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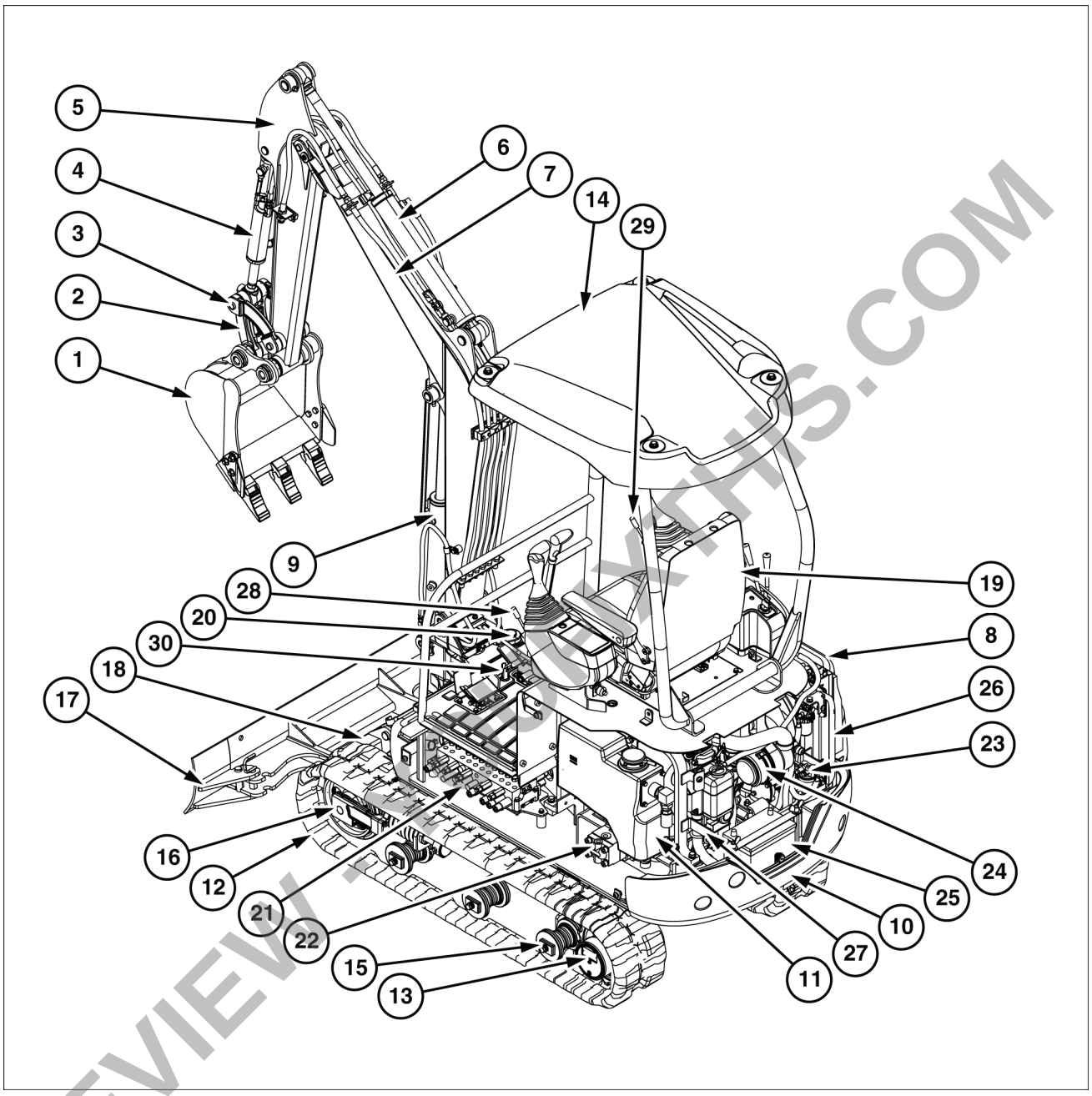
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Part identification



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1. Bucket
2. Link rod
3. Lever
4. Bucket cylinder
5. Arm
6. Arm cylinder
7. Boom
8. Fuel tank
9. Boom cylinder
10. Counterweight
11. Hydraulic oil tank
12. Crawler
13. Travel motor
14. Canopy
15. Lower roller
16. Idler adjuster
17. Dozer
18. Dozer cylinder
19. Operator’s seat
20. Swing cylinder
21. Control valve
22. Pump
23. Engine
24. Air filter
25. Battery
26. Radiator
27. Muffler
28. Left-hand safety lever
29. Right-hand safety lever (only on models with canopy)
30. Upper structure slewing locking pin

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Metric coarse thread standard tightening torque values. Be certain to tighten all capscrews and nuts to proper torque values

Classification	4.8T		7T		10.9T	
Nominal dimension	No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M6 x 1	3.9 - 4.9 N·m (2.88 - 3.61 lb ft)	3.3 - 4.1 N·m (2.43 - 3.02 lb ft)	8.6 - 10.6 N·m (6.34 - 7.82 lb ft)	7.3 - 8.9 N·m (5.38 - 6.56 lb ft)	15.6 - 19.2 N·m (11.51 - 14.16 lb ft)	13.2 - 16.2 N·m (9.74 - 11.95 lb ft)
M8 x 1.25	9.6 - 11.8 N·m (7.08 - 8.70 lb ft)	8.1 - 9.9 N·m (5.97 - 7.30 lb ft)	21.5 - 25.5 N·m (15.86 - 18.81 lb ft)	17.6 - 21.6 N·m (12.98 - 15.93 lb ft)	38.3 - 46.1 N·m (28.25 - 34.00 lb ft)	31.4 - 39.2 N·m (23.16 - 28.91 lb ft)
M10 x 1.5	19.6 - 23.6 N·m (14.46 - 17.41 lb ft)	16.1 - 19.7 N·m (11.87 - 14.53 lb ft)	41.2 - 51 N·m (30.39 - 37.62 lb ft)	35.3 - 43.1 N·m (26.04 - 31.79 lb ft)	74.6 - 92.2 N·m (55.02 - 68.00 lb ft)	63.7 - 77.5 N·m (46.98 - 57.16 lb ft)
M12 x 1.75	32.4 - 40.2 N·m (23.90 - 29.65 lb ft)	28.5 - 34.3 N·m (21.02 - 25.30 lb ft)	71.6 - 87.2 N·m (52.81 - 64.32 lb ft)	59.8 - 73.6 N·m (44.11 - 54.28 lb ft)	128 - 158 N·m (94.41 - 116.53 lb ft)	109 - 133 N·m (80.39 - 98.10 lb ft)
M14 x 2	52 - 63.8 N·m (38.35 - 47.06 lb ft)	44.1 - 53.9 N·m (32.53 - 39.75 lb ft)	113 - 139 N·m (83.34 - 102.52 lb ft)	96 - 116 N·m (70.81 - 85.56 lb ft)	206 - 246 N·m (151.94 - 181.44 lb ft)	172 - 210 N·m (126.86 - 154.89 lb ft)
M16 x 2	79.5 - 97.1 N·m (58.64 - 71.62 lb ft)	67.6 - 81.4 N·m (49.86 - 60.04 lb ft)	171 - 211 N·m (126.12 - 155.63 lb ft)	145 - 177 N·m (106.95 - 130.55 lb ft)	304 - 382 N·m (224.22 - 281.75 lb ft)	255 - 313 N·m (188.08 - 230.86 lb ft)
M18 x 2.5	110 - 134 N·m (81.13 - 98.83 lb ft)	93 - 113 N·m (68.59 - 83.34 lb ft)	236 - 294 N·m (174.06 - 216.84 lb ft)	206 - 246 N·m (151.94 - 181.44 lb ft)	432 - 530 N·m (318.63 - 390.91 lb ft)	363 - 441 N·m (267.74 - 325.26 lb ft)
M20 x 2.5	155 - 189 N·m (114.32 - 139.40 lb ft)	130 - 158 N·m (95.88 - 116.53 lb ft)	334 - 412 N·m (246.35 - 303.88 lb ft)	285 - 343 N·m (210.21 - 252.984 lb ft)	598 - 736 N·m (441.06 - 542.846 lb ft)	500 - 618 N·m (368.78 - 455.813 lb ft)
M22 x 2.5	206 - 246 N·m (151.94 - 181.44 lb ft)	172 - 212 N·m (126.86 - 156.36 lb ft)	451 - 549 N·m (332.64 - 404.92 lb ft)	383 - 461 N·m (282.49 - 340.02 lb ft)	814 - 990 N·m (600.38 - 730.19 lb ft)	677 - 833 N·m (499.33 - 614.39 lb ft)
M24 x 3	265 - 323 N·m (195.45 - 238.23 lb ft)	206 - 264 N·m (151.94 - 194.72 lb ft)	568 - 706 N·m (418.94 - 520.72 lb ft)	471 - 569 N·m (347.39 - 419.67 lb ft)	1042 - 1278 N·m (768.54 - 942.60 lb ft)	843 - 1039 N·m (621.76 - 766.33 lb ft)
M27 x 3	392 - 470 N·m (289.12 - 346.65 lb ft)	314 - 392 N·m (231.59 - 289.12 lb ft)	843 - 1039 N·m (621.76 - 766.33 lb ft)	687 - 843 N·m (506.71 - 621.76 lb ft)	1533 - 1867 N·m (1130.68 - 1377.03 lb ft)	1233 - 1507 N·m (909.41 - 1111.51 lb ft)
M30 x 3.5	529 - 647 N·m (390.17 - 477.2 lb ft)	441 - 539 N·m (325.26 - 397.55 lb ft)	1158 - 1412 N·m (854.10 - 1041.44 lb ft)	971 - 1187 N·m (716.17 - 875.49 lb ft)	2065 - 2535 N·m (1523.07 - 1869.72 lb ft)	1744 - 2136 N·m (1286.31 - 1575.43 lb ft)
M33 x 3.5	716 - 872 N·m (528.09 - 643.20 lb ft)	598 - 736 N·m (441.06 - 542.85 lb ft)	1549 - 1903 N·m (1142.48 - 1403.58 lb ft)	1304 - 1598 N·m (961.78 - 1178.62 lb ft)	2796 - 3424 N·m (2062.22 - 2525.41 lb ft)	2345 - 2875 N·m (1729.58 - 2120.49 lb ft)
M36 x 4	932 - 1128 N·m (687.41 - 831.97 lb ft)	775 - 951 N·m (571.61 - 701.42 lb ft)	2000 - 2452 N·m (1475.12 - 1808.5 lb ft)	1677 - 2049 N·m (1236.89 - 1511.26 lb ft)	3608 - 4412 N·m (2661.12 - 3254.12 lb ft)	3027 - 3693 N·m (2232.60 - 2723.82 lb ft)

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Difficult starting

Check items before troubleshooting

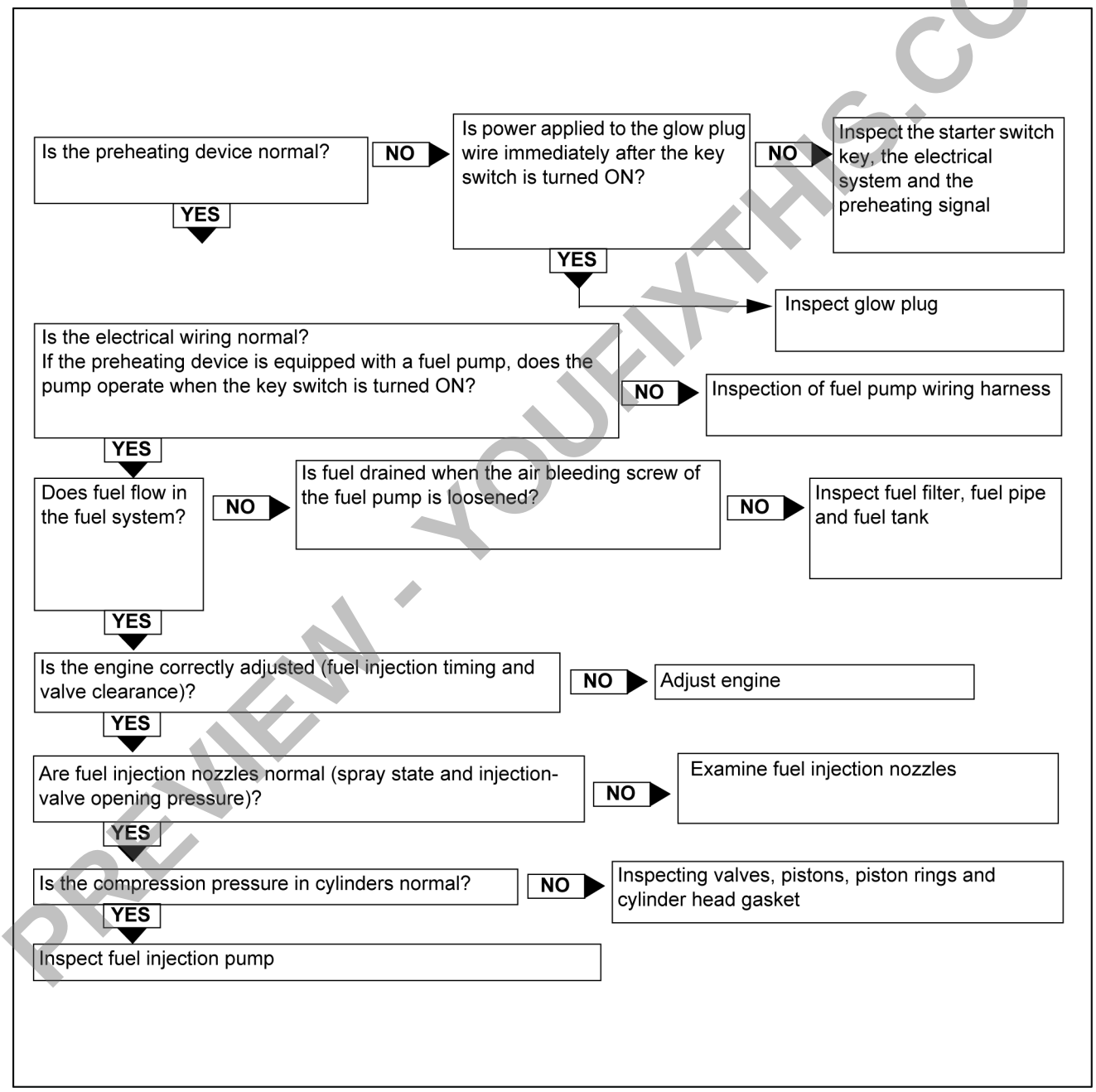
Clogging of air cleaner element

Engine oil thickening

Use of poor quality fuel

Drop in cranking speed

Problem: Difficult starting



TULI12EXN3496GA 1

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Engine - Service instruction

Break-in operation

After the engine is overhauled, couple the engine to the dynamometer, and run the engine for break-in operation and inspection.

Starting up

Before starting the engine, check the level of coolant, engine oil and fuel.

Bleed air from the fuel system and cooling system.

Stop fuel supply and start the engine with the starter motor for about **10 s** to lubricate the engine.

Move the control lever slightly in the fuel increase direction (but not to the “full injection” position), and then turn the starter switch key to the “START” position to start the engine.

After the engine is started, adjust the control lever to let the engine operate at a minimum no-load speed (low idle speed).

Turn the starter switch key to the “OFF” position and make sure that the engine is stopped.

Inspecting engine condition after starting up

During the break-in operation, check the following. If any abnormality is found, stop the engine, investigate the cause, and take appropriate measures.

The oil pressure must be within the specified value.

The coolant temperature must be within the specified value.

The engine must be free from any leakages such as oil, coolant and fuel. Pay special attention to oil leakage from the fitting face of turbocharger lube oil pipe.

Check for an abnormal noise.

NOTE: *Knocking noise will disappear as the coolant temperature rises.*

Check for the colour of smoke and odours.

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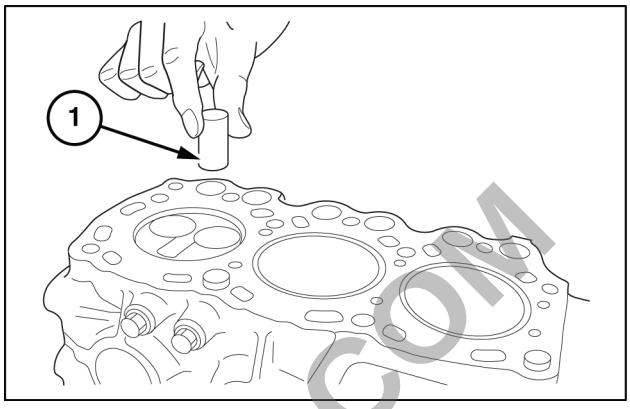
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Camshaft Tappets - Assemble

Coat the periphery of tappets **(1)** with engine oil, insert them into the tappet holes and place them gently on the camshafts.



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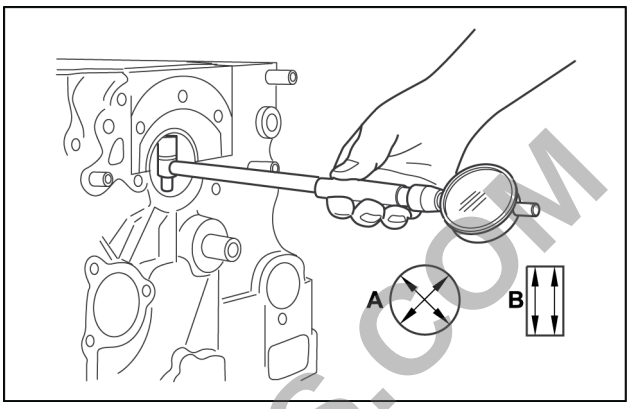
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Crankshaft - Inspect

Measuring clearance between main bearing and crankshaft journal

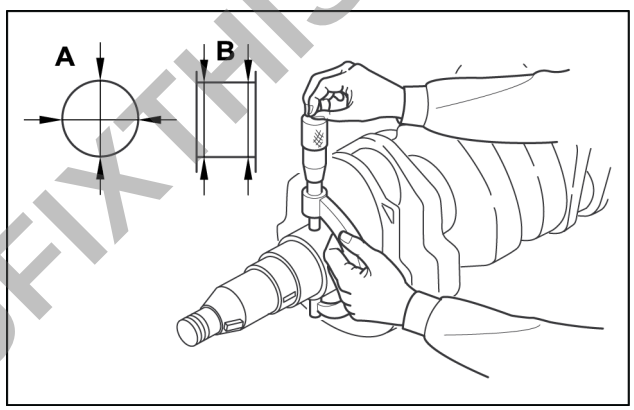
NOTICE: *When grinding crank journals, be sure to grind all the journals to the same size.*
Finish the fillet radius to the specified dimension.

1. Reassemble main bearings.
2. Tighten the main bearing supports to the specified torque.
3. Measure the inner diameter of the main bearings.
4. Measure the outer diameter of the journal.
5. Calculate the clearance between the inner diameter of the main bearing and the outer diameter of the journal.
6. Replace the main bearing if the clearance exceeds the limit.
7. Measure the clearance between the main bearing support and the journal again. Use the undersize bearing if the limit is exceeded.
8. If an undersized bearing is used, grind the journal to the specified undersize.



TULI12EXN3329AA 1

A. Measuring directions
B. Measuring points



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Item	Nominal	Standard	Allowable limit
Journal outer diameter (STD)	**ø43 mm (1.69 in)**	**42.965 - 42.98 mm (1.692 - 1.692 in)**	-
Clearance between main bearing and journal	-	**0.03 - 0.075 mm (0.001 - 0.003 in)**	**0.1 mm (0.004 in)**

Item	Undersize	Finish dimension
Journal undersize	**0.25 mm (0.01 in)**	**ø42.715 - 42.73 mm (1.682 - 1.682 in)**
	0.050 mm (0.002 in)	**ø42.4998 - 42.4993 mm (1.673 - 1.673 in)**

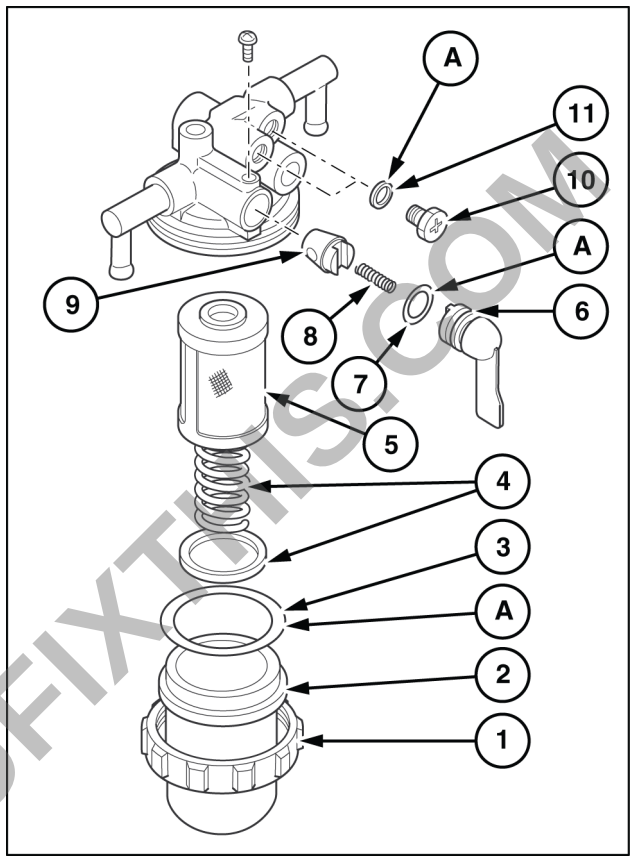
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Fuel-water separator filter - Service instruction

Disassembly, inspection and reassembly of water separator

(1) Ring nut
(2) Body
(3) O-ring
(4) Spring
(5) Filter element
(6) Lever
(7) O-ring
(8) Spring
(9) Valve
(10) Air removal plug
(11) Gasket



TULI12EXN3435BB 1

Checks

(A) Replace: O-ring

Disassemble

Disassemble the fuel filter only while cleaning or replacing the filter element. Do not disassemble the lever unless it is absolutely necessary.
When removing the cock lever and reassembling it after cleaning, apply silicon oil to the O-ring of the lever.

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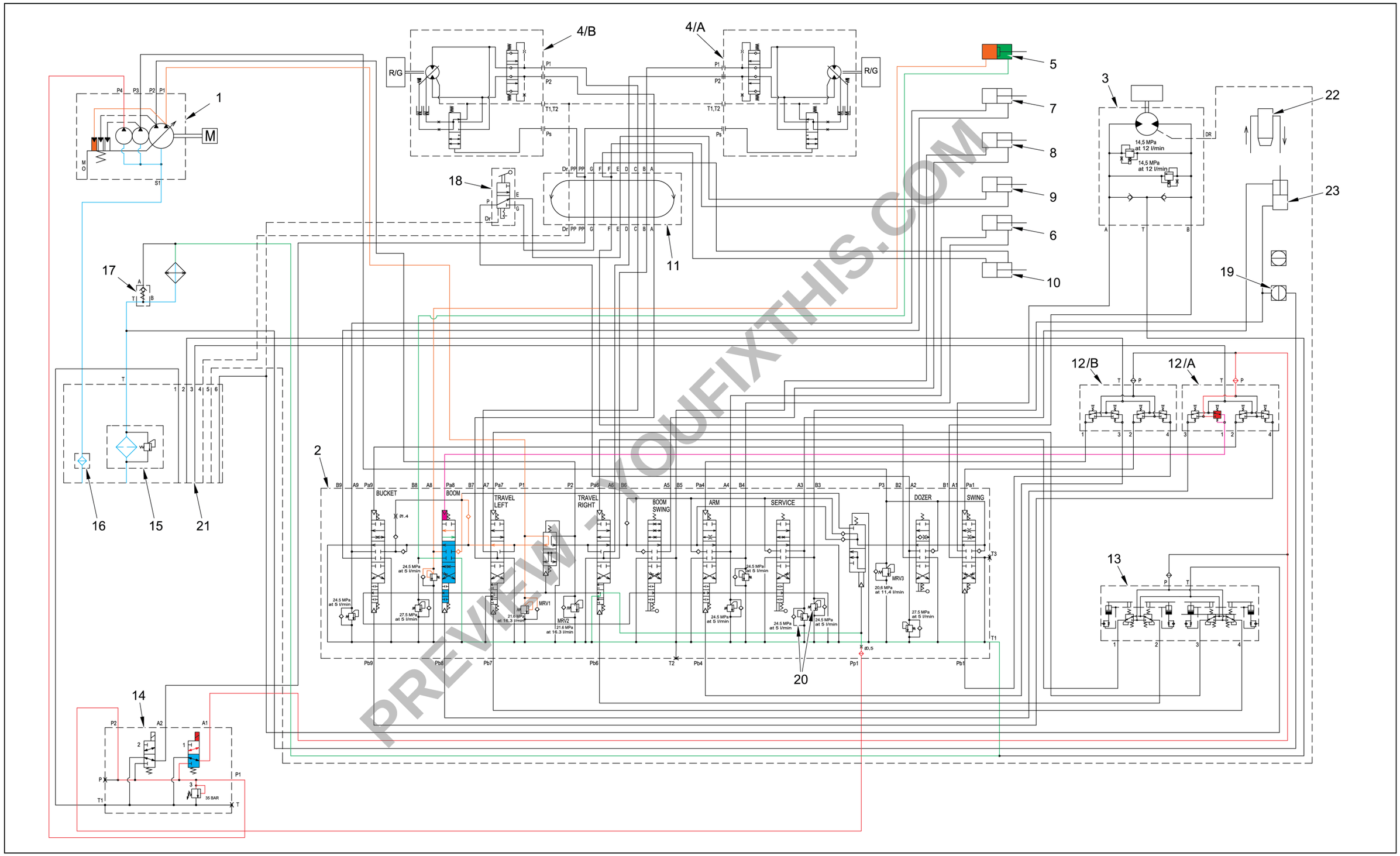
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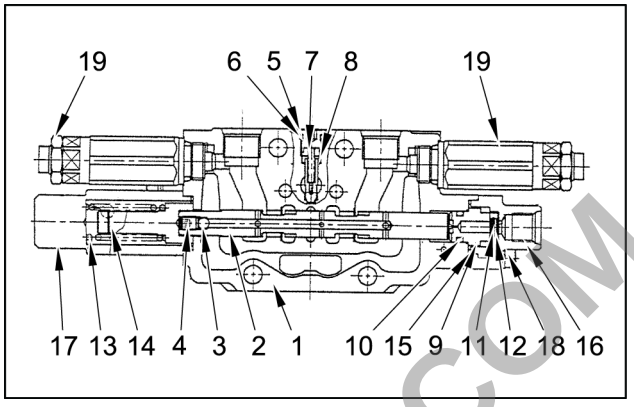
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Straight travel section

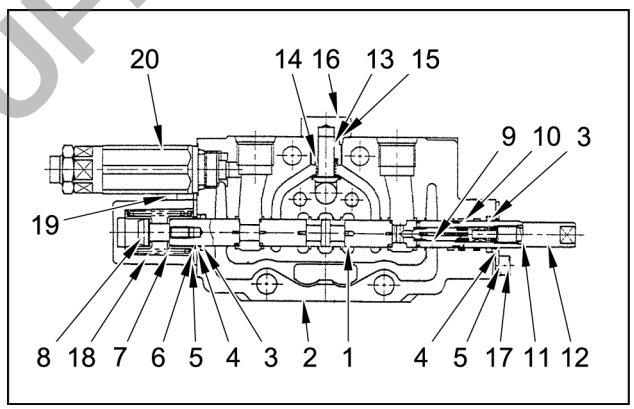
No.	Name	Qty.
1.	Body	1
2.	Spool	1
3.	Ball	1
4.	Plug	1
5.	Plug	2
6.	O-ring	2
7.	Spring	2
8.	Load check valve	2
9.	Filter housing	1
10.	O-ring	1
11.	Filter	2
12.	Ring stopper	1
13.	Spring	1
14.	Spring guide	1
15.	O-ring	2
16.	Cover	1
17.	Cover	1
18.	Screw	4
20.	Relief valve	2



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Dozer section

No.	Name	Qty.
1.	Body	1
2.	Spool	1
3.	O-ring	2
4.	Wiper ring	2
5.	Plate	2
6.	Spring seat	2
7.	Spring	1
8.	Spool terminal	1
9.	Needle	1
10.	Spring	1
11.	O-ring	1
12.	Spool	1
13.	Load check valve	1
14.	Spring	1
15.	O-ring	1
16.	Plug	1
17.	Screw	2
18.	Plug	1
19.	Screw	2
20.	Relief valve	1

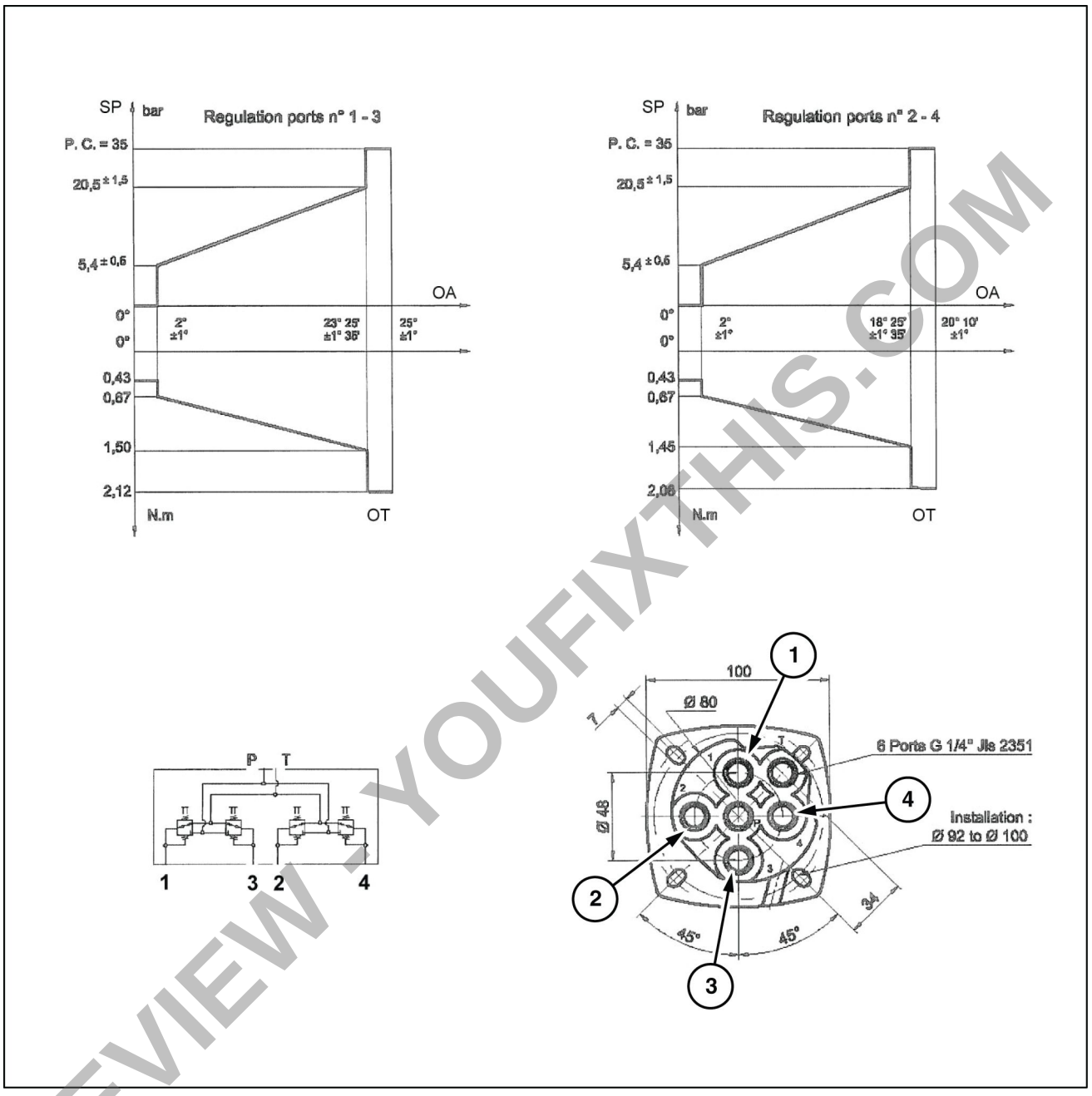


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Hand control - General specification



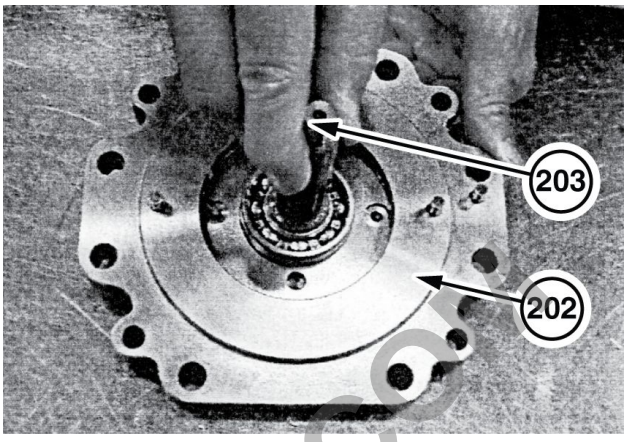
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OA. Operating angle
OT. Operating torque
SP. Secondary pressure

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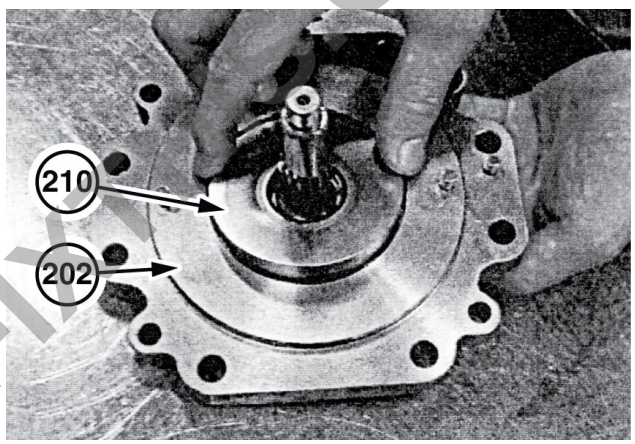
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9. Place the shaft **(203)** into the body S **(202)**.



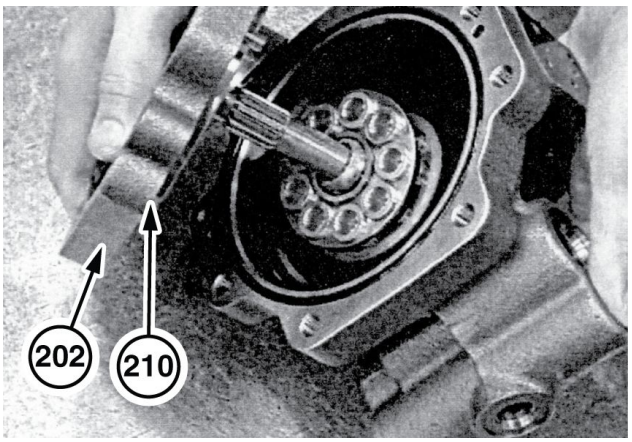
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10. Place the swash plate **(210)** onto the body S **(202)**.
11. In case the swash plate drops out, supply grease to the plate S side of it.



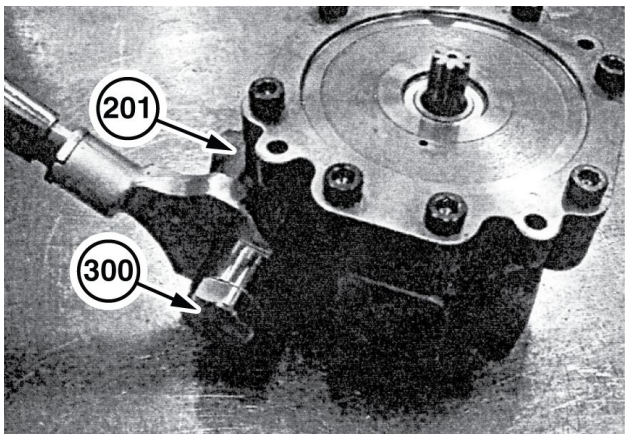
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12. Join the body H **(201)** and the body S **(202)**.



TUPH12EXN3216AB 10

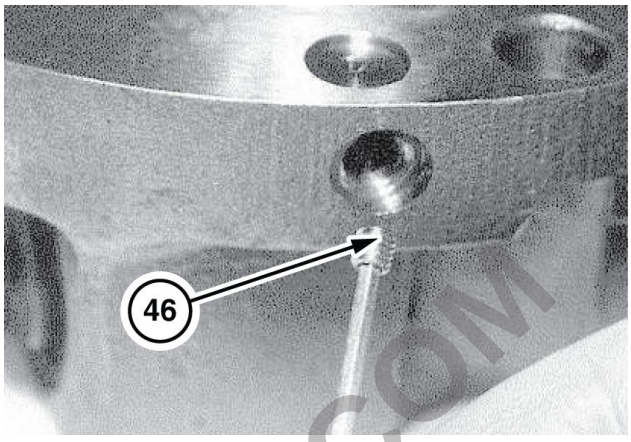
13. Screw the relief valve assembly **(300)** into the body H **(201)**.
14. Relief valve assembly tightening torque: **132.4 - 161.8 N·m** (**97.65 - 119.34 lb ft**).



TUPH12EXN3217AB 11

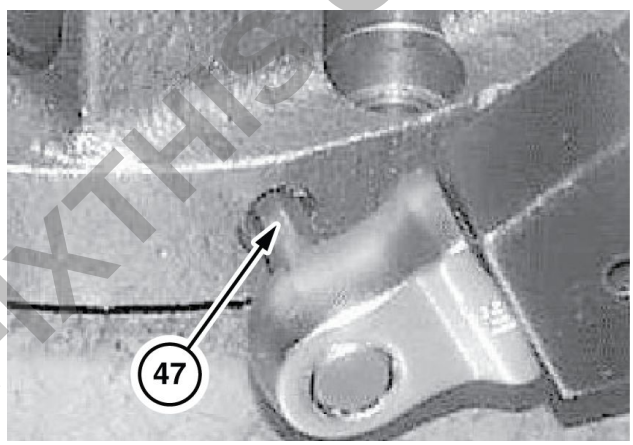
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36. Tighten the restrictors **(46)** with a torque wrench to a tightening torque of **2 - 3 N·m** (**1 - 2 lb ft**).



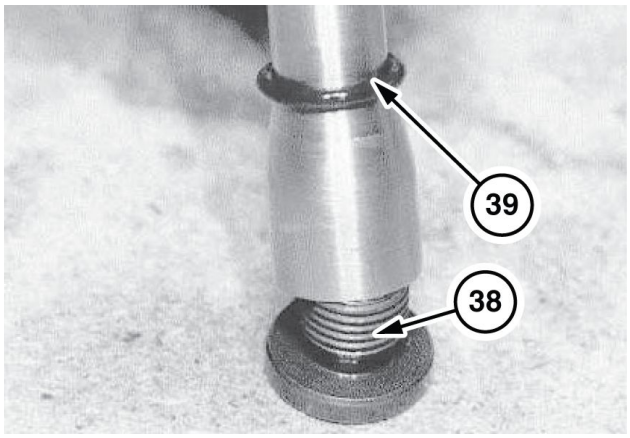
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37. Tighten the plugs **(47)** with a torque wrench to a tightening torque of **9 - 11 N·m** (**7 - 8 lb ft**).



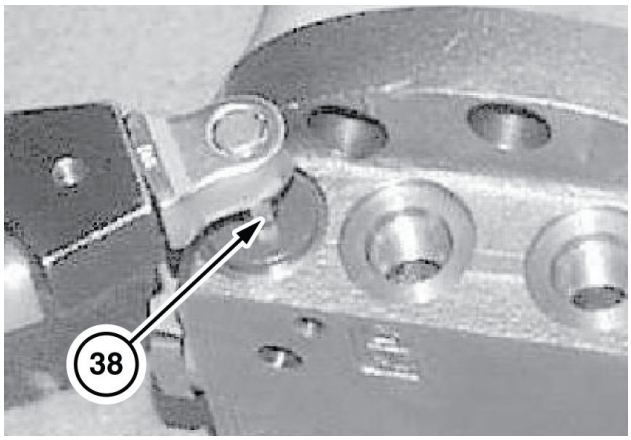
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38. Using a pad, fit the O-ring **(39)** onto the plug **(38)**.



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39. Tighten the plug **(38)** with a torque wrench to a tightening torque of **34.3 - 39.3 N·m** (**25 - 29 lb ft**).

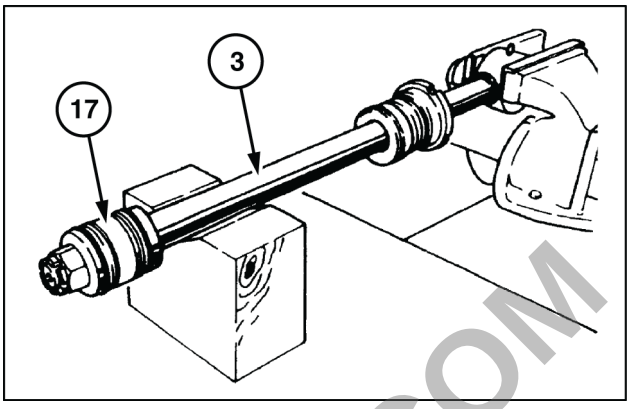


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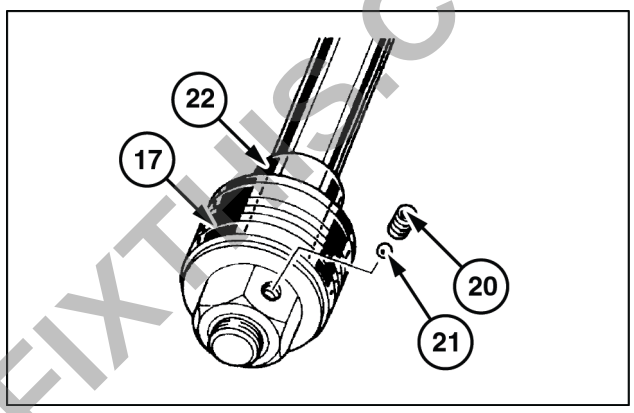
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6. Place the cylinder rod **(3)** in horizontal position.
7. Disassembly of the piston **(17)**.
   - Remove the dowel **(20)**, then the ball **(21)**. Since the dowel **(20)** is caulked in 2 portions with a punch, remove the caulking using a hand drill.
   - Remove the piston assy. **(17)**.
   - Remove the bushing **(22)** (for boom cylinder only).

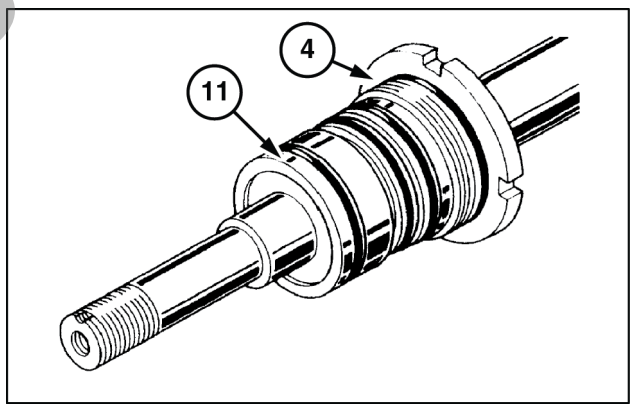


TULI12EXN3576AB 4



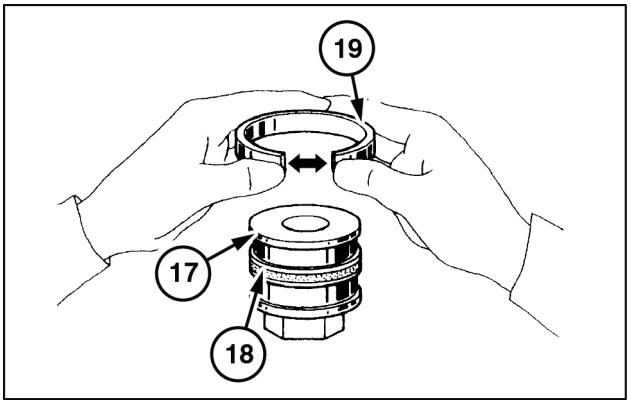
TULI12EXN2691AB 5

8. Remove the cylinder head **(4)** and the holder **(11)**. (Only boom and arm cylinders have a holder).



TULI12EXN2692AB 6

9. Remove the piston guide ring **(19)** from the piston **(17)**.
   - Expand the piston guide ring **(19)** as little as possible to be able to extract it in axial direction.
10. Remove the piston gasket **(18)**.
   - Cut the piston gasket **(18)** or remove it using a screw-driver.



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- Install 4

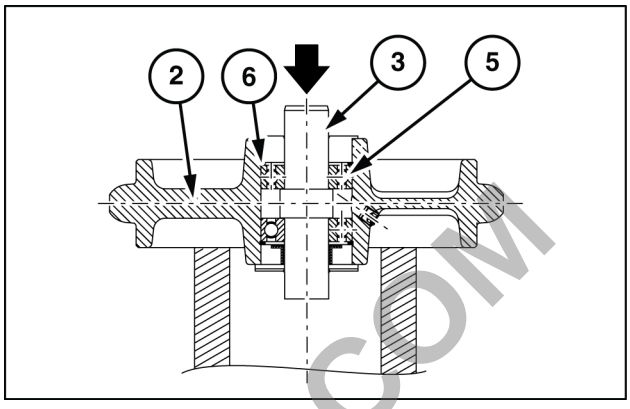
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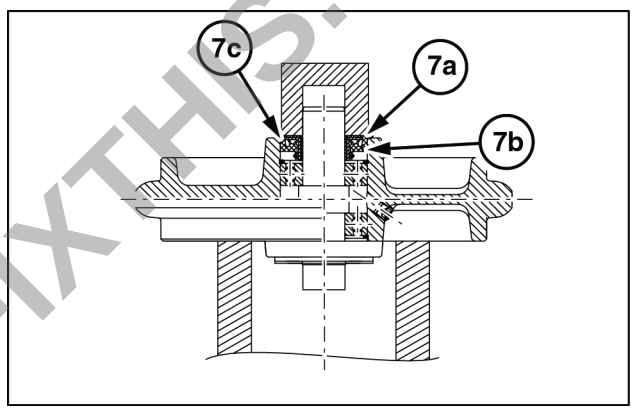
Idler wheel - Assemble

1. Apply some grease to the shaft **(3)** and install the bearing **(5)** on it.
2. In case the bearing is reused, check that its rotation is correct and that it does not show defects or rust.
3. Apply some grease to the wheel **(2)**, press-fit the shaft **(3)** along with the bearing **(5)** into the crawler idler.
4. Install the elastic ring **(6)**.



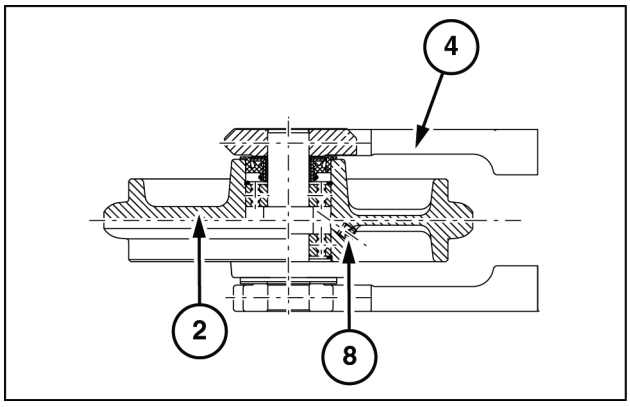
TULI12EXN2970AB 1

5. As regards the seal ring **(7)**, firstly apply some grease in the lip seat **(7c)** of the seal body **(7a)**. The evenly push the seal body **(7a)** and the sleeve **(7b)** into the seat with a tool, paying attention not to damage the lip **(7c)**.
   - Replace the seal ring with a new one during reassembly.
   - If the seal ring is incorrectly installed because of an uneven pressure, it could get damaged quickly and not guarantee sealing.
6. Following the same procedure, assemble the seal ring **(7)** on the opposite side.



TULI12EXN2971AB 2

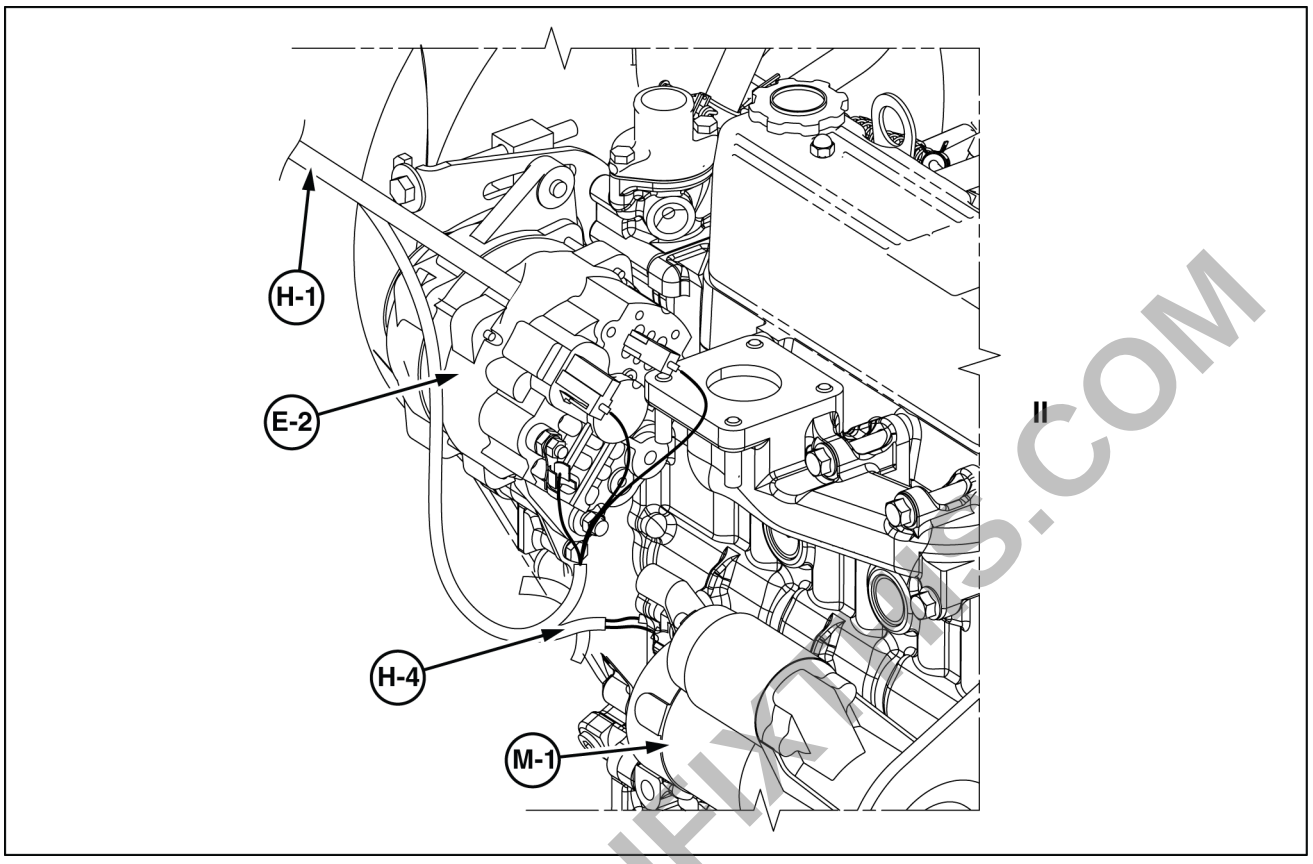
7. Install the supports **(4)**.
8. Fill **60 cm³** (**3.66 in³**) of gear oil through the plug hole **(8)**.
9. Tighten the plug **(8)**.



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TULI12EXN2545FB 7

E-2.	Alternator	H-4.	Starter cable
H-1.	Main wiring harness	M-1.	Starter motor

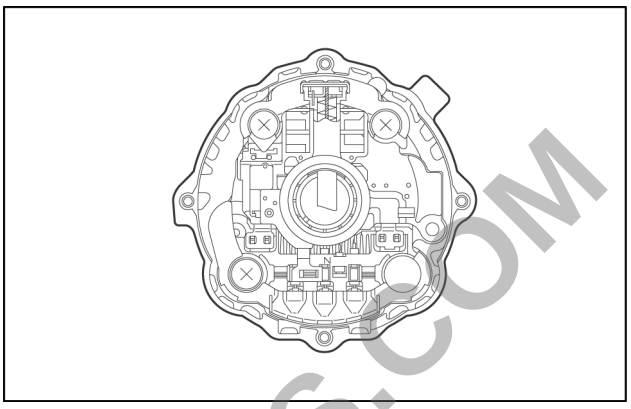
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Alternator - Assemble

Installation of rectifier assembly and regulator assembly

Install the rectifier assembly and regulator assembly on the rear bracket.

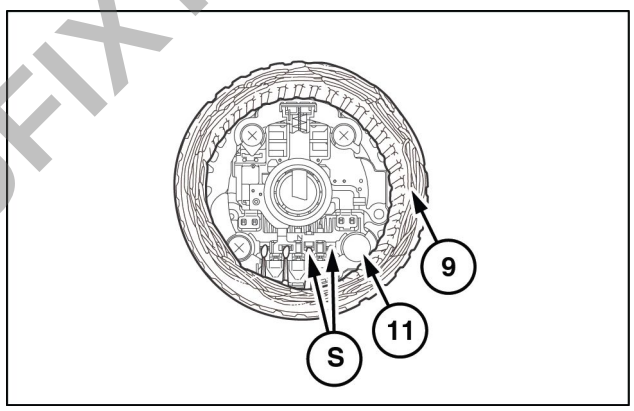


TULI12EXN3501AA 1

Install the stator

NOTICE: *Soldering* ***(S)*** *must be finished as quickly as possible. Extended heating will damage the diodes.*

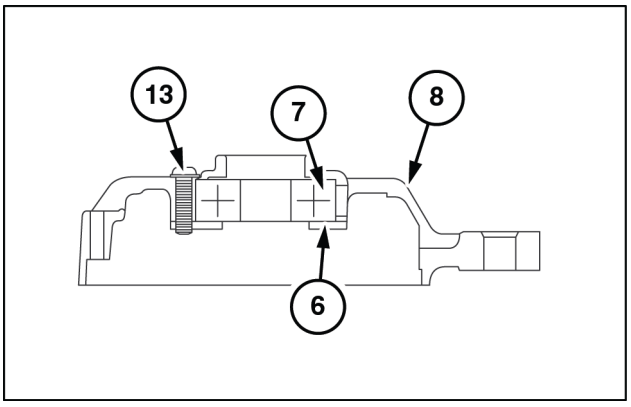
Install the stator **(9)** and solder the leads of the stator to the rectifier **(11)**.



TULI12EXN3502AB 2

Installation of front bearing

Drive the front bearing **(7)** into the front bracket **(8)** and secure the bearing stopper **(6)** with the screw **(13)**.



TULI12EXN3503AB 3

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