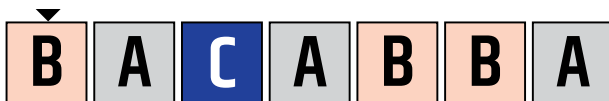
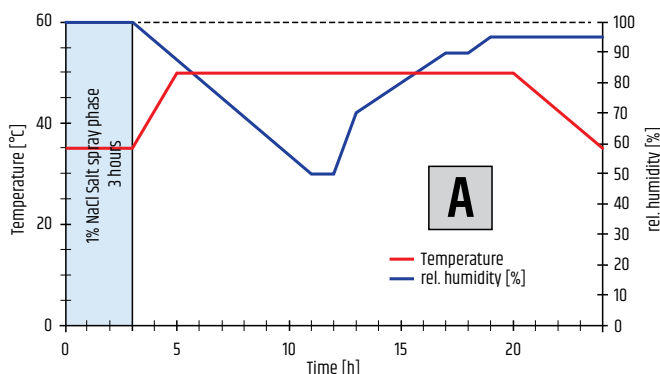
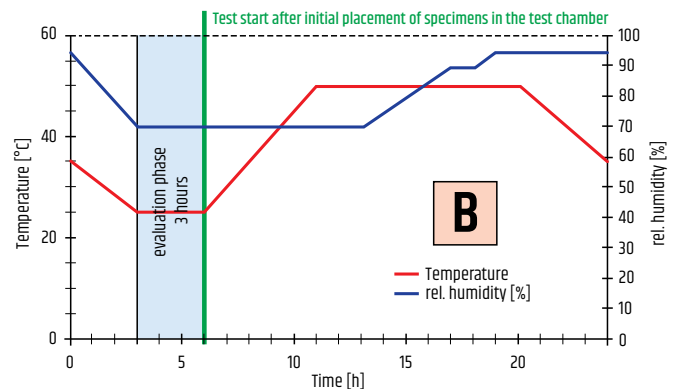
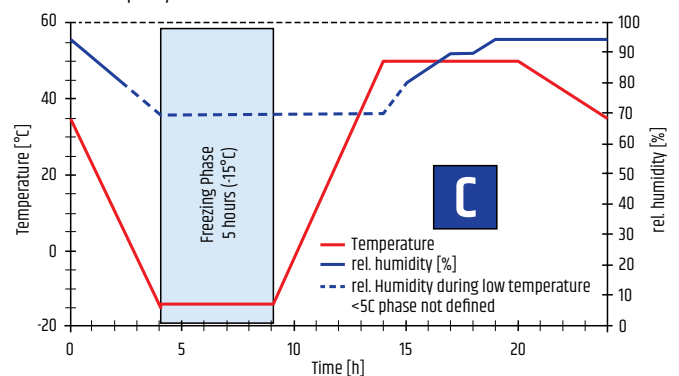


STANDARD: **VDA 233-102**EQUIPMENT: **Ascott Cyclic Corrosion Chambers & Accessories****1. Scope**

- 1.1 This methodology is to be used to perform VDA 233-102 Cyclic corrosion testing of materials and components in automotive construction in an Ascott corrosion chamber. This document should be used in conjunction with the VDA 233-102 test standard document. The test standard takes precedence over this method statement and this method may need to be altered to follow/ comply with the standard.
- 1.2 This method is based on VDA 233-102 June 2013 edition which consist of:
- 3 x 24h cycle A without freezing phase, with 3 h salt spray phase (1 % NaCl solution, pH 6.5 -7.1) - Figure 1
 - 3 x 24h cycle B without freezing phase, without salt spray, including assessment of specimens (or walk-around inspection) - Figure 2
 - 1 x 24h cycle C with freezing - Figure 3
 - The above cycles are repeated in the below order for 6 weeks.

**Figure 1:** 24 h-cycle A, with 3 h salt spray phase (1 % NaCl)**Figure 2:** 24 h-cycle B without freezing phase, without salt spray, with evaluation phase**Figure 3:** 24 h-cycle C, with freezing phase, without salt spray

- 1.3 The tolerances around the set values are as follows:

- Temperature Tolerance $\pm 2^{\circ}\text{C}$
- Relative Humidity $\pm 3\%$
- When temperature ramps are passed through during periods of constant relative humidity, deviations of -8% to +5% relative humidity are accepted.

- 1.4 The chamber will be loaded with test samples as required by the customer or in accordance with VDA 233-102.

2. Instrumentation

- 2.1 All measuring equipment must be calibrated. The recalibration renewal date must not fall within the test duration.

- 2.1.1 The Ascott corrosion chamber should be calibrated for chamber air temperature and relative humidity as a minimum.

If required, the following 'chamber' items may also be calibrated:

- Chamber air saturator temperature.
- Chamber air pressure gauge (atomiser pressure).

2.2 Peripheral devices also should be calibrated prior to use and may include the following:

- **Hand Held pH Meter** - is calibrated using buffer solutions and following manufacturers' instructions. The first solution pH 4.01 and second solution pH 7.01. Tolerance acceptable is +/- 0.01.

Once completed the electrode is rinsed using Electrode Rinse solution. The buffer solution is certified to NIST Standard Reference material.

Hand Held pH Meter (Ascott Accessory No: ACC11)

Digital pH meter, for measuring the pH of salt solution fallout over range 0-14 pH with a resolution of 0.01 pH. Supplied complete with buffers for calibration.

[View all our accessories at www.ascott-analytical.com](http://www.ascott-analytical.com)

- **Salinity Refractometer** is calibrated using Refractometer calibration liquid calibration solution (3.5%).

Salinity Refractometer (Ascott Accessory No: ACC100)

A salinity refractometer optimized to give a direct reading of percentage sodium chloride in the range 0 to 28%, with automatic temperature compensation.

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- **Conductivity meter** is calibrated using standard solution, used for checking the conductivity of the water used for the salt solution.

2.3 The chamber temperature may be continuously monitored if required, using an independently calibrated data logger. For salt spray testing, it may be satisfactory to record the chamber temperature manually using the Ascott chamber display on a daily basis.

2.4 The test should be ran in a single chamber allowing all programmed climates to be run in order to ensure minimal disturbance of the climates. The correct execution of VDA 233-102 requires a programmable test chamber allowing continuous programming of temperature, relative humidity, and salt spray.

2.4.1 Required equipment to run the test as follows:

- Programmable corrosion test chamber
- Using a data logger
- Monitoring of constant testing conditions by means of mass-loss specimens
- Measuring cylinder plus funnel
- pH meter.

2.5 Exposure to Salt Solution

2.5.1 Collection rates are monitored manually using collection vessels placed at sample height. The collection rates are to be within the range of range of $3\text{ml} \pm 1\text{ml} / \text{hr}/80\text{cm}^2$.

2.6 The salt solution exposure is by means of atomisation using compressed air. The air delivered to the spray nozzle must be 'heated and moistened' by passing the air through an air saturator, the temperature of the chamber air saturator is set according to the pressure at the atomiser gauge. (See ISO 9227-2017 for reference).

This test can be ran in its entirety in an Ascott Cyclic Corrosion chamber fitted with an Air Temperature control unit with psychrometric humidity control (Ref ACC29 -20°C) and Additional spray nozzles (Ref ACC25) for the increased fallout requirements.



3. Salt Solution Preparation

CorroSalt for Salt Spray Testing (Accessory No: SALA530)

Highest purity salt for fully compliant testing. For all salt spray testing including the stringent ASTM B117. Available in 25Kg (55lb) drums or bags.



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- 3.1 Salt solution to be prepared in accordance with ISO 9227-2017(E).
- Check that the water conductivity is measured and monitored and is within the requirements of the standard using a conductivity meter. (Less than 20 $\mu\text{S}/\text{cm}$ at 25 °C \pm 2 °C).
 - Salt solution concentration is measured & monitored and is within the requirements of the standard using a calibrated Salinity Refractometer.
 - Salt solution pH is measured & monitored and is within the requirements of the standard using a calibrated pH Meter.

4. Sample Preparation

- 4.1 The test samples should be thoroughly cleaned before testing commences. This should not include the use of abrasives or solvents. This process should be agreed with the customer.
- 4.2 The specimens shall preferably be positioned in the chamber at an angle of 65° to 75° relative to the horizontal with the side to be tested uppermost. Components are to be positioned as agreed with the principal, preferably in the orientation in which they will be installed. The specimens (or components) may not contact each other or shield other specimens from the salt spray.

5. Monitoring of the Test System (Corrosivity Checks)

- 5.1 To ensure reproducibility of test results, it is recommended to check the corrosivity of the chamber

in use each quarter using the mass loss method defined in ISO 9227-2017(E). To verify the apparatus, use at least four reference specimens of 1,0 mm \pm 0,2 mm thickness and 150 mm \times 70 mm of CR4-grade steel in accordance with ISO 3574.

CR4 Grade Steel Corrosion Test Coupon

(Ascott Accessory No: ACC131)

CR4 Grade Steel Corrosion test coupons are used to check the reproducibility and repeatability of the test results for Salt Spray or Cyclic Corrosion Test Chambers, before being used to run ISO 9227 or VDA 233-102.

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- 5.2 The mass-loss specimens are positioned at 65° to 75° relative to the horizontal. The back-side is to be protected from corrosion attack, for example with removable adhesive tape. The removal of the corrosion products is defined in ISO 8407.
- 5.3 The evaluation of the mass loss specimens is performed by weighing the specimens pre and post test. If the average mass-loss of at least 3 mass-loss specimens after 3 cycle testing time is 900 \pm 220 g/m², the test chamber is working satisfactorily.

6. Operation

6.1 Pre-test evaluation

- Run a 12-hour salt spray test with the chamber empty and collection funnels positioned. Record the temperature and ensure it remains in tolerance of 35°C (\pm 2°C)
- Ensure the salt fog collection rates are within the expected range of 2-4ml/hr/80cm². Record all results
- Check that the collected salt solution has a concentration of 10 (\pm 1) g/L
- Check that the collected solution pH falls within the requirement of the standard. Record all results
- If required, adjust the pH of the salt solution within the solution reservoir to offset any change to the pH when collected; so that the collected solution is within requirements of the standard. This may require additional testing to prove results before testing with samples commences

- Create and run a complete 24-hour cycle of cycle C
- Record the profile using an independent data logger or Ascott's logging software (ACC121)
- Verify that the chamber can follow the example test profile and that the transition times and values for temperature and relative humidity are within tolerance of the standard.

6.2 Starting the test cycle

6.2.1 Programme the required test steps ensuring Ramping is set to **ON**.

6.2.2 Test Exposure Conditions

VDA 233-102 - Main Program

Step	Function	Temp	Time (HH.mm)	%RH
0	Sub Prog B			
1	Sub Prog A			
2	Sub Prog C			
3	Sub Prog A			
4	Sub Prog B			
5	Sub Prog B			
6	Sub Prog A			
7				
8				
9				
10				

VDA 233-102 - Sub-Program A

Step	Function	Temp	Time (HH.mm)	%RH
0	Salt Spray	35	00:01	N/A
1	Salt Spray	35	2.59	N/A
2	ATCU	50	02:00	87
3	ATCU	50	06:00	50
4	ATCU	50	01:00	50
5	ATCU	50	01:00	70
6	ATCU	50	04:00	90
7	ATCU	50	01:00	90
8	ATCU	50	01:00	95
9	ATCU	50	01:00	95
10	ATCU	35	04:00	95

VDA 233-102 - Sub-Program B

Step	Function	Temp	Time (HH.mm)	%RH
0	ATCU	35	00:01	95
1	ATCU	25	02:59	70
2	ATCU	25	03:00	70
3	ATCU	50	05:00	70
4	ATCU	50	02:00	70
5	ATCU	50	04:00	90
6	ATCU	50	01:00	90
7	ATCU	50	01:00	95
8	ATCU	50	01:00	95
9	ATCU	35	04:00	95

VDA 233-102 - Sub-Program C

Step	Function	Temp	Time (HH.mm)	%RH
0	ATCU	35	00:01	95
1	ATCU	5	02:23	70
2	ATCU	-15	01:36	N/A
3	ATCU	-15	05:00	N/A
4	ATCU	5	01:32	70
5	ATCU	50	03:28	70
6	ATCU	50	01:00	80
7	ATCU	50	02:00	90
8	ATCU	50	01:00	90
9	ATCU	50	01:00	95
10	ATCU	50	01:00	95
11	ATCU	35	04:00	95

- Position samples within the chamber in accordance of the test standard
- Set the chamber air saturator temperature according to the table within the test standard
- Ensure that no samples 'shadow' other samples and that droplets from one sample cannot fall onto other samples
- Insert clean and empty salt spray collection vessels around the samples within the chamber, preferably at sample height, and never underneath samples or anything else that may drip into them from above
- Start the test cycle and record test parameters at start
- Interruption of the test or opening of the test chamber is only permitted during the evaluation phase (cycle B). The test chamber may not be switched off during this time. No interruption of the salt spray phase is permitted. Longer interruptions of the cyclic climate phases are to be avoided; if unavoidable, they must be mentioned in the test report
- Photographs to be taken prior to starting the test and at customer specified times.

6.3 Quality Control

- 6.3.1 Daily checks to ensure the standard is being followed with variable parameters within limits - Record all parameters.
- Check that the chamber temperature is within acceptable limits (for each part of the cycle if applicable)
 - Check that air saturator temperature is within acceptable limits
 - Check that collected solution is within acceptable limits for fallout rates

- Check the reservoir salt solution is within 1.0% NaCl
- Record the reservoir salt solution pH
- Check that collected salt solution pH is within acceptable limits
- Record the conductivity of the DI water when used.
- Monitor the level of salt solution in the reservoir and ensure that there is enough for the next 24/48 hours. (Allow extra for weekends).

6.4 After Exposure

- 6.4.1 The handling of the tested specimens varies depending upon their material. Refer to the test standard and agree the correct procedure with the customer

Latex gloves must always be worn when handling samples

Photographs of the samples should be taken.

6.5 Deviation Handling

- 6.5.1 General deviations such as downtime, out of tolerance recordings should be noted in the test report, including details of any alterations made.

For further information, please contact us.

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Typical Daily Checks

Hours	Chamber Temp °C	Air Sat Temp °C	Collected ml/hr (2 vessels per atomiser)		Collected Solution pH	Reservoir Salinity %	Pump Speed	Atomiser Air Pressure PSI	Initials	Photos Taken
			1	2						