# YANMAR

# SERVICE MANUAL

## EXCAVATOR

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## MODEL B50-2(A)

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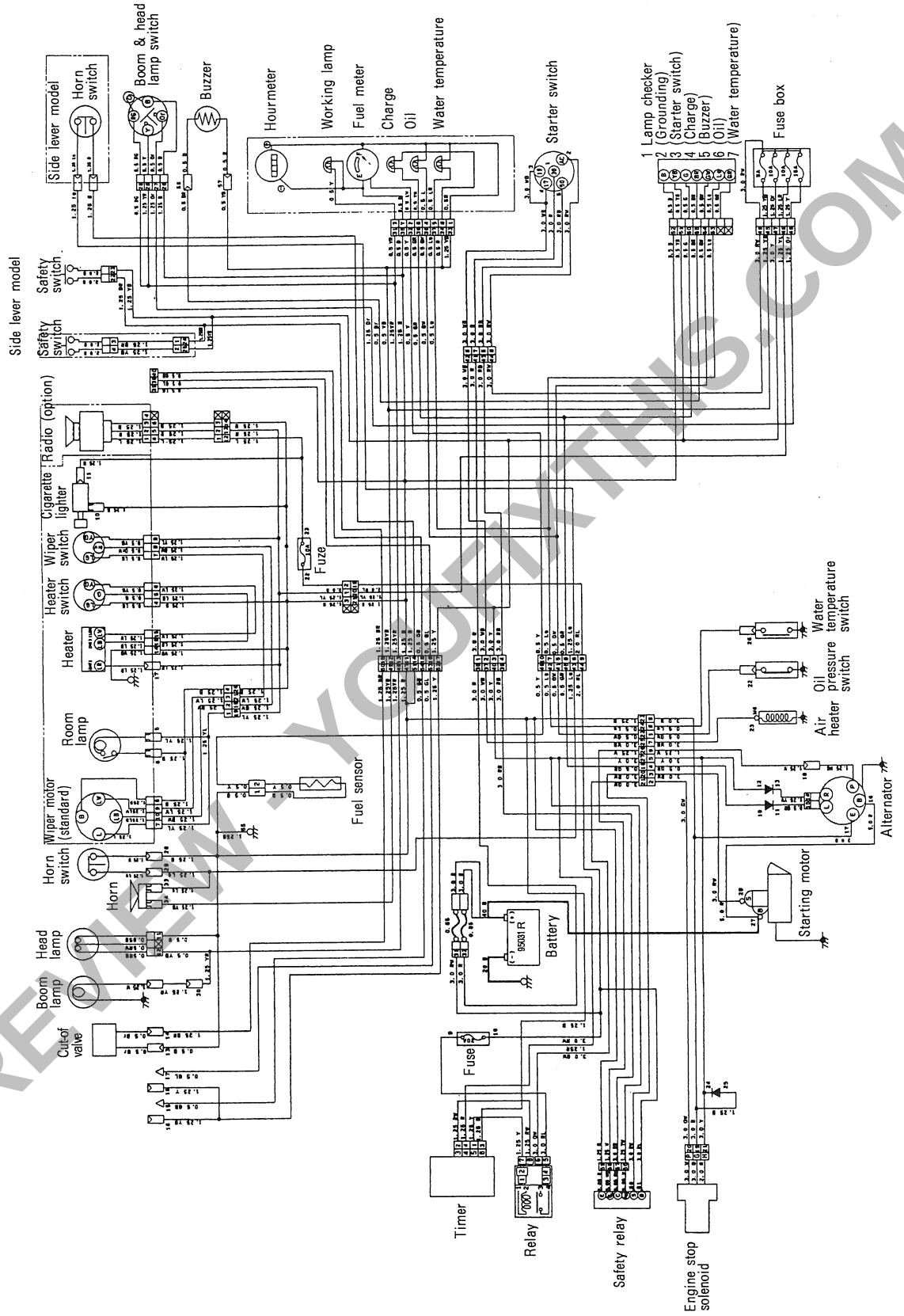
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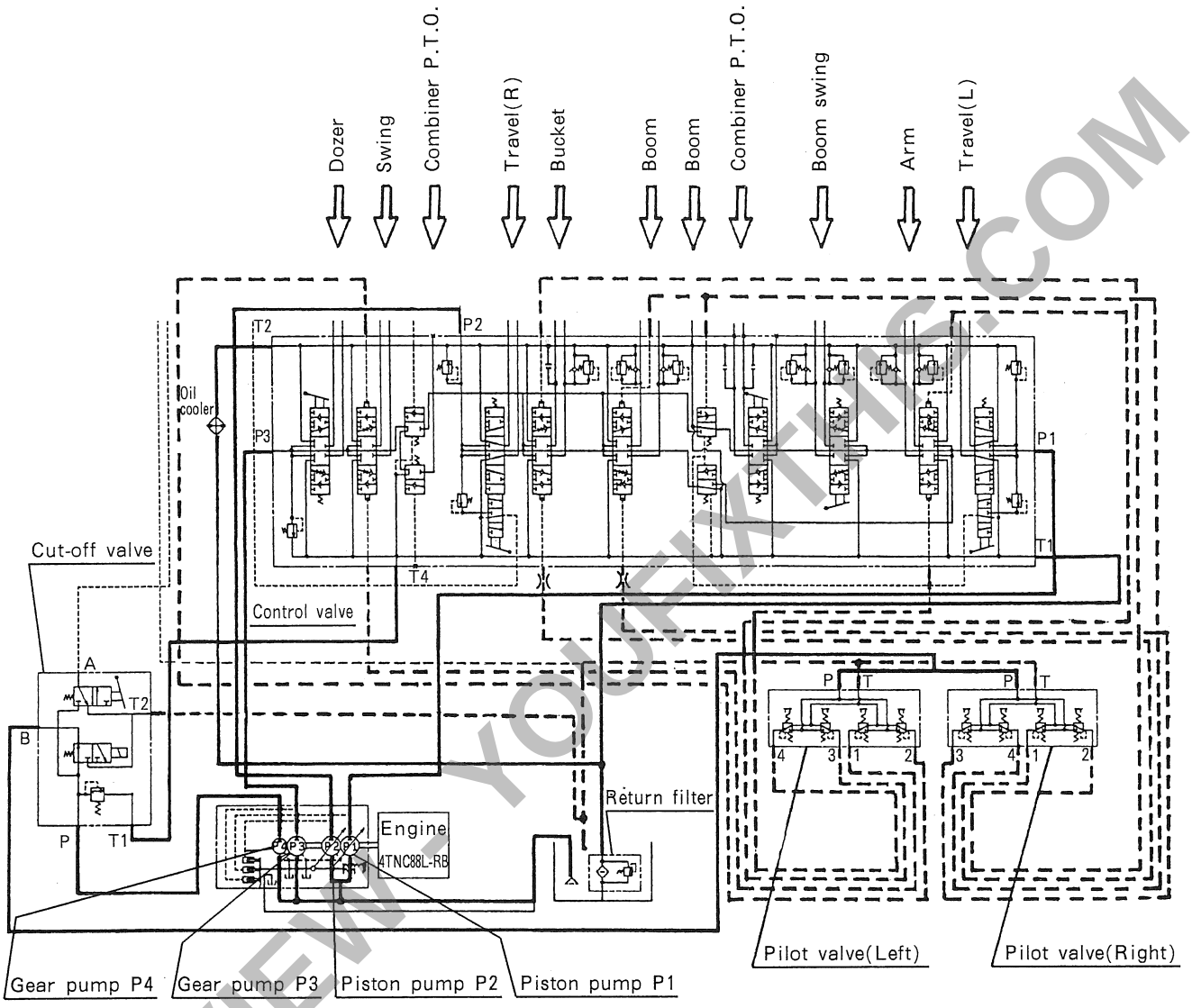



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## 5-1-1 Function of Control Valve




Oil from the piston pump P1 is fed to the left travel motor, arm and boom swing cylinders. Oil from the piston pump P2 flows to the right travel motor, bucket and boom cylinders. Oil from the gear pump P3 is fed to the dozer cylinder and the swing motor.

In the circuit, traveling is prior to other actuators. When machine is traveling (travel motors are actuated), hydraulic oil to the implements are fed from the gear pump P3 so that oil discharged from the piston pumps P1 and P2 flows only to both travel motors.

That is how machine runs straight even when the implements are operated while traveling.

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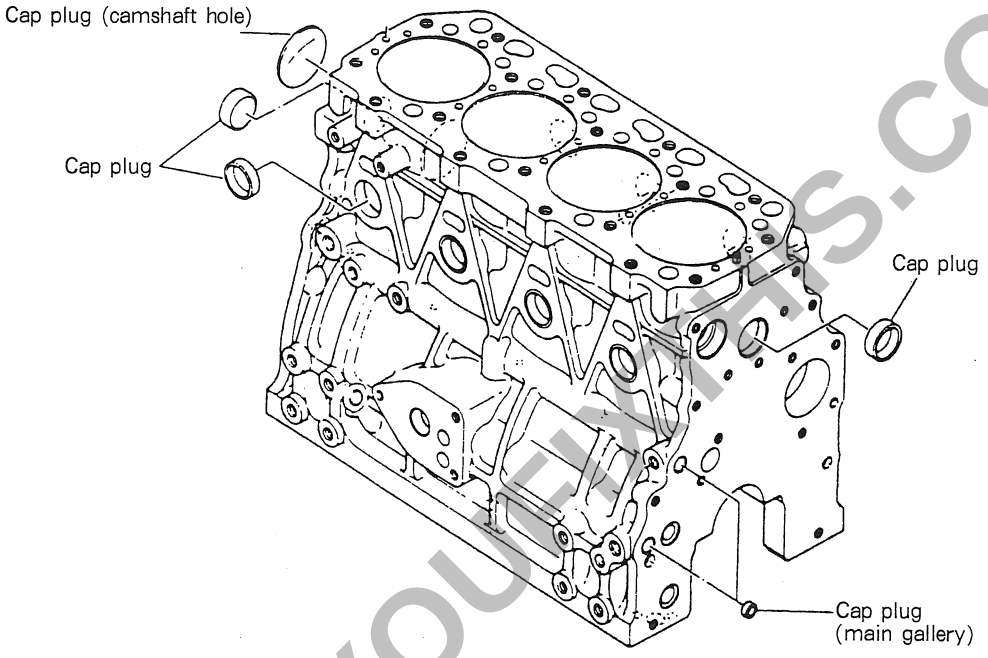


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# 4. ENGINE

## 4-1 Cylinder Block

The cylinder block is thin-skinned, (low-weight), short skirt type with rationally placed ribs. The side walls are wave shaped to maximize rigidity for strength and low noise.



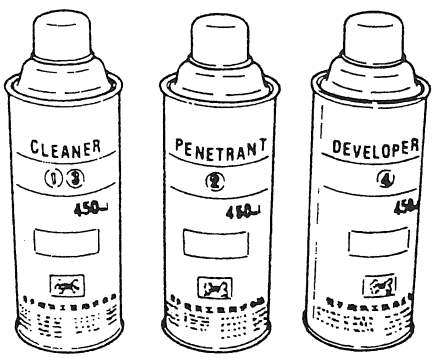

### 4-1-1 Inspection of parts

Make a visual inspection to check for cracks on engines that have frozen up, overturned or otherwise been subjected to undue stress. Perform a color check on any portions that appear to be cracked, and replace the cylinder block if the crack is not repairable.

### 4-1-2 Cleaning of oil holes

Clean all oil holes, making sure that none are clogged up and the blind plugs do not come off.

| | Quantity |
|---|---|
| Penetrant | 1 |
| Developer | 2 |
| Cleaner | 3 |




### 4-1-3 Color check procedure

(1) Clean the area to be inspected.
(2) Color check kit
The color check test kit consists of an aerosol cleaner, penetrant and developer.
(3) Clean the area to be inspected with the cleaner.
Either spray the cleaner on directly and wipe, or wipe area the with a cloth moistened with cleaner.
(4) spray on red penetrant
After cleaning, spray on the red penetrant and allow 5 - 10 minutes for penetration. Spray on more red penetrant if it dries before it has been able to penetrate.
(5) Spray on developer
Remove any residual penetrant on the surface after the penetrant has penetrated, and spray on the developer. If there are any cracks in the surface, red dots or a red line will appear several minutes after the developer dries.
Hold the developer 300 - 400mm (11.8110 - 15.7480in.) away from the area being inspected when spraying, making sure to coat the surface uniformly.
(6) Clean the surface with the cleaner.

***Note:*** *Be sure to read the instruction for the color it before use.*

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## 3-7 List of Tightening Torque

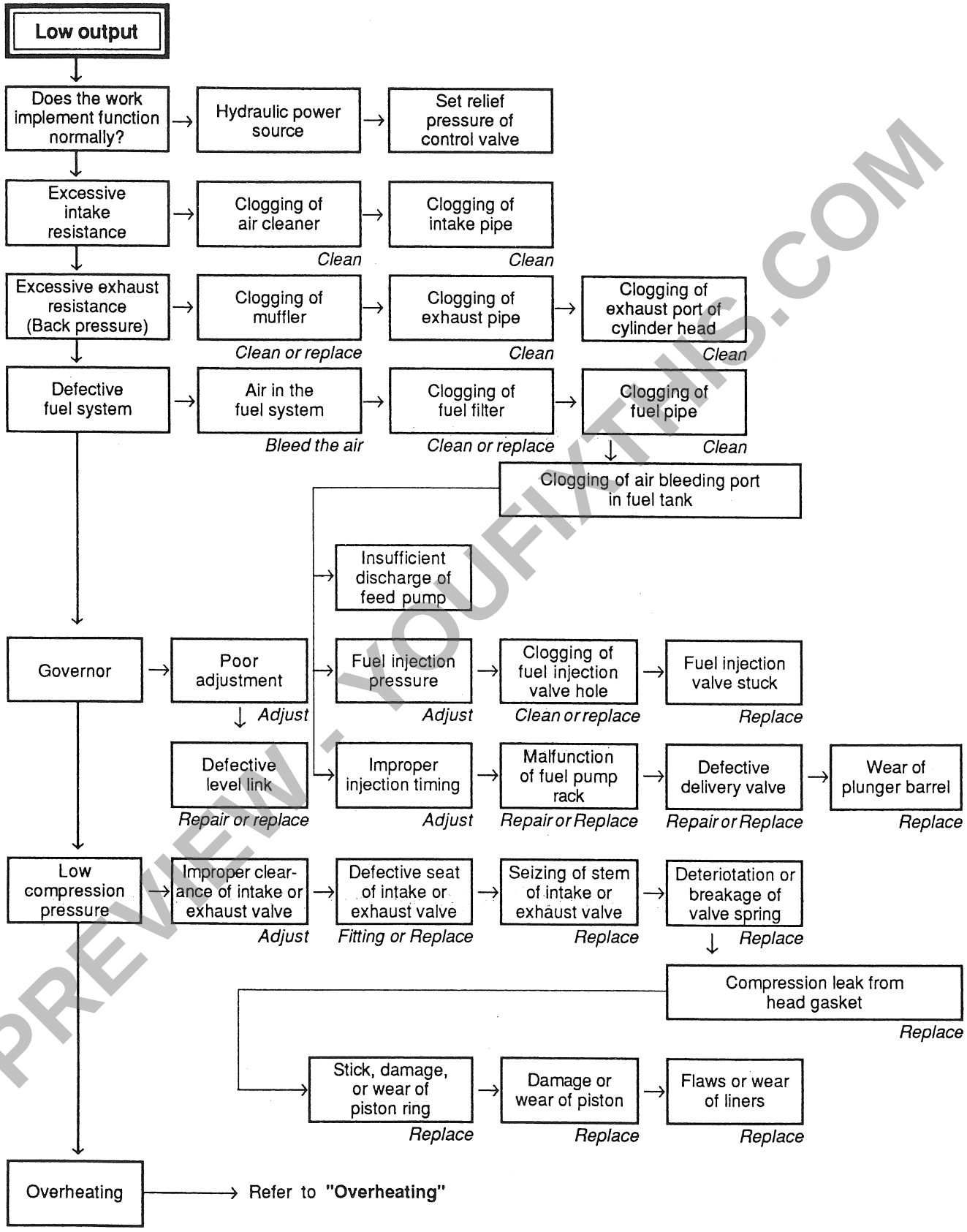
### 3-7-1 Machine

| Applicable model | | | B50-2 | | |
|---|---|---|---|---|---|
| Equipment | | | Thread size | Tightening torque (kgf-m) | Screw locking agent |
| | No. | Tightening part | | | |
| Engine · Electrical equipment | | | | | |
| | 1 | Engine flexible mount | M16 | 2.1 ~ 2.4 | Three Bond 1324 |
| | 2 | Radiator flexible mount | Nut M8 | 1.3 ~ 1.7 | |
| | 3 | Engine × Engine mount (Flywheel side) | M12 | 11 ~ 13 | Three Bond 1324 |
| | 4 | Engine × Engine mount (Radiator side) | M10 | 6.5 ~ 7.5 | Three Bond 1324 |
| | 5 | Exhaust pipe clamp tightening nut | Nut M10 | 10 ~ 12 | |
| | 6 | Hose clip, 70 (air cleaner side) | — | 0.7 | |
| | 7 | Muffler × flange (muffler) | Nut M8 | 1.3 ~ 1.7 | |
| | 8 | Fuel gauge hose | — | 0.3 | |
| | 9 | Wiper arm | M6 | 0.8~1.2 | |
| | 10 | Fuel oil tank | M14 | 13 ~ 15 | Three Bond 1324 |
| | 11 | Battery fastening rod | Nut M8 | 0.3(Lock nut:1.3 ~ 1.7 kgf-m) | |
| | 12 | Fuel gauge unit | M5 | 0.2 | |
| | 13 | Cooling water sensor × Engine block | M16 | 2.4 ~ 3.2 | |
| Driving equipment | | | | | |
| | 1 | Sprocket | M14 | 13 ~ 15 | Three Bond 1324 |
| Travel equipment | | | | | |
| | 1 | Plug (idler, track roller & carrier roller) | PT 1/8 | 0.9 ~ 1.0 | Loctite 572 |
| | 2 | Idler seal cover × track spring | M12 | 8 ~ 10 | Three Bond 1324 |
| | 3 | Track roller tightening nut | Cap nut M16 | 14 ~ 19 | Three Bond 1324 |
| | 4 | Track guard × track frame (Steel track spec. only) | M16 | 17 ~ 21 | Three Bond 1324 |
| | 5 | Stone guard × track frame (Optional for steel track only) | M14 | 13 ~ 15 | Three Bond 1324 |
| | 6 | Nipple valve | M16 | 5.0 | |
| Control equipment | | | | | |
| | 1 | Lever installation | M14 | 7.5 ~ 8.5 | Three Bond 1324 |
| | 2 | Knob installation | M4 | 0.2 ~ 0.3 | |
| | 3 | L-ball 8 × link ball 8, 8L | U nut M8 | 1.3 ~ 1.7 | |
| | 4 | Link ball 8(8L) × rod | Nut M8 | 1.3 ~ 1.7 | |
| | 5 | L-ball 8 × rod | Nut M8 | 0.8 ~ 1.0 | |
| | 6 | Valve mount × frame | M10 | 2.0 ~ 2.6 | Three Bond 1324 |
| Frame | | | | | |
| | 1 | Swing bearing × lower frame | M16 | 27 ~ 31 | Loctite 262 |
| | 2 | Swing bearing × turning frame | M16 | 27 ~ 31 | Loctite 262 |
| | 3 | Swing gear case gauge pipe | PT 3/4 | 5.0 ~ 6.5 | Seal tape |
| | 4 | Center weight × turning frame | M16 | 27 ~ 31 | Three Bond 1324 |
| | 5 | Side weight × turning frame | M16 | 27 ~ 31 | Three Bond 1324 |
| | 6 | Counter weight × turning frame | M16 | 27 ~ 31 | Three Bond 1324 |

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# 2. TECHNICAL DATA

## 2-1 Specifications

| Item | | | | Unit | B50-2 (A) |
|---|---|---|---|---|---|
| **Main Specifications of Machine** | | | | | |
| **Dimensions** | | | | | |
| Overall length (Transportation position) | | | | mm | 5460 |
| Cabin | Overall height | | Transportation position | mm | 2490 |
| | | | Traveling position | mm | 2490 |
| | Overall width | | Full machine width | mm | 1850 |
| Canopy | Overall height | | Transportation position | mm | 2440 |
| | | | Traveling position | mm | 2440 |
| | Overall width | | Full machine width | mm | 1840 |
| Tumbler center distance | | | | mm | 1850 |
| Track gauge | | | | mm | 1440 |
| Minimum ground clearance | | | | mm | 330 |
| **Traveling performance** | | | | | |
| Traveling speed | Steel track | | Forward | km/hr | High 4.3, Low 2.2 |
| | | | Reverse | km/hr | High 4.3, Low 2.2 |
| | Rubber track | | Forward | km/hr | High 4.5, Low 2.3 |
| | | | Reverse | km/hr | High 4.5, Low 2.3 |
| Gradeability | | | | deg. | 30 |
| **Work performance** | | | | | |
| Bucket | Width (standard) | | | mm | 700 |
| | (JIS heaped capacity) | | | $m^3$ | 0.16 |
| | No. of teeth/installation method | | | pcs. | 4/bolt on |
| Max. digging depth | with dozer raising | | | mm | 3600 |
| | with dozer on ground | | | mm | 3800 |
| Max. vertical wall digging depth | | | | mm | 2700 |
| Max. dumping height | | | Cabin | mm | 3900 |
| | | | Canopy | mm | 4250 |
| Min. front swing radius (Boom front) | | | Cabin | mm | 2100 |
| | | | Canopy | mm | 1900 |
| Min. front swing radius (90° right boom swing) | | | Cabin | mm | 1650 |
| | | | Canopy | mm | 1500 |
| Rear swing radius | | | | mm | 1500 |
| Boom swing angle | Cabin | | Left | deg. | 57 |
| | | | Right | deg. | 83 |
| | Canopy | | Left | deg. | 57 |
| | | | Right | deg. | 83 |
| Max. digging force | Bucket | | | kgf | 3700 |
| | Arm | | | kgf | 2300 |
| Max. tractive force | | | | kgf | Steel 4580/Rubber 4300 |
| Max. swing inclination (w/std. bucket) | | | | deg. | 20 (loaded) |
| Swing speed | | | | rpm | 10 |

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# 1. GENERAL CAUTIONS FOR MAINTENANCE WORK

## 1-1 Correct Work

Correct work means the completion of the job as fast as possible according to the correct procedures and the specified standards.

It is important when conducting certain operations always to bear in mind the equipment, tools, gauges, materials, oil and grease, etc. that you must have ready, as well as items to be checked, adjusted, or disassembled, and cautions to watch out for.

## 1-2 Safety Precautions

(1) Wear work cloths, safety shoes and helmet.

(2) Check the equipment and tools before use. Especially, be sure to check the crane, lifting equipment and tools.

(3) When working together with other persons, allocate everyone's share of job, arrange the signals and act in concert with the other persons.

(4) The operation of the crane and slinging work must be performed by qualified persons.

(5) Do not enter or pass under the raised load.

(6) Lift and support the massive parts by crane before removing the installation bolts.

(7) Disconnect cables from battery before repairing the electric system.

(8) Remove the battery when welding the machine.

## 1-3 Preparations

(1) Check the service record of the machine. (That is, check how many months or hours the machine has been used since the preceding overhaul, what was the trouble then and what parts were replaced.)

(2) Have all servicing tools ready, i.e., tools, measuring devices (which have received periodic maintenance), containers, oil & grease, etc.

(3) Have the service literature (operation manual, parts catalog, etc.) ready.

## 1-4 Cautions for Disassembly and Reassembly

(1) Clean the machine before disassembly.

(2) Check and record the condition of the machine before disassembly:

- Model, machine number, operation hours
- Reasons for repair, history of repair
- Contamination of filters
- Fuel and oil condition
- Damage to parts, etc.

(3) Place alignment marks on the necessary parts to facilitate reassembly.

(4) Clean all the disassembled parts and newly used parts and put them in order.

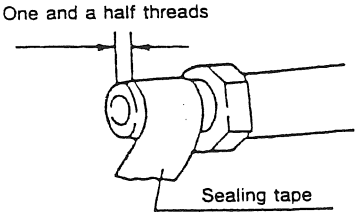
(5) Use new seals, split pins, etc. for reassembly.

(6) Keep the parts apt to be damaged by water or oil apart from the oily or wet parts.
e.g.: Electrical parts, rubber parts, V-belts, etc.

(7) Use the jig for press-fitting the bearings, bushes and oil seals. When using a hammer, use a pad block.

(8) Clean the joint surface of all parts and keep them free from dust.

(9) Wind the sealing tape securely, leaving a space of one or two threads from the tip of the male screw. The tape should have an overlap of about 10mm.






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# 8. FUEL, LUBE OIL AND GREASE RECOMMENDED

## 8. Fuel, Lube Oil and Grease Recommended by yanmar

| Name | Type | Capacity (ltr) |
|---|---|---|
| Fuel | Diesel light oil | 56 |
| Engine oil | Engine oil SAE10W30 (Class CD) | 8.5(8.9) |
| Hydraulic oil | Hydraulic oil (VG 56 or its equivalent) | Inside tank 75<br>Other section 43 } 118 |
| Swing reduction gearbox oil | Gear oil SAE 90 (GL-4) | 0.5 |
| Travel reduction gearbox oil | | Each 1.2 |
| Cooling water | Soft-water (drinking water) + antirust and antifreeze | Radiator tank 6.9<br>Sub-tank 0.4 } 7.3 |
| Grease | Multipurpose EP (Extreme pressure) grease | |
| Antifreeze | Long-life coolant | |

※The numeral in the parentheses of the engine oil shows the total oil amout when the oil filter is replaced.

★Cooling water

| Lowest ambient temperature (℃) | −5 | −10 | −15 | −20 | −25 | −30 | −35 | −40 |
|---|---|---|---|---|---|---|---|---|
| Antifreeze amount (ltr) | 0.7 | 1.5 | 2.2 | 2.6 | 2.9 | 3.3 | 3.7 | 4.0 |
| Water amount (ltr) | 6.6 | 5.8 | 5.1 | 4.7 | 4.4 | 4.0 | 3.6 | 3.3 |

NOTE: At the delivery, water and antifreeze are mixed at the rate of-15℃ temperature above.

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# 7. PERIODIC INSPECTION AND SERVICING

## 7. List of Periodic Inspection and Servicing

◇:Check ○:Resupply ●:Replace □:Adjust(clean) △:Oil & grease

| Check & service items | | | Daily | Every 50 | Every 100 | Every 250 | Every 500 | Every 1000 hrs |
|---|---|---|---|---|---|---|---|---|
| General | Check falling off, breakage of parts | | ◇ | | | | | |
| | Check loosened bolts & nuts, retighten | | ◇ | | | | | |
| | Check engine condition | | ◇ | | | | | |
| | clean | | □ | | | | | |
| Fuel system | Check oil level, resupply | | ○ | | | | | |
| | Drain water-separator, clean element | Drain | ◇ | | | | | |
| | | Clean | | | □ | | | |
| | F.O. filter element | Clean | | | □ | | | |
| | | Replace | | | | | ● | |
| | Drain water and sediment from F.O. tank | | | □ | | | | |
| Cooling water system | Cooling water | Check, resupply | ◇ | | | | | |
| | | Check water leakage | ◇ | | | | | |
| | Check and clean radiator fin | | | | | | □ | |
| | Check and clean cooling water system (drain water) | | | | | | □ within one year | |
| | Check and adjust fan belt tension | | ◇ | | | □ | | |
| Air cleaner | Check and clean air cleaner | | ◇ | | | | | |
| | Element 1) | Check, clean | | | | □ | | |
| | | Replace | | | | | ● | |
| Lube oil | Engine oil | Check, resupply | ◇ | | | | | |
| | | Replace | | ● 1 st time | | ● | | |
| | Replace engine oil filter | | | ● 1 st time | | ● | | |
| | *Swing gear case oil | Check, resupply | | | | ○ | | |
| | | Replace | | | | | | ● |
| | Travel reduction gear oil | Check, resupply | | | | ○ | | |
| | | Replace | | | ● 1 st time | | | ● |
| | *Transmission oil | Check, resupply | ◇ | | | | | |
| | | Replace | | | ● 1 st time | | | ● |
| | *Differential gear oil | Check, resupply | | | ◇ | | | |
| | | Replace | | | ● 1 st time | | | ● |
| Hydraulic system | Hydraulic oil | Check, resupply | ◇ | | | | | |
| | | Replace | | | | | | ● |
| | Clean suction filter | | | | | | | □ |
| | Replace return filter | | | | | | | ● |
| | Check for abnormality of hydraulic pump | | ◇ | | | | | |
| Grease | Check grease-up positions, grease | | △ | | | | | |

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# Notice of Service Manual Modification

## For the Model of B50-2

To update the manual for the design change from B-2 Series to B-2A Series, please replace and add the following pages to the current service manual for B50-2.
The following pages enable the current manual to be applicable for the models of B50-2 and B50-2A.

Note : Some current descriptions for B50-2, which are not modified, are applicable to B50-2A, too, but some specifications on such pages may be different. Please take care not to mix them up.

**R : Replacing Pages and A : Additional Pages**

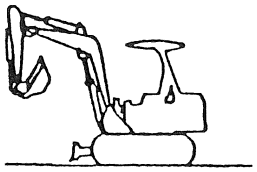
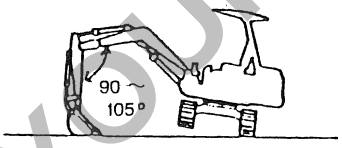
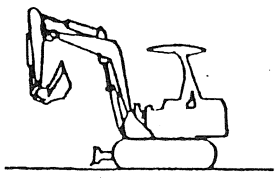
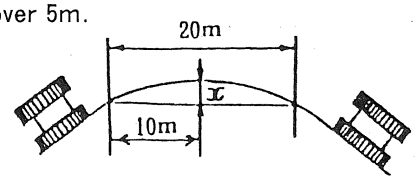
| | | |
|---|---|---|
| Binder | Front and Spine Title Covers (R) | |
| General | Contents (R) | |
| Chapter 1 | Contents | |
| | 1-8 R, 1-9 A | General Cautions for Maintenance Work |
| Chapter 2 | Contents | |
| | 2-1-1 R ~ 2-1-7 R | Specifications |
| | 2-3-1 R | Weight of Main Parts |
| Chapter 3 | Contents | |
| | 3-1-1 R ~ 3-1-4 R | Servicing Standards of Machine Performance |
| | 3-4-1 R | Control Devices |
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| | 6-1-1 R, 6-1-2 R | Electric Wirings |
| | 6-1-7 A, 6-1-8 A | Electric Wiring Diagrams |
| | 6-3-8 R | Adjustment of 2-Speed Pedal |

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*[Note] [ ]: Rubber track spec.*

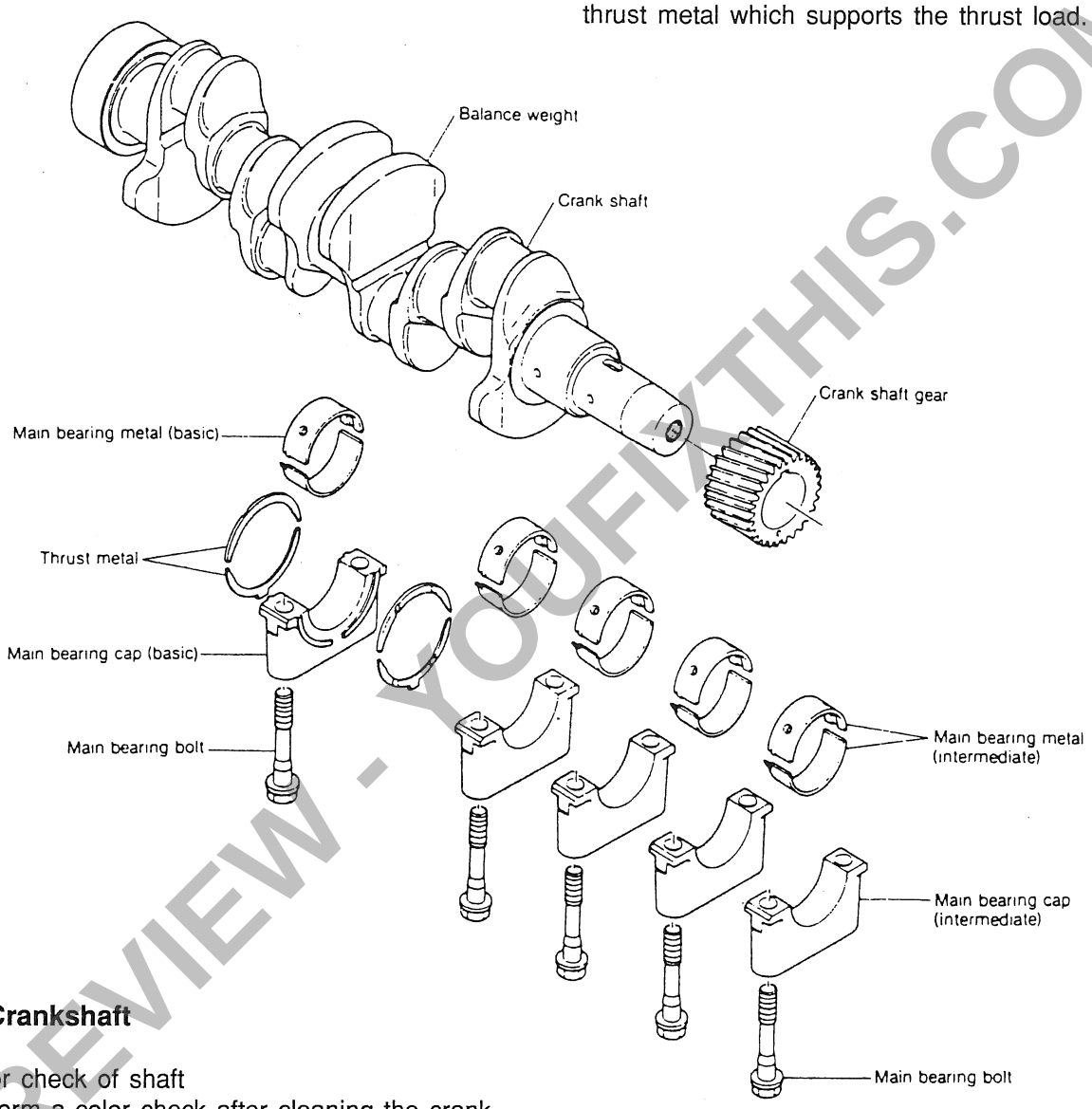
| Model | | | B50-2 (A) | | |
|---|---|---|---|---|---|
| | Item | Measuring condition | Unit | Standard | Allowance |
| Machine performance | Traveling speed | Machine position<br><br>• Engine : rated speed<br>• Hydraulic oil temp. : 50 ~ 60 ℃<br>• Site : Firm, flat ground<br>• Traveling time for 20m after an approach run of over 5m. | sec. | High speed<br>17<br>[16] | 20<br>[19] |
| | | | | Low speed<br>33<br>[31] | 36<br>[34] |
| | Track speed | Machine position<br><br>• Engine : rated speed<br>• Hydraulic oil temp. : 50 ~ 60 ℃<br>• Site : Firm, flat ground<br>• Traveling lever : Full throttle (Floating track side)<br>• Float one of the track. Make a mark on the track. After idling the floating track at full throttle more than once, measure the time needed for 3 turns of the track. | sec. | High speed<br>13 | 15 |
| | | | | Low speed<br>26 | 30 |
| | Track deviation | Machine position<br><br>• Engine : rated speed<br>• Hydraulic oil temp. : 50 ~ 60 ℃<br>• Site : Firm, flat ground<br>• Measure the deviation ( x ) in a traveling distance of 20m after an approach run of over 5m.<br> | mm | 300<br>or less | 360 |



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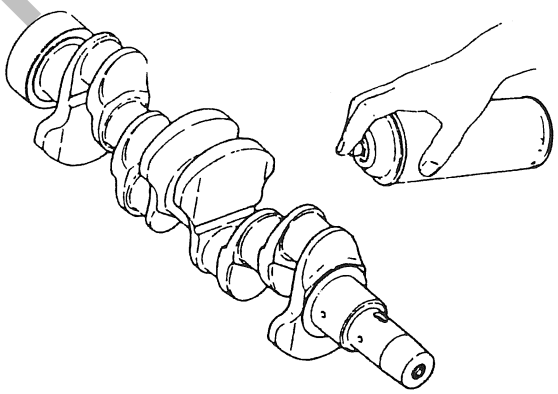
## 4-5 Crankshaft and Main Bearing

The crank pin and crank journal have been high-frequency hardened for superior durability, and the crankshaft is provided with four balance weights for optimal balance. The crankshaft main bearing is of the hanger type, with the upper metal (cylinder block side) provided with an oil groove, and with no oil groove on the lower metal (bearing cap side). The bearing cap (location cap) of the flywheel side has a thrust metal which supports the thrust load.




### 4-5-1 Crankshaft

(1) Color check of shaft
Perform a color check after cleaning the crankshaft, and replace the crankshaft if there is any cracking or considerable damage.

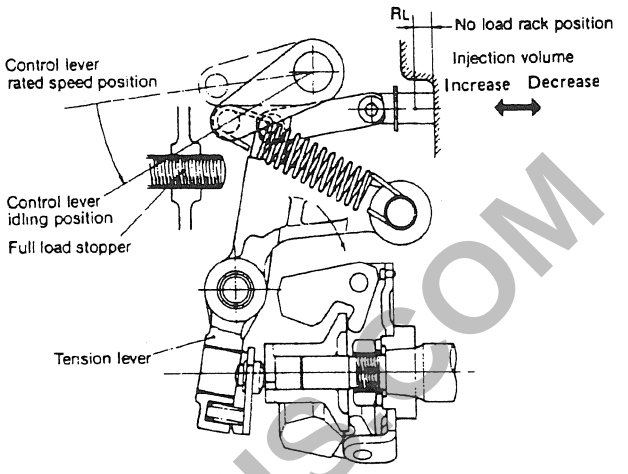




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**(3) Idling**

Idling is controlled by the governor spring and excess fuel spring as this governor is not equipped with an idling spring. When the control lever is returned to the idling position after the engine is started, the governor spring tension decreases and the tension lever descends clockwise, and the governor weight load keeps the governor spring and the excess fuel spring load in equilibrium to maintain idling speed at ($R_L$).

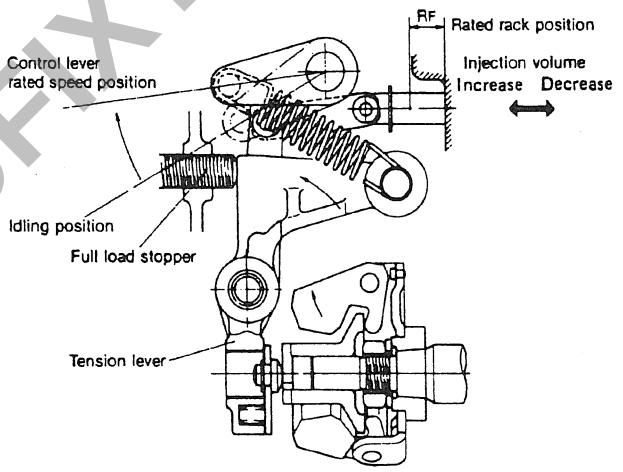



***Note:*** *Depending on specifications, the governor can be provided with an idling spring.*

**(4) Maximum speed**

The angle of the control lever is set at determined engine speed. The governor keeps engine speed constant by adjusting speed when load changes.

For example, if the operator moves the control lever with the link from the idling position to max. output, governor spring tension increases, the tension lever is pulled until it comes in contact with the full load stopper, the movement of the governor lever is transmitted to the control rack via the link, maintaining the full load rack position, and engine speed increases until the governor weight thrust load and governor spring tension come into equilibrium at full load max. speed.

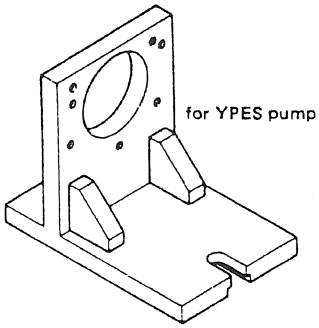
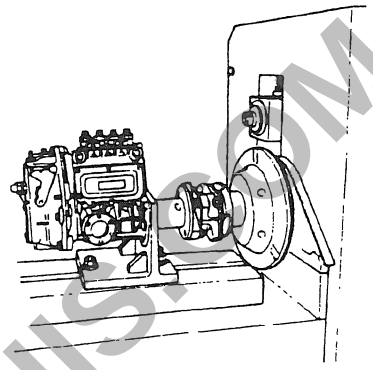
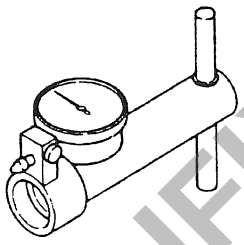
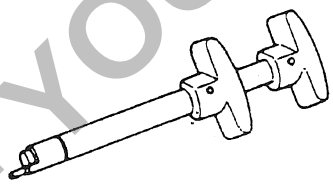
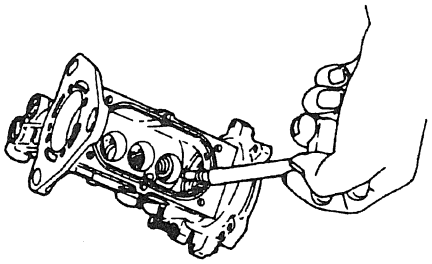
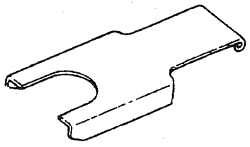
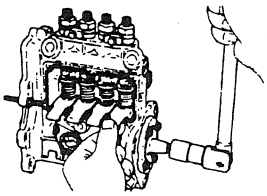
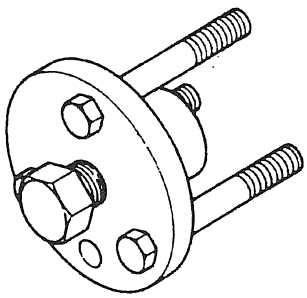
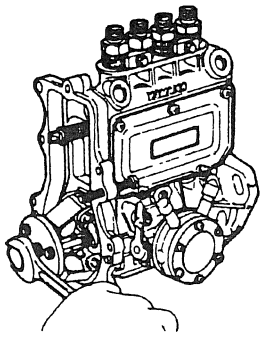



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## 4-11-7 Tools

| Name of tool | Shape and size | Application |
|---|---|---|
| Pump mounting scale (YPES)<br>for Yanmar tester 158090–51010<br>for Bosch (tester) 158090–51020 |  |  |
| Measuring device (cam backlash)<br>158090–51050 |  | |
| Plunger insert<br>158090–51100 |  |  |
| Tappet holder<br>158090–51200 |  |  |
| Weight extractor<br>158090–51400 for 3 pcs. governor weight<br>158090–51450 for 4 pcs. governor weight |  |  |

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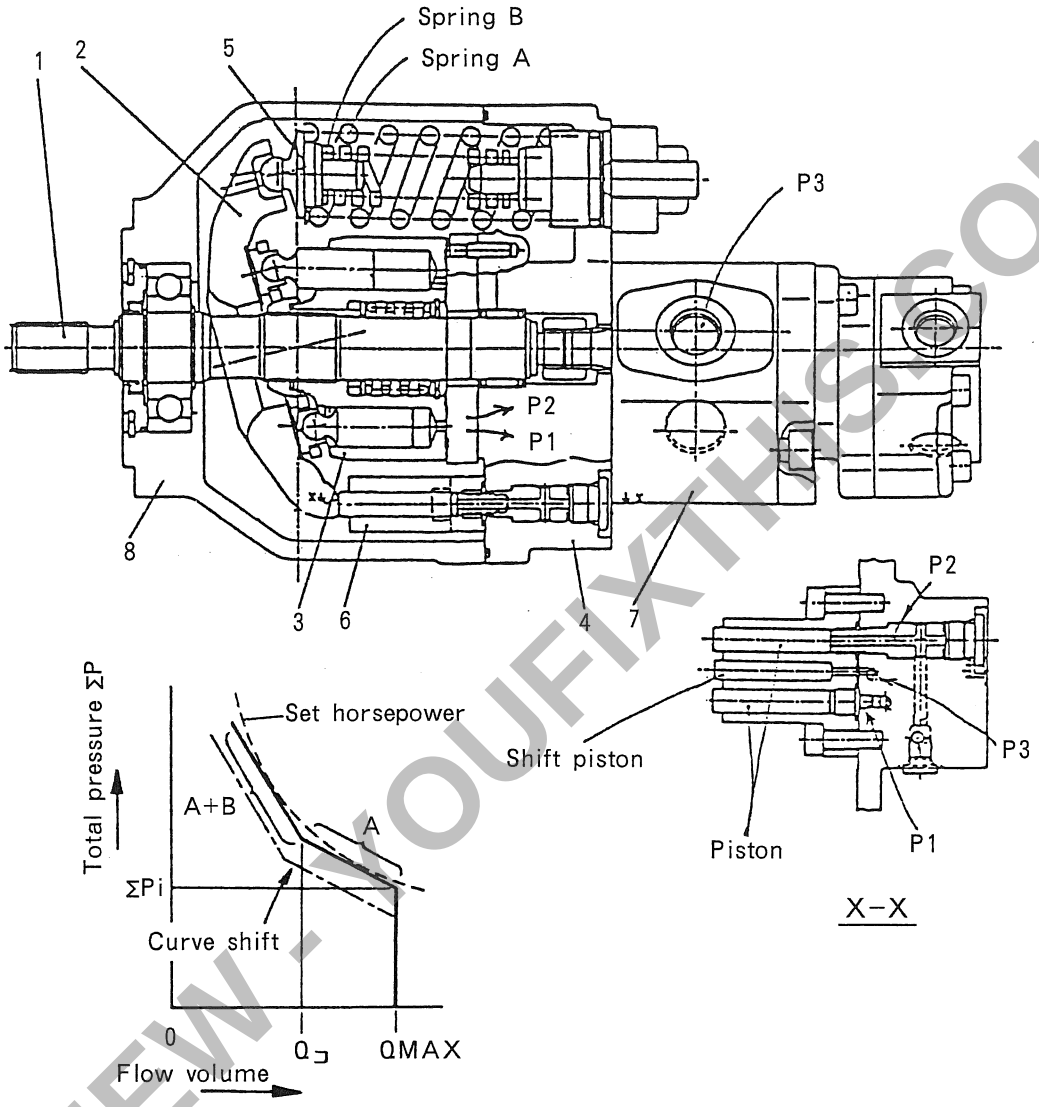


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### 2) Control Functions



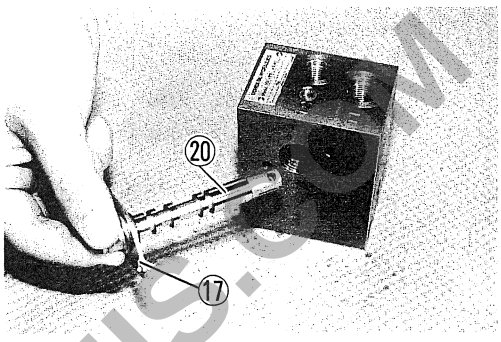
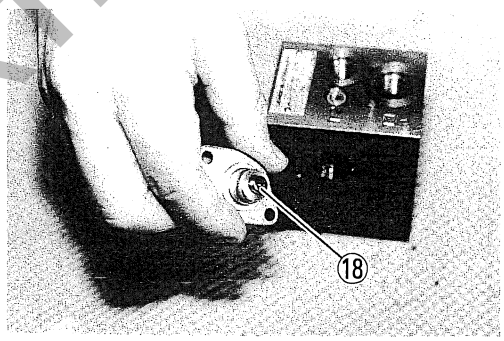
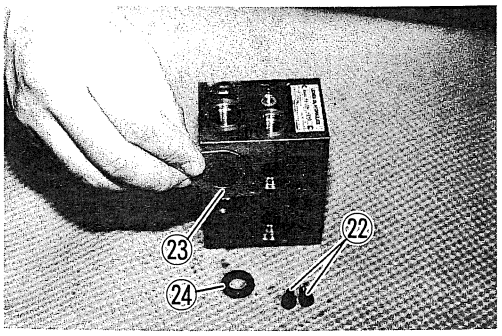

(Fig. 2)

- The hanger is operated by applying discharge pressures P1 and P2 to pistons with identical areas.
- The spring is provided to supply a force that opposes the discharge pressure. Under a no-load condition, because the hydraulic pressure applied to the piston is less than the force supplied by spring A, the hanger is set to the maximum incline angle position.
- When a load is applied to the actuator, the hydraulic pressure applied to the piston exceeds the force of spring A, the incline angle decreases, and the hanger becomes set at the incline angle where the hydraulic pressure equals the spring force. (Fig. 2 Zone A)
- When a large load is applied to the actuator, the hydraulic pressure applied to the piston rises, causing the incline angle to decrease further until spring B, which until now had been at rest begins to compress.
- Since more force is required to overcome the opposing force of the two springs, more hydraulic pressure is required, and accordingly the slope of the graph shown above significantly changes. (Fig. 2. Zone A+B)
- When hydraulic pressure P3 is applied to the shift piston, the control graph shifts.

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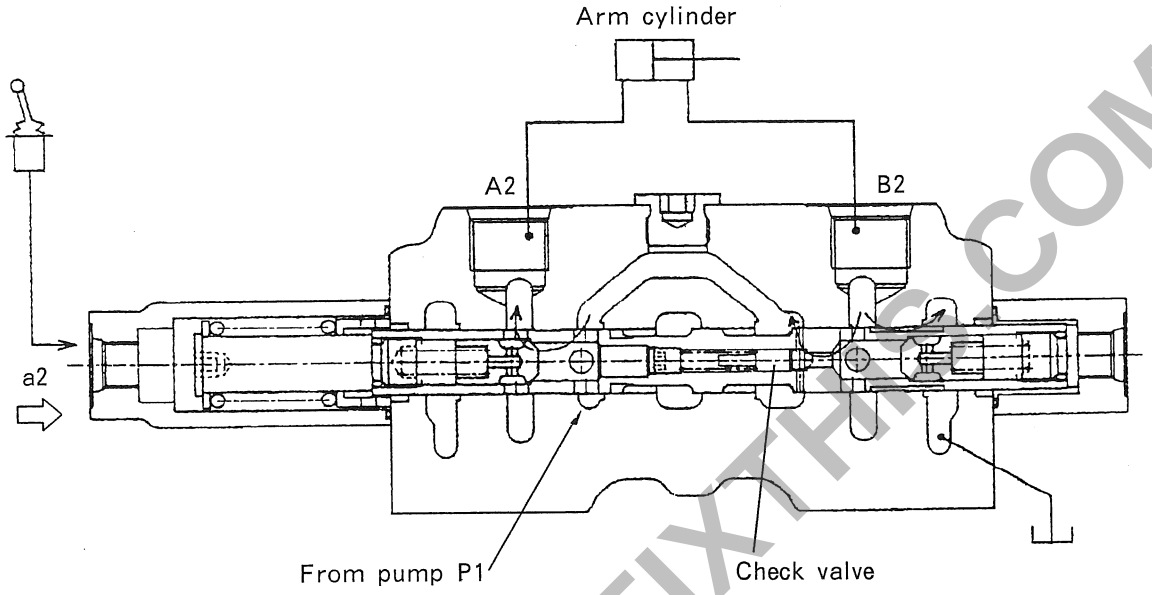
| Procedure | Photo |
|---|---|
| (5) Remove the spool ⑳, packing ㉑ and plate ⑰.<br><br>【*Note*】 *a. To avoid damaging the packing, remove the spool with the packing inside.*<br><br>*b. Only when the packing has to be replaced it had better be removed from the spool.* |  |
| (6) The hexagon screw ⑱ is coated with adhesive so as not to remove. |  |
| (7) Remove the hexagon screw ㉒, plate ㉓ and packing ㉔.<br><br>Hexagon bar wrench: 4 |  |
| | |

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### 3) Combined Oil Circuit for Arm




When the port a2 is pressurized, the spool of the arm section is moved to the right and the oil discharged from the piston pump P1 flows to the bottom side of the arm cylinder throught the port A2.

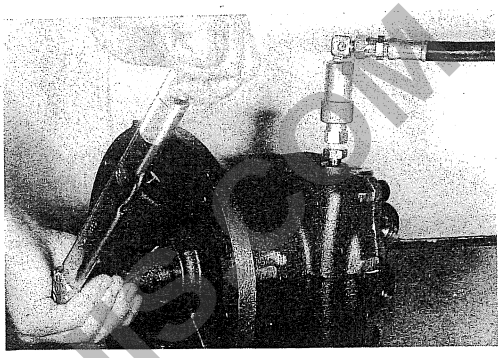
The oil returned from the rod side returns to the reservoir through the port B2 and the oil passage grooved on the spool.

The return oil also opens the check valve for recycle oil passage, combines with the oil discharged from the piston pump P1 and recirculate to the bottom side of the arm cylinder.

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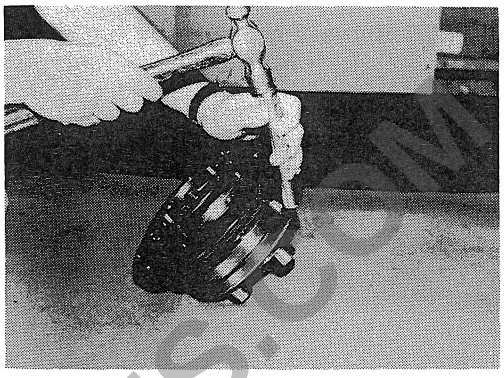
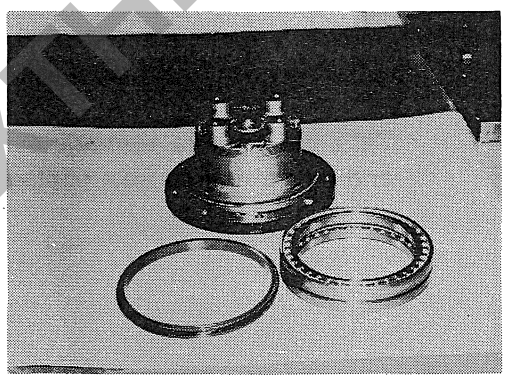
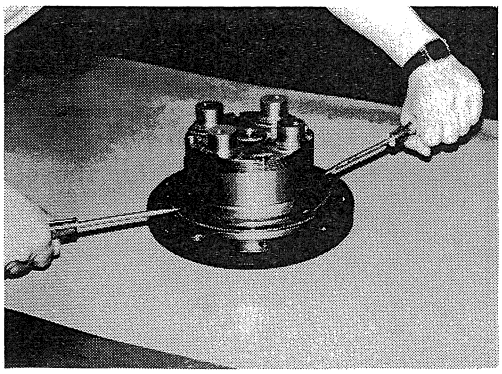
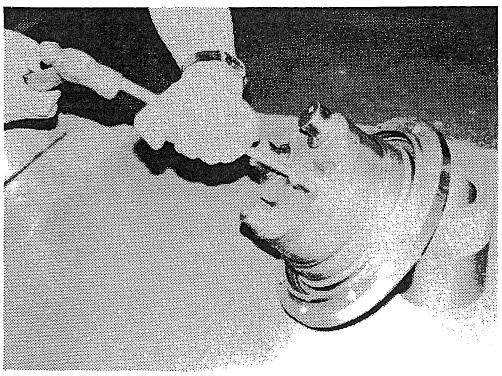
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| Procedure | Photo |
|---|---|
| (20) Check that the output shaft rotates smoothly in one rotation or more at a torque of approximately 2~3 kgf-m.<br><br>If it does not, check how it was reassembled. At this time, open the drain port. |  |

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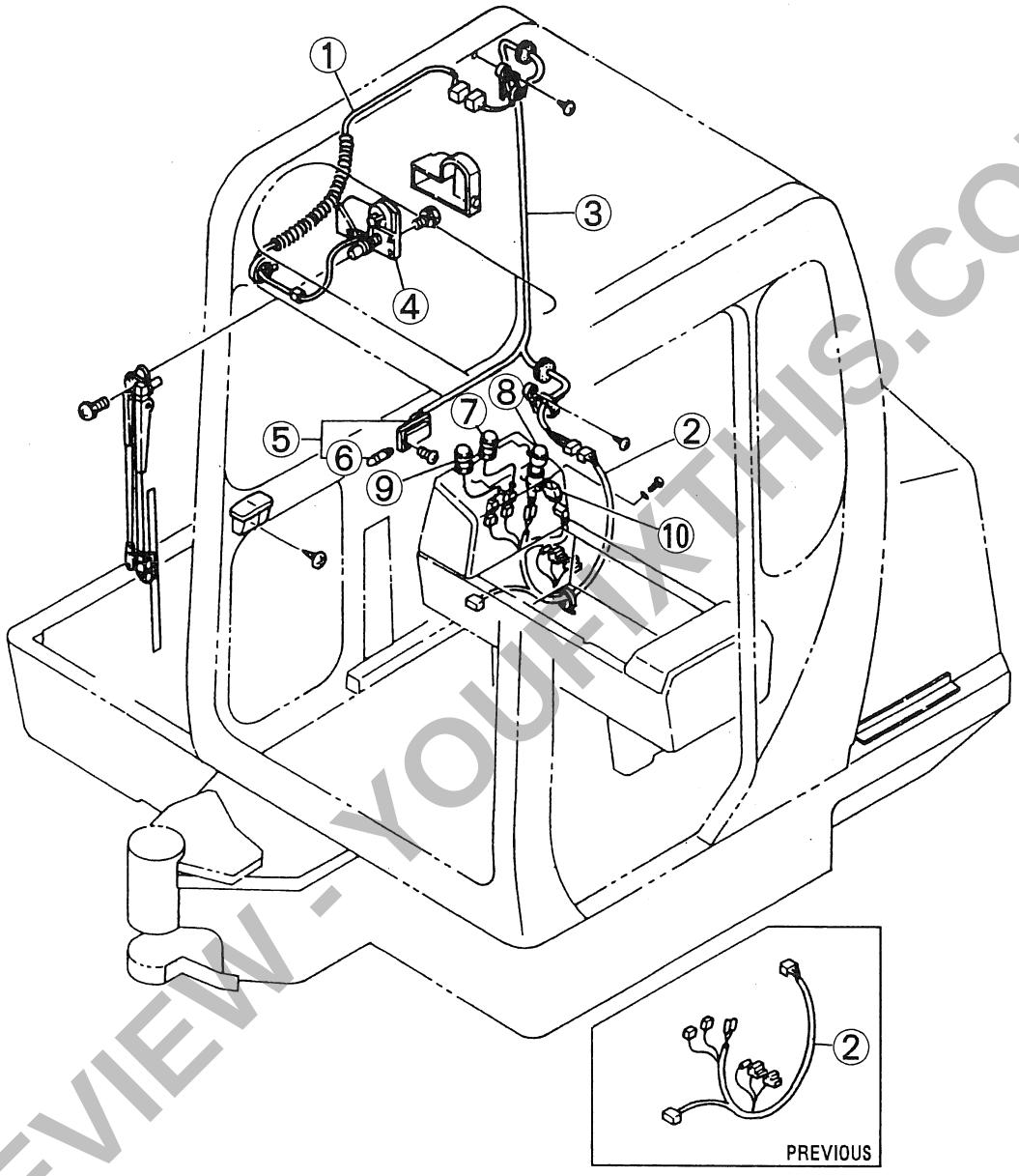
| Procedure | Photo |
|---|---|
| (29) Place the round rod on the groove of the steel ball ⑦ and lightly knock on the part with a hammer to remove the angular bearing ③.<br><br>**Tools:**<br>• Hammer (17)<br>• Round rod S-7 |  |
| (30) Remove the floating seal ② and the angular bearing ③. |  |
| (31) Remove the other floating seal with using two screw drivers.<br><br>**Tools:**<br>• Screw driver (16) |  |
| (32) Place the round rod on the spline hole of the shaft ㉜ and knock lightly on the rod with the hammer to remove the shaft.<br><br>**Tools:**<br>• Hammer (16)<br>• Round rod S-7 |  |

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**2. Cabin type only**




| No. | Parts Name | No. | Parts Name |
|---|---|---|---|
| 1 | Curl code | 6 | Electric bulb 12V5W |
| 2 | Wire harness E | 7 | Wiper switch |
| 3 | Wire harness F | 8 | Cigarette lighter |
| 4 | Wiper motor 520A | 9 | Heater switch |
| 5 | Room lamp | 10 | Relay |

***Note:***

*According to the modification of cabin heater circuit, the relay (10) is additionally installed from the unit of SN50862 and after on B50-2A.*



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# 6. ADJUSTMENT PROCEDURES FOR EACH EQUIPMENT

## 1. Disassembly and Reassembly of Swivel Joint

### ● Disassembly

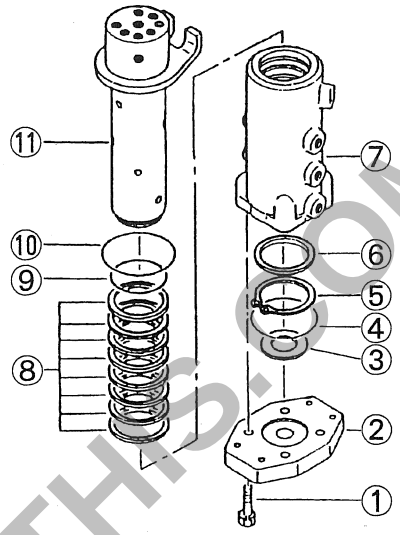
1) Remove the bolt ①.

2) Remove in the order of swivel plate ②, thrust washer ③ and O-ring ④.

3) Remove the circlip ⑤ and swivel spacer ⑥ from the swivel shaft ⑪.

4) Pull out the swivel shaft ⑪ from the hub (swivel) ⑦ and remove the O-ring ⑩.

5) Pull out the swivel seal ⑧ and O-ring ⑨ from the hub (swivel) ⑦.



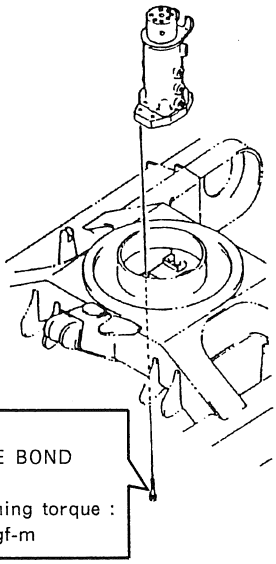

### ● Reassembly

1) Install the swivel seal ⑧ and O-ring ⑨ to the hub (swivel) ⑦.

2) Apply multi-purpose grease to the inner surface of the hub (swivel) ⑦.

3) Install the O-ring ⑩ on the swivel shaft ⑪ and insert these into the swivel hub ⑦ slowly.

- Use jig E-004.
- Apply multi-purpose grease to the outside circumference of the shaft.

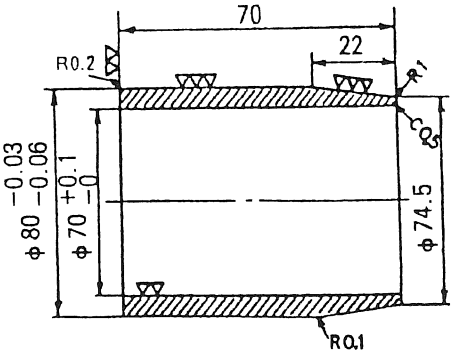



4) Install the swivel spacer ⑥ to the swivel shaft ⑪ and install the circlip ⑤.

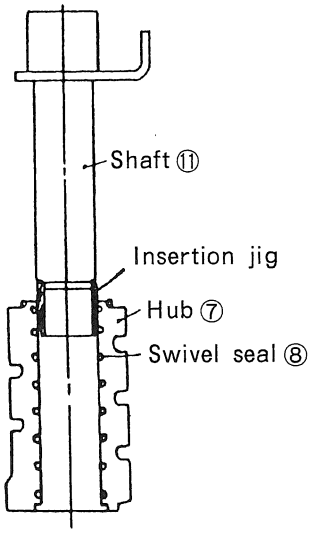
5) Install the O-ring ④, thrust washer ③ and swivel plate ② in that order to the hub (swivel) ⑪ and tighten the bolt ①.

| Tightening torque: | 4.5~6.0kgf-m |
|---|---|

**Shaft insertion jig No. E-004**




Insertion of Shaft




*[Note] : mmm area must be chromium plated.*



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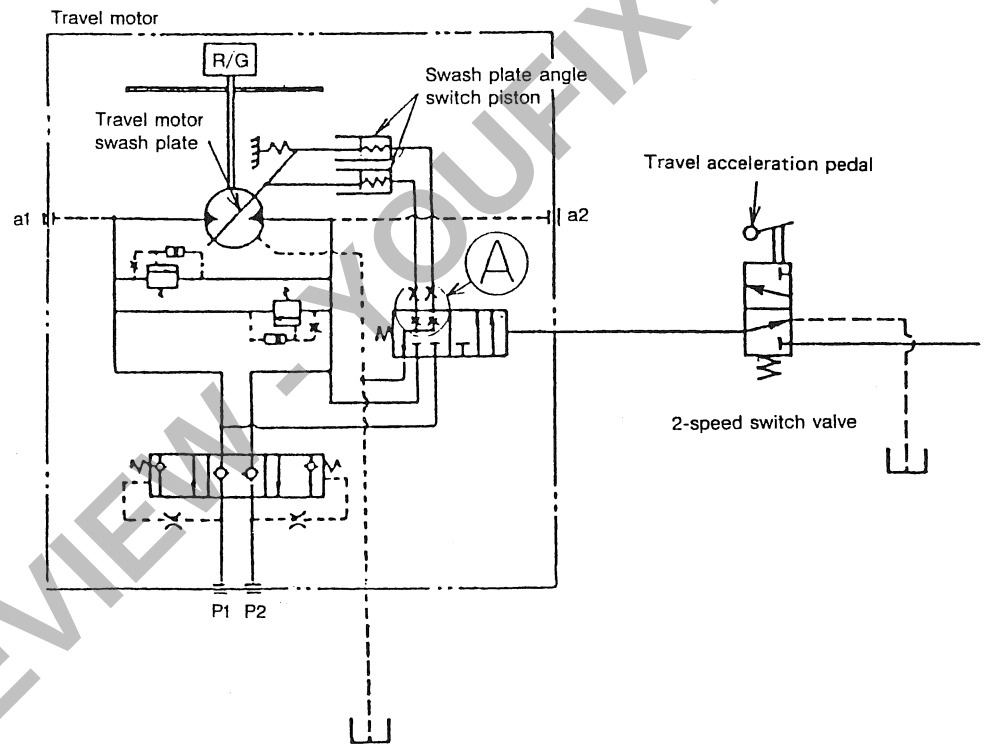
### 9-1-6 Time Lag on Switching Travel Speed

#### Phenomenon

In cold temperatures, there is a time lag in switching from the 2nd travel speed to 1st travel speed (with the travel acceleration pedal released).

#### Reason

The shock caused during switching from the 2nd speed to 1st speed is lightened by the throttles of A. In cold temperatures, however, the passage resistance of the throttles becomes larger and it takes more time for the swash plate of the travel motor to return to the 1st speed.




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