OPERATING MANUAL:

BLACK BRUIN ROTATORS

Translation of the original document

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CONTENTS

1 GENERAL INSTRUCTIONS

1.1 About the manual

This manual contains the instructions for Black Bruin hydraulic rotators installation, use and maintenance. Please read these instructions carefully before installing or commissioning the rotator.

The following symbols are used in this manual:

Information!

Useful information.

Danger!

Danger of death or injury.

Attention!

May cause damage to the rotator or the machine.

Ok!

Correct working method.

All information given in this manual is current and valid according to the information available at the time of publication. Black Bruin reserves the rights to implement changes without prior notice.

Please visit www.blackbruin.com for a product datasheet and the most recent version of this manual. Please ask Black Bruin for the product datasheets of custom models.

1.2 Revision comments

Week 1.2014	A case drain line added to the BBR H rotators.
Week 9.2014	All instructions checked and revised.
Week 35. 2015	New manual layout. Also minor additions to contents of this manual.
Week 48.2016	Symmetric brake installation added. Company name changed.

1.3 Applicability

This manual applies to the following rotator models:

MR

- MR08 A, MR08 F, MR10 A, MR10 F, MR10 MF, MR10 FD, MR10 MD

BBR H

- BBR 08H, BBR 15H, BBR 16H

BBR F

- BBR 15F

RH

- RH3016

Some parts of this manual only apply to certain rotator models. The applicability of these instructions can be determined according to the following markings:

Applies to Does not apply

Concerning older rotators or custom models, please contact Black Bruin for more information.

1.4 Intended use

A rotator is designed to be used in material and wood handling to lift, hold and rotate a grapple or harvester head. Appropriate security precautions must be taken in applications where the rotator breaking down would cause personal injury.

Technical data given on the rotator's nameplate, product data sheet, and in this manual must be observed. Any reference made to the rotator also applies to the associated links and fastening pins.

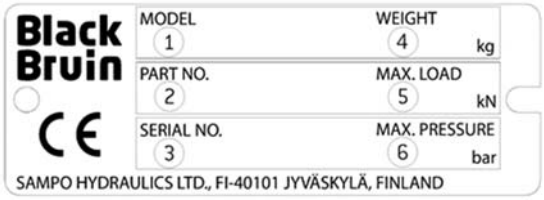
1.5 Warranty

The maintenance and installation operations described in this manual do not affect the warranty of the product. The warranty is void if the housing of the rotator has been opened prior arriving to the service.

Black Bruin is not responsible for damages resulting from misinterpreted, non-compliance, incorrect, or improper use of the rotator that goes against the instructions given in this manual.

1.6 Product identification

The product identification data can be found on the nameplate attached to the rotator.



(1) Model
(2) Part number (Item number)
(3) Serial Number
(4) Total weight of item
(5) Static load carrying capacity
(6) Maximum allowed operating pressure

Information!

In addition to the nameplate, the serial number may also be found stamped on the housing of the rotator. If required, a new nameplate may be delivered based on the serial number.

1.7 Safety instructions

Danger!

The following instructions apply to all procedures associated with the rotator. Read these instructions carefully and follow them closely.

- Installation and maintenance operations on the rotor may only be performed when the rotator has stopped and cooled and is not carrying a load.
- Only use the rotator for its intended purpose. Inappropriate use may cause severe personal injury and damage to the property.
- The operating temperature of the rotator may be over 60 °C (140 °F), which is hot enough to cause severe burns. Make sure not to touch the rotator and the brakes of the links immediately after use. Beware of hot hydraulic fluid when disconnecting the hydraulic connections.
- Even if the rotator has stopped, the pressure hoses connected to the rotator may still be pressurized. Ensure that there is no pressure in the working lines before you disconnect the connectors or open any check plugs.
- Prevent unintended use of the rotator during procedures by preventing pressurization of the working lines.
- Use only appropriate tools and attachments for lifting and transferring the rotator. Do not lift the rotator by hand.

Attention!

- A rotator is a hydraulic device which requires clean oil to operate. When disconnecting pressure hoses or other hydraulic parts of the rotator, ensure that no dirt or other impurities enter the hydraulic system. Any impurities that enter the rotator may damage the rotator or other hydraulic components of the system.
- Do not disassemble the rotator. Special tools are required for assembling the rotator. Other operations than those described in this manual may only be performed by a service provider authorized by the manufacturer.

2 OPERATING INSTRUCTIONS

2.1 Flushing the hydraulic system

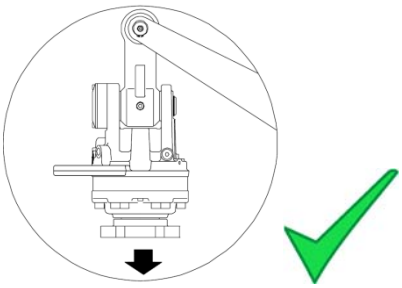
Prior to connecting the rotator as part of the hydraulic system, the hydraulic circuit of the rotator is recommended to be flushed by circulating hydraulic fluid through a filter installed in place of the rotator.

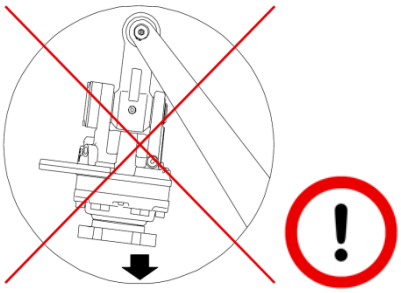
The flushing is carried out by circulating hydraulic fluid through the system with a minimum pressure for at least an hour.

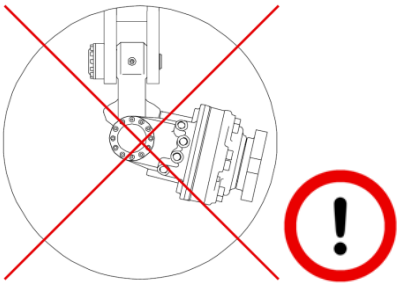
- After flushing, renew all filters.

Information!

Flushing the hydraulic system should also be performed after every system modification or repair.







2.2 Commissioning procedure

Ensure that the following things are in order before starting a new or replaced rotator:

- That the rotator has been installed appropriately and that joint bushes are in place.
- That the rotator and the link can move freely.
- That moving parts of the rotator have been lubricated (see chapter 2.4).
- That the rotator has been vented by flushing (see chapter 2.5).
- Post-tensioning of the attachment screws of the tool (grapple or harvesting head). (see chapter 3.1).
- Make sure the reservoir of the hydraulic system is full. When filling the reservoir, add oil through a filter.

Information!

The touching point of the rotator's swing limiter should be implemented so that it is as far from the joint as possible.

2.3 Use

During use, note the following:

- A rotator carrying load should be hanging freely on a vertical position.
- Avoid any movements of the crane, which would move the rotator to extreme positions.
- The rotator or the link may not touch a swing limiter when the rotator is carrying a load.
- Pushing the rotator or the link against the swing limiter is prohibited.
- Make sure that the grapple or the harvester head transferring or gripping position does not cause any adverse loads on the rotator joints.
- During all installation and service procedures, plug any open ports and hoses.

2.4 Lubrication

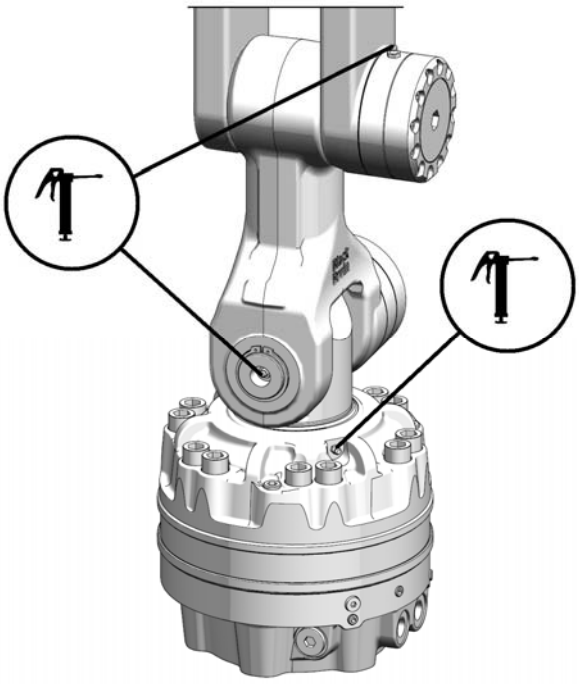
Ensure that the moving parts of the rotator always have sufficient lubrication. Add lubrication through all lubrication points so that small amount of extra lubricant comes out of the position being lubricated.

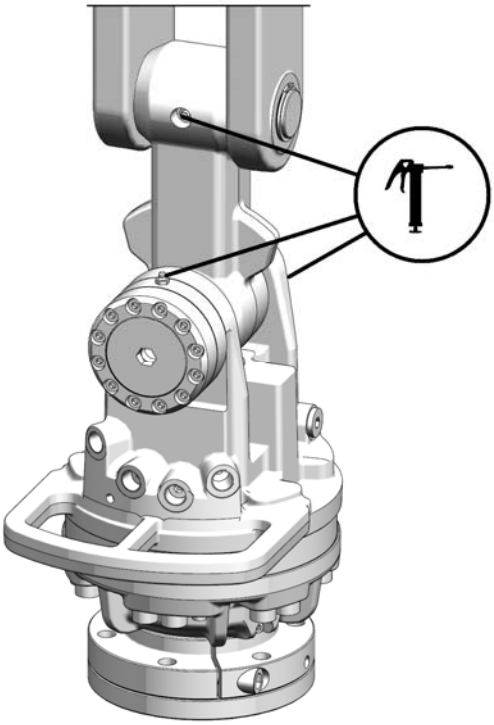
Lubrication points for rotators are:

- Lubrication nipples of the shaft seal on the rotator neck.
- Lubrication nipples on the joints of the link or on the sides of the link loop sides.
- Lubrication nipples on the ring of the brakes.
- Link with symmetric brake: Joint and brake is lubricated by using the lubrication nipple on the ring of the brake.

It is recommended that the lubrication process is performed during the normal lubrication routine of the machine, after every 16 hours of use, for example. But it must be done at least once a week or after every 50 hours of use.

Use only high grade lubricants with NLGI classification of 2. (For example, Mobil Mobilux EP 2.)





Information!

It is recommended to loosen the brakes of the swing damper before lubricating (see chapter 3.2.5). This method ensures that the braking torque is maintained during service.

Attention!

MR	BBR F	**BBR H**	**RH**

Regular lubrication of the upward-positioned shaft seals is very important. Insufficient lubrication may cause dirt and moisture to enter the rotator, which may reduce the service life of the rotator shaft sealing.

Information!

During installation it must be ensured that pockets within the rotator's swing damper's brakes and shaft seal are sufficiently filled with lubricant. This is ensured by removing the hex key plug or a nipple from the opposite side of the nipple, in which the lubricant is applied. Attach the removed plug after the filling operation and add more lubricant so that a small amount comes out of the position being lubricated.

2.5 Flushing

Flushing is performed as follows:

1) Attach the grapple or the harvesting head connected to the rotator to a fixed point. (By grabbing to a tree, for example.)
2) Apply constant pressure to one of the rotating lines for 1–2 minutes.
3) Release the grip.

When the rotator has been disconnected from the hydraulic system or has, for some other reason, been emptied of oil, the rotator must be vented by flushing before being used. Whilst flushing, the air remaining in the rotator housing will mix with the oil and will be removed from the rotator.

Regular flushing is recommended for rotators which have long hydraulic connections, or which are used only by short, back-and-forth movements. In these kinds of applications the hydraulic oil may not change in the rotator's circuit during normal use and it must be changed by flushing the rotator approximately once a week.

Attention!

If the hydraulic oil has not been changed for a long time, the impurities that have accumulated in the oil may damage the rotator or other hydraulic components of the system.

Information!

MR	BBR F	**BBR H**	**RH**

Changing of the oil may be improved by using the rotator's case drain line (see chapter 4.1). A rotator equipped with housing leak line must also be vented before use.

2.6 Storage

During short term storage of the rotator, the following should be taken into consideration:

- Store the rotator in vertical position.
- Cover any pressure openings and open threaded holes with suitable caps.
- Protect the unpainted surfaces from dirt and moisture.
- Store the rotator in a dry place with relatively stable temperature.
- The rotator should not be stored in a same place as substances with aggressive corrosive nature (solvents, acids, alkalis and salts).
- The rotator should not be exposed to strong vibrations.

Information!

For long-term storage (over 9 months) the following additional actions are recommended:

- Damages to surface paint must be repaired.
- Protect the unpainted surfaces with suitable anti-corrosion treatment.
- Fill the rotator completely with hydraulic fluid.

If these instructions are followed, the rotator may be stored for approximately two years. However, as storage conditions do have a significant effect, these times should only be considered as guide values.

2.7 Disposing of a rotator

Deliver the disused rotator parts for proper recycling or collection. Please follow the local regulations in force. In particular, take care that hydraulic oil and lubrication substances are disposed of appropriately.

3 INSTALLATION INSTRUCTIONS

3.1 General installation instructions

Consider the following during all installation procedures:

- Follow the security instructions given in chapter 1.7.
- Use only intact, correct, and original spare parts.
- Check that all installation surfaces are clean and smooth.

Consider the following when installing a link:

- Ensure that all the rotator and link lubricating nipples are available for use.
- Do not apply hard, stroke-like lateral forces to the brackets of the link or the rotator.

Consider the following when installing the tool (grapple or harvesting head):

- The tool is attached to the bottom of the rotator using rigid bolted joint.
- Check that the attachment screws of the tool are of suitable length.
- Clean the screws and threaded holes carefully from dirt and oil.
- Use self-locking nuts when attaching to the open holes.
- Use screws at least of strength class 10.9.
- The required pre-tensioning torques for the tool attachment screws:

  M16 screws: 310 ± 15 Nm

  M20 screws: 620 ± 30 Nm

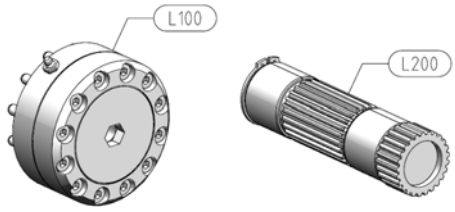
Attention!

Perform a post-tensioning of the attachment screws after the first working day. This ensures that the pre-tensioning remains.

3.2 The swing damper

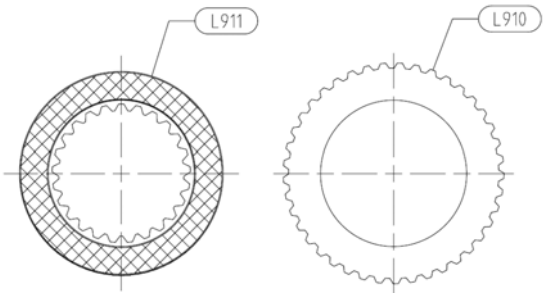
3.2.1 The design

The swing damper is a link between the rotator and the crane, which is equipped with one or two brakes for dampening rotator swinging.



The attachments are assembled from a brake kit (L100) and a pin kit (L200). Both the upper and lower attachments of the link are similar and may be installed according to the instructions in following chapters.

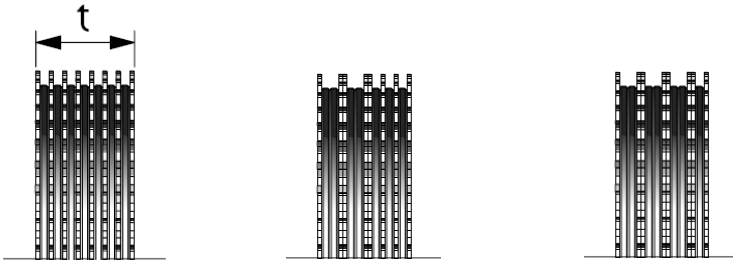
3.2.2 The brake lamella



Brake type		L / LC / LH	S / SC / SH	X / XC / XH
Number of lamella	L910 + L911	5 kpl + 4 kpl	9 kpl + 8 kpl	14 kpl + 13 kpl
Nominal thickness of a lamella pack	s	13 mm	25 mm	40 mm
Thickness of a lamella pack to be replaced	s_{min}	11 mm	21 mm	33,5 mm

Information!

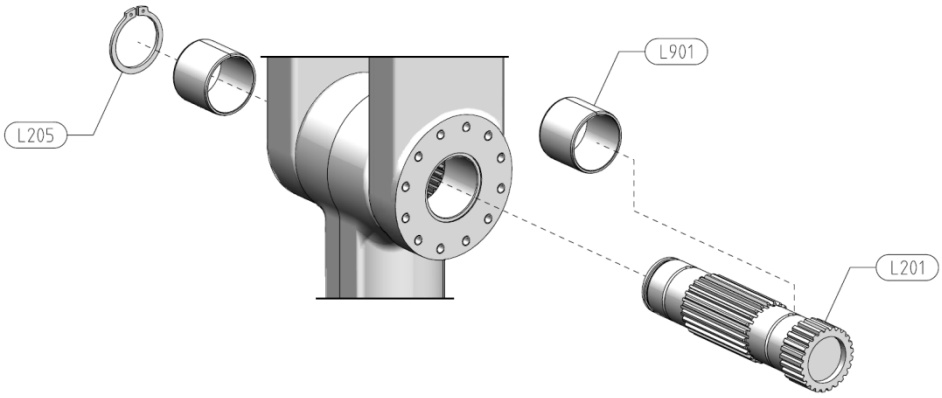
The brake torque of a brake may be decreased by pairing some of the brake lamella. A lamella with toothed outer rim (L910) must be placed as the first and as the last on the stack.



Nominal torque of the brake:	100 %	75 %	50 %

3.2.3 The pin kits

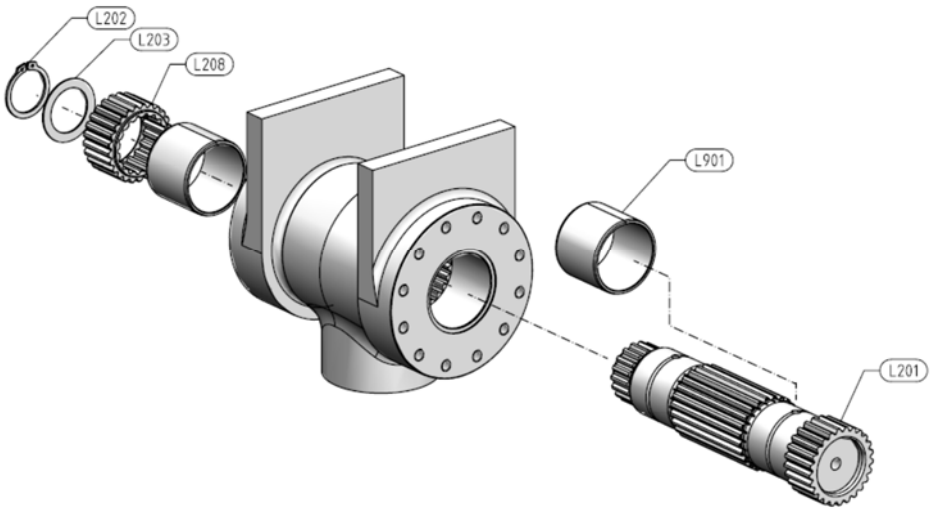
INSTALLING AN ATTACHMENT PIN - ONE-SIDED BRAKE



The attachment pin is installed into place before a brake kit.

1) First slide the bearing bush (L901) around the attachment pin (L201) in between the teeth.
2) Press the other bush into the hole of the bracket on the other side of the brake.
3) Lubricate the bushes and the splines before pressing the attachment pin into its position. The pin is inserted from the side of the brake fastening holes.
4) Check that the bushes are in the right position and install the retaining ring (L205) on the other side of the brake.

INSTALLING AN ATTACHMENT PIN - SYMMETRIC BRAKE



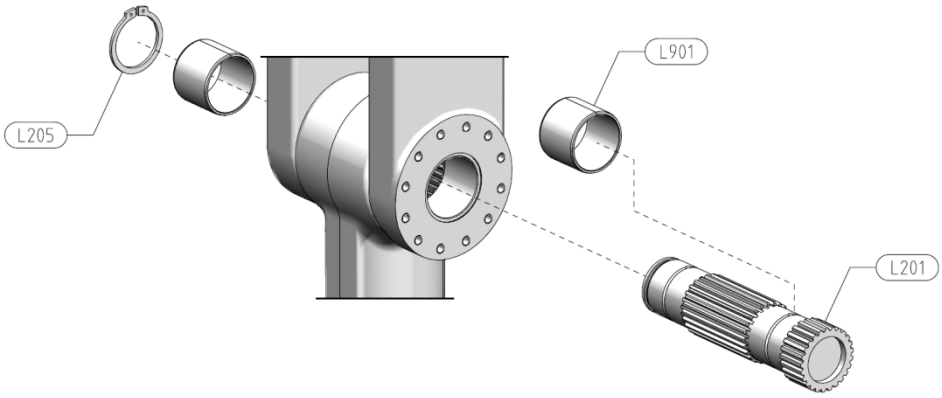
The attachment pin is installed into place before a brake kit.

1) First slide the bearing bush (L901) around the attachment pin (L201) in between the teeth.
2) Press the other bush into the hole of the bracket on the other side.
3) Lubricate the bushes and the splines before pressing the attachment pin into its position.
4) Check that the bushes are in the right position and install the ratchet ring (L208) on the pin.
5) Install the shim plate (L203) and the retaining ring (L202)

Information!

Avoid setting the seams of the bushes to the direction of the load.

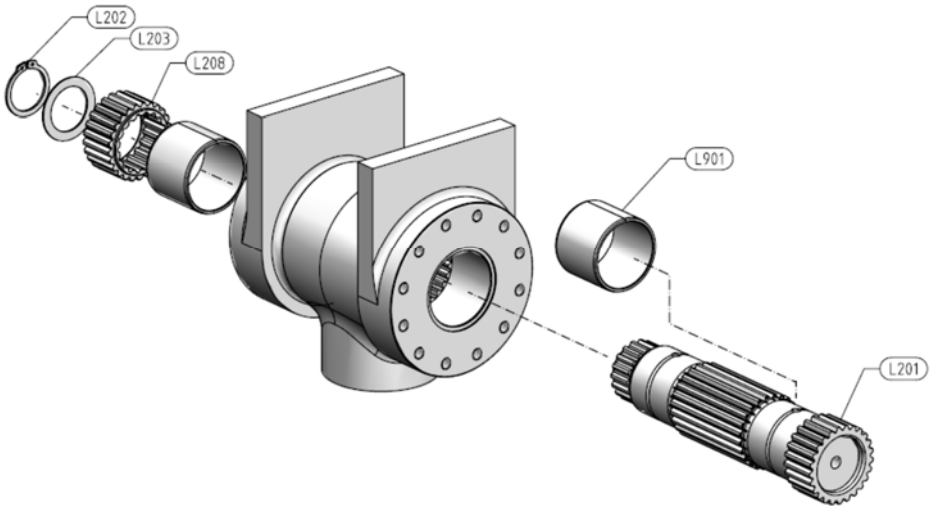
REMOVING AN ATTACHMENT PIN - ONE-SIDED BRAKE



Before removing the attachment pin, dismantle the joint brake.

1) Remove the retaining ring (L205) from the pin.
2) Push the pin (L201) out from the side of the retaining ring. The bush (L901) on the side of the brake detaches with the pin.
3) If necessary, remove the bush on the side of the retaining ring.
4) Clean all the parts and check wear on the bushes.

REMOVING AN ATTACHMENT PIN - SYMMETRIC BRAKE

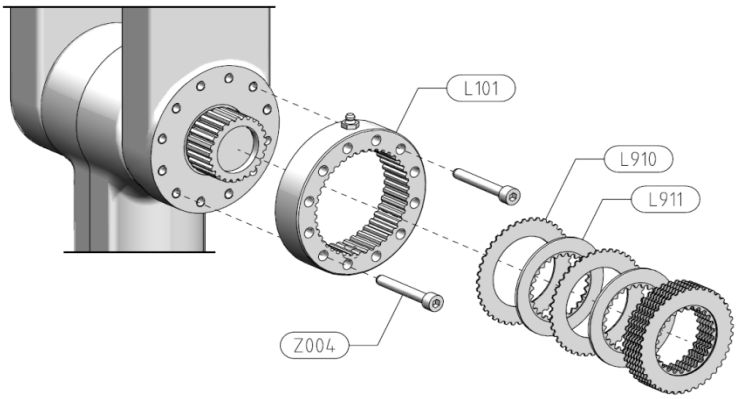


Before removing the attachment pin, dismantle the joint's brakes.

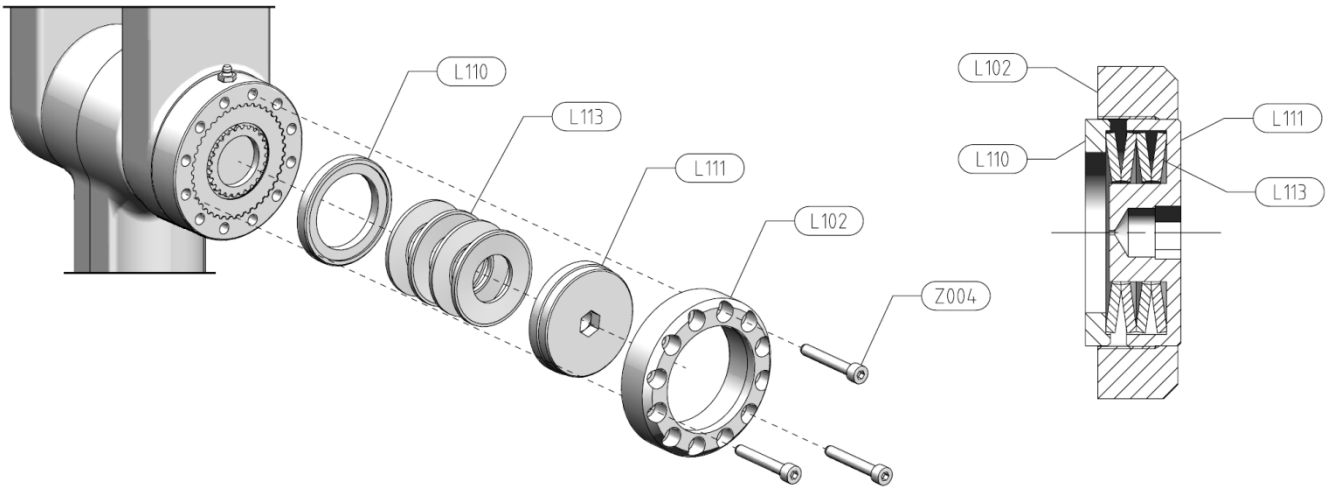
1) Remove the retaining ring (L202), shim plate (L203) and the ratchet ring (L208) from the pin.
2) Push the pin (L201) out from the side of the ratchet ring. The bush (L901) on the other side detaches with the pin.
3) If necessary, remove the bush on the side of the ratchet ring.
4) Clean all the parts and check wear on the bushes.

3.2.4 The brake kits

INSTALLING A SPRING LOADED BRAKE – L / S / X

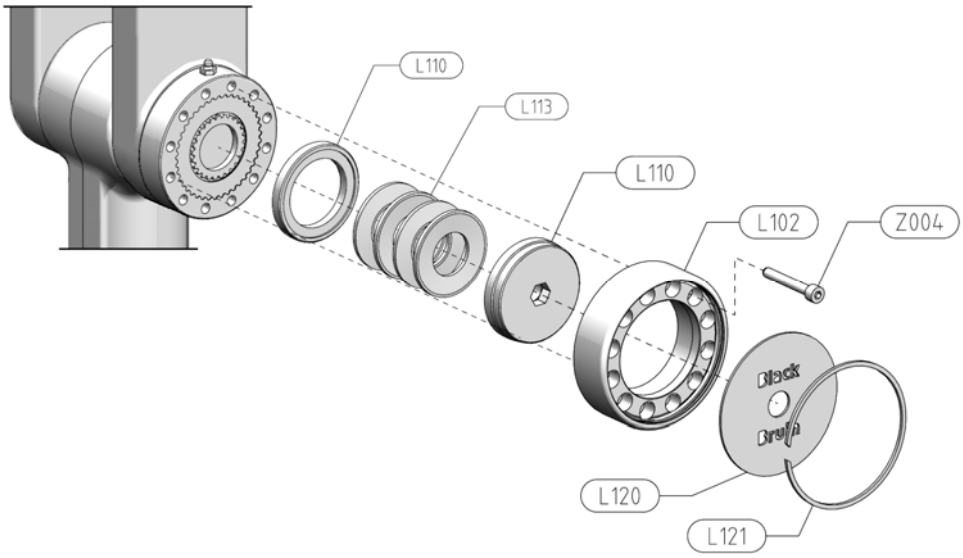


1) Position the toothed ring (L101) in the correct position using two attachment screws (Z004). Note the direction of the lubrication nipple when attaching the toothed ring. Position the nipple so that it can be accessed easily and it is protected against external shocks as well as possible.
2) Stack the brake lamella (L910 and L911) alternating them so that a lamella with toothed outer rim (L910) is placed as the first and as the last on the stack. Check the number of lamella (see chapter 3.2.2).
3) Remove the screws used for the positioning.



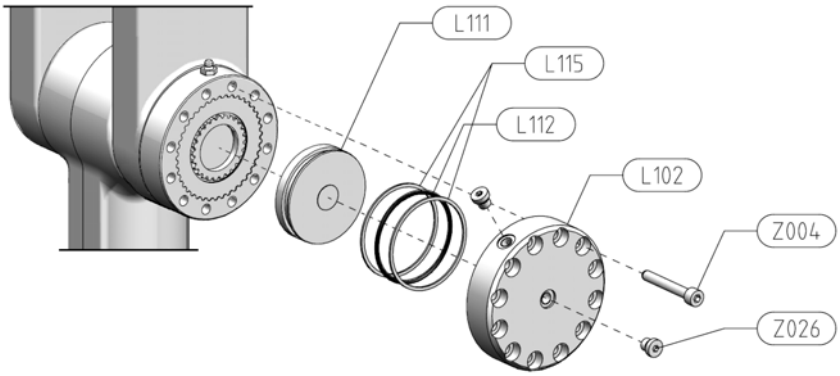
4) Lubricate the thread on the brake cover (L102) and lightly turn the threaded cover all the way on.
5) Assemble the cup strings (L113) and press ring (L110) inside the brake cover to make a cover assembly. Note the correct order of cup strings (4 pcs), as shown in the Figure above.
6) Place the cover assembly over the toothed ring and fasten the brake using three attachment screws (Z004).
7) Check that the brake parts are properly aligned and free from backlash, and attach the remaining screws.
8) Tighten the screws with torque of 43 ± 3 Nm.
9) Fill the brake with lubricant (see chapter 2.4).
10) Adjust the tension of the brake (see chapter 3.2.5).

INSTALLING A BRAKE WITH A COVER PLATE – LC / SC / XC



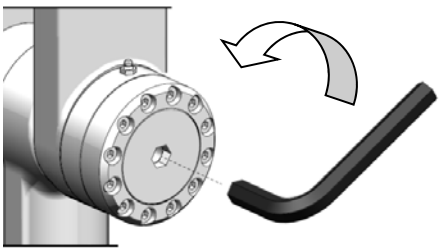
1) Install the brake into place same way as the spring loaded brake (L / S / X) (see above).
2) Finally insert the cover plate (L120) into place and secure it with the retaining ring (L121)

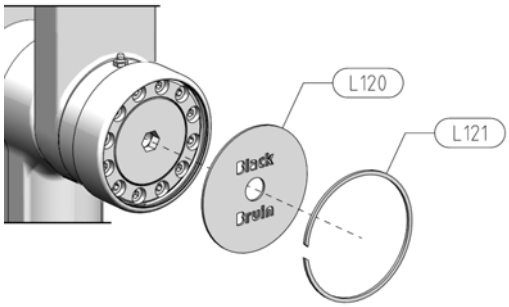
INSTALLING A HYDRAULIC BRAKE – LH, SH, XH



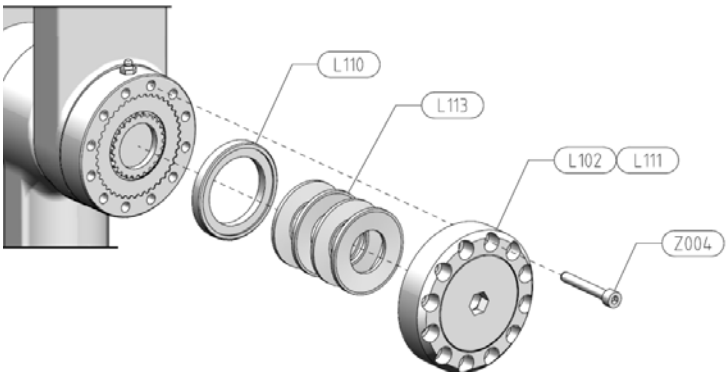
1) Install the toothed ring and the brake lamella same way as on spring loaded break
2) Install the seal (L112) to piston (L111) and lubricate the seal. The support rings (L115) are placed on both sides of the seal.
3) Assemble the brake cylinder by pushing the piston inside the cover (L102) with the side with the seal on first.
4) Place the brake cylinder on top of the toothed ring and fasten the brake using three attachment screws (Z004) with light tension.
5) Check that the brake parts are properly aligned and free from backlash, and attach the remaining screws.
6) Tighten the screws to 43 Nm pre-tensioning torque.
7) Fill the brake with lubricant (see chapter 2.4).
8) Plug the pressure inlets of the brake cylinder with plugs (Z026).
9) Connect a brake pressure line to one of the brake cylinder pressure inlets and bleed air from the brake by slightly opening one of the plugs (Z026).

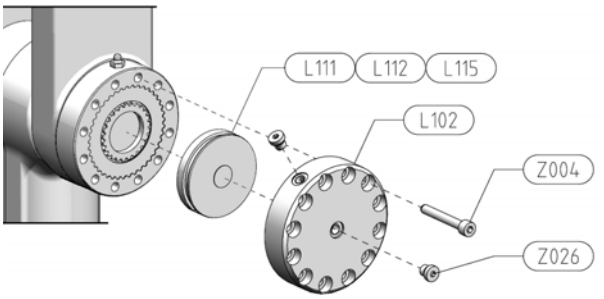
DISASSEMBLING THE BRAKES – L / S / X – LC / SC / XC – LH / SH / XH



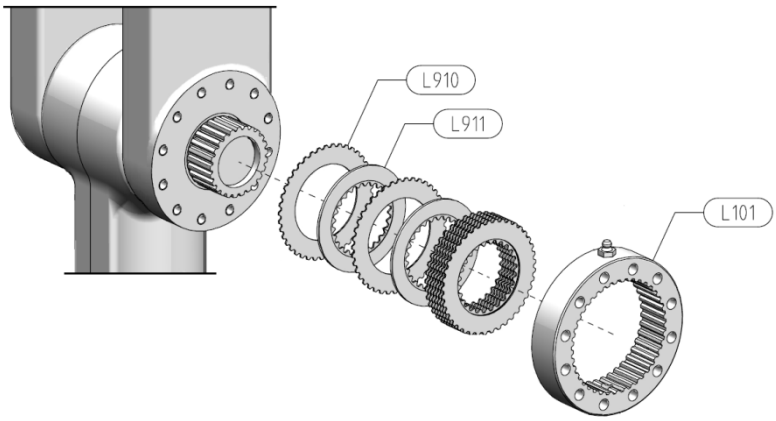


1) Remove the retaining ring (L120) and take out the cover plate (L120) (only brakes LC / SC / XC).
2) Clean the heads of the attachment screws and hex key hole on the brake cover.
3) Loosen the break by turning counter-clockwise from the hex key hole. Break is loosened when the thread cover is on the same plane with the brake cover.



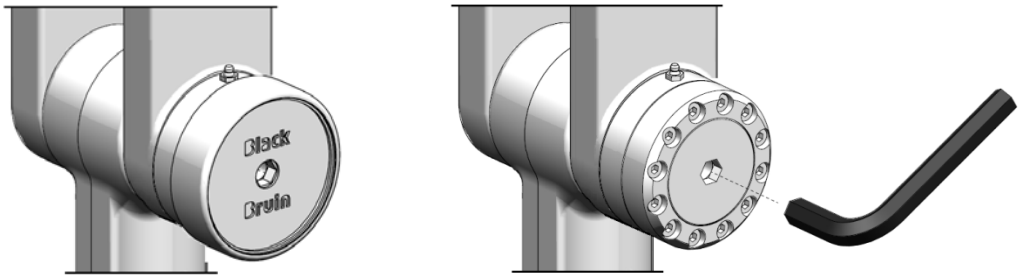


4) Remove the attachment screws of the brake to disassemble brake cover assembly.



5) Remove the toothed ring (L101) and brake lamella (L910 and L911) from the end of the attachment pin.
6) Clean all the parts and check the thickness of the lamella pack (see chapter 3.2.2).
7) Check also the condition of the brake piston seal (hydraulic brake LH / SH / XH only).

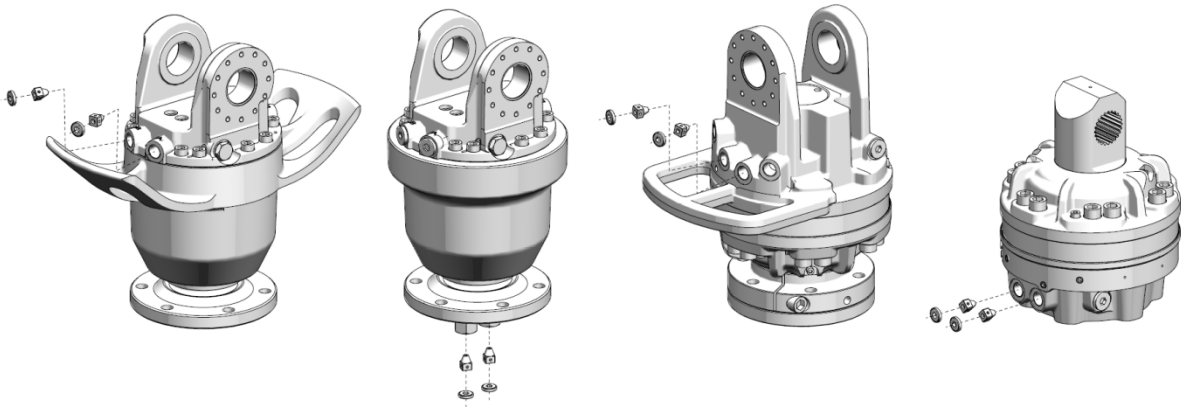
3.2.5 Adjusting the spring loaded brake – L / S / X – LC / SC / XC



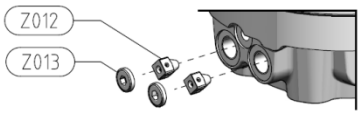
Adjusting the tightness of the swing damper's brakes is done by using the 17 mm hex key hole on the middle of the brake cover. Turning clockwise tightens the brake and turning counter-clockwise loosens the brake. The maximum allowed tensioning torque for the brake is 150 Nm.

3.3 The rotator

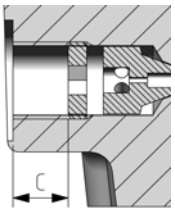
3.3.1 Working line restrictor check



The rotator's working line restrictors are on the connector openings of the pressure hoses. Checking of the working line restrictors is done as follows:



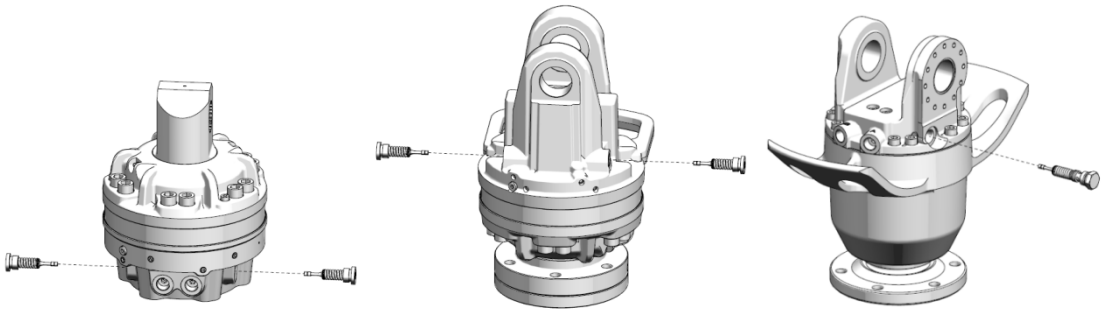
1) Make sure that the rotator is cool and not pressurized.
2) Disconnect the pressure hoses from the rotator.
3) Remove the retaining plate (Z013) from the connector opening and remove the restrictor (Z012).
4) Check that the restrictor holes are fully open.
5) Clean the retaining plate, the orifice, and the connector opening carefully before reassembly
6) Insert the restrictor and the retaining plate in place. Turn the retaining plate all the way in.
7) Check the installation depth of the retaining plate. C = 16 ± 1 mm.
8) Vent the rotator by flushing (see chapter 2.5).



Danger!

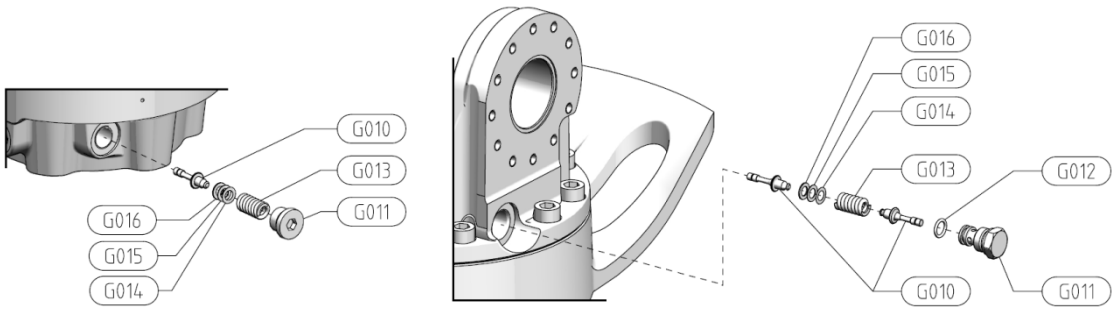
Unlimited rotating speed may cause danger. The working line restrictors limits the flow of hydraulic oil through the rotator and hence limit the rotation speed of the rotator. The work line restrictors may only be left out if the flow volume has been limited by some other means. Recommended flow volume and maximum allowed rotation speed are specified in the rotator's data sheet.

3.3.2 Pressure relief valve check



The rotator's pressure relief valves limit the pressure difference of the working lines to both rotating directions. The valves are located on the distribution head of the rotator. Checking the pressure relief valves is done as follows:

1) Make sure that the rotator is cool and not under pressure.
2) Open the valve by removing the plug (G011). On two-way valves the other spool (G010) of the valve is usually taken off with the plug.
3) Remove the spring (G013), possible shims (G014-G016) and the spool (G010) from the valve space. Note the number and thickness of shims.



4) Clean the parts and the valve space carefully.
5) Check the sealing surfaces of the spools and the seating surfaces on their bases. For two-way valves also check the sealing of the plug (G012).
6) Assemble the parts back in the valve space in the same order they were prior to the disassembly. For two-way valves insert the other spool inside the plug to ease the assembling operation.
7) Close the plug of the valve and tighten it with torque of 95 ± 5 Nm.
8) Vent the rotator by flushing (see chapter 2.5).

Information!

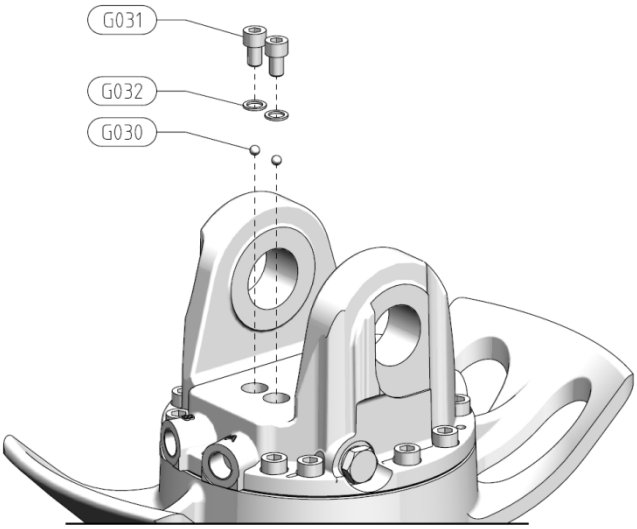
Note the number of possible shims. Opening pressure for the pressure relief valve is adjusted by them. To keep the original adjustment the number of shims should be equal when assembling the valve.

3.3.3 Return valve check

MR	BBR F	BBR H	RH

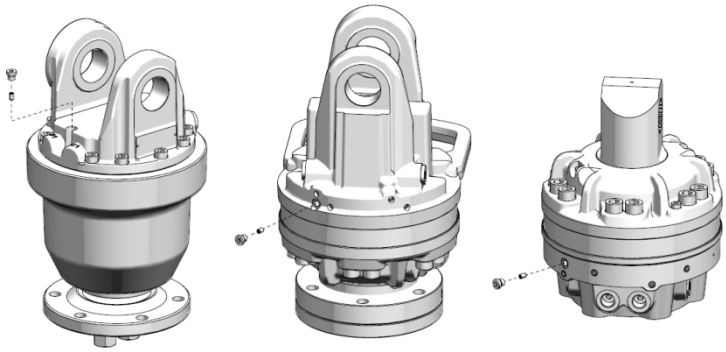
The return valves located on the upper surface of the rotator can be checked as follows:

1) Make sure that the rotator is cool and not under pressure.
2) Clean the valve hole carefully and remove the plug screw (G031).
3) Remove the seal ring (G032) under the screw head.
4) Remove the ball (G030) from the valve space.
5) Clean the parts and the valve space carefully.
6) Check the parts and the surface the ball is sealed against at the bottom of the valve space.
7) Insert the parts back to their space
8) Tighten the plug screw with torque of 43 ± 3 Nm.



3.3.4 By-pass orifice check

MR F	MR A	MR MF	**MR FD**	**MR MD**	**BBR F**	**BBR H**	**RH**



The by-pass orifice is located on the distribution head of the rotator. Checking the by-pass orifice is done as follows:

1) Make sure that the rotator is cool and not pressurized.
2) Open the plug of the orifice opening and remove the orifice using a long 3 mm hex key. If required, use a magnetic tool and take care not to drop the orifice into the crossing bores.
3) Check that the hole in the orifice is fully open.
4) Clean the orifice and its opening carefully before reassembling.
5) Set the orifice back to its space and tighten it with torque of 2,5–3 Nm.
6) Close the plug of the orifice opening and tighten it with torque of 20 ± 2 Nm.
7) Vent the rotator by flushing (see chapter 2.5).

3.3.5 Checking the shaft seal

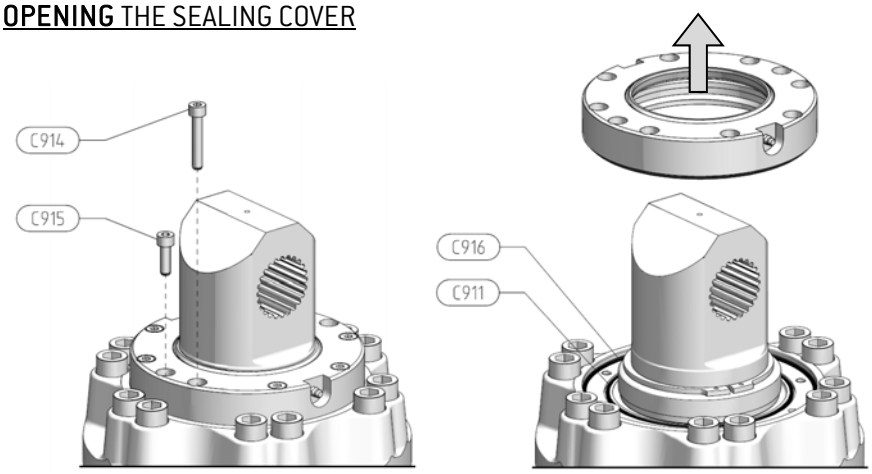
MR	BBR F	BBR H	**RH**

The shaft seal for a rotator with sealing cover can be checked and replaced according to the following instructions. Before opening the sealing cover, the rotator must be disconnected from the working machine.

Attention!

When changing the shaft seal, special attention must be paid to cleanliness. When the sealing cover is open, dirt may enter the rotator, which may allow it to spread to the hydraulic system.

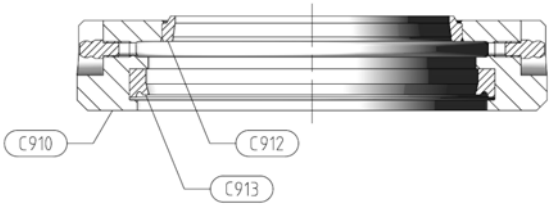
OPENING THE SEALING COVER



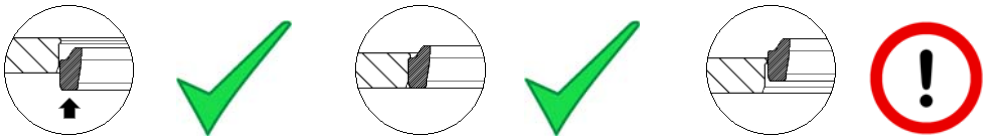
1) Clean the rotator thoroughly, but do not use any solvents.
2) Cover or smooth any dents and sharp edges on the shaft surface, by using tape, for example.
3) Unscrew all the screws on the sealing cover. There are 8 cover attachment screws (C914) and 2 short plug screws (C915) for the extraction threads.
4) Carefully lift the sealing cover away from the shaft. Use extraction screws (size M8) when removing the cover.
5) Check the o-rings (C911 and C916) under the cover.
6) Check the shaft seal (C913) and lip seal (C912) found on the sealing cover.
7) Check the collar contact surface for the shaft seal. The surface must be smooth and clean.
8) If necessary, remove the collar (see below).

Information!

The lip seal (C912) and shaft seal (C913) are removed and installed from the inner side of the seal cover. Consider the direction of the seal lip during installation.



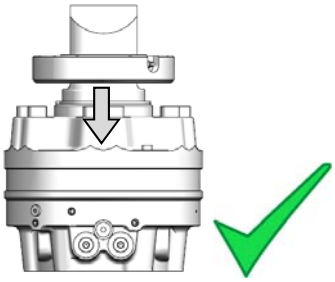
The lip seal is inserted evenly to the inner surface of the base. Use a suitable retaining compound to attach the lip seal.

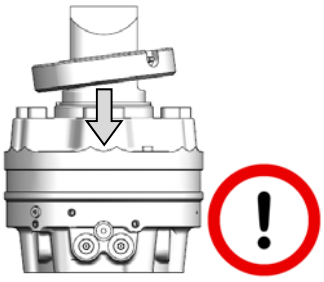


CLOSING THE SEALING COVER

Before closing the sealing cover, clean the parts carefully and replace worn-out seals and damaged parts. Be careful not to damage the lip of the shaft seal during installation. Closing the sealing cover is done as follows:

1) Lubricate the o-rings and put them in their places (C911 and C916).
2) Lubricate the lips of the seals inside the sealing cover.
3) Press the sealing cover evenly into its place. Position the sealing cover so that the greasing nipples are not left behind the screws of the rotator casing.
4) Tighten the sealing cover by evenly tightening a couple of the attachment screws (C914).
5) Install rest of the attachment screws and tighten with torque of 43 ± 3 Nm.
6) Install the extraction thread protective screws (C915) and tighten with torque of 20 ± 2 Nm.
7) Fill in the shaft seal lubrication pocket (see chapter 2.4).
8) Vent the rotator by flushing (see chapter 2.5).

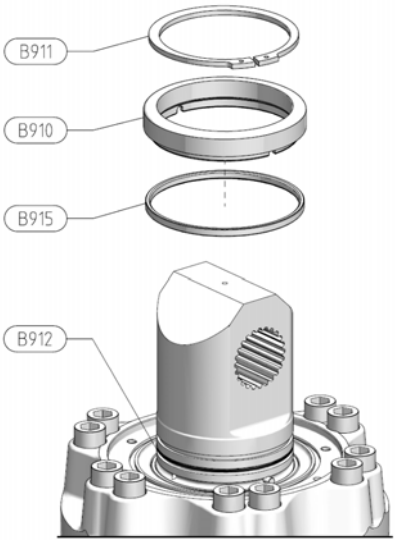




CHECKING THE SEALING COLLAR

The outer surface of the sealing collar is the contact surface with the shaft seal. The condition of the surface can be inspected without removing the collar. If required, the removing and attaching of the bush can be done as follows:

1) Remove the retaining ring (B911).
2) Pull the bush (B910) with its ring (B915) carefully away from the shaft. Be careful not to damage the sealing surfaces.
3) Check the revealed o-ring (B912) on the shaft.
4) Check the condition of the collar and replace when necessary.
5) Make sure that the positioning pins (2 pcs) for the collar are in the right positions.
6) Lower the whole collar with its ring back to its position applying even pressure to it. Ensure that the holes on the collar line up with the positioning pins.
7) Place the ring of the collar back on the shaft.



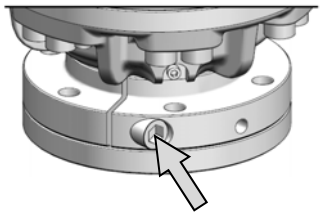
Information!

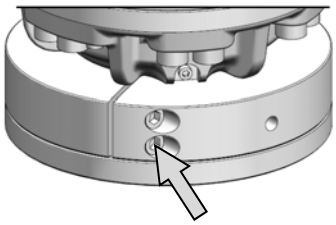
You may also check wear on the slide bearing as it appears on the root of the shaft. The slide bearing should be replaced in case of visible clearance between the bearing and the shaft. The rotator should be sent for repair for replacing the slide bearing.

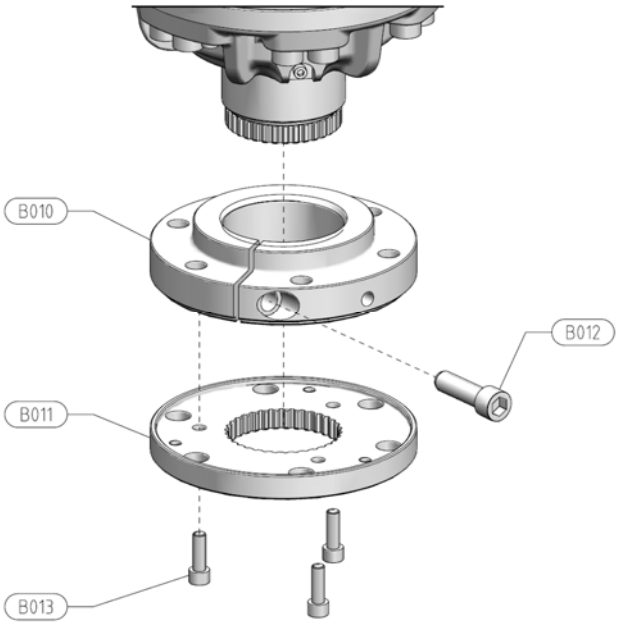
3.3.6 Checking the threaded flange

MR	**BBR F**	BBR H	RH

Check the persistence of pre-tension torque of the flange's clamping screws.







The pre-tension torques for the flange screws:

M12 screws: 135 ± 7 Nm

M16 screws: 330 ± 16 Nm

If the screws have turned loose, check the joint of the flange as follows:

1) Remove the grapple or harvesting head from the rotator.
2) Remove the toothed flange's attachment screws (B013) from the bottom of the flange (3 pcs).
3) Detach the toothed flange (B011). Use extraction screws (size M10) if necessary.
4) Remove the clamping screws (B012) of the threaded flange.
5) Remove the threaded flange (B010) from the rotator by rotating it counter-clockwise. If necessary, use a wedge on the split of the flange.
6) Clean all parts carefully and check the threading and teeth of the shaft and the flanges.

Attention!

If the joint of the flange is worn-out or damaged, send the rotator for repair. Do not use the rotator if the thread of the joint is worn-out.

7) Make sure, that the thread is clean and use anticorrosive agent on thread.
8) Turn the threaded flange (B010) back to its place almost all the way in.
9) Attach the toothed flange (B011) in its place and position the threaded flange (B010) so that the holes for the attachment screws align.
10) Place the attachment screws (B013) in their positions, but do not tighten them yet.
11) Install the flange's clamping screw(s) (B012) and tighten to pre-tension torque (see above). Use thread-locker.
12) Tighten the attachment screws of the flange (B013) with torque of 80 ± 5 Nm.

4 INSTRUCTIONS FOR SYSTEM DESIGN

4.1 Use of the case drain line

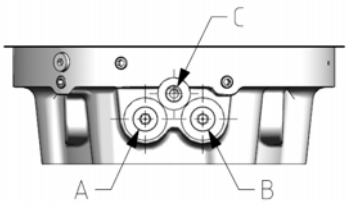
MR	BBR F	**BBR H**	**RH**

The use of the case drain line is to limit the housing pressure of the rotator. It can be utilized by connecting the case drain line's connector to any low pressure tank line in the hydraulic system.

By utilising the case drain line the following benefits can be attained:

- The service-life of the bearings and sealing is extended.
- The circulation of the hydraulic oil in the rotator's hydraulic circuit is enhanced.

The use of the case drain line does not affect the performance or running response of the rotator.



The port for the case drain line (C) is located between the working line ports (A and B). The port thread size is G1/4" and the port is closed with a metal plug by default.

Attention!

Using the housing leak line is highly recommended, if simultaneous high pressure may be applied to both of the rotator's working lines. Simultaneous high pressure on working lines may be caused by, for example, intermediate positions of the rotator's control valve, or by a worn-out / damaged valve spool. In applications like this the service life of the rotator may be significantly increased by using a case drain line.

4.2 Use of relief valves

The pressure of the rotator hydraulic system must not exceed the maximum allowed value for the rotator. Internal or external pressure relief valves must be used to limit the pressure. Make sure that the rotator has internal pressure relief valves if no external pressure relief valve is used.

Danger!

Do not use the rotator without relief valves. When a load is rotating the rotator, the hydraulic pressure may increase indefinitely. Rising pressure leads to danger if a hose or another component breaks.

4.3 Hydraulic fluid

4.3.1 Hydraulic fluid type

Black Bruin hydraulic rotators are designed to work with hydraulic fluids based on mineral oil. The following requirements should be considered when choosing hydraulic fluid:

- Hydraulic oils in accordance with ISO 6743-4 are recommended to be used.
- Motor oils in accordance with API-grades SF, SG, SH and SL may also be used.
- Fire resistant hydraulic fluids HFB and HFC or similar may be used under certain circumstances.

Information!

Please consult Black Bruin or its representative, if other than mineral oil based hydraulic fluids are to be used.

4.3.2 Hydraulic fluid properties

Take into consideration the following requirements concerning the hydraulic fluid properties:

- The recommended fluid viscosity range for constant use is 25 - 50 cSt.
- The minimum permissible intermittent viscosity is 15 cSt.
- The viscosity index must be at least 100.
- For best service life, avoid over 70 °C (158 °F) operating temperature.
- Hydraulic fluid must fulfill cleanliness level 18/16/13 in accordance with ISO 4406 (NAS-1638 grade 7).

Take into account that the effect of the additives improving the viscosity index can decrease during operation.

Information!

Temperature has a significant effect on the viscosity and the lubricating capability of the hydraulic fluid. Take into consideration the real or assumed operating temperature when defining the fluid viscosity.

The need for service and the overall service life may be improved by using hydraulic fluids with higher viscosity. In addition higher viscosity may improve the running smoothness.

5 TROUBLESHOOTING GUIDE

Description of the malfunction	Possible cause	Action
The rotator makes loud hissing or metallic noises when rotating in one or both directions.	The volume flow being fed into the rotator is too high.	Check the volume flow recommendations on the data sheet of the rotator.
	Impurities in work line restrictors.	Check work line restrictors (see chapter 3.3.1).
	The by-pass orifice is not in place or there are impurities in it.	Check the by-pass orifice (see chapter 3.3.4).
The rotator does not rotate in one or both directions. OR The rotator accelerates or rotates slowly in one or both directions.	The work line restrictors are fully or partially blocked.	Check the work line restrictors (see chapter. 3.3.1).
	There are impurities in the relief valve.	Check the relief valves (see chapter 3.3.2).
	There is damage to the internal parts of the rotator.	Send the rotator for repair.
The rotator's movement stops slowly in one or both directions. OR The rotator head is not stiff when stopped.	There are impurities in the relief valves.	Check the relief valves (see chapter 3.3.2).
	The return valves of the housing are leaking.	MR rotators. Check the return valves (see chapter 3.3.3).
		Send the rotator for repair.
	The by-pass orifice is not in place.	Check the by-pass orifice (see chapter 3.3.4).
	There is an internal leak in the rotator.	Send the rotator for repair.
	The by-pass orifice is too loose for the application.	Ask Black Bruin or your local sales representative for an optional orifice.
The rotator makes a backward turn when stopped.	The by-pass orifice is fully or partially blocked.	Check the by-pass orifice (see chapter 3.3.4).
	The by-pass orifice is too tight for the application.	Ask Black Bruin or your local sales representative for an optional orifice.
Oil spills out from the rotator's shaft's neck when rotating.	Leak in shaft seal.	BBR H and RH rotators A small leak may be temporally fixed by connecting a case drain line (see chapter 4.1).
		RH rotator Replace the leaking seal (see chapter 3.3.5).
		Send the rotator for repair.
The swing damper does not hold.	The spring-loaded brake is loose. (L / S / X / LC / SC / XC brakes)	Tighten the brake of the swing damper (see chapter 3.2.5).
	The brake lamella of the damper are worn out.	Check the brake lamella (see chapter 3.2.2).
The grapple grip strength is weak. (MR and BBR F -rotators)	The shaft feed-through seals are leaking.	Send the rotator for repair.
Oil is leaking out from the swing damper brake or the base of the attachment pin. (LH / SH / XH brakes)	The brake piston seal is worn out.	Check the brake piston seal (see chapter 3.2.4).

6 DECLARATION OF CONFORMITY

EC DECLARATION OF CONFORMITY 1(1)

2017-01-09

Black Bruin Inc.

EC DELARATION OF CONFORMITY (in accordance with EC Machinery Directive 2006/42/EC, Annex II A)

Manufacturer	Black Bruin Inc.
Address	Valmetintie 9 FI-40420 Jyskä, FINLAND
Product description	Black Bruin hydraulic rotator series: ▪ **BBR** ▪ **MR** ▪ **RH**

We hereby declare that the product(s) specified above complies the relevant requirements of EC Machinery Directive 2006/42/EC, as amended.

And that the following harmonised standards have been applied:

- **EN ISO 4413:2010** (Hydraulic fluid power - General rules and safety requirements for systems and their components)
- **EN ISO 12100:2010** (Safety of machinery – General principles for design – Risk assessment and risk reduction)

The product(s) must be applied and installed in accordance with all the technical documents applicable to the product(s).

This document supersedes all previous releases to this subject.

Place and date: Jyväskylä, 2017-01-09

On behalf of Black Bruin Inc.

Seppo Koiranen

Name: Seppo Koiranen
Title: Technical Director

BLACK BRUIN INC.
P.O. Box 633, FI-40101 JYVÄSKYLÄ, FINLAND
+358 20 755 0755 | info@blackbruin.com | www.blackbruin.com

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BLACK BRUIN INC.
P.O. Box 633
FI-40101 Jyväskylä, FINLAND

+358 20 755 0755
info@blackbruin.com
www.blackbruin.com

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