

MANUAL

Q-SUN

Q-SUN Xe-1 Xenon Test Chambers



For Serial Numbers:
20-XXXXX-79-X1SE
20-XXXXX-79-X1BCE
20-XXXXX-79-X1SCE
20-XXXXX-79-X1WE



Revision Date
21 Sep 2020

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1. Specifications, Classifications, Symbols

1.1 Specifications, Classifications (Mar 2019)

- The recommended ambient operating temperature and relative humidity (RH) for the Q-SUN tester is 23 ± 5 °C and $50 \pm 25\%$ 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).

1.2 Symbols (Aug 2020)



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 Technical 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 (Aug 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 Xe-1 tester.



Figure 2.1a: Hot surface warning label.

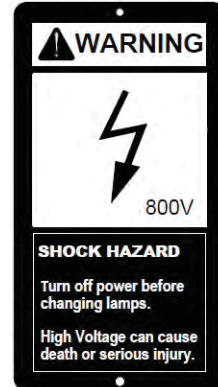


Figure 2.1b: Shock hazard warning label.

- All Q-SUN Xe-1 models are equipped with an interlock switch that turns off the xenon lamps when the lamp access door is opened.



Figure 2.1c: Right side panel and lid.



Figure 2.1d: Interlock switch location (lid open).

2.2 Ultraviolet and Infrared Hazards (Aug 2020)

Ultraviolet (UV) Light



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: Xe-1 Chamber door interlock.

3. General Description (Aug 2020)

The LX-5090-TM Q-SUN Xe-1 Technical Manual provides information on the installation, operation, and maintenance of Q-SUN Xe-1 test chambers.

Overview

- Q-SUN Xe-1 test chambers are laboratory simulators of the effects of indoor and outdoor light stability and weathering.
- The Q-SUN chiller option (Xe-1-BCE, Xe-1-SCE) allows testing at reduced temperatures by combining an air chilling system with a Q-SUN Xe-1 to reduce the temperature of the air entering the test chamber.
- The Q-SUN temperature-controlled water immersion option (Xe-1-WE) allows testing that requires samples to be submerged in water with precisely controlled temperature.
- This Technical Manual covers Q-SUN Xe-1 "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-1-B tester, see LX-5090B-TM Q-SUN Xe-1-B Technical Manual.

Xe-1 Models Description

Model	Configuration	Installation
Xe-1-SE	S: Water Spray	Tabletop
Xe-1-BCE	C: Basic + Chiller	Stand-Alone
Xe-1-SCE	Spray + Chiller	Stand-Alone
Xe-1-WE	W: Water Immersion	Tabletop

NOTE: All Q-SUN "E" models have enhanced performance over the basic tester, including longer lamp life, or higher irradiance capability.

Partial List of Standard Test Methods Met by Q-SUN Xe-1 Xenon Test Chambers

Standard	Met by
ASTM C1442 – Conducting Tests on Sealants Using Artificial Weathering Apparatus	Xe-1-SE, SCE
ASTM D2565 – Xenon Arc – Plastics for Outdoor Applications	Xe-1-SE, SCE
ASTM D3424 – Lightfastness of Printed Material	Xe-1-SE, BCE, SCE
ASTM D4303 – Lightfastness of Artists' Pigments	Xe-1-SE, BCE, SCE
ASTM D4798 – Xenon Arc – Bituminous Materials	Xe-1-SE, SCE
ASTM D5071 – Xenon Arc – Exposure of Photodegradable Plastics	Xe-1-SE, BCE, SCE
ASTM D6662 - Standard Specification for Polyolefin-Based Plastic Lumber Decking Boards	Xe-1-SE, SCE
ASTM D6901 - Standard Specification for Artists' Colored Pencils	Xe-1-SE, BCE, SCE
ASTM G155 – Xenon Arc – Test Apparatus for Exposure of Nonmetallic Materials	Xe-1-SE, SCE
GB/T 2424.14 - Environmental testing for electric and electronic products Part 2:Test methods-Guidance for solar radiation testing	Xe-1-SE, BCE, SCE
GB/T 16422.2 - Plastics - Methods of exposure to laboratory light sources - Part 2: Xenon-arc sources	Xe-1-SE, BCE, SCE
IEC 60068-2-5 - Environmental Testing - Part 2-5: Tests - Simulated solar radiation at ground level and guidance for solar radiation testing	Xe-1-BCE, SCE
ISO 3865 - Rubber, vulcanized or thermoplastic - Methods of test for staining in contact with organic material	Xe-1-SE, BCE, SCE
ISO 4892-2 Plastics – Methods of Exposure to Laboratory Light Sources – Part 2: Xenon-Arc Sources	Xe-1-SE, BCE, SCE
ISO 11431 - Building Construction - Jointing Products	Xe-1-SE, SCE
ISO 12040 - Graphic technology - Prints and printing inks - Assessment of light fastness using filtered xenon arc light	Xe-1-SE, BCE, SCE
ISO 12311 - Personal protective equipment - Test methods for sunglasses and related eye wear.	Xe-1- BCE, SCE
ISO 16474-2 - Paints and varnishes - Methods of exposure to laboratory light sources - Part 2: Xenon-arc lamps	Xe-1-SE, BCE, SCE
ISO 24443 - Determination of sunscreen UVA photo protection in vitro	Xe-1-BCE, SCE
ETAG 002 European Technical Approval Guidelines Part 1 Test A.	Xe-1-WE
JG/T 471 (2015) - Elastic sealants for insulating glass units of windows and curtain walls	Xe-1-SE
JG/T 475 - Structural silicon sealants for building curtain wall	Xe-1-WE

NOTE: Some standards include multiple test cycles, not all of which can necessarily be performed by Q-SUN Xe-1 testers. Please contact Q-Lab (see [Section 19](#)) for questions regarding specific test cycles.

4. Operating Environment



The Tester Must Be Located in a Suitable Environment

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

4.1 Suitable Environments (May 2020)

Ambient Laboratory Temperature and Humidity

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

Physical Environment

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

4.2 Unsuitable Environments (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, SO₂ 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 Uncrating (May 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.

Shipping Weights (Approximate)	Xe-1-SE	Xe-1-WE	Xe-1-BCE, Xe-1-SCE
Tester On Skid With Wooden Frame	134 kg (296 lbs)	163 kg (359 lbs)	227 kg (500 lbs)
Tester On Skid With Carton Only	89 kg (195 lbs)	131 kg (288 lbs)	172 kg (380 lbs)
Tester Only*	50 kg (110 lbs)	89 kg (195 lbs)	124 kg (272 lbs)

* Tester weight varies based on installed options and includes chiller, where applicable.

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	Stubby Screwdriver (Xe-1 chiller models)

*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 wooden frame crates.

Models Q-SUN Xe-1-SE, Xe-1-WE

- Q-SUN Xe-1-SE, Xe-1-WE testers are shipped in one of two types of packaging (Figure 5.1.a and Figure 5.1.b).
- Labels on the carton indicate the location of the instructions to be opened first (Figure 5.1.c).
- Instructions for unpackaging and setting up the tester are located in the envelope shown in Figure 5.1.d.

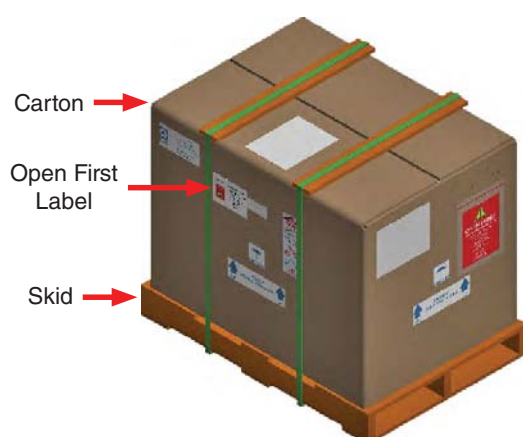


Figure 5.1.a: This packaging has a carton banded to a wooden skid

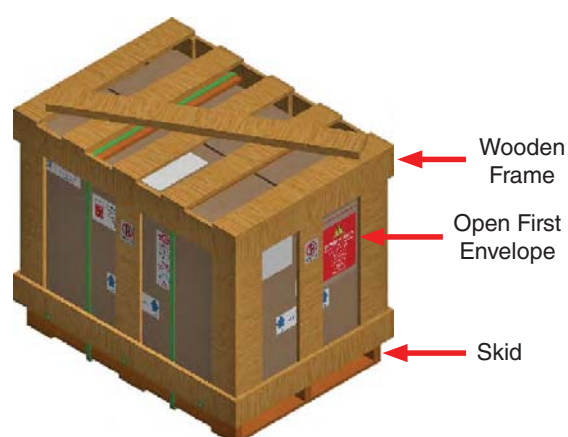


Figure 5.1.b: This packaging has a carton surrounded by a wooden frame fastened to a wooden skid.



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



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



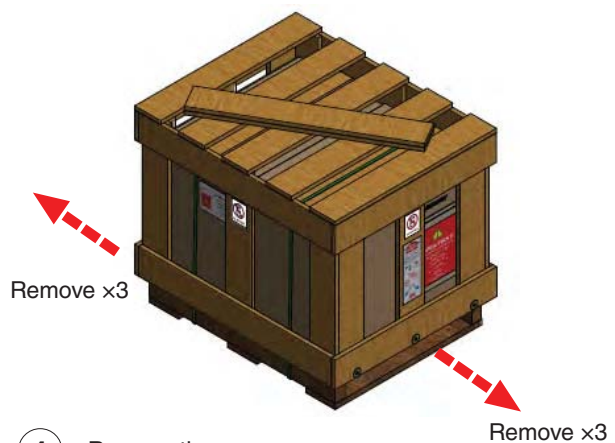
1. Uncrating instructions are located in this envelope. Remove and read the instructions.



2. Packaged with wooden frame continue with [Step 3](#). Packaged with carton only, go to [Step 7](#).



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

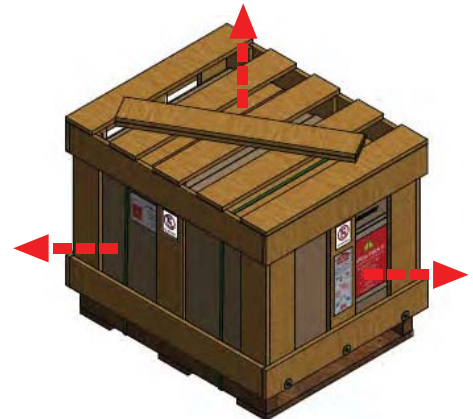


4. Remove the screws.

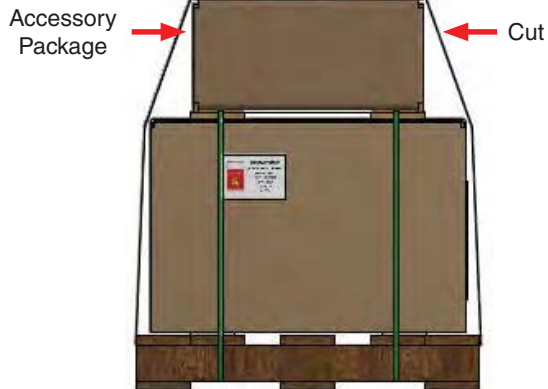
Use Fork Lift to Remove Crate in One Piece



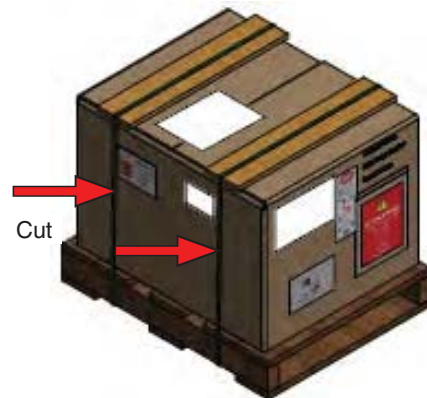
5. If a fork lift is available, use it to carefully lift the wooden frame up and off of the tester.



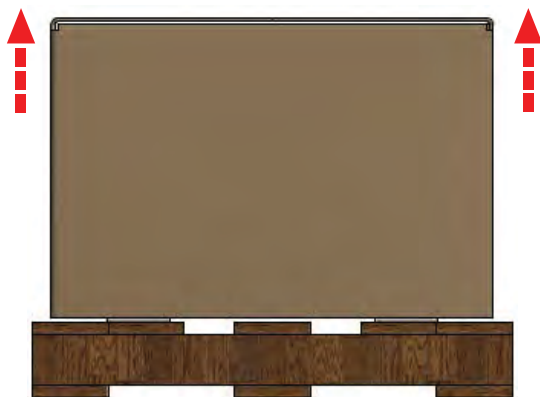
6. If a fork lift is not available, use a pry bar to carefully remove the horizontal and vertical wooden pieces off of the tester.



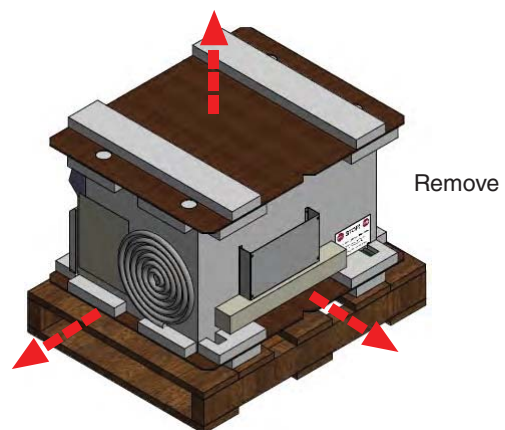
7. If there is an accessory package, cut the band and remove the plastic wrap. Set the package aside.



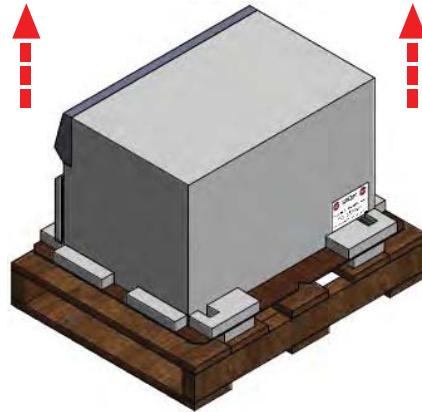
8. Cut the bands holding the carton to the skid. Remove the bands and boards.



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



10. Remove all packaging materials from inside and outside the tester. Remove any accessory boxes.



-
11. Q-Lab recommends that at least two people remove the Q-SUN from the skid.

-
12. Carefully lift the tester off of the skid



To complete tester installation see [Section 5.2](#) through [Section 5.5](#).

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13. Go to the sections listed above.

Models Q-SUN Xe-1-BCE, Xe-1-SCE

- Q-SUN Xe-1-BCE and Xe-1-SCE testers are shipped in one of two types of packaging (Figure 5.1.e and Figure 5.1.f).
- Labels on the carton indicate the location of the instructions to be opened first (Figure 5.1.g).
- Instructions for uncrating and setting up the tester are located in the envelope shown in Figure 5.1.h.

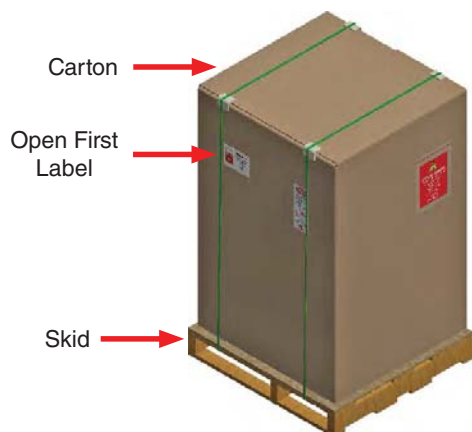


Figure 5.1.e: This packaging has a carton banded to a wooden skid.



Figure 5.1.f: This packaging has a carton surrounded by a wooden frame fastened to a wooden skid.



Figure 5.1.g: Labels on the carton indicate the envelope to be opened first.

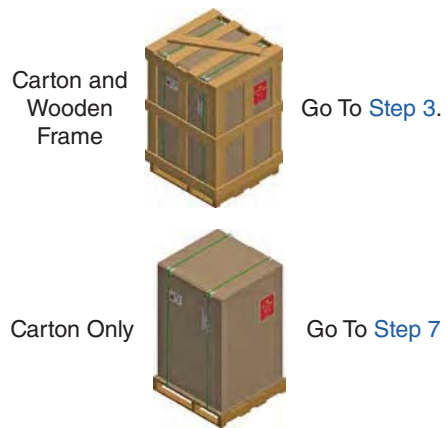


Figure 5.1.h: Open this envelope for important uncrating instructions.

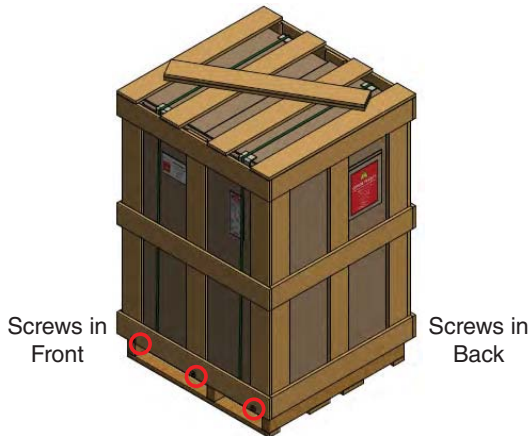
Section 5. Setup



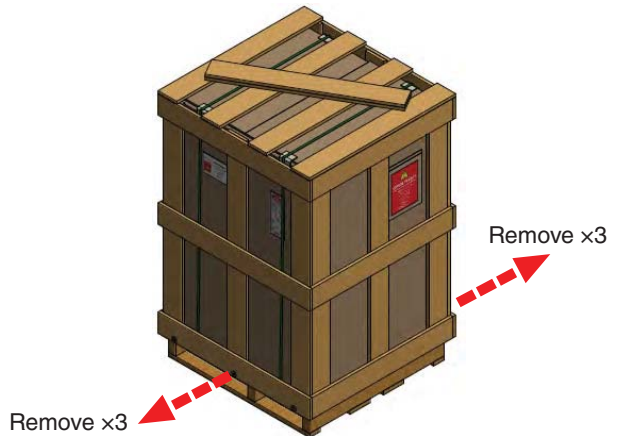
1. Uncrating instructions are located in this envelope. Remove and read the instructions.



2. Packaged with wooden frame continue with [Step 3](#). Packaged with carton only, go to [Step 7](#).



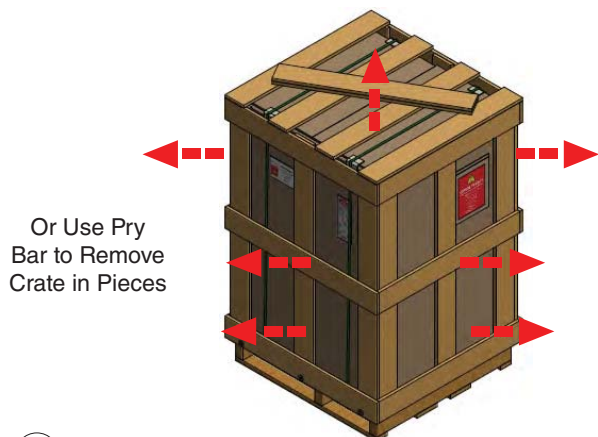
3. Locate the Phillips screws in the bottom front and back horizontal boards.



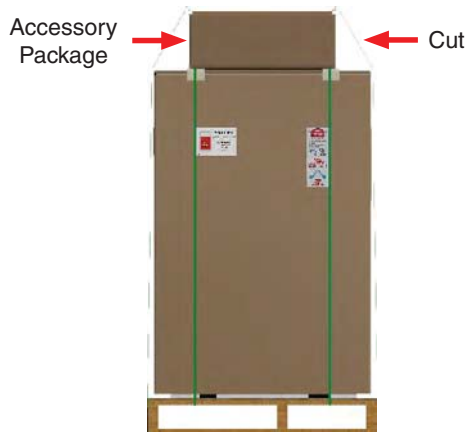
4. Remove the screws.



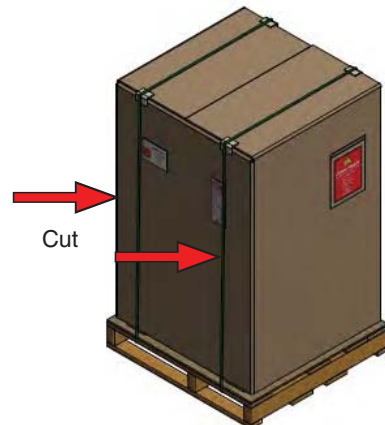
5. If a fork lift is available, use it to carefully lift the wooden frame up and off of the tester.



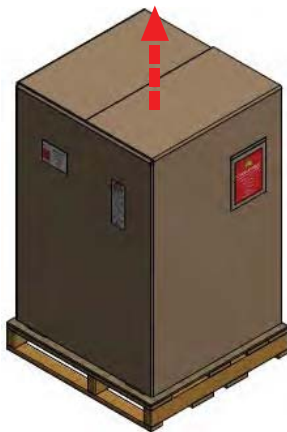
6. If a fork lift is not available, use a pry bar to carefully remove the horizontal and vertical wooden pieces off of the tester.



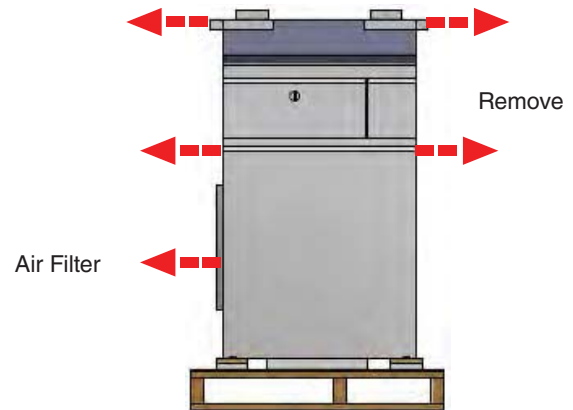
7. If there is an accessory package, cut the band and remove the plastic wrap. Set the package aside.



8. Cut the bands holding the carton to the skid. Remove the bands and boards.



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



10. Remove all packaging materials from inside and outside the tester.

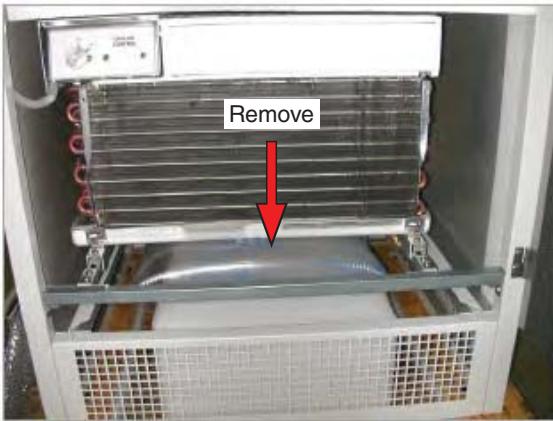


11. Remove the air filter packaged at the side of the unit. Set aside.

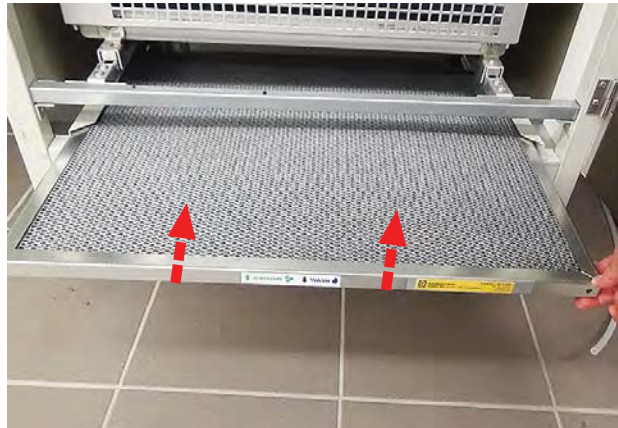


12. Open the chiller front access door.

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13. Remove the air bag from inside the chiller.



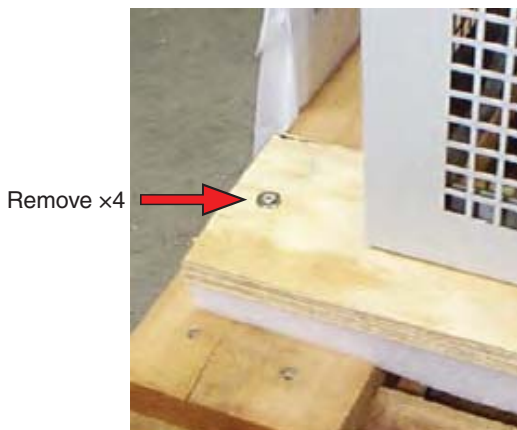
14. Install the air filter in the chiller.



15. Make sure the air flow arrow on the edge of the air filter frame points up. Close the door.



16. Screws (2 each side) attach runners to skid.

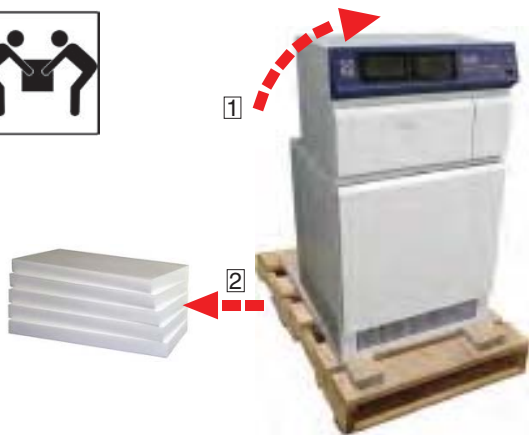


17. Remove the four (4) screws.



At least two people are needed to remove the Xe-1 with chiller from the skid.

18. Follow [Step 19](#) through [Step 26](#) to remove the Xe-1 with 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 so that the runners overhang the skid by about 100 mm (4").



21. From the bottom of each runner, use a short screwdriver to remove the screw holding the runner to the unit.



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 and carefully, slide the unit (and runners) off the skid onto the floor.

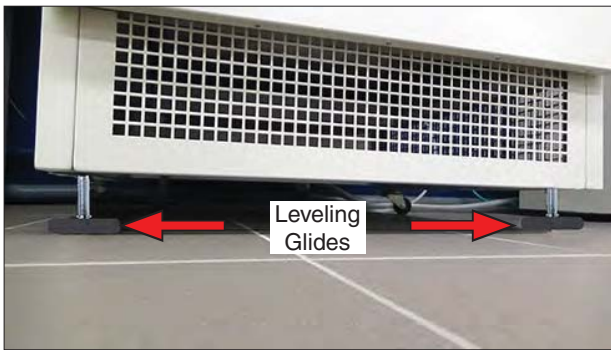
Section 5. Setup



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. When moving a tester with leveling glides, do not hit floor drain, cracks, etc, as the glides may be damaged.



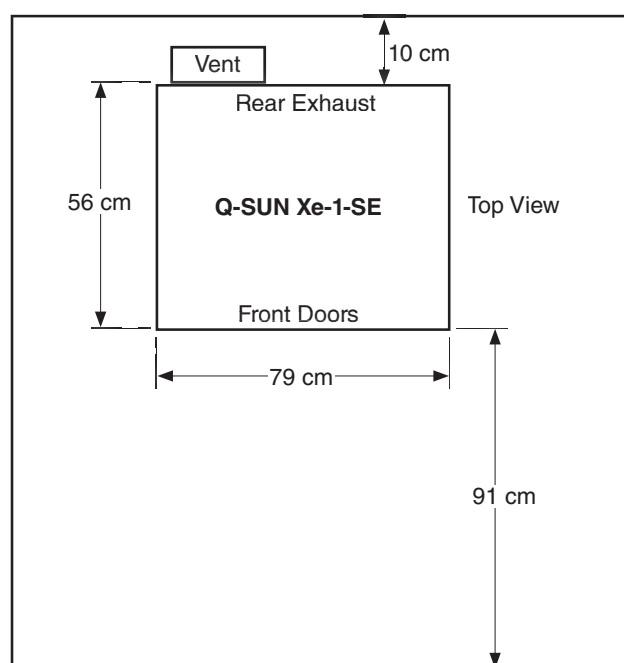
To complete tester installation see [Section 5.2](#) through [Section 5.5](#).

28. Go to the sections listed above.

5.2 Dimensions and Space Requirements (Aug 2020)

Model	Xe-1-SE	Xe-1-BCE, Xe-1-SCE	Xe-1-WE
External Dimensions With Leveling Pads (W x H x D)	78 cm x 52 cm x 65 cm 30.5" x 20.5" x 25.5"	78 cm x 138 cm x 79 cm 30.5" x 54.5" x 31.0"	99 cm x 72 cm x 65 cm 39.0" x 28.25" x 26"
External Dimensions With Casters (W x H x D)	No Casters	78 cm x 143 cm x 79 cm 30.5" x 56.1" x 31.0"	No Casters

- The Q-SUN Xe-1-SE is designed for tabletop or benchtop installation.
- [Figure 5.2.a](#) shows external dimensions and space requirements.



Drawing not to scale.

Figure 5.2.a: Q-SUN Xe-1-SE minimum clearance and counter space requirement.

Section 5. Setup

- Q-SUN Xe-1-BCE and Xe-1-SCE models are designed for stand-alone installation.
- [Figure 5.2.b](#) shows external dimensions and space requirements

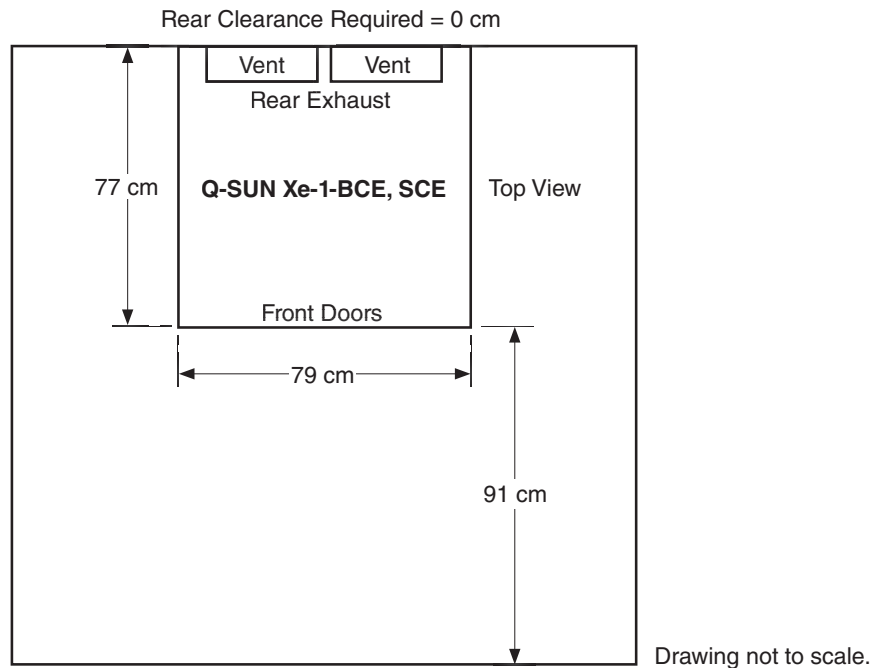


Figure 5.2.b: Q-SUN Xe-1-BCE, Xe-1-SCE minimum clearance and space requirement.

- Q-SUN Xe-1-WE is designed for tabletop or benchtop installation.
- [Figure 5.2.c](#) shows external dimensions and space requirements

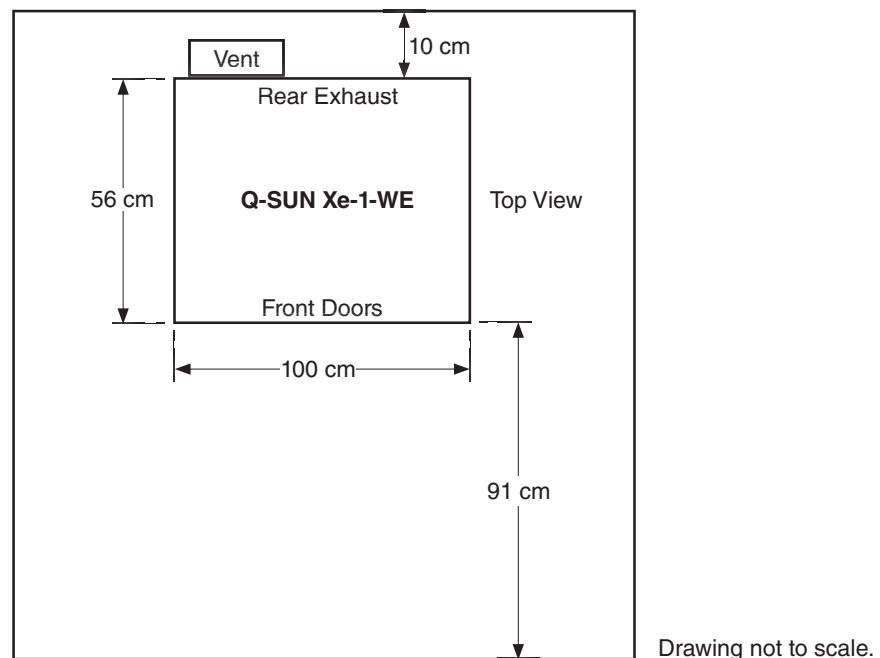


Figure 5.2.c: Q-SUN Xe-1-WE minimum clearance and counter space requirement.

5.3 Electrical (Aug 2020)

Specifications

Voltage	All	208 V or 230 V \pm 10% - single phase
Current	Xe-1-SE	12 A @ 208 V, 11 A @ 230 V
	Xe-1-BCE, Xe-1-SCE	19 A @ 208 V, 16 A @ 230 V
	Xe-1-WE	13 A @ 208 V, 12 A @ 230 V
Frequency	50 or 60 Hz	
Installation	Rated as Installation (Over voltage) Category II for transient over voltages.	

Figure 5.3.a: Electrical specifications.

Connections

- Q-SUN Xe-1 models come in 208 V single phase and 230 V single phase versions (Figure 5.3.a).
- 208 V or 230 V is specified when the machine is ordered.
- The input voltage and current rating are shown on the nameplate attached to the rear of the unit (Figure 5.3.b).



The voltage supplied to the machine must be within $\pm 10\%$ of the voltage rating of the machine and the circuit must be capable of supplying the rated current.

- Q-SUN Xe-1 models come with a 16 ft (4.9 m) power cord.
- A properly-sized plug must be supplied and attached by the user.

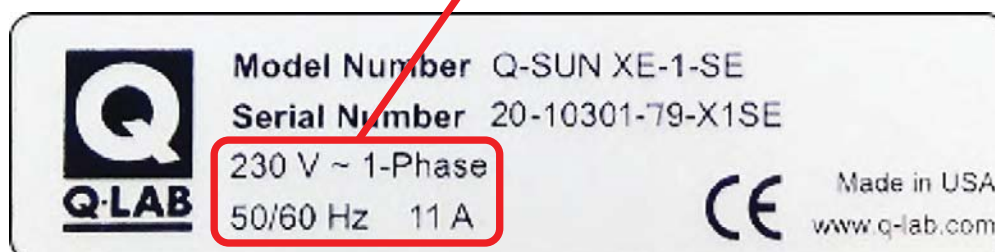



Figure 5.3.b: Voltage and current shown on nameplate.

5.4 Water (May 2020)

Supply

Xe-1-SE, Xe-1-SCE, Xe-1-WE	 Purified water is required for proper operation. The Q-SUN tester warranty is voided if this condition is not met.
Xe-1-BCE	No water is required.

System	Pressure	Flow Rate	Average Daily Volume	Resistivity	Conductivity	Silica	Total Dissolved Solids	pH
Spray*	207-620 kPa (30-90 PSI)	1.4 L/min	0.12 L/min × spray time**	>5M ohm•cm	<0.2 µS/cm	<0.1 ppm	<0.1 ppm	6-8
Water Immersion	69-620 kPa (10-90 PSI)	0.04 L/hr	1.0 L/day					

* 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. Q-Lab offers a water inlet pump for installations that do not have sufficient water pressure. See for more information.

** Average daily volume during a spray step is based on a spray on time of 5 seconds and a spray off time of 55 seconds. Adjusting the spray on/off time will change the average daily volume.

The reverse osmosis / deionized (RO/DI) water system shown in [Figure 5.4.a](#) produces water pure enough for spray systems. **This type of RO/DI system is required for Xe-1-SE, Xe-1-SCE and Xe-1-WE 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.

Reverse Osmosis / Deionization System

- [Figure 5.4.a](#) 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.

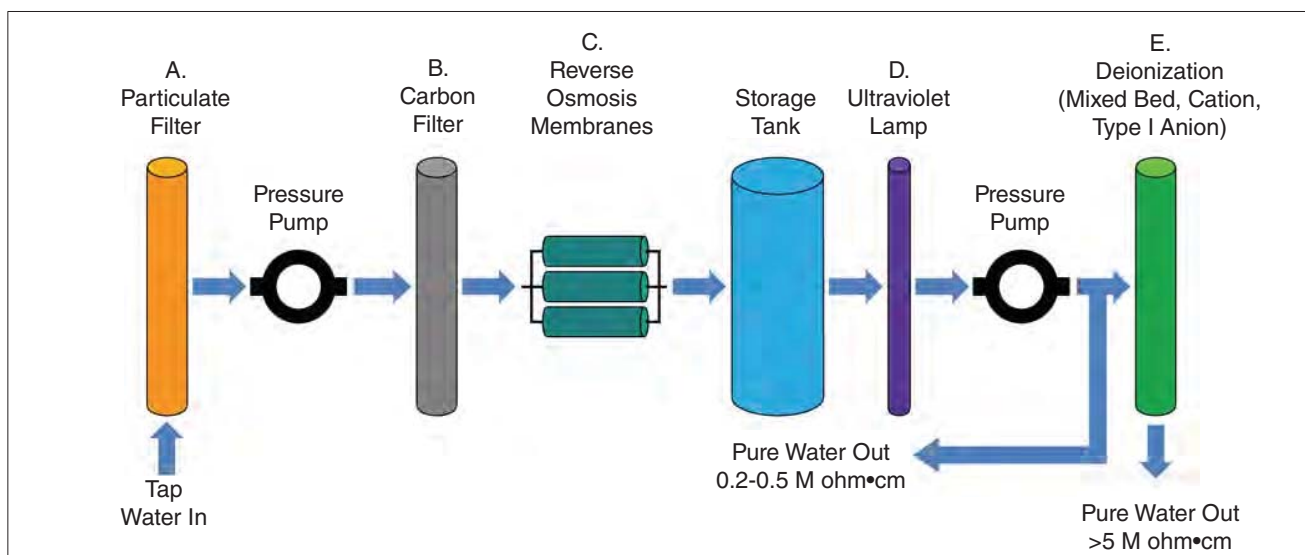


Figure 5.4.a: Reverse osmosis / deionized water system.

- 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 contaminants	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

Water Repurification System

- Q-Lab offers an optional water repurification system for the Q-SUN to conserve purified water.
- The system re-circulates and re-purifies the spray water instead of letting it go down the drain and can save over 50 liters of purified water per day.
- See [Specification Bulletin LW-6048 Water Repurification System](#) for more information.

Connections

- Water supply and drain connection requirements for Xe-1 models are listed in [Figure 5.4.b](#) below:

Connections	Xe-1-BCE	Xe-1-SE	Xe-1-SCE	Xe-1-WE
Water Supply Required	No	Yes	Yes	Yes
Drain Required	Yes			

Figure 5.4.b: Xe-1 water connection requirements.

For Xe-1 Models Requiring Connections

- Water supply and drain connections are made at the lower rear of the tester ([Figure 5.4.c](#)).
- Water inlet and drain fittings to meet various connection configurations are supplied ([Figure 5.4.e](#) to [Figure 5.4.h](#)).
- A 10 mm water fitting adapter (U-40817-X) for connecting the tester to a 10 mm inlet water supply is also supplied ([Figure 5.4.d](#)).
- The water inlet tube is not supplied with the tester. Drain hose is supplied with the tester.
- Refer to the diagrams included with the tester or visit [Q-Portal](#) for detailed plumbing information.

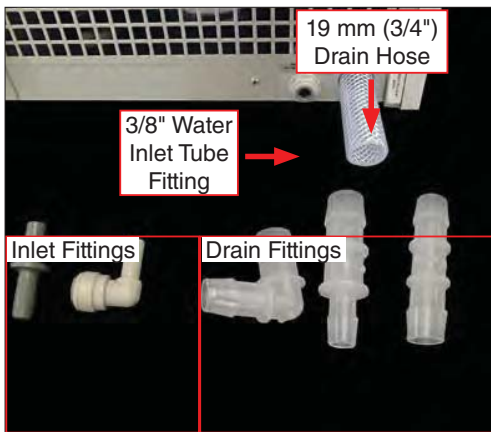


Figure 5.4.c: Hose barsbs and elbows supplied with models requiring supply and drain connections.

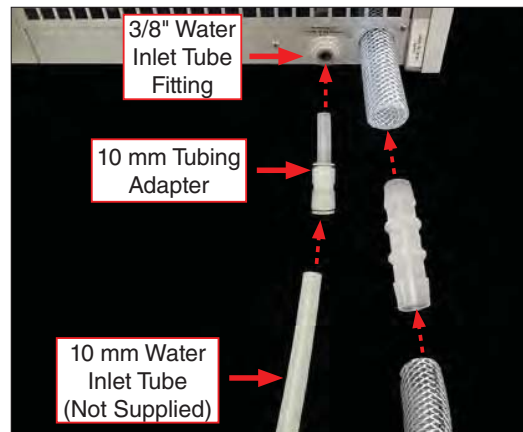


Figure 5.4.d: Connect to 10 mm water inlet supply tubing.

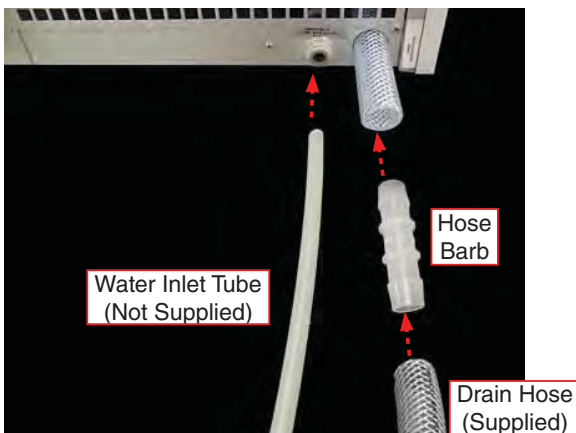


Figure 5.4.e: Water connections - Configuration 1.

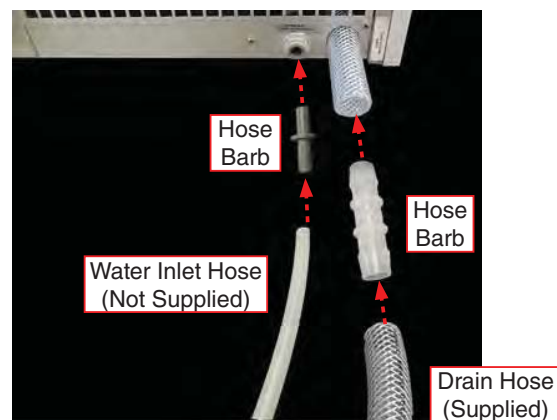


Figure 5.4.f: Water connections - Configuration 2.

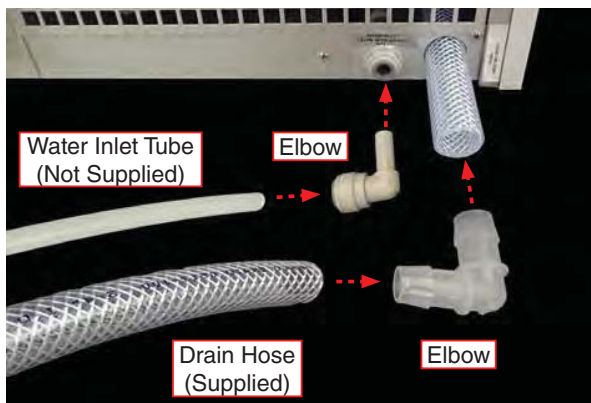


Figure 5.4.g: Water connections - Configuration 3.

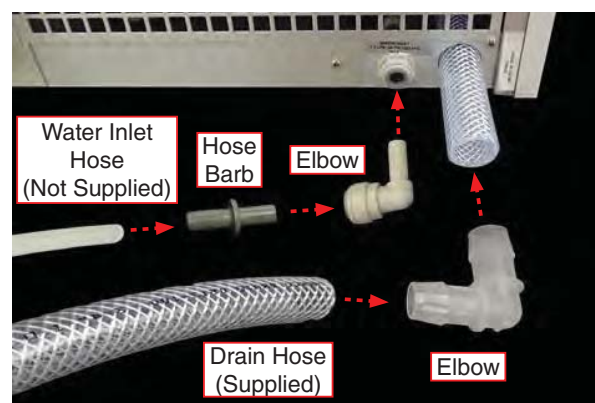


Figure 5.4.h: Water connections - Configuration 4.

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

For Xe-1 Chiller Models (Xe-1-BCE, Xe-1-SCE)

- The air chiller condenses water on its evaporator coil. This water must then be drained away.
- The chiller has a short piece of 1.3 cm (1/2") drain hose exiting below the rear panel. (Figure 5.4.i).
- A reducer (Figure 5.4.j) is supplied to connect the chiller drain hose to the 2 cm (3/4") supplied drain hose.



Figure 5.4.i: Chiller drain hose.

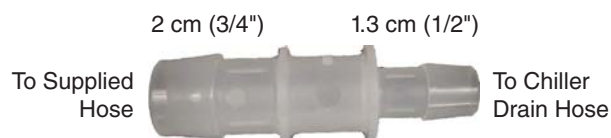


Figure 5.4.j: Chiller drain hose reducer.

For Raised Drain Installations

- If a drain hose must rise more than 100 mm (4.0") above the tester drain outlet at any point before reaching a drain, a pump is needed, or the tester must be elevated.
- An optional drain pump kit is available to pump drain water over obstacles or to an elevated drain (Figure 5.4.k).
- Alternatively, for chiller models an optional lift kit is available to raise the entire tester up off of the floor (Figure 5.4.k).
- See Section 14 for information on drain pumps and lift kits.
- Do not use concrete blocks, pallets, bricks, or other means to raise the tester to achieve proper drainage.

Raised Drain Options	Xe-1-BCE	Xe-1-SE	Xe-1-SCE	Xe-1-WE
Drain Pump	Available	Available	Available	Available
Lift Kit	Available	Not Available	Available	Not Available

Figure 5.4.k: Raised drain options.

5.5 Venting (May 2020)

- Xe-1 models are designed to release warm exhaust air directly into the room (See [Figure 5.5.b,c,d](#)).
- Xe-1 testers do not require a vent hood or ducting.
- Do not attach to a powered vent.

Model	Heat Load Dissipation
Q-SUN Xe-1-SE	1,200 watts (4,100 BTU/Hr)
Q-SUN Xe-1-BCE and Xe-1-SCE	2,400 watts (8,200 BTU/Hr)
Q-SUN Xe-1-WE	1,400 watts (4,800 BTU/Hr)

Figure 5.5.a: Heat load dissipation by model.



IMPORTANT: Air intakes and exhausts must not be obstructed. Keep filters clean. See [Section 15.5](#) for more information on filter cleaning.

Q-SUN Xe-1-SE

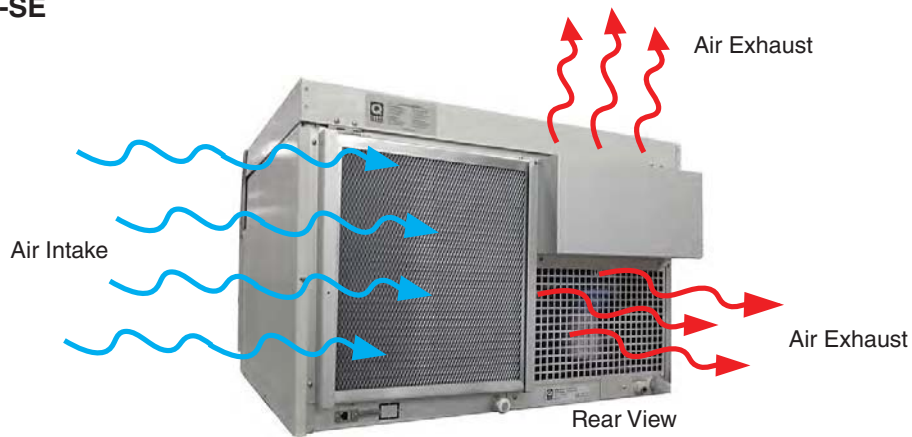


Figure 5.5.b: Q-SUN Xe-1-SE air intake and exhaust areas.

Q-SUN Xe-1-BCE, Xe-1-SCE



Figure 5.5.c: Q-SUN Xe-1-BCE and Xe-1-SCE chiller cooling air intake areas.

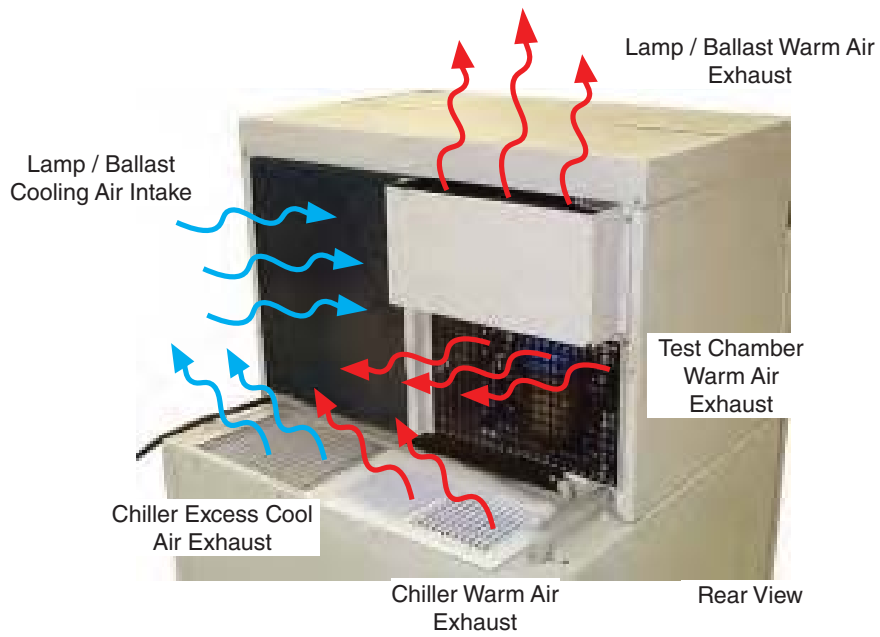


Figure 5.5.d: Q-SUN Xe-1-BCE and Xe-1-SCE lamp / ballast air intake and air exhaust areas.

Q-SUN Xe-1-WE

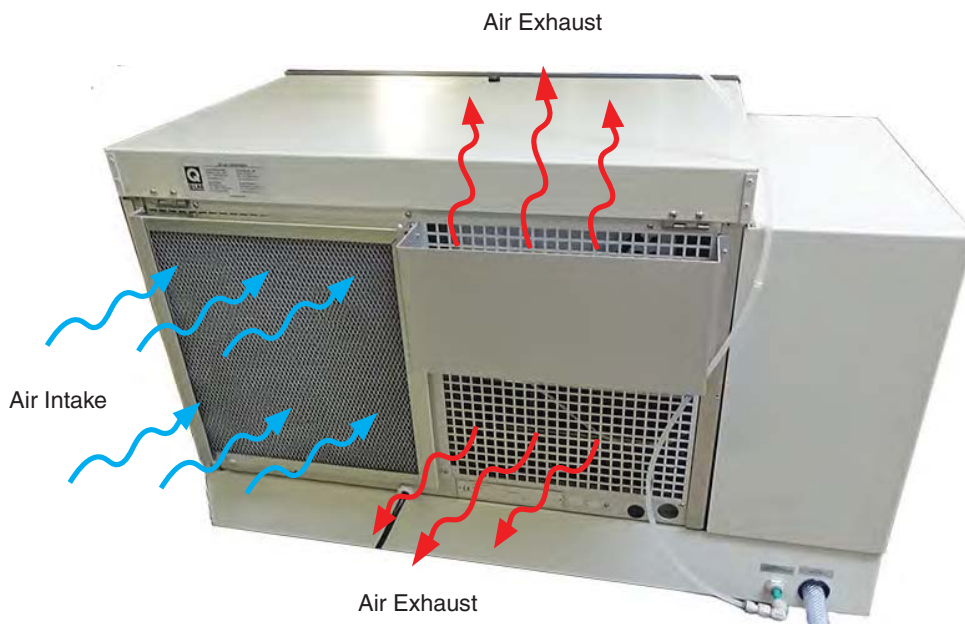


Figure 5.5.e: Q-SUN Xe-1-WE air intake and exhaust areas.

6. Xenon Light System

6.1 Xenon Lamps and Specimen Geometry (Jun 2016)

Lamps

Q-SUN Xe-1 testers use a xenon lamp to reproduce the damaging effects of sunlight. Read [Section 2](#) on safety before operating the xenon lamps.

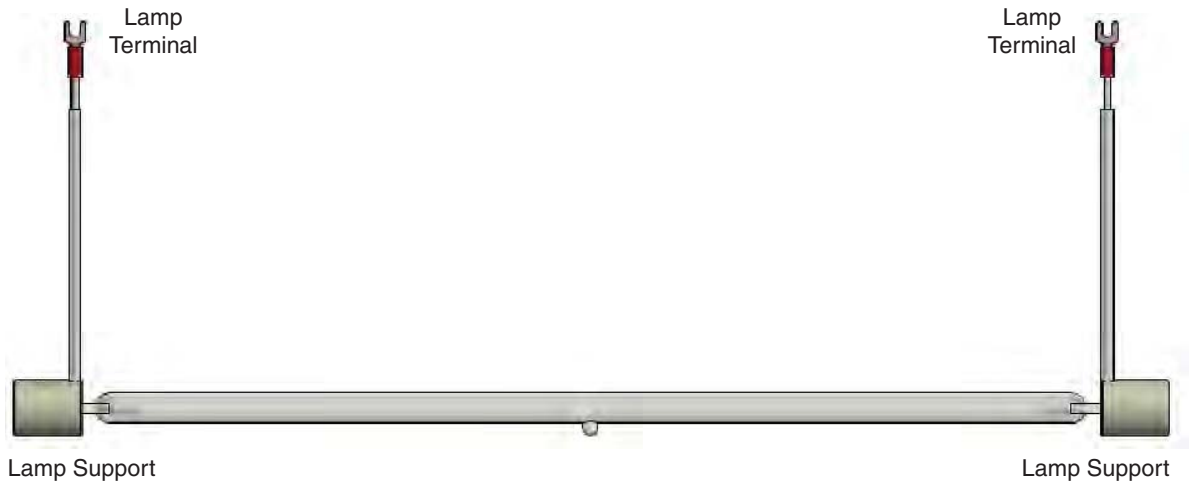


Figure 6.1a: Q-SUN xenon lamp.

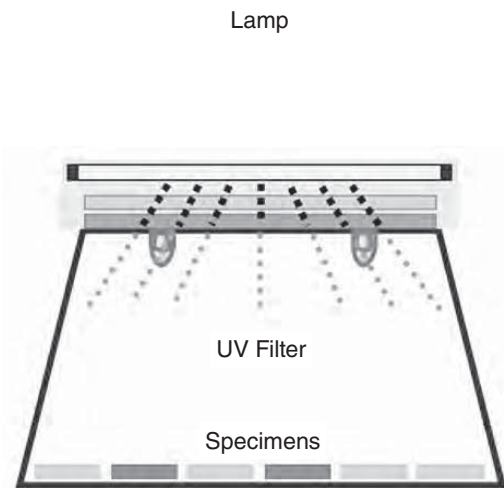


Figure 6.1b: Xe-1 Lamp and specimen geometry.

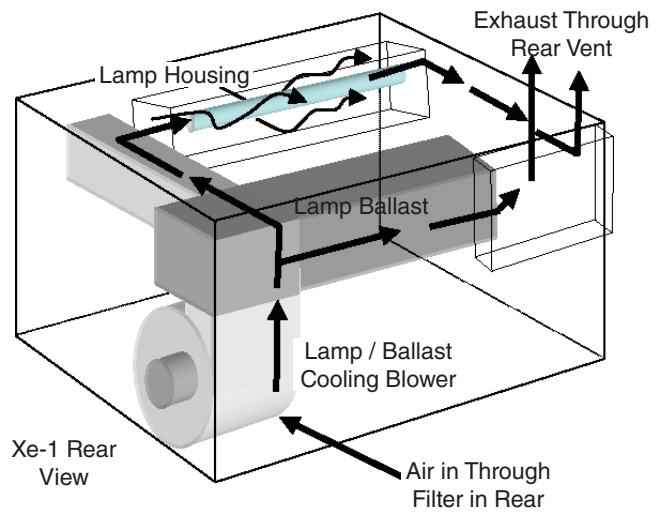


Figure 6.1c: Xe-1 Lamp cooling airflow.

6.2 SOLAR EYE Irradiance Control System (Jun 2016)

Control

All Q-SUN Xe-1 models use an irradiance sensor, ballast, and lamp.

- The irradiance sensor measures light intensity and sends information to the controller.
- The controller regulates the ballast, which determines the light intensity of the lamp.

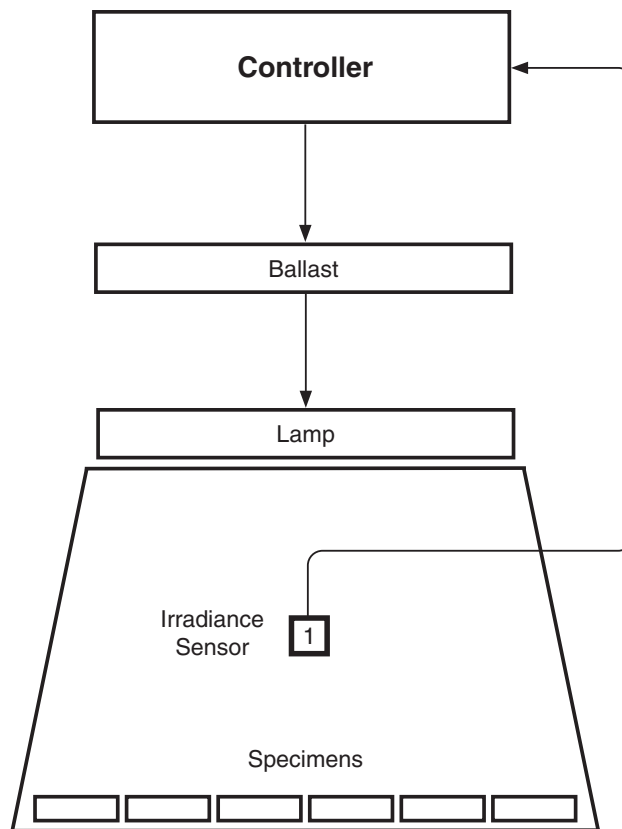


Figure 6.2: SOLAR EYE® feedback loop system.

6.3 Irradiance Sensors (Mar 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 sensor is 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).
- See Section 17 for sensor replacement part information.
- The irradiance control system must be re-calibrated whenever the sensor is changed. See Section 12.1 for calibration instructions.

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: Xe-1 Irradiance sensor located on rear chamber wall (behind shield).

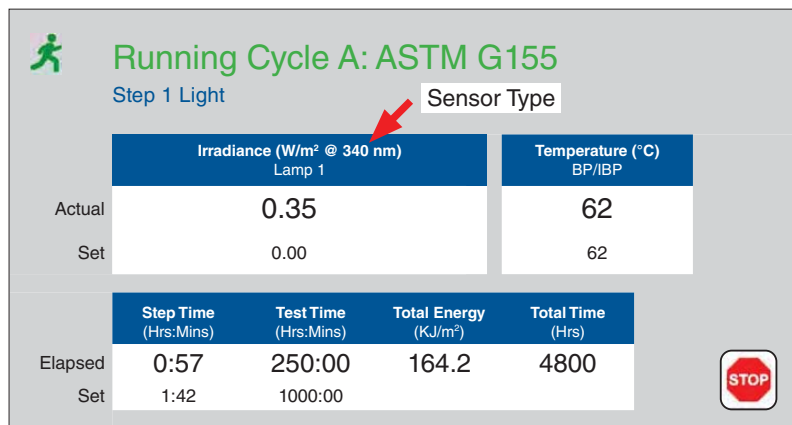



Figure 6.3b: Sensor type shown on Xe-1 Status Display.

6.4 UV Filters (Sep 2020)

- 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.

Filter Type	Description
Daylight-Q	Noon summer sunlight.
Daylight-F	Noon summer sunlight, with an even more realistic match to the solar spectrum.
Daylight-B/B	Matches the spectrum of rotating rack machines with borosilicate inner and outer filters. Passes shortwave UV that is not found in natural sunlight (harsher UV).
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	<p>Similar to Window-Q, but with reduced IR transmission (heat absorbing filter).</p>  <p>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.</p>
Window-SF5	Spectrum specified in Ford test method.
Extended UV-Quartz	Extremely harsh short wavelength UV.
Extended UV-Q/B	More UV than natural sunlight.
UV Blocking	Blocks all UV light. Used with another filter to meet ICH guidelines. See X-10521-L ICH Guidelines Test Protocol for Q-SUN Xenon Arc Test Chambers for more information (see Figure 6.4h).

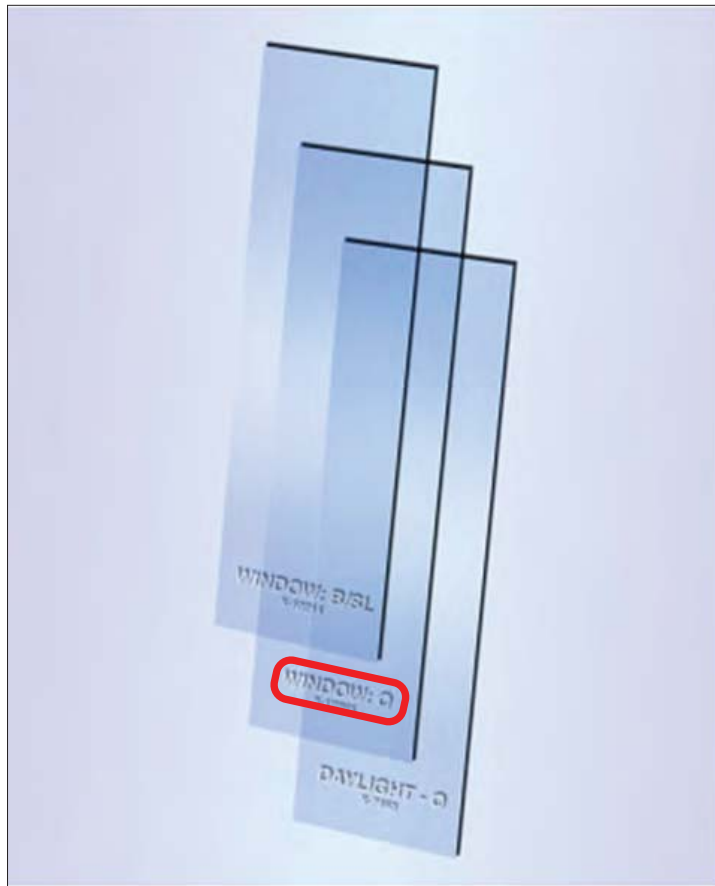


Figure 6.4a: Q-SUN Xe-1 UV filters are labeled with filter type.

Spectral Power Distributions (also called Spectral Irradiance)

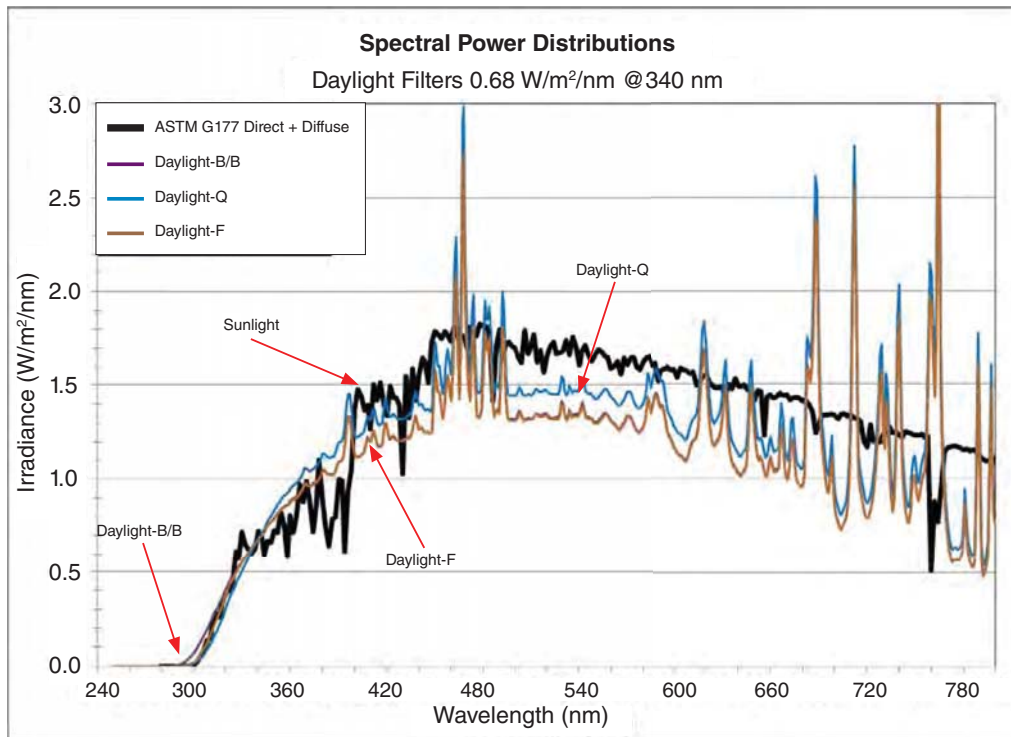


Figure 6.4b: Spectral power distributions of Daylight filters from 250-800 nm.

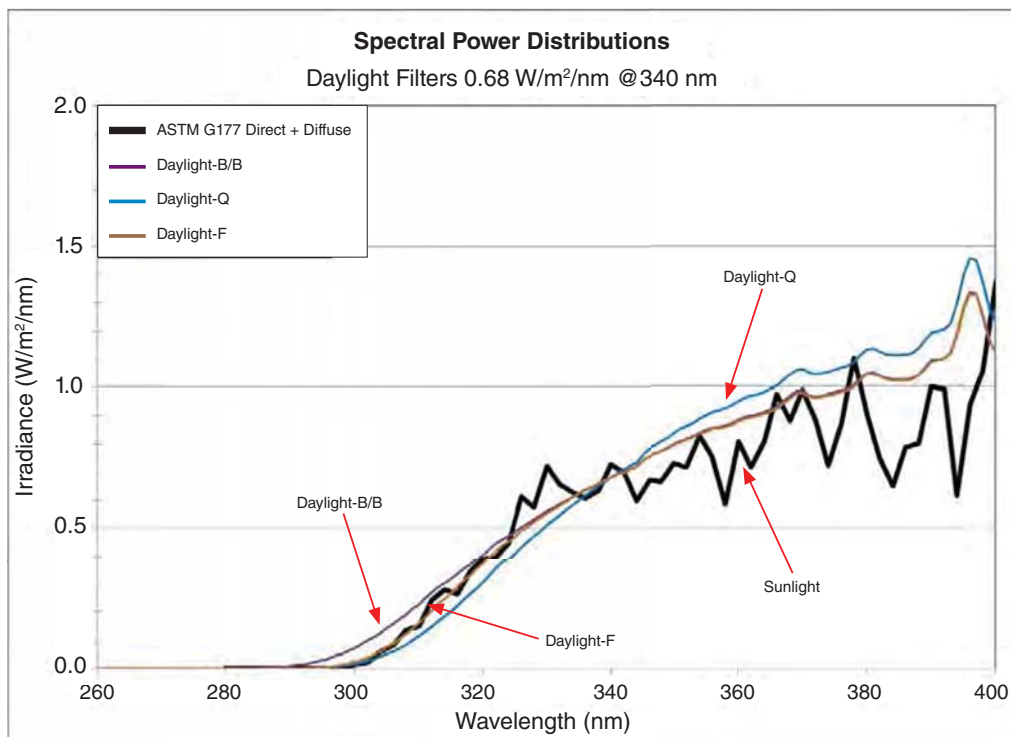


Figure 6.4c: Spectral power distributions of Daylight filters from 260-400 nm.

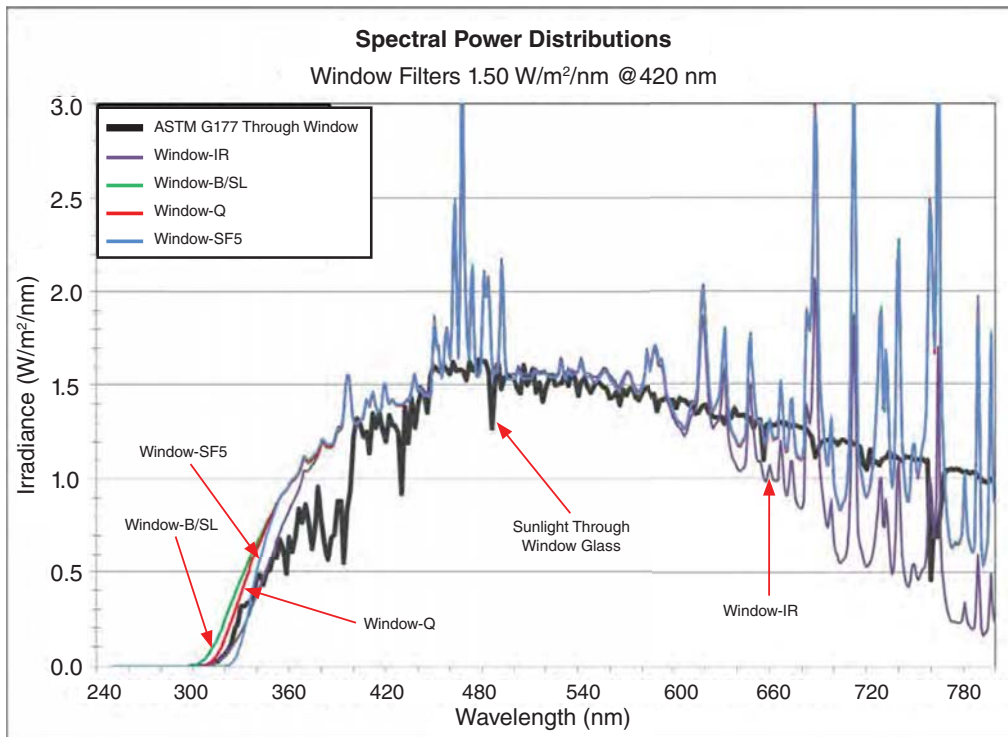


Figure 6.4d: Spectral power distributions of Window filters from 250-800 nm.

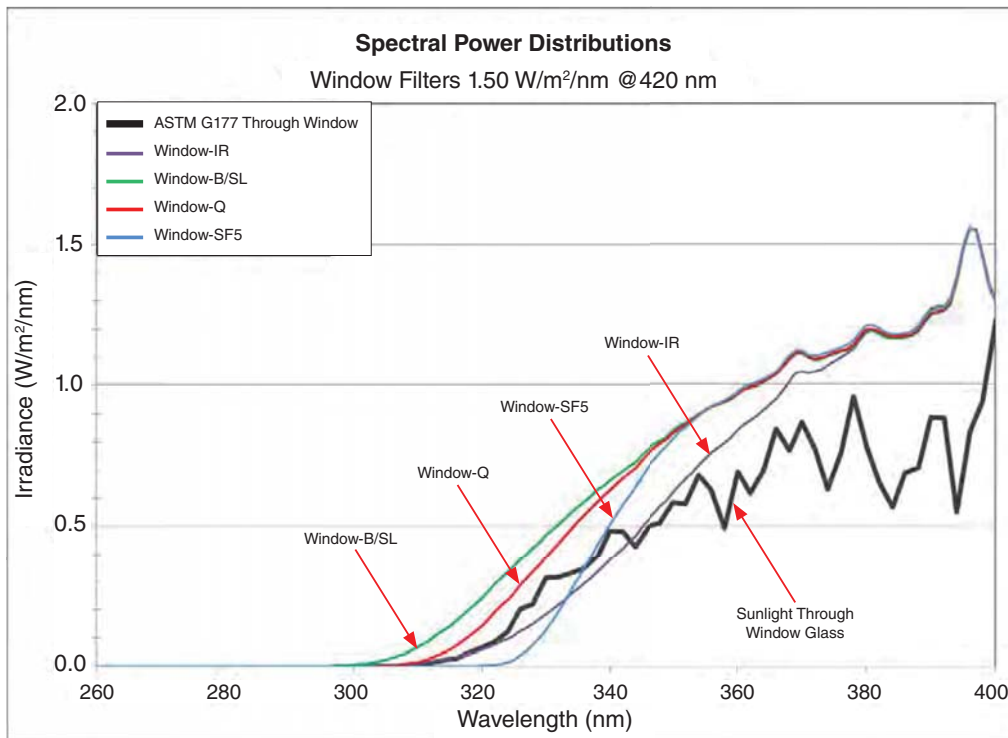


Figure 6.4e: Spectral power distributions of Window filters from 260-400 nm.

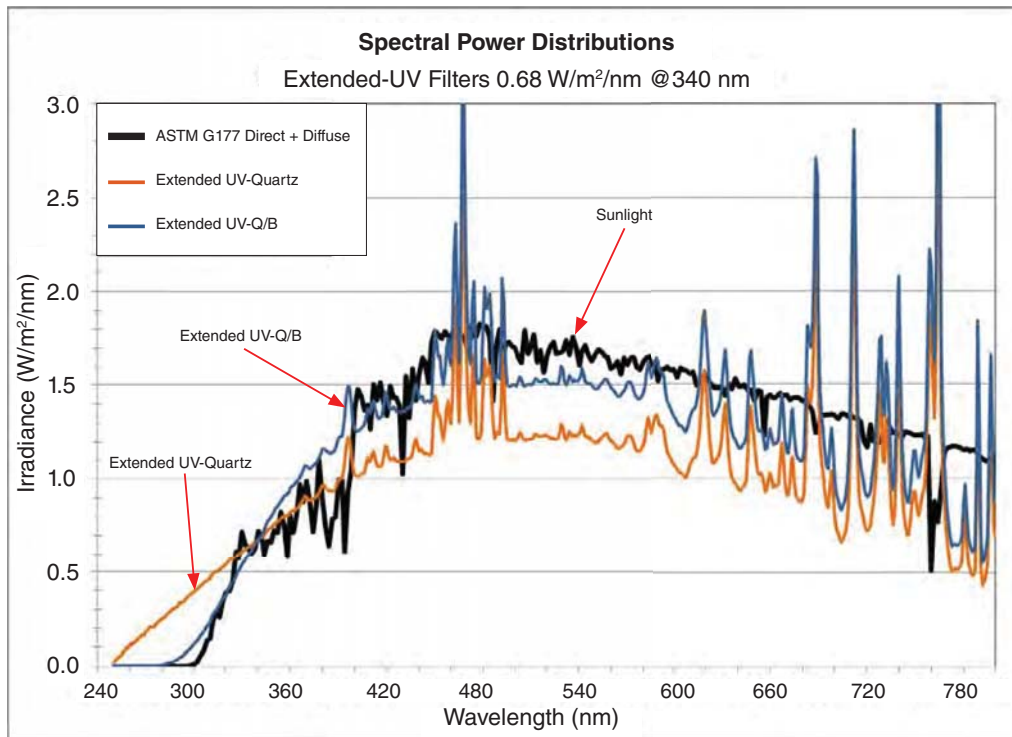


Figure 6.4f: Spectral power distributions of Extended-UV Filters from 250-800 nm.

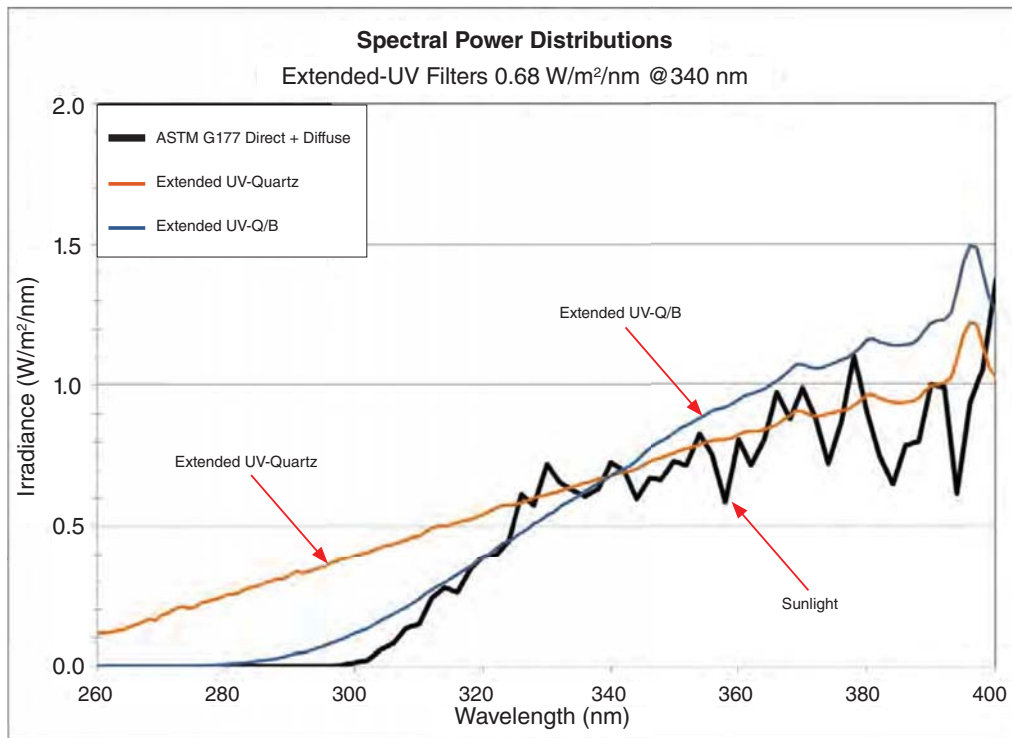


Figure 6.4g: Spectral power distributions of Extended-UV Filters from 260-400 nm.

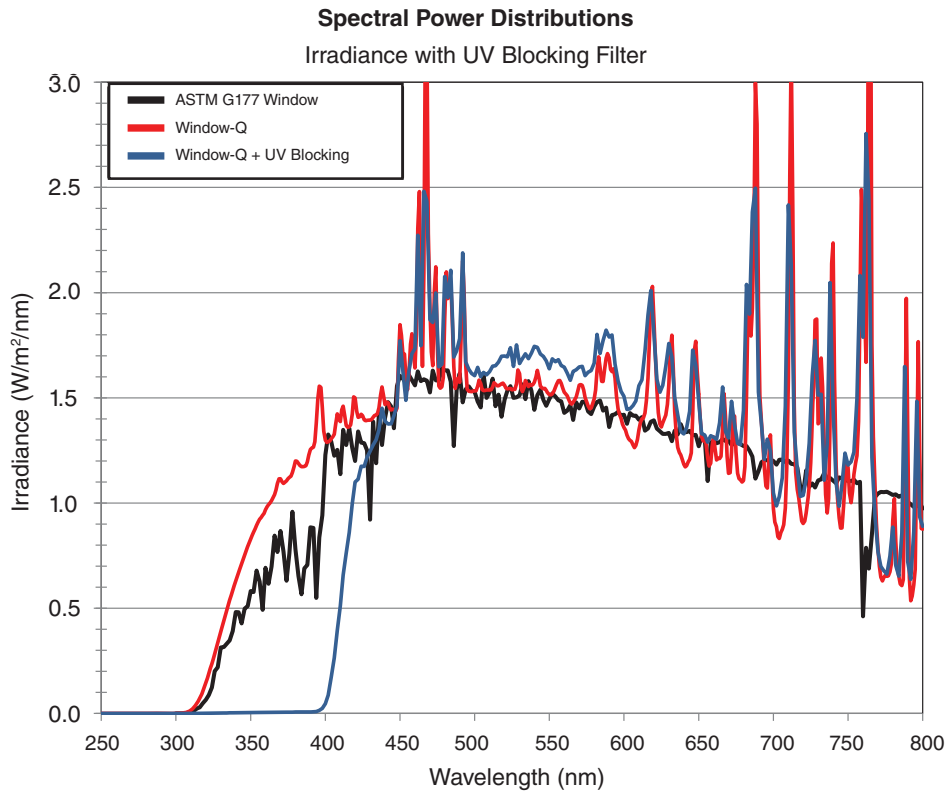


Figure 6.4h: Spectral power distributions for a Q-SUN with Window-Q filters (red) and Window-Q plus UV blocking filters (blue), plus the ASTM G177 reference Window glass spectrum (black line). **NOTE:** The Window-Q is set to 1.50 W/m²/nm @ 420 nm but the UV blocking filter is shown at 1.00 W/m²/nm @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

7. Spray System (Mar 2019)

For Xe-1-SE, Xe-1-SCE Models Only

- The Q-SUN Xe-1-SE and Xe-1-SCE testers simulate outdoor moisture with water spray.
- The Q-SUN Xe-1-SE and Xe-1-SCE have two spray nozzles (Figure 7a).
- See [LX-5090-SO Q-SUN Xe-1 System Overviews](#) for detailed spray system information and diagrams.



Important: Very high purity water is required. See [Section 5.4](#) for water purity requirements.

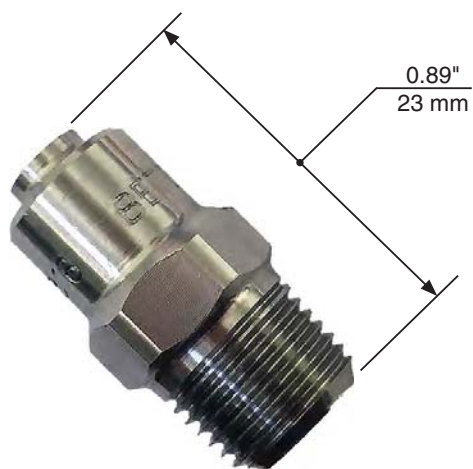


Figure 7a: Spray nozzle.

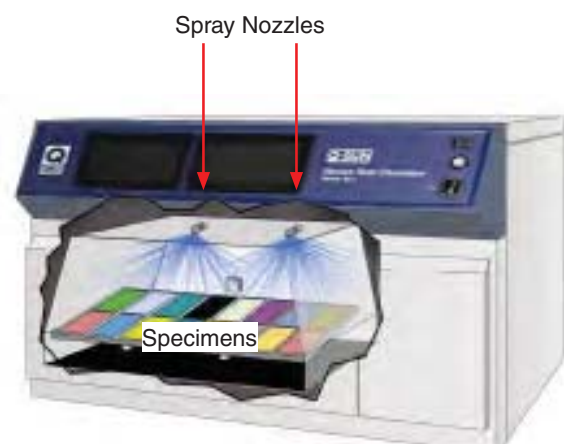


Figure 7b: Cut-away drawing showing spray nozzle location in test chamber.

Spray System Components

- Located in test chamber ([Figure 7b](#))
 - o Spray nozzles
- Located in plumbing box ([Figure 7c](#))
 - o Pressure gauge
 - o Pressure regulator
 - o Flow meter
- Located behind test chamber ([Figure 7d](#))
 - o Shut-off valve
 - o Water filter
 - o Flow switch
 - o Solenoid valve

For Xe-1-SE, Xe-1-SCE Models Only

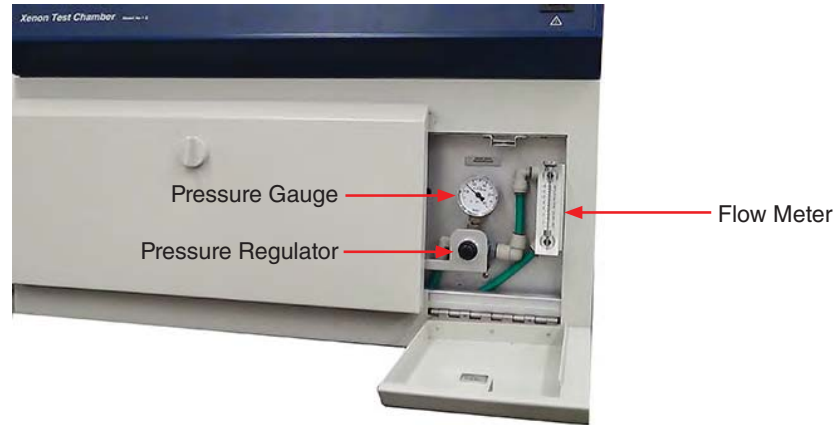


Figure 7c: Plumbing box inside right front door.

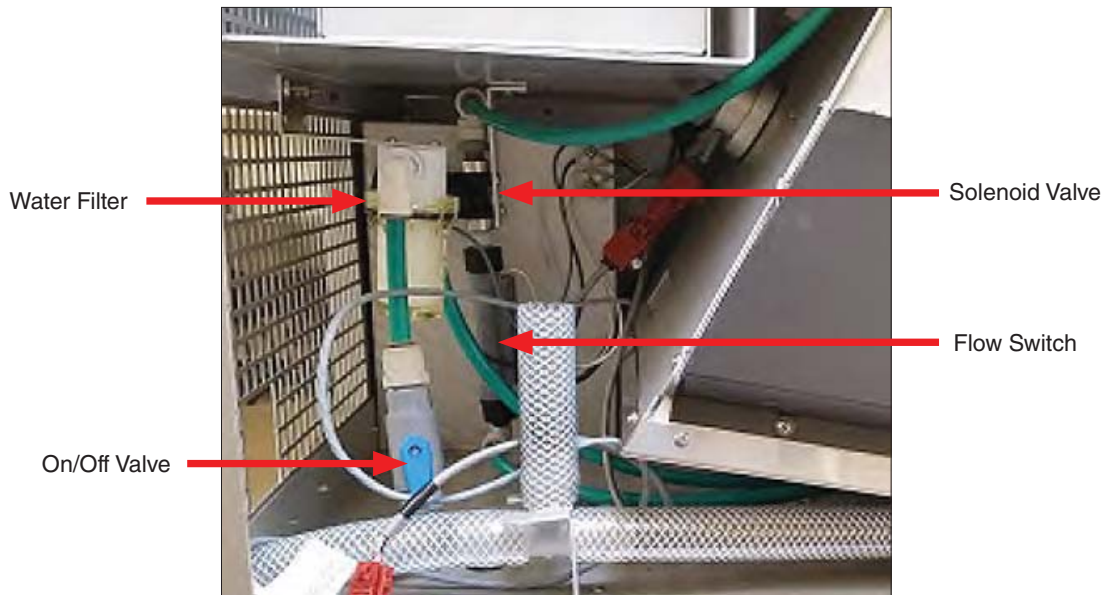


Figure 7d: Left side access panel removed to show spray system components.

Operation

- Use the pressure regulator to set flow rate to 1.4 liter per minute when spray is ON.
- During normal operation, the pressure gauge should read approximately 138 kPa (20 PSI).
- For testers with water spray (Xe-1-S, Xe-1-SC) the spray is pulsed 5 seconds on and 55 seconds off.
- 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.
- The spray pulse rates can be changed (see [Section 10.7](#)).
- Contact Q-Lab Repair and Tester Support ([Section 19](#)) for more information on setting spray pulse rates.

8. Xe-1-WE Water Immersion System (Aug 2016)

Overview

- The Q-SUN Xe-1-WE is the only Xe-1 model capable of submerging test specimens in a temperature-controlled water bath and also draining the water when desired.
- This capability meets the requirements of standards such as ETAG 002.
- The wedge-shaped base tilts the Xe-1 tester so that the specimen tray is horizontal (Figure 8a).
- Specimens are placed in the ponding tray that sits on the specimen tray.
- Water heated in the reservoir is pumped through the deionization cartridge and the fill tubes into the ponding tray.
- Water fills the ponding tray and drains out through holes in the corners and also over the top edge of the tray.
- The water then drains back to the reservoir.
- The purity meter monitors the quality of the water.
- See [LX-5090-SO Q-SUN Xe-1 System Overviews](#) for additional information.



Important: Very high purity water is required. See [Section 5.4](#) for water purity requirements.

Water Immersion System Components

- Located on cabinet exterior
 - Water purity meter ([Figure 8a](#))
 - Deionization enclosure ([Figure 8a](#))
 - Wedge shaped base ([Figure 8a](#))
- Located in test chamber
 - Fill tubes ([Figure 8b](#))
 - Ponding tray ([Figure 8b](#))
 - Specimen Tray ([Figure 8b](#))
- Located in base
 - Pump ([Figure 8c](#))
 - Water reservoir ([Figure 8c](#))
 - Water heater ([Figure 8c](#))
- Located in Deionization Enclosure
 - Deionization (DI) cartridge ([Figure 8d](#))



Figure 8a: Xe-1-WE exterior.

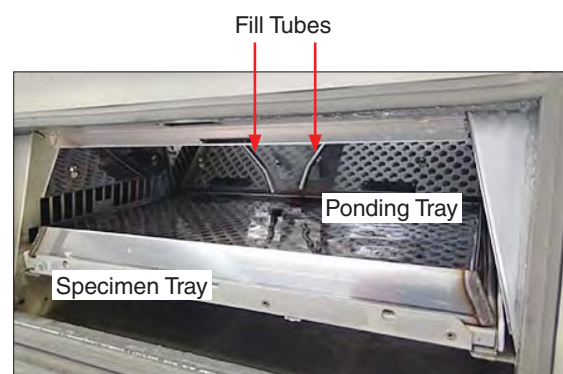


Figure 8b: Xe-1-WE test chamber with ponding tray.



Figure 8c: Lower door open showing reservoir and pump.



Figure 8d: Deionization enclosure access panel removed showing DI cartridge.

Operation

- The Xe-1-W can run LIGHT, DARK, LIGHT + IMMERSION, and DARK + IMMERSION steps.
- For immersion steps the ponding tray will fill in 2.5 minutes in 50 Hz testers and 1.75 minutes in 60 Hz testers.
- It takes about one hour to heat the water to 45 °C.
- In an Immersion step, on initial startup, or if the DI cartridge has been emptied of water, the pump will begin pumping water through the immersion system.
- The water in the reservoir will be too low until the DI cartridge fills and water begins to refill the reservoir through the fill tubes. See [LX-5090-SO Q-SUN Xe-1 System Overviews](#).
- Low water level in the reservoir will trigger an **M47 RESERVOIR WATER LEVEL TOO LOW** message and the tester will stop (see [Section 16](#) for troubleshooting information).
- This message is normal when the DI cartridge must be refilled.
- Clear the message. Wait 10 minutes for the reservoir to refill.
- Press **RUN**.
- The tester should run normally.
- If **M47** reappears, see [Section 16](#) for other possible **M47** causes.

NOTE: When not running a test cycle with an immersion step, the ponding tray should be removed.

9. Temperature Control System

9.1 Panel Temperature Sensors (Aug 2020)

Overview

- Xe-1 testers use a temperature sensor to control operating temperature during a test.
- The far more common black-painted sensors (Figure 9.1a and Figure 9.1b), as well as white-painted sensors (Figure 9.1d and Figure 9.1e) 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 9.1c).
- Uninsulated and insulated sensors produce very different test 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"x4" specimen holder in the Xe-1-SE, Xe-1-BCE and Xe-1-SCE (Figure 9.1f).
- The panel sensor is attached to the mesh insert in the ponding tray in the Xe-1-WE (Figure 9.1g).
- In the Xe-1-WE the panel temperature sensor is immersed in water during immersion steps.
- When running a standard test method, be sure to use the type of panel temperature sensor specified in the standard.

Black Panel Temperature Sensors



Figure 9.1a: Uninsulated black panel temperature sensor.



Figure 9.1b: Insulated black panel temperature sensor.

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 9.1c: ASTM vs. ISO designations for black panel temperature sensors.

White Panel Temperature Sensor

- White panel temperature sensors are identical to black panel temperature sensors, except painted white. White panel sensors are not used widely.
- Uninsulated and insulated white panels are available.
- 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-15350-L Q-SUN Xe-1 White Panel Installation](#) for detailed information on installing and operating white panel temperature sensors.



Figure 9.1d: Uninsulated white panel temperature sensor.



Figure 9.1e: Insulated white panel temperature sensor.

Sensor Location

- Securely mount the panel temperature sensor to the specimen tray or ponding tray (Xe-1-WE).
- Do not allow specimens to touch, cover, or shade the sensor (See [Section 9.1](#)).



Figure 9.1f: Correct location of the Xe-1-SE, Xe-1-BCE and Xe-1-SCE panel temperature sensor.

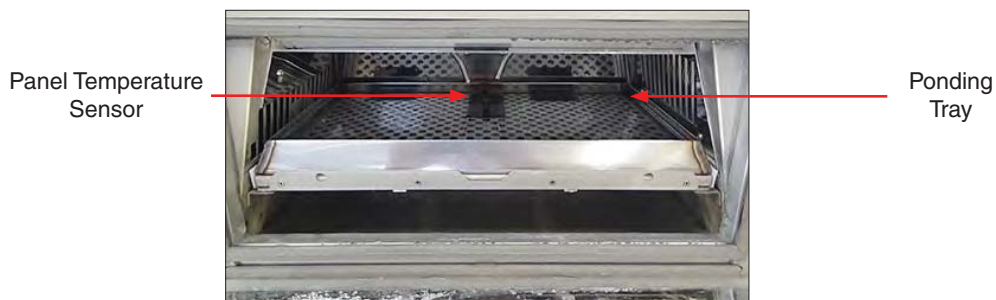


Figure 9.1g: Correct location of the Xe-1-WE panel temperature sensor.

9.2 Chamber Air Temperature Sensor (Aug 2020)

Xe-1-BCE and Xe-1-SCE Only

- In addition to the panel temperature sensor, Xe-1-BCE and Xe-1-SCE testers include a chamber air temperature sensor ([Figure 9.2](#)).
- A chamber air temperature sensor can also be installed in Xe-1-SE models as an option.
- Either the panel temperature or the chamber air temperature can be controlled.
 - Both temperatures cannot be controlled simultaneously.
 - The temperature to control is specified when the test cycle is programmed (see [Section 10.6.4](#))



Figure 9.2: Chamber air temperature sensor location in Xe-1-BCE and Xe-1-SCE test chambers.

9.3 Temperature Control (Aug 2020)

Xe-1-SE

- The black panel temperature is controlled using a variable speed blower and an electric heater (Figure 9.3a).
- Air is pulled into the tester through a filter and exhausted through vents in the rear of the chamber (Figure 9.3b).
- To lower black panel temperature, room air is circulated through the air duct into the chamber.
- The electric heater in the air duct is controlled to raise the black panel temperature.
- During Xe-1-SE and Xe-1-SCE spray steps, water spray reduces black panel temperature. As a consequence, black panel temperature is not controlled during spray steps.

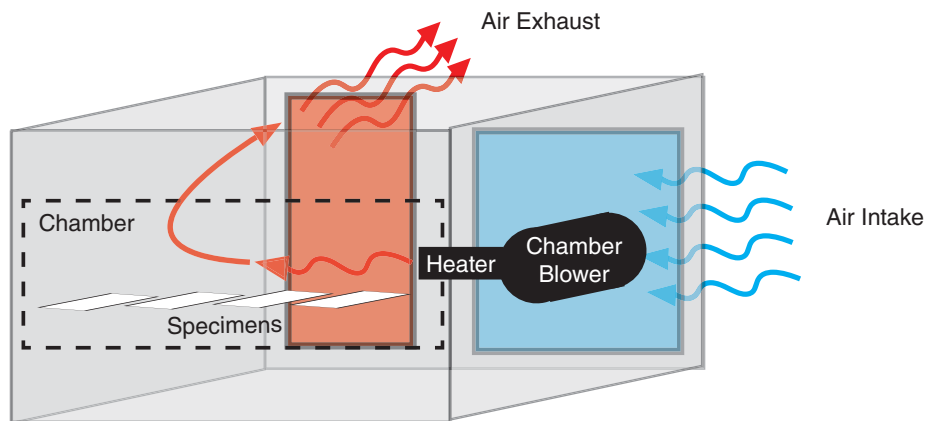


Figure 9.3a: Schematic front view Xe-1-SE air circulation.

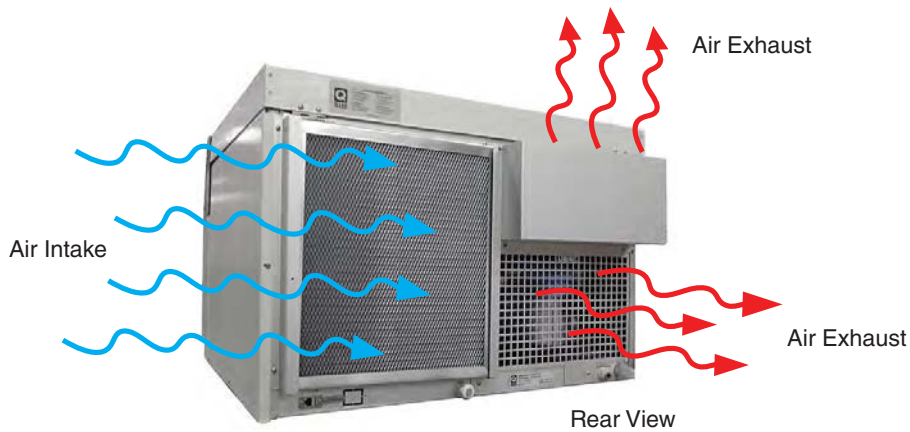


Figure 9.3b: Rear view Xe-1-SE air intake and exhaust areas.

Xe-1-BCE and Xe-1-SCE

- Q-SUN Xe-1-BCE and Xe-1-SCE models cool the test chamber by blowing either room air (if the chiller is off) or room air that has been cooled (if the chiller is on) into the chamber (Figure 9.3c).
- The Xe-1 automatically controls the chamber temperature by:
 - o Turning the chiller on or off
 - o Varying the amount of air blown into the chamber
 - o Heating the air if necessary

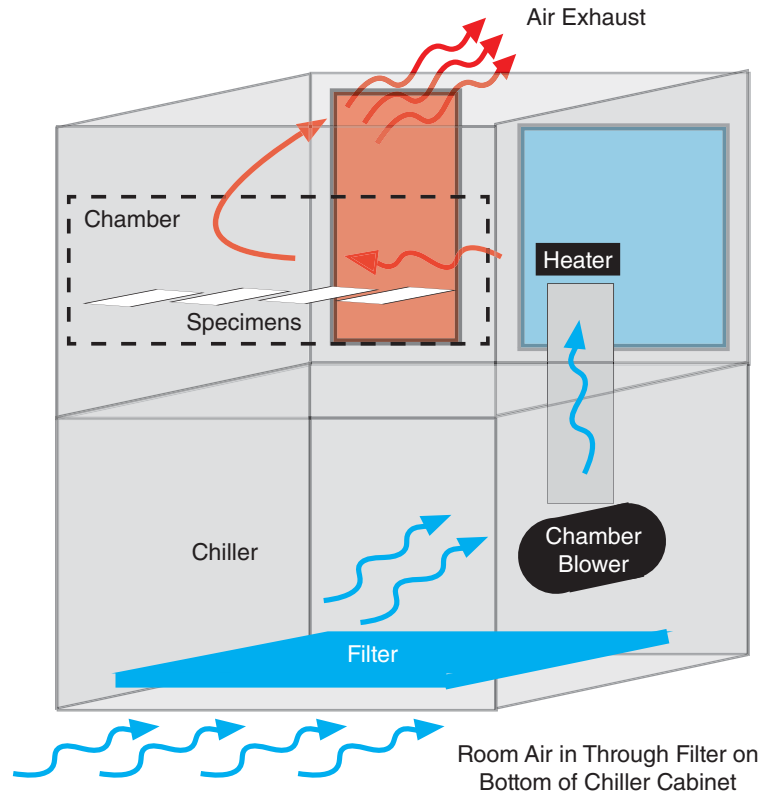


Figure 9.3c: Schematic front view of Xe-1-BCE and Xe-1-SCE air circulation.

Xe-1-BCE and Xe-1-SCE Damper Adjustment

- With most chiller systems, if the room temperature drops to about 20 °C (68 °F), the temperature of the cooling coil on the chiller can get below 0 °C (32 °F).
- 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 Xe-1-BCE and Xe-1-SCE chiller includes a manually-operated damper which is opened in a warm or normal temperature lab to allow maximum cooling efficiency, but is partially closed in a cool (20 °C / 68 °F or less) room to recirculate some of the exhausted heat (Figure 9.3d).
- This increases the air temperature going through the cooling coil, reducing the danger of freeze-up.
- A label (Figure 9.3e) listing the recommended damper adjustment levels is located near the damper adjustment lever.

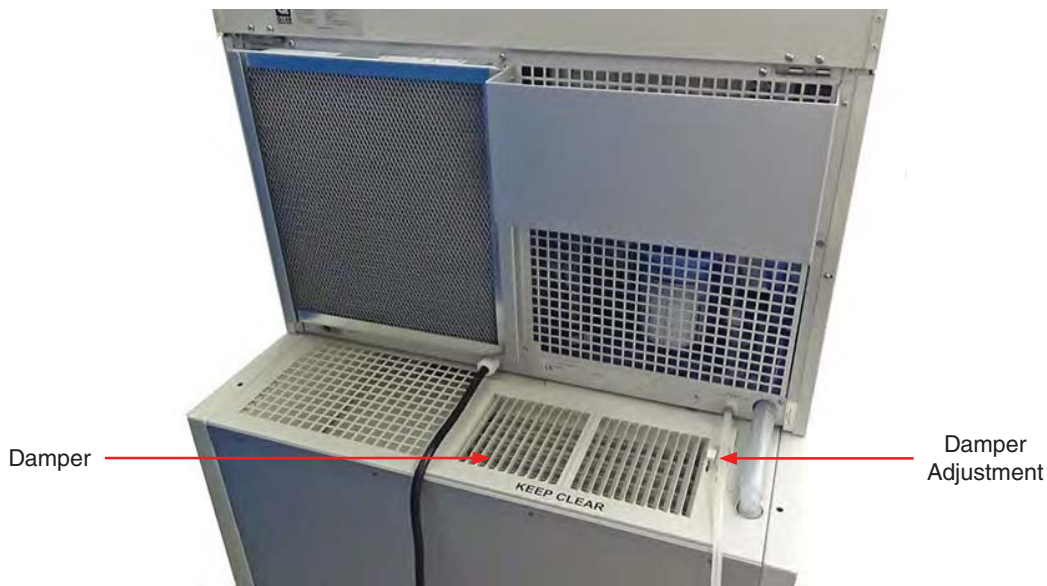


Figure 9.3d: Rear view of Xe-1-BCE or Xe-1-SCE showing damper.

SET DAMPER FOR LOWEST EXPECTED ROOM TEMP.	
←	20+ (68)
←	18 (64)
←	16 (61)
←	14 (57)
←	12 (54)
←	10 (50)
	°C °F

Figure 9.3e: Damper adjustment levels.

Xe-1-WE

- During LIGHT and DARK steps the panel temperature is controlled in the same way as the Xe-1-SE model.
- During LIGHT + IMMERSION and DARK + IMMERSION steps the black panel temperature is controlled using the water heater instead of the air heater (Figure 9.3f).
- When the black panel is immersed in water the black panel temperature is the same as the water temperature.

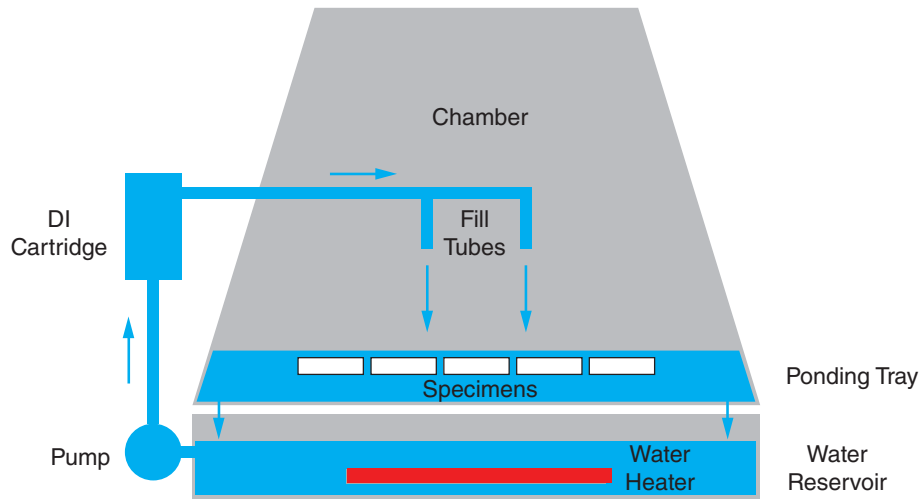


Figure 9.3f: Xe-1-WE water circulation schematic.

10. Main Controller Operation

10.1 Overview (Aug 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.

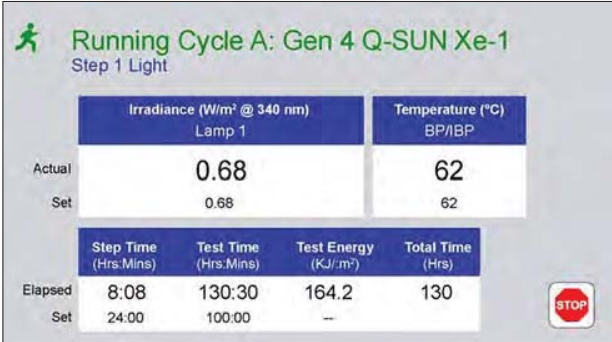


Figure 10.1b: Status screen displaying typical operating conditions.



Figure 10.1c: Menu screen displaying the main menu.



Figure 10.1d: Touch to activate.

10.2 Status Screen (Aug 2020)

- The Status Screen (Figure 10.2a) displays:
 - o The status icon and state that indicates the overall status of the tester (see Overall Test Status).
 - o The cycle identification and the name of the test being run.
 - o The current test step number and type of step.
 - o Actual irradiance and set point irradiance values.
 - o Actual temperature and set point temperature of the panel temperature sensor.
 - o Elapsed and set step time and test time.
 - o Tester total operation time.
 - o RUN / STOP button. This button is the only operator control interface on the status screen.

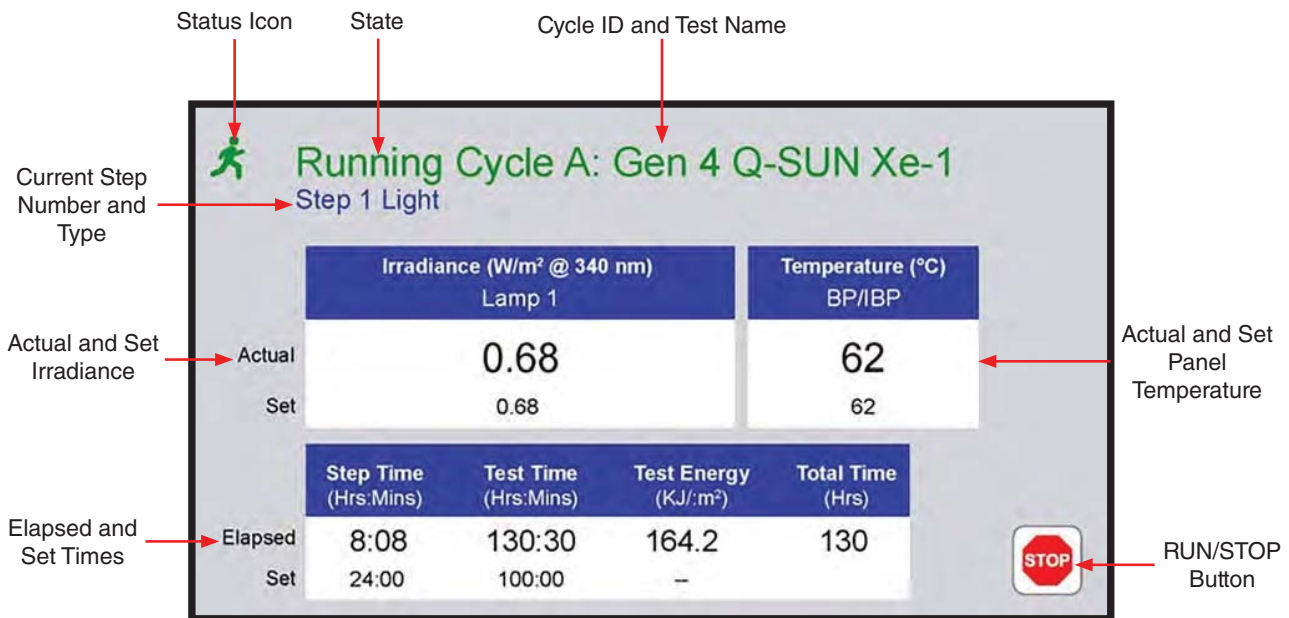


Figure 10.2a: Status screen components.

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.

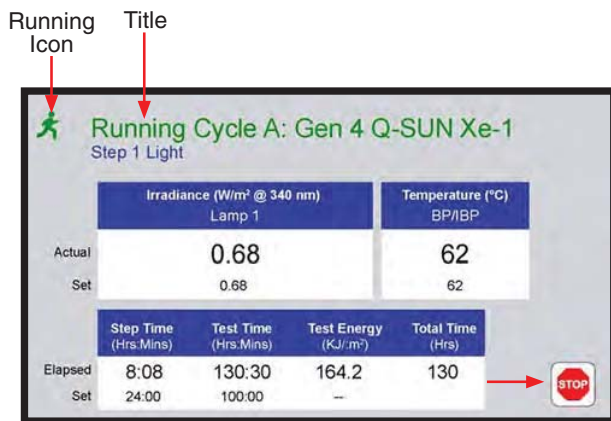


Figure 10.2b: Status icon and title when test running.

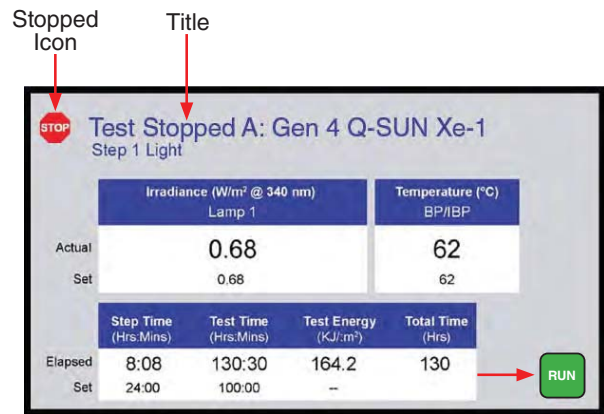


Figure 10.2c: Status icon and title when test stopped.

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:
 - o Notifications (Section 10.4)
 - o Manage Test Timers (Section 10.5)
 - o Manage Cycles (Section 10.6)
 - o Calibration (Section 12)
 - o Settings (Section 10.7)
 - o Diagnostics (Section 10.8)
 - o Contact Q-Lab (Section 10.9)



Figure 10.3: Main Menu screen.

10.4 Notifications (Aug 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).
 - A red triangle indicates an error occurred that stopped the test.
 - A yellow triangle indicates an event that did not stop the test, such as a maintenance reminder.
 - A blue triangle indicates the successful completion of a test.
- Touch the notification information icon to display details (Figure 10.4f and Figure 10.4g).
- See Section 16.2 for a complete list of notifications.

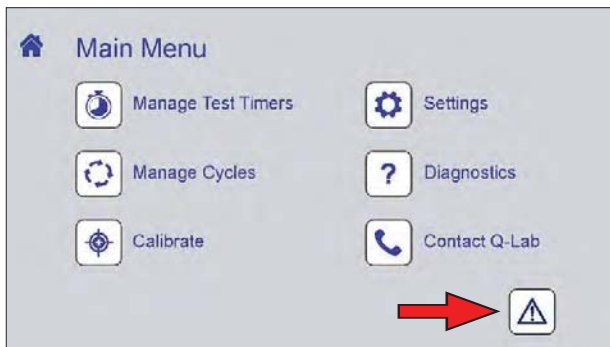


Figure 10.4a: The notifications icon. Icon color changes depending on notification status.



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.

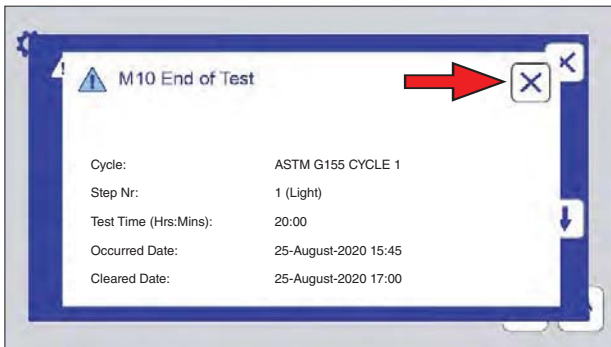


Figure 10.4g: Notification details. Touch the Close icon to return to the Notifications Screen.



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.

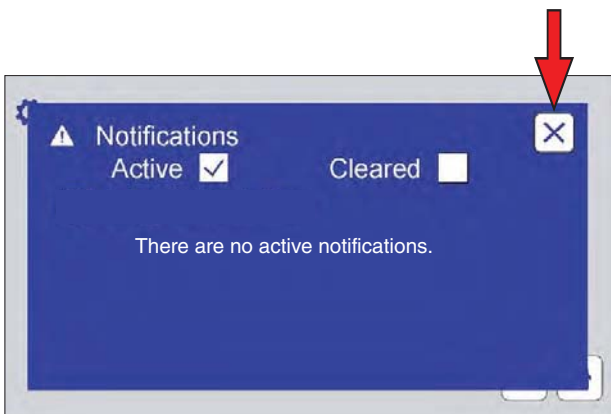


Figure 10.4i: Touch the Notification Screen close icon to re-display the main menu.

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 (Aug 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.

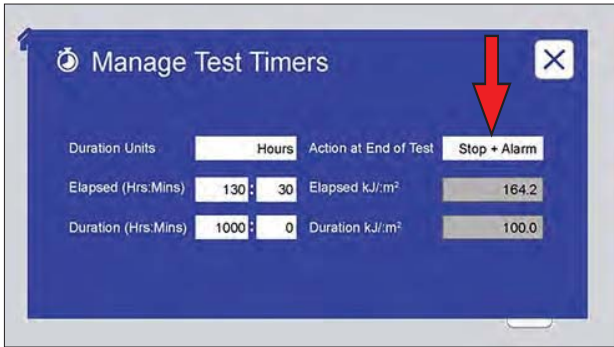


Figure 10.5b: Manage Test Timers screen. Touch the Action at End of Test text box to specify the action.



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

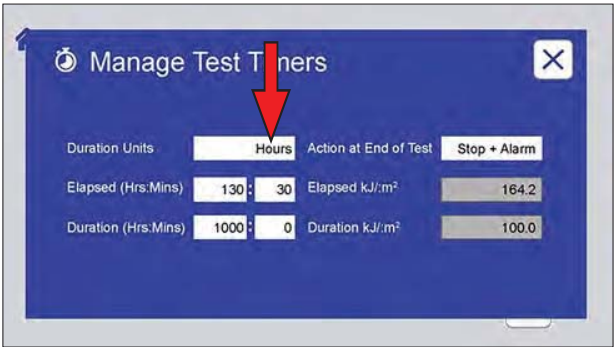


Figure 10.5d: Touch the Duration Units text box to set the test duration units in hours or in energy (kJ/m²).

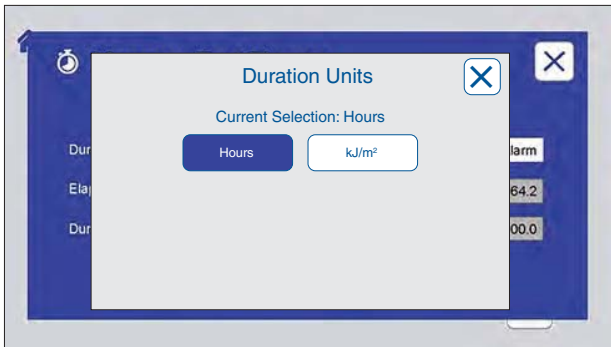


Figure 10.5e: Touch the Hours or kJ/m² text boxes to select the duration units.

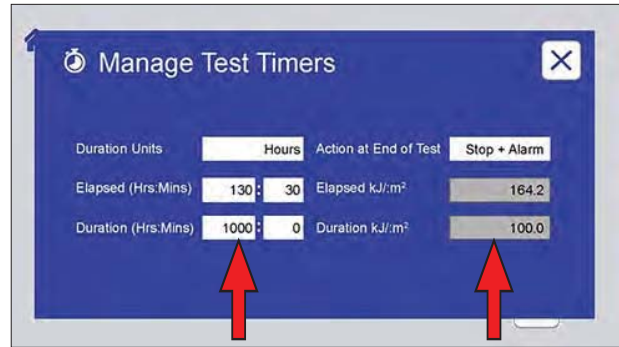


Figure 10.5f: The value text boxes for the selected duration unit are enabled. The text boxes for the unselected duration unit are disabled (grayed out).

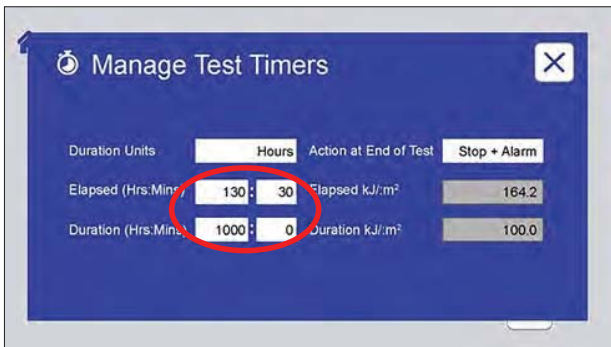


Figure 10.5g: Touch the enabled text box(s) to enter the new values.

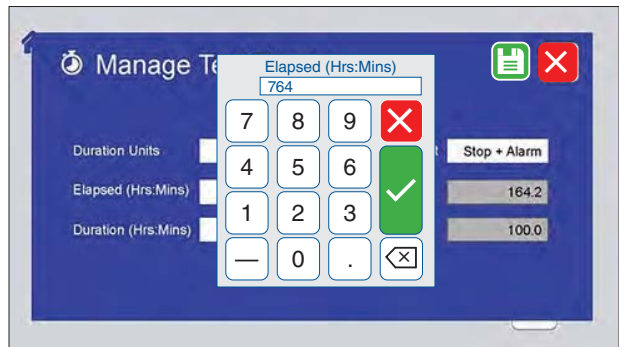


Figure 10.5h: Enter the new values using the numeric keypad. Touch the check mark to accept, or the X to cancel changes.

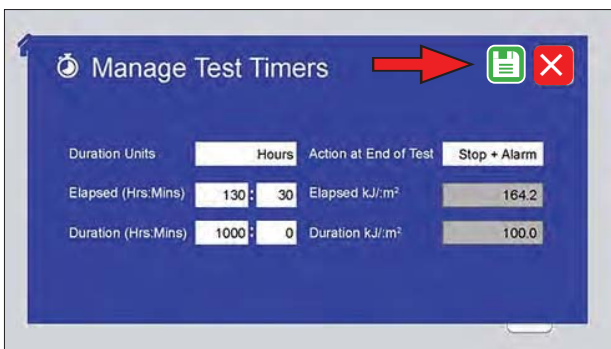


Figure 10.5i: If any changes have been made, touch the save changes icon or the cancel changes icon to re-display the Main Menu screen.

10.6 Manage Cycles (Aug 2020)

- On the Main Menu screen touch the Manage Cycles icon (Figure 10.6.1a) to display the Manage Cycles screen.
- The Manage Cycles screen is displayed showing the active test cycle and the steps in the cycle, with the currently executing step indicated (Figure 10.6.1b).
- Each cycle is stored with an alphanumeric (A through J) identification tab (Figure 10.6.1b).
 - Touch a tab to select a cycle.
 - The cycle name (ex. ASTM G155) along with step number, function, irradiance and temperature set points, and time are shown for each step in the cycle.
- Each lettered cycle tab provides controls to:
 - Delete a cycle (Figure 10.6.2a through Figure 10.6.2c).
 - An actively running cycle cannot be deleted.
 - Deleting an inactive cycle will create a blank cycle with only a final step.
 - Lock a cycle to prevent unauthorized changes (Figure 10.6.3a through Figure 10.6.3e).
 - Add, edit, or delete steps in a cycle (Figure 10.6.4a through Figure 10.6.6d). Pre-programmed test cycles cannot be edited (they can be deleted).
 - Create a new cycle (Figure 10.6.7a through Figure 10.6.7e).
 - Run a cycle from any of its steps (Figure 10.6.8a through Figure 10.6.8d).
- Pre-programmed test cycles cannot be modified. They can, however, be deleted.
- The Q-SUN main controller can store ten (10) test cycles.
- A test cycle can consist of up to twenty-five (25) steps.

10.6.1 Select a Cycle



Figure 10.6.1a: Manage Cycles icon.

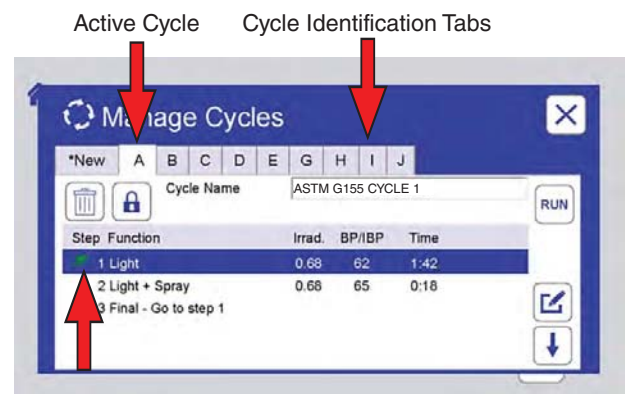


Figure 10.6.1b: Manage Cycles screen. The active cycle is displayed. The currently running step is indicated. From here you can run that cycle, or perform other actions as in the next sections

10.6.2 Delete a Cycle



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

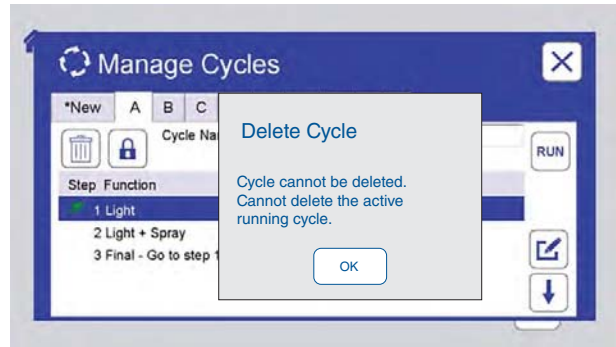


Figure 10.6.2b: The active running cycle cannot be deleted. Touch OK to clear message.

10.6.3 Lock a Cycle

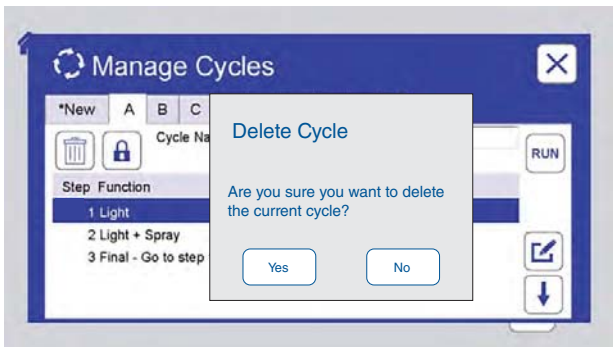


Figure 10.6.2c: To delete an inactive cycle, the operator is prompted for verification. Touch No to cancel delete. Touch Yes to create a blank cycle.

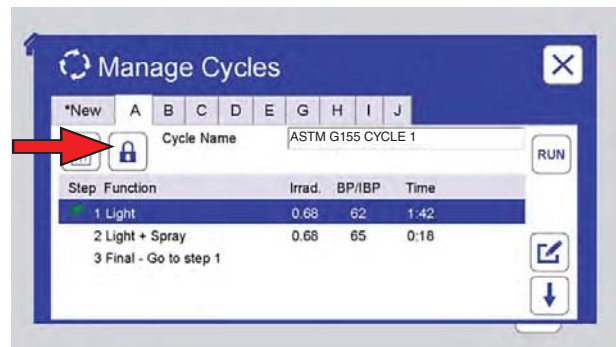


Figure 10.6.3a: Touch the lock icon to lock the cycle. **NOTE:** Pre-programmed test cycles are locked by Q-Lab.

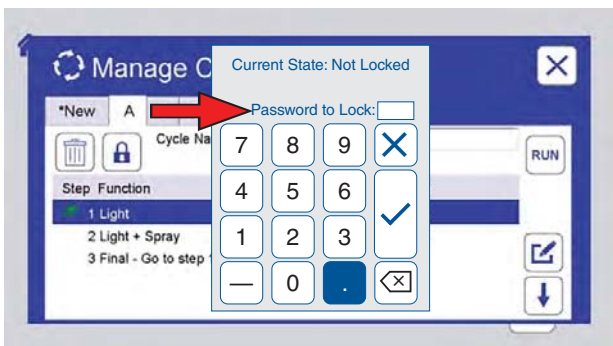


Figure 10.6.3b: The numeric keypad is displayed. A password must be entered to lock the cycle.

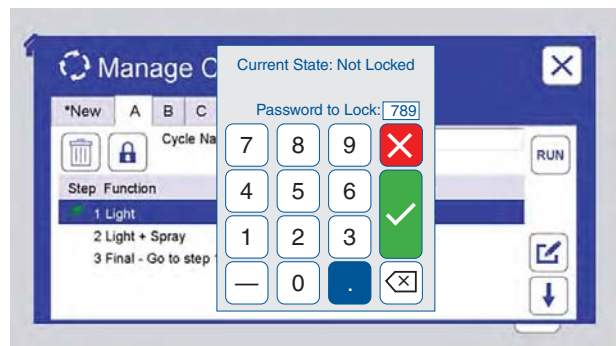


Figure 10.6.3c: Enter the numeric password. Touch the check mark button to save, or the X button to cancel setting the password.

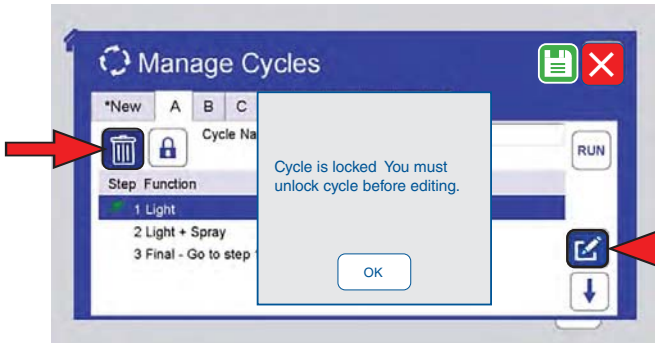


Figure 10.6.3d: This message is displayed if a delete or edit icon is touched on a locked cycle.

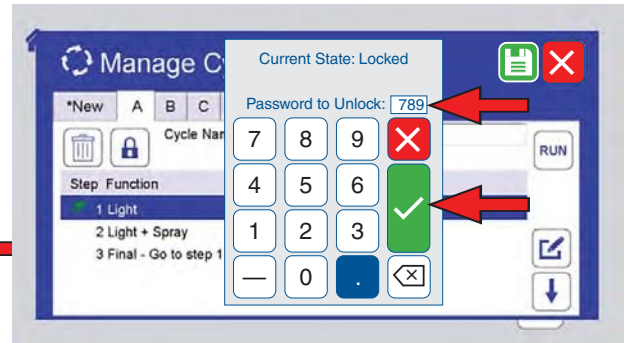


Figure 10.6.3e: To unlock a cycle, touch the lock icon, enter the password, then touch the check mark button.

10.6.4 Add a Step to a Cycle

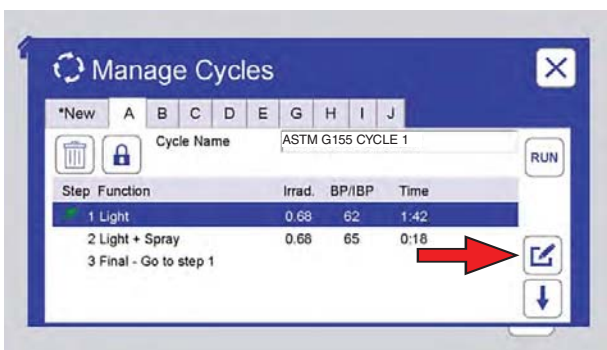


Figure 10.6.4a: For any cycle, a new step can be added before or after an existing step. Select the existing step then touch the Edit icon.

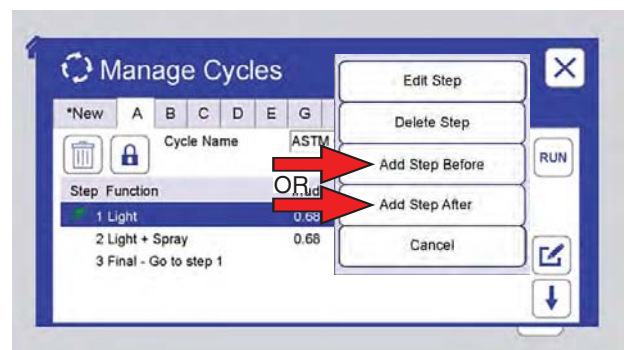


Figure 10.6.4b: The step revision control is displayed. Touch Add Step Before or Add Step After.

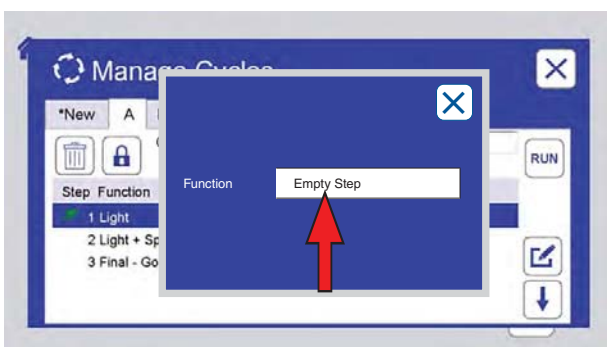


Figure 10.6.4c: Touch the function text box to select a function.

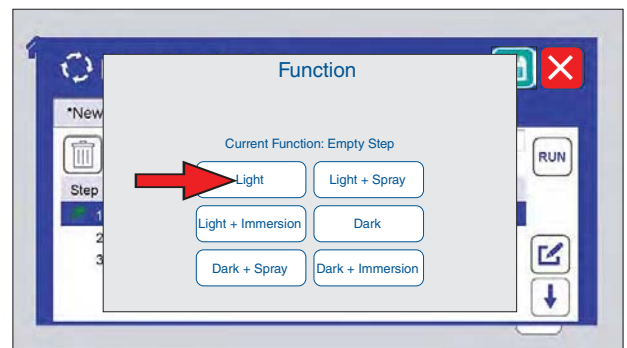


Figure 10.6.4d: Touch the desired function. Spray functions are displayed for spray (S) models only. Immersion functions are displayed for immersion (WE) models only.

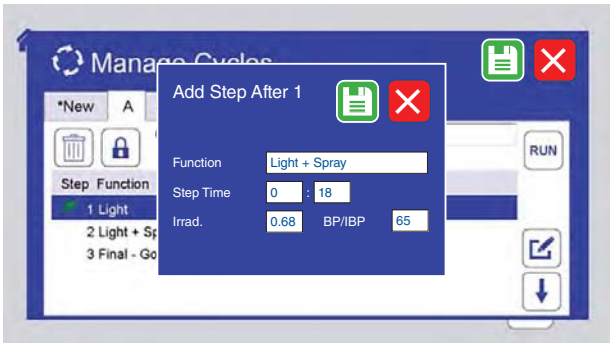


Figure 10.6.4e: Step values must be entered. Touch the Step Time (Hrs:Mins), Irrad(iance), and BP/IBP text boxes to select.

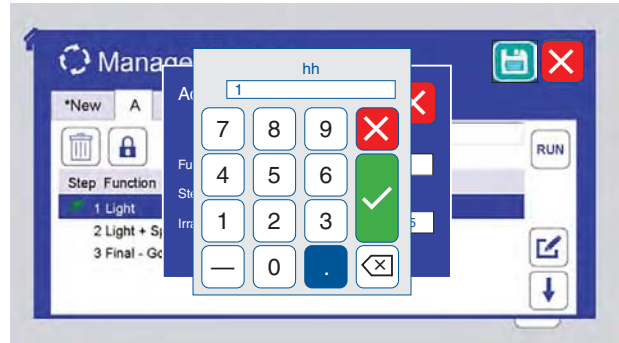


Figure 10.6.4f: Use the numeric keypad to enter the values for each parameter. Touch the check mark button to accept those values or the X button to cancel.

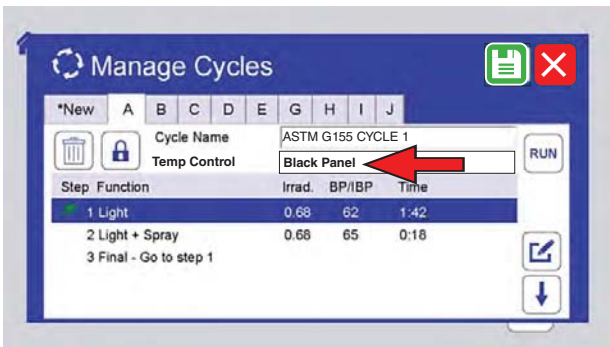


Figure 10.6.4g: For testers with chamber air temperature sensors, touch the Temp Control text box to select black panel or chamber air temperature control.

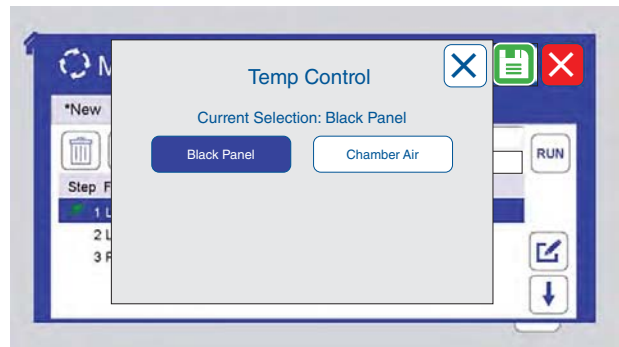


Figure 10.6.4h: Touch the Black Panel or the Chamber Air button to select that sensor for temperature control.

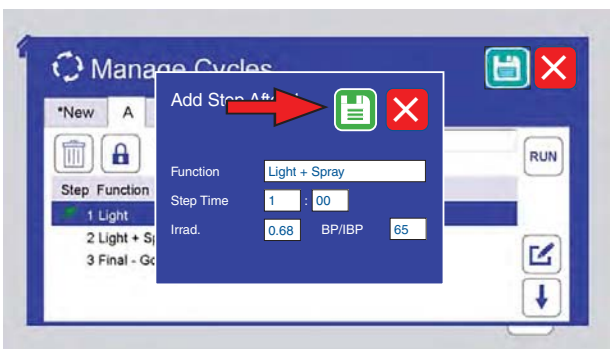


Figure 10.6.4i: The new step values are displayed. Touch the save icon to save the new step.

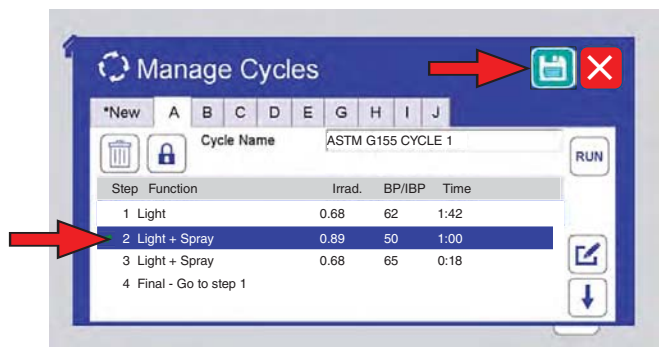


Figure 10.6.4j: The new step is shown for the cycle. Touch the save icon to save the modified cycle.

10.6.5 Edit a Step

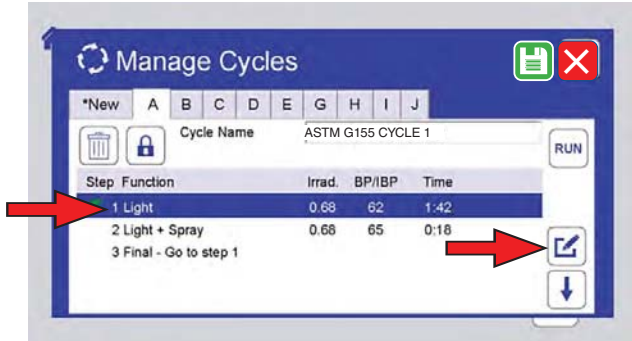


Figure 10.6.5a: To edit a step, touch the cycle ID tab, touch the step to select, then touch the pencil icon.

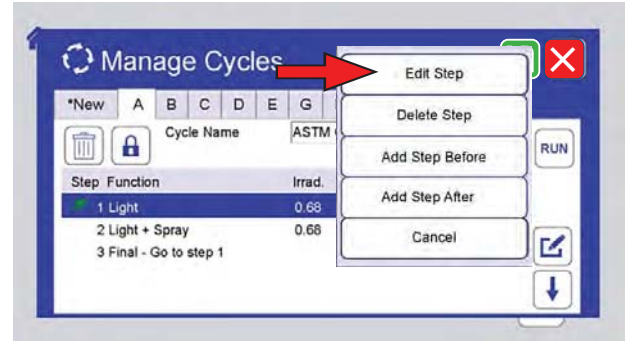


Figure 10.6.5b: Touch the Edit Step button.

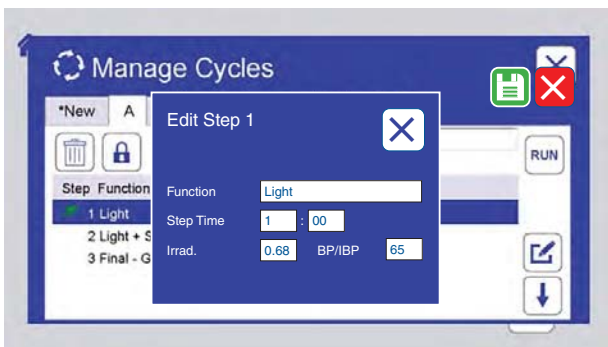


Figure 10.6.5c: Touch the Function, Step Time, Irradiance, or BP/IBP text boxes to select.

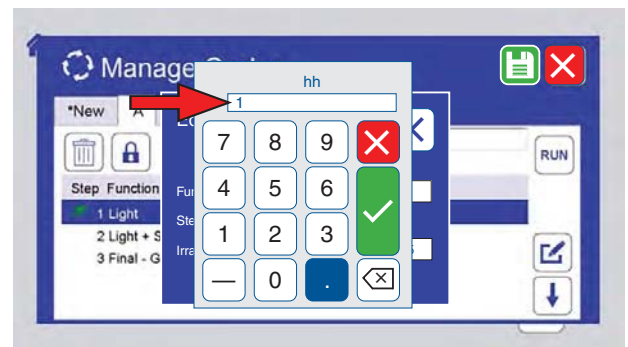


Figure 10.6.5d: Use the numeric keypad to enter the new values for the selected step. Touch the check mark button to accept those values or the X button to cancel.

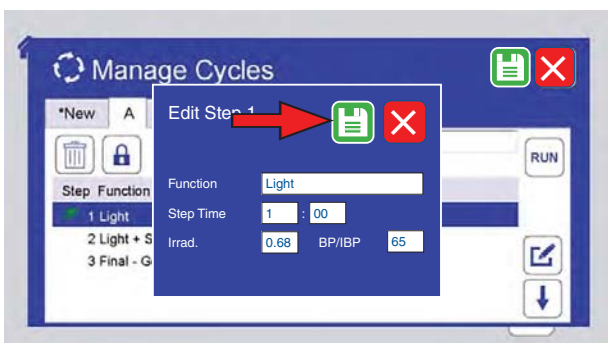


Figure 10.6.5e: Touch the save icon to save the edited step.



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

10.6.6 Delete a Step

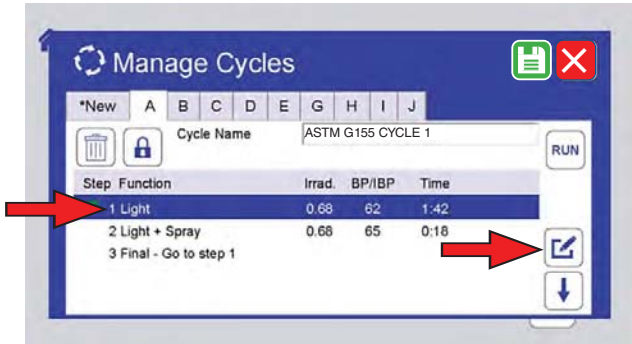


Figure 10.6.6a: To delete a step, touch the cycle ID tab, touch the step to delete, then touch the pencil icon.

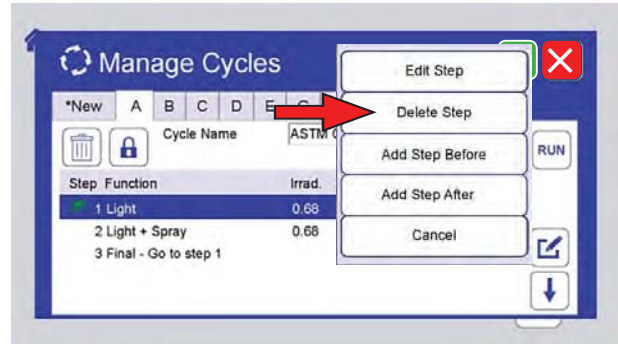


Figure 10.6.6b: Select Delete Step.

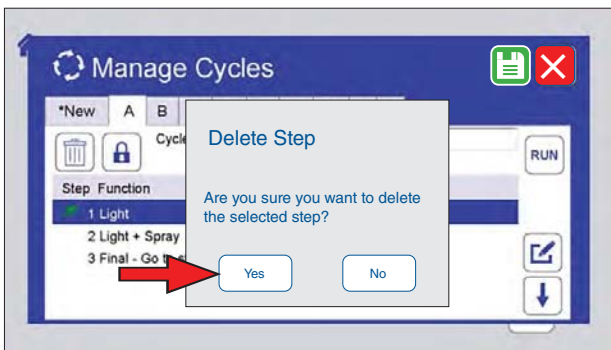


Figure 10.6.6c: Touch the Yes button to delete the step or touch No to cancel the delete.

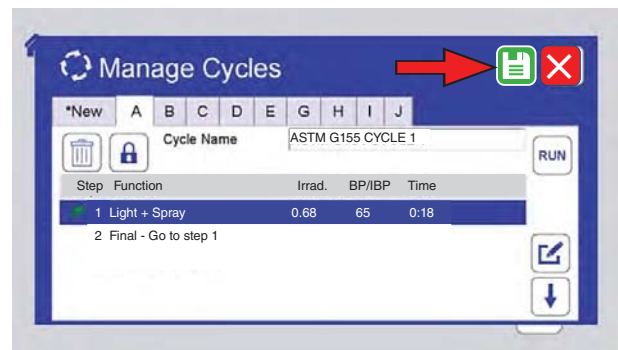


Figure 10.6.6d: Touch the save icon to save the edited cycle.

10.6.7 Create a New Cycle

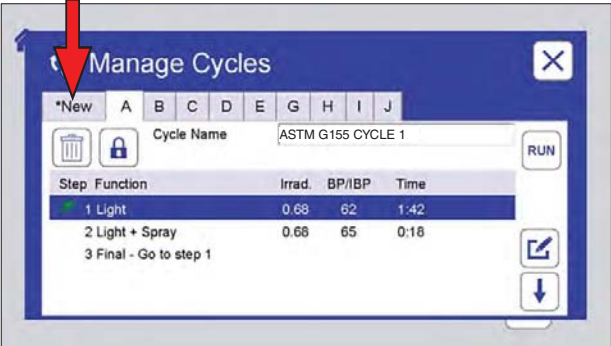


Figure 10.6.7a: To create a new cycle, touch the *New tab.

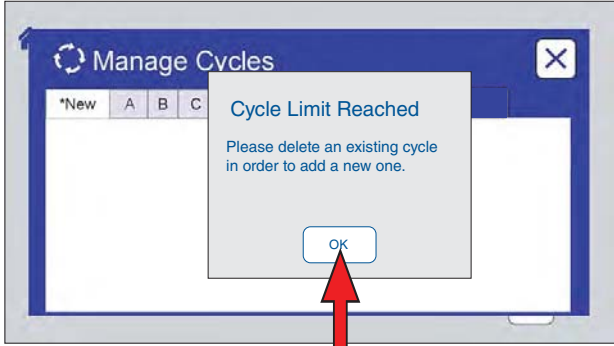


Figure 10.6.7b: If all available cycles are programmed, this message is displayed Touch OK.

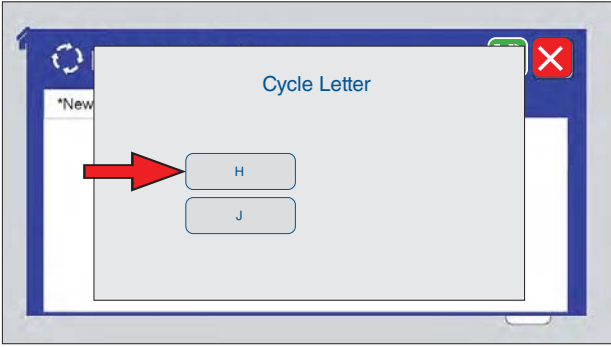


Figure 10.6.7c: If there are open cycles, the available cycle letters are displayed. Touch a letter to program that cycle.

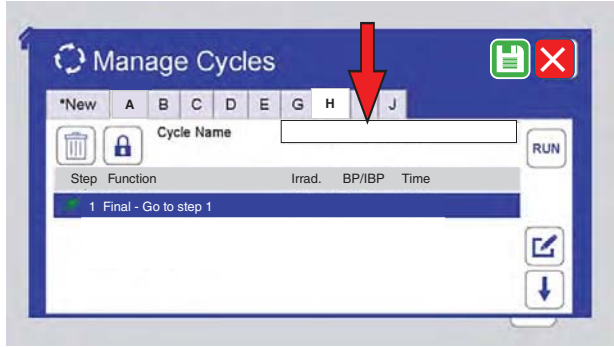


Figure 10.6.7d: An empty cycle is created with only a final step. Enter a name for the new cycle.

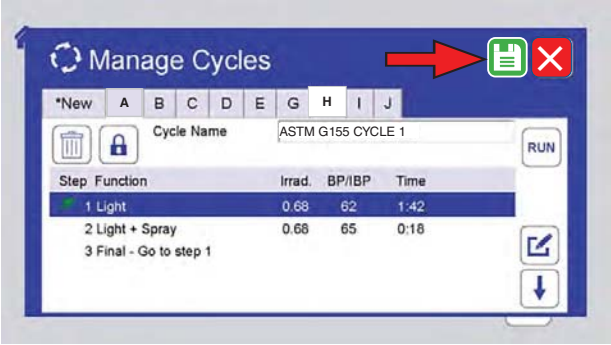


Figure 10.6.7e: Follow Figure 10.6.4a through Figure 10.6.4j to add steps and save the new cycle.

10.6.8 Run From Step

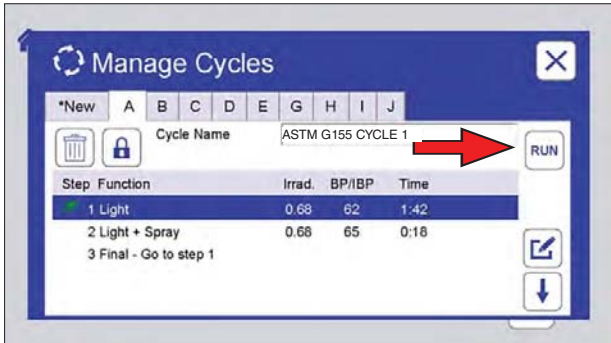


Figure 10.6.8a: A cycle can be run from a specified time in one of its steps. Select the step, then touch the Run icon.

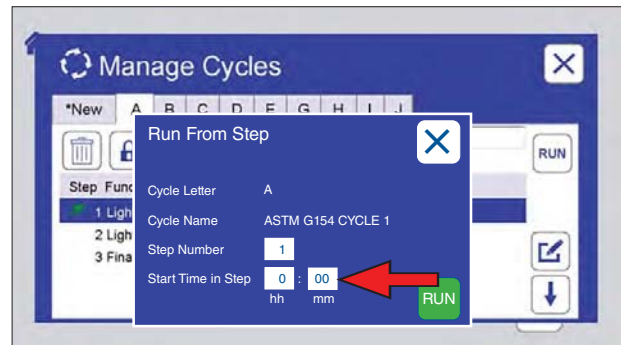


Figure 10.6.8b: Touch the start time hh (hours) text box or the mm (minutes) text box to set the time. Start time can be set to 0 to start at the beginning of the step

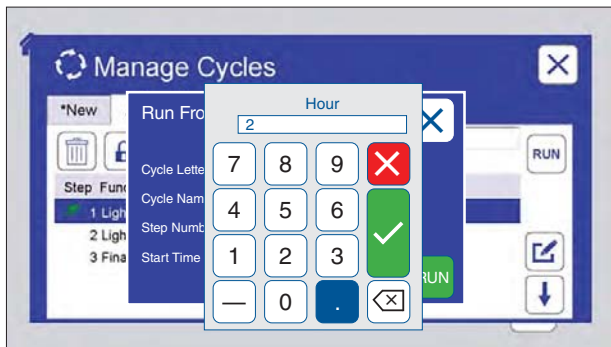


Figure 10.6.8c: Use the numeric key pad to set the time. Touch the check mark button to accept those values or the X button to cancel.

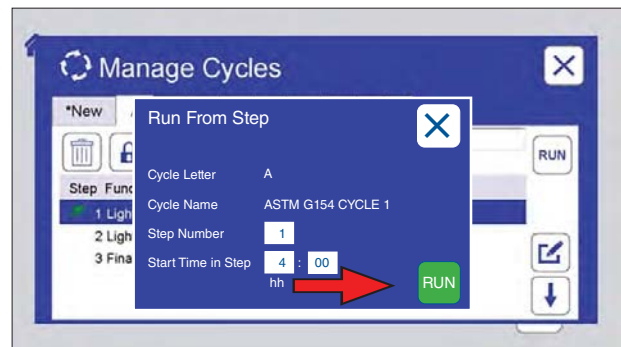


Figure 10.6.8d: Touch the Run icon to run the step from the time entered.

10.7 Settings (Sep 2020)

- 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), available are:
 - 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 the appropriate error message M900, M901, or M902 (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](#)).

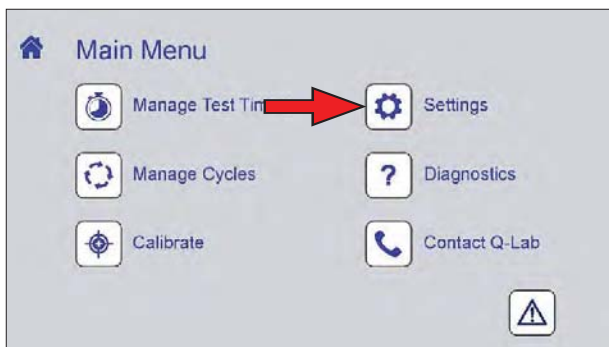


Figure 10.7a: Touch the Settings icon on the Main Menu screen to display settings controls.

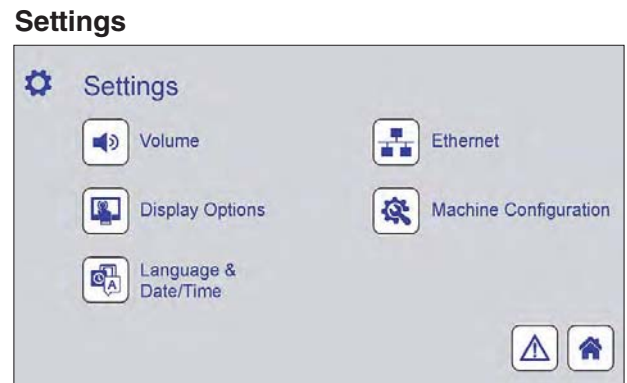


Figure 10.7b: Settings screen. Touch any icon to display controls for that function. The notification screen ([Section 10.4](#)) and the home screen can also be displayed.

Volume

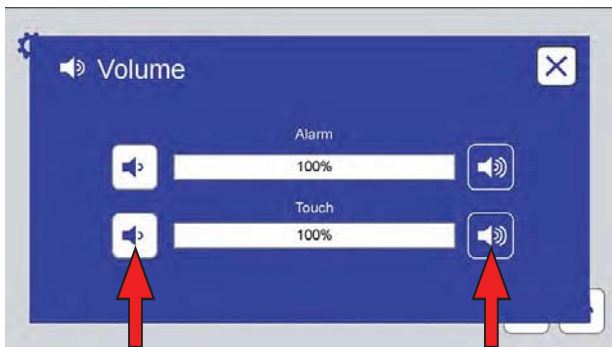


Figure 10.7c: The Volume screen provides controls to set volume (0 to 100) for machine alarms and for the screen touch indicator. Touch a volume icon to adjust.

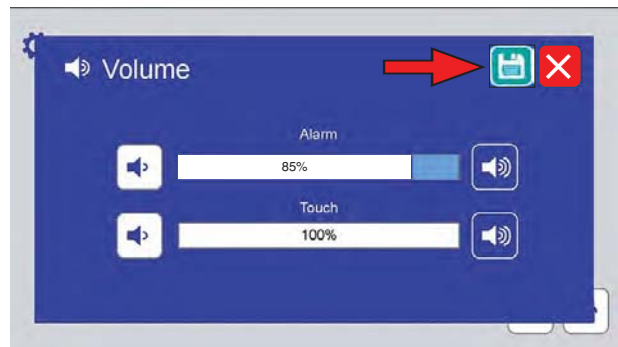


Figure 10.7d: If a volume is changed, touch the save icon to save the new volume level.

Display Options

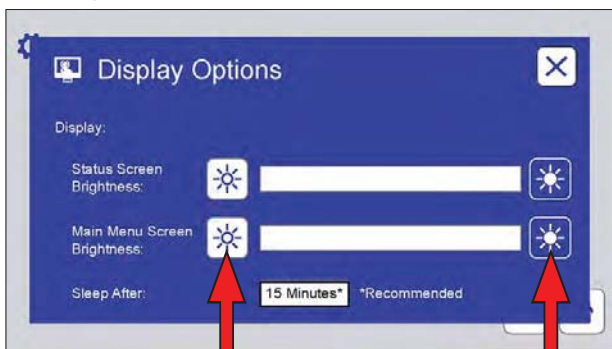


Figure 10.7e: The Display Options screen provides controls to adjust the brightness of the status and menu screens. Touch a brightness icon to adjust.

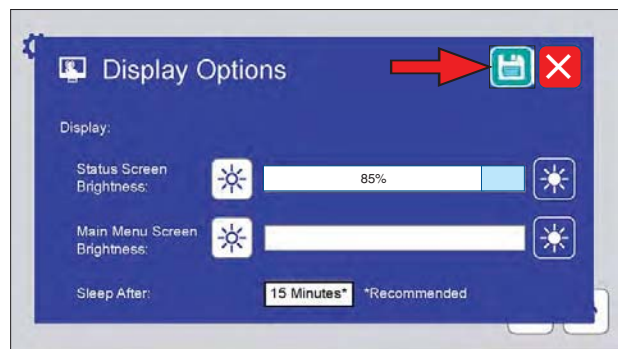


Figure 10.7f: If a brightness is changed, touch the save icon to save the new brightness level.

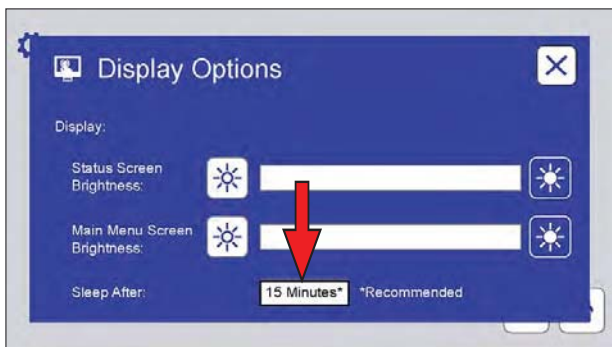


Figure 10.7g: The Display Options screen can also be used to adjust the inactive time that elapses before the screens “go to sleep” (i.e. deactivate). 15 minutes is recommended.

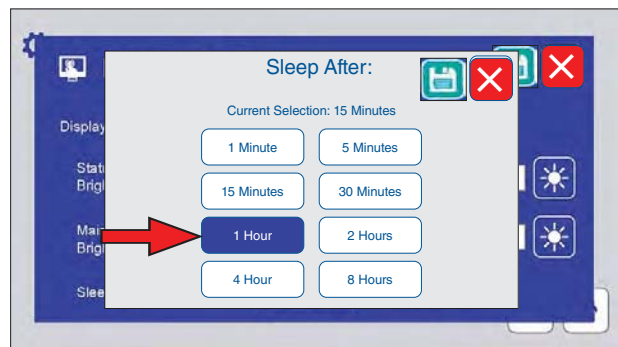


Figure 10.7h: Touch a time button to change the time before screens go to sleep. If changed, touch the save icon to save the new time.

Language



Figure 10.7i: This screen displays controls to select the control interface language.



Figure 10.7j: Touch the language text box to display the possible display 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.

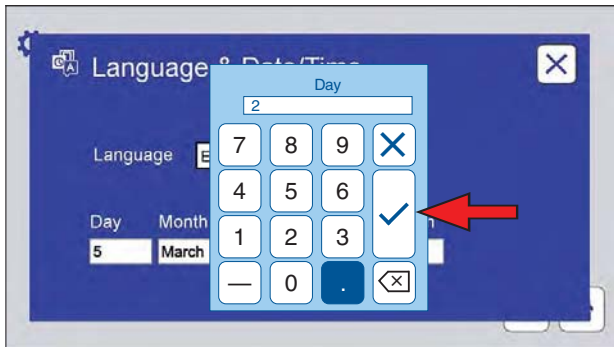


Figure 10.7n: The numeric keypad is used to set Day, Year, hh, and mm. Enter the number, then touch the check mark button.

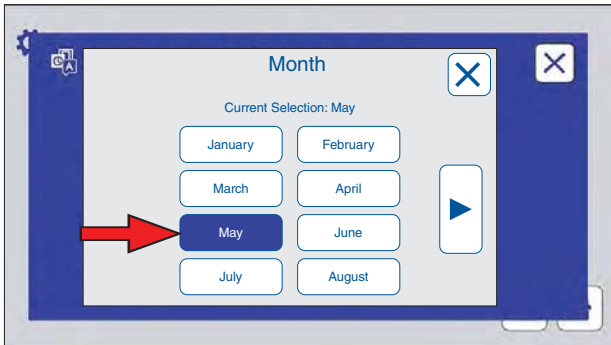


Figure 10.7o: Touch the month button to select the month on this display. Touch the right arrow button to display the remaining months.

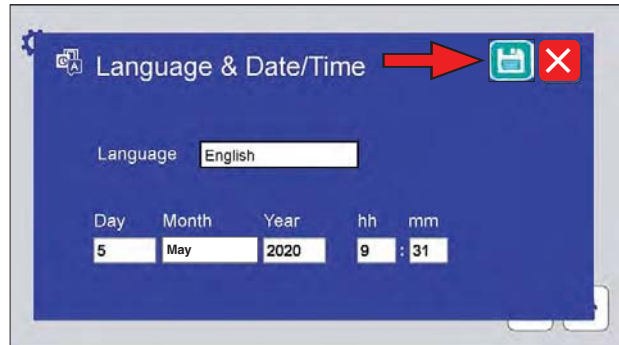


Figure 10.7p: Touch the save icon to save any changes to the Language & Date/Time.

Ethernet

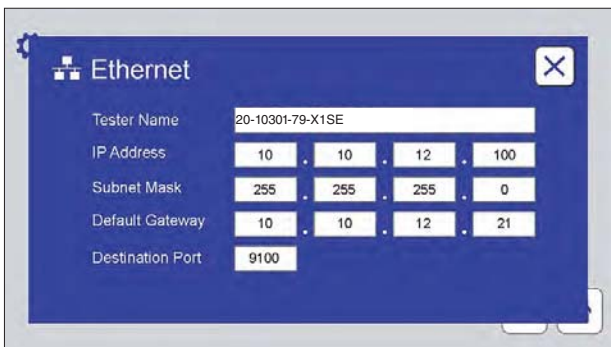


Figure 10.7q: This screen displays and provides text boxes to enter ethernet connection parameters.

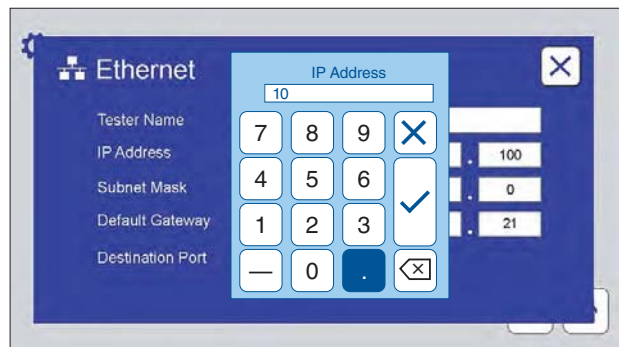


Figure 10.7r: Touch any text box to use the numeric keypad to input the parameter.

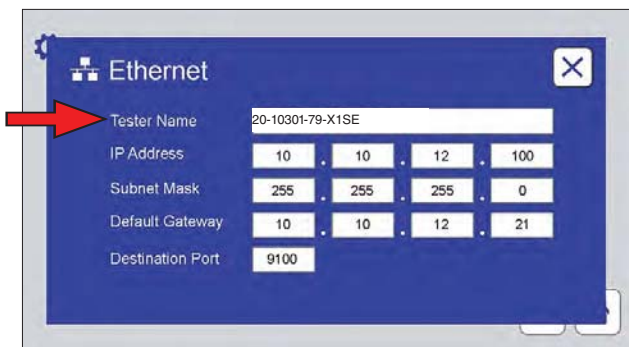


Figure 10.7s: Additionally, this screen has the name of the tester as it would appear on a network, if using the VIRTUAL STRIPCHART network version.

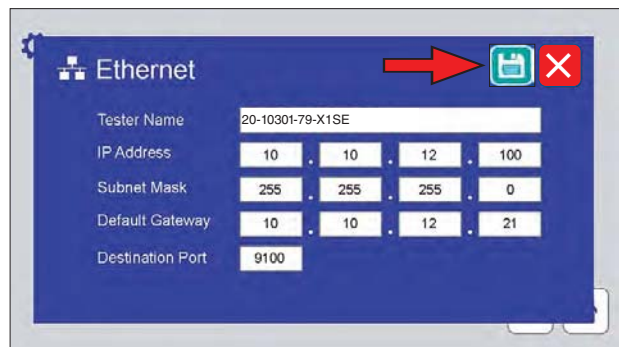


Figure 10.7t: Touch the save icon to save any changes to Ethernet parameters.

Machine Configuration

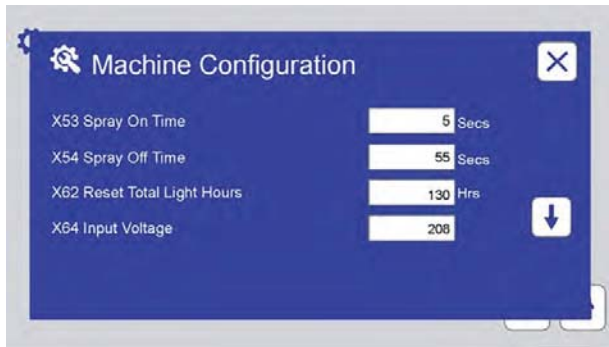


Figure 10.7u: Machine Configuration includes several customizable parameters. Contact [Q-Lab Repair](#) with questions about parameters. Touch the down arrow to display additional parameters.

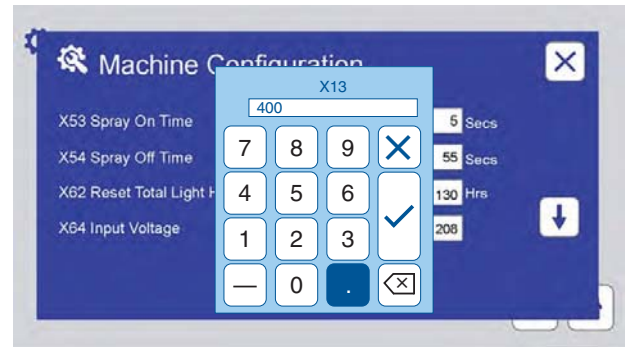


Figure 10.7v: Touch the parameter text box to use the numeric keypad to enter a value. Contact [Q-Lab Repair and Tester Support](#) ([Section 19](#)) for more information.

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 “M14 Perform Routine Service” reminders.
X125	Reset Routine Service	Hrs	1-900	This sets the time until the next “M14 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 Operation



Figure 10.7x: Main Menu in single screen mode. Touch the screen icon.

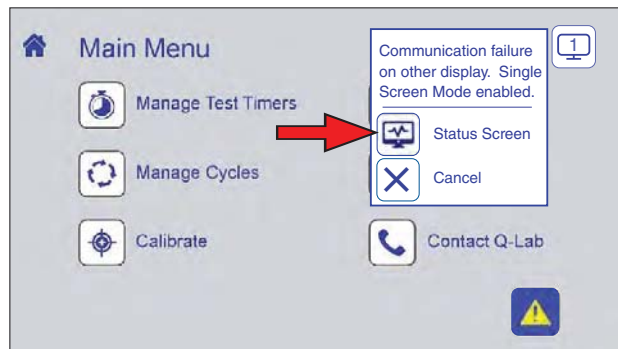


Figure 10.7y: Touch the Status Screen icon to display the Status Screen.

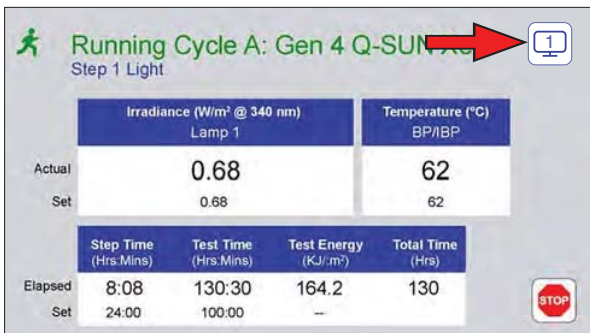


Figure 10.7z: Status Screen in single screen mode. Touch the screen icon.

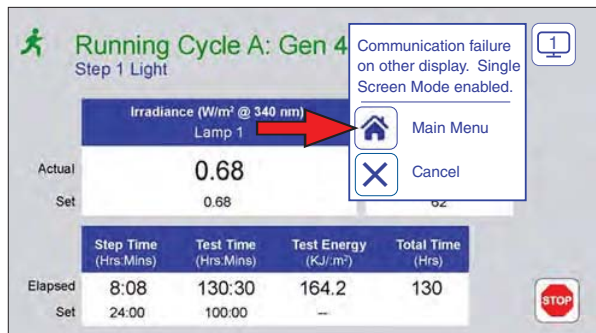


Figure 10.7aa: Touch the Main Menu icon to display the Main Menu.

10.8 Diagnostics (Sep 2020)

- Diagnostics are a list of tester current operating conditions (Figure 10.8a).
- 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.

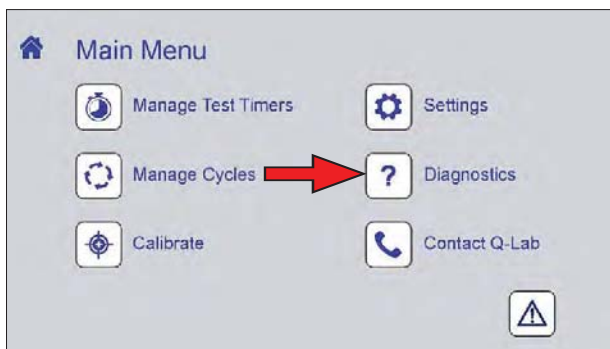


Figure 10.8a: Touch the Diagnostics icon on the Main Menu screen to display diagnostic information.



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

Section 10. Main Controller Operation

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. The light calibration interval is set to X21. When the timer exceeds X21, the "M14 TIME TO REPLACE LAMP X X X" and the "M31 CALIBRATE LIGHT SENSORS" alarms occur. The M14 alarm is reset when all light channels are recalibrated.
D6	Chamber Blower On= XXX%	This shows the chamber blower output. X74 ("Max Fresh Air Blower Speed") sets the maximum DC blower speed. The chamber blower's speed is controlled using PWM of the DC voltage used to operate the chamber blower.
D7	Air Heater On= XXX%	This shows the air heater output. The air heater's output is dictated by PI control. As the chamber temperature nears the temperature set point, the air heater output is reduced.
D9	Version 4.00X 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%	This shows the lamp output for the lamp in light steps.
D11	Air Temperature= XXX°C	This shows the current air temperature inside of the tester chamber. This is useful when the black panel is being used to control and a Chamber Air Temp (CAT) sensor is installed.
D12	Auxiliary Panel Temperature= XXX°C	This shows the current temperature of the auxiliary panel. X6 must be set to Yes to activate the auxiliary panel temperature sensor.
D14	Total Lamp Hours Elapsed= XXXXXX	This shows the total time that the lamps have been on. This timer value can be reset with expert parameter X62.
D19	Lamp Hours: 1=XXXX	This shows the current value of each lamp change timer. When a lamp timer reaches X104 hours, then 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.
D21	Black Panel Temperature= XXX°C	This shows the current temperature of the black panel. This is useful when Chamber Air Temp (CAT) control is selected
D22	Chiller On/Off	This shows whether the chiller output is on or off. Expert parameter X139 enables the chiller function.
D23	Water Heater On= XXX%	This shows the reservoir water heater output for a Xe-1 immersion model when in an immersion step.
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

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](http://q-lab.com/support) on q-lab.com.

Contact Q-Lab

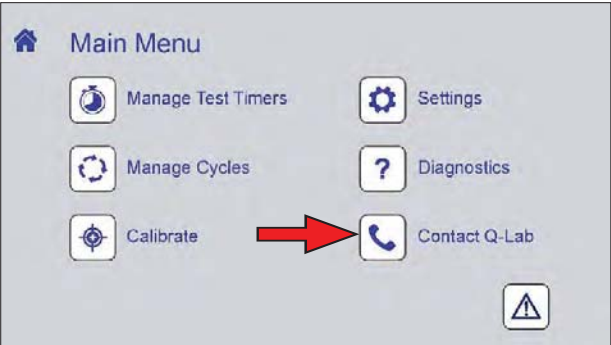


Figure 10.9a: Touch the Contact icon on the Main Menu screen to display Q-Lab contact information.



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](#).
- 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 (Aug 2020)

ASTM G155 (2013) Cycle 1				
Standard Practice for Operating Xenon Arc Light Apparatus for Exposure of Non-Metallic Materials				
Models: Xe-1-SE, Xe-1-SCE				
Optical Filters: Daylight-Q, Daylight-BB		UV Sensor: 340 nm	Black Panel: Uninsulated	
		Spray: (Xe-1-S, Xe-1-SC) 5 sec on, 55 sec off		
Step	Function	Irradiance (W/m ² /nm)	Black Panel 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			

ISO 4892-2 (2013) Cycle B1				
Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps				
Models: Xe-1-SE, Xe-1-SCE				
Optical Filters: Daylight-Q, Daylight-BB		UV Sensor: 340 nm	Black Panel: Insulated	
		Spray: (Xe-1-S, Xe-1-SC) 5 sec on, 55 sec off		
Step	Function	Irradiance (W/m ² /nm)	Black Panel Temp. (°C)	Step Time (hh:mm)
1	Light	0.51	65	1:42
2	Light + Spray	0.51	65	0:18
3	FINAL STEP – GO TO STEP 1			

ISO 4892-2 (2013) Cycle B2 Plastics – Methods of exposure to laboratory light sources – Part 2: Xenon-arc lamps				
Models: Xe-1-SE, Xe-1-BCE, Xe-1-SCE, Xe-1-WE				
Optical Filters: Window-Q, Window-BSL		UV Sensor: 420 nm	Black Panel: Insulated	
Step	Function	Irradiance (W/m ² /nm)	Black Panel Temp. (°C)	Step Time (hh:mm)
1	Light	1.10	65	24:00
2	FINAL STEP – GO TO STEP 1			

ETAG 002 European Technical Approval Guidelines Part 1 Test A Guideline for European Technical Approval for Structural Sealant Glazing Kits (SSGK), Part 1				
Models: Xe-1-WE				
Optical Filters: Daylight-BB, Daylight-Q		UV Sensor: TUV	Black Panel: Insulated	
Step	Function	Irradiance (W/m ²)	Black Panel Temp. (°C)	Step Time (hh:mm)
1	Light + Immersion	60.0	45*	24:00
2	FINAL STEP – GO TO STEP 1			

*45 °C is a water temperature specification. The Xe-1-WE black panel temperature indicates water temperature.

International Conference on Harmonization (ICH) Guidelines

ICH Guidelines for the Photostability Testing of New Drug Substances and Products				
Models: Xe-1-BCE, Xe-1-SCE				
Optical Filters: Window-Q, UV Blocking		UV Sensor: 420 nm	Black Panel: Uninsulated	
Step	Function	Irradiance (W/m ²)	Black Panel Temp. (°C)	Step Time (hh:mm)
See X-10521-L ICH Guidelines Test Protocol for Q-SUN Xenon Arc Test Chambers for detailed programming information.				

11.2 Selecting Test Parameters (Sep 2020)

Optical Filters and Radiometers

- 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.

	Xe-1 Irradiance Values		
	Typical (& Maximum) ^{A,B,C}		
	W/m ² /nm @340 nm	W/m ² /nm@420 nm	W/m ² @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	0.55 (0.85)		70 (108)
Window (-Q, -B/SL)			42 (68)
Window (-SF5, -IR)	—		
UV Blocking	—	Contact Q-Lab Repair and Tester Support ^D	

Notes:

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

Figure 11.2a: Irradiance ranges.

- The approximate intensity of noon summer sunlight at 340 nm is 0.68 W/m².



Calibrate the Q-SUN UV sensor whenever irradiance set point, lamp, UV sensor, or UV filter are changed.

Panel and Chamber Air Temperature Ranges

- The table below shows the panel temperature and chamber air temperature ranges when the lab temperature is 23 °C.
- Higher or lower lab temperatures will change the temperature control range.
- For example, if the lab temperature is 33 °C, the temperature range will be raised by approximately 10 °C.
- The Xe-1 can control temperature by either the panel temperature or the chamber air temperature, but not by both.

Models ¹	Xe-1-SE		Xe-1-BCE, Xe-1-SCE		Xe-1-WE	
	BP	IBP	BP	IBP	BP	IBP
Light Cycle	45-90	50-100	25-90	25-100	45-90	50-100
Light Cycle w/IR Filter	40-70	45-80	20-70	20-80	40-70	45-80
Dark Cycle	25-50	25-50	10-50	10-50	25-50	25-50
Light+Immersion Cycle	—	—	—	—	35-55	35-55
Dark+Immersion Cycle	—	—	—	—	30-50	30-50
Chamber Air Temp (°C)	CAT		CAT		CAT	
Light Cycle (any filter)	35-55		15-55		—	
Dark Cycle	30-45		10-40		—	

1. Model designations: Spray (SE), Chiller (BCE & SCE), Water immersion (WE).

2. Minimum and maximum black panel (BP), insulated black panel (IBP), and chamber air temperatures (CAT) are dependent on ambient laboratory temperature and irradiance level. Interdependencies between these parameters limit achievable operating conditions in the tester.

Figure 11.2b: Panel and chamber air temperature ranges.

Xe-1-BCE and Xe-1-SCE Temperature Control and Display

- The Q-SUN Xe-1-BCE and Xe-1-SCE can control the temperature of either the black panel or the chamber air.
- The control method is selected when programming the test cycle (Section 10.6).
- Whichever temperature has been programmed, black panel or chamber air, is shown on the tester display.
- Both temperatures can be displayed in diagnostic mode (Section 10.8):
 - D11 is the air temperature
 - D21 is the black panel temperature
- Data from both temperature sensors are stored on the main controller secure digital (SD) card (see Section 13.2).

Chiller Control

- Based on the type of step, temperature setpoint, and lab temperature, the Q-SUN will turn the chiller unit on and off as needed.
- A circuit breaker is located behind the chiller front door (Figure 11.2c).
- The circuit breaker controls the chiller compressor only – the fan will operate regardless of the circuit breaker switch position.
- The switch should always remain in the "ON" position.

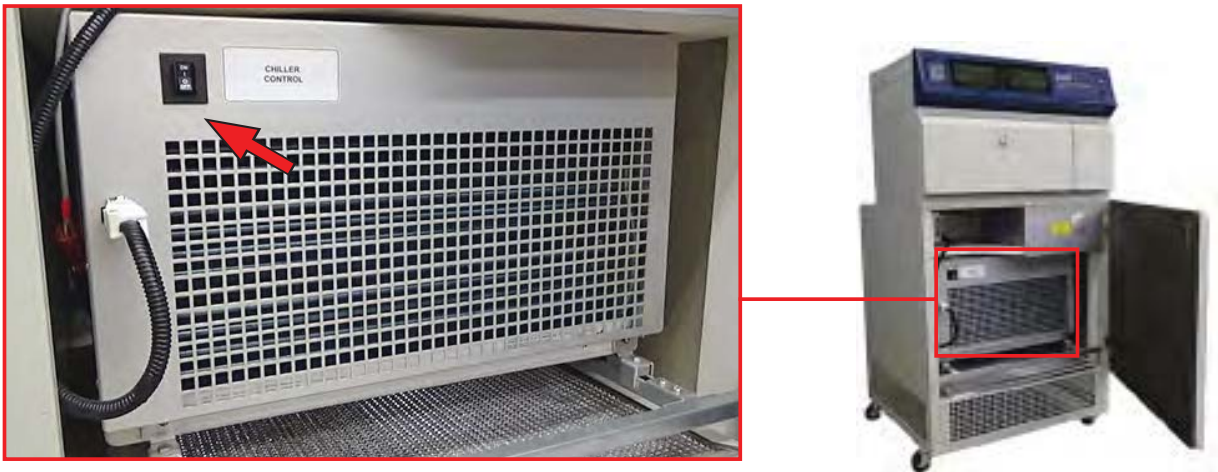


Figure 11.2c: Chiller circuit breaker switch location.

Xe-1-BCE and Xe-1-SCE Damper Adjustment

- The damper position must be set to the lowest temperature expected in the room where the Q-SUN is operating (see [Section 9.3](#)).
- Using the graduations on the damper as a guide, the damper louvers ([Figure 11.2d](#)) should be fully open if the room is 20 °C (68 °F) or warmer.
- In a room of 10 °C (50 °F) the damper should be almost closed.



Figure 11.2d: Xe-1-BCE and Xe-1-SCE damper adjustment.

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.
- Beverages, cosmetics and pharmaceuticals are typically exposed for a few hours to a few days.

NOTE: Consult material specification sheets whenever appropriate.

11.3 Changing UV Optical Filters (Sep 2020)

Overview

- All Q-SUN Xe-1 testers must have a glass UV filter (Section 6.4) installed below the lamp. The glass filter is required for proper operation of the tester. The Q-SUN is shipped with filters as ordered. The filters are easily replaced.

Changing the UV Optical Filter

IMPORTANT: The Xe-1 MUST be OFF with main power DISCONNECTED before changing the filter. Always wear gloves when changing the optical filters.

- Remove the lamp housing to access the filter (see Figure 11.3a, Figure 11.3b).
- To change the filter, remove the four screws that secure the frame and gently remove the frame (Figure 11.3c, Figure 11.3d).
- The filter type name is etched into the filter surface for positive identification (Figure 11.3e).
- Multi-segment filters are permanently installed in frames and can not be removed from the frame (Figure 11.3f).
- The UV filter can now be lifted out and replaced.



IMPORTANT: Never operate the tester without a glass UV filter below the lamp.



Figure 11.3a: Open the Xe-1 lid.

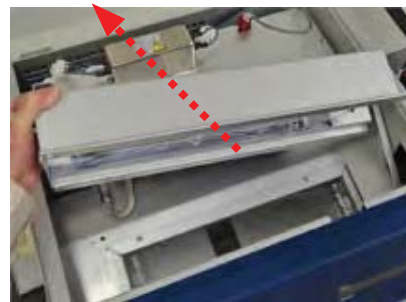


Figure 11.3b: Remove the lamp housing.



Figure 11.3c: Unscrew UV filter frame.



Figure 11.3d: Remove the UV filter.



Figure 11.3e: Optical filter type etched into filter.



Figure 11.3f: Multi-segment optical filter in frame.

11.4 Mounting Test Specimens (Sep 2020)

Specimen Trays



Figure 11.4a: Specimen tray without clips (X-10195-X).



Figure 11.4b: Xe-1-WE with ponding tray mounted on specimen tray.

Do Not Cover Black Panel



Caution: Do not cover or shadow the black panel.

- Covering the black panel with specimens or shadow lowers its temperature and can cause the heater to stay on too long, overheating the specimens (Figure 11.4c).
- Mount three dimensional specimens far enough away from the black panel to avoid casting a shadow on it (Figure 11.4d).

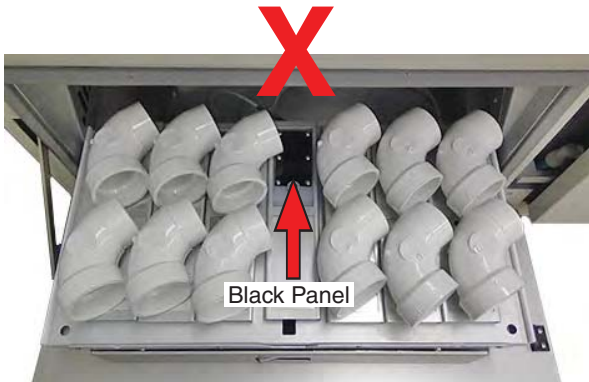


Figure 11.4c: Do not cover or shade black panel.

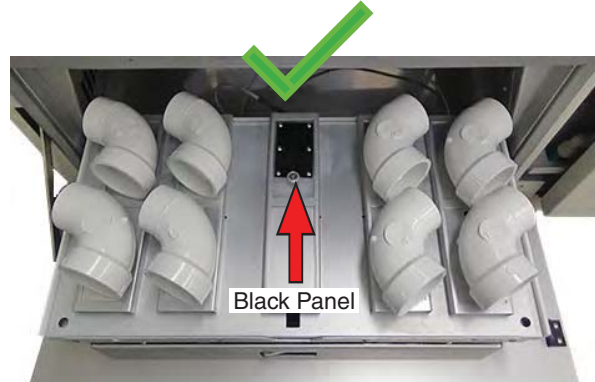


Figure 11.4d: Black panel must be uncovered.

Flat and Three Dimensional Specimens

- Whenever possible, specimens should be mounted in a specimen holder (Figure 11.4e). If this is not possible specimens may be mounted directly on the tray.
- High air flow through the chamber and water immersion (Xe-1-WE) may make it necessary to secure lightweight specimens.



Figure 11.4e: Three dimensional specimens mounted in specimen holders.

Panel Holders

- Panel holder assemblies are available to hold flat, 50×100 mm (2"×4") specimens.
- The panel holder assemblies come with blank anodized aluminum Q-PANEL® test panels and retaining rings.

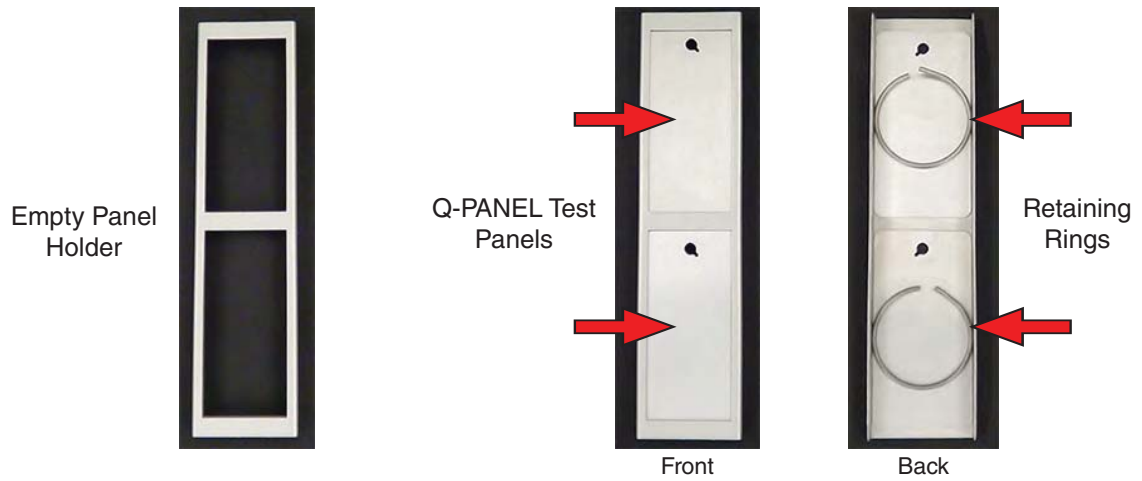


Figure 11.4f: 50×100 mm (2"×4") Panel holder assembly X-10115-X.



Figure 11.4g: Panel holder kit (X-10113-K) with eight (8) panel holders holding fifteen (15) 50×100 mm (2"×4") specimens and one (1) black panel.

Mounting an Insulated Black Panel When Using Panel Holders

When using panel holders and an insulated black panel (IBP, or Black Standard), the IBP should be mounted on a special holder shown below (Figure 11.4h, i). These special holders are included in the specimen holder kits. The second IBP holder is used when calibrating with the UC202/IBP. A single panel holder assembly for mounting (1) 50×100 mm (2"×4") specimen next to the IBP is also included in the specimen holder kits (Figure 11.4j, k).



Figure 11.4h: Insulated black panel holders.



Figure 11.4i: Single panel holder assembly.



Figure 11.4j: Insulated black panel mounted on special holder and single panel holder with (1) 50×100 mm (2"×4") specimen.



Figure 11.4k: 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 (2"×4") panel holder (Figure 11.4l). Use a retaining ring to hold the BP in place. Fill the panel holder with a 50×100 mm (2"×4") specimen (Figure 11.4m). When calibrating the BP, mount the UC202/BP in the same 50×100 mm (2"×4") holder and hold in place with a retaining ring (Figure 11.4n).



Figure 11.4l: Standard 50×100 mm (2"×4") panel holder.

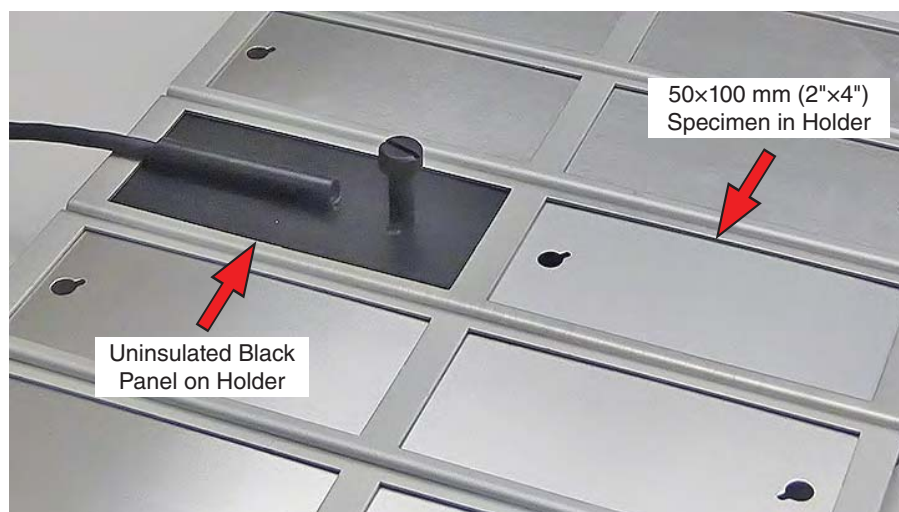


Figure 11.4m: Uninsulated black panel and one (1) 50×100 mm (2"×4") specimen mounted on standard 50×100 mm (2"×4") holder.

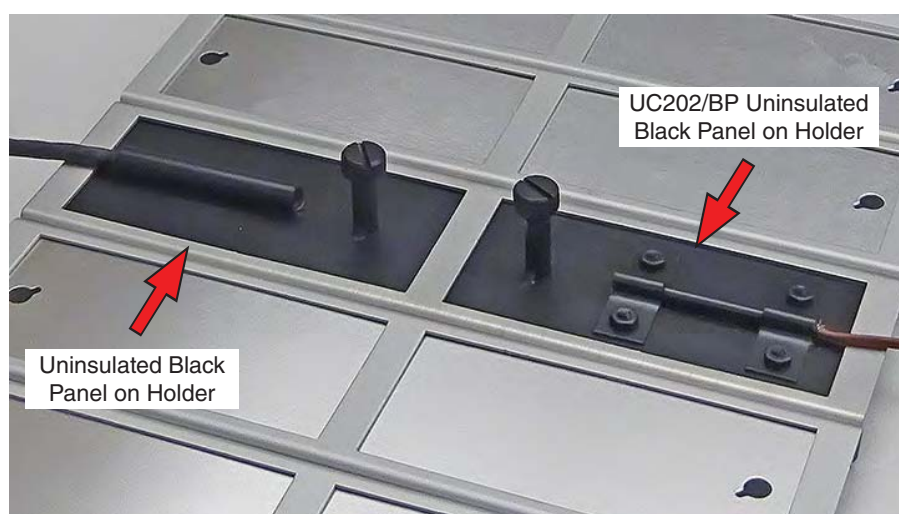


Figure 11.4n: Uninsulated black panel and UC202/BP uninsulated black panel mounted on standard 50×100 mm (2"×4") holder.

Mounting Thin Films or Textile Specimens with Standard Panel

- Thin films and textile specimens can be wrapped around a standard panel and mounted in a holder (Figure 11.4o).

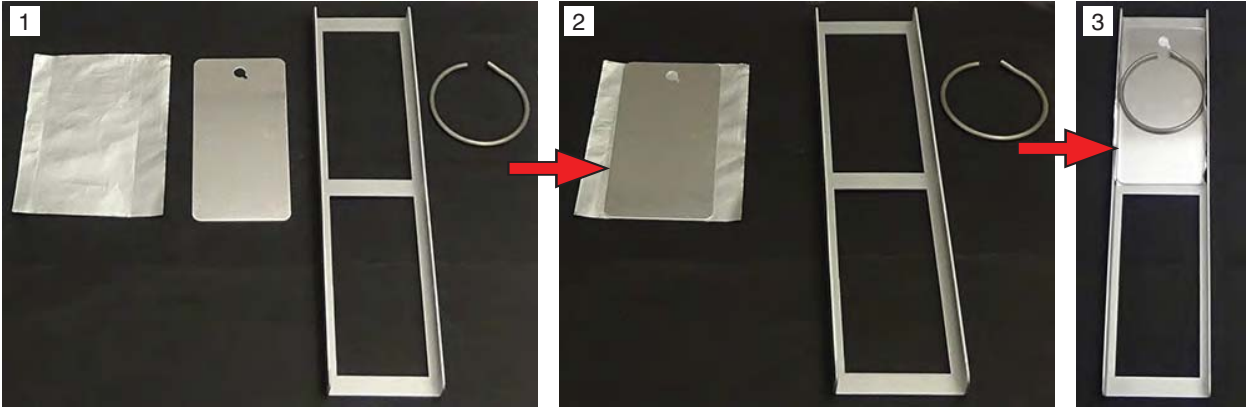


Figure 11.4o: Thin film mounted in panel holder.

Mounting Thin Films or Textile Specimens with Open Panel

- To mount thin films or textile specimens without a panel backing (so both sides of the specimen are exposed to air), a special panel holder is available.
- The textile/thin film holder (Part Number X-10255-X) is shown in Figure 11.4p.
- Notice that the solid backing panel is replaced with a backing panel that is open in the center.

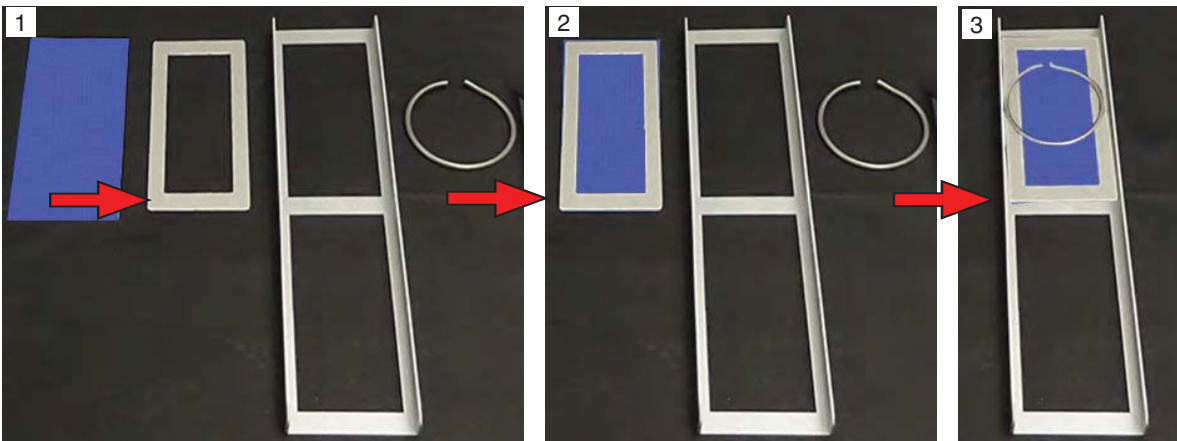


Figure 11.4p: Textile specimen mounted in textile/thin film holder.

Bottle Holders

- Special holders are available to mount cylindrical objects such as bottles (Figure 11.4q and Figure 11.4r).

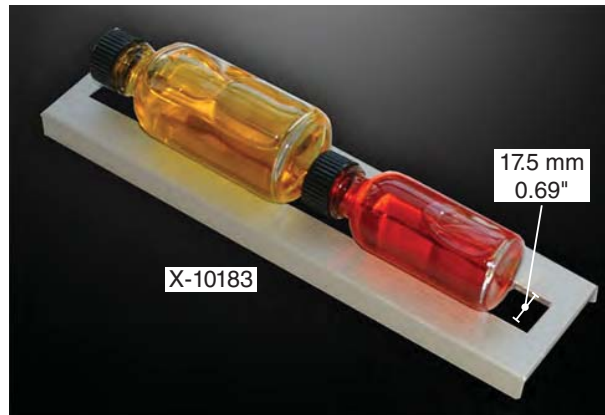


Figure 11.4q: Holder is slotted to hold narrow cylindrical specimens



Figure 11.4r: Holder is slotted to hold wider cylindrical specimens

Xe-1- WE Specimen Immersion

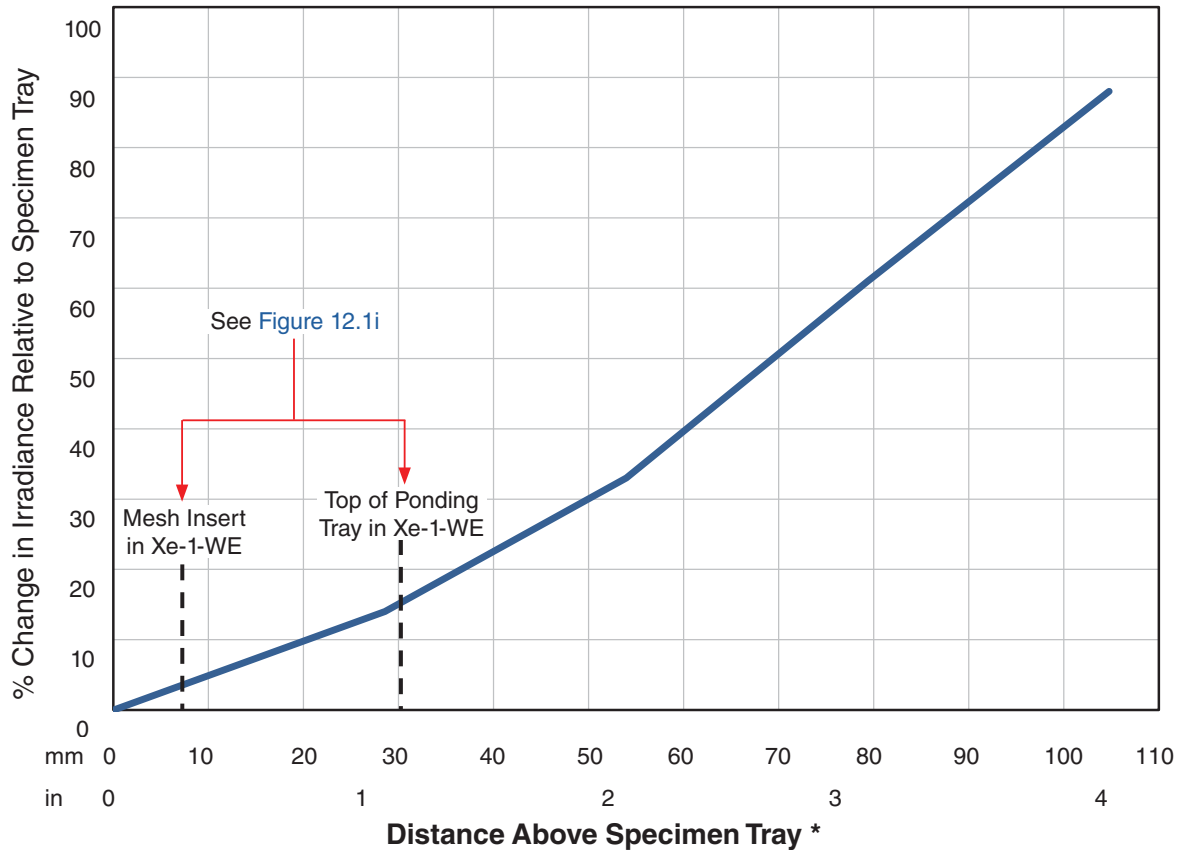
- Specimens are placed on the mesh insert in the Xe-1-WE ponding tray ([Figure 11.4s](#)).



Figure 11.4s: Place specimens on the mesh insert.

3D Specimens

- The following graph (Figure 11.4t) shows the relationship between distance above the specimen tray and irradiance.
- Specimen surfaces above the specimen tray receive higher irradiance.



* The specimen tray is the base Xe-1 tray for any model, including the Xe-1-WE with the ponding tray removed.

Figure 11.4t: Distance above specimen tray vs. irradiance change.



NOTE: Having specimens closer than 100 mm from the lamp may result in burning of specimens and will significantly impact irradiance uniformity.

11.5 Repositioning Test Specimens (Sep 2016)

Regular repositioning of 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.

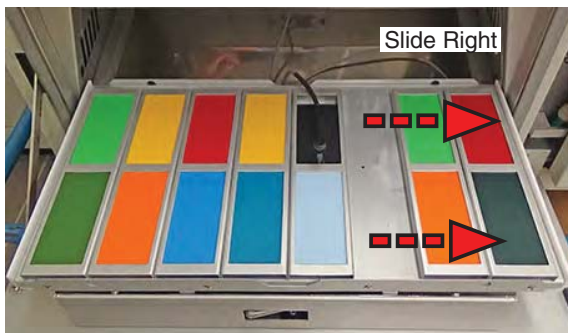
A suggested repositioning plan is shown below.



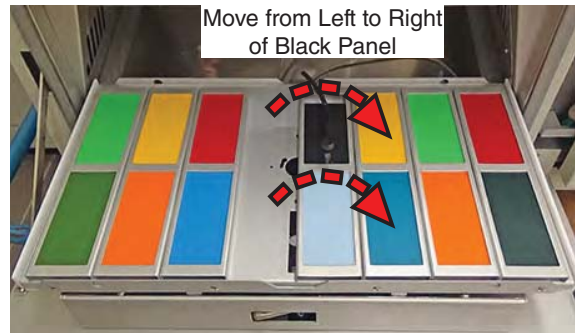
1. Specimens in specimen holders in the starting positions.



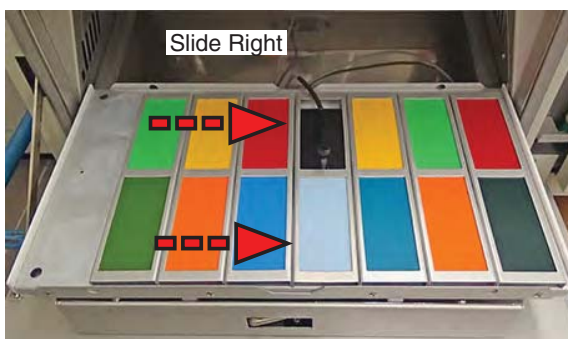
2. Remove the specimen holder on the right side of the tray.



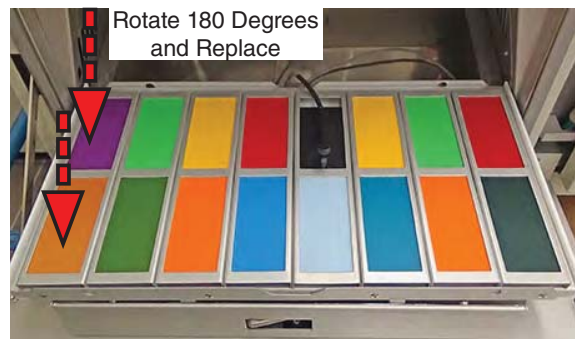
3. Slide the specimen holders to the right of the black panel to the right.



4. Move the specimen holder on the left of the black panel to the right of the black panel



5. Slide the specimen holders on the left of the black panel to the right.



6. Rotate the specimen holder removed in **Step 2** 180° and place on the left end of the tray.

12. Calibration

- Irradiance for all models is calibrated with the UC20 Smart Sensor ([Section 12.1](#)).
- Xe-1-WE irradiance must be calibrated with no water in the ponding tray.
- The Panel temperature sensor for all Xe-1 models, except Xe-1-WE running in immersion mode, is calibrated with a UC202 Smart Sensor ([Section 12.2](#)).
- Panel temperature for Xe-1-WE running in immersion mode is calibrated with a calibrated reference thermometer
- Chamber air temperature is calibrated with a calibrated reference thermometer.
- The table below lists the Q-SUN Xe-1 sensors that require periodic re-calibration or replacement.
- Please contact Q-Lab for more information ([Section 19](#)).

Sensor	Model	Calibration Frequency	Calibration Instrument
Irradiance	All ¹	500 hours ²	UC20 Smart Sensor
Black Panel Temperature	All	6 months ³	UC202 Smart Sensor ⁴
Chamber Air Temperature	Xe-1-BCE, SCE	6 months	Calibrated Reference Thermometer

¹ For the Xe-1-WE, irradiance calibration can be done with or without the ponding tray in the test chamber, but never with water.

² Or whenever the lamp, irradiance sensor, or test cycle conditions are changed.

³ Or whenever the lamp, panel temperature sensor, or test cycle conditions are changed.

⁴ If the Xe-1-WE is not running in immersion mode, black panel calibration is done with a UC202 Smart Sensor and the ponding tray removed. If the Xe-1-WE is running in immersion mode, black panel calibration is done with a Calibrated Reference Thermometer and the ponding tray in place.

12.1 Irradiance Calibration

Smart Sensors

- Irradiance is calibrated with a UC20/340, UC20/420, UC20/LUX or UC20/TUV Smart Sensor (Figure 12.1a through Figure 12.1d).
 - The UC20/LUX Smart Sensor is identical to the UC20/420 except that illuminance can also be displayed 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 11.1d and Figure 11.1e).
 - Calibration information can also be displayed on the Xe-1 menu screen when the Smart Sensor is connected (Figure 11.1f).
- 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 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)

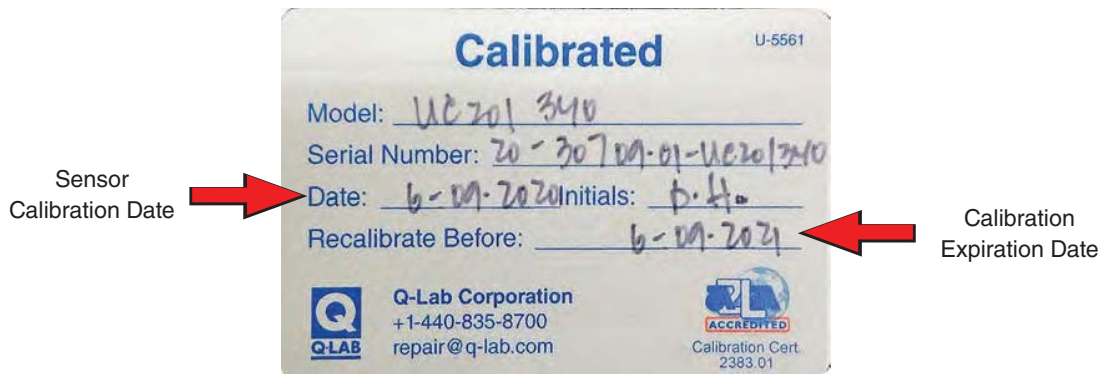


Figure 12.1e: Clean the sensor face with alcohol and a soft cloth.



Sensor Calibration and Expiration Dates

Figure 12.1f: UC20/340 calibration certificate.



Sensor Calibration Date

Calibration Expiration Date

Figure 12.1g: Smart Sensor calibration label on case.

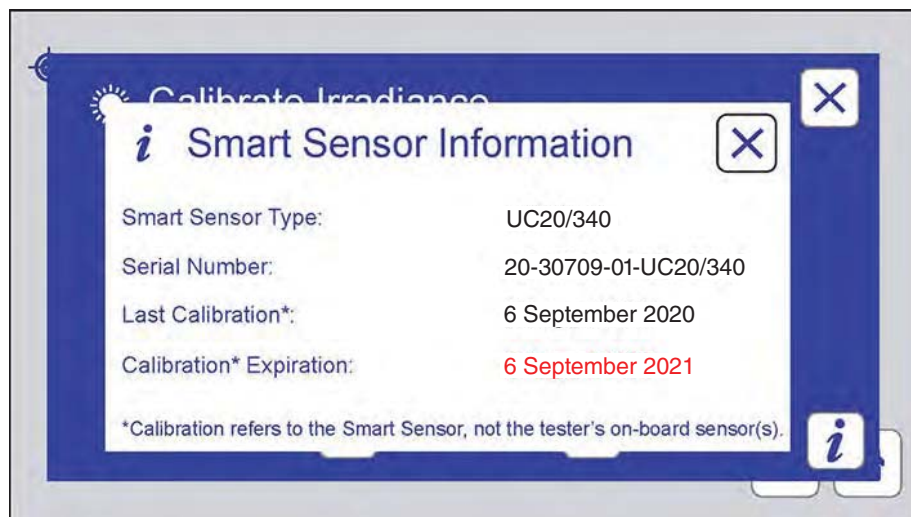


Figure 12.1h: Smart Sensor information displayed on Xe-1 menu screen.

Irradiance Calibration Procedure



Do not calibrate the irradiance sensor during spray or immersion steps. The Smart Sensor is not waterproof.

To calibrate Xe-1-WE running immersion tests there must be no water in the ponding tray (see [Step 12](#)).

- The calibration instructions are listed in the steps below.
- Calibrate the Q-SUN Xe-1 in a light cycle and at normal operating temperature and irradiance.
- Calibrate with test specimens in place.
- Irradiance calibration should always be done before black panel calibration.

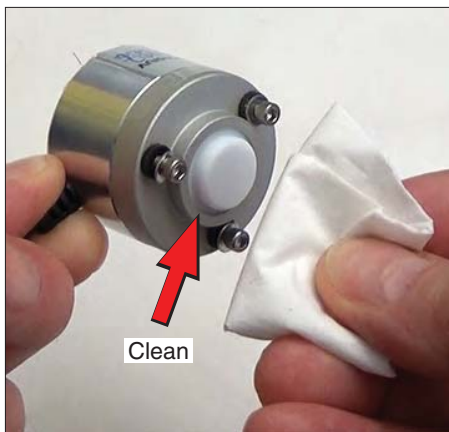
Irradiance (W/m ² @ 340 nm) Lamp 1		Temperature (°C) BP/BP	
Actual	0.68	62	
Set	0.68	62	

	Step Time (Hrs: Mins)	Test Time (Hrs: Mins)	Test Energy (KJ/m ²)	Total Time (Hrs)
Elapsed	8:08	130:30	164.2	130
Set	24:00	100:00	—	

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



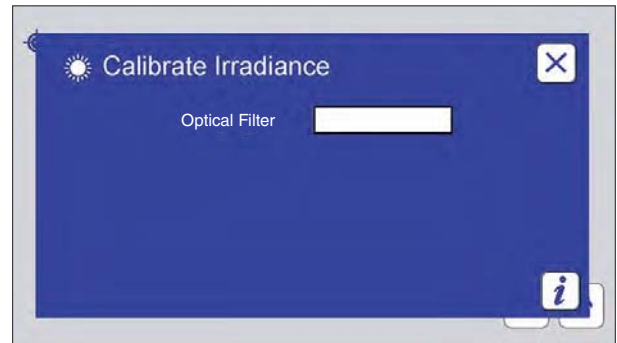
2. Remove the UC20 Smart Sensor from the case.



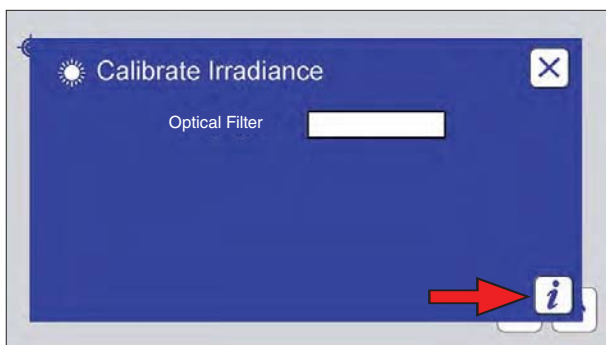
3. Clean the sensor face with alcohol and a soft cloth.



4. Plug the Smart Sensor into USB connector on the Xe-1 control panel.



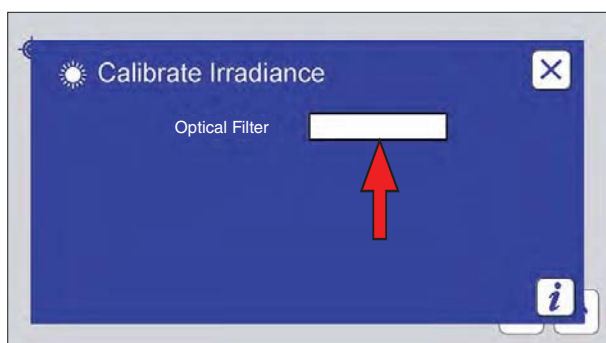
- ▶ The calibrate irradiance screen is displayed. **NOTE:** If the Smart Sensor does not match the Xe-1 sensor a message indicating the correct sensor will be displayed.



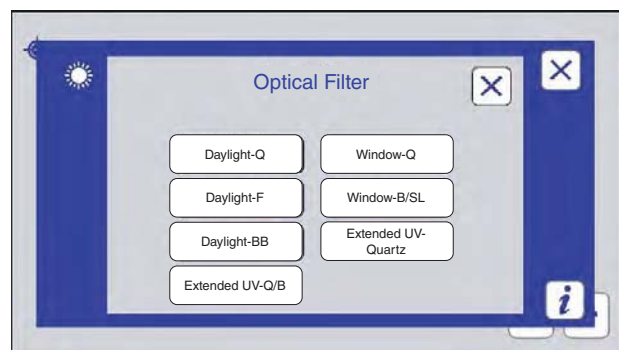
5. **Optional:** to display the Smart Sensor calibration information, touch the information icon.



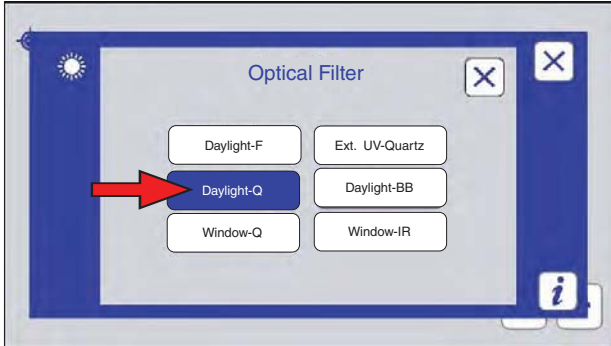
- ▶ The Smart Sensor information screen is displayed. Touch the close icon to close the information screen.



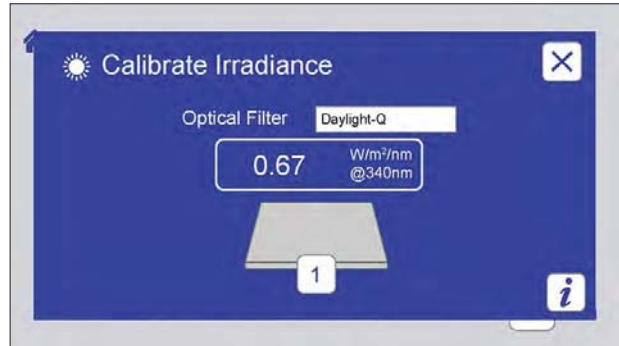
6. Touch the filter type text box.



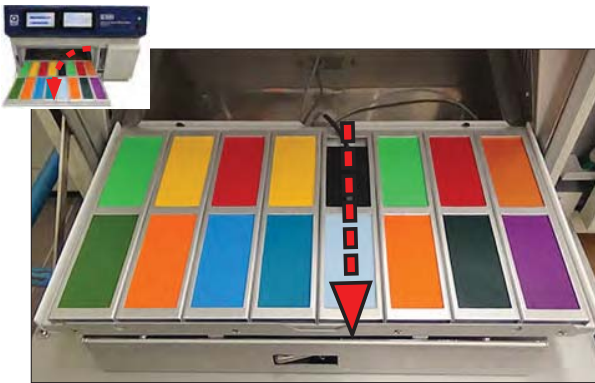
- ▶ The optical filter screen is displayed.



7. Touch the optical filter button that matches the optical filter installed in the tester.



- The Calibrate Irradiance screen is displayed.



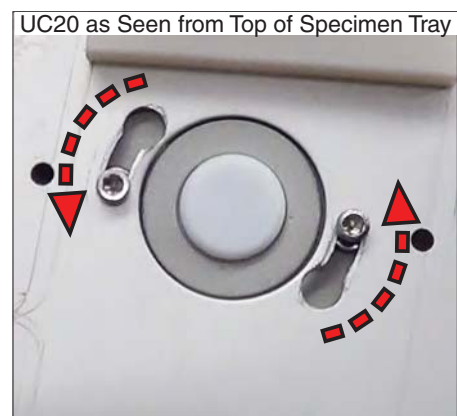
8. For all models except Xe-1-WE, open the test chamber door and pull the specimen tray out. Xe-1-WE go to [Step 12](#).



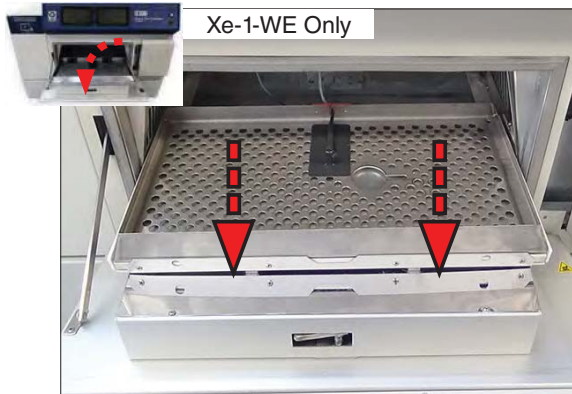
9. Locate the calibration port in the specimen tray.



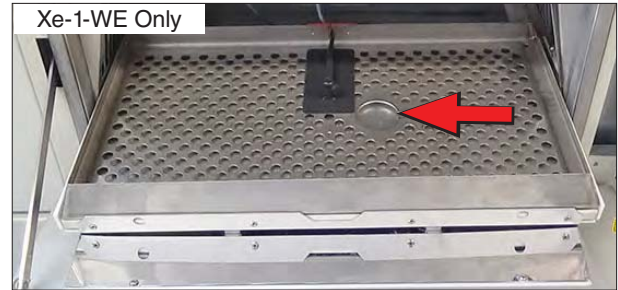
10. Lift the specimen tray. From the bottom of the tray insert the UC20 Smart Sensor face-up into the calibration port.



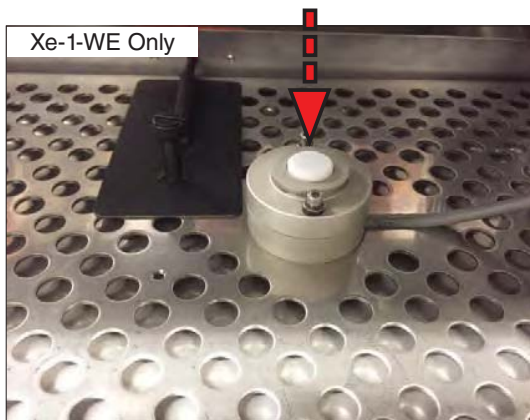
11. Rotate the UC20 to lock it in to the calibration port. Go to [Step 15](#).



12. Open the test chamber door. Pull the ponding tray out. **IMPORTANT:** Make sure there is no water in the ponding tray. The irradiance sensor is not waterproof.



13. Locate the calibration sensor cutout in the ponding tray mesh insert.



14. Place the UC20 Smart Sensor in the calibration cutout in the mesh insert. In this position, the top of the sensor is at the same height as the top of the ponding tray. See [Section 8](#) for more information.



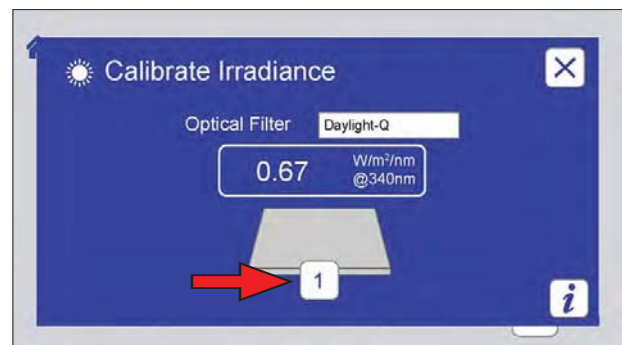
15. Slide the tray back into the chamber and close the door with the Smart Sensor cord routed out of the chamber. Keep the cord away from the door latch.



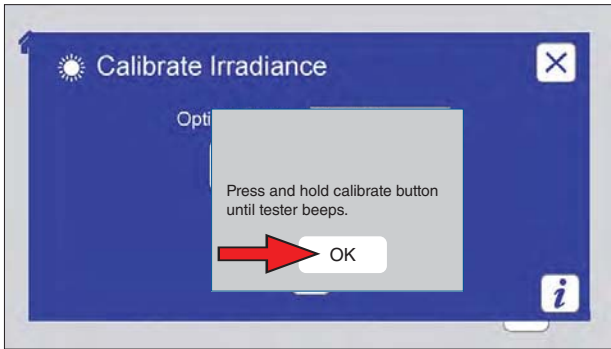
Wait for the irradiance to stabilize.



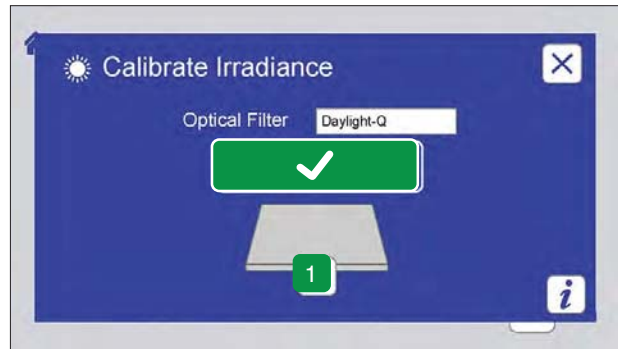
16. Wait a few seconds to allow the irradiance to stabilize.



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



18. 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.



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



- Complete the calibration within approximately 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.
- Never leave the Smart Sensor in a calibration port for more than 5 minutes.

Additional information on Calibration for Immersion Testing

- The immersion calibration procedure provides accurate irradiance readings for 25 mm (1") tall specimens, i.e. a specimen plane at the same vertical position as the top of the ponding tray.
- The irradiance level for shorter specimens is less by the amount shown in [Figure 12.1i](#).

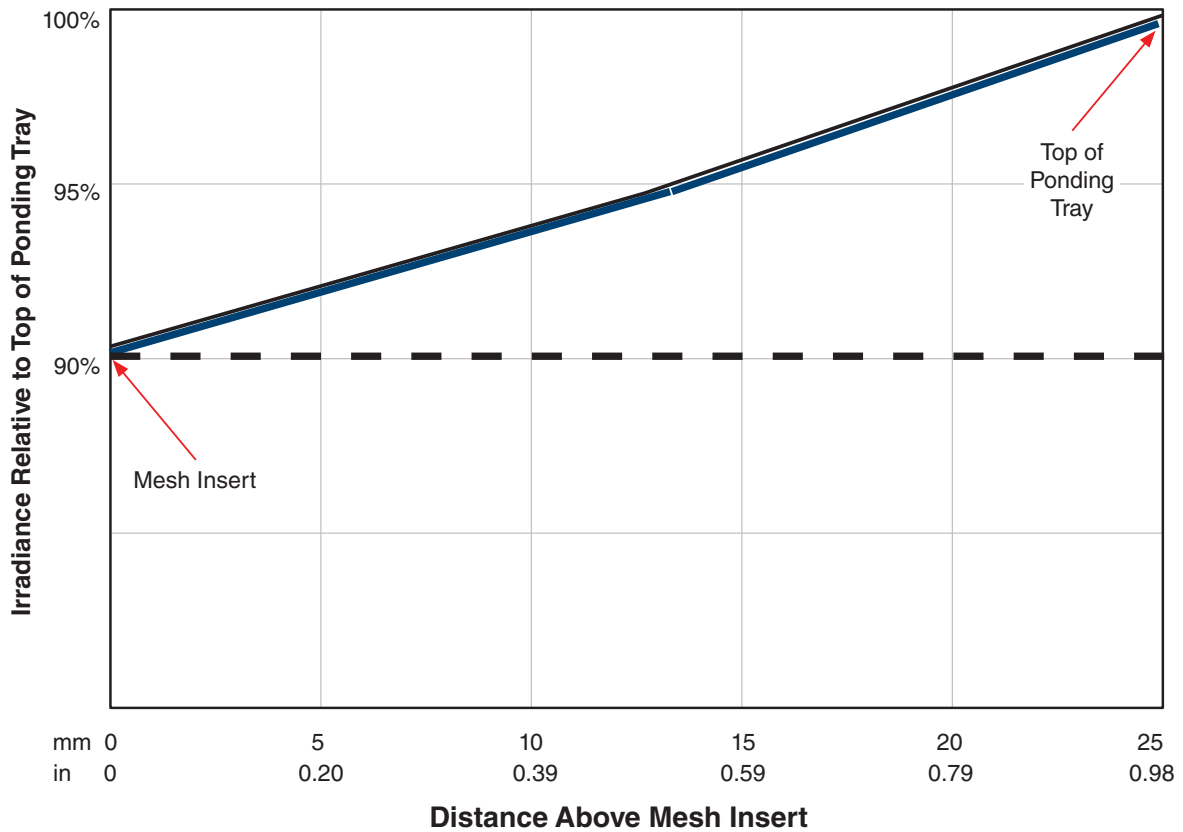


Figure 12.1i: Distance above mesh insert vs. irradiance for the Xe-1-WE.

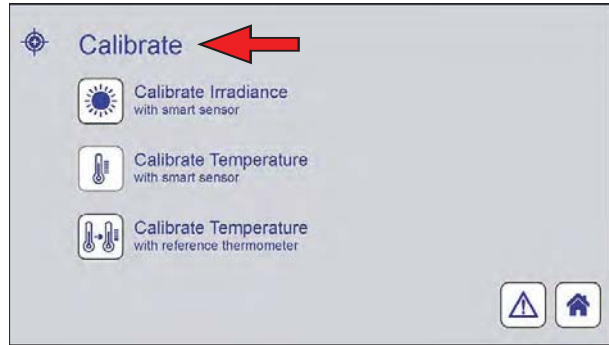
- Note that this entire graph is between the dashed lines in [Figure 11.4t](#).
- To obtain the required irradiance on specimens less than 25 mm tall, the irradiance set point must be adjusted:
 - For example, to obtain 0.55 W/m²/nm on a very thin specimen (specimen plane very close to mesh insert), the irradiance set point must be set to 0.55 W/m²/nm / 90% = 0.61 W/m²/nm.

Access Calibrate Functions Through the Main Menu

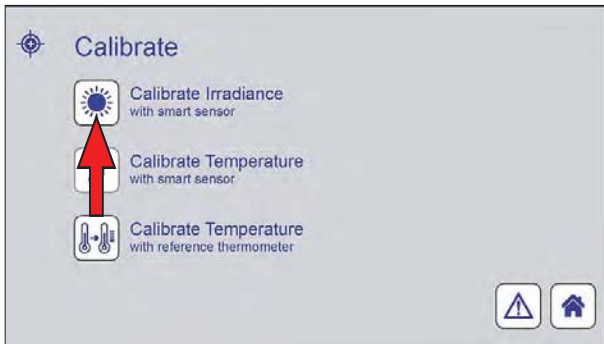
- The calibrate screens can also be accessed through the Main Menu.



- ▶ Calibrate functions can also be accessed by touching the calibrate icon on the Xe-1 main menu screen.



- ▶ The calibrate screen is displayed.



- ▶ Touch the Calibrate Irradiance icon.

12.2 Black Panel Temperature Sensor (Sep 2020)

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](#).

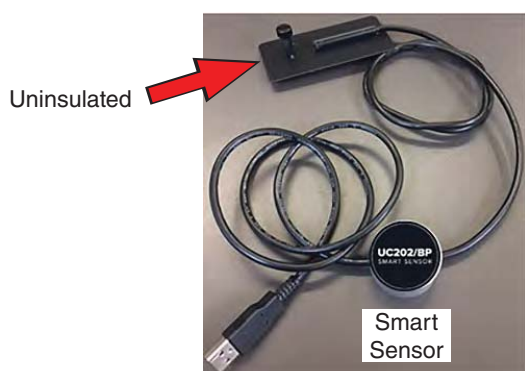


Figure 12.2a: UC202/BP Temperature Smart Sensor with Uninsulated Black Panel (Black Panel)



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-1 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.
- Clean the Smart Sensor face with alcohol and a soft cloth before calibrating irradiance ([Figure 12.1e](#)).
- Store the Smart Sensor in its case when not in use to avoid any contamination.

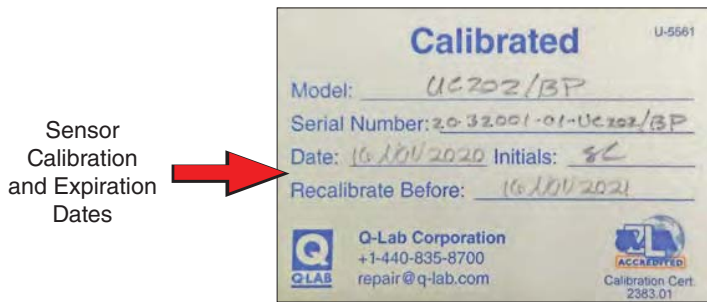
For Testers Equipped with a White Panel Temperature Sensor

- If the white panel is installed without a black panel, the temperature sensor calibration is exactly the same as for a black panel.
- If the white panel is installed with a black panel it is not calibrated directly. The [D12](#) Auxiliary Panel Temperature diagnostic value is used to calculate the white panel temperature offset. See [Section 10.8](#) and [X-15350-L Q-SUN Xe-1 White Panel Installation](#) 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

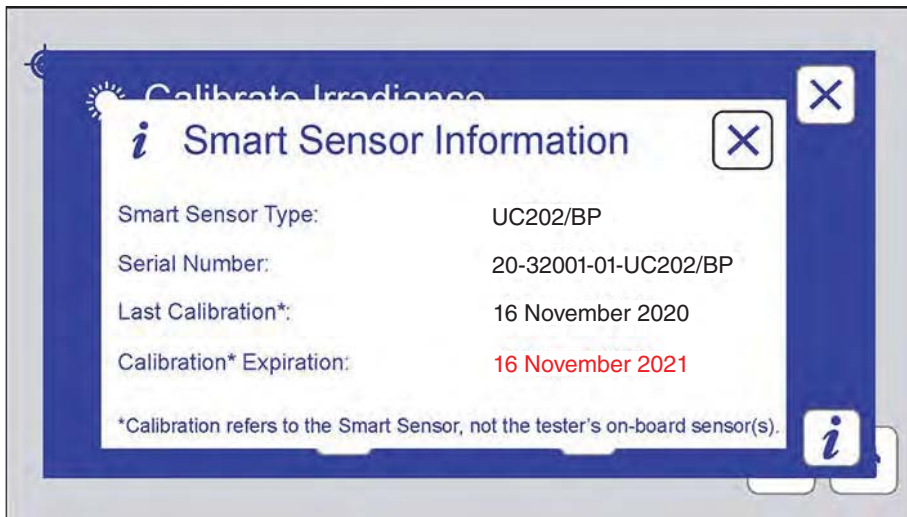


Figure 12.2e: Smart Sensor information displayed on Xe-1 menu screen.

Calibration Procedure (all Models except Xe-1-WE in immersion mode)

- 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.
 - If the Q-SUN panel temperature sensor will be attached to the specimen tray during testing, it should be calibrated that way.
 - 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 insulated black panel and UC202/IBP insulated black panel holders are available in specimen holder kit X-10113-K.
- To calibrate the Xe-1-WE temperature sensor not in immersion mode follow these instructions. The ponding tray must be removed.
- To calibrate the Xe-1-WE temperature sensor in immersion mode, use a calibrated reference thermometer, not a Smart Sensor. See [Calibration Procedure for Xe-1-WE in Immersion Mode](#).

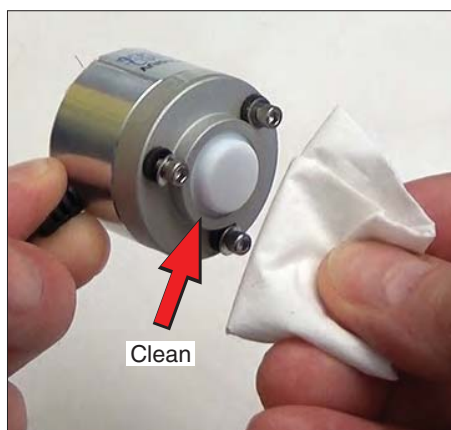
	Irradiance (W/m ² @ 340 nm) Lamp 1	Temperature (°C) BP/IBP
Actual	0.68	62
Set	0.68	62

	Step Time (Hrs.Mins)	Test Time (Hrs.Mins)	Test Energy (KJ./m ²)	Total Time (Hrs)
Elapsed	8:08	130:30	164.2	130
Set	24:00	100:00	—	

1. Run the Xe-1 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.

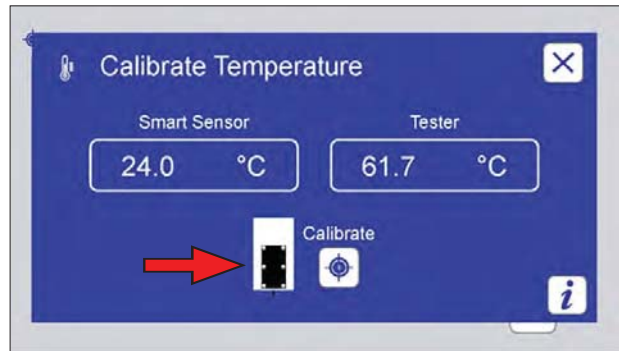


3. Clean the sensor face with alcohol and a soft cloth.

Section 12. Calibration



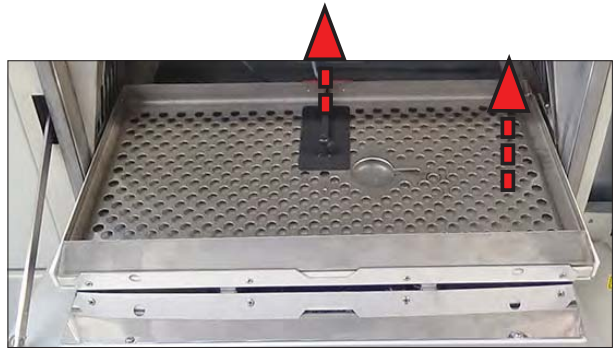
4. Plug the UC202 Smart Sensor into USB connector on the Xe-1 control panel.



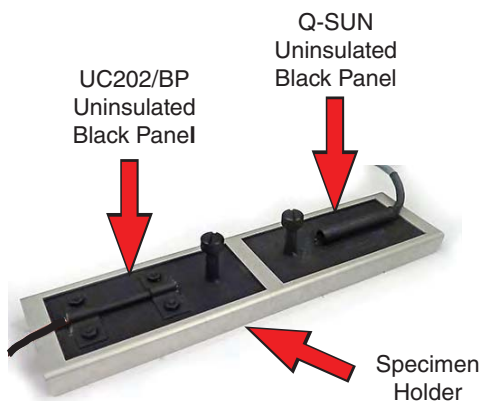
- The calibrate temperature screen is displayed. The Smart Sensor type (BP or IBP) is recognized by the tester. UC202/BP in this example.



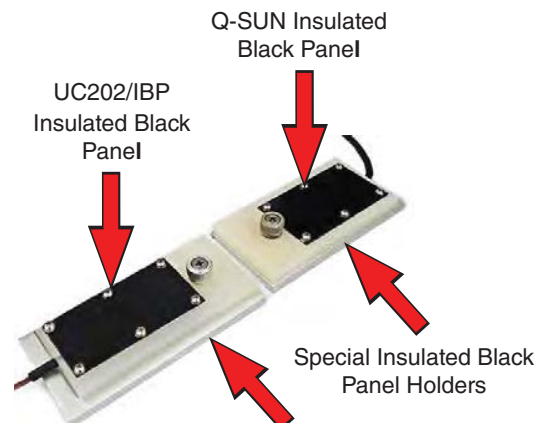
5. For all models except Xe-1-WE, open the test chamber door and pull the specimen tray out. Go to [Step 7](#).



6. For Xe-1-WE, remove the panel temperature sensor from the ponding tray. Remove the ponding tray from the tester. Go to [Step 10](#)



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



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



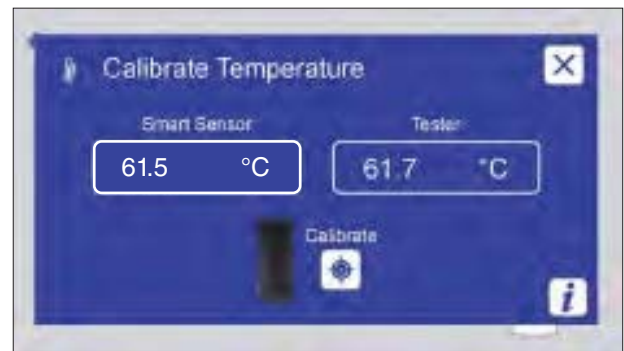
9. Place Q-SUN and UC202 black panels in holders on the tray with specimens in holders.




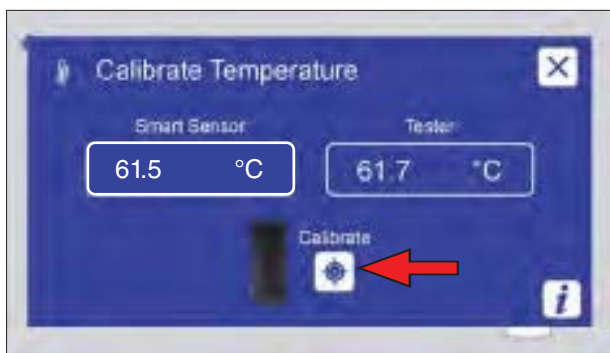
10. Or place Q-SUN and UC202 black panels directly on the specimen tray with specimens on the tray. No specimens for Xe-1-WE.



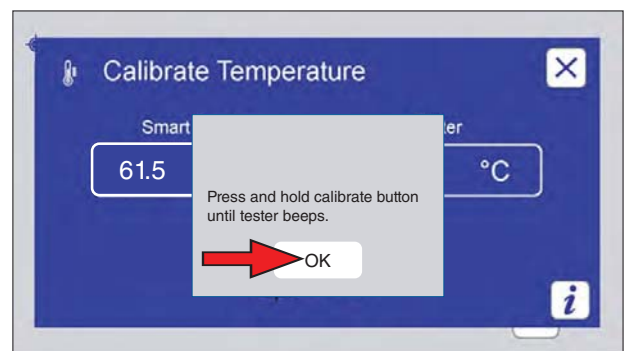
11. Slide the tray back into the chamber and close the door with the Smart Sensor cord routed out of the chamber. Keep the cord away from the door latch.



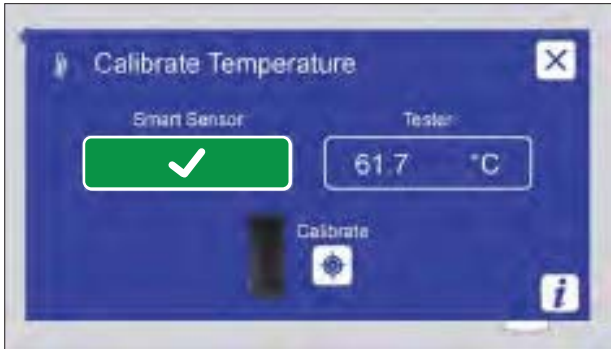
12.  Wait a few seconds to allow the sensors temperature to stabilize.



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



14. 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.



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



16. Disconnect the UC202 Smart Sensor from the USB connector on the Xe-1 control panel.



- The calibrate screen is displayed.

Calibration Procedure for Xe-1-WE in Immersion Mode

- For calibrating the Xe-1-WE in immersion mode use a calibrated reference thermometer to calibrate the panel temperature sensor.
- **DO NOT** use a Smart Sensor to calibrate the Xe-1-WE in immersion mode.
- The following tools are needed to calibrate the panel temperature sensor:
 - o Calibrated reference thermometer
 - o Insulated container. **IMPORTANT:** The opening of the insulated container must be at least 5.5 cm wide to insert the Xe-1- WE panel temperature sensor.
 - o Hot water
- Q-Lab offers an optional Temperature Calibration Kit, U-41085-K (see [Figure 17az](#)) which includes an easy-to-use insulated container.
- Fill the container with water at approximately the highest temperature called for in the test cycle.
- Place the panel temperature sensor and a calibrated reference thermometer sensor in the insulated container ([Figure 12.2f](#)).



Figure 12.2f: Place the Xe-1-WE panel temperature sensor and the reference thermometer in an insulated container of water.

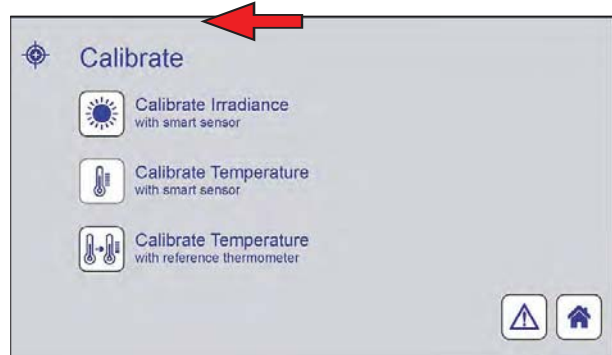


1. Wait 10 minutes for the sensors to stabilize.

Section 12. Calibration



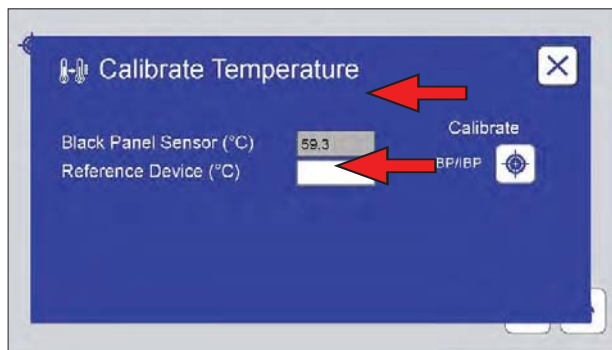
2. Touch the calibrate icon on the Main Menu screen.



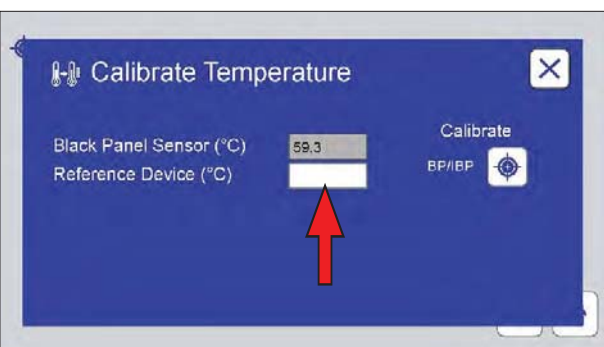
► The calibrate screen is displayed.



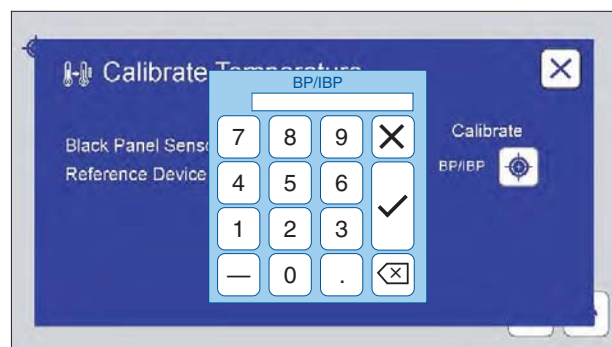
3. Touch the **Calibrate Temperature with reference thermometer** icon.



► The Calibrate Temperature screen is displayed. The current reading of the black panel temperature sensor is shown. The CAT will be shown too if it's installed.



4. Touch the **Reference Device** text box.



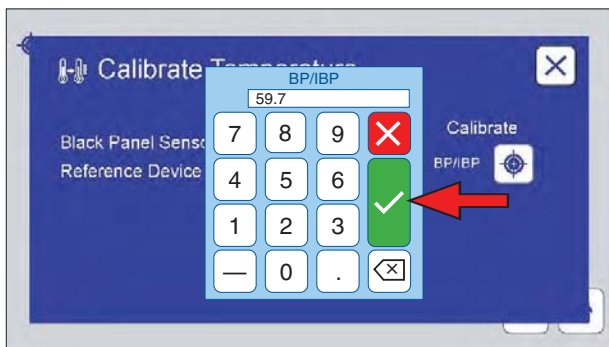
► The BP/IBP temperature enter keypad is displayed.



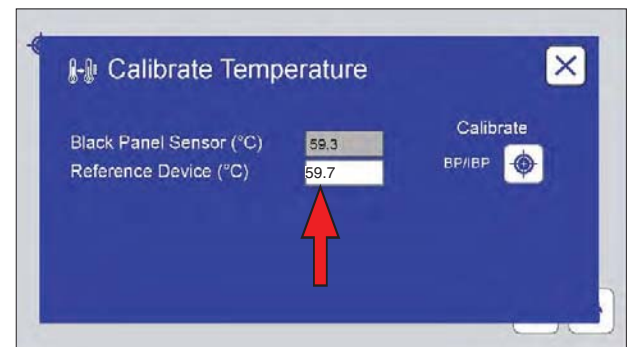
5. Read the temperature displayed on the reference thermometer.



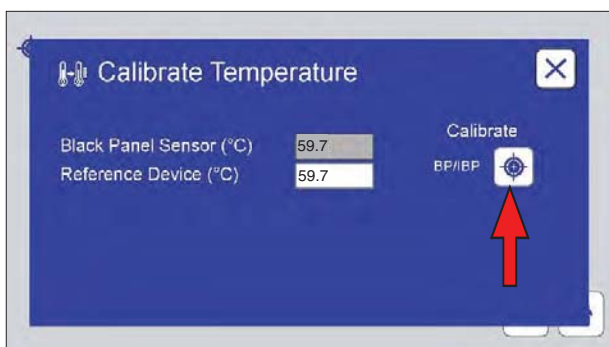
6. Use the keypad to enter the reference temperature into the reference device text box.



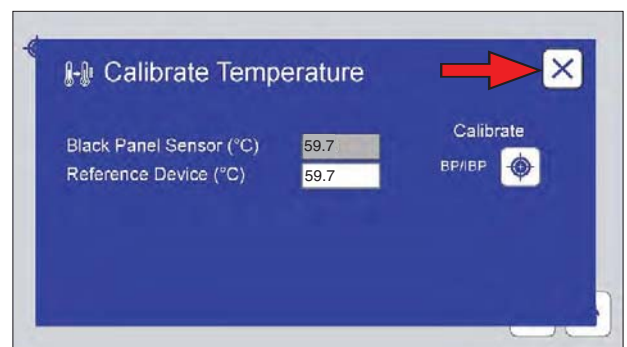
7. Touch the check mark button.



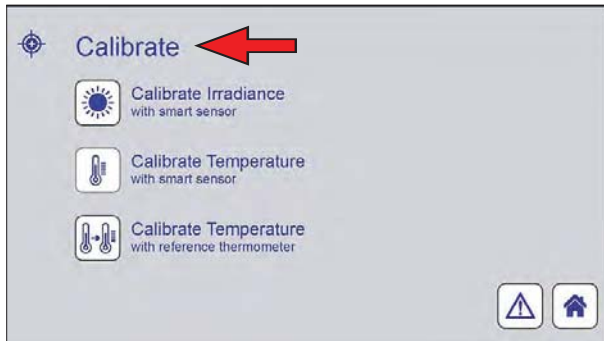
► The keypad is removed. The reference temperature is displayed in the reference device text box.



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



9. Touch the close icon to complete the calibration process.



- The calibrate screen is displayed.

12.3 Chamber Air Temperature (CAT) Sensor Calibration (Sep 2020)

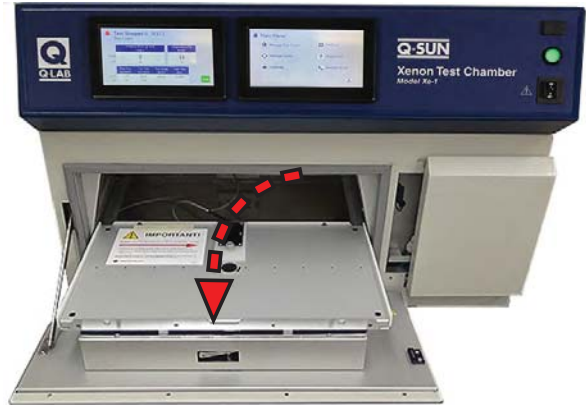
Xe-1-BCE and Xe-1-SCE Models, and Xe-1-SE with Optional Chamber Air Temperature Sensor

- A chamber air temperature sensor is standard for Q-SUN Xe-1-BCE and Xe-1-SCE models.
- A chamber air temperature sensor is optional for Q-SUN Xe-1-SE models.
- The chamber air temperature sensor should be calibrated every 6 months.
- The following tools are needed to calibrate the chamber air temperature sensor:
 - Calibrated reference thermometer
 - Insulated container.
 - Hot water
- Q-Lab offers an optional Temperature Calibration Kit, U-41085-K (see [Figure 17az](#)) which includes an easy-to-use insulated container.

Section 12. Calibration



1. Touch the **STOP** icon on the Status Screen.



2. Open the test chamber door.



3. Locate the air temperature sensor mounted on the grill in the left side of the chamber.



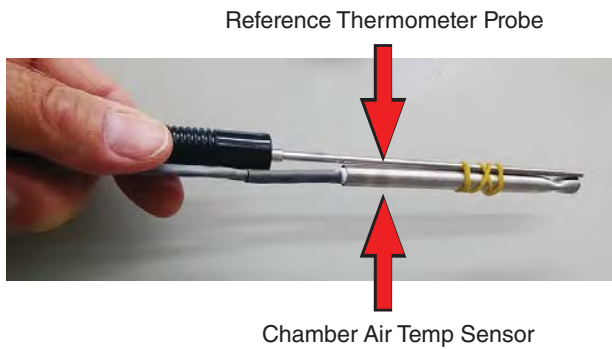
4. Lift the sensor out of the clip and carefully pull the sensor and cable out to the front of the machine.



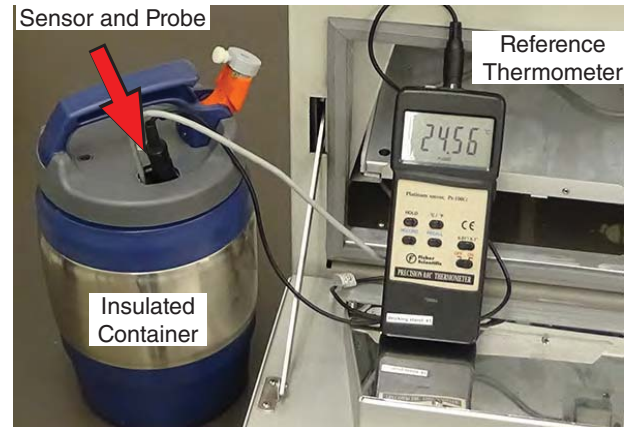
5. Fill an insulated container with water of approximately the same temperature to which the chamber air temperature will be set.



The Water Should be at Approximately the Same Temperature as the Chamber Air Temperature Set Point.



6. Tie the chamber air temperature sensor and the reference thermometer probe together using string or a rubber band.



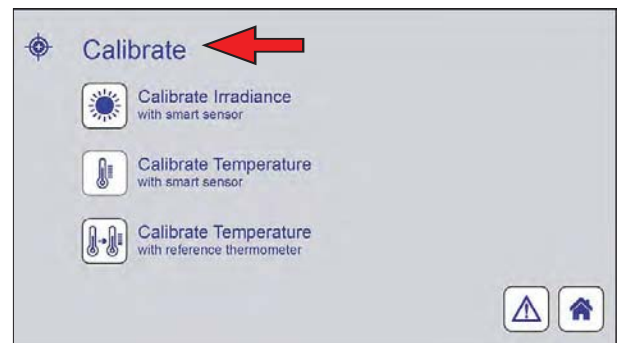
7. Place the probes into the container of water and stir the water frequently.



8. Wait 10 minutes for the sensors to stabilize.



9. Touch the calibrate icon on the Main Menu screen.

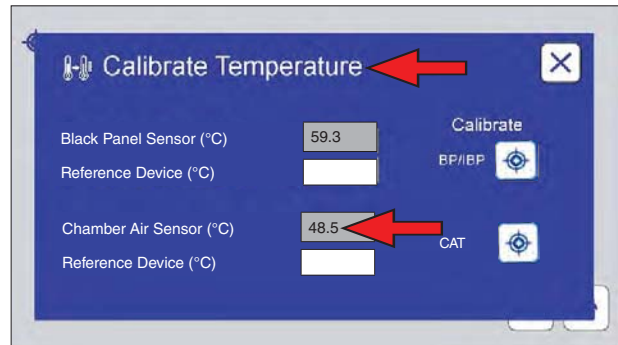


► The Calibrate screen is displayed.

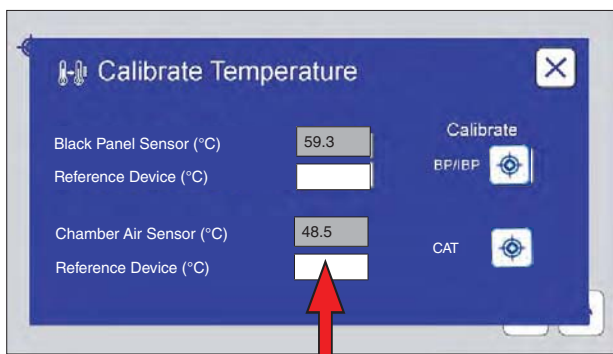
Section 12. Calibration



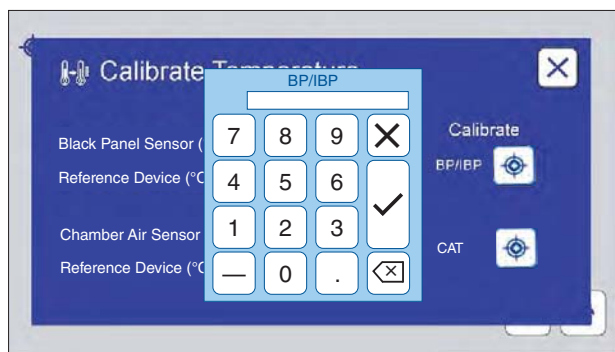
10. Touch the Calibrate Temperature with reference thermometer icon.



► The Calibrate Temperature screen is displayed. The current reading of the chamber air temperature sensor is shown.



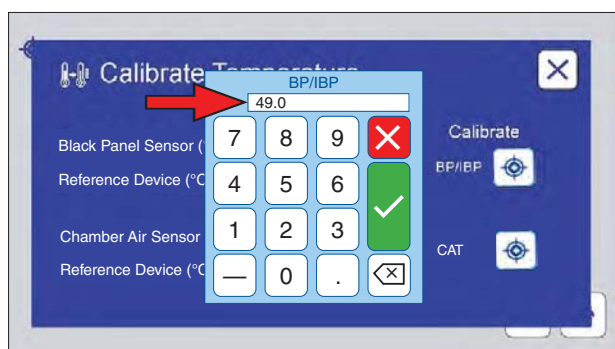
11. Touch the Reference Device text box.



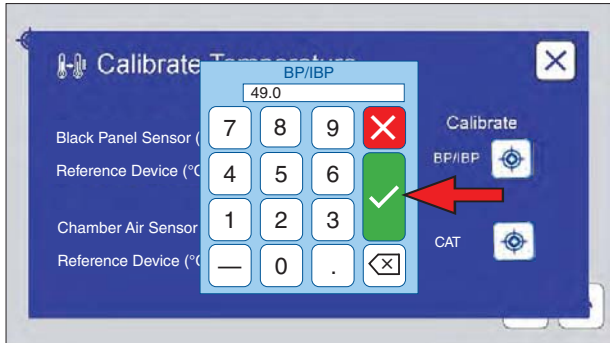
► The BP/IBP temperature enter keypad is displayed.



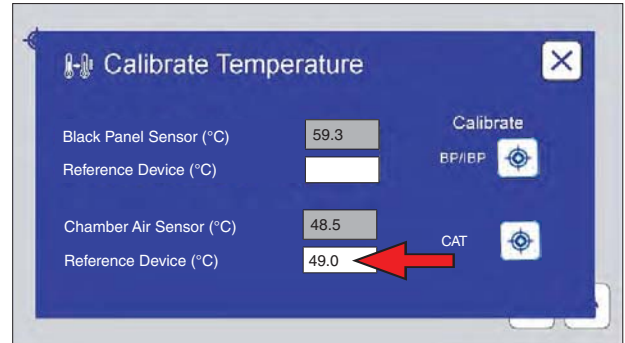
12. Read the temperature displayed on the reference thermometer.



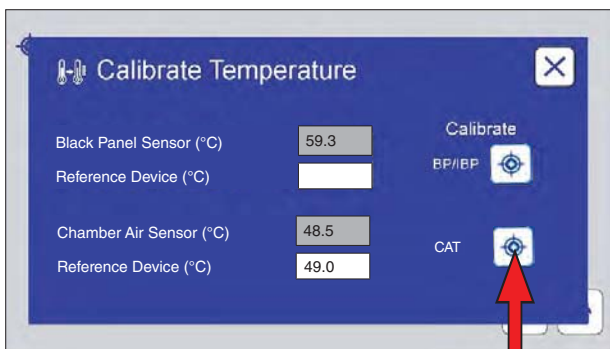
13. Use the keypad to enter the reference temperature into the reference device text box.



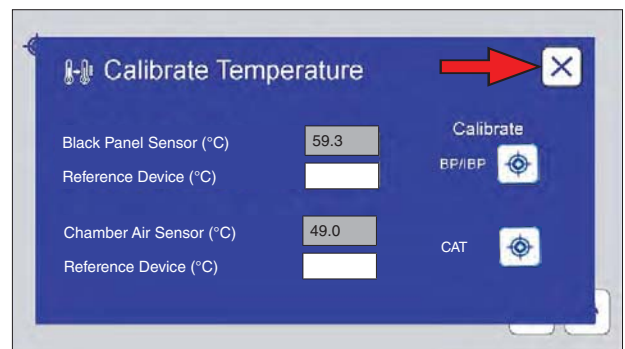
14. Touch the check mark button.



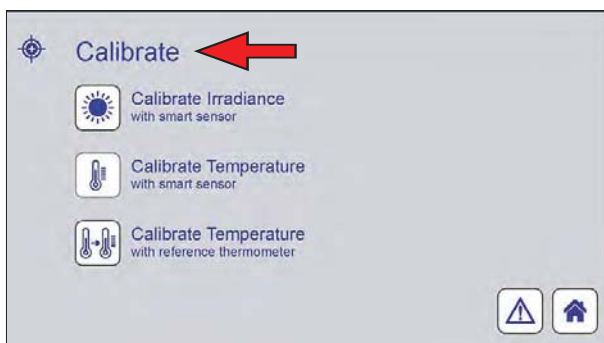
► The keypad is removed. The reference temperature is displayed in the reference device text box.



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



16. Touch the close icon to complete the calibration process.



► The calibrate screen is displayed.

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 rear lower left corner of the tester ([Figure 13.1a](#) 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](#).
- The strip chart program will be able to setup communications, request data groups, and save and display that data.

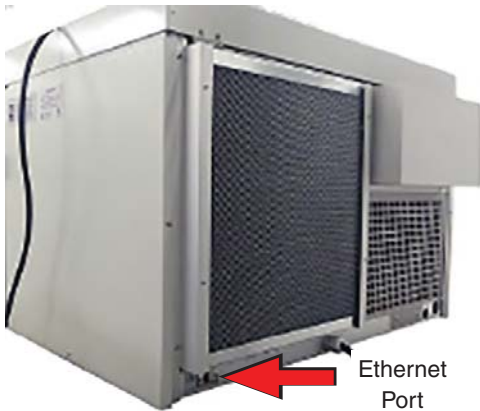


Figure 13.1a: Ethernet port located on lower left rear of tester.

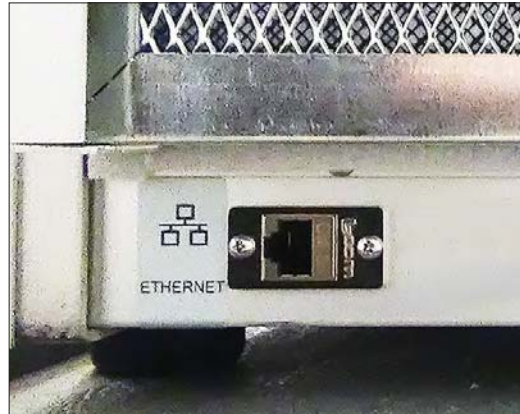


Figure 13.1b: Ethernet port.

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

- 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).
- 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.

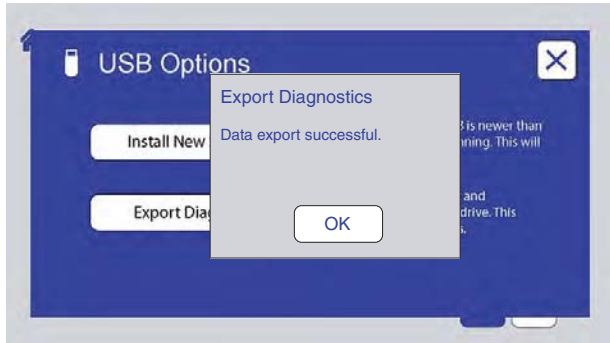
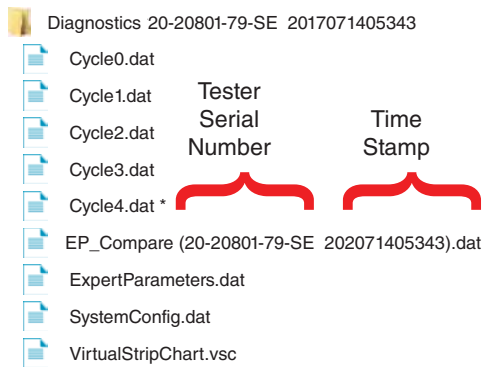


Figure 13.3e: When the Export Diagnostics data transfer is complete, this message is displayed. Touch OK.



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



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

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.

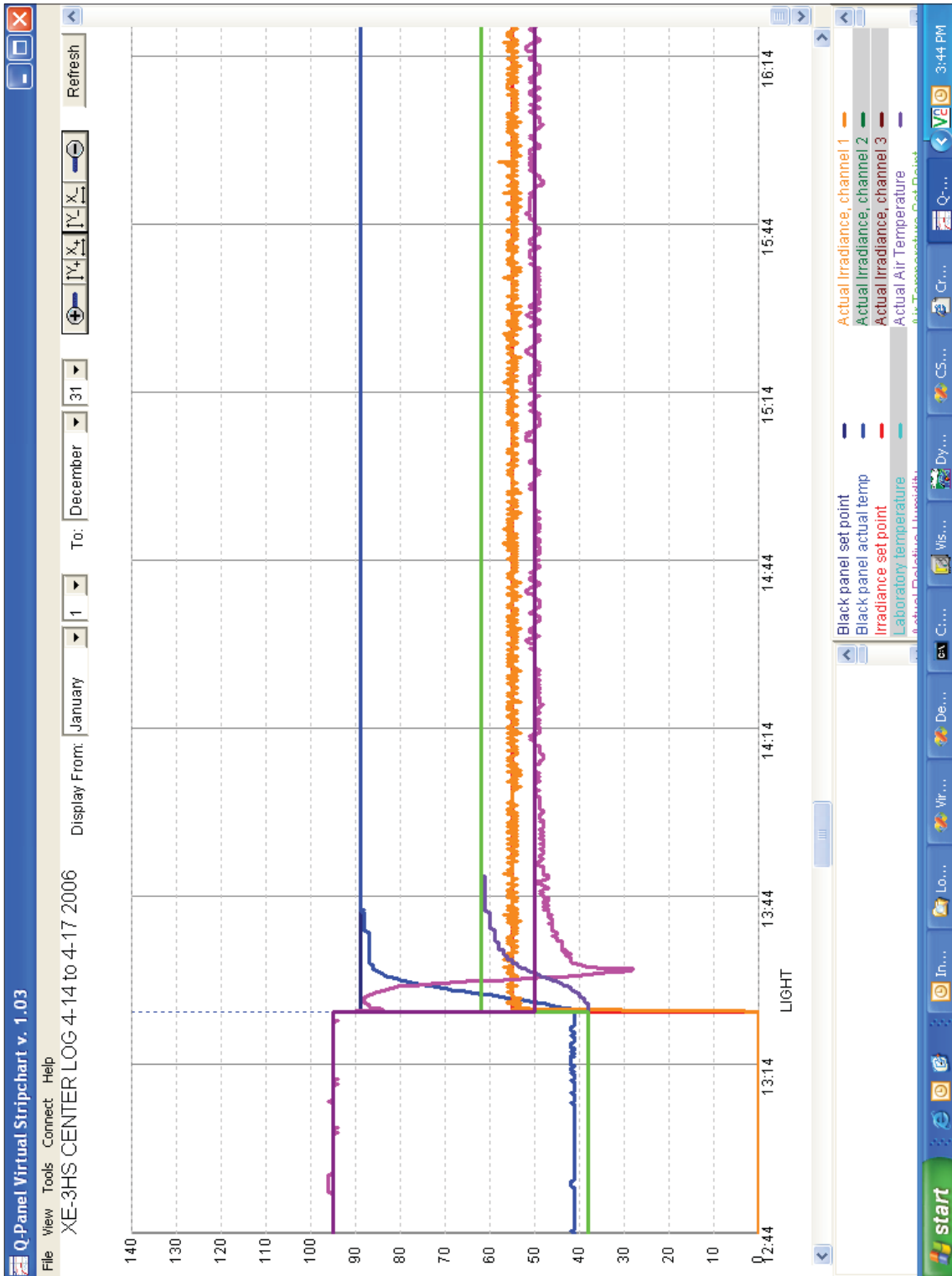


Figure 13.3h: Example stripchart view of Q-SUN operational data.

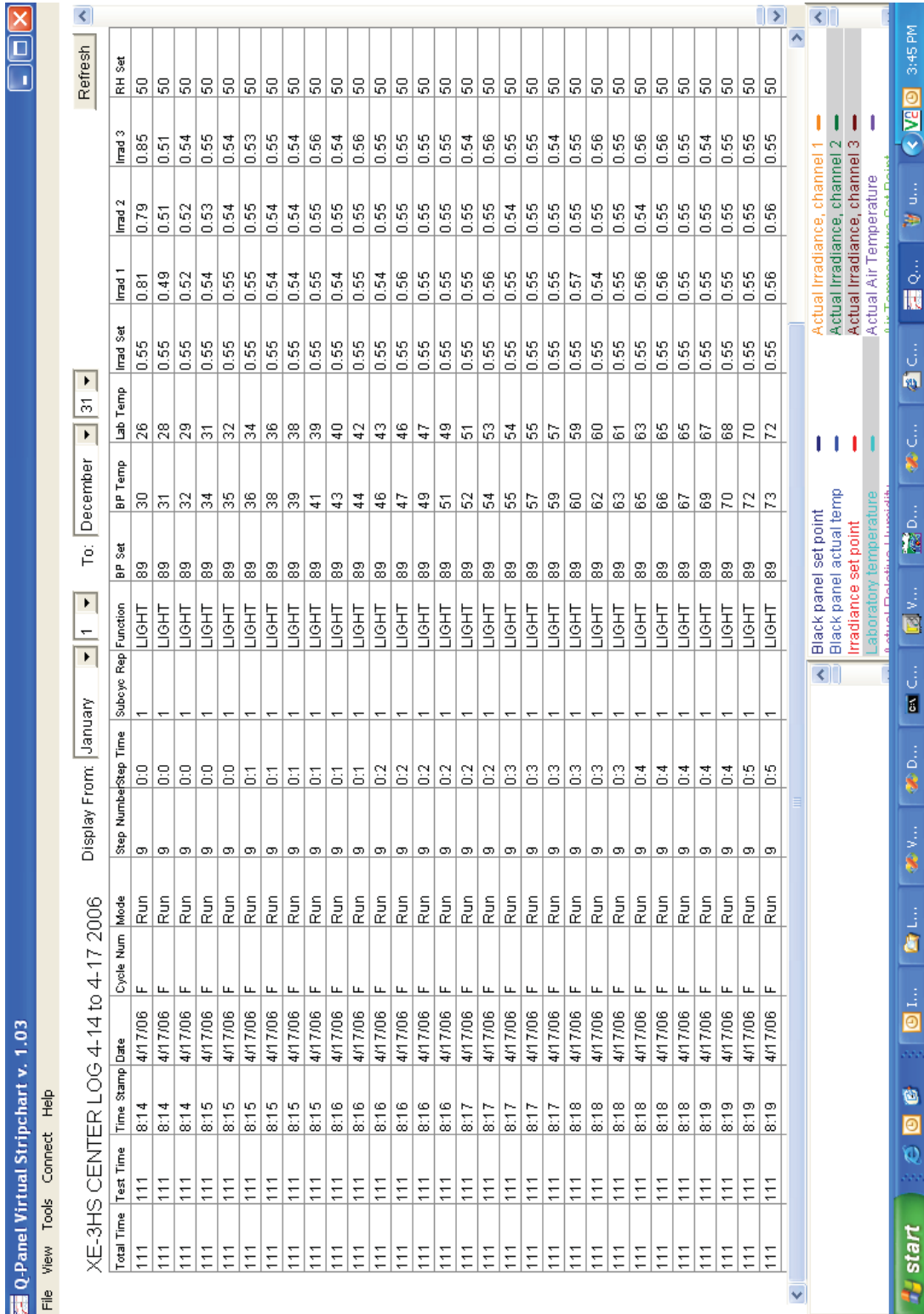


Figure 13.3: Example table view of Q-SUN operational data.

13.4 Import VIRTUAL STRIPCHART Data (Aug 2020)

- At the Q-Lab [Q-Portal Asset Center](#), customers can register their Q-SUN Xe-1 testers.
- Once a tester is registered, customers can access important information relating to the tester as well as view, customize, export, and create .pdf files of their virtual stripchart data .
- The .vsc files must first be downloaded using the Export Diagnostics function (see [Section 13.3](#)). Contact Q-Lab Repair and Tester Support ([Section 19](#)) for more information.

14. Options

14.1 Drain Pump (Mar 2019)

- 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

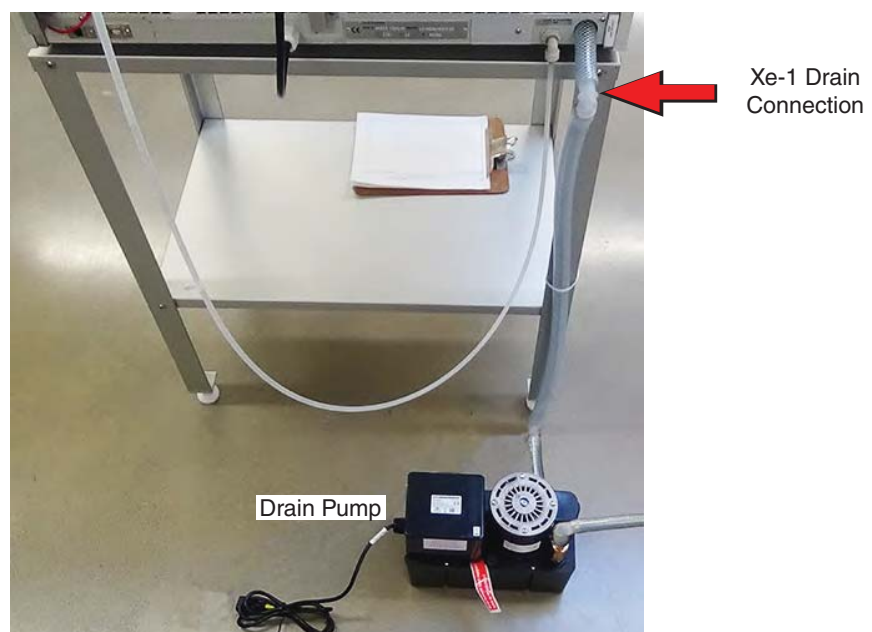


Figure 14.1: Drain Pump

14.2 Lift Kit (Sep 2020)

For Q-SUN Xe-1-BCE and Xe-1-SEC models

- 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 14.2.a) and necessary hardware.
- A leveling foot comes installed on each riser (Figure 14.2.b).
- If the chiller unit is on casters, the casters can be installed on the risers (Figure 14.2.c), 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 (Section 19) with any questions about tester drainage requirements.



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



Figure 14.2.b: Riser installed with leveling foot.



Figure 14.2.c: Riser installed with caster.

14.3 Water Inlet Pump (Sep 2020)

For Xe-1-SE, Xe-1-SCE, and Xe-1-WE Models

- Q-Lab offers a water inlet pump kit (Part Number X-10570-K) for Xe-1-SE, Xe-1-SCE and Xe-1-WE installations that do not have sufficient water pressure (Figure 14.3).
- See *X-10564-L, Water Pump Installation* for details.
- The water pump is for applications where low water pressure causes insufficient flow and water spray.
- 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.
- The pump is controlled by a pressure switch – starting when pressure is less than 275 kPa (40 PSI) and stopping when pressure reaches a maximum pressure of 413 kPa (60 PSI).
- The pump is installed between the water supply source and the tester, then plugged into an electrical power source.

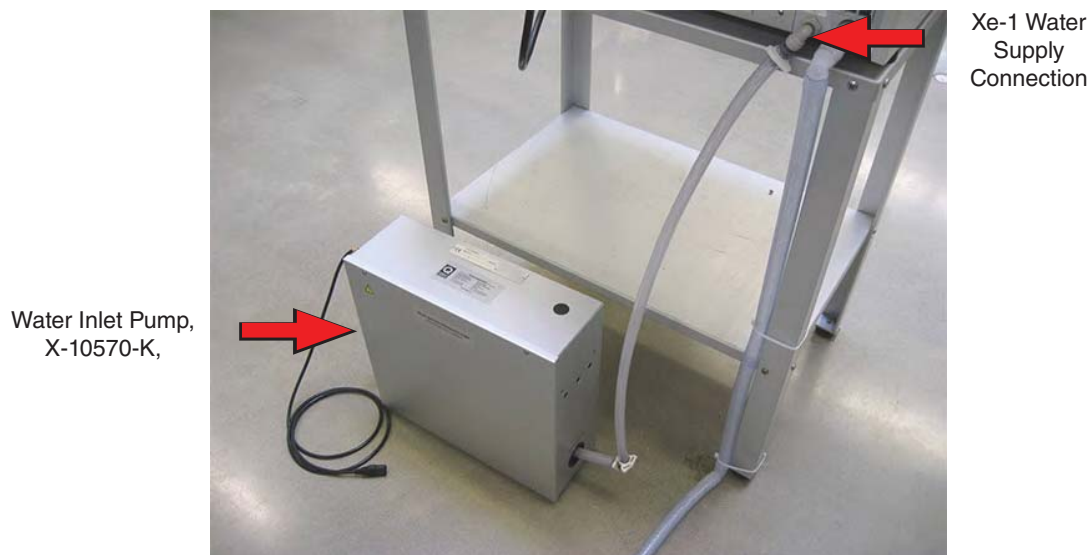


Figure 14.3: The water inlet pump connects to the Q-SUN water supply.

14.4 Water Repurification System (Sep 2020)

For Xe-1-SE and Xe-1-SCE Models

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

- During a spray step the pump turns on and draws water out of the reservoir.
- The water first goes through a repurification cartridge (filter) to remove any contaminants. It is then sprayed on the test specimens (or fills the ponding tray) 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.
- The system has built in water purity monitor which should be checked once a month.
- When the Q-SUN Xe-1 is supplied with pure water the repurification cartridge should last several months.
 - o Impurities that are introduced into the water (for example, particles dislodged from specimens) may significantly reduce the life of the repurification cartridge.
 - o The repurification cartridge should be changed when the Total Dissolved Solids exceed 1 ppm.
 - o To replace cartridge order part number V-4979-K, Demineralizer Cartridge Kit.

NOTE: The water repurification system requires a drain. If needed, a lift kit (see Section 14.2) can be used to raise the water repurification system to the correct drainage height.

Water Repurification System	
Part Number	Description
X-10897-K	Water Repurification Kit for Q-SUN



Figure 14.4: Q-SUN Xe-1 with water repurification system.

NOTE: The Xe-1-WE has a built-in repurification system; an optional water repurification system is not necessary.

14.5 0° Adapter Wedge for Xe-1 (Sep 2020)

For Xe-1-SE, Xe-1-BCE and Xe-1-SCE Models

- Q-Lab offers a 0° adapter wedge kit (Part Number X-10551-K) to tilt the Q-SUN Xe-1 backward, so that the specimen tray is in a horizontal or 0° position (Figure 14.5.a and Figure 14.5.b).
- The specimen tray in a horizontal position keeps soft, viscous specimens from running down a sloped tray and keeps liquid specimens level.
- A horizontal tray is also needed to keep water on the specimens instead of running off.

NOTE: The Xe-1-WE includes the adapter wedge in its standard configuration.

Adapter wedge tilts the Q-SUN so that the specimen tray is horizontal

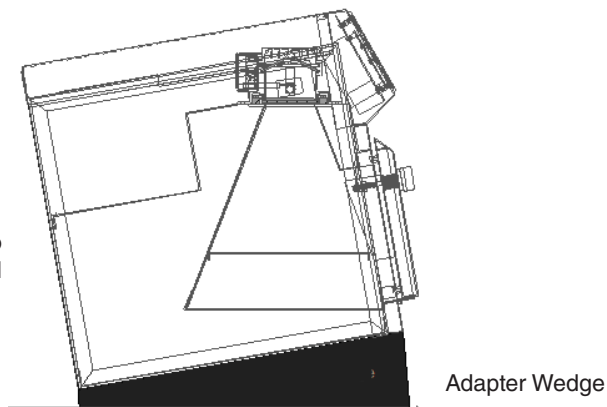


Figure 14.5.a: Side view Xe-1 with adapter wedge showing horizontal specimen tray.



Figure 14.5.b: Xe-1 with adapter wedge X-10551-K.

15. Maintenance

15.1 Lamp Replacement (Sep 2020)

Display Lamp Age

- The Xe-1 Xenon lamp must be replaced at regular intervals.
- The lamp change interval time is set by Machine Configuration parameter X104 (see [Figure 10.7w](#)).
- The current age of the lamp is displayed in the D19 Diagnostic (see [Figure 10.8c](#)).
- Touch the Diagnostics icon of the Xe-1 Main Menu to display diagnostics ([Figure 15.1.a](#)).
- Use the scroll icon to display the D19 "Lamp Hours" diagnostic ([Figure 15.1.b](#)).

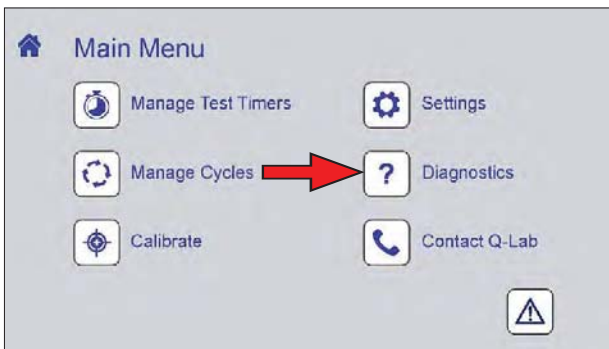


Figure 15.1.a: Touch the Diagnostics icon on the Main Menu screen to display diagnostic information.

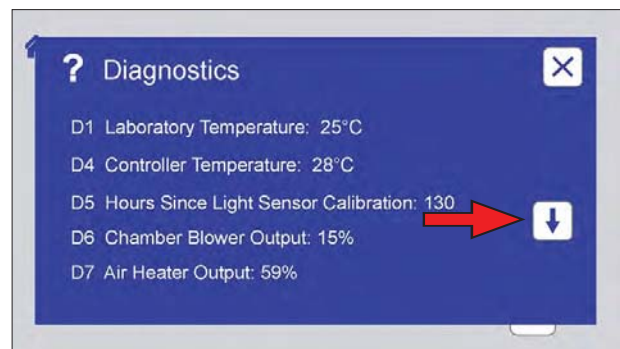
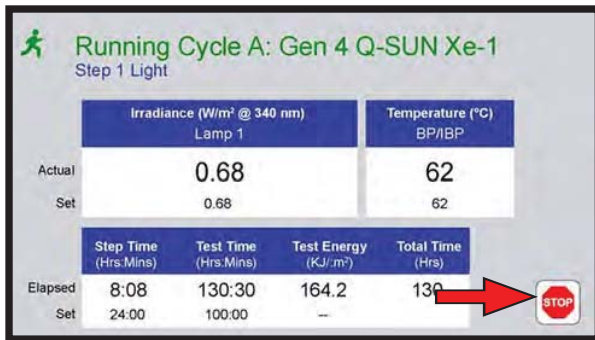


Figure 15.1.b: Use the scroll icon to display D19 lamp hours.

Replace Lamps (Sep 2020)

- Lamps should be replaced every 3000 hours when operated at Typical irradiance values, and every 1000 hours when operated at Maximum irradiance values, as listed in [Figure 11.2a](#).



1. Touch the Stop icon on the Status Screenshot.



2. Power the Xe-1 OFF.



3. Main power OFF.



4. Disconnect power.



5. Use a flat blade screwdriver to open the latch on the lamp door.

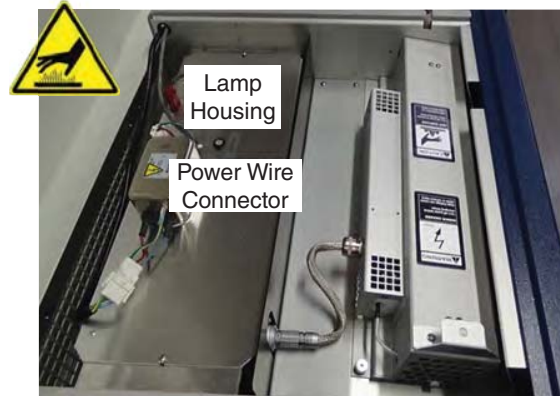


6. Open the lamp door.



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Download.com

7. **CAUTION:** Lamp is hot. Wait 15 minutes for lamp to cool.



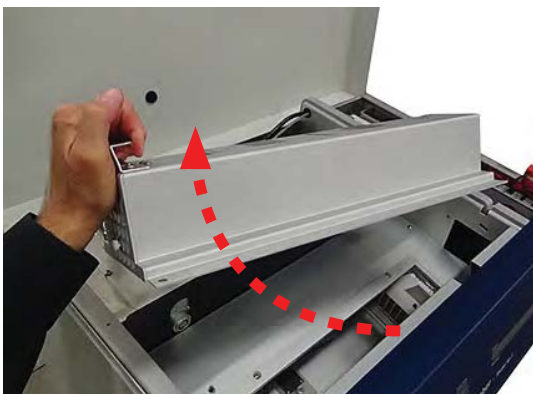
8. Locate the lamp housing and power wire connector.



9. Disconnect the power wire.



10. Loosen the captive stud in the left corner of the lamp housing.



11. Carefully remove the lamp housing from the Xe-1 cabinet.



12. Place the housing on a flat surface.



13. Locate the center hole in each end of the lamp housing cover.



14. Insert a Phillips screwdriver in the center hole. Loosen the screw.



15. Pull the lamp wire through the hole to disconnect.



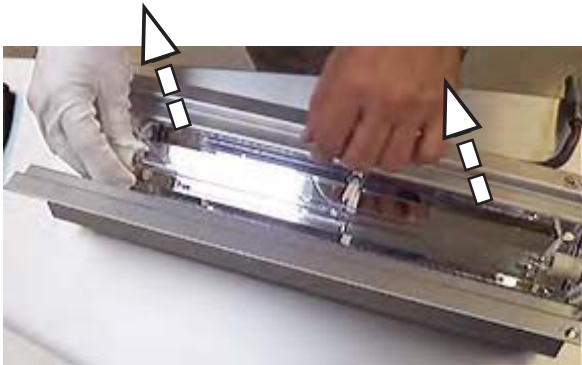
16. Disconnect wire at opposite end of lamp housing cover.



17. Turn the lamp housing over to show the lamp.



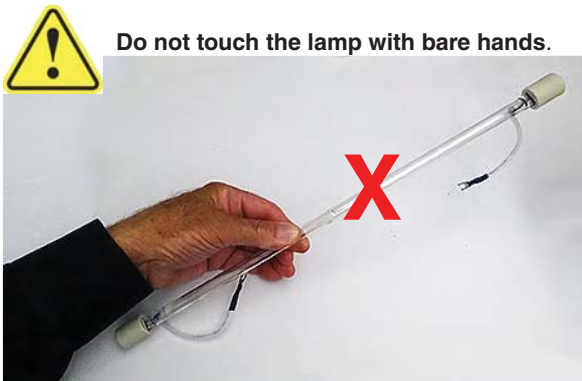
18. Release the lamp from the lamp housing by pulling lamp release lever away from the lamp.



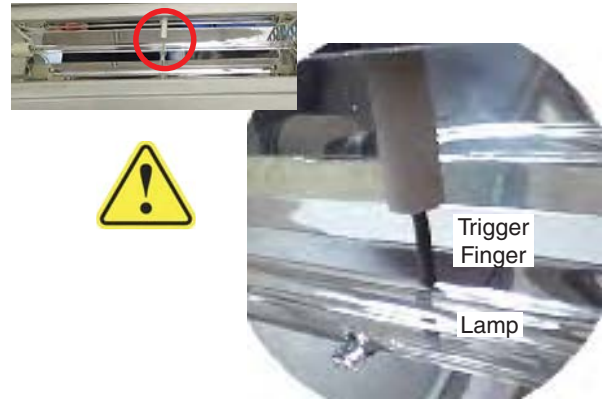
19. Remove the old lamp from the housing. Discard the old lamp.



20. Install the new lamp in the housing. Guide the wires through the holes in the housing. Pull back the release lever to seat the lamp.



21. If you accidentally touch the lamp, clean it with alcohol and a clean cloth. Oil from your skin will shorten the life of the lamp.



22. Make sure the trigger finger is in contact with the lamp but is **not exerting excessive force**.



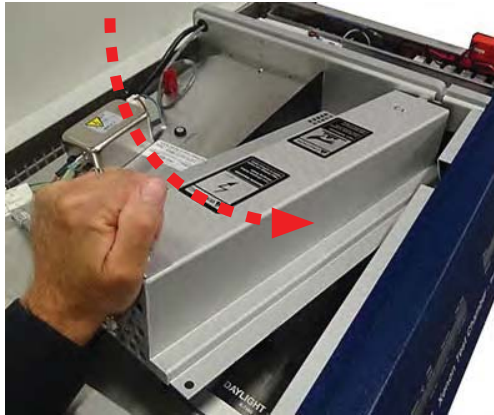
- If the trigger finger is exerting excessive force on the lamp, the lamp may break.
- If the trigger finger is not in good contact with the lamp:
 - o The lamp may not start.
 - o The lamp may fail prematurely due to arcing between the lamp and the finger.
- The trigger finger can be adjusted by gently bending the metal rod.



23. Reconnect the lamp wires. Tighten the screws.



Before reinstalling the lamp housing clean the UV optical filter. See [Section 15.3](#) for more information.



24. Reinstall the lamp housing in the Xe-1.



25. Tighten the captive stud.



26. Reconnect the power wire.



27. Close and latch the lid.



28. Reconnect Power. Power ON. Xe-1 power ON.



IMPORTANT:
Irradiance must be re-calibrated
after the lamps are changed.

29. See [Section 12.1](#) Irradiance Sensor Calibration for more information.

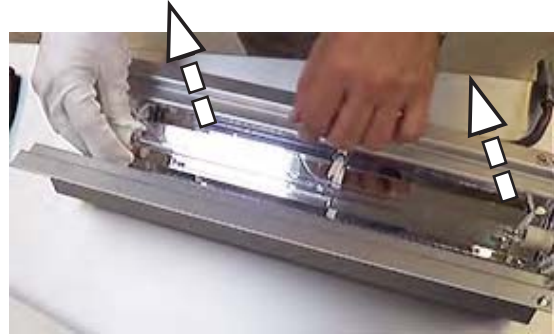
15.2 Lamp Trigger Wire and Reflector Cleaning (Sep 2020)

Trigger Wire Cleaning

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



1. If necessary, follow Section 15.1, [Step 1](#) through [Step 11](#) to remove the lamp housing from the Xe-1 tester.



2. Remove the lamp from the housing. Use gloves, do not touch the glass with your bare hand. Set the lamp aside.



3. Clean the trigger finger.



4. Wipe the trigger clean. Clean any dust and debris from the lamp reflector. See **Lamp Reflector Cleaning** on following page.



5. Follow Section 15.1, [Step 24](#) through [Step 28](#) to reinstall the lamp housing in the Xe-1 tester.



IMPORTANT:
Irradiance must be re-calibrated
after the trigger is cleaned.

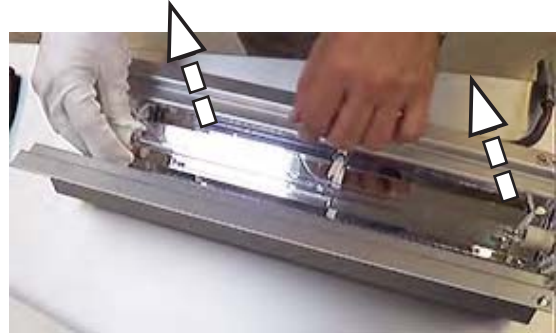
6. See [Section 12.1](#) Irradiance Sensor Calibration for more information.

Lamp Reflector Cleaning

If the lamp reflector is discolored or cloudy it should be cleaned as detailed in the steps below.



1. If necessary, follow Section 15.1, [Step 1](#) through [Step 11](#) to remove the lamp housing from the Xe-1 tester.



2. Remove the lamp from the housing. Use gloves, do not touch the glass with your bare hand. Set the lamp aside.



3. Clean any dust and debris from the lamp reflector. Wipe the reflector with isopropyl alcohol and a soft cloth.



4. Follow Section 15.1, [Step 24](#) through [Step 28](#) to reinstall the lamp housing in the Xe-1 tester.



IMPORTANT:

Irradiance must be re-calibrated after the reflector is cleaned.

5. See [Section 12.1](#) Irradiance Sensor Calibration for more information.

15.3 UV Optical Filter Cleaning (Sep 2020)

- The UV optical filter may be cleaned without being removed from the tester.
- To perform a more complete cleaning, see *Service Instruction X-10940-L, Xe-1 and Xe-3 Optical Filter Cleaning* for detailed instructions for removing, cleaning and reinstalling the optical filters.



1. Follow Section 15.1, [Step 1](#) through [Step 11](#) to remove the lamp housing from the Xe-1 tester.



2. Clean the top surface of the UV optical filter with an ammonia glass cleaner and soft cloth.



3. Open the test chamber door. Slide the specimen tray out of the chamber.



4. Reach into the chamber and clean the bottom surface of the UV Optical filter with glass cleaner and soft cloth.



5. Follow Section 15.1, [Step 24](#) through [Step 28](#) to reinstall the lamp housing in the Xe-1 tester.



IMPORTANT:
Irradiance must be re-calibrated
after the filter is cleaned.

6. See [Section 12.1 Irradiance Sensor Calibration](#) for more information.

15.4 Window-IR Filter Replacement (Jun 2016)

The Spectral Transmission of Window-IR UV Filters Changes With Age

For consistent results over time, Window-IR optical filters (Figure 15.4) should be replaced every 8400 hours. This is only necessary with Window-IR optical filters.

The spectral transmission of all the other Q-SUN filters does not change with age.

See *Service Instruction X-10110-L Q-SUN Window-IR Filter Installation* for detailed information on Window - IR filter replacement.

NOTE: Window-IR optical filters are permanently mounted in the frame.



Figure 15.4: UV filter, Window-IR, part number X-10110-K.

15.5 Monthly Maintenance (Aug 2020)

For All Models - Air Filters

- Remove and inspect the air filter every month (Figure 15.5.a).
 - Washable air filters (part number X-10997-K) are standard on Xe-1 testers.
 - Disposable air filters (part number X-7918) can be ordered as an option.
- Also inspect the air intake and exhaust areas (see Section 5.5) to make sure they are not plugged or obstructed with dust or debris.
- If dirty, disposable air filters must be replaced (see Section 17 for part numbers).
- Washable air filters in service for more than three (3) years must be replaced (see Section 17 for part numbers).
- 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 chiller air filter make sure the air flow direction arrow on the filter points toward the front of the tester (Figure 15.5.d).



Figure 15.5.a: Q-SUN Xe-1 Air Filter Removal

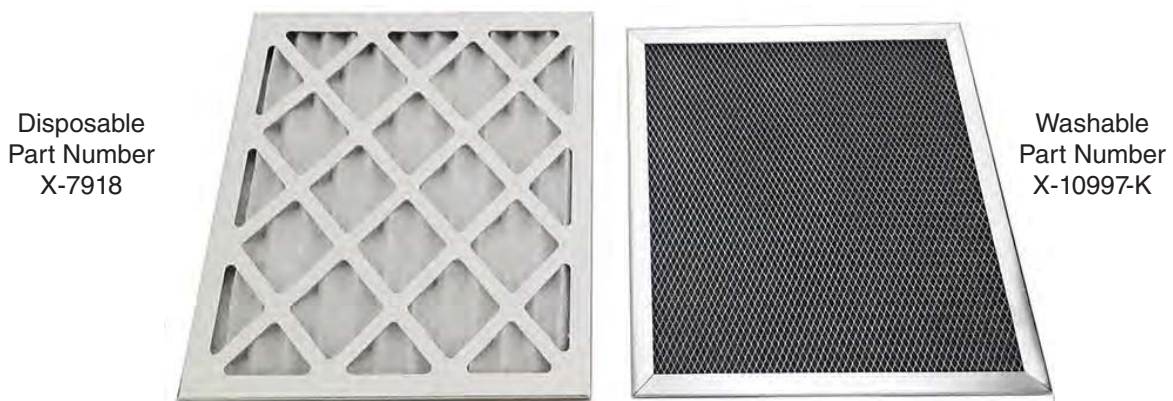


Figure 15.5.b: Xe-1 Air Filters

For Xe-1-BCE and Xe-1-SCE Models - Chiller Air Filter

- Remove and inspect the chiller air filter every month (Figure 15.5.c).
 - Washable air filters (part number X-10998-K) are standard on chillers.
 - Disposable air filters (part number X-6658) can be ordered as an option.
- Also inspect the air intake and exhaust areas (See Section 5.5) to make sure they are not plugged or obstructed with dust or debris.
- If dirty, disposable air filters must be replaced (see Section 17 for part numbers).
- Washable air filters in service for more than three (3) years must be replaced (see Section 17 for part numbers).
- 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 chiller air filter make sure the air flow direction arrow on the filter points up (Figure 15.5.d).

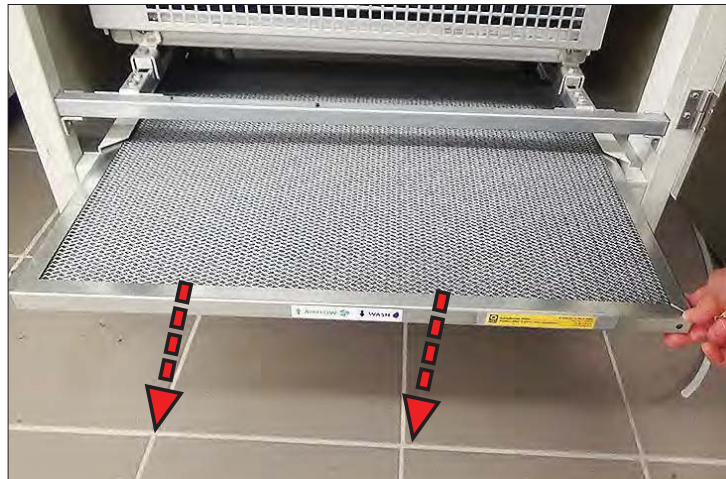


Figure 15.5.c: Remove Air Filter to Inspect



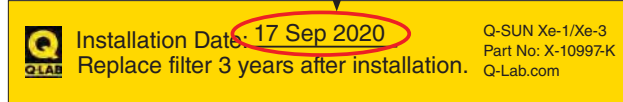
Figure 15.5.d: Make Sure the AIRFLOW Arrow Points Up

Washable Air Filter Cleaning



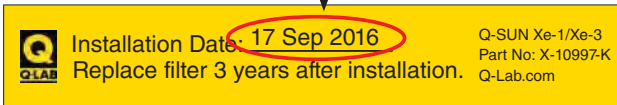
1. Remove the washable filter from the rear of the Xe-1 tester.

Less Than 3 Years Old - Wash



2. **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 4](#) through [Step 8](#).

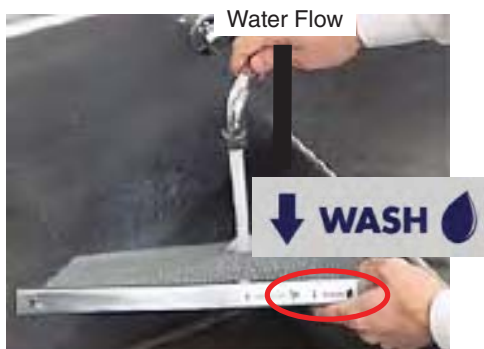
Greater Than 3 Years Old - Discard



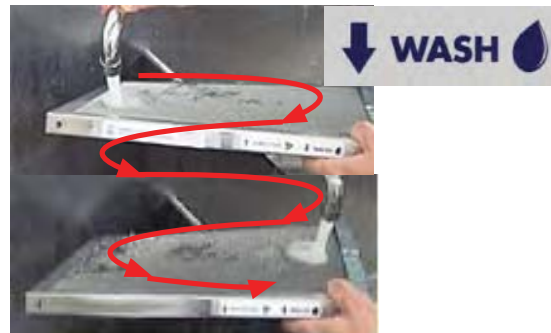
3. If the date is greater than 3 years older than the current date, discard the filter. Replace with new air filter. See Replacement Parts ([Section 17](#)) for part numbers.



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



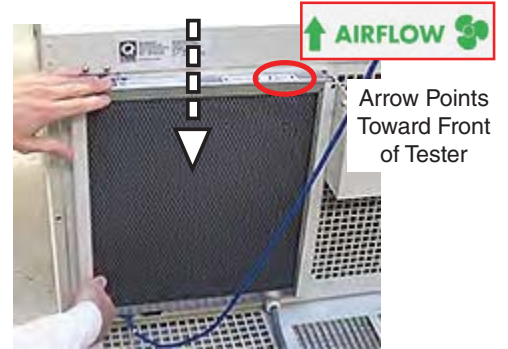
5. Hold filter under **CLEAN** running water. **IMPORTANT:** Water flow **MUST BE** in direction of **WASH** arrow.



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



7. Allow water to drain from the air filter.



8. Reinstall the washable air filter (Xe-1 air filter shown). **IMPORTANT:** Make sure arrow on the airflow label is in direction shown.



9. Reinstall the washable air filter (Xe-1 chiller air filter shown). **IMPORTANT:** Make sure arrow on the airflow label is in direction shown.

For Xe-1-WE, Xe-1-SE and Xe-1-SCE Models with Repurification Systems - Water Repurification Cartridge

- The water purity meter on the repurification system should be checked once a month (Figure 15.5e, f).
- The water purity meter shows the Total Dissolved Solids (TDS) in the repurified water.
- Press the ON/OFF button on the meter to display the TDS (Figure 15.5g).
- The water filter should be changed when TDS is ≥ 1 parts per million (PPM).
- To replace the filter, order part number V-4979-K, Demineralizer Cartridge Kit. The Demineralizer Cartridge Kit includes instructions for replacing the filter.



Figure 15.5.e: Xe-1-WE Purity Meter



Figure 15.5.f: Xe-1-SE and Xe-1-SCE Purity Meter

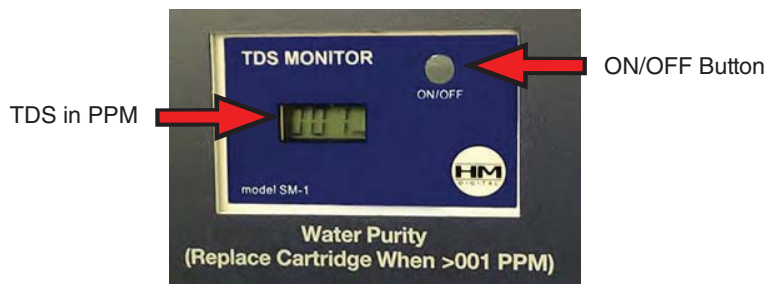
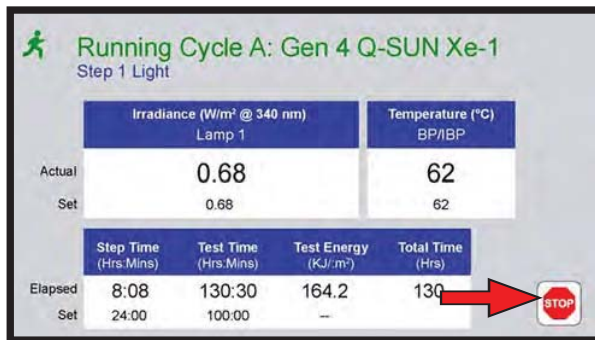


Figure 15.5.g: Water Purity Meter

Replace Xe-1-WE Water Filter

To Replace the Xe-1-WE Water Filter Use V-4979-K, Demineralizer Cartridge Kit

- Tools Required
 - o Bucket or sink to empty water.
 - o Paper Towels



1. Touch the Stop icon on the Status Screen.



2. Power the Xe-1 OFF.



3. Main power OFF.



4. Disconnect.

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5. Turn the main water supply **OFF**.



6. Open the latches on the left side access panel.



7. Remove the access panel. Set aside.




8. Place paper towels in the Xe-1-WE below the filter housing to absorb any spilled water.



9. Locate the filter wrench (V-60003) supplied with the Xe-1-W.



10. Place the wrench on the housing.

 CAUTION: The housing will be filled with water.



11. Rotate the wrench to loosen the filter housing.



12. Continue rotating the housing by hand to remove it from the filter cap.

 CAUTION: The housing will be filled with water.



13. Carefully remove the housing from the Xe-1-WE. Keep the housing vertical to avoid spilling water.



14. Empty water from the housing into a bucket or a sink.

 CAUTION: The filter may contain water.



15. Remove old filter from the housing. Discard the filter.



16. Locate the new filter in the kit.

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Gasket

17. Make sure the end of the filter marked "THIS END UP" is up and the filter gasket is in place.



18. Insert the new filter in the housing.



Gasket

19. Make sure the housing gasket is in place.



20. Carefully thread the housing back into the cap. **Do not over-tighten.**



21. Wipe up any spilled water with the paper towels. Discard the towels.



22. Reconnect the main power.



23. Main Power ON.



24. Xe-1-WE power ON.



25. Main water supply ON.



26. Touch the Run icon on the Xe-1 Status Screen.



27. Allow the filter housing to fill with water.



28. Check for water leaks around the housing cap. If any leaks, re-tighten the housing.

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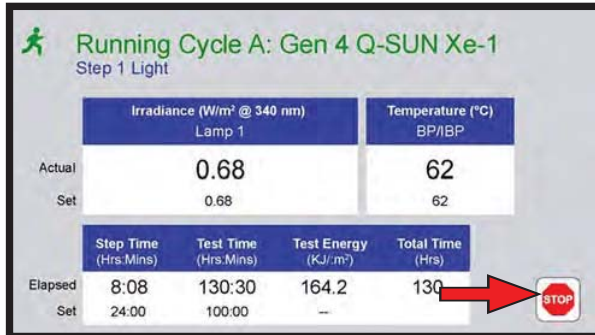
29. Replace the access panel.



30. Close the access panel latches.

15.6 Six Month Maintenance (Sep 2020)

For Xe-1-SE and Xe-1-SCE Check Water Filter, Replace if Dirty



1. Touch the Stop icon on the Status Screen.



2. Power the Xe-1 OFF.



3. Main power OFF.



4. Disconnect.

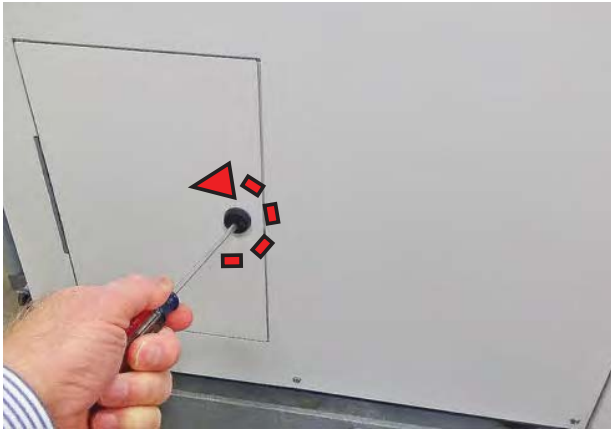


5. Use a flat blade screwdriver to open the latch on the lamp door.



6. Open the lamp door.

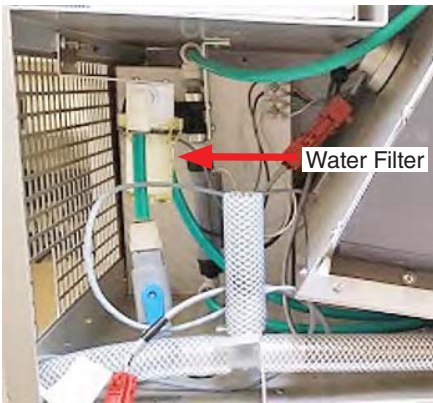
Section 15. Maintenance



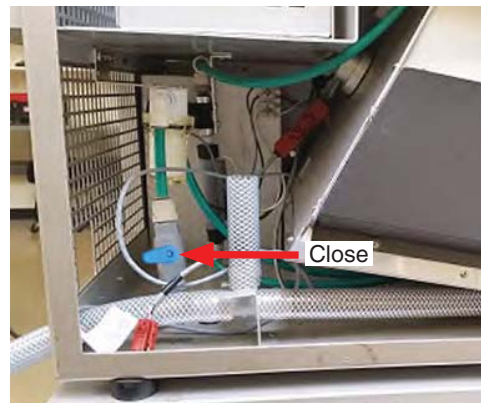
7. Use a flat blade screwdriver to open the access door latch.



8. Open the access door.



9. Locate the water filter inside the Xe-1 enclosure.



10. Close the water valve.



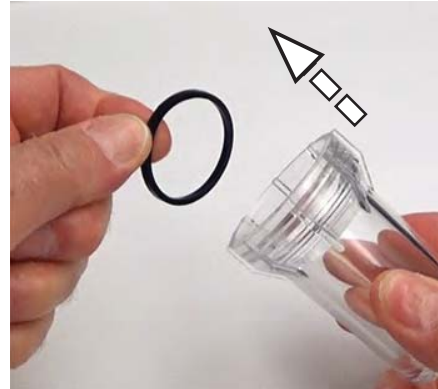
11. Unscrew the filter housing.



12. Remove the filter housing from the filter cap.



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



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



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



16. Replace the gasket in the filter housing.

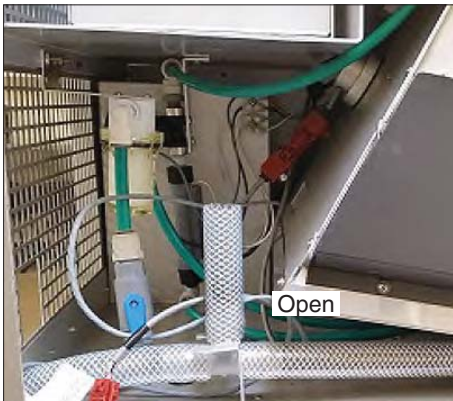


17. Install a new filter (Part Number F-8066.5) in the filter cap.

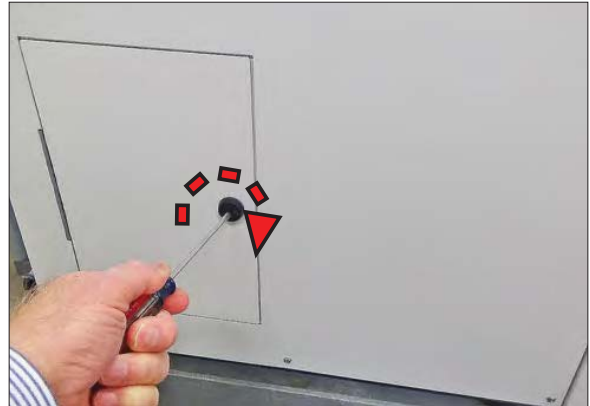


18. Reinstall the filter housing on the cap. Do Not Over-Tighten.

Section 15. Maintenance



19. Open the water valve. Allow housing to fill with water.



20. Close and latch the access door.



21. Close and latch the lid.



22. Reconnect Power. Power **ON**. Xe-1 power **ON**.

For Xe-1-S and Xe-1-SC Check Spray Uniformity

- Observe spray operation by opening the chamber door while the unit is operating in a spray cycle (Figure 15.6.a).
- The unit will spray 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 (Figure 15.6.b and Figure 15.6.c).
- Clean with a decalcifying agent (such as lemon juice), a small brush, and compressed air.



Figure 15.6.a: Cut-away drawing showing spray nozzle location in test chamber.



Figure 15.6.b: Interior of chamber showing right-side spray nozzle.



Figure 15.6.c: Spray nozzle.

Check 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 cannot 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 15.6.d](#)).
- If the reflectors are cloudy, have stains, or have any deposit that degrades the mirror finish ([Figure 15.6.e](#)); the chamber reflectors must be replaced.
- Part Number X-7979-K, Chamber Wall Replacement Kit, Xe-1 includes replacement reflectors and installation instructions. See [Section 17](#) for replacement parts.



Figure 15.6.d: Clean Reflector - OK



Figure 15.6.e: Cloudy Reflector - Replace

15.7 Q-SUN Xe-1 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 mandatory software updates have been released and should be installed.
- The files required to perform software updates can only be obtained by contacting Q-Lab.

Software Version and Tester Serial Number

- The currently-installed Q-SUN software version number and tester serial number are required to determine if a software update needs to be performed.
- The Q-SUN serial number and the software version are listed in the diagnostics screen accessed from the controller main menu.
- See [Section 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-1 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. 5.101 and 5.200 would both be more recent than 5.100).
 - **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 a USB flash drive (Figure 15.7.a).
- Connect the drive to the tester USB port on the control panel (Figure 15.7.b).
- 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 15.7.c).
 - *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 15.7.d).
- 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 15.7.a: Copy the software files from Q-Lab to a USB drive.



Figure 15.7.b: Connect the drive to the USB port on the Q-SUN control panel.



Figure 15.7.c: The USB Options screen displays the software installation button.

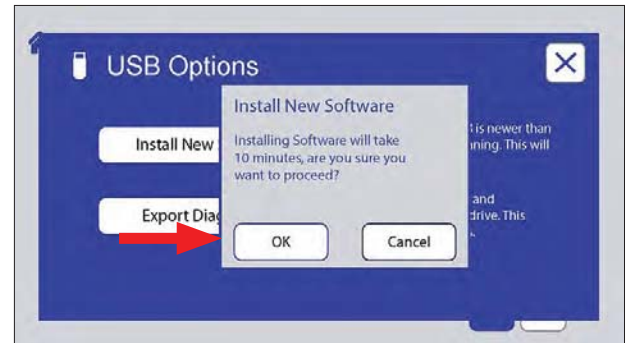


Figure 15.7.d: Touch OK to proceed with software installation.

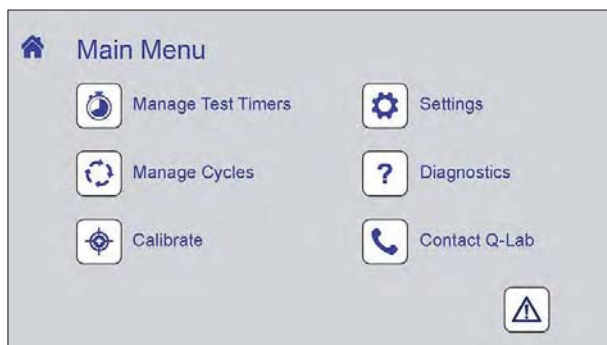


Figure 15.7.e: After software installation, the tester will restart automatically. Following that restart, the tester can be operated normally.

16. Troubleshooting and Repair

- Q-SUN Xe-1 testers are designed so that the user can make virtually all repairs.
- Only use parts that have been supplied or recommended by Q-Lab.

16.1 Main Power and Short Circuits (Nov 2014)

Problem - No Power At All

Possible Cause

- 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

Problem - Power Switch/Circuit Breaker Trips

Possible Cause

- Power switch is broken
- Short Circuit

16.2 Notification Condition & Recommended Actions (Sep 2020)

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



IMPORTANT WARNING

The “recommended actions” shown below will sometimes instruct the technician to work in areas inside of the Xe-1 that allow exposure to high voltage and hot surfaces. Only a qualified technician should perform work on the Xe-1 electrical system.

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	3000 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 15 of this manual for preventative maintenance information.
M20	CHAMBER TEMP TOO HOT XXX°C	The chamber is too hot. Step 1. The air heater relay is bad. Step 2. The chamber blower is bad.
M21	CHAMBER TEMP TOO COLD XXX°C	The chamber temperature is below the minimum allowable temperature. Step 1. The air heater relay is bad. Step 2. The air heater is bad. Step 3. The chamber blower is bad.

Section 16. Troubleshooting and Repair

Code	Message	Condition & Recommended Action
M24	LAB TEMPERATURE AT ALARM XXX°C	Lab temperature may be the cause of a chamber temperature fault. This notification accompanies other M codes as additional information, indicating that lab temperature is a contributing factor to the primary fault.
M25	CONTROLLER TOO HOT XXX°C	The controller temperature is higher than the maximum allowable temperature. Consult with Q-Lab Repair and Tester Support.
M26	LAMP/BALLAST BLOWER FAILURE	The lamp or ballast blower is supposed to be on AND the airflow switch is open. Step 1. The blower is bad. Step 2. The blower relay is bad. Step 3. The airflow switch is bad.
M27	LAMP/BALLAST BLOWER ON: SHOULD BE OFF	The lamp or ballast blower is running but should be off. Step 1. The blower relay is bad. Step 2. The airflow switch is bad.
M30	REPLACE BATTERY	The controller's battery voltage is too low. Replace the battery. CAUTION: Dispose of the old Lithium battery according to local regulations and ordinances.
M31	CALIBRATE LIGHT SENSORS	The lamps have been on for 500 hours. Recalibrate the sensors.
M33	WRONG RADIOMETER SHOULD BE UC20/340	The radiometer being used is a 420 nm or TUV type, but the Q-SUN has 340 nm sensors installed. Use a UC20/340 radiometer.
M34	WRONG RADIOMETER SHOULD BE UC20/420	The radiometer being used is a 340 nm or TUV type, but the Q-SUN has 420 nm sensors installed. Use a UC20/420 radiometer.
M35	WRONG RADIOMETER SHOULD BE UC20/TUV	The radiometer being used is a 340 or 420 nm type, but the Q-SUN has TUV sensors installed. Use a UC20/TUV radiometer.
M41	WATER IMMERSION OFF: SHOULD BE ON	Xe-1-WE only. Water flow from the reservoir to the immersion tray has stopped during an immersion step.
M42	WATER IMMERSION ON: SHOULD BE OFF	Xe-1-WE only. Water is flowing from the reservoir to the immersion tray when the unit is not in an immersion step.
M43	SPRAY WATER OFF: SHOULD BE ON	The Q-SUN is running a spray step, but the spray is off. Possible causes are: Step 1. The water supply is turned off. Step 2. The solenoid valve is bad. Step 3. The flow switch is bad.
M44	SPRAY WATER ON: SHOULD BE OFF	The Q-SUN is NOT running a spray step, but the spray is on. Possible causes are: Step 1. The solenoid valve is bad. Step 2. The flow switch is bad.

Code	Message	Condition & Recommended Action
M47	RESERVOIR WATER LEVEL TOO LOW	<p>Xe-1-WE only. The water level in the reservoir is low. Only active during immersion steps. The test will stop. Possible causes are:</p> <p>Step 1. DI cartridge is empty. Clear Message. Wait 10 minutes for the reservoir to fill then press START.</p> <p>Step 2. The water supply is turned off.</p> <p>Step 3. The flow switch (X-15250-X) is bad.</p> <p>Step 4. The water level sensor (X-15195-X) is bad.</p> <p>Step 5. The water pump (X-15244-K) is bad.</p>
M49	POWER DISRUPTED	<p>This message indicates power was off and then came back on during a RUN step.</p> <p>The message appears if power goes out for any reason, including if the user turns power OFF when the tester is in RUN mode.</p> <p>Always press STOP before powering the Xe-1 off to prevent the M49 message from being displayed when the tester is powered back on.</p>
M54	CHAMBER TEMP RUNAWAY XXX°C	<p>The chamber temperature is more than 10 °C too hot for 1 minute.</p> <p>Step 1. The set point is too low for the lab temperature.</p> <p>Step 2. The air heater relay is defective (failed on).</p> <p>Step 3. The chamber blower is defective.</p> <p>Step 4. The power supply board is defective.</p>
M60	LOW IRRADIANCE: CHANGE LAMP	<p>Irradiance of the lamp is 5% below set point. Replace the lamp and recalibrate.</p>
M61	LAMP OUT	<p>The irradiance is 30% below the set point.</p> <p>Step 1. The lamp burned out.</p> <p>Step 2. The ballast is defective.</p> <p>Step 3. The lamp relay is defective.</p> <p>Step 4. The trigger finger is defective.</p>
M63	IRRADIANCE TOO HIGH	<p>The irradiance is 5% above the set point.</p> <p>Step 1. The dimming cable from the ballast and the controller is not properly connected.</p> <p>Step 2. The ballast is defective.</p>
M64	LAMPS ON: SHOULD BE OFF	<p>The Q-SUN is in a dark cycle, but the controller senses the irradiance is above 0.05 W/m². Replace the lamp relay.</p>
M65	AC VOLTAGE OUT OF RANGE	<p>The input voltage drops below 185 V or above 265 V.</p>
M67	LAMP RELAY STUCK ON	<p>The irradiance is above 0.05 W/m² during the “Relay Check.”</p> <ol style="list-style-type: none"> 1. The lamp relay is defective. 2. Replace the lamp relay.

Code	Message	Condition & Recommended Action
M68	RUN RELAY STUCK ON	The irradiance is above 0.05 W/m ² during the “Relay Check.” 1. The run power relay is defective. 2. Replace the run power relay.
M70	BLACK PANEL TEMP SENSOR FAIL XXX°C	The Black Panel Temperature is less than 3 °C. 1. Make sure connector is firmly seated. 2. Replace the Black Panel Temperature sensor.
M72	AIR TEMPERATURE SENSOR FAIL	The Air Temperature is less than 3 °C. 1. Make sure connector is firmly seated. 2. Replace the Air Temperature Sensor.
M74	LAB TEMPERATURE SENSOR FAIL	The Lab Temperature is less than 3 °C. 1. Make sure connector is firmly seated. 2. Replace the Lab Temperature Sensor.
M80	FLASH MEMORY FAILURE	Checksum test on program failed. Contact Q-Lab Repair. See Section 19 for contact information.
M81	FLASH DATA CORRUPT	Parameter and setup data corrupted. Contact Q-Lab Repair. See Section 19 for contact information.
M82	RAM CORRUPTED, RAM RELOADED	Error in RAM data. Contact Q-Lab Repair. See Section 19 for contact information.
M101	SD CARD MISSING	The SD card on the main controller board is missing or not seated properly. Contact Q-Lab Repair. See Section 19 for contact information.
M103	SYSTEM AUTO REBOOT: SEE TECH MANUAL	The Q-SUN has restarted itself in order to avoid a potential problem in operation. Please contact Q-Lab Repair.
M104	SOFTWARE INSTALL COMPLETED SUCCESSFULLY	Software has been installed without issue
M900	STATUS SCREEN COMMUNICATIONS FAILURE	Communication lost between main controller and Status Screen. Tester will enter single-screen mode.
M901	MENU SCREEN COMMUNICATIONS FAILURE	Communication lost between main controller and Menu Screen. Tester will enter single-screen mode.
M902	MAIN CONTROLLER COMMUNICATIONS FAILURE	Message that appears on a screen that has experienced M900 or M901

See for [Section 10.4](#) for information on viewing and clearing notifications. See [Section 19](#) for Q-Lab Repair and Tester Support contact information.

16.3 Lamp Does Not Light (Sep 2020)

For All Xe-1 Models

Symptom - Lamp Does Not Light

- Trigger finger is not in good contact with lamp, or requires cleaning. See [Section 15.2](#).
- Faulty trigger/transformer assembly. See [Section 17](#) 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 15.2](#).
- Reverse lamp ([Figure 16.3.a](#) and [Figure 16.3.b](#)).
- Replace lamp. See [Section 15.1](#).



Figure 16.3.a: Remove the lamp.



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

16.4 Water Flow (Sep 2020)

For Xe-1-SE and Xe-1-SCE Models

- Water low controls for the spray system are located in the plumbing enclosure at the front lower right corner of the Xe-1 cabinet (Figure 16.4.a and Figure 16.4.b).
- During the 5 seconds per minute of a spray step, when the water spray is on, the flow rate should be 1.4 Liter/minute.
- During the 55 seconds per minute of a spray step, when the water spray is off, the flow rate should be 0 Liter/minute.
- The pressure gauge should read about 104-155 kPa (15-25 PSI).
- Refer to the following table for troubleshooting water flow problems.

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



Figure 16.4.a: Pressure Gauge, Pressure Regulator, and Flow Meter Location

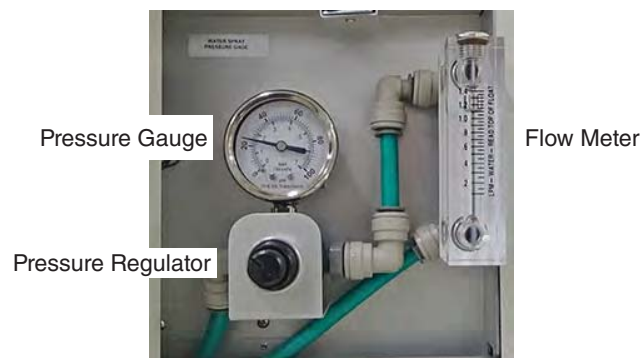


Figure 16.4.b: Pressure Gauge, Pressure Regulator, and Flow Meter Detail