

Maintenance Instructions

CH440:04



This publication is copyright of Sandvik – © Sandvik 2019

It must not be copied*, reproduced or otherwise made available in full or in part to any third party without Sandvik's prior written consent.

All rights reserved.

* The maintenance checklists in the Maintenance Instructions and Operator's Instructions may be copied solely for maintenance purposes of Sandvik equipment.

Document number: S 223.1707

Version: 8

Language: en-US

Issue: 04/04/2024



Sandvik

Stationsplan, SE-233 81 Svedala, Sweden
Tel: +46 (0)40 409000, Fax: +46 (0)40 409260
www.sandvik.com

 WARNING	
	IGNORING INSTRUCTIONS HAZARD! To avoid death or injury you MUST read, understand and follow operator's and maintenance manuals before installing, inspecting, operating, servicing, testing, cleaning, transporting, storing, dismantling or disposing of the product or a part or accessory of the product. Keep this publication for future reference.

This page is intentionally left blank

Table of Contents

1	Basic maintenance instructions.....	11
1.1	Clearing out the crushing chamber.....	12
1.2	Plastic backing.....	12
1.2.1	Backing procedure.....	12
1.2.2	Hygienic aspects and protective measures.....	13
1.3	Accumulators.....	14
1.3.1	General accumulator information.....	14
1.3.2	Flow regulator.....	15
1.3.3	Charging kit (option).....	15
1.3.3.1	Checking the gas pressure.....	16
1.3.3.2	Charging with nitrogen.....	17
2	Periodic maintenance.....	19
2.1	Determining inspection and maintenance intervals.....	20
2.2	Inspection and care when it is dark.....	20
2.3	Weekly inspection and care.....	20
2.4	Monthly inspection and care.....	22
2.5	Inspection and care for every 6 months.....	22
2.6	Yearly inspection and care.....	23
3	Maintenance instructions.....	25
3.1	Feed hopper.....	26
3.1.1	Replacing the feed hopper.....	26
3.1.1.1	Removing the feed hopper.....	26
3.1.1.2	Inspecting the feed hopper.....	27
3.1.1.3	Installing the feed hopper.....	27
3.2	Top shell.....	30
3.2.1	Replacing the spider cap.....	30
3.2.1.1	Removing the spider cap.....	30
3.2.1.2	Spider cap removal checks.....	32
3.2.1.3	Installing the spider cap.....	34
3.2.2	Inspecting the crushing chamber.....	35
3.2.2.1	Inspecting the liners.....	35
3.2.2.2	Inspecting the concave and mantle.....	36
3.2.3	Replacing the spider bushing and the seal ring.....	36
3.2.3.1	Removing the spider bushing and the seal.....	36
3.2.3.2	Checking the spider bushing and the seal ring.....	40
3.2.3.3	Installing the spider bushing and the seal.....	41
3.2.4	Checks prior to removal of the top shell.....	43
3.2.5	Replacing the top shell.....	44
3.2.5.1	Removing the top shell.....	44
3.2.5.2	Checking the top shell.....	46
3.2.5.3	Installing the top shell.....	46
3.2.6	Replacing the concave ring	49
3.2.6.1	Removing the concave ring.....	50

Maintenance Instructions

3.2.6.2	Installing the concave ring.....	53
3.2.7	Replacing the filler ring.....	56
3.2.7.1	Removing the filler ring.....	57
3.2.7.2	Inspecting the filler ring.....	59
3.2.7.3	Installing the filler ring.....	59
3.2.8	Replacing the arm shields.....	61
3.2.8.1	Removing the arm shields.....	61
3.2.8.2	Installing the arm shields.....	61
3.3	Main shaft.....	62
3.3.1	Replacing the main shaft and the mantle.....	62
3.3.1.1	Removing the main shaft assembly.....	63
3.3.1.2	Checking the main shaft and the mantle.....	64
3.3.1.3	Installing the main shaft assembly	65
3.3.2	Replacing the head nut.....	67
3.3.2.1	Removing the head nut.....	67
3.3.2.2	Checking the head nut.....	69
3.3.2.3	Installing the head nut.....	70
3.3.2.4	Removing the inner head nut.....	73
3.3.2.5	Installing the inner head nut.....	74
3.3.3	Replacing the mantle.....	75
3.3.3.1	Checking the play between the head center and the mantle	75
3.3.3.2	Removing the mantle.....	76
3.3.3.3	Installing the mantle.....	77
3.3.4	Replacing the main shaft sleeve.....	82
3.3.4.1	Inspecting the main shaft sleeve.....	82
3.3.4.2	Removing the main shaft sleeve.....	83
3.3.4.3	Installing the main shaft sleeve.....	88
3.3.5	Inspecting the head center.....	97
3.3.6	Replacing the main shaft step.....	98
3.3.6.1	Removing the main shaft step.....	98
3.3.6.2	Inspecting the main shaft step.....	100
3.3.6.3	Installing the main shaft step.....	100
3.3.7	Replacing the dust seal ring.....	102
3.3.7.1	Removing the dust seal ring.....	103
3.3.7.2	Checking the dust seal ring.....	107
3.3.7.3	Installing the dust seal ring.....	107
3.3.8	Replacing the scraper.....	111
3.3.8.1	Checking the scraper.....	111
3.3.8.2	Removing and installing the scraper.....	112
3.4	Dust collar.....	112
3.4.1	Replacing the dust collar.....	112
3.4.1.1	Removing the dust collar.....	112
3.4.1.2	Inspecting the dust collar.....	114
3.4.1.3	Installing the dust collar.....	114
3.4.2	Replacing the seating ring.....	116
3.4.2.1	Removing the seating ring.....	116
3.4.2.2	Installing the seating ring.....	117
3.4.3	Replacing the locating bar.....	117
3.4.3.1	Checking the locating bar clearance.....	117

3.4.3.2	Removing the locating bar.....	118
3.4.3.3	Installing the locating bar.....	119
3.5	Eccentric.....	119
3.5.1	Replacing the eccentric bushing.....	119
3.5.1.1	Removing the eccentric bushing.....	121
3.5.1.2	Removing the eccentric bushing - Alternative method.....	122
3.5.1.3	Inspecting the eccentric bushing.....	123
3.5.1.4	Installing the eccentric bushing.....	124
3.5.2	Replacing the eccentric assembly.....	126
3.5.2.1	Removing the eccentric assembly.....	126
3.5.2.2	Inspecting the eccentric assembly.....	127
3.5.2.3	Installing the eccentric assembly.....	128
3.5.3	Replacing the eccentric hub and gear.....	129
3.5.3.1	Removing the eccentric hub and gear	129
3.5.3.2	Inspecting the eccentric hub and gear.....	134
3.5.3.3	Installing the eccentric hub and gear.....	134
3.5.4	Replacing the eccentric wearing plate.....	138
3.5.4.1	Inspecting the eccentric wearing plate.....	138
3.5.4.2	Removing the eccentric wearing plate.....	138
3.5.4.3	Installing the eccentric wearing plate.....	140
3.6	Bottom shell.....	142
3.6.1	Replacing the bottom shell bushing.....	142
3.6.1.1	Removing the bottom shell bushing.....	142
3.6.1.2	Installing the bottom shell bushing.....	143
3.6.2	Replacing the Hardox liners.....	144
3.6.2.1	Removing the Hardox liners.....	144
3.6.2.2	Installing the Hardox liners.....	147
3.7	Hydroset cylinder.....	150
3.7.1	Replacing the Hydroset piston.....	150
3.7.1.1	Removing the Hydroset piston.....	150
3.7.1.2	Inspecting the Hydroset piston.....	152
3.7.1.3	Installing the Hydroset piston.....	152
3.7.2	Replacing the step bearing components.....	153
3.7.2.1	Removing the step bearing components.....	154
3.7.2.2	Inspecting the step bearing components.....	159
3.7.2.3	Installing the step bearing components.....	160
3.7.3	Replacing the chevron packing.....	166
3.7.3.1	Removing the chevron packing.....	167
3.7.3.2	Inspecting the chevron packing.....	167
3.7.3.3	Installing the chevron packing.....	168
3.7.4	Checking the torque of the Hydroset cylinder joints.....	170
3.7.5	Replacing the Hydroset cylinder bushing.....	171
3.7.5.1	Removing the Hydroset cylinder bushing.....	171
3.7.5.2	Inspecting the Hydroset cylinder bushing.....	174
3.7.5.3	Installing the Hydroset cylinder bushing.....	174
3.7.6	Replacing the Hydroset piston position transmitter K1-GT1.....	177
3.7.6.1	Removing the Hydroset piston position transmitter K1-GT1	177
3.7.6.2	Installing the Hydroset piston position transmitter K1-GT1	178

3.8	Hydroset system.....	179
3.8.1	Bleeding air from the Hydroset system	179
3.8.2	Checking the gas pressure.....	180
3.8.3	Relieving the Hydroset pressure.....	181
3.8.4	Replacing the hydraulic hose.....	181
3.8.4.1	Removing the hydraulic hose.....	181
3.8.4.2	Inspecting the hydraulic hose.....	184
3.8.4.3	Installing the hydraulic hose.....	184
3.8.5	Checking the valves in the Hydroset control valve.....	186
3.9	Pinionshaft housing.....	188
3.9.1	Checking the oil flow to the pinionshaft housing.....	188
3.9.2	Replacing the pinion shaft housing assembly.....	189
3.9.2.1	Checks prior to removal.....	189
3.9.2.2	Preparations before removing the pinion shaft housing....	189
3.9.2.3	Removing the pinion shaft housing assembly.....	193
3.9.2.4	Inspecting the pinion shaft housing assembly.....	196
3.9.2.5	Installing the pinion shaft housing assembly.....	197
3.9.2.6	Restoration after installing the pinion shaft housing.....	201
3.9.3	Replacing the pinionshaft and the pinion.....	205
3.9.3.1	Removing the crusher pulley - Only with V-belt drive.....	205
3.9.3.2	Removing the pinion.....	206
3.9.3.3	Removing the pinion shaft.....	208
3.9.3.4	Removing the roller bearings and the spacers.....	213
3.9.3.5	Installing the roller bearings and the spacers.....	217
3.9.3.6	Installing the pinion shaft.....	221
3.9.3.7	Installing the outer bearing cover.....	228
3.9.3.8	Installing the level tube and the discharge tube.....	230
3.9.3.9	Installing the inner bearing cover.....	233
3.9.3.10	Installing the pinion.....	234
3.9.3.11	Installing the crusher pulley.....	234
3.9.3.12	Preparation for the installation of a complete pinion shaft assembly.....	237
3.9.4	Bevel gears.....	238
3.9.4.1	Checking the gear backlash.....	238
3.9.4.2	Adjusting the gear backlash.....	241
3.9.4.3	Determining the gasket thickness.....	242
3.9.4.4	Tooth bearing "footprint".....	243
3.10	Dust seal air pressure system.....	246
3.10.1	Replacing the dust seal air pressure needle valve.....	246
3.10.1.1	Removing the dust seal air pressure flow valve.....	246
3.10.1.2	Installing the dust seal air pressure needle valve.....	247
3.10.2	Flow valve setting.....	248
3.11	V-belt drive.....	248
3.11.1	Checking the V-belt tension.....	248
3.11.2	Replacing the V-belt guards.....	250
3.11.2.1	Removing the V-belt guards.....	250
3.11.2.2	Installing the V-belt guards.....	250
3.11.3	Replacing the V-belts.....	251
3.11.3.1	Removing the V-belts.....	251
3.11.3.2	Installing the V-belts.....	251

3.11.4	Replacing the V-belt drive motor.....	253
3.11.4.1	Removing the V-belt drive motor.....	253
3.11.4.2	Installing the V-belt drive motor.....	254
3.11.5	Setting the V-belt speed monitor.....	256
3.11.6	Preparations before removing the pinion shaft housing.....	257
3.11.7	Restoration after installing the pinion shaft housing.....	262
3.12	Start-up after maintenance.....	266
3.12.1	Checklist for an overhauled crusher.....	266
3.13	Starting up the crusher.....	268
3.13.1	Preparing a tank that has been stored more than six months.....	268
3.13.2	Running-in.....	269
3.13.3	Replacing the filters for the first time.....	273
4	Maintenance personnel's troubleshooting.....	275
4.1	Problems and corrective actions.....	276
4.2	The crusher does not start.....	276
4.3	The crusher stops.....	276
4.4	The lubrication oil temperature is too high.....	278
4.5	The CSS varies or the product is oversized.....	278
4.6	The pinion shaft does not operate correctly.....	280
4.7	The crusher sounds different.....	281
4.8	The crusher's capacity drops.....	282
4.9	The bearing component wear increases.....	283
4.10	A bearing in the crusher fails.....	283
4.11	The main lubrication oil is contaminated.....	284
4.12	The Hydroset bolts are broken.....	285
4.13	The concave bolts are broken.....	285
4.14	The main lubrication oil capacity is low or non-existent.....	285

This page is intentionally left blank

1 Basic maintenance instructions

1.1 Clearing out the crushing chamber

NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE.

Do not start the crusher if it has stalled because of uncrushable material (metal, wood etc.). Empty the crusher manually or unbolt the top shell so that all material can leave the crushing chamber.

NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE.

Never start the crusher with a loose top shell.

If the crusher stalls with the crushing chamber full of material, clear it out as follows:

1. Make sure that the crusher's feeding arrangement is switched off.
2. If there is material in the discharge chute beneath the crusher, remove the material.

Note! *The control system must be switched off to prevent automatic main shaft regulation.*

3. Use the CSS control box CB1 to lower the main shaft, keeping an eye on the Hydroset pressure.
4. If the Hydroset pressure drops below 0.3 MPa, then raise the main shaft again until the pressure gauge displays at least 0.5 MPa.
5. Start the crusher.

Note! *Check for material build-up on the bottom shell arms. If damp, wet feed is causing packing, operate at a larger setting.*

Note! *Check the interlocking between the feeding arrangement and discharge system. There must be room beneath the crusher for material in the crushing chamber and feed hopper, in case the discharge system stops.*

1.2 Plastic backing

1.2.1 Backing procedure

Note! *When backing is carried out in cold weather, the containers must be heated to approximately 25 °C(77 °F) before mixing. At a lower temperature, the components will be too viscous.*

Note! *Heat the components that are to be backed, to between 40 °C and 50 °C (104 °F and 122 °F) to shorten the setting time. If the components are very cold, the plastic will not set.*

Note! *Do not heat the plastic backing with an open flame, as this can damage the material.*

Maintenance Instructions

To mix the plastic backing, and pour it into the cone crusher, follow this procedure:

 WARNING	
 	TOXIC HAZARD You can suffer eye and skin irritation, sensitization and burns if you handle the plastic backing incorrectly. Follow the instructions on the plastic backing containers and in each component's MSDS.

1. Mix the plastic backing for a minimum of 5 minutes, according to the instructions on the containers.
2. Immediately after mixing, pour the mix into the backing space in the crusher.
3. Let the plastic backing set in the cone crusher.
The setting time for Korrobond 65 varies from 7 to 24 hours, depending on the ambient temperature.

1.2.2

Hygienic aspects and protective measures

 WARNING	
 	TOXIC HAZARD You can suffer eye and skin irritation, sensitization and burns if you handle the plastic backing incorrectly. Follow the instructions on the plastic backing containers and in each component's MSDS.

In addition to the instructions on the containers and in each component's MSDS, follow the recommendations below to minimize the risks associated with working with the plastic backing components.

1. Establish whether there are any applicable national standards covering the handling and use of epoxy products. If so, follow the prescribed procedures.
2. Soap, water and paper towels must be available at the workplace.
3. Mix the plastic backing components in a clean room.
4. Clean up any spill.

1.3 Accumulators

1.3.1 General accumulator information

WARNING

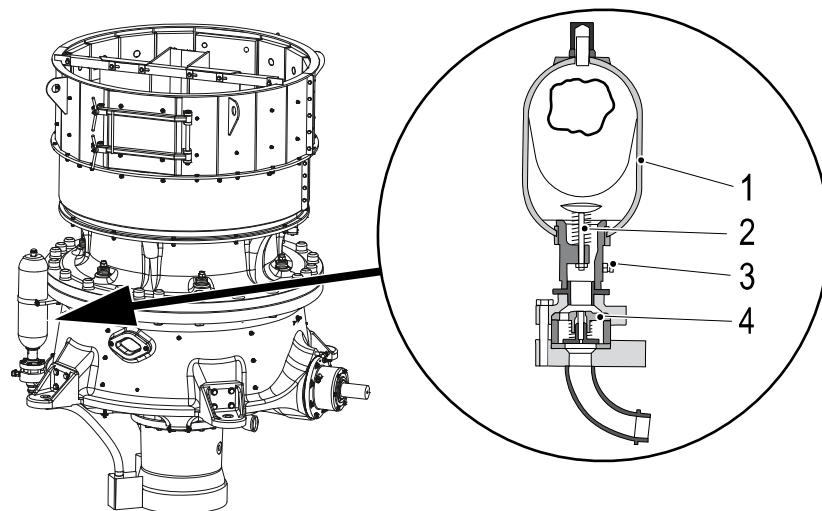


EXPLOSION HAZARD

You can suffer severe injuries or even die if the accumulator explodes.

Protect the accumulator from mechanical and thermal damage (impact, welding, etc.).

The accumulator (1) is a cylindrical steel pressure vessel which contains a rubber bladder fixed at the top of the vessel by a charging valve. The rubber bladder is filled with nitrogen. This crusher type has one accumulator. It is mounted on a foot opposite of the pinionshaft. The accumulator is connected to the Hydroset cylinder cover by a hose. The Hydroset line to the tank unit is connected to the flow regulator beneath the accumulator.



- 1 Accumulator
- 2 Anti-extrusion valve
- 3 Air bleed screw
- 4 Flow regulator

Increase of CSS due to overload

Oil is forced out of the Hydroset cylinder and into the accumulator, allowing the mantle to sink far enough to let the tramp iron pass through the crushing chamber. The gas pressure in the accumulator forces the oil back into the Hydroset cylinder as soon as the obstruction has left the crushing chamber.

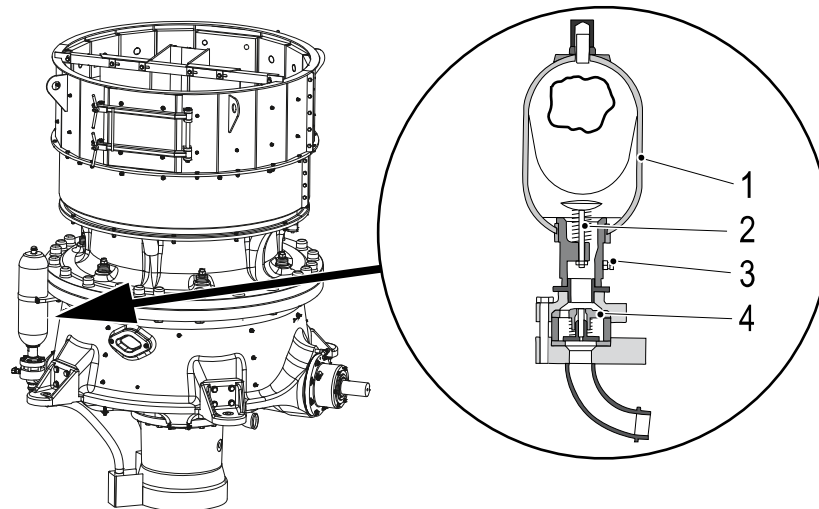
Owner's responsibility

The crusher's owner must arrange for re-certification of the accumulator (1) if there are grounds to suspect that the accumulator has been damaged. New components are best obtained from Sandvik.

1.3.2

Flow regulator

The flow regulator (4) is a throttling check valve between the Hydrosset cylinder and the accumulator (1). It prevents the mainshaft rising too quickly after the tramp iron has passed through the crusher. When oil flows from the crusher to the accumulator, it passes unhindered through the flow regulator. When the oil returns from the accumulator, it is slowed down so that the mantle is slowly raised to its original position.



- 1 Accumulator
- 2 Anti-extrusion valve
- 3 Air bleed screw
- 4 Flow regulator

1.3.3

Charging kit (option)

WARNING



EXPLOSION HAZARD

You can suffer severe injuries or even die if the accumulator explodes.

Use only nitrogen (N₂) in the accumulator as a mixture of air (oxygen) and oil under high pressure can explode.

An optional charging kit (FBU-1) can be used to check the gas pressure in the accumulator and to add nitrogen when necessary. The charging kit consists of a connector assembly with pressure gauge and bleed valve, a hose and an adapter for connection to the accumulator.

Maintenance Instructions

1.3.3.1

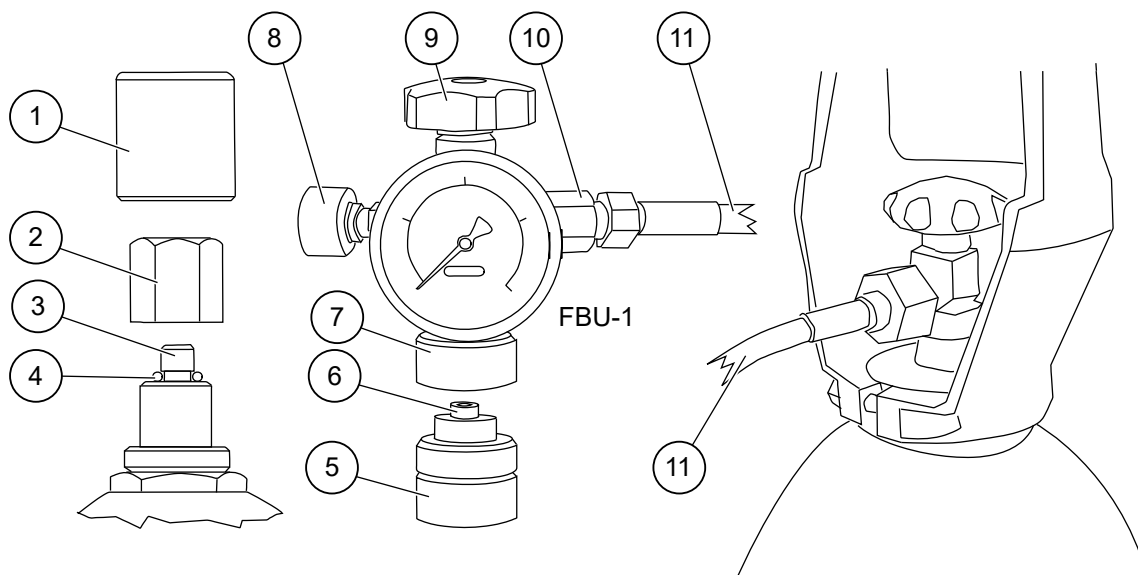
Checking the gas pressure

Fitting the charging kit

1. Unscrew the protective caps (1) and (2) from the accumulator's charging valve, located on top of the accumulator.
2. Unscrew the internal hexagon screw (6) so the cut on its side is visible over the top of the adapter (5).
3. Close the bleed valve (8).
4. Attach the adapter (5) to the accumulator's charging nipple (3). Tighten by hand sufficiently to prevent gas leakage.
5. Attach the screw connector (7) to the adapter (5). Tighten by hand sufficiently to prevent gas leakage.
6. Screw down the spindle (9) so that the valve in the accumulator opens.
7. Read off the charging pressure on the pressure gauge.

Removing the charging kit

8. Unscrew the spindle (9).
9. Open the bleed valve (8).
10. Unscrew the screw connector (7) and remove the charging kit (FBU-1).
11. Remove the adaptor from the accumulator's charging nipple (3).
12. Check that there is no gas leakage from the valve. Use soapy water or oil for this check.
13. Refit the protective caps on the accumulator's charging valve.



- 1 Protective cap
- 2 Protective cap
- 3 Nipple
- 4 O-ring

- 7 Screw connector
- 8 Bleed valve
- 9 Spindle
- 10 Connector

5 Adaptor
6 Hexagon screw

11 Charging hose

1.3.3.2

Charging with nitrogen

	Accumulator charging pressure	Tolerance
Without Control system	5 MPa (725 psi)	±5 %
With Control system	6.0 MPa (870 psi)	±5 %

1. Attach the screw connector (7) with the charging hose (11) to the nitrogen gas bottle.
2. Unscrew the protective caps (1) and (2) from the accumulator's charging valve.
3. Unscrew the internal hexagon screw (6) so that the cut on its side is visible over the top of the adapter (5).
4. Close the bleed valve (8).
5. Attach the adapter (5) to the accumulator's charging nipple (3). Tighten by hand sufficiently to prevent gas leakage.
6. Attach the screw connector (7) to the adapter (5). Tighten by hand sufficiently to prevent gas leakage.
7. Screw down the spindle (9) so that the valve in the accumulator opens.
8. Carefully open the valve on the nitrogen gas bottle so that the bladder expands slowly inside the accumulator and closes the oil valve. Check that this is the case before raising the pressure to the full charging pressure given in the table above.

Note!

Take into account that the pressure in the accumulator will drop slightly when the compressed gas cools down. Charge the accumulator bladder to 20% above the desired pressure.

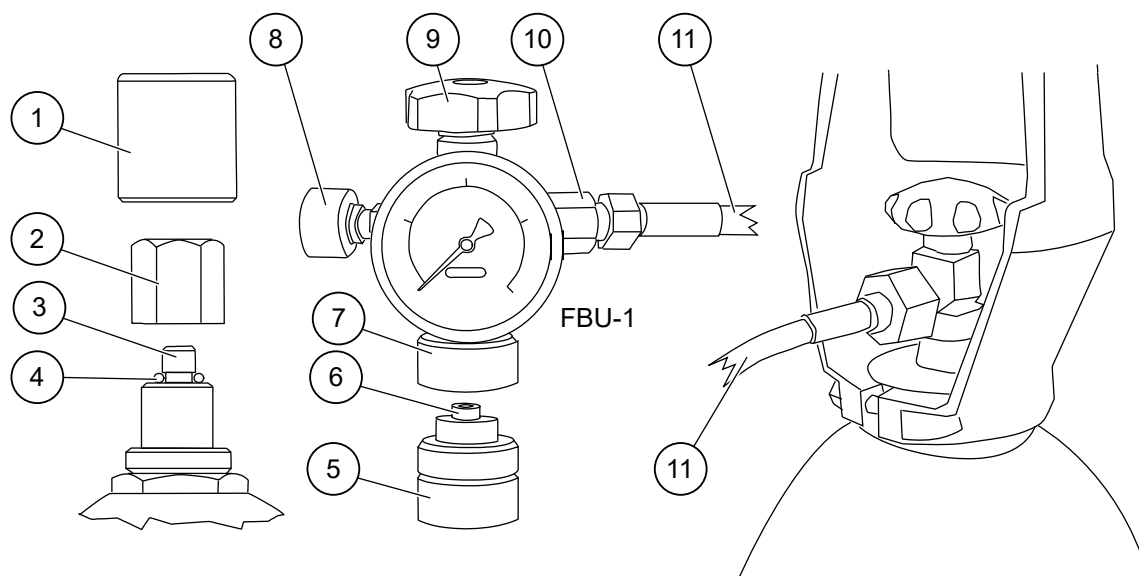
9. Close the valve on the nitrogen gas bottle and wait for five minutes. Check the pressure. If the pressure is too high, release gas through the bleed valve (8) until the correct pressure is reached.
10. Unscrew the spindle (9).
11. Open the bleed valve (8).
12. Unscrew the screw connector (7) and remove the charging kit (FBU-1).
13. Remove the adaptor from the accumulator's charging nipple (3).
14. Check that there is no gas leakage from the valve. Use soapy water or oil for this check.
15. Refit the protective caps (1) and (2) on the accumulator's charging valve.

Maintenance Instructions

16. Remove the charging kit from the nitrogen gas bottle.

Note!

Check the charging pressure after 1, 2 and 3 weeks and thereafter at 6-month intervals.



- 1 Protective cap
- 2 Protective cap
- 3 Nipple
- 4 O-ring
- 5 Adaptor
- 6 Hexagon screw

- 7 Screw connector
- 8 Bleed valve
- 9 Spindle
- 10 Connector
- 11 Charging hose

2 Periodic maintenance

Maintenance Instructions

2.1 Determining inspection and maintenance intervals

Every equipment must be subjected to regular systematic checks. This will result in fewer and smaller repairs, less downtime and thus lower overall running costs.

Note! *New equipment must be inspected often during the initial operating period. The intervals between inspections can then be increased until a suitable frequency is found.*

Keep a written log including the crusher's and tank unit's operating conditions and loads, important data and details of adjustments made and any repairs carried out.

Since equipment operates under widely differing conditions, it is impossible to recommend an inspection and care schedule applicable to all equipment. However, regular inspections are necessary.

2.2 Inspection and care when it is dark

Use a flashlight when it is dark. There is no light in the tank unit.

2.3 Weekly inspection and care

Use the **Periodic Inspection Protocol - Weekly** when performing the weekly inspection and care.

Inspection	Description
Crusher inspection, Bottom shell/Inspection hatch level	
16. Main shaft rubber scrapers condition.	Check the condition of the rubber scrapers on the main shaft and take relevant action. Replace scrapers if in bad condition or worn out.
17. Excessive material build up on dust collar or bottom shell arms.	Check for and remove excessive material build up on the dust collar and on the bottom shell arms.
18. Concave support ring condition/wear.	Check the condition and potential wear on the concave support ring. Replace the support ring if worn to prevent failure and risk of concave falling down.
19. Measure the play between dust seal ring and dust collar and that the ring is not fixed to collar.	Input the measured value. Make sure that the play is within tolerances as stated for this equipment.
Crusher inspection, Feed hopper level	
20. Feed arrangement wear, repair and adjustments.	Check the feed arrangement for wear. Adjust if uneven and repair if necessary.
21. Measure spider assembly grease level, main shaft in bottom position.	Measure the grease level and adjust as stated for this equipment.

Maintenance Instructions

Inspection	Description
22. Top shell to bottom shell movement, check with feeler gauge	Inspect the movement between the top shell and the bottom shell with a feeler gauge to make sure that there is no gap in between. Movement in the taper indicates wear that requires repairs.
23. Feed hopper to top shell fasteners.	Check that the feed hopper is fastened properly to the top shell. Make sure that all fasteners are in place and tightened properly.
Crusher inspection, Oil tank, Coolers & Over pressure equipment	
24. Oil level main lubrication circuit.	Check the oil level in the vessel. If the level has dropped, fault trace for leakage
25. Oil level pinion shaft lubrication circuit.	Check the oil level in the vessel. If the level has dropped, fault trace for leakage.
26. Oil level hydroset system, main shaft in bottom position.	Check the oil level in the vessel. If the level has dropped, fault trace for leakage.
27. Cooler condition and cleaning.	Check the condition of the cooler and clean it if clogged by dust.
28. Main lubrication oil pump condition and oil flow, record flow if available.	Check the condition of the main lubrication oil pump and replace it if worn out. Check the oil flow, if a flow meter is available and input the value (if not automatically pre-filled.)
ASRi/ACS/EDV control panels	
29. Total operating hours.	Check the total operating hours of the equipment (since original start up time) on the ASRi/ACS panel and input the value (if not automatically pre-filled.)
30. Loaded operating hours.	Check the loading hours of the equipment (since original start up time) on the ASRi/ACS panel and input the value (if not automatically pre-filled.)
31. Number of uncrushable objects.	Check the number of uncrushable objects on the ASRi/ACS panel. Input the maximum value for the relevant time period (if not automatically pre-filled.) Inform responsible personnel if events occurs in the log. Uncrushable objects creates potential risk for breakdown.
32. Number of active/repeating alarms.	Check for active and repeating alarms on the ASRi/ACS panel. Input the value for number of alarms. Refer to troubleshooting as stated for this equipment.
33. Check the maximum main lubrication oil temperature.	Check the temperature on the ASRi/ACS panel and make sure that the temperature does not exceed the limit as stated for this equipment. Input the maximum value for the relevant time period (if not automatically pre-filled.) Inform responsible personnel if temperature gets close to or exceeds limit.

Maintenance Instructions

2.4 Monthly inspection and care

Operation hours - Monthly or after every 160 hours of operation				
Maintenance procedure				Notes
Perform the maintenance procedures of all relevant shorter intervals at the same time.			☐	See the instructions for reading maintenance cards.
SPIDER CAP REMOVAL CHECKS				
Clean the air vent passage in the topshell		34	☐	
REPLACING THE MANTLE				
Check the play between the head center and the mantle		75	☐	
REPLACING THE DUST SEAL RING				
Check the dust seal ring for wear		107	☐	
BEVEL GEARS				
Check the gear backlash		238	☐	
PINIONSHAFT HOUSING				
Check the oil flow to the pinionshaft housing		188	☐	
Check the gear backlash		238	☐	

When completed:

Date Operation hours

Approved

2.5 Inspection and care for every 6 months

Operation hours - Twice a year or after every 1000 hours of operation				
Maintenance procedure				Notes
Perform the maintenance procedures of all relevant shorter intervals at the same time.			☐	See the instructions for reading maintenance cards.
SPIDER CAP REMOVAL CHECKS				
Check the play in the spider bushing		33	☐	
HYDROSET SYSTEM				
Check the gas pressure in the accumulator.		180	☐	

When completed:

Date Operation hours

Approved

Maintenance Instructions

2.6 Yearly inspection and care

Operation hours - Yearly or after every 2000 hours of operation				
Maintenance procedure				Notes
Perform the maintenance procedures of all relevant shorter intervals at the same time.			☐	See the instructions for reading maintenance cards.
REPLACING THE MAIN SHAFT SLEEVE				
Check the main shaft sleeve for wear		82	☐	
REPLACING THE ECCENTRIC BUSHING				
Check the eccentric bushing for wear		123	☐	
REPLACING THE ECCENTRIC ASSEMBLY				
Check the eccentric for wear		127	☐	
REPLACING THE STEP BEARING COMPONENTS				
Check the step bearing components for wear		159	☐	
REPLACING THE CHEVRON PACKING				
Check the chevron packing for wear		167	☐	
REPLACING THE HYDROSET CYLINDER BUSHING				
Check the Hydroset cylinder bushing for wear		174	☐	
HYDROSET CYLINDER				
Check the step bearing components for wear		159	☐	
Check the chevron packing for wear		167	☐	
Check the torque of the Hydroset cylinder joints		170	☐	
Check the Hydroset cylinder bushing for wear		174	☐	

When completed:

Date Operation hours

Approved

This page is intentionally left blank

3 Maintenance instructions

Maintenance Instructions

3.1 Feed hopper

3.1.1 Replacing the feed hopper

3.1.1.1 *Removing the feed hopper*

1. Clean out all process material from the feed hopper (1).
2. Remove the screws (6), the washers (7) and (8), and the nuts (9).
3. Install lifting eye bolts (5) with a smallest recommended size M12 with shackles on the upper flange (10).
 - If lifting the whole feed hopper; use at least three lifting eye bolts (preferably four) installed as shown by (2) and (3).
 - If lifting only one half of the feed hopper's use two lifting eye bolts installed as a pair at either (2) or (3).
4. Attach suitable lifting slings to the lifting eye bolts and to the hook.
5. Position the hook of a crane vertically above the feed hopper (1).

WARNING



SUSPENDED LOAD HAZARD

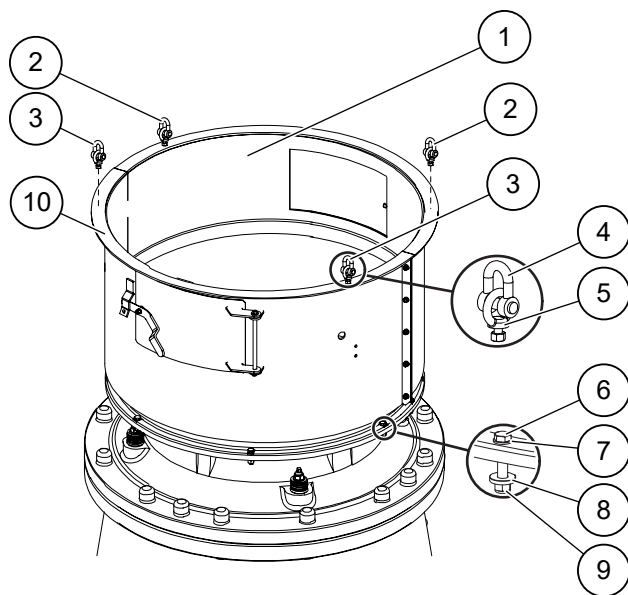
A feed hopper weighs up to 600 kg (1323 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

6. Take up the slack in the lifting tackle. The tackle should now be tight but not lifting the feed hopper (1).

Maintenance Instructions

7. Carefully lift the feed hopper (1) off the topshell and position it on an even surface on the ground.



1 Feed hopper

2 Lifting eye bolt

3 Lifting eye bolt

4 Shackle

5 Lifting eye bolt

6 Screw

7 Washer

8 Washer

9 Nut

10 Upper flange

3.1.1.2

Inspecting the feed hopper

Examine the feed hopper, the feed distributor and/or the cone plates for wear and damage.

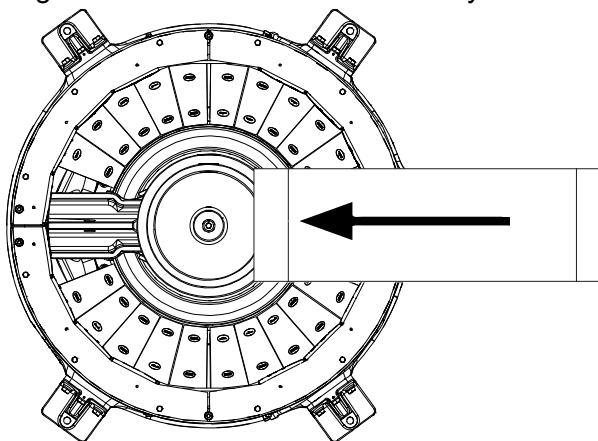
3.1.1.3

Installing the feed hopper

The crusher can be installed with or without a distributor.

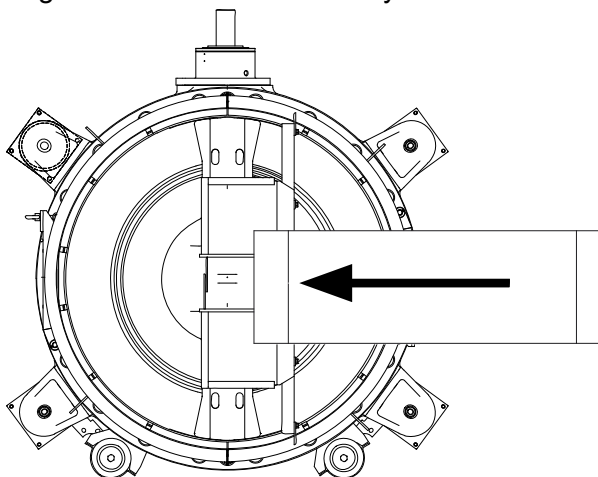
Maintenance Instructions

- If the crusher is installed without a distributor the spider arms must be aligned with the feeder or the conveyor.



Cone crusher without a distributor

- If the crusher is installed with a distributor the spider arms are at right angles to the feeder or conveyor.



Cone crusher with a distributor

1. Position the hook of a crane vertically above the feed hopper (1).
2. Attach the lifting slings to the lifting eye bolts (2) and (3) with shackles (4) on the feed hopper and to the lifting hook.
3. Take up the slack in the lifting tackle. The tackle should now be tight but not lifting the feed hopper.

WARNING

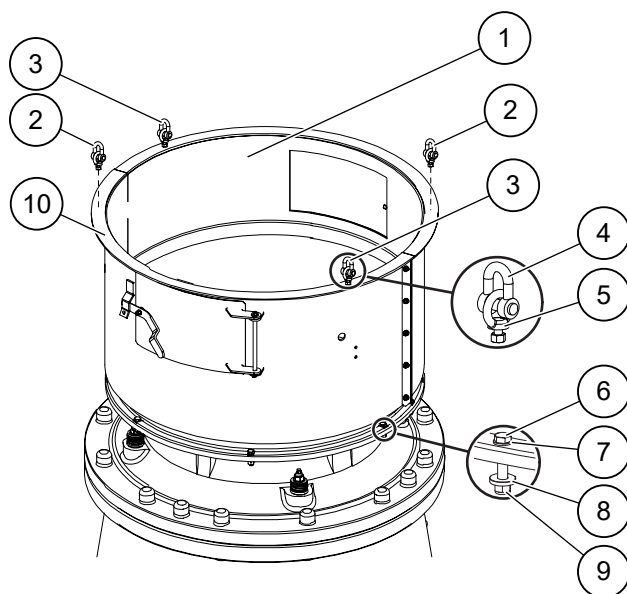


SUSPENDED LOAD HAZARD

A feed hopper weighs up to 600 kg (1323 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

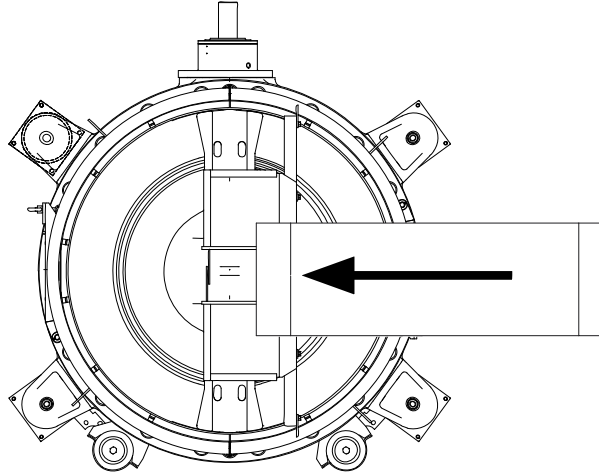
4. Carefully lift the feed hopper (1) on to the upper flange of the topshell.
5. Remove the lifting gear.
6. Install the screws (6), the washers (7, 8) and the nuts (9).



- 1 *Feed hopper*
- 2 *Lifting eye bolt*
- 3 *Lifting eye bolt*
- 4 *Shackle*
- 5 *Lifting eye bolt*
- 6 *Screw*
- 7 *Washer*
- 8 *Washer*
- 9 *Nut*

Maintenance Instructions

7. Regulate the feed so there is a build-up of process material in the feed hopper (choke feed). The process material should be level with the top of the spider cap. Choke feeding will create a better result in the form of a finer and more uniform product size. This will also make the crusher run more smoothly and lower the power consumption.



3.2 Top shell

3.2.1 Replacing the spider cap

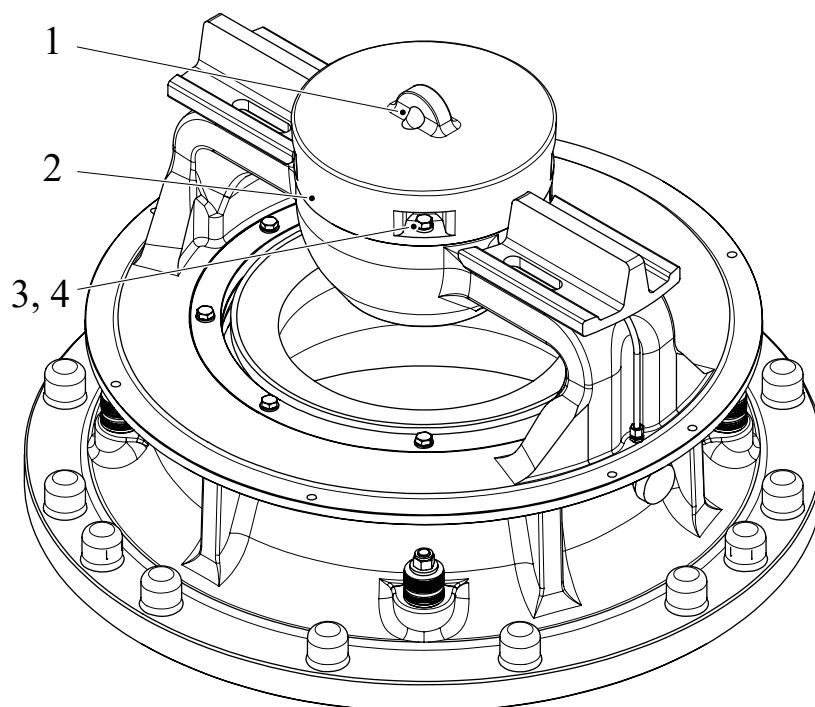
Note! *Remove the feed distributor/splitter and clean out all process material from the feed hopper before removing the spider cap.*

3.2.1.1 Removing the spider cap

1. Clean out all process material from the spider cap.
2. Remove the four screws (3) and the washers (4) that hold the spider cap (2) to the top shell.
3. Position the hook of a crane vertically above the spider cap (2).
4. Attach the lifting equipment to the lifting lug (1).

Maintenance Instructions

5. Take up the slack in the lifting equipment.



1 Lifting lug
2 Spider cap

3 Screw
4 Washer

WARNING



SUSPENDED LOAD HAZARD

A spider cap weighs up to 160 kg (353 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

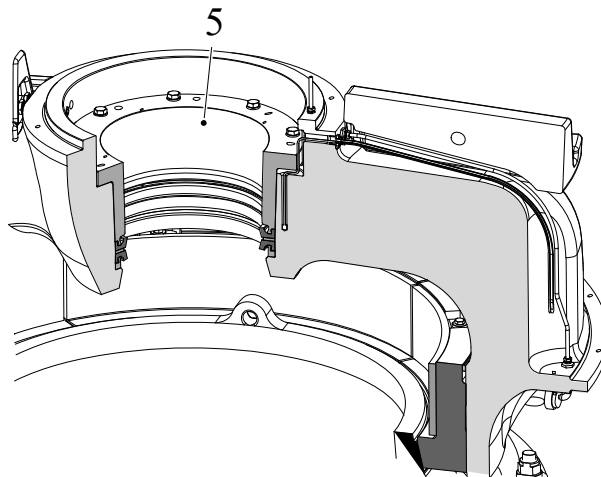
NOTICE

RISK OF EQUIPMENT AND PROPERTY DAMAGE

You can damage the air vent pipe if it is struck by the spider cap. Mind the air vent pipe located just inside the spider cap when you remove/install the spider cap.

6. Carefully lift the spider cap (2) from the top shell.
7. Remove the O-ring from the spider cap.
8. Place the spider cap (2) on the ground. Make sure that internal parts are protected from dust and water.

9. Clean out all the grease from the top shell and the spider bushing (5).

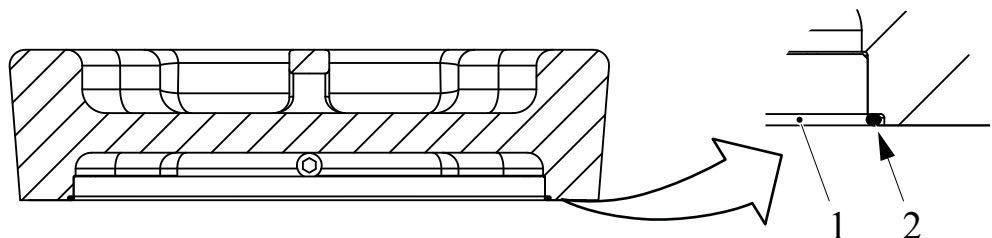


5 Spider bushing

3.2.1.2

Spider cap removal checks

1. Measure the play in the spider bushing at the pivot point with a feeler gauge. Record the play and compare with earlier measurements. See section [3.2.1.2.1. Inspecting the spider bushing \(Page 33\)](#).
2. Clean the O-ring (2).
3. Check the O-ring (2) and the rim (1) of the spider cap and the top shell where the O-ring fits. If the O-ring is damaged it must be replaced.



1 Rim of the spider cap

2 O-ring

4. Check the spider cap for wear. If it is worn, change the spider cap.
5. Clean the air vent passage in the top shell. Make sure that it is not clogged. See section [3.2.1.2.2. Cleaning the air vent passage in the topshell \(Page 34\)](#).
6. Check that the lubrication passage through the top shell is unobstructed.

Inspecting the spider bushing

Max. permissible play and position of pivot point

Spider bushing	S	L
Maximum permissible value (when spider bushing is worn)	2.1 mm (0.0827 in)	165 mm (6.5 in)

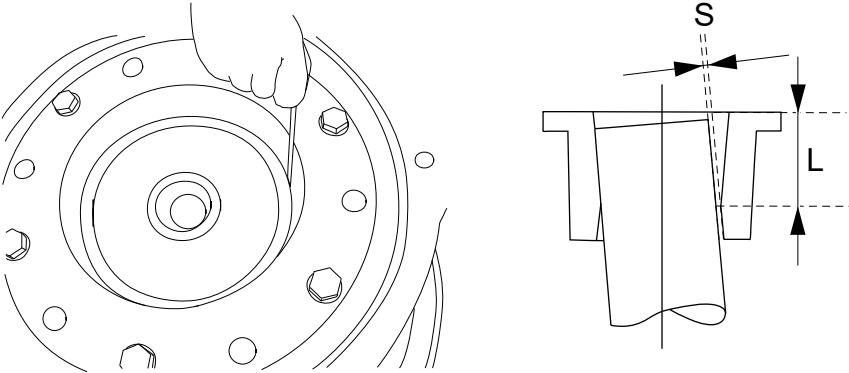
Check the play (S) in the spider bushing each time the liners are changed or at least twice per year (1000 h). Check the play more frequently if the material being crushed is abrasive or if a leakage is suspected or confirmed.

1. Measure the play (S) at the pivot point on distance (L) from top of the bushing, using a feeler gauge. Insert the feeler gauge until the pivot point (L) is passed. Measure the play where the distance between the mainshaft and the spider bushing is the greatest. Make a note of the value and compare it to earlier measurements.

**NOTICE**

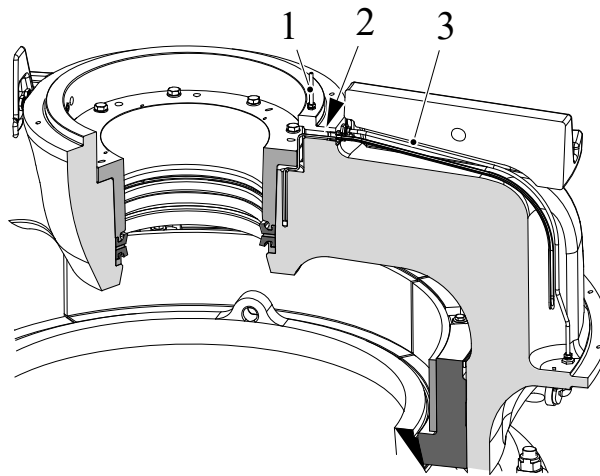
RISK OF EQUIPMENT AND PROPERTY DAMAGE
When the play between the mainshaft and the spider bushing increases, the grease is exposed to more contaminants.
If the play (S) is close to the maximum, change the spider bushing grease more frequently.

2. If the play exceeds the maximum permissible value, the spider bushing and/or the mainshaft sleeve must be replaced.



Cleaning the air vent passage in the topshell

1. Clean the air vent passage (2).



- 1 Air vent pipe
- 2 Air vent passage
- 3 Air vent line

3.2.1.3

Installing the spider cap

1. Position the hook of a crane vertically above the spider cap.
2. Attach the lifting equipment to the lifting lug (1) on the spider cap (2).
3. Take up the slack in the lifting equipment. The equipment should now be tight but not lifting the spider cap (2).

WARNING

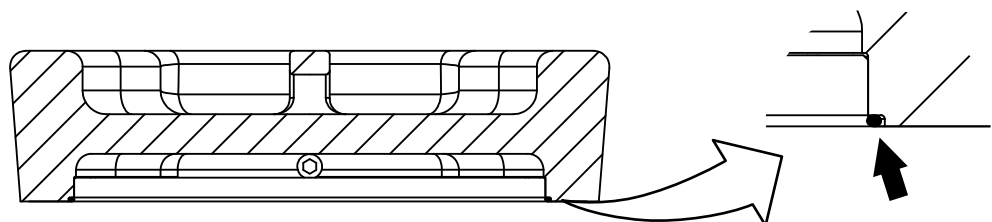


SUSPENDED LOAD HAZARD

A spider cap weighs up to 160 kg (353 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

4. Carefully lift the spider cap from the ground.
5. Lubricate the contact surfaces of the spider cap (2) and its seating.
6. Lubricate the O-ring and install it on the spider cap (2).



Maintenance Instructions

7. With the main shaft in its lowest position, fill the spider bushing with grease to the same level as the top of the spider bearing screws. Refer to *Grease for spider bushing lubrication* in the *Technical specifications*.

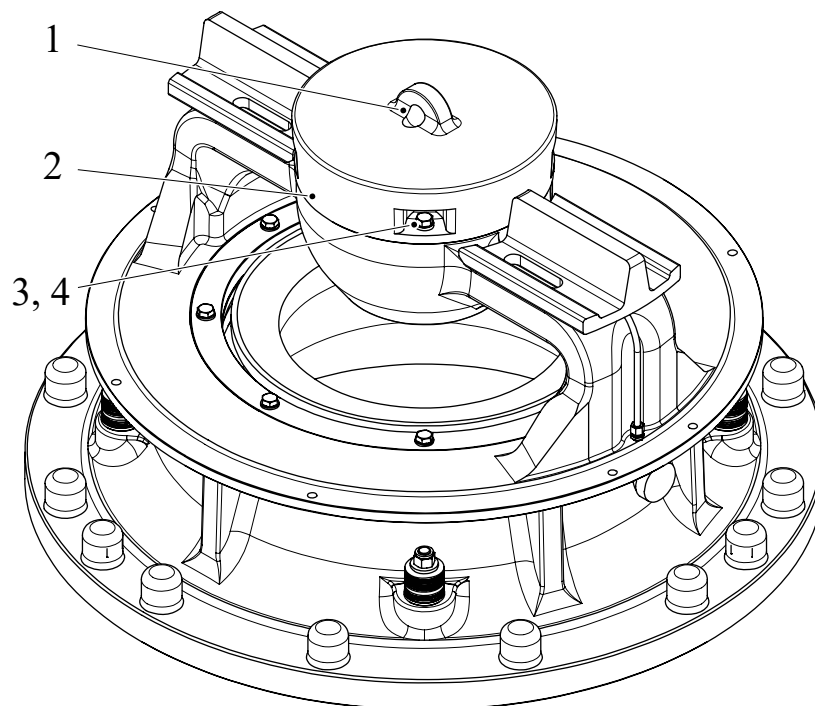


NOTICE

RISK OF EQUIPMENT AND PROPERTY DAMAGE

You can damage the air vent pipe if it is struck by the spider cap. Mind the air vent pipe located just inside the spider cap when you remove/install the spider cap.

8. Place the spider cap (2) on the top shell.
9. Install the screws (3) and the washers (4). Refer to *Tightening torques* in the *Technical specifications*.



- 1 Lifting lug
- 2 Spider cap
- 3 Screw
- 4 Washer

3.2.2 Inspecting the crushing chamber

3.2.2.1 Inspecting the liners

Inspection of the liners must be carried out at the correct intervals. Refer to *Operator's inspection and care* in the *Operator's Instructions*. A new machine must be inspected at frequent intervals. After one or two liner changes, the intervals between inspections can be successively increased.

These routine inspections will give an indication of when the liners must be changed. It is difficult to give an exact limit at which the liners are worn out.

They are probably worn out when the thickness has been reduced so much that indentations or cracks have occurred.

Extreme operating conditions can require liner replacement before the liners are worn out. One reason can be incorrect feeding so that increased wear occurs over a certain section of the concave ring. This may also mean that the setting varies according to where the measurement is carried out around the crushing chamber. Examples of different feed arrangements are given in the Installation manual.

An unevenly graded mixture of feed material can also cause wear. The crushing chamber is selected on the basis of the maximum feed size. If almost all of the feed is close to the maximum size, crushing will be concentrated to the upper portion of the chamber. This can give rise to a groove around the upper portion of the chamber. If the feed material consists primarily of fines, the crushing is concentrated to the lower part of the chamber.

3.2.2.2 *Inspecting the concave and mantle*

The concave and mantle must be replaced if the maintenance of the desired setting entails raising the mainshaft so high that the distance between the head nut and the underside of the spider (the A-dimension) is less than 15 mm (0.59 in).

3.2.3 Replacing the spider bushing and the seal ring

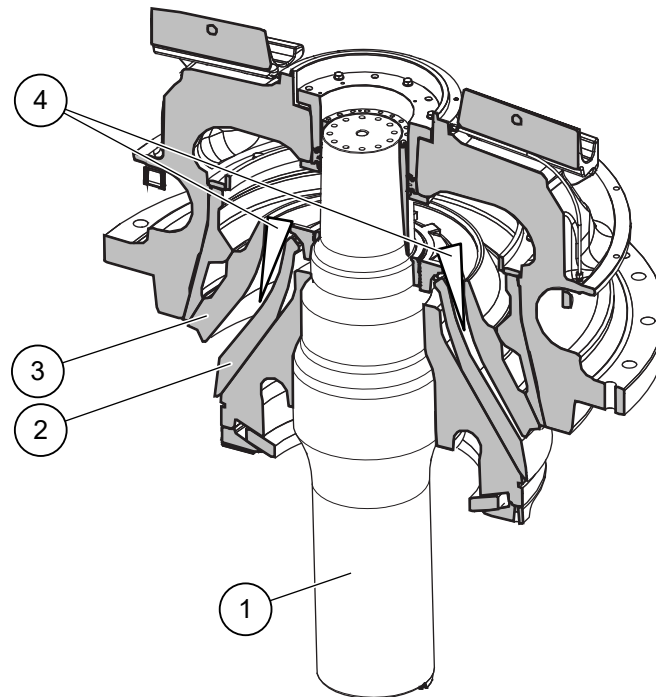
Note! ***Two different procedures are used to exchange the spider bushing and seal ring depending on whether the topshell has been removed or is still installed on the bottomshell. The following procedure is applicable when the topshell is still installed on the bottomshell.***

3.2.3.1 Removing the spider bushing and the seal

1. Remove the spider cap according to section [3.2.1.1.Removing the spider cap \(Page 30\)](#).

Maintenance Instructions

2. Stabilize and center the main shaft (1) by driving wooden wedges (4) in between the mantle (2) and the concave (3).



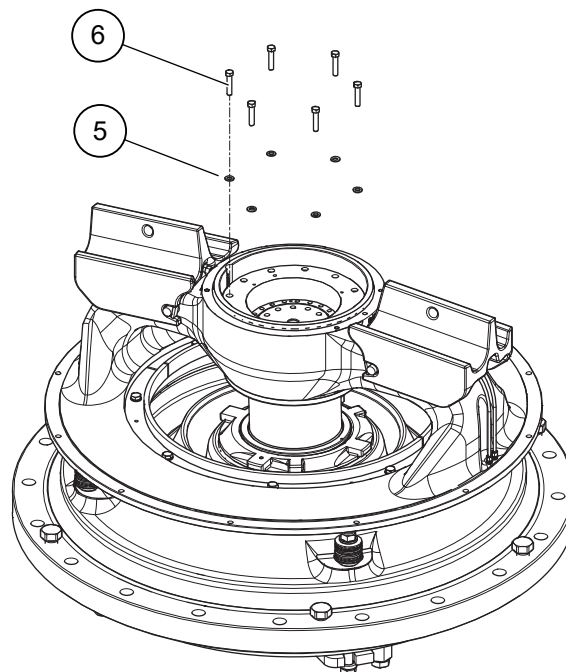
1 Main shaft

2 Mantle

3 Concave ring

4 Wooden wedge

3. Remove the screws (6) and the washers (5).

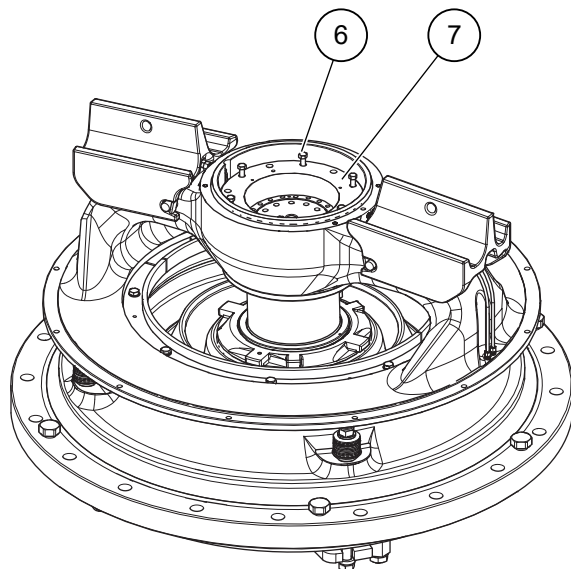


5 Washer

6 Screw

Maintenance Instructions

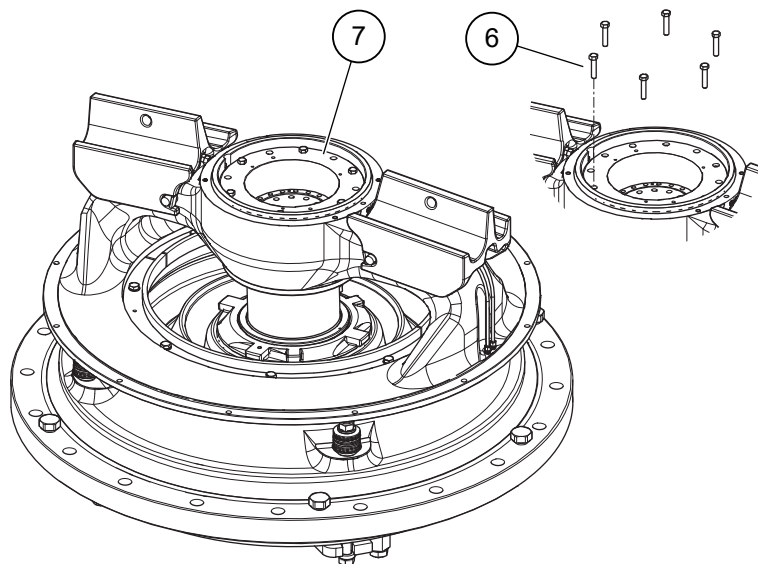
4. Insert the screws (6) in the threaded holes in the top flange of the spider bushing (7).
5. Use the screws (6) as jacking screws. Tighten all of the screws (6) in rotation with gradually increasing torque to press the spider bushing (7) upwards.



6 Screw

7 Spider bushing

6. Remove the screws (6) from the spider bushing (7).

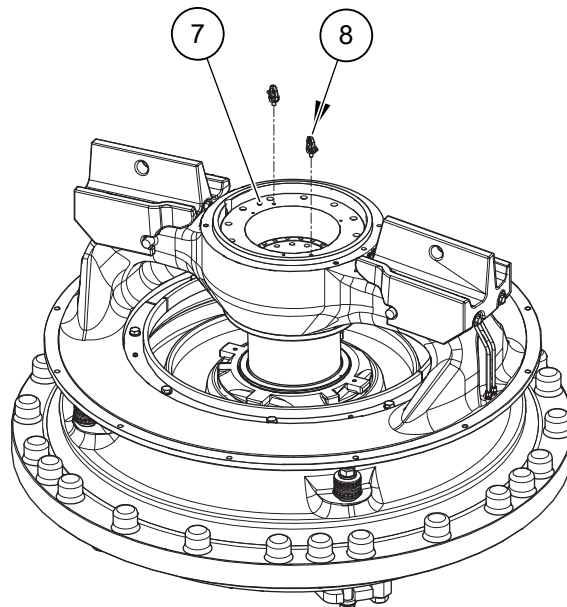


6 Screw

7 Spider bushing

Maintenance Instructions

7. Attach the lifting eye bolts (8) to the threaded holes in the spider bushing (7).



7 Spider bushing

8 Lifting eye bolt



WARNING



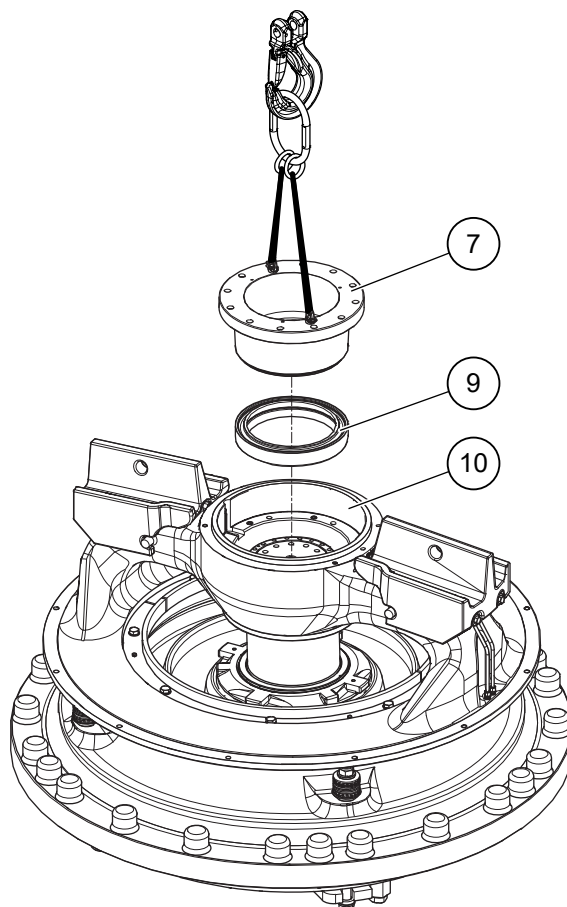
SUSPENDED LOAD HAZARD

A spider bushing weighs up to 70 kg (155 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

8. Lift out the spider bushing (7) from the top shell (10).
9. Remove the seal ring (9) from the spider bushing (7).

10. Lower the spider bushing (7) carefully down on a clean area on the ground.



- 7 Spider bushing
9 Seal ring
10 Top shell

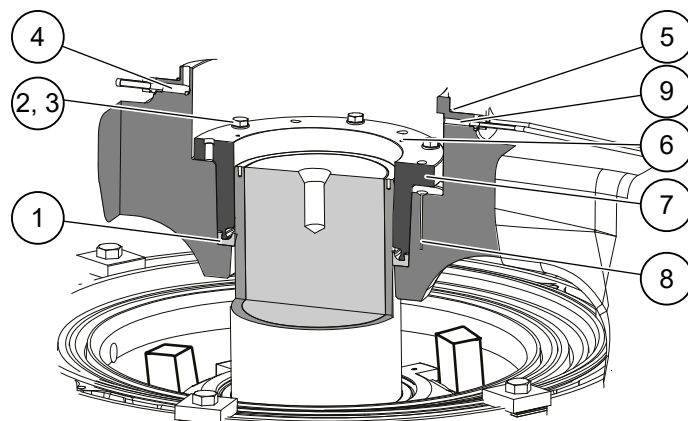
3.2.3.2

Checking the spider bushing and the seal ring

1. Clean the seat for the O-ring (5) between the spider cap and the topshell. Check for wear or damage.
2. Clean the contact surfaces between the topshell and the spider bushing (7) and the seal ring (1). Check for wear or damage.
3. Clean the spider bushing (7). Make sure that the circulation holes (6) in the spider bushing (7) are clean and unobstructed.
4. Check the seal ring (1). Replace it if it is worn or damaged.

Maintenance Instructions

5. Make sure that the lubrication (9) and air vent passages (4) in the topshell are not blocked.



1 Seal ring

2 Screw

3 Washer

4 Air vent passage

5 O-ring

6 Circulation hole

7 Spider bushing

8 Temperature transmitter

9 Lubrication passage

3.2.3.3

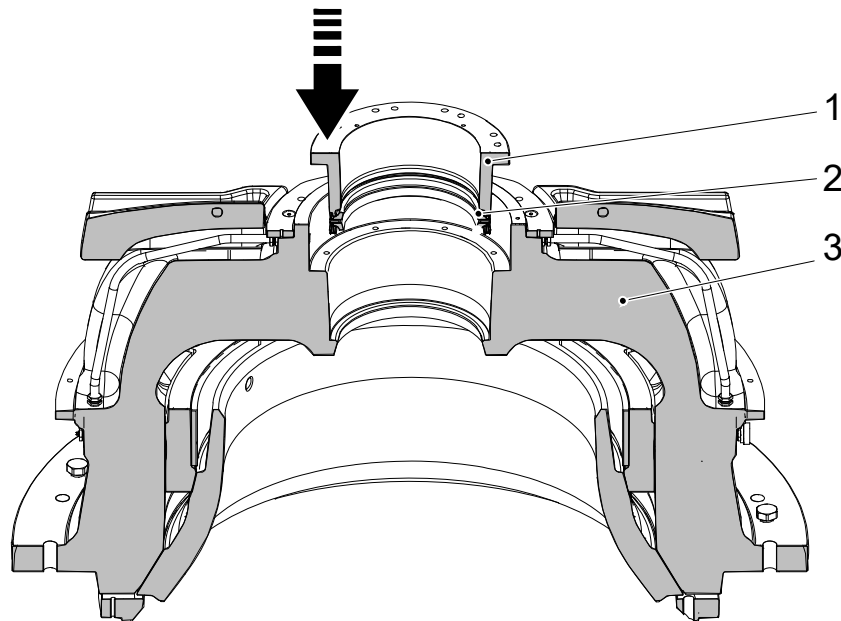
Installing the spider bushing and the seal

Note!

Center the top of the mainshaft in the spider hub and lock it in position with wooden wedges. See figure in section [3.2.3.1.Removing the spider bushing and the seal \(Page 36\)](#).

Maintenance Instructions

1. Snap the seal ring (2) onto the locating tongue at the bottom of the spider bushing (1) and make sure that the sealing lip points upward.



- 1 Spider bushing
- 2 Seal ring
- 3 Topshell

2. Position the hook of a crane vertically above the spider bushing (1).
3. Attach three lifting chains to the hook.
4. Attach the lifting chains to the lifting eye bolts.
5. Take up the slack in the lifting chains. The tackle should now be tight but not lifting the spider bushing.
6. Grease the inner surface of the spider bushing (1) well, so that it is coated with a thick layer of grease.

WARNING



SUSPENDED LOAD HAZARD

A spider bushing weighs up to 70 kg (155 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

7. Carefully lift the spider bushing (1) above the topshell and carefully lower it into place.

Maintenance Instructions

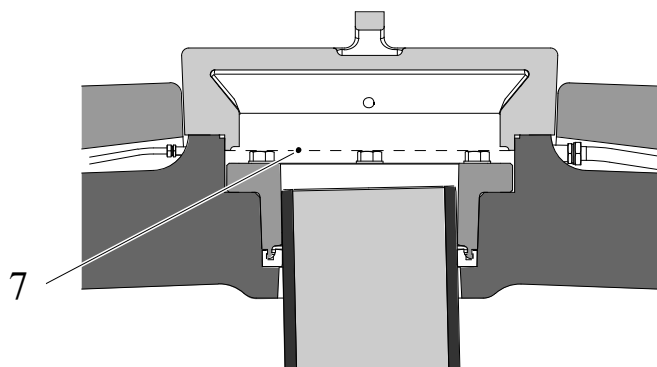
8. Use a sliding caliper in any threaded hole to measure the gap between the top shell and the spider bushing flange.

Gap (C) between top shell and spider bushing flange	
New spider bushing	5 mm (0.20 in)
Worn spider bushing, replacement necessary	Approaching 0

9. Perform this measurement every time the spider bushing is reinstalled. When the gap approaches zero, prepare for a spider bushing replacement.
10. Tighten all the screws in rotation, gradually increasing the torque. The flange on the spider bushing (1) should be flush against the topshell. Tighten the screws to the correct torque, refer to *Tightening torques* in *Technical Specifications*.

Risk of property damage. Make sure to use the correct grease for the spider bushing.

11. The mainshaft must be at its lowest position. Fill the spider bushing (1) with grease until the screw heads are covered (7). This corresponds to approximately 6-8 kg (13.2-17.6 lbs). Refer to section *Grease for spider bushing lubrication* in the *Technical Specifications*.
12. Grease the O-ring and place it in its seating on the spider cap.
13. Install the spider cap. See section [3.2.1.3. Installing the spider cap \(Page 34\)](#).



7 Grease level

3.2.4

Checks prior to removal of the top shell

Note!

The checks that are described in this section must be carried out before the top shell is removed, in order to determine how much of the crusher must be removed if, for instance, a liner change is planned.

1. Check the play between the main shaft sleeve and the spider bushing. See section [3.2.1.2.1. Inspecting the spider bushing \(Page 33\)](#).
2. Check the play between the dust seal ring and the dust collar. Refer to *Checking the dust seal ring for wear* in the *Operator's instructions*.

Maintenance Instructions

3. Check the backlash in the gears. See section [3.9.4. Bevel gears \(Page 238\)](#).
4. Inspect the return oil screen for contamination. If an unusual amount or type of contamination is found (metal particles for instance), the cause must be investigated. Refer to *Clean the return oil screen* in the *Operator's instructions* in the tank unit.

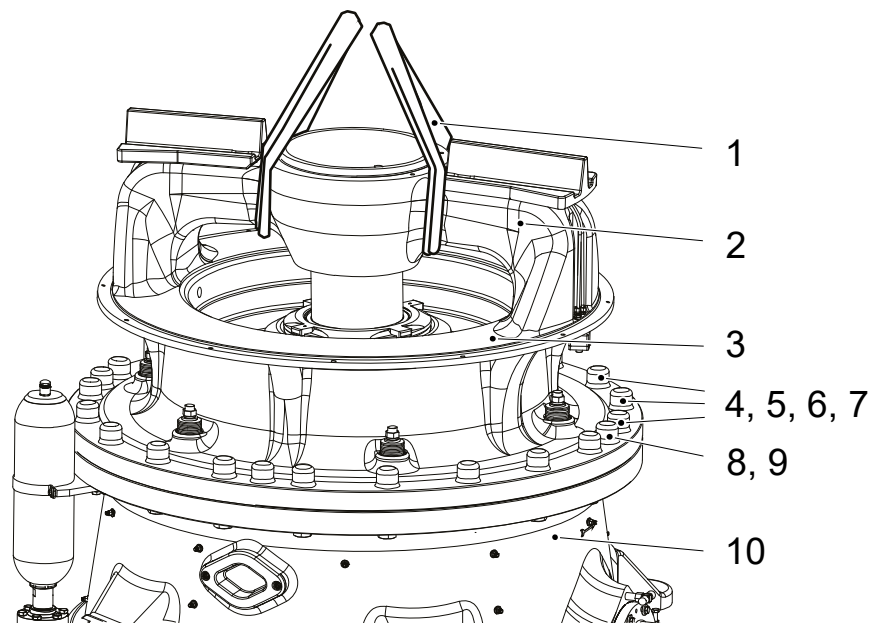
3.2.5 Replacing the top shell

Note! *Before starting these procedures it is necessary to first remove the spider cap. See section [3.2.1.1. Removing the spider cap \(Page 30\)](#) for further information.*

3.2.5.1 Removing the top shell

Note! *Before starting these procedures it is necessary to first remove the feed hopper, the arm shields, and the spider cap.*

1. Lower the main shaft to its bottom position, with the Hydroset piston resting on the Hydroset cylinder cover.
2. Remove the protective caps (7) and (9).
3. Remove the clamping screws (4) that clamp the top shell (3) to the bottom shell (10).
4. Tighten the jacking screws (8) in sequence to press the top shell upwards.



- 1 Lifting sling
- 2 Spider arm
- 3 Top shell
- 4 Clamping screw
- 5 Nut
- 6 Washer

Maintenance Instructions

- 7 Protective cap
- 8 Jacking screws
- 9 Protective cap
- 10 Bottom shell

5. Position the hook of a crane vertically above the top shell.
6. Put the lifting slings (1) around the spider arms.
7. Attach the lifting slings (1) to the hook.
8. Take up the slack in the lifting tackle.

Note!

Be careful when lifting the top shell to avoid damage to the main shaft, the spider bushing or any other machined surfaces.



WARNING



SUSPENDED LOAD HAZARD

A top shell assembly weighs up to 5 110 kg (11 266 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

9. Carefully lift the top shell (3) from the bottom shell (10).
10. Place the top shell (3) on timber supports so that the machined surfaces are not damaged.

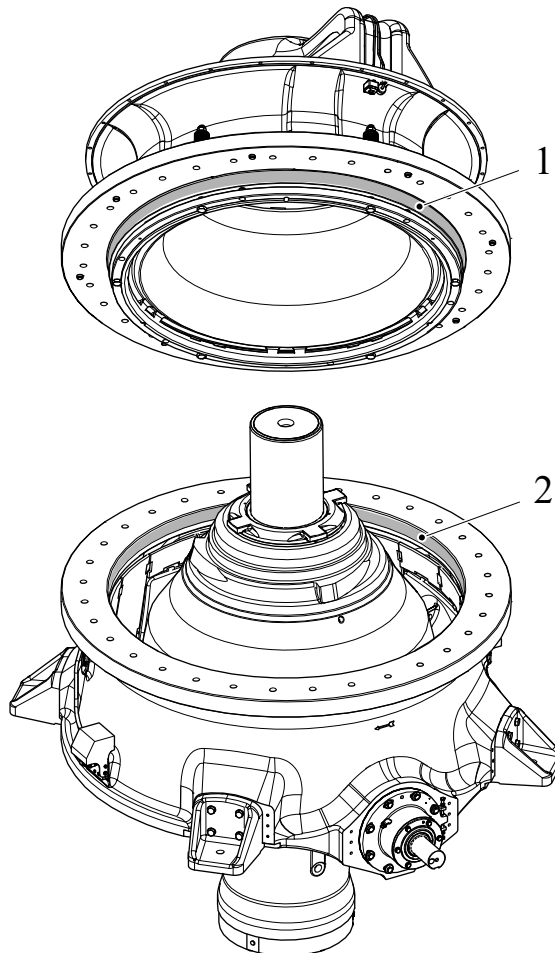
3.2.5.2

Checking the top shell

1. Clean the tapered mating surfaces on the top shell (1) and the bottom shell (2).
2. Check the tapered mating surfaces (1) and (2) for rust and damage.

Note!

If motion between the top shell and the bottom shell has caused damage to the tapered mating surfaces the surfaces must be built up by welding and re-machined. Consult Sandvik for further information.



1 Tapered mating surface, top shell

2 Tapered mating surface, bottom shell

3.2.5.3

Installing the top shell

1. Coat the tapered mating surfaces and the contact faces of the flanges with thick oil or grease.

Note!

Oil containing molybdenum disulfide will reduce the risk of contact corrosion.

2. Lubricate the spider bushing, the seal ring and the main shaft with ordinary spider bushing grease. See *Grease for spider bushing lubrication* in *Technical specifications*.

Maintenance Instructions

3. Adjust the jacking screws (8) in the top shell flange, so that they protrude approximately 5 mm (0.20 in).
4. Position the hook of a crane vertically above the top shell.
5. Put the lifting slings around the spider arms.
6. Attach the lifting slings to the hook.
7. Take up the slack in the lifting tackle.



NOTICE

RISK OF PROPERTY DAMAGE

It is very important that the top shell (3) is kept level to protect the tapered bore from damage.



WARNING



SUSPENDED LOAD HAZARD

A top shell assembly weighs up to 5 110 kg (11 266 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

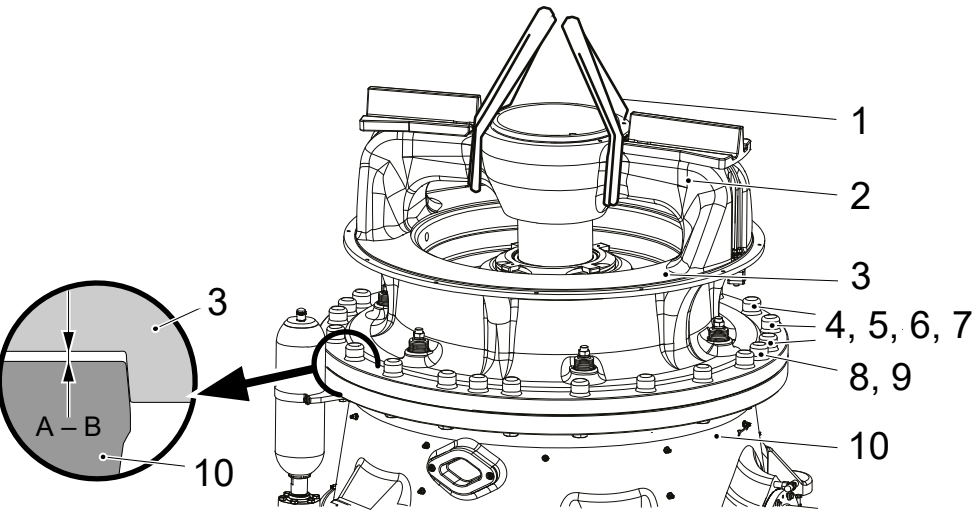
Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

8. Carefully lift the top shell off the timber supports.

 NOTICE

RISK OF PROPERTY DAMAGE
Make sure that the main shaft does not damage the seal ring when the top shell is lowered onto the bottom shell.

9. Carefully lower the top shell until the jacking screws (8) rest upon the bottom shell (10).



- 1 Lifting gear

2 Spider arm

3 Top shell

4 Clamping screw

5 Nut
- 6 Washer

7 Protective cap

8 Jacking screws

9 Protective cap

10 Bottom shell

Minimum (new parts)	Maximum (new parts)	Minimum (worn parts)
2.7 mm (0.11")	4.3 mm (0.17")	2.0 mm (0.079")

Distance between flanges (A-B above)

10. Use clamping screws (4) to adjust the position of the top shell.
11. Retract the jacking screws (8) until the top shell is resting on the bottom shell.
12. When the top shell is resting on the bottom shell, measure the gap between the flanges of the top shell and the bottom shell. Make four measurements around the periphery, with 90° between them. There should be an even gap between the flanges, see the table above for values. If the gap is less than 2.0 mm (0.079"), contact Sandvik.
13. Tighten the clamping screws in circular rotation in stages, until the flanges are tight against each other.

Maintenance Instructions

14. Torque the screws until there is no play between the flanges.

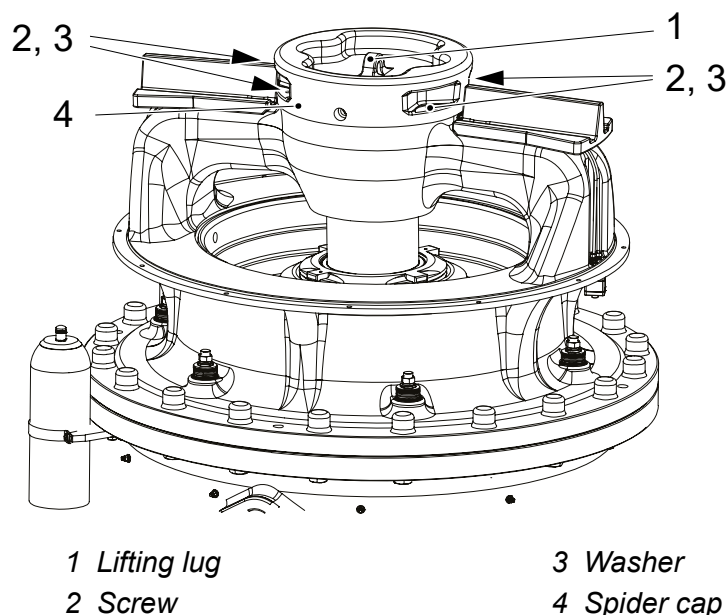
Note! *Wear and damage can cause the joint between the top shell and the bottom shell to deteriorate after a long period of operation. There must be no movement in the joint after the screws have been tightened. If there are signs of movement, the tapered mating surfaces must be corrected. Consult Sandvik for instructions.*

Note! *Risk of property damage. Make sure to use the correct grease for the spider bushing.*

15. Fill the spider bushing with 6-8 kg (13.2-17.6 lbs) of grease. Refer to *Grease for spider bushing lubrication* in *Technical specifications*.

16. Lubricate the contact surfaces of the spider cap (4) and its seating.

17. Install the spider cap. See section [3.2.1.3. Installing the spider cap \(Page 34\)](#).



3.2.6

Replacing the concave ring

The design of this cone crusher is such that all concave rings (3), from EC to EF, can be fitted into a single top shell (1). This is possible, despite the differences in shape of the various concave rings, by using filler rings.

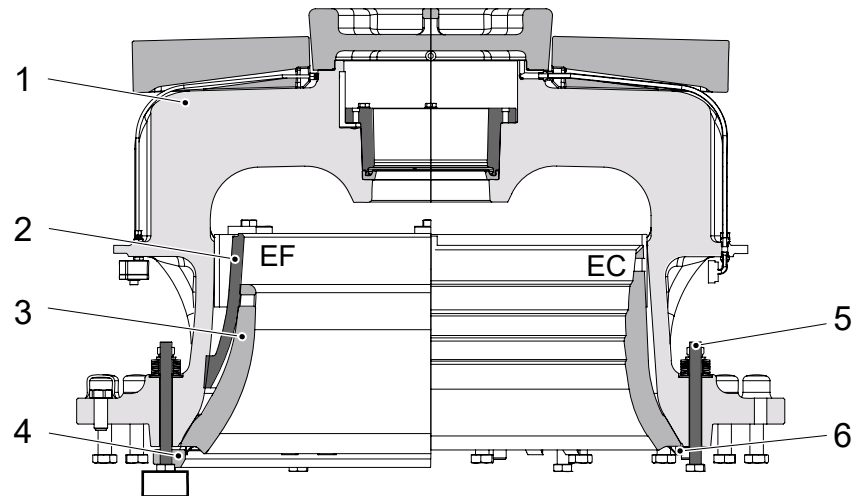
No filler ring (2) is used with C and EC concave rings. These are mounted directly in the topshell, with plastic backing.

The concave ring is pulled into the top shell by a support ring (4) with clamping screws (5). The concave ring has locating bosses (6) which fit into recesses in the support ring, while the ring itself is positioned against the top shell by locating dowels.

If lifting lugs are to be welded onto the concave ring, make sure that the lugs are amply dimensioned. Use an electrode that meet the requirements of EN 1600: E 18 8 Mn B 4 2, for example ESAB OK 67.45. Refer to *Safety and Environmental instructions* for information about welding, and to *Lifting*

Maintenance Instructions

lugs for the mantle in *Technical specifications* for dimensions of suitable lifting lugs.



- 1 Top shell
- 2 Filler ring
- 3 Concave ring

- 4 Support ring
- 5 Clamping screw
- 6 Locating boss

3.2.6.1

Removing the concave ring

Remove the topshell (2) before removing the concave ring (3). See section [3.2.5.1.Removing the top shell \(Page 44\)](#). Position the topshell on wooden blocks, so that the machined surfaces are not damaged and the concave ring is accessible.

1. Clean the area around the top of the filler ring (4).

WARNING



RISK OF CRUSHING

**Do not stand inside the top shell when the concave ring is removed.
Only stay on the equipment if it is necessary for inspections and maintenance work.**

2. Remove the locking nuts, sleeves, washers and disc springs which hold the concave ring in the topshell. Make a note of the way the disc springs are arranged.

Note!

The screws (5) in the upper flange of the topshell hold the filler ring and should not be removed during a normal concave change.

WARNING



TOXIC HAZARD

You can suffer damage to the lungs, eyes, liver, kidney and central nervous system and you are at risk of cancer if you inhale flame cutting fumes.

Use a suitable welding helmet and a respirator that is approved for the emissions that are released. Remember that some parts of the crusher contain manganese.

Make sure that the area is well ventilated.

Follow the instructions provided by the flame cutting equipment supplier/s.

3. Remove the concave ring from the topshell. If the concave ring is backed with plastic, it may have to be driven out of the topshell. Use one of the following methods:
 - Hit the top rim of the concave ring with a sledge hammer. This is the method described below in steps [3.2.6.1.4 \(Page 51\)](#) to [3.2.6.1.9 \(Page 52\)](#).
 - If hitting the concave ring is insufficient, two jacks can be used between the top rim and the topshell arms. Hit the concave ring around the top rim at the same time as the jacks are operated. Place the topshell on wooden blocks on the ground and use jacks.
 - If the concave ring can not be removed using either of the two methods described above, the concave ring must be split with a cutting torch. Take great care to avoid damage to the topshell and the filler ring.
4. Position the hook of a crane vertically above the topshell (2).
5. Put lifting slings around the spider arms.
6. Attach the lifting slings to the hook.
7. Take up the slack in the lifting tackle. The tackle should now be tight but not lifting the topshell.

WARNING



SUSPENDED LOAD HAZARD

A top shell assembly weighs up to 5 110 kg (11 266 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

WARNING



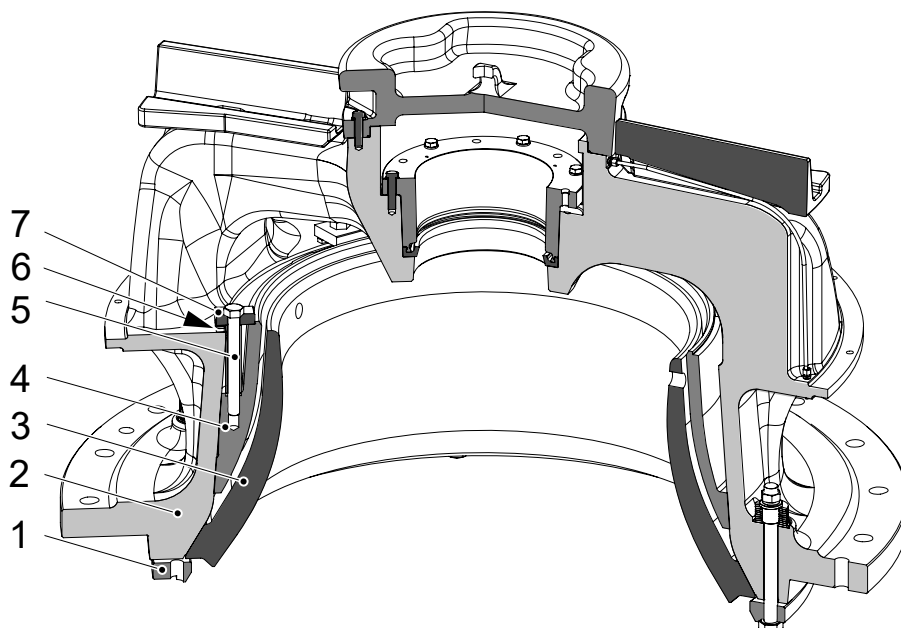
SUSPENDED LOAD HAZARD

A concave ring weighs up to 845 kg (1 863 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

If you lift the top shell with the concave ring in it, remember that the concave ring can come loose and fall out.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

8. Carefully lift the topshell off the ground.
9. Place the topshell (2) on wooden blocks next to the concave ring (3).



- 1 Support ring
- 2 Topshell
- 3 Concave ring
- 4 Filler ring
- 5 Screw

6 Shim

7 Square washer

3.2.6.2

Installing the concave ring

1. Position the support ring (9) on wooden blocks, with the six clamping screws (11) installed in their holes.
2. Position the concave ring on the support ring. Make sure that the locating bosses (16) on the concave ring fit the corresponding recesses in the support ring.
3. Make sure that the locating dowels are securely installed in the lower edge of the top shell.
4. Lightly lubricate the surfaces of the top shell and the filler ring (5) that will be in contact with plastic backing, with grease or silicone spray.
5. Position the hook of a crane vertically above the top shell (1).
6. Put lifting slings around the spider arms.
7. Attach the lifting slings to the hook.
8. Take up the slack in the lifting tackle. The tackle should now be tight but not lifting the top shell.

WARNING

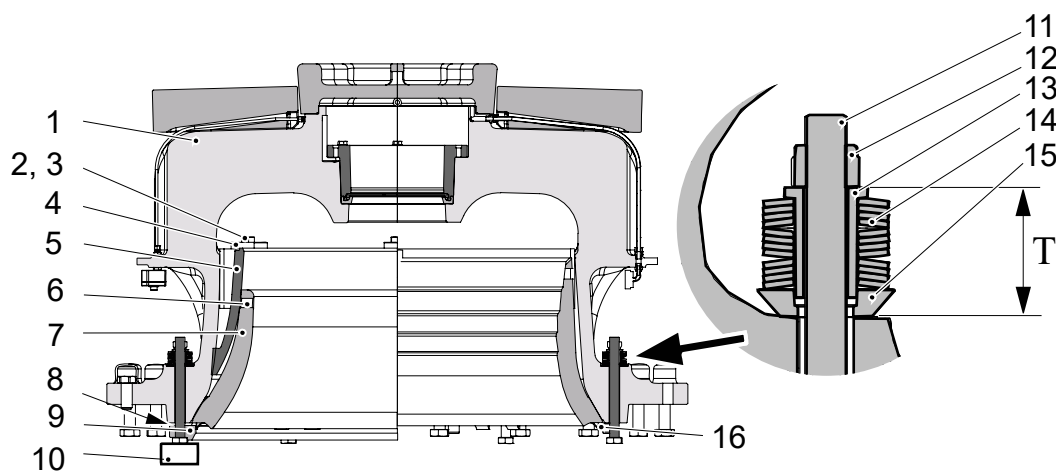


SUSPENDED LOAD HAZARD

A top shell assembly weighs up to 5 110 kg (11 266 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

9. Carefully lift the top shell and lower it onto the support ring. Use the locating dowels to ensure correct positioning. Make sure that the gap between the support ring and the top shell is even all around.



- | | |
|--|-------------------|
| 1 Top shell | 9 Support ring |
| 2 Screw | 10 Wooden block |
| 3 Square washer | 11 Clamping screw |
| 4 Washer | 12 Lock nut |
| 5 Filler ring | 13 Sleeve |
| 6 Plastic backing level hole | 14 Disc spring |
| 7 Concave ring | 15 Washer |
| 8 Gap between the support ring and the top shell | 16 Locating boss |

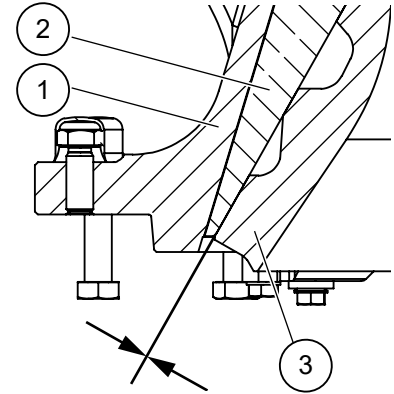
Note!

In order to increase the life of the support ring, with respect to wear on the inner surface, it can be rotated relative to the top shell ($6 \times 60^\circ$).

10. Arrange the disc springs the way they were before the topshell was removed. See the note of how the disc springs were arranged in 2. under section [3.2.6.1.Removing the concave ring \(Page 50\)](#), and the figure in the previous step.

Maintenance Instructions

11. Measure dimension (T). See the figure in the previous step.
12. Make sure that there is an even fit all around the topshell, by tightening the screws in circular rotation until the dimension T-4.5 mm (T-0.18 in) is reached. This corresponds to approximately a 460° rotation of the nut.
13. After all the screws have been tightened, make sure that there is no play between the spacer ring (2) and the lower part of the concave (3). Use a feeler gauge.



- 1 Top shell
- 2 Spacer ring
- 3 Concave

Note!

There are holes in the support ring to facilitate this check.

WARNING



TOXIC HAZARD

You can suffer eye and skin irritation, sensitization and burns if you handle the plastic backing incorrectly.

Follow the instructions on the plastic backing containers and in each component's MSDS.

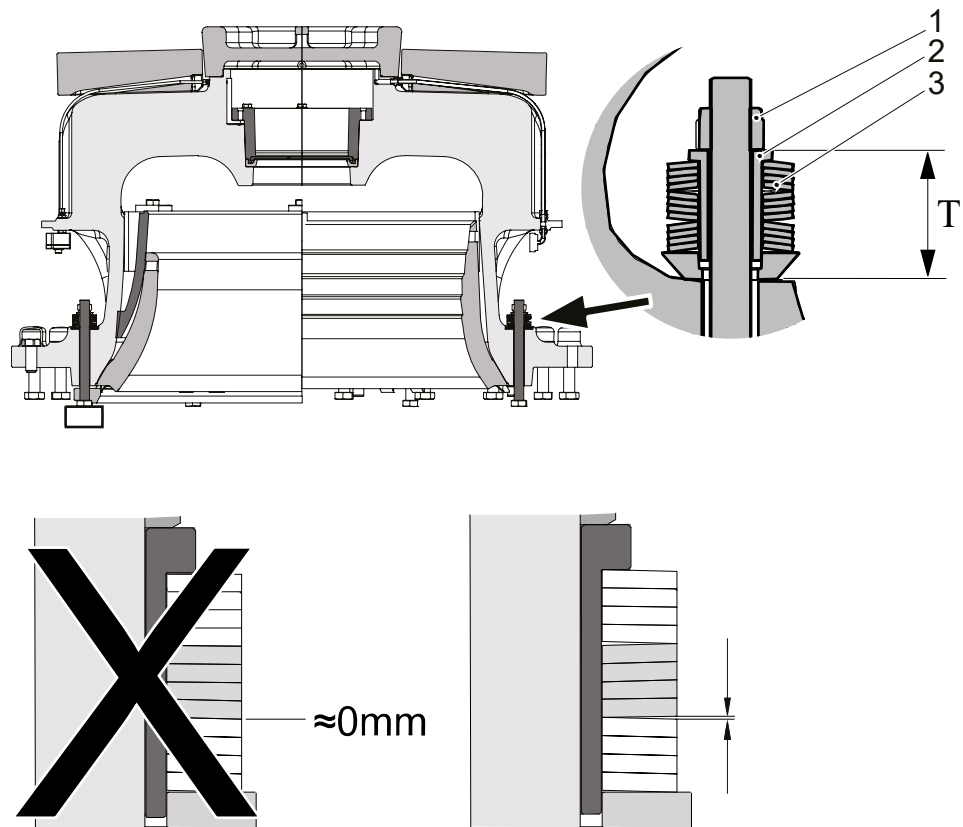
14. Fill the space between the concave ring and the top shell or filler ring with plastic backing, refer to *Plastic backing* in the *Technical Specifications*.

Checking the tightness of the clamping screws

1. Check the tightness of the clamping screws after a short period of operation. If necessary, retighten the screws.
2. Check that the dimension (T) is T-4.5 mm (T-0.18 in).

Note!

If crushing hard, but less abrasive material, it can be necessary to loosen the nuts after the concave ring's half lifetime. If the distance between the lower disc springs group and the middle disc spring group is close to 0 mm (0") loosen the nut.



- 1 Topshell
- 2 Sleeve
- 3 Disc spring

3.2.7

Replacing the filler ring

The filler ring in the cone crusher reduces the volume of the space between the topshell and the concave, and therefore reduces the amount of plastic backing that is required.

Two types of filler rings are used, the MF and the MC:

Maintenance Instructions

The MF filler ring is backed with plastic composition in its upper part and has metallic contact with the topshell in the lower part.

The MC filler ring has full-height metallic contact and is not backed against the topshell.

The MF filler ring (4) is intended for F and MFconcaves (3), while the MC filler ring is intended for M and MC concaves. The C and EC concaves are installed directly in the topshell, without a filler ring, and are backed with plastic.

Note! *If a filler ring comes loose during operation it must be removed, inspected, reinstalled and backed with plastic again.*

3.2.7.1 Removing the filler ring

Note! *The filler ring cannot be removed until the concave ring has been removed.*

Note! *If the intention is to change to a coarser crushing chamber, the filler ring may have to be removed.*

WARNING



SUSPENDED LOAD HAZARD

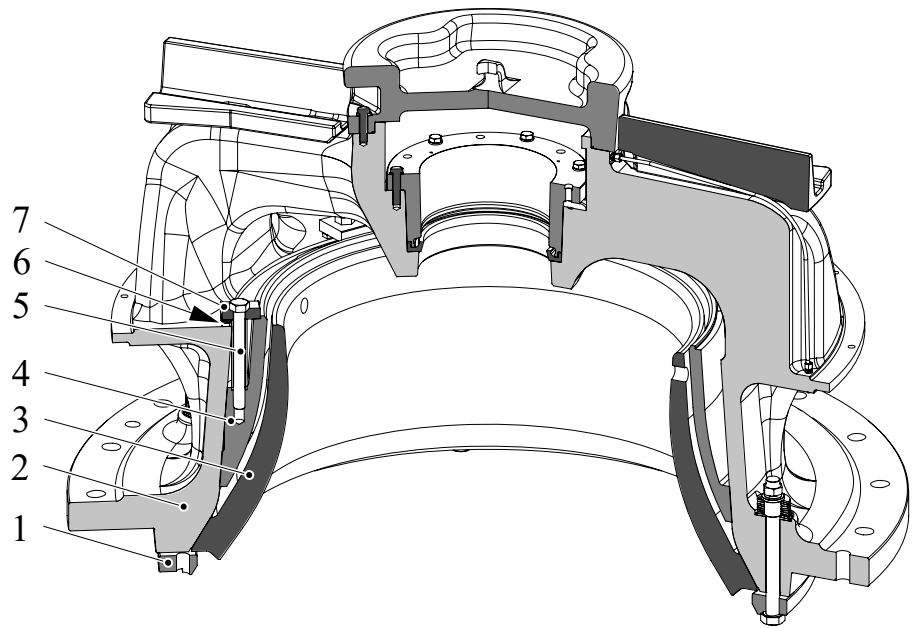
A filler ring weighs up to 596 kg (1 314 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

1. Remove the screws (5) that hold the filler ring (4) in the topshell (2).

Maintenance Instructions

2. The filler ring has a tapered seating in the topshell and jacks must be used to press it out. Use two jacks, each with a capacity of approximately 40 000 kg (88 000 lbs), as follows:
 - a) Position the jacks between the top edge of the filler ring and the topshell arms.
 - b) Press out the filler ring and at the same time use a sledge hammer to hit around the top edge and the inside of the filler ring.
 - c) If the filler ring still does not come free, it may be necessary to heat the topshell while the jacks are operated.

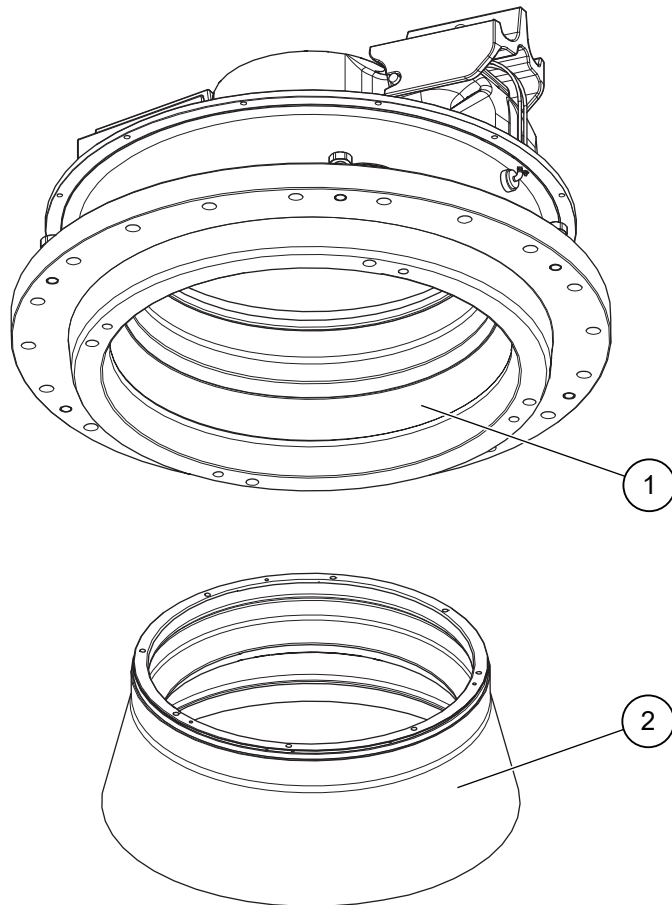


- 1 *Support ring*
- 2 *Topshell*
- 3 *Concave ring*
- 4 *Filler ring*
- 5 *Screw*
- 6 *Shim*
- 7 *Washer*

3.2.7.2

Inspecting the filler ring

1. Clean the filler ring.
2. Examine the tapered surfaces of the filler ring (2) and the topshell (1). If there are any ridges or depressions, these must be ground off before the reassembly is started.



1 Tapered surface, topshell

2 Tapered surface, filler ring

3.2.7.3

Installing the filler ring

1. Put a little grease into each threaded hole in the filler ring.

WARNING



TOXIC HAZARD

You can suffer eye and skin irritation, sensitization and burns if you handle the plastic backing incorrectly.

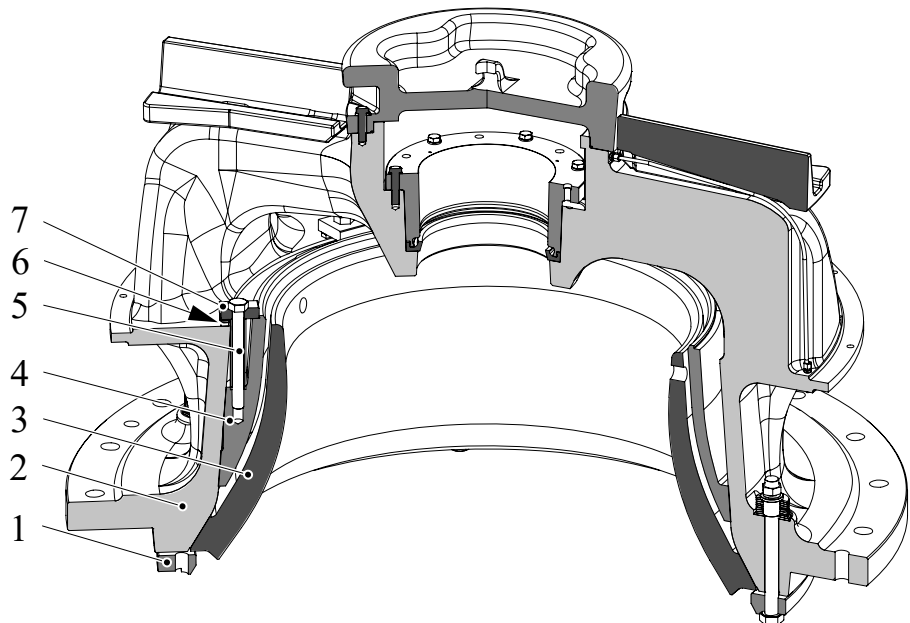
Follow the instructions on the plastic backing containers and in each component's MSDS.

2. For MF filler: Push a piece of plastic hose over the screws (5) to protect them from the plastic backing.
3. Install the screws, the square washers (7) and the shims (6) under the square washer.
4. When the screws are threaded all the way into the filler ring, the holes must be completely filled with grease to prevent corrosion and the accumulation of dirt.
5. Pull the filler ring up into position in the topshell by tightening the six screws in circular rotation, refer to *Tightening torques* in the *Technical Specifications*.

Note!

For MF filler: When an MF filler has been properly seated, back it with plastic, see section *Plastic backing in the Technical Specifications*.

6. Check the tightness of the screws after a few days of operation. If necessary, re-tighten the screws.



- 1 Support ring
- 2 Topshell
- 3 Concave ring
- 4 Filler ring

- 5 Screw
- 6 Shim
- 7 Washer

Maintenance Instructions

3.2.8 Replacing the arm shields

3.2.8.1 Removing the arm shields

1. Weld a suitable lifting lug on the worn arm shield (1). Use an electrode that meet the requirements of EN 1600: E 18 8 Mn B 42 or ISO 3581: E 18 8 Mn B (for example ESAB OK 67.45).
2. Cut the worn arm shield with an angle grinder.
3. Position the hook of a crane vertically above the arm shield.
4. Attach a lifting sling to the lifting lug.
5. Connect the lifting hook to the lifting sling.
6. Take up the slack in the lifting tackle.

WARNING



SUSPENDED LOAD HAZARD

An arm shield weighs up to 43 kg (95 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

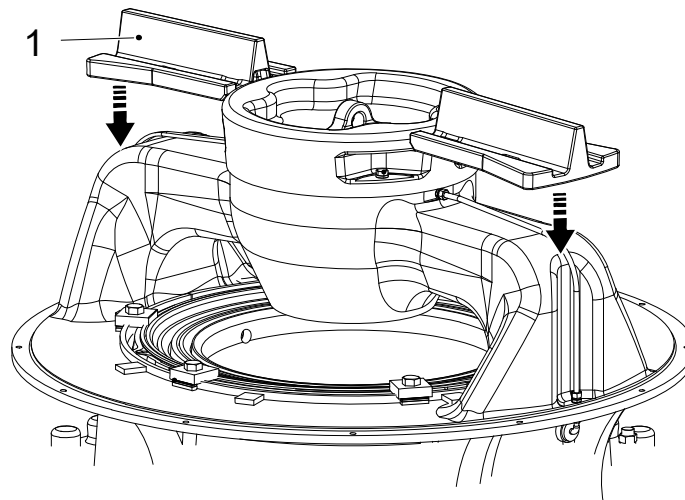
Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

7. Carefully lift the arm shield off the top shell.

3.2.8.2

Installing the arm shields

1. Weld a suitable lifting lug on the new arm shield (1). The electrode must meet the requirements of EN 1600: E 18 8 Mn B 42 or ISO 3581: E 18 8 Mn B (for example ESAB OK 67.45).
2. Attach a lifting sling to the lifting lug.
3. Arrange the lifting equipment.



1 Arm shield



WARNING



SUSPENDED LOAD HAZARD

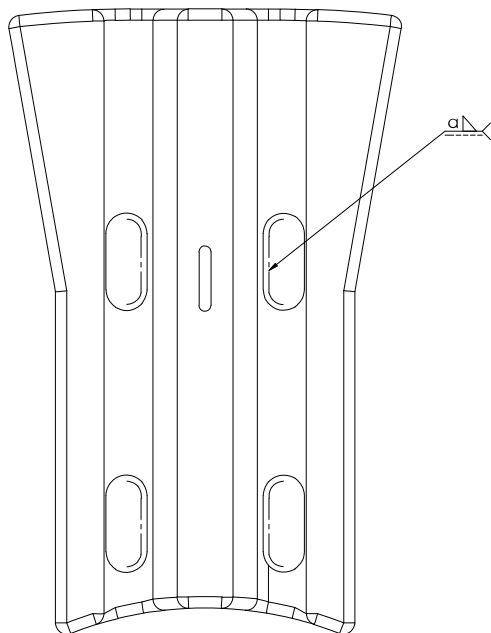
An arm shield weighs up to 43 kg (95 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

4. Carefully lift the arm shield (1).
5. Carefully lower the arm shield onto the top shell.
6. Weld the arm shield (1) to the top shell. The electrode must meet the requirements of EN 1600: E 18 8 Mn B 42 or ISO 3581: E 18 8 Mn B (for example ESAB OK 67.45).

Note!

Weld only the side of the attachment slots that is closest to the middle of the arm shield.



a-dimension

4-6 mm (0.16-0.24")

3.3

Main shaft

3.3.1

Replacing the main shaft and the mantle

Note!

Before starting these procedures, it is necessary to remove the top shell, see section [3.2.4.Checks prior to removal of the top shell \(Page 43\)](#)

When the top shell assembly is removed, the main shaft assembly remains in the bottom shell. At this stage, it is wise to carry out various inspection

Maintenance Instructions

and maintenance procedures, for example, to change the mantle and inspect the play between the dust collar and the dust seal ring.

Even if the mantle is changed without removing the main shaft from the crusher, the main shaft must be lifted so that the step bearing can be inspected.

3.3.1.1 **Removing the main shaft assembly**

Note! *If the main shaft and the eccentric bushing has seized up.*

Note! *These instructions can be performed without removing the main shaft cover.*

1. Carefully clean the main shaft (4), the flange of the bottom shell, the arms of the bottom shell and around the dust seal ring retainer, to prevent dirt from entering the bearings when the main shaft is removed.
2. Install a lifting eye bolt (3) in the top of the main shaft (4).
3. Arrange the lifting equipment.



WARNING



SUSPENDED LOAD HAZARD

A main shaft assembly with mantle weighs up to 3 520 kg (7 761 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

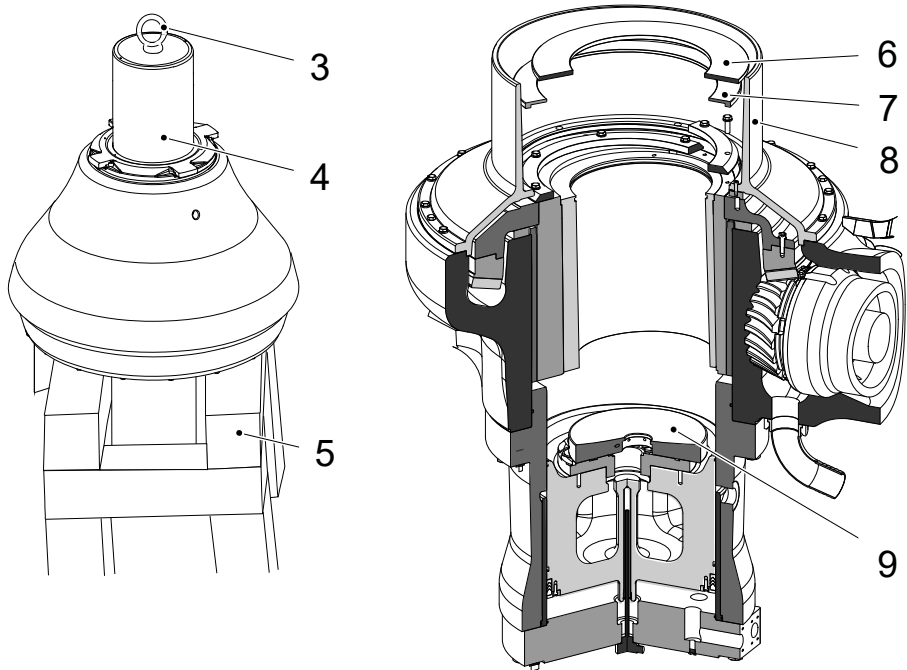
Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

4. Lift the main shaft approximately 20 mm(0.8").

Note! *The step washer can fall off the main shaft at once, but sometimes it sticks to the main shaft, depending on the temperature and viscosity of the oil. Wait for 10 minutes before you continue, to make sure that the step washer has fallen off the main shaft.*

5. Carefully lift out the main shaft and make sure that the step washer has dropped off.
6. Make sure that the step washer (9) has not landed upside down (the concave surface should face upward).
7. Lower the main shaft (4) onto a trestle (5) at working height.
8. When the main shaft is removed, the inner dust seal ring (6) usually remains inside the dust collar (8). Remove the inner dust seal ring (6) from the inside of the dust collar (8).

9. Put a cover over the dust collar (8), to prevent dirt from contaminating the oil and the bearings.



3 Lifting eye bolt
4 Main shaft
5 Trestle
6 Inner dust seal ring

7 Seating ring
8 Dust collar
9 Step washer

3.3.1.2

Checking the main shaft and the mantle

Main shaft diameter	Maximum play between the main shaft and the eccentric bushing mm (in)
340 mm (13.40 in)	1.8 mm (0.071 in)

1. Measure the diameters of the main shaft and the eccentric bushing and calculate the play. The play must not exceed 1.8 mm (0.071 in).

Note!

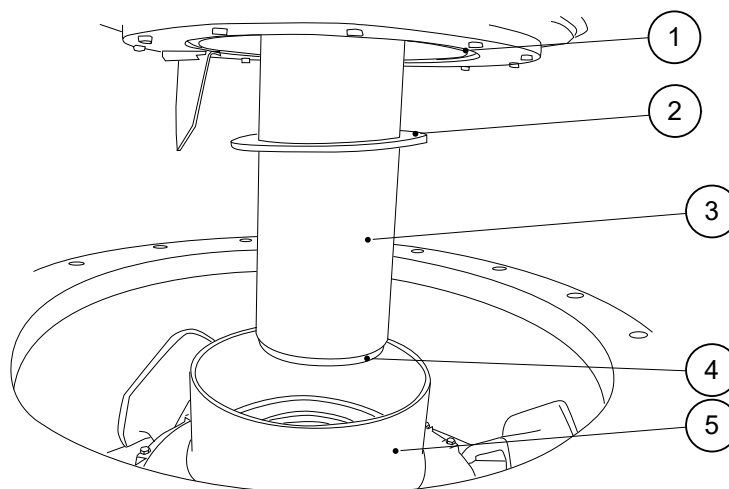
A larger play is permissible, if the bearing surfaces are evenly worn, and neither part is to be repaired (that is, a larger play is permissible for components that have worn against each other). If the eccentric bushing is changed, the spider bushing must also be checked, see section [3.2.3.2. Checking the spider bushing and the seal ring \(Page 40\)](#).

2. Check the main shaft sleeve for wear, see section [3.3.4.1. Inspecting the main shaft sleeve \(Page 82\)](#).
3. Clean the dust seal ring, and make sure that the drain holes in the dust collar are free from obstructions.
4. Check that the inner dust seal ring rests horizontally on the seating ring. The seating ring should be flat in the dust collar.

Maintenance Instructions

5. Measure the play between the inner dust seal ring (2) and the main shaft (3). The play must not exceed 2.5 mm (0.10 in).

Main shaft diameter	Maximum play between the main shaft and the inner dust seal ring mm (in)
340 mm (13.40 in)	2.5 mm (0.10 in)



- 1 Dust seal ring
- 2 Inner dust seal ring
- 3 Main shaft
- 4 Main shaft step
- 5 Dust collar

6. Check the step bearing components for wear, see section [3.7.2.2. Inspecting the step bearing components \(Page 159\)](#).
7. If there is more dirt than is to be expected on the inside of the dust collar, see section [3.4.1.3. Installing the dust collar \(Page 114\)](#).
8. Check the lower bearing surface of the main shaft. A dull surface is a sign of contaminated oil. A shiny surface usually indicates clean oil.
9. Check the dust seal ring, see section [3.3.7.2. Checking the dust seal ring \(Page 107\)](#).

3.3.1.3

Installing the main shaft assembly

1. Install a lifting eye in the top of the main shaft (3).
2. Arrange the lifting equipment.
3. Align the step washer so that it is centered on the piston wearing plate. Make sure that the concave surface is facing upwards.
4. Coat the lower part of the main shaft with oil.
5. Fix the inner dust seal ring (2) on the main shaft (3) by placing it askew. When the main shaft has entered the eccentric bushing, the ring will be released from the main shaft inside the dust collar (5).

WARNING



SUSPENDED LOAD HAZARD

A main shaft assembly with mantle weighs up to 3 520 kg (7 761 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

6. Carefully lift the main shaft (3).

NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

Be very careful when installing the main shaft and the inner dust seal ring. Make sure that the bearing surfaces of the main shaft, and the main shaft step, are not damaged by impact with the bottom shell.

NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

Make sure that the dust seal ring (1) moves correctly over the dust collar (5), otherwise the dust seal ring (1) may be damaged when the shaft is lowered.

7. Lower the main shaft (3) into the bottom shell. Be very careful when you lower it into the eccentric bushing.

Note!

With a larger eccentric throw, it may be necessary to move the crane slightly as the bottom of the main shaft slides into the eccentric bushing.

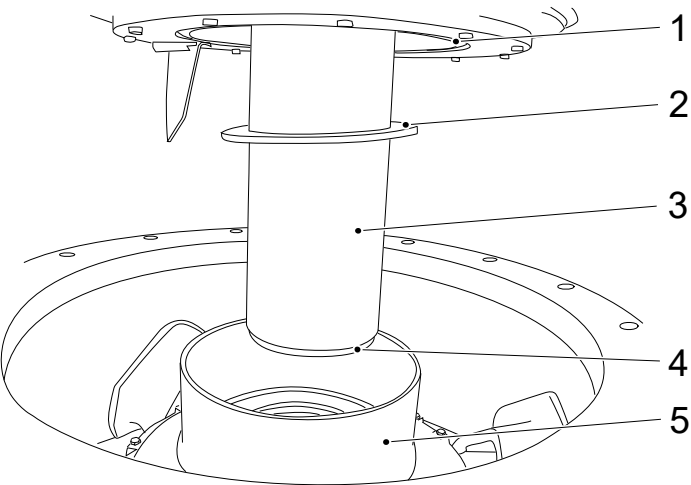
8. Lower the inner dust seal ring (2) into the dust collar (5).
9. Use the inspection holes to check how the dust seal ring (1) lies in relation to the dust collar (5). Adjust if necessary.

Note!

The dust seal ring (1) can be adjusted by pushing it with a suitable pole or similar. An alternative method is to spin the main shaft (3) rapidly by hand when the dust seal ring approaches the dust collar. Stop the spinning as soon as the dust seal ring (1) has seated properly.

10. Centralize the dust seal ring (1) and make sure the dust seal ring (1) slides smoothly over the dust collar (5).
11. Rotate the main shaft (3) slowly to check that it does not jam in the eccentric bushing.

12. As soon as the dust seal ring (1) has passed the top edge of the dust collar (5), stop the rotation of the main shaft (3).



- 1 Dust seal ring
- 2 Inner dust seal ring
- 3 Main shaft
- 4 Main shaft step
- 5 Dust collar

13. If the main shaft cover has been removed, install it. See section [3.3.4.3.Installing the main shaft sleeve \(Page 88\)](#).

3.3.2 Replacing the head nut

3.3.2.1 Removing the head nut

Note! *The weld between the mantle (1) and the burning ring (3) is made with a stainless electrode. Since it is difficult to cut stainless material with a cutting torch, it is advisable to grind off the weld first. This procedure also minimizes the heat input to the inner head nut (5), which reduces the risk that the adhesion of the locking fluid to the main shaft is destroyed.*

 NOTICE	
	RISK OF PROPERTY DAMAGE Make sure you keep the flame away from the main shaft and the head center.

1. Burn off the burning ring (3) between the mantle (1) and the head nut (4).

Maintenance Instructions

WARNING



WORN PART HAZARD

You can sustain musculoskeletal injuries if you miss the lug on the head nut when you attempt to strike it.

Weld on new lugs if the existing lugs on the head nut are reduced to about half their original size.

2. Inspect the head nut. If the lugs on the head nut are worn more than 50%, weld new lugs onto the head nut. Replace the head nut with a new one before installation.

WARNING



ERGONOMIC HAZARD

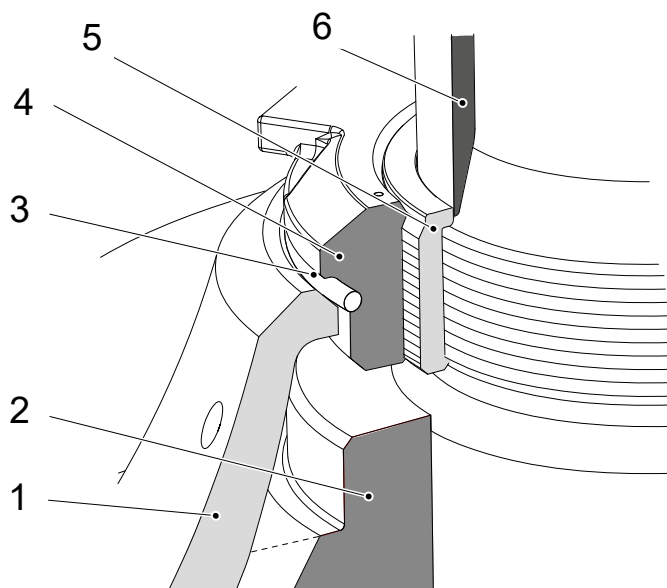
When striking the head nut with a sledgehammer be careful not to bend or twist your back to avoid injuries to discs and back muscles.

Take a wide stance and find the best positions for your feet, bend your hips and knees and use your leg muscles.

Note!

The head nut is right hand threaded.

3. Hit the lugs of the head nut with a sledgehammer. Unscrew the head nut.



1 Mantle

2 Head center

3 Burning ring

4 Head nut

5 Inner head nut

6 Main shaft sleeve

4. Attach lifting slings to the lugs (7) on the head nut (8).

Maintenance Instructions

WARNING



SUSPENDED LOAD HAZARD

A head nut with burning ring weighs up to 56 kg (123 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

WARNING

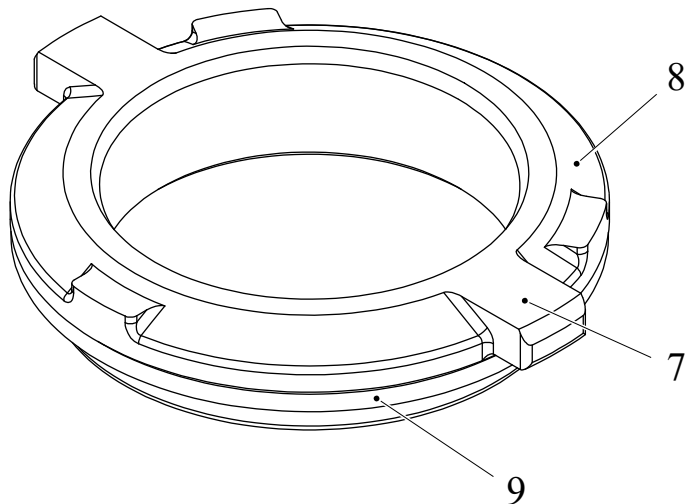


HOT SURFACE HAZARD

You can suffer severe burns from the heated components.

Allow the components to cool down before you touch them.

5. Arrange the lifting equipment. Lift off the head nut. Remove any remains of the burning ring (9).



7 Lug

8 Head nut

9 Burning ring

3.3.2.2

Checking the head nut

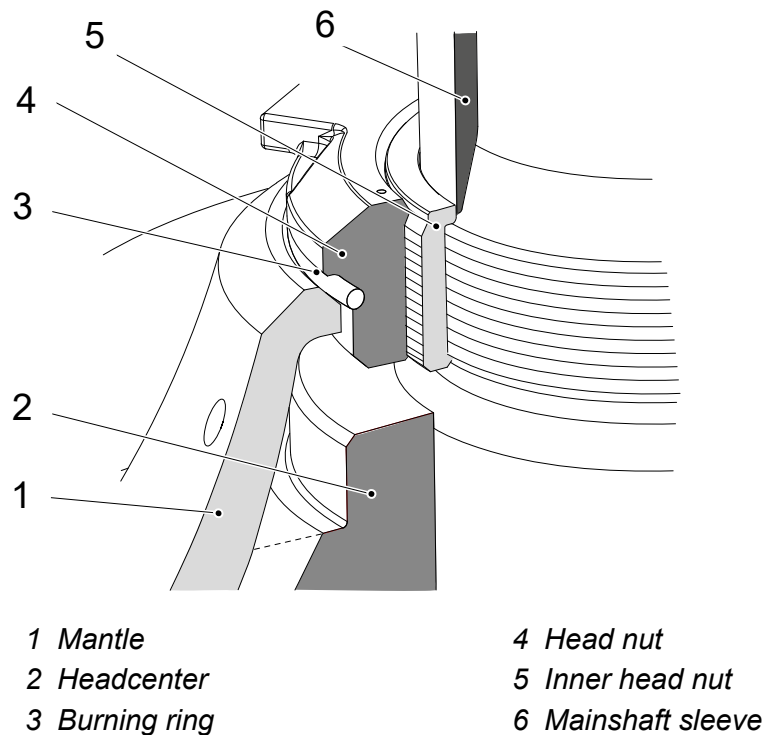
1. Check the condition of the lugs on the head nut. If the lugs are worn more than 50%, replace the head nut.
2. Carefully clean the threads on the head nut (4) and on the inner head nut (5) (which remains installed on the mainshaft) with a wire brush.
3. Check the condition of the threads on the head nut (4) and on the inner head nut (5).

4. Lubricate the threads with anti-seizing paste.

Note!

Remove the inner head nut only if its outer threads have been damaged, see section [3.3.2.4.Removing the inner head nut \(Page 73\)](#).

5. Check the surface of the main shaft below the threads. Polish any damaged areas until a smooth surface is obtained.
6. To check the fit of the head center (2), measure the distance from the top of the headcenter to the top of the main shaft. Compare this dimension to the larger of the two values that are stamped on the top of the main shaft, see section [3.3.5.Inspecting the head center \(Page 97\)](#).



3.3.2.3 Installing the head nut

Note!

If a new mantle (1) is to be installed, install the mantle (1) and the burning ring (3) before installing the head nut (4). Apart from the instructions in this section, see also section [3.3.3.3.Installing the mantle \(Page 77\)](#) before you install the mainshaft and the mantle.

Note!

For detailed information about measurements, locking fluid, anti-seize paste and electrode alternatives, see drawing BG01579814 in Mechanical Drawings.

1. Lubricate the outer threads of the inner head nut (5) with an ample amount of anti-seize paste.

WARNING



SUSPENDED LOAD HAZARD

A head nut with burning ring weighs up to 56 kg (123 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

2. Arrange the lifting equipment.

WARNING



WORN PART HAZARD

You can sustain musculoskeletal injuries if you miss the lug on the head nut when you attempt to strike it.

Replace the head nut if the lugs are reduced to about half their original size.

Also replace the head nut if you think the lugs will be reduced to about half their original size when you need to remove the head nut next time.

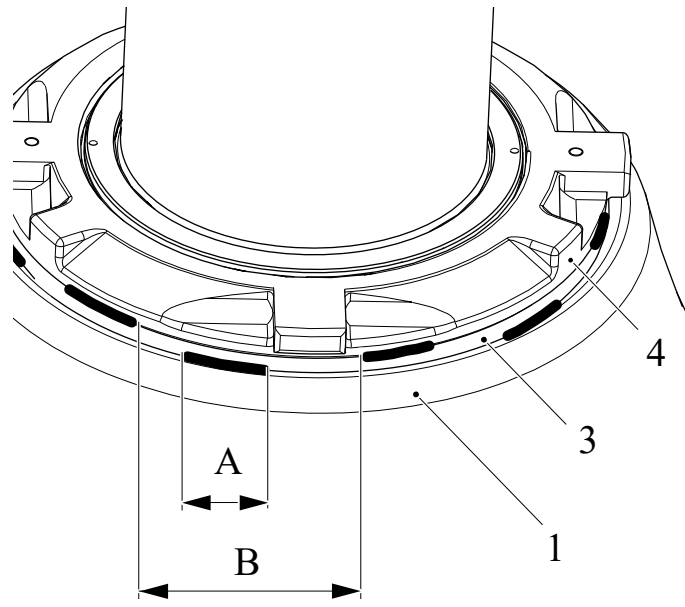
Note!

The head nut is right hand threaded.

3. Install the head nut (4) and tighten it hard by using a sledgehammer to hit the lugs. To make sure that the head nut is tightened evenly, it is recommended that installation is carried out by two persons who simultaneously hit on one nut lug each.

Maintenance Instructions

4. Weld the burning ring (3) to the head nut (4) and the mantle (1) as follows:
- a) Begin by welding between the burning ring (3) and the head nut (4).
 - b) Align the welds to the mantle (1) with the gaps between the welds to the head nut.



- 1 Mantle
- 3 Burning ring
- 4 Head nut

 NOTICE	
	RISK OF EQUIPMENT OR PROPERTY DAMAGE Always ground close to the welding area. Always connect the ground to the head nut/mantle.

- Note!**

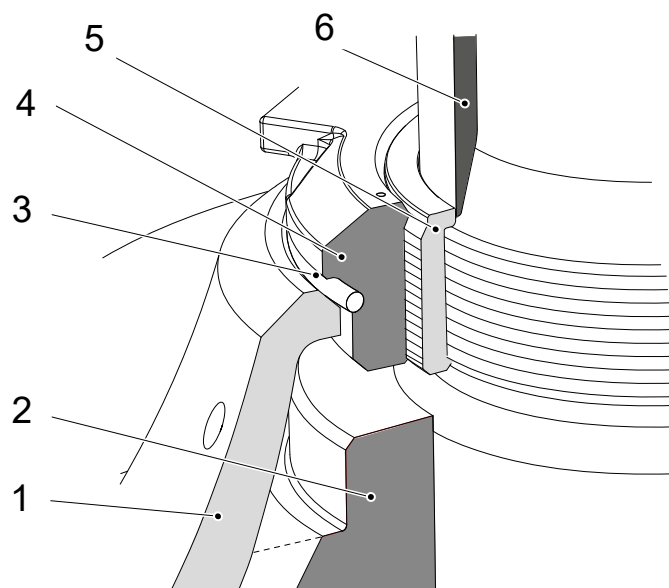
Avoid welding immediately below the lugs on the head nut (4). A weld in this area makes it more difficult to remove the head nut.
- Note!**

In some cases, when moist material is crushed for example, it can be necessary to weld all the way around the burning ring (3).
- Note!**

In order to prevent fine material from entering through the opening in the burning ring, close the opening with a weld.

Maintenance Instructions

5. Weld between the burning ring (3) and the head nut (4).



1 Mantle
2 Headcenter
3 Burning ring

4 Head nut
5 Inner head nut
6 Mainshaft sleeve

3.3.2.4

Removing the inner head nut

Note!

Remove the inner head nut (3) only if its outer threads have been damaged.



NOTICE

RISK OF PROPERTY OR EQUIPMENT DAMAGE

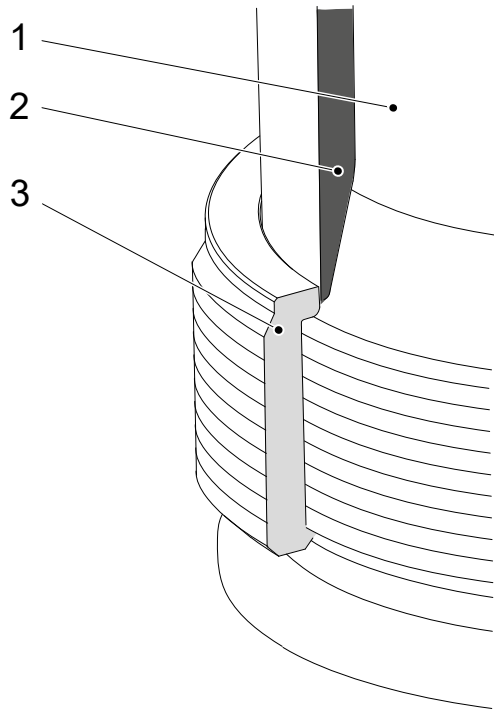
Be very careful when you grind or chisel. Make sure that you do not damage the threads of the main shaft.

1. Carefully grind or chisel a groove in the inner head nut (3).
2. Split the inner head nut (3) with a wedge.

Maintenance Instructions

Note! *The inner head nut is right hand threaded.*

3. Remove the inner head nut (3).



- 1 Main shaft
- 2 Main shaft sleeve
- 3 Inner head nut

3.3.2.5 **Installing the inner head nut**

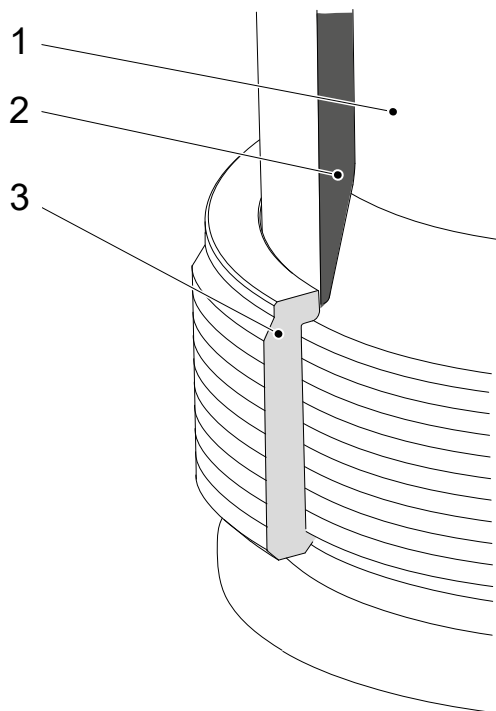
1. Clean the threads of the main shaft (1) and of the inner head nut (3) with a degreasing fluid.
2. Check that the inner head nut (3) can be run down to the end of the thread.
3. Remove the inner head nut (3) again.
4. Apply an ample amount of Loctite 270 or similar (high strength), to the threads of the main shaft (1) and of the inner head nut (3). The threads should be completely filled.

Maintenance Instructions

Note!

The inner head nut is right hand threaded.

5. Install the inner head nut (3) and make sure it is tight against the main shaft.



- 1 Main shaft
- 2 Main shaft sleeve
- 3 Inner head nut

3.3.3

Replacing the mantle

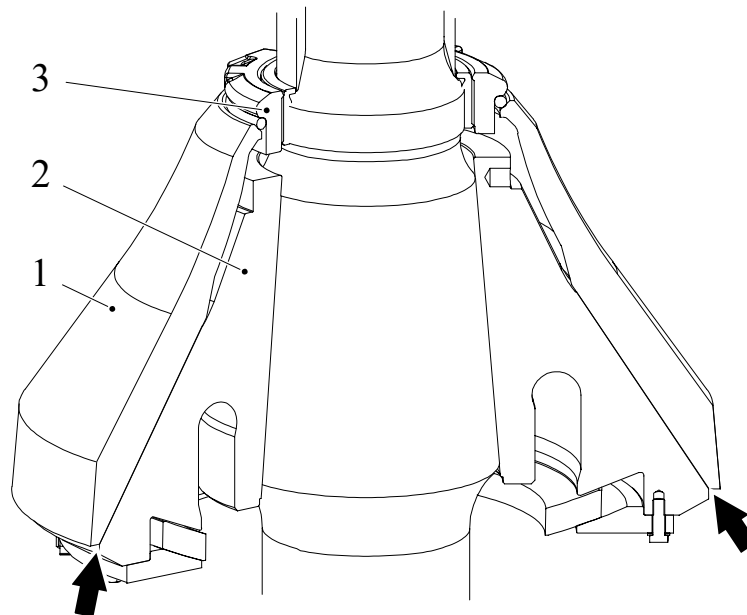
3.3.3.1

Checking the play between the head center and the mantle

Manganese flow in the mantle can cause a gap between the head center and the mantle, allowing these components to move relative to each other. This causes wear, particularly on the lower part of the contact surface on the head center. If this occurs, the fit must be restored by grinding and polishing. If the wear is severe, consult Sandvik for advice.

Maintenance Instructions

1. Check with a feeler gauge, all around the periphery (see arrows), that there is contact between the lower part of the mantle (1) and the head center (2).



- 1 Mantle
- 2 Head center
- 3 Head nut

3.3.3.2

Removing the mantle

Note!

Start by removing the complete main shaft assembly, see section [3.3.1.1.Removing the main shaft assembly \(Page 63\)](#), and then section [3.3.2.1.Removing the head nut \(Page 67\)](#).

NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

Always ground close to the welding area. Always connect the ground to the mantle.

1. Weld two lifting lugs (3) on the mantle (2). The lifting lugs must be amply dimensioned and must be welded with an electrode suitable for manganese. See section *Lifting lugs for the mantle* in the *Technical Specifications*.
2. Attach suitable lifting slings to the lifting lugs (3) on the mantle (2).
3. Arrange the lifting equipment.

Maintenance Instructions

WARNING



SUSPENDED LOAD HAZARD

A mantle weighs up to 765 kg (1 687 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

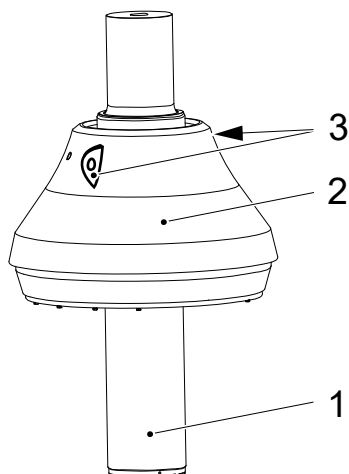
The plastic backing Korrobond 65 decomposes at a temperature of approximately 160 °C (320 °F). Make sure that the working area is well ventilated.

NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

Take care to avoid damaging the bearing surfaces and the threads of the main shaft with the mantle when it is lifted off.

4. Lift the mantle (2) off the head center. The mantle (2) can be difficult to remove because of the plastic backing. If the mantle (2) cannot be lifted off, hit it with a sledgehammer while you lift it. If necessary, heat the mantle (2).



1 Main shaft

2 Mantle

3 Lifting lug

3.3.3.3

Installing the mantle

1. Thoroughly clean the head center (5) and the mantle (2).

Maintenance Instructions

2. Lightly lubricate the outer surface of the head center (5) with a thin coat of grease or silicone spray, to simplify future removal of the mantle (2).

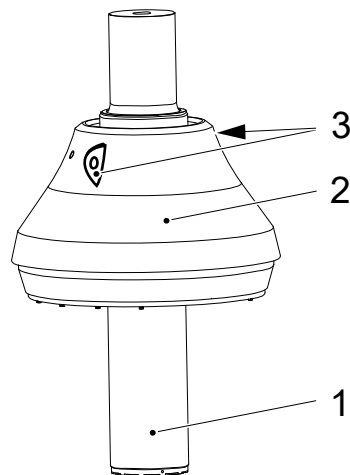


NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

Always ground close to the welding area. Always connect the ground to the mantle.

3. Weld two lifting lugs (3) on the mantle (2). The lifting lugs must be amply dimensioned and must be welded with an electrode suitable for manganese, refer to section *Lifting lugs for the mantle* in the *Technical Specifications*.



1 Main shaft

2 Mantle

3 Lifting lug

4. Attach the lifting slings to the lifting lugs (3).
5. Arrange the lifting equipment.



WARNING



SUSPENDED LOAD HAZARD

A mantle weighs up to 765 kg (1 687 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

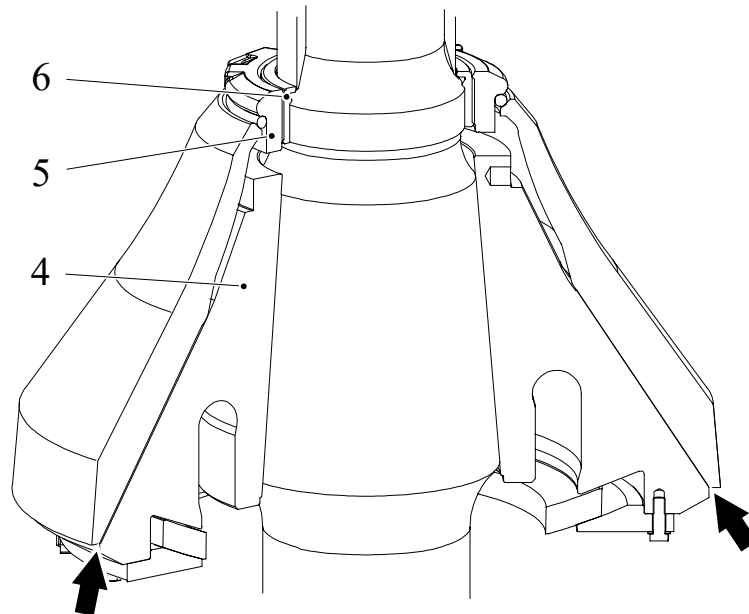
6. Carefully lift the mantle (2).
7. Position the mantle on the head center (4).
8. Lubricate the outer threads of the inner head nut (5) with a lubricating paste. Use an ample amount of spider bushing grease.

Maintenance Instructions

Note!

The head nut is right hand threaded.

9. Install the head nut (5).
10. Tighten the head nut (5) so that the bottom edge of the mantle (2) touches the head center (4) all round.
11. Check with a feeler gauge, all around the periphery, that there is contact between the lower part of the mantle (2) and the head center (4).



- 4 Head center
- 5 Head nut
- 6 Inner head nut

Note!

The head nut is right hand threaded.

12. Remove the head nut (5).
13. Lubricate the outer threads of the inner head nut (6) with lubricating paste, to protect it from the plastic backing that is to be poured in.

WARNING

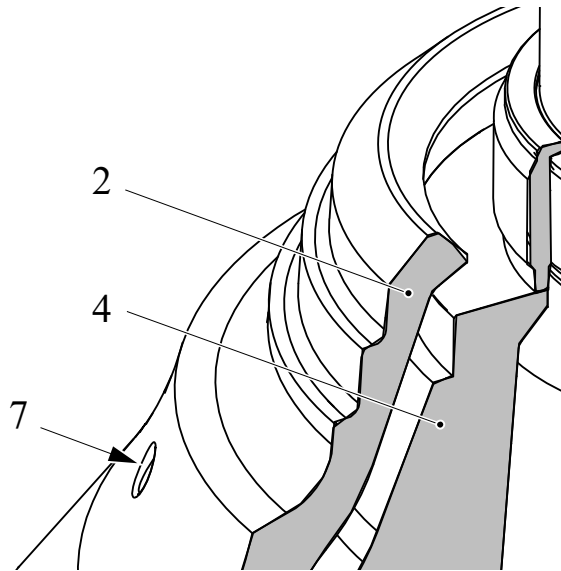


TOXIC HAZARD

You can suffer eye and skin irritation, sensitization and burns if you handle the plastic backing incorrectly.

Follow the instructions on the plastic backing containers and in each component's MSDS.

14. Fill the space between the mantle (2) and the head center (4) with plastic backing through a pouring hole (7). Do not let the level of the plastic backing rise above the pouring hole (7) in the mantle (2), see section [1.2. Plastic backing \(Page 12\)](#) and refer to section *Plastic backing* in the *Technical Specifications*.



2 Mantle

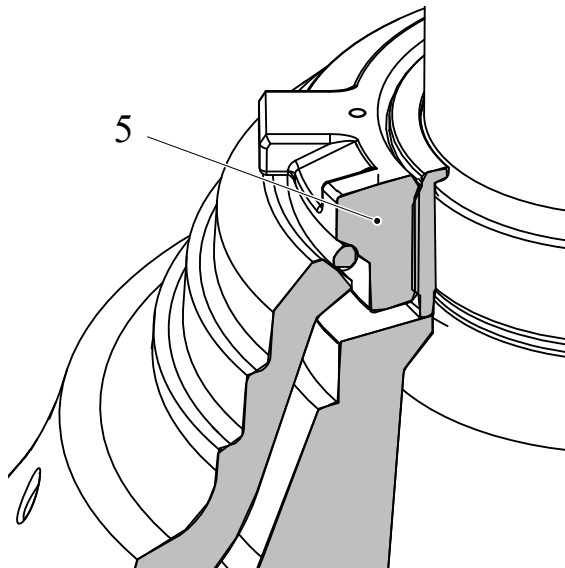
4 Head center

7 Pouring hole (max level for plastic backing)

Maintenance Instructions

The head nut is right hand threaded.

15. As soon as the plastic backing has been poured in, install the head nut (5) again and tighten it.



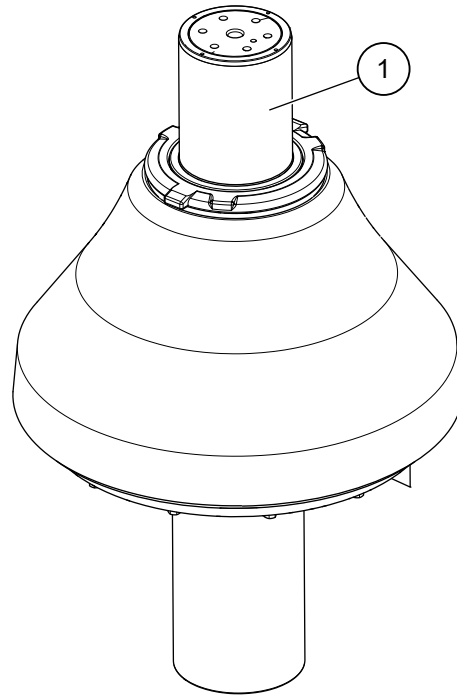
5 Head nut

16. Remove the lifting lugs.

3.3.4 Replacing the main shaft sleeve

3.3.4.1 *Inspecting the main shaft sleeve*

1. Examine the bearing surface of the main shaft sleeve (1) for wear. If the surface wear exceeds 0.4 mm (0.016 in), the main shaft sleeve (1) must be replaced. Wear on the bearing surface of the main shaft sleeve (1) can form a regular pattern. The lip of the spider bearing seal can cause similar wear.
2. The lower part of the main shaft sleeve (1) is exposed to wear from the feed material. Remove burrs and ridges with emery paper, every time the top shell is removed (e.g. for manganese replacement).

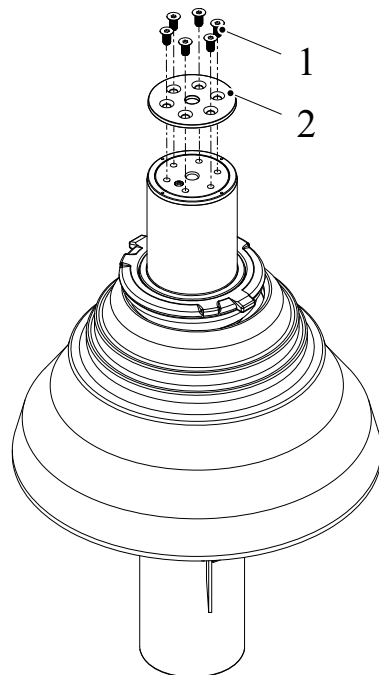


1 Main shaft sleeve

3.3.4.2

Removing the main shaft sleeve

1. Remove the screws (1) and the main shaft cover (2)



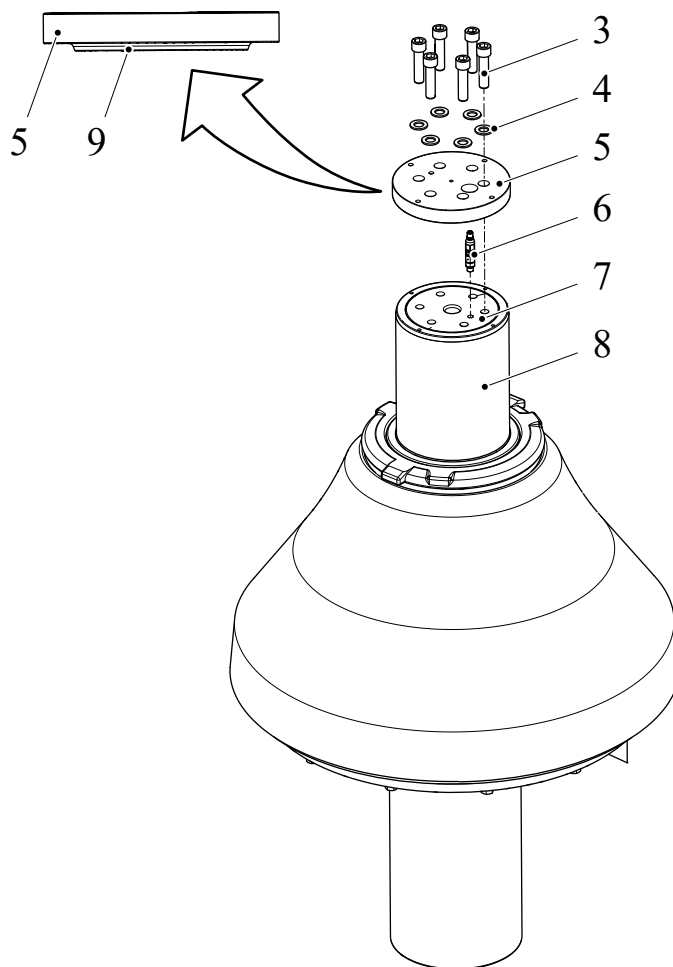
1 Screw

2 Main shaft cover

2. Attach the nipple (6) to the threaded hole on top of the main shaft (7).
3. Turn the cover (5) so that the protrusion (9) points downward.
4. Place the cover (5) on top of the main shaft sleeve (8), so that the nipple (6) passes through the widest hole of the cover (5).
5. Lubricate the screws (3) with oil.

Maintenance Instructions

6. Attach the cover (5) to the main shaft (7) with the screws (3) and the washers (4). Tighten the screws (3) by hand.



- 3 Screw
- 4 Washer
- 5 Cover
- 6 Nipple
- 7 Main shaft
- 8 Main shaft sleeve
- 9 Protrusion

7. Connect the hose (10) to the nipple (6).

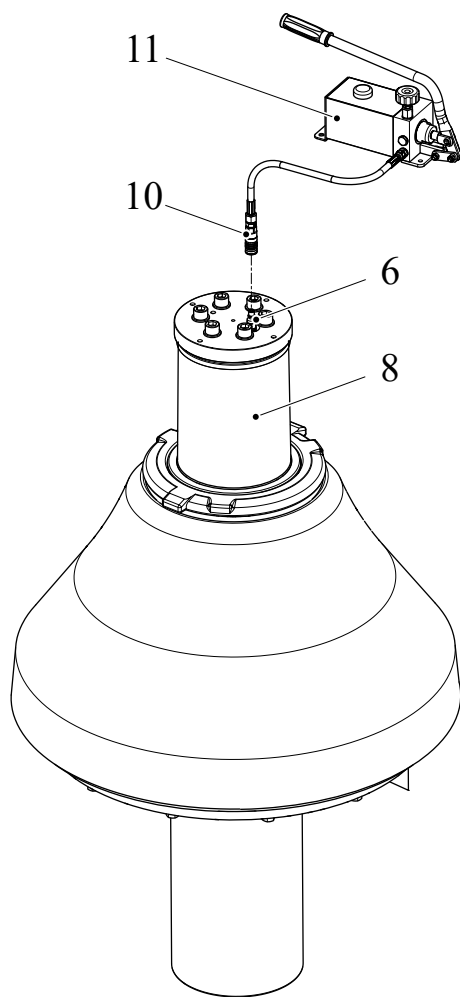
Note!

The main shaft sleeve (6) releases its grip suddenly, and can emit a loud banging noise.

8. Pump up the oil pressure with the oil pump (11) until the main shaft sleeve (6) releases its grip from the main shaft.
9. Release the oil pressure at the pump (11).

Maintenance Instructions

10. Disconnect the hose (10) from the nipple (6) and remove the pump (11).



6 Nipple

8 Main shaft sleeve

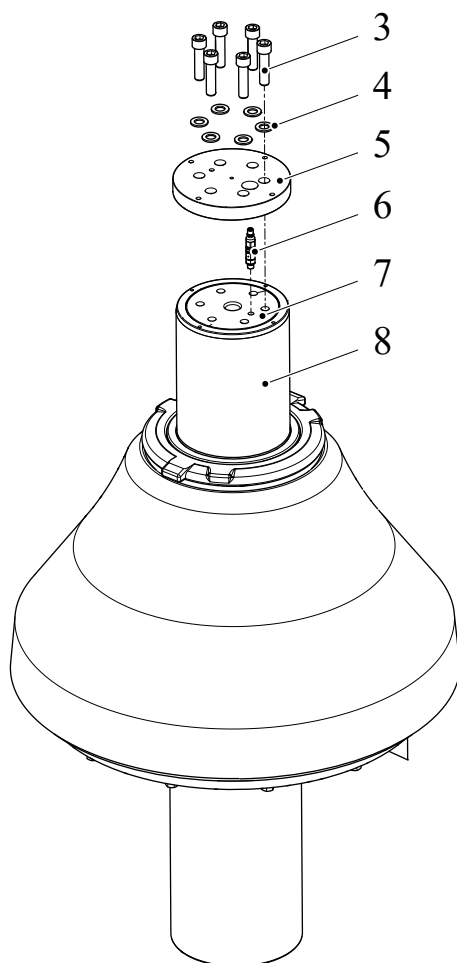
10 Hydraulic hose

11 Hydraulic oil pump

11. Remove the screws (3), the washers (4) and the cover (5) from the top of the main shaft (7) and the main shaft sleeve (8).

Maintenance Instructions

12. Remove the nipple (6) from the threaded hole on top of the main shaft (7).



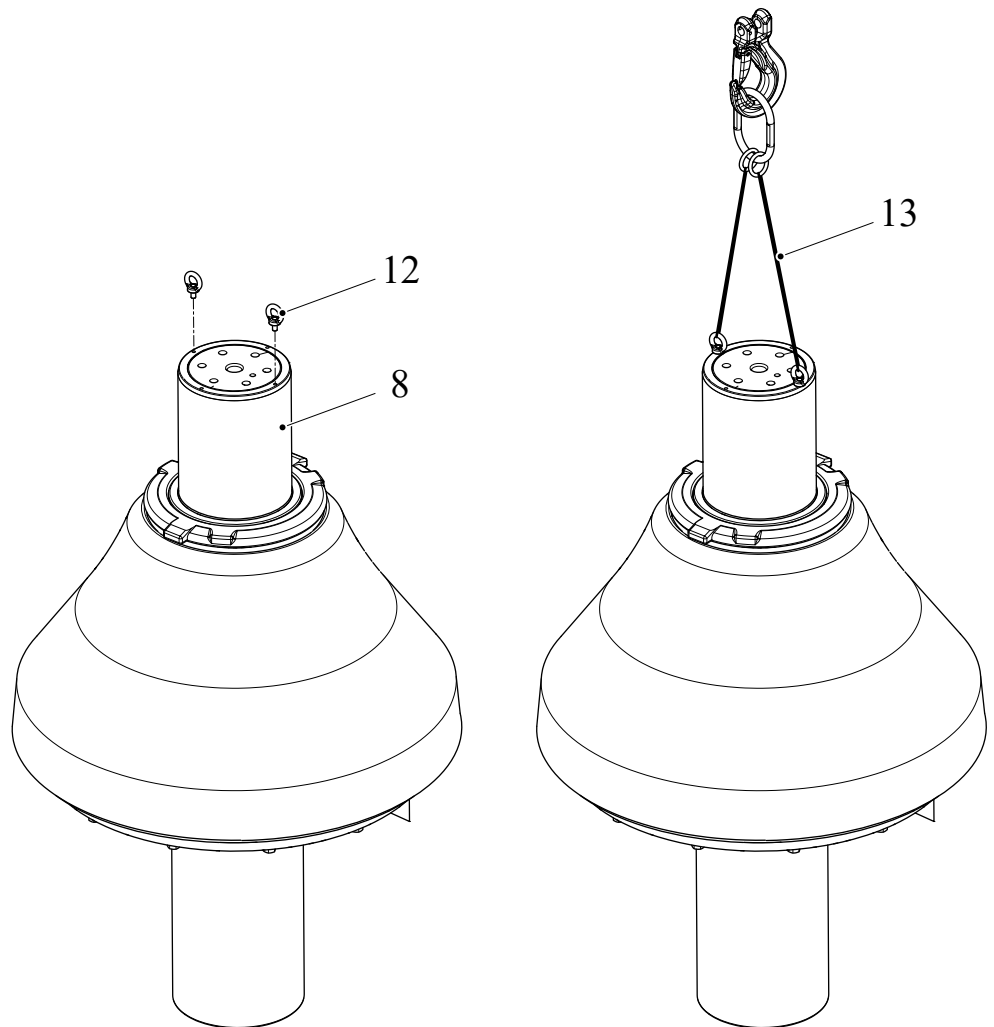
3 Screw
4 Washer
5 Cover

6 Nipple
7 Main shaft
8 Main shaft sleeve

13. Attach lifting eye bolts (12) to the threaded holes on the main shaft sleeve (8).

Maintenance Instructions

14. Arrange the lifting equipment (13).



- 8 Main shaft sleeve
- 12 Lifting eye bolt
- 13 Lifting equipment

WARNING

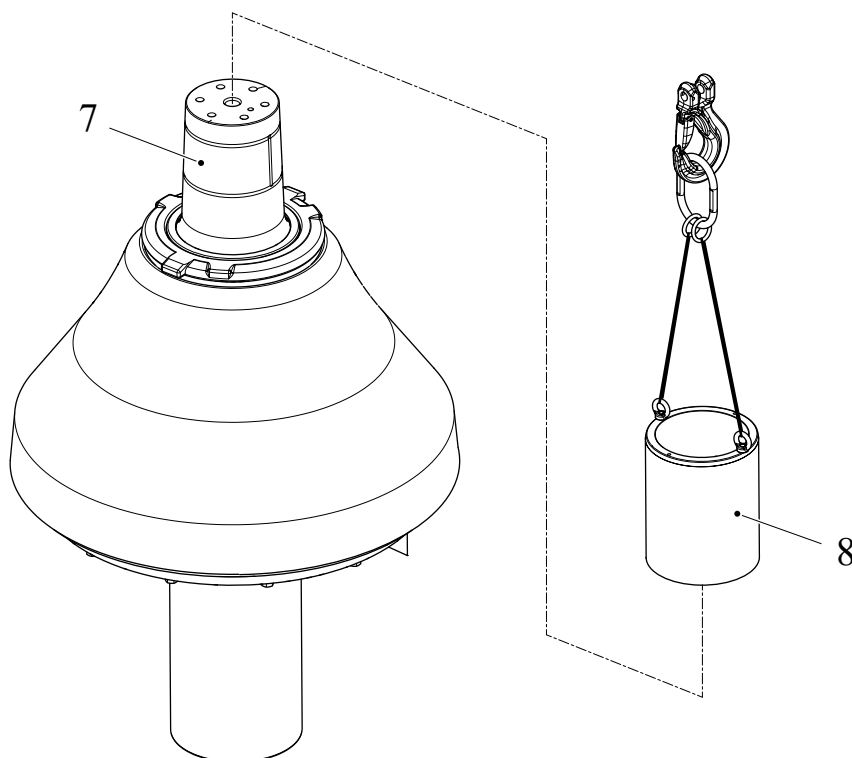


SUSPENDED LOAD HAZARD

A main shaft sleeve weighs up to 36 kg (80 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

15. Lift off the main shaft sleeve (8) from the main shaft (7).



7 Main shaft

8 Main shaft sleeve

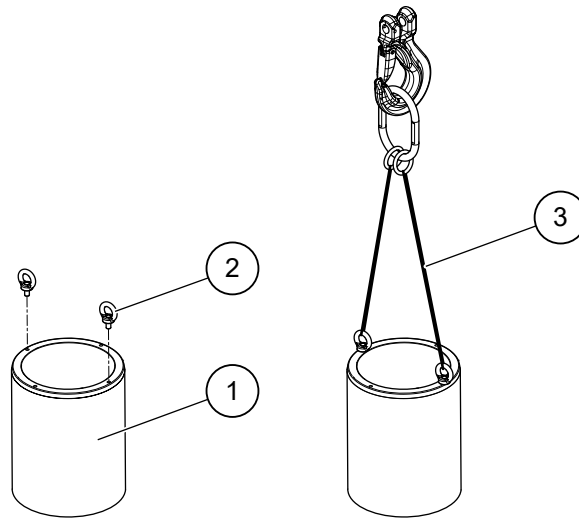
3.3.4.3

Installing the main shaft sleeve

1. Make sure that all surfaces are clean and smooth.
2. Attach lifting eye bolts (2) to the threaded holes on the rim of the main shaft sleeve (1).

Maintenance Instructions

3. Arrange the lifting equipment (3).



- 1 Main shaft sleeve
- 2 Lifting eye bolt
- 3 Lifting equipment

WARNING

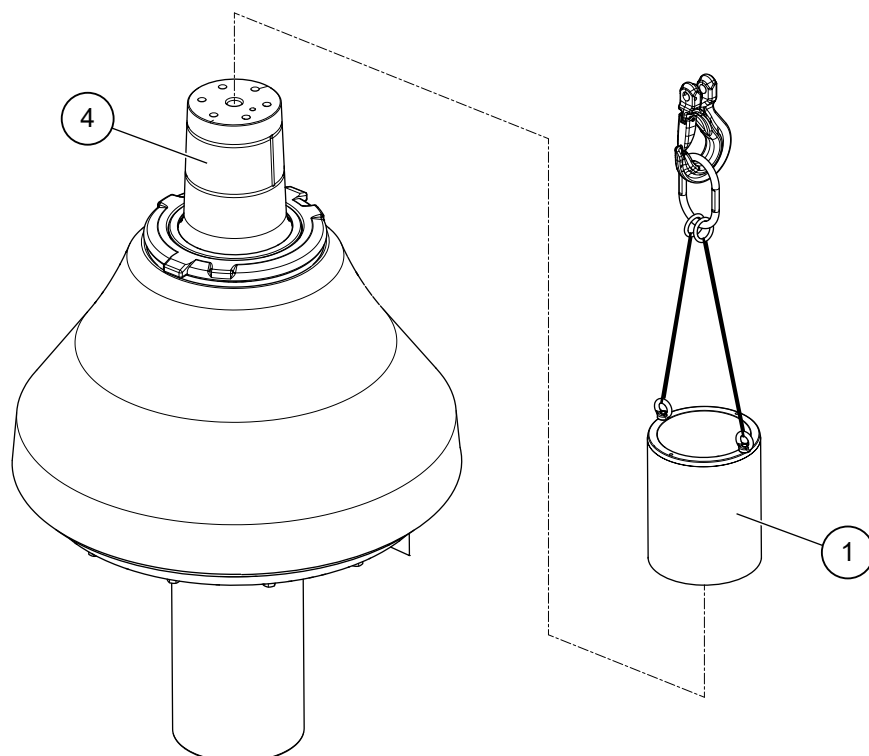


SUSPENDED LOAD HAZARD

A main shaft sleeve weighs up to 36 kg (80 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

4. Lift the main shaft sleeve (1) and lower it onto the main shaft (5).



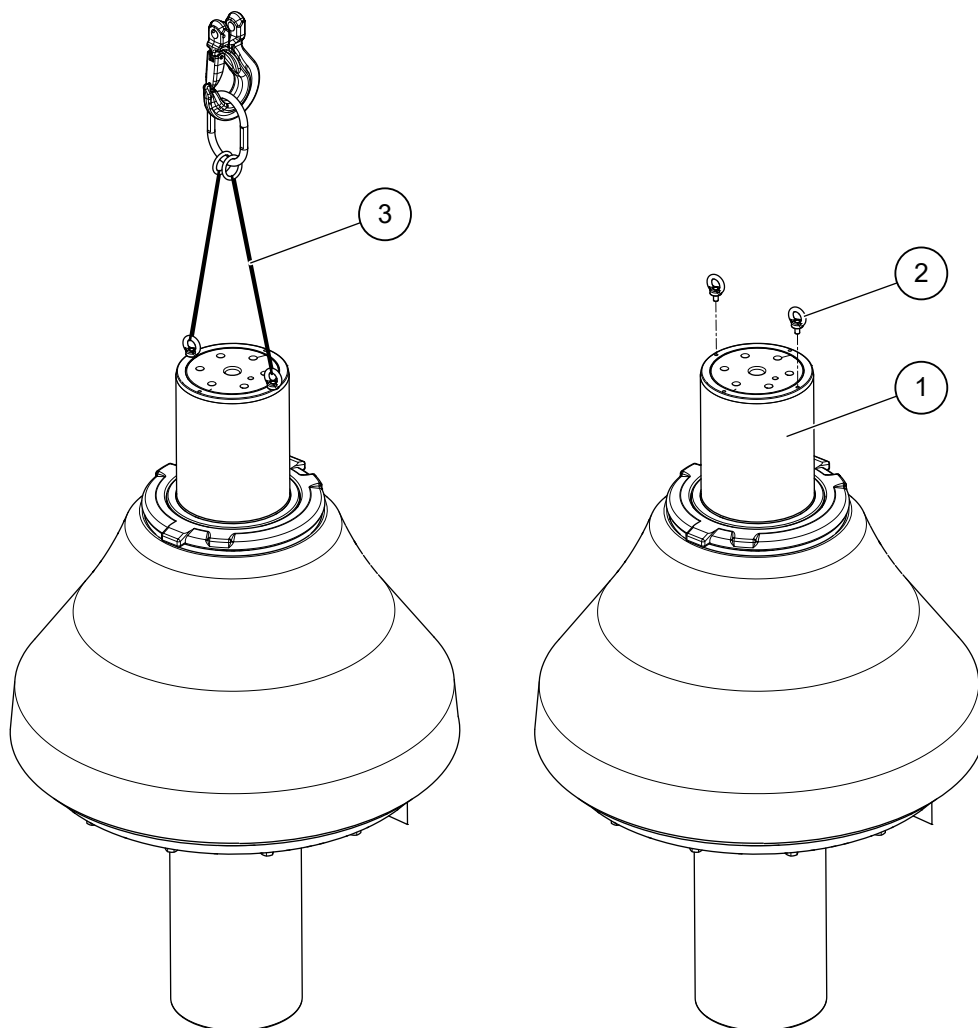
1 Main shaft sleeve

4 Main shaft

5. Remove the lifting equipment (3).

Maintenance Instructions

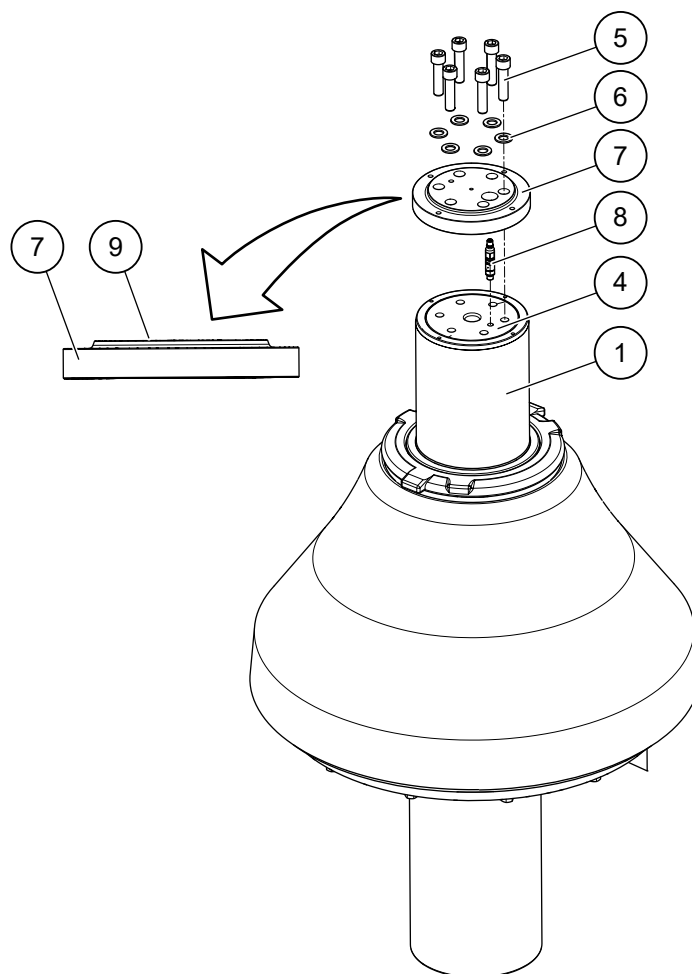
6. Remove the lifting eye bolts (2) from the main shaft sleeve (1).



- 1 Main shaft sleeve
- 2 Lifting eye bolt
- 3 Lifting equipment

7. Attach the nipple (8) to the threaded hole on top of the main shaft (4).
8. Turn the cover (7) so that the protrusion (9) points upward.
9. Place the cover (7) on top of the main shaft sleeve (1), so that the nipple (8) passes through the widest hole of the cover (7).
10. Lubricate the screws (5) with oil.
11. Attach the cover (7) to the main shaft (4) with the screws (5) and the washers (6).

12. Tighten the screws (5) using a torque wrench.



1 Main shaft sleeve

4 Main shaft

5 Screw

6 Washer

7 Cover

8 Nipple

9 Protrusion

13. Connect the hose (10) to the nipple (8).

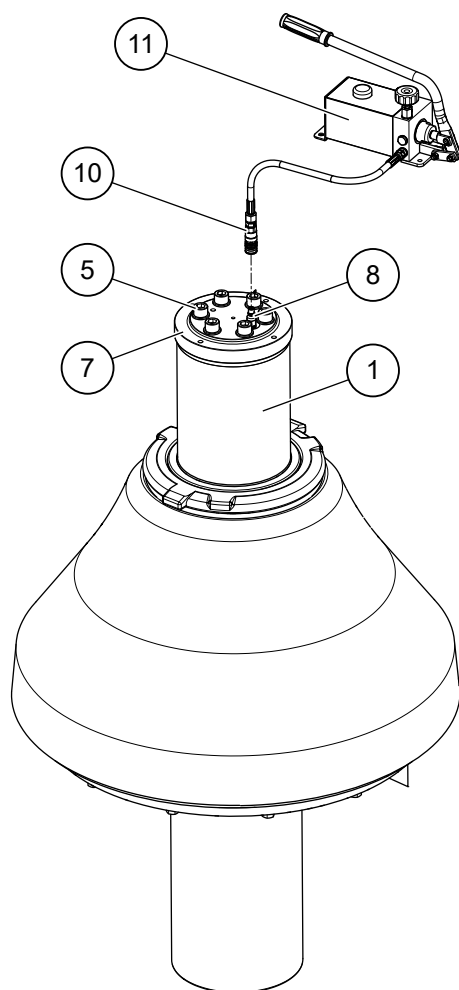
14. Pump oil through the hose (10) with the oil pump (11). Pump until the oil grooves are filled.

15. Pump up the oil pressure with the oil pump (11) and jack down the main shaft sleeve (1) with the cover (7) by tightening the screws (5) in a circular motion. Torque all screws (5) up to 649 Nm (479 ft lbs).

16. Wipe off superfluous oil with a cloth.

Maintenance Instructions

17. Release the oil pressure at the pump (11).



1 Main shaft sleeve

5 Screw

7 Cover

8 Nipple

10 Hydraulic hose

11 Hydraulic pump

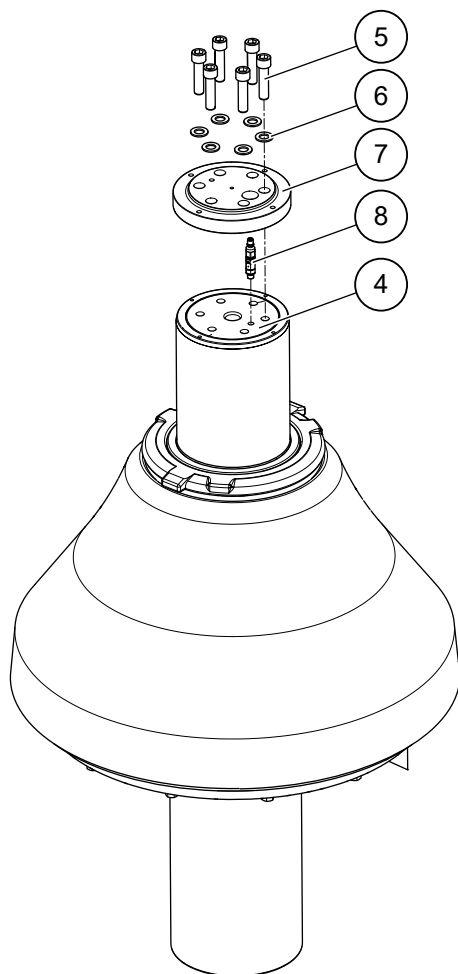
18. Use a feeler gauge in the gap (12) to check that the bottom end of the main shaft sleeve (1) does not bear against the main shaft (4).

19. Contact Sandvik if the main shaft sleeve (1) bears against the main shaft (4).

20. Remove the screws (5), the washers (6) and the cover (7).

Maintenance Instructions

21. Remove the nipple (8) from the threaded hole on top of the main shaft (4).



4 Main shaft

5 Screw

6 Washer

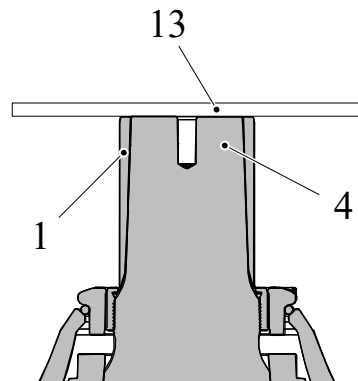
7 Cover

8 Nipple

22. Wipe off superfluous oil with a cloth.

Maintenance Instructions

23. Use a steel ruler (13) to make sure that the top surface of the main shaft sleeve (1) is aligned with the top surface of the main shaft (4).

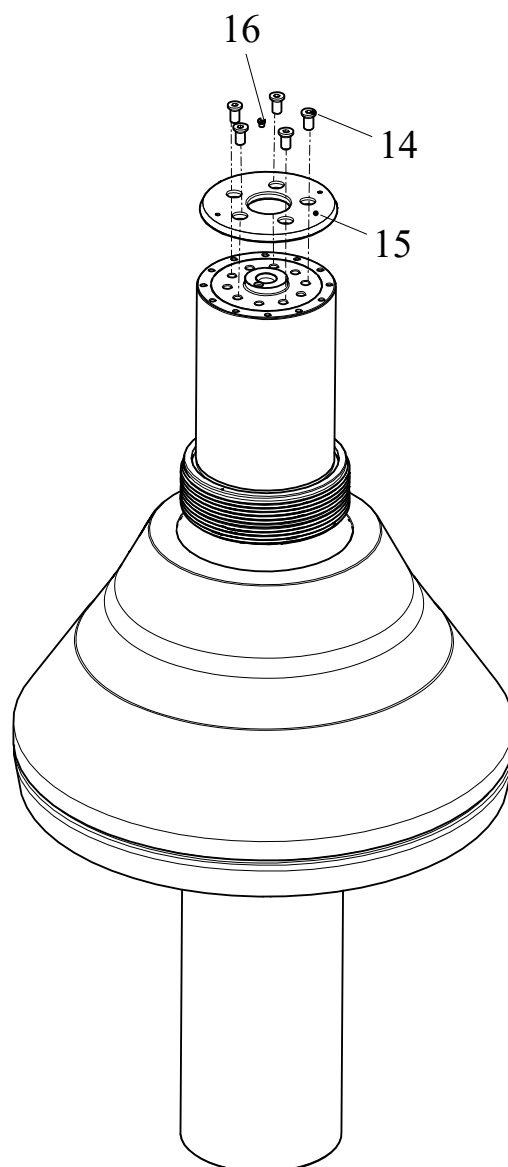


- 1 Main shaft sleeve
- 4 Main shaft
- 13 Steel ruler

24. If necessary, repeat steps [3.3.4.3.7 \(Page 91\)](#) to [3.3.4.3.18 \(Page 93\)](#).

Maintenance Instructions

25. Install the mainshaft cover (15). Apply Loctite 222, or an equivalent, to the screws (14).

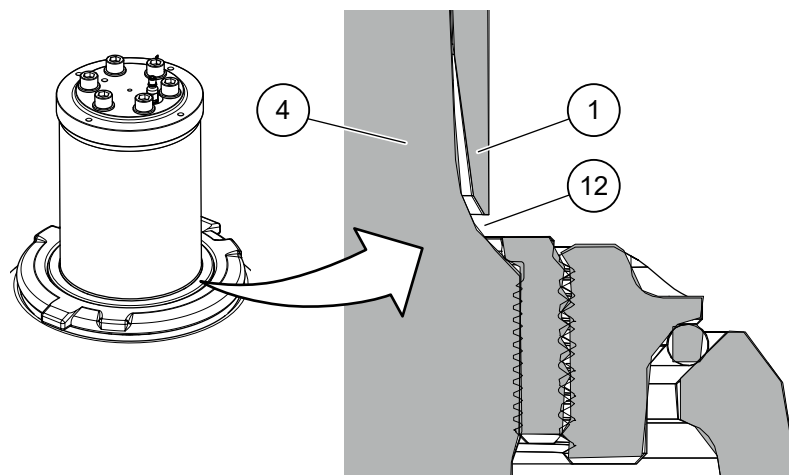


14 Screw

15 Mainshaft cover

26. Install and tighten the screws (14) in a circular sequence, gradually increasing the torque to 220 Nm (162 ft lb).

27. Seal the gap (12) with silicon.



- 1 Mainshaft sleeve
- 4 Mainshaft
- 12 Gap

3.3.5

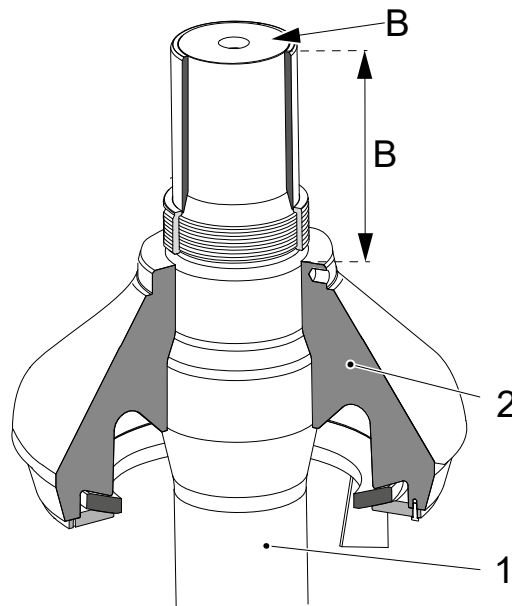
Inspecting the head center

Note!

Before making repairs on the head center, consult Sandvik.

The head center (2) is installed with a shrink fit on the main shaft (1) at the factory. To confirm that the shrink fit is still sound, check the position of the head center by measuring from the top of the head center to the top of the main shaft. See dimension "B" in the figure below. The measured dimension "B" must correspond to the larger value that is stamped on the top end of the main shaft.

Also, check the fit at the larger end of the head center and main shaft. No play is permitted. If dimension "B" does not correspond to the stamped value, or if there are other signs that the head center has come loose, consult Sandvik.



1 Main shaft
2 Head center

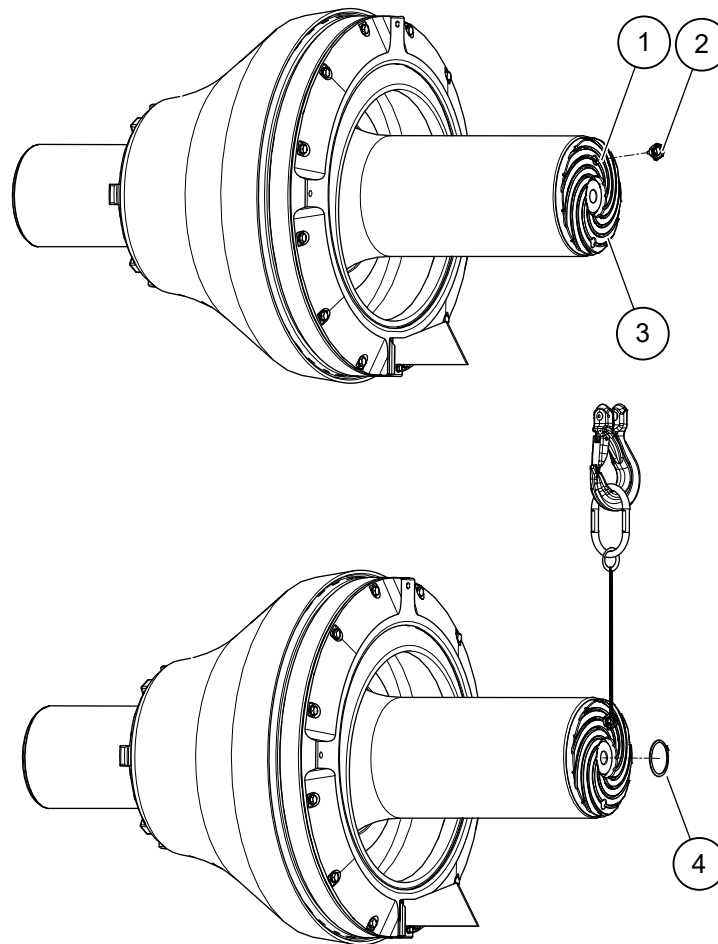
3.3.6 Replacing the main shaft step

3.3.6.1 *Removing the main shaft step*

1. Put the main shaft on stands so that it rests horizontally.
2. Attach the lifting eye bolt (2) to the threaded hole (1) on the main shaft step (3).
3. Arrange the lifting equipment.

Maintenance Instructions

4. Remove the retaining ring (4).



- 1 Threaded hole
- 2 Lifting eye bolt
- 3 Main shaft step
- 4 Retaining ring

WARNING

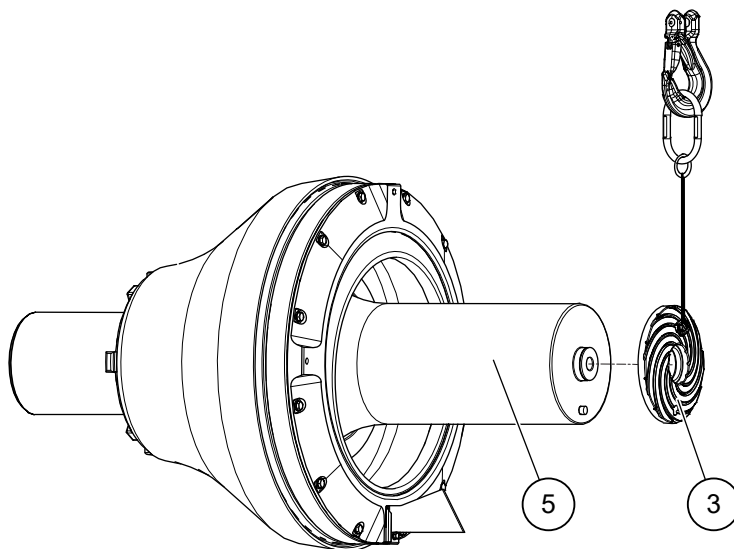


SUSPENDED LOAD HAZARD

A main shaft step bearing weighs up to 23 kg (51 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

5. Remove the main shaft step (3) from the main shaft (5).



3 Main shaft step

5 Main shaft

3.3.6.2 Inspecting the main shaft step

1. Inspect the step bearing components, see section [3.7.2.2. Inspecting the step bearing components \(Page 159\)](#).

3.3.6.3 Installing the main shaft step

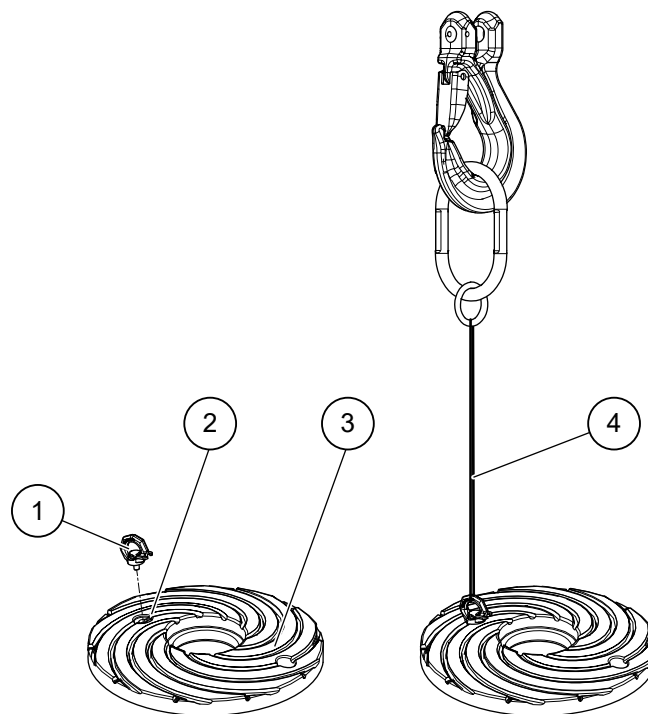
Note!

If main shaft step is changed to new, please refer to the Running-in schedule in the Technical Specifications.

1. Attach the lifting eye bolt (1) to the threaded hole (2) on the main shaft step (3).

Maintenance Instructions

2. Arrange the lifting equipment (4).



- 1 Lifting eye bolt
- 2 Threaded hole
- 3 Main shaft step
- 4 Lifting equipment

WARNING



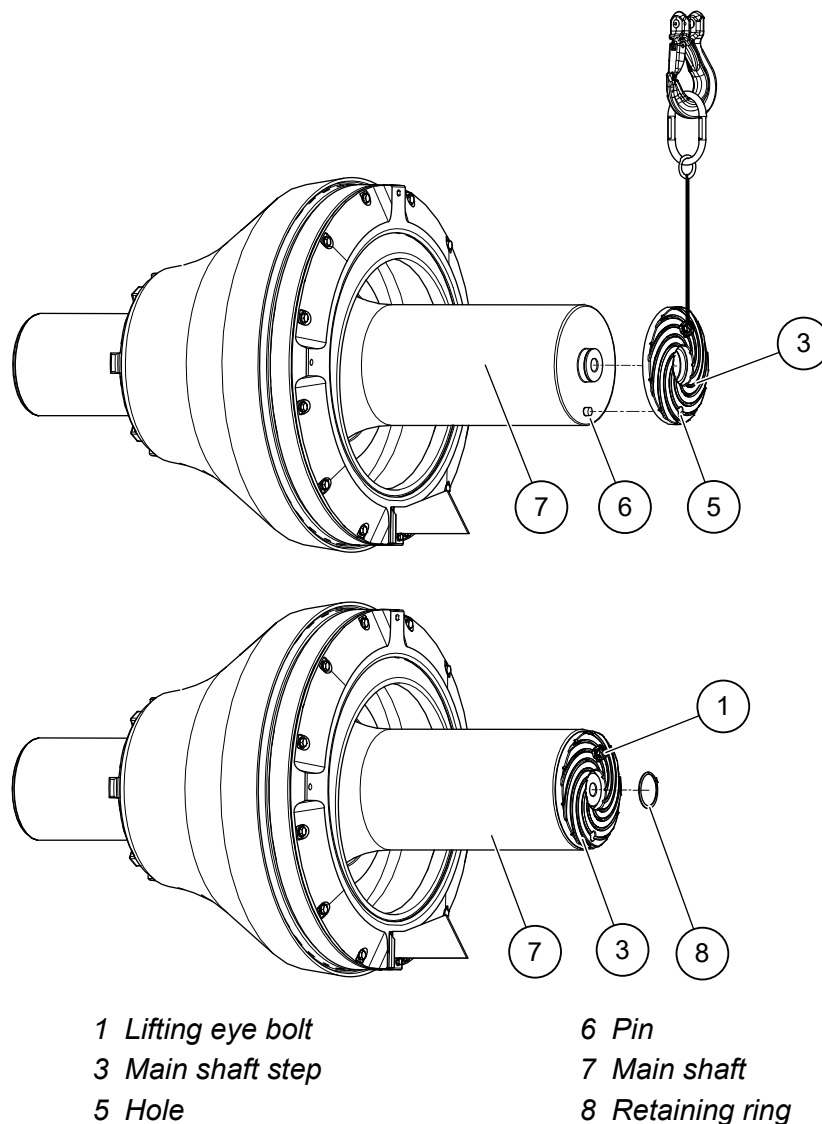
SUSPENDED LOAD HAZARD

A main shaft step bearing weighs up to 23 kg (51 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

3. Lift the main shaft step (3) carefully to a vertical position.
4. Align the hole (5) on the main shaft step (3) with the pin (6) at the bottom of the main shaft (7).
5. Secure the main shaft step (3) to the main shaft (7) with the retaining ring (8).

6. Remove the lifting equipment and the lifting eye bolt (1).



3.3.7

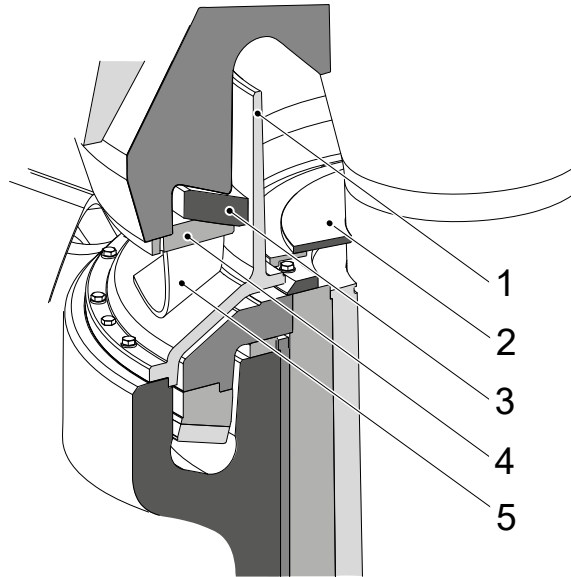
Replacing the dust seal ring

The dust seal consists of the dust seal ring (3) and a retaining ring (4).

The dust seal ring (3), which is supported below the head center, has a sliding fit on the dust collar (1). It is the most important seal for the crusher's oil system.

The retaining ring (4) is secured to the head center with screws.

The crusher also has an inner dust seal ring (2), see section [3.3.1.Replacing the main shaft and the mantle \(Page 62\)](#).



1 Dust collar

2 Inner dust seal ring

3 Dust seal ring

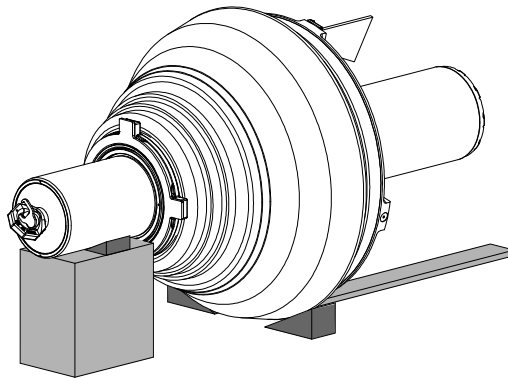
4 Retaining ring

5 Scraper

3.3.7.1

Removing the dust seal ring

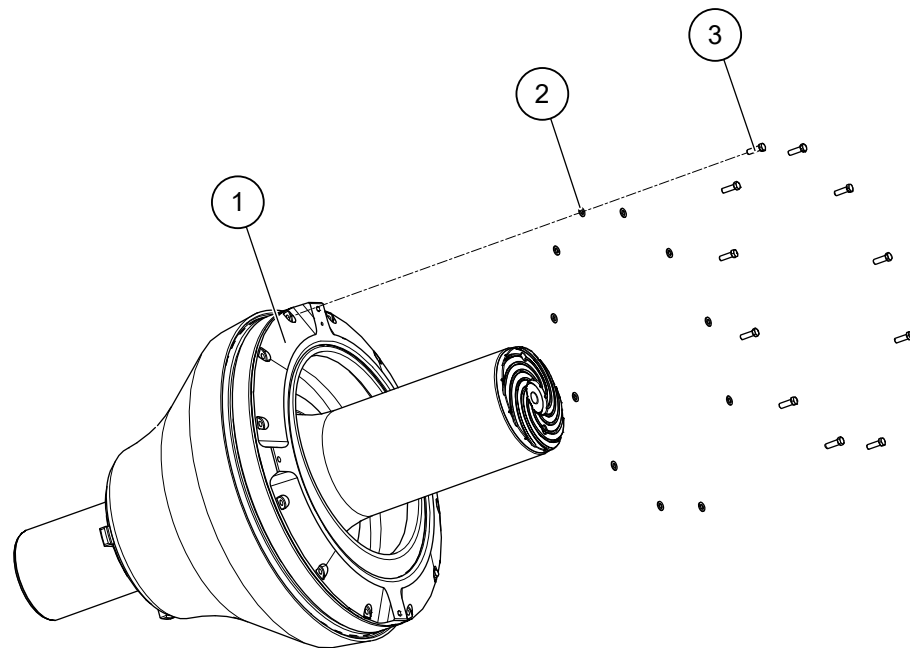
1. Remove the main shaft, see section [3.3.1.1.Removing the main shaft assembly \(Page 63\)](#).
2. Place the main shaft on suitable supports (planks or similar) on its side, so that the retaining ring is accessible. Chock up with the wooden wedges so that the main shaft assembly cannot roll.



3. Protect the bearing surfaces on the main shaft and main shaft step.
4. Remove the scraper, see section [3.3.8.2.Removing and installing the scraper \(Page 112\)](#).

Maintenance Instructions

5. Remove the screws (3) and the washers (2) from the retaining ring (1).



1 Retaining ring

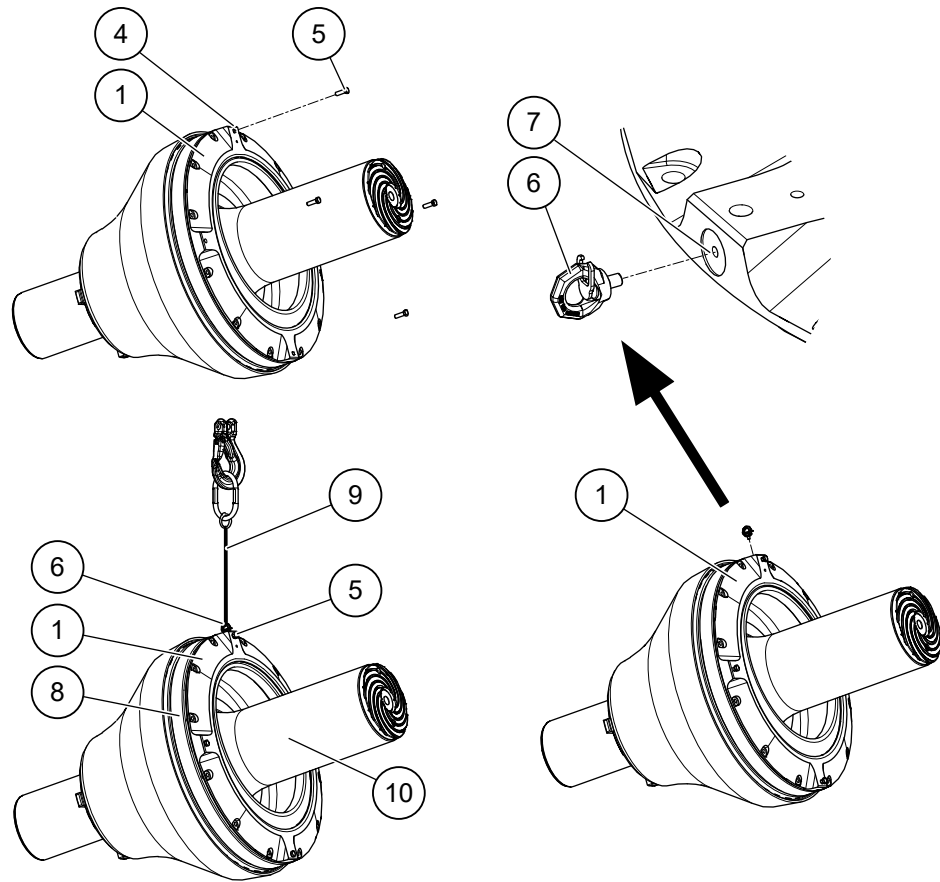
2 Washer

3 Screw

6. Attach the M12x70 screws (5) into the threaded jacking holes (4) in the retaining ring (1).
7. Attach the lifting eye bolt (6) to the threaded hole (7) on the retaining ring (1).
8. Take up the slack in the lifting equipment (9) in order to prevent the retaining ring (1) from falling and damaging the main shaft (10).

Maintenance Instructions

9. Tighten the screws (5) to press off the retaining ring (1) from the head center (8).



- 1 Retaining ring
4 Threaded hole
5 Screw M12x70
6 Lifting eye bolt

- 7 Threaded hole
8 Head center
9 Lifting equipment
10 Main shaft

WARNING



SUSPENDED LOAD HAZARD

A retaining ring for the dust seal ring weighs up to 69 kg (153 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

WARNING

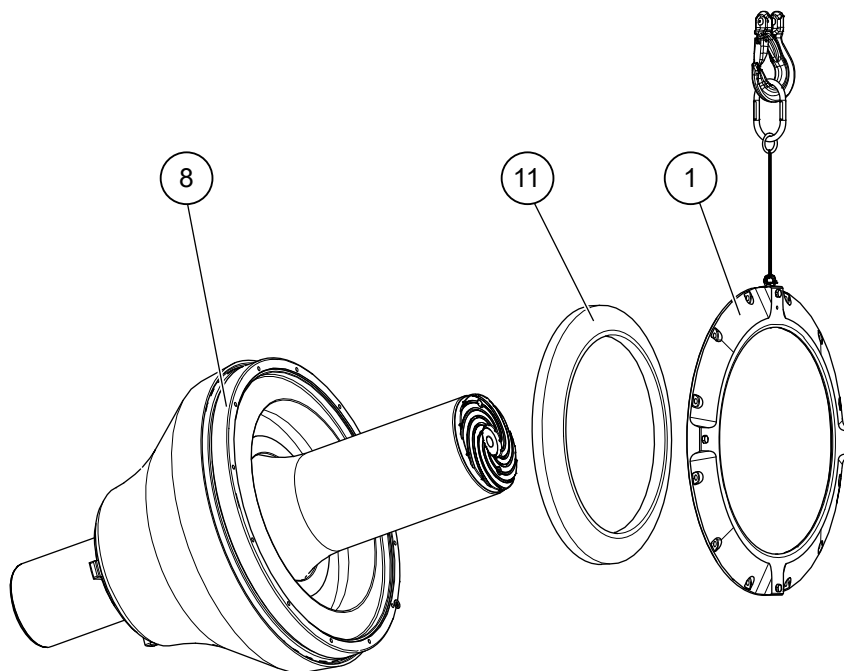


SUSPENDED LOAD HAZARD

A dust seal ring weighs up to 15 kg (33 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

10. Remove the retaining ring (1) and the dust seal ring (11) from the head center (8).

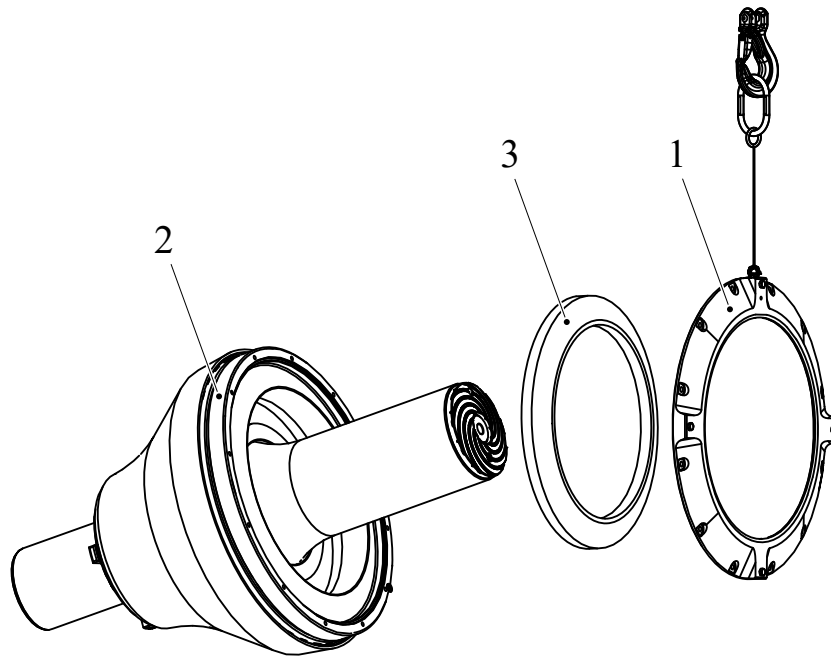


- 1 Retaining ring
- 8 Head center
- 11 Dust seal ring

3.3.7.2

Checking the dust seal ring

1. Check the machined surfaces on the retaining ring (1) for damage and rust. Remove scratches and rust by polishing.
2. Check the fit between the retaining ring (1) and the head center (2). No movement is permissible between these two components.
3. Make sure that the dust seal ring (3) moves easily on the dust collar under its own weight. If it does not, the hole in the dust seal ring (3) can be deformed. Adjust the dust seal ring (3) so that it can easily be moved up and down on the dust collar.
4. Measure the play between the dust seal ring (3) and the dust collar. The play must not exceed 1.5 mm (0.059").



- 1 Retaining ring
2 Head center
3 Dust seal ring

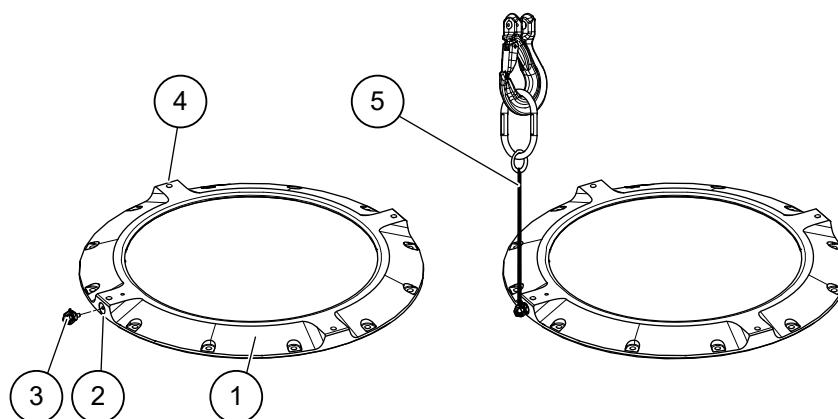
3.3.7.3

Installing the dust seal ring

1. If the same retaining ring (1) is to be re-used, make sure that the jacking screws are removed from the threaded holes (4).
2. Attach the lifting eye bolt (3) to the threaded hole (2) on the retaining ring (1).

Maintenance Instructions

3. Arrange the lifting equipment (5).



1 Retaining ring
2 Threaded hole
3 Lifting eye bolt

4 Threaded hole
5 Lifting equipment

WARNING



SUSPENDED LOAD HAZARD

A dust seal ring weighs up to 15 kg (33 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

4. Lift the dust seal ring (7) into place in the recess at the bottom of the head center (6).

WARNING

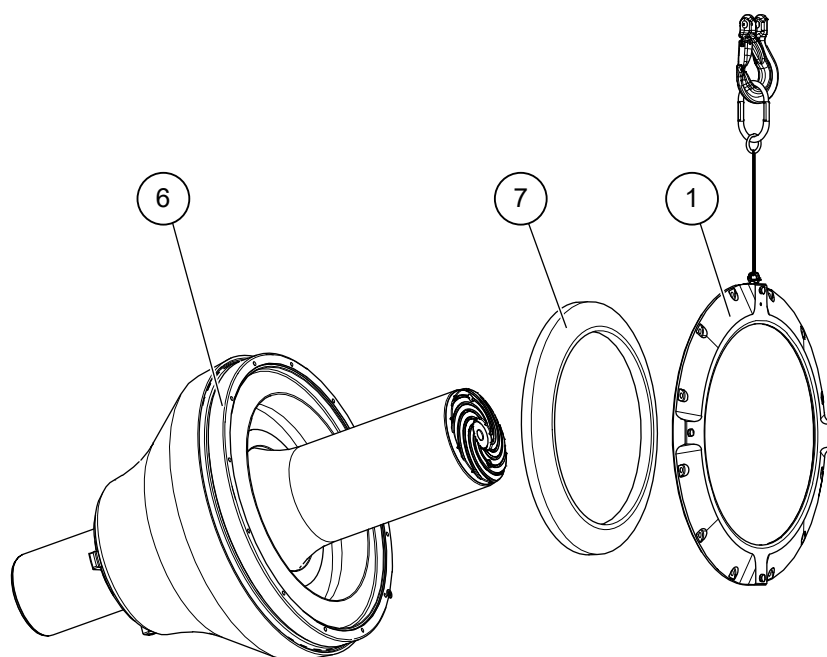


SUSPENDED LOAD HAZARD

A retaining ring for the dust seal ring weighs up to 69 kg (153 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

5. Lift the retaining ring (1) and position it at the head center (6).



1 Retaining ring

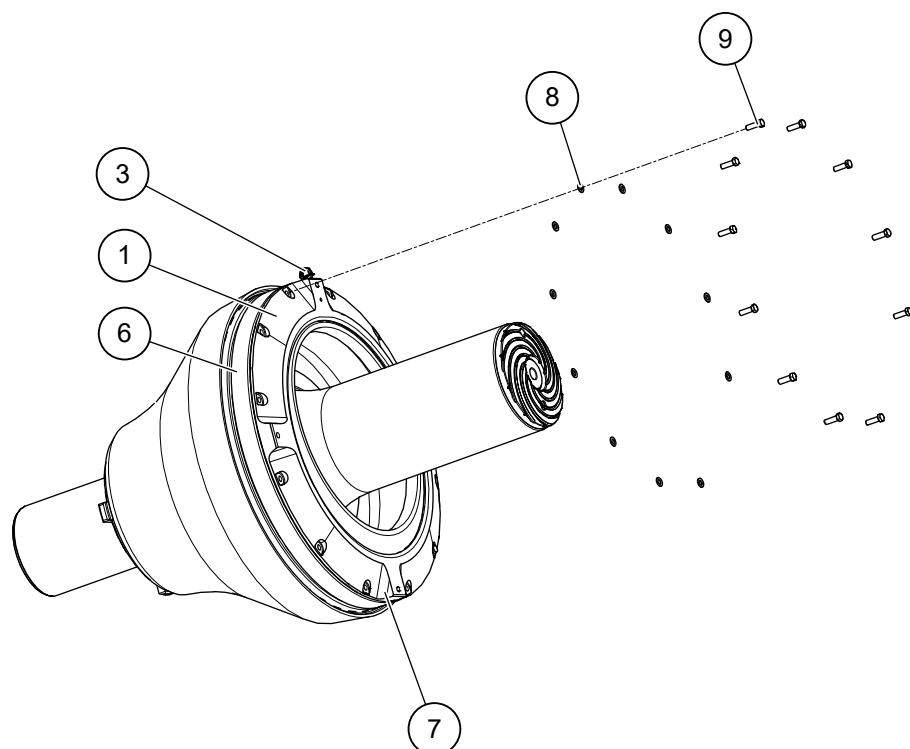
6 Head center

7 Dust seal ring

6. Attach the retaining ring (1) to the head center (6) with the washers (8) and the screws (9).
7. Remove the lifting equipment and the lifting eye bolt (3).
8. Torque the screws (9) to 169 Nm(125 ft lb).
9. Make sure that the dust seal ring (7) can move freely between the head center (6) and the retaining ring (1).

Maintenance Instructions

10. Make sure that there is no movement between the retaining ring (1) and the head center (6).



1 Retaining ring
3 Lifting eye bolt
6 Head center

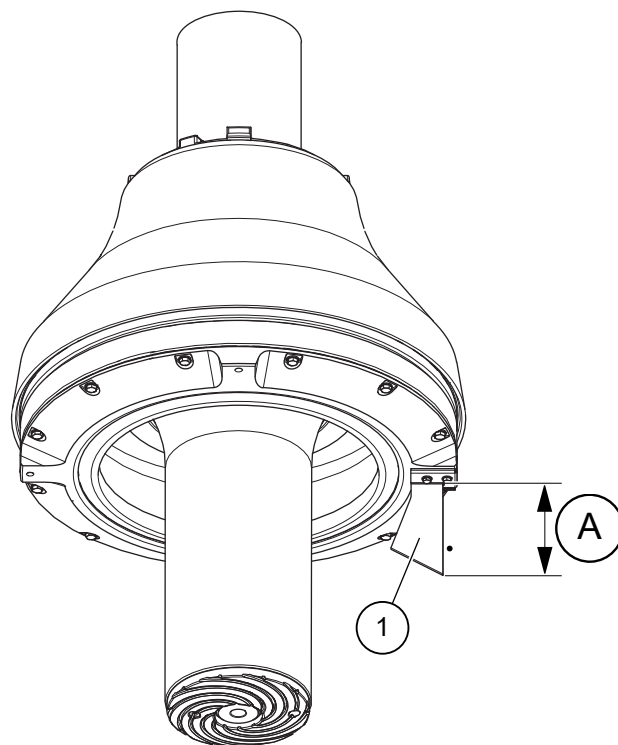
7 Dust seal ring
8 Washer
9 Screw

Maintenance Instructions

3.3.8 Replacing the scraper

3.3.8.1 Checking the scraper

1. Check the scraper for wear and damage. Use the inspection holes in the bottom shell. If necessary, remove the scraper.
2. Measure the length (A) of the hanging scraper. If the length of the hanging scraper is less than 130 mm (5.1 in), replace it according to section [3.3.8.2.Removing and installing the scraper \(Page 112\)](#).



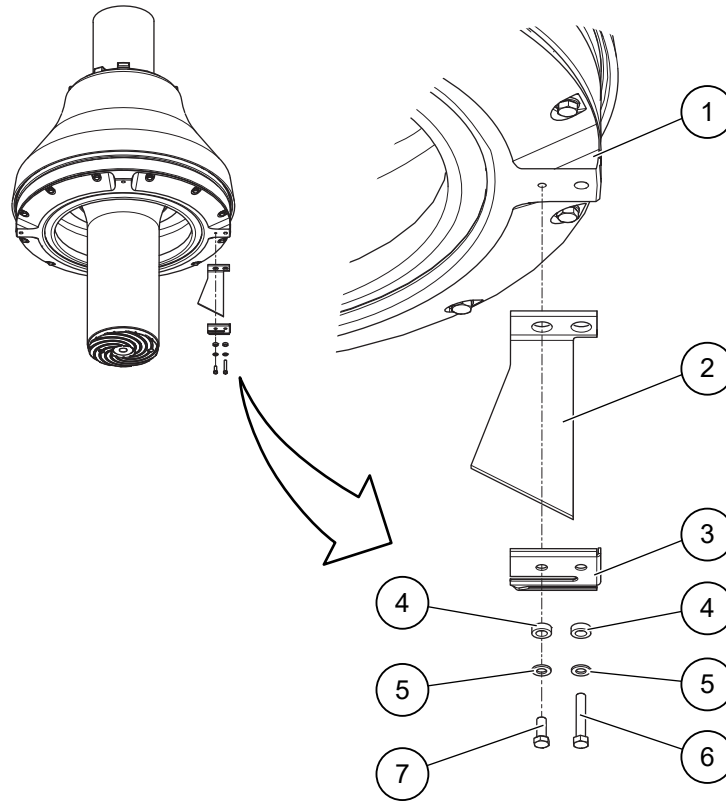
1 Scraper

Maintenance Instructions

3.3.8.2

Removing and installing the scraper

1. Remove the screws (6) and (7), the washers (5), the spacers (4), the retaining plate (3) and the scraper (2) from the retaining ring (1).
2. Replace the scraper and assemble in the reverse order.
3. Torque the screws (6) and (7) to 70 Nm (52 ft lb).



1 Retaining ring
2 Scraper
3 Retaining plate
4 Spacer

5 Washer
6 Screw
7 Screw

3.4

Dust collar

3.4.1

Replacing the dust collar

Note!

Remove the dust collar only if the eccentric assembly is to be removed.

3.4.1.1

Removing the dust collar

Note!

Be careful when the dust collar is removed, so that you do not damage the underlying gasket.

1. Remove the screws (1) and the washers (2) from the dust collar (3).
2. Use the full-length threaded screws (4) to press the dust collar off the bottomshell. Remove the screws.

Maintenance Instructions

3. Install the lifting eye bolts (7), distributed evenly in the threaded holes.
4. Attach the lifting slings to the lifting eye bolts (7). Use four slings (8).
5. Arrange the lifting equipment.

WARNING

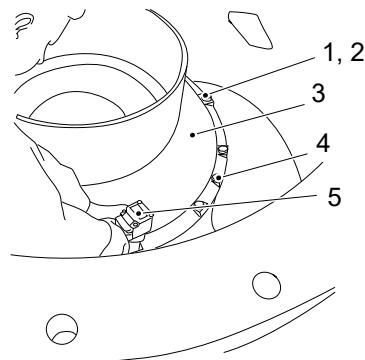


SUSPENDED LOAD HAZARD

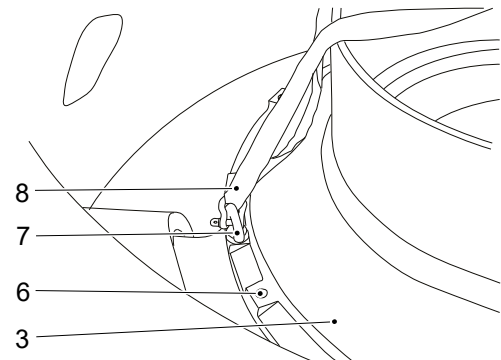
A dust collar weighs up to 200 kg (441 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

6. Carefully lift the dust collar (3) from the bottomshell.



- 1 Screw
- 2 Washer
- 3 Dust collar
- 4 Screw



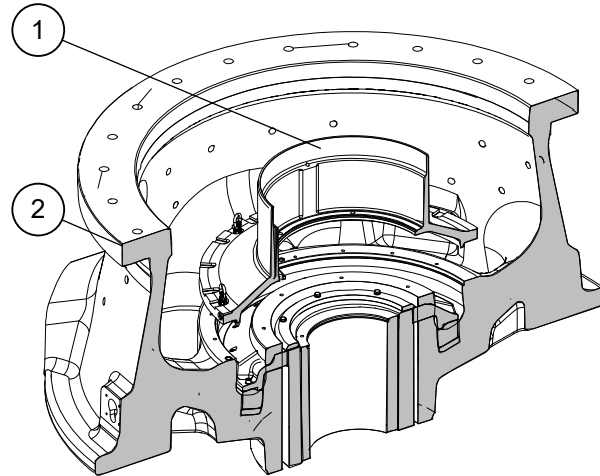
- 5 Hydraulic wrench
- 6 Hole
- 7 Lifting eye bolts
- 8 Lifting sling

7. Clean out the remains of the gasket on the mating surfaces of the dust collar and of the bottomshell.
8. Remove the O-ring. Check the O-ring condition.

3.4.1.2

Inspecting the dust collar

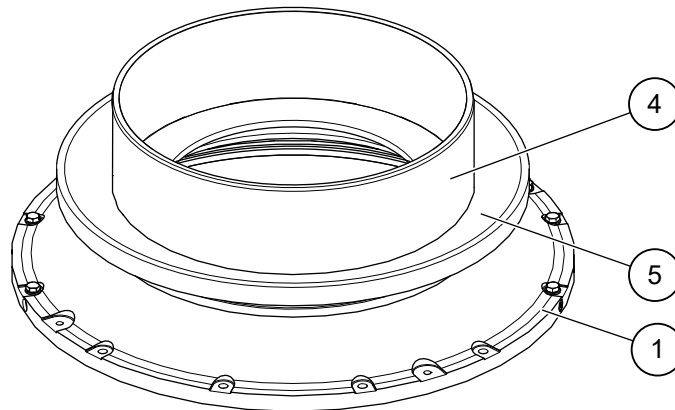
1. Before inspection, make sure to prevent dust from entering the crusher.
2. Inspect the fit of the dust collar (1) against the bottom shell (2). If the dust collar (1) has come loose and the fit against the bottom shell (2) has been lost, consult Sandvik.



1 Dust collar

2 Bottom shell

3. Inspect the outer surface (4) of the dust collar (1). Make sure that wear or damage has not made it possible for dust to enter the crusher between the dust collar (1) and the dust seal ring (5).



1 Dust collar

4 Dust collar outer surface

5 Dust seal ring

3.4.1.3

Installing the dust collar

1. Attach the lifting slings to the lifting eye bolts (2).
2. Arrange the lifting equipment.

WARNING

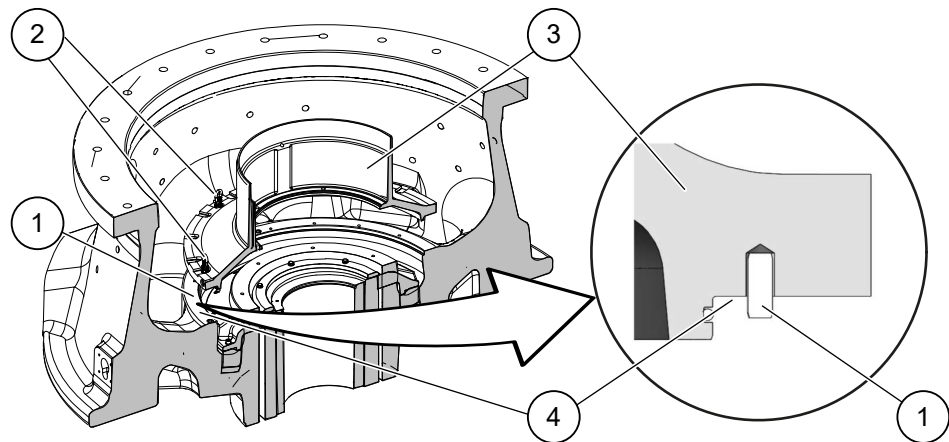


SUSPENDED LOAD HAZARD

A dust collar weighs up to 200 kg (441 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

3. Carefully lift the dust collar (3) and position it above the bottomshell.
4. Grease the gasket (4) and place it on the dust collar (3).
5. Align the holes in the gasket (4) with the corresponding holes in the dust collar (3).
6. Align the locating dowel (1) in the bottomshell with the corresponding hole in the dust collar (3).
7. Lower the dust collar (3), with the gasket (4), onto the bottomshell.
8. Remove the lifting equipment and the lifting eye bolts (2).
9. Install the screws and the washers in the dust collar.
10. Torque the screws in a diagonal sequence in several stages until the specified torque is reached, refer to *Tightening torques* in *Technical Specifications*.



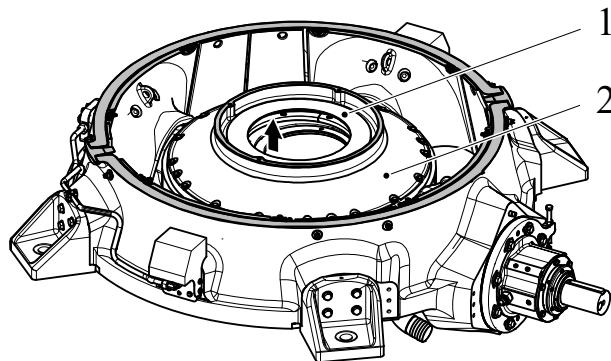
- 1 Locating dowel
- 2 Lifting eye bolt
- 3 Dust collar
- 4 Gasket

Maintenance Instructions

3.4.2 Replacing the seating ring

3.4.2.1 *Removing the seating ring*

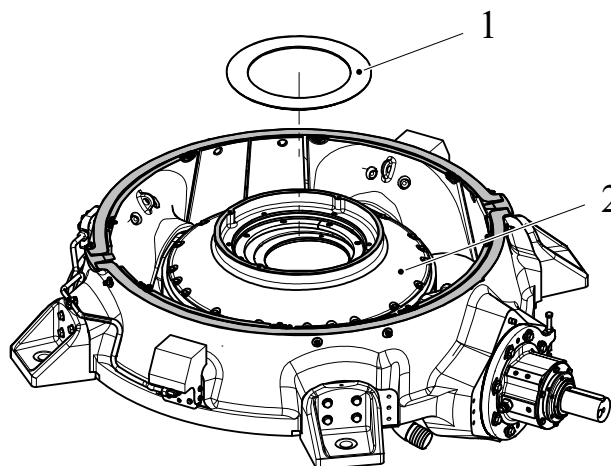
1. Gently tap the seating ring (1) from below to release it from its seating in the dust collar (2).



1 Seating ring

2 Dust collar

2. Lift out the seating ring (1) from the dust collar (2).



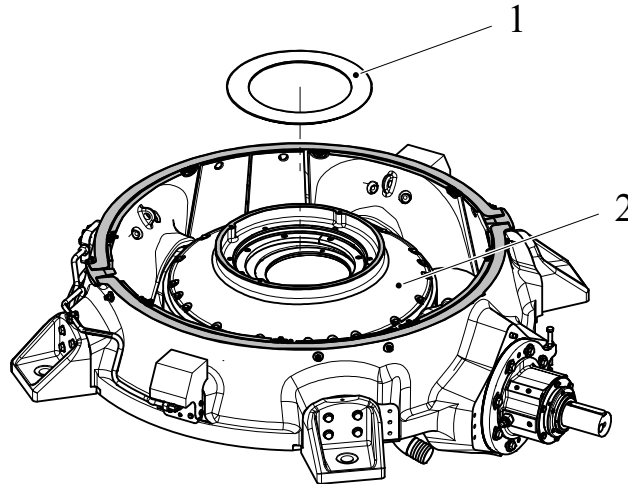
1 Seating ring

2 Dust collar

3.4.2.2

Installing the seating ring

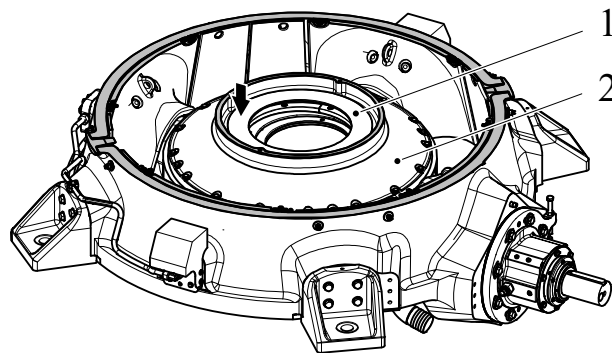
1. Lower the seating ring (1) into its seating in the dust collar (2).



1 Seating ring

2 Dust collar

2. Gently tap the seating ring (1) into place from above.



1 Seating ring

2 Dust collar

3.4.3

Replacing the locating bar

3.4.3.1

Checking the locating bar clearance

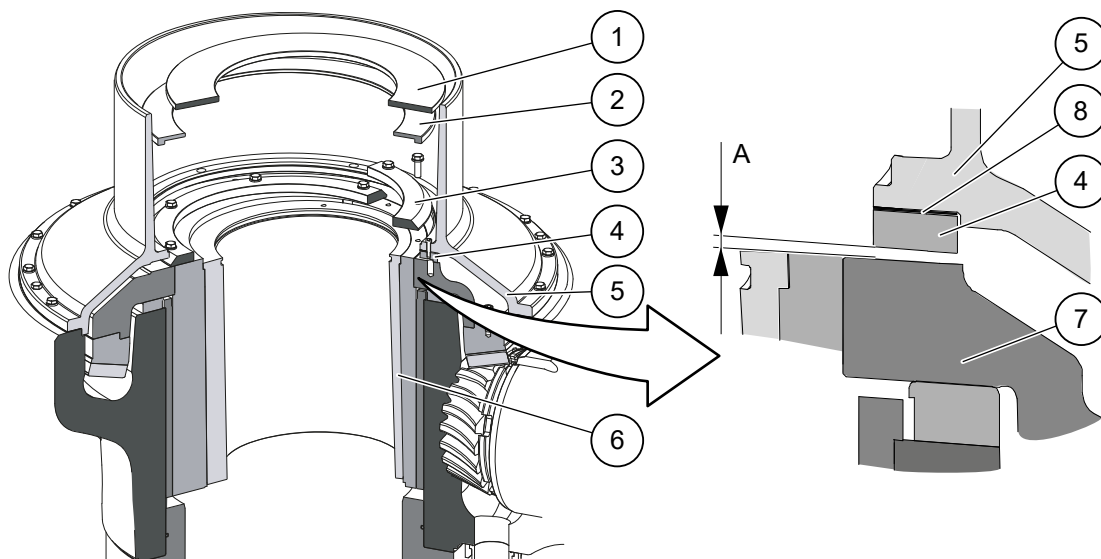
Note!

If the gear backlash is adjusted, the locating bar clearance must be checked.

1. Remove the inner dust seal ring (1), the seating ring (2) and the bushing retaining ring (3).
2. Measure the clearance "A" between the locating bar (4) and the hub (7) with a feeler gauge.
 - The clearance "A" is normally 0.2 mm (0.008").
 - The maximum permissible clearance is 0.4 mm (0.016").

Maintenance Instructions

3. If necessary, adjust the clearance "A" by removing or adding shims (8) between the locating bar (4) and the dust collar (5).



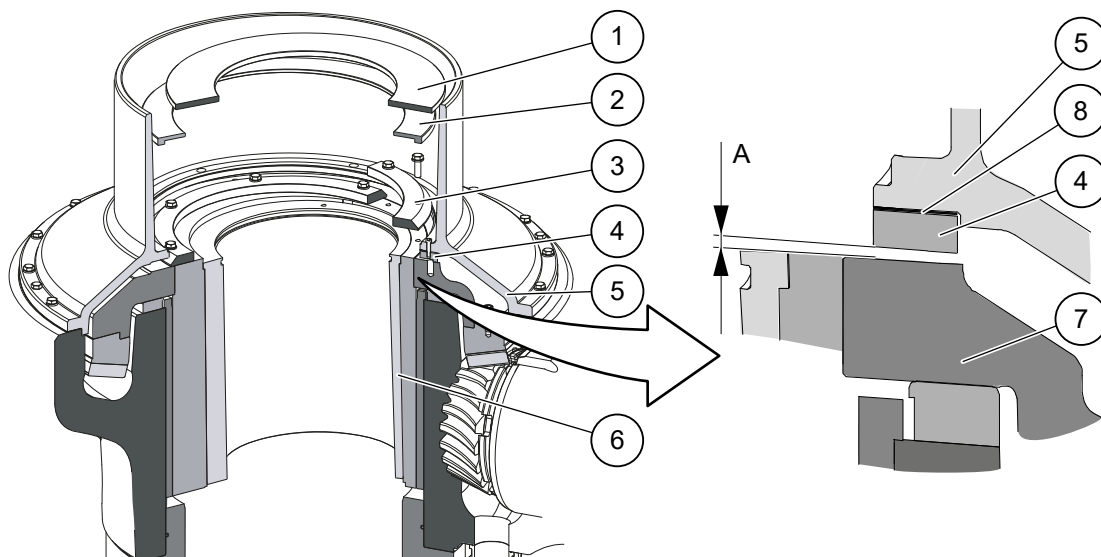
1 Inner dust seal ring
2 Seating ring
3 Bushing retaining ring
4 Locating bar

5 Dust collar
6 Eccentric bushing
7 Hub
8 Shims

3.4.3.2

Removing the locating bar

1. Remove the screws that hold the locating bar (4) to the underside of the dust collar (5).
2. Remove the locating bar (4).



1 Inner dust seal ring
2 Seating ring

5 Dust collar
6 Eccentric bushing

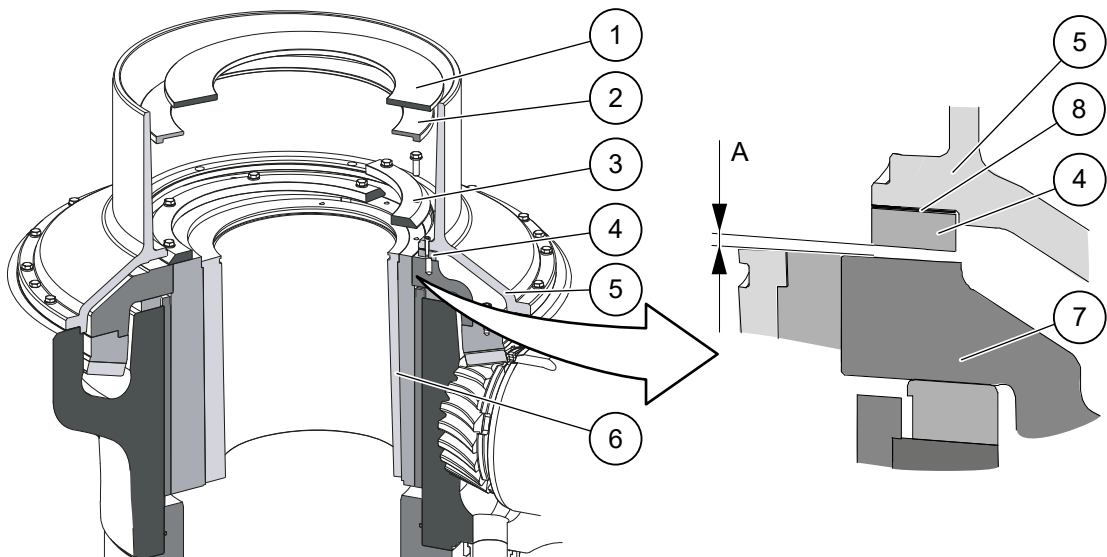
3 Bushing retaining ring
4 Locating bar

7 Hub
8 Shims

3.4.3.3

Installing the locating bar

1. Position the locating bar (4) on the underside of the dust collar (5). Make sure that the holes in the locating bar (4) are aligned with the corresponding holes in the dust collar (5) and remember to fit the shims, see section [3.4.3.1. Checking the locating bar clearance \(Page 117\)](#).
2. Apply locking fluid, Loctite 243 or similar (medium strength), to the threads.
3. Install the screws that hold the locating bar (4) to the dust collar (5).
4. Tighten the screws to 45 Nm (33 ft lbs) ± 10 %. (This torque is calculated with the strength of the threads in the locating bar (4) taken into consideration, and is independent of what grade of screw is used.) Refer to *Tightening torques in Technical specifications*.



1 Inner dust seal ring
2 Seating ring
3 Bushing retaining ring
4 Locating bar

5 Dust collar
6 Eccentric bushing
7 Hub
8 Shims

3.5

Eccentric

3.5.1

Replacing the eccentric bushing

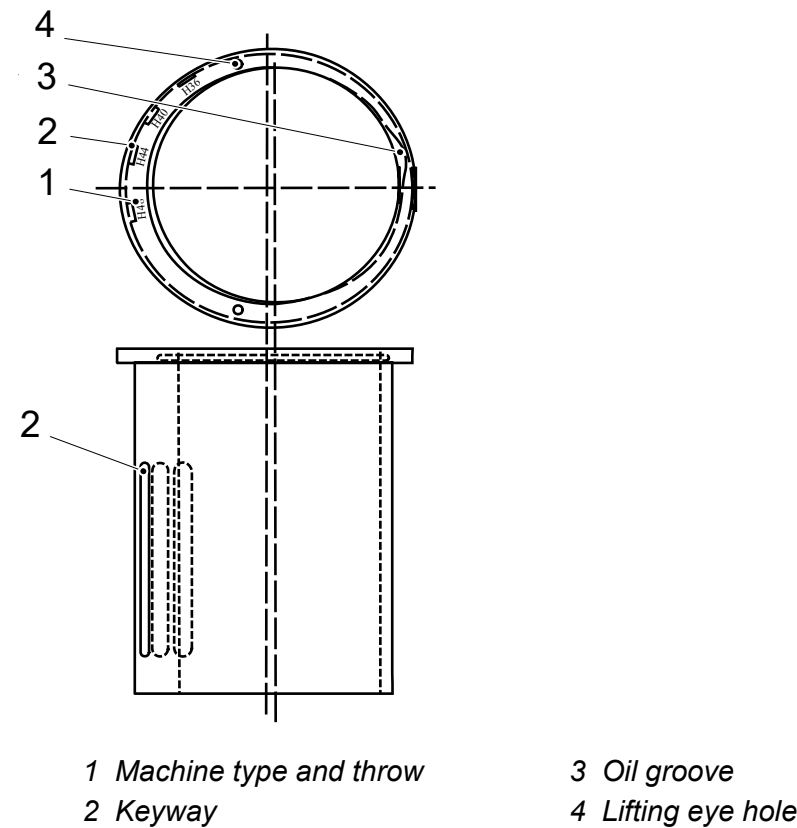
The eccentric bushing is part of the eccentric assembly and it is held in place by a retaining ring and a key. The eccentric throw of the crusher is altered by changing the eccentric bushing or by lifting up the bushing and moving the key to another keyway in the eccentric. Three different bushings are available for the crusher, each with different eccentric throws.

Note!

The throw (in mm) (1) is stamped into the top edge of the bushing near the relevant keyway (2) together with the letter H for an H-type

Maintenance Instructions

Cone crusher. An arrow stamped into the top of the eccentric in line with the keyway indicates which eccentric throw has been set (e.g. H-32).



Eccentric throw combinations	
mm	inches
13	0.51
16	0.63
20	0.79
24	0.94
24	0.94
28	1.10
32	1.26
32	1.26
36	1.42
40	1.57
44	1.73

For details of the play between the mainshaft and the eccentric bushing, see section [3.3.1.2.Checking the main shaft and the mantle \(Page 64\)](#).

If the bushing is a tight fit, the whole eccentric assembly can be removed, see section [3.5.2.1.Removing the eccentric assembly \(Page 126\)](#).

Maintenance Instructions

There are two alternative methods to remove the eccentric bushing from the cone crusher. If the first method does not work, then try the alternative method.

3.5.1.1 Removing the eccentric bushing

Note! *Before starting these procedures it is necessary to remove the mainshaft, the inner dust seal ring and the seating ring.*

If the ambient air temperature is $< 30\text{ }^{\circ}\text{C}$ ($86\text{ }^{\circ}\text{F}$), then continue as described below. If the ambient air temperature is $> 30\text{ }^{\circ}\text{C}$ ($86\text{ }^{\circ}\text{F}$), cool the bushing with a plastic bag of dry ice placed inside the bushing for 30 minutes before removal is started.

1. Remove the eccentric bushing retaining ring (1) from the top of the eccentric (3). The ring is in two parts, of which only the part locking the eccentric bushing need be removed.
2. Use the special lifting tool (5) in the tool kit which is supplied with the cone crusher to pull the eccentric bushing (4) from the eccentric.
3. Attach the lifting slings to the lifting tool (5).
4. Arrange the lifting equipment.

WARNING



SUSPENDED LOAD HAZARD

An eccentric bushing weighs up to 130 kg (287 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

Never start the lift by using just the lifting eye bolts, threaded into the top edge of the eccentric bushing. If the eccentric is jammed, the threads may be damaged. Always start removal by using the special lifting tool.

5. Carefully lift the eccentric bushing (4) approximately 10 mm (0.39").

Note! *The eccentric bushing (4) can still be stuck in the eccentric (3). Make sure not to overload the lifting equipment.*

6. Install four lifting eyes in the threaded holes in the top of the eccentric bushing (4).
7. Arrange the lifting equipment.

WARNING

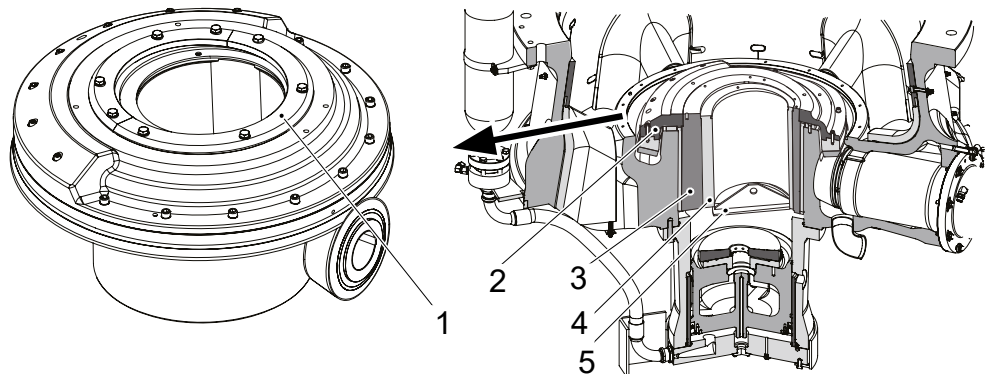


SUSPENDED LOAD HAZARD

An eccentric bushing weighs up to 130 kg (287 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

8. Carefully lift out the eccentric bushing (4) for a better balanced removal.



1 Bushing retaining ring

2 Hub

3 Eccentric

4 Eccentric bushing

5 Lifting tool

3.5.1.2

Removing the eccentric bushing - Alternative method

Note!

If the eccentric bushing (3) is a tight fit, the whole eccentric assembly can be removed, see section [3.5.2.1.Removing the eccentric assembly \(Page 126\)](#).

If the ambient air temperature is < 30 °C (86 °F), then continue as described below.

If the ambient air temperature is > 30 °C (86 °F), cool the eccentric bushing (3) with a plastic bag of dry ice placed inside the bushing for 30 minutes before removal is started.

Drive out the eccentric bushing (3) from the eccentric (4) with a wooden block (5) and a hammer.

NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

Protect the bearing surface on the upper side of the hub from damage.

Note!

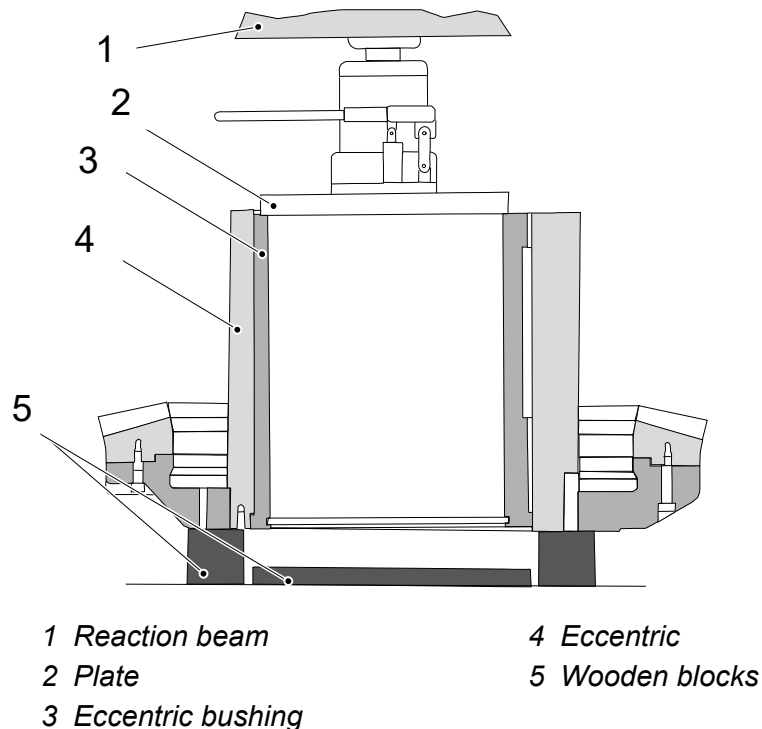
If the bushing cannot be driven out in this way, it must be pressed out with a hydraulic jack, as shown below:

Maintenance Instructions

If the mainshaft and the mantle have rotated at the same speed as the eccentric (4) during operation, it is probable that the eccentric bushing (3) has seized on the mainshaft. If so, the mainshaft can not be removed the normal way. The dust collar must be freed so that the mainshaft and eccentric assembly can be lifted out.

Try to remove the screws that hold the eccentric bushing retaining ring to the top of the eccentric.

If it is not possible to remove the screws, try to push the eccentric downwards. If this cannot be done, the dust collar must be destroyed. The eccentric (4) can then be removed from the mainshaft and the eccentric bushing (3).

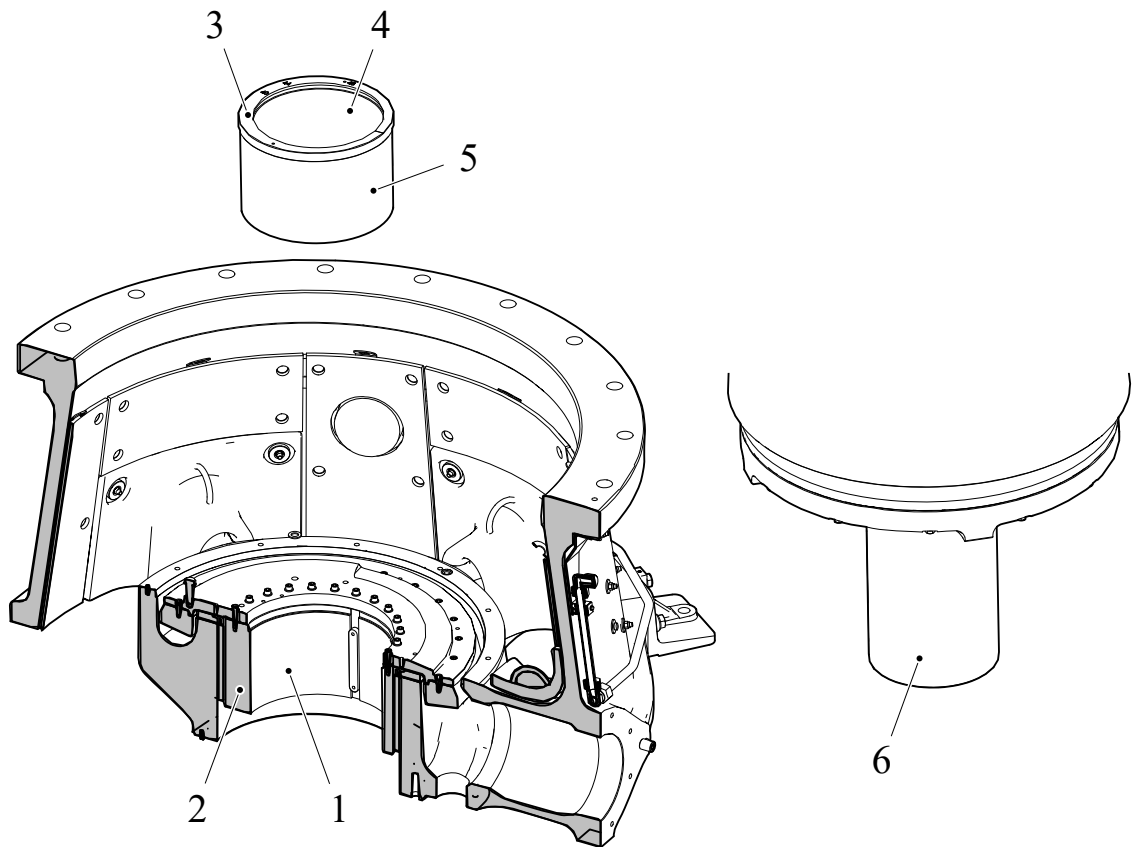


3.5.1.3

Inspecting the eccentric bushing

1. Inspect the bore (1) of the eccentric (2). It must be smooth and not oval or conical. Any ovality or conicity must be corrected by scraping or grinding the bore of the eccentric with a belt grinder.
2. Measure and calculate the play between the eccentric bushing bearing surface (5) and the eccentric (1). The maximum permitted play is 0.22 mm (0.009 in).
3. Inspect the bearing surface (6) of the main shaft for wear and damage.

4. Inspect the bore (4) of the eccentric bushing (3) to make sure that it is not deformed, and that the surface is smooth.



1 Eccentric bore

2 Eccentric

3 Eccentric bushing

4 Eccentric bushing bore

5 Eccentric bushing bearing surface

6 Main shaft bearing surface

Note!

If the main shaft is seized in the eccentric bushing, the resulting high temperature can lead to so-called heat cracks (reminiscent of fish scales) on the bearing surface of the main shaft. These heat cracks are narrow vertical lines, between 3 and 5 mm (0.12-0.2 in) long and up to 0.5 mm (0.02 in) deep, and can be difficult to discover. If they are not dealt with there is a major risk of a new failure. Consult Sandvik for information on corrective measures.

3.5.1.4

Installing the eccentric bushing

1. Make sure that the key is correctly installed in the eccentric bushing (4) before the bushing is installed in the eccentric (3).
2. Install lifting eye bolts (5) into the threaded holes in the top of the eccentric bushing (4).
3. Attach lifting slings to the lifting eye bolts (5).
4. Arrange the lifting equipment.

Maintenance Instructions

5. Coat the outer surface of the eccentric bushing (4) with oil.

Note!

Under certain circumstances, for instance if the ambient air temperature is higher than 35°C (95°F), the bushing can be distorted. If so, let it cool and then carefully press the bushing into place. Never hit the bronze bushing. An out-of-round bushing must be replaced.

WARNING

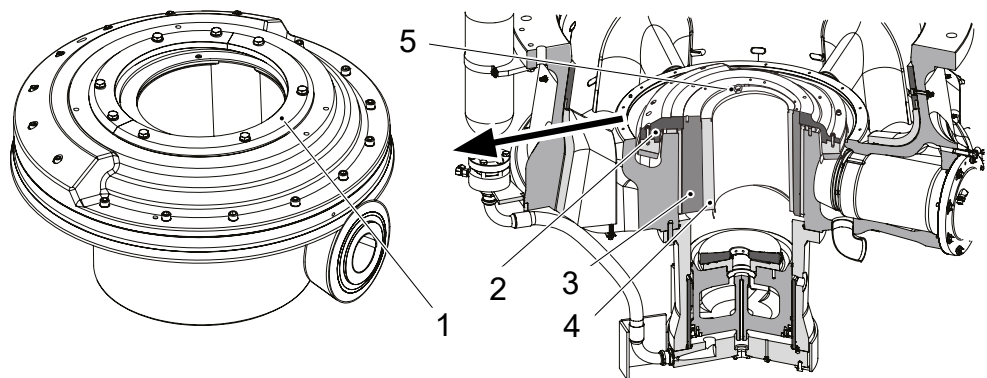


SUSPENDED LOAD HAZARD

An eccentric bushing weighs up to 130 kg (287 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

6. Carefully lift the eccentric bushing (4).
7. Make sure that the top flange of the eccentric bushing (4) seats properly in the recess at the top of the eccentric (3), and does not lie above the top of the eccentric (3).
8. Fit the eccentric bushing retaining ring (1) which locks the eccentric bushing (4) in the eccentric (3).
9. Apply locking fluid to the screws and tighten them to the correct torque, refer to *Locking fluids for threaded fasteners* and *Tightening torques* in *Technical Specifications*.
10. If the eccentric throw has been changed, be sure to make a note of the new value.



- 1 Bushing retaining ring
- 2 Hub
- 3 Eccentric

- 4 Eccentric bushing
- 5 Lifting eye bolt

11. If a new eccentric bushing has been installed, follow the procedure described in [3.13.2. Running-in \(Page 269\)](#)

Maintenance Instructions

3.5.2 Replacing the eccentric assembly

3.5.2.1 Removing the eccentric assembly

1. Remove the top shell, see section [3.2.5.1.Removing the top shell \(Page 44\)](#).
2. Remove the main shaft, see section [3.3.1.1.Removing the main shaft assembly \(Page 63\)](#).
3. Remove the dust collar, see section [3.4.1.1.Removing the dust collar \(Page 112\)](#).



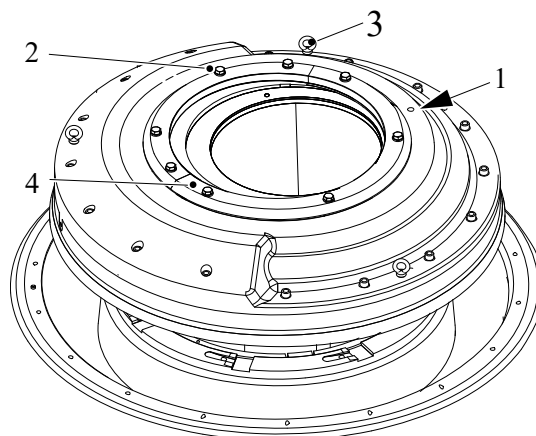
NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

The eccentric may fall out if the bushing retaining ring (4) is removed before the lift.

Do not remove the bushing retaining ring (4) before the lift.

4. Attach lifting eye bolts (3) to the threaded holes on top of the gear carrier (2).



1 Inspection hole

2 Gear carrier

3 Lifting eye bolt

4 Bushing retaining ring

5. Arrange the lifting equipment.



WARNING



SUSPENDED LOAD HAZARD

An eccentric assembly weighs up to 750 kg (1654 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

6. Lift the eccentric assembly approximately 10 mm (0.4").

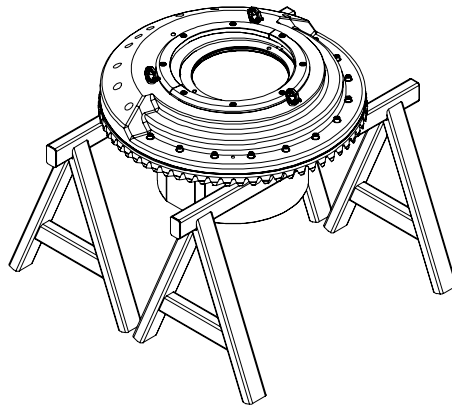
Maintenance Instructions

Note! *If the eccentric has seized in the bottom shell bushing, the bottom shell bushing and the wearing plate will also be removed when the eccentric assembly is lifted out.*

7. Use a screwdriver through the inspection hole (1) in the gear carrier (2) to make sure that the wearing plate has not been lifted with the eccentric assembly, but remains in the bottom shell.

Note! *If there is severe damage to the bearing surface of the bottom shell bushing, the bushing must sometimes be split in order to remove it.*

8. Carefully lift out the eccentric assembly and place it on trestles. Make sure that you do not damage the bottom shell bushing.



3.5.2.2 *Inspecting the eccentric assembly*

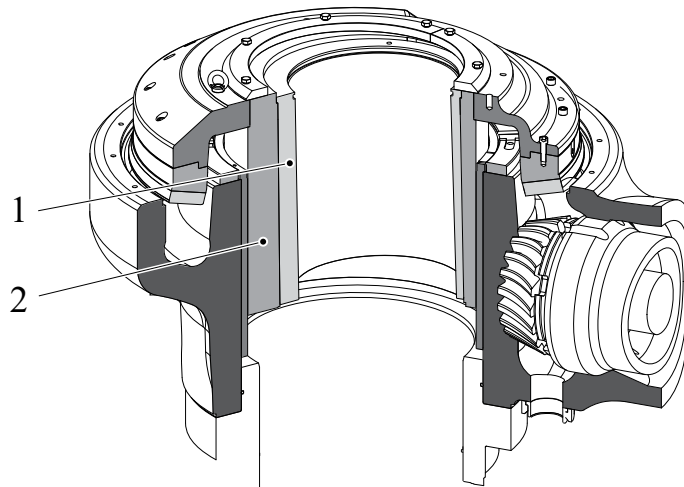
1. Examine the bearing surfaces of the eccentric (2) for scratches and signs of heavy wear or excessive temperature, such as dark spots or patterns of heat cracks.

Note! *If the main shaft is seized in the eccentric bushing (1), the resulting high temperature can lead to so-called heat cracks (reminiscent of fish scales) on the bearing surface of the main shaft. These heat cracks are narrow vertical lines, 3 to 5 mm (0.12 to 0.20") long and up to 0.5 mm (0.02") deep and can be difficult to discover. If they are not dealt with there is a major risk of a new failure. Consult Sandvik for information about corrective measures.*

2. Examine the inner surface of the eccentric bushing (1) for wear, scratches or dark spots, which can indicate that the bushing has been subjected to high temperatures.
3. Inspect the eccentric wearing plate according to section [3.5.4.1. Inspecting the eccentric wearing plate \(Page 138\)](#).

Maintenance Instructions

4. Inspect the bottom shell bushing according to section [3.6.1.2. Installing the bottom shell bushing \(Page 143\)](#).



1 Eccentric bushing

2 Eccentric

3.5.2.3

Installing the eccentric assembly

1. Attach lifting eye bolts (3) to the threaded holes on the gear carrier (2).
2. Arrange the lifting equipment.
3. Coat the outer surface of the eccentric with oil.



NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

The eccentric may fall out if the bushing retaining ring (4) is not mounted.

Make sure that the bushing retaining ring (4) is mounted before the lift.



WARNING



SUSPENDED LOAD HAZARD

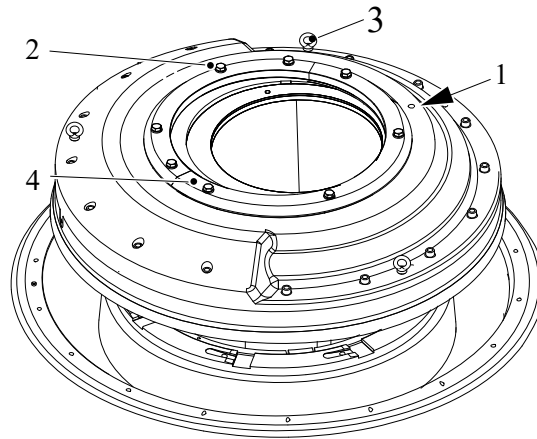
An eccentric assembly weighs up to 750 kg (1654 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

4. Lift the eccentric assembly.
5. Carefully lower the eccentric assembly into the bottomshell bushing. Make sure that you do not damage the bottomshell bushing.

Maintenance Instructions

6. When the eccentric is approximately 10 mm (0.4") from its final position, rotate the pinionshaft slightly, in both directions, while carefully lowering the eccentric assembly, to ensure that the gear and the pinion mesh correctly.



1 Inspection hole

2 Gear carrier

3 Lifting eye bolt

4 Bushing retaining ring

3.5.3

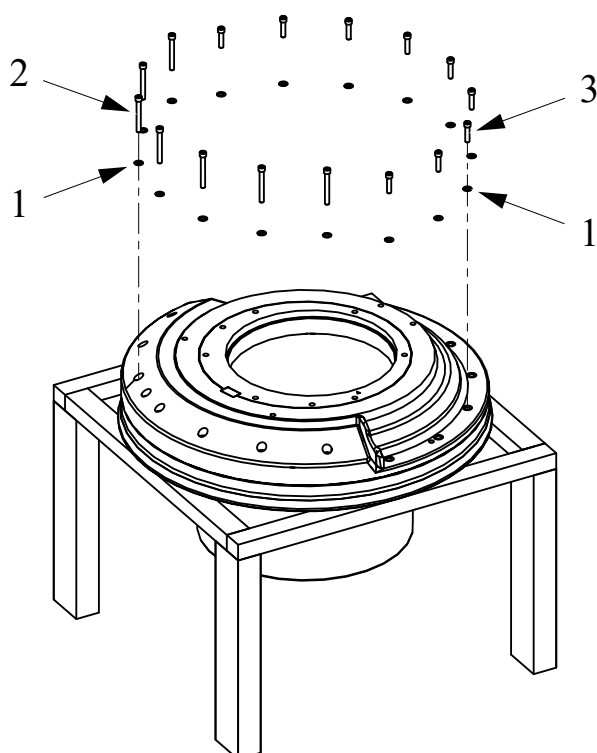
Replacing the eccentric hub and gear

3.5.3.1

Removing the eccentric hub and gear

1. Remove the eccentric assembly, see section [3.5.2.1.Removing the eccentric assembly \(Page 126\)](#) and put it on a stand.
2. Remove the eccentric bushing from the eccentric, see section [3.5.1.1.Removing the eccentric bushing \(Page 121\)](#).

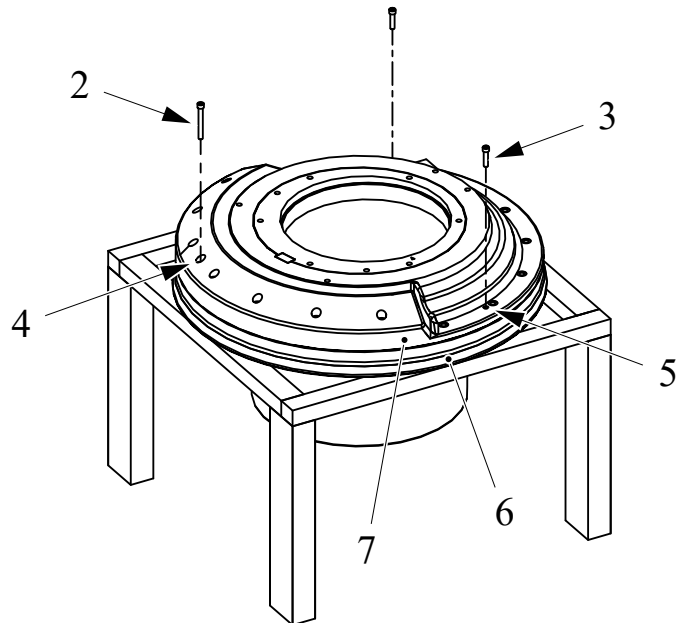
3. Remove the screws (2) and (3) and the washers (1).



- 1 Washer
- 2 Screw
- 3 Screw

Maintenance Instructions

4. Release the gear (6) from the hub (7) by using the screws (2) and (3) as jacking screws in the threaded holes (4) and (5) on the hub (7).



2 Screw

3 Screw

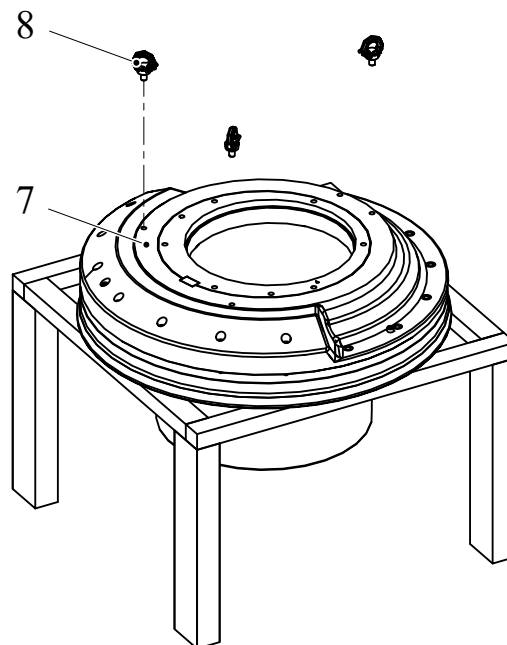
4 Threaded hole

5 Threaded hole

6 Gear

7 Hub

5. Attach lifting eye bolts (8) to the threaded holes on the hub (7).



7 Hub

8 Lifting eye bolt

6. Arrange the lifting equipment.

WARNING

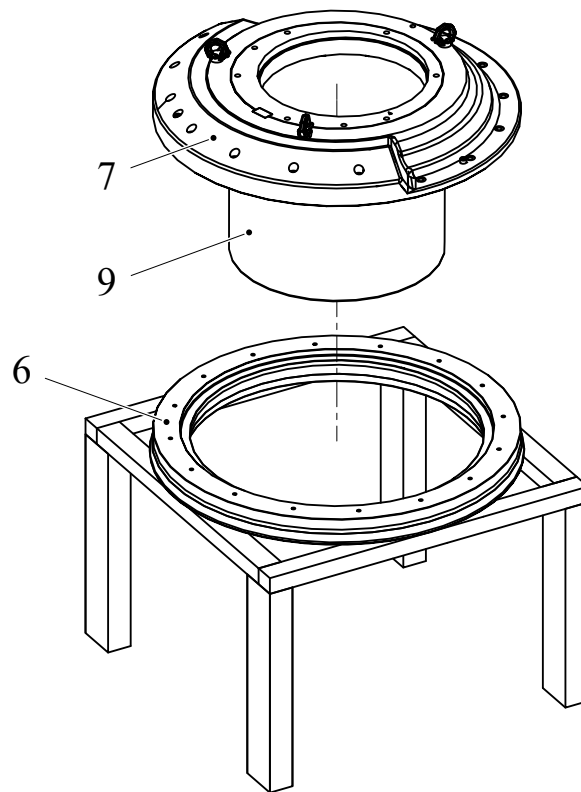


SUSPENDED LOAD HAZARD

A hub assembly weighs up to 330 kg (728 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

7. Carefully lift off the hub and eccentric assembly (7), (9) from the gear (6) and place it on a wooden support.



6 Gear

7 Hub

9 Eccentric

8. Heat the hub (7) to 40 °C (104 °F) above the ambient air temperature. For example, heat to 60 °C (140 °F) in an ambient air temperature of 20 °C (68 °F).

WARNING

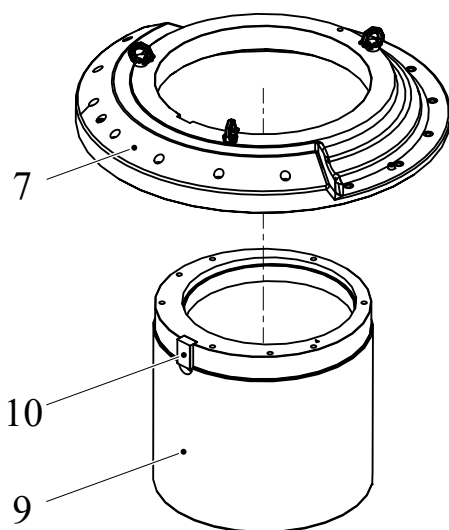


SUSPENDED LOAD HAZARD

A hub weighs up to 170 kg (375 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

9. Carefully lift off the hub (7) from the eccentric (9) and place it on a wooden support.
10. Make sure to collect the key (10).
11. Remove the lifting equipment and the lifting eye bolts.



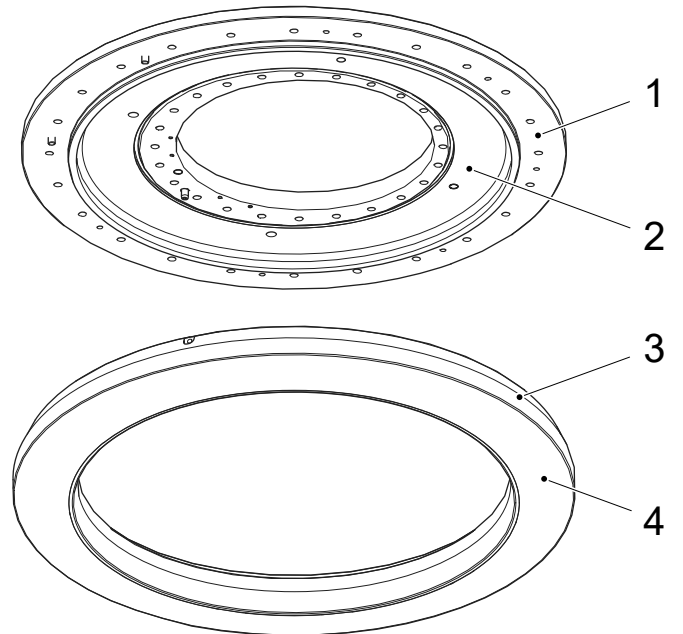
- 7 Hub
9 Eccentric
10 Key

Maintenance Instructions

3.5.3.2

Inspecting the eccentric hub and gear

1. Examine the bearing surfaces (2) on the hub (1) for wear and damage.
2. Examine the teeth (4) on the gear (3) for signs of wear, see section [3.9.4.4. Tooth bearing "footprint" \(Page 243\)](#).



1 Hub

2 Bearing surface

3 Gear

4 Teeth

3.5.3.3

Installing the eccentric hub and gear

1. Remove the eccentric assembly, see section [3.5.2.1. Removing the eccentric assembly \(Page 126\)](#).
2. Remove the eccentric bushing, see section [3.5.1.1. Removing the eccentric bushing \(Page 121\)](#).
3. Heat the hub (3) to 40 °C (104 °F) above the ambient air temperature. For example, heat to 60 °C (140 °F) in an ambient air temperature of 20 °C (68 °F).



WARNING



HOT SURFACE HAZARD

You can suffer severe burns from the heated component.

Use heat-resistant protective gloves.

4. Attach lifting eye bolts (5) to the hub (3).
5. Arrange the lifting equipment.

Maintenance Instructions

6. Make sure that the key (2) is in place on the eccentric (1).

WARNING

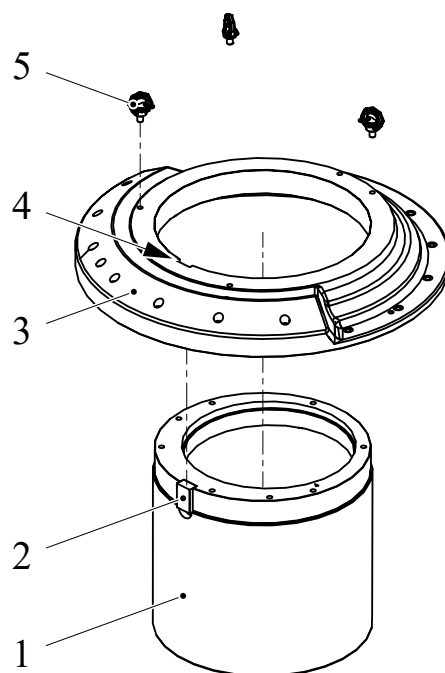


SUSPENDED LOAD HAZARD

A hub weighs up to 170 kg (375 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

7. Carefully lift the hub (3). Align the groove (4) on the hub (3) with the key (2) on the eccentric (1) and lower the hub (3) onto the eccentric (1).
8. Allow the hub (3) to cool down before continuing the installation.



1 Eccentric

2 Key

3 Hub

4 Groove

5 Lifting eye bolt

9. Put the gear (7) on a suitable support (6).

WARNING

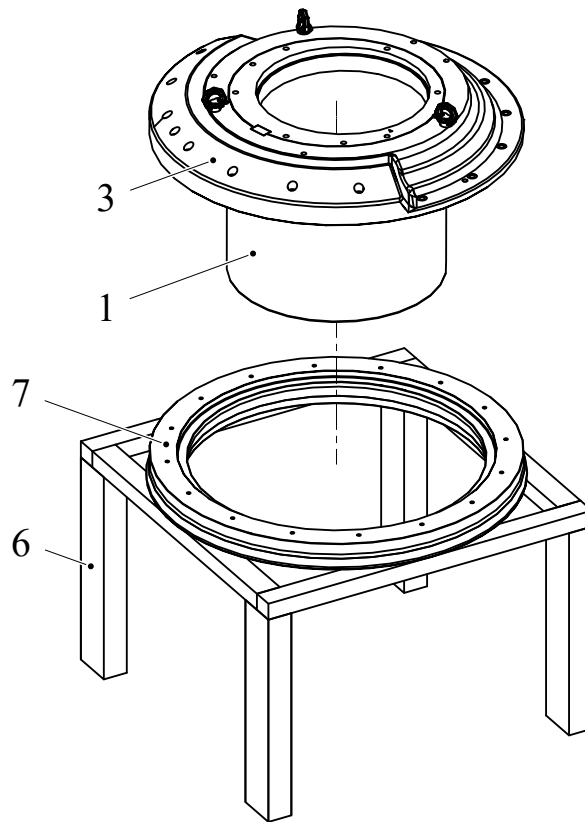


SUSPENDED LOAD HAZARD

A hub assembly weighs up to 330 kg (728 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

10. Carefully lift the hub and eccentric assembly (1), (3). Align the unthreaded holes on the hub (3) with the threaded holes on the gear (7) and lower the hub and eccentric assembly (1), (3) onto the gear (7).



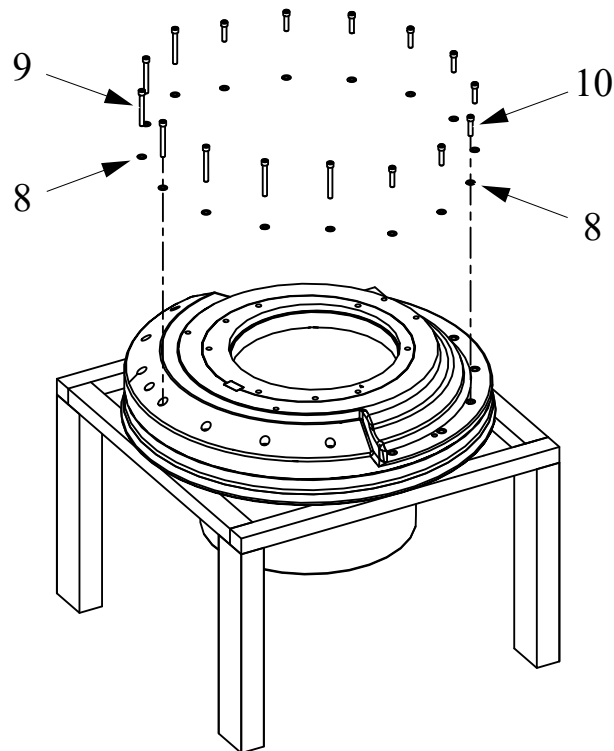
1 Eccentric
3 Hub

6 Support
7 Gear

11. Remove the lifting equipment.
12. Apply locking fluid, Loctite 241 or similar (medium strength), to the threads of the screws (9) and (10).

Maintenance Instructions

13. Attach the gear (7) to the hub (3) with the washers (8) and the screws (9) and (10). Tighten the screws (9) and (10), refer to *Tightening torques* in *Technical specifications*.



- 8 Washer
9 Screw
10 Screw

3.5.4 Replacing the eccentric wearing plate

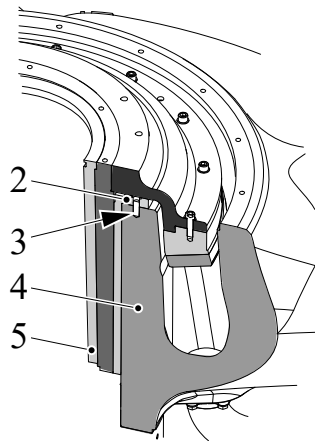
3.5.4.1 Inspecting the eccentric wearing plate

1. Measure the thickness of the eccentric wearing plate (2). Replace the eccentric wearing plate (2) if the thickness is less than 25 mm (0.98 in).

Note!

Check the gear backlash, see section [3.9.4.1. Checking the gear backlash \(Page 238\)](#), if the eccentric wearing plate is worn, but has not yet reached the minimum thickness. This to prevent damage to the gear and pinion.

2. Inspect the spiral pins (3) that lock the eccentric wearing plate (2) to the bottom shell (4). If the spiral pins are damaged, replace them.



1 Locking lug

2 Eccentric wearing plate

3 Spiral pin

4 Bottom shell

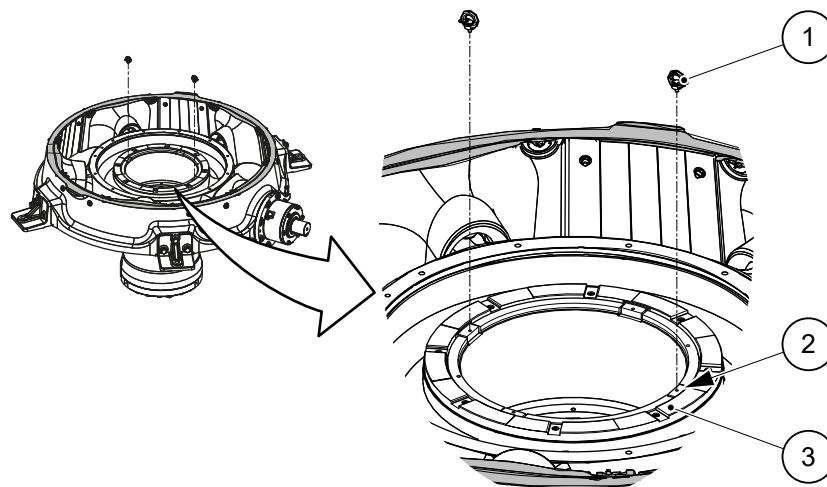
5 Bottom shell bushing

3.5.4.2 Removing the eccentric wearing plate

1. Remove the topshell, see section [3.2.5.1. Removing the top shell \(Page 44\)](#).
2. Remove the mainshaft, see section [3.3.1.1. Removing the main shaft assembly \(Page 63\)](#).
3. Remove the dust collar, see section [3.4.1.1. Removing the dust collar \(Page 112\)](#).
4. Remove the eccentric assembly, see section [3.5.2.1. Removing the eccentric assembly \(Page 126\)](#).

Maintenance Instructions

5. Attach lifting eye bolts (1) to the threaded holes (2) on the eccentric wearing plate (3).



- 1 *Lifting eye bolt*
2 *Threaded hole*
3 *Eccentric wearing plate*

WARNING

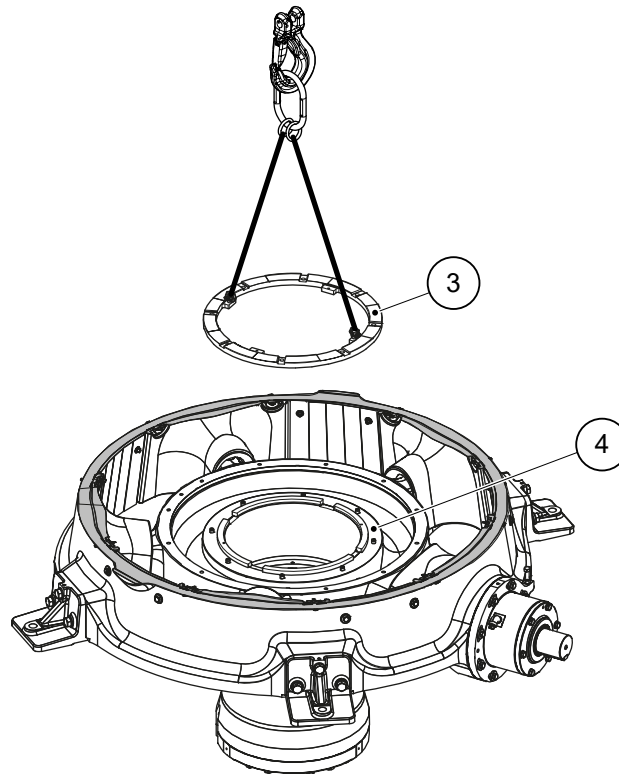


SUSPENDED LOAD HAZARD

An eccentric wearing plate weighs up to 22 kg (49 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

6. Lift out the eccentric wearing plate (3) from the bottomshell (4).



3 Eccentric wearing plate

4 Bottomshell

3.5.4.3

Installing the eccentric wearing plate

1. Attach the lifting eye bolts (1) to the threaded holes (2) on the eccentric wearing plate (3).
2. Arrange the lifting equipment.

WARNING

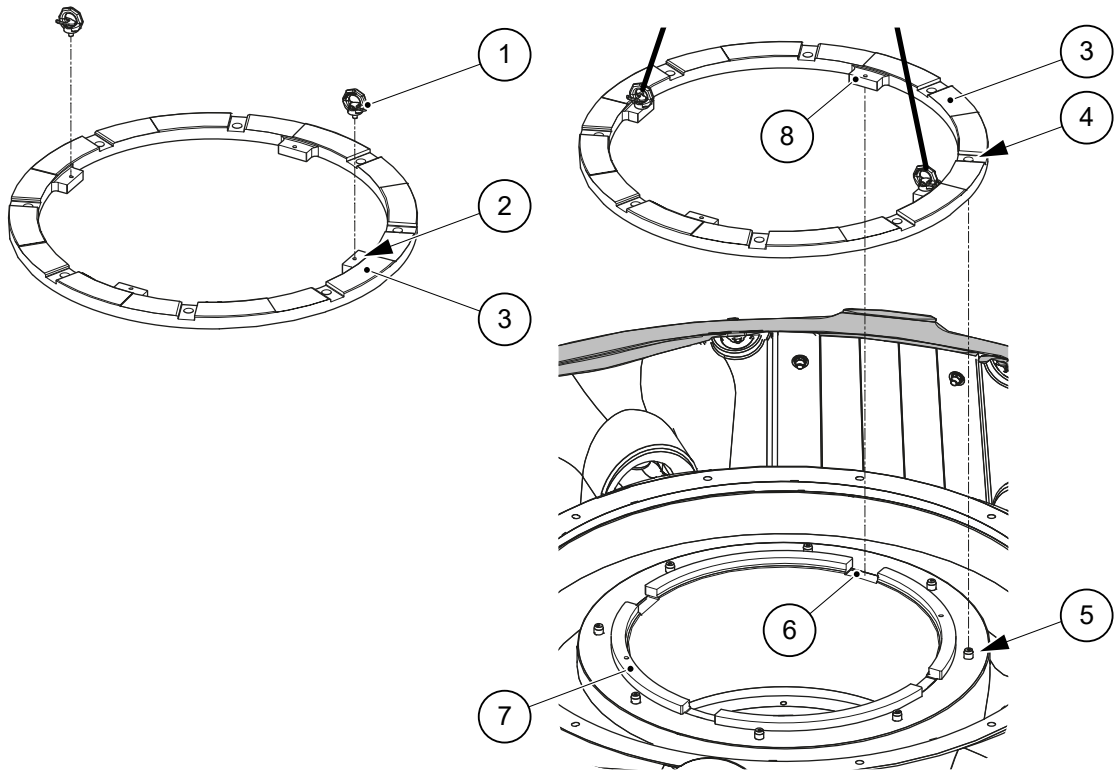


SUSPENDED LOAD HAZARD

An eccentric wearing plate weighs up to 22 kg (49 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

3. Lift the eccentric wearing plate (3).
4. Lower the eccentric wearing plate (3) to a position just above the bottom shellbushing (7).
5. Align the holes on the eccentric wearing plate (3) with the spiral pins (5).
6. Align the recesses (6) on the bottom shell bushing (7) with the locking lugs (8) on the eccentric wearing plate (3) by turning the bottom shell bushing (7).



1 Lifting eye bolt

2 Threaded hole

3 Eccentric wearing plate

4 Hole

5 Spiral pin

6 Recess

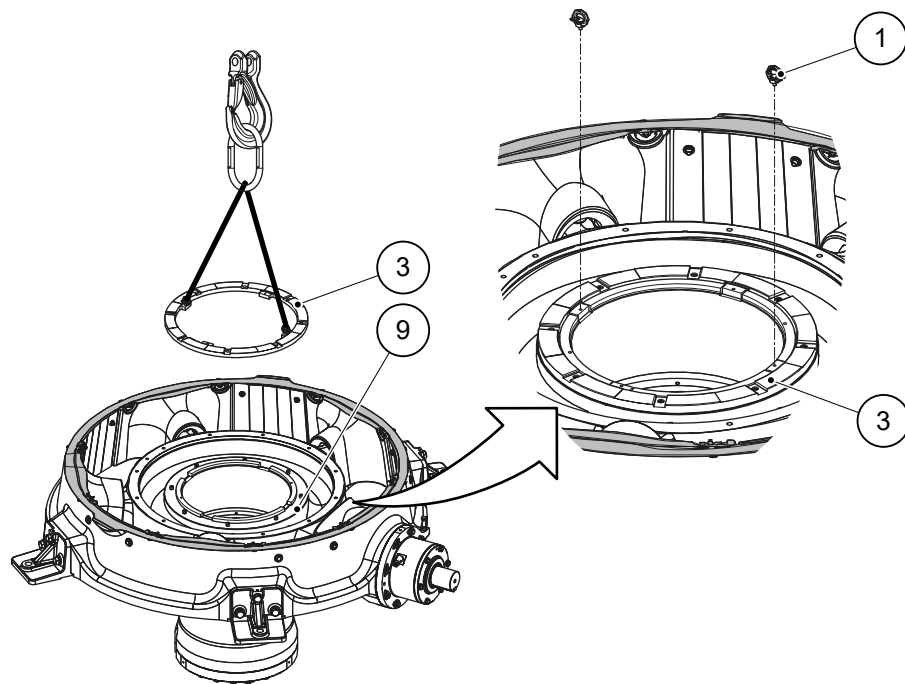
7 Bottom shell bushing

8 Locking lug

7. Lower the eccentric wearing plate (3) into the bottom shell (9).
8. Remove the lifting equipment.
9. Remove the lifting eye bolts (1) from the eccentric wearing plate (3).

Maintenance Instructions

10. Install the eccentric assembly, see section [3.5.2.3.Installing the eccentric assembly \(Page 128\)](#).
11. Install the dust collar, see section [3.4.1.3.Installing the dust collar \(Page 114\)](#).
12. Install the main shaft, see section [3.3.1.3.Installing the main shaft assembly \(Page 65\)](#).
13. Install the top shell, see section [3.2.5.3.Installing the top shell \(Page 46\)](#).



- 1 Lifting eye bolt
3 Eccentric wearing plate
9 Bottom shell

3.6 Bottom shell

3.6.1 Replacing the bottom shell bushing

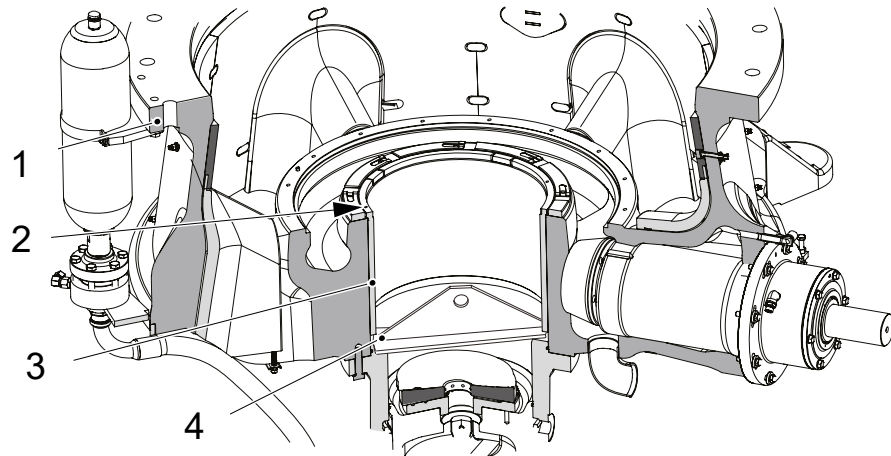
Note! *There must be enough space for the bottom shell bushing to expand due to friction heat.*

3.6.1.1 Removing the bottom shell bushing

Normally, the bottom shell bushing (3) can be easily removed.

Maintenance Instructions

1. Place a lifting tool (4) under the bottom edge of the bottom shell bushing (3). Use the lifting tool that is supplied with this upgrade kit. For more information refer to the lifting tool manual.



1 Bottom shell

2 Threaded hole

3 Bottom shell bushing

4 Lifting tool

2. Lift the bushing slightly from its seating in the bottom shell (1).

Note!

The lifting tool is not to be used to lift the bushing out of the bottom shell.

3. Install lifting eye bolts in the holes (2) in the bottom shell bushing (3). Use the lifting eye bolts that are supplied with the crusher's tool kit.

Note!

The lifting eye bolts are not to be used to pull the bushing from its seating in the bottom shell.

4. Arrange the lifting equipment.

WARNING



SUSPENDED LOAD HAZARD

A bottom shell bushing weighs up to 100 kg (221 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

5. Lift the bottom shell bushing (3) out of the bottom shell.

Note!

The bottom shell bushing (3) can still be stuck to the bottom shell. Make sure not to overload the lifting equipment.

3.6.1.2

Installing the bottom shell bushing

1. Install lifting eye bolts in the holes (2) in the bottom shell bushing (3). Use the lifting eye bolts that are supplied with the crusher's tool kit.
2. Arrange the lifting equipment.

Maintenance Instructions

Note!

The lugs on the eccentric wearing plate are fixed in relation to the bottom shell, so that the bottom shell bushing must be rotated to a position where its indentations match the eccentric wearing plate protrusions. The flange around the top of the bottom shell bushing (3) must be in contact with the top of the bottom shell hub.



WARNING

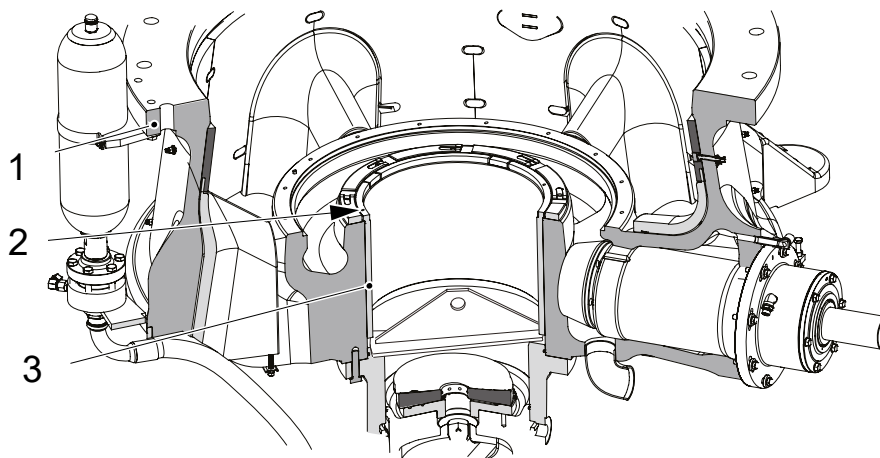


SUSPENDED LOAD HAZARD

A bottom shell bushing weighs up to 100 kg (221 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

3. Lift the bottom shell bushing (3) and lower it into the bottom shell (1).
 - a) If the bore of the bottom shell is not circular, it can be difficult to install the bottom shell bushing (3). Any ovality or conicity of the bottom shell bore must be removed by scraping or grinding.
 - b) If the bottom shell bore is circular, a slightly oval bushing can be carefully pressed down into place.



- 1 Bottom shell
2 Threaded hole
3 Bottom shell bushing

3.6.2

Replacing the Hardox liners

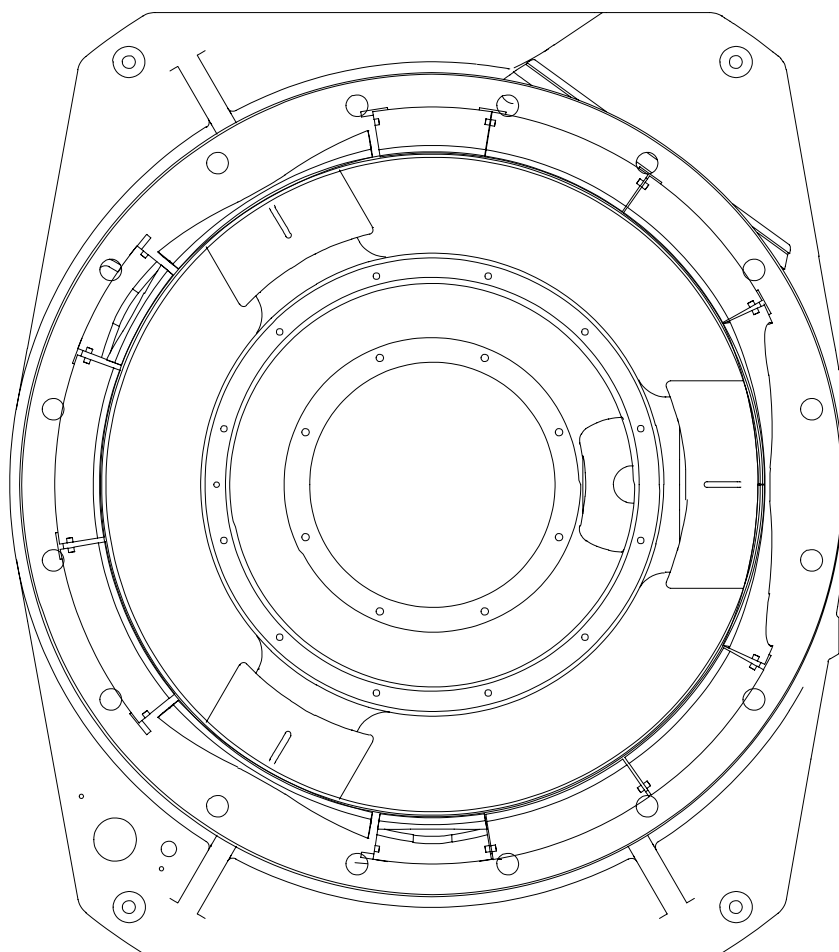
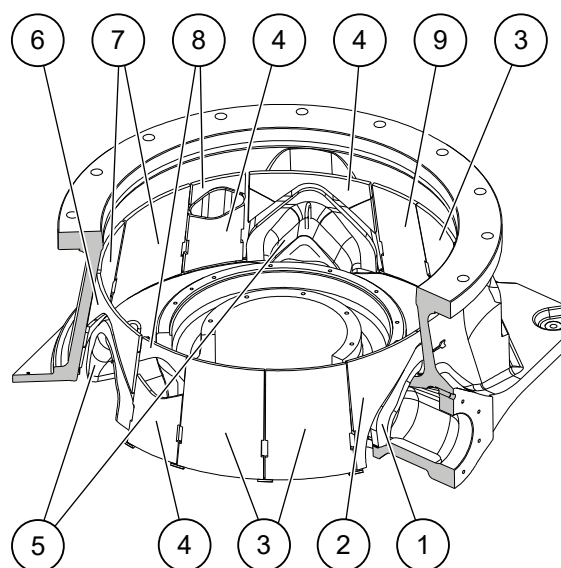
3.6.2.1

Removing the Hardox liners

To protect the bottomshell from wear, it is necessary to replace the liners on the inside of the bottomshell, when they are worn out. If holes have been worn in the liners, they must be replaced immediately.

Maintenance Instructions

1. Remove the old liner plates from the inside of the bottomshell.
2. Remove the old bottomshell arm liners.



- 1 Liner -pin shaft arm
- 2 Wearing plates
- 3 Wearing plates

- 6 Wearing plates
- 7 Wearing plates
- 8 Wearing plates

4 Wearing plates

5 Liner - narrow arm

9 Wearing plates

3.6.2.2

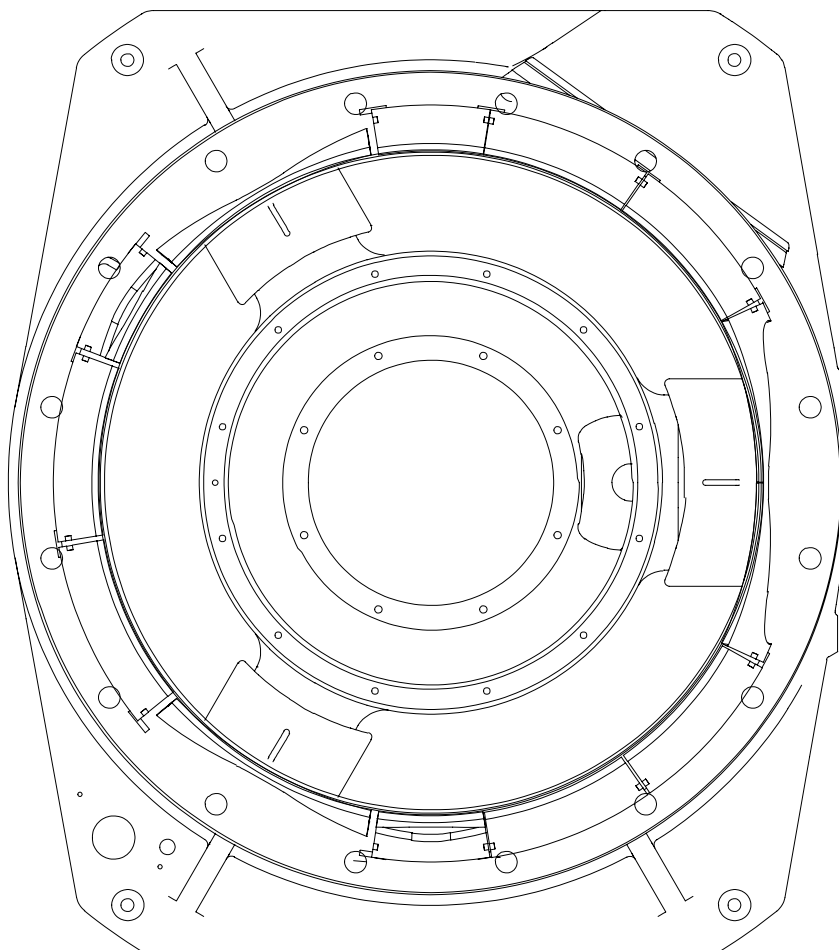
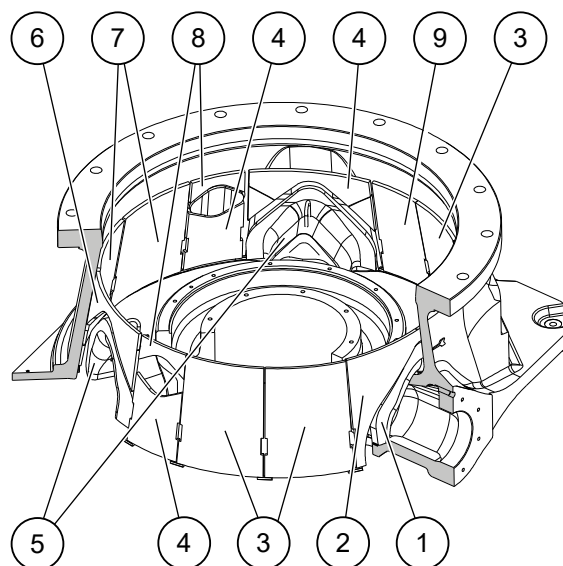
Installing the Hardox liners

To protect the bottomshell from wear, it is necessary to replace the liners on the inside of the bottomshell, when they are worn out. If holes have been worn in the liners, they must be replaced immediately.

1. Clean the new liner plates for the inside of the bottomshell.
2. Weld lifting lugs to the liners. The electrode must meet the requirements of SS-EN ISO 2560: E42 4 B 42 H5 (for example, an ESAB OK 48.00 electrode). Use an A-dimension of 6 mm (0.24").
3. Position the plates as shown in the figure below. Use timber or similar to press the plates into position.
4. Weld the plates to the inside of the bottomshell in the recesses provided. Use an A-dimension of 6 mm (0.24").
5. Clean the new bottomshell arm liners.
6. Position the arm liners on the bottomshell arms.
7. Use pieces of round bar to fill the gaps between the manganese liners and the bottomshell.
8. Weld between the round bar and the bottomshell. The electrode must meet the requirements of SS-EN ISO 2560: E42 4 B 42 H5 (for example ESAB OK 48.00 electrode). Use an A-dimension of 6 mm (0.24").

Maintenance Instructions

9. Weld between the round bar and the manganese liners. The electrode must meet the requirements of EN ISO 1600: E 18 8 Mn B 4 2 (for example ESAB OK 67.45 electrode). Use an A-dimension of 6 mm (0.24").



1 Liner -pin shaft arm
(1010-1)

2 Liner - narrow arm (1010-2)

6 Wearing plates (1320-4)

7 Wearing plates (1320-5)

- 3 Wearing plates (1320-1)
- 4 Wearing plates (1320-2)
- 5 Wearing plates (1320-3)

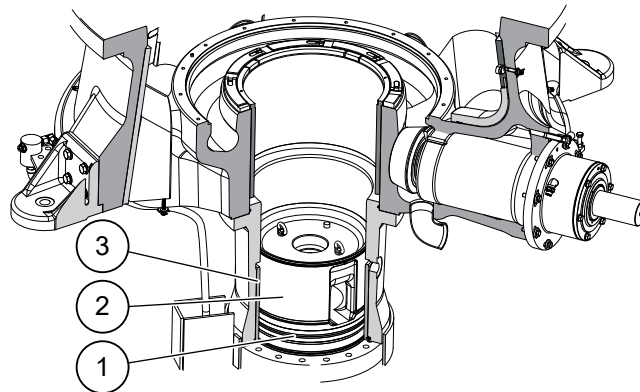
- 8 Wearing plates (1320-6)
- 9 Wearing plates (1320-7)

3.7 Hydroset cylinder

3.7.1 Replacing the Hydroset piston

The chevron packing (1) is attached to the bottom of the piston with a clamping ring.

Narrow oil channels on the outside of the piston (2) supply oil to an oil groove in the upper part of the piston. This lubricates the upper part of the piston, and prevents dirt from entering between the piston and the Hydroset bushing (3). The oil enters the crusher through the wall of the Hydroset cylinder, flows through the Hydroset piston and up through the step bearing.



- 1 Chevron packing
- 2 Hydroset piston
- 3 Hydroset bushing

3.7.1.1 Removing the Hydroset piston

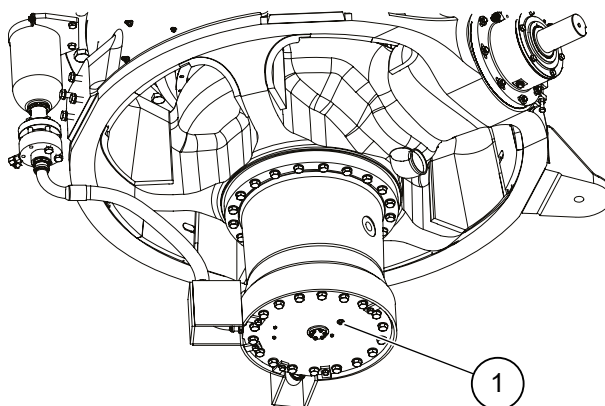
1. Disconnect the supply line for the lubricating oil.
2. Raise the piston (2) far enough for the oil inside the piston to drain.
3. Remove the Hydroset piston position transmitter, see section [3.7.6.1.Removing the Hydroset piston position transmitter K1-GT1 \(Page 177\)](#), to avoid damage when the piston is lowered.
4. Lower the piston (2) to its lowest position.

Note!

Do not remove the Hydroset oil hoses (3). The oil can be drained from the Hydroset hoses and the Hydroset cylinder by removing the drain plugs. This will also ensure that there is no vacuum when the piston is lifted.

Maintenance Instructions

5. Remove the drain plug (1).



1 Drain plug

Note!

***The oil volume to be drained is approximately 8 liters (2.1 US gallons).
The oil volume can vary depending on hose length.***

6. Drain the Hydroset line by disconnecting the hose from the back of the Hydroset tank unit.
7. Install the lifting eye bolts (4) in the holes in the Hydroset piston.
8. Position the hook of a crane vertically above the bottom shell (5). Attach lifting slings to the hook.
9. Arrange the lifting equipment.

WARNING



SUSPENDED LOAD HAZARD

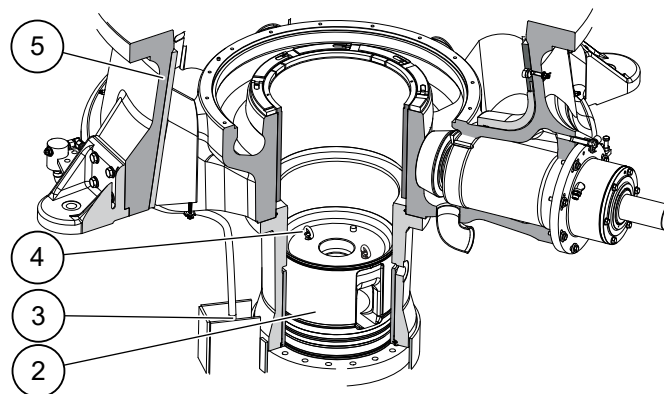
A Hydroset piston weighs up to 186 kg (410 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

10. Lift the Hydroset piston (2) out of the bottom shell (5).

Note!

A small quantity of oil can still remain inside the Hydroset piston (2). Be prepared to collect this oil.



2 Hydroset piston
3 Connections for Hydroset hoses

4 Lifting eye bolt
5 Bottom shell

3.7.1.2

Inspecting the Hydroset piston

1. Clean the Hydroset piston.
2. Inspect the outer surface of the piston for wear and damage.
3. Inspect the chevron packing. If necessary, replace it, see section [3.7.3.Replacing the chevron packing \(Page 166\)](#).
4. Inspect the bore of the Hydroset cylinder bushing, see section [3.7.5.2.Inspecting the Hydroset cylinder bushing \(Page 174\)](#).

3.7.1.3

Installing the Hydroset piston

1. Coat the rubbing surfaces of the piston and the Hydroset cylinder bushing with molybdenum disulfide.
2. Carefully lubricate the sealing lips of the chevron packing.
3. Install lifting eye bolts in the threaded holes in the Hydroset piston.
4. Position the hook of a crane vertically above the Hydroset piston. Attach lifting slings to the hook.

Maintenance Instructions

5. Attach the lifting slings to the lifting eye bolts.
6. Take up the slack in the lifting tackle.

WARNING



SUSPENDED LOAD HAZARD

A Hydroset piston weighs up to 186 kg (410 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

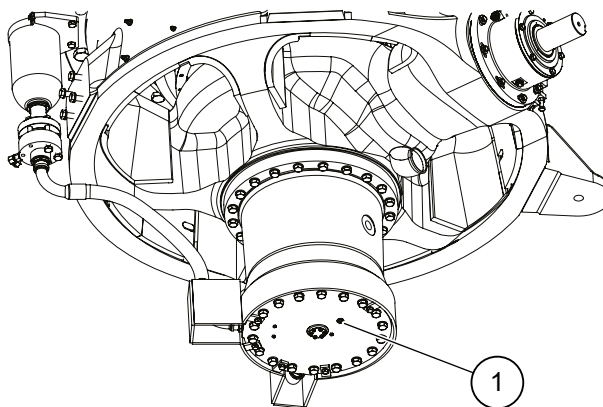
Make sure that you do not damage the sealing lips of the chevron packing when the piston is lowered into the Hydroset cylinder and into the Hydroset cylinder bushing.

7. Lift the Hydroset piston, then carefully lower it into the bottom shell.

Note!

A new chevron packing can make it difficult to push the piston down into the bushing. If so, install the step bearing components and use the main shaft as a weight to carefully press the piston into the bushing.

8. Install the drain plug (1).



1 Drain plug

9. Fill the Hydroset system with oil and bleed out all air, see section [3.8.1. Bleeding air from the Hydroset system \(Page 179\)](#)

3.7.2

Replacing the step bearing components

Sandvik recommends that you inspect the step bearing components in conjunction with liner changes and renew the bearing components at intervals which are based on experience.

Maintenance Instructions

Note! *If wear on the step bearing components is severe, see Operator's troubleshooting in the Operator's Instructions.*

Note! *When replacing the step bearing components it is important that they are run in before the crusher is fully loaded. Please refer to the Technical Specifications.*

3.7.2.1 Removing the step bearing components

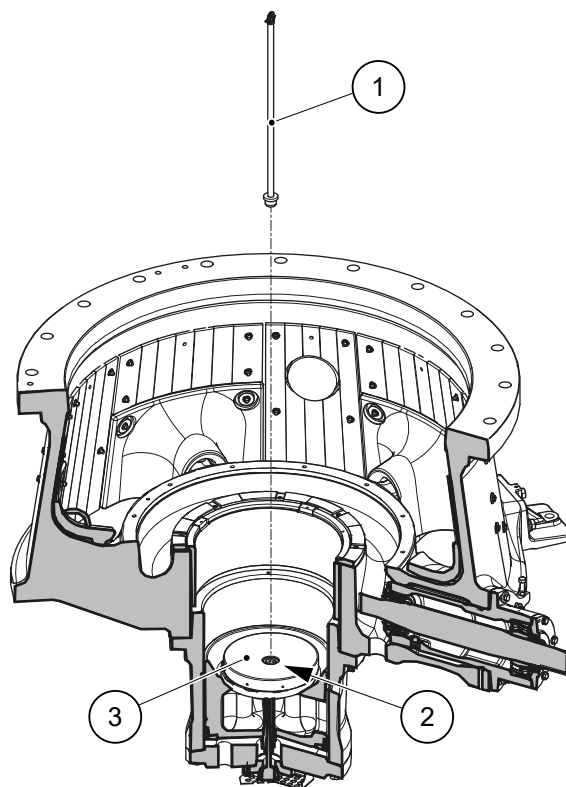
The step bearing components can be lifted up through the eccentric bushing with the help of the special lifting tool kit, which is supplied with the crusher.

Note! *Since the step bearing components are covered in oil, they stick together. When removing the plates it is crucial to make a circular movement before lifting the bearing components. The adhesive oil film will then let go. The procedure is done with advantage when the oil is warm. It is important to lift the step washer extremely slow, without sudden snatch.*

Note! *WLL (working load limit) for the lifting tool is 700 kg (1545 lbs).*

Note! *Avoid damaging or scratching the eccentric bushing.*

1. Attach the lifting tool (1) to the threaded hole (2) on the step washer (3).



- 1 Lifting tool
- 2 Threaded hole
- 3 Step washer

WARNING



SUSPENDED LOAD HAZARD

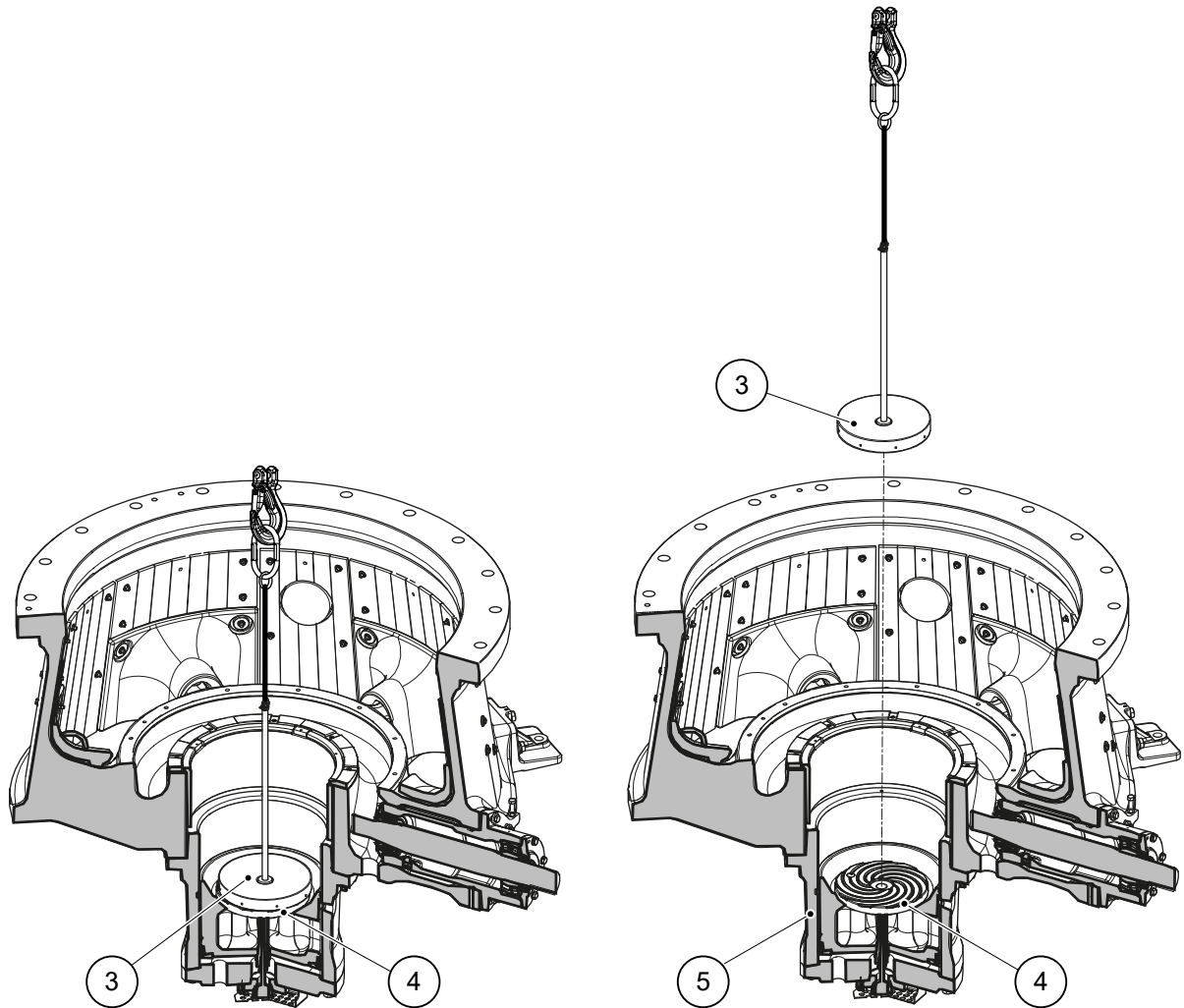
A main shaft step bearing weighs up to 23 kg (51 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

2. Make a circular movement while holding the lifting sling, until the adhesive oil film lets go. It is advisable to lift the step washer (3) a few centimeters at first, and then have a break for a few minutes. In case the piston wearing plate (4) is stuck to the step washer (3), it will then let go.
3. Lift off the step washer (3) very slowly upwards until it reaches the brim of the eccentric bushing.
4. Carefully lift until the whole step washer (3) is visible. Check that the washer (3) has come loose. If not, lower the step washer (3) carefully to its bottom position and follow the instructions from *step 2.*) again.

Maintenance Instructions

5. Lift off the step washer (3) from the piston wearing plate (4) and out from the Hydroset cylinder (5). Lower it onto timber supports on the ground.



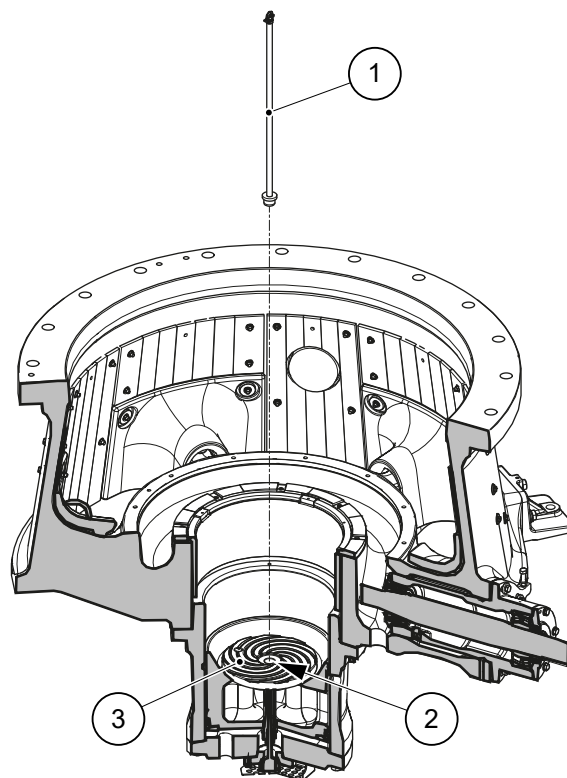
- 3 Step washer
4 Piston wearing plate
5 Hydroset cylinder

Maintenance Instructions

Note! *WLL (working load limit) for the lifting tool is 700 kg (1545 lbs).*

Note! *Avoid damaging or scratching the eccentric bushing.*

6. Attach the lifting tool (1) to the threaded hole (2) on the piston wearing plate (3).



- 1 Lifting tool
2 Threaded hole
3 Piston wearing plate

WARNING

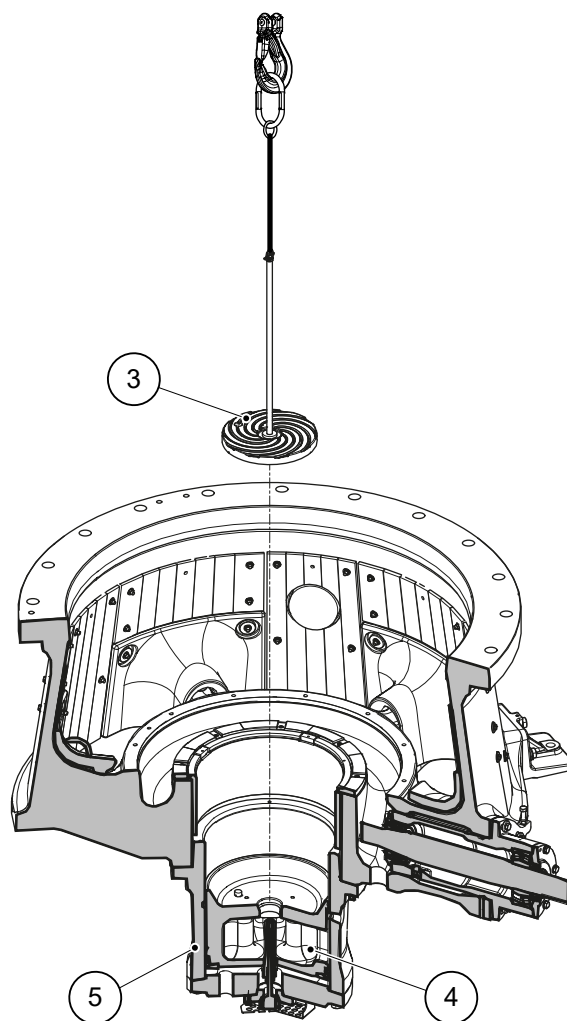


SUSPENDED LOAD HAZARD

A piston wearing plate weighs up to 25 kg (56 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

7. Lift off the piston wearing plate (3) from the Hydroset piston (4) and out from the Hydroset cylinder (5). Lower it onto timber supports on the ground.



3 *Piston wearing plate*

4 *Hydroset piston*

5 *Hydroset cylinder*

8. Remove the main shaft step, see section [3.3.6.1.Removing the main shaft step \(Page 98\)](#).

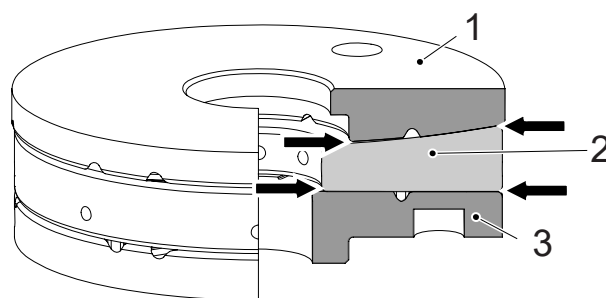
3.7.2.2

Inspecting the step bearing components

The main shaft step (1) and the piston wearing plate (3) are made of bronze with a high lead content, which sometimes causes a temporary blackening of the rubbing surfaces. The step washer (2) is made of steel. Even though the step washer manually wears less than the other two components all three must be changed at the same time to ensure that the geometry of the bearing is correct.

Recurrent problems with the step bearing indicate that the crusher is overloaded or that the oil is contaminated.

If the surfaces have been overheated, it is very likely that they are uneven. With the three step bearing components assembled on top of each other, use feeler gauges to measure the play between the step bearing components, as shown by the arrows.

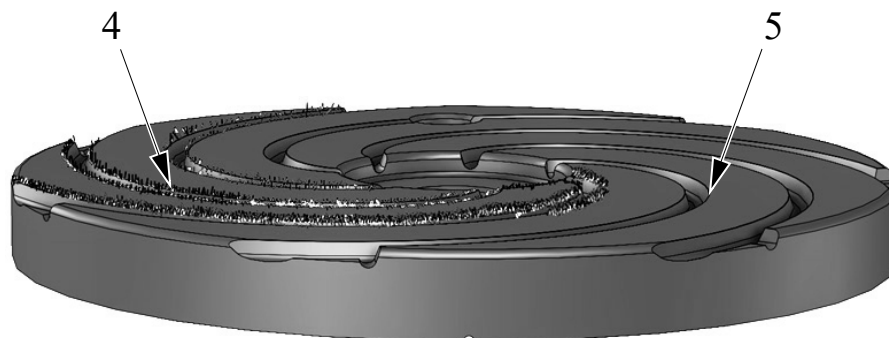


- 1 Main shaft step
- 2 Step washer
- 3 Piston wearing plate

Measure both from the outside and the inside at four points 90° apart. This means totally 16 measurements. The maximum permitted play is 0.03 mm (0.001 in).

Maintenance Instructions

1. Make sure that the step bearing and the main shaft step are clean from burr and have no sharp edges. If the grooves have burr or sharp edges (4), grind them to a radius of 0.2 mm (0.008").



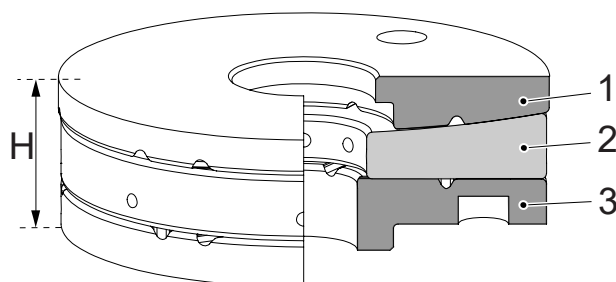
4 Burr

5 Sharp edge

Note!

If the wear on the step bearings is severe, see section [4.6.The pinion shaft does not operate correctly \(Page 280\)](#).

2. Use a straight-edge to measure the total thickness (H-dimension) of the step bearing. The thickness of a new step bearing is 110 mm (4.33 in). When the total thickness of the step bearing has been reduced to 95 mm (3.74 in), all three step bearing components must be replaced.



1 Main shaft step

2 Step washer

3 Piston wearing plate

3.7.2.3

Installing the step bearing components

Note!

WLL (working load limit) for the lifting tool is 700 kg (1545 lbs).

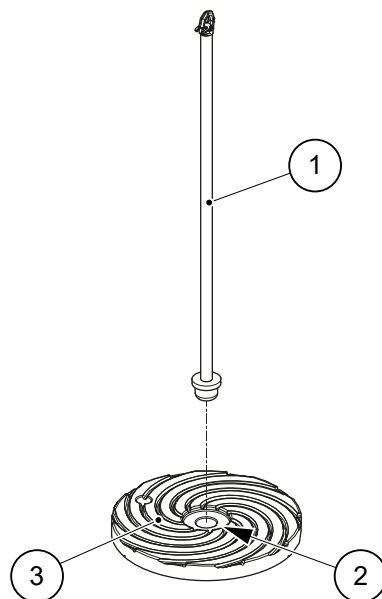
Note!

Avoid damaging or scratching the eccentric bushing.

1. Clean the piston wearing plate (3).
2. Turn the piston wearing plate (3) so that the flat (grooved) surface is facing upwards.

Maintenance Instructions

3. Attach the lifting tool (1) to the threaded hole (2) on the piston wearing plate (3).



- 1 Lifting tool
2 Threaded hole
3 Piston wearing plate

WARNING



SUSPENDED LOAD HAZARD

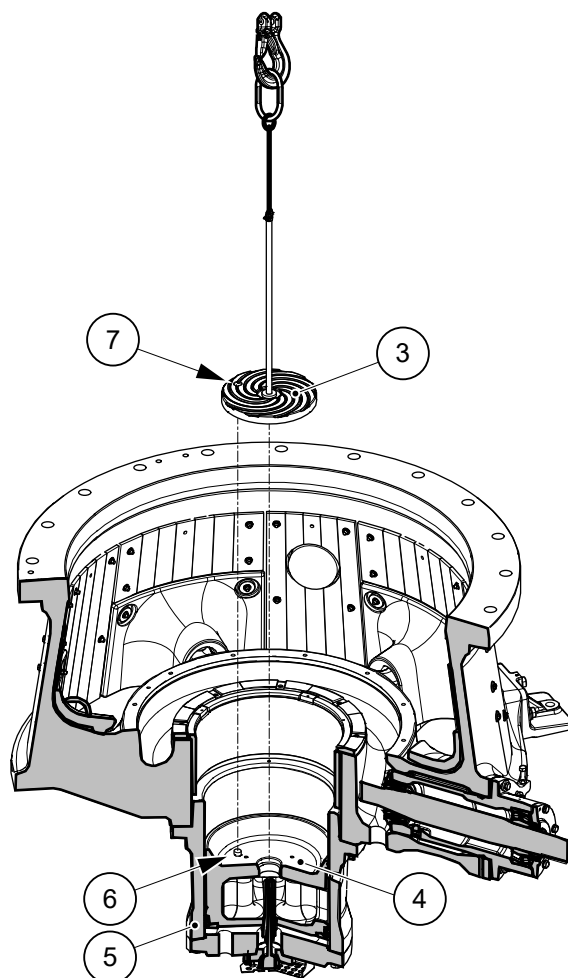
A piston wearing plate weighs up to 25 kg (56 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

4. Lift the step piston wearing plate (3).
5. Apply a coat of lubricating oil to the top surface of the piston wearing plate (3).
6. Align the hole (7) on the piston wearing plate (3) with the pin (6) on the Hydroset piston (4).

Maintenance Instructions

7. Lower the piston wearing plate (3) onto the Hydroset piston (4) in the Hydroset cylinder (5).

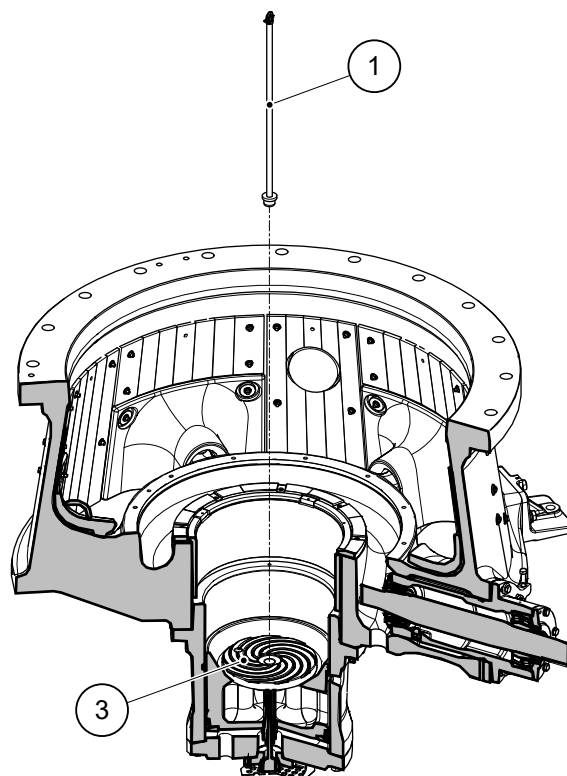


- 3 Piston wearing plate
- 4 Hydroset piston
- 5 Hydroset cylinder
- 6 Pin
- 7 Hole

8. Remove the lifting equipment.

Maintenance Instructions

9. Remove the lifting tool (1) from the piston wearing plate (3).



1 Lifting tool

3 Piston wearing plate

Note! **WLL (working load limit) for the lifting tool is 700 kg (1545 lbs).**

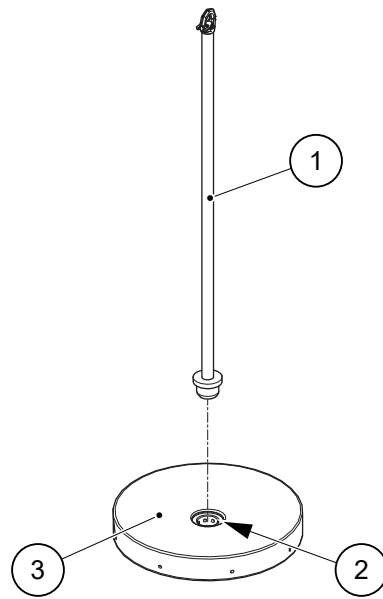
Note! **Avoid damaging or scratching the eccentric bushing.**

10. Clean the step washer (3).

11. Turn the step washer (3) so that the flat surface is facing downwards.

Maintenance Instructions

12. Attach the lifting tool (1) to the threaded hole (2) on the step washer (3).



- 1 Lifting tool
- 2 Threaded hole
- 3 Step washer

WARNING



SUSPENDED LOAD HAZARD

A main shaft step bearing weighs up to 23 kg (51 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

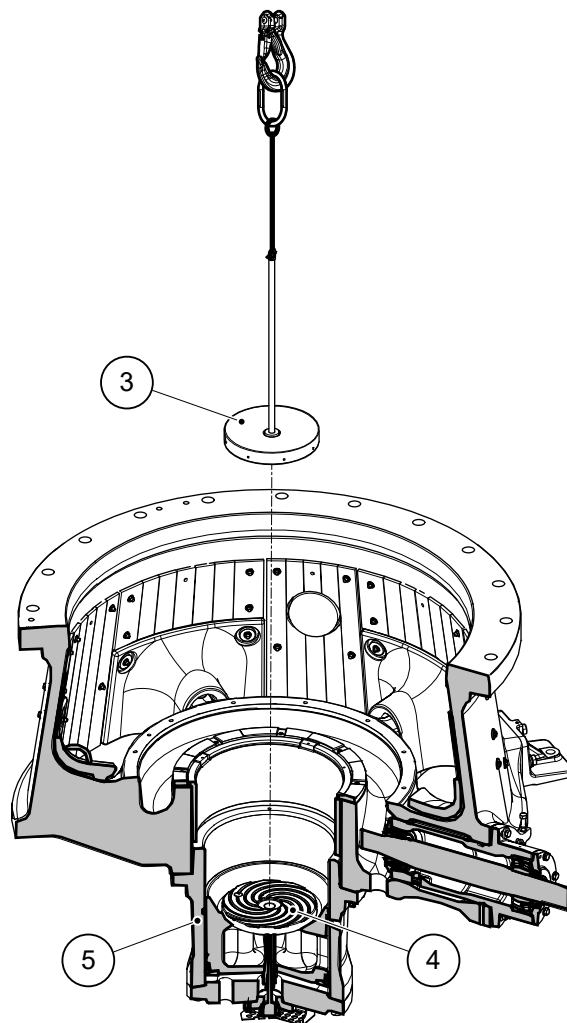
Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

13. Lift the step washer (3).

14. Apply a coat of lubricating oil to both surfaces of the step washer (3).

Maintenance Instructions

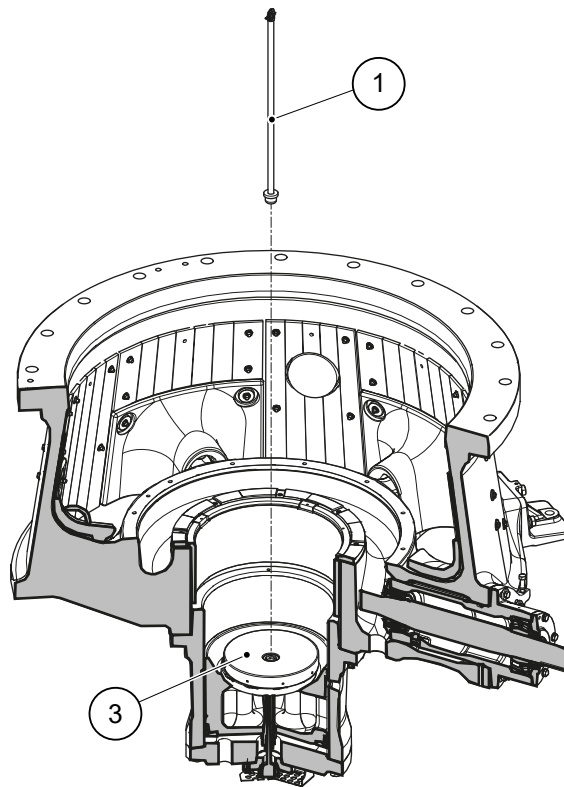
15. Lower the step washer (3) onto the piston wearing plate (4) in the Hydroset cylinder (5).



- 3 Step washer
4 Piston wearing plate
5 Hydroset cylinder

16. Remove the lifting equipment.

17. Remove the lifting tool (1) from the step washer (3).



- 1 Lifting tool
3 Step washer

18. Install the main shaft step, see section [3.3.6.3.Installing the main shaft step \(Page 100\)](#).

19. If a new set of step bearing components has been installed, follow the procedure described in [3.13.2.Running-in \(Page 269\)](#)

3.7.3

Replacing the chevron packing

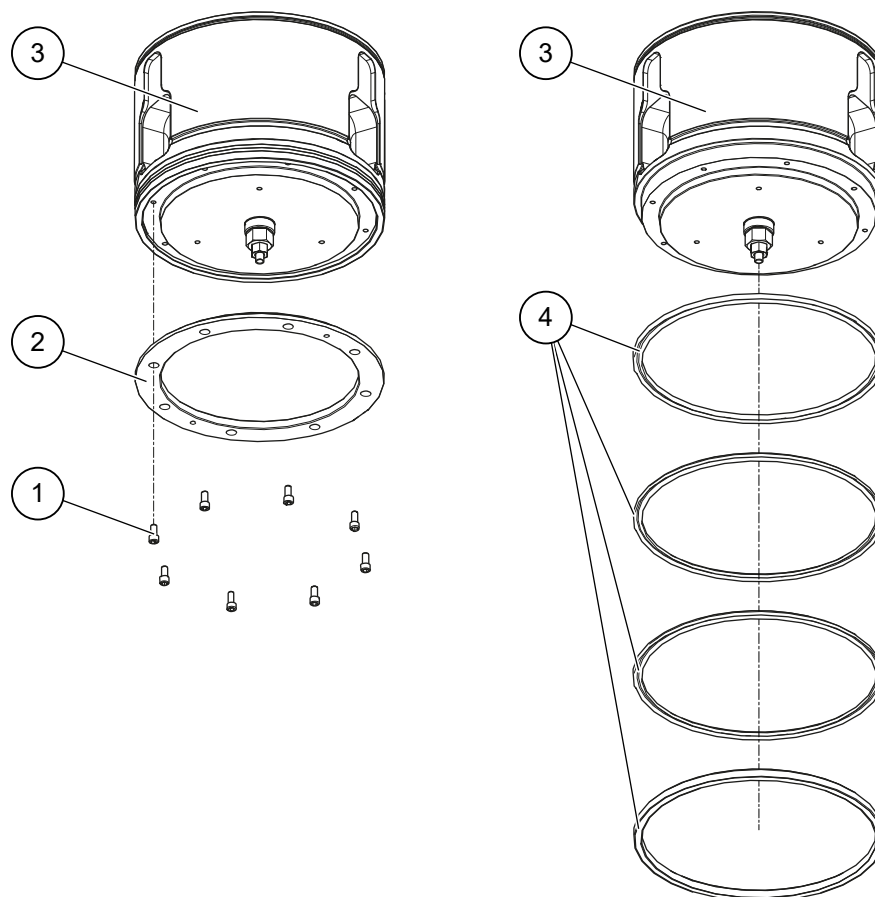
Note!

If only the chevron packing is to be changed, it is most convenient to do the job from below.

3.7.3.1

Removing the chevron packing

1. Remove the Hydroset piston, see [3.7.1.1.Removing the Hydroset piston \(Page 150\)](#).
2. Remove the screws (1) and the packing clamping plate (2) from the Hydroset piston (3).
3. Remove the chevron packing (4) from the Hydroset piston (3).



1 Screw

2 Packing clamping plate

3 Hydroset piston

4 Chevron packing

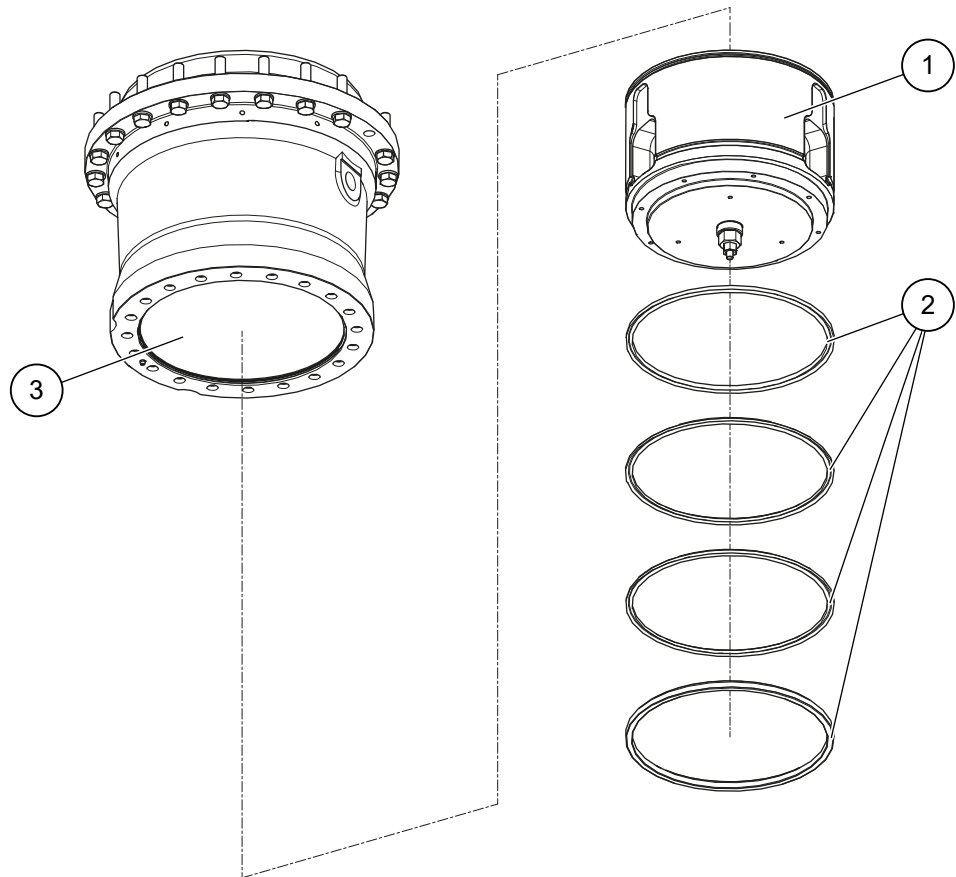
3.7.3.2

Inspecting the chevron packing

1. Remove the Hydroset cylinder, see section [3.7.1.1.Removing the Hydroset piston \(Page 150\)](#).
2. Inspect each ring of the chevron packing (2) for damage.
3. Inspect the step bearing components, see section [3.7.2.2.Inspecting the step bearing components \(Page 159\)](#) and the Hydroset cylinder bore, see section [3.7.5.2.Inspecting the Hydroset cylinder bushing \(Page 174\)](#).

Maintenance Instructions

4. Install the Hydroset cylinder, see section [3.7.1.3. Installing the Hydroset piston \(Page 152\)](#).



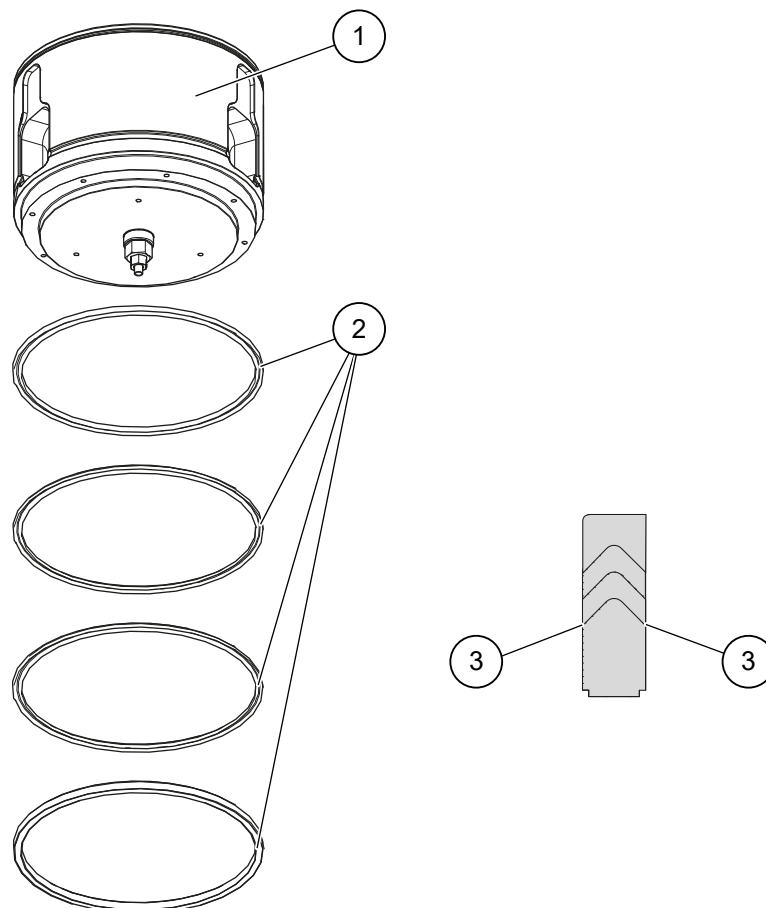
- 1 Hydroset cylinder
- 2 Chevron packing
- 3 Hydroset cylinder bore

3.7.3.3 **Installing the chevron packing**

1. Lubricate each ring of the chevron packing (2).

Maintenance Instructions

2. Install the chevron packing (2) on the Hydroset piston (1). Make sure that the sealing lips (3) point downward.

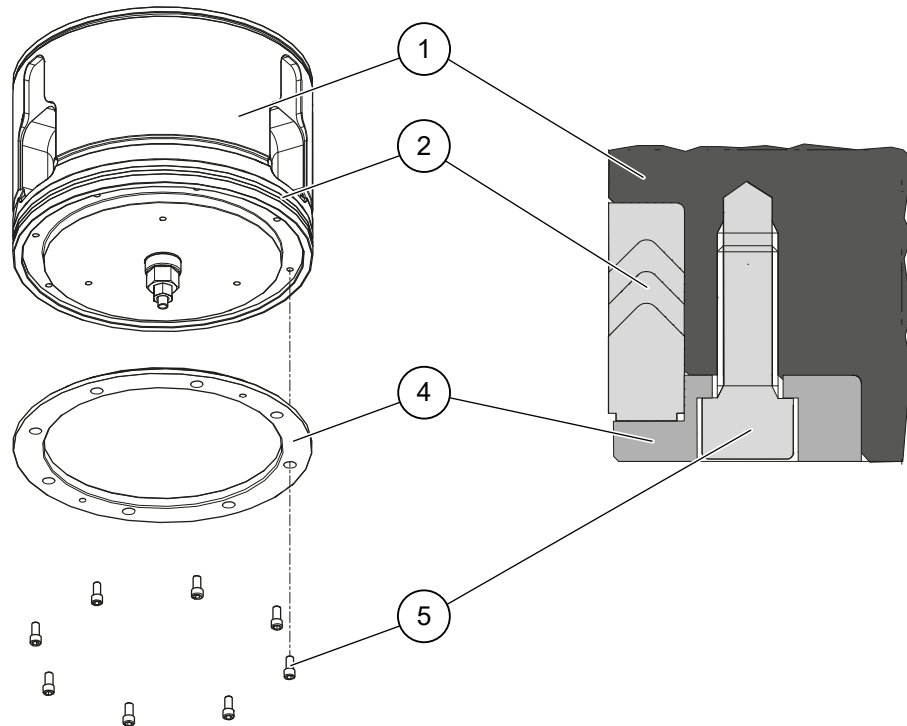


- 1 Hydroset piston
- 2 Chevron packing
- 3 Sealing lips

3. Apply locking fluid to the screws (5).
4. Attach the packing clamping plate (4) to the Hydroset piston (1) with the screws (5).
5. Torque the screws (5) to 70 Nm (52 ft lb.)

Maintenance Instructions

6. Make sure that the packing clamp plate (4) is pulled up tight against the Hydroset piston (1), so that the chevron packing (2) is compressed slightly.



1 Hydroset piston

2 Chevron packing

4 Packing clamping plate

5 Screw

Note!

The chevron packing (2) will be correctly clamped once it and the piston (1) is installed in the Hydroset cylinder.

3.7.4

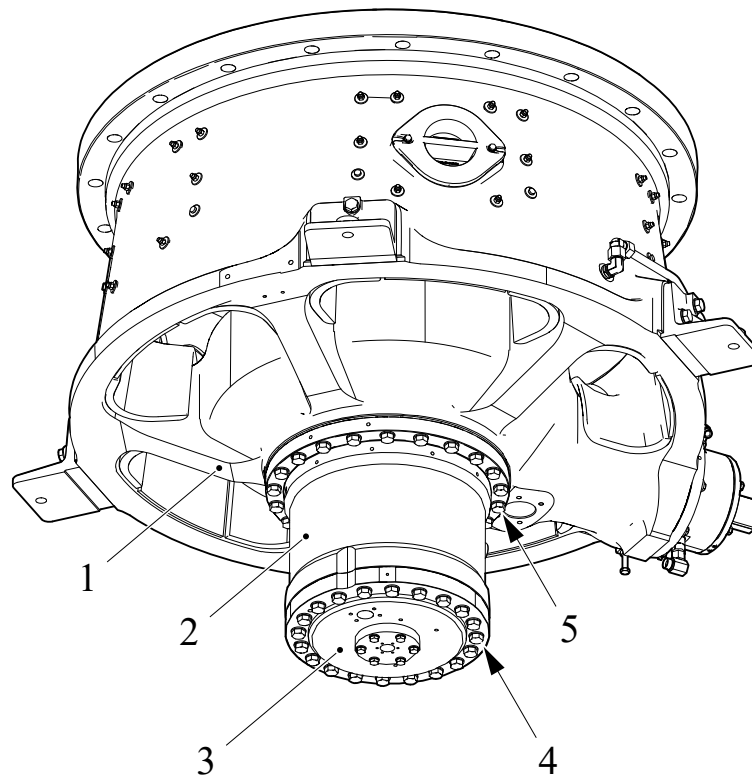
Checking the torque of the Hydroset cylinder joints

Normally, it is not necessary to remove the Hydroset cylinder (2) from the bottom shell (1) or the Hydroset cylinder cover (3) from the Hydroset cylinder (2).

The joints between the Hydroset cylinder (2) and the bottom shell (1) and the joint between the Hydroset cylinder cover (3) and the Hydroset cylinder (2) are sealed with O-rings. Unless there is severe leakage, they do not need to be replaced.

Hydroset cylinder cover/Hydroset cylinder and Hydroset cylinder/bottomshell joints

1. Lightly lubricate the screws (4) and (5) with oil.
2. Clean the threads in the bottom shell (1) and in the Hydroset cylinder (2).
3. Torque the screws (4) and (5) in stages, and in circular rotation. Refer to *Tightening torques* in *Technical specifications*. Use a torque wrench that can be calibrated, or a bolt/nut runner with a torque limiter.



1 Bottom shell

2 Hydroset cylinder

3 Hydroset cylinder cover

4 Screw

5 Screw

3.7.5

Replacing the Hydroset cylinder bushing

3.7.5.1

Removing the Hydroset cylinder bushing

1. Depending on the on-site circumstances, step 2 can be performed first or last.

WARNING

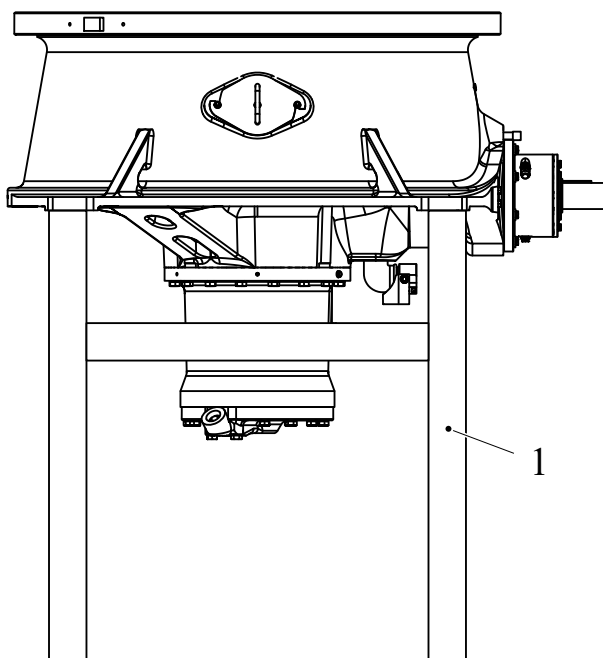


SUSPENDED LOAD HAZARD

A crusher weighs up to 16 200 kg (35 715 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

2. Remove the crusher from its foundation/subframe and place it in a clean environment. Place the crusher on a suitable support (1), which is placed on a hard surface. Make sure that there is enough room under the Hydroset cylinder in order to be able to remove the Hydroset cylinder bushing from below with the help of a hydraulic jack.

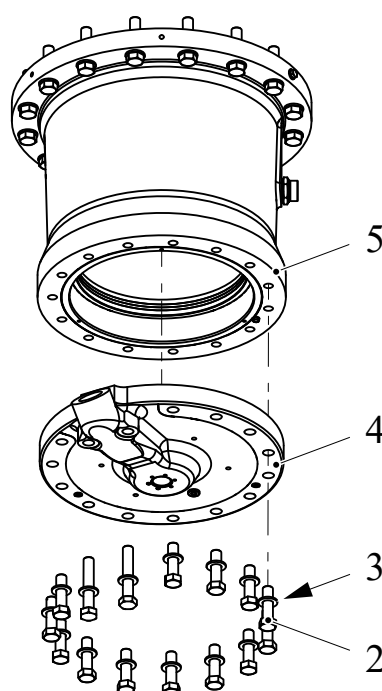


1 Support

3. Remove the feed hopper, see section [3.1.1.1.Removing the feed hopper \(Page 26\)](#).
4. Remove the spider cap, see section [3.2.1.1.Removing the spider cap \(Page 30\)](#) and the spider bearing grease.
5. Remove the top shell, see section [3.2.5.1.Removing the top shell \(Page 44\)](#).
6. Remove the main shaft, see section [3.3.1.1.Removing the main shaft assembly \(Page 63\)](#).
7. Remove the dust collar, see section [3.4.1.1.Removing the dust collar \(Page 112\)](#).
8. Remove the eccentric assembly, see section [3.5.2.1.Removing the eccentric assembly \(Page 126\)](#).

Maintenance Instructions

9. Remove the step washer and the piston wearing plate, see section [3.7.2.1.Removing the step bearing components \(Page 154\)](#).
10. Remove the Hydroset piston position transmitter and the Hydroset piston, see section [3.7.1.1.Removing the Hydroset piston \(Page 150\)](#).
11. Place a hydraulic jack with a wooden block under the Hydroset cylinder (5). Raise the jack until the wooden block supports the Hydroset cylinder cover (4) from below.
12. Remove the screws (2) and the washers (3).
13. Lower the jack and remove the Hydroset cylinder cover (4) from the Hydroset cylinder (5).

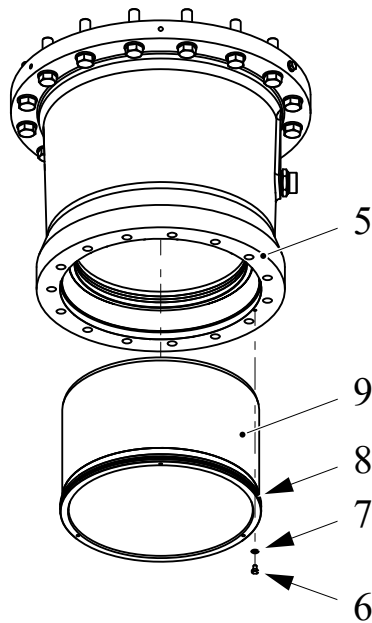


2 Screw
3 Washer

4 Hydroset cylinder cover
5 Hydroset cylinder

14. Place the hydraulic jack with a wooden block under the Hydroset cylinder (5). Raise the jack until the wooden block supports the Hydroset cylinder bushing (9) from below.
15. Remove the screw (6) and the washer (7).
16. Lower the jack and remove the Hydroset cylinder bushing (9) from the Hydroset cylinder (5).

17. Remove the o-ring (8) from the Hydroset cylinder bushing (9).



5 Hydroset cylinder
6 Screw
7 Washer

8 O-ring
9 Hydroset cylinder bushing

3.7.5.2

Inspecting the Hydroset cylinder bushing

1. Inspect the inner surface of the Hydroset cylinder bushing for damage, such as scratches or unevenness. No damage is permitted. (Scratches or unevenness can allow Hydroset oil to leak past the chevron packing into the lubrication system, and cause the Close Side Setting (CSS) to increase.)
2. Inspect the upper part of the Hydroset cylinder, above the bushing, which acts as a locating surface for the piston. Remove any scratches or unevenness by polishing.

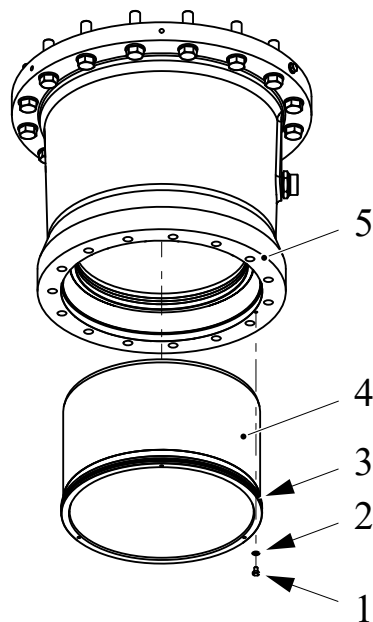
3.7.5.3

Installing the Hydroset cylinder bushing

1. Install a new O-ring (3) on the Hydroset cylinder bushing (4).
2. Coat the contact faces of the Hydroset cylinder bushing (4) and the Hydroset cylinder (5) with molybdenum disulfide.
3. Use a hydraulic jack and a wooden support to press the Hydroset cylinder bushing (4) into the Hydroset cylinder (5).

Maintenance Instructions

4. Lock Hydroset cylinder bushing (4) in position with the screw (1) and a washer (2).

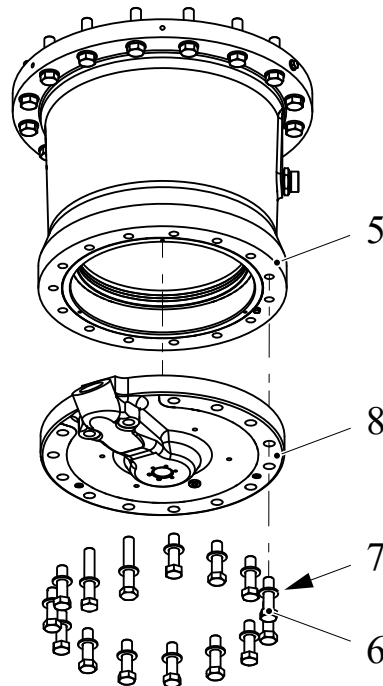


1 Screw
2 Washer
3 O-ring

4 Hydroset cylinder bushing
5 Hydroset cylinder

5. Use the hydraulic jack and a wooden support to raise the Hydroset cylinder cover (8) into position under the Hydroset cylinder (5).
6. Attach the Hydroset cylinder cover (8) to the Hydroset cylinder (5) with the screws (6) and the washers (7).

7. Tighten the screws (6), see section [3.7.4.Checking the torque of the Hydroset cylinder joints \(Page 170\)](#).



5 Hydroset cylinder
6 Screw

7 Washer
8 Hydroset cylinder cover

8. Depending on the on-site circumstances, [3.7.5.3.17 \(Page 177\)](#) can be performed first or last.
9. Install the Hydroset piston position transmitter and the Hydroset piston, see section [3.7.1.3.Installing the Hydroset piston \(Page 152\)](#).
10. Install the step washer and the piston wearing plate, see section [3.7.2.3.Installing the step bearing components \(Page 160\)](#).
11. Install the eccentric assembly, see section [3.5.2.3.Installing the eccentric assembly \(Page 128\)](#).
12. Install the dust collar, see section [3.4.1.3.Installing the dust collar \(Page 114\)](#).
13. Install the main shaft, see section [3.3.1.3.Installing the main shaft assembly \(Page 65\)](#).
14. Install the top shell, see section [3.2.5.3.Installing the top shell \(Page 46\)](#).
15. Install the spider cap, see section [3.2.1.3.Installing the spider cap \(Page 34\)](#) and the spider bearing grease.
16. Install the feed hopper, see section [3.1.1.3.Installing the feed hopper \(Page 27\)](#).



WARNING



SUSPENDED LOAD HAZARD

A crusher weighs up to 16 200 kg (35 715 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

17. Install the crusher onto its foundation/subframe.

3.7.6

Replacing the Hydroset piston position transmitter K1-GT1

3.7.6.1

Removing the Hydroset piston position transmitter K1-GT1

1. Lower the main shaft to its lowest position.
2. Remove the cover for the Hydroset piston position transmitter K1-GT1.
3. Place a suitable container under the Hydroset cylinder.

Note!

The oil volume to be drained is approximately 8 liters (2.1 US gallons).



WARNING



HIGH PRESSURE HAZARD

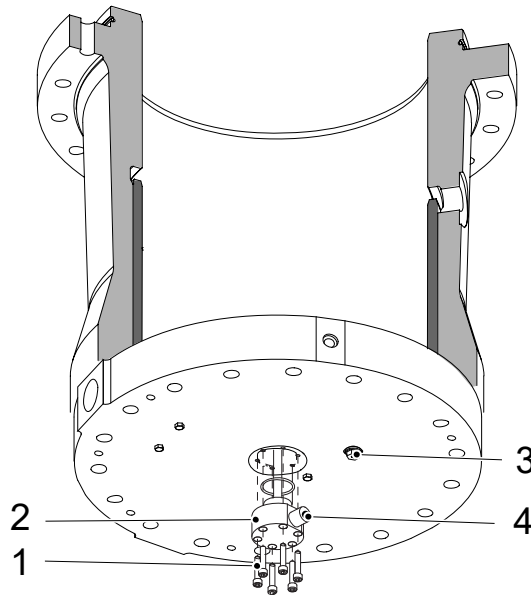
You can sustain injection and severing injuries if you are struck by a jet of oil.

Relieve the pressure before you carry out any work on the hydraulic/lubrication system.

4. Open the drain plug (3) to drain the crusher of oil.
5. Disconnect the signal cable (4) from the transmitter.
6. Remove the screws (1).

Maintenance Instructions

7. Carefully remove the transmitter.



- 1 Screw
- 2 Transmitter
- 3 Drain plug
- 4 Connector

3.7.6.2

Installing the Hydroset piston position transmitter K1-GT1

Note!

The 0.15 m signal convert cable W4103-01 for the Hydroset piston position transmitter, with the black sticker, K1-GT1 must be used and always connected. It provides a pin reconfiguration.

WARNING



HIGH PRESSURE HAZARD

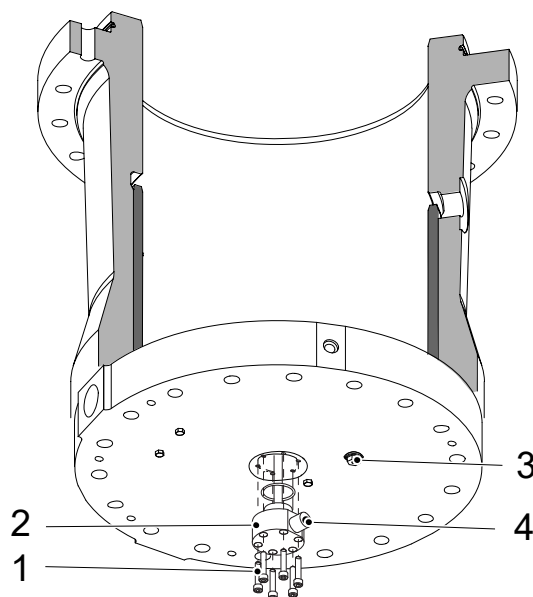
You can sustain injection and severing injuries if you are struck by a jet of oil.

Relieve the pressure before you carry out any work on the hydraulic/lubrication system.

1. Make sure the O-ring on the transmitter (2) is in place.
2. Install the transmitter (2).
3. Install the transmitter attachment screws (1). Refer to *Tightening torques* in the *Technical specifications*.
4. Connect the sensor cable to the transmitter.
5. Close the drain plug (3).
6. Install the cover for the Hydroset piston position transmitter K1-GT1.

Maintenance Instructions

7. Bleed the Hydroset system of air before operation, see section [3.8.1. Bleeding air from the Hydroset system \(Page 179\)](#).
8. Also calibrate the A-dimension before operation.



- 1 Screw
- 2 Transmitter
- 3 Drain plug
- 4 Connector

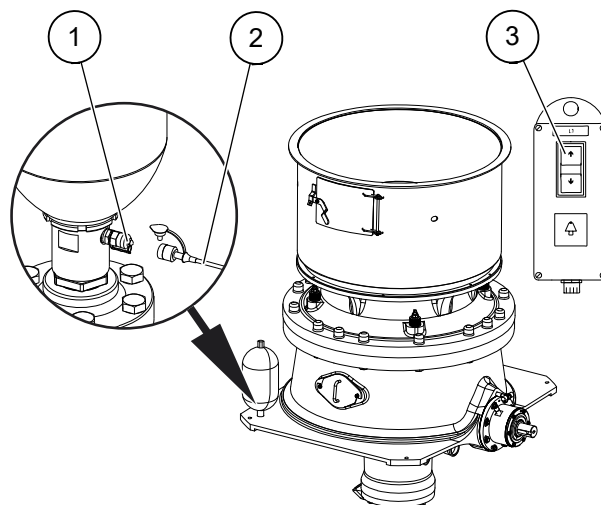
3.8 Hydroset system

3.8.1 Bleeding air from the Hydroset system

The air bleed measuring nipple (1) is mounted on the throat of the accumulator.

1. Raise the main shaft 2-4 millimeters (0.08-0.16") by using the CSS control box (3)CB1, which is located near the crusher.
2. Prepare to connect the air bleed hose (2) to the test point (1).
3. Position the free end of the air bleed hose in a suitable container.
4. Screw the hose onto the test point (1). The non-return valve in the test point (1) will automatically open when the hose is screwed on.
5. When the amount of air in the oil decreases, raise the main shaft 2-4 millimeters (0.08-0.16") more.
6. Repeat this until bubble-free oil comes out of the air bleed hose.

7. Unscrew the hose from the test point (1). The non-return valve in the test point (1) will automatically close.



- 1 Test point
- 2 Air bleed hose
- 3 CSS control box CB1

3.8.2

Checking the gas pressure

Fitting the charging kit

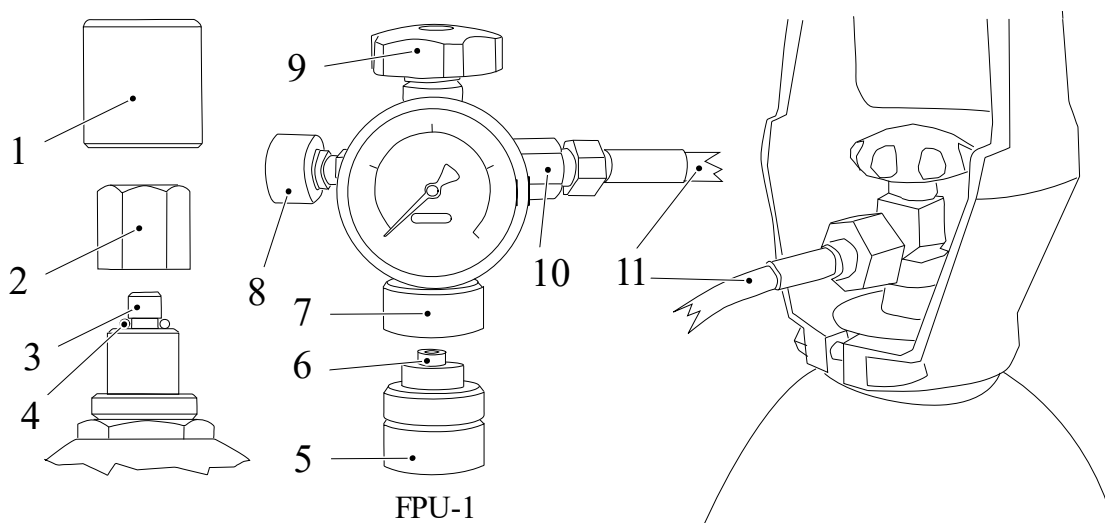
1. Remove the protective caps (1) and (2) from the accumulator's charging valve.
2. Unscrew the internal hexagon screw (6) so the cut on its side is visible over the top of the adapter (5).
3. Unscrew the spindle (9) as much as possible.
4. Close the bleed valve (8).
5. Attach the adapter (5) to the accumulator's charging nipple (3). Tighten by hand sufficiently to prevent gas leakage.
6. Attach the screw connector (7) to the adapter (5). Tighten by hand sufficiently to prevent gas leakage.
7. Screw down the spindle (9) so that the valve in the accumulator opens.
8. Read off the charging pressure on the pressure gauge.

Removing the charging kit

9. Unscrew the spindle (9).
10. Open the bleed valve (8).
11. Unscrew the screw connector (7) and remove the charging kit (FPU-1).
12. Remove the adapter (5) from the accumulator's charging nipple (3).
13. Check that there is no gas leakage from the valve. Use soapy water or oil for this check.

Maintenance Instructions

14. Refit the protective caps on the accumulator's charging valve.



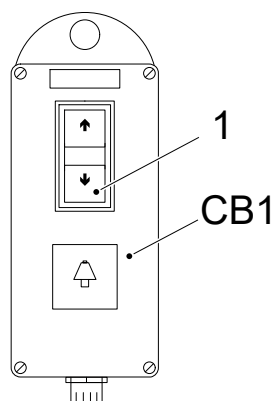
- 1 Protective cap
- 2 Protective cap
- 3 Nipple
- 4 O-ring
- 5 Adaptor
- 6 Hexagon screw

- 7 Screw connector
- 8 Bleed valve
- 9 Spindle
- 10 Connector
- 11 Charging hose

3.8.3

Relieving the Hydroset pressure

1. Lower the main shaft to the bottom position to relieve the Hydroset pressure. Use the arrow down button (1) on the CSS control box CB1.



- 1 Arrow down button
- CB1 CSS control box

3.8.4

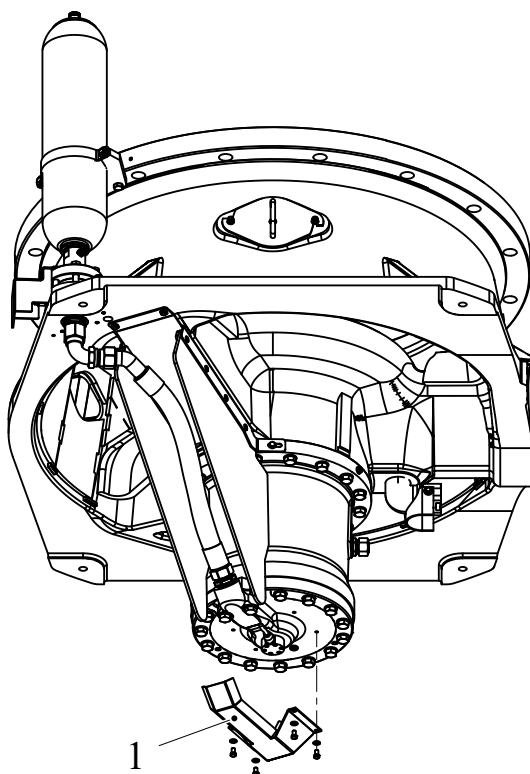
Replacing the hydraulic hose

3.8.4.1

Removing the hydraulic hose

1. Relieve the pressure in the Hydroset system, see section [3.8.3.Relieving the Hydroset pressure \(Page 181\)](#).

2. Remove the cover (1).

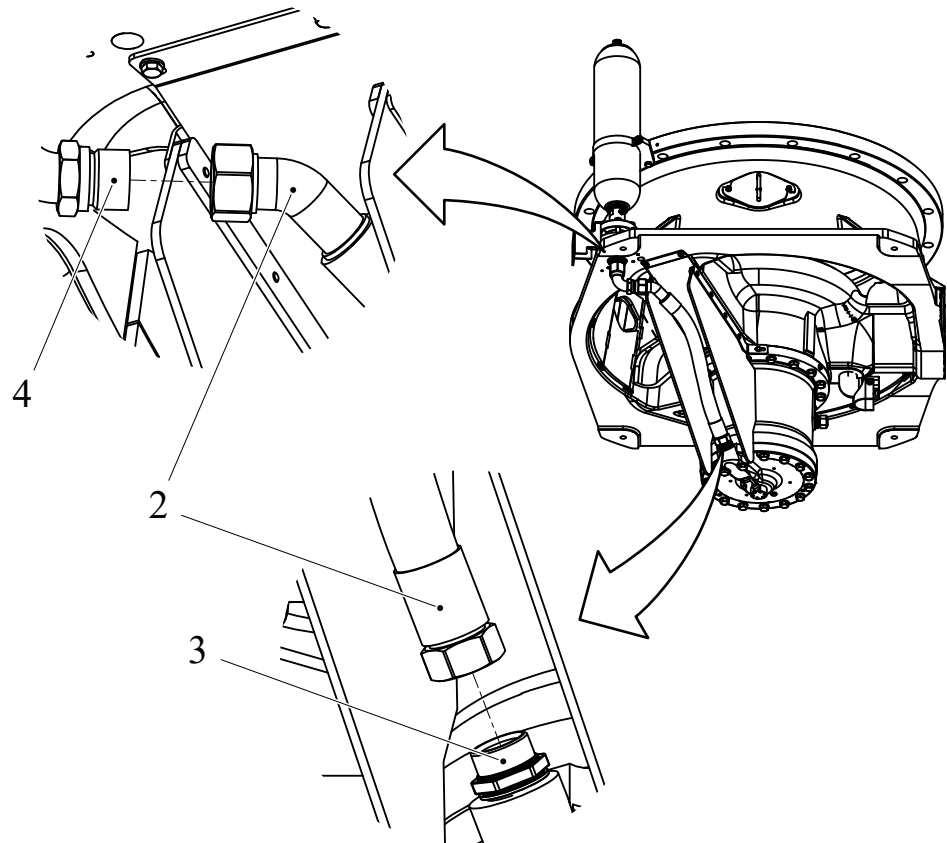


1 Cover

3. Put a suitable container under the hose (2).
4. Disconnect the hose (2) from the adapter (3) and drain the oil from the hose into the container.

Maintenance Instructions

5. Disconnect the hose (2) from the adapter (4).

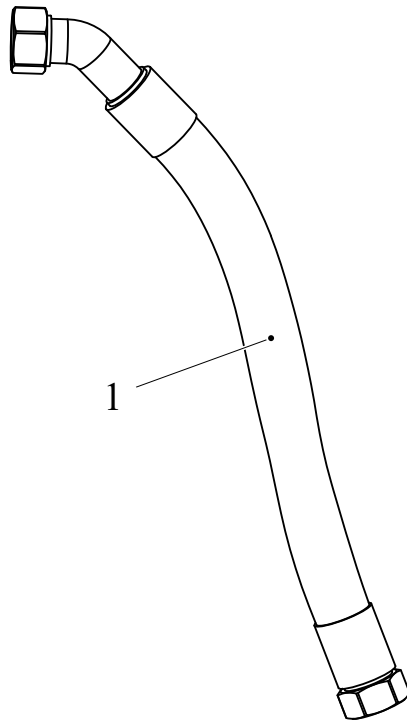


- 2 Hydraulic hose
3 Adapter
4 Adapter

Maintenance Instructions

3.8.4.2 *Inspecting the hydraulic hose*

1. Check the hose (1) for wear or damage. Replace if necessary.



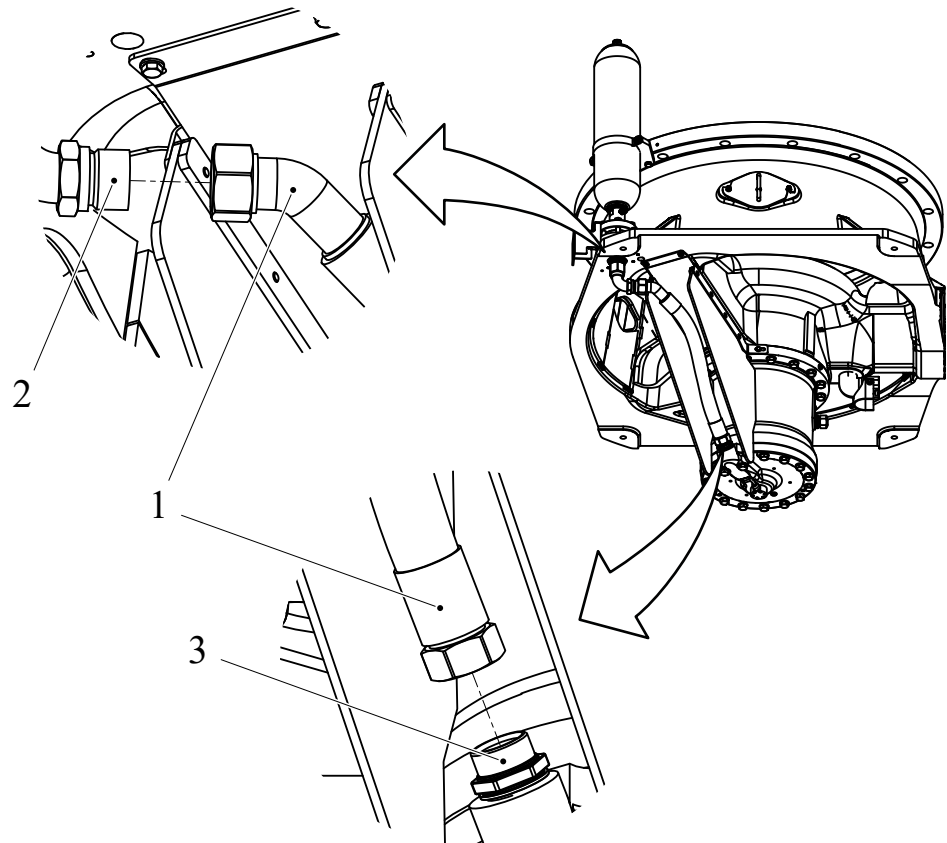
1 Hydraulic hose

3.8.4.3 *Installing the hydraulic hose*

1. Connect the hose (1) to the adapter (2).
2. Connect the hose (1) to the adapter (3).

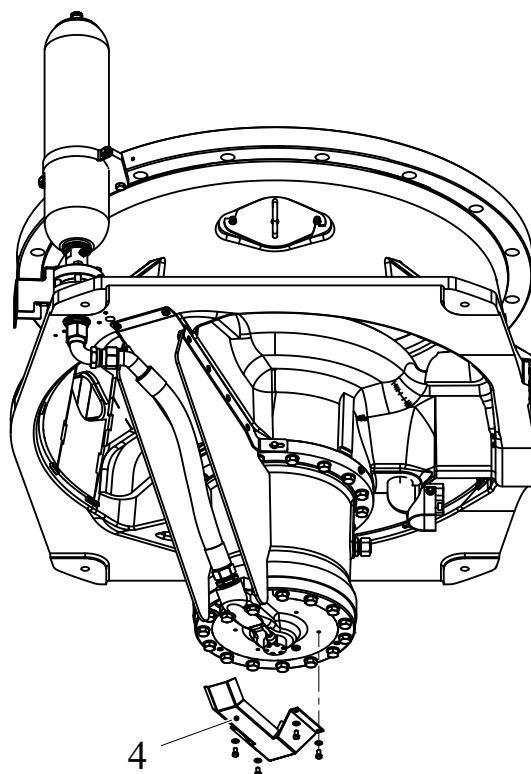
Maintenance Instructions

3. At both ends, torque the hose (1) to 300 Nm (221 lbf ft).



- 1 Hydraulic hose
- 2 Adapter
- 3 Adapter

4. Install the cover (4).



4 Cover

5. Restore and bleed the Hydroset system, see section [3.8.1. Bleeding air from the Hydroset system \(Page 179\)](#).

3.8.5

Checking the valves in the Hydroset control valve

1. Lower the main shaft as far as possible with the CSS control box CB1.
2. Stop and lock out the crusher so that it cannot be accidentally started.
3. Make sure the Hydroset pump motor K1-M1 cannot be started.
4. Close the shut-off valve K1-V1 between the Hydroset tank and the Hydroset control valve.
5. Loosen the lock nut (1) on the needle valve K1-V2 with a ring wrench.
6. Loosen the Allen head screw (2) on the needle valve K1-V2 with an Allen key.
7. Wait until the main shaft reaches its bottom position.
8. Press the push button K1-V3 and make sure that the pressure is 0 on the indicator K1-PI1.
9. Disconnect the hose from connection C in the Hydroset control valve K1-HA1 and plug the hose.
10. Unscrew and perform a visual inspection for any dirt in the valves K1-CV2, K1-CV1, K1-RV1, K1-RV2, K1-RV3 and K1-V2.
11. If needed, blow clean with compressed air.

Maintenance Instructions

12. Refit and tighten the valves carefully.



NOTICE

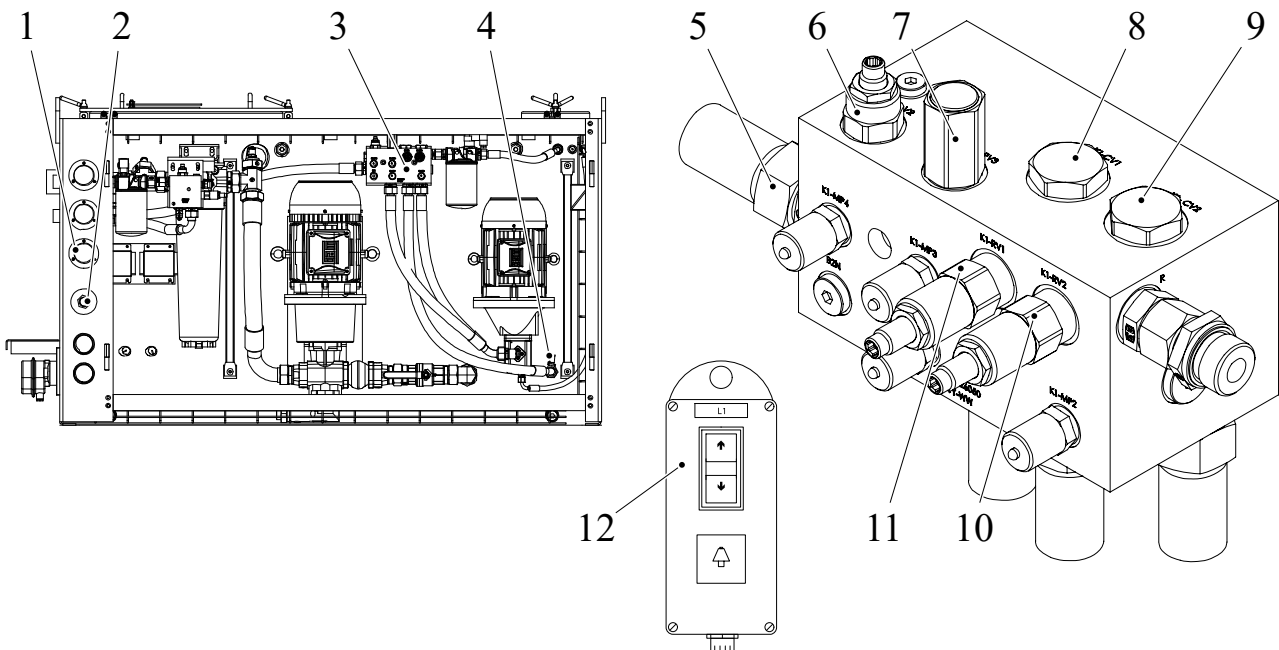
RISK OF EQUIPMENT OR PROPERTY DAMAGE
The valve breaks if it is tightened too much.
Be careful when you tighten the Allen head screw.

13. Tighten the Allen head screw (2) on the needle valve K1-V2.
14. Refit and tighten the lock nut (1) on the needle valve K1-V2.
15. Unplug and reconnect the hose to connection C.
16. Make sure there is oil in the valve K1-CV2, see section [3.13.1.Preparing a tank that has been stored more than six months \(Page 268\)](#).
17. IMPORTANT! Open the shut-off valve K1-V1 between the Hydroset tank and the Hydroset control valve.
18. Enable start of the Hydroset pump motor K1-M1. The crusher must be switched off.
19. Test raising and lowering the mainshaft.
20. If needed, bleed air from the Hydroset system, refer to section *Bleeding air from the Hydroset system* in the *Maintenance Instructions* for the crusher.
21. Set the mainshaft to the desired position.

Note!

If the Hydroset control valve still does not operate correctly, check for wear and/or damage and replace the damaged part.

Always keep the Hydroset system clean to reduce the risk that contamination interferes with the valve.



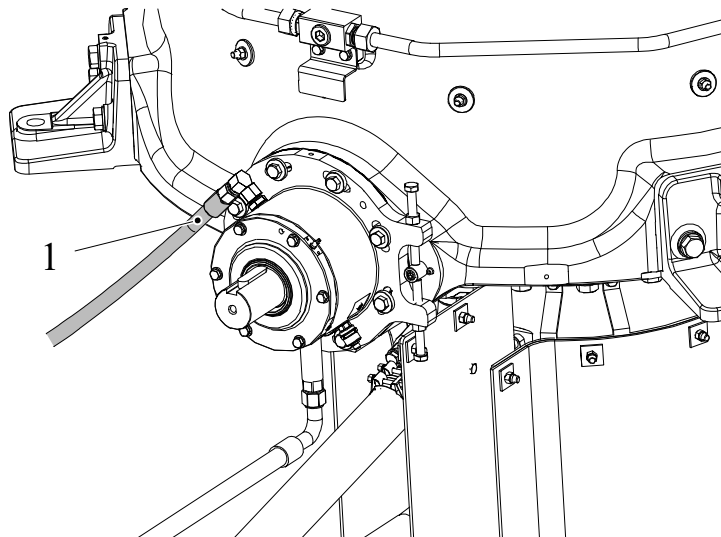
- 1 K1-PI1 Hydroset pressure indicator
- 2 K1-V3 Activates the Hydroset pressure indicator
- 3 K1-HA1 Hydroset control valve
- 4 K1-V1 Shut-off valve, Hydroset tank to Hydroset control valve
- 5 C Connection, Hydroset control valve to crusher
- 6 K1-V2 Needle valve, relieves the hydraulic pressure
- 7 K1-RV3 Valve, limits the maximum pressure in the Hydroset cylinder
- 8 K1-CV2 Check valve, used when increasing the CSS
- 9 K1-CV1 Check valve, used when decreasing the CSS
- 10 K1-RV2 Valve, limits the pump pressure
- 11 K1-RV1 Valve, used to build up the pilot pressure for the check valve K1-CV3
- 12 CB1 CSS control box

3.9 Pinionshaft housing

3.9.1 Checking the oil flow to the pinionshaft housing

Carry out this check above the opening of the main lubrication oil tank – after removing the cover – to avoid oil spillage.

1. Disconnect the oil hose L2-H4 from the pinionshaft housing.
2. Put the hose into a container with a known volume.
3. Measure the time it takes to fill the container. Examples:
It takes 60 seconds to fill a 1 liter container. The oil flow is $(60/60) \times 1 = 1$ l/min.
It takes 60 seconds to fill a ¼ US gallon container. The oil flow is $(60/60) \times \frac{1}{4} = \frac{1}{4}$ US gal/min.



1 L2-H4 Oil hose

4. Reconnect the oil hose L2-H4 to the pinionshaft housing.

3.9.2 Replacing the pinion shaft housing assembly

3.9.2.1 Checks prior to removal

Note! *If the pinion shaft housing is warm, allow it to cool before you perform the steps below.*

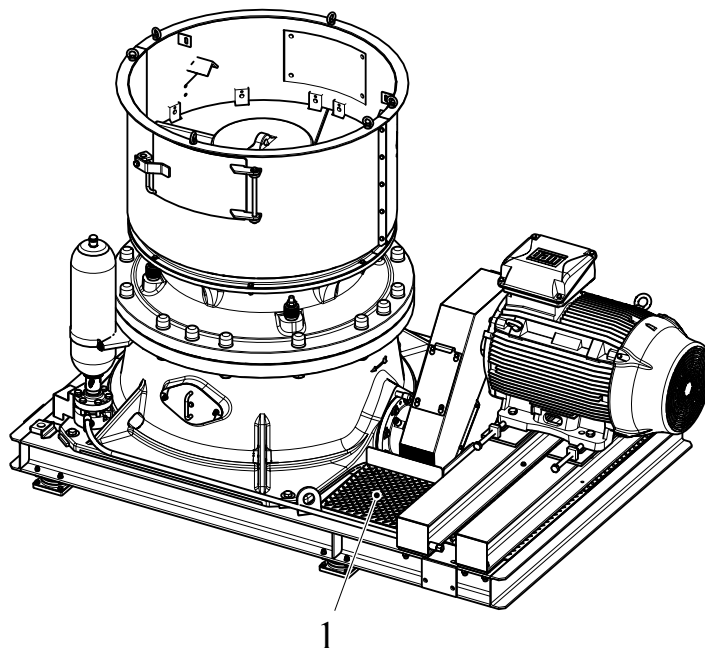
1. Measure the gear backlash. See section [3.9.4.1. Checking the gear backlash \(Page 238\)](#).
2. Check the axial play in the bearings by pulling the crusher drive shaft outwards. Play can be an indication that a bearing replacement is necessary.

Note! *This measure will be useful if the gasket is damaged when the pinion shaft assembly is removed from the crusher.*

3. Measure the distance between the pinion shaft housing flange and the bottom shell with a feeler gauge. There is a recess (5) in the edge of the gasket to facilitate this. Make a note of the measured distance.

3.9.2.2 Preparations before removing the pinion shaft housing

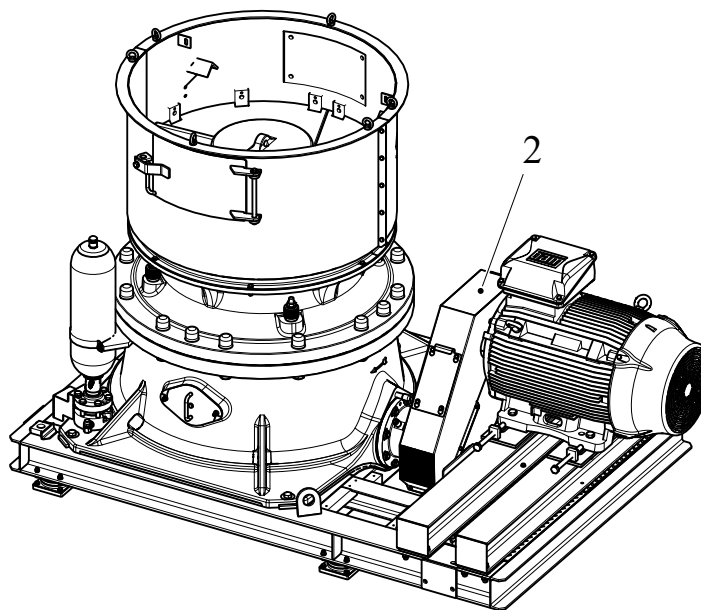
1. Remove the floor (1).



1 Floor

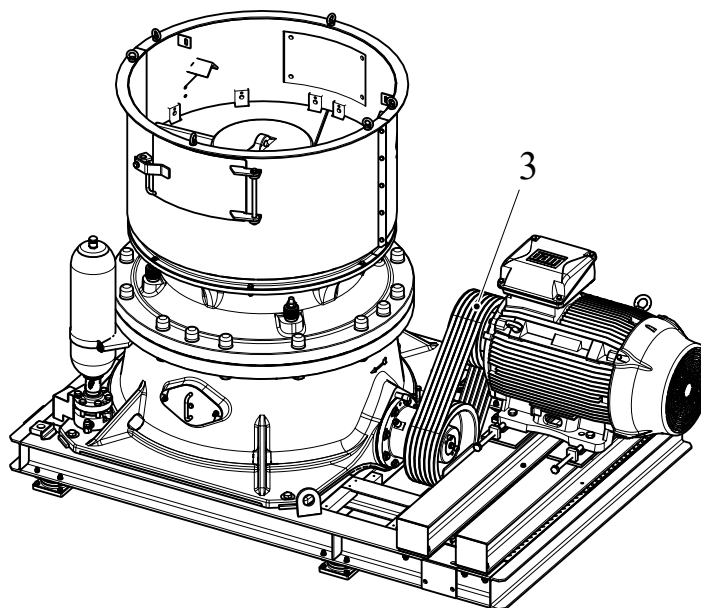
Maintenance Instructions

2. Remove the V-belt guards (2), see section [3.11.2.1.Removing the V-belt guards \(Page 250\)](#).



2 V-belt guards

3. Remove the V-belts (3), see section [3.11.3.1.Removing the V-belts \(Page 251\)](#).



3 V-belts

WARNING

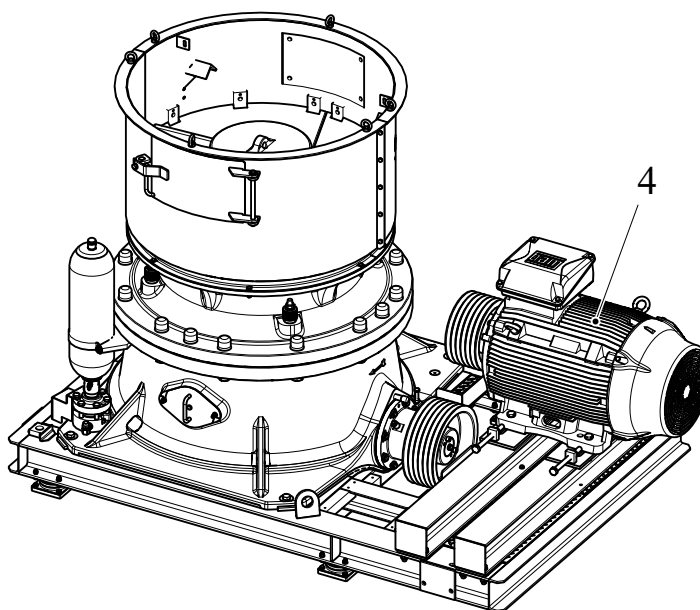


SUSPENDED LOAD HAZARD

A drive motor weighs up to 1 500 kg (3 307 lbs) $\pm 10\%$. You can sustain crush injuries, fall or even die if you are struck by the load.

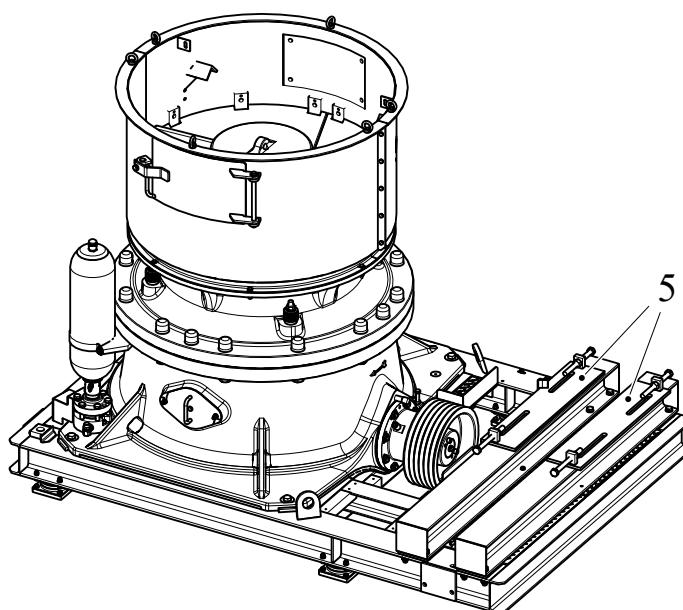
Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

4. Remove the motor (4), see section [3.11.4.1.Removing the V-belt drive motor \(Page 253\)](#).



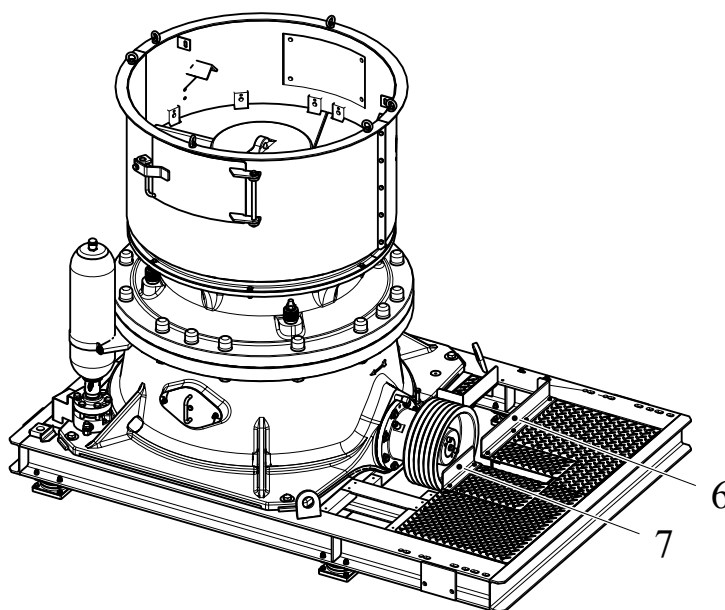
4 Motor

5. Remove the motor brackets (5).



5 Motor bracket

6. Remove the angle bars (6) and (7).

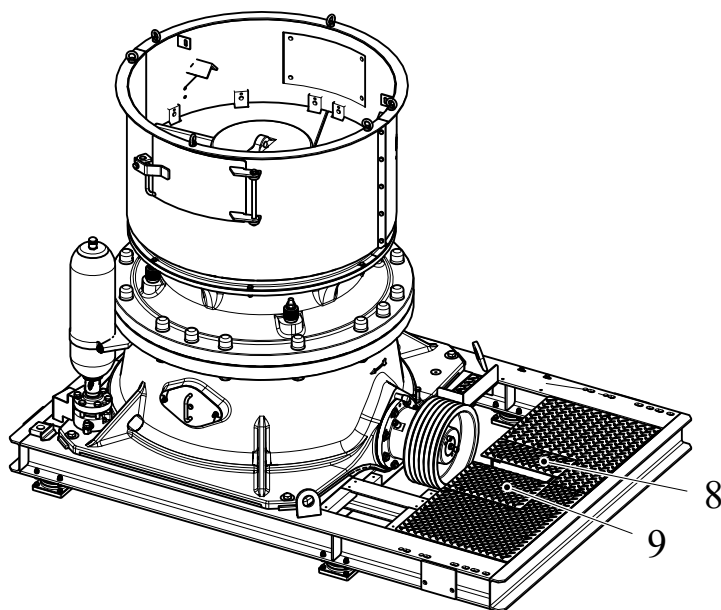


6 Angle bar

7 Angle bar

Maintenance Instructions

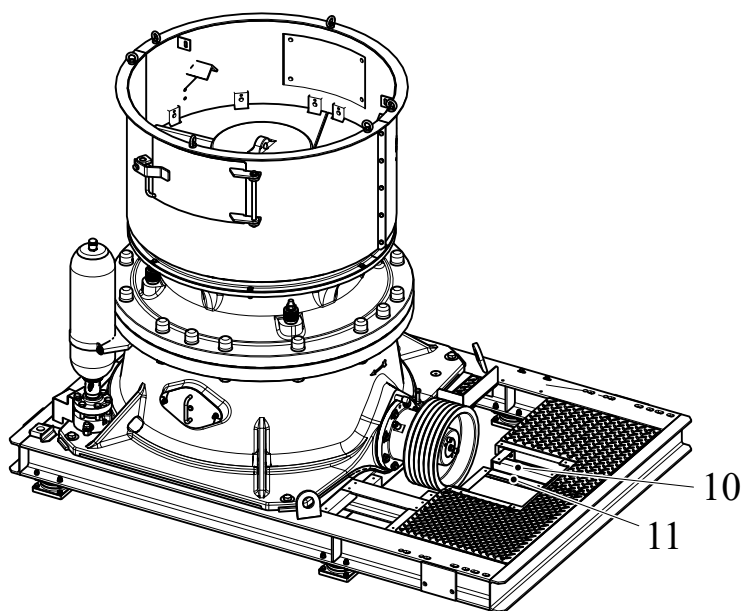
7. Remove the floors (8) and (9)



8 Floor

9 Floor

8. Remove the floor supports (10) and (11).



10 Floor support

11 Floor support

3.9.2.3

Removing the pinion shaft housing assembly

Note!

It is necessary to remove drive parts before proceeding with this instruction, see section [3.11.4.1.Removing the V-belt drive motor \(Page 253\)](#).

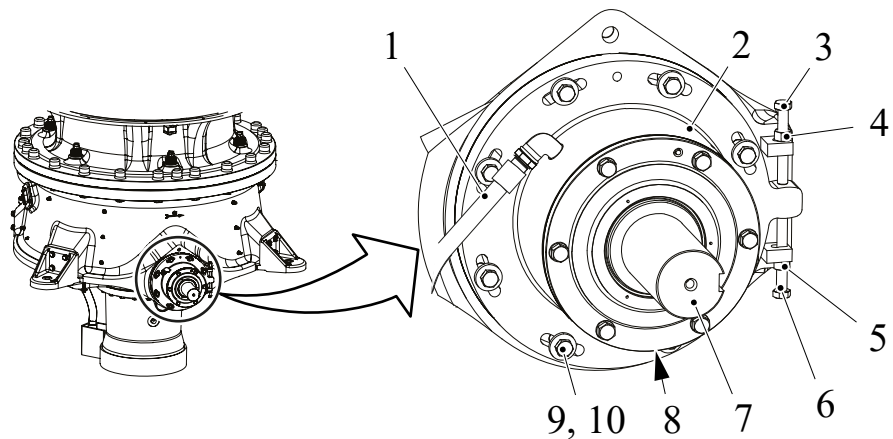
Maintenance Instructions

Note! *If the pinion shaft housing is warm, allow it to cool before performing the steps below.*

1. Remove the oil hose (1) from the pinion shaft housing (2).
2. Remove the magnetic drain plug (6) in the bottom of the pinion shaft housing (2) and drain out the oil.

Note! *Check if there is metal swarf or similar on the drain plug. If this is the case, the pinion shaft bearings have probably been damaged.*

3. Make sure that the lock nut (4) on the upper backlash adjustment screw (3) is tight.
4. Loosen the lock nut (5) on the lower backlash adjustment screw (6).
5. Remove the lower backlash adjustment screw (3).
6. Remove the screws (9) and the washers (10) that attach the pinion shaft housing assembly (2) to the bottom shell.



1 Oil hose

2 Pinion shaft housing assembly

3 Upper backlash adjustment screw

4 Lock nut

5 Lock nut

6 Lower backlash adjustment screw

7 Pinion shaft

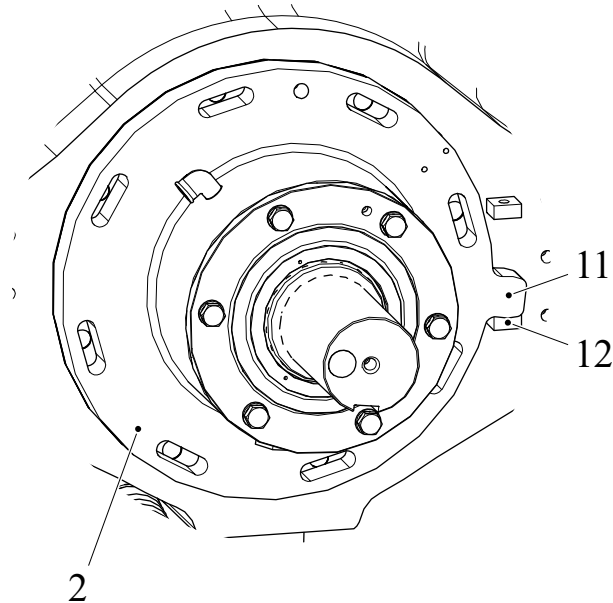
8 Drain plug (obscured in the illustration)

9 Screw

10 Washer

Maintenance Instructions

7. Rotate the pinion shaft housing assembly (2) so that the protrusion (11) on the flange rests against the bracket (12) of the lower backlash adjustment screw (4).



2 Pinion shaft housing assembly
11 Protrusion
12 Bracket

8. Position the hook of a crane vertically above the pinion shaft.
9. Place a lifting sling (13) around the end of the pinion shaft housing assembly (2) and attach the sling to the lifting hook.
10. Install two press screws in the threaded holes, at 180° spacing.
11. Tighten the press screws to push the pinion shaft housing assembly (2) out from its seating in the bottom shell. Let the assembly hang in the opening in the bottom shell.
12. Move the lifting sling (13) to the opposite side of the housing flange (14).
13. Place a lifting sling (13) around the pinion shaft housing assembly (2) and attach it to the lifting hook. Remove the present lifting chain from the hook.
14. Pull the pinion shaft housing assembly further and move the lifting sling inwards until the assembly is in balance.

WARNING

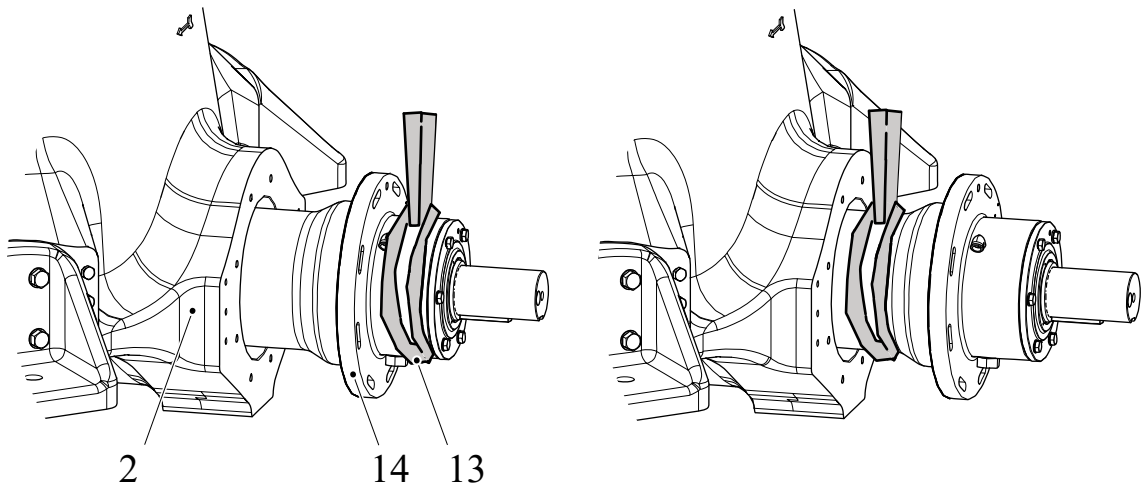


SUSPENDED LOAD HAZARD

A pinion shaft housing assembly weighs up to 251 kg (553 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

15. Lift the pinion shaft housing assembly out of the bottom shell and place it on a pair of trestles.



- 2 Pinion shaft housing assembly
- 13 Lifting sling
- 14 Flange

3.9.2.4

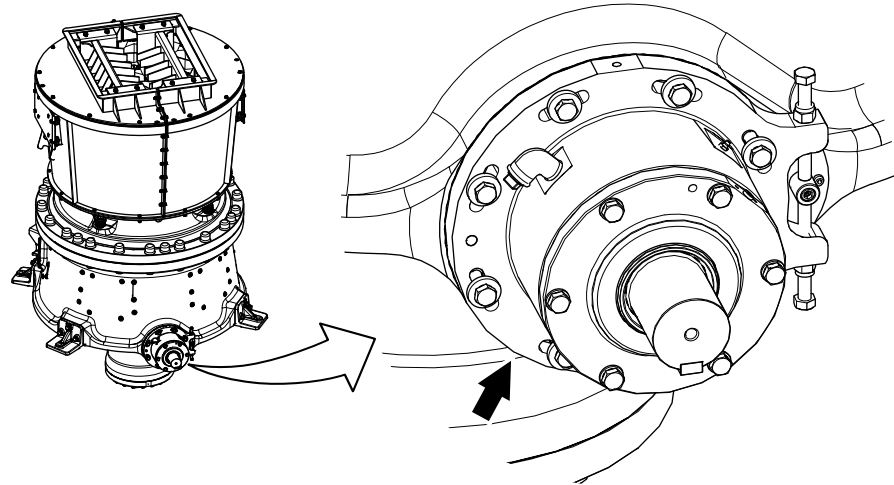
Inspecting the pinion shaft housing assembly

Inspect the tooth bearing “footprint” according to section [3.9.4.4. Tooth bearing “footprint” \(Page 243\)](#).

If no components have been replaced and the pinion shaft housing assembly is to be re-installed, fit a gasket of appropriate thickness between the pinion shaft flange and the bottom shell. Use the measurement noted during the removal. See section [3.9.2.1. Checks prior to removal \(Page 189\)](#) and the table in section [3.9.4.3. Determining the gasket thickness \(Page 242\)](#).

Note!

Make sure that the gasket is mounted with the measuring recess (arrow) in the correct position, seen from the side.



3.9.2.5

Installing the pinion shaft housing assembly

1. Place a lifting sling (2) around the pinion shaft housing (3), on the pinion side of the flange (4).
2. Position the hook of a crane vertically above the pinion shaft housing assembly.
3. Attach the lifting sling (2) to the hook.
4. Take up the slack in the lifting tackle.
5. Adjust the position of the sling to keep the assembly in balance.

Note!

When the pinion shaft assembly is to be put back into the bottom shell, make sure that the protrusion (5) in the housing flange is in the correct position relative to the bracket (6) for the lower adjustment screw.

WARNING

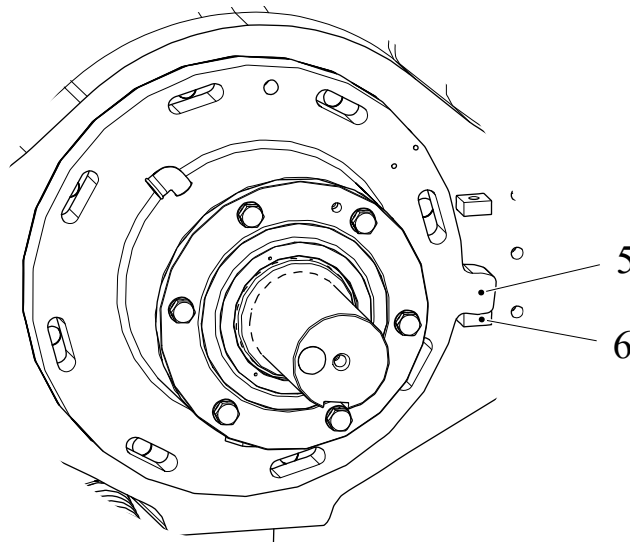
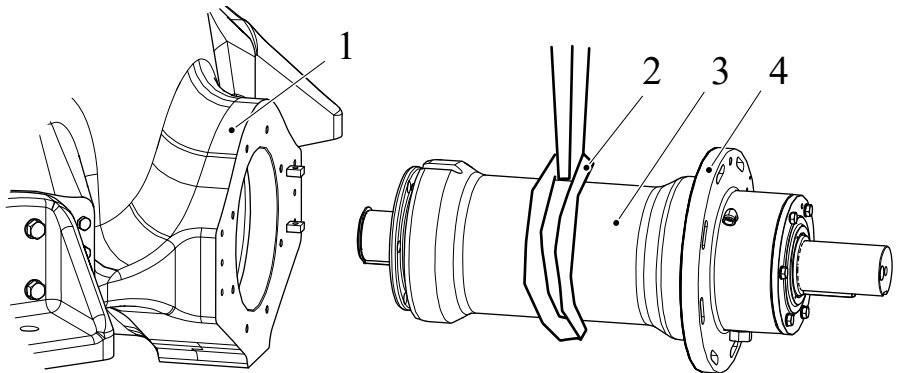


SUSPENDED LOAD HAZARD

A pinion shaft housing assembly weighs up to 251 kg (553 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

6. Lift the pinion shaft housing assembly and position it in line with the hole in the bottom shell.



- 1 Seating
- 2 Lifting sling
- 3 Pinion shaft housing
- 4 Flange
- 5 Protrusion
- 6 Bracket

WARNING

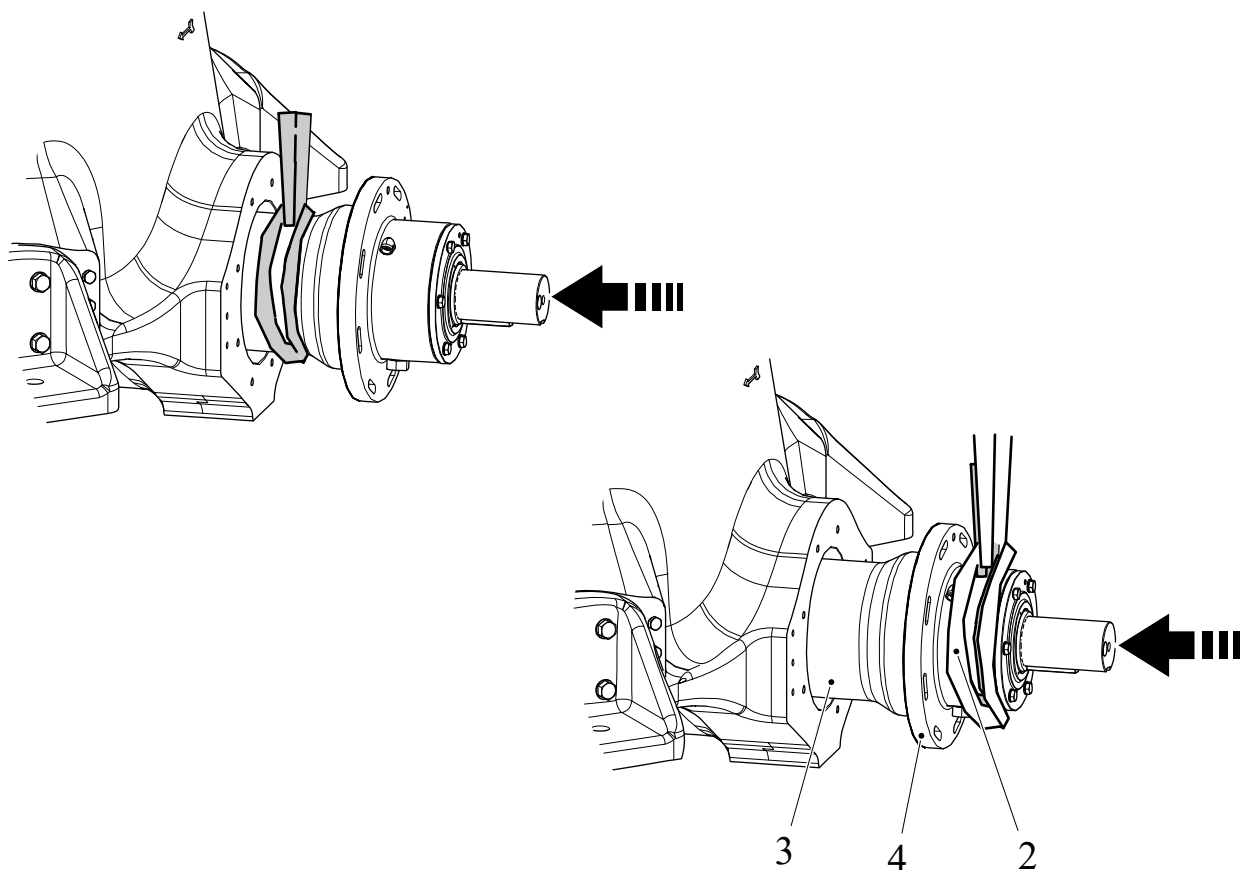


MOVING AND FIXED PARTS HAZARD

You can sustain crush injuries if body parts get caught between the pinion shaft housing and the bottom shell.

Be careful when you maneuver the pinion shaft housing.

7. Push the pinion shaft housing assembly into the bottom shell. This may require moving the lifting sling outwards as the assembly moves into the bottom shell.

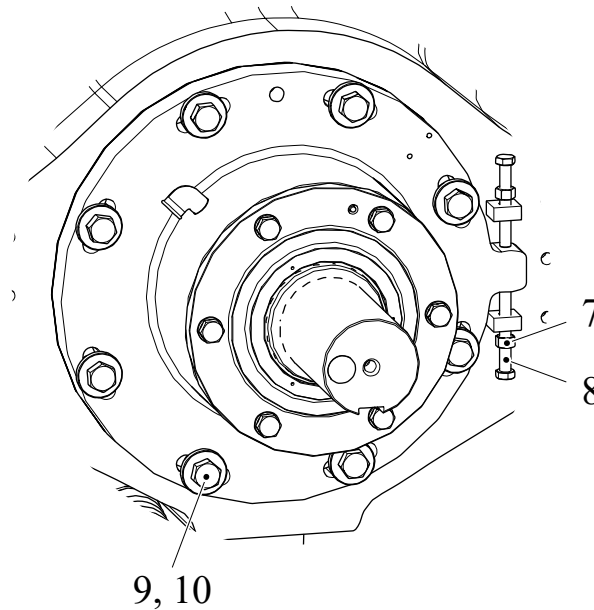


- 2 *Lifting sling*
- 3 *Pinion shaft housing*
- 4 *Flange*

8. When the pinion shaft housing assembly gets closer to its correct position in the bottom shell, slowly turn the shaft backwards and forwards to make sure that the pinion meshes correctly with the eccentric gear.
9. Install the screws (9) and the washers (10) in the bottom shell.

Maintenance Instructions

10. Install the lower backlash adjustment screw (8) and its lock nut (7).



7 Lock nut

9 Screw

8 Adjustment screw

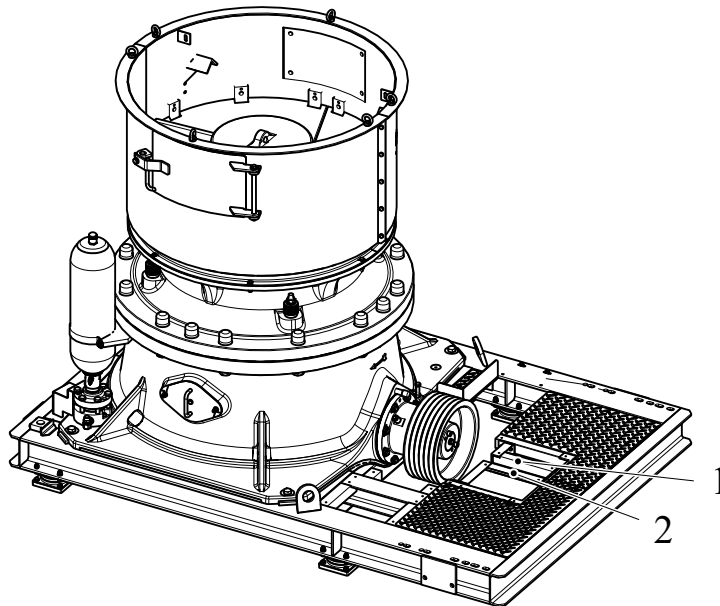
10 Washer

11. Torque the screws that clamp the pinion shaft housing assembly to the bottom shell, refer to *Tightening torques* in the *Technical Specifications*.
12. Make sure that the distance between the flange of the pinion shaft housing and the bottom shell is the same as before the pinion shaft assembly was removed, see section [3.9.2.1.Checks prior to removal \(Page 189\)](#).
13. Examine the backlash in the gears, see section [3.9.4.1.Checking the gear backlash \(Page 238\)](#).
14. Install all the components of the circulatory pinion shaft lubrication system.
15. Fill the pinion shaft housing with oil to the correct level, see section [3.12.1.Checklist for an overhauled crusher \(Page 266\)](#).

3.9.2.6

Restoration after installing the pinion shaft housing

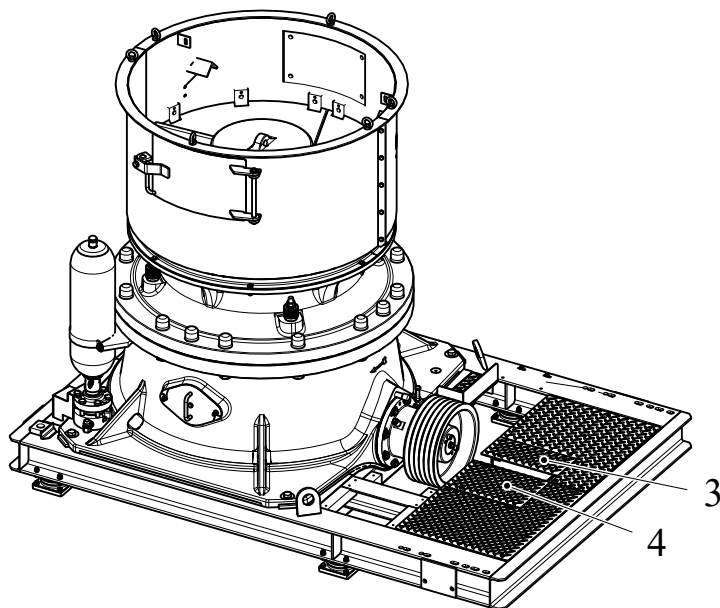
1. Install the floor supports (1) and (2).



1 Floor support

2 Floor support

2. Install the floors (3) and (4).

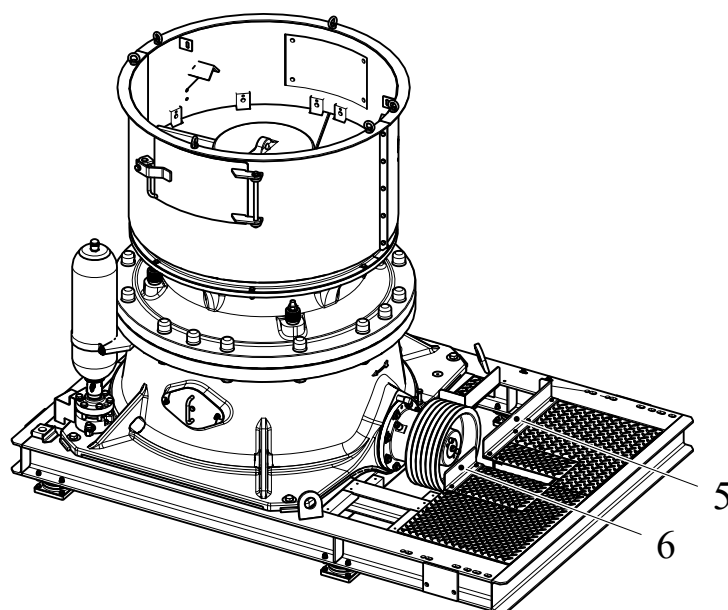


3 Floor

4 Floor

Maintenance Instructions

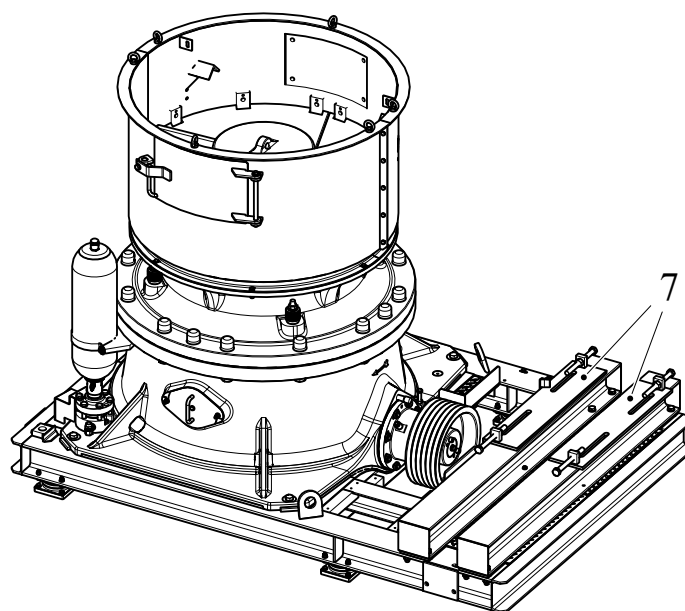
3. Install the angle bars (5) and (6).



5 Angle bar

6 Angel bar

4. Install the motor brackets (7).



7 Motor brackets

WARNING

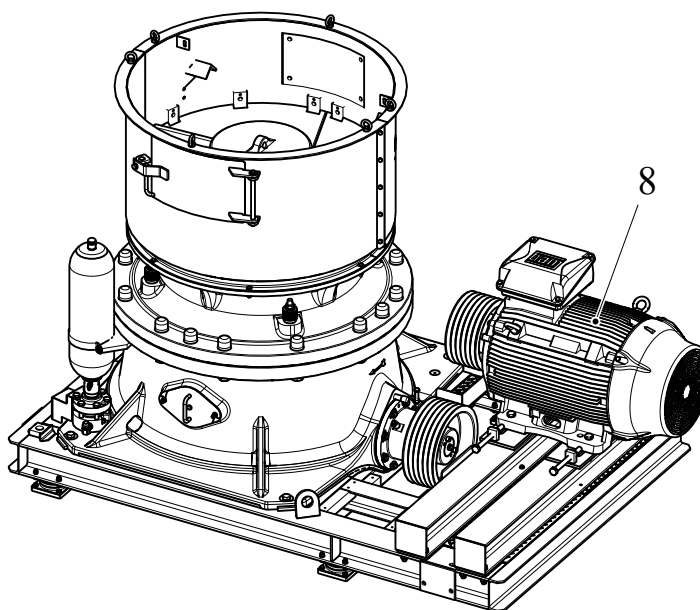


SUSPENDED LOAD HAZARD

A drive motor weighs up to 1 500 kg (3 307 lbs) $\pm 10\%$. You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

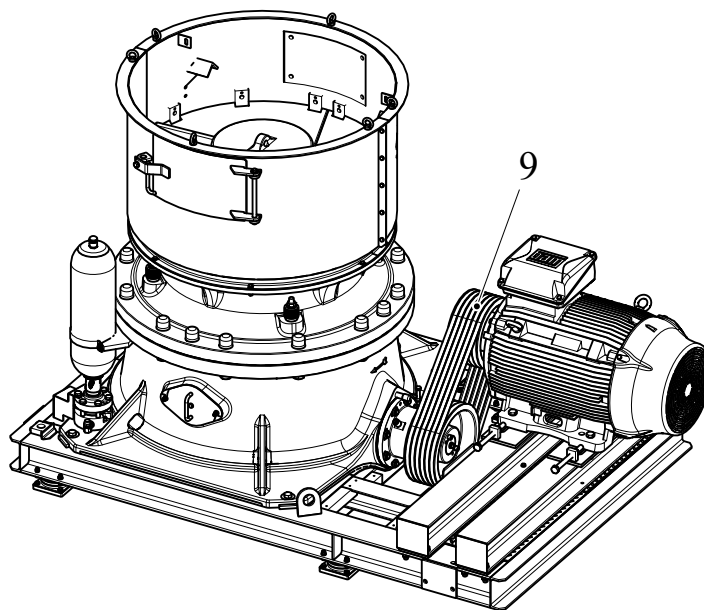
5. Install the motor (8), see section [3.11.4.2. Installing the V-belt drive motor \(Page 254\)](#).



8 Motor

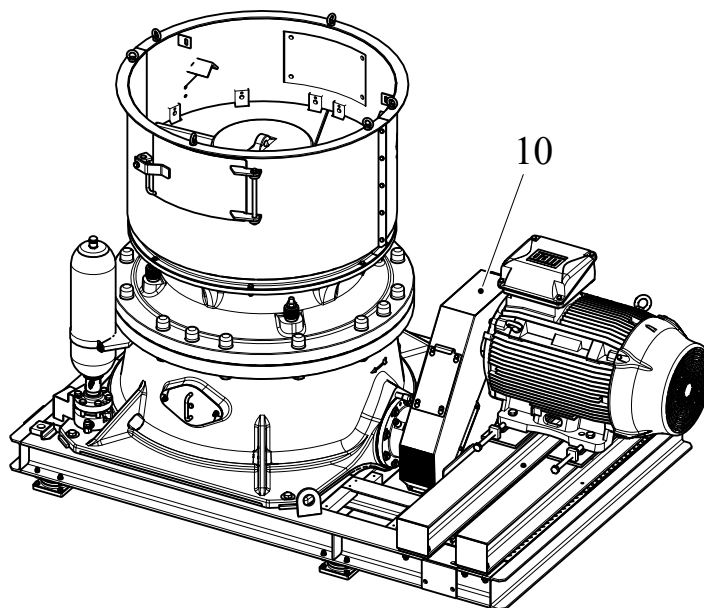
Maintenance Instructions

6. Install the V-belts (9), see section [3.11.3.2.Installing the V-belts \(Page 251\)](#).



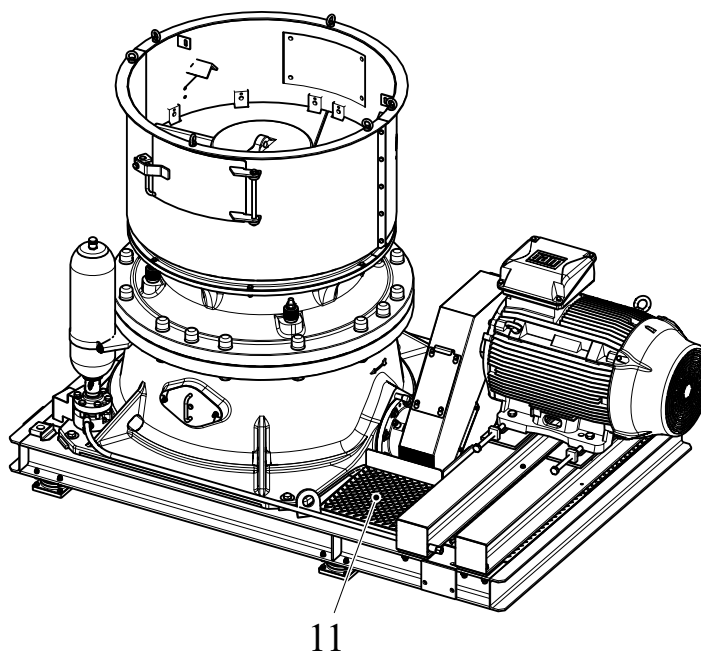
9 V-belts

7. Install the V-belt guards (10), see section [3.11.2.2.Installing the V-belt guards \(Page 250\)](#).



10 V-belts guards

8. Install the floor (11).



11 Floor

3.9.3 Replacing the pinionshaft and the pinion

3.9.3.1 *Removing the crusher pulley - Only with V-belt drive*

1. Remove the screw (10), the washer (9) and the retaining washer (8).
2. Place a lifting sling into one of the grooves near the middle of the crusher pulley.
3. Remove the screws (7) between the crusher pulley (6) and the tapered bushing (4).
4. Position the hook of a crane vertically above the crusher pulley and attach the sling to the hook.
5. Install two of the screws (7) in the threaded holes in the crusher pulley (6) and tighten them, so that the crusher pulley is pushed slightly outwards.
6. Take up the slack in the lifting tackle.

WARNING

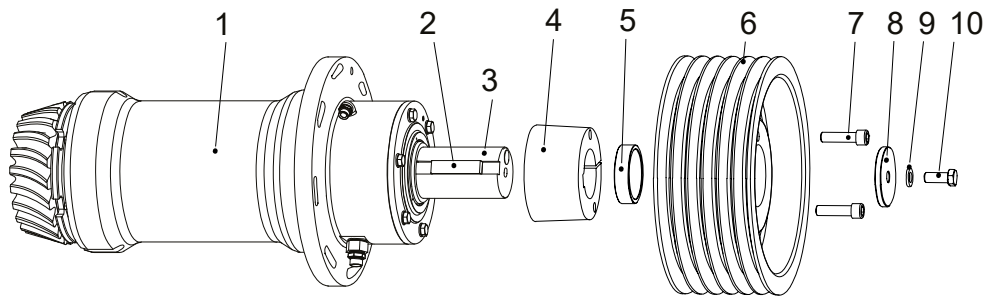


SUSPENDED LOAD HAZARD.

A crusher pulley weighs up to 102 kg (225 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

7. Pull the crusher pulley (6) off the end of the pinionshaft and lower it to the ground.
8. Remove the tapered bushing (4), the spacer (5) and the key (2).



- 1 Pinionshaft housing
- 2 Key
- 3 Pinionshaft
- 4 Tapered bushing
- 5 Spacer

- 6 Crusher pulley
- 7 Screw
- 8 Retaining washer
- 9 Washer
- 10 Screw

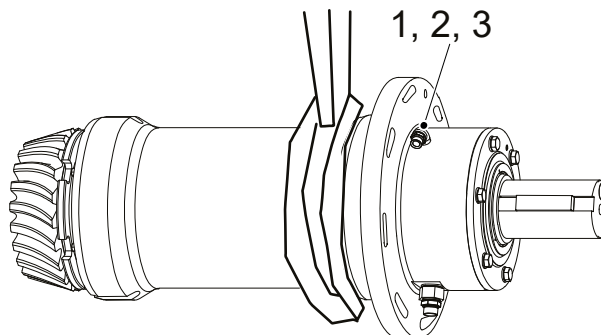
3.9.3.2

Removing the pinion

Note!

Carry out this procedure indoors, in a clean environment.

1. Place the pinion shaft housing on the ground on a sheet of plywood.
2. Unscrew the oil inlets (1), (2) and (3).
3. Place a lifting sling around the middle of the pinion shaft housing.



- 1 Elbow
- 2 Screw
- 3 Adapter

Maintenance Instructions

4. Position the hook of a crane vertically above the pinion shaft housing and attach the sling to the hook.
5. Take up the slack in the lifting tackle.

WARNING

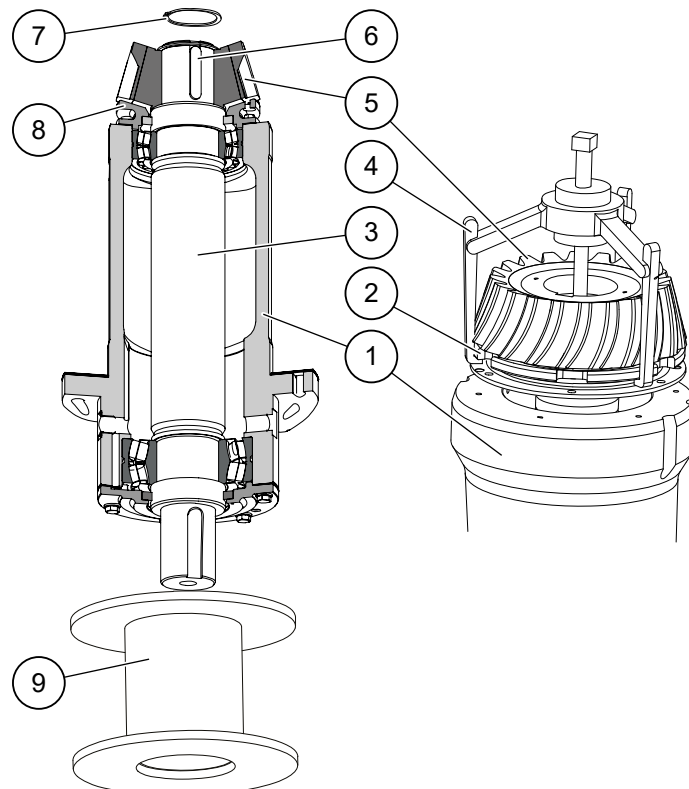


SUSPENDED LOAD HAZARD

A pinion shaft housing assembly with pulley weighs up to 375 kg (828 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

6. Lift the pinion shaft housing assembly, then lower it with the pinion (5) upwards, onto a suitable support (9) for example a cable drum.
7. Remove the lifting sling from the pinion shaft housing.
8. Remove the retaining ring (7) from the top of the pinion shaft (3).
9. Remove the screws from the inner bearing cover (8).
10. Mount an extractor (4) with adequate capacity on the end of the pinion shaft, to remove the pinion (5). The inner bearing cover has a lip (2) for an extractor.



1 Pinion shaft housing
2 Lip

6 Key
7 Retaining ring

3 Pinion shaft

4 Extractor

5 Pinion

8 Inner bearing cover

9 Support (drum)

Note!

If the pinion can not be removed using only the extractor, then carefully heat the pinion while the extractor is tightened. Take great care when the pinion heats up and comes loose. Never heat the pinion in one spot only, as that could ruin the hardening.

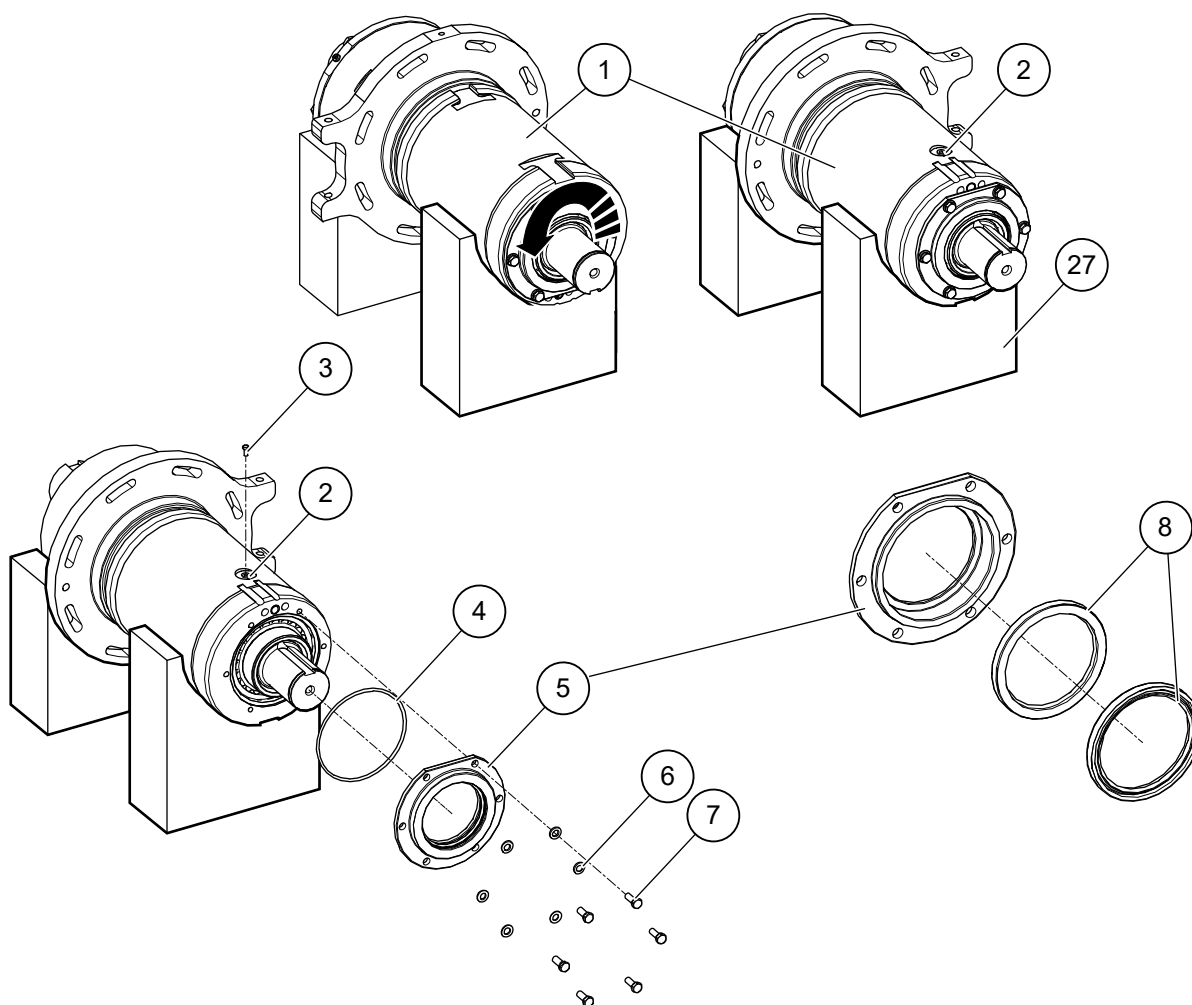
11. Remove the key (6) and make sure that there are no burrs on the end of the shaft.

3.9.3.3

Removing the pinion shaft

1. Ensure the pinion shaft housing assembly (1) is placed on a pair of stands (27).
2. Turn the pinion shaft housing assembly (1) so that the oil level plug (2) is facing upwards.
3. Remove the screws (7), the washers (6), the inner bearing cover (5) and the O-ring (4).
4. Attach the extractor screw (3) to the oil level plug (2).

5. Pull out the seal rings (8) from the inner bearing cover (5).



- 1 Pinion shaft housing assembly
- 2 Oil level plug
- 3 Extractor screw
- 4 O-ring
- 5 Inner bearing cover
- 6 Washer
- 7 Screw
- 8 Seal ring
- 27 Pair of stands

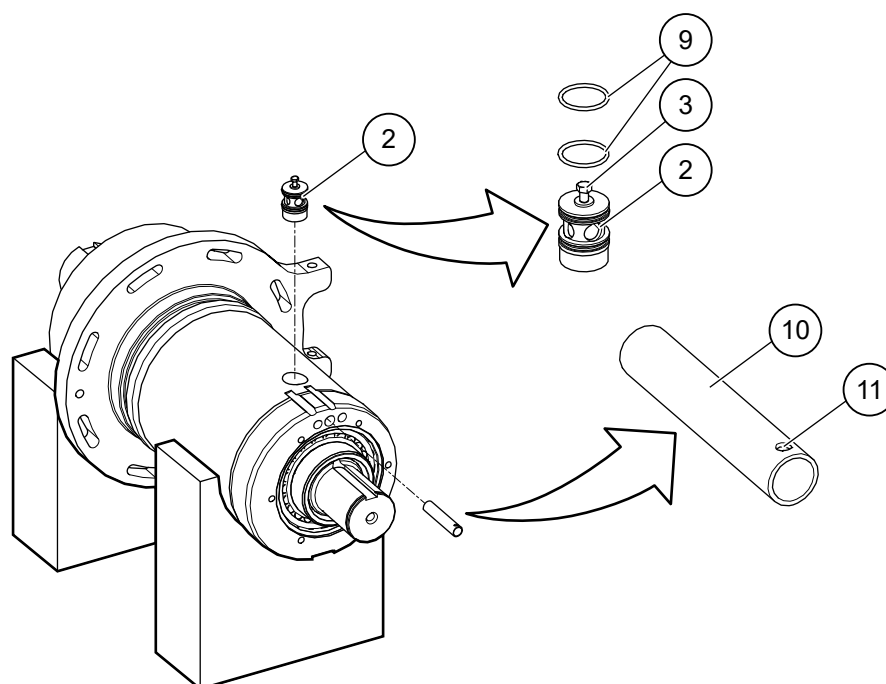
Note!

The oil level plug (2) must be removed before the pinion shaft assembly can be pulled out from the pinion shaft housing assembly.

6. The pipe (10) has a hole (11) to facilitate the extraction of the pipe (10). Pull out the pipe (10) with a steel wire hook.
7. Use the screw (3) as a lever and pull out the plug (2) with a crow bar.

Maintenance Instructions

8. Remove the O-rings (9) from the plug (2).



2 Plug

3 Extractor screw

9 O-ring

10 Pipe

11 Extraction hole

9. Attach a lifting eye bolt (13) to the pinion shaft (12).

WARNING

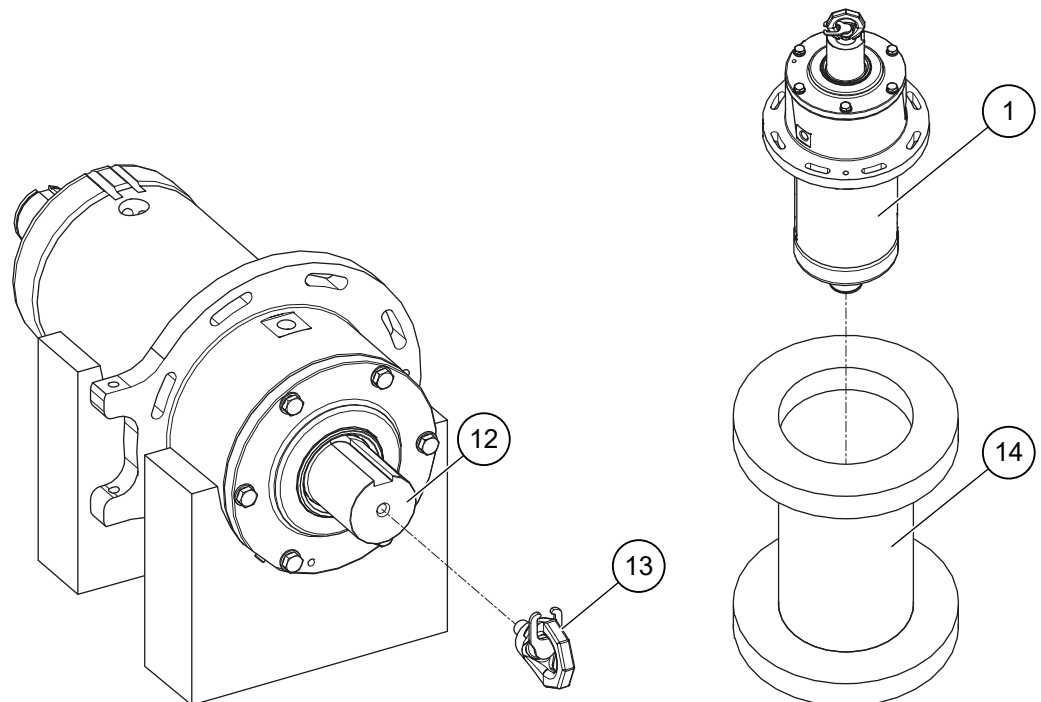


SUSPENDED LOAD HAZARD

A pinion shaft housing assembly weighs up to 251 kg (553 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

10. Carefully lift the pinion shaft housing assembly (1) to the vertical position and place it on a support (14).



1 Pinion shaft housing assembly

12 Pinion shaft

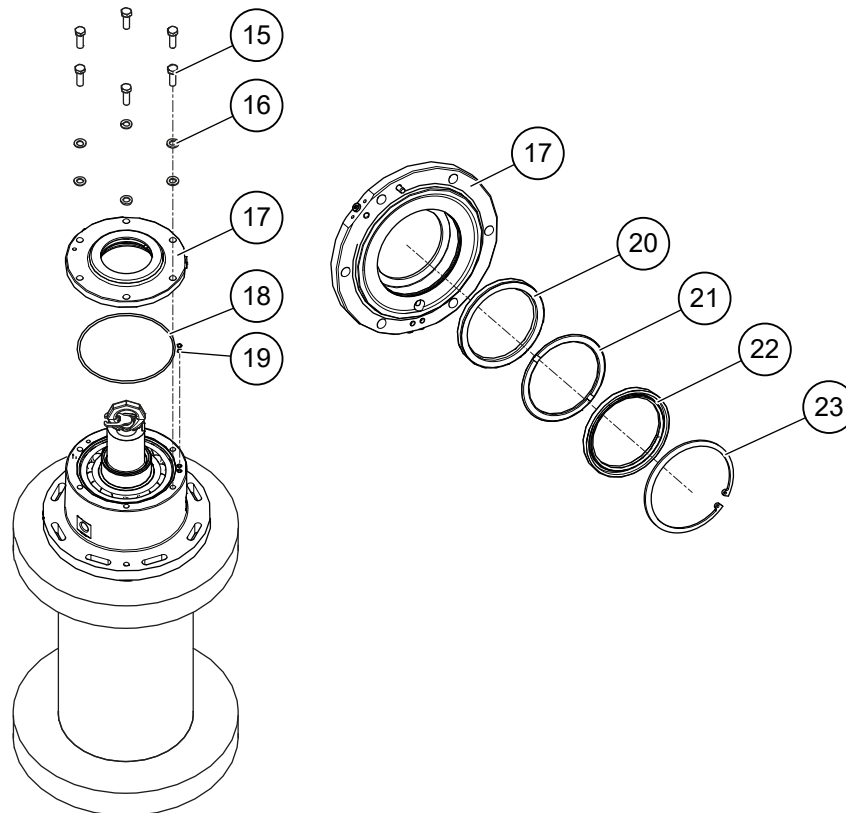
13 Lifting eye bolt

14 Support

11. Remove the screws (15), the washers (16) and the outer bearing cover (17).
12. Remove the O-ring (18) and the O-rings (19).

Maintenance Instructions

13. Remove the retaining ring (23) from the outer bearing cover (17) and pull out the seal ring (22), the distance (19) and the seal ring (20).



- 15 Screw
- 16 Washer
- 17 Outer bearing cover
- 18 O-ring
- 19 O-ring
- 20 Seal ring
- 21 Distance
- 22 Seal ring
- 23 Retaining ring

WARNING



SUSPENDED LOAD HAZARD

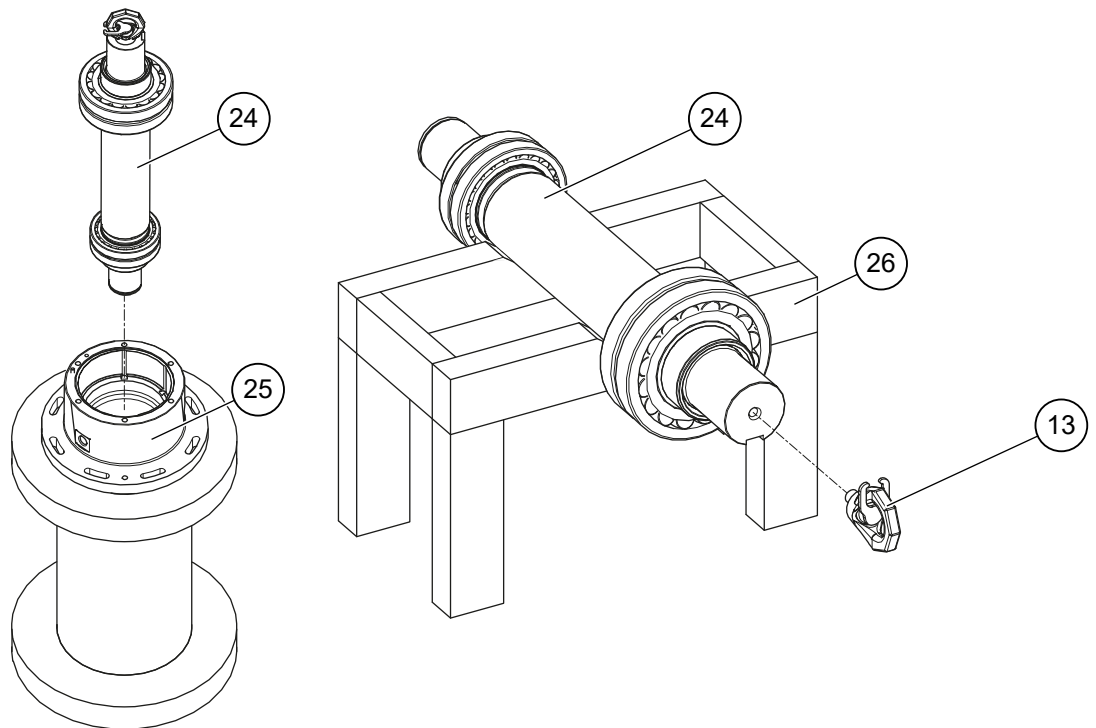
A pinion shaft assembly (shaft and bearings) weighs up to 100 kg (221 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

14. Lift out the pinion shaft assembly (24) from the pinion shaft housing (25).

Maintenance Instructions

15. Carefully lower the pinion shaft assembly (24) and place it horizontally on a support (26).
16. Remove the lifting equipment and the lifting eye bolt (13).



- 13 Lifting eye bolt
24 Pinion shaft assembly
25 Pinion shaft housing
26 Support

3.9.3.4

Removing the roller bearings and the spacers

1. Heat the outer spacer (1) with a blow torch.

WARNING



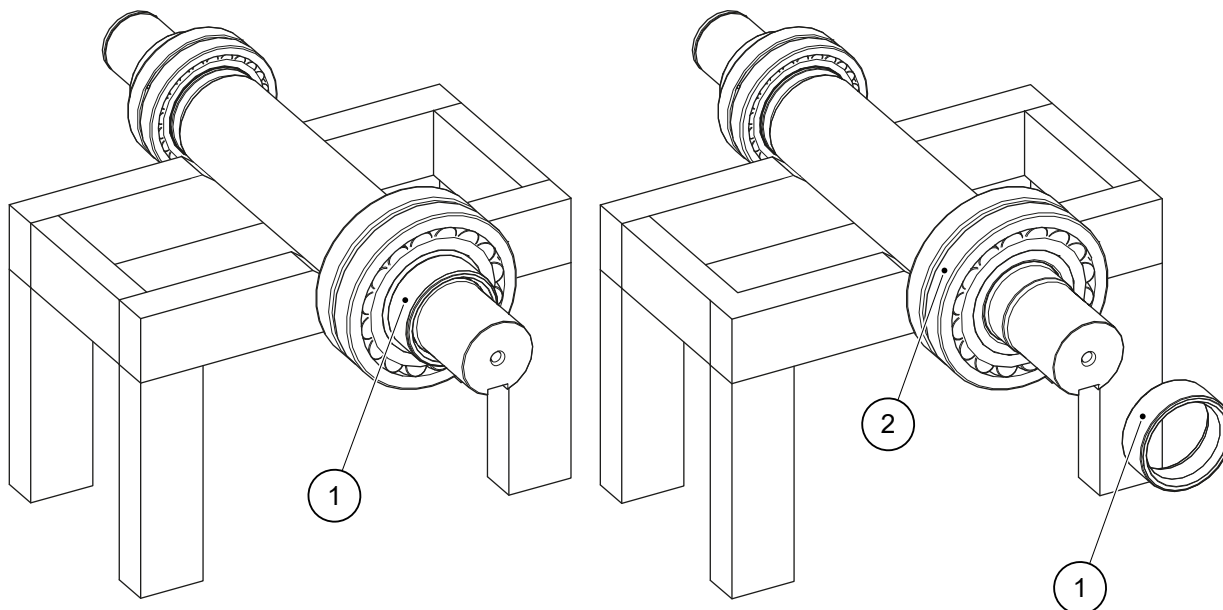
HOT SURFACE HAZARD

You can suffer severe burns from the heated component.
Use heat-resistant protective gloves.

2. Remove the outer spacer.

Maintenance Instructions

3. Cut the outer ring (2) of the outer roller bearing at two diametrically opposite points.



- 1 Outer spacer
2 Outer ring

WARNING



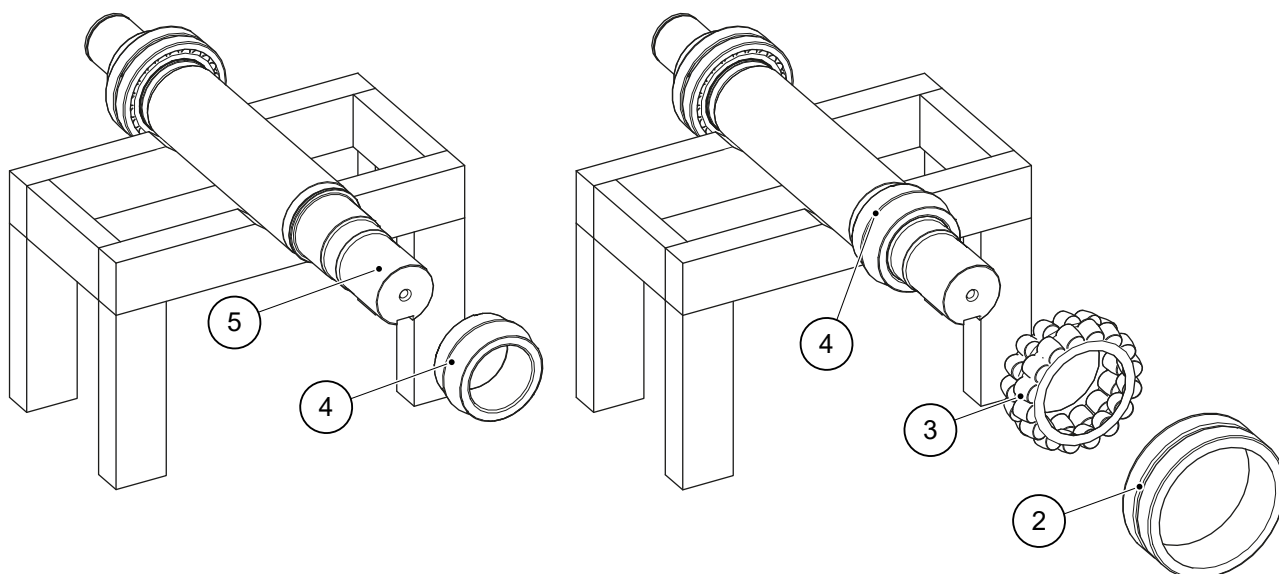
HOT SURFACE HAZARD

**You can suffer severe burns from the heated component.
Use heat-resistant protective gloves.**

4. Remove the outer ring (2) and the rollers (3).
5. Heat the inner ring (4) of the outer roller bearing.

Maintenance Instructions

6. Remove the inner ring (4) from the pinion shaft (5).



- 2 Outer ring
- 3 Rollers
- 4 Inner ring
- 5 Pinion shaft

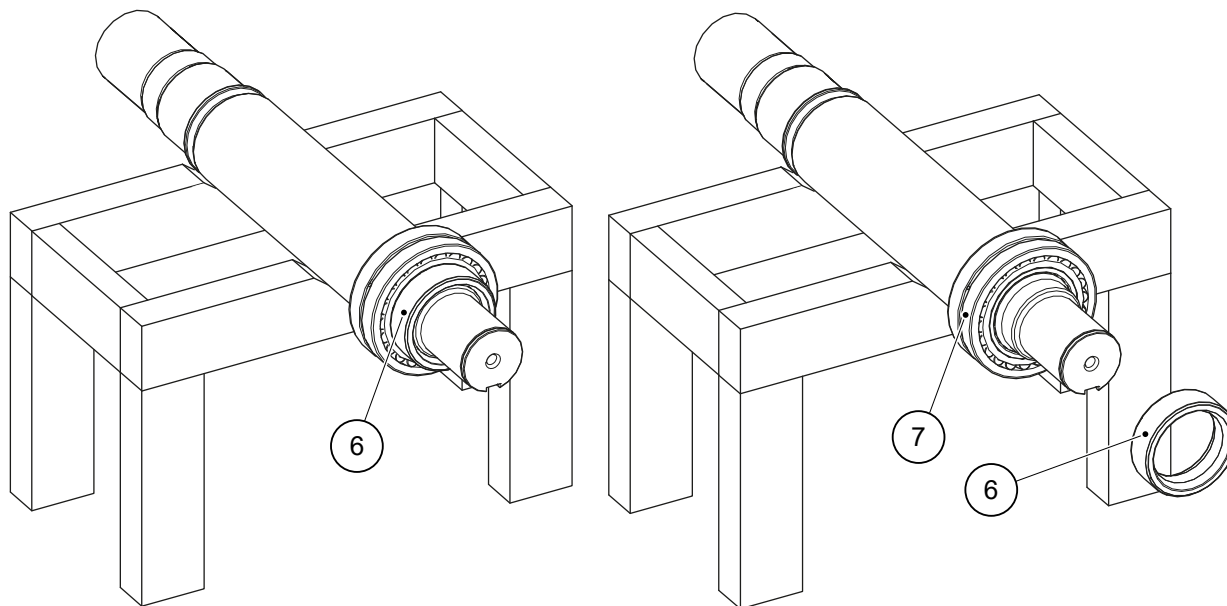
7. Heat the inner spacer (6).

 WARNING	
 	HOT SURFACE HAZARD You can suffer severe burns from the heated component. Use heat-resistant protective gloves.

8. Remove the inner spacer (6).

Maintenance Instructions

9. Cut the outer ring (7) of the inner roller bearing at two diametrically opposite points.



6 Inner spacer

7 Outer ring

WARNING



HOT SURFACE HAZARD

You can suffer severe burns from the heated component.

Use heat-resistant protective gloves.

10. Remove the outer ring (7) and the rollers (8).
11. Heat the inner ring (9) of the outer roller bearing.

WARNING

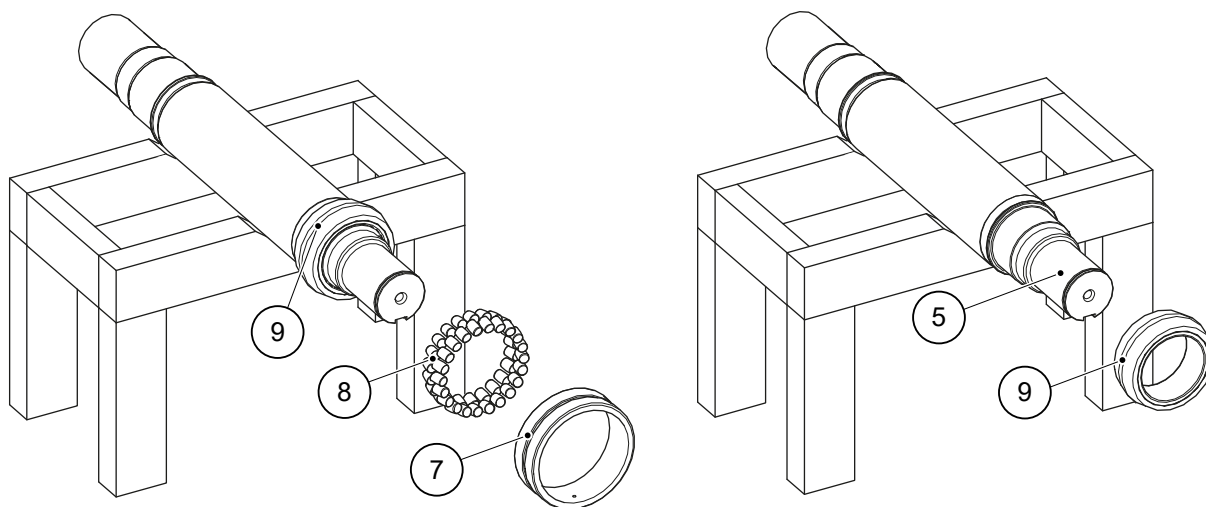


HOT SURFACE HAZARD

You can suffer severe burns from the heated component.

Use heat-resistant protective gloves.

12. Remove the inner ring (9) from the pinion shaft (5).



5 Pinion shaft

7 Outer ring

8 Rollers

9 Inner ring

3.9.3.5

Installing the roller bearings and the spacers

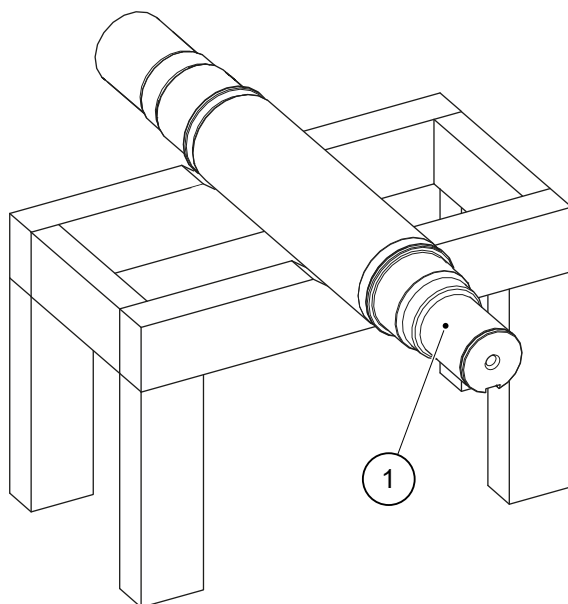
Note!

Carry out this procedure indoors in a clean environment. Use an oil bath, an induction heater or an oven to heat the components that are going to be shrunk into place. Avoid using an open flame since there is a risk of overheating.

1. Spray the pinon shaft (1) with de-greasing fluid and clean it with a soft cloth.
2. Remove shavings, grindings or dirt from the keys ways at both ends.

Maintenance Instructions

3. Clean the pinion shaft (1) ends with compressed air.



1 Pinion shaft

Note!

When heating the bearing, check the temperature with a thermometer or another technique recommended by the bearing manufacturer.

4. Heat the inner roller bearing (2) to 90 °C (194 °F) above the ambient air temperature. For example, heat to 110 °C (230 °F) in an ambient air temperature of 20 °C (68 °F).

WARNING



HOT SURFACE HAZARD

You can suffer severe burns from the heated component.

Use heat-resistant protective gloves.

5. Attach the inner roller bearing (2) to the pinion shaft (1) with a suitable drive.
6. Push the bearing (2) against the stop on the pinion shaft (1) and keep the pressure on the drive until the bearing (2) has shrunk onto the pinion shaft (1).
7. Heat the inner spacer (3) to 90 °C (194 °F) above the ambient air temperature. For example, heat to 110 °C (230 °F) in an ambient air temperature of 20 °C (68 °F).

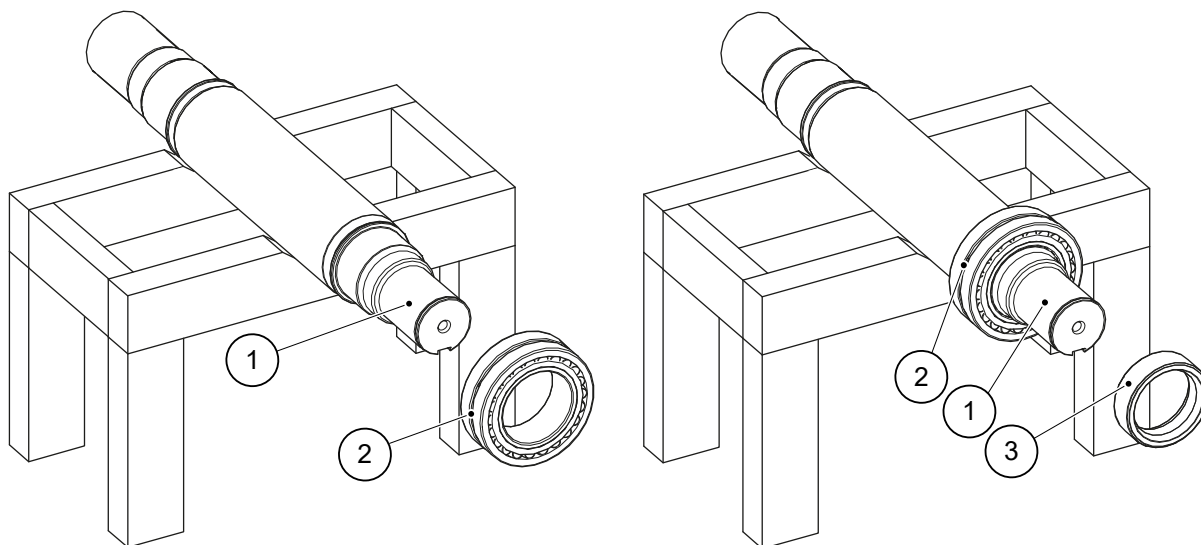
Note!

Remember to fit a new o-ring between the spacer (3) and the pinion shaft (1).

8. Attach the inner spacer (3) to the pinion shaft (1) with a suitable drive.

Maintenance Instructions

9. Push the spacer (3) against the inner ring of the inner roller bearing (2) and keep the pressure on the drive until the spacer (3) has shrunk onto the pinion shaft (1).



- 1 Pinion shaft
- 2 Inner roller bearing
- 3 Inner spacer

Note!

10. Let the inner roller bearing (2) and the inner spacer (3) cool down.

When heating the bearing, check the temperature with a thermometer or another technique recommended by the bearing manufacturer.

11. Heat the outer roller bearing (4) to 90 °C (194 °F) above the ambient air temperature. For example, heat to 110 °C (230 °F) in an ambient air temperature of 20 °C (68 °F).

WARNING



HOT SURFACE HAZARD

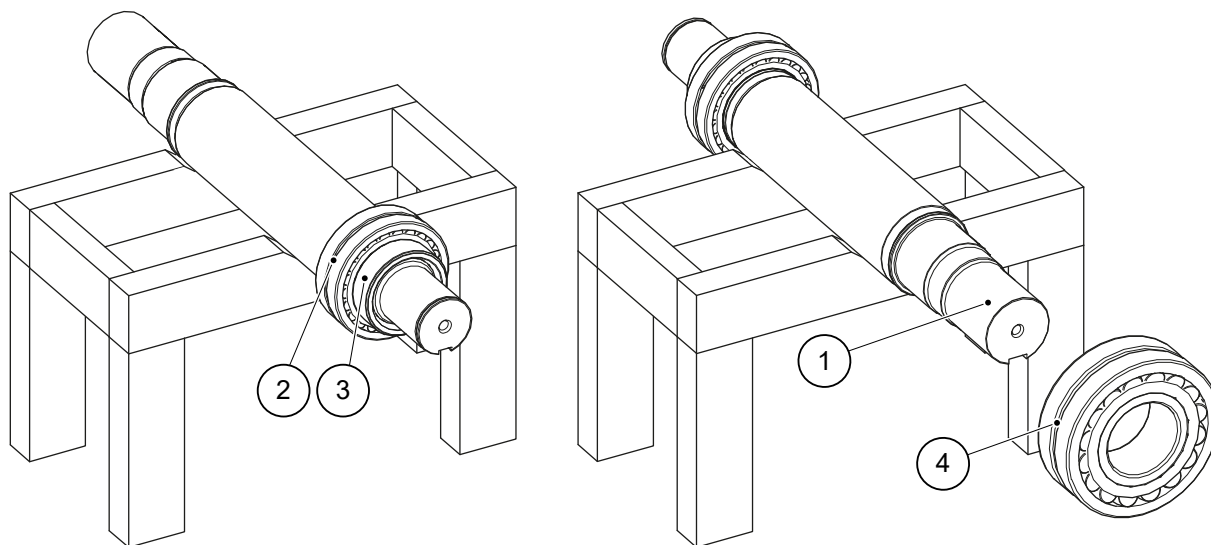
You can suffer severe burns from the heated component.

Use heat-resistant protective gloves.

12. Attach the outer roller bearing (4) to the pinion shaft (1) with a suitable drive.

Maintenance Instructions

13. Push the bearing (4) against the stop on the pinion shaft (1) and keep the pressure on the drive until the bearing (4) has shrunk onto the pinion shaft (1).



- 1 Pinion shaft
- 2 Inner roller bearing
- 3 Spacer
- 4 Outer roller bearing

14. Heat the outer spacer (5) to 90 °C (194 °F) above the ambient air temperature. For example, heat to 110 °C (230 °F) in an ambient air temperature of 20 °C (68 °F).

Note!

Remember to fit a new o-ring between the spacer (5) and the pinion shaft (1).

WARNING



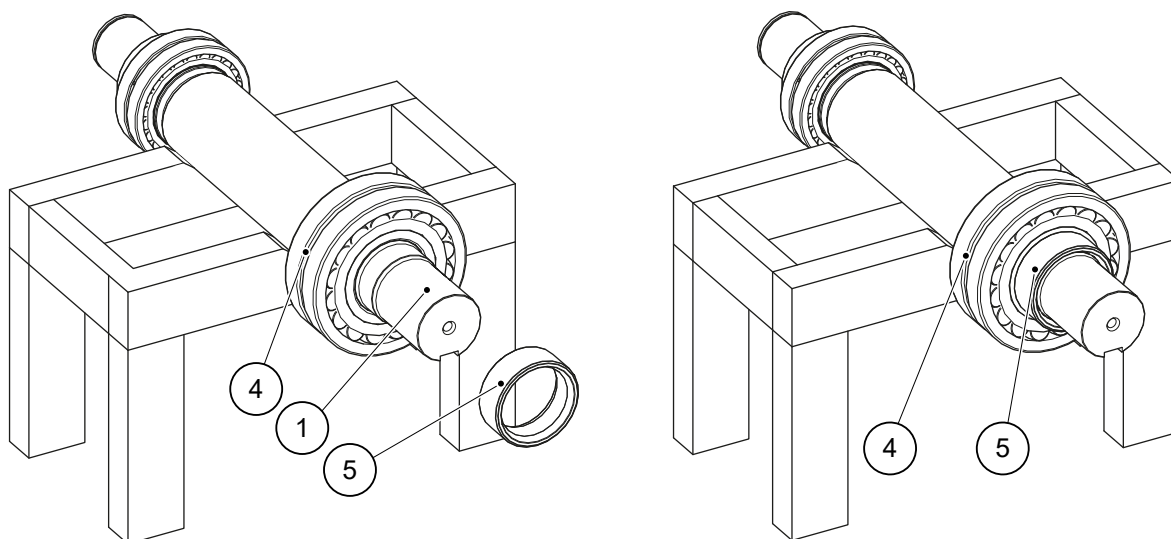
HOT SURFACE HAZARD

**You can suffer severe burns from the heated component.
Use heat-resistant protective gloves.**

15. Attach the outer spacer (5) to the pinion shaft (1) with a suitable drive.
16. Push the spacer (5) against the inner ring of the outer roller bearing (4) and keep the pressure on the drive until the spacer (5) has shrunk onto the pinion shaft (1).

Maintenance Instructions

17. Let the outer roller bearing (2) and the outer spacer (3) cool down.



- 1 Pinion shaft
- 4 Outer roller bearing
- 5 Outer spacer

3.9.3.6

Installing the pinion shaft

1. Attach the lifting eye bolt (2) to the pinion shaft (1).
2. Arrange the lifting equipment.



WARNING



SUSPENDED LOAD HAZARD

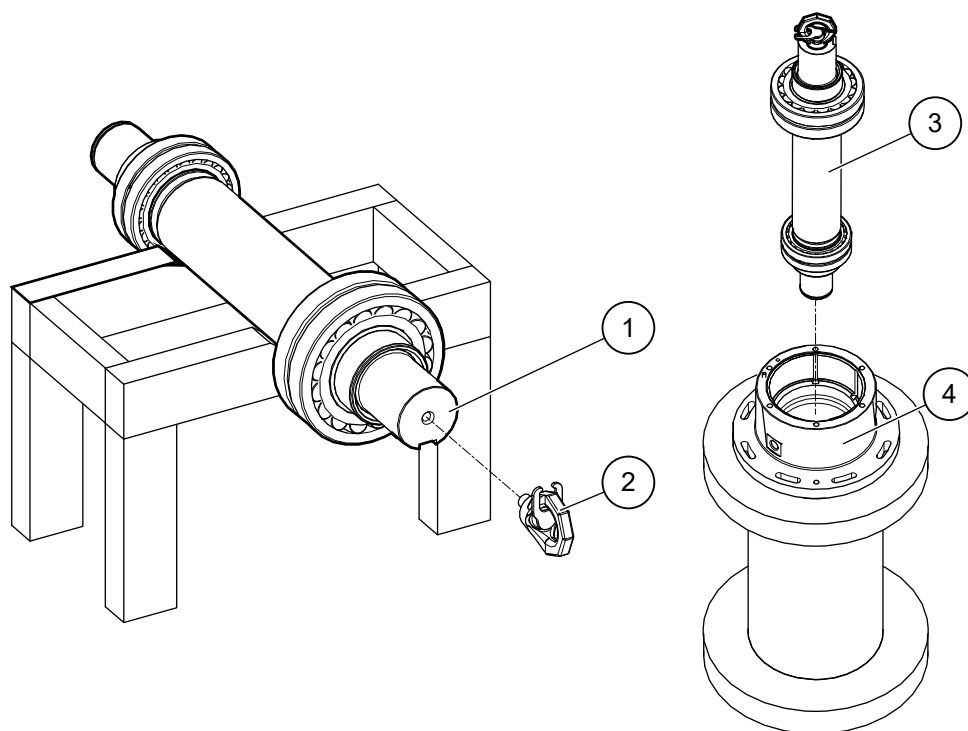
A pinion shaft assembly (shaft and bearings) weighs up to 100 kg (221 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

3. Carefully lift the pinion shaft assembly (3) to the vertical position.
4. Lower the pinion shaft assembly (3) into the pinion shaft housing (4).

Maintenance Instructions

5. Disconnect the lifting tackle.

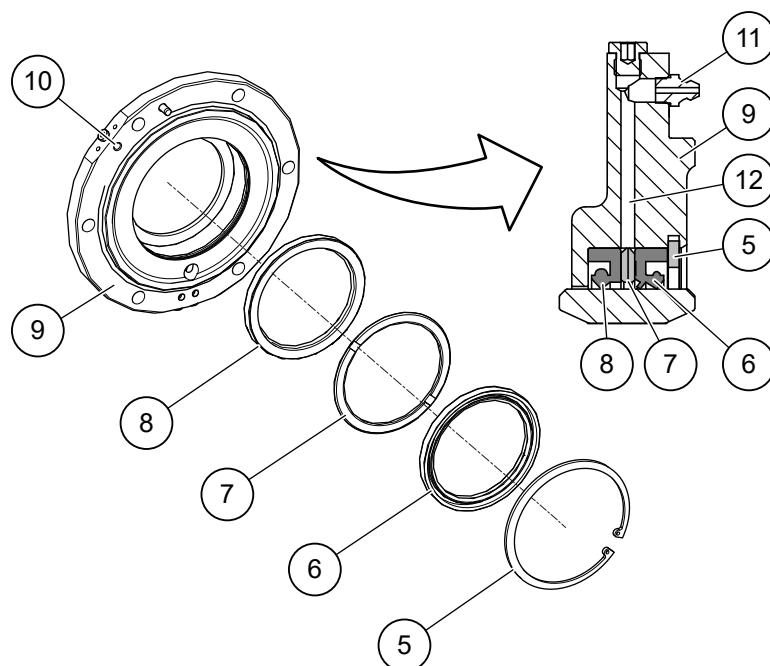


- 1 Pinion shaft
- 2 Lifting eye bolt
- 3 Pinion shaft assembly
- 4 Pinion shaft housing

6. Grease the seal rings (6) and (8).
7. Insert the seal ring (6), the distance (7) and the seal ring (8) into the outer bearing cover (9). Make sure that the seal rings (6) and (8) are mounted in the correct directions, see the illustration below.
8. Lock the seal ring (6), the distance (7) and the seal ring (8) into place with the retaining ring (5).
9. Attach the lubrication nipple (11) to the threaded hole (10) on the outer bearing cover (9).
10. Connect a grease gun to the lubrication nipple (11) and fill the grease channel (12) with grease. Continue to fill until grease is pressed out at the seal rings (6) and (8)

Maintenance Instructions

11. Disconnect the grease gun and remove the lubrication nipple (11).



5 Retaining ring

6 Seal ring

7 Distance

8 Seal ring

9 Outer bearing cover

10 Threaded hole

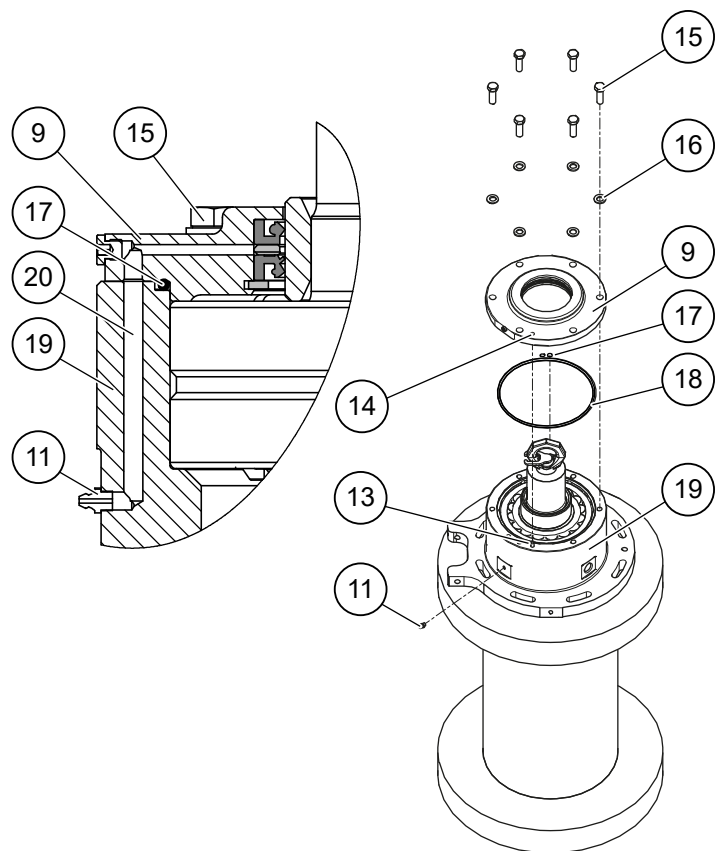
11 Lubrication nipple

12 Grease channel

12. Insert the O-rings (17).
13. Insert the O-ring (18) into the groove in the pinion shaft housing assembly (19).
14. Attach the lubrication nipple (11) to the pinion shaft housing assembly (19).
15. Connect a grease gun to the lubrication nipple (11) and fill the grease channel (20) with grease. Fill until clean grease comes out from the grease channel (20).
16. Disconnect the grease gun and remove the lubrication nipple (11).

Maintenance Instructions

17. Attach the outer bearing cover (9) to the pinion shaft housing assembly (18) with the washers (16) and the screws (15).



- 2 Lifting eye bolt
- 9 Outer bearing cover
- 11 Lubrication nipple
- 12 Grease channel
- 13 Spiral pin
- 14 Hole

- 15 Screw
- 16 Washer
- 17 O-ring
- 18 O-ring
- 19 Pinion shaft housing assembly
- 20 Grease channel

WARNING



SUSPENDED LOAD HAZARD

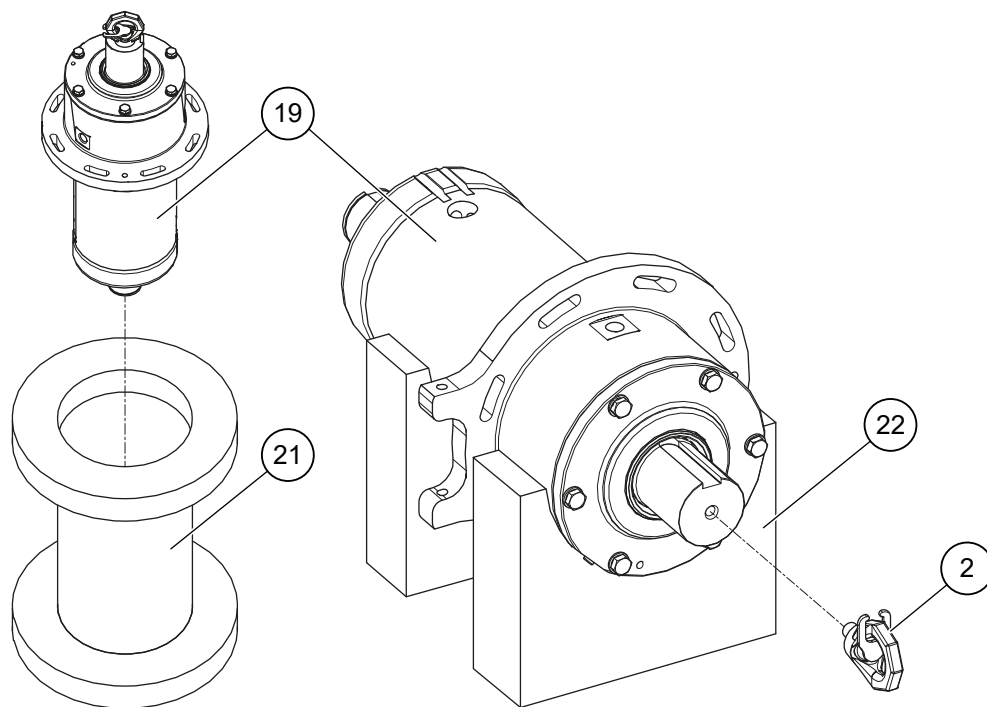
A pinion shaft housing assembly weighs up to 251 kg (553 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

18. Lift off the pinion shaft housing assembly (19) from the support (21).
19. Place the pinion shaft housing assembly (19) horizontally on a pair of stands (22).

Maintenance Instructions

20. Remove the lifting eye bolt (2).



- 2 Lifting eye bolt*
- 19 Pinion shaft housing assembly*
- 21 Support*
- 22 Pair of stands*

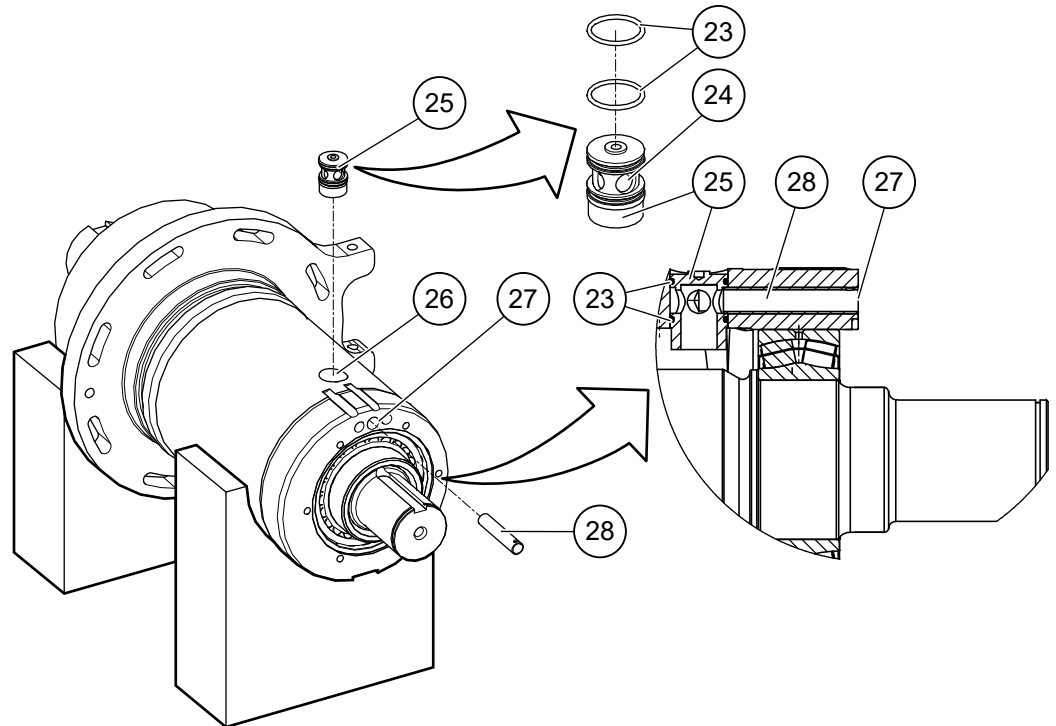
21. Grease the O-rings (23) and attach them to the plug (25).

22. Insert the plug (25) into the hole (26).

23. Insert the pipe (28) into the hole (27).

Maintenance Instructions

24. Align the hole (24) on the plug (25) with the pipe (28) and tap in the pipe (28). See the illustration below.



- 23 O-ring
- 24 Hole
- 25 Oil level plug
- 26 Hole
- 27 Hole
- 28 Pipe

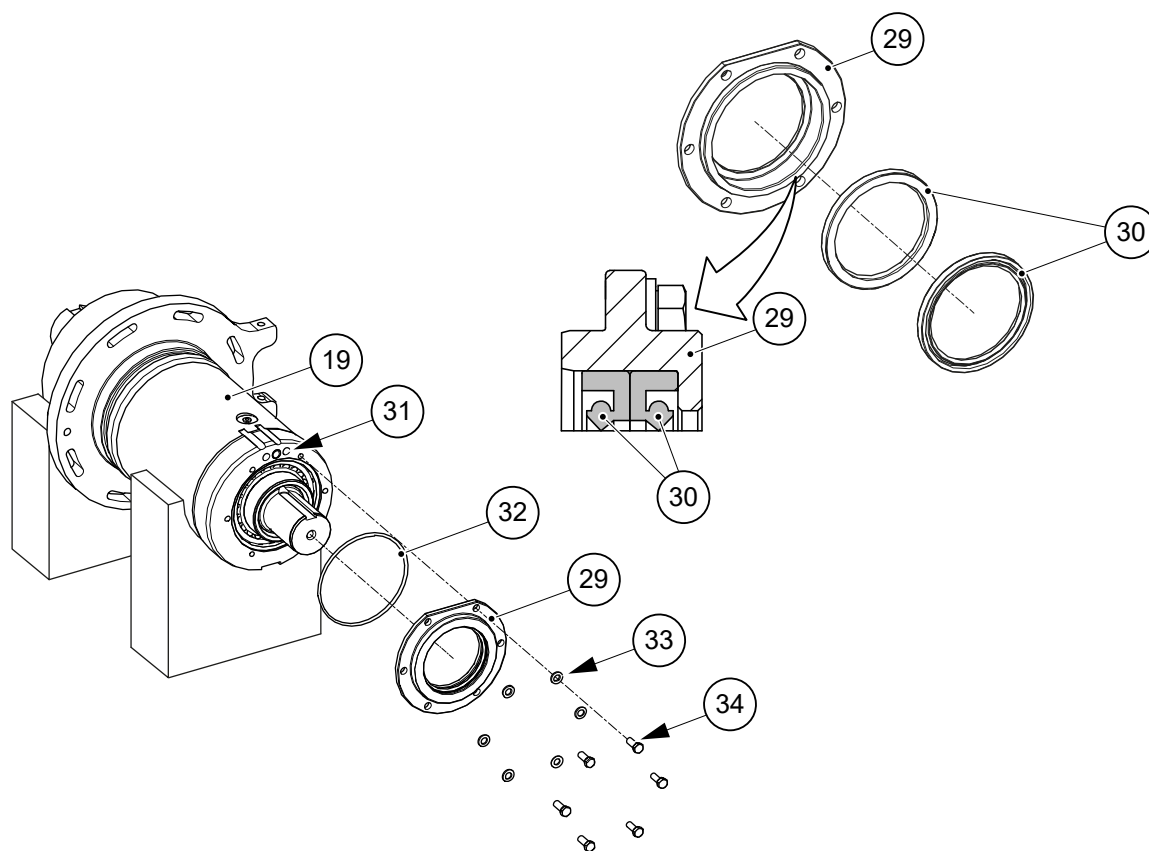
25. Grease the seal rings (30).

26. Insert the seal ring (30) into the inner bearing cover (29). Make sure that the seal rings (30) are mounted in the correct directions, see the illustration below.

Maintenance Instructions

Note! Orient the inner bearing cover (29) so that the oil channels (31) are not blocked by the cover.

27. Insert the O-ring (32) into the groove the pinion shaft housing assembly (19).



19 Pinion shaft housing assembly

29 Inner bearing cover

30 Seal ring

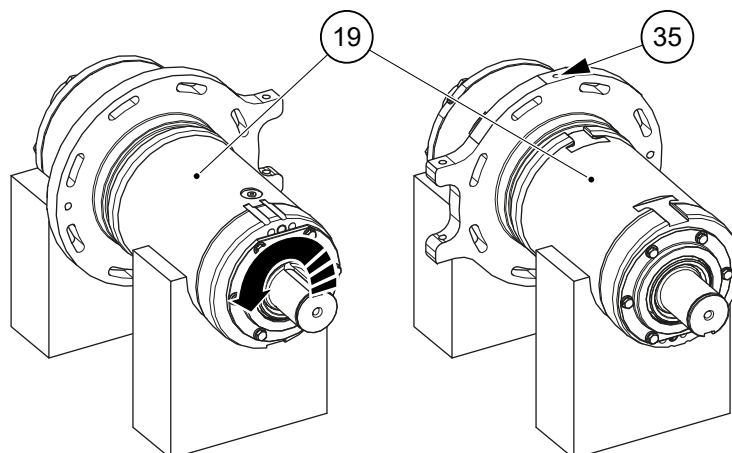
31 Oil channel

32 O-ring

33 Washer

34 Screw

28. Turn the pinion shaft housing assembly (19) so that the threaded hole (35) is facing upwards.



19 Pinion shaft housing assembly
35 Threaded hole

3.9.3.7

Installing the outer bearing cover

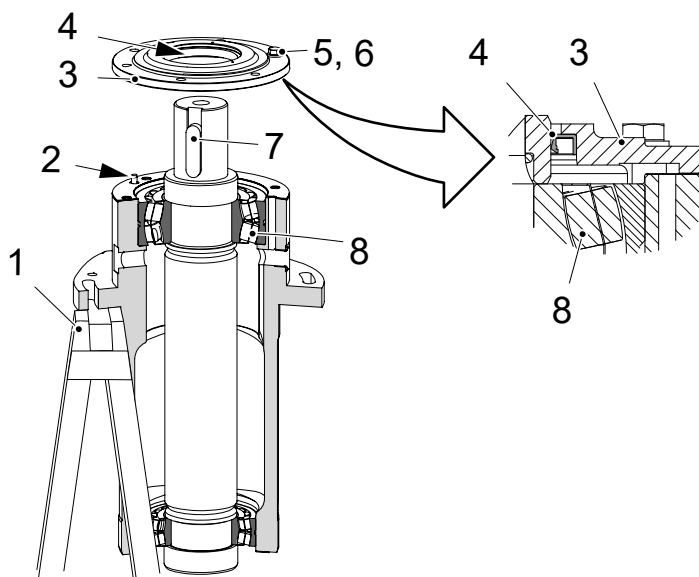
1. Clean the inside of the outer bearing cover (3) with a cloth.
2. Lubricate the inside of the bearing cover with oil.

Make sure that the open end of the oil seal ring (4) is directed towards the center of the crusher.

3. Install the oil seal ring (4) to the bearing cover with a suitable tool. Carefully push the oil seal ring inside the bearing cover to avoid damage.

Maintenance Instructions

4. Make sure that the oil seal ring (4) is flush against the bearing cover all the way around.

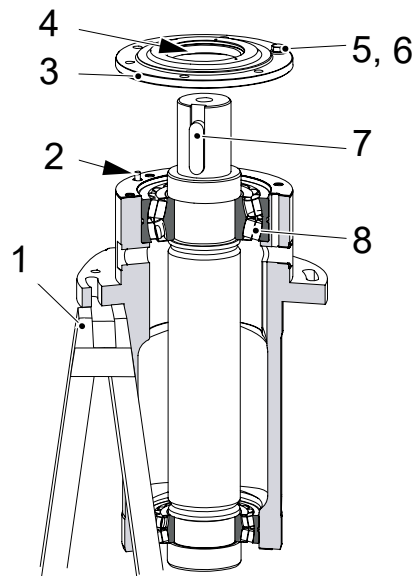


- | | |
|-----------------------|----------|
| 1 Trestle | 5 Screw |
| 2 Spring pin | 6 Washer |
| 3 Outer bearing cover | 7 Key |
| 4 Oil seal ring | 8 Gasket |

5. Prepare the inner bearing cover in the same way.
6. Position the outer bearing cover on the outboard end of the pinionshaft housing so that the spring pin enters the corresponding hole in the bearing cover.
7. Apply locking fluid to the threads of the screws, refer to *Locking fluid for threaded fasteners* in *Technical specifications*.
8. Install washers on the screws. Tighten the screws in circular rotation to fasten the bearing cover, refer to *Tightening torques* in *Technical specifications*.
9. Grind the keys so that they fit into the keyways at each end of the pinionshaft.

Maintenance Instructions

10. Install the outer key (7) in the keyway at the outboard end of the pinionshaft.



- | | |
|-----------------------|----------|
| 1 Trestle | 5 Screw |
| 2 Spring pin | 6 Washer |
| 3 Outer bearing cover | 7 Key |
| 4 Oil seal ring | 8 Gasket |

3.9.3.8

Installing the level tube and the discharge tube

1. Loop a lifting sling around the pinionshaft housing (2) near the inboard end.
2. Attach the lifting sling to the hook of the crane.
3. Take up the slack in the lifting tackle.

WARNING

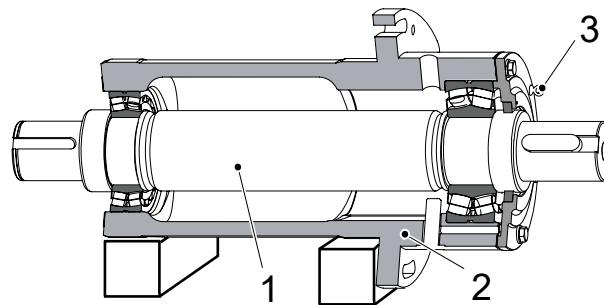


SUSPENDED LOAD HAZARD

A pinion shaft housing assembly weighs up to 251 kg (553 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

4. Position the pinionshaft housing (2) on its side on sheets of plywood or a wooden trestles on the floor.



- 1 Pinionshaft
- 2 Pinionshaft housing
- 3 Lifting eye bolt

5. Install the lifting eye bolts (3) in the inboard end of the pinionshaft (1).
6. Attach lifting slings to the lifting eye bolts (3) and the pinionshaft (1).
7. Take up the slack in the lifting tackle.

WARNING



SUSPENDED LOAD HAZARD

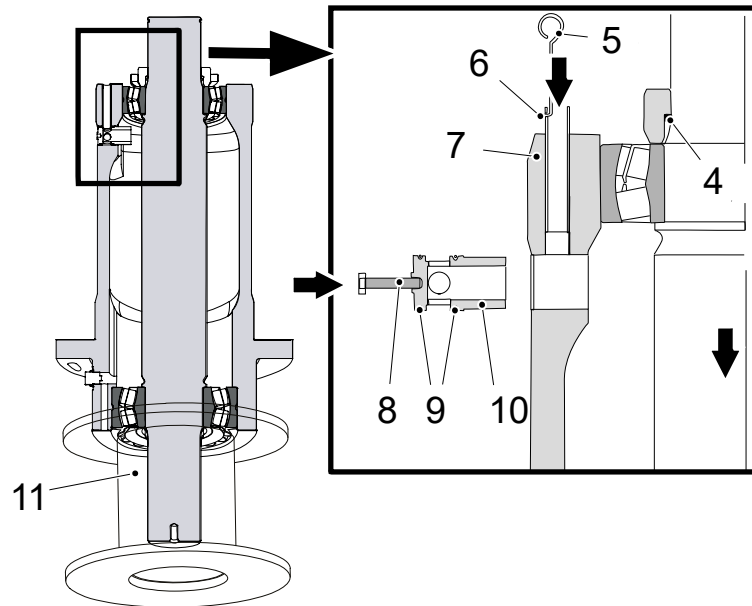
A pinion shaft housing assembly weighs up to 251 kg (553 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

8. Raise the pinionshaft housing (2) and turn it around to the vertical position.
9. Position the pinionshaft housing (2) onto a suitable support (11) for example a cable drum.
10. Clean the level tube (10) and the discharge tube (7). Make sure that there are no burrs. Use compressed air to remove all loose dirt.
11. Attach O-rings (9) in the grooves in the level tube (10).

Maintenance Instructions

12. Apply grease to the level tube (10) and its O-rings (9). Use a brush to apply the grease.
13. Install the level tube (10) in the corresponding hole on the outside of the pinionshaft housing (2).
14. Install the discharge tube (7) in the hole on the end of the pinionshaft housing (2). Make sure that the small hole (6) on the discharge tube (7) is upward.
15. Carefully tap the level tube (10) until it falls into place between the O-rings (9).

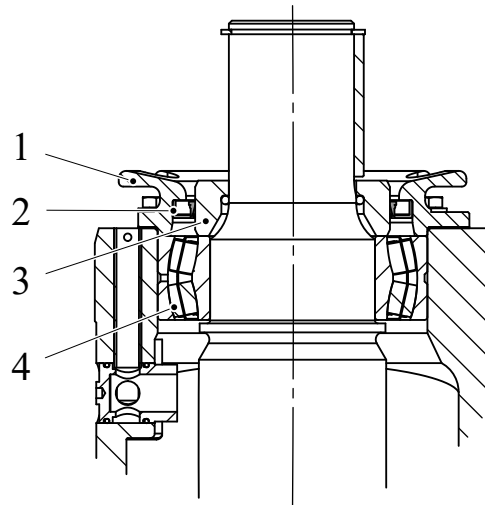


- 4 O-ring
- 5 Steel wire hook
- 6 Hole in discharge tube for removal
- 7 Discharge tube
- 8 Extractor screw
- 9 O-rings
- 10 Level tube
- 11 Support

3.9.3.9

Installing the inner bearing cover

1. Lubricate the inner spacer ring (3) with oil. Pour oil down into the inner roller bearing (4).



1 Inner bearing cover

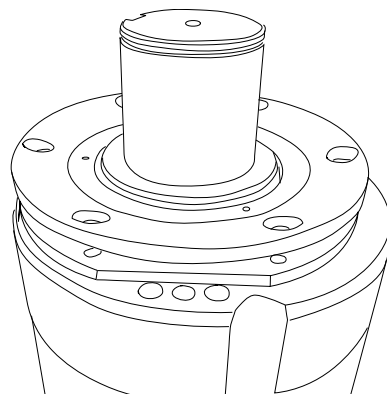
2 Seal ring

3 Spacer ring

4 Roller bearing

Make sure that the open end of the oil seal ring (2) is directed towards the center of the crusher.

2. Install the oil seal ring (2) to the bearing cover (1) with a suitable tool. Carefully push the oil seal ring inside the bearing cover to avoid damage.
3. Position the inner bearing cover (1) on the inboard end of the pinion shaft housing. Make sure that the chamfering on the bearing cover is aligned with the three holes in the pinion shaft housing. See the figure below.



4. Apply locking fluid to the threads of the six screws, refer to *Locking fluid for threaded fasteners* in the *Technical Specifications*.

5. Install washers on the screws. Tighten the screws in circular rotation to fasten the bearing cover, refer to *Tightening torques* in the *Technical Specifications*.
6. Make sure that the key fits properly into the keyways in the pinion and on the pinion shaft.

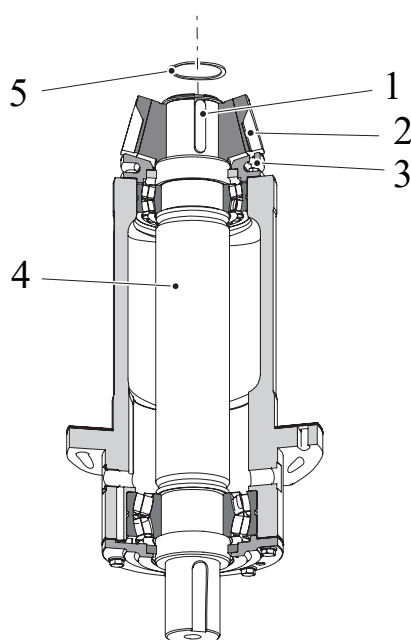
3.9.3.10

Installing the pinion

Note!

Carry out this procedure indoors in a clean environment. Use an oil bath, an induction heater or an oven to heat the components that are going to be shrunk into place. Avoid using an open flame since there is a risk of overheating.

1. Heat the pinion (2) to 150 °C (302 °F) above the ambient air temperature. For example, heat to 170 °C (338 °F) in an ambient air temperature of 20 °C (68 °F).
2. Fit the key (1) to the pinion shaft (4).
3. Lift the pinion (2) in place.
4. Attach the pinion (2) to the pinion shaft (4).
5. Let the pinion (2) cool down.
6. Secure the pinion (2) to the pinion shaft (4) with the retaining ring (5).



1 Key
2 Pinion
3 Lip

4 Pinion shaft
5 Retaining ring

3.9.3.11

Installing the crusher pulley

To get a better balance when the pinionshaft housing assembly is being installed, it is recommended to install the pulley before installing the pinionshaft housing.

Maintenance Instructions

1. Loop a lifting sling around the pinionshaft housing near the inboard end.
2. Attach the lifting sling to the hook of the crane.

WARNING

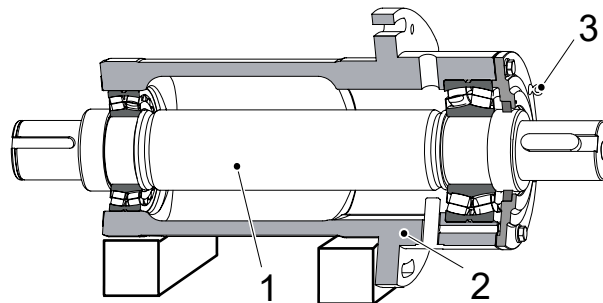


SUSPENDED LOAD HAZARD

A pinion shaft housing assembly weighs up to 251 kg (553 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

3. Position the pinionshaft housing on its side on sheets of plywood or wooden trestles on the floor.



- 1 Pinionshaft
- 2 Pinionshaft housing
- 3 Lifting eye bolt

4. Install lifting eye bolts in the outer end of the pinionshaft housing.
5. Position the hook of a crane vertically above the pinionshaft housing.
6. Attach suitable lifting slings to the lifting eye bolts.
7. Attach the lifting slings to the hook.
8. Take up the slack in the lifting tackle.

WARNING



SUSPENDED LOAD HAZARD

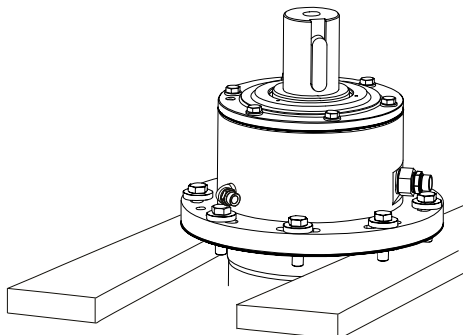
A pinion shaft housing assembly weighs up to 251 kg (553 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

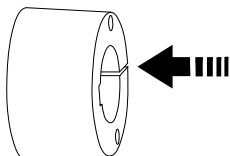
9. Raise the pinionshaft housing and turn it to the vertical position.

Maintenance Instructions

10. Position the pinionshaft housing with the outer end upwards and with the flange supported on two planks resting on suitable trestles.



11. Use a screwdriver or similar wedge-shaped tool. Insert the tool as shown by the arrow. Carefully (to avoid damage to the edges) enlarge the slit in the tapered bushing (4). The slit must be wide enough for the bushing to move freely when being installed on the pinionshaft.



12. Install the tapered bushing (4).
13. Install the spacer (5).
14. Attach two lifting eye bolts on the pulley (6).
15. Position the hook of a crane vertically above the pulley.
16. Attach the lifting sling to the lifting eye bolt on the pulley.
17. Attach a lifting sling to the hook.
18. Take up the slack in the lifting tackle.

WARNING



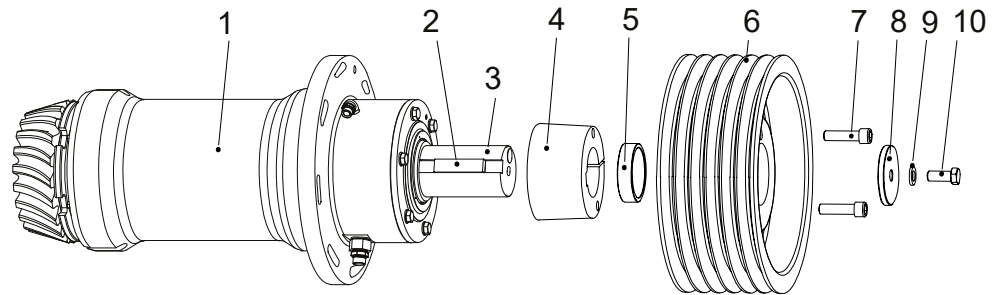
SUSPENDED LOAD HAZARD

A pulley weighs up to 102 kg (225 lbs). You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

19. Lift the pulley.
20. Install the pulley on the pinionshaft.
21. Install the two screws (7).

22. Torque the screws alternately, refer to *Tightening torques* in *Technical Specifications*.



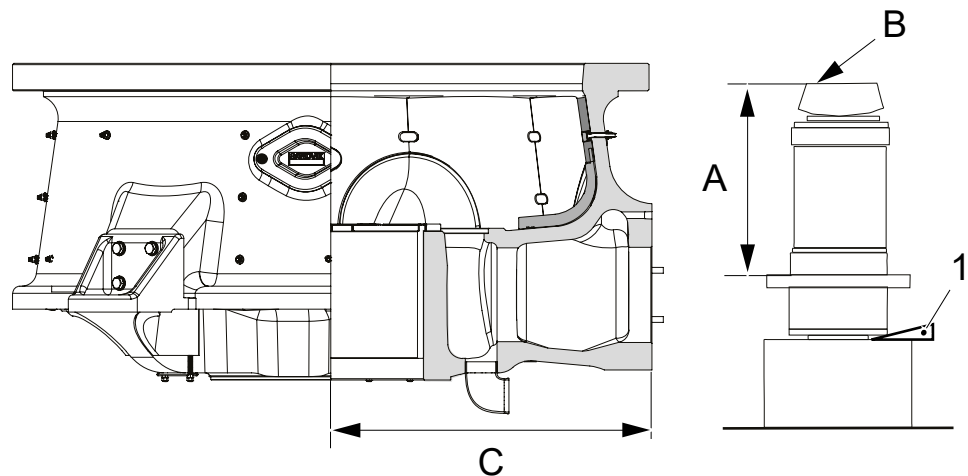
- 1 Pinionshaft housing
- 2 Key
- 3 Pinionshaft
- 4 Tapered bushing
- 5 Spacer

- 6 Crusher pulley
- 7 Screw
- 8 Retaining washer
- 9 Washer
- 10 Screw

3.9.3.12

Preparation for the installation of a complete pinion shaft assembly

If the gear and pinion, pinion shaft housing etc. has been replaced, or when a check was not made on the thickness of the gasket between the pinion shaft housing flange and the bottom shell during removal, the tooth bearing “footprint” and the backlash must be adjusted. The thickness of the gasket can be calculated as follows.



- 1 Wedge

1. Position the pinion shaft assembly upright, resting on the crusher pulley.
2. To compensate for the axial play in the bearings, drive in a wooden wedge (1) between the crusher pulley and the outer bearing cover.
3. Calculate the gasket thickness, see section [3.9.4.3.Determining the gasket thickness \(Page 242\)](#).
4. Fit gaskets of the correct thickness, as determined above.

Maintenance Instructions

5. Install the pinion shaft assembly, see section [3.9.2.5. Installing the pinion shaft housing assembly \(Page 197\)](#).
6. Check the backlash and the tooth bearing "footprint". Adjust if necessary.

Note! *When a new eccentric gear and pinion set is installed, the correct "tooth print" will be obtained with the gasket thickness calculation described above.*

3.9.4 Bevel gears

The cone crusher has spiral bevel gears. Under normal conditions this type of transmission requires very little maintenance. The gear and pinion are manufactured and marked as a matched set. For this reason, do not use a gear from one set with a pinion from another set.

3.9.4.1 Checking the gear backlash

The correct values for the backlash in the crusher are presented in the table.

Pinion pitch circle diameter	Backlash on pitch circle diameter	Crusher pulley outer diameter	Movement on outer diameter of pulley, with correct play
192 mm (7.6 in)	0.80 mm (0.031 in) to 1 mm (0.039 in)	385 mm (15.2 in)	1.60 mm (0.063 in) to 2 mm (0.079 in)

Note! *The values in the table above are theoretically calculated for reference during manufacture and installation of the gears.*

Practical experience has shown that the nominal gear backlash can be exceeded due to the geometry of the installation, but the values given in the table above should be considered as guidelines when judging the condition of the gear and pinion. Consult Sandvik if problems are encountered. Correct backlash and tooth bearing "footprint" are essential if the gears are to operate properly.

Since there is play between the eccentric and the bottom shell bushing, the backlash in the gears will vary with the position of the eccentric.

It is necessary to make four measurements to determine the backlash, while turning the pinion and rotating the eccentric gear 90° between each measurement. The gear backlash is calculated as the average of these measurements.

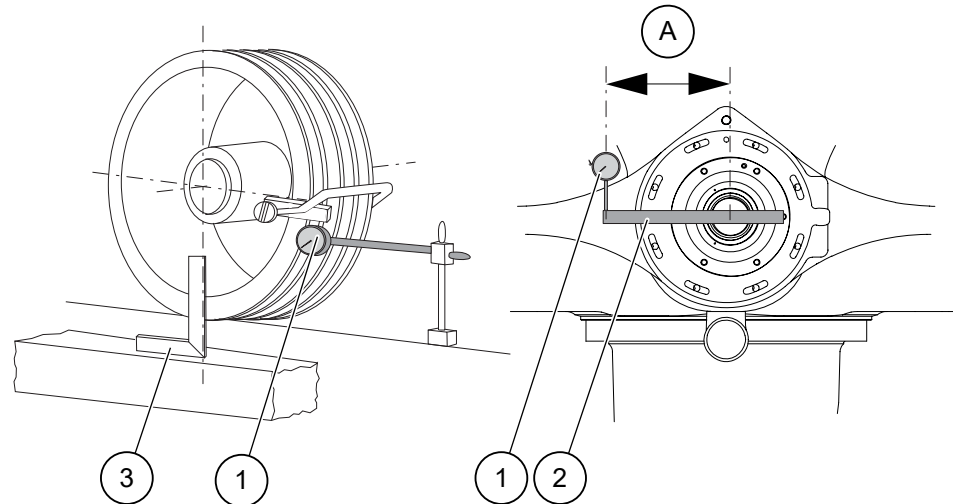
90° rotation of the eccentric corresponds to slightly less than one revolution of the pinion shaft.

Note! *Due to the play in the pinion shaft bearings it is important to pull the pulley and the shaft outwards when the backlash is measured. Make sure that the screws that hold the pinion shaft housing flange are tight.*

Maintenance Instructions

A dial gauge should be used for these measurements. If a dial gauge is not available, a set square can be used. In this case, scribe marks are made on the pulley and the distance between the marks is measured.

With V-belt pulley installed to the left, with direct drive/removed V-belt pulley to the right.



1 Dial gauge

2 Lever

3 Set square

Since the backlash cannot be measured between the pinion and the eccentric gear, the movement of the crusher pulley is measured to calculate the backlash.

Calculating the backlash - with V-belt pulley

$$\text{Crusher pulley movement on outer diameter} = \frac{\text{Play in gears on pitch line} \times \text{Crusher pulley outer diameter}}{\text{Pinion pitch circle diameter}}$$

Example:

The crusher has a crusher pulley with 385 mm (15.2 in) outer diameter. What movement should be found on the outer diameter of the crusher pulley (with a 50 Hz gear set)?

See the table below for the correct backlash, and then use the formula to calculate the movement as follows:

Minimum movement:

$$\text{Min. movement on crusher pulley outer diameter} = \frac{0.80 \times 385}{192.5} = 1.60 \text{ mm}$$

or (in inches)

Maintenance Instructions

$$\text{Min. movement on crusher pulley outer diameter} = \frac{0.031 \times 15.2}{7.6} = 0.062''$$

Maximum movement:

$$\text{Max. movement on crusher pulley outer diameter} = \frac{1.00 \times 385}{192.5} = 2.00 \text{ mm}$$

or (in inches)

$$\text{Max. movement on crusher pulley outer diameter} = \frac{0.039 \times 15.2}{7.6} = 0.079''$$

Calculating the backlash - V-belt pulley removed or direct drive

$$\text{Movement shown on dial gauge} = \frac{\text{Play in gears on pitch line} \times 2 \times A}{\text{Pinion pitch circle diameter}}$$

The dial gauge is placed 250 mm (9.84") (distance A) 180 mm (7.087") from the center. What movement should be found at this radius, to achieve the correct backlash in the gears on the pitch line (with a 50 Hz gear set)?

See the previous table for the correct backlash, and then use the formula to calculate the movement as follows:

Minimum movement:

$$\text{Minimum movement} = \frac{0.80 \times 2 \times 250}{192} = 2.1 \text{ mm}$$

or (in inches)

$$\text{Minimum movement} = \frac{0.031 \times 2 \times 9.84}{7.6} = 0.08''$$

Maximum movement:

$$\text{Maximum movement} = \frac{1.00 \times 2 \times 250}{192} = 2.6 \text{ mm}$$

or (in inches)

$$\text{Maximum movement} = \frac{0.039 \times 2 \times 9.84}{7.6} = 0.10''$$

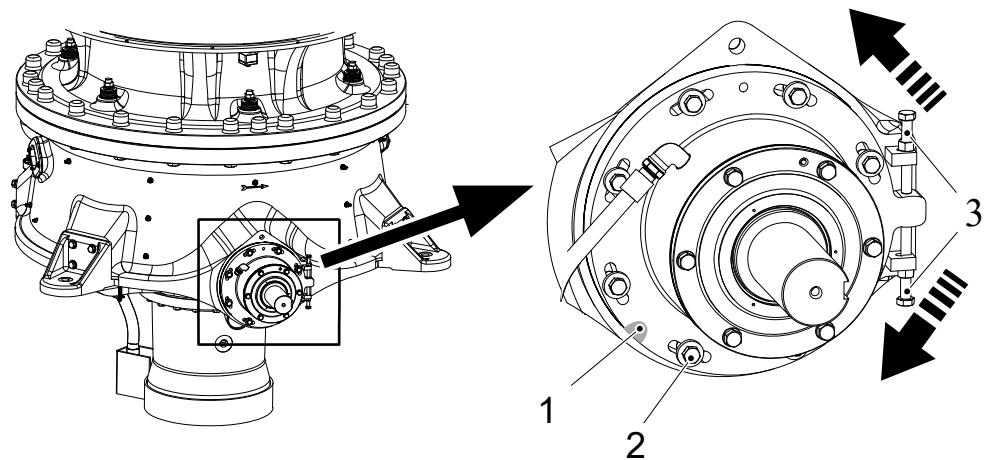
3.9.4.2 Adjusting the gear backlash

Note!

If the gear backlash is adjusted, the clearance of the locating bar must be checked, see section [3.4.3.1.Checking the locating bar clearance \(Page 117\)](#).

Since the pinion shaft housing is eccentrically mounted, the backlash in the gears can be adjusted by rotating the pinion shaft housing. Follow the procedure described below:

1. Use a feeler gauge to measure the thickness of the gasket between the flange on the pinion shaft housing and the bottom shell. Record this measurement. There is a recess (1) in the edge of the gasket to facilitate this. New shims may be needed.
2. Loosen the screws (2) that hold the pinion shaft assembly.
3. Carefully release the gasket from the flange on the pinion shaft housing, to avoid damage. The gear backlash can then be adjusted:
 - a) Increase the gear backlash by moving the adjustment screws (3) downwards (= clockwise).
 - b) Reduce the gear backlash by moving the adjustment screws (3) upwards (= anti-clockwise).
4. When the backlash is correct, tighten the screws (2) and lock the adjustment screws (3).



- 1 Recess for measurement with feeler gauge
2 Screw, Washer
3 Adjustment screws

5. Check the backlash again, see section [3.9.4.1.Checking the gear backlash \(Page 238\)](#). Adjust if necessary.

Note!

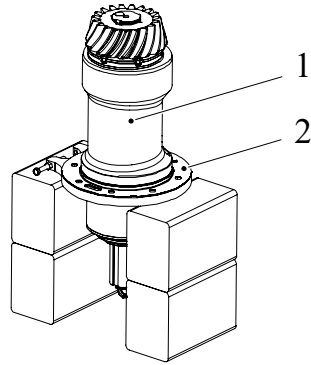
If the pinion shaft assembly is to be removed, and the backlash is correct, remove only one of the adjustment screws (3), see section [3.9.2.Replacing the pinion shaft housing assembly \(Page 189\)](#).

3.9.4.3

Determining the gasket thickness

If a check was made on the thickness of the gasket between the pinion shaft housing flange and the bottom shell before the pinion shaft assembly was removed, the correct thickness(es) of the new gasket(s) can be determined with the help of the table below.

1. Position the pinion shaft housing assembly (1) upright, resting on the flange (2).

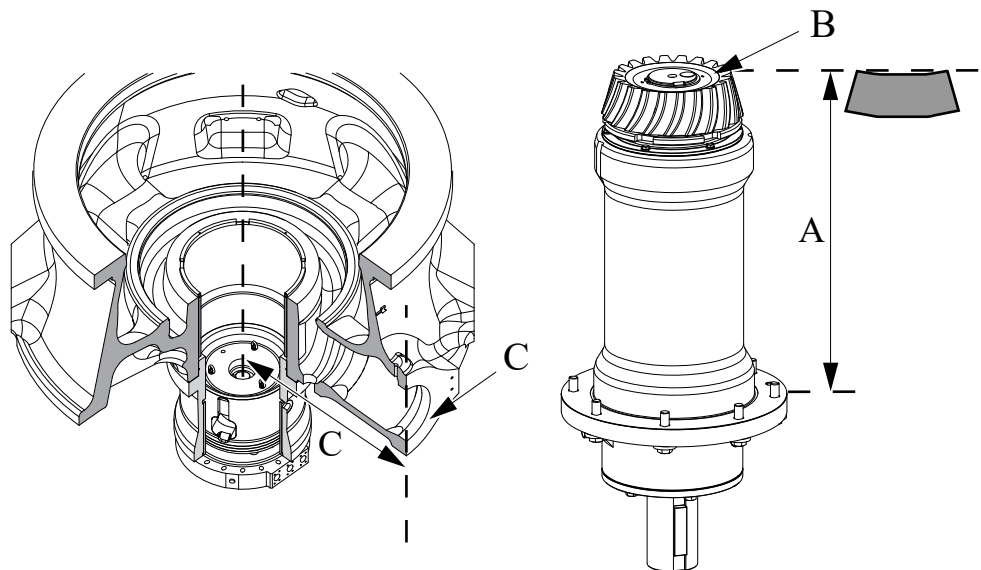


1 Pinion shaft housing assembly

2 Flange

2. Use a rod-type micrometer to measure the distance (A). Note down dimension (A).
3. Make a note of dimension (B), which is stamped into the small end of the pinion.
4. Make a note of dimension (C), which is stamped into the bottom shell, adjacent to the hole for the pinion shaft housing.
5. Calculate the compressed gasket thickness using this formula:

Compressed gasket thickness = $A + B - C$



Maintenance Instructions

6. Use the calculated gasket thickness and the table below to determine the required thickness of the gasket to be installed.

Gasket thickness, un-compressed mm (inches)	Gasket thickness, compressed mm (inches)
0.5 mm (0.02")	approximately 0.3 mm (0.012")
0.8 mm (0.03")	approximately 0.5 mm (0.020")
1.5 mm (0.06")	approximately 0.9 mm (0.035")

7. Fit gaskets of the correct thickness, as determined above.

3.9.4.4

Tooth bearing "footprint"

The gear installation is correct only when the correct "footprint" (3) and the correct backlash have been obtained.

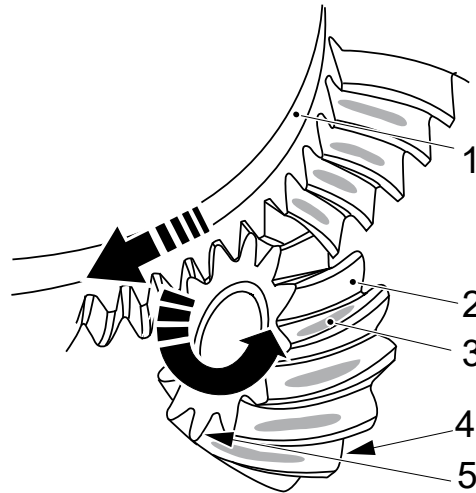
Checking the "footprint"

Spiral bevel gears are manufactured for operation with a certain tooth bearing "footprint". To check the "footprint". Follow the procedure described below:

1. Apply Molykote Spray Rapid or marking blue to the teeth of the pinion (2).

Maintenance Instructions

2. Rotate/drive the crusher pulley or drive shaft so that the “footprints” can be seen clearly.
 - a) The ideal “footprint” is obtained when the contact mark is slightly high on the pinion and slightly low on the eccentric gear (1).
Under light load, the length of the “footprint” is usually half the length of the teeth.
 - b) Under heavy load, the “footprint” usually moves towards the “heel” (the large end) (4) of the tooth. Therefore, the gears are adjusted so that the “footprint” is nearer the toe (the small end) (5).



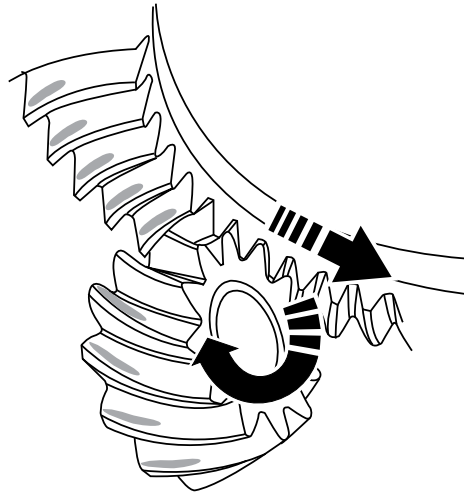
- 1 Eccentric gear
- 2 Pinion
- 3 "Footprint"
- 4 Heel
- 5 Toe

Adjustment of the “footprint”

If the tooth bearing “footprint” differs from the ideal, the gear tooth meshing can be adjusted by using gaskets/shims of different thickness between the flange of the pinion shaft housing and the bottom shell:

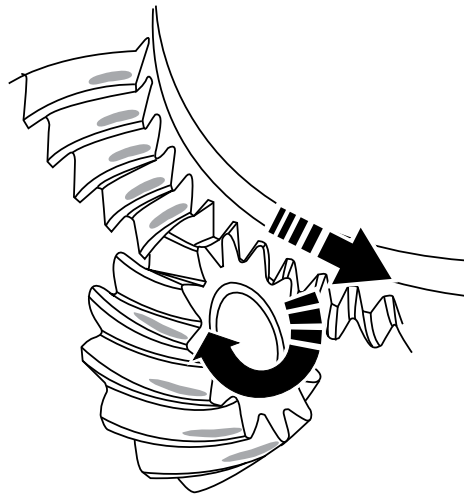
Maintenance Instructions

4. If the “footprint” is at the large end of the pinion (near the outside of the gear), move the pinion outward from the center of the eccentric gear. To do this, increase the thickness of the gasket/shim between the pinion shaft housing and the bottom shell.



Footprint at the larger end

2. If the “footprint” is at the small end of the pinion (toward the inside of the gear), move the pinion inward towards the center of the eccentric gear. To do this, reduce the gasket/shim thickness.



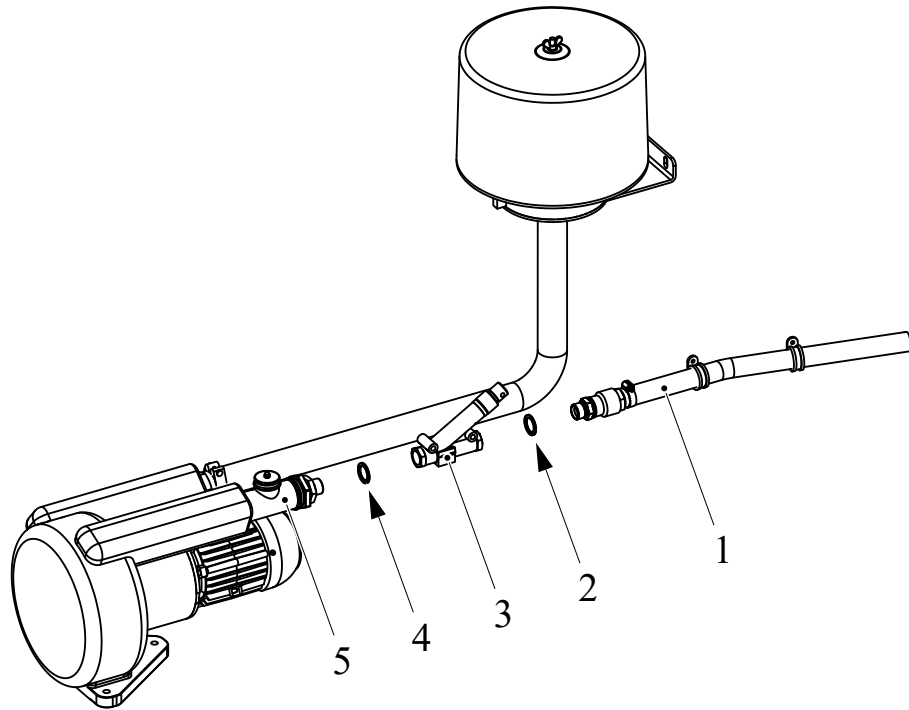
Footprint at the smaller end

3.10 Dust seal air pressure system

3.10.1 Replacing the dust seal air pressure needle valve

3.10.1.1 *Removing the dust seal air pressure flow valve*

1. Remove the hose (1) and the seal ring (2) from the flow valve (3).
2. Remove the flow valve (3) and the seal ring (4) from the dust seal air pressure unit (5). Note the mounting direction of the flow valve (3), with the arrow on the flow valve (3) pointing towards the dust seal air pressure unit (5).

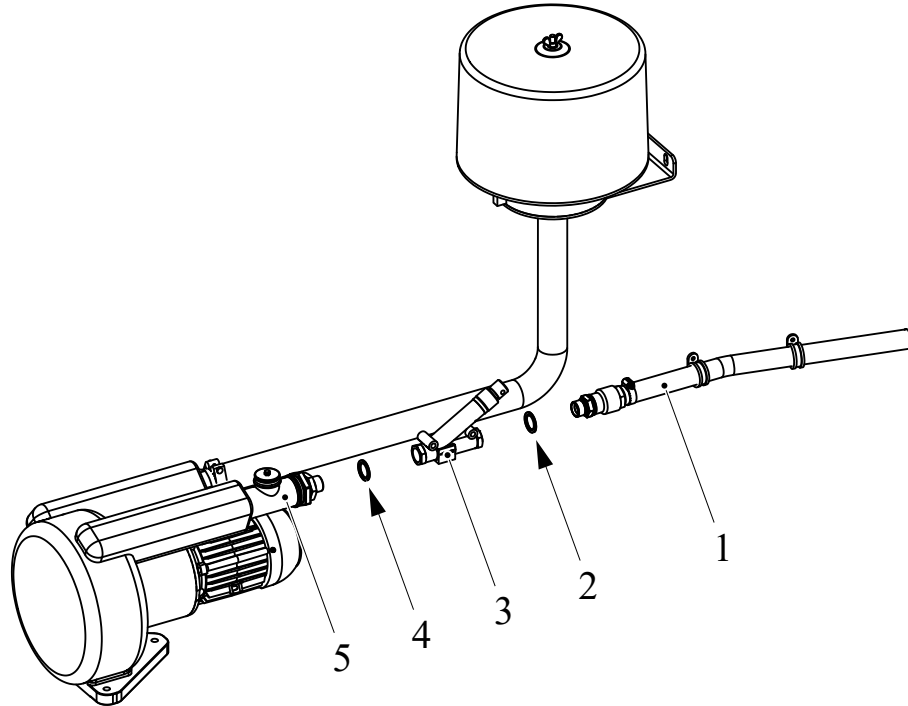


- 1 Hose
- 2 Seal ring
- 3 Flow valve
- 4 Seal ring
- 5 Dust seal air pressure unit

3.10.1.2

Installing the dust seal air pressure needle valve

1. Attach the seal ring (4) and the flow valve (3) to the dust seal air pressure unit (5). The mounting direction of the flow valve (3) is with the arrow on the flow valve (3) pointing towards the dust seal air pressure unit (5).
2. Attach the seal ring (2) and the hose (1) to the flow valve (3).



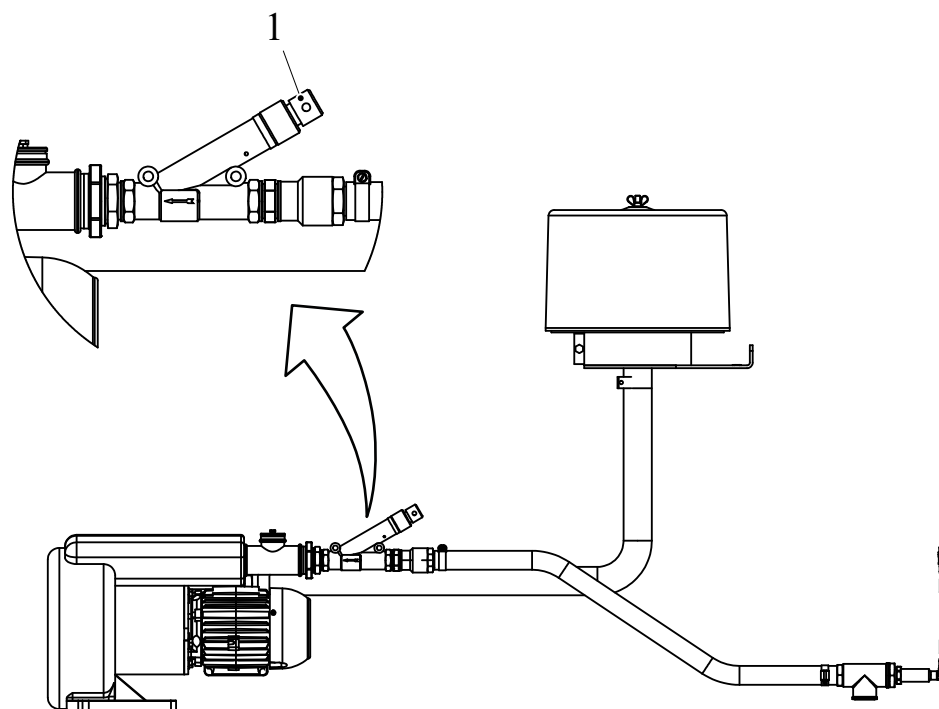
- 1 Hose
- 2 Seal ring
- 3 Flow valve
- 4 Seal ring
- 5 Dust seal air pressure unit

3. Set the flow valve, refer to section [3.10.2.Flow valve setting \(Page 248\)](#)

3.10.2

Flow valve setting

1. Turn the flow valve knob (1) anticlockwise to fully open.
2. Turn the flow valve knob (1) 7 revolutions clockwise to set the starting air flow.
3. If oil is leaking through the dust seal ring at the recommended starting air flow, then turn the flow valve knob (1) one full revolution clockwise to reduce the air flow.



1 Flow valve knob

3.11

V-belt drive

3.11.1

Checking the V-belt tension

During the first few days of operation, the V-belt tension must be checked frequently since new belts stretch. If the V-belts are not tensioned sufficiently, slipping can occur and the life time of the V-belt will be reduced considerably.

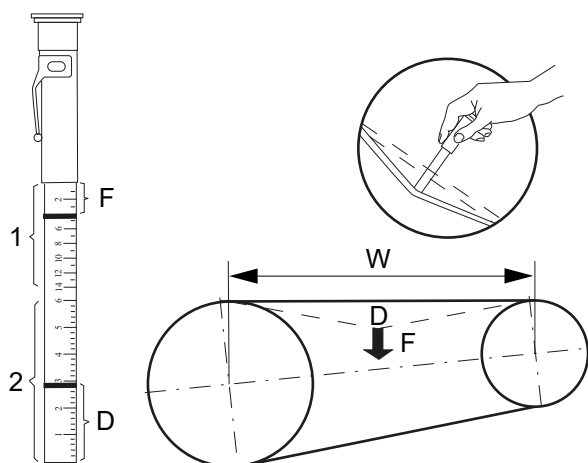
Proper V-belt tension can be determined with the help of the deflection load. Check the deflection load with a spring balance or a special instrument, a tensiometer or its equivalent.

Recommended deflection load (F)

The deflection load varies, depending on belt type and manufacturer and also if it is new or worn belts. Check the recommended deflection load with the belt manufacturer.

Maintenance Instructions

1. Checking the deflection load with a tensiometer:
 - a) Measure the V-belt span (W) in meters, as shown below.
 - b) Multiply the span by 1.5, to give the V-belt deflection (D) in cm.
 - c) On the tensiometer: Set the top side of the lower O-ring to the correct deflection in cm on the meter's lower scale.
 - d) Push the upper O-ring up against the lower edge of the outer sleeve.
 - e) Press the meter against the V-belt in the middle of the span and press sufficiently hard to bring the top side of the lower O-ring level with the V-belt alongside.
 - f) Remove the meter and read off the load (F) in kp (lbf) at the top side of the upper O-ring. The correct load is obtained from the table above, which should be reproduced on the meter.
 - g) If the load is too low or too high on any of the V-belts, tighten or slacken them, see section [3.11.3.2. Installing the V-belts \(Page 251\)](#) for information on how to set the tension.



1 F -scale

2 D -scale

D = deflection

W = V-belt span

F = deflection load

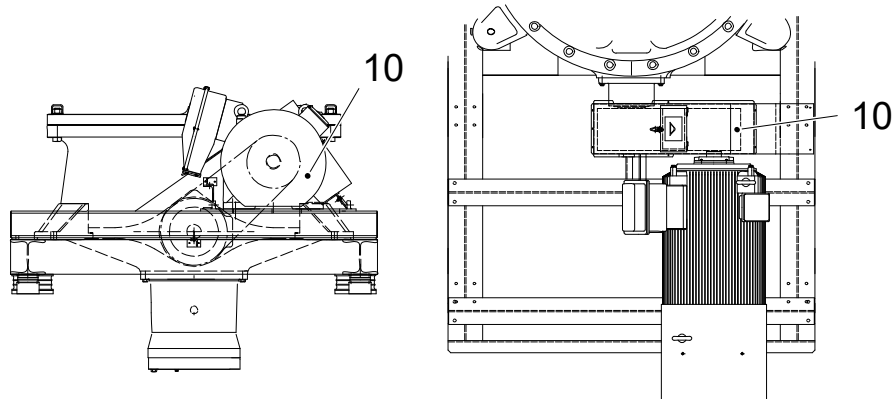
Maintenance Instructions

3.11.2 Replacing the V-belt guards

3.11.2.1 Removing the V-belt guards

1. Remove the screws, the washers and the nuts from the guard sections (10).
2. Remove the guard sections.

V-belt drive.



10 V-belt guard

3.11.2.2 Installing the V-belt guards

When all adjustments are finished, install the guards.



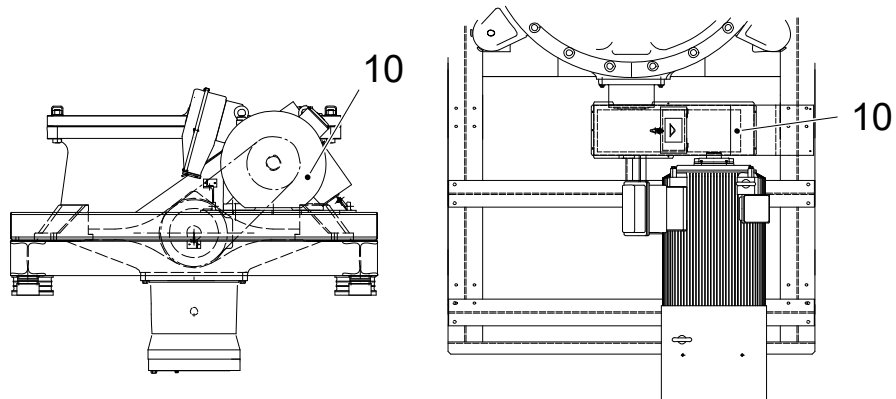
NOTICE

RISK OF PROPERTY DAMAGE

Do not start the motor/crusher before the V-belt guards have been correctly installed.

1. Position the guard sections (10) over the V-belt drive.
2. Install the screws, the washers and the nuts.

V-belt drive.



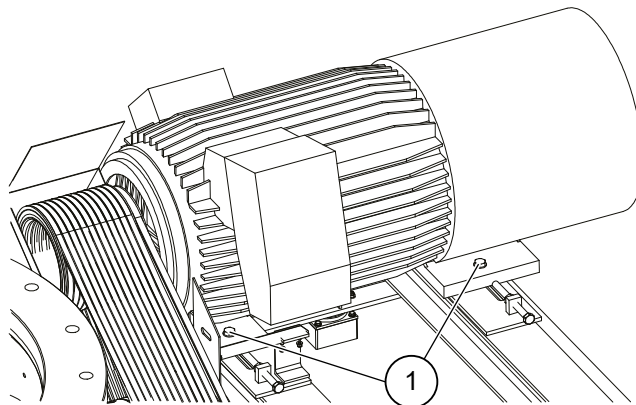
10 V-belt guard

Maintenance Instructions

3.11.3 Replacing the V-belts

3.11.3.1 *Removing the V-belts*

1. Make sure the drive motor is properly locked out.
2. Remove the guard from the V-belt drive.
3. Slacken the nuts on the screws (1) that fasten the motor to the motor beams.



1 Fastening screws

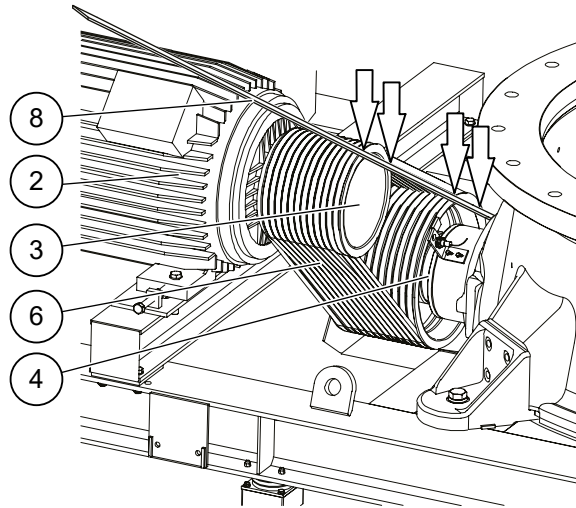
4. Push the motor (2) with the motor pulley (3) towards the crusher pulley (4) on the motor beams (5).

3.11.3.2 *Installing the V-belts*

1. Clean both pulleys.
2. Make sure that the fastening screws have been loosened.
3. Install the V-belts (6) on the pulleys (3) and (4).
4. Push the motor (2) away from the crusher to tension the belts (6).

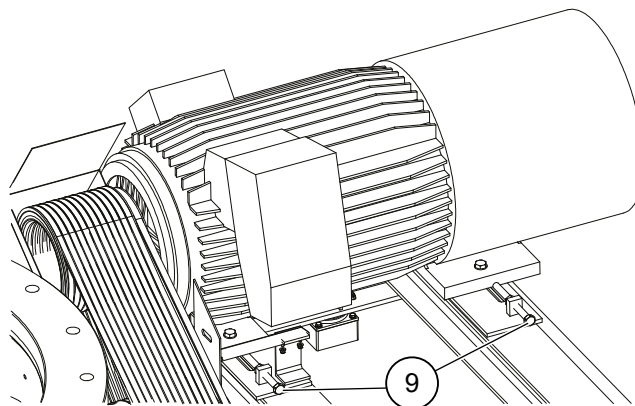
Maintenance Instructions

5. Check the alignment of the crusher pulley and the motor pulley with a ruler/straight-edge (8). Use a feeler gauge to confirm that there is metallic contact between the ruler and the pulleys at the four points in the figure as shown by the arrows below. Metallic contact confirms that the pulleys are correctly aligned. If necessary use a crow bar to move the motor into the correct position.



- 2 Motor
- 3 Motor pulley
- 4 Crusher pulley
- 6 V-belt
- 8 Ruler/ straight-edge

6. Check the tension of the V-belts (6). See section [3.11.1.Checking the V-belt tension \(Page 248\)](#).
7. Use the adjusting screws (9) to move the motor sideways to obtain correct belt tension.



- 9 Screws

8. Make a final check with the tensiometer and the ruler before locking the nuts on the adjusting screws.
9. Tighten the fastening screws.

Maintenance Instructions

10. Install the guards, see section [3.11.2.2.Installing the V-belt guards \(Page 250\)](#).

3.11.4 Replacing the V-belt drive motor

3.11.4.1 *Removing the V-belt drive motor*

1. Remove the screws from the nuts and T-bolts.
2. Position the hook of a crane vertically above the electric motor (4) and connect the lifting slings to the lifting eye bolts on the motor (4) and to the hook.
3. Take up the slack in the lifting tackle. The tackle should now be tight but not lifting the motor.

WARNING



SUSPENDED LOAD HAZARD

A drive motor weighs up to 1 500 kg (3 307 lbs) $\pm 10\%$. You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

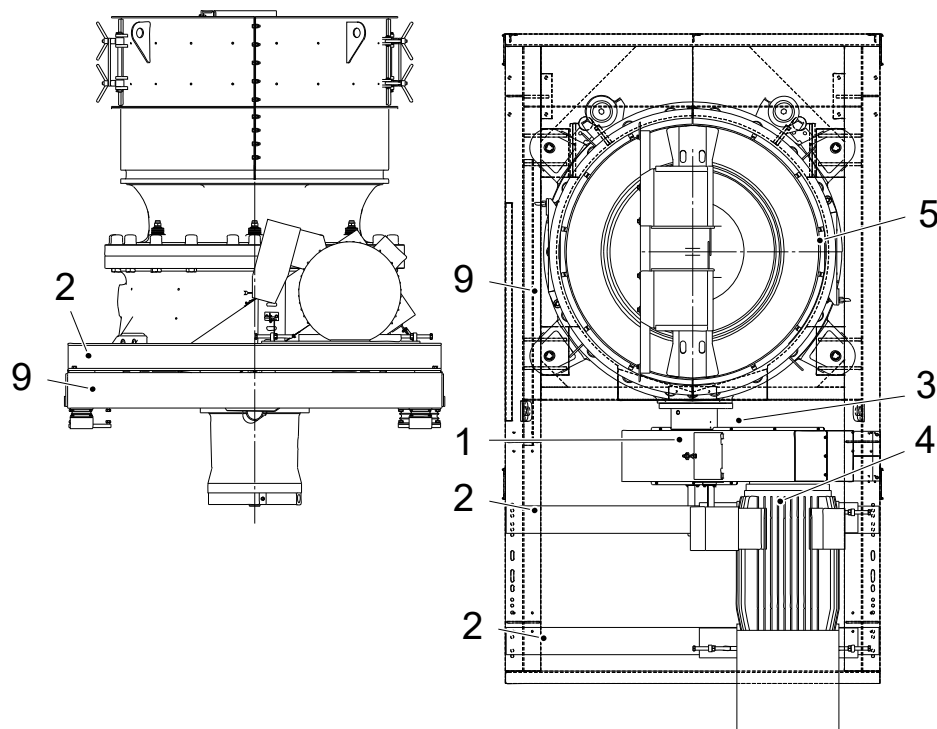
4. Lift the motor (4) away from the motor beams (2).

Maintenance Instructions

Note!

V-belt drive, right-hand layout. The entire drive assembly can also be mounted on the left-hand side.

5. Mount the washers and the nuts on the T-bolts. Do not tighten.



- 1 V-belt guard
- 2 Motor beams
- 3 Inspection door
- 4 Motor
- 5 Cone crusher
- 9 Sub-frame

3.11.4.2

Installing the V-belt drive motor

1. Position the hook of a crane vertically above the electric motor (2) and connect the lifting slings to the lifting eye bolts on the motor (2) and to the hook.
2. Take up the slack in the lifting tackle. The tackle should now be tight but not lifting the motor.

WARNING



SUSPENDED LOAD HAZARD

A drive motor weighs up to 1 500 kg (3 307 lbs) $\pm 10\%$. You can sustain crush injuries, fall or even die if you are struck by the load.

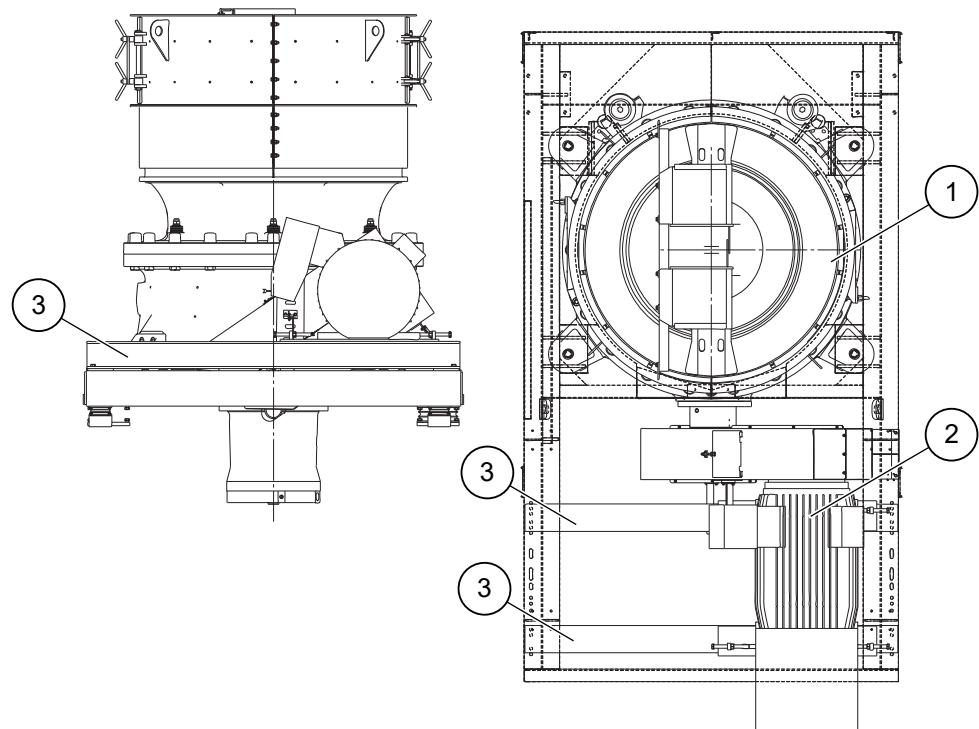
Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

3. Lower the motor (2) on to the motor beams (3).
4. Mount the washers and the nuts on the T-bolts. Do not tighten.

Note!

V-belt drive, right-hand layout. The entire drive assembly can also be mounted on the left-hand side.

5. Align the motor (2) and crusher (1).

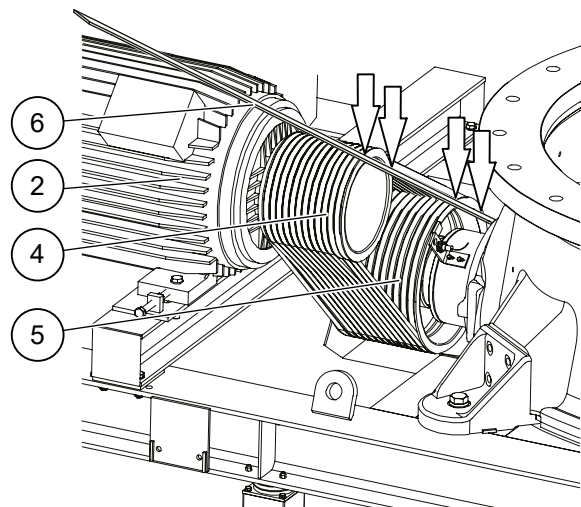


- 1 Crusher
- 2 Motor
- 3 Motor beam

6. Put a steel ruler (6) so that it bears against the pulleys (4) and (5) at four points (see the arrows in the illustration below).
7. Use a crow bar to move the motor lengthwise or to rotate it until the motor pulley (4) and the crusher pulley (5) are aligned.

Maintenance Instructions

8. Use a feeler gauge to check that there is metallic contact between the ruler (6) and the pulleys (4) and (5) at the four points. Metallic contact confirms that the pulleys are correctly aligned.



2 Motor

4 Motor pulley

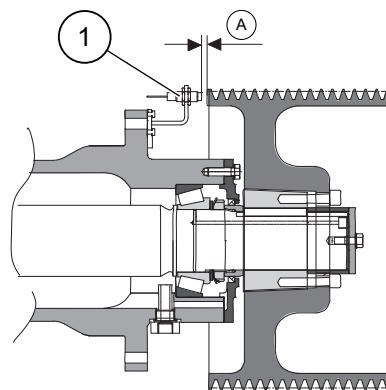
5 Crusher pulley

6 Ruler/ straight-edge

3.11.5

Setting the V-belt speed monitor

1. Fit a speed monitor, to avoid the problems caused by slipping or broken V-belts. It should be connected in such a way that the feed to the crusher is stopped if the pinionshaft speed drops by 5 %.
2. Set the distance A to 7 mm (0.28")

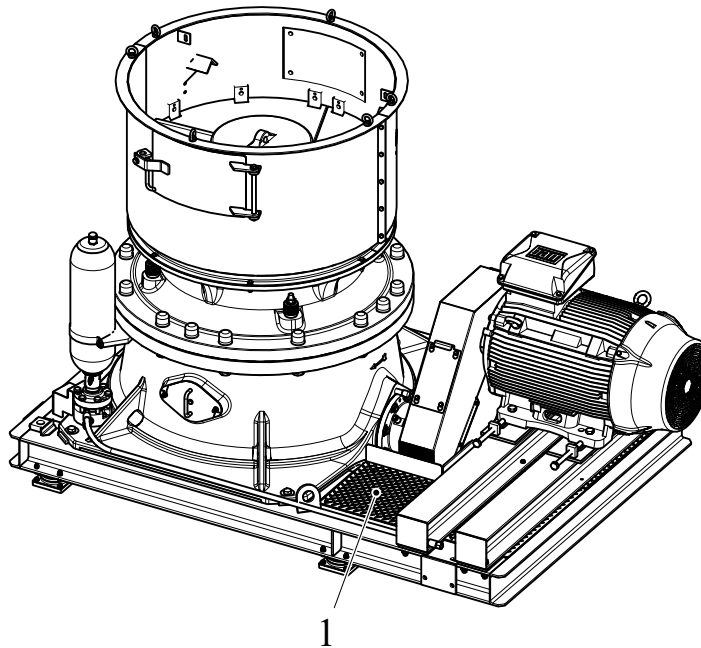


1 Speed monitor

3.11.6

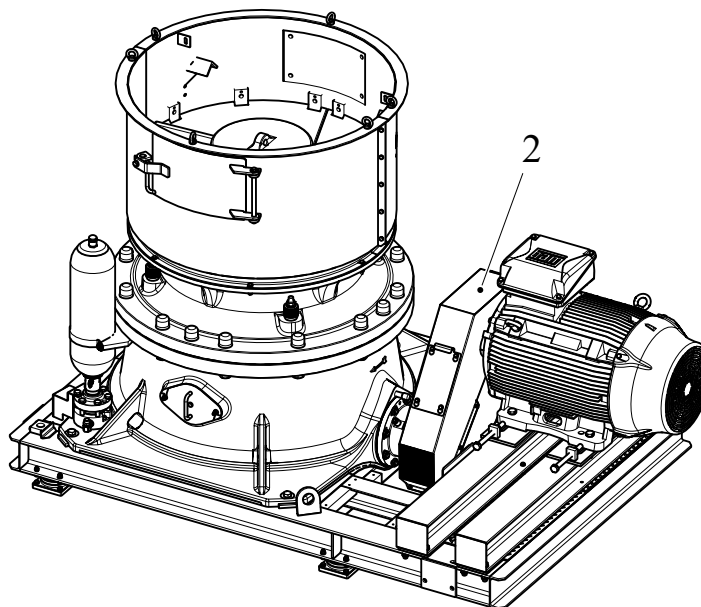
Preparations before removing the pinion shaft housing

1. Remove the floor (1).



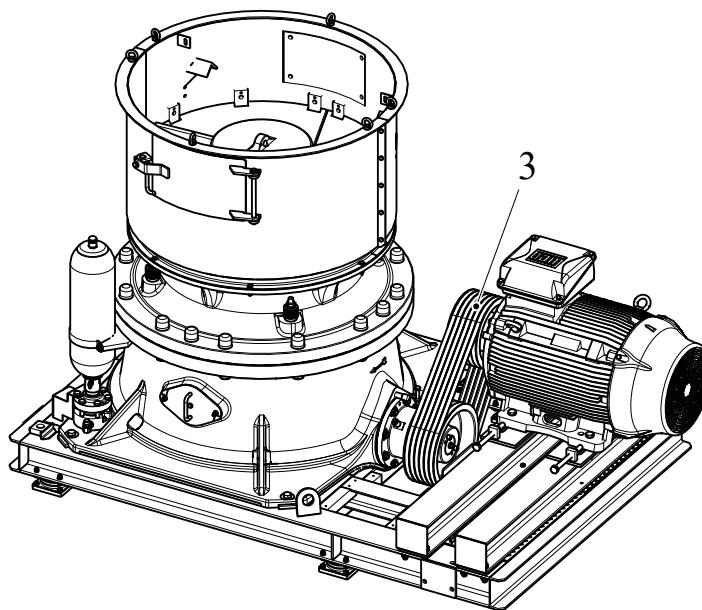
1 Floor

2. Remove the V-belt guards (2), see section [3.11.2.1.Removing the V-belt guards \(Page 250\)](#).



2 V-belt guards

3. Remove the V-belts (3), see section [3.11.3.1.Removing the V-belts \(Page 251\)](#).



3 V-belts

WARNING

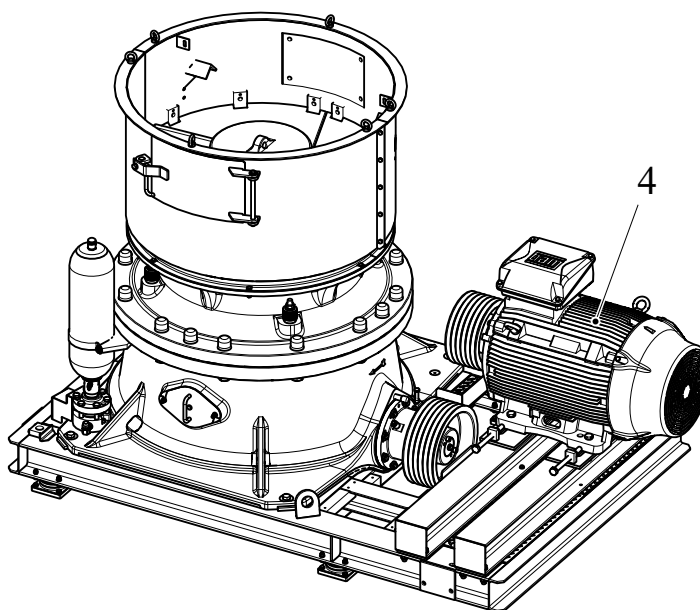


SUSPENDED LOAD HAZARD

A drive motor weighs up to 1 500 kg (3 307 lbs) $\pm 10\%$. You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

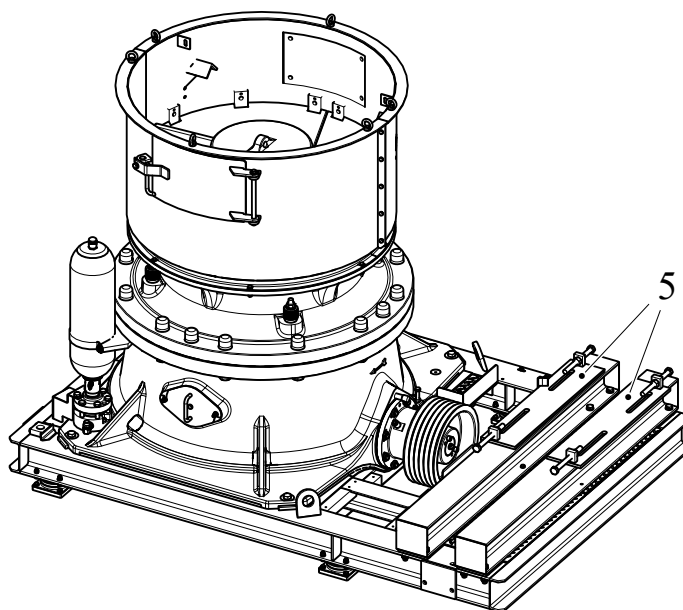
4. Remove the motor (4), see section [3.11.4.1.Removing the V-belt drive motor \(Page 253\)](#).



4 Motor

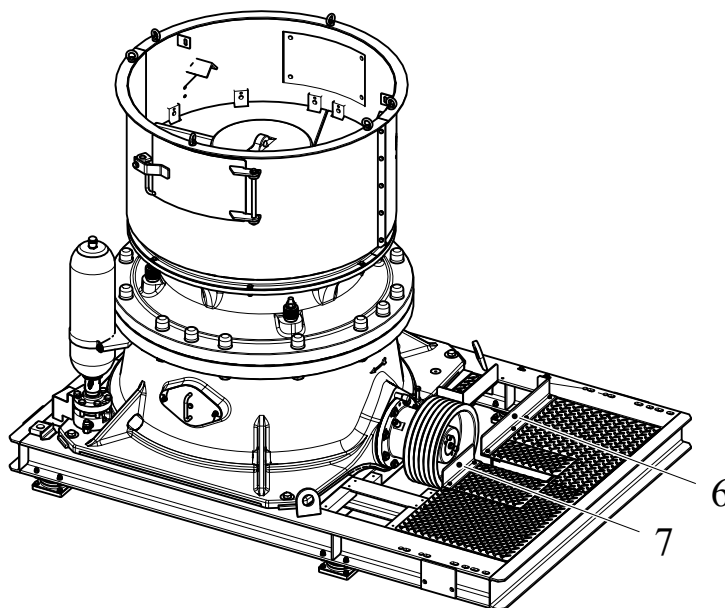
Maintenance Instructions

5. Remove the motor brackets (5).



5 Motor bracket

6. Remove the angle bars (6) and (7).

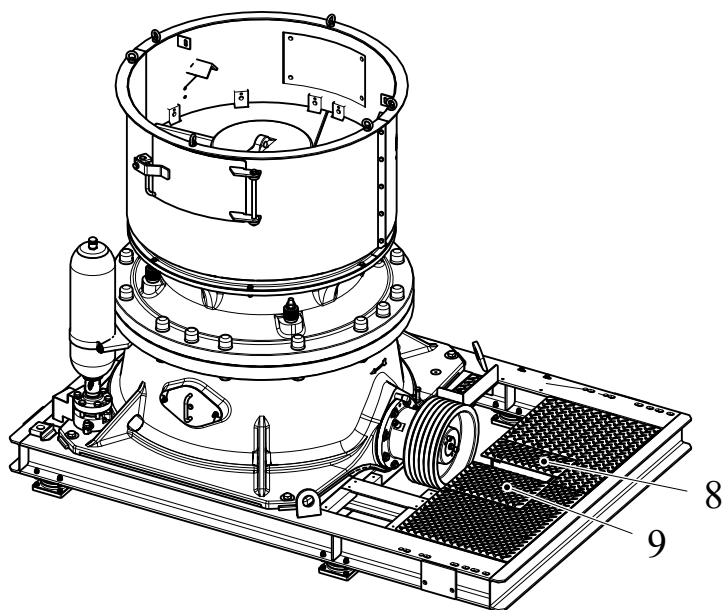


6 Angle bar

7 Angle bar

Maintenance Instructions

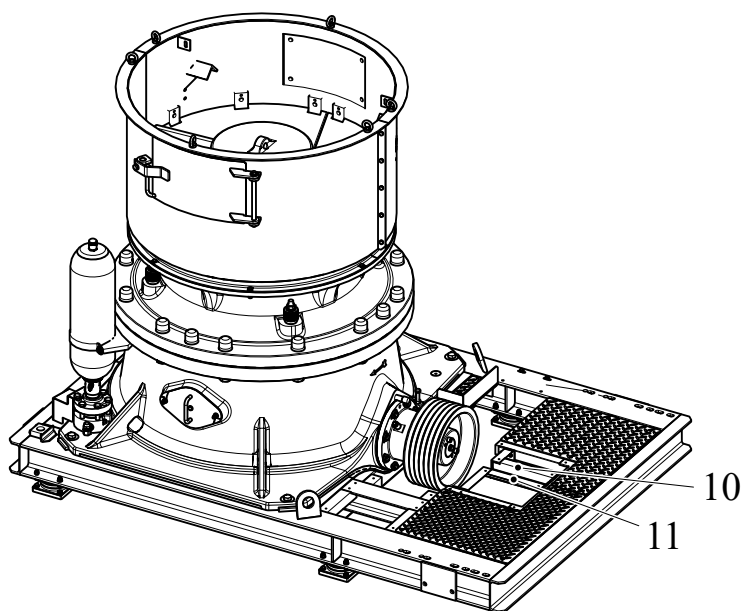
7. Remove the floors (8) and (9)



8 Floor

9 Floor

8. Remove the floor supports (10) and (11).



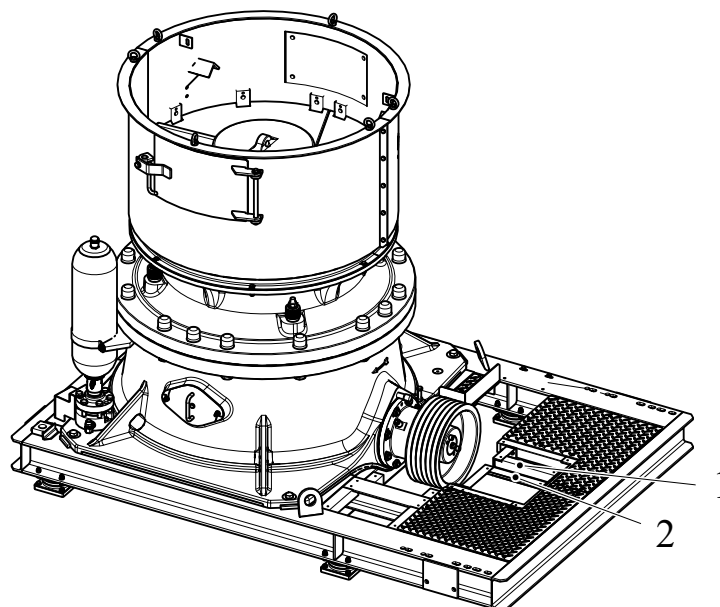
10 Floor support

11 Floor support

3.11.7

Restoration after installing the pinion shaft housing

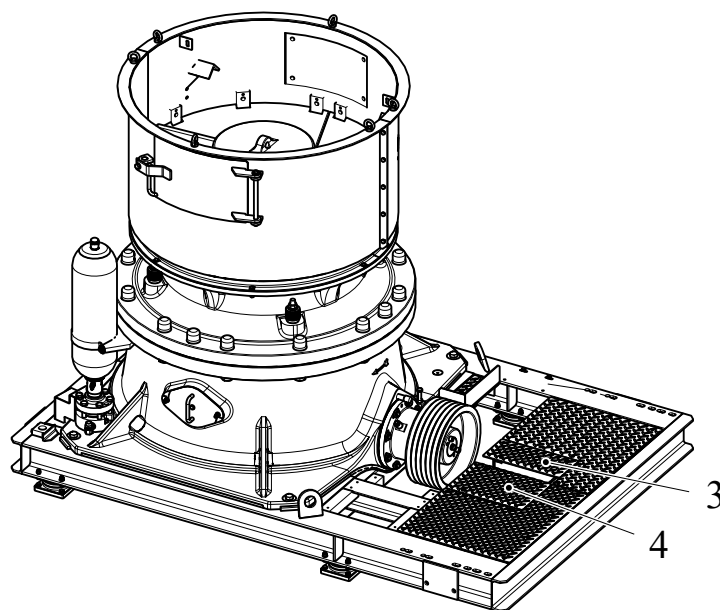
1. Install the floor supports (1) and (2).



1 Floor support

2 Floor support

2. Install the floors (3) and (4).

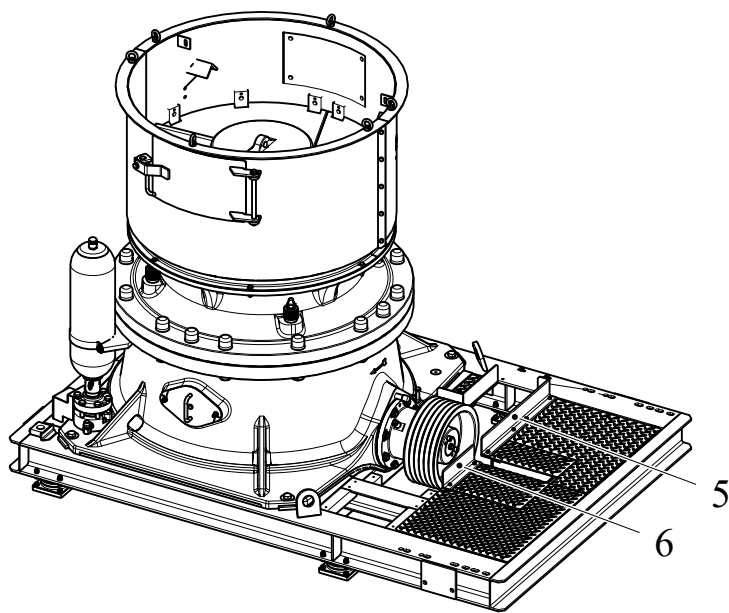


3 Floor

4 Floor

Maintenance Instructions

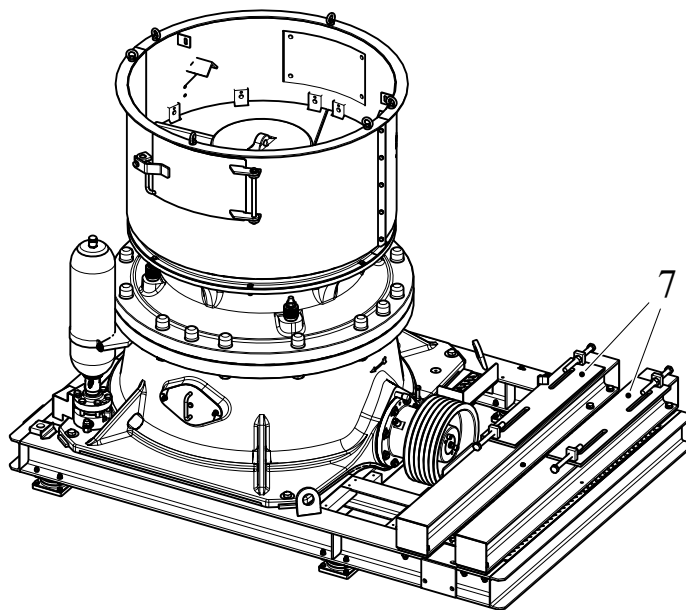
3. Install the angle bars (5) and (6).



5 Angle bar

6 Angel bar

4. Install the motor brackets (7).



7 Motor brackets

WARNING

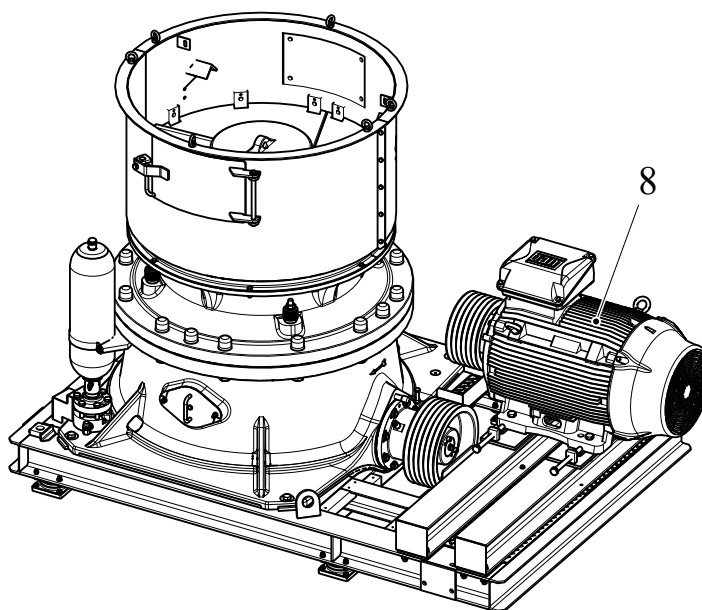


SUSPENDED LOAD HAZARD

A drive motor weighs up to 1 500 kg (3 307 lbs) $\pm 10\%$. You can sustain crush injuries, fall or even die if you are struck by the load.

Make sure that the load is secure. Stand clear of suspended loads. Use ropes or poles to steady and maneuver loads – never use hands or feet.

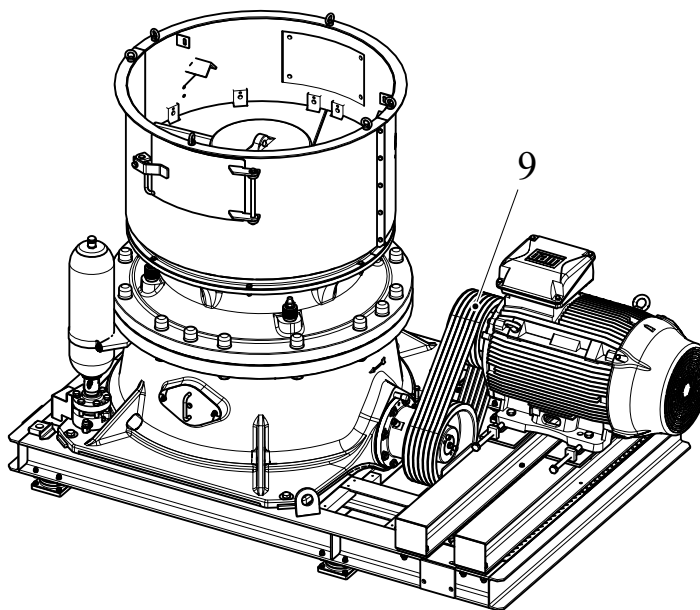
5. Install the motor (8), see section [3.11.4.2. Installing the V-belt drive motor \(Page 254\)](#).



8 Motor

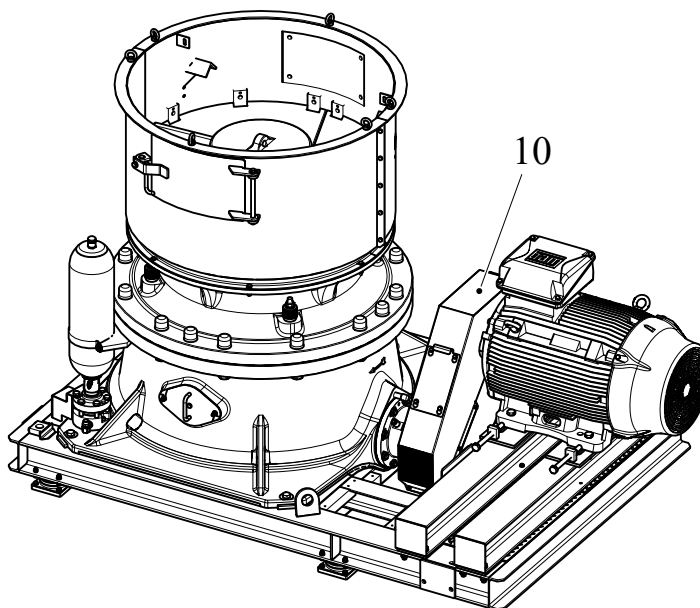
Maintenance Instructions

6. Install the V-belts (9), see section [3.11.3.2.Installing the V-belts \(Page 251\)](#).



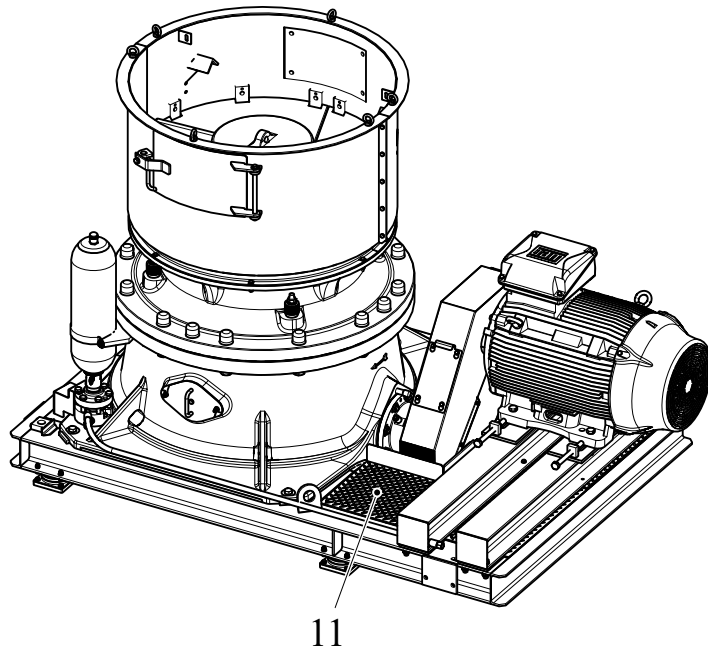
9 V-belts

7. Install the V-belt guards (10), see section [3.11.2.2.Installing the V-belt guards \(Page 250\)](#).



10 V-belts guards

8. Install the floor (11).



11 Floor

3.12 Start-up after maintenance

3.12.1 Checklist for an overhauled crusher

1. Check that the lubrication and Hydroset lines between the crusher and the tank units are correctly installed, and that the oil return lines have sufficient inclination and are adequately dimensioned. For further information about mechanical installation and connections, refer to the *Installation instructions*.
2. Check that the voltage and frequency of the electrical supply match the data given on the motors and the heaters.
3. Check that the motor overload protection relays are set to the correct current values.
4. Fill the lubrication tank and the Hydroset tank with oil. Refer to *Lubrication systems* in the *Technical specifications*, for oil quality and oil quantity.

Note!

Use the same type of oil in the Hydroset tank and the main lubrication tank, but with different viscosities.

5. Switch on the oil heaters.
6. If the pinion shaft housing has been emptied of oil, let the lubrication pump run for five minutes before starting the crusher.
7. Check that the spider bushing is filled with grease to the top of the bushing, when the main shaft is in its lowest position. Refer to *Lubrication systems* in the *Technical specifications*, for grease recommendations.

Maintenance Instructions

8. Check that the spider bushing seal does not leak.
9. Check that the direction of rotation of the motor on the lubrication oil pump is the same as the arrow on the pump.
10. If the crusher is fitted with a cooler, check the direction of rotation of the fan motor(s) and the air flow direction. Air should be drawn through the cooler matrix.
11. Start the crusher's lubrication oil pump and check that there is no leakage in the oil lines. Run the pump for about 30 minutes, then clean the return oil screen from any contaminants (e.g. remnants of sealing compound etc.). Start the pump again.
12. Slightly raise and lower the main shaft several times, and check that the electrical setting control circuits are correctly connected.
13. Bleed all air out of the Hydroset system, see section [3.8.1. Bleeding air from the Hydroset system \(Page 179\)](#).
14. Lower the main shaft to its lowest position and measure the distance between the head nut and the underside of the spider. Make a note of this dimension (A-dimension), it will help determine the wear on the step bearing, without taking the crusher apart.
15. Raise the main shaft between 10 and 15 mm (0.4 to 0.6") from its lowest position.
16. Check that the crusher's drive is correctly aligned. Check that the V-belts are correctly tensioned, see section [3.11.1. Checking the V-belt tension \(Page 248\)](#).
17. Start the crusher's drive motor and check that the direction of rotation is correct. Run the crusher without load until the return oil temperature reaches about 40 °C (104 °F).
18. Check that the pinion shaft lubrication pump starts when the crusher drive motor starts.
19. Check the operation of the return oil flow switch and, if necessary, make an adjustment. Refer to *Checking the function of the return oil flow switch* in the *Operator's instructions*.
20. Bleed the Hydroset system again. See section [3.8.1. Bleeding air from the Hydroset system \(Page 179\)](#).
21. The crusher's drive motor must also stop if there is a high temperature alarm from the protective thermostat. Lower the temperature limit to a value below the temperature of the oil. The motor must stop. Reset the temperature limit to the recommended value, refer to *Temperature switches* in the *Technical specifications*.



NOTICE

RISK OF PROPERTY DAMAGE

The lubrication pump must never be stopped until the crusher has stopped completely.

22. Stop the crusher's drive motor and the lubrication pump.

- 23. Clean the return oil screen, Refer to the Operators Instructions for the tank.
- 24. Check that material cannot be fed to the crusher unless both the crusher and the discharge system are running.

3.13 Starting up the crusher

3.13.1 Preparing a tank that has been stored more than six months

- 1. Look at the *Production Date* on the tank unit's identification plate. If more than six months have passed since the tank unit was manufactured , the following steps must be performed.
- 2. Make sure the Hydroset pump motor K1-M1 cannot be started.
- 3. Close the shut-off valve K1-V1 between the Hydroset tank and the Hydroset control valve.
- 4. Unscrew the valve K1-CV2 in the Hydroset valve K1-HA1.

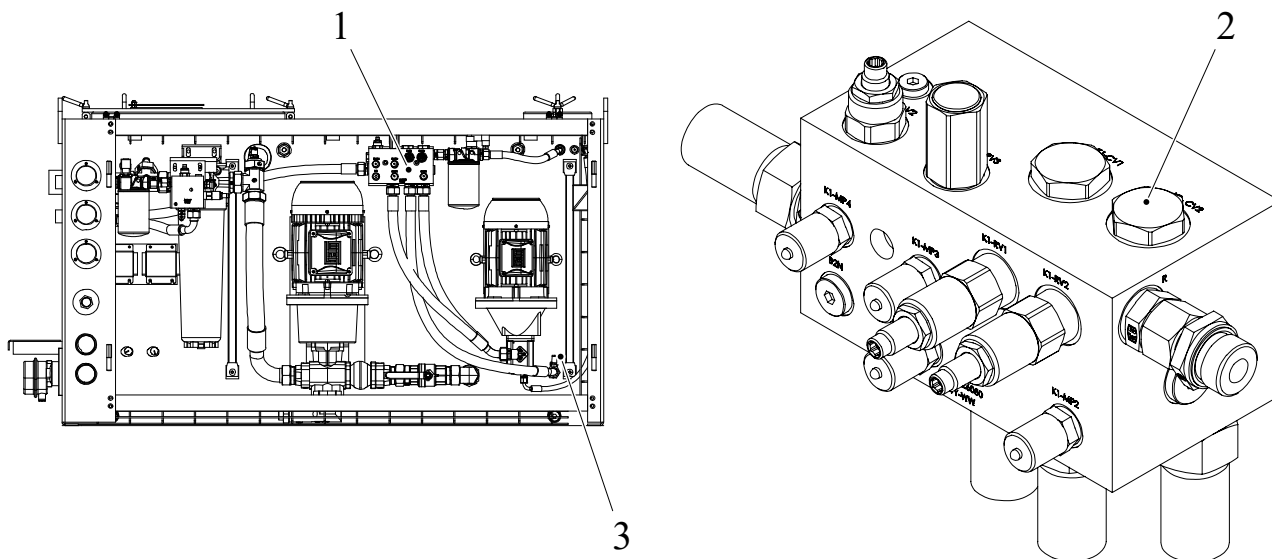
 **NOTICE**

	RISK OF EQUIPMENT OR PROPERTY DAMAGE Some oils are not compatible. Use the same oil as in the lubrication tank.
--	--

- 5. Pour oil in the opening K1-CV2 until it is filled.
- 6. Refit and tighten the valve carefully.
- 7. Open the shut-off valve K1-V1
- 8. Enable start of the Hydroset pump motor K1-M1. The crusher must be switched off.
- 9. Test raising and lowering the main shaft.

Maintenance Instructions

10. If needed, bleed air from the Hydroset system, refer to section *Bleeding air from the Hydroset system* in the *Maintenance Instructions* for the crusher.



- 1 K1-HA1 Hydroset control valve
2 K1-CV2 Check valve, decreases the CSS
3 K1-V1 Shut-off valve, Hydroset tank to Hydroset control valve

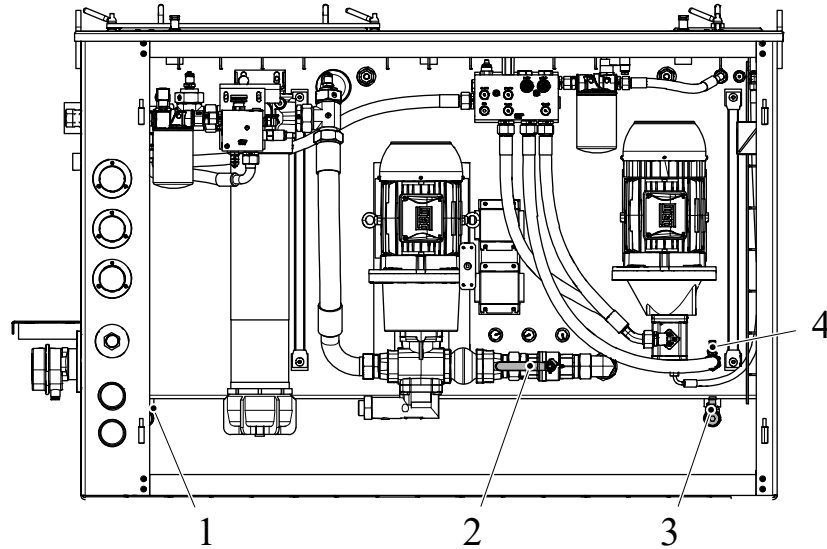
3.13.2

Running-in

The appropriate parts of this section apply also after repair work and the fitting of new parts.

Maintenance Instructions

1. Make sure that the shut-off valves L1-V1 and K1-V1 between the tanks and the pumps are open, and that the tank shut-off valves L1-V5 and K1-V4 are closed.

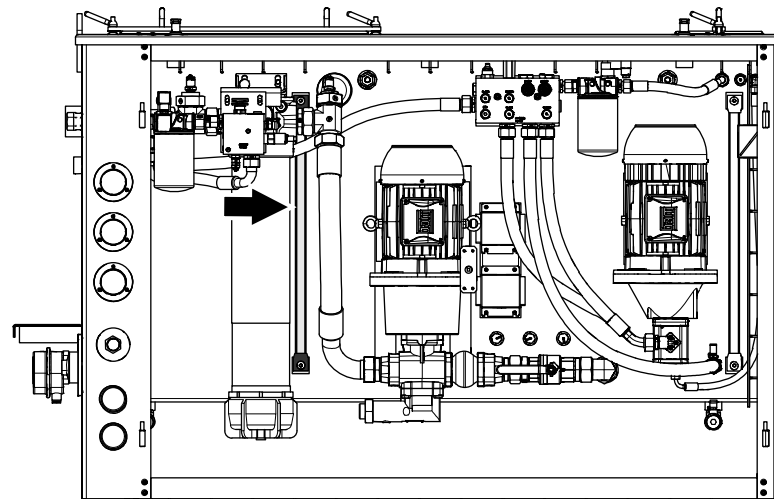


- 1 L1-V5 Shut-off valve, lubrication tank
- 2 L1-V1 Shut-off valve, lubrication oil to pump
- 3 K1-V1 Shut-off valve, Hydroset oil to Hydroset control valve
- 4 K1-V4 Shut-off valve, Hydroset tank

Note!

When the pumps are started, it will take some time before the oil reaches the pinion shaft housing.

2. If the pinion shaft housing has been emptied of oil, let the lubrication pump run for five minutes before starting the crusher.
3. Before the main lubrication oil pump is started check the oil level L1-LI1. When the pumps are started, the oil tank must be filled to the Max. level so that the pump does not run dry.



4. Start the main lubrication oil pump.
When the pump is started, it will take some time before the oil reaches the pinion shaft housing.

Maintenance Instructions

5. When the “Ready for start” signal is obtained, start the crusher’s drive motor.
6. Make sure that the main shaft is in its bottom position. Bleed the Hydroset system, refer to section *Bleeding air from the Hydroset system* in the *Maintenance Instructions* for the crusher.
7. Check and adjust the setting. Refer to *Checking the CSS with lead* in the *Operator’s instructions*.

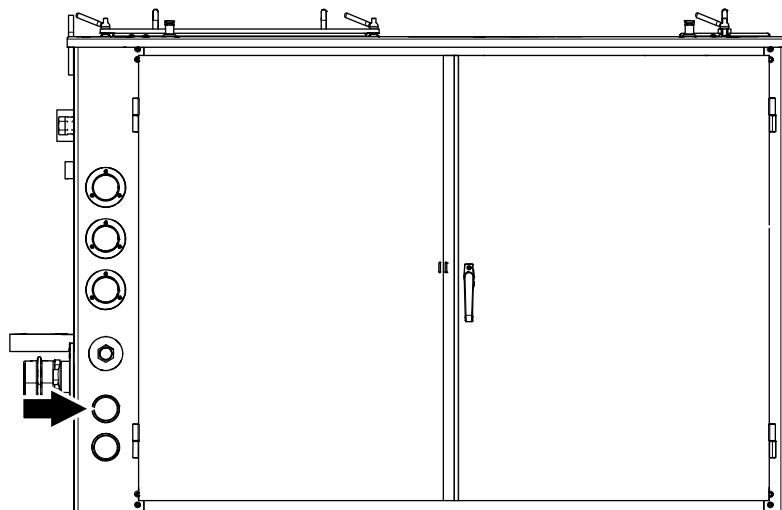


NOTICE

RISK OF PROPERTY DAMAGE

The load at the start of running-in must never exceed 50% of the maximum load. If possible the crushing chamber should be full. The crusher will not be run-in by idling. The crusher is normally run-in after approximately 16 hours of a gradually increase of power and pressure started at 50% load. Depending on the availability of material, and for other process engineering reasons, running-in can take longer. It is important that steps [3.13.2.10 \(Page 272\)](#) to [3.13.2.12 \(Page 272\)](#) are followed carefully during the entire running-in procedure.

8. Start the feed to the crusher. Feed the crusher carefully and gradually increase the power and pressure from 50% load until it reaches full load after 16 hours. Then run the crusher at full load during approximately 8 hours. The total time to run in the crusher is approximately 24 hours. Refer to section *Running-in schedule* in the *Technical specifications*. The load is altered by changing the setting.
9. Check the return oil temperature regularly at the temperature indicator L1-TI2.
This temperature should normally be between 40 °C (104 °F) and 45 °C (113 °F).



Maintenance Instructions

10. Check that the cooling system cuts in and out at the correct oil temperatures. For further information about the temperature switches, refer to the *Technical specifications*.

Note!

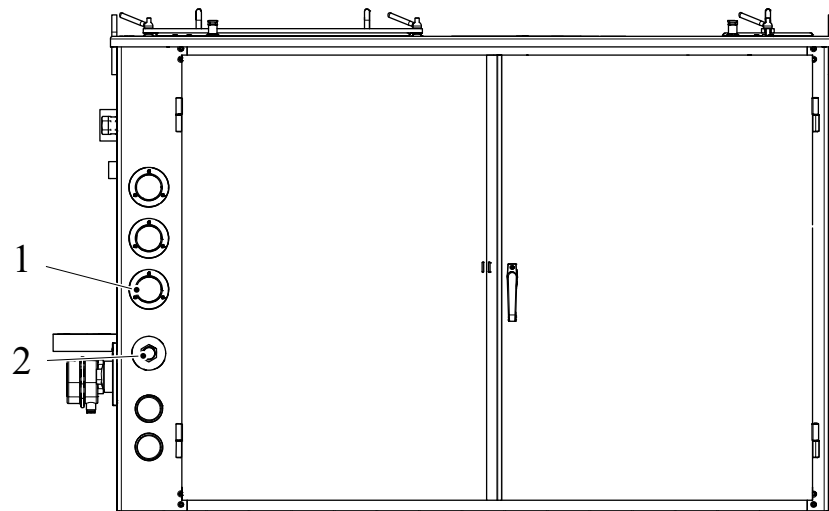
If operating conditions differ from normal (Oil = ISO VG 150 viscosity), set the temperature switches. For further information about the temperature switches and oil heating control, refer to the Technical specifications.

11. Check that the oil returns to the tank from the pinion shaft assembly.
12. Inspect and clean the return oil screen daily. Quite often, a small quantity of fine steel and bronze particles can be found on the return oil screen during the initial running-in period.

For further information about the return oil screen, Refer to the *Operators Instructions* for the tank.

13. Bleed the Hydroset system, refer to section *Bleeding air from the Hydroset system* in the *Maintenance Instructions* for the crusher.
14. Check that there is no movement between the top shell and bottom shell. Put a finger on the joint between the top shell and bottom shell flanges to detect any possible relative motion.
15. Check that there are no oil leaks from the lubrication and Hydroset lines.
16. Check that the Hydroset pressure is within the limits. Push the button K1-V3 and check the pressure on pressure indicator K1-PI1.

For further information about pressure limits and technical specifications, refer to the *Technical specifications*.



1 K1-PI1 Hydroset pressure indicator

2 K1-V3 Button to activate the Hydroset pressure indicator

17. Check the temperature outside the pinion shaft housing with a suitable thermometer, for example an infrared temperature sensor. The normal temperature is 50–60 °C (122–140 °F).
18. Check that the feed is correctly distributed around the crushing chamber, refer to the *Installation instructions*.

19. Check the power consumption and Hydroset pressure, refer to section *Maximum load* in the *Technical specifications*.
20. Check and record the main lubrication system's oil pressure on pressure indicator L1-PI1. For further information about the main lubrication system, refer to section *Checking the pressure of the main lubrication system* in *Operator's instructions*.
21. Check and record the pinion shaft lubrication system's oil pressure on pressure indicator L2-PI1. For further information about the pinion shaft lubrication system, refer to section *Checking the pressure of the pinion shaft lubrication system* in *Operator's instructions*.
22. Check for a ringing sound during crushing, it can indicate a loose mantle or concave ring.
23. Check that there are no grease leaks from the spider bushing.
24. After a few hours of operation, bleed the Hydroset system again, refer to section *Bleeding air from the Hydroset system* in the *Maintenance Instructions* for the crusher.
25. After running-in is completed, check the tightness of all bolts and if the crusher is equipped with a V-belt drive, re-tension the V-belts. Refer to section *Checking the V-belt tension* in the *Maintenance Instructions* for the crusher.

3.13.3

Replacing the filters for the first time

A set of filters for the tank unit is included at delivery.

1. Change the filters after the first 500 operation hours. For more information refer to the operators instructions for the tank.

If the filter's pressure switch is connected to the plant control system, change the filter as indicated by the control system.

This page is intentionally left blank

4 Maintenance personnel's troubleshooting

4.1 Problems and corrective actions



NOTICE

RISK OF EQUIPMENT OR PROPERTY DAMAGE

If the crusher stalls with the crushing chamber full of material, see section [1.1.Cleaning out the crushing chamber \(Page 12\)](#).

Before you carry out any corrective actions:

- Read and understand the instructions.
- Make sure that you have the required training and skills before performing any corrective actions.

When you perform corrective actions, use appropriate approved personal protective equipment. Refer to *Safety and Environmental instructions* for general safety precautions when handling Sandvik equipment.

If the problem remains after you have followed the troubleshooting in this chapter, or if the problem is not covered here, contact Sandvik.

4.2 The crusher does not start

Possible cause	Corrective action
No "Ready for start" signal and oil pump not running	Check the electrical circuits and the starter of the pump motor.
No "Ready for start" signal and low lubrication oil flow	Check the oil hoses and pipes and remove any obstacles.
	If necessary, change the filter cartridges. Refer to the <i>Operator's Instructions</i> for the tank.
	Check the pump capacity. Also see section 4.14.The main lubrication oil capacity is low or non-existent (Page 285) . If necessary, change the pump.
Oil pump running and "Ready for start" signal obtained	Check starter of crusher's drive motor and other electrical circuits. Refer to the <i>Installation Instructions</i> for the crusher.

4.3 The crusher stops

The crusher stops when idling or with material in the chamber.

Maintenance Instructions

Possible cause	Corrective action
Oil pump not running	Check the electrical circuits and the starter of the pump motor.
Low lubrication oil flow	Check the oil hoses and pipes and remove any obstacles.
	If necessary, change the filter cartridges. Refer to the <i>Operator's Instructions</i> for the tank.
	Check the pump capacity. Also see section 4.14. The main lubrication oil capacity is low or non-existent (Page 285) . If necessary, change the pump.
Oil too hot	See section 4.4. The lubrication oil temperature is too high (Page 278) .
If applicable: V-belts slipping	Adjust the V-belt tension, see section 3.11.1. Checking the V-belt tension (Page 248) . Change the V-belts if necessary.
Crusher's drive motor overloaded	Make sure that the eccentric throw and the crushing chamber are correct for the chosen CSS and the material that is crushed.
	Check for bearing failure or seizure in the crusher. See section 4.10. A bearing in the crusher fails (Page 283) .
Tramp metal or blockage in crushing chamber	Reset the drive motor and the overload protection. If applicable: Check the V-belt, see section 3.11.1. Checking the V-belt tension (Page 248) and adjust if necessary.
	If increasing the CSS doesn't help, it can be necessary to loosen the top shell bolts and to lift the top shell. For top shell removal instructions, see section 3.2.5. Replacing the top shell (Page 44) .

4.4

The lubrication oil temperature is too high

Possible cause	Corrective action
Protective temperature switch L1-TS3 shuts the crusher down	Air/oil cooler: check the fan motor and the starter.
	If the contamination in the return oil screen L1-OS1 has increased, check for incipient bearing failure. See section 4.9. The bearing component wear increases (Page 283) .
	Check the operation of the oil cooling system.
	Check the temperature on the temperature gauge next to the thermostatic valve. If it is significantly higher than the operating temperature for the thermostatic element, replace the thermostatic element. Refer to the <i>Operator's Instructions</i> for the tank.
Cooler cooling continuously	See <i>Protective temperature switch L1-TS3 shuts the crusher down</i> above.
	If the lubrication oil viscosity is incorrect, change the oil. Refer to <i>Oil for the main lubrication system</i> in <i>Technical specifications</i> .
Low lubrication oil flow	Check the oil hoses and pipes for leaks. Replace or seal any defective parts.
	If necessary, change the filter cartridges. Refer to the <i>Operator's Instructions</i> for the tank.
	Check the pump capacity. If necessary, change the pump. Refer to the <i>Operator's Instructions</i> for the tank.

4.5

The CSS varies or the product is oversized

Possible cause	Corrective action
Low Hydroset pressure	Check the capacity of the Hydroset pump. If necessary, change the pump.
Leakage in Hydroset system	Check the Hydroset oil hoses and pipes for leaks. If possible without going below the smallest A-dimension, decrease the CSS until the mantle and concave are in metal-to-metal contact. Check the Hydroset pressure indicator K1-PI1 by pressing the button K1-V3 to see if the pressure is falling. Replace or seal any defective parts.

Maintenance Instructions

Possible cause	Corrective action
Hydroset relief valve leaking. CSS increase has caused oil level to rise in the Hydroset tank	If there are overload pressure peaks, change the feed arrangement. The crusher should be choke fed without segregation, refer to the <i>Installation instructions</i> . If there are no overload pressure peaks, change the damaged Hydroset relief valve.
Hydroset hydraulic assembly leaking. CSS increase has caused oil level to rise in the Hydroset tank	Clean or replace the Hydroset control valve K1-HA1. Refer to the <i>Operator's Instructions</i> for the tank.
Chevron packing leaking CSS increase has caused oil level to rise in the main lubrication oil tank	Replace the chevron packing, see 3.7.3.Replacing the chevron packing (Page 166) .
Air in Hydroset system or accumulator gas pressure too low. CSS increases during crushing but returns to pre-set value during idling	Bleed air from the Hydroset system, see section 3.8.1.Bleeding air from the Hydroset system (Page 179) . Charge the accumulator to the correct pressure, see section 3.8.2.Checking the gas pressure (Page 180) . Replace the accumulator bladder or the complete accumulator if necessary.
Accumulator bladder damaged. Mainshaft "climbs" to metal-to-metal position when crusher idles, or nitrogen leaks from the accumulator bladder and renders Hydroset oil milky white.	Replace the accumulator bladder or the complete accumulator. Bleed air from the Hydroset system, see section 3.8.1.Bleeding air from the Hydroset system (Page 179) .
Crusher's feed not evenly distributed. Hydroset pump cannot reduce CSS because of pressure peaks	Change the feed arrangement. The crusher should be choke fed without segregation, refer to the <i>Installation instructions</i> .
Mantle and/or concave worn	Fasten the mantle and concave if they are loose. Change the mantle and concave if they are worn out.

Maintenance Instructions

Possible cause	Corrective action
Concave ovality	Check the CSS at four points evenly spaced around the crushing chamber. The difference between the largest and smallest reading is an indication of the ovality.
Headcenter loose	Check if there is play between the headcenter and the mainshaft, see section 3.3.3.1. Checking the play between the head center and the mantle (Page 75) .

4.6

The pinion shaft does not operate correctly

Possible cause	Corrective action
High temperature inside and outside pinion shaft housing. Oil leakage through outer bearing cover	Check if the drain plug leaks, see section 3.9.2.3. Removing the pinion shaft housing assembly (Page 193) . Check for other leaks. Replace or seal any defective parts.
	Remove the pinion shaft assembly for inspection, see section 3.9.2.3. Removing the pinion shaft housing assembly (Page 193) . Replace worn bearings and seals. Change the lubrication oil.
	Check if the outer seal ring, the spacer ring or the O-ring is worn or damaged. Remove the pinion shaft assembly for inspection, see section 3.9.2.3. Removing the pinion shaft housing assembly (Page 193) . Replace worn components.
Abnormal noise in pinion shaft assembly. Incipient bearing failure	Remove the pinion shaft assembly for inspection, see section 3.9.2.3. Removing the pinion shaft housing assembly (Page 193) . Replace worn components. Change the lubrication oil.

Possible cause	Corrective action
Vibration in crusher, pinion shaft housing or motor	Remove the pinion shaft assembly for inspection, see section 3.9.2.3.Removing the pinion shaft housing assembly (Page 193). Replace worn components. If applicable: Check the grooves in the V-belt pulleys. Check the V-belt tension, see section 3.11.1.Checking the V-belt tension (Page 248). If necessary replace them, see section 3.11.3.Replacing the V-belts (Page 251).
Excessive axial play in bearings because of heavy wear on rollers and races Increasing noise or temperature rise in the pinion shaft assembly	Replace the bearings, see section 3.9.3.Replacing the pinionshaft and the pinion (Page 205).

4.7

The crusher sounds different

Possible cause	Corrective action
Incorrectly fitted bevel gears or incorrect gear meshing causing noise from gears. Insufficient backlash emitting a high-frequency rattle	Remove the pinionshaft assembly. Adjust the gear backlash, see section 3.9.4.2.Adjusting the gear backlash (Page 241).
Heavy wear on the eccentric wearing plate leading to reduced backlash. Insufficient backlash emitting a high-frequency rattle	Replace the eccentric wearing plate. Readjust the backlash, see section 3.9.4.2.Adjusting the gear backlash (Page 241). If the eccentric wearing plate wear accelerates, see section 4.9.The bearing component wear increases (Page 283).
Mantle and/or concave loose	Check and tighten the concave ring bolts. Check if there is play between headcenter and mantle, see section 3.3.3.1.Checking the play between the head center and the mantle (Page 75).

Maintenance Instructions

Possible cause	Corrective action
Unusual noise from spider bearing when material is fed	Check grease level and add grease more frequently if necessary, refer to <i>Checking the grease level in the spider bearing</i> in the <i>Operator's instructions</i> .
	Measure the play at the pivot point. If more than permissible, replace the spider bushing and/or the mainshaft sleeve. See section 3.2.3.Replacing the spider bushing and the seal ring (Page 36) and section 3.3.4.Replacing the main shaft sleeve (Page 82) .
"Grating" step bearing components	Extend the running-in period. See section 3.13.2.Running-in (Page 269) .
	If the contamination in the return oil screen L1-OS1 has increased, check for incipient bearing failure. See section 4.9.The bearing component wear increases (Page 283) .
	Check for liner ovality. See section 4.5.The CSS varies or the product is oversized (Page 278) .
Packing in crushing chamber Mantle and concave in "metal-to-metal" contact	Check for concave ovality. See section 4.5.The CSS varies or the product is oversized (Page 278) .
Excessive Hydroset action	Check the lower section of the crushing chamber for "ski-slopes" on the mantle and the concave ring. Change the mantle and/or concave.

4.8

The crusher's capacity drops

Possible cause	Corrective action
If applicable: V-belts slipping	Check the grooves in the V-belt pulleys. Check the V-belt tension. if necessary, tighten or replace them, refer to <i>Checking the wear and tension of the V-belt</i> in the <i>Operator's instructions</i> .
Bridging or blocking in crushing chamber	Check the mantle and concave. If necessary, replace the mantle and/or concave, see section 3.3.1.Replacing the main shaft and the mantle (Page 62) and section 3.2.6. Replacing the concave ring (Page 49) .

4.9 The bearing component wear increases

Possible cause	Corrective action
Contaminated oil leading to increased wear on eccentric wear- ing plate	Check the oil condition regularly. Refer to the <i>Operator's Instructions</i> for the tank. Change the oil at regular intervals. Refer to the <i>Operator's Instructions</i> for the tank.
Oil filter blocked	Change filter cartridges L1-FU1 and L2-FU1. Refer to the <i>Operator's Instructions</i> for the tank.
Dust seal ring worn or damaged	If the play between the dust collar and the dust seal ring exceeds the value in <i>Checking the dust seal ring for wear</i> in the <i>Operator's instructions</i> , replace the dust seal ring.
Dust seal air pressure system not working	Inspect the entire dust seal air pressure system and check the operation of the dust seal air pressure system, refer to section <i>Checking the dust seal air pressure system</i> in the <i>Operator's instructions</i> .

4.10 A bearing in the crusher fails

Possible cause	Corrective action
Main shaft assembly rotates very fast or at the same speed as the eccentric (high head spin). Seizure between mainshaft and eccentric bushing	Disassemble the crusher to inspect the bearing components, see section 3.5.1.3. Inspecting the eccentric bushing (Page 123) .
Pinionshaft cannot be turned. Seizure between eccentric and bottom shell bushing	If possible, take out the bolts that hold the dust collar. Remove the main shaft assembly and the complete eccentric assembly, see section 3.3.1.1. Removing the main shaft assembly (Page 63) and section 3.5.2.1. Removing the eccentric assembly (Page 126) .
Pinionshaft cannot be turned. Bearing failure in pinion shaft assembly	See section 3.9.3. Replacing the pinionshaft and the pinion (Page 205) .

Maintenance Instructions

Possible cause	Corrective action
Increased amount of lead and/or bronze on the return oil screen. Seizure in step bearing or bronze bushings	Remove the step bearing components, see section 3.7.2.Replacing the step bearing components (Page 153) . De-burr the edges of the oil grooves. Polish the bearing surfaces of the bushings and the step bearing components. If necessary, replace the step bearing components. Inspect the bearing surfaces of the bushings.
Needle-like particles on the return oil screen. Seizure or wear in bevel gears	Check the gear backlash, see section 3.9.4.1.Checking the gear backlash (Page 238) . Listen for noise from the bevel gears or the pinion. Clean the return oil screen. Refer to the <i>Operator's Instructions</i> for the tank.
High temperature or localized overheating and partial seizure in bushings or step bearing components Lead flakes in return oil screen	See section 4.4.The lubrication oil temperature is too high (Page 278) .

4.11

The main lubrication oil is contaminated

Possible cause	Corrective action
Contamination in the return oil screen L1-OS1 has increased	Check for incipient bearing failure, see section 4.9.The bearing component wear increases (Page 283) .
High return oil temperature	See section 4.4.The lubrication oil temperature is too high (Page 278) .
Dirt	Check the dust seal. A worn dust seal lets dust into the system. Check the function of the dust seal air pressure system, refer to section <i>Checking the dust seal air pressure system</i> in the <i>Operator's Instructions</i> .

4.12 The Hydrosset bolts are broken

Possible cause	Corrective action
Incorrect torque	Replace all the bolts if any of them is defect. Use only bolts intended as Hydrosset bolts. Tighten to recommended torque. Refer to <i>Tightening torques</i> in <i>Technical specifications</i> .
High Hydrosset pressure	Feeding the crusher with tramp metal can cause the Hydrosset bolts to fail. Make sure any tramp metal is removed before the material reaches the crusher.

4.13 The concave bolts are broken

Possible cause	Corrective action
Worn topshell	Inspect the seating area for the concave ring during a concave change. Remove any upset metal that can stop the concave ring from seating correctly in the topshell.
Incorrectly tightened bolts	Tighten bolts correctly. Refer to <i>Tightening torques</i> in <i>Technical specifications</i> .

4.14 The main lubrication oil capacity is low or non-existent

Possible cause	Corrective action
Pump sucks air through a leak	Check the suction lines. Replace or seal any defective parts.
	Check the shaft seal. Replace or seal any defective parts.
Pump rotates in wrong direction	Check if the direction of rotation corresponds to the arrow on the motor housing. If not, change the direction of rotation.
High pressure but still low capacity because of wrong type of oil	Change the oil, refer to <i>Oil for the main lubrication system</i> in the <i>Technical Specifications</i> .
Suction line blocked	Remove the obstruction.
Broken pump, e.g. cavitation in pump or broken coupling	Replace the pump. Refer to the <i>Operator's Instructions</i> for the tank.

This page is intentionally left blank



www.sandvik.com