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<td>Index</td>
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</tr>
</tbody>
</table>
1 Notes on the Manual

This Manual provides technical guidelines for the safe operation of the device. Read this Manual through carefully before installing, putting into service and operating the device. Reading and understanding this Manual is essential for handling the device safely and as intended.

This Manual does not contain any repair instructions. Please contact your supplier or contact Retsch GmbH directly if anything is unclear or you have questions about these guidelines or the device, or in the case of any faults or necessary repairs.

You can find further information about your device at http://www.retsch.com on the pages for the specific device concerned.

Amendment status:
The document amendment 0002 of the "Bond Index Tester BT 100" manual has been prepared in accordance with the Machinery Directive 2006/42/EC.

1.1 Disclaimer

This Manual has been prepared with great care. We reserve the right to make technical changes. We assume no liability for personal injuries resulting from the failure to follow the safety information and warnings in this Manual. No liability will be assumed for damage to property resulting from the failure to follow the information in this Manual.

1.2 Copyright

This document or parts of it or its content may not be reproduced, distributed, edited or copied in any form without prior written permission of Retsch GmbH. Damage claims shall be asserted in the case of infringements.
2 Safety

Safety Officer
The operating company itself must ensure the following with respect to persons authorised to work on the device:
- that they have read and understood all regulations contained in the chapter on safety;
- that they are aware before they start work of all instructions and regulations for the target group related to the work;
- that they have easy access to the manual for this device at all times;
- that they have been familiarised with the safe and correct handling of the device before starting work on it, by means of a verbal introduction by a competent person and/or using this manual.

⚠️ Improper operation can lead to personal injuries. The operating company itself is responsible for its safety and that of its staff. The operating company itself must ensure that no unauthorised persons have access to the device.

Target group
All those operating, cleaning or working with or on the device.

This device is a modern, powerful product from Retsch GmbH and has been developed in line with the state-of-the art. The device is safe to use when operated correctly and when following the instructions in this manual.

⚠️ People under the influence of intoxicating substances (medications, drugs, alcohol) or who are overtired may not operate the device or work on the device.
2.1 Explanations of the Safety Instructions

The following warnings in this Manual warn of possible risks and damage:

![DANGER]

**Risk of fatal injuries**
Source of danger
- Possible consequences if the danger is ignored.
  - Instructions and information on how to avoid the risk.

**Fatal or serious injuries** may result if the “Danger” sign is disregarded. There is a **very high risk** of a life-threatening accident or lasting personal injury. The signal word ![DANGER] is additionally used in the running text or in instructions.

![WARNING]

**Risk of life-threatening or serious injuries**
Source of danger
- Possible consequences if the danger is ignored.
  - Instructions and information on how to avoid the risk.

**Life-threatening or serious injuries** may result if the "Warning" sign is disregarded. There is a **increased risk** of a serious accident or of a possibly fatal personal injury. The signal word ![WARNING] is additionally used in the running text or in instructions.

![CAUTION]

**Risk of injuries**
Source of danger
- Possible consequences if the danger is ignored.
  - Instructions and information on how to avoid the risk.

**Average to slight injuries** may result if the “Caution” sign is disregarded. There is an average or slight risk of an accident or personal injury. The signal word ![CAUTION] is additionally used in the running text or in instructions.
NOTICE

Type of damage to property
Source of the damage to property
- Possible consequences if the information is ignored.
  - Instructions and information on how to avoid the damage to property.

Damage to property may result if the information is disregarded. The signal word NOTICE is additionally used in the running text or in instructions.

2.2 General Safety Instructions

CAUTION

Risk of injury
Lack of knowledge of the Manual
- The Manual contains all safety-related information. Disregarding the Manual can therefore lead to injuries.
  - Read the Manual carefully before operating the device.

CAUTION

Risk of injury
Improper modifications to the device
- Improper modifications to the device can result in injuries.
  - Do not make any unauthorised changes to the device.
  - Only use the spare parts and accessories approved by Retsch GmbH!

NOTICE

Changes to the device
Improper modifications
- The conformity declared by Retsch GmbH with the European Directives will lose its validity.
  - Any warranty claims will be terminated.
  - Do not make any modification to the device.
  - Use spare parts and accessories that have been approved by Retsch GmbH exclusively.
2.3 Repairs

This manual does not contain any repair instructions. For safety reasons, repairs may only be carried out by Retsch GmbH or an authorised representative or by qualified service technicians.

In case of repair, please inform...
...the Retsch GmbH representative in your country,
...your supplier, or
...Retsch GmbH directly.

Service address:
2.4 Responsibility of the operating company

The user of the machine (the operating company) is responsible for ensuring that every person who works on the machine has been given precise instructions on the basis of this Manual (commissioning, operation, servicing). Training for operators must cover the following points:

- Intended purpose of the machine
- Hazardous areas
- Safety provisions
- You must be satisfied that staff have the requisite qualifications
- General instructions and actions in an emergency
- Applicable accident prevention regulations
- Personal protective clothing required
- Operation of the machine in line with this Manual
- Accepted, applicable rules governing occupational health and safety

Incorporate the BT 100 into your emergency planning:

- Integrate the BT 100 into your operating procedures regulating conduct in emergency situations.
- To prevent accidents during work processes, incorporate the BT 100 into your risk assessment in acc. with the German Ordinance on Industrial Health and Safety (BetrSichV).
- Take into consideration fire-fighting measures, combatting the effect of leaking substances, potential radiation, rescuing people, first-aid measures.

2.5 Personnel qualification and target group of this manual

This manual is intended for trained assembly personnel, maintenance staff and users. Training must be provided in the language of the personnel concerned so that all instructions are understood. As such the following personnel qualifications are necessary:

<table>
<thead>
<tr>
<th>Assembly, commissioning, instruction, troubleshooting, servicing work, as described in this manual</th>
<th>Skilled technical staff as well as external service providers who speak German and the language of the operating personnel. The usual skills communicated during training, e.g. as a plant fitter, mechatronics engineer or toolmaker, are prerequisites for the assembly, commissioning and troubleshooting of the machine. Employees must be able to manage all applicable mechanical tasks and be familiar with and have experience of dealing with these.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation</td>
<td>Education/training in accordance with the above section, responsibilities of trained employees.</td>
</tr>
<tr>
<td>Servicing/repairs</td>
<td>They must be experienced, trained professionals, familiar with requirements and guidelines.</td>
</tr>
</tbody>
</table>
2.6 Confirmation Form for the Managing Operator

This manual contains essential instructions for operating and maintaining the device which must be strictly observed. It is essential that they be read by the user and by the qualified staff responsible for the device before the device is commissioned. This manual must be available and accessible at the place of use at all times.

The user of the device herewith confirms to the managing operator (owner) that he has received sufficient instructions about the operation and maintenance of the system. The user has received the manual, has read and taken note of its contents and consequently has all the information required for safe operation and is sufficiently familiar with the device.

The managing operator should for legal protection have the user confirm the instruction about the operation of the device.

<table>
<thead>
<tr>
<th>User</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surname, first name (block letters)</td>
</tr>
<tr>
<td>Position in the company</td>
</tr>
<tr>
<td>Place, date and signature</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Managing operator or service technician</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surname, first name (block letters)</td>
</tr>
<tr>
<td>Position in the company</td>
</tr>
<tr>
<td>Place, date and signature</td>
</tr>
</tbody>
</table>
3 Packaging, Transport and Installation

3.1 Packaging

The packaging has been adapted to the mode of transport. It complies with the generally applicable packaging guidelines.

**NOTICE**

Complaint or return
Keeping the packaging

- Inadequate packaging and insufficient securing of the device can jeopardise the warranty claim in the event of a complaint or return.

- Keep the packaging for the duration of the warranty period.

3.2 Transport

**NOTICE**

Damage to components
Transport

- Mechanical or electronic components may be damaged during transport.

- The device must not be knocked, shaken or thrown during transport.

**NOTICE**

Complaints
Incomplete delivery or transport damage

- The forwarding agent and Retsch GmbH must be notified immediately in the event of transport damage. It is otherwise possible that subsequent complaints will not be recognised.

- Please check the delivery on receipt of the device for its completeness and intactness.

- Notify your forwarding agent and Retsch GmbH within 24 hours.

3.3 Temperature Fluctuations and Condensation

**NOTICE**

Damaged components due to condensation
Temperature fluctuations

- The device may be exposed to substantial fluctuations in temperature during transport. The ensuing condensation can damage electronic components.

- Wait until the device has acclimatised before putting it into service.

Temporary storage:
Also in case of an interim storage the device must be stored dry and within the specified ambient temperature range.
3.4 Conditions for the Installation Site

- Installation height: max. 2 000 m above sea level
- Ambient temperature: 5 °C – 40 °C

**NOTICE**

**Ambient temperature**
Temperatures outside the permitted range
- Electronic and mechanical components may be damaged.
- The performance data alter to an unknown extent.
  - **Do not exceed or fall below the permitted temperature range (5 °C to 40 °C ambient temperature) of the device.**
- Maximum relative humidity < 80 % (at ambient temperatures ≤ 31 °C)

For ambient temperatures $U_T$ between 31 °C and 40 °C, the maximum relative humidity value $L_F$ linearly decreases according to $L_F = -(U_T - 55) / 0.3$:

<table>
<thead>
<tr>
<th>Ambient temperature</th>
<th>Max. rel. humidity</th>
</tr>
</thead>
<tbody>
<tr>
<td>≤ 31 °C</td>
<td>80 %</td>
</tr>
<tr>
<td>33 °C</td>
<td>73.3 %</td>
</tr>
<tr>
<td>35 °C</td>
<td>66.7 %</td>
</tr>
<tr>
<td>37 °C</td>
<td>60 %</td>
</tr>
<tr>
<td>39 °C</td>
<td>53.3 %</td>
</tr>
<tr>
<td>40 °C</td>
<td>50 %</td>
</tr>
</tbody>
</table>

**NOTICE**

**Humidity**
High relative humidity
- Electronic and mechanical components may be damaged.
- The performance data alter to an unknown extent.
  - **The relative humidity in the vicinity of the device should be kept as low as possible.**
3.5 Electrical Connection

**WARNING**

Risk to life caused by an electric shock
Connection to socket without a protective earth conductor
- Connecting the device to sockets without a protective earth conductor can lead to life-threatening injuries caused by an electric shock.
- Always operate the device using sockets with a protective earth conductor (PE).

**NOTICE**

Electrical connection
Failure to observe the values on the type plate
- Electronic and mechanical components may be damaged.
- Connect the device only to a mains supply matching the values on the type plate.

**WARNING**

When connecting the power cable to the mains supply, use an external fuse that complies with the regulations applicable to the place of installation.
- Check the type plate for details on the necessary voltage, frequency, and maximum external current source fuse for the device.
- The listed values must agree with the existing mains supply.
- Only use the supplied power cable to connect the device to the mains supply.

The drive on the machine is fitted with a frequency converter. In order to comply with the EMC Directive, this is equipped with a mains filter and shielded cables to the motor. If your mains connection for the machine includes a residual current device, the anti-interference circuit on the frequency converter may result in false alarms on the residual current device when it is switched on – it is always switched on when the grinding chamber cover is closed – without there being any fault on the machine or the mains installation.
In accordance with the state of the art, selected all current sensitive residual current devices are recommended for such cases. The trip current must be adequately dimensioned because short-term capacitive compensation currents (shielded cable, mains filters) can easily lead to false alarms when switched on.
In some circumstances it may be necessary to operate the machine without the residual current device, although in this case checks must be conducted to ensure that this does not contradict any local regulations of electricity companies or other institutions as well as any applicable standards.
### 3.6 Transport

#### WARNING

**Risk of injury due to the device falling down**

Lifting the device above head height

- The device can fall causing serious injuries when lifted above head height.
- **Never lift the device above head height!**

#### NOTICE

**Transportation lock**

Transport without transportation lock, or operation with transportation lock

- Mechanical components may be damaged.
- **Only transport the device with mounted transportation lock.**
- **Do not operate the device with built-in transportation lock.**

**Damage to components**

Transport

- Mechanical or electronic components may be damaged during transport.
- **The device must not be knocked, shaken or thrown during transport.**

---

**Fig. 1:** Unscrewing the transport lock from the transport pallet

The transport lock (TS) uses four nuts to secure the machine to the pallet.

- Use a 17 mm wrench to unscrew the four nuts.
3.7 Installing the device

- Place the machine on a firm surface.

Further parameters can be found in the “Technical data” chapter. The machine must be secured prior to commissioning.

3.8 Position of the user

The position of the operator for normal operation is in front of the housing door, at the height of the control panel and the emergency stop button.

3.9 Description of type plate

Fig. 2: Type plate

1 Device designation
2 Year of manufacture
3 Article number
4 Serial number
5 Manufacturer’s address
6 CE mark
7 Disposal sign
8 Barcode
9 Voltage
10 Supply frequency
11 Output
12 Current
13 Number of fuses
14 Fuse design and fuse rating
4 Technical data

4.1 Intended use of the device

**CAUTION**

Risk of burns or poisoning
Varying sample properties

- The properties and therefore also the chemical reactivity of the sample can change during the grinding process and can cause burns or poisoning as a result.
- **Do not process any substances in this device whose chemical reactivity is so changed by grinding that there is a risk of explosion or poisoning.**
- **Take note of the safety data sheets for the sample material.**

**CAUTION**

Risk of injury
Potentially explosive atmosphere

- The device is not suitable for use in potentially explosive atmospheres. Operating the device in a potentially explosive atmosphere can lead to injuries caused by an explosion or fire.
- **Never operate the device in a potentially explosive atmosphere!**

**CAUTION**

Risk of injury
Sample material that is harmful to health

- Sample material that is harmful to health can injure people (illness, contamination).
- **Use suitable extraction systems with sample material that is harmful to health.**
- **Use suitable personal protective equipment with sample material that is harmful to health.**
- **Take note of the safety data sheets for the sample material.**

Target group: Users, operators
Machine type designation: BT 100
Ball and rod mill or drum mill with a function as test machine for quantifying the grindability of ores and minerals or similar materials from the application areas of building materials, geology, metallurgy, environment and recycling. Any other use is regarded as improper use and may lead to damage to equipment and even to injuries.

A detailed overview and knowledge of the properties of the raw material is extremely important, especially when planning the structure of a grinder. To minimise all potential risks, extensive tests are needed to obtain information about the properties of the raw materials. The Bond Work Index test method can provide a clear definition of the requisite crushing capacities and quality of the desired products.
Benefits

- Suitable for identifying the work index according to Bond
- Use as ball or rod mill
- Variable speed, reproducible results
- Tipping mechanism for simple emptying of the drum
- Solid housing with steel frame
- Removable sample collector
- Convenient parameter setting on the display
- Separation screen for different grinding ball diameters (ball mill)
- Grinding drum with seal for loss-free work
- Solid soundproof hood with safety switch

NOTICE

Range of application of the device

Long-term operation

- This laboratory device is designed for eight-hour single-shift operation with a duty cycle of 30 %.
- This device may not be used as a production machine nor is it intended for continuous operation.
4.2 Grinding drum nominal volume

**NOTICE**

Wear or damage to the grinding set

- Insufficient filling quantity
  - Increased wear or damage to the grinding set is possible when operating the grinding set with insufficient filling quantity.
  - The grinding set must always be filled to at least 40% of the nominal volume.

Dry grinding:

**Ball module**

Steel 1.3541: 21.7 litres

**Rod module**

Steel 1.3541: 43.4 litres

Wet grinding:

**Ball module**

Steel 1.4404: 5/10/21.7 litres
4.3 Feed size

The maximum feed size depends on the material and the specifications of the ball and rod module within the Bond Work Index standard.

**Ball module:**

Examples:
Minerals pre-crushed to < 3.35 mm (identified by means of sieve analysis)
Core samples pre-crushed to < 3.35 mm (identified by means of sieve analysis)
Split core samples pre-crushed to < 3.35 mm (identified by means of sieve analysis)

The ball filling is specified by the Bond Work Index and contains the following:
43 x 1.45"
67 x 1.17"
10 x 12
71 x 0.75"
94 x 0.61"

The optimum number of grinding balls is 285. As the diameter of balls varies over time due to wear, the ball filling should be adjusted periodically to produce an overall weight of 20.125 kg. Where possible, no changes should be made to the correct proportion of ball diameters specified above.

**Rod module:**

Examples:
Minerals pre-crushed to < 12.5 mm (identified by means of sieve analysis)
Core samples pre-crushed to < 12.5 mm (identified by means of sieve analysis)
Split core samples pre-crushed to < 12.5 mm (identified by means of sieve analysis)

The rod filling is specified by the Bond Work Index and contains the following:
6 x 1.25" diameter and a length of 21"
2 x 1.75" diameter and a length of 21"

4.4 Payload

Maximum quantity of sample material: 30 kg
4.5 Rated Power

**NOTICE**

**Wear or damage to the machine**
Operating without grinding set and with overloading

- Operating the machine without a grinding set, grinding media and sample can result in increased wear or damage to the machine.
- Only operate the machine with clamped grinding set with grinding media and sample.
- Do not overload the machine. We recommend filling approx. 25% of the nominal volume with sample and a maximum 50% of the nominal volume with grinding media.

0.75 KW, 3-phase, various supply voltages

Make sure that the voltage and frequency of your mains connection corresponds to the type plate on the machine. The mains connection must be fused to at least 16 A.

4.6 Motor Rotation Speed

The speed can be set to between 1 and 80 rpm, but is specified using the Bond Work Index at 70 rpm with the ball module or 46 rpm with the rod module.
4.7 Emissions

**CAUTION**
Risk of injury caused by not hearing acoustic signals

- Loud grinding noise may result in not hearing acoustic warning signals, leading to injuries.
- **Take the volume of grinding noise into consideration when designing the acoustic signals in the working environment.**
- Where necessary, use additional visual signals.

4.7.1 Noise levels

**Noise levels BT 100:**
Noise measurement in accordance with DIN 45635-31-01-KL3
The noise levels are mainly influenced by the machine speed, the material being ground and the grinding set.

**Noise levels with ball module**
Workplace-related emissions value \( L_{peq} = \) up to 96 dB(A)
Sound power level \( L_{WA} = 104 \) dB(A)

Measurement conditions:
- Grinding drum: 21.7 litres, steel 1.3541
- Grinding tools: 20 kg steel balls, 20 mm diameter
- Sample material: 1500 g cement clinker, particle size <20 mm
- Sound level meter: Brüel & Kjaer 2237 Controller

**Noise levels with rod module**
Workplace-related emissions value \( L_{peq} = \) up to 94 dB(A)
Sound power level \( L_{WA} = 102 \) dB(A)

Measurement conditions:
- Grinding drum: 43.4 litres, steel 1.3541
- Grinding tools: 23.65 kg grinding rods, 30mm diameter
- Sample material: 3000 g cement clinker, particle size <20 mm
- Sound level meter: Brüel & Kjaer 2237 Controller

4.8 Degree of Protection

- IP 55

4.9 Protective Equipment

The machine is fitted with a safety mechanism which prevents the machine being started in an unsafe state.
- The machine can only be started when the housing door is closed.
- It is only possible to open the housing door when the machine is stationary.
4.10 Dimensions and Weight

- **Height:** 1255 mm
- **Width:** 1500 mm
- **Depth:** 775 mm
- **Weight:** net approx. 295 kg

4.11 Required Floor Space

- **Height:** 1255 mm
- **Width (housing door open):** 2055 mm
- **Depth (housing door open):** 1125 mm
4.12 Installation drawing

construction size
5 Operating the device

**CAUTION**

Risk of injury
Sample material that is harmful to health
- Sample material that is harmful to health can injure people (illness, contamination).
  - Use suitable extraction systems with sample material that is harmful to health.
  - Use suitable personal protective equipment with sample material that is harmful to health.
  - Take note of the safety data sheets for the sample material.

**CAUTION**

Risk of hearing loss
High sound level
- The sound level may be high depending on the type of material, the number of balls used, the set grinding frequency and the grinding time.
  - Excess noise in terms of intensity and duration can lead to impairments or permanent damage to hearing.
  - Ensure you take suitable soundproofing measures.
  - Wear hearing protection if there is loud or lasting noise.
5.1 Views of the device

Fig. 3: Front view of the machine
## 5.1.1 Overview table of the parts of the device

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Housing door</td>
<td>Closes the grinding chamber.</td>
</tr>
<tr>
<td>B</td>
<td>Bar</td>
<td>Prevents the housing door being closed if the rod module is not correctly positioned.</td>
</tr>
<tr>
<td>C</td>
<td>Handle</td>
<td>For opening the housing door.</td>
</tr>
<tr>
<td>D</td>
<td>Emergency stop button</td>
<td>Pressing this switches the machine off immediately.</td>
</tr>
<tr>
<td>E</td>
<td>Control panel</td>
<td>For controlling the machine.</td>
</tr>
<tr>
<td>F</td>
<td>Main switch</td>
<td>Turning this switches the machine on/off.</td>
</tr>
<tr>
<td>G</td>
<td>Grinding drum</td>
<td>Grinding drum (e.g. 21.7 litres).</td>
</tr>
<tr>
<td>H</td>
<td>Grinding drum support</td>
<td>Holds and rotates the grinding modules.</td>
</tr>
<tr>
<td>I</td>
<td>Locking screw</td>
<td>For securing the grinding drum position; use a 36 mm open end wrench.</td>
</tr>
<tr>
<td>J</td>
<td>Fixture for the grinding drum support</td>
<td>Screw for changing the grinding modules.</td>
</tr>
<tr>
<td>K</td>
<td>Locking holes</td>
<td>5 different locking positions possible.</td>
</tr>
<tr>
<td>O</td>
<td>Screws (Grinding drum cover)</td>
<td>4 screws secure the cover of the grinding drum.</td>
</tr>
</tbody>
</table>
5.2 Operating elements and displays

Fig. 4: View of the control panel

5.2.1 Overview Table of the Operating Elements and the Display

<table>
<thead>
<tr>
<th>Element</th>
<th>Description</th>
<th>Function</th>
</tr>
</thead>
<tbody>
<tr>
<td>L</td>
<td>Operating button</td>
<td>For operating the machine settings.</td>
</tr>
<tr>
<td>M</td>
<td>Button to open/lock the housing door</td>
<td>Unlocks/locks the housing door.</td>
</tr>
<tr>
<td>N</td>
<td>Display</td>
<td>Displays the control functions and parameters.</td>
</tr>
</tbody>
</table>

5.3 Opening the device

The following steps are necessary to open the housing door so that the grinding modules can be used:
- Connect the machine to the power supply.
- Switch on the main switch (F) at the front.
- Press button F3 (Lock / Unlock).
  The safety lock opens and the housing door (A) can be opened.

5.4 Closing the device

It is only possible to lock the grinding chamber when the machine is connected to the power supply and the main switch has been switched on.
- Make sure that nobody is in the grinding chamber.
- Close the housing door (A).
- A sensor detects the correct position of the closing pin on the housing door (A).
  The housing door can now be locked using button F3 (M) on the control panel.
5.5 Emergency Unlocking

**CAUTION**

**Risk of injuries**

**Drive coasting**

− In the event of a power failure, the drive on the device continues to coast for a long time, as does the drive on connected device parts. After activating the emergency release, items of clothing and parts of the body can get caught in moving components of the device. This can result in substantial injuries.

− **Disconnect the device from the power supply before activating the emergency release.**

− **Wait until all parts of the device have stopped moving.**

---

**Fig. 5:** Emergency release (on the back of the machine)

A key is supplied with the machine (in the electronics cabinet) on delivery, using which the machine can be opened manually in the event of a power failure.

− **Remove the cap (AK).**

− **Place the key (SN) into the opening (NR).**

− **The key must be pushed into the mechanism to unlock the gear drive.**
Operating the device

Fig. 6: Emergency release procedure

- Turn the key (SN) as far as it will go in a clockwise direction.
- The interlock is open, and the hood can be opened.
- The interlock must be set to “lock” again in order to be able to restart the machine.
- To do this, turn the key (SN) as far as it will go in an anticlockwise direction.
5.6 Inserting the grinding drum

**NOTICE**

Wear or damage to the machine
Operating without grinding module
- Operating the machine without a grinding module can result in increased wear or damage to the machine.
- Only operate the machine with an installed grinding module.

5.6.1 Grinding modules

**Fig. 7:** 5 litre ball module

**Fig. 8:** 10 litre ball module
Operating the device

Fig. 9: 21.7 litre ball module

Fig. 10: 43.4 litre rod module
5.7 Preparing the grinding process

5.7.1 Filling the grinding balls

The grinding drum must be mounted when filling and emptying the grinding drum.

- Place the grinding drum in the filling position.

Fig. 11: Grinding drum (21.7 litres) in the filling position

Load the grinding drum with grinding balls

- First fill the balls into the grinding drum, followed by the material.

Fig. 12: Positioning the grinding balls
5.7.2 Filling the rods

Load the grinding drum with grinding rods

- First fill the rods into the grinding drum, followed by the material.

Fig. 13: Positioning the grinding rods

5.7.3 Locking the grinding drum

⚠️ CAUTION

Risk of burns and scalding
Hot grinding drum and/or sample material
- The sample material and grinding drum can get very hot during grinding.
- Always wear protective gloves when touching the grinding drum after grinding.
- Never open a hot grinding drum!
- Allow the grinding drum to cool down to room temperature before opening.

Fig. 14: Grinding drum with closed lid
If you have not already done so, tilt the grinding drum into a vertical position and close the grinding drum with the lid.

- Tighten all 4 screws by hand.

5.7.4 Changing the grinding drum-positions

Fig. 15: Image of the filling position

- Unscrew the locking screw (I) and change the position of the grinding drum to the grinding position.
5.8 Grinding drum positions

**CAUTION**

Risk of crushing
Movement of the grinding drum
- There is a risk of crushing caused by the turning and swinging of the grinding drum.
- Turn the grinding drum carefully and make sure that your fingers do not get trapped in the supports while turning the drum.

The grinding drums can be placed in five different positions.
- To do this, the locking screw (I) is unscrewed.
- You must hold the grinding drum with your other hand.
- You can then place the grinding drum in the desired position and then tighten the locking screw (I) again by hand.

5.8.1 Filling position

![Grinding drum in the filling position](image)

*Fig. 16: Grinding drum in the filling position*
5.8.2 Mixing position

Fig. 17: Grinding drum in the mixing position

- Mixing is only possible with grinding drum sizes of up to 21.7 litres

5.8.3 Grinding position

Fig. 18: Grinding drum in the grinding position
5.8.4 Emptying position

Fig. 19: Grinding drum in the emptying position

5.8.5 Complete emptying position

Fig. 20: Grinding drum in the complete emptying position
5.9 Removing sample material after grinding

**CAUTION**

Risk of burns and scalding
Hot grinding drum and/or sample material
- The sample material and grinding drum can get very hot during grinding.
  - Always wear protective gloves when touching the grinding drum after grinding.
  - Never open a hot grinding drum!
  - Allow the grinding drum to cool down to room temperature before opening.

**CAUTION**

Risk of crushing
Movement of the grinding drum
- There is a risk of crushing caused by the turning and swinging of the grinding drum.
  - Turn the grinding drum carefully and make sure that your fingers do not get trapped in the supports while turning the drum.

The following steps are required to remove the sample material after grinding:
- Wait until the end of the grinding process and for the grinding drum to be in the correct position. Both are shown on the display (N).
- Open the housing door (A).
- Position the collecting receptacle with suitable separation screen beneath the grinding drum (G).
- Unscrew and remove the four screws (O) on the grinding drum lid and lift the grinding drum lid off.
- Hold the grinding drum (G) firmly by the handle in one hand before unscrewing the locking screw (I) with your other hand.
- Turn the grinding drum (G) to the emptying position and then to the complete emptying position to empty all sample material into the collecting receptacle.
Operating the device

5.10 Accessories

The BT 100 is supplied with a suitable collecting receptacle and separation screen. This includes sieves to suit all ball sizes for separating the grinding balls from the material.

1. Use a sieve with slightly smaller holes than the diameter of the balls used. The balls will otherwise also be sifted out.

![Fig. 21: Separation screen](image)

![Fig. 22: Connection for dust extraction](image)

1. The separation screen (P) is suitable for grinding balls with different diameters. The collecting receptacle is fitted with a connection (R) for dust extraction.
6 Control panel – Operating the machine

6.1 Start menu

Press any function button.

Fig. 23: Start menu – Housing door not locked

Fig. 24: Start menu – Housing door locked

F1: Start/Stop
Starts or stops the machine.

F2: No function in the start menu.

F3: Lock / Unlock
Locks or unlocks the housing door.

(open / close)
When the housing door is closed and can be locked, “Ready” is shown on the display; the grinding process can be started by pressing button F1.

F4: Set
Opens the settings.
6.2 Settings

Select button F4 to go to the menu settings.
Grinding can be configured using this menu.

The display then shows the following functions:

![Settings selection menu 1/6](image)

**Fig. 25: Settings selection menu 1/6**

**Runtime** (duration of the grinding process)

- **F1**: +1 Increases the duration of the grinding process.
- **F2**: - 1 Reduces the duration of the grinding process.
- **F3**: h/m/s Switches between setting for hours/minutes/seconds
- **F4**: Next Opens the next menu page.

The following setting appears after pressing button F4:
In this menu you can specify the desired number of revolutions per minute to be made by the grinding drum.

**Speed** (number of revolutions of the grinding drum)

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1:</td>
<td>+1 Increases the speed.</td>
</tr>
<tr>
<td>F2:</td>
<td>-1 Decreases the speed.</td>
</tr>
<tr>
<td>F3:</td>
<td><strong>Toggle</strong> (Setting the direction of rotation) Pressing once switches between the two directions of rotation.</td>
</tr>
<tr>
<td></td>
<td><strong>Rev-Mode: no</strong> Clockwise rotation of the grinding drum.</td>
</tr>
<tr>
<td></td>
<td>If interval mode is specified in the next menu, the direction of rotation of the grinding drum remains unchanged after each interval (clockwise rotation)</td>
</tr>
<tr>
<td></td>
<td><strong>Rev-Mode: yes</strong> Anticlockwise rotation of the grinding drum.</td>
</tr>
<tr>
<td></td>
<td>If interval mode is specified in the next menu, the direction of rotation of the grinding drum is changed after each interval (anticlockwise rotation/clockwise rotation)</td>
</tr>
<tr>
<td>F4:</td>
<td><strong>Next</strong> Opens the next menu page.</td>
</tr>
</tbody>
</table>
The following setting appears after pressing button F4.

![Image of settings selection menu 3/6](image)

**Fig. 28: Settings selection menu 3/6**

In this menu you can specify the desired interval duration for the grinding process.

**Interval duration**

<table>
<thead>
<tr>
<th>Button</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>F1: +1</td>
<td>Increases the interval duration.</td>
</tr>
<tr>
<td>F2: -1</td>
<td>Decreases the interval duration.</td>
</tr>
<tr>
<td>F3: h/m</td>
<td>Switches between setting for hours/minutes.</td>
</tr>
<tr>
<td>F4: Next</td>
<td>Opens the next menu page.</td>
</tr>
</tbody>
</table>

The following setting appears after pressing button F4.
In this menu you can specify the desired duration of breaks between the intervals. This is only possible if you have previously selected interval mode.

**Break duration** (duration of breaks between the intervals)

- **F1**: +1  
  Increases the break duration.
- **F2**: -1  
  Decreases the break duration.
- **F3**: h/m  
  Switches between setting for hours/minutes.
- **F4**: Next  
  Opens the next menu page.

The following setting appears after pressing button F4.
**Revolution**s (specifying the total number of revolutions)

- **F1**: + 1
  Increases the total number of revolutions.
- **F2**: - 1
  Decreases the total number of revolutions.
- **F3**: Toggle
  Pressing once switches between the two stop options.
  - **Stop on: Revolut**
    Stopping after the set number of revolutions.
  - **Stop on: Time**
    Stopping after the set time.
- **F4**: OK
  Saves the settings.

The following setting appears after pressing button F4.
In this menu you can specify the desired time for a delayed start of the grinding process.

**Start delay**

- **F1: +1** Increases the time until the start of grinding.
- **F2: -1** Decreases the time until the start of grinding.
- **F3: h/m** Switches between setting for hours/minutes.
- **F4: OK** To the start menu

After confirming the selection you return to the start menu.

Start the grinding process by pressing button F1.
6.3 Starting the grinding process

The display initially shows the following view once grinding has been started by pressing button F1.

![Display after start grinding with start delay](image)

**Fig. 34**: Display after starting grinding with start delay

Confirm the safety question using button F1 if the grinding drum is in the horizontal position. Grinding will then start.

Confirm the safety question using button F4 if the grinding drum is not in the horizontal position. Grinding will not then start, and instead you will return to the start menu.

After starting by confirming the safety question using button F1, the display shows the following view if a delayed start time has previously been specified.

![Display after starting grinding with start delay](image)

**Fig. 35**: Display after starting grinding with start delay

This view provides information about a delayed start to grinding if this has been specified in the settings. The time runs down, then grinding begins automatically.
Control panel – Operating the machine

Fig. 36: Display during the grinding process 1

Fig. 37: Display during the grinding process 2

Fig. 38: Display during the grinding process 3
The display provides information about the current grinding process:

**Speed** (In revolutions per minute) Provides information about the current speed of the grinding module.

**Torque** (In percent) Provides information about the current torque of the grinding module.

**Time** (In hours, minutes and seconds) Provides information about the time until grinding is finished.

**Revolutions** Provides information about the current number of grinding drum revolutions.

The grinding process can be ended at any time by pressing button F1.

### 6.4 Information Notes

The display shows this note once a grinding process has been stopped or is finished.

![Fig. 39: Note - Positioning](image)

The display provides information that the grinding drum is being placed in the correct position.

Wait for the correct positioning of the grinding drum before opening the housing door and removing the sample material.
6.5 Error Messages

An error message appears on the display if it is not possible to start the grinding process.

The display shows the following error message if the emergency stop is activated or the housing door cannot be locked:

![Error Message](image)

**Fig. 40:** Check safety

With this error message, deactivate the emergency stop or open and close the housing door and start the grinding process again.
7 Maintenance

**WARNING**

**Risk to life caused by an electric shock**

Cleaning live parts with water

- Cleaning the device with water can lead to life-threatening injuries caused by an electric shock if the device has not been disconnected from the power supply.
- Only carry out cleaning work on the device when it has been disconnected from the power supply.
- Use a cloth moistened with water for cleaning.
- Do not clean the device under running water!

**WARNING**

**Risk of loss of life due to an electric shock**

High voltage due to capacitor discharge

- Due to the capacitor discharge on the frequency converter, the device conducts voltage for up to 3 minutes after the mains plug has been removed.
- You could touch live contacts when the device is open. An electric shock can cause serious injuries in the form of burns and cardiac arrhythmia, respiratory failure or cardiac arrest.
- Wait 3 minutes after removing the power cable before opening the device.
7.1 Removing the side cover

- Release the locks marked on the image with the help of the supplied key.
- Disconnect the earth cable on the inside of the cover.
- Remove the cover.
- Carry out the specified maintenance work.
- Connect the earth cable again.
- Put the cover back on.
7.2 Lubrication

The drive of the BT 100 has 2 lubrication points (SP) behind the side cover; these must be regularly lubricated after 150 hours of operation.

Use a lithium based grease (without graphite) such as Shell Gadus S2 V220 2 or BP Energrease LS-EP 2.
7.3  Return for Service and Maintenance

Fig. 44: Return form

The acceptance of devices and accessories of the Retsch GmbH for repair, maintenance or calibration can only be effected, if the return form including the decontamination declaration service has been correctly and fully completed.

⇒ Download the return form located in the download section "Miscellaneous" on the Retsch GmbH homepage (http://www.retsch.com/downloads/miscellaneous/).
⇒ When returning a device, attach the return form to the outside of the packaging.

In order to eliminate any health risk to the service technicians, Retsch GmbH reserves the right to refuse the acceptance and to return the respective delivery at the expense of the sender.
8 Disposal

In the case of a disposal, the respective statutory requirements must be observed. In the following, information on the disposal of electrical and electronic devices in the European Community are given.

Within the European Community the disposal of electrically operated devices is regulated by national provisions that are based on the EU Directive 2012/19/EU on Waste Electrical and Electronic Equipment (WEEE).

Accordingly, all devices supplied after August 13th 2005 in the business-to-business area, to which this product is classified, may no longer be disposed of with municipal or household waste. To document this, the devices are provided with the disposal label.

![Disposal label](image)

**Fig. 45: Disposal label**

Since the disposal regulations worldwide and also within the EU may differ from country to country, the supplier of the device should be consulted directly in case of need.

This labelling obligation is applied in Germany since March 23rd 2006. From this date on, the manufacturer must provide an adequate possibility of returning all devices delivered since August 13th 2005. For all devices delivered before August 13th 2005 the end user is responsible for the proper disposal.
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BT 100 | 71.004.xxxx

EU DECLARATION OF CONFORMITY

Herewith we declare, represented by the signatory, that the above mentioned device complies with the following directives and harmonized standards:

Machinery Directive 2006/42/EC
Applied standards, in particular:
DIN EN ISO 12100 Safety of machinery

EMC Directive 2014/30/EU
Applied standards, in particular:
DIN EN 55011 Industrial, scientific and medical equipment - Radio-frequency disturbance characteristics - Limits and methods of measurement

Low Voltage Directive 2014/35/EU
Applied standards, in particular:
DIN EN 61310-1 Safety requirements for electrical equipment for measurement, control and laboratory use

Authorized person for the compilation of technical documents:
Dr.-Ing. Frank Janetta (Senior Development Manager)

Furthermore, we declare that the relevant technical documentation for the above mentioned device has been compiled according to Annex VII Part A of the Machinery Directive, and we undertake to submit this documentation on request to the market surveillance authorities.

In case of a modification of the device not previously agreed with Retsch GmbH, as well as the use of unauthorised spare parts or accessories, this declaration will lose its validity.

Retsch GmbH

Haan, 02/2019

Dr. Alexander Mühlig, Technical Director