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Cyclic Corrosion Test (CCT&CRH) Cabinets

For most artificial accelerated tests in laboratory, getting a consistent testing results with outdoor is the most important purpose. Prior to cyclic corrosion testing, conventional salt spray (a continuous salt spray at 35°C), was the most popular way to simulate corrosion in a lab. Because conventional salt spray methods failed to simulate the natural wet/dry cycles of the outdoors, test results frequently provided poor correlation to outdoors. In order to better simulate the complex and changeable external natural environment, cyclic corrosion test has gradually been considered as an important and effective method for the life assessment of industrial products.

The Cyclic Corrosion Test Cabinets is also called CCT&CRH Cabinets. Some industrial products need to be exposed to repeated cyclic salt spray, dry and static environment with high humidity and low humidity. These tests were initially switched between several test chambers manually. The multi-functional Cyclic Corrosion Test Cabinets solves this problem well, and realizes the automatic test of these cycles in a chamber.

In a typical cyclic corrosion cabinets, all specimens are exposed to a series of different environments in a repetitive cycle that simulates the outdoors. Simple cycles, such as Prohesion, may consist of cycling between salt fog and dry conditions. More sophisticated automotive methods may ask for multi-step cycles that incorporate humidity, dry air or condensation, along with salt spray and dry-off.

Within one chamber, users can cycle easily through a series of the most significant corrosion environments. Even extremely complex test cycles can easily be programmed with the controller. Biuged CCT&CRH Cabinets can perform salt spray, Prohesion, and 100% humidity for most cyclic automotive tests.

The Cyclic Corrosion Test Cabinets developed and produced by Biuged sets and controls various parameters through the touch screen, and combines multiple tests such as salt spray corrosion, humidity (high temperature and high humidity, low temperature and low humidity), air drying (hot drying and air drying) to simulate a variety of cyclic corrosion tests. Of course, special cyclic corrosion test can also be simulated through the combination of other accessories. The instrument can also conduct neutral salt spray test (NSS), acetic acid salt spray test (AASS), copper accelerated acetic acid salt spray test (CASS), water spray test, damp heat test, drying test and standard atmospheric environment test separately.



Standards

ISO 4611 《Plastics -- Determination of the effects of exposure to damp heat, water spray and salt mist》

ISO 7253 《Paints and varnishes -- Determination of resistance to neutral salt spray (fog) 》

ISO 9227 《Corrosion tests in artificial atmospheres -- Salt spray tests》

ISO 11493 《Corrosion of metals and alloys - Accelerated testing involving cyclic exposure to salt mist, "dry" and "wet" conditions》

ISO DIN EN 16151 《Corrosion of Metals and Alloys - Accelerated Cyclic Tests With Exposure to Acidified Salt Spray, "dry" and "wet" Conditions》

ISO 16701 《Corrosion of metals and alloys -- Corrosion in artificial atmosphere -- Accelerated corrosion test involving exposure under controlled conditions of humidity cycling and intermittent spraying of a salt solution》

ASTM B 117 《Standard Practice for Operating Salt Spray (Fog) Apparatus》

ASTM B368 《Standard Test Method for Copper-Accelerated Acetic Acid-Salt Spray (Fog) Testing (CASS Test) 》

ASTM B 380 《Standard Test Method for Corrosion Testing of Decorative Electrodeposited Coatings by the Corrodokote Procedure》

ASTM G85 - 11 《Standard Practice for Modified Salt Spray (Fog) Testing》

ASTM D 1735 《Standard Practice for Testing Water Resistance of Coatings Using Water Fog Apparatus》

DIN 50021 《Salt Spray Testing》

Features

1. Cabinet Material

◆ The inner cabinet is welded with imported 1mm high corrosion preventive pure titanium panel, and the outer cabinet is made of 1.2mm stainless steel and the surface is treated with baking paint.

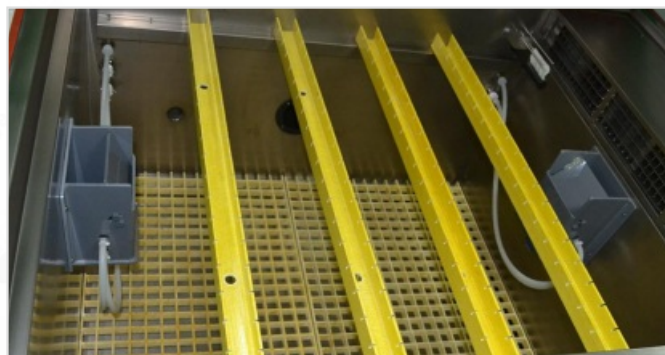
◆ The top angle is 110° , which can prevent condensate water during the test from dropping to specimen surface and affect testing results. Moreover, there is a transparent observing window made of tempered glass (400mm×280mm).

◆ Cabinet Cover Lifting Operation: The cabinet cover lifting is controlled by air cylinder. The lifting speed can be adjusted by air pressure. The operation is easy.

◆ The outer cabinet is sealed with thermostability and corrosion preventive silicone strips to ensure that the corrosive gas in the cabinet does not leak.

◆ Sample Holder: The upper sample holder is a U-shaped slot strip made of corrosion preventive insulating resin material, with evenly distributed bayonets on both sides of each slot strip to ensure that the angle of the placed test piece meets the standard requirements ($20^{\circ} \pm 5^{\circ}$ to the vertical plane); The lower sample holder is a solid and dismountable mesh platform, which is specially used to place workpieces, special-shaped samples or large samples. The platform surface mesh can prevent the accumulation of solution after fog falling, which is also conducive to the air circulation in the instrument. The mesh material is made of reinforced glass steel, and the bearing capacity is $\geq 600\text{kg/m}^2$ (when the samples are evenly distributed). The platform is placed above the heating layer at the bottom of the instrument, about 150mm from the bottom panel of the inner cabinet.

◆ The electrical control part and the working room are left and right integrated structure: the left is the working room, and the right is the dry, damp heat control electrical part. The water and electricity separation structure effectively prevents water from entering the electrical control part to damage the accessories,





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which is safe and reliable.

- ◆ The whole instrument is a desktop structure. The bottom of the instrument is welded with a frame structure with stainless steel square tubes. The bottom is equipped with the mobile Fuhma foot cups to move and positioning the instrument.
- ◆ The rear of the instrument is distributed with a working room drainage hole, a saturation barrel drainage hole, a fog drainage hole, a test hole and an automatic liquid inlet hole.

2.Spray Fog System

- ◆ Spray Solution Supply System: The configured spray solution is stored in the water tank (external type, volume of about 300L), and the spray solution in the water tank is absorbed by the peristaltic pump and supplied to the nozzle. Each nozzle can independently control the supply amount of spray solution. This design avoids nozzle crystallization caused by the traditional siphon spray method.
- ◆ Spray Amount Adjustment System: Self-developed patented technology to precisely adjust the spray amount.
 - ① The peristaltic pump is used to precisely control the flow of spray solution, and the high-precision stepping motor drives the peristaltic pump to work. The operator can adjust the spray solution supply according to the required spray amount, so as to achieve constant spray amount control and water saving.
 - ② The spray pressure of the nozzle can be precisely controlled by the coordinated secondary voltage control, which can achieve the precision atomization and spray the salt fog to the working room to ensure the uniform settlement of the spray solution.
 - ③ The spray amount adjustment baffle is installed above the nozzle, and its opening can be adjusted to control the spray amount.
- ◆ Spray Nozzle: Self-developed patented anti-blocking nozzle, which is made of pure titanium corrosion resistant material, and it can control the spray amount and angle.
- ◆ Spray Amount Monitoring: On the left and right sides of the working room, two $\Phi 100\text{mm}$ fog collectors are installed at 170mm away from the cabinet wall and about 1/3 of the height from the bottom of the cabinet. The end of the funnel is extended to the outside of the cabinet with a hose. A measuring cylinder with a volume of 50ml is installed on the outer wall of the cabinet to monitor the spray fog amount.
- ◆ Spray Fog or Drain-away Fog: Spray fog can be done by manual or setting a program. Draining-away fog also can be run by manual or setting a program (feed fresh compressed air to working room then drain away the fog of the working room quickly).
- ◆ Saturation Pressure Barrel: Also called air filtration heating pressure barrel, it is welded with SUS304# stainless steel, which is used to ensure that the compressed saturated air used for spray is pure and constant temperature. The pressure barrel is designed with a water level control device, a heating device and a temperature control system. At the same time, a circle of compressed air overflow fine holes are uniformly drilled at the bottom of the pressure barrel. The barrel is connected to the oil-water separator of the compressed air source and the pressure regulating valve of the compressed air source. After the compressed air is adjusted to the required pressure, it enters the heating pressure barrel, then enters the water in the pressure barrel through the fine hole at the bottom. Then it becomes the bubbles overflow that supplies the spray nozzle from the top of the pressure barrel. There is a water level probe near the bottom and near the top of the pressure barrel, which can realize automatic water supply and keep the water level of the barrel constant in the specified range. At the same time, the saturation tower has the function of liquid level monitoring and liquid level limit alarm.

3.Temperature/Humidity Control System

- ◆ Heating System
 - ① Salt Spray Cycle Heating: A heating device with titanium tube armouring is installed on both sides of the bottom of the inner cabinet. It adopts thermal radiation heating mode and P.I.D control heating amount, then achieving a long-term temperature

balance.

② Damp Heat Cycle Heating: Titanium tube fin heater is adopted, circulating fan is used for forced air supply and circulation, and P.I.D controls the heating amount to achieve temperature balance.

③ Saturation Barrel Heating: The titanium tube armouring heating tube is used to heat water. Pressured air enter the hot water, then overflow by the bubbles. The P. I.D control heating amount thus getting constant temperature and pure air for spraying.

◆ Humidification System: The humidification method of external boiler is adopted, and the humidification tube adopts pure titanium tube armouring heating tube. The P.I.D output control SSR action controls the heating output. Use a compressor to dehumidify, and the humidity was measured by A class PT100 precision platinum resistance sensor for wet and dry bulb comparison.

◆ Cooling System: Adopts low-temperature cooling compressor imported from Europe (use environment-friendly refrigerant R404a), the system adopts cold balance technology, which can save 30% of electric energy and effectively reduce the use cost. The whole system pipeline was ventilated and pressurized by 22kg leak test. All programs run cooling system are controlled by micro-computer completely. Heating system and cooling system is separated completely. With high or low pressure protection device, it can monitor the pressure of refrigerant when the chamber is working. Once the refrigerant pressure is higher than limiting pressure or lower than the lowest pressure set by system, it can alarm and power off till troubleshoot all problems. And compressor comes with PTC temperature sensor, can protect itself once the temperature is over. At the bottom of compressor, there is a drain pan which is used to collect condensation water generated from frosting.

◆ Air Circulation System: The high temperature resistant long-axis motor circulator can be forced to supply air for circulation. The temperature mixing chamber is installed behind the cabinet, and the circulating air duct, evaporator, humidifying steam outlet and fin heating pipe are installed in the mixing chamber. The louver outlet is installed at the top, and the return air outlet is installed at the bottom. The circulating air blows out from the top louver, passes through the working room, and then recovers the circulation from the bottom.



4.Operation System

◆ Programmable Controller (Touch screen): 7 inches, 800×480 lattice, TFT colorized LCD screen, Chinese / English / Russian free switching. It supports constant temperature salt water spray fog, salt water spraying, high temperature drying, constant damp heat, alternating damp heat, salt spray damp heat cycle and other functions. The operation mode can be program mode, constant value mode or timed start and stop.

◆ Programmable: Spray time and interval time can be set freely, max. continuous spraying time is 9,999 hours, max. spraying time for discontinuous spray is 99 hours and 59 minutes, max. interval time (no spray) is 99 hours and 59 minutes; Can edit 120 programs, each program consists of 1~99 segments. Memory capacity is 1,200 segments and can execute command repeatedly (each command can be executed for 999 times). Different program time can be combined to run, segment time can be set from 1minute to 999 hours.

◆ Data Recording Method: RAM with battery protection, 8-10 years, can save the set value, sampling value and time of sampling time of the instrument; The curve recording cycle can be set to 30 ~ 180 sec. The maximum memory time storage can



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continuously store the historical curve for 90 days. The historical data (when the sampling time is 1min) can be stored for more than 10 years without continuous use.

- ◆ Communication Function: RS-232 interface, RJ45 Ethernet interface and USB interface, which can be used to remote control and assist the instrument after connecting through the professional software. Test data can also be collected through the network (hot plug function, 1G-16G U disk can be inserted to download the historical curve, historical data and control system parameters), and can also control multiple machines at the same time.
- ◆ Open Software Function: It supports the third-party upper computer to send codes, and can control the start, stop and data recording functions of the instrument. The controller provides function code, and the user can edit the upper computer software program to realize unified monitoring and control.
- ◆ Intelligent Function: Intelligent interconnection, intelligent Fuzzy function and ARW start-suppress overrange, intelligent power saving, intelligent extend instrument life function, intelligent up to 28 kinds of output (built-in timer), intelligent humanized control, etc.
- ◆ Power Failure Memory Function: The power failure recovery mode can be set as hot start / cold start / stop.
- ◆ Reserved Startup Function: The startup time can be set at will. After the power is turned on, the machine will run automatically when the time reaches the set time.

5.Safety Protection System

- ◆ Safety Protection System: Cooling System: For compressor, over-heat, over-load, over-pressure and over-temperature protection. Chamber: Over limiting temperature protector, balance pressure automatically protector. Humidifying System: Dry heating protector, water shortage protector for humidifying tube. Heating System: Over limiting temperature protector and short circuit protector for heating tube. Power: Over-load protector, short circuit protector for main power. Over-load protector, short circuit protector. Circulating Fan: Over-load protector, short circuit protector and anti-reversal protector.
- ◆ Working State Display on the top of the Instrument: Cylindrical three color sound-light alarm (with LED lamp beads): The yellow light is on when waiting for startup or operation completion; The green light is always on during normal operation; In case of emergency stop or instrument fault alarm, the red light is on and the buzzer buzzes.



Main Technical Parameters

Ordering Information → Technical Parameters ↓	BGD 886/T	BGD 887/T	BGD 888/T
Working Room Size (W×H×D), mm	1200 × 800 × 1000	1600 × 800 × 1000	2000 × 800 × 1200
Working Room Capacity (no including V shape cover)	960L	1280L	1920L
Overall Size (W×H×D), mm	2500 × 1650 × 1220	2900 × 1650 × 1220	3300 × 1720 × 1420
Power/Max. Current	28.6KW/31A	28.6KW/31A	30.6KW/35A
Power Supply	AC 380V 3 phase 31A	AC 380V 3 phase 31A	AC 380V 3 phase 35A
Temperature Range	20°C ~ 70°C (Continuously adjustable)		
Temperature Uniformity	≤ 2°C(When RH ≥ 75%); ≤ 3°C(When Rh < 75%)		
Temperature Stability	± 0.5°C		
Temperature Rise and Fall Rate	15°C → 70°C ≥ 3°C/min (no-load conditions during whole process average) 70°C → 15°C ≥ 1.2°C/min (no-load conditions during whole process average)		
Humidity Range	20%~98%(Adjustable in P150 range)		
Humidity Uniformity	≤ 2%RH ~ 3%RH(When RH ≥ 75%); ± 5% RH(When Rh < 75%)		
Humidity Stability	± 2%RH		
Salt Fog Precipitation	1ml ~ 2ml/ 80cm ² .h(Adjustable)		
Salt Fog Precipitation Uniformity	± 0.5ml/ 80cm ² .h(Collect 16 hours or more)		
Spray Method	Continuous or Cyclical		
Required Work Environment	Tem: 5 ~ 30°C; RH: 45% ~ 85%RH; Barometric Pressure: 86kPa ~ 106kPa		
Required Air Supply	Air consumption: 4m ³ /h, Pressured air without water and oil which has been dried and filtered, pressure is (0.4 ~ 0.8)Mpa.		
Required Water Supply	It meets the secondary water standard specified in ISO 3696 water specification and test method standard for analytical laboratory. The water supply pressure is within the range of 0.1MPa~0.4MPa. The instrument reserves 1/4" internal teeth for water supply interface. Note: Distilled water or deionized water is required for preparing spray solution, water consumption is near 60L/24hour under continuous spraying.		
Exhaust and drainage	The exhaust pipe of the instrument shall be extended to the outdoor designated position, and shall be led out of the room through opening in the wall near the instrument installation. The exhaust pipe shall not be kept unblocked without water. The exhaust pipe diameter shall be Φ 50mm; The instrument drainage pipeline shall be extended to the outside, and the drainage pipeline shall be unblocked. The drainage outlet shall be lower than the instrument drainage outlet, and the drainage pipe diameter shall be Φ 1/2".		

Note: Temperature uniformity and stability datas are tested under 25°C environment temperature, RH ≤ 85% and no any samples