

Document Title: Function description	Function Group:	Information Type: Service Information	Date: 2015/7/9 0
Profile: EXC, EC235C NL [GB]			

Function description

Track gearbox consists of a two stage planetary mechanism that converts the high speed rotation of the hydraulic motor, into low speed, high torque rotating force at the sprocket hub.

See [990 Hydraulic diagram, travel](#).

Gearbox, torque flow

The power transmitted from the hydraulic motor output shaft is transmitted to the 1st stage sun gear → spline of 1st carrier → 2nd sun gear → 2nd planetary gear → ring gear.

At this time, the reduction ratio of reduction gear is as follows :

Reduction ratio

1st reduction ratio

$$i_1 = ((Zs1 + Zr) \cdot (Zs2 + Zr) / (Zs1 \cdot Zs2)) - 1$$

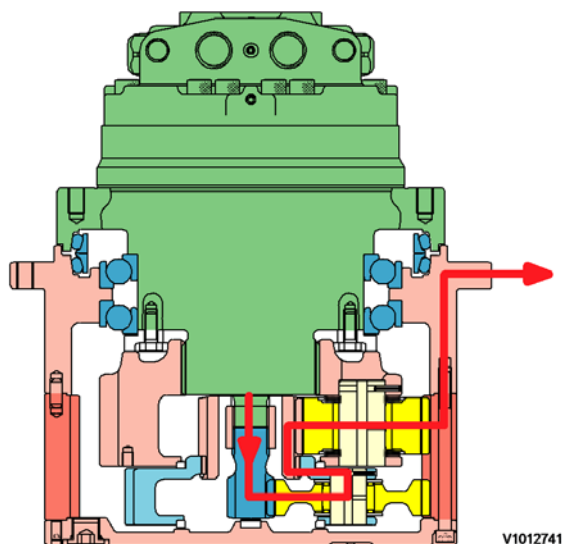


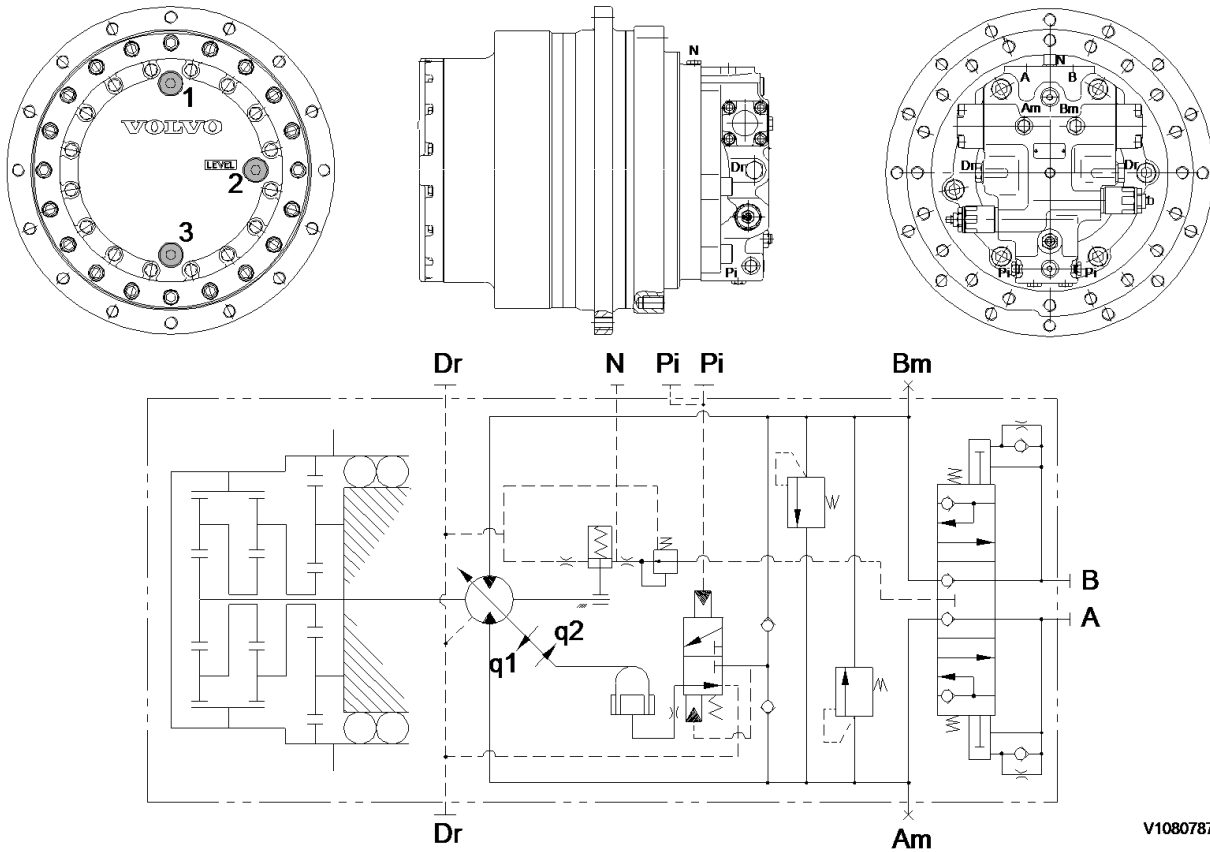
Figure 1

Track gearbox, torque flow

- Zs1 = No. of tooth of 1st sun gear
- Zs2 = No. of tooth of 2nd sun gear
- Zr = No. of tooth of ring gear

Document Title: Track gearbox, description	Function Group:	Information Type: Service Information	Date: 2015/7/9 0
Profile: EXC, EC235C NL [GB]			

Track gearbox, description



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Figure 1
Port connections

1. Oil filling port (PF 3/4)
2. Oil level check port (PF 3/4)
3. Oil drain port (PF 3/4)

Port connections

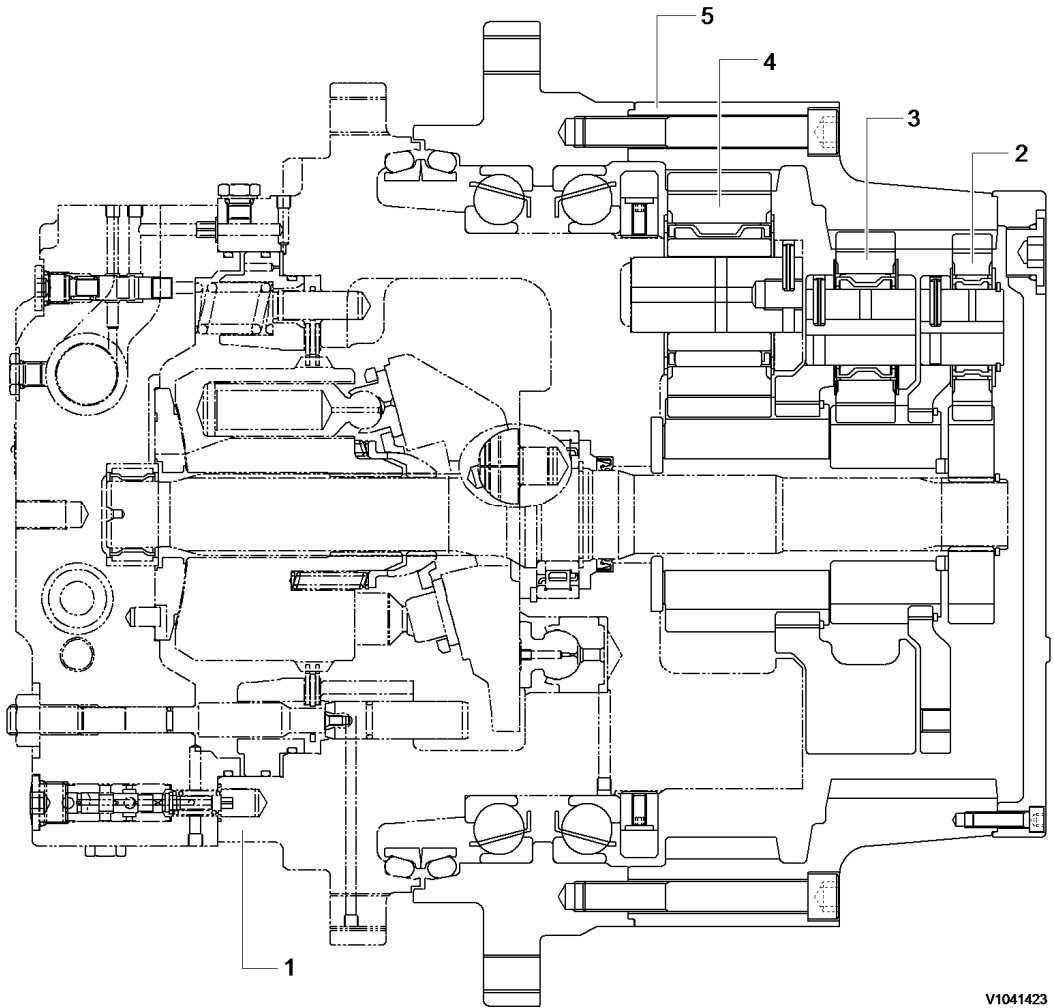
Port symbol	Port size	Port
A, B	ø25	Oil supply (Return)
Am, Bm	2-PF 1/2	Pressure measurement port
Pi	2-PF 1/4	Displacement change pilot port
N	2-PF 1/4	Port for manual release of brake
Dr	2-PF 1/2	Motor drain

Rotational direction

View from Vaxis	Inlet port	Outlet port
------------------------	-------------------	--------------------

Clockwise	B	A
Counterclockwise	A	B

Track gearbox consists of a three stage planetary mechanism that converts the high speed rotation of the hydraulic motor, into low speed, high torque rotating force at the sprocket hub.



V1041423

Figure 2
3 stage planetary gearbox

1. Motor
2. No.1 planetary gear assembly
3. No.2 planetary gear assembly
4. No.3 planetary gear assembly
5. Ring gear

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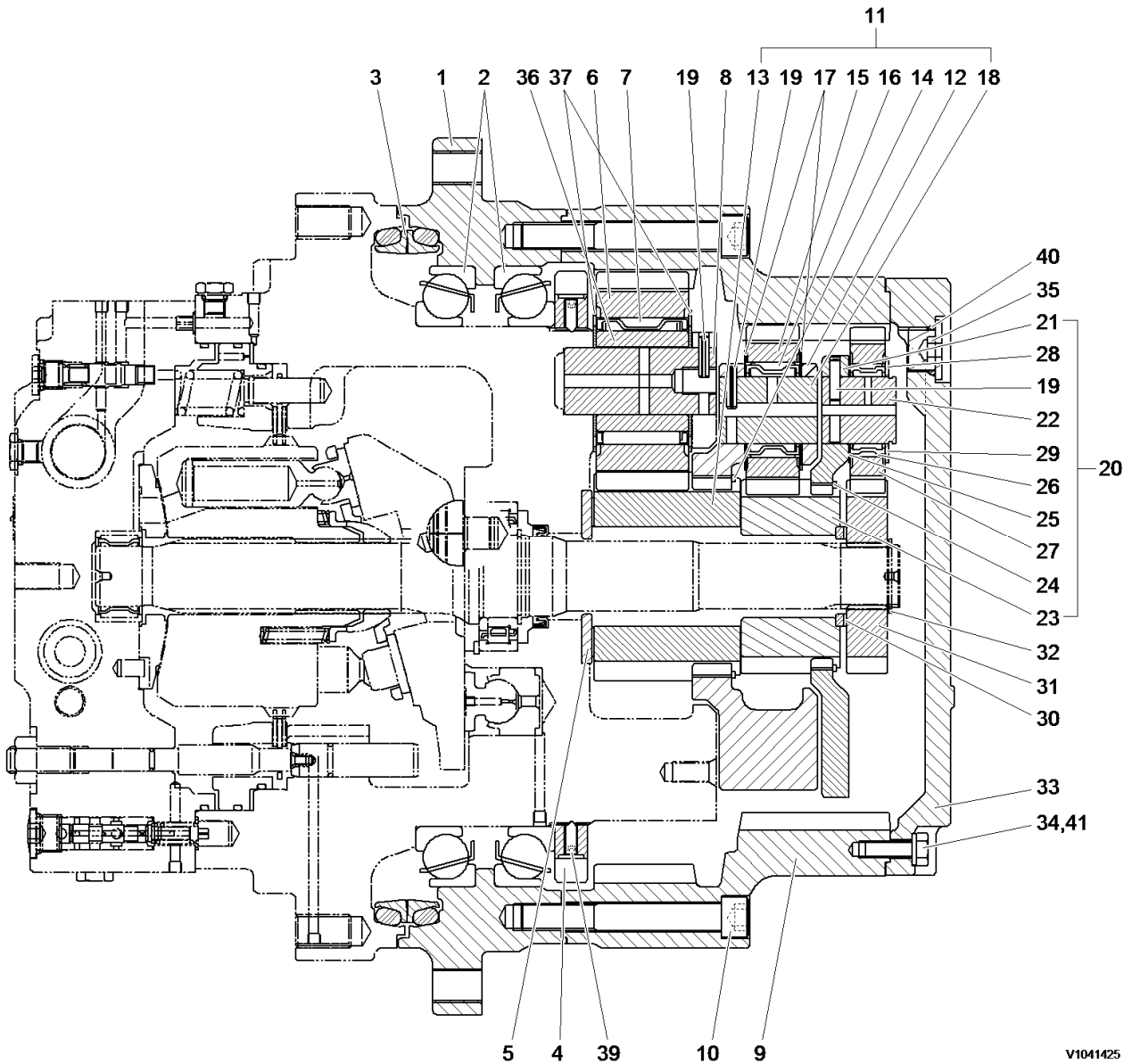
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V1041425

Figure 3
Track gearbox, sectional view

1	Housing	15	No.2 planetary gear	29	Retaining ring
2	Angular bearing	16	Needle bearing	30	Thrust ring
3	Seal	17	Thrust washer	31	No.1 sun gear
4	Adjust nut	18	No.2 pin	32	Retaining ring
5	Thrust ring	19	Spring pin	33	Cover
6	No.3 planetary gear	20	No.1 planetary gear assembly	34	Screw
7	Needle bearing	21	No.1 carrier	35	Plug
8	No.3 pin	22	No.1 pin	36	Inner ring
9	Ring gear	23	No.2 sun gear	37	Thrust washer
10	Screw	24	Retaining ring	39	Set screw
11	No.2 planetary gear assembly	25	Thrust washer	40	O-ring
12	No.2 carrier	26	Needle bearing	41	Spring washer
13	No.3 sun gear	27	No.1 planetary gear		
14	Retaining ring	28	Thrust washer		

The power transmitted from the hydraulic motor output shaft is transmitted to the 1st stage sun gear (31) → spline of 1st carrier (21) → 2nd sun gear (23) → 2nd planetary gear (15) → spline of 2nd carrier (12) → 3rd sun gear (13) → 3rd planetary gear (6) → ring gear (9).

At this time, the reduction ratio of reduction gear is as follows:

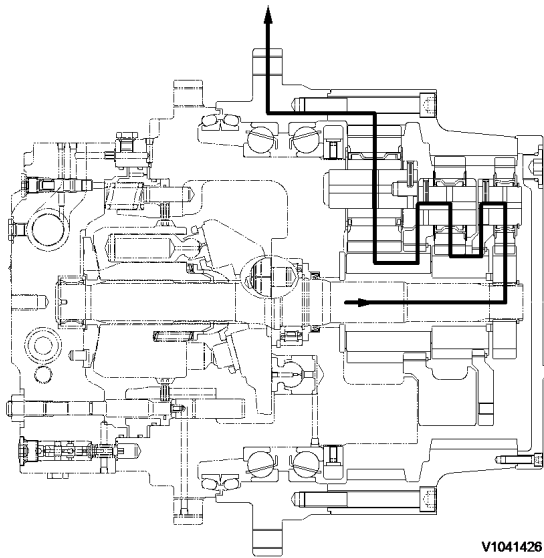


Figure 4
Track gearbox, torque flow

Reduction ratio

$$i_1 = ((Z_{s1} + Z_{r1}) \cdot (Z_{s2} + Z_{r1}) \cdot (Z_{s3} + Z_r) / Z_{s1} \cdot Z_{s2} \cdot Z_{s3}) - 1$$

- Z_{s1} = Number of No.1 sun gear teeth
- Z_{s2} = Number of No.2 sun gear teeth
- Z_{s3} = Number of No.3 sun gear teeth
- Z_{r1} = Number of No.1 and 2 ring gear teeth
- Z_r = Number of No.3 ring gear teeth

Document Title: Track gearbox, precautions for operation	Function Group:	Information Type: Service Information	Date: 2015/7/9 0
Profile: EXC, EC235C NL [GB]			

Track gearbox, precautions for operation

Installation

- Check that the mating mount surfaces are clean.

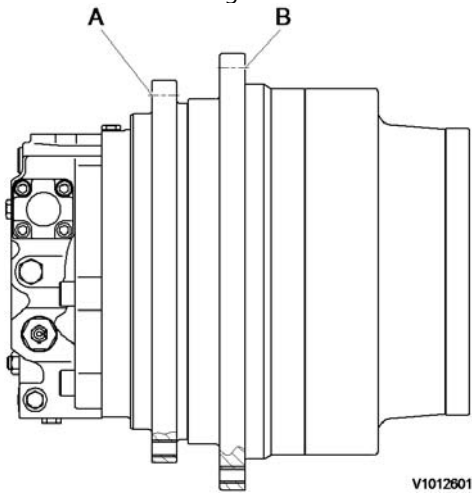


Figure 1
Mounting location

- A. Reduction gear to frame
- B. Sprocket to reduction gear

- Check that the motor is positioned correctly in the frame.
- If the gearbox to frame fit is tight, draw the assembly into the frame evenly with the mounting screws.
- Tighten the screws in a crisscross pattern in several stages to the specified torque.
- Apply these same precautions when mounting the sprocket.

Tightening torque

Tightening torque, unit : kgf-m (lbf-ft)

	Quantity	Thread	Tightening torque
Reduction screw (A)	20	M20	52.2 (377)
Sprocket screw (B)	16	M20	44 (318)

NOTE!

The screws must be 10.9 KS strength classification or above.

Lubricating oil

NOTE!

Prior to operating the travel function, fill the gearbox with the specified oil to the correct level.

Gear oil specification

Use a gear oil equivalent to API classification GL4 ~ GL5, SAE 90.

Gear oil replacement period

- First (initial) oil replacement: 500 operating hours
- Subsequent oil replacement: 2000 operating hours
- After maintenance (initial): 250 operating hours

NOTE!

Regardless of the operating hours the gear oil must be replaced at least once per year.

NOTE!

Do not mix different types, classifications or brands of oil.

NOTE!

Drain the gear oil while it is still warm to flush out any contaminants.

Gear oil replacement procedure

1. Rotate the gearbox until the drain plug and the fill plug are on the vertical axis.

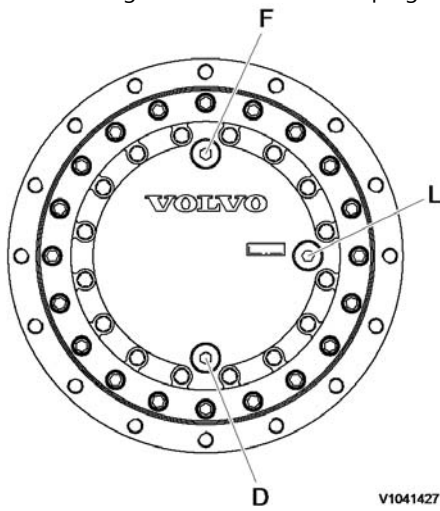


Figure 2
Oil replacement location

F	Fill port
L	Level check port
D	Drain port

2. Remove the 3 plugs in the end cover and drain the oil into a suitable container.
3. Refill the gearbox through the fill port until oil exits from the level check port.

NOTE!

Oil capacity: 6.2 liters (1.64 US gal)

Operating checks



The temperature of the case is high just after running. Use a thermometer to measure. Do not touch directly by hand to prevent a burn injury.

1. Check the oil level prior to operating the travel function.
2. Check for oil leakage on the gearbox assembly.
3. Check for loose mounting screws.
4. Check for abnormal sound or vibration while rotating.
5. Check for any abnormal temperature increase after operating for a short time.

NOTE!

The temperature of the case must be lower than atmospheric temperature + 60 °C, during continuous operation.

Document Title: Track gearbox, troubleshooting	Function Group:	Information Type: Service Information	Date: 2015/7/9 0
Profile: EXC, EC235C NL [GB]			

Track gearbox, troubleshooting

Track gearbox, troubleshooting

Gearbox does not rotate.	Motor overloaded.	Reduce the load.
	Gearbox is damaged.	Replace the gearbox.
Oil leakage from mating joint surfaces.	Liquid gasket improperly applied.	Disassembly and re-apply.
	Mating surface damaged.	Repair or replace.
	Loosen screws.	Tighten to specified torque.
	Loosen plug.	Tighten to specified torque.
Casing leakage.	Cracks or pin holes.	Replace the housing.
	Cover damaged.	Replace the cover.

Track gearbox, troubleshooting

Floating seal leakage.	Sliding surface worn.	Replace the floating seal assembly.
	O-ring distorted.	
Abnormal operating temperature.	Insufficient gear oil.	Refill to specified level.

Document Title: Track gearbox, removal	Function Group:	Information Type: Service Information	Date: 2015/7/9 0
Profile: EXC, EC235C NL [GB]			

Track gearbox, removal

Op nbr 00000

1. Remove cover screw (2) of track gearbox, and remove cover (1).

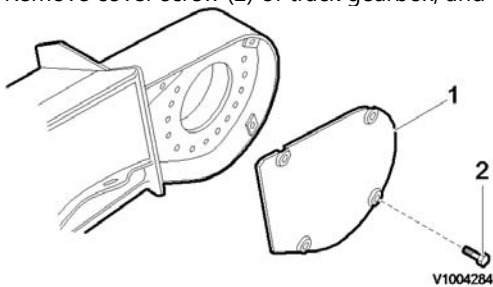


Figure 1
Removal, cover

2. Remove the track.
3. Place a wooden block on the track, and place the lower roller on the block to raise the sprocket off the track.
4. Disconnect the hydraulic hoses at the track motor. Plug the pipe ends and ports to prevent the outflow of oil and the entry of contamination.

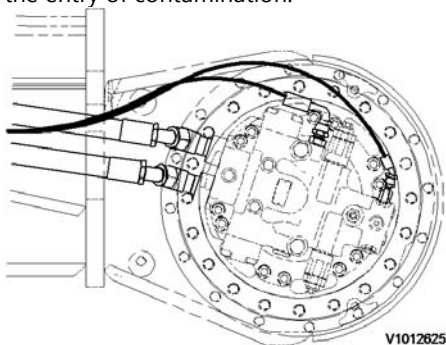


Figure 2
Removal, hydraulic hoses and screws

5. Remove the track motor mounting screws from the undercarriage.
6. Pass a wire rope around the gearbox, and lift it. Remove the track motor as an assembly.

NOTE!

Lift the gearbox as close to the sprocket as possible to maintain balance.

NOTE!

Putting match-marks on the track frame and track gearbox will facilitate reassembly.

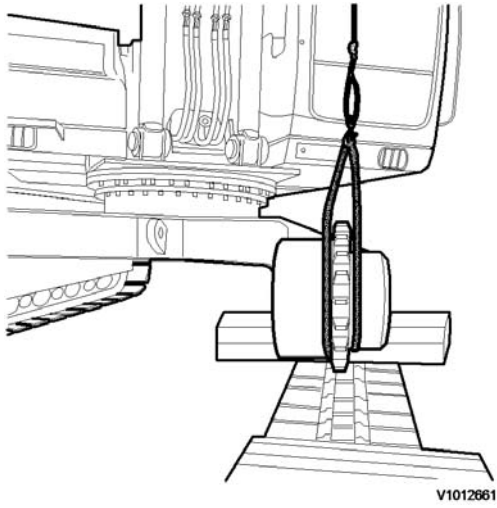


Figure 3
Removal, track gearbox

Document Title: Track gearbox, installation	Function Group:	Information Type: Service Information	Date: 2015/7/9 0
Profile: EXC, EC235C NL [GB]			

Track gearbox, installation

Op nbr 00000

NOTE!

Carefully check the mating surface of the undercarriage and the gearbox for burrs, dirt and rust scale.

1. Pass a wire rope around the gearbox, lift and install the gearbox to the undercarriage.

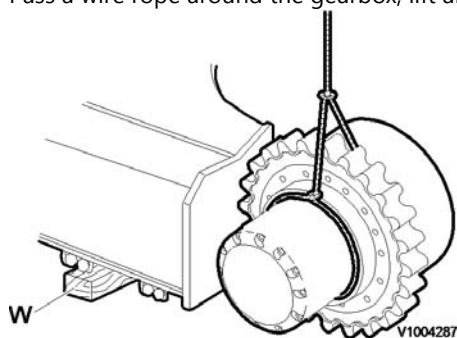


Figure 1
Install, track gearbox

2. Apply Loctite #277 to the gearbox mounting screws, and tighten them to the specified torque.
Tightening torque : 44 ± 4 kgf·m (318 ± 29 lbf·ft)
3. Connect the hydraulic hoses at the track motor.
4. Install the gearbox cover.
5. Check the gear oil level of gearbox. If necessary, replace or refill the oil.

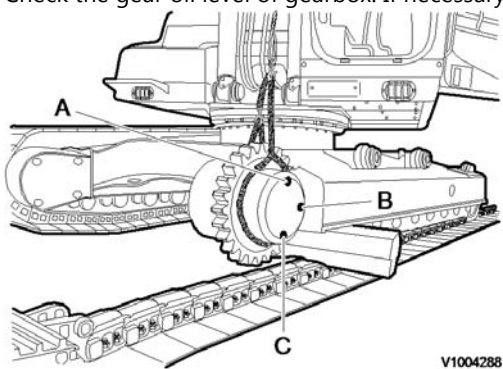


Figure 2
Checking, oil level

- A. Filling port
- B. Level port

C. Drain port

Document Title: Track gearbox, maintenance standard	Function Group:	Information Type: Service Information	Date: 2015/7/9 0
Profile: EXC, EC235C NL [GB]			

Track gearbox, maintenance standard

The parts are precision finished and must be handled carefully.

Keep the parts of the planetary carrier (s) together, do not mix the bearings, gears, pins and thrust washers.

Seals

Replace the seals and O-ring, although they appear not damaged.

Part replacement criteria

Replace all parts that appear damaged or are not within the allowable value.

Replace some parts in sets, i.e. gears, bearings, pins and thrust washers.

Part replacement criteria

Item no.	Part	Condition	Allowable value
9 6 13 11 23 20 31	Ring gear No.3 planetary gear No.3 sun gear No.2 planetary gear No.2 sun gear No.1 planetary gear No.1 sun gear	The tooth surface is pitted or non-uniformly worn. The gear is cracked.	Area rate : within 5%
7 16 26 2	Needle bearing Needle bearing Needle bearing Angular bearing	Fitting or flaking of the balls, rollers or races. Does not rotate smoothly by hand.	
3	Seal	Rust or damage on sliding face. O-ring distorted or damaged.	
8 18 22	No.3 pin No.2 pin No.1 pin	The pin is cracked, galled or pitted.	
17	Thrust washer	Excessively worn on the face area.	

Remove air in the track motor before operating.

1. Check that the gearbox axis is horizontal. Rotate the gearbox housing until the drain plug is on the bottom of the vertical axis of the end cover.

The gearbox is supplied with oil plugs (draining, filling and level) equipped with an hole that allows the air to bleed.

NOTE!

Remove the oil plugs with care. When the gearbox is warm, the air inside can be pressurized and this can cause their strongly expulsion towards the worker.

2. Loose with caution the plugs (2~3 rounds) counterclockwise.
3. Clean the plug to be sure that the air bleed hole is not obstructed.
4. Wait a few seconds to allow the pressurized air to bleed from the gearbox.
5. Remove the plugs and let the oil flow in a large enough container; in order to facilitate the draining must be oil still warm.
6. Wait a few minutes until all the oil is drained and then proceed to screw on the plugs.
7. Proceed with the oil fill-up following the procedures given.

NOTE!

Never mix mineral oils with synthetic oils and vice versa.

Do not dispose of the oil in the natural environment but be careful to eliminate it in compliance with the relative rules and regulations that govern locally.

Tightening torque plug. See track gearbox, description.

Document Title: Track gearbox, replacing cover	Function Group:	Information Type: Service Information	Date: 2015/7/9 0
Profile: EXC, EC235C NL [GB]			

Track gearbox, replacing cover

Op nbr 431-117

1. Park the machine in the service position B, see [091 Service positions](#).
Rotate the gearbox until the drain plug and fill plug are on the vertical axis.
2. Remove the 3 plugs on the cover and drain the oil into a suitable container.

NOTE!

Oil capacity: 6.2 liters (1.6 US gal)

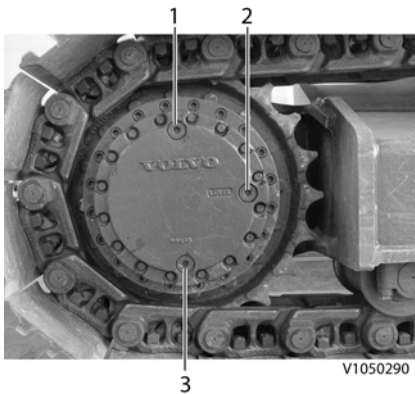


Figure 1
Removal, plugs

1. Fill port
 2. Level check port
 3. Drain port
3. Remove the screws (1) of gearbox cover (2).

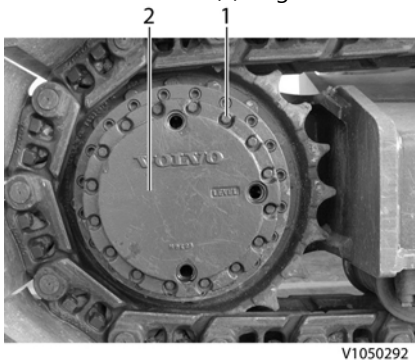


Figure 2
Replacing, gearbox cover

1. Screws (16 EA)
2. Track gearbox cover

4. Replace the gearbox cover (2) to a new one.

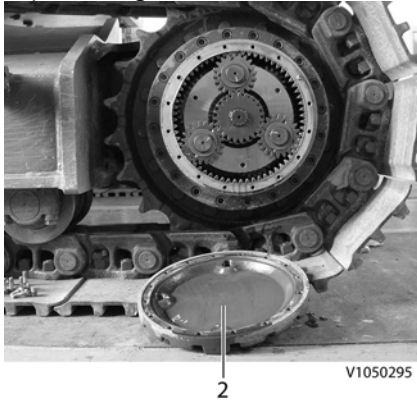


Figure 3
Replacing, gearbox cover

NOTE!

Before replacing cover (2), remove impurities on mounting surface cleanly and apply the sealing compound on mounting surface.

5. Apply the loctite #277 to the screws (1) of gearbox cover (2), and tighten them to the specified torque.
6. Install the drain plug and tighten it to the specified torque.
7. Fill the oil through the fill port until oil exits from the level check port.
8. Install the fill and level check plug and tighten them to the specified torque.

Document Title: Track gearbox, disassembly	Function Group:	Information Type: Service Information	Date: 2015/7/9 0
Profile: EXC, EC235C NL [GB]			

Track gearbox, disassembly

Precautions

- Thoroughly clean the gearbox assembly prior to disassembly.
- Select a clean work area.
- Match mark attached components to indicate proper positioning during reassembly.
- Take care not to mix parts of sub assemblies i.e. planetary bearings, gears and thrust washers.
- Thoroughly clean all parts and the inside of the casings.
- Inspect and analyze all failures.
- Determine the root cause !

Disassembly



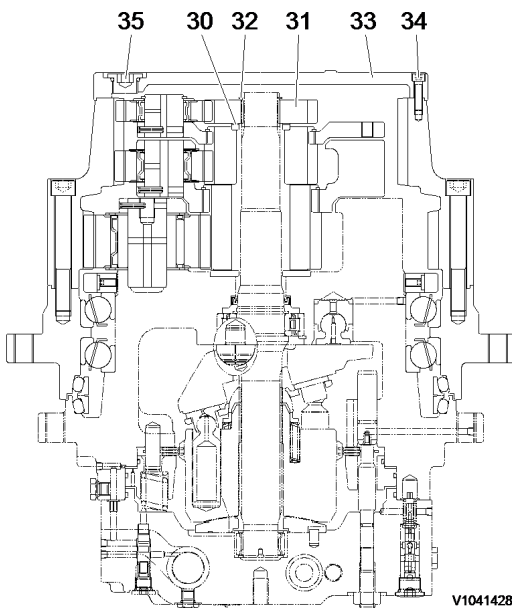
WARNING

The parts are heavy. Take appropriate safety precautions.

1. After loosening plug (35), drain oil from casing.

NOTE!

Drain oil into a clean container and check oil thoroughly for contamination. Do not reuse drained oil.



V1041428

Figure 1

Plug and cover, removal

2. Put side cover upward and remove screws (34) and take side cover (33) off.
3. Remove snap ring (32), and remove No.1 sun gear (31).
4. Remove No.1 planetary gear assembly (20) from No.2 planetary gear assembly (11).



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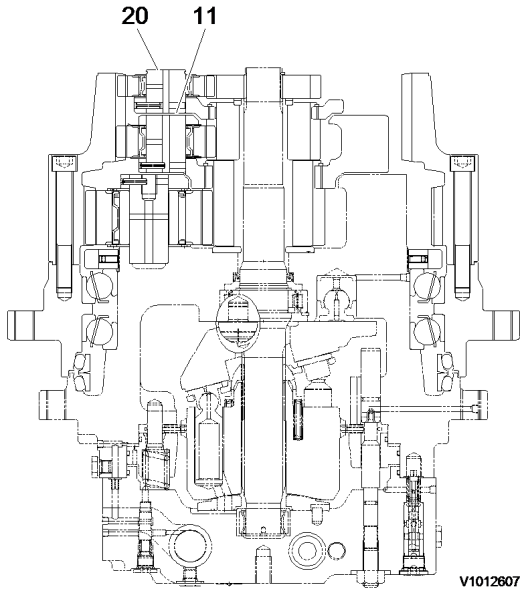


Figure 2

No.1 planetary gear assembly, removal

5. Disassembling No.1 planetary gear assembly.

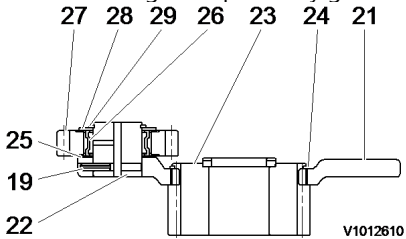


Figure 3

No.1 planetary gear assembly, disassembly

- Remove snap ring (29) first, then thrust washer (28), No.1 planetary gear (27), needle bearing (26) and thrust washer (25).
- After removing retaining ring (24), disassemble No.1 carrier (21) from No.2 sun gear (23).

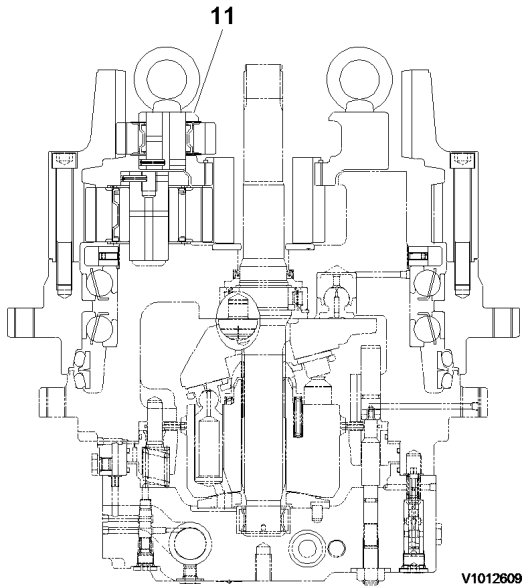
NOTE!

If No.1 pin (22) is normal, do not disassemble from No.1 carrier (21). If the surface of No.1 pin is flaky, replace No.1 pin, No.1 carrier, No.1 planetary gear and needle bearing as a set. Mark each planetary gear and carrier for reassembly. Do not reuse spring pin.

NOTE!

Do not mix the gears, bearings, thrust washers and pin assemblies. Above is the same for No.2 and No.3 carrier.

6. Remove No.2 planetary gear assembly (11) from No.3 planetary gear assembly.

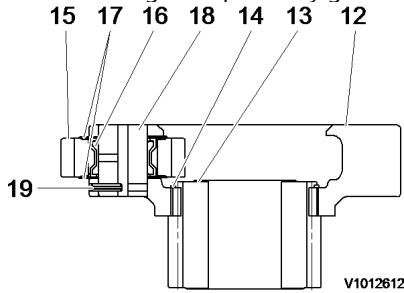


V1012609

Figure 4

No.2 planetary gear assembly, removal

7. Disassembling No.2 planetary gear assembly.



V1012612

Figure 5

No.2 planetary gear assembly, disassembly

NOTE!

Check for the following before disassembling and do not disassemble if you can not find any problem. Scratches, pitching or cracks on tooth surface of the planetary gear. Noise, eccentricity or play when being rotated.

NOTE!

Mark each planetary gear and carrier for reassembly.

NOTE!

Do not reuse spring pin.

- Tap spring pin (19) and take out No.2 pin (18), remove from rear side of No.2 carrier.
- Remove thrust washer (17), No.2 planetary gear (15) and needle roller bearing (16) from No.2 carrier (12).

8. Remove screw (10) and screw two M8 eye bolts into the front side of ring gear (9), and remove it by a crane.

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