Operating Manual

FULLY AUTOMATIC MultiCORR® CORROSION TEST CABINET

Type MultiCORR® 3500-FL

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VLM GmbH - Business Unit Corrosion Test Equipment

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Contents

1. Introduction

1.1. Purpose of this document

This operating manual introduces the users/ operator of the VLM Corrosion Test Cabinet with:

- the working principle of the test device
- the operation of the cabinet
- safety instructions
- maintenance

The operation manual should be always at hand.

This type of the corrosion test cabinets have been developed to carry out salt spray tests according to ISO 9227 as well as for condensed water tests pursuant to ISO 6270-2 part 1, controlled humidity, forced drying and other international standards. Please see further details in the corresponding standard specifications.

Please read this operation manual thoroughly before starting using the unit.

The operating manual instructs the operator to handle this test cabinet with safety and only for the purpose it is designed for. Knowledge of the relevant chapters is an imperative for the safe and correct use. For this reason operators are obliged to get familiarized with the safety instructions and operating conditions in order to avoid personal injury and material damage. All claims and liabilities will be rejected if their cause is incorrect operation and/or incorrect use.

Necessary maintenance works may only be carried out by personnel of VLM or their representatives. Otherwise all claims and liabilities will be rejected.

Our indications are based on the state of our current knowledge.

The information in this manual is subject to technical alterations!

1.2. Operators

VLM corrosion testing instruments may only be operated by personnel instructed and authorized by the owner.

1.3. Note to the Reader

Dear reader,

Our operating instructions are updated regularly. You will find the latest version on our website www.vlmgmbh.de. You help us with your suggestions for improvement to form a most user-friendly operating manual.

Let us know your suggestions by e-mail info@vlmgmbh.de or fax +49 5205 87 963-50.

2. Basic Safety Instructions

2.1. Safety Symbols

The following designations and symbols are used for safety indications throughout this manual:

DANGER!
Immediate danger to life and health of persons. Ignoring these indications can result in severe health hazards.

WARNING!
Possibly dangerous situation. Ignoring these signs may result in slight injuries or causes material damages.

IMPORTANT!
Important indications for the correct use of the unit and other useful information. Ignoring these signs may result in material or surrounding damages.

2.2. Obligations and liabilities

Please observe the indications in this operating manual!

A precondition for the safe and trouble-free use of the VLM corrosion testing instrument is the knowledge of the basic safety instructions. This operating manual, especially the safety indications, have to be followed by all persons who work with this unit. Furthermore, the local regulations and instructions of accident prevention apply as well.

2.3. Safety First

The devices are equipped with electrical and mechanical protectors. They were subjected to a strict safety rules and they all passed acceptance test.

However, incorrect use can:

- threaten life and body of the operator
- damage the instrument and the operator´s property
- diminish the instrument´s operating efficiency

All persons concerned with the installation, commissioning, operation, maintenance and repair of the instrument must:

- be appropriately qualified
- respect follow the rules and instructions provided in this manual

Please resolve any problem that can affect the safety immediately.

2.4. Correct Use

The unit is intended exclusively for the performance of salt spray tests (DIN EN ISO 9227) as well as condensed water test according to DIN EN ISO 6270-2 part 1 Constant Water Condensation.

The instrument was specifically developed for this purpose and must not be operated in a manner in which it was not intended to be used.

Important!

The conditions mentioned in this manual concerning operation and maintenance must be strictly obeyed.

2.5. Authorized Operators

- Only approved persons are allowed to operate the instrument
- The minimum age of operators is 18
- The operator is responsible for third parties within working area
- The areas of responsibility for the different activities in the relation with the instrument must be clearly defined and observed. Ambiguous areas of competence are a safety risk

The owner of the test device must:

- Make this manual accessible to the operator
- Check that the operator has read and understood this manual
- Provide the necessary personal protective equipment
- Make sure that the operating manual is kept nearby the test unit at all times
- The general as well as the local regulations for accident prevention must be accessible and followed
- All safety and danger instructions must be kept nearby the test unit in a readable condition and renewed if necessary

2.6. Protective Equipment

The unit has the following protective equipment:

- Lockable testing chamber door
- Main switch with thermal overcurrent protection

The protective equipment:

- has been installed for the safety of the operator in the surrounding area
- must, under no circumstances, be changed, removed or by-passed as a result of changes to the instrument

Important:

Attention is drawn to the possible existence of additional local statutory requirements of national institutions responsible for the health and safety of the operators

Figure 1 The door switch

Opening and closing mechanism of the pivoting chamber door is supported by gas springs as well as by a pneumatically driven mechanical system. This system works only by permanently pressing the dedicated switch (up or down) which is located on the control panel (Figure 1). The compressed air supply (6 bar) has to be connected to the test chamber.

This means that the door does not open and close automatically; it has to be supported by the right hand and using the handle.

The pneumatic cylinders are adjusted in a way that there is just enough pneumatic power to press the door against the seal. The chamber is tightly closed without danger that operator's hand gets stuck between the door and

Figure 2 The door hinge

the seal. When operating the door use only the control switch mounted on the control panel. Pay attention to persons or objects which may be in the range.

Please do not loosen the hinges of the door without supervision of VLM personnel or authorised service personnel. Unproper handling may result in equipment damage or human injuries

Should the door not be closing properly please check if the supporting cabinet is fully aligned and in horizontal position.

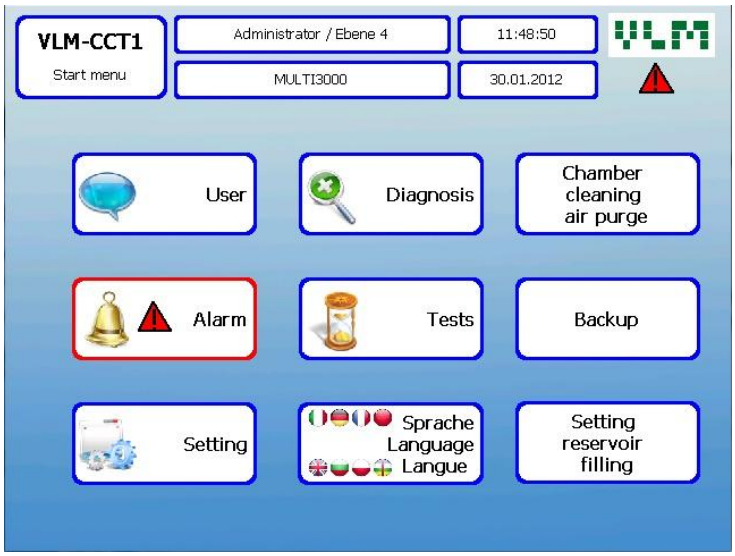

Figure 3 Air purge button on the touch screen

Avoid any contamination of the lab atmosphere by salt fog from the test chamber. When using hazardous chemicals in tests please pay attention to the guidelines concerning the protection of the health of the lab personal. Always use the Air Purge (Figure 3) function (main control menu) before opening the test chamber immediately after the salt spray test has been performed.

2.7. Conduct in the Event of Emergency

In case of emergency turn the main switch immediately to the O setting and disconnect the mains plug.

3. Transport

VLM corrosion test cabinets and accessories are put into fumigated wooden crates thoroughly protected against damages.

Nevertheless check the outer packaging if there are damages such as scratches, cracks, holes which may indicate an impact on the goods. If so accept the consignment only under protest.

Figure 4 Transport with a fork lift

Be careful, when you take the cabinet and accessories out of the crate. If you use a fork lifter you can take the cabinet from the front side as the forks are longer than the depths of the cabinet (Figure 4).

However, if you want to transport the cabinet through narrow doors you should take it from the left hand (heavier) side. In this case we strongly recommend to use wooden bars transversely to the longitudinal axis of the cabinet protect the bottom of the cabinet.

If the cabinet is stored for a longer period of time make sure that the storage room is dry. The temperature should not fall below 0°C.

Important!

Remove all packaging materials such as foam particles from all inlets and outlets. Be aware of all components under the bottom of the cabinet when you transport the cabinet by a forklifting or hand pallet truck.

4. Technical Description

4.1. Operating Range

Temperature range:

Ambient temperature up to + 80 °C

Lower operating than the ambient is possible with an optional external climate module.

Relative humidity (RH) inside the test chamber:

- ca. 100 % RH condensation on the specimens
- controlled humidity ramps
- regulated RH from ambient humidity up to 98% (humidity lower than the ambient is possible with an optional external climate module)
- Ventilation with room air under ambient conditions, heated to 80 °C or air-conditioned (optional external climate module).

4.2. Standard Salt Spray Test Procedure

A specially designed movable spray nozzle made of polycarbonate is placed at the bottom of the test chamber. The nozzle generates a fine fog by spraying the mixture of the compressed air and the test solution. The most commonly used standards such as the DIN EN ISO 9227 or the ASTM B117-73 usually prescribe 5% sodium chloride solution.

Up to 300 liter solution is stored in the separate reservoir on castors inside the lower part of the cabinet. An electronically controlled diaphragm dosing pump is pumping the solution to the spray nozzle at constant flow rate. This flow rate is indicated on the illuminated display on the pump (not available on all models) and is recorded among more relevant test measurements.

A fine moist fog is created in the nozzle by mixing the solution with clean compressed air (0,8 - 1,0 bar) which is saturated with humidity. The humidity is added to the compressed air in the humidifier at 50 °C before entering the nozzle.

Finally, the salt spray condensates on test specimens inside the test chamber (fine moist fog).

Relevant Test Standards

Cyclic Climate Tests:
VDA 621-415
VW PV 1210
Nissan CCT I
Renault ECC1 (dry compressed air or climate module is required)
Volvo STD 423-0014
General Motors GMW 3172

Salt Spray Test:
DIN EN ISO 9227
DIN 50942, DIN 53 167
ASTM B 117-73
ASTM B 287-74
ASTM B 368-68
ISO 7253 ISO 3678
BS 1224, BS 2011, BS3900 F4
BS 3900 F12
BS 5466 Part I
BS 5466 Parts 2 + 3
NFX 41002,
AS 21331 Section 3.1
SIS 1841190
JIS Z 2371

Condensation water test:
ISO 6270-2
BS 3900F2, BS 3900 F15,
ASTM D2242

Literature:
Standards are available from:

Beuth Verlag GmbH,
Burggrafenstr. 6,
10787 Berlin

ASTM International, 100 Barr Harbor Drive,
PO Box C700, West Conshohocken,
PA 19428-2959
United States
Annual Book of ASTM Standards Vol 03.02

4.3. Benefits of the VLM Technology

In conventional test chambers the salt solution is sucked out of constant level vessels by the compressed air. The size of the droplets depends of the pressure of the compressed air.

VLM salt spray cabinets are equipped with an advanced diaphragm pump which allows a very accurate control of the solution flow rate. In this case the flow rate of the test solution does not

depend on the pressure of the compressed air. Moreover, the flow rate and air pressure can be controlled independently. This technique allows the maximum reproducibility of the size of the droplets in the mist which guaranties the reproducibility of the salt spray test.

4.4. Water Condensation Test (CON AIR) According to ISO 6270-2/50014

For compliance with these conditions, the test chamber should be located in a room with normal ambient conditions and without any corrosive ingredients (e.g. not in a chemical laboratory). The room temperature should be 18 °C - 28 °C (according to DIN 50014) and the relative humidity not higher than 75%. Also the test chamber should be protected from draft and direct sun radiation.

In comparative studies, the temperature in the test chamber should be the same as the ambient temperature (23 ± 2) °C according to DIN 50014.

Note: A decrease in ambient temperature it leads to increase the amount of water condensation

Relevant Test Standards

DIN EN ISO 6270-2 CH
(DIN 50017 KK)
BS 3900F2, BS 3900 F15,
ASTM D2247, ASTM G 87-02

Literature:
Standards are available from:

Beuth Verlag GmbH,
Burggrafenstr. 6,
10787 Berlin

ASTM International, 100 Barr Harbor Drive,
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United States
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For the implementation of Cyclic Climate test according to VW PV 1210 the cooling phase should take place under normal humidity (according to DIN 50014). In order to achieve this an optional climate module (Order No. V.850.400.000) is available from VLM which maintains fully compliant air conditions in the test chamber (23 °C ± 2 °C and 50% ± 6% moisture).

According to ISO 6270-2 three phases (Table 1) are defined in the Cyclic Climate test being:

- Water condensation – Constant humidity (CH)
- Water Condensation – Alternating Humidity (AHT)
- Water Condensation – Alternating Humidity (AT)

Table 1 High humidity test procedures

Testing Climate Description		Abbreviation	Duration of a Cycle Total	1. Test Section / 2. Test Section	Conditions of the Chamber after equilibration: Air temperature	Relative Humidity
High Humidity Constant Climate		**CH**		**From heating up until end of the test**	**40 ±3 °C**	**Ca. 100% with condensation on the specimen**
Alternating High Humidity Climate	With change of the humidity and -temperature	AHT (Option)	24 h	8 h including heating up	40 ±3 °C	Ca. 100% with condensation on the specimen
				16 h Including cooling down to ambient (Chamber opened of ventilated)	18 - 28 °C	< 100%
	With change of the air temperature only	AT (Option)	24 h	8 h including heating up	40 ±3 °C	Ca. 100% with condensation on the specimen
				16 h Including cooling down to ambient Chamber closed	18 - 28 °C	Ca. 100 %

The water condensation test is most commonly conducted in the following way. The trough of the test chamber is filled with ±3,5 liter purified water and heated up uniformly to 40 °C. This allows all test specimens in the chamber to have a uniform and constant temperature (± 0,2 °C).

4.5. Controlled Water Condensation System

VLM has developed an innovative CON AIR CWC system equipped with the patented CWC concept (Controlled Water Condensation system - Figure 5). This system allows an accurate regulation of pre-selected condensation parameters such as the temperature difference between the bottom and the roof of the test chamber. This allows a maximum reproducibility and comparability of test results.

During the salt spray phase, the air under the roof saturated with salt fog acts as a heat insulator. This insulation is removed after switching to water condensation phase. The battery of fans installed in the roof construction are pumping the ambient (room) air through the double shelled roof which cools down the air under the roof in order to keep the required vertical temperature gradient of 1 °C between the air under the roof and the air above the water bath in the test chamber. In this way a uniform and reproducible condensation temperature in the test sample zone is controlled to very tight tolerances.

Prerequisites for having such a highly sensitive temperature control system are an advanced software control and a stainless steel construction of the test chamber coated with PTFE. This makes possible to have a fast and uniform heat transfer from the heating grid under the floor and behind the back wall of the chamber.

As a result the CWC concept allows a very good horizontal temperature stability and reproducibility of climate conditions.

By varying the test room and the rooftop cooling temperature various test chambers can be simulated which is important in order to compare test results. In order to do this it is necessary to know the rate of condensation of these test chambers. The way how to determine this is scribed in DIN EN ISO 6270-2.

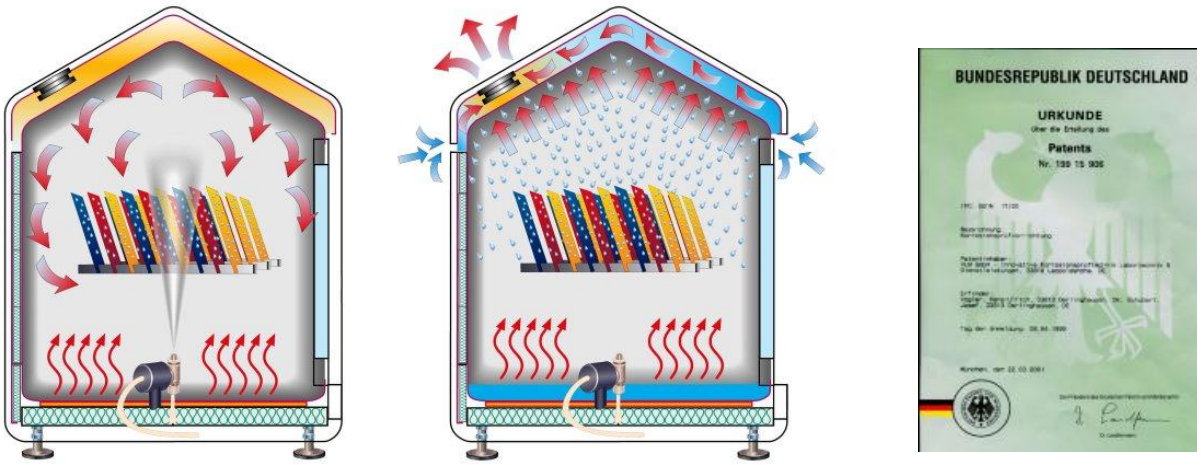


Figure 5 VLM's patented CON AIR CWC method for water condesation

Ventilation in accordance with DIN 50014

VLM Cyclic Climate test chambers are equipped with pneumatically operated valves and ball-valve. For this reason all VLM chambers fully comply with the DIN 50014 requirements in terms of the ventilation and cooling of the ambient air. The specification of the chosen ventilators is

selected such as to resemble the storage conditions in normal environmental conditions. The air can flow into the lower rear part of the test chamber through a specially designed air tube which can be adjusted such as to ensure uniform drying of the test specimens.

Optionally, the test chamber can be equipped with fans with adjustable speed in order to meet specific company standards (e.g. GM).

As mentioned earlier, for the implementation of Cyclic Climate test according to VW PV 1210 the cooling phase should take place under normal atmospheric humidity according to DIN 50014 (climate module is recommended).

4.6. General View of MultiCORR® 3500-FL

Figure 7 shows the front view of the test device.

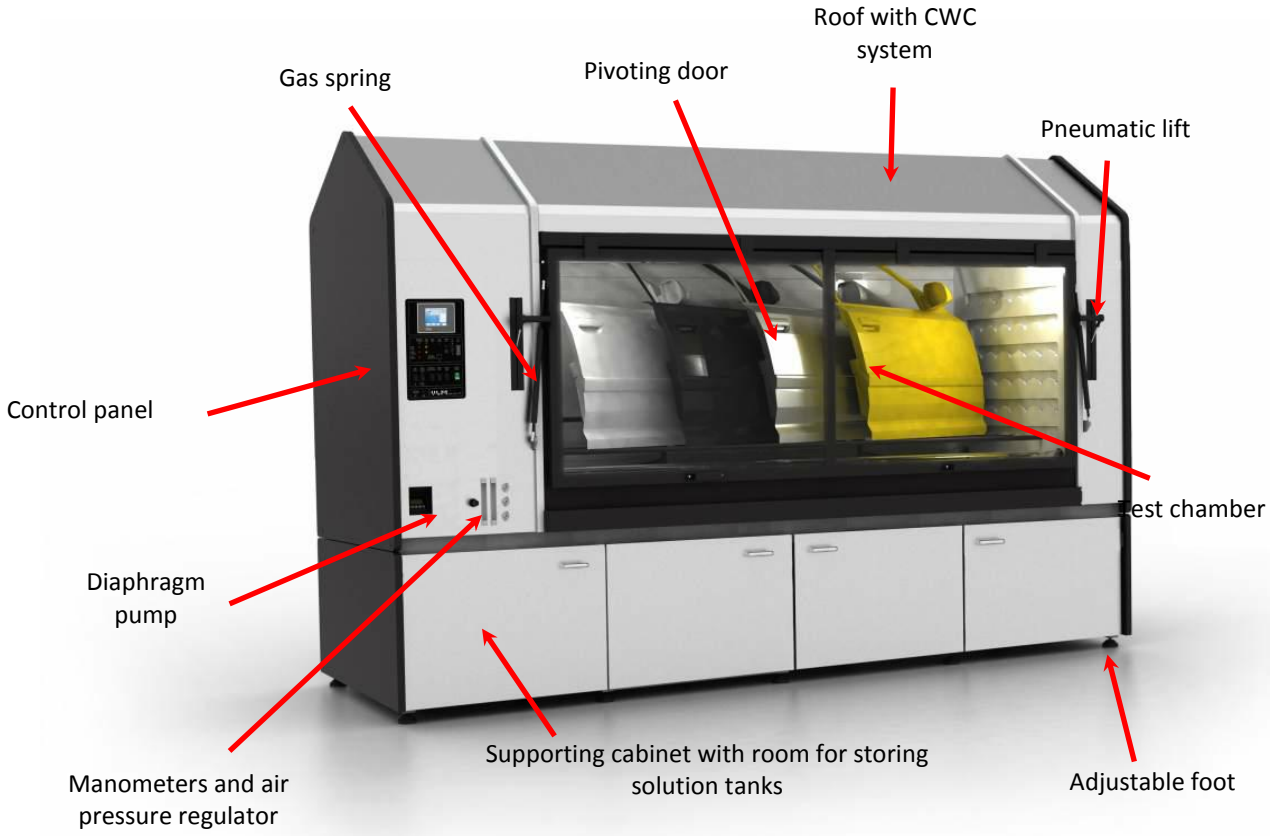


Figure 6 Front view of the test cabinet

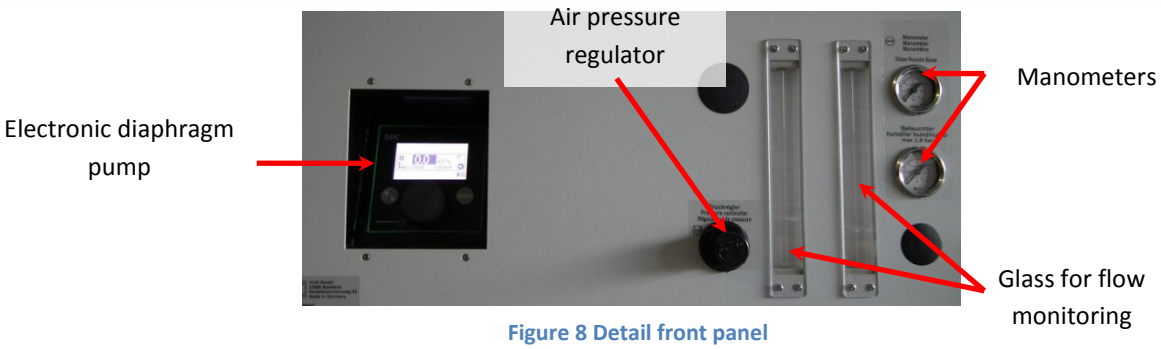


Figure 8 Detail front panel

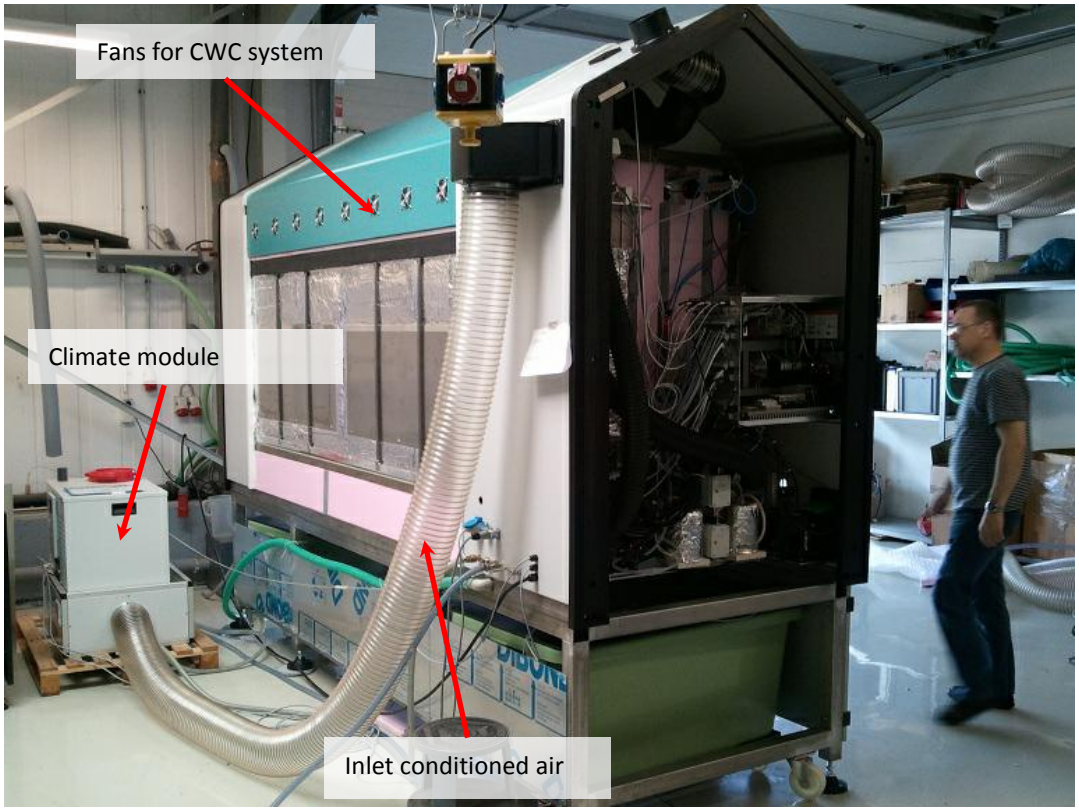


Figure 9 Rear view of the test cabinet

Figure 10 shows the rear view of the test Chest.

Figure 10 Control panel

4.7. Technical Drawings with Dimensions

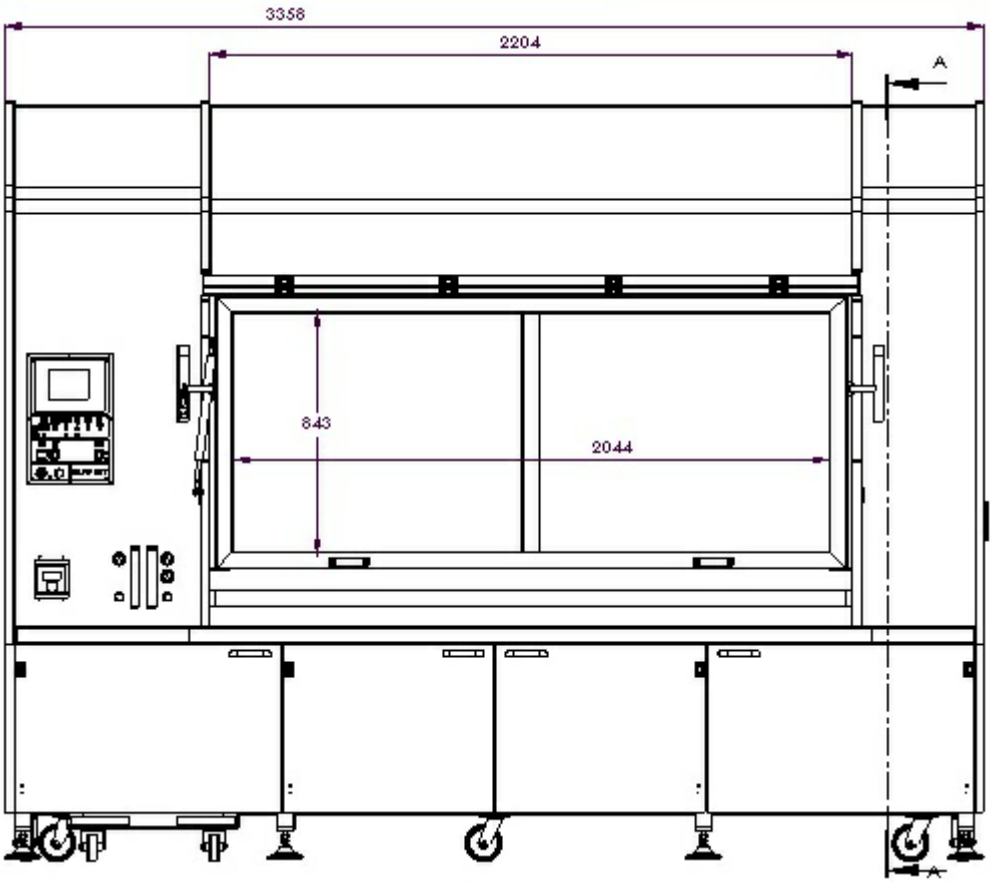
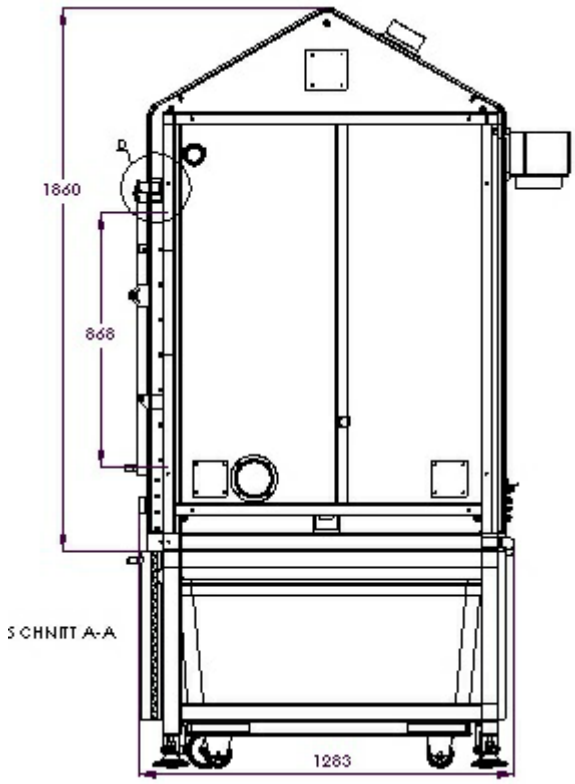


Figure 11 Mechanical dimensions



4.8. Technical Specification

Model	MultiCORR® 3500-FL
Test Chamber (mm):	
Volume test chamber	3500 liter (dm^3)
Dimensions test chamber W/D/H1/H2 (mm)	2200/1100/1000/1400
Outer Dimensions Casing W/D/H (mm):	
Width (mm)	3358/1283/2460
Door opening (mm)	2044 x 843
Heating andregulated humidity	
Operating temperature	Ambient up to +80 °C
Regulated Humidity	Ambient up to 98% RH (not in the full temperature range)
Temperature stability	±0,5 %
Humidity stability	±1 %
Protection	Over-temperature protection
Heating system	Micanite surface heating under the floor and side walls
Sensors	- corrosion resistant and highly sensitive temperature sensors above the floor, at the side wall and under the roof - a mobile temperature sensor in the sample zone, which is relevant as reference sensor for temperature control of the testing room - humidity sensor
Extra temperature control	- wall flushing for rapid climate change
Other:	
Demineralized water (connection type)	< 20µS/cm (¾“ outer diameter)
Tap water (connection type)	Always via Ion-exchangeing cartridge (¾“ outer diameter)
Electrical supply	400V, 10700 W (CEE plug 16A 5P)
Compressed Air	6-8 bar (connection nipple size 7)
Waste water, drain	Pipe fittings (spiral hose ID 32mm)
Power socket for climate module	230V (Schucko)
Exhaust pipe outer diameter	Pipe fitting (75 mm external diameter)
Test solution capacity (option)	Internal tank 10 liter with automatic replenishment from a central supply tank
Communication	Ethernet
Total weight including the bench	1200 kg
Material	Stainless steel coated with ECTFE (Halar®), polypropylene side panels, coated stainless steel rod with plastic Dry cover gasket made of EPDM Foam
CWC System	Double-shell cover with built-in fans for cooling in accordance with the CWC
Opening mechanism	gas springs and pneumatic cylinder for easy and safe opening of the trunk lid
Chamber flushing	Rotary nozzle for flushing the test chamber with clean water
Special	Grommet for electrical cables
Technical Data are subject to amendments!	

4.9. MultiCORR® 3500-FL System Description

4.9.1. Process Control

The process control is implemented by means of a high performance PLC controller with touch screen user interface. Main features are:

- Windows CE operating system, remote control and monitoring possible
- MultiCORR® process control generates optimal test conditions over the entire operating range
- Touch screen with user friendly menu structure
- Data communication via ethernet port
- password-protected access, three user levels
- Accurate control of temperature and humidity with very tight tolerances (0,5%-1%)
- Preconfigured standard tests and cyclic climate tests required in the automobile industry
- Easy programming of new tests with provided test segments
- Manual control of each subsystem for functional testing
- Alarm list with history storing error messages

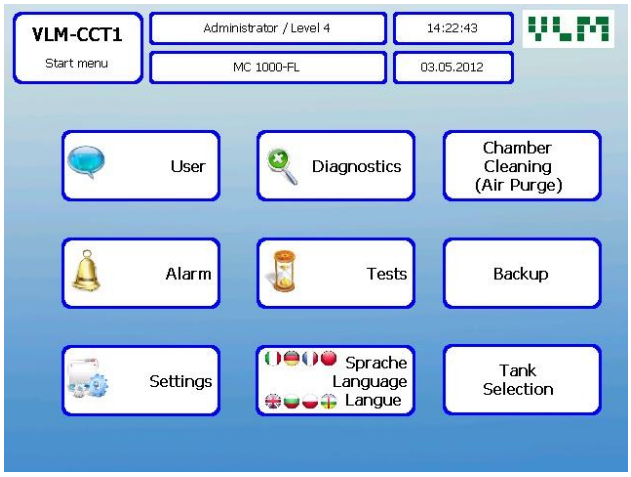


Figure 12 Main menu

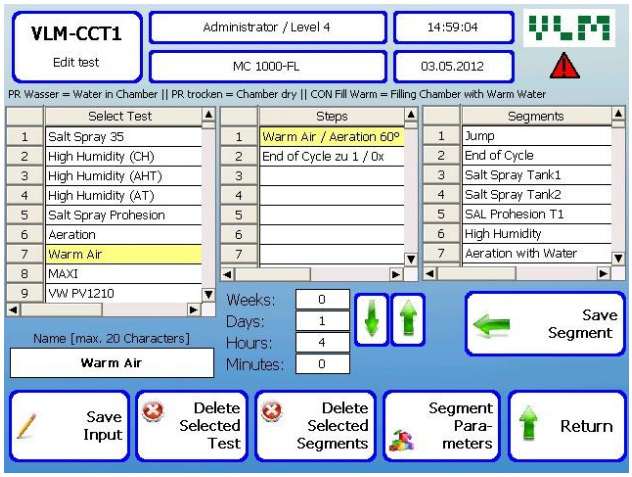


Figure 13 Corrosion test management menu

4.9.2. Operating Mode - Salt Spray

The following components are part of the Salt Spray subsystem:

- Electronically controlled self-venting membrane pump with electronic flow check (flow quantity and bubble detector)
- Hi-end nozzle for two fluids (test solution and compressed air) with adjustable air cap made of polycarbonate with PEEK
- Transparent humidifier of Duran glass with easily replaceable PE-sintered filters for fine distribution of compressed air or full saturation with moisture, automatic water
- automatically and manually activating compressed air to blow out the flushing salt mist from the test area
- Accessories: 1 or 2 tanks for test solution (volume each 200 L),

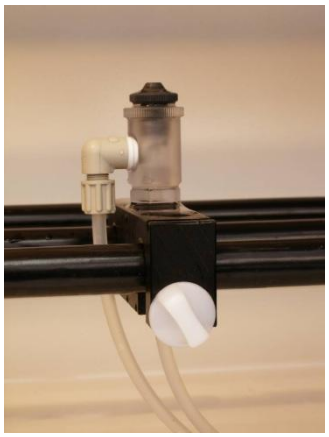


Figure 14 Spray nozzle

covered with lid and on wheels, with optional sensors for the measuring the level of test solution (required for process control)

- Optional: in case of a central supply of test solution VLM offers a 10 L intermediate tank with automatic refill
- Optional: pump for preparing test solution

Figure 15 Humidifier

4.9.3. Operating Mode – Water Condensation

The subsystem for Water Condensation facilitates the following:

- Uniform heating of the water bath (trough) through the special floor surface heating; this results in even evaporation of the water in the bath
- CWC system (Controlled Water Condensation) for controlled condensation
- 100% relative humidity during condensation test
- temperature stability of: ± 0,5 °C

4.9.4. Operating Mode – Regulated Humidity

The subsystem for regulated humidity features:

- a highly sensitive humidity sensor which is pneumatically inserted into the test chamber
- compact steam generator (Figure 16)
- rapid and uniform distribution of moisture by means of two-fluid nozzle

Figure 16 Steam generator

4.9.5. OPTION: Operating Mode – Ventilation / Warm Air

The subsystem for climate control and change consists of:

- adjustable fan for a variable ventilation rate
- adjustable air conductive pipe from heat and cold resistant PVDF material for uniform drying of test samples
- Optional: external climate module (Figure 17) connected to the test chamber for producing a standard room climate (air temperature of 23 °C ± 2 °C and relative humidity of 50% ± 5%), alternatively this climate module can produce dry air with relative humidity <20% at 35 °C (Renault ECC1 test)
- hot air drying to +80 °C

Figure 17 External climate module

4.9.6. OPTION: Operating Mode – Volvo and GM Test

For the purpose of Volvo and GM corrosion tests (STD 423-0014 and GMW 3172 respectively) a dedicated hardware has been added to the MultiCORR® 3500 L cabinet consisting of two pumps

and additional plastic pipes for spraying test solution. The pipes for spraying (Figure 18) are located under the roof.

The Volvo test (STD 423-0014) requires a swivel pipe located in the middle of the chamber under the roof. The swivel angle is about 30°. The corresponding pump is located in the compartment with control systems (Figure 19).

The GM test requires two symmetrically positioned fixed spraying pipes which are able to spray up to 60 liter/min of test solution. The pump with sufficient capacity is located underneath the test chamber and connected to a 130 liter tank with the test solution. The pump, test chamber, reservoir and the pipes are connected in a closed circuit system.

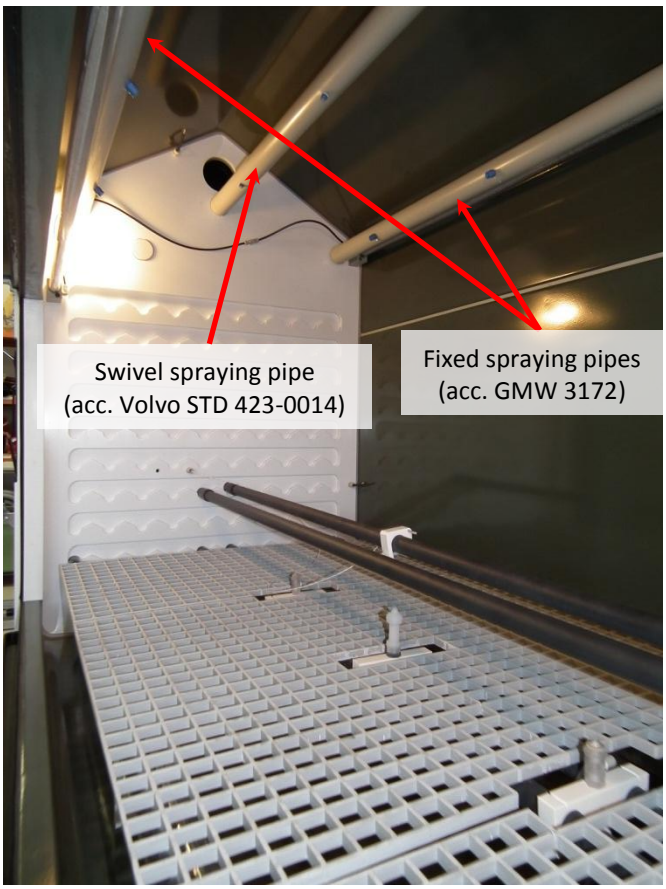


Figure 18 Interior of the 3500 L test chamber

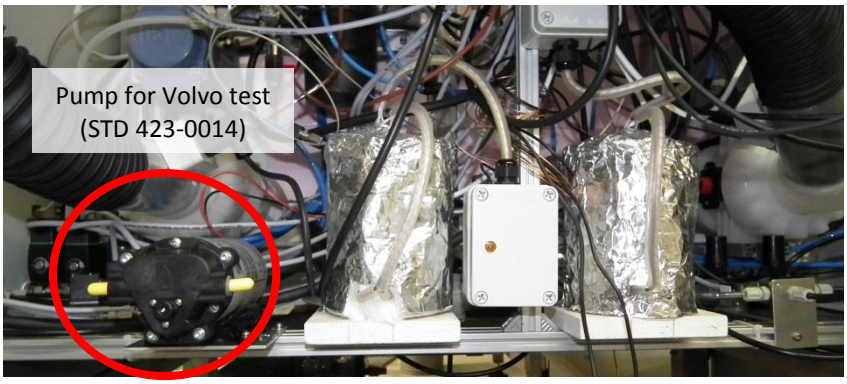


Figure 19 Location of the pump for Volvo test

5. Installation, Connections and Key System Components

5.1. Overview Connections

All inlets for electricity (mains, control) and fluids (purified water and compressed air) are located at the rear side of MultiCORR® cabinet. Also the water drain outlet is located there (Figure 20).

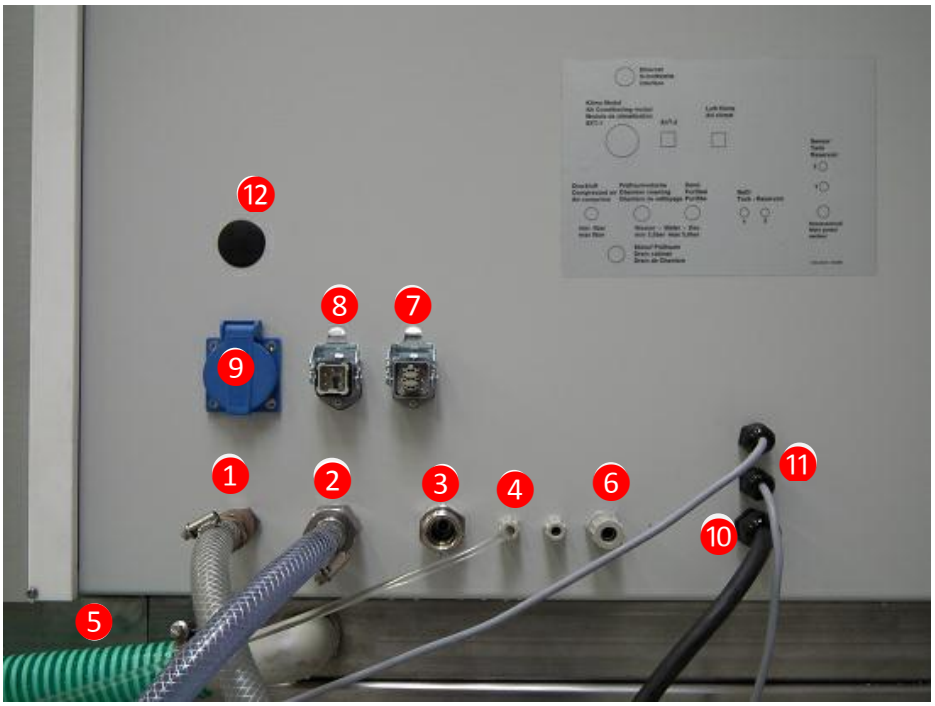


Figure 20 Connections at the rear of the MultiCORR cabinet

Table 2 Legend

		Standard	Pressure	Connection
1	Compressed air	Particle and oil-free (DIN EN ISO 9227)	6-7 bar	Nipple size. 7
2	Demineralized water	0,1 - 20 µS/cm (DIN EN ISO 9227)	2-5 bar	¾" male thread
3	Demineralised or tap water (chamber flushing	< 500 µS/cm	3,5 – 5 bar	¾" male thread
4	Test solution from Tank 1 (free opening for Tank 2)	gem. DIN EN ISO 9227	No pressure	compression fitting
5	Drain water		No pressure	PVC hose Ø 32 mm
6	Demineralised water for swivel tube			Hose
7	Control socket for external climate module			Harting connector
8	Socket for other external device			Harting connector
9	Power socket for external climate module	230 V		AC outlet
10	Mains connection	400 V		
11	Fill sensor of the internal tank or external Tank1 / Tank2			
12	Ethernet socket			optional connector on the back
	Air exhaust (not shown in Figure 20)			PU hose Ø 125 mm

All connections for water supply / water drain as well as electrical connections are in the lower part of the rear panel.

5.2. Demineralized Water Supply

Figure 21 Leakage safety unit

Connection to the cabinet: 3/4" (outer thread)

Water purity: max. 20µS/cm

If there is no central supply of demineralised water an ion-exchanger cartridge has to be installed (Figure 22). The water pressure must be at least 2 bar in order to be able to fill the humidifier. For this purpose a stop cock (with ¾" male thread) for the fresh water supply should be installed in the vicinity of the test cabinet / chest. If there is no floor drain a leakage safety unit (Figure 21) has to be installed in order to avoid flooding in case of a break of the tubing.

A 230 V socket must be also installed in the vicinity of the test cabinet / chest.

It is recommend to always have a spare ion-exchanger cartridge at hand with a quick coupling system. This will prevent interruption of tests when the exhausted cartridge requires replacement.

Figure 22 Ion-exchanger cartridge

Very Important!

Any connection pipe or hose between the water purification plant and the corrosion test cabinet must either be made of stainless steel or plastic for demineralised water is very aggressive to brass, iron or copper and would cause a failure of the humidifier due to contamination by those metal oxides.

Check if all parts are delivered before starting the installation of the water purification plant. Pay attention to the instruction manual of the manufacturer of the ion-exchanger cartridges.

Figure 25 Purified water splitter

Figure 23 Analog conductivity meter

Figure 24 Digital conductivity meter

Important!

If there is no drain in the floor a leakage water safety unit (Figure 21) has to be installed to prevent any damages caused by flooding. In case of a leakage or burst of the hoses the sensor to be placed on the floor will immediately give a signal to the magnetic valve to installed at the water tap thus this will be actuated and close.

1. Mount the delivery unit at the wall thus it is convenient to be operated
2. Mount the quick connector nipples on the ¾“ threads of the outlet / inlet of the cartridge
3. Connect the plastic nipple with the female quick connector and the other side with the hose. Press this female connector on the nipple of the freshwater inlet of the cartridge (indicated on the cartridge)
4. Connect this hose with the fresh water tap resp. to the safety unit
5. Screw the second female quick connector on the plastic double-nipple and the conductivity meter on the other side. Press this unit on the pure water outlet of cartridge (indicated on the cartridge). Connect this unit with the delivery unit by a hose.
6. Connect the delivery unit with the water inlet of the cabinet with a hose.
7. Mount the stop-cock at the delivery unit and push a PVC hose on the outlet of the stop cock
8. Put the plug of the conductivity meter into a socket (230 V).

Figure 26 Ion-exchange cartrige

Important!
Note, that the actual conductivity will only be indicated when the water is flowing. Conductivity meters are shown in Figure 23 and Figure 24

Once you put an ion exchanger cartridge Figure 26 into use pay attention to the fact that the air will be completely displaced by the water. Open the venting screw at the top of the cartridge thus the air can escape. Close this screw after there is only water coming out of the cartridge.

5.3. Drain

The waste water is leaded into a siphon by a plastic hose with 25 inner diameter. In case of CASS solutions regional environmental protection regulations have to be taken into account.

If there is no sufficient downward slope we offer a sewage water pumping system (Figure 27).

Figure 27 Drain water pump

5.4. Compressed Air

According to the standard ISO 9227 the compressed air has to be oil and particle free. For this purpose a maintenance unit has to be installed and connected to the cabinet (Figure 29). There is an inlet nipple of size no. 5.

In case there is no permanent supply of compressed air it is recommended to use a low noise screw compressor (Figure 28).

Figure 28 Air compressor

5.5. Electrical Power Supply

The cabinet is equipped with 2m electrical cord with a plug. For more information please refer to the table with technical data.

Voltage: 230 V, frequency: 50-60 Hz, fault-current circuit breaker,

Recommendation: pursuant to the requirement 3-5 sockets

Figure 29 Water and oil filter for compressed air

5.6. Compressed Air Supply

Figure 30 Compressed air inlet

The pressure of the compressed air should be between 6 and 8 bar which is required for the air purge in order to disperse the salt mist in short time.

Make sure that the compressed air entering the cabinet complies with the requirements of the ISO 9227 and is oil free (0,2 mg/m³) and particle free < 5 µm.

Be aware of shavings in case new pipes have been installed. These particles may enter the inlet valve and block it.

We strongly recommend the installation of a compressed air maintenance unit (Figure 31) which is available as an accessory.

There is a female connector Size 5 to connect the hose (Figure 30).

In case there is no clean compressed air available VLM can supply silent compressors fit to the salt spray cabinets.

5.7. Air Pressure Regulators (Control Panel)

Figure 31 Compressed air filter

Figure 33 shows the part of the control panel with air pressure control. The air pressure in the humidifier and spray nozzle will be regulated by turning the black knob clockwise to increase the pressure and vice versa. We recommend to run salt spray tests at 1.0 bar in the spray nozzle. The cabinet has been calibrated and tested in the factory at this pressure in the nozzle.

Figure 32 Air filter (humidifier)

The manometers (Figure 33) indicate the pressure in the nozzle and before the humidifier. With a new air filter (Figure 32) in the humidifier there is only a small pressure difference of +/-0,2 bar. However in the course of time and depending of the purity of the compressed air the ability of the filter to pass compress air will deteriorate. It is recommended to change the air filter in the humidifier if a pressure difference indicated by two manometers exceeds 0.6 bars.

Figure 33 Air pressure control on the control panel

Never adjust the air pressure before the humidifier to above 1.6 bar otherwise the cap of the filter may be shot off the filter and the safety valve will be activated.

Besides the manometers the compressed air pressure is monitored by the pressure inlet switch and indicated green pilot lamp provided the minimum pressure of 2 bars are exceeded.

If there is no compressed air or does not reach the absolutely minimum of 2.5 bar the test procedure will be automatically stopped.

5.8. Exhaust

The exhaust hose should be connected to a plastic pipe d=125 mm which should be led through the wall into the open air (Figure 34). Please mind that there is no counter-pressure from outside.

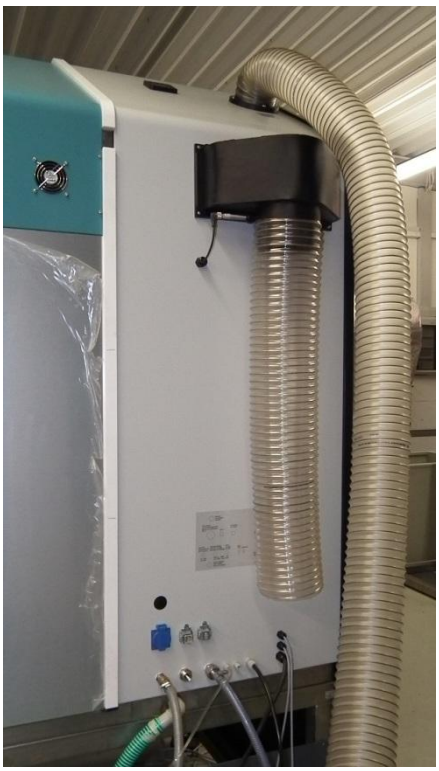


Figure 34 Properly connected exhaust

Please avoid connect the hose directly to the laboratory air conditioning system while the highly corrosive salt fog can spread throughout the building and damage equipment. Also do not connect it to any drainage pipe system because the climate inside the testing chamber could be affected by under- or overpressure.

During the installation fill the gaps inside the spiral hose with silicon adhesive to seal it in order to prevent the condensed liquid to contaminate the case with salt. Pull the end of the hose over the exhaust pipe of the cabinet and fix it with the clamp. Fix the other end in the same way and make sure that the hose will not form a curve which could get blocked with the condensate (Figure 35).

When installing the exhaust piping between the exhaust outlet of the cabinet and the outdoor environment please make sure that there is no segment in the piping which forms siphon effect (Figure 35)

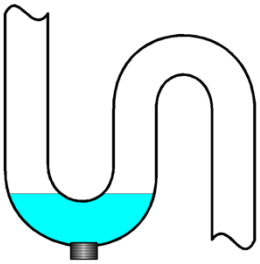


Figure 35 Siphon effect

Should there be no other choice than connecting the exhaust to the laboratory air conditioning system please make sure that the exhaust hose coming from the cabinet has smaller diameter (Δd=5 mm) than the diameter of the local air conditioning system. Slide the hose approximately 20 mm into the venting pipe. In this case the venting pipe will suck only ambient air and will not affect the ambient in the test chamber (Figure 36).

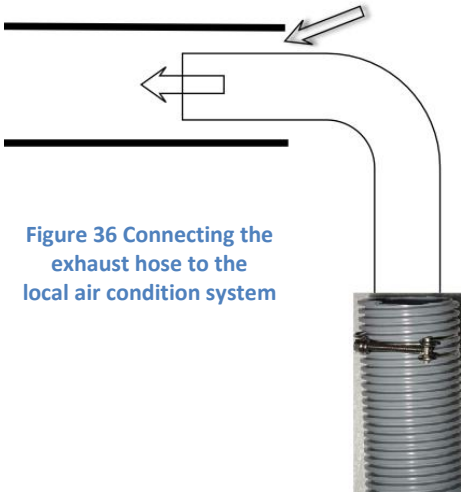


Figure 36 Connecting the exhaust hose to the local air condition system

Attention: The exhaust air of the cabinet may cause corrosion of the cabinet and other equipment if it enters the room.

Before connecting the spiral hose to the end of the exhaust port please apply liquid silicone (see accessories). This will ensure that the condensate cannot leak outside the hose.

The hose end should be secured with stainless steel clamps.

5.9. The Salt Solution Reservoir

Make sure that the external reservoir for solution is clean, otherwise the salt solution filter will be blocked in short time. Always cover the tank with the lid.

Figure 37 Solution filter

Test the function of the cabinet with pure demineralised water instead with the salt solution and adjust the salt spray system (the fall-out rate) to be in compliance with the standard. For this purpose fill the reservoir with ±30 litre demineralised water.

In case of a dual reservoir plant connect the second hose according to the connection scheme in Figure 20. Make sure that the plastic screws are tight in order to avoid any air entering the hose while the solution is being sucked by the diaphragm pump.

Figure 38 External reservoir with test solution

Figure 39 Internal buffer tank (optional)

In this case (dual reservoir) the plug of the automatic switch-over sensor should be plugged into the socket installed at reservoirs.

Note that the red LED is illuminated according to the active reservoir.

Optional:

In case of a centralized supply of demineralized water a small 10 L internal buffer tank (Figure 39) can be used. It is located in the lower area behind the left sidewall. The buffer tank is equipped with automatic refill system which is connected to the central test solution tank.

5.10. Drain Water

The drain pipe should have downward slope in order to allow a free flow of the run-off water. Should this not be possible (e.g. the siphon is on a higher level than the test chamber) it is recommended to install a sewage water pump which is available as an accessory (Figure 40).

Moreover, make sure that over pressure or under pressure will not occur when connecting to the sewage system since this might affect the climate conditions in the testing chamber.

Figure 40 Drain pump

5.11. Power Supply and Safety

Make sure that there are enough sockets to connect the cabinet and the conductivity meter (if a water purification unit is installed). The electrical installation may only be carried out by an expert. The rated voltage of the unit has to be corresponding to the mains voltage. In order to reach the maximum electrical safety a current-operated earth-leakage protection/tripping current 30 mA is recommended.

The following are electrical requirements for ClimaCORR® test chest:

- The MultiCORR® test cabinet requires 3 phase, 380 V mains supply and consumes 6 kW of electrical power

- The conductivity meter in the ion exchange cartridge 230 V
- The water leak detectors 230 V
- Any container of a pump to dissolve the sodium chloride, 230 V
- Any of an air compressor 230 V

5.12. Key System Components

5.12.1. Salt Spray Nozzle

The spray nozzle is mounted in the middle of the two lowest bars in the test chamber. Make sure that the nozzle is tight fastened and that it sprays in the vertical direction.

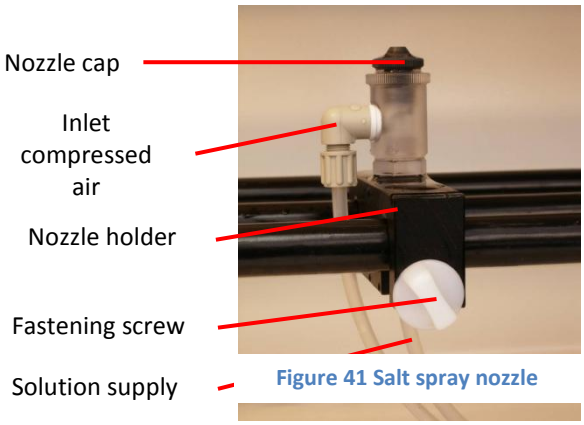


Figure 41 Salt spray nozzle

5.12.2. Diaphragm Pump

The diaphragm pump (Figure 43) is furnished with a head made from polypropylene thus it is resistant to corrosion.

If the pump head is empty or if there are air bubbles the pump may not be able to press the liquid through the valve. In this case the venting screw has to be opened and the pump should be operating for a short period of time so that the air can escape through the transparent PVC venting hose. When the water starts coming out of the venting hose the venting screw should be tightened again. The pump is now ready for normal operation.

Please note that the control wheel on the front side should not be manually operated (Figure 42). In the normal operation the pump is controlled by the controller.

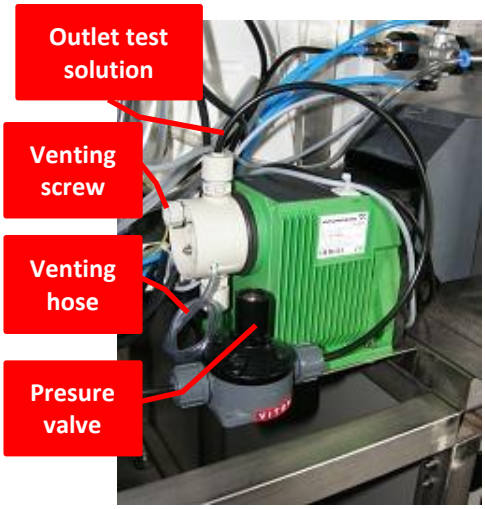


Figure 43 Rear view (pump model might differ)

Figure 42 Front view of the DDE pump model

Figure 44 Front view control panel

5.12.3. Humidifier

According to ISO 9227 the compressed air has to be saturated with moisture. For this reason the air is introduced into the humidifier filled with demineralized water (Figure 45). The air is distributed by the filter with 5µm pores thus small bubbles are formed. If the air or the water purity does not comply with the ISO 9227 the filter will be blocked very soon. In this case the pressure on the manometer “Humidifier” will increase. If the difference to the pressure on the manometer “Nozzle” is more than 0,6 bar, the filter has to be renewed. This can be done by local personnel as described in the chapter service and maintenance.

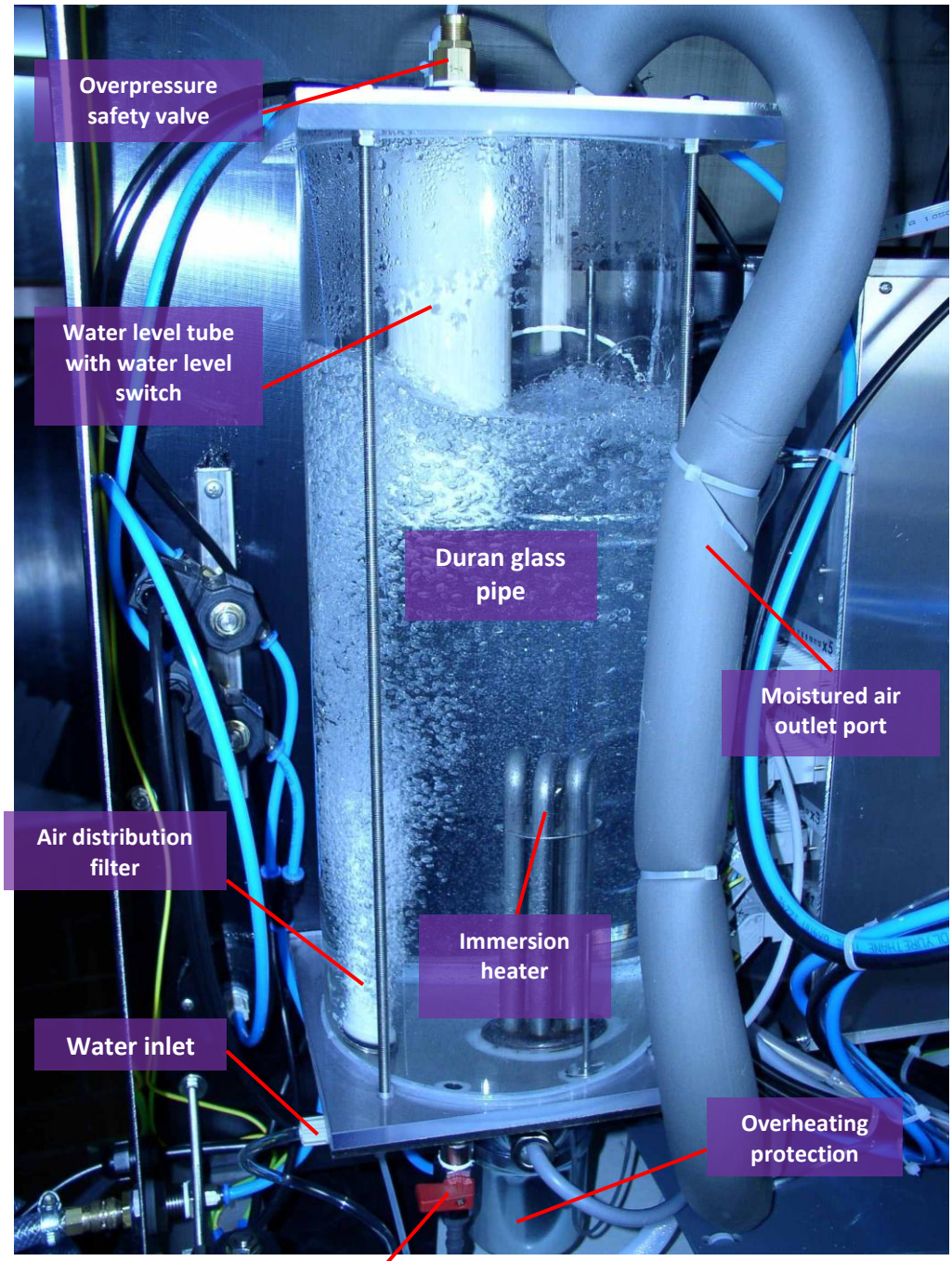


Figure 45 Humidifier and its components

According to ISO 9227 the compressed air has to be saturated with moisture. For this reason the air is introduced into the humidifier filled with demineralized water. The air is distributed by the filter with 5µm pores thus small bubbles are formed. If the air or the water purity does not comply with the ISO 9227 the filter will be blocked very soon. In this case the pressure on the manometer "Humidifier" will increase. If the difference to the pressure on the manometer "Nozzle" is more than 0,6 bar, the filter has to be renewed. This can be done by local personnel as described in the chapter service and maintenance.

Note that the conductivity of the supplied demineralized water must not exceed 20µS/cm. Otherwise hardness builder will fall out and contaminate the humidifier. For proper function watch the conductivity meter on the ion-exchanger cartridge and interchange it in time.

There is only a low consumption of demineralized water (0,5 - 1 liter per 24 h). However if there is no water supply the water level switch indicates low level and the salt spray working system will be cut off.

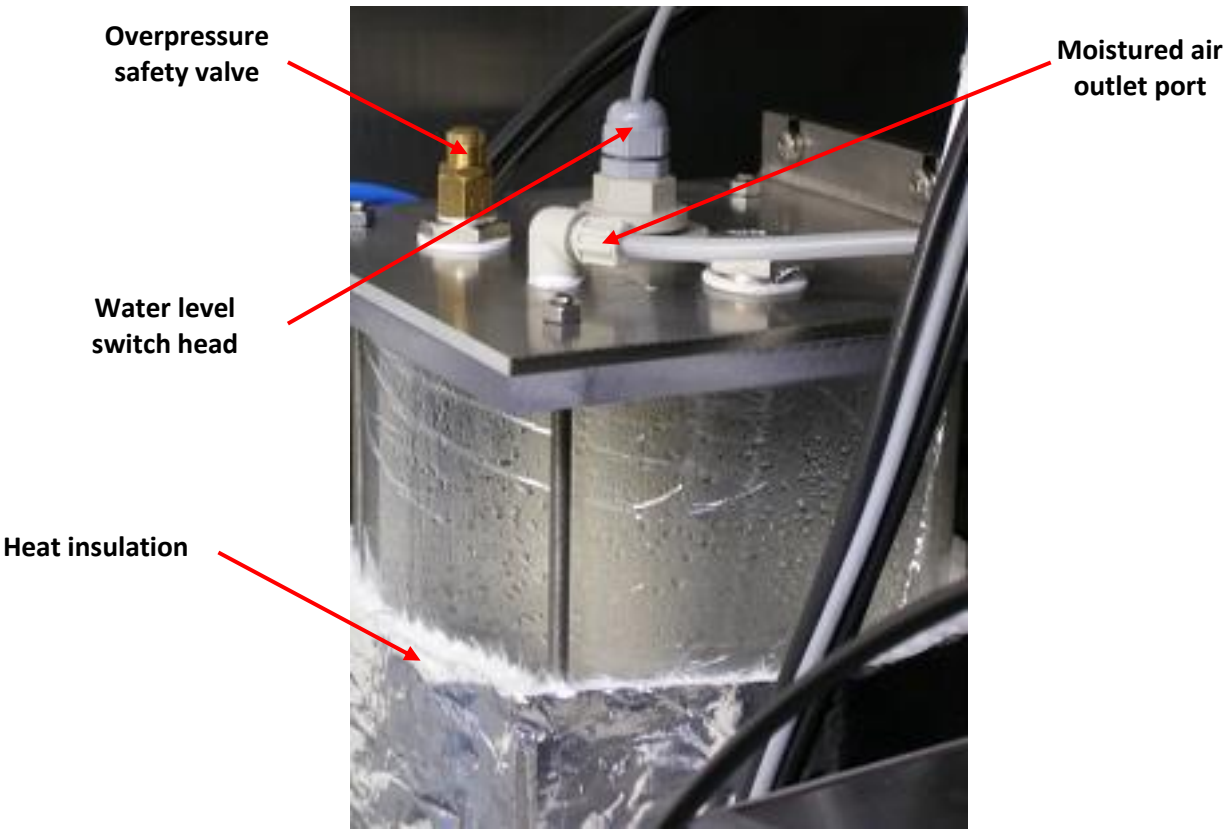


Figure 46 Humidifier - top view

The humidifier heater over temperature switch is accessible by dismounting the upper part of the heater housing (Figure 47). In case of over temperature the spring will jump in the upper position. After cooling down the spring can be pressed down to the normal position (Figure 48).

Figure 47 Heater housing located below the humidifier

Do not turn the screw for adjusting the humidifier temperature!

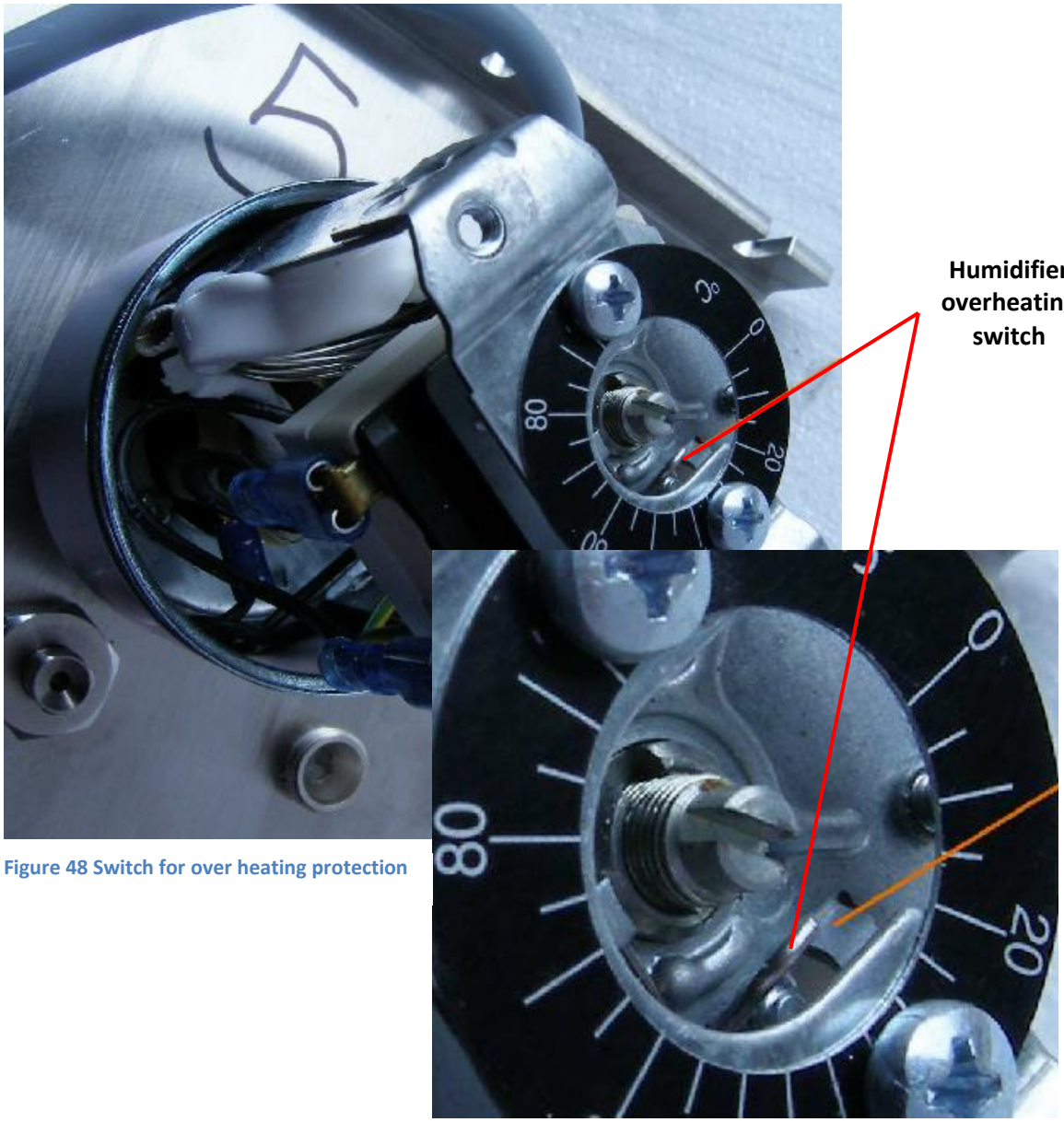


Figure 48 Switch for over heating protection

5.12.4. The Controller

Figure 49 shows the main control panel with the touch screen, pilot lamps and main switches. The controller is based on high-end Beckhoff PLC controller.

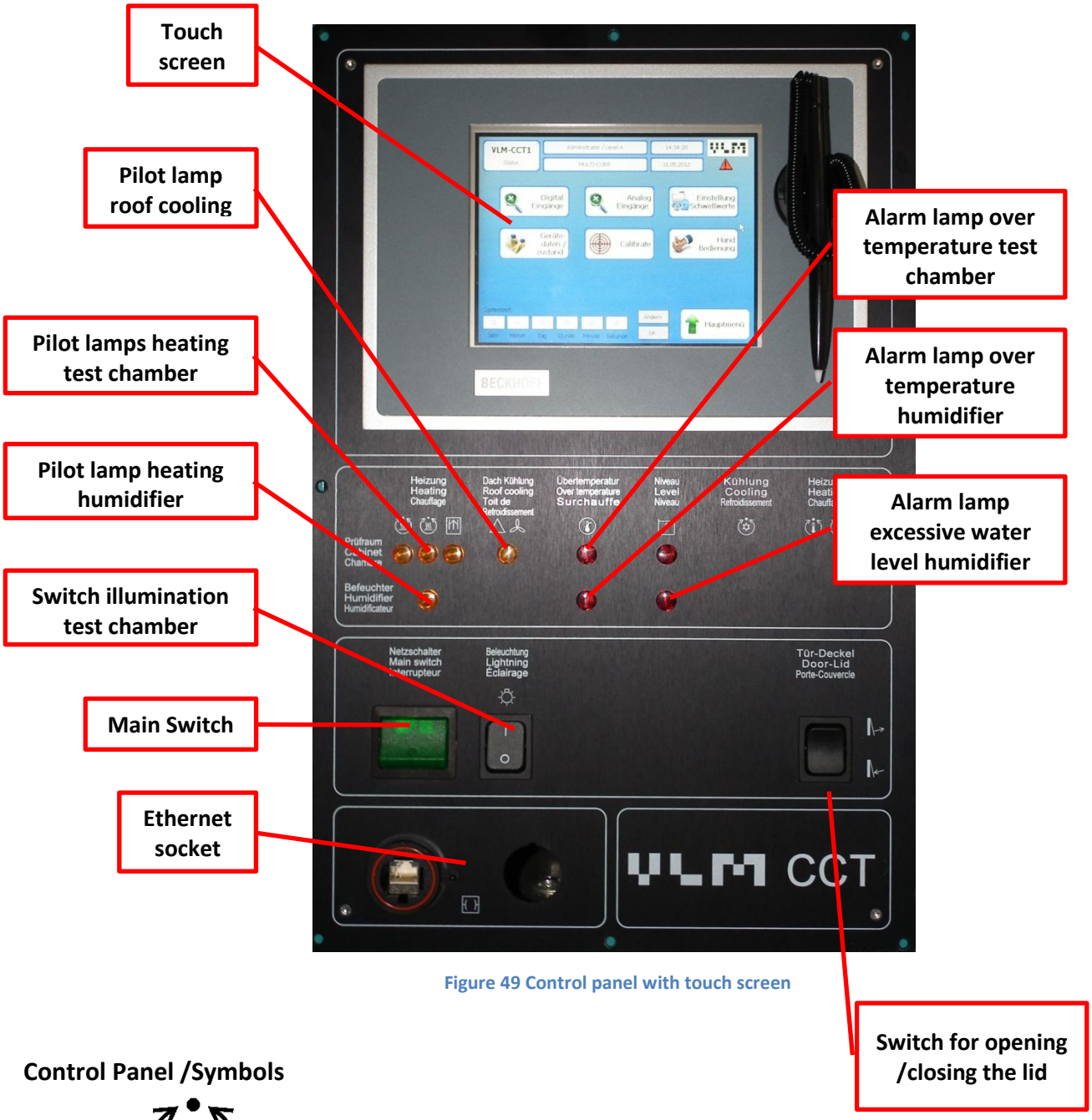


Figure 49 Control panel with touch screen

Control Panel /Symbols

Temperature regulation (controller)

Temperature regulation (test chamber)

Temperature limitation (over temperature protection)

6. Operation of the Fully Automatic MyltiCORR® Control

6.1. Basic Functions

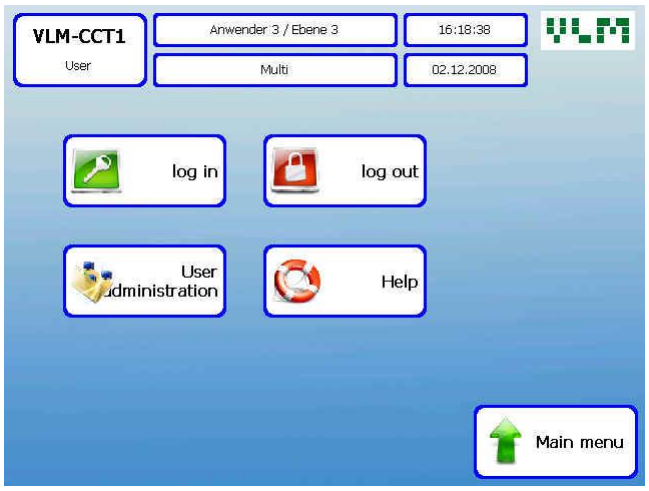


Figure 50 User login screen

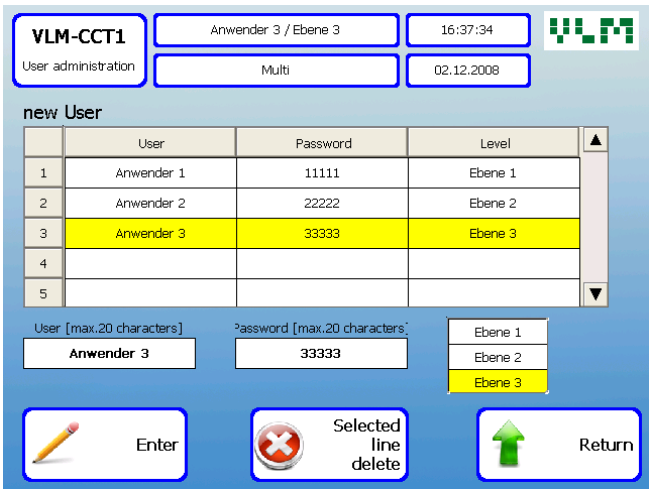


Figure 51 User managements screen

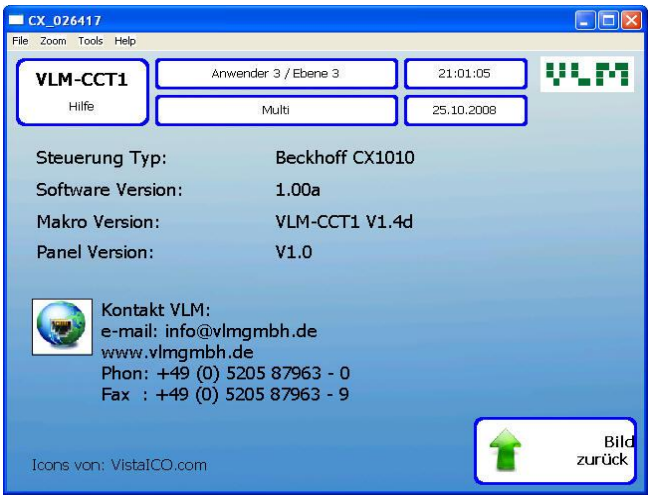


Figure 52 Help screen

User Login Screen
After switching on the cabinet the welcome screen appears followed by the screen "User". From this screen the user can navigate through the control program. The menu structure is clearly structured allowing an easy navigation.

User Management Screen
To avoid faulty operations and to exclude unauthorized access to the control system three (from in total 4) access levels can be defined as follows:

- **1. Level** Observer
- **2. Level** User
- **3. Level** Administrator

The "observer" can only browse between few screens but cannot impose any change of the running program or select a new Test.

The "operator" may start prescribed / preconfigured test procedures, make selections between existing tests. However he cannot define new tests or change existing test procedures.

The "administrator" has access to all screens, unless they are reserved for VLM personnel only (Level 4). The administrator can assign the access rights, can assemble new test procedures from various segments, performs all the queries (alarm diagnostics) and changes.
The login and logout of operators will be logged (documented) in a form of a text file (Test data file).

Help Screen
The details necessary when contacting technical support as well as the contact address of VLM can be found on this screen.

6.2. Main Menu

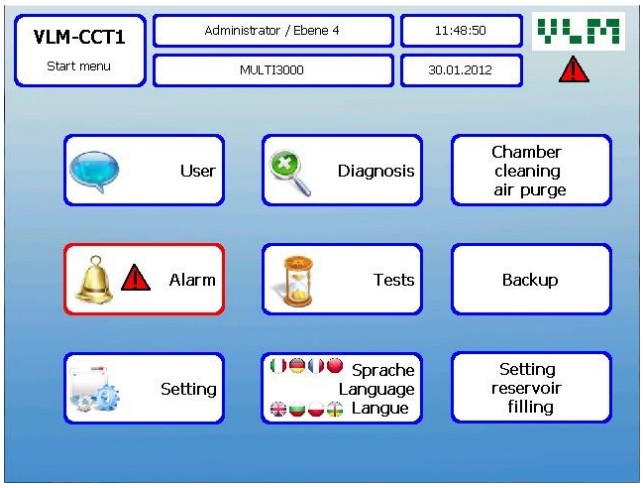


Figure 53 Main menu

From any submenu in which various parts of the system are controlled it is possible to return to the Start Menu. This screen allows the following choices:

User

The button "user" opens a submenu where the user can login or logout. The administrator can, for example, assign authorizations of personnel, chose the language or view the help screen.

Diagnosis

With the button "diagnosis" it is possible to monitor the set values of control parameters.

Tests

The "Test" opens the submenu where various corrosion tests can be selected. It is also possible to modify tests, compile new ones or delete them. The menu shows the information about the test procedures.

Setting Reservoir Filling

Manual control of the valve which toggles between the Tank 1 and Tank2

Alarm Status

This command shows a list of alarms that took place during the operation of the test cabinet.

Data Backup

The backup of data can be turned on or off.

Chamber Cleaning Air Purge

This button opens a submenu which allows the removal of the salt fog or of the hot water steam (by compressed air) before opening the test chamber. Furthermore, the rotating cleaning nozzle is turned on to flush the test chamber. This function is disabled during a test.

6.3. User Management / Login

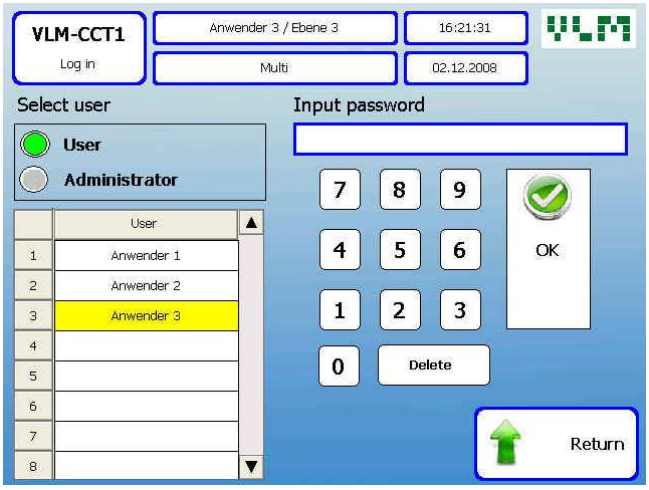


Figure 54 Main user configuration screen

Three users are already preconfigured in the factory (Anwender 1, Anwender 2 and Anwender 3). There are also 3 user levels (Ebene 1, Ebene 2 and Ebene 3) which can be allocated to each user. Each level allows user a different set of authorisations ranging from Ebene 3 (highest administrative level) which allows full test management and configuration of new tests down to Ebene 1 which allows only viewing of actual test parameters (e.g. temperature, humidity, time elapsed).

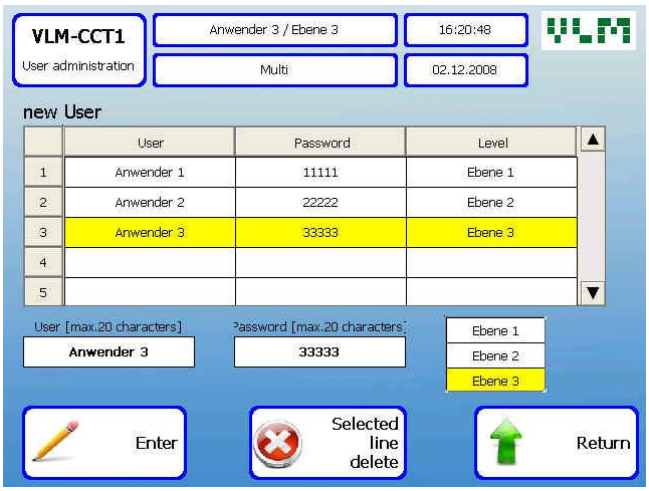


Figure 55 Secondary user configuration screen

Beside the three preprogramed users in the beginning of the user list there is also a “reserve” user (Ebene 3) at the end of the list (position 50). This one can be used in emergency should by any chance all other users in the beginning of the list be deleted. The password for level 3 (Ebene 3) user is 33333. The level 3 user is authorised to change the information for other users in order to protect the system from unauthorized access.

The option Administrator in the main screen is reserved only for authorised VLM personnel since it allows full access to all programming and configuration levels of the controller.

Once the access rights are assigned, the login is done by the following action:

- Select a desired user name and enter your code number on the box. Confirm with "OK"

6.4. Test Management and Test Configuration

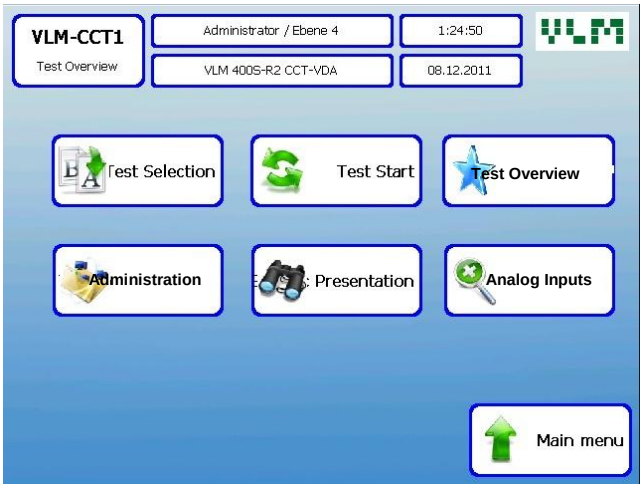


Figure 56 Main menu test management

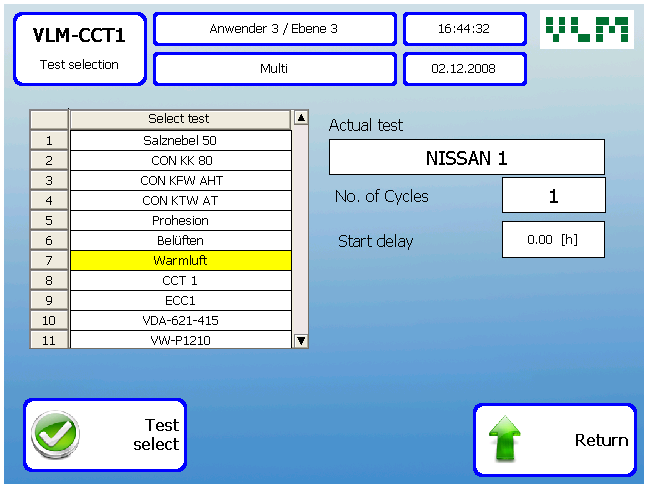


Figure 57 Menu Test Selection

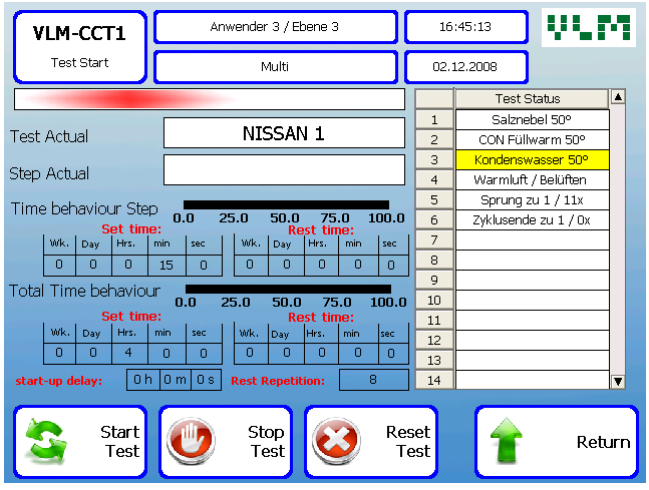


Figure 58 Screen Test Start

The screen shown in Figure 56 appears after pressing the button "Test" in the main menu. In this menu several options are available:

- Test Selection
- Test Start (test start and stop)
- Test Administration (select preprogramed tests and configure new ones from available segments)
- Trends (graphical presentation)
- Analog Inputs
- Test overview (all parameters at a glance)

Screen: Test Selection (Figure 57)

This menu allows selection of preconfigured standard corrosion tests. The selection is made by ticking the corresponding box and pressing the button "Test Select". The name appears in the field "Actual Test". The number of cycles to be run is set by entering desired number in the filed “No. of Cycles”.

If required, it is possible to choose a time delay of the test start (e.g. on Friday it can be decided to start the test on Sunday).

Confirm with pressing "Test Select" button. Please note that changing test parameters can be performed only in the access level 3.

Screen: Test Start (Figure 58)

After starting a test the test name (Active Test) and the currently active segment (Active Segment) will appear on this screen. The active segment will be also highlighted in yellow in the list on the right side of the screen.

The elapsed and remaining time of the active Segment and Test is shown both graphically and numericallv.

With the button "Stop Test" the test can be stopped and with the button "Start Test" the test will continue.

If a test is not completed according to schedule or needs to be cancelled then the "Reset Test" button should be pressed at least 7 seconds. This time delay is to prevent resetting the test by accident.

Screens: Test Overview (Figure 60) and Graphic Presentation (Figure 59)

This screen is very useful for users since it shows all relevant test parameters such as active test, active segment, chamber temperature, humidity, elapsed and remaining time at a glance.
A graphic presentation of the temperature and humidity in the test chamber versus time is shown in Figure 59

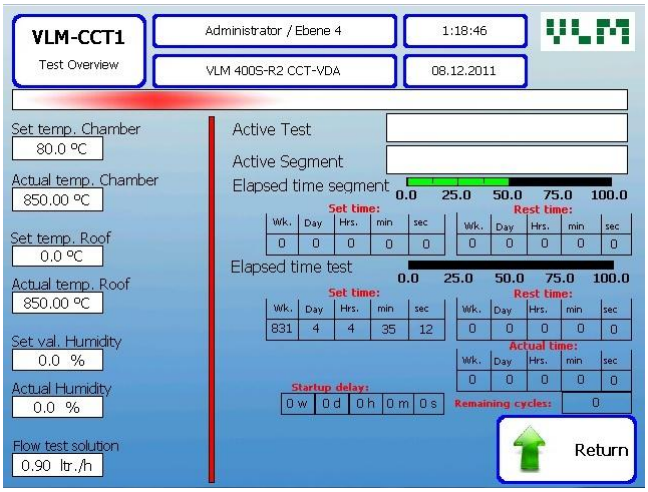


Figure 60 Screen Test Overview

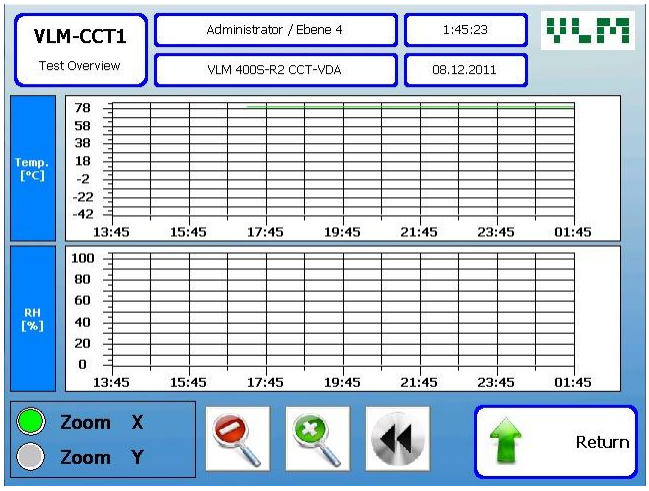


Figure 59 Graphic presentation

6.4.1. How to Define New Tests From Segments

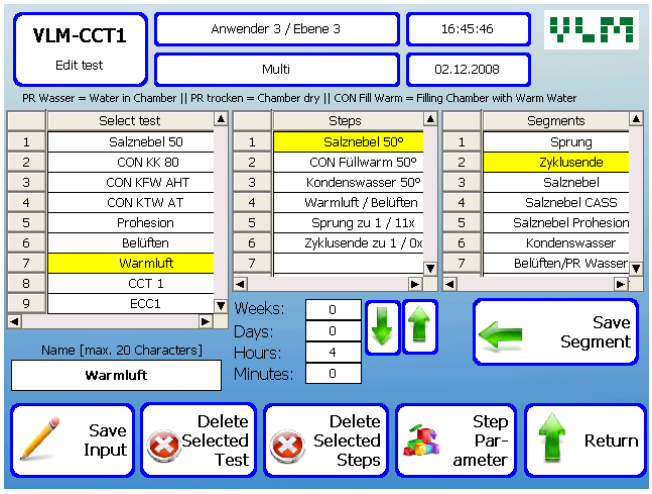


Figure 61 Screen for test configuration

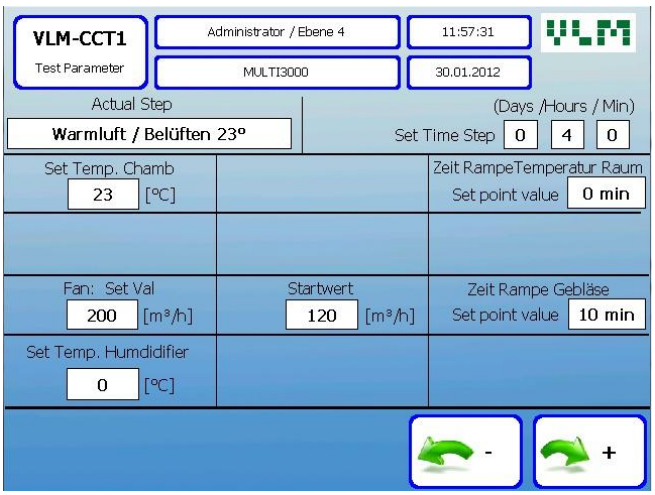


Figure 62 Screen for setting test parameters

On this screen (Figure 61) the existing tests can be edited or new ones created. Should a new test be creted please select an empty position at the end of the the left column and enter a name of the new test.

Select the required Segment in the right column (Segments) by clicking on it. Transfer the selected segment into the new test procedure (middle column) by pressing the button "Save Segment". Repeat this with the following required Segments from the list on the right hand side. In this way a new test of desired complexity and duration can be configured by adding individual test Segments (Steps) in desired order.

The command "Jump" (in the list with Segments on the right hand side) allows repeating one or more steps (segments) during one test (ie program loops).

Two green arrows allows to change the order of individual Segments (Steps) in the new Test. These arrows also allow creating an empty space in the list if a specific test segment (Step) was by accident missed.

The total duration of a test cycle is shown

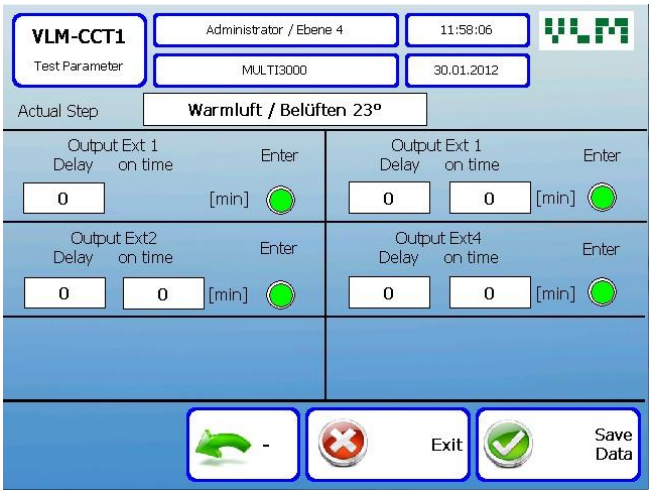


Figure 63 On-screen keyboard for editing parameter values

in the boxes next to the two green arrows.

Each segment is defined by a set of parameters such as temperature and humidity which can be individually configured in the corresponding screen (Figure 62). This screen opens by pressing the button "Step Parameters" shown in Figure 61.

The MultiCORR® control allows to connect an external device to the test cabinet / chest (e.g. a climate module). The external device can be turned on at any given time. In order to turn this device on please check the box Output Ext1 (it will turn green) in the screen shown in Figure 63 and allow some time for the device to start (if time delay is set).

In order to edit the parameter value click on the corresponding empty gray field and the on-screen keyboard will appear). Fill in the desired parameter value and press OK. Repeat this action for each parameter which has to be specified or edited.

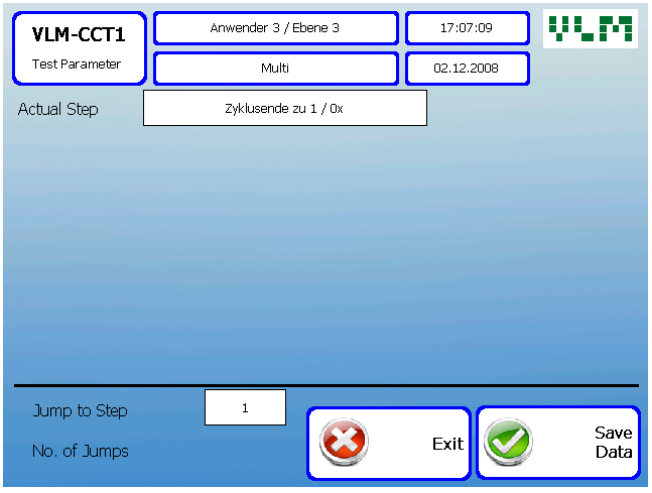


Figure 64 Configuring Jump command

Editing Jump Command

To repeate a group of test segments within one test the command "***Jump***" is used. Simply insert the line "***Jump***" at the location in the “Steps” list. From this location will the program jump to a specific previous location with Segment in the “Steps”list.

In order to configure the ***Jump*** command simply select the Jump line in the “Steps”list (it will highlight yellow) and hit the Step Parameter buttton. The screen shown in Figure 64 will open where the number of repetitions (hops) of the selected segment or group of segments can be set.

Important:
Please always end every test program with "End of cycle".
Save the test sequence by pressing the left button "Save Input".
It is very important to blow the salt spray out of the test chamber when a "Salt Spray" segment is followed by a "Humidity" segment. Failure to do so will cause a damage of the humidity sensor. In order to clean the chamber from the salt fog iit is necessary to run "Air Purge" segment after the "Salt Spray" segment.

6.4.2. Managing and Understanding Test Segments

Nr.	Segment Name	Description
1.	**Jump**	Should be selected if a repetition of a test segment (program loop) is required.
2.	**End of Cycle**	Must be always put at the end of a cycle!
3.	**Salt Spray**	Salt Spray Test according to DIN EN ISO 9227 NSS (35°C) from Tank 1
4.	**Salt Spray CASS**	Salt Spray Test according to DIN EN ISO 9227 CASS (50°C) from Tank 2
5.	**Salt Spray Prohesion**	Salt spray test according to Mebon Prohesion test with dry compressed air
6.	**High Humidity (CON)**	Condensation test according to DIN EN ISO 6270-2 CH (constant climate)
7.	**Aeration With Water**	Venting the test chamber with water in the bottom tray acc. AHT DIN EN ISO 6270-2 AHT
8.	**Cooling With Water**	Cooling of the test chamber with water in the bottom tray acc. DIN EN ISO 6270-2 AT
9.	**Cooling Without Water**	Cooling of the test chamber without water and without venting
10.	**Warm Air / Aeration**	Forced drying with conditioned air or venting without water in the test chamber according to PV 1210 (23 °C / 50% RH). Climate module required.
11.	**Heating With Dry Air**	Test chamber is only heated with no ventilation
12.	**Humidity**	Increasing humidity from 20% to 95% - Controlled humidity
13.	**Cooling Test Chamber**	Acceleration of the cooling of the test chamber to observe time-limited transitional periods of temperature change from temperature A to temperature B
14.	**Fill With Warm Water**	Avoid temperature drops by filling the bottom tray with water from the humidifier instead with cold water
15.	**Air Purge**	Avoid temperature drops by filling the bottom tray with water from the humidifier instead with cold water
16	**Spray Test Solution**	Direct spraying of the test solution on the test samples ("wetting") with a separate pump
17.	**Air Climate**	Ventilation of the test room with conditioned air (climate module) according to Nissan/Renault ECC1 standard (35 °C / 20% RH)
18.	**Cool Air**	Ventilation of the test room with conditioned air (climate module) (6 °C / 100% RH)
19.	**Volvo Test**	Spraying with test solution through a swivel plastic pipe located under the roof of the test chamber. According to Volvo STD 423-0014 standard
20.	**GM Test**	Spraying with test solution through two fixed plastic pipes located under the roof symetrically on each side of the test chamber. According to GMW 3127

The detailed description of which components of the MultiCORR® control system are used for implementation of each segment is presented in Appendix 1.

All segments are programmed in the factory and for reasons of safety these functions can not be changed by the user. In case of special test to be programmed (possibly with hardware adjustments) please call VLM at : +49 5205 879630.

Temperature, humidity and test duration can be changed by the user at level 3

6.5. Diagnostics and Manual Operation

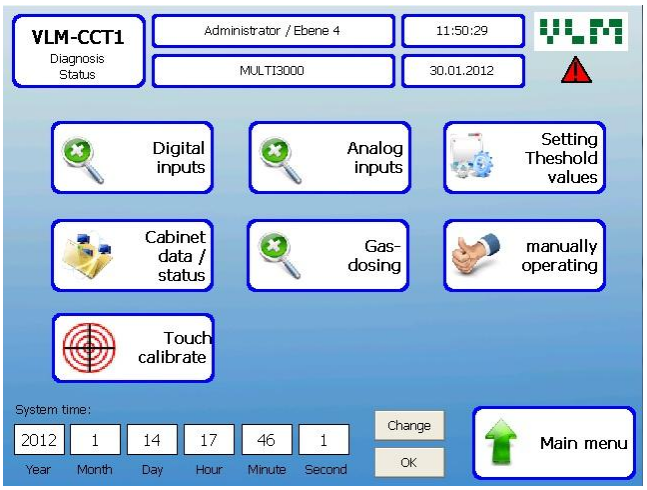


Figure 65 Diagnostics menu

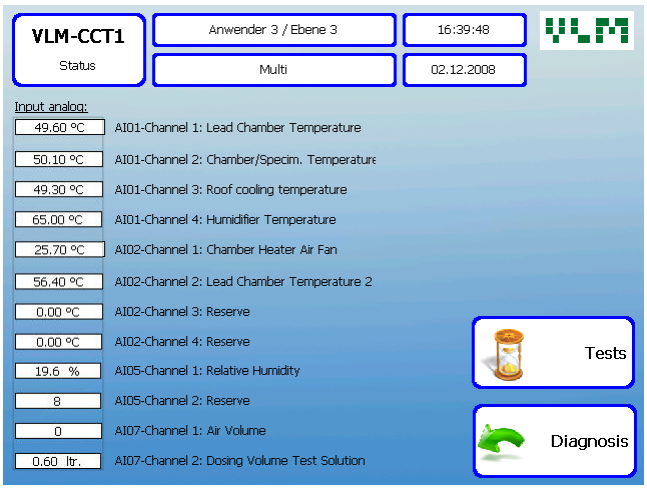


Figure 66 Screen showing analog inputs

Diagnostics Menu (Figure 65)

By pressing the button Diagnostics in the Main Menu the user arrives at the Diagnostics menu with several options as indicated in Figure 65.

Analog Inputs (Figure 66)

After pressing the button "Analog Inputs" the corresponding screen appears with the actual values for temperature and relative humidity.

Please note that the relative humidity is only measured when the humidity sensor is inserted in the test chamber. The position of this sensor is controlled by a pneumatic system in order to protect the humidity sensor from the aggressive corrosive elements in the test chamber (salt fog).

Digital Inputs (Figure 68)

The “Digital Inputs" screen shows the status of all components of the control system which can be either on or off. This makes possible to monitor the proper functioning of the complete system.

Threshold (Limit) Values (Figure 67)

Tolerance values for temperature and relative humidity can be changed by pressing the button "Set Threshold Values".

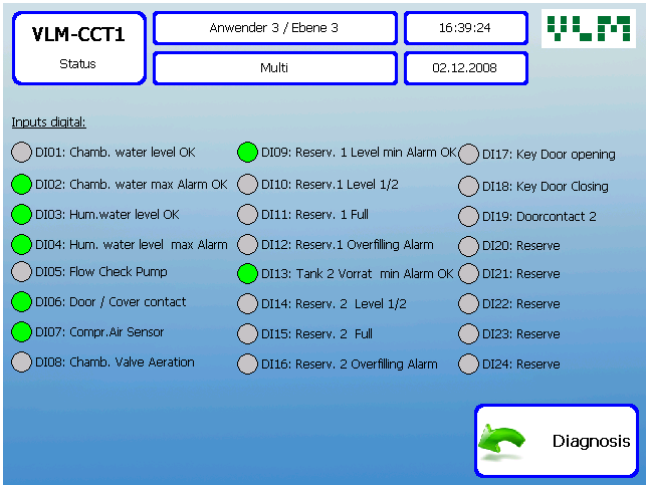


Figure 68 Screen showing status of digital inputs

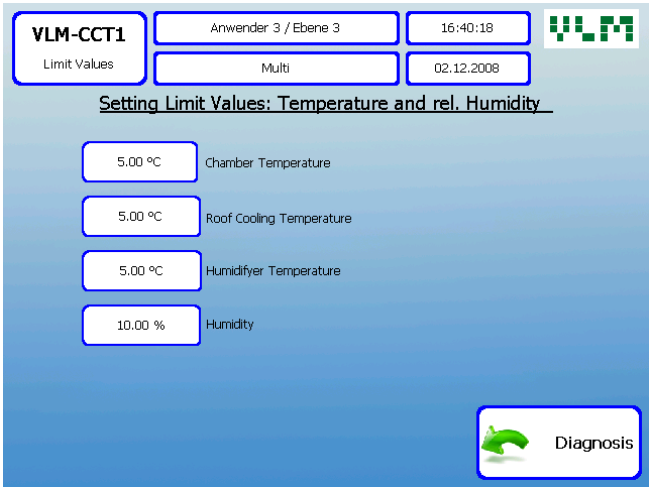


Figure 67 Threshold (limit) values for parameters

6.5.1. Manual Operation

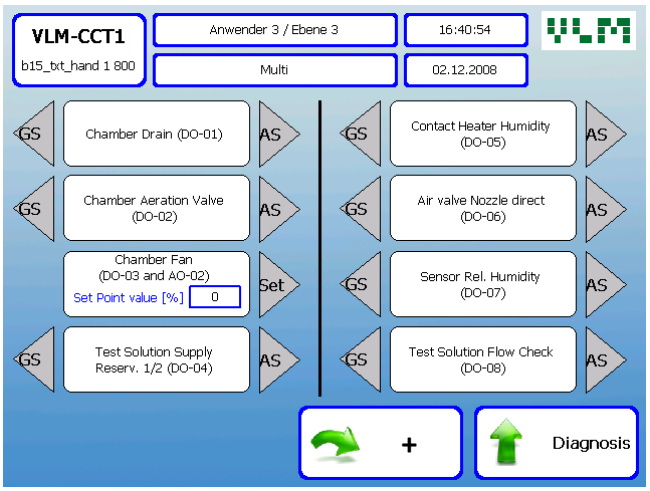


Figure 69 Manual control (screen 1)

These three screens allow manual control of all control systems in the MultiCORR® test cabinet / chest. To activate various hardware components manually choose the corresponding ON (AS on some versions) button. To manually disable the specific function choose the corresponding OFF (GS on some versions) button on Manual Control screens.

Note:
Manual control is disabled when automatic tests are running.

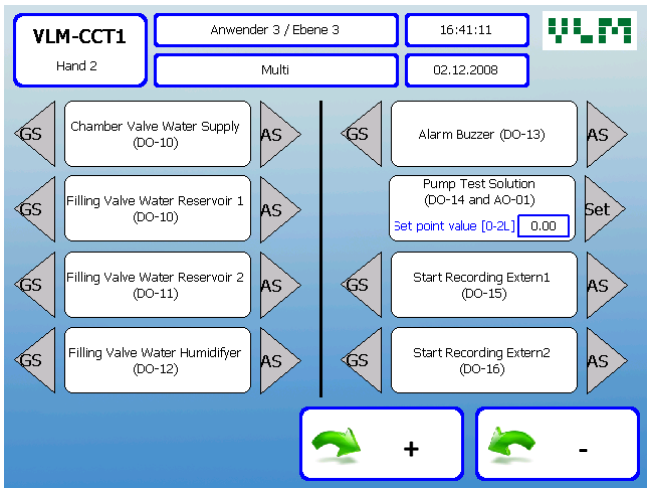


Figure 71 Manual control (screen 2)

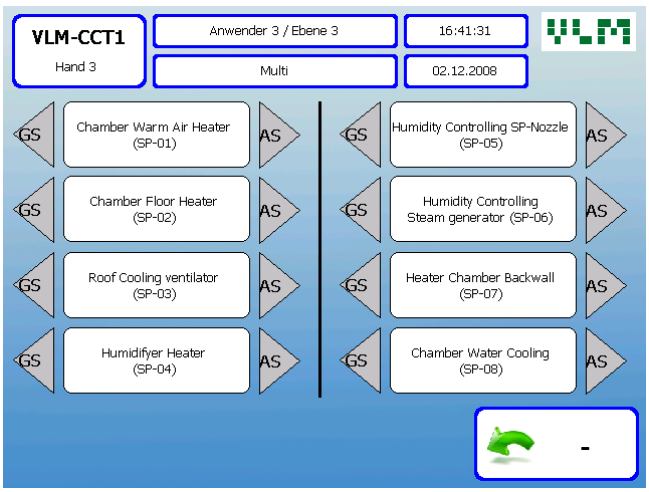


Figure 70 Manual control (screen 3)

6.6. Backup of Test Results

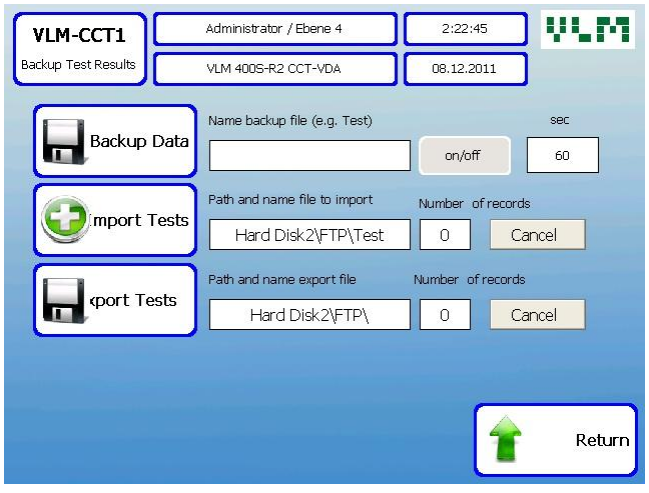


Figure 72 Screen with backup functionality

The test results are stored on an internal USB memory stick (flash drive). To enable storing test results please press Backup button in the Main Menu and then choose this option on the Backup screen.

Every test run creates a new data file (in txt format) with test results. This file is accessible via Windows Explorer (or any Internet browser) on a PC which is connected to the MultiCORR® control unit via Ethernet connection. To access the data file the following ftp address should be entered in the address line of the Windows Explorer (or browser):

ftp://192.168.1.100

The data can be copied to a PC and then used for graphical presentation (import to Excel).

Note:
There are two possible ways to extract the data file with test results from the MultiCORR® control unit:

1. ***Connect a PC directly to the control panel of the test chamber via Ethernet interface (use standard UTP network cable). The default (factory) setting of the Win CE network adapter is a fixed IP address 192.168.1.100 (subnet mask 255.255.255.0). For this reason the PC which is connected to test chamber should also have the fixed IP address 192.168.1.xxx (where xxx should be any number between 1 and 255 except for 100) and the subnet mask 255.255.255.0.***
2. ***Connect the test chamber to the local network (Intranet). Make sure that the network adapter on the Win CE based controller is setup to automatically obtain an IP address from the local DHCP server. Please consult your local IT support for making all arrangements. Please note that only level 4 Administrator has acces to the Win CE network configuration. This access level is reserved for VLM specialists or local VLM distributors.***

6.7. Alarm Screen

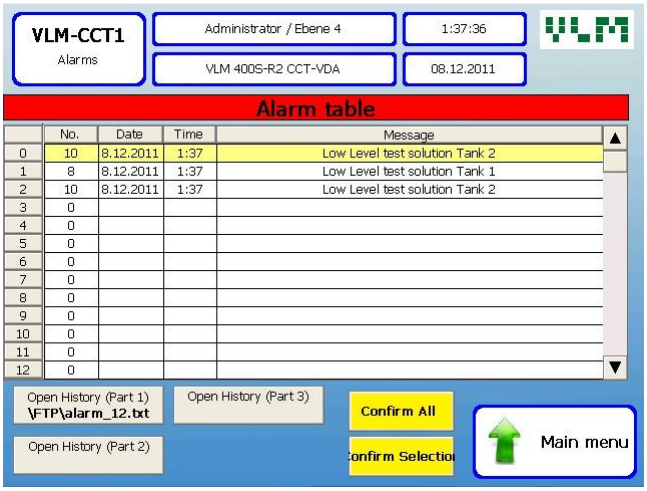


Figure 73 Alarm screen

In this screen (Figure 73) all alarm messages are listed in chronological order. After user confirmation all these messages are archived in a log file.

The list of all error messages is shown in Table 3

Table 3 Alarm messages

Alarm Messages			
1	Mains power loss (duration…)	11	Solution Tank 1 overfill
2	Lack of compressed air	12	Temperature test chamber too high
3	Cabinet door / lid not closed	13	Temperature test chamber too low
4	Water level in the test chamber too high	14	Roof cooling temperature too high
5	Level water in the humidifier too high	15	Roof cooling temperature too low
6	Diaphragm pump failure	16	Temperature humidifier too high
7	Air valve not opened	17	Temperature humidifier too low
8	Solution tank 1 empty	18	Relative humidity too high
9	Solution tank 1 level too high (Overflow)	19	Relative humidity too low
10	Failure valve cooling test chamber		

6.8. Gas Dosing

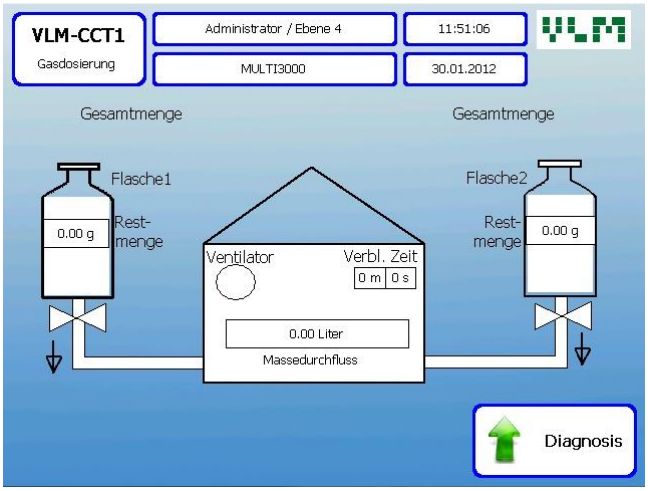


Figure 74 Control screen for gas dosing

In the ***Diagnosis*** menu it is possible to choose the ***Gas Dosing*** option. This is an option which allows the Kesternich test in SO_2 environment. Please note that for this test it is necessary to equip the MultiCORR cabinet with a special hardware and bottles with the SO_2 gas.

Figure 74 shows the screen which allows the configuration and monitoring of the Kesternich test.

7. Installation of the cabinet

7.1. Aligning of the Cabinet

Follow the following procedure for aligning the cabinet:

1. Align the cabinet that way that there is a downward slope towards the drain. This will allow the condensate to flow freely and completely out of the test chamber. This should be done by adjusting the height of the feet (Figure 75).
2. Close the drain by a rubber stopper.
3. Put water into the chamber so the base is covered. Pull the stopper out of the drain outlet. Watch the water if it is running evenly and completely off the base to the drain. If necessary adjust the feet.

Figure 75 Adjusting the length of feet

Make sure, that the cabinet / chest is placed tension free.

7.2. Requirements and Accessories

Table 4 shows an overview of basic requirements for installing corrosion test equipment and conducting corrosion tests.

	Quality	Pressure	Connection
Compressed Air	Particle and oil free acc. to DIN EN ISO 9227	6 - 8 bar	Nipple size 7
Demineralised water	0,1-20 µS/cm	2 - 5 bar	¾" outer thread
Fresh or Demi water	Clean	3,5 - 5 bar	¾" outer thread
Test solution	NaCl purity acc. To DIN EN ISO 9227	No pressure	Squeeze connection
Drain water	corrosive	No pressure	PVC hose ø 32 mm
Air exhaust	corrosive	<1 bar	PU hose ø 125 mm

Table 4 Basic requirements for conducting corrosion tests

8. Commissioning

8.1. Preparation for Tests

Important!

Make sure, that all supplying or waste tubes have been connected properly and the fresh water tap is open.

Press the green main switch:

- The diaphragm pump is running
- The humidifier is being filled with water

Pay attention to:

- The door is tightly closed
- The green pilot lamp is illuminated and the manometer “nozzle” indicates the pressure of the compressed air at 1.0 bar

Figure 76 Humidifier

Once the humidifier is filled up to the top level the heater is switched on. This is indicated by the orange pilot lamp.

The chamber heater is on indicated by the orange pilot lamp.

If the test cabinet has not been working for a long time it might be necessary to bleed the diaphragm pump for the test solution. In order to perform the bleeding the pump should be operating and the air relief screw should be slightly opened. This procedure is recommended in order to get the air out of the tubing system in the shortest possible time. When all air from the tubing is escaped and only water start coming out the screw should be closed again.

Figure 77 Control panel with the diaphragm pump

In order to measure the fall-out distribution in the test chamber pursuant to the ISO standard 9227 the salt spray test should be running and the measuring cylinders (Figure 78) should be carefully placed in the test chamber (in the middle of the areas on the right and left hand side besides the spray nozzle).

If the fall-out rate is out of the range of 1,0 - 2,0 ml/h after at least 16 hours or shows big differences among the cylinders you should check the pressure of the compressed air. Lower pressure will increase the share of bigger droplets. Preferably the pressure should set at 1,0 bar in order to produce a fine salt mist.

Figure 78 Measuring cylinders

If the fall-out rate is less than 1 ml/hour the flow rate you should be increased by turning the control button on the operating panel of the pump.

Only if these optimising measurements are not sufficient the spray nozzle has to be adjusted.

Attention:

Do not open the chamber door before the salt mist has been evacuated. The escaping salt spray may cause corrosion on surfaces of other devices, furniture or electronic boards. Use the air purge.

Note that the condensate has to be lead to the drain. It must not be reused.

Purity of the water

Do not use fresh water, neither for the preparation of the test solution nor for the humidifier. Stick to the specification indicated in the standards, such as the ISO 9227.

We strongly recommend to use the ion exchange cartridges as a reliable pure water source. Always watch the conductivity on the measuring gauge and timely replace the cartridge by a regenerated one.

Regard and treat this cabinet as a testing device. Keep it clean and make sure, that it will be serviced within the set intervals.

Note that the inside of the test chamber is coated with ECTFE (Halar®) which may only be cleaned by a soft cloth and non abrasive cleaning agent.

Remove any salt residues on the outer case with a wet cloth.

Protect the surfaces by applying cleaning and protecting sprays.

General Test Procedure

Never put specimens directly on the floor of the chamber.

Place specimens in the testing chamber in accordance with the ISO 9227. Specimen racks with slits of an angle of 20° for test panels are available as standard accessories. Moreover VLM offers a variety of specimen holders for special parts such as very small specimens, disc brakes, or wheels.

Place the specimens in the testing chamber as stipulated in the ISO 9227 so that they will not affect each other. Make sure that no condensate can rinse or drop from one specimen to another one below. Note that no test solution will accumulate in the cavities of specimens.

A variety of Stylus tools for applying cuts on coated surfaces are available as accessories.

Attention:

- ***Check if there is enough test solution in the reservoir to run the test.***
- ***Make sure that the compressed air at the required pressure is permanently available.***
- ***Check if the fresh water tap is open and the pure water supply is guaranteed all the time***

8.2. Starting the Salt Spray Test

Figure 79 Solution reservoir

Before starting the test make sure that:

1. There is sufficient test solution in the reservoir
2. The fresh water tap is open
3. The distribution of the salt solution from the reservoir to the inlet of the cabinet is properly done
4. The door of the chamber has been closed tightly

Starting the test:

1. Press the green main switch
2. Press the purge switch to top position (Spraying Symbol)

Figure 80 Manometer

Check if:

1. The correct flow rate is indicated on control button of the pump (not all provided pump models have digital display)
2. The inspection tube is full of test solution
3. The manometer indicates the correct pressure of 1.0 bar and the green pilot lamp on the panel is permanently illuminated
4. The set value of the chamber temperature has been set to 35,0 °C and the orange pilot lamp is blinking
5. The set value of the humidifier is set to +15 °C > chamber temperature and the orange pilot lamp is blinking

8.3. Preparation of the Test Solution

Figure 81 Reservoir with circulation pump

Read the ISO 9227 to be well informed about the stipulated specification of the preparation of the test solution.

As impurities of sodium chloride, such as anti-caking compounds, have a more or less impact on the chemical reactions on the surface of the specimen we strongly recommend to use SaliCORR® suitable for corrosion tests.

Note that the concentration is indicated weight /weight. If you want to make 100 kg test solution you have to solve 5000 g NaCl in 95 kg demineralised water.

Weigh the exact quantity of high pure NaCl on a suitable balance or take a pre-packed bag of SaliCORR® (Figure 82).

Pour it slowly into the test solution reservoir and simultaneously demineralised water so most of the NaCl will be solved during the filling of the reservoir.

It is recommended to use a circulation pump and immerse the hose with demi water into the water thus no carbon dioxide will be introduced into the solution while refilling.

Mix the solution after a little while again and check the concentration by a refractometer (Figure 83, see Accessories) and the pH value with a pH measuring gauge (Figure 84).

Figure 82 SaliCORR

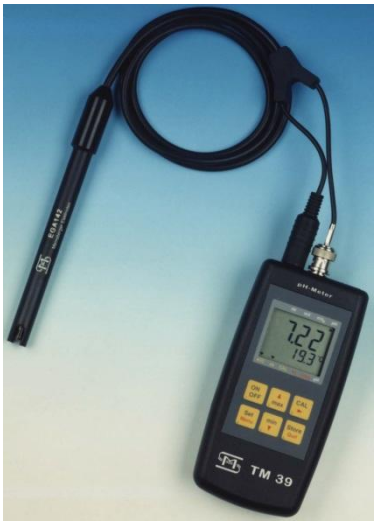


Figure 84 pH meter

Check the pH value by an electronic pH meter.

Adjust the pH value by adding of sodium hydroxide solution (10% conc.) resp. hydrochloric acid (10% conc.) thus the pH range of 6,5 - 7,2 is guaranteed.

Figure 83 Refractometer

8.4. SaliCORR® Sodium Chloride for Corrosion Tests

According to the standards impurities of the applied sodium chloride must not exceed 0,3 %. Particularly the content of sodium iodide must not more than 0,1 % and that of copper and nickel not more than 0,001%. The special quality of sodium chloride offered by VLM complies with the requirements described in the standards

Important: Do not use sodium chloride commonly used in the food industry or technical applications. Those kind of salt often contents anti caking substances such as calcium carbonate which inhibits the corrosion process and affects the function of the function of the cabinet.

Another method to prevent sodium chloride from caking is spraying with potassium hexacyanoferrate solution. However, it has been proved by scientists of the University of Graz (Austria) that this compound has an accelerating effect as a catalyst on the corrosion process on metal surfaces.

We certify that our sodium chloride is free of Hexacyanoferrate.

Sample

Quality Certificate

saliCORR® Sodium Chloride, NaCl Special quality for Salt Spray Tests acc. to EN ISO 9227, ASTM B117, NASM1312-1

Batch: V-AP 32204600-12.07	Batch values
Assay (argentometric; calculated on dried substance)	100.0 %
Identity	passes test
Appearance of solution	passes test
Acidity or alkalinity	passes test
pH-value (5 % Water)	6.5
Bromide (Br)	≤ 0,005 %
Nitrite (NO_2)	passes test
Hexacyanoferrate ($Fe(CN)_6$)	≤ 0,0001 %
Iodide (I)	≤ 0,001 %
Phosphate (PO_4)	≤ 0,0025 %
Sulphate (SO_4)	≤ 0,01 %
Nickel (Ni)	≤ 0,0005 %
Copper (Cu)	≤ 0,0005 %
Barium (Ba)	passes test
Calcium (Ca)	≤ 0,002 %
Iron (Fe)	≤ 0,0002 %
Potassium (K)	≤ 0,003 %
Ammonium (NH_4)	≤ 0,002 %
Magnesium, Earth alkali metals (as Ca)	≤ 0,01 %
Loss on drying (130°C)	< 0,1 %

Hans-Ulrich Vogler
Managing Director

33689 Bielefeld, 2010, 02.19

Ready to use sodium chloride without anticaking compounds

8.5. Conducting Condensed Water Test

1. Clean the testing chamber so that no salt residues are left.
2. Adjust the chamber temperature at 40,0°C
3. Close the drain port by a rubber stopper
4. Pour ca. 4 l demineralised water into the chamber so the
   - bottom is covered completely with water.
   - Minimum depths : 10 mm
5. Put the specimens on the support. Note that in case of est panels a different rack with slits at 15° has to be used
6. Close the door thoroughly
7. Watch the water level and refill the base manually

Figure 85 VLM's patented CON AIR CWC method for water condesation

8.6. Determination of Corrosivity

VLM provides test panels, devices and other materials as well as complete sets for the evaluation of the corrosivity of corrosion test chambers acc. to ISO 9227: 2006

Figure 87 Test specimens

Figure 86 Various material for tests

Article Nr.	Description
V.852.000.502	Test panels, made from steel CR4 , for testing of the corrosivity of salt spray test cabinets in accordance with the EN ISO 9227, Dimensions L/W 150 x 70 mm, Thickness 1 ± 0,2 mm, pre cleaned, corrosion protected, individually packed in plastic foil
V.852.100.513	Adhesive Tape, width 75 mm, Roll with 66 m
V.852.000.504	Standard test panels made from Zinc for testing of salt spray cabinets in accordance with DIN EN ISO 9227, Annex B, L 100 mm. W 50mm , Thickness 1 mm, Impurities < 0,1 %.
V.852.100.512	Adhesive Tape, width 50 mm, Roll with 66 m
A.0761.2500	Petroleum benzene 80-110°C for cleaning of the test panels
A.5007.2500	Ethanol 99%,denaturated, for drying of the test panels
A.3998.1000	Hydrochloric acid 20% with Hexamethylentetramine
A.1667.1000	di-Ammoniumhydrogencitrate analytical grade , 1 kg-Pack
A.1377.0500	Glycine analytical grade, for cleaning of the Zinc test panels
V.851.210.030	Test panel holder for exposure of the test panels acc. to EN ISO 9227, Length 550 mm, 21 Slots, 3,5 mm, 20 °
V.851.210.130	Test panel holder for exposure of the test panels acc. to EN ISO 9227, Length 650 mm, 26 Slots, 3,5 mm, 20 °
112111653	Beaker, 800 ml, tall shape
330502100	Crucible tong, Length 200 mm
V.852.100.510	Brush for cleaning of the test panels
V.1.117.200. 003 or 004	Chemical protection gloves (Nitrile), Pack with 50 pcs. Size L or XL
V.852.100.550	Drying box made from PC for storing of the test panels
KE.EG-220-3NM	Precise balance for weighing of the test panels
V.852.100.552	Complete set for the evaluation of the corrosivity, incl. 10 test panels made from steel CR 4
V.852.100.553	Complete set for the evaluation of the corrosivity, incl. 10 test panels made from zinc

9. Maintenance and Troubleshooting

9.1. Maintenance

What ?	When ?	Who?
Cleaning the testing chamber, but do not scratch the ECTFE coated base.	monthly	Operator
Checking the door sealing for leakage and if necessary changing it	monthly	Operator
Checking the salt solution filter in the reservoir, if necessary changing it	monthly	Operator
Checking the filter of the humidifier by reading the difference of the pressure of the compressed air before the humidifier and before the nozzle, change it, if the difference is > 0,6 bar	monthly	Operator
Checking the filter of the pure water inlet port and change it if necessary	quarterly	Operator
Checking the filter of the filter unit for clean compressed air, change it if necessary	quarterly	Operator
Cleaning the drain system by rinsing water through the drain port in the base.	monthly	Operator
Cleaning and polishing the case	monthly	Operator
Determination of the corrosivity of the chamber according to ISO 9227	Six monthly	Operator

In the course of time the elasticity of the silicon foam seal can decrease. Consequently there may be not enough even surface pressure against the door / lid so the chamber will not be hermetically closed anymore.

If the seal has been damaged for chemical or mechanical reasons it has to be replaced. The seal can be removed very easily as it is not fixed in the gap by adhesives.

9.2. Consumables

Order-No.	Description Consumables
V.424.013.120	Air filter for the humidifier (Figure 89)
V.852.221.000	Filter for the salt solution tank (Figure 88)
	Filter for purified water inlet port
V.241.231.000	Spray jet nozzle (Figure 90)
.	Cleaning and protecting Spray for stainless steel

Figure 89 Air filter

Figure 88 Solution filter

Figure 90 Spray nozzle

9.3. Adjustment of the Spray Nozzle

Attention:

The device has already been optimised for conducting salt spray test pursuant to ISO 9227 and thoroughly checked. Therefore do not alter the adjustments if you are not sure how what are you doing.

Fill the test solution reservoir with 30-40 litre demineralised water, to avoid any contamination of the laboratory with salt spray.

After opening the door press the key “Air purge” just to the opposite position of “Salt Spray”. The working system salt spray will be active for ca. 1 minute to allow the adjustment of the spray nozzle (Figure 91). If necessary press the key twice.

Adjust the flow rate to 0,58 l /h by turning the control button on the control panel of the diaphragm pump left or right

- Adjust the air pressure to 1,0 bar
- Open the door and bridge the door sensor by the service tool, so the cabinet keeps running
- Loose the check disc of the nozzle by turning counter clockwise.
- Now you can turn the cap of the nozzle clock wise or counter clockwise so that a narrow cone of spray is formed. You will hear an even sound of the escaping compressed air out of the orifice of the nozzle
- Do not forget to fix the position of the cap by turning the lock disc clockwise

Warning:

Never apply power when turning the cap of the spray nozzle in the “close” direction! You will damage the inner plastic cone so the nozzle will no longer produce the desired fine mist.

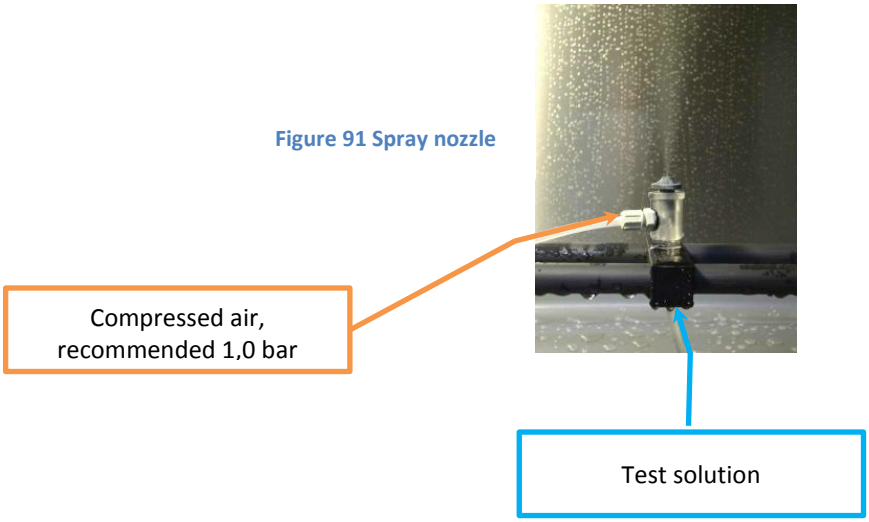


Figure 91 Spray nozzle

9.4. How to replace the filter of the humidifier

Although a filter unit is provided to secure a clean compressed air in compliance with the standards such as DIN EN ISO 9227 or ASTM B117-73 the pores of the air filter inside the humidifier may be blocked over a period of time.

An indication of a blocked air filter is the difference between the pressure of the compressed air before the humidifier and the air pressure in the nozzle exceeds 0,7 bar. In this situation the filter has to be replaced. For this maintenance job the control compartment has to be opened and the humidifier approached from underneath. The only tool you will need is a box spanner No. 30.

- Press the main switch of the cabinet on “0” (switch off the device)
- Wait a while thus the water in the humidifier is cooled down to < 40°C (Figure 93)
- Push a hose on the spout and place a bucket on the floor below the humidifier
- Open the stop cock (Figure 92) by turning the red lever downwards so the water will rinse out of the humidifier
- Pull off the blue plastic hose of the compressed air supply (Figure 94) after pushing the blue ring of the connector back thus the hose get loose.
- Loose the (biggest!) screw (Figure 95) of the filter unit with the box spanner
- Replace the filter (Figure 96) and screw the unit into the threaded hole again. Make sure that the connection is tight.
- Push the blue plastic hose into the connector
- Set the cabinet in working mode thus the humidifier will be refilled with pure water

Figure 93 Humidifier

Figure 92 Stop cock

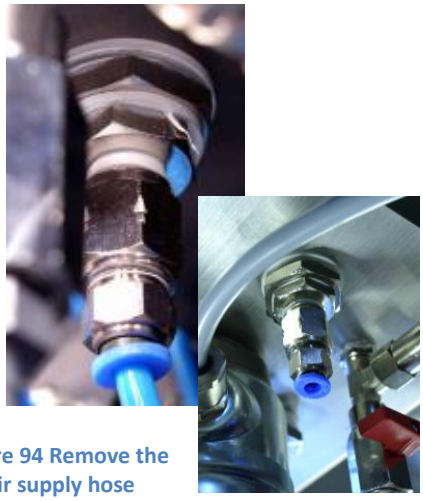


Figure 94 Remove the air supply hose

Figure 95 Loose the biggest screw

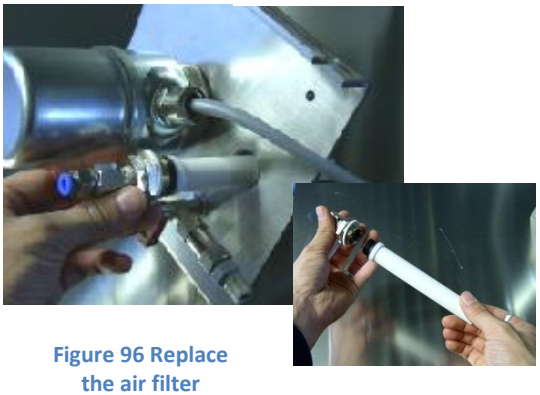


Figure 96 Replace the air filter

It is strongly recommend to mount an air filter (Figure 97) unit to guarantee the supply of oil free and particle free compressed air as stipulated in the ISO 9227.

Figure 97 Air filter unit

9.5. Troubleshooting

General:

Check that all controller, manometer, pilot lamps are running properly indicating normal values and conditions.

Problem: No salt fog

Please check:

1. if the air switch is on the position “Nozzle” ?
2. if the door is properly closed?
3. if there is enough salt solution available?
4. if the salt solution filter is contaminated (blocked)?
5. if the salt solution hose is blocked?
6. if the water tap is opened?
7. is there air in the diaphragm pump?
8. is there any dirt inside the spray nozzle?

Problem: Incorrect Salt Solution Fallout Collection Rates

Please check:

1. is the correct flow rate being pumped ?
2. is the spray jet nozzle air pressure is set correctly?
3. is the spray jet nozzle positioned central ?
4. is the spray jet nozzle blocked or partially blocked?
5. If the salt solution fallout rates are evenly distributed but either high or low in collection adjust the pump speed by increasing or decreasing accordingly.
6. If the salt solution collection rates are satisfactory but the distribution is uneven
   a) If there are high collection rates in the centre of the test chamber but low collection rates in the outer edges increase spray jet nozzle pressure
   b) If there are low collection rates in the centre of the test chamber and high collection rates on the outer edges decrease spray jet nozzle pressure

Figure 98 Measuring cylinders

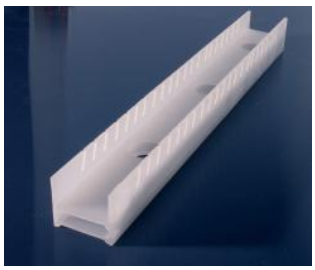
10. Spare Parts and Consumables

10.1. Spare Parts List

Article Nr.	Description	Description in the circuit diagram
V.272.202.710	Main switch 12 A	Q1
V.272.202.610	Switch air purge / spraying	S2
V.272.102.002	Switch lightning	S1
V.277.017.404	Clip connector 2 poles	X2-X11
V.277.017.434	Clip Connector 5 poles	X2-X11
V.277.017.473	Connector pin block 12 poles	X2/X3/X5/X11
V.277.017.414	Clip connector 3 poles	X2/X3/X5/X11
V.277.017.424	Clip connector 4 poles	X2/X3/X5/X11
V.282.412.000	Temperature controller JUMO dTRON 304	D1A/D1B/D1C
V.271.103.004	Pilot lamp green (pressure/ air	H 13
V.271.103.002	Pilot lamp yellow (heating/ventilation)	H1/H2
V.271.103.003	Pilot lamp red (over temperature/low level.	H3/H4
V.287.500.010	Filter for controller and timer	Z1
V.273.231.010	Relais	K5/K8
V.273.231.012	Relais	K2
V.285.110.020	Solid State Relais (ELR/SSR)	V1/V2
V.275.402.033	Compact fluorescent lamp	E2
V.475.111.005	Heater testing chamber	E1
V.576.100.000	Temperature sensor testing chamber Pt 100	B1

10.2. Accessories for Placing the Specimens

Article No.	Accessories	
V.851.210.300	Specimen rack 20° acc. To ISO 9227, 26 slits gap 3,5 mm, length 550 mm	1 Pc
V.851.210.100	Specimen rack 15° acc. To ISO 6270-2 (High Humidity CH Constant Humidity, 26 slits gap 3,5 mm, length 550 mm	11 Pc
V.851.212.000	S-hooks straight (10 Pcs/Unit)	1 U
V.851.212.001	S-hooks twisted by 90° (10 Pcs/Unit)	1 U
V.851.200.820	Specimen support rods	1 Pc
V.851.200.010	Cross connector	1 Pc.
V.851.220.000	Special specimen holder for steel-discs	1 Pc.
	Specimen holder for very small specimens	-
	Further individual holder, hooks upon request	
	Accessories	1 Pc



10.3. Other Accessories

Order-No.	Test solution
V.1.06400.5000	Sodiumchloride NaCl Purity acc. to DIN EN ISO 9227 PE Bags á 5000g, further packages upon request
	Reagents for CASS Test upon request
V.852.220.000	PH-Meter Set for testing the NaCl-solution and fall-out
	Reagents for adjusting the pH-value upon request
V.852.000.610	Fall-out rate measuring set (2 Cylinders, stoppers and funnels
V.852.270.000	Chloride Test + Accessories
V.852.220.000	PE-Reservoir on castors 130 L with hoses and filter
V.852.221.130	PE-Reservoir 130 L
V.852.225.130	Container pump for convenient solving of the NaCl
V.852.000.620	Duct for even distribution of fine mist
	Water purification plant
V.852.250.028	Ion exchanger stainless steel cartridge DI 2800
V.852.250.020	Ion exchanger stainless steel cartridge DI 2000
V.852.250.1500	Adapter for quick release coupling Pack. 2 Pc.
V.852.250.1506	Quick release coupling Pack. 2 Pc.
V.852.250.1601	Conductivity meter, analog mountable on top of the cartridge
V.852.250.1805	Conductivity meter, digital, mountable on the wall
V.852.250.1402	Distribution unit 1 inlet port 3 outlet ports
V.852.250.1400	Stop cock straight, plastic
V.852.901.000	Hose 1,50 m length with 3/4” connectors
V.852.901.001	Hose 2,00 m length with 3/4” connectors
V.852.901.005	Extension hose 2,00 m
	Compressed Air Supply
V.852.211.101	Screw compressor
V.852.211.000	Laboratory compressor
V.852.211.100	Capsuled laboratory compressor
	Coupling No. 5
	Plastic hose
V.852.210.100	Purification unit for oil- and particle free clean air
V.852.221.003	GFK Grid to protect the base










SaliCORR® Sodium Chloride for Corrosion Tests

Sample

Quality Certificate

SaliCORR® Sodium Chloride, NaCl Special quality for Salt Spray Tests acc. to EN ISO 9227, ASTM B117, NASM1312-1

Batch: V-AP 32204600-12.07	Batch values
Assay (argentometric; calculated on dried substance)	100.0 %
Identity	passes test
Appearance of solution	passes test
Acidity or alkalinity	passes test
pH-value (5 % Water)	6.5
Bromide (Br)	≤ 0,005 %
Nitrite (NO_2)	passes test
Hexacyanoferrate ($Fe(CN)_6$)	≤ 0,0001 %
Iodide (I)	≤ 0,001 %
Phosphate (PO_4)	≤ 0,0025 %
Sulphate (SO_4)	≤ 0,01 %
Nickel (Ni)	≤ 0,0005 %
Copper (Cu)	≤ 0,0005 %
Barium (Ba)	passes test
Calcium (Ca)	≤ 0,002 %
Iron (Fe)	≤ 0,0002 %
Potassium (K)	≤ 0,003 %
Ammonium (NH_4)	≤ 0,002 %
Magnesium, Earth alkali metals (as Ca)	≤ 0,01 %
Loss on drying (130°C)	< 0,1 %

Hans-Ulrich Vogler
Managing Director

33689 Bielefeld, 2010, 02.19

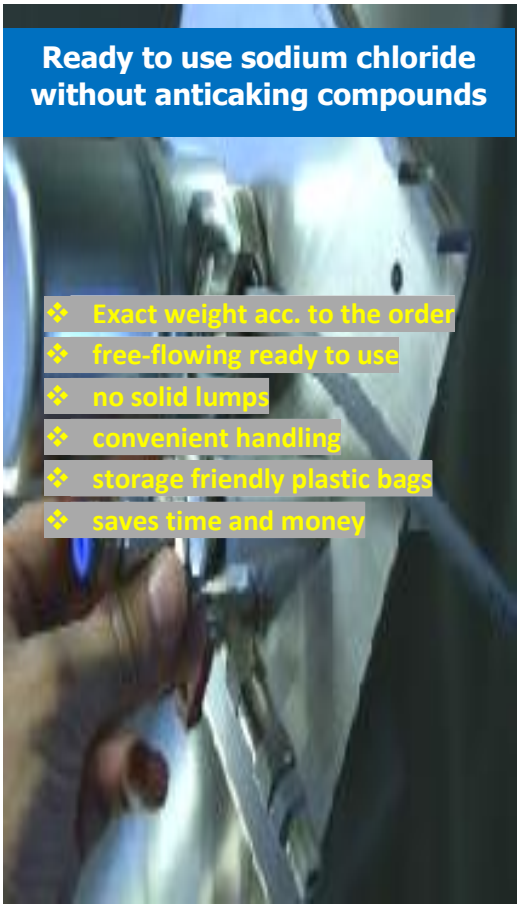


Figure 99 SaliCORR

11. Declaration of Conformity

Quality Certificate

To Whom it may concern:

We, the VLM GmbH, 33689 Bielefeld, Germany, herewith certify that we are the developer, manufacturer and seller of our full range of corrosion test cabinets.

We are committed to the task of supplying innovative technology to achieve the best reproducibility and accuracy of test conditions so the user gets most reliability on his results of atmospheric corrosion tests.

We confirm that our cabinets have been manufactured in accordance with the following guidelines and standards valid for laboratory devices:

73/23/EWG ammended by 93/68/EWG,
89/336/EWG ammended by 92/31/EWG and 93/68/EWG,
EN 61010-1, EN 61010-2

We only use VDE approved components from certified well-known manufacturers. Each cabinet has to pass a final test procedures after optimizing the control parameters. So there is a 100 % individual quality control for all our products before leaving the company.

We provide calibration certificates, final test reports and EC Conformity certificates to all cabinets attached to the delivery documents.

Bielefeld, den 12.10.2011

Hans-Ulrich Vogler
Managing Director

VLM GmbH Innovative Corrosion Test Equipment, Laboratory Technology & Services
D-33689 Bielefeld, Heideblümchenweg 50, Germany
Fon: +49 5205 87 963-0 Fax: +49 5205 87 963-50
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Appendix 1 – Segments Explained in Detail

	Segments																	
Segment No.	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
	SAL*	**SAL CASS**	**SAL Prohesion**	**High Humidity**	**Aeration w Water**	**Cooling w Water**	**Cooling wo Water**	**Warm Air Aeration**	**Heating**	**Humidity**	**Cooling Chamber**	**Fill w Warm Water**	**Air Purge**	**SAL Solution**	**Air Climate**	**Cool Air**	**Volvo**	**GM**
Water Drain	Open	Open	Open	Closed	Closed	Closed	Open	Open	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open
Flow control solution	Active	Active	Active	Not active	Not Active	Not Active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active
Fill valve water humidifier	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Not active	Active	Active	Active	Active	Active	Active
Pump for test solution	Active	Active	Active	Not active	Not active	Not Active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not Active	Not Active	Not Active
Door / Lid sensor	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Exhaust outlet siphon	Open	Open	Open	Closed	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open	Open
Floor Heating	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Back wall heating	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Heating humidifier	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active	Active
Chamber wall flushing	Active	Active	Active	Not active	Not active	Not Active	Not active	Not active	Not active	Active	Active	Not active	Not active	Not active	Not active	Not Active	Not Active	Not Active
Supply solution from Tank 2	Not active	Active	Not active	Not active	Not active	Not Active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active	Not active
Roof cooling (CWC)	Not active	Not active	Not active	Active	Not active	Not Active	Not active	Not active	Not active	Not active	Active	Not active	Not active	Not active	Not active	Not active	Not active	Not active
Aeration system	Not active	Not active	Not active	Not Active	Active	Not Active	Not Active	Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Active	Active	Not active	Not Active
External climate module	Not active	Not active	Not active	Not active	Not active	Not Active	Active (heating)	Active (heating)	Not Active	Not Active	Not Active	Not active	Not active	Not active	Active (heating)	Active (no heating)	Not active	Not active
System for humidity	Not active	Not active	Not active	Not active	Not active	Not Active	Not Active	Not Active	Not Active	Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not active	Not active	Not active
Air valve spray nozzle direct	Not active	Not active	Active	Not active	Not active	Not Active	Not Active	Not Active	Not Active	Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not active	Not active	Not active
Water supply valve chamber	Not active	Not active	Not active	Active	Active	Active	Not Active	Not Active	Not Active	Not Active	Not Active	Active	Not Active	Not Active	Not Active	Not active	Not active	Not active
Air Purge	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Active	Not Active	Not Active	Not active	Not active	Not active
Volvo spray system	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not active	Not Active	Not Active	Not active	Active	Not active
GM spray system	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not Active	Not active	Not Active	Not Active	Not active	Not active	Active

Detailed information about each segment please find in tables on following pages.

* SAL – Salt spray test

	Segment 3: Salt Spray	Salt Spray test according to DIN EN ISO 9227
1.	Water drain	**Open**
2.	Flow control test solution	**Active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water
4.	Pump for test solution	**Active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/Lid is Monitored**, test will start when door/lid is closed
7.	Exhaust outlet siphon	**Open**, not available with all models (prevents SO2 to leave chamber in case of test with SO2)
8.	Floor heating	**Active**, always when chamber heating required
9.	Back wall heating	**Active**, only during heating up of the test chamber. When the Set temp is reached it switches OFF
10.	Heating humidifier	**Active**, humidifier heater is turned on
11.	Chamber wall flushing	**Active**, is turned on automatically when Set temperature (threshold value) is exceeded.
12.	Supply solution Tank 2	**Not Active**, test solution comes only from tank 1
13.	Roof cooling (CWC)	**Not Active,** only used for the condensation test
14.	Aeration system	**Not Active**, aeration fan is off and related ball valve is closed
15.	External climate/cooling module	**Not Active**, for devices with cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not Active**, humidifier is normally operating but the steam generator not. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not Active,** test solution is sprayed with dry compressed air (humidifier bypassed) at room temperature. The test chamber is heated to 35 °C.
18.	Water supply valve test chamber	**Not Active**, the test chamber will fill with water to the max level and be refilled automatically during the test period if the level falls below the minimum level

	Segment 4: Salt Spray CASS	Salt Spray test according to DIN EN ISO 9227 CASS
1.	Water drain	**Open**
2.	Flow control test solution	**Active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water
4.	Pump for test solution	**Active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, not available with all models (prevents SO2 to leave chamber in case of a test with SO2)
8.	Floor heating	**Active**, always when chamber heating required
9.	Back wall heating	**Active**, only during heating up of the test chamber. When the Set temp is reached it switches OFF
10.	Heating humidifier	**Active**, humidifier heater is turned on
11.	Chamber wall flushing	**Active**, is turned on automatically when Set temperature (threshold value) is exceeded.
12.	Supply solution Tank 2	**Active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not Active**, only used for the condensation test
14.	Aeration system	**Not Active**, aeration fan is off and related ball valve is closed
15.	External climate/cooling module	**Not Active**, for devices with cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not Active**, humidifier is normally operating but the steam generator not. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not Active,** test solution is sprayed with dry compressed air (humidifier bypassed) at room temperature. The test chamber is heated to 35 °C.
18.	Water supply valve test chamber	**Not Active**, the test chamber will fill with water to the max level and be refilled automatically during the test period if the level falls below the minimum level

	Segment 5: Salt Spray Prohesion	Salt Spray test according to Prohesion test
1.	Water drain	**Open**
2.	Flow control test solution	**Active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water
4.	Pump for test solution	**Active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/Lid is Monitored**, test will start when door/lid closed
7.	Exhaust outlet siphon	**Open**, not available with all models (prevents SO2 to leave chamber in case of a test with SO2)
8.	Floor heating	**Active**, always when chamber heating required
9.	Back wall heating	**Active**, only during heating up of chamber. When Set temp reached it switches OFF
10.	Heating humidifier	**Active**, humidifier heater is turned on
11.	Chamber wall flushing	**Active**, is turned on automatically when the Set temperature (threshold value) is exceeded.
12.	Supply solution Tank 2	**Not Active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not Active**, only used for the condensation test
14.	Aeration system	**Not Active**, aeration fan is off and related ball valve is closed
15.	External climate/cooling module	**Not Active**, for devices with cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not Active**, humidifier is normally operating but the steam generator not. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Active,** test solution is sprayed with dry compressed air bypassing the humidifier at room temperature. The test chamber is heated to 35 °C.
18.	Water supply valve test chamber	**Not Active**, the test chamber will fill with water to the max level and be refilled automatically during the test period if the level falls below the minimum level

	Segment 6: High Humidity	Water Condensation test according to DIN EN ISO 6270-2 CH (100% Constant Humidity)
1.	Water drain	**Closed**
2.	Flow control test solution	**Not Active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not Active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/Lid is Monitored**, test will start when door/lid is closed
7.	Exhaust outlet siphon	**Closed**, siphon will be filled with water in order to stop loss of steam or warmth (only with devices which facilitate SO2 tests)
8.	Floor heating	**Active**, always when chamber heating required
9.	Back wall heating	**Active**, only during heating up of chamber. When Set temp reached it switches OFF
10.	Heating humidifier	**Active**, humidifier heater is turned on but set to 30 °C to save energy
11.	Chamber wall flushing	**Not Active**, is turned on automatically when Set temperature (threshold value) is exceeded.
12.	Supply solution Tank 2	**Not Active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Active**, it maintains 1 °C temp difference inside the chamber
14.	Aeration system	**Not Active**, aeration fan is off and related ball valve is closed
15.	External climate/cooling module	**Not Active**, for devices with cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not Active**, humidifier is normally heated but the steam generator is not active. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not Active,** test solution is sprayed with dry compressed air (humidifier bypassed) at room temperature. The test chamber is heated to 35 °C.
18.	Water supply valve test chamber	**Active**, the test chamber will fill with water to the max level and be refilled automatically during the test period if the level falls below the minimum level

	Segment 7: Aeration with water	**Venting the chamber with environmental air, trough filled with water according to DIN EN ISO 6270-2 AHT (Alternating RH and Temperature)**
1.	Water drain	**Closed**
2.	Flow control test solution	**Not Active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not Active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**, is set to 23 °C
9.	Back wall heating	**Active**, is set to 23 °C
10.	Heating humidifier	**Active**, humidifier heater is turned on but set to 30 °C to save energy
11.	Chamber wall flushing	**Not Active**, is turned on automatically when Set temperature (threshold value) is exceeded.
12.	Supply solution Tank 2	**Not Active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not Active**, only active during condensation test
14.	Aeration system	**Active**, aeration fan is operating and related ball valve is open
15.	External climate/cooling module	**Not Active**, for devices with cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not Active**, humidifier is normally heated but the steam generator is not active. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not Active,** test solution is sprayed with dry compressed air (humidifier bypassed) at room temperature. The test chamber is heated to 35 °C.
18.	Water supply valve test chamber	**Active**, the test chamber will fill with water to the max level and be refilled automatically during the test period if the level falls below the minimum level

	Segment 8: Cooling with water	**Cooling the test chamber filled with water according to DIN EN ISO 6270-2 AT (Alternating Temperature)**
1.	Water drain	**Closed**
2.	Flow control test solution	**Not Active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not Active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**, is set to 23 °C
9.	Back wall heating	**Active**, is set to 23 °C
10.	Heating humidifier	**Active**, humidifier heater is turned on but set to 30 °C to save energy
11.	Chamber wall flushing	**Not Active**, is turned on automatically when Set temperature (threshold value) is exceeded.
12.	Supply solution Tank 2	**Not Active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not Active**, only active during condensation test
14.	Aeration system	**Not Active**, aeration fan is not operating and related ball valve is closed
15.	External climate/cooling module	**Not Active**, for devices with cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not Active**, humidifier is normally heated but the steam generator is not active. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not Active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Active**, the test chamber will fill with water to the max level and be refilled automatically during the test period if the level falls below the minimum level

	Segment 9: Cooling without water	**Cooling the test chamber without water according to VDA 621-415 (last test section)**
1.	Water drain	**Open**
2.	Flow control test solution	**Not Active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not Active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**, is set to 23 °C
9.	Back wall heating	**Active**, is set to 23 °C
10.	Heating humidifier	**Active**, humidifier heater is turned on but set to 30 °C to save energy
11.	Chamber wall flushing	**Not Active**, the plastic pipes along the chamber walls which carry water for wall flushing are emptied of water.
12.	Supply solution Tank 2	**Not Active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not Active**, only used for the condensation test
14.	Aeration system	**Not Active**, aeration fan is operating and related ball valve is open. The inlet of the aeration system is connected to external climate module
15.	External climate/cooling module	**Active**, for devices with cooling/climate module (e.g. ClimaCORR) the ball valve for recirculation system is open
16.	System for generating humidity	**Not Active**, the steam generator is not active. **Humidity sensor is inside the test chamber (RH is measured)!**
17.	Air valve spray nozzle direct	**Not active,**
18.	Water supply valve test chamber	**Not active**, there is no water in the test chamber

	Segment 10: Warm Air / Aeration	**Aeration of the test chamber with warm air according to PV 1210 (23°C / 50% RH)**
1.	Water drain	**Open**
2.	Flow control test solution	**Not Active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not Active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, humidifier heater is turned on but set to 30 °C to save energy
11.	Chamber wall flushing	**Not Active**, the plastic pipes along the chamber walls which carry water for wall flushing are emptied of water.
12.	Supply solution Tank 2	**Not Active**
13.	Roof cooling (CWC)	**Not Active**
14.	Aeration system	**Active**, aeration fan is operating and the related ball valve is open. The inlet of the aeration system is connected to external climate module
15.	External climate/cooling module	**Active**, for devices with the cooling/climate module (e.g. ClimaCORR) the ball valve for recirculation system is open. **Temperature and RH in the test chamber are controlled solely by the climate/cooling module!**
16.	System for generating humidity	**Not Active**, the steam generator is not active. **Humidity sensor is inside the test chamber (RH is measured)!**
17.	Air valve spray nozzle direct	**Not active,**
18.	Water supply valve test chamber	**Not active**, there is no water in the test chamber

	Segment 11: Heating	**Heating the test chamber without hot air and without water in the trough. Application: Prohesion test section 2**
1.	Water drain	**Open**
2.	Flow control test solution	**Not active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, humidifier heater is turned on but set to 30 °C to save energy
11.	Chamber wall flushing	**Not active**, is turned on automatically when Set temperature (threshold value) is exceeded.
12.	Supply solution Tank 2	**Not active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not active**
14.	Aeration system	**Not active**, aeration fan is not operating and related ball valve is closed
15.	External climate/cooling module	**Not Active**, for devices with cooling module (ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not active**, humidifier is normally heated but the steam generator is not active. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Not active**, no water in the trough of the test chamber

	Segment 12: Humidity	**Controlled, non-condensing humidity in the test chamber**
1.	Water drain	**Open**
2.	Flow control test solution	**Not active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, humidifier is heating water 10°C above the set chamber temp.
11.	Chamber wall flushing	**Active**, is turned on automatically when the Set temperature (threshold value) is exceeded.
12.	Supply solution Tank 2	**Not active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not active**, only for the condensation test
14.	Aeration system	**Not active**, aeration fan is not operating and related ball valve is closed
15.	External climate/cooling module	**Not active**, for devices with cooling module (ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Active**, steam generator is active and the humid (warm) air from humidifier is blown through the nozzle. **Humidity sensor is inside the test chamber (RH is measured)!**
17.	Air valve spray nozzle direct	**Active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Not active**, no water in the trough of the test chamber

	Segment 13: Cooling chamber	**Purpose: Reduce the test chamber by rinsing the walls with water**
1.	Water drain	**Open**
2.	Flow control test solution	**Not active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, keep temperature around 30°C
11.	Chamber wall flushing	**Active**, cold water is flushing the walls of the test chamber
12.	Supply solution Tank 2	**Not active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Active**
14.	Aeration system	**Not active**, aeration fan is not operating and related ball valve is closed
15.	External climate/cooling module	**Not Active**, for devices with cooling module (ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not active**, steam generator is not active. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Not active**, no water in the trough of the test chamber

	Segment 14: Fill with warm water	**Purpose: To prevent temperature drops when switching to High Humidity (Water Condensation) test. The chamber is filled with the warm water from the humidifier. The chamber is than filled with cold demineralized water in order to reach the mix temperature close to the Set value**
1.	Water drain	**Closed**
2.	Flow control test solution	**Not active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Not active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, normal temperature
11.	Chamber wall flushing	**Not active**, cold water is flushing the walls of the test chamber
12.	Supply solution Tank 2	**Not active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not active**
14.	Aeration system	**Not active**, aeration fan is not operating and related ball valve is closed
15.	External climate/cooling module	**Not active**, for devices with climate/cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not active**, steam generator is not active. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Active**, first warm water from the humidifier and then cold demineralized water

	Segment 15: Air purge	**Purpose: To blow out the salt spray out of the test chamber before the next test segment commences. This is required in order to avoid contamination or damage of the humidity sensor**
1.	Water drain	**Open**
2.	Flow control test solution	**Not active**, monitored by a bubble sensor embedded in the pump
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not active**, pump test solution according to the given flow rate
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, normal temperature
11.	Chamber wall flushing	**Not active**, cold water is flushing the walls of the test chamber
12.	Supply solution Tank 2	**Not active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not active**
14.	Aeration system	**Not active**, aeration fan is not operating and related ball valve is closed
15.	External climate/cooling module	**Not active**, for devices with cooling module (ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not active**, steam generator is not active. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Not active**, first warm water from the humidifier and then cold demineralized water

	Segment 16: Spray test solution	**Spraying of test solution without compressed air with a separate pump through separate nozzles in the test room (optional)**
1.	Water drain	**Open**
2.	Flow control test solution	**Not active**
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not active**, **a separate pump and separate set of nozzles is used for this test.**
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, normal temperature
11.	Chamber wall flushing	**Not active**, cold water is flushing the walls of the test chamber
12.	Supply solution Tank 2	**Not active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not active**
14.	Aeration system	**Not active**, aeration fan is not operating and related ball valve is closed
15.	External climate/cooling module	**Not Active**, for devices with climate/cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not active**, steam generator is not active. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Not active**, first warm water from the humidifier and then cold demineralized water

	Segment 17: Air Climate	**Create a climate in the test chamber solely by the external climate module according to DIN 50014 standard (35°C temperature, 20% RH). This is a well known Renault/Nissan ECC1**
1.	Water drain	**Open**
2.	Flow control test solution	**Not active**
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not active**
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, energy saving temperature 30°C
11.	Chamber wall flushing	**Not active**, cold water is flushing the walls of the test chamber
12.	Supply solution Tank 2	**Not active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not active**
14.	Aeration system	**Active**, aeration fan is operating and related ball valve is open
15.	External climate/cooling module	**Active**, for devices with cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not active**, steam generator is not active. **Humidity sensor is inside the test chamber (RH is measured)!**
17.	Air valve spray nozzle direct	**Not active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Not active**, first warm water from the humidifier and then cold demineralized water

	Segment 18: Cool Air	**Create a climate in the test chamber solely by the external climate module (6°C temperature, 100% RH)**
1.	Water drain	**Open**
2.	Flow control test solution	**Not active**
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Diaphragm pump for test solution	**Not active**
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, energy saving temperature 30°C
11.	Chamber wall flushing	**Not active**, cold water is flushing the walls of the test chamber
12.	Supply solution Tank 2	**Not active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not active**
14.	Aeration system	**Active**, aeration fan is operating and related ball valve is open
15.	External climate/cooling module	**Active**, for devices with cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed. The heating of the external module is not used – only a cold air at 6°C is blown into the chamber.
16.	System for generating humidity	**Not active**, steam generator is not active. **Humidity sensor is inside the test chamber (RH is measured)!**
17.	Air valve spray nozzle direct	**Not active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Not active**, first warm water from the humidifier and then cold demineralized water

	Segment 19: Volvo Test	**Spraying of test solution by using a swivel plastic pipe located under the roof. This is according to Volvo STD 423-0014 standard.**
1.	Water drain	**Open**
2.	Flow control test solution	**Not active**
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not active**, **a separate pump and separate set of nozzles is used for this test.**
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, energy saving temperature 30°C
11.	Chamber wall flushing	**Not active**, cold water is flushing the walls of the test chamber
12.	Supply solution Tank 2	**Not active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not active**
14.	Aeration system	**Not active**, aeration fan is not operating and the related ball valve is closed
15.	External climate/cooling module	**Not active**, for devices with cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not active**, steam generator is not active. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Not active**, first warm water from the humidifier and then cold demineralized water
19	Volvo spraying system	**Active,** a dedicated pump is pumping the test solution through the swivel pipe with nozzles

	Segment 20 GM Test	**Spraying of the test solution through two pipes symmetrically located under the roof of the chamber. This is done according to GMW 3172**
1.	Water drain	**Open**
2.	Flow control test solution	**Not active**
3.	Fill valve water humidifier	**Active**, humidifier is automatically filled with pure water to the max
4.	Pump for test solution	**Not active**, **a separate pump and separate set of nozzles is used for this test.**
6.	Door/ lid sensor	**Door/lid is Monitored**, test will start when lid closed
7.	Exhaust outlet siphon	**Open**, siphon will be emptied allowing free air circulation (Aeration)
8.	Floor heating	**Active**
9.	Back wall heating	**Active**
10.	Heating humidifier	**Active**, energy saving temperature 30°C
11.	Chamber wall flushing	**Not active**, cold water is flushing the walls of the test chamber
12.	Supply solution Tank 2	**Not active**, normal test solution comes from tank 1 but CASS solution comes from tank 2
13.	Roof cooling (CWC)	**Not active**
14.	Aeration system	**Not active**, aeration fan is not operating and related ball valve is closed
15.	External climate/cooling module	**Not active**, for devices with cooling module (e.g. ClimaCORR) the ball valve for recirculation system is closed
16.	System for generating humidity	**Not active**, steam generator is not active. **Humidity sensor is outside the test chamber (RH is not measured)!**
17.	Air valve spray nozzle direct	**Not active,** used for spraying test solution with dry compressed air (humidifier bypassed) at room temperature.
18.	Water supply valve test chamber	**Not active**, first warm water from the humidifier and then cold demineralized water
19.	GM spraying system	**Active,** a dedicated pump is pumping the test solution through two fixed pipes located under the roof