

Corrosion and Chemical Resistance Testing

Preface

MAXMAC evaluates ion modules through salt-mist exposure, flowing mixed-gas corrosion and chemical-fluid contact. Each method defines the exposure, sample arrangement and functional or physical checks used to evaluate the modules.

The three test records cover six salt-mist samples, six mixed-gas samples and ten chemical-fluid samples. All three tests received a Pass judgment. This note brings the methods, original photographs and recorded results together in one document.

Three Exposure Methods

Test	Recorded program	Sample group	Result
Salt-mist corrosion	3 cycles / 3 days; mode 1.2	43#-48#, 6	Pass
Flowing mixed-gas corrosion	IEC 60068-2-60, method 4; 10 days; mode 1.1	31#-36#, 6	Pass
Chemical-fluid resistance	10 fluids; 23 °C / 24 h; mode 1.2	49#-58#, 10	Pass

Table 1 Test programs and sample groups from the corresponding execution records.

What the Checks Evaluate

Salt mist: function following repeated salt-mist and humid exposure, together with exterior and sequence-end internal inspection records.

Mixed gas: function following exposure to four corrosive gases. Copper-coupon mass measurements provide a separate record of the corrosive atmosphere.

Chemical fluids: surface and marking condition after contact with each recorded fluid, followed by functional inspection.

Functional Acceptance

The corrosion procedures specify **Class A** after testing: working current ≤ 0.1 A (100 mA), normal function and ion generation. The chemical-fluid record also reports Class A following exposure.

From Exposure to Result

1. Identify each sample and retain its original condition photographs.
2. Apply the defined environmental exposure or chemical fluid.
3. Complete the recovery or conditioning steps stated for the method.
4. Inspect the sample and verify function. Retain the photographs and test judgment.

Test Basis and Laboratory

Q/MAT 5502-2023:

9.9.2 Salt-mist corrosion

9.12 Flowing mixed-gas corrosion

11 Chemical-fluid resistance

Testing: Zhejiang Kezheng Electronic Information Product Inspection Co., Ltd.

Source records: Leg6 pp. 24-52; Leg4 pp. 73-83; Leg7 pp. 20-53.

Salt-Mist Corrosion: Exposure, Recovery and Inspection

Three-Cycle Exposure Program

Parameter	Recorded condition
Method	IEC 60068-2-52; test method 2
Samples	43#-48#; six modules
Operating mode	1.2; unpowered, harness connected
Installation	Simulated vehicle mounting angle
Salt-mist phase	35 ± 2 °C for 2 h
Humid phase	40 ± 2 °C; 93 ± 3% RH for 22 h
Repetition	3 cycles over 3 days

Cycle duration: 2 h + 22 h = 24 h.

Three-cycle duration: 3 × 24 h = 72 h.

Post-Exposure Conditioning

The execution sheet specifies rinsing with distilled water below **35 °C for 5 min**, removing water by hand shaking or an air jet, drying at **55 °C for 1 h**, and then cooling for **more than 1 h and less than 2 h**.

Recorded Result

The test result states that the samples met **Class A**. The group received **Pass**. The report retains exterior, functional and opened-module inspection photographs for samples 43#-48#.

The acceptance checks also cover sealing function and legibility of marks and labels. The procedure places opening and internal corrosion inspection at the **end of the full test sequence**.

Dates: 11-14 July 2025.

Sources: Leg6 p. 24; execution pp. 38-52; internal photographs pp. 42-45; final function pp. 49-51.

Original Chamber Arrangement

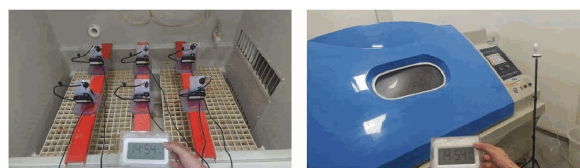


Figure 1 Original mounting and salt-mist chamber, source p. 38.

Sample 43#: Final Function



Figure 2 Original electrical, ion-output and monitoring checks after the test, source p. 49.

Sample 43#: Internal Inspection

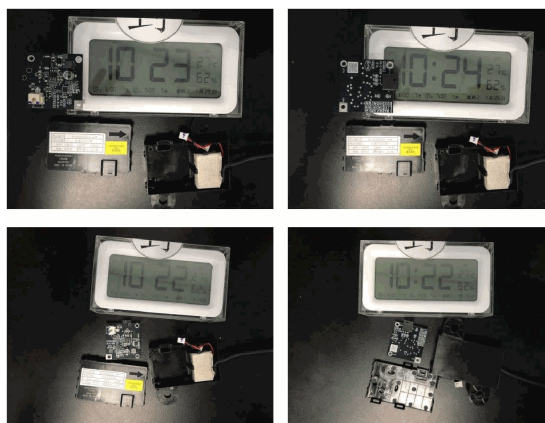


Figure 3 Original opened-module photographs from the sequence-end inspection, source p. 42.

Flowing Mixed-Gas Corrosion: Atmosphere and Method

Exposure Conditions

Parameter	Recorded condition
Method	IEC 60068-2-60, method 4
Execution duration	10 days
Operating mode	1.1
Samples	31#-36#; six modules
Clearance	>10 mm between samples
Temperature setup	Stabilize at 25 °C before gas introduction

Four-Gas Composition

Gas	Concentration (ppm)
SO ₂	0.2
H ₂ S	0.01
NO ₂	0.2
Cl ₂	0.01

Table 2 Gas concentrations in the recorded procedure, source p. 77.

Atmosphere Control

Introduce chlorine into the humid airflow first and stabilize its concentration for at least **2 h**. Introduce the remaining gases and adjust temperature, humidity and concentrations. Exposure timing begins when all four gases are present.

Arrange samples and copper coupons uniformly, without contact or shielding of the test atmosphere. Establish the chamber conditions to prevent condensation during sample introduction.

Original Chamber and Sample Setup

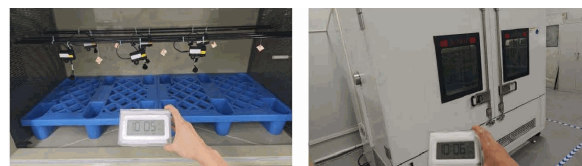


Figure 4 Original sample suspension and chamber exterior, source p. 75.

Copper-Coupon Monitoring

Expose copper coupons with the modules. The procedure calls for a balance with **0.01 mg resolution** and uses coupon mass increase to monitor the corrosive atmosphere and test repeatability.

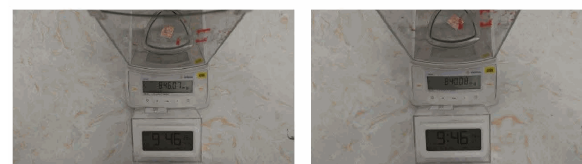


Figure 5 Original copper-coupon weighing photographs before exposure, source p. 78.

Completion and Functional Check

At the end of exposure, stop the other gases while maintaining chlorine flow long enough to clear them from the chamber. Recheck chlorine concentration, then complete the module functional inspection.

Physical acceptance: no exterior damage and no abnormal loose-part sound during shaking.

Recorded outcome: Class A; overall Pass.

Dates: 4-14 July 2025.

Sources: Leg4 pp. 73-83; execution duration p. 75; atmosphere and result p. 77.

Mixed-Gas Results: Copper Coupons and Module Function

Copper-Coupon Measurement Results

Coupon	Before (mg)	After (mg)	Mass gain (mg)	Daily gain mg/(dm ² ·d)
1	846.07	848.80	2.73	1.82
2	840.08	842.10	2.02	1.35
3	837.85	840.10	2.25	1.50
4	838.77	841.60	2.83	1.89
5	835.68	837.80	2.12	1.41

Table 3 Original copper-coupon results transcribed from Leg4 p. 79. Daily gains are the values reported in that table.

Mass gain: $\Delta m = m(\text{after}) - m(\text{before})$.

Example, coupon 1: 848.80 mg – 846.07 mg = 2.73 mg.

Original Copper-Coupon Records

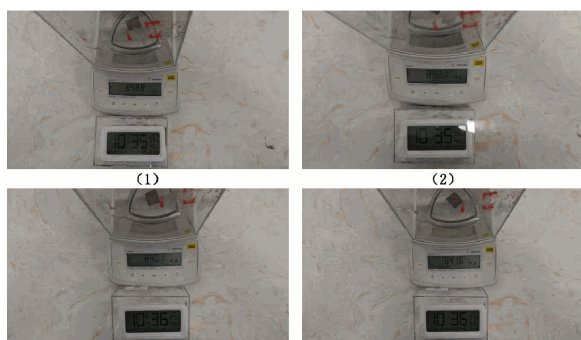


Figure 6 Original post-exposure weighing photographs, source p. 79.

	1#	2#	3#	4#	5#
实验前质量mg	846.07	840.08	837.85	838.77	835.68
试验后质量mg	848.80	842.10	840.10	841.60	837.80
累计增量mg	2.73	2.02	2.25	2.83	2.12
每日增量 (mg/(dm ² ·d))	1.82	1.35	1.50	1.89	1.41

Figure 7 Original before/after mass and daily-gain table, source p. 79.

Sample 31#: Post-Test Function

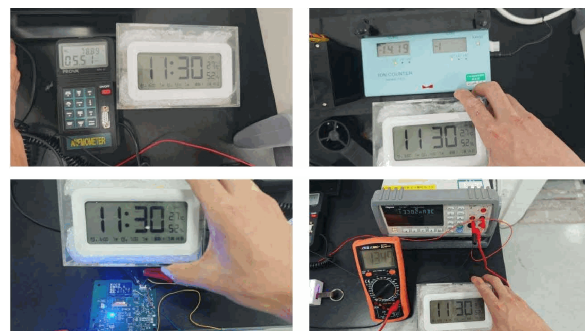


Figure 8 Original air-speed, ion-output, module-monitoring and electrical checks, source pp. 79-80.

Check	Recorded outcome
Functional status	Meets Class A
Sample group	31#-36#
Overall judgment	Pass

The source retains final functional photographs across pp. 79-82 and the test conclusion on p. 83.

Chemical-Fluid Resistance: Ten Recorded Exposures

Fluid-to-Sample Assignment

Sample	Chemical fluid
49#	Battery electrolyte
50#	Interior cleaner
51#	Glass cleaner
52#	Acetone
53#	Ammonia-containing cleaner
54#	Denatured alcohol
55#	Artificial perspiration
56#	Cosmetics
57#	Beverage / coffee
58#	Cream / coffee creamer

Table 4 The ten fluid assignments in the execution table, Leg7 p. 42. Every row records 23 °C / 24 h.

Contact and Aging Procedure

1. Prepare the specified chemical fluid and identify the assigned module.
2. Apply the fluid to the module surface in mode 1.2. Use a separate exposure area for each different fluid.
3. Store at 23 °C for 24 h.
4. Visually inspect the module, then complete the functional checks.

Original Fluid Application Setup



Figure 9 Original setup for battery electrolyte (49#) and interior cleaner (50#), source p. 35.

Method and Acceptance

The execution record references **ISO 16750-5:2010** and **Q/MAT 5502-2023, section 11**. Ten modules, 49#-58#, were assigned to the ten recorded fluid exposures.

The post-test requirement is **Class A**. The module must retain normal operation, including sealing function, and its marks and identification must remain legible.

Recorded Test Outcome

The result states that the modules met Class A, showed no change detrimental to normal operation, and retained clear marks and identification. The test conclusion is **Pass**.

Exposure duration: 24 h for each fluid.

Execution dates: 26-27 June 2025.

Sources: Leg7 p. 20; execution method p. 35; fluid table and result p. 42; conclusion p. 53.

Functional Verification and Source-Record Index

Sample 49#: Battery Electrolyte

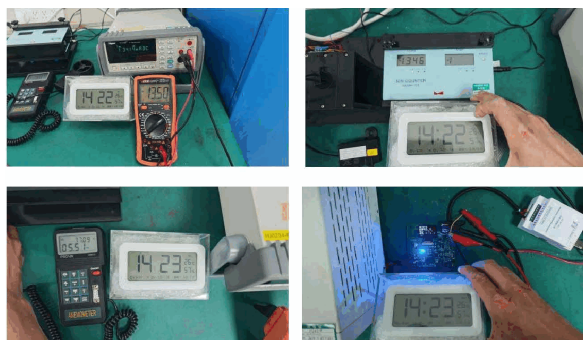


Figure 10 Original pre-test functional check: current, ion output, airflow and monitoring, source p. 42.



Figure 11 The same sample after the chemical-fluid exposure, source p. 47.

Recorded Chemical-Resistance Result

The ten-sample group received **Pass**. The source result records Class A function, no detrimental change to normal operation, and legible marking and identification.

Sample-Level Photograph Index

Test / sample	Original final record
Salt mist 43#	Leg6 p. 49
Salt mist 44#-46#	Leg6 pp. 49-50
Salt mist 47#-48#	Leg6 pp. 50-51
Mixed gas 31#-32#	Leg4 pp. 79-80
Mixed gas 33#-35#	Leg4 pp. 80-81
Mixed gas 36#	Leg4 p. 82
Chemical 49#-50#	Leg7 pp. 47-48
Chemical 51#-52#	Leg7 pp. 48-49
Chemical 53#-54#	Leg7 pp. 49-50
Chemical 55#-56#	Leg7 pp. 50-51
Chemical 57#-58#	Leg7 pp. 51-52

Table 5 Page locations for sample-level final functional photographs.

Recorded Results at a Glance

Test	Function	Result
Salt mist	Class A	Pass
Mixed gas	Class A	Pass
Chemical fluids	Class A	Pass

Original reports:

Leg6: Kunlun-DVC_R-30.01-P000025455001-006-V1.0

Leg4: Kunlun-DVC_R-30.01-P000025455001-004-V1.0

Leg7: Kunlun-DVC_R-30.01-P000025455001-007-V1.0