

YANMAR

SERVICE MANUAL

EXCAVATOR

ViO25-6

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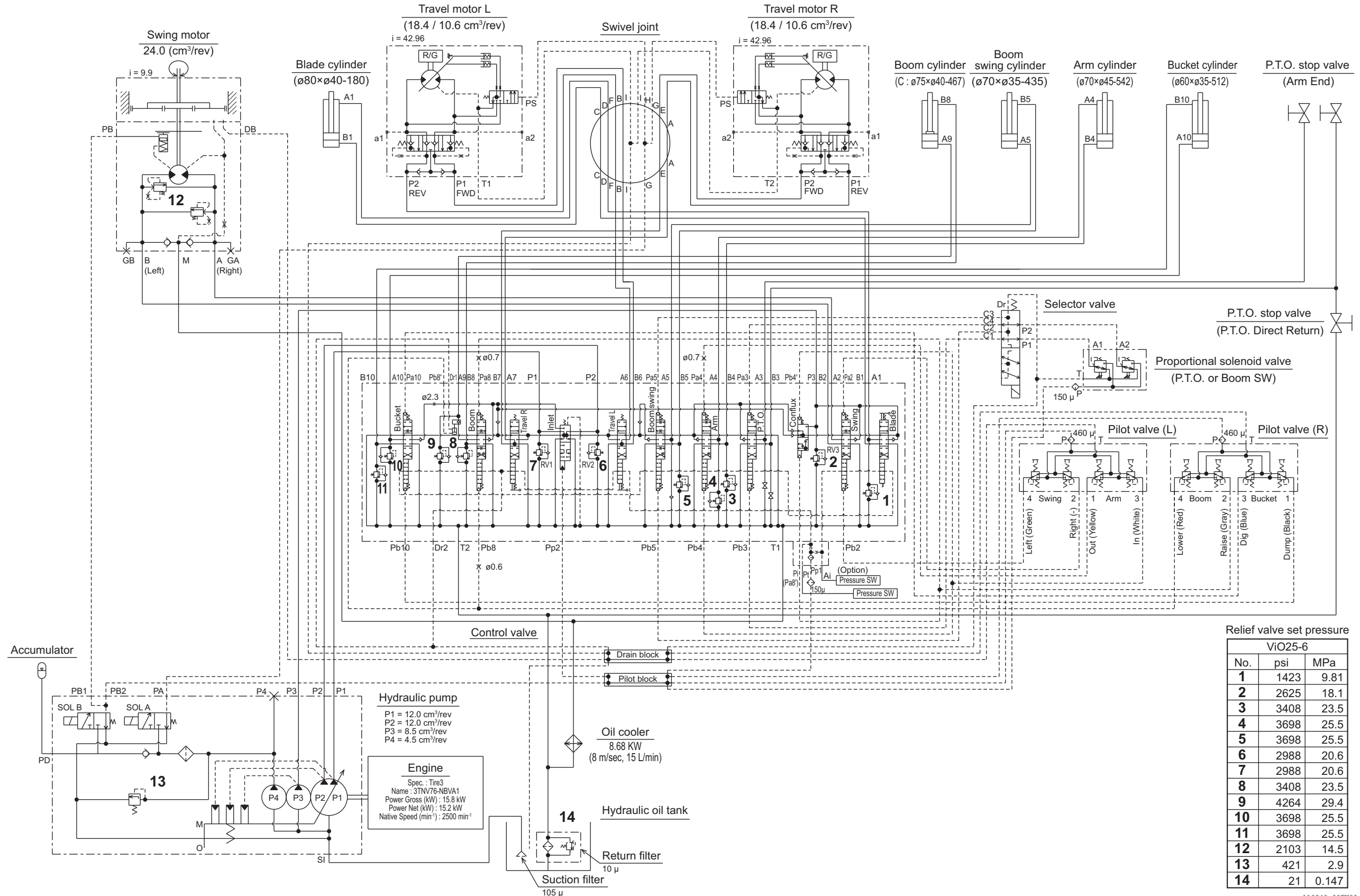
2. TECHNICAL DATA

| Item | Unit | ViO25-6 |
|---|--------------------|--|
| Engine | | |
| Governor | | |
| Name | - | - |
| Type | - | - |
| Fuel feed system | | |
| Fuel filter | - | Filter paper with automatic air release device |
| Fuel filter filtration area | sq.cm | 432 |
| Oil/water separator | - | Mesh filter |
| Feed pump | - | Electro magnetic type |
| Lubrication system | | |
| Lubrication pump | - | Trochoid pump |
| LO pressure regulating valve opening pressure | MPa | 0.29 to 0.39 |
| LO filter | - | Full flow filter |
| LO filter filtration area | sq.cm | 800 |
| Filter valve opening pressure | MPa | 0.08 to 0.12 |
| Operating pressure of alarm switch | MPa | 0.04 to 0.06 |
| Cooling device | | |
| Cooling system | - | Water-cooling (Radiator) |
| Fan belt size | - | 36 |
| Thermostat opening temperature | °C | 71 |
| Thermostat full-open temperature | °C | 85 |
| Radiator cap pressure | kPa | 88.3 |
| Radiator fan | Blade pcs.× Ømm | 5 × 310 |
| Operating temperature of water temperature alarm switch | °C | 107 to 113 |
| Air cleaner | | |
| Type | - | Cyclone type |
| Filtration area | sq.m | 0.9 |
| Fuel injection pump | | |
| Injection pump type | - | YPES-3M1 |
| Injection pump plunger diameter | mm | 6 |
| Injection pump cam lifting height | mm | 7 |
| Fuel injection timing (FIT) | degrees | 15 to 17 |
| Firing order | - | 1 - 3 - 2 |
| Nozzle | | |
| Type | | NP-DN0PDN 161 |
| Nozzle hole diameter × Number of holes | Ømm ×pcs. | 1.0 × 1 |
| Spray angle | degrees | 5 to 10 |
| Fuel injection pressure | MPa | 11.8 to 12.7 |

2. TECHNICAL DATA

2-8 Hydraulic Circuit Schematic


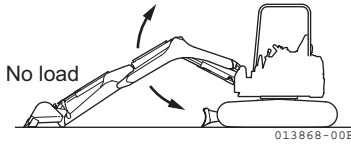

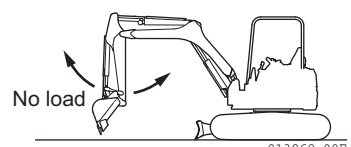

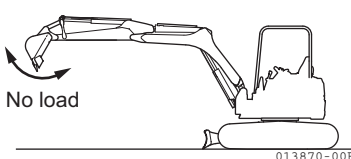

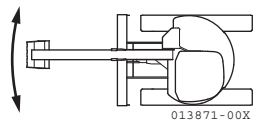
Applicable model : ViO25-6



3. SERVICE STANDARDS

3. Service Standards

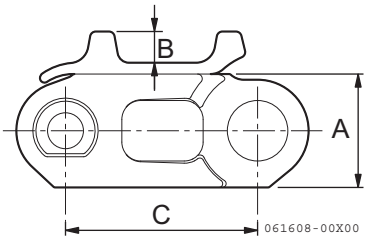
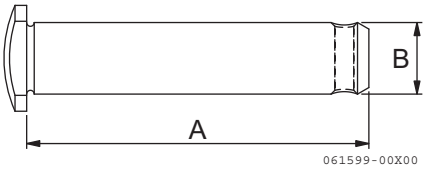
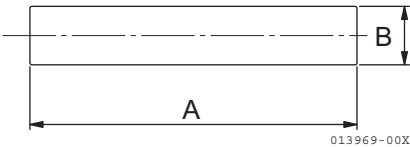
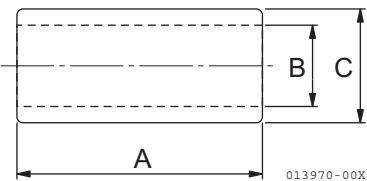
3-1 Machine Performance

| Applicable model | | | ViO25-6 | |
|--|---|-------------------------------|------------------|---------------------------|
| Item | Measuring condition | Unit | Standard | Allowable |
| Machine performance | | | | |
| Working speed | | | | |
| Boom speed Max. cylinder extension  Bucket teeth grounded | Machine position  <ul style="list-style-type: none"> • Engine: Rated speed • Hydraulic oil temp.: 50 to 60°C • Excluding cushion • Site: Firm, flat ground | Up Down | sec. sec. | 1.6 2.0 2.2 |
| Arm speed Max. cylinder retraction  Max. cylinder extension | Machine position  <ul style="list-style-type: none"> • Engine: Rated speed • Hydraulic oil temp.: 50 to 60°C • Site: Firm, flat ground | Extend Retract | sec. sec. | 1.7 2.3 2.5 |
| Bucket speed Max. cylinder retraction  Max. cylinder extension | Machine position  <ul style="list-style-type: none"> • Engine: Rated speed • Hydraulic oil temp.: 50 to 60°C • Site: Firm, flat ground | Dump Curl | sec. sec. | 1.8 2.7 2.9 |
| Boom swing speed Max. cylinder retraction  Max. cylinder extension | Machine position  <ul style="list-style-type: none"> • Engine: Rated speed • Hydraulic oil temp.: 50 to 60 °C • Site: Firm, flat ground • Full stroke | Right swing Left swing | sec. sec. | 5.6 5.5 5.8 |

3. SERVICE STANDARDS

3-3-2 Steel Track Specifications

[Unit: mm]

| Applicable model | ViO25-6 | | |
|--|--------------------|----------|------------|
| Part | Measuring position | Standard | Wear limit |
| Steel track specifications | | | |
| (1) Track link  Note: For the link pitch, measure 5 links at three places and obtain the average value. | A | 60 | 57 |
| | B | 16.5 | 6.5 |
| | C | 101.6 | 103 |
| (2) Master pin  | A | 90.5 | - |
| | B | Ø18.9 | Ø16.9 |
| (3) Pin  | A | 92.5 | - |
| | B | Ø19.2 | Ø17.2 |
| (4) Bush & master bush  | A | 52 | - |
| | B | Ø19.3 | Ø20.2 |
| | C | Ø32.2 | Ø30.2 |

3. SERVICE STANDARDS

| Applicable model | | ViO25-6 | | |
|------------------|---|-----------------------------|--------------------------|----------------|
| Equipment | | Thread size | Tightening torque N•m | Adhesive |
| No | Tightening part | | | |
| Implement | | | | |
| 1 | Boom fulcrum pin lock plate | M12×25 | 78.5 to 98 | ThreeBond 1324 |
| 2 | Arm fulcrum pin lock plate | M12×25 | 78.5 to 98 | ThreeBond 1324 |
| 3 | Boom cylinder rod end pin lock plate | M12×25 | 78.5 to 98 | ThreeBond 1324 |
| 4 | Boom swing cylinder bottom end pin lock plate | M10×20 | 44.1 to 58.9 | ThreeBond 1324 |
| 5 | Boom swing cylinder rod end pin lock plate | M12×30 | 78.5 to 98 | ThreeBond 1324 |
| 6 | Arm cylinder bottom end pin lock plate | M12×25 | 78.5 to 98 | ThreeBond 1324 |
| 7 | Arm cylinder rod end pin lock plate | M12×25 | 78.5 to 98 | ThreeBond 1324 |
| 8 | Bucket cylinder bottom end pin lock plate | M12×25 | 78.5 to 98 | ThreeBond 1324 |
| 9 | Blade fulcrum pin lock plate | M10×25 | 44.1 to 58.9 | ThreeBond 1324 |
| 10 | Blade cylinder pins lock plates | M12×30 | 78.5 to 98 | ThreeBond 1324 |
| 11 | Guide CMP's × Boom and bucket cylinders | M10×16 | 44.1 to 58.9 | ThreeBond 1324 |
| 12 | Guide CMP's × Cylinders | M10×25 (10.9T) | 63.7 to 73.5 | ThreeBond 1324 |
| 13 | PTO tube clamp × Boom | M12×40 | 78.5 to 98 | ThreeBond 1324 |
| 14 | PTO tube clamp × Boom | M12×40 | 78.5 to 98 | ThreeBond 1324 |
| 15 | PTO hose stay × Boom | M12×30 | 78.5 to 98 | ThreeBond 1324 |
| 16 | PTO tube clamp × PTO hose stay | M12×40 | 78.5 to 98 | ThreeBond 1324 |
| 17 | Slide plate | M6×16 (Allen head screw) | 9.8 to 11.8 | ThreeBond 1324 |
| 18 | Stop valve × Arm | M10×65 | 44.1 to 58.9 | ThreeBond 1324 |
| 19 | PTO hose guide × Arm | M10×20 | 44.1 to 58.9 | ThreeBond 1324 |

CHAPTER 4

ENGINE

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4. ENGINE

NOTICE

- NEVER attempt to modify the engine's design or safety features such as defeating the engine speed limit control or the fuel injection quantity control.
- Failure to comply may impair the engine's safety and performance characteristics and shorten the engine's life. Any alterations to this engine may affect the warranty coverage of your engine.

NOTICE

Protect the air cleaner, turbocharger (if equipped) and electric components from damage when you use steam or high-pressure water to clean the engine.

NOTICE

NEVER use high-pressure water or compressed air at greater than 193 kPa; 19 686 mmAq or a wire brush to clean the radiator fins. Radiator fins damage easily.

NOTICE

NEVER attempt to adjust the low or high idle speed limit screw. This may impair the safety and performance of the machine and shorten its life. If the idle speed limit screws require adjustment, see your authorized Yanmar industrial engine dealer or distributor.

NOTICE

The tightening torque in the *Standard Torque Chart* in *General Service Information* should be applied only to the bolts with a "7" head. (JIS strength classification: 7T)

- Apply 60% torque to bolts that are not listed.
- Apply 80% torque when tightened to aluminum alloy.



NOTICE

Establish a periodic maintenance plan according to the engine application and make sure you perform the required periodic maintenance at intervals indicated. Failure to follow these guidelines will impair the engine's safety and performance characteristics, shorten the engine's life and may affect the warranty coverage on your engine.

NOTICE

If the fuel filter / water separator is positioned higher than the fuel level in the fuel tank, water may not drip out when the fuel filter / water separator drain cock is opened. If this happens, turn the air vent screw on the top of the fuel filter / water separator 2-3 turns counterclockwise.

Be sure to tighten the air vent screw after the water has drained out.

NOTICE

- When the engine is operated in dusty conditions, clean the air cleaner element more frequently.
- NEVER operate the engine with the air cleaner element(s) removed. This may allow foreign material to enter the engine and damage it.

NOTICE

The maximum air intake restriction, in terms of differential pressure measurement, must not exceed 6.23 kPa; 635 mmAq. Clean or replace the air cleaner element if the air intake restriction exceeds the above mentioned value.

4. ENGINE

- 1 – Baffle Plate
- 2 – Oil Fill Cap
- 3 – Valve Cover / Intake Manifold
- 4 – Gasket
- 5 – Rocker Arm Shaft
- 6 – Rocker Arm Shaft Support
- 7 – Adjuster Lock Nut
- 8 – Valve Adjuster Screw
- 9 – Rocker Arm
- 10 – Circlip
- 11 – Valve Cap
- 12 – Keeper
- 13 – Valve Spring Retainer
- 14 – Valve Spring
- 15 – Valve Stem Seal
- 16 – Valve Guide
- 17 – Cylinder Head
- 18 – Exhaust Valve
- 19 – Intake Valve
- 20 – Cylinder Head Gasket
- 21 – Push Rod (2 per cylinder)
- 22 – Glow Plug
- 23 – Glow Plug Wiring Harness
- 24 – Cylinder Head Bolt

Disassembly of Cylinder Head

Prepare a clean, flat working surface on a workbench large enough to accommodate the cylinder head assembly. Discard all gaskets, O-rings and seals. Use new gaskets, O-rings and seals on reassembly of cylinder head.

IMPORTANT

Mark all valve train components so they can be installed in their original locations.

Note: Record all measurements taken during disassembly.

1. Drain coolant from engine into a suitable container.

NOTICE

Identify all parts and their location using an appropriate method. It is important that all parts are returned to the same position during the reassembly process.

2. Remove the coolant pump. *See Disassembly of Engine Coolant Pump on page 4-4-4.*
3. Remove the high-pressure fuel lines and fuel injectors from the cylinder head. *See Removal of Fuel Injectors on page 4-3-18.*

4. ENGINE

Reassembly of Cylinder Head

- Carefully clean both the combustion surface of the cylinder head and the top surface of the cylinder block. Install a new cylinder head gasket (**Figure 4-2-29, (2)**) on the cylinder block.
- Position the cylinder head on the cylinder head gasket.

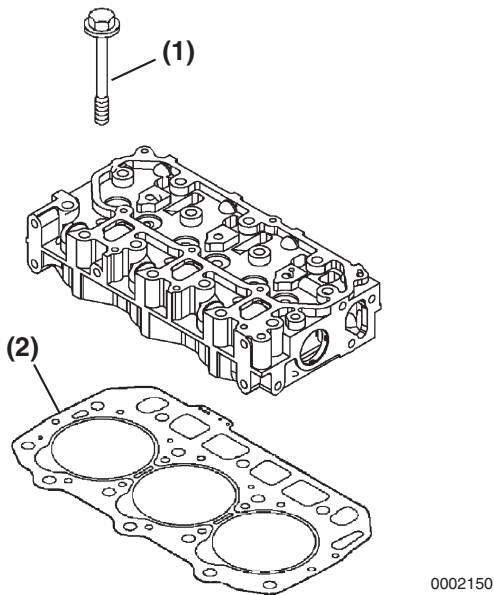
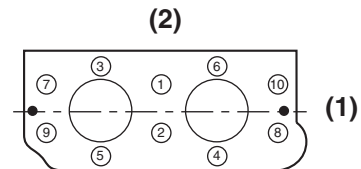
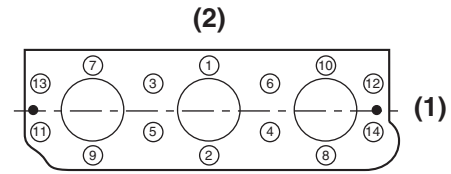


Figure 4-2-29

- Lightly oil the threads of the cylinder head bolts (**Figure 4-2-29, (1)**). Tighten the bolts to the specified torque shown in the chart below. Tighten in the sequence shown in **Figure 4-2-30**. See "3-7-2 Engine Tightening Torque" section for tightening torque.

| | |
|-------------|---------------------|
| First Step | 1/2 of final torque |
| Second Step | Final torque |



- 1 – Cooling Fan End
2 – Camshaft Side

Figure 4-2-30

- Insert the push rods in their respective positions.

Reassembly of Rocker Arm Assembly

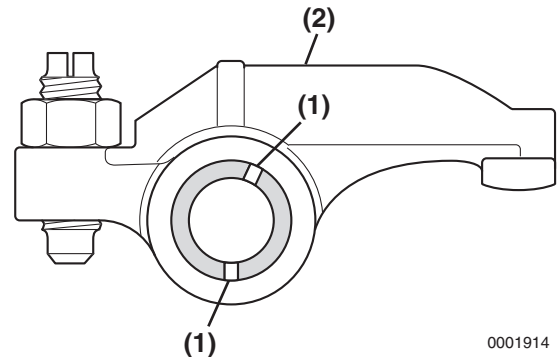


Figure 4-2-31

IMPORTANT

Ensure the lubrication holes in the rocker arm shaft (**Figure 4-2-31, (1)**) are oriented correctly with respect to the rocker arms (**Figure 4-2-31, (2)**).

- Lubricate the rocker arm shaft. Slide the rocker arm supports (**Figure 4-2-32, (5)**), springs (**Figure 4-2-32, (4)**) and rocker arms (**Figure 4-2-32, (1)**) onto the shaft.

4. ENGINE

Removal of Camshaft

1. Before removing the camshaft, check the camshaft end play.
 - **Method A:** Install a dial indicator (**Figure 4-2-46, (1)**) on the cylinder block. Move the camshaft and gear (**Figure 4-2-46, (2)**) in and out to measure the end play. Record the measurement. See "3-2 Engine Service Standard" section for the service limit.

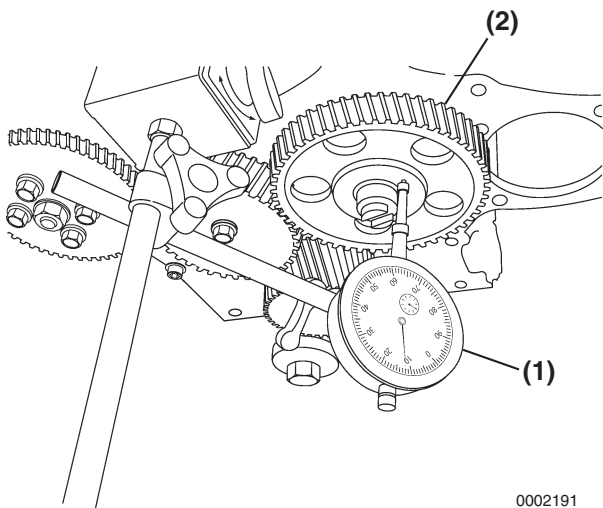


Figure 4-2-46

- **Method B:** Use a feeler gauge to measure the clearance between the thrust plate (**Figure 4-2-47, (1)**) and front camshaft bearing (**Figure 4-2-47, (2)**). Record the measurement. See "3-2 Engine Service Standard" section for the service limit.

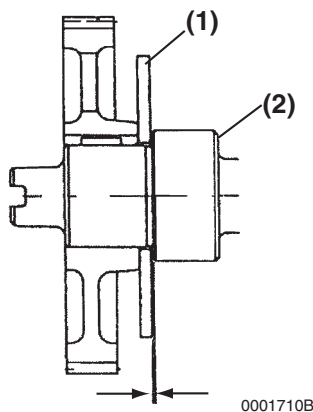


Figure 4-2-47

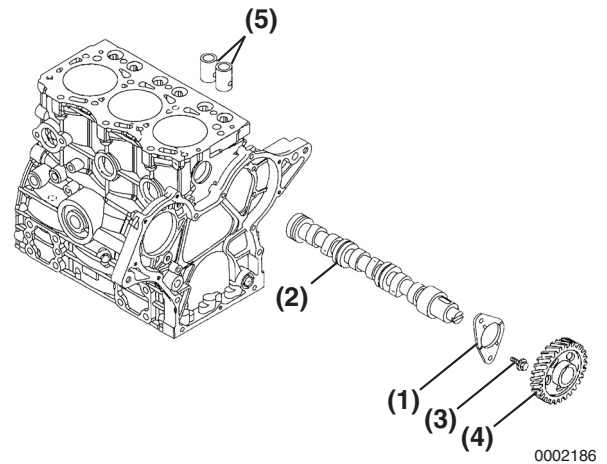


Figure 4-2-48

3. Extract the tappets (**Figure 4-2-48, (5)**) through the top of the cylinder block. Mark the tappets so they can be reinstalled in the same location.
 4. Slowly pull the camshaft (**Figure 4-2-48, (2)**) assembly out of the engine being careful not to damage the front camshaft bushing.
 5. Remove the camshaft gear (**Figure 4-2-48, (4)**) only if the gear or camshaft require replacement. Use a knife-edge puller and a press to remove the gear. The gear is a shrink-fit and will need to be heated to 180° - 200°C to remove.
2. Remove two bolts (**Figure 4-2-48, (3)**) retaining the camshaft thrust plate (**Figure 4-2-48, (1)**).

4. ENGINE

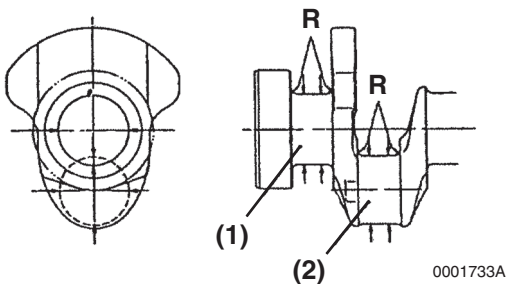
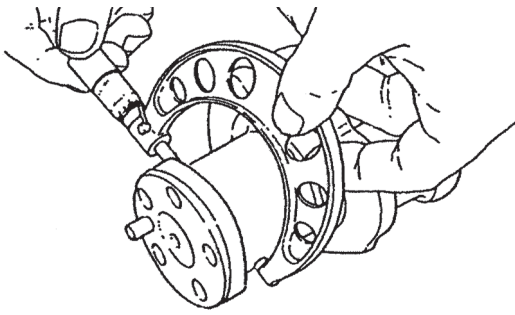


Figure 4-2-75

Reconditioning the Crankshaft

If any of the crankshaft journals do not meet the specifications, it may be possible to grind any or all of them to an undersize. The connecting rod bearings, main bearings, and thrust bearing inserts are available as 0.25 mm undersize. If the journals are ground undersize, the following finishing standards (**Figure 4-2-76**) must be adhered to:

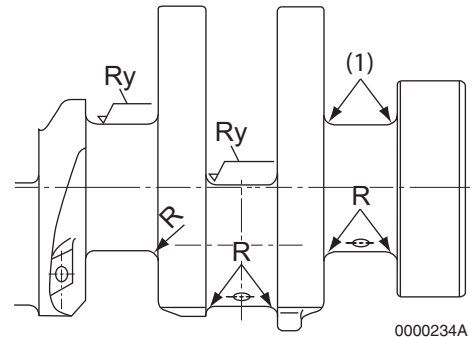


Figure 4-2-76

| Item | Finishing Precision |
|--|---------------------|
| Connecting Rod Journal Undersize Finished Size | 41.702 - 41.712 mm |
| Main Bearing Journal Undersize Finished Size | 46.702 - 46.712 mm |
| Journal Radius (R) | 3.5 - 3.8 mm |
| Journal Face Finish (Ry) | 0.8S (Super Polish) |
| Thrust Face Finish (1) | 1.6 |

Inspection of Camshaft

1. Use V-blocks and a dial indicator to check camshaft bend (**Figure 4-2-77**). Place the indicator on the center bearing journal.

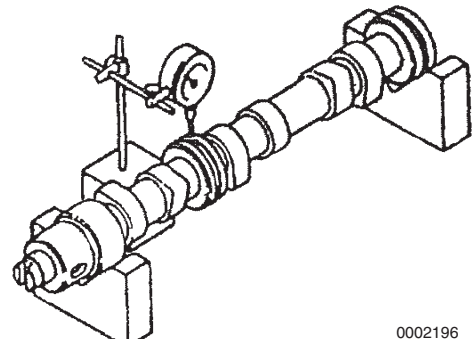


Figure 4-2-77

2. Rotate the camshaft and observe the runout. Record the measurements. See "3-2 Engine Service Standard" section for the service limit.
3. Measure the height of each lobe (**Figure 4-2-78, (1)**). Record the measurements. See "3-2 Engine Service Standard" section for the service limit.

4. ENGINE

5. Reinstall the crankshaft pulley.
6. Reinstall the washer and bolt. Tighten to the specified torque. *See "3-7-2 Engine Tightening Torque" section for tightening torque.*

Installation of Oil Pan

1. Reinstall the oil pickup tube (**Figure 4-2-100, (1)**) and a new O-ring (**Figure 4-2-100, (2)**).

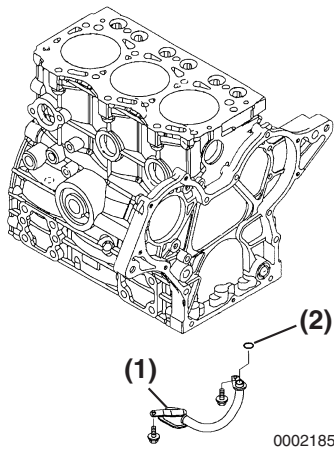


Figure 4-2-100

2. Apply a continuous bead of ThreeBond Liquid Gasket No. 1212, Yanmar Part No. 977770-01212 to the mounting surface of the oil pan (**Figure 4-2-101, (2)**) and crankcase extension (if equipped) (**Figure 4-2-101, (1)**). Be sure to circle each bolt hole.
3. If equipped, reinstall the crankcase extension (**Figure 4-2-101, (1)**). Reinstall the oil pan and tighten the bolts securely.

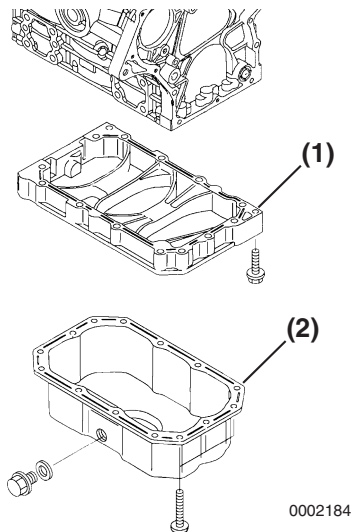


Figure 4-2-101

Final Assembly of Engine

1. Reinstall the starter motor.
2. Reinstall the cylinder head. *See Reassembly of Cylinder Head on page 4-2-15.*
3. Reinstall the engine in the machine.
4. Reconnect the fuel and coolant lines.
5. Reinstall the alternator.
6. Reconnect and adjust the throttle cable.
7. Reconnect all electrical connections.
8. Fill the engine with oil and coolant.
9. Reconnect the battery cables, negative (-) cable last.

4. ENGINE

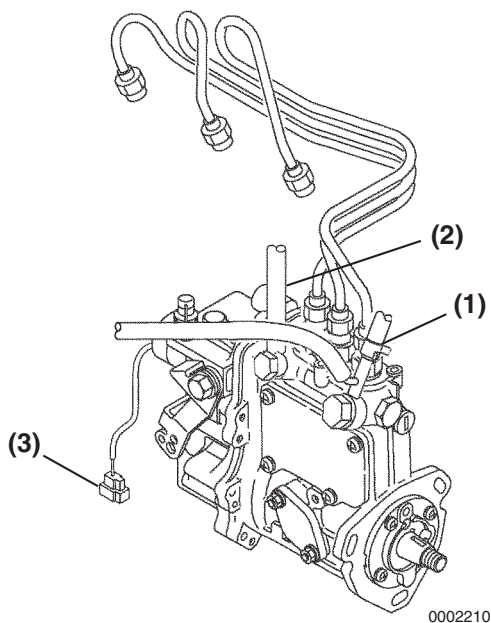


Figure 4-3-8

8. Remove the fuel supply line (**Figure 4-3-8, (2)**) from the fitting on the fuel injection pump.
9. Plug or cap all openings to minimize leakage and prevent contamination.
10. Remove the throttle cable from the fuel injection pump.
11. Separate the stop solenoid wiring connector (**Figure 4-3-8, (3)**).
12. Remove the lube oil line (**Figure 4-3-9, (1)**) from the fuel injection pump and cylinder block.

IMPORTANT

Take care to not damage or bend the lube oil line.

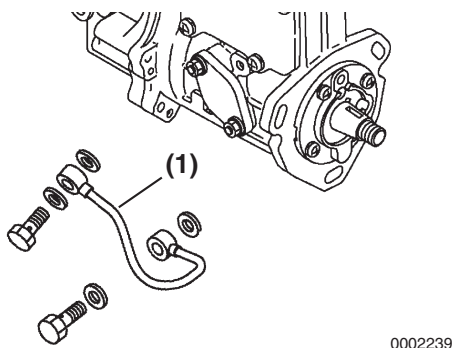


Figure 4-3-9

13. Remove the fuel injection pump drive gear access cover (**Figure 4-3-10, (1)**) from the gear case cover (**Figure 4-3-10, (2)**).

Note: The cover is secured with an adhesive sealant. Use a gasket scraper to separate the cover from the gear case cover.

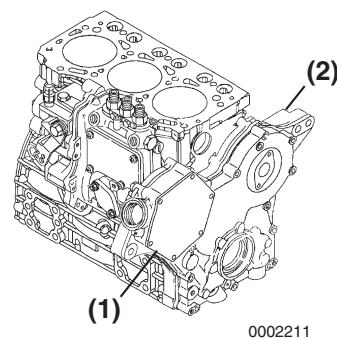


Figure 4-3-10

14. To aid in reassembly, make reference marks (**Figure 4-3-11, (1)**) on the drive gear and idler gear.

NOTICE

After marking the position of the pump drive gear, do not rotate the engine crankshaft. Rotating the crankshaft will cause the fuel injection pump to become misaligned.

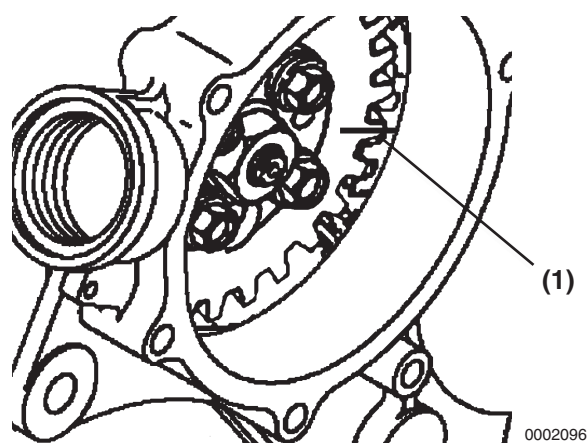


Figure 4-3-11

NOTICE

Do not loosen or remove the four bolts retaining the fuel injection pump drive gear to the fuel injection pump hub. Do not disassemble the fuel injection pump drive gear from the hub. Correct fuel injection timing will be very difficult or impossible to achieve.

4. ENGINE

5. Pump the operating lever slowly to hold the pressure steady at a point just below the opening pressure and hold that pressure for five seconds. Observe the injector to see that it is sealing properly and is not “dripping.” If fuel leaks from the return line fitting, check that the nozzle case nut is tight. Service or replace the injector if fuel continues to leak from either the return line fitting or nozzle.
6. Pump the operating lever more rapidly to repeatedly “pop” the injector and observe the spray pattern. The pattern should be a very fine uniform spray. If dripping or an uneven pattern is seen, service or replace the injector. *See Fuel Injector Test Results on page 4-3-21.*

4. ENGINE

Reassembly of Engine Coolant Pump

1. Reinstall the thermostat (**Figure 4-4-9, (1)**).

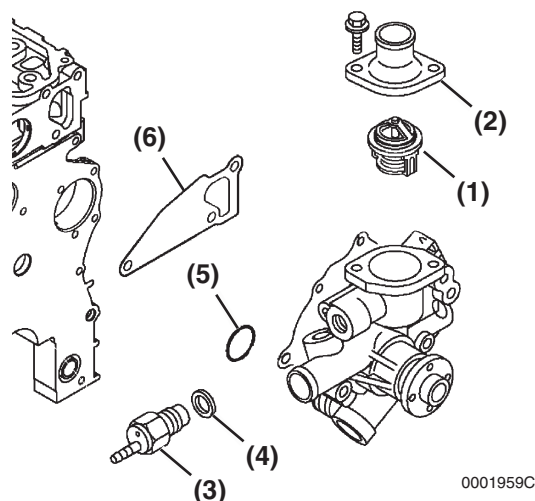


Figure 4-4-9

2. Reinstall the thermostat cover (**Figure 4-4-9, (2)**). Tighten the thermostat cover bolts.
3. Reinstall the temperature switch (**Figure 4-4-9, (3)**) and a new gasket (**Figure 4-4-9, (4)**).
4. Position the engine coolant pump on the engine and install a new gasket (**Figure 4-4-9, (6)**). Use a new special O-ring (**Figure 4-4-9, (5)**) on assembly between the engine coolant pump and the joint.

NOTICE

Use a new special O-ring between the engine coolant pump and the joint. Be sure to use the special O-ring for each engine model. Although the O-ring dimensions are the same as a commercially available O-ring, the material is different.

5. Reinstall the engine coolant pump bolts. Tighten the bolts.
6. Inspect and reinstall the coolant hoses and the temperature switch lead wire.
7. Reinstall the engine coolant pump V-pulley (**Figure 4-4-10, (3)**), spacer (**Figure 4-4-10, (2)**) engine coolant fan (**Figure 4-4-10, (1)**) and engine coolant fan guard (if equipped).

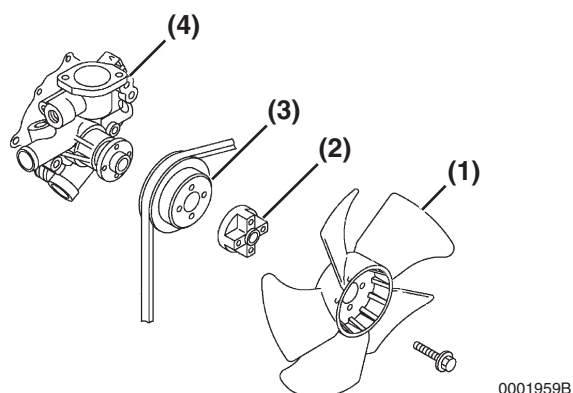


Figure 4-4-10

8. Inspect the condition of the V-belt. There must be clearance (**Figure 4-4-11, (1)**) between the V-belt and the bottom of the pulley groove. If there is no clearance (**Figure 4-4-11, (2)**) between the V-belt and the bottom of the pulley groove, replace the V-belt.

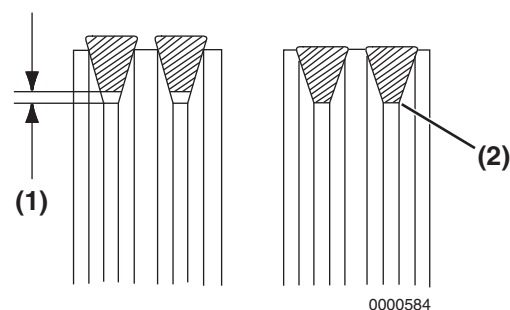
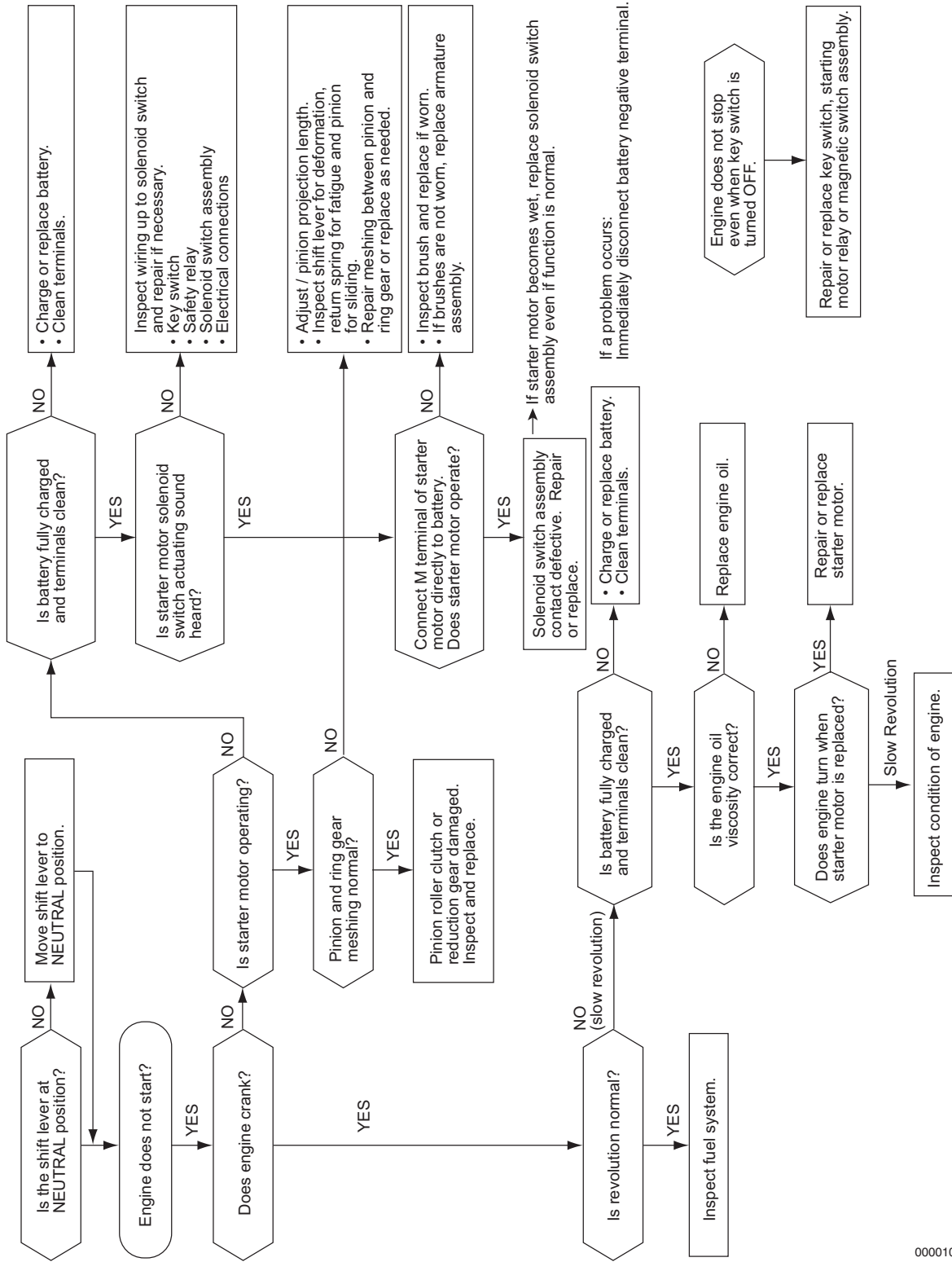


Figure 4-4-11

9. Reinstall the V-belt. Tighten the V-belt to the proper tension.
10. Reinstall and tighten the drain plug or close the drain cock in the radiator. Reinstall and tighten the engine block drain plug or reconnect the coolant hose at the oil cooler.
11. Fill radiator and engine with engine coolant.

4. ENGINE

4-6-4 Starter Motor Troubleshooting



000102

4. ENGINE

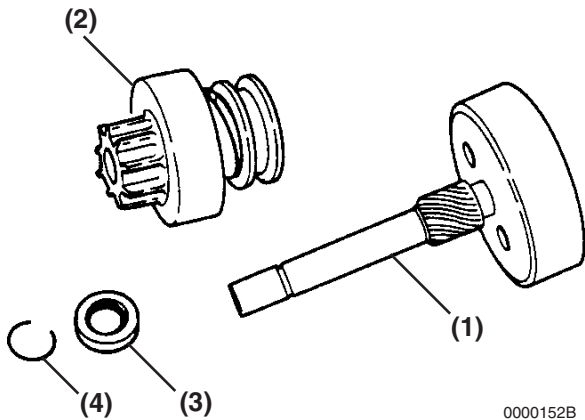


Figure 4-6-29

4. Apply a small amount of high temperature lithium grease (obtain locally) to the contact surfaces of the shift lever. Reassemble the shift lever (**Figure 4-6-30, (2)**), spacer (if equipped) (**Figure 4-6-30, (1)**), and pin.
5. Reinstall the pinion shaft assembly (**Figure 4-6-30, (4)**) in the pinion housing (**Figure 4-6-30, (3)**). Be sure the shift lever properly engages the pinion.

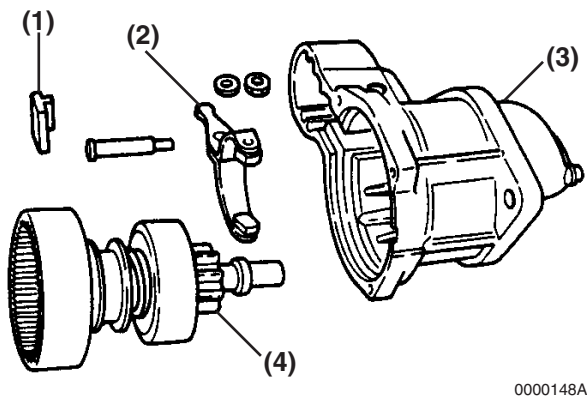


Figure 4-6-30

6. Apply a small amount of high temperature lithium grease (obtain locally) to the surface of the plunger and the hole that engages the shift lever.
7. Attach the plunger to the shift lever.
8. Reinstall the plate onto the intermediate housing and carefully reinstall the armature assembly (**Figure 4-6-31, (2)**) into the pinion shaft assembly.

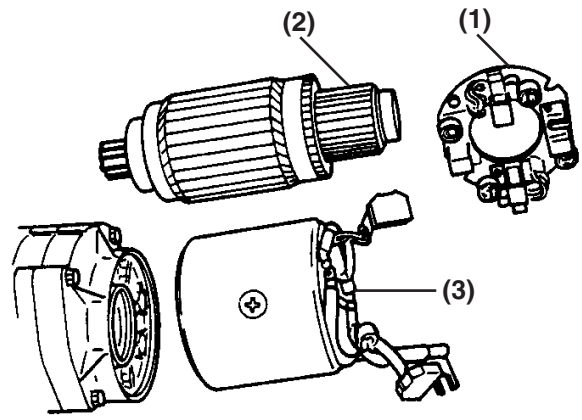


Figure 4-6-31

9. Reinstall the field assembly (**Figure 4-6-31, (1)**) over the armature assembly and align to the pinion housing.
10. Position the brush springs in brush holders. Reinstall the brushes in the brush holders. Reversing the brushes will cause the starter motor to turn backwards.
11. Carefully reinstall the brush holder (**Figure 4-6-32, (3)**) assembly.
12. Reinstall the rear cover (**Figure 4-6-32, (2)**) and secure with two bolts (**Figure 4-6-32, (1)**).

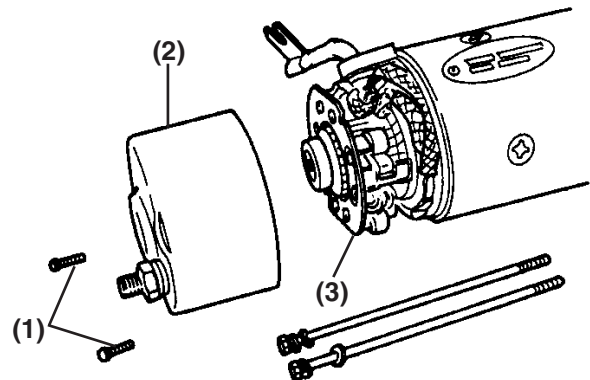


Figure 4-6-32

13. Reinstall the two through bolts and tighten securely.

4. ENGINE

2. Remove the three bolts (**Figure 4-7-6, (1)**) retaining the rear cover (**Figure 4-7-6, (2)**) to the rear frame assembly.

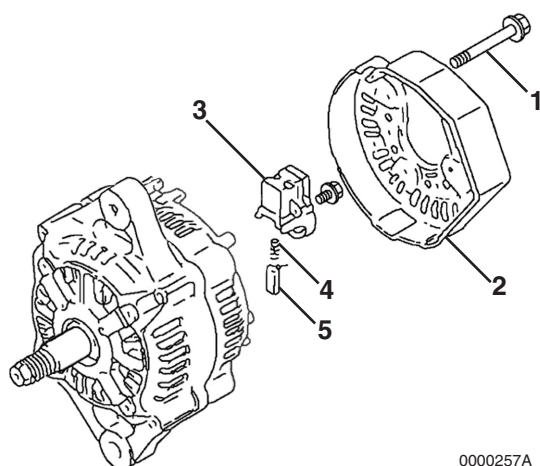


Figure 4-7-6

3. Remove the brush holder (**Figure 4-7-6, (3)**). Remove the brush springs (**Figure 4-7-6, (4)**) and brushes (**Figure 4-7-6, (5)**).
4. Remove the bolt retaining the regulator assembly (**Figure 4-7-7, (1)**) to the holder (**Figure 4-7-7, (2)**).

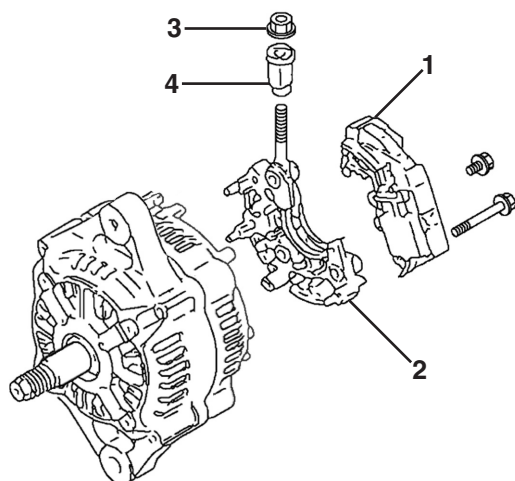


Figure 4-7-7

5. Remove the bolts retaining the holder (**Figure 4-7-7, (2)**) to the rear frame housing. Remove the holder.
6. Remove the nut (**Figure 4-7-7, (3)**) retaining the insulation bushing (**Figure 4-7-7, (4)**). Remove the insulation bushing.

7. Remove the two bolts (**Figure 4-7-8, (1)**) and two nuts (**Figure 4-7-8, (2)**) securing the rear frame housing to the front frame housing.

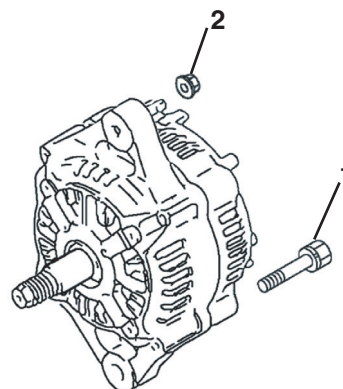


Figure 4-7-8

8. Using a press, remove the rotor assembly (**Figure 4-7-9, (1)**) from the front frame housing (**Figure 4-7-9, (2)**) and rear frame housing (**Figure 4-7-10, (1)**).

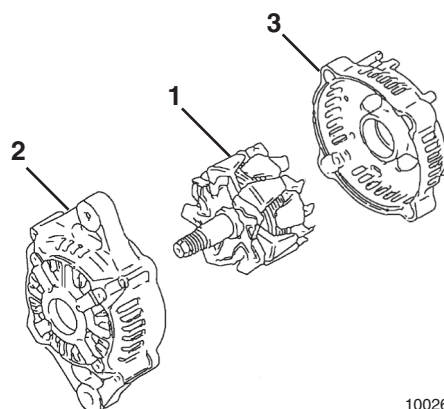


Figure 4-7-9

4. ENGINE

Troubleshooting Charts

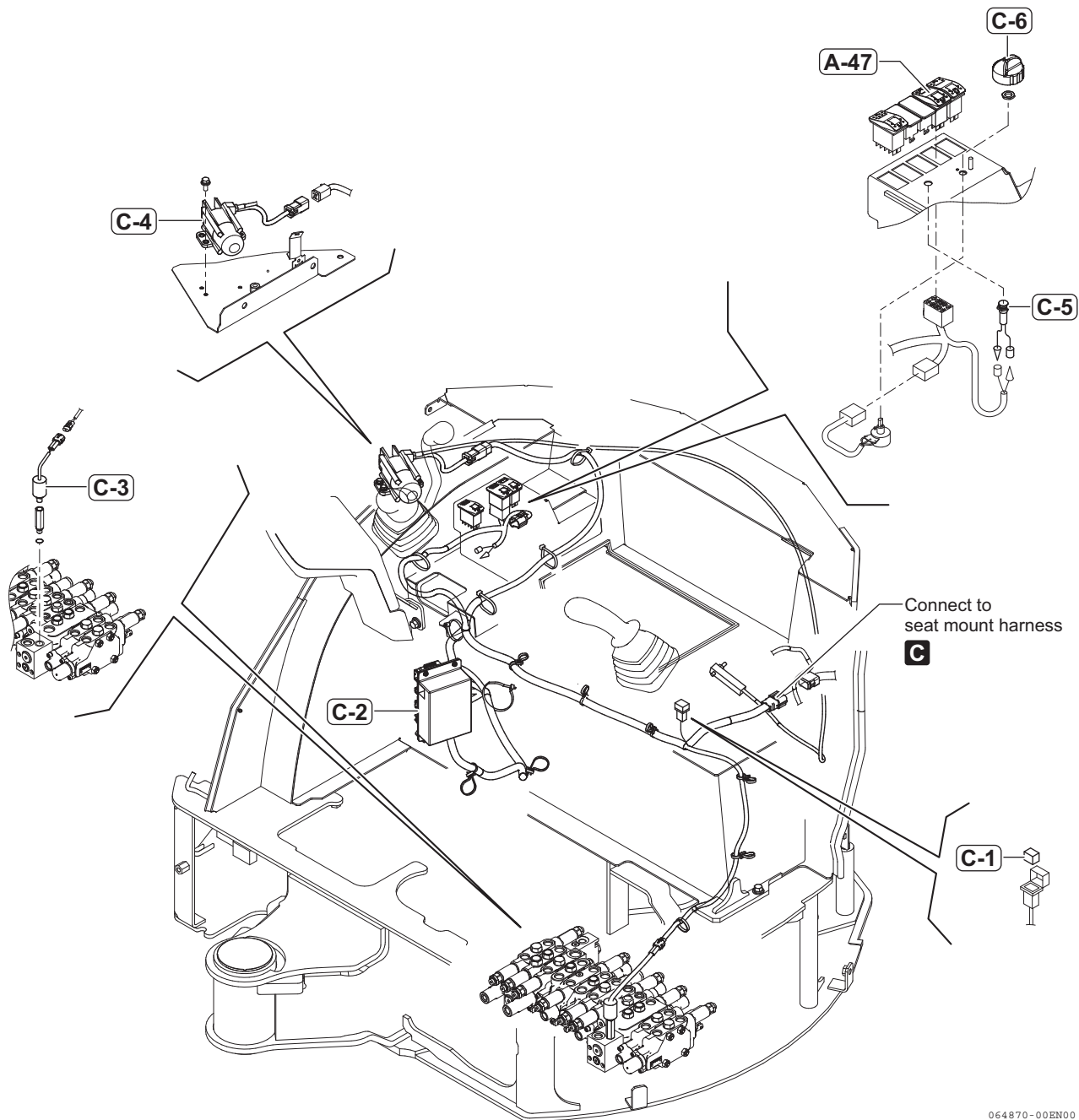
| Cause | Starting Problem | | | Insufficient Engine Output | | Poor Exhaust Color | | High Knocking Sound During Combustion | Abnormal Engine Sound | Uneven Combustion Sound | Engine Surging | | Difficulty in Returning to Low Speed | Excessive Fuel Consumption | Engine Oil | | | | Engine Coolant | | Air Intake | | Exhaust Temperature Rise | Corrective Action | Reference Page | | |
|---------------|--|-------------------------------|--------------------------|----------------------------|--------------------------|--------------------|--------------------------|---------------------------------------|--------------------------|-------------------------|--------------------------|--------------------------|--------------------------------------|----------------------------|----------------------------|---------------------------|-------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--------------------------|--|---|----------------|---------------|---------------|
| | Engine Does Not Start | Engine Starts But Stops Soon. | | Exhaust Color | | During Work | | | | | During Idling | During Work Operation | | | Excessive Engine Vibration | Excessive Oil Consumption | Dilution by Diesel Fuel | Oil with Water | Low Oil Pressure | Excessive Blow-by Gas | Overheat | Low Water Temperature | | | | Pressure Drop | Pressure Rise |
| | | None | Little | Much | Ordinary | White | Black | | | | | | | | | | | | | | | | | | | | |
| Engine System | Improper Intake/Exhaust Valve Clearance | <input type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> | | | | <input type="checkbox"/> | | | | | | | | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | Adjust the Valve Clearance. | See Measuring and Adjusting Valve Clearance on page 4-2-20 | | | |
| | Compression Leakage from Valve Seat | | | | <input type="checkbox"/> | | <input type="checkbox"/> | | <input type="checkbox"/> | | | | | <input type="checkbox"/> | | <input type="checkbox"/> | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | Lap the Valve Seat. | See Valve Face and Valve Seat on page 4-2-14 | | | |
| | Intake/Exhaust Valve Seizure | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> | | <input type="checkbox"/> | | <input type="checkbox"/> | | | | <input type="checkbox"/> | | | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | Correct or Replace Intake/Exhaust Valve. | See Inspection of Intake and Exhaust Valves on page 4-2-13 | | | |
| | Cylinder Head Gasket Blowout | | | | <input type="checkbox"/> | | | | | | | | | | | <input type="checkbox"/> | | <input type="checkbox"/> | | | | | Replace the Gasket. | See Disassembly of Cylinder Head on page 4-2-7 | | | |
| | Seized or Broken Piston Ring | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> | | <input type="checkbox"/> | | <input type="checkbox"/> | | | | <input type="checkbox"/> | <input type="checkbox"/> | | | <input type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> | Replace the Piston Ring. | See Reassembly of Cylinder Head on page 4-2-17 | | | |
| | Worn Piston Ring, Piston or Cylinder | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | | <input type="checkbox"/> | | | | | | | | <input type="checkbox"/> | <input type="checkbox"/> | | | <input type="checkbox"/> | | | | Perform Honing and Use Oversize Parts. | See Honing and Boring on page 4-2-39 | | | |
| | Seized Crankpin Metal or Bearing | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | <input type="checkbox"/> | | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | | | | | | <input type="checkbox"/> | | | | Repair or Replace. | See Inspection of Crankshaft and Camshaft Components on page 4-2-32 | | | |
| | Improper Arrangement of Piston Ring Gaps | | <input type="checkbox"/> | | <input type="checkbox"/> | | | | | | | | | | <input type="checkbox"/> | | | | <input type="checkbox"/> | | | | Correct the Ring Joint Positions. | See Reassembly of Pistons on page 4-2-40 | | | |

4. ENGINE

| Trouble Symptom | Starting Problem | | | Insufficient Engine Output | | | Poor Exhaust Color | | High Knocking Sound During Combustion | Abnormal Engine Sound | Uneven Combustion Sound | Engine Surging | | Excessive Engine Vibration | Difficulty in Returning to Low Speed | Excessive Fuel Consumption | Engine Oil | | | | Excessive Blow-by Gas | Engine Coolant | | Air Intake | | Exhaust Temperature Rise | Corrective Action | Reference Pages | |
|------------------------|--|------------------------|--------|----------------------------|---------------|-------|--------------------|-------------|---------------------------------------|-----------------------|-------------------------|----------------|-----------------------|----------------------------|--------------------------------------|----------------------------|---------------------------|-------------------------|----------------|------------------|-----------------------|----------------|-----------------------|---------------|-------------------|--------------------------------------|--|-----------------|-------|
| | Cause | Engine Does Not Start. | | | Exhaust Color | | | During Work | | | | During Idling | During Work Operation | | | | Excessive Oil Consumption | Dilution by Diesel Fuel | Oil with Water | Low Oil Pressure | | Overheat | Low Water Temperature | Pressure Drop | Pressure Rise | | | | |
| | | None | Little | Much | Ordinary | White | Black | White | | | | | | | | | | | | | | | | | | | | | Black |
| Air/Exhaust Gas System | Clogged Air Filter | | | ○ | | | | ○ | | | ○ | | | | | | | | | | | | | | Clean Air Filter. | | | | |
| | Engine Used at High Temperatures or at High Altitude | | | | | | | ○ | | | | | | | ○ | | | | | ○ | | ○ | | | | Study Output Drop and Load Matching. | | | |
| | Clogged Exhaust Pipe | | | | | | | ○ | | | ○ | | | | | | | | | | | | | ○ | | Clean Exhaust Pipe. | | | |
| Electrical System | Starting Motor Defect | ○ | | | | | | | | | | | | | | | | | | | | | | | | Repair or Replace Stater Motor. | <i>See Starter Motor on page 4-6-1</i> | | |
| | Alternator Defect | ○ | | | | | | | | | | | | | | | | | | | | | | | | Repair or Replace Alternator. | | | |
| | Open-Circuit in Wiring | ○ | | | | | | | | | | | | | | | | | | | | | | | | Repair Open Circuit. | | | |
| | Battery Voltage Drop | ○ | | | | | | | | | | | | | | | | | | | | | | | | Inspect and Change the Battery. | | | |

5. ELECTRIC SYSTEM

3) Auto deceleration



064870-00EN00

| Ref. No. | Part | Ref. No. | Part |
|----------|----------------------|----------|-----------------------------|
| A-47 | SW (P.T.O./swing) | C-4 | Actuator (decel) |
| C-1 | Diode (work signal) | C-5 | Lamp (decel) |
| C-2 | Control unit (decel) | C-6 | Accel, decel |
| C-3 | SW (working signal) | C-7 | (Refer to 5-1-1 and 5-1-3.) |

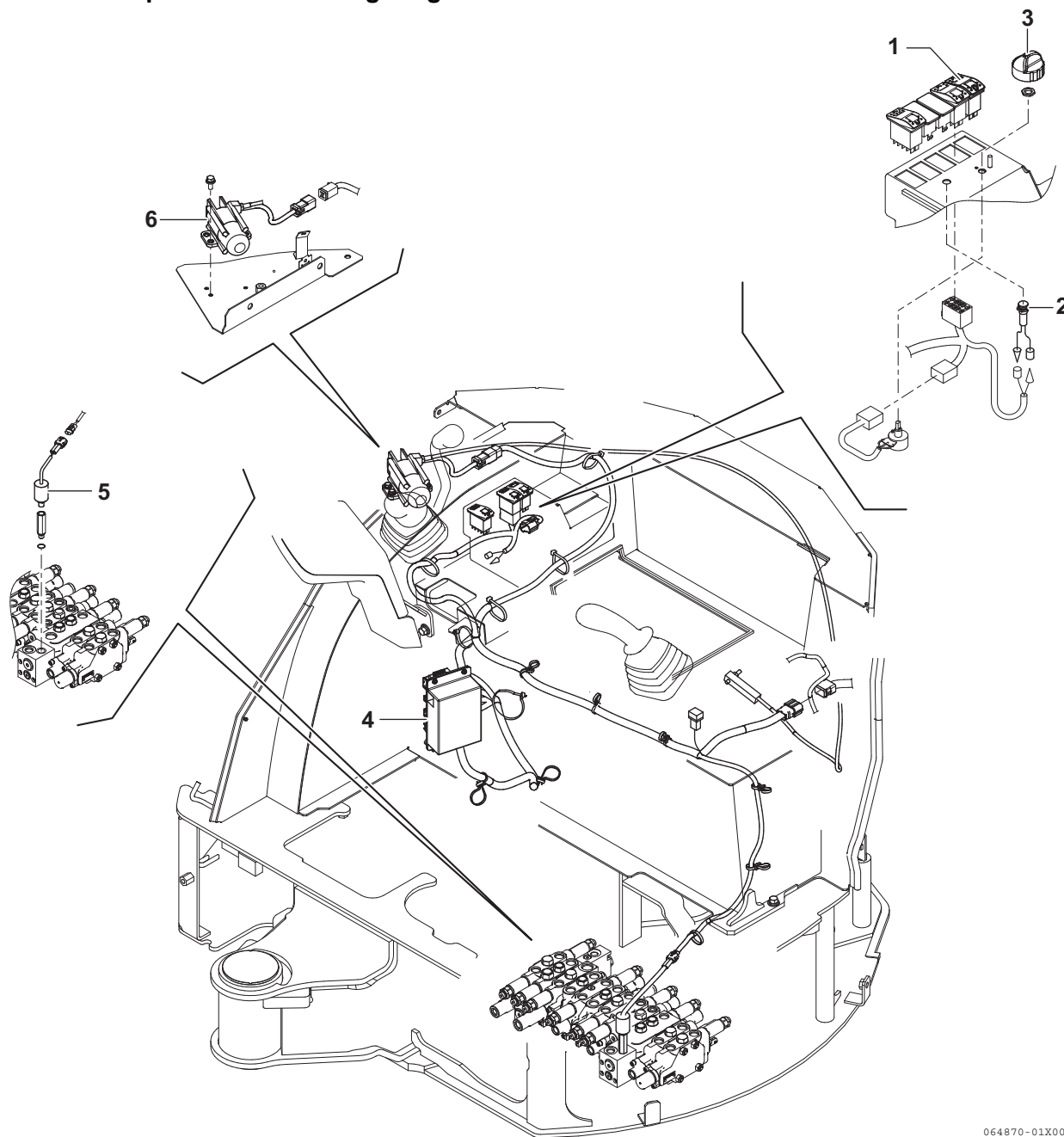
Each reference number (e.g., A-1) corresponds to the numbers described in Section "2-9 Wiring Diagram" and "APPENDIX Wiring Diagram".

5. ELECTRIC SYSTEM

5-3 Automatic Deceleration System

When the automatic deceleration system works and every operation lever or switch is in neutral or OFF, engine rpm is automatically reduced to the low idling speed in order to control unnecessary fuel consumption.

5-3-1 Main Components and Wiring Diagram



064870-01X00

| Ref. No. | Part | Ref. No. | Part |
|----------|-------------------------------|----------|-------------------------------|
| 1 | Auto deceleration switch | 4 | Control unit |
| 2 | Auto deceleration pilot light | 5 | Hydraulic oil pressure switch |
| 3 | Accelerator dial | 6 | Actuator |

5. ELECTRIC SYSTEM

| Error code | Classification | Error description | Detection condition | Causes | Corrective measures |
|--------------|----------------|---|--|--|---|
| 00 522251.04 | Caution | EGR stepping motor "A": circuit fault A | ON signal is detected although EGR stepping motor "A" OFF command has been sent. | <ul style="list-style-type: none"> • Connection failure of connectors • Harness wiring failure (EGR stepping motor phase A line disconnected or short circuited to GND) • Faulty phase A of EGR stepping motor • Engine ECU internal circuit failure | Check the connectors, harnesses and EGR stepping motor. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522252.03 | Caution | EGR stepping motor "B": circuit fault B | OFF signal is detected although EGR stepping motor "B" ON command has been sent. | <ul style="list-style-type: none"> • Connection failure of connectors • Harness wiring failure (EGR stepping motor phase B line short circuited to power supply) • Faulty phase B of EGR stepping motor • Engine ECU internal circuit failure | Check the connectors, harnesses and EGR stepping motor. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522252.04 | Caution | EGR stepping motor "B": circuit fault A | ON signal is detected although EGR stepping motor "B" OFF command has been sent. | <ul style="list-style-type: none"> • Connection failure of connectors • Harness wiring failure (EGR stepping motor phase B line disconnected or short circuited to GND) • Faulty phase B of EGR stepping motor • Engine ECU internal circuit failure | Check the connectors, harnesses and EGR stepping motor. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522253.03 | Caution | EGR stepping motor "C": circuit fault B | OFF signal is detected although EGR stepping motor "C" ON command has been sent. | <ul style="list-style-type: none"> • Connection failure of connectors • Harness wiring failure (EGR stepping motor phase C line short circuited to power supply) • Faulty phase C of EGR stepping motor • Engine ECU internal circuit failure | Check the connectors, harnesses and EGR stepping motor. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522253.04 | Caution | EGR stepping motor "C": circuit fault A | ON signal is detected although EGR stepping motor "C" OFF command has been sent. | <ul style="list-style-type: none"> • Connection failure of connectors • Harness wiring failure (EGR stepping motor phase C line disconnected or short circuited to GND) • Faulty phase C of EGR stepping motor • Engine ECU internal circuit failure | Check the connectors, harnesses and EGR stepping motor. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522254.03 | Caution | EGR stepping motor "D": circuit fault B | OFF signal is detected although EGR stepping motor "D" ON command has been sent. | <ul style="list-style-type: none"> • Connection failure of connectors • Harness wiring failure (EGR stepping motor phase D line short circuited to power supply) • Faulty phase D of EGR stepping motor • Engine ECU internal circuit failure | Check the connectors, harnesses and EGR stepping motor. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522254.04 | Caution | EGR stepping motor "D": circuit fault A | ON signal is detected although EGR stepping motor "D" OFF command has been sent. | <ul style="list-style-type: none"> • Connection failure of connectors • Harness wiring failure (EGR stepping motor phase D line disconnected or short circuited to GND) • Faulty phase D of EGR stepping motor • Engine ECU internal circuit failure | Check the connectors, harnesses and EGR stepping motor. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522314.00 | Caution | Abnormal coolant temperature | Coolant temperature switch is on after engine has started. | <ul style="list-style-type: none"> • Engine overheating • Insufficient amount of engine coolant • Defective engine cooling system • Harness wiring failure (coolant temperature switch wiring short circuited to GND) • Defective coolant temperature switch • Engine ECU internal circuit failure | Inspect the engine cooling system. Check the harnesses and coolant temperature switch. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522727.12 | Caution | Engine ECU malfunction: sub CPU error A | <ul style="list-style-type: none"> • Flash ROM checksum failure • Reading / writing failure • Faulty checksum | Engine ECU internal circuit failure | Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522727.12 | Caution | Engine ECU malfunction: sub CPU error B | <ul style="list-style-type: none"> • Flash ROM checksum failure • Reading / writing failure • Faulty checksum | Engine ECU internal circuit failure | Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522727.12 | Caution | Engine ECU malfunction: sub CPU error C | <ul style="list-style-type: none"> • Flash ROM checksum failure • Reading / writing failure • Faulty checksum | Engine ECU internal circuit failure | Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |
| 00 522728.12 | Warning | Engine ECU malfunction: engine map data version error | Invalid map format | Faulty ROM data of engine ECU (mismatching of map data type) | Rewrite the engine ECU software. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again. |

6. HYDRAULIC SYSTEM

6-2-3 Bucket

1) Bucket "Curl"

(1) Pilot oil flow

When the bucket control lever is moved to the left to curl the bucket, the oil from the pilot pump P4 flows through the cut-off valve, the port 3 of the pilot valve (RH) to the port Pa10 of the bucket section to move its spool.

(2) Oil flow from hydraulic pump

The oil from the piston pump P1 flows through the port P1 of the inlet section and the parallel passage to the bucket section, the port A10 of the control valve and to the A10 of the bucket cylinder to extend its cylinder rod. The return oil from B10 of the bucket cylinder flows back to the hydraulic oil tank through the port B10 of the bucket section and the ports T1 and T2 of the control valve. The return oil from the port T1 flows through the oil cooler.

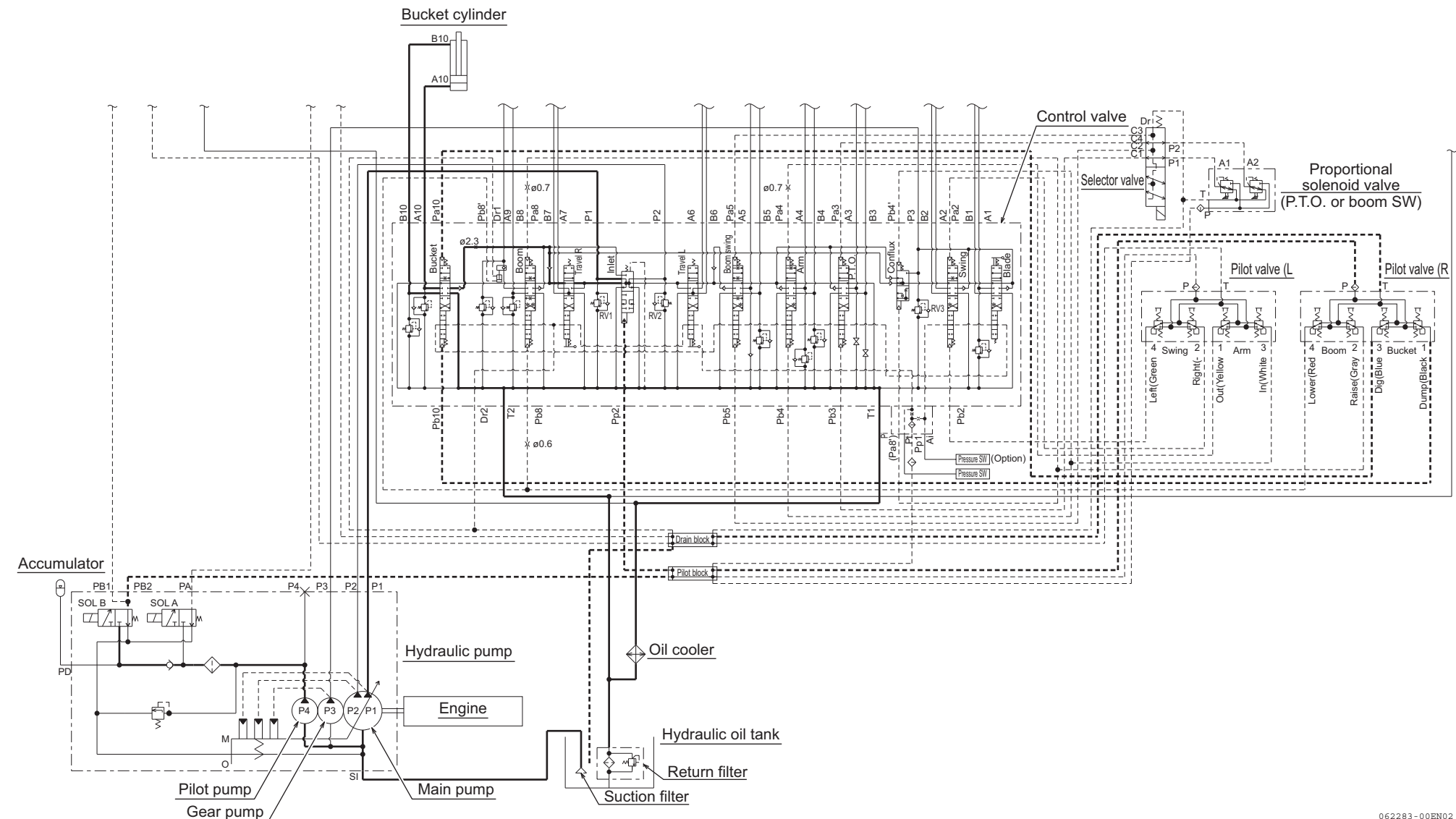
2) Bucket "Dump"

(1) Pilot oil flow

When the bucket control lever is moved to the right to dump the bucket, the oil from the pilot pump P4 flows through the cut-off valve, the port 1 of the pilot valve (RH) and the port Pb10 of the control valve to the bucket section to move its spool.

(2) Oil flow from hydraulic pump

The oil flows in the opposite direction to the oil flow in the Bucket Curl operation with regard to the bucket cylinder.



062283-00EN02

6. HYDRAULIC SYSTEM

6-2-13 Hydraulic P.T.O.

P.T.O. switch controls the P.T.O. proportional solenoid valve through the output current of the solenoid driver in the remote control lever.

1) Switching between Single Acting and Double Acting

Open or close the P.T.O. stop valve to select single or double acting of the P.T.O.

2) Single Acting P.T.O.

(P.T.O. stop valve is open)

(1) Pilot oil flow

When the P.T.O. switch is moved to the left, the oil from the pilot pump P4 flows through the port PB2 of the solenoid valve B, the port A2 of the proportional solenoid valve and the port C4 of the selector valve to the port Pa3 of the P.T.O. section to move its spool.

(2) Oil Flow from Hydraulic Pump

The oil from the piston pump P2 flows to the P.T.O. section through the port P2 of the inlet section. The oil from the gear pump P3 flows through the parallel-flow divider section and the parallel oil passage to the P.T.O. section and is combined with the oil from the piston pump P2. The combined oil flows to the port A3 of the P.T.O. section.

Some return oil directly flows back to the hydraulic oil tank and the remaining returns through the port B3 of the P.T.O. section and the ports T1 and T2 of the control valve. The return oil from the port T1 flows through the oil cooler.

3) Double Acting P.T.O.

(P.T.O. stop valve is closed)

(1) Pilot oil flow

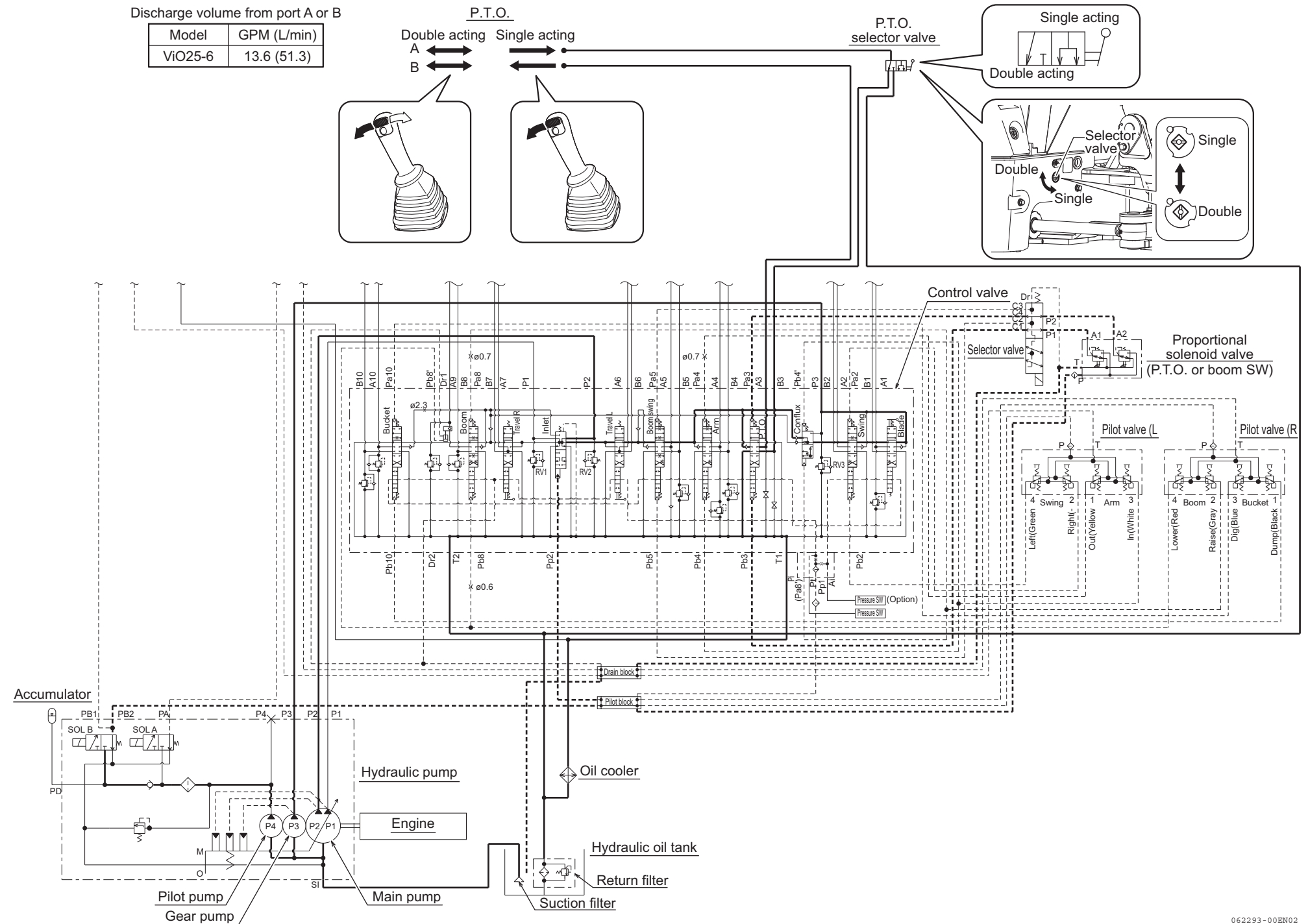
When the P.T.O. switch is moved to the left, the oil flow is same as the flow in "Single acting P.T.O."

When the P.T.O. switch is moved to the right, the oil from the pilot pump P4 flows through the port PB2 of the solenoid valve B, the port A1 of the proportional solenoid valve and the port C1 of the selector valve to the port Pb3 of the P.T.O. section to move its spool.

(2) Oil Flow from Hydraulic Pump

When the P.T.O. switch is moved to the left, the oil flows to P.T.O. circuit in the same direction to the oil flow in the "Single acting P.T.O." The return oil from the P.T.O. circuit flows to the hydraulic oil tank through the port B3 of the P.T.O. section and the ports T1 and T2 of the control valve. The return oil from the port T1 flows through the oil cooler.

When the P.T.O. switch is moved to the right, the oil flows in opposite direction to the oil flow when the P.T.O. slide switch is moved to the left.



062293-00EN02

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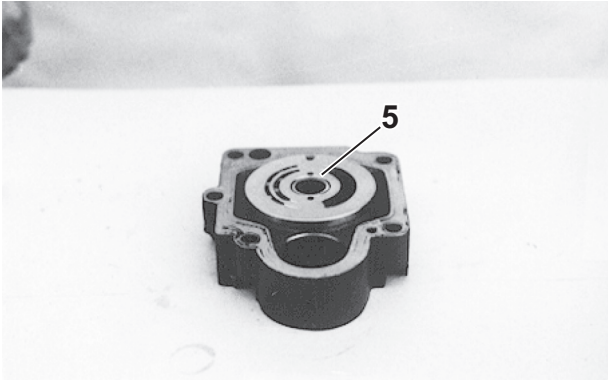
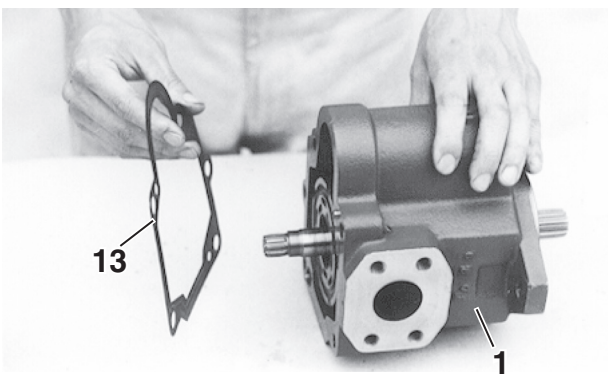
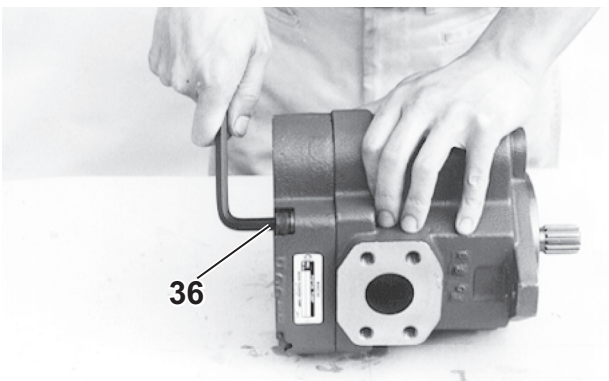
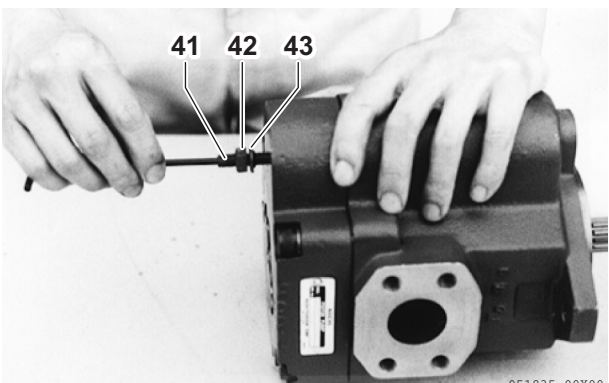
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6. HYDRAULIC SYSTEM

| No. | Part | Q'ty | No. | Part | Q'ty |
|-----|-----------------|------|-----|-------------------------------|------|
| 1 | Body S | 1 | 28 | Coned disc spring | 4 |
| 2 | Body H | 1 | 29 | Internal snap ring | 1 |
| 3 | Drive shaft | 1 | 30 | Internal snap ring | 1 |
| 4 | Cylinder barrel | 1 | 31 | External snap ring | 1 |
| 5 | Valve plate | 1 | 32 | O-ring | 1 |
| 6 | Piston | 10 | 33 | O-ring | 3 |
| 7 | Shoe | 10 | 34 | Plug | 1 |
| 8 | Shoe holder | 1 | 35 | O-ring | 1 |
| 9 | Barrel holder | 1 | 36 | Hexagon socket head bolt | 5 |
| 10 | Swash plate | 1 | 37 | Hexagon socket head plug | 5 |
| 11 | Needle | 3 | 38 | Plug | 1 |
| 12 | Rocking pin | 2 | 40 | Spring pin | 1 |
| 13 | Packing | 1 | 41 | Hexagon socket head set screw | 1 |
| 14 | Spring C | 1 | 42 | Hexagon nut | 1 |
| 15 | Spring T1 | 1 | 43 | Seal washer | 1 |
| 16 | Spring holder | 1 | 44 | Gear pump kit | 1 |
| 17 | Spring guide | 1 | 45 | Coupling | 1 |
| 18 | Pin | 1 | 46 | Collar | 1 |
| 19 | Rod | 1 | 47 | Hexagon bolt | 2 |
| 21 | Retainer | 2 | 48 | O-ring | 1 |
| 22 | Stopper pin A | 1 | 49 | Washer | 2 |
| 23 | Stopper pin B | 1 | 50 | O-ring | 1 |
| 24 | Pin | 1 | 51 | O-ring | 2 |
| 25 | Ball bearing | 1 | 52 | Valve assembly | 1 |
| 26 | Needle bearing | 1 | 53 | Hexagon socket head bolt | 3 |
| 27 | Oil seal | 1 | 54 | Spring washer | 3 |

6. HYDRAULIC SYSTEM

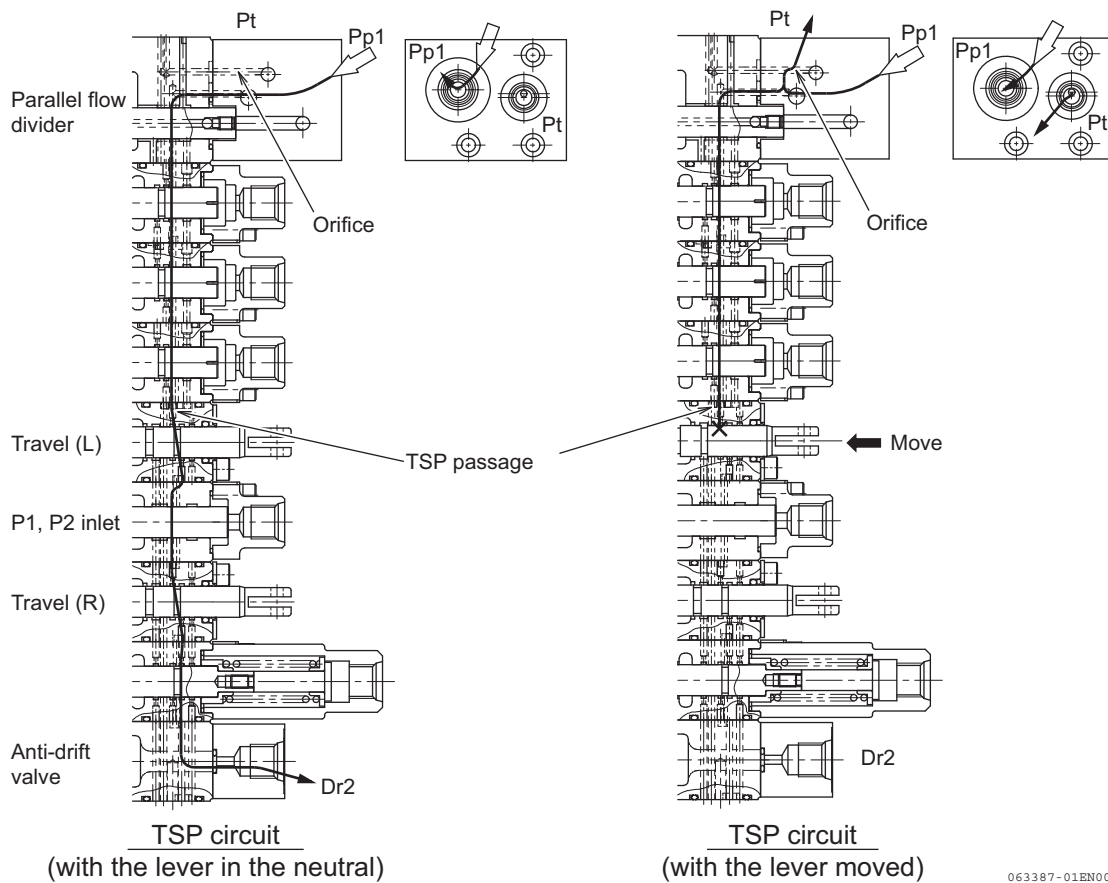
| Procedure | |
|---|--|
| <p>(2) Place the valve plate 5 on the body H 2 quietly with the spring pin 40 on body H 2 fitted into the thin groove of valve plate 5.</p> <p>Note : Take care not to place the valve plate on the wrong side on body H. The thin-grooved side of the valve plate should be contacted with the cylinder barrel.</p> |  |
| <p>5. Joining body S and body H</p> <p>(1) Install the packing 13 on the mating surface of body S 1 using the pin 18 and 24.</p> <p>Note : Replace the removed packing with a new one.</p> |  |
| <p>(2) To put the body S and the body H together, install and softly tighten the two hexagon socket head bolts (M10×65) for temporary installation in place of the upper two hexagon socket head bolts 36 (M10×45). When the clearance between the mating surfaces of body S and body H gets narrow to 5 to 10 mm, install and tighten the other three hexagon socket head bolts 36 (M10×45). Remove the hexagon socket head bolts for temporary installation, and instead, install and tighten the two hexagon socket head bolts 36 (M10×45). Tool : Hexagon bar wrench 8</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> Tightening torque : 51.0 to 64.7 N•m </div> |  |
| <p>6. Installation of hexagon socket head set screw</p> <p>Fasten the hexagon socket head set screw 41 with the hexagon nut 42 so that the set screw has the same projection height as that before disassembly.</p> <p>Tools : Offset wrench 13 and hexagon bar wrench 4</p> <p>Note: Replace the removed seal washer 43 with a new one.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin-top: 10px;"> Tightening torque: 14.7 to 19.6 N•m </div> |  |

6. HYDRAULIC SYSTEM

When the TSP (travel signal pilot) circuit is used

The oil from the port Pp1 flows to the TSP passage through the orifice in the P3 inlet section. When the travel lever is not moved, the oil in the TSP passage flows to the port Dr2 and its pressure equals at down stream passage of the orifice to that at the port Pt (TSP port) connected to upstream oil passage of the travel section.

When right or left travel lever is moved, TSP passage is blocked in the travel section operated, so that the pressure at the port Pt goes up to that at the port Pp1.



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6. HYDRAULIC SYSTEM

6) P.T.O. Operation

When the P.T.O. switch is operated, the oil discharged from the pilot oil pump P4 flows through the cut-off valve, the proportional solenoid valve and the selector valve to the port Pa3 to move the spool of the P.T.O. section.

The P2 by-pass passage is blocked by the P.T.O. spool as it has been moved, so that the oil from the port P2 flows through the passage installed between the boom swing section body and the P.T.O. section body to the parallel passage of the P.T.O. section.

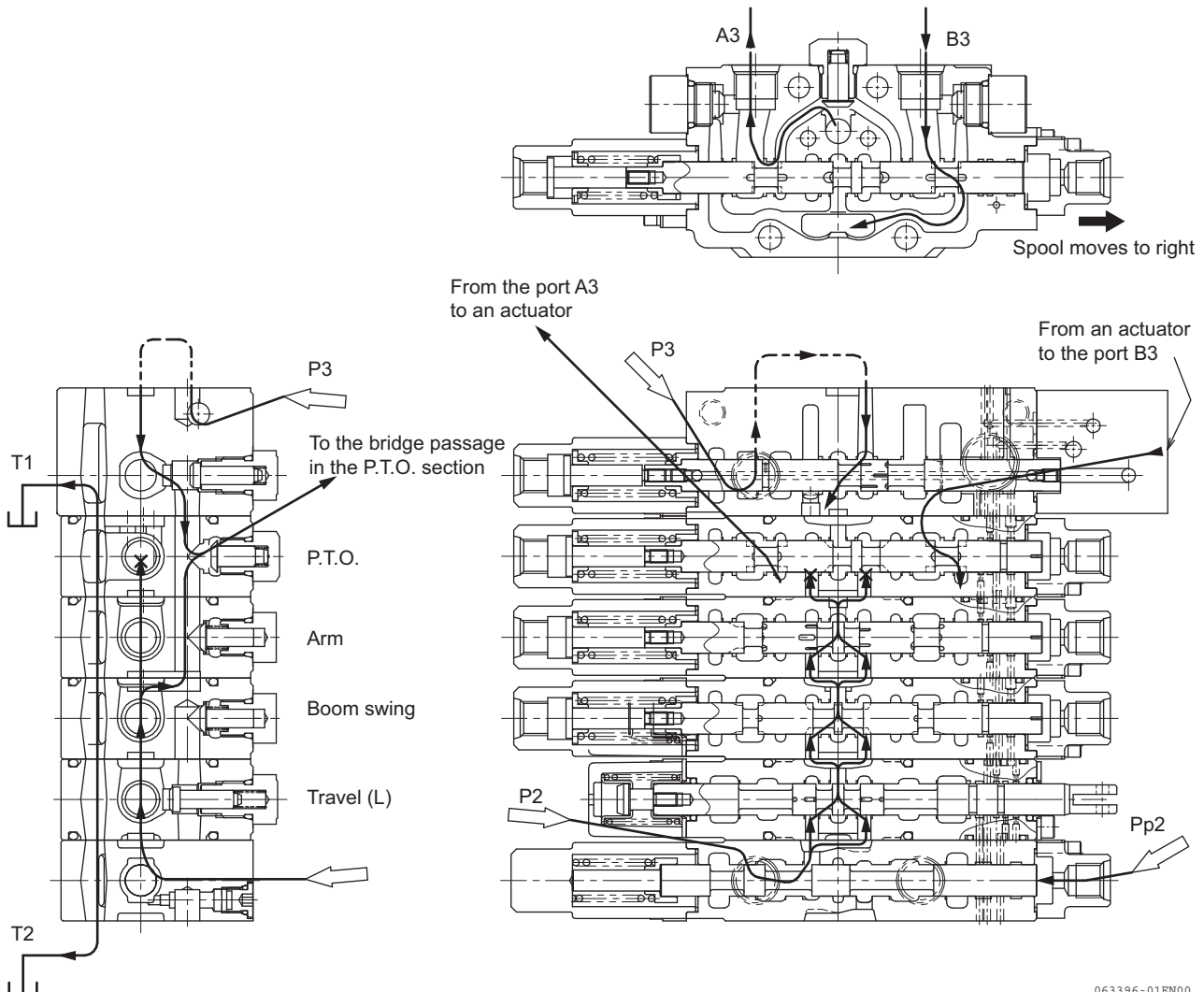
As the P2 by-pass passage is blocked by the P.T.O. section spool as it has been moved, the oil from the port P2 flows to the parallel passage of the P.T.O. section through the oil passage installed between the boom swing section and the P.T.O. section.

The passage between the port A4 and the bridge passage is opened as the P.T.O. section spool has been moved, so that the oil from the parallel passage flows through the load check valve in the P.T.O. section and the bridge passage to an attachment actuated by the P.T.O.

The oil from the port P3 flows through the swing and blade sections and the check valve in the P3 inlet section to the parallel passage in the P.T.O. section, so that the combined oil discharged from the pumps P2 and P3 is fed to the parallel passage in the P.T.O. section.

Meanwhile, the return oil from the attachment connected to the P.T.O. port flows through the port B4 to the return oil passage, which is opened as the P.T.O. spool has been moved.

When the pilot oil is supplied to the port for the operation of a double acting attachment, oil flows to the other way but the valve actuation theory is the same.



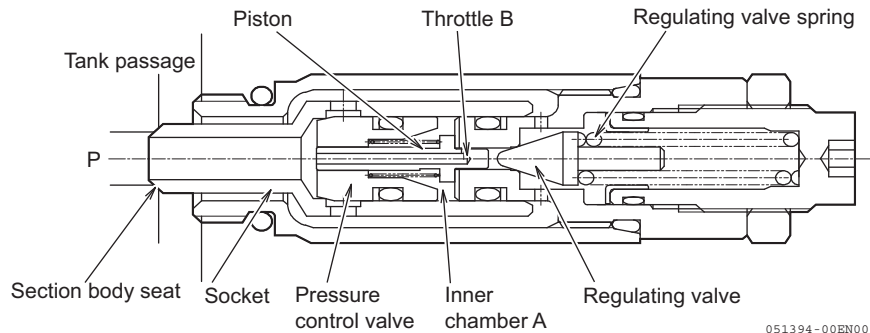
6. HYDRAULIC SYSTEM

13) Circuit Relief Valves

The circuit relief valve is installed in the rod and bottom sides of the bucket, boom and arm cylinders and the rod side of the boom swing and blade cylinders.

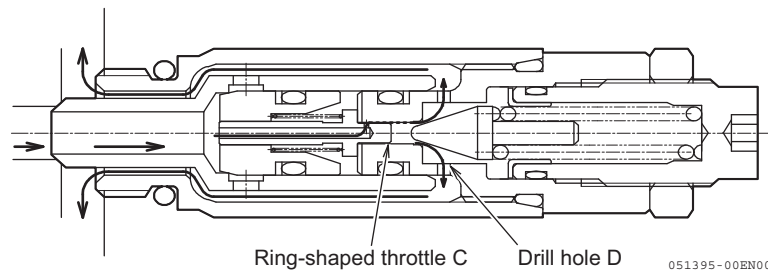
(1) Relief operation

[1] Pressure oil flows through the inside of the piston installed in the pressure control valve (the parent valve) and the throttle B to the inner chamber A, so that it is filled with oil. The pressure control valve and the socket are securely seated, and so are the socket and the section body seat.

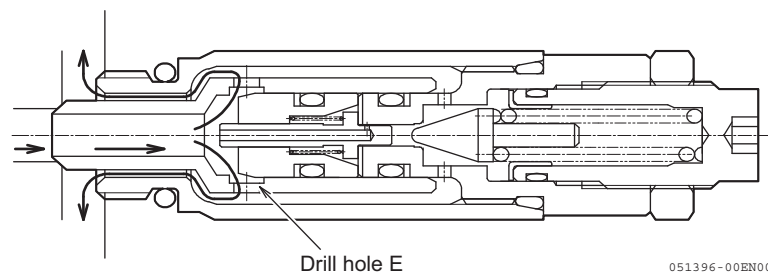


[2] When the oil pressure in the port P reaches the set pressure of the regulating valve spring, the pressure oil flows to the regulating valve to open it.

At this time, the pressure oil passes through the inside of the piston, the throttle B, the inner chamber A, the ring-shaped throttle C and the drill hole D in sequence, and flows outside the socket to the tank passage.

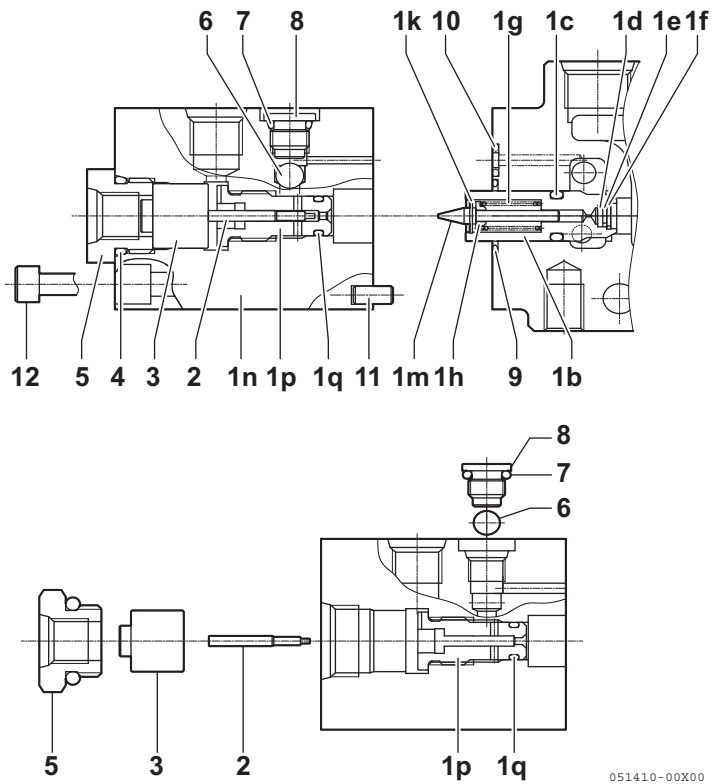


[3] When the regulating valve opens, the pressure in the inner chamber A is lowered, and consequently, the pressure control valve is opened and the pressure oil in the port P flows directly to the tank passage through the drill hole E.



[4] When the pressure in the port P lowers to less than the set pressure of the regulating valve spring, the regulating valve is pressed on the seat with the force of the regulating valve spring and the pressure in the inner chamber A becomes equal to that in the port P. Therefore, the pressure control valve is also pressed on the seat portion of the socket and returned to the original state ([1]).

6. HYDRAULIC SYSTEM



051410-00X00

| No. | Part |
|-----|----------------------------------|
| 1 | Anti-drift valve assembly |
| b | Anti-drift valve |
| c | Cap seal 1B E10 |
| d | Filter |
| e | Spacer |
| f | Snap ring |
| g | Anti-drift valve spring A |
| h | Spring holder |
| k | Internal snap ring 9 |
| m | Needle valve |
| n | Anti-drift valve case |
| p | Piston guide |
| q | O-ring 1B P8 |
| 2 | Piston A1 |
| 3 | Piston B |
| 4 | O-ring 1B P18 |
| 5 | Bush PF1/2 X 1/4 |
| 6 | Steel ball $\phi 7$ mm |
| 7 | O-ring 1B P8 |
| 8 | Ball retainer |
| 9 | O-ring AS 1B17 |
| 10 | O-ring 1A P6 |
| 11 | Dowel pin |
| 12 | Hexagon socket head bolt M6 X 65 |

6. HYDRAULIC SYSTEM

4) Reassembly Procedure

4)-1. Reassembly of Valve Sections

- [1] Put a clean rubber plate on a surface plate to prevent damage to the surfaces of the valve sections and place them on the rubber plate in order of assembly shown in the table on the following page with the actuator port side down.

CAUTION

During this step, be sure to check that there is no dirt or other foreign matter on the mating surfaces of the valve sections and that the O-rings have been securely installed in the O-ring grooves.

Twisted O-rings may cause degradation of seal performance, resulting in external leakage.

O-rings improperly installed in the O-ring grooves may cause them to be caught between valve bodies, resulting in external leakage.

- [2] Insert four tie rods **2** through the holes in the valve section with the identification of SZ and manually tighten the tie rods into the tapped holes in the valve section with the identification of VR.

- [3] After that, install four M8 nuts **1** onto tie rods **2** on the valve section with the identification of SZ and manually tighten them.

- [4] After tightening the nuts, check that the surfaces of all valve sections on each side of the control valve assembly are aligned.

If they are not aligned, use a plastic hammer or a similar tool to align the surfaces.

Note that since the surfaces of all valve sections on the bottom side of the control valve assembly (the side opposite to the actuator ports) cannot be aligned, be sure to place the valve sections with the actuator port side down and align their surfaces on the actuator port side.

CAUTION

Do not hit the surfaces of the valve sections hard with a plastic hammer.

Hitting them hard may cause the already-aligned surfaces to be shifted, resulting in misaligned surfaces.

After surface alignment, using a flat board, check that the surfaces are fully aligned.

Misaligned surfaces may cause poor connection between oil passages in the valve sections, resulting in malfunctions of the control valve.

In addition, any oil passages crossing over a sealing position may cause external leakage.

- [5] After confirming the alignment of the surfaces, tighten the four M8 nuts to the specified torque with a 13 mm socket wrench.

WARNING:

Be sure to gradually tighten the four M8 nuts evenly in several passes.

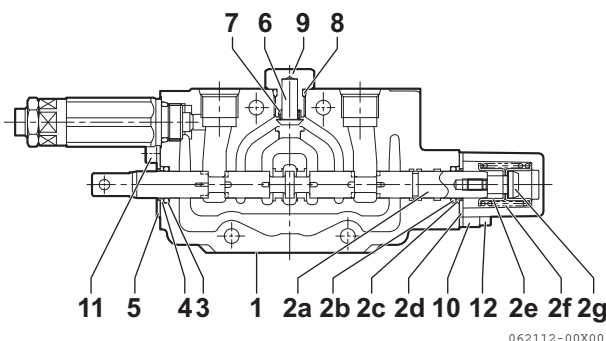
Failure to do so may cause the control valve assembly to warp or curve easily after installation on the machine, resulting in oil leaks or malfunctions.

If the control valve assembly is warped or curved, loosen the M8 nuts and re-align the surfaces of the valve sections or re-align the surfaces using a press or a similar tool.

6. HYDRAULIC SYSTEM

(2) Manually operated type (blade, P.T.O., boom swing and travel sections)

Taking the blade spool as typical example, the assembly procedure is described below.



Manual operated type

- [1] Check that no dirt or any other foreign matter is attached to the spool assembly or around the spool bore of the valve body, and then insert the spool assembly into the spool bore of the valve body in the correct position and direction.

Note:

Before inserting the spool assembly, apply a small amount of hydraulic oil to the spool.

WARNING:

Carefully insert the spool assembly horizontally into the bore.

If the spool assembly is not inserted easily, do not force it into the bore. Doing so may cause dents inside the bore or on the spool, resulting in malfunction of the machine.

If the spool assembly is not installed into the bore smoothly, do not forcibly insert it. Remove it and check it for dirt, flaws and burrs.

If there are any flaws or burrs, be sure to replace the spool assembly together with the valve body to avoid malfunctions.

Note:

Even if the spool assembly is inserted smoothly, take it in and out several times to check again that it moves smoothly.

- [2] Install return spring cap **1** onto the side of the valve body from which the spring of the spool assembly is protruding. Then install and tighten hexagon socket head bolts **2** to the specified torque with a hexagon bar wrench (4 mm).
[Tightening torque: 5.9 to 6.9 N·m]

CAUTION:

*When tightening hexagon socket head bolts **2**, use the bolts to align the bolt holes in return spring cap **1** and oil seal retainer **3** of the spool assembly and fasten them together.*

Fastening only the return spring cap with the bolt may cause damage to the return spring cap and oil seal retainer.

- [3] Install O-ring **4** and dust wiper **5** onto the spool at the clevis side protruding from the valve body.

WARNING:

*Be sure to install dust wiper **5** in the correct direction.*

(Install it in the direction shown in the figure above.)

Installing it in the reverse direction may cause malfunction or external leaks.

- [4] Put the spool through the hole in the center of oil seal retainer **6** and push dust wiper **5** and O-ring **4** in with oil seal retainer **6**. Then install and tighten hexagon socket head bolts **7** to the specified torque with a hexagon bar wrench (4 mm).

[Tightening torque: 5.9 to 6.9 N·m]

- [5] To assemble other spools of the manually operated type, follow the same procedure as above.

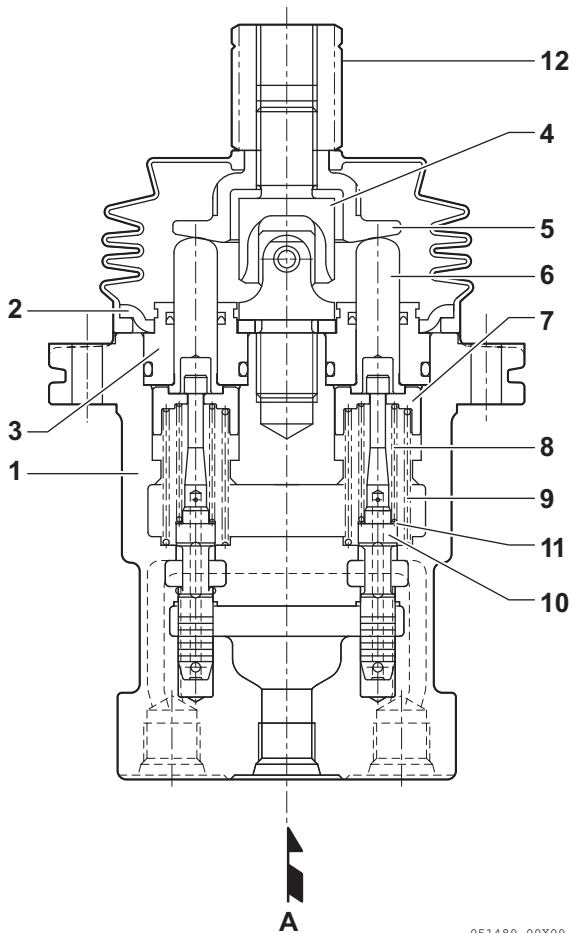
6. HYDRAULIC SYSTEM

6-5 Pilot Valve

1. Overview

The pilot valve serves to operate the spools of the control valve by outputting pilot pressure corresponding to the stroke of the control lever from the corresponding output port.

• Structure



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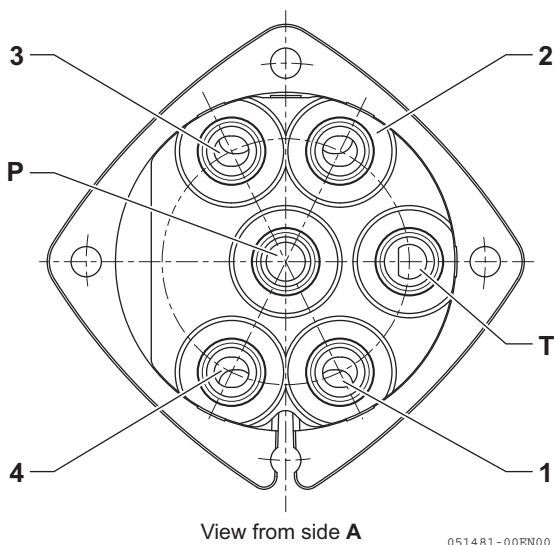
• Specifications

| | |
|-------------------------|---|
| Primary pressure | Maximum pressure: 6.9MPa |
| Secondary pressure | Maximum control pressure: 0 to 4.4 MPa |
| Allowable back pressure | Maximum: 0.3 MPa |
| Rated flow | 15 L/min |
| Operating angle | ±19, ±25 (For independent operation) |
| Mass | 1.6 kg |

• Parts

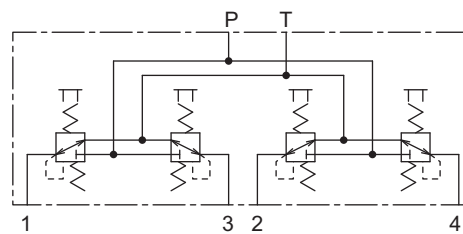
| No. | Part | No. | Part |
|-----|----------|-----|----------------------------------|
| 1 | Casing | 7 | Spring seat |
| 2 | Plate | 8 | Spring (Secondary pressure) |
| 3 | Plug | 9 | Spring (Return) |
| 4 | Joint | 10 | Spool |
| 5 | Disc | 11 | Washer 2 |
| 6 | Push rod | 12 | Adjusting nut (Lever connection) |

• Port layout



View from side A

051481-00EN00



051482-00X00

Hydraulic symbols

P: Port P (from pilot pump)

T: Port T (to tank)

1: Port 1

2: Port 2

3: Port 3

4: Port 4

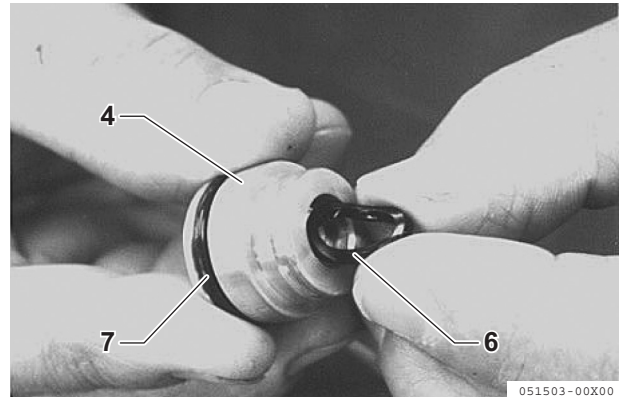
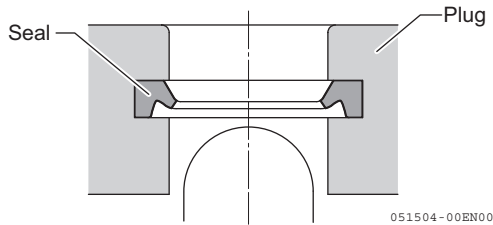
6. HYDRAULIC SYSTEM

Procedure

(6) Install seal **6** into plug **4**.

Note:

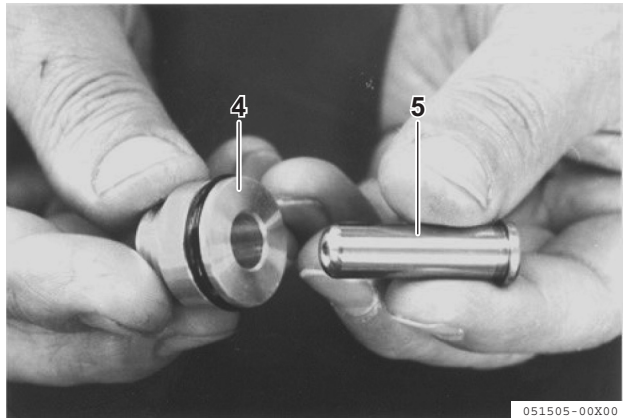
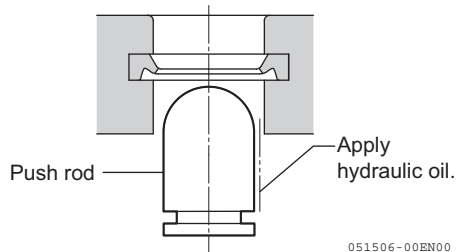
Install seal **6** with its lip facing the direction as shown in the figure below.



(7) Install push rod **5** into plug **4**.

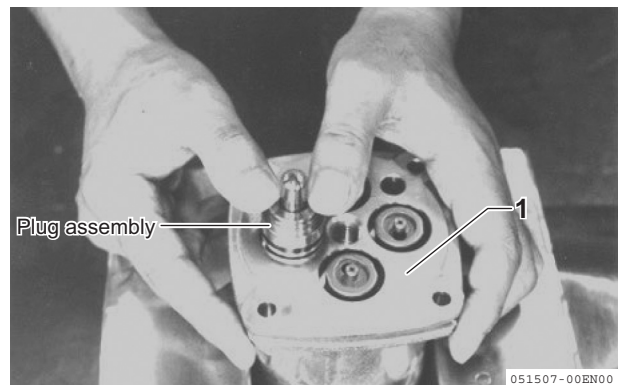
Note:

Apply hydraulic oil to the surface of push rod **5**.



(8) Install plug assemblies into holes in casing **1**.

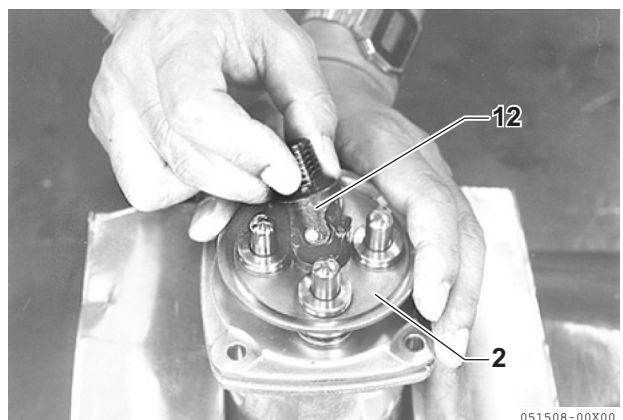
- If return spring **10** is weak, the plug assembly will stay in place due to the sliding resistance of O-ring **7**.
- If return spring **10** is strong, use plate **2** to simultaneously install four plug assemblies into the holes in casing **1** and temporarily secure them with joint **12**.



(9) Install plate **2** and joint **12**.

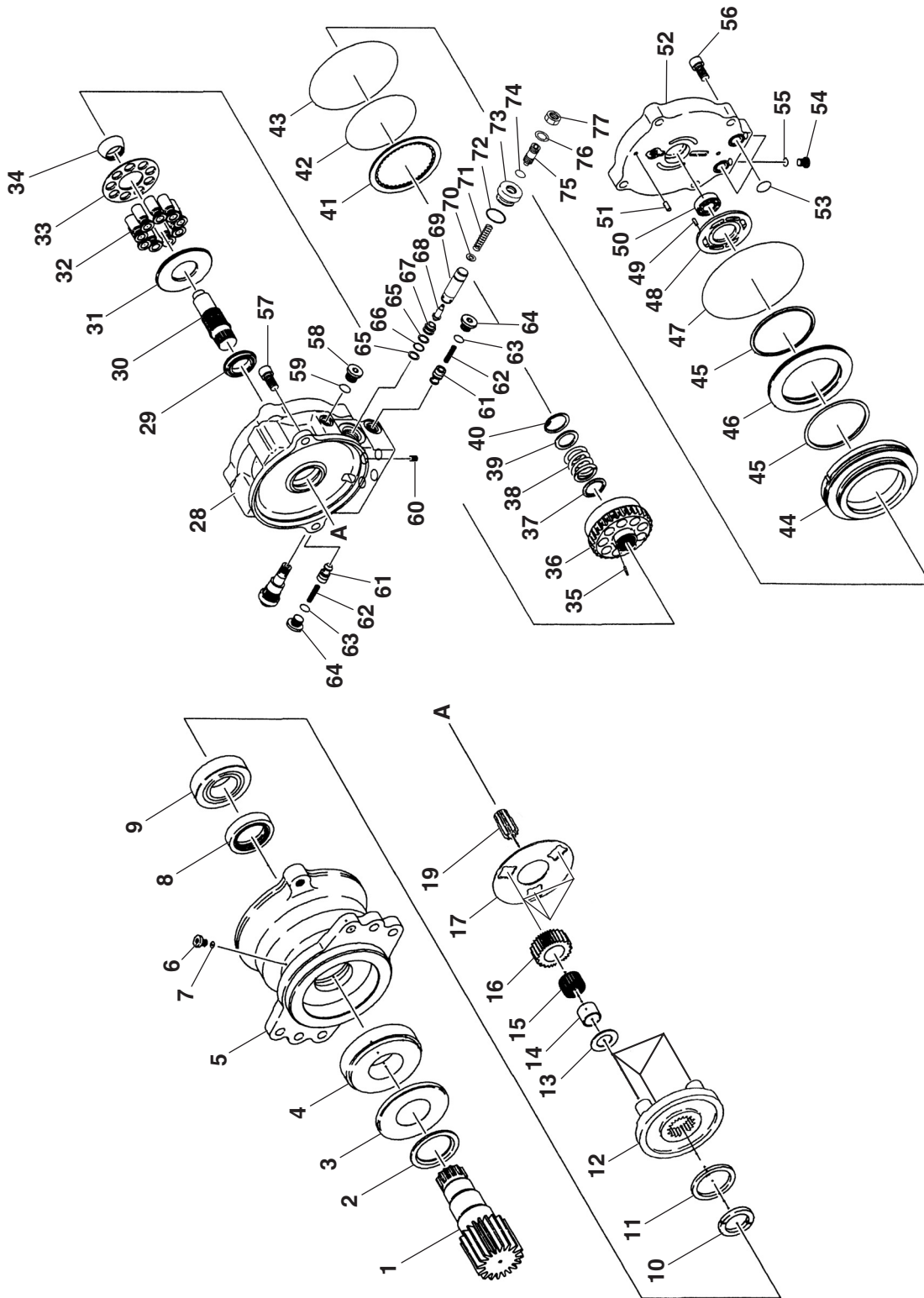
Notes:

- Be careful not to damage the holes in casing **1** by the contact of spool **3** during installation.
- Be careful of the plug assemblies and plate **2** because they may jump out.



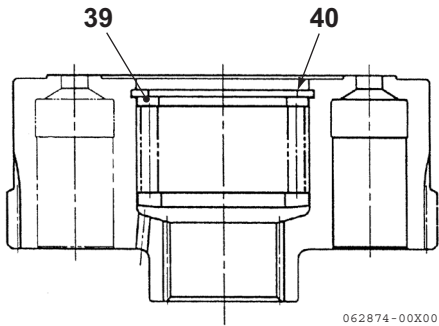
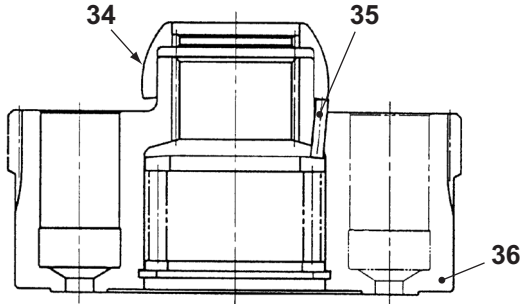
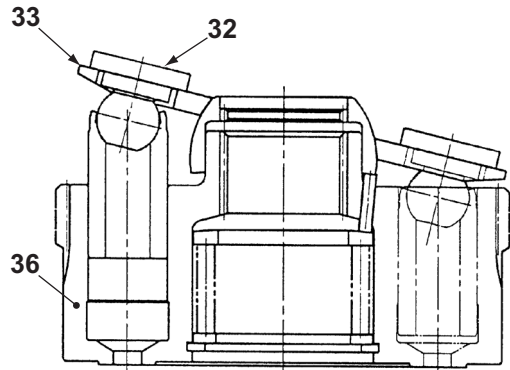
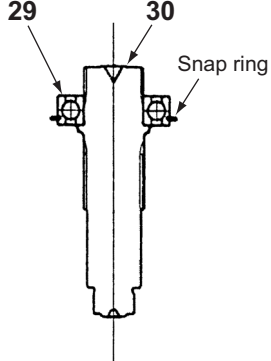
6. HYDRAULIC SYSTEM

3. Exploded View and Component Parts



062820-00X00

6. HYDRAULIC SYSTEM

| Procedure | |
|---|---|
| <p>(5) Install snap ring 40 pressing washer 39.</p> |  <p>062874-00X00</p> |
| <p>(6) Apply grease to pins 35, and then install them into cylinder barrel 36.</p> <p>(7) Install retainer holder 34.</p> |  <p>062875-00X00</p> |
| <p>(8) Set piston assemblies 32 into retainer plate 33, and install them into cylinder 36.</p> <p>Note: Apply sufficient grease to sliding parts before installing.</p> |  <p>062876-00X00</p> |
| <p>(9) Press-fit ball bearing 29 onto shaft 30.</p> <p>Note: Install ball bearing 29 with snap ring set to direction shown in right figure.</p> |  <p>062877-00EN00</p> |

6. HYDRAULIC SYSTEM

2) Valve

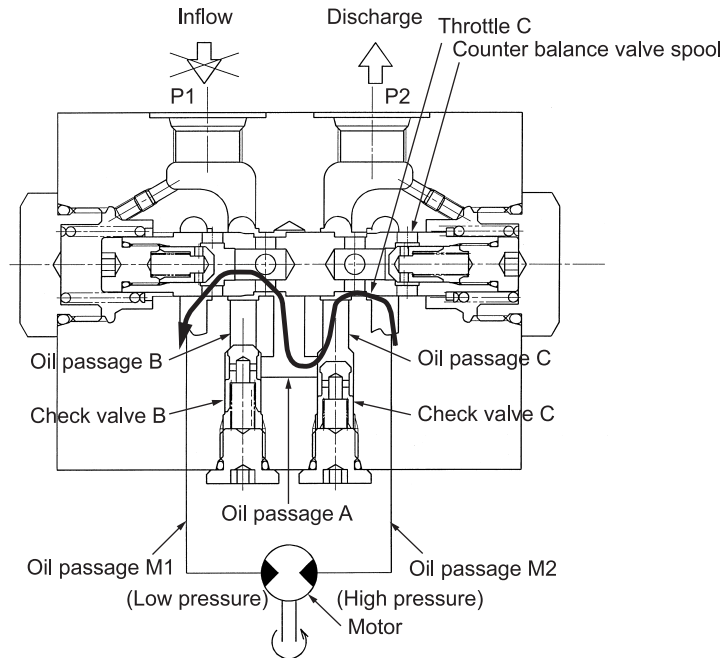
| Trouble | Cause | Measure |
|---|--|--|
| 1. Motor does not rotate, or rotate at a low speed. | (1) Malfunction of equipment other than piston motor, valve (built-in motor) and reduction gear. | Check whether the specified volume of hydraulic oil is fed to suction side of valve. Then, check and repair each part. |
| | (2) Increasing inner leaking due to breakage of relief valve, O-ring or seal. | Replace O-ring and backup ring with new one. |
| | (3) Defective seat of make-up valve. [1] Foreign substances caught inside. [2] Rough and damaged sliding surface of check valve. [3] Broken spring. | <ul style="list-style-type: none"> • Remove all foreign substances, repair any damaged area, clean parts and reassemble them. If damage is serious and too much oil leaks, replace make-up valve seat. • Repair sliding surface, or replace check valve with new one. • Replace spring. Remove all foreign substances, repair any damaged area, clean parts and reassemble them. Replace if seriously damaged and too much oil leaks. |
| | (4) Defective seat of relief valve. [1] Foreign substances caught inside. [2] Broken spring. | <ul style="list-style-type: none"> • Remove all the foreign substances, repair any damaged area, clean the parts and reassemble them. Replace if the damage is serious and too much oil leaks. • Replace relief valve assembly. |
| | (5) Too low cracking pressure of relief valve. [1] Permanent set of spring. [2] Clogged poppet orifice. | <ul style="list-style-type: none"> • Replace relief valve assembly. • Clean part with wash oil and reinstall it. |
| 2. Motor does not stop or is slow to stop. | (1) Defective seat of make up valve. [1] Foreign substances caught inside. [2] Rough and damaged sliding surface of check valve. [3] Broken spring. | <ul style="list-style-type: none"> • Remove all foreign substances, repair any damaged area, clean parts and reassemble them. If damage is serious and too much oil leaks, replace make-up valve seat. • Repair sliding surface, or replace check valve with new one. • Replace spring. Remove all foreign substances, repair any damaged area, clean parts and reassemble them. Replace if seriously damaged and too much oil leaks. |
| | (2) Defective seat of relief valve. [1] Foreign substances caught inside. [2] Broken spring. | <ul style="list-style-type: none"> • Remove all the foreign substances, repair any damaged area, clean the parts and reassemble them. Replace if the damage is serious and too much oil leaks. • Replace relief valve assembly. |
| | (3) Too low cracking pressure of relief valve. [1] Permanent set of spring. [2] Clogged poppet orifice. | <ul style="list-style-type: none"> • Replace relief valve assembly. • Clean part with wash oil and reinstall it. |

6. HYDRAULIC SYSTEM

(3) Regular Rotation of Motor → In Speed Reduction

When reducing the motor speed, the hydraulic oil flows through the oil passage M2 out of the port P2 while the counter balance valve is open although the motor still keeps rotating with the inertia force. Then the cavitation occurs on the oil passage M1 side due to the shortage of oil supply from the port P1.

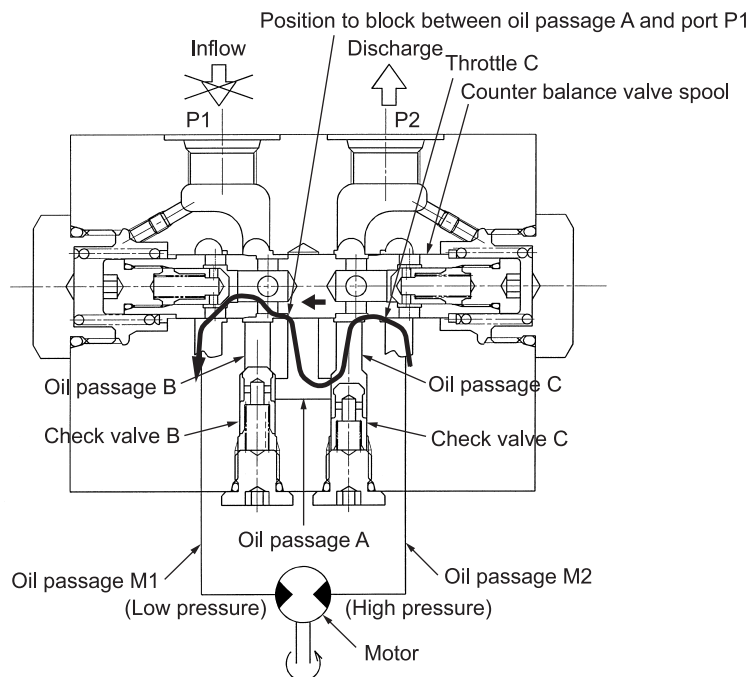
However, with this anti-cavitation mechanism, the hydraulic oil passes through the oil passage M2, the counter balance valve throttle C, the oil passage C, the check valve C, the oil passage A, the port P1, and the oil passage M1, and returns to the motor to reduce the cavitation while the counter balance valve spool is returning to the neutral position.



Anti-cavitation valve (in speed reduction)

(4) In Motor Speed Reduction → Stop

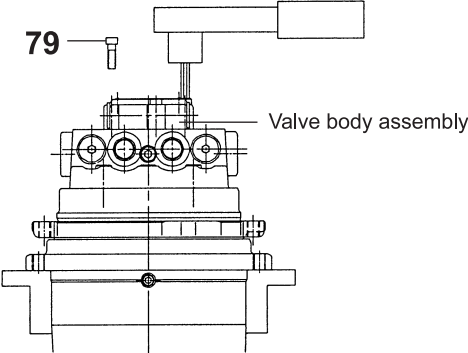
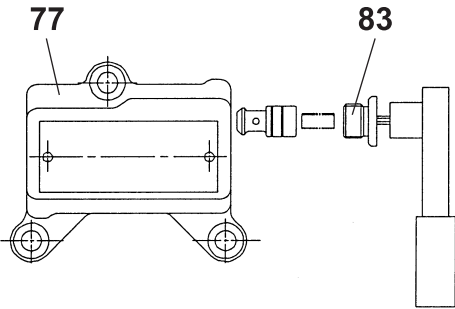
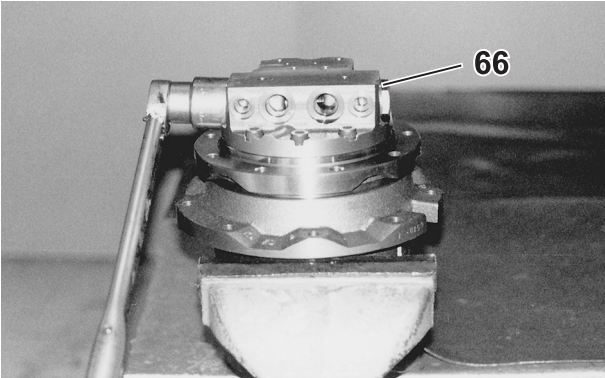
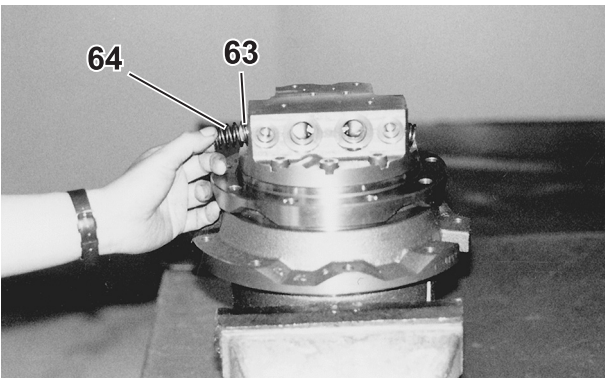
The anti-cavitation mechanism works until the oil flow from the passage A to the P1 port is blocked at the point shown in the figure below.



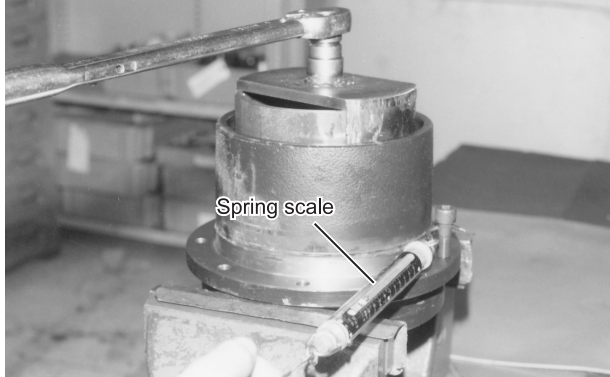
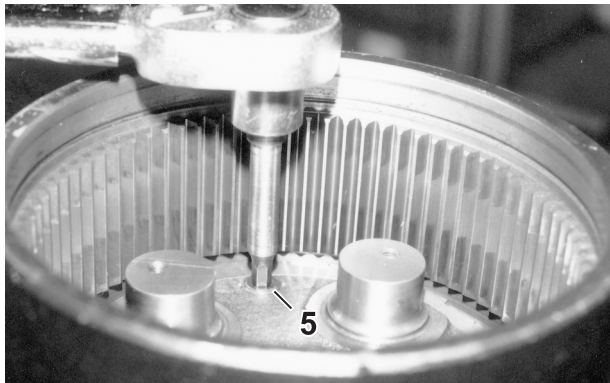
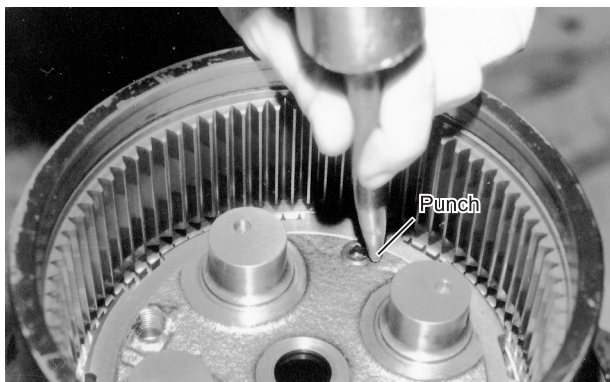
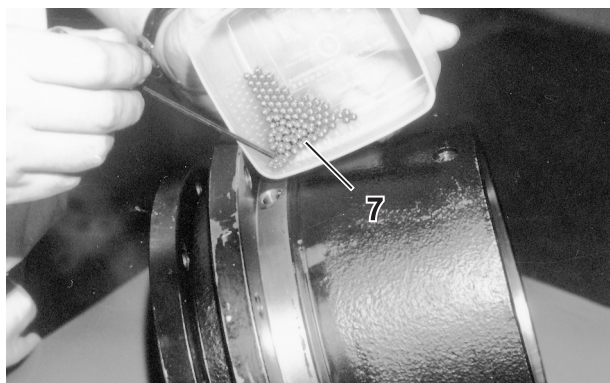
Anti-cavitation valve in stop

6. HYDRAULIC SYSTEM

3) Disassembly

| Procedure | |
|--|---|
| <p>(1) Hold the motor with a vice and remove the three hexagon socket head bolts 79 to remove the valve body assembly.</p> <p>Tools :</p> <ul style="list-style-type: none">• Torque wrench 1• Hexagon bit 6 |  <p>79</p> <p>Valve body assembly</p> |
| <p>(2) Hold the valve body 77 with a vice and remove the plugs 83 to remove the relief valve assembly.</p> <p>Notes :</p> <ul style="list-style-type: none">• When removing the relief valve assembly, cover it with waste cloth or the like.• Do not disassemble the valve body assembly if not required. <p>Tools :</p> <ul style="list-style-type: none">• Torque wrench 2• Hexagon bit 7 |  <p>77</p> <p>83</p> |
| <p>(3) Remove the plugs 52 and the caps 66.</p> <p>Tools :</p> <ul style="list-style-type: none">• Torque wrench 2, 4• Hexagon bit 7, 9 |  <p>66</p> |
| <p>(4) Remove the springs 64 and the spring seats 63.</p> |  <p>64</p> <p>63</p> |

6. HYDRAULIC SYSTEM

| Procedure | |
|--|--|
| <p>(5) Tighten the ring nut 4 so that there is no clearance between the housing and the angular bearing. Turn the housing several times and then measure the starting load. Assume the measured load is "F" N·m. Tighten the ring nut to adjust the starting load to $F+16.7$ to 24.5 N·m</p> <p>Tools :</p> <ul style="list-style-type: none">• Torque wrench 3• Ring nut tightening jig (S-3)• Spring scale (S-17) |  |
| <p>(6) Tighten the plugs 5.</p> <div style="border: 1px solid black; padding: 5px; width: fit-content; margin: 10px auto;">Tightening torque : 9.8 to 19.6 N·m</div> <p>Note : <i>Do not wind a seal tape onto these plugs.</i></p> <p>Tools :</p> <ul style="list-style-type: none">• Torque wrench 1• Hexagon bit 7 |  |
| <p>(7) Caulk each plug 5 at the two places with a punch to prevent it from loosening.</p> <p>Tools :</p> <ul style="list-style-type: none">• Hammer 12• Punch 16 |  |
| <p>(8) Insert steel balls 7 (109 pcs.)</p> |  |

6. HYDRAULIC SYSTEM

6. Service Standards

Clean the removed parts, dry them with compressed air and repair or replace them, if necessary, according to the following service standards :

| No. | Parts | Inspection item | Standard value (recommended value for replacement) | Measure |
|-----|---|---|--|---|
| 1 | Floating seal 2 | Sliding surface | No excessive flaws, wear or seizure | Replace. |
| 2 | Angular bearing 3 | Moving surface | No excessive flaws, wear or flaking in ball or race | Replace. |
| 3 | Housing 6 | Gear tooth surface | No excessive flaws, wear or flaking on tooth surface (More than 10% pitting in the engaged area of a tooth surface) | Replace. |
| 4 | Planetary gears B 12 and A 21 | Gear tooth surface. Rolling contact surface of cage & roller | Same as No.3. No excessive flaws, wear or flaking on the rolling contact surface | Replace. |
| 5 | Needle bearing 20 Cage & roller 11 | Cage & roller (needle bearing) surface | No excessive flaws, wear or flaking | Replace. |
| 6 | Thrust washer 9 | Sliding surface | No excessive flaws, wear or seizure | Replace. |
| 7 | Thrust plates 13 and 22 | Sliding surface | No excessive flaws, wear or seizure | Replace. |
| 8 | Sun gear 15 | Gear tooth surface | Same as No.3 | Replace. |
| 9 | Inner races 10 and 19 | Cage & roller (needle bearing) surface | No excessive flaws, wear or flaking | Replace. |
| 10 | Drive gear 17 | Gear tooth surface | Same as No.3 | Replace. |
| 11 | Holder 18 | Sliding surface against planetary gear B | No excessive flaws, or wear | Replace planetary gear B and holder together |
| 12 | O-rings 23, 25, 29, 48, 51, 56, 61, 65, 69, 73, 80, and 83 | Surface condition and hardness | No flaws or distortion. Not hardened | Rubber seal members deteriorate with the lapse of time. Replacement with new seals is recommended every time they are reassembled. |
| 13 | Shaft 32 | Oil seal surface | No flaws or excessive wear | Replace. |
| 14 | Ball bearings 31 and 47 | Moving surface | Same as No.2 | Replace. |
| 15 | Oil seal 30 | Lip surface and hardness | No flaws, distortion or excessive wear. Not hardened | Replace. |
| 16 | Swash plate 36 | Sliding surface against piston assembly Surface roughness | No excessive flaws over 0.02 mm, wear or seizure 0.8 Ra | When sliding surface has roughened, repair it by lapping (#1000). Replace it if the damage is beyond repair. |

6. HYDRAULIC SYSTEM

(2) Reassembly procedure

- Preparation of proportional solenoid pressure reducing valve **601**.
If retaining ring **326** was cut and sleeve **312** was removed from solenoid **801**, a new proportional solenoid pressure reducing valve assembly must be used. If sleeve **312** was not removed from solenoid **801** during disassembly, the proportional solenoid pressure reducing valve can be used again.
- Installation of proportional solenoid pressure reducing valve **601**.
Install proportional solenoid pressure reducing valve **601** into casing **101** and secure it with hexagon socket head bolts **171**. Be careful about the valve installation direction.

8. Special Notes

- Solenoids
Do not hit the solenoids or apply excessively large force to them. Doing so may cause solenoid malfunctions.
- Input current
Do not apply a current of more than 1.6 A to the solenoid coils.
- Dither adjustment
If the pipes and related parts are slightly vibrating, in general, the dither frequency should be increased and the dither amplitude reduced.
To improve operational performance including smoothness and reproducibility, the dither frequency should be reduced and the dither amplitude increased.
- Adjusting screws
Do not change the settings of the adjusting screws unless necessary because they were adjusted correctly before shipping. Turning the adjusting screw clockwise will increase secondary pressure.

9. Servicing Standards

| Inspection Item | Criteria |
|-------------------------|--|
| Quantity of oil leakage | The valve assembly must be replaced if the quantity of oil leakage has increased and affects the related system. |
| Solenoid | The valve assembly must be replaced if the solenoid has been deformed or damaged by external forces or any other forces. |

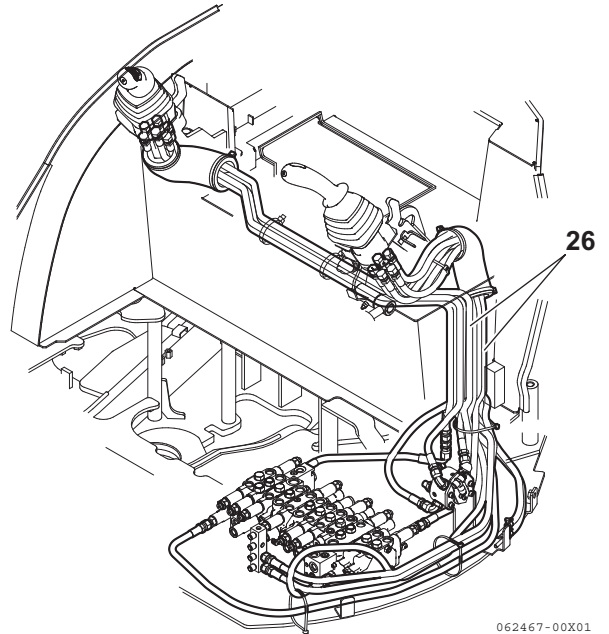
7. ADJUSTMENT AND REPAIR

Procedure

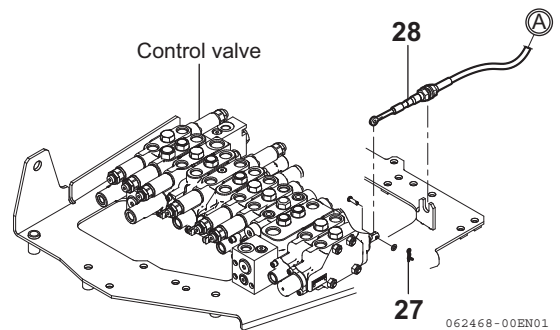
(17) Disconnect pilot hoses **26** from control valve.

Notes:

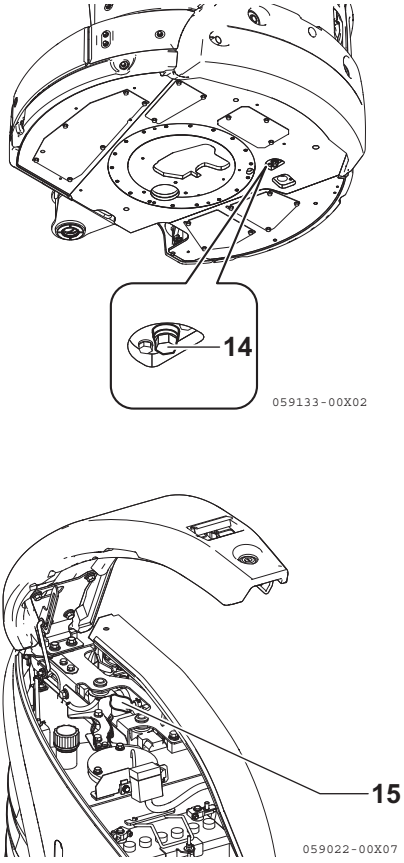
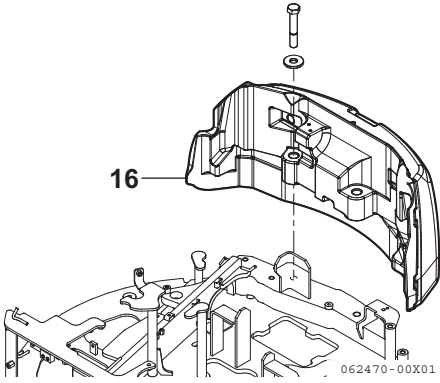
- Put mark on pilot hoses to reinstall them to correct positions.
- Put cap or cover each hose end and fitting on control valve for dust prevention.



(18) Remove pin **27** to disconnect blade cable **28**.



7. ADJUSTMENT AND REPAIR

| Procedure | |
|--|--|
| <p>(7) Put container under coolant drain plug 14.</p> <p>(8) Remove drain plug 14 to drain coolant.</p> <p>Quantity: 3.4 L</p> <p>Open radiator cap 15 to drain coolant smoothly.</p> |  <p>The diagram consists of two parts. The top part is a top-down view of the engine compartment, showing the location of the coolant drain plug labeled 14. A callout box provides a magnified view of the plug. The bottom part is a side view of the engine compartment with the radiator cap labeled 15 open.</p> <p>059133-00X02</p> <p>059022-00X07</p> |
| <p>(9) Disconnect coolant hose from coolant sub-tank and remove rear weight 16.</p> |  <p>The diagram shows a side view of the engine compartment. A rear weight labeled 16 is shown being removed from the coolant sub-tank area. A callout box shows the weight being lifted away from the sub-tank.</p> <p>062470-00X01</p> |

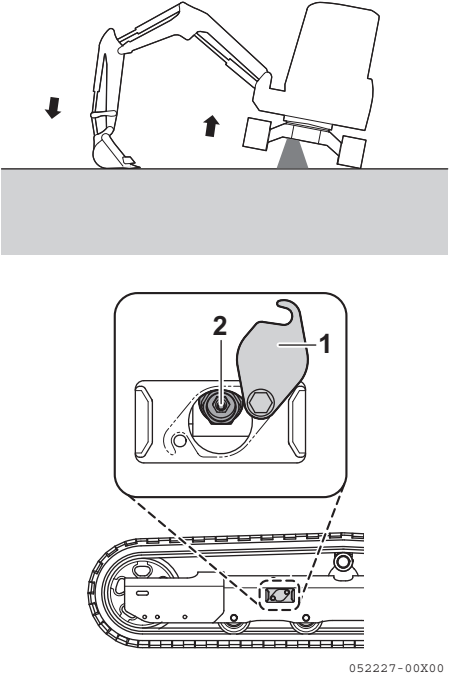
7. ADJUSTMENT AND REPAIR

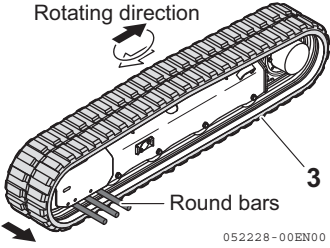
7-2-5 Removal and Reinstallation of Track

! When loosening or removing nipple valve **2**, the inside high-pressure grease can splash or cause the nipple valve to fly out, which is hazardous. Do not bring your face close to the nipple valve.

1) Removal of Rubber Track

! Handle the rubber tracks with great care, as they are heavy.
109 kg / for each track

| Procedure | |
|---|---|
| <p>(1) Prepare grease gun and iron bars.</p> <p>(2) Remove cover 1.</p> <p>(3) Raise machine with implement. To do this, operate control levers slowly.</p> <p>(4) Gradually loosen nipple valve 2 and discharge grease. Never loosen nipple valve 2 more than one turn.</p> |  <p>052227-00X00</p> |

| | |
|--|---|
| <p>(5) Insert iron bars between track frame and rubber track 3 and turn sprocket in reverse direction. Slide rubber track off when rubber track is separated from idler by iron bars.</p> |  <p>052228-00EN00</p> |
|--|---|

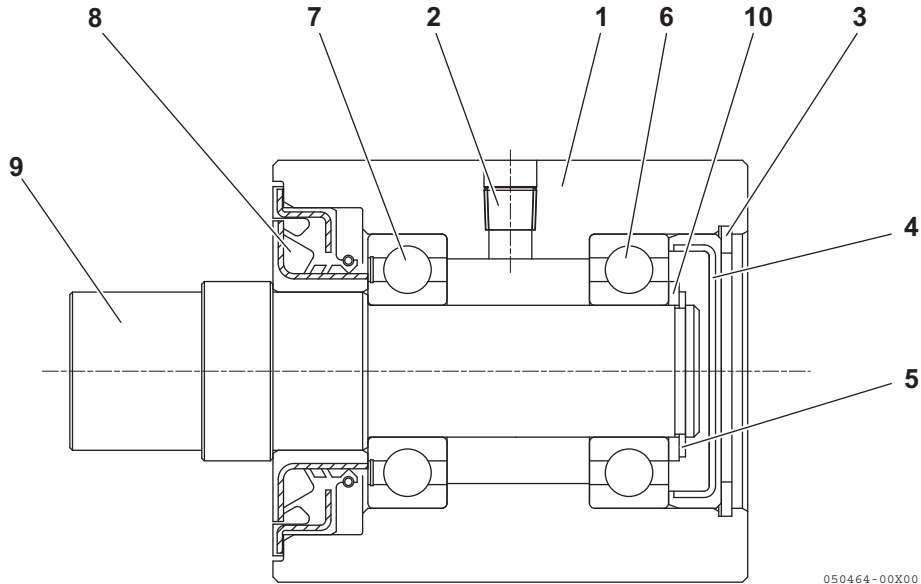
2) Reinstallation of Rubber Track

Reinstall the rubber track in the reverse order to the removal procedure.

7. ADJUSTMENT AND REPAIR

7-2-9 Disassembly and Reassembly of Carrier Roller

1) Structure



050464-00X00

| No. | Part | Q'ty | No. | Part | Q'ty |
|-----|---------------------------|------|-----|-----------------|------|
| 1 | Carrier roller | 1 | 6 | Bearing (6205) | 1 |
| 2 | Screw plug R 1/8 | 1 | 7 | Bearing (6205U) | 1 |
| 3 | Internal snap ring C (52) | 1 | 8 | Oil seal | 1 |
| 4 | Plug (52) | 1 | 9 | Shaft | 1 |
| 5 | External snap ring C (25) | 1 | 10 | Collar | 1 |

2) Disassembly

| Procedure | |
|--|--|
| <p>(1) Loosen tightening bolt for carrier roller assembly to remove roller from track frame.</p> <p>Note: Put a wedge into slit in bracket to remove roller smoothly.</p> | |

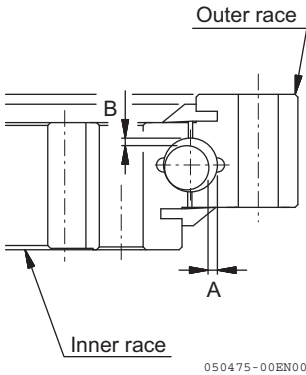
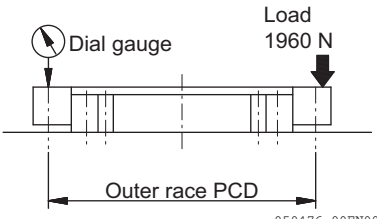
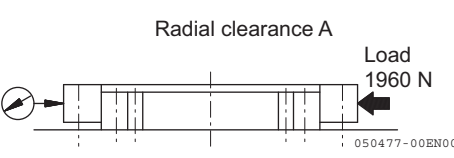
050465-00EN00

7. ADJUSTMENT AND REPAIR

4) Inspection

- (1) Check the gear tooth surfaces for the nicks, flaws, cracks, wear and breakage. Replace if the damage is excessive.
- (2) Check for abnormal sound. Clean, grease or replace if necessary.
- (3) Check for the play in the inner and outer races and rotation fluctuation. Refer to the service standards for repair or replacement.
- (4) Check for the grease leak from the swing bearing seal. Replace if the leakage is excessive.

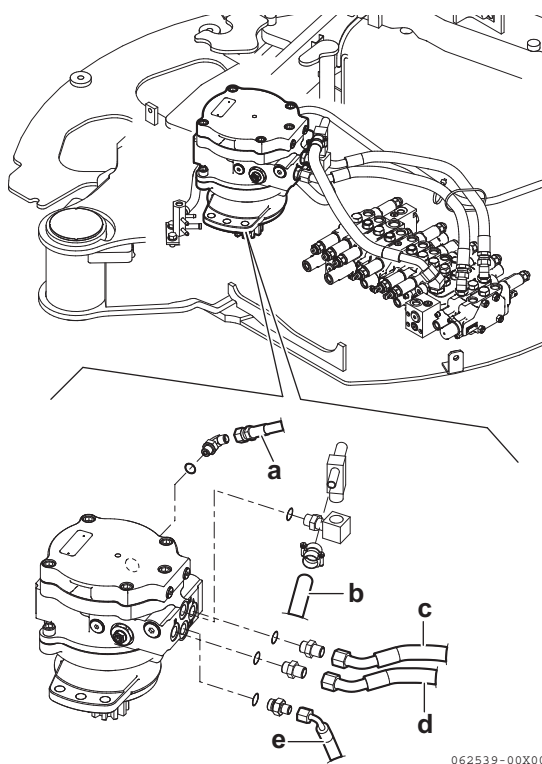
5) Service Standards

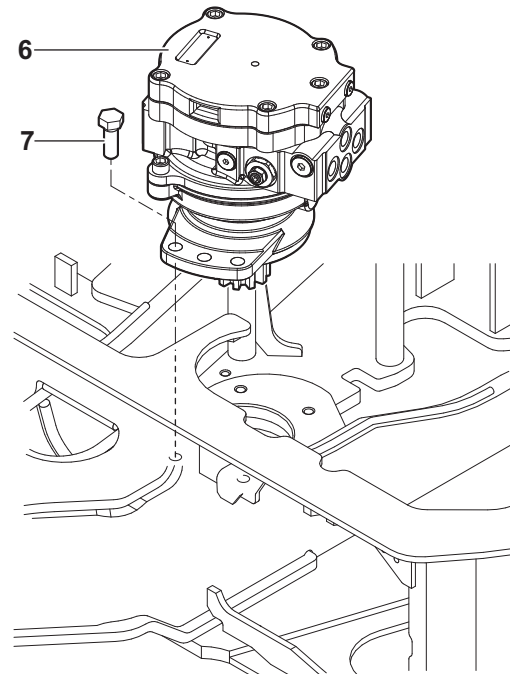
| | | | Standard | Wear limit |
|---|--|----------------------|--------------------|-----------------------------------|
|  <p>Outer race</p> <p>Inner race</p> <p>050475-00EN00</p> |  <p>Axial clearance B</p> <p>Dial gauge</p> <p>Load 1960 N</p> <p>Outer race PCD</p> <p>050476-00EN00</p> | | 0.05 to 0.25 mm | — |
| |  <p>Radial clearance A</p> <p>Load 1960 N</p> <p>050477-00EN00</p> | | 0.05 to 0.30 mm | — |
| Steel ball dia. | | | Ø17.46 mm | — |
| Tightening torque | Upperstructure × outer race Undercarriage × inner race | M12 × 60 M12 × 55 | 117.7 to 127.5 N·m | Loctite 262 or K965 equivalent |

Note:

Supply multi-purpose grease to the swing bearing.

7. ADJUSTMENT AND REPAIR

| Procedure | |
|---|---|
| <p>(4) Disconnect hydraulic hoses from swing motor 6.</p> <ul style="list-style-type: none">a. Hose (Pump - Swing motor)b. Drain hose (Swing motor - Control valve)c. Hose (Control valve - Swing motor)d. Hose (Control valve - Swing motor)e. Drain hose (Swing motor - Drain block) |  <p>062539-00X00</p> |

| | |
|---|--|
| <p>(5) Loosen four mounting bolts (M12) 7 for swing motor to remove swing motor 6.</p> <p>Note: <i>Install an eye bolt (M8) to swing motor, put rope or sling belt through eye bolt and remove swing motor using lifting device.</i></p> |  <p>062540-00X00</p> |
|---|--|

2) Reinstallation

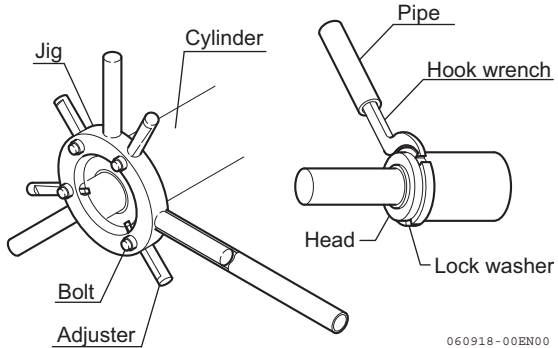
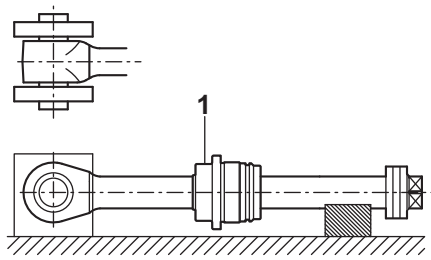
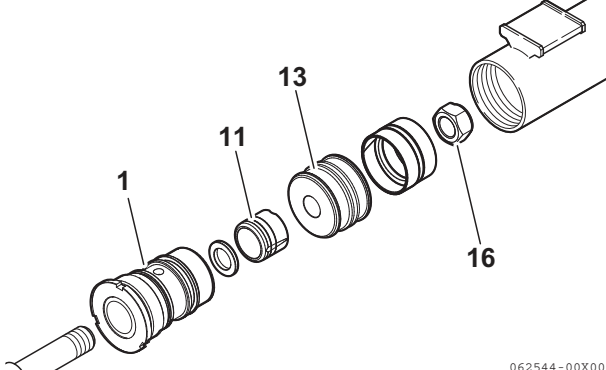
Reinstall the swing motor in the reverse order to the removal procedure.

7. ADJUSTMENT AND REPAIR

2) Cautions for Disassembly and Reassembly

- (1) Parts are produced so accurately. Be careful not to damage any parts by dropping them or knocking them together.
- (2) If there are any burrs on the surface of the seal installation part or the O-ring groove, remove them.
- (3) Never use the lock washer removed once.
- (4) Replace once removed seals and O-rings with new ones.
- (5) Clean all the parts and dry them by air blow.

3) Disassembly

| Procedure | |
|--|---|
| <p>(1) Drain oil from hydraulic cylinder.</p> <p>(2) Hold cylinder in bottom end or pin hole on bottom side, and put rod side of cylinder on a block.</p> <p>(3) Raise pawl of lock washer on head to loosen head.</p> <p>Note : Use hook wrench or jig to loosen head.</p> |  <p style="text-align: right;">060918-00EN00</p> |
| <p>(4) After loosening head 1, pull out rod assembly from cylinder tube, and then hold cylinder rod assembly in rod end or pin hole on rod side.</p> |  <p style="text-align: center;">Hold cylinder rod assembly.</p> <p style="text-align: right;">060919-00EN01</p> |
| <p>(5) Disassembly of boom cylinder. Loosen Locknut 16 to remove piston 13, cushion bearing 11 and head 1 from rod in order.</p> |  <p style="text-align: right;">062544-00X00</p> |

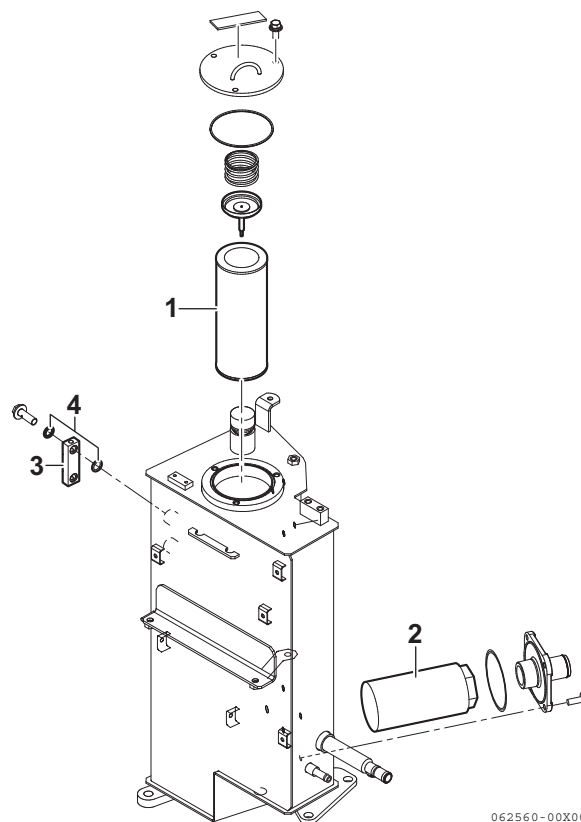
7. ADJUSTMENT AND REPAIR

2) Reinstallation

Reinstall the hydraulic oil tank in the reverse order of the removal procedure.

- (1) Completely drain the oil from the hydraulic oil tank and wipe the impurities off the bottom of the tank.
- (2) Replace return filter **1** with a new one.
- (3) Clean suction filter **2**. Replace it if its wire gauze is damaged.
- (4) Replace the oil when it reaches the replacement time or it has been deteriorated. If reusing the oil, maintain the oil quality so that it has no impurities.
- (5) Check O-rings **4** of oil level gauge **3** for oil leak, and replace any defective seals or other parts if necessary.

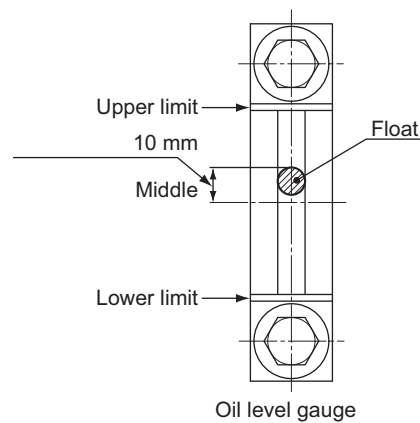
| Hydraulic oil tank mounting bolt (M14) | |
|--|-----------------------------------|
| Lock agent | Three Bond 1324 or its equivalent |
| Tightening torque | 117.7 to 147.1 N·m |



062560-00X00

3) Oil Level Check

- Place the machine on a firm and flat ground when checking the hydraulic oil level.
- Check the hydraulic oil level with the oil level gauge when the oil temperature is 0 to 30°C.
- The proper oil level is 10 mm above the middle of the oil level gauge. The hydraulic oil level increases or decreases depending on the hydraulic oil temperature due to its nature; therefore, check it when the oil is cooled.

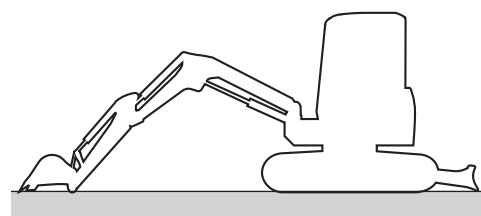


Oil level gauge

052276-00EN00

4) Machine Position in Oil Level Check

- Retract the bucket and arm cylinder rods completely to lower the bucket to the ground.
- Lower the blade to the ground.

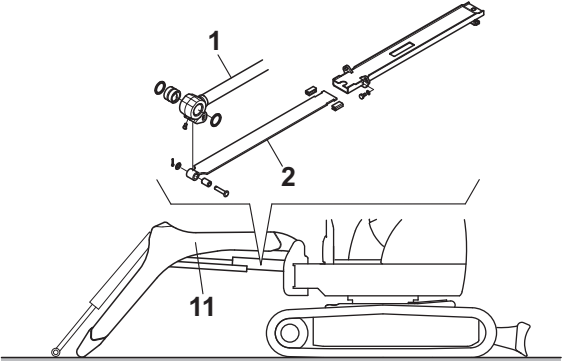
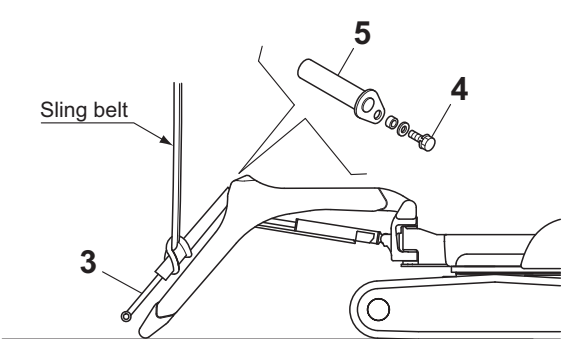
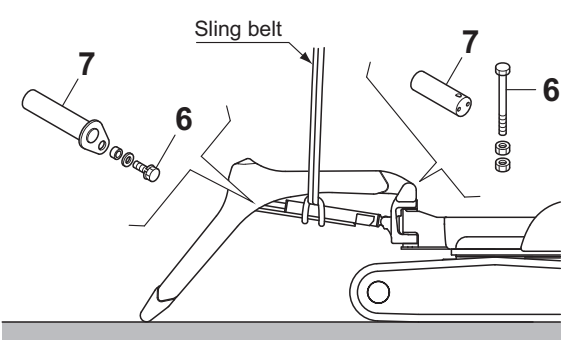


Machine position

046783-00EN01

7. ADJUSTMENT AND REPAIR

3) Removal of Boom

| Procedure | |
|--|---|
| <p>(1) After raising boom 11 to maximum, remove slide cover 2 from boom cylinder 1.</p> <p>(2) Place the top end of boom 11 on ground.</p> <p>Note : <i>Install an expansion plug to joint of removed hydraulic hose and start engine.</i></p> |  <p>015285-01X00</p> |
| <p>(3) After putting sling belt round arm cylinder 3, remove hydraulic hoses from arm cylinder.</p> <p>(4) Loosen bolt 4 (M12) to pull out pin 5, and remove arm cylinder 3.</p> <p>Note : <i>Use a lifting device to remove arm cylinder.</i></p> |  <p>015286-00EN01</p> |
| <p>(5) After putting sling belt to boom cylinder 1, remove hydraulic hoses from boom cylinder.</p> <p>(6) Loosen bolts 6 (M12) to pull out pins 7, and remove boom cylinder 1.</p> <p>Note : <i>Use a lifting device to remove boom cylinder.</i></p> |  <p>015287-00EN01</p> |

TROUBLESHOOTING

| | |
|--|-------|
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