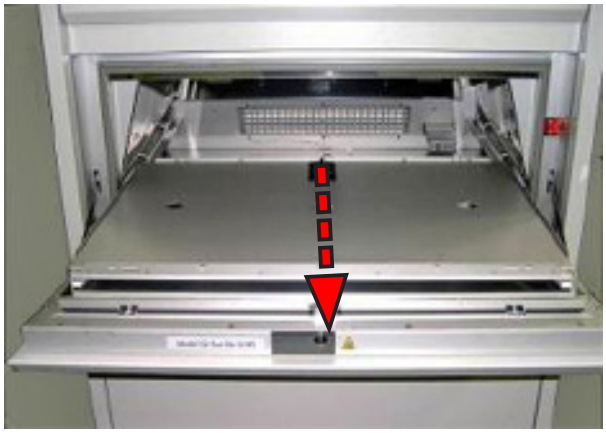
12. For testers with a 420 nm sensor, this screen is displayed.



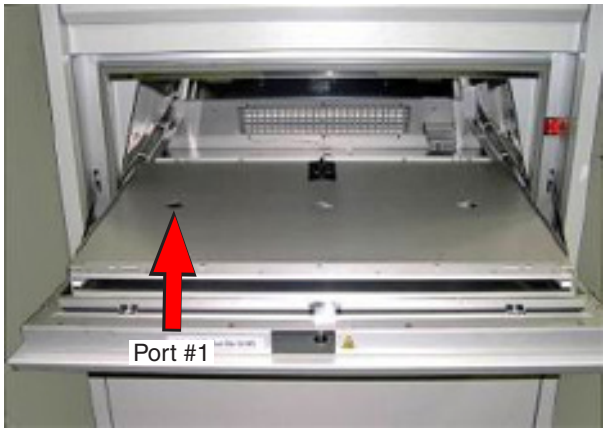
13. **Optional:** to display the Smart Sensor calibration information, touch the information icon.



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. Pull the specimen tray out.

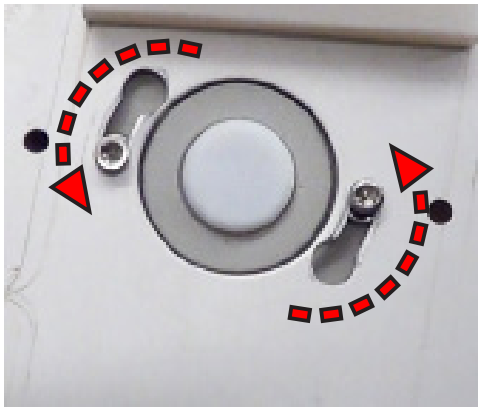


16. Locate calibration port #1 in the specimen tray.

17. The UC20 has a spring-mounted flange for docking in the tester calibration ports.

18. Lift the specimen tray. From the bottom of the tray insert the UC20 Smart Sensor face-up into calibration port #1 compressing the flange.

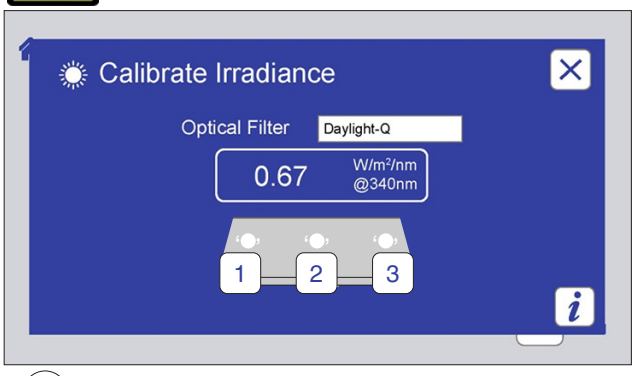
UC20 as Seen from Top of Specimen Tray



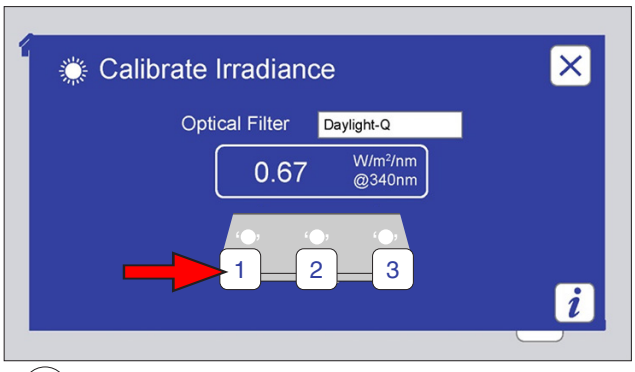
19. Rotate the UC20 to lock it in to the calibration port.

20. Slide the tray back into the chamber and close the door with the Smart Sensor cord routed out of the chamber. Keep the cord away from the door latch.

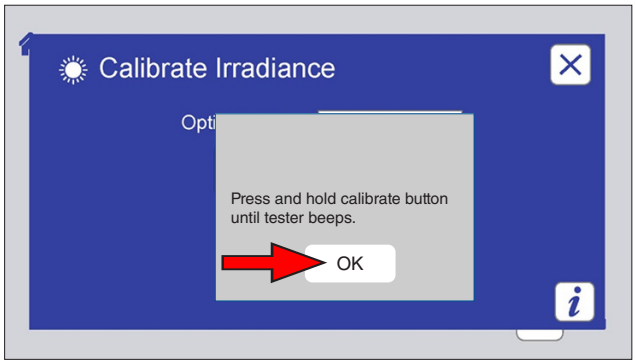
Wait for the irradiance to stabilize.



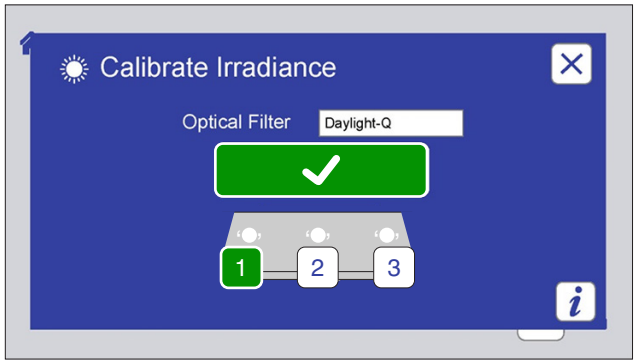
21. Wait a few seconds to allow the irradiance to stabilize.



22. Press and hold the channel 1 calibration button until the tester beeps.



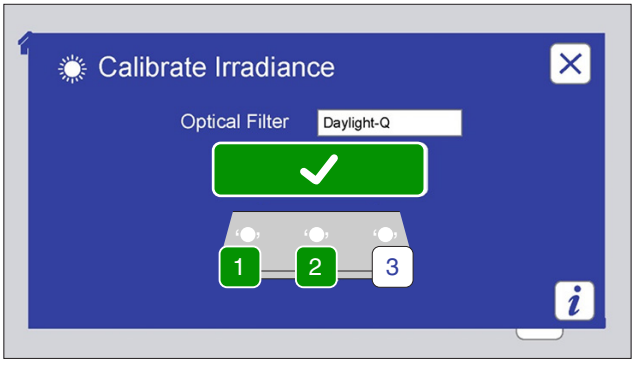
23. If the button is not pressed long enough, this message is displayed. Touch the OK button to close the message. Press and hold the channel 1 button again until the tester beeps.



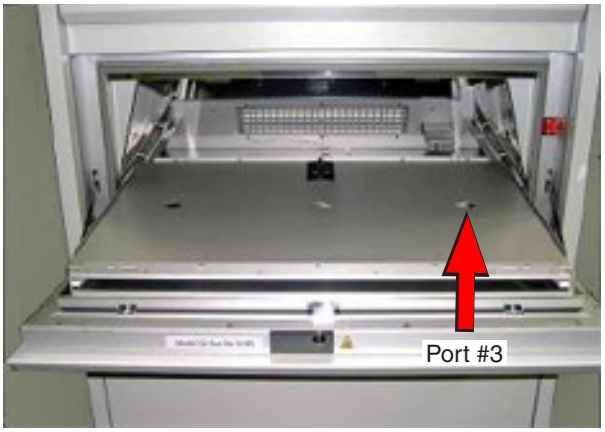
24. The channel button turns green and a check mark is displayed indicating successful calibration.

25. Open the chamber door. Locate calibration port #2 in the specimen tray.

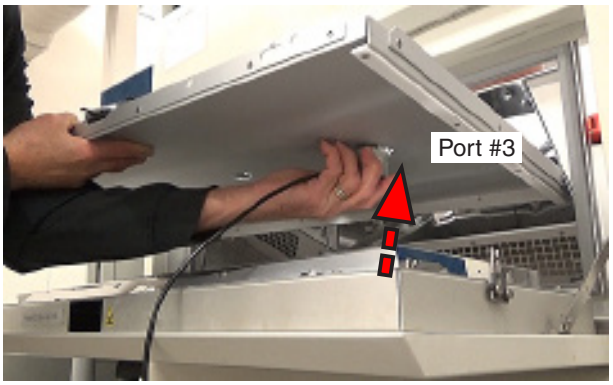
26. Move the Smart Sensor to calibration port #2. Slide the tray into the chamber and close the door.



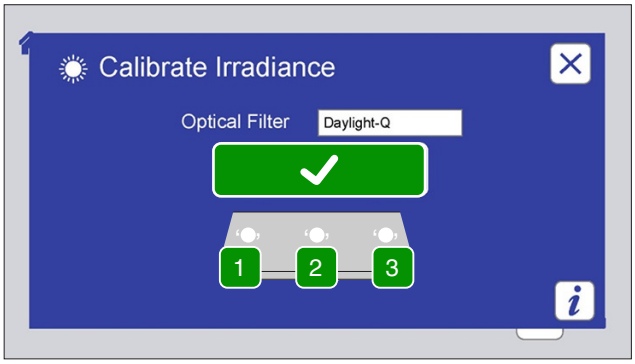
27. Repeat Step 19 through Step 24 to calibrate sensor #2.



28. Open the chamber door. Locate calibration port #3 in the specimen tray.



29. Move the Smart Sensor to calibration port #3 in the specimen tray.



30. Repeat Step 19 through Step 24 to calibrate sensor #3.

31. Disconnect the UC20 Smart Sensor from the tester.

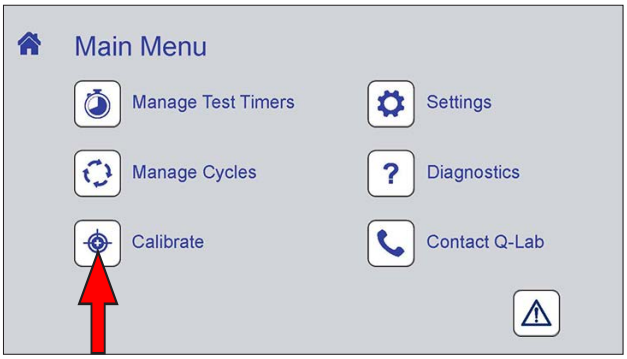
32. Remove the UC20 Smart Sensor from the test chamber.

33. Slide the tray into the test chamber. Close the door. Close the latch.

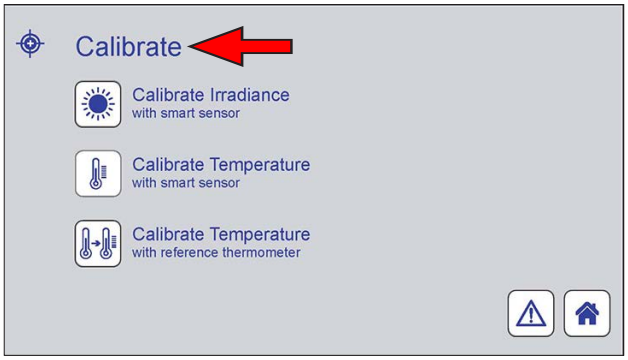
34. Replace the UC20 Smart Sensor in the case.

- Calibration of all three irradiance channels 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 (Step 10 through Step 33).

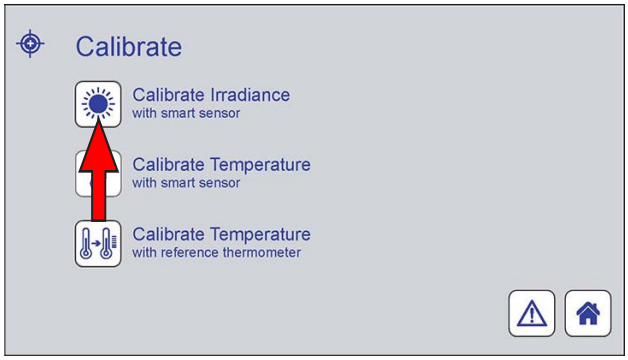
Access Calibrate Functions Through the Main Menu



▶ Calibrate functions can also be accessed by touching the calibrate icon on the Xe-3 main menu screen.



▶ The calibrate screen is displayed.



▶ Touch the Calibrate Irradiance icon.

12.2 Black Panel Temperature Sensor (Mar 2022)

Overview

- For accurate temperature readings, calibrate the black panel temperature sensor every six months in accordance with ASTM E220.
- The black panel 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 12.2a.
  - Use the UC202/IBP with insulated black panel (also known as "black standard"), Figure 12.2b.

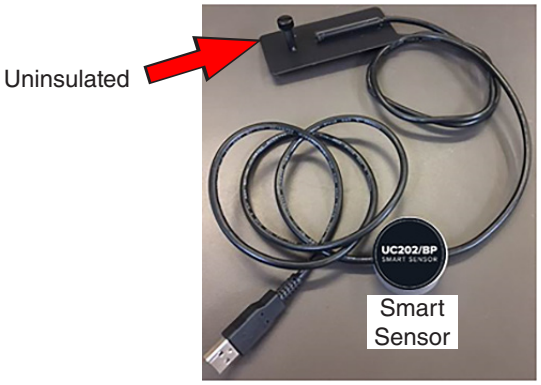


Figure 12.2a: UC202/BP Temperature Smart Sensor with Uninsulated Black Panel (Black Panel)

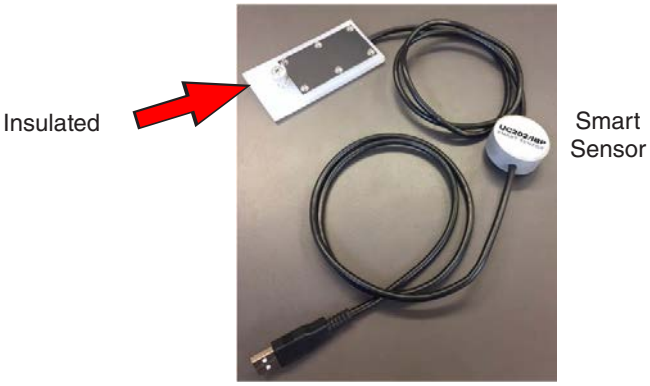
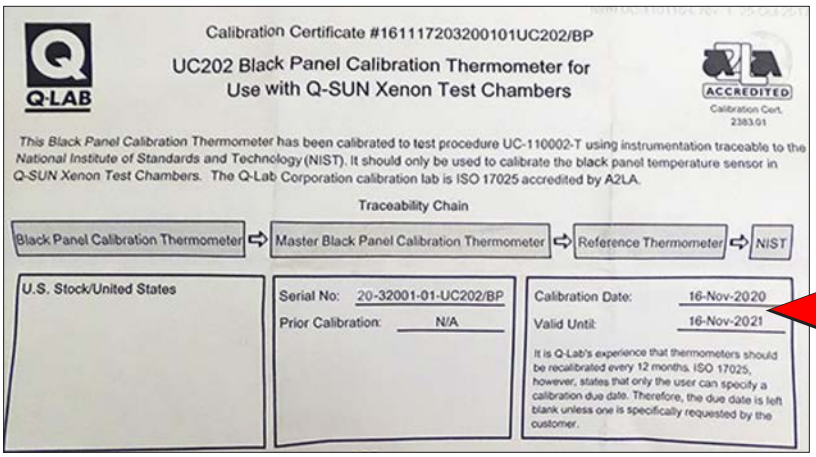


Figure 12.2b: UC202/IBP Temperature Smart Sensor with Insulated Black Panel (Black Standard)

- 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 12.2c and Figure 12.2d).
  - Calibration information can also be displayed on the Xe-3 menu screen when the Smart Sensor is connected (Figure 12.2e).
- 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 17.
  - 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 (see Section 10.8) is used to calculate the white panel temperature offset. See Section 10.8 for more information.



Sensor Calibration and Expiration Dates

Figure 12.2c: UC202 Calibration Certificate

Sensor Calibration and Expiration Dates

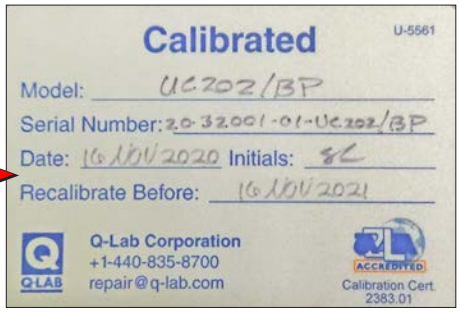


Figure 12.2d: UC202 Temperature Smart Sensor Calibration Label on Case

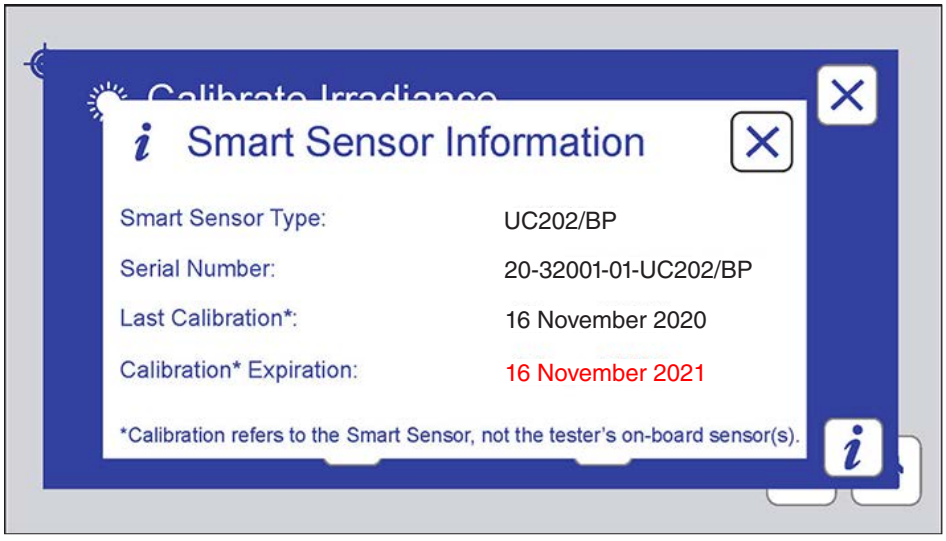
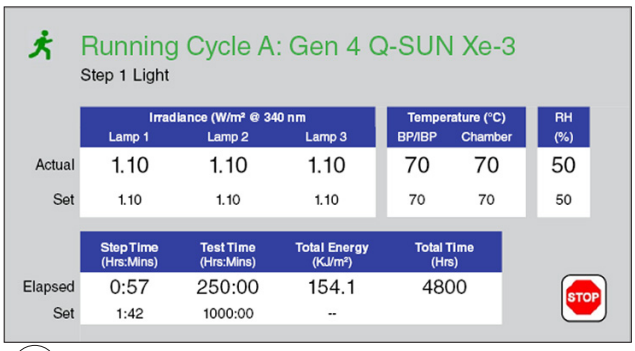


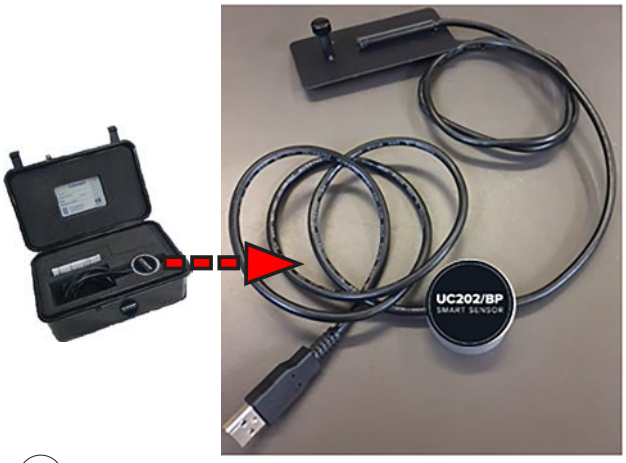
Figure 12.2e: Smart Sensor information displayed on Xe-3 menu screen.

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.

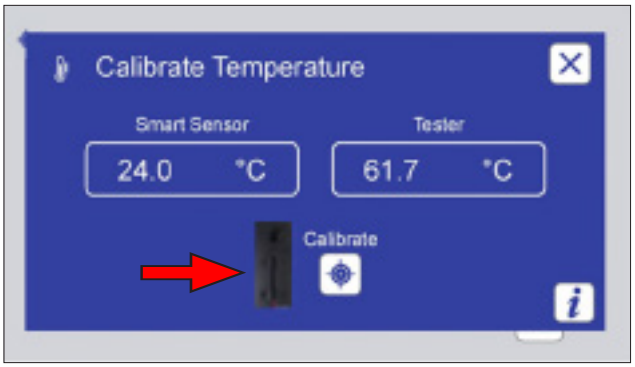


1. Run the Xe-3 in a Light Step (see Section 10). Make sure the black panel temperature and the irradiance are at the normal operating set points.

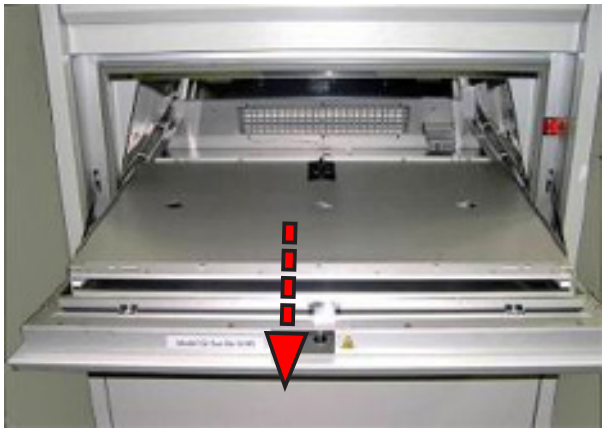


2. Remove the UC202 Temperature Smart Sensor from the case.

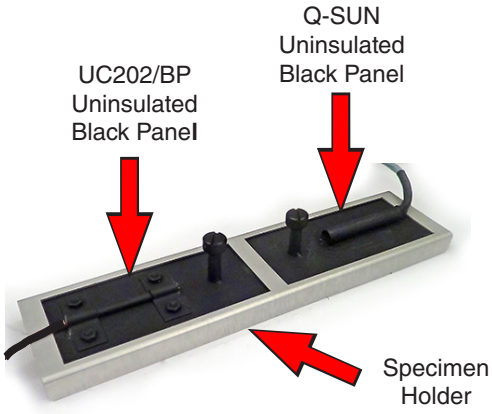
3. Plug the UC202 Smart Sensor into the USB connector on the Xe-3 control panel.



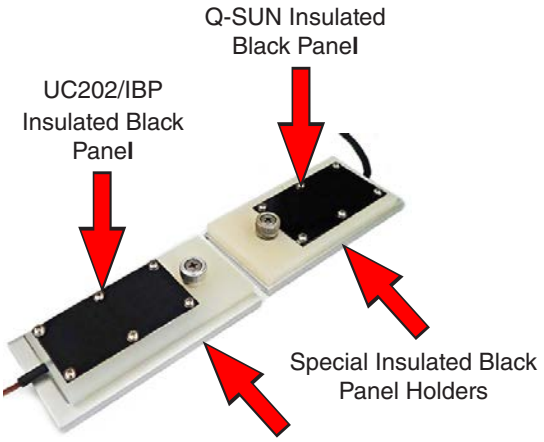
▶ The calibrate temperature screen is displayed. The Smart Sensor type (BP or IBP) is recognized by the tester. UC202/BP in this example.



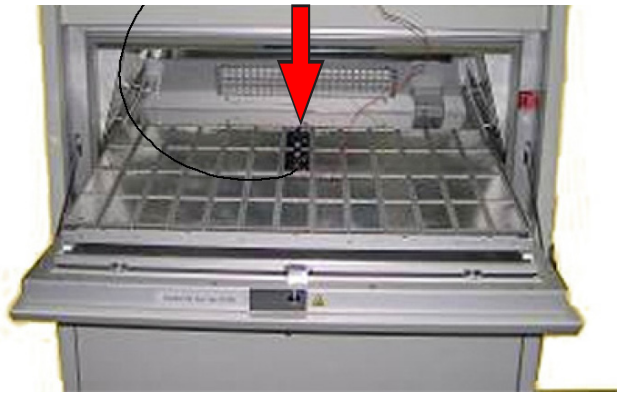
4. Open the test chamber door. Pull the specimen tray out.



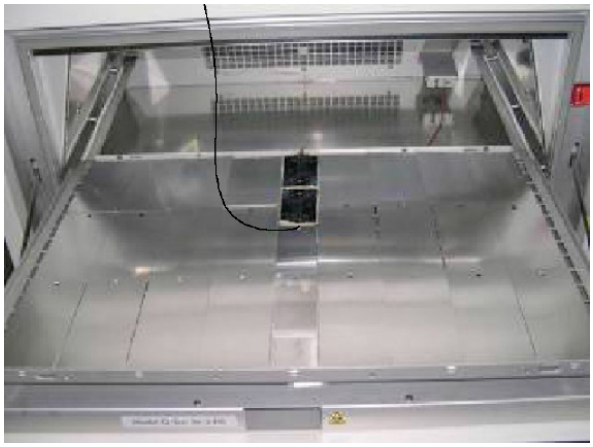
5. If specimens and Q-SUN Uninsulated Black Panel are in holders, mount UC202/BP in a holder.



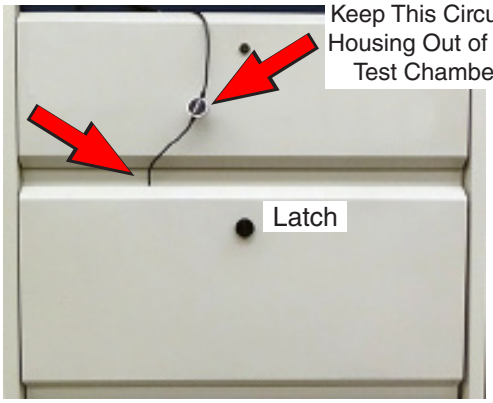
6. If specimens and Q-SUN Insulated Black Panel are in holders, mount UC202/IBP in a holder.



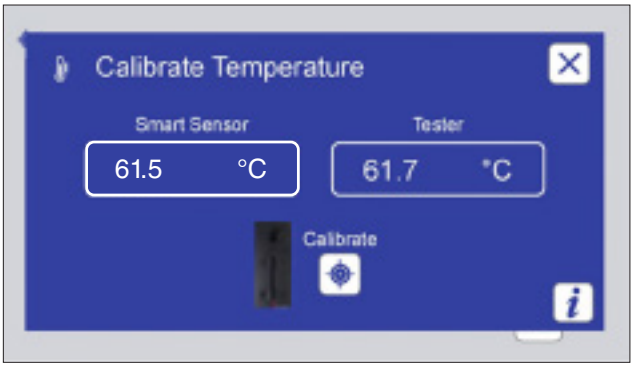
7. Place Q-SUN and UC202 black panels in holders on the tray with specimens in holders.



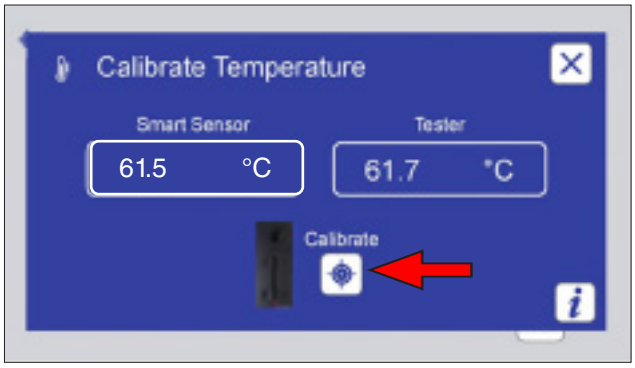
8. Or place Q-SUN and UC202 black panels directly on the specimen tray with specimens on the tray.



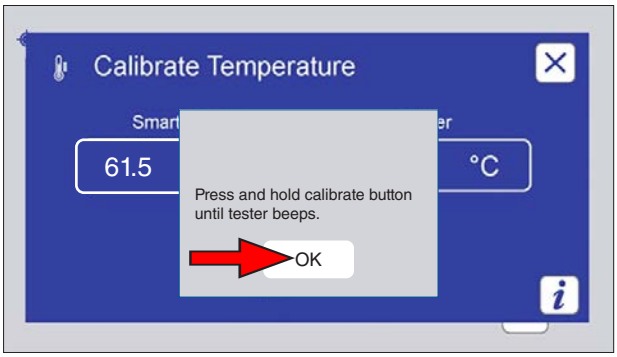
9. Push the specimen tray into the chamber. Close the chamber door. Keep the sensor cord away from the door latch. Allow the Q-SUN to stabilize at the irradiance and temperature set points.



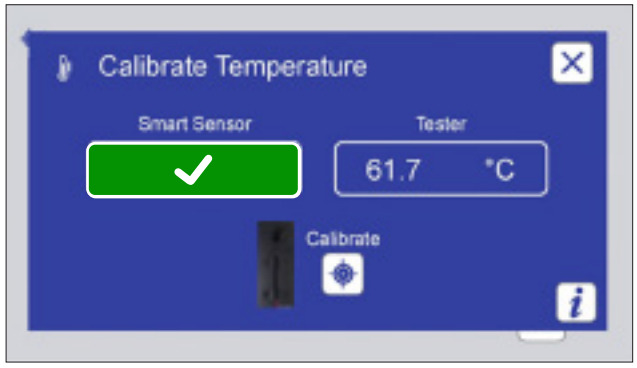
10. Wait a few seconds to allow the sensors temperature to stabilize.



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



12. 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.



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

14. Disconnect the UC202 Smart Sensor from the tester.

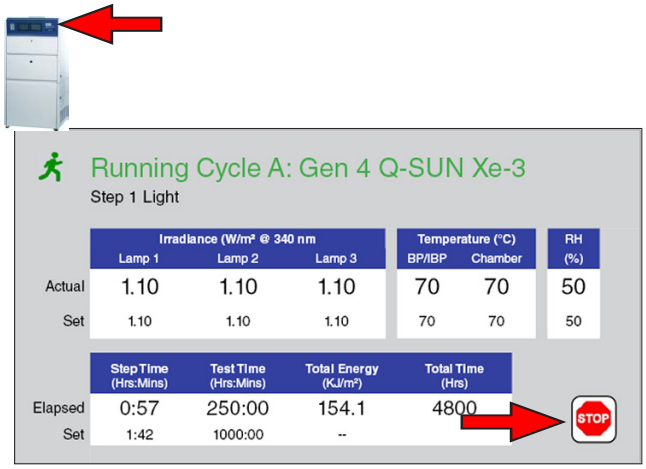
- Black panel temperature sensor calibration is complete.
- Remove the UC202 Smart Sensor from the test chamber.
- Run test cycles as normal on the tester.

12.3 White Panel Temperature Sensor (Oct 2020)

Overview

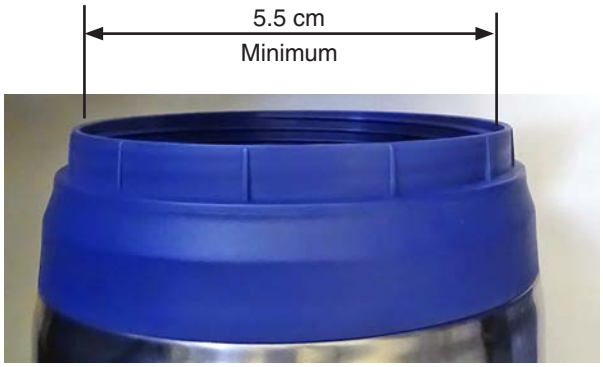
- This section details the calibration process for the optional white panel temperature sensor (see Section 7.1).
- There are two separate white panel temperature sensor calibration processes:
  - For white panel sensors installed without a black panel sensor follow the instructions in Section 12.3.1.
  - If the white panel is installed with a black panel follow the instructions in Section 12.3.2.
- For accurate temperature readings, calibrate the white panel temperature sensor every six months in accordance with ASTM E220.
- The white panel panel temperature sensor should also be recalibrated whenever the panel temperature sensor, optical filters, UV sensor, or test cycle conditions are changed.
- Calibration is done in hot water with a calibrated reference thermometer, not with a UC202 Smart Sensor.
- The following tools are needed to calibrate the white panel temperature sensor:
  - Calibrated reference thermometer
  - Phillips screwdriver
  - Insulated container
  - Hot water
- Q-Lab offers an optional Temperature Calibration Kit (see Section 10.8) which includes an easy-to-use insulated container.
- Follow the steps below to calibrate the white panel temperature sensor.
- The calibration procedure is the same for uninsulated and insulated panel temperature sensors.

12.3.1 White Panel without Black Panel



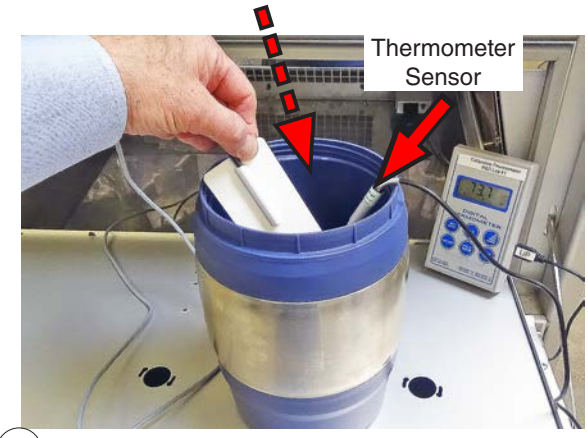
1. If a test is running, touch the STOP icon on the status screen to suspend the test.

2. Reference thermometer and insulated water container for calibrating the white panel.

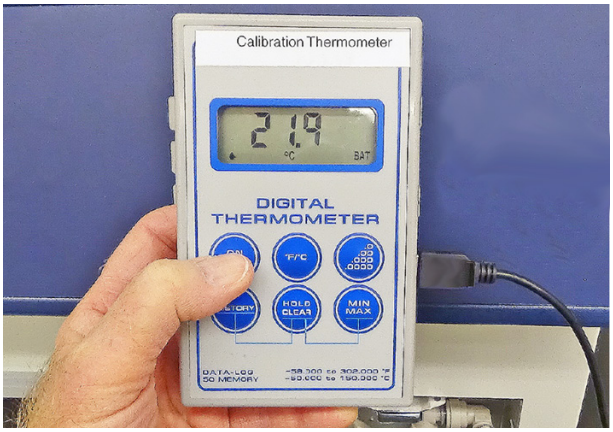


3. **IMPORTANT:** The opening of the insulated container must be at least 5.5 cm wide to insert the white panel.

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

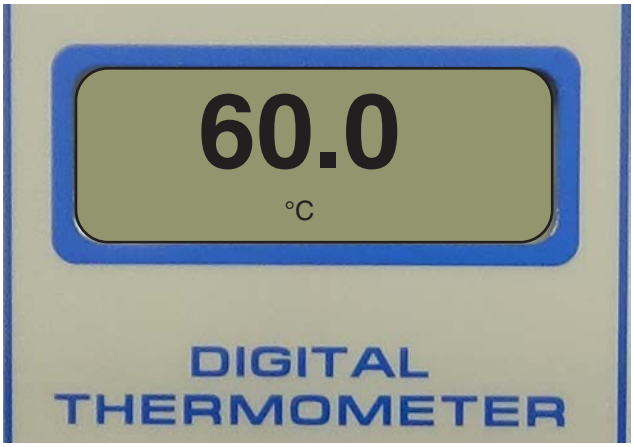


5. One the test chamber door. Remove the white panel from the tester. Place the white panel and the calibrated reference thermometer sensor in the insulated container.

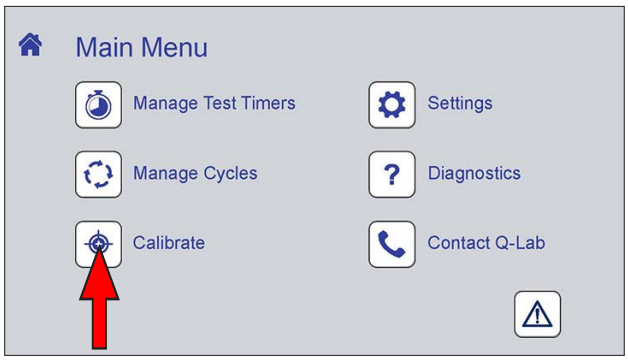


6. Turn the reference thermometer ON.

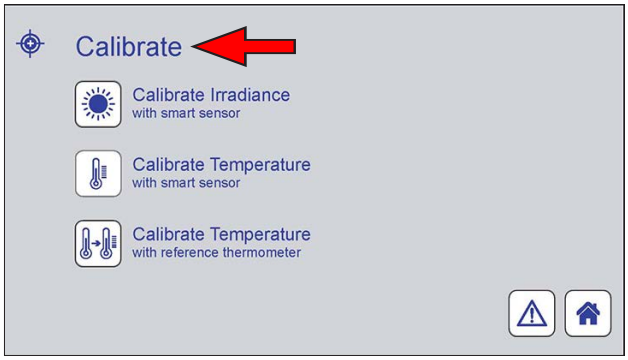
7. Wait 10 minutes for the sensors to stabilize.



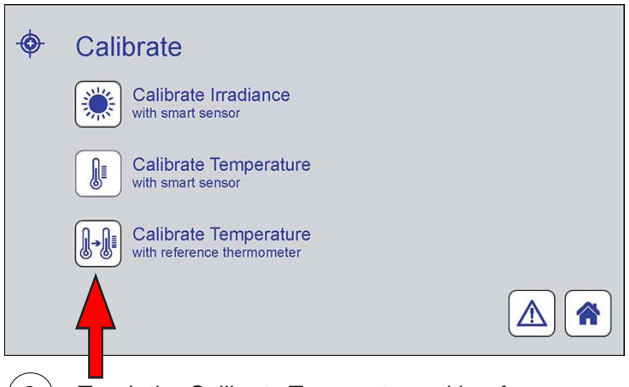
▶ The reference temperature is displayed.



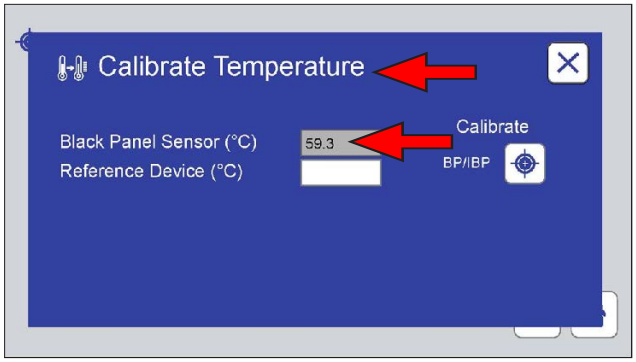
8. Touch the calibrate icon on the Xe-3 menu screen.



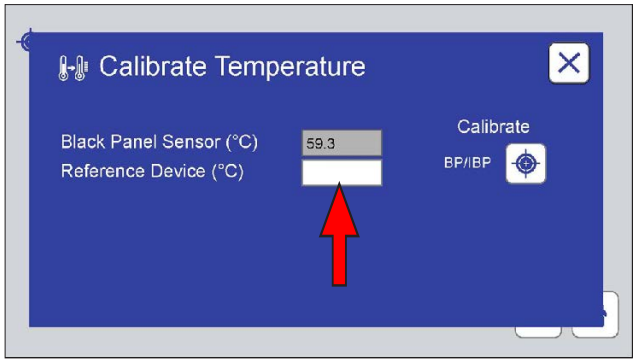
▶ The calibrate screen is displayed.



9. Touch the Calibrate Temperature with reference thermometer icon.

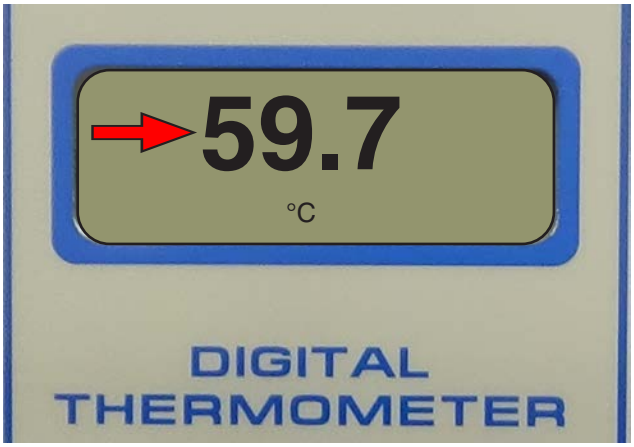


▶ The Calibrate Temperature screen is displayed. The current reading of the panel temperature sensor is shown. The label is "Black Panel Sensor," but a white panel is being calibrated.



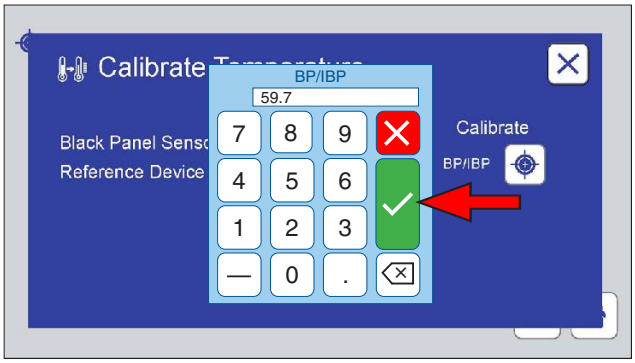
10. Touch the Reference Device text box.

▶ The BP/IBP temperature enter keypad is displayed.

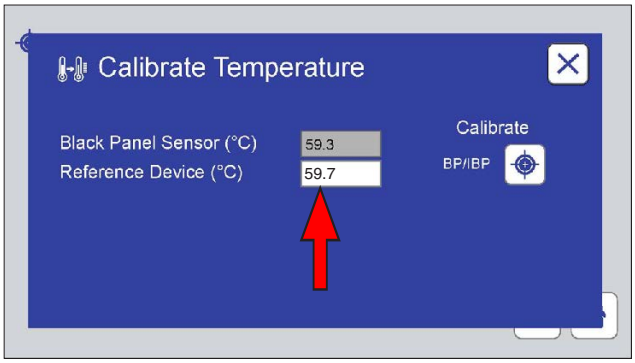


11. Read the temperature displayed on the reference thermometer.

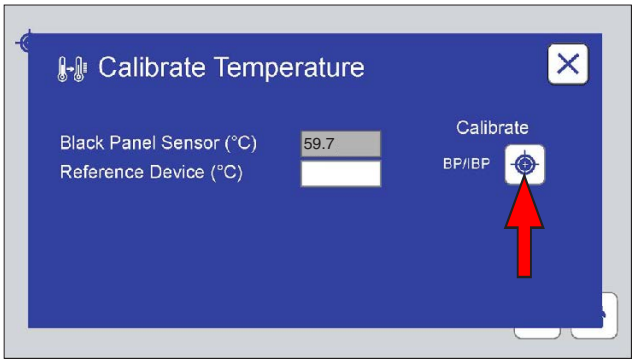
12. Use the keypad to enter the reference temperature into the reference device text box.



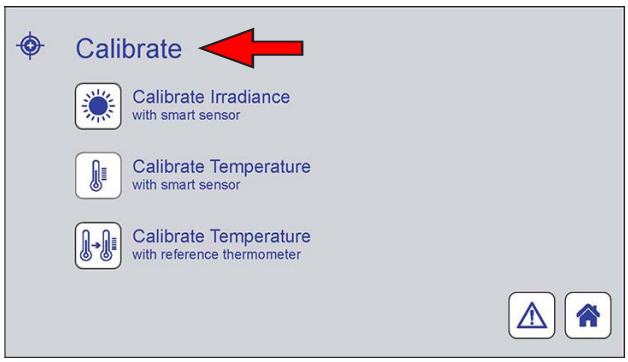
13. Touch the check mark button.



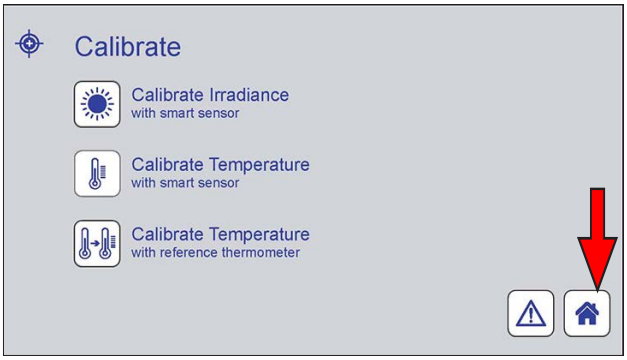
▶ The keypad is removed. The reference temperature is displayed in the reference device text box.



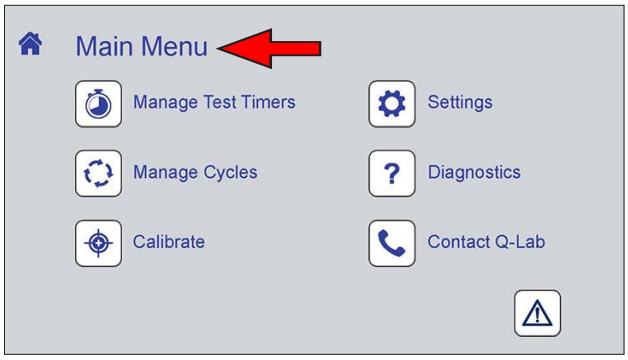
14. Touch the calibrate icon to complete the calibration process.



▶ The calibrate screen is displayed.

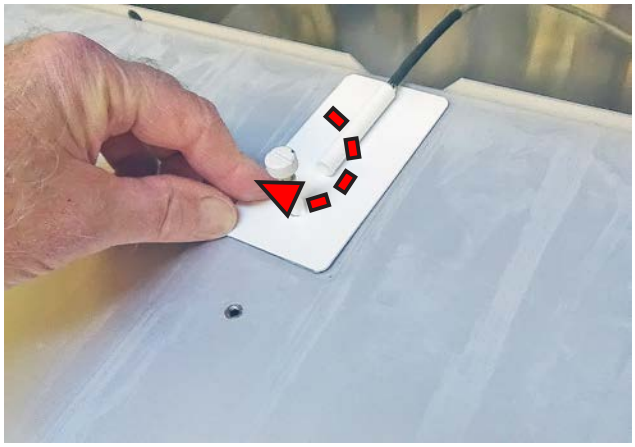


15. Touch the home icon.

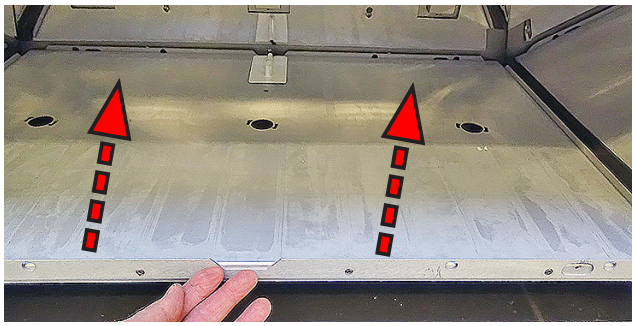


▶ The main menu screen is displayed.

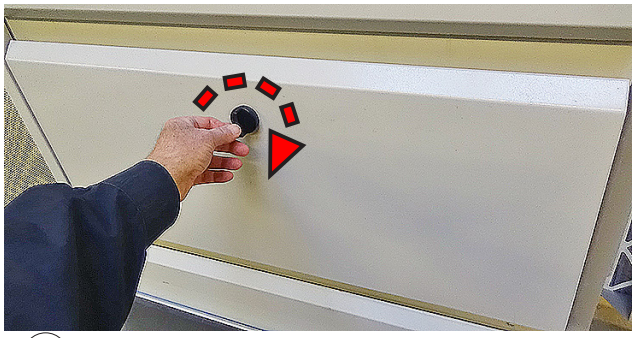
16. Remove the white panel from the container. Remove the reference thermometer and container from the tester.



17. Dry the white panel. Reinstall the white panel in the tester.



18. Slide the specimen tray into the test chamber.



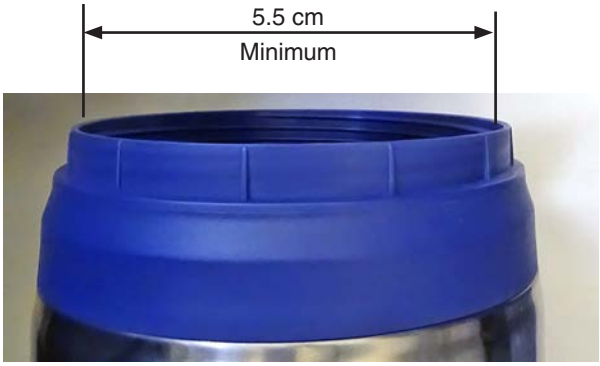
19. Close the chamber door. Close the latch. White panel temperature sensor calibration is complete. Run test cycles normally.

12.3.2 White Panel Installed with Black Panel

Determining White Panel Temperature Offset

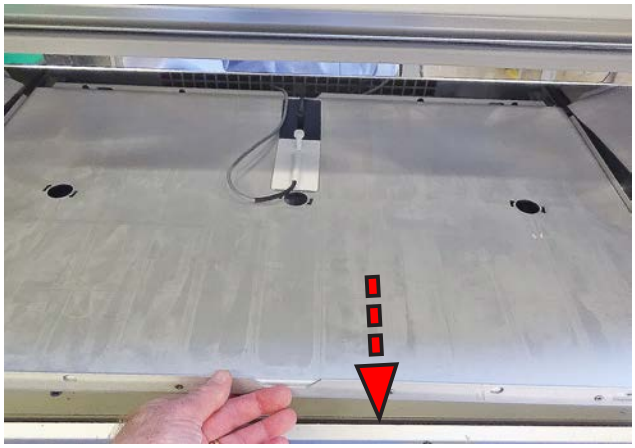
- The white panel, when installed along with a black panel, is not calibrated in the standard way.
- Rather than calibration, a white panel offset value is found which is used to manually adjust the white panel temperature reading to correspond with a calibrated reference thermometer temperature.
- To 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 displayed in the D12 Diagnostic (see Section 10.8) 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 D12 white panel temperature to give the adjusted white panel temperature.
- The adjusted white panel temperature should be used in place of the D12 value and temperatures shown on VIRTUAL STRIPCHART output.
- Follow the steps below to find the white panel temperature offset.
- The following steps show an uninsulated white panel. Find the temperature offset of an insulated white panel in exactly the same way.

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

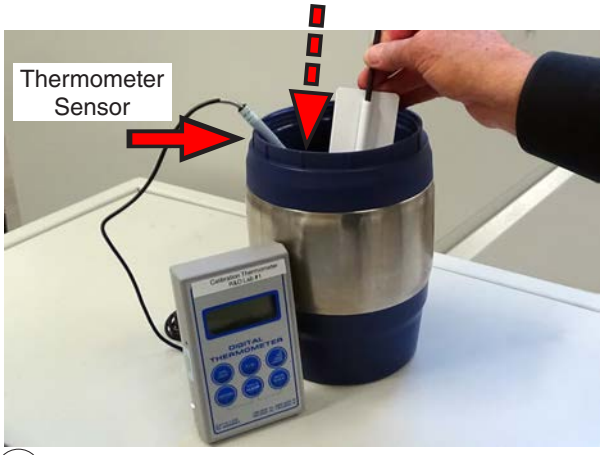


2. **IMPORTANT:** The opening of the insulated container must be at least 5.5 cm wide to insert the white panel.

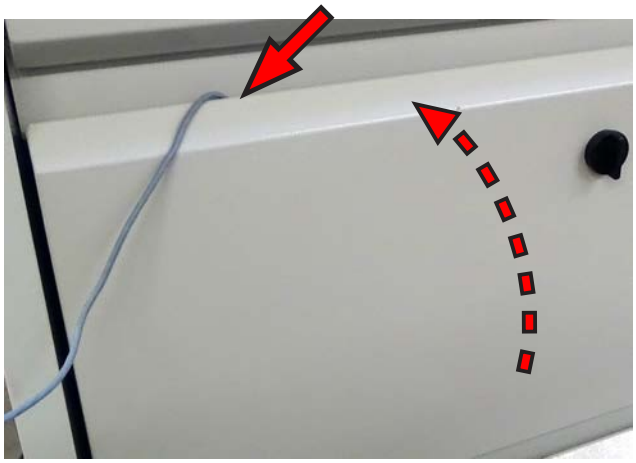
3. Fill the insulated container with water of approximately the highest temperature called for in the test cycle.



4. Open the test chamber door. Slide the specimen tray out.

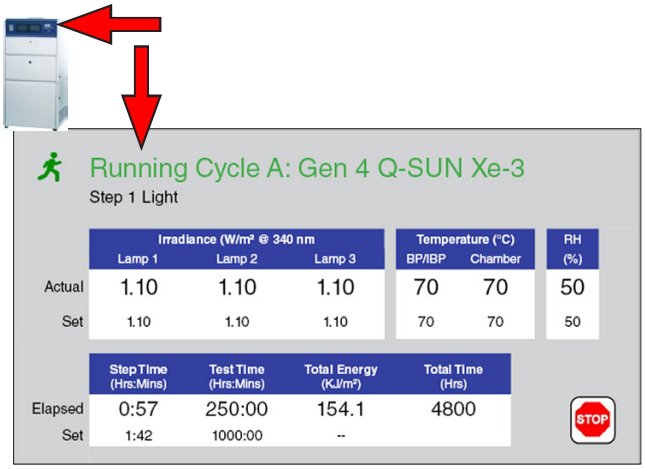


5. Remove the white panel from the tester. Place the white panel and the calibrated reference thermometer sensor in the insulated container.



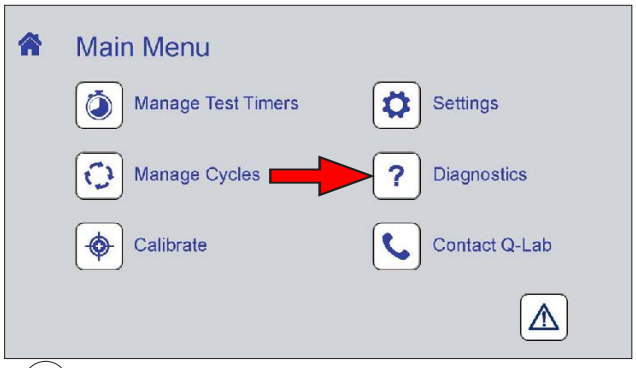
6. Close and latch the test chamber door. Make sure white panel cable is not crimped.

8. Turn the reference thermometer ON.

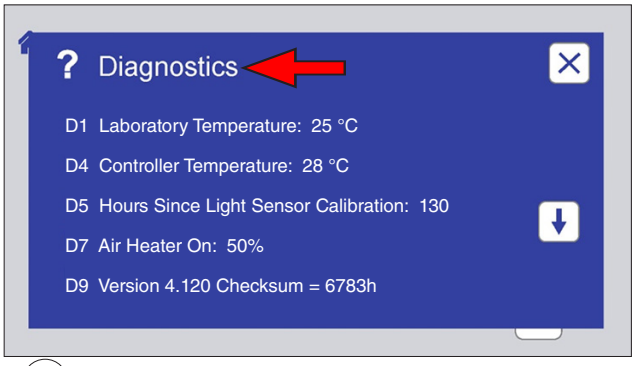


7. **RUN** a test cycle in a LIGHT step.

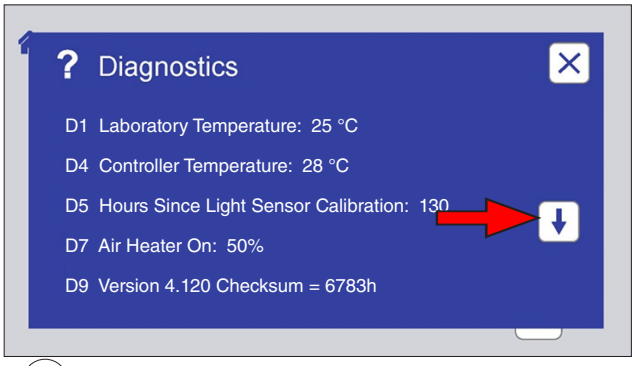
9. Wait 10 minutes for the sensors to stabilize.



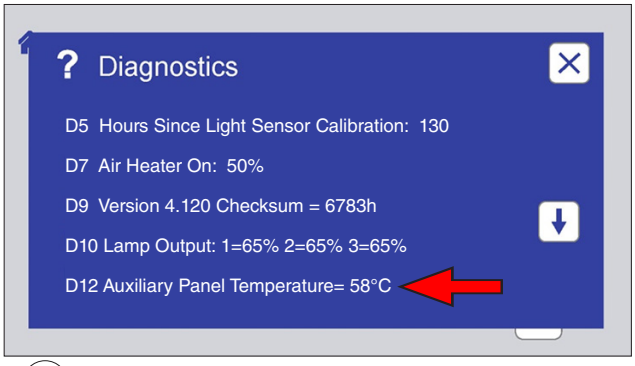
10. Touch the Diagnostics icon on the Main Menu screen to display diagnostic information.



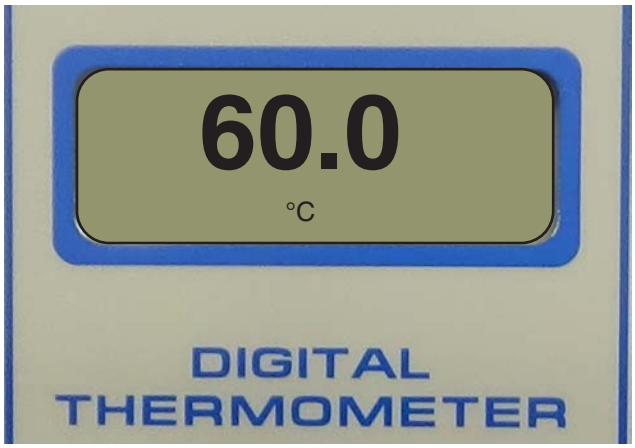
11. The Diagnostics screen displays current machine operating conditions.



12. Touch the scroll icon to scroll to D12.



13. *D12 Auxiliary Panel Temperature* is displayed. This is the temperature value based on factory default calibration, which may differ from your white panel.



14. Read the temperature on the reference thermometer.

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

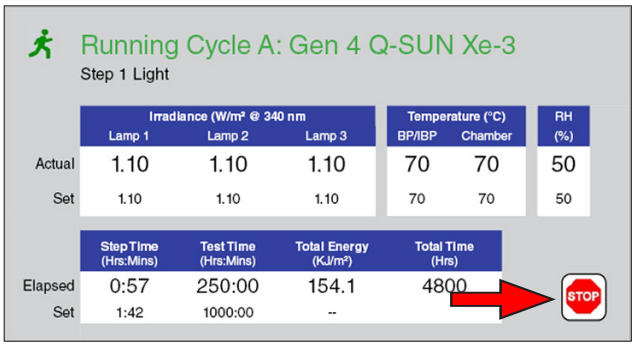
Reference Thermometer Temperature: 60 °C

D12 Value: 58 °C

White Panel Temperature Offset: 2 °C

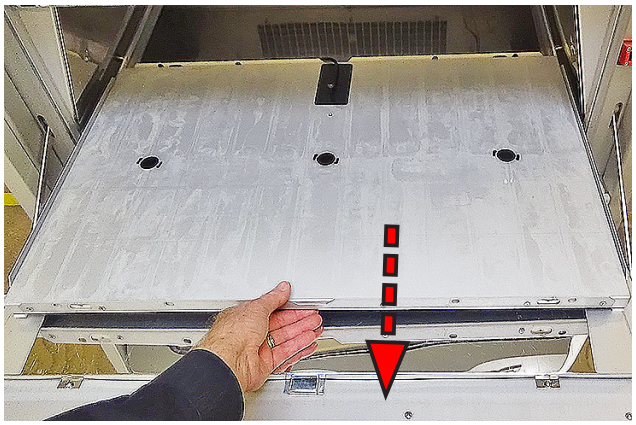
NOTE: If D12 is greater than the reference value the offset will be negative.

15. Calculate the white panel temperature offset.
NOTE: Record this value for later reference.

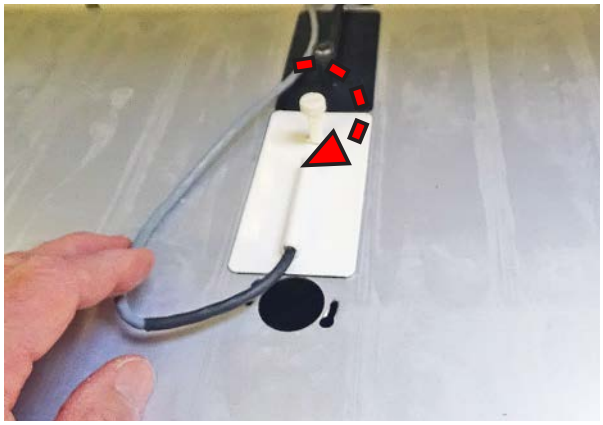


16. Touch the STOP icon on the status screen to suspend the test.

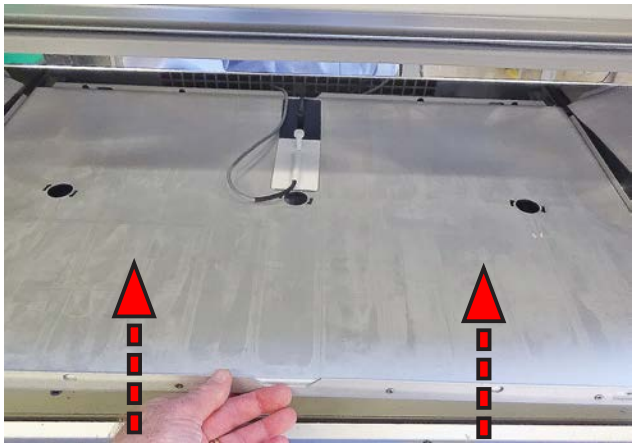
17. Remove the white panel from the container.



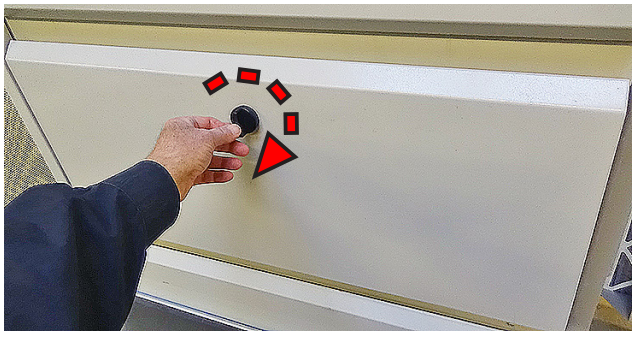
18. Open the test chamber door. Pull the specimen tray out of the test chamber.



19. Dry the white panel. Reinstall the white panel on the tray.



20. Replace any specimens on the tray. Slide the tray into the test chamber.



21. Close the test chamber door and close the latch. White panel temperature offset is complete.

- White panel temperature offset determination is complete.
- Run test cycles as normal with the tester.
- Remember to apply the white panel temperature offset value to all D12 auxiliary panel temperature values.

12.4 Relative Humidity / Air Temperature Sensor (Sep 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 17 for more information.

1. Open the chamber door and pull out the specimen tray.
2. Locate the sensor in the back right corner of the chamber (Figure 12.4a).
3. Push up slightly and pull to remove the sensor (Figure 12.4b).
4. Push the connector release lever to disconnect cable from the sensor.
5. Connect the new sensor to the cable and reinstall the sensor (Figure 12.4c).

Figure 12.4a: RH/Chamber Air Temperature sensor location.

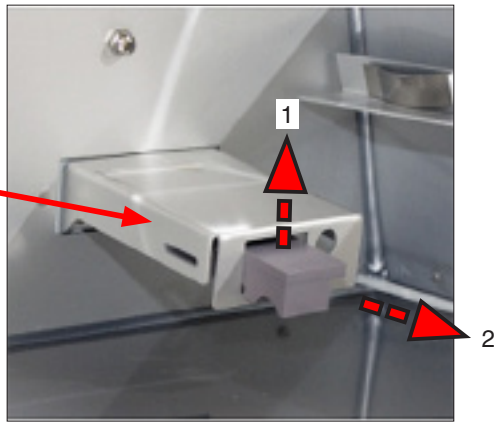


Figure 12.4b: RH/Chamber Air Temperature sensor removal.

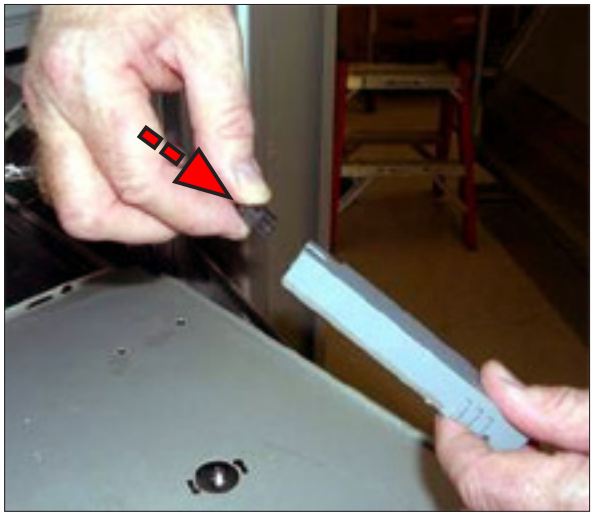


Figure 12.4c: RH/Chamber Air Temperature sensor connection.

13. Data Storage and Transfer

13.1 Ethernet Communications (Sep 2020)

- The Q-SUN main controller has the capability to transfer data via Ethernet.
- A Ethernet port is located at the top left corner of the tester back panel (Figure 13.3a and Figure 13.1b).
- 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.

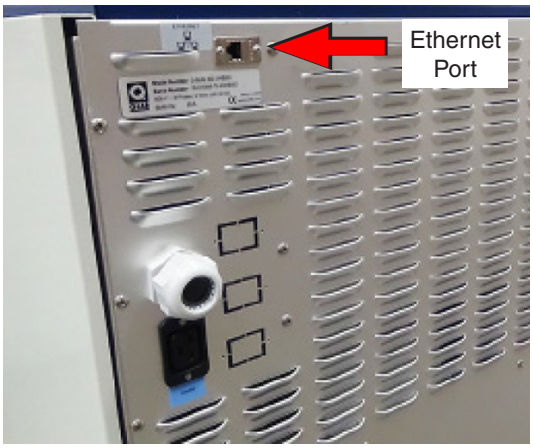


Figure 13.1a: Ethernet port located at the top left corner of the tester back panel.

Figure 13.1b: Ethernet port.

13.2 Secure Digital (SD) Card (Sep 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 19) 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.

13.3 Export Diagnostics (Sep 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 13.3a)
- Connect the USB drive to the USB port on the Q-SUN control panel (Figure 13.3b).
- The USB Options screen will be displayed (Figure 13.3c).
- Touch the Export Diagnostics button to begin the export process (Figure 13.3d and Figure 13.3e).
- Transfer the USB drive to a computer (Figure 13.3f).
- The exported files (Figure 13.3g) can be uploaded to the Q-Portal Asset Center where customers can view basic operational data (Figure 13.3h and Figure 13.3i) and Q-Lab personnel can view extended operational data.

Figure 13.3a: USB drive needed to export diagnostics.

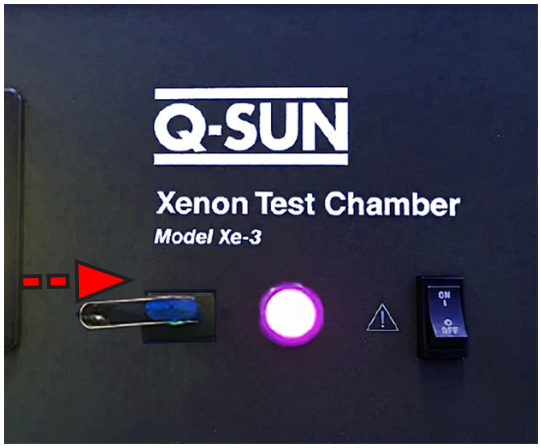


Figure 13.3b: Connect the drive to the USB port on the Q-SUN control panel.

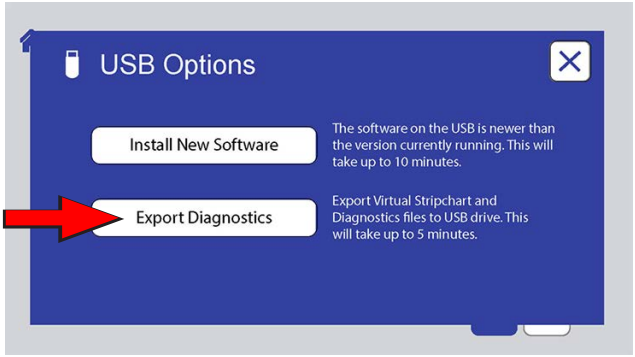


Figure 13.3c: USB Options screen showing the Export Diagnostic button.

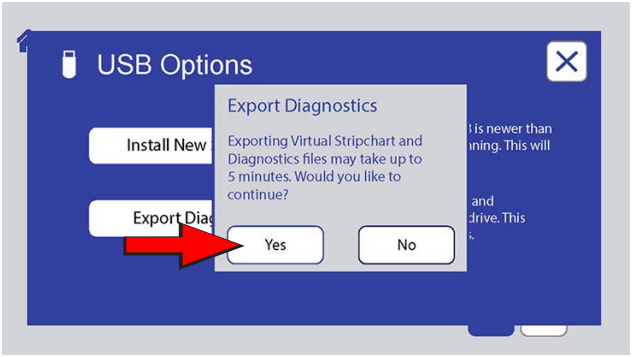


Figure 13.3d: Touch Export Diagnostics then the Yes button to begin export.

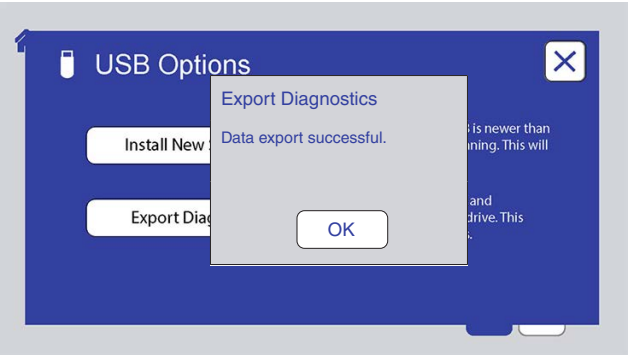


Figure 13.3e: When the Export Diagnostics data transfer is complete, this message is displayed. Touch OK.

Figure 13.3f: Insert the USB drive into a computer to display the list of files

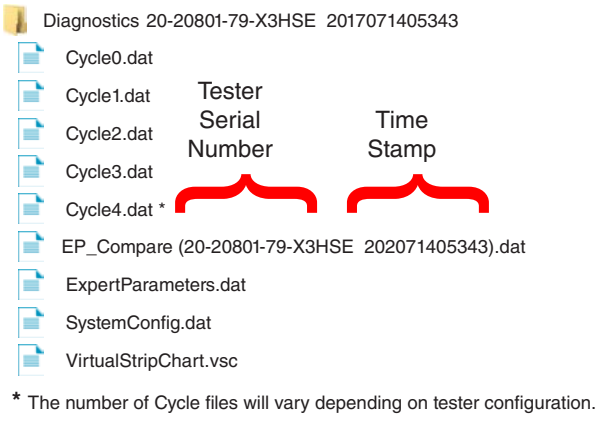


Figure 13.3g: The USB drive will have a folder with the diagnostic data files exported from the tester.

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 13.4 or contact Q-Lab Repair and Tester Support for instructions on importing .vsc files to the Q-Portal Asset Center for analysis.

- Two views are available in the VIRTUAL STRIPCHART software.
  - Stripchart view
  - Table view

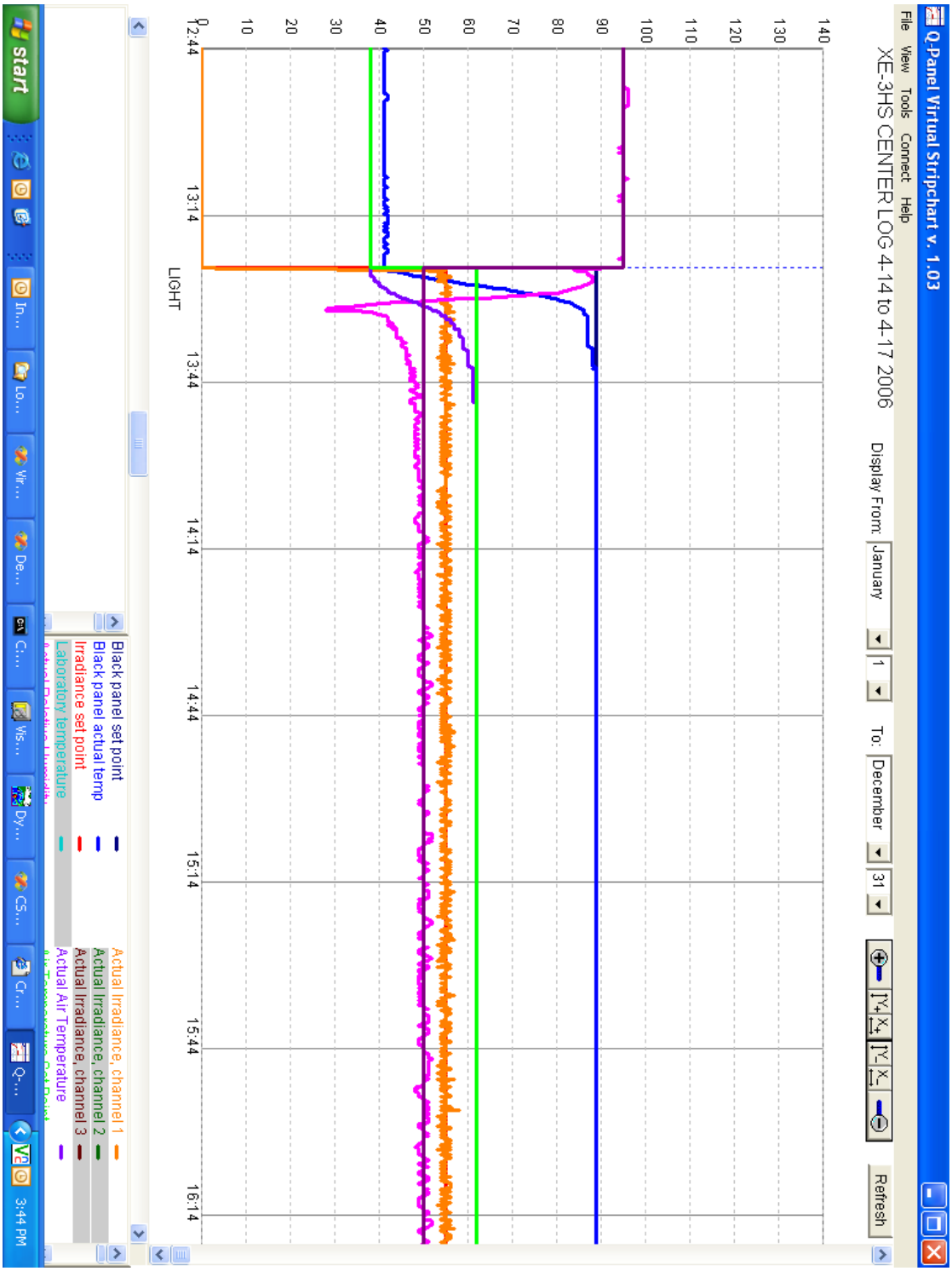
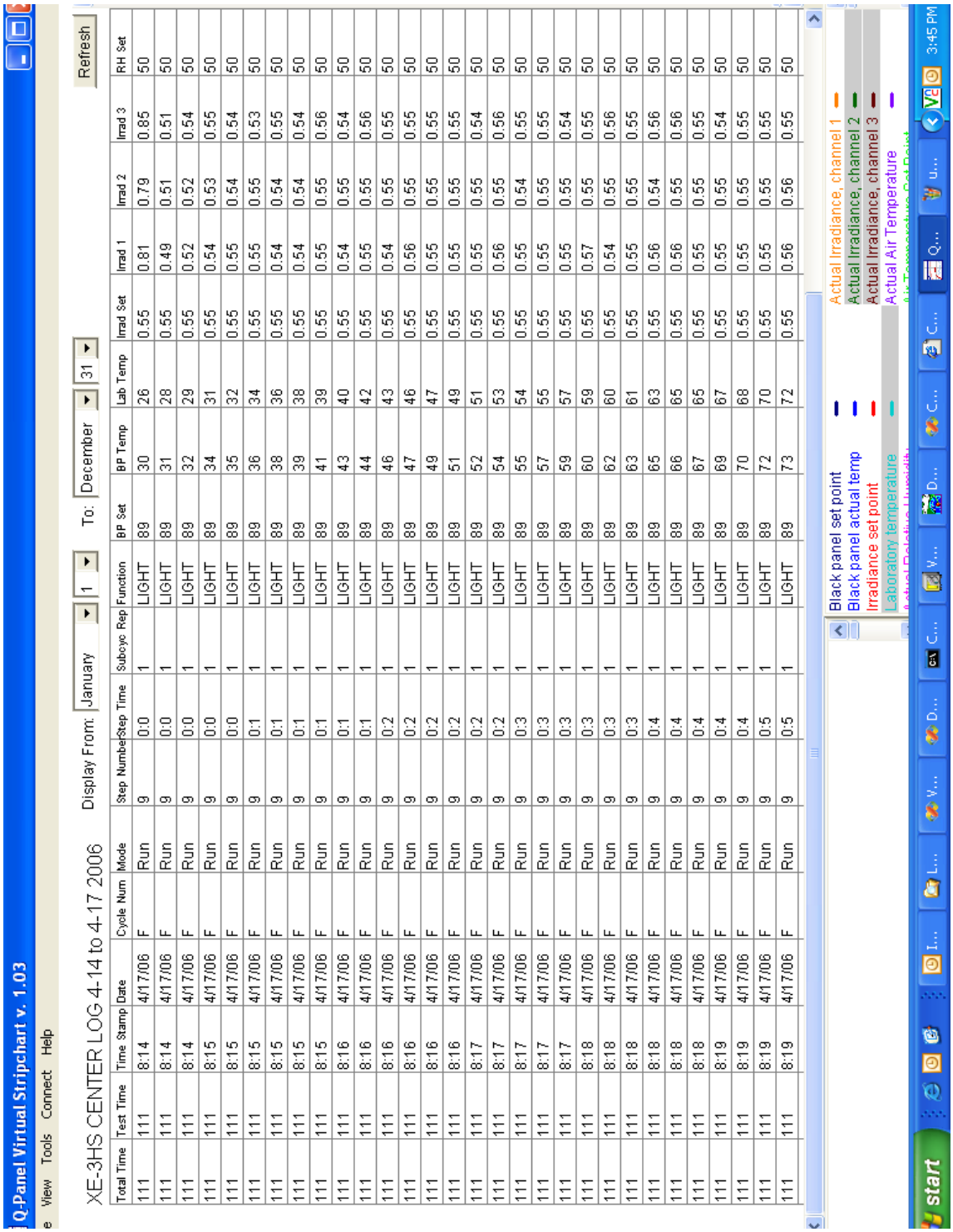


Figure 13.3h: Example stripchart view of Q-SUN operational data.



Total Time	Test Time	Time Stamp	Date	Cycle Num	Mode	Step Number	Step Time	Subcyc Rep	Function	BP Set	BP Temp	Lab Temp	Irrad Set	Irrad 1	Irrad 2	Irrad 3	RH Set
111	111	8:14	4/17/06	F	Run	9	0:0	1	LIGHT	89	30	26	0.55	0.81	0.79	0.85	50
111	111	8:14	4/17/06	F	Run	9	0:0	1	LIGHT	89	31	28	0.55	0.49	0.51	0.51	50
111	111	8:14	4/17/06	F	Run	9	0:0	1	LIGHT	89	32	29	0.55	0.52	0.52	0.54	50
111	111	8:15	4/17/06	F	Run	9	0:0	1	LIGHT	89	34	31	0.55	0.54	0.53	0.55	50
111	111	8:15	4/17/06	F	Run	9	0:0	1	LIGHT	89	35	32	0.55	0.55	0.54	0.54	50
111	111	8:15	4/17/06	F	Run	9	0:1	1	LIGHT	89	36	34	0.55	0.55	0.55	0.53	50
111	111	8:15	4/17/06	F	Run	9	0:1	1	LIGHT	89	38	36	0.55	0.54	0.54	0.55	50
111	111	8:15	4/17/06	F	Run	9	0:1	1	LIGHT	89	39	38	0.55	0.54	0.54	0.54	50
111	111	8:15	4/17/06	F	Run	9	0:1	1	LIGHT	89	41	39	0.55	0.55	0.55	0.56	50
111	111	8:16	4/17/06	F	Run	9	0:1	1	LIGHT	89	43	40	0.55	0.54	0.55	0.54	50
111	111	8:16	4/17/06	F	Run	9	0:1	1	LIGHT	89	44	42	0.55	0.55	0.55	0.56	50
111	111	8:16	4/17/06	F	Run	9	0:2	1	LIGHT	89	46	43	0.55	0.54	0.55	0.55	50
111	111	8:16	4/17/06	F	Run	9	0:2	1	LIGHT	89	47	46	0.55	0.56	0.55	0.55	50
111	111	8:16	4/17/06	F	Run	9	0:2	1	LIGHT	89	49	47	0.55	0.55	0.55	0.55	50
111	111	8:16	4/17/06	F	Run	9	0:2	1	LIGHT	89	51	49	0.55	0.55	0.55	0.55	50
111	111	8:17	4/17/06	F	Run	9	0:2	1	LIGHT	89	52	51	0.55	0.55	0.55	0.54	50
111	111	8:17	4/17/06	F	Run	9	0:2	1	LIGHT	89	54	53	0.55	0.56	0.55	0.56	50
111	111	8:17	4/17/06	F	Run	9	0:3	1	LIGHT	89	55	54	0.55	0.55	0.54	0.55	50
111	111	8:17	4/17/06	F	Run	9	0:3	1	LIGHT	89	57	55	0.55	0.55	0.55	0.55	50
111	111	8:17	4/17/06	F	Run	9	0:3	1	LIGHT	89	59	57	0.55	0.55	0.55	0.54	50
111	111	8:18	4/17/06	F	Run	9	0:3	1	LIGHT	89	60	59	0.55	0.57	0.55	0.55	50
111	111	8:18	4/17/06	F	Run	9	0:3	1	LIGHT	89	62	60	0.55	0.54	0.55	0.56	50
111	111	8:18	4/17/06	F	Run	9	0:3	1	LIGHT	89	63	61	0.55	0.55	0.55	0.55	50
111	111	8:18	4/17/06	F	Run	9	0:4	1	LIGHT	89	65	63	0.55	0.56	0.54	0.56	50
111	111	8:18	4/17/06	F	Run	9	0:4	1	LIGHT	89	66	65	0.55	0.56	0.55	0.56	50
111	111	8:18	4/17/06	F	Run	9	0:4	1	LIGHT	89	67	65	0.55	0.55	0.55	0.55	50
111	111	8:19	4/17/06	F	Run	9	0:4	1	LIGHT	89	69	67	0.55	0.55	0.55	0.54	50
111	111	8:19	4/17/06	F	Run	9	0:4	1	LIGHT	89	70	68	0.55	0.55	0.55	0.55	50
111	111	8:19	4/17/06	F	Run	9	0:5	1	LIGHT	89	72	70	0.55	0.55	0.55	0.55	50
111	111	8:19	4/17/06	F	Run	9	0:5	1	LIGHT	89	73	72	0.55	0.56	0.56	0.55	50

Figure 13.3i: Example table view of Q-SUN operational data.

13.4 Import VIRTUAL STRIPCHART Data (Aug 2020)

- At the Q-Lab Q-Portal Asset Center, customers can register their Q-SUN Xe-3 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 (seeSection 13.3). Contact Q-Lab Repair and Tester Support (Section 19) for more information.

14. Options

14.1 Drain Pump (Dec 2020)

- Drain pumps are available for Q-SUN models which have water spray or controlled humidity features.
- A drain pump is required if the drain tube must rise more than 100 mm (4") above the floor before reaching the drain.
- The drain pump is powered from a wall outlet.
- The drain pump kit includes necessary hoses and 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

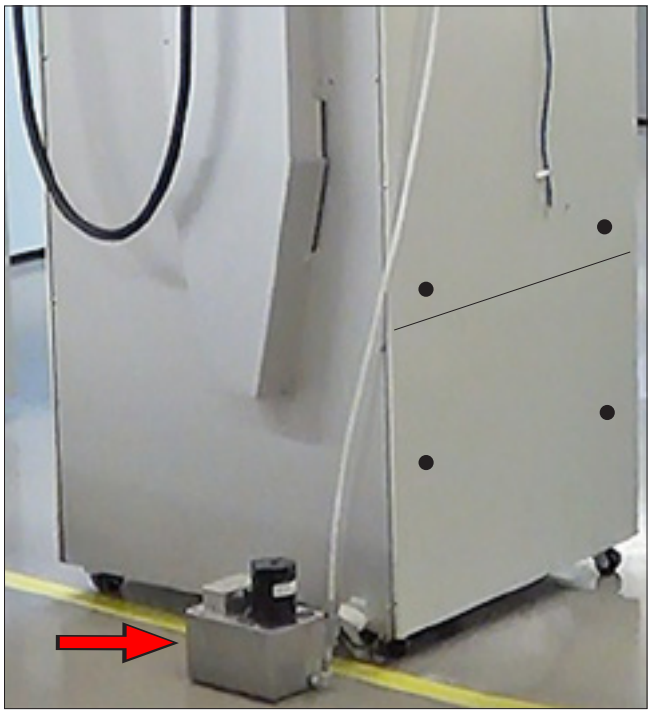


Figure 14.1: Drain pump.

14.2 Lift Kit (Mar 2020)

For All Q-SUN Xe-3 Models and Chillers

- If the laboratory drain is above floor level, or the drain hose from the tester with chiller 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 14.2a through Figure 14.2c) and necessary hardware.
- A leveling foot comes installed on each riser.
- If the tester is on casters, the casters can be installed on the risers, raising the tester by 15 cm (6").
- 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 14.4) to the correct drainage height.
- Contact Q-Lab Repair and Tester Support with any questions about tester drainage requirements.

Figure 14.2a: Lift kit includes four (4) risers.

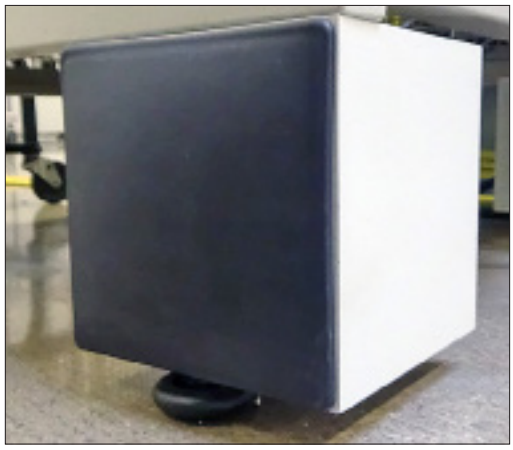


Figure 14.2b: Riser installed with leveling foot.

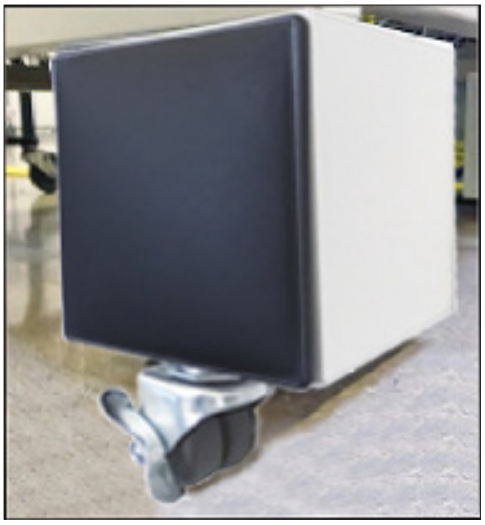


Figure 14.2c: Riser installed with caster.

14.3 Water Pressure Pump (Nov 2014)

Q-Lab offers a water pressure (booster) pump for 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.

Water Inlet Pumps	
Part Number	**Description**
X-10570-K	Water Pressure Booster Pump, Standalone
X-10730-K	Water Pressure Booster Pump, Integrated

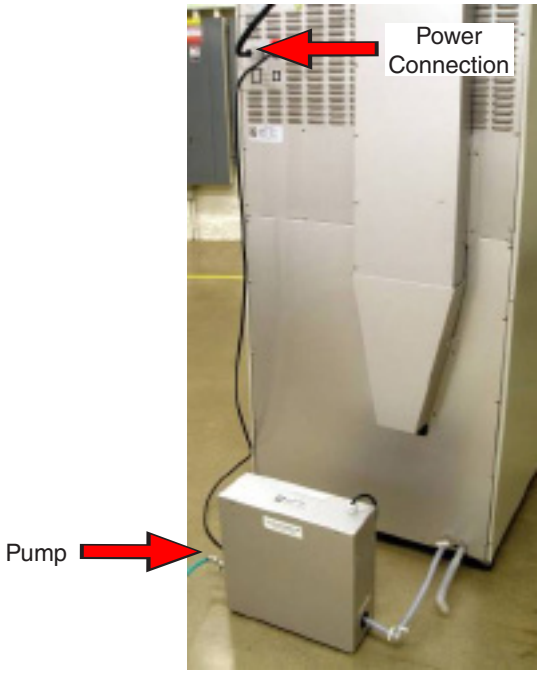


Figure 14.3: X-10730-K Water inlet pump plugs into tester as shown.

14.4 Water Repurification System (Mar 2022)

- Q-Lab offers an optional water repurification system for the Q-SUN to conserve water (Figure 14.4).
- 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 water repurification system can be purchased as a factory installed option (part no. X-10897-K-IINST), or it can also be purchased as a retrofit kit (part no. X-10897-K).

Figure 14.4: Q-SUN Xe-3 with Water Repurification System.

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.

IMPORTANT: Xe-3 Dual Spray models must not have a Water Repurification System installed. Drainage must go directly to waste and cannot be reused. Using a repurification system will result in adding the solution to the repurification reservoir, contaminating purified water and compromising tester components.

- During a spray step the pump turns on and draws water out of the reservoir.
- The water goes through a repurification cartridge and other filters 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 Figure 14.2a) can be used to raise the water repurification system to the correct drainage height.

14.5 3D Specimen Stand (Mar 2020)

- Stands (Figure 14.5a) are available to mount three-dimensional parts so that the top of the part is at the normal specimen tray height.
- This is done by removing the normal specimen tray and placing the 3D stands on the floor of the chamber.
- The 3D specimen stands are then adjusted up or down to bring the top of the specimen even with the top of the 3D specimen stand post (the top of the post is at the same height as the normal specimen tray).
- Specimens up to 100 mm tall can be tied to the stands.
- When using 3D specimen stands, air deflectors (included in the kit) must be attached to the air inlet channels in the roof of the chamber to force air to the sides of the chamber.

NOTE: When using specimen stands, place all five (5) of the stands in the test chamber (Figure 14.5b), even if there are not specimens on all the stands. The stands should be spaced uniformly in the chamber and to cover the RH/Chamber air sensor. Failure to properly position all stands in the chamber may result in *M18 Chamber Air Too Hot* error messages. The black panel must also be placed on the black panel stand included in the kit.

3D Specimen Stand Kit

Part Number	Description
X-10476-K	3D Specimen Stand Kit

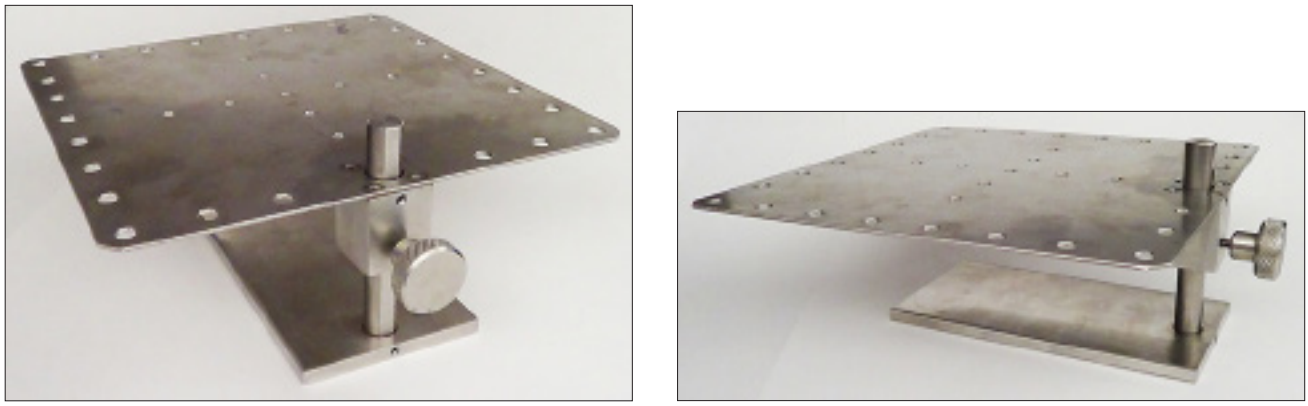


Figure 14.5a: 3D Specimen Stand - All 5 stands included in the kit must be placed in the chamber.

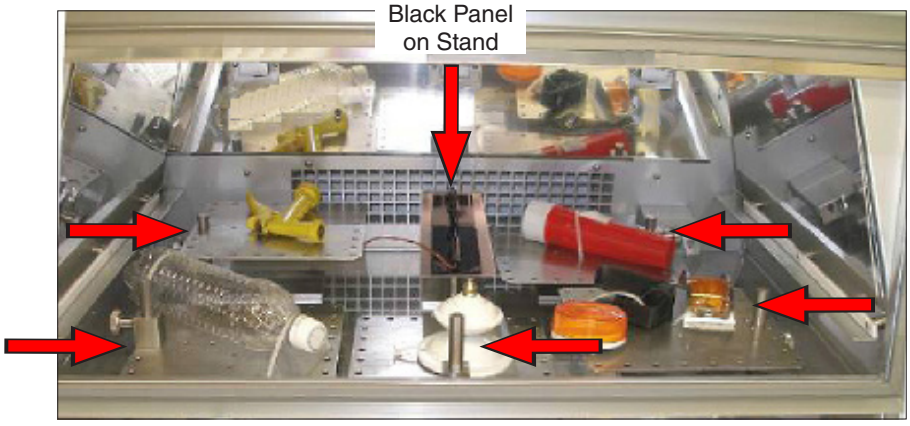


Figure 14.5b: Specimens mounted on 3D specimen stands.

14.6 Test Chamber Access Port (Mar 2022)

- A chamber access port is now available as a standard option to allow cables or tubes to be inserted into the test chamber.
- The chamber access port consists of a slot ≈ 19 mm × 76 mm (0.75" × 3.0") in the right side wall of the test chamber.
  - o The slot is covered on the outside of the chamber with a silicone gasket with a slit in the middle. A cover holds the gasket in place. (Figure 14.6a).
- There is an additional slot in the back cover of the tester (Figure 14.6b).
- Cables, wires, and hoses can be inserted through the slot in the tester back cover and then through the slot in the chamber wall into the test chamber.
- A field retrofit is available, but because the slots in the chamber wall and rear cover must be sawed, the retrofit must be performed by trained Q-Lab technicians.

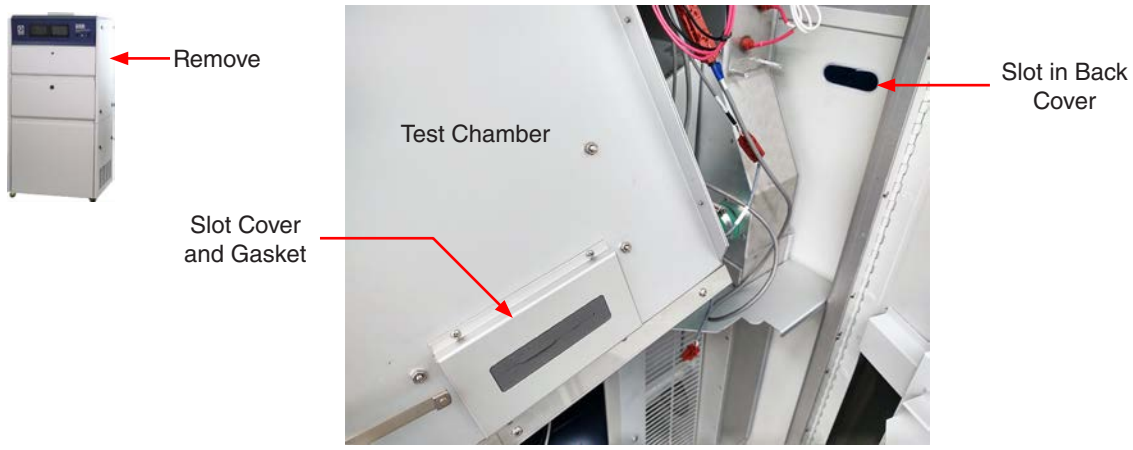


Figure 14.6a: Top right access panel removed to view access port in test chamber right side wall.

Figure 14.6b: Slot in back cover of the tester.

15. Maintenance

15.1 Lamp Replacement (Dec 2020)

Replace Lamps Every 3000 Hours

Monitoring Lamp Age – On the Xe-3 Main Menu screen, touch the Diagnostics icon (see Section 10.8).
Scroll to diagnostic *D19 LAMP HOURS: 1=XXXX 2=XXXX 3=XXXX* to read total lamp hours.

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

The lamps are 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. Open the lamp access door latch with a flat blade screwdriver. There is a screwdriver mounted on the inside of the lower access door.

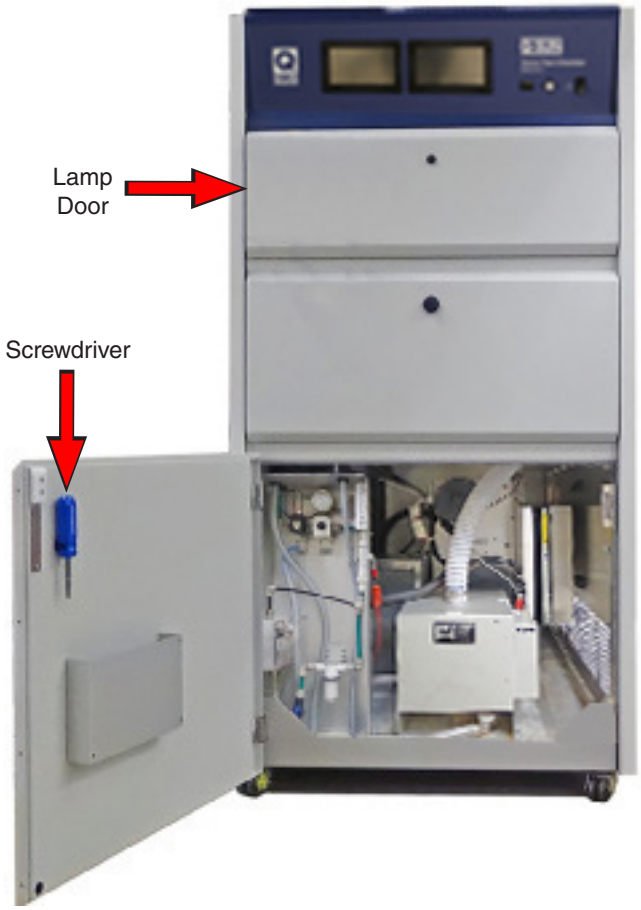


Figure 15.1a: Lamp door and screwdriver locations.

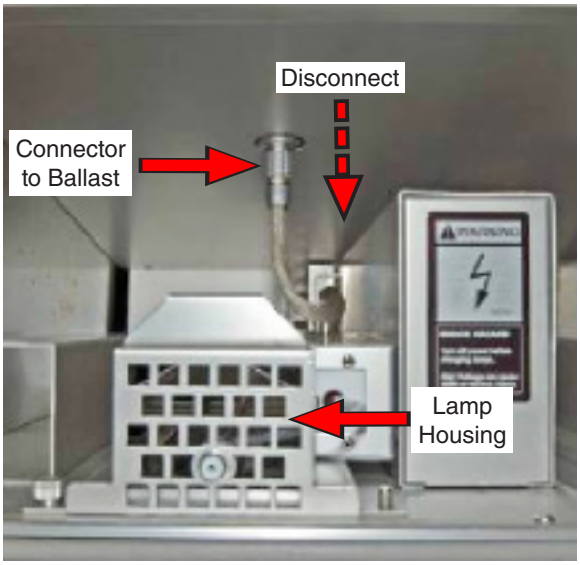


Figure 15.1b: Disconnect the connector from lamp housing to ballast.

- The lamp housing is secured by a captive screw and pilot pin.
- Loosen the captive screw.

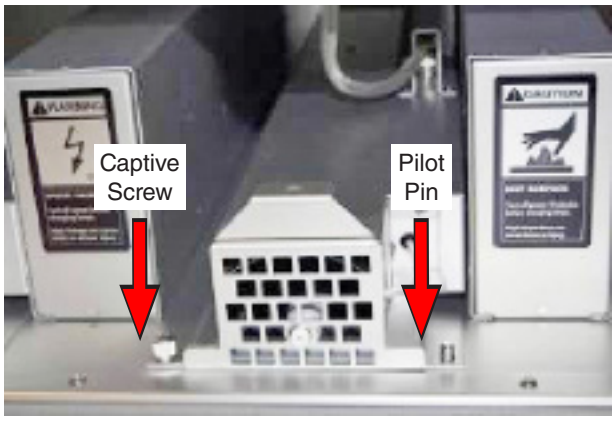


Figure 15.1c: Captive screw and pilot pin location.

2. Lift the front of the lamp housing off the pilot pin.
3. Remove the housing and set it on a table.
4. Put a flat blade screwdriver through the access holes in the wire cover to loosen lamp leads from the terminal blocks.

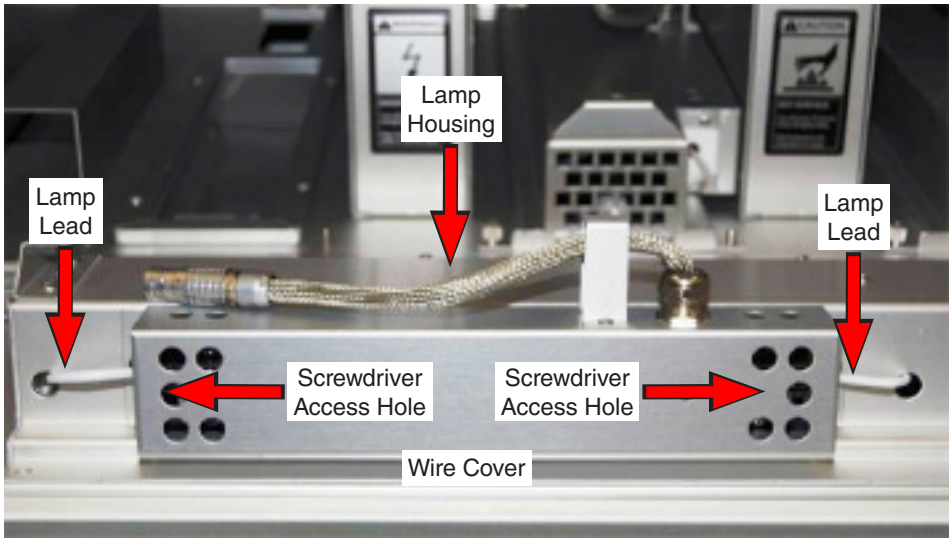


Figure 15.1d: Lamp housing with terminal block access holes in wire cover.

5. Release the lamp from the lamp housing by pulling lamp release lever away from the lamp.

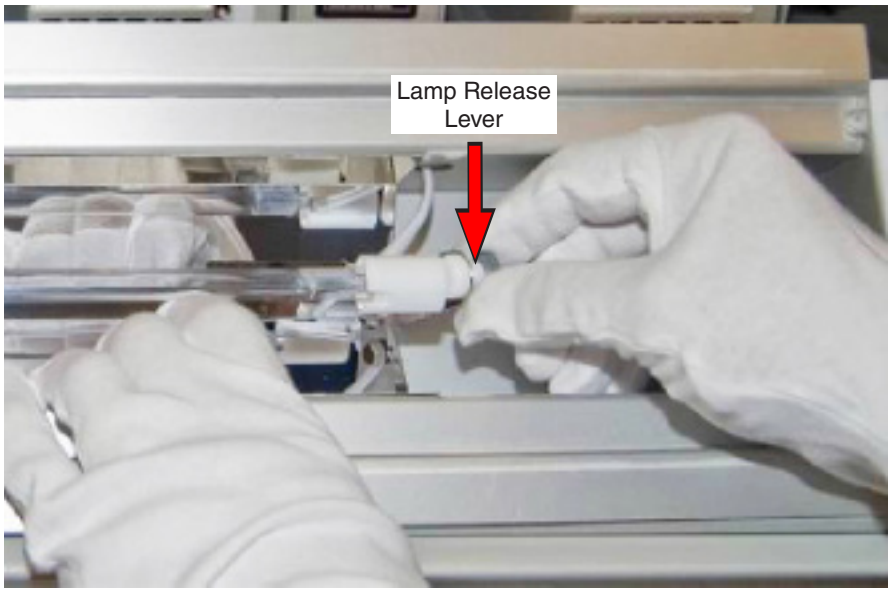


Figure 15.1e: Lamp removal.

Do not touch the lamp with bare hands. If you accidentally touch the lamp, you should clean it with alcohol and a clean cloth. Oil from your skin will shorten the life of the lamp.

6. Install the new lamp.
   - When installing the new lamp, make sure the trigger finger is in contact with the lamp but **is not exerting excessive force (**Figure 15.1f**).**
   - If the trigger finger is exerting excessive force on the lamp, the lamp may break.
   - If the trigger finger is not in good contact with the lamp:
     - The lamp may not start
     - The lamp may fail prematurely due to arcing between the lamp and the finger.
7. The trigger finger can be adjusted by gently bending the metal rod.

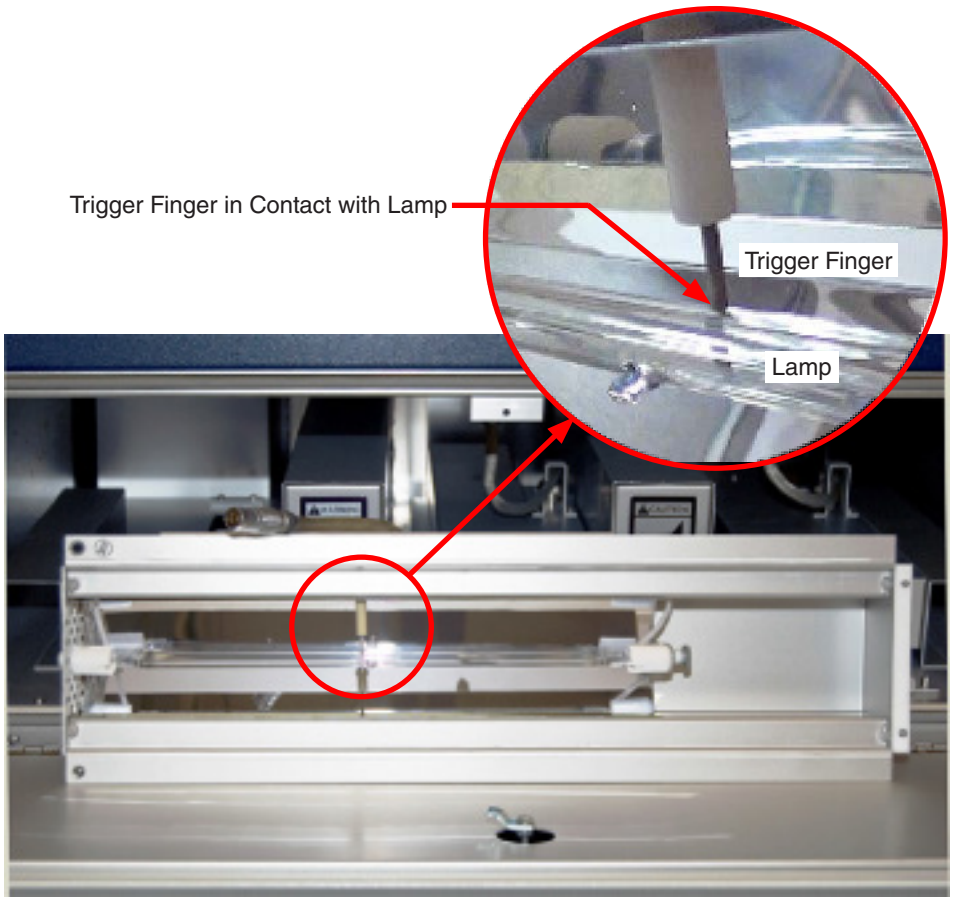


Figure 15.1f: Trigger finger in lamp housing.

IMPORTANT: The Q-SUN must be re-calibrated after the lamps are changed. See Section 12.1 for more information.

15.2 Lamp Housing Cleaning (Nov 2014)

Trigger Finger

If the trigger finger is discolored or corroded it should be cleaned with fine emery cloth, sandpaper, or steel wool.

1. Push lamp release lever right to release the lamp (Figure 15.2a).
2. Move the lamp to one side.
3. Clean the trigger finger.
4. Re-seat the lamp.

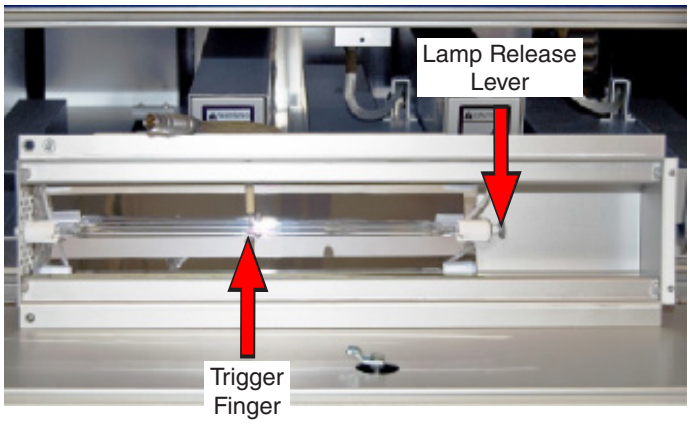


Figure 15.2a: Lamp housing showing trigger finger and lamp release lever.

Lamp Reflector

1. Push lamp release lever right to release the lamp.
2. Move the lamp to one side.
3. Wipe the reflector with alcohol and a soft cloth (Figure 15.2b).
4. Re-seat the lamp.

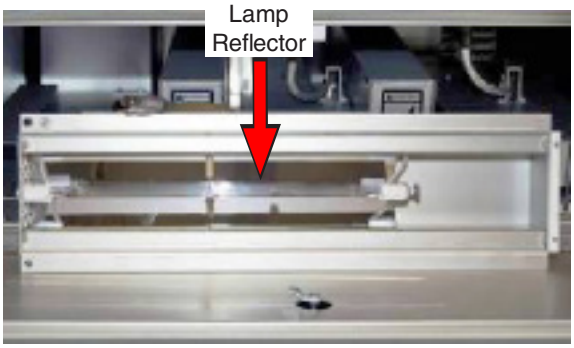


Figure 15.2b: Q-SUN Xe-3 lamp reflector in housing.

IMPORTANT: The Q-SUN must be re-calibrated after cleaning trigger wire or reflectors. See Section 12.1 for more information.

15.3 UV Optical Filter Cleaning (Nov 2014)

The UV optical filters may be cleaned without being removed from the tester.

1. Open the lamp compartment and remove the lamp housing(s). **CAUTION:** Lamp Housings and optical filters may be hot.
2. Clean the top surface of the UV optical filter(s) with an ammonia glass cleaner and soft cloth.
3. Open the test chamber door.
4. Clean the bottom surface of the UV Optical filter(s) with an ammonia glass cleaner and soft cloth.
5. Reinstall the lamp housing(s).

To perform a more complete cleaning, contact Q-Lab (Section 19) and request *Service Instruction X-10940-L Xe-1 and Xe-3 Optical Filter Cleaning* for detailed instructions for removing, cleaning and reinstalling the optical filters.

Figure 15.3a: Cleaning top surface of optical filters.

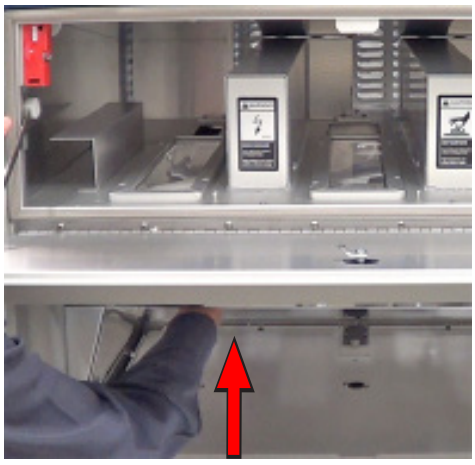


Figure 15.3b: Cleaning bottom surface of optical filters.

IMPORTANT: The Q-SUN Xe-3 must be re-calibrated after cleaning trigger wire or reflectors. See Section 12.1 for more information.

15.4 Window-IR Filter Replacement (Oct 2020)

The spectral transmission of Window-IR filters changes with age.

- Therefore, for consistent results over time, they should be replaced every 8400 hours.
- Rotate and replace one filter every 2800 hours as shown in the diagram below.

However, if you are running Marks & Spencer test method C9 or C9A, the test method requires rotating and replacing the Window-IR filters every 1167 hours as shown in Figure 15.4 below (this results in each filter being used for a total of 3500 hours).

1. Discard filter #3
2. Rotate filter #1 to position #3
3. Rotate filter #2 to position #1
4. Install a new filter in position #2

This is only necessary with Window-IR filters.
The spectral transmission of all the other Q-SUN filters does not change with age.

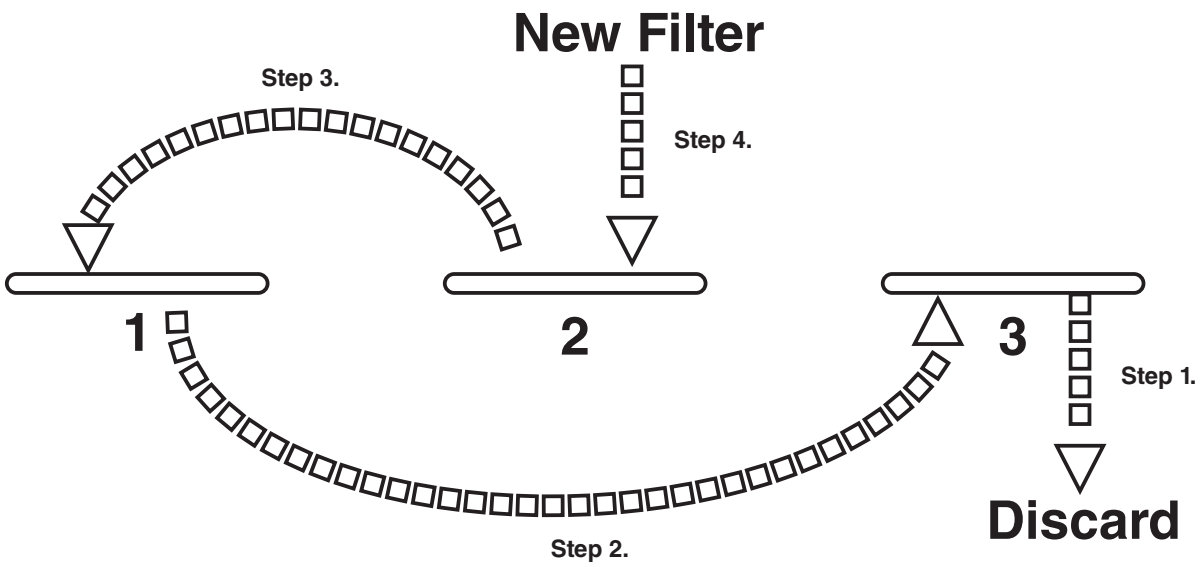


Figure 15.4: Window-IR Optical Filter Replacement Process

15.5 Dual Spray System (Oct 2020)

- Maintenance items particular to the Dual Spray system are listed here.

Daily

- Verify that there is enough liquid in the reservoir to supply the test being performed.
- There are no low flow or low fluid level alarms to alert the operator of problems.

Weekly

- Inspect the liquid in the reservoir to insure that bacteria, fungus or other biohazards are not growing in the reservoir.
- If there is any visible contamination in the liquid:
  - Stop the Xe-3 tester.
  - Disconnect the Dual Spray power cord from the Xe-3 power connection (see Section 9.3).
  - Make sure the reservoir drain hose empties into an appropriate drain.
  - Open the reservoir drain valve (Figure 15.5a) to drain all liquid.
  - Properly dispose of the liquid.
  - Clean the reservoir and piping with an appropriate agent.
  - Inspect the Dual Spray system filter element (V-2288, Figure 15.5a) Replace if dirty or showing contamination.
  - Refill the reservoir.
- Consider mixing only enough liquid for a short time, to reduce the opportunity for bacteria growth.

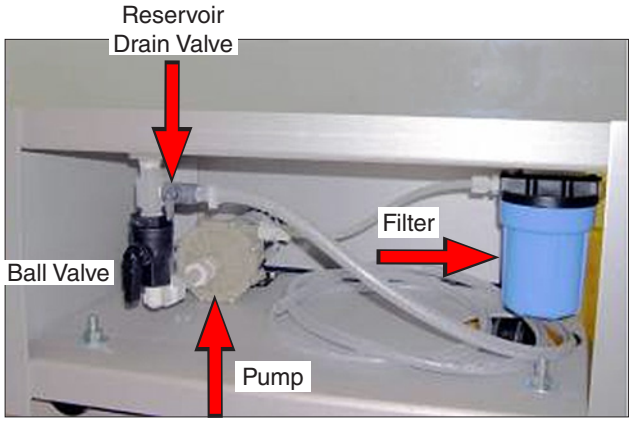


Figure 15.5a: Reservoir drain location. Remove cart side panel to access.

Monthly

- Check that the flow through the Dual Spray nozzles is adequate by verifying the specimens are covered immediately after an AUXILIARY step.
- See Section 15.7 for spray nozzle cleaning information.

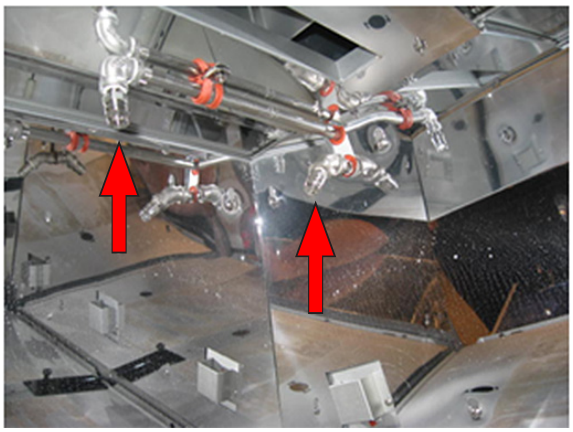


Figure 15.5b: Two (2) Dual Spray nozzles located at the top of the test chamber.

15.6 Monthly Maintenance (Oct 2020)

Air Filters

- Two (2) washable air filters, part number X-10997-K (Figure 15.6a), are standard on non-chiller Xe-3 testers.
- Washable air filter, part number X-10998-K, specifically for the chiller is standard on Xe-3 models with chiller.
- A disposable air filter (X-6658) specifically for the chiller can be ordered as an option.
- Open the Xe-3 lower front door to inspect the chamber air and the lamp/ballast filters every month (Figure 15.6b and Figure 15.6c).
- Open the front door of the chiller unit to access the chiller filter (Figure 15.6d).
- Also inspect the air intake and exhaust areas (SeeSection 5.7) to make sure they are not plugged or obstructed with dust or debris.
- If dirty, disposable air filters must be replaced (see Section 17).
- Washable air filters in service for more than three (3) years must be replaced (see Section 17).
- Washable air filters in service for less than three (3) years can be cleaned as shown in the Washable Air Filter Cleaning instructions.
- **IMPORTANT:** When reinstalling the air filters make sure the air flow arrow points toward the direction indicated in Step 9 and Step 10.
- Contact Q-Lab and request *Service Instruction X-10997-L Q-SUN Washable Air Filters* for more information.

X-6658 X-10998-K X-10997-K

Figure 15.6a: Xe-3 air filters.

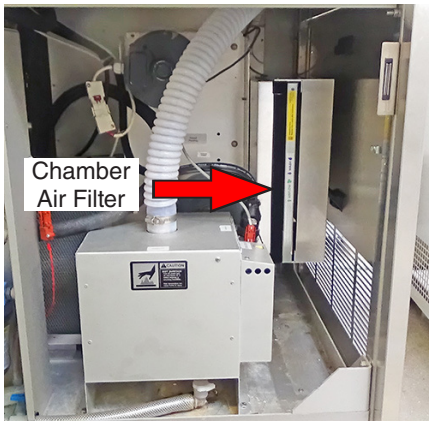
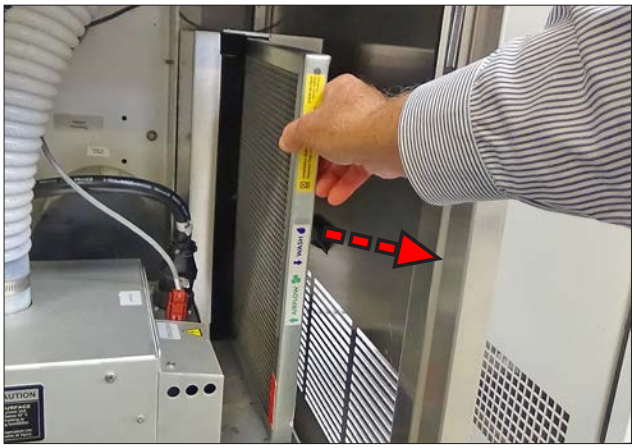


Figure 15.6b: Chamber air filter location.

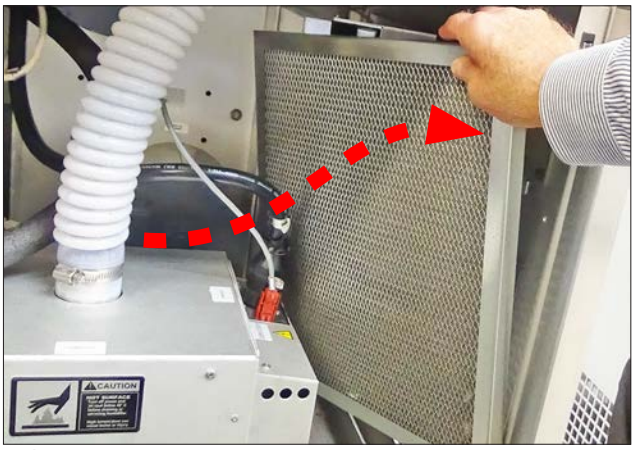
Figure 15.6c: Lamp/ballast air filter location.

Figure 15.6d: Chiller air filter location.

Washable Air Filter Cleaning



1. Pull the chamber air filter straight out to remove.



2. Slide the lamp/ballast filter to the right, then lift and rotate forward to remove.

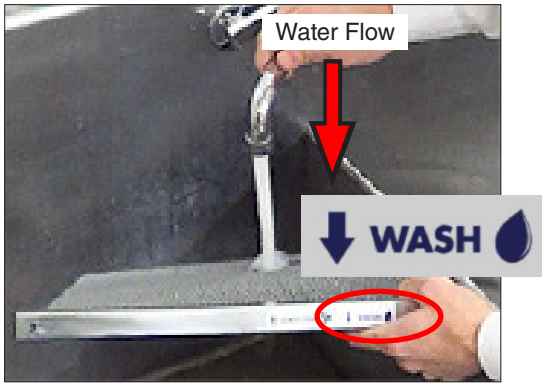
Less Than 3 Years Old - Wash

3. **IMPORTANT:** Check the date on the filter date label. If the date is less than 3 years older than the current date, the filter can be washed and reinstalled. See Step 5 through Step 10.

Greater Than 3 Years Old - Discard

4. If the date is greater than 3 years older than the current date, discard the filter. Replace with new air filter. See Figure 15.6a for part numbers.

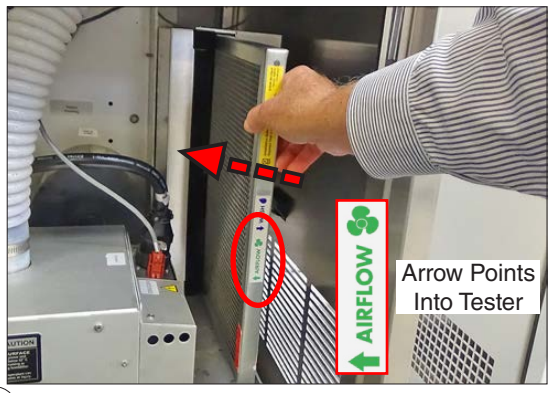
5. Locate the **WASH** label on edge of filter.



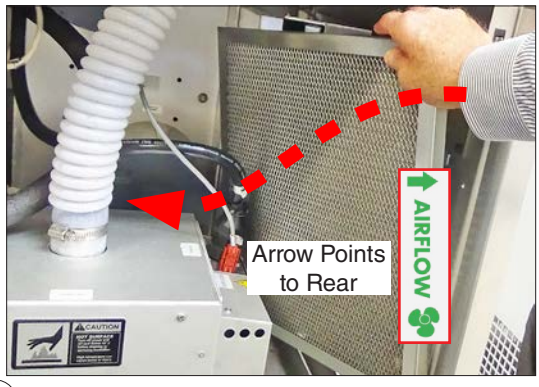
6. Hold filter under **CLEAN** running water. **IMPORTANT:** Water flow MUST BE in direction of **WASH** arrow.

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.



9. Reinstall the right side door washable air filter. **IMPORTANT:** Make sure arrow on the airflow label is in direction shown.



10. Reinstall the lamp/ballast washable air filter. **IMPORTANT:** Make sure arrow on the label points to the rear of the tester.

15.7 Six Month Maintenance (Dec 2020)

Check Water Filter

- Inspect water filter - Check that the flow rate through the front (top) nozzles has been maintained where it was set.
- If the flow rate will not reach the desired setpoint or the filter is dirty, the water filter element may require replacement.

To replace the water filter:

1. Turn the water valve off
2. Unscrew the filter housing
3. Remove the dirty filter from the housing
4. Install a new filter (Part Number F-8066.5) in the housing
5. Reinstall the filter housing
6. Turn water valve on

Filter Location

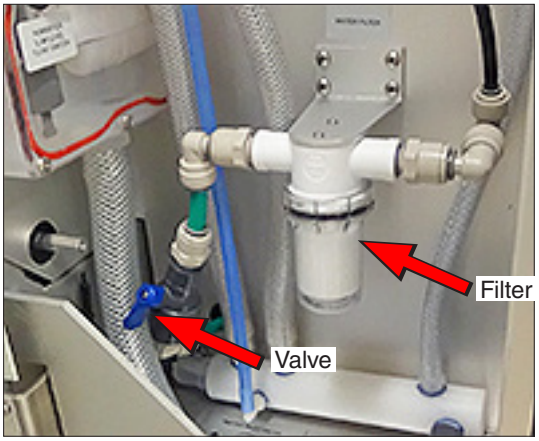


Figure 15.7a: Water ON / OFF valve.

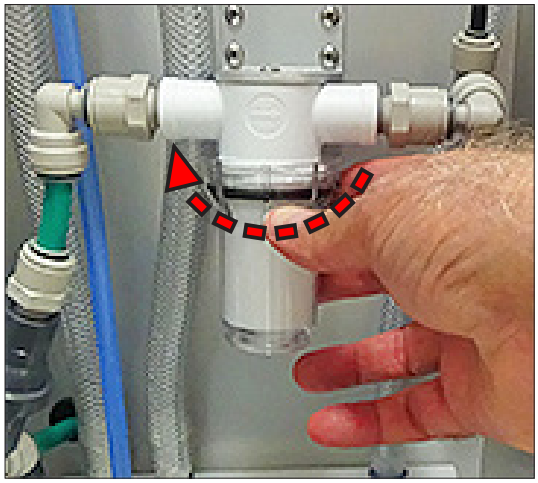


Figure 15.7b: Water filter removal.

Drain and Refill Humidifier

1. **STOP** the tester.
2. Power the tester **OFF**.
3. Make sure the tester drain hose is connected to a drain.
4. Open the Xe-3 lower front door.
5. **CLOSE** the water inlet valve (Figure 15.7d).
6. **OPEN** the humidifier drain valve (Figure 15.7d).
7. Wait for all water to drain out of the humidifier (15 to 20 minutes).
8. **CLOSE** the humidifier drain valve
9. **OPEN** the water inlet valve.
10. Wait 30 minutes for the humidifier to fill with water.

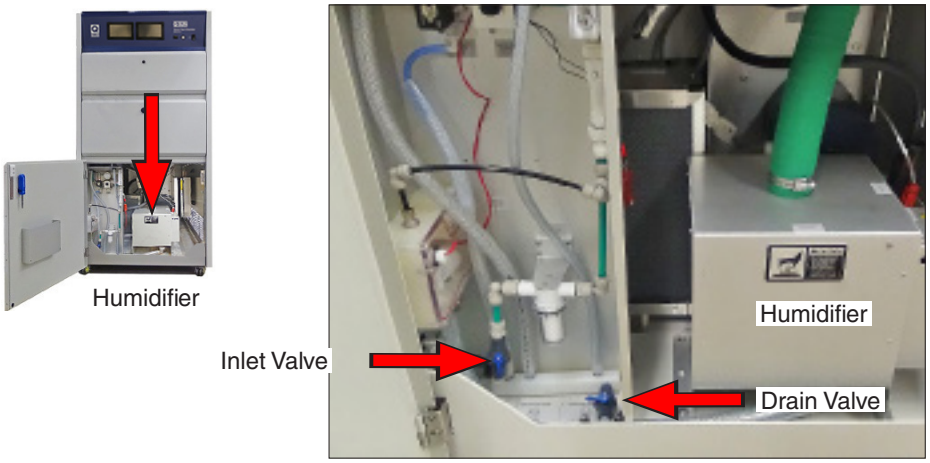


Figure 15.7c: Valve locations.

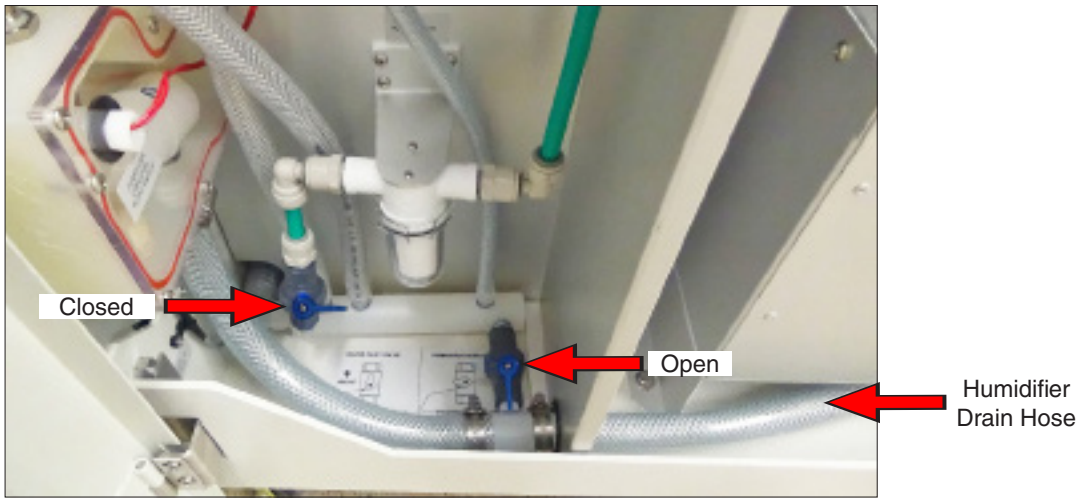


Figure 15.7d: Inlet valve closed, drain valve open.

Check Spray Uniformity (S, BS, and DS Models)

- Observe spray operation by opening the chamber door while the Xe-3 is operating in a spray step (see Section 10.6.8).
- Front Spray (S) nozzles should be inspected during a *Spray* step.
- Back Spray (BS) nozzles must be inspected during a *Dark+Spray Front+Back* step.
- Dual Spray (DS) nozzles must be inspected during a *Auxiliary Spray* or a *Light + Aux Spray* step.
- Inspect water filter - Check that the flow rate through the front (top) nozzles has been maintained where it was set.
- If the flow rate will not reach the desired setpoint, the water filter element may require replacement
- The spraying will continue for one minute.
- While the spray is on, examine the spray pattern.
- The spray should be symmetrical and steady.
- Also check to see that the spray distribution is even over the specimen tray.
- If irregularities in the spray are found, remove the nozzle (see Section 9 for important nozzle removal information).
- Clean the nozzle with a decalcifying agent (such as lemon juice) a small brush and compressed air.

See Section 9 for important information on nozzle removal.

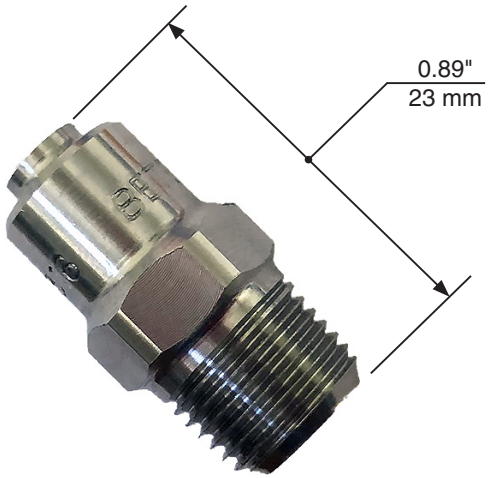


Figure 15.7e: Spray Nozzle

NOTE: When replacing or cleaning the nozzles, remove the nozzle and bracket assembly from the top of the test chamber first, then use the appropriate tools to remove the nozzle from the elbow. Use care to avoid damaging the tubing when removing the nozzle. See Section 9 for important nozzle removal information.

Check Test Chamber Wall Reflectors

- The mirror-like finish of the chamber wall reflectors helps to maintain irradiance uniformity across the test specimens. The reflectors should be inspected periodically.
- The reflectors can not be cleaned.
- If there are deposits on the reflectors they must be replaced.
- Open the test chamber door.
- Inspect the reflectors on the sides, rear, and door of the chamber.
- The reflectors must be clean and shiny like mirrors (Figure 15.7f).
- If the reflectors are cloudy, have stains or have any deposit that degrades the mirror finish; the chamber reflectors must be replaced (Figure 15.7g).
- Part Number X-15113-K, Chamber Wall Replacement Kit, Xe-3 includes replacement reflectors and installation instructions. See Section 17.

Figure 15.7f: Clean reflector, continue in service.

Figure 15.7g: Cloudy reflector must be replaced.

15.8 Q-SUN Xe-3 Software Updates (Sep 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 required 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 10.8 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-3 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

- 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 15.8a).
- Connect the drive to the tester USB port on the control panel (Figure 15.8b).
- 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 15.8c).
  - *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 15.8d).
- 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 19 for Q-Lab Repair and Tester Support contact information.

Figure 15.8a: Copy the software files from Q-Lab to a USB drive.

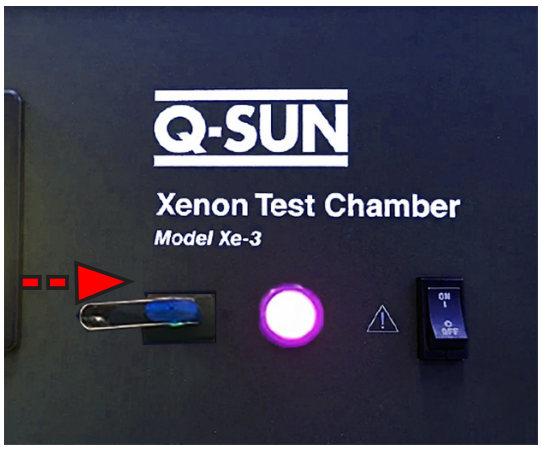


Figure 15.8b: Connect the drive to the USB port on the Q-SUN control panel.

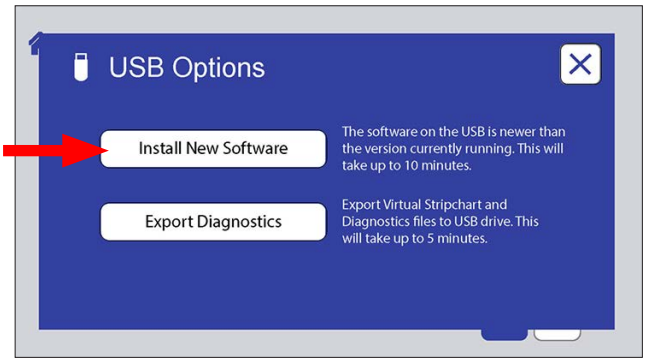


Figure 15.8c: The USB Options screen displays the software installation button.

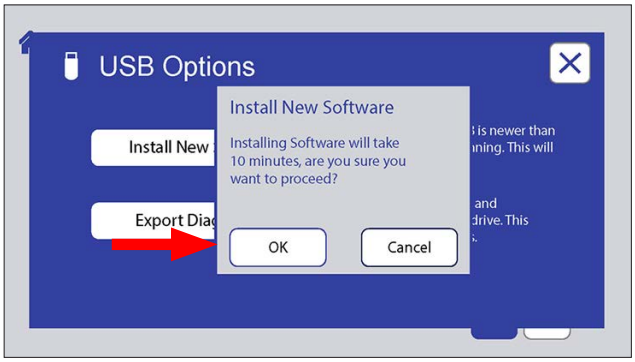


Figure 15.8d: Touch OK to proceed with software installation.

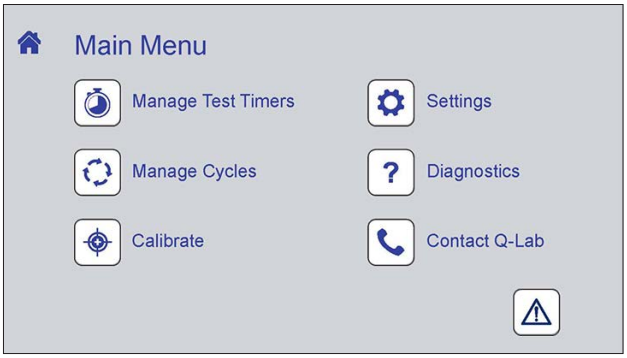


Figure 15.8e: After software installation, the tester will restart automatically. Following that restart, the tester can be operated normally.

16. Troubleshooting and Repair

Q-SUN testers are designed so that the user can make virtually all repairs. Use parts that have been supplied or recommended by Q-Lab.

16.1 Main Power and Short Circuits (Nov 2014)

Possible Causes if Tester Has No Power At All

- Power cord disconnected, or no power being supplied to the Q-SUN
- Power switch is broken
- Transformer is broken
- Fuse(s) blown on the main terminal strip

Possible Causes if Power Switch/Circuit Breaker Trips

- Power switch is broken
- Short Circuit

16.2 Notifications (Mar 2022)

Descriptions & Suggested Actions

- Notifications provide useful diagnostic information for technicians and repair personnel.
- Notifications show significant tester events and errors that occurred in the recent past.
- See Section 10.4 for more information on displaying and clearing Notifications.
- The table below lists all Xe-1 Notification descriptions along with suggested diagnostic actions.
- For some suggested actions a part number is listed, see Section 17 for replacement part information.

If there are no Suggested Actions for a message description, you don't feel comfortable performing the Action, or you've tried unsuccessfully, then please contact Q-Lab Repair and Tester Support (Section 19).

Code	Message	Icon	Test Status	Description • Suggested Action
M1	Chamber Door is Open		Stopped	The chamber door is open. • Close the test chamber door. • If the chamber door is closed and this message appears, the door interlock is defective or needs adjustment.
M2	Lamp Door is Open		Stopped	The lamp door is open. • Close the lamp door. • If the lamp door is closed and this message appears, the lamp door interlock is defective or needs adjustment.
M10	End of Test		Complete	Test completed successfully. No alarm is generated. • *No action required*
M11	End of Test		Complete	Test completed successfully. An alarm, as set in Section 10.5, is generated. • *No action required*
M12	End of Test Shutdown		Complete & Stopped	Test completed successfully. No alarm is generated. • *No action required*
M13	End of Test Shutdown		Complete & Stopped	Test completed successfully. An alarm, as set in Section 10.5, is generated. • *No action required*
M14	Time to Replace Lamp		Running	3000 light hours have elapsed since this message appeared previously. • Replace the Xenon lamp. See Section 15.1 for more information. Recalibrate irradiance (Section 12.1).
M15	Time for Routine Service - See Manual		Running	2000 operation hours have elapsed since this message appeared previously. • See Section 15 for maintenance information.

Code	Message	Icon	Test Status	Description • Suggested Action
M16	Black Panel Temp Too Hot XXX °C		Stopped	Black panel temperature is 3 or more degrees higher than the setpoint for 55 minutes. • Check if the black panel setpoint is too low for the chamber air temperature setpoint. • Check the recirculated air blower and drive. • Check the fresh air blower and drive.
M17	Black Panel Temp Too Cold XXX °C		Stopped	Black panel temperature is 3 or more degrees lower than the setpoint for 55 minutes. • Check if the black panel setpoint is too high for the chamber air temperature setpoint. • Check the recirculated air blower and drive. • Check the fresh air blower and drive.
M18	Chamber Air Temp Too Hot XXX °C		Stopped	Chamber air temperature is 3 or more degrees higher than the setpoint for 55 minutes. • Check if the setpoint is too low for the lab temperature. • Check the air heater relay (failed on). • Check the recirculated air blower and drive. • Check the fresh air blower and drive.
M19	Chamber Air Temp Too Cold XXX °C		Stopped	Chamber air temperature is 3 or more degrees lower than the setpoint for 55 minutes. • Check if the setpoint is too high for the lab temperature. • Check the air heater relay (failed off). • Check the air heater. • Check the recirculated air blower and drive. • Check the fresh air blower and drive.
M24	Lab Temperature at Alarm XXX °C		Running	This notification is not an error by itself; it notes what the laboratory temperature was at the time a different, stopping fault occurred. • *No action required*
M25	Controller Too Hot		Stopped	The controller temperature is greater than the controller temperature limit. (55 °C). • Check room temperature. • Check overheating of relays.
M26	Lamp / Ballast Blower Failure		Stopped	A lamp or ballast blower is off but should be on. • Check the lamps / ballast blower. • Check the lamps / ballast relay. • Check the lamps / ballast airflow switch.
M27	Lamp / Ballast Blower On: Should be Off		Stopped	The lamp or ballast blower is on but should be off. • Check the lamp / ballast blower relay. • Check the lamp / ballast airflow switch.
M28	Humidifier Too Hot - May be Empty XXX °C		Stopped	The humidifier temperature is too high. • Check water level in humidifier.

Code	Message	Icon	Test Status	Description • Suggested Action
M29	Humidifier Too Cold XXX °C		Stopped	The humidifier temperature is too low. • Check for proper operation of the humidifier water heaters.
M30	Replace Battery		Running	The battery voltage is less than the low voltage limit. • Replace the battery (V-4086) on the main controller circuit board (see Section 17). • **CAUTION:** Dispose of the old Lithium battery according to local regulations and ordinances.
M31	Calibrate Light Sensors		Running	The lamps have been on for 500 hours since the onboard irradiance sensors were last calibrated. • Recalibrate the irradiance sensors (see Section 12.1).
M33	Wrong Radiometer: Should be UC20/340		Stopped	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		Stopped	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		Stopped	The radiometer being used is a 340 or 420 nm type, but the Q-SUN has TUV sensors installed. • Use a UC20/TUV radiometer.
M38	Light Sensors Do Not Match		Stopped	The irradiance sensors in the chamber are not all the same type. • Make sure that all 3 irradiance sensors are the same.
M43	Water Spray Off: Should be On		Stopped	The Q-SUN is running a spray step, but the spray is off. • Make sure the water supply is turned on. • Check the solenoid valve. • Check the flow switch.
M44	Water Spray On: Should be Off		Stopped	The Q-SUN is NOT running a spray step, but the spray is on. • The solenoid valve is bad. • The flow switch is bad.
M45	Humidifier Water Level Too Low		Stopped	The water level in the humidifier is too low. • Make sure the water supply is turned on. • Check the water float valve.
M49	Power Disrupted		Running	This message indicates power was off and then came back while the tester was in Run mode. 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 Xe-1 off to prevent the M49 message from being displayed when the tester is powered back on.

Code	Message	Icon	Test Status	Description • Suggested Action
M50	Chamber Humidity Too High XX%		Stopped	The chamber humidity is 5% or more above set point. • Check the RH set point. • Check the RH sensor. • Check if the specimens are retaining water. • Check the fresh air VFD. • Check the fresh air blower.
M51	Chamber Humidity Too Low XX%		Stopped	The chamber humidity is 5% or more below set point. • Check the RH sensor. • Check the water supply. • Check the RH set point. • Check the Irradiance set point. • Check the humidifier relay. • Check the humidifier power supply.
M52	Black Panel Temp Runaway XXX °C		Stopped	The black panel temperature is more than 10°C above set point for 1 minute. • Check if the black panel set point is too low for the chamber air temperature set point. • Check the recirculated air blower and drive. • Check the fresh air blower and drive.
M53	Chamber Air temp Runaway XXX °C		Stopped	The chamber air temperature is more than 10°C above set point for 1 minute. • Check if the set point is too low for the lab temperature. • Check the air heater relay (failed on). • Check the fresh air blower and drive. • Check the recirculated air blower drive.
M56	Blower Controller Fault		Stopped	One of the Variable Frequency Drive input faults is on. • Check for input voltage fluctuations. • Check the blowers, VFDs and drive board • Check if the lab temperature is too high.
M60	Low Irradiance: Chan X Change Lamp		Running	The irradiance of the lamp channel is 5% below set point. • Replace the lamp. • Check if the irradiance set point is too high. • Clean the lantern or chamber wall reflectors. • Check the UV sensor. • Check the ballast and ballast blower. • Recalibrate the irradiance sensor (Section 12.1).
M61	Lamp Out Chan X		Stopped	Irradiance of the lamp is more than 30% below the set point. • The lamp burned out, replace the lamp and recalibrate irradiance (see Section 12.1). • Check the ballast. • Check the lamp relay. • Check the lamp trigger finger.

Code	Message	Icon	Test Status	Description • Suggested Action
M63	Irradiance Too High: Chan X		Stopped	Irradiance of the lamp is greater than 5% above the set point. • Make sure the dimming cable from the ballast to the controller is properly connected. • Check the ballast.
M64	Lamp On: Should Be Off		Stopped	The tester is running a dark step, but the main controller senses the irradiance is above 0.05 W/m^2. • Replace the lamp relay.
M65	AC Voltage Out of Range		Running	The tester input voltage varies by more than ± 10% from the voltage specified on the serial number nameplate. • Check the main power supply. • For 400V testers make sure the neutral wire is connected.
M67	Lamp Relay Stuck On		Stopped	The irradiance is above 0.05 W/m^2 during the “Relay Check”. • Replace the lamp relay.
M70	Black Panel Temp Sensor Fail XXX °C		Stopped	The black panel temperature is less than 5 °C or greater than 150 °C. • Make sure black panel cable connector is firmly seated. • Replace the Black Panel Temperature sensor.
M72	Air Temperature Sensor Fail		Stopped	The chamber air temperature sensor is activated and the temperature is less than 3 °C or greater than 180 °C. • Make sure the sensor cable connector is firmly seated. • Replace the air temperature sensor.
M74	Lab Temperature Sensor Fail		Running	The lab temperature sensor is activated and the temperature is less than 3 °C or greater than 99 °C. • Make sure the sensor cable connector is firmly seated. • Replace the lab temperature sensor.
M76	Humidifier Temp Sensor Fail		Stopped	The humidifier temperature sensor reads less than 3 °C or greater than 180 °C. • Replace the humidifier temperature sensor.
M77	RH Sensor Fail		Stopped	The RH sensor is reading less than 3% or greater than 140%. • Replace the RH Sensor.
M80	Flash Memory Failure		Stopped	Checksum test on program failed. • Contact Q-Lab Repair and Tester Support (see Section 19).
M81	Flash Memory Corrupt		Stopped	Parameter and setup data corrupted. • Contact Q-Lab Repair.
M82	RAM Corrupted, RAM Reloaded		Stopped	Error in RAM data. • Contact Q-Lab Repair.

Code	Message	Icon	Test Status	Description • Suggested Action
M90	Time to Replace RH Sensor		Running	The RH sensor replacement timer expired. • Replace RH sensor
M101	SD Card is Missing		Running	The SD card is missing from the main controller. • Contact Q-Lab Repair.
M103	System Auto-Reboot		Running	System restarts because of fail-safe intended to prevent system locking up. • *No action required.*
M104	Software Install Completed Successfully		Running	Software has been installed without issue. • *No action required.*
M900	Status Screen Communications Failure		Running	Communication lost between main controller and Status Screen. Tester will enter single-screen mode. • Check for loose cable between main controller and the display. Re-seat cable.
M901	Main Menu Screen Communications Failure		Running	Communication lost between main controller and Menu Screen. Tester will enter single-screen mode. • Check for loose cable between main controller and the display. Re-seat cable.
M902	Main Controller Communications Failure		Running	Message that appears on a screen that has experienced M900 or M901. • *No action required.*

16.3 Lamp Will Not Light (Nov 2014)

Lamp Does Not Light

- Trigger finger is not in good contact with lamp, or requires cleaning. See Section 15.1.
- Faulty trigger/transformer assembly. See **Section 16** for replacement parts.
- Faulty ballast.
- Faulty lamp relay.
- Replace lamp.

Lamp Flickers During Operation

- Trigger finger is not in good contact with lamp, or requires cleaning**.** See Section 15.1.
- Reverse lamp (Figure 16.3a and Figure 16.3b).
- Replace lamp.

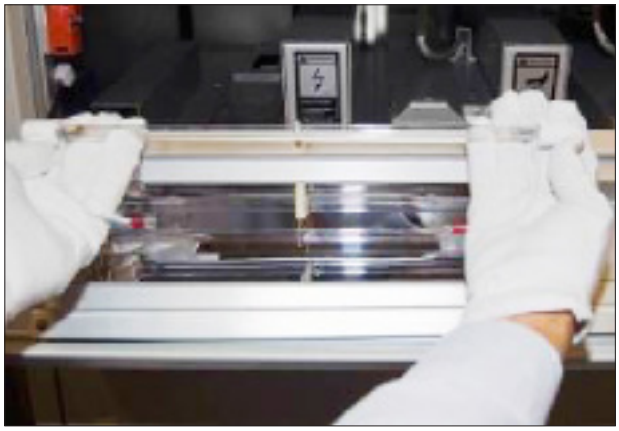


Figure 16.3a: Remove the lamp.

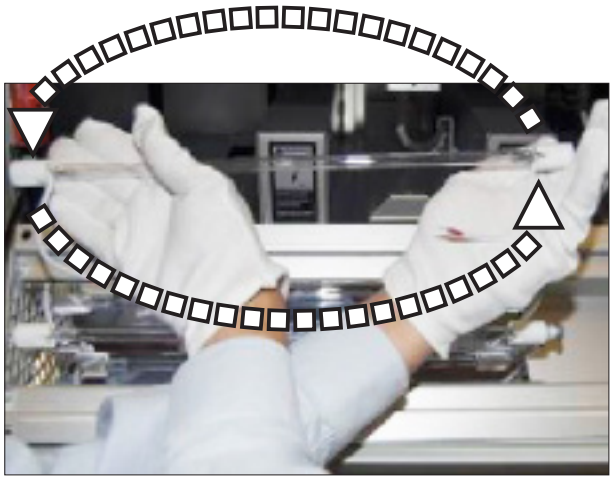


Figure 16.3b: Swap ends to reverse the lamp and reinstall.

16.4 Water Flow (Nov 2014)

- During a Front Spray step, the water flow rate should be 1.4 liter/min (see Section 9.1).
- The pressure gauge should read about 15-25 psi (104-155 kPa).
- Refer to Figure 16.4 for troubleshooting water flow problems.

Flow Rate Symptom	Pressure Gauge Symptom	Probable Cause(s)
< 1.4 l/min	< 15 psi	1. Pressure regulator not adjusted. 2. Water supply is shut off. 3. Water pressure is too low. 4. Clogged water filter. 5. Bad solenoid.
< 1.4 l/min	> 25 psi	1. Clogged nozzle.
= 1.4 l/min	< 15 psi	1. Nozzles leaking. 2. Fitting leak.
> 1.4 l/min	> 25 psi	1. Pressure regulator not adjusted. 2. Bad pressure regulator.

Figure 16.4: Water flow conditions.