Title Page

Boomer L2D - Workshop Manual Boomer L2 D





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1 Introduction

1.1 Safety First

Always read the information in the safety manual before starting to use the machine or before starting any maintenance work.

1.2 The Purpose of this Publication

The objective of the maintenance instructions is to give information about routine preventive maintenance, which is necessary to keep the machine in good working order and helps prevent faults and breakdowns.

The instructions require that maintenance is done on a set schedule.

Preventive maintenance is a precondition for planning necessary interruptions in operation such as reconditioning and repairs.

1.3 Target Group

The information in this publication is intended for everyone involved in the application, operation, and maintenance of the machine and related equipment. All readers are expected to possess basic competence regarding mining methods, construction methods, and the machines used for that kind of operation.

Epiroc is not liable for any damage, injuries, or deaths caused by users who misunderstand the published information and/or use it incorrectly.

1.4 Product Warranty

The product warranty relies on correct use, maintenance, and repair of the machine and its components at all times.:

- Use only Epiroc original parts. Any damage or operational interruptions caused by using spare parts of other manufacturers than Epiroc will not be covered by warranty.
- Epiroc is not liable for any damage caused by unauthorized modification to the machine and its equipment.
- · Epiroc is not liable for damage caused by inappropriate use.
- Overloading the machine can result in damage to the structure which is not noticed during normal usage. Such damage is not covered by the warranty.
- Damage that occurs as a result of inadequate maintenance, substandard repairs, or damage to equipment that is attributable to older unrepaired damage, is not covered by the warranty.
- Read the Epiroc warranty policy.

2 Operator Environment

2.1 Technical Data

Air Conditioning Unit

Refrigerant	R134a
Amount of refrigerant	1.1 kg (2.42 lbs)
Refrigerating capacity (27°C, RH 30%)	4.8 kW (6.43 hp)
Heating capacity, from diesel engine	1.2 kW (1.6 hp)
Air flow	470 m³/h

2.2 Troubleshooting Air Conditioner

Fault Symptom	Action
No cooling at all	Check the fuses, electrical connections, compres- sor ground, electromagnets, switches, and pres- sure switches.
	Check the V-belt and compressor.
	Check the expansion valve and temperature con- trol valve.
	Check the coolant hoses.
Poor cooling	Check the fresh-air fan and V-belt tension.
	Check whether the air is passing the evaporator in the unit.
	Check that the evaporator and condenser are not clogged and that the filter in the air intake is not dirty.
	Check that the expansion valve capillary tube is firmly tightened against the evaporator outlet pipe.
	Check that the thermostat does not cut out too early.
Uneven cooling	Check that the connections to switches, magnetic coupling, or pressure switch are not loose.
	Check that the expansion valve is not clogged.
	Check that the system is filled and that the ther- mostat is working.

Fault Symptom	Action
Abnormal noise	Check that the multi-V-belt to the compressor is properly tightened and that the compressor retain- ing bolts are tightened.
	Check that the system is filled sufficiently and not overfilled.
	Check that the expansion valve is in working or- der.
	Check that the airflow across the evaporator is sufficient.
	Check that the condenser is clean and the airflow is sufficient.
	NOTE: Abnormal system noise is often related to incorrectly as- sembled components. If the compressor is noisy at a certain speed and the noise disappears when the speed increases or decreases, there is probably nothing wrong with the compres- sor itself. The difference be- tween the pressure on the suc- tion side and the pressure side also affects the level of noise. A compressor with low suction makes more noise than a com- pressor with high suction. Like- wise, a compressor with high pressure makes more noise be- cause it puts more load on bear- ings and other components

3 Boom Unit

3.1 Safety Precautions before Working on Boom Unit

	WARNING
	Disassembling and Assembling Components
	Can cause personal injury.
•	Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.

3.2 BUT 35 M

NOTE: All weights are in respect of boom, excluding feeder and rock drill.

Weight

Description	Data
Complete boom, including hydraulic hoses	3060 kg (6,746 lb)
Rear boom section (1)	1700 kg (3,747 lb)

Description	Data
Intermediate boom section (2)	410 kg (903 lb)
Front boom section (3)	640 kg (1,410 lb)

Length

Description	Data
Telescope contracted	7252 mm (285 in.)
Telescope extended	9052 mm (356 in.)

3.3 Boom Overview



Boom

А	Attachment plate	В	Bulkhead connection
С	Feed extension cylinder	D	Rotary actuator
E	Tilt cylinder	F	Boom head
G	Front boom cylinders	н	Telescopic unit
J	Rear boom cylinders		

The hydraulic boom is a telescopic boom with 360° feed rotation. It features three-point suspension at front and rear. Each three-point suspension unit includes two hydraulic cylinders which, through series connection in pairs, provide parallel feed both vertically and horizontally.

A tilt cylinder enables the feeder to be positioned for roof and cross-cut drilling.

The rotary motion is obtained by a hydraulic rotary actuator and transferred via a stub shaft to the feeder.

Boom BUT 35 G is available in two different basic versions, model M (medium) and model L (large). Both models are available for left-mounted and right-mounted feeder and with or without bulkhead connection.



BUT 35 G model S, left-mounted feeder

1	Rear boom section	2	Intermediate boom section
3	Front boom section		



BUT 35 G model M, left-mounted feeder

1	Rear boom section	2	Intermediate boom section
3	Front boom section		



BUT 35 G model L, left-mounted feeder

1	Rear boom section	2	Intermediate boom section
3	Front boom section		

3.4 Starting To Use a New Boom

When starting to use a new or reconditioned boom, or one that has been out of service for a long period, the following steps should be taken:

- 1. Lubricate the boom as described in the maintenance schedule. It is important for lubrication to be effective right from the start.
- 2. Thoroughly clean all piston rods and sliding surfaces that have been treated with corrosion inhibitor.
- 3. Check and retighten all bolted joints and expander shafts at least once every shift during the first week the boom is in use.
- 4. Make sure the pressure in the hydraulic circuits is correctly adjusted. The pressure should be 195-220 bar in the high-pressure circuit and 40 bar in the pilot circuit.

- 5. Check all operating movements to ensure that all hydraulic cylinders travel to their end positions.
- 6. Also check that no hoses can be caught up or pinched and that no oil leakage occurs.

3.5 Hose Location in Bulkhead Connection



AF	Air flushing	AL	Air lubrication
BAN	Anti-parallel holding	BE	Boom extension
BFL	Left boom cylinder front	BFR	Right boom cylinder front
BRL	Left boom cylinder rear	BRR	Right boom cylinder rear
DS	Hydraulic drill rod support, option	F	Feed
FE	Feed extension	FL	Tilt cylinder
FR	Feed rotation	HD	Percussion drain
HDP	Reflex damper, drill	HP	Percussion in
HT	Percussion tank	LS	Automatic drill return
М	Electric cable, option Rod Adding System (RAS)	RA	Rod handling arm, option RAS
RG	Claw gripper, option RAS	RGF	Front claw gripper, rod handling, option RAS
RGR	Rear claw gripper, rod handling, option RAS	RRL	Rotation left, drill
RRR	Rotation right, drill	SR	Stinger, option

WA M	Water mist, option	WC	Water lubrication feed, option
WF	Water flushing		

3.6 Lubricate Boom



Boom BUT 36

- O Lubricate boom attachment (A).
- O Lubricate attachment shaft (B).
- O Lubricate front and rear cylinders (C).
- O Lubricate feed lookout cylinder (D).
- O Lubricate telescope bearing (E).

NOTE: Operate telescope while lubricating.

- Lubricate rotation unit (F).
- O Lubricate cylinder link (G).
- O Lubricate boom link (H).

3.7 Check Grease Nipples on Boom

O Check the grease nipples on the boom for damage.

➔ Replace if necessary.

3.8 Check Tightening Torques on Boom on BUT 35G

The following table specifies the bolted joints requiring a special tightening torque. Other bolted joints can be tightened to the torque specified in Epiroc standard K4369, see maintenance instructions General.

NOTE: All bolted joints in the following table should be lubricated with Molycote 1000 thread grease or other thread grease having a friction coefficient of 0.11 μ .



Bolted joint BUT 35 model S



Bolted joints, BUT 35 G model M



Bolted joints, BUT 35 G model L

Tightening torques

No.	Bolted joints	Thread	Torque Nm	Tolerance +/- Nm	Quantity
А	Bolt, rear boom link	M20	365	36	2
В	Expander shaft, rear cylinder link	M20	290	50	2
С	Expander shaft, rear cylinder	M20	290	50	4
D	Expander shaft, tele- scope cylinder and feed extension cylinder	M16	195	20	2
E	Bolt, bearing housing- rear boom body (model S and M) Bolt, bearing housing-ex- tension (model L)	M16	315	31	16
F	Bolt, telescope-front boom attachment	M16	315	31	12
G	Bolt, front boom link	M20	365	36	1
Н	Bolt, front boom link	M16	187	18	1
J	Expander shaft, front cylinder	M16	195	20	4
К	Expander shaft, front cylinder link	M16	195	20	2
L	Bolt, front boom attach- ment-rotary actuator	M16	315	31	15

No.	Bolted joints	Thread	Torque Nm	Tolerance +/- Nm	Quantity
Μ	Expander shaft, tilt cylin- der	M16	195	20	2
Ν	Bolt, feed holder-attach- ment shaft	M12	128	13	4
Ρ	Lock nut, feed extension cylinder	M24	290	50	1
Q	Bolt, rotary actuator- cover	M12	128	13	4
R	Bolt, extension-rear boom body	M16	315	31	16
S	Bolt, telescope-interme- diate boom section	M12	128	13	12
Т	Bolt, feed holder-rotation unit	M12	315	31	16
U	Bolt, attachment plate- boom console	M24	630	60	18



NOTE: The bolts in bolted joint number 19, attachment plate-boom console, must be of strength class 12.9. The strength class for other joints is given in the spare parts list for the boom.

3.9 Check Hoses, Cylinders, Valves, and Valve Plates

 $\circ~$ Check for damage and leaks.

3.10 Check Hydraulic Pressure

O Check the pressure setup.

3.11 Check Bearing Points

O Check bearing points for damage and leakage.

3.12 Checking the Bushings in the Bearing Housing



Checking the bushings in the bearing housing

А	Telescope tube	В	Cover
С	Bushings	D	Bearing housing
G	Washer	Н	Seal

Thoroughly inspect the telescope device for signs of damage and wear.

- 1. Extend the telescope tube (A).
- 2. Remove the washer (G) and seal (H) and then undo the cover (B).
- Measure the play (J) between the telescope tube (A) and the two upper bushings (C). If the play is greater than 1 mm, remove the bearing housing (D) and change the worn bushings.



Play between the telescope tube and bushings

3.13 Hoist the Boom

WARNING

Heavy Objects

Slinging and hoisting heavy objects can cause personal injury.

- Lift at the center of gravity.
- Only use slings which are intact and designed for the load that is to be carried.
- Fasten the straps to the lifting eyes when available.
- Do not stand below the object being hoisted.



Slinging BUT 35 G, model L

- 1. Check that the lifting device is designed for the load it is to carry.
- 2. Attach the sling and adapt the positions so that the lifting takes place as close as possible to the center of gravity.
- 3. Hoist carefully.



NOTE: Make sure that the boom does not start to swing and that the slings do not start to slide off.



3.14 Checking Keys on Telescope Device

Telescope device

С	Bushing	D	Bearing housing
E	Keys	F	Slide rails

 Check the keys (E) carefully. If they are deformed, the damaged area should be ground smooth in order to avoid future damage to the drill cradles (F), bearing housing (D) and bushings (C).

3.15 Checking Slide Rails on Telescope Device

- 1. Remove the washer (G) and seal (H) and then undo the cover (B).
- 2. Place the feeder on a support and rotate the boom so that the load is taken up on only one side of the keys.
- 3. The slide rails (F), see above figure, can then be removed from the bearing housing and inspected. Change them if they are worn or scratched.



Bearing housing

А	Telescope tube	В	Cover
С	Bushing	D	Bearing housing
G	Washer	н	Seal

3.16 Disassembling the Boom

3.16.1 Disassembly of Feeder



Dismantling the feeder

- 1. Fit slings round the feeder before dismantling it so that it cannot fall down.
- 2. Detach all hoses from the feed hose retainer.
- 3. Unscrew the feed extension cylinder from the feeder.
- 4. Remove the feeder from the boom by unscrewing the holders (A) from the feed holder.

3.16.2 Disassembling Boom Body BUT 35 SL



Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



The boom can be shortened by separating it between the telescope tube and front boom beam.

Precondition ✓ The front boom beam is secured with slings or supported in stands.

- 1. Disconnect the hydraulic hoses from the cylinders.
- 2. Plug the hoses and nipples.
- 3. Disconnect the sensor cables.
- 4. Remove bolts (A) and washers (B).

3.16.3 Disassembling Boom Body BUT 35 M and L

	WARNING
	Disassembling and Assembling Components
	Can cause personal injury.
•	Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



The boom can be shortened by separating it between the extension tube flange and front cylinder bracket.

Precondition ✓ The front boom beam is secured with slings or supported in stands.

- 1. Disconnect the hydraulic hoses from the cylinders.
- 2. Plug the hoses and nipples.
- 3. Disconnect the sensor cables.
- 4. Remove bolts (A) and washers (B).

3.17 Disassembly Boom Extension

Disassembling Boom Extension

Can cause personal injury.

- Observe great care when disassembling the boom extension.
- Support rotary actuators and front boom beam securely before removing the boom extension.

The boom must be separated before the telescope device can be removed for maintenance or replacement.



Dismantling the boom

- 1. Extend the telescope to its front end position.
- 2. Rotate the feed beam up and down.
- 3. Lower the boom until the feed beam rests on the ground.
- 4. Position supports firmly under the rotary actuator and front boom beam before removing the telescope.
- 5. Remove the bolts (A) from the front boom beam.

3.18 Disassembly of Telescope and Bearing Housing

The figure below shows the BUT 35 G model M. The method of dismantling the telescope and bearing housing is the same as for model L. The only difference is that the bearing housing (E) on model L is screwed into the extension segment (G) instead of in the rear boom body.





Dismantling of telescope and bearing housing

- 1. Retract the telescope to the rear end position.
- 2. Fit slings round the bearing housing (E). Use an overhead crane or hoist, etc.
- 3. Detach the hydraulic hoses (C).
- 4. Loosen the bolts (A) for the bearing housing (E).
- 5. Remove the expander shaft (D).
- 6. Carefully withdraw the telescope tube (F), cylinder (B) and bearing housing (E).

3.19 Disassemble Expander Shafts



Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



Precondition ✓ The part of the boom that is held by the expander shaft is secured with slings or rests on stands.

- 1. Remove nut (A).
- 2. Pull out bolt (D).
- 3. Install a bolt appropriate to threads in the bushings (B) and tighten it until one of the bushings loosens.
- 4. Remove the other bushing.
- 5. Remove shaft (C).

3.20 Assemble Expander Shafts

WARNING Heavy Objects Can cause crushing injury or death. Do not stand under the heavy object being lifted. Use approved lifting device.



Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.

Play can be eliminated by tightening the lead-through bolt.



- 1. Lubricate the shaft (C).
- 2. Install the shaft (C) in the cylinder lug or link.
- 3. Attach bushings (B).



4. Install the bolt (D) and nut (A) in the expander shaft and tighten to recommended special tightening torques.



NOTE: If the play cannot be eliminated, replace or repair is necessary. If it is tightened too much, the attaching lug could crack.

4 Feed Unit

4.1 Check Wear on Dowel





Feed BMH 6064 R

 $\circ~$ Check the wear on the dowel (A).

4.2 Safety Precautions Before Working on Feed Unit



WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.

4.3 Feed 6000-Series



The hydraulic feeds on the BMH/BMHT 6000 series are primarily intended for drift and tunnel drilling. They are fitted on hydraulic booms of type BUT 32, BUT 35, BUT 36, and BUT 45. The feeds are available in different versions depending on the drill that is installed on them. The different numbers are explained, for example, BMH 6818 and BMHT 6816/10.

The first number states the type of feed: 6 = 6000 series.

The second number states the type of drill for which the feed is intended:

- 3 = COP 1238
- 7 = COP MD20
- 8 = COP 1638/1838/2238
- 9 = COP 3038/4038
- 0 = Rotary drill SMAG 2587

The third and fourth number state the length of drill rods in feet. For example, 16 = 16 feet. The fifth and sixth number state the length of the short drill rods in feet and only apply to the telescopic feeds (BMHT).

4.4 Feed 6000 Series Technical Data

NOTE: The total length of the feed depends on the type of drill and the length of drill steel for which it is intended. By adding the following length to the length of the drill steel (XX) (XX/XX), it is possible to obtain the overall length of the feed.

Description	Length
BMH 63XX	1580mm
BMH 68XX	1580mm
BMH 69XX	1680mm
BMHT 63XX/XX	1590mm
BMHT 68XX/XX	1590mm
BMHT 69XX/XX	1690mm



NOTE: Only the weight of the shortest and longest standard feed is specified for each type of feed.

Description	Weight
BMH 6312 - BMH 6321	425 - 540 kg
BMH 6812 - BMH 6821	430 - 570 kg
BMH 6912 - BMH 6921	480 - 640 kg
BMHT 6314/08 - BMHT 6318/10	635 - 680 kg
BMHT 6814/08 - BMHT 6818/10	640 - 690 kg
BMHT 6914/08 - BMHT 6918/10	690 - 745 kg

4.5 Install Rock Drill and Rotation Unit

WARNING

Disassembling and Assembling Components

Can cause personal injury.

Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.

WARNING

Risk of Lifting the Rock Drill

Incorrect handling can cause serious crushing injury or death.

- Use extreme caution when strapping and lifting heavy objects.
- Lifting must be done through the center of gravity.
- Only use straps that are intact and designed for the load they will carry.
- Do not approach a suspended load.

Heavy Object

The rock drill is a heavy object and can cause serious injury if it tips over or fall down.

- Do not remove all attachment screws at the same time without having the rock drill supported.
- Do not leave the rock drill unsupported if it needs to be disassembled from the feeder.
- Mount the rock drill on a folding plate for stability when performing work.

NOTE: The procedure describes the installation of rock drill only but can also be applied to the rotation unit.

- 1. Clean the corrosion inhibitor from the feed unit.
- Remove burrs, paint, or coatings from the cradle and the contact surfaces on the rock drill.
- 3. Remove the attaching bolts from the cradle.
- 4. Position the rock drill with shims on the cradle and reinstall the bolts, and make sure that the rock drill is installed firmly in place.



5. Tighten the bolts (A) alternately to the proper torque.



- 6. Connect and attach the hoses to the rock drill.
- 7. Adjust slide rails and hoses.
- 8. After four hours, perform a safety check of the rock drill or rotation unit installation.

Tightening Torque

200 Nm (147.5 lbf.ft)

See Reference Documentation

Rock drill instruction manual

4.6 Location of Drill Hoses

Depending on the drill that is fitted on the feed, the hoses must be positioned in the water hose drum and the feed hose retainer.

Drill Hose Designations

Hose Designations	Description
AL1	Air lubrication
D1	Drainage
HPD1	Damper
HP1	Hammer pressure
HT1	Hammer tank
RRL1	Rotation left
RRR1	Rotation right
WF2	Flushing



Hose Drum COP 1838/1638/2238



Feed Hose Retainer COP 1838/1638/2238



Hose Drum COP 1838/1638/2238 (feed with bulkhead connection)



Feed Hose Retainer COP 1838/1638/2238 (feed with bulkhead connection)



4.7 Locations of Haul and Return Ropes

Locations

А	Adjustment for haul rope	В	Adjustment for return rope
С	Scraper plate	D	Haul rope tensioner
E	Holder for intermediate drill rod support		

4.8 Adjusting Hoses on Rock Drill

- 1. Loosen the bolts on the hose retainer slightly when adjusting and tensioning the hoses.
- 2. Tension the hoses and make sure that they are not crossed.

4.9 Check Pull and Return Rope on Feed

WARNING

Disassembling and Assembling Components

Can cause personal injury.

Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- ► Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



Feed BMH



Feed BMHT

• Check wear and tension on pull and return rope (A).



4.10 Check Drill Rod Bushings on Feed

Feed BMH, BMHE, BHMS

• Check wear on drill rod bushings (A).

4.11 Check Slide Rails on Feed

WARNING Disassembling and Assembling Components Can cause personal injury. Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



Feed BMHT



Feed BMH, BMHE, BHMS

• Check wear and damage on slide rails (A).

4.12 Check Wear on Slide Pieces on Feed

WARNING

Disassembling and Assembling Components

Can cause personal injury.

Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- ► Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



Feed BMHT



Feed BMH, BMHE, BHMS

• Check the play and the wear on the slide pieces (A).

4.13 Check Tightening Torque on Feed

WARNING

Disassembling and Assembling Components

Can cause personal injury.

Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



Feed BMH, BMHE, BHMS

• Check tightness on bolted joints (A).

4.14 Clean Feed Unit

WARNING Disassembling and Assembling Components Can cause personal injury. Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.
 - O Clean the complete feed unit.

4.15 Replacing the Haul Rope



- 1. Operate the rock drill to about half its length of travel.
- 2. Slacken the tension on the ropes, bolt (F) and nut (D).
- 3. Remove the haul rope from its front attachment (C) on the rock drill cradle.
- 4. Remove the scraper plate (A) from the intermediate drill rod support.
- 5. Loosen the intermediate drill rod support holder (B) so that the intermediate drill rod support can be lifted.
- 6. Remove the rope from the rope tensioner (E) in the rear part of the beam.



- 7. Fit the new rope and refit the scraper plate.
- 8. Adjust the ropes.

4.16 Replace Pull Rope

WARNING

Disassembling and Assembling Components

Can cause personal injury.

Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



- 1. Operate the drill to about half its length of travel.
- 2. Slacken the tension on the ropes, bolt (A), and nut (B).
- 3. Remove the pull rope from its front attachment on the rock drill cradle.
- 4. Remove the scraper plate (C) from the intermediate drill steel support.
- 5. Loosen the intermediate drill steel support holder (E) so that the intermediate drill steel support can be lifted.
- 6. Remove the rope from the rope tensioner (D) in the rear part of the beam.



- 7. Install the new rope and reinstall the scraper plate.
- 8. Adjust the ropes.



4.17 Adjust Haul and Return Ropes

Precondition

 \checkmark

Cradle is put at the rear end of the feed beam.

- ✓ Drill rod with drill bit is fitted on the rock drill.
- 1. Adjust the haul rope with bolt (A) and the return rope with nut (B).
- 2. Adjust the ropes so that the bit is behind the spike.
- 3. Adjust the position measurement (M1).



Measurement for current feed unit is specified in the feed measurement drawing supplied in the machine documentation.

4.18 Adjust Tension of Return Rope

- 1. Position a plank between the rock drill cradle and the intermediate drill rod support.
- Run the cradle forward until it stops against the plank and keep the feed force applied.

3. Tension the return rope so there is no risk that it jumps out of the cable drum.



NOTE: Do not tension the return rope too tightly.

Step result

→ There must be a couple of centimeters of slack remaining when the return rope is correctly tensioned.

4.19 Adjusting Cradle on Feed Beam

WARNING

Disassembling and Assembling Components

Can cause personal injury.

Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.

The cradle plates for the rock drill, intermediate drill rod support, and water hose drum are guided along the feed beam by holder (A). Each pair of holders is locked in position with bolts (B). The bolt holes in the holders are in the form of angled grooves. The cradle can be adjusted on the feed beam by shifting the holders lengthways.



Precondition ✓ Feed is in the horizontal position and the drill rod is installed in the rock drill.

 \checkmark Holders are turned the same way as in the illustration so that the outer part of the angled grooves is facing to the rear of the beam.

- 1. Remove the bolts (B).
- 2. Adjust the upper holders so the cradle is lying straight on the beam and is C mm above the beam. The measurement C depends on the drill unit.



Drill Unit	с
1838	4 mm
2238	
1638	
MD20	
3038	6 mm
4038	

Step result

- → Shank adapter is set at the correct height.
- 3. Shift the lower holders lengthways until a clearance of 1 mm is attained between the lower holder and feed beam.
- 4. Install the bolts (B).

5. Check by running the cradle along the entire beam.

The cradle runs forward within the maximum pressure with the hydraulic oil at operating temperature. If the pressure exceeds the maximum value, means that the holders are too tight and must be readjusted.

- 6. Install the rock drill straight on the cradle.
- 7. Replace damaged hoses and tighten leaking connections.



Maximum Pressure	30 bar (435 psi)
------------------	------------------

4.20 Adjust Feed Beam on Telescope Feed

The upper beam is guided on the lower beam by similar holders to the ones used for the cradle.



Precondition \checkmark The holders are turned so that the outer part of the angled groove is facing to the rear.

✓ The feed is in the horizontal position.

1. Run the upper beam along the lower beam to about half its length of travel.

- 2. Remove the bolts (A) that attach the holders (B).
- 3. Adjust the upper holders so that the upper beam is positioned straight on the lower and the measurement is 5–7 mm (0.19–0.27 in.).
- 4. Shift the lower holders lengthways until a clearance of 1 mm (0.039 in.) is attained between the lower holder and feed beam.



- 5. Install the bolts (A).
- 6. Run the beam along its entire length of travel.

The beam runs forward within the maximum pressure of 30 bar (435 psi) with the hydraulic oil at operating temperature. If the pressure exceeds maximum pressure, the holders are too tight and must be adjusted.

4.21 Replace Slide Pieces in the Holder



Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.

NOTE: If the wear allowance for any of the slide pieces is less than 1 mm, replace all the slide pieces.



- 1. Remove the bolts (B) to remove the holder (A) from the cradle (E).
- 2. Remove the keys (D).

Each slide piece is kept in place by three keys.

- 3. Remove the slide pieces (C) from the holder.
- 4. Slide a new slide piece into the holder track and install it to the holder.
- 5. Install new keys.
- 6. Adjust the cradle on the feed beam.

4.22 Replace Slide Rails

WARNING

Disassembling and Assembling Components

Can cause personal injury.

Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.

Н

NOTE: Replace side rails if they are worn or severely scratched.



- 1. Remove the rock drill cradle, the intermediate drill rod support, and the water hose drum from the beam.
- 2. Remove the old slide rails (A). Press the lower edges of the bar outwards.
- 3. Clean the beam surfaces thoroughly.
- 4. Install the new slide rails with the larger edge on the slide rail facing upwards. The rails are pressed in a place by hand.
- 5. Reinstall the rock drill cradle, intermediate drill rod support, and the water hose drum.
- 6. Adjust the cradle on the feed beam.
- 7. Check the feed idling pressure.



4.23 Adjust Different Drill Rods Lengths for the Telescope Feed

The use of different drill rods lengths is made possible by moving a mechanical stop mechanism on the lower feed cylinder.

- 1. Operate the lower feed cylinder backwards towards the mechanical stop mechanism.
- 2. Remove socket head cap screws (A) and move one of the screws to the top of the mechanical stop mechanism.
- 3. Operate forward or backward to the correct drill rods length.

The drill bit must be behind the rubber dowel.

4. Replace the socket head cap screws (A) to its original position and tighten the mechanical stop mechanism.

4.24 Disassemble Feed Cylinder

WARNING

High Hydraulic Oil Pressure

Working on the hydraulic system involves a high risk of personal injury.

▶ Make sure that the system is de-pressurized before starting any work.

WARNING

Hydraulic Oil and Water Pressure

Can cause personal injury.

- ▶ Do not replace high-pressure hoses with hoses of lower quality than the originals.
- Do not replace high-pressure hoses with hoses that are installed with removable couplings.

WARNING

Disassembling and Assembling Components

Can cause personal injury.

Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



Precondition ✓ The hydraulic system is depressurized.

- 1. Operate the rock drill cradle to about half the feed length.
- 2. Relieve the tension from pull and return ropes with bolt (A) and nut (F).
- 3. Remove the bolts from the center of the water hose drum and lift the entire drum.
- 4. Disconnect the hoses at the hose retainer.
- 5. Loosen the bolts (D) and (G) on cradle plates (E) and (H).
- 6. Remove the bolt (A) from the end piece (B).
- 7. Remove the end plate (C).
- 8. Pull the cylinder and fork backwards, out of the beam.
- 9. Remove the pin (J).
- 10. Remove the fork (K) from the spacer (L).

NOTE: Avoid removing the spacer (L). If the spacer must be removed, first measure (SP) so the spacer can be replaced in the same position.



4.25 Disassemble Tension Bushing for Spacer

WARNING Disassembling and Assembling Components

Can cause personal injury.

Components that could move or fall down must be securely supported or strapped in place during service and maintenance work.

WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.

NOTE: Measurement (SP) is specified in the Spare Parts Catalog.

The spacer at the front of the cylinder is held in place with an expanding bushing. In order for the feed to function correctly, the spacer measurement (SP) must be correct. This measurement varies depending on the feed length and type of feed.



Precondition ✓ Spacer measurement (SP) is noted, so the bushing can be replaced in the same position.

- 1. Remove the plastic plugs (A).
- 2. Remove the bolts (B) from the bushing.
- 3. Place the bolts (B) into the threaded holes and pull them alternately until the bushing are separated.

4.26 Assemble Tension Bushing for Spacer

WARNING Disassembling and Assembling Components Can cause personal injury. Components that could move or fall down must be securely supported or strapped in place during service and maintenance work. WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



NOTE: The (SP) measurement is noted before disassembling and is also specified in the Spare Parts Catalog.

The spacer at the front of the cylinder is held in place with an expanding bushing. For the feed to function correctly, the spacer measurement (SP) must be correct. This measurement varies depending on the feed length and type of feed.



- 1. Assemble the bushing and the bolts (B). Do not tighten the bolts (B).
- 2. Install the spacer and bushing into the sleeve.
- 3. Tightening the bolts (B) in circles from 1–8 until the bolts set.
- 4. Install the plastic plugs (A).

Tightening Torque

28 Nm (20 lbf.ft)

Tightening Torque

18 Nm (13 lbf.ft)

Tightening Torque

38 Nm (28 lbf.ft)

4.27 Replace Rock Drill Retaining Bolts



WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use approved lifting device.

WARNING

Moving Parts

Can cause personal injury.

- Shut off the machine and lock the battery isolation switch before starting any work.
- Make sure that the hydraulic pump is off and that the system is depressurized before starting work.



- 1. Position the feed horizontally with the rock drill upwards.
- 2. Remove and replace the retaining bolts (A) one at a time.
- 3. Torque-tighten the retaining bolts alternately.

See Reference Documentation

Rock drill instruction manual

4.28 Long-Term Storage

- 1. Clean the feed thoroughly.
- 2. Lubricate as directed.

- 3. Protect unpainted surfaces with corrosion inhibitor.
- 4. Store the feed in a dry and clean environment.

5 Rotation Unit

5.1 Safety Precautions before Working on Rotation Unit

A	WARNING
	Disassembly Rotation Unit
	Can cause personal injury.
►	Observe great care when disassembly the rotation unit.
►	Support the feed unit securely so that it is stable.

5.2 Rotation Unit Overview

The rotation unit consists of a rotary actuator and a bearing housing that is attached to the feed holder attachment shaft.



А	Rotary actuator	В	Bearing housing
С	Attachment shaft	D	Feed holder
E	Tilt cylinder		



5.3 Function of Rotary Actuators

The rotary actuator for boom rotation, which is attached to the front of the telescope unit, converts the linear movement of piston (B) into a rotary movement. The rotary actuator for feed swing, which is mounted at right angles on the rear rotary actuator, has the equivalent function.

The rotary actuator consists of a housing (A) with a ring gear (C) and two moving parts: a piston (B) and a shaft (D). The shaft has splines that engage with the internal splines of the piston. The external splines of the piston engage with the ring gear splines. The piston moves back and forth in the housing and the splines rotate the shaft.



5.4 Main Components of Rotary Actuator

А	Bolt	в	Plug
С	Retaining ring	D	Locking pin
Е	Cover	F	Thrust ring
G	O-ring	н	Seal
J	Washer	К	Shaft seal
L	Wear ring	М	Outer piston seal
N	Outer piston seal (without O-ring)	Р	Inner piston seal
Q	Inner piston seal (without O-ring)	R	Piston skirt
S	Piston	Т	Grease relief valve
U	Housing	V	Lubricating nipple
W	Locking pin	х	Shaft



5.5 Remove Rotary Actuator from Boom

- 8. Plug all hoses and connections.
- 9. Lift the boom straight, without damaging the sliding bearings (L) in the bearing housing.

- 10. Rotate the bearing housing (M) so it reaches its original position.

- 11. Attach slings around the bearing housing (M).
- 12. Remove the bolts (P), hose retainer (Q) and cover (N).
- 13. Remove the bolts (R) and remove the bearing housing.
- 14. Remove the hydraulic hoses from the overcenter valve.
- 15. Plug the hoses and connections.
- 16. Attach slings around the rotary actuator.
- 17. Remove the bolts (S).



18. Remove the rotary actuator from the boom head.

5.6 Disassembly of Rotary Actuator

l

NOTE: When assembling the component parts of the rotary actuator, the splined parts (shaft and piston) must be refitted in their original positions.

There are two permanent position marks:

- One mark for piston-ring gear
- One mark for shaft-piston



Permanent marking piston-ring gear



Permanent marking shaft-piston

Assembly of the rotary actuator will be facilitated if additional positioning marks are made during dismantling.

- 1. Place the rotary actuator on a clean workbench.
- 2. Remove all hydraulic connections.
- 3. Remove the overcentre valve and associated components.
- 4. Mark the relative positions of the retaining ring (B), cover (E) and shaft (F) using a scriber or pen.
5. Unscrew the bolts (A) and plugs (C). Screw two of the bolts (A) in the threaded holes of the retaining ring (B). By means of the bolts, remove the retaining ring from the shaft splines (ring gear).



Removing the retaining ring

6. Screw two bolts with washers or sleeves in the cover (E) and use a tommy bar or similar to unscrew the cover from the shaft.



Removing the cover



7. Screw two bolts in the shaft (F) flange. These bolts enable the shaft to be turned with the aid of a tommy bar or similar. Turn the shaft clockwise. It will start to rotate out of the housing.



NOTE: Do not turn the shaft so much that it no longer engages with the piston. Before the shaft is unscrewed all the way out its position relative to the piston must be marked, see next point.



Removing the shaft

8. Using a pen, mark the position of the shaft relative to the piston, i.e. mark one of the shaft splines and the corresponding groove in the piston. See example in the following figure.



Marking shaft-piston

- 9. Unscrew the shaft all the way out of the housing.
- 10. Use a plastic drift and hammer to drive the piston (J) (including piston skirt (H)) out of the housing (G).

NOTE: Auxiliary marks must be made to ensure that the piston will be refitted in its correct position. For this to be possible, however, the piston must first be released fully from the ring gear. Hold the piston in this position and use a pen to mark the housing (*G*), piston skirt (*H*) and piston (*J*).



Marking housing-piston skirt-piston

After marking, the piston can be removed from the housing. Exercise care to avoid damaging the piston and housing.

11. The piston and piston skirt need not be removed further unless it is suspected that the O-ring may be damaged. If the O-ring is to be changed mark the relative positions of the piston and piston skirt and then remove the wear rings. Press out the locking pins and unscrew the piston from the piston skirt.

Replace the O-ring and reassemble piston and piston skirt.

- 12. Unscrew the grease nipples and valves.
- 13. Remove all seals and bearings.

14. Clean all parts thoroughly and check them for wear.

NOTE: The minimum thickness of the wear rings should be 3.098 mm. The washers should have a minimum thickness of 3.048 mm.

5.7 Assembly of Rotary Actuator

- 1. Thoroughly clean all parts and blow them dry with compressed air. Make sure that all position marks are still clearly visible.
- 2. Carefully inspect the threads on the shaft (F) and cover plate (E) and grind away any burrs with abrasive cloth.
- 3. Screw the cover on the shaft.
- 4. Lubricate all seals and contact surfaces with hydraulic oil.

NOTE: Always change the seals and bearings when assembling rotary actuators. **NOTE:** Never use sharp tools when fitting seals.

5. Fit the wear rings on the piston.



NOTE: Fitting the piston is the most difficult part of reassembling the rotary actuator. It may therefore be a good idea to practice this without any seals on the piston.

6. Stand the housing upright with the flange upwards. Fit the piston in the housing. Use the markings to make sure it is in the right position. Lay the housing down in a horizontal position when the piston has engaged with the ring gear and check at the other end of the housing that the position of the piston coincides with the permanent markings.



Permanent markings piston-ring gear

Screw the piston in fully so that the piston skirt bottoms against the ring gear.

7. Grease the washers (L).

8. Fit a set consisting of washer (L) and seals (M) and (K) on the shaft (F) and another set on the cover (E).



Fitting washers and seals

9. Stick masking tape on the ring gear of the shaft so that the piston seals will not be damaged when the shaft (F) is fitted.



Shaft ring gear and threads

- 10. Fit the shaft in place so that its marking is opposite the piston skirt marking. Then remove the masking tape.
- 11. Apply thread paste to the threaded part of the cover (E) and screw it on the shaft. Tighten to a torque of 800-950 Nm.
- 12. Apply grease generously to the shaft ring gear. Also grease the bright metal surfaces of the cover.
- 13. Fit the retaining ring (B) on the shaft and try to find a position where its through hole comes opposite the threaded hole of the cover (E). It may be necessary to loosen or tighten the cover slightly to achieve this.
- 14. Apply Loctite 242 (or the equivalent) to the bolts (A) and tighten them to a torque of 116 Nm. Apply sealing compound to the plugs (C) and screw them flush into the retaining ring.
- 15. Pump grease into the grease nipples to remove any impurities and to check that they are in working order. Wipe off surplus grease.

- 16. Screw the grease nipples and valves in place.
- 17. Fit the hydraulic connections and overcentre valve.

5.8 Action after Rotary Actuator Assembly

After mounting of the rotary actuator a check for oil leakage should be performed. If possible, connect up the rotary actuator in a hydraulic test bench and give it a trial run before fitting it on the boom.

- 1. Pressurize port P2 at 210 bar. No oil should leak out of port P1 or round the cover.
- Pressurize port P1 with 210 bar. No oil should leak out at port P2 or round the shaft flange.
- 3. Pump grease into the grease nipples until it comes out through the vales. Repeat this after having run the rotary actuator through a number of cycles.
- 4. Run at least 15 cycles and check that no oil leakage occurs.

5.9 Mounting of Rotary Actuator on Boom

1. Apply slings round the rotary actuator and mount it on the boom head using the bolts (A).



Mounting of rotary actuator on boom

2. Connect the hydraulic hoses to the overcentre valve.



3. When mounting the bearing housing it is important to ensure that the stop position for feed rotation is correct.

Stop position for feed rotation for side-mounted feeder

1	Boom with right-mounted feeder	2	Boom with left-mounted feeder
A	Bearing housing in horizontal po- sition	В	Bearing housing rotated in under boom to stop position



Stop position for feed rotation for top-mounted feeder

1	Boom with right-mounted feeder	2	Boom with left-mounted feeder
A	Bearing housing in horizontal po- sition	В	Bearing housing rotated in under boom to stop position

a. Rotate the rotary actuator to the stop position.

- b. Then rotate it in the opposite direction so that the pattern of holes on the rotary actuator's shaft flange is displaced by two holes for side-mounted booms, and by one hole for top-mounted booms.
- c. With the rotary actuator rotated to this position the bearing housing (C) can be mounted hanging vertically. Tighten the bolts (B) to a torque of 315 Nm.



Mounting the bearing housing

4. Mount the cover (D) and hose retainer (E) using the bolts (F). Tighten the bolts (F) to a torque of 128 Nm.



Mounting of cover and hose retainer

 Mount the feeder by rotating the bearing housing through 90°. Lower the boom straight down against the feed holder's attachment shaft. Take care to avoid damaging the sliding bearings (L) in the bearing housing.



Mounting the feeder

- 6. Mount shims (B) and inner cover (C). Tighten the bolts (K) to a torque of 128 Nm.
- Mount the inner cover (E) using the bolts (D). Tighten the bolts (5D) to a torque of 75 Nm.
- 8. Mount the sensor (J) using the bolts (F).

NOTE: This point applies only to rigs with the RCS electronic control system and one of the ABC Regular or ABC Total options.

- 9. Mount the protection (H).
- 10. Mount the tilt cylinder with the aid of the expander shaft (A). Tighten the expander shaft (A) to a torque of 195 Nm.
- 11. Lift the boom and rotate the feeder through 90°. Refit the hydraulic hoses.

5.10 Adjusting the Tilt Cylinder

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NOTE: When mounting the tilt cylinder, start from the basic setting of 782 mm (30.8 in) between the expander shaft centers. Then continue with fine adjustment of the tilt cylinder.



- 1. Position the boom horizontally.
- 2. Position the rotary actuator bearing housing horizontally using a spirit level (placed vertically on the rotary actuator flange).
- 3. Operate the rotary actuator to bring the feed holder into a horizontal position.
- 4. When the boom is in this position, the feed holder can be tilted with the tilt cylinder. When the tilt cylinder piston rod is all the way inside the cylinder, the feed holder must be horizontal.
- 5. To adjust, loosen the locking screws (A) and screw the piston rod in or out using an open-end wrench on the piston rod flats (B) until the feed holder is horizontal.

6 Hydraulic System

6.1 Safety Precautions Before Working on Hydraulic System

High Hydraulic Oil Pressure

Working on the hydraulic system involves a high risk of personal injury.

Make sure that the system is de-pressurized before starting any work.

WARNING

Hydraulic Oil and Water Pressure

Can cause personal injury.

- Do not replace high-pressure hoses with hoses of lower quality than the originals.
- Do not replace high-pressure hoses with hoses that are installed with removable couplings.

WARNING

Uneven Surface

The top of the machine is uneven. When the personnel do maintenance work on the top of the machine, tripping over or falling off the machine is possible, which can result in serious injury or death.

- Pay attention to the uneven surface when walking on it.
- Make sure that there is sufficient friction when walking on the uneven surface.
- Always put on fall protection equipment.

WARNING

Working at Heights

Climbing the machine without proper holding, balance, and equipment, can cause personnel to fall off the machine, which can result in serious injury or death.

- Put on approved fall protection equipment.
- Hold the handle tightly when climbing the machine.
- Put on safety shoes to avoid slipping on the steps.
- Focus on the center of gravity of the body to keep balance.

6.2 Pumps

Main Pump (Positioning and Percussion Unit)

Туре	Axial plunger pump
Model	A10V
Displacement	71 cm ³ /rev
Displacement (rigs with the function for selecting drilling/bolting)	100 cm ³ /rev

Rotation pump

Туре	Gear pump
Model	P330
Displacement	48 cm ³ /turn

Rotation and compressor pump

Туре	Gear pump
Model	PGP640/620
Displacement, rotation	50 cm ³ /turn
Displacement, compressor	26 cm ³ /turn

Pump for positioning/steering and brake

Туре	Dual gear pump
Model, positioning/steering and brake	P315
Displacement, positioning	20 cm ³ /turn
Displacement, steering and brake	40.6 cm ³ /turn

Hydraulic Tank

Volume, min	200 litres
Volume, max	250 litres

6.3 About Working on Hydraulic Components

The hydraulic system is sensitive to contamination. The environment where the machine is used is usually an incorrect area for repairing hydraulic components. Avoid repairing hydraulic systems outside workshops.

Observe the following points to minimize interruptions in operation because of dirty hydraulic oil:

- Keep the machine clean.
- Use a degreasing additive for washing.
- Before opening any hydraulic connection, clean the area around it.
- Use clean tools and work with clean hands.
- · Always plug hydraulic connections immediately after they are disengaged.
- Use clean protective plugs.
- Hydraulic components, like hoses, valves, and motors, must always be stored with applicable protective plugs installed.
- · Spare parts for hydraulic components must always be kept in sealed plastic bags.
- Change filter cartridges when filters are clogged.

6.4 Hydraulic Workshops

Workshops that are used for the repair of hydraulic components must include:

- · A clean environment to avoid dust and particles
- · Applicable washing equipment for component repair
- · Applicable tools for working on hydraulic systems
- Adequate ventilation system

6.5 Replace Hydraulic Hoses

WARNING

High Hydraulic Oil Pressure

Working on the hydraulic system involves a high risk of personal injury.

Make sure that the system is de-pressurized before starting any work.

WARNING

Hydraulic Oil and Water Pressure

Can cause personal injury.

- Do not replace high-pressure hoses with hoses of lower quality than the originals.
- Do not replace high-pressure hoses with hoses that are installed with removable couplings.

Load, vibration, and mechanical stresses have many requirements on hydraulic hoses. When replacing, check that replacement hoses have:

- · The correct crimped couplings
- The correct quality class
- The correct dimensions

All pressurized components must be purchased from Epiroc. The grades and dimensions of hoses are specified in the Spare Part Catalog. Make sure that hose couplings are clean, undamaged, and correctly tightened.

6.6 Filling Hydraulic Oil

New oil must only be filled with the filler pump fitted on the machine. This is because the oil must be filtered before reaching the tank. This is achieved automatically if the filler pump is used.

NOTE: Take into account that the position of the cylinders will affect the level in the tank. Make sure all the cylinders are retracted.

NOTE: If the tank is overfilled, the breather filter will be destroyed. In this case, the filter must be changed. See section Filter: Breather filter.

Electric Hydraulic Oil filling

- 1. Check the return oil filter, see section Filter: Return oil filter.
- 2. Make certain all connections and hoses that are used to fill oil are clean.
- 3. Press the button at (A81) to start pump (A).



Electric filling, hydraulic oil tank

А	Electric pump	В	Oil level glass / Oil level tube
С	Thermometer	A8 1	Button, start electric pump

- 4. Check the oil level on the level tube (B).
- 5. Release the button at (A81) when the correct level is attained.

The correct level is obtained when oil becomes visible in the upper part of the oil level tube.

Filling Hydraulic Oil Manually

- 1. Check the return oil filter, see section, Filter: Breather filter.
- 2. Make certain all connections and hoses that are used to fill oil are clean.

3. Pump manually using hand pump (A).



Hydraulic oil tank hand pump

A	Hand pump
В	Oil level glass
С	Thermometer

- 4. Check the level in oil level glass (B).
- 5. Stop pumping when the correct level is attained. The correct level is obtained when oil becomes visible in the upper part of the oil level glass.

6.7 Oil Sampling

An oil sample gives a good indication of how well the hydraulic system has been maintained.

The system is equipped with nipples that are used together with special equipment to take oil samples. The nipples are on the delivery line from the hydraulic pumps. The nipples can also be used as pressure outlets for the pressure gauge.

6.8 Oil Monitoring

If the machine is equipped with oil monitoring, there are sensors that are installed for measuring moisture in the oil and the cleanliness of the oil. The sensors are connected to the RCS system to provide continuous information about the oil condition.

- The moisture sensor shows a percentage value relative to the oil saturation value. The oil begins to precipitate out water and is no longer able to bind moisture when the percentage value reaches 100%.
- Cleanliness measurement is made by obtaining the numbers of particles in the oil by passing the oil through a particle counter.



6.9 Check Oil Level in Carrier Hydraulic Tank

Precondition Service platform in transport position.

O Check oil level through the sight glass (B).

6.10 Drain Condensation from the Hydraulic Oil Tank

NOTE: Water in the hydraulic oil can seriously damage components in the hydraulic system and cause corrosion.

NOTE: Before draining the hydraulic oil tank, the system must stay unused for approximately 12 hours so that any condensation has had time to sink to the bottom of the tank. The water can be drained off through the ball valve on the bottom of the tank.



1. Remove the plug (A) from the valve.

- 2. Put a container below the ball valve.
- 3. Open the ball valve partially and allow the water to run out.
- 4. Close the ball valve when oil starts to drain.
- 5. Screw back the plug to protect the valve.

6.11 Emptying Hydraulic Oil Tank



- 1. Remove the plug on the ball valve that is below the hydraulic oil tank.
- 2. Connect a hose to the ball valve and place the other end of the hose into an empty oil drum.
- 3. Drain the oil from the tank by opening the ball valve.
- 4. Close the ball valve when the oil stops running out of the hose.
- 5. Disconnect the hose from the ball valve.
- 6. Insert the plug to protect the ball valve.

6.12 Clean Hydraulic Tank

WARNING

High Hydraulic Oil Pressure

Working on the hydraulic system involves a high risk of personal injury.

Make sure that the system is de-pressurized before starting any work.

WARNING

Hydraulic Oil and Water Pressure

Can cause personal injury.

- ▶ Do not replace high-pressure hoses with hoses of lower quality than the originals.
- Do not replace high-pressure hoses with hoses that are installed with removable couplings.



A	Top Plate
В	Gasket

The hydraulic tank is cleaned manually through the top plate.

Precondition \checkmark The oil is drained from hydraulic tank.

- 1. Remove the top plate.
- 2. Clean inside the tank completely.
- Wipe all sides, the top, and the bottom of the tank using only lint-free rags. Clean thorough especially in corners, edges, and, around connecting holes.



NOTE: Make sure that no pieces of dirt or foreign body is stuck in suction hoses or left in the tank. It results in damage or failure of hydraulic pump.

4. Reattach the top plate as fast as possible after cleaning to prevent any particles from entering.



6.13 Check Return Oil Filter

The return oil filter cleans the oil before it is returned to the tank.

A return oil filter comprises a tube containing three filter inserts. The return oil filter is installed inside the hydraulic oil tank cover plate. The number of return oil filters on the tank vary.



Location of Filter Inserts, Return Oil Filter

NOTE: The filter cartridges cannot be cleaned but must be replaced when they are clogged.

O Check return oil filter.

Replace the filter elements (A) according to the maintenance schedule but if the operator panel indicates clogged filter, replace all return oil filters immediately.

6.14 Replace Return Oil Filter

First read: Safety Precautions Before Working on Hydraulic System [> 83]



- 1. Clean on and around the filter cap.
- 2. Remove the nuts and washers (A).
- 3. Remove cap (B).
- 4. Remove the filter canister by the handle.
- 5. Replace with a new O-ring (C).
- 6. Remove the overflow valve (E) by pressing down and turning the handle counterclockwise.
- 7. Replace the filter cartridges (D) with new ones.
- 8. Install the overflow valve and filter canister.
- 9. Install cap (B) with nuts and washers (A) and tighten.

6.15 Check Hydraulic Tank Breather Filter



The breather filter equalizes the pressure differences in the tank that would otherwise arise when the level in the tank changes.

• Check breather filter (A) for clogging.

NOTE: If the hydraulic tank is overfilled, hydraulic oil covers the breather filter and ruins it. Breather filter must be replaced if it is clogged or found contaminated.

6.16 Replace Breather Filter

1. Wash clean on and around the filter (A).



Breather filter

- 2. Unscrew the old filter.
- 3. Fit a new filter.
- 4. Tighten the filter by hand.

6.17 Replace Water Separator Particle Filter

This equipment is optional.

High Hydraulic Oil Pressure

Working on the hydraulic system involves a high risk of personal injury.

▶ Make sure that the system is de-pressurized before starting any work.

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WARNING

Hydraulic Oil and Water Pressure

Can cause personal injury.

- ▶ Do not replace high-pressure hoses with hoses of lower quality than the originals.
- Do not replace high-pressure hoses with hoses that are installed with removable couplings.

WARNING

Danger of Falling Parts

NOTE: The particle filter must be replaced according to the maintenance interval, and if the filter pressure is greater than 1.5 bar (22 psi). The pressure is read on the pressure gauge above the particle filter.



Precondition ✓ The hydraulic pumps and water separator are switched off.

- 1. Drain the oil from the filter from the tap (H) into a suitable vessel.
- 2. Remove the bleed screw (A) to drain any pressure from the water separator.
- 3. Remove the lock nut (B) and lift away the cover plate (C).
- 4. Remove the filter nut (D) and lift away the spring (E) and filter holder (F).

- 5. Remove the old filter (G).
- 6. Clean the filter housing.
- 7. Replace with a new filter.
- 8. Install all disassembled components.

6.18 Bleed Water Separator Particle Filter

This equipment is optional.

WARNING High Hydraulic Oil Pressure

Working on the hydraulic system involves a high risk of personal injury.

Make sure that the system is de-pressurized before starting any work.

WARNING

Hydraulic Oil and Water Pressure

Can cause personal injury.

- Do not replace high-pressure hoses with hoses of lower quality than the originals.
- Do not replace high-pressure hoses with hoses that are installed with removable couplings.



- 1. Plug the pump to the electrical socket on the machine, or to an external electrical socket.
- 2. Loosen the bleed screw (A).
- 3. Start the pump to run until oil without air bubbles runs out.

P1

P3

- 4. Retighten the bleed screw (A).
- 5. Check for leaks.

6.19 Overview of Power Unit Pumps



6.20 Checking Pump Rotation Direction

An arrow on the pump coupling housing indicates the correct direction of rotation.



Pump rotation direction

- 1. Start the pump and stop it again at once so that it rotates only a few turns. Check the direction in which the motor-pump coupling rotates.
- 2. If the pump rotates in the wrong direction, reverse two of the phase leads in the electric motor connection cable.

NOTE: This work is to be carried out by authorized electricians.

6.21 Start New or Reconditioned Pump

WARNING High Hydraulic Oil Pressure Working on the hydraulic system involves a high risk of personal injury.

▶ Make sure that the system is de-pressurized before starting any work.

WARNING

Hydraulic Oil and Water Pressure

Can cause personal injury.

- Do not replace high-pressure hoses with hoses of lower quality than the originals.
- Do not replace high-pressure hoses with hoses that are installed with removable couplings.

NOTE: If a major intervention has been made in the system, such as replacing or reconditioning components in the hydraulic system, the system must be bled.

1. Fill the pump housing with oil.

- 2. Bleed air from the pump housing.
- 3. Circulation-pump the system.

6.22 Bleed Hydraulic Pump

WARNING

High Hydraulic Oil Pressure

Working on the hydraulic system involves a high risk of personal injury.

Make sure that the system is de-pressurized before starting any work.

WARNING

Hydraulic Oil and Water Pressure

Can cause personal injury.

- Do not replace high-pressure hoses with hoses of lower quality than the originals.
- Do not replace high-pressure hoses with hoses that are installed with removable couplings.

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NOTE: If a major intervention has been made in the system, such as replacing or reconditioning components in the hydraulic system, the system must be bled.



Precondition ✓ All hoses are connected to the pump.

- Check the level of the hydraulic oil in the oil sight glass on the hydraulic oil tank. Top up if necessary.
- 2. Remove plug (B).
- 3. Install plug when oil starts to run out of the plug hole.
- 4. Loosen drain hose (A).
- 5. Tighten the drain hose (A) when clean oil with no air bubbles runs out.

6.23 Circulate the Pump

NOTE: The machine must be connected to water to prevent the oil temperature from rising too high.

NOTE: Circulation pumping must be carried out to make sure that any contaminants are collected in the filter. This is done by connecting the delivery and return lines in the percussion, rotation and feed circuits, and allowing oil to be pumped through the system at no pressure for at least five minutes.



Principles for Circulating the Pump

- 1. Connect together the delivery and return hoses for the percussion unit with suitable coupling.
- 2. Connect together the delivery and return hoses for the rotation motor with suitable coupling.
- 3. Connect together the delivery and return hoses for the hydraulic cylinder of the feed with suitable coupling.
- 4. Start the hydraulic pump.
- 5. Start drilling.
- 6. Allow oil to circulate in the hoses for at least five minutes.
- 7. Stop the hydraulic pump.
- 8. Reconnect the hoses to their previous positions.

6.24 Pressure Settings and Rotation Speeds

Suitable rotation speeds for the rock drill, and suitable pressure for percussion and antijamming depend on:

- The state of the rock
- Type of drill bit
- Diameter of drill bit

Pressure and speed can therefore require adjustment if the drilling conditions change.

The feed pressure must also be adjusted according to:

- Dimension of drill rod
- Type of feed
- Percussion pressure

The feed pressure must be set so that the threaded joints of the drill rod equipment do not come loose, causing abnormal wear or damage. Nor must the pressure be set too high, subjecting the drill rod to abnormal loads or increasing the risk of jamming.

Recommended settings

Setting	Value	Read from
Percussion pressure for collaring	130–140 bar (1,885–2,031 psi)	Drill panel
Percussion pressure for full drilling	180–230 bar (2,611− 3,336 psi)	Drill panel
Switching level, percussion	55 bar (798 psi)	Drill panel
Positioning pressure	210–230 bar (3,046−3,336 psi)	See hydraulic diagram, position 72
Rotation speed, small hole	Depends on type of drill bit and its diameter	Drill rod rev counter
Rotation speed, reaming hole	Depends on type of drill bit and its diameter	Drill rod rev counter
Rock drill damper pressure	40 bar (580 psi)	Drill panel
Drilling system DCS 1800		
Max feed pressure for full drilling	120 bar (1,740 psi)	Drill panel
Feed pressure for collaring	40 bar (580 psi)	Drill panel
Feed pressure at full drilling, small hole	65–120 bar (943 −1,740 psi)	Drill panel
Feed pressure at full drilling, reaming hole	50–70 bar (725–1,015 psi)	Drill panel
Feed pressures reverse, tele- scope feed	120 bar (1,740 psi)	See hydraulic diagram, position 30
Pressure difference upper and lower feed cylinder, telescope feed	30–35 bar (435–508 psi)	See hydraulic diagram, position 30

Setting	Value	Read from
Anti-jamming protection, RPCF	20 bar (290 psi) above normal rotation pressure during drilling	Drill panel
Anti-jamming protection, feed re- turn movement	40 bar (580 psi) above normal rotation pressure during drilling	

6.25 Positioning Pump

6.25.1 Position Pump Stand-by Pressure

NOTE: This is always set by the pump supplier.

Normally, the stand-by pressure need not be checked or adjusted. If you suspect that the pump is not supplying a sufficient flow to the system, check the stand-by pressure and adjust it if necessary.

 Remove screw (A) and pull out the connector to disengage anti-inductive protection (Y172).



- 2. Start the pump.
- 3. Connect a pressure gauge to the pressure test outlet.
- 4. Make sure the pressure stays in the interval 18–25 bar (261–362.6 psi).



5. Remove the lock nut on valve (B) to adjust the socket head cap screw and read the pressure from the pressure gauge connected to the test outlet.

Screw in the screw to increase the pressure.

Step result



- 6. Tighten the lock nut.
- 7. Engage the anti-inductive protection (Y172) by connecting the connector.



8. Secure the anti-inductive protection (Y172) with the screw (A).

6.25.2 Set Positioning Pump Pressure



1. Connect a pressure gauge to the pressure test outlet.

- 2. Start the pump.
- Remove the lock nut on valve (B) to adjust the socket head cap screw and read the
 pressure on the pressure gauge that is connected to the pressure test outlet.
 Screw in the screw to increase the pressure.

Step result

- → The pressure gauge reads 210-230 bar (3,045-3,335 psi).
- 4. Tighten the lock nut.

6.25.3 Adjust Positioning Pressure with Diesel Power

NOTE: Setting the load-sensing diesel positioning pump must be carried out in accordance with the instructions below.



- 1. Connect a pressure gauge (0-400 bar, 0-5,802 psi) at pressure test outlet (C).
- 2. Remove the protective caps to loosen the lock nuts on the pump actuators and fully loosen the two adjustment screws (A and B).
- 3. Deactivate the knob for diesel positioning pressure and start the diesel engine.Refer to chapter Tramming in operation manual.
- 4. Screw in adjustment screw (B) for diesel positioning pressure until the accumulators stop charging at approximately 150 bar (2,176 psi).

Step result

Step result

- → The pressure falls on the pressure gauge at pressure test outlet (C) to approximately 0–5 bar (0–72.5 psi).
- 5. Set the standby pressure on the diesel positioning pump with adjustment screw (A) to 30 bar (435 psi) on the pressure gauge.
- 6. Activate the knob for diesel positioning pressure in the cab or canopy.
- 7. Adjust the diesel positioning pressure with adjustment screw (B).
- → The pressure gauge reads 210 bar (3,045.8 psi).
- 8. Remove the pressure gauge from the test outlet.
- 9. Lock the adjustment screws and install the protective caps on the pump actuators.

6.26 Percussion Pump

6.26.1 Percussion Pump Stand-by Pressure and Sequence Valve

NOTE: The percussion pump has a pilot-controlled sequence valve (A) in the valve plate of the pump. The sequence valve makes sure that the stand-by pressure does not reach the hammer at the neutral position. It must be set to 70 bar (1,015.3 psi).



- 1. Connect a pressure gauge to the pressure test outlet (B).
- Connect a needle valve in the percussion circuit and make sure that the valve is open.
- Set the percussion lever in rearmost position to make sure that the percussion is switched off.
- 4. Start the hydraulic pump and fully close the needle valve.
- 5. Adjust the pressure if necessary with the outer adjustment screw (C) on the control valve of the pump.



Percussion pump control valve (S1)

С	Set the stand-by pressure	D	Set maximum pressure
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Step result

- → The stand-by pressure on the pressure gauge is 18-25 bar (261-362.6 psi).
- Set the percussion lever to collaring position (center position) and open the needle valve 1/8 turn.
- 7. Screw in the inner adjustment screw (D) on the control valve of the pump until the pressure gauge shows 70 bar (1,015 psi).

8. Screw in the adjustment screw on the sequence valve (A) so that it closes.

→ The pressure on the pressure gauge should decrease to 0 bar.

Step result

Step result

- 9. Examine the function of the sequence valve by screwing in and out the adjustment screw (D) on the control valve of the pump.
- Adjust the sequence valve setting if necessary so that it closes at approximately 70 bar (1,015 psi).

6.26.2 Set Percussion Pressure for Collaring

The pressure is best adjusted during collaring.



- 1. Remove the lock nut on valve (A) for adjusting percussion pressure collaring.
- 2. Start the pump.
- 3. Set the percussion unit lever to its middle position (collaring).
- Adjust the set screw for valve (A) until the desired pressure of 130 bar (1,885.5 psi) is attained. Read the pressure from the percussion pressure gauge on the operator panel.

Screw in the screw to increase the pressure.

- 5. Tighten the lock nut.
- 6. Cover the protective cap.

6.26.3 Set Percussion Pressure for Full Drilling

The pressure is best adjusted during full drilling.



A Set the stand-by pressure B Set maximum pressure
--

- 1. Set the percussion lever in its front position.
- 2. Read the pressure on the percussion pressure gauge on the operator panel.
- Adjust to the desired pressure 180–230 bar (2,610–3,336 psi) with the setting screw (B) on the percussion pump control valve (S1).

Screw in the screw to increase the pressure.

6.27 Check Hydraulic Hoses and Couplings

•	
	WARNING
	High Hydraulic Oil Pressure
	Working on the hydraulic system involves a high risk of personal injury.

Make sure that the system is de-pressurized before starting any work.

WARNING

Hydraulic Oil and Water Pressure

Can cause personal injury.

- Do not replace high-pressure hoses with hoses of lower quality than the originals.
- Do not replace high-pressure hoses with hoses that are installed with removable couplings.
 - Inspect all hydraulic hoses and connections thoroughly with respect to cracking and swelling that indicates an external or internal leak. Inspect the hose location and clips.
 - Inspect the hose casing with respect to any swelling that indicates inner hose or cord breakage.
 - Inspect the hydraulic couplings with respect to leaks, indentations, and adapters. The couplings should be fastened securely if they have screw flanges. If there are any signs of connection leaks, replace the seals or the complete coupling.

- Check that all hose attachments and clamps are intact.
- Inspect all pressed couplings for signs of cracks or damage to compression sleeves. Replace any defective hoses with new ones.

6.28 Adjust Rock Drill Damper Pressure



6.29 Start New or Reconditioned Motor

If the machine has been idle, or if a major intervention has been made in the system such as replacing or reconditioning components in the hydraulic system, carry out the following points:



- 1. Fill the hydraulic motor at the plug (A) with oil.
- 2. Operate the hydraulic motor for a few minutes.
- 3. Bleed the hydraulic motor by carefully opening the plug a few turns.
- Close the plug when pure oil without air runs out from the plug. The hydraulic motor is filled with oil.

6.30 Rotation Pump

6.30.1 Set Rotation Speed for Small Hole Bit



Precondition ✓ The lever for selecting small hole or reaming hole is in the position for small hole.

- 1. Start the pump.
- 2. Set the rotation lever to its forward position (rotary drilling).
- 3. Measure the rotation speed with a rev counter on the drill rod.



NOTE: Take the following measures if the rotation speed needs adjusting.

4. Loosen lock knob (B) on the valve for adjusting rotation speed, small hole at the hydraulic pump.
- Set control knob (A) until the desired speed is attained.
 Screw in the screw to reduce the speed.
- 6. Tighten the lock knob (B).

6.30.2 Set Rotation Speed for Reaming Hole Bit

The reaming hole kit is extra equipment that allows the rapid switch between settings for small hole and settings for reaming hole.

The set includes extra valves that allow the setting of individual reaming hole values for feed pressure and rotation speed.



Precondition ✓ The lever for selecting small hole or reaming hole is in the position for reaming hole.

- 1. Start the pump.
- 2. Set the rotation lever to its forward position (rotary drilling).
- 3. Check the rotation speed with a drill rod rev counter.

NOTE: Take the following measures if the speed needs adjusting.

- 4. Remove the lock nut of the valve (A) for adjusting rotation speed, reaming hole.
- 5. Use a socket head cap screw to adjust the valve adjustment screw until the desired speed is attained, which can be read on the rev counter.

Screwing the screw out reduces the speed.

6. Tighten the lock nut.

6.31 Feed Pressure

6.31.1 Drilling Valves, Blocks, and Sensors



Valves for feed pressure, operator panel

A	Feed pressure, collaring
В	Feed pressure, drilling
С	Max. feed pressure

6.31.2 Adjust Maximum Feed Pressure

The pressure must **not** be adjusted when drilling.



Valve for max. feed pressure

1. Place a wooden block (10–20 cm wide) in the feed in front of the forward drill rod support so that the limit sensor will not be activated.

- 2. Make sure that all the control levers on the operator panel are in neutral.
- 3. Start the pump.
- 4. Maneuver the drill on towards the wooden block.
- 5. Screw valve (A) clockwise as far as it goes to disengage the valve.
- 6. Remove the lock nut used for valve (A).
- 7. Adjust the set screw to 120 bar (1,740 psi).

Read the pressure from the feed pressure gauge on the operator panel.

- 8. Tight the lock nut.
- 9. Reset the valve (A).
- 10. Operate the drill back to its rear end position.
- 11. Stop the pump.
- 12. Remove the wooden block.

6.31.3 Setting Feed Pressure for Collaring

- 1. The percussion lever must be at the middle position (low percussion pressure) and the feed lever must be at its forward position.
- 2. Adjust the pressure to 40 bar on the valve on the operator panel.
- 3. Read the pressure from the feed pressure gauge located on the operator panel.

6.31.4 Setting Feed Pressure for Full Drilling

NOTE: The feed pressure may often require manual adjustment while drilling is in progress. Consideration must be made of drill bit diameter, drill bit type, percussion pressure, rock conditions etc.

- 1. Undo the lock screw on the pressure control valve.
- Regulate the feed pressure on the pressure control valve to approx. 100 bar. A suitable feed pressure depends on the quality of the rock and is suitably adjusted during full drilling. Then set the feed pressure to a level where drilling can take place without more serious jamming tendencies.

Turning the adjusting screw clockwise increases the feed pressure.

3. Read the pressure from the feed pressure gauge on the operator panel.

6.31.5 Set Feed Pressure for Reaming Hole

The reaming hole kit is extra equipment that allows the rapid switch between settings for small hole and settings for reaming hole.

The set includes extra valves that allow the setting of individual reaming hole values for feed pressure and rotation speed.



Valve for setting the feed pressure, reaming hole

- 1. Check that the lever for selecting small hole or reaming hole is in the position for reaming hole.
- Use an hex key to adjust the feed pressure on valve (A) on the right-hand side of drill panel. The pressure must be 50–70 bar (725.2 psi–1,015.3 psi).

Read the pressure from the feed pressure gauge on the drill panel.

6.32 Adjust the Feed Pressure for BMHT 6000 Series Feeder



Two step operation of telescope feed

The telescope feed has two different designs to lock the beam cylinder:

- Either of the two, one-way restrictor
- One Lever



В

One-way restrictor



Lever

- 1. BMHT-feeder with one-way restrictor for beam locking
 - a. Fully open both the valves.
- 2. BMHT-feeder with lever for beam locking
 - a. Set the lever in unlocked position.
- 3. Connect a pressure gauge to pressure test outlet (C) for lever, (A) for restrictors.
- 4. Screw out the adjustment screw on the pressure regulator (D) several turns.
- 5. Set the directional valve for feed in feed reverse position so that the rock drill cradle and telescope cylinder move to the rear position.

6.32.1 Adjust Maximum Feed Pressure Reverse

6. Set the return feed pressure on pressure regulator (D) to 120 bar, read on the pressure gauge connected to pressure test outlet (C).

6.32.2 Adjust Maximum Feed Pressure

- 1. Place a wooden block in the feed beam behind the front drill rod support so that the limit position switch on the feeder is not activated.
- 2. Connect a pressure gauge to the telescope feed
 - a. At one-way restrictor: pressure test outlet (A) Figure 1.
 - b. At lever: pressure test outlet (E) Figure 2.
- 3. Screw in the pressure control valve for the telescope feeder upper beam.
- 4. Set the directional valve on the drill panel for feed forward.
- 5. Increase the feed pressure on the pressure control valve for high feed pressure so that the telescope feed beam moves towards the wooden block.
- Continue to increase the feed pressure, while observing the pressure gauge connected to the pressure test outlet (A) or (E) until maximum feed pressure 120 bar has been reached.



NOTE: If feed pressure is below or above maximum pressure, then the pressure regulator for maximum feed pressure must be adjusted to 120±3 bar.

- 7. Check the setting by reversing the rock drill cradle and beam slightly. Loosen the pressure control valve for high feed pressure a couple of turns. Run the telescope feed beam towards the wooden block again and increase the feed pressure on the pressure control valve so that maximum pressure is reached. The pressure must stop at 120 bar, even if the pressure control valve is tightened further.
- 8. Screw out the pressure control valve for high feed pressure.

6.32.3 Check the Idling Feed Pressure and Limit Valve on the Feeder

- 1. Screw out the pressure control valve for the telescope feeder upper beam.
- 2. Reverse the rock drill cradle and the telescope step to the rear position.
- 3. Set the directional valve for feed on the drill panel forward.
- 4. Increase the feed pressure on the pressure control valve for high feed pressure until the rock drill cradle starts to move forward. Lower the pressure so that the rock drill cradle just moves. Allow the cradle to run along the whole feed beam. Check that the pressure on feed pressure gauge (GF) must not exceed 30 bar at any point.

5. Increase the feed pressure on the pressure control valve for high feed pressure until the telescope step starts to move forward. Then lower the pressure so that the telescope just moves and allow it to run along the whole feed beam. The pressure must not exceed 50 bar at any point.

NOTE: If any of the measured values is too high, the feed beam must be adjusted.

NOTE: Normal play between cradles and beam is 1 mm on each side of the beam.

6.32.4 Adjust Feed Pressure of the Telescope Cylinder

- 1. Screw in the pressure control valve for the telescope feeder upper beam.
- 2. Set the directional valve for feed on the drill panel forward.
- 3. Screw in the pressure control valve for high feed pressure so that the pressure on pressure gauge connected to pressure test outlet (E) or (A) shows 100±3 bar.
- 4. Open the pressure control valve until the pressure on feed pressure gauge (GF) shows 70±2 bar.
- 5. Lock the pressure regulator.
- 6. Set the directional valve for the feed in neutral position.
- 7. Fully close both of the one-way restrictors and check the telescope feed restrictors.
- 8. Set the directional valve for feed forward and allow the rock drill cradle and the telescope to move to their front positions.
- 9. Set the directional valve for the feed on the drill panel in reverse position.
- 10. The rock drill cradle should move backwards while the telescope should remain stationary.

6.32.5 Check the Telescopic Feed Lever Locking

- 1. Move the lock lever to the Locked position.
- 2. Set the directional valve for feed forward and allow the rock drill cradle and the telescope to move to their front positions.
- 3. Set the directional valve for the feed on the drill panel in reverse position.
- 4. The rock drill cradle must move backwards while the telescope must remain stationary.



NOTE: The setting of the pressure control valve might have to be adjusted during drilling to obtain smooth operation of the feed.

6.33 Anti-Jamming Protection

There are two types of anti-jamming protection:

- RPCF (feed control)
- Feed return, commonly called anti-jamming protection

The anti-jamming protection is integrated and interacts. An example to show the occurrence and the result once the protection is activated.

If the drill bit tends to jam in the drill hole due to cracks in the rock or if the rotation pressure increases due to poor flushing of the drill hole:

- The feed pressure successively drops until it is almost non-existent.
- If the rotation pressure continues to rise, the feed changes direction and the rock drill returns. A damaged drill bit or low hydraulic oil temperature can give the same effect.
- The setting of when the RPCF valve is to start reducing the feed pressure must be made by trial and error during a period of drilling. This also applies to setting the feed return.
- If the valves are adjusted too low, the rock drill either does not move forward at all or move forward with low feed force.
- If the valve is adjusted too high, the anti-jamming protection does not work satisfactorily resulting in a risk of jamming.
- The anti-jamming protection must be set so it is possible to drill with both small hole and reaming hole bits.

6.33.1 RPCF Feed Control

Rotation Pressure Controlled Feed (RPCF) is a type of anti-jamming protection that is activated by increased rotation pressure. The increasing rotation pressure have the following causes:

- The drill bit tends to jam in the rock.
- Broken or worn drill bit.
- · Low hydraulic oil temperature.

When RPCF is activated, the feed pressure will gradually drop until it almost reaches zero.

6.33.2 Feed Return Movement

If RPCF is activated but the rotation pressure still rises, then the second anti-jamming protection engages. This means that the feed changes direction so that the drill reverses.

6.33.3 Anti-Jamming Protection Settings

To set the anti-jamming protection, make the following settings in the sequence:

- 1. Set RPCF.
- 2. Set the feed return movement.

There are two ways to proceed with RPCF setting:

- Setting RPCF during drilling: Provides better adaptation to the state of the local rock.
- Setting RPCF in a workshop: Option to be selected if it is impossible to drill but still want to set the RPCF valve or valves.

Set RPCF During Drilling

Ī	NOTE: The hydraulic oil must be at normal operating temperature before setting.
Į	NOTE: Normal rotation pressure setting for drilling is around 50 bar (725 psi) for small holes and 40–50 bar (580–725 psi) for reaming holes. If the pressure rises above the normal pressure, there is risk that the drill rod jams. The RPCF valve must be activated if the normal rotation pressure rises by about 20 bar (290 psi) during drilling.
l	NOTE: If the machine is provided with a special reaming hole kit (option), the following settings are also to be made for reaming hole valve (9b).

Valve (9a) affects the rotation pressure at which the feed pressure will start to be reduced for a small hole bit.

Valve (9b) affects the rotation pressure at which the feed pressure will start to be reduced for a reaming hole bit.



Precondition ✓ If the machine is equipped with a special reaming hole kit (option), make sure that the lever for selecting small hole or reaming hole is at the correct position.

- \checkmark The lever must be in the small hole position to set the small hole valve (9a).
- ✓ The lever must be in the reaming hole position to set the reaming hole valve (9b).
- 1. Find some homogeneous rock in the area being drilled.
- 2. Screw in the adjustment screw used for the RPCF valve all the way.
- 3. Collar the hole firmly and proceed to full drilling at a suitable feed pressure.
- 4. Read the rotation pressure from the pressure gauge on the operator panel.
- 5. Screw out the adjustment screw used for the RPCF valve until the feed pressure starts to drop.

6. Screw in the adjustment screw used for the RPCF valve about one turn.

One turn corresponds to about 20 bar (290 psi) of rotation pressure.

In other words, a 20-bar (290 psi) increase in the normal rotation pressure is required during full drilling before the RPCF function will start to reduce the feed pressure.

7. Tighten the RPCF valve lock nut.

Set RPCF in a Workshop

!	NOTE: The hydraulic oil must be at normal operating temperature before setting.
ī	NOTE: Normal rotation pressure setting for drilling is around 50 bar (725 psi) for small holes and 40–50 bar (580–725 psi) for reaming holes. If the pressure rises above the normal pressure, there is risk that the drill rod jams. The RPCF valve must be activated if the normal rotation pressure rises by about 20 bar (290 psi) during drilling.



Precondition ✓ If the machine is equipped with a special reaming hole kit (option), make sure that the lever is at the correct position.

- ✓ The lever must be in the small hole position to set the small hole valve (9a).
- ✓ The lever must be in the reaming hole position to set the reaming hole valve (9b).
- 1. Read the normal rotation pressure during drilling from the rotation pressure gauge on the operator panel.
- 2. Operate the drill back to its rear position on the feed.
- 3. Screw out the adjustment screw all the way for the RPCF valve.
- 4. Jamming must be simulated when setting RPCF in a workshop.

One way to simulate jamming is to disengage the drill rotation hoses (RRR4) and (RRL4), and connect the hoses together with a cock or needle valve (A).



- 5. Set the rotation lever to the forward position (rotary drilling).
- 6. Screw in needle valve (A) until the rotation pressure gauge on the operator panel reads 60 bar (870 psi).
- 7. Set the feed lever to its forward position (forward feed).
- 8. Screw in the adjustment screw on the RPCF valve until the rock drill cradle starts to move forward on the feed.
- 9. Screw out the adjustment screw used for the RPCF valve until the cradle stops.
- 10. Tighten the lock nut used for the RPCF valve.
- 11. Examine the function of the anti-jamming protection before making any further settings.

Examine RPCF Function



Precondition	\checkmark If the machine is equipped with a special reaming hole kit (option), make sure that lever for selecting small hole or reaming hole is at the small hole position.
	1. Open the needle valve (A) slowly.
Step result	The rock drill must now start to move forward slowly while the rotation pressure starts to drop.
	2. Close needle valve (A) slowly.
Step result	The rock drill cradle must stop when the rotation pressure reaches about 70 bar.
	3. Continue to close the needle valve (A) slowly.
Step result	➔ The anti-jamming protection is to be activated and the rock drill cradle is to reverse direction when the rotation pressure reaches about 80 bar (1,160 psi).

- 4. Set the lever for selecting small hole or reaming hole in the reaming hole position and repeat steps 2–4.
- 5. Move the rotation lever and feed lever to their neutral positions.

6.33.4 Set Feed Pressure to Return Movement

NOTE: The hydraulic oil must be at normal operating temperature before setting.

The valve (A) for feed return on the valve pillar is to set at which rotation pressure the drill should change direction.



- 1. Check the rotation pressure during normal drilling. Read the rotation pressure from the pressure gauge on the operator panel.
- 2. Connect a pressure gauge to the pressure test outlet beside the valve (A).
- 3. Adjust to 30-40 bar (435–580 psi) above the normal rotation pressure approximately 90 bar (1,305 psi) on the valve (A).

NOTE: If the valve is adjusted too low, the drill will change direction too early.

NOTE: If the valve is adjusted too high, the drill will not change direction and the risk of jamming will increase.

6.34 Switch Percussion Pressure Level

Control the percussion pressure with the feed pressure. This function is termed FPCI (Feed Pressure Controlled Impact).



- 1. Connect a needle valve into the percussion circuit and open it 1/4 turn.
- 2. Place a wooden block (10–20 cm wide) in the feed behind the forward drill rod support so that the limit sensor will not be activated.
- 3. Maneuver the drill on towards the wooden block.
- 4. Activate rotation left, feed forward, and low percussion (collaring).
- 5. Set a rotation pressure of 30–40 bar (435–580 psi) with the needle valve in the rotation circuit.
- 6. Move the percussion lever to the high percussion position and lower the feed pressure slowly with the feed knob on the operator panel.

Check the feed pressure on the feed pressure gauge of the operator panel. When feed pressure decreases to approximately 55 bar (797.7 psi), the percussion switches from high pressure to low. The switching level can be adjusted on valve (A).

6.35 Adjust Maximum Pressure and Speed of Reeling Units

If it is not possible for the slip clutch on the reel gear to unwind the hose and cable, the reel hydraulic motor can be used for unwinding. The winding-in and winding-out speed can be adjusted by the restrictions beneath valve (Y414) for the cable reeling unit and (Y415) for the water hose reeling unit.



- 1. Connect a pressure gauge (250 bar) to pressure reducing valve (A).
- Adjust the pressure to 150 bar (2,175.5 psi) with the pressure reducing set screw (C).
- 3. Start the reeling unit for winding-in and winding-out.

4. Adjust the winding-in and winding-out speed with the restrictions (B).

The speed for **reeling in** can be adjusted 10–12 rpm (**one revolution each 5–6 seconds**).

The speed for **reeling out** can be adjusted 5–6 rpm (**one revolution each 10–12 seconds**).

NOTE: During normal operation, the cable and water hose reels must not be operated hydraulically when being reeled out. The cable and hose must be pulled out by the gear friction coupling instead.

6.36 Set the Pilot Pressure and Boom Positioning Pilot Pressure



1. Connect a pressure gauge to the pressure test outlet (73). Read the pressure on the pressure gauge.

If the pressure is not 35 bar (507.6 psi), do the following steps to adjust the pressure.

- 2. Remove the lock nut of the valve (8) for adjusting pilot pressure.
- 3. Adjust the set screw to provide 35 bar (507.6 psi). Read the pressure from the pressure gauge that is connected to pressure test outlet (73).
- 4. Tighten the lock nut.

6.37 Set Water Pump Speed

1. Check that the maximum water pump speed reading is 3000 rpm. Read the speed from the tachometer on the water pump hydraulic motor coupling.



2. Adjust the water pump speed using flow valve (B) until the tachometer on the water pump hydraulic motor coupling reads 3000 rpm.



Valve Section (Y162)





6.38 Adjusting the Positioning Valves for Front and Rear Boom

Boom positioning valves and steering lever

A	Adjusting screws for boom speed and parallelism
В	Adjusting screws for valve opening pressure
В	Steering lever
PPxx	Hose marking



Cross-section of boom positioning valve

A	Socket head cap screw for adjusting boom speed and parallelism
В	Hexagon-headed screw for adjusting valve open- ing pressure
D	Lock nut

6.39 Speed Control for Air Flow

1. Check that air pressure gauge on the operator panel reads 3 bar.



2. Screw out adjusting knob (A) on the flow regulator all the way.



Valve section (Y171)

- 3. Remove protective cap (C).
- 4. Undo lock nut (D).



Detail of valve

- 5. Adjust setting screw (E) until the pressure gauge reads 3 bar.
- 6. Tighten lock nut (D).
- 7. Screw in flow regulator (A) until the pressure begins to drop.
- 8. Then open the flow regulator a half turn.
- 9. Refit protective cap (C).

6.40 Clean Strainer

There is a strainer on the line from the limit valve for rock drill stop. If the strainer that is connected to valve Y114, becomes clogged, rock drill stops to function after drilling a hole. The strainer must be cleaned.



- 1. Loosen the strainer housing (A) from the line.
- 2. Remove the strainer (B).
- 3. Blow compressed air to clean the strainer.
- 4. Install the strainer (B) again.

7 Electrical System, IEC

7.1 Safety Precautions Before Working on Electrical System

WARNING

Dangerous Voltage

Can cause severe personal injury.

- Check that the electrical system is de-energized before starting to work.
- Only authorized electricians are allowed to service the electrical system.

WARNING

Uneven Surface

The top of the machine is uneven. When the personnel do maintenance work on the top of the machine, tripping over or falling off the machine is possible, which can result in serious injury or death.

- Pay attention to the uneven surface when walking on it.
- Make sure that there is sufficient friction when walking on the uneven surface.
- Always put on fall protection equipment.

WARNING

Working at Heights

Climbing the machine without proper holding, balance, and equipment, can cause personnel to fall off the machine, which can result in serious injury or death.

- Put on approved fall protection equipment.
- Hold the handle tightly when climbing the machine.
- Put on safety shoes to avoid slipping on the steps.
- ▶ Focus on the center of gravity of the body to keep balance.

7.2 Safety Precautions before Working on Lighting

WARNING

Xenon Bulbs

Working with high voltage can cause serious personal injury.

- The supply voltage to the xenon bulb must be switched off before replacing the bulb or starting other work on the supply circuit.
- Only the authorized maintenance personnel can handle the xenon bulbs.

Risk on Bulb Replacement

Hot surfaces can cause burns while replacing a bulb. Dirt on bulb glass is burned in and shortens the life of the bulb.

- Do not touch the glass on a bulb with fingers.
- Always use a clean cloth when installing the bulb or hold the bulb at its base.
- ▶ Wait until the bulb has cooled before replacing it.

7.3 Cable Marking

All the cables are marked with cable numbers corresponding to the external connection diagram.

Voltage (V)	Туре	Dimension (mm ²)	Diameter (mm)	Length (m)
400	H07RN-F	4G150	67	60
440	H07RN-F	4G120	60	75
440	Buflex	3×150+3G25	52	100
460-500	H07RN-F	4G120	60	75
460-500	Buflex	3×150+3G25	52	100
500-550	H07RN-F	4G95	55	90
500-550	Buflex	3×120+3G25	46	135
660-700	H07RN-F	4G70	49	125
660-700	Buflex	3×95+3G16	42	150

7.3.1 Power Supply Cable on Rigs with COP 1638

Voltage (V)	Туре	Dimension (mm ²)	Diameter (mm)	Length (m)
400	Buflex	3x185+3G35	55	100
440-500	Buflex	3×150+3G25	52	110
550	Buflex	3×120+3G25	46	135
690	Buflex	3×95+3G16	42	150
1000	Buflex	3×50+3G10	32	250

7.3.2 Power Supply Cable on Rigs with COP 1838

7.3.3 Power Supply Cable on Rigs with COP 1838ME

Voltage (V)	Туре	Dimension (mm ²)	Diameter (mm)	Length (m)
400	H07RN-F	4G150	67	60
440	H07RN-F	4G120	60	75
440	Buflex	3×150+3G25	52	100
460-500	H07RN-F	4G120	60	75
460-500	Buflex	3×150+3G25	52	100
500-550	H07RN-F	4G95	55	90
500-550	Buflex	3×120+3G25	46	135
660-700	H07RN-F	4G70	49	125
660-700	Buflex	3×95+3G16	42	150
1000	Buflex	3×50+3G10	32	250

7.4 Electrical Component Marking

When replacing a component, make sure the new component has the same Epiroc part number as the old one. Mark new components with the same marking as the ones they replace.

7.5 Low-Voltage Circuit

Low voltage refers to an alternating current circuit with a voltage greater than 50 V but less than or equal to 1000 V. The machines low-voltage circuit is a high-current circuit.

Low-voltage sources are:

- · Cable on reeling unit and collector
- Electric cabinet
- Electric motors for hydraulic pumps
- · Operating circuits
- Service outlet
- Battery charger for the carrier (also a source of extra low voltage)
- · Indicator lamps on electric cabinet
- · Electric motor for compressor
- Electric motor for water pump

7.6 Extra Low-Voltage Circuit

Extra low-voltage refers to an alternating current with a voltage less than or equal to 50 V or a direct current with a voltage less than or equal to 120 V.

Examples of extra low-voltage sources:

- · Operating circuits
- · Monitors in the system
- Battery charger for the carrier (also a source of low-voltage)
- Lighting
- · Indicator lamps on electric cabinet
- RCS system

7.7 Check Electrical System before Starting

- Check that all high-current connections in the electric cabinet, collector, and electric motors.
- Check that the plug is plugged in properly.

7.8 Before Troubleshooting Electrical System

Check the following before troubleshooting the electrical system:

- O All fuses are intact and switched on.
- Correct power supply is connected (see voltmeter).
- All warning lamps on the electric cabinet are in working order (lamp test).

7.9 Electrical Distribution Cabinet, High-Current



7.9.1 Electrical Distribution Cabinet A10 Y/D-Start IEC (400–690 V)

U40	Battery charger	P01	Voltmeter and Ammeter
K51	Ground fault relay (fire protection)	F25	Ground fault breaker (personal protection)
K50	Phase sequence monitor	Q01	Main power switch
F01	Motor protection relay (one relay for each hydraulic pump motor)		



7.9.2 Electrical Distribution Cabinet A10 Direct Start IEC (1000 V)

Electrical distribution cabinet A10, direct start (1000V)

U40	Battery charger	P01	Voltmeter and ammeter
Q01	Main switch	K51	Ground fault relay (fire protection)
F25	Ground fault breaker (personal protection)	S11	Motor switch
S12	Motor switch	K50	Phase sequence monitor
F01	Motor protection relay (one for each hy- draulic pump unit)		

7.9.3 Checking Voltage, Current, and Percussion Running Hours

	WARNING
	Dangerous Voltage
	Can cause severe personal injury.
►	Check that the electrical system is de-energized before starting to work.
►	Only authorized electricians are allowed to service the electrical system.

The Meter (P01), on the electric cabinet, is a combined voltmeter, ammeter, and hour meter. The light under the buttons indicates if button is activated.



- O Press button (V) to check that the input voltage to the machine complies with the rated voltage specified on the data plate of the machine.
- O Check the current of the hydraulic pumps electric motors by pressing the buttons (A1, A2, A3). The number of buttons (A1, A2, A3) that are functional varies depending on number of hydraulic pump units on the machine.
- Check that the hydraulic pumps electric motors are not overloaded in operation by comparing the meter readings with the rated current specified on the data plates of the electric motor.
- Check the running hours of the percussion unit button (T).

Does not apply for machines with RCS.

7.10 Electrical System Protection

7.10.1 Main Switch Q01

The main switch (Q01) is on the 3-phase circuit in the electric cabinet, and has built in protections. The main switch has a knob for on and off. If triggered by a protection, the switch can be reset by turning the knob to position 0 (OFF) and then back to position 1 (ON).

7.10.2 Setting Overload Protection IEC



First read: Safety Precautions Before Working on Electrical System [> 127]



11	Dip switches for setting overload protec- tion	t1	Dip switches for setting overload duration
12	Dip switches for setting short circuit pro- tection		

The overload protection setting depends on the supply voltage and total electric motor output. The setting is made with DIP switches (I1) on the main power switch. Next to the DIP switches is a mark indicating the different setting alternatives.

Precondition \checkmark The duration (t1) is set at 12 seconds.

Supply Voltage	Electric Motor	Setting
380–400 V	2 x 55 kW	0.6 x 400 A
380–400 V	2 x 75 kW	0.8 x 400 A
440 V	2 x 55 kW	0.5 x 400 A
440 V	2 x 75 kW	0.7 x 400 A
500 V	2 x 55 kW	0.5 x 400A
500 V	2 x 75 kW	0.6 x 400A

2 x 55 kW

2 x 75 kW

2 x 55 kW

2 x 75 kW

2 x 95 kW

2 x 55 kW

2 x 75 kW

2 x 95 kW

0.4 x 400 A

0.5 x 400 A

0.4 x 400 A

0.4 x 400 A

0.6 x 400 A

0.4 x 250 A

0.5 x 250 A

0.7 x 250 A

• Follow the table for correct settings.

7.10.3 Set Short-Circuit Protection

WARNING

Dangerous Voltage

550 V

550 V

660-690 V

660–690 V

660-690 V

1000 V

1000 V

1000 V

Can cause severe personal injury.

- Check that the electrical system is de-energized before starting to work.
- Only authorized electricians are allowed to service the electrical system.

The settings for the short-circuit protection depend on the method of starting. The setting is made with DIP switches (I2) on the main power switch. Next to the DIP switches is a mark, indicating the different setting alternatives.



DIP Switches

- Set the short-circuit protection to 4.5 × the main power switch rated current (In) for Y/D start or soft start.
- Set the short-circuit protection to 10 × the main power switch rated current (In) for direct start.

7.10.4 Reset Phase Sequence Alarm



The electrical system has a phase sequence monitor (K50) to prevent the electric motors from starting if the power supply has the wrong phase sequence. If there is a phase sequence problem, an indicator lamp on the electric cabinet comes on.

If the phase sequence fault indicator lamp comes on, a qualified electrician must take action.

- 1. Turn off the main power switch for the input cable and remove the plug.
- 2. Switch two of the phases in the consumer mains source.
- 3. Install the plug and turn on main power switch.

7.10.5 Set Phase Sequence Relay



- Set the minimum voltage to 180 V.
- Set the delay to 10 seconds.

7.10.6 Ground Fault Equipment

WARNING

Dangerous Voltage

Can cause severe personal injury.

- Check that the electrical system is de-energized before starting to work.
- Only authorized electricians are allowed to service the electrical system.

The electrical system has a ground fault relay (K51) and a ground fault breaker (F25).

- The purpose of the ground fault relay is to protect against fires in the main circuits. This switch is set to 300 mA and 500 ms.
- The ground fault switch provides personal protection. When it trips, the supply to the transformer circuit for service outlet 230 VAC and to the battery charger is disconnected. This switch is set to 30 mA and maximum 40 ms.

A qualified electrician must test the ground fault equipment regularly. The ground fault equipment settings are checked before delivery and sealed.

7.10.7 Motor Protection

Motor Protection Relay Epiroc



NOTE: The information applies to models GL 16, GL 40, GL 90 and GL 200. Appearance may vary between models.

Each hydraulic pump motor has an electronic motor protection relay. The motor protection has a green lamp (A) that indicates that the power supply is on and that the output relay is in operating position. If the motor protection is triggered, the lamp goes off.

The motor protection has three lamps to indicate which type of fault has triggered the protection.

- Lamp (B) comes on if the permitted motor current is exceeded (over-current). Motor protection trips because the motor is overloaded (thermal overload).
- Lamp (C) comes on in the event of a phase loss or a phase error. The electric motor stops or cannot be started
- Lamp (D) comes on if the permitted motor temperature is exceeded (overheating). The electric motor stops.

The motor protection has a DIP switch for setting rated current (H) and a DIP switch for phase sequence monitoring (E). It is possible to set the trip class (F). It also has a reset button (G) to reset alarms.

Check if Motor Protection is Triggered

WARNING

Dangerous Voltage

Can cause severe personal injury.

- Check that the electrical system is de-energized before starting to work.
- Only authorized electricians are allowed to service the electrical system.



- 1. Check the lamp to analyze which protection is triggered.
 - a. If lamp (A) is ON: The motor current exceeds the set rated current and that the motor protection has tripped.
 - b. If lamp (B) is ON: Turn off the main power and pull out the plug from the wall socket. Check the cables in the electric motor circuit and the electric motor.
 - c. If lamp (C) is ON: Check that the electric motor is properly cooled or if it has been overloaded for a long time.
 - d. Check that the power supply complies with the rated voltage on the data plate. If the voltage is correct, check the electric motor circuit.
- 2. Reset the motor protection with button (D) after the fault is rectified.

Setting Rated Current



First read: Safety Precautions Before Working on Electrical System [> 127]

The motor protection must be set to the rated current of the motor unless the motor has a service factor (SF) higher than 1.0. The motor protection has a basic value of 4 A for GL 16, 15 A for GL 40, 40 A for GL 90 or 60 A for GL 200 that must be considered when setting. The value set for direct start must therefore be 4 A, 15 A, 40 A or 60 A lower than the rated current for the motor. Alternatively 4 A, 15 A, 40 A or 60 A lower than the rated current for the motor times the service factor (1.15 or 1.3). For Y/D, start the value must be as above but times 0.58. Adjust settings using the DIP switches on the motor protection.

Precondition The rated current and service factor are specified on the electric motor data plate.

- If the service factor is 1.15, set the motor protection to a value 15% higher than the rated current.
- If the service factor is 1.3, set the motor protection to a value 30% higher than the rated current.
- Set Trip class to a value of 10.

7.11 Battery Charger

The battery charger (U40) supplies the rig's 24 V-system and is fitted integrated into the electrical distribution cabinet (A10).

The supply voltage to the battery charger must be 240 V AC, 45-65 Hz.



Battery charger (U40)

When replacing a battery charger the correct charging voltage must be set. The charging voltage is adjusted on screw (A) and must be set at 26.8V. Measure the set voltage between B (+) and C (-) using a voltmeter.

7.12 Before Troubleshooting Electrical System

Check the following before troubleshooting the electrical system:

- O All fuses are intact and switched on.
- Correct power supply is connected (see voltmeter).
- All warning lamps on the electric cabinet are in working order (lamp test).

7.13 Starting with Auxiliary Battery

WARNING Risk of Explosion There is a risk of personal injury if a charged battery is connected to a discharged battery. Use a well ventilated area. Fire extinguisher must be close at hand. Use face shield. Use protective safety glasses. Use protective gloves.

NOTE: The connections to the drill rig batteries must under no circumstances be broken during operation as this could lead to faults arising in the alternator.



- 1. Check that the auxiliary batteries (A) have the same voltage as the chassis batteries (B).
- 2. Connect the positive terminal of the auxiliary batteries (A) to the positive terminal of the chassis batteries (B).
- Connect the negative terminal of the auxiliary batteries (A) to ground on the chassis.

NOTE: Do not connect the negative terminal of the auxiliary batteries (A) to the chassis batteries (B) negative terminal.

- 4. Disconnect the cable from the chassis ground when the engine starts.
- 5. Disconnect the cable from the negative terminal on the auxiliary batteries (A).
- 6. Disconnect the cable between the positive terminal of the chassis batteries (B) and the auxiliary batteries (A).

8 Pneumatic and Water Systems

8.1 Safety Precautions Before Working on Pneumatic System

High System Pressure

There is a risk of personal injury when working with pressurized systems.

- ▶ Do not perform maintenance work while the machine is operating.
- Check that the hydraulic, water, and air systems are depressurized and that the electrical system is de-energized before starting to work on these systems.

8.2 Safety Precautions before Working on Water System

WARNING

High System Pressure

There is a risk of personal injury when working with pressurized systems.

- Do not perform maintenance work while the machine is operating.
- Check that the hydraulic, water, and air systems are depressurized and that the electrical system is de-energized before starting to work on these systems.

8.3 Incoming Water Hose

Recommended Hose Sizes

Hose dimension,	2-boom	machine
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38 mm (1.5 in)



8.4 Check Water Pump Rotation Direction



- O Check the rotation direction of the water pump corresponds with the arrow (A).
- Switch the delivery and return hoses on the motor and valve if the rotation direction of the pump is incorrect.

8.5 Set Water Flow Switch



Flow Switch

- 1. Remove the black plastic cover from the guard.
- 2. Remove the screw on top of the switch.
Step result

3. Adjust sensor body (A).



4. Set the flow switch (B141) as a making contact (B).

The filled red triangle (B) shows interval for making contact and white triangle (C) for breaking contact.

- 5. Adjust the water flow switch so that just the tip of the red triangle is visible.
- 6. Tighten the screw and install the plastic cover.
- 7. Check that desired function is reached by turning ON and OFF the flow.
- The flow switch (B141) senses the water flow during drilling. The adjustment of the sensor body determines the water flow value. If the flow is below the set value, the water pump stops and the drilling is interrupted.

8.6 Replacing Water Pump Shaft Seal - Hydraulic Drive

WARNING High System Pressure There is a risk of personal injury when working with pressurized systems. Do not perform maintenance work while the machine is operating. Check that the hydraulic, water, and air systems are depressurized and that the electri-

Check that the hydraulic, water, and air systems are depressurized and that the electrical system is de-energized before starting to work on these systems.



Precondition ✓ The water pump is removed from the machine.

- 1. Remove the protection (L) from the lantern piece.
- 2. Remove the hub bolts (E) and associated lock tabs.
- 3. Remove the locking pin (G), which is inside the lock tabs (F).
- 4. Remove the bolts that attach the hydraulic motor in flange (C) and lift off the hydraulic motor together with the hub (B).
- 5. Remove the plug (M).
- 6. Remove the nuts (A) and the lift off the lantern piece (K).
- 7. Lift off the disk (J) and remove the upper part of the shaft seal (H) from the disk underside.
- 8. Wash the upper part of the new shaft seal with alcohol and install it in place on the disk.
- 9. Pull off the lower part of the old shaft seal from the shaft.
- 10. Wash the lower part of the new seal with alcohol and place on the shaft.
- 11. Install the disk (J) with the upper part of the shaft seal in place.
- 12. Install the lantern piece (K) with the nuts (A).



13. Press in the fork-shaped shim (M) on the shaft.

If there is no shim, then a fitting piece of 5 ± 0.1 mm (0.196 ± 0.0039 in) can be used.



- 14. Lower the hub (B) over the shaft.
- 15. Attach the locking pin (G) in the shaft hole.
- 16. Install the lock tabs (F) and the hub bolts (E).
- 17. Install the hydraulic motor into the flange (C) on the lantern piece.
- 18. Remove the fork-shaped shim and fit the plate protection (L).

8.7 Adjust Thermostat

The hydraulic oil tank opens and releases water to increase the flow of water through the oil cooler when hydraulic oil temperature reaches 50 °C (122° F) in a thermostat.



• Set the thermostat to 50° C (122° F) using the control knob (A).

NOTE: The thermostat has a scale graduated 1–5 value. The value 1 on the scale is equivalent to approximately 25° C (77° F) and the value 5 is equivalent to approximately 65° C (149° F).

• Check the setting on the thermometer (B) on the hydraulic oil tank.

8.8 Adjust Water Pressure in Thermostat



- Check the input water pressure on pressure gauge that is connected to outlet (B).
- Adjusted the pressure using the reducing valve (A) to approximately 5 bar (72 psi) located near the hydraulic oil tank.

NOTE: Input water pressure must be maximum of 14 bar (203 psi).

8.9 Clean Water Strainer

WARNING

High System Pressure

There is a risk of personal injury when working with pressurized systems.

- ▶ Do not perform maintenance work while the machine is operating.
- Check that the hydraulic, water, and air systems are depressurized and that the electrical system is de-energized before starting to work on these systems.



✓ The hose connection points are clean.

- 1. Connect a water supply to the water inlet (B) on the machine.
- 2. Open the main stop valve (A).
- 3. Open the drain valve (E) and let water run through the water strainer (C).
- 4. Close the drain valve (E) and the stop valve (A)
- 5. Disconnect the water supply from the water inlet (B).
- 6. Remove the end piece (D) if the water strainer is damaged.
- 7. Remove the strainer drum.
- 8. Clean the strainer drum or replace with a new one if necessary.

8.10 Adjusting Compressor Speed GAR 5 for Machines Without Hole Blowing

If the machine lacks the hole blowing option, then the air is only used for drill lubrication. Compressor speed must be set so that lubricating air pressure is 3 bar (43 psi).

- 1. Mark the compressor pulley with reflective tape.
- 2. Measure the rotation speed using a tachometer.

The rotation speed must be 3500-4000 rpm.

3. Remove the anti-inductive protection (Y171).



4. Connect a pressure gauge to the test outlet (A).

The pressure must be 170 bar (2465 psi). If not, adjust the pressure on pressure reducing valve (B).

- 5. Adjust the rotation speed of the compressor using the flow regulator (C).
- 6. Attach the anti-inductive protection (Y171).

8.11 Adjusting Compressor Speed GAR 5 for Machines with Hole Blowing

- 1. Mark the compressor pulley with reflective tape.
- 2. Measure the rotation speed using a tachometer.

The rotation speed must be 4000 rpm.

3. Remove the anti-inductive protection (Y210) from the relief valve of compressor.



Anti-inductive Protection (Y210)

4. Connect a pressure gauge to pressure test outlet (A).

The pressure must be 220 bar (3190 psi). If not, adjust the pressure on pressure reducing valve (B).



Valve Post

- 5. Adjust the rotation speed of the compressor using the flow regulator (C).
- 6. Attach the anti-inductive protection (Y210) to the relief valve of compressor.

8.12 Adjusting Booster RPM Compressor Speed GAR 5

If the machine has the compressor boost function, then a higher rotation speed is activated using a lever at the operator station.

Adjust both the lower basic speed (4000 rpm) and the higher speed (7000 rpm).

- 1. Mark the compressor pulley with reflective tape.
- 2. Measure rotation speed using a tachometer.

The rotation speed must be 4000 rpm.

3. Remove the anti-inductive protection (Y210) from the compressor relief valve.



Anti-inductive Protection (Y210)

4. Connect a pressure gauge to pressure test outlet (A).

The pressure must be 220 bar (3190 psi). If not, adjust the pressure on pressure reducing valve (B).



Valve Post

- 5. Adjust the rotation speed of compressor using the flow regulator (C).
- 6. Activate compressor boost using the lever at the operator station.
- 7. Measure the rotation speed on the tachometer.

The rotation speed for compressor boost must be 7000 rpm. If not, adjust the rotation speed using the flow regulator (D).

8. Attach the anti-inductive protection (Y210) to the relief valve of compressor.

8.13 Adjusting Compressor Speed GAR 30

- 1. Mark the compressor pulley with reflective tape.
- 2. Measure rotation speed using a tachometer.

The rotation speed must be 4000 rpm.

3. Remove the anti-inductive protection (Y210) from the compressor relief valve.



Anti-inductive Protection (Y210)

4. Connect a pressure gauge to pressure test outlet (A).

The pressure must be 220 bar (3190 psi). If not, adjust the pressure on pressure reducing valve (B).



Valve Post

- 5. Adjust the rotation speed of compressor using the flow regulator (C).
- 6. Attach the anti-inductive protection (Y210) to the relief valve of compressor.

8.14 Adjusting Booster RPM Compressor Speed GAR 30

If the rig has the compressor boost function then a higher rotation speed is activated using a lever at the operator's station.

When adjusting, both the lower basic speed (approx. 1800 rpm) and the higher speed (approx. 4500 rpm) should be adjusted.

- 1. Mark with reflective tape on the compressor's pulley.
- 2. Remove the anti-inductive protection Y210 and Y171.
- 3. Connect a pressure gauge to pressure test outlet (D). The pressure should be approx. 200 bar.



If necessary, adjust the pressure on pressure reducing valve (A).

- 4. Refit the anti-inductive protection Y171.
- 5. Activate compressor boost using the lever on the operator's station.
- 6. Adjust the compressor's booster speed to approx. 4500 rpm using the flow regulator (C).
- 7. Switch off compressor boost with the lever at the operator's station.

- Adjust the compressor's rotation speed to approx. 1800 rpm using the flow regulator (B).
- 9. Refit the anti-inductive protection (Y210) to the compressor's relief valve.

8.15 Load and Unloading the Compressor



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NOTE: The compressor pressure switch (B188) must only be adjusted while the system is pressurized. If not, it can be damaged.

- 1. Remove the locking pin (A).
- 2. Pull the setting knob (B) up to adjust the unloading pressure.
- 3. Check the air pressure on the operator panel pressure gauge.
- 4. Turn the adjuster knob (B) to set the unloading pressure to 8 bar (116 psi).

Clockwise = Increase pressure

Counterclockwise = Decrease pressure

- 5. Push the adjuster knob (B) down to adjust the difference between the unloading and loading pressures.
- The pressure difference between the unloading and loading pressures must be 2 bar (29 psi).
- 7. Check the air pressure again on the operator panel pressure gauge.
- 8. Adjust the pressure so that the compressor loads at 6 bar (87 psi).
- 9. Install the locking pin (A).

8.16 Check Pressure Sensor B188:1

Pressure sensor B188:1 detects the pressure in the air circuit. If the pressure is too low, then drilling is stopped after a certain time to prevent damage to the drill due to deficient lubrication.



1. Check that the pressure sensor has the correct power supply +24 VDC and that it sends the correct output signal to the air-water system.



NOTE: The special terminal block that is included in the Epiroc service bag must be used to measure the voltage supply.

2. Calibrate sensors after replacement. Refer to FAM (Feed Angle Measurement) manual.

8.17 Freeze Prevention Measures

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NOTE: The water system must be drained at temperatures approaching or below 0 $^{\circ}$ C (32 $^{\circ}$ F).

8.17.1 Draining Water System

- 1. Make sure the diesel engine and hydraulic pumps are turned off to avoid the risk of damaging the water pump.
- 2. Connect air to water inlet (F).



Water inlet

3. Open cocks (E) and (A) to blow the water out through the reeling unit.

- 4. Close cock (A).
- 5. Move the water/air flushing lever forward, so that the water valve opens and the compressed air expels the water through the system.
- 6. Repeat the above procedure for the other boom.

8.17.2 Draining Water Mist System

- Disconnect the induction connector from the solenoid valve Y 162 and Y162:2 so that the water pumps do not start.
- 2. Connect air to water inlet (F).



Water inlet

- 3. Close cock (A).
- 4. Open cock (E).
- 5. Open both drain cocks in the system for water mist.
- 6. Close the drain cocks when only air is blown out.
- 7. Start the hydraulic pump and activate water mist. Deactivate it when only air is blown out from the rock drill. Switch off the hydraulic pump.
- 8. Repeat the above procedure for the other boom.
- 9. Open both drain cocks in the system for watermist.
- 10. Reconnect the induction connectors to the solenoid valves Y162 and Y162:2.

8.17.3 Drain Water Pump

WARNING

High System Pressure

There is a risk of personal injury when working with pressurized systems.

- Do not perform maintenance work while the machine is operating.
- Check that the hydraulic, water, and air systems are depressurized and that the electrical system is de-energized before starting to work on these systems.



- 1. Open the water pump drain valve (A).
- 2. When the flow of water stops, close the drain plug.

8.17.4 Draining Condensate from Air Tank

Air tank is installed on machine with the air flushing option.



Precondition ✓ Machine is parked on a flat and level surface.

- 1. Open the drain tap on the air tank.
- 2. Close the drain tap when the flow of water stops.

8.18 ECL Lubricating System Adjustment

8.18.1 Metering Lubricating Oil



ECL Lubrication System

ECL	Pulse relay	В	LED on lubrication pump anti-inductive protection
GI	Pressure gauge for lubricant pressure. Lo- cated on operator panel.		

- 1. Start the pump.
- 2. Check that the LED (B) on the pulse relay in the electric cabinet.

It indicates that power is turned On.



ECL Pulse Relay

- 3. Adjust screw (T1) so that the LED (A) is on for approximately 0.5 second.
- 4. Set the correct lubricating oil dosage with screw (T2) including LED (A) to indicate 25 pulses/minute.

5. Check the lubrication pump LED (B) after each shift to confirm that the correct pulse frequency is obtained and that oil is emerging from the front section of the rock drill.

8.18.2 Lubricating Air Pressure for Rigs with Hole Blowing

Rigs equipped with hole blowing have a pressure regulator that limits the air pressure used for lubricating the drill adapter.

Pressure switch B188:1 monitors the lubricating air pressure. If the pressure falls below 2 bar then a warning lamp illuminates on the drill panel.

1. Undo lock nut (A).



Pressure regulator with pressure gauge used for lubricating air pressure

- 2. Adjust the lubricating pressure to 3 bar using set screw (B). Read the value from pressure gauge (Gal).
- 3. Tight the lock nut (A).

8.18.3 Lubricant Level Monitor

The lubricant level monitor is extra equipment and is therefore not available on standard rigs.

The lubricant level monitor is located in the bottom of the lubricating oil tank. If the lubricant level is too low then a lamp (A) illuminates, located on the junction box at the operator's station.



Junction box and indication

The lubricant level monitor acts on time relay K107T which is set at 5 minutes. This means that if the lubricating oil tank is not filled within this time then the pumps will be switched off after five minutes.

If the pumps have stopped, it will suffice to fill the lube oil tank before the pumps are started again.

9 Power Train

9.1 Safety Precautions before Working on Power Train

WARNING

Hot Surface

Hot components can cause serious personal injury.

- Turn off the machine and allow the components to cool down before starting maintenance work.
- ▶ Use Personal Protective Equipment (PPE).
- Be careful when draining hot fluids.
- Do not handle flammable fluids near hot surfaces, sparks, or open flames.

WARNING

Uneven Surface

The top of the machine is uneven. When the personnel do maintenance work on the top of the machine, tripping over or falling off the machine is possible, which can result in serious injury or death.

- Pay attention to the uneven surface when walking on it.
- Make sure that there is sufficient friction when walking on the uneven surface.
- Always put on fall protection equipment.

WARNING

Working at Heights

Climbing the machine without proper holding, balance, and equipment, can cause personnel to fall off the machine, which can result in serious injury or death.

- Put on approved fall protection equipment.
- ► Hold the handle tightly when climbing the machine.
- Put on safety shoes to avoid slipping on the steps.
- Focus on the center of gravity of the body to keep balance.

9.2 Power Train

Wheels

Description	Data
Tyres L1, L2 (boom and engine section)	14.00 x 24
Rims L1, L2 (boom and engine section)	10.00 x 24
Tyre pressure	10 bar
Tightening torque wheel nuts	550 Nm

Steering/Brakes

Description	Data	
Control valve	Danfoss OSPB 800 LS	
Gear pump:		
Steering cylinder	VOAK 125/63-400	
Steering wheel turns, lock-to-lock	6.0 turns from full left lock to full right lock	

Front axle

Description	Data
Shaft type	DANA 114/51
Max. load	28000 kg
Weight	950 kg

Rear axle

Description	Data
Shaft type	DANA 114/51
Max. load	7000 kg
Weight	950 kg

9.3 Power Train Overview



А	Axle boom side Clark Hurt 176	В	Transmission Clark 24000 long drop
С	Axle Engine side Clark Hurt 176		

9.4 Replace Tyres and Wheels

- The air pressure in the tires should be 10 bar (145 psi).
- When changing wheels, the contact surface between hub and rim must be cleaned in order maintain tightening torque.
- O The wheel nuts must be torque-tightened to 350 Nm (258 lb-ft).

9.5 Drive Axles

9.5.1 Check Oil Level in Central Housing



The center of the axles

- 1. Make sure that the machine is standing level.
- 2. Remove the plug (A) and check the oil level.
- 3. Fill the central housing with oil as necessary. See the specification in Fluids and Lubricating Greases manual.

9.5.2 Replace Oil in Central Housing

- 1. Oil should be changed after operating the machine, while the oil is still hot.
- 2. Unscrew the three plugs (B) and drain the oil.





3. The oil will drain faster if plug (A) is also unscrewed



The center of the axles

- 4. Refit the plugs (B) and tighten them.
- 5. Fill with new oil through the hole for plug (A) until the oil reaches the hole.
- 6. Screw in and tighten plug (A).

9.5.3 Check Oil Level in Planetary Gear



- 1. Make sure the machine is standing level.
- 2. Rotate the wheel so that the two level markings (A) on the hub are horizontal.
- 3. Remove the screw (B) and check that the oil level.
- 4. Fill the planetary gear with oil as necessary. See the specification in Fluids and Lubricating Greases manual.

9.5.4 Replace Oil in Planetary Gear



See Separate Manual

Fluids and Greases

Oil Volume for Planetary Gear	Oil Volume for Planetary Gear	Oil Volume for Planetary Gear
on Wheel Axle, Dana 123	on Wheel Axle, Dana 113	on Wheel Axle, Dana 114
2.1 L (0.55 gallon)	2.6 L (0.68 gallon)	4.5 L (1.18 gallon)

9.5.5 Check Tightening Torque on Bolted Joints on Wheel Axle

- Check all the bolts that hold the axle to the frame for damage.
- O Check that no bolt is missing.
- Check and tighten all bolted joints to the frame.

9.6 Hydraulic Transmission

9.6.1 Safety Precautions before Working on Hydraulic Transmission of Power Train

A	WARNING
	Hot Engine and Components
	Can cause personal injury
►	Make sure that the engine is switched off for all maintenance work.
►	Take care when draining hot oil and fluids to avoid burns.

The oil must reach normal operating temperature 80-95 °C before the level is checked and the filter is replaced.

9.6.2 Transmission

Clark 24 000 long drop	kg	lb
Weight	333	734
Clark 32 000 long drop	kg	lb
Weight	490	1,080
Clark 32 000	kg	lb
Weight	502	1,106

9.6.3 Cooling the Transmission Oil

Cooling of the transmission oil is controlled by a thermostat valve (A) which does not open the flow to the radiator before the oil has reached a temperature of 70 $^{\circ}$ C.



Cooling the transmission oil



NOTE: Thermostat valve (A) location may vary slightly depending on engine type.

9.6.4 Check Oil Level



Checking oil

- 1. Check the oil with the dipstick (A) while the engine is idling, 750 800 rpm.
- 2. Top up as needed through the filler pipe (A) to the FULL mark on the dipstick. See maintenance instructions Lubricants, coolants and propellants.

9.6.5 Replace Oil Clark-24 000

First read: Safety Precautions before Working on Power Train [> 161]



Precondition

✓ Engine is switched off.

- Oil is at operating temperature, 80-95 °C (176-203 °F). \checkmark
- 1. Place a vessel under the transmission.
- 2. Remove plug (C) to drain the oil from the transmission housing.
- 3. Install the plug.
- 4. Fill the transmission housing with oil through the filler pipe (B) up to the low mark on the dipstick (A).
- 5. Start the diesel engine and idle at 750-800 rpm to fill up the torque converter and lines.
- 6. Check the oil level while the engine is idling and fill oil through the filler pipe (B) to the low mark on the dipstick (A).
- 7. Check the oil level after it has reached normal operating temperature.
- 8. Fill with oil up to the full mark on the dipstick (A).

See Separate Manual

Fluids and Greases

Oil Volume for Hydraulic Transmission, Clark 24000

21 L (5.54 gallon)

9.6.6 Replace Filter Clark-24 000



First read: Safety Precautions before Working on Power Train [> 161]



Precondition ✓ Oil is at operating temperature 80 °C to 95 °C (176 °F to 203 °F).

- ✓ Engine is switched off.
- 1. Remove the filter (C).
- 2. Replace the filter.
- 3. Start the diesel engine and idle at 750–800 rpm to fill up the torque converter and lines with oil.
- 4. Check the oil level while the engine is idling and fill the oil through filler plug (B) to the low mark on the dipstick (A).
- 5. Check the oil level after it has reached normal operating temperature.
- 6. Fill with oil through filler plug (B) up to the full mark on the dipstick (A).

See Separate Manual

Fluids and Greases

Oil Volume for Hydraulic Transmission, Clark 24000

21 L (5.54 gallon)

Oil Volume for Hydraulic Transmission, Clark 24000

27 L (7.13 gallon)

9.6.7 Replace Filter and Oil



Changing oil in the transmission

- 1. Drain the oil from the transmission housing when it has reached normal operating temperature by opening the plugs (C). Screw the plugs back in place
- 2. Remove filter (B) and fit a new one in its place.
- 3. Fill the transmission housing with oil through (A) up to the "LOW" mark on the dipstick (A). See maintenance instructions Lubricants, coolants and propellants.
- 4. Start the diesel engine and let it idle, 750-800 rpm, to fill up the torque converter and lines.
- 5. Check the oil level again with the engine idling and top up to the "LOW" mark on the dipstick (A).
- 6. Check the oil again once it has reached normal operating temperature, 80-95 °C.
- 7. Fill with oil to the "FULL" mark on the dipstick.

9.7 Carrier

9.7.1 Check Carrier Central Lubrication

	WARNING
	Hot Surface
	Hot components can cause serious personal injury.
►	Turn off the machine and allow the components to cool down before starting mainte- nance work.
►	Use Personal Protective Equipment (PPE).
►	Be careful when draining hot fluids.
►	Do not handle flammable fluids near hot surfaces, sparks, or open flames.

- O Check the central lubrication hoses and nipples for wear or other damage.
- O Fill the central lubrication with grease if necessary.

9.7.2 Lubricate Cardan Shafts

1. Pump grease into the grease nipples (A) in the center of the universal joints. Refer to Fluids and Lubricating Greases manual.



2. Make sure that the grease appears.

See Reference Document

Fluids and Lubricating Greases

9.7.3 Lubricate Central Chassis



Central lubrication

The chassis is equipped with a lubricating system that lubricates the rear axle's pendulum suspension from 2 nipples (B).

- 1. Press grease into the grease nipples (A). See manual Fluids and greases.
- 2. Make sure grease comes out at all positions (B).

9.8 Towing

9.8.1 Safety Precautions Before Towing

	WARNING
	Machine Movement
	injury or death.
►	Always attach a tow bar between the machine and the towing machine before releasing the brakes or removing the cardan shafts.
	Make sure that the towing machine and the tow bar are suitable to pull the load.
•	Make sure that the towing machine's brakes are in good condition and have enough power to stop both machines in any condition.

NOTICE

Incorrect Towing

Starting the machine when towing could damage the hydraulic transmission seriously.

Do not start the machine by towing.

9.8.2 Preparing for Towing

WARNING Machine Movement The machine has no working brakes when it is being towed which can cause serious injury or death. Always attach a tow bar between the machine and the towing machine before releasing the brakes or removing the cardan shafts. Make sure that the towing machine and the tow bar are suitable to pull the load. Make sure that the towing machine's brakes are in good condition and have enough

NOTICE

Incorrect Towing

Starting the machine when towing could damage the hydraulic transmission seriously.

Do not start the machine by towing.

Tow the carrier only if it is necessary.

power to stop both machines in any condition.

Do not tow the carrier more than 1 km (0.621 miles) or at a speed greater than 5 km/h (3.10 miles/h).

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NOTE: The brakes do not function while the machine is being towed.

- 1. Connect a tow bar between the machine and the towing machine.
- 2. Disable the parking brake mechanically.
- 3. Disassemble the cardan shaft from the drivetrain.
- 4. If the diesel engine or traction motor is not working, disconnect the steering cylinder.

9.8.3 Disconnect Parking Brake Mechanically

WARNING Machine Movement The machine has no working brakes when it is being towed which can cause serious injury or death. Always attach a tow bar between the machine and the towing machine before releasing the brakes or removing the cardan shafts. Make sure that the towing machine and the tow bar are suitable to pull the load. Make sure that the towing machine's brakes are in good condition and have enough power to stop both machines in any condition.



Precondition A tow bar is connected between the machine and the towing machine.

- 1. Loosen the lock nuts (A).
- Tighten the bolts (B) alternately until the brake is released.
 Both the bolts must be tightened to the same extent.
- 3. Lock the bolts with the nuts.
- 4. Disable the brakes on both wheel axles.

9.8.4 Remove Cardan Shafts



- 1. Mark the flanges on the cardan shafts so they can be installed in the same way.
- 2. Remove the bolted joints (A) and remove the cardan shafts.

9.8.5 Disconnect Steering Cylinder

First read: Safety Precautions Before Towing [> 173]

If the diesel engine is not working during towing, the steering cylinder must be disconnected hydraulically.

 $\label{eq:precondition} \qquad \checkmark \quad \mbox{The unions on the cylinder are not plugged to allow oil to run out.}$

- \checkmark $\;$ The unions are protected from dirt.
- 1. Remove both hoses from the steering cylinder.
- 2. Plug the hoses.
- 3. Protect the steering cylinder against dirt.

9.8.6 Restoring after Towing

- 1. Refit the cardan shafts.
- 2. Connect the hoses to the steering cylinder.



3. Apply the brakes. Undo the lock nut (A) and unscrew the bolt until it protrudes 47 mm.

Setting the brake screw

- 4. Remove the drawbar between the chassis and the towing vehicle.
- 5. Check the brakes after towing. See maintenance instructions Brake system: Checking service brake pressure.

10 Brake System

10.1 Safety Precautions before Working on Brake System

	WARNING
	High Hydraulic Oil Pressure
	Can cause personal injury.
►	Switch off the machine.
►	Make sure that the system is de-pressurized before starting any work.
•	Press the brake pedal repeatedly after the machine has been switched off to make sure that the system is de-pressurized.
•	Check with a pressure gauge on both brake system accumulators to make sure that the system is de-pressurized.

10.2 Brake Systems

Service Brake

System	Dual independent circuits. Hydraulic disk brakes in oil bath in both axels.
Hydraulic pressure	80–85 bar (1160.3 to 1232.82 psi)

Parking and Emergency Brake

System	SAHR (Spring Applied Hydraulic Released)
Maximum hydraulic pressure	30 bar (435 psi)

Parking and Emergency Brake

System	SAHR (Spring Applied Hydraulic Released)	
Maximum hydraulic pressure	35 bar (507.63 psi)	

Parking and Emergency Brake

System	МІСО
Maximum hydraulic pressure	75 bar

Parking and Emergency Brake

System	SAHR (Spring Applied Hydraulic Released)
Maximum hydraulic pressure	25 bar (362.59 psi)

10.3 Brake System Overview



Transmission

А	Axle boom side Clark Hurt 176	В	Axle engine side Clark Hurt 176
С	Transmission Clark 24000 long drop		

10.4 Check Service Brake Pressure

Preparation

- 1. Ensure that the rig is on a level surface and that the parking brake is applied.
- 2. Connect a pressure gauge to the brake system pressure test outlet (C).


A	Front axle
В	Rear axle
C	Test outlet

Check

- 1. Start the diesel engine.
- 2. Depress the brake pedal and read off the pressure on the pressure gauge. It should read 80 +5/-0 bar.

The pressure is factory set and cannot be adjusted.

3. Stop the diesel engine.

Finishing

1. Disconnect the pressure gauge for the brake system test outlet (C).

10.5 Check Parking Brake Pressure

- 1. Connect a pressure gauge to the brake system pressure test outlet.
- 2. Start the diesel engine.
- Release the parking brake while reading off the pressure on the pressure gauge. The pressure should be 35 bar. The pressure can be adjusted on the pressure regulator (A) under the control platform.



Regulating parking brake pressure

4. Stop the diesel engine and disconnect the pressure gauge from the pressure test outlet.

10.6 Bleeding Service Brake

WARNING Hydraulic Oil at High Pressure Thin jets of hydraulic oil under high pressure can penetrate the skin and cause permanent damage. Never use your fingers to check for hydraulic fluid leaks. Keep your face away from any possible leaks.



Precondition

✓ The machine is parked on a flat and leveled surface.

- \checkmark The jacks are extended and the wheels are suspended from ground.
- 1. Attach plastic hoses to the nipples (B2).
- 2. Start the diesel engine or the traction motor.
- 3. Press and hold the brake pedal.
- 4. Open the nipples (B2), about half a turn.
- 5. Use a vessel to collect the fluid residue.
- 6. Tighten the nipples when there is no air in the fluid.
- 7. Shut down the engine and turn on the ignition key.
- 8. Press the brake repeatedly.

→

Step result

The Stopped to 110 bar (1595 psi).

9. Press and hold the brake pedal completely and release.

Repeat this four times.

If the brake pressure drops below 90 bar (1305 psi) after this step is completed, repeat steps 1-6.

Repair the service brakes if they do not work.

- 10. Switch off the diesel engine or the traction motor.
- 11. Remove the plastic hoses.

10.7 Bleeding Parking Brake

WARNING

Pressurized System

The parking brake is bled while the system is pressurized and the hydraulic oil in the system can cause personal injury.

- Never unscrew the bleeder nipples fully when bleeding the parking brakes.
- Follow the instructions carefully.



Precondition

 \checkmark The machine is parked on a flat and leveled surface.

- ✓ The jacks are extended and the wheels are suspended from ground.
- 1. Attach the plastic hoses to the nipple (B1).
- 2. Start the diesel engine.

- 3. Release the parking brake.
- 4. Open the nipple (B1), about half a turn.
- 5. Use a vessel to collect the fluid residues.
- 6. Tighten the nipple when there is no air in the fluid.



- 7. Switch off the diesel engine.
- 8. Remove the plastic hoses.

10.8 Checking Brake System Wear

Precondition ✓ The brakes must be applied when checking brake disc wear. The discs can be checked in connection with changing oil in the final drive.

1. Remove the level plugs in the final drive, two for each brake.

2. Check the distance between the brake discs. Check the distance from both level plugs. Use a drift or similar tool with diameter 4.5 mm.



Checking brake disc wear

3. If the distance between the brake discs is less than 4.5 mm, they must be replaced. A new disc is 4.9 mm thick

10.9 Adjust the Brakes

• The machine is equipped with self-adjusting brakes.

10.10 Checking Accumulator Charge Pressure



NOTE: The accumulator's charge pressure is specified on each accumulator's sign.

1. Connect a pressure gauge to a pressure gauge outlet at (DS2).



Checking the service brakes

2. Depressurise the system by depressing the brake pedal 30-40 times.

3. Disconnect fuse F112 in fuse box (A50) and crank the starter motor. The pressure gauge will indicate a rapid increase in pressure to the lowest pressure with which an accumulator is charged.



Electric cabinet A50

- 4. The pressure will subsequently rise very slowly. The accumulators are charged to 60-70 bar.
- 5. An accumulator with pre-charge pressure lower than 35 bar is faulty and must be replaced.
- 6. For identifying which accumulator to change, see section Checking the accumulators.

10.11 Checking Brake Pressure Control Valve

1. Connect a pressure gauge to the pressure test outlet at DS2.



Checking brake pressure control valve

- 2. Start the engine and let it run until max. brake pressure is attained.
- 3. Stop the diesel engine and brake repeatedly. The "low brake pressure" lamp should illuminate when the pressure has dropped to 110 bar.

- 4. Start the diesel engine and brake repeatedly with the engine idling. When the pressure has dropped to 125 bar, the brake system control valve should engage so the pressure rises again to max. for the brake system, 150 bar.
- 5. Stop the engine when max pressure is attained.
- 6. "Brake hard" four times, i.e. depress the pedal fully and release completely each time. If the brake pressure drops below 90 bar after braking hard four times, there is a fault in the brake system. This can be caused by:
 - a. air in the brake lines.
 - b. there is no charge pressure in an accumulator or the pressure is too low, e.g. due to a broken diaphragm, see section Checking accumulator charge pressure.
- 7. Continue to brake hard until the pressure drops below 80 bar, the parking brake should then be applied.
- 8. For identifying if an accumulator is uncharged and if so which one, see section Checking the accumulators.

10.12 Replace Accumulator

WARNING

High Hydraulic Oil Pressure

Can cause personal injury.

- Switch off the machine.
- Make sure that the system is de-pressurized before starting any work.
- Press the brake pedal repeatedly after the machine has been switched off to make sure that the system is de-pressurized.
- Check with a pressure gauge on both brake system accumulators to make sure that the system is de-pressurized.

Moving Cab

A moving cab can cause serious personal injury.

- Make sure that no personnel remain under the cab when it is operated.
- Make sure that the cab is secured with associated lockpins during all cab maintenance work.

WARNING

Pressure Vessel

Can cause personal injury.

- A discarded accumulator must be rendered harmless.
- A discarded accumulator that has not been punctured must be handled as a pressure vessel.
- Be careful when draining the accumulator.
- ▶ Work with pressure vessel must be carried out by personnel with prescribed training.



- 1. Remove the protective cap at the top of the accumulator.
- 2. Loosen the plug (A) with an Allen wrench, one turn at a time to release any pressure.
- 3. Disconnect the accumulator.



NOTE: A discarded accumulator that has not been punctured must be treated as a pressure vessel.

4. Install a new accumulator.

10.13 Scrap an Accumulator

WARNING Pressure Vessel Can cause personal injury A discarded accumulator must be rendered harmless. A discarded accumulator that has not been punctured must be handled as a pressure vessel. Take care when draining the accumulator.

- 1. Remove the protective cap at the top to scrap the accumulator.
- 2. Remove the plug (A) carefully with a hex key wrench, one turn at a time to release any pressure.



10.14 Check after Working With Brake System

10.14.1 Check Service Brake



✓ The diesel engine or traction motor is turned on.

- 1. Press and hold the brake pedal down.
- 2. Release the parking brake.
- 3. Engage second gear.
- 4. Gradually increase engine rpm to maximum.
- 5. Check the machine movement.

Step result

➔ If the machine moves, then the brakes must be repaired or replaced before operating the machine.

10.14.2 Check Parking Brake

NOTICE Property Damage Risk of overheating the transmission system. Do not perform the brake test for longer than four seconds.

Precondition

- ✓ The machine is parked on a flat and leveled surface.
- ✓ The parking brake is applied.
- 1. Start the diesel engine and engage second gear.
- 2. Gradually increase the engine rpm to maximum.
- 3. Check the machine movement.

If the machine moves, then the brakes must be repaired or replaced before operating the machine.

11 Swellex

11.1 Safety Precautions Before Working on Swellex

	WARNING
	High Water Pressure
	The high water pressure from the pump can cause personal injury.
►	Examine and rectify the leaks in high-pressure lines and couplings.
►	Set the main circuit breaker to turn off position before working on the pump.
►	Make sure that the hydraulic system is depressurized before working on the pump.
►	Swellex pump must be activated to check that the water system is depressurized be- fore working on the pump.

11.2 Swellex H1

Water

Water pressure, in	2-20 bar (29.0 to 290.07 psi)
Maximum water pressure, out	320 bar (4641.21 psi)
Maximum water consumption	17 litres/minute (4.49 g/min)
Maximum water temperature	70 °C (158 °F)

Hydraulic

Minimum hydraulic pressure	150 bar (2175.57 psi)
Maximum hydraulic pressure	250 bar (3625.94 psi)
Flow	40 litres/minute (10.56 g/min)

Weight

Pump unit	36 kg (79 36 lb)
	50 Kg (75.50 lb)

Size

Pump unit (length × width × height)	550 mm × 280 mm × 270 mm (21.65 in. × 11.02	
	in. × 10.62 in.)	

11.3 Swellex Arm



11.4 Check Swellex Arm



- 1. Check that the equipment is not damaged.
- 2. Connect the hydraulics and water connections to the pump.
- 3. Check that all hoses are tightened and are not damaged.
- 4. Check the water pressure to the Swellex pump.
- 5. Check that the water strainer is clean.
- 6. Check that the gaskets in the chuck (A) are intact and that the chuck is clean.

Δ

11.5 Replace Chuck Seals of Swellex Arm

WARNING

High Water Pressure

The high water pressure from the pump can cause personal injury.

- Examine and rectify the leaks in high-pressure lines and couplings.
- Set the main circuit breaker to turn off position before working on the pump.
- Make sure that the hydraulic system is depressurized before working on the pump.
- Swellex pump must be activated to check that the water system is depressurized before working on the pump.



Chuck seals must be replaced if the chuck leaks while installing the bolts.

- 1. Remove nut (A).
- 2. Remove the seals (B) and the spacer ring (C).
- 3. Clean all parts.
- 4. Replace the seals (B), spacer ring (C), and also replace if any damaged parts.
- 5. Lubricate the plunger (D) with waterproof grease.
- 6. Install the chuck with the new seals.
- 7. Install and tighten the nut (A).

11.6 Swellex Pump H1

The Swellex pump is optional equipment.



А	Water Strainer	В	Draining Valve
С	Pump Unit	D	Pressure Regulator

11.7 Swellex Pump Connections

The Swellex pump is **optional** equipment.



NOTE: The Swellex pump must be fitted at flat level. It must be possible to see whether water is leaking from the overflow hole under the pump.

Position	Function	Connection Dimen- sion in inches	Comment
А	Oil pressure in	3/8	N/A
В	Water connection	3/4	N/A
С	Activating hydraulic pressure	3/8	N/A
D	Oil return	1/2	N/A

Position	Function	Connection Dimen- sion in inches	Comment
E	Pressure gauge	N/A	Water pressure 0–400 bar (0–5802 psi)
F	Drainage	1/4	N/A
G	Swellex chuck water	1/4	N/A

11.8 Drain Swellex Pump

The Swellex pump is optional equipment.

High Water Pressure

The high water pressure from the pump can cause personal injury.

- Examine and rectify the leaks in high-pressure lines and couplings.
- Set the main circuit breaker to turn off position before working on the pump.
- Make sure that the hydraulic system is depressurized before working on the pump.
- Swellex pump must be activated to check that the water system is depressurized before working on the pump.

Drain the water system if the ambient air temperature around the pump is below the freezing point to prevent the pump from freezing.

Protect the Swellex pump against frost by storing it in a frost-free environment.



- 1. Remove the water hoses from the connections on the pump.
- 2. Connect compressed air to the Swellex pump.

3. Press the Swellex arm trigger (C) for ten seconds to run the pump, and then release it.



4. Turn off the compressed air and drain the water strainer (B) by the draining valve (A).

11.9 Clean Water Strainer on Swellex Pump

The Swellex pump is optional equipment.

WARNING High Water Pressure The high water pressure from the pump can cause personal injury. Examine and rectify the leaks in high-pressure lines and couplings. Set the main circuit breaker to turn off position before working on the pump. Make sure that the hydraulic system is depressurized before working on the pump. Swellex pump must be activated to check that the water system is depressurized before working on the pump.



- 1. Open the drain valve (A).
- Clean the water strainer by flushing water through the strainer (B) for a few seconds.
- 3. Check the filter.
 - a. Remove the nipple (C) from the water strainer.

- b. Pull the filter out from the water strainer.
- c. Check that the filter is clean and intact.
 Replace the filter with a new one if necessary.
- d. Install the filter.
- e. Install the nipple (C) on the water strainer.

11.10 Prepare the Swellex Pump for Long-Term Storage

Starting a frozen pump can cause extensive damage.

- 1. Protect the pump with corrosion inhibitor.
- 2. Drain the pump before storage.
- 3. Store the pump in a frost-free place.

11.11 Adjust Swellex Water Pressure

The Swellex pump is optional equipment.



- 1. Start the Swellex pump.
- 2. Remove the protective cap from the pressure regulator (A).
- 3. Adjust the hydraulic pressure on the pressure regulator (A) to deliver the correct water pressure.

Adjust the Swellex water pressure according to the type of Swellex bolt that is used.

Turn the pressure regulator clockwise to increase the pressure and turn counterclockwise to decrease the pressure.

Read the pressure on the pressure gauge in the Swellex pump.

240 bar (3481 psi)	300 bar (4351 psi)
Swellex Mn16	Swellex Mn 12
Swellex Pm 16	Swellex Pm 12
Midi Swellex	Swellex Mn 24
	Swellex Pm 24
	Standard Swellex
	Super Swellex

11.12 Troubleshooting Swellex Pump

The Swellex pump is **optional** equipment.



Failure	Cause	Action
No water when activating the Swellex arm handle	Water not connected to the pump	Connect to water supply.
	No flow or low flow of hydraulic fluid	Adjust the hydraulic flow rate.
	Reverse flow of hydraulic fluid	Check the connection of the hy- draulic hoses.
		Install the delivery hose to con- nection (A) and the return to connection (B).
	Hydraulic pressure too low	Adjust the hydraulic pressure.
Water flow rate too low	Insufficient hydraulic flow or pressure	Adjust to the recommended hy- draulic flow rates and pressure.
Water pressure too low	Insufficient hydraulic flow or pressure	Adjust to the recommended hy- draulic flow rates and pressure.
	Leaking seals in the Swellex chuck	Replace seals.

Failure	Cause	Action
	Insufficient water flow	Check the hose and connec- tions.
		If possible, use pressurized sup- ply of water.
Pulsing water pressure The pump is cavitating because 0 water hose diameter is too small. a		Check the diameter of the hose and replace as necessary.
	The pump is cavitating due to the water connection drawing in air.	Check the water hose and rectify any faults.
Pump is not receiving water	The water hose is not connected or is leaking.	Check the hose and the connec- tions.
	The water connection is clogged.	Check and clean the water strainer.
Leakage	Hydraulic oil leak	Check bolted joints, couplings, and seals.
	Water leak	Check bolted joints, couplings, and seals.
	The hydraulic oil or water is leak- ing from the overflow hole under the pump.	Replace the pump seals if it ex- ceeds 10 drops per minute.

12 Reeling Unit

12.1 Overview of Reeling Unit

The reeling unit is controlled by a hydraulic motor. Unwinding from the reel while tramming takes place allowing the clutch on the reel gear to slip. The unwinding control is left in neutral. Winding is done with the hydraulic motor. The slip clutch is adjusted so that it is able to wind up the cable or hose hydraulically but can slip when the cable is unwound during travel.

12.1.1 Cable Reeling Unit

WARNING Risk of Pulling Loose the Power Supply Cable Can cause serious injuries or death. Can cause material damage. Can make the machine and peripheral equipment live. Always make sure that the power supply cable is relieved of strain at both ends.



А	Gear with motor	В	Collector
С	Drive chain		

12.1.2 Hose Reeling Unit

NOTICE Risk of Pulling Loose the Water Hose Can cause water leakage on the machine. Can cause water leakage on the machine. Can cause material damage. Make sure that the water hose is relieved of strain at the hose reel.



A Gear with motor

12.2 Safety Precautions Working with Power Supply Cable

	WARNING
	Risk of Short Circuit or Fire
	Can cause serious injuries or death.
	Can cause material damage.
•	Always use a cable with sufficient area for the current ambient temperature and power output of the machine.
•	Make sure that the cable is intact before using the machine. Replace the cable in the event of damage, discoloration, or deformation.
•	Make sure that the cable is routed on the tunnel floor so that it is protected from being driven over by other mobile machines.
►	Unwind the whole cable for intensive operation.
•	Make sure that the cable does not overheat during intensive use of the machine.

For intensive operation with short intervals for cooling down, there is a risk of the electrical cable overheating. For instance, during long drilling cycles with a short time between the cycles.

Many external factors affect the ability of the electrical cable to cool down. For example:

- The number of layers on the reel.
- The ambient temperature.
- The air exchange.
- The dirt accumulation.

Therefore, make a habit of always unreeling the entire length of the electrical cable during operation.

12.3 Reeling-Unit-Gear Overview



A	Key for adjusting reel torque, and oil filler hole	В	Upper sight glass
С	Lower sight glass, and drain plug	D	Attachment bolts
E	Screw for adjusting drive chain		

12.4 Adjust Reeling Unit Drive Chain



- 1. Undo the four bolts (D) that holds the gear.
- 2. Adjust the chain with the set screw (C). The chain slack should be 10-15 mm.
- 3. Tighten the four bolts (D).

12.5 Adjust Reeling Unit Slip Clutch

NOTICE

Damage to Reeling Unit Gear and Chain

The gear and chain of the reeling unit can be damaged.

- Always turn off the hydraulics when not using the reeling unit.
- Do not adjust the winding torque too high.

Adjust the reeling unit slip clutch when necessary and according to maintenance interval.

The slip clutch is designed to slip when winding and unwinding the electric cable and water hose. The torque is transferred trough a clutch in the gear. The torque must be measured in operation while the clutch is slipping. The torque must only be adjusted hard enough to lift and wind the cable or hose without any slack.

Replace oil in the gear regularly, for fault-free operation and retained torque.

The torque setting is carried out by making small adjustments to the spring package, 1/6 of a turn at a time. After adjusting, test the operation and change the torque until it is correct.



- 1. Remove the set key (A).
- 2. Insert the set key upside down into the gear housing.
- 3. Rotate the drum slowly until the set key falls into locked position.

Step result

→ The set torque increases if the drum is rotated clockwise and decreases if it is rotated counterclockwise.

- 4. Remove the set key (A).
- 5. Insert the set key in the correct position.
- 6. Fasten the set key.
- 7. Check the torque.
- Step result

→ Repeat the procedure until the correct torque is obtained.

Cable Reeling Unit	Hose Reeling Unit
Torque in operation on drum periphery: 25–30 kg	Torque in operation on drum periphery: 10–15 kg
(55–66 lb) (maximum 40–50 kg (88–110 lb))	(22–33 lb) (maximum 15–20 kg (33–44 lb))

Hose Reel for 150 m (492 ft) Hose

Torque in operation on drum periphery: 15–20 kg (33–44 lb) (maximum 20–25 kg (44–55 lb))

12.6 Cable Reeling Unit Collector F460/1 and K4122/1



A Collector

12.7 Check Cable Reeling Unit Collector

WARNING

Dangerous Voltage

Can cause serious personal injury.

- Keep away from high-voltage cables.
- Check that the system is de-energized before starting any maintenance work.
- Only authorized electrician must service the electrical system.

The location of the collector depends on the type of machine. On some machine, the collector is located inside the cable reel unit and is protected by a cover plate that must be removed during inspection. On the other machines, the collector is located in a protective box that is attached on the outside of the reeling unit. **NOTE:** Tighten the nuts on all the cable terminals on a new or reconditioned collector after about a week of use. The collector slip rings must be tightened according to the torque table.

- Make sure that the collector housing and collector rings are dry, clean, and free from oil, copper deposits, and other impurities.
- O Use a vacuum cleaner, clean cloth, and a brush for cleaning.



- Tighten the collector unions.
- Replace damaged components with new ones.
- Make sure that the protective cable stocking is installed properly.

12.8 Settings

Refer to chapter Hydraulic System for setting the speed of the reeling units.

12.9 Limit Switch

Limit switch on reeling unit is an option. The limit switch is used to:

- · Warn when there are only three turns left on the drum of the cable reeling unit.
- Activate the parking brake when there is one turn left on the drum of the cable reeling unit.

12.9.1 Adjust Limit Switch

Adjust the limit switch if the cable or cable reel has been changed, or of the limit switch setting has unintentionally been changed.



- 1. Remove the limit switch cover (F).
- 2. Loosen the lock screw (A).

- 3. Unwind the cable until three turns are left on the drum of the cable reeling unit.
- 4. Adjust the screw (C) until the contactor (D) activates the cable reel warning lamp on the control panel.
- 5. Unwind the cable reel unit until there is one turn on the drum.
- 6. Adjust the screw (B) until contactor (E) activates the parking brake.

Step result

- → Parking brake lamp on the control panel comes on.
- 7. Check the adjustment by winding the cable in and out.

NOTE: Repeat the procedures if further adjustment is needed.

- 8. Tighten the locking screw (A).
- 9. Attach the limit switch cover (F).

12.10 Adjust Maximum Pressure and Speed of Reeling Units

If it is not possible for the slip clutch on the reel gear to unwind the hose and cable, the reel hydraulic motor can be used for unwinding. The winding-in and winding-out speed can be adjusted by the restrictions that are located beneath valve (Y414) for the cable reeling unit and (Y415) for the water hose reeling unit.





Valve Stack

A Cable reeling valve

1. Adjusting pressure setting

- a. Plug the hoses CR1, CR2 with the measuring socket into the hydraulic motor.
- b. Start the diesel engine.
- c. Activate the diesel positioning with knob S141.
- d. Connect a P400 to CR1, CR2.
- e. On machines without gearbox, adjust the pressure regulator to 150 bar (2,175.5 psi) with the pressure reducing set screw.
- f. Drain the pressure by turning the diesel engine OFF, ignition ON, diesel pump ON and turn knob S248 or S143 until pressure is drained.

2. Adjusting speed setting

a. Start the reeling unit for winding-in and winding-out.



NOTE: Start the hose winch for rolling the waster hose with knob S249 or S144.

b. Adjust the winding-in and winding-out speed with the restrictions.

The speed for **reeling in** can be adjusted 10–12 rpm (**1 rev each 5–7 sec-onds**).

The speed for **reeling out** can be adjusted 5–6 rpm (**1 rev each 10–12 sec-onds**).



c. Stop the diesel engine.

12.11 Adjusting Limit Switch

Adjust the limit switch if the cable or cable reel has been changed, or if the limit switch setting has unintentionally been changed.



- 1. Check that cable is connected correctly with wire mesh hose and strain relieved.
- 2. Remove the limit switch cover.
- 3. Wind in one turn with cable on the reel.
- 4. Turn the adjustment screw (E) so the ride on the ridge wheel (C) is moving clock wise until the relay is clicking or buzzer / multi-meter activates over switch (G).
- 5. Turn the screw (D) so that the cam on the cam wheel (B) moves counterclockwise until the switch clicks or that a buzzer or multimeter activates over switch (F).

NOTE: If the screw is hard to adjust, then remove cover (A) and loosen that screw slightly until adjustment screw runs easily.

- 6. Run the cable until three turns are left on the drum of the cable reeling unit.
- 7. Turn the screw (D) so that the cam on the cam wheel (B) moves counterclockwise until the switch clicks or that a buzzer or multimeter activates over switch (F).

- 8. Wind in one more turn on cable reel and connect a buzzer or multimeter (Ω) over switch (F).
- 9. Unwind and check that switch gives signal with three laps returning on cable reel.
- 10. Adjust if necessary and redo check.
- 11. Connect a buzzer or multimeter over switch (G).
- 12. Unwind and check that switch gives signal with one lap returning on cable reel.
- 13. Adjust if necessary and redo check.

12.12 Reeling Unit Operation Hints

WARNING

Risk Due to Inexperience

Inexperienced operator can cause personal injury.

- Start or operate the machine only if experienced with the machine operating system, system instruments, or controls.
 - Cable reel drive must be used at maximum speed 6 km/hr only on first gear forward and reverse.
 - G39 is a pilot pressure for brake release, it must read more than 13–15 bar (188–217 psi) while reel in and reel out operation.
 - Maximum continuous pressure for operating hydraulic motor is 175 bar (2538 psi).
- H

NOTE: Do not set pressure relief valve at pressure more than 175 bar (2538 psi).

13 Automatic Central Lubrication System CLS

13.1 Central Lubrication System

The CLS lubricates all joints in the rear boom body. The CLS is started by a pressure switch, B186, in the hydraulic positioning circuit.



Lincoln Quicklub 203 Lubricating Pump

А	Pump element	В	Safety valve
С	Plug (Timer for pause and running time)	D	Filler nipple
E	Reservoir		



13.2 Central Lubrication System Power Supply

Timer Terminal

А	Ground	В	Ignition switch
С	Motor	D	Low-Level Indication
E	Level indication	F	Extra lubrication
G	Lamp in push button		

- The timer receives power through the ignition switch and ground.
- Operating time and the lubrication system pause time are started and stopped when the electric motor is started and stopped.
- The system stores the time setting when the voltage is switched off.



13.3 Central Lubrication System Circuit Diagram

Automatic Lubrication System Circuit Diagram with Two Versions

А	Pump housing	В	Terminal 1
С	Cable contact 1 (Black) with 2-core cable	D1	Pump without extra push button
D2	Pump with extra push button	E	Ignition switch
F	Fuse 6A	G	Cable, black
Н	Cable, brown	J	Terminal 2
К	Cable contact 2 (Grey) with 3-core cable	L	Push button with lamp

13.4 Lubrication Pump Safety Valve



Location of Safety Valve on Lubrication Pump

The safety valve (A) is used to limit the pressure in the system. The valve opens at a pressure of 350 bar (5076 psi).

Grease that leaks out of the safety valve indicates that a hose, lubricating point, or nipple is blocked and that troubleshooting is required.

13.5 Lubrication Return Connection



Excess lubricant after dosage to the primary distributor must be routed back to the pump through the return connection (A).

13.6 Fill Lubricant



The container is transparent for visual inspection of the level. One filler nipple is located above the running lights on the left-hand side and one filler nipple is located directly on the pump.

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NOTE: Use a filler pump to fill the lubricant.

1. Remove the protective cover on the nipple (A).
2. Fill through the nipple (A) to the MAX marking on the container.



See Separate Manual

Fluids and Greases

13.7 Test Central Lubrication System



Lubrication System Timer

Precondition	\checkmark	The battery isolation switch is ON.
	✓	One of the hydraulic pumps is ON.

1. Press the pushbutton (A) for two seconds.

Step result

- → The lubrication system starts.
- 2. Check the indicator (B) to see if the lubrication pump follows the set pause time and the running time.

Reset the pause time and running time if necessary.

3. Check that lubricant grease emerges from all lubrication points.

13.8 Set Lubrication Pause and Running Time

Integrated in the lubrication pump is a timer which controls pause and running times. To access the timer, remove the plug from the lubrication pump.

Precondition

- ✓ The battery isolation switch is ON.
- One of the hydraulic pumps is ON.

• Adjust the pause time in increments of 15 (1, 2, 3,.....15 hours) with the blue rotary switch (A).



NOTE: Pause time is preset at six hours.

O Adjust running time in increments of 15 (2, 4, 6,.....30 minutes) with the red rotary switch (B).



14 Component Locations

14.1 Unit Location References

The component locations vary depending on the options with which the machine is equipped.



А	Boom frame	В	Hydraulic pumps and tank
С	Engine/Motor and transmission	D	Water pump
E	Compressor	F	Valve plate and rear frame
G	Operator station		



14.2 Valves, Sensors, and Pressure Test Outlets on Boom Frame

Location of valves and sensors - Boom frame



14.3 Valves, Sensors, and Pressure Test Outlets on Operator's station

Location of valves and sensors - Operator's station

14.4 Valves, Sensors, and Pressure Test Outlets on Hydraulic pumps and tank



Location of valves, sensors and pressure test outlets - Hydraulic pumps and tank

A	Percussion pump control valve
С	Positioning pump control valve
G	Percussion pump sequential valve



14.5 Valves, Sensors, and Pressure Test Outlets on Valve plate, engine frame

Location of valves and pressure test outlets - Valve plate, engine frame

A	Flow regulator water pump's speed
В	Flow regulator compressor's speed
с	Flow regulator compressor's booster speed
D	Test outlet

А

14.6 Valves, Sensors, and Pressure Test Outlets on Compressor



Location of valves, sensors and pressure test outlets - Compressor GAR5



Location of valves, sensors and pressure test outlets - Compressor GAR 30

В	Air pressure gauge
Μ	Test outlet

14.7 Valves, Sensors, and Pressure Test Outlets on Engine and transmission - Deutz TCD 2012 and TCD 2013



Location of valves, sensors and pressure test outlets - Engine and transmission



14.8 Valves, Sensors, and Pressure Test Outlets on Engine and transmission - Deutz TCD 4.1 and TCD 6.1

Location of valves, sensors and pressure test outlets - Engine and transmission

1	Valve locations vary depending on transmission
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14.9 Overview of Electric Cabinets and Electric Boxes

Location of electric cabinets and electric boxes

*	Alternative location depending on options speci-
	fied

14.10 Overview of Modules and Fuse Boxes



Modules and fuse boxes

14.11 Sensors on Boom



Location of sensor



14.12 Electronic Components FAM3 and MWD

A65	Control Box	D551	Fuse Box
D552	Fuse Box	A66	Apparatus Panel
B307	Hole depth measuring BMH	D101	I/O Module MWD
D120	Resolver Module	D121	Resolver Module

14.13 Component Location MWD



E130	Laser Unit	D501	Display
B312	Inclinometer	B313	Inclinometer
B250	Flowmeter Water	B252	Rotation flow
B307	Hole depth measuring BMH	D220	Resolver Module
D221	Resolver Module	D201	I/O Module MWD
D510	I/O Module FAM3	D503	Display

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