Document Title: **Function description**	Function Group:	Information Type: **Service Information**	Date: **2014/10/8**
Profile: **EXC, ECR235C L [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

$i1 = ((Zs1 + Zr) \cdot (Zs2 + Zr) / (Zs1 \cdot Zs2)) - 1$

- 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: **2014/10/8**
Profile: **EXC, ECR235C L [GB]**			

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Track gearbox, description

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

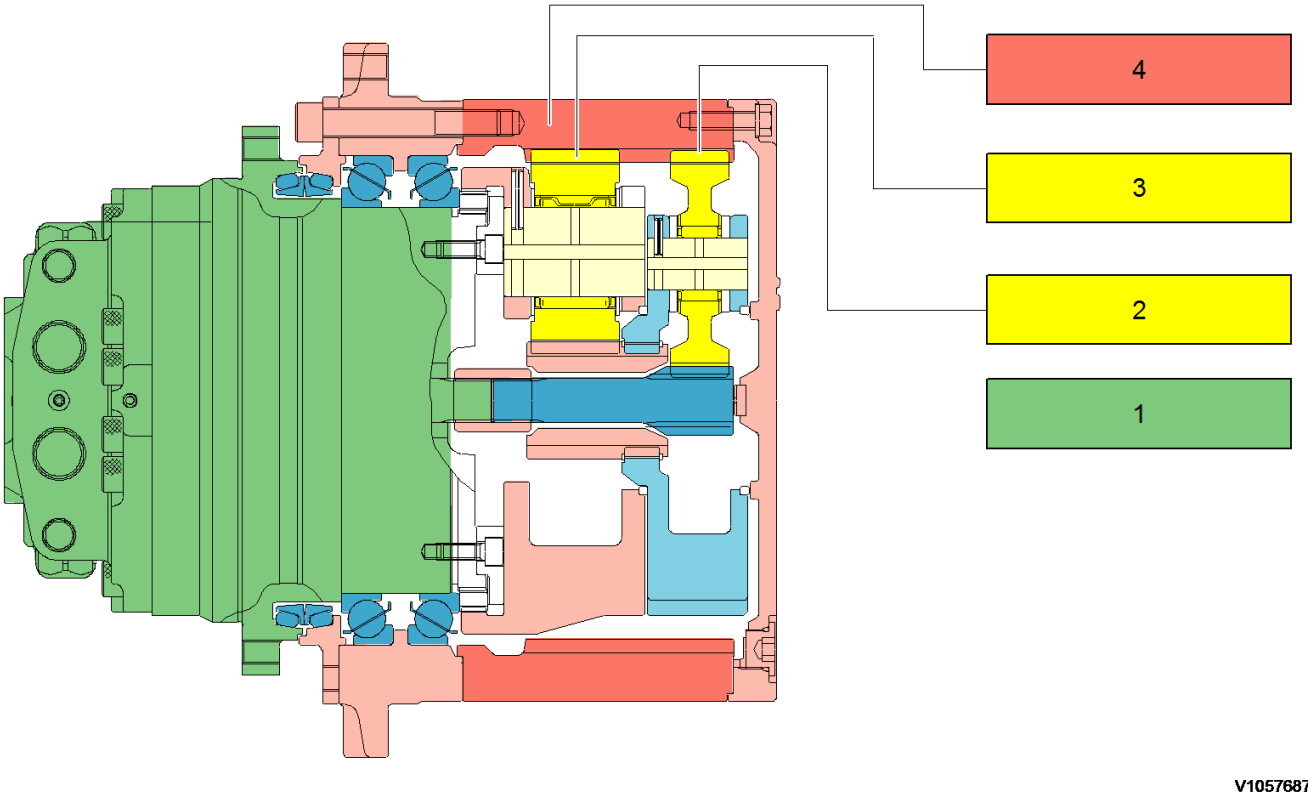

Figure 1
2 stage planetary gearbox

1. Track motor
2. No.1 planetary gear assembly
3. No.2 planetary gear assembly
4. Ring gear

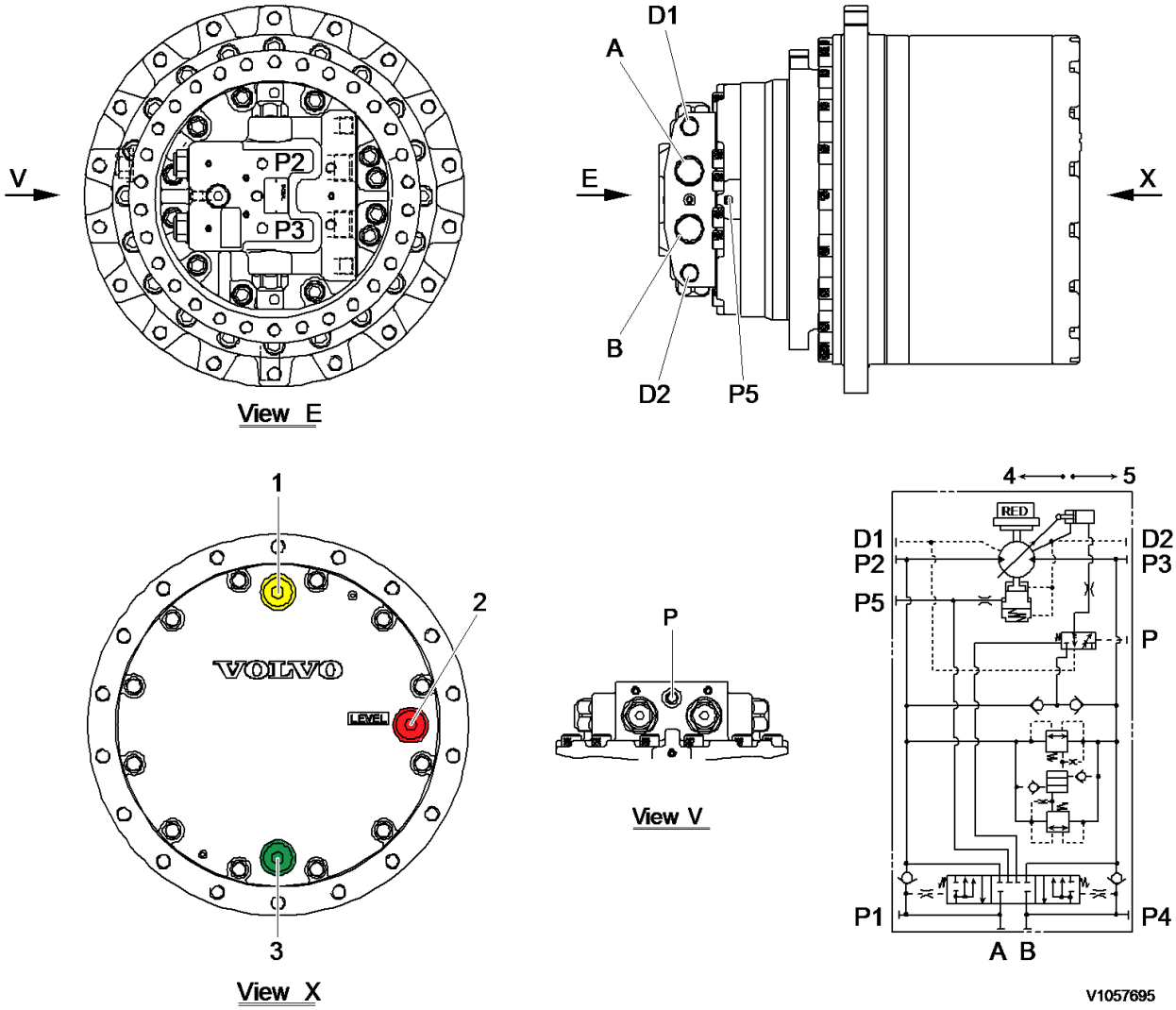

Figure 2
Port connections

1. Oil filling port (PF 3/4) 147 Nm (15 kgf m)
2. Oil level check port (PF 3/4) 147 Nm (15 kgf m)
3. Oil drain port (PF 3/4) 147 Nm (15 kgf m)
4. High speed
5. Low speed

Port connections

Port symbol	Port size	Port
(A), (B)	1-5/16-12UN	Oil supply (Return)
(P2), (P3)	PT 1/4	Pressure check
(P5)	PT 1/8	Brake release pressure Parking brake can be released manually when supply pressure minimum 1.47 MPa (14.99 kgf cm2) (213.2 psi) (14.7 bar) to port P5
(P)	7/16-20UNF	Displacement changeover valve oil supply
(D1), (D2)	3/4-16UNF	Motor drain

Rotational direction

View from E axis	Inlet	Outlet
Clockwise	A	B

Counterclockwise	B	A

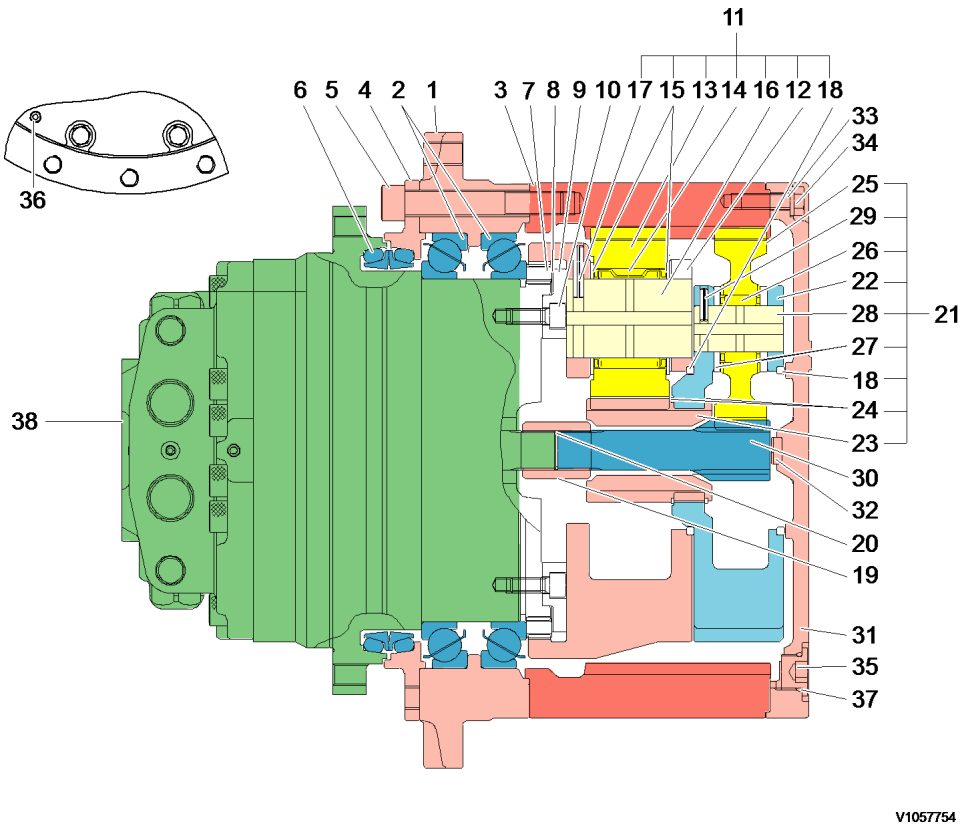

Figure 3
Track gearbox, sectional view

1	Housing	14	Bearing_needle	27	Washer_thrust
2	Bearing_main	15	Washer_thrust	28	Pin_no.1
3	Gear_ring	16	Pin_no.2	29	Pin_spring
4	Seal_ring	17	Pin_spring	30	Gear_sun no.1
5	Bolt 416 Nm (42.3 kgf m)	18	Ring_thrust	31	Cover
6	Seal_floating	19	Coupling	32	Pad
7	Gear_coupling	20	Ring_retaining	33	Washer_spring
8	Shim	21	Carrier_assy no.1	34	Bolt 111 Nm (11.3 kgf m)
9	Retainer	22	Carrier_no.1	35	Plug_hydraulic
10	Bolt 122.5 Nm (12.5 kgf m)	23	Gear_sun no.2	36	Screw_hex.socket
11	Carrier_assy no.2	24	Ring_retaining	37	O-ring
12	Carrier_no.2	25	Planetary gear_no.1	38	Name plate
13	Planetary gear_no.2	26	Bearing_needle		

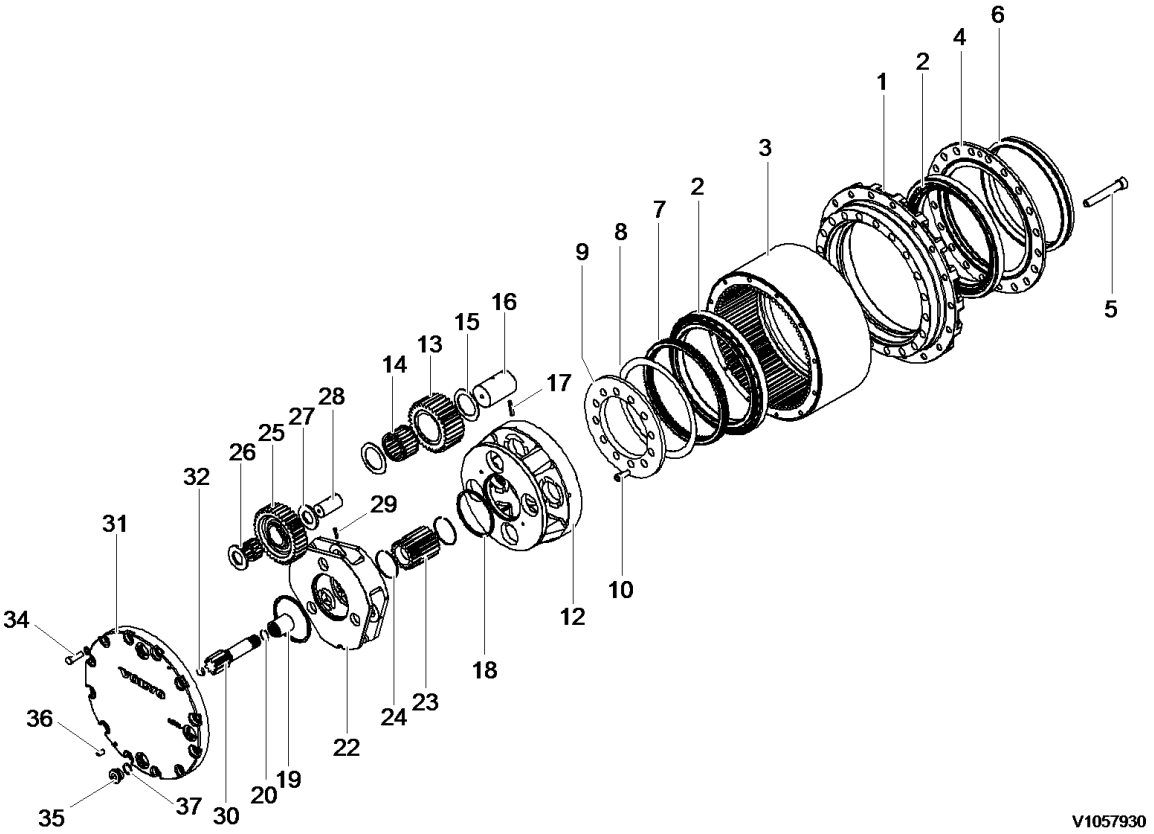

Figure 4
Track gearbox, exploded view

The power transmitted from the hydraulic motor output shaft is transmitted to the gear_sun no.1 (30) → carrier_no.1 (22) → gear_sun no.2 (23) → planetary gear_no.2 (13) → gear_ring(3).

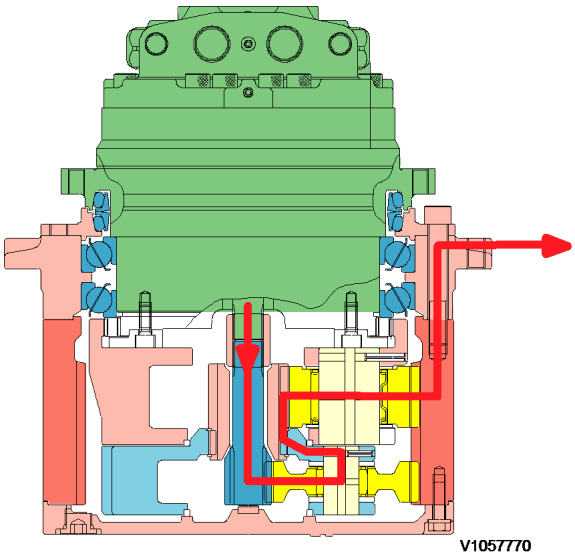

Figure 5
Track gearbox, torque flow

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

(1) 1st reduction ratio

$i1 = ((Zs1 + Zr) \cdot (Zs2 + Zr) / (Zs1 \cdot Zs2)) - 1$

- 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: **2014/10/8**
Profile: **EXC, ECR235C L [GB]**			

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Track gearbox, 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.

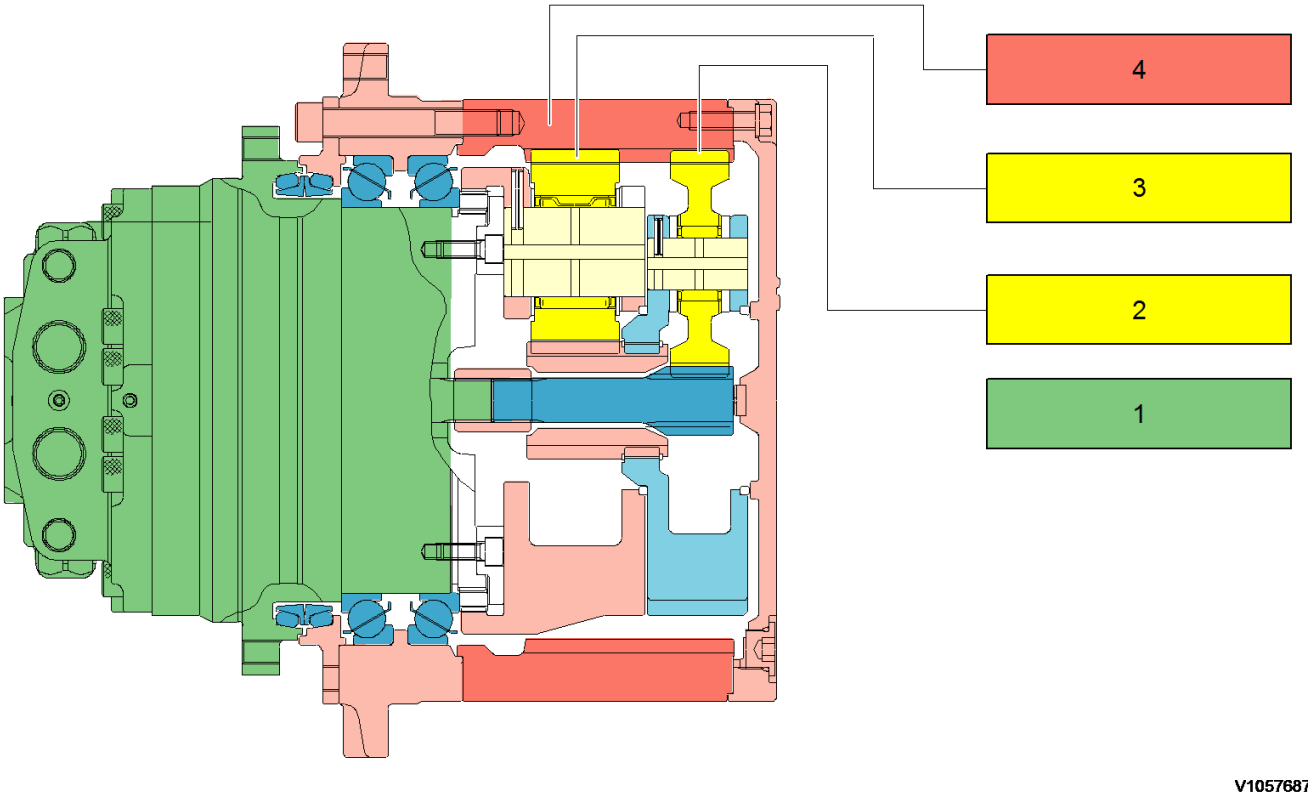

Figure 1
2 stage planetary gearbox

1. Track motor
2. No.1 planetary gear assembly
3. No.2 planetary gear assembly
4. Ring gear

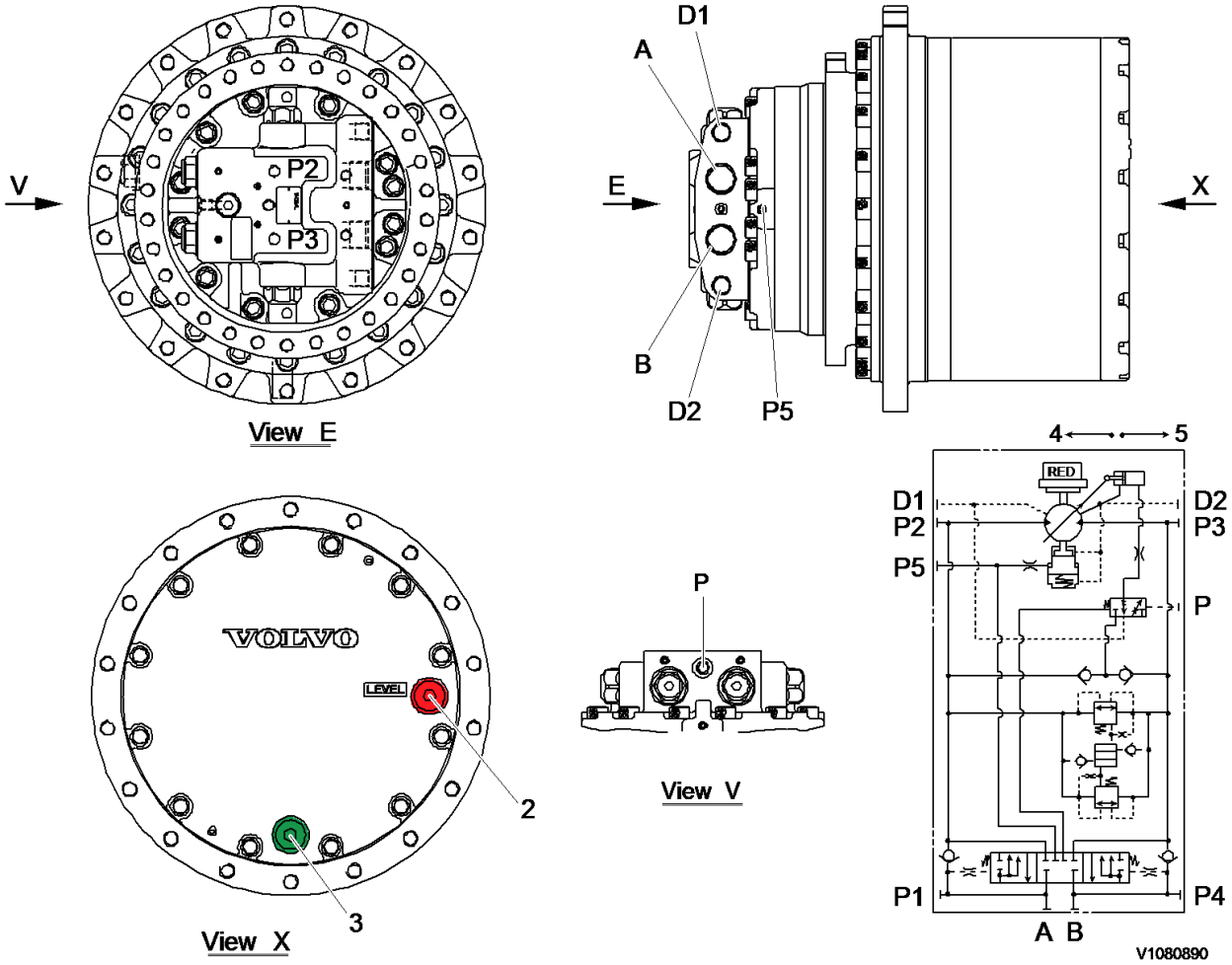

Figure 2
Port connections

1. –
2. Oil level check and oil filling port (PF 3/8): 74 Nm (7.5 kgf m)
3. Oil drain port (PF 3/8): 74 Nm (7.5 kgf m)
4. High speed
5. Low speed

Port connections

Port symbol	Port size	Port
(A), (B)	1-5/16-12 UN	Oil supply (return)
(P2), (P3)	PT 1/4	Pressure check
(P5)	PT 1/8	Brake release pressure Parking brake can be released manually when supply pressure minimum 1.47 MPa (14.99 kgf cm2) (213.2 psi) (14.7 bar) to port P5
(P)	7/16-20 UNF	Displacement changeover valve oil supply
(D1), (D2)	3/4-16 UNF	Motor drain

Rotational direction

View from E axis	Inlet	Outlet
Clockwise	A	B
Counterclockwise	B	A

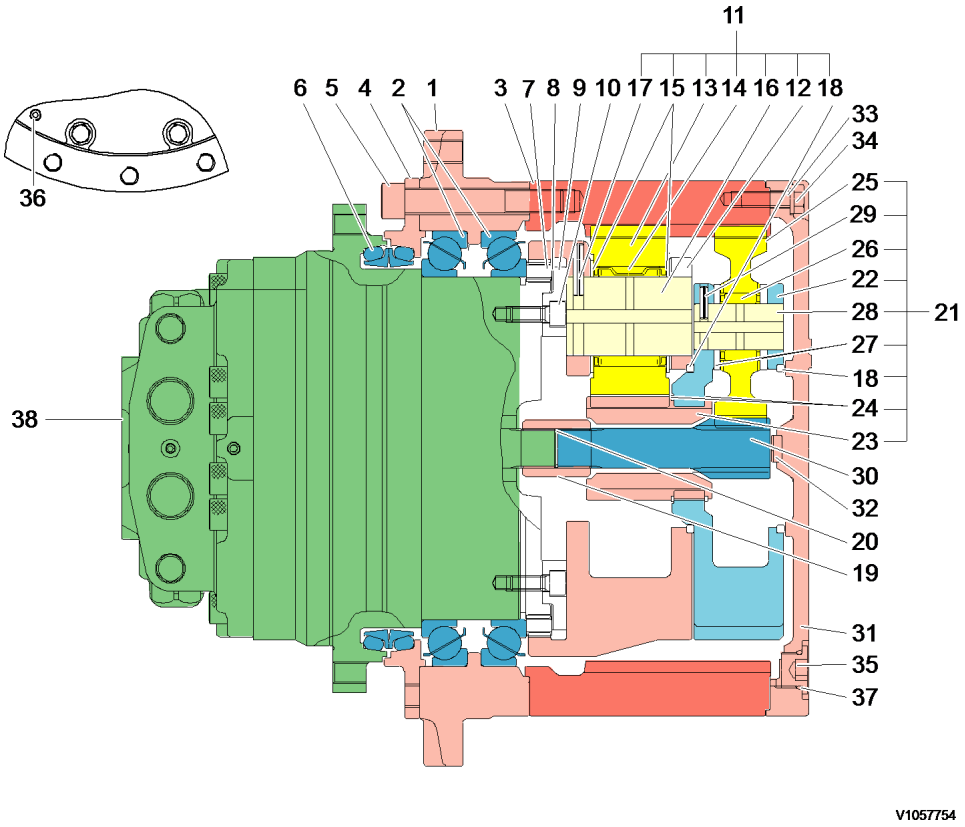

Figure 3
Track gearbox, sectional view

1	Housing	14	Needle bearing	27	Thrust washer
2	Main bearing	15	Thrust washer	28	No.1 pin
3	Ring gear	16	No.2 pin	29	Spring pin
4	Ring seal	17	Spring pin	30	No.1 sun gear
5	Screws 416 Nm (42.3 kgf m)	18	Thrust ring	31	Cover
6	Floating seal	19	Coupling	32	Pad
7	Coupling gear	20	Retaining ring	33	Spring washer
8	Shim	21	No.1 carrier assy	34	Screws 171.5 Nm (17.5 kgf m)
9	Retainer	22	No.1 carrier	35	Hydraulic plug
10	Screws 122.5 Nm (12.5 kgf m)	23	No.2 sun gear	36	Screw
11	No.2 carrier assy	24	Retaining ring	37	O-ring
12	No.2 carrier	25	No.1 planetary gear	38	Name plate
13	No.2 planetary gear	26	Needle bearing		

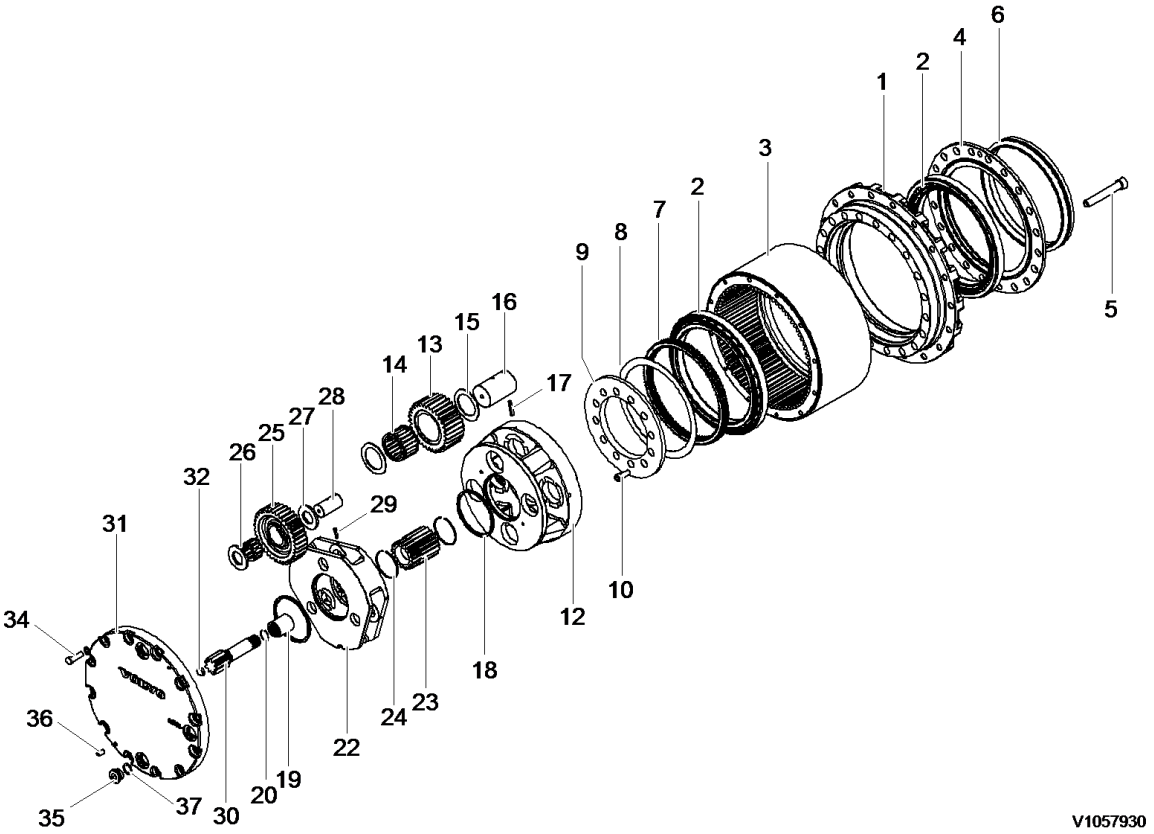

Figure 4
Track gearbox, exploded view

The power transmitted from the hydraulic motor output shaft is transmitted to the gear_sun no.1 (30) → carrier_no.1 (22) → gear_sun no.2 (23) → planetary gear_no.2 (13) → gear_ring(3).

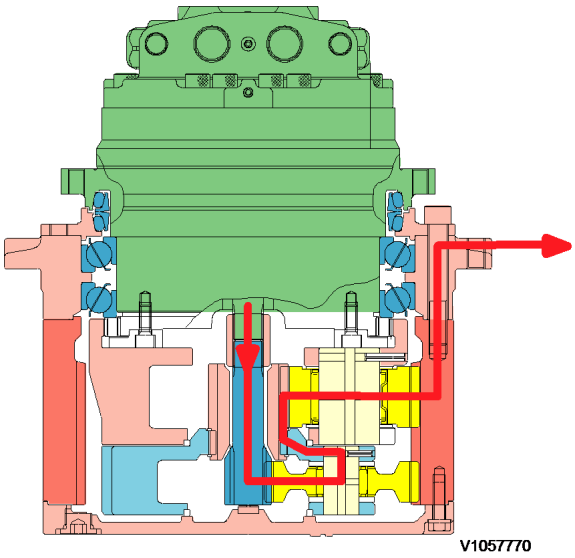

Figure 5
Track gearbox, torque flow

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

(1) 1st reduction ratio

$i1 = ((Zs1 + Zr) \cdot (Zs2 + Zr) / (Zs1 \cdot Zs2)) - 1$

- 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, precautions for operation**	Function Group:	Information Type: **Service Information**	Date: **2014/10/8**
Profile: **EXC, ECR235C L [GB]**			

Track gearbox, precautions for operation

Installation

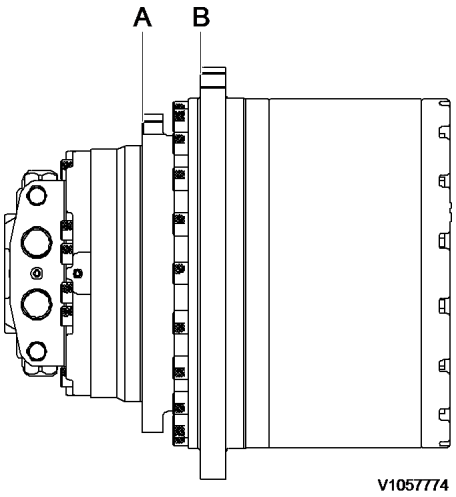

Figure 1
Mounting location

A. Main body mounted area
B. Sprocket mounted area

- Check that the mating mount surfaces are clean.
- 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

	Quantity	Thread size	Tightening torque
Reduction screw (A)	30	M16 (P2.0)	265 ± 29.4 Nm (195 ± 22 lbf ft)
Sprocket screw (B)	18	M18 (P2.5)	373 ± 37 Nm (275 ± 27 lbf ft)

NOTE!
The screws must be 10.9 KS strength classification or above.

Lubricating oil

NOTICE

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

NOTE!
Gear oil specification

Use a gear oil equivalent to API classification GL–4 or GL–5, 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

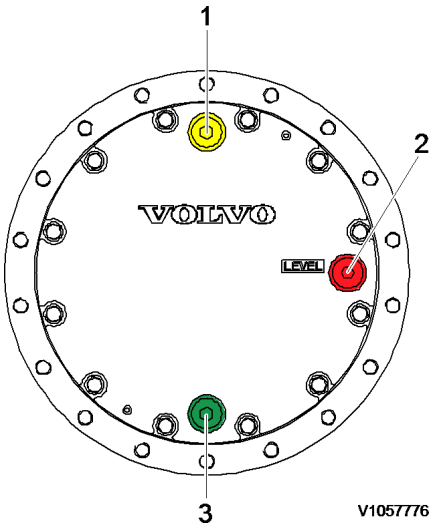

Figure 2
Oil replacement location

1. Fill port
2. Level check port
3. Drain port

- Rotate the gearbox until the drain plug and the fill plug are on the vertical axis.
- Remove the 3 plugs in the end cover and drain the oil into a suitable container.
- Ensure that the drain plug O-ring is not damaged, then install the plug and torque to specification.
- Refill the gearbox through the fill port until oil exits from the level check port.
- Ensure that the O-ring on each plug is not damaged, then install the plugs and torque to specification.

NOTE!
Oil capacity: 5 liters (1.32 US gal)

Operating checks

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

WARNING

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.

NOTE!
The temperature of the case must be lower than 90 °C, during continuous operation.

Document Title: **Track gearbox, maintenance standard**	Function Group:	Information Type: **Service Information**	Date: **2014/10/8**
Profile: **EXC, ECR235C L [GB]**			

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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-rings, 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.

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.

Part replacement criteria

Item No.	Part	Condition	Allowable value
8 12 20 22	Ring gear No.2 planetary gear No.2 sun gear No.1 planetary gear	The tooth surface is pitted or non uniformly worn. The gear is cracked.	Area rate: within 5%

27	No.1 sun gear		
23 13 Needle bearing 2	Needle bearing Angular bearing	Fitting/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.	
15 25	No.2 pin No.1 pin	The pin is cracked, galled or pitted.	
24 14	Thrust washer	Excessively worn on the face area.	

General tools

General tools

No.	Description	Size	Quantity
1	Socket wrench	18 mm (0.71 in)	1
2	L wrench & Hexagon wrench socket	5 mm (0.2 in) 10 mm (0.39 in) 14 mm (0.55 in)	1
3	Torque wrench	100 ~ 150 Nm (73 ~ 110 lbf ft) 400 ~ 450 Nm (295 ~ 332 lbf ft)	1
4	Eye bolt	PF 3/4 M10 M12 M18	2
5	Plastic hammer	Approximately L = 300 ~ 500 mm (11.8 ~ 19.7 in)	1
6	Screwdriver	Approximately L = 200 mm (7.9 in)	1
7	Depth gauge (Vernier calliper)	Range approximately 300 mm (11.8 in) Minimum scale 0.01 mm (0.00039 in)	1

Special tool

Special tool

No.	Description	Part number	Quantity
1	Bearing shim thickness measuring tool	14599552	1

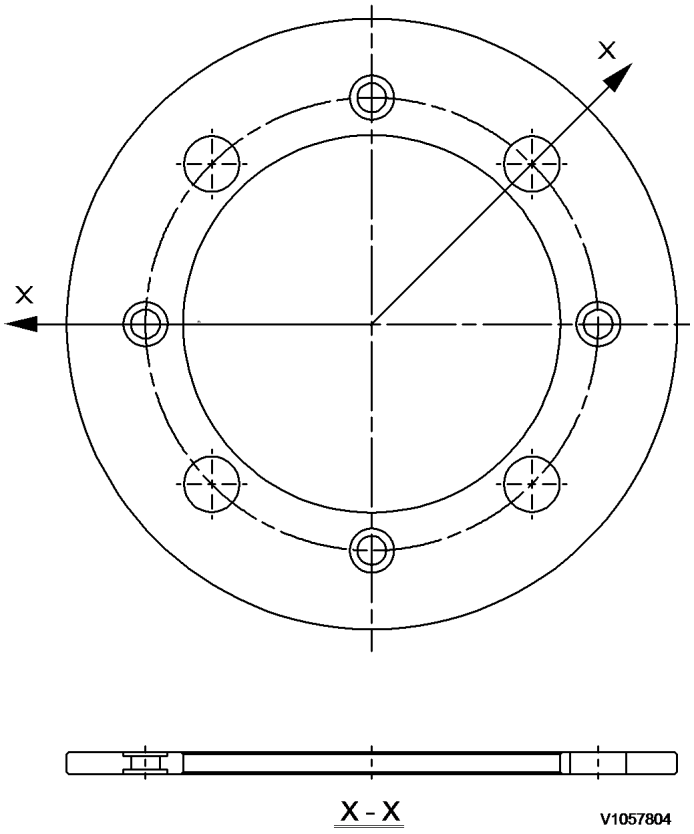

Figure 2
Bearing shim thickness measuring tool

Document Title: **Track gearbox, maintenance standard**	Function Group:	Information Type: **Service Information**	Date: **2014/10/8**
Profile: **EXC, ECR235C L [GB]**			

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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-rings, 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

No.	Part	Condition	Allowable value
8 12 20 22 27	Ring 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%
23 13 2	Needle bearing Needle bearing Angular bearing	Fitting/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.	
15 25	No.2 pin No.1 pin	The pin is cracked, galled or pitted.	
24 14	Thrust washer	Excessively worn on the face area.	

General tools

General tools

No.	Description	Size	Quantity
1	Socket wrench	18 mm (0.71 inch)	1
2	L wrench & Hexagon wrench socket	5 mm (0.2 inch) 10 mm (0.39 inch) 14 mm (0.55 inch)	1
3	Torque wrench	100 ~ 150 Nm (73 ~ 110 lbf ft) 400 ~ 450 Nm (295 ~ 332 lbf ft)	1
4	Eye bolt	PF 3/4 M10 M12 M18	2
5	Plastic hammer	Approximately L = 300 ~ 500 mm (11.8 ~ 19.7 inch)	1
6	Screwdriver	Approximately L = 200 mm (7.9 inch)	1
7	Depth gauge	Range approximately 300 mm (11.8 inch)	1

(Vernier calliper)	Minimum scale 0.01 mm (0.00039 inch)

Special tool

Special tool

No.	Description	Part number	Quantity
1	Bearing shim thickness measuring tool	14599552	1

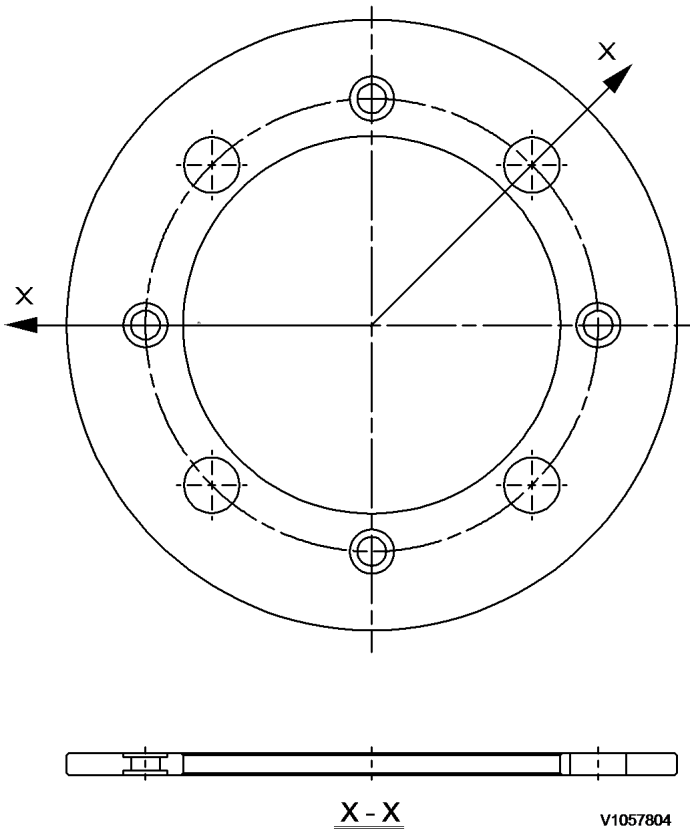

Figure 1
Bearing shim thickness measuring tool

Track gearbox, precautions for operation

Installation

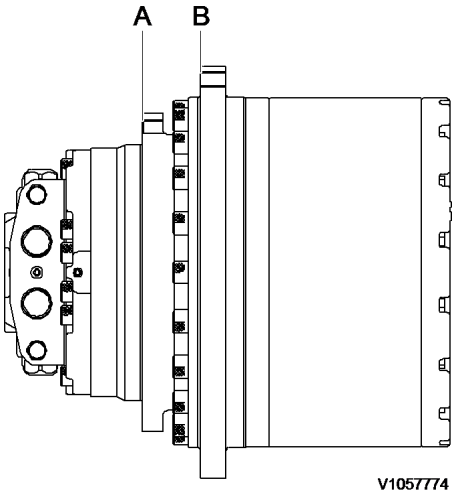

Figure 2
Mounting location

A. Main body mounted area
B. Sprocket mounted area

- Check that the mating mount surfaces are clean.
- 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

Reduction screw (A). See 700 Undercarriage, tightening torque.
Sprocket screw (B). See 700 Undercarriage, tightening torque.

NOTE!
The screws must be 10.9 KS strength classification or above.

NOTICE

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

NOTE!
Gear oil specification

Use a gear oil equivalent to API classification GL-4 or GL-5, SAE90.

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

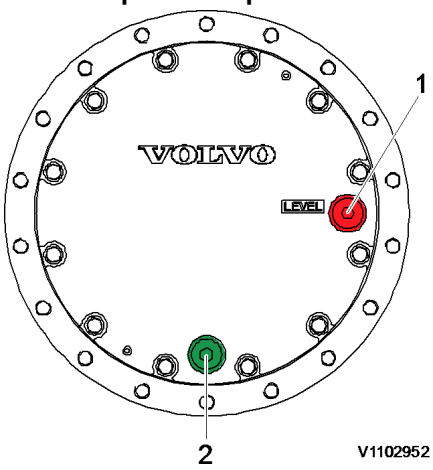

Figure 3
Oil replacement location

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