

diagenode

A Hologic Company

Bioruptor[®] Pico

Sonication System



Guarantee

Limited one year global warranty

Diagenode guarantees all products from any manufacturing defects as we rigorously test all products to meet strict quality standards. Diagenode warrants that all standard components of its instruments will be free of defects in materials and workmanship for a period of one (1) year from the date that the warranty period begins, unless the original quotation or accompanying documentation states a different warranty period. All warranty periods begin on the date of delivery and apply only to the first purchaser of the product. If a manufacturing defect arises and a valid claim is received within the warranty period, Diagenode, at its discretion, will repair or replace the product in accordance with the warranty terms and conditions stated herein. In case of repair or replacement of a product under warranty, Diagenode will cover the expenses to return the repaired or replacement product.

This warranty covers only manufacturing defects and does not cover any damage caused by misuse, lack of compliance to recommendations stated in the manual, neglect, accidents, abrasion, or exposure to extreme temperatures, chemical solvents, or acids. We strongly recommend that maintenance or repairs of Diagenode's products are performed by our approved Diagenode service center. Improper or incorrectly performed maintenance or repairs will void the warranty.

Technical assistance & ordering information

For the rest of the world, please contact Diagenode s.a.

Diagenode s.a. BELGIUM | EUROPE

LIEGE SCIENCE PARK
Rue Bois Saint-Jean, 3
4102 Seraing (Ougrée) - Belgium
Tel: +32 4 364 20 50
Fax: +32 4 364 20 51
techsupport@diagenode.com
orders@diagenode.com

Diagenode LLC. USA | NORTH AMERICA

400 Morris Avenue, Suite #101
Denville, NJ 07834 - USA
Tel: +1 862 209-4680
Fax: +1 862 209-4681
techsupport.na@diagenode.com
orders.na@diagenode.com

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BIORUPTOR® PICO

Critical steps for maintenance and efficient shearing

General warnings

- **DO NOT** turn on the instrument without water.
- **DO NOT** tilt the Bioruptor® Pico. To change the water, use either the plastic pump or a beaker (be careful not to scratch the bottom of the sonication bath).

Sonication bath levels

- The sonication bath must be filled with distilled water to the fill line. Fill line replacement stickers can be obtained by contacting Diagenode.
- At least once per month.

Sonication bath temperature

- Optimal temperature for sonication is 4°C. Sample temperature should not exceed 8°C.
- The Bioruptor® Cooler (Cat. No. B02010010, B02010011, B02010012) has to be used to guarantee the automatic temperature control of the sonication bath during the entire sonication process.

Validated tubes for the Bioruptor® Pico

- DNA shearing: 0.1 ml (Cat.No. C30010015), 0.2 ml (Cat.No. C30010020) and 0.65 ml (New Cat. No. C30010011; Old Cat. No. WA-005-0500) Bioruptor® Microtubes for DNA shearing.
- Chromatin shearing: 0.1 ml (Cat. No. C30010015), 0.2 ml (Cat.No. C30010020) and 1.5 ml (Cat.No. C30010016) Bioruptor® Microtubes and 15 ml (Cat.No. C01020031) Bioruptor® Tubes & sonication beads.

Fitting 0.1, 0.65, 1.5, or 15 ml tubes in the tube holder

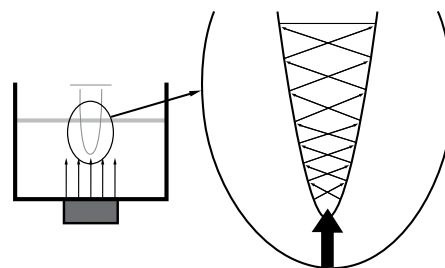
- Place the tubes in the corresponding tube holder. Never leave empty spaces in the tube holder. Fill the empty spaces with tubes containing the same volume of water. Screw the lid on the tube holder without over-tightening it.
- Carefully place the tube holder on the holding plate.
- During sonication, samples must remain at the bottom of the tube. If needed, briefly centrifuge samples during sonication after pausing the run.

Introduction

Diagenode's Bioruptor® Pico uses a gentle method of sonication to retain the integrity of DNA and/or biological complexes, including chromatin, protein-protein binding, protein-DNA complexes and other biochemical and biological assay systems. The Bioruptor® Pico sonication system uses a sonication bath to generate indirect sonication waves, which emanate from an ultrasound element below the water tank. Because the system is gentler than other sonicators, the Bioruptor® Pico produces better and more consistent results than with harsher sonication methods. Up to 16 closed tubes can be sonicated in parallel and the continuous rotation of tubes allows even distribution of the energy for efficient sonication. The Bioruptor® Pico enables automation of sonication, guaranteeing higher reproducibility of results.

The effect of ultrasound on biological sample

The Bioruptor® Pico sonication system uses ultrasound to create focused mechanical stress to shear chromatin or DNA. Ultrasound waves pass through the sample expanding and contracting the liquid. During expansion, negative pressures pull the molecules away from one another to form a cavity or bubble. This process is called cavitation. The bubble continues to absorb energy until it can no longer sustain itself and implodes. This produces intense focused shearing forces, that disperse and break biomolecules. The fragmentation of chromatin or DNA takes place as a consequence of this mechanical stress or shear.



With the Bioruptor® Pico, the entire volume of water present in the sonication bath is exposed to ultrasound, allowing all the samples to be efficiently sonicated in parallel (Figure 1).

Use of Bioruptor® Pico by pregnant women

Exposure to 20-60 kHz sound waves has not been shown to be harmful to human health. However, we would recommend avoiding unnecessary exposure. Diagenode recommends that pregnant women should not be exposed to 20-60 kHz wave lengths for a long period of time.

Bioruptor® Pico technical specifications

BIORUPTOR® PICO	
Power supply	100-230V, 50/60Hz, 2.1A (EU) / 4.2A (US)
Ultrasonic wave frequency	20-60 kHz
Ultrasonic wave output power	25-210 W
Sonication unit dimensions	350 (W) x 245 (D) x 280 (H) mm
Sonication bath volume	750 ml
Timer	Digital
Possibility to control water flow via connector kit for Bioruptor® Cooler	Yes
Tube holder	Available for 0.1, 0.65, 1.5 or 15 ml tubes
Total weight	7,90 kg
Number of samples to be processed simultaneously	0.1 ml tubes – 12 samples 0.2 ml tubes – 16 samples 0.65 ml tubes – 12 samples 1.5 ml tubes – 6 samples 15 ml tubes – 6 samples

Getting to know your Bioruptor® Pico system

Bioruptor® Pico components overview



Power cable (EU)



Power cable (US)



Tube holder

Bioruptor® Cooler



Sonication bath

The sonication bath is a critical component of the instrument. The generators below the tank produce ultrasonic waves which are then transferred through water. The sonication bath requires special handling and care as described below.

Handling

The sonication unit must remain upright at all times, especially when moved. Tilting the sonication unit or handling roughly may damage the ultrasound emitter component, resulting in a substantial drop in sonication efficiency. If transportation of the apparatus is required after initial set-up, it is imperative to keep the sonication unit at a right angle to the ground during the transport at all times.

Water level and quality

The level of the water has been optimized and should always reach the red line (sticker on the wall of the tank). **Distilled water** should be used to fill the tank. Replacement stickers can be obtained from Diagenode.



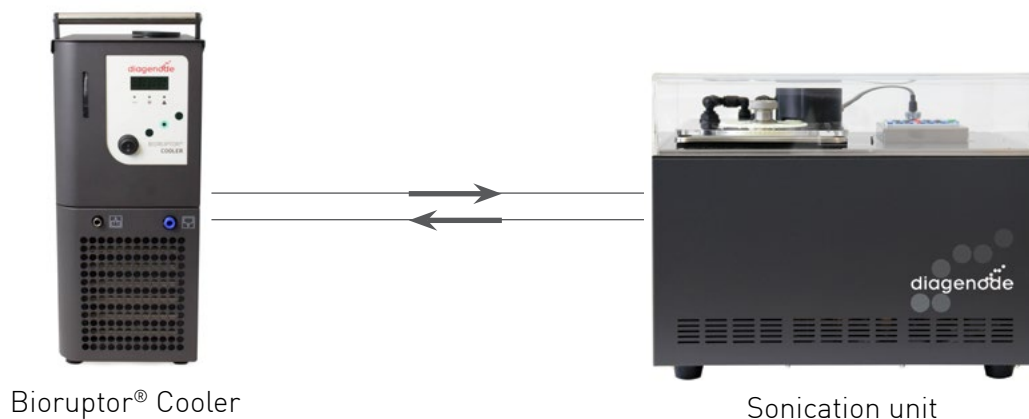
Water temperature

The water in the sonication bath must be kept at **4°C**. Ultrasonic waves produced by the Bioruptor® Pico generate heat. Drop off in sonication efficiency will occur above 8°C. To ensure preservation of the samples and to prevent damage to the instrument, it is necessary to start the sonication process with cold water and to keep it at 4°C during the sonication process.

Automatic temperature control

The Bioruptor® Cooler (Cat. No. B02010010, B02010011, B02010012) to guarantee the automatic temperature control of the sonication bath during the entire sonication process (Figure 2). The cooling system features two pumps and produces a regular water flow to

maintain a constant water level in the tank. The integrated regulating valve ensures that water will only be replaced during the off cycle to avoid any interference between the water flow and the sonication process.



Motorized lid

The motorized lid, along with the gear plate accessory, keeps the sample tubes in constant rotation and ensures optimal position in the sonication bath during sonication. When in motion, do not hamper the rotation of the white gear plate. Avoid the immersion of the motor into the water. Do not heat the white plastic as it will warp.



Tube holders

Several sizes of tubes can be used with the Bioruptor® Pico.

The minimum and maximum sample volume to be used with each tube is given in the table below.

TUBE SIZE	MINIMUM	MAXIMUM
0.1 ml	5 or 10 µl	50 µl
0.2 ml	20 µl	100 µl
0.65 ml	100 µl	100 µl
1.5 ml	100 µl	300 µl
15 ml	500 µl	2 ml

Equipment installation

The following pages contain information on installing your particular Bioruptor® Pico model. This equipment must only be installed by personnel after reading this section. Consider all hazards even though no particular hazards have been identified during installation. Before starting installation work, turn the main switch off and secure the unit against being re-energized. No special tools are required. One square meter is needed to set-up the Bioruptor® Pico.

Devices are designed to be safe under the following conditions:

- Indoor use
- Altitude up to 2,000 meters
- Operating external temperature 15°C to 25°C (do not install the Bioruptor in a cold room)
- Maximum relative humidity 80%
- Transient overvoltage typically present on the MAINS supply
- Degree of protection: IP20
- Power plug must be grounded
- POLLUTION DEGREE 2 (Normally only non-conductive pollution occurs. However, occasionally a temporary conductivity caused by condensation is expected)
- Never install this equipment in a place where environmental conditions and warnings mentioned above are infringed

Installation overview

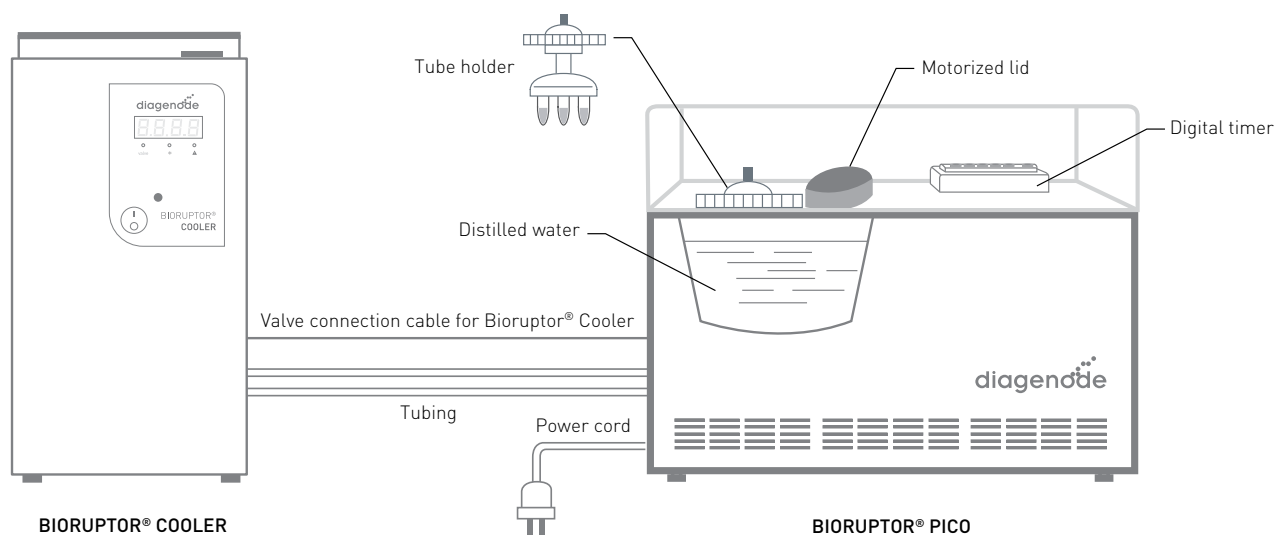


Fig. Schematic installation overview of the Bioruptor® Pico System in combination with the Bioruptor® Cooler.

Installing the Bioruptor® Pico system

Before starting the installation, turn the main switches off and make sure that the unit is not plugged into an electrical outlet.

1. Open the boxes and unpack all components



Bioruptor® Pico



Bioruptor® Cooler

2. Place the Bioruptor® on a bench
 - **Important Note:** Please make sure that the Bioruptor® Pico is always placed on a level surface.
3. Place the Bioruptor® Cooler on the bench or below the Bioruptor®
4. Connect the Bioruptor® Pico to the Bioruptor® Cooler with the cooling long red and blue isolated tubing by inserting them into the connectors as shown in the image. Respect the red and blue color codes. (Optional: Cut the length you need for the output and input flow. Make sure there is enough slack.)
5. Plug the Bioruptor® cable into the outlet on the back side of the Single Cycle Valve Box and on the Bioruptor® Pico.
6. Plug the power cord into the outlet and switch on the power switch on the back side of the sonication unit.
7. Plug the power cord into the outlet of the Bioruptor® Cooler.
8. Press main switch on the front side of the Bioruptor®
9. Fill the tank of the Bioruptor® Cooler with 3.5 liter and the sonication bath of the Bioruptor® up to the mark (700 or 730 ml; depending on the model) with **distilled or deionized water**.
11. Set the temperature to 4°C.
12. Detailed operating instructions for the Bioruptor® Cooler are available at page XXX.

Controlling the sonication



- ① **Digital Timer:**
Allows the user to easily program the sonication of samples (ON/OFF pulse time & total time). See use of digital timer in next section below.
- ② **Start Button:**
Begins sonication
- ③ **Stop Button:**
Cancels sonication

Switch on power switch (back side of sonication unit)

Digital timer

CYCLE NUMBER, **TIME ON** and **TIME OFF** are the parameters controlling sonication. For changing these parameters press the OK button. First the **TIME ON** screen appears with the flashing number. This parameter can be modified with the up (↑) and down button (↓). Please respect the range for each value. Press again the **OK** button to confirm the setting. To select **TIME OFF** and **Cycle Num** proceed the same way.

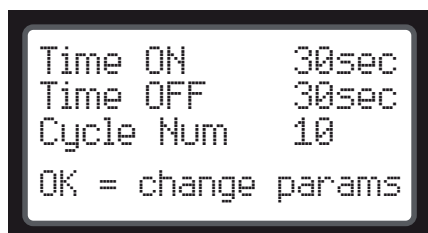
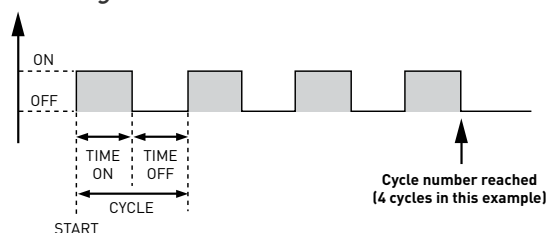


Figure 1. Main Screen



Bioruptor® Pico will sonicate as shown.

Once parameters are set press **START** (Figure 2).

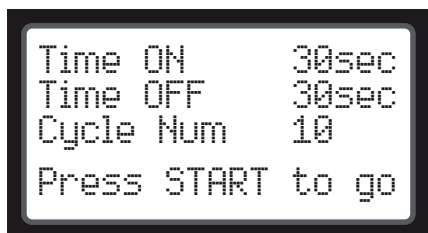


Figure 2. Main Screen

The information: **Close the lid to start the run** indicates that the sonication only starts when the acrylic glass cover is closed. The cover also prevents from any noise disturbance.

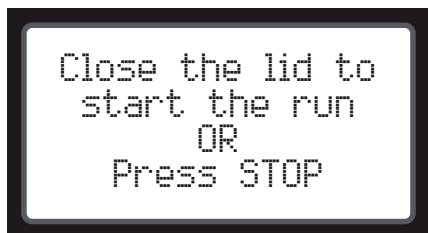


Figure 3. Close Lid Screen

Once the run started the **RUNNING** screen appears. As shown in Figure 4 the **RUNNING** screen indicates the elapsed time **ON**, time **OFF** and the **number of cycles**.



Figure 4. RUNNING Screen

If the acrylic glass cover will be opened during a run the sonication will automatically pause. Once the cover is again closed the machine continues with the sonication process. As shown in Figure 5, the **BREAK CYCLE** screen shows the information when the run stopped. In the example the machine stopped during the second sonication cycle, after 30 sec of **TIME ON** and 8 sec of **TIME OFF**.

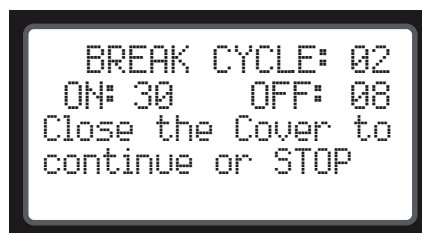


Figure 5. BREAK CYCLE Screen

If the sonication process worked properly (without any error messages) the **RUN OVER** screen appears (Figure 6). Press **ESC** to get back to the **Main screen** to start another sonication round.

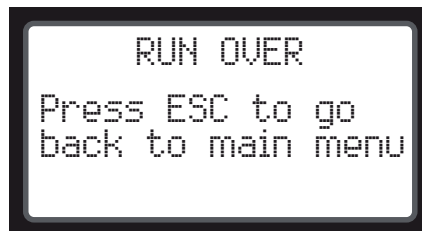


Figure 6. RUN OVER Screen

IMPORTANT NOTE: Machine has to rest for **20 minutes** before starting the next sonication run.

Tube holders & tubes

For chromatin and DNA shearing we highly recommend to use the below mentioned tube holders and the corresponding tubes.

To guarantee homogeneity of chromatin or DNA shearing, the tube holders should always be completely filled with tubes. Never leave empty spaces in the tube holder. Fill the empty spaces with tubes containing the same volume of distilled water.



0.1 ml tube holder & tube adaptor for Bioruptor® Pico
(Cat. No. B01200041)



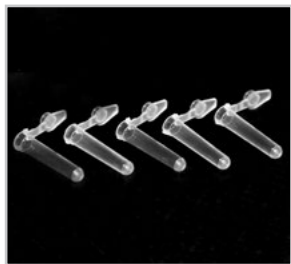
0.65 ml tube holder for Bioruptor® Pico
(Cat. No. B01200043)



1.5 ml tube holder for Bioruptor® Pico
(Cat. No. B01200040)



15 ml sonication accessories for Bioruptor® Pico
(Cat. No. B01200016)



0.1 ml Bioruptor® Microtubes (recommended for chromatin & DNA shearing)
(Cat. No. C30010015)



0.65 ml Bioruptor® Microtubes (recommended for chromatin & DNA shearing)
(New Cat. No. C30010011;
Old Cat. No. WA-005-0500)



1.5 ml Bioruptor® Microtubes (recommended for chromatin, not recommended for DNA shearing)
(Cat. No. C30010016)



15 ml Bioruptor® Tubes (recommended for Tissue disruption for protein extraction)
(Cat. No. C30010017)



15 ml Bioruptor® Tubes & sonication beads (recommended for chromatin, not recommended for DNA shearing)
(Cat. No. C01020031)

BIORUPTOR[®] COOLER

Safety

General safety instructions

- The equipment must only be operated for the intended use under the conditions stated in this operating manual. Any other type of operation is considered to be not-intended use and can impair the protection provided by the device.
- The operating manual is part of the device. The information in this operating manual must therefore be available in close vicinity to the device. Also store this copy of the operating manual carefully.

Any hazards (electrical shock, fire, contact with movable parts, etc.) caused by the use of the device must be eliminated as much as possible by the design in accordance with the appropriate standards. Residual hazards are reduced using any of the following measures:

- If relevant, there are safety devices for the device. These devices are essential for the safety of the device. Their functionality must be ensured with appropriate maintenance activities.
- If relevant, there are warning symbols on the device. These symbols must always be observed.
- There are safety instructions in this operating manual. These instructions must always be observed.
- There are additional specific requirements for the personnel and for the personal protective equipment.

Intended use

The present device is exclusively permitted to be used for tempering and delivering non-flammable heat transfer liquids to the Bioruptor®.

Non-intended use

The following applications are considered to be not-intended:

- in potentially explosive areas
- for tempering foodstuffs
- with a glass reactor without overpressure protection
- medical use.

Foreseeable misuse

Misuse of the device must always be prevented.

Among other things, the following uses are considered to be foreseeable misuse:

- Operation of the device without heat transfer liquid
- Incorrect connection of tubes

Modifications to the device

Any technical modifications to the machine are prohibited. Service works may be carried out only by qualified personal.

Heat transfer liquid

The device is exclusively designed for nonflammable heat transfer liquids in Class I according to DIN 12876-1.

Heat transfer liquids are used for the temperature control.

In each case, the heat transfer liquids cover a specific temperature range. This temperature range must match the temperature range of your application.

The use of heat transfer liquids can cause hazards from high or low temperatures and fire if certain temperature thresholds are exceeded or undercut or if the container breaks and there is a reaction with the heat transfer liquid.

The heat transfer liquid safety data sheet specifies all possible hazards and appropriate safety measures for handling the liquid. The safety data sheet must therefore be consulted for the intended use of the device.

Materials

All parts coming into contact with the heat transfer liquid are made of high quality materials suitable for the operating temperature. Stainless steel and temperature-resistant plastics are used.

Hoses

When selecting suitable hoses for the application, the permissible temperature range and the maximum permissible pressure must be particularly observed.

Application area

The device is exclusively permitted to be used in the following areas.

- Room temperature (+15 – 25°C)?
- Indoor use, no outdoor installation

Personnel qualification

Operating personnel

Operating personnel are employees that have been instructed by technical staff in the intended use of the device according to the operating manual.

Personal protective equipment

Protective clothing

- Protective clothing is required for certain activities. This protective clothing must comply with the legal requirements for personal protective equipment. Protective clothing should have long sleeves. Safety footwear is additionally required.

Protective gloves

- CE protective gloves are required for certain activities. These protective gloves must comply with the legal requirements for personal protective equipment of the European Union.

Protective goggles

- Protective goggles are required for certain activities. These protective goggles must comply with the legal requirements for personal protective equipment of the European Union.

Structure of the safety instructions

Danger

- A safety instruction of the type "Danger" indicates an immediately hazardous situation.
- This results in death or severe, irreversible injuries if the safety instruction is disregarded.

Warning

- A safety instruction of the type "Warning" indicates a potentially hazardous situation.
- This can result in death or severe, irreversible injuries if the safety instruction is disregarded.

Caution

- A safety instruction of the type "Caution" indicates a potentially hazardous situation.
- This can result in minor, reversible injuries if the safety instruction is disregarded.

Notice

- A "notice" warns about possible property or environmental damage.

Unpacking

Personnel: Operating personnel

1. Unpack the device.

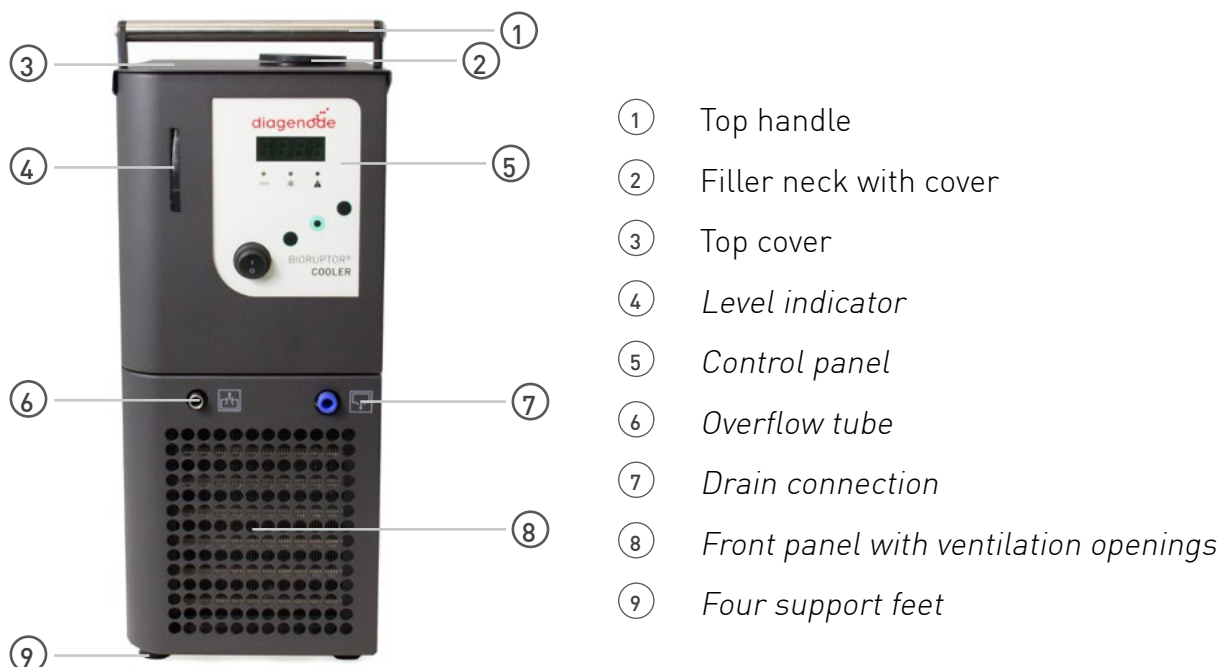
Keep the original packaging of the device for later transport.

2. Inspect the device and the accessories immediately after delivery for completeness and transport damage.

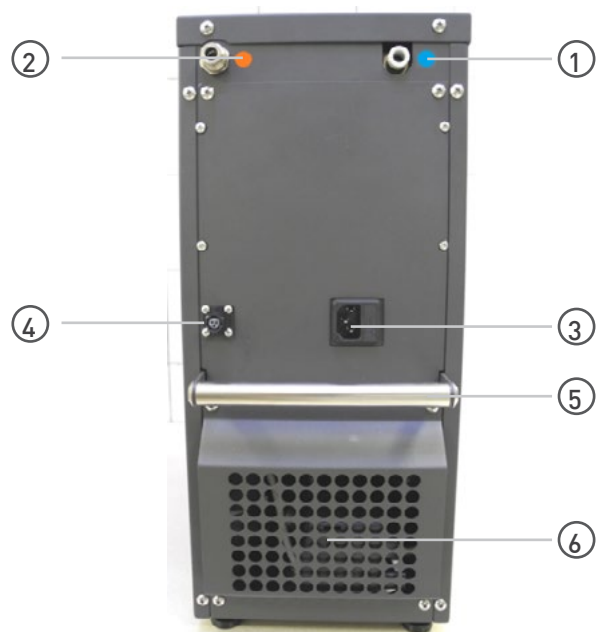
If there is unexpected damage to the device or accessories, inform the carrier immediately so that a damage report is produced and a check of the transport damage can be made.

Design and function

Design of the circulation chiller - Front side



Design of the circulation chiller - Back side



- ① Supply water connection (blue)
- ② Return water connection (red)
- ③ Mains power socket with fuse
- ④ 24Vdc socket (to be connected to the Bioruptor®)
- ⑤ Back handle
- ⑥ Ventilation openings

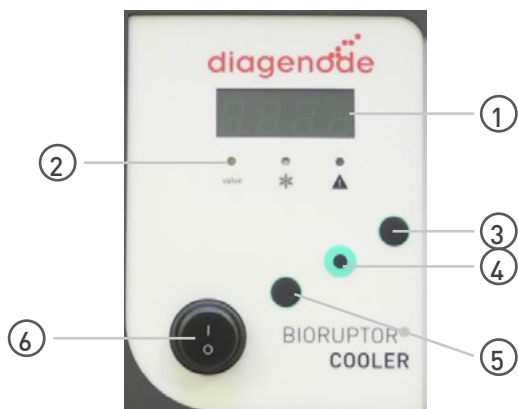
Controls

Mains power switch

The mains power switch can be put in the following positions:

- In position [I], the device is switched on.
- In position [O], the device is switched off.

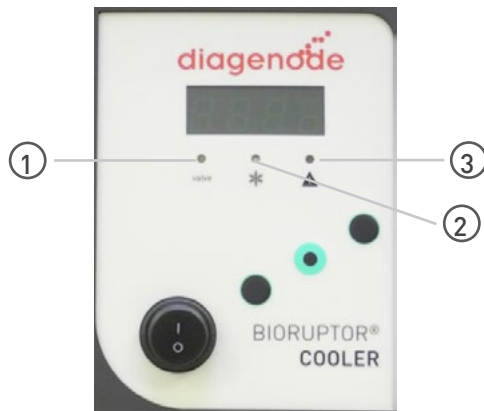
Control Panel and display buttons



- ① Display
- ② LEDs
- ③ UP arrow button
- ④ ENTER button
- ⑤ DOWN arrow button
- ⑥ Mains power switch

Function elements

LEDs for function display



- ① Yellow LED: valve
- ② Blue LED: refrigeration
- ③ Red LED: fault

Each device has three LEDs with the following functions:

- The yellow LED lights if the 24 Vdc signal from the Bioruptor is present (open solenoid valve).
- The blue LED indicates whether the refrigeration unit is active.
- The red LED lights in the event of device faults.

Hydraulic circuit

Hydraulic circuit

The hydraulic circuit designates the circuit through which the heat transfer liquid flows.

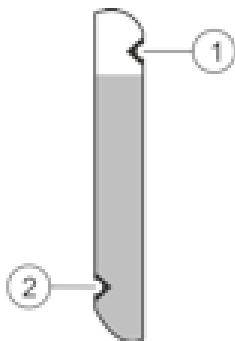
The circuit basically consists of the following components:

- internal storage bath with heat transfer liquid
- pumps for conveying the heat transfer liquid into the external consumer via the pumps connections

Pumps

The devices are equipped with a pressure pump for the supply and a membrane suction pump for the return.

Level indicator



The fill level of the heat transfer liquid in the circuit can be read using the level indicator.

The top arrow indicates the maximum liquid level of the machine.

The bottom arrow indicates the minimum liquid level of the machine.

- 1 Maximum level (approx. 3 liters)
- 2 Minimum level (approx. 2 liters)

3.3.5 Refrigeration unit

The refrigeration unit includes the following components

Compressor

A hermetically sealed compressor is used in the refrigeration unit. The compressor is equipped with overload protection which trips on the compressor temperature and compressor current consumption.

Condenser

An air-cooled condenser is used in the refrigeration unit. The condensation heat is discharged to the environment. The fresh air is sucked in through the front of the device using a fan, heated and discharged on the rear of the device.

Evaporator

In the internal bath, heat is discharged using a pipe coil evaporator.

3.4 Rating plate

The rating plate information is explained in detail in the following table.

SPECIFICATION	DESCRIPTION
Type	Device type
Order No.	Order number of the device
Serial No.	Serial number of the device <i>(Manufacturing year indicated with two digits after the letter "S")</i>
Voltage	Device must only be connected to this voltage and frequency
Refrigerant I	Refrigerant that is used in the compressor of the device <i>(GWP-value indicated in brackets)</i>
Fill quantity I	Fill quantity of the refrigerant <i>(tons of CO2 equivalent in brackets)</i>
PS high pressure I	maximum permitted operating pressure on the refrigerant high pressure side (compressor, condenser)
PS low pressure I	maximum permitted operating pressure on the refrigerant low pressure side (expansion, evaporation)
Current consumption	Current consumption of the device during operation
Protection class	IP protection class of the device
Fuse	Fuse used in the device
Class according to DIN 12876-1	German standard for electrical laboratory equipment

Before commissioning

EMC classification

Approval of the equipment according to EMC classification

COUNTRIES	EMC CLASS
Europe	Class B, oder? This classification has been made according to the EMC standard DIN EN 61326-1 (corresponds to VDE 0843-20-1).
USA	Class A This classification has been made according to the FCC (Federal Communications Com- mission) regulations, Section 15.
Canada	Class A This classification has been made according to the ICES-003 (Interference Causing Equipment Standards) and NMB-003 regulations.

Instructions for machines, Europe

EMC classification of the equipment:

- Class A: Operation only on mains power supplies without connected residential areas.
- • Class B: Operation on mains power supplies with connected residential areas.

In the case of unfavorable mains conditions, disruptive voltage fluctuations can occur.

Instructions for Class A digital device, USA

“This equipment has been tested and found to comply with the limits for Class A digital device, pursuant to Part 15 of the FCC (Federal Communication Commission) Rules. These limits are designed to provide reasonable protection against harmful interference when the equipment is operated in a commercial environment. This equipment generates, uses, and can radiate radio frequency energy and, if not installed and used in accordance with the instruction manual, may cause harmful interference to radio communications. Operation of this equipment in a residential area is likely to cause harmful interference in which case the

user will be required to correct the interference at his own expense.”

Instructions for Class A digital device, Canada

This Class A digital apparatus complies with Canadian ICES-003” (ICES = Interference Causing Equipment Standards).

« Cet appareil numérique de la classe A est conforme à la norme NMB-003 du Canada ».

Device Placement

Very specific placement conditions are applicable for the equipment. These placement conditions are specified in the technical data of the device for the most part.

Additional placement conditions are described below.

- Toxic vapors can be produced depending on the heat transfer liquid used and type of operation. Ensure sufficient extraction of the vapors.
- Observe the requirements of the device for electromagnetic compatibility (EMC).
- Do not cover the ventilation openings.

WARNING!

Rolling away, falling over of the device

Impact, crushing

- Do not tilt the device.
- Place the device on a level, non-slip surface with sufficient load bearing capacity.
- Engage the castor brake when setting up the device.
- Do not place any heavy parts on the device.

1. Place the device at a suitable location in the room. Place tabletop devices on a suitable table. Support the device for this by reaching under the device.
2. The device requires 20 cm of clearance at the front and rear side in order to allow proper airflow through the refrigeration unit.
3. The device must be installed at RT (10C – 25°C) and can be placed below or at the same level of the Bioruptor

Commissioning

Heat transfer liquids

Note the following:

- The heat transfer liquids each cover a recommended temperature range and must be suitable for the temperature range of your application.
- Never use contaminated or degenerated heat transfer liquid.

Heat transfer liquid water

- The alkaline earth ions content (hardness) of the water must be between 0.71 mmol/l and 1.42 mmol/l (equivalent to 4.0 and 8.0 °dH). Harder water results in lime deposits in the device.
- The pH value of the water must be between 6.0 and 8.5.
- Distilled, deionized, demineralized (DM) water or seawater must not be used due to the corrosive properties. Ultra-pure water and distillates are suitable as medium after addition of 0,1 g soda (Na₂CO₃, sodium carbonate) per liter of water.
- Any chlorine content in the water must be strictly avoided. Do not add any chlorine to the water. Chlorine is contained, for example, in cleaning agents and disinfectants
- The water must be free of impurities. Water containing iron is unsuitable due to rust formation and untreated river water is unsuitable due to algae formation.
- The addition of ammonia is not permitted.

Establishing power supply

Personnel: Operating personnel

NOTICE!

Use of unauthorized mains voltage or mains frequency

Device damage

- Compare the rating plate with available mains voltage and mains frequency.

Also note the following:

- The mains plug of the device provides a mains power disconnection component. The mains plug must be easily recognizable and easily accessible.
- Only connect the device to an earthed (PE) power socket.

Switching on device and filling with water

Filling mode

The device has a software program (starting from and including software version 61.15) that supports the operator for filling the temperature control device. If the fill level is too low, the Fill mode is started immediately after switching on the device. FILL is shown on the display and the level indicator is illuminated. The pumps and the refrigerant unit are not started. When the minimum level has been reached, the pumps are automatically started.

Personnel: Operating personnel

NOTICE! Overheating of the compressor

Device damage

- Never operate water cooled device without cooling water.

DANGER! Use of incorrect heat transfer liquid

Fire

- Select a heat transfer liquid with a temperature range 20 K above the temperature range of the application

WARNING! Overflow of heat transfer liquid

Electric shock

- Ensure that the device is not overfilled. Note the level indicator and the thermal volume expansion of the heat transfer liquid

WARNING! Spraying of heat transfer liquid

Electric shock

- Avoid spraying heat transfer liquid. Use a funnel for filling

Fill level sufficient

1. Switch on the device using the mains power switch. A signal tone sounds. The software version is shown on the display. The actual temperature is shown on the display afterwards. The temperature control device starts operation; the pumps are started. Depending on the specified set point temperature, the refrigerant unit is started after 2 minutes at the earliest. The blue LED lights if the refrigerant unit is activ

Fill level too low (Low Level)

2. Switch on the device using the mains power switch. A signal tone sounds. The software version is shown on the display. FILL is shown on the display afterwards. In the case of Low Level, the pumps and the refrigerant unit are not started. Fill the device with heat transfer liquid.
3. Carefully pull up the cover of the filler neck; do not turn.
4. Fill the heat transfer liquid into the filler neck carefully. Monitor the level indicator. Fill the device up to the maximum fill level. The pumps start when the minimum level is reached.

If necessary, use a funnel for the filling.

The level indicator must not be above the maximum fill level.

Fill level drops

5. Top up the heat transfer liquid carefully as the consumer is now being filled. If the fill level drops too far, the device automatically goes into the FILL mode and the pump and refrigerant unit are switched off. Continue with the filling until operation without problems is possible. Monitor the level indicator for this.
6. Press the cover carefully into the filler neck.

Operation

Switching on the device

Personnel: Operating personnel

NOTICE! Overheating of the compressor

Device damage

- Never operate water cooled device without cooling water.

1. Switch on the device using the mains power switch. A signal tone sounds. The software version is shown on the display. The actual temperature is shown on the display afterwards. The temperature control device starts operation; the pumps are started. Depending on the specified set point temperature, the refrigerant unit is started after 2 minutes at the earliest. The blue LED lights if the refrigerant unit is active.
2. Depending on the water level, heat transfer liquid must be refilled if necessary. Monitor the level indicator for this.

Default display and set point temperature

1. Press the ENTER button to reach set point menu from the default display of the actual temperature.

If no button has been pressed for longer than 4 seconds, you exit from the set point menu.

2. Select a set point temperature (between 2°C and 20°C) using the arrow buttons.
3. The changed value or setting is applied immediately by pressing the ENTER button

Standby mode

The Display shows: "STBY" alternating with the bath temperature.

The device goes into Standby mode if no 24V signal from the Bioruptor is received for a period of time of more than 2 hours.

In Standby mode the compressor and the pumps are turned off.

If during Standby mode the bath temperature reaches a value higher than 10 K above the set point, the compressor and the pumps turn on automatically to cool down to set point. The

compressor and the pumps turn off again when the set point is reached.

If a display button is pushed during Standby mode, the device goes into normal operation mode.

Sleep mode

The Display shows: "SLEP" alternating with the bath temperature.

The device goes into Sleep mode if no 24V signal from the Bioruptor is received for a period of time of more than 16 hours.

In Sleep mode the compressor and the pumps are turned off.

If a display button is pushed during Sleep mode, the device goes into normal operation mode.

Maintenance

General safety instructions

DANGER! Contact with live or moving parts

Electric shock, impact, cutting, crushing

- The device must be disconnected from the mains power supply before any maintenance work.
- Repairs must only be carried out by specialists.

CAUTION! Contact with hot / cold device parts, accessories and heat transfer liquid.

Burns, scalding, frostbite

- Ensure device parts, accessories and heat transfer liquid are at room temperature before touching them

Also note the following:

Before all maintenance work, you should ensure that decontamination of the device has been performed if it came into contact with hazardous materials.

Maintenance intervals

The maintenance intervals described in the following table must be complied with. The following maintenance work is mandatory before every longer unsupervised operation.

INTERVAL	MAINTENANCE WORK
daily	Inspection of the drain plug by visual inspection from the outside
monthly	Inspection of the external hoses for material fatigue Cleaning of the condenser Inspection of the heat transfer liquid

Cleaning the device

Personnel: Operating personnel

WARNING! Ingress of cleaning agents in the device

Electric shock

- Use a moist cloth for cleaning.

Also note the following:

Only clean the control panel with water and detergent. Do not use acetone or solvents. The consequence would be permanent damage of the plastic surfaces.

Cleaning air-cooled condenser

Personnel: Operating personnel

1. Switch off the device.
2. Remove the front cover by holding underneath with both hands and pulling the grating to the front. Remove the front cover slowly and carefully to prevent damage.
3. Brush off or vacuum the condenser.
4. Remount the front cover carefully.

Checking the heat transfer liquid

Soiled or degenerated heat transfer liquid must be replaced.

Replace fuse

1. Switch off the device.
2. Remove power cord from the main power socket at the back of the device.
3. Remove fuse holder from the main power socket at the back of the device.
4. Replace fuse T10AH (10 ampere time delay fuse with high breaking capacity).
5. Remount fuse holder in the main power socket.

Cleaning the mesh filter



1. Switch off the device.
2. Remove the top cover by dismounting the top handle and unscrewing the two screws at the back of the device.
3. Unscrew mesh filter holder (counter-clockwise).
4. Remove the metallic mesh filter and clean it.
5. Mount the mesh filter back in the holder and screw it back in the by-pass block (clockwise).
6. Mount top cover and top handle back in the device.

Faults

Alarms, errors and warnings

Any alarms, error signals and warnings triggered on the device are shown on the display as 7-segment text.

Procedure in the event of alarms

Alarms can be cancelled using the ENTER button after rectification of the cause of the fault.

Procedure in the event of warnings

Warnings can be cancelled using the ENTER button after rectification of the cause of the fault.

Procedure in the event of errors

A two-tone signal is output if any error occurs. The red LED on the device also lights.

In the case of an error, switch off the device at the mains power switch. If the error occurs again after restarting the device, note the error code and contact the Service partner.

Errors are symbolized with an E and a sequential three- digit number.

Decommissioning

Draining the device

Personnel: Operating personnel

WARNING! Contact with cold heat transfer liquid

Frostbite

- Bring the heat transfer liquid to room temperature before draining.

Also note the following:

Observe the regulations for disposal of the used heat transfer liquid.

1. Switch off the device.
2. Connect the end of an 8 mm exterior diameter pipe to the self-closing drain connector of the device. Place the other end of the pipe in a container with appropriate capacity under the level of the device.
3. Let the water flow until the device is completely empty.

Disposal

Disposing of refrigerant

The refrigerant must be disposed of in accordance with EC Directive 303/2008/EC in combination with 842/2006/EC.

CAUTION! Uncontrolled escape of refrigerant.

Impact, cutting

- Do not dispose of any pressurized refrigerant circuit.
- The decommissioning is only permitted by a specialist.

Global Warming Potential (GWP), comparisons CO₂ =1.0

according to IPCC IV - time horizon 100 years - also basis for EU Fluoride Gases Directive 517/2014/EC

Type and fill quantity of the refrigerant can be seen on the rating plate.



Device disposal

The following applies for Europe: The device must be disposed of according to EU Directive 2012/19/EC.

Disposing of packaging

The packaging must be disposed of in accordance with EU Directive 94/62/EC.

Technical data

General data

The device sound pressure level is below 70 dB. According to EC Directive 2006/42/EC the sound pressure level of the devices is therefore not specified further.

SPECIFICATION	VALUE	UNIT
Placement	Indoor areas	
Placement height above sea level	up to 2,000	m
Humidity	Maximum relative humidity 80% at 31 °C and up to 40 °C decreasing linearly to 50%	
Ambient temperature range	10 - 40	°C
IP protection rating	IP 32	
Degree of soiling	2	
Clearance from surroundings (front and rear sides)	20	cm
Overvoltage	Overvoltage category II and transient overvoltages according to category II	
Protection class for electrical operating equipment DIN EN 61 140 (VDE 0140-1)	1	
Classification according to DIN 12 876-1 (class designation / identification)	I/NFL (non-flammable liquids, only)	
Display	7-segment, LED	
Display resolution	1	°C
Adjustment resolution	1	°C
Temperature stability	+ - 2	K
Storage temperature range	5 - 40	°C
Transport temperature range	-20 - 60	°C

	WORKING TEMPERATURE RANGE	DIMENSIONS (W X D X H)	WEIGHT
	°C	mm x mm x mm	kg
BC 100	2 - 200	200 x 390 x 495	26,9

Cooling capacity

		BC 100
<i>Cooling capacity (at 20 °C)</i>	<i>W</i>	<i>250</i>
<i>Cooling capacity (at 4 °C)</i>	<i>W</i>	<i>120</i>
<i>Refrigerant</i>	<i>--</i>	<i>R-134A</i>

The cooling capacity is measured for a specified temperature of the heat transfer liquid. Information is provided in brackets. The ambient temperature for the measurement is 20 °C; water was used as heat transfer liquid.

Hydraulic circuit

		BC 100
<i>Fill capacity</i>	<i>l</i>	<i>2 - 3</i>
<i>Maximum flow rate</i>	<i>l/min (water 20 °C)</i>	<i>2</i>
<i>Supply and return connections</i>	<i>Quick connector (ext. hose diameter in mm)</i>	<i>8</i>
<i>Drain connector</i>	<i>Self-closing quick connector (ext. hose diameter in mm)</i>	<i>8</i>
<i>Overflow tube</i>	<i>Tube (int. hose diameter in mm)</i>	<i>10</i>

Maximum power consumption

	BC 100
	<i>kW</i>
<i>230 V; 50 Hz</i>	<i>0.29</i>
<i>115 V; 60 Hz</i>	<i>0.29</i>
<i>100 V; 50/60 Hz</i>	<i>0.29</i>

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