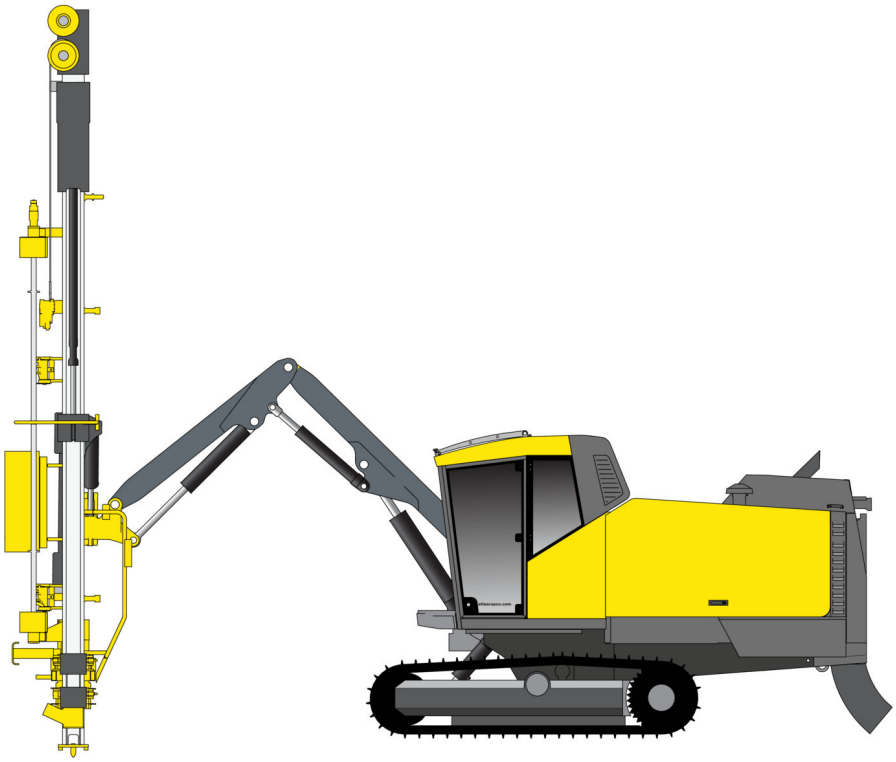
SmartROC T35/T40

Maintenance



Original Instructions
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Epiroc

Table of Contents

1 Introduction

1.1 Safety First

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

1.2 The Purpose of This Publication

The objective of these maintenance instructions is to detect and correct the faults at an early stage so that breakdowns, costly secondary damage, and accidents can be prevented.

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

The publication allows maintenance to be carried out when most suitable regarding production instead of causing a complete breakdown.

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.

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 manufactures 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 Epiroc policy warranty.

2 About Maintenance Management

2.1 Maintenance Management and Hour Meters

Maintenance management is organized in scheduled intervals.

Scheduled intervals supplement each other. A longer interval comprises maintenance tasks supplementary to tasks from a shorter interval. Maintenance management must be done regularly at the shortest interval of the unit or function (whichever comes first during operation of the machine).

Operational maintenance is planned based on the following hour meters:

- Hour meters for the rock drill operation system
- Hour meter for the engine
- Time-based maintenance is vital for:
  - All rubber components
  - Lubricants that are at risk of breaking during standstills
  - Pressure vessel corrosion and wear
  - Substance regression
  - Environmental exposure

! ***NOTE:*** *Local conditions can affect the scheduled intervals.*

2.2 Maintenance Records

Correct record keeping enables maintenance personnel to identify the correct maintenance records and to evaluate problems and high-cost areas. All maintenance procedures must be checked off as each inspection or procedure is completed. Quantities of replenished lubricants and fluids, and pressure and flow readings, must be recorded. Any faults or deviations must be recorded irrespective of whether they have been rectified or are waiting for rectification.

3 Specifications

3.1 Standard Tightening Torques Bolted Joints

All bolted joints are tightened to the torque required by Epiroc Standard K 4369:01 K (metric) and 4368K/-01K (imperial) unless otherwise stated. In such cases, this torque is specified in the maintenance instructions of the module in question.

Size	Strength Class	Torque		Tolerance ±	
		Nm	lbf.ft	Nm	lbf.ft
M6	8.8	8	6	2	1.5
M8	8.8	20	15	5	3.6
M10	8.8	41	30	10	7.3
M12	8.8	73	54	18	13.2
M14	8.8	115	85	25	18.4
M16	8.8	185	136	45	33
M20	8.8	355	262	85	62
M24	8.8	600	443	150	110
M12 x 1.25	10.9	135	100	6	4.4
M16 x 1.25	10.9	315	232	15	11
M18 x 1.25	10.9	460	340	20	15
M6	12.9	14	10	3	2.2
M8	12.9	34	25	8	5.9
M10	12.9	70	52	17	12.5
M12	12.9	120	89	30	22
M14	12.9	195	144	45	33
M16	12.9	315	232	75	55.3
M20	12.9	600	443	150	110.6
M24	12.9	1020	752	250	184.3

Table 1: Epiroc Standard Torques

3.2 Type Designation Signs for Ordering Spare Parts

Type designation signs are posted on the larger components. The type designation and serial number must always be stated when ordering spare parts or making inquiries regarding the machine. Type designations and serial numbers are also specified in a separate document, Machine Identification (MI). Spare parts can be ordered from Epiroc.

4 Maintenance Tables

4.1 Calender Time

Maintenance Task		Calendar Time
5.1	Wash Machine Externally	Daily
5.2	Check Condition of Signs	Daily
6.1	Check Fire Extinguishers	Daily
9.11	Check Rock Drill or Rotation Unit	Daily
10.1	Check Rock Drill	Daily
10.2	Check Lubricant Level	Daily
12.5	Check Hoses and Couplings	Daily
12.7.1	Check Hydraulic Tank	Daily
13.2	Check Engine Oil Level	Daily
13.3	Drain Water Condensation from Preliminary Fuel Filter	Daily
13.5	Filling Fuel Manually	Daily
14.2	Check Coolant Level	Daily
15.2	Check Emergency Stops and Work Lights	Daily
17.3	Check Compressor Oil Level	Daily
18.4	Check Track Frames	Daily
21.1	Check Winch	Daily
21.2	Check Attachment of Winch Cable	Daily
21.5	Check Small Remote Control	Daily
6.2	Loosen Up Powder in Handheld Fire Extinguisher	Biannually
13.21.3	Replace Air Filter Cartridge	Every Second Year

4.2 Drilling Hours

Maintenance Task		Drilling Hours
9.4	Lubricate Drill Rod Support	4
9.5	Check Feed	20
9.7	Check Silence Kit	20
9.9	Lubricate Rod Handling	20

Maintenance Task		Drilling Hours
9.6	Check Feed	100
9.8	Check Rod Handling	100
11.1	Check Dust Collector	100
9.12	Check Drill Rod Support	200

4.3 Diesel Engine Hours First Service

Maintenance Task		Diesel Engine Hours First Service
18.7	Replace Oil on Traction Gears for Track Frames	150

4.4 Diesel Engine Hours

Maintenance Task		Diesel Engine Hours
7.1	Check Cab	50
8.1	Lubricate Boom and Feed	50
12.7.2	Drain Water Condensation from Hydraulic Oil Tank	50
12.8.3	Check Hydraulic Tank Breather Filter	50
13.4	Drain Water Condensation from Fuel Tank	50
14.3	Clean Radiators	50
17.4	Drain Water Condensation from Compressor Tank	50
17.5	Check Compressor Components	50
18.5	Check Track Frames	50
21.3	Check Winch Unit Attachment	50
7.2	Check Attachment of Cab	250
7.3	Lubricate Cab Door Hinges	250
7.6	Replace Air Condition Circulation Filters	250
8.2	Check Boom Condition	250
10.4	Drain Water Condensation from Lubrication Tank	250
11.2	Check Dust Collector Tightening Torque	250
12.8.4	Replace Breather Filter	250
13.10	Maintain Diesel Engine	250
13.14	Replace Preliminary Fuel Filter	250
13.15	Replace Secondary Fuel Filter	250

Maintenance Task		Diesel Engine Hours
13.16	Replace Coarse Filter	250
15.3	Check Battery	250
18.1	Check Tension of Crawler Tracks	250
18.3.1	Check Front Wheel for Wear	250
18.3.2	Check Track Roller for Wear	250
18.3.3	Check Carrier Roller for Wear	250
18.3.4	Check Track Shoe for Wear	250
18.3.5	Check Track Shoe for Wear	250
18.3.6	Check Track Link Depth for Wear	250
18.3.7	Check Bushing for Wear	250
18.3.8	Check Track Chain Elongation for Wear	250
18.6	Check Track Frames	250
19.1	Check Seals on Water Mist Pump	250
12.6	Check Mounting Hydraulic Jack	500
13.13	Replace Engine Oil Filter	500
13.19	Check Diesel Engine Mounting	500
13.21.3	Replace Air Filter Cartridge	500
13.21.2	Check Air Filter Indicator Lamp Function	1000
17.7	Replace Air Compressor Oil and Oil Filter	1000
17.8	Check Safety Valve on Compressor System	1000
19.5	Clean Filter in Water Mist Tank	1000
12.7.3	Replace Hydraulic Oil	1500
12.8.2	Replace Return Oil Filter	1500
13.17	Replace Crankcase Ventilation Filter	1500
13.21.4	Replace Air Filter Safety Cartridge	1500
18.7	Replace Oil on Traction Gears for Track Frames	1500
21.4	Lubricate Winch	1500
21.6	Check Tightening Torque on Winch	1500
11.5	Replace Dust Collector Filters	2000
13.18	Replace Primary Fuel Filter on Engine Heater	2000
17.9	Replace Separator Filter	2000
13.8	Drain Diesel Exhaust Fluid (DEF) Tank	5000

Maintenance Task		Diesel Engine Hours
13.11	Replacing DEF Tank Filter	5000
14.5	Replace Long-term Effective Coolant	6000

5 General Machine Condition

5.1 Wash Machine Externally

Disconnect fire-fighting equipment if steam washing or high-pressure washing.

- Rinse the machine with water at least once a day to remove drill cuttings, mud, and dirt.

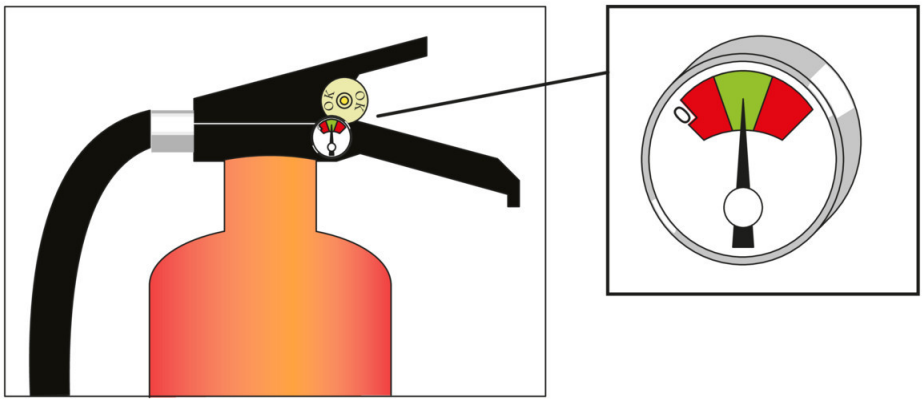
The feed, front part of the boom, and track frames are particularly important to keep clean.

5.2 Check Condition of Signs

- Make sure that all signs are in place.
- Make sure that all signs are intact, clean, and fully readable.
- Always replace defect or missing signs.

6 Fire Fighting Equipment

6.1 Check Fire Extinguishers



- Check that the indicator is in the green zone.

  Replace the fire extinguisher if the indicator is in the red zone.
- Check the seals for damage.

  Replace if necessary.
- Check the fire extinguisher body and holder for damage.

  Replace if necessary.

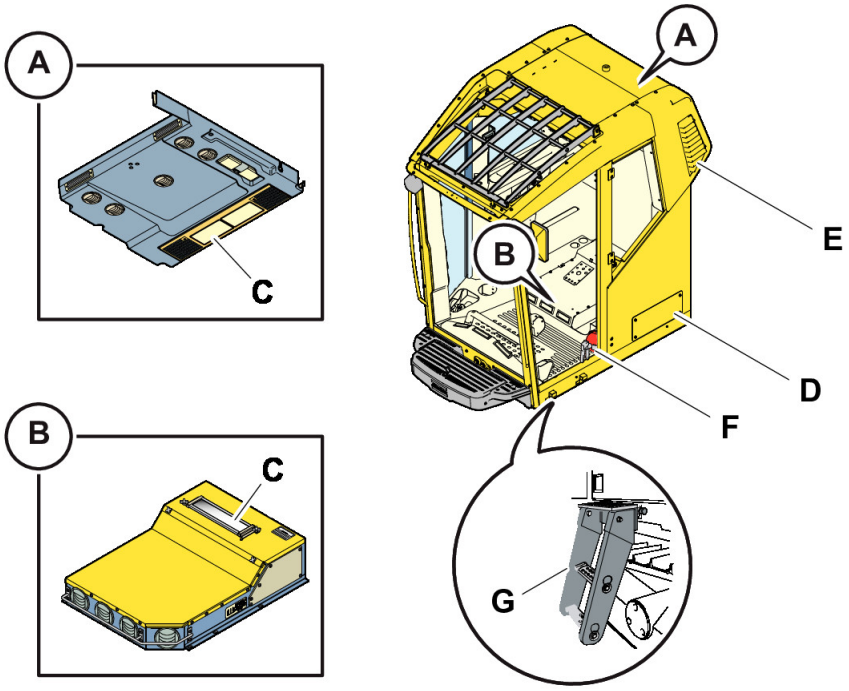
6.2 Loosen Up Powder in Handheld Fire Extinguisher

The powder in a fire extinguisher can settle to the bottom of the canister over time. This reduces the effectivity of the extinguisher.

- Tap the fire extinguisher canister carefully with a rubber mallet in order to loosen-up the powder.

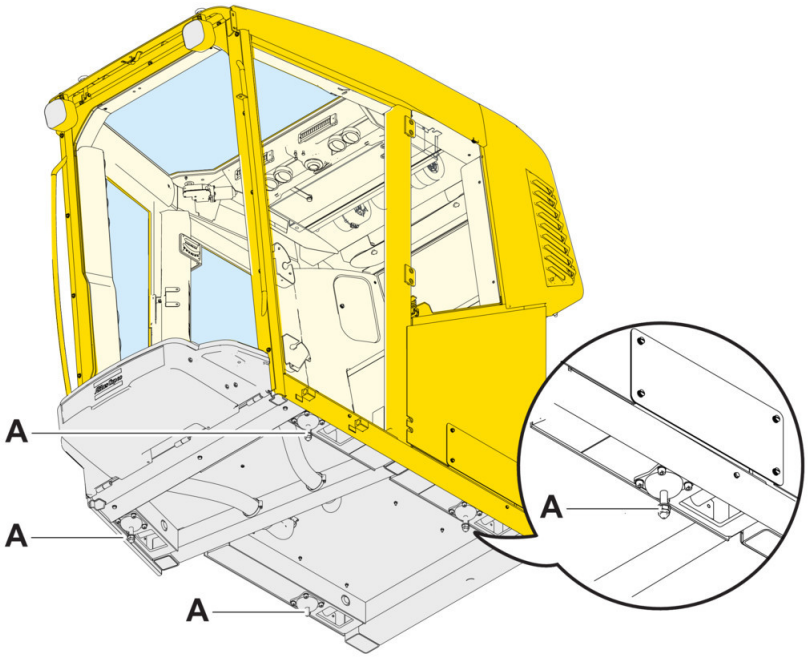
7 Operator Environment

7.1 Check Cab



- Clean or change the filter elements (C) in the circulation filters (A) and (B).
- Clean or change the primary filter (D).
- Clean or change the prefilter (E).
- Run the air conditioning system for 5 minutes.
- Clean the condenser element with compressed air.
- Check that the instructions on the fire extinguisher (F) are legible.
- Check the mounting on steps (G) for cracks and other damage.
- Check the mounting on the handle for cracks and other damage.
- Check the protective roof mountings for damage.
- Check that the horn is working.
- Check function of the reversing alarm signal and beacon.
- Check that all warning and safety labels are properly attached and legible.

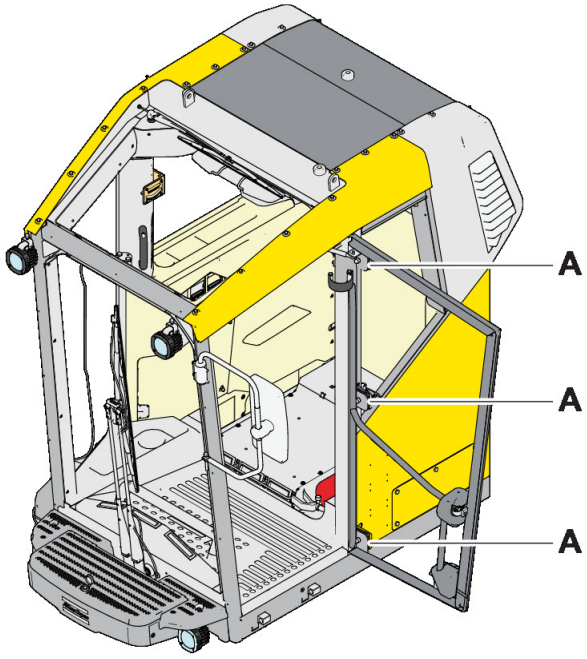
7.2 Check Attachment of Cab



- Check the tightening torque (A).
- Check for damages on the cab.

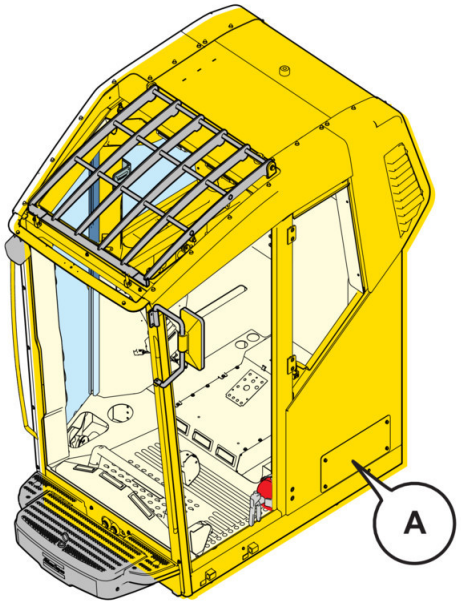
Torque	Tolerance ±
185 Nm (136 lbf.ft)	45 Nm (33 lbf.ft)

7.3 Lubricate Cab Door Hinges



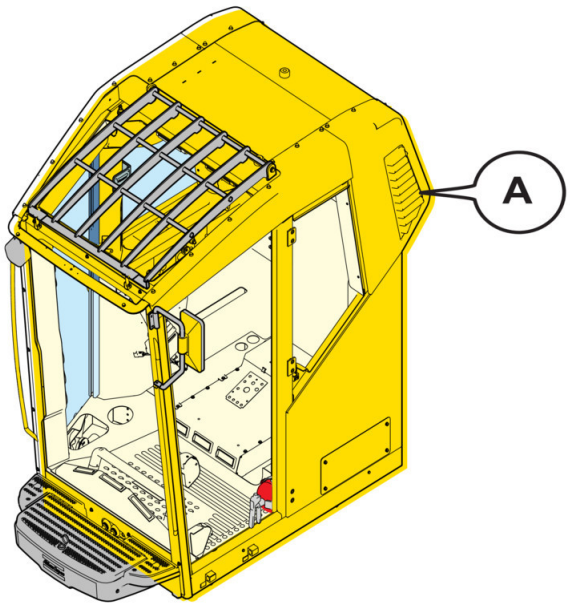
- Lubricate the cab door hinges (A).

7.4 Replace Air Condition Main Air Filter



1. Remove the screws from the cover (A).
2. Open the cover and lift out the filter.
3. Replace with new filter.
4. Close the cover and install the screws.

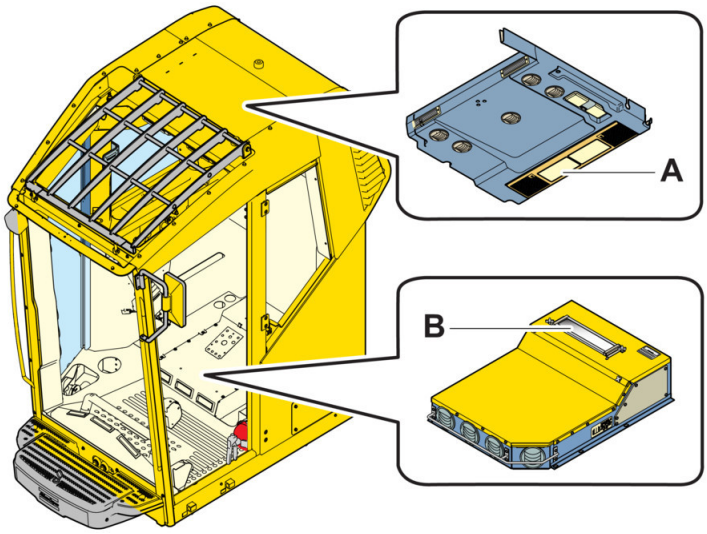
7.5 Replace Air Condition Pre-filter



1. Remove the screws on the louvre cover (A).
2. Open the louvre cover and lift out the filter.
3. Replace with a new filter.

4. Close the cover and refit the screws.

7.6 Replace Air Condition Circulation Filters



1. Remove the screws on the covers (A) and (B).
2. Open the covers (A) and (B) and lift out the filters.
3. Replace with new filters.
4. Close the covers (A) and (B) and install the screws.

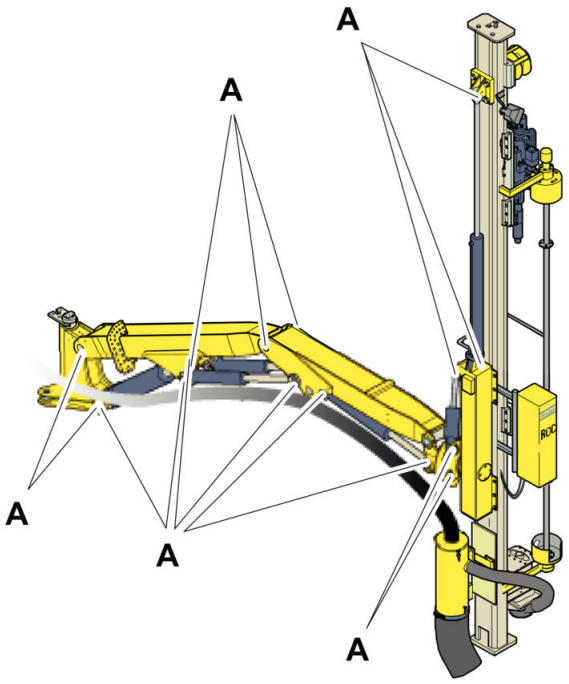
7.7 Troubleshooting Air Conditioner

Fault Symptom	Action
No cooling at all	Check the fuses, electrical connections, compressor ground, electro-magnets, switches, and pressure switches.
	Check the V-belt and compressor.
	Check the expansion valve and temperature control 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.

Fault Symptom	Action
	Check that the system is filled and that the thermostat is working.
Abnormal noise	Check that the multi-V-belt to the compressor is properly tightened and that the compressor retaining bolts are tightened.
	Check that the system is filled sufficiently and not overfilled.
	Check that the expansion valve is in working order.
	Check that the airflow across the evaporator is sufficient.
	Check that the condenser is clean and the airflow is sufficient.
	• Abnormal system noise is often related to incorrectly assembled 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 compressor itself. The difference between the pressure on the suction side and the pressure side also affects the level of noise. A compressor with low suction makes more noise than a compressor with high suction. Likewise, a compressor with high pressure makes more noise because it puts more load on bearings and other components.

8 Boom Unit

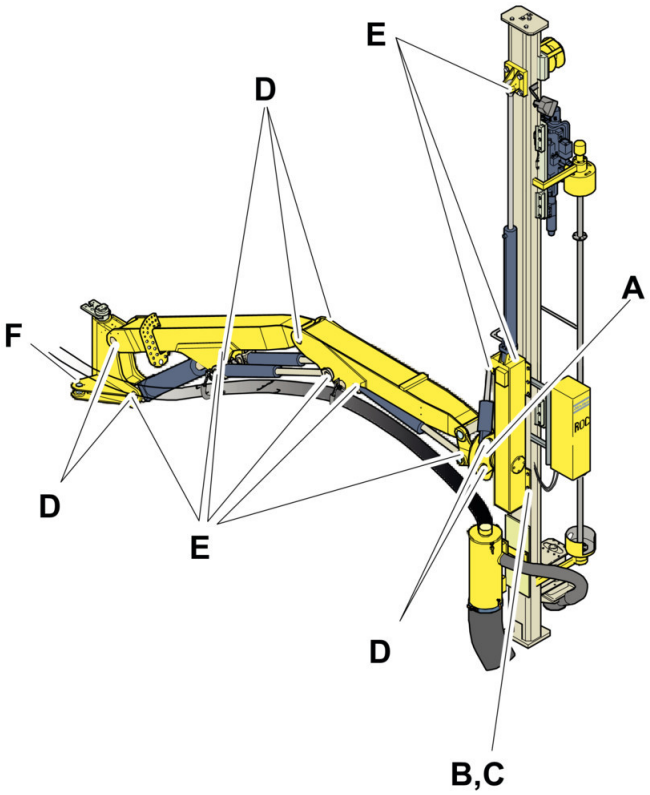
8.1 Lubricate Boom and Feed



- Pump grease into the 21 grease nipples (A).

If Central Lubrication System (CLS) is installed, the functions and connections of CLS must be checked.

8.2 Check Boom Condition



- Check the attachment on the boom head (A).
- Check the clearance between the feed and feed attachment (B).
- Check the attachment on the feed attachment (C).
- Check the clearance between the bushings, shaft, and holder (D).
  Replace the bushings and the shaft if necessary.
- Check clearance on the bearings in cylinder lugs (E).
- Check attachment and damage on 9 locking plates (F).

Component	Tightening Torque
Attachment on the boom head (A)	73 Nm (54 lbf.ft)
Attachment on the feed attachment (C)	185 Nm (136 lbf.ft)
Attachment on locking plates (F)	73 Nm (54 lbf.ft)
Clearance between the feed and feed attachment (B)	2–4 mm
Maximum clearance on the bearings in cylinder lugs (E)	1 mm

9 Feed Unit

9.1 Safety Precautions before Working on 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 adequate lifting equipment.

WARNING

Moving Parts

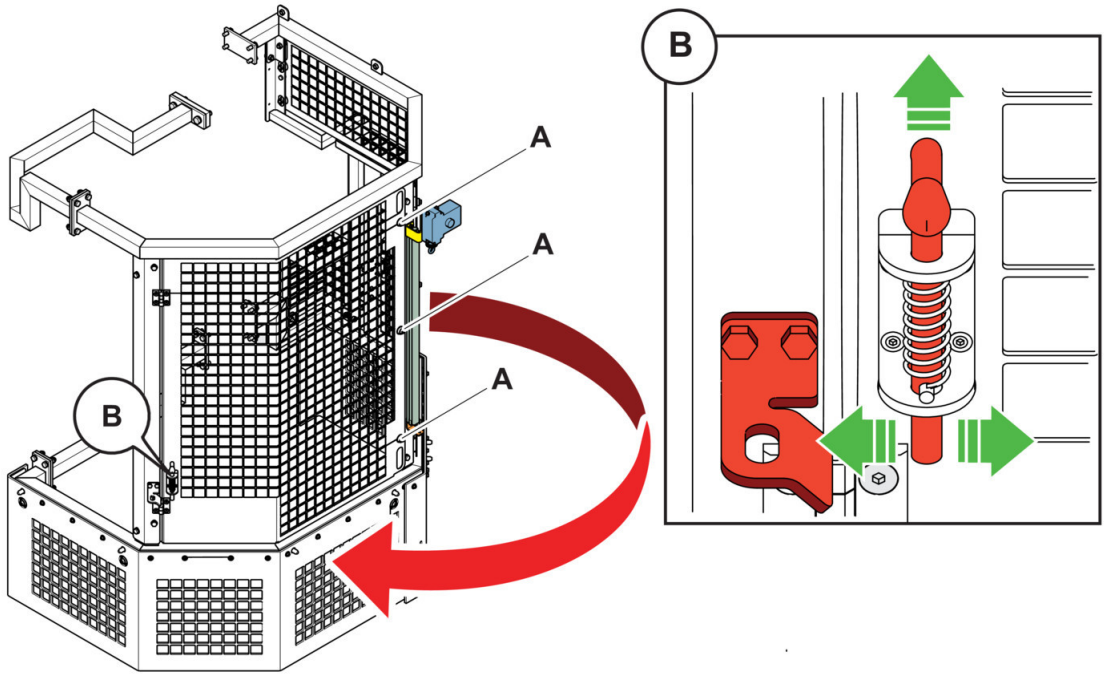
Can cause personal injury.

- 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.

9.2 Opening and Closing the Feed Guard

9.2.1 Opening the Feed Guard

When maintenance is required on the feeder, it could be necessary to open the feed guard.



Precondition ✓ The machine is parked in a safe location.

✓ The machine is switched off.

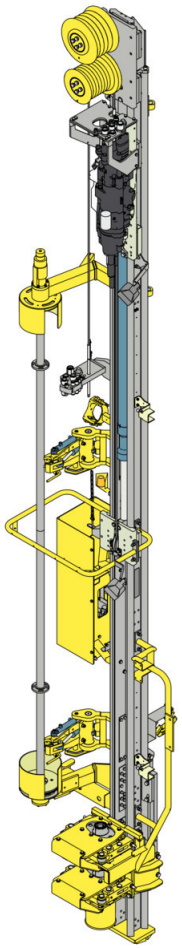
1. Loosen the bolts (A).
2. Open the guard.
3. Lock the guard in an open position with the latch (B).

> ! ***NOTE:*** *Always lock the guard in position if it necessary to open it when performing maintenance.*

9.2.2 Closing the Feed Guard

1. Pull up the latch (B) and close the cover.
2. Tighten the bolts (A).

9.3 Feeder 6000-Series



The hydraulic feeders on the BMH 6000 series are primarily intended for drift and tunnel drilling. The feeders are available in different versions depending on the rock drill installed on them.

The different numbers are explained, for example, BMH 6618.

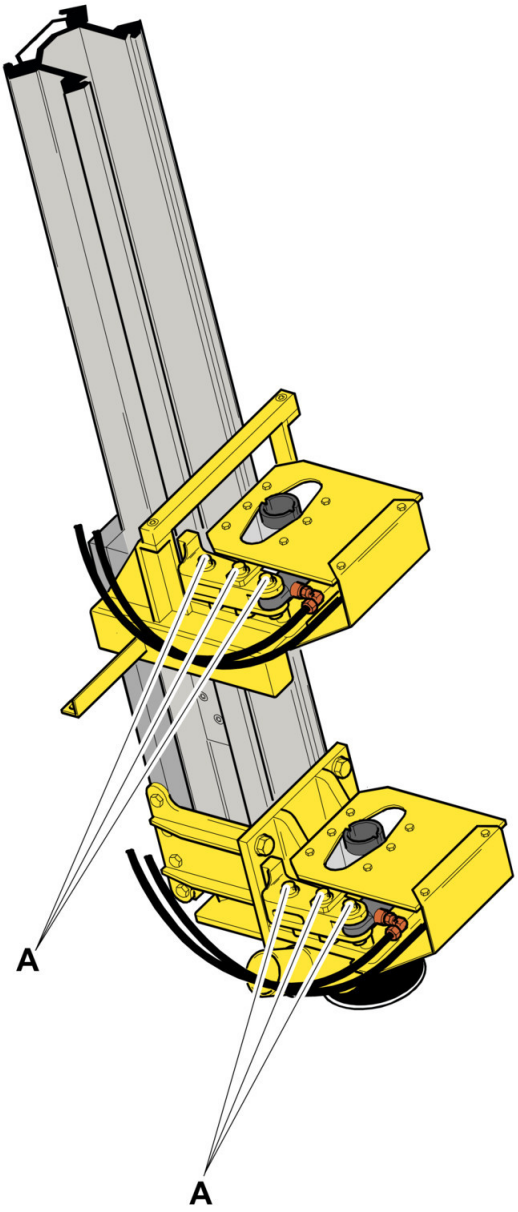
The first number states the type of feed: 6 = 6000 series.

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

- 3 = COP 1840
- 3 = COP 1840
- 6 = COP 2150/60
- 8 = COP 2540/60

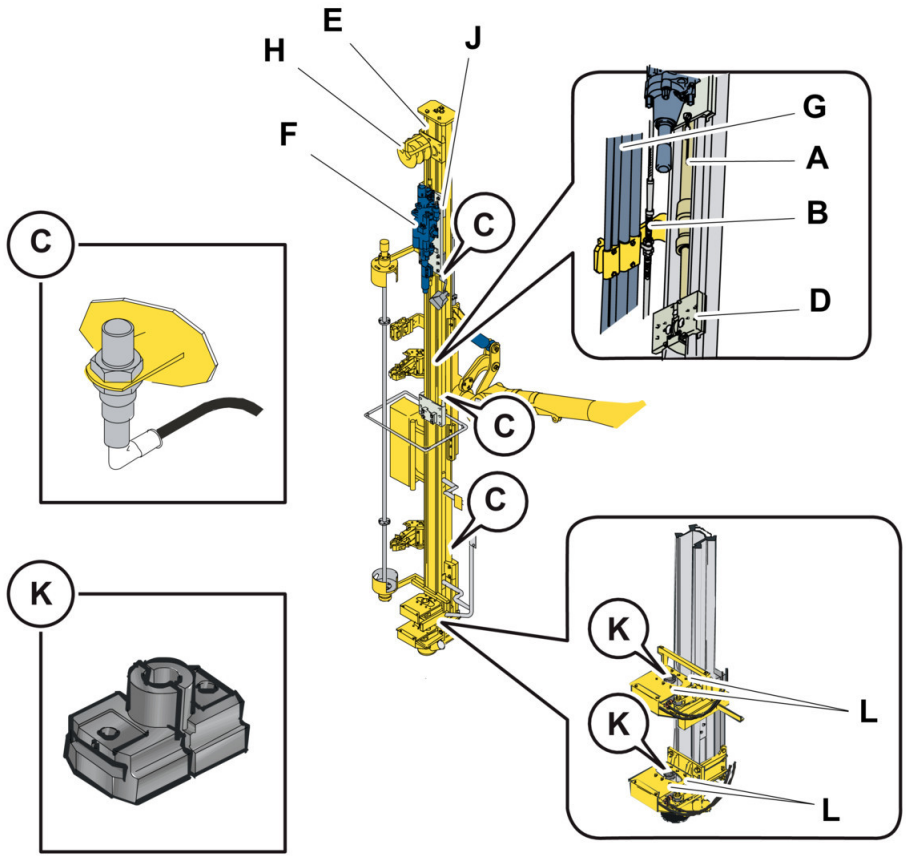
The third and fourth number states that the length of drill rods in feet. For example, 18 = 18 feet.

9.4 Lubricate Drill Rod Support



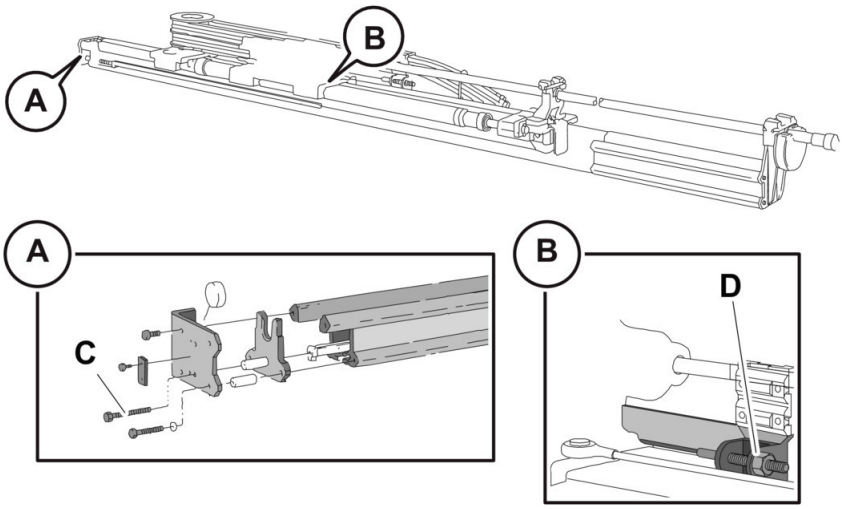
- Pump grease into 12 grease nipples (A).

9.5 Check Feed



- Check feed cylinder (A) for leaks.
- Check haul and return wire ropes (B) for lubrication. Adjust tension.
- Check mounting and function of limit switches (C).
- Check for wear on the intermediate drill rod support bearing (D) and replace as necessary.
- Check feed beam (E) for wear and damage.
- Check rock drill (F) for installing. Tighten bolted joints.
- Check hydraulic hoses (G) for wear and tension.
- Check lubrication and wear on water hose drum bearing (H).
- Check rock drill cradle (J) for installing, play, leaks, and damage.
- Check drill rod support halves (K) for wear.
- Tighten bolted joints (L).

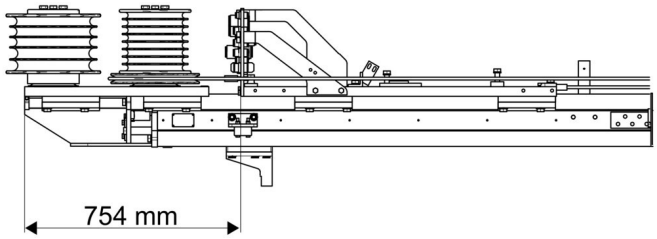
9.5.1 Adjusting Haul and Return Wire Ropes



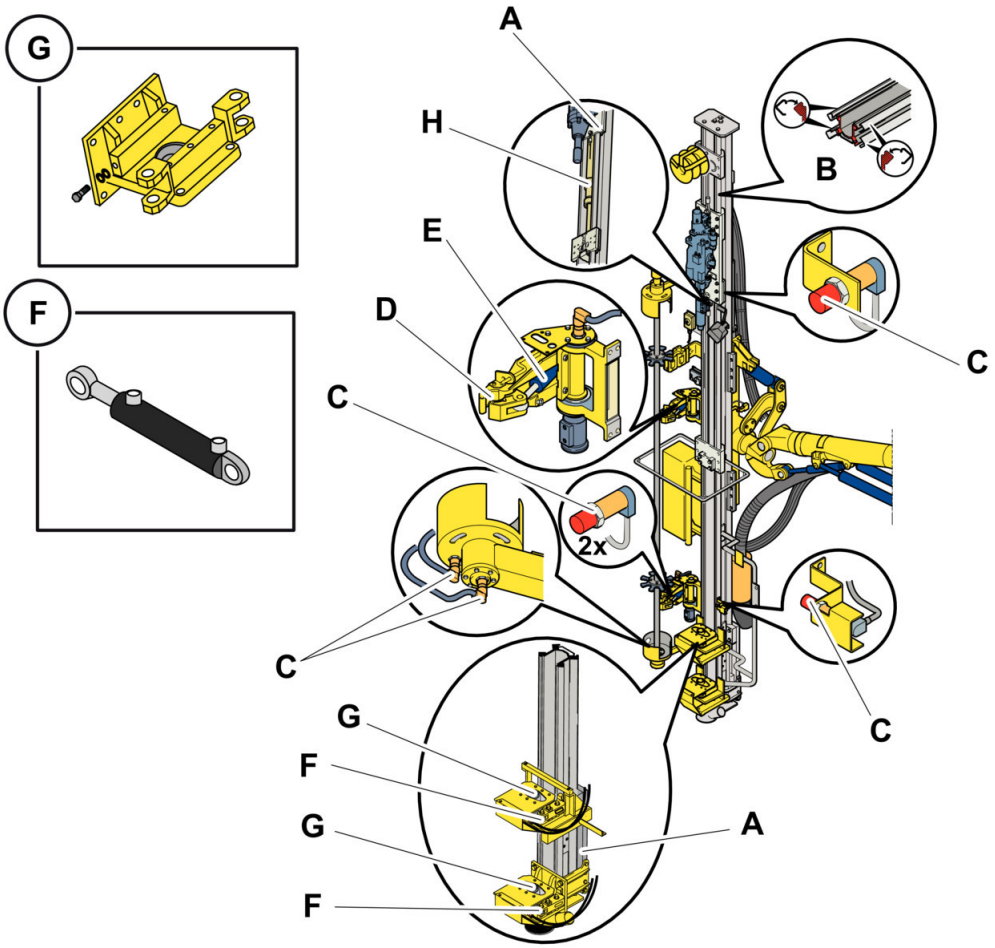
Precondition ✓ The cradle is located in the rear position on the feed beam.

✓ Drill rods with drill bit is installed on the rock drill.

1. Adjust the haul wire rope with bolt (C) and the return wire rope with nut (D).
2. Adjust the wire ropes so that the bit is behind the spike.
3. Adjust the measurement to 754 mm (29.8 in.).



9.6 Check Feed



- Check for damage on slide rails (A). Check that the play is 2–4 mm and the tightening torque is of 185 Nm (136.4 lb-ft).
- Check the slide pieces (B) for wear. Check that the thickness is at least 4 mm.
- Check the mounting and function of the sensors (C).
- Check the bushing halves (D) for wear and cracks.
- Check the mounting of hydraulic cylinders (E).
- Check the ball bearing play in cylinder lugs (F). Maximum play is 0.5 mm.
- Check the drill-steel support halves (G) for adjustment, wear, and cracks.
- Check the attachment of the feed cylinders (H) and check for damage.

9.6.1 Replacing Slide Pieces in the Holder

WARNING

Disassembling and Assembling Components

Can cause personal injury.

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WARNING

Heavy Objects

Can cause crushing injury or death.

- Do not stand under the heavy object being lifted.
- Use adequate lifting equipment.

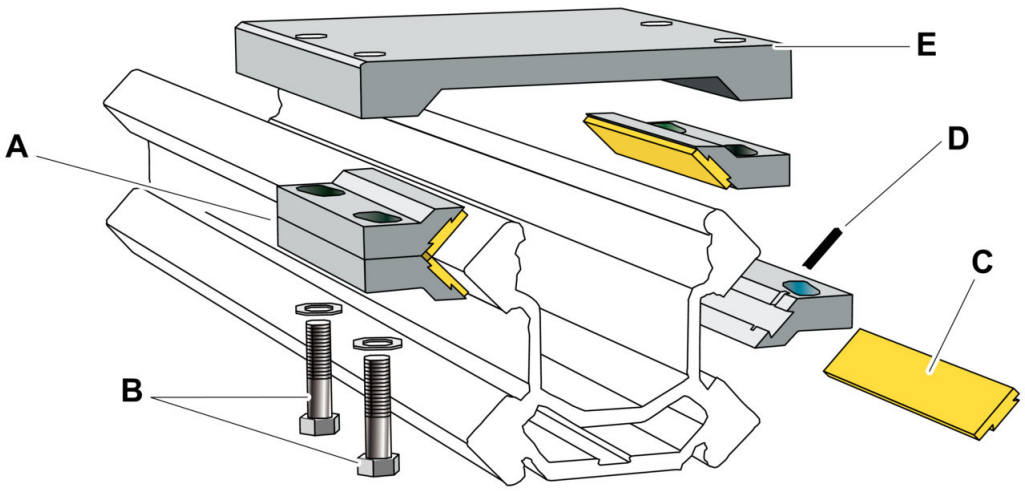
WARNING

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.

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.

Adjusting Cradle on Feed Beam

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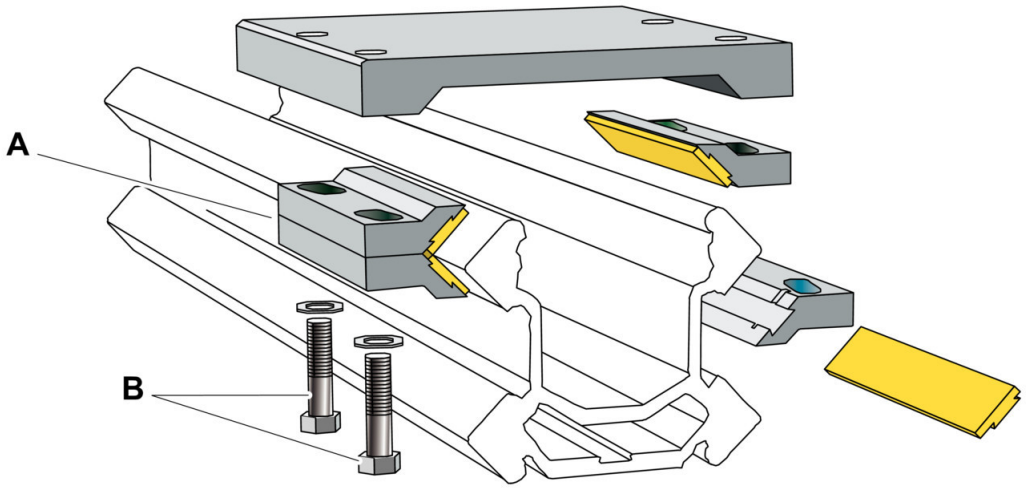
- ▶ Make sure that the hydraulic pump is off and that the system is depressurized before starting work.

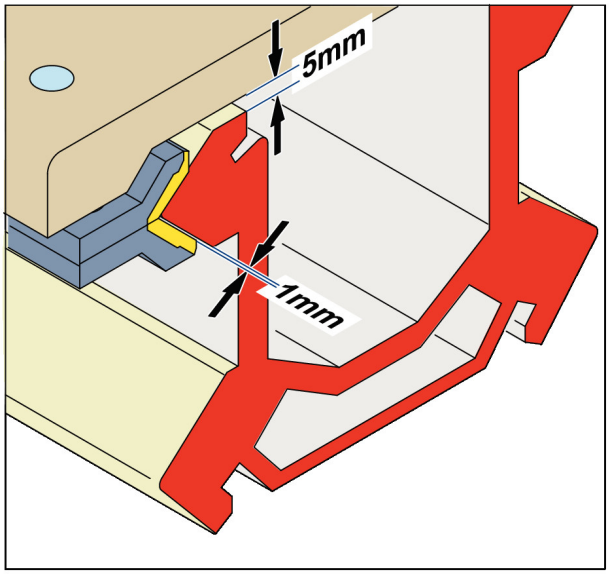
The cradle plates for the rock drill, intermediate drill rod support, and water hose drum are guided along the feed beam by holder (A). Each pair of holders is locked in position with bolts (B). The bolt holes in the holders are in the form of angled grooves. The cradle can be adjusted on the feed beam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



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

✓ 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 5–7 mm (0.19–0.27 in.) above the beam.



➔ 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.

> **NOTE:** *The hoses are correctly adjusted as they do not hang down when the feeder is in the horizontal position.*

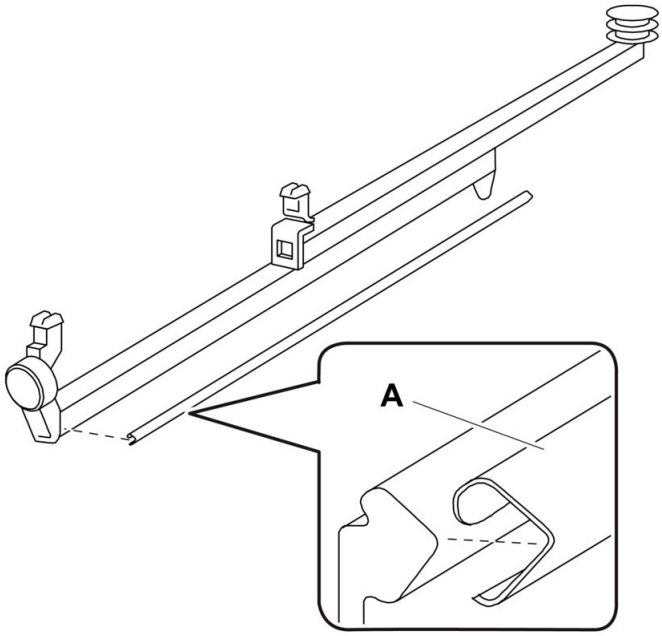
9.6.2 Replacing Slide Rails

WARNING

Sharp Edges

Worn slide rails are sharp and can cause injuries.

- ▶ Use pliers or a crowbar when removing the slide rails.
- ▶ Never remove slide rails by hand.



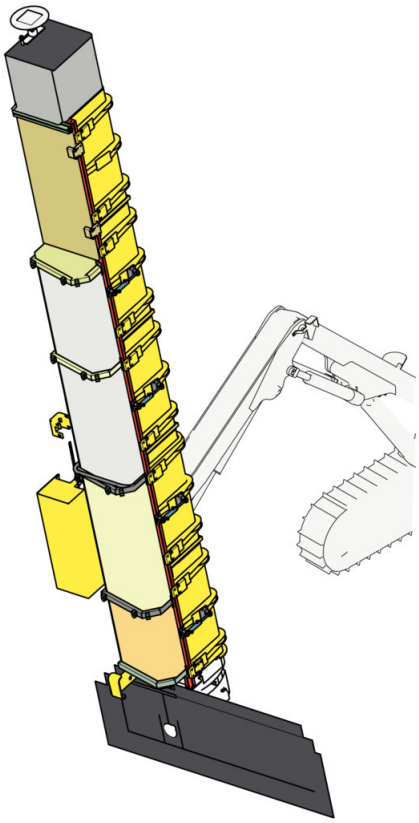
Precondition ✓ Slide rails must be replaced if they are worn or severely scratched.

✓ Before replacing the front slide rails, run the rock drill or rotation unit to its rear end position.

✓ Before replacing the rear slide rails, run the rock drill or rotation unit to its front-end position.

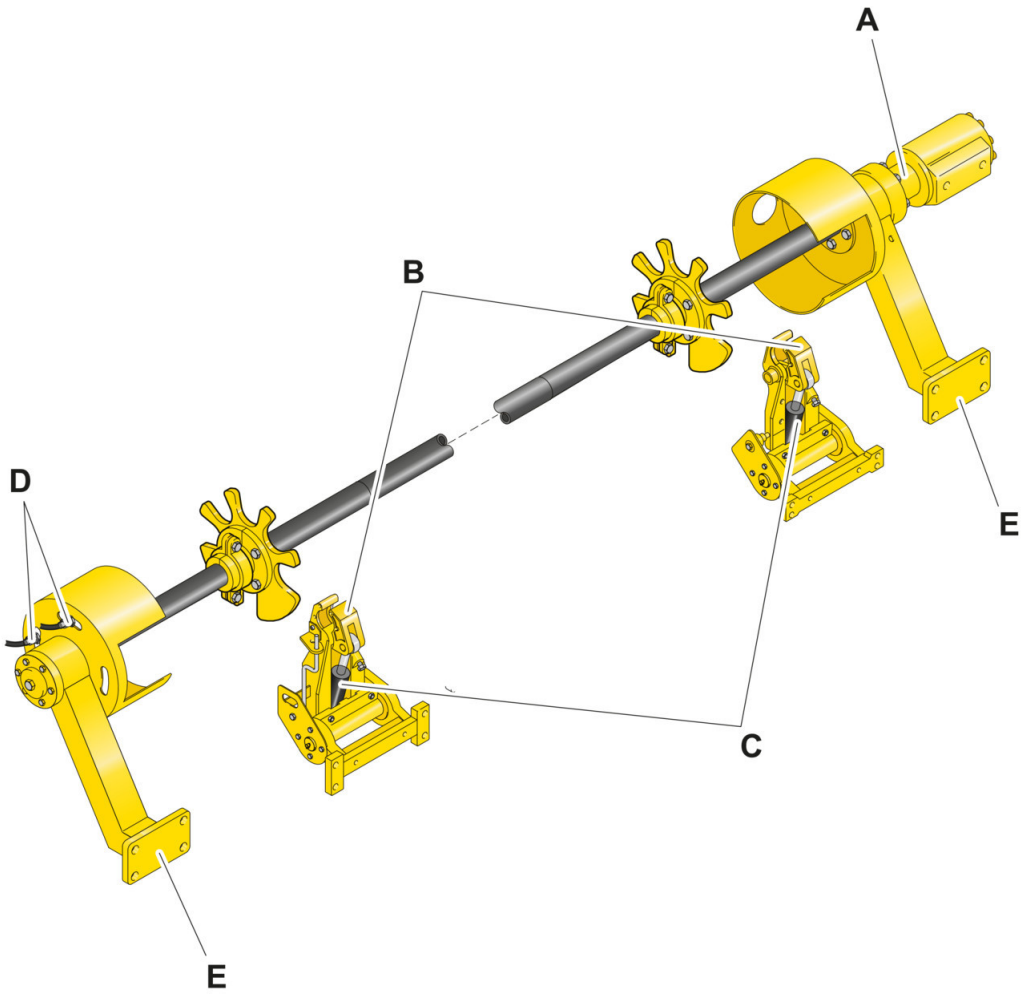
1. Remove the cradle for the rock drill, intermediate drill rod support, and the water hose drum from the beam.
2. Remove the slide rails (A) by prising the lower edges of the bars outwards.
3. Clean the beam surfaces thoroughly.
4. Install the new slide rails so that the larger edge on the slide rail faces up. Press the rails in place by hand. Use a hammer and a wooden block.
5. Install the rock drill cradles, intermediate drill rod support, and water hose drum again.

9.7 Check Silence Kit



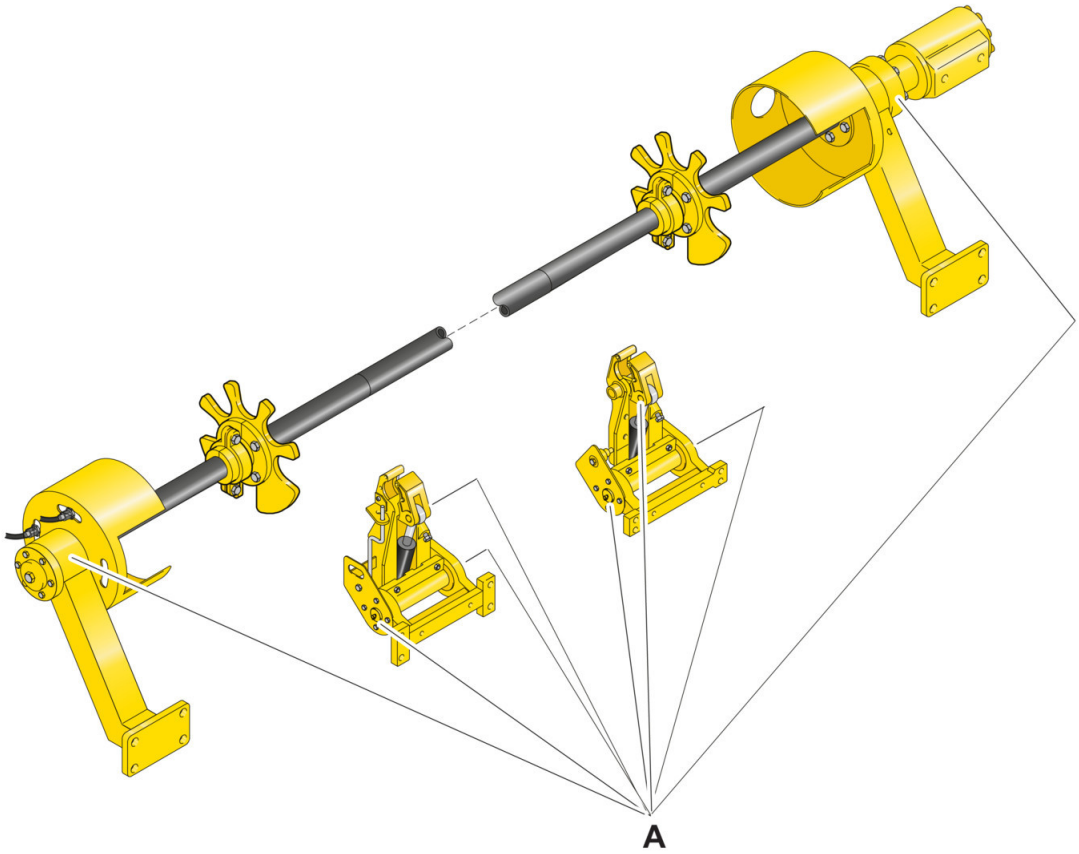
- Check mountings and tightening torque.

9.8 Check Rod Handling



- Check the attachment of the hydraulic motor (A). Applies only to machines installed with RHS.
- Check for wear and cracks on the bushing halves (B).
- Check the attachment of the hydraulic cylinders (C).
- Check the attachment and functionality of the sensors (D). Applies only to machines installed with RHS.
- Check the bracket (E) for cracks and proper attachment. Applies only to machines installed with RHS.

9.9 Lubricate Rod Handling



- Pump grease into the 14 grease nipples (A).

If Central Lubrication System (CLS) is installed, the functions and connections of CLS must be checked.

9.10 Mounting Rock Drill on Cradle

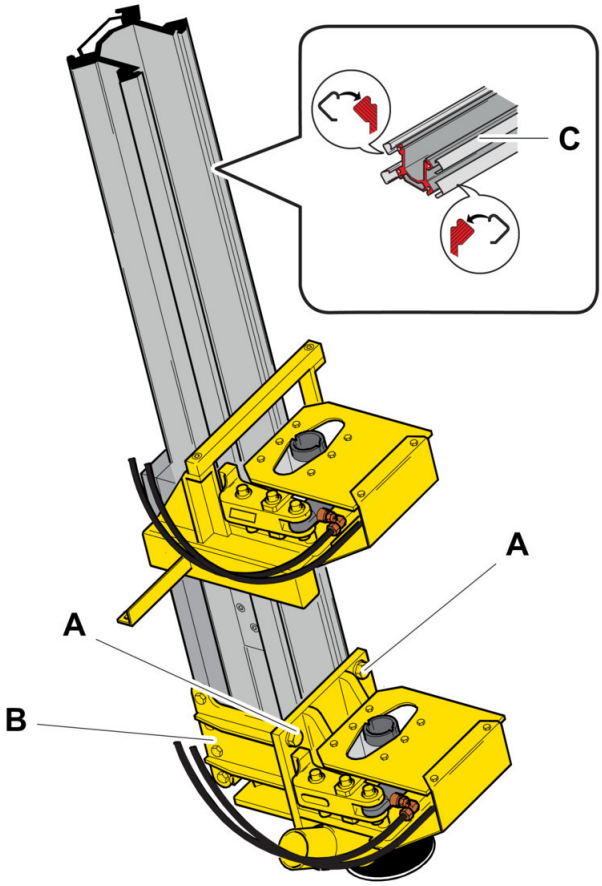
1. Clean the feeder using rust inhibitor
2. Remove burrs, paint or other coatings from the cradle and the contact surfaces on the rock drill.
3. Remove the mounting bolts from the cradle.
4. Position the rock drill with shims on the cradle.
5. Check the rock drill fits firmly in place.
6. Refit the bolts to the cradle.
7. Check that the rock drill is properly positioned.
8. Tighten the bolts alternately until the correct torque is achieved.
9. Connect and fit the hoses to the rock drill.

Rock Drill Bolts Tightening Torque	Metric Data	Imperial Data
SmartROC T35 and T40	200 Nm	147.5 lb-ft

9.11 Check Rock Drill or Rotation Unit

- Check and tighten all bolted joints.
- Check and adjust the tension of the ropes.
- Check all hoses for leakage.
- Tighten and adjust the tension of the hoses if necessary.
- Check and adjust the slide rail alignment on the feed beam.

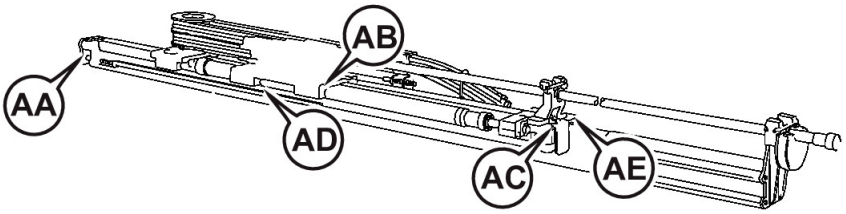
9.12 Check Drill Rod Support

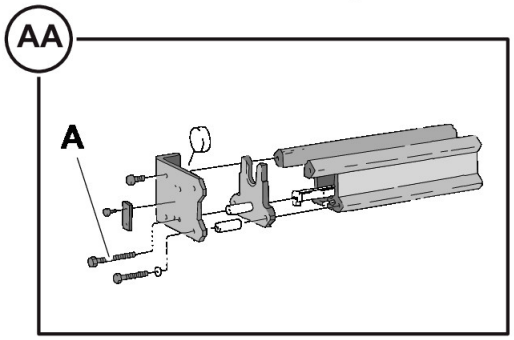


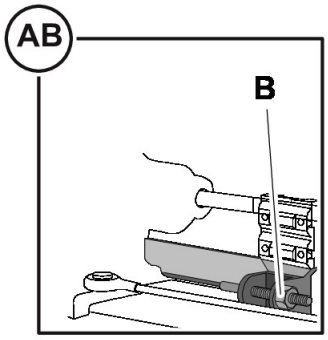
- Check attachment and direction of the drill rod support attachment (A).
- Check that the tightening torque of the drill rod support attachment (A).
- Check that bolted joints (B) are properly tightened.
- Check the slide pieces (C) for wear.

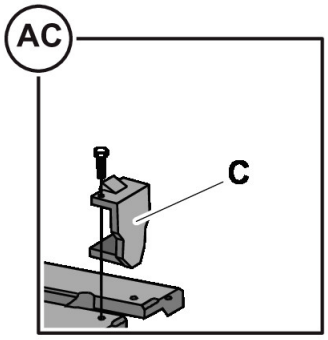
Component	Tightening Torque
Drill rod support attachment	185 Nm (136 lbf.ft)

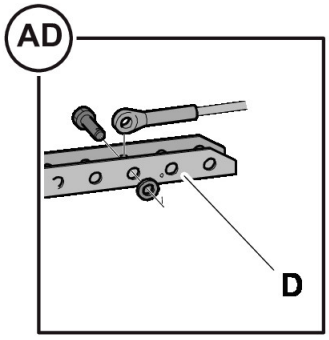
9.13 Replacing Haul Wire Rope

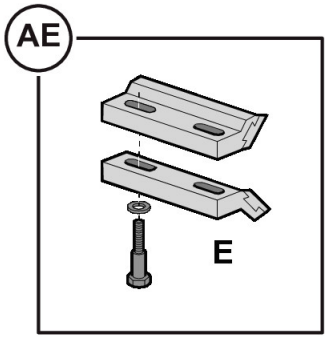












1. Operate the drill to about half its length of travel.
2. Slacken the tension on the wire ropes, bolt (A), and nut (B).
3. Remove the haul wire rope from its front attachment on the rock drill cradle.
4. Remove the scraper plate (C) from the intermediate drill rod support.
5. Loosen the intermediate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

> ! ***NOTE:*** *Make sure that the new wire rope is installed in the same hole as the old one.*

7. Install the new wire rope and install the scraper plate again.
8. Adjust the wire ropes.

9.14 Disassembling 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 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.

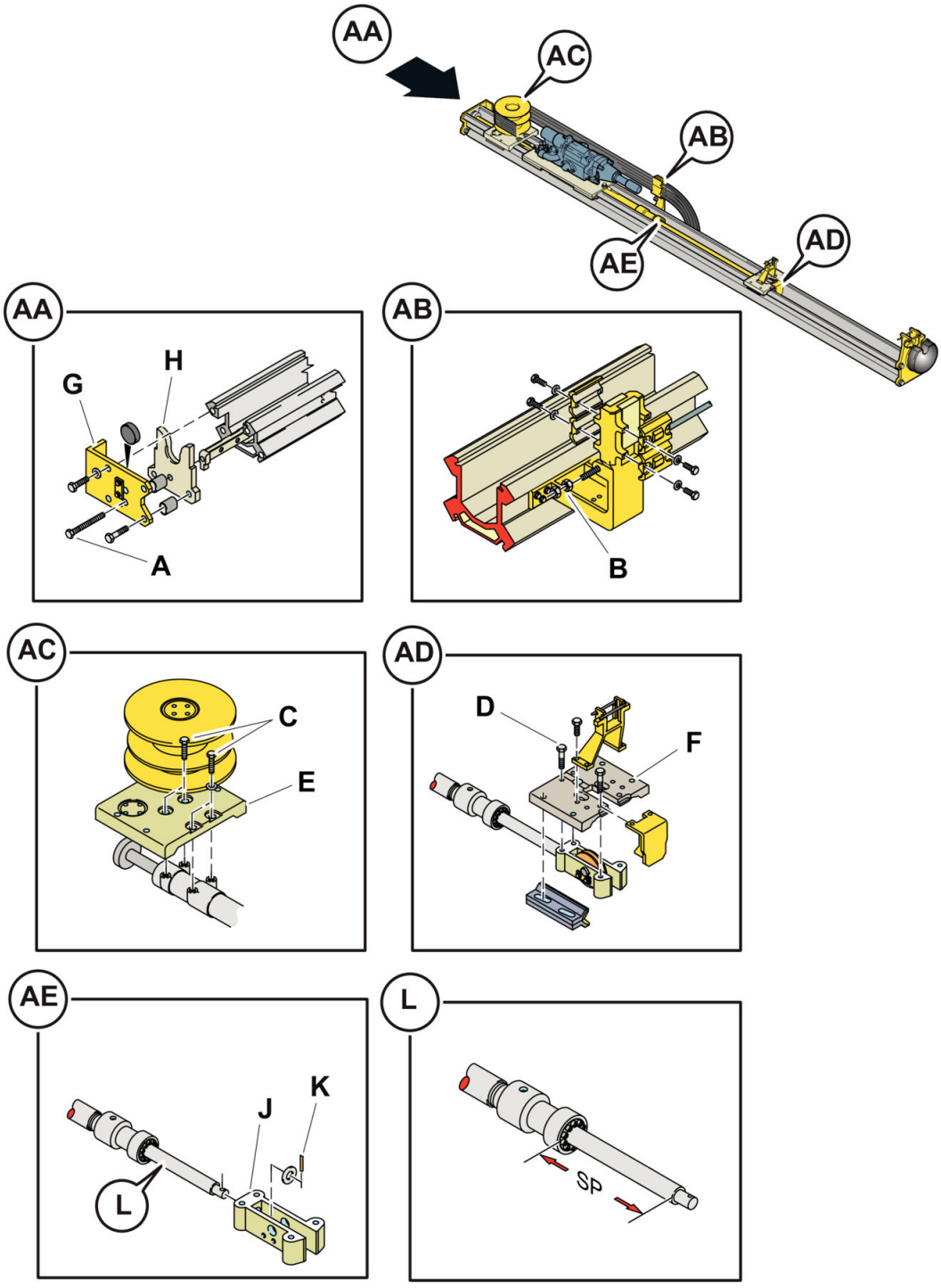
- ▶ Do not stand under the heavy object being lifted.
- ▶ Use adequate lifting equipment.

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.



Precondition ✓ 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 (B).
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 bolts (C) and (D) on cradle plates (E) and (F).
6. Remove bolt (A) from the end piece (G).

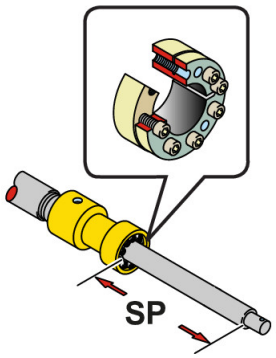
7. Remove the end plate (H).
8. Pull the cylinder and fork backwards, out of the beam.
9. Remove the pin (K).
10. Remove the fork (J) from the spacer (L).

! ***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.*

! ***NOTE:*** *Measurement SP = 492 mm (19.37 in.)*

9.15 Tension Bushings for Spacers

The spacer at the front end of the cylinder is kept in place with a tension bushing. For the feed to function properly, the measurement SP on the spacer must be correct. The measurement varies depending on the feed length and type of feed.



Spacer and Tensioning Bushing

Spacer Measurement (SP)	492 mm (19.37 in)

Table 2: Spacer Measurement (SP)

9.15.1 Disassembling 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.

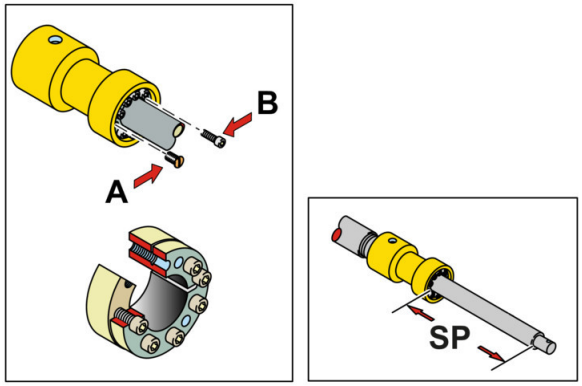
- ▶ Do not stand under the heavy object being lifted.
- ▶ Use adequate lifting equipment.

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.



Spacer Measurement (SP)	492 mm (19.37 in)

Table 3: Spacer Measurement (SP)

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, were the plastic plugs (A) were removed from, and pull them alternately until the bushing are separated.

9.15.2 Assembling 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.

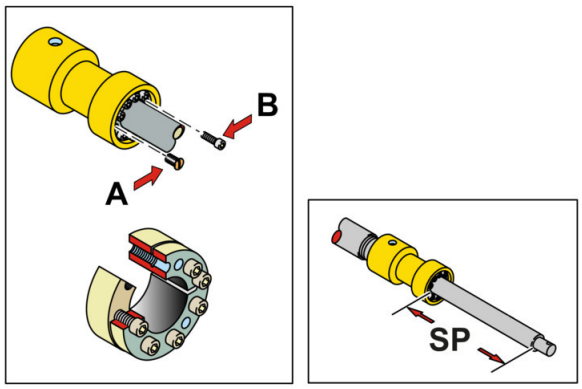
- ▶ Do not stand under the heavy object being lifted.
- ▶ Use adequate lifting equipment.

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.



Spacer Measurement (SP)	492 mm (19.37 in)

Table 4: Spacer Measurement (SP)

1. Assemble the bushing and the bolts (B). Do not tighten the bolts (B).
2. Install the spacer and bushing into the sleeve.
3. Criss-cross tighten the bolts (B), turning them ¼ turn each time. Repeat until the tightening torque is reached.

Tightening Torque	38 Nm (28 lb-ft)

4. Install the plastic plugs (A).

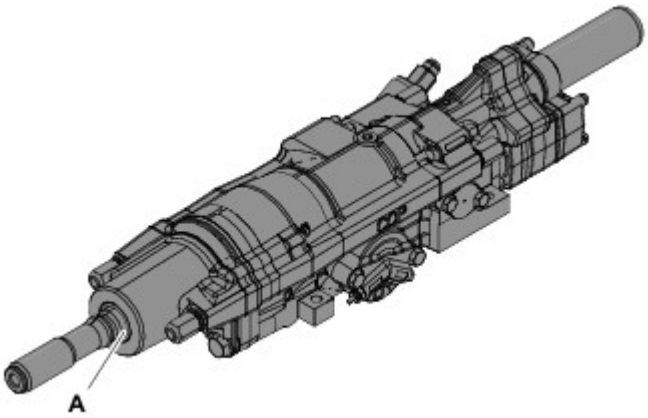
9.16 Preparing Feed for Long-Term Storage

The feed must be stored in a dry and clean environment.

1. Clean the feed thoroughly.
2. Lubricate the feed.
3. Protect unpainted surfaces with rust inhibitor.
4. Store the feed in a dry and clean environment.

10 Lubrication System for Rock Drill

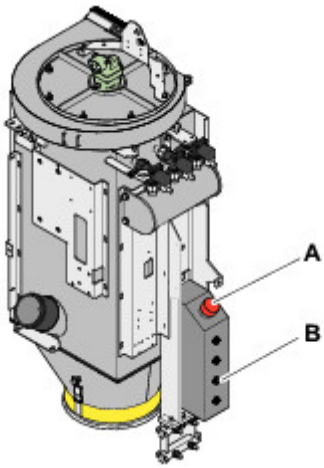
10.1 Check Rock Drill



- Visually check that the oil trickles out between the front and the shank adapter (A).

10.2 Check Lubricant Level

The lubrication tank is attached on the dust collector.

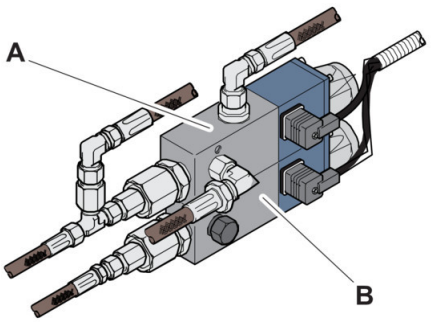


- Check the tank and connections for signs of leakage.
- Check that the lubricant level is above the second sight glass (B) from the bottom.
- Top up the lubricant, through filler (A) if necessary. Use a funnel with strainer when refilling.

! ***NOTE:*** *The lubricant level must not be below 40 mm (1.6 in). If the lubrication system is drained, the operator must bleed the system.*

10.3 Drill Lubrication Pumps

The lubrication pumps are located behind the lubricant tank.



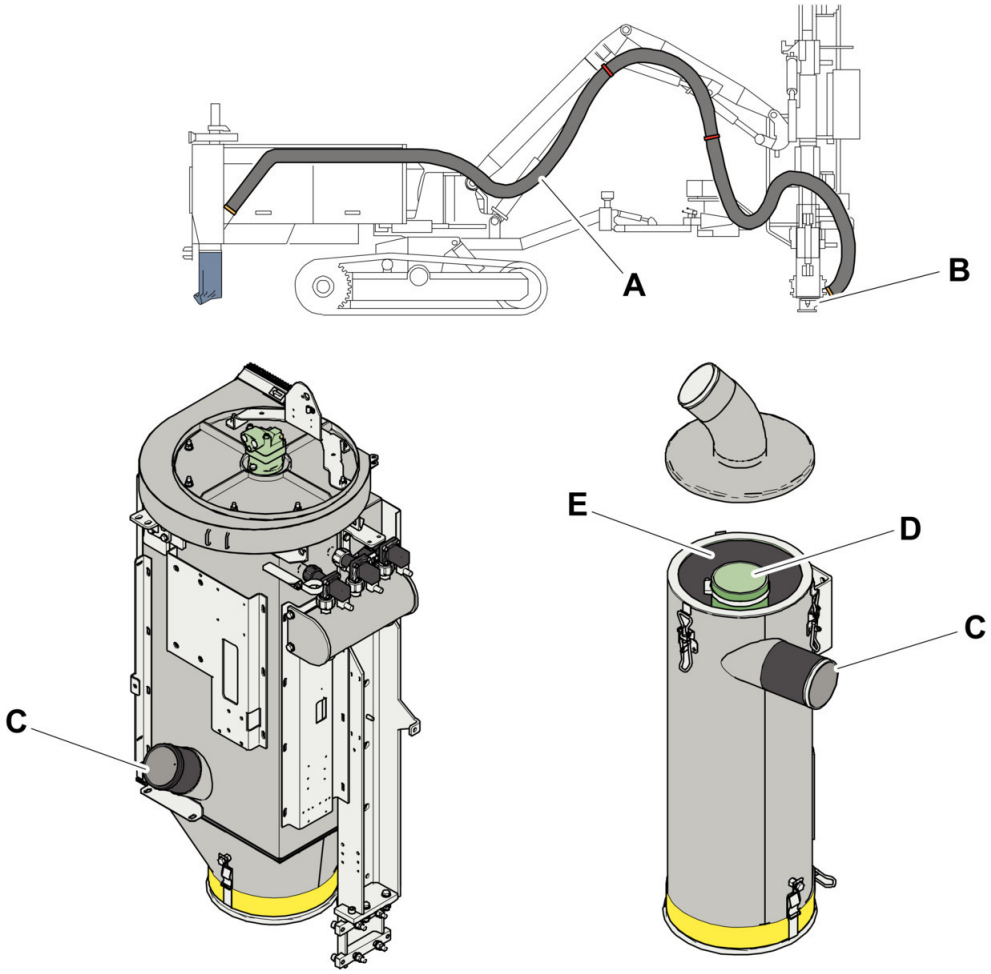
A	Thread lubrication pump (ECG)
B	Rock drill lubricating pump (ECL)

10.4 Drain Water Condensation from Lubrication Tank

- Drain water from lubrication tank.

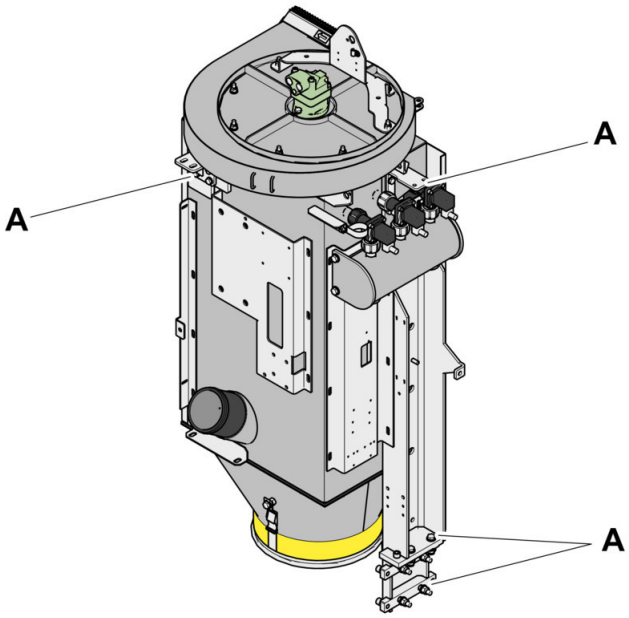
11 Dust Collector

11.1 Check Dust Collector



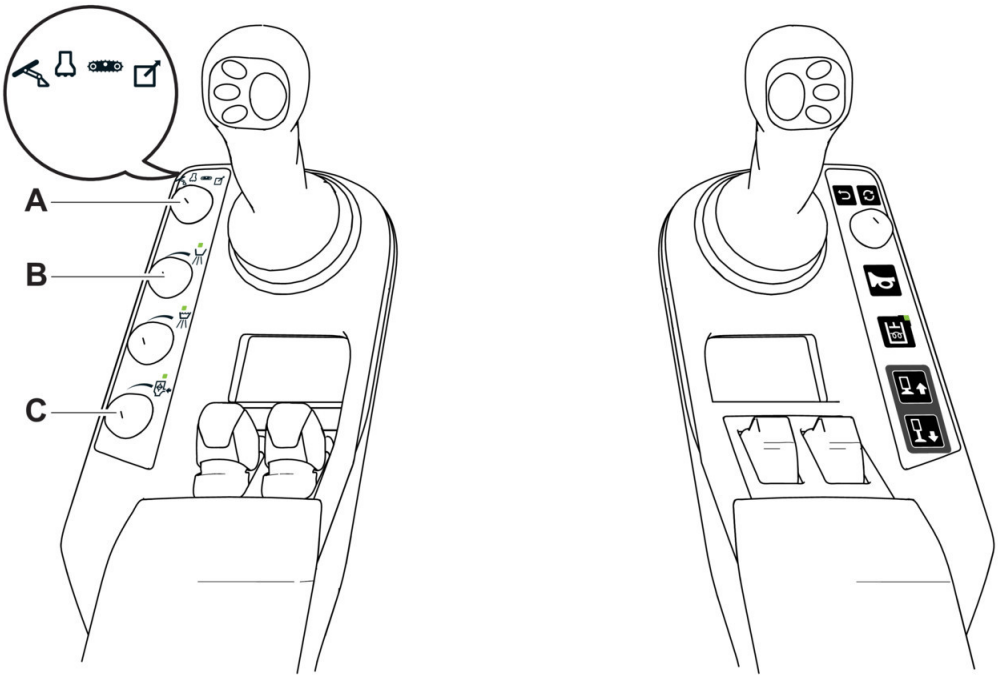
- Check the suction hoses (A) for damage.
- Check the dust gasket (B) for damage and sealing around the pipe.
- Check the inlet connector piece (C) for wear.
- Check the center hose (D) for its intactness and the sealing.
- Check the wear protectors (E) for wear and attachment.

11.2 Check Dust Collector Tightening Torque



- Check the tightening torque on bolts (A).

11.3 Checking Function of Dust Collector

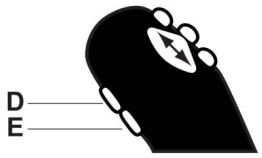


Factory setting is 4-6 pulses during cleaning time.

Precondition ✓ The air pressure must be less than 8 bar (manual valve).

1. Turn the ignition key to ignition position. Set the mode selector (A) to drill mode on the operating panel.
2. Activate the dust collector by pressing the button (C). Make sure flush air (B) is in position “Reduced flush air”.

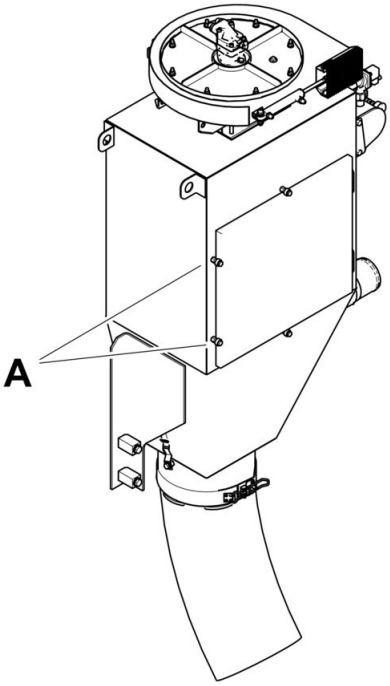
3. Activate flush air with the right drill lever by moving it maximal to the left. Terminate the function by pressing button (D/E) on the right drill lever.



4. Check that air blows through the filters and check pulse interval.

➤ Adjust the number of pulses in the control system if necessary.

11.4 Checking Dust Collector Filters

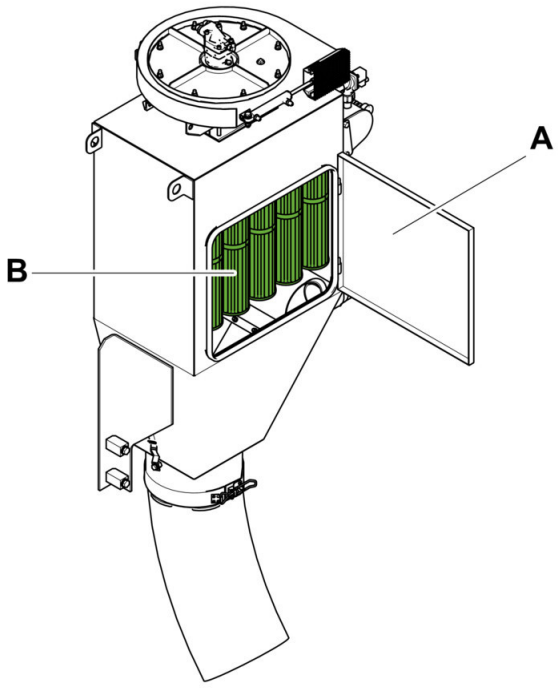


1. Remove the plugs (A) and connect a differential pressure gauge to the two holes.
2. Measure the pressure drop while air flushing is activated.

   If the pressure drop is greater than 800 mm/31.5 in (wg) column of water, all filters must be replaced.

> ! ***NOTE:*** *Do not operate the dust collector with a deficient filter.*

11.5 Replace Dust Collector Filters



1. Open the door (A).
2. Remove the old filters (B).
3. Replace with new filters.

Component	Tightening Torque	
	Nm	lbf.ft
New filters	18–20	13–15

12 Hydraulic System

12.1 Safety Precautions before Working on Hydraulic System

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 installed with removable couplings.

12.2 About Working on Hydraulic Components

The hydraulic system is sensitive to contamination. The environment where the machine is normally used is generally an unsuitable place for repairing hydraulic components. Avoid repairing hydraulic systems outside workshops.

Observe the following points to minimize interruptions in operation due to contaminated hydraulic oil:

- Keep the machine clean.
- Use a degreasing additive for washing.
- Before opening any hydraulic connection, clean the area round 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 suitable protective plugs are installed.
- Spare parts for hydraulic components must always be kept in sealed plastic bags.
- Change filter cartridges when filters indicate clogging.

12.3 Hydraulic Workshops

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

- A clean environment to avoid dust and particles
- Suitable washing equipment for component repair
- Suitable tools for working on hydraulic systems

- Adequate ventilation system

12.4 Replacing 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 installed with removable couplings.

Load, vibration, and mechanical stresses place many demands 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 properly tightened.

12.5 Check 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

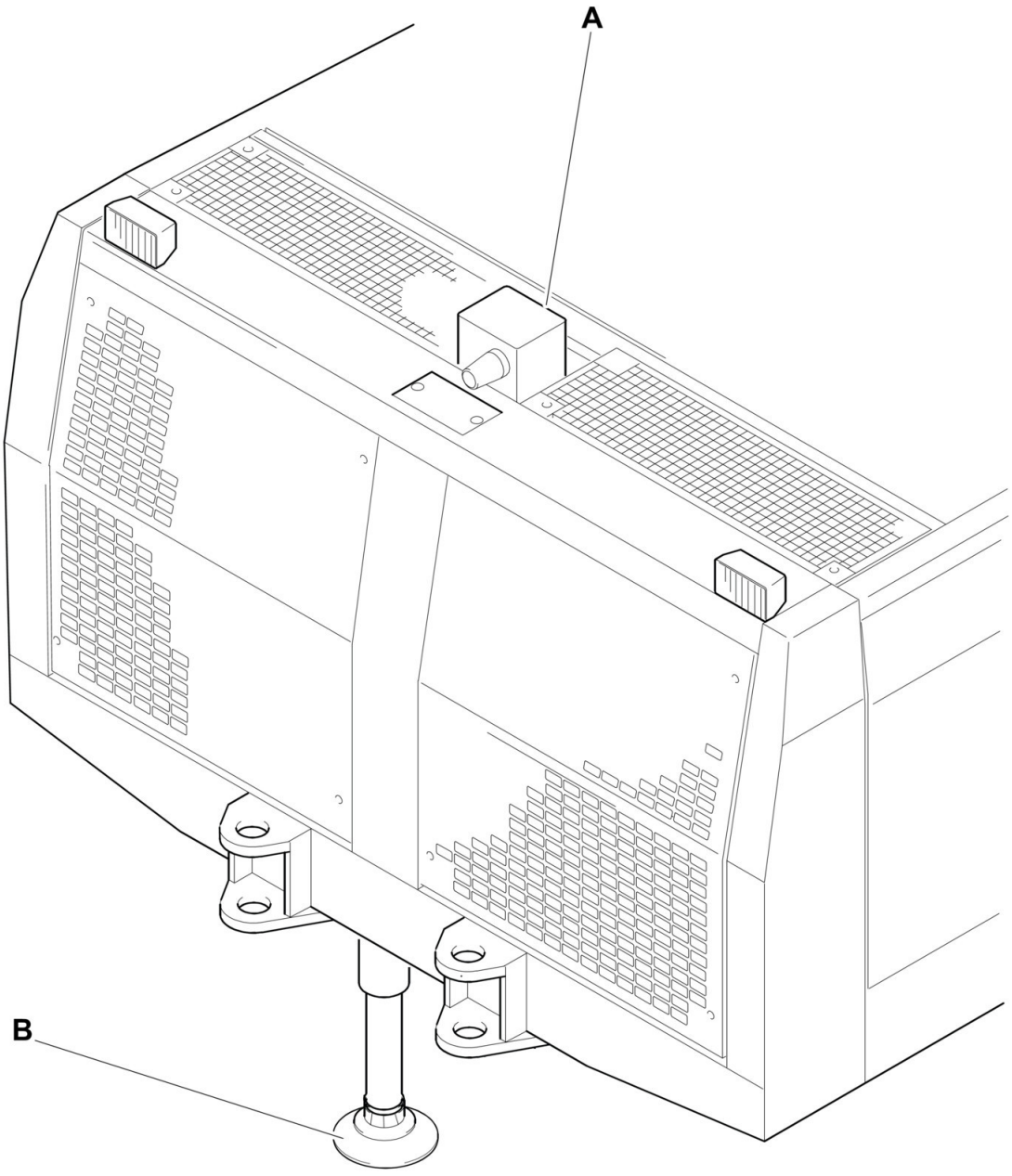
Can cause personal injury.

▶ Do not replace high-pressure hoses with hoses of lower quality than the originals.

▶ Do not replace high-pressure hoses with hoses installed with removable couplings.

- Inspect all hydraulic hoses and connections thoroughly. Any cracking or swelling indicates an external or internal leak. Inspect the hose location and clips.
- Inspect the hose casing. Any swelling indicates inner hose or cord breakage.
- Inspect the hydraulic couplings for leaks, indentations, and adapters. The couplings must be fastened securely if they have screw flanges. If there are any signs of leaks around connections, replace the seals or the complete coupling.
- Check that all hose retainers and clamps are intact.
- Inspect all pressed couplings for signs of cracks or damage to compression sleeves. Replace any defective hoses with new ones.

12.6 Check Mounting Hydraulic Jack

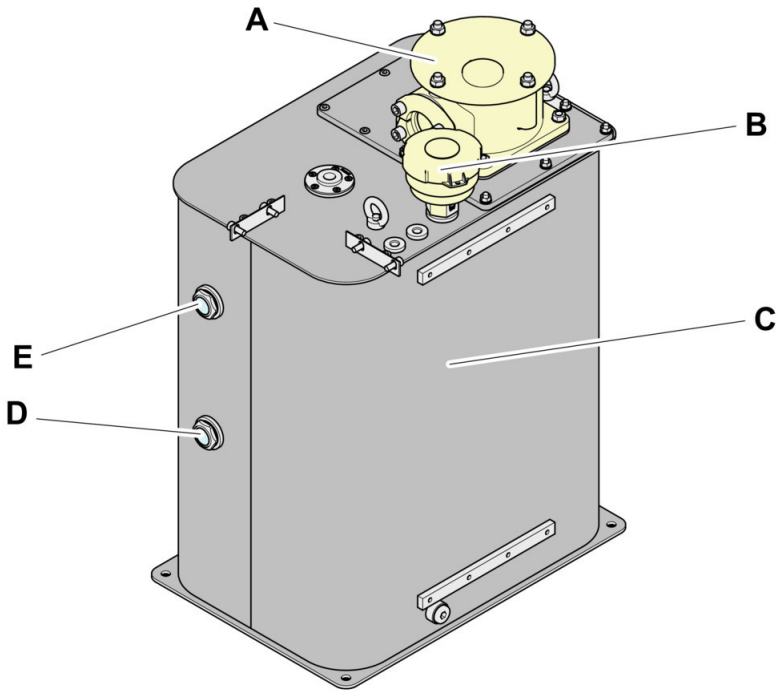


- Check the mounting and torque on hydraulic jack (A).

- Check the mounting and torque on foot plate (B).

12.7 Hydraulic Tank

12.7.1 Check Hydraulic Tank

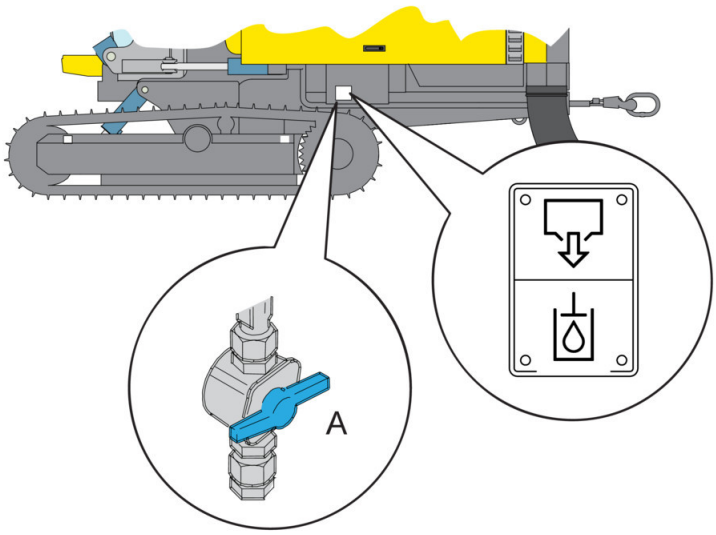


Precondition ✓ The machine is parked on a flat and leveled surface.

✓ The oil temperature is 40°C / 104°F.

- Replace the return oil filter (A) if the warning sign is displayed.
- Check the breather filter (B).
- Check the tank (C) and connections for signs of leakage.
- Check that the oil level covers the lower sight glass (D) and half of the upper sight glass (E).

12.7.2 Drain Water Condensation from Hydraulic Oil Tank

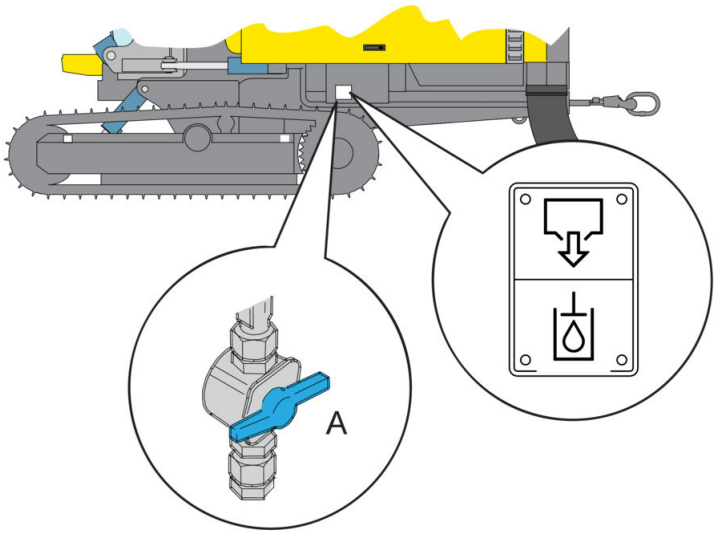


The ball valve (A) is used to drain water that can seriously damage components in the hydraulic system and cause corrosion. It is also used for draining all hydraulic oil from the tank.

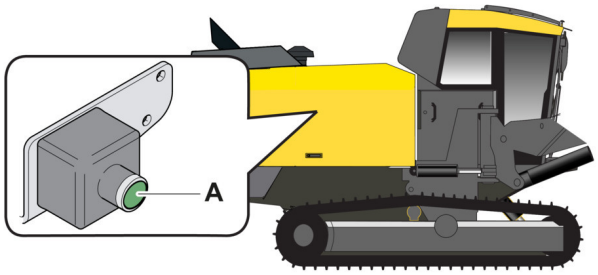
Precondition ✓ The hydraulic system has not been in operation for eight hours before draining the hydraulic oil tank.

1. Remove the plug on the ball valve (A) underneath the hydraulic oil tank.
2. Place a vessel under the ball valve (A).
3. Open the ball valve to drain the water.
4. Close the ball valve when oil starts to drain.
5. Install the plug.
6. Check and fill up oil level.

12.7.3 Replace Hydraulic Oil



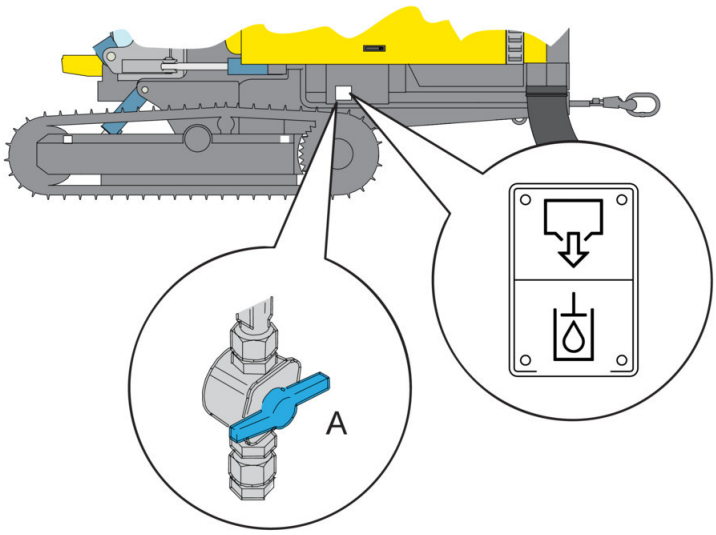
1. Remove the plug from the ball valve (A) under the hydraulic tank.
2. Fit a hose to the ball valve and place the other end of the hose into a vessel.
3. Open the ball valve and empty the tank.
4. Activate the **Enable hydraulic oil filler pump** function in the **Settings**/**Rig** menu in the control system.
5. Connect the attached hose to the oil source.
6. Press button (A) to start filling.



7. Check that the lower sight glass is fully covered and the upper sight glass is half covered.

> ! ***NOTE:*** *The electric filler pump stops automatically when the hydraulic tank is full. It also stops if the source of oil runs out.*

12.7.4 Draining Hydraulic Oil Tank



1. Remove the plug from the ball valve (A) under the hydraulic tank.
2. Install a hose to the ball valve and place the other end of the hose into a vessel.
3. Open the ball valve and empty the tank.
4. Close the ball valve and remove the hose.
5. Install the plug on the ball valve.

12.7.5 Filling Hydraulic Oil

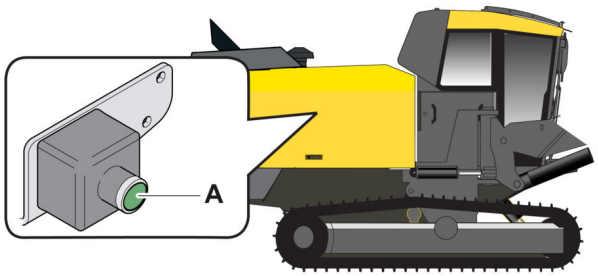
WARNING

Hydraulic Oil Under Pressure

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

▶ Use personal protective equipment.

1. Check the return oil filter.
2. Check that all the couplings and hoses that are normally filled with hydraulic oil are clean.
3. Activate the **Enable hydraulic oil filler pump** function in the **Settings**/**Rig** menu in the control system.
4. Connect the attached hose to the oil source.
5. Press button (A) to start filling.



6. Check that the lower sight glass is fully covered and the upper sight glass is half covered.

! ***NOTE:*** *The electric filler pump stops automatically when the hydraulic tank is full. It also stops if the source of oil runs out.*

Hydraulic Oil Tank Volume
100 L (26.4 gal)

12.8 Hydraulic Filters

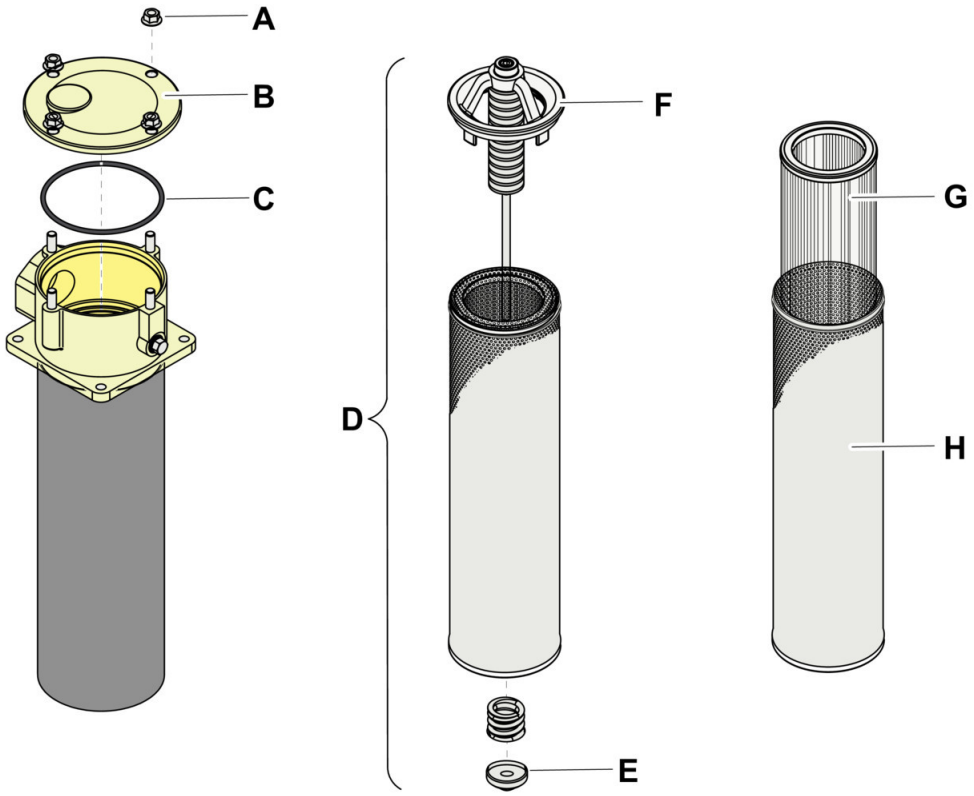
12.8.1 Return Oil Filter

The return oil filter cleans the oil before it returns to the tank. The filter cartridges should be replaced according to the maintenance schedule. If the return filter pressure gauge on the operator display indicates a clogged filter, all return oil filters must be changed immediately.

Symbol for Clogged Filter

12.8.2 Replace Return Oil Filter

The filter inserts are located in the hydraulic tank.



1. Clean on and around the filter cap. Loosen and remove the nuts (A).
2. Lift off the cap (B) and replace the O-ring (C) if damaged.
3. Lift out the filter cannister (D).
4. Remove the nut (E). Lift out and clean the magnetic rod (F).
5. Remove filter cartridge (G) from the cover (H) and replace with a new filter cartridge.
   Only the filter cartridge is replaced. The filter cover is reused.
6. Refit all parts.

12.8.3 Check Hydraulic Tank Breather Filter

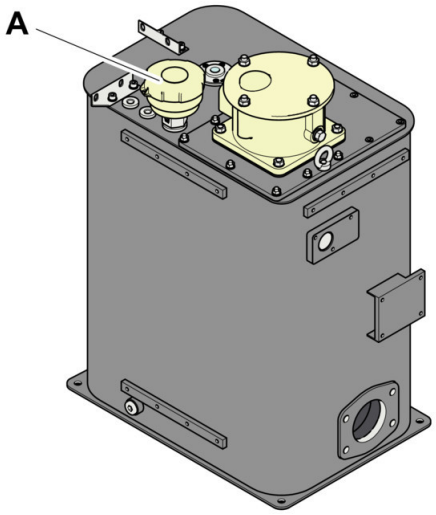
WARNING

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.

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

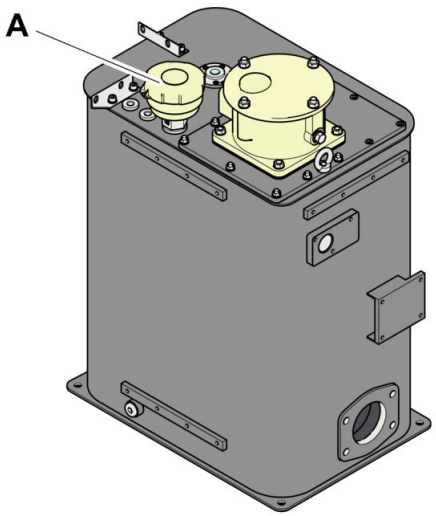


■ Check breather filter (A) for clogging.

> ***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.*

12.8.4 Replace Breather Filter

Replace the filter as per the maintenance schedule or if the tank is overfilled and the filter gets covered in oil.



1. Clean thoroughly on and around the filter housing (A).
2. Remove the cover plate by turning it counterclockwise.
3. Replace with a new filter.
4. Apply a little hydraulic oil to the sealing surface and threads.
5. Install the cover.

13 Diesel Engine

13.1 Safety Precautions before Working on Diesel Engine

WARNING

Burning Hazard

Hot components can cause serious personal injury.

- ▶ Turn off the machine before starting maintenance work.
- ▶ Be careful when draining hot oils and fluids.
- ▶ Use personal protective gear.
- ▶ Do not handle flammable fluids near hot surfaces, sparks, or open flames.

13.2 Check Engine Oil Level

WARNING

Burning Hazard

Hot components can cause serious personal injury.

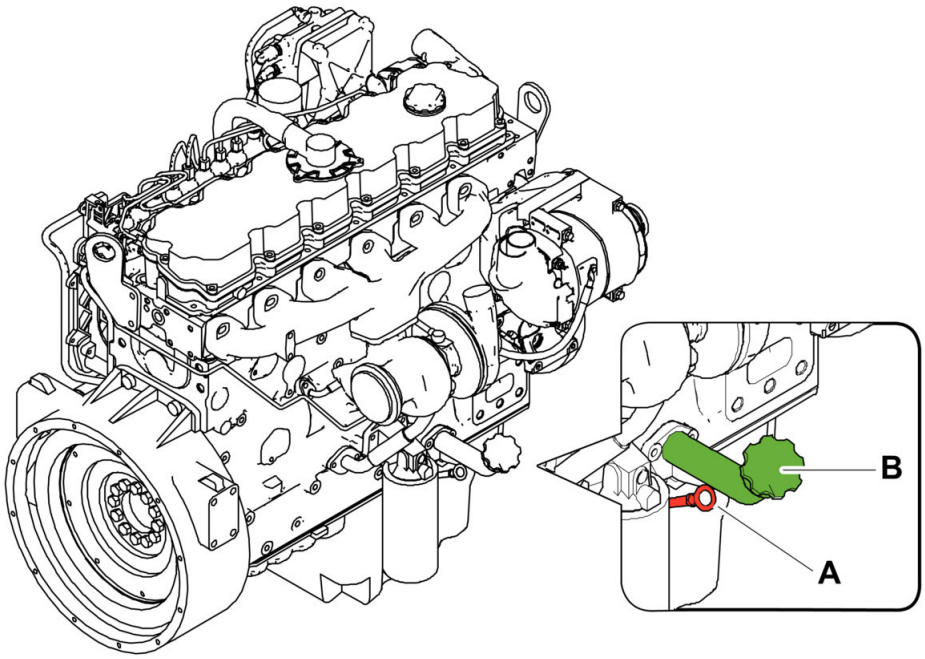
- ▶ Turn off the machine before starting maintenance work.
- ▶ Be careful when draining hot oils and fluids.
- ▶ Use personal protective gear.
- ▶ Do not handle flammable fluids near hot surfaces, sparks, or open flames.

WARNING

Burning Hazard

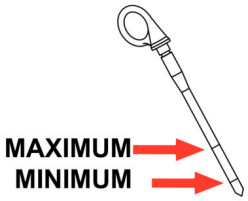
High oil temperature can cause serious personal injury.

- ▶ Shut off the engine.
- ▶ Use working gloves, face shield, and cover your arms with long sleeves.



Precondition ✓ The diesel engine is turned off.

1. Check that the oil level is between the upper and lower mark on the dipstick (A).



2. Top up the oil through the filler cap (B), if necessary.

> ! ***NOTE:*** *Only use engine oil that the engine manufacturer approves for engine and type of operation.*

See Reference Documentation

Diesel engine instruction manual

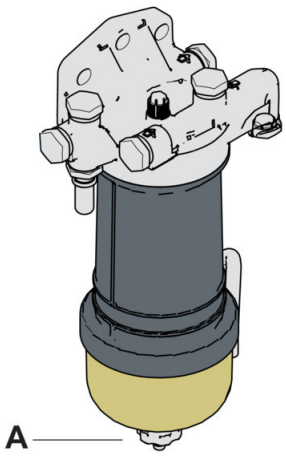
13.3 Drain Water Condensation from Preliminary Fuel Filter

⚠ WARNING

Burning Hazard

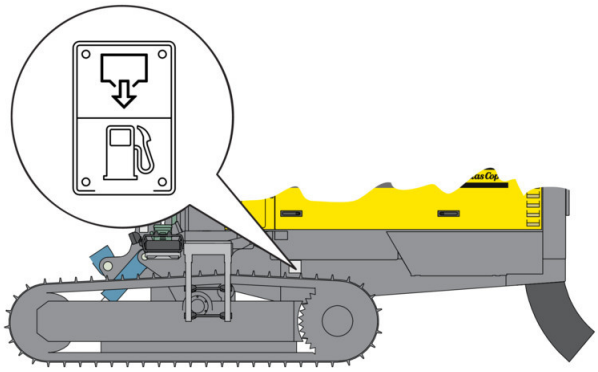
Hot components can cause serious personal injury.

- ▶ Turn off the machine before starting maintenance work.
- ▶ Be careful when draining hot oils and fluids.
- ▶ Use personal protective gear.
- ▶ Do not handle flammable fluids near hot surfaces, sparks, or open flames.



1. Loosen the drain plug (A).
2. Drain the water.
3. Tighten the drain plug.

13.4 Drain Water Condensation from Fuel Tank



1. Release the steel cover.
2. Open the ball valve and allow the water to drain.
3. Close the ball valve.
4. Tighten the steel cover.

13.5 Filling Fuel Manually

WARNING

Flammable and Toxic Liquid

Fuel is toxic and can cause injury. Fuel is flammable and causes burns, serious personal injury, or death.

- ▶ Shut off the engine.
- ▶ Use personal protective gear.
- ▶ Do not handle flammable fluids near hot surfaces, sparks, or flames.
- ▶ Clean up fuel spills.

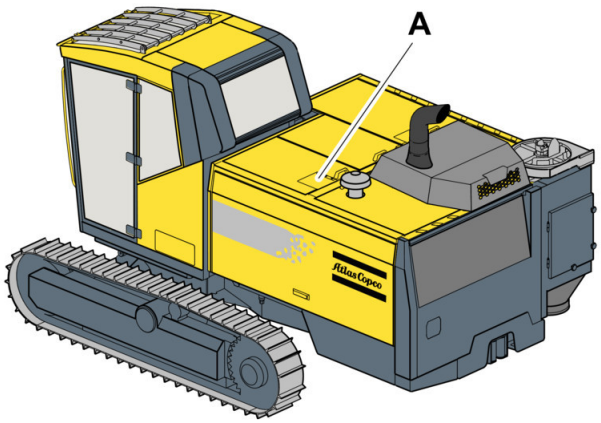
NOTICE

Damage to Diesel Engine or Particle Filter

The use of fuel of a lower quality other than that recommended by the diesel engine manufacturer, damages the diesel engine and particle filter.

- ▶ Always use the recommended fuel.

Avoid filling fuel if there is a risk of contamination, for example, in windy or wet weather, or when there is dust in the air.



Precondition ✓ The diesel engine is turned off.

✓ Tank and tank cover are clean.

1. Remove the filler cap (A).
2. Fill with fuel.

13.5.1 Fuel Quality

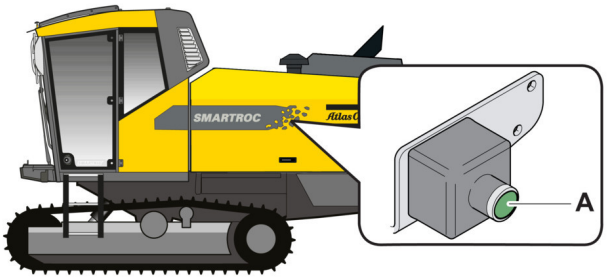
- Fuel that is stored must not have contact with air. Fuel must be stored in a closed and clean vessel, that is approved for its purpose.
- Only use manufacturer approved fuel for the engine and type of operation.

Fuel Quality	Sulphur Grade
Ultra Low Sulfur Diesel (ULSD)	

13.6 Filling Fuel Using Electric Fuel Filling System

This equipment is **optional**.

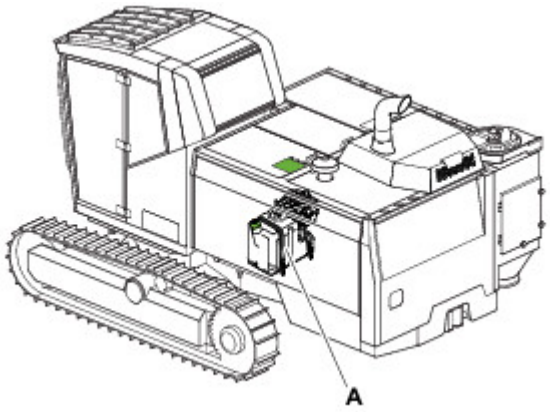
1. Activate the **Enable diesel filler pump** function on the **Settings**/**Rig** menu in the control system.
2. Check that the hose and the filter are clean.
3. Connect the attached hose to the fuel source.
4. Press button (A) to start filling.



➔ The electric filler pump stops automatically when the fuel tank is full. It also stops if the source of fuel runs out.

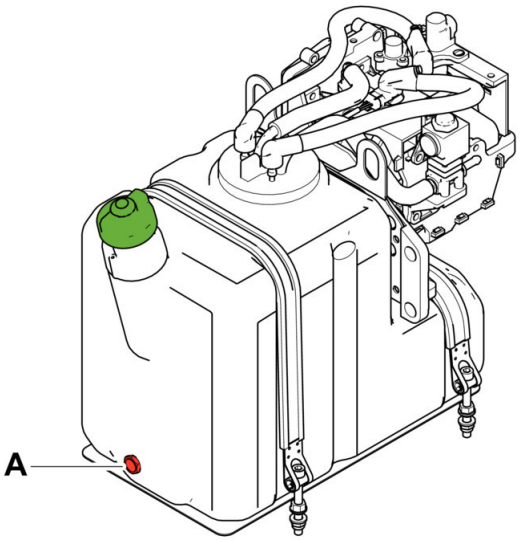
Diesel Tank Volume
370 L (97 gal)

13.7 Location of DEF Tank



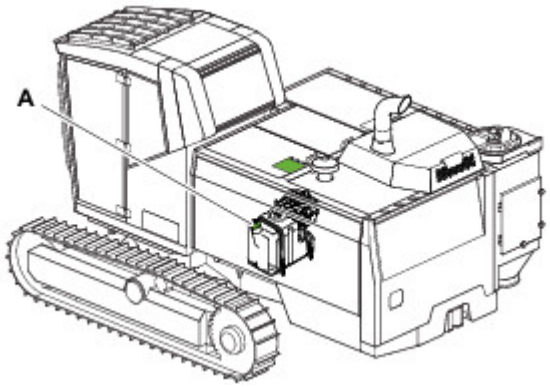
A	DEF tank

13.8 Drain Diesel Exhaust Fluid (DEF) Tank



- Drain the DEF tank by loosening the plug (A).

13.9 Filling DEF Tank



Precondition ✓ The engine is switched off.

1. Check that the DEF tank and funnel are clean.
2. Unscrew the filler cap (A).
3. Fill with DEF.

See Reference Documentation
Diesel engine instruction manual

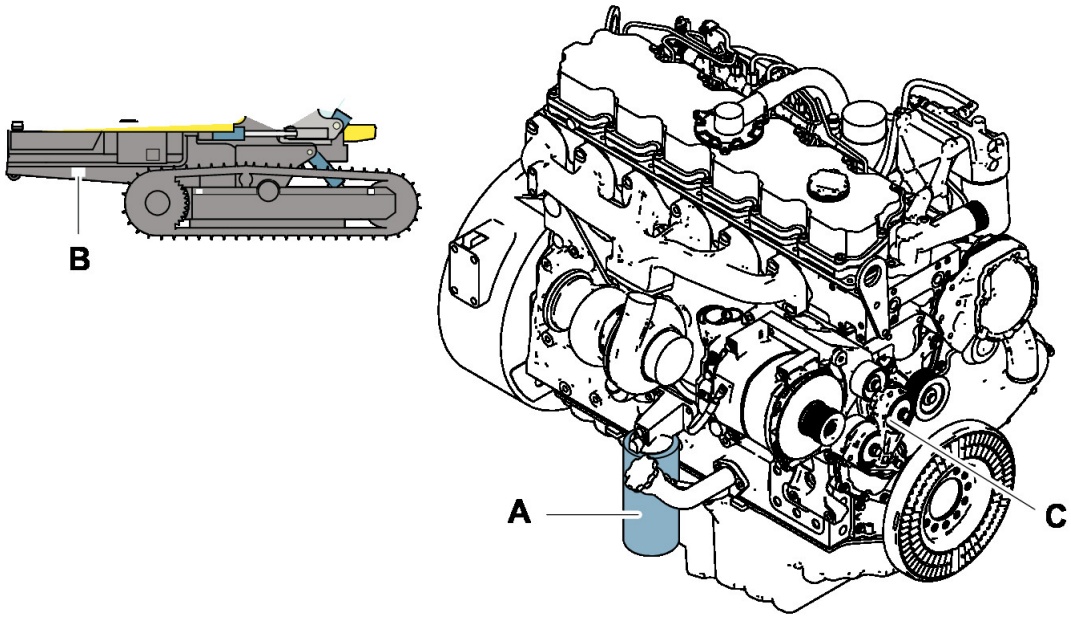
13.9.1 Diesel Exhaust Fluid (DEF)

- The DEF must fulfil the requirements specified in ISO 22241-1, DIN 70070 or ASTM D 7821.
- Store DEF in clean tanks resistant of DEF.
- Avoid storing DEF in the sun.
- DEF is affected by temperatures.
- Store DEF maximum one year. Storage time depends on storage conditions.

See Reference Documentation

Diesel engine instruction manual

13.10 Maintain Diesel Engine



- Replace the engine oil filter (A).
- Change the engine oil (B).
- Check the multi-belt (C) for wear.
- Check the hoses and clamping brackets for leaks and wear.

See Reference Documentation

Diesel engine instruction manual

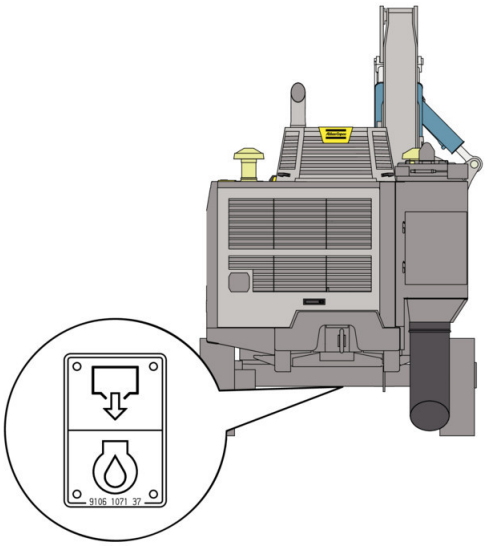
13.11 Replacing DEF Tank Filter

- See the separate instructions for the diesel engine regarding DEF tank filter replacement.

See reference documentation

Diesel engine instruction manual

13.12 Replace Engine Oil



Precondition ✓ Machine is placed on flat surface.

1. Switch off the engine and allow the oil to drain down from the engine's internal parts for some minutes.
2. Place a vessel under the drain plug.
3. Remove the drain plug and drain all oil.
4. Fill oil up with recommended amount.
5. Oil level should be close to top mark on the dipstick. Top up if oil level is low.
6. Start the engine and allow it to idle for about two minutes.
7. Check the engine oil pressure.
8. Check for leaks.
9. Stop the engine and check oil level. Top up if necessary.

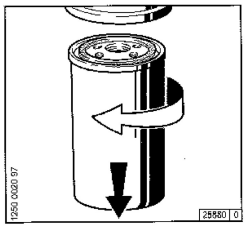
13.13 Replace Engine Oil Filter

WARNING

Burning Hazard

Hot components can cause serious personal injury.

- ▶ Turn off the machine before starting maintenance work.
- ▶ Be careful when draining hot oils and fluids.
- ▶ Use personal protective gear.
- ▶ Do not handle flammable fluids near hot surfaces, sparks, or open flames.



Placement of oil filter can differ depending on brand and model.

> ! ***NOTE:*** *Use engine oil that the engine manufacturer approves for engine and type of operation.*

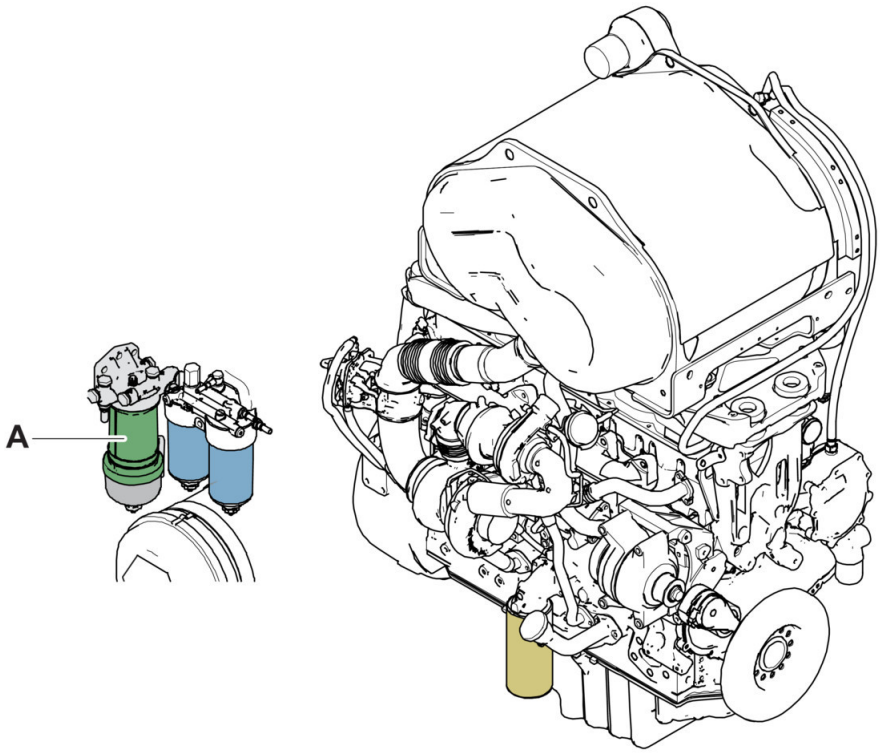
> ! ***NOTE:*** *Always replace oil filter when replacing oil.*

Precondition ✓ The engine oil is drained.

1. Place a vessel under the oil filter.
2. Remove the oil filter.
3. Clean the surface of the filter holder.
4. Lubricate the gasket of the new oil filter.
5. Turn the filter by hand until the gasket makes contact with the filter base.
6. Tighten the filter.

See Reference Documentation
Diesel engine instruction manual

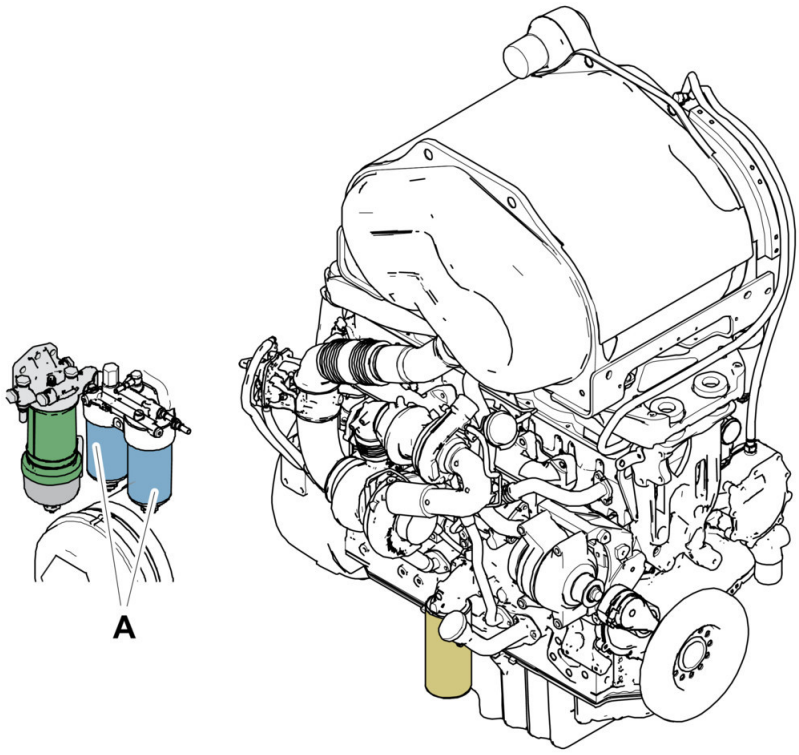
13.14 Replace Preliminary Fuel Filter



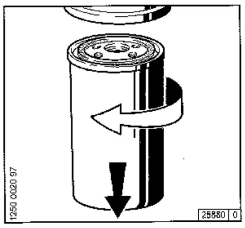
1. Loosen the preliminary fuel filter (A) using a suitable tool.
2. Collect any residual fuel.
3. Clean the surface of the filter holder.
4. Oil the rubber seal of the new fuel filter sparingly.
5. Tighten the filter all the way by hand.
6. Tighten the filter an extra half turn using a suitable tool.
7. Check that the fuel filter does not leak.

See Reference Documentation
Diesel engine instruction manual

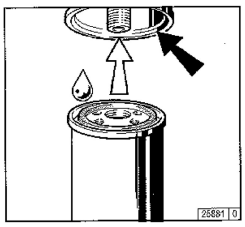
13.15 Replace Secondary Fuel Filter



1. Remove the secondary fuel filters (A) with a suitable tool.



2. Collect any residual fuel.
3. Clean the surface of the filter holder.
4. Lubricate the rubber seal of the new fuel filter sparingly with a little oil.
5. Install the new filter and hand tighten it until the gasket makes contact with the surface of the filter holder.



6. Check that the fuel filter does not leak.

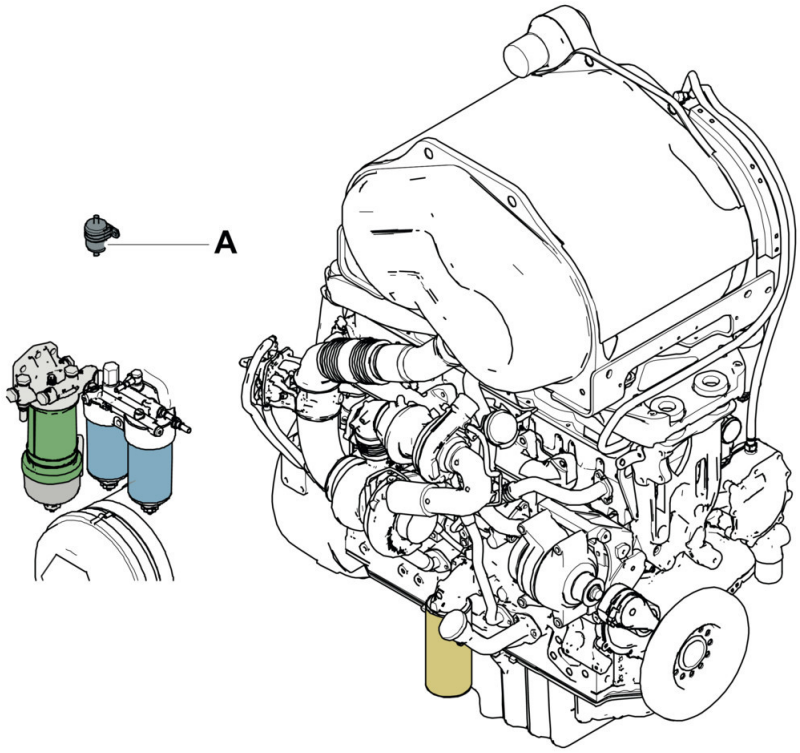
> ! ***NOTE:*** *Bleed the system after filter replacement.*

7. Bleed the fuel system.

See Reference Documentation

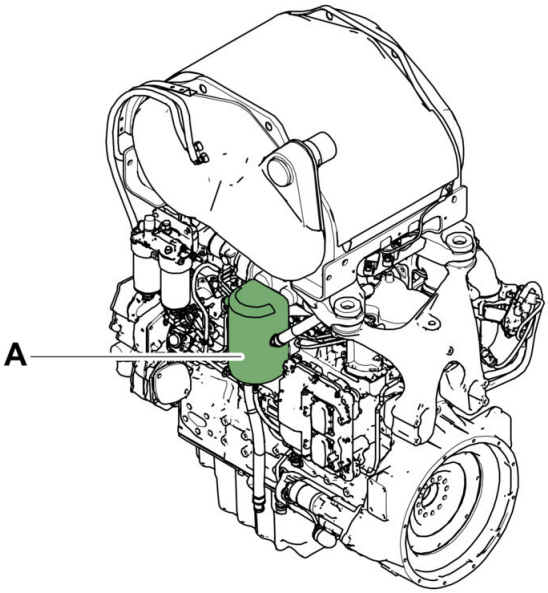
Diesel engine instruction manual

13.16 Replace Coarse Filter



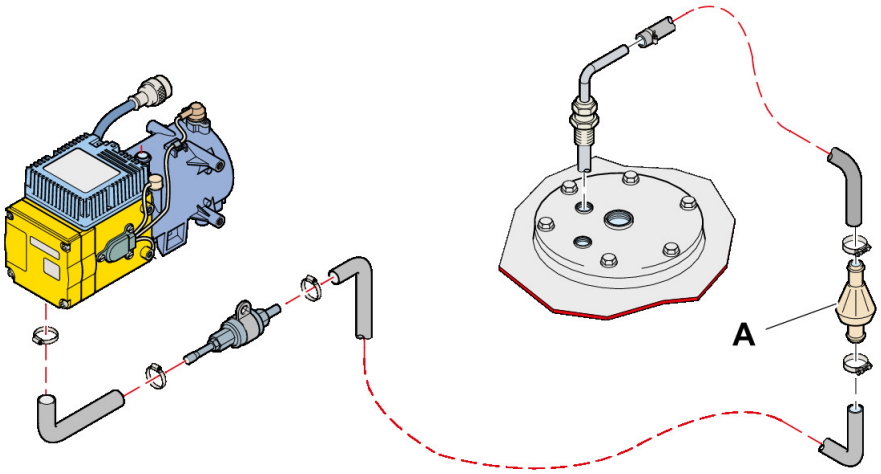
- Replace coarse filter (A).

13.17 Replace Crankcase Ventilation Filter



- Replace the diesel engine crankcase ventilation filter (A).

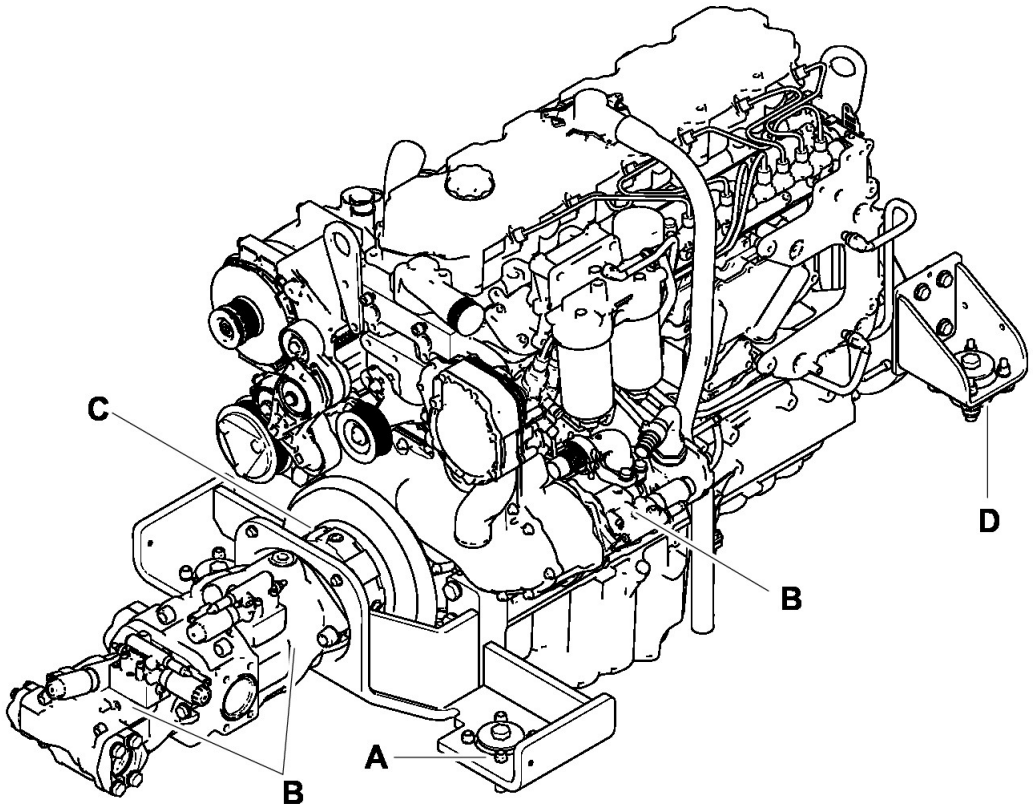
13.18 Replace Primary Fuel Filter on Engine Heater



Engine Heater

- Replace primary fuel filter (A).

13.19 Check Diesel Engine Mounting

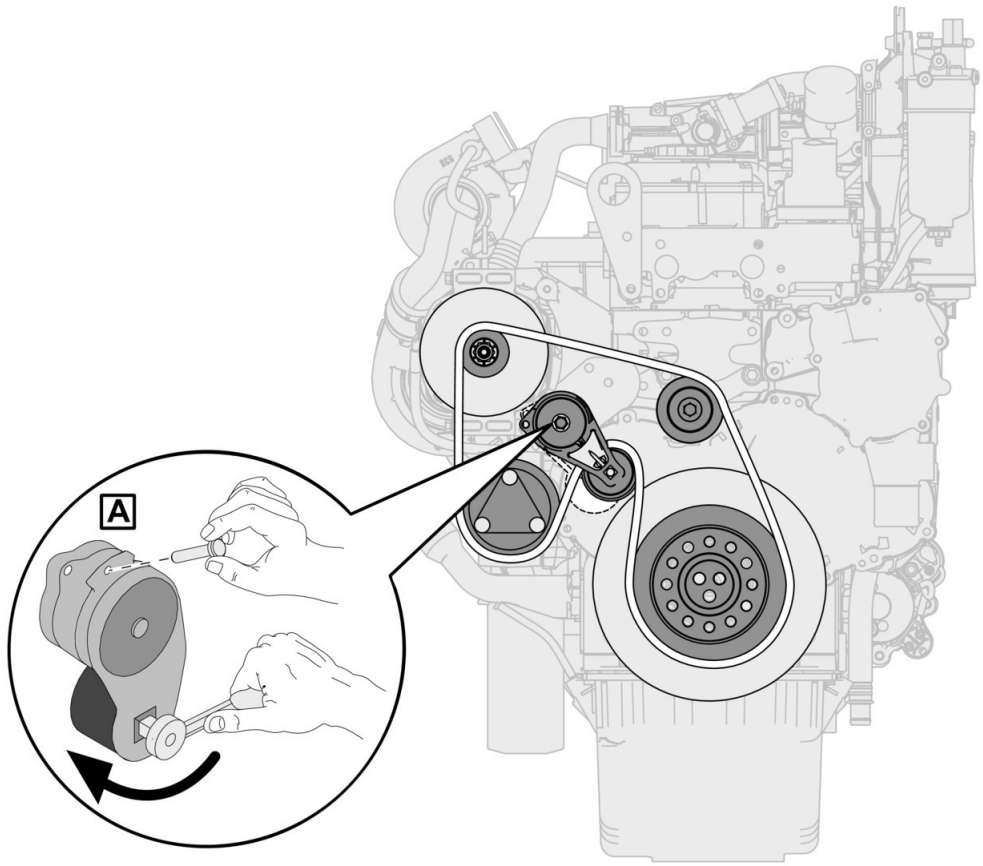


- Check the tightening torque of the bolts (A) on the power frame.
- Check mounting and tightening torque in hydraulic pumps (B).
- Check rubber coupling (C) between diesel engine and hydraulic pump for cracks and wear.
- Check the tightening torque of the bolts (D) on engine.

Component	Tightening Torque	
	Nm	lbf.ft
Bolts on power frame (A)	185	137
Bolts on engine (D)	73	54
Hydraulic pump 1	86	62
Hydraulic pump 2, 3, and 4	49	36

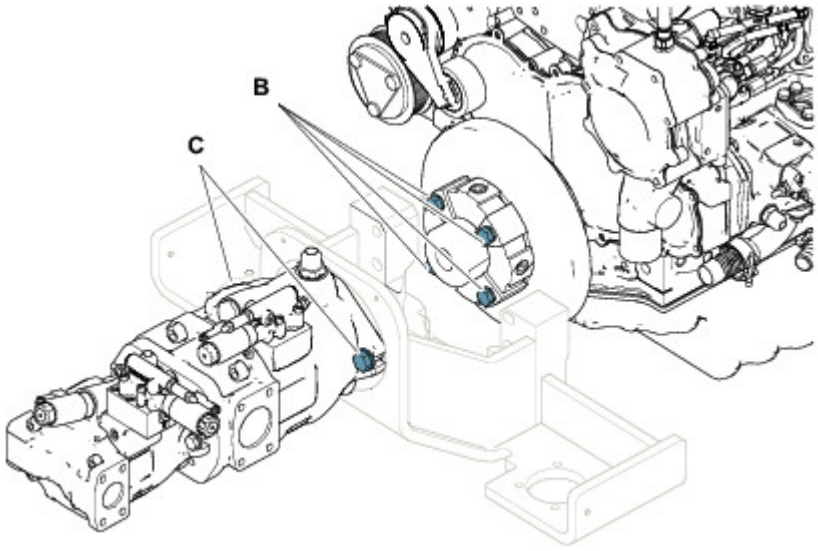
13.20 Belts

13.20.1 Replace Multi-belt



Precondition ✓ Engine is switched off.

1. Remove the belt cover.
2. Turn the tensioning wheel (A) to loosen the belt tension.
3. Use a pin to lock the tensioning wheel in position at the point where the belt is slack.
4. Remove the four bolts (B) in the shaft coupling to create clearance.



5. Remove the two bolts (C) to detach the pump.
6. Replace the belt by inserting it through the clearance between the coupling rubber and the shaft flange.
7. Tighten the bolts (C).
8. Refit the coupling rubber and tighten the bolts (B) to tightening torque 185 Nm (136.44 lb-ft).
   ➔ The belt is tensioned automatically when the lock-out assembly is removed from the tensioning wheel.
9. Reinstall the belt cover.

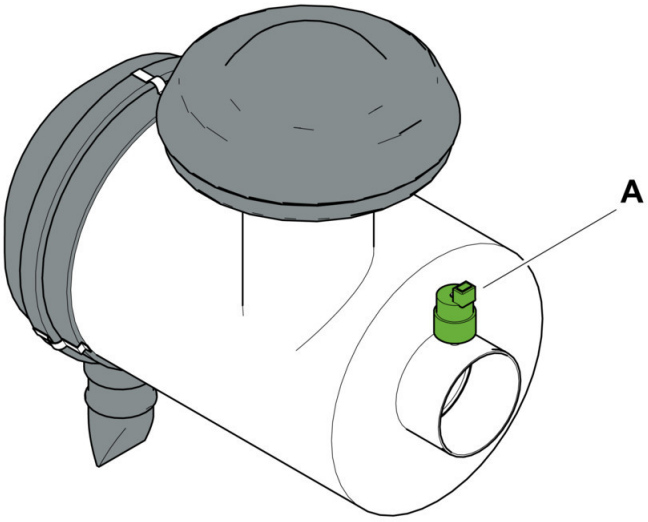
13.21 Air System

! ***NOTE:*** *Location and shape of air filter differs depending on brand and model.*

The air filters consist of a filter housing (F) with cover (A), clamps (B), main cartridge (D), safety cartridge (E), and evacuation valve (C). Air filtration is done in two stages. The first stage comprises a cyclone and the second stage a normal filter. Both filtration stages take place in the filter housing. The filter performance improves right up until it becomes clogged. There is an indicator that is on the filter housing to advise when the filter cartridge is clogged. The indicator is connected to the display in the cab. A warning symbol comes on in the status bar at the bottom of the display if a filter is starting to clog.

It is important to keep the air filter and air cleaner in good condition so that the exhaust gases are as clean as possible. Repeated disassembling and assembly can damage the gasket between the insert and the filter housing. Smoke and poor engine performance can be an indication of clogged filters.

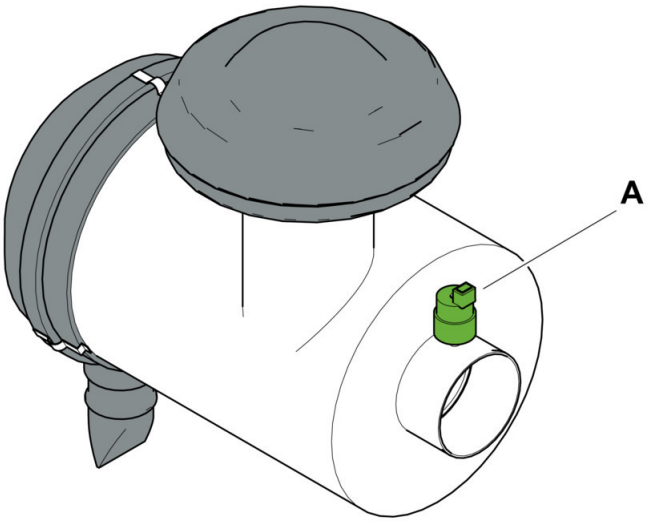
13.21.1 Air Filter Indicator Function



To ensure filter clogging is detected, the function of the air filter indicator must be checked regularly. This is done by gradually covering the air intake with a piece of wood or similar. The sensor (A) should then send a signal and the warning symbol or the warning light should come on. If a warning is not indicated, start by checking the cable connections. If there are no problems with the connections, then the sensor is faulty and must be replaced. The sensor is not included in the filter housing, but is ordered separately.

! ***NOTE:*** *Be sure to use an intact and clean piece of wood so that dirt or other particles do not enter the filter housing.*

13.21.2 Check Air Filter Indicator Lamp Function



! ***NOTE:*** *Check that no dirt or other particles enter the filter housing.*

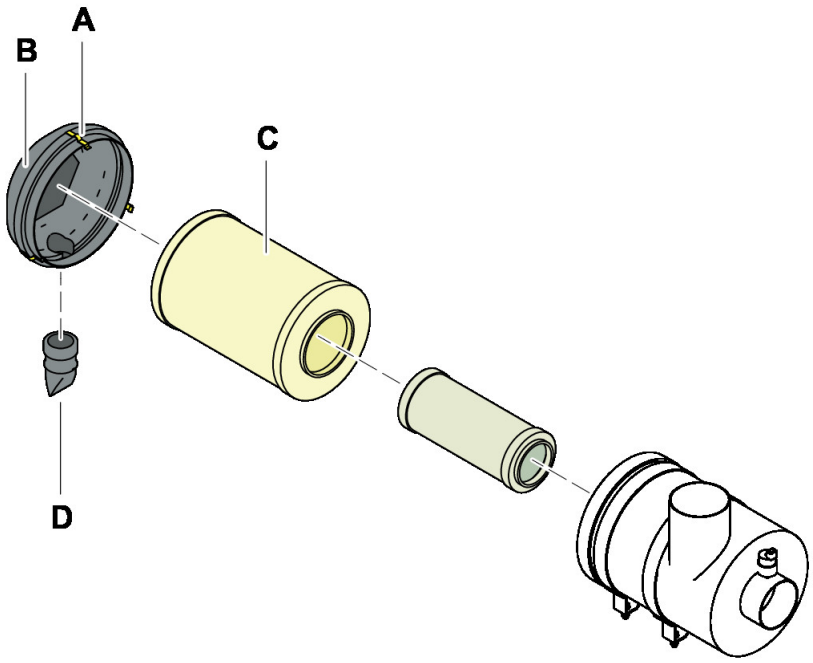
1. Remove the air intake cover on the filter housing.

2. Allow the engine to idle.
3. Use a piece of board or similar to cover part of the air intake.
4. Check that the alarm indicator lamp is turned on.
   ➔ The alarm indicator lamp is turned on.

> ! ***NOTE:*** *If an alarm indicator lamp is not turned on, check cable connections. If there are no problems with the connections, then the alarm indicator lamp (A) is faulty and must be replaced.*

5. Stop the engine and reset the alarm indicator lamp (A) by pressing the button on the indicator lamp.
6. Install the air intake cover.

13.21.3 Replace Air Filter Cartridge

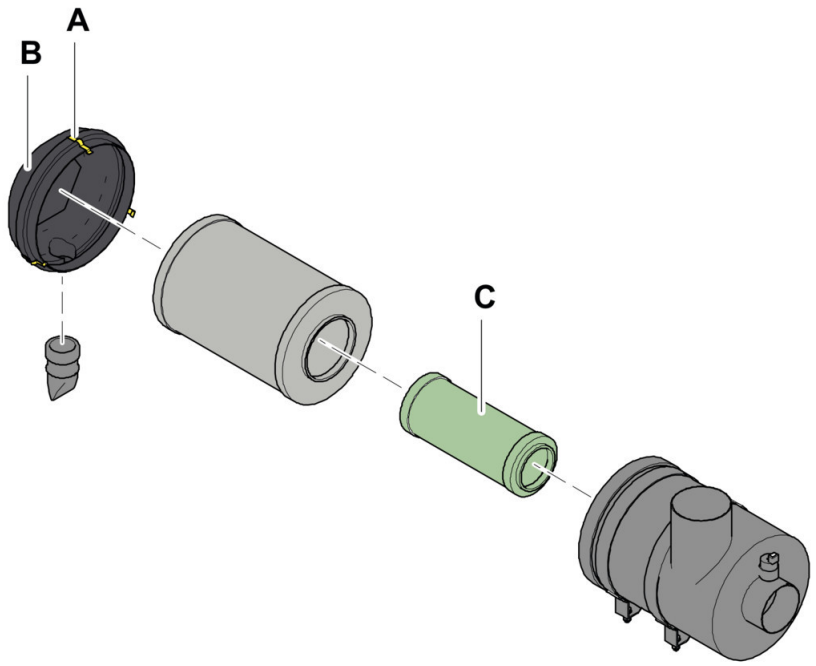


> ! ***NOTE:*** *Do not clean the filter cartridge.*

1. Remove the clamps (A).
2. Remove the cover (B).
3. Remove the filter cartridge (C).
4. Clean inside the filter housing and lid.
5. Check the evacuation valve (D).
6. Install a new filter cartridge (C).
7. Install the cover (B) and attach the clamps (A).

> ! ***NOTE:*** *Replace air filter cartridge every second year irrespective of how many hours the diesel engine has been running.*

13.21.4 Replace Air Filter Safety Cartridge



1. Remove the clamps (A).
2. Remove the cover (B).
3. Pull out the safety cartridge (C).
4. Cover the air outlet with adhesive tape.
5. Clean inside the filter housing and the lid.
6. Install the new safety cartridge (C).
7. Install the cover (B) and attach the clamps (A).

14 Cooling System

14.1 Safety Precautions before Working on Cooling System

WARNING

Burning Hazard

Hot fluids can cause severe personal injury.

- ▶ Shut off the engine.
- ▶ Wait for the diesel engine to cool down before working on the cooling system.
- ▶ Use personal protective gear.

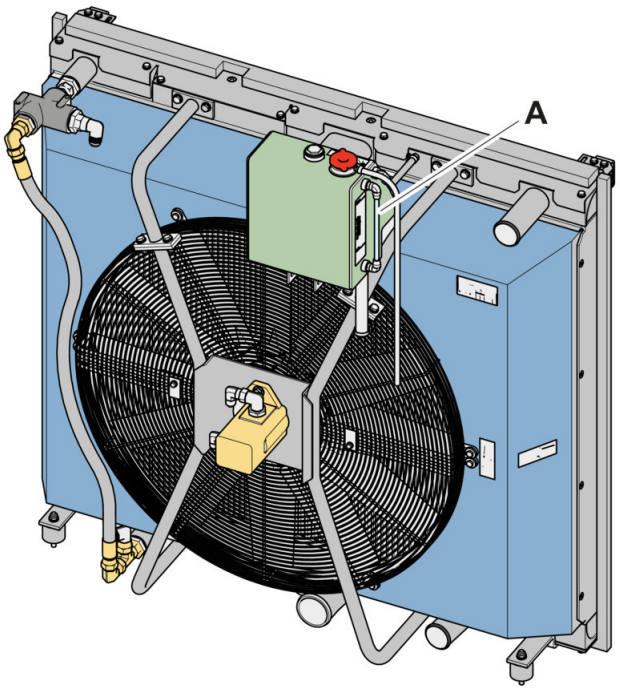
WARNING

Burning Hazard

The cooling elements may become hot during operation which can cause serious burn injury.

- ▶ Do not touch the elements until they have cooled down.
- ▶ Use personal protective gear.

14.2 Check Coolant Level

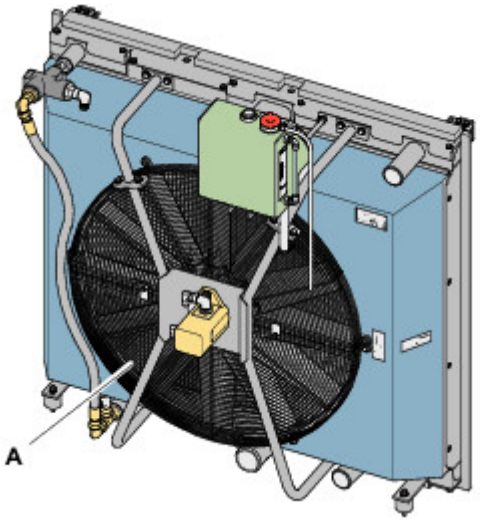


Precondition ✓ Diesel engine is cold.

- Check that the coolant level (A) is between the upper and lower mark in sight glass.

14.3 Clean Radiators

The radiators must be kept clean to maintain efficient cooling.



- Check that the radiators (A) are not clogged.

  Use compressed air to clean the radiators (A).

14.4 Adding Coolant

WARNING

Danger of Scalding and Pressure

Can cause serious personal injury.

▶ Release the pressure in the radiator before removing the radiator cap.

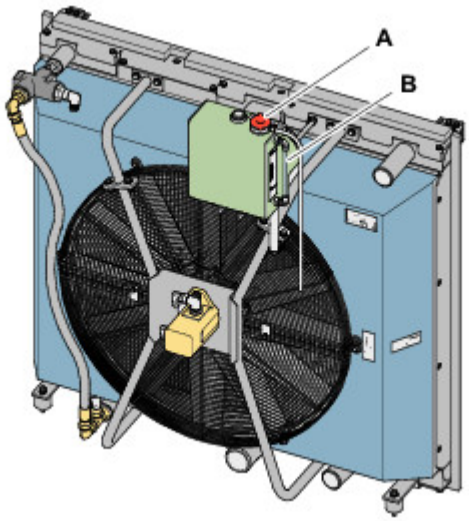
NOTICE

Mixing Coolant

Mixing coolant can damage the equipment.

▶ Do not mix the coolants.

Use only ready mixed coolant that meets ASTM with DG210.



1. Loosen the radiator cap (A) to the stop position to release the pressure in the cooling system.
2. Remove the radiator cap (A).
3. Top up the coolant until the level is between the upper and the lower mark (B).

Coolant
CAT ECL Coolant

14.5 Replace Long-term Effective Coolant

- Replace the long-term effective coolant (ECL).

See Reference Documentation
Diesel engine instruction manual

15 Electrical System

15.1 Safety Precautions before Working on Electrical System

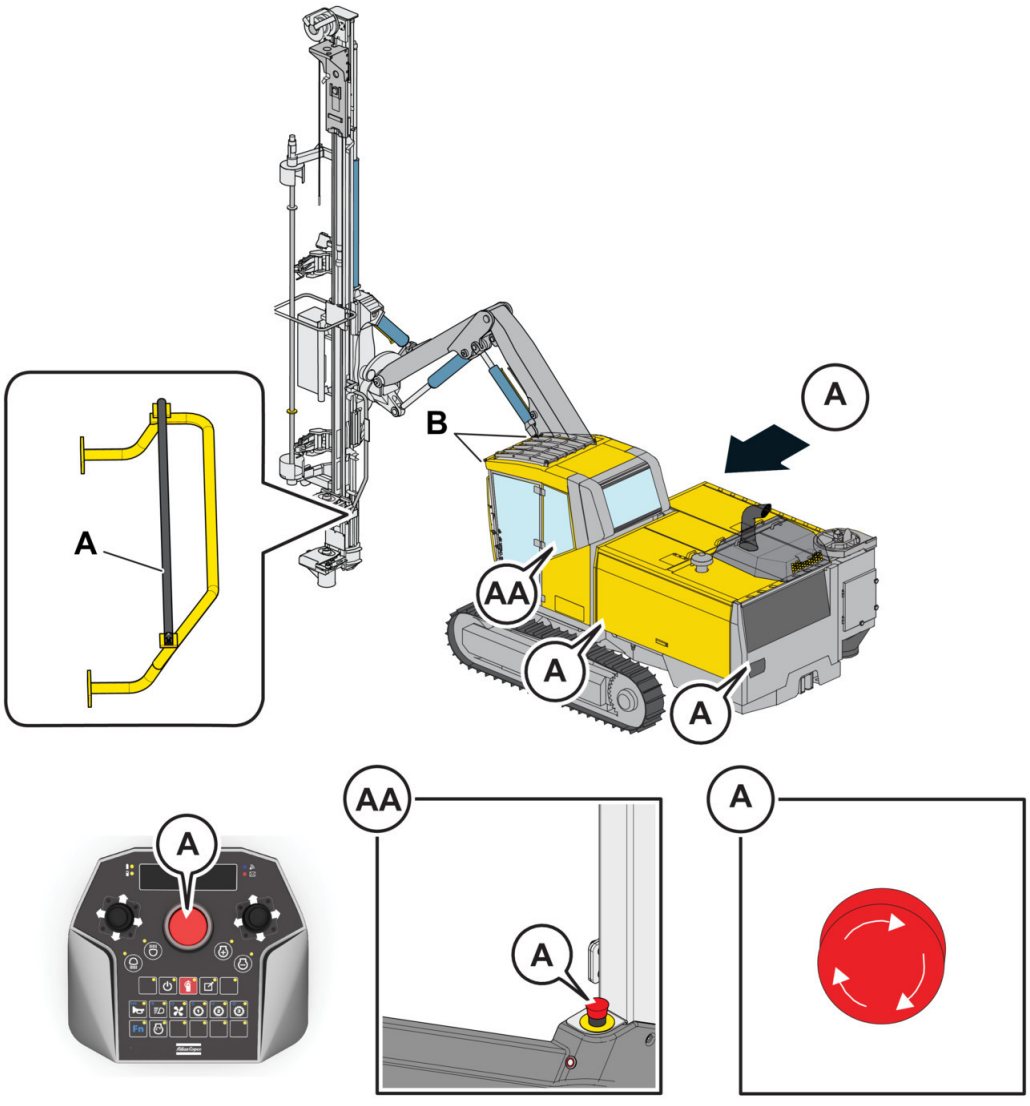
WARNING

Dangerous Voltage

Can cause severe personal injury.

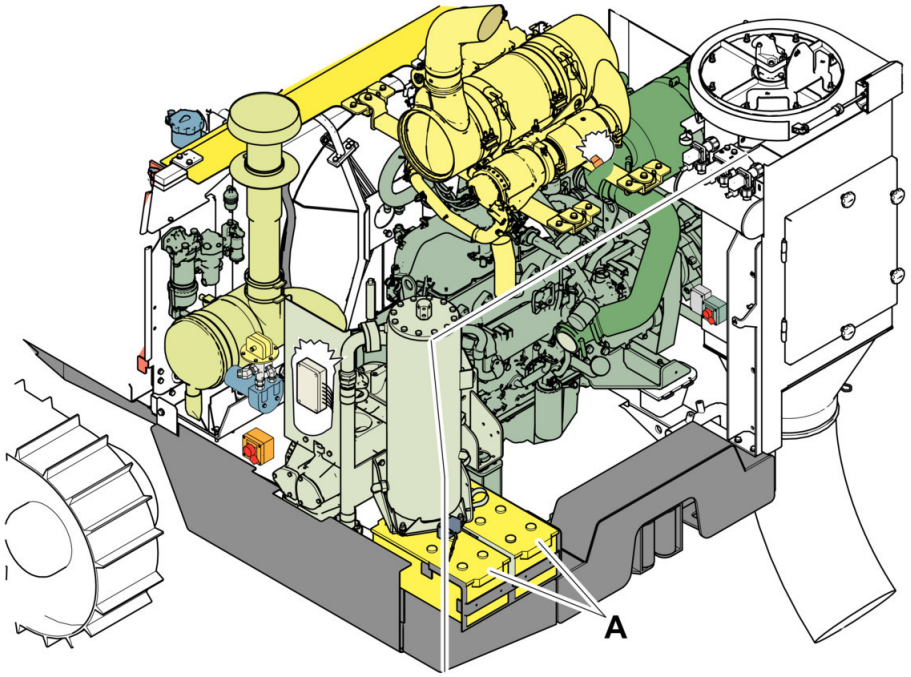
- ▶ Check that the electrical system is de-energized before starting to work.
- ▶ The electrical system must only be serviced by authorized electrician.

15.2 Check Emergency Stops and Work Lights



- Check that each emergency stop (A) stops the engine when activated. Before checking the next emergency stop, the previous emergency stop must be reset.
- Check the functionality of all work lights (B).

15.3 Check Battery



- Check electrolyte level in batteries (A).

15.4 Battery Charging

The battery is normally charged by the alternator and as well when the main power supply of the machine is on. If the battery is fully discharged for some reason, it must be recharged using a battery charger. Cell plugs must be loosened and left in the holes during charging. Batteries contain corrosive fluid. Always turn off the charge current before disconnecting the clips. If the density has not risen noticeably despite some hours of charging, the battery is probably expended. Rapid charging, when carried out correctly, does not damage the battery. Rapid charging must rarely be undertaken and is not recommended for old batteries. Repeated dischargings for long periods impair the service life of the battery. Avoid, for example, leaving the lights on while the engine is stationary. Discharging with high current is not normally harmful.

Since the 24-V electrical system is powered by two 12-V batteries that are connected in series, observe:

- The batteries must have the same capacity (Ah).
- The batteries must be the same age because the charging current required to bring a battery up to a certain voltage changes with age.
- The batteries must not be loaded unevenly.
- Series coupling maintains the same capacity but increases the voltage. For example, when 2 x 12 V 60-Ah batteries are connected in series, the voltage is 24 V but the capacity remains at 60 Ah.

- Use a 24-V charger when charging both batteries connected. Use a 12-V charger when charging each battery individually. Observe the voltage before connecting a battery charger.

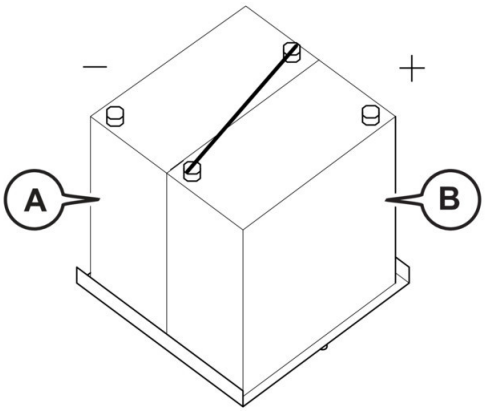
15.5 Charging Battery Using External 24-V Charger

WARNING

Risk of Fire and Explosion

Gas that is formed in the battery during charging and discharging is explosive which can cause serious personal injury and property damage.

- ▶ Avoid open flames and sparks.
- ▶ Make sure that the ventilation is good.
- ▶ Disconnect the negative terminal first, and connect it last.
- ▶ Disconnect the fire suppression system.
- ▶ Use protective safety glasses.
- ▶ Use protective gloves.



Precondition ✓ The battery isolation switch is turned off.

1. Disconnect the cable between chassis ground and the negative terminal on battery (A).
2. Connect the battery chargers positive cable to the batteries positive terminal (B).
3. Connect the battery chargers negative cable to the batteries negative terminal (A).
4. Start the battery charger.
5. Turn off the battery charger when batteries are charged.
6. Disconnect the battery chargers negative cable from the batteries negative terminal (A).
7. Disconnect the battery chargers positive cable from the batteries positive terminal (B).
8. Connect the cable between chassis ground and the negative terminal on battery (A).
9. Turn on the battery isolation switch.

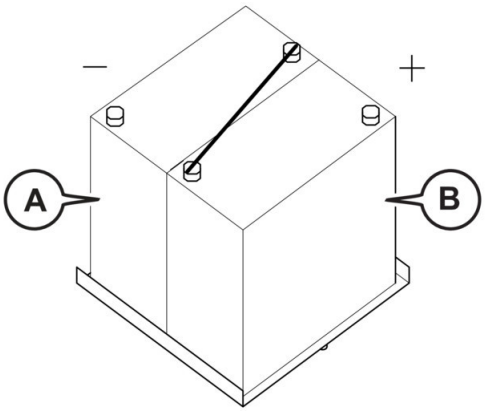
15.6 Charging Battery Using External 12-V Charger

WARNING

Risk of Fire and Explosion

Gas that is formed in the battery during charging and discharging is explosive which can cause serious personal injury and property damage.

- Avoid open flames and sparks.
- Make sure that the ventilation is good.
- Disconnect the negative terminal first, and connect it last.
- Disconnect the fire suppression system.
- Use protective safety glasses.
- Use protective gloves.



Precondition ✓ The battery isolation switch is turned off.

1. Disconnect the cable between chassis ground and the negative terminal on battery (A).
2. Disconnect the jumper lead between the negative terminal on battery (B) and the positive terminal on battery (A).
3. Connect the battery chargers positive cable to the positive terminal on battery (A).
4. Connect the battery chargers negative cable to the negative terminal on battery (A).
5. Start the battery charger.
6. Turn off the battery charger when battery (A) is charged.
7. Disconnect the battery chargers negative cable from the negative terminal on battery (A).
8. Disconnect the battery chargers positive cable from the positive terminal on battery (A).
9. Connect the battery chargers positive cable to the positive terminal on battery (B).
10. Connect the battery chargers negative cable to the negative terminal on battery (B).
11. Start the battery charger.
12. Turn off the battery charger when battery (B) is charged.

13. Disconnect the battery chargers negative cable from the negative terminal on battery (B).
14. Disconnect the battery chargers positive cable from the positive terminal on battery (B).
15. Connect the jumper lead between the negative terminal on battery (B) and the positive terminal on battery (A).
16. Connect the cable between chassis ground and the negative terminal on battery (A).
17. Turn on the battery isolation switch.

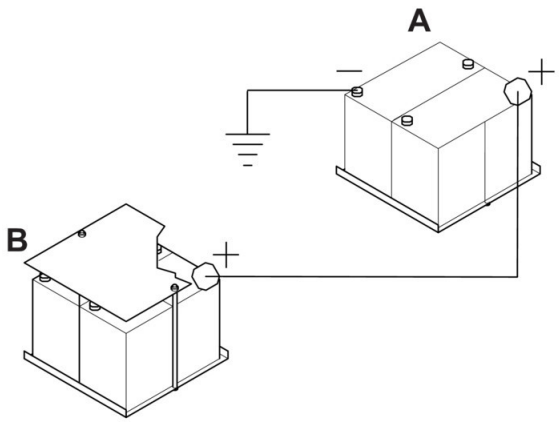
15.7 Starting with Auxiliary Battery

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 protective safety glasses.
- ▶ Use protective gloves.



Precondition ✓ The RCS system on the control system panel is turned off.

✓ The fire suppression system is disconnected.

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).
3. 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).

16 Control System and Sensors

16.1 Remote Control Batteries

- The remote control batteries must be fully discharged and then fully recharged regularly.
- Charging can only take place in the temperature range of +10 °C to +40 °C (+50 °F to +104 °F).
- NiCd batteries can be partially charged or discharged before arrival. Batteries must always be fully charged before use.

! ***NOTE:*** *Protect the batteries against short circuiting. Do not store them in a tool box or loose in a pocket together with metal objects as these can short circuit the battery.*

16.2 Cleaning Remote Control

The remote control may require cleaning. It is important that the remote control is not damaged.

- Make sure the active stop on the remote control is not blocked by dirt or similar.
- The battery contacts should be cleaned and lubricated at regular intervals.
- To clean the remote control use a damp rag or a fine brush to remove dirt and dust.

! ***NOTE:*** *Never clean the remote control using high-pressure or steam washing. Strong chemicals can destroy the remote control rubber bellows.*

17 Compressed Air System

17.1 Safety Precautions before Working on Pneumatic System

WARNING

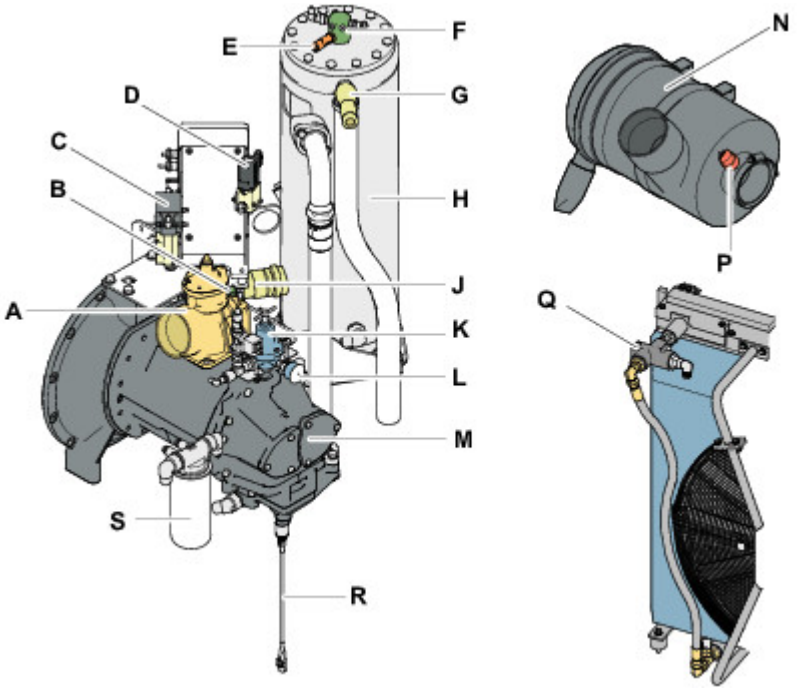
High System Pressure

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.

17.2 Overview Air Compressor System

The machine is installed with a single-stage screw compressor. The diesel engine drives the machine. The compressed air from the compressor flows to an air receiver, which also functions as an oil separator. Most the oil is removed in the air tank by centrifugal force. The remaining oil is separated in an oil separator element in the air receiver. The separated oil is collected in the lower section of the air receiver, which functions as an oil tank.



Compressor System Parts

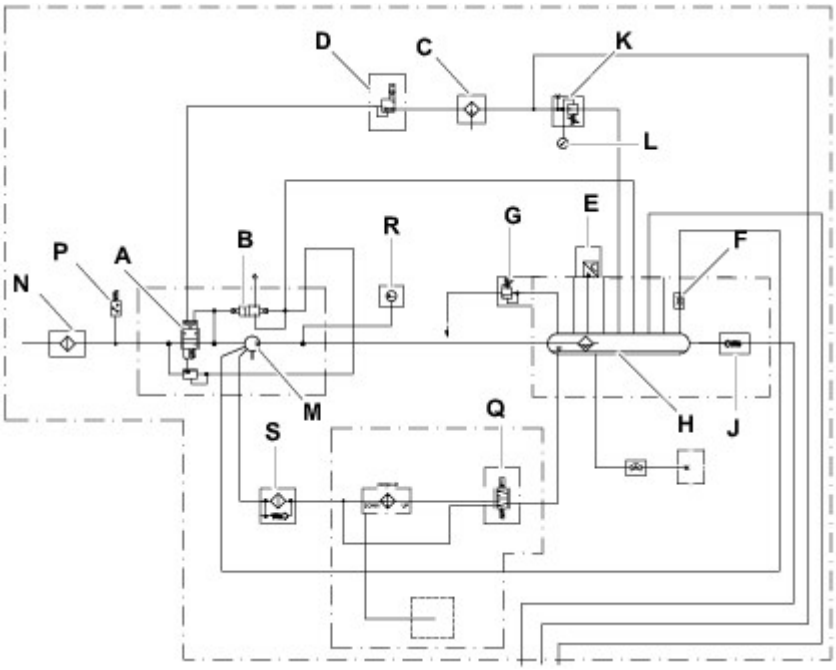
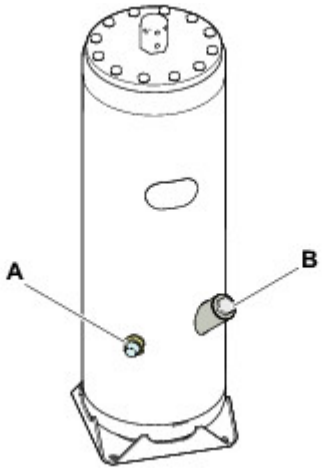


Diagram Air Compressor System

A	Intake valve
B	Outlet valve
C	Air filter
D	Air valve (pressure regulator)
E	Pressure sensor
F	Restriction
G	Safety valve
H	Pressure tank
J	Minimum pressure valve
K	Pressure reducing valve
L	Pressure gauge
M	Compressor
N	Air filter
P	Air filter switch
Q	Thermostat
R	Temperature sensor
S	Oil filter

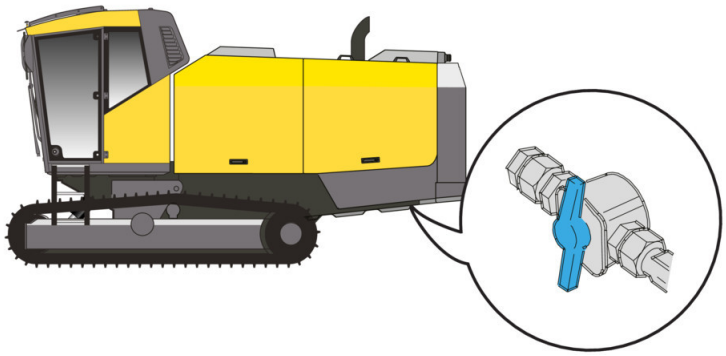
17.3 Check Compressor Oil Level



Precondition ✓ The machine is parked on a flat and level surface.

1. Switch off the machine and allow the oil level to settle for at least 5 minutes.
2. Check that the indicator on the gauge (A) is in the green zone.
3. Fill with oil through inlet (B), if necessary. Use the correct amount and oil grade.

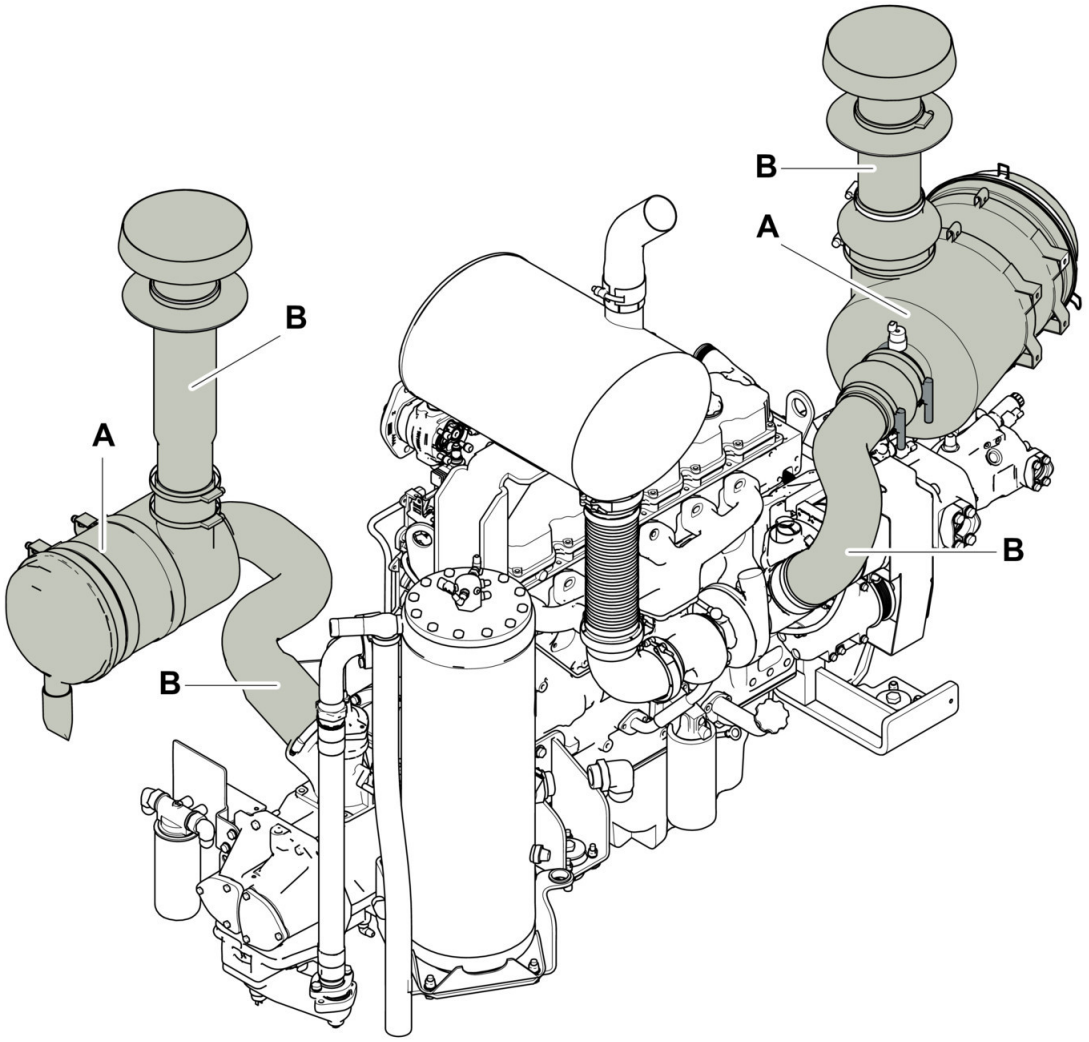
17.4 Drain Water Condensation from Compressor Tank



Precondition ✓ The machine has been shut down for eight hours.

- Open the drain plug below the machine and drain off the water.

17.5 Check Compressor Components



- Check for signs of oil or water or air leakage on the compressor (A).
- Check connections and couplings on intake manifolds (B) on the air filters for compressor and diesel engine.

17.6 Oil Change and Oil Filter Replacement

Oil grade and operating temperature determines the intervals for oil change. The prescribed interval is based on an oil temperature of up to 120 ºC (248 ºF) and normal operating conditions. Oil must be changed more frequently when working in high ambient temperatures or dusty or damp conditions.

The system must be flushed clean before new oil is filled if the oil is

- Contaminated by incorrect oil.
- Broken down due to excessive temperature.
- Used beyond the operating interval.

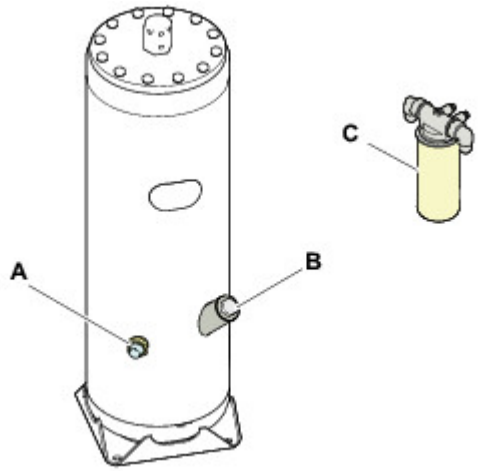
17.7 Replace Air Compressor Oil and Oil Filter

WARNING

Risk of Fire and Explosion

Using incorrect or old oil may lead to a risk of fire or explosion in the compressor system

- ▶ Use correct, new oil according to the Fluids and Lubricating Greases manual.

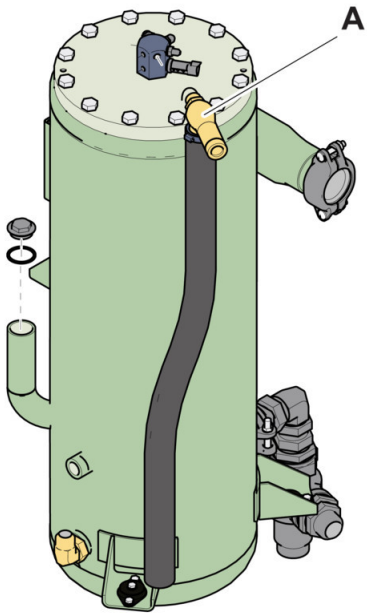


1. Run the compressor to operating temperature and confirm that the pressure is zero.
2. Place the vessel below the drain plug to collect the oil.
3. Loosen the oil filler plug (B) one turn to release pressure from the system.
4. Drain the oil through the drain plugs for compressor tank, compressor cooler, and compressor element.
5. Tighten the plugs after draining.
6. Place the vessel below the filter (C) to collect the oil.
7. Remove the compressor oil filter (C).
8. Clean the filter seat on the manifold using new oil, and make sure that no dirt enters into the system.
9. Lubricate the gasket on the new filter.
10. Replace with new filter.
11. Remove the filler plug (B) and fill oil into the compressor tank until the oil level reaches the filler pipe.

    The indicator on the gauge (A) must be in the upper section of the green zone.
12. Insert and tighten the filler plug.
13. Operate the compressor without any load for several minutes to circulate the oil and force out any air in the oil system.
14. Stop the compressor, let the oil to settle for several minutes.
15. Repeat steps 10 and 11.

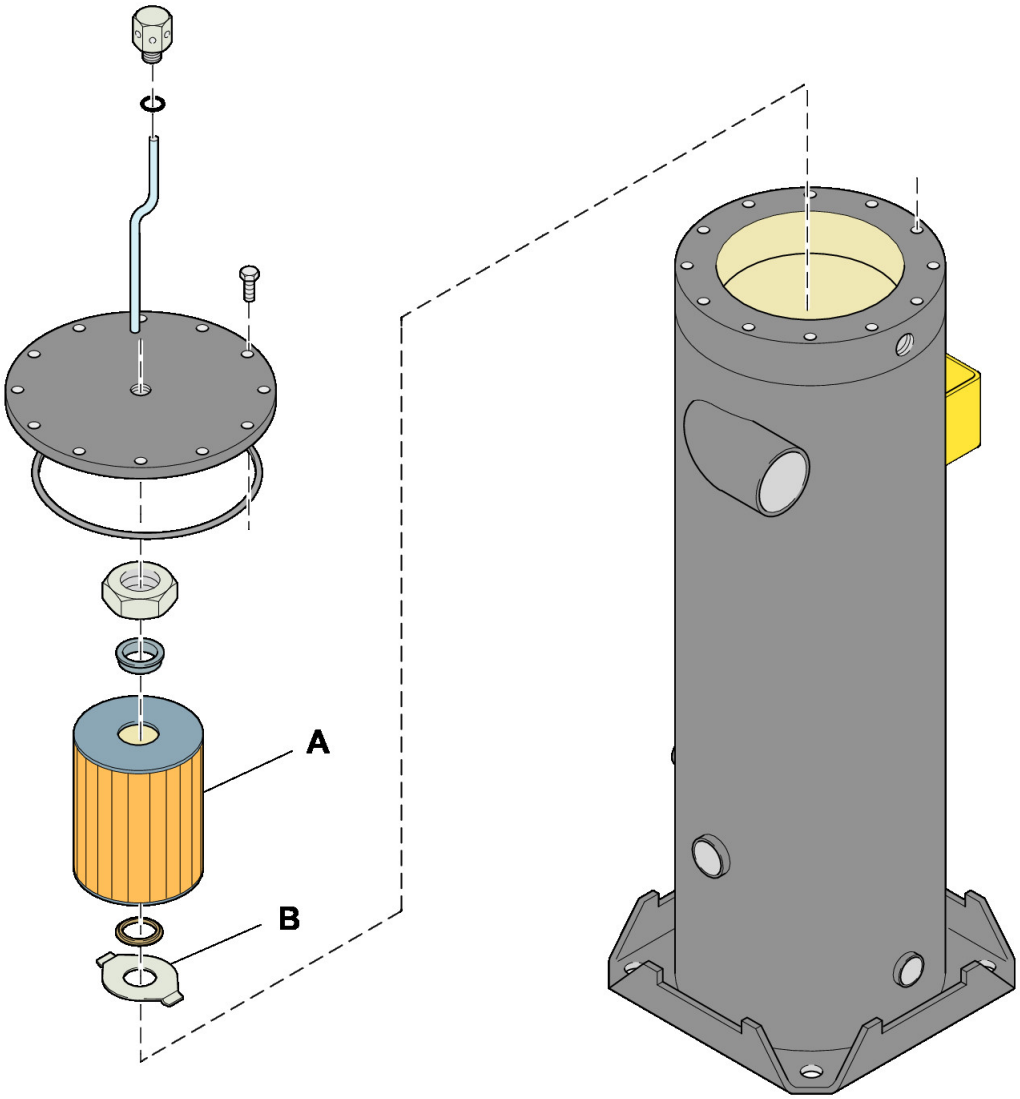
> ! ***NOTE:*** *If the oil has been contaminated, the system must be flushed clean before new oil is filled.*

17.8 Check Safety Valve on Compressor System



- Perform a 15 bar (217 psi) pressure test on the safety valve (A).

17.9 Replace Separator Filter



- Replace the separator filter (A) in the pressure tank.

> **NOTE:** *Check that the washer (B) under the filter remains in place. Do not throw it away with the old filter during replacement.*

17.10 Changing to New Type of Compressor Oil

To avoid problems when changing to a new type of oil, a special procedure for compressor oil flushing must be followed. The table is only applicable if the replaced oil has not passed its expiration date. Old oil is best detected by using an analysis program for oil samples, SOS (Scheduled Oil Sampling). Indications that the oil is old are that it has a strong odor, there are contaminants such as sediments inside the oil reservoir and the stop valve, or the oil has a brownish color.

	Paroil M	**Paroil S**	**Paroil Sxtreme**
Paroil M	Drainage *	Flushing	Flushing
Paroil S	Drainage **	Drainage *	Drainage

Paroil Sxtreme	Drainage **	Drainage	Drainage *

* When changing to the same oil within the interval between changes, drainage is sufficient

** Changing not recommended

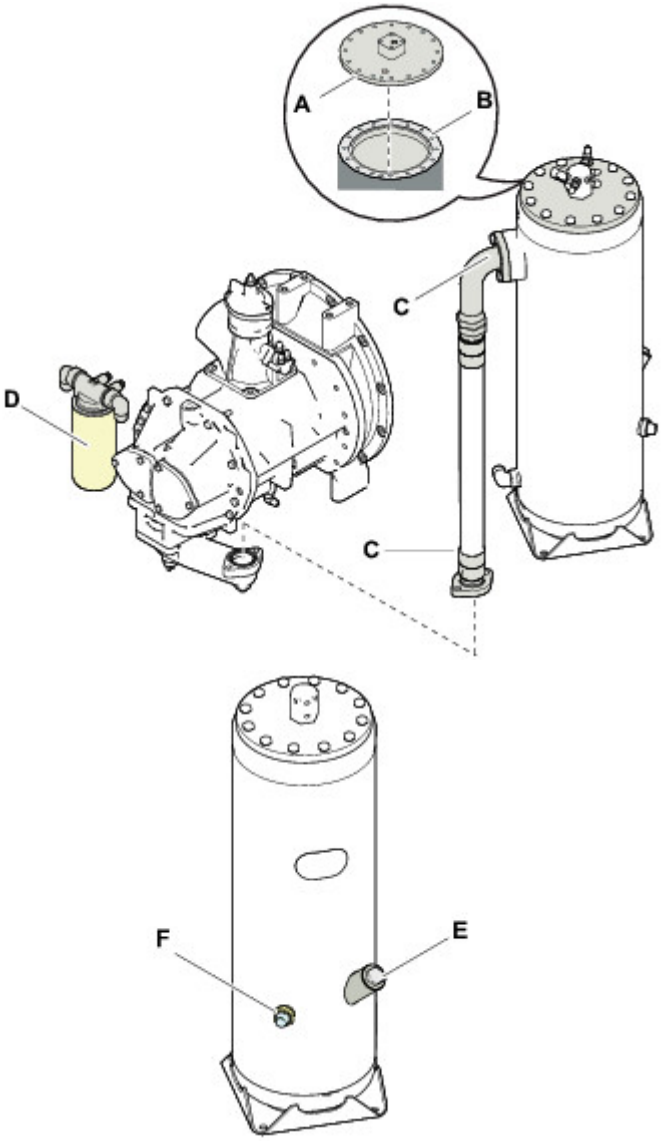
17.11 Flushing Air Compressor

WARNING

Risk of Fire and Explosion

Using incorrect or old oil may lead to a risk of fire or explosion in the compressor system

▶ Use correct, new oil according to the Fluids and Lubricating Greases manual.



Precondition ✓ Run the compressor to operating temperature and confirm that the pressure is zero.

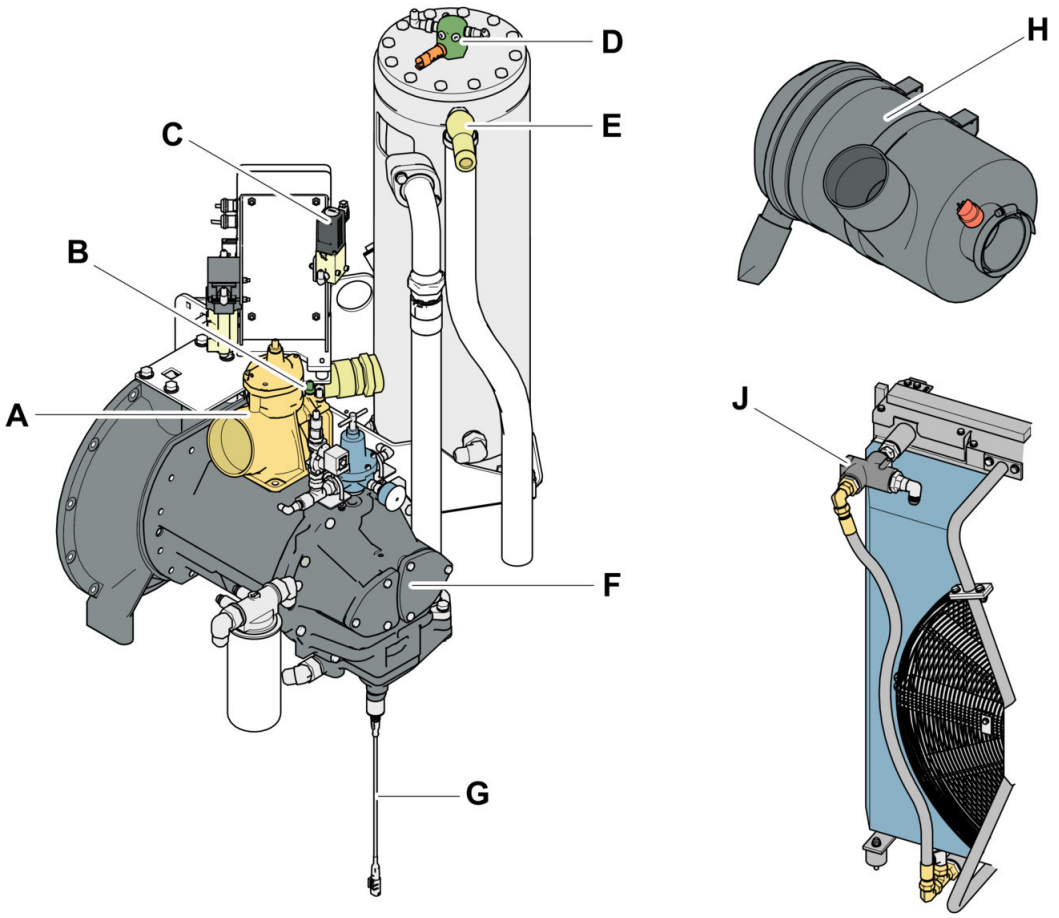
1. Place vessels under the drain plugs.

2. Remove drain plugs for compressor tank, compressor cooler, and compressor element and drain the oil.
3. Install and tighten the plugs.
4. Remove the oil filters (D).
5. Open the cover plate (A) on the air reservoir and remove the oil separator element.
6. Check inside the oil reservoir (B).
   ➔ If sediments are detected, the parts (A, B, and C) must be thoroughly cleaned before the procedure is completed.
7. Insert a new oil separator element and install the cover plate (A).
8. Clean the filter seat on the manifold using new oil, and make sure that no dirt falls down into the system.
9. Lubricate the gasket on the new filters with new oil.
10. Replace the filters (D) and close the valve.
11. Fill the oil reservoir with the minimum amount of oil permissible through the oil inlet (E).
12. Run the compressor that is unloaded in light mode for 30 minutes.
13. Drain the oil.
14. Fill the system with new oil.

    The indicator on the gauge (F) must be in the upper section of the green zone.
15. Run the compressor without load in light mode for 15 minutes and check for leaks.
16. Check that the oil level on the gauge is in green zone. Top up if necessary.

17.12 Troubleshooting Air Compressor

Use the troubleshooter to help solve mechanical problems. It is assumed that the diesel engine is in good condition.



Air Compressor System

Fault Symptom	Possible Faults	Action
The compressor is automatically loaded to full capacity after starting.	The intake valve (A) has jammed in open position	Remove and inspect the intake valve, replace parts if necessary.
	Air is leaking in the control system	Check hoses and connections for leaks. Stop leaks and replace leaking hoses.
	Freezing problems in the control circuit	Operate the machine with the intake valve (A) activated. Run the machine to operating temperature together with the compressor system heating cable. Turn the valve (A) back after approximately 15 minutes and check that the compressor is not loaded.
	The air valve (C) is faulty	Check that the contact is connected. Check the air valve for faults and replace if necessary.
The compressor does not provide air when flushing or pressure is required	The air valve (C) has no power supply	Check the electrical wiring and connection.
	The intake valve (A) has jammed in closed position	Remove and inspect the intake valve, replace parts if necessary.

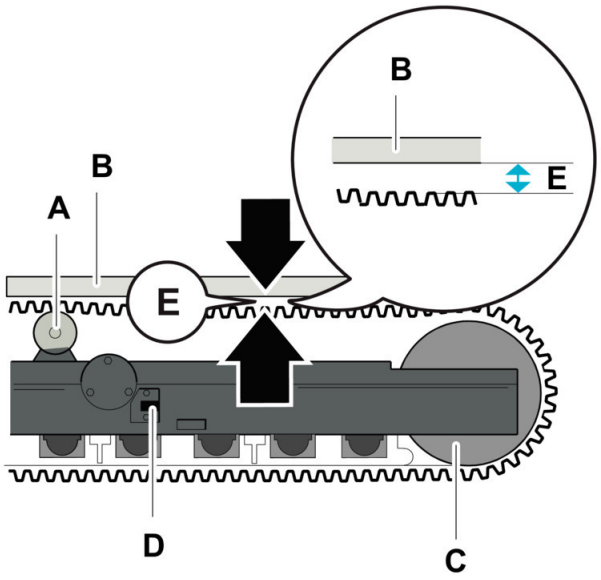
Fault Symptom	Possible Faults	Action
	The air valve (C) is faulty	Check the air valve for faults and replace if necessary.
Excessive oil consumption. Oil mist emerges from the drill bit. Compressor oil in the DCT filter and cleaning valves	Oil level too high	Ease the pressure, wait for approximately 30 minutes. Check if the oil level is too high and drain to the correct level if necessary.
	The restriction (D) is clogged	Remove the hoses and clean the restriction
	Oil separator filter faulty	Call a service technician from Epiroc to remove and inspect the oil filter
Compressor capacity or pressure below normal	The air consumption exceeds compressor capacity	Check the connected equipment for leaks.
	Blocked air filter element (H)	Remove and inspect the air filter elements. Replace if necessary.
	The air valve (C) is faulty	Check the air valve for faults and replace if necessary.
	Oil separator filter blocked	Check the oil separator filter for blockage and replace if necessary.
	The intake valve (A) is still partly closed	Remove and inspect the intake valve, replace parts if necessary.
	The safety valve (E) is leaking	Remove and inspect the safety valve. Replace the safety valve if it is not air tight after reinstallation.
	The outlet valve (B) is leaking	Check the outlet valve for leaks and replace if necessary.
Air and oil mist is escaping from the air filters (H)	If it mainly consists of air: check the intake valve (A)	Remove and inspect the valve, replace if necessary. Replace air filter elements and safety cassettes. Check the oil level and fill with oil if necessary. Operate the unit for several minutes, stop, and check the oil level again.
The compressor is overheated	Insufficient compressor cooling	Check the fan speed.
	The oil cooler is clogged externally	Clean the oil cooler.
	The oil cooler is clogged internally	Contact Epiroc.

Fault Symptom	Possible Faults	Action
	Low oil level	Before checking the oil level, wait for about 30 minutes after the unit has stopped. Check the oil level and top up with oil, if necessary.
	The thermostatic safety valve (J) stalls in closed position	Remove and check the thermostat for the correct opening and closing temperature. Replace the valve in the event of incorrect function.
	Faulty cooling fan	Replace the fan.
	Temperature sensor (G) faulty	Check the temperature sensor and replace if faulty.
Air emission temperature above normal value	Compressor element (F) is not in order	Contact Epiroc

18 Track Frames

18.1 Check Tension of Crawler Tracks

Track tension is checked between the front wheel (C) and carrier roller (A).



Precondition ✓ The machine is parked on a flat and level surface.

✓ Tracks are under normal load.

1. Place a leveling board (B) on top of each track and maintain a clearance (E) between them.

   > ! ***NOTE:*** *If the tracks do not have a carrier roller (A), position the leveling board between the end wheels with a maximum of 50 mm (1.96 in) slack in the center.*

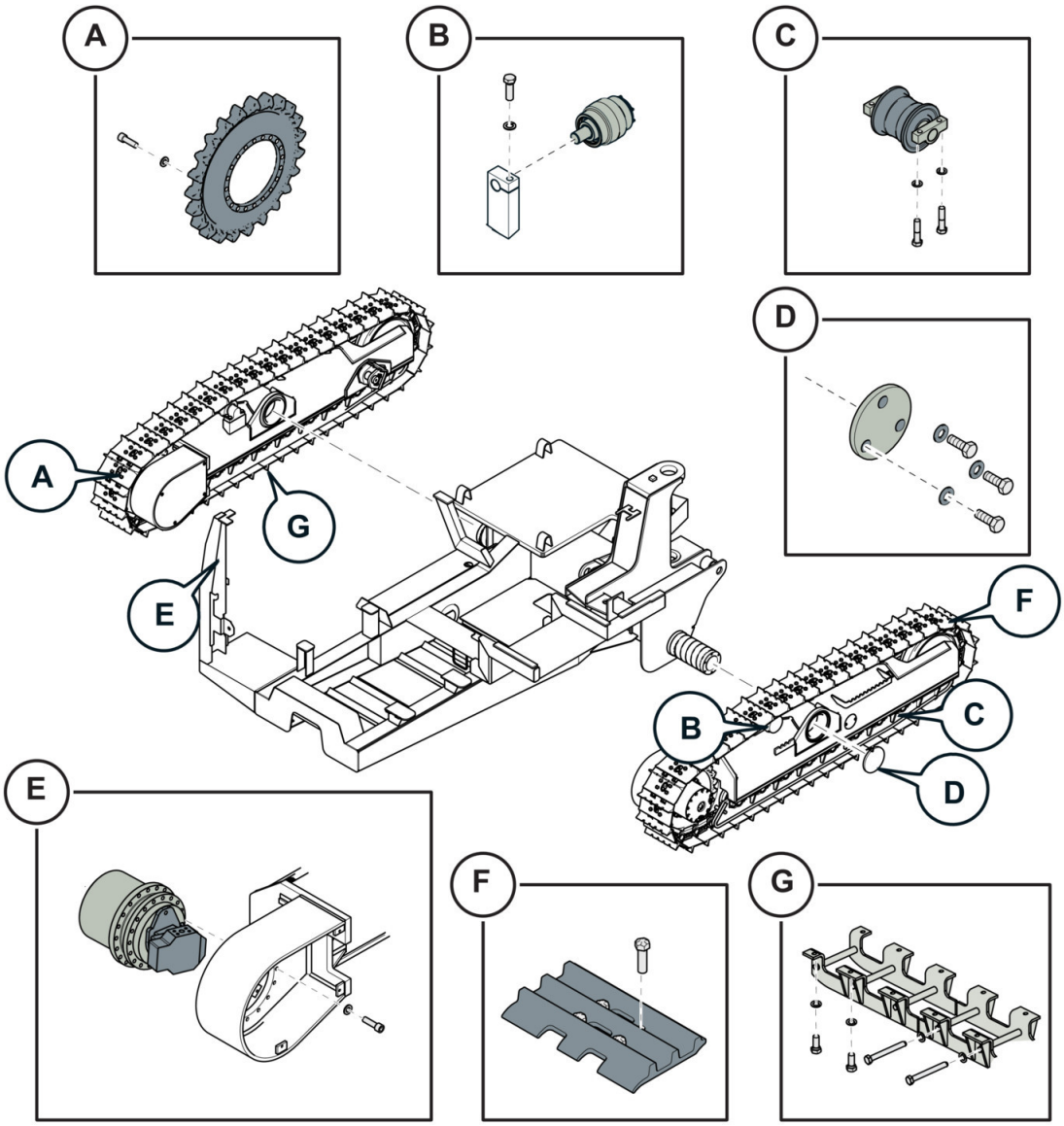
2. Fill grease through the nipple (D) to tension the track.

   > ! ***NOTE:*** *Do not use this grease nipple during lubrication, it is used only during this procedure.*

3. If the track tension becomes too tight, grease can also be drained from the tension cylinder by loosening the nipple (D).

Clearance (E)	5–15 mm

18.2 Checking Tightening Torques on Track Frames



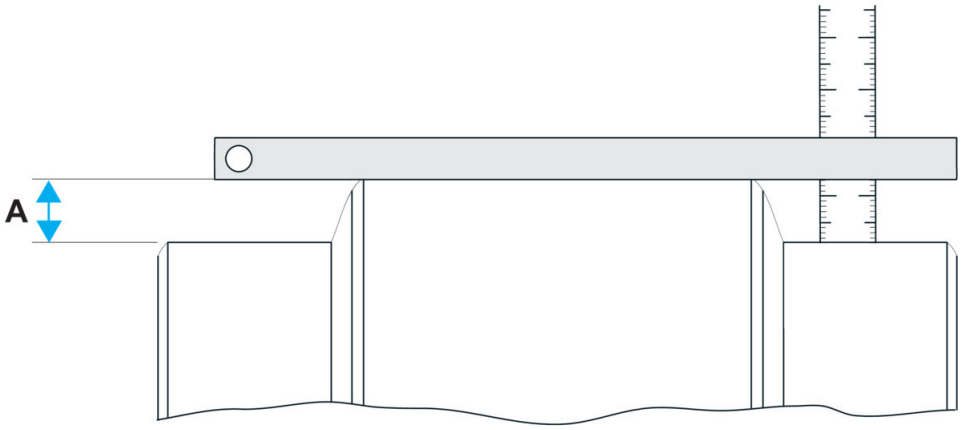
- Check tightening torques on track frames.

	Size	Torque	Quantity/Track Frames
A	M16	347 Nm (256 lbf.ft)	20
B	M16	289 Nm (213 lbf.ft)	1
C	M16	289 Nm (213 lbf.ft)	32
D	M12	90 Nm (66 lbf.ft)	3
E	M16	347 Nm (256 lbf.ft)	18
F	M14	260 ± 10 Nm (192 ± 7 lbf.ft)	176
G	M16	289 Nm (213 lbf.ft)	28
G	M16	289 Nm (213 lbf.ft)	10

18.3 Procedures for Checking Wear

- When components on the track frames are worn down to the minimum recommended levels, they must be replaced with new components.
- Regular and accurate measuring is required in order to establish the extent of the wear and when replacement is necessary.
- The components must be thoroughly cleaned for measuring.
- Measurements must be taken at several points. The degree of wear is determined by the maximum value, not the average value.

18.3.1 Check Front Wheel for Wear



■ Check the wear by measuring the distance (A) between the top and bottom of the front wheel.

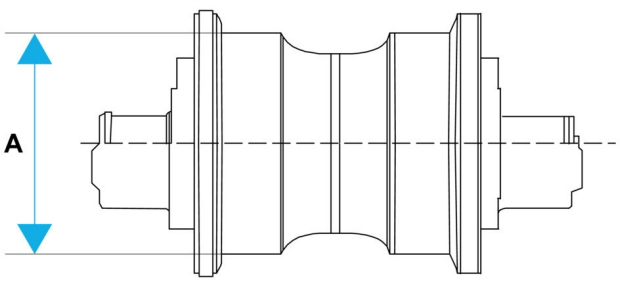
Specification	Metric Data	Imperial U.S Data
New Front Wheel	17 mm	0.66 in
Wear 25%	17.2 mm	0.67 in
Wear 50%	17.4 mm	0.68 in
Wear 75%	17.6 mm	0.69 in
Wear 100%	17.8 mm	0.70 in

Also see about this

Procedures for Checking Wear [▶ 113]

18.3.2 Check Track Roller for Wear

■ Check the wear by measuring the diameter (A) of the track rollers.



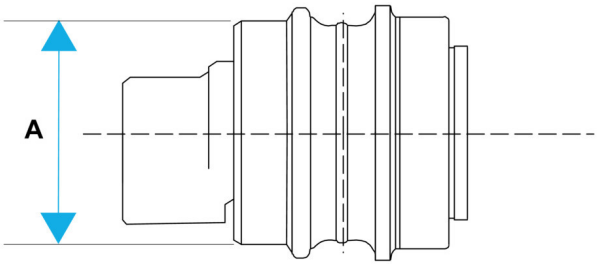
Specification	Metric Data	Imperial U.S Data
New Track Roller	160.0 mm	6.30 in
Wear 25%	159.5 mm	6.27 in
Wear 50%	159 mm	6.25 in
Wear 75%	158.5 mm	6.24 in
Wear 100%	158 mm	6.22 in

Also see about this

Procedures for Checking Wear [▸ 113]

18.3.3 Check Carrier Roller for Wear

- Check the wear by measuring the diameter (A) of the carrier roller.



Specification	Metric Data	Imperial U.S Data
New Limberoller	140 mm	5.51 in
Wear 25%	139.5 mm	5.49 in
Wear 50%	139 mm	5.47 in
Wear 75%	138.5 mm	5.45 in
Wear 100%	138 mm	5.43 in

Also see about this

Procedures for Checking Wear [▸ 113]

18.3.4 Check Track Shoe for Wear

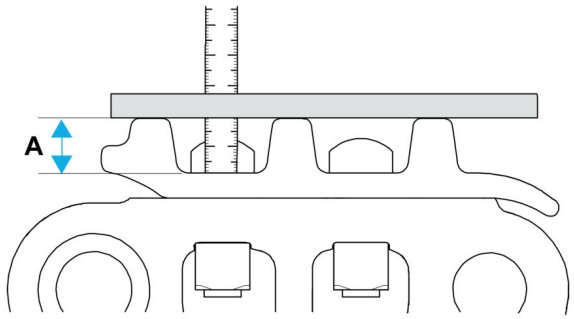
CAUTION

Increased Risk of Sliding

Worn track shoes reduce the friction with the ground considerably and increase the risk of sliding

▶ Always follow the maintenance recommendation for wear of track shoes.

- Check the track shoe wear by measuring the distance (A) between the top and bottom of the track shoe.



Specification	Metric Data	Imperial U.S Data
New Track Shoe	22 mm	0.86 in
Wear 25%	21.2 mm	0.83 in
Wear 50%	20.4 mm	0.80 in
Wear 75%	19.6 mm	0.77 in
Wear 100%	18.8 mm	0.74 in

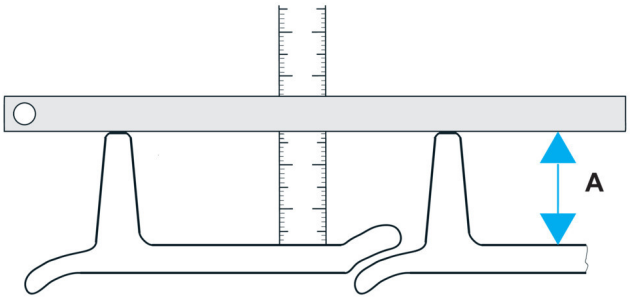
Also see about this

Procedures for Checking Wear [▷ 113]

18.3.5 Check Track Shoe for Wear

Precondition

- Check the track shoe wear by measuring the distance (A) between the top and bottom of the track shoe.



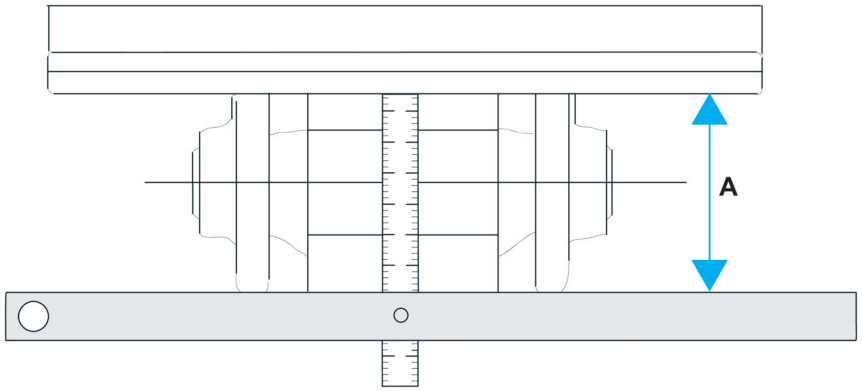
Specification	Metric Data	Imperial U.S Data
New Track Shoe	47.0 mm	1.85 in
Wear 25%	40.9 mm	1.61 in
Wear 50%	34.2 mm	1.35 in
Wear 75%	27.5 mm	1.08 in
Wear 100%	20.8 mm	0.82 in

Also see about this

Procedures for Checking Wear [▷ 113]

18.3.6 Check Track Link Depth for Wear

■ Check the wear by measuring the dimension (A) for the chain.



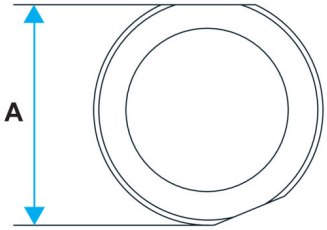
Specification	Metric Data	Imperial U.S Data
New Chain	83.0 mm	3.27 in
Wear 25%	81.6 mm	3.22 in
Wear 50%	79.8 mm	3.15 in
Wear 75%	77.9 mm	3.07 in
Wear 100%	75.7 mm	2.98 in

Also see about this

Procedures for Checking Wear [▸ 113]

18.3.7 Check Bushing for Wear

■ Check the wear by measuring the dimension (A) for the bushing.



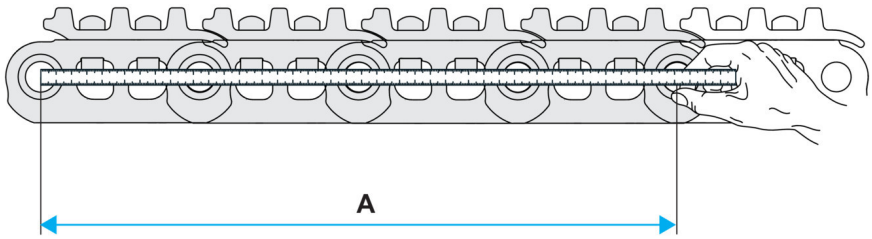
Specification	Metric Data	Imperial U.S Data
New Bushing	45 mm	1.771 in
Wear 25%	44.9 mm	1.767 in
Wear 50%	44.8 mm	1.763 in
Wear 75%	44.7 mm	1.759 in
Wear 100%	44.6 mm	1.755 in

Also see about this

Procedures for Checking Wear [▸ 113]

18.3.8 Check Track Chain Elongation for Wear

- Check chain wear by measuring the distance (A) between the center point in the first pin to the center point of the fifth pin.

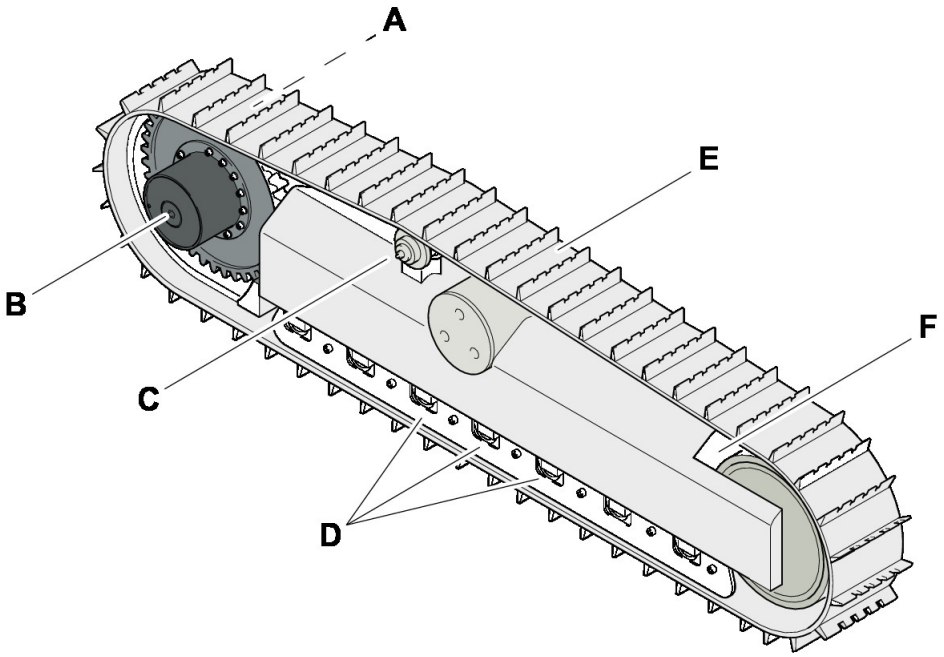


Specification	Metric Data	Imperial U.S Data
New Track Roller	640 mm	25.19 in
Wear 25%	640.5 mm	25.21 in
Wear 50%	641 mm	25.23 in
Wear 75%	641.5 mm	25.25 in
Wear 100%	642 mm	25.27 in

Also see about this

Procedures for Checking Wear [▷ 113]

18.4 Check Track Frames



- Check for signs of leakage on the traction motor (A).
- Check for signs of leakage on the traction gears (B).
- Check for signs of leakage on the carrier roller (C).
- Check for signs of leakage on the track rollers (D).

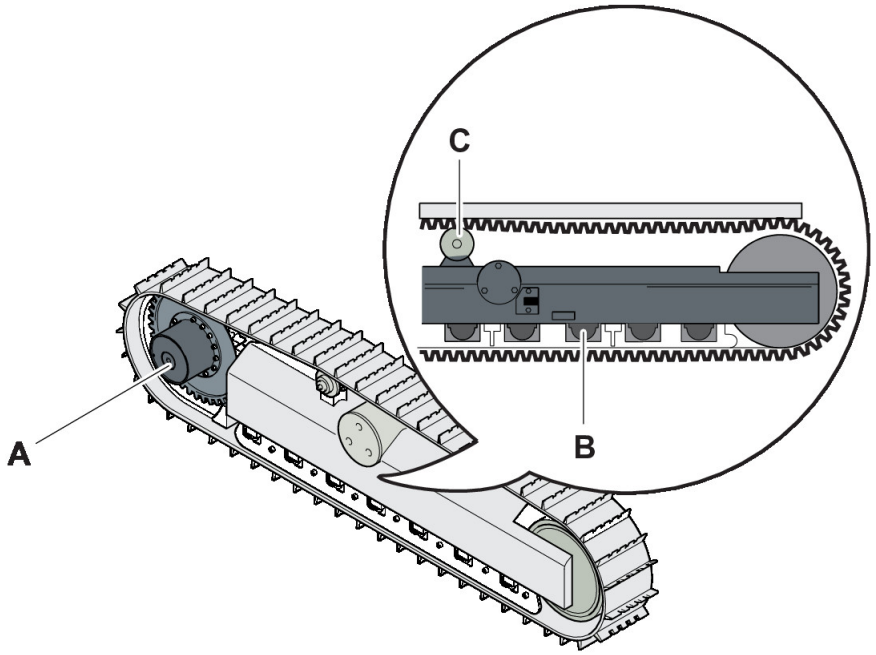
- Visually inspect the tension on the crawler tracks (E).
- Check that the springs and dampeners move freely on the front wheel (F). Clean, if necessary.
- Check for loose screws and nuts.

18.5 Check Track Frames

- Check for signs of leakage on the traction gears (A).
- Pump grease into the grease nipples (B).
- Check for signs of leakage on the front wheel (C) and damper.
- Check the position of the damper (D).

  Replace the chain if the slide block sticks out more than 50 mm (1.9 in.) outside the frame.
- Tighten all attachments.

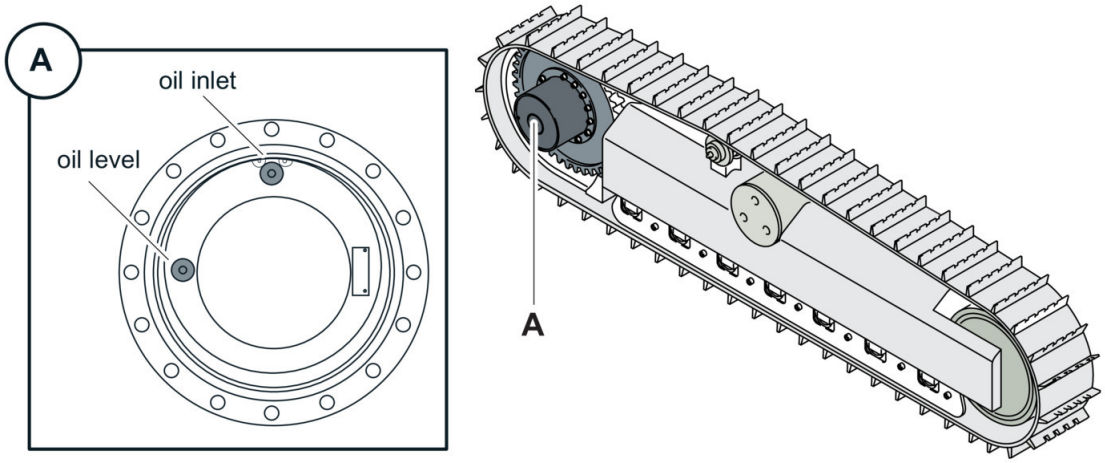
18.6 Check Track Frames



- Check oil level on the traction gear (A).

  Position the level plug on the traction gear at 9 o'clock to check the level of the oil.
- Check for signs of leakage on the track rollers (B).
- Check for signs of leakage on the carrier roller (C).
- Check for any damage to the frame.
- Tighten all attachments.

18.7 Replace Oil on Traction Gears for Track Frames



Precondition ✓ The inlet plug on the traction gear is positioned at 12 o'clock.

1. Flush the gear with oil.
2. Fill the traction gear (A) with new oil until some oil drains from the oil level bore.

Traction Gear Volume
2 liters (0.5 gallon)

19 Water Mist System

NOTICE

Damage to Water Mist Pump

Risk of damage to water mist pump if it is run without water in the system.

- ▶ Do not run the pump without water in the system.

NOTICE

Risk of Damage to Water Mist System

During cold weather, the water in the water mist system can freeze and damage the system when the machine is turned off for a prolonged period.

- ▶ Drain the water mist tank.
- ▶ Flush anti-freeze through the system.

NOTICE

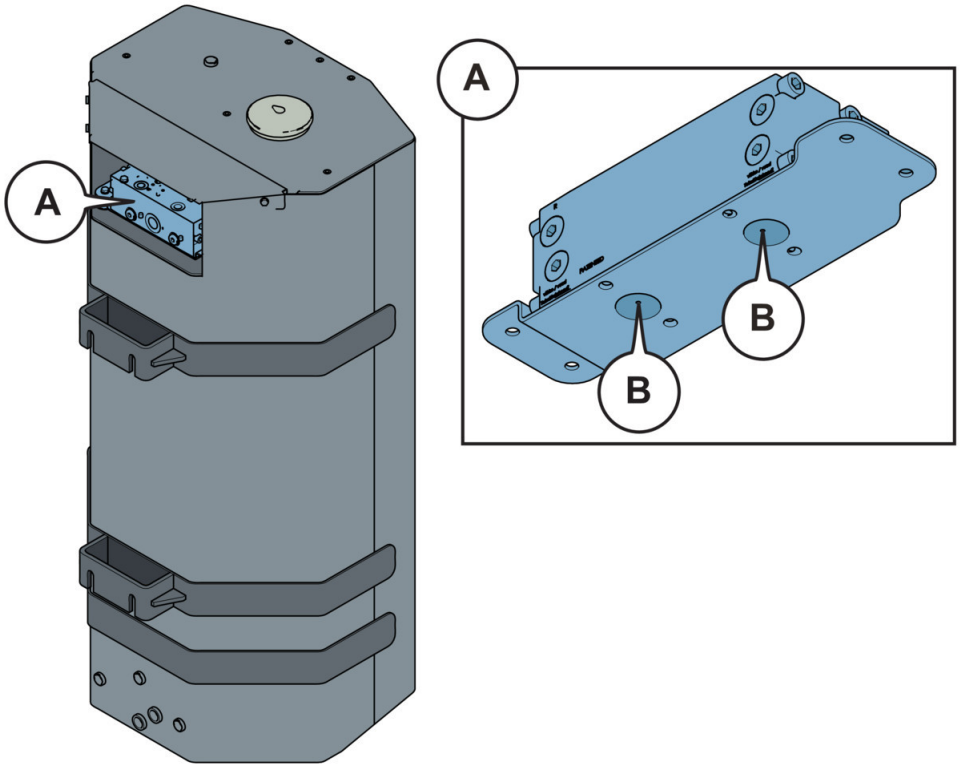
Risk of Damage to DCT

When dust collecting in the DCT is damp or water starts flushing out of the drill hole, hoses and filters in the DCT can clog.

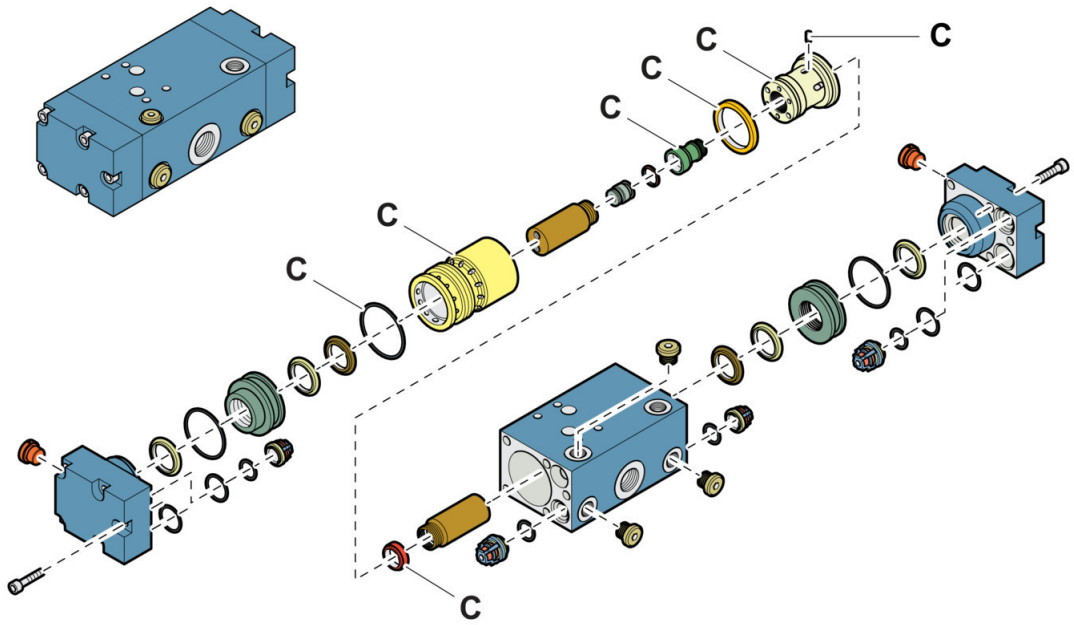
- ▶ Switch off the dust collector if the dust is damp or if water starts flushing out of the drill hole.

Water is pumped from a tank on the machine into the air circuit by a hydraulic-driven pump. The pump is located in a compartment on top of the water tank. The water mist system is not pressurized.

19.1 Check Seals on Water Mist Pump



1. Run the water mist pump (A) for a minute.
2. Count the number of water drops that run out from the drain holes (B).
   ➔ Replace all old seals with new ones if more than 10 drops leak out of the drain holes for a minute.



Seals on Water Mist Pump

C	Seal kit items

19.2 Filling Water Mist Tank

WARNING

Explosion Risk

Adding wrong type of fluid to the water tank could result in injury and damage to machine.

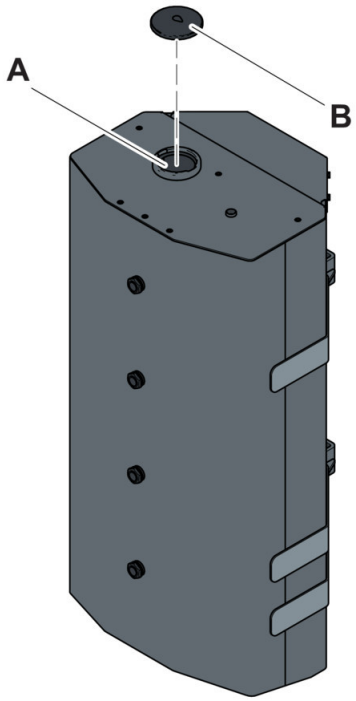
- ▶ Always fill the water mist tank with clean water.
- ▶ Never add explosive fluid or flammable additives to the water tank.

NOTICE

Damage to the Water Mist System

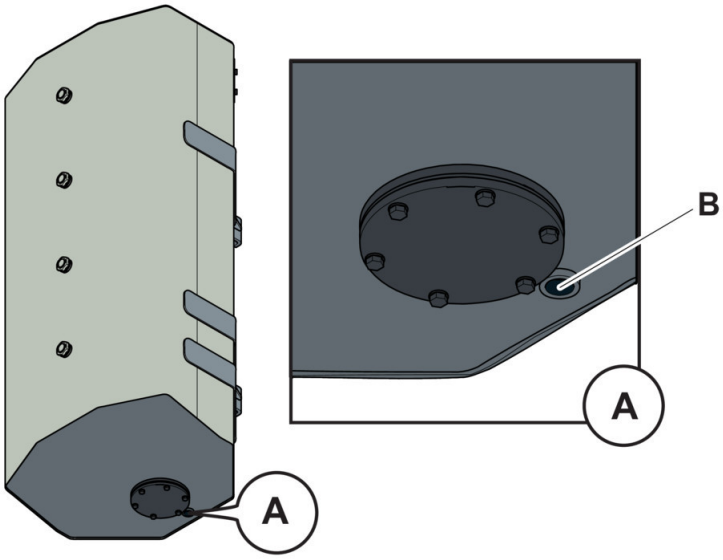
Filling the water mist tank with dirty water can cause damage to the system.

- ▶ Always fill the water mist tank with clean water.



1. Remove the filler cap (B).
2. Add water to the tank through hole (A).
3. Install the filler cap (B).

19.3 Draining Water Mist System



1. Remove bolt from the drain hole (B).
2. Drain water from water mist tank.
3. Install the bolt back into the drain hole (B).
4. Put the machine in drilling mode.
5. Turn off flushing air.
6. Run the water mist pump for 20 seconds at full power to purge the water from the hoses.
7. Turn on flushing air for a few seconds to blow out the remaining water from the system.

19.4 Starting Up Water Mist System from Dry

NOTICE

Damage to the Water Mist System

Filling the water mist tank with dirty water can cause damage to the system.

▶ Always fill the water mist tank with clean water.

NOTICE

Damage to Water Mist Pump

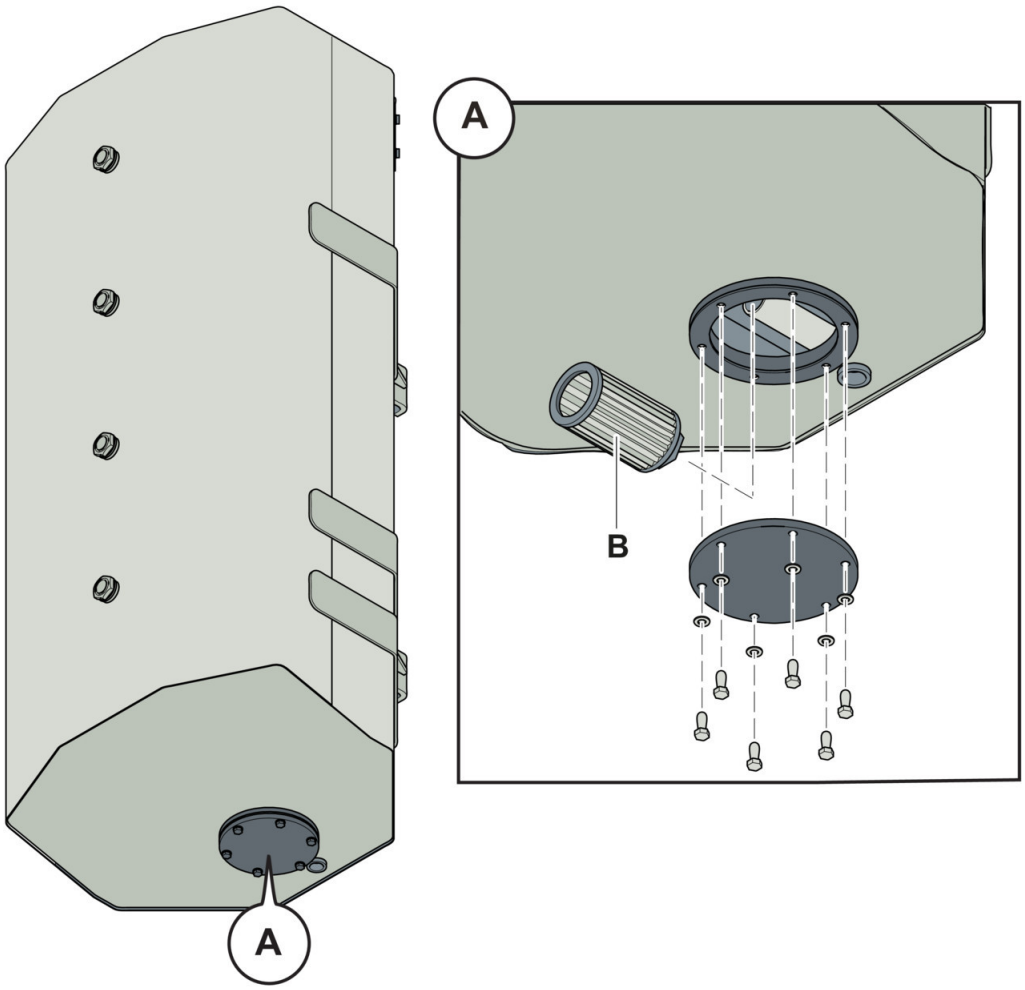
Risk of damage to water mist pump if it is run without water in the system.

▶ Do not run the pump without water in the system.

1. Fill up the water mist tank.

2. Turn off flushing air.
3. Run the water mist pump at full speed for a few seconds so that the system fills up with water.

19.5 Clean Filter in Water Mist Tank



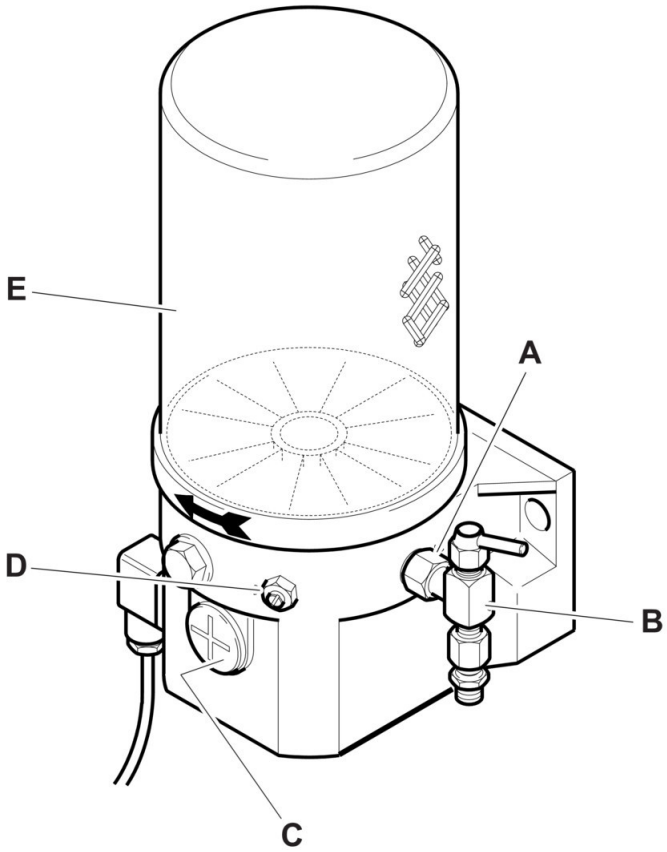
Precondition ✓ The water mist tank is empty.

1. Remove the bolts holding the cover (A) in place.
2. Reach into the hole and slide the filter (B) off the water intake pipe and remove it from inside the tank.
3. Inspect and clean the filter. If the wire mesh is damaged, replace it with a new filter.
4. Reach into the tank and push the filter back onto the water intake pipe.
5. Install the cover using the bolts. Make sure that all washers and seals are correctly placed.
6. Fill up the water mist tank with clean water and check that the cover does not leak.

20 Automatic Central Lubrication System CLS

20.1 Automatic Central Lubrication System (CLS)

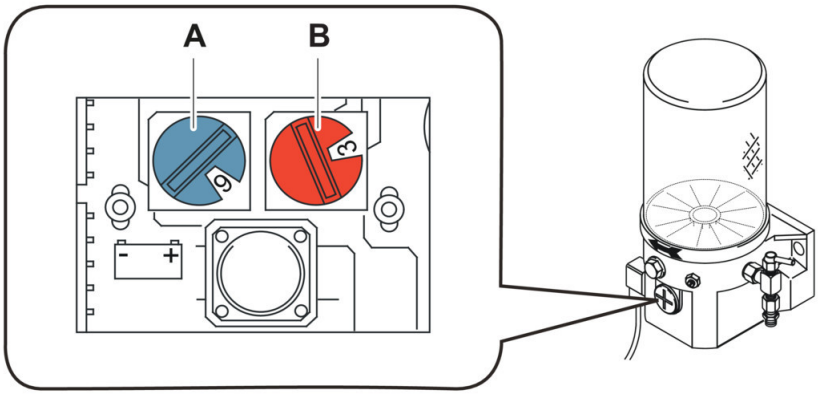
The CLS is auxiliary equipment that lubricates all joints on the complete machine.



A	Pump element
B	Safety valve
C	Plug (timer for pause and running time)
D	Filler nipple
E	Reservoir

20.2 Pause Time and Running Time Settings

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



- Pause time can be adjusted to increments of 15 with the blue rotary switch (A). Pause time is preset from factory.
- Running time can be adjusted to increments of 15 with the red rotary switch (B). Running time is preset from factory.

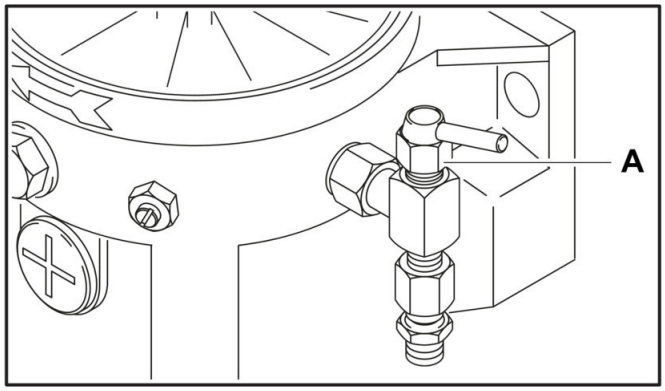
Rotary switch position	1	2	3	4	5	6	7	8	9
Hours	1	2	3	4	5	6	7	8	9
Rotary switch position	A	B	C	D	E	F			
Hours	10	11	12	13	14	15			

Table 5: Pause Time Rotary Switch

Rotary switch position	1	2	3	4	5	6	7	8	9
Minutes	2	4	6	8	10	12	14	16	18
Rotary switch position	A	B	C	D	E	F			
Minutes	20	22	24	26	28	30			

Table 6: Running Time Rotary Switch

20.3 Lubrication Pump Safety Valve

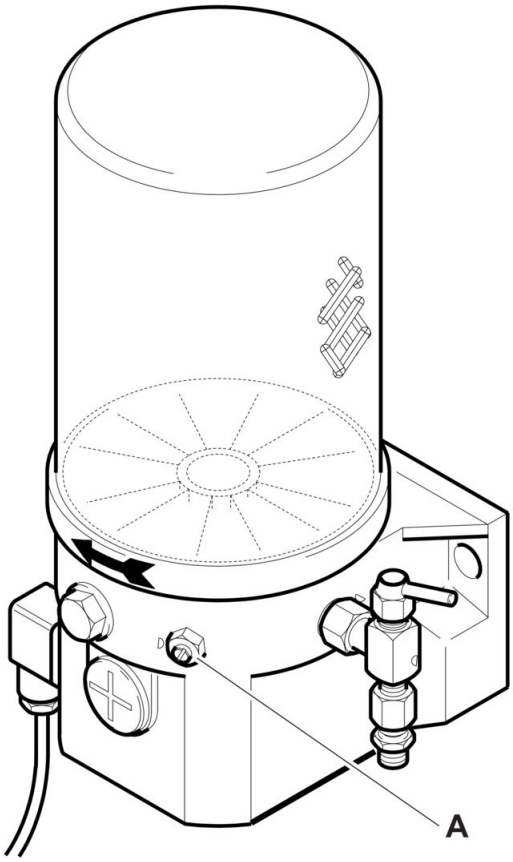


Location of Safety Valve on Lubrication Pump

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

If a hose, lubrication point, or nipple is blocked, the lubricant grease leaks out of the safety valve. Troubleshooting is required when it happens.

20.4 Filling Lubricant



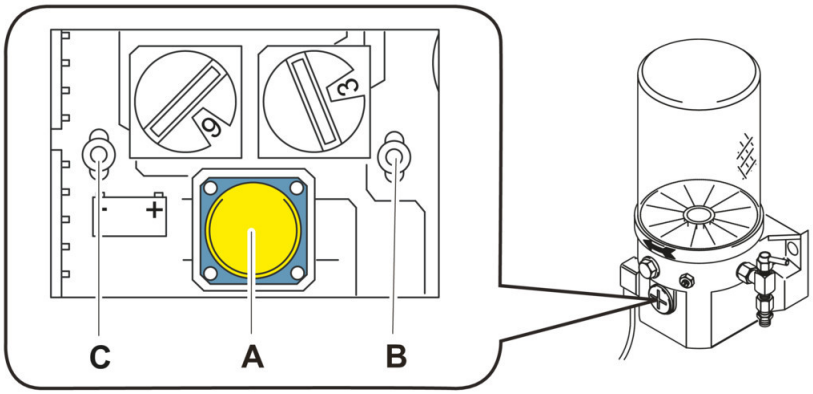
The container is transparent for visual inspection of the level. The filler nipple (A) is located directly on the pump.

> ***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. Do not overfill.
3. Refit the protective cover.

20.5 Testing Central Lubrication System or Starting Extra Lubrication

This test function makes it possible to check that the timer and the system are working.

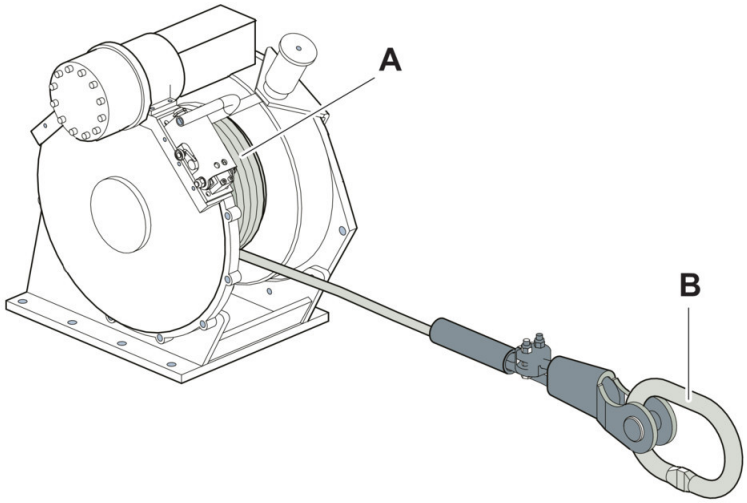


Lubrication System Timer

1. Turn on the ignition key.
   ➔ The diode (C) for ignition current comes on.
2. Press the push button (A) for two seconds.
   ➔ The pump starts to run the preset running time and the diode (B) for the electric motor comes on.
3. Check that the agitator in the reservoir is rotating.

21 Winch

21.1 Check Winch



- Check for damage, unwinding, wear, and corrosion on the winch wire rope (A).
- Check for damage, cracks, and wear on the hook (B) and check that it is properly mounted.

21.2 Check Attachment of Winch Cable

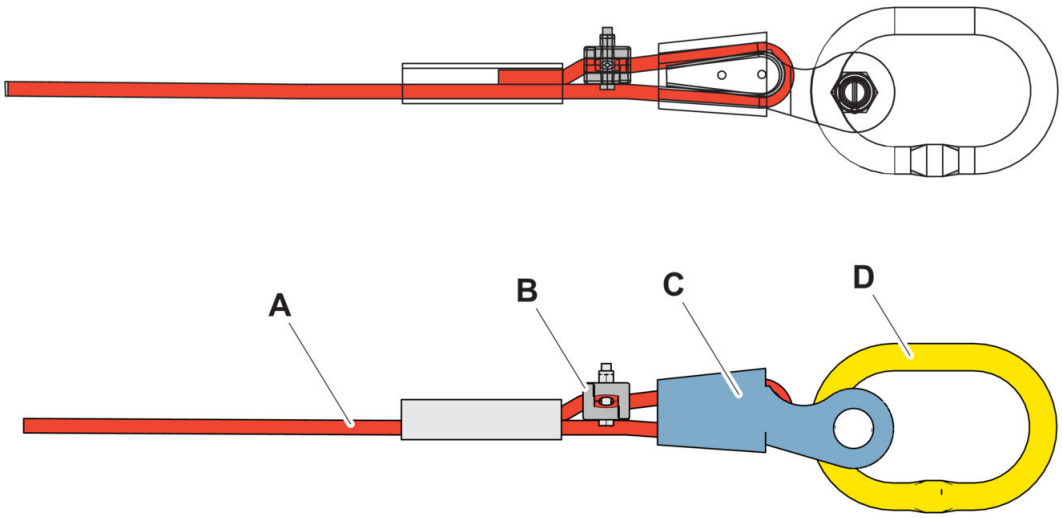
WARNING

Risk of Tipping and Cable Failure

Can cause serious personal injury and damage to property.

- ▶ The anchorage point must be firm and secure.
- ▶ The safety hook must not slide or detach from the attachment point.
- ▶ Do not use a damaged cable or hook.

NOTE: *It is important that the cable is correctly fitted in the winch eye.*



A	Cable
B	Rope lock
C	Connector sleeve with wedge plug
D	Hook

Correct assembly:

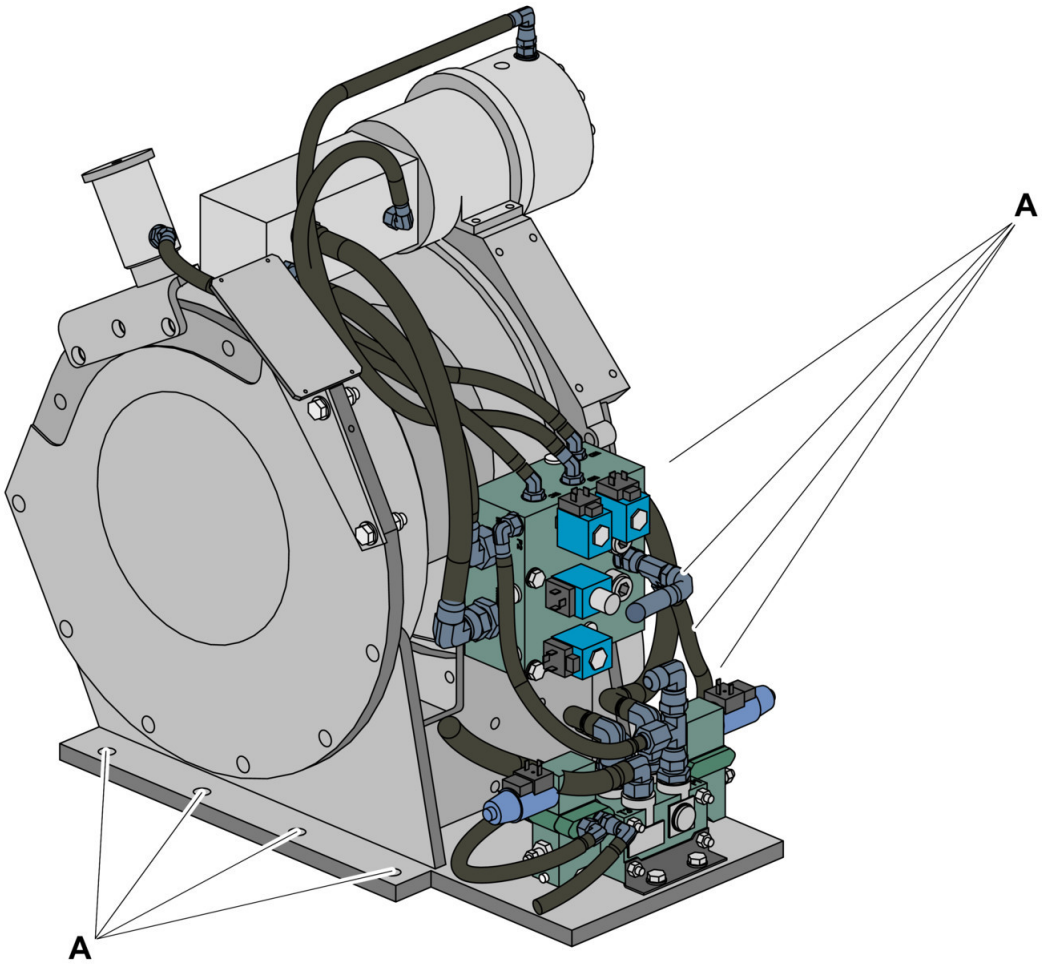
- The cable must run in line with the eye on the connector sleeve.
- The rope lock must only lock the end cable.
- The free end must be at least 6-9 times the diameter of the cable in order to ensure that the whole section of the cable that is either lashed-in or annealed and tapered is outside the connector sleeve.

The cable and winch eye must be checked:

- before each use.
- when replacing the cable.
- when attaching the cable after shortening.

Check that the winch locking mechanism is fully engaged in the drum before use, following the attachment of the cable eye on the anchorage point.

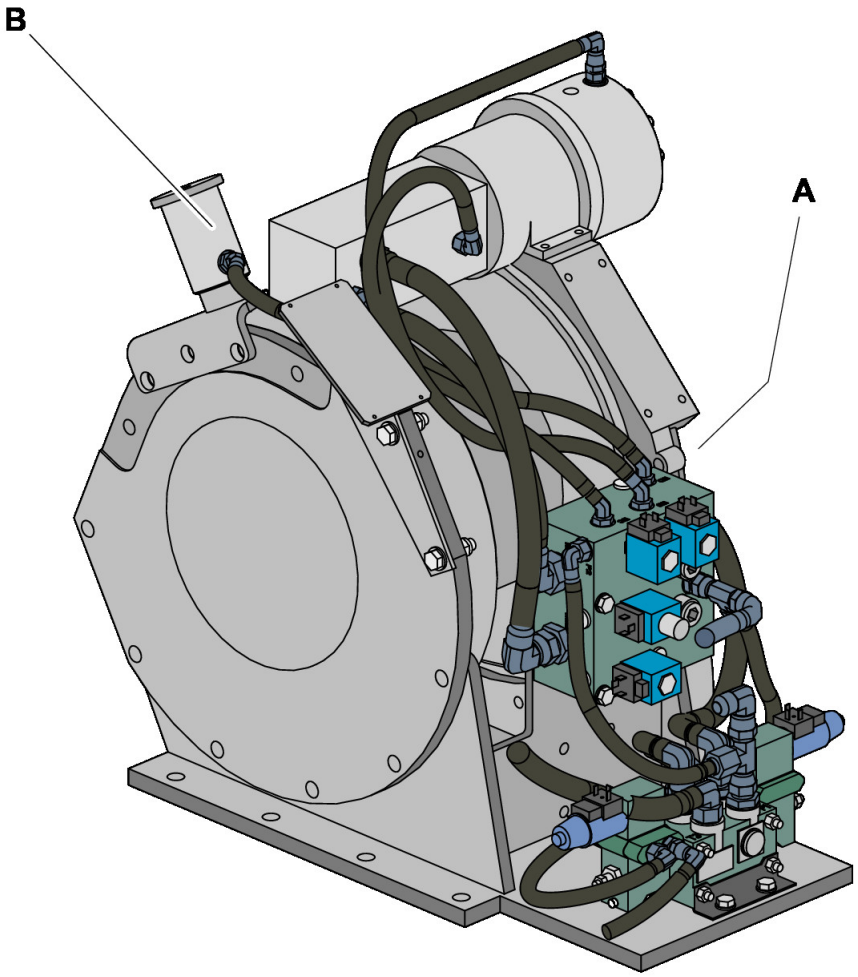
21.3 Check Winch Unit Attachment



- Check the tightening torque on attachment bolts (A).

Number of Bolts	Tightening Torque Value
8	350 Nm (258 lbf.ft)

21.4 Lubricate Winch

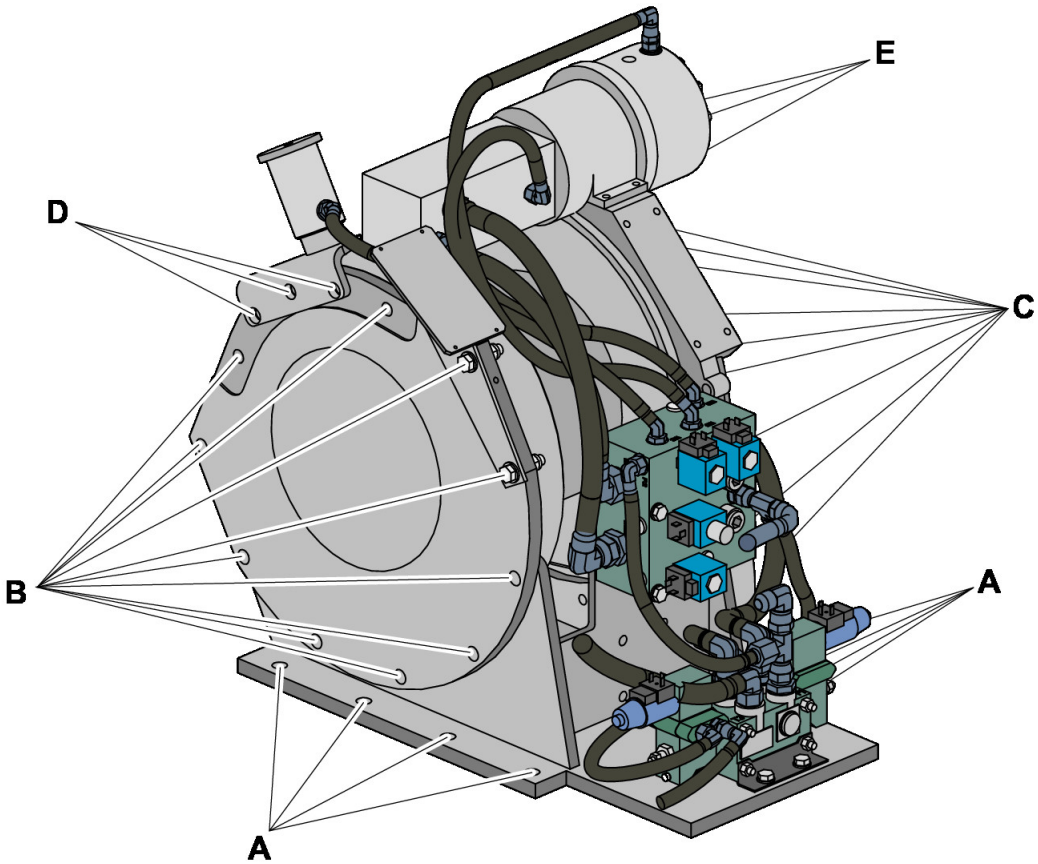


1. Remove the plug (A) in the bottom of the gear housing for draining. The gearing is permanently lubricated.
2. Lubricate with oil if the drum brake (B) does not rotate freely.

21.5 Check Small Remote Control

- Make sure none of the rubber bellows (A) on the switches/levers of the control unit are damaged

21.6 Check Tightening Torque on Winch



- Check that the mounting and the tightening torque for winch frame (A).
- Check that the tightening torque for side bolts (B) and (C).

- Check that the tightening torque on (D).
- Check that the tightening torque for hydraulic motor (E).

Component	Tightening torque
Winch frame	350 Nm (258 lbf.ft)
Slide bolts	140 Nm (103.25 lbf.ft)
Attachment bolts	350 Nm (258 lbf.ft)
Hydraulic motor	29 Nm (21.38 lbf.ft)

21.7 General Checking Guidelines for Wire Ropes

Wire ropes must be scrapped when they display any of the following:

- Wire rope break at attachment
- Certain number and type of wire rope breaks
- Concentrations of wire rope breaks
- Occurrence of wire rope breaks due to operating time
- Occurrence of strand breaks
- Surface wear
- Effects of heat
- Reduced elasticity
- Decreased wire rope diameter
- Permanent extension of the wire rope
- Deformation of the wire rope

21.7.1 Checking Wire Rope for Wire Breaks

Wire breaks occur after a certain operating time depending on operating conditions and then occur more frequently. The number of wire breaks in relation to the operating time must be determined and documented. It can then be used to estimate the future increase in wire breaks and the foreseeable time point for scrapping. On 6 and 8-strand wire ropes, wire breaks are primarily superficial.

- Broken wires at wire rope ends indicate that they have been heavily loaded and can cause faulty end mountings. Shorten the wire rope and reattach it. Check that the length of the remaining wire rope sufficient.
- If there are concentrations of wire rope breaks, the wire rope must be scrapped. If such concentrations occur within a length less than 60 cm (23.6 in.) or on an individual strand, the wire rope must be scrapped. Even if the number of wire breaks is less than the maximum specified in the table.

Number of load-bearing wires in outer strand. Filler wire is not considered load-bearing.	Number of visible wire breaks that require scrapping Machine groups M1 and M2 Over a length of wire rope diameter (d)			
	Cross Lay		Equal Lay	
	6d	30d	6d	30d
201–220	9	18	4	9

221–240	10	19	5	10

In wire ropes with several layers of strands, only the outer, visible layer is considered. In wire ropes with steel cores, the core is regarded as an inner strand, and is not included. In the event of a wire break, two ends can be visible.

21.7.2 Checking Wire Rope for Strand Breaks

If there are strand breaks, scrap the wire rope.

21.7.3 Checking Wire Rope for Surface Wear

Inner surface wear is caused by friction between the wires and the strands.

Outer surface wear is caused by friction between the cable drums (rolls) and the wire rope under pressure (acceleration and braking). Outer surface wear is visible through the formation of reflected images on the outer wires.

Surface wear is increased through faulty or no lubrication, increasing the effect of dirt and dust. Surface wear reduces static tensile strength through reduction in the wire ropes metallic cross section and dynamic strength through surface wear nicks. If the wire ropes diameter decreases more than 7% in relation to the nominal diameter of the wire rope, it must be scrapped. It must be scrapped even if no wire breaks are detected.

21.7.4 Checking Wire Rope for Corrosion

Corrosion is especially problematic in marine environments and in areas where the air is polluted by industrial emissions. Corrosion can reduce operational strength through rust spots and static tensile strength through a reduction in the cross section of the wire rope. Severe corrosion can reduce elasticity.

Outer corrosion can be easily detected through visual examination.

Inner corrosion is more difficult to detect. Inner corrosion is characterized on the following:

- Absence of gap between the strands in the outer layer of the wire rope, often with wire breaks in the strands.
- The wire rope diameter varies.

The parts of the wire rope that are bent over discs usually have a decreased diameter. At any sign of corrosion, an authorized person must check the wire rope. If inner corrosion is detected, the wire rope must be scrapped.

21.7.5 Checking Wire Rope for Decreased Diameter

A decrease in the wire rope diameter can occur because of material fatigue. Material fatigue can be caused by:

- Inner surface wear and surface wear nicks
- Inner surface wear through friction between the strands and wires in the wire rope
- Fatigue in the plastic core
- A break in the steel core
- A break in the inner layer in a multi-strand wire rope

If the diameter if the wire rope decreases more than 10% in relation to the nominal diameter of the wire rope, it must be scrapped. It must be scrapped even if no breaks have been detected.

21.7.6 Checking Wire Rope for Reduced Elasticity

Under certain conditions, the wire rope loses its elasticity. Reduced elasticity is difficult to detect. If in doubt, consult a specialist. If the wire rope has lost elasticity, the following characteristics usually appear:

- Decrease in wire rope diameter
- Extension of the wire rope
- No gap between individual wires and between the strands. It causes during component pressing.
- Fine, brown dust inside the strands.
- Even if there are no visible wire breaks, the wire rope is noticeably stiffer.
- The wire ropes diameter decreases more quickly than during normal wear of the individual wire rope strands.

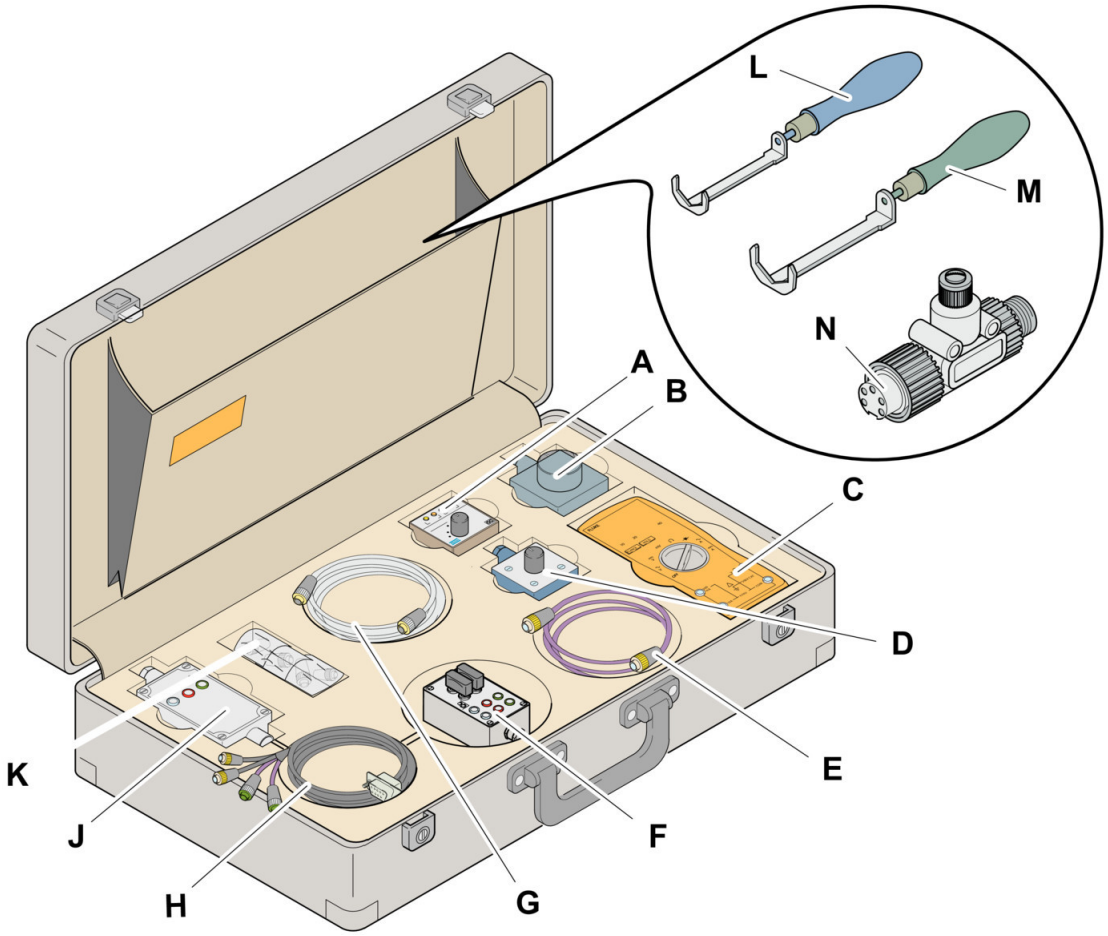
Reduced elasticity can lead to sudden wire rope breaks during heavy loads. The wire rope must be scrapped.

21.7.7 Checking Wire Rope for Heat Exposure

The effects of heat can be established through annealing color. Scrap the wire ropes that are exposed to extreme heat.

22 Service Tool Bag RCS

The service tool bag is used for troubleshooting machines that are equipped with Epiroc RCS.

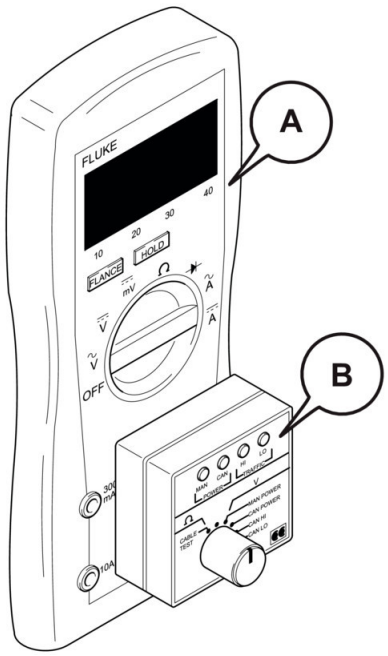


A	CAN tester
B	Resolver tester
C	Multimeter
D	Encoder tester
E	CAN open cable
F	I/O tester
G	Signal cable
H	Test cables
J	Test box
K	Connectors
L	Torque tools

M	Torque tools
N	Contact

22.1 Checking CAN Network

The power supply for the module, the CAN power supply and the CAN communication can be measured and checked using the CAN test equipment.



CAN Test Equipment

Connect the CAN tester (B) on the multimeter (A). Make certain the pins are positioned correctly as indicated by the colour coding. The red pin goes to V/Ohm on the multimeter.

Always use the torque tools to tighten cable connections.

Pin	Function
1	Screen/Shield
2	CAN +
3	CAN -
4	CAN Hi
5	CAN Low

Table 7: Pin Configuration, CAN Inputs and Outputs, I/O Modules

Pin	Function
1	NC/Not Connected
2	CAN +
3	CAN -
4	CAN Hi

Pin	Function
5	CAN Low

Table 8: Pin Configuration, CAN Inputs and Outputs, Other Modules

1. Set the multimeter range to DC volt.
2. Connect the 5-pin connectors of the tester to the CAN network requiring measurement:
   a. Decoder: contact X3 or X4
   b. Display, application, and master modules: connector X2, X3, or X4
   c. I/O modules: contact X1 or X19
   d. Resolver modules: contact X3 or X4

➔
Main power (supply voltage) 24–28 V (shines green)
CAN power (CAN power supply) 20–24 V (shines green)
CAN Hi (CAN communication), about 2.5 V (flashes green)
CAN Low (CAN communication), about 2.3 V (flashes green)

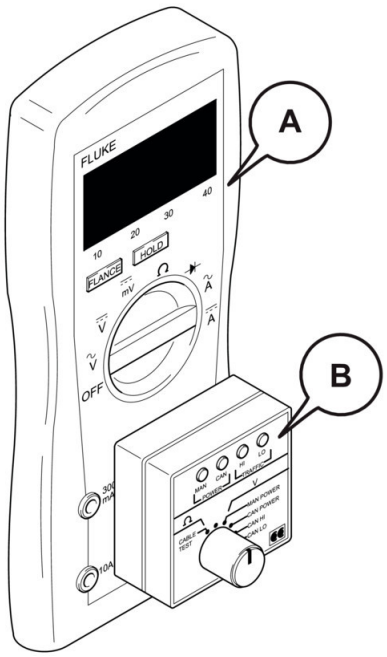
Table 9: Normal State

CAN Hi glows red constantly for short circuit to ground
CAN Hi glows green constantly for voltage above 3.5 V
CAN Low glows green constantly for short circuit to ground
CAN Low glows red constantly for voltage above 3.5 V
If neither CAN Hi nor CAN Low is lit, there is no communication even though power is being supplied to CAN.
If any light is flashing red, then CAN communication is at the wrong level or is inverted.

Table 10: Fault Indication

22.2 Checking CAN Power Supply

The power supply for the module, the CAN power supply and the CAN communication can be measured and checked using the CAN test equipment.



CAN Test Equipment

Connect the CAN tester (B) on the multimeter (A). Make certain the pins are positioned correctly as indicated by the colour coding. The red pin goes to V/Ohm on the multimeter.

Always use the torque tools to tighten cable connections.

Pin	Function
1	Screen/Shield
2	CAN +
3	CAN -
4	CAN Hi
5	CAN Low

Table 11: Pin Configuration, CAN Inputs and Outputs, I/O Modules

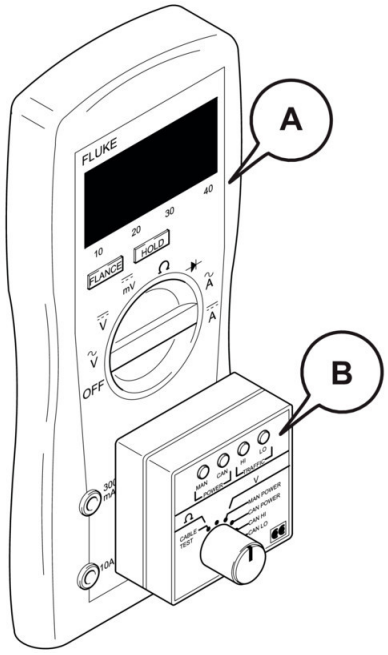
Pin	Function
1	NC/Not Connected
2	CAN +
3	CAN -
4	CAN Hi
5	CAN Low

Table 12: Pin Configuration, CAN Inputs and Outputs, Other Modules

1. Set the multimeter range to DC volt.
2. Connect the 5-pin connector of the tester to the power supply of the module.
   a. I/O modules: contact X25. 7-pin contact. Use enclosed T-cross.
   b. Other modules: connector X1. 4-pin connectors.
   ➔ The power supply (main power) is between 24–28 V (lights green).

22.3 Checking CAN Cable

The power supply for the module, the CAN power supply and the CAN communication can be measured and checked using the CAN test equipment.



CAN Test Equipment

Connect the CAN tester (B) on the multimeter (A). Make certain the pins are positioned correctly as indicated by the colour coding. The red pin goes to V/Ohm on the multimeter.

Always use the torque tools to tighten cable connections.

Pin	Function
1	Screen/Shield
2	CAN +
3	CAN -
4	CAN Hi
5	CAN Low

Table 13: Pin Configuration, CAN Inputs and Outputs, I/O Modules

Pin	Function
1	NC/Not Connected
2	CAN +
3	CAN -
4	CAN Hi
5	CAN Low

Table 14: Pin Configuration, CAN Inputs and Outputs, Other Modules

Precondition ✓ The RCS is shut down.

1. Set the multimeter measuring range to ohms.

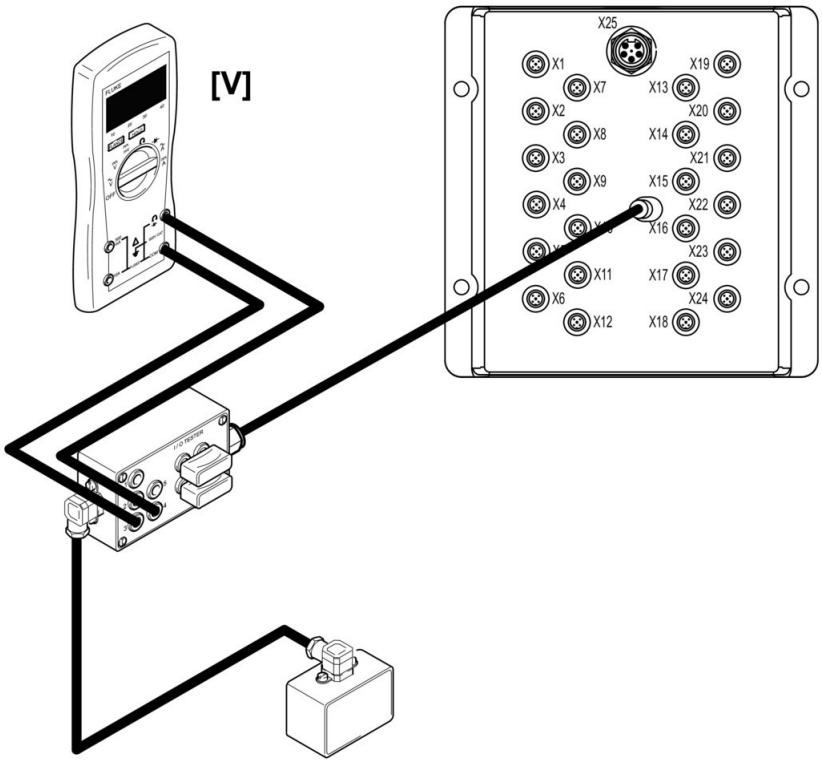
2. Connect the 5-pin connectors of the tester to the CAN network requiring measurement:
   a. Decoder: contact X3 or X4
   b. Display, application, and master modules: connector X2, X3, or X4
   c. I/O modules: contact X1 or X19
   d. Resolver modules: contact X3 or X4
3. Select cable test on the CAN tester.
   ➔ The multimeter reads about 60–65 Ohms if the cable is intact.

   The multimeter reads 120 Ohms if the end plug is missing or there is a break in a cable.

> ! ***NOTE:*** *Because of the internal resistance in the tester, the multimeter reads about 100 kOhm if the cables are not connected or if there is an open circuit.*

22.4 Checking Digital Inputs on I/O Module

Each designated contact has two digital inputs, A and B.



1. Connect the 5-position connector on the I/O tester between the input of interest on the I/O model and the guard.
2. Connect the multimeter between ground and the signal A (+A) or signal B (+B) output of interest.
3. Measure the voltage according to the table.

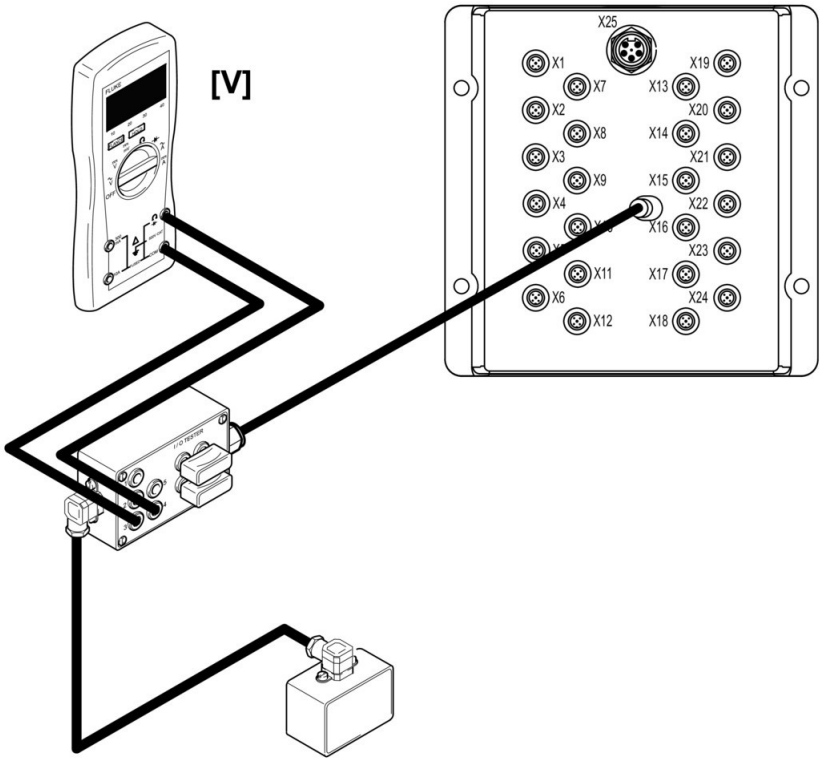
➔ The signal is 0 V for an open contact and +24 V for a closed contact.

Pin	Function
1	+24 V DC
2	Signal B
3	Ground
4	Signal A
5	Ground

Table 15: Pin Configuration

22.5 Checking Digital Outputs Voltage on I/O Module

Each designated contact has two digital outputs, A and B.



1. Connect the 5-position connector on the I/O tester between the output of interest on the I/O module and the valve.
2. Connect the multimeter between ground and the signal A (+A) or signal B (+B) output of interest.
3. Activate the function.

➔ The multimeter reads 24 ±1 V.

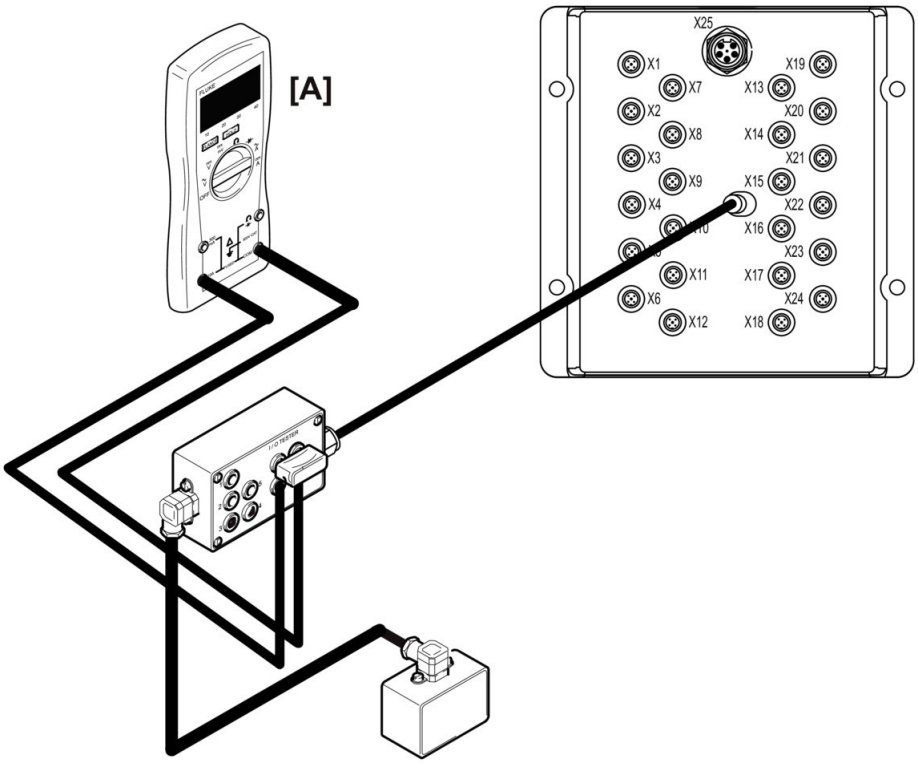
If the valve is not activated, there can be an open circuit in the cable running to the valve or in the coil in the valve.

Pin	Function
1	+24 V DC
2	Signal B
3	Ground
4	Signal A
5	Ground

Table 16: Pin Configuration

22.6 Checking Digital Outputs Current on I/O Module

Each designated contact has two digital outputs, A and B.



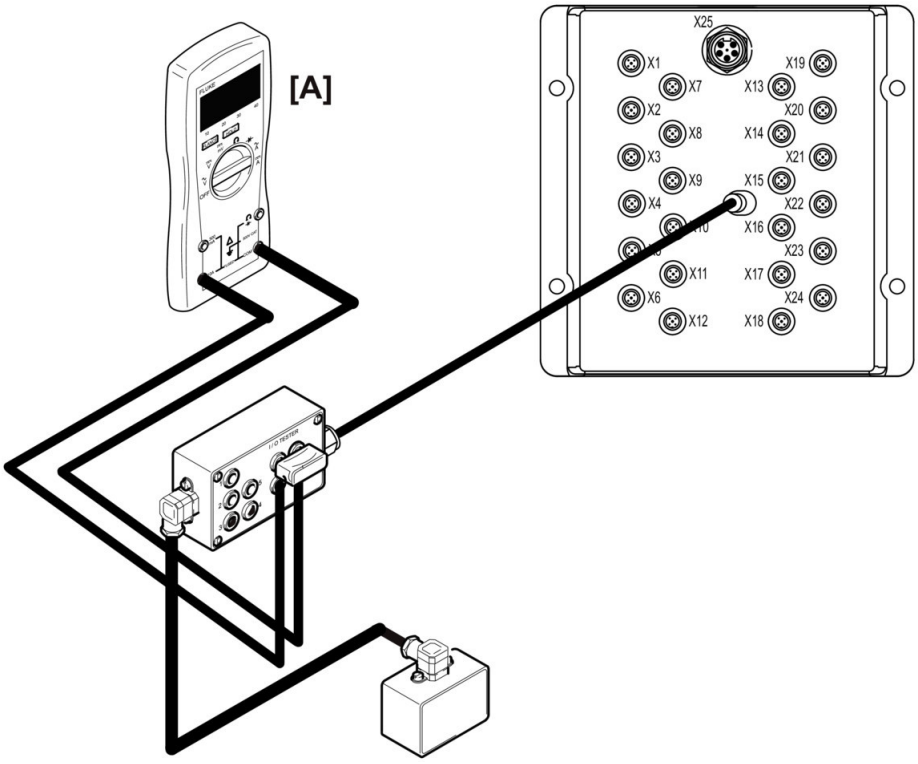
1. Connect the 5-position connector on the I/O tester between the output of interest on the I/O module and the valve.
2. Connect the multimeter in series with the +A or +B output.
3. Activate the function.

➔ The multimeter reads 1 A.

If the multimeter reads 0.00 A and the solenoid coil diode comes on, there could be an open circuit in the valve coil.

22.7 Checking PWM Outputs Current on I/O Module

Each designated contact has two PWM outputs, A and B.



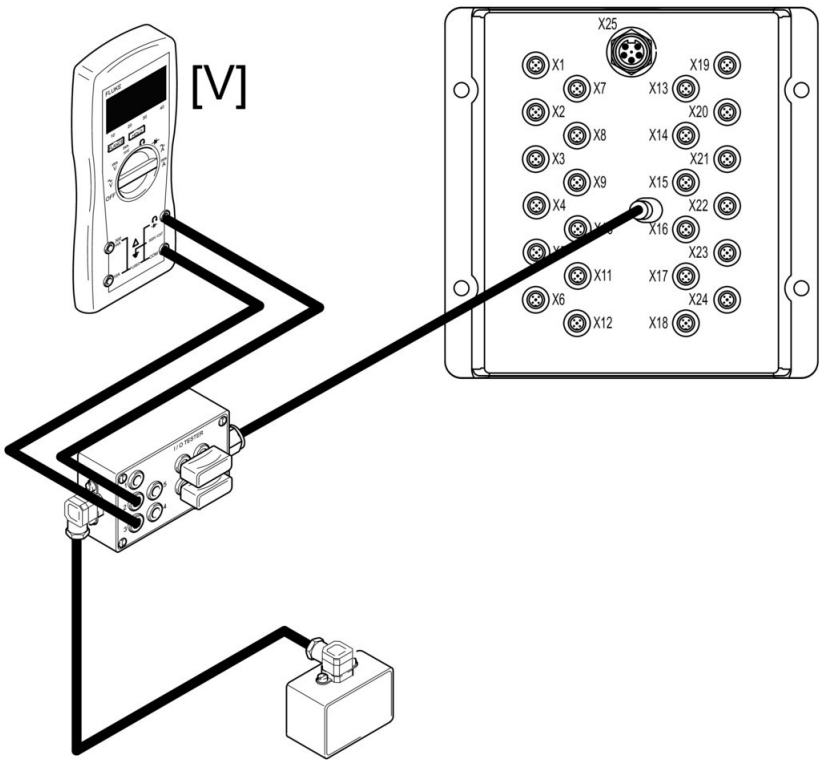
1. Connect the 5-position connector on the I/O tester between the output of interest on the I/O module and the valve.
2. Connect the multimeter in series with the +A or +B output that is of interest.
3. Activate the function.
4. Check that the current corresponds with the actuated value on the display.

Pin	Function
1	Not Used
2	Out +B
3	Out -B
4	Out +A
5	Out -A

Table 17: Pin Configuration

22.8 Checking Analog Inputs on I/O Module

Each designated contact has one analog input.



1. Connect the 5-position connector on the I/O tester between the input of interest on the I/O model and the sensor.
2. Measure the values according to the table.

Pin	Function
1	+24 V DC
2	0–5 V
3	Ground
4	4–20 mA
5	+5 V DC

Table 18: Pin Configuration

22.9 Encoder Inputs

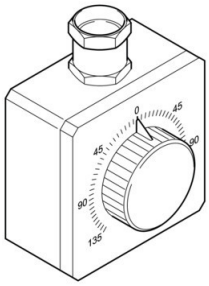
Each encoder connector has two signals, A and B.

There are two designated contacts, X12 and X18, for the pulse sensor.

Pin	Function
1	+24 V DC
2	B
3	Ground
4	A
5	Ground

22.10 Checking Resolver Module Resolver Inputs

For the inputsX6 - X9 there are designated contacts.



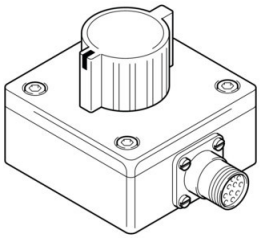
1. Connect the resolver tester to the relevant cable. Turn the test sensor slowly and check that the angle shown on the sensor menu changes.
   a. If the angle changes, the sensor on the boom is faulty.
   b. If the angle does NOT change, the cable on the boom must be checked.
2. Connect the test sensor and test cable directly to the resolver module input. Turn the test sensor slowly and check that the angle on the sensor menu changes.
   a. If the angle changes, the cable on the boom is faulty
   b. If the angle does NOT change, the resolver module is faulty.

Pin	Function
1	Ref +
2	Ref -
3	Sine Signal
4	Sine Ground
5	Cosine Signal
6	Cosine Ground

Table 19: Pin Configuration

22.11 Checking Resolver Module Encoder Inputs

There is a designated contact, X10, for the pulse sensor.



1. Connect the encoder tester to the relevant cable. Turn the test sensor slowly and check that the length measurement shown on the sensor menu changes.
   a. If the measured value changes, the sensor on the boom is faulty.

b. If the measured value does NOT change, the cable on the boom must be checked.

2. Connect the test sensor with test cable directly to the resolver module input. Turn the test sensor slowly and check that the length measurement shown on the sensor menu changes.

   a. If the measured value changes, the cable on the boom is faulty.

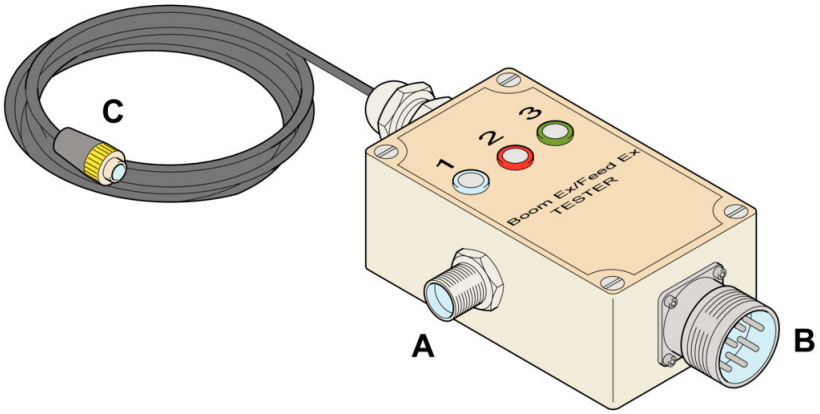
   b. If the measured value does NOT change, the resolver module is faulty.

Pin	Function
1	+ 15V
2	+ 15V
3	Signal A
4	Ground
5	Signal B
6	Ground

Table 20: Pin Configuration

22.12 Checking Resolver Module Analog Inputs

There are two designated connectors, X11 and X12, for analog input.



Pin	Function
1	Ground
2	+ 4.5-V DC power supply out
3	Signal in
4	Not Used
5	Not Used

Table 21: Pin Configuration for Input X11

Pin	Function
1	Ground

Pin	Function
2	+ 15-V DC power supply out
3	Signal in
4	Not Used
5	Not Used

Table 22: Pin Configuration for Input X12

1. Connect the resolver module connector X11 or X12 to test box connector (B).
2. Connect the multimeter to test box pins 2 and 3.
3. Set the multimeter to DC voltage.

   It must read 4.5 V on connector X11 and 15 V on connector X12.

   If the multimeter reading is 0 V, there could be a fault in the signal cable or resolver module. Continue as follows:

   a. Connect the cable (C) on the test box to resolver module input X11 or X12 and measure 1 and 2.

   b. Recheck the multimeter reading.

      If it is 0 V, there is a fault on the resolver module input, X11 or X12.

22.13 Replacing RCS Module

! ***NOTE:*** *Avoid starting the engine/motor while the program is being loaded.*

! ***NOTE:*** *Do not turn off the system while the program is being loaded.*

Precondition ✓ The electric power is present at the machine or that the engine/motor is running before loading the program.

1. Make sure that the module has the correct address plug and that the end plug (if any) is put in place.
2. Read the program into the system again when any of the application modules, I/O, or resolver module is replaced.
3. Insert the USB memory stick with the program into the USB port.
4. Start the RCS.
5. Follow the instructions on the display.
   ➔ **Remove card and restart the system!** appears on the display when the program is fully loaded.
6. Switch off the RCS.
7. Remove the USB memory stick.
8. Start the RCS.

23 Welding

23.1 About Welding

WARNING

Risk of Poisoning

When heated, the paint forms substances that can cause eczema, eye irritation, respiratory system difficulties, and in severe cases, asthma, or other health problems.

- ▶ Always use personal protection such as appropriate breathing apparatus, eye protection, and gloves.
- ▶ Always make sure that there is good ventilation when welding, grinding and other hot work that involves heating the paint.

WARNING

Thermal Cracks

Can cause severe personal injury.

- ▶ Follow the instructions.
- ▶ Do not weld on the booms.
- ▶ Do not weld on the framework of the cab or mountings.
- ▶ Pay attention to special certification for FOPS and ROPS.

NOTE: *Unauthorized modification of the machine is not allowed.*

NOTE: *Always keep a fire extinguisher for oil fires near during all types of welding, cutting, and grinding. Screen off the work area from flammable materials.*

Contact Epiroc before repair welding on components or frames, approval of welding method and choice of electrodes.

- Qualified personnel must perform all welding.
- Turn off the current supply to the machine.
- Disconnect the cables from the alternator, the battery, the electronic modules, and the firefighting equipment.
- Grind off rust and paint from the area to be welded and carefully prepare the joint.
- Welding equipment must be grounded correctly.
- Weld in a dry area.
- If repair welding is necessary, damaged units must preferably be removed and repaired separately.

- Framework, brackets, and load-carrying structures are made of special materials. Any repair welding performed with incorrect materials or additives can weaken the structure.
- Avoid welding close to bearings and bushings.
- Do not weld on the boom, hydraulic tanks, hydraulic cylinders, valve blocks, compressed air tanks, or pressure lines.
- Do not weld on a FOPS and ROPS approved cab. The certification would then be invalid.
- Protect hoses, cables, and electrical components.
- If possible, grind the surface of the weld smooth and treat it with anti-corrosion paint.

23.2 CAN Bus System Disconnection before Welding

! ***NOTE:*** *The CAN bus and RCS can be severely damaged when welding.*

NOTE: *Consult Epiroc for approval of welding and choice of electrodes.*

- Locate all modules present on the machine. Disconnect supply voltage to all modules, both + (positive) and - (ground).
  - Example of modules which can be present: application module, I/O module, resolver module, and CS-module.
- Locate all sensors on the machine and disconnect them.
- Locate the safety controller and disconnect supply voltage, both + (positive) and - (ground).
- Locate all panels included in RCS and disconnect supply voltage, both + (positive) and - (ground).
- Remove the battery ground cable.

24 Storage

24.1 Preparations before Long-Term Storage

Protect the equipment from corrosion and storage damage if the storage is expected to last three months or longer. If environment is, for example, corrosive or dusty, extra protection is necessary.

- Wash the equipment thoroughly and wipe it dry. Use compressed air to blow any collections of water out of cavities and pockets.
- Protect from rain, snow, and strong sunshine. Keep regulated temperature and ventilation. Recommended storage environments must maintain a temperature of 10–20 °C (50–68 °F) and maximum 20–50% humidity. Storage site must be free from severe vibration to avoid spot damage to the equipment.
- Apply corrosion inhibitor (For example, Tectyl 506) to machined surfaces.
- Apply touch-up paint to any scratches and damage on painted areas.
- Cover all equipment with plastic sheet.
- Clean old lubricant grease from lubrication points to prevent coke formation. Apply lubricant grease into the lubrication nipples. Apply lubricant grease with a brush to sliding surfaces and splines where it occurs. Use the correct lubricant grease for each point.
- Observe the strictest cleanliness when disassembling hydraulic, compressed air, and water flushing hoses. Immediately plug all hoses, nipples and hydraulic oil pipes, or seal and protect them from dirt in some other suitable way.
- Mark hoses, pipes, and other connections to make reassembly easier and prevent mix-ups.
- Hoses and rubber parts must be packed in air-tight plastic to reduce aging and drying. Make sure that the components are dry before packing.
- Fill fuel tanks and oil tanks.

24.1.1 Preparing Electrical System for Long-Term Storage

If the temperature falls below freezing point, the battery must be stored indoors.

- ■ Disconnect the battery terminal connections.
- ■ Clean and grease battery terminal connections.

24.1.2 Preparing Feed for Long-Term Storage

The feed must be stored in a dry and clean environment.

1. Clean the feed thoroughly.
2. Lubricate the feed.
3. Protect unpainted surfaces with rust inhibitor.
4. Store the feed in a dry and clean environment.

24.1.3 Preparing Rock Drill for Long-Term Storage

1. Remove the rock drill.
2. Apply corrosion inhibitor (For example, Tectyl 506) to the machined surfaces.
3. Apply touch-up paint to any scratches and damage on painted areas.

24.1.4 Preparing Water Mist System for Long-Term Storage

1. Drain the water mist system.
2. Rinse with anti-freeze.
3. Blow dry the water mist system with compressed air.

24.2 Restoring after Long-Term Storage

- Change lubricant and hydraulic oil where appropriate.
- Change filter and drain water separators where appropriate.
- Inspect joints, bushings, and splines for corrosion. Remedy any corrosion by cleaning or replacing components.
- To remove any moisture binding from lubrication points: Pump new grease into the grease nipples and apply grease with a brush to splines and sliding surfaces. Use the correct grease for each point.

24.3 Inspection and Maintenance during Long-Term Storage

- Check levels for oils and coolants.
- Start the diesel engine and run until the normal operating temperature is reached.
- Operate the machine a few metres back and forth so that the tramming gears are lubricated.
- Operate the tilt cylinders, boom, feed, drill rod support, and rod handling until all cylinders reach their end positions.
- Drain condensed water from the hydraulic oil tank and compressor oil tank.
- Rotate the electric motors a few turns at least every three months to avoid spot damage on motor bearings.

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