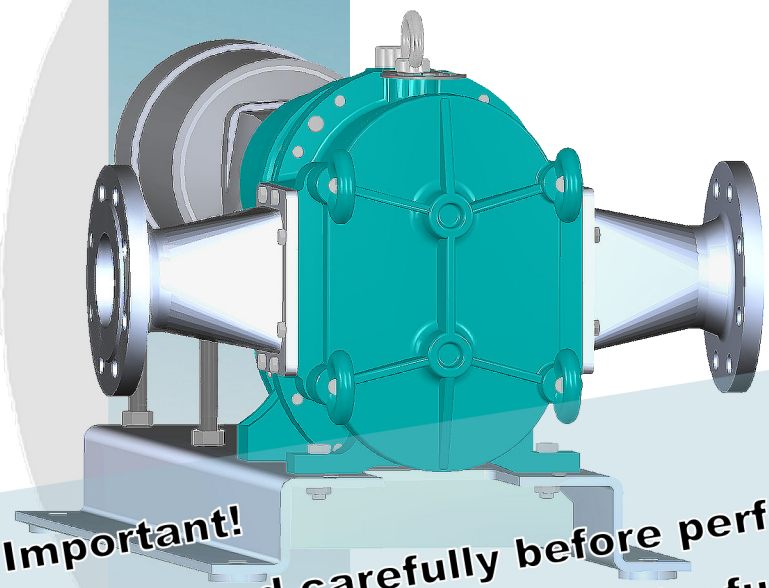
BÖRGER®
EXCELLENCE - MADE TO LAST

Operating Manual

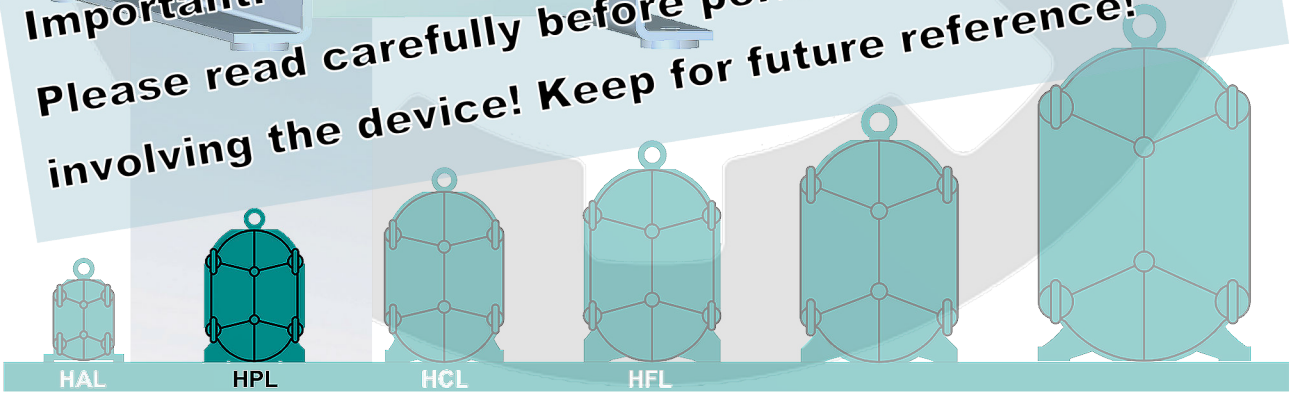
Börger Multicrusher

Classic

Series HPL



Important!
Please read carefully before performing any activity involving the device! Keep for future reference!



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Product Specifications

Unit:	
Product group:	Multicrusher
Type:	HPL 200, HPL 300, HPL 300 N
	Precise product specifications for your unit, with the exception of control units, can be found in the data sheet enclosed with this operating manual.
Manufacturer's address:	
Company:	Börger GmbH
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Town / city:	46325 Borken-Weseke
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E-mail:	service@boerger.de
Spare parts orders and customer service in other countries:	
	See separate contact data for your regional sales partner
Document data:	
Document:	BA-Classic HPL_EN
Issue date:	24.01.2024
Language:	English translation of the German original, available at service@boerger.de

Table of Contents

1 General information

1.1 Introduction

This operating manual is an important aid for the correct and safe operation of the Börger machine.

It contains important information for operating the Börger machine in a safe, proper and economical manner.

Adhering to these instructions will help avoid associated dangers, reduce repair costs and downtimes and increase the reliability and service life of the Börger machine.

The operating manual must be made available at all times. All personnel who work on or with the Börger machine must read and adhere to the manual. This work includes:

— operation and troubleshooting
— maintenance (machine care, maintenance and repairs)
— transportation.

1.2 Notes on copyrights and property rights

This operating manual must be treated as confidential. It may only be made accessible to authorized persons. The manual may only be passed on to third parties following written approval from Börger GmbH.

All documents are protected according to the copyright laws. The distribution and reproduction of documents, in whole or in part, plus the exploitation and distribution of all associated content is forbidden unless expressly authorized in writing.

Violations will be prosecuted and may lead to claims for compensation. All rights for exercising industrial property rights are reserved by Börger GmbH.

1.3 Information for the operator

The operating manual is an integral part of the Börger machine. The operator is responsible for making the operating personnel aware of this manual.

Additionally, the operator is obligated to ensure the notice and observance of national regulations for accident prevention and environmental protection, plus the notice and observance of supervision and reporting duties taking special operational aspects into account, e.g. regarding work organization, work processes and personnel.

Aside from the operating manual and the currently valid accident prevention regulations in the country of operation and at the installation site, all recognized special regulations for safe and proper operation must be observed.

The operator is not permitted to make or arrange for any changes, modifications or alterations to the Börger machine without approval from Börger GmbH.

Any spare parts used must comply with the technical requirements specified by Börger GmbH. This is always guaranteed when original spare parts are used. Only original spare parts may be used during the warranty period, failing which the warranty is void.

Only trained or instructed personnel may be assigned to operate, maintain, repair or transport the Börger machine. Clearly define the personnel responsible for operation, maintenance, repair and transportation.

1.4 Training and instruction

As the operator, you are obligated to inform and, if necessary, instruct your operating personnel in regard to the applicable legal and accident prevention regulations, as well as the available safety equipment on the Börger machine.

This obligation also applies to all other safety equipment on and around the Börger machine. The different technical qualifications of the operating personnel must be taken into account. The operating personnel must have fully understood the instructions, and adherence to the instructions must be guaranteed. Only then can your personnel work safely and be fully aware of associated risks.

Adherence to instructions must be checked on a regular basis. As the operator, you should therefore have each instructed staff member confirm their training participation in writing.

Sample training topics and a sample form for confirming participation in the training/instruction can be found on the following pages.

Börger GmbH, their regional subsidiaries or your local sales partner will be happy to help you regarding staff instruction. They can also carry out training on the functionality, commissioning, maintenance and repair of the Börger machine, on request.

Contact us for a detailed quotation.

1.5 Sample training topics

1. Operational safety

- Accident prevention regulations
- General legal regulations
- General safety instructions
- Measures in the event of emergencies
- Safety instructions for operating the Börger machine
- Using the safety equipment on the Börger machine
- Safety equipment on and around the Börger machine
- Explanation of symbols and signs

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2. Operating the Börger machine

— Using the operating elements on the Börger machine
— Explanation of the operating manual for operating personnel
— Specific experiences in using the Börger machine
— Troubleshooting / dealing with malfunctions

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3. Repair and maintenance regulations

— Correct handling of cleaning agents and lubricants
— Specific experiences regarding repair, maintenance, cleaning and care of the Börger machine

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Confirmation of training		
Training topic		
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No.	Surname, first name	Signature
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2 Safety

2.1 General information

The Börger machine has been developed and constructed according to current state-of-the-art technology and recognized safety guidelines in observance of the valid safety regulations in the country of manufacture.

However, operation of the Börger machine may endanger the operating person and cause damage to the Börger machine or other material assets in the following circumstances:

— When operated by untrained or uninstructed personnel
— When not used properly
— When not maintained or repaired properly

2.2 Notes on signs and symbols

The following terms, signs and symbols are used in this operating manual, and indicate particularly important information.

DANGER!

Warns of an immediate hazardous situation with unavoidable serious injuries or death as a result if the instructions shown are not strictly adhered to.

WARNING!

Warns of a hazardous situation with the possible risk of subsequent serious injuries or death if the instructions shown are not strictly adhered to.

CAUTION!

Warns of a possible hazardous situation with the risk of subsequent moderate or light injuries and material damage if the instructions shown are not strictly adhered to.

NOTICE!

Indicates a possible hazardous situation or unsafe, dangerous work processes that may lead to damage to the machine or surrounding area.

NOTE!

Offers useful information on safe and proper operation.

Arrow symbols describe work and/or operational steps. These steps must be carried out in the sequence of the numbering.

— Indents indicate lists.

Arrow symbols indicate references to further chapters.

NOTE!
Illustration of work steps:

Some of the diagrams and photographic images used in this operating manual, which are only used to illustrate a function or a particular work step, show a different type of device, however the functional principle or work step is the same.

2.3 Proper use

The Multicrusher is a macerating unit used for preventing blockages in a system and preventing damage to downstream machines (especially to pumps) caused by solids in the medium.

The unit can process coarse materials in the flow medium such as wood and plastic parts, PET bottles, fabric strips, skin strips, small bones, potatoes, apples, turnips etc., toiletries, leaves, hay/straw, paper, cardboard and similar materials and plaited fiber materials etc. Even single straw belts or plastic tapes are usually no problem.

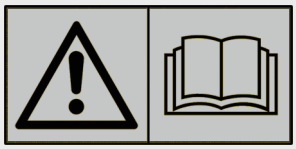
Large quantities of very long solids such as straw belts or plastic tapes, complete textile sheets, large fabric cloths are processed. However blockages can still occur that require reversing or manual cleaning.

The Multicrusher cannot process hard coarse materials such as stones, metal objects and similar items. If such hard coarse materials cannot be excluded from the flow medium, a stone trap / foreign body separator must be installed upstream of the Multicrusher to prevent damage to the device and downstream pump.

NOTE!
Proper use

The Börger machine or unit is configured exclusively for the operating conditions entered in your request/order and specified in the order confirmation and enclosed data sheet.

— Observe the technical specifications in the data sheet.
— Therefore, proper use is restricted to the specified pumped medium, temperatures, speeds and output only.



Proper use includes compliance with the instructions

— on safety,
— on operation and control,
— on repairs and maintenance,

specified in this operating manual.

Any other use or use over and above these specifications is deemed as improper use. The operator of the Börger machine is solely liable for any resulting damage.

2.4 Residual risk

Even when all safety instructions are adhered to, there are residual risks involved in operating the Börger machine as detailed below.

All persons that work on and with the Börger machine must be aware of these residual risks and observe the associated instructions to avoid accidents or damage caused by these residual risks.

It may be necessary to remove on-site safety equipment during installation and when making modifications. This causes a residual risk and potential danger that each operating person must be aware of:

DANGER!
Risk of fatal injury due to electric power!

There is an immediate risk of fatal electric shock if live components are touched. Damage to the insulation of the individual components can be fatal.

- Have all work on the electrical equipment performed by skilled electricians.
- In the event of damage to the insulation, cut off the power supply immediately and initiate repairs.
- Before working on live components of electrical systems and equipment, de-energize these components and secure them in this state for the duration of the work.

  Adhere to the following safety rules in this regard:

  - Disconnect.
  - Secure against restart.
  - Verify that components have been de-energized.
  - Ground and short-circuit.*
  - Cover or shield any adjacent live components.*
- Never bypass or disable any fuses. Comply with the correct amperage specification when replacing fuses.
- Keep moisture away from all live components. This may lead to short circuits.
- Ensure that all electric connections have been properly reconnected before switching the unit on again and that the cables used are undamaged and have not been sharply bent.
- Ensure that the control cabinet is properly closed before switching on and during operation.

* Under certain circumstances, exceptions may apply for systems with a nominal voltage of up to 1000V (see DIN VDE 0105-100)

DANGER!
Risk of injury due to rotating parts!

Moving parts can cause severe injury.

— Do not reach into rotating parts or handle rotating parts when the machine is in operation.
— Never open protective covers when in operation.
— Perform work on the Börger machine only when stationary.
— Observe the delay time: Prior to opening protective covers, make sure that all components have stopped moving.
— Shut down the machine and upstream and downstream system components before carrying out any work on the Börger machine or accessories. *Chapter 5.3 “Downtimes” on page 111*
— The operating person is obligated to check that all safety equipment is installed and fully functional before putting the machine into operation.
— The Börger machine must only be switched on when the inlet and outlet connections have been established and the maintenance openings have been securely installed.

WARNING!
Risk of fatal injury due to suspended loads!

Loads can swing and fall during lifting operations. This can cause severe injury, including death.

— Never stand under or within the swinging range of suspended loads.
— Do not move loads unsupervised.
— Only use approved hoists and slings with sufficient load-bearing capacity.
— Do not use torn or worn hoists such as ropes and belts.
— Do not place hoists such as ropes and belts near sharp corners and edges and do not tie them together or twist them.
— Put the load down when leaving the operating site.

WARNING!
Risk of serious injuries caused by liquid spouting out or escaping gases!

Gases or liquids may escape uncontrollably from seals and screw connections. Especially when flange connections are released and maintenance openings are opened, pressurized liquid can spout out at the cover.

Never loosen connections when the unit is pressurized.

— Ensure that all valves and shut-off devices on the inlet and outlet are closed.
— Release the pressure and empty the Börger machine via a drainage device (if available).
— Collect any leakage of medium by suitable means and dispose of it in accordance with the applicable local guidelines.
— Therefore, wear your personal protective equipment (PPE) ↬ *Chapter 2.6 “Personal protective equipment” on page 25* when opening the cover and take all necessary precautions.

CAUTION!
Risk of burns!

Particularly when used outside at correspondingly high ambient temperatures and high medium temperatures, individual parts of the Börger machine can become hot and should not be touched during operation.

Stop the feed and shut down the Börger machine prior to any troubleshooting, maintenance and repair work on the Börger machine and the accessories.

Allow the system to cool down completely, if necessary, before carrying out troubleshooting, maintenance and repair work.

Avoid dust formation as this contributes to heat build-up.

CAUTION!
Health hazard due to residues of dangerous medium inside and on the Börger machine!

There is an increased health hazard from contact with the medium and contaminated components.

Generally, the following applies:

— When using dangerous or health-endangering media, take all necessary safety measures when performing work on the Börger machine.
— Avoid direct contact with the medium (skin/eye contact, swallowing, inhaling).
— Remove spillage from your skin without delay.
— Do not store or consume beverages, food or tobacco in the working area.

2.5 Qualifications for operating personnel

WARNING!
Personnel with insufficient qualifications represent a hazard!

Insufficiently qualified personnel are not able to assess the risks when using the machine and expose themselves and others to the risk of serious or fatal injuries.

— All work must only be performed by personnel with the appropriate qualifications.
— Keep insufficiently qualified personnel away from the working area.

The various tasks described in this manual impose different requirements on the qualifications of personnel who are entrusted with these tasks.

Only personnel of whom it can be expected that they perform these tasks reliably, are approved for all tasks. Persons whose capability to react is impaired, for instance through drugs, alcohol, or medication, are not approved.

The operating personnel must have been informed or instructed on the applicable legal and accident prevention regulations as well as the safety equipment on and around the Börger machine. The operating personnel must have fully understood the instructions, and adherence to the instructions must be guaranteed. Only then can all personnel work safely and in full awareness of the associated risks.

— Appoint only trained or instructed personnel.
— Clearly define the personnel responsible for operation, installation, maintenance and repair.
— In addition, also specify the area of responsibility for the operating persons and allow them to reject unsafe instructions from others.

Manufacturer
Certain work may be carried out by manufacturer's qualified personnel only. Other personnel is not authorized to carry out this work. To have this work carried out, please contact our customer service.

Mechanics
Mechanics have completed professional training or are able to provide evidence of having completed further training which enables them to perform the special tasks mentioned in these instructions on the system and its components.

The skills acquired during training or further training enable mechanics to identify and evaluate hazards associated with the system and its components.

These include:

— Knowledge about health and safety at work
— Knowledge about the basics of first aid
— Technical knowledge
— Knowledge about assembly, maintenance and repair
— Knowledge about machine operation, system management and system operation

Operating person
Operating persons are able to provide evidence of having completed further training which enables them to perform the simple tasks mentioned in these instructions on the system and its components.

The knowledge acquired during further training enables operating persons to identify and evaluate hazards associated with the system and its components.

These include:

— Knowledge about health and safety at work
— Knowledge about the basics of first aid
— Technical knowledge
— Knowledge about assembly, maintenance and repair
— Knowledge about machine operation, system management and system operation

Qualified electricians

Qualified electricians have completed professional training in electrical engineering or are able to provide evidence of having completed further training which enables them to perform the special tasks mentioned in these instructions on the electrical system and its components.

The skills acquired during training or further training enable qualified electricians to identify and evaluate hazards associated with the system and its components.

These include:

— Knowledge about health and safety at work
— Knowledge about the basics of first aid
— Basics of electrical engineering
— Construction, wiring and checking of circuits
— Effects and dangers associated with electricity
— Troubleshooting and documentation of the electrical system
— Installation of electrical systems
— Special regulations

Warehouse worker

Warehouse workers are able to provide evidence of having completed further training which enables them to perform the special transport and storage tasks mentioned in these instructions with the system and its components.

The knowledge acquired during further training enables warehouse workers to identify and evaluate hazards associated with the system and its components during transport and storage.

These include:

— Knowledge about health and safety at work
— Knowledge about the basics of first aid
— Receiving goods and checking them for completeness and integrity
— Selecting storage locations with regard to technical and safety-related aspects
— Storing goods using handling equipment, taking into consideration the type, character, volume and weight of the products
— Selecting handling systems or hoists depending on the product type, quantity and distance

2.6 Personal protective equipment

Personal protective equipment serves to protect personnel from adverse effects to safety and health whilst working. Staff must wear personal protective equipment whilst carrying out various work on the plant. The individual sections of these instructions make specific reference to the requirements.

Light respiratory protection
Light respiratory protection protects against harmful dusts.

Occupational safety clothing, chemical-resistant
The chemical-resistant occupational safety clothing is used to protect the skin from contact with chemicals which are a health hazard.

Safety gloves, chemical-resistant
Chemical-resistant safety gloves are used to protect the hands from corrosive chemicals.

Safety goggles
Safety goggles (closed on all sides) are used to protect the eyes from flying particles and liquid spray.

Safety shoes
Safety shoes protect the feet from crushing, falling parts and prevent slipping on a slippery floor.

2.7 Securing the machine against restart

WARNING!
Risk of fatal injury if the plant is switched back on uncontrolledly or without authorization!

Switching the Börger machine on without authorization or uncontrolledly can cause serious injuries.

— Before switching back on, make sure that all safety devices are fitted and fully functional and that staff are not at any risk.
— Always adhere to the sequence to secure the plant to prevent it from being switched back on. *Chapter 2.7 “Securing the machine against restart” on page 26*

1. Shut off the media supply by closing the respective shut-off valves.
2. Shut off the energy supply.
3. Inform the person responsible that work is being carried out in the danger area.
4. Attach a sign to the control cabinet to indicate that work is being carried out in the danger area and that switching on is prohibited. The sign must include the following information:
   — Switched off on:
   — Switched off at:
   — Switched off by:
   — Note: Do not switch on!
   — Note: Do not switch on before ensuring that personnel are at no risk.

2.8 Description of the safety equipment

WARNING!
Risk of fatal injury if safety devices are not fully functional!

Non-functional or overridden safety devices may cause severe injuries, including death.

— Check whether all safety devices are functional and correctly installed before starting work with the machine.
— Never override or bypass safety devices.
— Ensure that all safety devices are accessible at all times.

The Börger machine is equipped with the required safety equipment according to the applicable legal guidelines in the country of manufacture, current state-of-the-art technology and recognized safety regulations.

2.8.1 EMERGENCY STOP

When pressing the EMERGENCY STOP button, the machine is shut down by the energy supply being switched off or the machine being mechanically disconnected from the drives. Once the EMERGENCY STOP switch has been activated, it must be turned in order to reset it and restart the machine.

WARNING!
Risk of fatal injury if the plant is switched back on uncontrolledly or without authorization!

Switching the machine on without authorization or uncontrolledly can cause serious injuries.

— Ensure that the cause of the EMERGENCY STOP has been eliminated and all safety features are installed and functional prior to a restart.
— Do not reset the EMERGENCY STOP switch before the danger has been eliminated.

2.8.2 Covering of the rotating cutting unit

When installed correctly, the cutting blades rotate inside a completely sealed casing. Therefore, the manufacturer is not required to provide additional safety equipment for the cutting unit.

However, the Multicrusher must only be switched on when the connections on the inlet and outlet are established and the quick-release cover is installed securely. ↳ ***Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146***.

— Otherwise, there is a risk of serious injuries to hands and limbs when reaching into the casing.

2.8.3 Coupling guard

The rotating shafts between the drive and functional unit are connected by a coupling, and must be secured by a fixed safety guard against reaching in and blockages caused by falling parts.

Börger GmbH delivers units with couplings and drives including a screw-fixed coupling guard as standard.

This coupling guard may not be removed, and must always be reinstalled carefully following removal due to maintenance.

If your Börger machine is delivered without an installed drive, you must attach the supplied coupling guard (or another suitable coupling guard) after the drive is installed.

This also applies to the V-belt/chain guards on overhead mounted drive assemblies and to the coupling lanterns on units with hydraulic drives and coupling lanterns.

2.8.4 Intermediate chamber

The intermediate chamber with safety plug separates the hydraulic part of the Multicrusher from the Multicrusher gear unit. It is used for monitoring the integrity of the mechanical seals on Multi-crushers with single-acting mechanical seals.

Overflowing caused by penetrating flow medium indicates that the mechanical seals must be replaced immediately in order to prevent the flow medium from entering the gear unit.

During vacuum operation, when the flow medium is sucked through the Multicrusher by a downstream pump, the intermediate chamber running dry is an indicator for a leak in the mechanical seal.

The fill hole in the intermediate chamber may only be closed with the safety plug.

When the safety opening is closed tightly, emerging flow medium from the cutting chamber cannot escape through the intermediate chamber and will penetrate the gear unit if the mechanical seal is defective. This could damage the gear unit.

2.8.5 Optional monitoring devices

If the Börger machine is equipped with additional monitoring devices, then the corresponding safety instructions can be found in the manufacturer’s operating manual in the appendix.

If your Börger machine was supplied with such monitoring devices, you must ensure that these devices function correctly.

2.9 Markings and signs

The symbols and information signs below are located in the work area. They refer to the immediate environment in which they are attached.

WARNING!
Danger due to illegible signage!

Over time, stickers and signs can get soiled or become illegible due to other reasons, so that dangers are not recognized and necessary operating instructions cannot be observed. This poses a risk of injury.

— Do not remove any safety notes, warnings and operating instructions.
— Keep them completely legible.
— Replace damaged signs or stickers immediately.

Meaning:
Nameplate according to directive 2006/42/EC (machinery directive)

Location:
In a clearly visible position on the Multicrusher

Different address possible, e.g. when delivered through a subsidiary.

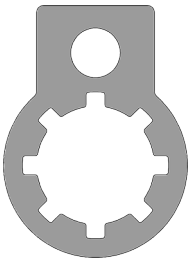
CE marking not applicable for incomplete machines
where only a declaration of incorporation may be delivered, and in certain other cases.

Meaning:
Grounding (bore hole for ground screw or terminal)

Location:
On the base frame

Meaning:
Do not touch rotating parts/blades, risk of serious, permanent injury

Location:
In a clearly visible position on the Multicrusher

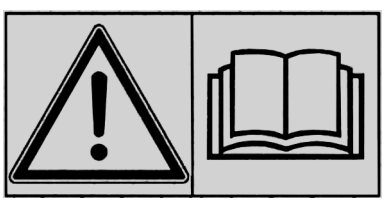


Meaning:
Multicrusher with rotating blades (to distinguish from a rotary lobe pump that has the same outer appearance)

Location:
In a clearly visible position under the lifting eye bolt

Meaning:
Flow direction

Location:
In a clearly visible position on the Multicrusher



Meaning:
Please read the operating manual carefully before performing any activity involving the device! Keep for future reference!

Location:
In a clearly visible position on the packaging of the operating manual

2.10 Markings and signs to be attached by the operator

The flow direction for which the Multicrusher was designed is already indicated at the plant by appropriate adhesive labels.

The operator is obligated to label any changes in flow direction after any such modification. *Chapter 4.5.3 “Checking the flow direction” on page 102*

The operator is also obligated to label the flow medium on the Multicrusher.

The operator may also be required to attach additional markings and signs on or around the Börger machine.

These additional markings and signs may relate to regulations for wearing personal protective equipment, for example.

2.11 Safety instructions for operating personnel

The Börger machine may only be operated while it is in perfect working condition and only for its intended purpose, in a safe and risk-conscious manner having regard to this operating manual. All malfunctions must be rectified immediately, especially those affecting safety.

Every person assigned with commissioning, operation or maintenance work must have fully read and understood this operating manual beforehand – specifically *Chapter 2 “Safety” on page 13*. Consulting the manual during work is already too late. This applies especially to personnel that only work occasionally on the Börger machine.

The operating manual must always be kept accessible next to the Börger machine.

No liability will be assumed for any damage and accidents caused by non-compliance with the operating manual.

Adhere to the applicable accident prevention regulations and all other generally recognized safety regulations and guidelines for occupational health at work.

Clearly specify the responsible parties for the various maintenance and repair tasks and adhere thereto. Only then can handling errors be avoided, especially in dangerous situations.

The operator must make personal protective equipment mandatory for operating and maintenance personnel. This applies to safety shoes, protective goggles and protective gloves. Always wear this protective equipment when working on the Börger machine.

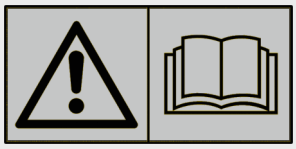
Keep long hair tied and do not wear loose clothing or jewelry. There is always a danger of getting caught, pulled in or dragged along by moving components.

2.11.1 General work on the Börger machine

NOTE!
Work on the Börger machine!

— Work on the Börger machine may only be carried out by trained, reliable personnel.
— Personnel in training or requiring instruction, as well as persons currently in vocational training, may only operate the Börger machine under the constant supervision of an experienced staff member.

Personnel:	■ Mechanics ■ Operating person ■ Warehouse worker ■ Manufacturer
Protective equipment:	■ Occupational safety clothing, chemical-resistant ■ Safety shoes ■ Safety gloves, chemical-resistant ■ Safety goggles ■ Light respiratory protection
Tool:	■ Tools, general



Further operating manuals / supplementary operating manuals

You must completely read the separate operating manuals and/or supplementary operating manuals for components and/or special versions.

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance.

Supplier documentation

You must completely read the separate supplier documentation.

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance.

If malfunctions occur on the Börger machine:

1. Shut down the Börger machine and downstream and upstream system components. *Chapter 5.3 “Downtimes” on page 111*
2. Secure the Börger machine against unauthorized or uncontrolled reactivation. *Chapter 2.7 “Securing the machine against restart” on page 26*
3. Report the malfunction to the responsible department/person.
   — This especially applies to safety-related alterations to the Börger machine.

NOTE!

Adhere to the prescribed intervals for regular maintenance and inspections or those specified herein and in the operating manuals of the components.

— Suitable workshop equipment as well as specified special tools are essential for carrying out maintenance work.
↳ *Chapter 9.4.1 “Tools / installation aid” on page 204*
— Modifications, repairs, maintenance and troubleshooting may only be carried out when the Börger machine is switched off. Accidental restarting of the unit must be prevented completely.
— To the extent necessary, amply secure the surrounding area when performing maintenance. Cordon off the working area with a red and white safety chain and a warning sign.
— Also observe any
  — supplementary operating manuals
  — operating manuals of the components

  in the appendix.
— Large assemblies and components must be carefully attached and secured to hoists when they are removed or replaced so that associated dangers are minimized. Only appropriate hoists and lifting media in technically perfect working condition with sufficient load capacities may be used.
  — Never stand under suspended loads.
— At the start of maintenance, repairs or machine care, clean any dirt or cleaning agents off the connections and screw connections. Do not use any aggressive cleaning agents. Use lint-free cleaning cloths.
— During installation, always tighten any screw connections that have been loosened for maintenance and repair work. Tighten to the prescribed torque, where this is specified.
— Dispose of operating materials and replacement parts in a safe and environmentally-friendly manner.

2.11.2 Work on the electrical system

DANGER!
Risk of fatal injury due to electric power!

There is an immediate risk of fatal electric shock if live components are touched. Damage to the insulation of the individual components can be fatal.

— Have all work on the electrical equipment performed by skilled electricians.
— In the event of damage to the insulation, cut off the power supply immediately and initiate repairs.
— Before working on live components of electrical systems and equipment, de-energize these components and secure them in this state for the duration of the work.

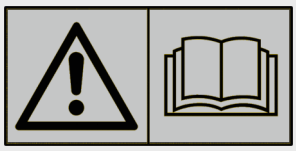
  Adhere to the following safety rules in this regard:

  — Disconnect.
  — Secure against restart.
  — Verify that components have been de-energized.
  — Ground and short-circuit.*
  — Cover or shield any adjacent live components.*

— Never bypass or disable any fuses. Comply with the correct amperage specification when replacing fuses.
— Keep moisture away from all live components. This may lead to short circuits.
— Ensure that all electric connections have been properly reconnected before switching the unit on again and that the cables used are undamaged and have not been sharply bent.
— Ensure that the control cabinet is properly closed before switching on and during operation.

* Under certain circumstances, exceptions may apply for systems with a nominal voltage of up to 1000V (see DIN VDE 0105-100)

Personnel:	■ Qualified electricians
Protective equipment:	■ Occupational safety clothing, chemical-resistant ■ Safety shoes ■ Safety gloves, chemical-resistant ■ Safety goggles
Tool:	■ Tools for electrical work



Operating manuals of electronic parts

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance,
— in the operating manuals of electronic parts in the appendix.

NOTE!

Adhere to the prescribed intervals for regular maintenance and inspections of the electrical system and/or components or to those intervals specified herein and in the operating manuals of the components.

— The electrical system may only be opened, maintained and repaired by qualified electricians, while having proper regard to the attached electric circuit diagrams.
— Carry out modifications, repairs, maintenance and trouble-shooting on the control unit only when the electrical system is switched off. Accidental restarting of the unit must be prevented completely.
— To the extent necessary, amply secure the surrounding area when performing maintenance. Cordon off the working area with a red and white safety chain and a warning sign.
— Suitable workshop equipment as well as specified special tools are essential for carrying out maintenance work.
Chapter 9.4.1 “Tools / installation aid” on page 204
— Also observe any
  — supplementary operating manuals
  — operating manuals of the components
  — Operating manuals of electronic parts

  in the appendix.
— Protect the electronic components from moisture and impurities. Clean the electronic components with suitable agents according to the manufacturers' operating manuals only. Do not use aggressive cleaning agents to clean the surface. Use lint-free cleaning cloths.
— Dispose of any replacement parts in a safe and environmentally-friendly manner.

2.12 Safety instructions for maintenance and rectifying malfunctions

WARNING!
Risk of injury due to inadequate troubleshooting, maintenance and repair work!

Inadequate troubleshooting, maintenance and repair work can lead to severe injury and significant material damage.

- To the extent necessary, amply secure the surrounding area when performing maintenance. Cordon off the working area with a red and white safety chain and a warning sign.
- Ensure sufficient installation space before commencing work.
- Keep the installation site clean and tidy! Loosely stacked or scattered components and tools cause accidents.
- Ensure correct installation where components have been removed, reinstall all fastening elements and observe the tightening torques of screws.
- Ensure the following before putting the machine back into operation:
  - Ensure that all troubleshooting, maintenance and repair work is performed and completed as per the information and notes provided in this manual.
  - Ensure that nobody enters the hazardous area.
  - Ensure that all covers and safety features are installed and function correctly.

WARNING!
Risk of fatal injury if the plant is switched back on uncontrolledly or without authorization!

Switching the Börger machine on without authorization or uncontrolledly can cause serious injuries.

- Before switching back on, make sure that all safety devices are fitted and fully functional and that staff are not at any risk.
- Always adhere to the sequence to secure the plant to prevent it from being switched back on. *Chapter 2.7 “Securing the machine against restart” on page 26*

WARNING!
Risk of fatal injury if safety devices are not fully functional!

Non-functional or overridden safety devices may cause severe injuries, including death.

— Check whether all safety devices are functional and correctly installed before starting work with the machine.
— Never override or bypass safety devices.
— Ensure that all safety devices are accessible at all times.

WARNING!
Risk of injury when using unsuitable spare parts!

The use of unsuitable spare parts can cause malfunctions which can lead to severe injury, including death, and to significant material damage.

— Only use suitable spare parts.
— Always contact the manufacturer if in doubt.

WARNING!
Severe injury due to residual pressure!

Despite having depressurized the Börger machine, it may be under residual pressure in the event of congestion or lump formation in the medium.

— Take extra care when removing the flange connections and maintenance openings to prevent accidents caused by the release of residual pressure.

NOTICE!
Risk of severe material damage due to a delayed shut-down in the event of a malfunction!

A delayed shut-down in the event of malfunction can cause permanent damage to the Börger machine.

— In the event of a malfunction, shut down the Börger machine and all upstream and downstream system components immediately until the cause has been rectified.

NOTICE!
Risk of damage caused by frost!

Frost can cause damage to the Börger machine.

— Protect the Börger machine and its connections against frost.

NOTICE!
Improper cleaning of the Börger machine can lead to malfunctions and damage!

— Do not use water jets.
— Do not use aggressive cleaning agents, solvents or sandpaper, as these can damage the metallic and plastic surfaces, casing coating and seals.
— Do not use metal objects such as scrapers and screwdrivers for cleaning coated machine parts.
— Never clean sensitive components with hard scrubbing and strong mechanical pressure.
— Do not use a vacuum cleaner or a hand brush with plastic bristles etc. to clean electronic components because the production of static electricity can damage the electronic components.

NOTICE!
There is a danger of considerable material damage if the limits are not complied with!

Failure to comply with the limits can cause permanent damage to the Börger machine and its components.

— The values may neither exceed nor fall below the limits specified in *Chapter 3.3 “Technical data” on page 64* of the standard operating manual and the specifications on the data sheet.
— On Börger machines that operate with a frequency converter, make sure that the operating speed is sufficiently below the maximum permissible speed (for speed limit based on machine configuration, see enclosed data sheet).
— Take all necessary precautions to ensure that the permissible differential pressure between the inlet and outlet of the Börger machine is not exceeded.
— Make sure that the pressure on the outlet does not exceed the permissible pressure of the pipe system and the Börger machine, and not overload the drive and its elastic connections.
— The temperature values according to the data sheet may not exceed or fall below the limits. Double-check this.

NOTICE!
Risk of material damage due to impermissible changes to limit values.

The settings at the evaluation units or at the frequency converter must not be changed. Non-compliance may lead to material damage.

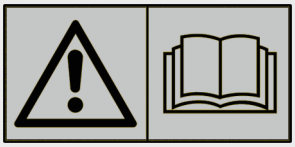
NOTE!
Presettings of parameters

Unit-specific values, limits as well as variable parameters are preset by factory default according to the order specifications for the particular case.

NOTE!
When using frequency converters

Due to their working principle, frequency converters generate leakage current.

— For proper operation of a frequency converter at a residual current device, the use of an AC/DC sensitive **residual current device (type B)** according to **EN50178/VDE0160** is required due to the DC component of the leakage current.



Further operating manuals / supplementary operating manuals

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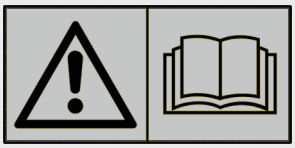

Supplier documentation

You must completely read the separate supplier documentation.

Pay particular attention to all instructions

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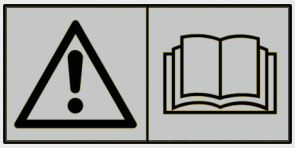
— on operation and control,
— on repairs and maintenance.



Operating manuals of electronic parts

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance,
— in the operating manuals of electronic parts in the appendix.

2.13 Information on special dangers

2.13.1 Oil, grease and other chemical substances

ENVIRONMENT!
Danger due to incorrect handling of environmentally hazardous substances!

Inappropriate handling of environmentally hazardous substances, especially incorrect disposal, can cause significant damage to the environment.

- Especially water-polluting materials such as grease and lubricating oil must not pollute the soil or enter the sewage system during installation, repair and maintenance work.
  - These materials must be collected, stored, transported and disposed of in suitable containers.
- When handling oil, grease and other chemical substances, pay attention and adhere to the applicable regulations and safety data sheets issued by the respective manufacturer relating to storage, handling, correct use and disposal.
- Comply with the legal obligations regarding waste avoidance and the proper recycling/disposal of waste during all work

When handling oil, grease and other chemical substances, pay attention and adhere to the applicable regulations and safety data sheets issued by the respective manufacturer relating to storage, handling, correct use and disposal.

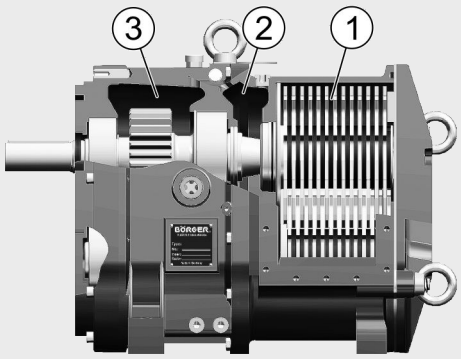
2.13.2 Noise

The A-weighted equivalent continuous noise level on the workstations is below 80 dB(A) during normal operation of the Börger machine. Higher noise levels may occur at the Börger machine installation site due to local conditions. In this case, the operator is obligated to provide operating personnel with appropriate protective equipment.

3 Product Description

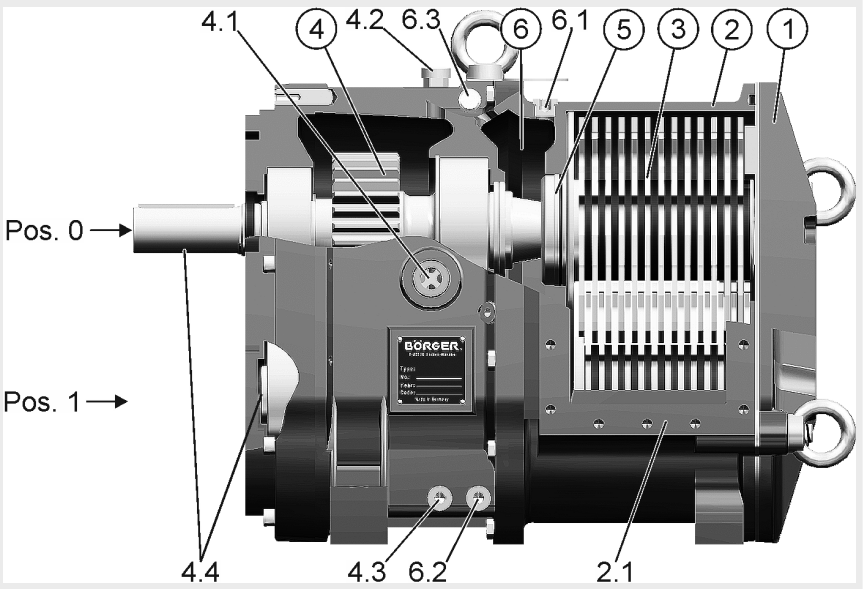
3.1 Construction of the Börger machine

Components



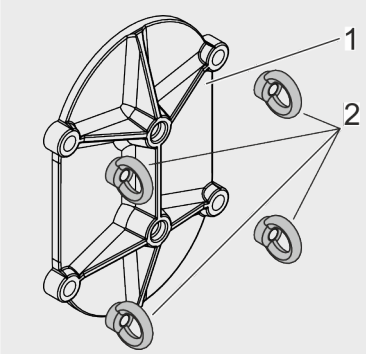
1	Macerator
2	Intermediate chamber
3	Gear unit

Construction



1	**Quick-release cover**
2	**Multicrusher casing**
2.1	Connection flange (inlet, outlet)
3	**Cutting unit**
4	**Timing gear**
4.1	Oil sight glass
4.2	Breather, oil filler for gear unit
4.3	Oil drain for gear unit
4.4	Two shafts with parallel axes; drive shaft can optionally be at position 0 or 1
5	**Cutting chamber shaft seal**
6	**Intermediate chamber (quench)**
6.1	Intermediate chamber fill hole
6.2	Drain from intermediate chamber
6.3	Breather

3.1.1 Quick-release cover

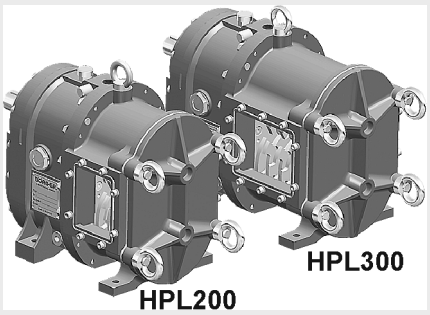


- This cover enables easy access to the interior of the casing and to all parts subject to wear in the Börger machine.
- The pipes on the inlet and outlet can remain connected.
- The quick-release cover can be removed after loosening the four ring nuts (2). *Chapter 6.3.1 “Notes on repair work” on page 145*
Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146
- The Börger machine can be inspected, serviced and repaired directly at its point of installation.
- The supplementary operating manual in the Appendix contains a description of other cover types, if these types have been supplied.

3.1.2 Casing

HPL 200 / HPL 300

Depths



- **HPL 200**
- **HPL 300**

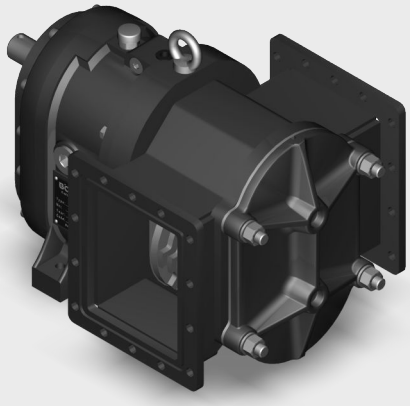
The block-type, one-piece casing is equipped as standard with an internal casing protection plate towards the gear unit and one towards the quick-release cover.

The casing protection plates are each equipped with a counter blade.

The casing is manufactured from high-quality gray cast iron, spheroidal cast iron or stainless steel.

HPL 300 N

Depth



— **HPL 300 N**

The welded casing is equipped as standard with an internal casing protection plate towards the gear unit and one towards the quick-release cover.

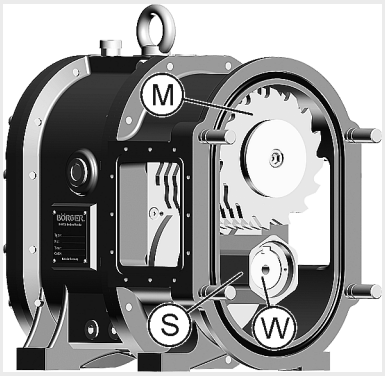
The casing protection plates are each equipped with a counter blade.

The inlet and outlet openings are optimized for a better flow rate.

The casings are manufactured from high-quality steel or stainless steel.

3.1.3 Cutting unit

Example: HFL Multicrusher



Construction and function

On the hexagonal shaft (S), which is pushed over the carrier shaft (W), there are cutting blades (M) and spacer rings in alternating sequence.

Several blade designs and constructions are available for Börger Multicrushers.

As standard, the Multicrusher is equipped on the faster rotating drive shaft with the blade types G, F or S, see *Chapter 3.1.3 “Cutting unit” on page 49*.

The teeth of these blade types must always point in the direction of rotation. A change to the flow direction is only possible after refitting the blades and changing the direction of rotation of the respective shaft.

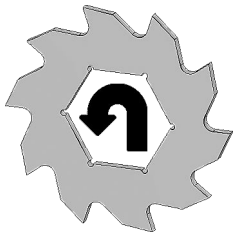
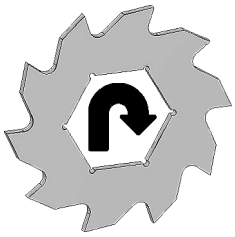
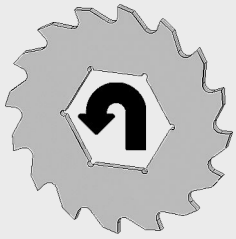
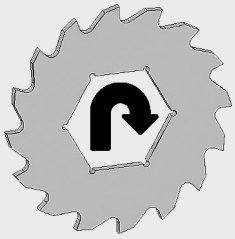
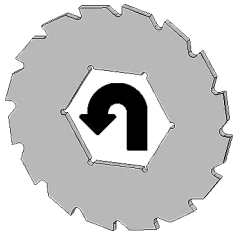
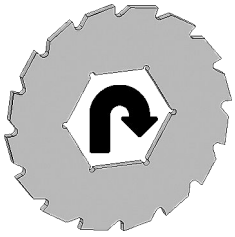
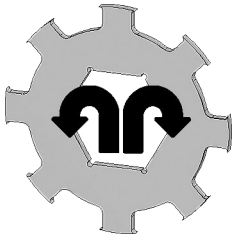
The bi-directional blade type R is usually mounted on the short shaft that turns more slowly. This guarantees optimum intake of solids and enables clearing of the cutting blades with brief reverse rotation.

In special application cases, for example with pre-macerated solids, a combination of directional blades on the drive shaft and short shaft is possible. The blades on the drive shaft and short shaft must always have the same thickness.

The blade design and the arrangement of the blades in your Multicrusher depend on the properties of the flow medium as specified in the order.

You can find details of the arrangement under the following code for the cutting unit in the data sheet for your Multicrusher.

Cutting unit versions

Blade types			
Installation of directional blades in respect of shaft rotation[1]:			
 Direction of rotation: – L	 Direction of rotation: – R	Coarse cutting output, 10 teeth	Type **G**
 Direction of rotation: – L	 Direction of rotation: – R	Fine cutting output, 16 teeth	Type **F**
 Direction of rotation: – L	 Direction of rotation: – R	Very fine cutting output, 16 teeth	Type **S**
Installation of bi-directional blades in respect of shaft rotation:			
 Direction of rotation: –U		Coarse cutting output, 8 double teeth	Type **R**

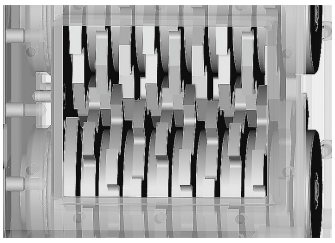
[1] Check the direction of rotation depending on the flow direction. ↳ *Chapter 4.5.3 “Checking the flow direction” on page 102*.

Blade thicknesses	
Blade thickness approx. 4 mm (0.16 ") Series — HAL — HAN	Code **4**
Blade thickness approx. 5 mm (0.20 ") Series — HPL — HCL	Code **5**
Blade thickness approx. 6 mm (0.24 ") Series — HFL — HLA	Code **6**
Blade thickness approx. 8 mm (0.31 ") Series — HPL — HCL — HFL — HLA	Code **8**
Special thicknesses Series — HPL — HCL — HFL — HLA	Code **X**

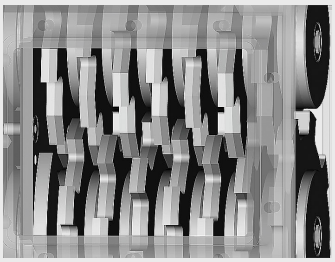
Materials	Code
Standard material for common applications	**A**
Corrosion-resistant special version	**B**
Special material	**X**

Arrangement

The arrangement of the blades depends on the properties of the flow medium and the desired cutting performance:



— **Individual blades**
(Code **E**)
For the finest possible cutting result



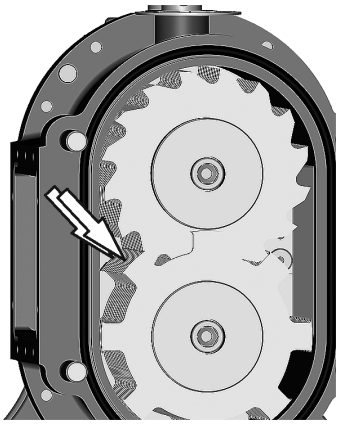
— **Blades in blocks of two**
(Code **B**)
For a higher flow rate with a coarser cutting result

In exceptional cases blocks of three blades (code **T**) are possible.

Spacer rings are arranged between the individual blades or blocks of blades. The number of spacer rings **between** the blades / blade blocks corresponds to the number of blades in this position on the second shaft.

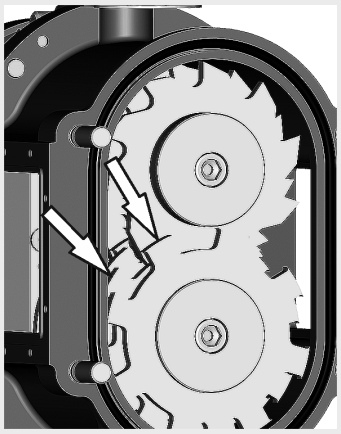
Alignment

The blades or blocks of blades on any given shaft can be arranged in radial alignment with each other as follows:



— Parallel (code **p**)

For optimum intake performance for coarse solids such as potatoes, turnips, apples



— Offset (code **v**)

For optimum intake performance for tough, longer solids such as intestines, skin strips

(The offset corresponds to a $^{1}/_{6}$ rotation on the hexagonal shaft on which the blades are mounted, i.e. 60°.)

The blades of a multi-blade block are always arranged in parallel to each other.

The arrangements on the drive shaft and the short shaft are usually the same, i.e. depending on version:

— On top and bottom shaft: individual blades parallel to each other
— On top and bottom shaft: individual blades offset to each other
— On top and bottom shaft: blocks of two blades in parallel to each other
— On top and bottom shaft: blocks of two blades offset to each other

Deviations from this are possible in rare exceptions.

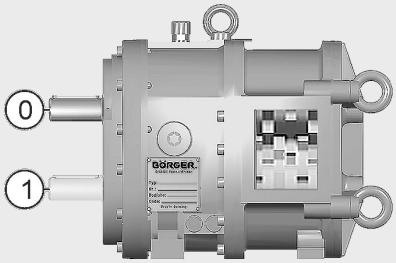
In such cases the arrangement of the blades and spacer rings is specified explicitly for the drive shaft and the short shaft. The arrangement is described from the gear side to the quick-release cover.

The number of blades is dependent upon the construction depth of the Multicrusher casing. *Chapter 6.3 “Repairs” on page 144*

Cutting unit code:

	Drive shaft blade type	Direction of rotation	Short shaft blade type	Direction of rotation	Blade thickness	Material	Arrangement	Alignment
Coarse, 10 teeth	G		G					
Fine, 16 teeth	F		F					
Very fine, 16 teeth	S		S					
Coarse, 8 double teeth	R		R					
Special geometry	X		X					
Shaft rotates counter-clockwise		–L		–L				
Shaft rotates clockwise		–R		–R				
Independent of the direction of rotation (bi-directional) (only type R)		–U		–U				
8 mm (.31") thick (for HPL, HCL, HFL series)					8			
6 mm (.24") thick (for HFL series)					6			
5 mm (.20") thick (for HPL, HCL series)					5			
4 mm (.16") thick (for HAL, HAN series)					4			
Special thickness					X			
Standard material for common applications						A		
Corrosion-resistant special version						B		
Special material						X		
Individually arranged blades							E	
Blades arranged in blocks of two							B	
Block of three (special version)							T	
Other special combination							X	
Blades/blocks parallel to each other								p
Blades/blocks offset to each other								v
Special combination								x
Example code:	G	–L	R	–U	8	A	E	p

3.1.4 Multicrusher gear unit



- The two shafts of the Multicrusher mounted on one side of the carrier gear unit drive the cutting units.
- The carrier gear unit of the Multicrusher functions as a gear reducer. The rotary motion of the drive shaft is transferred to the "short shaft" by gear wheels of different sizes so that it rotates slower than the drive shaft. This creates the basis for the highly effective macerating function of the Multicrusher.
- As the gear unit is completely separate from the cutting chamber, disassembly is not necessary for any maintenance work.
- Depending on the ordered version, the drive shaft is installed in position 0 or position 1.
- The Multicrusher can also be delivered with two drive shafts, e.g. a Multicrusher driven mechanically by a PTO shaft, where the direction of rotation can be changed briefly to remove a blockage by switching the PTO shaft.
- The Multicrusher gear unit is equipped with a breather system for compensating increasing pressure as a result of rising temperatures. The breather system must always be installed on the highest point of the Multicrusher, compare the illustrations of the versions for the different mounting positions in *Chapter 3.1.7 “Designs, mounting positions” on page 57*.

3.1.5 Shaft seal

Börger Multicrushers are equipped as standard with specially designed and optimized mechanical seals. These are used to completely seal off the cutting chamber from the gear unit, or from the intermediate chamber. *Chapter 3.1.6 “Intermediate chamber (quench)” on page 56*

These seals can be quickly accessed through the cutting chamber without dismantling the Multicrusher, and can be replaced easily.

Mechanical seals are available in a variety of material combinations.

The shaft seal of the cutting chamber of your Multicrusher is described in the enclosed data sheet.

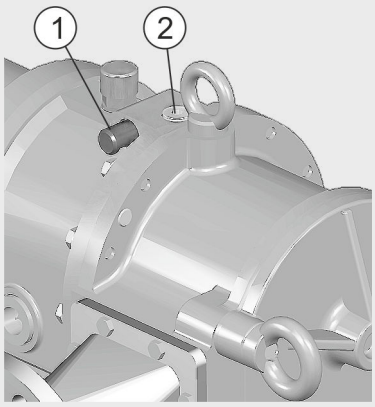
Information about any special seals that apply to your Multicrusher can be found in the additional documentation in the appendix.

3.1.6 Intermediate chamber (quench)

NOTICE!
Risk of damage to the gear unit when the intermediate chamber is closed tightly!

When the vent hole is closed tightly or has become blocked, emerging medium from the working chamber cannot escape through the intermediate chamber and will penetrate the gear unit if the mechanical seal is defective. This could damage the gear unit.

- The safety opening in the intermediate chamber is used for monitoring the integrity of the mechanical seal, and must not be closed.
  - Overflowing of the intermediate chamber indicates a seal malfunction.



- The cutting chamber and gear chamber are separated by an intermediate chamber filled with quench fluid as standard.
- The heat-absorbing quench fluid prevents the mechanical seals from running dry and captures any flow medium that enters the intermediate chamber due to leaks in a mechanical seal. This **quench** function also prevents the gear unit from being damaged by intrusion of the flow medium.
- The contact area between the shaft and the hexagonal shaft is also lubricated with quench fluid, thus preventing corrosion.
- To compensate an increase in pressure at rising temperatures, the intermediate chamber features a breather at the side with a vent hole (1, at the side on standing versions, see *Chapter 3.1.7 “Designs, mounting positions” on page 57*). The vent hole on the intermediate chamber can be positioned in a visible location via an extension pipe for special applications, e.g. on submerged Multicrushers. Optionally, the Multicrusher can also be supplied with a safety plug in the fill hole (2) of the intermediate chamber. The safety plug must be able to move out of the fill hole without pressure when fluid overflows in the event of a seal leakage. There is no breather on the side on this version. The fill hole (2) may only be closed with the optional safety plug.
- Overflowing of the intermediate chamber indicates a seal malfunction. In vacuum operation, the intermediate chamber running dry is an indicator for a leak in a mechanical seal.
- The intermediate chamber is sealed from the gear unit with DUO lip seals.

3.1.7 Designs, mounting positions

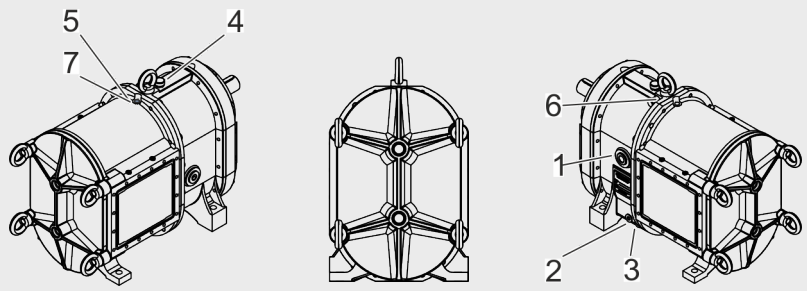
NOTE!
Fill holes and breathers

Depending on the Börger machine and the mounting position, the positions of the oil sight glass, breathers, fill holes and drain holes for the gear unit and the intermediate chamber can vary.

— Observe the assembly drawing and the spare parts list of your Börger machine.
Chapter 9.3 “Assembly drawing” on page 198
Chapter 9.4 “Spare parts list” on page 200

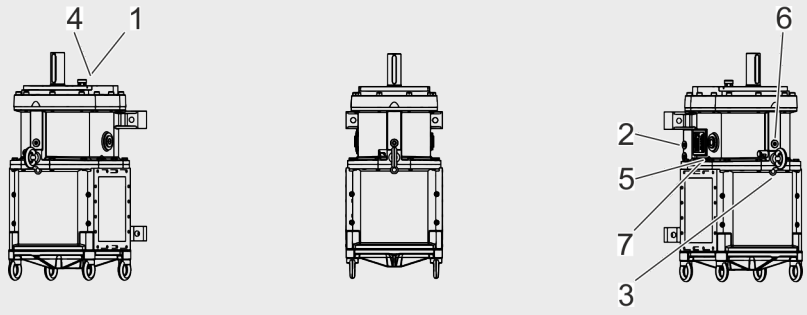
NOTE!
Special version

On immersion models (special version), the fill holes and breathers have been relocated e.g. with extension pipes to the visible area or, depending on usage, are optionally closed completely.



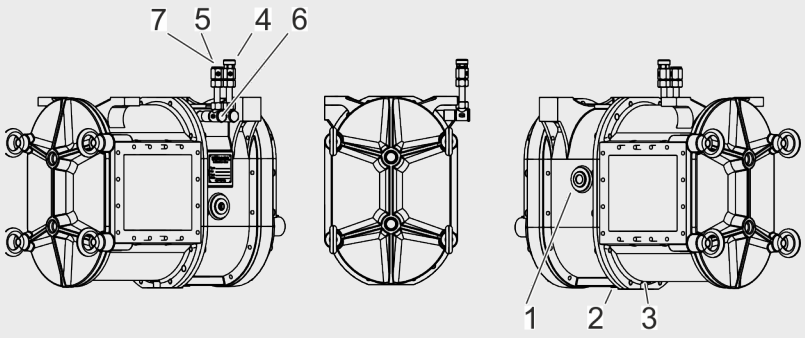
Example: Classic FL series

Mounting position M1
— Upright
— Feet at bottom
— Horizontal shafts



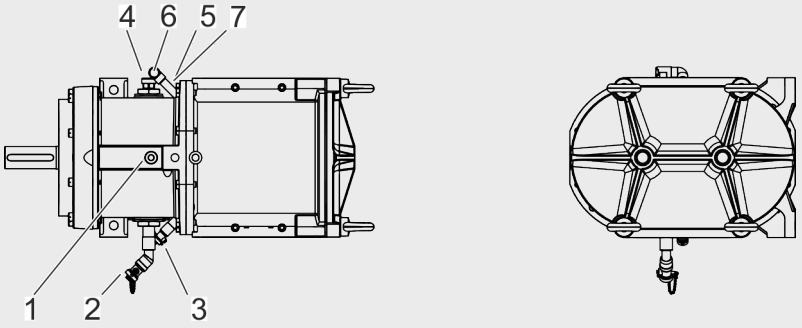
Example: Classic FL series

Mounting position M2
— Vertical
— Quick-release cover at bottom
— Feet at side
— Vertical shafts
— Drive shaft pointing upwards



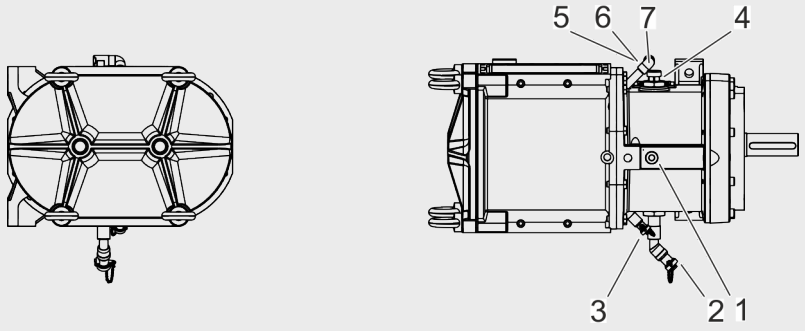
Example: Classic FL series

Mounting position M3
- Upside-down
- Feet upwards
- Horizontal shafts



Example: Classic FL series

Mounting position M5
- Turned 90° to the left
- Feet to the right
- Horizontal shafts



Example: Classic FL series

Mounting position M6
- Turned 90° to the right
- Feet to the left
- Horizontal shafts

1	Oil level check on gear unit (oil sight glass / oil dipstick)	5	Fill hole on intermediate chamber
2	Oil drain for gear unit	6	Breather for the intermediate chamber
3	Drain from intermediate chamber	7	Intermediate chamber fill level indicator
4	Fill hole for gear unit, with breather system		

3.1.8 Pipe connections on inlet and outlet

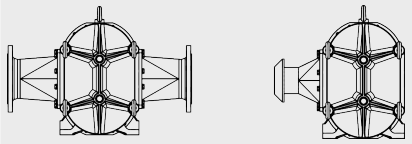
In most cases, two-shaft Börger machines are equipped with pipe connectors on the inlet and outlet that have been specially designed for the different applications and mounting conditions.

The inlet and outlet can be equipped with the same or different pipe connectors. Pipe connectors are available with a variety of connections, for example:

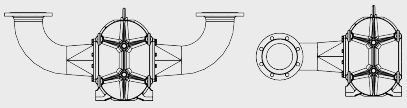
— DIN EN flange
— ANSI/ASME flange
— Quarter turn coupling
— Quick-release coupling, e.g. Perrot, female adapter (optional male)
— Dairy screw connections, and others

The pipe connectors can be equipped with optional additional fittings, **e.g.** screw sockets G½" or G 1" or screw sockets with NPT threads, for the connection of pressure gauges, shut-off devices or breather systems.

Pipe connectors (sample designs)

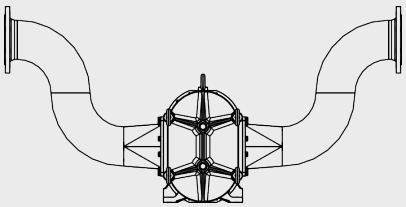


Short, straight pipe connector



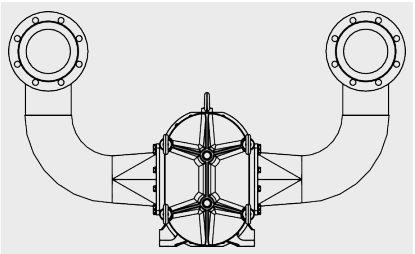
90° pipe bend

— connection towards the front, back, top or bottom



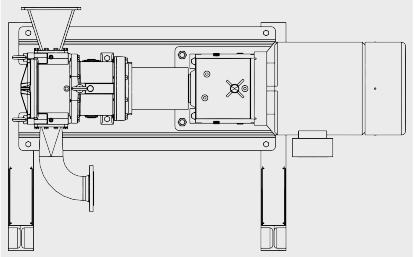
Gooseneck version

— connection towards the front, back or side



Double bend upwards

— connection towards the front, back, top, bottom or side



Intake hopper on the inlet

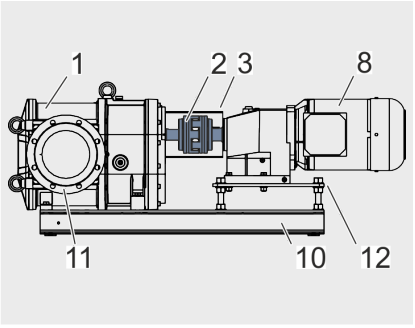
— For highly viscous but still fluid material, a 90° turned Börger machine can be equipped with an **intake hopper on the inlet** instead of a pipe connector

3.1.9 Units / drive options

The majority of Börger machines are delivered as a complete unit, i.e. with mounted drive fixed on a base frame.

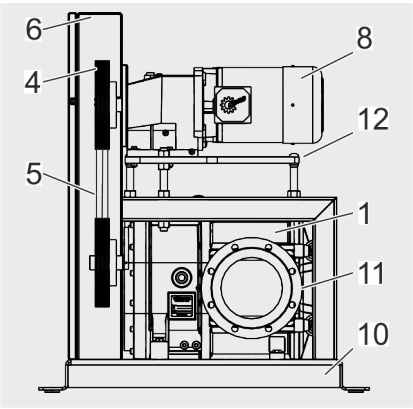
The most common unit variations are as follows:

Standard unit



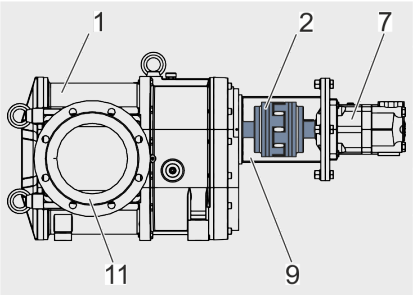
1	Börger-Multicrusher
2	Torsionally flexible coupling
3	Coupling guard
8	Drive (with gear reducer in this example)
10	Base frame
11	Pipe connector (short, straight pipe connector with flange in this example)
12	Motor plate

Overhead mounted drive assembly (piggyback)



1	Börger-Multicrusher
4	V-belt pulley / chain drive
5	V-belt (up to five belts, depending on the drive) or chain drive
6	V-belt/chain guard
8	Drive (with gear reducer in this example)
10	Base frame
11	Pipe connector (short, straight pipe connector with flange in this example)
12	Motor plate

Unit with hydraulic drive



1	Börger-Multicrusher
2	Torsionally flexible coupling (does not apply for directly flanged hydraulic drive)
7	Hydraulic drive
9	Coupling lantern (adapter flange on directly flanged hydraulic drive)
11	Pipe connector (short, straight pipe connector with flange in this example)

3.1.10 Options and accessories

NOTE!
Special equipment

A variety of special equipment and additional accessories are available for the safe operation of the Börger machine according to its application. *Chapter 8 “Accessories” on page 191*

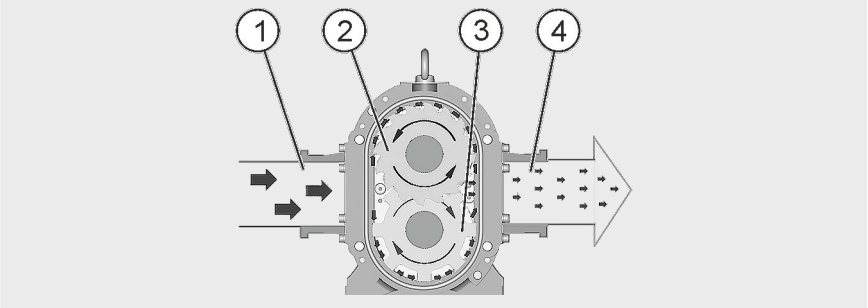
You will find explanations referring to the special equipment and any delivered accessories in the appendix.

NOTICE!
Risk of material damage due to non-compliance with the operating manuals for accessories!

Non-compliance with supplementary operating manuals for special equipment or accessories can lead to damage to the Börger machine.

— If your Börger machine is equipped with special equipment, then you must first read the corresponding supplementary operating manual for the equipment or accessories before carrying out any installation, commissioning, maintenance or repair work on the machine.

3.2 Operating principle



1	Inlet of flow medium with coarse materials
2	Blades of the drive shaft
3	Blades of the short shaft with intake and reversing effect
4	Outlet of flow medium with shredded parts

The Börger Multicrusher is a dual-shaft grinder that has been constructed according to the principle of the successful Börger rotary lobe pump.

Instead of the rotating lobes (rotors), this device has intermeshing cutting blades that are installed on the hexagonal carrier shafts and secured with a central bolt.

The different rotational speeds of the two shafts and optimized blade geometry ensure an excellent cutting result.

The Multicrusher itself does not pump the medium. It was primarily developed as a macerator for flow media containing solids with the aim of protecting a downstream pump. *Chapter 2.3 “Proper use” on page 15* Due to the excellent pulling in, tearing and cutting performance of the Multicrusher, the robust device, for example as a 90° turned version with gravity feed, is increasingly being used as an independent macerator (without a pump).

3.3 Technical data

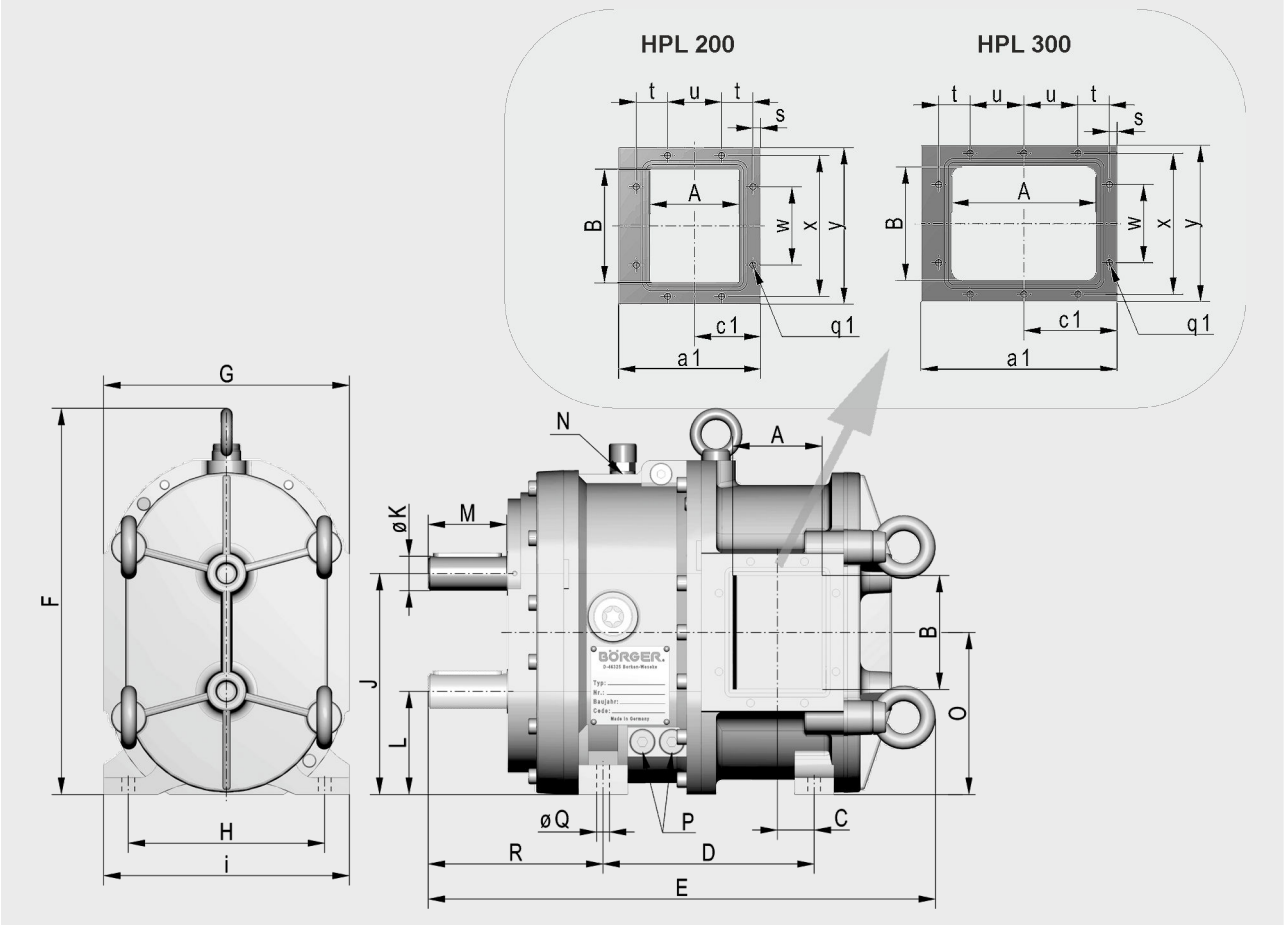
Börger machines are configured individually for the application requirements. This leads to a wide range of variations that have been optimized for specific applications. Therefore, only the data of some of the standard versions can be listed here as examples.

Detailed specifications for your Börger machine or unit can be found in the data sheet and the **individual dimensional drawing** sent when the machine was ordered.

Please contact Börger customer service if you require a copy of this drawing.

3.3.1 Dimensions

Multicrusher without attachment parts - HPL200/ HPL300

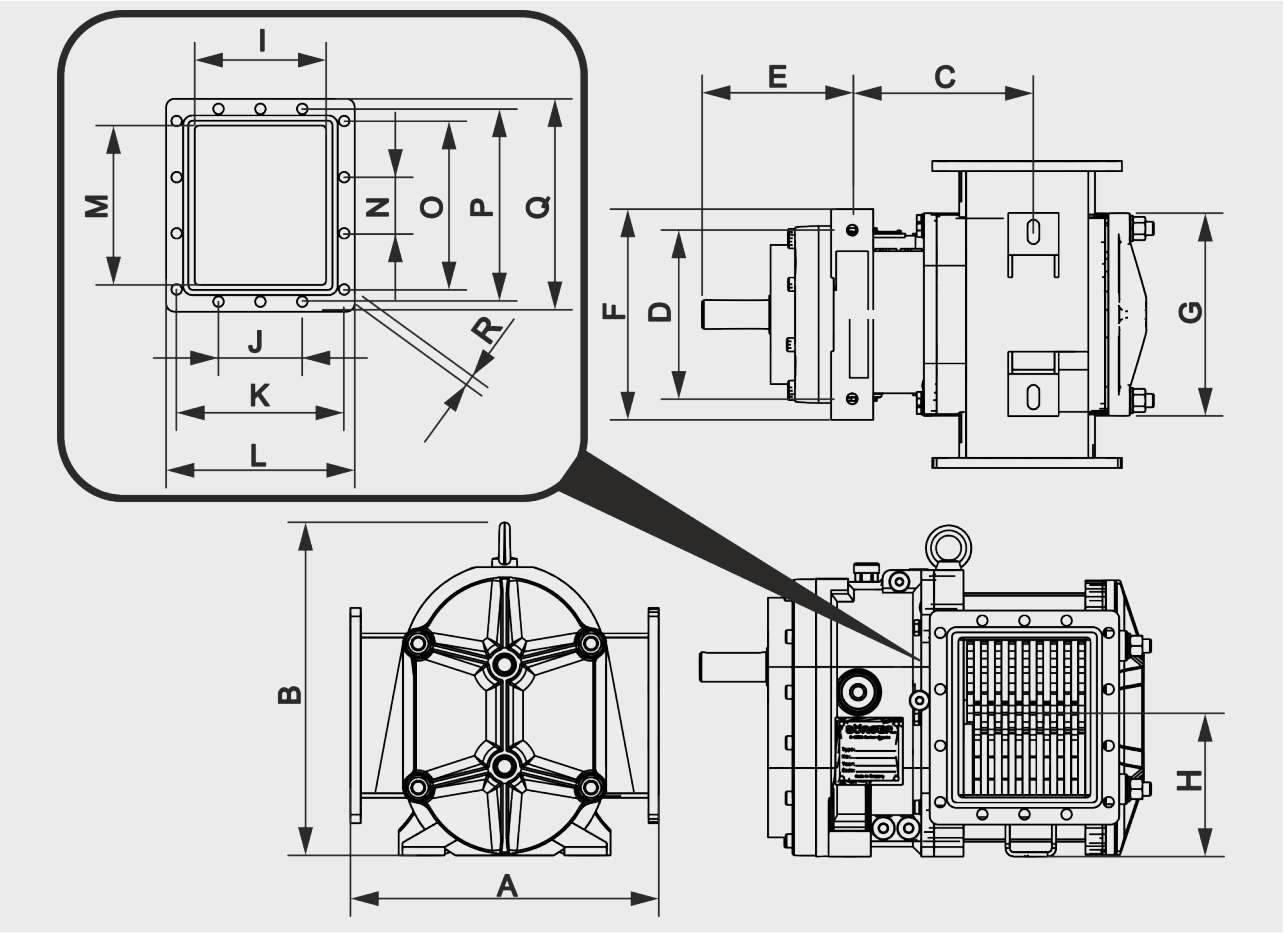


Dimensions without attachment parts (HPL 200, HPL 300)

Dimensions	approx. [mm]		approx. [inch]	
	HPL 200	HPL 300	HPL 200	HPL 300
A	91	147	3.58	5.79
a1	145	200	5.71	7.87
B	116	116	4.57	4.57
C	37.5	65	1.48	2.56
c1	67.5	95	2.66	3.74
D	215	270	8.46	10.63
E	515	570	20.28	22.44
F	395	395	15.55	15.55
G	250	250	9.84	9.84
H	200	200	7.87	7.87
i	250	250	9.84	9.84
J	225	225	8.86	8.86
∅K	35	35	1.38	1.38
L	105	105	4.13	4.13
M	80	80	3.15	3.15
N	G½	G½	G½	G½
O	165	165	6.5	6.5
P	G½	G½	G½	G½
∅Q	13	13	0.51	0.51
q1	M8x15	M8x15	M8x15	M8x15
R	178	178	7.01	7.01
s	8	8	0.31	0.31
t	32	32	1.26	1.26
u	55	55	2.17	2.17
w	80	80	3.15	3.15
x	144	144	5.67	5.67
y	160	160	6.3	6.3

	approx. [kg]		approx. [lb]	
	HPL 200	HPL 300	HPL 200	HPL 300
Weight	120	134	265	296

Multicrusher without attachment parts - HPL 300 N



Dimensions without attachment parts (HPL 300 N)

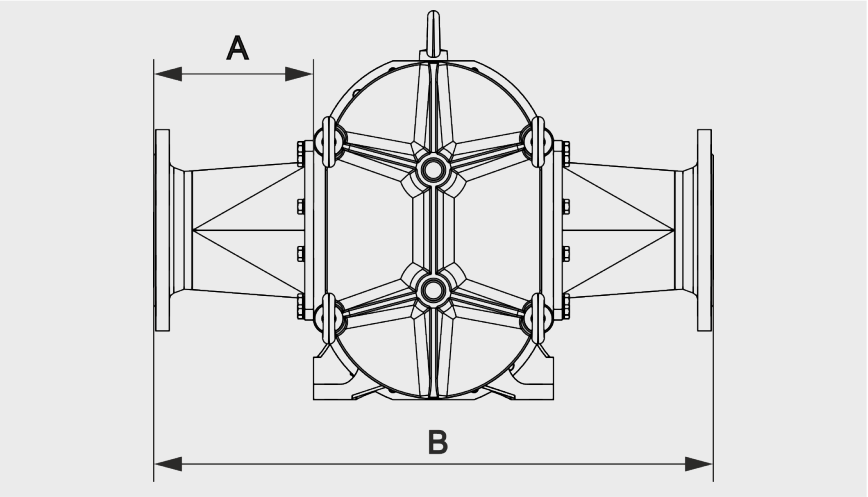
Dimensions	HPL 300 N	
	approx. [mm]	approx. [inch]
A	364	14.3
B	393	15.5
C	215	8.5
D	200	7.9
E	178	7.0
F	250	9.8
G	241	9.5
H	165	6.5
I	157	6.2
J	100	3.9
K	200	7.9
L	225	8.9
M	190	7.5
N	67	2.6
O	201	7.9
P	230	9.1
Q	254	10.0
∅R	13	0.5

	HPL 300 N	
	approx. [kg]	approx. [lb]
Weight	140	310

Pipe connectors

The pipe connectors are designed according to the dimensional drawing created for the order. We deliver short, straight pipe connectors as standard, with flanges (selectable) according to:

— DIN EN 1092-1, type 11
— ANSI/ASME B 16.5 RF Class 150.



Dimensions A and B in [mm] (approx.)

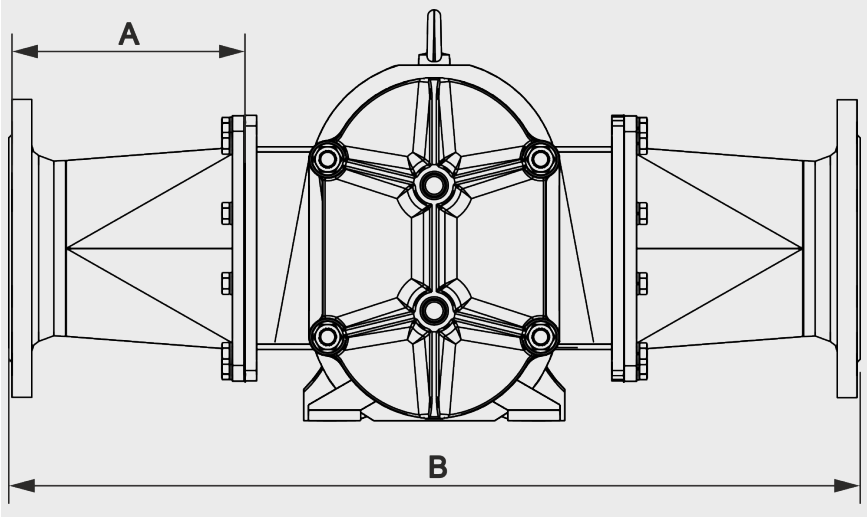
DN Type:	HPL 200				HPL 300			
Standard:	DIN/EN		ANSI/ASME		DIN/EN		ANSI/ASME	
Dimension:	A	B	A	B	A	B	A	B
DN 100 (4")	136	522	160	570	201	652	225	700
DN 125 (5")	151	552	185	620	161	572	195	640
DN 150 (6")	181	612	215	680	166	582	200	650
DN 200 (8")	251	752	291	832	196	642	236	722

When using two 2 mm (.08") gaskets, **+ 4 mm** must be added to the specified **B** dimensions and **+ 2 mm** to the specified **A** dimensions.
Deviations in individual dimensions within an acceptable tolerance due to production cannot be ruled out.

Dimensions A and B in [inch] (approx.)

DN Type:	HPL200				HPL300			
Standard:	DIN/EN		ANSI/ASME		DIN/EN		ANSI/ASME	
Dimension:	A	B	A	B	A	B	A	B
DN 100 (4")	5.65	20.55	6.30	22.44	7.91	25.67	8.89	27.56
DN 125 (5")	5.94	21.73	7.28	24.41	6.34	22.52	7.68	25.20
DN 150 (6")	7.13	24.09	8.46	26.77	6.54	22.91	7.87	25.59
DN 200 (8")	9.88	29.61	11.46	32.76	7.72	25.28	9.29	28.43

When using two 2 mm (.08") gaskets, **+0.16”** must be added to the specified **B** dimensions and **+0.08”** to the specified **A** dimensions.
Deviations in individual dimensions within an acceptable tolerance due to production cannot be ruled out.



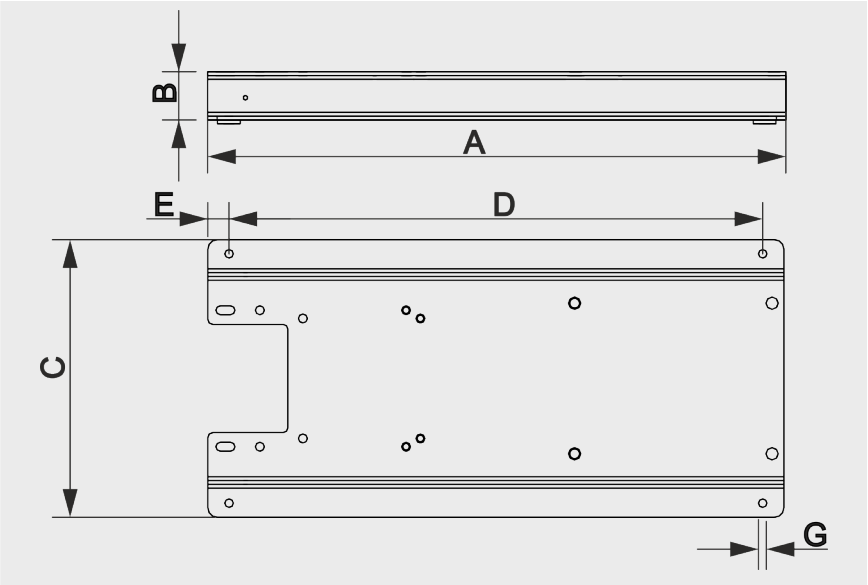
Dimensions A and B - HPL 300 N

DN Type:	HPL 300 N approx. [mm]				HPL 300 N approx. [inch]			
Standard:	DIN/EN		ANSI/ASME		DIN/EN		ANSI/ASME	
Dimension:	A	B	A	B	A	B	A	B
DN 100 (4")	206	776	—	—	8.1	30.5	—	—
DN 125 (5")	201	766	235	834	7.9	30.1	9.3	32.9
DN 150 (6")	176	716	210	784	6.9	28.1	8.3	30.9
DN 200 (8")	151	666	191	746	5.9	26.1	7.5	29.3
DN 250 (10")	251	866	285	934	9.9	34.1	11.2	36.7

When using two 2 mm (.08") gaskets, **+ 4 mm** must be added to the specified **B** dimensions and **+ 2 mm** to the specified **A** dimensions.
Deviations in individual dimensions within an acceptable tolerance due to production cannot be ruled out.

Base frame

Base frame HPL 200, HPL 300, HPL 300 N



Base frame

Dimensions	approx. [mm]	approx. [inch]
A	890	35.0
B	90	3.5
C	420	16.5
D	810	31.9
E	40	1.6
G	17.5	0.7

	approx. [kg]	approx. [lb]
Weight	40	88

Complete unit

The dimensions can be found in the specific dimensional drawing created for the order. The dimensions and weights of the drive and gear unit etc. can be found in the corresponding manufacturer’s documentation. The weight of the complete unit is specified in the data sheet.

3.3.2 Performance data and maximum loads

Multicrusher

The specification of the rated capacity for which the Multicrusher was actually configured can be found in the data sheet.

General limits:

Multicrusher	Flow rate max.	Speed n [rpm]		Operating pressure	
		Recom-mended	Permitted	Min.	max
HPL 200	40 m³/h (176 gpm)	50–120	50–600	0.1 bar (1.45 psi)	12 bar (174 psi)
HPL 300	60 m³/h (265 gpm)	50–120	50–600	0.1 bar (1.45 psi)	12 bar (174 psi)
HPL 300 N	150 m³/h (660 gpm)	50–120	50–600	0.1 bar (1.45 psi)	12 bar (174 psi)

The actual possible flow rate and the permissible (and technically sensible) speed depend

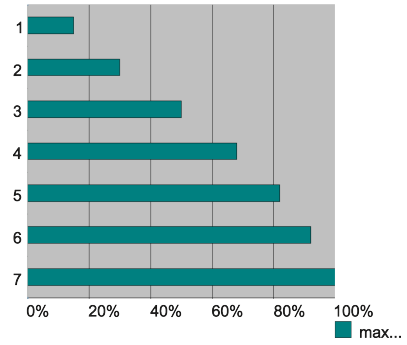
— on the solid content (dry solids, DS),
— on the type of the solids (size, firmness) in the flow medium,
— on the viscosity of the flow medium and
— on the desired cutting result.

The higher the solid content, the lower the flow rate or the flow speed should be. Otherwise the cutting performance could be reduced and there would be a danger of blockages.

Furthermore, undesired loss of pressure and cavitations could occur in one of the downstream pumps due to increased resistance.

The values of the following diagram can be used as a guideline. However, the type of solid is not defined. Considerable deviations can arise due to the properties of the solids.

Guideline for the flow rate depending on the DS content



1	Sludge up to 30% DS or hardly flowing materials
2	Sludge up to 20% DS or still flowing materials
3	Sludge up to 12% DS or moderately flowing materials
4	Sludge up to 6% DS or flowing materials
5	Sludge up to 3% DS or well flowing materials

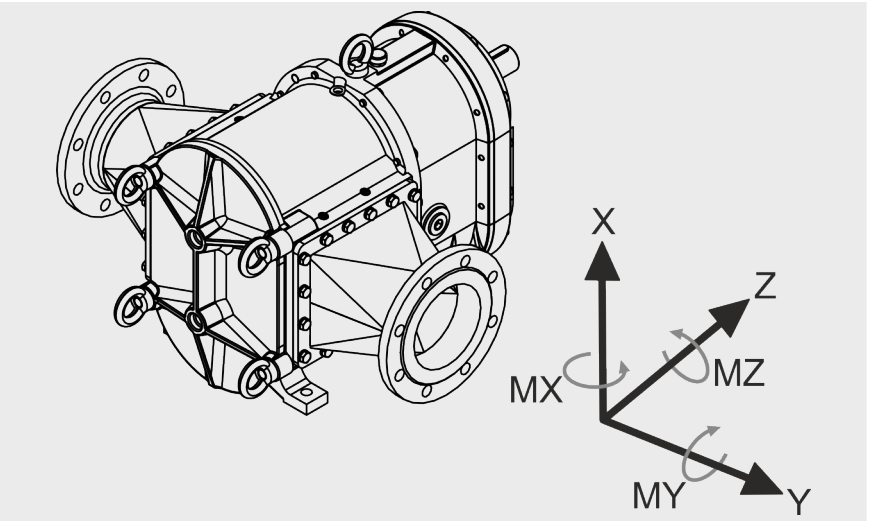
6	Sludge up to 1% DS or very well flowing materials
7	Water or materials similar to water

Pipe connections

NOTICE!
Risk of damage due to incorrectly installed pipe system!

Börger machines are robust, and are constructed for use with high loads. However, they must not be used as an anchor point for the pipe under any circumstances. Even at low vibrations, the stress generated on the pipe during operation can lead to cracks on weaker components / weld seams.

— Pipes and any additional components such as valves, check valves etc. must not subject the machine and flange connections to stress.
— Avoid misalignment between the machine pipe connectors and the pipe.
— All attachment parts must be supported as close to the machine as possible according to the valid general technical rules.



Example: Classic FL series

Forces and torques on metal pipe connectors (short, straight pipe connectors)

Value:	Pipe nominal diameter (mm)	Forces N max				Torques Nm max			
		F_x	F_y	F_z	$F_{(total)}$	M_x	M_y	M_z	$M_{(total)}$
Valid for Börger machine	**100, 125, 150, 200, 250**	7000	9200	7000	13514	1500	1300	1800	2680
For comparison: Specification acc. to **EN 14847**	200		930		1320		500		735
	250		1140		1620		625		920

The values Fx, Fy and Fz as well as Mx, My and Mz may never be used simultaneously as maximum values.

The specified values are calculated, and may deviate in practice due to casting tolerances and structural changes. It is therefore recommended not to exceed the limits specified in terms of EN ISO 14847 for rotary positive displacement pumps, pipe diameter 200 or 250 mm, wherever possible.

The values Fx, Fy and Fz as well as Mx, My and Mz may never be used simultaneously as maximum values.

The specified values are calculated, and may deviate in practice due to casting tolerances and structural changes. It is therefore recommended not to exceed the limits specified in terms of EN ISO 14847 for rotary positive displacement pumps, pipe diameter 200 mm, wherever possible.

4 Transportation, Storage and Installation

4.1 Transportation

WARNING!
Risk of fatal injury due to suspended loads!

Loads can swing and fall during lifting operations. This can cause severe injury, including death.

— Never stand under or within the swinging range of suspended loads.
— Do not move loads unsupervised.
— Only use approved hoists and slings with sufficient load-bearing capacity.
— Do not use torn or worn hoists such as ropes and belts.
— Do not place hoists such as ropes and belts near sharp corners and edges and do not tie them together or twist them.
— Put the load down when leaving the operating site.

WARNING!
Risk of injury by falling or tilting packages!

Packages can have their center of gravity elsewhere than in the middle. If not properly aligned, the package can tilt and fall. Falling or tilting packages can cause severe injuries.

— Lift the package carefully and monitor whether it tilts. Realign if necessary.

NOTICE!
Material damage due to improper lifting of the Börger unit at the ring bolt.

The ring bolt is not designed to bear the weight of the entire Börger unit. It may tear out when the unit is lifted by the ring bolt.

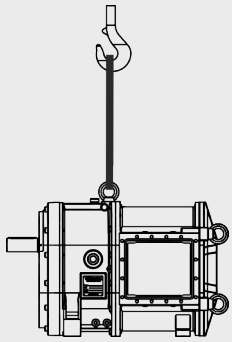
— Use the ring bolt only to lift a Börger machine without attachment parts!
— Aways screw in the ring bolt completely!

Tool: ■ Hoists

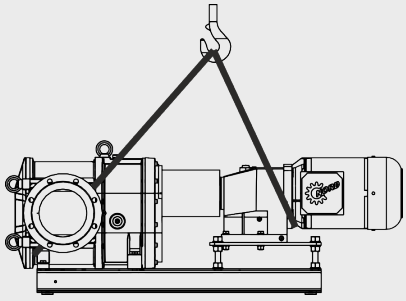
Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

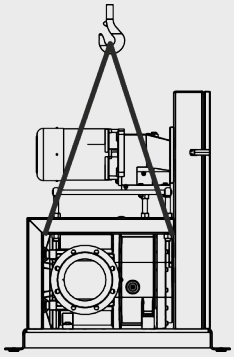
1. Observe the specifications in the hoist instructions, especially for the inclination angle allowed.
2. Transport the Börger machine using a suitable hoist.
3. If a special base frame with additional lifting lugs or forklift pockets was delivered, use them accordingly.



— Without attachment parts, Börger machines can be lifted using the ring bolt.



— Standard Börger machines with electric drives can be transported safely using the method shown here, for example.



— Overhead mounted drive assemblies can be transported safely using the method shown here, for example.

4.2 As-delivered condition

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

The Börger machine is delivered in a pre-assembled, packed state. Optional accessories may be included in separate packaging.

1. Observe the applicable delivery conditions for the order.
2. Check that the delivery is complete when you receive it.
3. Inspect the delivery immediately for any signs of transport damage.
4. Ensure that the unit is not put into operation in the event of incorrect or incomplete delivery, or transport damage.
5. Inform the shipping agent immediately of any transport damage and contact Börger GmbH.

4.3 Storage and interim storage

4.3.1 Storage

NOTICE!
Risk of damage caused by frost!

Frost can cause damage to the Börger machine.

— Protect the Börger machine and its connections against frost.

NOTICE!
Inadequate maintenance can result in malfunctions and damage!

— When the machine is stored for longer periods, rotate the shafts several times after about six months (or more often, depending on the storage conditions), according to *Chapter 4.5.1 “Checking smooth running following storage and long downtimes” on page 97*.
  — This way the gears, bearings and shaft seals are moved and coated again with lubricant.

NOTE!
Storage conditions

If the Börger machine is not used immediately, then appropriate storage conditions are as important as the correct installation and maintenance for subsequent trouble-free operation.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

Always adhere to the following storage conditions for the Börger machine:

- The storage room must be evenly ventilated and free of dust and vibrations
- The relative humidity must be below 65% and the temperature between 15 °C and 25 °C (59 °F and 77 °F)
- Avoid exposure to direct heat sources (sunlight, heating)

1. Repair any damage to the external coating, galvanized components and corrosion protection on bare metal parts caused by external influences.
2. Protect the Börger machine from cold, particularly from frost, as well as from moisture, contamination and mechanical influences. Close the inlet and outlet connections in particular (flange, coupling etc.), plus any other openings to the interior with covers impermeable to moisture.
3. Before commissioning / recommissioning at a later date, remove all protective covers and anti-corrosion coatings.

If the device was stored for two years or more, or if the storage conditions detailed above could not be met:

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Remove the quick-release cover. ↳ *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*

1. Replace the lubricants before commissioning. ↳ *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*
2. Check all O-rings that come into contact with the medium and the mechanical seal and replace them if necessary. ↳ *Chapter 6.3.5 “Replacing the mechanical seal” on page 172*
3. Observe the instructions of the drive manufacturer for storing the **drive**.
4. Observe the manufacturer’s instructions for storing any **accessories**.

NOTE!
Börger customer service

If you have any questions on troubleshooting, installation, maintenance and repair work, contact Börger customer service.

4.3.2 Interim storage

For the interim storage of a used Börger machine, the following applies:

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

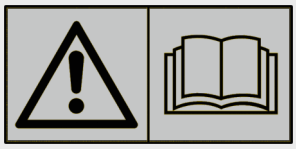
1. Clean the Börger machine thoroughly. *Chapter 6.1 “Machine care” on page 125*
2. Apply suitable corrosion protection to the machine.
3. Follow the storage instructions. *Chapter 4.3.1 “Storage” on page 78*

4.4 Installation

WARNING!
Risk of fatal injury as a result of incorrect installation!

Errors during installation may lead to extremely dangerous situations and cause severe material damage.

— Install the component parts professionally. Observe specified screw tightening torques.
— Please observe the following prior to initial commissioning.
  — Ensure that all installation work is performed and completed as per the information and notes provided in this manual.
  — Ensure that all covers and safety features are installed and function correctly.
  — Ensure that nobody enters the hazardous area.



Further operating manuals / supplementary operating manuals

You must completely read the separate operating manuals and/or supplementary operating manuals for components and/or special versions.

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance.

Supplier documentation

You must completely read the separate supplier documentation.

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance.

Operating manuals of electronic parts

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance,
— in the operating manuals of electronic parts in the appendix.

4.4.1 Preparation for installation

NOTICE!
Risk of material damage due to non-compliance with the operating manuals for accessories!

Non-compliance with supplementary operating manuals for special equipment or accessories can lead to damage to the Börger machine.

— If your Börger machine is equipped with special equipment, then you must first read the corresponding supplementary operating manual for the equipment or accessories before carrying out any installation, commissioning, maintenance or repair work on the machine.

NOTE!
Pipe layout

Check that the original pipe layout is still correct before installing the Multicrusher.

— A change in pipe diameter, length etc. can completely change the suction and pressure conditions in the system.
— Börger Multicrushers are configured for different mounting positions. *Chapter 3.1.7 “Designs, mounting positions” on page 57*.
  — Depending on the design, it may be necessary to replace the temporary shipping plugs in the intermediate chamber and gear unit with the breather (intermediate chamber) and the breather system (gear unit).

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

1. Check all specifications in the technical data sheet and only install the Multicrusher if it is suitable for the intended application.
2. Apart from the performance data on the Multicrusher, also check that the materials are compatible with the pumped medium.
3. Check that any accessories for the operation of the Multicrusher are available and make sure that the accessories are ready for operation according to the operating manual of the manufacturer.

Incomplete machine

Tool:
- Hammer drill
- Torque wrench

If an incomplete unit has been delivered by request, fully assemble the machine first.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

1. **Base frame**

   Attach the Börger machine to a solid, rigid surface.

2. **Drive**

   Connect the Börger machine which is installed on a Börger base frame or a suitable rigid surface to a suitable drive.

   Observe the appropriate speed and sufficient torque, and take all necessary parameters into account, such as viscosity and the solid content of the medium.

3. Attach a suitable cover (coupling guard) for the rotating parts.

4. **Pipe connectors**

   If your two-shaft Börger machine was delivered without pipe connectors (with standard rectangular flanges on the inlet and outlet), the appropriate pipe connectors must be attached as follows:

   Use:

   - Suitable flange screws
   - Suitable spring washers to secure the flange screws
   - Seals made from materials compatible with the medium
     - O-ring seals must be used as standard, and are to be installed in the O-ring groove of the rectangular flange on the inlet/outlet.

       Optionally, gaskets are also used, e.g. in the agricultural sector.

5. Gradually tighten the flange screws used to install the pipe connectors on the inlet and outlet crosswise so that the leak tightness of the connection is guaranteed.

   - Make sure that the seals and the spring washers are not damaged and not to squeeze out the rubber gaskets (NBR, EPDM, FKM).

PL / HPL

Pipe connectors - Seals / Fastening screws

Seal	Fastening screw	Torque max.
O-ring — 3.5 mm (0.14") — Materials as per spare parts list	**M8x25 (M8x30)** — Hexagon socket head cap screw, DIN EN ISO 4762	Steel (8.8) — **25 Nm** — **18 ft-lbs** Stainless steel (property class 70) — **20 Nm** — **15 ft-lbs**
Gasket — 2.0 mm (0.08") — PTFE base	**M8x25 (M8x30)** — Hexagon socket head cap screw, DIN EN ISO 4762	Steel (8.8) — **25 Nm** — **18 ft-lbs** Stainless steel (property class 70) — **20 Nm** — **15 ft-lbs**

NOTE!
Gaskets

The torque cannot be attained when using gaskets made of NBR, EPDM or FKM.

— For these seals, gradually tighten the screws crosswise, however only insofar that the seals are not squeezed out.

4.4.2 Setup

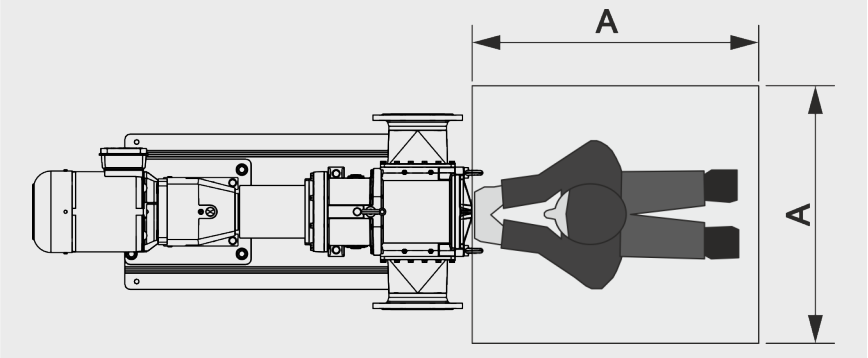
NOTICE!
Risk of damage caused by frost!

Frost can cause damage to the Börger machine.

— Protect the Börger machine and its connections against frost.

NOTICE!
Sufficient air circulation at the drive!

— Ensure that there is sufficient circulation of air around the drive; see the drive manufacturer's operating manual.



Standard units are installed ready for operation on a rigid base frame together with elastic shaft connections, a coupling guard and pipe connectors.

The recommended service space (A x A) is 1.0 x 1.0 m (3.28 ft x 3.28 ft).

A space of at least 0.8 m x 0.8 m (2.62 ft x 2.62 ft) is necessary to access the unit easily for maintenance and repair work.

NOTE!
Base frame installation

The nuts underneath the base frame must be accessible with a wrench from the front and back. If realignment is required or the machine is reinstalled on the base frame (e.g. following repairs or replacement), then it must be possible to hold the nuts in place with a wrench.

Only set the base frame in concrete if a suitable special base frame has been delivered as agreed upon in advance.

Tool: ■ Hammer drill

Versions with base frames

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

1. Position the base frame without subjecting it to stress.
2. Compensate for any unevenness in the floor, e.g. by using washers or shims.
3. Install the base frame onto the reinforced surface without subjecting it to stress, e.g. using four suitable anchor bolts and appropriate resin capsules or four other safe fixing systems suitable for the surface and the application.

Example: anchor bolts

Rotary lobe pump	Multicrusher	Anchor bolts
AL, AN	HAL, HAN	M12 x 130 mm (5.1 ")
PL, PN, QN, CL, FL, EL	HPL, HCL, HFL	M16 x 160 mm (6.3 ")
XL	HLA	M20 x 160 mm (6.3 ")

Other versions

— **Mobile units** must be operated on a solid surface and be secured in place. Double-check this.
— When installing **special versions**, check whether a supplementary operating manual is enclosed in the appendix and, if so, follow the instructions.

4.4.3 Installing the inlet and outlet

NOTICE!
Risk of damage due to incorrectly installed pipe system!

Börger machines are robust, and are constructed for use with high loads. However, they must not be used as an anchor point for the pipe under any circumstances. Even at low vibrations, the stress generated on the pipe during operation can lead to cracks on weaker components / weld seams.

— Pipes and any additional components such as valves, check valves etc. must not subject the machine and flange connections to stress.
— Avoid misalignment between the machine pipe connectors and the pipe.
— All attachment parts must be supported as close to the machine as possible according to the valid general technical rules.

Suitable seals are required for installing the inlet and outlet pipe connectors to the pipes / hoses, i.e. gaskets are required on flange connections. These must be resistant against the medium.

The type, design, nominal diameter and nominal pressure of the connection flanges (or any special connections) are specified in the order confirmation / data sheet. Only suitable counter flanges / connectors may be attached in combination with the appropriate seals.

The pipes to be connected must correspond to the specifications in the order (material, DN, PN, $NPSH_A$ value etc.).

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

1. Clean all connection flanges and all other connections before installation and ensure that they are not damaged.
2. On flange connections, ensure that the flanges are positioned exactly face to face, even without being fixed by screws. They must not be inclined, nor pressed together, nor spring backwards due to tensile forces.
3. Prevent any stress on the pipes connected to the Börger machine by taking suitable measures.
4. Use seals that are suitable for the connections.
5. Install the connections to the matching pieces on the pipes or hoses without stress. When necessary, apply the appropriate torque for the connection. Consult the manufacturer's instructions for coupling connections.

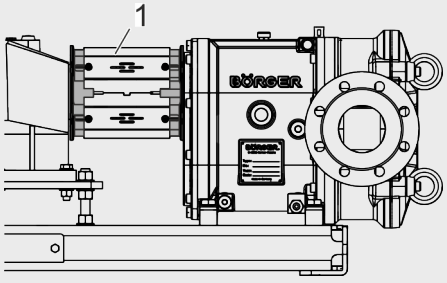
4.4.4 Aligning the unit

NOTE!
Coupling guard and V-belt/chain guard

The coupling guard and V-belt/chain guard are safety-relevant protective devices.

— They prevent reaching into the rotating parts and protect the rotating elements from coming into contact with other parts and thereby generating sparks.

Version with torsionally flexible coupling



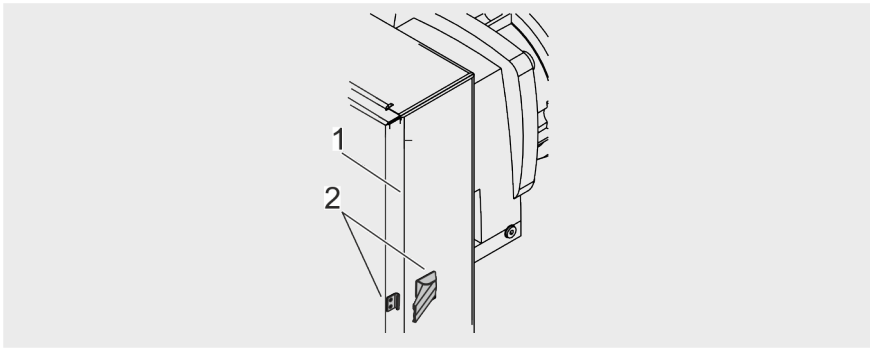
After the Börger machine is installed, in order to rule out damage caused by displacement, you must check the alignment of the coupling on units mounted on a base frame that have gear motors.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Read and observe the instructions from the coupling manufacturer in the appendix.

1. Loosen the fastening screws of the coupling guard and pull the coupling guard out of the groove of the fastening ring, if available (depending on version).
2. Bend up the coupling guard (1) shown here slightly.
3. Lift off the coupling guard (1).
4. Check the alignment of the coupling in several positions using a suitable tool (straightedge, laser-optical sensor).
5. When necessary, carefully correct any misalignment according to the specifications of the coupling manufacturer, e.g. using the set screws on the motor plate.
6. Reattach the coupling guard (1) correctly. Retighten all fastening screws.
7. Check the screws used to fasten the Börger machine to the base frame and retighten them, if necessary.

Version with belt or chain drive



The correct belt pre-tension or chain tension is necessary for correct belt drive or chain drive functionality and a long service life for the V-belts/chains.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Read and observe the instructions from the V-belt or chain manufacturer in the appendix.

1. Open the retaining clamps (2) on the V-belt/chain guard and lift off the protection cover (1).
2. Check that the V-belts or chains are positioned correctly and that the pre-tension is correct according to the manufacturer's specifications.
3. Put the protection cover (1) of the V-belt/chain guard with the pins back into the corresponding bores of the base frame and fasten the cover with the retaining clamps (2).
4. Check the screws used to fasten the Börger machine to the base frame and retighten them, if necessary.

4.4.5 Electrical connection

DANGER!
Risk of fatal injury due to electric power!

There is an immediate risk of fatal electric shock if live components are touched. Damage to the insulation of the individual components can be fatal.

- Have all work on the electrical equipment performed by skilled electricians.
- In the event of damage to the insulation, cut off the power supply immediately and initiate repairs.
- Before working on live components of electrical systems and equipment, de-energize these components and secure them in this state for the duration of the work.

  Adhere to the following safety rules in this regard:

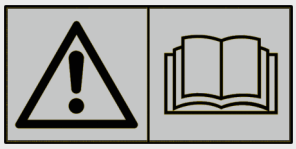
  - Disconnect.
  - Secure against restart.
  - Verify that components have been de-energized.
  - Ground and short-circuit.*
  - Cover or shield any adjacent live components.*
- Never bypass or disable any fuses. Comply with the correct amperage specification when replacing fuses.
- Keep moisture away from all live components. This may lead to short circuits.
- Ensure that all electric connections have been properly reconnected before switching the unit on again and that the cables used are undamaged and have not been sharply bent.
- Ensure that the control cabinet is properly closed before switching on and during operation.

* Under certain circumstances, exceptions may apply for systems with a nominal voltage of up to 1000V (see DIN VDE 0105-100)

NOTE!
When using frequency converters

Due to their working principle, frequency converters generate leakage current.

— For proper operation of a frequency converter at a residual current device, the use of an AC/DC sensitive **residual current device (type B)** according to **EN50178/VDE0160** is required due to the DC component of the leakage current.



Operating manuals of electronic parts

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance,
— in the operating manuals of electronic parts in the appendix.

The Börger machine must be completely installed before establishing the electrical connections.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

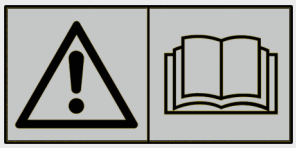
1. Connect all electrical monitoring devices according to the operating manuals from the manufacturers.
2. Connect the drive **on versions with an electric drive** according to the operating manual from the manufacturer.
3. Ground the Börger machine properly, see operating manual of the drive manufacturer. Also use the bore hole for the ground terminal.

4.4.6 Hydraulic connection

DANGER!
Risk of fatal injury due to hydraulic oil spurting out under pressure!

Hydraulically actuated moving parts can cause severe injury.

— Have all work on the hydraulic system performed by hydraulic specialists.
— Depressurize the hydraulic system completely before starting work on it. Depressurize the pressure accumulator completely.
— Do not reach into moving parts or handle moving parts when the machine is in operation.
— Never hold body parts or any objects into the jet of liquid. Keep personnel away from the hazardous area.
— Activate the EMERGENCY STOP immediately. If required, take further measures to reduce the pressure and stop the jet of liquid.
— Have defective components repaired immediately.
— Collect any escaping fluid properly and dispose of it.



Operating manual of drive manufacturer

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance,
— in the operating manual of the drive manufacturer.

The Börger machine must be completely installed before establishing the hydraulic connections.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

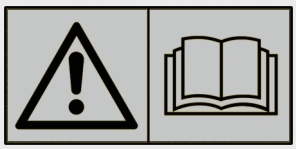
→ Connect the hydraulic connections on Börger machines with a hydraulic drive according to the operating manual from the drive manufacturer.

4.4.7 PTO shaft connection

DANGER!
Risk of injury due to rotating parts!

Moving parts can cause severe injury.

— Do not reach into rotating parts or handle rotating parts when the machine is in operation.
— Never open protective covers when in operation.
— Perform work on the Börger machine only when stationary.
— Observe the delay time: Prior to opening protective covers, make sure that all components have stopped moving.
— Shut down the machine and upstream and downstream system components before carrying out any work on the Börger machine or accessories. ↳ *Chapter 5.3 “Downtimes” on page 111*
— The operating person is obligated to check that all safety equipment is installed and fully functional before putting the machine into operation.
— The Börger machine must only be switched on when the inlet and outlet connections have been established and the maintenance openings have been securely installed.



Operating manual for PTO shaft components

— Pay particular attention to all **instructions and safety regulations** contained in the operating manuals for PTO shaft components.

The Börger machine must be completely installed before connecting the PTO shaft.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

1. **On versions with a PTO shaft drive**, ensure that the drive side of the PTO shaft is properly connected to the drive.
2. Connect the suitable PTO shaft - which has to be mounted properly to the drive - with the corresponding shaft end of the Börger machine according to the operating manual from the PTO shaft manufacturer.
3. Check the length of the PTO shaft and adjust it if necessary.

4.5 Checks before commissioning

4.5.1 Checking smooth running following storage and long downtimes

DANGER!
Risk of injury due to rotating parts!

Moving parts can cause severe injury.

— Do not reach into rotating parts or handle rotating parts when the machine is in operation.
— Never open protective covers when in operation.
— Perform work on the Börger machine only when stationary.
— Observe the delay time: Prior to opening protective covers, make sure that all components have stopped moving.
— Shut down the machine and upstream and downstream system components before carrying out any work on the Börger machine or accessories. *Chapter 5.3 “Downtimes” on page 111*
— The operating person is obligated to check that all safety equipment is installed and fully functional before putting the machine into operation.
— The Börger machine must only be switched on when the inlet and outlet connections have been established and the maintenance openings have been securely installed.

NOTICE!
Inadequate maintenance can result in malfunctions and damage!

— When the machine is stored for longer periods, rotate the shafts several times after about six months (or more often, depending on the storage conditions), according to *Chapter 4.5.1 “Checking smooth running following storage and long downtimes” on page 97*.
  — This way the gears, bearings and shaft seals are moved and coated again with lubricant.

NOTICE!
Risk of material damage caused by loosening of the fastening screw!

Accidental loosening of the fastening screw that fastens the rotating parts to the shafts when checking for smooth running may cause severe damage.

— The fastening screw must not be loosened when checking for smooth running.

Following long storage periods and downtimes, check that the mechanical seals (or any special seals) and the rotating parts run smoothly before commissioning the Börger machine again:

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

1. Open the quick-release cover. *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*
2. Attach a hexagon socket wrench or ratchet to one of the hexagon socket head cap screws that fasten the rotating parts to the shafts. Use the tool to rotate the shaft **clockwise**. The shafts and the rotating parts must not become jammed.

3. On used machines, remove any foreign bodies that may cause the rotating parts to jam. If this does not solve the problem, then removal and possibly replacement of the mechanical seals or rotating parts is necessary.
4. Install the quick-release cover. ↳ *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*

4.5.2 Checking readiness for operation

NOTE!
Integration into the EMERGENCY STOP system

A Börger machine must be integrated in an **EMERGENCY STOP system**.

— It is only permissible to do without an emergency stop device if the emergency stop device would not reduce the stopping time and if it would not enable the special measures required to deal with the risk to be taken.
— The normal shutdown equipment must then be labeled accordingly.

NOTE!

The quench fluid is used for monitoring the integrity of the mechanical seals, and also for protection, lubrication and cooling of the mechanical seals. ↳ *Chapter 3.1.5 “Shaft seal” on page 55*
↳ *Chapter 3.1.6 “Intermediate chamber (quench)” on page 56*

Be sure to read and follow all instructions:

— on safety,
— on operation and control,

— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Ensure that the Börger machine is integrated into an **emergency stop** system, or, if such a system is not mandatory, that the shutdown device is adequately labeled.

1. If your Börger machine was delivered with special **accessories**, then ensure that these accessories are installed correctly and ready for operation. This especially applies to devices used for safety and monitoring system functionality. Adhere to the relevant operating manuals for the accessories.
2. Ensure that you have removed the **transport lock from the breather system on the drive** if one was present according to the operating manual of the drive manufacturer.
3. Check the **oil level in the gear unit of the Börger machine**. On standing versions, the oil level must reach at least halfway up the oil sight glass. If this is not the case, the gear oil (cf. data sheet) must be refilled. ↳ *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*.
4. Ensure that the **breather system at the gear unit** is properly installed.
5. Ensure that the **breather at the intermediate chamber** is properly installed and the quench fluid can drain off freely in the event of a seal leakage, or, when medium must not be released into the atmosphere, that a suitable drain system is installed.
6. Check whether the **delivered quench fluid** (see enclosed data sheet) is suitable or whether an alternative fluid must be used in order to observe environmental protection regulations, or for biological or other reasons. This must be compatible with the medium, and must not adversely affect the O-rings of the mechanical seals. Consult Börger GmbH regarding this, if necessary.

7. Check the **fill level in the intermediate chamber**. On standing versions, the quench fluid must reach halfway up the top shaft. Otherwise, the quench fluid (cf. data sheet) must be refilled. If there is much more fluid in the intermediate chamber than the optimum fill level when the mechanical seal is intact, some of the fluid should be drained off in order to prevent premature overflowing. Otherwise, the functionality of the leak monitor may be compromised.
↬ *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*
8. Check that the **coupling guard or the V-belt or chain guard** is positioned correctly and fixed securely.
9. Ensure that the **supply lines** to the drive are connected and secured according to the relevant regulations.
10. Ensure that the unit is properly **grounded**.
11. Check that the **pipe connectors** are attached correctly and do not leak (torque for the connection between Börger machine and pipe connector according to ↬ *Chapter 4.4.1 “Preparation for installation” on page 83*).
12. Check that all **screws and nuts**, which may have become loose during transportation and installation, are tight.
13. Rectify all errors determined by this check.

4.5.3 Checking the flow direction

DANGER!
Risk of injury due to rotating parts!

Moving parts can cause severe injury.

— Do not reach into rotating parts or handle rotating parts when the machine is in operation.
— Never open protective covers when in operation.
— Perform work on the Börger machine only when stationary.
— Observe the delay time: Prior to opening protective covers, make sure that all components have stopped moving.
— Shut down the machine and upstream and downstream system components before carrying out any work on the Börger machine or accessories. ↳ *Chapter 5.3 “Downtimes” on page 111*
— The operating person is obligated to check that all safety equipment is installed and fully functional before putting the machine into operation.
— The Börger machine must only be switched on when the inlet and outlet connections have been established and the maintenance openings have been securely installed.

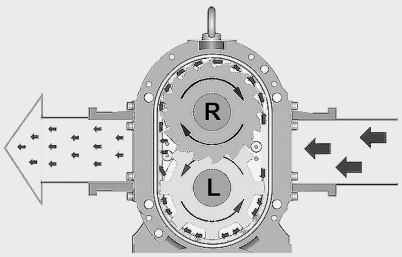
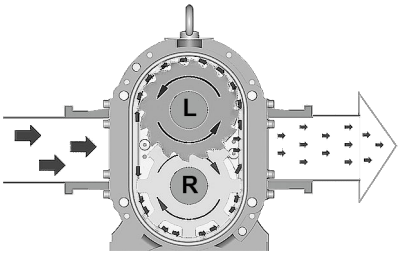
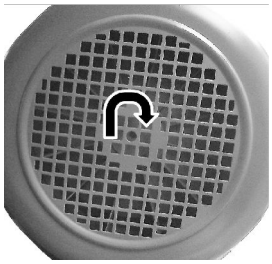
NOTICE!

Risk of material damage (to the system) when operating the Multicrusher with incorrect direction of rotation!

The Multicrusher must not be put into operation during the following function test.

Ensure that all valves and shut-off devices are closed.

Example: Standard drive with <u>two-stage</u> helical gear unit:

View of quick-release cover:	**View of drive with drive shaft at the top[1]:**
	
Flow direction from **right to left**, when the upper shaft turns clockwise	⇒ Required direction of rotation of the shaft / the fan wheel **<u>when looking at the drive</u>: counter-clockwise**
View of quick-release cover:	**View of drive with drive shaft at the top[1]:**
	
Flow direction from **left to right**, when the upper shaft turns counter-clockwise	⇒ Required direction of rotation of the shaft / the fan wheel **<u>when looking at the drive</u>: clockwise**

1) If the lower shaft is the drive shaft, the motor of a version with a two-stage helical gear unit must turn in the other direction (when looking at the drive) than shown here.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Open the quick-release cover. ↳ *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*

1. Consult the operating manual from the drive manufacturer for details on checking the direction of rotation. With three-stage gear units, the motor must turn in the opposite direction for example (when looking at the drive). This is different from two-stage gear units which are used as an example here.

2. Check the direction of rotation of the drive shaft, for example, by briefly switching on the motor and observing the fan wheel of the motor.

3. If the direction of rotation and therefore the flow direction are incorrect, change the direction of rotation of the drive or switch the PTO shaft for versions with two drive shafts.
4. Mark the selected flow direction on the Börger machine using the adhesive label provided.
5. **Special drives**

   Make sure the direction of rotation of the drive shaft for the required flow direction is correct according to the function description above as described in the operating manual of the drive manufacturer.
6. Close the quick-release cover. ↬ *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*

5 Operation

WARNING!
Risk of injury as a result of improper operation!

Improper operation may cause severe injury and considerable material damage.

— Prior to commissioning, ensure that all installation work is performed and completed as per the information and notes provided in this manual.
— Ensure that all operating steps are performed as per the information and notes provided in this manual.
— Ensure the following before starting work:
  — Ensure that all covers and safety features are installed and function correctly.
  — Ensure that nobody is in the hazardous area.
— Never bridge or disable safety features during operation.

NOTICE!
There is a danger of considerable material damage if the limits are not complied with!

Failure to comply with the limits can cause permanent damage to the Börger machine and its components.

— The values may neither exceed nor fall below the limits specified in *Chapter 3.3 “Technical data” on page 64* of the standard operating manual and the specifications on the data sheet.
— On Börger machines that operate with a frequency converter, make sure that the operating speed is sufficiently below the maximum permissible speed (for speed limit based on machine configuration, see enclosed data sheet).
— Take all necessary precautions to ensure that the permissible differential pressure between the inlet and outlet of the Börger machine is not exceeded.
— Make sure that the pressure on the outlet does not exceed the permissible pressure of the pipe system and the Börger machine, and not overload the drive and its elastic connections.
— The temperature values according to the data sheet may not exceed or fall below the limits. Double-check this.

NOTICE!
Risk of severe material damage caused by running a Börger machine against closed valves!

Running against closed valves may cause permanent damage to your Börger machine.

— The Börger machine must not be run against closed valves.
  — Make sure that the pipes are open when the Börger machine is switched on, e.g. by a suitable control unit.

NOTICE!
Risk of material damage due to blockage and imbalances of the drive shaft!

Inadequate cleaning and foreign bodies can cause permanent damage to your Börger machine.

— Make sure that long-fibrous particles and other foreign bodies which might result in a blockage of the drive shaft do not enter the working chamber.
— Make sure that the unit does not become imbalanced, e.g. due to inadequate cleaning (adhesive residues of the pumped medium) or foreign bodies.
— Take the appropriate precautions if necessary (install a macerator and/or stone trap upstream).

NOTICE!
Risk of damage caused by frost!

Frost can cause damage to the Börger machine.

— Protect the Börger machine and its connections against frost.

ENVIRONMENT!
Danger due to incorrect handling of environmentally hazardous substances!

Inappropriate handling of environmentally hazardous substances, especially incorrect disposal, can cause significant damage to the environment.

— Especially water-polluting materials such as grease and lubricating oil must not pollute the soil or enter the sewage system during installation, repair and maintenance work.
  — These materials must be collected, stored, transported and disposed of in suitable containers.
— When handling oil, grease and other chemical substances, pay attention and adhere to the applicable regulations and safety data sheets issued by the respective manufacturer relating to storage, handling, correct use and disposal.
— Comply with the legal obligations regarding waste avoidance and the proper recycling/disposal of waste during all work

NOTE!
Contamination caused by production residues!

Börger machines may contain residues from the manufacturing process, e.g. grease or oil. Contamination caused by packaging and transport cannot be ruled out.

— If necessary, thoroughly rinse the Börger machine with a suitable agent as part of the test run (*Chapter 5.1 “Commissioning” on page 108*) while adhering to the limits before commissioning the machine for the first time.

5.1 Commissioning

NOTICE!
Risk of damage to the mechanical seal due to a lack of quench fluid!

Risk of damage to the mechanical seal due to a lack of quench fluid!

— The heat-absorbing quench fluid prevents the mechanical seal from running dry and captures any medium that enters the intermediate chamber due to leaks in the mechanical seal.
— This quench function also prevents the gear unit from being damaged by the ingress of medium.
— Make sure that the fill level in the intermediate chamber is sufficient.

5.1.1 Test run with medium

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

This test run may only be made when

— the Börger machine has been completely installed,
↳ *Chapter 4.4 “Installation” on page 81*
— the unit is completely ready for operation,
↳ *Chapter 4.5.2 “Checking readiness for operation” on page 99*
— all errors have been rectified and
— the functional checks without medium have shown the required smooth running and the desired direction of rotation.
↳ *Chapter 4.5 “Checks before commissioning” on page 97*

1. Adhere to the manufacturers' operating manuals for all attached control components.
2. First, switch on all additional devices, especially those with measurement and control functions relevant to safety.
3. Open the pipe shut-off devices on the inlet and the outlet side.

4. Switch on the drive of the Multicrusher at the same time as the pump (or the pumps or the gravity feed, depending on the system). If it is not possible to switch on the drive and pump simultaneously as recommended, then switch on the Multicrusher first, followed immediately by the pump (or the pumps or the gravity feed).
5. Check all pipe connectors, the quick-release cover and/or the counter bearing cover, etc., for leaks.
6. Check that the function/display of all additional devices is working properly.
7. Check that the Börger machine runs quietly and vibration-free. If the Börger machine or drive emit uneven, rattling sounds, then the cause must be determined.
8. Check the current consumption of the drive. Compare the values with those in the operating manual for the drive.
9. Check the development of noises and temperature at the drive.
10. The Börger Multicrusher allows you to adjust the cutting properties to the circumstances of your system, by simply changing the blade arrangement. ↬ *Chapter 3.1.3 “Cutting unit” on page 49*.

    If the Multicrusher in the version delivered does not yield the desired cutting performance or required flow rate without jamming, change the arrangement or the type of blades.
    ↬ *Chapter 3.1.3 “Cutting unit” on page 49* ↬ *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.

5.1.2 Complete commissioning

The Börger machine can be operated properly when all functions run correctly and no leaks are detected.

NOTE!
Checklist for commissioning

A checklist for commissioning the Börger machine can be found in the appendix.
Chapter 9.6 “Checklist for commissioning” on page 209

5.2 Continuous operation

Be sure to read and follow all instructions:

- on safety,
- on operation and control,
- on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

Börger Multicrushers are suitable for continuous operation.

1. Make sure that the unit does not become imbalanced due to inadequate cleaning (adhesive residues of the flow medium, threads wrapped around the blades) or non-macerable foreign bodies.
2. Observe the maintenance and inspection intervals.
Chapter 6.2 “Maintenance and inspection” on page 132
3. Following downtimes, switch on the drive of the Multicrusher at the same time as the pump (or the pumps or the gravity feed, depending on the system). If it is not possible to switch on the drive and pump simultaneously as recommended, always switch on the Multicrusher first, followed immediately by the pump (or the pumps or the gravity feed).

5.3 Downtimes

Be sure to read and follow all instructions:

— on safety,

— on operation and control,

— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

1. Switch off the Börger machine (or the pumps or the gravity feed, depending on the system) at the same time.
2. Close the valves on the suction and pressure line if required by the system.
3. The flow medium can be left in the Börger machine during normal downtimes, provided the flow medium type does not prevent this (e.g. medium hardens when cooling down).

   — Clean the Börger machine in these cases and before long downtime periods. *Chapter 6.1 “Machine care” on page 125*

5.4 Emergency shut-down

NOTE!
EMERGENCY STOP

The **EMERGENCY STOP button** as an **EMERGENCY STOP** enables the **immediate shut-down** of the Börger machine.

In cases of emergency, the Börger machine must be shut down as fast as possible, the energy supply must be switched off and pressure must be released.

Please proceed as follows in emergencies:

1. Activate the EMERGENCY STOP by pressing the EMERGENCY STOP button immediately.
2. If a risk to your own life can be excluded, evacuate other persons from the danger zone.
3. If necessary, initiate first aid measures.
4. Alert emergency personnel.
5. Inform person responsible on site.
6. Switch off the Börger machine and secure against restart.
7. Clear access routes for emergency personnel.
8. Brief emergency personnel.
9. Commission qualified personnel with troubleshooting.

WARNING!
Risk of fatal injury if the plant is switched back on uncontrolledly or without authorization!

Switching the machine on without authorization or uncontrolledly can cause serious injuries.

— Ensure that the cause of the EMERGENCY STOP has been eliminated and all safety features are installed and functional prior to a restart.
— Do not reset the EMERGENCY STOP switch before the danger has been eliminated.

5.5 Malfunctions

WARNING!
Risk of injury due to inadequate troubleshooting, maintenance and repair work!

Inadequate troubleshooting, maintenance and repair work can lead to severe injury and significant material damage.

- To the extent necessary, amply secure the surrounding area when performing maintenance. Cordon off the working area with a red and white safety chain and a warning sign.
- Ensure sufficient installation space before commencing work.
- Keep the installation site clean and tidy! Loosely stacked or scattered components and tools cause accidents.
- Ensure correct installation where components have been removed, reinstall all fastening elements and observe the tightening torques of screws.
- Ensure the following before putting the machine back into operation:
  - Ensure that all troubleshooting, maintenance and repair work is performed and completed as per the information and notes provided in this manual.
  - Ensure that nobody enters the hazardous area.
  - Ensure that all covers and safety features are installed and function correctly.

WARNING!
Risk of injury when using unsuitable spare parts!

The use of unsuitable spare parts can cause malfunctions which can lead to severe injury, including death, and to significant material damage.

- Only use suitable spare parts.
- Always contact the manufacturer if in doubt.

NOTICE!
Risk of severe material damage due to a delayed shut-down in the event of a malfunction!

A delayed shut-down in the event of malfunction can cause permanent damage to the Börger machine.

— In the event of a malfunction, shut down the Börger machine and all upstream and downstream system components immediately until the cause has been rectified.

Fault	Possible causes	Fault elimination
Flow rate of the Multicrusher under the target value	Shut-off devices not open / not open completely	— Open shut-off devices
	Pipes blocked	— Clean the pipes — Agitate the substrate fed, if required (lumps which are too large regularly enter the pipe at once)
	Flow speed not optimized	— Adjust the pump speed or the feed
	Speed of the Multicrusher not optimized	— Adjust the speed
	Incorrect parameterization of the control unit or frequency converter	— Correct the settings — Check that the frequency converter is suitable (it must emit a constant torque)
	Inlet pipe diameter too big/small	— Adjust the pipe cross section to the inlet opening of the Multicrusher — Make sure there are no constrictions in the inlet pipe
	Outlet pipe diameter too small	— Adjust the pipe cross section to the outlet opening of the Multicrusher
	Output of the connected pump insufficient	— Adjust the output of the connected pump — Adjust the pipe cross section to the outlet opening of the Multicrusher
	Blade arrangement or blade types not optimal for the type of solids fed in	— Change the blade arrangement — Use a suitable blade type
	Viscosity of flow medium too high	— Reduce the viscosity when possible — If necessary, change the position of the Multicrusher

Fault	Possible causes	Fault elimination
The Multicrusher does not shred / does not shred optimally	Flow speed not optimized	— Adjust the pump speed or the feed
	Speed of the Multicrusher not optimized	— Adjust the speed
	Incorrect drive direction of rotation	— Correct the direction of drive rotation
	Incorrect flow direction	— Connect the inlet and outlet with the correct pipes as indicated on the unit — If necessary, re-equip the Multicrusher and indicate the new flow direction. ↳ *Chapter 6.3.7 “Modifications for changing the flow direction” on page 183*
	Inlet pipe diameter is too small or too big, inlet volume not optimal	— Make sure there are no constrictions in the inlet pipe — Adjust the pipe cross section to the inlet opening of the Multicrusher
	Formation of blockages in the inlet area, bridging in case of versions with feed hopper	— Feed in the flow medium more slowly — Adjust the pipe cross section to the inlet opening of the Multicrusher — Agitate the substrate fed, if required (lumps which are too large regularly enter the pipe at once)
	Blades jammed with material	— Clean blades, remove remaining material — If necessary, use different blade types more suitable for the solids
	Cutting unit not properly installed	— Install the cutting unit properly ↳ *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150* ↳ *Chapter 6.3.4 “Replacing the hexagonal shaft” on page 168*
	Blade arrangement or blade types not optimal for the type of solids fed in	— Change the blade arrangement — Use a suitable blade type

Fault	Possible causes	Fault elimination
	Wear or damage to the blades	— Replace blades and, if necessary, spacer rings — Determine and rectify the cause of the damage — Install a stone trap upstream, if necessary — Only use the Multicrusher for its intended purpose
	Wear or damage to a hexagonal shaft	— Replace hexagonal shaft(s) — Determine and rectify the cause of the damage — Install a stone trap upstream, if necessary — Only use the Multicrusher for its intended purpose
	Wear on casing liners (counter blades)	— Replace worn parts — Determine and rectify the cause of the damage — Install a stone trap upstream, if necessary — Only use the Multicrusher for its intended purpose

Fault	Possible causes	Fault elimination
Multicrusher blocked (e.g. current consumption of the electric motor exceeds limit)	Pump (pumps / gravity feed) switched on too early	— Switch pump (pumps / gravity feed) on at the same time as or after the Multicrusher *Chapter 5.2 “Continuous operation” on page 110*
	Long-fibrous or film-like particles have become wrapped around the blades	— Clear the blades by running the unit forwards and in reverse in short sequences Recommendation: — Reversing cycle max. 30 seconds — Reversing sequence max. 10 seconds — Approx. 4 reversing cycles in 10 minutes — If the problem is not rectified with max. 5 reversing cycles: remove all foreign bodies manually — Only use the Multicrusher for its intended purpose
	Incorrect parameterization of the control unit or frequency converter	— Correct the settings — Check that the frequency converter is suitable (it must emit a constant torque)
	Excessively high flow speed with high DS content	— Adjust the pump speed or the feed
	Inlet volume greater than outlet volume, solids blocking the cutting unit	— Make sure there are no constrictions in the outlet pipe — Adjust the pipe cross section to the inlet opening of the Multicrusher — Adjust the inlet volume — Adjust the outlet volume — Agitate the substrate fed, if required (lumps which are too large regularly enter the pipe at once) — In case of gravity feed: if regular blockages occur due to sedimentation during downtime, program the reversing control unit in such a way that the machine is restarted in backward operation
	Blade arrangement or blade types not optimal for the type of solids fed in	— Change the blade arrangement — Use a suitable blade type

Fault	Possible causes	Fault elimination
	Cutting unit incorrectly installed	— Install the cutting unit properly *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150* *Chapter 6.3.4 “Replacing the hexagonal shaft” on page 168*
	Drive output too low	— Install a more powerful drive

Fault	Possible causes	Fault elimination
The Multicrusher emits rattling noises	Foreign bodies in the cutting chamber	— Remove foreign bodies — Install a stone trap upstream, if necessary
	Pipe not supported / not supported close enough to the unit	— Support the pipe sufficiently, taking the weight of the flow medium into account
	Cutting unit incorrectly installed (e.g. fastening screw of the cutting unit not tightened with the specified torque)	— Install the cutting unit properly *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150* *Chapter 6.3.4 “Replacing the hexagonal shaft” on page 168*
	Parts of the cutting unit broken by hard foreign bodies	— Replace damaged parts — Install a stone trap upstream, if necessary — Only use the Multicrusher for its intended purpose
	Drive incorrectly installed, e.g. coupling not aligned correctly	— Install drive correctly; align coupling
	Cam ring (coupling) or V-belt etc worn	— Replace cam ring or V-belt
	Damage to the Multicrusher gear unit or drive gear unit	— Please contact Börger customer service

Fault	Possible causes	Fault elimination
Liquid escapes from the safety opening or the vent hole	Temperature-related expansion with too much fluid in intermediate chamber	— Drain some quench fluid — Adhere to temperature limits — Use suitable quench fluid
	Cover disk, O-ring or sealing washer of the cutting unit damaged	— Replace damaged parts
	Shaft seal of the cutting chamber damaged	— Replace the mechanical seals or MultiSeal cartridges

Fault	Possible causes	Fault elimination
Complete loss of quench fluid	Unsuitable, quickly evaporating quench fluid	— Use suitable quench fluid — Adhere to temperature limits
	Maintenance intervals exceeded	— Adhere to maintenance intervals — Fill intermediate chamber — Exclude consequential damage to the seals by performing regular fill level checks and by checking the quality of the gear oil
	During vacuum operation: shaft seal of the cutting chamber damaged	— Replace the mechanical seals or MultiSeal cartridges

Fault	Possible causes	Fault elimination
The Multicrusher does not start, or runs with difficulty after a downtime	Drive not switched on, not installed correctly or defective	— Establish the correct drive function by connecting it to the power supply, installing it correctly etc.
	Incorrect parameterization of the control unit or frequency converter	— Correct the setting — Check that the frequency converter is suitable (it must emit a constant torque)
	Pump (pumps / gravity feed) switched off too late	— Clean the working chamber of the Multicrusher manually — Switch pump (pumps / gravity feed) off at the same time as or before the Multicrusher, see *Chapter 5.1 “Commissioning” on page 108* and *Chapter 5.3 “Downtimes” on page 111*
	Long-fibrous or film-like particles have become wrapped around the blades	— Clear the blades by running the unit forwards and in reverse in short sequences Recommendation: – Reversing cycle max. 30 seconds – Reversing sequence max. 10 seconds – Approx. 4 reversing cycles in 10 minutes — If the problem is not rectified with max. 5 reversing cycles: remove all foreign bodies manually — Only use the Multicrusher for its intended purpose
	Flow medium has solidified in the cutting chamber after a long downtime	— Clean the working chamber — Close the valve of the feed line and clean the working chamber before longer downtimes

NOTE!
Börger customer service

If you have any questions on troubleshooting, installation, maintenance and repair work, contact Börger customer service.

5.6 Measures following on demand work!

Following completion of the work and before starting the unit, carry out the following steps:

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

1. Check all screws that have been loosened previously for firm seat.
2. Check whether all safety devices and covers that have been removed previously are reinstalled properly.
3. Ensure that all tools, materials and other equipment used have been removed from the work area.
4. Clean the work area and remove any spilled substances, e.g. liquids, processing material or similar.
5. Reset the emergency stop devices, if required.
6. Confirm malfunctions at the control unit.
7. Ensure that nobody enters the hazardous area.
8. Ensure that all safety features of the unit function perfectly.
9. Take the unit into operation again. ↳ *Chapter 5.2 “Continuous operation” on page 110*

6 Maintenance and repairs

WARNING!
Risk of injury due to inadequate troubleshooting, maintenance and repair work!

Inadequate troubleshooting, maintenance and repair work can lead to severe injury and significant material damage.

- To the extent necessary, amply secure the surrounding area when performing maintenance. Cordon off the working area with a red and white safety chain and a warning sign.
- Ensure sufficient installation space before commencing work.
- Keep the installation site clean and tidy! Loosely stacked or scattered components and tools cause accidents.
- Ensure correct installation where components have been removed, reinstall all fastening elements and observe the tightening torques of screws.
- Ensure the following before putting the machine back into operation:
  - Ensure that all troubleshooting, maintenance and repair work is performed and completed as per the information and notes provided in this manual.
  - Ensure that nobody enters the hazardous area.
  - Ensure that all covers and safety features are installed and function correctly.

WARNING!
Risk of injury when using unsuitable spare parts!

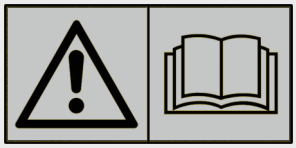
The use of unsuitable spare parts can cause malfunctions which can lead to severe injury, including death, and to significant material damage.

- Only use suitable spare parts.
- Always contact the manufacturer if in doubt.

NOTE!
Minimum requirements

The instructions described in this chapter are to be understood as the minimum requirements.

— Depending on the operating conditions, further work may be necessary to maintain the Börger machine in an optimum condition.
— The maintenance tasks detailed in this chapter may only be carried out by trained personnel employed by the operator.
— Repair work on the Börger machine may only be carried out by qualified, authorized specialists employed by the operator.



Further operating manuals / supplementary operating manuals

You must completely read the separate operating manuals and/or supplementary operating manuals for components and/or special versions.

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

1. Observe the assembly drawing, the spare parts list and the wear parts list when carrying out repairs or ordering spare parts. ↳ *Chapter 9.2 “Wear parts” on page 194*
↳ *Chapter 9.4 “Spare parts list” on page 200*
2. Read and strictly comply with the applicable regulations, manufacturer's safety data sheets and operator's instructions in respect of the storage, handling, use and disposal of oils, grease and other chemical substances.
3. Dispose of operating materials and replaced parts in a safe and environmentally-friendly manner.
↳ *Chapter 7 “Disposal” on page 189*

6.1 Machine care

Appropriate machine care helps to maintain the functionality of the Börger machine in the long term. In general, regular cleaning of dust and deposits from all surfaces is sufficient.

CAUTION!
Health hazard due to residues of dangerous medium inside and on the Börger machine!

There is an increased health hazard from contact with the medium and contaminated components.

Generally, the following applies:

— When using dangerous or health-endangering media, take all necessary safety measures when performing work on the Börger machine.
— Avoid direct contact with the medium (skin/eye contact, swallowing, inhaling).
— Remove spillage from your skin without delay.
— Do not store or consume beverages, food or tobacco in the working area.

NOTICE!
Improper cleaning of the Börger machine can lead to malfunctions and damage!

— Do not use water jets.
— Do not use aggressive cleaning agents, solvents or sandpaper, as these can damage the metallic and plastic surfaces, casing coating and seals.
— Do not use metal objects such as scrapers and screwdrivers for cleaning coated machine parts.
— Never clean sensitive components with hard scrubbing and strong mechanical pressure.
— Do not use a vacuum cleaner or a hand brush with plastic bristles etc. to clean electronic components because the production of static electricity can damage the electronic components.

ENVIRONMENT!
Danger due to incorrect handling of environmentally hazardous substances!

Inappropriate handling of environmentally hazardous substances, especially incorrect disposal, can cause significant damage to the environment.

- Especially water-polluting materials such as grease and lubricating oil must not pollute the soil or enter the sewage system during installation, repair and maintenance work.
  - These materials must be collected, stored, transported and disposed of in suitable containers.
- When handling oil, grease and other chemical substances, pay attention and adhere to the applicable regulations and safety data sheets issued by the respective manufacturer relating to storage, handling, correct use and disposal.
- Comply with the legal obligations regarding waste avoidance and the proper recycling/disposal of waste during all work

6.1.1 Cleaning the outside

Protective equipment: ■ Light respiratory protection

Be sure to read and follow all instructions:

- on safety,
- on operation and control,
- on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
- Shut down the Börger machine and downstream and upstream system components. *Chapter 5.3 “Downtimes” on page 111*

1. Keep all markings on the Börger machine in a legible state at all times.
2. Only clean the outside of the Börger machine by wiping or brushing it down. Use lint-free cleaning cloths.
3. When required, use a standard aqueous industrial cleaner.

6.1.2 Pressure relief

WARNING!
Risk of serious injuries caused by liquid spouting out or escaping gases!

Gases or liquids may escape uncontrollably from seals and screw connections. Especially when flange connections are released and maintenance openings are opened, pressurized liquid can spout out at the cover.

Never loosen connections when the unit is pressurized.

— Ensure that all valves and shut-off devices on the inlet and outlet are closed.
— Release the pressure and empty the Börger machine via a drainage device (if available).
— Collect any leakage of medium by suitable means and dispose of it in accordance with the applicable local guidelines.
— Therefore, wear your personal protective equipment (PPE) *Chapter 2.6 “Personal protective equipment” on page 25* when opening the cover and take all necessary precautions.

WARNING!
Severe injury due to residual pressure!

Despite having depressurized the Börger machine, it may be under residual pressure in the event of congestion or lump formation in the medium.

— Take extra care when removing the flange connections and maintenance openings to prevent accidents caused by the release of residual pressure.

CAUTION!
Health hazard due to residues of dangerous medium inside and on the Börger machine!

There is an increased health hazard from contact with the medium and contaminated components.

Generally, the following applies:

— When using dangerous or health-endangering media, take all necessary safety measures when performing work on the Börger machine.
— Avoid direct contact with the medium (skin/eye contact, swallowing, inhaling).
— Remove spillage from your skin without delay.
— Do not store or consume beverages, food or tobacco in the working area.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Shut down the Börger machine and downstream and upstream system components. *Chapter 5.3 “Downtimes” on page 111*
— Secure the Börger machine against unauthorized or uncontrolled reactivation. *Chapter 2.7 “Securing the machine against restart” on page 26*

1. Close all valves and shut-off devices so that no medium can enter the working chamber of the Börger machine.
2. Release the pressure and empty the Börger machine via a drainage device (if available).
   — Collect any leakage of medium by suitable means and dispose of it in accordance with the applicable local guidelines.
3. Close the drainage device, if available.

6.1.3 Internal cleaning

WARNING!
Severe injury due to residual pressure!

Despite having depressurized the Börger machine, it may be under residual pressure in the event of congestion or lump formation in the medium.

— Take extra care when removing the flange connections and maintenance openings to prevent accidents caused by the release of residual pressure.

WARNING!
Risk of serious injuries caused by liquid spouting out or escaping gases!

Gases or liquids may escape uncontrollably from seals and screw connections. Especially when flange connections are released and maintenance openings are opened, pressurized liquid can spout out at the cover.

Never loosen connections when the unit is pressurized.

— Ensure that all valves and shut-off devices on the inlet and outlet are closed.
— Release the pressure and empty the Börger machine via a drainage device (if available).
— Collect any leakage of medium by suitable means and dispose of it in accordance with the applicable local guidelines.
— Therefore, wear your personal protective equipment (PPE) ↬ *Chapter 2.6 “Personal protective equipment” on page 25* when opening the cover and take all necessary precautions.

ENVIRONMENT!
Danger due to incorrect handling of environmentally hazardous substances!

Inappropriate handling of environmentally hazardous substances, especially incorrect disposal, can cause significant damage to the environment.

- Especially water-polluting materials such as grease and lubricating oil must not pollute the soil or enter the sewage system during installation, repair and maintenance work.
  - These materials must be collected, stored, transported and disposed of in suitable containers.
- When handling oil, grease and other chemical substances, pay attention and adhere to the applicable regulations and safety data sheets issued by the respective manufacturer relating to storage, handling, correct use and disposal.
- Comply with the legal obligations regarding waste avoidance and the proper recycling/disposal of waste during all work

Be sure to read and follow all instructions:

- on safety,
- on operation and control,
- on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

— Shut down the Börger machine and downstream and upstream system components. *Chapter 5.3 “Downtimes” on page 111*
— Secure the Börger machine against unauthorized or uncontrolled reactivation. *Chapter 2.7 “Securing the machine against restart” on page 26*
— Relieve the pressure in the Börger machine. *Chapter 6.1.2 “Pressure relief” on page 127*

1. Remove the required flange connections and maintenance openings to get to the working chamber of the Börger machine.
2. Thoroughly clean the rotating parts and the working chamber of the machine from deposits and contamination.
3. Thoroughly clean all parts before reinstalling removed parts.
4. Check all removed parts for wear and only reuse them if they are undamaged.
5. Only replace worn components, seals, screws, nuts etc., but especially the wetted parts, with original spare parts.
6. Reassemble the flange connections and maintenance openings that have been loosened previously.

6.2 Maintenance and inspection

6.2.1 Maintenance and inspection plan

NOTICE!
Risk of material damage due to improper maintenance!

— Also observe the maintenance intervals detailed in the operating manuals for the drive gear unit, motor etc., which are included in the appendix.
— Prepare a maintenance schedule adapted to the operating conditions.

NOTE!
Maintenance intervals

The following intervals are guidelines. These intervals can be significantly reduced depending on the operating conditions.

when necessary

Checking the outer surfaces for dust deposits and dirt

— If necessary, clean the outer surfaces *Chapter 6.1 “Machine care” on page 125*

Motor, gear reducer, coupling, sensor systems

— According to the enclosed manufacturer's documentation

daily

Audible check for smooth running

— In the event of a malfunction: take appropriate measures *Chapter 5.5 “Malfunctions” on page 113*

Visual check for leaks (including overflow check at the ventilation opening of the intermediate chamber)

— Replace the seals, if necessary *Chapter 6.3.5 “Replacing the mechanical seal” on page 172*
— Correct the fill level of the intermediate chamber if a seal leakage can be excluded *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*

weekly

Checking the barrier fluid fill level

— In the event of a malfunction: take appropriate measures ↳ *Chapter 5.5 “Malfunctions” on page 113*

Checking the functions and flow rate

— Take appropriate measures to eliminate the malfunction ↳ *Chapter 5.5 “Malfunctions” on page 113*
— Replace damaged parts, if necessary

monthly

Checking the oil level of the machine gear unit on the oil sight glass

— Refill, if necessary ↳ *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*
— If there are leaks in the gear unit / lip seal, contact Börger customer service or send the Börger machine for repair ↳ *Chapter 6.3.8 “Other repairs” on page 186*

quarterly

Checking the Börger machine and attachment parts for tight fit and possible damage

— Tighten any loosened parts
— Replace damaged parts

Checking all safety notes, warnings and operating instructions

— If necessary, replace damaged signs or stickers immediately

biannually

Checking the quality of the quench fluid

— Replace the quench fluid, if necessary ↳ *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*
— Replace seals, if necessary ↳ *Chapter 6.3.5 “Replacing the mechanical seal” on page 172*

Belt drive: Checking the belt tension

— Correct belt tension, if necessary

Belt drive: Visual check for cracks and porous areas

— Replace belt, if necessary (always replace the belts completely and with belts which consist of a single piece, have discharging properties and are of the same set)

yearly

Checking the electrical system and control unit for integrity and proper function

every 2 years / every 10,000 operating hours

Changing the lubricants *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*

NOTE!
Observe the operating conditions!

The oil change intervals apply to normal operating conditions and operating temperatures up to 80 °C.

— Change the lubricants after approximately 10,000 operating hours or after two years, whichever occurs first.
— Extreme operating conditions (higher operating temperatures, high air humidity, aggressive environment and frequent changes in operating temperature) shorten the oil change intervals.

NOTE!
Changing the lubricant

Observe the detailed information and instructions on changing the lubricant as described in the lubricant list and in the data sheet regarding the lubricants used. *Chapter 9.9 “Lubricant list” on page 215*

every 10 years / every 40,000 operating hours

General overhaul (includes checking the carrier shafts)

— Contact Börger customer service or send the Börger machine for a general overhaul *Chapter 6.3.8 “Other repairs” on page 186*

6.2.2 Lubricant fill level and changing the lubricants

CAUTION!
Health hazard due to residues of dangerous medium inside and on the Börger machine!

There is an increased health hazard from contact with the medium and contaminated components.

Generally, the following applies:

— When using dangerous or health-endangering media, take all necessary safety measures when performing work on the Börger machine.
— Avoid direct contact with the medium (skin/eye contact, swallowing, inhaling).
— Remove spillage from your skin without delay.
— Do not store or consume beverages, food or tobacco in the working area.

NOTICE!
Risk of severe material damage if the quench fluid is not compatible with the medium!

Loss of seal function if the quench fluid is not compatible with the medium may lead to severe material damage.

— Observe the detailed specifications and instructions on changing the lubricants in the lubricant list, which is part of this operating manual, as well as the specifications in the data sheet regarding the lubricants used. *Chapter 9.9 “Lubricant list” on page 215*
— **Regarding the quench fluid, especially consider:**
Due to the possibility, though unlikely, of quench fluid entering the working chamber and thus intruding on the process itself, the quench fluid must be compatible with the medium in addition to the other materials (especially with the material of the O-rings).

NOTE!
Behavior of the quench fluid

The level of quench fluid may not drop below the minimum indicated on the level indicator.

— The quench fluid can rise to the rim of the fill hole due to its function and depending on the operating temperature. A leak of the mechanical seal can only be assumed if the fluid overflows.
— A slow and slight loss of quench fluid may occur due to evaporation as well as due to lubrication of the mechanical seal.
— A sudden and persistently strong or complete loss of quench fluid in vacuum operation is indicative of a leak in the mechanical seal.

NOTE!
Quench function

The quench fluid can rise to the rim of the fill hole due to its **quench function** and depending on the operating temperature. A leak of the mechanical seal can only be assumed if the fluid overflows. The fill level specified below relates to the optimal volume of pure lubricant.

ENVIRONMENT!
Danger due to incorrect handling of environmentally hazardous substances!

Inappropriate handling of environmentally hazardous substances, especially incorrect disposal, can cause significant damage to the environment.

- Especially water-polluting materials such as grease and lubricating oil must not pollute the soil or enter the sewage system during installation, repair and maintenance work.
  - These materials must be collected, stored, transported and disposed of in suitable containers.
- When handling oil, grease and other chemical substances, pay attention and adhere to the applicable regulations and safety data sheets issued by the respective manufacturer relating to storage, handling, correct use and disposal.
- Comply with the legal obligations regarding waste avoidance and the proper recycling/disposal of waste during all work

Checking the oil level and the quench fluid

The intervals for changing the lubricants can vary significantly and be reduced considerably depending on the operating conditions, such as high levels of humidity, high temperatures, temperature variations, aggressive atmospheres etc.

Be sure to read and follow all instructions:

- on safety,
- on operation and control,
- on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
- Shut down the Börger machine and downstream and upstream system components *Chapter 5.3 “Downtimes” on page 111*.
- Secure the Börger machine against unauthorized or uncontrolled reactivation *Chapter 2.7 “Securing the machine against restart” on page 26*.

1. Observe the operating manual and maintenance instructions for the drive regarding the lubricants, lubricant fill level and changing the lubricants in drive components.
2. In accordance with the maintenance and inspection plan *Chapter 6.2.1 “Maintenance and inspection plan” on page 132* or more often depending on the operating conditions, check
   - the oil level and oil quality of the gear unit on the oil sight glass and
   - the level and quality of the quench fluid.
     - Use an oil dipstick, if necessary.

PL / HPL

Rotary lobe pump BLUEline (Classic) / Multicrusher

Optimum fill level

Design (mounting position)	Gear unit	Intermediate chamber
M1 (upright)	Center of oil sight glass	Top shaft, center to covered
M2 (vertical)	Completely filled[1)]	Lower edge, test bore[2)]
M3 (upside-down)	Center of oil sight glass	Top shaft, center to covered
M5, M6 (turned 90°)	Center of oil sight glass	approx. up to the bend in the fill hole

1) **In this case:** Expansion of the gear oil caused by the temperature cannot be compensated. The operating temperature must not exceed the temperature specified in the order.

2) **For submerged machines:** approx. 10 cm (3.94") below the edge of the extension pipe

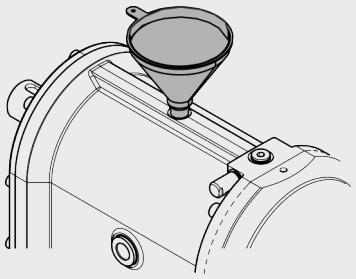
Correcting the lubricant fill levels

If necessary, correct the fill level of the intermediate chamber, unless a seal leakage is to be assumed, and the fill level of the gear unit according to the following description.

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance.
↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctior*
— Shut down the Börger machine and downstream and upstream system components. ↳ *Chapter 5.3 “Downtimes” on page 111*
— Secure the Börger machine against unauthorized or uncontrolled reactivation. ↳ *Chapter 2.7 “Securing the machine against restart” on page 26*

1. Observe the operating manual and maintenance instructions for the drive regarding the lubricants, lubricant fill level and changing the lubricants in drive components.
2. Use a safe drip pan when draining used lubricant.
3. Position of drain and fill holes: see designs and mounting positions. ↳ *Chapter 3.1.7 “Designs, mounting positions” on page 57*



Example: Classic FL series

Filling:

1. Remove the closure from the fill hole.
2. Fill the lubricant up to the optimum fill level having regard to the information in the lubricant list. *Chapter 9.9 “Lubricant list” on page 215*
3. Properly close the fill hole with the closure removed previously.

Draining:

1. Carefully loosen the screw plug at the drain hole and drain some lubricant until the optimum fill level is reached.
2. Tightly close the drain hole with the screw plug.

NOTE!
Changing the lubricant

Observe the detailed information and instructions on changing the lubricant as described in the lubricant list and in the data sheet regarding the lubricants used. *Chapter 9.9 “Lubricant list” on page 215*

Changing the lubricants

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance.
Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctior
— Shut down the Börger machine and downstream and upstream system components. *Chapter 5.3 “Downtimes” on page 111*
— Secure the Börger machine against unauthorized or uncontrolled reactivation. *Chapter 2.7 “Securing the machine against restart” on page 26*

1. Use a safe drip pan when draining used lubricant.
2. Position of drain and fill holes: see designs and mounting positions. *Chapter 3.1.7 “Designs, mounting positions” on page 57*
3. For draining the lubricant, remove the screw plug from the drain hole and drain the lubricant.
4. Tightly close the drain hole.
5. Remove the closure from the fill hole for filling.
6. Fill the lubricant up to the optimum fill level having regard to the information in the lubricant list. *Chapter 9.9 “Lubricant list” on page 215*
7. Properly close the fill hole with the closure removed previously. If the breather had to be removed, reinstall it with the opening facing downwards.

PL / HPL

Rotary lobe pump BLUEline (Legend) / Multicrusher

Fill quantity

Design (mounting position)	Gear unit		Intermediate chamber	
	approx. [l]	approx. [gal]	approx. [l]	approx. [gal]
M1 (upright)	**2.3**	0.61	**1.1**	0.30
M2 (vertical)	**3.4**	0.90	**1.2**	0.32
M3 (upside-down)	**2.3**	0.61	**1.1**	0.30
M5, M6 (turned 90°)	**1.6**	0.42	**0.9**	0.24

6.3 Repairs

WARNING!
Risk of injury due to inadequate troubleshooting, maintenance and repair work!

Inadequate troubleshooting, maintenance and repair work can lead to severe injury and significant material damage.

- To the extent necessary, amply secure the surrounding area when performing maintenance. Cordon off the working area with a red and white safety chain and a warning sign.
- Ensure sufficient installation space before commencing work.
- Keep the installation site clean and tidy! Loosely stacked or scattered components and tools cause accidents.
- Ensure correct installation where components have been removed, reinstall all fastening elements and observe the tightening torques of screws.
- Ensure the following before putting the machine back into operation:
  - Ensure that all troubleshooting, maintenance and repair work is performed and completed as per the information and notes provided in this manual.
  - Ensure that nobody enters the hazardous area.
  - Ensure that all covers and safety features are installed and function correctly.

CAUTION!
Health hazard due to residues of dangerous medium inside and on the Börger machine!

There is an increased health hazard from contact with the medium and contaminated components.

Generally, the following applies:

- When using dangerous or health-endangering media, take all necessary safety measures when performing work on the Börger machine.
- Avoid direct contact with the medium (skin/eye contact, swallowing, inhaling).
- Remove spillage from your skin without delay.
- Do not store or consume beverages, food or tobacco in the working area.

6.3.1 Notes on repair work

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Shut down the Börger machine and downstream and upstream system components. *Chapter 5.3 “Downtimes” on page 111*
— Secure the Börger machine against unauthorized or uncontrolled reactivation. *Chapter 2.7 “Securing the machine against restart” on page 26*
— Relieve the pressure in the Börger machine *Chapter 6.1.2 “Pressure relief” on page 127*.
— Clean the interior of the Börger machine *Chapter 6.1.3 “Internal cleaning” on page 129*.

1. Thoroughly clean all parts and the working chamber of the machine before reinstalling removed parts.
2. Check all removed parts for wear and only reuse them if they are undamaged.
3. Only replace worn components, seals, screws, nuts etc., but especially the wetted parts, with original spare parts according to the following instructions.

NOTE!
Assembly drawing / spare parts list

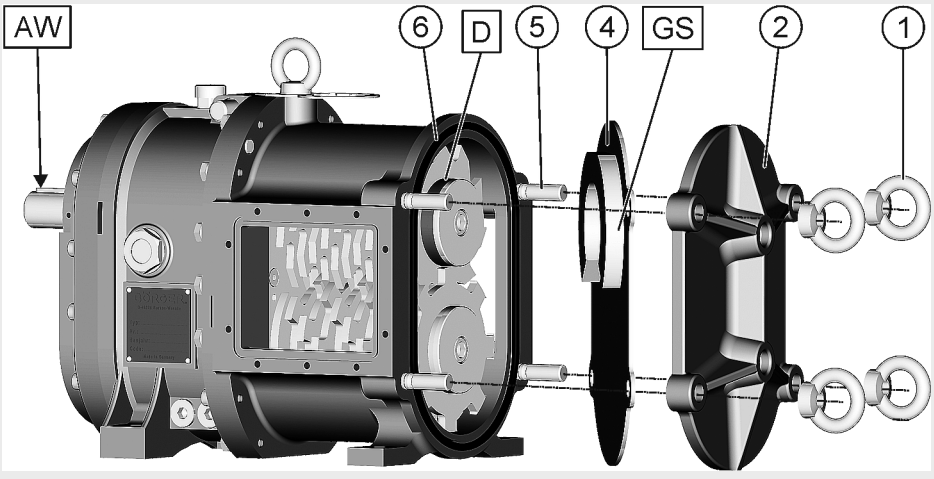
— Observe the assembly drawing of the Börger machine. *Chapter 9.3 “Assembly drawing” on page 198*
— Observe the spare parts list of the Börger machine. *Chapter 9.4 “Spare parts list” on page 200*

6.3.2 Opening and closing the quick-release cover

WARNING!
Severe injury due to residual pressure!

Despite having depressurized the Börger machine, it may be under residual pressure in the event of congestion or lump formation in the medium.

— Take extra care when removing the flange connections and maintenance openings to prevent accidents caused by the release of residual pressure.



1	Ring nut	**AW**	Drive shaft
2	Quick-release cover	**D**	Spacer ring
4	Cover-side casing protection plate	**GS**	Counter blade
5	Stud screw		
6	O-ring		

All parts on the Börger machine that are subject to wear are accessible after the quick-release cover has been removed.

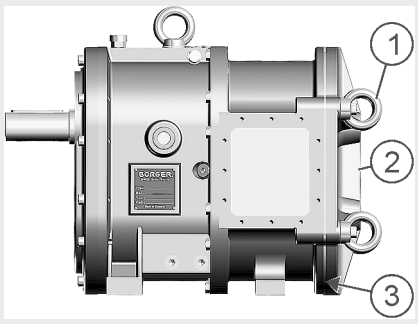
Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

—
— Shut down the Börger machine and downstream and upstream system components. ↳ *Chapter 5.3 “Downtimes” on page 111*
— Secure the Börger machine against unauthorized or uncontrolled reactivation. ↳ *Chapter 2.7 “Securing the machine against restart” on page 26*
— To the extent necessary, amply secure the surrounding area when performing maintenance. Cordon off the working area with a red and white safety chain and a warning sign.
— Relieve the pressure in the Börger machine according to ↳ *Chapter 6.1.2 “Pressure relief” on page 127*.

1. **<u>Opening the quick-release cover:</u>**

Use a suitable cover to prevent the medium from spouting out.



2. Place a drip pan underneath.

3. Loosen the four ring nuts (1) uniformly by approx. 5 mm (.20") using a wrench.

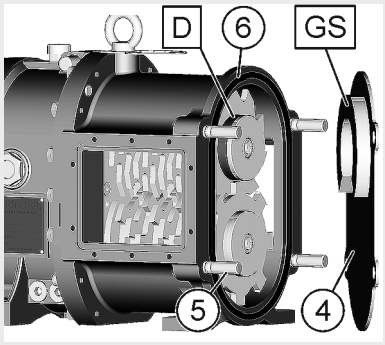
4. Initially, only open the cover (2) at the bottom (3, on standing versions) by a small gap (approx. 5 mm (.20")) to allow all residual pressure to escape and catch any flow medium that spouts out.

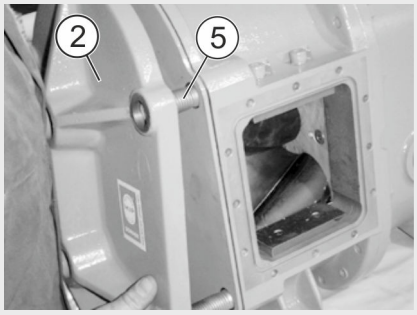
5. Completely loosen and remove the four ring nuts (1).

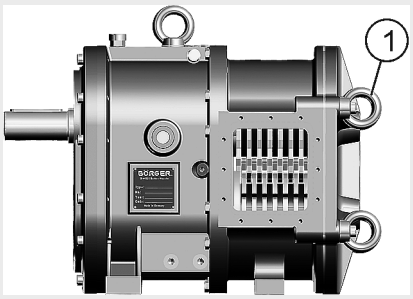
6. Remove the quick-release cover (2).

7. Remove the cover-side casing protection plate (4).
8. Clean the interior of the Börger machine. *Chapter 6.1.3 “Internal cleaning” on page 129*
9. **Closing the quick-release cover:**

   Check the O-ring (6). Replace the O-ring (6) if it shows signs of damage.







10. Clean the O-ring groove before inserting/reinserting the O-ring (6).
11. Press the O-ring seal (6) carefully into the O-ring groove.
12. Clean the cover-side casing protection plate (4) and check the casing protection plate (4) for wear. If the cover-side casing protection plate (4), especially the counter blade [GS], exhibits signs of wear, the plate has to be replaced.
13. Attach the cover-side casing protection plate (4) in such a way that it corresponds to the blade arrangement. The counter blade [GS] must be oriented around the shaft of which the first blade has the larger distance to the casing protection plate (4), see the figures of the installation of blades and spacer rings in *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.
14. Push the quick-release cover (2) over the stud screws (5) and fasten it with the ring nuts (1).
15. Tighten the ring nuts (1) crosswise with uniform strength using a wrench. Take care not to damage the O-ring (6) or to push it out of position.

    Make sure that the ring nuts (1) are fastened tight enough so they cannot be loosened by hand.

NOTE!
Replacing the casing protection plate

If the cover-side casing protection plate is damaged, make sure that you use a suitable new casing protection plate.

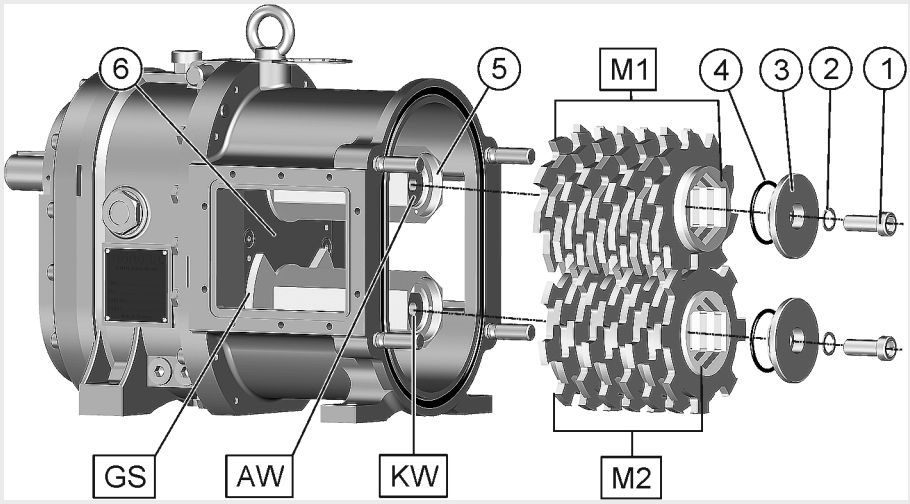
— The counter blades differ in size for the blade thicknesses 5 mm (.20") and 8 mm (.31") and the casing protection plates are not interchangeable on the Multicrusher, unlike the rotary lobe pump.

6.3.3 Replacing the blades and spacer rings

DANGER!
Risk of injury due to rotating parts!

Moving parts can cause severe injury.

— Do not reach into rotating parts or handle rotating parts when the machine is in operation.
— Never open protective covers when in operation.
— Perform work on the Börger machine only when stationary.
— Observe the delay time: Prior to opening protective covers, make sure that all components have stopped moving.
— Shut down the machine and upstream and downstream system components before carrying out any work on the Börger machine or accessories. ↳ *Chapter 5.3 “Downtimes” on page 111*
— The operating person is obligated to check that all safety equipment is installed and fully functional before putting the machine into operation.
— The Börger machine must only be switched on when the inlet and outlet connections have been established and the maintenance openings have been securely installed.



1	Hexagon socket head cap screw	**GS**	Counter blade
2	Sealing washer	**AW**	Drive shaft
3	Cover disk	**KW**	Short shaft
4	O-ring	**M1**	Blades, spacer rings on the drive shaft
5	Hexagonal shaft	**M2**	Blades, spacer rings on the short shaft
6	Gear-side casing protection plate		

Rotor / hexagonal shaft (tightening torques)

Size	Fastening screw (rotor) (hexagonal shaft) Thread	Tightening torques					
		Pump / Multicrusher approx. [Nm]		Counter bearing approx. [Nm]		Counter bearing with mechanical seal approx. [Nm]	
		Steel (10.9)	Stainless steel	Steel (10.9)	Stainless steel	Steel (10.9)	Stainless steel
AL HAL	M 12	80	50	70	40	-	-
AN HAN	M 12	80	50	-	-	-	-
PL HPL	M 16	220	120	180	100	-	-
PN	M 16	220	120	-	-	-	-
QN	M 16	220	120	-	-	-	-
CL HCL	M 16	220	120	180	100	-	-
FL HFL	M 20	400	240	350	180	-	-
EL	M 20	400	240	350	180	480	-
XL	M 24	800	400	600	300	800	-

Size	Fastening screw (rotor) (hexagonal shaft) Thread	Tightening torques					
		Pump / Multicrusher approx. [in-lbs]		Counter bearing approx. [in-lbs]		Counter bearing with mechanical seal approx. [in-lbs]	
		Steel (10.9)	Stainless steel	Steel (10.9)	Stainless steel	Steel (10.9)	Stainless steel
AL HAL	M 12	710	445	620	355	-	-
AN HAN	M 12	710	445	-	-	-	-
PL HPL	M 16	1950	1065	1595	885	-	-
PN	M 16	1950	1065	-	-	-	-
QN	M 16	1950	1065	-	-	-	-
CL HCL	M 16	1950	1065	1595	885	-	-
FL HFL	M 20	3540	2130	3100	1595	-	-
EL	M 20	3540	2130	3100	1595	4250	-
XL	M 24	7080	3540	5310	2655	7080	-

The arrangement of blades [M1, M2] can be determined from the code in the data sheet. ↬ *Chapter 3.1.3 “Cutting unit” on page 49*

The following section lists the standard combinations and arrangements.

For special applications, blade types G, F or S can also be installed on the short shaft. The arrangement variants apply for this accordingly.

The blade tips of the blade types G, F and S must point in the direction of rotation of the shaft. The shafts turn in opposite directions.

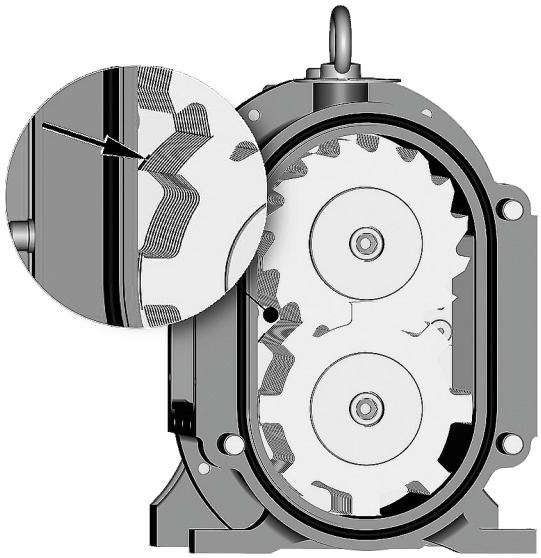
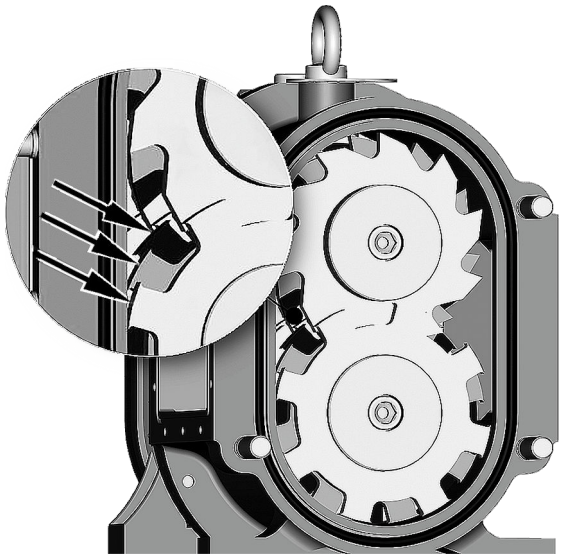
The installation sequence of the different spacer rings and blades and the specific arrangement variants (blocks, individual) with the various blade thicknesses for the particular Multicrusher type are shown in the following figures. The blade type shown is an example. ↬ *Chapter 3.1.3 “Cutting unit” on page 49*

NOTE!
Sequence of the blades and spacer rings

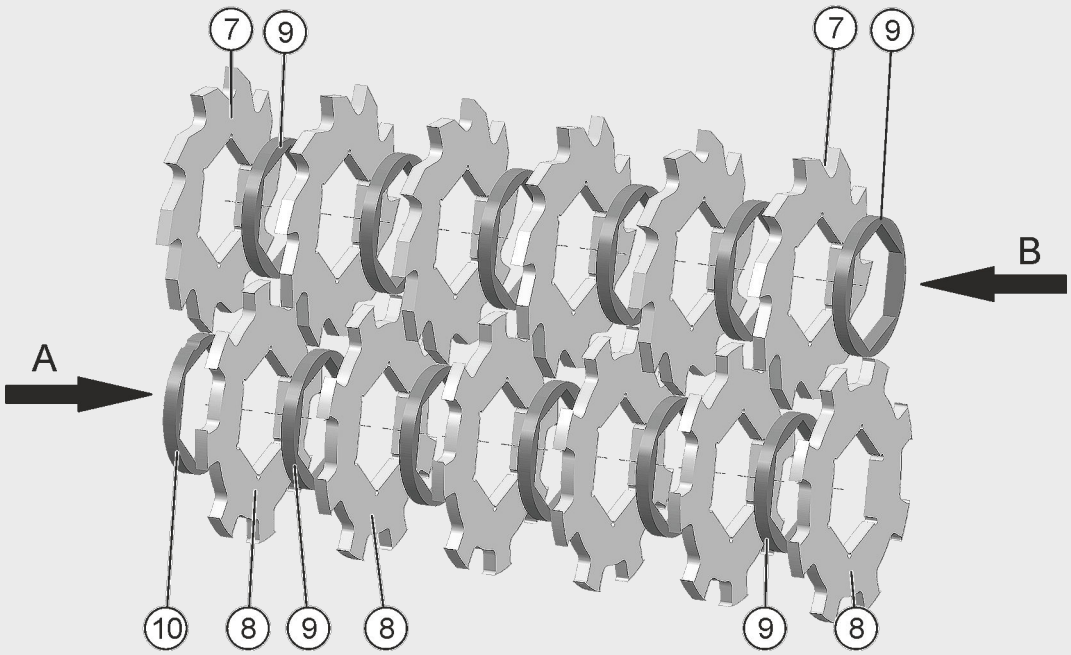
Before removing the blades [M1, M2], make sure that the necessary sequence of the blades and spacer rings (arranged in blocks, arranged individually), the radial alignment of the blades with each other (parallel or offset) and the installation direction of the blade tips that corresponds to the direction of rotation have been recorded so they can be reinstalled correctly. See the following figures. ↳ *Chapter 3.1.3 “Cutting unit” on page 49*

Blades and spacer rings or all blades and all spacer rings do not need to be replaced at the same time in every case. If you wish to reuse blades or spacer rings, make sure they are free of damage.

Arranged individually (code E)
— The alignment must be parallel or offset — Check before removing the blades!

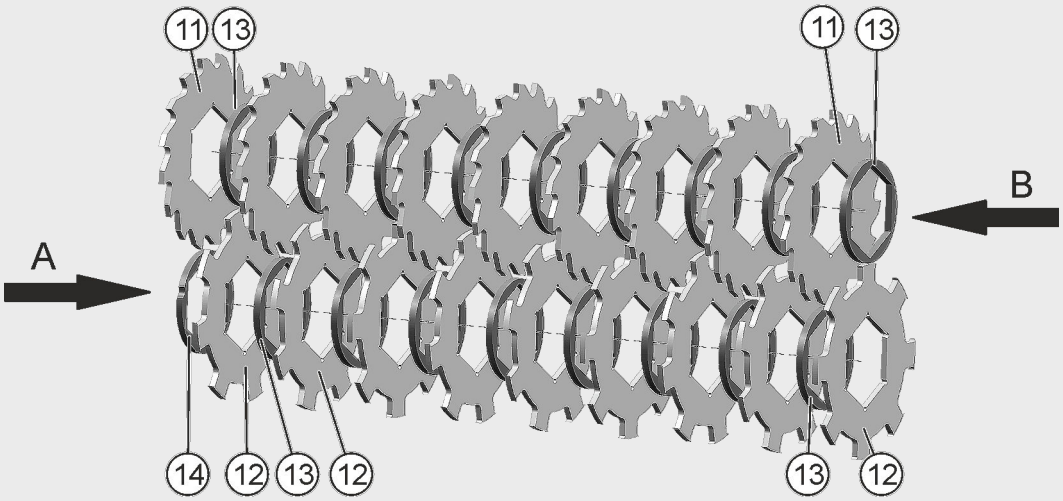
Parallel alignment (code p)	**Offset alignment** (code v)
	

a) HPL 200, blade thickness 8 mm (.31"), 6 blades per shaft



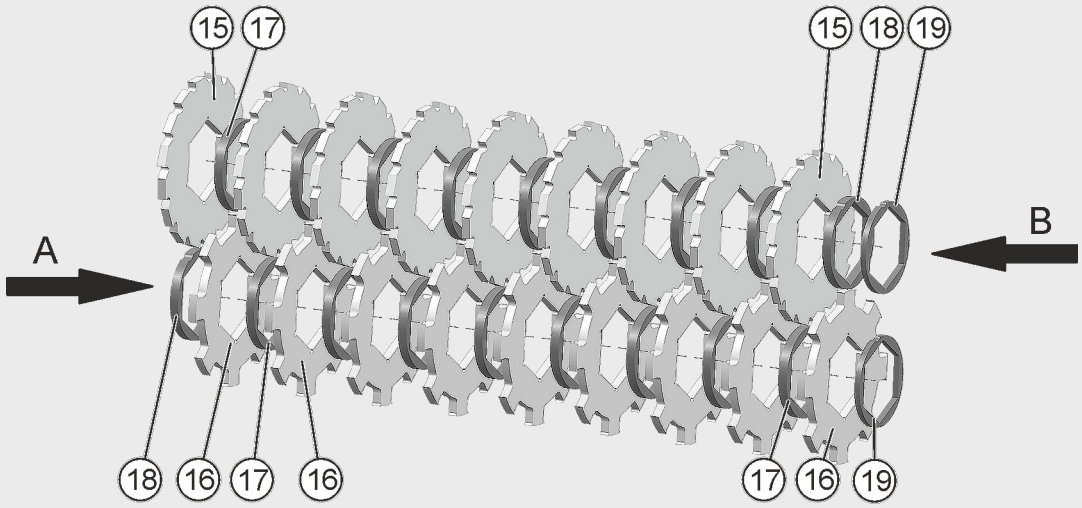
7	Blade types G, F or S, 8 mm (.31")	A	Gear-side counter blade
8	Blade type R, 8 mm (.31")	B	Cover-side counter blade
9	Spacer ring 8.5 mm (.33") (6x on AW, 5x on KW)		
10	Spacer ring 8.25 mm (.32") (1x on KW)		

b) HPL 200, blade thickness 5 mm (.20"), 9 blades per shaft



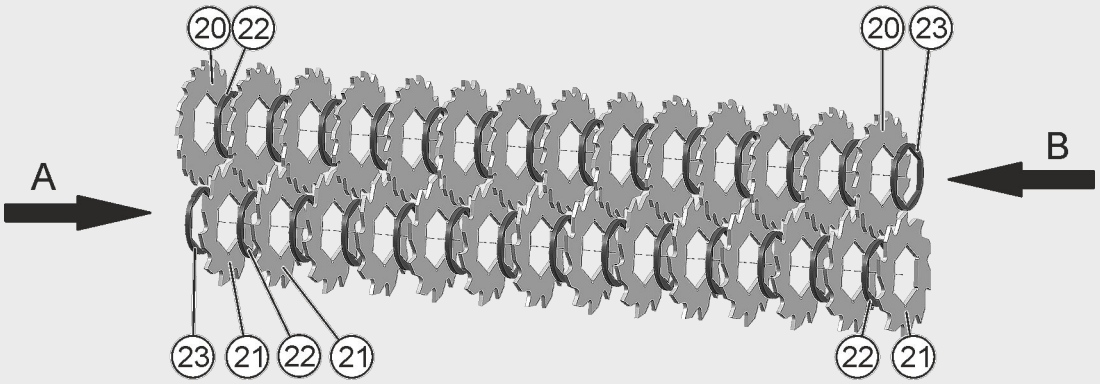
11	Blade types G, F or S, 5 mm (.20")	A	Gear-side counter blade
12	Blade type R, 5 mm (.20")	B	Cover-side counter blade
13	Spacer ring 6 mm (.24") (9x on AW, 8x on KW)		
14	Spacer ring 5.5 mm (.22") (1x on KW)		

c) HPL 300, blade thickness 8 mm (.31"), 9 blades per shaft



15	Blade types G, F or S, 8 mm (.31")	A	Gear-side counter blade
16	Blade type R, 8 mm (.31")	B	Cover-side counter blade
17	Spacer ring 8.5 mm (.33") (8x on AW, 8x on KW)		
18	Spacer ring 8.25 mm (.32") (1x on AW, 1x on KW)		
19	Spacer ring 5.5 mm (.22") (1x on AW, 1x on KW)		

d) HPL 300, blade thickness 5 mm (.20"), 14 blades per shaft

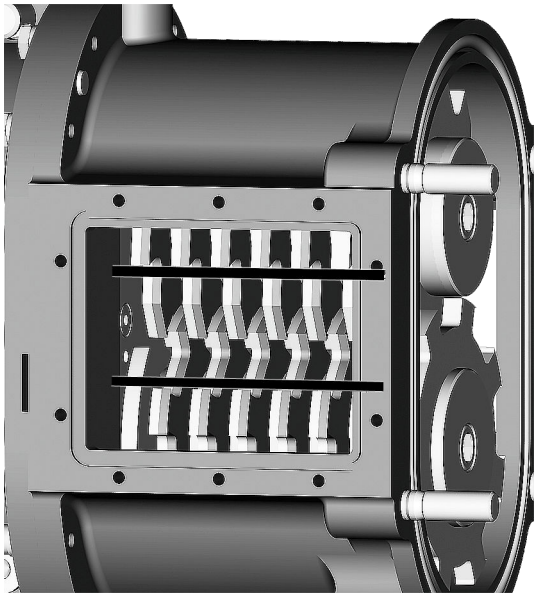
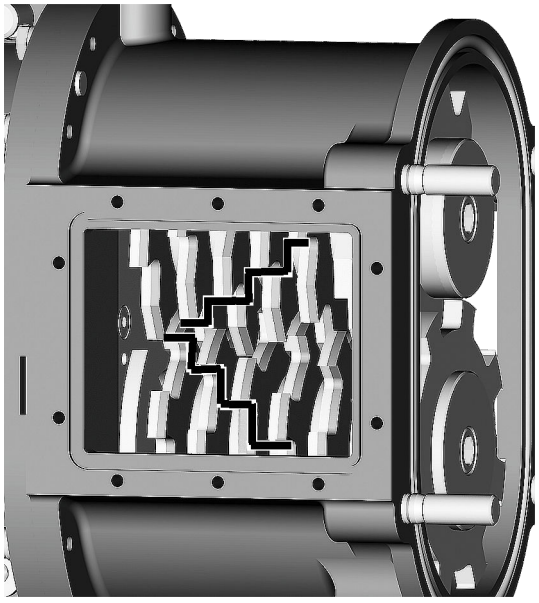


20	Blade types G, F or S, 5 mm (.20")	A	Gear-side counter blade
21	Blade type R, 5 mm (.20")	B	Cover-side counter blade
22	Spacer ring 6 mm (.24") (13x on AW, 13x on KW)		
23	Spacer ring 5.5 mm (.22") (1x on AW, 1x on KW)		

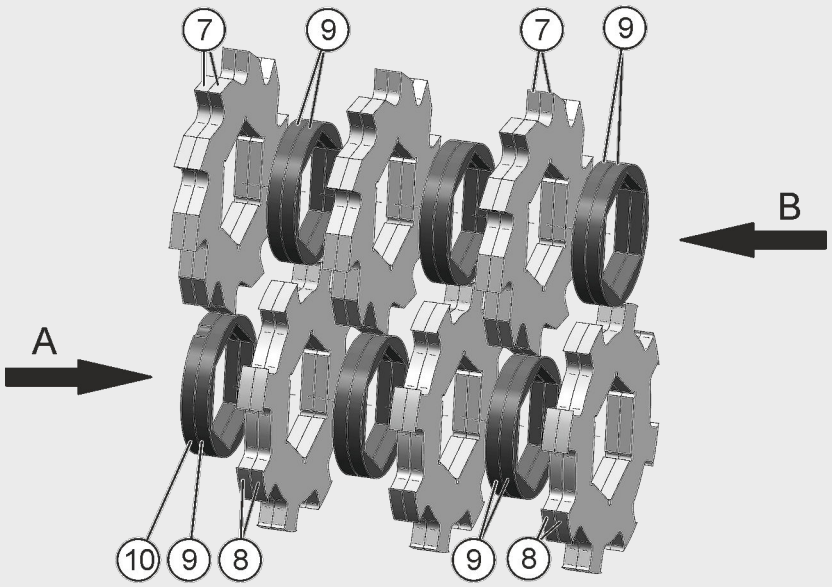
Arranged in blocks of two (code B)

The alignment must be parallel or offset

— Check before removing the blades!

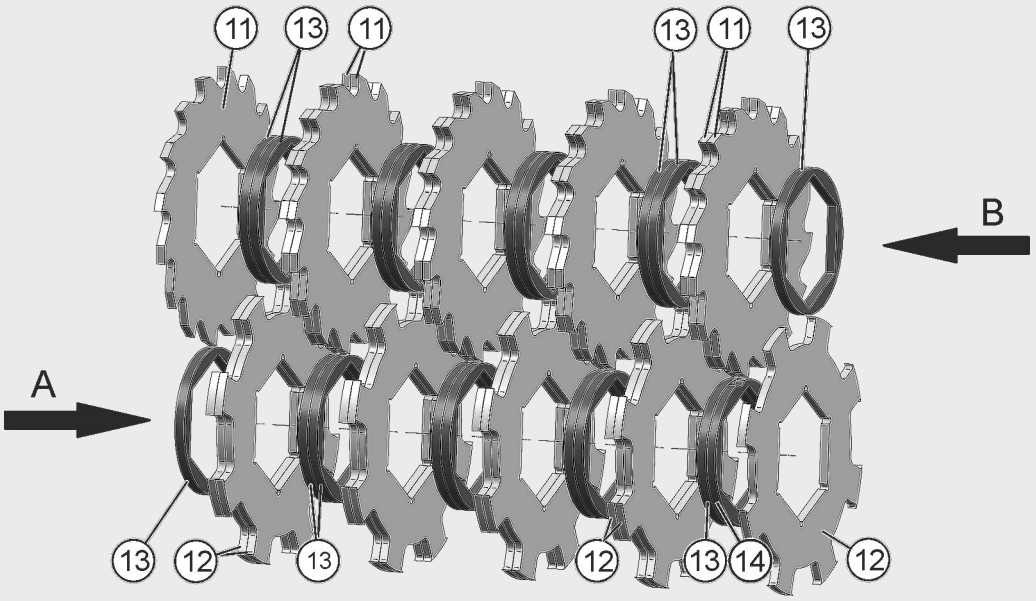
Parallel alignment (code p)	**Offset alignment** (code v)
	

e) HPL 200, blade thickness 8 mm (.31"), 6 blades per shaft, blocks



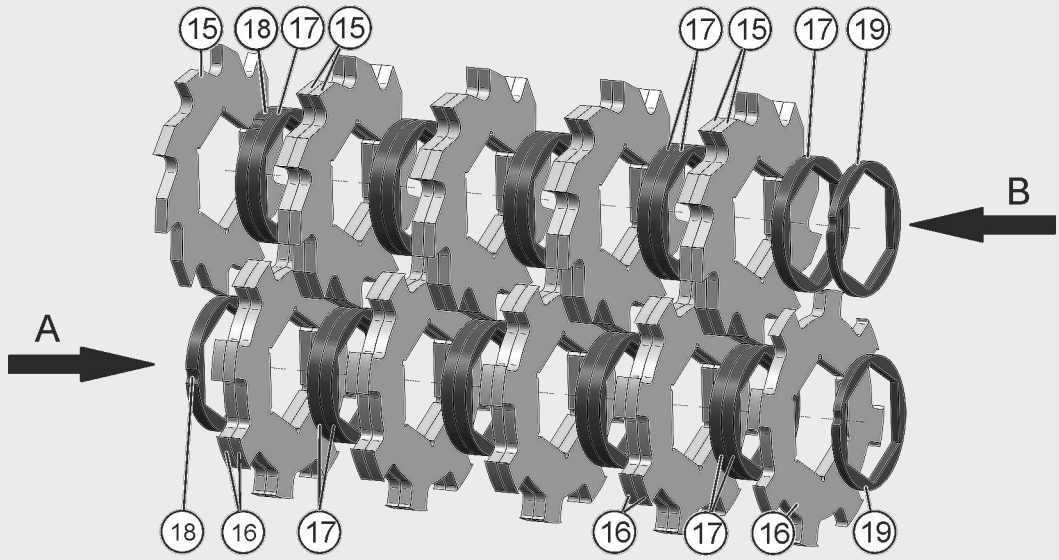
7	Blade types G, F or S, 8 mm (.31")	A	Gear-side counter blade
8	Blade type R, 8 mm (.31")	B	Cover-side counter blade
9	Spacer ring 8.5 mm (.33") (6x on AW, 5x on KW)		
10	Spacer ring 8.25 mm (.32") (1x on KW)		

f) HPL 200, blade thickness 5 mm (.20"), 9 blades per shaft, blocks



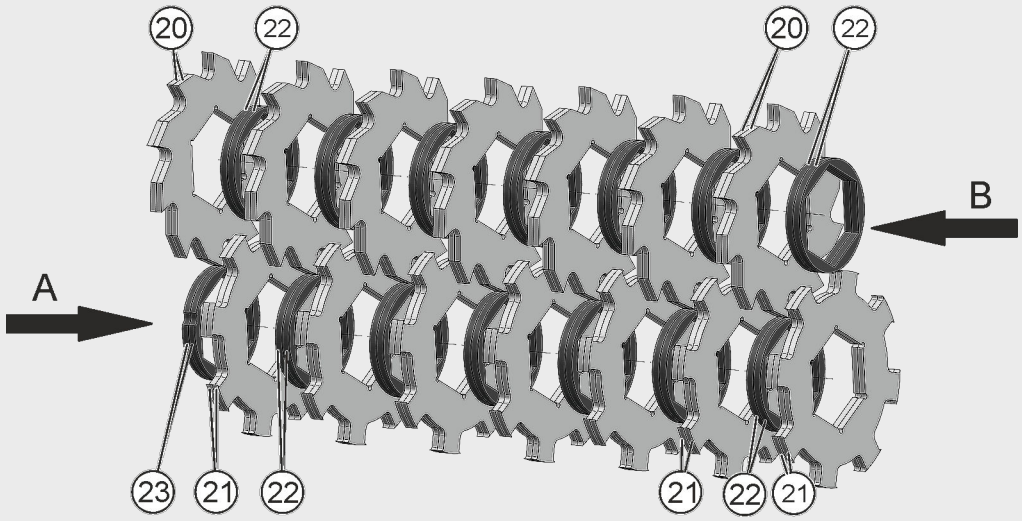
11	Blade types G, F or S, 5 mm (.20")	A	Gear-side counter blade
12	Blade type R, 5 mm (.20")	B	Cover-side counter blade
13	Spacer ring 6 mm (.24") (9x on AW, 8x on KW)		
14	Spacer ring 5.5 mm (.22") (1x on KW)		

g) HPL 300, blade thickness 8 mm (.31"), 9 blades per shaft, blocks



15	Blade types G, F or S, 8 mm (.31")	A	Gear-side counter blade
16	Blade type R, 8 mm (.31")	B	Cover-side counter blade
17	Spacer ring 8.5 mm (.33") (8x on AW, 8x on KW)		
18	Spacer ring 8.25 mm (.32") (1x on AW, 1x on KW)		
19	Spacer ring 5.5 mm (.22") (1x on AW, 1x on KW)		

h) HPL 300, blade thickness 5 mm (.20"), 14 blades per shaft, blocks



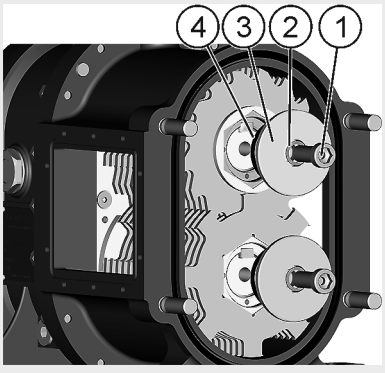
20	Blade types G, F or S, 5 mm (.20")	A	Gear-side counter blade
21	Blade type R, 5 mm (.20")	B	Cover-side counter blade
22	Spacer ring 6 mm (.24") (14x on AW, 12x on KW)		
23	Spacer ring 5.5 mm (.22") (2x on KW)		

Tool: ■ Torque wrench

Be sure to read and follow all instructions:

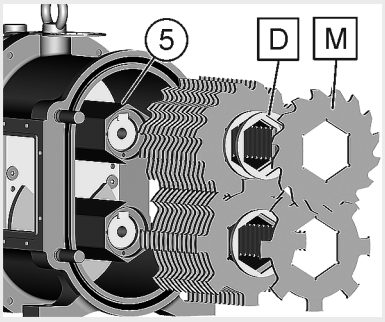
— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Shut down the Börger machine and downstream and upstream system components. ↳ *Chapter 5.3 “Downtimes” on page 111*
— Secure the Börger machine against unauthorized or uncontrolled reactivation. ↳ *Chapter 2.7 “Securing the machine against restart” on page 26*
— Relieve the pressure in the Börger machine. ↳ *Chapter 6.1.2 “Pressure relief” on page 127*
— Open the quick-release cover. ↳ *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*
— Clean the interior of the Börger machine. ↳ *Chapter 6.1.3 “Internal cleaning” on page 129*

1. Block the blades by clamping an object with no sharp edges between the blades, e.g. a plastic wedge.

2. 

Loosen the hexagon socket head cap screws (1) using a 14 mm hexagon socket wrench, then remove the screws and sealing washers (2).

3. In each case, remove the cover disk (3) and O-ring (4) using a suitable hook or two slotted screwdrivers.

4. 

Pull the blades [M] and the spacer rings [D] off the hexagonal shafts (5) one after the other.

5. Thoroughly clean all parts and the cutting chamber before reinstalling removed parts.

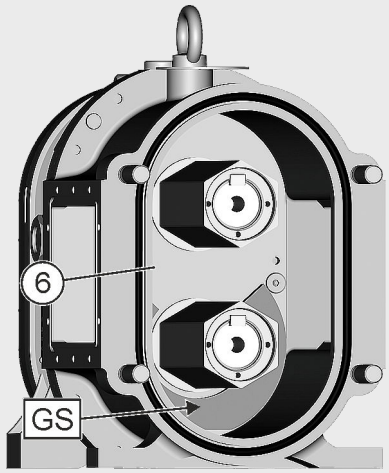
6. Check all removed parts for wear and only reuse them if they are undamaged.

7. Check the hexagonal shafts (5) for wear and replace them when necessary, see *Chapter 6.3.4 “Replacing the hexagonal shaft” on page 168*.

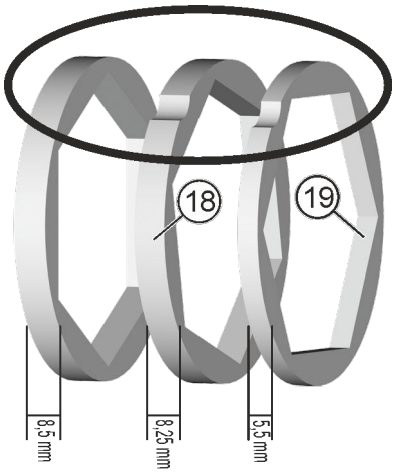
NOTE!

Some quench fluid may escape from between the hexagonal shaft and the carrier shaft as a result of the normal lubricating function. This is not a malfunction.

8.



The casing protection plates are fitted with counter blades [GS].
As standard, the gear-side casing protection plate (6) is mounted so that the counter blade [GS] is oriented around the short shaft (i.e. the shaft that is not connected to the drive).
When installing the blades and spacer rings at the position where the counter blade [GS] is attached to the gear-side casing protection plate, always start with a spacer ring or with two spacer rings for some versions.

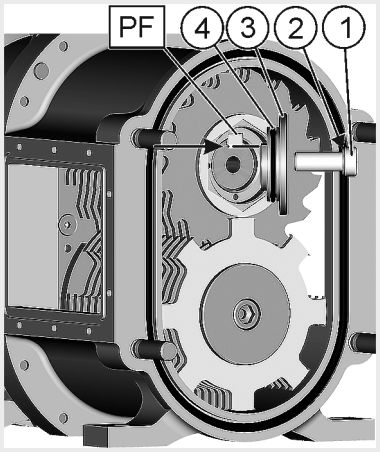


The narrower spacer rings can generally be distinguished from the wider spacer rings by a notch.
The narrow spacer rings 18 and 19 can be distinguished from each other by the clear difference in their thicknesses.

Push the suitable spacer rings and blades onto the shafts in accordance with the specified arrangement (blocks or individual) and radial alignment (parallel or offset) as shown in the figures a) to h) for the different blade thicknesses and arrangements.

Strictly comply with the positions of the narrower spacer rings. Otherwise, the cutting unit may not function properly. Consider the required installation direction of the directional blade types G, F or S for your application. ↬ *Chapter 3.1.3 “Cutting unit” on page 49*

9.



Use new O-rings (4) and coat them depending on their resistance, e.g. with oil or flushing agent.

10. Use new cover disks (3) if required.

11. In each case, push on the cover disk (3) with the O-ring (4) correctly fitted into the groove so that the recess points towards the parallel key [PF].

12. Use new sealing washers (2).

13. In each case, screw in the hexagon socket head cap screws (1) with the sealing washer (2).

14. Tighten the hexagon socket head cap screws (1) applying the appropriate torque.

15. Check that the installed blades run smoothly. The easiest way of doing this is by turning the drive shaft **clockwise** with an appropriate amount of force using a hexagon socket wrench or a ratchet.

NOTE!
Troubleshooting when checking for smooth running.

A spacer ring that is too thin and in an incorrect position can have the result that the blades of the drive shaft and the short shaft do not have the required distance to each other and rub against each other.

— Make sure that the correct spacer rings are used at the correct position.

If the fastening screw of the cutting unit is not tightened with the prescribed torque, the blades can become bent.

— Install the cutting unit correctly.

An incorrect or unsuitable blade can also hinder smooth running.

— Make sure that the correct blades have been used. Make sure that the blades used are not damaged.

A worn hexagonal shaft (5) can also hinder smooth running.

— If necessary, replace the hexagonal shaft (5), see *Chapter 6.3.4 “Replacing the hexagonal shaft” on page 168*.

16. Attach the cover-side casing protection plate and quick-release cover in accordance with *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*.

17. Before releasing the Multicrusher, check once again that it runs smoothly by switching the drive on **briefly**.

If correct true-running is not obtained, the cause must be determined and the installation must be corrected.

6.3.4 Replacing the hexagonal shaft

DANGER!
Risk of injury due to rotating parts!

Moving parts can cause severe injury.

— Do not reach into rotating parts or handle rotating parts when the machine is in operation.
— Never open protective covers when in operation.
— Perform work on the Börger machine only when stationary.
— Observe the delay time: Prior to opening protective covers, make sure that all components have stopped moving.
— Shut down the machine and upstream and downstream system components before carrying out any work on the Börger machine or accessories. ↳ *Chapter 5.3 “Downtimes” on page 111*
— The operating person is obligated to check that all safety equipment is installed and fully functional before putting the machine into operation.
— The Börger machine must only be switched on when the inlet and outlet connections have been established and the maintenance openings have been securely installed.

NOTICE!

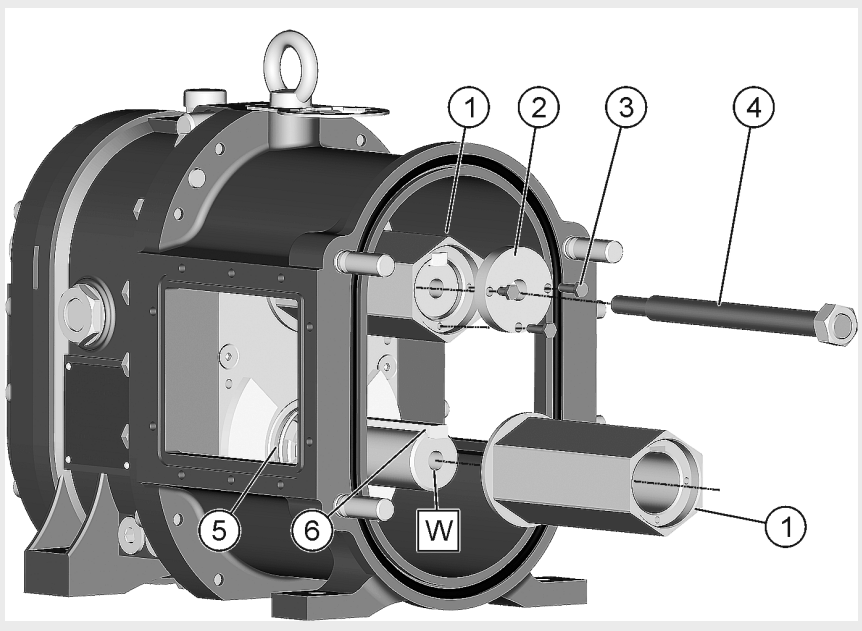
Risk of damage due to incorrect cleaning and switching on the machine without a hexagonal shaft installed!

If the hexagonal shaft is not properly installed, the parallel key cannot reliably fix the rotating seal holding bushes. This may cause permanent damage to the Multicrusher.

— Do not use pressurized fluid in the cutting chamber and never switch the Multicrusher on, even for testing or cleaning, if the hexagonal shafts are not properly installed.

NOTE!
Inspection of the condition of the hexagonal shaft

Only in rare exceptional cases , the hexagonal shaft must be replaced. However, regular inspections of the condition of the hexagonal shaft are recommended. Ensure that there is no excessively large play between the blades and the hexagonal profile. Otherwise, the blades no longer turn while the shaft continues rotating. If the blades can be moved by more than 5° on the hexagonal shaft, the hexagonal shaft must be replaced.



1	Hexagonal shaft	**5**	O-ring
2	Auxiliary puller for hexagonal shaft	**6**	Parallel key
3	Screw for auxiliary puller	**W**	Shaft
4	Puller		

Tool:

- Puller and auxiliary puller for hexagonal shaft

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Shut down the Börger machine and downstream and upstream system components. ↳ *Chapter 5.3 “Downtimes” on page 111*
— Secure the Börger machine against unauthorized or uncontrolled reactivation. ↳ *Chapter 2.7 “Securing the machine against restart” on page 26*
— Relieve the pressure in the Börger machine. ↳ *Chapter 6.1.2 “Pressure relief” on page 127*
— Open the quick-release cover. ↳ *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*
— Clean the interior of the Börger machine. ↳ *Chapter 6.1.3 “Internal cleaning” on page 129*

1. Remove the blades and spacer rings in accordance with ↳ *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.
2. Secure the auxiliary puller (2) for hexagonal shafts with the three screws (3) on the corresponding hexagonal shaft (1).
3. Screw in the puller (4) and pull the respective hexagonal shaft (1) off the shaft [W].

NOTE!
Escape of quench fluid

Some quench fluid may escape from between the rotating seal holding bush and shaft as a result of the normal lubricating function. This is not a malfunction.

4. Thoroughly clean all parts and the cutting chamber before reinstalling removed parts.

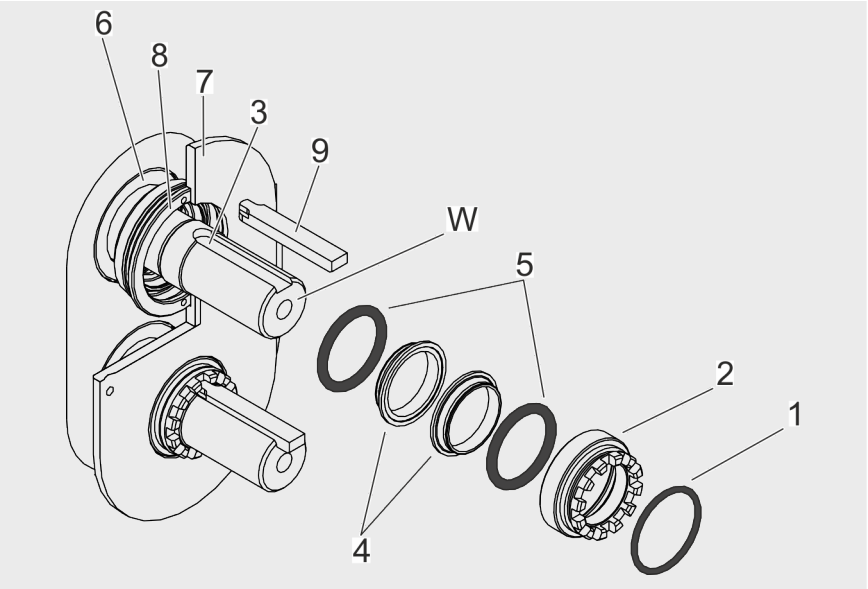
5. Check the O-rings (5) on the rotating seal holding bushes and replace them when necessary, see *Chapter 6.3.5 “Replacing the mechanical seal” on page 172*.

NOTE!
Börger GmbH recommends:

— Always replace the O-rings as well in this situation.

6. Check all removed parts for wear and only reuse them if they are undamaged.
7. Check the condition and correct positioning of the parallel keys (6) in the shafts [W]. *Chapter 6.3.5 “Replacing the mechanical seal” on page 172* *Chapter 9.5 “Parallel keys” on page 209*
8. Oil the shafts [W] and the fit bore of the new hexagonal shaft (1) in each case.
9. Push on the new hexagonal shaft (1) up to its stop limit on the shaft [W] so that the parallel key (6) fits into the keyway of the hexagonal shaft (1). If required, use a plastic mallet.
10. Install the blades and spacer rings, cover disks with new O-rings and hexagon socket head cap screws with new sealing washers and tighten the hexagon socket head cap screws with the torque specified in *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.
11. Attach the cover-side casing protection plate and quick-release cover, see *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*.
12. Before releasing the Multicrusher, check that it runs smoothly by switching the drive on **briefly**. If correct true-running is not obtained, the cause must be determined and the installation must be corrected.

6.3.5 Replacing the mechanical seal



1	O-ring	**6**	Lip seal
2	Rotating seal holding bush	**7**	Gear-side casing protection plate
3	Keyway	**8**	Stationary seal holding bush
4	Seal faces	**9**	Parallel key
5	O-ring	**W**	Shaft

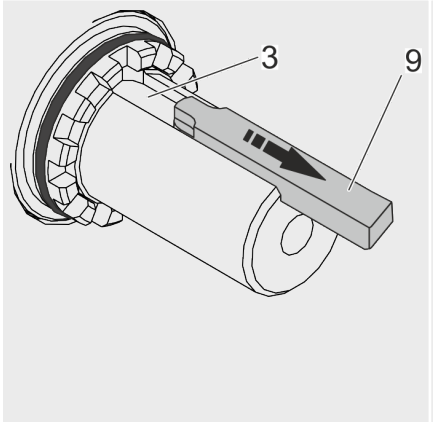
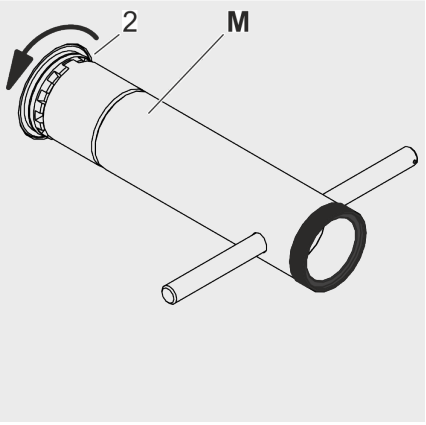
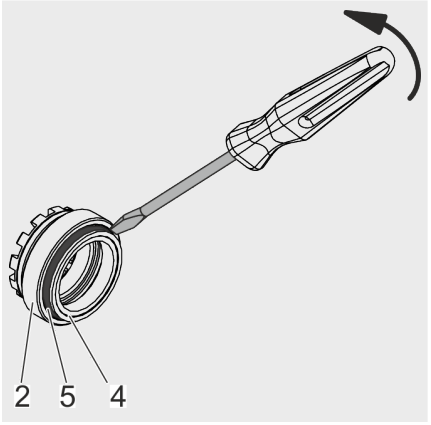
Tool: ■ Multitool [M]

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Shut down the Börger machine and downstream and upstream system components. ↳ *Chapter 5.3 “Downtimes” on page 111*
— Secure the Börger machine against unauthorized or uncontrolled reactivation. ↳ *Chapter 2.7 “Securing the machine against restart” on page 26*
— Relieve the pressure in the Börger machine. ↳ *Chapter 6.1.2 “Pressure relief” on page 127*
— Open the quick-release cover. ↳ *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*
— Clean the interior of the Börger machine. ↳ *Chapter 6.1.3 “Internal cleaning” on page 129*

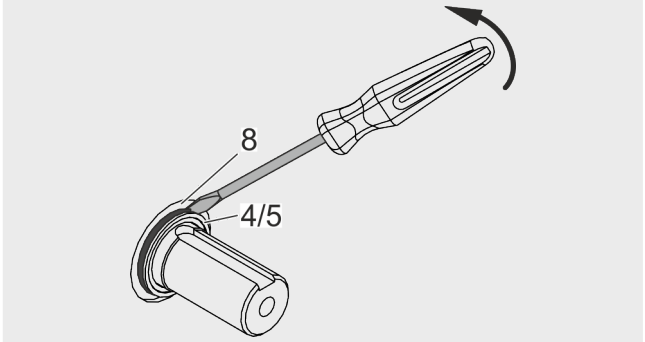
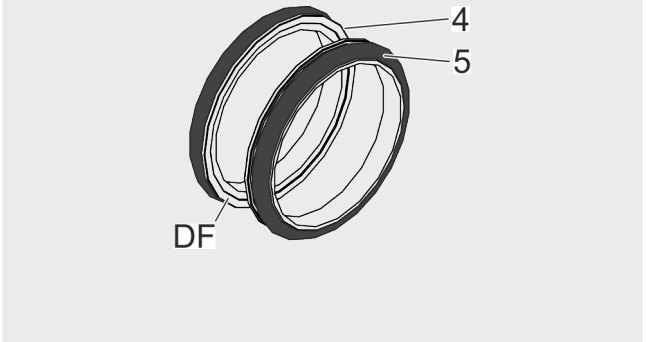
1. Remove the blades and spacer rings in accordance with ↳ *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.
2. Remove the hexagonal shaft in accordance with ↳ *Chapter 6.3.4 “Replacing the hexagonal shaft” on page 168*.
3. Empty the intermediate chamber in accordance with ↳ *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*.
4. Thoroughly clean the intermediate chamber following a leak in the mechanical seal in order to remove all medium deposits from the chamber and from in front of the lip seals (6). To do this, flush a suitable liquid (water, if appropriate) through the fill hole with the drain open, see designs and mounting positions. ↳ *Chapter 3.1.7 “Designs, mounting positions” on page 57*.
   — Also refer to the lubricant list for cleaning. ↳ *Chapter 9.9 “Lubricant list” on page 215*
5. In each case, lift the parallel key (9) out of the keyway (3) of the shaft using a suitable tool (e.g. small lever). Make sure that the parallel key is not damaged while doing this.

6. In each case, unscrew the rotating seal holding bush (2) using the special tool (**M**) and pull it off the shaft.

Removing the parallel key	Unscrewing the rotating seal holding bush	Rotating seal holding bushes - removing the seal faces
		

7. Remove the seal face (4) with O-ring (5) out of the corresponding rotating seal holding bush (2).

8. Remove the seal faces (4) with O-rings (5) out of the stationary seal holding bushes (8) remaining in the Börger machine using a suitable tool (e.g. screwdriver).

Stationary seal holding bushes - removing the seal faces	Fit O-rings, if required
	

9. Clean the O-ring seats with a suitable agent that is compatible with the seal material, quench fluid and medium, e.g. alcohol-based industrial cleaner.

10. Thoroughly clean all parts and the working chamber of the machine before reinstalling removed parts.

11. Check all removed parts for wear and only reuse them if they are undamaged.

NOTICE!
Risk of material damage due to incorrect handling of mechanical seals!

Make sure not to damage the sealing surfaces of the new seal faces.

— The sealing surfaces must be clean and should not be scratched.

12. If delivered separately, fit the O-rings (5) onto the new seal faces (4). The mechanical seals are normally equipped with O-rings on delivery.

NOTICE!
Risk of loss of seal function due to oil/grease on the O-rings of mechanical seals!

Material damage resulting from loss of seal function

— The O-rings of a mechanical seal must be installed without oil or grease.

NOTE!
Spray cleaner (degreaser)

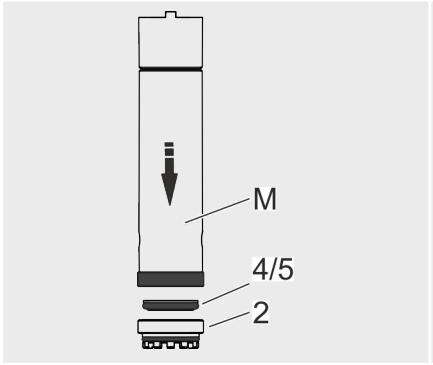
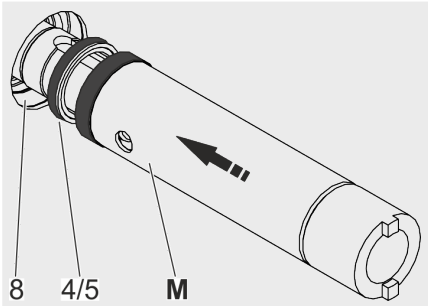
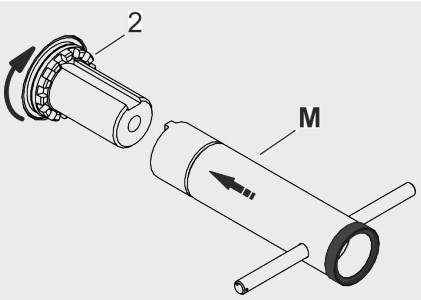
Generally, the seal faces equipped with O-rings can be inserted dry.

— In order to ensure that they are free of grease and to aid insertion, the O-rings can be sprayed lightly, depending on their resistance, with a quickly-volatilizing spray cleaner (degreaser) that leaves no residue.

13. Remove the handle from the Multitool (**M**).

14. Press one seal face (4) with O-ring (5) into each rotating seal holding bush (2) using the push-in tool for mechanical seals (M).

15. Press both remaining seal faces (4) with O-rings (5) into the stationary seal holding bushes (8) using the push-in tool for mechanical seals (**M**).

Press the mechanical seals into the rotating seal holding bushes (2)	Press the mechanical seals into the stationary seal holding bushes (8)	Screw in the rotating seal holding bushes (2)
		

16. Lightly coat the clean **sealing surfaces** [DF] of the seal faces (4) with suitable oil.

NOTICE!
Risk of material damage if the rotating seal holding bushes are installed incorrectly!

- First install one rotating holding bush with new mechanical seal completely according to the following description and secure the bush with the parallel key before installing the second rotating holding bush with new mechanical seal on the second shaft.
- If the rotating holding bush with thread is not secured when the shafts are turned, the position of the holding bush can imperceptibly change while the second bush is being aligned. Use the special tool / Multitool for the installation.

NOTICE!
Risk of material damage due to insufficient or excessive pre-tension of mechanical seals!

Risk of consequential damage if the rotating seal holding bushes are installed incorrectly.

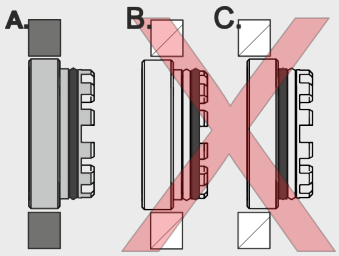
The pre-tension on the seal faces required for a correct seal is generated by the correct setting of the rotating holding bush.

— Do not **unscrew** the rotating seal holding bush **too far**.
— Do not **screw in** the rotating seal holding bush **too far**.

17. Flush installation

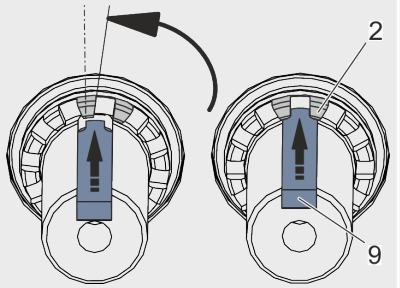
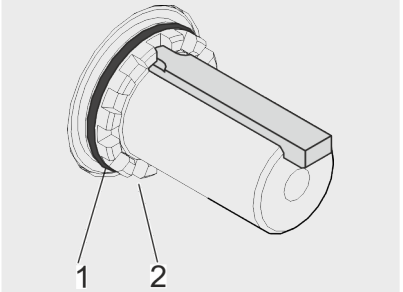
Screw in the rotating seal holding bush (2) flush with the gear-side casing protection plate (7) and then unscrew it until the first groove is aligned with the keyway, see step 16.

Flush installation



A	**Flush installation**
B	Recessed
C	Protruding

18. Insert the parallel key (9) so that it fits into the groove of the rotating seal holding bush (2) and the keyway of the shaft (3). The side of the parallel key must fit into the rotating seal holding bush with the nib upwards. If the parallel key consists of two or three pieces and there is a straight front on one of the parallel keys, then this must point towards the quick-release cover.

Insert the parallel key	Renew O-ring
	

19. Fit the new O-ring (1) onto the rotating seal holding bush (2). Only reuse an old O-ring when damage can be completely ruled out.

NOTE!
Installing the O-ring

Depending on the installation conditions, it might be easier to push the O-ring (1) into the groove of the rotating seal holding bush (2) prior to screwing in the rotating seal holding bush using the Multitool [**M**]. In doing so, ensure that the O-ring (1) is not damaged and not pushed out of its seat.

20. Install the second rotating seal holding bush with new mechanical seal in the same way.

21. Oil the outer surfaces of the shafts [W] and the fit bores of the hexagonal shafts and install the hexagonal shaft in accordance with *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.

22. Install the blades and spacer rings in accordance with *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.

    Check that the blades run smoothly:

    — If a rotating seal holding bush is screwed in too far, the collar of the hexagonal shaft rubs against the gear-side casing protection plate and the shaft can only turn with difficulty. If the rotating seal holding bushes are not installed equally, the hexagonal shafts are not parallel. The blades rub against each other.

      Remove the blades and the hexagonal shaft and unscrew the relevant rotating seal holding bush by $^{1}/_{12}$ of a turn (one groove).

    — If a rotating seal holding bush is not screwed in far enough, the hexagonal shaft with the cover disk protrudes on the cover side. In this case, the cover disk will rub on the cover-side casing protection plate when the ring nuts are tightened. If the rotating seal holding bushes are not installed equally, the hexagonal shafts are not parallel. The blades rub against each other.

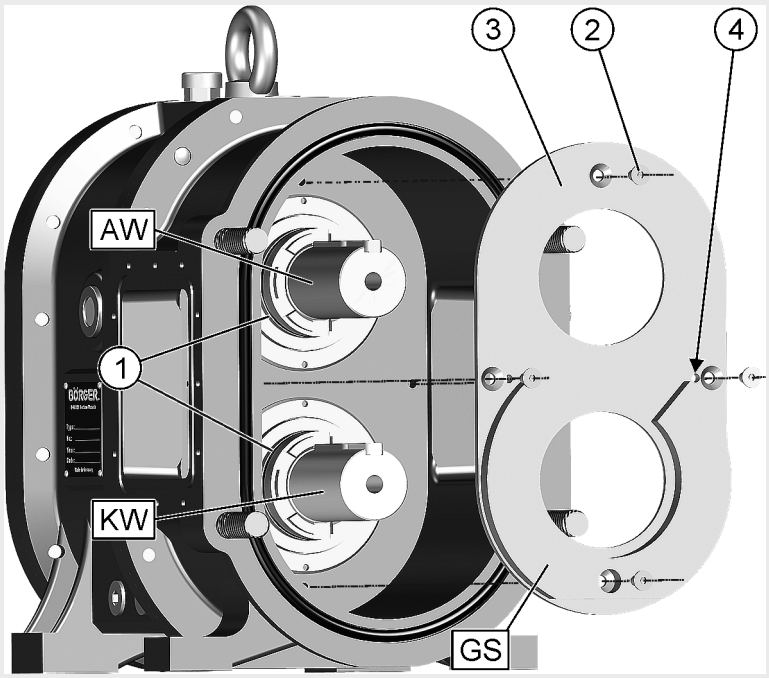
      If necessary, screw in the rotating seal holding bush further by $^{1}/_{12}$ of a turn (one groove).

23. Attach the cover-side casing protection plate and quick-release cover, see *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*.

24. Before releasing the Börger machine, check once again that it runs smoothly by switching the drive on **briefly**. If correct true-running is not obtained, the cause must be determined and the installation must be corrected.

25. Fill the intermediate chamber and close the fill hole in accordance with *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*.

6.3.6 Replacing the gear-side casing protection plate



1	O-ring f. rotating seal holding bush	**AW**	Drive shaft
2	Countersunk screw	**KW**	Short shaft
3	Gear-side casing protection plate	**GS**	Counter blade
4	Jacking thread		

Be sure to read and follow all instructions:

— on safety,

— on operation and control,

— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

— Shut down the Börger machine and downstream and upstream system components. ↳ *Chapter 5.3 “Downtimes” on page 111*

— Secure the Börger machine against unauthorized or uncontrolled reactivation. ↳ *Chapter 2.7 “Securing the machine against restart” on page 26*

— Relieve the pressure in the Börger machine. ↳ *Chapter 6.1.2 “Pressure relief” on page 127*

— Open the quick-release cover. ↳ *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*

— Clean the interior of the Börger machine. ↳ *Chapter 6.1.3 “Internal cleaning” on page 129*

1. Remove the blades and spacer rings in accordance with *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.
2. Remove the hexagonal shaft in accordance with *Chapter 6.3.4 “Replacing the hexagonal shaft” on page 168*.
3. Unscrew the countersunk screws (2) from the gear-side casing protection plate [standard: M8 with Torx® head, ISR-T40].
4. Screw two suitable screws into the threaded bores (4) to loosen the casing protection plate from the rear casing wall, then remove the plate.
5. Clean any sealing compound from the rear wall of the machine casing.

NOTE!

The casing protection plates are fitted with counter blades [GS]. As standard, mount the gear-side casing protection plate (3) in such a way that the counter blade [GS] is oriented around the short shaft [KW] (i.e. the shaft that is not connected to the drive).

- For blades with a thickness of 8 mm (.31"), a different casing protection plate is required than for blades with a thickness of 5 mm (.20").
- For blades with a thickness of 8 mm (.31"), a different casing protection plate with a counter blade is required than for blades with a thickness of 6 mm (.24").

6. Make sure that you use the appropriate, new casing protection plate for the blade thicknesses installed in your Multicrusher.
7. Apply sealing compound (position W1 of the spare parts list) to that side of the new casing protection plate which faces away from the medium.
8. Install the new gear-side casing protection plate with the counter blade [GS] oriented around the short shaft [KW] and secure it with the screws (2). For the position of the short shaft. *Chapter 3.1.4 “Multicrusher gear unit” on page 55*
9. Replace the O-rings (1) on the rotating seal holding bushes.

10. Attach the hexagonal shaft, see *Chapter 6.3.4 “Replacing the hexagonal shaft” on page 168*.
11. Install the blades and spacer rings, cover disks with new O-rings and hexagon socket head cap screws with new sealing washers and tighten the hexagon socket head cap screws with the torque specified in *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.
12. Attach the cover-side casing protection plate and quick-release cover, see *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*.

6.3.7 Modifications for changing the flow direction

DANGER!
Risk of injury due to rotating parts!

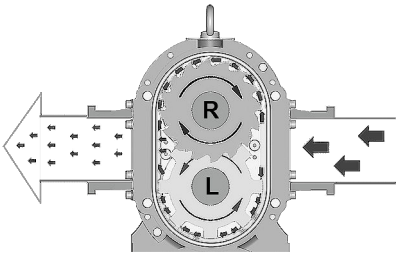
Moving parts can cause severe injury.

— Do not reach into rotating parts or handle rotating parts when the machine is in operation.
— Never open protective covers when in operation.
— Perform work on the Börger machine only when stationary.
— Observe the delay time: Prior to opening protective covers, make sure that all components have stopped moving.
— Shut down the machine and upstream and downstream system components before carrying out any work on the Börger machine or accessories. ↳ *Chapter 5.3 “Downtimes” on page 111*
— The operating person is obligated to check that all safety equipment is installed and fully functional before putting the machine into operation.
— The Börger machine must only be switched on when the inlet and outlet connections have been established and the maintenance openings have been securely installed.

Required directions of rotation of the shafts depending on the flow direction:

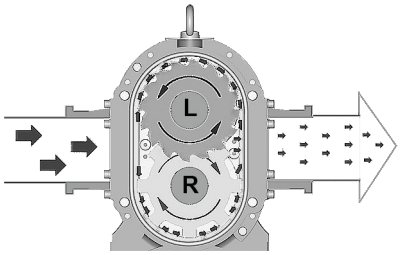
View of quick-release cover / counter bearing cover:

— Flow direction from **right to left**



View of quick-release cover / counter bearing cover:

— Flow direction from **left to right**



NOTE!
Observe the direction of rotation!

The tips of the directional blade types G, F and S must always point in the direction of rotation. *Chapter 3.1.3 “Cutting unit” on page 49*

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. ↳ *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*
— Shut down the Börger machine and downstream and upstream system components. ↳ *Chapter 5.3 “Downtimes” on page 111*
— Secure the Börger machine against unauthorized or uncontrolled reactivation. ↳ *Chapter 2.7 “Securing the machine against restart” on page 26*
— Relieve the pressure in the Börger machine. ↳ *Chapter 6.1.2 “Pressure relief” on page 127*
— Open the quick-release cover. ↳ *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*
— Clean the interior of the Börger machine. ↳ *Chapter 6.1.3 “Internal cleaning” on page 129*

1. Remove the blades and spacer rings in accordance with ↳ *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.
2. Turn the directional blades so that the tips are oriented for the new flow direction.
3. Install the blades and spacer rings, cover disks with new O-rings and hexagon socket head cap screws with new sealing washers and tighten the hexagon socket head cap screws with the torque specified in ↳ *Chapter 6.3.3 “Replacing the blades and spacer rings” on page 150*.
4. Attach the cover-side casing protection plate and quick-release cover, see ↳ *Chapter 6.3.2 “Opening and closing the quick-release cover” on page 146*.
5. Make sure that the inlet and outlet pipe connections are installed in accordance with the new flow direction. ↳ *Chapter 4.4.3 “Installing the inlet and outlet” on page 89*
6. Make sure that the direction of rotation of the drive corresponds to the new flow direction. ↳ *Chapter 4.5.3 “Checking the flow direction” on page 102*.
7. Mark the new flow direction on the Multicrusher. ↳ *Chapter 2.9 “Markings and signs” on page 30*

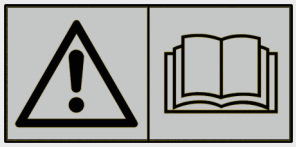
6.3.8 Other repairs

If repairs to your Börger machine are required that are not covered by the described repair and maintenance measures, we recommend contacting Börger customer service.

The factory can only accept repair orders if a completed safety certificate / declaration of decontamination accompany the device submitted for repair, as well as any necessary safety data sheets for the medium and / or cleaning agent.

The relevant form is also available as a download from our website under the service menu.

6.3.9 Maintenance instructions for special equipment



Further operating manuals / supplementary operating manuals

You must completely read the separate operating manuals and/or supplementary operating manuals for components and/or special versions.

Pay particular attention to all instructions

- on safety,
- on operation and control,
- on repairs and maintenance.

6.3.10 Measures following repair and maintenance work!

Following completion of the work and before starting the unit, carry out the following steps:

Be sure to read and follow all instructions:

— on safety,
— on operation and control,
— on installation, repairs and maintenance. *Chapter 2.12 “Safety instructions for maintenance and rectifying malfunctions” on page 39*

1. Check all screws that have been loosened previously for firm seat.
2. Check whether all safety devices and covers that have been removed previously are reinstalled properly.
3. Ensure that all tools, materials and other equipment used have been removed from the work area.
4. Clean the work area and remove any spilled substances, e.g. liquids, processing material or similar.
5. Reset the emergency stop devices, if required.
6. Confirm malfunctions at the control unit.
7. Ensure that nobody enters the hazardous area.
8. Ensure that all safety features of the unit function perfectly.
9. Take the unit into operation again. *Chapter 5.2 “Continuous operation” on page 110*

6.3.11 Queries

Börger machines are easy to maintain. We hope that we have clearly described all the relevant operating steps in this operating manual. Nevertheless, Börger machines are customized and developed for the specific requirements of the operator so that not all questions can be fully answered in a general operating manual.

— If you have any questions, please contact Börger customer service. We will be happy to help.

We would also be grateful to receive feedback on any errors or unclear passages in this operating manual. This will help us to improve and develop this document and to offer you and all of our customers the best possible service.

7 Disposal

7.1 Environmental protection

ENVIRONMENT!
Danger due to incorrect handling of environmentally hazardous substances!

Inappropriate handling of environmentally hazardous substances, especially incorrect disposal, can cause significant damage to the environment.

- Especially water-polluting materials such as grease and lubricating oil must not pollute the soil or enter the sewage system during installation, repair and maintenance work.
  - These materials must be collected, stored, transported and disposed of in suitable containers.
- When handling oil, grease and other chemical substances, pay attention and adhere to the applicable regulations and safety data sheets issued by the respective manufacturer relating to storage, handling, correct use and disposal.
- Comply with the legal obligations regarding waste avoidance and the proper recycling/disposal of waste during all work

7.2 Oil, oily waste and grease

Oil, oily waste and grease pose a significant risk to the environment. Therefore, disposal of such materials must be handled by a specialist company.

→ Collect any oil and oily waste and only dispose of them according to the legal requirements through authorized waste disposal companies/authorities.

7.3 Plastics

1. → Sort any plastic waste as thoroughly as possible.
2. → Dispose of plastics according to the legal requirements through authorized waste disposal companies/authorities.

7.4 Metals

1. Sort and separate different metal types.
2. Dispose of these metals according to the legal requirements through authorized waste disposal companies/authorities.

7.5 Electrical and electronic waste

Electrical and electronic waste must be disposed of separately. Electrical and electronic waste must not be disposed of with domestic waste.

- Only dispose of electrical or electronic waste according to the legal requirements through authorized waste disposal companies/authorities, e.g. recycling plants.

7.6 Final decommissioning

- Check which materials can be recycled and make the appropriate arrangements.

8 Accessories

The range of accessories supplied by Börger GmbH is as multi-faceted as the areas of application for Börger machines.

If your Börger machine was delivered with accessories, the corresponding operating manuals can generally be found in the appendix or in the packaging of the units, if delivered as originally packed.

8.1 Frequency converter

The machine can be operated with a frequency converter. Only frequency converters that deliver a constant torque are suitable for the Börger machine.

NOTE!
When using frequency converters

Due to their working principle, frequency converters generate leakage current.

— For proper operation of a frequency converter at a residual current device, the use of an AC/DC sensitive **residual current device (type B)** according to **EN50178/VDE0160** is required due to the DC component of the leakage current.

NOTE!
External drive cooler

An external drive cooler may be necessary if the motor frequency is set very low.

8.2 Reversing control unit

Multicrushers can be operated with a reversing control unit.

The reversing control unit enables alternating forward and reverse runs in short sequences to allow the blades to clear themselves after they have become clogged or stuck in solids. A preprogrammed reversing control unit is available for the Multicrusher from Börger GmbH.

8.3 Monitoring equipment

8.3.1 Dry run protection with conductivity sensor

In a correctly installed Multicrusher, direct frictional heat is not generated when dry running for a short period.

Frictional heat or spark formation as a result of incorrect maintenance and repair work, due to foreign bodies or adhesive solids that have penetrated the unit, could however – in case of a dry run – result in dangers that must be precluded with appropriate monitoring equipment.

If dry running of the Multicrusher is to be precluded, a conductivity sensor is usually used as a level control indicator.

Conductivity sensors measure the electrical conductivity on the Multicrusher inlet and switch the Multicrusher/system off by means of a control unit when the value drops beneath a specified limit.

Conductivity sensors and control units are available from Börger GmbH.

8.3.2 Temperature sensor

The temperature monitoring function in the Multicrusher is not suitable as dry run protection as frictional heat only occurs if the Multicrusher is incorrectly installed or impermissible, hard foreign bodies are present.

Monitoring the temperature of the flow medium in the Multicrusher casing can, however, be desirable for specific technical reasons pertaining to the system.

— Moreover, temperature monitoring on an optional packing is required for use in areas subject to explosion hazards.
— Moreover, temperature monitoring on the counter bearings (Classic HLA) might be required for use in areas subject to explosion hazards.

You can obtain the PT100 temperature sensors and control units from Börger GmbH.

8.3.3 Pressure monitoring devices as overpressure protection

Exceeding the maximum permissible working pressure can cause lasting damage to parts of the Börger machine and all attachment parts. There is also a risk of leakage and subsequent risks to personnel and the environment, depending on the flow medium.

Pressure monitoring devices of different manufacturers offer protection from damage due to overpressure. The Börger machine or system can thus be switched off when a preset pressure is exceeded, or other measures for reducing the pressure can be carried out.

8.3.4 Flow monitoring devices

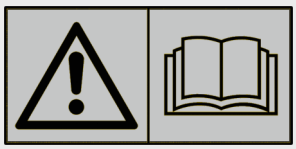
Flow measurement devices / flow monitors are optionally available for applications in which the unit is not controlled by a connected pump to regulate flow speed and therefore attain the optimum cutting results.

8.3.5 Auger feed

An auger feed with a feed hopper at the inlet of the Börger machine allows non-flowing or hardly flowing media that are just able to be pumped to be conveyed in certain cases.

9 Appendix

9.1 Data sheet



Data sheet

The data sheet is enclosed separately with the operating manual.
The data sheet contains all relevant data for your Börger machine or unit.

— Especially consider the operating conditions and limits mentioned in the data sheet. They may deviate from the information mentioned in this operating manual if the machine has special equipment.

9.2 Wear parts

WARNING!
Risk of injury when using unsuitable spare parts!

The use of unsuitable spare parts can cause malfunctions which can lead to severe injury, including death, and to significant material damage.

— Only use suitable spare parts.
— Always contact the manufacturer if in doubt.

The following wear parts list includes the quantity, designation and position number of the elements that are replaced during the corresponding repair work. Also observe the assembly drawing according to *Chapter 9.3 “Assembly drawing” on page 198* and the spare parts list according to *Chapter 9.2 “Wear parts” on page 194*.

The required number of individual parts will to some extent depend on your Börger machine. Take note of the number of parts removed during repair work, cf. also figures in the repair chapters.

Replacing the blades and spacer rings

Pos. no.	Designation	Quantity
9.1a, 9.2a	Blade for drive shaft	6 / 9 / 14
9.1b, 9.2b	Spacer ring for drive shaft	6 / 9 / 8 / 13 / 14
9.1c, 9.2c	Spacer ring for drive shaft, narrow	0 / 1
9.1d	Spacer ring for drive shaft, extra narrow	0 / 1
9.1e, 9.2d	Blade for short shaft	6 / 9 / 14
9.1f, 9.2e	Spacer ring for short shaft	5 / 8 / 13 / 12
9.1g, 9.2f	Spacer ring for short shaft, narrow	1 / 2
9.1h	Spacer ring for short shaft, extra narrow	0 / 1 / 2
30	O-ring for quick-release cover	1
32	O-ring for cover disk	2
24	Cover disk	2
64	Hexagon socket head cap screw for fastening the cutting unit to the shaft	2
74	Sealing washer	2

Replacing the hexagonal shafts

Pos. no.	Designation	Quantity
9.1g, 9.2g	Hexagonal shaft	2
30	O-ring for quick-release cover	1
31	O-ring for rotating seal holding bush	2
32	O-ring for cover disk	2
24	Cover disk	2
64	Hexagon socket head cap screw for fastening the cutting unit to the shaft	2
74	Sealing washer	2

Replacing the mechanical seals

Pos. no.	Designation	Quantity
15	Mechanical seal — 2 x seal face — 2x O-ring	2
30	O-ring for quick-release cover	1
31	O-ring for rotating seal holding bush	2
32	O-ring for cover disk	2
74	Sealing washer	2
64	Hexagon socket head cap screw for fastening the cutting unit to the shaft	2
74	Sealing washer	2

Replacing the casing protection plates

Pos. no.	Designation	Quantity
10	Cover-side casing protection plate	1
11	Gear-side casing protection plate	1
30	O-ring for quick-release cover	1
31	O-ring for rotating seal holding bush	2
32	O-ring for cover disk	2
52	Screw for casing protection plate	2
74	Sealing washer	2

NOTE!
Spare parts orders!

<u>The data below are required:</u>

- **Serial number**
  - see nameplate
- **Type code**
  - according to data sheet
    (Important! - comparison with serial number!)

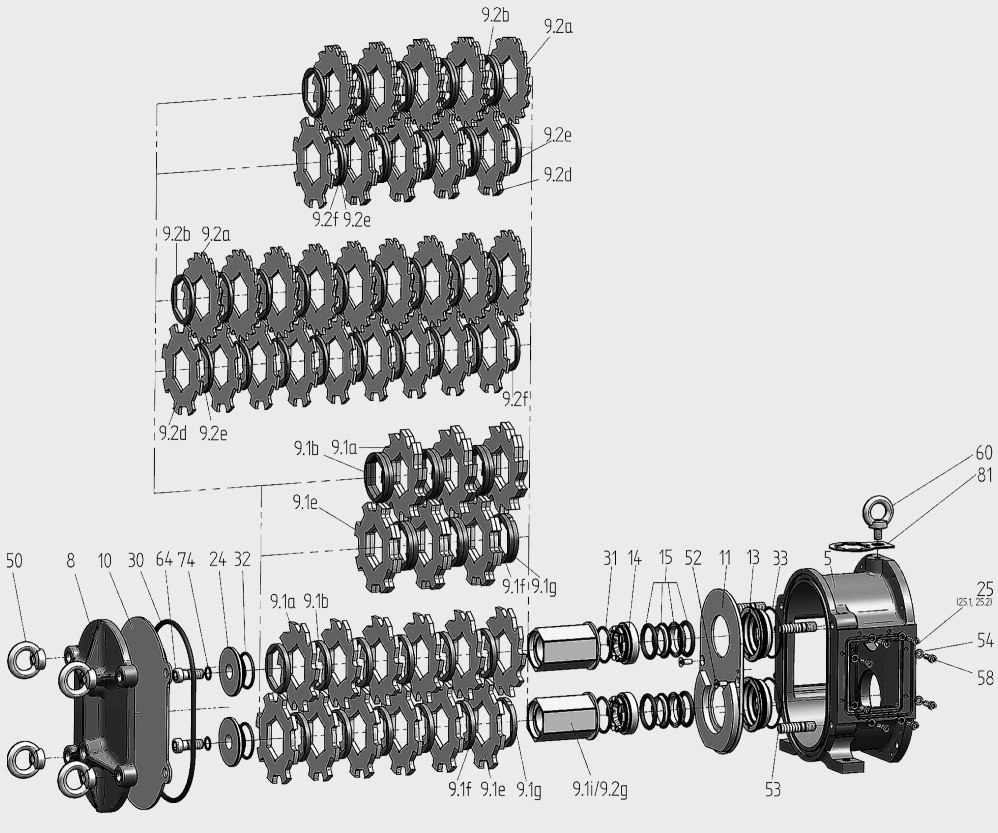
Börger GmbH will then obtain the information for **the appropriate spare parts for you from the production documents of your machine**.

- Record all modifications made to the equipment after the initial delivery, such as changes to rotating components (type, material) or seals.
- In order to avoid incorrect deliveries, always quote all modifications made when ordering spare parts.

9.3 Assembly drawing

The assembly drawing shows the positions of the spare parts as described in *Chapter 9.4 “Spare parts list” on page 200*.

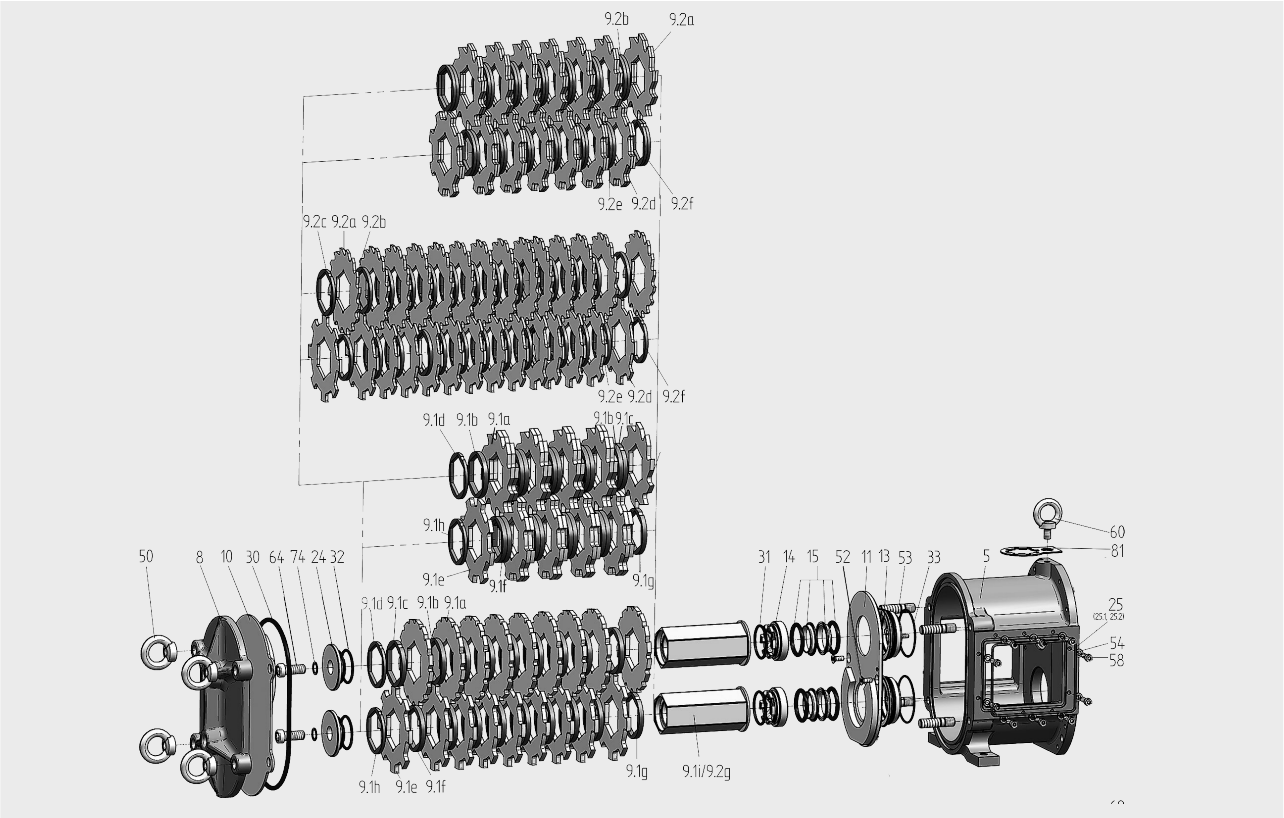
9.3.1 HPL 200



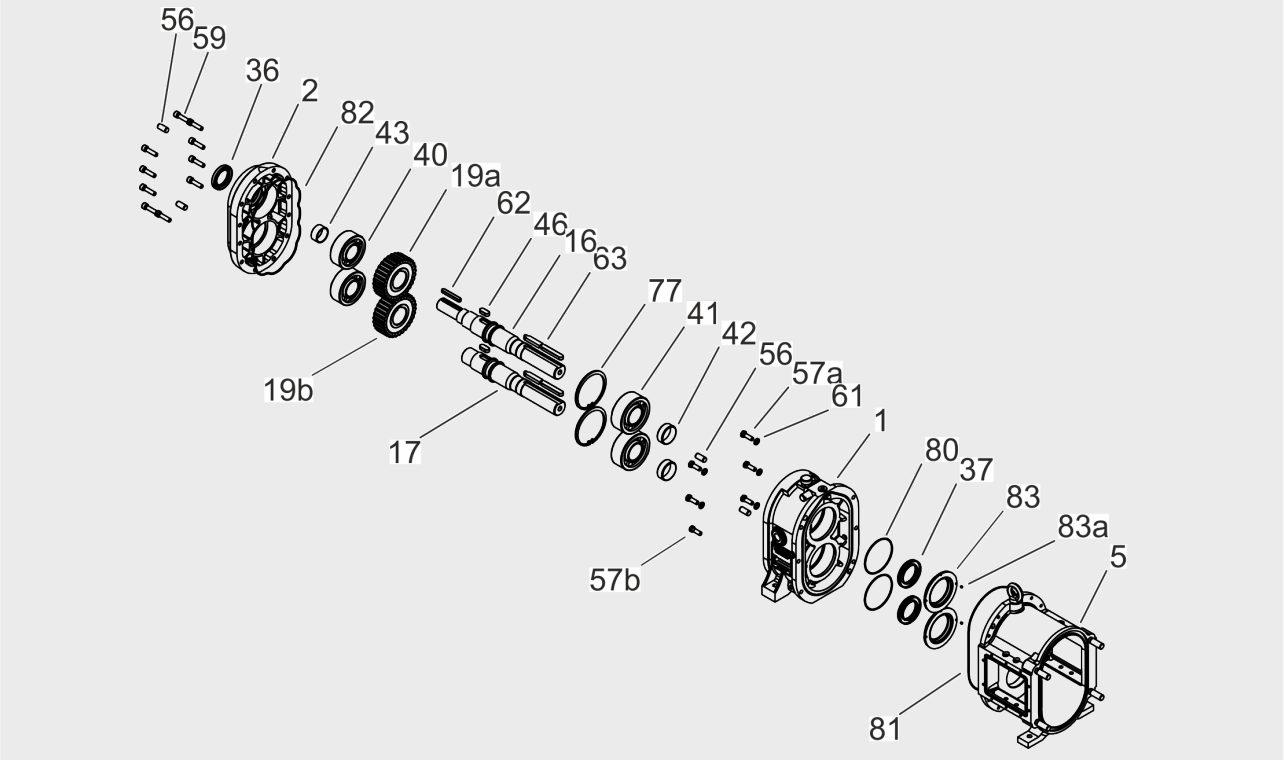
16.3

16.1

9.3.2 HPL 300 / HPL 300 N



9.3.3 HPL gear unit



9.4 Spare parts list

WARNING!
Risk of injury when using unsuitable spare parts!

The use of unsuitable spare parts can cause malfunctions which can lead to severe injury, including death, and to significant material damage.

— Only use suitable spare parts.
— Always contact the manufacturer if in doubt.

The spare parts list is universal. The positioning of the parts can be seen in the assembly drawing. The parts used in your Börger machine are defined according to the type designation and all the additional specifications in the data sheet.

Pos.	Item description	Quantity HPL...	
		200	300
1	Gear casing PL	1	1
2	Gear casing cover	1	1
5	Casing, PL	1	1
8	Quick-release cover	1	1
9.1a	Blade, 8 mm, drive shaft	6	9
9.1b	Spacer ring, 8.5 mm, drive shaft	6	8
9.1c	Spacer ring, 8.25 mm, drive shaft HPL 300	—	1
9.1d	Spacer ring, 5.5 mm, drive shaft HPL 300	—	0 / 1
9.1e	Blade, 8 mm, short shaft	6	9
9.1f	Spacer ring 8.5 mm, short shaft	5	8
9.1g	Spacer ring 8.25 mm, short shaft	1	1
9.1h	Spacer ring 5.5 mm, short shaft, HPL300	—	1 / 2
9.1i	Hexagonal shaft HPL	2	2
9.2a	Blade, 5 mm, drive shaft	9	14
9.2b	Spacer ring, 6 mm, drive shaft	9	13 / 14
9.2c	Spacer ring, 5.5 mm, drive shaft, HPL 300	—	0 / 1
9.2d	Blade, 5 mm, short shaft	9	14
9.2e	Spacer ring 6 mm, short shaft	8	13 / 12
9.2f	Spacer ring 5.5 mm, short shaft	1	1 / 2
9.2g	Hexagonal shaft, HPL	2	2
10	Cover-side casing protection plate, HPL200, for 8 mm blade	1	1
11	Gear-side casing protection plate	1	1
13	Stationary seal holding bush	2	2
14	Rotating seal holding bush with thread	2	2
15	Mechanical seal: 2 x seal face, O-ring 47.5 x 6.5 mm	2	2
16.1	Shaft with cylindrical shaft end DIN 748-1, Ø 35 mm, with keyway DIN 6885-1, PL	1	1
16.2	Short shaft, PL	1	1
16.3	Shaft with straight-sided spline profile, external, 1⅜", 6 splines, PL	1	—
	Shaft with straight-sided spline profile, external, 1⅜" according to former DIN 9611, 6 splines, PL300	—	1
17.1	Short shaft, PL	1	1
17.2	Shaft with cylindrical shaft end DIN 748-1, Ø 35 mm, with keyway DIN 6885-1, PL	1	1
17.3	Shaft with straight-sided spline profile, external, 1⅜", 6 splines, PL	1	—
19.a	Gear wheel 4/34 with keyway in foot center	1	1
19.b	Gear wheel 4/26 with keyway in foot center (on drive shaft)	1	1
24	Cover disk	2	2

Pos.	Item description	Quantity HPL...	
		200	300
25.1	O-ring, PL	2	2
25.2	Gasket, PL	2	2
30	O-ring for cover	1	1
31	O-ring for rotating seal holding bush, 54x4 mm	2	2
32	O-ring for cover disk, 54x4 mm	2	2
33	O-ring for stationary seal holding bush, 80x3 mm	2	2
36	Lip seal with dust protection lip, DIN 3760 form AS, 45x70x10 mm	1 / 2	1 / 2
37	DUO double lip seal, 55x80x10 mm	2	2
40	Cylindrical roller bearing, NJ2309, DIN 5412	2	2
41	Self-aligning roller bearing, 22310, DIN 635	2	2
42	Inner ring as shaft protection sleeve, 50x55x25 mm	2	2
43	Inner ring as shaft protection sleeve, 40x45x20.5 mm	1 / 2	1 / 2
46	Parallel key, gear wheel, DIN 6885-1, 14x9x32 mm	2	2
50	Cover nut	4	4
52	Countersunk screw, M8x16 according to DIN EN ISO 7046-2, but with Torx® head (former DIN 965)	2	2
53	Stud screw, M16x45, DIN 939	4	4
54	Spring washer B8	16	20
55	Dowel pin, 14x32, DIN EN ISO 8735 form A	2	2
56	Dowel pin, 14x40, DIN EN ISO 8735 form A	2	2
57a	Hexagon head screw, M10x30, DIN EN ISO 4017	13	13
57b	Hexagon socket head cap screw, M10x30, DIN 6912	1	1
58	Hexagon socket head cap screw, M8x25, DIN EN ISO 4762	16	20
59	Hexagon socket head cap screw, M10x40, DIN EN ISO 4762	12	12
60	Eye bolt M12, DIN 580	1	1
61	Spring washer, bent, A10 (former DIN 127)	13	13
62	Parallel key for drive shaft, DIN 6885-1, form A, 10x8x70 mm	1 / 2	1 / 2
63	Parallel key, DIN 6885-1 modified, HPL	2	2
64	Hexagon socket head cap screw, M16x40, DIN 6912	2	2
65	Oil sight glass 1"	1	1
66	Screw plug G½A, DIN 908	2	2
67	Breather system, ½"	1	1
68	Grub screw, M8x12, EN ISO4027	4	4
69	Screw plug G⅜", male thread, DIN 908	1	1
70	Sealing washer, A33x39x2, DIN 7603 (for screw plug, pos. 78)	1	1
71	Sealing washer, A21x26X1.5, DIN 7603 (for pos. 66)	2	2
72	Sealing washer, 33x39x2 mm (for position 65)	1	1

Pos.	Item description	Quantity HPL...	
		200	300
73	Sealing washer, 21x26x1.5 mm, for oil sight glass ½" for 90° turned version	0 / 1	0 / 1
74	Sealing washer, A17x23x1.5, DIN 7603	2	2
75	Breather G⅜"	1	1
77	Snap ring DIN 472 - 110x4	2	2
78	Screw plug for gear unit, G1A, DIN 908	1	1
79	Sealing washer A17x23x1.5, DIN 7603 (for pos. 69 and 80)	3	3
80	Screw plug G⅜", DIN 908	2	2
81	Multicrusher label 106.8x78.4x2 mm	1	1

9.4.1 Tools / installation aid

General work on the Börger machine

NOTE!

Adhere to the prescribed intervals for regular maintenance and inspections or those specified herein and in the operating manuals of the components.

— Suitable workshop equipment as well as specified special tools are essential for carrying out maintenance work.
Chapter 9.4.1 “Tools / installation aid” on page 204
— Modifications, repairs, maintenance and troubleshooting may only be carried out when the Börger machine is switched off. Accidental restarting of the unit must be prevented completely.
— To the extent necessary, amply secure the surrounding area when performing maintenance. Cordon off the working area with a red and white safety chain and a warning sign.
— Also observe any
  — supplementary operating manuals
  — operating manuals of the components

  in the appendix.
— Large assemblies and components must be carefully attached and secured to hoists when they are removed or replaced so that associated dangers are minimized. Only appropriate hoists and lifting media in technically perfect working condition with sufficient load capacities may be used.
  — Never stand under suspended loads.
— At the start of maintenance, repairs or machine care, clean any dirt or cleaning agents off the connections and screw connections. Do not use any aggressive cleaning agents. Use lint-free cleaning cloths.
— During installation, always tighten any screw connections that have been loosened for maintenance and repair work. Tighten to the prescribed torque, where this is specified.
— Dispose of operating materials and replacement parts in a safe and environmentally-friendly manner.

Work on the electrical system

NOTE!

Adhere to the prescribed intervals for regular maintenance and inspections of the electrical system and/or components or to those intervals specified herein and in the operating manuals of the components.

— The electrical system may only be opened, maintained and repaired by qualified electricians, while having proper regard to the attached electric circuit diagrams.
— Carry out modifications, repairs, maintenance and trouble-shooting on the control unit only when the electrical system is switched off. Accidental restarting of the unit must be prevented completely.
— To the extent necessary, amply secure the surrounding area when performing maintenance. Cordon off the working area with a red and white safety chain and a warning sign.
— Suitable workshop equipment as well as specified special tools are essential for carrying out maintenance work.
↳ *Chapter 9.4.1 “Tools / installation aid” on page 204*
— Also observe any
  — supplementary operating manuals
  — operating manuals of the components
  — Operating manuals of electronic parts

  in the appendix.
— Protect the electronic components from moisture and impurities. Clean the electronic components with suitable agents according to the manufacturers' operating manuals only. Do not use aggressive cleaning agents to clean the surface. Use lint-free cleaning cloths.
— Dispose of any replacement parts in a safe and environmentally-friendly manner.

Tools, general

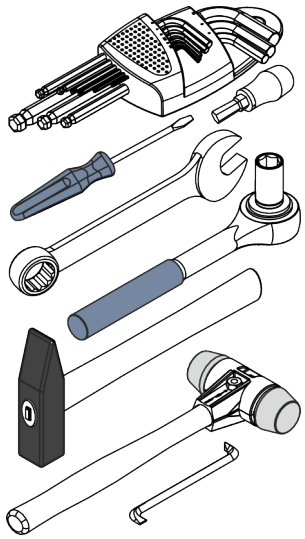
Tool:

- Tools for electrical work
- Tools, general

Standard tools

Tools for electrical work

— These tools shall comply with the international standard **IEC 60900** (identical to **EN 60900** for Europe and **DIN EN 60900** for Germany).
  — The standard applies to “Insulated and insulating hand tools” used for live working and work near live parts, with voltage ratings up to 1000V AC or 1500V DC.
— Products designed and manufactured according to this standard contribute to the user’s safety, provided they are used by qualified electricians in compliance with the safe working practices and the operating manual (if applicable).



Tools, general

— Various hexagon socket wrenches and/or sockets for hexagon socket head cap screws.
— Various open-end / ring spanners and/or sockets for hexagon head screws.
— Hammer
— Soft face hammer
— Screw drivers in various sizes
— Lever

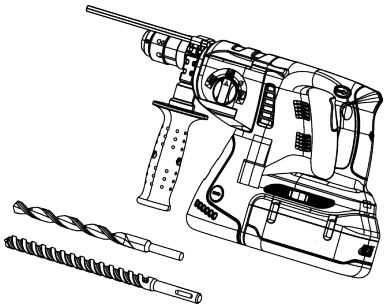
Special tools

Tool:

- Hammer drill
- Torque wrench
- Hoists
- Multitool [M]
- Puller and auxiliary puller for hexagonal shaft

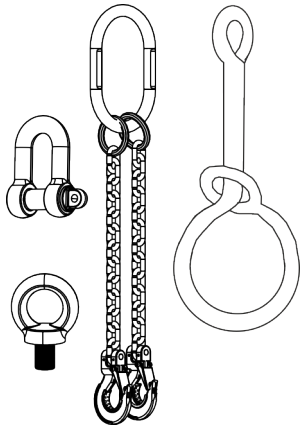
Special tools

Hammer drill



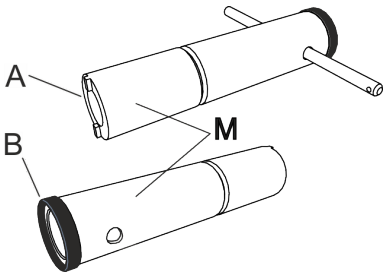
— A hammer drill is a power tool to drill holes into mineral material, e.g. stone or concrete. Through the impact, the cutting edge of the drill pulverizes the material

Hoists



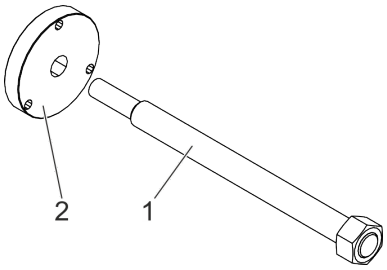
Lifting and slinging gear must be designed and dimensioned adequately according to the particular hazard and the loads occurring during transport.

Multitool [M]

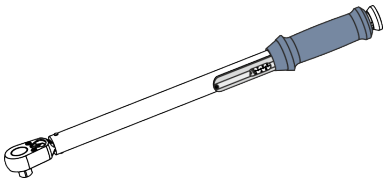


— Special tool [A] for rotating seal holding bushes
— Push-in tool [B] for mechanical seals
  — (Remove handle!)

Puller and auxiliary puller for hexagonal shaft



— 1 - Puller
— 2 - Auxiliary puller for the hexagonal shaft
— - Screw M6 for puller (not illustrated)



Torque wrench

— A torque wrench is a hand-held fastening tool, with which a defined torque can be applied to a connecting element (screw or nut), so as to ensure the required clamping force between the connecting components even at maximum operating forces.

9.5 Parallel keys

The following parallel key lengths must be adhered to and checked.

NOTICE!

Risk of material damage when operated with an incorrect or damaged parallel key!

Imprecise parallel key lengths can lead to misalignment of the rotating holding bush and can cause mechanical damage to the Börger machine or to the complete unit.

Parallel key dimensions	
HPL 200:	**HPL 300:**
— 14 x 9 x **81** mm	— 14 x 9 x **136** mm
— 0.55 x 0.35 x **3.19** “	— 0.55 x 0.35 x **5.35** “

9.6 Checklist for commissioning

This checklist can be used as an additional aid when commissioning a Börger machine. It is not a substitute for careful reading of the operating manual before commissioning the unit.

Customer:	**Börger order confirmation no.:**
Machine number:	**Type code:**
Your project:	**Order number:**
Commissioning date:	**Delivery date:**

	Test point	Carried out by: (date/signature)	Checked by: (date/signature)
1	Operating manual and appendices read and understood		
2	Application data and operating parameters according to data sheet correspond to application		
3	Base frame fixed correctly to solid, even surface		
4	Coupling alignment within the permitted tolerance, coupling guard attached; in case of overhead mounted drive assembly, V-belt / chain tension OK, V-belt / chain attached		
5	Pipes laid correctly on inlet and outlet side, pipes fixed and not leaking, flow direction complies with the marking		
6	Optional safety equipment installed correctly, connected and functions checked		
7	Electrical connections and grounding OK, direction of rotation of drive shaft correct		
8	Oil level in drive OK, transport lock removed from breather system (if present)		
9	Oil level in the gear unit of the Börger machine OK; in M2 mounting position: screw plug replaced by breather system		
10	Fluid level in the intermediate chamber OK, breather installed in the correct position and open		
11	All valves in pipes opened; check valves installed correctly		
12	Noise and vibration levels normal when drive is switched on		
13	Pipes checked for leaks again with Börger machine switched on		
14	Power consumption of drive checked to guarantee correct installation		
15	Flow rate and working pressure checked		
16	Maintenance and inspection intervals organized for the machine		

9.7 EU Declaration of Conformity / EU Declaration of Incorporation

9.7.1 EU Declaration of Conformity

Börger GmbH | Benningsweg 24 | 46325 Borken-Weseke | Germany CE

We hereby declare that the following products:

Product description:	Multicrusher
Type descriptions:	HAL, HAN, HPL, HCL, HFL, HLA
Version:	Classic, Protect, Select
Serial number:	from 1000 0000
Year of manufacture:	from 2018

are in compliance with all relevant provisions of the **Machinery Directive (2006/42/EC)**.

The machines are further in compliance with all provisions of the **Electrical Equipment (2014/35/EU)** and **Electromagnetic Compatibility (2014/30/EU)** Directives.

The following harmonized standards were applied:
- DIN EN ISO 13857
- DIN EN 809
- DIN EN 12162

Name and address of the authorized representative:	Bernd Valtwies Börger GmbH

Borken-Weseke, Town / city	04.01.2024 Date	 Alois Börger - Managing Director

9.7.2 EU Declaration of Incorporation

Börger GmbH | Benningsweg 24 | 46325 Borken-Weseke | Germany CE

We hereby declare that the following products:

Product description:	Multicrusher
Type descriptions:	HAL, HAN, HPL, HCL, HFL, HLA
Version:	Classic, Protect, Select
Serial number:	from 1000 0000
Year of manufacture:	from 2018

are in compliance with the requirements of the **Machinery Directive (2006/42/EC)**: Annex I, para. 1.1.2, 1.1.3, 1.1.5, 1.3.2, 1.3.4 and 1.5.1.

The incomplete machine is further in compliance with all provisions of the **Electrical Equipment (2014/35/EU)** and **Electromagnetic Compatibility (2014/30/EU)** Directives.

The incomplete machine may only be put into operation when it has been determined that the machine in which the incomplete machine is to be installed is in compliance with the provisions of the Machinery Directive (2006/42/EC).

The manufacturer is obligated to electronically submit the specific documentation for the incomplete machine to the authorities of individual member states upon request.

The specific technical documentation associated with the machine has been created in accordance with Annex VII Part B.

Name and address of the authorized representative:	Bernd Valtwies Börger GmbH

Borken-Weseke, Town / city	04.01.2024 Date	 Alois Börger - Managing Director

9.8 UK - Declaration of Conformity / UK - Declaration of Incorporation

9.8.1 UK - Declaration of Conformity

Börger GmbH | Benningsweg 24 | 46325 Borken-Weseke | Germany	UK CA

We hereby declare that the following products:	
Product description:	Multicrusher
Type descriptions:	HAL, HAN, HPL, HCL, HFL, HLA
Version:	Classic, Protect, Select
Serial number:	from 1000 0000
Year of manufacture:	from 2018

are in compliance with all relevant provisions of the
Supply of Machinery (Safety) Regulations 2008 - (2008 No. 1597).

The machines are further in compliance with all provisions of the
Electrical Equipment (Safety) Regulations 2016 (2016 No. 1101) and the
Electromagnetic Compatibility Regulations 2016 (2016 No. 1091).

The following harmonized standards were applied:
— DIN EN ISO 13857
— DIN EN 809
— DIN EN 12162

Name and address of the authorized representative:	Bernd Valtwies Börger GmbH

Borken-Weseke, Town / city	04.01.2024 Date	 Alois Börger - Managing Director

9.8.2 UK - Declaration of Incorporation

Börger GmbH | Benningsweg 24 | 46325 Borken-Weseke | Germany	UK CA

We hereby declare that the following products:	
Product description:	Multicrusher
Type descriptions:	HAL, HAN, HPL, HCL, HFL, HLA
Version:	Classic, Protect, Select
Serial number:	from 1000 0000
Year of manufacture:	from 2018

are in compliance with the following essential requirements of the
Supply of Machinery (Safety) Regulations 2008 - (2008 No. 1597).

The incomplete machine is further in compliance with all provisions of the
Electrical Equipment (Safety) Regulations 2016 (2016 No. 1101) and the
Electromagnetic Compatibility Regulations 2016 (2016 No. 1091).

The incomplete machine may only be put into operation when it has been determined that the machine in which the incomplete machine is to be installed is in compliance with the provisions of the
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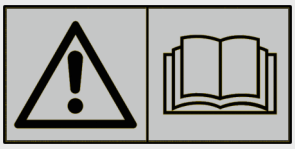
Name and address of the authorized representative:	Bernd Valtwies Börger GmbH

Borken-Weseke, Town / city	04.01.2024 Date	 Alois Börger - Managing Director

9.9 Lubricant list



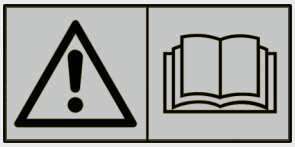
Lubricant list

— The lubricant list is enclosed separately with the operating manual.

Area of validity

— Unless subject to special agreements, the lubricant list applies to all standard Börger pump versions, Powerfeed units, macerating units, Bioselect units and submersible mixers.
— Deviations can be agreed upon individually for special applications. In such cases, only the agreement applies instead of this lubricant list.
— For delivered drives, the corresponding operating manual and lubricant list by the drive manufacturer applies.

9.10 Additional documentation



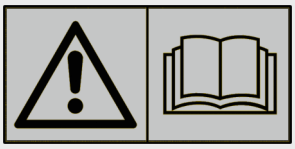
Further operating manuals / supplementary operating manuals

You must completely read the separate operating manuals and/or supplementary operating manuals for components and/or special versions.

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance.

9.11 Supplier documentation



Supplier documentation

You must completely read the separate supplier documentation.

Pay particular attention to all instructions

— on safety,
— on operation and control,
— on repairs and maintenance.

9.12 Technical data (maintenance)

9.12.1 Lubricants - fill levels

NOTE!
Lubricant list and data sheet!

Observe the detailed information and instructions on changing the lubricant as described in the lubricant list *Chapter 9.9 “Lubricant list” on page 215* and in the data sheet regarding the lubricants used.

NOTE!
Fill level of gear unit!

— Check the **fill level in the gear unit of the Börger machine** having regard to the information detailed under lubricant fill level and changing the lubricants. *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*

NOTE!
Fill level in the intermediate chamber!

Check the **fill level in the intermediate chamber** having regard to the information detailed under lubricant fill level and changing the lubricants. *Chapter 6.2.2 “Lubricant fill level and changing the lubricants” on page 135*

— Check whether the **delivered quench fluid** (see enclosed data sheet) is suitable or whether an alternative fluid must be used in order to observe environmental protection regulations, or for biological or other reasons. This must be compatible with the medium, and must not adversely affect the O-rings of the mechanical seals. Consult Börger GmbH regarding this, if necessary.

PL / HPL

Rotary lobe pump BLUEline (Classic) / Multicrusher

Optimum fill level

Design (mounting position)	Gear unit	Intermediate chamber
M1 (upright)	Center of oil sight glass	Top shaft, center to covered
M2 (vertical)	Completely filled[1)]	Lower edge, test bore[2)]
M3 (upside-down)	Center of oil sight glass	Top shaft, center to covered
M5, M6 (turned 90°)	Center of oil sight glass	approx. up to the bend in the fill hole

1) **In this case:** Expansion of the gear oil caused by the temperature cannot be compensated. The operating temperature must not exceed the temperature specified in the order.

2) **For submerged machines:** approx. 10 cm (3.94") below the edge of the extension pipe

PL / HPL

Rotary lobe pump BLUEline (Legend) / Multicrusher

Fill quantity

Design (mounting position)	Gear unit		Intermediate chamber	
	approx. [l]	approx. [gal]	approx. [l]	approx. [gal]
M1 (upright)	**2.3**	0.61	**1.1**	0.30
M2 (vertical)	**3.4**	0.90	**1.2**	0.32
M3 (upside-down)	**2.3**	0.61	**1.1**	0.30
M5, M6 (turned 90°)	**1.6**	0.42	**0.9**	0.24

9.12.2 Tightening torques (guidelines)

Rotor / hexagonal shaft (tightening torques)

Size	Fastening screw (rotor) (hexagonal shaft) Thread	Tightening torques					
		Pump / Multicrusher approx. [Nm]		Counter bearing approx. [Nm]		Counter bearing with mechanical seal approx. [Nm]	
		Steel (10.9)	Stainless steel	Steel (10.9)	Stainless steel	Steel (10.9)	Stainless steel
AL HAL	M 12	80	50	70	40	-	-
AN HAN	M 12	80	50	-	-	-	-
PL HPL	M 16	220	120	180	100	-	-
PN	M 16	220	120	-	-	-	-
QN	M 16	220	120	-	-	-	-
CL HCL	M 16	220	120	180	100	-	-
FL HFL	M 20	400	240	350	180	-	-
EL	M 20	400	240	350	180	480	-
XL	M 24	800	400	600	300	800	-

Size	Fastening screw (rotor) (hexagonal shaft) Thread	Tightening torques					
		Pump / Multicrusher approx. [in-lbs]		Counter bearing approx. [in-lbs]		Counter bearing with mechanical seal approx. [in-lbs]	
		Steel (10.9)	Stainless steel	Steel (10.9)	Stainless steel	Steel (10.9)	Stainless steel
AL HAL	M 12	710	445	620	355	-	-
AN HAN	M 12	710	445	-	-	-	-
PL HPL	M 16	1950	1065	1595	885	-	-
PN	M 16	1950	1065	-	-	-	-
QN	M 16	1950	1065	-	-	-	-
CL HCL	M 16	1950	1065	1595	885	-	-
FL HFL	M 20	3540	2130	3100	1595	-	-
EL	M 20	3540	2130	3100	1595	4250	-
XL	M 24	7080	3540	5310	2655	7080	-

PL / HPL

Pipe connectors - Seals / Fastening screws

Seal	Fastening screw	Torque max.
O-ring — 3.5 mm (0.14") — Materials as per spare parts list	**M8x25 (M8x30)** — Hexagon socket head cap screw, DIN EN ISO 4762	Steel (8.8) — **25 Nm** — **18 ft-lbs** Stainless steel (property class 70) — **20 Nm** — **15 ft-lbs**
Gasket — 2.0 mm (0.08") — PTFE base	**M8x25 (M8x30)** — Hexagon socket head cap screw, DIN EN ISO 4762	Steel (8.8) — **25 Nm** — **18 ft-lbs** Stainless steel (property class 70) — **20 Nm** — **15 ft-lbs**

NOTE!
Gaskets

The torque cannot be attained when using gaskets made of NBR, EPDM or FKM.

— For these seals, gradually tighten the screws crosswise, however only insofar that the seals are not squeezed out.

9.12.3 Anchor bolts - setup

Example: anchor bolts

Rotary lobe pump	Multicrusher	Anchor bolts
AL, AN	HAL, HAN	M12 x 130 mm (5.1 ")
PL, PN, QN, CL, FL, EL	HPL, HCL, HFL	M16 x 160 mm (6.3 ")
XL	HLA	M20 x 160 mm (6.3 ")

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