LF-8151-TM

Technical Manual

# Q-FOG
# Cyclic Corrosion Tester


**For Q-FOG Models:**

| | |
|---|---|
| SSP600 | CCT600 |
| SSP1100 | CCT1100 |

Serial Numbers: XX-XXXXX-55

Q-LAB

Revision Date
07 Dec 2021

## Table of Contents

# 1. Purpose (Sep 2021)

- This Technical Manual provides detailed information on the operation and maintenance of Q-FOG® SSP and CCT cyclic corrosion testers.
  - Model SSP performs traditional salt spray and Prohesion tests.
  - Model CCT performs salt spray, Prohesion, and 100% humidity for most cyclic automotive tests.
- See Section 7 for more information on Q-FOG functionality.
- This technical manual can also be accessed online at Q-Portal Documents.

## Q-FOG model numbers covered in this guide:

| | |
|---|---|
| Q-FOG/SSP600 | Q-FOG/CCT600 |
| Q-FOG/SSP1100 | Q-FOG/CCT1100 |

## Model number nomenclature:

- Q-FOG/SSP or Q-FOG/CCT - Base model.
- 600 or 1100 - Test chamber volume, either **600** L or **1100** L.
- The tester model number is shown on the nameplate (Figure 1) attached to the rear of the chamber.
- Tester electrical requirements are also shown on the nameplate. See Section 6.3 for more information.

Nameplate Location

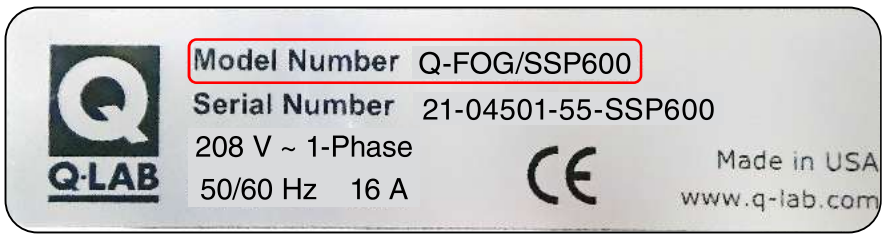



Figure 1: Q-FOG nameplate showing model number.

# 2. Specifications, Classifications, Symbols (Aug 2021)

## Specifications, Classifications

- Replacement (Make-up) Air: 60 CFM
- Transportation and Storage Temperature: -40 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.

## Symbols

Electrical Shock Hazard

Hot Surfaces Hazard

Attention

Finger/Hand Crushing Hazard

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

# 3. Safety (Aug 2021)

Q-Lab accepts no responsibility for the consequences if the user fails to comply with the instructions in this document. 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 document 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-FOG meets the European Low Voltage Directive 2014/35/EU and complies with the requirements of EN61010-1: 2010 (Third Edition), “Safety of Electrical Equipment for Measurement, Control and Laboratory Use”.
- The Q-FOG meets the European Electromagnetic Directive 2014/30/EC and complies with the requirements of EN 55011:2007 Radiated and Conducted Emissions – class A.
- Do not use gases such as $SO_2$ in the Q-FOG. Do not use hazardous or petroleum based organics (solvents). Purge the chamber of airborne mist or fog before opening the chamber lid.
- Use only parts that have been supplied or recommended by Q-Lab.

## Safety Devices

- Chamber Cabinet Residual Current Device
- Chamber Cabinet Electrical Power Circuit Breakers
- Chamber Over Temperature Cut-out
- Bubble Tower Over Temperature Cut-out
- Bubble Tower Low Water Level Indicator
- Bubble Tower High Water Level Indicator
- Bubble Tower O-Rings and Compression Springs
- Bubble Tower Pressure Relief Valve
- Solution Reservoir Low Level Indicator
- Solution Reservoir Empty Indicator
- Chamber Heater Over Current Switch
- Control Top Protected Area Tool Access

# 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 (Jul 2020)

### Ambient Laboratory Temperature and Humidity

- The recommended ambient operating temperature and relative humidity (RH) for Q-FOG testers is 23 ± 5 °C and 50 ± 25% RH.
- Operating outside the recommended range (or in rare cases, even within it), certain standards or test cycle conditions may not be achievable.
- Operating outside the recommended range can result in the tester producing chamber temperature and/or humidity faults.
- Never operate a Q-FOG 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 6.1.

## 4.2. Unsuitable Environments (Aug 2021)

### Salt Fog or Other Airborne Contamination

- Always wait five (5) minutes for the purge blower to clear the chamber of mist or fog before opening the Q-FOG test chamber lid.
- Do Not install Q-FOG corrosion chambers in a room with Q-SUN xenon testers or QUV weathering testers.
- Do Not locate Q-FOG in a room with machines or processes that generate dust, particles, vapors, gases, etc.

Figure 4.2a: Do not install Q-FOG in a room with Q-SUN or QUV testers.

Figure 4.2b: Do not locate tester 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.
- Do not locate tester near sources of cold or hot air.


Figure 4.2c: Do not locate Q-FOG near open windows.


Figure 4.2d: Keep tester away from sources of hot or cold air.

## Other Unsuitable Environments

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

**For further detail on laboratory environment requirements, please contact Q-Lab Repair and Tester Support (see Section 18).**

# 5. Uncrating

## 5.1. Test Chamber (Aug 2021)

**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.**

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

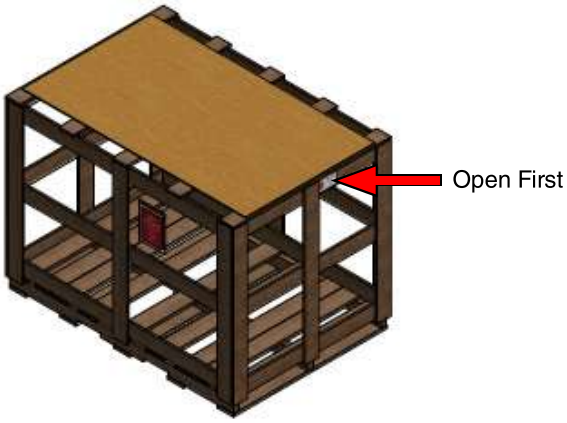



Figure 5.1a: This crate has a flat top.

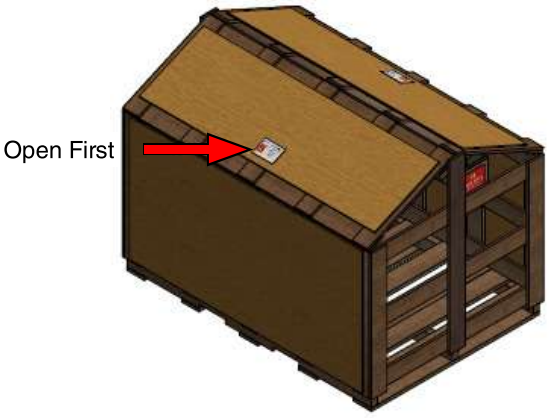



Figure 5.1b: This crate has a peaked top.


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


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

| Shipping Weights (Approximate) | SSP600 and CCT600 | SSP1100 and CCT1100 |
|---|---|---|
| Q-FOG in Crate | 499 kg (1100 lb) | 544 kg (1200 lb) |
| Q-FOG Only | 224 kg (494 lb) | 269 kg (594 lb) |

| Tools Required | |
|---|---|
| Phillips Screwdriver | Ratchet |
| Utility Knife | 15 mm (9/16") Socket |
| Fork Lift* | 11 mm (7/16") Socket |
| Step Stool or Small Ladder | Pry Bar for Closed Sided Crates |

*A fork lift or other mechanical lifting device is recommended for use in moving the crated tester to the installation location. Follow all local, OSHA, EHS, and other applicable equipment operation safety requirements, recommendations, and practices.

- For flat top crate uncrating instructions go to Section 5.2.
- For peaked crate uncrating instructions go to Section 5.3.

**Use extreme care when uncrating to avoid damaging the Q-FOG cabinet.**

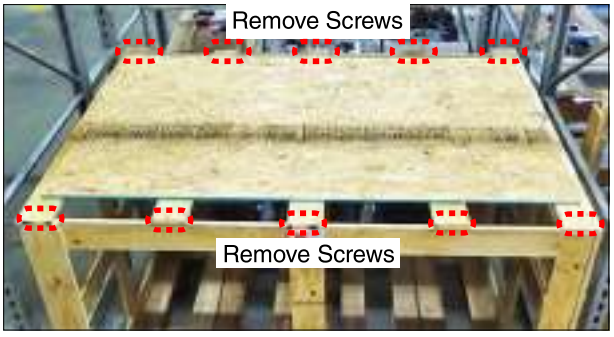
**Do not attempt to remove the chamber lid without special instructions. Contact Q-Lab Repair and Tester Support for detailed instructions (Section 18).**

## 5.2. Flat Top Crate (Aug 2021)

**This type of crate is used for container shipping.**

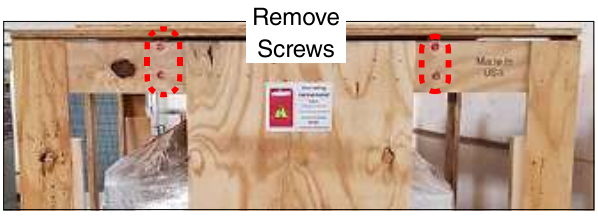

**1.** Uncrating instructions are located in this envelope attached to the tester. Remove and read first.


**2.** Uncrating instructions are located in the red envelope attached to the top of the tester. Remove the envelope and read the instructions.




**3.** Remove the screws along the top front and back edges of the crate in areas shown.

Right End of Crate



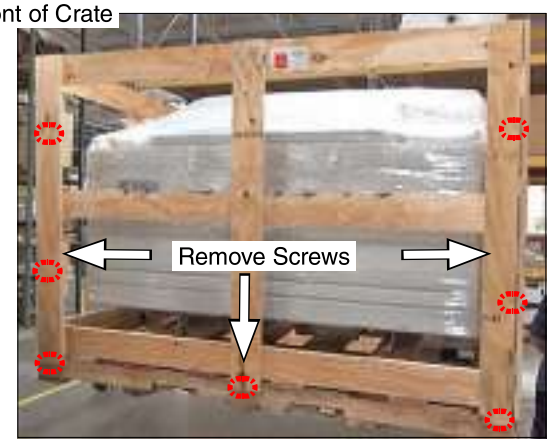

**4.** Remove the screws at the top right end of the crate.

Left End of Crate


**5.** Remove the screws at the top left end of the crate.


**6.** **IMPORTANT:** Use two persons. Lift off the top of the crate. The top may be discarded.

Front of Crate



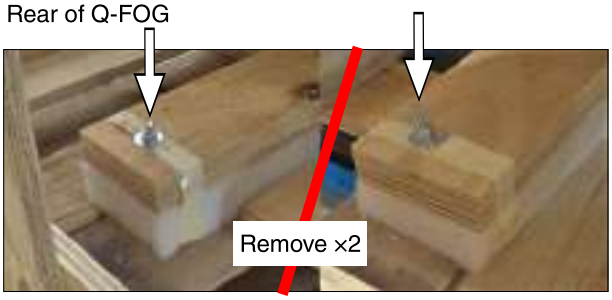

7. Remove the screws in the front side of the crate in the areas shown.

8. Remove the front side of the crate. The front side may be discarded.

Front of Q-FOG


9. Remove the two (2) 15 mm (9/16") bolts and nuts holding the front of the Q-FOG to the pallet.

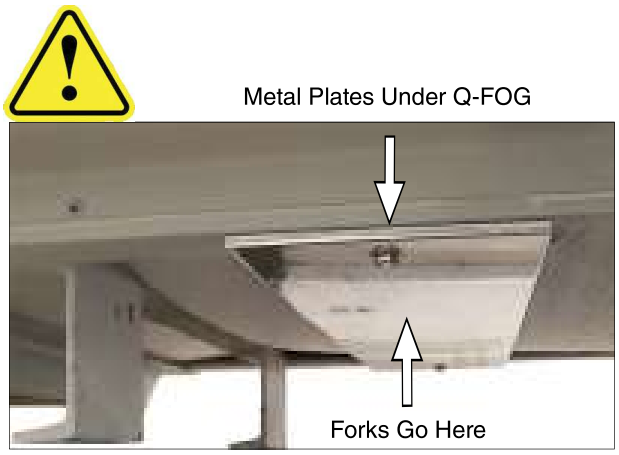
Rear of Q-FOG



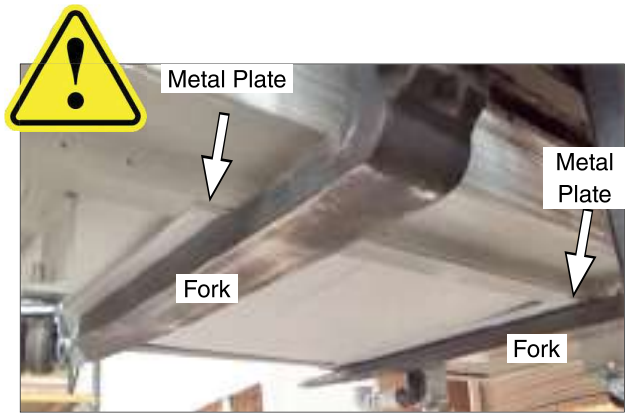

10. Remove the two (2) 15 mm (9/16") bolts and nuts holding the rear of the Q-FOG to the pallet.


11. **IMPORTANT:** Locate the forklift labels on the front of the Q-FOG chamber. **Follow all local, OSHA, EHS, and other applicable equipment operation safety requirements, recommendations, and practices.**

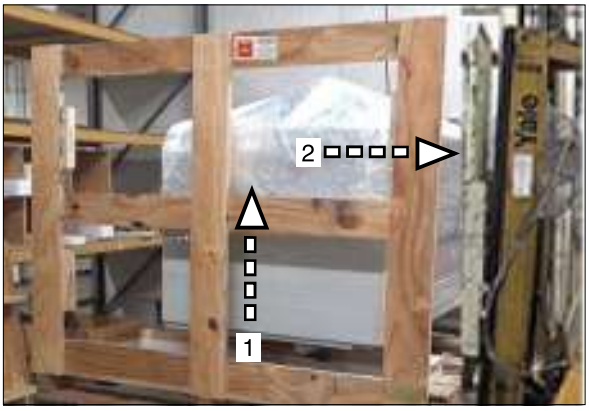
12. Location of lift plates under Q-FOG.



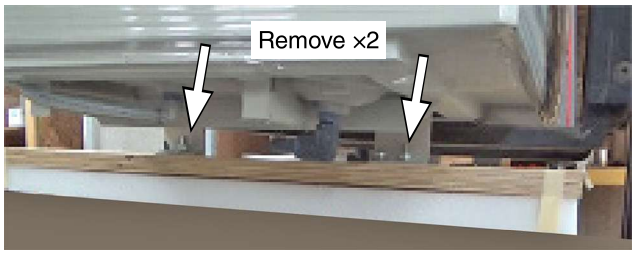

13. Make sure lift forks are under the metal plates on the bottom of the Q-FOG.



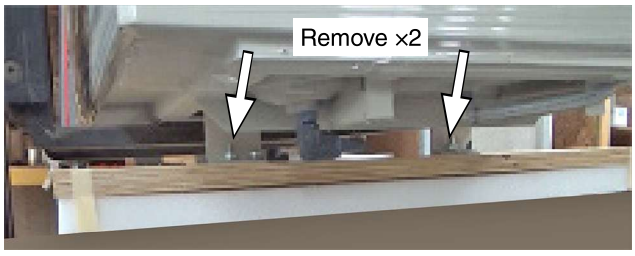

14. **USE EXTREME CAUTION: Forks can easily damage the Q-FOG. Make sure forks are under metal plates before lifting.**



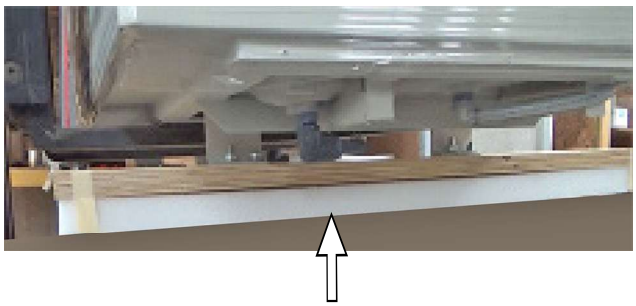

15. Use a forklift to lift Q-FOG a few inches up off the pallet. Move the Q-FOG away from the crate. Lower the Q-FOG to the floor.




16. Use a 15 mm (9/16") wrench to remove the 2 nuts from the bolts in the left angle brackets under the Q-FOG cabinet.




17. Use a 15 mm (9/16") wrench to remove the 2 nuts from the bolts in the right angle brackets under the Q-FOG cabinet.




18. Lift the Q-FOG a few inches and remove the bolts, both boards, and the foam pieces from the tester. Discard.

**19.** Carefully move the Q-FOG to the installation location and lower into position. See Section 6.1.


**20.** Use a utility knife to carefully remove the plastic wrapping. Use care to avoid scratching the Q-FOG cabinet.

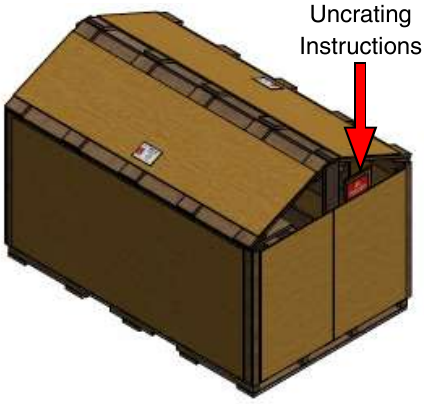

**21.** Q-FOG cabinet uncrating is complete.


**22.** If any accessories are attached to the pallet, remove them and remove the plastic wrap.

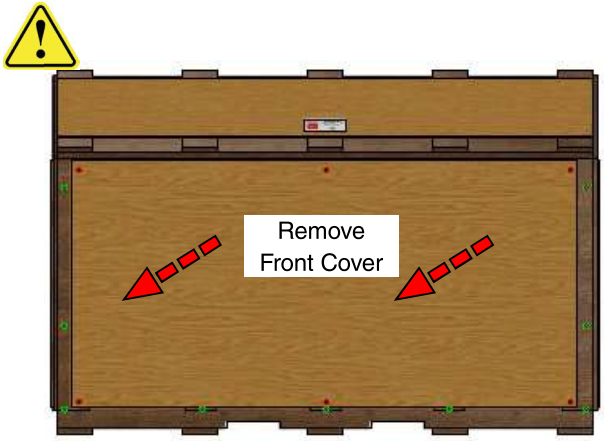
## 5.3. Peaked Crate (Aug 2021)

**This type of crate is used for domestic and air shipping.**

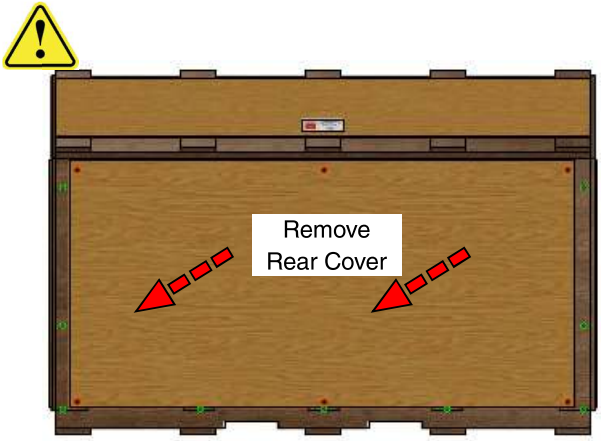

**1.** Uncrating instructions are in this envelope attached to the end of the tester. Remove and read first.



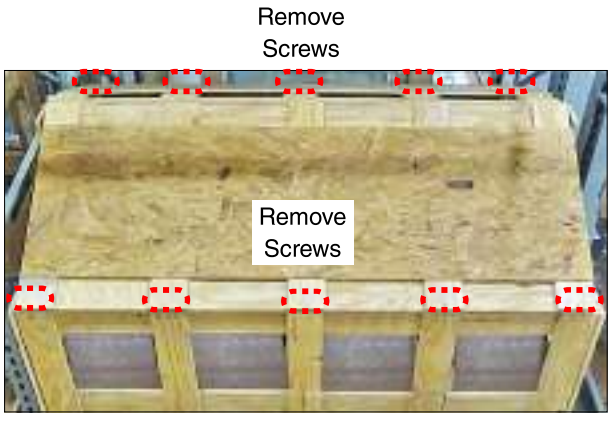

**2.** Uncrating instructions are located in the red envelope attached to the end of the tester. Remove the envelope and read the instructions.




**3.** Carefully pry the front cover off of the crate.




**4.** Carefully pry the rear cover off of the crate.

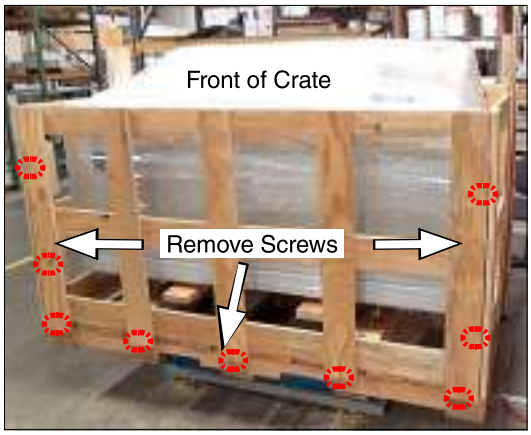



**5.** Remove the screws along the top front and back edges of the crate in areas shown.


**6.** Remove the screws in the vertical support at the right end of the crate.


7. Remove the screws in the vertical support at the left end of the crate.


8. **IMPORTANT:** Use two persons. Lift off the two sides of the top of the crate. Set aside.



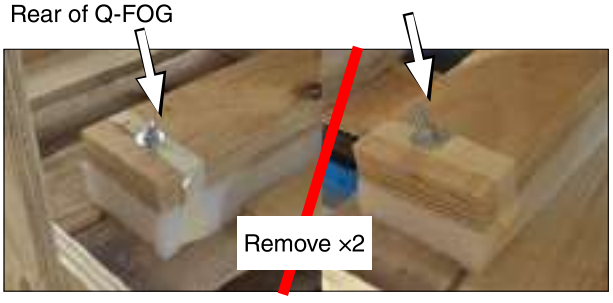

9. Remove the screws in the front side of the crate in the areas shown.

10. Remove the front side of the crate. The front side may be discarded.

Front of Q-FOG


11. Remove the two (2) 15 mm (9/16") bolts and nuts holding the front of the Q-FOG to the pallet.

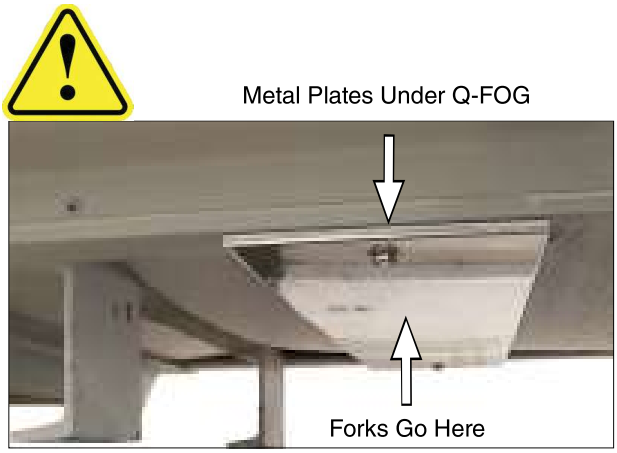
Rear of Q-FOG



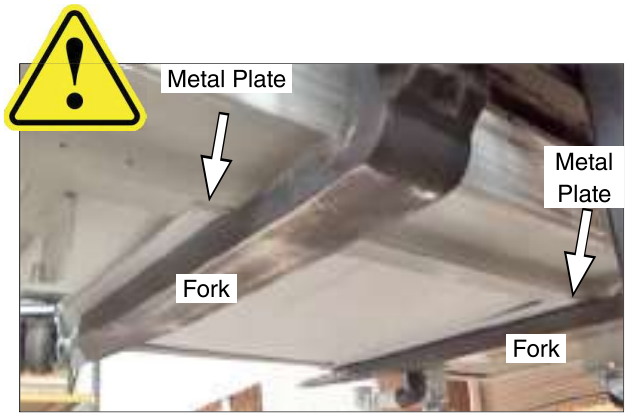

12. Remove the two (2) 15 mm (9/16") bolts and nuts holding the rear of the Q-FOG to the pallet.


13. **IMPORTANT:** Locate the forklift labels on the front of the Q-FOG chamber. **Follow all local, OSHA, EHS, and other applicable equipment operation safety requirements, recommendations, and practices.**

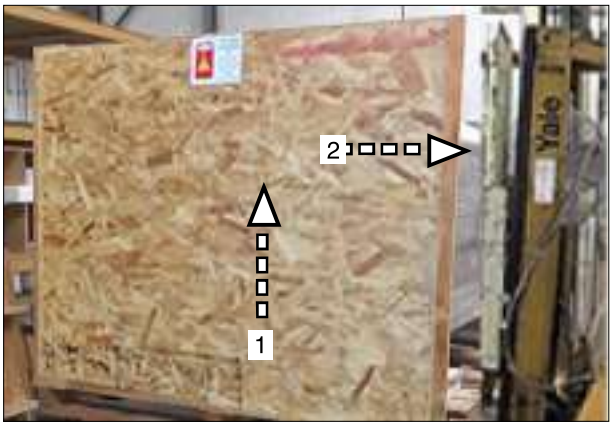
14. Location of lift plates under Q-FOG.




15. Make sure lift forks are under the metal plates on the bottom of the Q-FOG.




16. **USE EXTREME CAUTION: Forks can easily damage the Q-FOG. Make sure forks are under metal plates before lifting.**




17. Use a forklift to lift Q-FOG up off the pallet. Move the Q-FOG away from the crate.


18. Follow Step 16 through Step 22 in Section 5.2 to complete cabinet uncrating.

# 6. Setup

## 6.1. Dimensions and Space Requirements (Nov 2021)

- Figure 6.1a shows the external dimensions of the Q-FOG SSP and CCT test chamber.
- Installation location space requirements are shown in Figure 6.1b.

### External Dimensions

| | SSP600 and CCT600 | | SSP1100 and CCT1100 | |
|---|---|---|---|---|
| **A** | 184 cm | 73" | 221 cm | 87" |
| **B** | 187 cm | 74" | 224 cm | 88" |
| **C** | 187 cm | 74" | 200 cm | 79" |
| **D** | 126 cm | 50" | 131 cm | 52" |
| **E** | 84 cm | 33" | 100 cm | 40" |
| **F** | 102 cm | 40" | 107 cm | 42" |
| **G** | 113 cm | 45" | 129 cm | 51" |
| **H** | 120 cm | 47" | 138 cm | 54" |

**NOTE:** All dimensions approximate. Vertical dimensions vary based upon caster (leveling feet) adjustment.
Dimension **C** is overall height of tester with lid in 90° open position.
Dimension **D** is overall height of tester with lid closed.
Dimension **H** is overall depth of tester with lid in 90° open position.

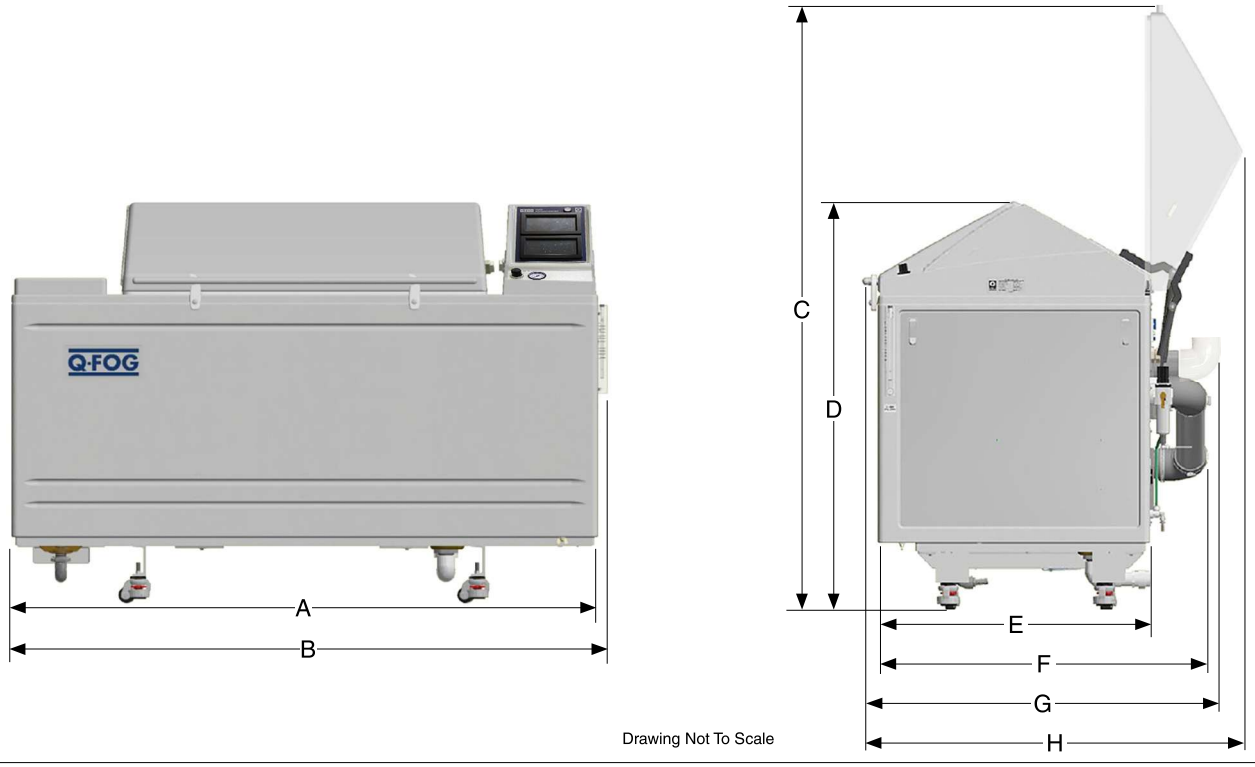



Figure 6.1a: Q-FOG external dimensions.

## Space Requirements

- The Q-FOG should be installed away from walls or other obstructions by the minimum distances shown in Figure 6.1b.
- These minimum distances provide sufficient surrounding space to operate the unit, gain access to service areas, and allow proper ventilation.
- See Section 4 for other installation location guidelines.

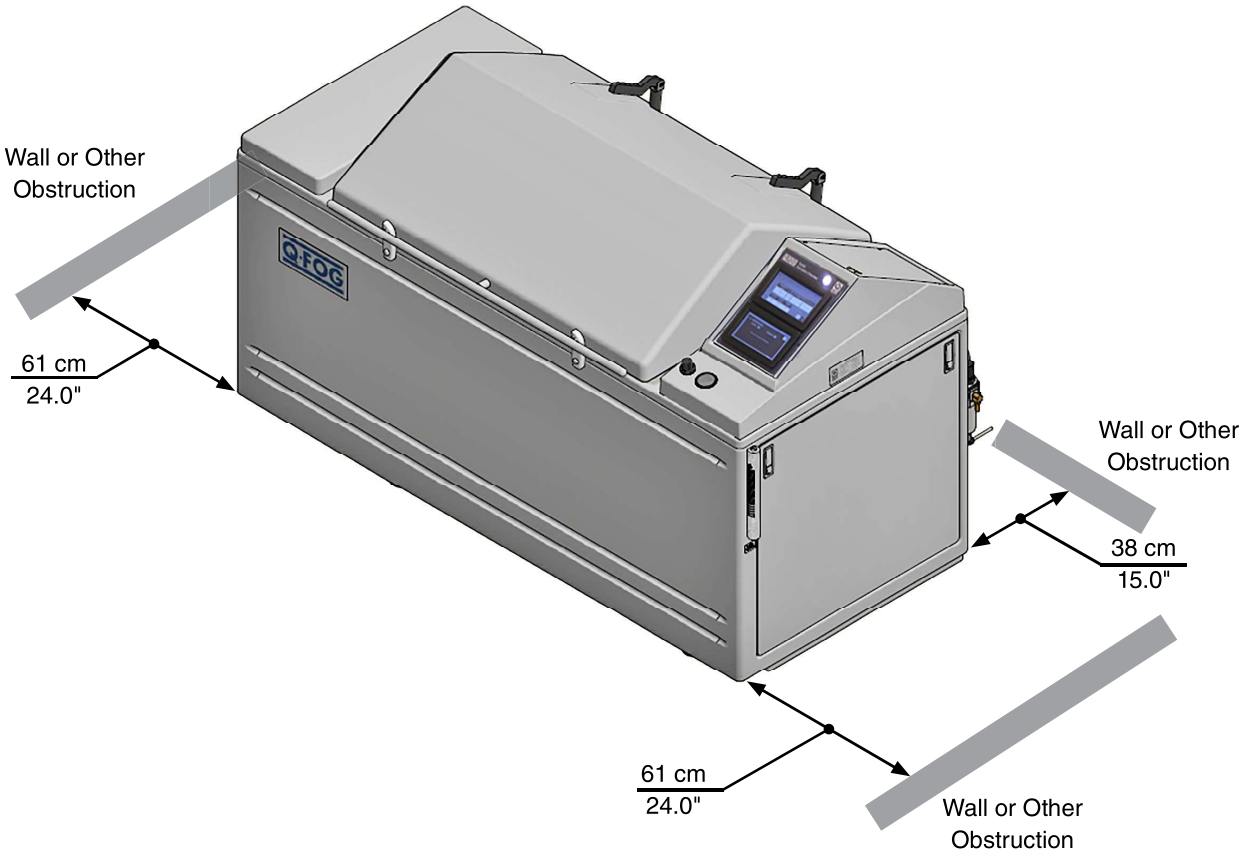



Figure 6.1b: Q-FOG installation space requirements.

## 6.2. Leveling (Nov 2021)

- The Q-FOG must be leveled correctly to assure a proper lid seal and prevent leakage of corrosive fog into the laboratory.
- The Q-FOG is a fiberglass chamber and, therefore, it is not perfectly rigid. Because of this, the chamber can flex a small amount.
- Flexing can cause the lid seal to leak if the Q-FOG chamber is not properly adjusted.
- The Q-FOG is equipped with leveling casters that can be adjusted to level the chamber (Figure 6.2a).
- An optional leveling pad kit (Part Number F-8977-K) is available (Figure 6.2b).
- Be sure to follow these instructions to level the chamber so that the lid seals properly.

### Instructions for Leveling the Q-FOG to Prevent Leakage

1. Position the Q-FOG where you want to operate it. The floor should be flat and level.
2. Close the lid and close the lid latch by rotating the latch counter-clockwise until in fully engages with the center lid handle post.
3. Adjust the leveling casters support feet (or optional leveling pads) so the Q-FOG is reasonably level and all four casters touch the ground (does not rock). The leveling casters or pads are adjusted using a wrench.
4. To check for leakage put a light inside the chamber, darken the room, and look for light escaping around the lid seal. Insert the light into the chamber through the air vent at the rear on the chamber. See Section 6.7.
5. Make sure the lid is closed and latched. Look all along the lid seal for light escaping between the lid seal and the chamber.
6. If light is escaping from the left side of the lid, lift the left front corner of the chamber by adjusting the left front support caster or pad. If light is escaping from the right side of the lid, lift the right front corner of the chamber by adjusting the right front caster or pad. The adjustments should be made just enough to prevent light from escaping the chamber.
7. After adjustment, the Q-FOG may rock because only three feet are touching the ground. If it rocks, extend the caster or pad that is not touching until it touches the ground. The caster or pad should be extended just enough to touch the ground. Too much extension may create another leak.


Figure 6.2a: Standard leveling caster.

Figure 6.2b: Optional leveling pad.

Do not use other leveling devices. Contact Q-Lab Repair and Tester Support for more information (Section 18).

## 6.3. Electrical (Sep 2021)

**IMPORTANT**: Do not switch main power ON until the other services have been connected.

- The Q-FOG chamber power requirements are listed in Figure 6.3a
- This voltage requirement was specified by the purchaser at the time the chamber was ordered.
- The input voltage is shown on the nameplate attached to the rear of the chamber, Figure 6.3b.
- It is important that the cabinet be connected to the correct voltage.
- If the voltage is too low, the chamber will not heat up quickly enough.
- If the voltage is too high, it could cause damage to the chamber.

### Power Cord Not Supplied

- The power cord connection between the facility main power supply and the Q-FOG main power circuit breaker **IS NOT** supplied with the Q-FOG (see Mains Power Installation).

| Model | Voltage | Maximum Current | Frequency |
|---|---|---|---|
| SSP600<br>CCT600 | 208 V± 10%, 1-Phase | 16 A | 50/60 Hz |
| | 230 V± 10%, 1-Phase | 14 A | |
| SSP1100<br>CCT1100 | 208 V± 10%, 1-Phase | 20 A | |
| | 230 V± 10%, 1-Phase | 18 A | |

Figure 6.3a: Q-FOG power requirements.

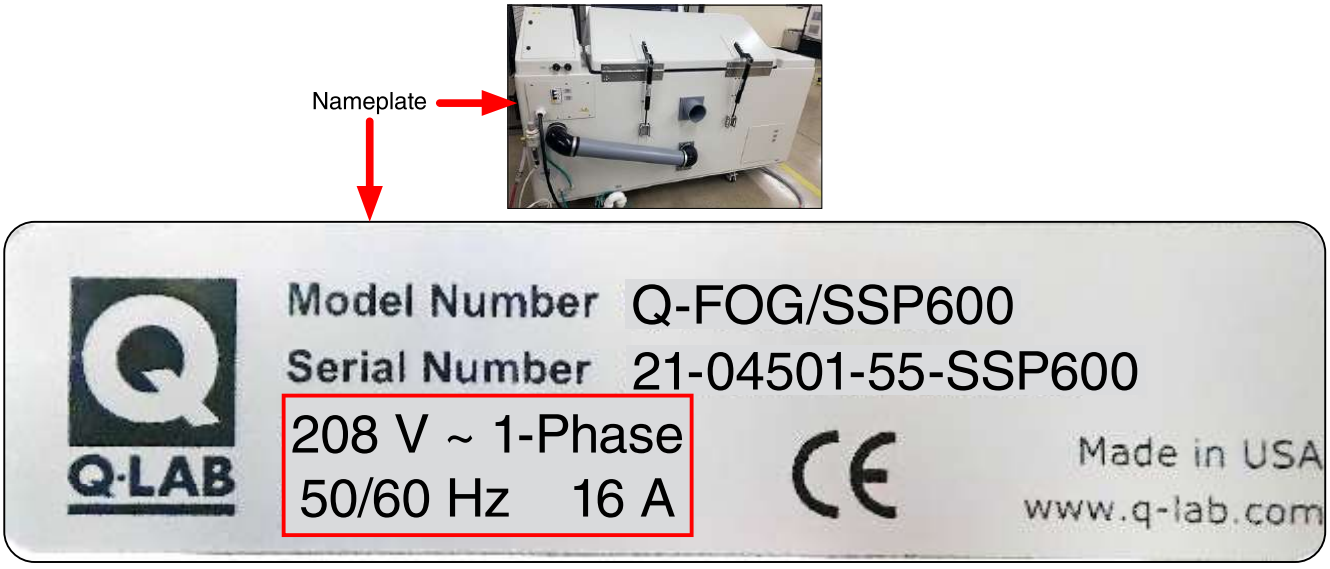



Figure 6.3b: Typical Q-FOG nameplate showing power requirements.

## Mains Power Installation

- A qualified electrician should connect the mains according to local codes using approved disconnect and over-current protection.
- On the rear of the Q-FOG is a Main Power Circuit Breaker and a Residual Current Device (RCD), (Figure 6.3c).
- Near the breaker is a hole with strain relief for the mains power entry.
- The electrician can enlarge this hole to accept the chosen electrical conduit or power cord.
- The mains wires should be connected to the breaker, Figure 6.3d and Figure 6.3e
- For USA style 1-phase systems, both the brown and blue wires are live.
- For European style 1-phase systems, the brown is live and the blue is neutral.
- For detailed electrical wiring information see *LF-8151-SO - Q-FOG SSP and CCT System Overviews*.

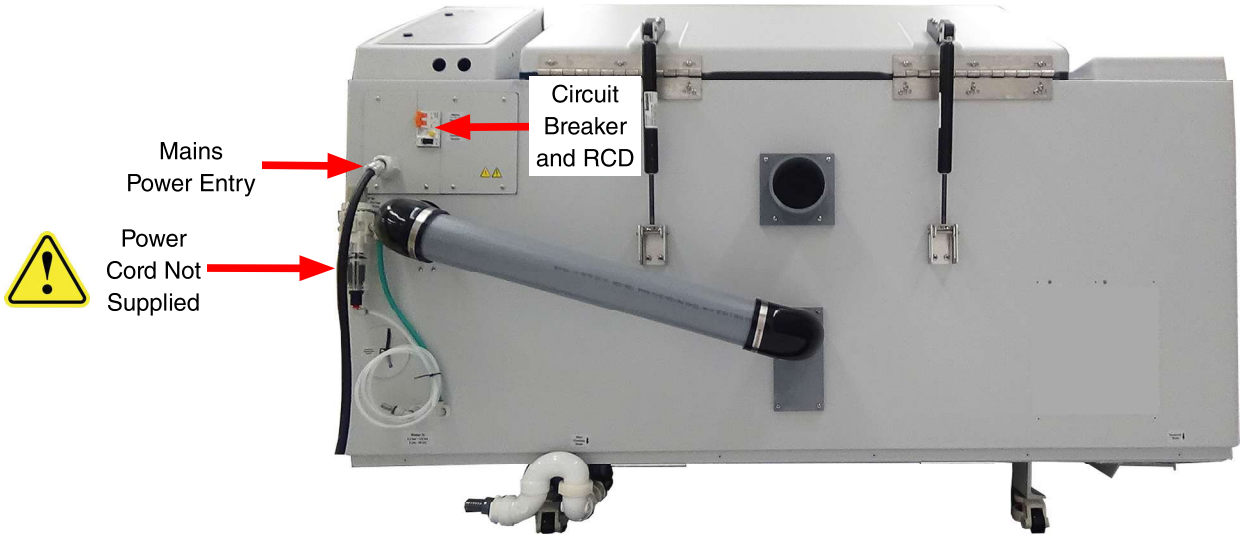



Figure 6.3c: Mains power entry and circuit breaker locations.

## Wiring Connections

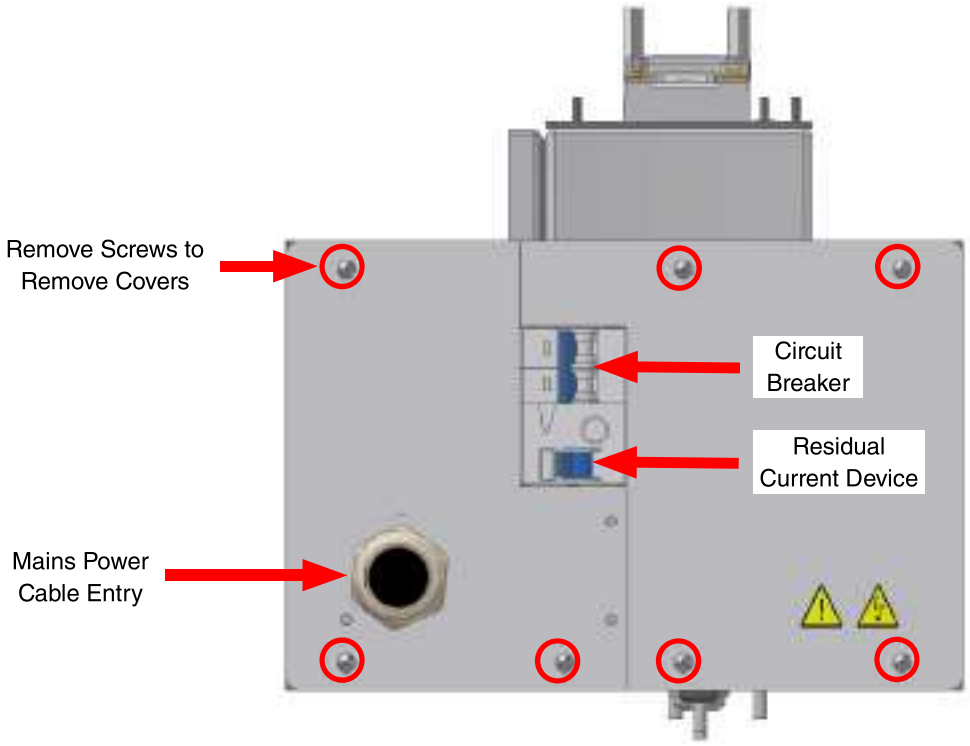



Figure 6.3d: 208/230 V 1-phase electrical power entry and circuit breakers with covers.

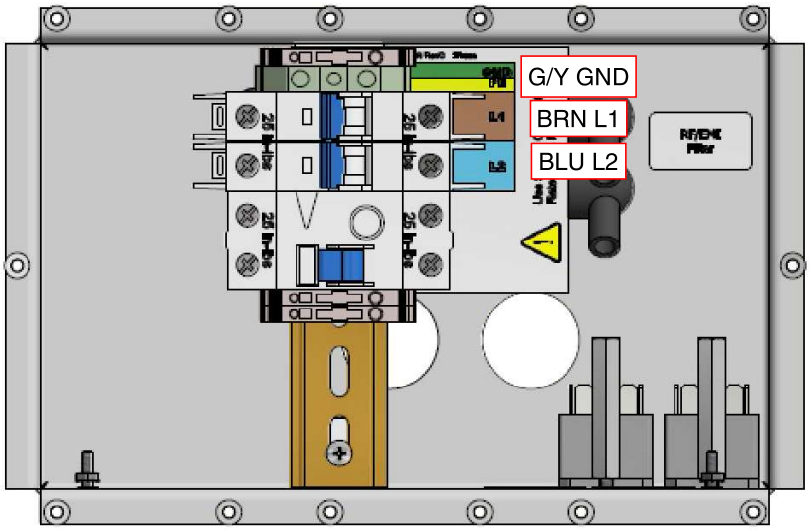



Figure 6.3e: 208/230 V 1-phase electrical power entry and circuit breakers with covers removed.

## 6.4. Compressed Air (Aug 2021)

### Purity

- The compressed air supply must be clean, dry, and oil-free.
- The presence of solid impurities, water, oil, or other contaminants in the compressed air may affect test results.
- Do not add a lubricator to your compressed air system.
- Oil in the air will reduce the corrosive effects of the electrolyte on the test specimens.
- Pollutants in the air may increase the corrosive effects.
- Impurities in the air supply may also clog the spray nozzle, solenoid valves, or check valves, and cause maintenance problems.
- The Q-FOG is equipped with a moisture filter to improve the incoming compressed air quality (Figure 6.4a).
- As moisture accumulates, the filter purges to a water drain.

### Installation

- The Q-FOG is equipped with a pressure regulator and gauge (Figure 6.4b).
- Incoming air pressure should be in this range: 40-150 psi (2.8 – 10.3 bar) as shown on label behind pressure regulator adjustment knob (Figure 6.4b).
- Set the pressure regulator to 40 psi.
- Volume: 3.5 CFM (1.7 LPS) maximum.
- A 9 mm or a 3/8 " inside diameter (ID) compressed air supply hose is required to connect to the air inlet at the rear of the cabinet (Figure 6.4a).
- The distance from the floor to the air inlet on a Q-FOG chamber with casters is approximately 67.3 cm (26.5"). Without casters the distance is approximately 60 cm (23.5"). With the chamber in the installation location, measure the distance from the floor to the air inlet to determine the actual height.

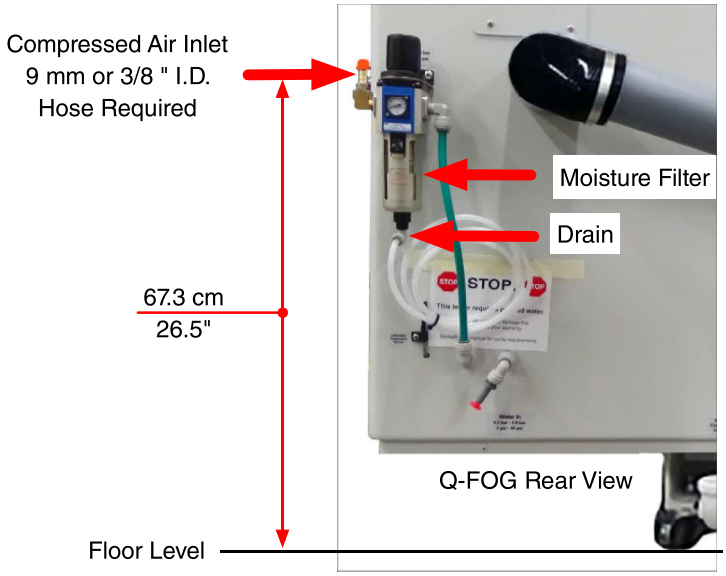



Figure 6.4a: Compressed air connection.


Figure 6.4b: Compressed air pressure regulator.

## 6.5. Water Supply (Sep 2021)

### Purity

**Important Caution:** Q-FOG testers require purified water.

- **The Q-FOG tester warranty is voided if this condition is not met.**
- Water purity requirements are listed below.

- Q-FOG testers require a supply of pure water for the bubble tower.
- This is used for saturating the compressed air with water vapor during the fog function.
- Q-FOG CCT tester also needs pure water for producing chamber humidity.
- The reverse osmosis / deionized (RO/DI) water system described on the next page produces water pure enough for Q-FOG CCT testers.
- **This type of RO/DI system is required for Q-FOG testers.**

| Pressure | Maximum Flow Rate | Maximum Volume | Resistivity | Conductivity | Total Dissolved Solids | pH |
|---|---|---|---|---|---|---|
| 0.2-3.8 bar (3-56 psi) | 0.4 Liter/min. | 2 Liters/hr. | > 200k ohm•cm | < 5 µS/cm | < 2.5 ppm | 6-8 |

- Remove Solid Particles: > 20 µm
- If line pressure is greater than 4.0 bar (56 psi), install a pressure regulator.
- In CCT models, maximum volume value is during a humidity function, or a fog function when the chamber air temperature set point is greater than 48 ˚C.
- Typical maximum volume will be approximately 7 Liters/day.
- Additionally, the purified water system must be sized to accommodate maximum peak demand during short duration bubble tower refill step at 0.4 liters/minute.

### Recirculation

- To avoid the build-up of organic contaminants in the water supply system, Q-Lab recommends the use of a recirculating RO/DI system. Contact Q-Lab Repair and Tester Support for more information (See Section 18).

## Reverse Osmosis / Deionization System (RO/DI)

The system shown below allows water at two different purity levels (RO and RO/DI) to be distributed throughout the laboratory. RO/DI water output by Stage E is required for Q-FOG CCT testers.

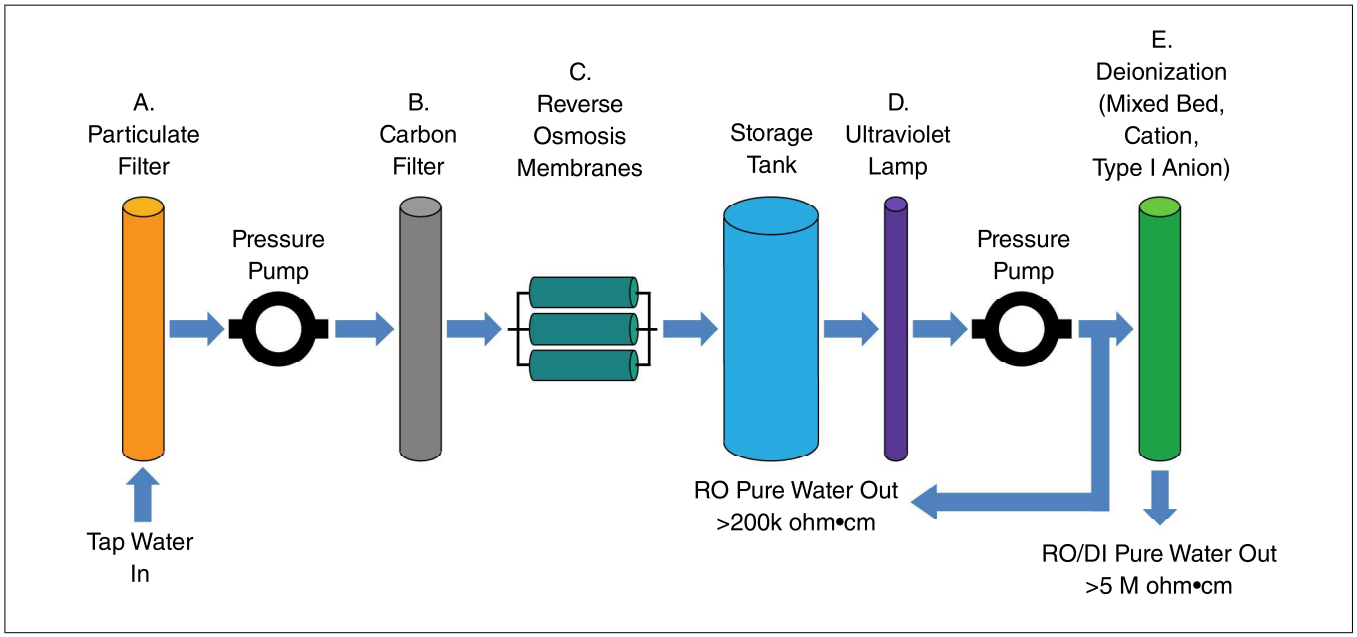



Figure 6.5a: An Effective Reverse Osmosis / Deionized Water System with Anion Type I Resin for Spray Water Silica Removal. For more information on RO/DI systems contact the Life Science business of Merck KGaA, Darmstadt, Germany. The Life Science business of Merck KGaA, Darmstadt, Germany operates as MilliporeSigma in the USA and Canada.

| Stage | Purpose | Outgoing Purity | Notes |
|---|---|---|---|
| A. Particulate Filter | Remove small particles | | Replace once per year |
| B. Carbon Filter | Remove chlorine | | Replace once or twice per year |
| C. R/O Membranes | Remove dissolved solids, colloidal silica, organic and biological contaminates | >200k ohm•cm | Produces pure (RO) water |
| D. Ultraviolet Lamp | Disinfect water | | Any bacteria or algae from the storage tank is removed |
| E. Mixed Bed Tank | Final polishing to remove positively and negatively charged ions | > 5 M ohm•cm | Produces ultra pure (RO/DI) water required for the Q-FOG CCT |

**Important: For Stage E, use Type I, not Type II anion in the mixed bed tanks of the DI system.**

The Strong Base Type I Anion resin in the mixed bed tanks is an important part of these systems. This is because strong base Type I anion resin is the only resin that can effectively remove suspended silica. 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.

## Installation

**Flush out the water supply line prior to connecting to the Q-FOG tester.**

- A 9 mm (3/8 ") inside diameter purified water supply hose is required to connect to the water inlet at the rear of the cabinet.
- Distance from floor to purified water inlet on tester with casters is approximately 31.8 cm (12.5")*. Without casters the distance is approximately 23 cm (9").
- Optionally, for connection to 10 mm water supply tubing, a metric installation kit (part number F-70099-K) is available.
- The water supply connection should be fitted with a stop valve.

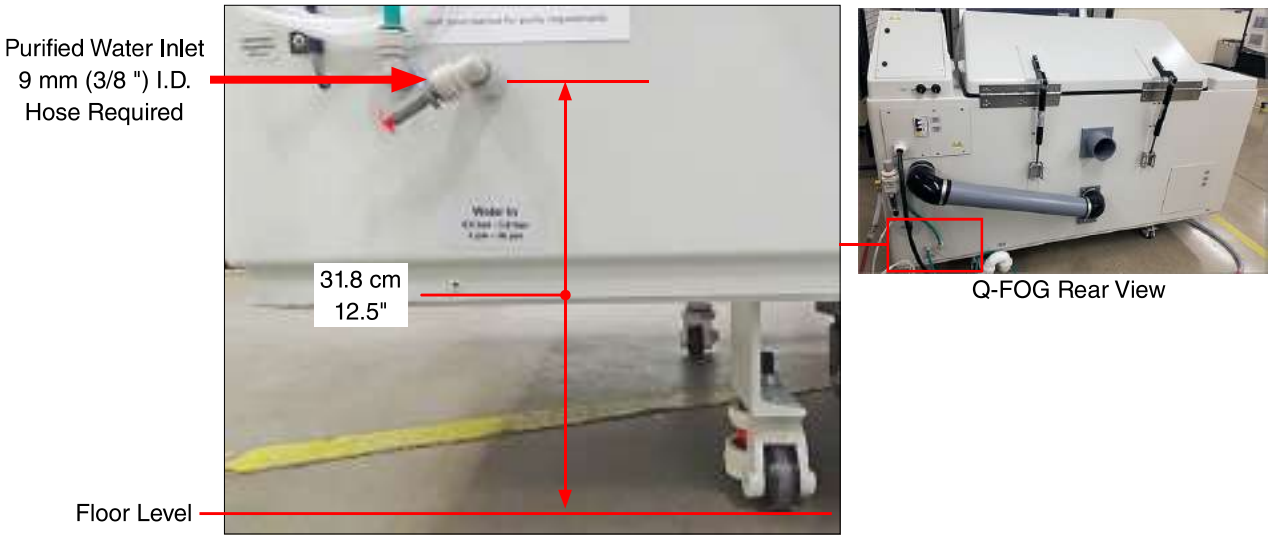



Figure 6.5b: Purified water connection.

* Actual distance from the floor to the center of the water inlet will vary based upon adjustment of leveling feet or installation of optional casters. Once the tester is in position, measure the distance to determine the actual height.


Figure 6.5c: 9 mm (3/8") Supplied quick-connect hose barb and elbow for water connection.

- When electrical, compressed air, and purified water have been connected, turn on the air and water, and check for leaks at the connection points.

## 6.6. Water Drainage (Oct 2021)

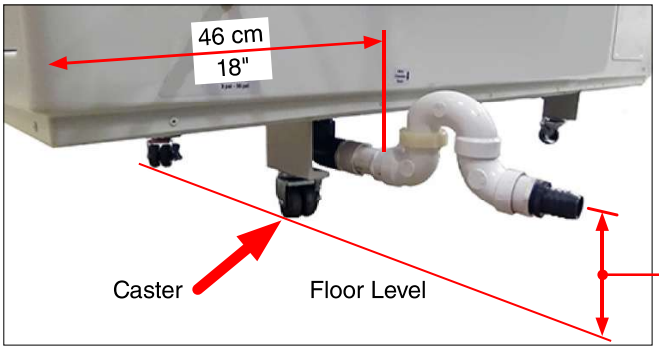
**A floor drain is <u>required</u>.** The Q-FOG tester has multiple drains (See Figures below).

- Waste water disposal must be made in accordance with local ordinances regarding chemical disposal.
- Usually simple salt water is not regulated
- The main testing chamber is fitted with a drain to enable excess solution to go to a sanitary sewer drain.
- A supplied trap <u>must be installed</u> on the drain so that corrosive vapors cannot escape.
- Run the supplied hose from the trap to a drain.

### Chamber Drain


Figure 6.6a: Drain trap installation.

Q-FOG Rear View




**NOTE:** Trap may be positioned at an angle to facilitate connection to drain.

Figure 6.6b: Chamber drain location with 70 mm (2.75") high optional caster.

* Actual distance from the floor to the center of the chamber drain will vary based upon adjustment of leveling feet or installation of optional casters. Once the tester is in position, measure the distance to determine the actual height.

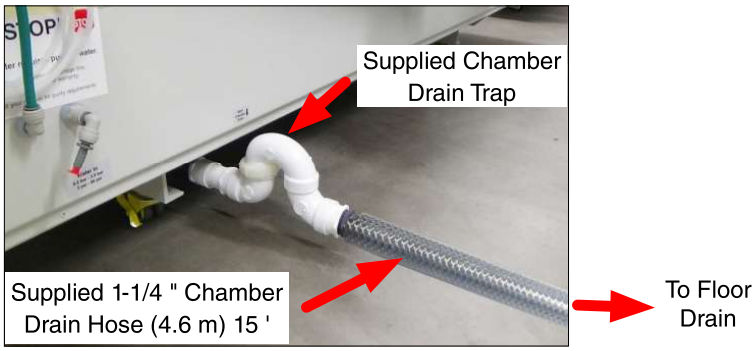



Figure 6.6c: Chamber drain connection.

## Solution Reservoir Drain

- The supplied 19 mm (3/4 ") hose and ball valve shut off must be attached to the reservoir drain.
- This hose is used only when cleaning out the reservoir and does not have to be run to a drain.
- However, for convenience, we recommend that this hose be connected to a drain.
- Plastic pipe (not supplied) may be used to connect all Q-FOG drains permanently into a sanitary drain.
- Make sure the ball valve is attached and closed before filling the reservoir.


Figure 6.6d: Solution reservoir drain location with 70 mm (2.75") high optional caster.

* Actual distance from the floor to the center of the reservoir drain will vary based upon adjustment of leveling feet or installation of optional casters. Once the tester is in position, measure the distance to determine the actual height.

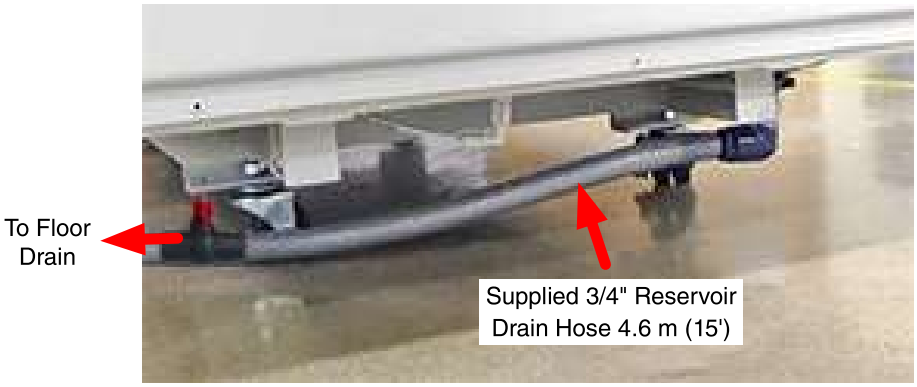



Figure 6.6e: Solution reservoir drain connection.

## Bubble Tower and Vapor Generator Drain

- This system consists of a 13 mm (1/2 ") hose.
- This hose is used only when cleaning out the Bubble Tower (SSP and CCT), or Vapor Generator (CCT only), and does not have to be run to a drain.
- However, for convenience, we recommend that this hose be connected to a drain.

Q-FOG Rear View

Supplied 1/2" Bubble Tower/Vapor Generator Drain Hose 0.6 m (2')

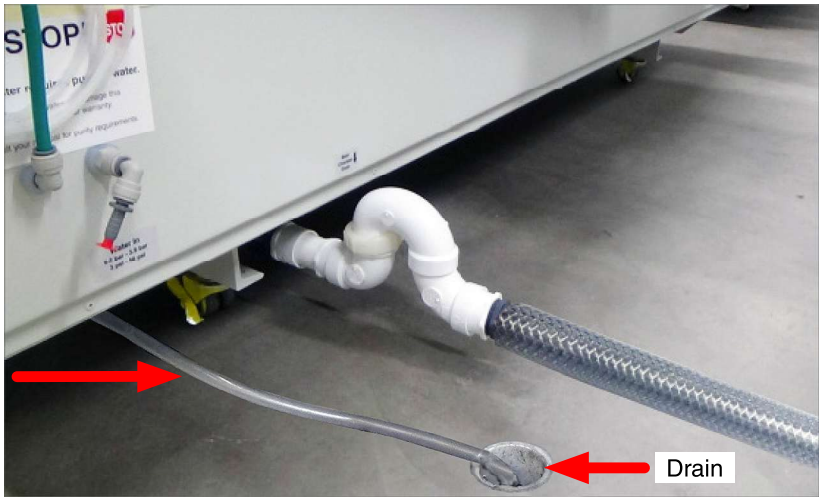



Figure 6.6f: Bubble tower/vapor generator drain connection.

## Air Filter Drain

The end of the supplied 1/4" tubing from the bottom of the air filter should be placed into a floor drain.

Q-FOG Rear View

Figure 6.6g: Air filter drain location.

## 6.7. Venting (Dec 2021)

- Each Q-FOG corrosion chamber must be vented to the outdoors.
- Be sure to comply with all local regulations regarding chemical exhaust. Usually simple salt water is not regulated.
- Mechanical Extraction Ventilation systems are not recommended for use in Q-FOG vent installations.
- A special valve kit (F-70629-K) is available from Q-Lab to connect the exhaust vents from multiple Q-FOG testers together.
    - Connecting multiple Q-FOG vents together requires a proportionally larger ventilation system. Contact Q-Lab Repair and Tester Support for more information.
- The Q-FOG exhausts air from the test chamber at a rate of approximately 60 CFM.
- For proper operation of the venting system, 60 CFM of replacement (make up) air must be available to the room where the Q-FOG is installed.
- Heat load dissipation is 1000 W for SSP600 and CCT600, and 1500 W for SSP1100 and CCT1100.
- Proper venting will prevent corrosive mist from entering the laboratory and assure correct performance of your Q-FOG tester.
- Air venting from the chamber is done via a 114 mm (4.5 ") outside diameter vent tube (Figure 6.7a).
- The user must connect an exhaust system with a 102 mm (4.0 ") inside diameter (minimum) vent line.
- Optionally, for connection to an exhaust system having 100 or 110 mm outside diameter tubing, a metric installation kit (part number F-70099-K) is available. See Figure 6.7b, c and d for various metric installation configurations.
- Because of the typically corrosive nature of the exhaust, plastic vent tubing is strongly recommended.
- The length of the venting system must be less than 30 meters (100 feet) and contain fewer than 10 elbows (i.e. 90° turns).
- If it must be longer, or if it must contain more turns, there could be significant back pressure on the chamber and this might cause corrosive mist to enter the laboratory and/or reduce the tester's performance capabilities.
- A "tee" is recommended at the end of the vent to reduce the risk of periodic back-pressure from the wind (Figure 6.7e).
- Place a screen over the vent to discourage birds and small animals.

## Vent Location

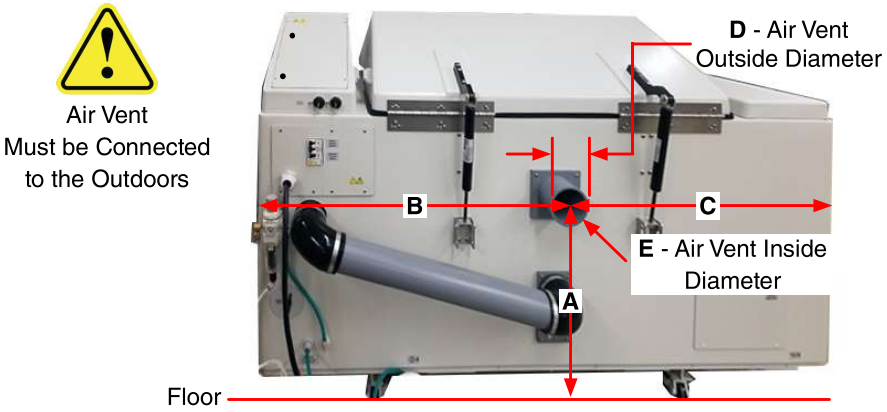



Figure 6.7a: Vent location.

**Air Vent Location**

| | Model 600 | | Model 1100 | |
|---|---|---|---|---|
| **A*** | 71.1 cm | 28.0" | 71.1 cm | 28.0" |
| **B** | 90.2 cm | 35.5" | 109.2 cm | 43.0" |
| **C** | 91.4 cm | 36.0" | 110.5 cm | 43.5" |
| **D** | 11.4 cm | 4.5" | 11.4 cm | 4.5" |
| **E** | 10.2 cm | 4.0" | 10.2 cm | 4.0" |

* Distance from floor to center of vent varies based upon adjustment of leveling feet and optional installation of casters. Measure tester to determine actual height.

## Optional Metric Venting

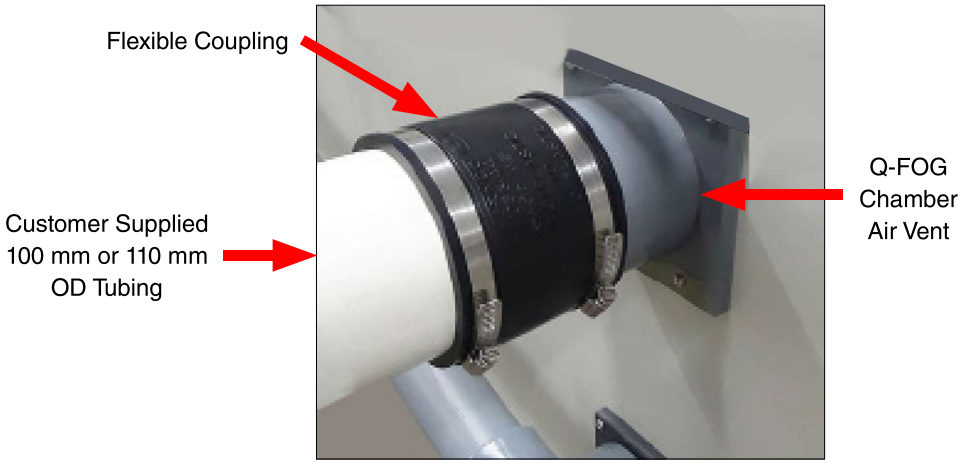



Figure 6.7b: Metric kit flexible coupling installed for straight out venting.

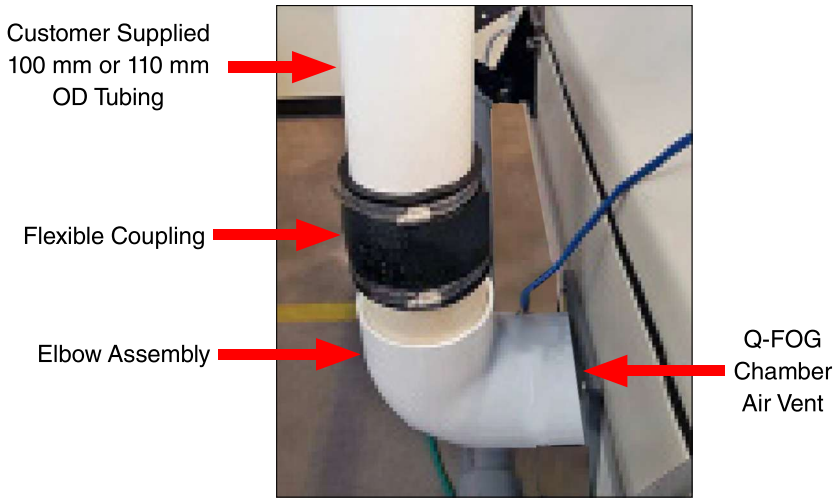



Figure 6.7c: Metric kit flexible coupling and elbow assembly installed for vertical venting.

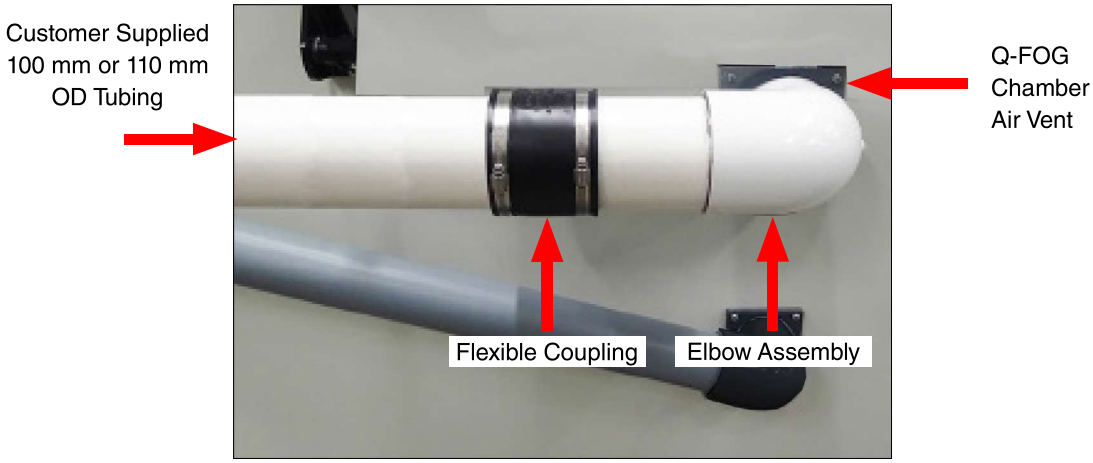



Figure 6.7d: Metric kit flexible coupling and elbow assembly installed for horizontal venting.

## Vent Connections

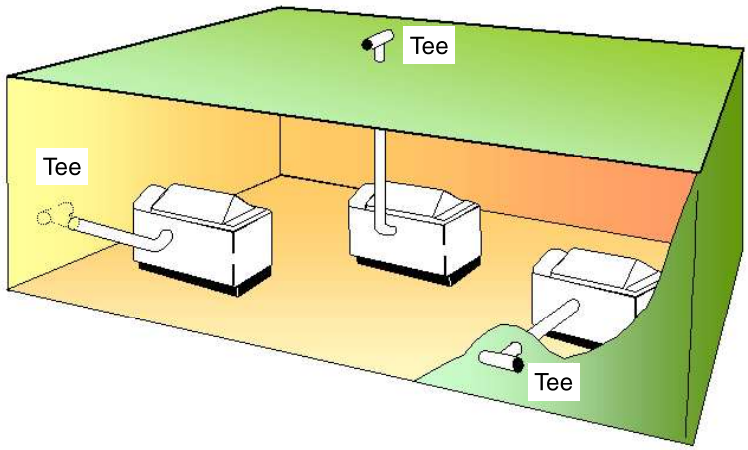



Figure 6.7e: Recommended venting.

- Because some liquid from the salt fog may condense on the inside of the vent tube, we recommend that all sections of the vent tube have a slope either back toward the chamber or away to a drain (see Figure 6.7f).
- Otherwise, liquid may build up in the vent tube and cause problems with back-pressure and operation of the chamber.
- Avoid all installations that could create moisture traps (see Figure 6.7g).
- Flexible tubing is not recommended due to the potential for creating moisture traps. Excessive amounts of moisture build up can create a weight load on the vent tubing.
- When venting variations are necessary, please consult Q-Lab Repair and Tester Support for recommendations. See Section 18 for contact information.

Figure 6.7f: Correct vent installations.

**Important:** Make sure the vent is installed so that moisture cannot build up and create a trap as shown below.

Figure 6.7g: Incorrect vent installations.

## 6.8. Data Communication (Aug 2021)

### Connections

- An Ethernet connector is located on the rear of the control top (Figure 6.8) to connect the Q-FOG to a network or directly to a personal computer for displaying test parameter data using VIRTUAL STRIPCHART™ software from Q-Lab (see Section 13.1).
- See *Specification Bulletin L-4035 VITRTUAL STRIPCHART Data Logging Software for Q-Lab Testers* for more information on VIRTUAL STRIPCHART software.
- A USB connector is also located on the rear of the control top to enable tester data export and software upgrades.
- Both connectors have removable covers to protect against corrosion.
- See Section 13 for more information.


Figure 6.8: Data Connections Location

# 7. Functions

- In Q-FOG corrosion testers, specimens are exposed to a series of different environments in a repetitive cycle that mimics the outdoors.
- Q-FOG corrosion test chambers can cycle between four conditions:
  1. Fog (Section 7.1).
  2. Dry (Section 7.2).
  3. Humid (CCT Only, Section 7.3).
  4. Dwell (Section 7.4)
- Simple cycles, such as Prohesion, may consist of cycling between salt fog and dry conditions.
- More sophisticated automotive methods may call for multi-step cycles that incorporate humidity or condensation, along with salt spray and dry-off. Many of these methods can only be performed with the CRH model.
- Test conditions and timing are controlled by a built-in microprocessor.
- A simple, dual full-color touchscreen interface allows for easy programming and operation.
- The operator can quickly create new cycles, or run any of the programmed cycles.
- The Q-FOG controller includes complete self-diagnostics, including warning messages, routine service reminders and safety shut down.
- See *LF-8151-SO Q-FOG SSP and CCT System Overviews* for detailed information on Q-FOG functions.

## 7.1. Fog Function (Nov 2021)

The fog system sprays a fine mist of corrosive solution throughout the chamber (Figure 7.1). The system works as follows.

- The pump sends solution from the reservoir to the spray nozzle.
- Pump speed is selected via the Main Menu touchscreen using the Machine Configuration menu (see Section 9). The flow rate is displayed on the flow meter.
- The air solenoid valve sends compressed air through the bubble tower and then to the spray nozzle where it atomizes the solution.
- The air supply pressure is set via the fog pressure regulator located on the control panel. The pressure is displayed on the pressure gauge.
- The chamber heaters maintain the chamber temperature.
- If the chamber air temperature set point is greater than 48 °C, the vapor generator is also used to maintain the chamber air temperature and maintain high humidity in the chamber (CCT only, Section 7.3).
- The first time a Fog step is run after initial setup, it can take 15-45 minutes for the solution to start spraying out of the fog nozzles. This time can be shortened by opening the peristaltic pump head (see Section 8.7). Then close the pump head when the solution starts flowing.
- See Section 12.2 for more information on setting air pressure and pump speed.

**NOTE:** When changing solution type, run a fog step for 45 minutes before adding test specimens to purge the old solution.

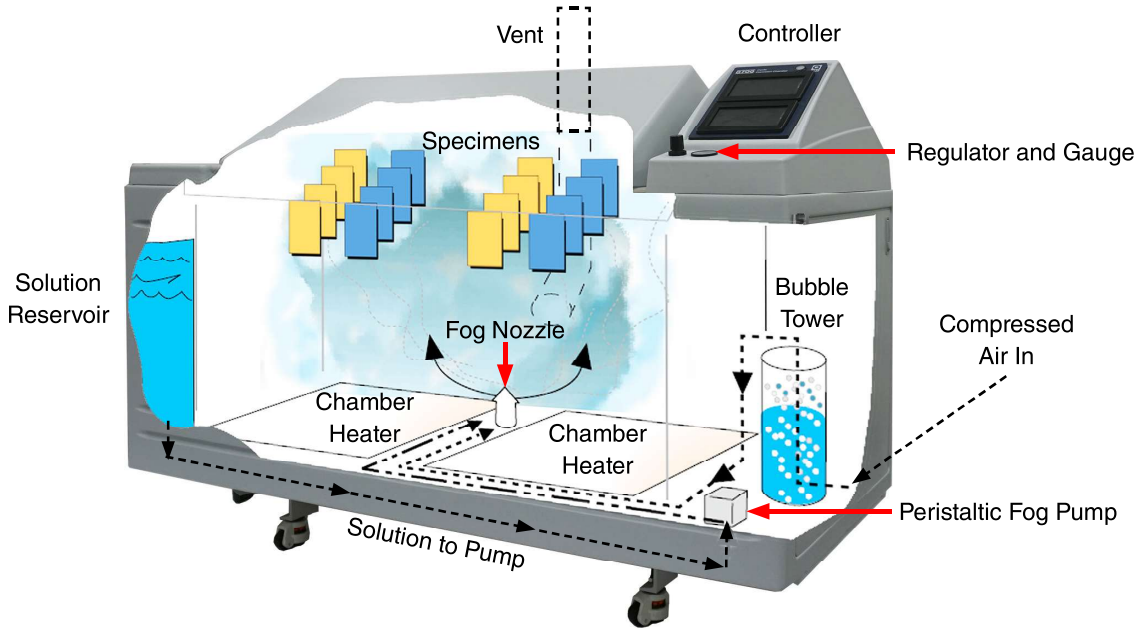



Figure 7.1: Schematic showing Fog Function.

## 7.2. Dry Function (Sep 2021)

The dry function blows air through the chamber to dry off the test specimens (Figure 7.2). The system works as follows.

- The purge air valve opens and the blower blows air into the chamber.
- The chamber heaters and air heater maintain the chamber temperature.

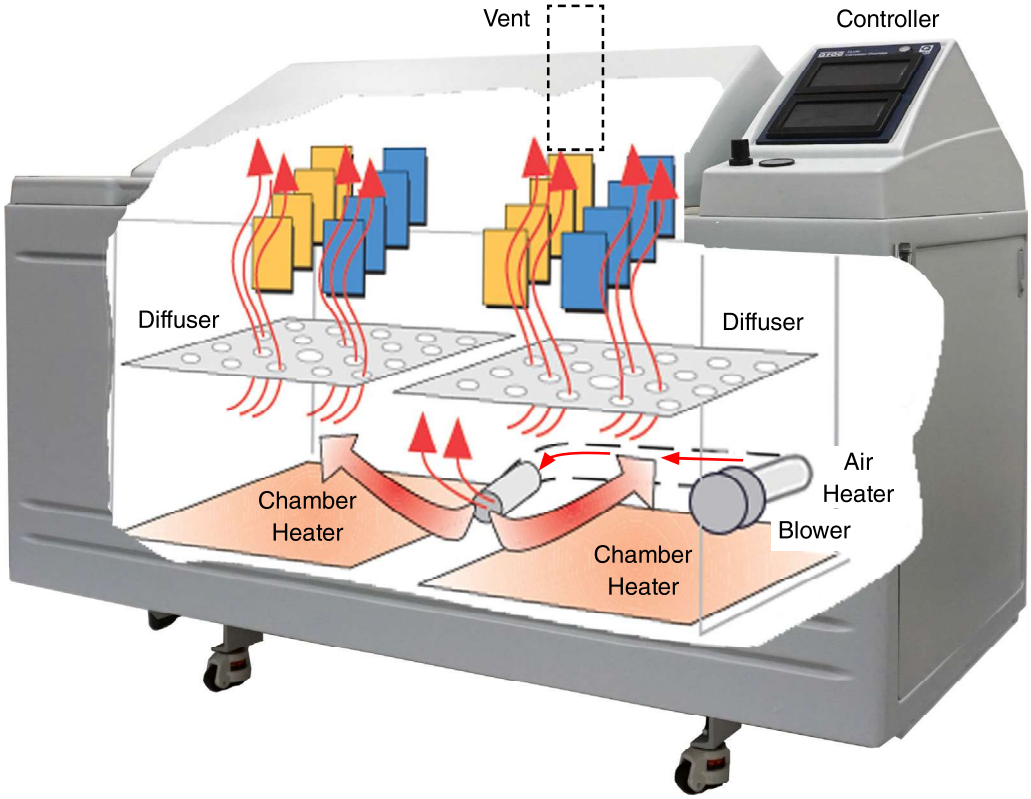



Figure 7.2: Schematic showing Dry Function.

## 7.3. Humid Function - CCT Models Only (Nov 2021)

The humid function injects hot water vapor into the chamber to increase the humidity to 100% (Figure 7.3). The system works as follows.

- The vapor generator (see Section 8.3) injects hot water vapor into the chamber and maintains chamber temperature.
- The vapor generator solenoid valve keeps the vapor generator full of water.

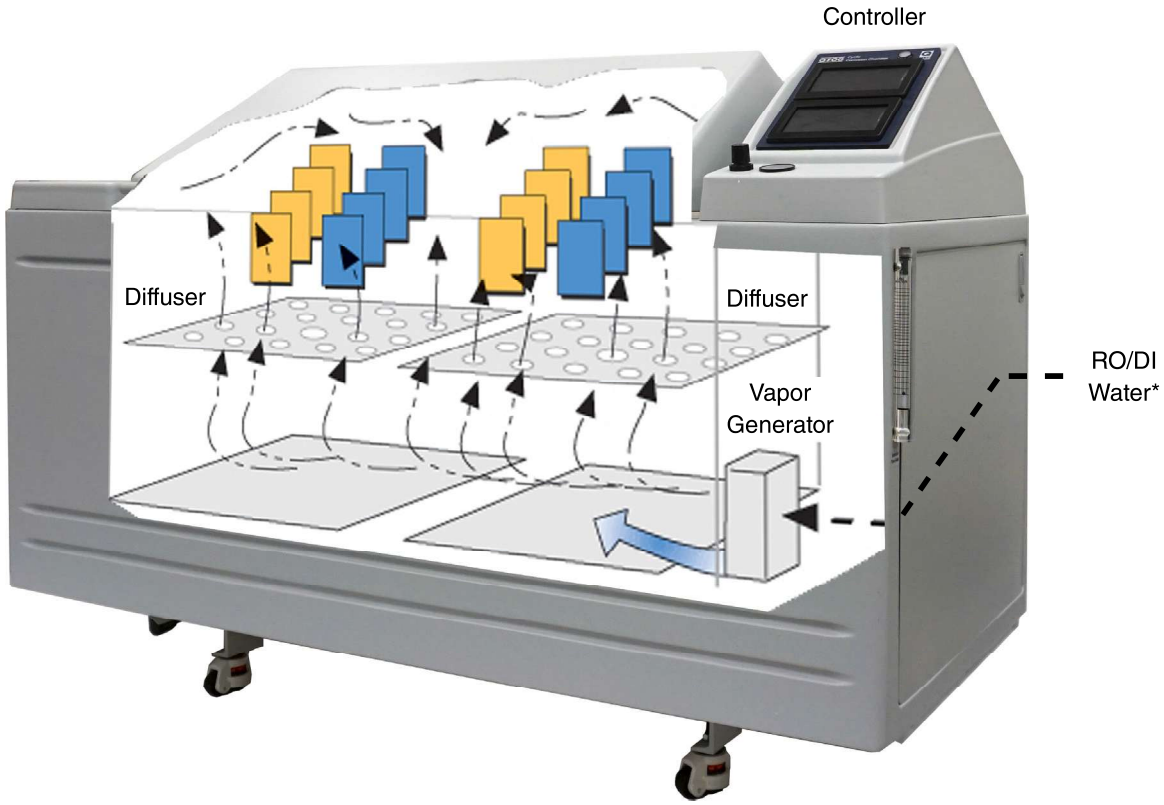



Figure 7.3: Schematic showing Humid Function.

* See Section 6.5 for important water purity information.

## 7.4. Dwell Function (Sep 2021)

The dwell function maintains a constant temperature in the chamber but does not blow air through the chamber (Figure 7.4). The system works as follows.

- The chamber heaters maintain the chamber temperature.
- The salt fog, purge air, and vapor generator are all off during dwell.

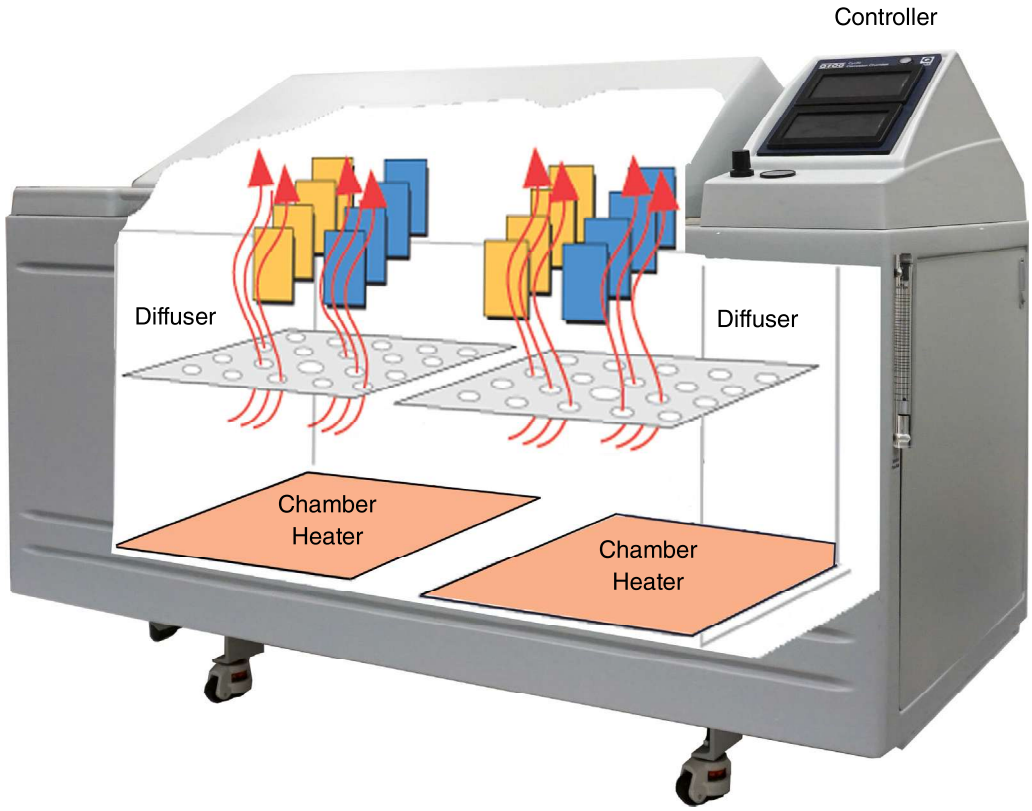



Figure 7.4: Schematic showing Dwell Function.

# 8. Major Components

- This section provides detailed information on the major components of the Q-FOG corrosion tester.
- Many of these components are available as replacement parts. See Section 16 for ordering information.
- See *LF-8151-SO Q-FOG SSP and CCT System Overviews* for additional component details and interactions.
- The major components are:
  - Solution Reservoir (Section 8.1)
  - Bubble Tower (Section 8.2)
  - Vapor Generator (Section 8.3)
  - Purge Blower and Air Heater (Section 8.4)
  - Diffusers (Section 8.5)
  - Chamber Heaters (Section 8.6)
  - Peristaltic Fog Pump (Section 8.7)
  - Fog Spray Nozzle (Section 8.8)
  - Lid Interlock Switch (Section 8.9)
  - Chamber Air Temperature Sensor & Over Temperature Switch (Section 8.10)
  - Laboratory Temperature Sensor (Section 8.11)
  - Lid Lifters (Section 8.12)

## 8.1. Solution Reservoir (Sep 2021)

- The salt solution reservoir, with a removable lid, is built into the left end of the Q-FOG cabinet (Figure 8.1a).
- The 120 liter (31.6 gallon) reservoir holds enough solution for five days of continuous salt spray.
- A label attached to the rear wall indicates the volume of solution in the reservoir (Figure 8.1b).
- Sensors detect when the solution level gets too low and will automatically stop the test when the reservoir is empty.
- A salt solution kit (F-9155-K) is available to make the ASTM B117 salt solution or the ISO 9227 salt solution.
- See Section 14.3 for important solution reservoir cleaning information.

**IMPORTANT:** Only use deionized water for preparing solutions. When changing solution type, run a fog step for 45 minutes before adding test specimens to purge the old solution.


Figure 8.1a: Solution reservoir location.

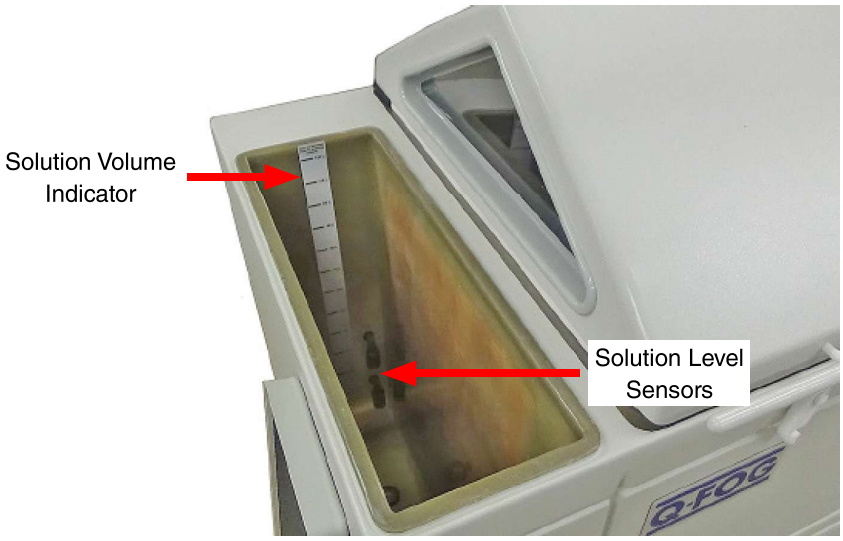



Figure 8.1b: Solution reservoir with lid removed.

## 8.2. Bubble Tower (Nov 2021)

- The purpose of the bubble tower is to saturate the compressed air used to atomize the salt solution.
- The bubble tower also acts as a filter to remove oil from the compressed air.
- The bubble tower contains a heater to keep the water 12 ˚C hotter than the chamber temperature during fog steps.
  - Water temperature is adjustable in software when necessary. Contact Q-Lab Repair and Tester Support for assistance.
- The water level in the bubble tower is automatically maintained by the level switches and water fill solenoid valve.
- The bubble tower is accessed by removing the right side access panel (Figure 8.2).
- See Section 14.1 for important bubble tower maintenance information.

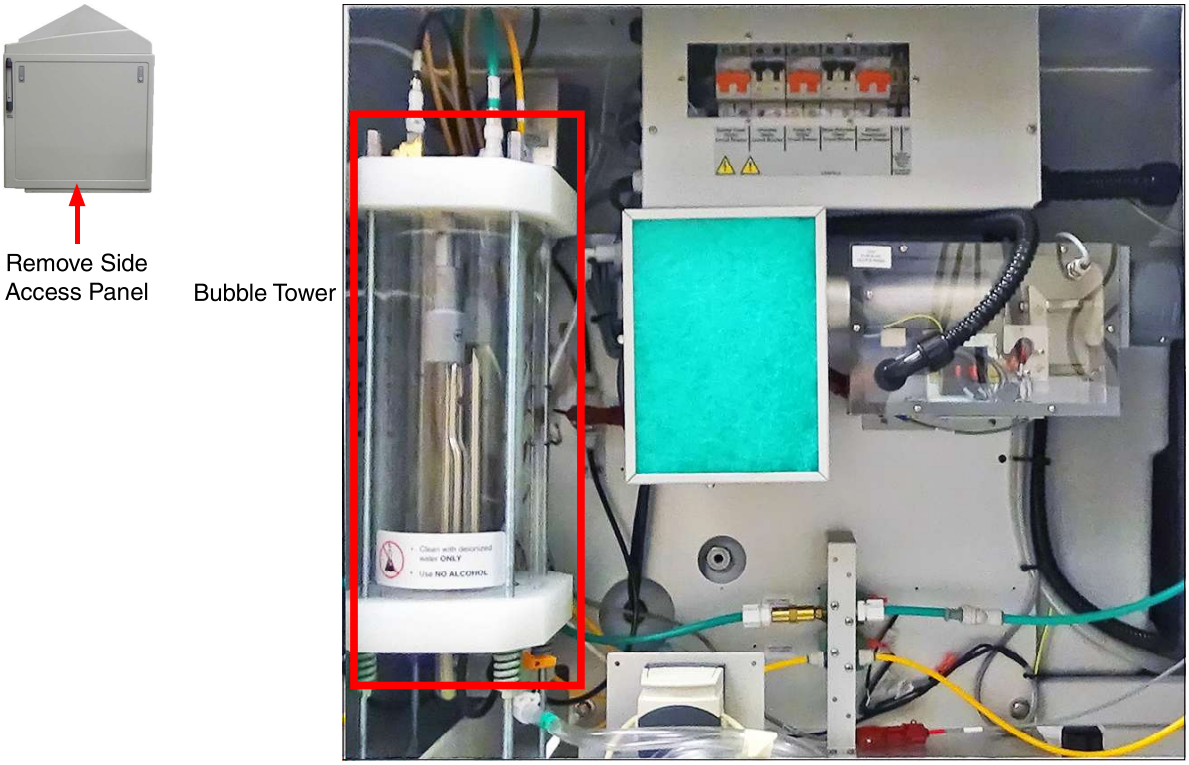



Figure 8.2: Access panel removed to show bubble tower (SSP model shown).

**NOTE:** The bubble tower can be bypassed. See Section 11.2 for more information.

## 8.3. Vapor Generator - CCT Models Only (Sep 2021)

- During humid steps the chamber is maintained at 100% relative humidity with hot water vapor from the vapor generator (Figure 8.3).
- The chamber temperature is maintained by controlling the amount of hot water vapor added to the chamber.
- The vapor generator also supplies hot water vapor to the chamber during fog steps with a chamber air temperature set point greater than 48 ˚C.
- The water level in the vapor generator is automatically maintained by a level switch and water fill solenoid valve.
- The vapor generator is activated by the X114 Machine Configuration parameter. X114 must be set to Yes to meet all of the solution collections requirements of the ISO 9227 CASS test (see Section 11.5).
- See *LF-8151-SO Q-FOG SSP and CCT System Overviews* for detailed vapor generation information.

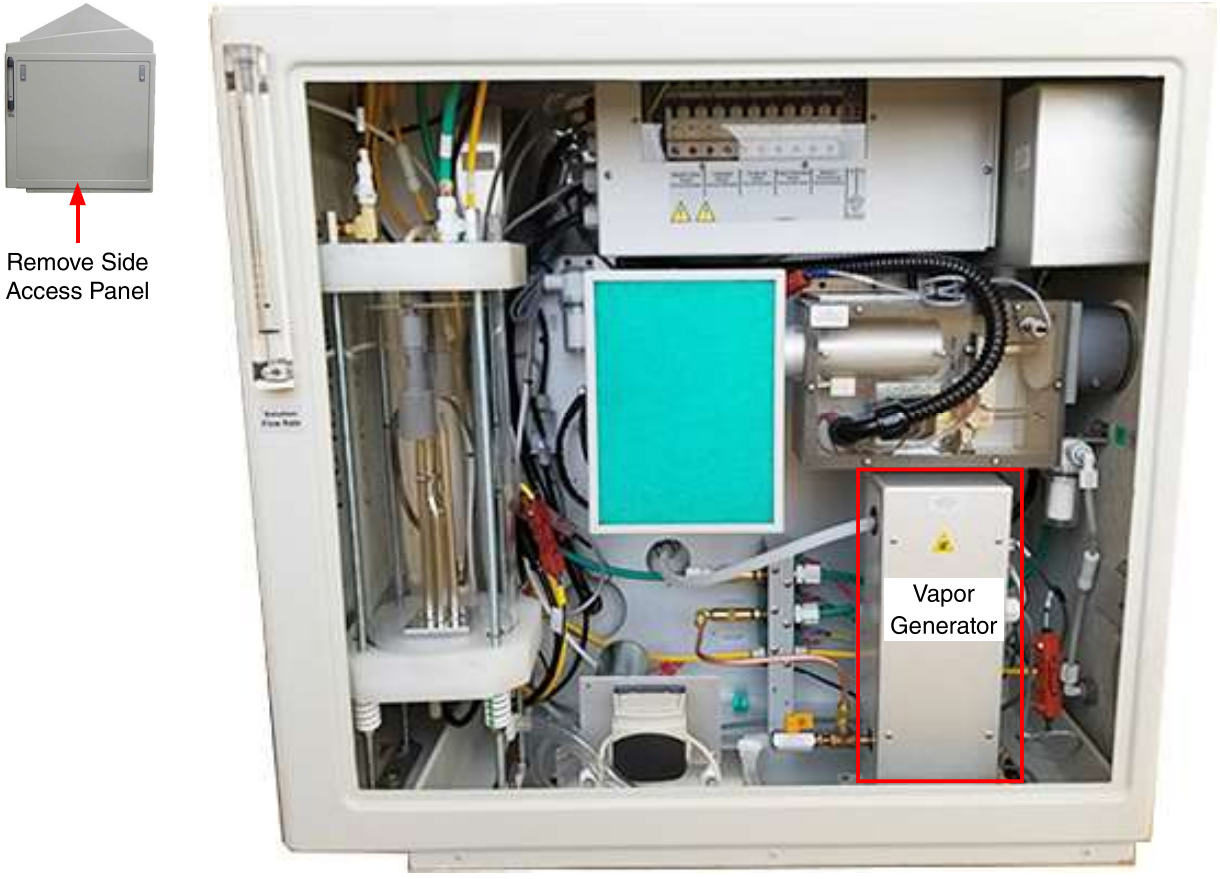



Figure 8.3: Access panel removed to show vapor generator.

## 8.4. Purge Blower and Air Heater (Sep 2021)

- During dry steps, the purge blower blows room air into the chamber (Figure 8.4).
- An air heater at the outlet of the blower heats the air if necessary.
- A valve opens to let the air into the chamber whenever the blower is on.
- When the blower is off, the valve closes to prevent salt fog from leaking out.

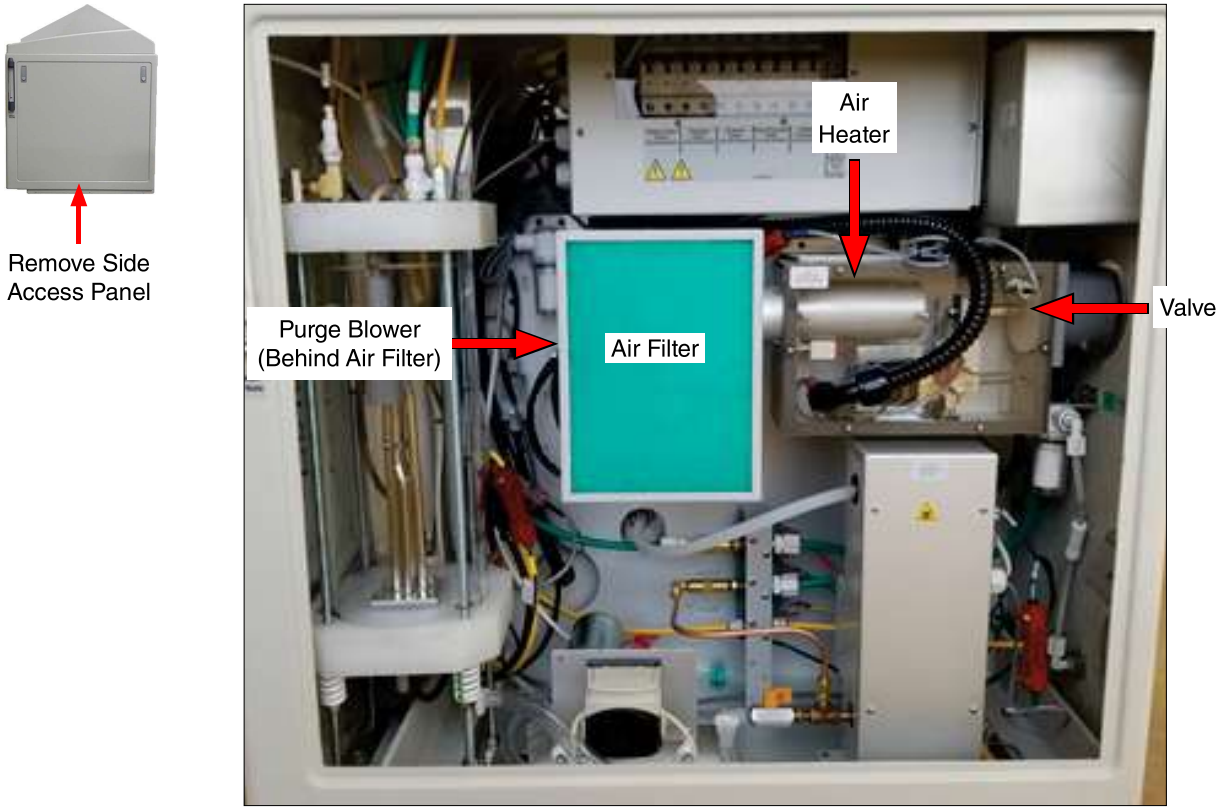



Figure 8.4: Purge blower and air heater location (right side access panel removed, CCT model shown).

## 8.5. Diffusers (Sep 2021)

- Perforated fiberglass sheets (diffusers) sit above the chamber heaters (Figure 8.5).
- The diffuser sheets help diffuse the purge air entering the chamber during dry steps and also protect users from touching the hot chamber heaters below.
- The diffusers are not intended to hold test specimens.
- Use panel racks or hanging rods to hold test specimens (see Section 10.2).


Figure 8.5a: Diffuser Location

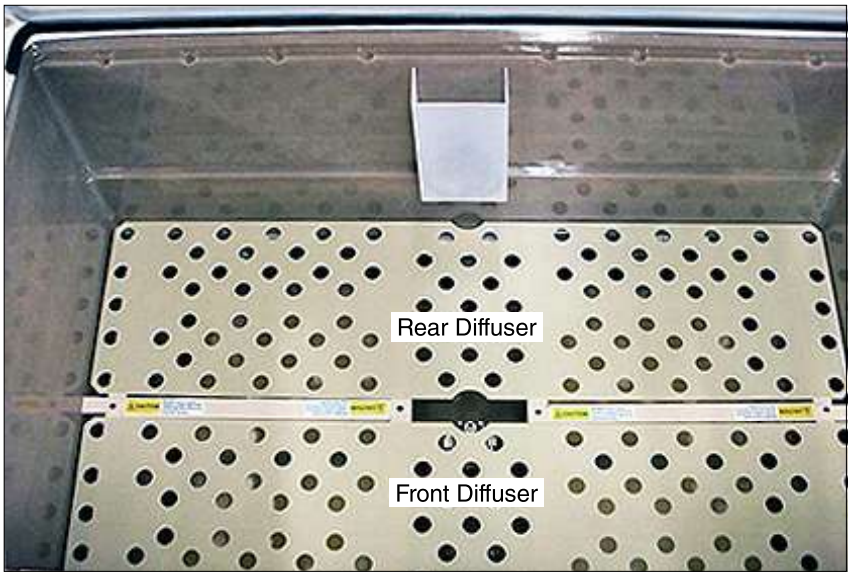



Figure 8.5: Diffusers in chamber.

## 8.6. Chamber Heaters (Oct 2021)

- The Q-FOG chamber heaters are located under the diffuser plates at the bottom of the chamber (Figure 8.6).
- The heaters are used to maintain chamber temperature during Fog, Dry, and Dwell steps.
- See Section 14.1 for chamber heater maintenance information.


Figure 8.6: Chamber heater location at bottom of chamber (diffuser plates removed).

### Important Note for Running the CASS Test (ISO 9227 or ASTM B368)

- Q-Lab recommends Extreme Environment Heaters (also known as “superalloy heaters”) be installed in Q-FOG CCT corrosion testers that are intended to perform the copper accelerated acetic acid salt spray (CASS) test.
- The CASS test, present in both the ISO 9227 and the ASTM B368 test methods, uses a harsh acid solution that is very harmful to standard Q-FOG CCT heaters.
- Extreme Environment Heaters can be ordered as a retrofit kit that can be installed in the field. See the table below for part number details.
- Contact Q-Lab Repair and Tester Support for more information.

| Q-FOG Model* | Voltage (V) | Part Number |
|---|---|---|
| CCT600 | 208 | F-8745.1-K |
| CCT600 | 230 | F-8746.1-K |
| CCT1100 | 208 | F-8748.1-K |
| CCT1100 | 230 | F-8749.1-K |

* The Q-FOG CCT tester is the only model that fully meets the CASS test standards, including satisfying all of the collections requirements. See Q-Tips #2016-29 for CASS testing requirements.

## 8.7. Peristaltic Fog Pump (Nov 2021)

- A peristaltic pump (Figure 8.7a and Figure 8.7b) is used to supply salt solution to the fog nozzle.
- Fog deposition quantity is controlled by peristaltic pump speed. See Section 9, Machine Configuration and Section 12.2, Fog Deposition (Quantity and Uniformity) Adjustment.
- The peristaltic pump is accessed by removing the Q-FOG right-side access panel.
- The salt solution filter (Figure 8.7a) before the pump prevents particles or contaminants from entering the pump and nozzle.
- The standard pump tubing is 1.6 mm in diameter. A larger diameter peristaltic pump tube (2.4 mm) is available in kit number F-70123-K.
- See Section 14.1 for pump and filter maintenance information.
- See *LF-8151-SO Q-FOG SSP and CCT System Overviews* for detailed fog system information.

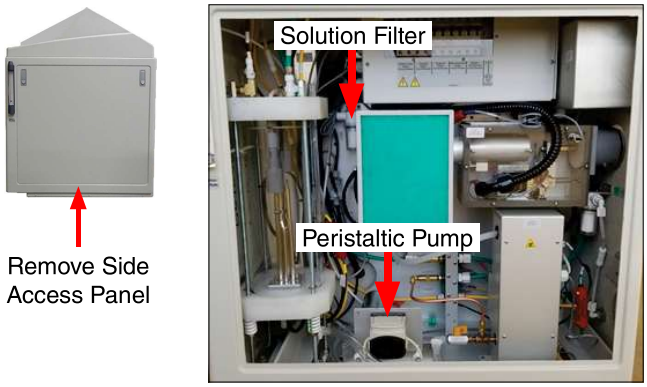



Figure 8.7a: Peristaltic pump location (right side access panel removed, CCT model shown).

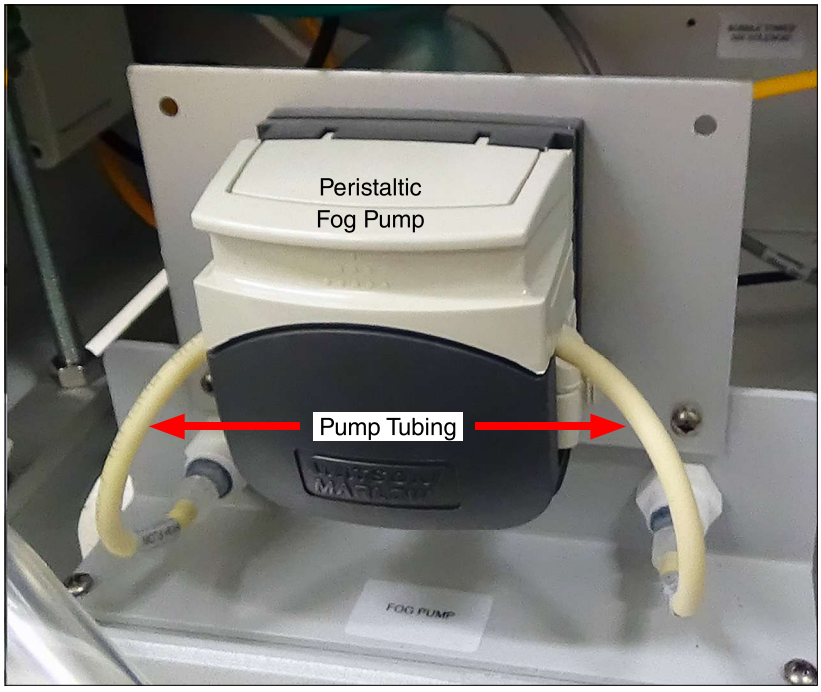



Figure 8.7b: Peristaltic pump detail.

## 8.8. Fog Spray Nozzle (Sep 2021)

- The fog spray nozzle is located at the bottom of chamber under the diffusers between heaters (Figure 8.8a).
- Salt solution enters on the right side of the nozzle and compressed air enters on the left side (Figure 8.8b).
- As the salt solution and the compressed air mix, the compressed air atomizes the salt solution into a fine mist (fog).
- See Section 14.2 for fog spray nozzle maintenance information.

Figure 8.8a: Fog spray nozzle located at bottom of test chamber (diffusers removed).

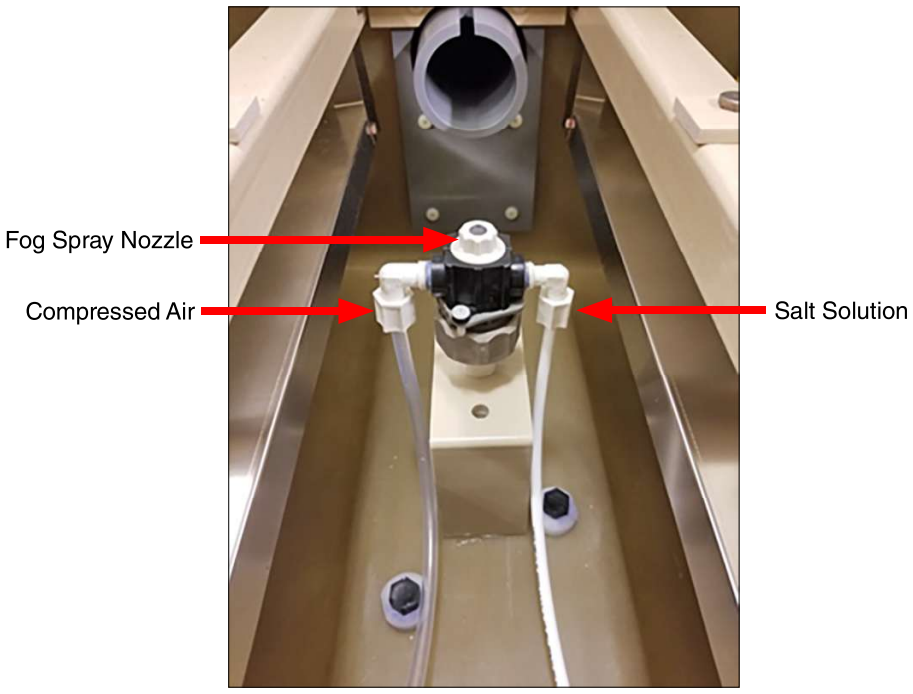


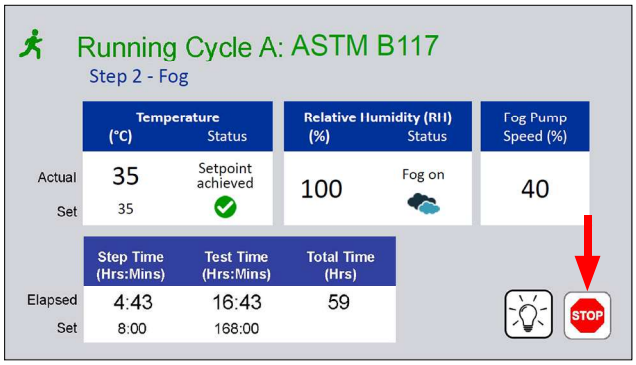

Figure 8.8b: Fog spray nozzle detail.

## 8.9. Lid Interlock Switch (Sep 2021)

- When the lid is opened the interlock switch (Figure 8.9a) will open and the pump, blower, and heaters will stop.


Figure 8.9a: Lid interlock switch location.

**If the lid is opened in a fog step, the chamber will be full of salt fog and this will escape into the room. Before opening the lid in a fog step:**




1. Touch the **STOP** icon on the status screen to stop the fog step.


2. Wait 15 minutes.

3. Open the test chamber lid.

## 8.10. Chamber Air Temperature Sensor and Over Temperature Switch (Sep 2021)

- The chamber temperature sensor is mounted in a flexible probe on the right end of the chamber (Figure 8.10).
- An over temperature switch inside a housing is also mounted on the right end of the chamber to protect the chamber from excessive heat.

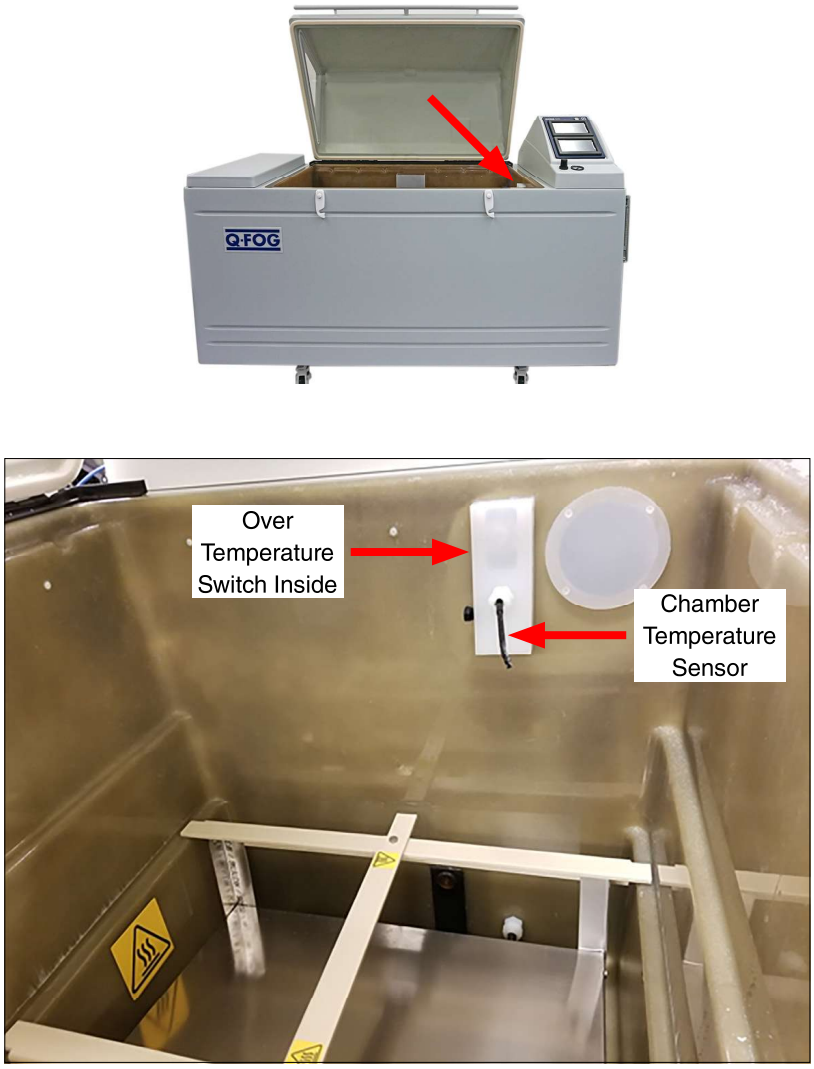



Figure 8.10: Chamber temperature sensor and over temperature switch locations.

## 8.11. Laboratory Temperature Sensor (Sep 2021)

- A temperature sensor is mounted on the lower left rear of the Q-FOG cabinet (Figure 8.11).
- The sensor measures the ambient temperature in the lab. See Section 4 for important operating environment information.
- Ambient temperature data is logged and can be exported to help troubleshoot miscellaneous faults (see Section 13.3).

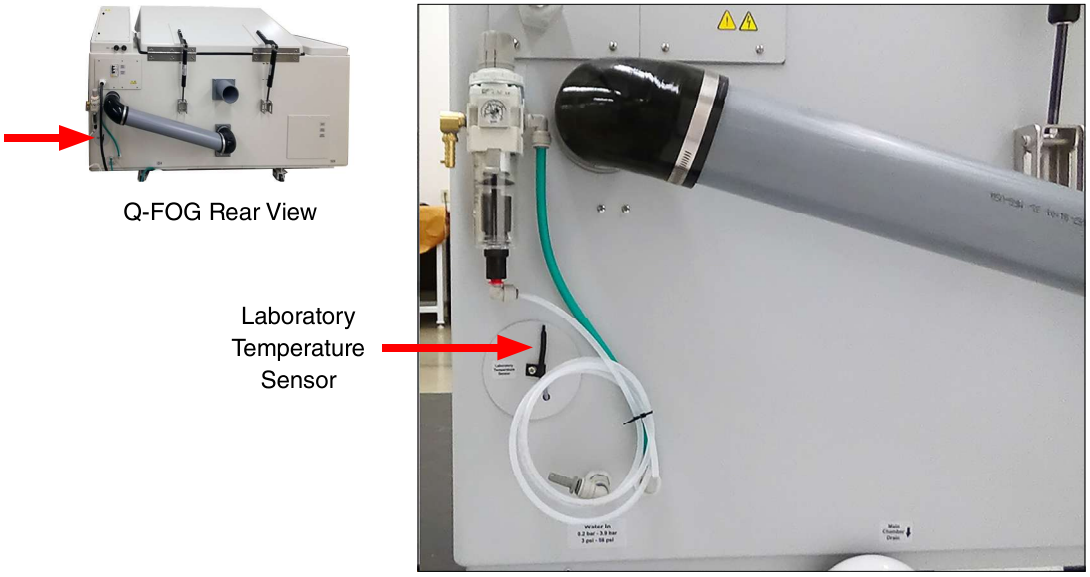



Figure 8.11: Laboratory temperature sensor location.

## 8.12. Lid Lifters (Sep 2021)

- Two gas spring lid lifters attached to the rear of the chamber assist in lifting the lid (Figure 8.12a).
- The lifters assist in lifting the lid the normal 60° opening (Figure 8.12b) with little effort.
- The lid can be further opened to a full 90° (Figure 8.12c) to allow heavy specimens to be loaded from an overhead crane.

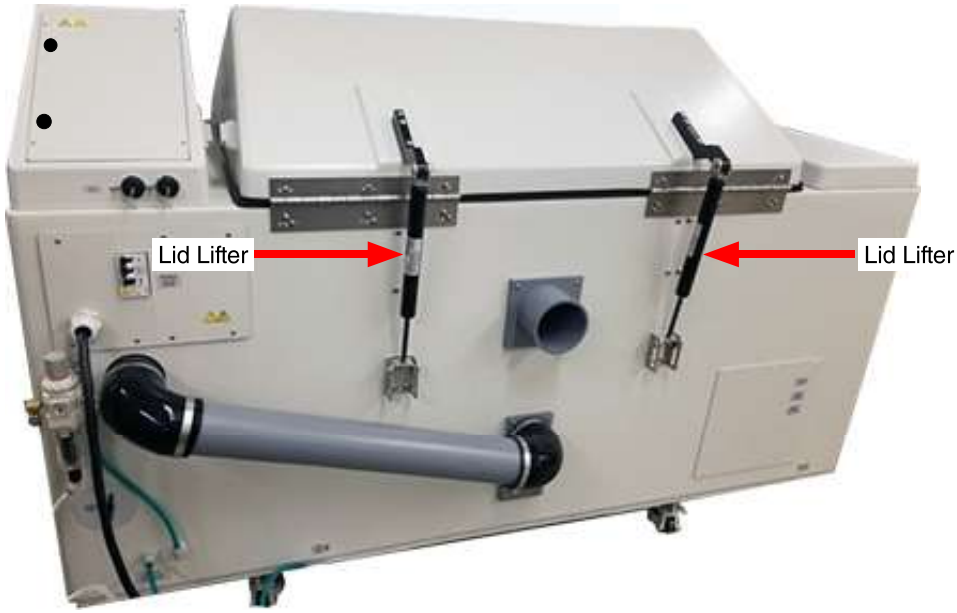



Figure 8.12a: Q-FOG rear view showing lid lifters.

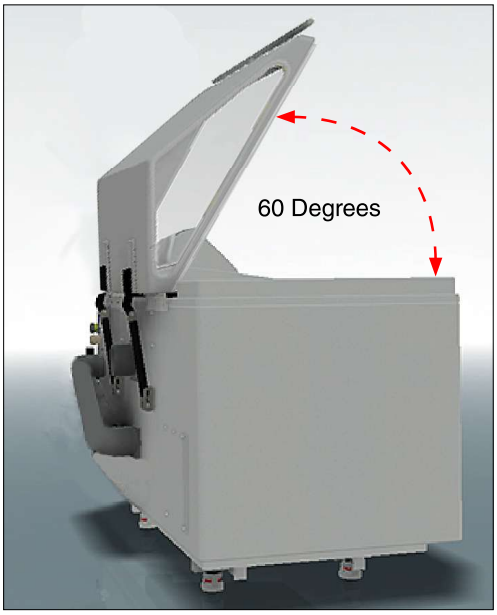



Figure 8.12b: Lid opened 60 degrees.

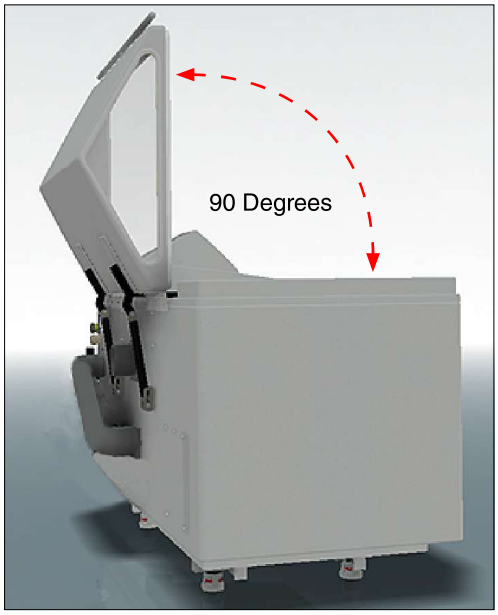



Figure 8.12c: Lid opened 90 degrees.

# 9. Main Controller Operation

## 9.1. Overview (Oct 2021)

### Purpose

- The main controller located in the Q-FOG control top (Figure 9.1a) controls all functions of the Q-FOG.
- Interactive software allows easy programming and operation 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.
- The controller can store up to 10 test cycles of 50 steps each.
- Each step consists of:
  - A function: Fog, Dry, Humid (CCT only), or Dwell
  - A temperature
  - A time
- Step time can range from 1 minute to 99 hours 59 minutes.

### Display Screens

- Two touch-screen monitors mounted on the Q-FOG control top are used to control tester operation and to display test status (Figure 9.1b).
- The Status Screen (Figure 9.1c) is on the top and the Menu Screen (Figure 9.1d) is on the bottom.
- 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 9.1e).
- 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, above the status screen and visible from a distance, changes colors to indicate current status of the test.


Figure 9.1a: Q-FOG control top.


Figure 9.1b: Touch-screens and LED location on control top.

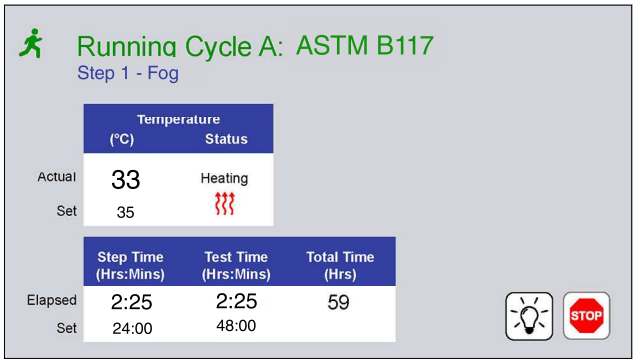



Figure 9.1c: Status Screen displaying typical operating conditions.

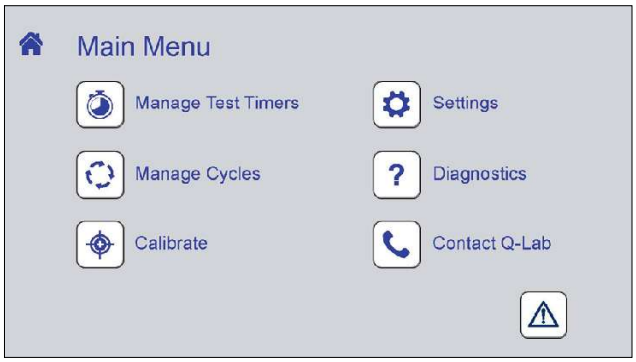



Figure 9.1d: Menu Screen displaying the main menu.


Figure 9.1e: Touch either screen to activate.

## 9.2. Status Screen (Nov 2021)

### Displays

- The Status Screen examples (Figure 9.2a through Figure 9.2e) display:
  - The status icon and state, which indicate the overall status of the tester (see Overall Test Status).
  - The cycle ID (identification) and the name of the test being run.
  - The current test step number and type (function) of step.
  - Step actual and set point values.
  - Status of step.
  - Other relevant step operational parameters.
  - Elapsed and set step time, elapsed and set test time, and tester total operation time.
  - RUN / STOP button. Touch this icon to RUN ( RUN ) or STOP ( STOP ) a test.
  - Touch the Light Bulb icon to turn the test chamber light ON or OFF.

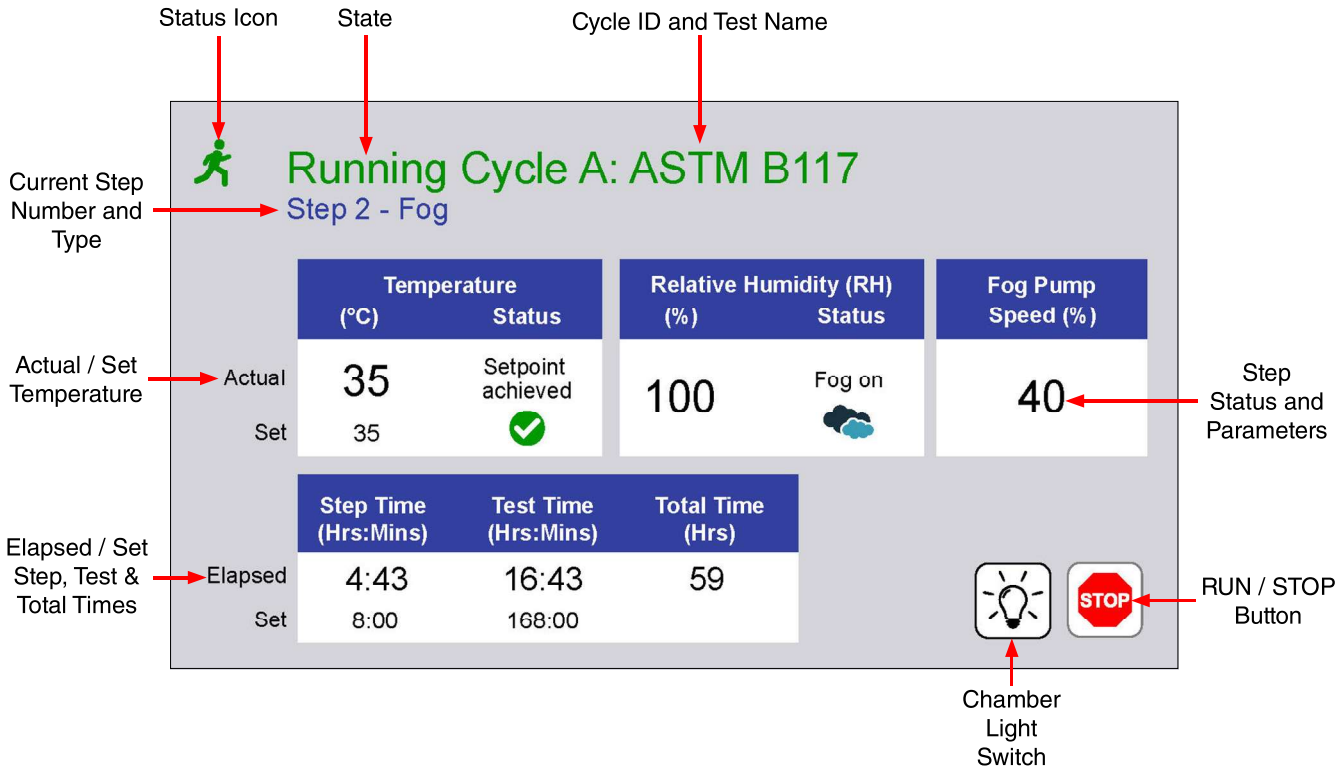



Figure 9.2a: Status Screen display during a fog step.

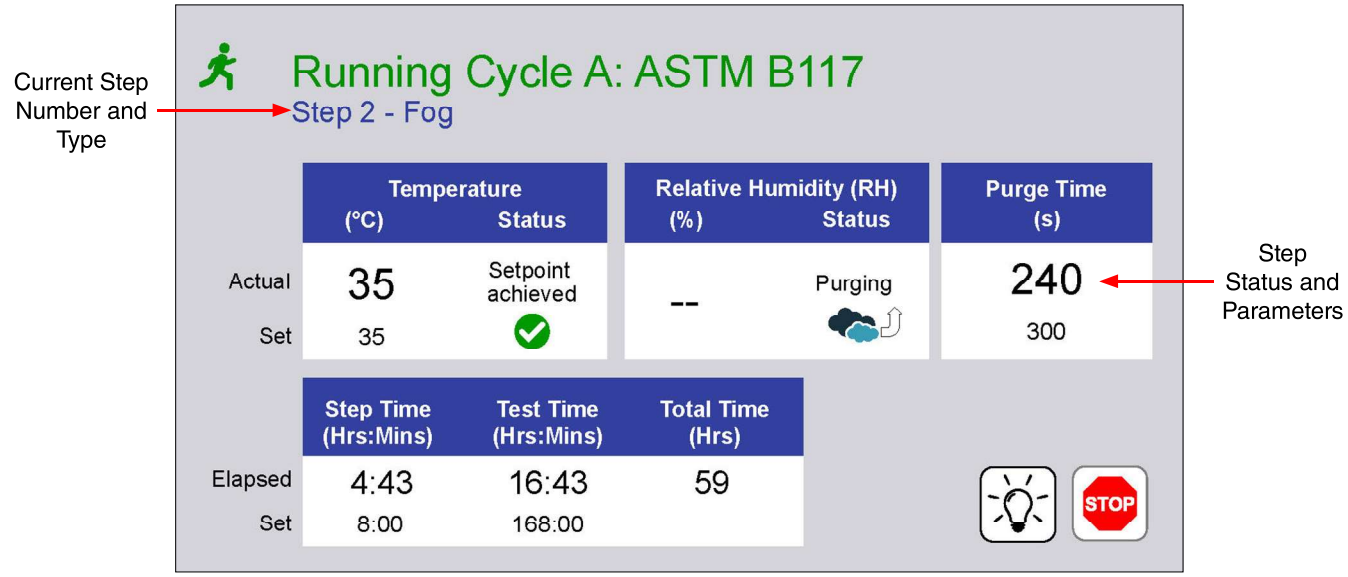



Figure 9.2b: Status Screen display during fog purge.

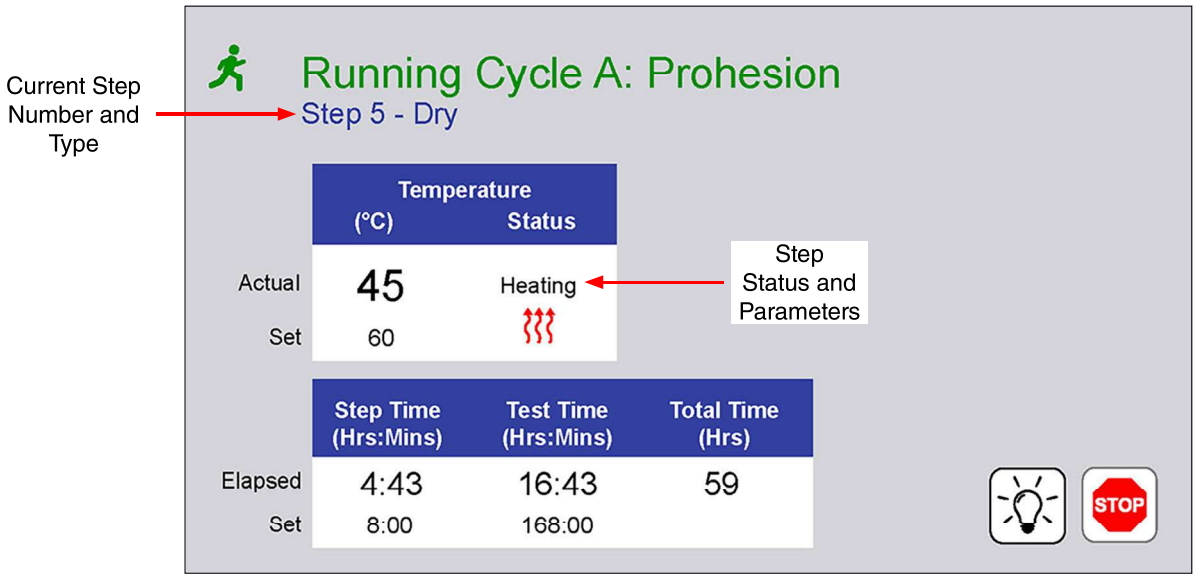



Figure 9.2c: Status Screen display during a dry step.

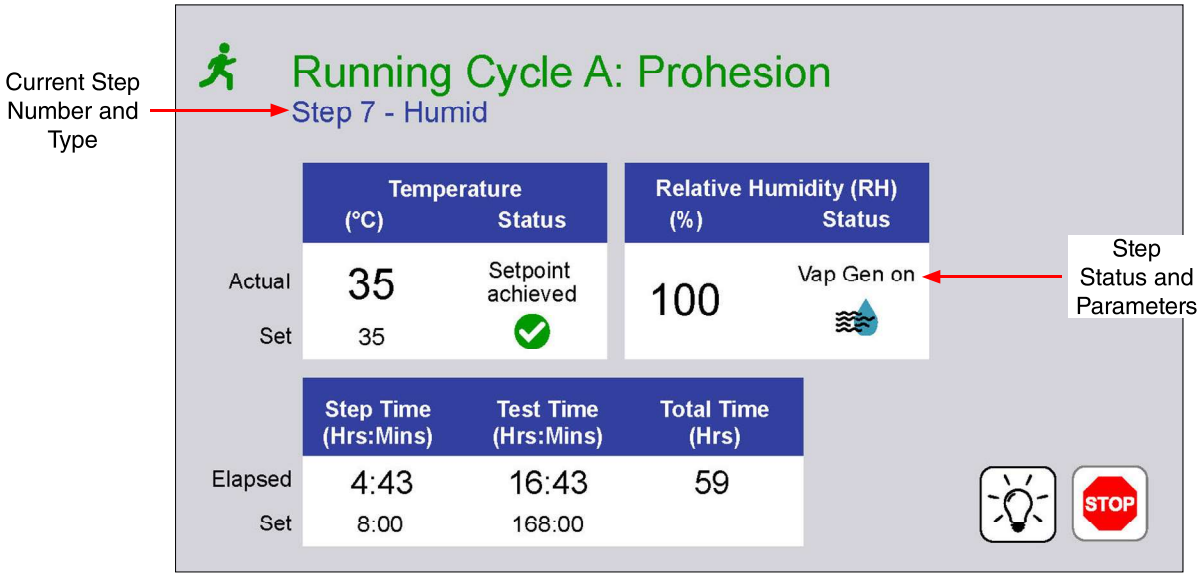



Figure 9.2d: Status Screen display during a Humid step (CCT models only).

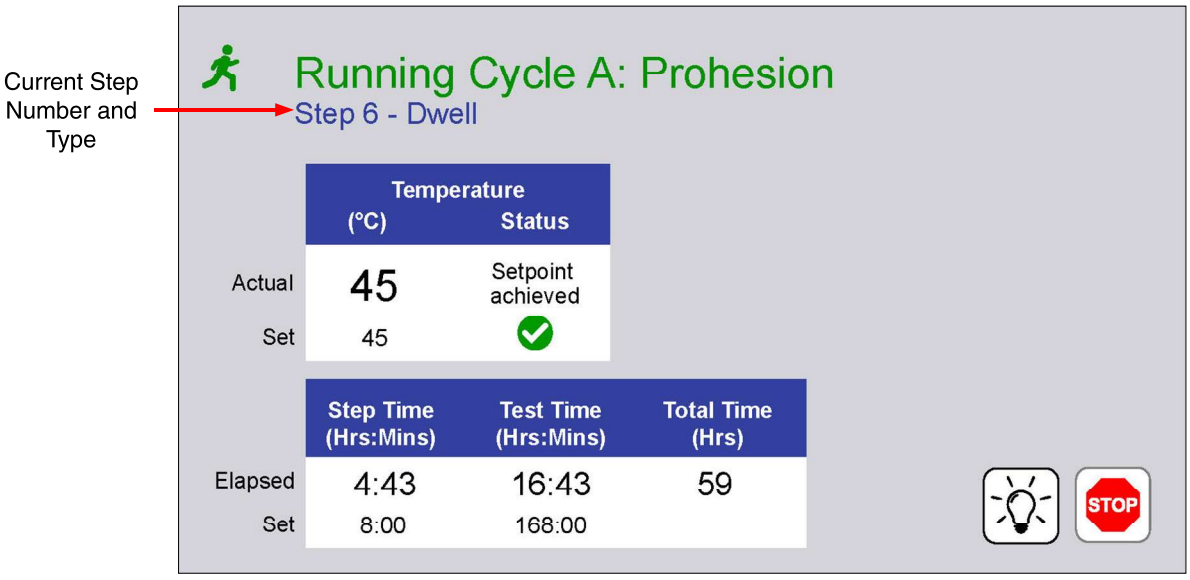



Figure 9.2e: Status Screen display during a dwell step.

## Overall Test Status

- A colored icon and state at the top of the screen indicate the overall status of the test (Figure 9.2f, Figure 9.2g).
- Icons in the lower right corner of the screen can be used to stop or run the test.
- The state also shows the test cycle letter and the name of the test cycle.
- The LED status indicator changes color corresponding to the icon and state status.
- Figure 9.2h summarizes all status conditions and indicators.

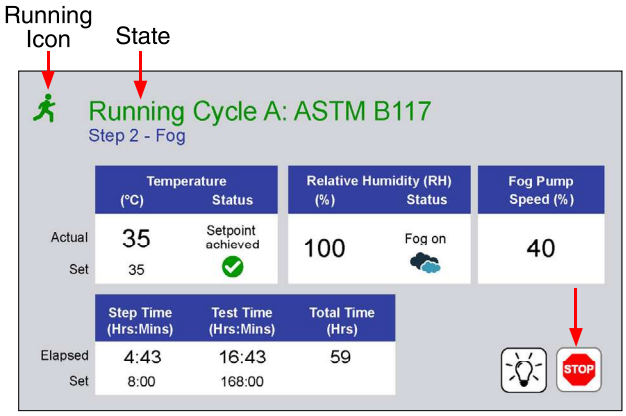



Figure 9.2f: Status icon and state when test running.

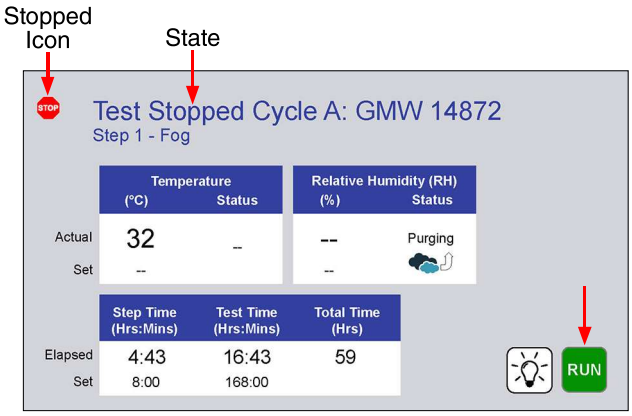



Figure 9.2g: Status icon and state when test stopped.

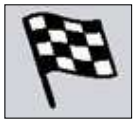
| Icon | State (color) | LED (color, condition) | Status |
|---|---|---|---|
|  | Running Cycle (Green) | (Green, Static) | Test running normally, no active notifications. |
|  | Test Completed (Blue) | (Blue, Flashing) | Test completed. |
|  | Running Cycle (Green) | (Yellow, Flashing) | Test running, one or more notifications. Icon display alternates. |
|  | 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 state. | (Magenta, Static) | Software Install or VSC transfer using USB port. |

Figure 9.2h: Status indicator summary.

## 9.3. Main Menu Screen (Sep 2021)

- The Main Menu is the home display for the menu screen (Figure 9.3).
- The Main Menu screen provides access to all other operator controls for the tester.
- The Main Menu displays icons to access these functions:
  - Notifications (Section 9.4)
  - Manage Test Timers (Section 9.5)
  - Manage Cycles (Section 9.6)
  - Calibration (Section 12)
  - Settings (Section 9.7)
  - Diagnostics (Section 9.8)
  - Contact Q-Lab (Section 9.9)

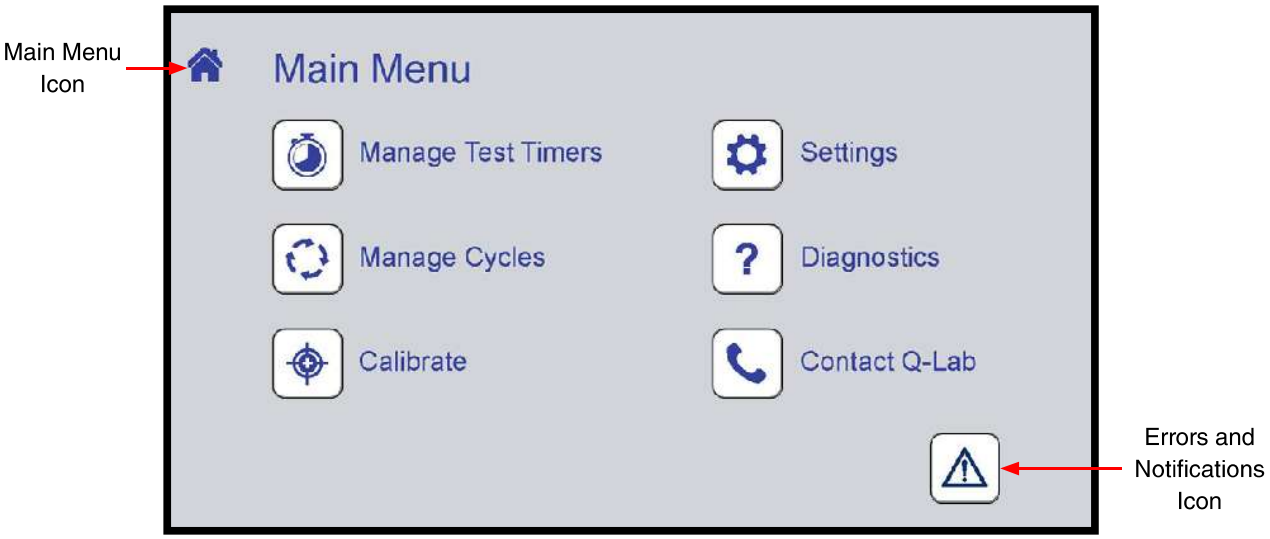



Figure 9.3: Main Menu screen.

## 9.4. Notifications (Sep 2021)

- 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-FOG main controller.
- On the Main Menu screen, touch the notification icon to display the Notifications Screen (Figure 9.4a).
- The type, information icon, identification code (ex. M49), and name are displayed for each notification (Figure 9.4b).
- "Active" and "Cleared" notifications are listed separately, in chronological order, most recent at the top of the list (Figure 9.4c, Figure 9.4d).
- Color-coded attention icons indicate the type of notification (Figure 9.4e).
  - 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 9.4f and Figure 9.4g).
- See Section 15.1 for a complete list of notifications.

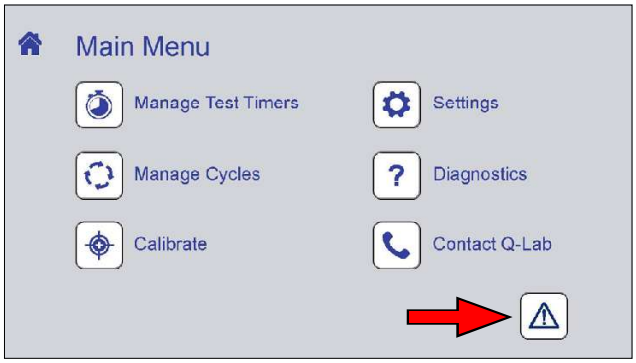



Figure 9.4a: The notifications icon. Icon color changes depending on notification status.

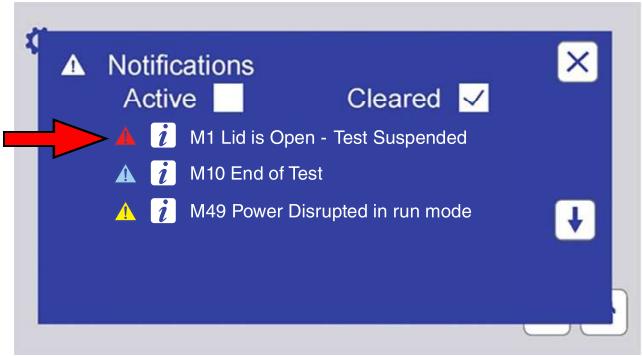



Figure 9.4b: The Notifications Screen lists notification information.

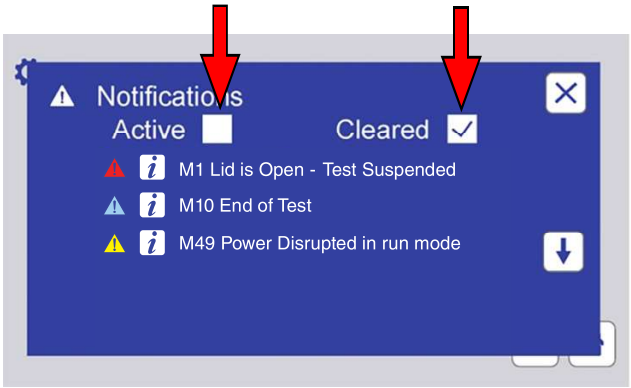



Figure 9.4c: Touch the Active or Cleared check box to view active or cleared notifications.

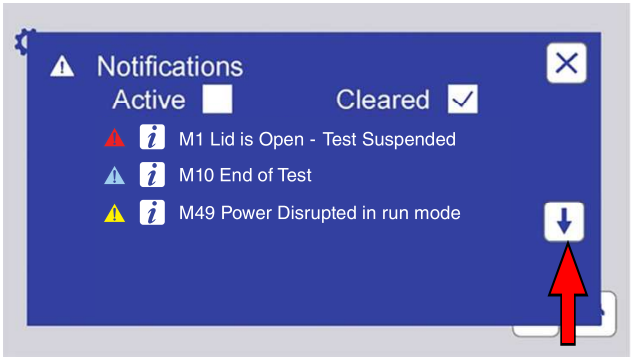



Figure 9.4d: Touch the scroll button(s) to move down or up the notification list.

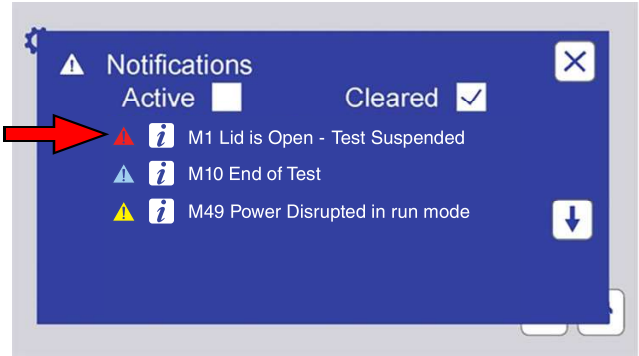



Figure 9.4e: Color coded icons show notification type.

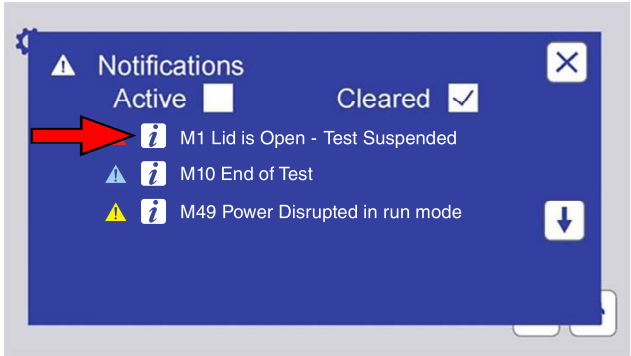



Figure 9.4f: Touch the information icon to display notification details.

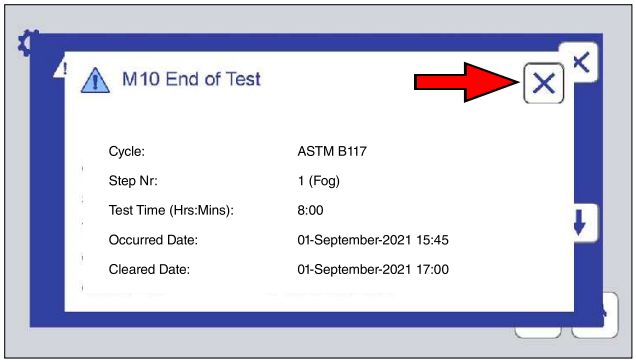



Figure 9.4g: Notification details. Touch the Close icon to return to the Notifications Screen.

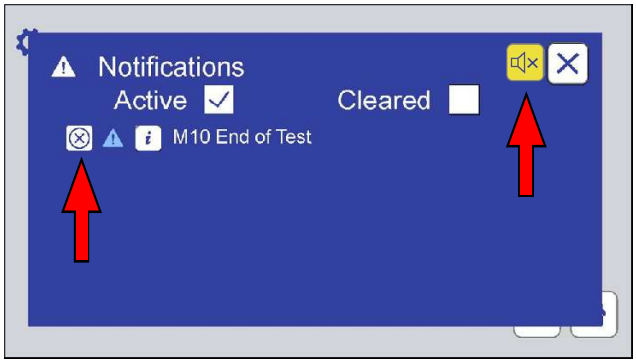



Figure 9.4h: If the alarm is active, touch the yellow mute icon to silence. When the notification has been resolved, touch the icon to the left of the notification to clear it.

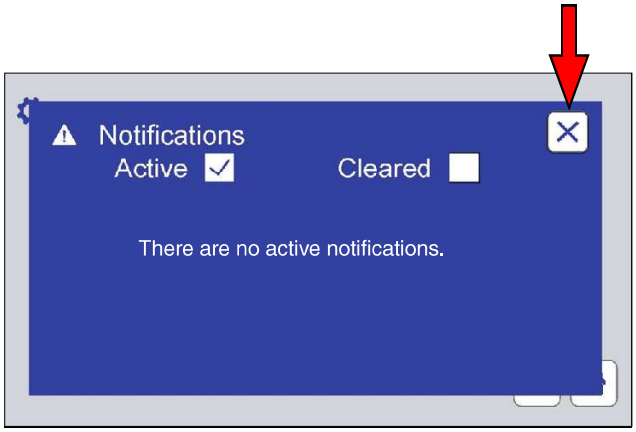



Figure 9.4i: Touch the Notification Screen close icon to re-display the main menu.

| 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 9.4j: A complete list of notifications and their meaning is given in Section 15.1.

## 9.5. Manage Test Timers (Oct 2021)

- On the Main Menu screen touch the Manage Test Timers icon to display the Manage Test Timers screen (Figure 9.5a).
- The Manage Test Timers screen provides three functions:
  1. Specify what action the tester should perform at the end of a test (Figure 9.5b and Figure 9.5c).
     - Stop
     - Message only
     - Alarm only
     - Stop and alarm
     - None
  2. Set the elapsed time for the current test (Figure 9.5d through Figure 9.5f).
  3. Set the duration time for the current test (Figure 9.5d through Figure 9.5f).


Figure 9.5a: Manage Test Timers icon.

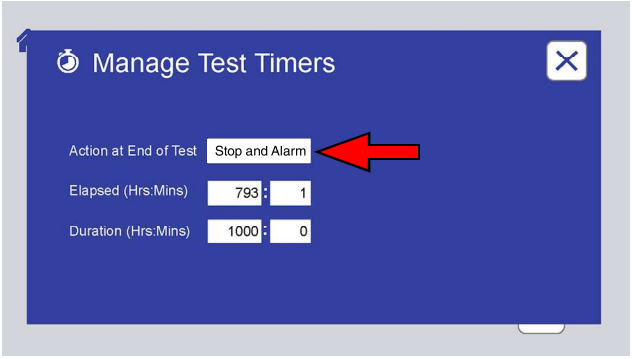



Figure 9.5b: Manage Test Timers screen. Touch the Action at End of Test text box to specify the action.

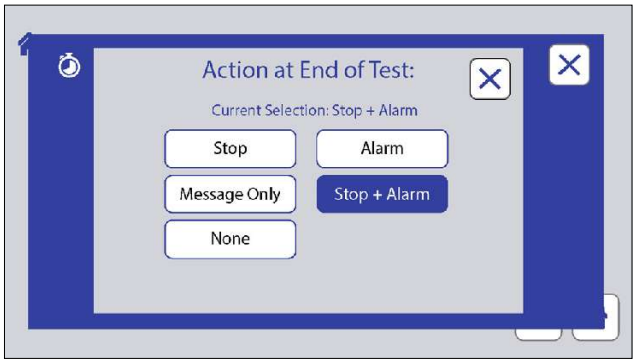



Figure 9.5c: Action at End of Test screen. Touch an action button to select that action.

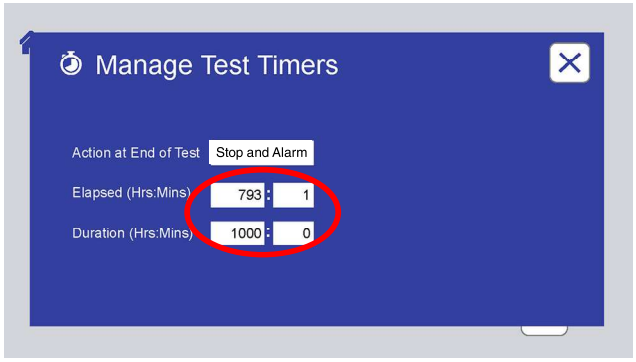



Figure 9.5d: Touch the Elapsed or Duration text box(s) to enter the new values.

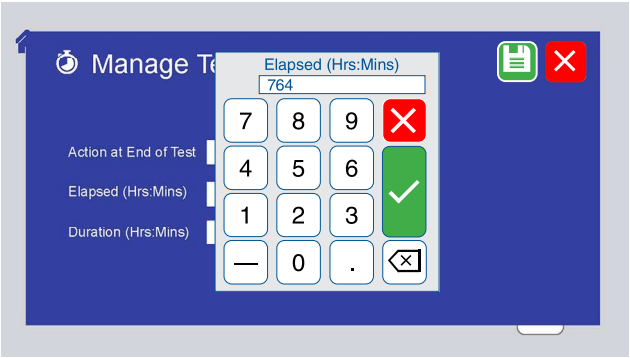



Figure 9.5e: Enter the new values using the numeric keypad. Touch the check mark to accept, or the X to cancel changes.

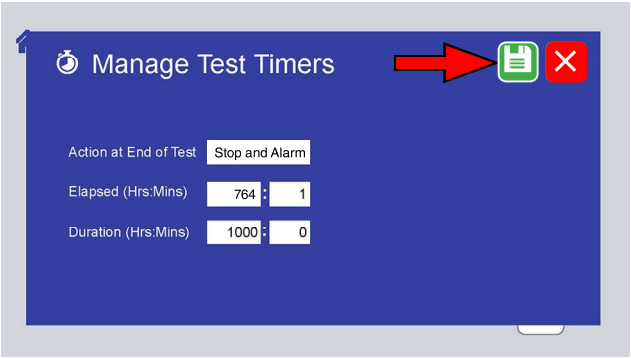



Figure 9.5f: If any changes have been made, touch the save changes icon or the cancel changes icon to re-display the Main Menu screen.

## 9.6. Manage Cycles (Sep 2021)

- On the Main Menu screen touch the Manage Cycles icon (Figure 9.6.1a) 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 9.6.1b).
- Each cycle is stored with an alphanumeric (A through J) identification tab (Figure 9.6.1b).
  - Touch a tab to select a cycle.
    - The cycle name (ex. ASTM B117) 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 9.6.2a through Figure 9.6.2c).
    - 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 9.6.3a through Figure 9.6.3e).
  - Add, edit, or delete steps in a cycle (Figure 9.6.4a through Figure 9.6.6d). **NOTE:** Pre-programmed test cycles cannot be edited (they can be deleted).
  - Create a new cycle (Figure 9.6.7a through Figure 9.6.7e).
  - Run a cycle from any of its steps (Figure 9.6.8a through Figure 9.6.8d).
- The Q-FOG main controller can store ten (10) test cycles.
- A test cycle can consist of up to fifty (50) steps.

### 9.6.1 Select a Cycle


Figure 9.6.1a: Manage Cycles icon.

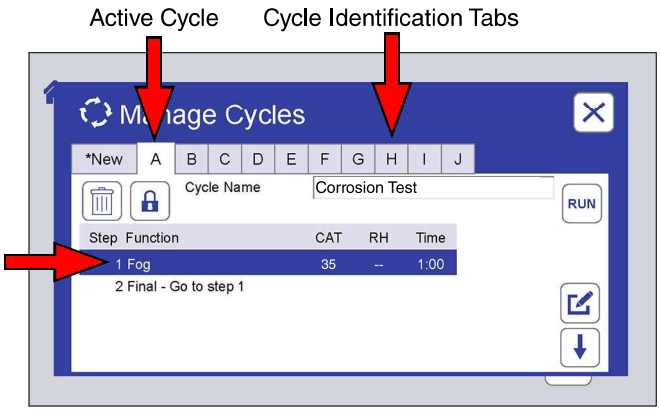



Figure 9.6.1b: Manage Cycles screen. The active cycle is displayed. The currently running step is indicated. From here you can run that cycle, or perform other actions described in the next sections

## 9.6.2 Delete a Cycle

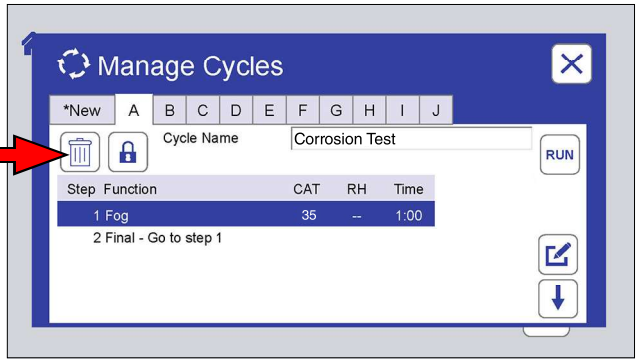



Figure 9.6.2a: Touch the Delete icon to delete the selected cycle.

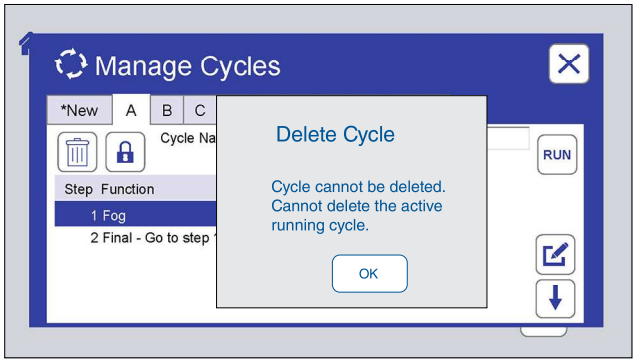



Figure 9.6.2b: The active running cycle cannot be deleted. Touch OK to clear message.

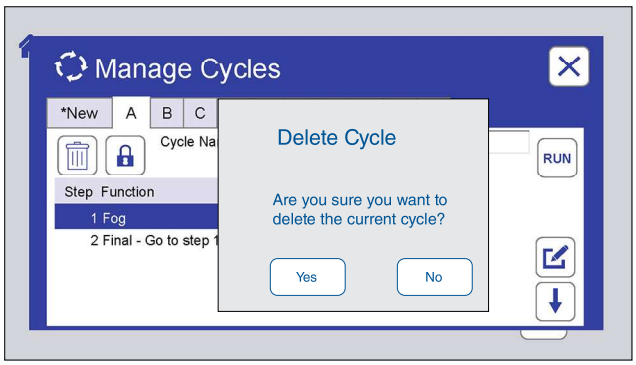



Figure 9.6.2c: To delete an inactive cycle, the operator is prompted for verification. Touch No to cancel delete. Touch Yes to create a blank cycle.

## 9.6.3 Lock a Cycle

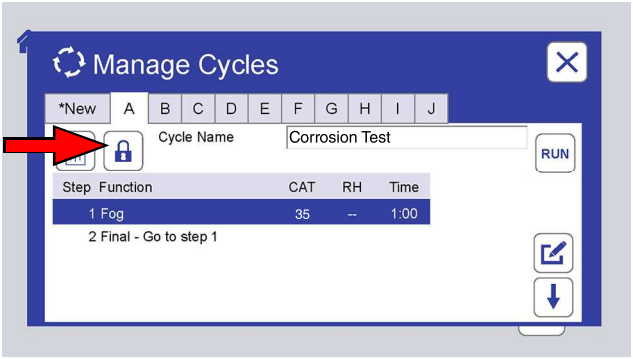



Figure 9.6.3a: Touch the Lock icon to lock the cycle.
**NOTE:** Pre-programmed test cycles are locked by Q-Lab.

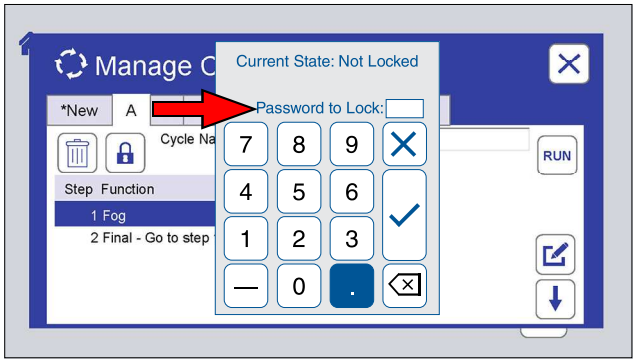



Figure 9.6.3b: The numeric keypad is displayed. A password must be entered to lock the cycle.

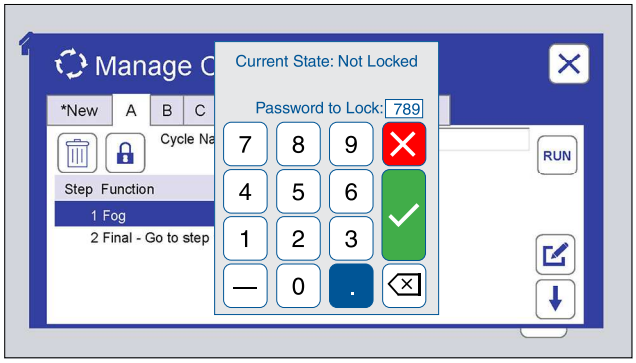



Figure 9.6.3c: Enter the numeric password. Touch the Check Mark button to save, or the X button to cancel setting the password.

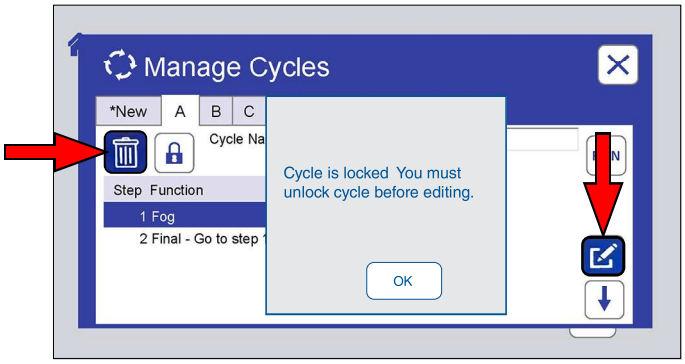



Figure 9.6.3d: This message is displayed if a delete or edit icon is touched on a locked cycle.

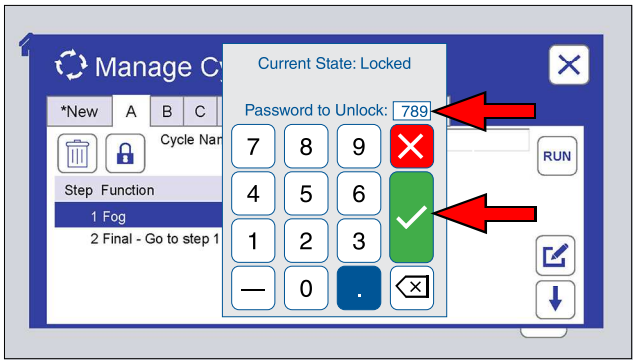



Figure 9.6.3e: To unlock a cycle, touch the lock icon, enter the password, then touch the Check Mark button. If the password has been forgottenprogram a different test cycle or contact Q-Lab for password reset.

## 9.6.4 Add a Step to a Cycle

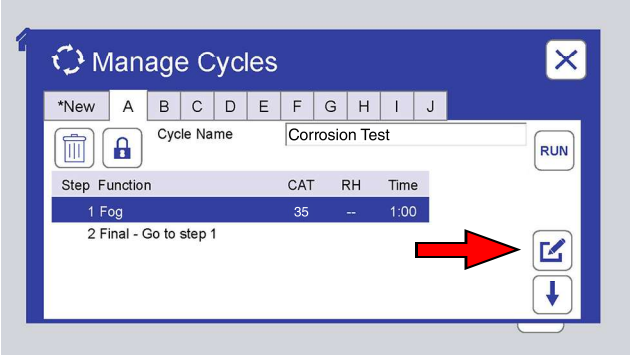



Figure 9.6.4a: For any cycle, a new step can be added before or after an existing step. Select the existing step then touch the Edit icon.

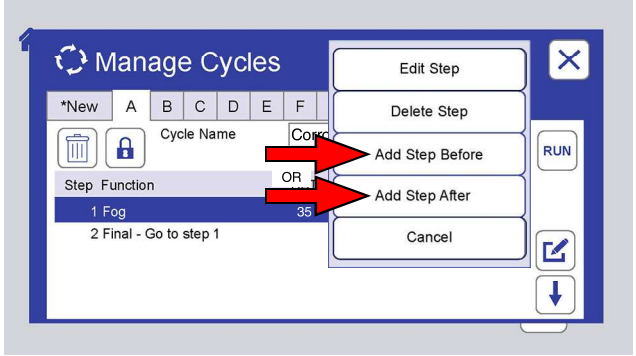



Figure 9.6.4b: The step revision control is displayed. Touch Add Step Before or Add Step After.

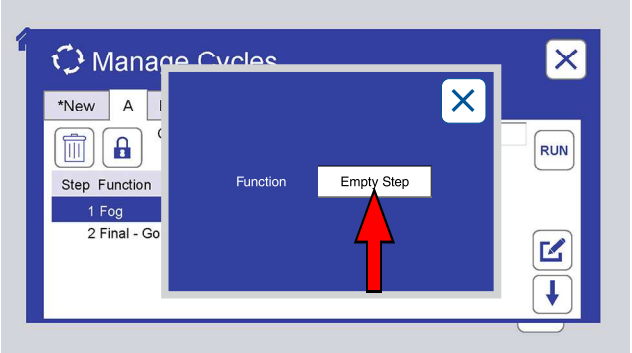



Figure 9.6.4c: Touch the function text box to select a function.

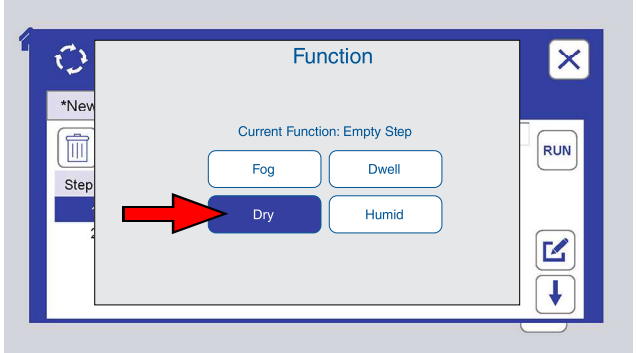



Figure 9.6.4d: Touch the desired function. Humid function is displayed for CCT models only.

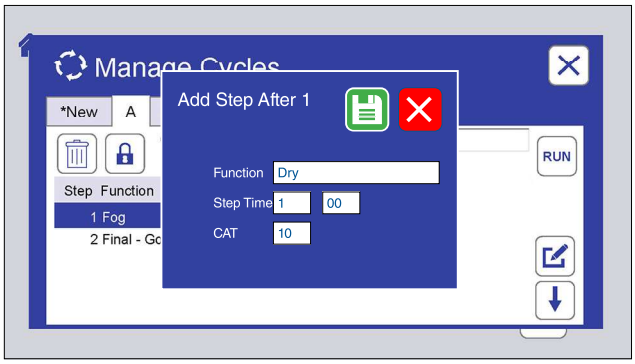



Figure 9.6.4e: Step values must be entered. Touch the Step Time (Hrs:Mins), and CAT (Chamber Air Temperature) (°C) text boxes to select.

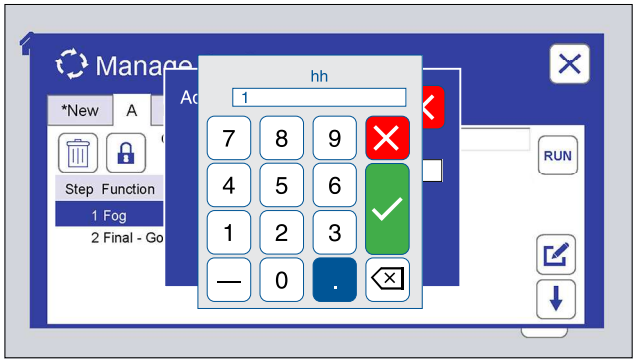



Figure 9.6.4f: Use the numeric keypad to enter the values for each parameter. Touch the Check Mark button to accept those values or the X button to cancel.

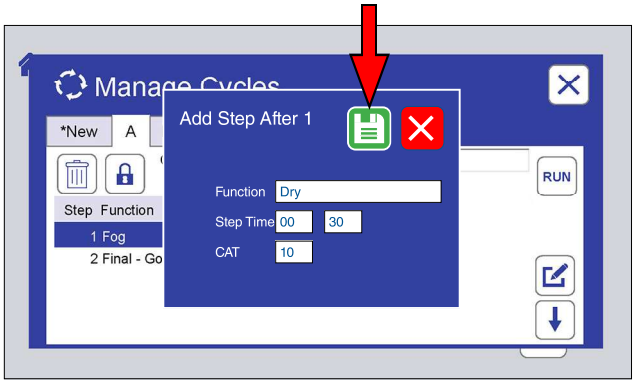



Figure 9.6.4g: The new step values are displayed. Touch the Save icon to save the new step.

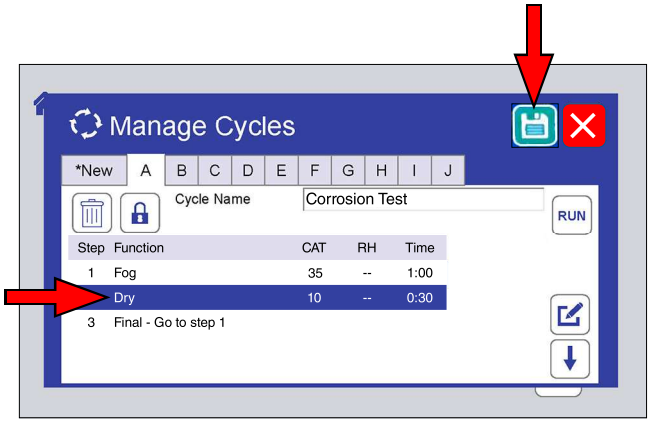



Figure 9.6.4h: The new step is shown for the cycle. Touch the Save icon to save the modified cycle.

## 9.6.5 Edit a Step

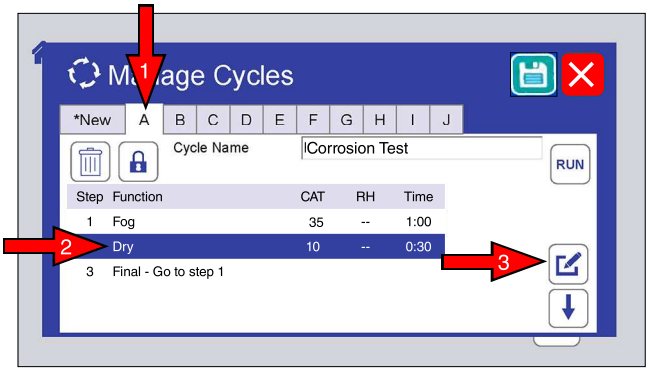



Figure 9.6.5a: To edit a step, touch the cycle ID tab, touch the step to select, then touch the Pencil icon. **NOTE:** Steps cannot be moved in the test cycle, a Step must be edited to change function sequence in the test cycle.

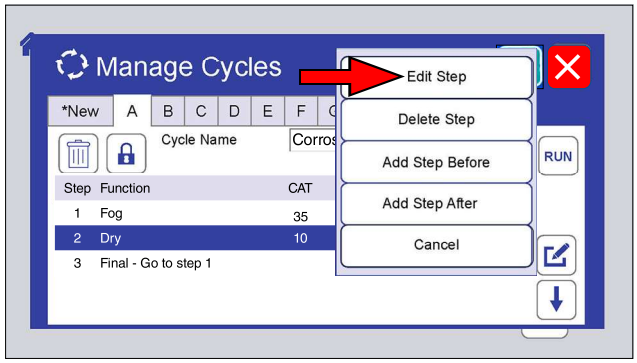



Figure 9.6.5b: Touch the Edit Step button.

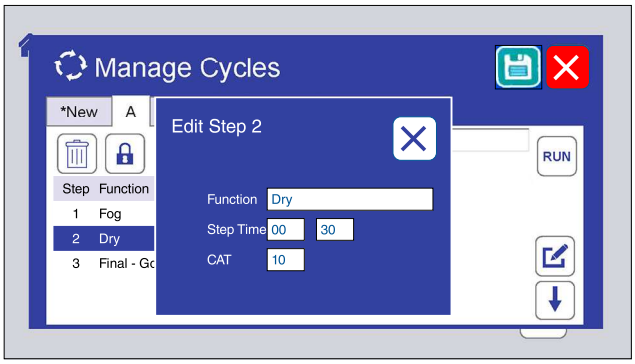



Figure 9.6.5c: Touch the Function, Step Time, or CAT text boxes to select.

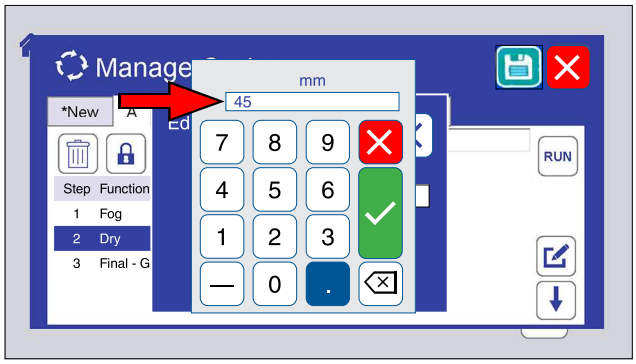



Figure 9.6.5d: Use the numeric keypad to enter the new values for the selected step. Touch the Check Mark button to accept those values or the X button to cancel.

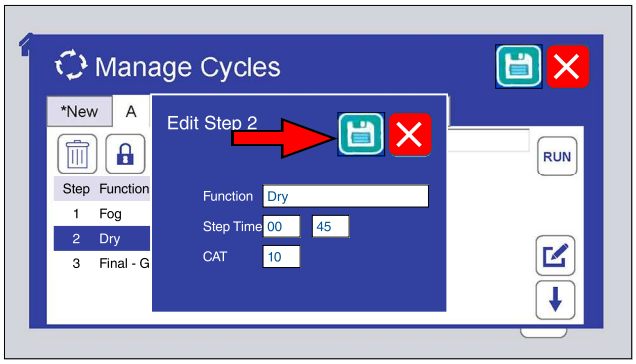



Figure 9.6.5e: Touch the Save icon to save the edited step.

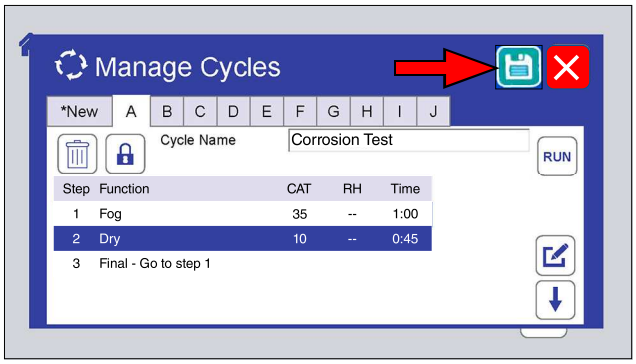



Figure 9.6.5f: The edited step is shown for the cycle. Touch the Save icon to save the edited cycle.
**NOTE:** pre-programmed test cycles cannot be edited.

## 9.6.6 Delete a Step

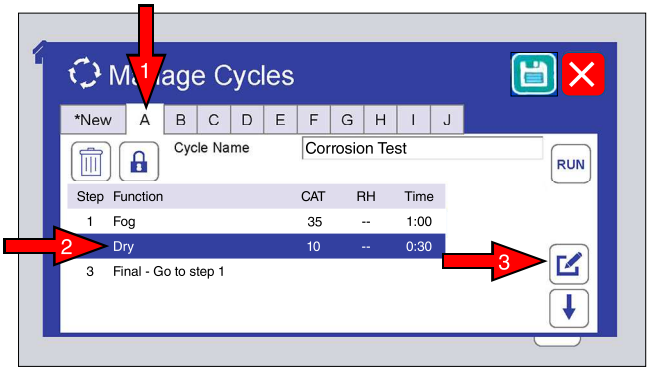



Figure 9.6.6a: To delete a step, touch the cycle ID tab, touch the step to delete, then touch the pencil icon.

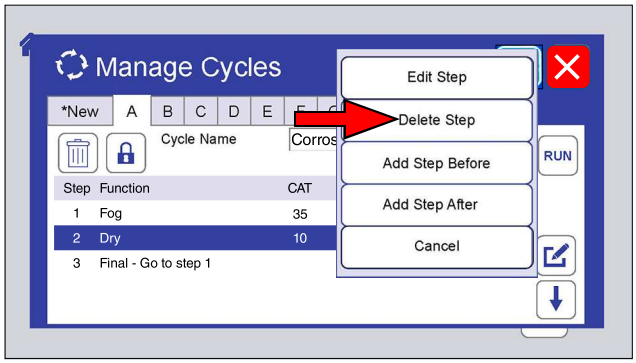



Figure 9.6.6b: Touch the Delete Step button.

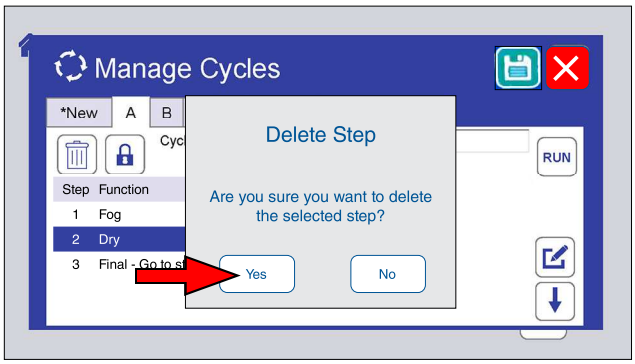



Figure 9.6.6c: Touch the Yes button to delete the step or touch the No button to cancel delete.

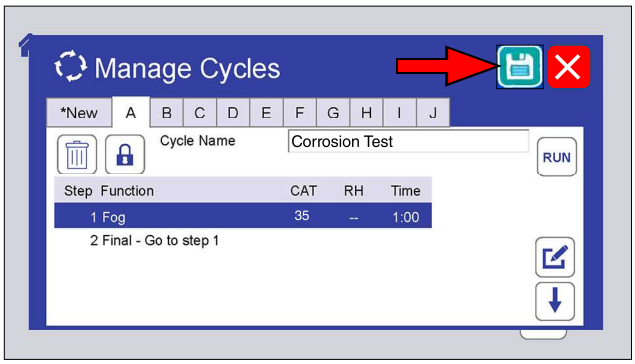



Figure 9.6.6d: Touch the Save icon to save the edited cycle.

## 9.6.7 Create a New Cycle

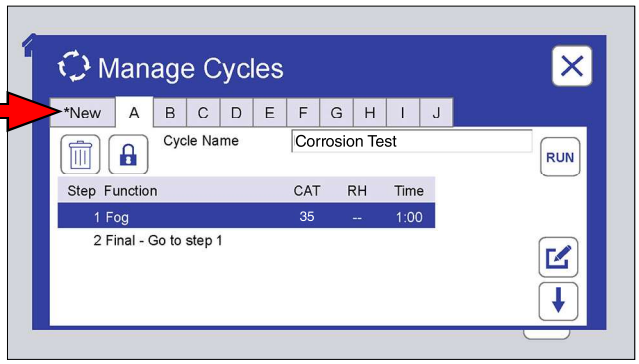



Figure 9.6.7a: To create a new cycle, touch the *New tab.

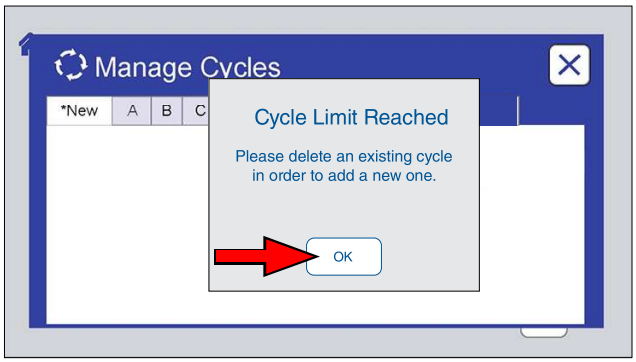



Figure 9.6.7b: If all available (10) cycles are programmed, this message is displayed. Touch the OK button.

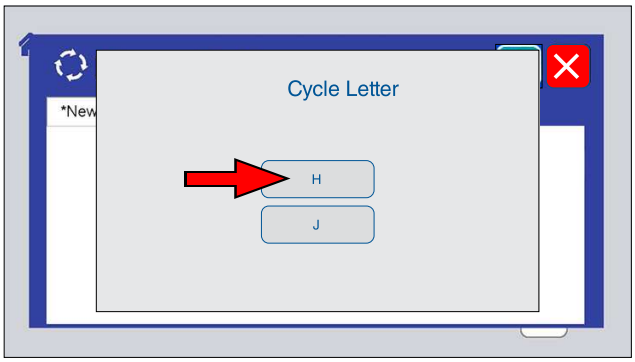



Figure 9.6.7c: If there are open cycles, the available cycle letters are displayed. Touch a letter to program that cycle.

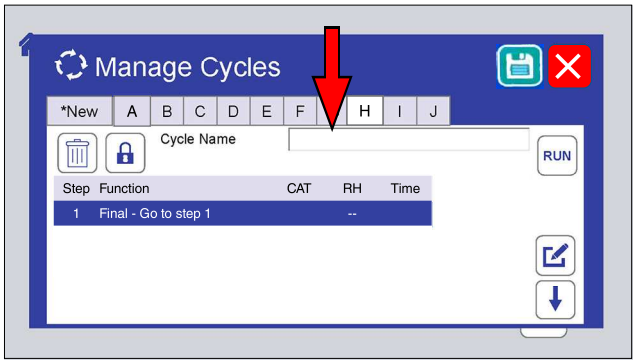



Figure 9.6.7d: An empty cycle is created with only a final step. Enter a name for the new cycle.

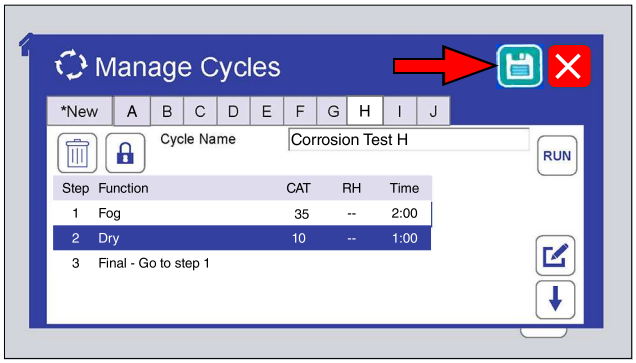



Figure 9.6.7e: Follow Figure 9.6.4a through Figure 9.6.4h to add steps and save the new cycle.

## 9.6.8 Run From Step

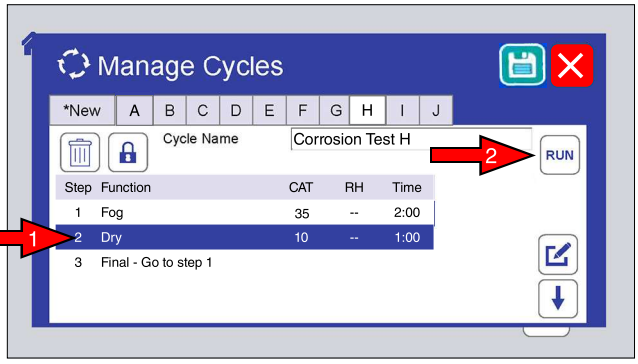



Figure 9.6.8a: A cycle can be run from a specified time in one of its steps. Select the step, then touch the RUN button

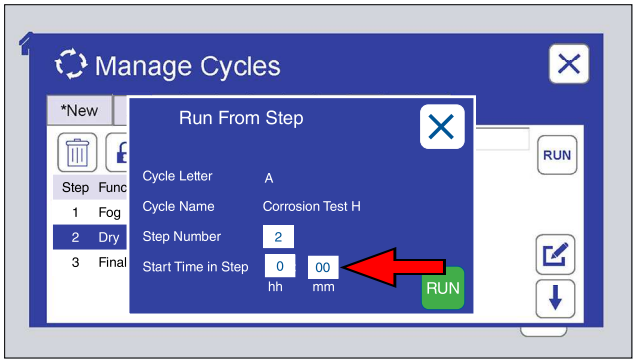



Figure 9.6.8b: Touch the start time hh (hours) text box or the mm (minutes) text box to set the time. Start time can be set to 0 to start at the beginning of the step.

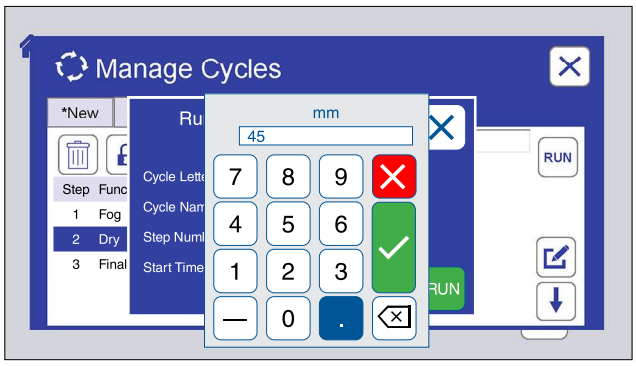



Figure 9.6.8c: Use the numeric key pad to set the time. Touch the check mark button to accept those values or the X button to cancel.

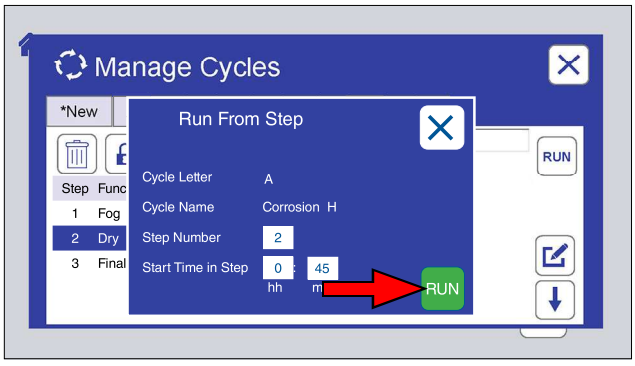



Figure 9.6.8d: Touch the Run icon to run the step from the time entered.

## 9.7. Settings (Oct 2021)

- On the Main Menu screen touch the Settings icon (Figure 9.7a) to display the Settings screen.
- The Settings screen displays user-selectable machine parameters (Figure 9.7b)
  - Volume (Figure 9.7c and Figure 9.7d).
    - Alarm
    - Touch
  - Display Options (Figure 9.7e through Figure 9.7h)
    - Status Screen Brightness
    - Menu Screen Brightness
    - Sleep Time
  - Language (Figure 9.7i through Figure 9.7l), available are:
    - English, French, Spanish, German, Italian, Chinese, Japanese, Korean, Czech, Dutch, Polish, Portuguese, Russian, Swedish, Thai, Turkish, and Vietnamese
  - Date/Time (Figure 9.7m through Figure 9.7p).
  - Ethernet (Figure 9.7q through Figure 9.7t).
  - Machine Configuration (Figure 9.7u and Figure 9.7v). Contact Q-Lab Repair and Tester Support for more information on using this setting.
- The Q-FOG can be operated using just one screen.
  - In the event of the failure of either screen, the controller will automatically reconfigure to use just the functioning screen to maintain full operation of the tester. This will be indicated by the appropriate error message M900, M901, and/or M902 (see Section 15.1).
  - A button appears in the upper right corner of the screen to toggle the remaining screen between Main Menu and Status displays (see Figure 9.7x through Figure 9.7aa).

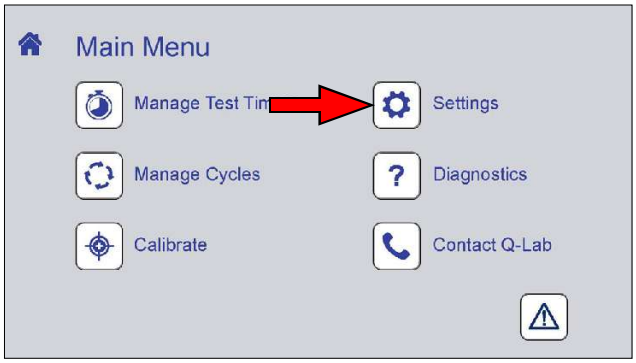



Figure 9.7a: Touch the Settings icon on the Main Menu screen to display settings controls.

**Settings**

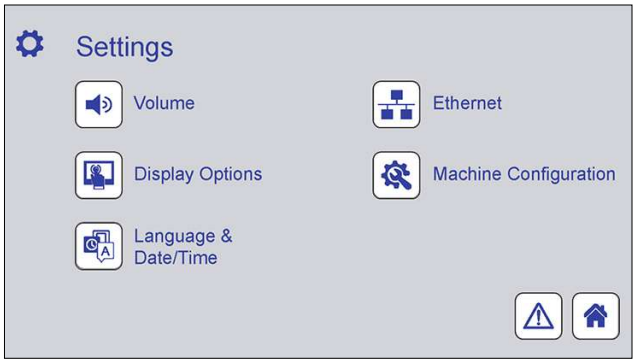



Figure 9.7b: Settings screen. Touch any icon to display controls for that function. The notification screen (Section 9.4) and the home screen can also be displayed.

## Volume

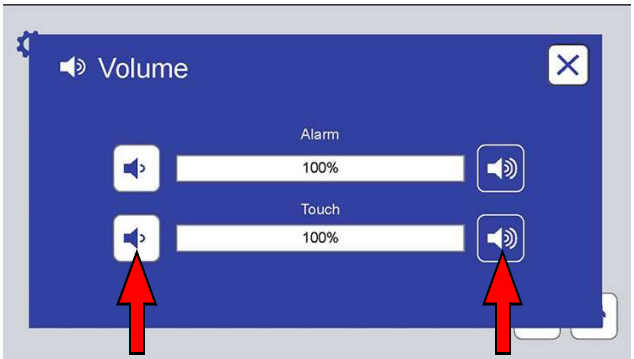



Figure 9.7c: The Volume screen provides controls to set volume (0 to 100) for machine alarms and for the screen touch indicator. Touch a volume icon to adjust.

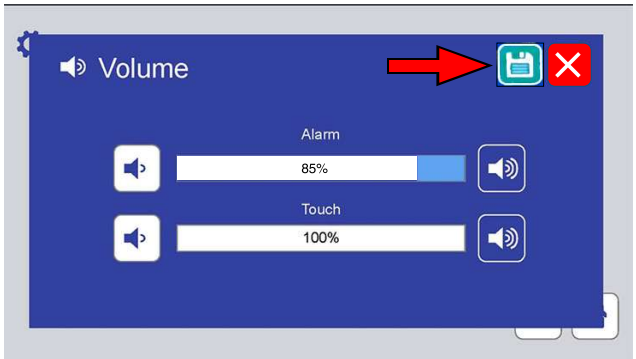



Figure 9.7d: If a volume is changed, touch the save icon to save the new volume level.

## Display Options

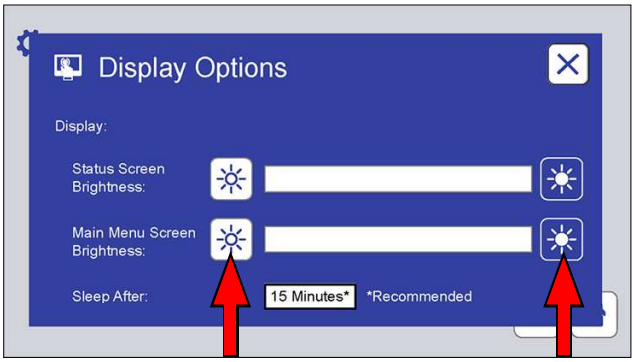



Figure 9.7e: The Display Options screen provides controls to adjust the brightness of the status and menu screens. Touch a brightness icon to adjust.

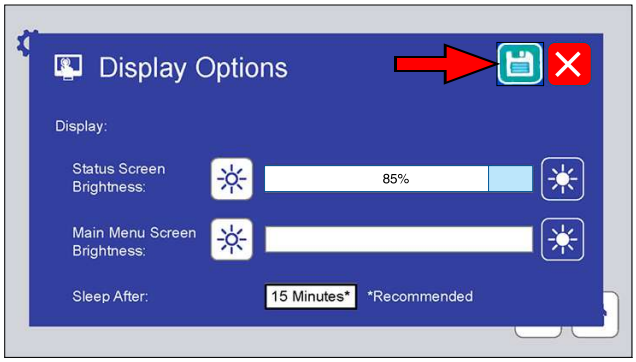



Figure 9.7f: If a brightness is changed, touch the save icon to save the new brightness level.

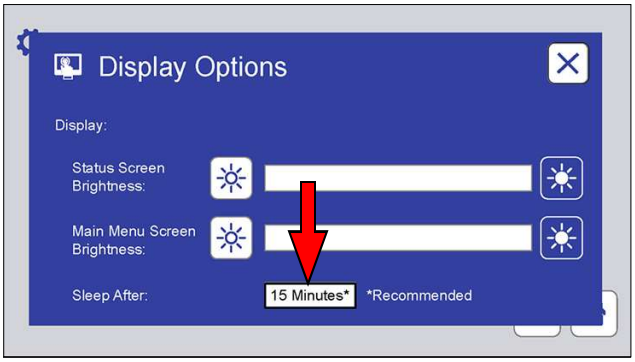



Figure 9.7g: The Display Options screen can also be used to adjust the inactive time that elapses before the screens "go to sleep" (i.e. deactivate). 15 minutes is recommended.

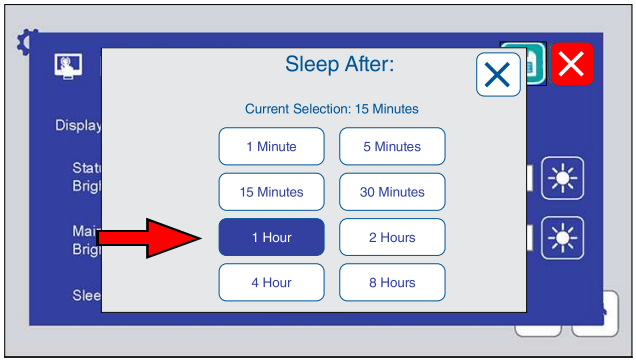



Figure 9.7h: Touch a time button to change the time before screens go to sleep. If changed, touch the save icon to save the new time.

## Language


Figure 9.7i: This screen displays controls to select the control interface language.

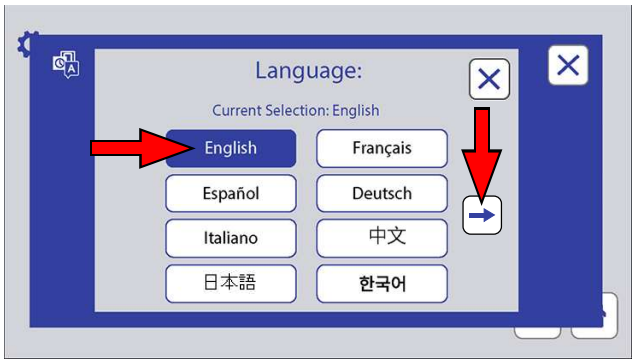



Figure 9.7j: Touch the language text box to select the control display language. Touch the Down Arrow icon to display additional available languages.

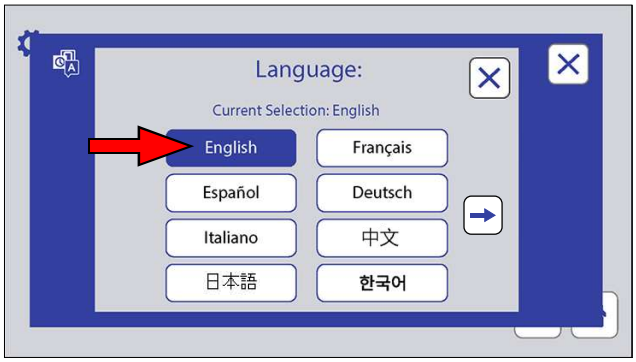



Figure 9.7k: Touch the text box for the desired language.


Figure 9.7l: All text on both screens will be in the selected language. Touch the save icon to save the selection.

## Date/Time

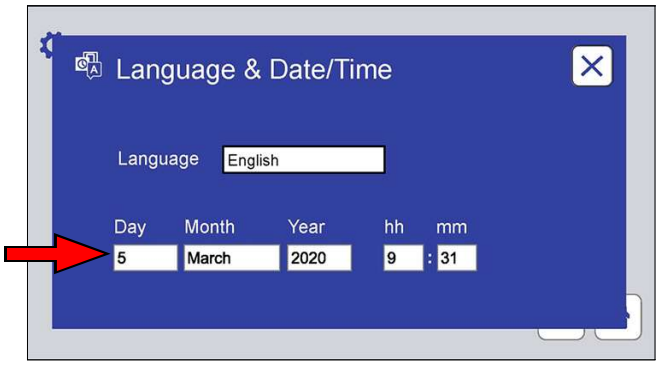



Figure 9.7m: This screen displays controls to set the date and time. Touch a text box to set Day, Month, Year, hh (hour) or mm (minute). hh display is always 24 hour time.

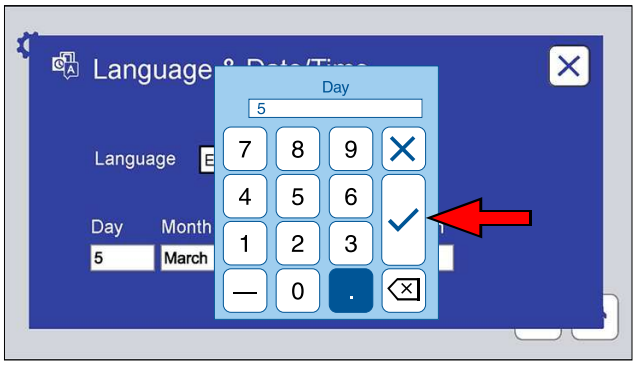



Figure 9.7n: The numeric keypad is used to set Day, Year, hh, and mm. Enter the number, then touch the check mark button.

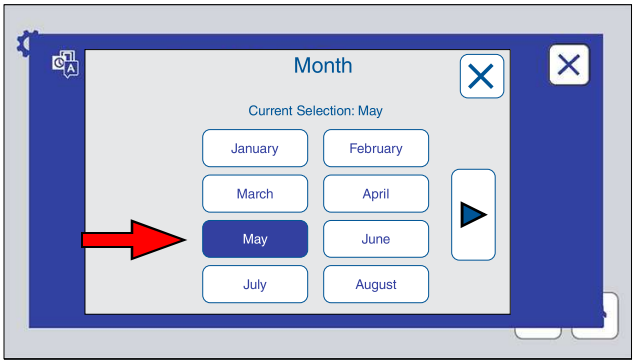



Figure 9.7o: Touch the month button to select the month on this display. Touch the right arrow button to display the remaining months.


Figure 9.7p: Touch the save icon to save any changes to the Language & Date/Time. **NOTE:** The controller does not automatically adjust for Daylight Savings Time.

## Ethernet

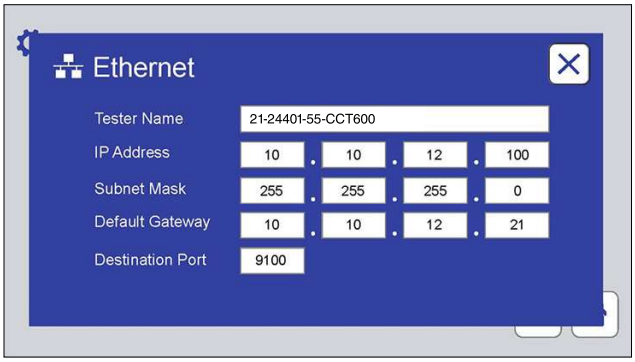



Figure 9.7q: This screen displays and provides text boxes to enter Ethernet connection parameters.

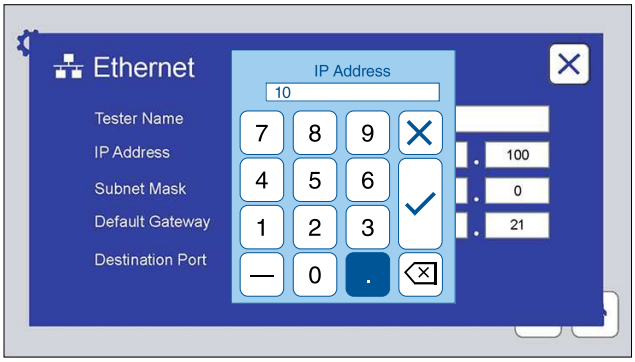



Figure 9.7r: Touch any text box to use the numeric keypad to input the parameter.

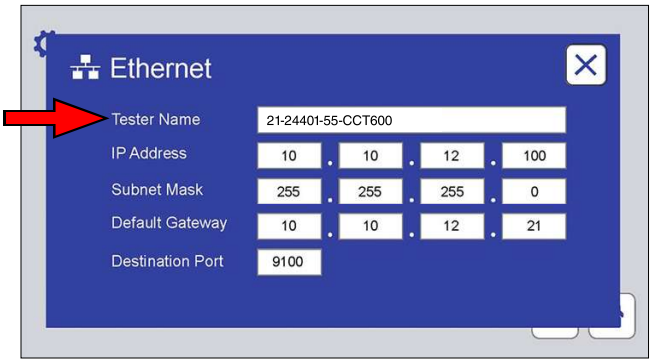



Figure 9.7s: Additionally, this screen has the name of the tester as it would appear on a network, if using the VIRTUAL STRIPCHART network version.

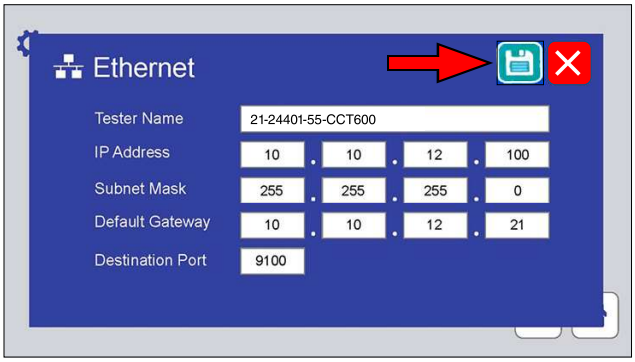



Figure 9.7t: Touch the save icon to save any changes to Ethernet parameters.

## Machine Configuration

- Machine Configuration parameters are the basic operating settings the main controller uses to determine which machine it is controlling, and how to control each of its functions.
- On the Settings screen touch the Machine Configuration icon to display the screen (Figure 9.7u and Figure 9.7v).
- Machine Configuration includes several operator-accessible parameters (Figure 9.7w).
- Contact Q-Lab Repair with questions about Machine Configuration.

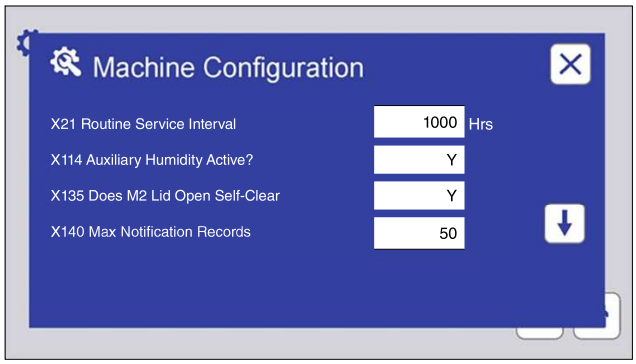



Figure 9.7u: Touch the down arrow to display additional parameters.

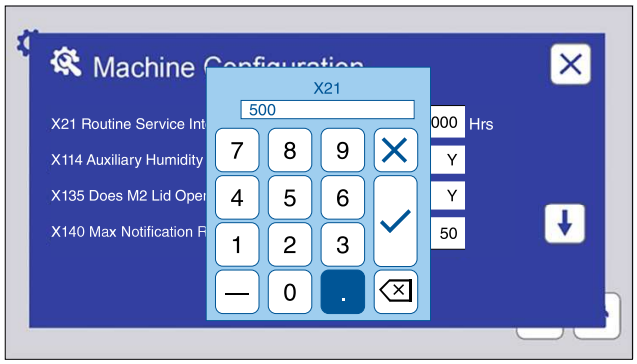



Figure 9.7v: Touch the parameter text box to use the numeric keypad to enter a value.

| No. | Name | Unit | Range | Description |
|---|---|---|---|---|
| X14 | Bubble Tower Temp Offset | °C | 1-99 | This determines the bubble tower water temperature set point which is equal to the chamber temperature set point in a fog step plus the "X14 Bubble Tower Temp Offset." Default: 12 |
| X21 | Routine Service Interval | Hrs | 0-5,000 | This is the time interval between "M14 Perform Routine Service" reminders. See Section 15.1. |
| X114 | Auxiliary Humidity Active? | — | Y or N | CCT models only. See Section 7.3 and Section 8.3. X114 is Yes by default, which is important to meet CASS test requirements. See Section 11.5. |
| X135 | Does M2 Lid Open Self-Clear? | — | Y or N | If an M2 message has occurred will it self-clear. X135 is Yes by default. |
| X140 | Max Notification Records | — | 10-400 | Maximum number of Notification Records stored by the Q-FOG main controller. X140 is 50 by default. See Section 9.4. |
| X141 | Pump Speed | % | 0-100 | The speed of the Peristaltic Fog Pump. See Section 8.7. |
| X500 | Serial Number Year | — | ## | Two-digit year of tester manufacture from serial number |
| X501 | Serial Number Unique ID | — | ##### | Five-digit unique tester ID from serial number |
| X502 | Serial Number Series | — | ### | Two- or three-digit tester series from serial number |

Figure 9.7w: Complete list of accessible Machine Configuration parameters.

## Single Screen Operation

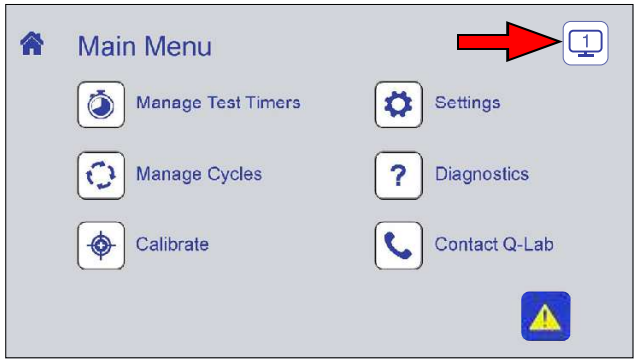



Figure 9.7x: Main Menu in single screen mode. Touch the screen icon.

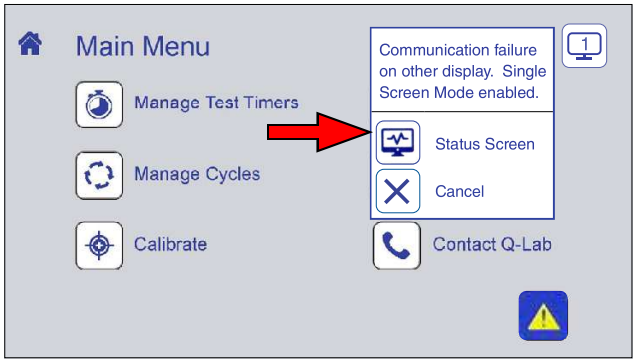



Figure 9.7y: Touch the Status Screen icon to display the Status Screen.

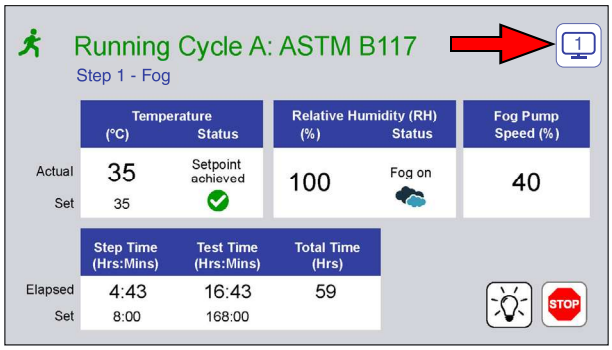



Figure 9.7z: Status Screen in single screen mode. Touch the screen icon.

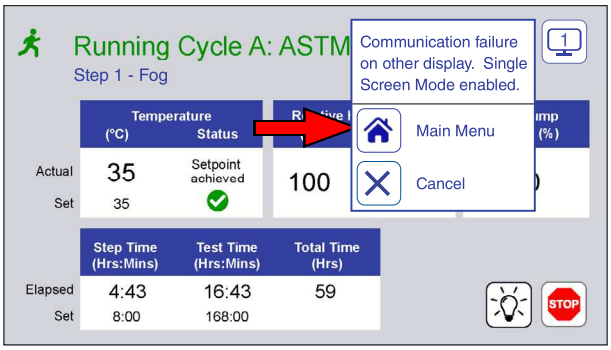



Figure 9.7aa: Touch the Menu Screen icon to display the Menu Screen.

## 9.8. Diagnostics (Sep 2021)

- Diagnostics are a list of tester current operating conditions.
- Diagnostics are an important tool to assist in troubleshooting tester conditions.
- On the Main Menu screen, touch the Diagnostics icon (Figure 9.8a) to display the Diagnostics screen (Figure 9.8b).
- 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 9.8c for a complete list of Diagnostics.

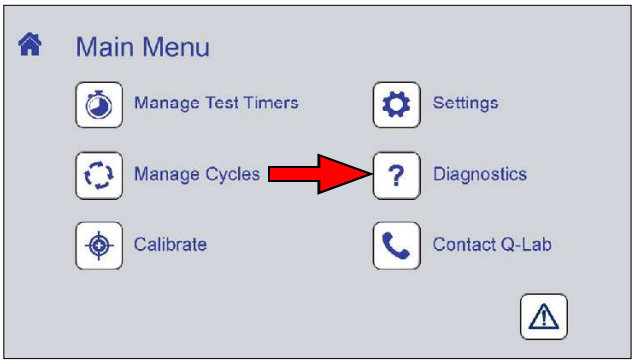



Figure 9.8a: Touch the Diagnostics icon on the Main Menu screen to display diagnostic information.

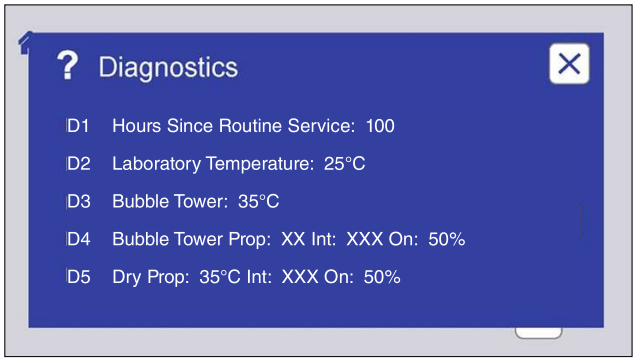



Figure 9.8b: The Diagnostics screen displays current machine operating conditions.

## Diagnostic Messages

| No. | Diagnostic Message | Description |
|---|---|---|
| D1 | Hours Since Routine Service: XXXX | This shows the number of hours since the M14 PERFORM ROUTINE SERVICE alarm was last cleared. |
| D2 | Laboratory Temperature: XX°C | This shows the current lab temperature. |
| D3 | Bubble Tower: XX°C | This shows the current temperature of the water inside the bubble tower. See Section 8.2. |
| D4 | Bubble Tower Prop: XX Int: XX On: XX% | This shows the settings for controlling the water temperature inside the bubble tower and the percentage of time the bubble tower heater is on. |
| D5 | Dry Prop: XX°C Int: XX On: XX% | This shows the settings for controlling the chamber temperature in a dry step and the percentage of time the chamber heater and purge heater are on. |
| D6 | Purge Air: XX°C Blower: XXX | This shows the current temperature inside the purge box and whether the purge blower is on or off. See Section 8.4. |
| D7 | Boiler: XX°C | This shows the current temperature of the vapor generator. CCT models only. See Section 8.3. |
| D8 | Humidity Prop: XX°C Int: XX On: XX% | This shows the settings for controlling the chamber temperature in a humid step and the percentage of time the boiler heater is on. CCT models only. |
| D9 | Fog Prop: XX°C Int: XX On: XX% | This shows the settings for controlling the chamber temperature in a fog step and the percentage of time the chamber heater is on. See Section 7.1. |
| D10 | Dwell Prop: XX°C Int: XX On: XX% | This shows the settings for controlling the chamber temperature in a dwell step and the percentage of time the chamber heater is on. See Section 7.4. |
| D11 | Controller Temperature: XX°C | This shows the current temperature of the controller. |
| D12 | Version: 6.XXX Checksum: XXXXX | This shows the software version and checksum. The checksum can be used to determine if there is a compiling error. |
| D13 | Bubble Tower Water Level: Hi/Medium/Low | This shows how much water is in the bubble tower. High if the high level switch is closed, medium if the high level switch is open and the low level switch is closed, low if the low level switch is open. |
| D14 | Run Power Relay: On/Off | This shows if the run power relay should be on or off. |
| D15 | Vapor Generator Water Level: XXXX | This shows how much water is in the vapor generator. High if the level switch is closed, low if the level switch is open. CCT models only. |
| D26 | MAC Address is: XX:XX:XX:XX:XX:XX: | Displays the media access control (MAC) address for the tester (see Figure 9.7q). |
| D30 | Serial Number: XX-XXXXX-XX-XXXXXXX | This shows the complete serial number of the tester, needed for software updates and troubleshooting (see Machine Configuration). |

Figure 9.8c: Q-FOG diagnostics list.

## 9.9. Contact Q-Lab (Sep 2021)

- Touch the Contact Q-Lab icon on the Menu Screen (Figure 9.9a).
- The Contact Q-Lab screen (Figure 9.9b) displays the link to Q-Lab Repair and Tester Support on q-lab.com.

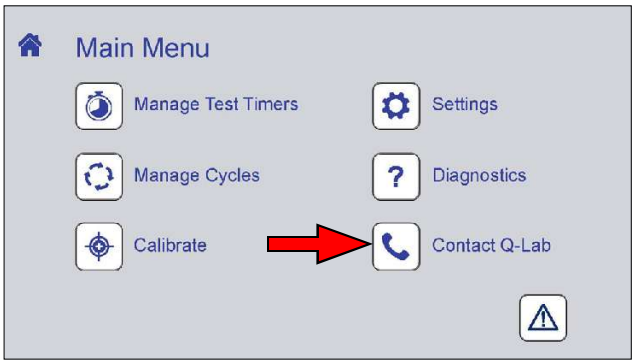



Figure 9.9a: Touch the Contact icon on the Main Menu screen to display Q-Lab contact information.

**Contact Q-Lab**


Figure 9.9b: Scan the code on this screen for Q-Lab contact information.

# 10. Test Chamber Capacity and Specimen Mounting

- This section provides detailed information on test chamber capacity and specimen mounting options.

## 10.1. Test Chamber Capacity (Feb 2021)

- Q-FOG test chamber internal dimensions listed in the table below correspond with dimensions shown in Figure 10.1a.
- Test chamber volumes are listed in Figure 10.1b .

### Chamber Internal Dimensions

| | Specimen | Model 600 | | Model 1100 | |
|---|---|---|---|---|---|
| Dimension | Mounting Level | cm | inches | cm | inches |
| A | Rack | 69.0 | 27.2 | 84.7 | 33.3 |
| B | Diffuser | 64.6 | 25.4 | 80.4 | 31.7 |
| C | Rack | 30.4 | 12.0 | 30.4 | 12.0 |
| D | Diffuser | 45.7 | 18.0 | 45.7 | 18.0 |
| E* | Diffuser | 74.0 | 29.1 | 79.0 | 31.1 |
| F | Rack | 108.1 | 42.6 | 144.9 | 57.0 |
| G | Diffuser | 107.6 | 42.4 | 144.3 | 56.8 |

* Vertical distance from the diffuser level to the inside peak of the closed lid.

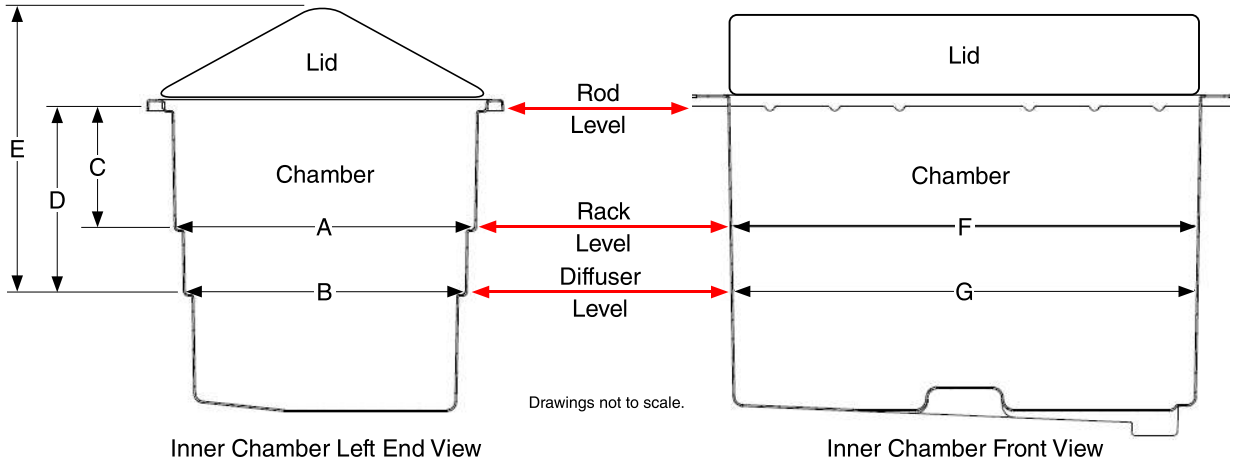



Figure 10.1a: Chamber internal dimensions.

### Chamber Volumes

| | 600 Models | | 1100 Models | |
|---|---|---|---|---|
| Volume Excluding Lid | 511 liters | 18.0 $ft^3$ | 857 liters | 30.2 $ft^3$ |
| Volume Including Lid | 640 liters | 22.6 $ft^3$ | 1103 liters | 38.9 $ft^3$ |

Figure 10.1b: Chamber volumes.

## 10.2. Specimen Mounting Options (Sep 2021)

- There are three primary methods of mounting specimens in the Q-FOG test chamber.
  1. Panel Racks
  2. Hanging Rods
  3. Grates

⚠ **IMPORTANT:** Maximum total weight of test specimens in the chamber must not exceed 544 kg (1200 lb).

### Panel Racks

- Typically, flat standard test panels are mounted in panel racks (Figure 10.2a and Figure 10.2b).
- Panel racks are available with mounting slots that are angled either 6° or 15° from vertical. See Section 16 for available racks.
- Visit the Q-Lab web site for detailed information on available Q-PANEL® standard test panels.

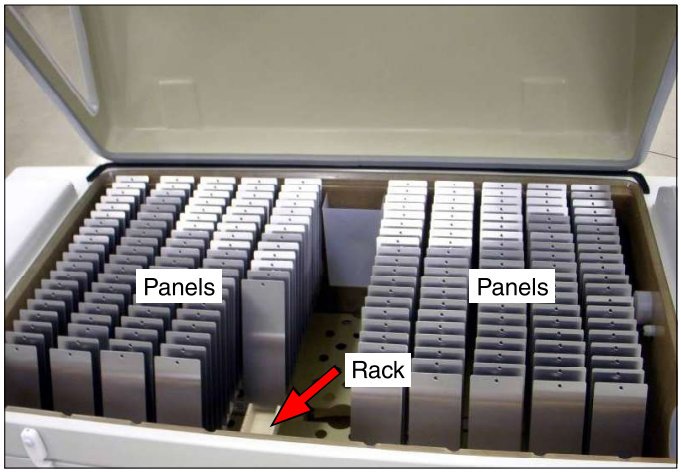



Figure 10.2a: Panels mounted on racks in chamber.

| | 600 Models | 1100 Models |
|---|---|---|
| **Rack Length** | 70 cm (27.5") | 85 cm (33.5") |
| **Maximum Weight per Rack** | 113 kg (250 lb) | |

| **75 × 150 mm (3 × 6") Panel Capacity** | | |
|---|---|---|
| **Racks per Chamber** | 10* | 12* |
| **Panels per Rack** | 16 | 20 |
| **Panels per Chamber** | 160 | 240 |

| **100 × 300 mm (4 × 12") Panel Capacity** | | |
|---|---|---|
| **Racks per Chamber** | 8* | 10* |
| **Panels per Rack** | 16 | 20 |
| **Panels per Chamber** | 128 | 200 |

* These are the maximum number of racks that will fit in the chambers. For more typical spacing, the racks per chamber would be 2 fewer than listed here.

Figure 10.2b: Rack specifications and capacities.

## Hanging Rods

- Three dimensional (3D) parts can be suspended from hanging rods (Figure 10.2c and Figure 10.2d).
- See Section 16 for available hanging rods.

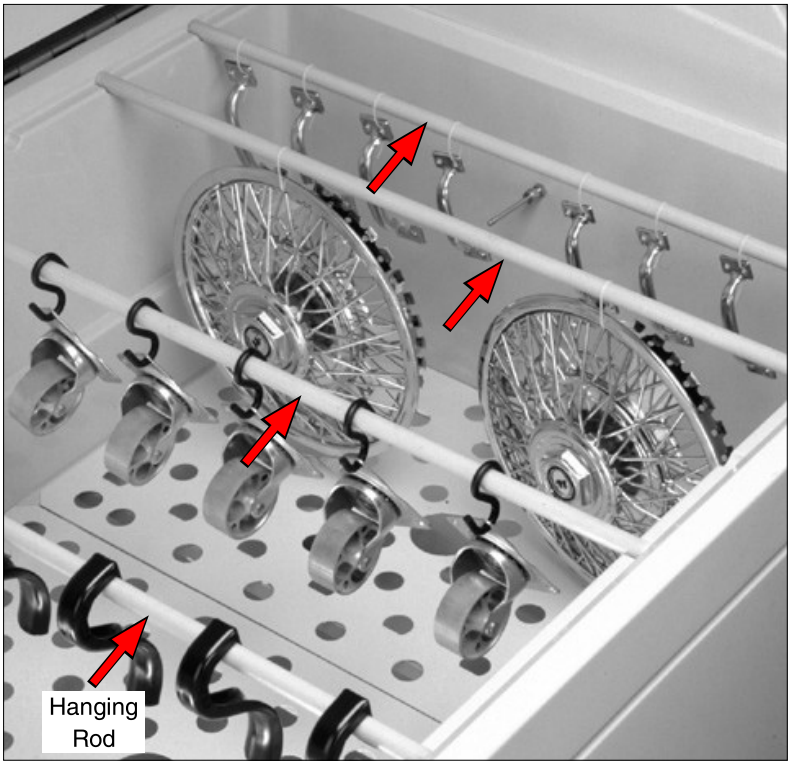



Figure 10.2c: 3D parts suspended from hanging rods in chamber.

| | 600 Models | 1100 Models |
|---|---|---|
| **Hanging Rod Length** | 75 cm (29.5") | 91 cm (36") |
| **Number of Rods per Chamber** | 6 | 8 |
| **Maximum Weight per Rod** | 45 kg (100 lb) | |

Figure 10.2d: Hanging rod specifications and capacities.

## Grates

- Very large parts can be mounted on grates installed in the chamber.
- Two different grates are available.
  1. Rack level grates (Figure 10.2e through Figure 10.2g) mount at the same height as the panel racks (see Figure 10.1a). Use the rack level grates if possible.
  2. Diffuser level grates (Figure 10.2h through Figure 10.2j) mount at the same height as the diffuser panels (see Figure 10.1a). Use the diffuser level grates if parts are too tall for the rack level grates.
- See Section 16 for grate part numbers.

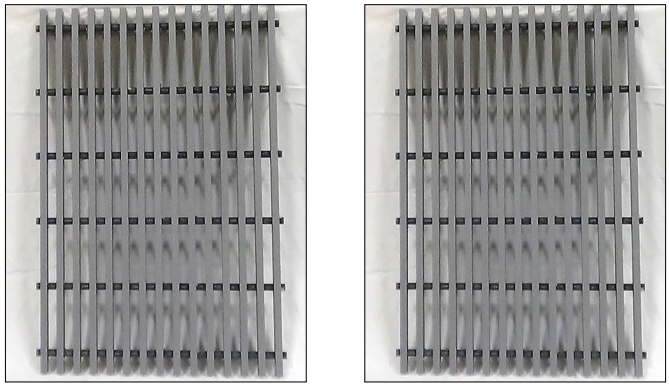


Figure 10.2e: Rack level mounting grates.

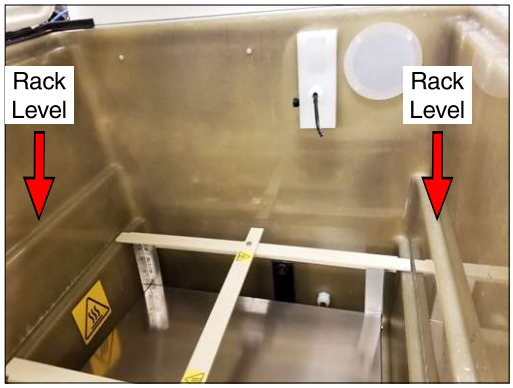



Figure 10.2f: Chamber interior showing rack grate mounting level

| Rack Level Mounting Grate | Grate Length × Width | Maximum Weight per Grate | Grates per Chamber |
|---|---|---|---|
| 600 Models | 69 cm (27.3") × 38 cm (15.0") | 272 kg (600 lb) | 2 |
| 1100 Models | 85 cm (33.6") × 57 cm (22.5") | 272 kg (600 lb) | 2 |

Figure 10.2g: Rack level grate specifications and capacities.

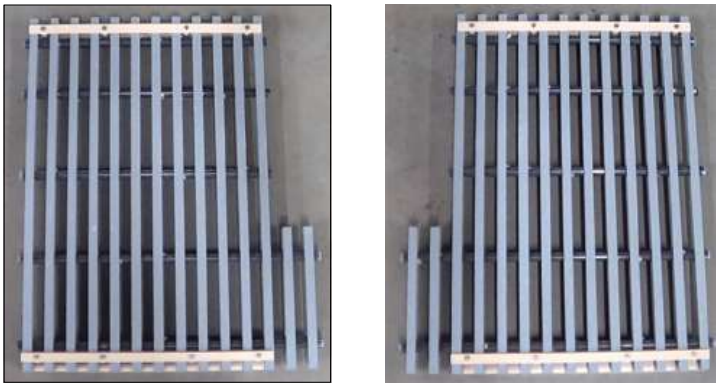


Figure 10.2h: Diffuser level mounting grates.

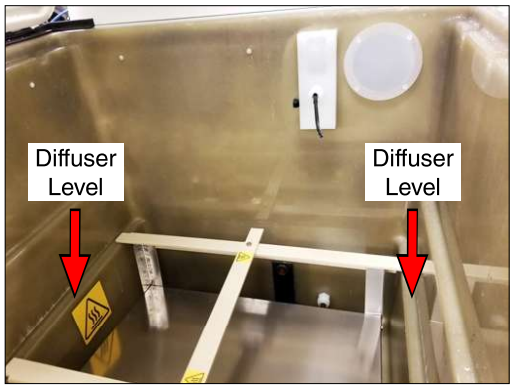



Figure 10.2i: Chamber interior showing diffuser grate mounting level (diffusers removed).

| Diffuser Level Mounting Grate | Grate Length × Width | Maximum Weight per Grate | Grates per Chamber |
|---|---|---|---|
| 600 Models | 65 cm (25.6") × 54 cm (21.2") | 272 kg (600 lb) | 2 |
| 1100 Models | 81 cm (31.8") × 72 cm (28.3") | 272 kg (600 lb) | 2 |

Figure 10.2j: Diffuser level grate specifications and capacities.

# 11. Running a Test

- The Q-FOG comes with several pre-programmed test cycles.
- Pre-programmed test cycles cannot be modified; they can be deleted (see Section 9.6).
- If you choose to create a custom test cycle (see Section 9.6.7) set the chamber temperature within the following limits.

## Chamber Temperature Limits

| Function* | Minimum | Maximum |
|---|---|---|
| Fog | Ambient | 60 °C |
| Dry | Ambient | 70 °C |
| Humid | Ambient + 5 °C | 60 °C |
| Dwell | Ambient | 60 °C |
| * See Section 7 for Function information. | | |

## Changing Solution Type

- When changing solution type, run a fog step (see Section 9.6) for 45 minutes before adding test specimens to purge the old solution.

## Common Test Procedures

- Several common test procedures are detailed in Section 11.1 through Section 11.5.
- Contact Q-Lab for more information on common test procedures that can be run in Q-FOG SSP and CCT test chambers.
- Many common test procedures specify the fog deposition rate. See Section 12.2 for detailed information on setting spray pressure, flow rate, and fog deposition rate

## 11.1. ASTM B117 (Oct 2021)

- ASTM B117 is pre-programmed as Cycle A in all Q-FOG models.
- This is the most widely-used corrosion test procedure but it is not a cyclic corrosion test. Samples remain wet at all times.
- Despite over 100 years of use, there has long been general agreement that ASTM B117 test results do not correlate as well with the corrosion seen in actual atmospheric exposures as cyclic tests do.

| ASTM B117 | | | |
|---|---|---|---|
| STEP | FUNCTION | Chamber Air Temp (˚C) | Step Time (hh:mm) |
| 1 | Fog | 35 | 24:00 |
| 2 | Final Step - Go To Step 1 | | |

Notes

**Solution:** 5% sodium chloride*

**pH:** 6.5 - 7.2*

*As measured in the collection vessels. The concentration and acidity of the solution are affected by test conditions. Adjust the mixture in the reservoir to achieve these values in the collection vessels.

**Fog Deposition Rate:** 1 to 2 milliliters/hour

**Spray Pressure:** Approximately 15 psi

**Flow Rate:** Approximately 0.45 liters/hour (model 600)

Approximately 0.7 liters/hour (model 1100)

## 11.2. Prohesion ASTM G85, Annex 5 (Dec 2021)

- Prohesion is pre-programmed as Cycle B in all Q-FOG models.
- The test was developed in England for industrial maintenance coatings.
- The solution is much more dilute than traditional salt fog.

| ASTM G85.A5 | | | |
|---|---|---|---|
| STEP | FUNCTION | Chamber Air Temp (°C) | Step Time (hh:mm) |
| 1 | Fog | 25 | 1:00 |
| 2 | Dry | 35 | 1:00 |
| 3 | Final Step - Go To Step 1 | | |

Notes

**Solution:** 0.05% sodium chloride & 0.35% ammonium sulfate*

**pH:** 5.0 - 5.4*

*As measured in the collection vessels. The concentration and acidity of the solution are affected by test conditions. Adjust the mixture in the reservoir to achieve these values in the collection vessels.

**Fog Deposition Rate:** 1 to 2 milliliters/hour of fog time

**Spray Pressure:** Approximately 15 psi

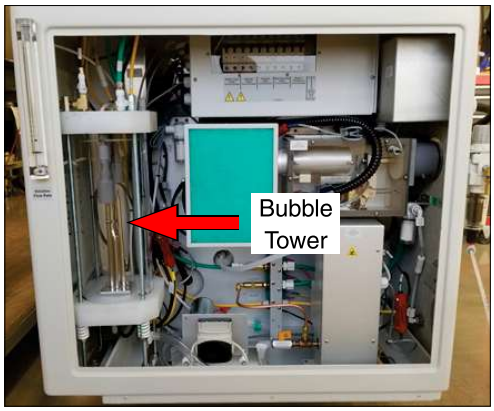
**Flow Rate:** Approximately 0.45 liters/hour (model 600)

Approximately 0.7 liters/hour (model 1100)

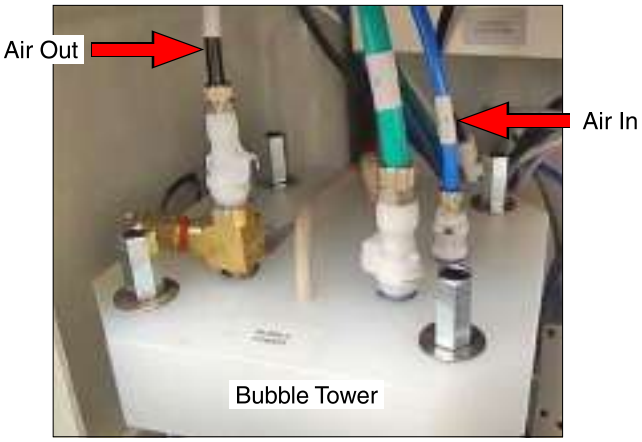
**IMPORTANT:** Although the ASTM G85 standard requires use of non-humidified air for the Prohesion test (Annex 5) by bypassing or draining the bubble tower, Q-Lab's own tests show minimal effect, if any, on chamber conditions or test results.

- The primary benefit of the bubble tower is final filtration of compressed air, which can contain oil or other impurities if not thoroughly filtered.
- Bypassing the bubble tower introduces the possibility of these contaminates clogging the atomizing spray nozzle or reaching test specimens.
- Therefore, caution is advised when following the instructions below to bypass the bubble tower.

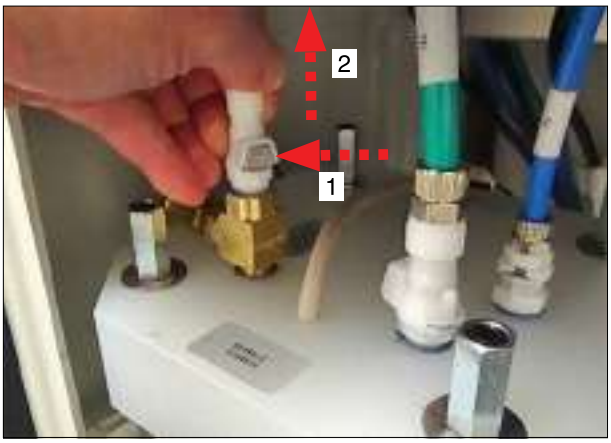
## To Bypass the Bubble Tower




1. **IMPORTANT:** Turn off and lock out the air supply before proceding with these instructions. Remove the Q-FOG right side access door.




2. Locate the air in and the air out lines on the top of the bubble tower.




3. Disconnect the air out line from the bubble tower. Press in the fitting release tab to disconnect the line.

4. Disconnect the air in line from the bubble tower. Press in the fitting release tab to disconnect the line.

5. Connect the air lines together.

6. Replace the access door.

## 11.3. CCT-I (Oct 2021)

- CCT-I is pre-programmed as Cycle C in Q-FOG CCT models. CCT-I is specified by some Japanese automotive manufacturers. It is also sometimes called CCT-A.
- Some versions of CCT-I specify maximum allowable transitions times between steps. A Q-FOG CRH model equipped with Rapid Ramp Heater is required to meet those requirements. See *LF-8165-TM Q-FOG CRH Technical Manual.*

| **CCT-I** | | | |
|---|---|---|---|
| STEP | FUNCTION | Chamber Air Temp (˚C) | Step Time (hh:mm) |
| 1 | Fog | 35 | 4:00 |
| 2 | Dry | 60 | 2:00 |
| 3 | Dry | 40 | 0:30 |
| 4 | Humid | 50 | 2:00 |
| 5 | Final Step - Go To Step 1 | | |

**Step 3 is not part of the test method as written. It has been added to improve transition times.**

| Notes |
|---|

**Solution:** 5% sodium chloride*

**pH:** Not specified*

*As measured in the collection vessels. The concentration and acidity of the solution are affected by test conditions. Adjust the mixture in the reservoir to achieve these values in the collection vessels.

**Fog Deposition Rate:** 1 to 2 milliliters/hour of fog time

**Spray Pressure:** Approximately 15 psi

**Flow Rate:** Approximately 0.45 liters/hour (model 600)

Approximately 0.7 liters/hour (model 1100)

## 11.4. CCT-IV (Oct 2021)

- CCT-IV is pre-programmed as Cycle D in Q-FOG CCT models. CCT-IV is specified by some Japanese automotive manufacturers. In the SAE and AISI research projects, CCT-IV was shown to correlate with actual vehicle corrosion results.
- Some versions of CCT-IV specify maximum allowable transitions times between steps. A Q-FOG CRH model equipped with Rapid Ramp Heater is required to meet those requirements.

| CCT-IV | | | |
|---|---|---|---|
| STEP | FUNCTION | Chamber Air Temp (˚C) | Step Time (hh:mm) |
| 1 | Fog | 35 | 0:10 |
| 2 | Dry | 60 | 2:10 |
| 3 | Dry | 50 | 0:15 |
| 4 | Humid | 60 | 1:15 |
| 5 | Sub-cycle Repeat Steps 6-8 5× | | |
| 6 | Dry | 60 | 2:25 |
| 7 | Dry | 50 | 0:15 |
| 8 | Humid | 60 | 1:20 |
| 9 | Dry | 35 | 0:10 |
| 10 | Final Step - Go To Step 1 | | |

**Steps 3, 7 & 9 are not part of the test method as written. They have been added to improve transition times.**

| Notes |
|---|

**Solution:** 5% sodium chloride*

**pH:** Not specified*

*As measured in the collection vessels. The concentration and acidity of the solution are affected by test conditions. Adjust the mixture in the reservoir to achieve these values in the collection vessels.

**Fog Deposition Rate:** 4 to 8 milliliters/hour of fog time

**Spray Pressure:** Approximately 15 psi

**Flow Rate:** Approximately 1.3 liters/hour (model 600)

Approximately 2.0 liters/hour (model 1100)

## 11.5. ISO 9227 CASS (Oct 2021)

- ISO 9227 CASS (copper accelerated acetic acid salt spray) is pre-programmed as Cycle E in Q-FOG CCT models.
- ISO 9227 CASS specifies the procedure used in conducting the copper-accelerated acetic acid salt spray (CASS) test for corrosion resistance of metallic materials.
- The CCT model is the only Q-FOG tester that simultaneously meets all of the solution collections requirements of the ISO 9227 CASS test. To meet this test, the X114 Auxiliary Humidity parameter (see Machine Configuration) must be set to Yes to activate the CCT Vapor Generator (see Section 8.3).
- ASTM B368 includes a very similar test that can be met using the CCT with X114 activated.
- See Section 8.6 for important information concerning the Q-FOG chamber heaters when running the CASS test.

| ISO 9227 CASS | | | |
|---|---|---|---|
| STEP | FUNCTION | Chamber Air Temp (˚C) | Step Time (hh:mm) |
| 1 | Fog | 50 | 24:00 |
| 2 | Final Step - Go To Step 1 | | |

Notes

**Solution:** 5% sodium chloride*

0.26 g/L of copper (II) chloride dihydrate

Add Glacial Acetic Acid to meet a pH of 3.0 to 3.1.
Do **NOT** use hydrochloric acid (HCl)

**pH:** 3.1 - 3.3*

*As measured in the collection vessels. The concentration and acidity of the solution are affected by test conditions. Adjust the mixture in the reservoir to achieve these values in the collection vessels.

**Fog Deposition Rate:** 1 to 2 milliliters/hour

**Spray Pressure:** Approximately 15 psi

**Flow Rate:** Approximately 0.45 liters/hour (model 600)

Approximately 0.7 liters/hour (model 1100)

# 12. Calibration

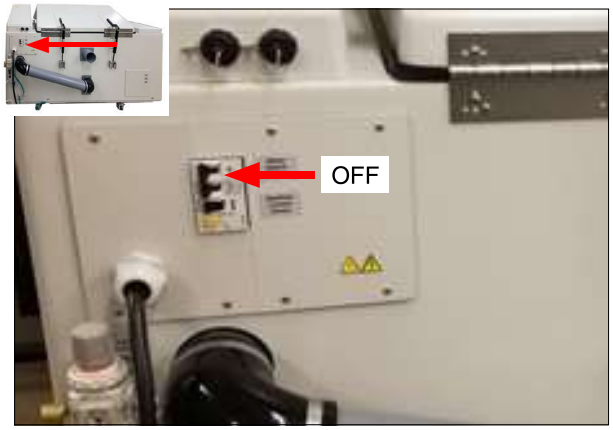
## 12.1. Chamber Temperature Sensor (Dec 2021)

- For accurate temperature readings, calibrate the chamber temperature sensor every six months in accordance with ASTM E220.
- The sensor is calibrated using an insulated container of hot water and a reference thermometer (not supplied).
- A Temperature Sensor Calibration Kit, U-41085-K (see Section 16) that includes an insulated container is optionally available from Q-Lab.
- Use the procedure detailed below to calibrate the thermometer. The images show the insulated container included in U-41085-K.

| **Tools Required** | | |
|---|---|---|
| Hot Water | Phillips Screwdriver | Insulated Container for hot water |
| Reference Thermometer | | |


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

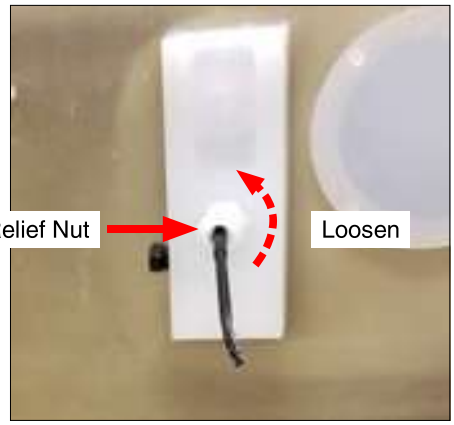

2. Wait **15 minutes** for the purge blower to clear the chamber of mist or fog.



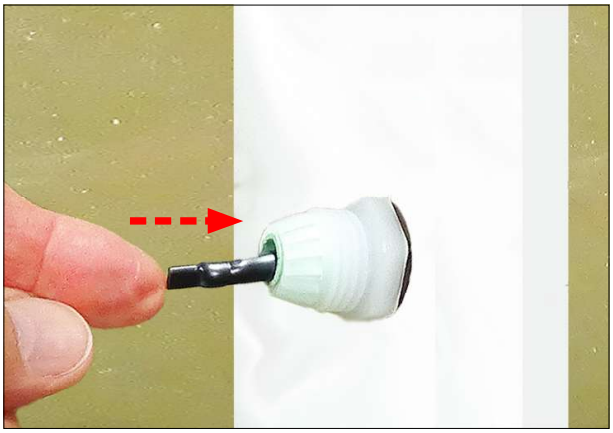

3. Power the tester **OFF**.


4. Undo latches and open the Q-FOG chamber lid.

5. Locate the air temperature sensor at the right end of the chamber.



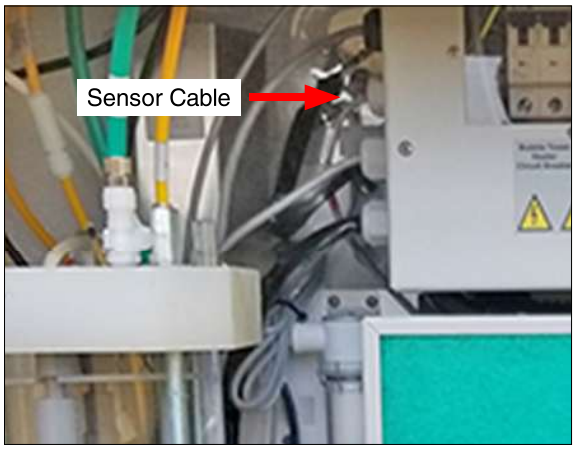

6. Loosen the strain relief nut. Do not remove the strain relief nut.



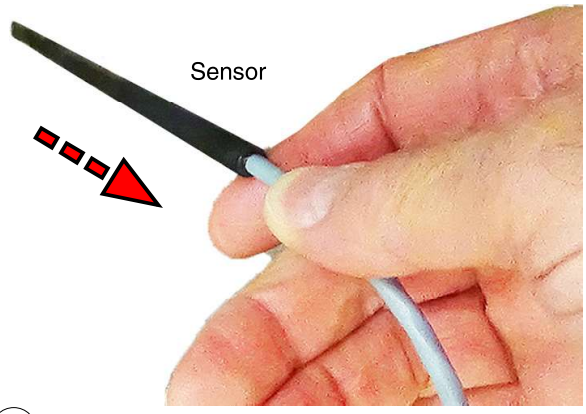
7. Push the sensor into the strain relief.

8. Open two latches on the right side access panel. Remove the panel. Set aside.

**9.** Chamber temperature sensor location in the enclosure.




**10.** The chamber temperature sensor cable extends from a fitting in the chamber interface bulkhead.




**11.** Remove the temperature sensor from the opening in the chamber interface bulkhead. Pull the sensor cable out away from the other cables.

If using an insulated container other than the container from the U-41085 kit, go to Step 13.

If using the U-41085-K kit insulated container (shown here) go to Step 14.

**12.** Go to the step indicated above.

1. Locate the insulated container.
2. Fill the container with water at approximately the same temperature as the highest temperature programmed in the test cycle.
3. Locate the reference thermometer.
4. Fasten the chamber air temperature sensor and the reference thermometer probe together using string or a rubber band.
5. Place the reference thermometer probe and the Q-FOG temperature sensor into the water.
6. Go to Step 24.

**13.** Follow the steps listed above if using a standard insulated container.

**14.** Locate the insulated container included in kit U-41085-K.

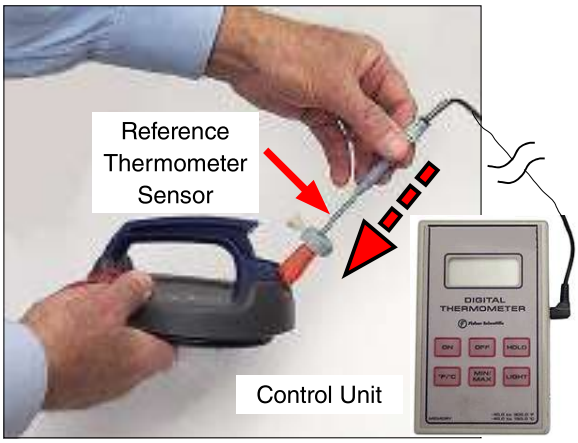
**15.** Remove the insulated calibration container lid.


**16.** Fill the container to 20 mm below the top with hot water. The water should be approximately the same temperature as the highest temperature programmed in the test cycle.

Reference
Thermometer
Fitting

**17.** Rotate the reference thermometer fitting away from the handle on the insulated calibration container lid.

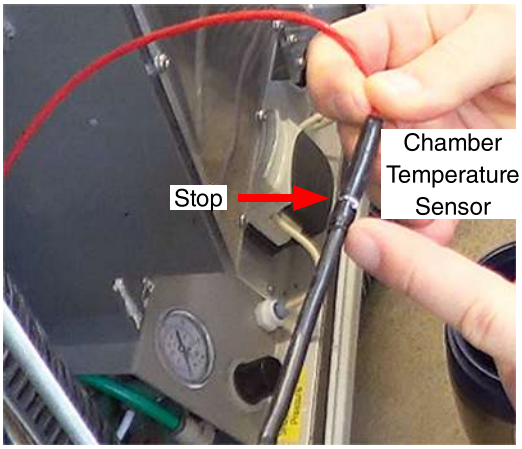

**18.** Locate the reference thermometer.



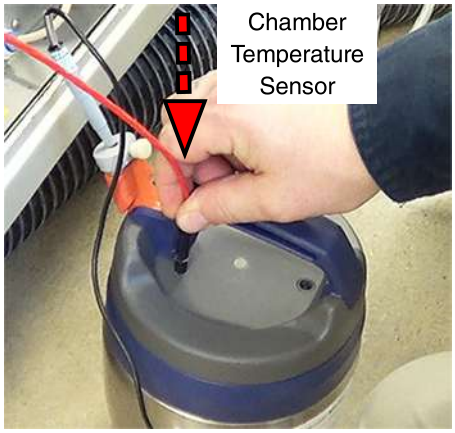

**19.** Insert the reference thermometer sensor into the reference thermometer fitting in the lid.


**20.** Hand tighten the reference thermometer fitting thumbscrew to hold the reference thermometer sensor in place.

21. Replace the lid on the insulated calibration container. Tighten the lid.




22. Locate the sensor removed in Step 11. Locate the stop on the sensor.

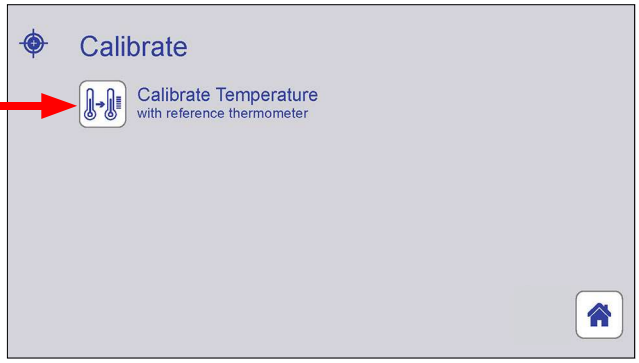



23. Insert the sensor into the small hole in the insulated calibration container lid. Push the sensor down until the sensor stop contacts the lid.

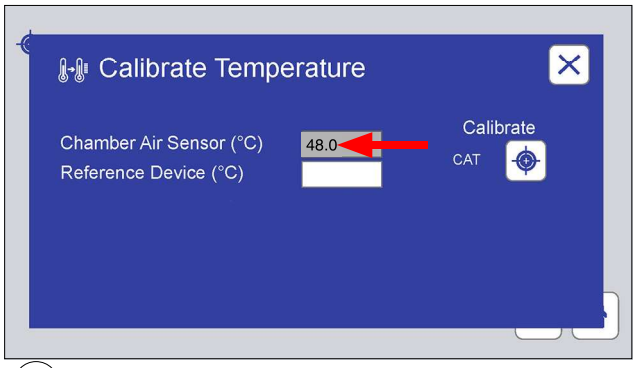

24. Power Q-FOG **ON**.


25. Before continuing you **MUST** wait a minimum of 15 minutes for the sensors to stabilize.

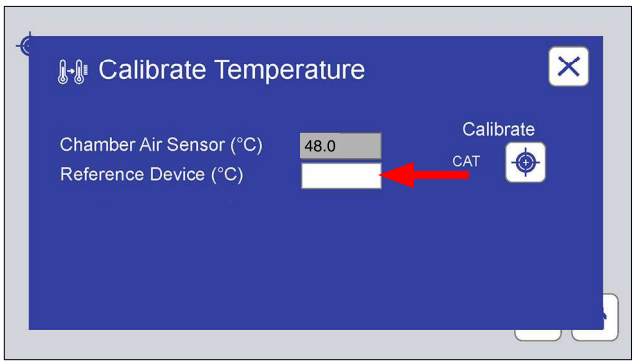

26. Touch the Calibrate icon on the Main Menu screen.




**27.** The Calibrate screen is displayed. Touch the Calibrate Temperature icon.




**28.** The Calibrate Temperature screen is displayed. The current reading of the chamber air sensor is displayed.

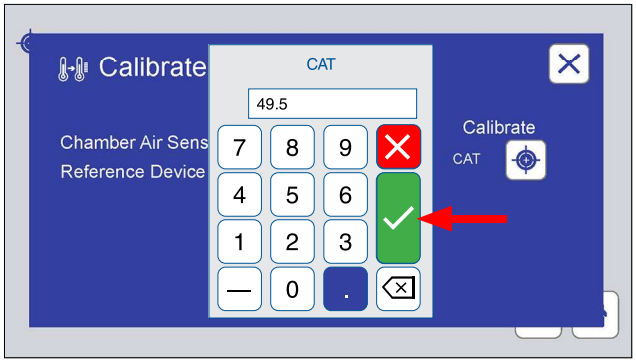



**29.** Touch the Reference Device text box.

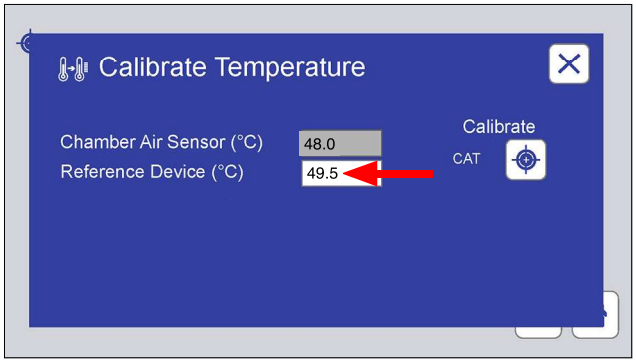

**30.** The Reference Device temperature enter keypad is displayed.


**31.** Read the temperature displayed on the reference thermometer.

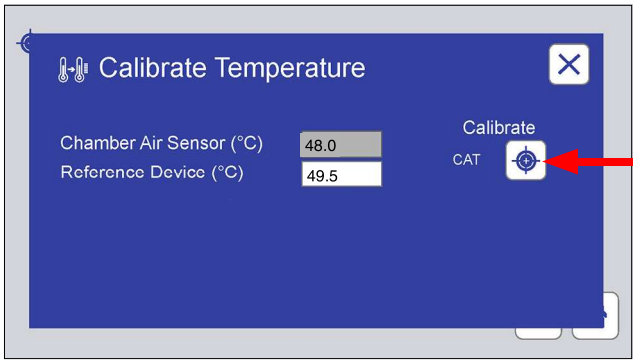

**32.** Use the keypad to enter the reference temperature into the Reference Device text box.



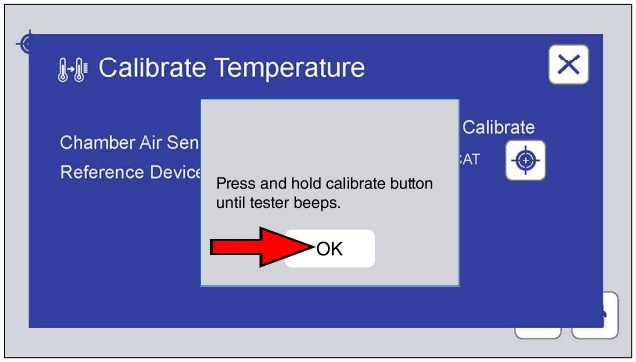

**33.** Touch the Check Mark icon.



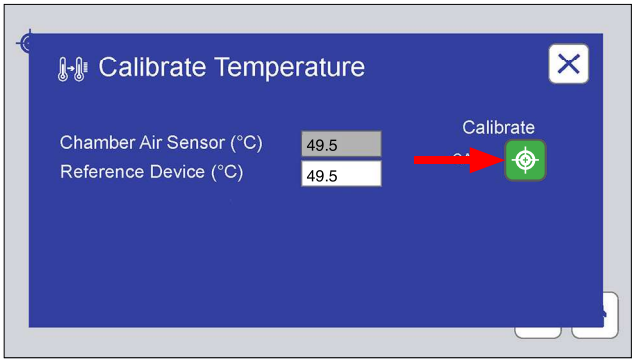

**34.** The keypad is closed. The reference temperature is in the Reference Device text box.



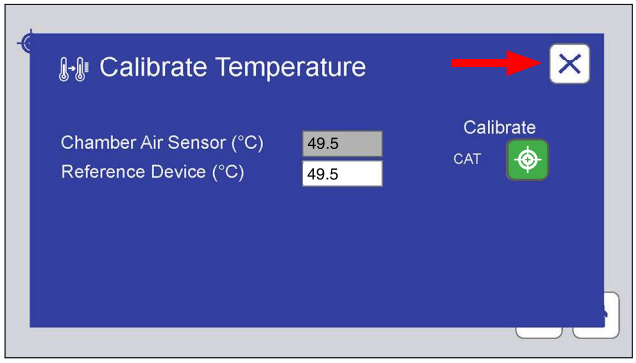

**35.** Press and hold the Calibrate icon until the tester beeps.



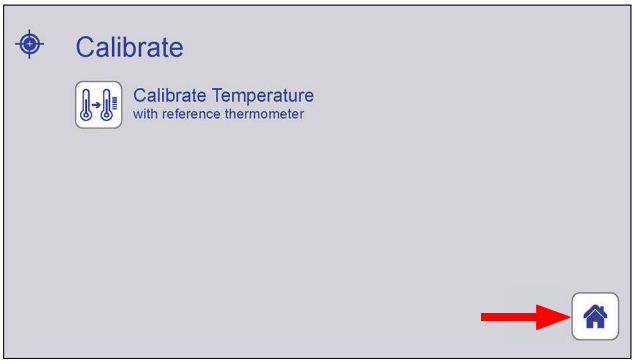

**36.** If the button is not pressed long enough, this message is displayed. Touch the OK button to close the message. Press and hold the calibrate button again until the tester beeps.



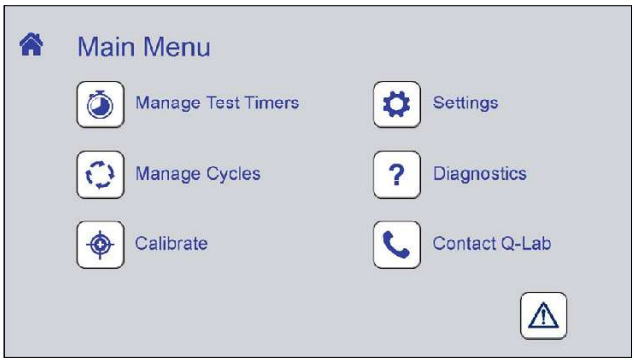

**37.** The Calibrate icon turns green indicating successful temperature sensor calibration.




**38.** Touch the X icon to close the Calibrate Temperature screen.




**39.** The Calibrate screen is displayed. Touch the Home icon to display the Main Menu screen.




**40.** Temperature calibration is complete.

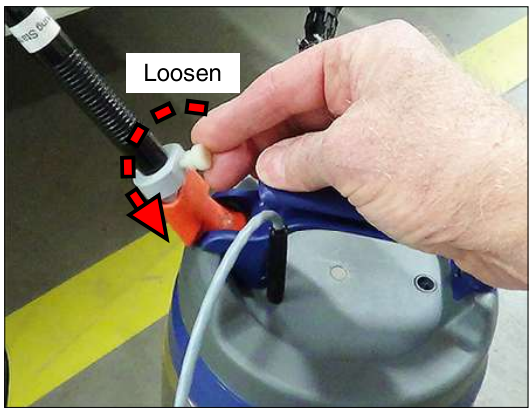
If an insulated container other than the container from the U-41085 kit was used to calibrate the thermometer, go to Step 42.

If the insulated container from the U-41085-K kit was used to calibrate the thermometer go to Step 43.

**41.** Go to the step indicated above.

1. Remove the chamber air temperature sensor and the reference thermometer probe from the container.
2. Separate the temperature sensor from the reference thermometer.
3. Dry the sensors.
4. Empty the water from the container.
5. Go to Step 48.

**42.** Follow the steps listed above if calibration was done using a standard insulated container.



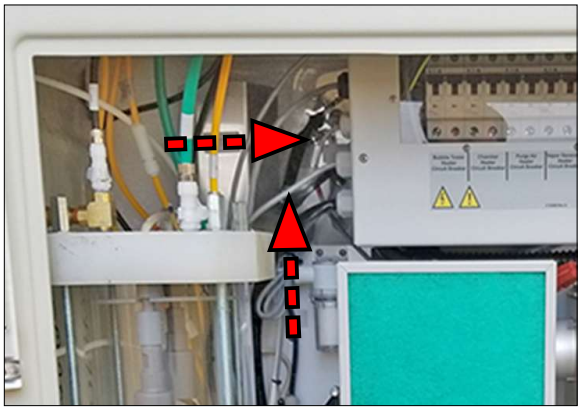

**43.** Loosen the thumbscrew on the reference thermometer sensor fitting on the insulated calibration container lid.


**44.** Remove reference thermometer sensor from the insulated calibration container. Dry the sensor.

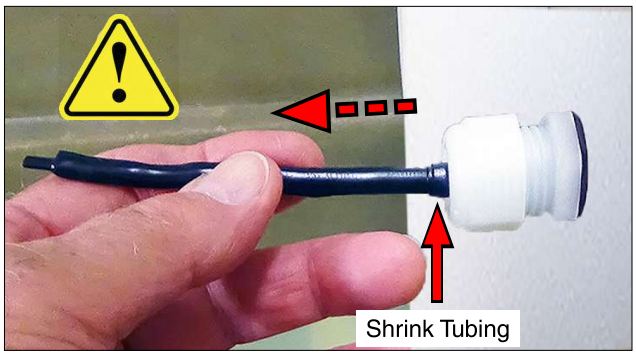

**45.** Remove the chamber temperature sensor from the insulated calibration container. Dry the sensor

**46.** Remove the lid from the insulated calibration container.

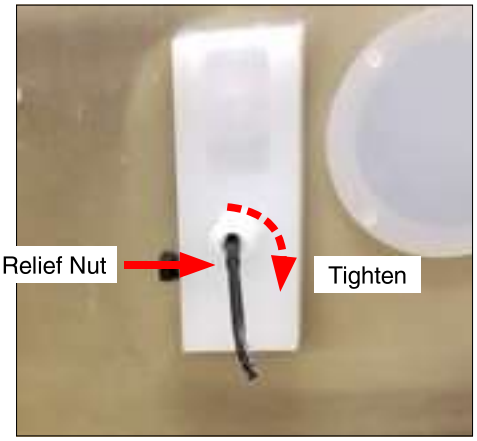
**47.** Empty the water from the insulated calibration container and replace the lid. Save the insulated calibration container for future calibrations.



**48.** Route the sensor cable up the enclosure back wall, behind the other cables. Feed the sensor back through the hole in the chamber interface bulkhead.




**49.** From inside the chamber, pull the sensor through the strain relief just until the shrink tubing is visible.




**50.** Tighten the strain relief nut. Hand tighten only.

**51.** Replace the access panel. Close the latches.

## 12.2. Fog Deposition Verification (Sep 2021)

- If running a fog step in a test cycle that requires evaluation of deposition, the uniformity and quantity of the fog deposition should be verified before each test.
- Deposition verification steps include the collection of fog deposited during a fog step and then adjusting Q-FOG controls to achieve the required fog quantities and uniformity throughout the test chamber.
- These steps are detailed in the sections below.

### Fog Collection Methods

- Fog can be collected using either standard in-chamber collection vessels (graduated cylinder plus funnel) or the optional external collection system.

#### Standard in-Chamber Deposition Collection Vessels (Graduated Cylinders)

- Deposition verification is done by placing collection vessels in the test chamber.
- Q-Lab recommends the use of 6 collection vessels, which are available as an accessory (see Figure 16ab).
- The collection vessel consists of a 10 cm diameter funnel and a graduated cylinder.
- The recommended placement is one of these vessels in each corner of the test chamber with at least a 5 cm gap between the edge of a funnel and the wall, and a vessel on each side of the fog spray nozzle approximately 15 cm from the nozzle (see Figure 12.2a).

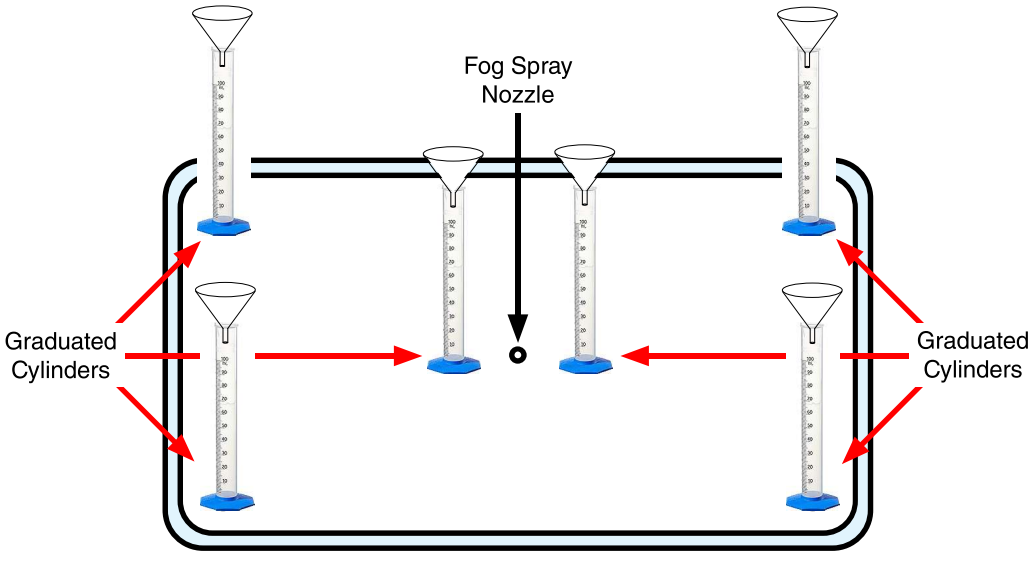



Figure 12.2a: Collection vessel placement - test chamber top view.

- Place the vessels on top of the diffuser plate (with racks removed) or through the holes in panel racks. (See Figure 12.2b or Figure 12.2c).
- If the vessels are placed in panel racks, remove the bases on the vessels and put an O-ring around the neck of the cylinder to hold it in the rack.
- Make sure that the test samples do not shield the funnels.

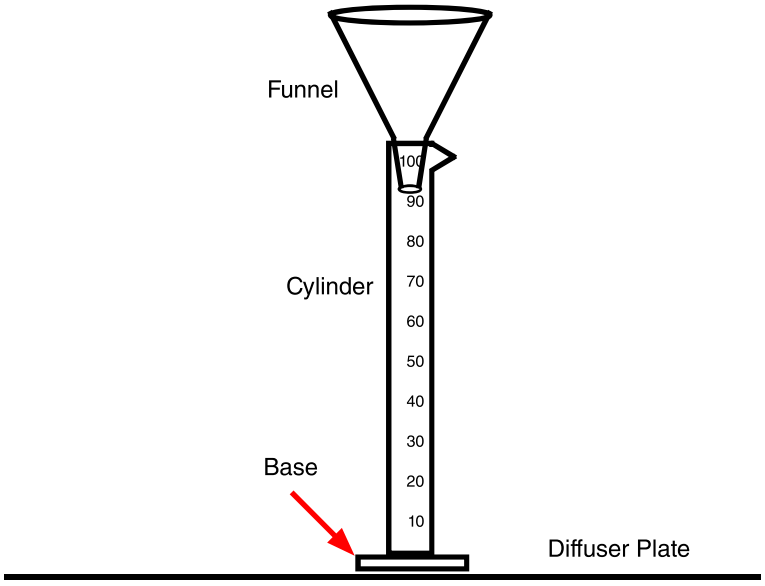



Figure 12.2b: Graduated cylinder with base attached placed on diffuser plate.

- To verify fog deposition, see Fog Deposition (Quantity and Uniformity) Adjustment.

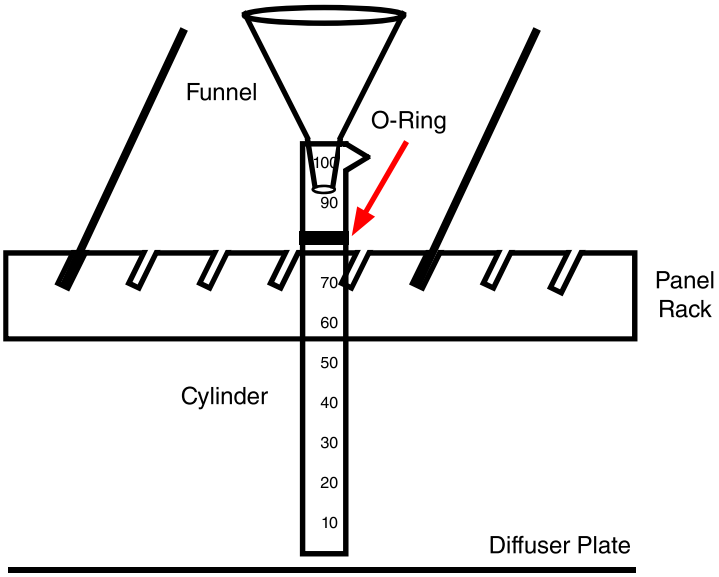



Figure 12.2c: Graduated cylinder with base removed resting in panel rack (held in place with O-ring positioned on 80 ml mark).

- To verify fog deposition, see Fog Deposition (Quantity and Uniformity) Adjustment.

## Optional External Collection System (Graduated Cylinders)

- Q-Lab offers an optional external fog collection system to enable fog collections without having to open the lid and interrupt the test. Part number F-70207-K for 600L models and F-70206-K for 1100L models.
- The external fog collection system includes six (6) graduated cylinders in a holder assembly mounted on the front of the outer shell of the Q-FOG chamber (Figure 12.2d).
- On the inside of the chamber, fog is collected in up to 6 funnels. A tube is connected to the bottom of each funnel. The tubes pass through a bulkhead assembly into the graduated cylinders on the front of the chamber (Figure 12.2e).


Figure 12.2d: External collection cylinders on chamber front.

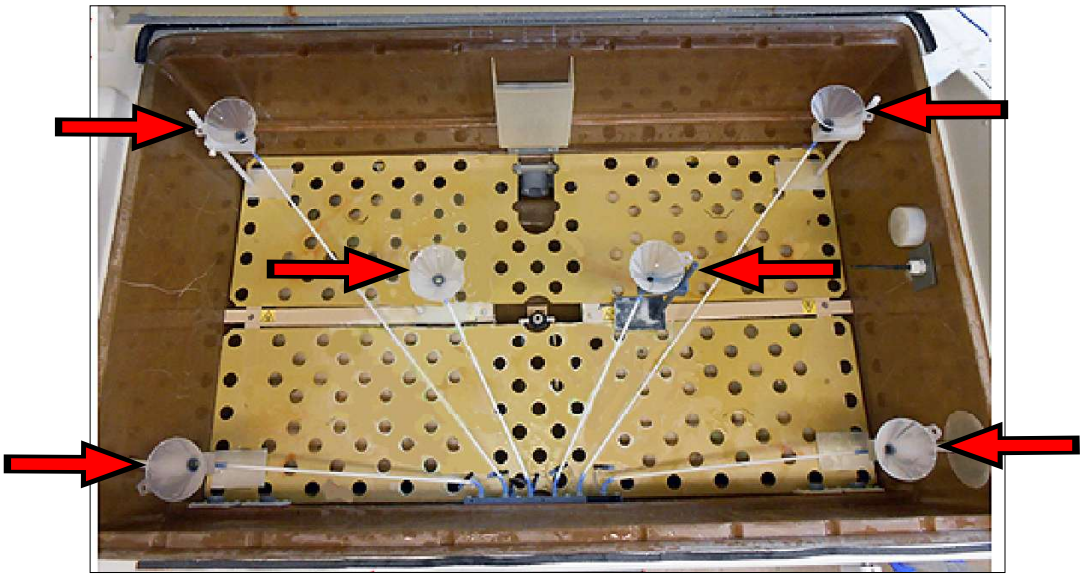


Figure 12.2e: Funnels with tubes inside the chamber.

## Fog Deposition (Quantity and Uniformity) Adjustment

- Fog deposition *quantity* is controlled by the speed of the peristaltic pump (see Section 8.7).
  - Pump speed is adjusted using Q-FOG Machine Configuration menu.
  - Adjusting pump speed changes the fog flow rate and thus the deposition quantity.
  - The flow rate is displayed on the flow meter. (Figure 12.2f).
- Fog deposition *uniformity* is controlled by fog spray pressure and nozzle alignment.
  - Fog deposition *uniformity* is adjusted using spray air pressure.
  - The fog spray pressure is set by the fog pressure regulator and shown on the fog pressure gauge (Figure 12.2f).

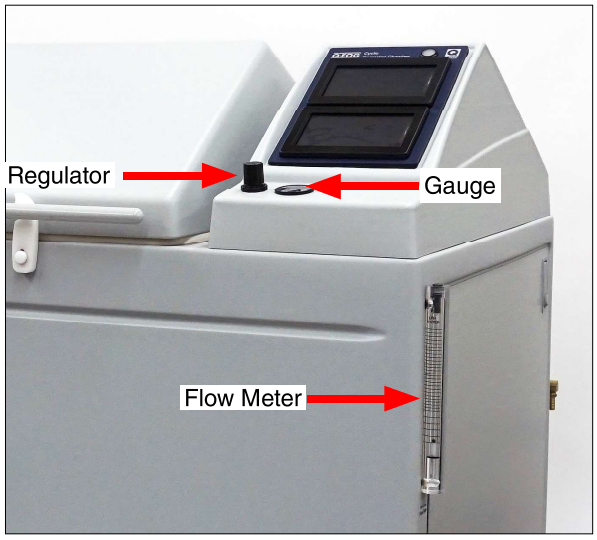
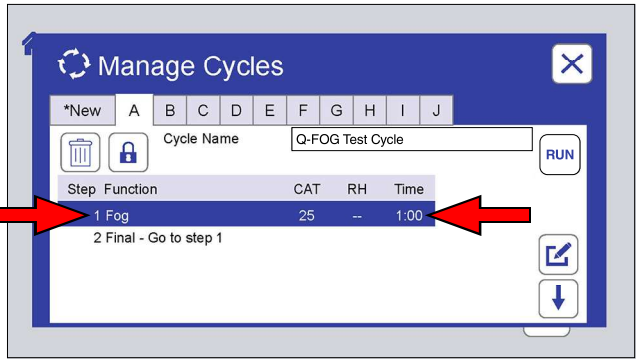



Figure 12.2f: Fog Spray Pressure Regulator, Pressure Gauge and Flow Meter

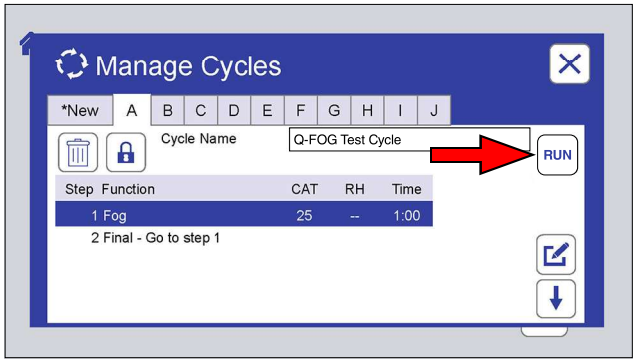
- Follow the steps below to run a fog step, collect fog deposition, and adjust deposition quantity and uniformity.

Set up the fog collection vessels as described in Fog Collection Methods.

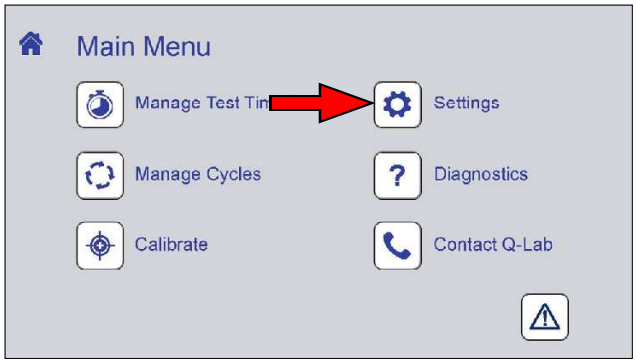

1. Set up the in-chamber or external collection system.
2. Close the Q-FOG lid.



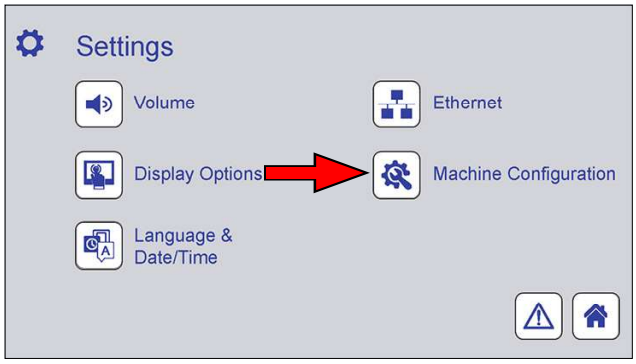

3. Program a test cycle with a fog step. Set the step time as specified in the relevant test standard. See Section 9.6.8.



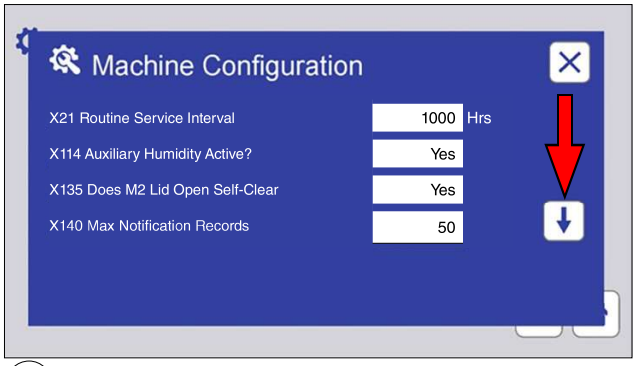

4. **RUN** the fog step.



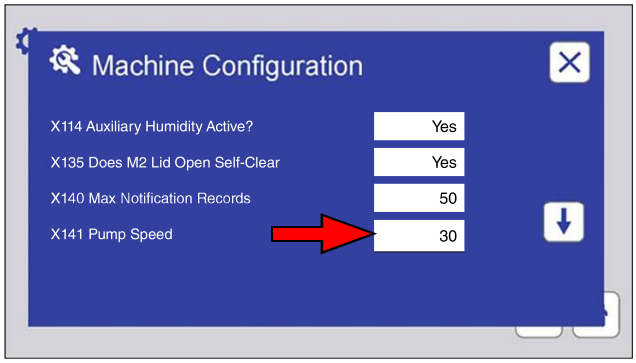

5. On the Main Menu screen touch the Settings icon.



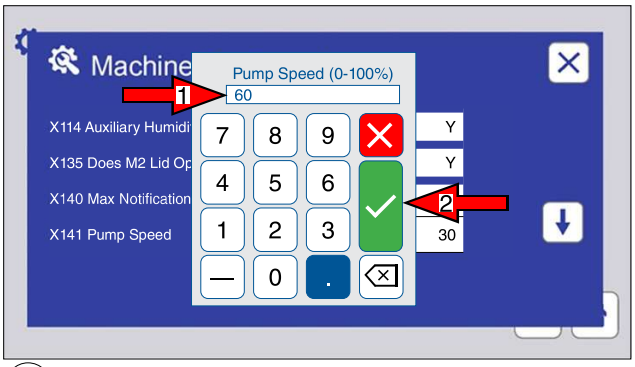

6. On the Settings screen touch the Machine Configuration Icon.



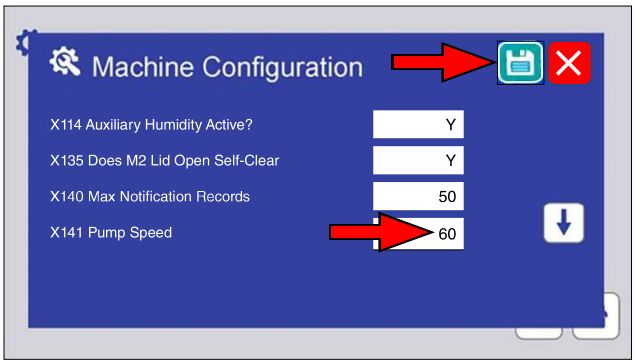

7. On the Machine Configuration screen touch the down arrow to scroll to the X141 Pump Speed parameter.



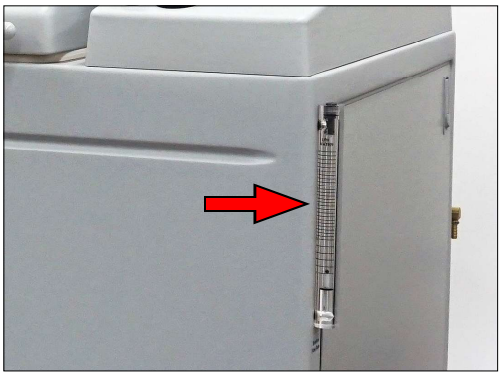

8. On the Machine Configuration screen touch the X141 Pump Speed text box.



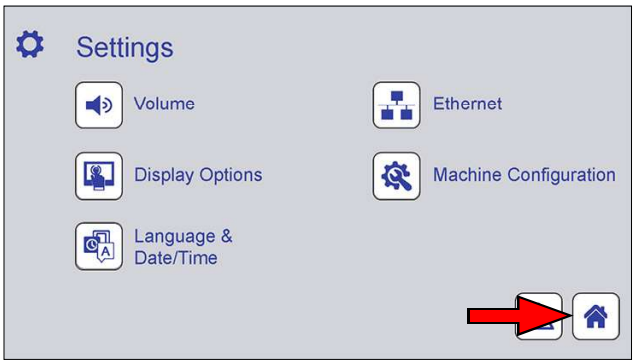

**9.** Use the keypad to enter the new pump speed [1]. **NOTE**: the speed must be between 0 and 100 %. Touch the Check Mark icon [2] to accept the new speed.



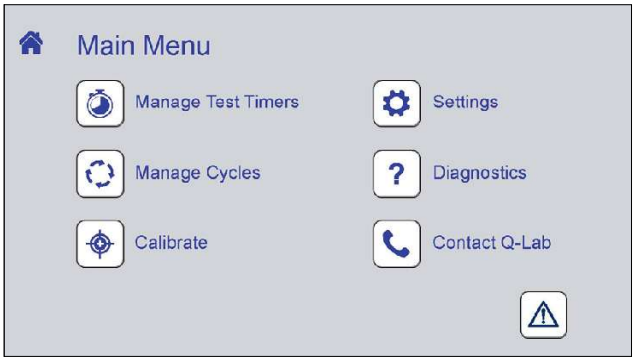

**10.** The new pump speed is displayed. Touch the Save icon to save the new speed.



**11.** Check the flow rate on the flow meter. Repeat Step 8 through Step 10 to adjust the flow rate to the rate shown in the appropriate standard.
See Section 11 for standards information.




**12.** On the Settings screen touch the Home Icon.




**13.** The Main Menu is displayed.


**14.** Use the fog pressure regulator to set the fog spray pressure to the level recommended in the standard.


15. When the fog step has run for the specified time, touch the **STOP** icon on the Status Screen.


16. Wait **15 minutes** for the purge blower to clear the chamber of fog.

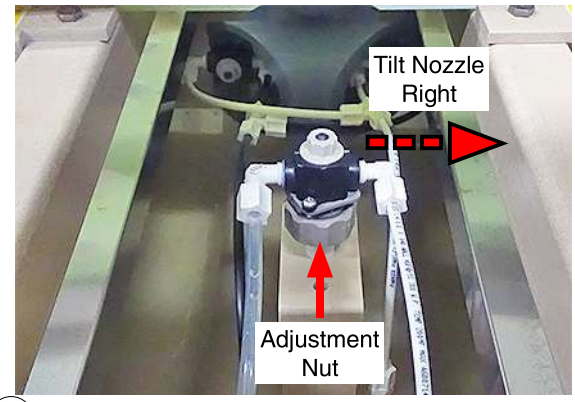

17. Undo latches and open the Q-FOG chamber lid.

| Graduated Cylinder Position | Deposition (ml) |
|---|---|
| Left Front | |
| Left Rear | |
| Left Center | |
| Right Front | |
| Right Rear | |
| Right Center | |

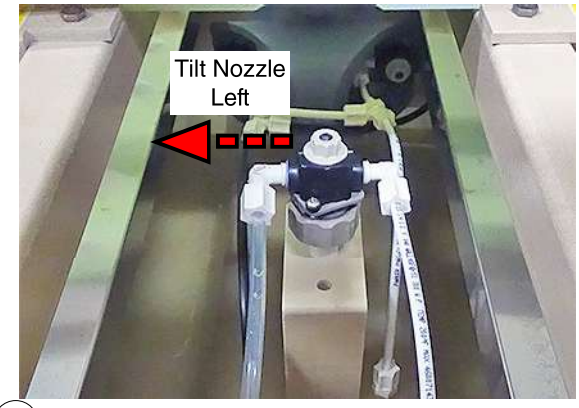
18. Record the amount of fog deposited in each of the graduated cylinders (example recording form shown).

| Graduated Cylinder Position | Deposition (ml) |
|---|---|
| Left Front | 6 ✓ |
| Left Rear | 6 ✓ |
| Left Center | 6 ✓ |
| Right Front | 6 ✓ |
| Right Rear | 6 ✓ |
| Right Center | 6 ✓ |

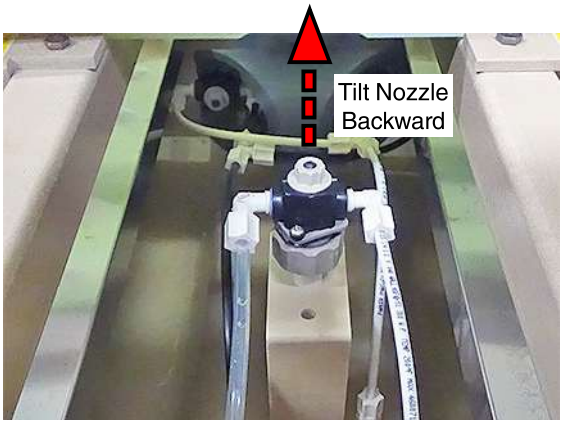
19. If the deposition amounts are within the specified quantity range and are uniform, verification is complete. If quantity is not in the specified range, or deposition amounts are not uniform continue with Step 20.



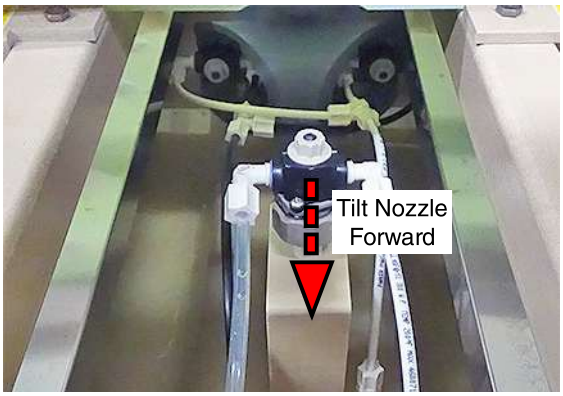

20. If there is too much deposition on the left side, loosen the large adjustment nut under the nozzle, tilt the nozzle to the *right*, then re-tighten the nut.




**21.** If there is too much deposition on the right side, loosen the large adjustment nut under the nozzle, tilt the nozzle to the *left*, then re-tighten the nut.

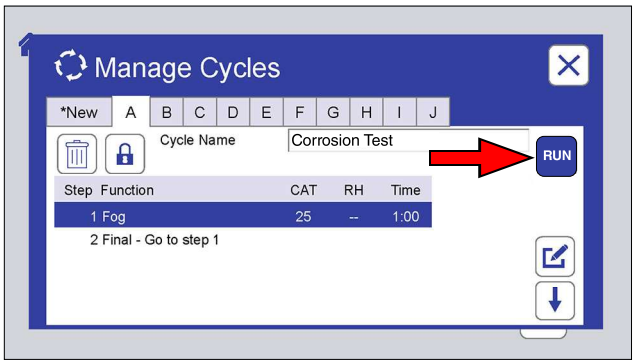



**22.** If there is too much deposition in the front, loosen the large adjustment nut under the nozzle, tilt nozzle *backward*, then re-tighten the nut.

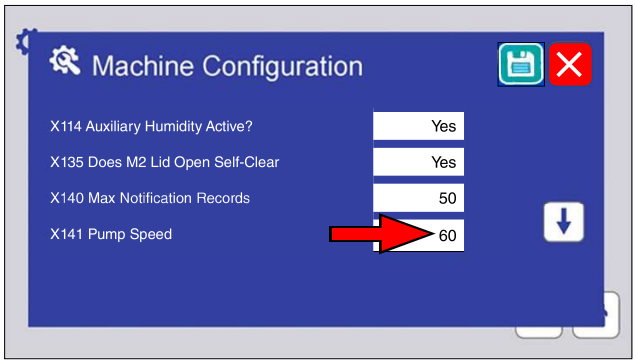



**23.** If there is too much deposition in the back, loosen the large adjustment nut under the nozzle, tilt nozzle *forward*, then re-tighten the nut.


**24.** Close the Q-FOG lid.




**25.** Re-run the fog step.




**26.** If there was too little or too much deposition overall, repeat Step 5 through Step 10 to increase or decrease the pump speed.


27. If the deposition in the outer vessels is less than the inner vessels, use the fog pressure regulator to increase the pressure to deposit more fog farther from the nozzle.


28. If the deposition in the outer vessels is more than the inner vessels, use the fog pressure regulator to decrease the pressure to deposit more fog closer to the nozzle.

**Contact Q-Lab with any questions on fog deposition verification.**

29. Repeat the verification process until all deposition parameters are within the test specifications.

# 13. Data Storage and Transfer

## 13.1. Ethernet Communications (Sep 2021)

- The Q-FOG main controller has the capability to transfer data via Ethernet (Figure 13.1).
- Q-Lab can supply a VIRTUAL STRIPCHART (VSC) program that runs on a PC.
  Contact Q-Lab Repair and Tester Support.
- The stripchart program will be able to set up communications, request data groups, and save and display that data.

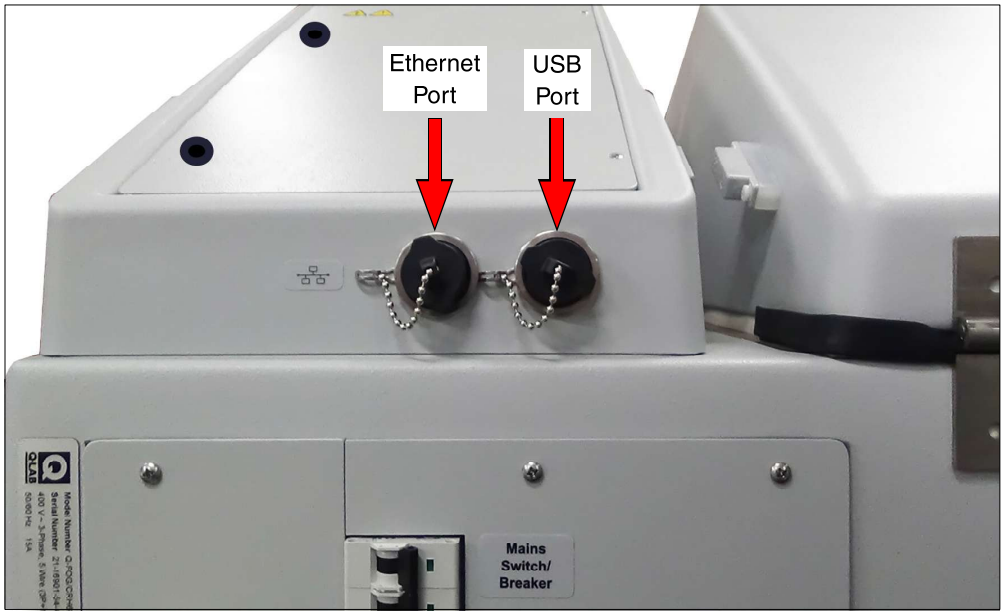



Figure 13.1: Ethernet and USB ports located on rear of control top.

## 13.2. Secure Digital (SD) Card (Sep 2021)

- All tester information, i.e. timers, expert parameters, error messages, set points, actuals, test cycles, and other system configuration information is written to an SD card every minute.
- All tester operating parameters written to the SD card are automatically being saved.
- The operating parameters can be viewed by the customer or by Q-Lab Repair and Tester Support using the export feature 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 re-enter the serial number and date/time, test cycles, expert parameters, or timer values.
- The information on the SD Card can also be copied and emailed to Q-Lab Repair and Tester Support.
- That information can be copied to another SD Card so the original tester's configuration can be "cloned" by Q-Lab Repair and Tester Support for analysis.

## 13.3. Export Diagnostics (Sep 2021)

- 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, set points, actuals, heater and blower percentages, 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 at the rear of the Q-FOG control top (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 13.3e and Figure 13.3f) can be uploaded to the Q-Portal Asset Center where customers can view basic operational data and Q-Lab personnel can view extended operational data.

Figure 13.3a: USB drive needed to export diagnostics. Q-Lab recommends the use of an unencrypted, standard-formatted (FAT 32) USB drive.


Figure 13.3b: Connect the drive to the USB port at the rear of the Q-FOG control top.

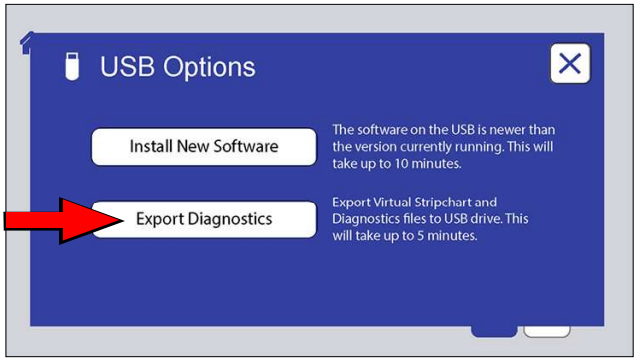



Figure 13.3c: USB Options screen showing the Export Diagnostic button.

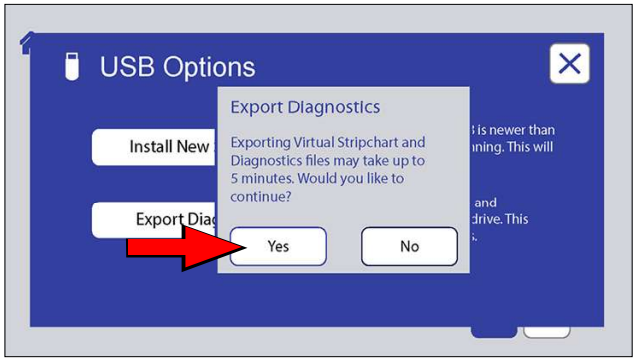



Figure 13.3d: Touch Export Diagnostics then the Yes button to begin export.

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

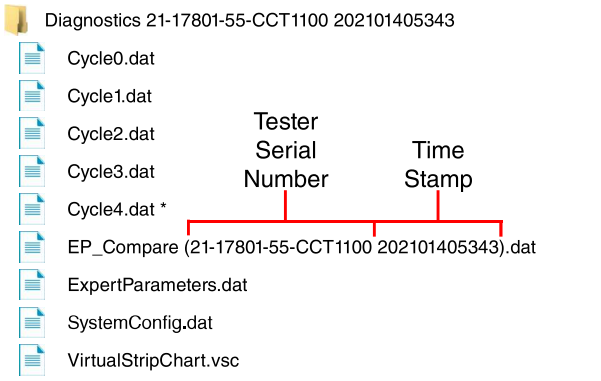



Figure 13.3f: The USB drive will have a folder with the diagnostic data files exported from the tester.

**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.

## 13.4. Import VIRTUAL STRIPCHART Data (Aug 2020)

- At the Q-Lab Q-Portal Asset Center, customers can register their Q-FOG 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 for more information.

# 14. Maintenance

## 14.1. Preventative Maintenance (Oct 2021)

- Power the tester **OFF** and disconnect the tester main power before performing any maintenance.
- All corrosion chambers require regular maintenance for proper operation.
- Basic Q-FOG maintenance items are listed in this section.
- The *F-8200-K Maintenance Kit, SSP & CCT* (see Figure 16ax) provided with the Q-FOG includes air, solution, and water filters and peristaltic pump tubing.

### Before Each Test

- Clean the chamber interior, use a sponge and warm water.
- Check the fog uniformity (see Section 12.2), clean fog nozzle if needed.
- Check solution concentration and pH. See Section 11 for standard test fog solution and pH requirements.

### Every 1000 Hours

- The Q-FOG is equipped with a Routine Service Timer (see Section 9.7 and Section 9.8).
- Every 1000 hours of operation (default), a convenient reminder message: “Perform Routine Service” is displayed. The items listed below should be inspected, cleaned or replaced as indicated:

1. **Peristaltic Pump Tubing:** Check for signs of wear, replace as necessary or once a year (Figure 14.1a and Figure 14.1b).
2. **Bubble Tower:** Drain and allow to refill with clean water (Figure 14.1a and Section 8.2).
    - The bubble tower may be cleaned, but disassembling the bubble tower for cleaning requires the installation of new gaskets (see Section 16).
    - See *F-8542-L Q-FOG Bubble Tower Service Instructions* for detailed instructions on bubble tower cleaning.
    - New gaskets and installation instructions are included in *F-8555-K Bubble Tower Gasket Kit*.
    - Use only deionized water or mild solution of dish soap to clean the bubble tower.
    - Do not use solvents such as Acetone or Isopropyl Alcohol to clean the bubble tower.
3. **Chamber:** Clean and wash down salt build-up on chamber walls and chamber heaters (Figure 14.1c).
4. **Deionized Water Supply:** Check for proper purity and neutral pH (Section 6.5).
5. **Compressed Air Filter:** Inspect and clean as necessary (see Section 6.4).
6. **Solution Filter Strainer:** (Figure 14.1d). Replace every year.
7. **Solution and Main Water Filters:** (Figure 14.1a). Replace every year.
8. **Purge Blower Air Filter:** Clean with air hose or vacuum cleaner (Figure 14.1a). Replace every year.
9. **Fog Spray Nozzle:** Inspect and clean (Section 14.2).
10. **Lid Seal:** Check for tears and leaks.
11. **Lid Latch:** Adjust if seal is not adequately compressed.

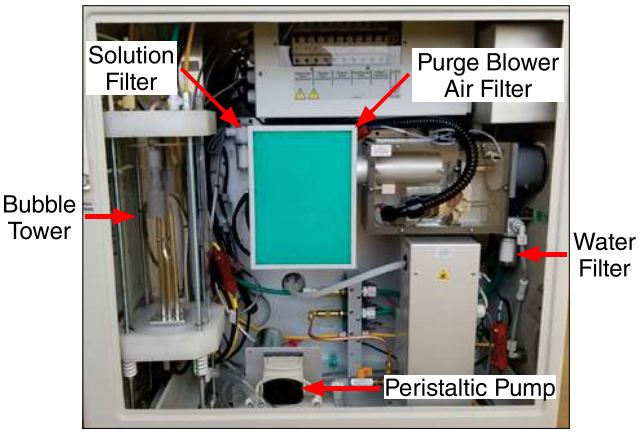



Figure 14.1a: Location of components requiring maintenance.

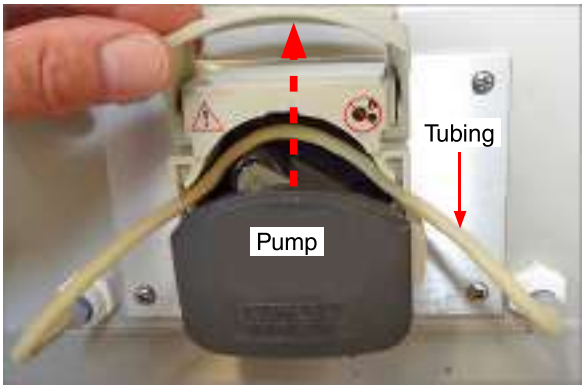



Figure 14.1b: Open the peristaltic pump to check the tubing.


Figure 14.1c: Metal plate chamber heaters with salt build-up.

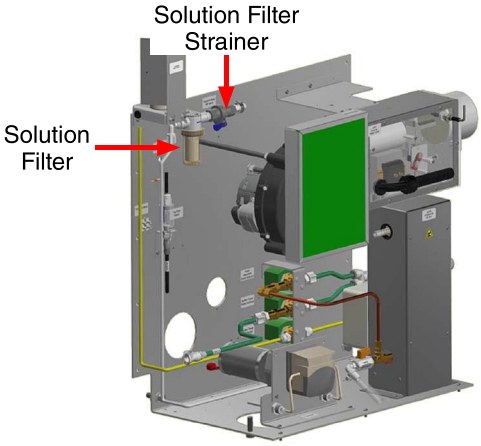



Figure 14.1d: Illustration showing solution filter strainer location behind purge blower air filter.

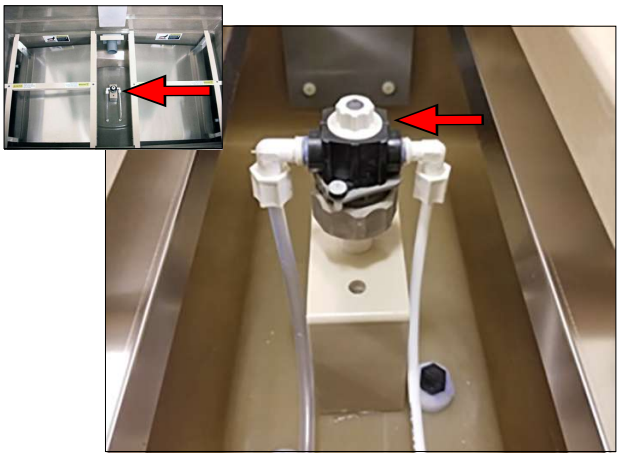
## Every 6 Months or 4000 Hours

- Calibrate the chamber temperature sensor (see Section 12.1).
- Drain and clean the solution reservoir (see Section 14.3 ).

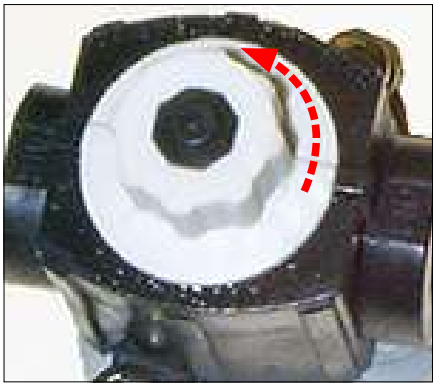
## 14.2. Fog Spray Nozzle Cleaning (Sep 2021)

### Follow the steps below to clean the fog nozzle.

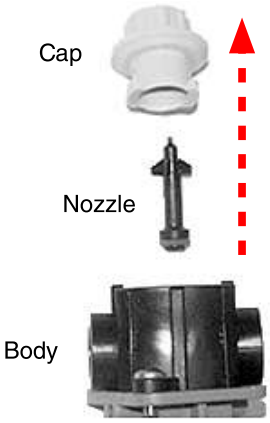
- Tools required:
  - Small plastic cup
  - Distilled white vinegar, 5% acidity
  - Paper towels
- **IMPORTANT:**
  - After cleaning make sure the nozzle and cap are reassembled correctly (Step 9).
  - After nozzle cleaning, run a Fog Deposition Verification (see Section 12.2).



**1.** Remove the panel racks and diffuser plates to access the fog spray nozzle.

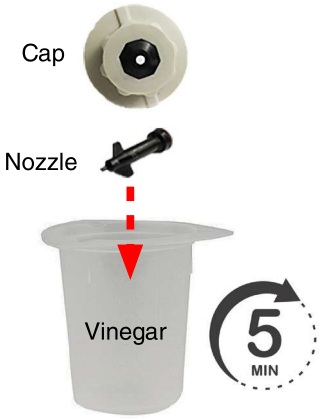


**2.** Turn the nozzle cap counter clockwise 1/4 turn.




**3.** Remove the nozzle assembly from the spray body

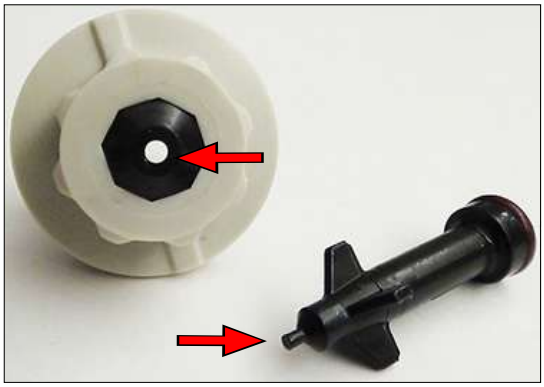

**4.** Fill a small cup about half full with distilled white vinegar.



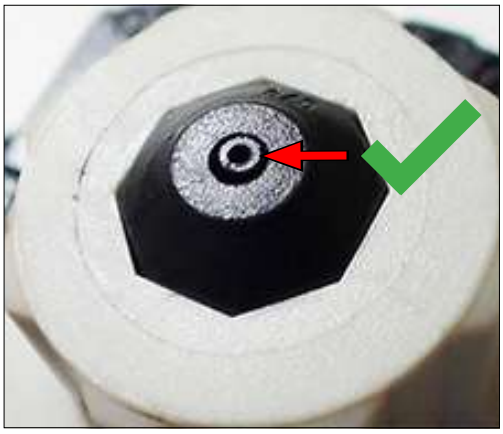

**5.** Drop the cap and nozzle into the cup. Soak for five (5) minutes.

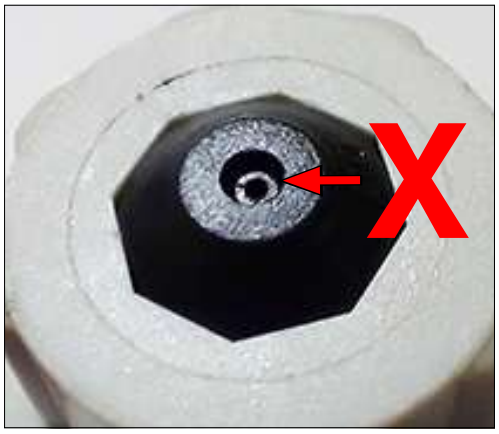
**6.** Under running clean tap water, fill the cup to overflowing.

**7.** Empty and refill the cup with clean water 4 times to throughly rinse nozzle and cap.



**8.** Dry the nozzle and cap. Make sure tip of nozzle and aperture in cap are clean and free of debris.





**9.** Reassemble the nozzle in the cap. **IMPORTANT:** Make sure tip of nozzle extends through hole in cap when reassembling.

## 14.3. Solution Reservoir Cleaning (May 2018)

The solution reservoir should be cleaned every six (6) months or after every 4000 hours of Q-FOG operation.

Solutions stored in the reservoir can create precipitates. Precipitates can build up inside the reservoir and can clog system filters, hoses and nozzles. Precipitates may not be soluble in water, so distilled vinegar is used to clean the reservoir.

### Tools Required:

- 7.6 liter (2 gallon) white vinegar
- Small bucket
- Long handled circular brush (Do not use a wire brush)
- Safety Glasses
- Clean water supply
- Phillips screwdriver

### To Clean the Reservoir

1. Open solution reservoir drain valve under the reservoir (see Section 5.8).

2. Allow all solution to drain out of reservoir.

3. Use a long handled circular brush (nylon or plastic, not wire) to remove deposits from sides and bottom of reservoir.

4. Use clean water to wash loose particulate material out of reservoir.

5. Use shop vacuum to remove any remaining loose particulate material.

6. Use clean water to flush out any particulate material that may have accumulated in reservoir outlet.

7. Close reservoir drain valve.

**NOTE:** Wear safety glasses when working with vinegar

8. Pour 1/2 gallon of white vinegar into reservoir, wetting reservoir sides as vinegar is poured into reservoir.

9. Use the brush to scrub sides and bottom of reservoir with vinegar.
10. Allow vinegar to soak in reservoir for about 30 minutes.
11. Open reservoir drain valve.
12. Allow all vinegar to drain out of reservoir.

13. Use clean water to rinse sides and bottom of reservoir.
14. Repeat **Steps 8 through 13.**
15. Close reservoir drain valve.
16. Fill reservoir with normal test solution.

## 14.4. Q-FOG Software Updates (Oct 2021)

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

### Software Version and Tester Serial Number

- The currently-installed Q-FOG software version number and tester serial number are required to determine if a software update needs to be performed.
- The Q-FOG serial number and the software version are listed in the Diagnostics screen (Section 9.8) accessed from the controller main menu.
- See Section 9.8 for instructions to display the tester serial number (diagnostic D30) and software version (diagnostic D12).
- The serial number can also be found on the nameplate attached to the rear of the Q-FOG cabinet (Figure 14.4a).

### 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-FOG 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-FOG (see previous section), that software needs to be installed.
    - More recent software versions are indicated by a higher version number (e.g. 6.110 and 6.200 would both be more recent than 6.100).
  - **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.

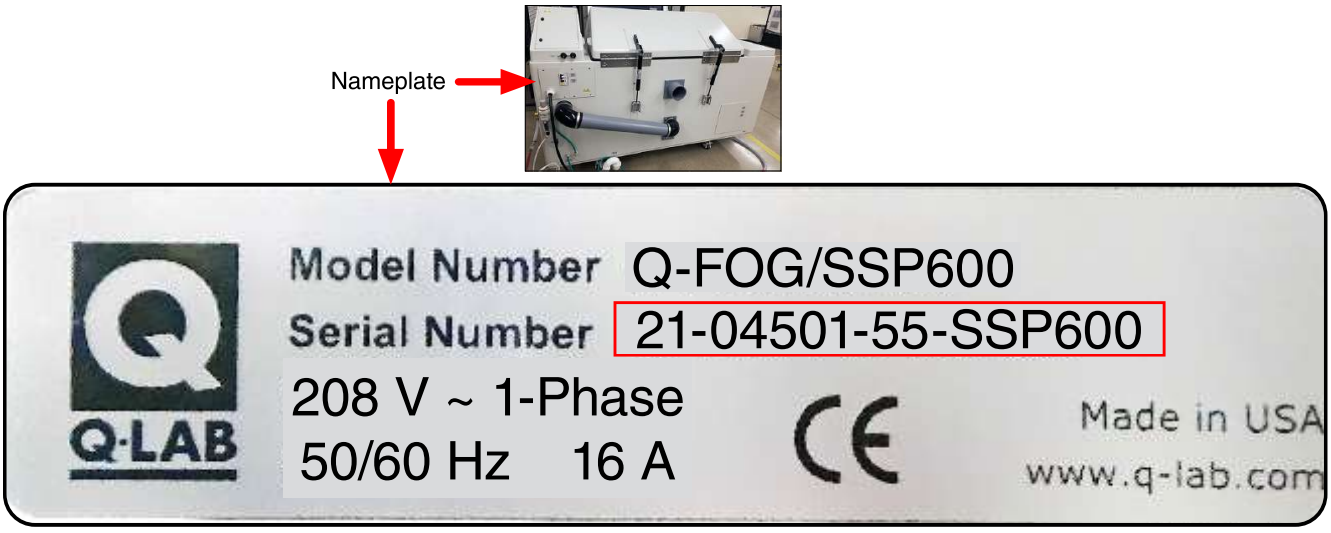



Figure 14.4a: Serial number on nameplate.

## 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) into a root directory (not a subfolder) on a USB flash drive (Figure 14.4b). Q-Lab recommends the use of an unencrypted, standard-formatted (FAT 32) USB drive.
- Connect the drive to the tester USB port of the control panel (Figure 14.4c).
- 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 14.4d).
  - *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 14.4e).
- 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 18 for Q-Lab Repair and Tester Support contact information.

Figure 14.4b: Copy Q-FOG software to a USB drive.


Figure 14.4c: Connect the drive to the USB port at the rear of the Q-FOG control top.

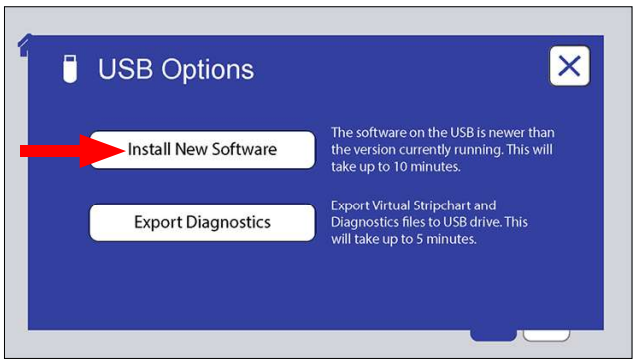



Figure 14.4d: The USB Options screen displays the software installation button.

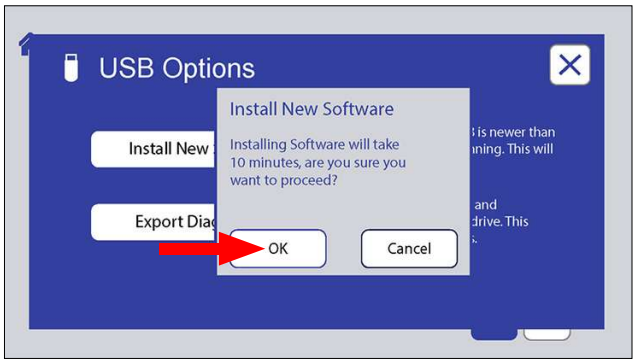



Figure 14.4e: Touch OK to proceed with software installation.

# 15. Troubleshooting and Repair

- The Q-FOG is designed so that virtually all repairs can be made by the user.
- Use only parts that have been supplied or recommended by Q-Lab (see Section 16).
- Q-Lab accepts no responsibility for the consequences of the use of non-approved parts.
- Please contact Q-Lab Repair and Tester Support with any questions regarding tester troubleshooting and repair.
- Or contact the nearest international office by telephone Monday through Friday from 8:30 AM to 5 PM or email for technical support.
- For immediate assistance, please contact us directly at +1-440-835-8700 (US), +44-1204-861616 (UK and Europe), +49-681-857470 (Germany/Austria/Switzerland), or +86-21-5879-7970 (China).
- Visit www.q-lab.com to register your tester to access additional useful troubleshooting guides, operating manuals, and technical information.
- The Q-FOG software includes functions to export data that can be used to help diagnose tester problems (see Section 13.3).


For sales, technical, or repair support please visit:

Q-Lab.com/support

Westlake, Ohio USA • Homestead, Florida USA • Buckeye, Arizona USA
Bolton, England • Saarbrücken, Germany • Shanghai, China

## 15.1. Notifications (Oct 2021)

- Notifications provide useful diagnostic information for technicians and repair personnel.
- Notifications show significant tester events and errors that occurred in the recent past.
- See Section 9.4 for more information on displaying and clearing Notifications.
- The table below lists all Q-FOG Notifications indicators along with possible diagnostic actions.

| Code | Message | Icon | Test Status | Action |
|---|---|---|---|---|
| M1 | Lid is open - Test suspended |  | Stopped | • Close lid |
| M2 | Lid is open - Stop test |  | Stopped | |
| M10 | End of Test |  | Complete | • Test completed successfully |
| M11 | End of Test |  | Complete | • Test completed successfully |
| M12 | End of Test Shutdown |  | Stopped | |
| M13 | End of Test Shutdown |  | Stopped | |
| M14 | Perform Routine Service |  | Running | • See Section 14 for maintenance information |
| M20 | Chamber High Temperature Fault XX°C |  | Stopped | • Check that chamber heater or vapor generator heater relays are not stuck closed<br>• Check chamber temperature sensor |

| Code | Message | Icon | Test Status | Action |
|---|---|---|---|---|
| M21 | Chamber Low Temperature Fault XX°C | | Stopped | • Check chamber heater circuit breaker<br>• Check chamber over-temperature switch<br>• Check chamber temperature sensor<br>• Check that run power and chamber heater relays are not stuck open<br>• Check the chamber heaters (wiring diagram shows correct resistance values) |
| M22 | Bubble Tower High Temp Fault XX°C | | Stopped | • Check that bubble tower heater relay is not stuck closed<br>• Check bubble tower temperature sensor |
| M23 | Bubble Tower Low Temp Fault XX°C | | Stopped | • Check that run power and bubble tower heater relays are not stuck open<br>• Check bubble tower temperature sensor<br>• Check bubble tower thermal fuse<br>• Check bubble tower heater (resistance should be 75 Ω and current should be 3 amps) |
| M24 | Boiler Heater Fault XX°C | | Stopped | • Check that run power and vapor generator heater relays are not stuck open<br>• Check vapor generator temperature sensor<br>• Check vapor generator thermal fuse<br>• Check vapor generator heater (resistance should be 17 Ω) |
| M25 | Purge Air Heater Fault XX°C | | Stopped | • Check that run power and purge air heater relays are not stuck open<br>• Check purge air temperature sensor<br>• Check purge air heater (resistance should be 50 Ω) |
| M30 | Fog Step Temperature Fault | | Running | • None; informative message that a temperature setpoint was not reached by the end of the step. |
| M31 | Dry Step Temperature Fault | | Running | • None; informative message that a temperature setpoint was not reached by the end of the step. |
| M32 | Humid Step Temperature Fault | | Running | • None; informative message that a temperature setpoint was not reached by the end of the step. |
| M39 | Lab Temp at Time of Fault XX°C | | Running | • This notification is not an error by itself; it notes what the laboratory temperature was at the time a different, stopping fault occurred. |
| M40 | Purge Air Temp Too Hot XX°C | | Stopped | • Check that purge air heater relay is not stuck closed<br>• Check purge air temperature sensor |
| M41 | Boiler Temp Too Hot XX°C | | Stopped | • Check that vapor generator heater relay is not stuck closed<br>• Check vapor generator temperature sensor |
| M42 | Chamber Temp Too Hot XX°C | | Stopped | • Check that chamber heater or vapor generator heater relays are not stuck closed<br>• Check chamber temperature sensor |

| Code | Message | Icon | Test Status | Action |
|---|---|---|---|---|
| M43 | Bubble Tower Too Hot XX°C | ▲ | Stopped | • Check that bubble tower heater relay is not stuck closed<br>• Check bubble tower temperature sensor |
| M44 | Controller Too Hot XX°C | ▲ | Stopped | • Check room temperature<br>• Check overheating of relays |
| M49 | Power Disrupted | ⚠ | Running | • This message indicates power was off and then came back on during a RUN step.<br>• The message appears if power goes out for any reason, including if the user turns power OFF when the tester is in RUN mode.<br>• Always press STOP before powering the Q-FOG off to prevent the M49 message from being displayed when the Q-FOG is powered back on. |
| M50 | Replace Battery | ⚠ | Running | • Replace the battery (V-4086) on the main controller circuit board. See Section 16. |
| M60 | Bubble Tower Fill | ⚠ | Running | • None; informative message that bubble tower is filling with water. Self-clearing once fill is complete. |
| M61 | Bubble Tower Fill Failure | ▲ | Stopped | • Check that water supply is turned on<br>• Check bubble tower water solenoid<br>• Check bubble tower hi water level sensor |
| M62 | Bubble Tower Water Level Sensor Fail | ▲ | Stopped | • Check bubble tower level sensors |
| M63 | Boiler Fill | ⚠ | Running | |
| M64 | Boiler Fill Failure | ▲ | Stopped | • Check that water supply is turned on<br>• Check vapor generator water solenoid<br>• Check vapor generator water level sensor |
| M70 | Solution Reservoir Low | ⚠ | Running | • Fill Solution Reservoir |
| M71 | Solution Reservoir Empty | ▲ | Stopped | • Fill Solution Reservoir |
| M74 | No Spray Air Flow | ▲ | Stopped | • Check that compressed air is turned on<br>• Check air solenoid<br>• Check that spray nozzle is not blocked<br>• Check spray air flow switch |
| M75 | Air Valve Leak | ▲ | Stopped | • Check spray air solenoid<br>• Check spray air flow switch |
| M77 | No Purge Air Flow | ▲ | Stopped | • Check purge blower<br>• Check purge air flow switch<br>• Check purge air solenoid<br>• Check for blockage in exhaust system |
| M78 | Purge Blower On, Should be Off | ▲ | Stopped | • Check purge air flow switch<br>• Check the purge blower relay |
| M80 | Flash Memory Failure | ▲ | Stopped | • Contact Q-Lab Repair and Technical Support |

| Code | Message | Icon | Test Status | Action |
|---|---|---|---|---|
| M81 | Flash Data Corrupt | | Stopped | • Contact Q-Lab Repair and Technical Support |
| M82 | Ram Corrupted, Ram Reloaded | | Stopped | • Contact Q-Lab Repair and Technical Support |
| M92 | Chamber Temperature Sensor Fail | | Stopped | • Contact Q-Lab Repair and Technical Support |
| M93 | Bubble Tower Temperature Sensor Fail | | Stopped | • Check bubble tower temperature sensor |
| M94 | Boiler Temperature Sensor Fail | | Stopped | • Check vapor generator temperature sensor |
| M95 | Purge Air Temperature Sensor Fail | | Stopped | • Check purge air temperature sensor |
| M99 | Lab Temperature Sensor Fail | | Running | • The sensed lab temperature is less than 3°C or greater than 99°C |
| M101 | SD Card Missing | | Running | • SD Card is missing. Contact Q-Lab Repair. |
| M102 | SD Card Corrupted | | Running | • SD Card is corrupted. Contact Q-Lab Repair. |
| M103 | System Auto-Reboot | | Running | • Contact Q-Lab Repair and Tester Support. |
| M111 | Relay Check In Progress | | Stopped | • Message displayed when M112 Diagnostic Sequence is in progress |
| M112 | Run Relay Stuck On | | Stopped | |
| M117 | Software Install Completed Successfully | | Running | • The tester has successfully installed software and restarted |
| M118 | Notification Center Data Error. Please Contact Q-Lab | | Running | • Data corruption has occurred in the Notification Center. Contact Q-Lab. |
| M119 | Non-Matching Displays Detected | | Running | • Displays from two different vendors are installed. Adjust screen brightness if necessary. |
| M900 | Status Screen Communications Failure | | Running | • Communication lost between main controller and Status Screen. Tester will enter single-screen mode. |
| M901 | Main Menu Screen Communications Failure | | Running | • Communication lost between main controller and Menu Screen. Tester will enter single-screen mode. |
| M902 | Main Controller Communications Failure | | Running | • Message that appears on a screen that has experienced M900 or M901 |