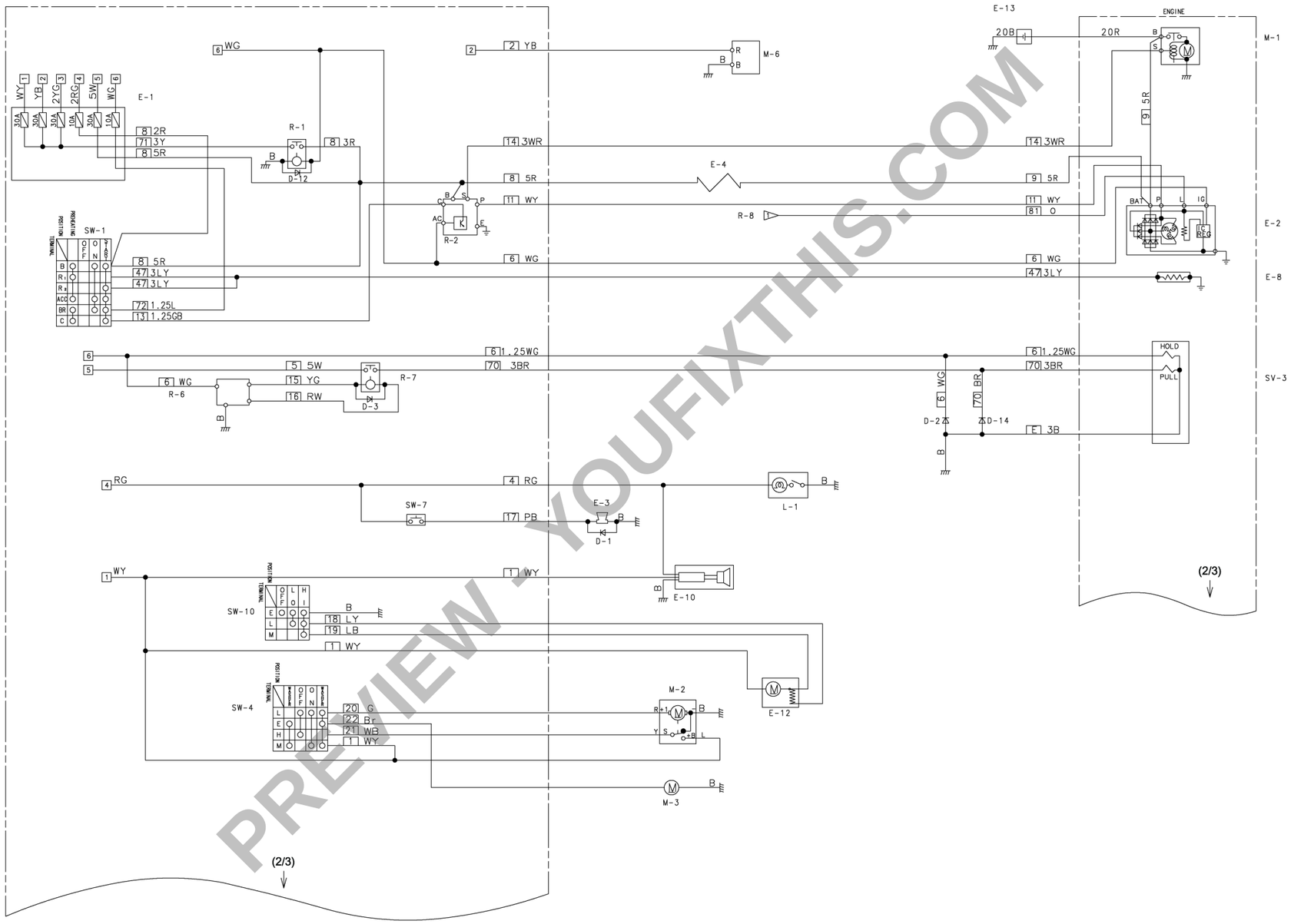
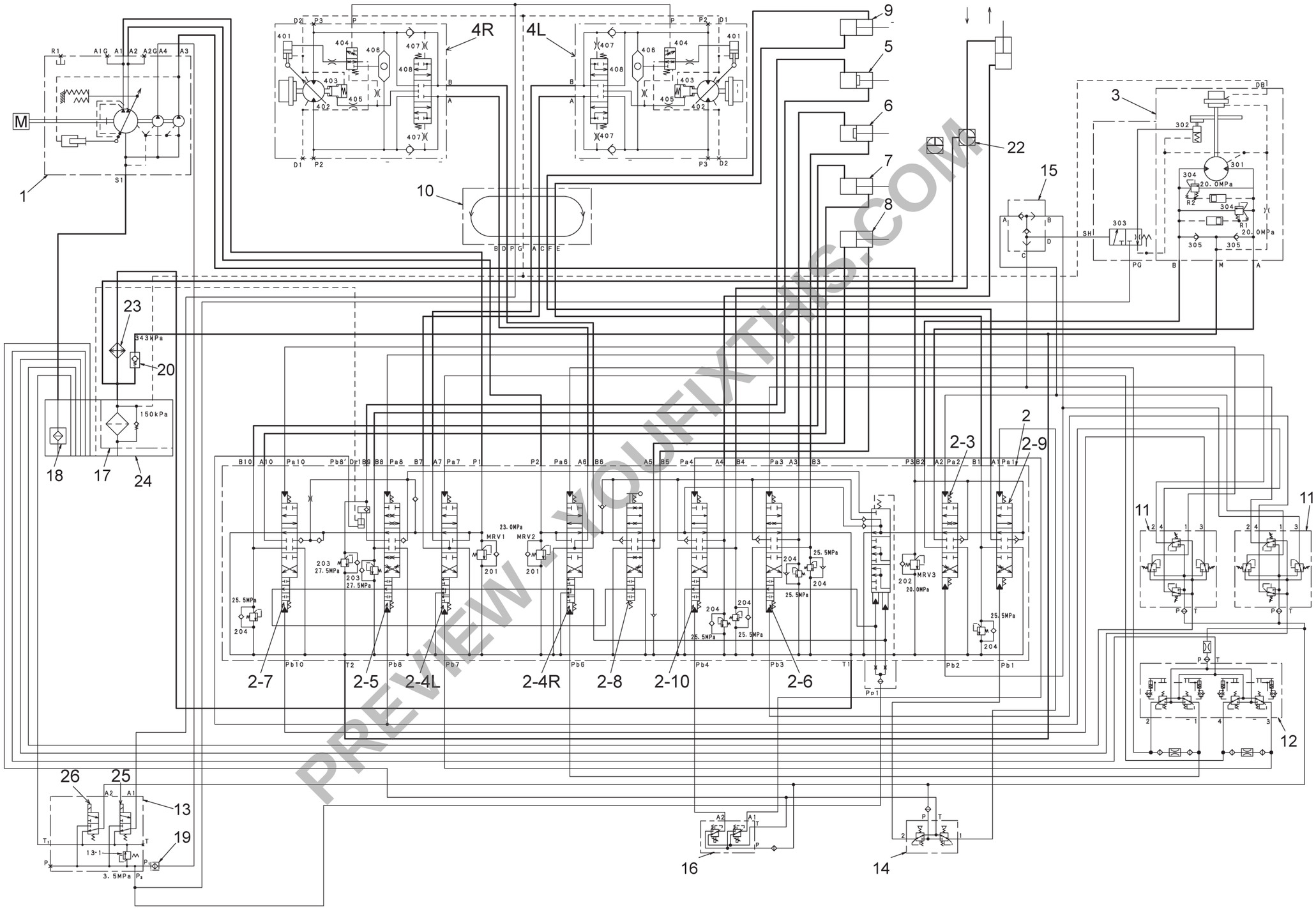



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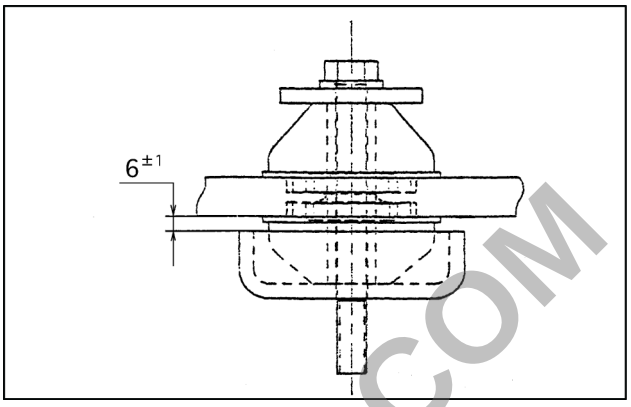
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# Engine - Install

Install the engine in reverse order of the removal.
See the following table for the tightening torque and the sealant:




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**Tightening torque:**

| Piece | Name | Tool | Torque |
|---|---|---|---|
| 10 and 11 | Screw **M10** | **19 mm** | **46.1 N·m** (**34.0 lb ft**)<br>Apply **LOCTITE® 262** |
| 12 | **M12** Bolt | **22 mm** | **79.4 N·m** (**58.6 lb ft**)<br>Apply **LOCTITE® 262** |

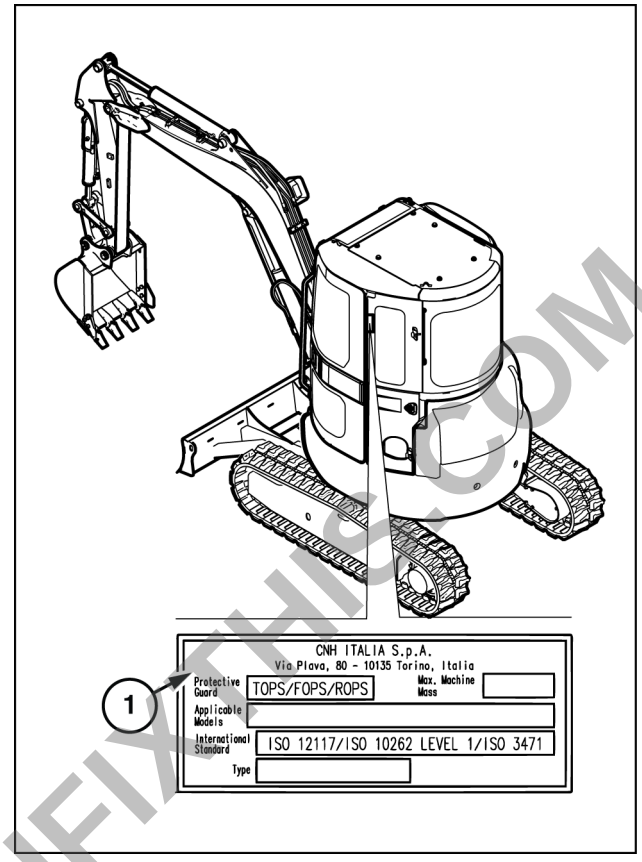
- Use the mount rubber **(6)** with identification color of “yellow” (three places).
- Use the mount rubber **(7)** with identification color of “red” (one place).

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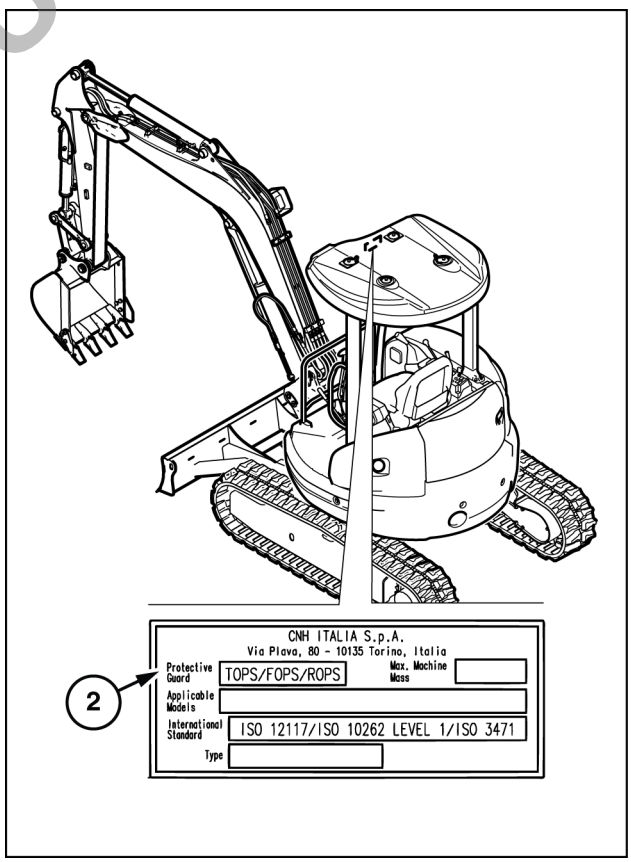

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## Tip/Roll Over Protective Structure (TOPS/ROPS) and Falling Object Protective Structure (FOPS)

**(1)** identification plate in the cab
**(2)** identification plate on the canopy



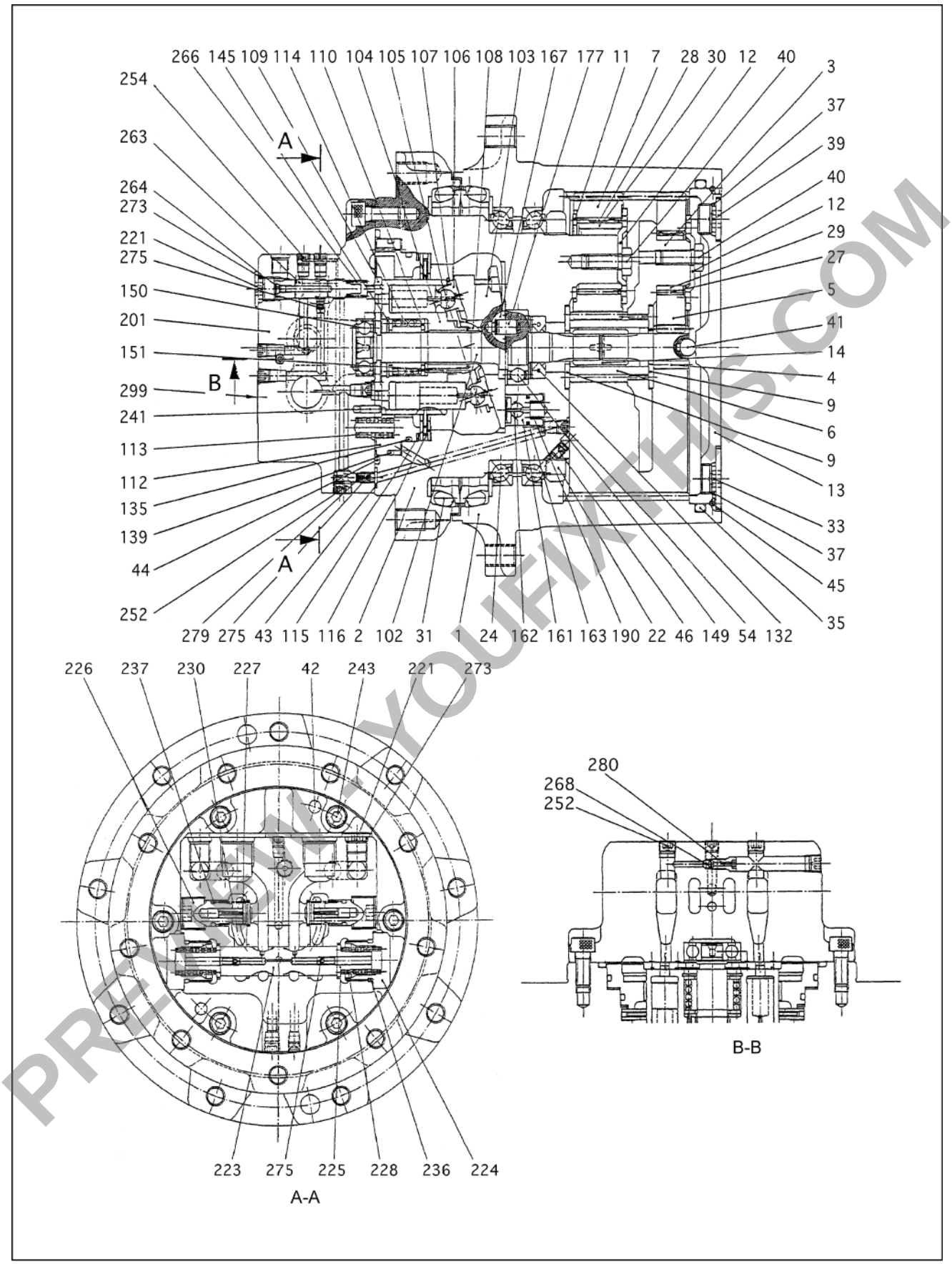

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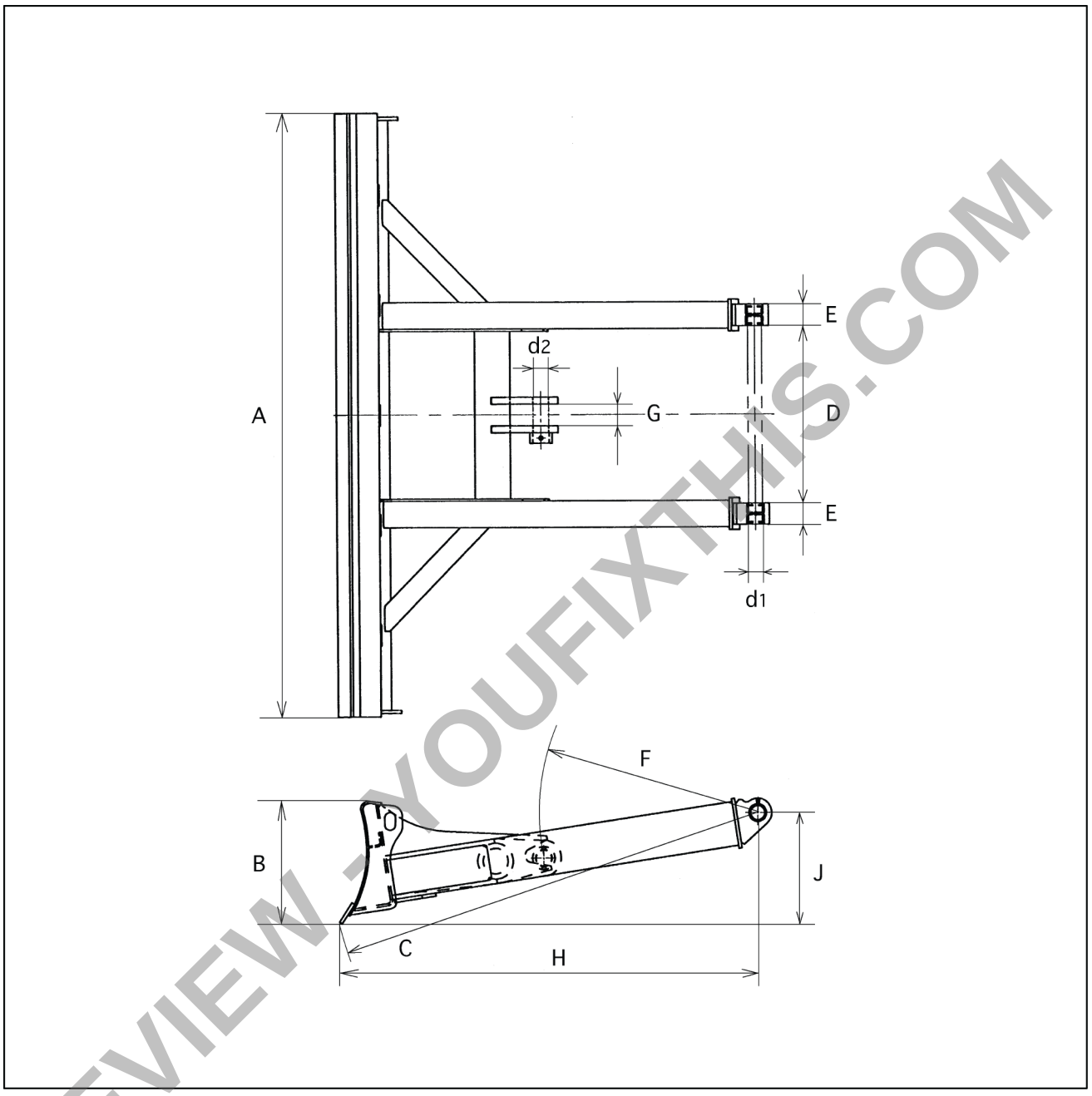



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# Dozer blade - Dimension




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# Engine - Static description

## 1. Emission reduction

New fuel injection pressure

- Mono plunger
- Higher injection pressure
- Injection timing, speed timer, load timer, cold start timer control

## 2. Noise reduction

Higher stiffness cylinder block

Higher stiffness gear-case

## 3. Emission reduction

Injection nozzle

- Low suck volume
- Multi injection holes

## 4. Emission reduction

Cylinder head

- Optimal nozzle angle
- Optimal swirl ratio
- Optional valve timing

## 5. Emission reduction

Piston

- New combustion chamber

## Noise reduction

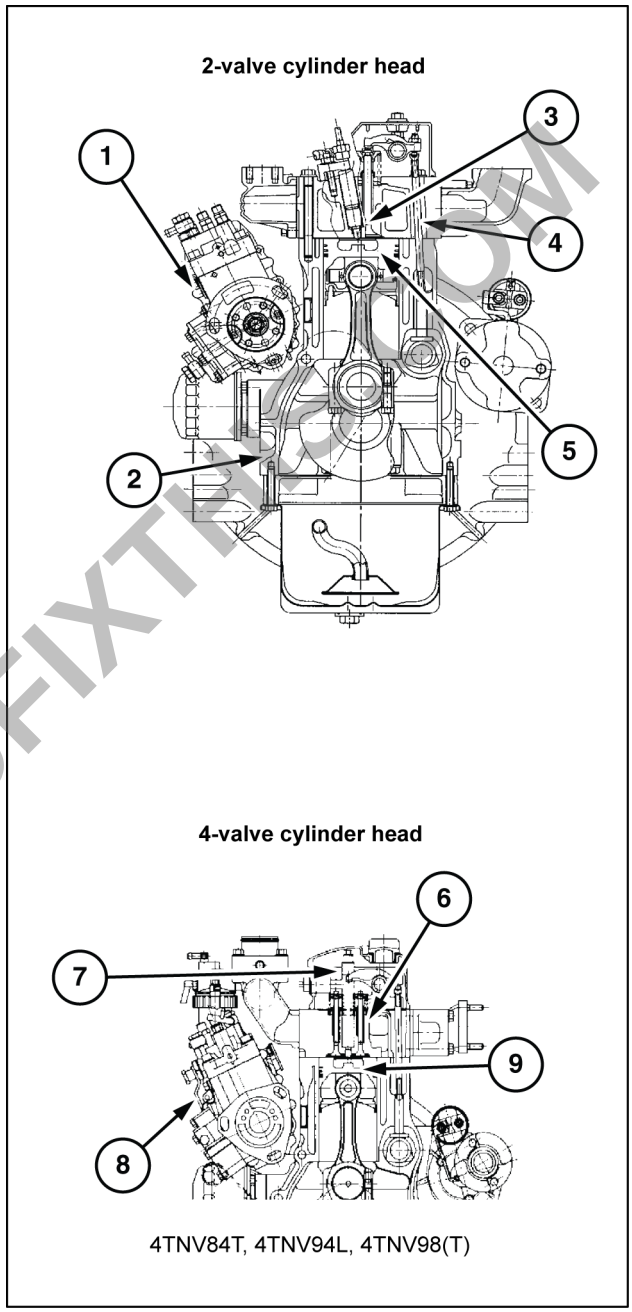
New lube oil pan

- Change rotor shape for low pulsation
- Driven by crankshaft directly

## 6. Emission reduction

Cylinder head

- 4 valve/cylinder (intake-2, exhaust-2)
- Optimal installation of the injection nozzle vertical installation and location of the centre of cylinder
- Optimal valve timing



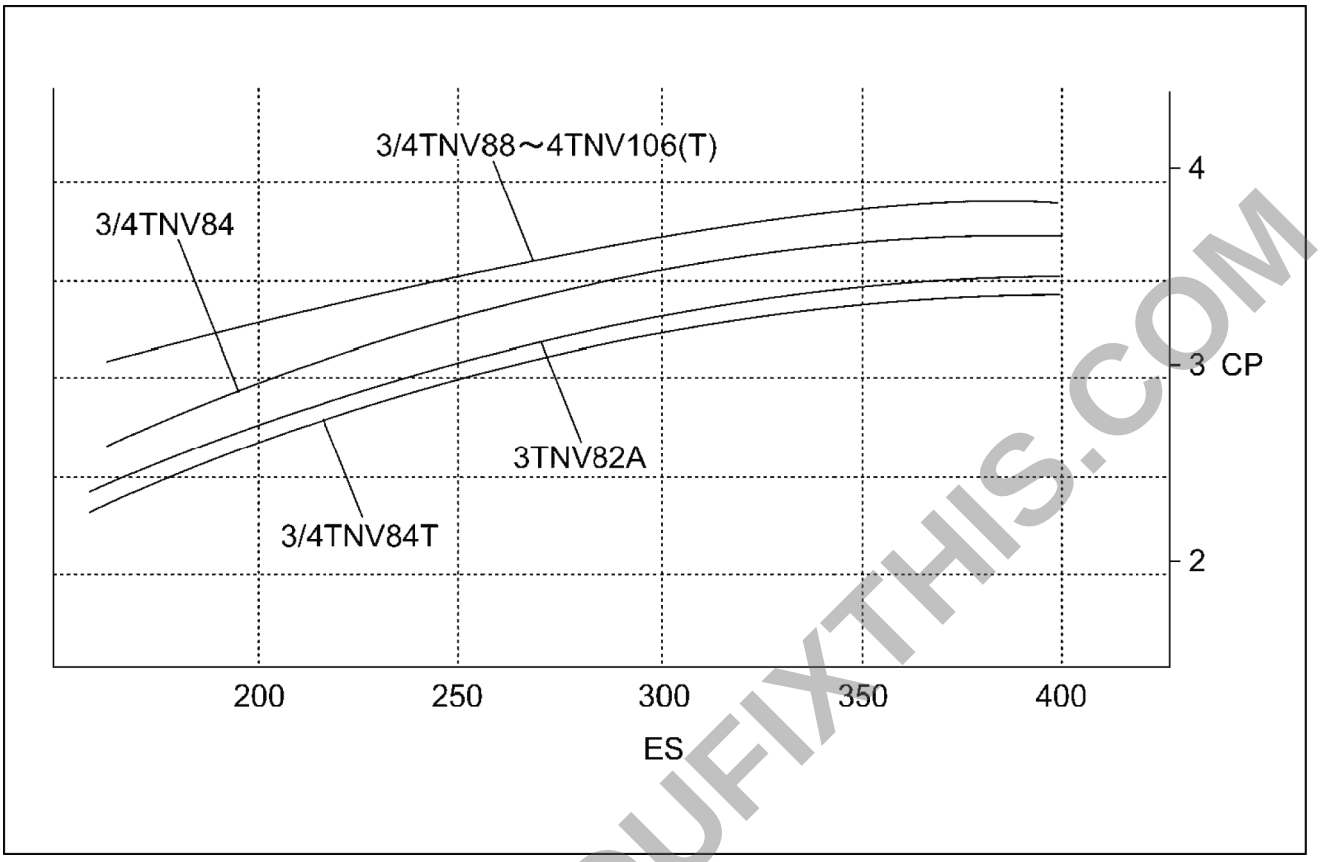

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## Engine speed and compression pressure (for reference)




TULI12EXN4842FA 2

CP. Compression pressure (MPa) ES. Engine speed (RPM)

## Measured value and troubleshooting

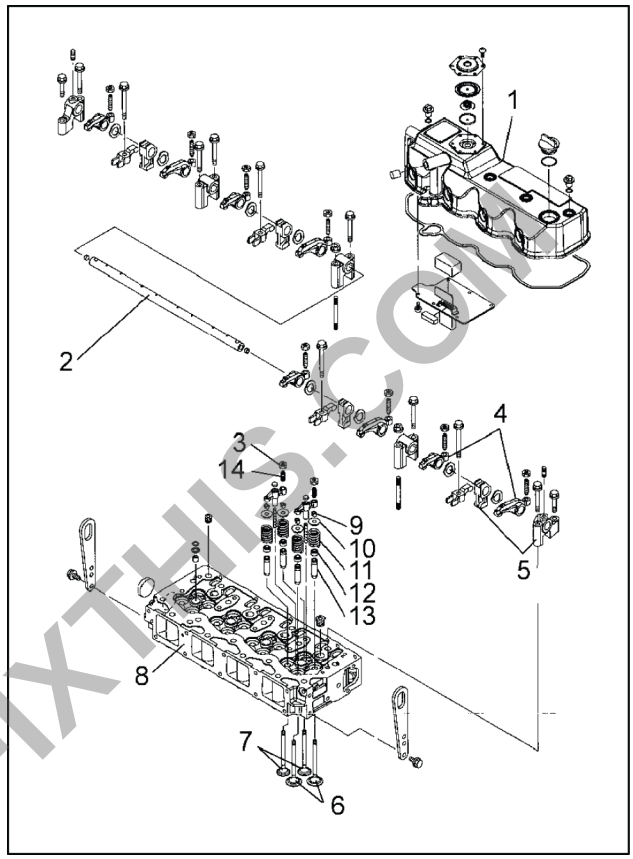
When the measured compression pressure is below the limit value, inspect each part by referring to the table below.

| No. | Piece | Cause | Corrective action |
|---|---|---|---|
| 1. | Air cleaner element | Clogged element<br>Broken element<br>Defect element seal portion | Clean the element<br>Replace the element |
| 2. | Valve clearance | Excessive or no clearance | Adjust the valve clearance |
| 3. | Valve timing | Incorrect valve clearance | Adjust the valve clearance |
| 4. | Cylinder head gasket | Gas leak from gasket | Replace the gasket Tighten the cylinder screws again to the specified tightening torque (See **Cylinder heads - Disassemble (10.101)** ) |
| 5. | Intake/exhaust valve<br>Valve seat | Gas leak due to worn valve seat or foreign matter trapping<br>Sticking valve | Lap the valve seat. (See **Valve seat - Regrind (10.101)** )<br>Replace the intake/exhaust valve |
| 6. | Piston<br>Piston ring<br>Cylinder | Gas leak due to scratching or wear | Perform honing and use oversize parts. (See **Cylinder heads - Disassemble (10.101)** -“Cylinder block”, “Link rod” and **Cylinder heads - Adjust (10.101)** |

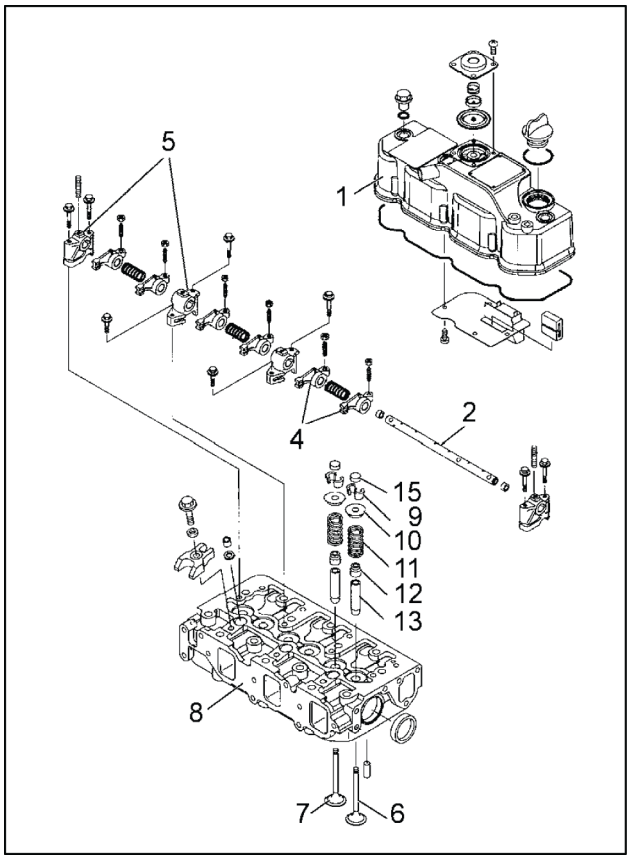

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# Cylinder heads - Assemble

1. Reverse order of the disassembly procedure.
    1. Rocker arm cover
    2. Rocker arm shaft
    3. Adjustment
    4. Rocker arm
    5. Rocker arm support
    6. Intake valve
    7. Exhaust valve
    8. Cylinder head
    9. Split pin
    10. Spring holder
    11. Valve spring
    12. Stem seal
    13. Valve guide
    14. Valve bridge
    15. Valve cap




TULI12EXN4877BA 1




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# Engine - 10

## Air cleaners and lines - 202

**E35B SR**
**E39B SR**

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# Engine lubrication system - Disassemble

## Disassembly (reverse the procedure below for assembly)

1. Loosen the belt, and remove the radiator pulley, fan and V-belt.
2. Remove the crankshaft pulley.
3. Remove the gear case cover.
4. Remove the lubricating oil pump assy from the gear case for 4TNV94/98/106 (“Point 1”).
   Remove the lube oil cover from gear case cover for 3TNV82A-88 (“Point 1”).
5. Remove the pressure regulating valve from the lubricating oil pump body (“Point 2”).

## Point 1

## Disassembly

Check if the pump rotates smoothly and see that there is no play between the shaft and gear, and inner rotor.

## Reassemble

***NOTE:*** *Always check if the pump rotates smoothly after installation on the gear case.*
*Running the engine when the pump rotation is heavy may cause the pump to be burnt.*

3TNV82A-88

- Apply lube oil to rotor (outer/inner) insertion part.
- Assemble the outer rotor so that the mark of the end face may become a cover side when inserting it in the gear case.
- Fasten a lube oil pump cover by the standard torque. Tightening torque: **5.4 - 8.4 N·m** (**4.0 - 6.2 lb ft**).
- When replacing the lube oil pump, replace the whole assy.

4TNV94L/98/106

- Apply lube oil to lube oil pump insertion part of gear case.
- Install the outer rotor in the gear case so that the punch mark on the end face is seen.
- When replacing the lube oil pump, replace the whole assy.

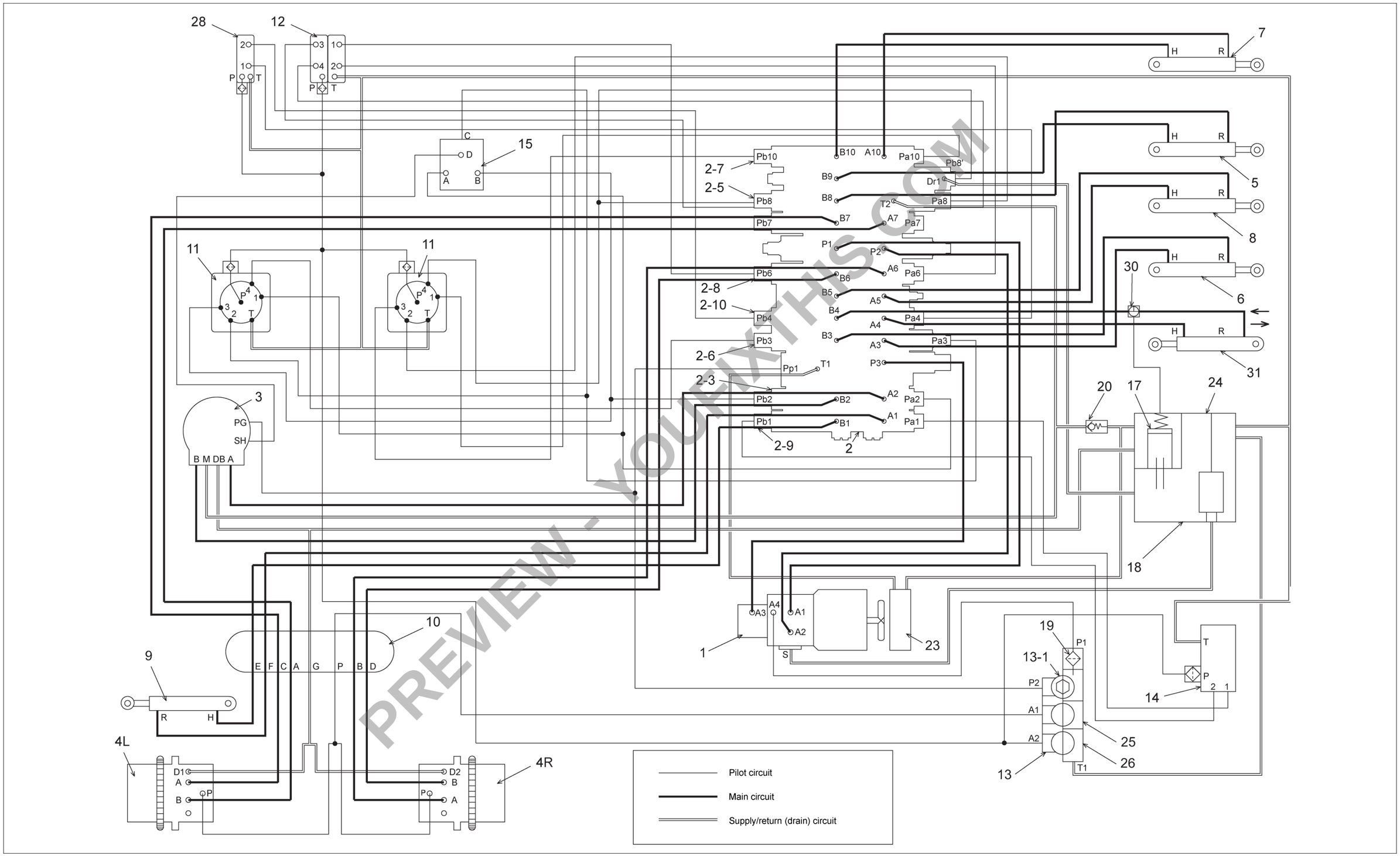
## Point 2

## Disassemble-reassemble

Only wash the pressure regulating valve. Disassembly is unnecessary unless any abnormality in operation is detected.

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A. The cylinder block is fitted on the spline and rotates with the drive shaft.

B. The piston fitted in the cylinder block follows the movements of the sliding surface of the plate.

C. The piston moves to increase the capacity from the bottom dead point to the top dead point, the pressure oil flows from the inlet port into cylinder block through the control plate. (Suction stroke 9)

D. But as the piston moves to decrease the capacity from the top dead point to the bottom dead point, the pressure oil is sent out to the delivery port. (Delivery stroke 10)

E. By changing the tilting angle of the plate (sliding surface), delivery varies.

F. The oil sucked from the inside port of the cylinder block is delivered from the delivery port inside of the control valve.

G. The oil sucked from the outside port of the cylinder block is delivered from the delivery port outside of the control plate.

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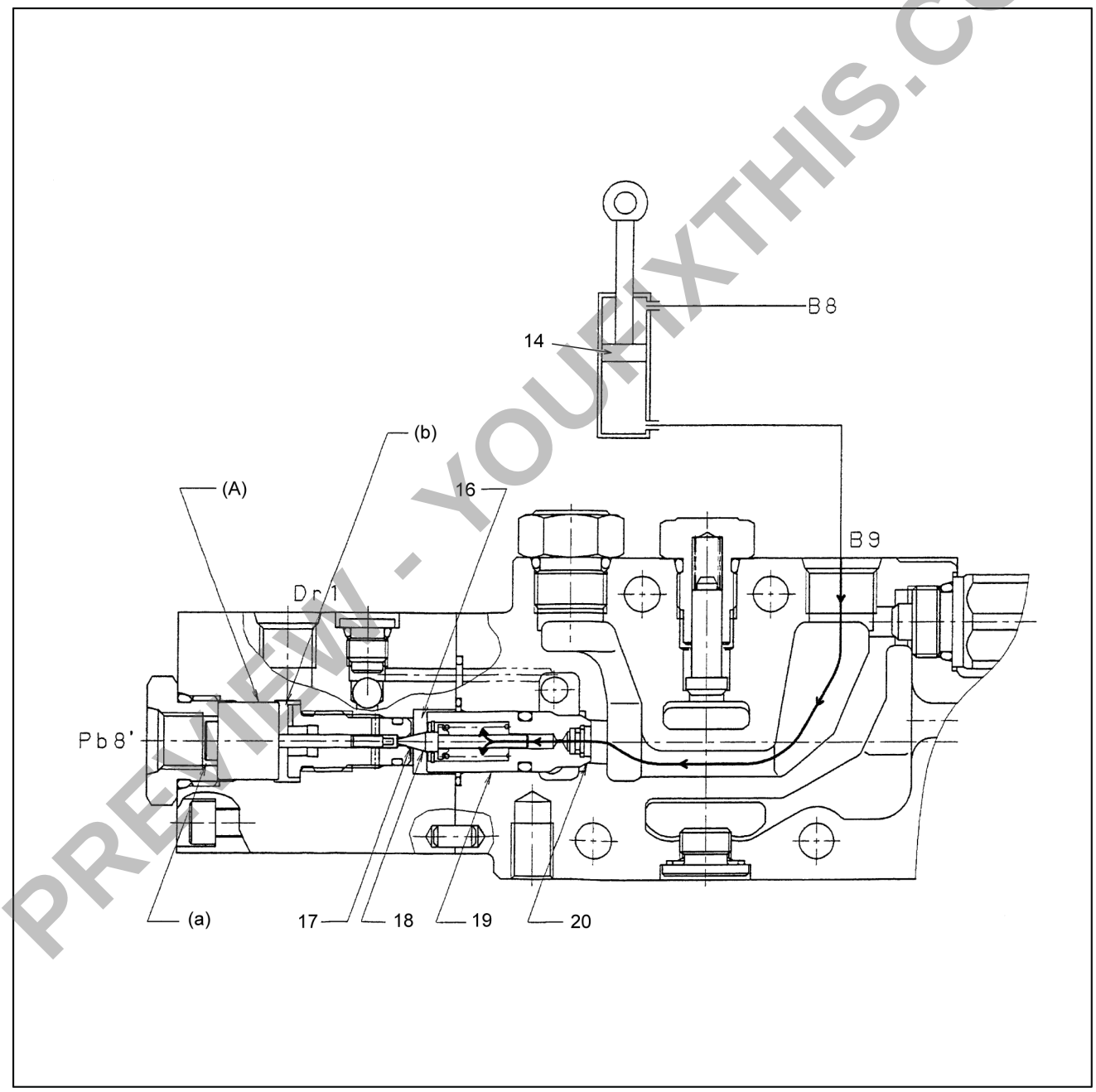
## Function of lock valve

## Piston holding

When the boom spool is at neutral position, the pilot piston chamber **(a)** is connected to the drain passage through the pilot port ( **Pb8'**) for releasing lock valve. And the piston chamber **(b)** is also connected to the drain passage through the drain port ( **Dr1**).

Therefore the piston **(A)** is held at the position shown in the figure.

And the hydraulic pressure to hold the boom cylinder is applied to the lock valve chamber as shown in the figure, pressing the needle valve and lock valve to their seats respectively. Then it prevents leakage on the head side of boom cylinder, and also prevents the arm cylinder from its movement due to leakage.

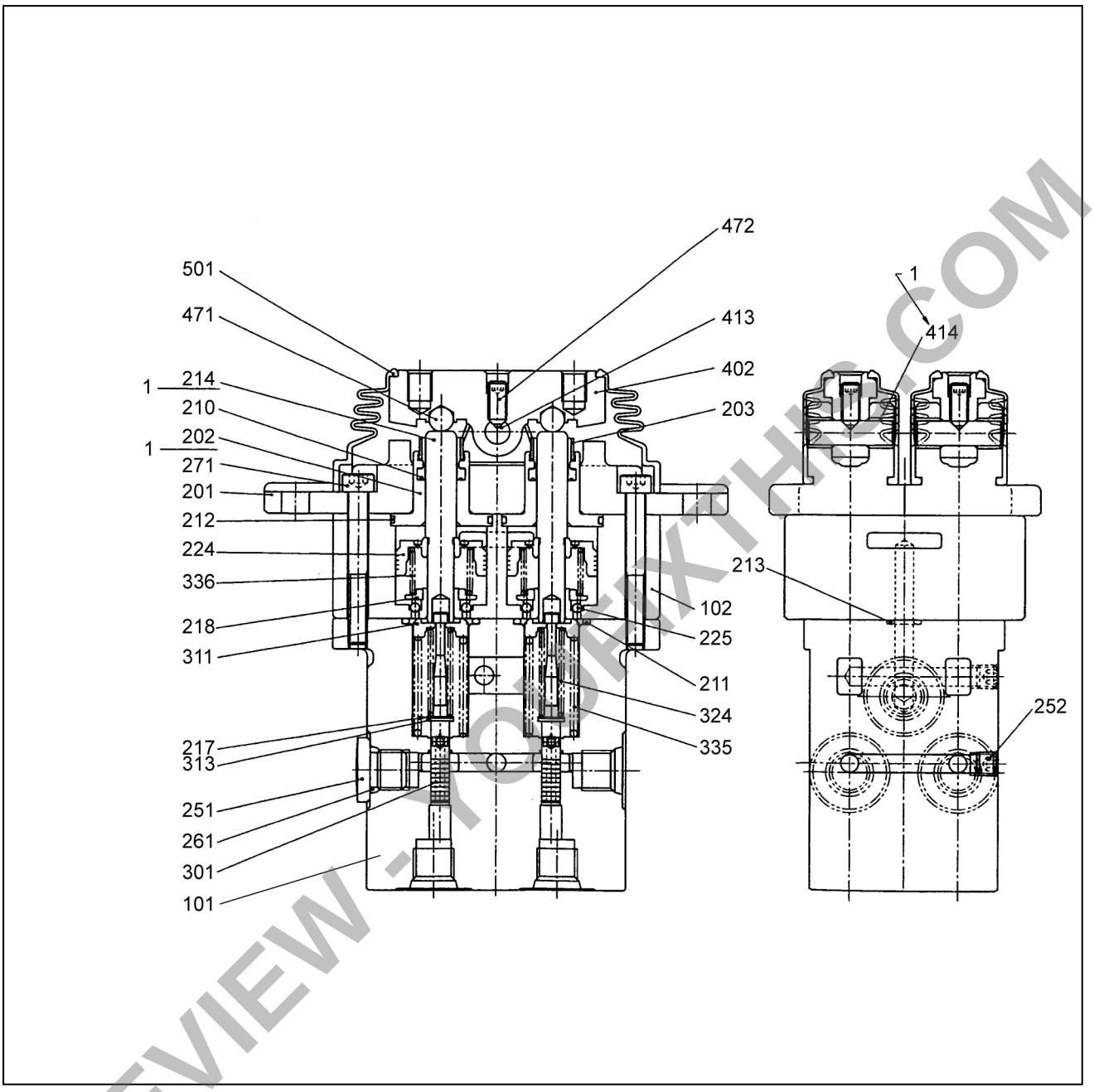



TULI12EXN4186GA 6

14. Boom cylinder
16. Lock valve chamber
17. Needle valve seat
18. Needle valve
19. Lock valve
20. Body seat


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# Pedal control - Sectional view




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| Torque | No. | Name | Qty. |
|---|---|---|---|
| | 101 | Housing | 1 |
| | 102 | Casing (damper) | 1 |
| | 201 | Cover | 2 |
| | 202 | Plug **(1)** | 4 |
| | 203 | Grease cup | 4 |
| | 210 | Seal | 4 |
| | 211 | O-ring | 4 |
| | 212 | O-ring | 4 |
| | 213 | O-ring | 2 |
| | 214 | Push rod **(1)** | 4 |
| | 217 | Shim | 4 |
| | 218 | Spring seat | 4 |
| | 224 | Piston | 4 |


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# Hydraulic travel system - Special tools

## Standard tools

| No. | Name | Size | Qty. |
|---|---|---|---|
| 1 | Allen wrench | 8 (for **M10** & **PF 3/4**), 10 (for **M17**), 14 (for **M16**) | 1 each |
| 2 | Socket wrench (ratchet handle) | Barrel type | 1 |
| 3 | Torque wrench | Dial type, about **12 N·m** (**8.85 lb ft**)<br>Dial type, about **90 N·m** (**66.38 lb ft**)<br>Dial type, about **280 N·m** (**206.52 lb ft**) | 1 each |
| 4 | Torque wrench adaptor | Nominal socket size **13 mm** (**0.51 in**)<br>Nominal rod size **8 mm** (**0.31 in**) and **10 mm** (**0.39 in**) | 1 each |
| 5 | Hexagon head | For passing through shims of **3 mm** (**0.12 in**) | 1 |
| 6 | Extension rod | **150 mm** (**5.91 in**) | 1 |
| 7 | Hammer | Nominal size **12 mm** (**0.47 in**) | 1 |
| 8 | Plastic hammer | L= about **300 mm** (**11.81 in**) | 1 |
| 9 | Minus driver | About **150 mm** (**5.91 in**), **50 mm** (**1.97 in**) | 1 |
| 10 | Snap ring pliers | For shaft<br>For hole | 1<br>1 |
| 11 | Cutting pliers (JIS B 4623) | **200 mm** (**7.87 in**) | 2 |
| 12 | Lifting tool | Lifting capacity: **300 kg** (**661.39 lb**) or more | 1 set |
| | | Lifting eye (for **M16**) | 2 |
| | | Eye (for **PF 3/8**) | 2 |
| | | Wire with hooks | 1 |
| 13 | Container | Vat for general use: W450 x D300 x H120 | 2 |
| 14 | Leather gloves | | 1 pair |

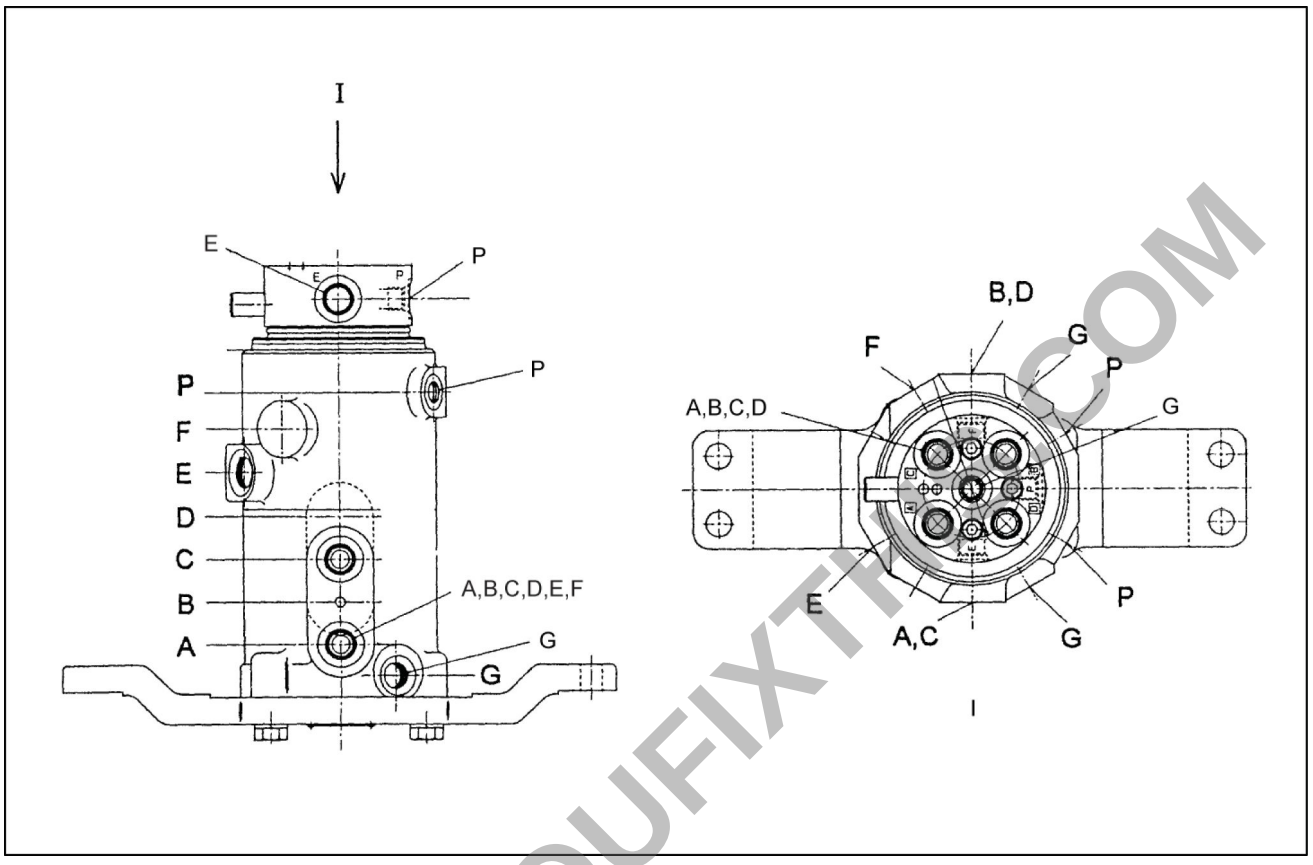
## Tools

| Application item (Item in cross-sectional or exploded view) | Name | Size | Notes | Qty. |
|---|---|---|---|---|
| Disassembly and assembly | General workbench | | | 1 set |
| Cleaning parts | Cleaning bath | For rough and finish cleaning | | 1 set |
| 104 and 149 | Workbench for press | Pressing capacity: **1.96 kN** (**440.63 lb**) or more | | 1 set |
| 149 | Heating bath | Heating capacity: **100 °C** (**212 °F**) or more<br>Volume **500 mm** (**19.69 in**) x **500 mm** (**19.69 in**) x **500 mm** (**19.69 in**) | | 1 set |
| Disassembly 161, 162, 163, and 112<br>Drying after cleaning | Compressed air | Pressure **294 - 490 kPa** (**3 - 5 bar**) | | |

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# Hydraulic swivel - General specification



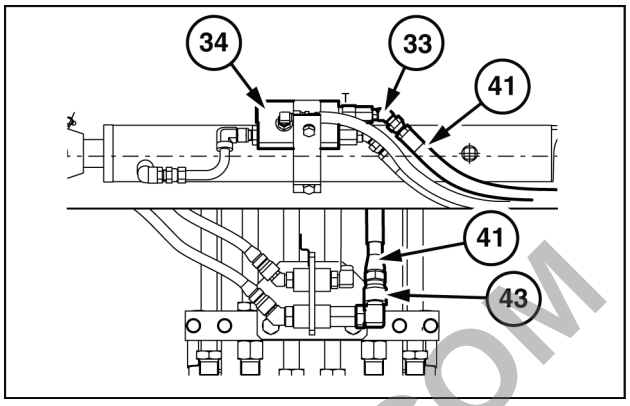

TULI12EXN6188FA 1

| Model (type) | YV-7200 | | | |
|---|---|---|---|---|
| Port No. | **A**, **B**, **C**, **D** | **E**, **F** | **P** | **G** (Drain) |
| Maximum working pressure | **22.6 MPa** (**3278 psi**) | **17.7 MPa** (**2567 psi**) | **3.9 MPa** (**566 psi**) | **0.49 MPa** (**71 psi**) |
| Pressure test | **33.9 MPa** (**4917 psi**) | **26.6 MPa** (**3858 psi**) | **5.9 MPa** (**856 psi**) | **0.735 MPa** (**107 psi**) |
| Delivery | **35 l/min** (**9.2 US gpm**) | **26 l/min** (**6.9 US gpm**) | **12 l/min** (**3.2 US gpm**) | **5 l/min** (**1.3 US gpm**) |
| Revolution | **10 RPM** max. | | | |
| Weigh | **21.5 kg** (**47.4 lb**) | | | |
| Port size | **PF3/8** | **PF3/8** | **PF1/4** | **PF1/4** |

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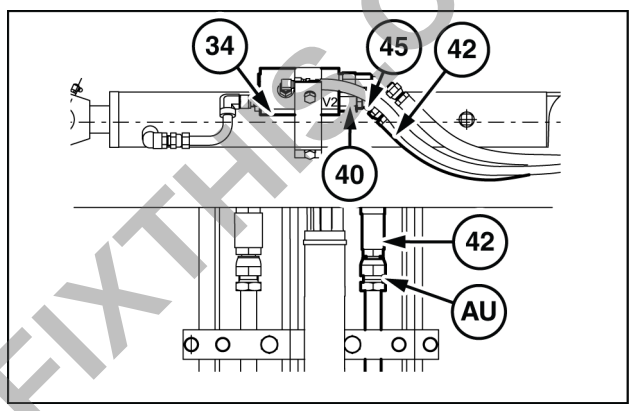

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5. Install the 3/8" draining hose **(41)** by connecting it on one side to the 3/8"-1/4" 45°-fitting **(33)** available in port **T** of the valve **(34)** and, on the other side, to the 3/8" 90°-fitting **(43)** available on the first portion of the boom.



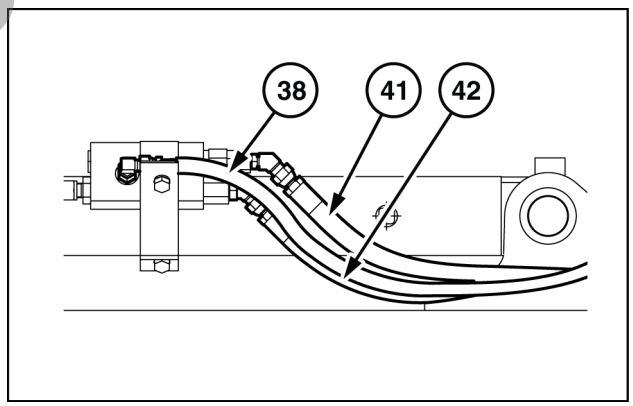

TULI12EXN7148AC 5

6. Install the 3/8" hose **(42)** by connecting it on one side to the 3/8" 45°-fitting **(45)** available in port **V2** of the valve **(34)** and, on the other side, to the rigid pipe **(AU)** available on the intermediate portion of the boom.




TULI12EXN7147AD 6

7. Direct and route between the “ears” of the boom all various hydraulic hoses: hose **(38)**, hose **(41)** and hose **(42)** just installed.




TULI12EXN7154AB 7

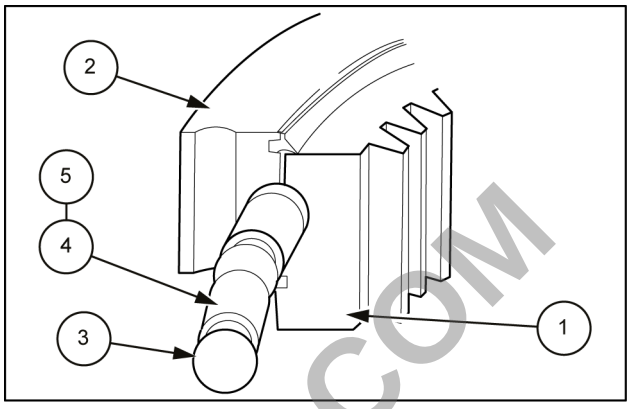
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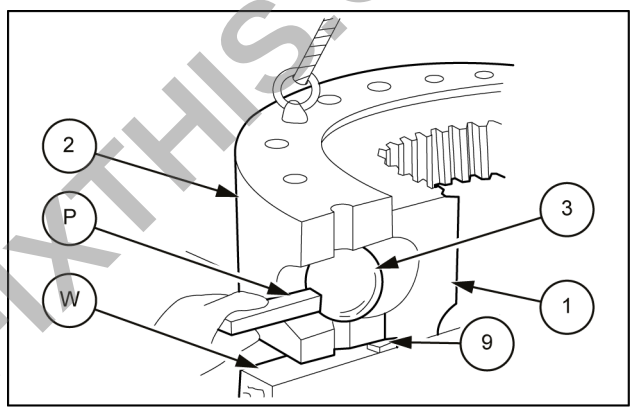
# Swing bearing - Assemble

1. Degrease thoroughly the groove for seal B **(9)** located in the outer circumference of inner race **(1)**. Coat the grooves with adhesive Cyano Bond PO-1, fit seal B **(9)** and place inner race on a surface table.
2. Lift and lower outer race **(2)** slowly till the top surface of inner race **(1)** matches the bottom of the sealing groove of outer race **(2)**. Place and adjusting washer under outer race **(2)** in order to support the outer race so the track surface of ball **(3)** is aligned.
3. Insert balls **(3)** and spacers **(4) (5)** coating with grease **AMBRA GRS PLUS** alternately through the hole for plug **(6)** on outer race **(2)**.

***NOTICE:*** *When inserting balls **(3)** and spacers **(4) (5)**, the ball tracks must be aligned completely.*
*To achieve it, outer race **(2)** should be adjusted. It is very dangerous to put you finger into the plug bore directly; always use a push rod **(P)** or a hooked rod **(H)**.*

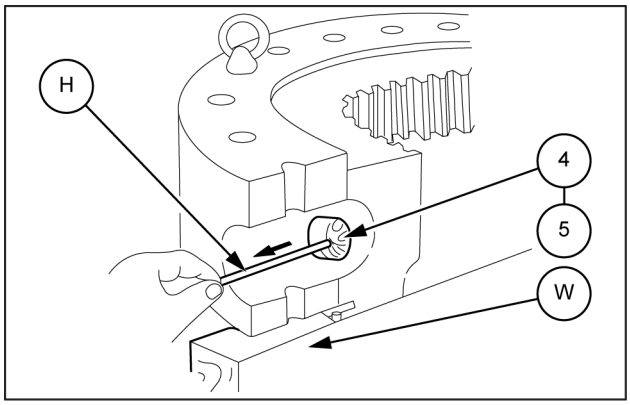


SMIL13MEX0091AB 1



SMIL13MEX0092AB 2

4. Install plug **(6)** to outer race **(2)**, confirming the direction and the position of the bore for taper pin **(7)**.
5. Push taper pin **(7)** into bore, and caulk the head of the taper pin with a punch.
6. Confirm that grease nipple **(10)** is useful. Apply grease **AMBRA GRS PLUS** and confirm that the outer race rotates smoothly and that the lip of the seal is not scored. Grease amount: **90 g** (**3.2 oz**)



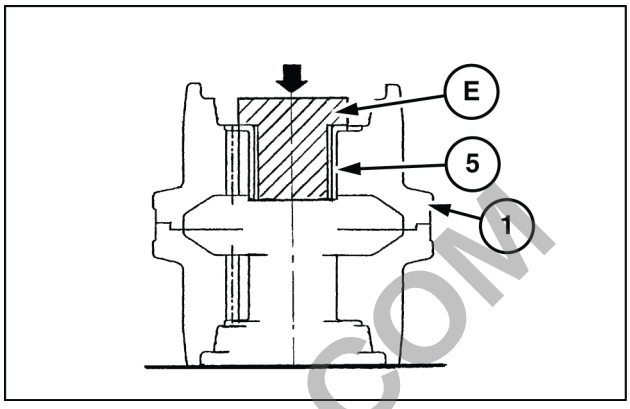
SMIL13MEX0093AB 3

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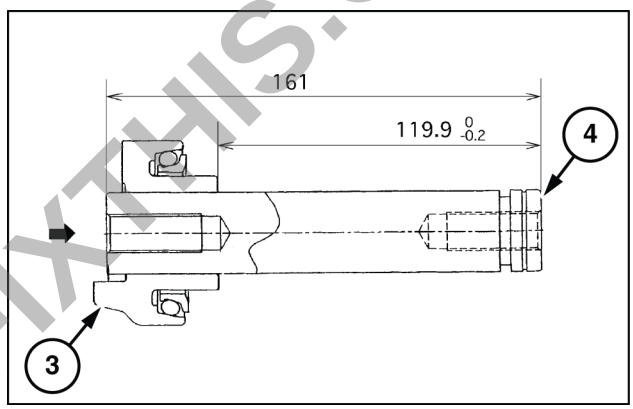

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# Track frame roller - Assemble

1. Press fitting bushing **(5)**
   Align the centre of the bushing **(5)** with that of the bore of the roller **(1)** with the bushing press fit jig **(E)** inserted to the bushing **(5)** to push the bushing in with a press vertically.
   Press fit the opposite side bushing **(5)** too.
   - Apply molybdenum disulfide grease to the press fit section of the bushing to press fit the bushing at a normal temperature.
   - If the press fit failed due to eccentric pushing and so on, always replace the bushing with new one.
2. Press fitting collar **(3)**
   Press fit the collar **(3)**, into which the seal **(7)** is built in advance, into the shaft **(4)** with a press.
   - Press fit according to the arrow and dimensions shown in Fig. **2**.

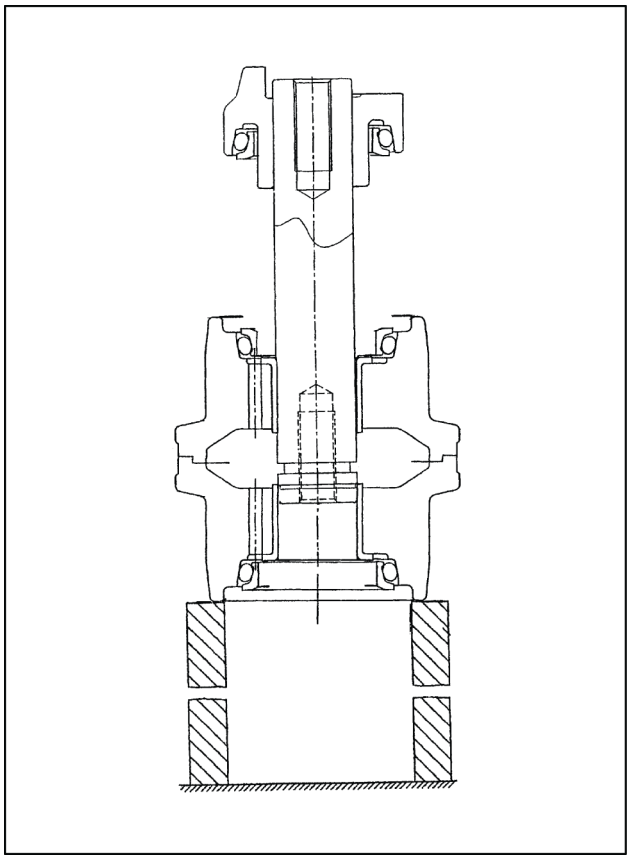



TULI12EXN4457AB 1




TULI12EXN4458AB 2

3. Installing roller side seal **(7)**
   Install the seals **(7)** into both ends of the roller **(1)**.
   - Reuse the seals after ensuring that their surfaces are free from damage or rust.
4. Inserting roller **(1)**
   Insert the roller to the shaft **(4)**.

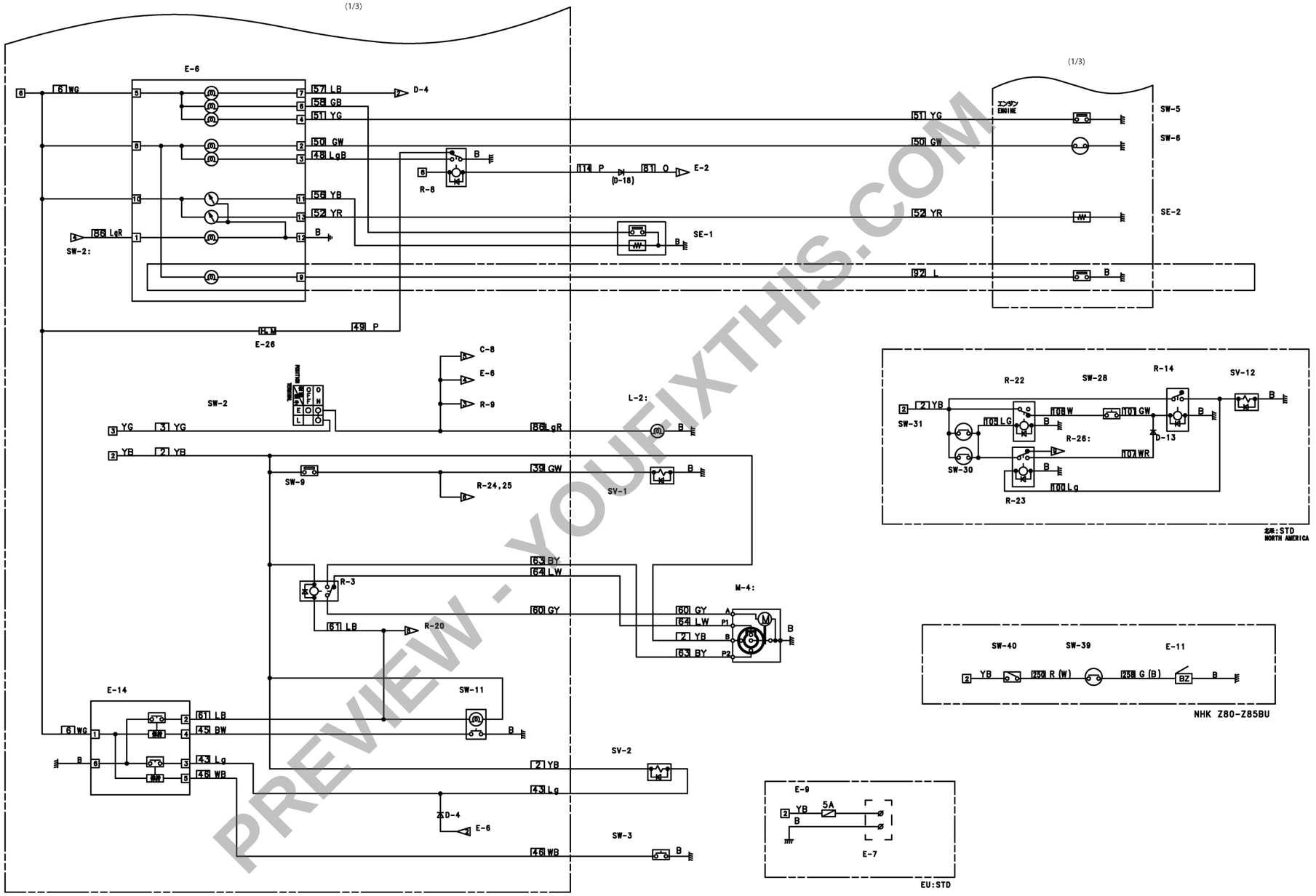


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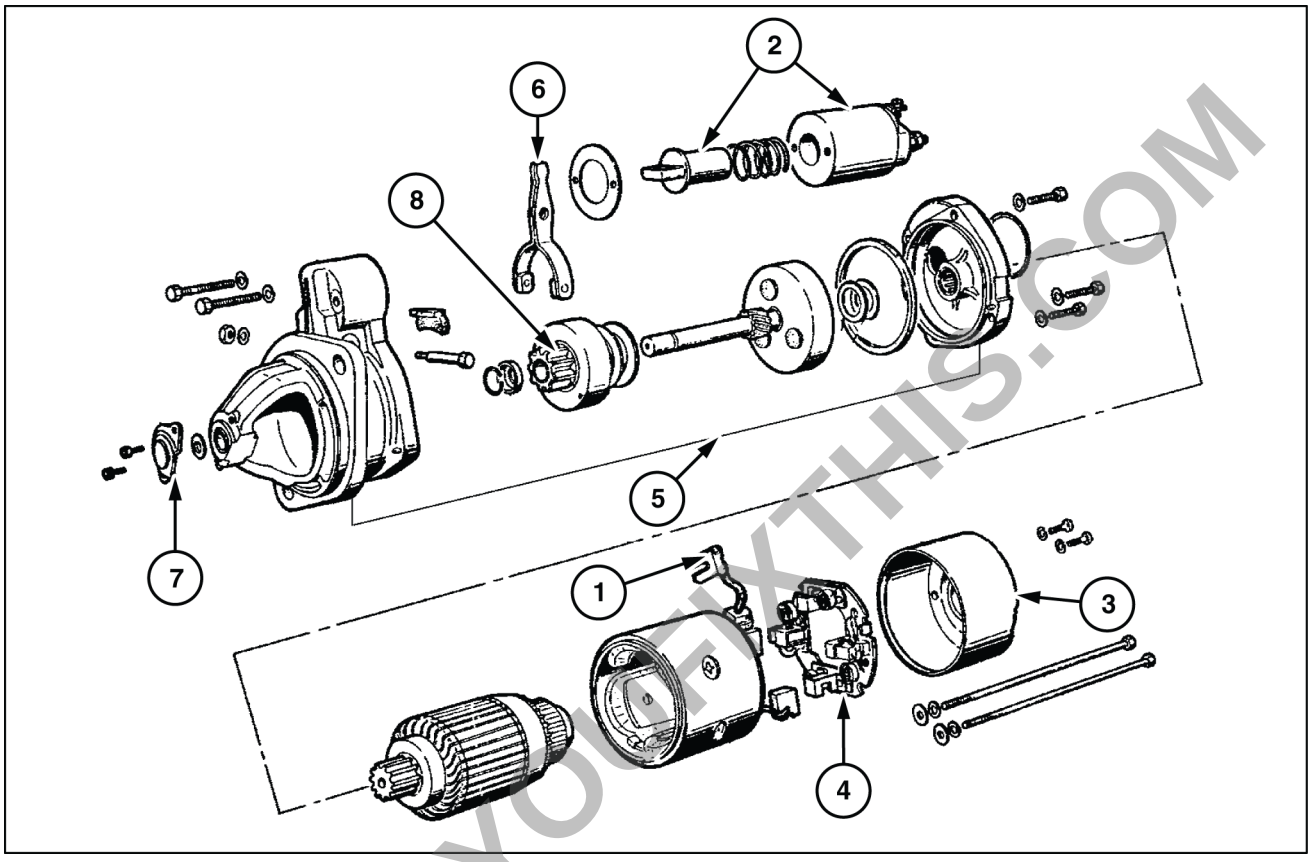
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# Engine starter - Exploded view – 4TNV106(T)

1. Disassembly procedure
2. Disassembly diagram




TULI12EXN5219FB 1

1. Disconnect the lead
2. Remove the magnetic switch
3. Remove the rear cover
4. Remove the brush holder
5. Disassemble the gear case and center bracket
6. Remove the shift lever pin
7. Remove the gear case dust cover
8. Remove the pinion

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# Electrical systems - 55

## Cab controls - 512

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## Bucket - 100

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