USER MANUAL | VERSION 3.0

Distillacid BSB-939-IR
Subboiling Apparatus

BERGHOF

Disclaimer

The content of this publication was checked for compliance with the hardware and software described. However, discrepancies may arise, therefore no liability is assumed regarding complete compliance. The information in this document will be checked regularly and all necessary corrections will be included in subsequent editions. Suggestions for improvements are always welcome.
Subject to technical changes.

Trademarks

Distillacid is a registered trademark of Berghof Products + Instruments GmbH.

General Information on this Manual

- → This user manual describes the Subboiling Apparatus Distillacid BSB-939-IR from Berghof Products + Instruments GmbH. It contains product specific information, current as of the date of publication of this manual.
- → This manual guides the user in the safe and proper use of the Subboiling Apparatus. Familiarity with the relevant chapters of this handbook is required for safe and intended use of the equipment.
- → Read this instructional manual carefully prior to operating the equipment. After unpacking, carefully check the equipment for mechanical damage and missing parts. Should you find any damage incurred during shipment, contact the manufacturer immediately and do not operate the equipment.
- → This instructional manual does not include repair instructions. Should repairs be required, please contact your dealer or Berghof Products + Instruments GmbH.

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Berghof Products + Instruments GmbH works in accordance with DIN EN ISO 9001:2008.

Contents

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1. General Notes

Please read this instruction manual carefully before operating your temperature controller. Failure to follow these instructions could result in damage to the equipment as well as personal injury.
Safety instructions are described in section 'Danger Categories and Signal Words'. These safety notes must be heeded in all cases!

1.1. Danger Categories and Signal Words

The signal words described below are used in connection with warnings throughout this manual. For your own safety and to avoid property damage, you must strictly heed these warnings!

The safety signals are printed in boldface or are otherwise marked throughout this manual and have the following meanings:

DANGER	Means that failure to follow the safety instructions **is likely to cause** severe personal injury, death or severe property damage.
WARNING	Means that failure to follow the safety instructions **may cause** severe personal injury, death or severe property damage.
CAUTION	Means that failure to follow the safety instructions **may cause** personal injury or some property damage.
NOTICE	This symbol indicates that this is important information regarding the product or refers to a part of the manual, which requires particular emphasis.

1.2. Qualified Users

Only Qualified Users should operate this equipment. Qualified Users with respect to this manual are relevantly schooled and trained specialists with a basic knowledge of chemistry and technology. They should be trained in the relevant legal regulations for handling of chemicals.

1.3. Proper Use

Explosion hazard!

The unit is not designed for the purification of high-boiling liquids (e.g. sulfuric acid, phosphoric acid) and for substances decomposing exothermically or forming explosive vapors upon heating (e.g. perchloric acid. alcohols, ether etc.).

Observe all operating instructions!

Careful working practices and conscious compliance with safety regulations is necessary when working with acids and chemicals. Please strictly comply with operating instructions and follow the appropriate safety measures of the individual acids and chemicals.

→ Application area for BSB-939

The subboiling apparatus Distillacid BSB-939-IR is used for the production of ultrapure acids for use in ultra trace analyses. The apparatus makes use of the principle of vaporization at normal pressure below the boiling point. Thus the transport of contaminants by droplets is largely suppressed, i.e. all not very volatile substances, especially salts, remain in the residue. Qualified handling and, possibly, proper transport, storage, set-up, and use, as well as conscientious maintenance are all prerequisites for the trouble-free and safe operation of the Distillacid BSB-939-IR subboiling system.
The system may only be used within the context of data and applications specified in this documentation and the associated user manuals.

The subboiling apparatus may only be used:

- → Properly
- → In a technically flawless condition
- → Without unauthorized alterations or modifications
- → By qualified users

Please also observe all regulations published by professional/trade associations, the TÜV, VDE regulations, or corresponding national regulations.

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53-0017-93-01-03-001

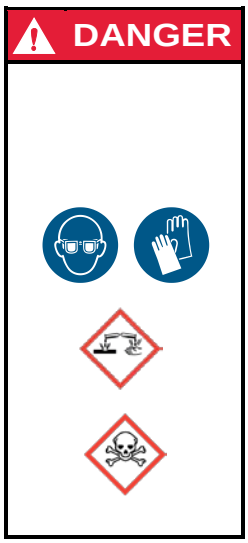
1.4. General Safety Information

Purifying acids and chemicals by Subboiling involves taking into account various safety precautions which go beyond those for general laboratory practices. The following general safety information should therefore be read carefully prior to using the system, and should be observed at all times.

We can assume no liability for damages resulting from improper handling of a failure to comply with this information.

Explosion hazard!

The unit is not designed for the purification of high-boiling liquids (e.g. sulfuric acid, phosphoric acid) and for substances decomposing exothermically or forming explosive vapors upon heating (e.g. perchloric acid. alcohols, ether etc.).



Acid Container!

Use only spare parts authorized by Berghof Products + Instruments GmbH for use with the Distillacid BSB-939-IR. These can be obtained either from your local dealer or directly from Berghof Products + Instruments GmbH (Refer to the “Repairs / Customer Service” section for contact addresses).

Always wear safety glasses/goggles and protective gloves when working with acids and chemicals! Never attempt to use force to open the container. Never use tools to open the container!

Hot gases and vapors may be released from the container when it is opened! Always make sure that it is cooled down to room temperature before opening!!

Only open the container under a fume hood or other exhaust system. Particular care is required when working with hydrofluoric acid (HF). Observe all relevant data sheets and safety instructions!

In general, running dry for longer periods of time should be avoided.

Always wear eye protection and protective gloves!

Always wear safety glasses/goggles and protective gloves during work which may involve contact with chemicals, that is, when working with acids during cleaning, etc.!

IR Lamp!

The subboiling apparatus Distillacid BSB-939-IR uses an IR lamp for heating. Never look directly into the IR lamp during operation.

Do not pour any liquids onto the IR lamp.

WARNING

The unit employs low voltage!

The Distillacid BSB-939-IR must always be carefully connected to a grounded conductor. Provided the wall outlet used is equipped with a ground connection, the supplied power cord will ensure proper connection. If it is necessary to use an extension cord to connect the system to the power supply, only a three-wire cord with a ground connection may be employed.

Repair and servicing of the equipment may only be performed by trained personnel of Berghof Products + Instruments.

CAUTION

Emissions!

Concentrated acids (e.g. HCl 37%) are depleted during distillation, since only the azeotropic concentration is maintained during distillation. The excess acid gas is generally released through the ventilation frit. If possible, use start concentrations as close to the azeoptrope as possible.

1.5. Safety and Emissions

In the following situations, the unit must be disconnected from the mains power supply and be locked out to prevent accidental use:

- → If the unit evidences visible signs of damage
- → If unit parts or components are found to be loose
- → If the unit fails to operate
- → If the unit is to be stored for extended periods of time under unfavorable conditions (e.g., outdoors, in very moist or humid environments)

Emissions!

Concentrated acids (e.g. HCl 37%) are depleted during distillation, since only the azeotropic concentration is maintained during distillation. The excess acid gas is generally released through the ventilation frit. If possible, use start concentrations as close to the azeoptrope as possible.

Safety information on the unit

Warning label is located on the base support.

European Community

→ EU-Norms

This device has been designed and tested in accordance with the following IEC publications:

Title	Norms
Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements	DIN EN 61010-1; VDE 0411-1 IEC 61010-1; German version EN 61010-1
Safety requirements for electrical equipment for measurement, control and laboratory use – Part 2-010: Particular requirements	DIN EN 61010-2-010; VDE 0411-2-010 IEC 66/481/CDV:2012); German version FprEN 61010-2-010
Safety requirements for electrical equipment for measurement, control and laboratory use – EMC- requirements Part 1: General requirements	DIN EN 61326-1; VDE 0843-20-1 IEC 61326-1:2012; German version EN 61326-1
Safety requirements for electrical equipment for measurement, control and laboratory use – EMC- requirements Part 2-2: Particular requirements	DIN EN 61326-2-2; VDE 0843-20-2-2 IEC 61326-2-2:2012; German version EN 61326-2-2

CE designation

Products from Berghof Products + Instruments GmbH comply with the guidelines of the VDE and the European Standards. The conformity tests performed by Berghof Products + Instruments GmbH comply with the currently required standards for electrical safety. All limit values with respect to interference emission and interference protection have been maintained.

Conformity declaration

Refer to chapter Appendix

1.6. Information on Disposal

→ Disposal within the EU

European Community

Electrical and electronic products should not be mixed with general household waste. Berghof Products and Instruments GmbH accepts its electrical and electronic instruments from on a free of charge basis for proper treatment, recovery and recycling from their business users. If you wish to discard electrical and electronic products, please contact your local dealer or Berghof Products and Instruments GmbH (laboratorytechnology@berghof.com). They will provide further information.
Disposing of this product correctly will help to protect our environment.

→ Disposal outside the EU

Countries outside the European Unionn

This regulation is only valid in the European Union

NOTICE	Berghof products are **not used** in private households.

1.7. Warranty / Limitation of Warranty

Limited Warranty
Each product manufactured by Berghof Products + Instruments GmbH is warranted to conform to Berghof Products + Instruments GmbH's applicable specifications on the date on shipment. The warranty period is twelve (12) months after the date of delivery, unless another period is specified. The warranty does not extend to damages due to improper installation, improper maintenance, abuse, accident, negligence, alteration, misuse, ordinary wear and tear, or the like. Claims for replacement of parts caused by ordinary wear and tear are excluded, as are claims for replacement of parts meant to be expended during the operation of the equipment.

Remedies
Under the limited warranty, Berghof Products + Instruments GmbH repairs or replaces any products which Berghof Products + Instruments GmbH determines to be defective and covered by this limited warranty. This is the sole and exclusive remedy. If Berghof Products + Instruments GmbH determines that repair or replacement fails its essential purpose, the purchaser will, at its option, be entitled to a refund of the purchase price for the products in question or a credit therefore.
All warranty claims must be accompanied by a description of the claim, which description must be attached to the equipment claimed to be defective. Claim descriptions must include the claimants name, address, department (if applicable) and telephone number.
The equipment should be returned in its original packaging, to the extent possible. We regret that Berghof Products + Instruments GmbH cannot be held responsible for damage caused during shipping due to improper packaging.

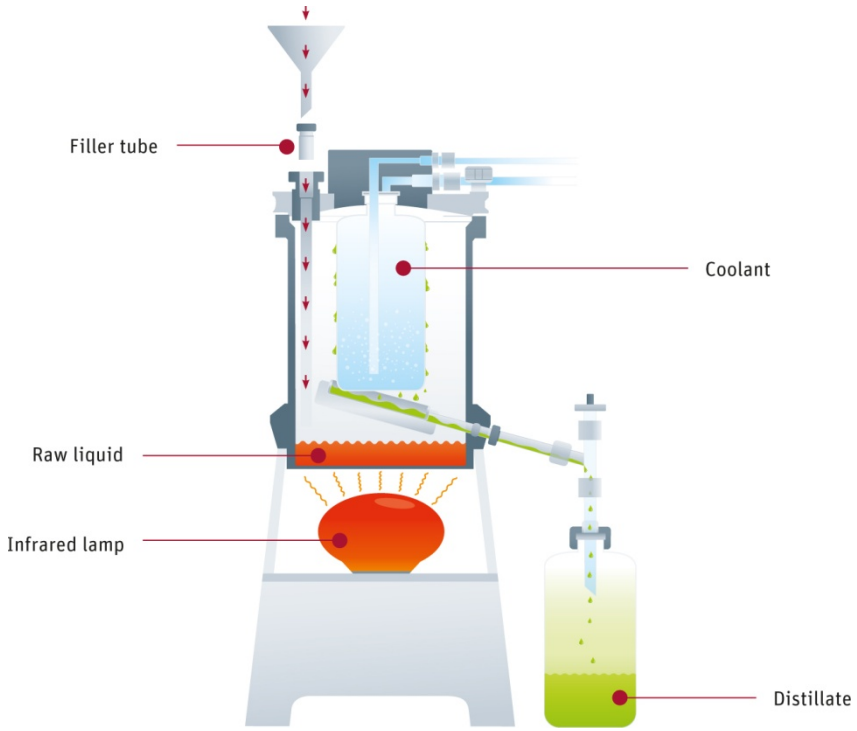
Limitation of warranty
Except as expressly set forth above, there are no other warranties hereunder, whether expressed or implied, arising by operation of law or otherwise, including without limitation, the warranties of merchantability, fitness for a particular purpose and any warranties arising under course of performance, course of dealing or usage of trade.
Under no circumstances will Berghof Products + Instruments GmbH be liable for any consequential, exemplary, incidental, indirect or special damages, or lost profits, expenses or loses arising out of or related to the sale or use of any of its products regardless of whether the liability resulted from any general or particular requirement or need which Berghof Products + Instruments GmbH knew or should have known of.

2. Device Description

2.1. Basic instrument

→ Subboiling principle

The subboiling apparatus BSB-939-IR is used for the production of ultra-pure acids for use in ultra trace analyses. The apparatus makes use of the principle of vaporization at normal pressure below the boiling point. Thus the transport of contaminants by droplets is largely suppressed, i.e. all not very volatile substances, especially salts, remain in the residue.
Only isostatically pressed PTFE / PFA as well as polypropylene were used as materials for its construction. Thereby, the whole apparatus has a very high service life even when using with aggressive acids or handling in the generally rough lab environment. The only parts which are subject to wear and tear (lamp, lamp socket) can be exchanged very easily.
Since the substance which is to be purified only comes in contact with PTFE and PFA, the BSB-939-IR is especially suitable for purifying hydrofluoric acid. The distillate is only in contact with PFA, thereby additionally reducing the chance of contamination and spreading. Any contact to metal (heating plate) is avoided by the non-contact heating through infrared radiation.



Connections
The BSB-939-IR has several connections as depicted in figure 1 (see. chapter Installation)

2.1.1. Technical Specification

BSB-939-IR	
Power supply	230 V
Frequency	50 / 60 Hz
Power consumption	250 W
approx. dimensions (W x D x H)	40 x 40 x 590 mm (15.7 x 15.7 x 23.2 inches)
approx. weight	7 kg (15.4 lb)
Noice level	< 40 dB
Materials	PTFE / PFA / PP
Operating temperature	10° C – 20°C (50 - 68°F) below the boiling point of the used acid
Max. operating temperature	150° C (302°F)
Cooling water	0,3 liter / min.
max. inlet temperature	20°C (68°F)
Control	Timer

Distillation performance	
Water	1,8 l / 24 h
HNO3	1,2 l / 24 h
HCl	1,1 l / 24 h
HF	1,0 l / 24 h

3. Setup and Commissioning

3.1. Standard Delivery

Refer to the delivery volume supplied with the appliance.

3.2. Setup and Commissioning

3.2.1. Ambient Conditions

Emissions!

Concentrated acids (e.g. HCl 37%) are depleted during distillation, since only the azeotropic concentration is maintained during distillation. The excess acid gas is generally released through the ventilation frit. If possible, use start concentrations as close to the azeoptrope as possible.

The entire apparatus should be set up under a hood, since it is not possible to completely avoid all release of acidic vapors, especially when using highly concentrated starting materials.

The apparatus must not be set up in wet conditions (it is not resistant to water sprays).

The setup location must meet the following requirements:

Ambient conditions	
Ambient temperature	+10°C (50°F) to +40°C (104°F) In addition, the temperature should lie between 40°C (-40°F) to +70°C (158°F) during shipping and storage
Max. rel. humidity	85%
Space requirements (W x D x H)	approx. 40 cm x 40 cm x 90 cm approx. 15,7 x 15,7 x 35,4 inch
Load bearing capacity	At least 7 kg (15,4 lb)
Electrical connection	90 – 240 V; 50/ 60 Hz

3.2.2. Unpacking / Inspection

Open the shipping packaging and carefully remove it. Please save all packaging in order to be able to return the unit to the manufacturer in its original packaging, should service be required.

Also remove all other components and accessories and inspect the delivery to make sure it is complete.

Inspect the system for shipping damage such as cracks, scratches, dents, etc

WARNING	**Visible damage!** For safety reasons, never operate the unit if it exhibits visible signs of damage. Contact your local, authorized dealer or Berghof Products + Instruments GmbH to obtain the required service (Refer to the “Repairs / Customer Service” section for contact addresses).
NOTICE	Should any components be missing or damages be detected, contact your local, authorized dealer or Berghof Products + Instruments GmbH directly (Refer to the “Repairs / Customer Service” section for contact addresses).

3.2.3. Installation

Positioning
Position the system on the intended work surface. The work surface must be able to support the weight of the Subboiling apparatus (ca.7 kg; 15,4 lb) and must have a surface area of approx. 40 x 40cm
(15.7 x 15,7 inches DxW)

NOTICE	Users are responsible for assuring that appropriate ventilation of toxic gases is assured. Make sure that all ventilation procedures conform to applicable laws.

Set up
Assemble all parts as shown in the figure below.

a) Assembling the components

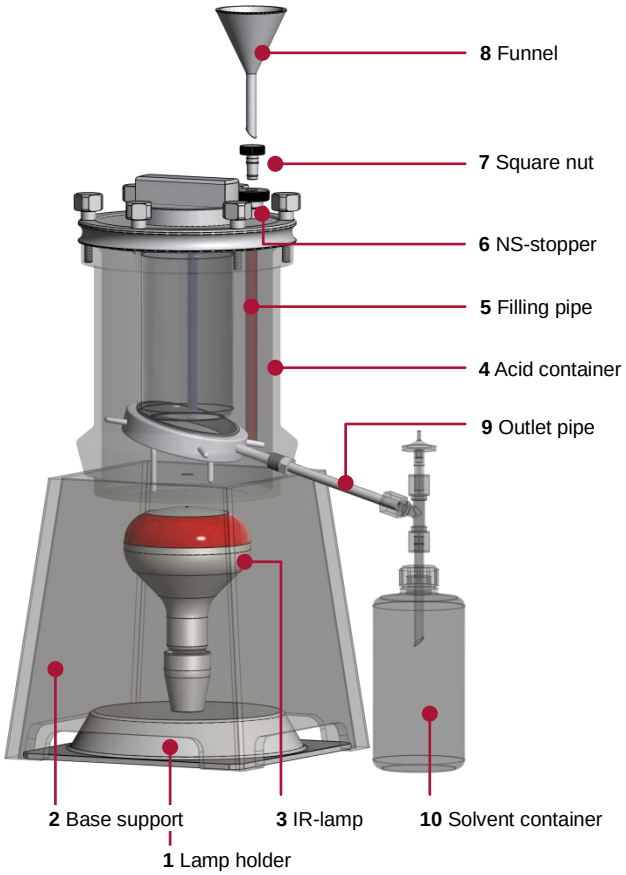
It is advisable to put first the (1) lamp holder with connection on the work space to protect the IR lamp.

Next put the (2) base support over the lamp holder and only then screw in the (3) IR-lamp from above.

Place the (4) acid container onto the base support and insert the (5) filling pipe together with the (6) NS-stopper into the lid of the acid container.

For closing use the (7) knurled plug or for refilling the (8) funnel.

The complete (10) solvent container with T-connection and filter is to be insert in the (9) outlet pipe and screwed together hand-tight.



CAUTION

Cooling of the IR lamp

After mounting the acid container, openings remain between the acid container and the lamp casing. These are part of the design and may not be sealed (cooling of the IR lamp). This also applies to the openings at the bottom of the lamp holder.

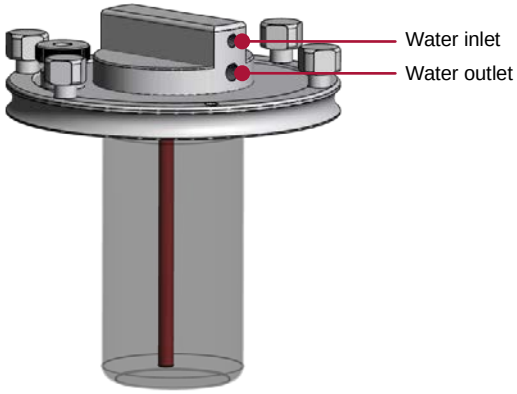
b) Connection cooling

NOTICE

To avoid overpressure in the cooler, tubes with different diameters for feed and discharge are used. The cooling water should always be running through the tube with the smaller diameter. The instrument must not be connected to a pressurized cooling water circulation.

The two PE tubes are put on to the hose connections of the connection block.

Connect the cooling water feed to a water faucet or a circulating refrigerant.
The required amount of cooling water is approximately 0.3 l/min



c) Electrical connection

WARNING

The unit employs low voltage 230V!

The Distillacid BSB-939-IR must always be carefully connected to a grounded conductor. Provided the wall outlet used is equipped with a ground connection, the supplied power cord will ensure proper connection. If it is necessary to use an extension cord to connect the system to the power supply, only a three-wire cord with a ground connection may be employed.

Repair and servicing of the equipment may only be performed by trained personnel from Berghof Products + Instruments GmbH.

Connect the timer to a suitable 230V; 50 / 60Hz (US-Version:115V, 60Hz) power source and connect the unit with the supplied power cord with the timer.

The system is now ready for use.

4. Operation

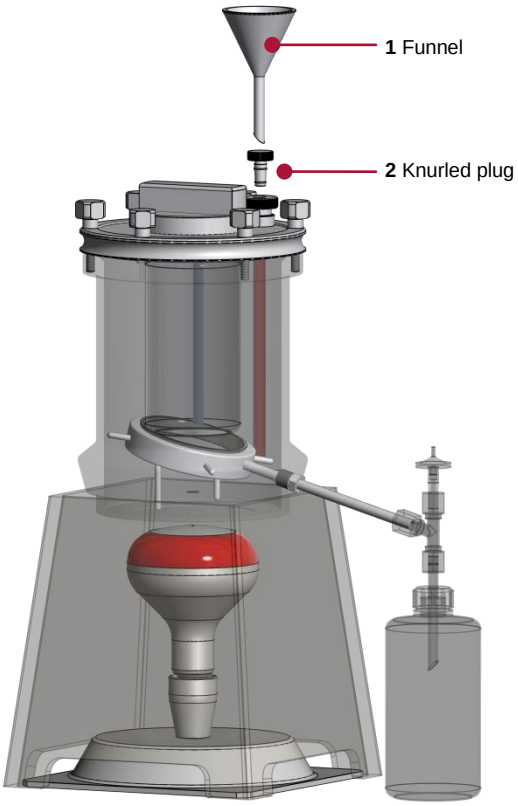
4.1. Filling the acid container

Always wear eye protection and protective gloves!

Always wear safety glasses/goggles and protective gloves during work which may involve contact with chemicals, that is, when working with acids during cleaning, etc.!

The acid container is filled through the filling hole in the lid using the filling tube and (1) funnel.

A maximum of 0.75 liters of liquid may be filled into the container. After filling the filling hole is sealed with the (2) TFM™-PTFE knurled plug.



4.2. Timer

Refer to the supplied manual for the timer.

4.3. Operation

Turn on cooling water and switch on IR lamp. To prevent the apparatus from running dry for an unnecessarily long time, turn it off in time. The complete distillation time for a particular amount of liquid can vary some from one apparatus to the next. Approximate values are listed in the technical data section.

Initially, a new apparatus should be run with an acid for several days before the purified acid is withdrawn.

It is recommended to use a starting material with at least p.a. quality.

NOTICE

If the apparatus runs dry for a short period of time (< 30 minutes), its functional ability is not reduced. If it runs dry for longer periods of time, the PTFE materials undergo much more wear and tear. In general, running it dry for longer periods of time should be avoided.

CAUTION

Emissions!

Concentrated acids (e.g. HCl 37%) are depleted during distillation, since only the azeotropic concentration is maintained during distillation. The excess acid gas is generally released through the ventilation frit. If possible, use start concentrations as close to the azeoptrope as possible.

4.4. Refill

WARNING

Always wear eye protection and protective gloves!

Always wear safety glasses/goggles and protective gloves during work which may involve contact with chemicals, that is, when working with acids during cleaning, etc.!

Always add as much liquid as was removed since the last refill (refer to `Filling of the acid container´).

5. Maintenance, Troubleshooting and Service

5.1. Cleaning

DANGER

Acid Container!

Use only spare parts authorized by Berghof Products + Instruments GmbH for use with the Distillacid BSB-939-IR. These can be obtained either from your local dealer or directly from Berghof Products + Instruments GmbH (Refer to the “Repairs / Customer Service” section for contact addresses).

Always wear safety glasses/goggles and protective gloves when working with acids and chemicals! Never attempt to use force to open the container. Never use tools to open the container!

Hot gases and vapors may be released from the container when it is opened! Always make sure that it is cooled down to room temperature before opening!! Only open the container under a fume hood or other exhaust system. Particular care is required when working with hydrofluoric acid (HF). Observe all relevant data sheets and safety instructions!

In general, running dry for longer periods of time should be avoided.

CAUTION

Acid burn hazard!

Acidic vapors, especially HCl and HF, can diffuse into the PTFE shell of the acid container after long exposure, so that even after rinsing with water acid vapors may still be released (wear gloves!).

Acid container

The residue from the distillation should be removed from time to time (approximately weekly or after approx. 10 l distillate), for example by using a vacuum pump.

IR lamp

Dirt deposits on top of the IR lamp may lead to a reduction in distillation rate after some time. The top of the lamp can be cleaned with a damp cloth. Allow to dry completely before switching it on again!

5.1.1. Basic cleaning

Always wear eye protection and protective gloves!

Always wear safety glasses/goggles and protective gloves during work which may involve contact with chemicals, that is, when working with acids during cleaning, etc.!

Hot acid parts!

The lid of the acid container may not be removed until the apparatus has cooled down completely.

Acid burn hazard!

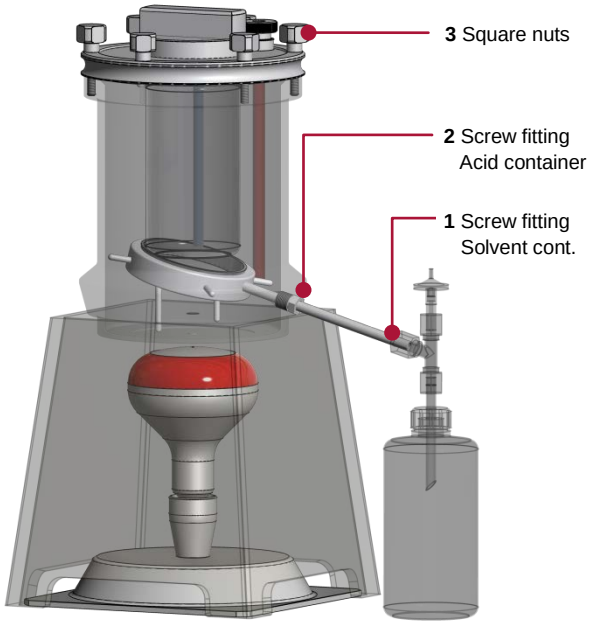
Acidic vapors, especially HCl and HF, can diffuse into the PTFE shell of the acid container after long exposure, so that even after rinsing with water acid vapors may still be released (wear gloves!).

The acid container can be removed from the lamp casing for cleaning. In order to do so, appropriate care must be taken in case any acid is left in the container.

To separate the solvent container from the acid container, open the screw fitting on the (1) solvent container and not on the (2) acid container.

The container should only be cleaned with bidistilled water.

To avoid damages during assembly it has to be taken care that the (3) square nuts are only crosswise hand tightend.



5.2. Maintenance

Es fallen keine regelmäßigen Wartungsarbeiten an.

5.3. Troubleshooting

Fault	Possible cause	Corrective action
Distillation rate is unusually high	Condenser not tightly screwed on, cooling water pass through.	Seal condenser
Poor qualtiy of acid	Cooling water pass through Contamination in the system	Seal condenser Cleaning (see ´Cleaning
Poor distillation performance	Contamination on IR lamp	Clean IR lamp (see ´Cleaning´)

You can obtain technical support from your regional Berghof dealer or directly from Berghof Products + Instruments GmbH by contacting:

Berghof Products + Instruments GmbH
Harretstr. 1
72800 Eningen / Germany
Tel: +49/(0)7121/894-202
Fax: +49/(0)7121/894-300
e-mail: service@berghof-instruments.de

Please provide your unit's serial number with all repair questions or repair orders. The serial number is located on the nameplate.

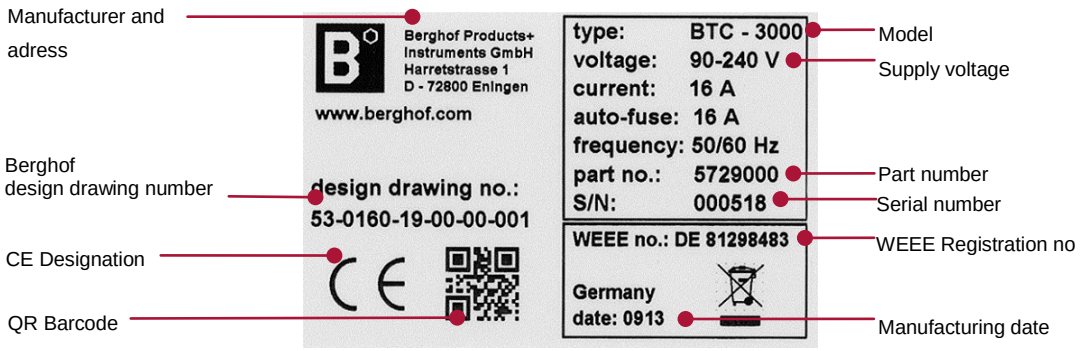
5.4. Repairs / Customer Service

You can obtain technical support from your regional Berghof dealer or directly from Berghof Products + Instruments GmbH by contacting:
Berghof Products + Instruments GmbH
Harretstr. 1
T +49.7121.894-202
F +49.7121.894-300
e-mail: service@berghof-instruments.de

Please provide your unit's serial number with all repair questions or repair orders. The serial number is located on the nameplate.

5.5. Nameplate

The nameplate is located on the bottom of the device.



6. Appendix

6.1. Conformity Declaration

DECLARATION OF CE-CONFORMITY S. 1/1

Distillacid BSB-939-IR
Subboiling Apparatus

Manufacturer	Berghof Products + Instruments GmbH Harretstrasse 1 D - 72800 Eningen
Product	BSB-939-IR
Part number	5037000, 5038000

This product meets the limit values for the following norms of the European community:

Safety requirements for electrical equipment for measurement, control and laboratory use Part 1: General requirements	DIN EN 61010-1; VDE 0411-1:2011-07:2011-07 IEC 61010-1:2010; German version EN 61010-1:2010
Safety requirements for electrical equipment for measurement, control and laboratory use – Part 2-010: Particular requirements	DIN EN 61010-2-010; VDE 0411-2-010:2013-01:2013-01 IEC 66/481/CDV:2012); German version FprEN 61010-2-010:2012
Safety requirements for electrical equipment for measurement, control and laboratory use – EMC- requirements Part 1: General requirements	DIN EN 61326-1; VDE 0843-20-1:2013-07:2013-07 IEC 61326-1:2012; German version EN 61326-1:2013
Safety requirements for electrical equipment for measurement, control and laboratory use – EMC- requirements Part 2-2: Particular requirements	DIN EN 61326-2-2; VDE 0843-20-2-2:2013-08:2013-08 IEC 61326-2-2:2012; German version EN 61326-2-2:2013

The unit is suited for installation in business and commercial areas and small businesses. Installation in an industrial area can lead to disturbances in the unit.

Eningen, November 7th 2013
Date

Dr. Dieter Gutwerk
Manager Labor-Technik

BERGHOF

Berghof Products + Instruments GmbH | Harretstrasse 1 | 72800 Eningen | www.berghof.com
53-0017-41-01-01-001, Änderungen und Irrtümer vorbehalten

6.2. Conversion Table

Conversation of units		
Dimension	**Unit**	**Conversation**
Temperature	°C = °F =	(°F – 32°) / 1.8 1.8 * °C +32°
Length	1 cm = 1 inch =	0.3937 inch 2.540 cm
Volume	1 ml = 1 $inch^3$ = 1 gallon =	0.06102 $inch^3$ = $2.642*10^{-4}$ gallon 16.387 ml = $43.29*10^{-4}$ gallon 3785 ml = 231 $inch^3$
Pressure	1 bar = 1 psi = 1 Mpa =	14.504 psi = 0.1 Mpa 0.06895 bar = 0.0068948 Mpa 10 bar = 145.04 psi
Weight	1 kg = 1 lb. =	2.2046 lb. 0.4536 kg

6.3. Abbreviation

Plastics			
Abbreviation	**Technical term**	**Melting point**	**Chemical resistance**
PE	Polyethylene	130 – 145 °C	high
PEEK	Polyetheretherketone	335 °C	high
PFA	Perfluoralkoxy	300 – 310 °C	very high
PTFE	Polytetrafluorethylene	327°C	high
TFM™-PTFE	Modified Polytetrafluorethylene	327°C	high
PP	Polypropylene	163°C	high