Instruction Manual

Reactor CO_2 Carbonator 5

Article No .....

Serial No .....

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Editorial

Translation of the original Instruction Manual

Index A

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EC Declaration of Conformity

of Machinery in the sense of the Directive 2006/42/CE

The manufacturer TFB AG, Lindenstrasse 10, CH-5103 Wildegg, declares hereby that the machinery as described below:

Designation:	**Reactor CO_2 Carbonator 5**	Brand:	**TFB**
Type:	**HCM**	Article No:	_____
Serial No:	_____		

placed in the market by himself, respects conceptual and constructual the essential health and security requirements as described in the Directive 2006/42/CE:

In case of modifications on the machinery without written agreement with us, cease to be valid.

The following harmonized technical standards were applied partially or fully:

2004/108/EC	Directive Electromagnetic compatibility (EMC) from 15th December 2004
2006/95/EC	Directive Low Voltage from 12th December 2006

The following harmonized technical standards were applied partially or fully:

EN ISO 12100:2010	Safety of machinery
EN 60204-1	Electrical equipment of machines Part 1: General requirements

- An Assembly Instruction was provided and will be delivered with the partly completed machinery.
- Relevant technical documentation for the machinery was provided according to the appendix VII of the Directive 2006/42/EC.
- The technical documentation will be delivered on demand of the competent authorities of the Member States as PDF files.
- Mister Fernand Deillon c/o TFB AG, Lindenstrasse 10, CH-5103 Wildegg, is the authorized person to assemble the relevant technical documentation.

Wildegg, _____
TFB AG

Fernand Deillon, CEO

Content

Content

1. Information on the Present Manual

1. 1. Purpose of the Manual

The present is intended to - in combination with the components' original instructions included with the delivery scope - enable those individuals working with the product defined herein to operate said product in accordance with the relevant health & safety provisions and to make full use of all its technological advantages.

1. 2. Target Group

- The Manual addresses the individuals assigned with the product's
- installation;
- operation;
- programming;
- maintenance;
- servicing;
- repair;
- or transportation.

It is additionally intended for individuals engaged with

- taking the product out of service;
- the possible storage;
- or disposal of the product.

1. 2. 1. Personnel Qualifications

Any and all work with and/or to our products are to be exclusively performed by duly qualified personnel. Defining the required professional qualifications for suchlike specialists shall be within the plant owner's responsibility.

1. 2. 2. Before You Start

Please thoroughly study the chapters "Intended Use" and "Safety".

1. 2. 3. Changes & Amendments

We strive to continuously improve our operation manuals. Therefore, please provide us with changes and/or amendments you possibly request us to include.

1. 3. Used Safety Tags in the Instructions

Below the safety tag an eventual hazard will be described and on the right side one ore more alert symbols points to the hazards classification.

Example: Warning of electric tensions.

⚠WARNING	
WARNING tags and tape: WARNING tags indicate a hazardous situation which, if not avoided, could result in death or serious injury.	

⚠CAUTION	
CAUTION tags and tape: CAUTION tags or tapes indicate a hazardous situation which, if not avoided, could result in minor or moderate injury.	

CAUTION	
CAUTION tags without the safety alert symbol will be used to indicate a message related to potential machinery damages.	

NOTICE	
NOTICE tags will be used to indicate a message related to environment damages.	

1. 4. Used Safety Alert Symbols in the Instructions

This safety alert symbol points to protect the eyes with goggles during the respective working situation.
In each case higher local working regulations must be respected.

This safety alert symbol points to protect the hands with working gloves during the respective working situation.
In each case higher local working regulations must be respected.

This safety alert symbol points to dangerous working situations which can cause personal general injuries .

This safety alert symbol points to dangerous working situations which can cause personal injuries on the eyes.

This safety alert symbol points to dangerous working situations which can cause personal injuries transportation of loads.

This safety alert symbol points to dangerous working situations which can cause personal injuries by flung away parts of tools or work pieces.

This safety alert symbol points to dangerous working situations which can cause personal injuries by explosions.

This safety alert symbol points to dangerous working situations which can cause personal injuries by squashing parts of the body.

This safety alert symbol points to dangerous working situations which can cause potential cut injuries.

This safety alert symbol points to dangerous working situations which can cause potential injuries by touch electric conducting parts.

This safety alert symbol points to dangerous working situations which can cause potential injuries by dangerous substances.

This safety alert symbol points to dangerous working situations which can cause potential machinery or work piece damages.

1. 5. Explanation of terms and abbreviations

1. 5. 1. Terms

Term	Signification
Maintenance	Entirety of the measures to the preservation and restoration of the expected status, as well as for the determination of the actual state.
Inspection	Measures for the determination of the actual state.
Repair	Measures for the restoration of the expected status through repair and exchange.

1. 5. 2. Abbreviations

Abbreviation	Designation
EN	Norm EU standard
SIA	Swiss Society of Engineers and Architects
ISO	International Standardisation Organisation
MRL	Directive 2006/42/EC
CE	Conformity European
EPI	Equipment of Protection Individual

2. Product Description

2. 1. Description

The equipment described hereunder serves to define the carbonation resistance of concrete as per SIA 262/1, Annex I. In the lower section of the cabinet, brackets serve to place the concrete samples on retractable shelf boards. These brackets ensure the samples are exposed to the conditions generated from any side.

By feeding in compressed air, humidity and CO_2, the respective conditions are then generated. Continuous recirculation realized by two fans ensures the climate to be perfectly identical all over the test area.

The control cabinet being placed onto this unit houses the entire control equipment required to feed in and blend the media needed. The front panel provides the control and monitoring devices. These are compact controllers with programming function, the related pressure indicators and the flow meters.

A paperless recorder with USB port serves to monitor the entire process. This paperless recorder can control up to 9 slaves (see options).

Possible failure reports can be e-mailed to an addressee to be defined.

The CO_2 is fed in from a provided cylinder equipped with respective pressure regulating valves. The CO_2's concentration can be adjusted to a value between 1 and 5%.

A CO_2 sensor serves to control the concentration within the reactor.

The compressed air required is to be provided for on-site and can be adjusted as needed by a compact controller.

The required humidity is ensured by a nebulizer and controlled by a humidity sensor.

The relative humidity can be set at a value of up to 90%.

The system is de-aerated by air ducts leading to the outdoor area. The indoor CO_2 concentration is to be controlled by a CO_2 sensor provided for on-site.

2. 2. Available Versions

2. 2. 1. Master

- Climate chamber with CO_2 controller to define the carbonation resistance of concrete in accordance with SIA 262/1, Annex I.
  Maximum capacity 28 prisms 12x12x 36 cm on 7 shelf boards.
- Data acquisition system Jumo NT providing 12 internal and 24 external analog outputs, 6 relays, installation and programming plus software.

2. 2. 2. Slaves

a) Climate chamber with CO_2 controller to define the carbonation resistance of concrete in accordance with SIA 262/1, Annex I. Height 180 cm with 7 shelf boards, max. capacity 28 prisms of 12 x 12 x 36 cm, without data acquisition system.

b) Climate chamber without CO_2 controller to pre-store concrete as per SIA 262/1, Annex I. Height 180 cm with 7 shelf boards, max. capacity 28 prisms of 12 x 12 x 36 cm, without data acquisition system.

One master is capable of recording maximum 9 slaves.

2. 3. Technical data

Designation	Values
Dimensions and wight	
Dimension reactor cupboard lxdxh	80x60x190 cm
Dimension command cupboard lxdxh	60x35x38 cm
Height total reactor CO_2	228 cm
Necessary working place lxd	80x150 cm
Weight reactor cupboard	156 kg
Weight command cupboard	28 kg
Weight total	184 kg

Electric supply	
Electrical connection by apparatus cable (standard accessory)	3 x 1.5 mm2
Connection (house)	socket
Connection (apparatus)	apparatus socket
Voltage	85 - 260 V
Protection by fuses (inhouse)	10 amp
Protection fuse on apparatus socket	FSF 3.15A/250V
Voltage of command	24 V

Connection compressed air	
Connecting pipe	A-Ø 8 mm
Apparatus connection by snap lock	A-Ø 8 mm
Air quality DIN ISO 8573-1	2 (whitout oil/dry)
Air supply pressure	6 bar
Working pressure	1 - 3 bar
Flow	1 - 3.5 l/min

Designation	Values
Connection CO_2	
Supply by gas cylinder CO_2	without submerged tube
Quality	3.0
Connection gas cylinder h pressure reducer	two-stage
Connection pipe	A-Ø 6 mm
Apparatus connection by snap lock	A-Ø 6 mm
Supply pressure	6 bar
Working pressure	1 bar
Flow	1 l/min
Daily consumption with two reactors	roughly 1.5 kg
Water connection	
PET bottle	Store tank 1 l PET
Water quality	demieralized
Consumption dependent desired of humidity	nombre of prisms
Aeration	
Aeration pipe	A-Ø 8 mm
Apparatus connection by snap lock	A-Ø 8 mm
Length	As short as possible

2. 4. Set of equipment supplied

Article	Article N°

- Instruction Manual
- Climate chamber analogous the specifications from the order with control unit (option with or without Jumo Logoscreen NT)
- Profiles V-form, plastic material, for ensure a homogeny air circulation in the climate chamber
- Ventilation exhaust pipe and gas connection pipe between the gas source an the climate chamber
- Store tank 1 l PET
- Data transfer software
- Data analysis software
- Apparatus documentation comprehensive:

  I. Documentation for the climate chamber

  II. Initial Start-Up protocol

  III. Instruction manual JUMO regulator

  IV. Instruction manual JUMO Logoscreen-NT

  V. Calibration certificate CO_2 detector

  VI. Control protocols concerning the humidity, the temperature and the CO_2 values

3. Intended Use

3. 1. Use

1. The CO_2 reactor has exclusively been designed and produced for the purpose of defining the carbonation resistance of concrete in a climate artificially generated by means of carbon dioxide (CO_2), compressed air and demineralized water.
2. The CO_2 reactor is not a product intended for the public and is thus to be operated by duly qualified personnel only.
3. When loading / unloading the system, ensure to only pull out one pallet at a time. Otherwise, the reactor's stability cannot be ensured.

3. 2. Precautions

1. Because CO_2 may escape when the cabinet is being opened, the reactor is to be run in premises controlled with CO_2 measuring devices only.
   Since CO_2 weighs more than air, the respective concentration is to be measured at low level generally.
2. The door to the room the reactor is operated in is to be labeled with the corresponding danger icon. Ensure the door can be opened from inside the room without key at any time in order to ensure respective evacuation in the event the door has been shut unintentionally.
3. Exclusively authorized qualified personnel may be granted access to this room.

3. 3. Foreseeable Misuse

The reactors have been designed to be used with CO_2. Malfunction, corrosion, and other events cannot be excluded if other gases are being used.

3. 4. Requested Alternative Use

Any requested alternative use of the equipment shall be confirmed in writing by TFB AG.

4. Safety Instructions

4. 1. Occupational Health & Safety

Operational Safety Requirements

NOTICE	
The health & safety instructions specified hereunder are subject to full compliance with internal corporate Health & Safety Instructions. Any and all shall not only apply to operating staffs but also to any other internal or external third party on site by chance.	

If the internal corporate provisions exceed the extent of the health & safety instructions described herein, these internal corporate provisions shall under all circumstances prevail.

4. 2. Residual Risk

Even though the CO_2 reactor has been designed and built in accordance with state-of-the-art technological know-how it is impossible to fully exclude all kinds of personal risk related to its use.

4. 2. 1. General Health Protection

According to SUVA brochure "Grenzwerte am Arbeitsplatz 2012 (Limit Values at the Workplace 2012)", CO_2 (carbon dioxide) features an MCW (=Maximum Concentration at the Workplace) of 5000 ppm (which equals to 0.5%). Short-term limit values and related time limits have not been defined.

The MCW is defined as follows:

The Maximum Concentration at the Workplace (MCW) is the highest permissible average concentration of gaseous, vaporous or powdered working materials in the air, which - according to current findings - do generally not harm the health of the vast majority of healthy employees being exposed to them for a working time of 8 hours a day and max. 42 hours a week even for extended periods.

For more information, please refer to http://www.sapros.ch.

4. 2. 2. Working with the Control Cabinet

Touching live parts

⚠WARNING	
Before opening the control cabinet, generally ensure to disconnect the reactor from the power supply. Remove its plug from the socket.	

4. 2. 3. Working with the Pneumatic Control

Parts flying off when the compressed air is relieved

⚠ CAUTION	
Before you start working with pneumatic control ensure to disrupt the compressed air supply and unpressurize the system. Sudden compressed air relief might damage your eyes.	

4. 2. 4. Working with the CO_2 Control

Harmful CO_2 concentrations

⚠ WARNING	
Before you start working with CO_2 control, ensure to shut the valve provided at the cylinder. Do not deactivate the CO_2 monitoring in the operation room.	

4. 2. 5. Feeding & Unloading the Reactor

Stability loss

⚠ CAUTION	
When laying the de-aeration ducts for the reactor ensure the ducts to be of sufficient size in order to prevent backpressure. Each reactor's de-aeration ducts are to be individually directed to the outdoor. Ensure the outlets to be designed in a way that the heavier-weighted CO_2 cannot accumulate in basements or at other low spots in order to prevent third parties accidentally on-site from being endangered.	 

4. 2. 6. De-Aerating the Reactor

CO_2 concentrations at low spots

⚠ CAUTION	
When laying the de-aeration ducts for the reactor ensure the ducts to be of sufficient size in order to prevent backpressure. Each reactor's de-aeration ducts are to be individually directed to the outdoor. Ensure the outlets to be designed in a way that the heavier-weighted CO_2 cannot accumulate in basements or at other low spots in order to prevent third parties accidentally on-site from being endangered.	

5. Installation Site, Transportation, Installation, Commissioning

5. 1. Works to be provided by the Customer

Before the system is being delivered, the customer is required to provide for the following

- suitable premises, air-conditioned (20 ± 2 °C) and de-aerated
- electricity supply (230V power outlet) and adequate lighting
- CO_2 gas supply, cylinder(s) with pressure control valve (please refer to Specifications), secured fixing of these CO_2 cylinders
- compressed air gas supply (please refer to Specifications)
- options to evacuate the reactor's exhaust to the outdoor area (please refer to Specifications)
- demineralized water
- highly recommended: CO_2 alarm in the reactor room - can be offered by TFB AG, if requested
- optionally: LAN (RJ45) connection, if Jumo Logoscreen NT is supposed to be operated via the network
- optionally: reactor wall-mounting equipment (anti-tilt equipment).

5. 2. Transportation

The system is to be exclusively transported by qualified personnel experienced with handling heavy loads.

The system is delivered as one part on pallet. The respective weights are:

reactor cabinet	156 kg
control cabinet	28 kg
total weight	184 kg

Use of approved hoisting equipment

ATTENTION	
Ensure the hoisting equipment used to be qualified for the respective load and to be in good state and condition. In order to prevent the cabinet from being damaged by diagonal loads, ensure the straps to run straight upward. Ensure there are no individuals underneath the load.	

The reactor cabinet's upper corners provide 4 lifting eyebolts that facilitate its transportation by crane or other suitable hoisting devices.

The complete reactor (reactor and control cabinet being bolted together) is to be transported by means of an adequate cross-head only (see illustration) in order to prevent possible damage to the control cabinet.

Alternatively, lift the system onto a pallet for transportation (please note respective ceiling and door heights).

5. 3. Installation

The reactor is to be set up on a surface area of at least 80x150 cm.

- Set up the reactor cabinet.
- For slave designs, connect reactor and control cabinet.

5. 4. Connection

5. 4. 1. Compressed Air

- Ensure the service unit on-site to provide for the required air quality and input pressure.
- Lay the connection line (PUR 8/6 mm white/transparent) between service unit and control cabinet. Ensure the line to be protected from external jamming. Avoid a radius that is too narrow in order to prevent the line from being bent.
- Connect the line to the service unit and the system.

5. 4. 2. Setting up and Connecting the CO_2 Cylinder

Danger imposed by toppled CO_2 cylinders

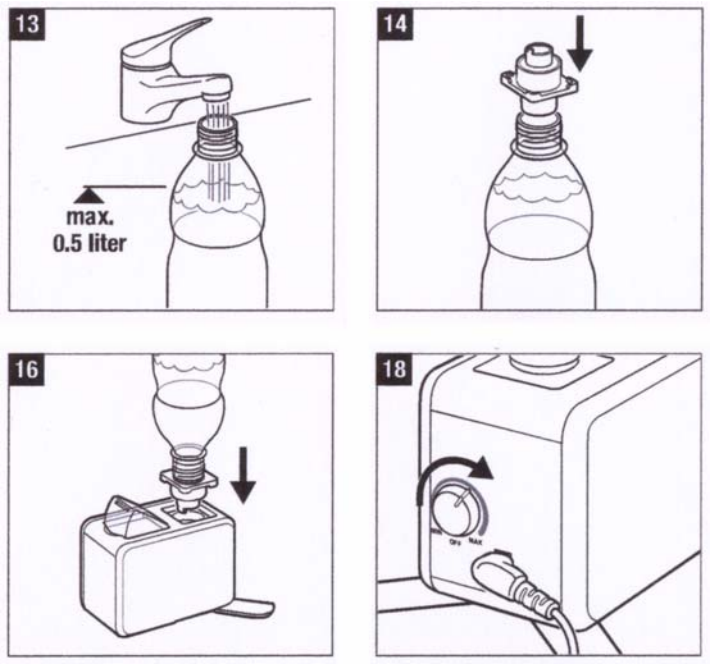
⚠WARNING	
Set the CO_2 cylinder up in a way that it is protected from toppling over. When cylinders topple over, the connection might be damaged and the cylinder might in consequence thereof be voided explosively. If necessary, use an adequate holder.	

Failure to observe the above instructions might result in individuals being injuring by flying parts and/or choking on CO_2 overdoses.

- Set the CO_2 cylinder up at the designate spot and secure it against toppling over.
- Install the pressure reducing valve and then lay the connection line (PUR 6/4 green highly flexible) between the pressure reducing valve and the control cabinet. Please observe the laying conditions that were already applied for the compressed air ducts.
- Connect the line to the pressure reducing valve and the system.

5. 4. 3. Water

1. In order to prevent possible lime scale, we recommend using distilled water instead of tap water.
2. Push the container's adapter into the PET container's opening all the way to the stop (14).
3. Put the PET container with the container adapter put on into the system's upper part (16). Do not compress the PET container (10).
4. Use the rotary button to switch on the system (17) (18).



5. 4. 4. Aeration

- Lay one de-aeration line to the outdoor area for each individual reactor. Ensure this line not be to damaged or jammed by external factors.
- Outside the building, ensure the CO_2 cannot accumulate at low-leveled spots. (Please also refer to the Safety Instructions).

5. 5. Initial Start-Up

Before the system left our factory, the control has been programmed, the sensors were checked and the reactor was subjected to an extensive functional test.

- The nominal values for controllers and recorder unit were set; the controller behavior was optimized.
- All parameters for measurements according to SIA 262, Annex I, were pre-programmed.
- The steps performed were recorded in the unit's documentation.
- Upon deliver, this documentation is handed over to the customer.

5. 5. 1. Settings

1. Set the input air pressure to 6 bar.
2. Set the input carbon dioxide pressure to 6 bar.
3. Connect the system's control unit to the power supply.
4. Set the switch provided on the control unit to "On".
5. For the settings related to automatic alarm reports via SMS/e-mail, please refer to the Logoscreen NT manual.

5. 6. Commissioning

- instructions feeding / unloading
- instructions regarding the settings, operation and servicing according to the operation manual
- issue an acceptance protocol
- hand the system over to the customer

6. Operation

6. 1. Opening the Reactor

Since the inside of the reactor features CO_2 conditions, please observe the below instructions for feeding and unloading:

1. Shut off the CO_2 supply.
2. Allow 2 minutes to pass by.
3. Open the door.

6. 2. Feeding & Unloading

Risk of injury due to stability loss

⚠ CAUTION	
Pull out only one pallet at a time when the system is being fed and/or unloaded. The weight of several pallets being pulled out at once might make the reactor tilt and thus harm you by falling prisms. Sharp edges at the samples impose the danger of injuring your hands. We thus recommend wearing suitable gloves.	

Failure to observe the above instructions might result in severe injury by crushing!

Prepare the samples in a way to prevent damage to fans or sensors by lose parts or sharp edges.

If necessary, brush the samples off outside the reactor.

6. 3. Commissioning

The reactor is delivered in a fully programmed state. Except for the automatic alarm settings, no further steps are thus required to be taken for conditions in accordance with SIA 262, Annex I.

6. 4. Setting the Climate

The reactor is delivered in a fully programmed state. Except for the automatic alarm settings, no further steps are thus required to be taken for conditions in accordance with SIA 262, Annex I.

6. 4. 1. Compact Controller

6. 4. 1. 1. Setting the Climate; Compact Controller Humidity

For alternative nominal humidity settings, press the Up or Down button on the front until the requested humidity value is indicated.

Any further settings are not required. The original manual is enclosed.

6. 4. 1. 2. Setting the Climate; Compact Controller CO_2

For alternative CO_2 content settings, press the Up or Down button on the front until the requested concentration is indicated.

The supplied sensor allows for possible settings from 1 - 5% CO_2.

Any further settings are not required. The compact controller's original manual is included with the unit's documentation.

6. 4. 2. Paperless Recorder

6. 4. 2. 1. Settings made to the Data Acquisition System

The data acquisition system is delivered fully programmed in accordance with the system's respective configuration (number of master / slaves).

The only settings required to be made relate to the alarm reports via SMS or e-mail. For those settings, please refer to the original Jumo Logoscreen NT manual enclosed with the documentation.

The software included with the delivery scope serves to read the data from the Jumo Logoscreen NT and to analyze the data thus obtained (reading by Jumo PCC, analyzing by Jumo PCA 3000).

Logoscreen NT provides an RJ45- (Ethernet) interface. It can be actuated through the network (if any) or directly.

Logoscreen NT is supplied with an internal user list comprising two users:

User: Master password: 9200

User: User password: 0

6. 4. 2. 2. Data Security

The measured data are stored by Jumo Logoscreen and can be read via software. For periods during which Logoscreen is disconnected from the power supply, measured data will not be available.

6. 5. Monitoring

Provided that Jumo Logoscreen NT's automatic alarm function has been activated, the system will automatically report exceedance and/or undercuts of alarm parameters CO_2, humidity and temperature. However, even in this case we recommend regularly checking the fill levels of gas cylinders and nebulizer water bottles.

When the climate chamber is opened manually, the CO_2 supply is automatically shut off and the automatic alarm report function is being deactivated.

The average water and CO_2 consumption depends on the chamber's operation mode. In early pre-storage stages, the unit will consume comparatively small amounts of water. When the samples are moved to the chamber supplied with CO_2, the initial CO_2 consumption will be at the highest level.

6. 6. Emergency Shut-Down

- Shut off the supply with CO_2 and compressed air and disconnect the unit from the gas connections, if necessary.
- •Switch the main switch off. Depending on the intended form of disconnection, pull the plug out of the power outlet.

6. 7. Temporary Shut-Down

- Shut off the supply with CO_2 and compressed air and disconnect the unit from the gas connections, if necessary.
- Switch the main switch off. Depending on the intended form of disconnection, pull the plug out of the power outlet.
- If tap water is being used for the nebulizer, remove PET water bottle (risk of lime scaling).

7. Service & Maintenance

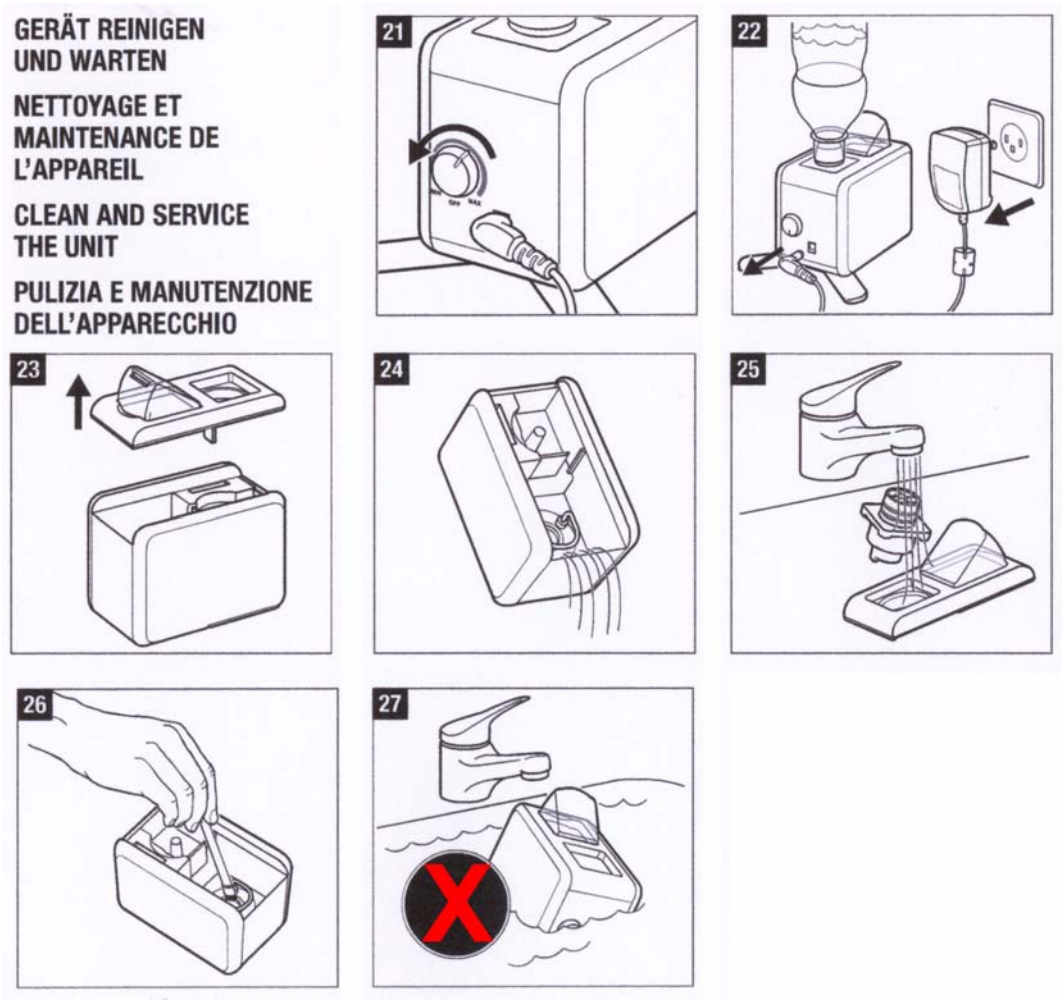
7. 1. Wear Parts & Utilities

Designation	Article N°
Nebulizer Cleaning Kit	
Water Sprayer Membrane	

7. 2. Inspection Activities

7. 2. 1. Weekly

1. Switch off the unit and pull its plug every time before you clean the system (21), (22).
2. Clean water bottle, water adaptor, unit's upper component with outlet nozzle and membrane once a week (23) – (25).
3. Use a decalcifier (CalcOff) to remove lime scale and contaminants.
   Do not clean the unit's components in a dishwasher.
4. Clean the membrane with the cleaning brush included with the delivery scope (26).



7. 2. 2. Annually

We recommend checking the sensors (humidity, temperature and CO_2) annually. The respective inspection works can be performed by TFB AG.

7. 3. Spare Parts / Repair / Service

For Swiss customers, TFB AG offers a repair and spare part service subject to a fee.

7. 3. 1. Calibration

In order to get your unit calibrated, please contact your competent accredited calibration laboratory.

8. Decommissioning / Disposal

8. 1. Shutting Down the Reactor

- Close the CO_2 cylinder.
- Disconnect the CO_2 cylinder from the unit.
- Shut off the air supply at the pneumatic service unit.
- Pneumatically disconnect the service unit from the system.
- Remove the PET water container.
- Disconnect the power supply.

8. 2. Transportation

Please observe the transportation instructions in Chapter 5.

8. 3. Storage

For the storage of the CO_2 reactor and the climate chamber, please observe the below ambient conditions:

- do not store outdoors
- min. temperature + 2°
- max. temperature + 35°
- max. relative humidity 55%

8. 4. Disposal

Please assign a designated specialist with the unit's disposal or return the reactor to the manufacturer who will ensure its proper disposal.

9. Appendix

- Technical Data
- Electrical flow diagram
- Pneumatic diagram
- Instruction Manual Jumo
- Calibration certificate CO_2 detector
- Reactor documentation

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