



# Q-FOG<sup>®</sup>

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Cyclic Corrosion Test Chambers



# Corrosion Basics

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Corrosion causes billions of dollars in product and infrastructure damage every year. It degrades the useful properties of materials, especially metals. The effects of corrosion include loss of strength, change in appearance, and increased permeability to liquids and gases. In just a few days or weeks, a Q-FOG tester can reproduce the damage that occurs over months or years outdoors.

**Will your product last outdoors? Don't guess when you can test!**



Industrial



Coatings



Architectural



Automotive

# Why Q-FOG?

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## Realistic

Cyclic corrosion testing provides the best possible laboratory simulation of natural corrosion. Current research indicates that cyclic corrosion testing results are similar to those from outdoor exposures in resulting structure, morphology, and relative corrosion rates. Prior to cyclic testing, conventional salt spray (a continuous salt spray at 35 °C) was the standard way to simulate corrosion in a lab. Because conventional salt spray methods failed to mimic the natural wet/dry cycles of outdoors, test results frequently provided poor correlation to outdoors.

Within one Q-FOG chamber, it is possible to cycle through all of the most significant corrosion environments. Even the most complex test cycles can easily be programmed with the easy-to-operate Gen 4 controller, featuring dual, full-color touchscreens.

## Affordable

Q-FOG corrosion testers were specifically designed to have the lowest total cost of ownership in the industry. Their low purchase price, high reliability, and low operating costs set a new standard for corrosion testers. And the model CRH represents a breakthrough in price-performance ratio for RH-controlled corrosion chambers. Now even the smallest lab can afford to perform the latest in cyclic corrosion testing.

## Easy to Operate

The Q-FOG tester's simple yet sophisticated design makes it easy to install, easy to use, and almost maintenance-free.

- > Simple dual, full-color touchscreen user interface for easy programming
- > Exposure conditions displayed continuously
- > Self-diagnostic warnings and service reminders
- > Multicolored LED for viewing tester status from a distance

## Reliable and Easy to Maintain & Repair

Q-FOG testers are legendary for their reliability. Q-Lab's innovative REPAIRPEDIA™ online troubleshooting guide allows users to quickly diagnose and correct tester performance issues. And it's free to all Q-Lab customers.

## Q-Lab's Experience

Q-Lab's scientists and engineers participate and offer leadership in ISO, ASTM, IEC, GB, and numerous other professional standards organizations, constantly striving to improve the state-of-the-art of modern corrosion test methods.



# Q-FOG Models

## TWO CONVENIENT SIZES

600 or 1100 L to accommodate small and large specimen sizes and quantities

## INTERNAL SOLUTION RESERVOIR

Large 120 L capacity to run most tests for 7 days or more

## REINFORCED FIBERGLASS CONSTRUCTION

Robust, heavy-walled chamber and lid have low thermal conductivity for efficient, precise temperature control

## HEAVY DUTY LEVELING CASTERS

For easy repair and maintenance access even when laboratory space is limited

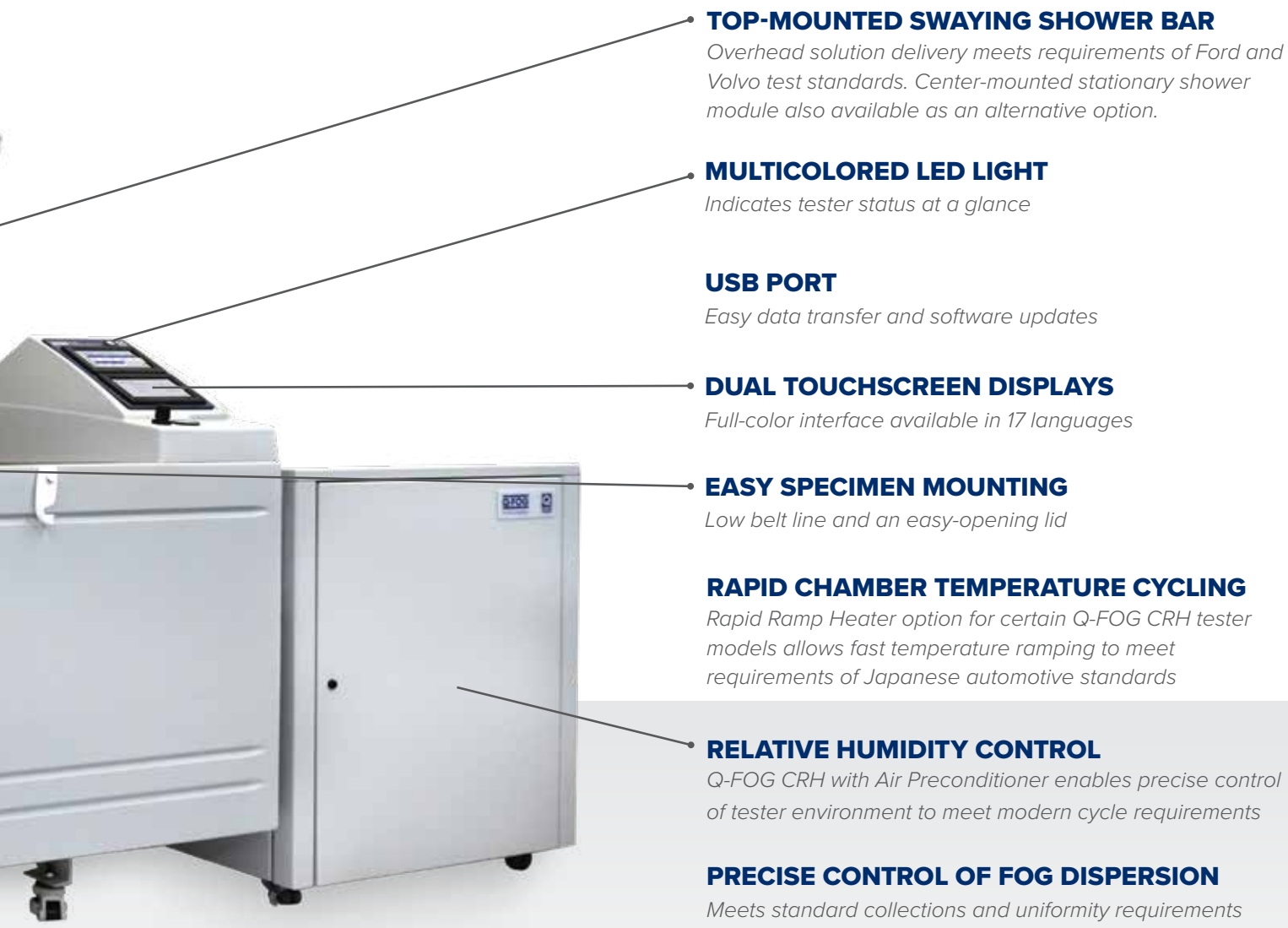


## Q-FOG SSP

The Q-FOG SSP corrosion tester can perform numerous accelerated corrosion tests, including continuous salt spray (ASTM B117 and ISO 9227) and Prohesion (ASTM G85 Annex 5). The Prohesion test uses fast cycling, rapid temperature changes, a low humidity dry-off cycle, and a different corrosive solution to provide a realistic test. The SSP chamber is our most economical model, and can perform salt fog, dwell and dry-off functions.

## Q-FOG CCT

The Q-FOG model CCT has all the advantages of the model SSP, but adds the flexibility of including a 95-100% Humid Function. The Q-FOG CCT model can meet many automotive corrosion test methods that require exposing specimens to a repetitive cycle of salt spray, high humidity, low humidity dry-off, and ambient conditions. Additionally, the CCT model is able to run Copper-Accelerated Acetic-Acid Salt Spray (CASS) tests such as ASTM B368 or ISO 9227 CASS.



**TOP-MOUNTED SWAYING SHOWER BAR**

*Overhead solution delivery meets requirements of Ford and Volvo test standards. Center-mounted stationary shower module also available as an alternative option.*

**MULTICOLORED LED LIGHT**

*Indicates tester status at a glance*

**USB PORT**

*Easy data transfer and software updates*

**DUAL TOUCHSCREEN DISPLAYS**

*Full-color interface available in 17 languages*

**EASY SPECIMEN MOUNTING**

*Low belt line and an easy-opening lid*

**RAPID CHAMBER TEMPERATURE CYCLING**

*Rapid Ramp Heater option for certain Q-FOG CRH tester models allows fast temperature ramping to meet requirements of Japanese automotive standards*

**RELATIVE HUMIDITY CONTROL**

*Q-FOG CRH with Air Preconditioner enables precise control of tester environment to meet modern cycle requirements*

**PRECISE CONTROL OF FOG DISPERSION**

*Meets standard collections and uniformity requirements*

**Q-FOG CRH**

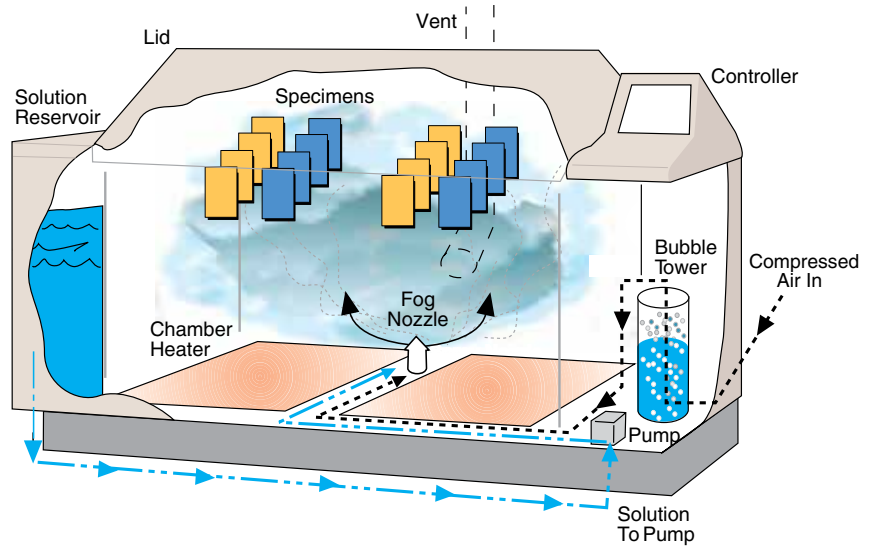
The Q-FOG model CRH represents a true breakthrough in the price-performance ratio of corrosion testers with Relative Humidity (RH) control. It has all the advantages of the model CCT, but adds full variable humidity control through the use of an innovative Air Preconditioner. It is compatible with most major automotive corrosion test standards, such as GMW 14872, SAE J2334 and others from ISO, GB/T, VW, Chrysler, Renault, and more. Additionally, this model includes a programmable shower function with an advanced cleaning feature for spray nozzles that prevents clogging frequently found in competitive chambers. The available Rapid Ramp Heater capability allows the Q-FOG CRH to meet fast temperature and transitions, like those called for in standards such as JASO M609, CCT-I, CCT-II, and CCT-IV, even when the chamber is fully loaded with specimens. The optional Top-Mounted Swaying Shower Bar feature allows the CRH to comply with language in automotive test standards from Ford and Volvo requiring overhead shower distribution.

# Corrosion Testing Functions

## FOG (ALL MODELS)

During the Fog Function, the corrosion tester operates as a conventional salt spray unit:

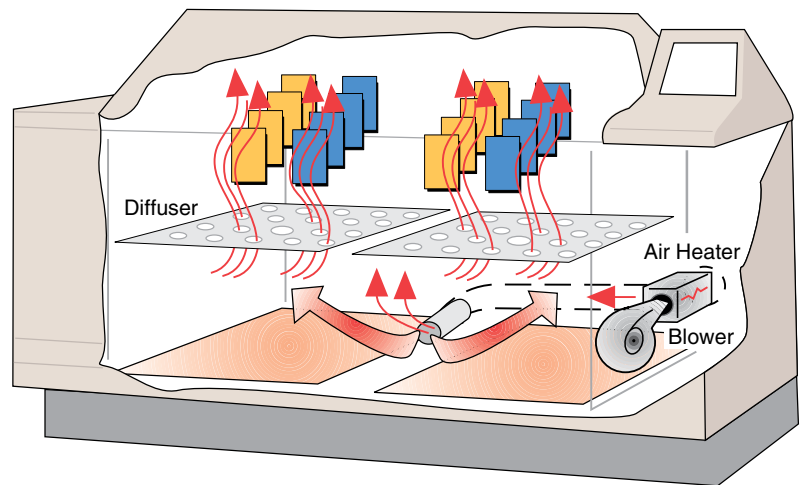
- Corrosive electrolyte solution from the internal reservoir is pumped to the nozzle
- Compressed air is humidified by passing through the bubble tower on its way to the nozzle
- Nozzle atomizes solution air into a fine, corrosive fog mist
- Chamber heaters maintain the programmed chamber temperature



## DRY-OFF & DWELL

During the Dry-off Function, a purge blower forces room air over an air heater, through diffusers, and across specimens in the chamber. This creates a low humidity condition inside the chamber, drying the specimens. The chamber temperature is controlled by the chamber heaters and the air heater.

During the Dwell Function (not shown) the chamber temperature is controlled by only the chamber heater.

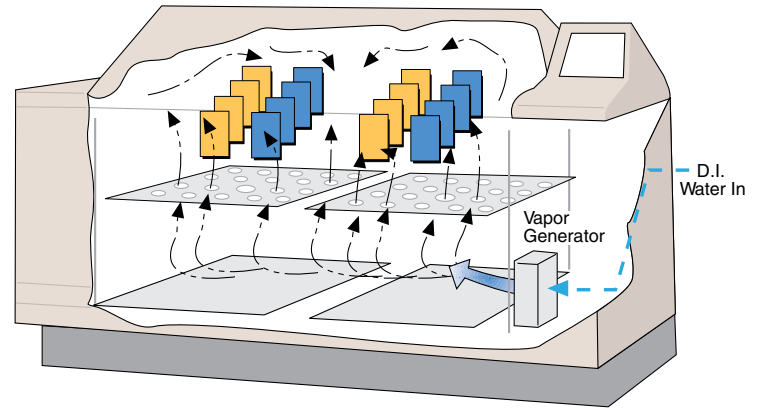


Q-FOG model CRH testers utilize the RH Function in place of the Dry-Off and Dwell Functions.

## HUMID (MODEL CCT ONLY)

During the Humid Function in CCT models, the chamber is maintained at 95-100% relative humidity by forcing hot water vapor into the chamber. Deionized water is required for proper operation. The vapor generator heater maintains the programmed chamber temperature.

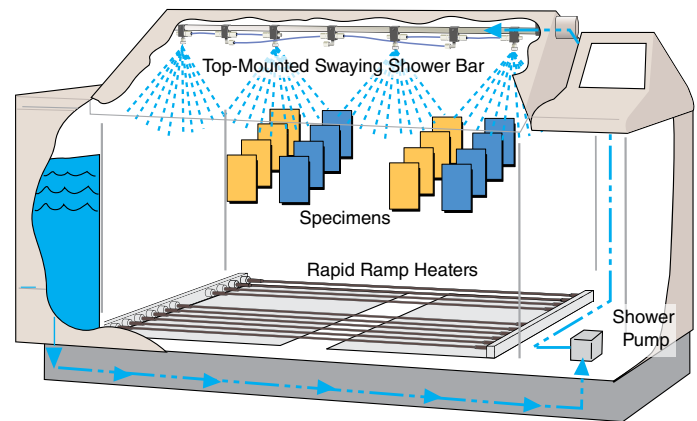
Q-FOG model CRH testers utilize the RH Function in place of the Humid Function.



## SHOWER (MODEL CRH ONLY)

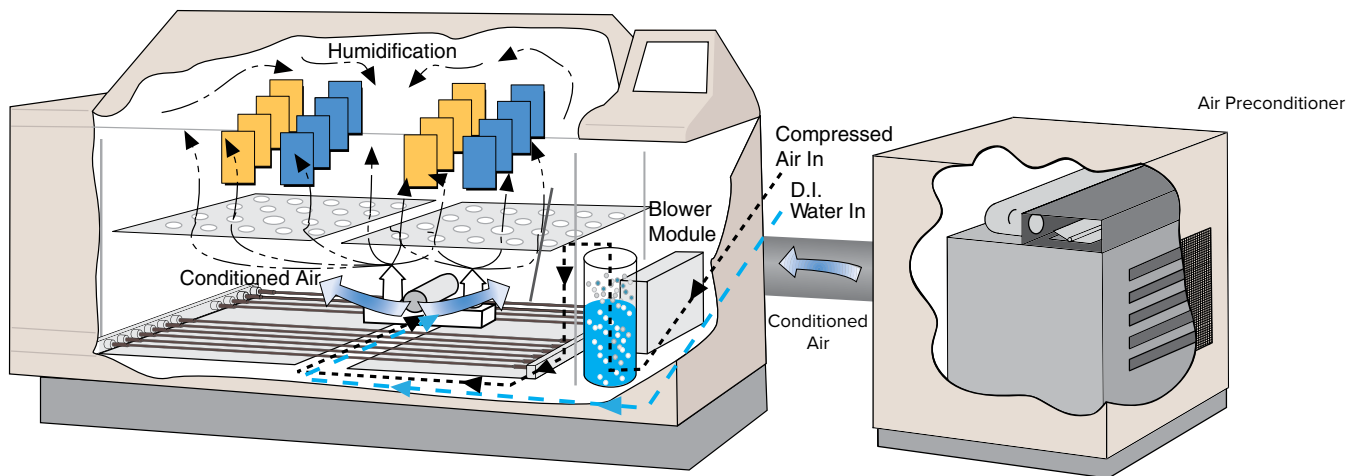
The Shower Function is used for some automotive test specifications. A user-adjustable volume of solution is uniformly sprayed onto specimens through specially-positioned nozzles:

- Spray droplets are bigger, flow rates are much higher, and shower times are much shorter than the atomized solution mist in the Fog Function.
- Nozzles are either positioned on a swaying bar above the specimens or in the center of the tester (not shown). The center-mounted module can be easily removed to perform Fog steps.
- Shower on/off times can be directly programmed to allow for excellent control of corrosion rates.



## RH (MODEL CRH ONLY)

In CRH models, the chamber can ramp to and maintain a defined RH value and temperature through the use of the Air Preconditioner, the blower module, and special atomizing humidification nozzles. DI water is required for proper operation. Optional Q-FOG Rapid Ramp Heaters (shown below) can meet very challenging temperature and ramp times. See operating manual for details on RH/temperature capabilities vs. laboratory condition requirements.



# Corrosion Testing

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Cyclic corrosion tests expose specimens to a series of different environments in a repetitive cycle. Simple tests may consist of cycling between two conditions: fog and dry. More sophisticated procedures (especially for automotive testing) call for multi-step cycles incorporating humidity, along with salt fog or shower functions, and dry-off.

## PROHESION AND CONVENTIONAL SALT SPRAY

Numerous accelerated corrosion tests may be performed in Q-FOG model SSP, including Prohesion, ASTM B117, ASTM G85, BS 3900 F4 and F9, DIN 50.021, ISO 9227, and GB/T 10125, just to name a few.

**Prohesion.** This test uses one-hour fog and one-hour dry-off, rapid temperature changes, and a different corrosive solution to provide a more realistic test. Many researchers have found this test useful for industrial maintenance coatings.

**Conventional Salt Spray.** Continuous salt spray exposures are widely specified for testing components and coatings for corrosion resistance. Applications include: plated and painted finishes, aerospace and military components, and electrical and electronic systems.

Most of these tests are performed to particular specifications that are widely used for quality control and validation testing. They are typically run at an elevated temperature and do not incorporate a dry-off cycle. They require heated, humidified air for the spray.



### CORROSION TESTING

A variety of test specimens can be exposed to accelerated corrosive conditions in Q-FOG test chambers.



## CYCLIC CORROSION TESTS

A more serious limitation of tests such as ASTM B117 is that they provide a continuous environment with no changes in conditions. In contrast, materials exposed to the weather experience cyclical changes in wetness, temperature, sunlight, and corrosive solution concentration. Corrosion in a cycling environment can be very different from corrosion in a continuous cycle, in terms of both the chemical reactions and the type of materials that will best resist corrosion.

As such, many automotive corrosion test methods typically call for exposing specimens to a repetitive cycle of salt spray, high humidity, low humidity dry-off, and ambient conditions. These test methods were originally developed as labor-intensive manual procedures. More recent cyclic automotive test methods, such as GMW 14872, incorporate controlled relative humidity conditions, which are often challenging to obtain in many lab conditions. These test methods sometimes call for a shower/rain step with higher flow than typical fine-mist salt fog. Ramp times are also often tightly controlled.

## CYCLIC CORROSION TESTS WITH UV EXPOSURE

The QUV® accelerated weathering tester and Q-FOG cyclic corrosion testers have outstanding advantages on their own. But when used together, they are revolutionizing corrosion testing, particularly for industrial maintenance paints on bridges and other infrastructure applications.

Ultraviolet light stability of a coating can be a major factor in its corrosion resistance. Research indicates that a test cycle alternating between a QUV accelerated weathering tester and a Q-FOG cyclic corrosion tester can give more realistic results than corrosion testing alone. See ASTM D5894 and ISO 12944 for more information.



## DELIQUESCENT

The presence of electrolytes, or salts, affects corrosion behavior testing in several ways. One mechanism is called deliquescence, which is the formation of liquid water in the presence of salt at relative humidity values less than 100%. The presence of liquid water enhances corrosion, meaning that salts promote corrosion in drier environments than would be possible in their absence. Furthermore, salts dissolve in water, producing ions that participate in corrosion chemical reactions. This phenomenon makes it critical to evaluate corrosion behavior at intermediate relative humidity values (neither fully dry nor fully wet) to capture fully the complex corrosion behavior experienced in outdoor environments.

## RELATIVE HUMIDITY

Continuous salt spray, prohesion, and wet/dry cyclic tests all deliver corrosive forces to test specimens, but cannot reproduce corrosion behavior observed at intermediate values of RH. Since phenomena like deliquescence and galvanic corrosion can lead to significantly different corrosion products and rates under these conditions, control of relative humidity is a key feature of advanced corrosion testing.

Many modern automotive test standards call for precise control and transition of relative humidity values to realistically capture the full range of corrosion behavior experienced outdoors. The Q-FOG CRH is able to meet the conditions called for in these more technically complex standards that can offer improved correlation to real-world exposure.

# Moisture

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The presence of moisture is critical to any corrosion testing. Dry materials rarely experience significant corrosion behavior, even in the presence of electrolytes, so laboratory testing needs to reproduce moisture experienced by materials in service.

## FOG

For over 100 years, corrosion tests have applied salt solution to test specimens by using a salt fog, or mist. These standard range from the earliest simple continuous salt spray tests - still widely used today - to salt fog used in even modern test methods.

In Q-FOG corrosion testers, a fine fog or mist is generated using compressed air and a solution pump. The volume and distribution of fog generated can be controlled by varying air pressure and solution pump speed to meet the quantity and uniformity requirements called for in test standards.



*Fog Nozzle*

## SHOWER

Many modern test standards, particularly for automotive applications, instead apply electrolyte solutions by direct spray, or shower. With a much higher volume than fog, these shower steps re-wet specimens and deliver solution much faster than traditional fog steps.

Q-FOG CRH testers have the ability to produce both fog and shower as standard features (though not simultaneously). Historically, Q-FOG CRH testers have used a stationary shower module located in the center of the chamber to generate shower with proper volume and uniformity. These Q-FOG models are designated with with “-S” for “Stationary Shower Module”.



*Stationary Shower Module*

## TOP-MOUNTED SWAYING SHOWER BAR

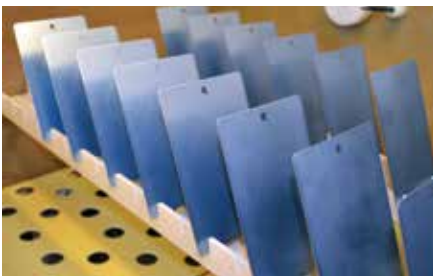
Although the Q-FOG “-S” models are very effective in delivering proper electrolyte solutions, some automotive test standards specifically require that shower be delivered from a top-mounted fixture. The Top-Mounted Swaying Shower Bar (“-T” model, for “Top-Mounted”) satisfies this requirement while providing the same excellent shower coverage as the stationary shower module.



*Top-Mounted Swaying Shower Bar*

# Specimen Mounting

Q-FOG chambers have a low belt line and an easy-opening lid for more convenient sample mounting. Standard rack panel holders are available to accommodate a variety of flat specimen panel sizes. They are available with slots at a 6 degree or 15 degree angle. Hanging rods allow convenient mounting of small, three-dimensional parts and other odd-shaped test specimens. Diffuser-level or rack-level specimen mounting grates can accommodate very large parts, up to 544 kg (1200 pounds) in total weight.



## TEST PANEL RACKS

Standard test panel racks are available to accommodate flat specimens, such as Q-PANEL® substrates. Racks can support up to 113 kg (250 pounds) each, and are slotted at 6 or 15 degrees from vertical. The 600 liter Q-FOG models can accommodate up to 160 specimens, 75 x 150 mm (3 x 6 in) in size, through 8 racks. The 1100 liter models can hold up to 240 specimens, using 10 racks.



## HANGING ROD KIT

A standard hanging rod kit is available for small, three-dimensional, and odd-shaped specimens. Each of the 20 mm (3/4 in) diameter rods can support up to 45 kg (100 pounds), and can be easily installed. The kit contains 6 rods for a 600 liter Q-FOG model and 8 rods for an 1100 liter version. Simple hooks or wire-ties may be used to mount samples.

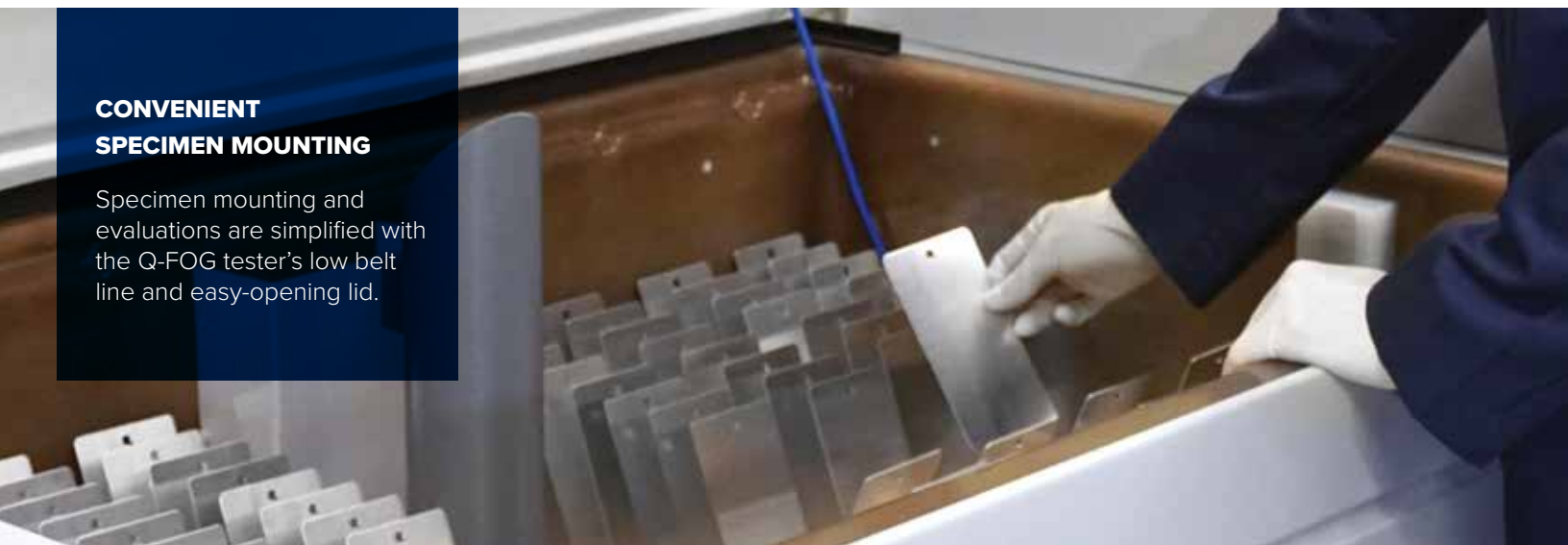


## MOUNTING GRATES

For extremely large or heavy three-dimensional objects (such as metal wheel rims, engine parts, etc.), rack-level or diffusion-level specimen mounting grates may be used. The Q-FOG tester's sturdy construction can support a well-distributed total load of up to 544 kg (1200 pounds), ensuring compatibility with even the heaviest of automotive and other components.

## CONVENIENT SPECIMEN MOUNTING

Specimen mounting and evaluations are simplified with the Q-FOG tester's low belt line and easy-opening lid.



# Maintenance & Calibration

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The Q-FOG tester's chamber temperature sensor (and RH sensor in CRH models) should be calibrated by the user every six months to ensure accurate and consistent results. Calibrating the temperature and RH sensors takes only a few minutes. It requires simple tools, a calibrated reference thermometer, and an insulated container.

Q-FOG chambers are equipped with a routine service timer. Every 1000 hours of operation, a convenient reminder message: "Perform Routine Service" is displayed. During this routine preventive maintenance, the bubble tower (used to saturate the compressed air for atomizing the salt solution) should be drained and refilled. Air and water filters should be cleaned at this time. It is also recommended to clean and wash down the chamber walls and heater. In addition to the 1000 hour inspection and cleaning, filters and peristaltic pump tubing are replaced, which takes only a few minutes.

Direct access to key maintenance or repair items is possible with a removable side access panel. The layout and position of all components in a Q-FOG tester were painstakingly designed to allow easy access for inspection and maintenance. The Q-FOG controller features complete self-diagnostics, including warning messages and automatic safety shut-down. An easy to understand user's manual allows even novice users to perform most troubleshooting.



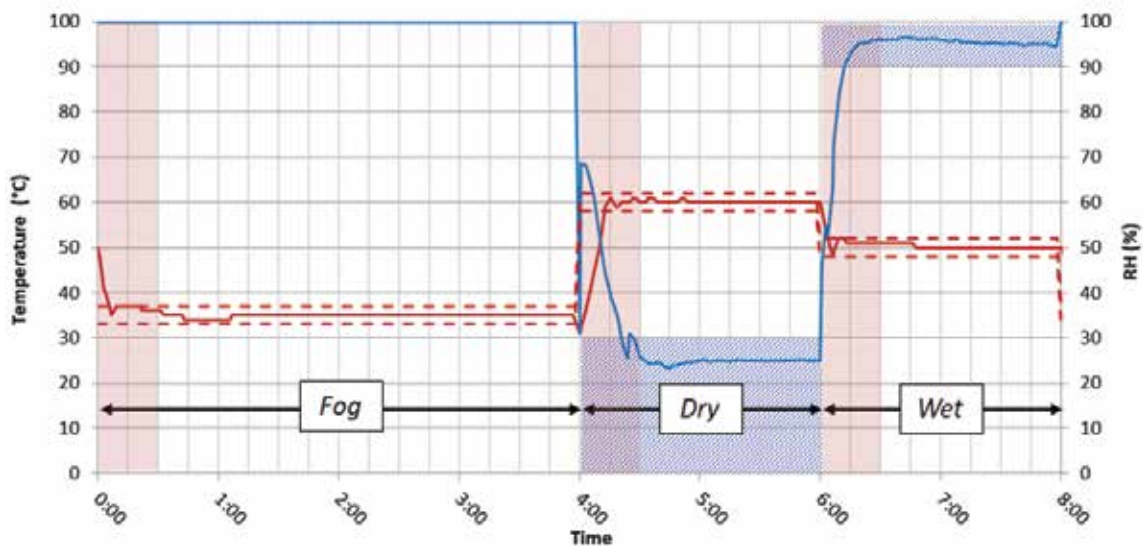
## SIMPLE MAINTENANCE

The layout and position of all components in a Q-FOG tester were designed to allow easy access for inspection and maintenance.

# Standards

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Q-FOG chambers are compatible with most major standards, including Prohesion, ASTM B117, GMW 14872, SAE J2334, and others from Ford, ISO, GB, VW, Volvo, Chrysler, Renault, JASO, etc. The Q-FOG CRH can meet the temperature and RH control requirements of these demanding international test standards, even with a fully-loaded chamber. The graphic below illustrates the Q-FOG CRH tester's ability to perform JASO M609. Several standards come factory pre-programmed for convenience. Refer to Technical Bulletin LF-8131 *Standards Met by Q-FOG Testers* for a more comprehensive list.



# Operation

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Q-FOG cyclic corrosion chambers are extremely simple to operate. Specimen mounting and evaluations are simplified with several specially designed specimen holder options. Programming is intuitive. All models are completely automated and can operate continuously, 24 hours per day, 7 days per week.



The Q-FOG Gen 4 controller can be programmed in 17 user-selectable languages and can store up to 10 test cycles in memory. Q-FOG testers automatically log key performance data that can be viewed remotely with VIRTUAL STRIPCHART (VSC) software. Updates for tester software and access to historic VSC data is available through the convenient USB port.

# Accessories & Options



## START-UP SALT KIT

A convenient salt kit is available, containing a pre-measured and certified quantity of NaCl (530 g) which allows for compatibility with ASTM B117 and ISO 9227. Just add the recommended amount of water to obtain a 5% solution.



## CORROSION COUPONS

Q-PANEL corrosion test coupons ensure repeatability and reproducibility when performing laboratory corrosion testing, and are designed to measure mass loss in order to meet GMW 14872, GM9540P, SAE J2334, SAE J2721, ASTM B117, ISO 9227, and VDA-233-102.



## EXTERNAL FOG COLLECTION CYLINDERS

An optional external fog collection system allows fog collections to be performed without opening the chamber lid and interrupting the test. The volume, salt concentration, and pH of externally-collected fog solution is very consistent with internal collection.



## ACCESS PORT

A 100 mm access port can be used to run electrical cables from equipment located outside of the test chamber to test specimens or equipment inside the chamber. This allows for corrosion testing of devices under test.

# Summary

● Standard ○ Optional

Feature	SSP	CCT	CRH
Two sizes available (600 and 1100 liter)	●	●	●
Performs Prohesion and other Fog/Dry-Off cycles	●	●	●
Performs conventional continuous salt fog	●	●	●
Performs cyclic automotive tests requiring 95-100% humidity	–	●	●
Performs cyclic automotive tests requiring variable humidity control	–	–	●
Internal salt solution reservoir (120 liter)	●	●	●
Internal chamber heaters for fast temperature cycling	●	●	●
Corrosion-free reinforced fiberglass construction	●	●	●
Remarkably simple user interface for easy programming	●	●	●
17 user-selectable languages	●	●	●
Controller with self-diagnostics, error messages, safety shutdown	●	●	●
Automatic VSC data logging and tester diagnostics via Ethernet/USB port	●	●	●
Salt Fog via variable speed peristaltic pump	●	●	●
Dry-Off (controlled temperature with forced air)	●	●	●
Dwell (controlled temperature without forced air)	●	●	–
Viewing window & interior chamber light	●	●	●
Programmable ramp times	–	–	●
Shower module with self-cleaning spray nozzles	–	–	●
Top-Mounted swaying shower bar	–	–	○
Performs automotive tests with fast temperature ramp specifications	–	–	○
Wall Wash Kit (for compliance with Renault ECC1)	–	–	○
Specimen panel racks, hanging rods, and mounting grates	○	○	○
Q-PANEL CX corrosion test coupons for GMW 14872, ASTM B117, ISO 9227, etc.	○	○	○
External fog collection cylinders	○	○	○
Access port (100 mm diameter for wiring access in chamber)	○	○	○
Water booster pump	○	○	○
Wet-bottom adapter kit for ASTM G85 Annex 2 and 3	○	○	○



## OUR GLOBAL NETWORK

We are committed to provide world-class technical, sales, and repair support in each of the 120 countries in which we operate. Visit [Q-Lab.com/support](https://www.q-lab.com/support) for contact information specific to your location and inquiry type.

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