

SERVICE MANUAL

Robex 28-7

SER. NO. HY2870001~

 **HYUNDAI**
HEAVY INDUSTRIES CO.,LTD.

INTRODUCTION

To insure a long life for the machine and the engine and to prevent failure and problems, proper operation, maintenance and repairs are imperative.

This service manual includes an “outline,” “structure and operation,” “inspection and adjustment,” “disassembly and assembly,” “standard maintenance,” and “repair and replacement of parts” of the machine which are necessary to carry out the inspections and repairs in the repair shop.

We trust that this manual will help you to effectively carry out the necessary. Repairs should they arise, also provide a accurate description of the product, and the correct repair procedures.

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1 PRECAUTIONS ON MAINTENANCE

1. Correct operation

Correct operation means to follow the correct “procedure” and “method.”

Procedure focuses on speed and accuracy of each job.

In the method, are addressed what type of facility, tools, instruments, materials, oil should be used, how and which part should be checked, adjusted or disassembled, and what matters to attend to.

2. Precautions on operation

1. Safety check

Check that stoppers and sleepers are correctly installed for the vehicle jack-up operation.

2. Preparation

Prepare all of the tools and inspect and adjust the instruments.

3. For efficiency

1) Understand the state before disassembly.

What is the problem? Is disassembly absolutely necessary?

2) Before disassembly

Determine whether match marks are necessary. For the electrical system, disconnect the cable from the battery terminal.

3) Precautions for disassembly

In stead of checking all of the disassembled parts at once, check each part individually as it is disassembled. When removing the hydraulic unit or the hoses, mount a dust cap on the connection.

4) Repair of disassembled parts

Keep the disassembled parts in order. Clearly distinguish the parts to be replaced with new parts from those to be reused. Packings, seals, rings, split pins must be replaced.

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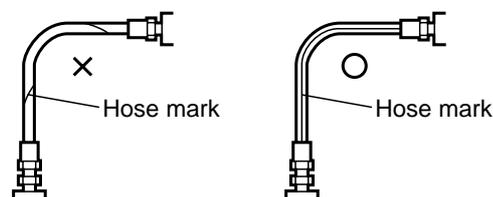
Electrical equipment, rubbers and V belts (which are easily affected by water and oil) must be handled carefully in order to prevent soiling them.

5) Clean disassembled parts

Thoroughly clean the disassembled parts.

6) Assembly

Perform the assembly correctly (tightening torque, application of Three Bond, screw lock, grease, use of seal tape, etc.). Also install the hose correctly.

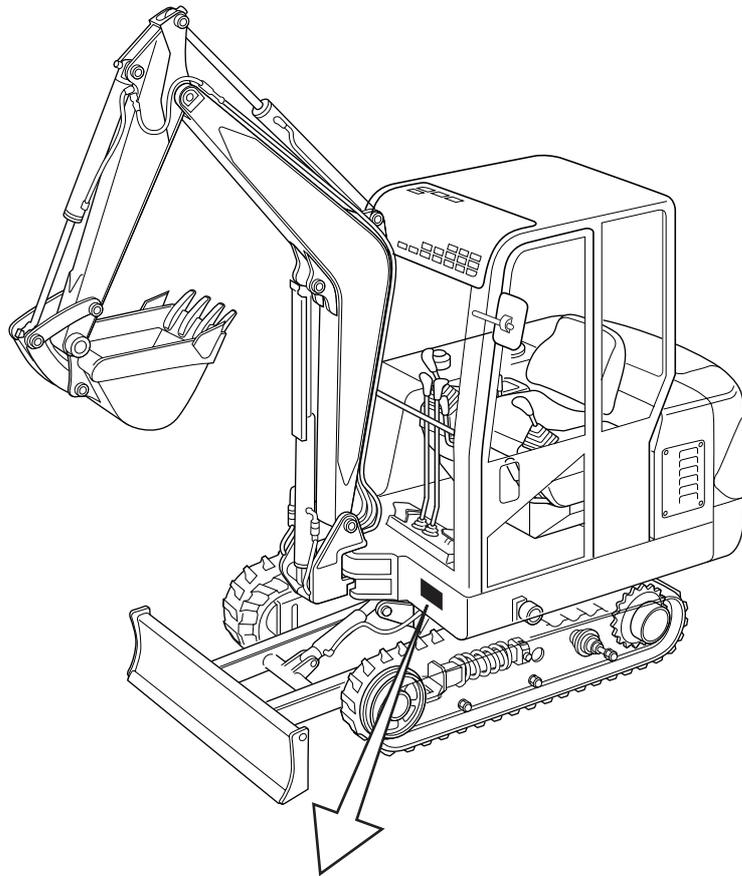


2 OUTLINE

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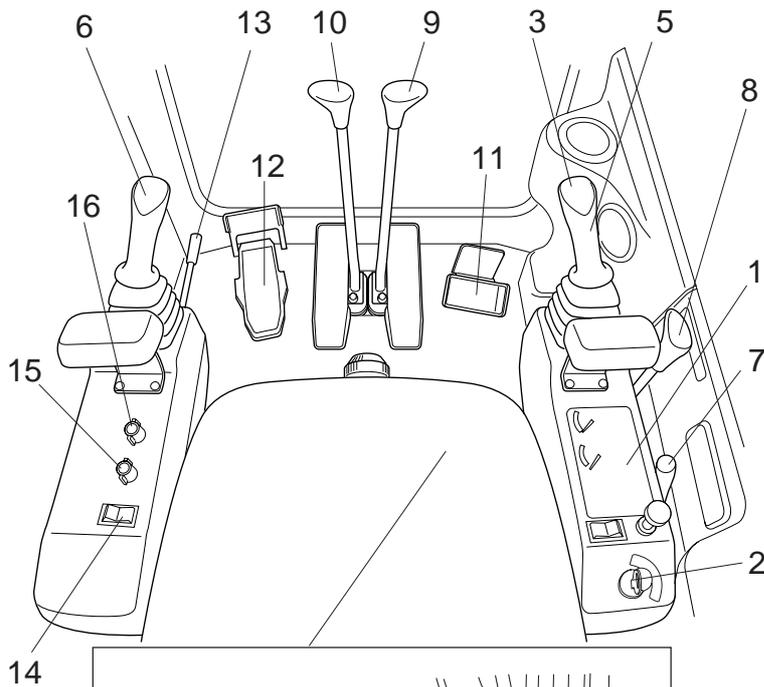
2-1 Location of Serial Number



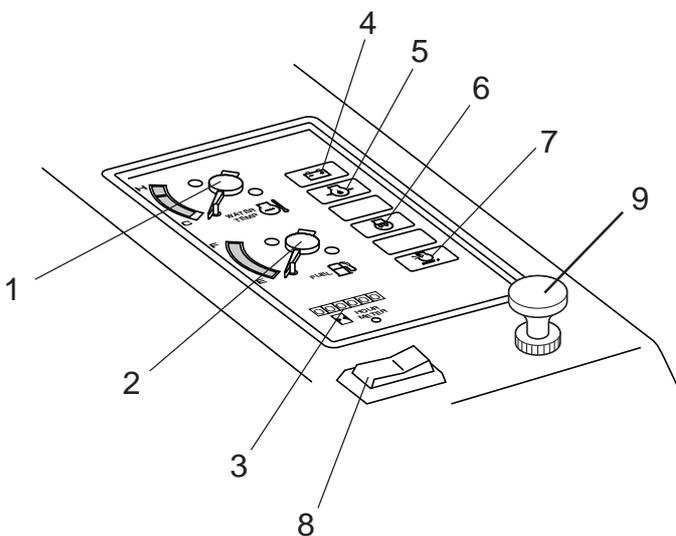
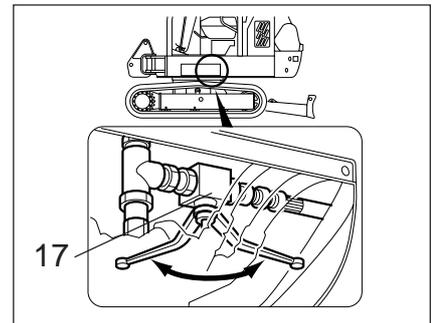
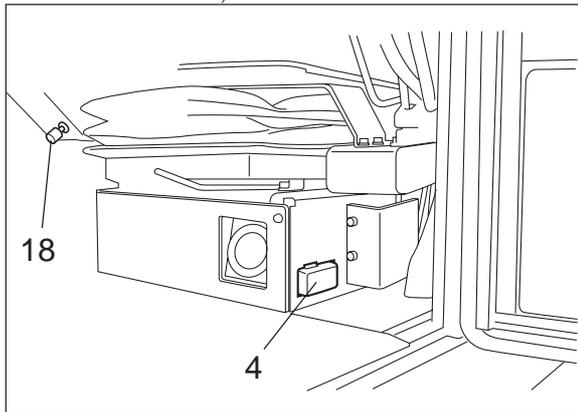
Model Name.

Serial No.

2-2 Name of each part

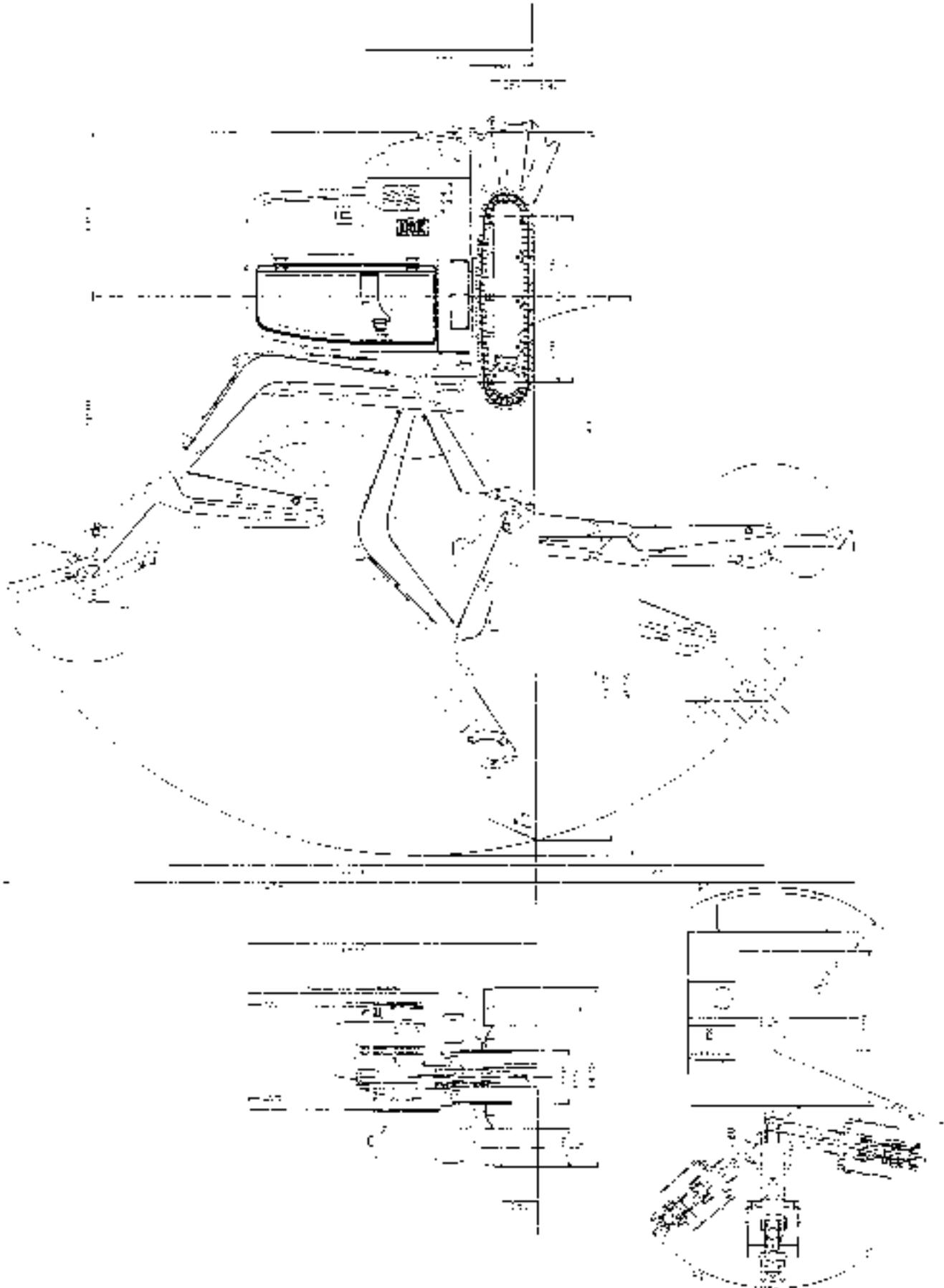


1. Meter unit
2. Starter switch
3. Horn switch
4. Fuse box
5. Right operation lever
6. Left operation lever
7. Accelerator lever
8. Dozer lever
9. Right travel lever
10. Left travel lever
11. Swing pedal
12. P.T.O. pedal
13. Operation lock lever
14. Over drive switch
15. Heater switch (for cabin)
16. Wiper switch (for cabin)
17. Manual boom lower lever
18. Cigarette lighter



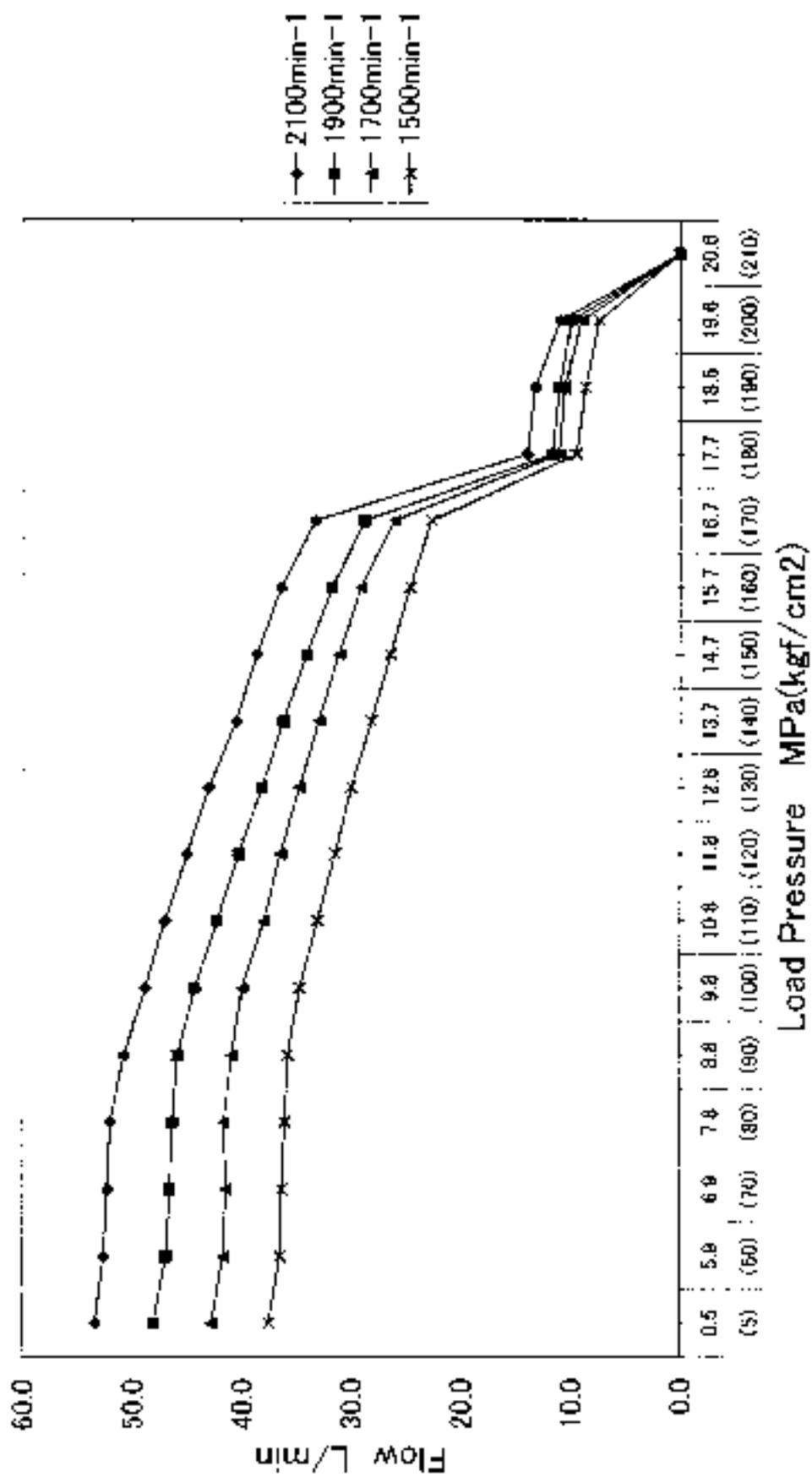
1. Water temperature meter
2. Fuel gauge
3. Hour meter
4. Charge lamp
5. Engine oil pressure lamp
6. Glow lamp
7. Air filter lamp
8. Head light switch
9. Heater change lever
(cold↔warm)

2-3 Dimensions and Specifications



| Description | | | Unit | Robex28-7 | |
|------------------------|--------------------------------|--------------------|---------------------------|---------------------|------------|
| Machine weight | Canopy | Rubber shoe | Kg | 2750 | |
| | | Steel shoe | | 2760 | |
| | Cabin | Rubber shoe | | 2660 | |
| | | Steel shoe | | 2670 | |
| Standard bucket | Capacity | | m ³ | 0.07 | |
| | Width | | mm | 450 | |
| Engine | Maker, model | | | MITSUBISHI S3L2 | |
| | Rated power | | ps(kW)/min ⁻¹ | 24.1(17.7)/2100 | |
| | Displacement | | cc | 1318 | |
| Working range | Arm length | | mm | 1165(std.) | 1465(long) |
| | Max.digging depth | | | 2610 | 2900 |
| | Max.vertical digging depth | | | 1870 | 2140 |
| | Max.digging height | | | 4380 | 4575 |
| | Max.dumping height | | | 3020 | 3220 |
| | Max.digging reach | | | 4590 | 4830 |
| | Min.swing radius | Front | | 1890 | 1950 |
| | | Swing | | 1530 | 1580 |
| | Rear end radius | | | | 1350 |
| Boom swing angle | | deg | Left80/Right50 | | |
| Dimension | Overall length | | mm | 4420 | |
| | Overall width | | | 1470 | |
| | Overall height | | | 2385 | |
| | Dozer(width × height) | | | 1470×300 | |
| Performance | Travel speed | | km/hr | 2.8/4.0 | |
| | Swing speed | | min ⁻¹ | 10.3 | |
| | Gradeability | | deg(%) | 30(58) | |
| | Max.digging force | Bucket | kN(kgf) | 25.6(2610) | |
| | | Arm | | 15.6(1595) | |
| Max. drawbar pull | | | 24.1(2460) | | |
| Under-carriage | Ground pressure | Canopy&rubber shoe | kpa(kgf/cm ²) | 30.4(0.31) | |
| | | Cabin&rubber shoe | | 29.5(0.30) | |
| | Tumbler distance × track gauge | | mm | 1360×1150 | |
| | Track shoe width | | | 300 | |
| | Type of travelling motor | | | Piston shoe-in type | |
| Crawler tension system | | | Grease cylinder | | |
| Hydraulic | Type of hydraulic pump | | | Piston×2, Gear×1 | |
| | Pump oil flow | | ℓ /min | 2×33.6+22.1 | |
| | Auxiliary circuit oil flow | | | 55.7 | |
| | Relief valve setting pressure | | MPa(kgf/cm ²) | 20.6/17.2(210/175) | |
| Capacity | Hydraulic oil tank | | ℓ | 50.5 | |
| | Engine oil | | | 4.5 | |
| | Fuel tank | | | 42 | |
| | Cooling water | | | 5.5 | |
| Noise | Noise level(LwA/LpA) | | dB | 94/78 | |

2-3-1 Robex 28-7 PTO Flow

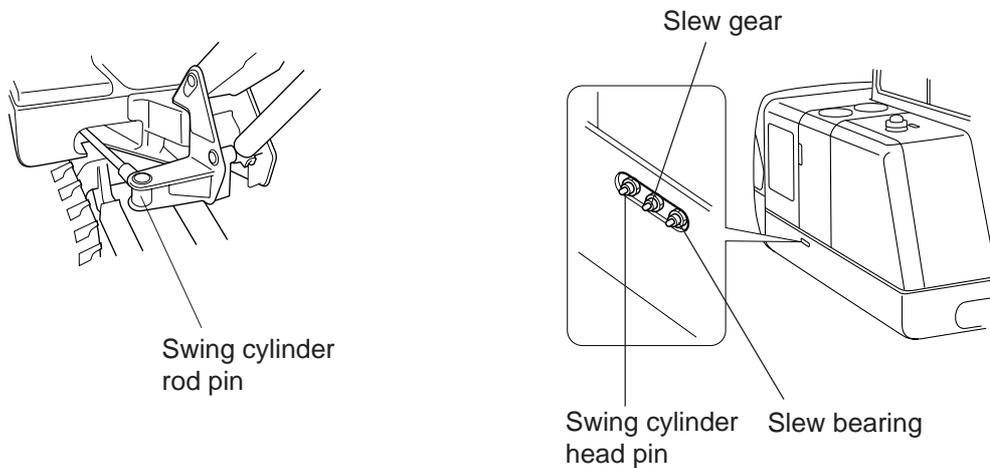
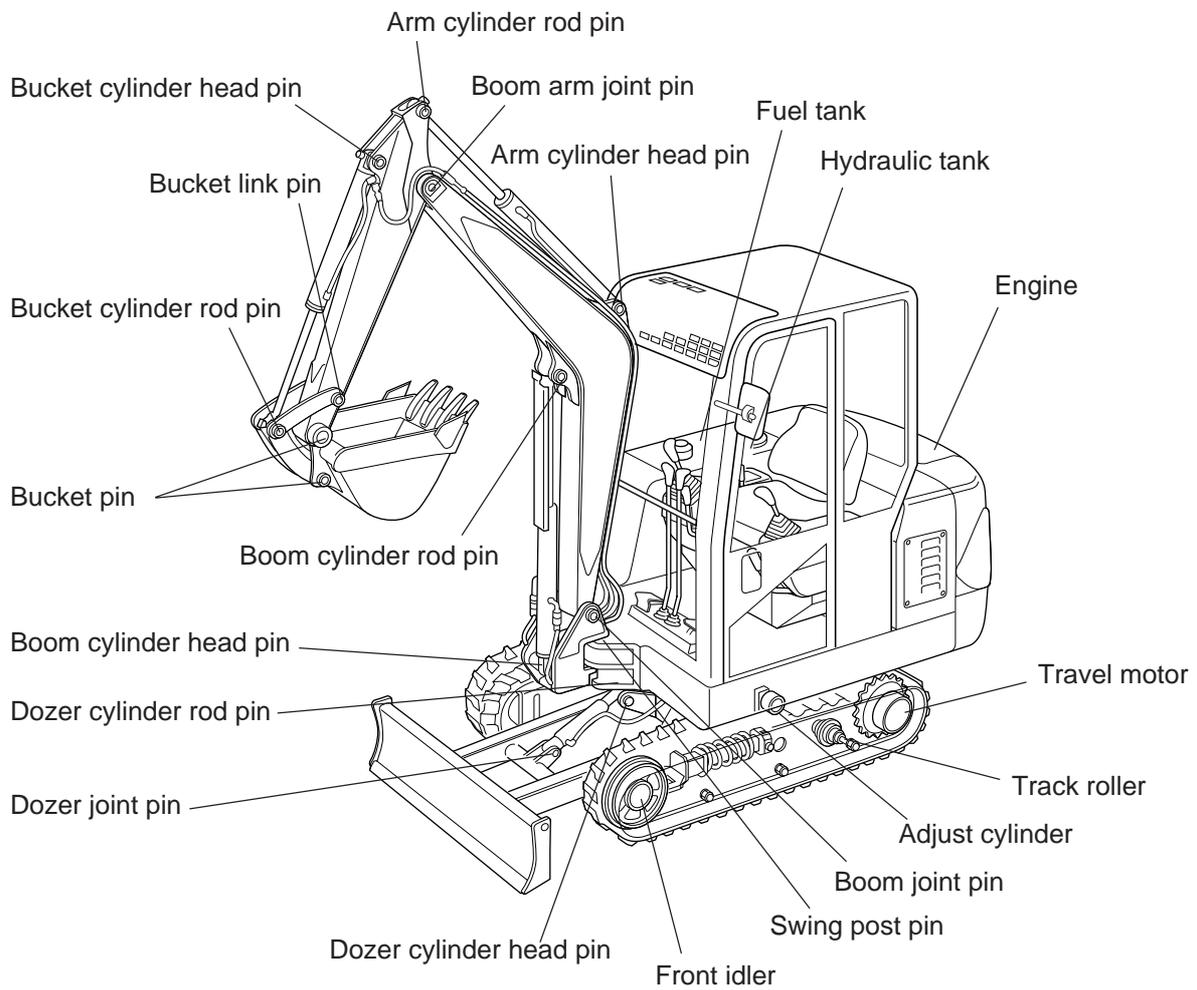


2-4 Weight list

Unit: kgf

| Part name | Robex 28-7 | Part name | Robex 28-7 |
|--------------------|------------|-----------------|------------|
| Boom | 98 | Swing cylinder | 22 |
| Arm | 55 | Dozer cylinder | 18 |
| Bucket | 51 | Turning bearing | 42 |
| Dump link | 10 | Track frame | 280 |
| Bucket link | 2.8×2 | Dozer | 113 |
| Boom joint pin | 2.6 | Steel crawler | 156×2 |
| Arm joint pin | 1.6 | Rubber crawler | 138×2 |
| Bucket pin | 1.7×3 | Idler | 19×2 |
| Swing post | 59 | Adjust cylinder | 18×2 |
| Swing post pin | 6.5 | Track roller | 6.8×6 |
| Swing frame | 325 | Carrier roller | 2.5×2 |
| Hydraulic oil tank | 35 | Sprocket | 6.5×2 |
| Fuel tank | 18 | Turning motor | 22 |
| Engine cover(A) | 31 | Drive motor | 36×2 |
| Engine cover(B) | 13.5 | Console box | 9×2 |
| Counter weight | 150 | Engine | 135 |
| Guard(R)(L) | 35×2 | Radiator | 6 |
| Guard(Center) | 10.5 | Battery | 22 |
| Tops roof | 90 | Battery cover | 3 |
| Operator cabin | 165 | Swivel joint | 21 |
| Boom cylinder | 28 | Control valve | 27 |
| Arm cylinder | 28 | Pump | 23 |
| Bucket cylinder | 23 | Seat plate | 14 |

2-5 Oil and grease supply points



2-6 List of lubrication

| Name | Quantity of oil/water | Type of oil according to ambient condition | |
|--------------------------------|-----------------------|--|-----------|
| | | -10°C~40°C | -20°C~0°C |
| Engine cooling water | 5.5 ℓ | Soft water (antifreeze is mixed in water) | |
| Fuel tank (effective capacity) | 42 ℓ | Diesel fuel with freezing point below -7°C | |
| Engine lubricating oil | 4.5 ℓ | SAE 10W-30 | |
| Travel motor (reduction gear) | 600 cc | SAE 30-CD | |
| Hydraulic tank | 50.5 ℓ | ISO VG 46 | |
| Track roller (1 piece) | 100 cc | SAE 30-CD | |
| Front idler (1 piece) | 80 cc | SAE 30-CD | |

Genuine oil

Be sure to use Castrol Hyspin 46.

Table of recommended Lubricants

| No. | LUBRICANT | SHELL | MOBIL |
|-----|---------------|------------------------|-----------------------|
| 1 | Engine Oil | Myrina oil 15W-40 | Delvac Super15W-40 |
| 2 | Gear Oil | Spirax Heavy Duty 140 | Mobilub HD 85W-140 |
| 3 | Hydraulic Oil | ISO VG 46 (equivalent) | ISO VG46 (equivalent) |
| 4 | Cup Grease | Alvinia 2 | Mobilux 2 |
| 5 | Anti Freeze | Anti Freeze | Anti Freeze |
| 6 | Diesel Fuel | — | — |

*The engine oil SAE-CD 15W=40 or equivalent at the time of shipment is used for the lubricating oil for slewing and travelling speed reducer.

Cooling water (antifreeze)

*To prevent the cooling system from freezing, add antifreeze to the cooling water. Replace the cooling water after 1 year from its delivery, because the effect will decrease.

*Use "Long-life coolant" for the antifreeze.

*Mixing ratio of antifreeze.

| Temperature | -5°C | -10°C | -15°C | -20°C | -25°C | -30°C |
|------------------|------|-------|-------|-------|-------|-------|
| antifreeze ratio | 1.7 | 2.2 | 2.7 | 3.1 | 3.5 | 3.8 |

| Engine inside capacity | Radiator capacity | Reserve tank capacity | Total |
|------------------------|-------------------|-----------------------|-------|
| 2.5 ℓ | 2.4 ℓ | 0.6 ℓ | 5.5 ℓ |

2-7 When to repair

It is difficult to judge when to perform periodic inspections, maintenance and repairs. Although the wearing rate of each component differs depending on the grade of daily inspection, the skill in machine operation, the working conditions, the quality of used lubricating oil, the frequency of oil replacement, the quality of land to be dug, the digging rate, the schedule for maintenance and repairs should be decided considering the state of engine, the indication of the hour meter, the degree of wear in each part, the state of hydraulic system, your experience and data.

2-7-1 Category of maintenance

| | |
|---|--|
| Prestart-up inspection | Execute every day before beginning operation |
| Maintenance after the first 25 service hours | Execute every 25 hours by the hour meter |
| Maintenance after the first 50 service hours | Execute once a week (every 50 hours by the hour meter) |
| Maintenance after the first 100 service hours | Execute every 100 hours by the hour meter |
| Maintenance after the first 250 service hours | Execute every 250 hours by the hour meter |
| Maintenance after the first 300 service hours | Execute every 300 hours by the hour meter |
| Maintenance after the first 500 service hours | Execute every 500 hours by the hour meter |
| Maintenance after the first 1,000 service hours | Execute every 1,000 hours by the hour meter |
| Maintenance after the first 2,000 service hours | Execute every 2,000 hours by the hour meter |

2-7-2 Maintenance procedure

| | Inspection and maintenance item | Inspection and maintenance interval (hours) | | | | | |
|----|--|---|---|--|--------------------------|--|-------------|
| | | 7 | 50 | 100 | 250 | 500 | 1,000 |
| 1 | Engine oil pan | Check oil level | Replace the engine oil (New machine only) | | Replace the engine oil | | Clean |
| | Engine oil filter | | Replace the cartridge (New machine only) | | Replace the cartridge | | |
| 2 | Fuel filter | | | Check and clean | | Replace the element | |
| 3 | Engine valve clearance | | Inspect and adjust (New machine only) | | | Inspect and adjust | |
| 4 | Fan belt | Check and adjust | | | | | |
| 5 | Fuel tank | Check oil level | Drain water and sediment, clean strainer | | | | |
| 6 | Radiator (sub-tank) | Check water level | | | | Replace and clean | |
| | Radiator fin | | Check and clean | | | | |
| 7 | Air cleaner | | | Check and clean | | Replace the element | |
| 8 | Hydraulic oil tank | Check oil level | | | Drain water and sediment | | Replace oil |
| 9 | Hydraulic line filter | | | Replace the cartridge (New machine only) | | Replace the cartridge | |
| 10 | Hydraulic suction filter | | | Clean the element (New machine only) | | Replace the element | |
| 11 | Bucket teeth and others | Inspect | | | | | |
| 12 | Slew bearing | | Inspect and grease | | | | |
| 13 | Inspect crawler tension (grease cylinder) and grease the crawler | Check and adjust | | | | | |
| 14 | Battery liquid amount and specific gravity | | Inspect, clean and supply distilled water | | | | |
| 15 | Inspect each body part for loosening and damage | Check and tighten | | | | | |
| 16 | Each lever and instrument | Inspect | | | | | |
| 17 | Lubricating oil of slew/travelling reduction gear | | | | | Replace oil (after the first 500 service hours only for a new machine) | Replace oil |
| 18 | Electrical wiring | Inspect | | | | | |
| 19 | Water and oil leakage in each body part | Inspect | | | | | |
| 20 | Inspect and grease attachment | Inspect attachment | | | | | |
| 21 | PTO filter element | | | | Replace the element | | |

2-7-3 Prestart inspections

(1)Prestart inspections

| | Item | Content | Remarks |
|----|---|---|--|
| 1 | Engine oil pan | Check oil level | Before starting operation |
| 2 | Fuel tank | Check fuel level | Check that the fuel level is above the center of level gauge. |
| 3 | Radiator | Check water level | Check that the amount of water in sub-tank is within a specified level. |
| 4 | Each oil/grease supply point | Oil and grease | Refer to page 2-6 |
| 5 | Inspect each body part for looseness and damage | Looseness, removal, water and oil leakage | Refer to tightening torque list. |
| 6 | Each lever and instrument | Operation check | Whether abnormal operation exists or not |
| 7 | Hydraulic oil tank | Check oil level | Add oil if its level falls below the specified level. (Be careful of the position of machine.) |
| 8 | Bucket teeth and others | Wear | Check whether the replacement of parts is necessary or not. |
| 9 | Electrical wiring | Looseness and tears | Loosened terminal, torn covering, etc. |
| 10 | Fan belt | Check and adjust | 10mm(0.4") to 12mm(0.5") sag at the center |

(2)Post operation inspections

| | Item | Content | Remarks |
|---|----------------|---|---|
| 1 | Each body part | Clean, check for water and oil leaks. Looseness, failure, etc. | Treatment of the part where cleaning was not sufficient such as dirt sticking to the body or muddy water remaining on the body. |
| 2 | Fuel tank | Fuel supply | Add fuel |
| 3 | Cooling water | Drain | Only when the danger of freezing exists |

Tightening torque list:

In the present inspection, always check for loosened bolts or nuts and correctly tighten them according to the following tightening torque list.

⬠N·m⬠ Tightening torque of the bolt and nut (Body)

| Material Size | 8.8 N·m | 10.9 N·m | 12.9 N·m |
|------------------|------------|-------------|-------------|
| M6 | 12.5 | 16 | 20 |
| M8 | 30 | 39 | 45 |
| M10 | 62 | 72 | 80 |
| M12 | 100 | 120 | 130 |
| M14 | 160 | 195 | 220 |
| M16 | 250 | 305 | 340 |

⬠N·m⬠ Tightening torque of the hydraulic pipings

PT screw

| Torque Size | N·m |
|----------------|-----|
| $\frac{1}{4}$ | 36 |
| $\frac{3}{8}$ | 55 |
| $\frac{1}{2}$ | 86 |
| $\frac{3}{4}$ | 130 |
| 1 | 195 |
| $1\frac{1}{4}$ | 300 |
| $1\frac{1}{2}$ | 400 |

PF screw

| Torque Size | N·m |
|----------------|---------|
| $\frac{1}{4}$ | 27-30 |
| $\frac{3}{8}$ | 47-52 |
| $\frac{1}{2}$ | 57-63 |
| $\frac{3}{4}$ | 108-120 |
| 1 | 126-140 |

2-7-4 Maintenance every 50 service hours

| | Item | Content | Remarks |
|----|------------------------------|-------------------------------|---|
| 1 | Engine oil pan | Replace engine oil and filter | Only for a new machine. After this, every 250 service hours |
| 3 | Engine valve clearance | Inspect and adjust | Only for a new machine. After this, every 500 service hours |
| 5 | Fuel tank | Drain sediment and water | Remove the drain plug on the lower part of the tank |
| | | Clean the strainer | Wash strainer with diesel fuel |
| | Radiator fin | Clean the fins | Dust sticking to the fin affects the cooling effect and causes overheating |
| 6 | Slew bearing | Inspect and grease | Always grease the machine after it is used in water |
| 12 | Battery | Liquid quantity | Whether the liquid level is proper or not. If short, add distilled water |
| 14 | Battery | Specific gravity | 1.26 when fully charged; 1.20 when discharged (Recharge the battery when 1.20.) |
| | | Clean | Clean each part, brush and connect terminal and apply grease |
| 20 | Each oil/grease supply point | Oil and grease | Refer to page 2-7 |

2-7-5 Maintenance every 100 service hours

| | Item | Content | Remarks |
|----|--------------------------|--|---|
| 2 | Fuel filter | Clean the element | After cleaning, open the cock to vent air |
| 7 | Air cleaner | Clean the dust cover, clean or replace the element | Check also for a loosened band |
| 9 | Hydraulic line filter | Replace the cartridge | Only for a new machine. After this, every 500 service hours |
| 10 | Hydraulic suction filter | Clean the element | Only for a new machine. After this, every 500 service hours |

2-7-6 Maintenance every 250 service hours

| | Item | Content | Remarks |
|----|--|--------------------------|--|
| 1 | Engine oil | Replace the engine oil | Remove the drain plug on the lower part of the tank. (After 50 service hours for a new machine) |
| | Engine oil filter | Replace the cartridge | After 50 service hours for a new machine |
| 8 | Hydraulic oil tank | Drain water and sediment | After air is vent, loosen the drain plug |
| 17 | Lubricating oil of slew and travelling reduction gears | Replace lubricating oil | Replace oil after the first 200 service hours. Every 1,000 service hours after this (Refer to Table of Oil/Grease Supply Points) |

2-7-7 Maintenance every 500 service hours

| | Item | Content | Remarks |
|----|--------------------------|--|--|
| 2 | Fuel filter | Replace the element | Clean the inside of bowl |
| 3 | Engine valve clearance | Check valve clearance | Clearance between the valve and the rocker |
| 6 | Radiator | Replace cooling water and clean the radiator | Remove the drain plug, clean the radiator and add water to the sub-tank up to the specified level. |
| 7 | Air cleaner | Replace the element | |
| 9 | Hydraulic line filter | Replace the cartridge | After 100 service hours for a new machine |
| 10 | Hydraulic suction filter | Clean the element | |

2-7-8 Maintenance every 1,000 service hours

| | Item | Content | Remarks |
|----|--|--|--|
| 1 | Engine oil pan | Clean engine oil pan | |
| 8 | Hydraulic oil tank | Replace the hydraulic oil and clean the oil tank | Clean the inside of the tank |
| 12 | Lubricating oil of slew and travelling reduction gears | Replace the lubricating oil | Refer to Table of Oil/Grease Supply Points. (For new machine, every 200 service hours) |

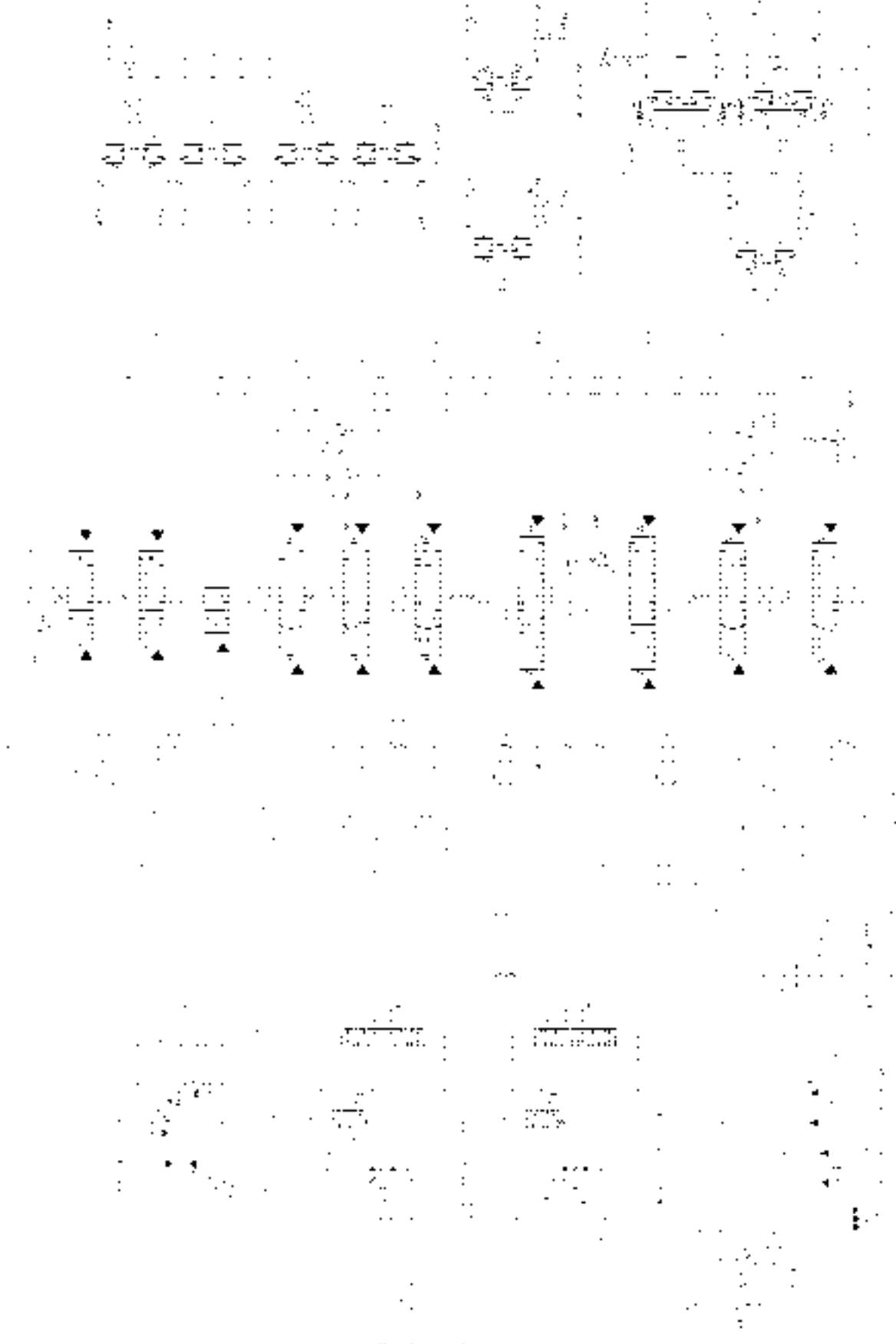
2-7-9 Maintenance every 2,000 service hours

| | Item | Content | Remarks |
|----|--------------|---------|---------|
| 15 | Track roller | Replace | |

Table of Oil/Grease Supply Points

| No. | Oil/Grease Supply Point | Specified oil (genuine part) | Quantity | Time |
|-----|-------------------------|--------------------------------------|----------|---|
| 1 | Travel motor | API Classification CD Class SAE30 | 600 cc | Every 1,000 service hours (At first, replace after the first 500 service hours) |
| 2 | Track roller | | 100 cc | Every 2,000 hours |
| 3 | Front idler | | 80 cc | Every 2,000 hours |

2-8 Hydraulic circuit diagram



| Item | Robex 28-7 |
|-----------------|---------------------|
| Boom cylinder | ø75×ø40×564 st |
| Arm cylinder | ø75×ø40×510 st |
| Bucket cylinder | ø70×ø45×417 st |
| Swing cylinder | ø65×ø40×627 st |
| Dozer cylinder | ø75×ø40×125 st |
| Slew motor | PCR-1B-05A-P-8446Z1 |
| Travel motor | PHV-250-37-1-8761A |

| | Item | Robex 28-7 | |
|----------------|-----------------|--------------------------------|----------|
| Pump capacity | P1 | 16.0 cc/rev | |
| | P2 | 16.0 cc/rev | |
| | P3 | 10.5 cc/rev | |
| Pressure | Main relief | P1 | 20.6 MPa |
| | | P2 | 20.6 MPa |
| | | P3 | 17.2 MPa |
| | Port relief | | 23.5 MPa |
| | Unload (pump) | | 2.9 MPa |
| | Slew | | 13.2 MPa |
| Pump flow rate | Q1 | 33.6 ℓ/min | |
| | Q2 | 33.6 ℓ/min | |
| | Q3 | 22.1 ℓ/min | |
| Engine | Type | S3L2 | |
| | Constant output | 17.7 kW (24.1 ps) | |
| | Speed | 2,100 min ⁻¹ | |
| | Torque | 85 N·m/1,800 min ⁻¹ | |

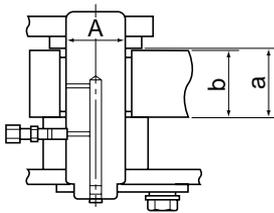
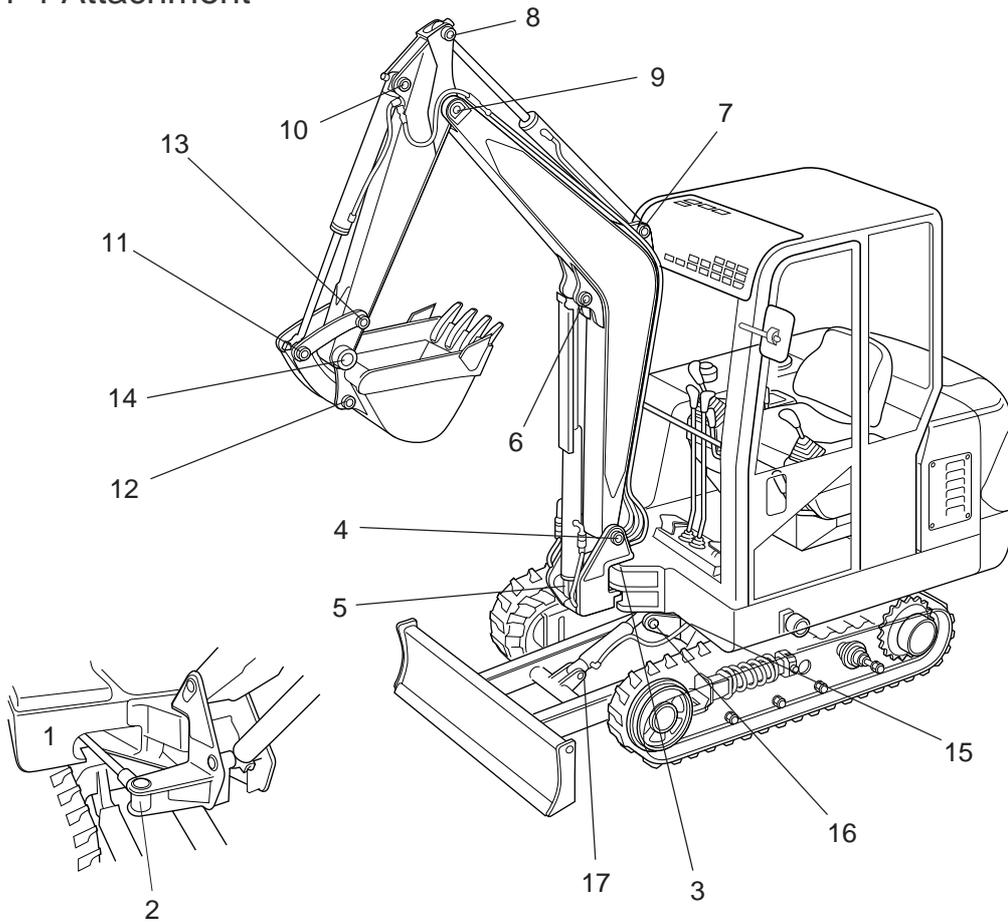
3 ATTACHMENT

CONTENTS

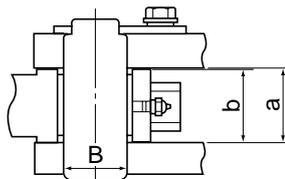
- 3-1 Standard of maintenance
 - 3-1-1 Attachment
- 3-2 Inspection and adjustment
 - 3-2-1 Measuring the fall of the attachment of its own weight
 - 3-2-2 Measuring the speed of the attachment cylinder

3-1 Standard of maintenance

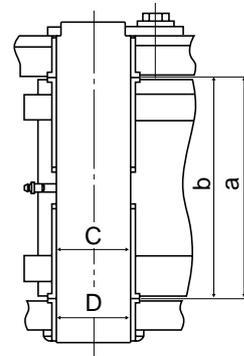
3-1-1 Attachment



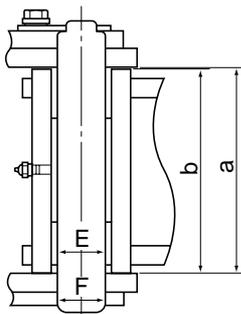
1. Swing cylinder head



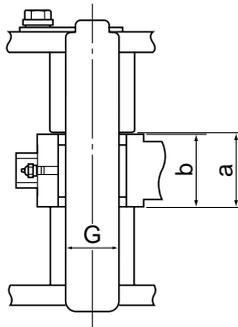
2. Swing cylinder rod



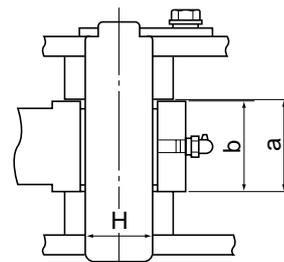
3. Swing post bracket and swing post



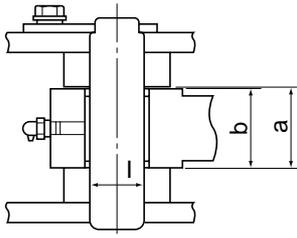
4. Boom joint



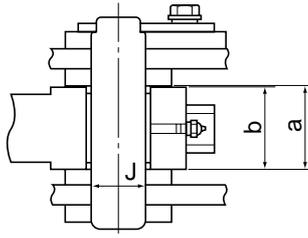
5. Boom cylinder head



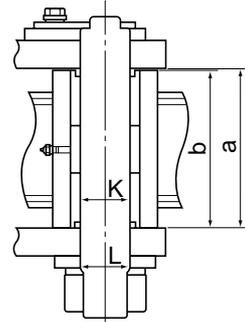
6. Boom cylinder rod



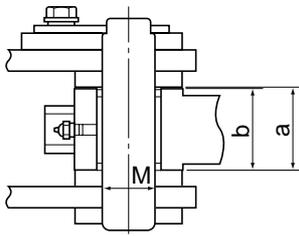
7. Arm cylinder head



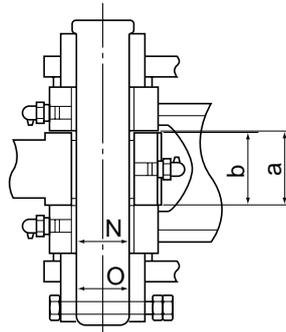
8. Arm cylinder rod



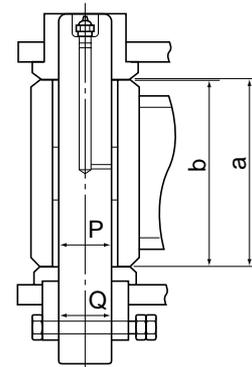
9. Boom/arm joint



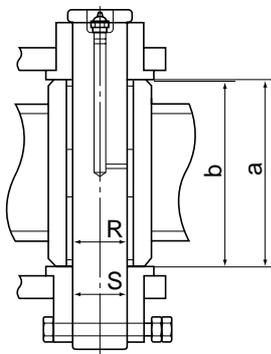
10. Bucket cylinder head



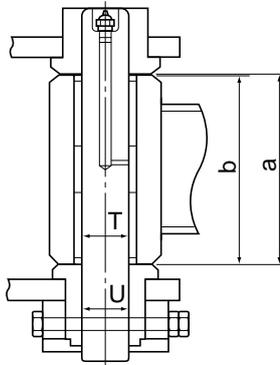
11. Bucket cylinder rod



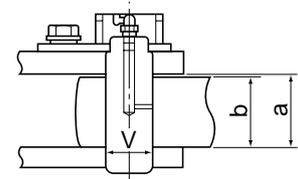
12. Bucket/dump link joint



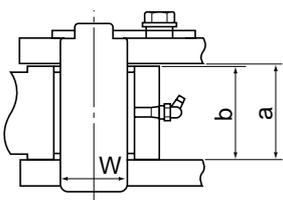
13. Arm/bucket link joint



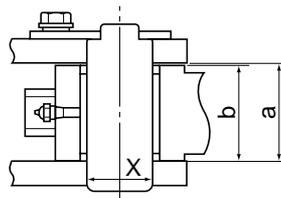
14. Arm/bucket joint



15. Dozer joint



16. Dozer cylinder rod



17. Dozer cylinder head

Unit: mm(in)

| No. | Item | Basic Dimension | Allowable Clearance |
|-----|--|-----------------|---------------------|
| A | Swing cylinder head pin and head bracket | ø34.7(1.37") | 1.0(0.04") |
| B | Swing cylinder head pin and the boss of head bracket | ø35(1.4") | 1.0(0.04") |
| C | Swing cylinder rod pin and swing post | ø35(1.4") | 1.0(0.04") |
| D | Swing post pin and bush | ø60(2.4") | 1.0(0.04") |
| E | Swing post pin and swing post bracket | ø60(2.4") | 1.0(0.04") |
| F | Boom joint pin and bush | ø40(1.6") | 1.0(0.04") |
| G | Boom joint pin and swing post | ø40(1.6") | 1.0(0.04") |
| H | Boom cylinder head pin and swing post | ø40(1.6") | 1.0(0.04") |
| I | Boom cylinder rod pin and boom | ø40(1.6") | 1.0(0.04") |
| J | Arm cylinder head pin and boom | ø35(1.4") | 1.0(0.04") |
| K | Arm cylinder rod pin and arm | ø35(1.4") | 1.0(0.04") |
| L | Boom/ arm joint pin and bush | ø35(1.4") | 1.0(0.04") |
| M | Boom/ arm joint pin and boom | ø35(1.4") | 1.0(0.04") |
| N | Bucket cylinder head pin and arm | ø35(1.4") | 1.0(0.04") |
| O | Bucket cylinder rod pin and dump link | ø35(1.4") | 1.0(0.04") |
| P | Bucket cylinder rod pin and bucket link | ø35(1.4") | 1.0(0.04") |
| Q | Bucket pin and bush | ø35(1.4") | 1.0(0.04") |
| R | Bucket pin and bucket | ø35(1.4") | 1.0(0.04") |
| S | Bucket link pin and bush | ø35(1.4") | 1.0(0.04") |
| T | Bucket link pin and bucket link | ø35(1.4") | 1.0(0.04") |
| U | Dozer joint pin and frame | ø35(1.4") | 1.0(0.04") |
| V | Dozer cylinder head pin and dozer | ø35(1.4") | 1.0(0.04") |
| W | Dozer cylinder rod pin and frame | ø35(1.4") | 1.0(0.04") |

Unit: mm(in)

| No. | Item | Criterion | | | Spacer | |
|-----|---|--------------|-------------|----------------------|--------------------------|----------------------|
| | | a | b | Standard clearance | Part Number | Dimension |
| 1 | Clearance between swing cylinder head and swing post | 53(2.1") | 50(2.0") | 2.0~3.5(0.08"~0.14") | NBU3-00020 NBU3-00021 | ø36×t0.5 ø36×t1.0 |
| 2 | Clearance between swing cylinder rod and head bracket | 51(2.0") | 50(2.0") | 0.5~2.0(0.02"~0.08") | ∕ | ∕ |
| 3 | Clearance between swing post and frame | 215(8.46") | 213(8.39") | 2.0~3.3(0.08"~0.13") | ∕ | ∕ |
| 4 | Clearance between boom and swing post | 173.5(6.8") | 172.5(6.8") | 1.0~3.5(0.04"~0.14") | MBU3-00022 MBU3-00023 | ø41×t0.5 ø41×t1.0 |
| 5 | Clearance between boom cylinder head and swing post | 51(2.0") | 50(2.0") | 1.0~2.5(0.04"~0.10") | MBU3-00020 MBU3-00021 | ø36×t0.5 ø36×t1.0 |
| 6 | Clearance between boom cylinder rod and boom | 51(2.0") | 50(2.0") | 1.0~2.5(0.04"~0.10") | ∕ | ∕ |
| 7 | Clearance between arm cylinder head and boom | 51(2.0") | 50(2.0") | 1.0~2.5(0.04"~0.10") | ∕ | ∕ |
| 8 | Clearance between arm cylinder rod and arm | 51(2.0") | 50(2.0") | 1.0~2.5(0.04"~0.10") | ∕ | ∕ |
| 9 | Clearance between boom and arm | 130.5(5.14") | 129(5.07") | 1.5~3.0(0.06"~0.12") | ∕ | ∕ |
| 10 | Clearance between bucket cylinder head and arm | 51(2.0") | 50(2.0") | 1.0~2.5(0.04"~0.10") | ∕ | ∕ |
| 11 | Clearance between bucket cylinder rod and dump link | 51(2.0") | 50(2.0") | 1.0~2.5(0.04"~0.10") | ∕ | ∕ |
| 12 | Clearance between dump link and bracket | 135(5.3") | 134.5(5.3") | 0.5~1.0(0.02"~0.04") | ∕ | ∕ |
| 13 | Clearance between arm and bucket link | 135(5.3") | 134.5(5.3") | 0.5~1.0(0.02"~0.04") | ∕ | ∕ |
| 14 | Clearance between arm and bucket | 135.5(5.3") | 134.5(5.3") | 1.0~1.5(0.04"~0.06") | ∕ | ∕ |
| 15 | Clearance between dozer and frame | 32(2.1") | 30(2.0") | 1.5~4.0(0.06"~0.16") | ∕ | ∕ |
| 16 | Clearance between dozer cylinder rod and frame | 51(2.0") | 50(2.0") | 1.0~2.0(0.04"~0.08") | ∕ | ∕ |
| 17 | Clearance between dozer cylinder head and dozer | 51(2.0") | 50(2.0") | 1.0~2.0(0.04"~0.08") | ∕ | ∕ |

3-2 Inspection and adjustment

3-2-1 Measuring the natural fall of the attachment

1. Measuring the location of the attachment

Set the temperature of the hydraulic oil to $50\pm 5^{\circ}\text{C}$. Adjust the height of arm/bucket joint so that it equals that of the boom joint. Then, retract the dozer cylinder to the minimum length and stop the engine.

2. Measurement

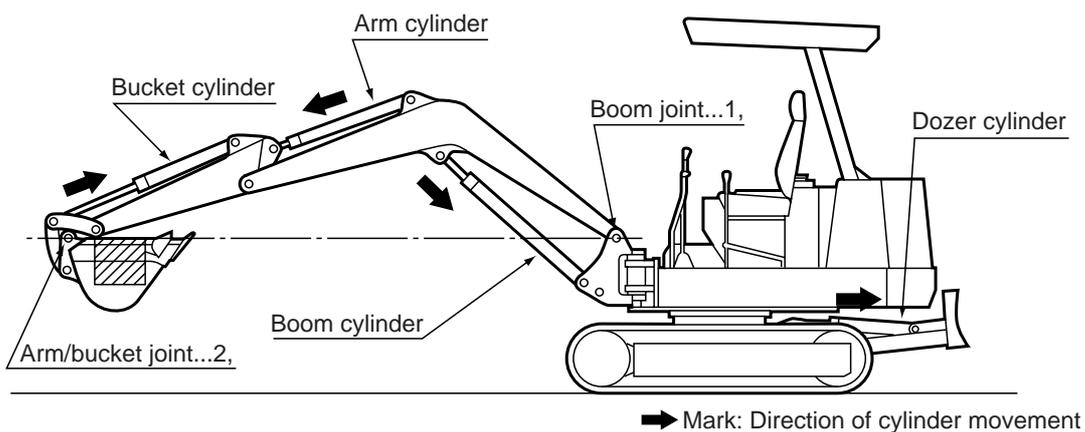
Draw a reference line on the cylinder head with a Magic Marker and measure the length from the line to the cylinder tube. Measure the length again 3 minutes later. Then record the difference in the length

Unit: mm (or less)

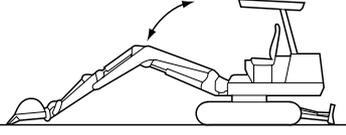
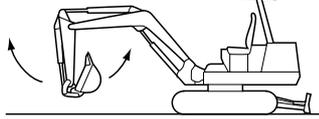
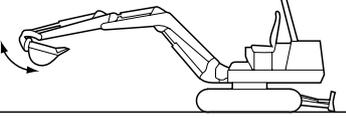
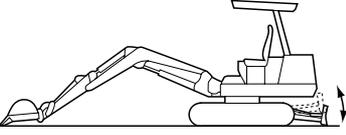
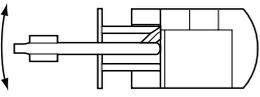
| Cylinder name | Standard value | Allowance |
|-----------------|----------------|-----------|
| Boom cylinder | 13 | 26 |
| Arm cylinder | 13 | 26 |
| Bucket cylinder | 8 | 16 |
| Dozer cylinder | 7 | 14 |

Make 1 and 2 the same height.

| | |
|-----------|---------------|
| W: Weight | About: 110 kg |
|-----------|---------------|



3-2-2 Measuring the speed of attachment cylinder
(at full engine speed and oil temperature $50\pm 5^{\circ}\text{C}$)

| Condition | Machine position | Unit | New standard value | Allowable limit |
|--|---|-------------|--------------------|-----------------|
| Boom Make bucket teeth touch the ground |  | Up | 2.8 ± 0.5 | 3.6 |
| Extend cylinder to the Maximum length | | Down | 2.7 ± 0.5 | 3.5 |
| Arm Retract cylinder to the minimum length |  | Dig | 3.1 ± 0.6 | 3.8 |
| Extend cylinder to the maximum length | | Dump | 3.0 ± 0.5 | 3.9 |
| Bucket Retract cylinder to the minimum length |  | Dig | 3.0 ± 0.5 | 3.9 |
| Extend cylinder to the maximum length | | Dump | 2.0 ± 0.4 | 2.8 |
| Dozer Make dozer contact the ground |  | Up | 1.2 ± 0.3 | 1.7 |
| Lift dozer to the maximum height | | Down | 0.9 ± 0.3 | 1.2 |
| Swing Retract cylinder to the minimum length |  | Right swing | 6.7 ± 0.5 | 8.7 |
| Extend cylinder to the maximum ground | | Left swing | 6.5 ± 0.6 | 8.5 |

4 ENGINE

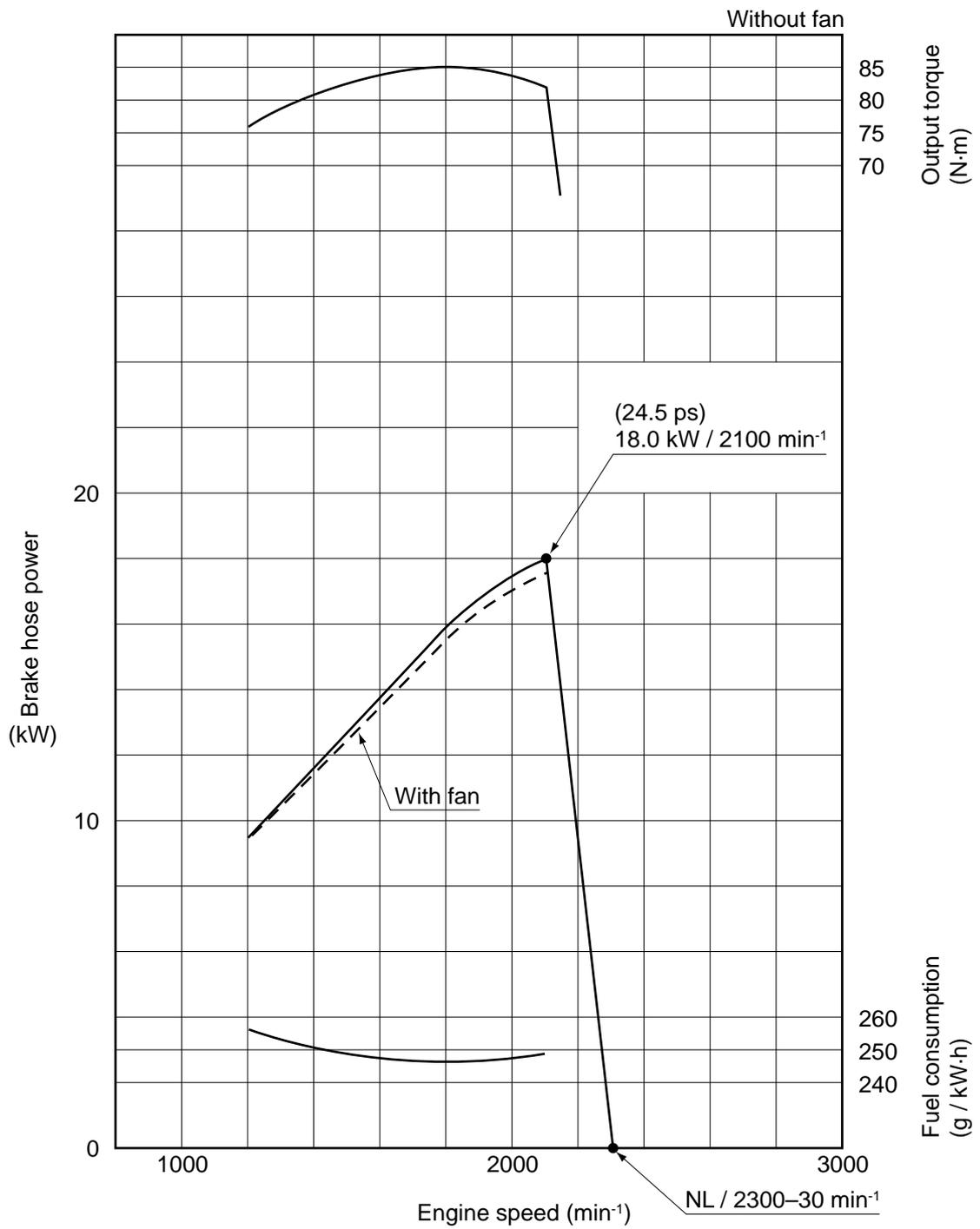
CONTENTS

- 4-1 Specification
- 4-2 Performance curve
- 4-3 Location of serial number
 - 4-3-1 Engine
 - 4-3-2 Standard engine speed
- 4-4 Inspection and maintenance procedures for engine parts

4-1 Specification

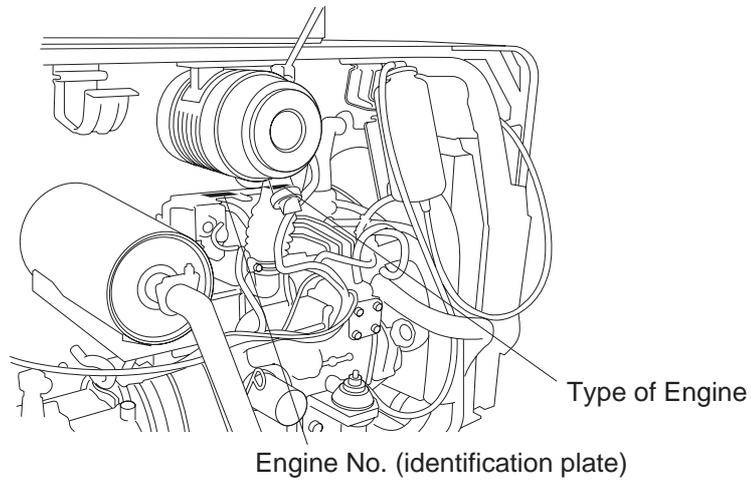
| | | |
|-----------------------------------|----------------------|---|
| Engine | | S3L2 |
| Type | | In-line 3 cylinder 4cycle overhead valve type |
| Number of cylinders–bore × stroke | | 3–78 mm × 92 mm |
| Displacement | | 1,318 cc |
| Ignition order | | 1–3–2 |
| Dimensions | Overall length | 556 mm |
| | Overall width | 440 mm |
| | Overall height | 615 mm |
| Performance | Rated output | 17.7 kW(24.1) / 2,100 min ⁻¹ |
| | Maximum torque | 85 N·m / 1,800 min ⁻¹ |
| | Maximum idling speed | 2,300 ± 30 min ⁻¹ |
| | Minimum idling speed | 1,200 ± 30 min ⁻¹ |
| | Fuel consumption | 247 g / kW.h |
| Dry weight | | 135 kg |
| Fuel oil | | Diesel fuel |
| Fuel pump | | Bosh type |
| Governor | | Centrifugal type |
| Generator | | 12V × 50A |
| Starter | | 12V × 1.7 kW |
| Battery | | 12V × 50 AH |

4-2 Performance curve



4-3 Location of serial number

4-3-1 Engine



4-3-2 Standard engine speed (at new machine delivery)

| Conditions | Idling speed |
|------------------------------|---------------------------------|
| Maximum idling speed | $2,300 \pm 30 \text{ min}^{-1}$ |
| Speed when 1P relief is used | $2,230 \pm 70 \text{ min}^{-1}$ |
| Speed when 2P relief is used | $2,200 \pm 70 \text{ min}^{-1}$ |

4-4 Inspection and maintenance procedure for engine parts

Inspecting and Adjusting Valve Clearance

NOTE

Make an adjustment to the valve clearance when the engine is cold.

- (1) Slightly loosen the cylinder head bolts and retighten them to the specified torque in number sequence.

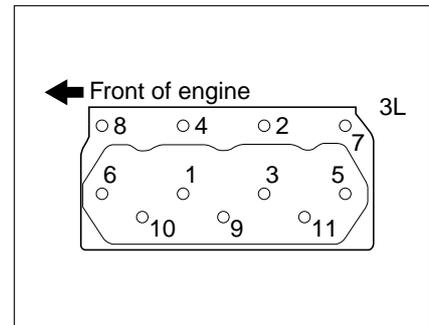
| | |
|-------------------|---|
| Tightening torque | $9 \pm 0.5 \text{ kgf}\cdot\text{m}$ ($88 \pm 5 \text{ N}\cdot\text{m}$) |
|-------------------|---|

- (2) Find top dead center compression position for No.1 piston by using the procedure that follows:
- Turn the crankshaft until TDC mark on the crankshaft pulley is aligned with the mark on the timing gear case.
 - With No.1 piston at top dead center on the compression stroke, the rocker arms will not be moved when the crankshaft is turned approximately 20° in both directions.
 - With No.1 piston at top dead center on the compression stroke, the rocker arms will not be moved when the crankshaft is turned approximately 20° in both directions.

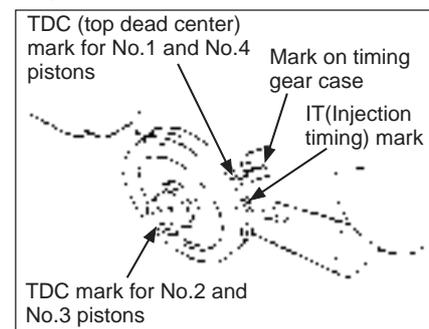
- (3) Loosen the lock nut for the adjusting screw. With a feeler gauge inserted between the rocker arm and valve cap, adjust the valve clearance by turning the adjusting screw.

Unit: mm(in.)

| Item | Standard |
|---|--------------|
| Valve clearance (both inlet and exhaust valves) | 0.25(0.0098) |



Cylinder head bolt tightening sequence



Timing mark

- (4) Hold the adjusting screw and tighten the lock nut.
- (5) After the valve clearance of the valves for No.1 cylinder has been adjusted, turn the crankshaft 180° in the direction of engine rotation and adjust the valve clearance on the valves for the remainder of the cylinders in firing order (injection sequence).

| Firing order (injection sequence) | | Crankshaft rotation angle |
|-----------------------------------|-------|---------------------------|
| S3L | 1-3-2 | 240° |



Adjusting valve clearance

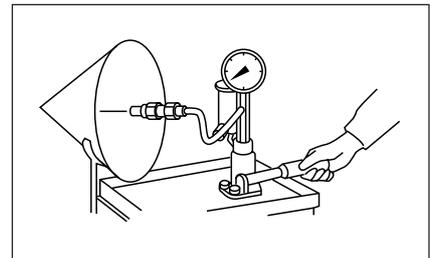
▲ CAUTION

After the valve clearance on the valves for all cylinders has been adjusted, turn the crankshaft two or three times and make sure the valve clearance is correct.

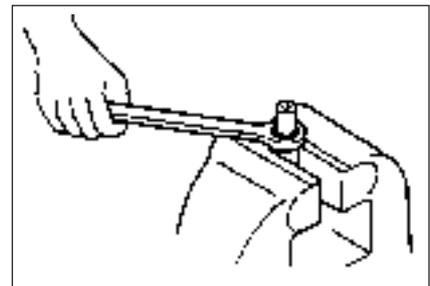
Inspecting and Adjusting Injection Nozzles

1. Inspection

- (1) Injection pressure (valve opening pressure test)
 - (a) Install the injection nozzle on the tester. Slowly operate the tester handle to bleed (remove) air from the tester.
 - (b) Operate the tester handle at a speed of one stroke per second to make a slow increase in pressure until the valve in the injection nozzle starts to open. Read the maximum gauge pressure at the instant fluid flows from the tip.
 - (c) If the injection pressure is incorrect, disassemble the nozzle and change the thickness of the washer.



Fuel injection nozzle ready for test



Removing tip from injection nozzle

| | |
|---|--|
| Injection pressure (valve opening pressure) Standard | 140_0^{+5} kgf/cm ² (1991_0^{+71} psi) [13729_0^{+490} kPa] |
|---|--|

NOTE

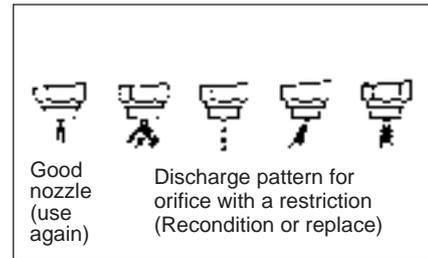
An increase or decrease of washer thickness by 0.1 mm(0.004 in.) will vary the injection pressure by 10kgf/cm² (142 psi)[981 kPa]. 10 kinds of washer are available in thickness from 1.25 mm(0.049 2 in.) to 1.70 mm(0.066 9 in.) in increments of 0.05 mm (0.002 0 in.)

▲ WARNING

When the injection nozzles are tested, be sure to wear eye protection. Fuel comes from the orifices in the nozzle tip with high pressure. The fuel can pierce (go through) the skin and cause serious injury to the operator. Keep the tip of the nozzle pointed away from the operator and into the fuel collector.

(2) Orifice restriction test

- (a) Look at the orifice discharge pattern (shape of discharge) when fluid begins to flow through the injection nozzle. The discharge must be straight. Any change is an indication of a bad nozzle.
- (b) Operate the tester handle at a speed of one stroke per second to make sure the discharge is straight.



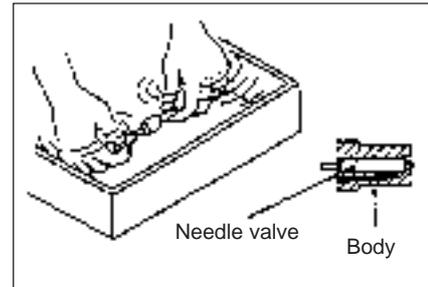
Orifice restriction test

(3) Nozzle tip washing and replacement

- (a) Loosen the retaining nut and remove the tip from the injection nozzle. Wash the needle valve and body in clean diesel fuel. After washing, put the needle valve in the body in clean diesel fuel.

CAUTION

Don not hit the tip when removing it from the injection nozzle.



Washing nozzle tip

NOTE

Keep the needle valves with their respective bodies. Do not use needle valves or bodies with other bodies or needle valves.

- (b) After cleaning the tip, install it in the nozzle and tighten the retaining nut to the specified torque.

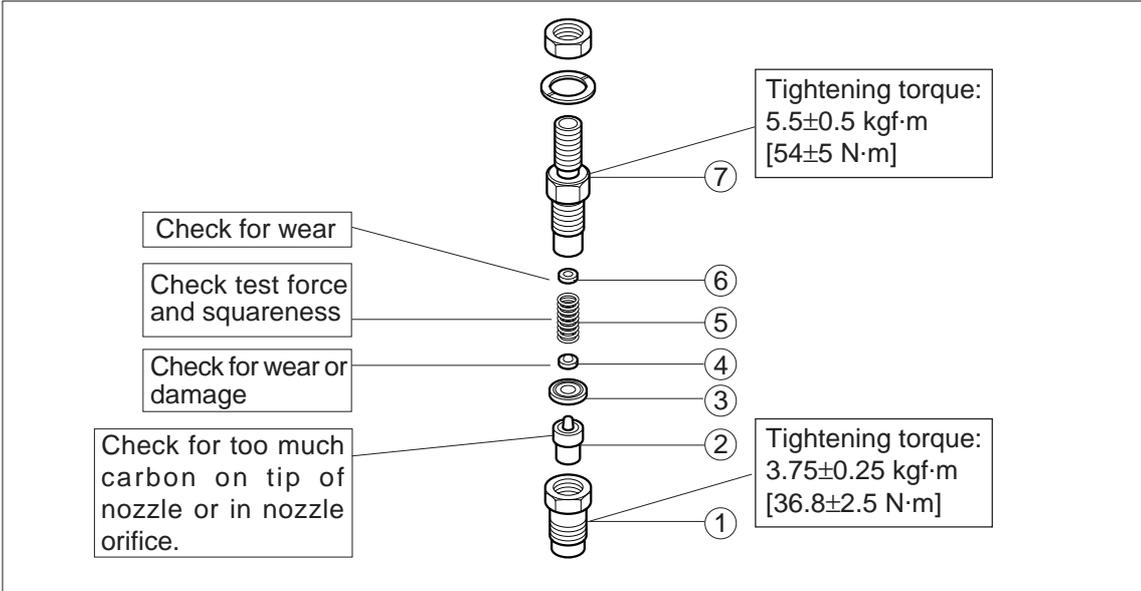
| | |
|-------------------|---|
| Tightening torque | $3.75 \pm 0.25 \text{ kgf}\cdot\text{m}$ $(36.8 \pm 2.5 \text{ N}\cdot\text{m})$ |
|-------------------|---|

- (c) If the injection nozzle is still bad after the tip has been washed, replace the tip.

NOTE

- a) Do not touch the sliding surface of the needle valve.
- b) When installing the new nozzle tip, remove synthetic resin film from the tip and slide the needle valve in the body in clean diesel fuel to wash off inhibitor completely.

Disassembly



Disassembly sequence and inspection points

- ① Retaining nut
- ② Nozzle tip asse
- ③ Piece
- ④ Pin
- ⑤ Spring
- ⑥ Washer
- ⑦ Body

Measuring Compression Pressure

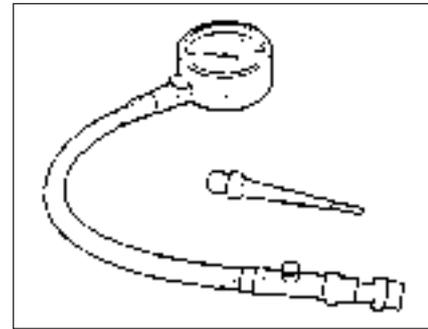
1. Inspection

Check to make sure—

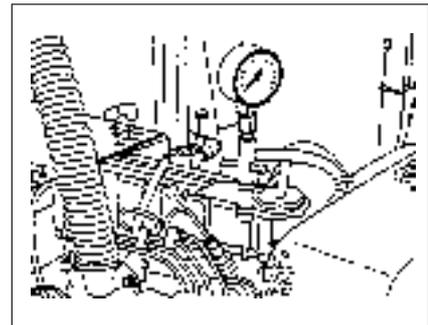
- (1) The crankcase oil level is correct. and the air cleaner, starter and battery are all in normal condition.
- (2) The engine is at the normal operating temperature.

2. Measurement

- (1) Move the control lever to a position for shutting off fuel supply.
- (2) Remove all glow plugs from the engine. Install the compression gauge and adapter(ST332270) combination to a cylinder on which the compression pressure is to be measured.
- (3) Turn the engine with the starter and read the gauge pressure at the instant the gauge pointer comes to stop.
- (4) If the gauge reading is below the limit, overhaul the engine.



Compression gauge and adapter



Measuring compression pressure

▲ CAUTION

- (a) Be sure to measure the compression pressure on all cylinders.
- (b) The compression pressure varies with change of engine rpm. This makes it necessary to check engine rpm at the time of measuring the compression pressure.

| Item | Standard | | Limit |
|---|----------------------|-----------------------|-----------------------|
| Engine speed, rpm | 290 | | — |
| Compression pressure kgf/cm ² (psi)[kPa] | SL | 30 (427) [2942] | 30 (427) [2942] |
| | SL2 | 32 (455) [3138] | 32 (455) [3138] |
| Maximum permissible difference between average compression pressure of all cylinders in the engine. kgf/cm ² (psi)[kPa] | 3 (42.7) [294] | | — |

▲ CAUTION

- (a) It is important to measure the compression pressure at regular intervals to obtain the data on the gradual change of the compression pressure.
- (b) The compression pressure would be slightly higher than the standard in a new or overhauled engine owing to breaking-in of the piston rings, valve seats, etc. It drops as the engine components wear down.

| Bolt or nut | Thread, mm | | | | Torque, kgf·m(lb·ft)[N·m] |
|--|------------|-------|--------------------|--------------|-------------------------------|
| | Diameter | Pitch | Width across flats | Clamp length | |
| Cylinder head bolt | M10 | 1.25 | 14 | 87 | 9±0.5(65±4)[88±5] |
| Rocker cover bolt | M8 | 1.25 | 12 | 40 | 1.15±0.15(8.3±1.1)[11.3±1.5] |
| Rocker shaft bracket bolt | M8 | 1.25 | 12 | 58 | 1.5±0.15(8.3±1.1)[11.3±1.5] |
| Thermoswitch | M16 | 1.5 | 17 | 31.5 | 2.3±0.4(16.6±3)[22.6±4] |
| Crankshaft pulley nut | M18 | 1.5 | 27 | — | 17.5±2.5(127±18)[172±25] |
| Main bearing cap bolt | M10 | 1.25 | 17 | 81 | 5.25±0.25(38±2)[51.5±2.5] |
| Connecting rod cap nut | M9 | 1.0 | 14 | — | 3.55±0.25(25.7±2)[34.8±2.5] |
| Rear plate bolt (for tractor engine) | M12 | 1.25 | 17 | 28 | 9.5±1(69±7)[93±10] |
| Rear plate bolt(standard) | M12 | 1.25 | 17 | 28 | 6.5±1(47±7)[64±10] |
| Rear plate bolt(stamping) | M8 | 1.25 | 12 | 16 | 1.15±0.15(8.3±1.1)[11.3±1.5] |
| Flywheel bolt | M12 | 1.25 | 19 | 29 | 13.5±0.5(98±4)[132±5] |
| Oil pan bolt (for tractor engine) | M8 | 1.25 | 12 | 25 | 2.8±0.3(20.3±2.2)[27.5±3] |
| Oil pan drain plug | M14 | 1.5 | 22 | 10 | 4±0.5(29±4)[39±5] |
| Pressure relief valve | M22 | 1.5 | 22 | 33 | 5±0.5(36±4)[49±5] |
| Oil filter | M20 | 1.5 | — | — | 1.2±0.1(8.7±0.7)[12±1] |
| Oil pressure switch | PT1/8 | — | 26 | 11 | 1±0.2(7.2±1.4)[10±2] |
| Fuel injection pipe nut | M12 | 1.5 | — | — | 3±0.5(22±4)[29±5] |
| Fuel leakoff pipe nut | M12 | 1.5 | 18 | — | 2.75±0.25(20±2)[27±2.5] |
| Delivery valve holder | — | — | 19 | — | 4.5±0.5(32.5±4)[44±5] |
| Fuel injection nozzle holder | M20 | 1.5 | 21 | — | 5.5±0.5(40±4)[54±5] |
| Retaining nut for delivery valve holder body | M16 | 0.75 | 19 | — | 3.75±0.25(27±2)[37±2.5] |
| Sliding sleeve shaft | M10 | 1.25 | 14 | 29.5 | 3.6±0.6(26±4)[35±6] |
| Special nut for torque spring set | M12 | 1.0 | 17 | — | 2±0.5(14±4)[20±5] |
| Glow plug | M10 | 1.25 | 12 | 60 | 1.75±0.25(12.7±2)[17.2±2.5] |
| Glow plug connection plate | M4 | 0.7 | 8 | — | 0.125±0.025(0.9±0.2)[1.2±0.2] |
| Stop solenoid nut | M30 | 1.5 | 36 | — | 4.5±0.5(32.5±4)[44±5] |
| Starter B terminal | M8 | 1.25 | 12 | — | 1.1±0.1(8±0.7)[10.8±1] |

Tightening Torques for Standard Bolts and Nuts

Unit:N-m{kgf-m}(lbf-ft)

| Bolt Size | 4T | 7T |
|-----------|-------------------------------|-------------------------------|
| M6 | — | 7.85-9.80{0.8-1.0}(5.8-7.2) |
| M8 | 9.80-12.7{1.0-1.3}(7.2-9.4) | 14.7-21.6{1.5-2.2}(10.8-15.9) |
| M10 | 17.7-24.5{1.8-2.5}(13.0-18.1) | 29.4-41.2{3.0-4.2}(21.7-30.4) |
| M12 | 9.4-41.2{3.0-4.2}(21.7-30.4) | 53.9-73.5{5.5-7.5}(39.8-54.2) |

Note:

- a. The table above applies only to standardized bolts and nuts.
All torques shown assume use of spring washer together with bolts and nuts.
All bolts and nuts appearing in this manual should be tightened according to this table unless otherwise indicated.
- d. Standard bolts and nuts should be tightened in "dry" condition, without lubricating threads with oils.

Tightening Torques for Standard Eye Bolts(for Dry Condition)

| Nominal Diaerer x Thread Pitch mm | Width Across Flars mm(in) | Torque | | |
|--------------------------------------|------------------------------|--------------------|----------|------------|
| | | Strength Class: 4r | | |
| | | N-m | kgf-m | lbf-ft |
| M8x1.25 | 12(0.47) | 8±1 | 8±0.1 | 5.8±0.7 |
| M10x1.25 | 14(0.55) | 15±2 | 15±0.2 | 15±1.4 |
| M12x1.25 | 17(0.67) | 25±3 | 25±0.3 | 18.0±2.2 |
| M14x1.5 | 22(0.87) | 34±4 | 35±0.4 | 25.3±2.9 |
| M16x1.5 | 24(0.94) | 44±5 | 4.5±0.5 | 32.5±3.6 |
| M18x1.5 | 27(1.06) | 74±5 | 75±0.5 | 54.2±3.6 |
| M20x1.5 | 30(1.18) | 98±10 | 10.0±10 | 72.3±7.2 |
| M24x1.5 | 36(1.42) | 147±15 | 15.0±1.5 | 108.5±10.8 |
| M27x1.5 | 42(1.61) | 226±20 | 23.0±2.0 | 166.3±14.5 |

Tightening Torques for Standard Union Nuts(for Dry Condition)

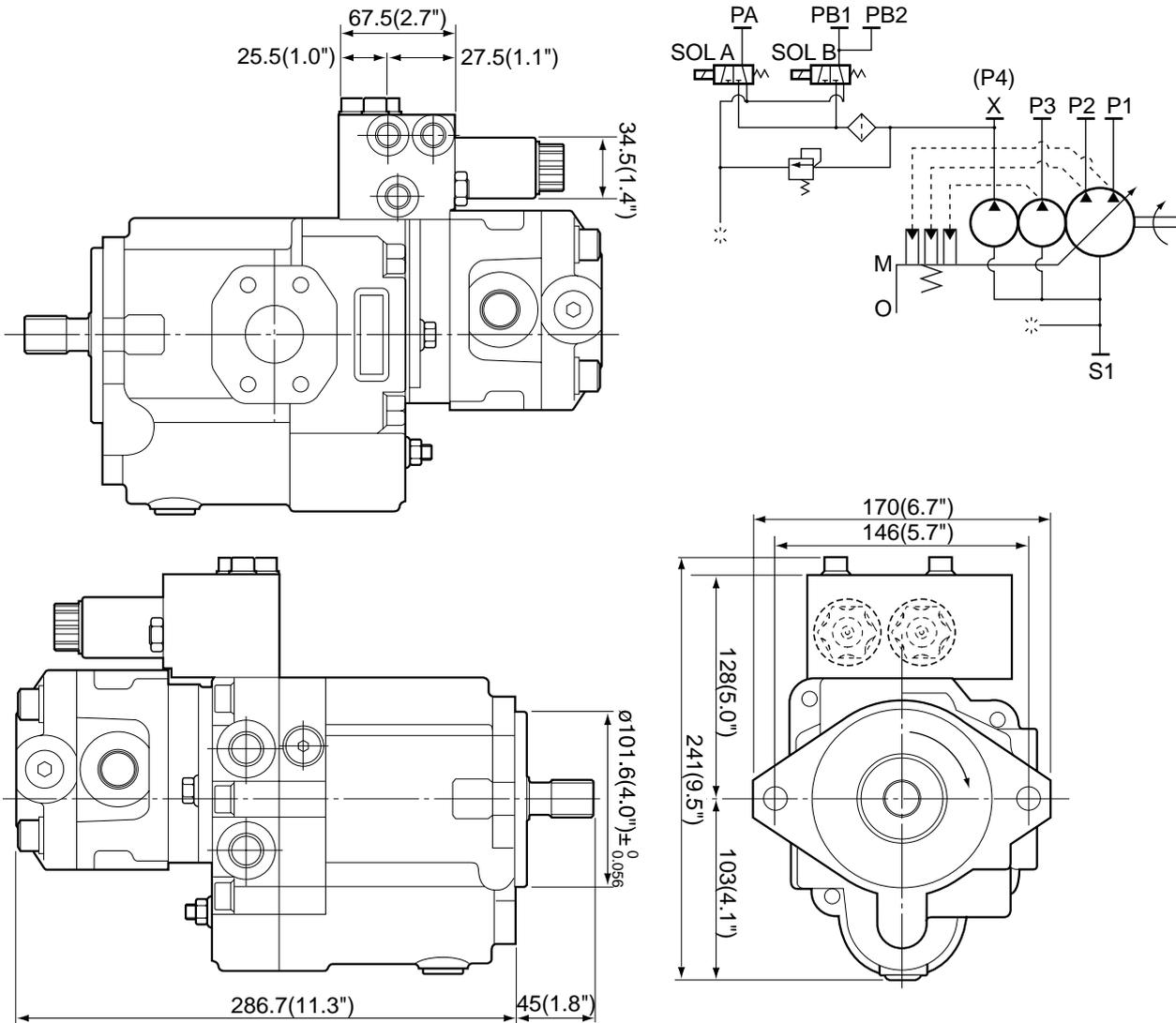
| Nominal Diameter | Internal Nominal Diameter x Thread Pitch | Width Across Flars mm(in) | N-m | kgf-m | lbf-ft |
|------------------|--|------------------------------|-----|-------|--------|
| 63 | M14x1.5 | 19(0.7) | 39 | 4 | 29 |
| 80 | M16x1.5 | 22(0.9) | 49 | 5 | 36 |
| 100 | M20x1.5 | 27(1.1) | 78 | 8 | 58 |
| 120 | M22x1.5 | 30(1.2) | 98 | 10 | 72 |
| 150 | M27x1.5 | 32(1.3) | 157 | 16 | 116 |
| 180 | M30x1.5 | 36(1.4) | 196 | 20 | 145 |
| 200 | M30x1.5 | 36(1.4) | 196 | 20 | 145 |
| 220 | M33x1.5 | 41(1.6) | 245 | 25 | 181 |
| 254 | M36x1.5 | 41(1.6) | 294 | 30 | 217 |

5 MAIN PUMP

CONTENTS

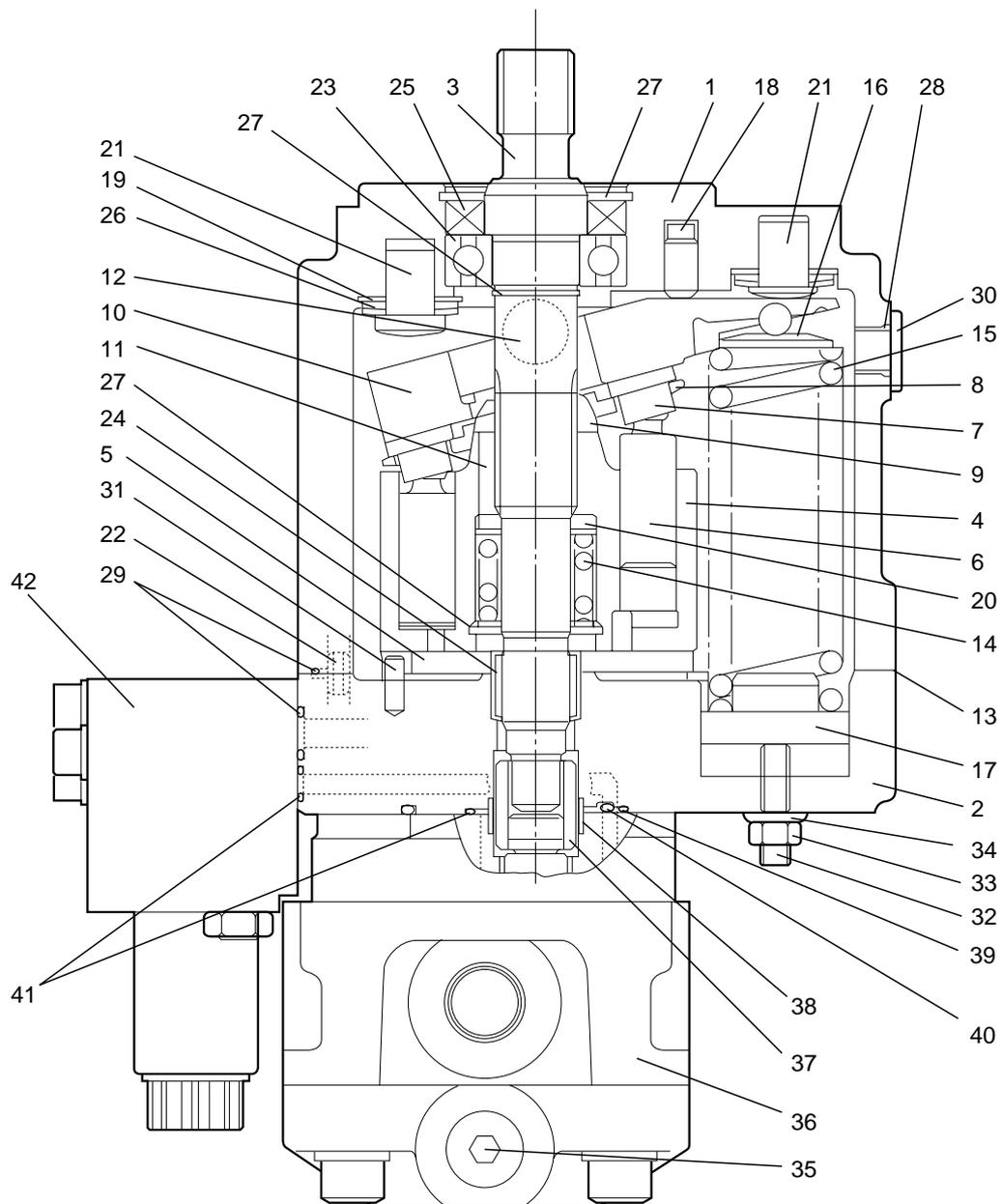
- 5-1 Specification
- 5-2 Structure
- 5-3 Removing and installing the pump
 - 5-3-1 Removing the pump
 - 5-3-2 Installing the pump
- 5-4 Performance test of the hydraulic pump
 - 5-4-1 Measuring instrument
 - 5-4-2 Preparation
 - 5-4-3 Connecting tester
 - 5-4-4 Measuring procedure
 - 5-4-5 P-Q characteristic curve

5-1 Specification



| | | | | | |
|-----------------------|------------|--------------------------------|------|------|-------|
| Pump type | | PVD-1B-32BP-11G5-4608H | | | |
| Displacement cc/rev | | P1 | P2 | P3 | PA,PB |
| | | 16.0 | 16.0 | 10.5 | 4.5 |
| Rated pressure MPa | | 20.6 | 20.6 | 17.2 | 2.9 |
| Port size | S1 | SAE 1 $\frac{1}{4}$ | | | |
| | P1,P2,P3 | PF 1 $\frac{1}{2}$ | | | |
| | PA,PB1,PB2 | PF 1 $\frac{1}{4}$ | | | |
| Direction of rotation | | Clockwise seen from shaft side | | | |
| Weight (kg) | | 23 | | | |

5-2 Structure



- | | | |
|-----------------|--------------------|----------------------|
| 1. Body | 15. Spring T1 | 29. O-ring |
| 2. Body | 16. Spring holder | 30. Plug |
| 3. Shaft | 17. Spring guide | 31. Spring pin |
| 4. Cylinder | 18. Rod | 32. Socket head bolt |
| 5. Valve plate | 19. Washer | 33. Nut |
| 6. Piston | 20. Retainer | 34. Seal washer |
| 7. Shoe | 21. Stopper pin | 35. Plug |
| 8. Shoe holder | 22. Pin | 36. Gear pump |
| 9. Barel holder | 23. Bearing | 37. Coupling |
| 10. Swash plate | 24. Bearing | 38. Collar |
| 11. Needle | 25. Oil seal | 39. O-ring |
| 12. Pin | 26. Conical washer | 40. O-ring |
| 13. Packing | 27. Snap ring | 41. O-ring |
| 14. Spring C | 28. O-ring | 42. Valve assembly |

5-3 Removing and installing the pump

5-3-1 Removing the pump

1. Remove the nipple, TEE, elbow and hoses around the pump. Attach a cap to the removed hoses to keep dust off. Store the nipples and elbows in treated oil.
2. Remove the pump mounting bolts(1).
3. Remove the pump from the flange 2. If removal is difficult, insert a screwdriver and remove the pump little by little with equal force applied on the right and left sides.

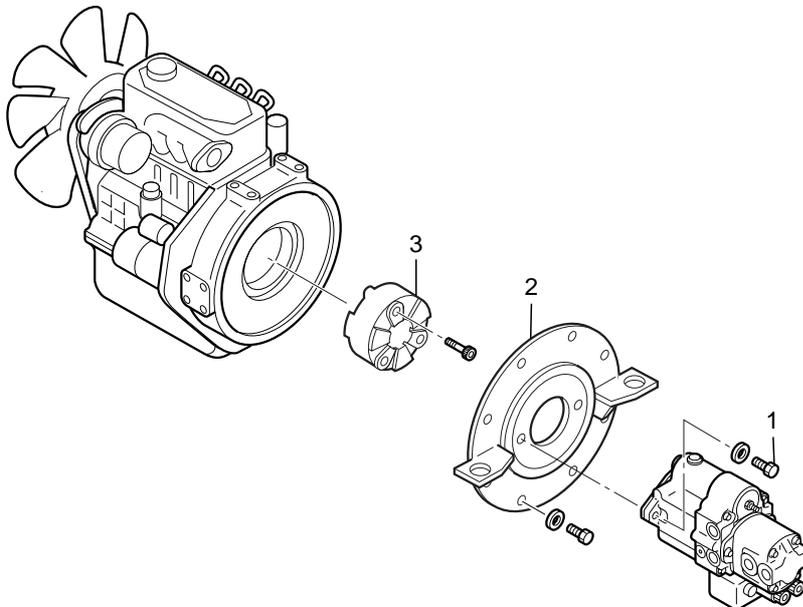
5-3-2 Installing the pump

1. Replace with a new pump and install it on the pump flange 2. Check that the spline of the shaft fits smoothly with the boss of the coupling.
When tightening the bolts 1, tighten the left and right side bolts slowly and evenly.

| Bolt | Tightening torque |
|-----------|-------------------|
| M12 × 30ℓ | 90~115 N·m |

* Precautions on installing the pump

1. Make sure there is no misalignment.



5-4 Performance test of the hydraulic pump

5-4-1 Measuring instrument

| | | |
|---------------------------|--|-----------------|
| Hydraulic pressure tester | Measuring range of flow rate (/min) | 7 ℓ |
| | Measuring range of pressure (MPa) | 0 ~ 34.3 |
| | Measuring range of temperature (°C) | 0 ~ 150 |
| | Port size | PF1 O ring type |
| Pressure gauge | 49 MPa, 4.9 MPa | |
| Tachometer | Diesel tachometer (digital type) | |
| Hose for testing | Equivalent to the hose of 20.6 MPa (2,987 psi) high pressure (Nominal size PF1/ 2-PF1/ 2×1m) | |

5-4-2 Preparation

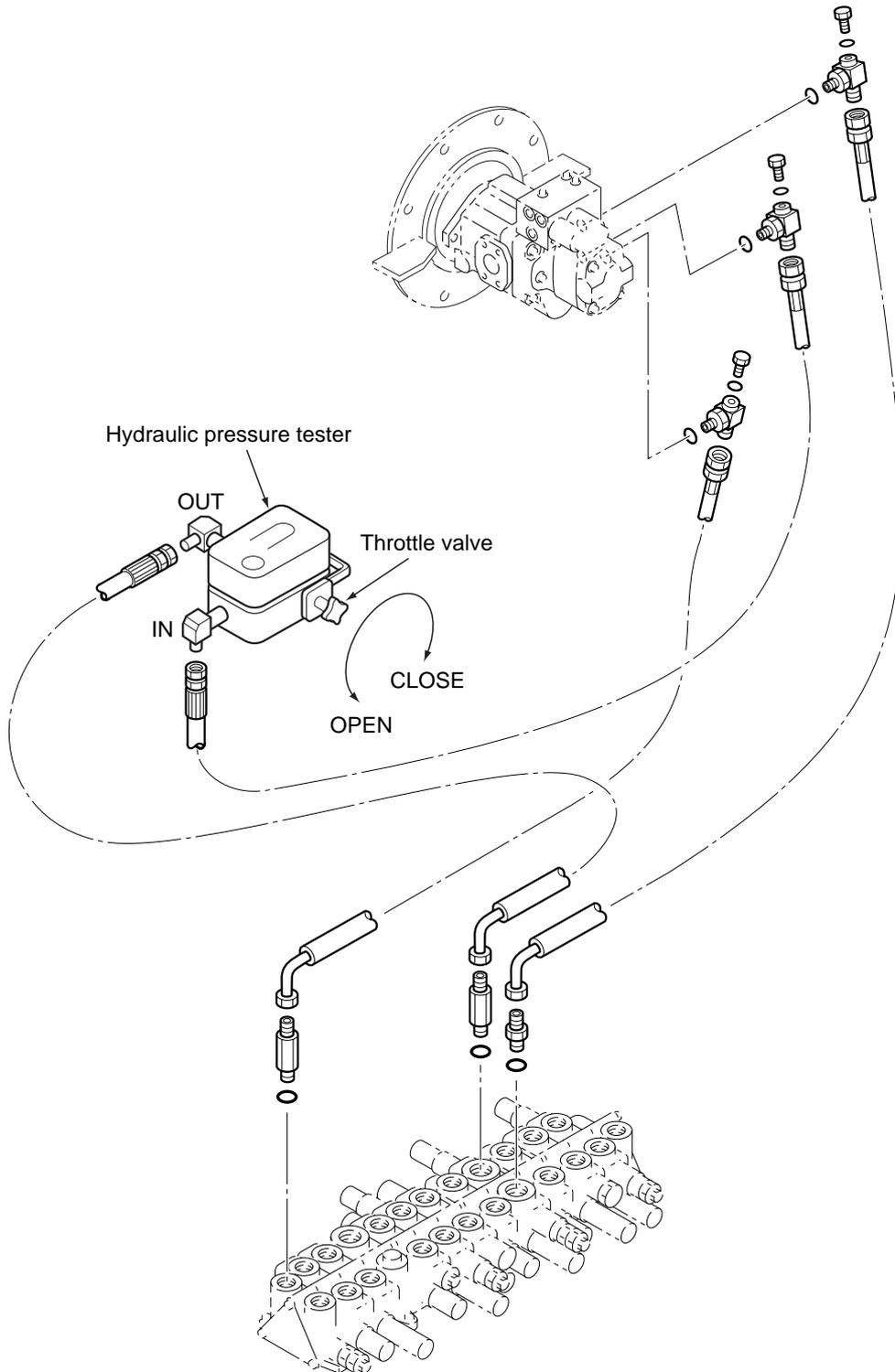
1. Park machine on flat ground and stop engine.

5-4-3 Connecting tester

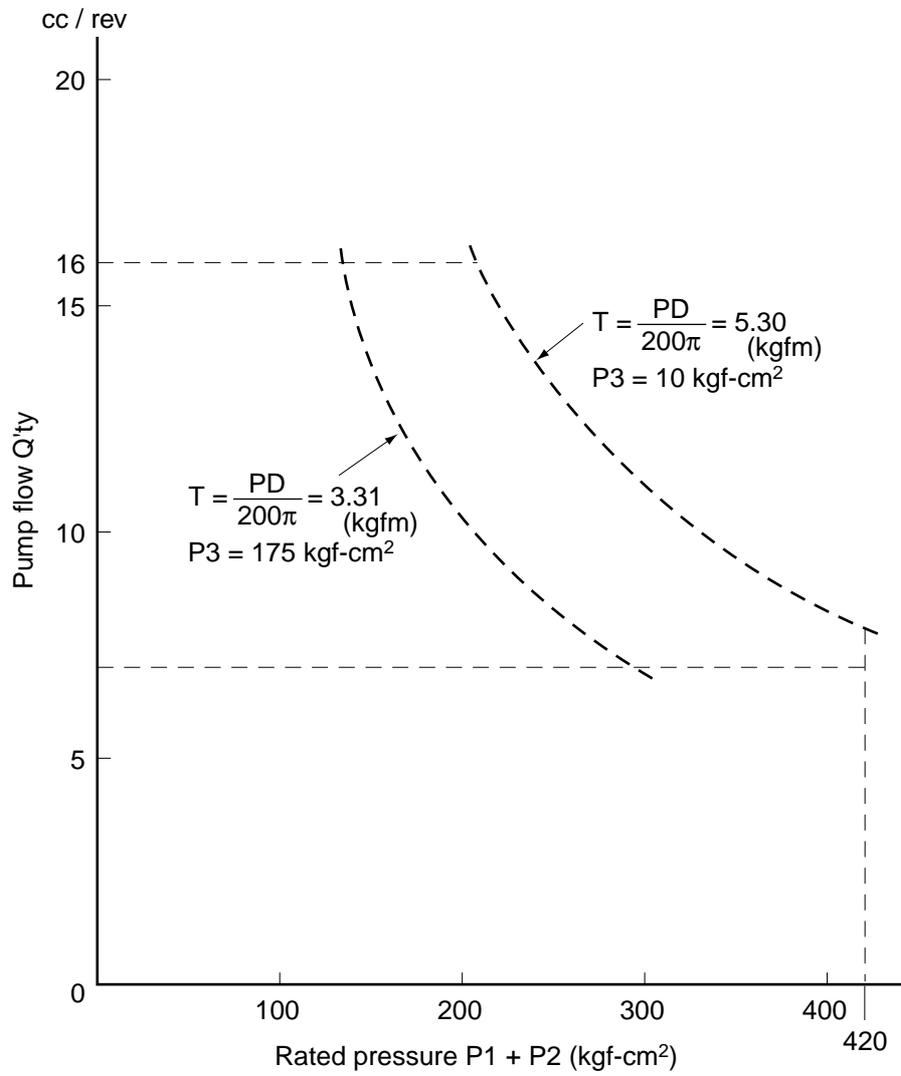
1. Remove the hose on the pump port of the control valve.
2. Connect the removed hose to the outlet of the tester.
3. Connect the hose on the discharge of the pump to the inlet of the tester.
4. Connect pressure gauge to port measuring port.

5-4-4 Measuring procedure

Open the throttle valve of the tester and start the engine. Read the pressures on the pressure gauge and measure the flow at that time. At the same time, record the engine speed.



5-4-5 H26C Pump Performance P-Q Characteristics

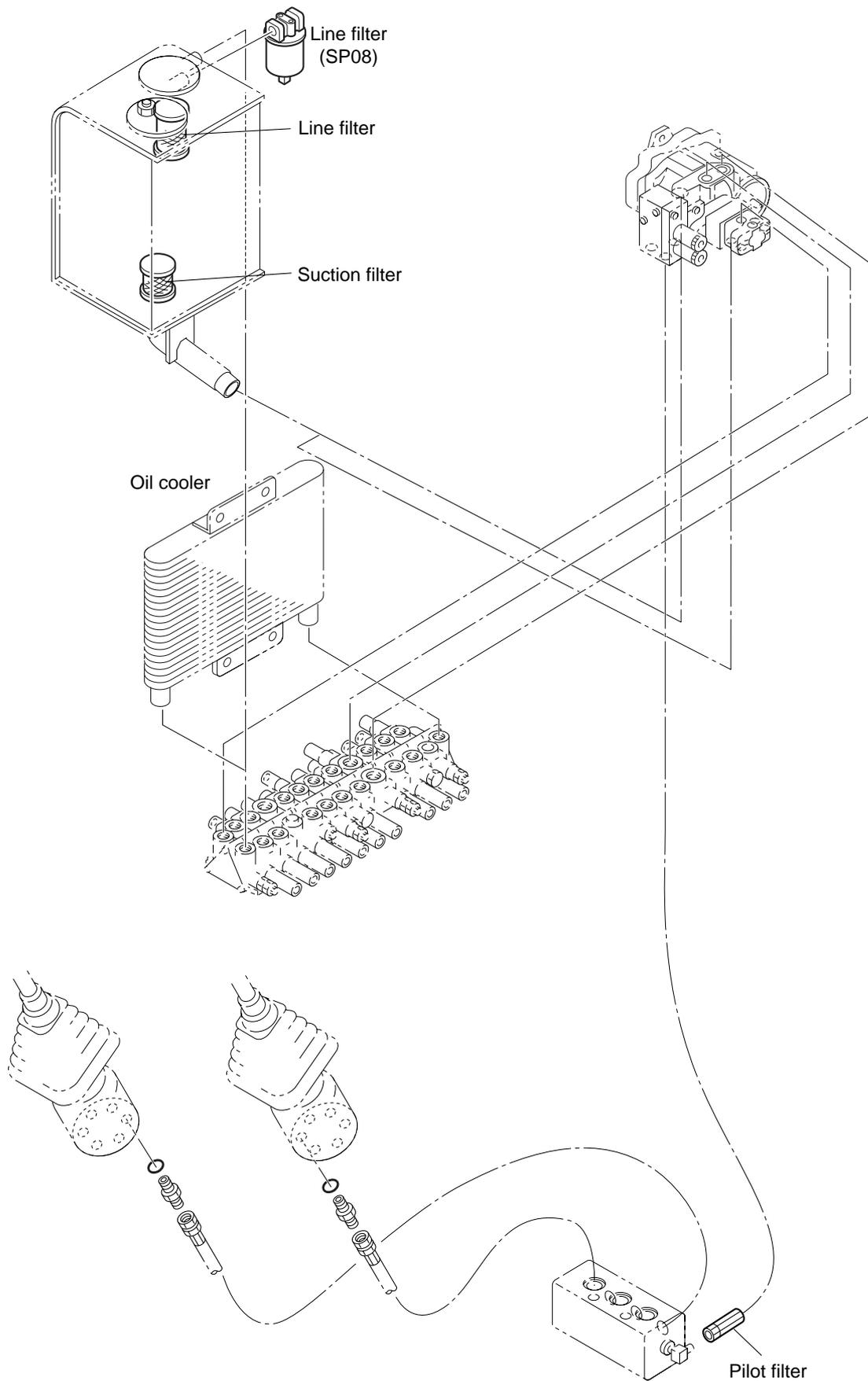


6 HYDRAULIC OIL FILTER

CONTENTS

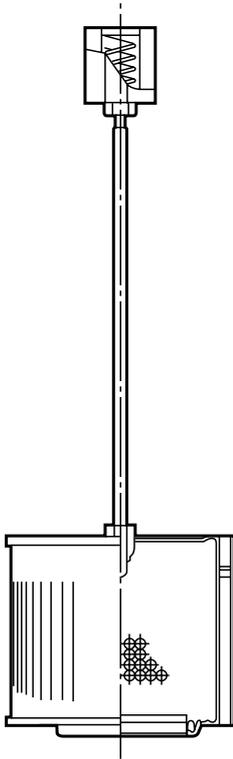
- 6-1 Installation
- 6-2 Hydraulic oil filter
 - 6-2-1 Line filter (SP10)
 - 6-2-2 Suction filter
 - 6-2-3 Pilot filter
 - 6-2-4 Line filter(SP08)
- 6-3 Maintenance procedure
 - 6-3-1 Replacing the line filter
 - 6-3-2 Replacing the suction filter
 - 6-3-3 Replacing the pilot filter
 - 6-3-4 How to clean the suction filter

6-1 Installation



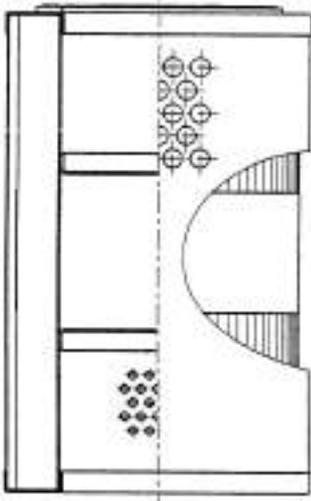
6-2 Hydraulic oil filter

6-2-1 Suction filter



| | |
|---------------------|----------------|
| Grain size | 150 mesh |
| Filtration capacity | 330ℓ /min(Max) |
| Oil temperature | -20°C~120°C |

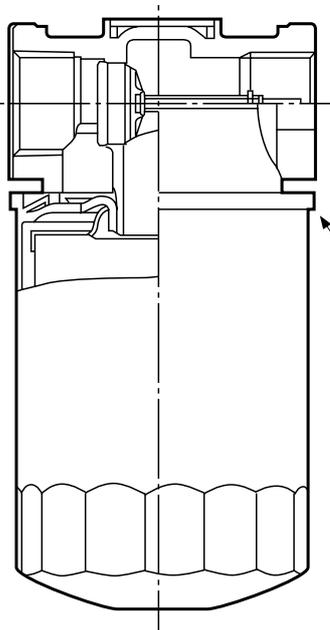
6-2-2 Line filter



| | |
|---------------------|------------------|
| Filtration accuracy | 10μ |
| Filtration capacity | 125ℓ /min (Max.) |
| Proof pressure | 0.7 MPa |
| Oil temperature | -20°C~120°C |

※ Opening pressure of bypass valve
(other part) 0.15Mpa

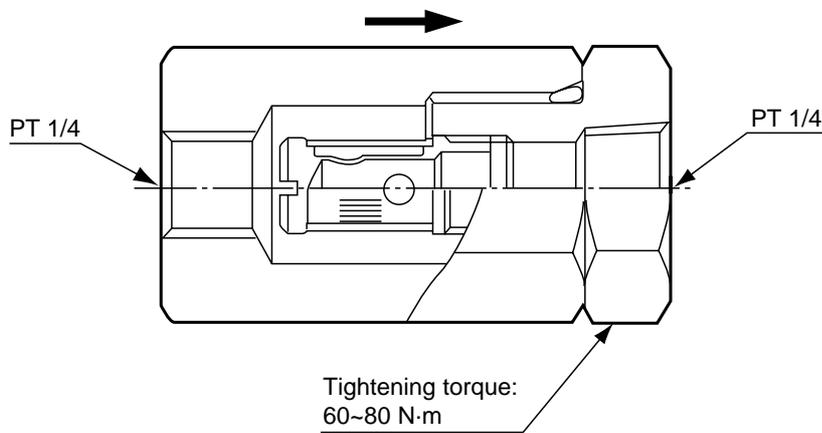
6-2-3 Line filter(only P.T.O return)



Tightening torque
20 N·m

| | |
|----------------------------------|------------------------|
| Filtration accuracy | 10 μ |
| Filtration capacity | 125 ℓ /min (Max.) |
| Opening pressure of bypass valve | 0.103 MPa |
| Proof pressure | 0.7 MPa |
| Oil temperature | -20°C~120°C |
| Port size | 2 \times PT1 |

6-2-4 Pilot filter



Tightening torque:
60~80 N·m

| | |
|---------------------|----------------------|
| Filtration capacity | 2 ℓ /min.(Max.) |
| Proof pressure | 3.9 MPa |
| Filtration accuracy | 31 μ |
| Filtration area | 5 cm ² |
| Oil temperature | -20°C~120°C |

6-3 Maintenance procedure

6-3-1 Replacing the line filter

1. Stop the engine.
2. Remove the line filter 6-2-1 with a filter wrench.
3. Check whether any foreign matter is sticking inside the element. If necessary, replace the cartridge assembly.

* In general, inspect and maintain line filters after the first 100 service hours, then every 500 service hours.

6-3-2 Replacing the suction filter

1. Stop the engine.
2. Remove the bolts and spring washers which retain the filter to the hydraulic oil tank, and pull off the filter.
3. Remove the suction filter to check whether the net of the element is damaged.

* Replace with a new one if the net is damaged or the mesh is widened.

6-3-3 Replacing the pilot filter

1. Stop the engine.
2. Remove the pilot filter 6-2-3 with a spanner (27 mm(1.06") width).
3. Remove the filter to check whether the net of the element is damaged.

* Replace with a new one if the net is damaged or the mesh is widened.

6-3-4 How to clean the suction filter

1. Prepare a can with clean treated oil. Immerse the element in it.
2. Using a brush, wash out foreign matter sticking to the element. Use a hard brush if the element is heavily stained.
3. After cleaning, blow compressed air inside the strainer to blow off the treated oil.
4. While cleaning the element, check the hydraulic oil tank at the same time, remove any sediment inside the tank and rinse out the tank.
5. Attach pipes to install the filter to the tank. When installing the filter, fit the O ring in the flange side groove firmly so that hydraulic oil does not leak.
6. Add new hydraulic oil through the hydraulic oil intake.

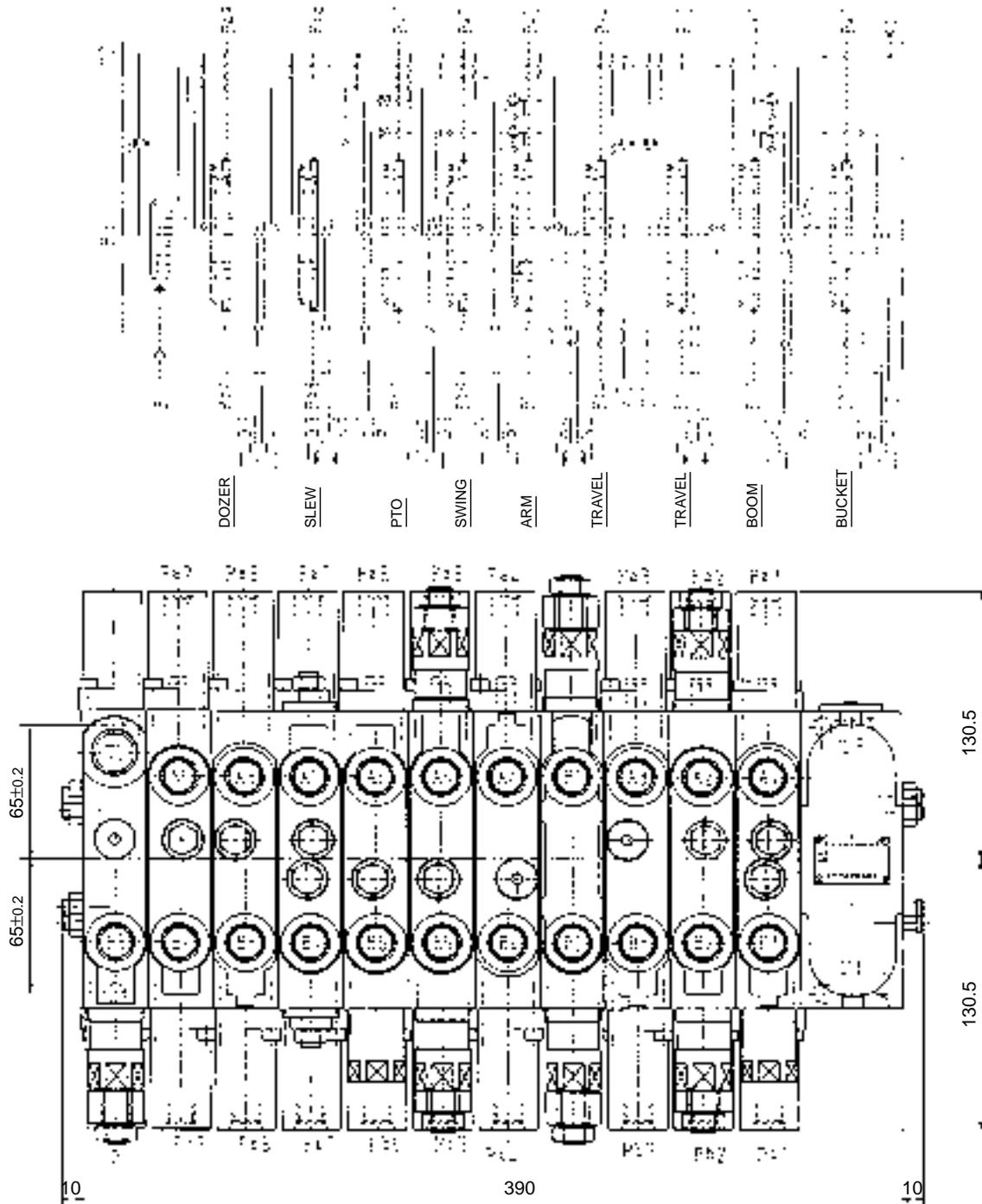
Total amount of hydraulic oil : 50.5 ℓ

7 CONTROL VALVE

CONTENTS

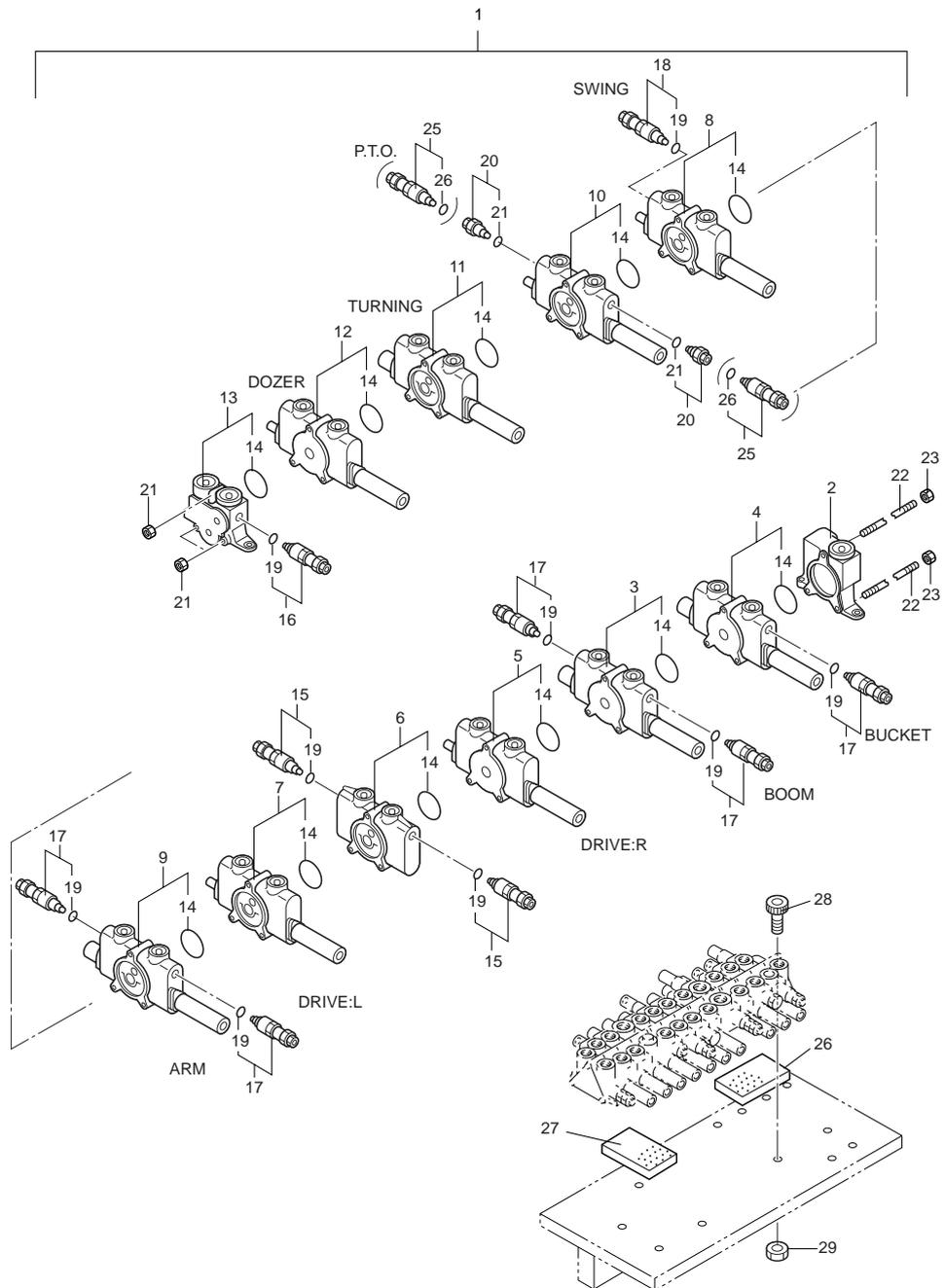
- 7-1 Specification
- 7-2 Disassembly and assembly
 - 7-2-1 Replacing the O ring on the contact surface and each block assembly
 - 7-2-2 Replacing the O ring on the Spool
 - 7-2-3 Removing the load check valve
 - 7-2-4 Replacing the relief valve assembly and the O ring
- 7-3 Structure of the relief valve
 - 7-3-1 Main relief valve
 - 7-3-2 Port relief valve
- 7-4 Precautions for handling
 - 7-4-1 Handling
 - 7-4-2 Installation
 - 7-4-3 Operation

7-1 Specification



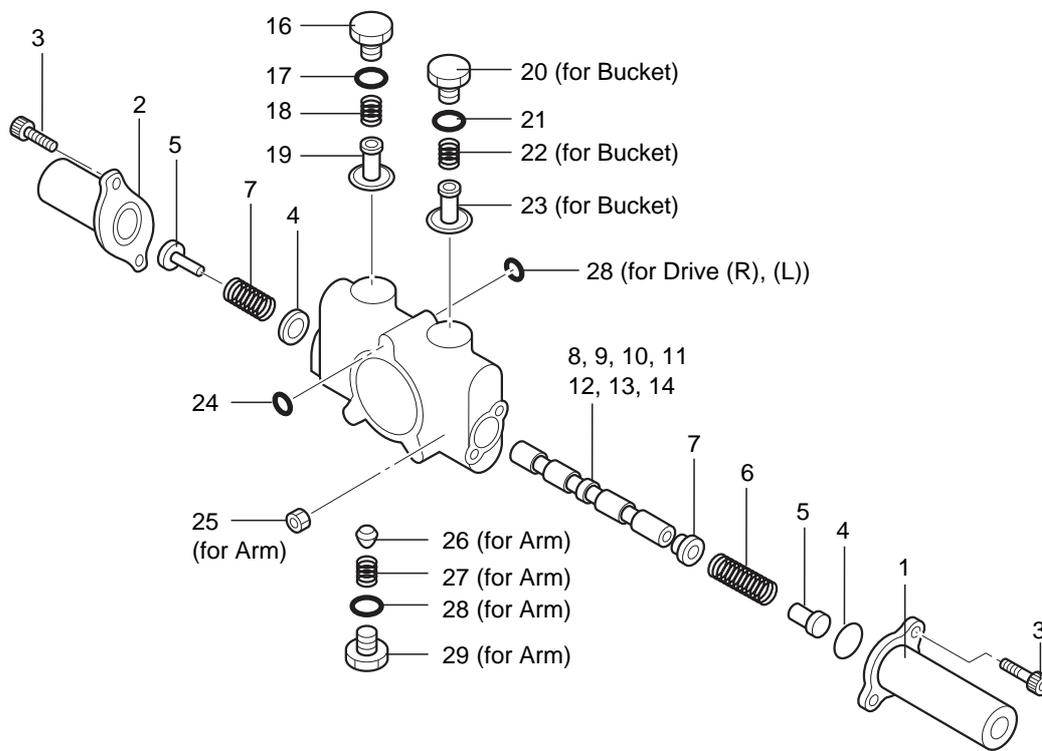
| | |
|----------------|----------|
| Port size | |
| P1, P2, P3, T1 | PF 1 / 2 |
| T2 | PF 3 / 4 |
| A1~A9, B1~B9 | PF 3 / 8 |

| | |
|-------------------------------------|-----------------------|
| P1 and P2 Main relief pressure | 20.6 MPa at 42 ℓ /min |
| P3 Main relief pressure | 17.2 MPa at 25 ℓ /min |
| A2, B2, A5, B5 Port relief pressure | 23.5 MPa at 5 ℓ /min |



1. CONTROL VALVE ASS'Y
2. OUTLET SECTION ASS'Y
3. BLOCK ASS'Y
4. BLOCK ASS'Y
5. BLOCK ASS'Y
6. SPACER SECTION ASS'Y
7. BLOCK ASS'Y
8. BLOCK ASS'Y
9. BLOCK ASS'Y
10. BLOCK ASS'Y
11. BLOCK ASS'Y
12. BLOCK ASS'Y
13. INLET SECTION ASS'Y
14. O-RING
15. RELIEF VALVE ASS'Y

16. RELIEF VALVE ASS'Y
17. RELIEF VALVE ASS'Y
18. ANTI-VOID VALVE ASS'Y
19. O-RING
20. SHUT OFF VALVE ASS'Y
21. NUT
22. O-RING
23. NUT
24. RELIEF VALVE ASS'Y
25. O-RING
26. MAT(A)
27. MAT(B)
28. BOLT
29. NUT



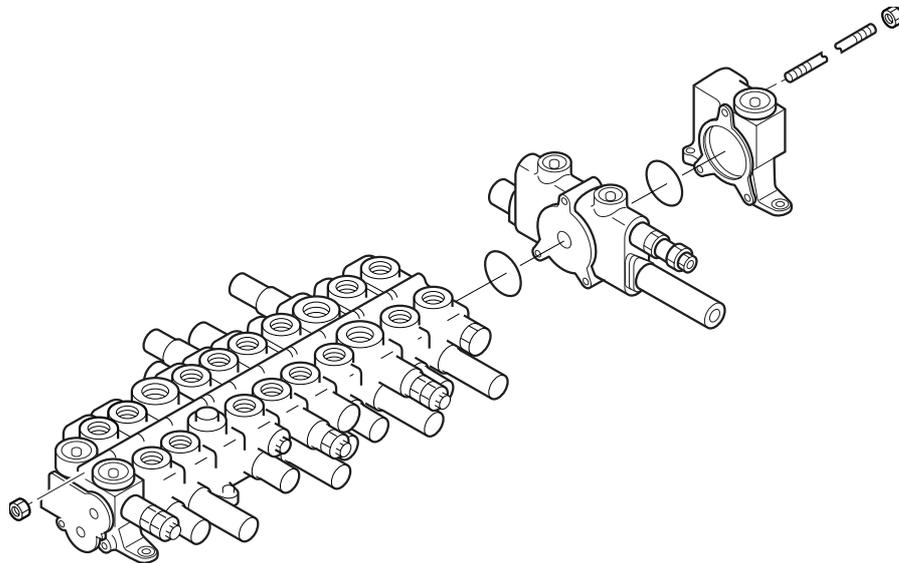
FOR BOOM/BUCKET/SLEW
 DRIVE(R)(L)/SWING
 P.T.O./DOZER/ARM

- | | |
|----------------------|------------------|
| 1. CAP | 17. O-RING |
| 2. CAP | 18. SPRING |
| 3. BOLT, SOCKET HEAD | 19. POPPET |
| 4. O-RING | 20. PLUG |
| 5. END, SPOOL | 21. O-RING |
| 6. SPRING | 22. SPRING |
| 7. SEAT, SPRING | 23. POPPET |
| 8. SPOOL | 24. O-RING |
| 9. SPOOL | 25. ORIFICE |
| 10. SPOOL | 26. POPPET |
| 11. SPOOL | 27. SPRING |
| 12. SPOOL | 28. O-RING |
| 13. SPOOL | 29. SPRING |
| 14. SPOOL | 30. PLUG |
| 15. SPOOL | 31. SEAT, SPRING |
| 16. PLUG | 32. SPOOL |

7-2 Disassembly and assembly

7-2-1 Replacing the O ring on the contact surface and each block assembly

1. Loosen the nut of tie rod.
2. Remove each block. Be careful not to damage the machine contact surface.
3. When disassembled, it is recommended to replace the O rings on the contact surface.
4. When assembling, clean the contact surface so that no dust sticks to the surface. Then attach the O ring and reassemble in the reverse order of the above procedure. When attaching the O ring, give grease to it.
5. Tighten nut temporarily.
6. After tightening, place them on their side. Pressing the inlet cover and end cover from above, check the level of the mounting legs and tighten the nut.
The tightening torque of the tie rod nut is 24 N·m. While tightening them, check that the Spool of each block operates smoothly.



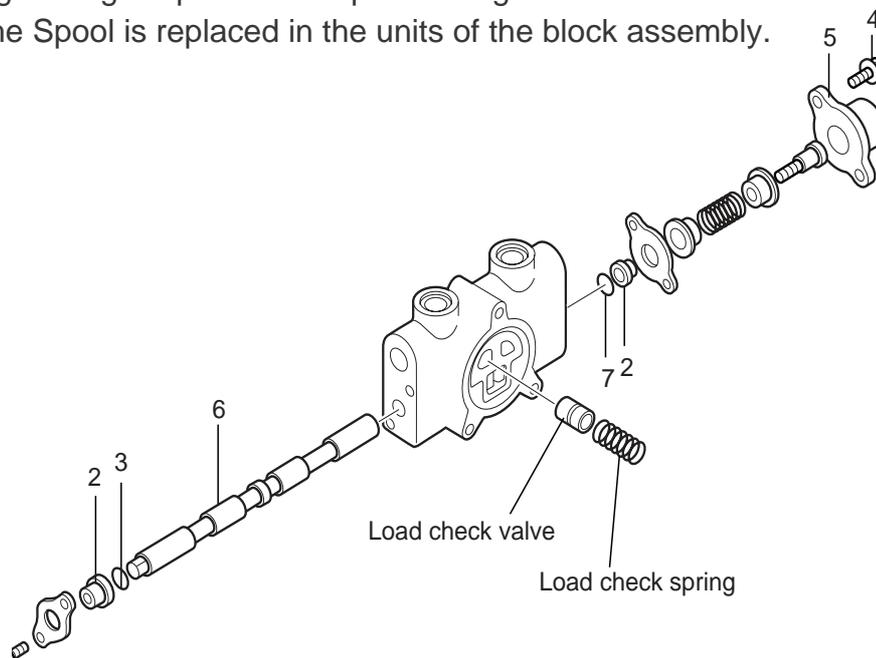
7-2-2 Replacing the O ring on the Spool

1. On the lever side

- 1) Remove the mounting screws (1) of the O-ring presser from the block.
- 2) Replace the backup ring (2) and O-ring (3).
- 3) When mounting the O-ring presser, be sure not to damage the O-ring.

2. On the cap side

- 1) Loosen the cap mounting screws (4) and remove the cap (5).
Take out Spool (6) and replace O-ring (7)
- 2) Rinse the Spool and insert it in the body.
- 3) When installing the spring cap, be careful not to damage the O-ring.
Tightening torque of the cap mounting screw is 9 N·m.
The Spool is replaced in the units of the block assembly.



7-2-3 Removing the load check valve (For Drive (R), (L))

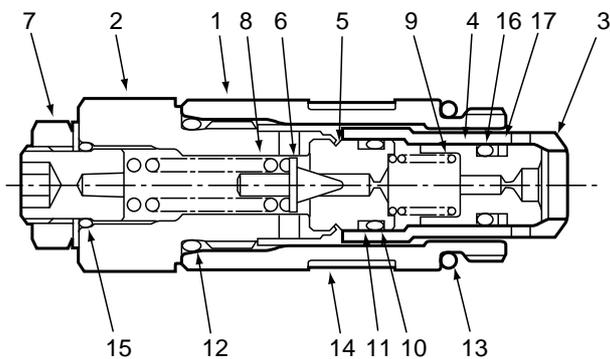
1. Remove the load check spring and load check valve from the valve block.
2. Keep each load check valve in order so as not to confuse it with other valve block.
2. Clean the parts sufficiently before assembling them.

7-2-4 Replacing the relief valve assembly and the O-ring.

1. Remove the inlet section assembly and the relief valve.
2. If necessary, replace the O-ring or the relief valve assembly.
3. During installation, give grease to the O-ring.
4. When the relief set, cap nut of adjusting screw and hexagon nut are loosened, always check relief set pressure using the pressure gauge.
At this time, the relief set pressure and flow rate shall be conformed to the specification indicated on the page of external drawing.
5. When the relief valve assembly is removed, check whether the small hole on the center of relief piston is clogged with foreign matter.

7-3 Structure of the relief valve

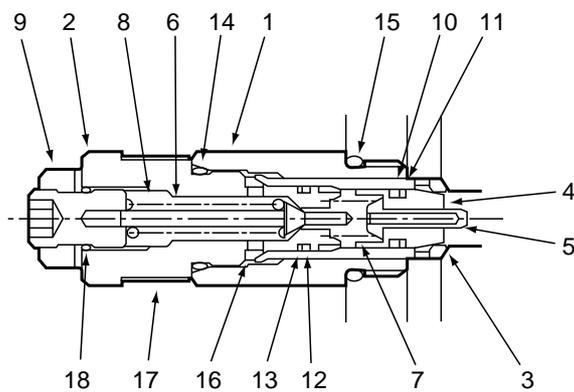
7-3-1 Main relief valve



- | | | |
|-----------------|-----------------|--------------------|
| 1. Cap | 7. Adjuster kit | 13.O-ring |
| 2. Plug | 8. Pilot spring | 14.Name plate |
| 3. Sleeve | 9. Spring | 15.O-ring (1B-P10) |
| 4. Main poppet | 10. O-ring | 16.O-ring |
| 5. Pilot sheet | 11. Backup ring | 17.Backup ring |
| 6. Pilot poppet | 12. O-ring | |

| Part | Tightening torque |
|----------------------------------|-------------------|
| Cap nut | 30 N·m |
| Installation of the relief valve | 70 N·m |

7-3-2 Port relief valve



- | | | |
|-----------------|-----------------|---------------------|
| 1. Cap | 7. Spring | 13. Backup ring |
| 2. Plug | 8. Pilot spring | 14. O-ring |
| 3. Poppet | 9. Adjuster kit | 15. O-ring |
| 4. poppet | 10. O-ring | 16. Wave washer |
| 5. Piston | 11. Backup ring | 17. Name plate |
| 6. Pilot poppet | 12. O-ring | 18. O-ring (1B-P10) |

| Part | Tightening torque |
|----------------------------------|-------------------|
| Cap nut | 30 N·m |
| Installation of the relief valve | 70 N·m |

7-4 Precautions for handling (Installation and operation should conform to the following items.)

7-4-1 Handling

When handling and carrying valves, be careful neither to drop them nor bang the spool end and cap.

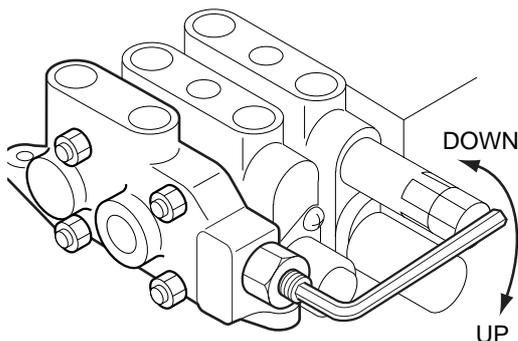
When stocking a valve for a long time, plug each port to prevent dust and water from entering it.

7-4-2 Installation

1. Tighten the valve joints with the specified tightening torque. Be careful so that no unnecessary force acts on the valve through the piping.
2. Install the operation link so that the spool moves correct in the direction of shaft.
3. Be careful when welding near a valve, because the high temperature and spatter may damage the O ring of the spool and the dust seal.
4. Do not paint the spool.
5. Never remove the plug on each port to prevent dust from entering until piping work begins.

7-4-3 Operation

1. Before operation, check that the hydraulic circuit and the oil are both clean (cleanliness of hydraulic oil must be higher than the NAS12 class).
2. Keep the oil temperature between -20°C and 80°C . If the temperature falls below 0°C , warm up the machine.
3. Never raise the set pressure of the main relief valve and port relief valve beyond the specified set pressure. If the set pressure differs from the specified value, adjust it in the following manner.
 - 1) Procedure for adjusting the main relief valve:
 - a. Install a pressure gauge between the pump and control valve in the measuring position. If there is a mounting hole for the pressure gauge, use it.
 - b. Raise the temperature of the hydraulic oil to 50 to 60°C and set the engine speed to the rated value.
 - c. Operate the control lever to read the indication of the pressure gauge when cylinder reaches the stroke end.
 - d. When raising the pressure, remove the cap nut and turn adjusting screw of the relief valve installed on the inlet section clockwise with an Allen wrench.



| Relief valve pressure adjustment | |
|----------------------------------|-------------------------------|
| Main relief valve | Approx. 17.7 MPa per rotation |
| Port relief valve | Approx. 15.7 MPa per rotation |

- e. Always lock the valve when it is set to the specified pressure.

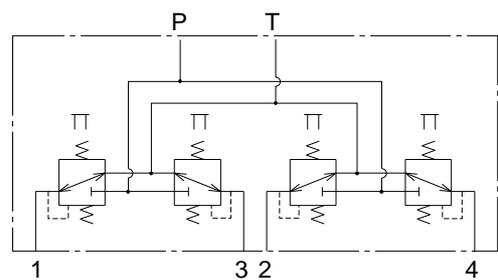
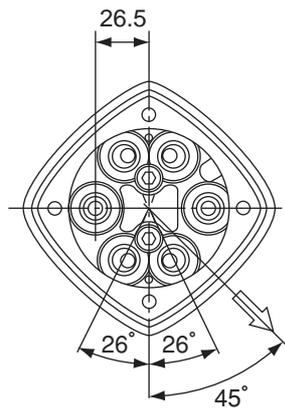
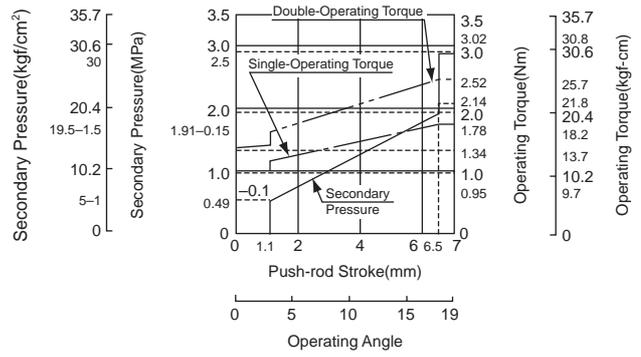
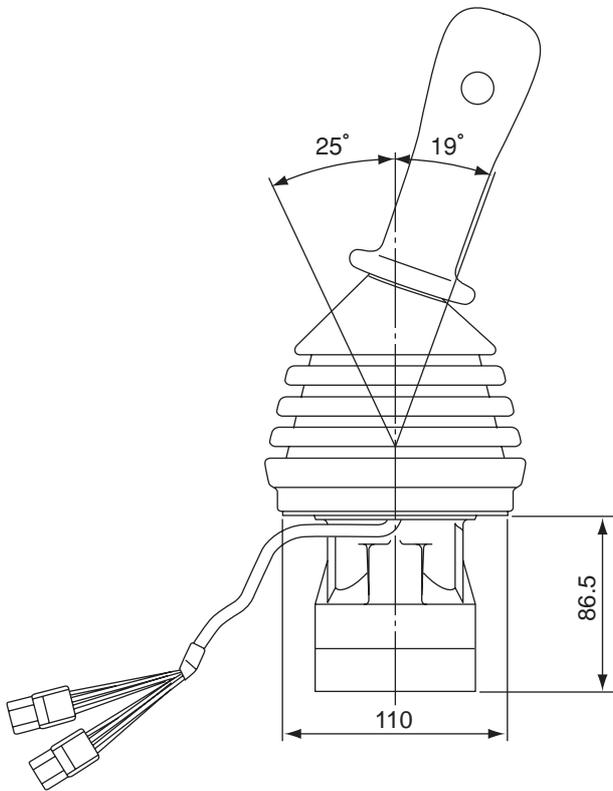
8

JOYSTICK (PILOT VALVE)

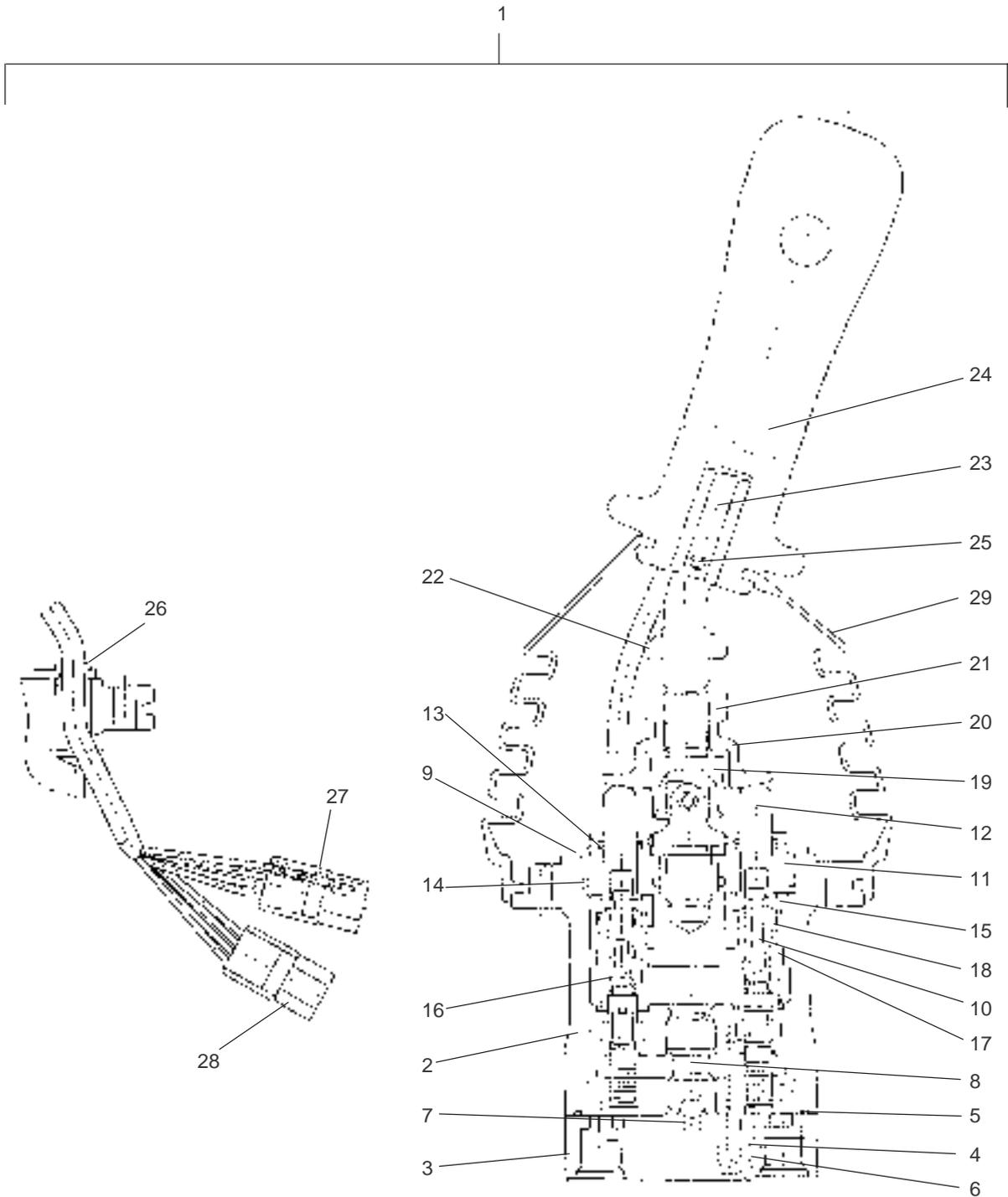
CONTENTS

- 8-1 Specification
- 8-2 Structure

8-1 Specification



8-2 Structure



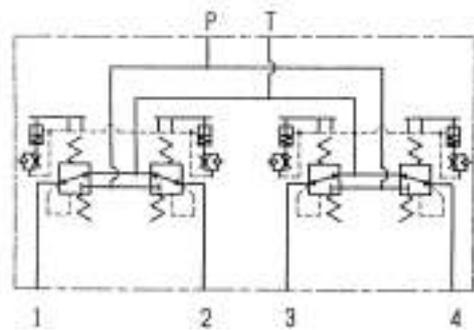
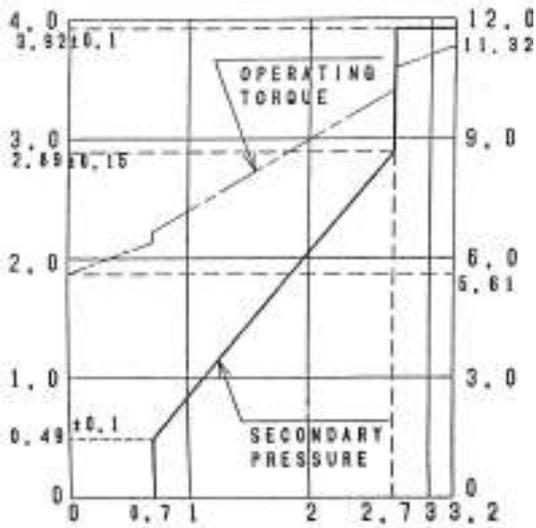
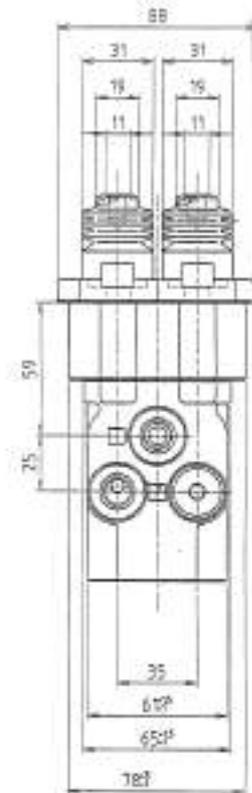
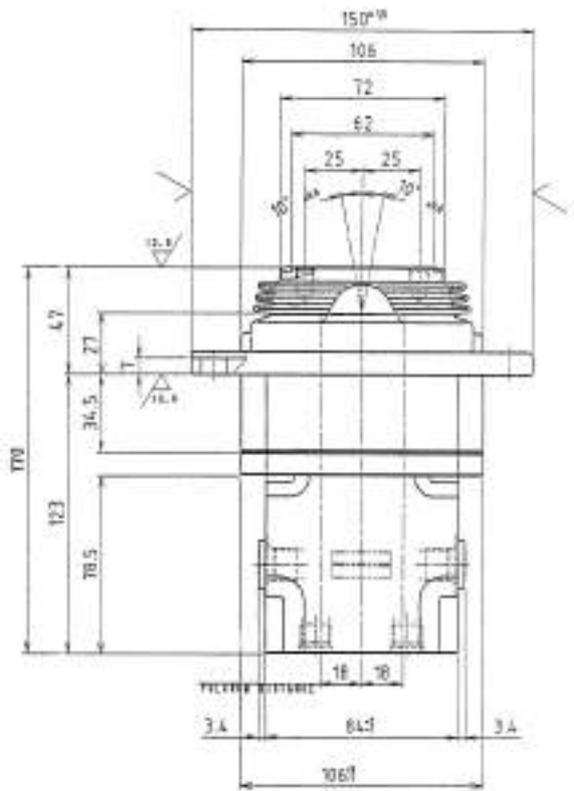
- | | | |
|-------------------------|--------------------|-------------------|
| 1. JOYSTICK VALVE ASS'Y | 11. PLUG | 21. ADJUSTING NUT |
| 2. CASING | 12. PUSH ROD | 22. LOCK NUT |
| 3. PORT PLATE | 13. SEAL | 23. LEVER |
| 4. SEAL WASHER | 14. O-RING | 24. KNOB |
| 5. O-RING | 15. SPRING SEAT | 25. SPRING PIN |
| 6. HEX. BOLT | 16. WASHER 2 | 26. BUSH |
| 7. SPRING PIN | 17. SPRING | 27. CONNECTOR |
| 8. BUSH | 18. SPRING | 28. HOUSING(4P) |
| 9. PLATE | 19. JOINT | 29. BELLOWS |
| 10. SPOOL | 20. CIRCULAR PLATE | |

9 PILOT VALVE(1) (TRAVEL)

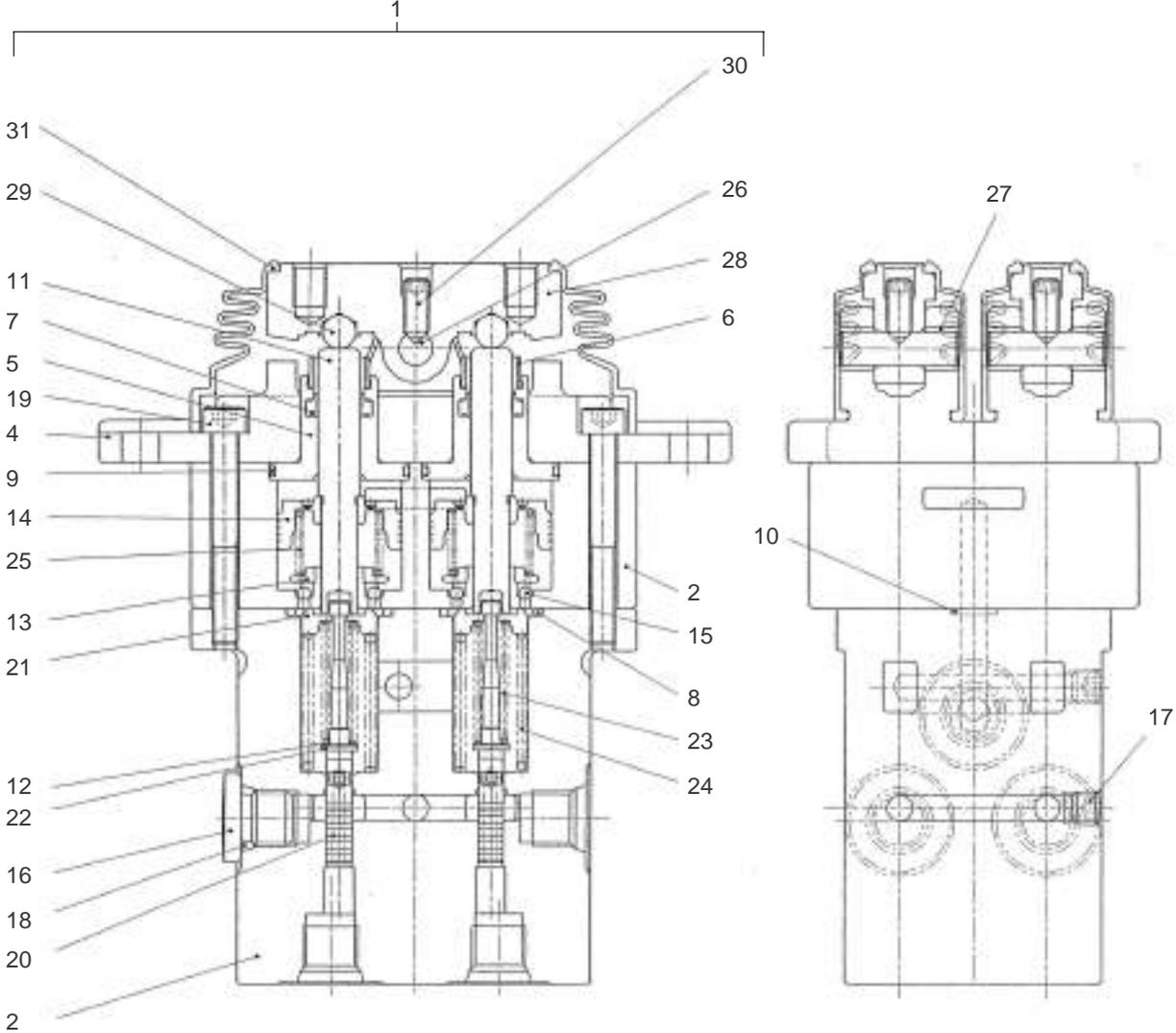
CONTENTS

- 9-1 Specification
- 9-2 Structure

9-1 Specification



9-2 Structure



- | | |
|---------------------|-----------------------|
| 1 PILOT VALVE ASS'Y | 18 O-RING |
| 2 CASING | 19 SCREW, HEX., S.H.C |
| 3 CASING(DAMPER) | 20 SPOOL |
| 4 COVER | 21 SEAT, SPRING |
| 5 PLUG | 22 WASHER |
| 6 GREASE CAP | 23 SPRING |
| 7 PACKING | 24 SPRING |
| 8 O-RING | 25 SPRING |
| 9 O-RING | 26 CAM SHAFT |
| 10 O-RING | 27 BUSH |
| 11 ROD, PUSH | 28 CAM |
| 12 SHIM | 29 BALL, STEEL |
| 13 SEAT, SPRING | 30 SET SCREW |
| 14 PISTON | 31 BELLOWS |
| 15 BALL, STEEL | |
| 16 RO PLUG | |
| 17 PLUG | |

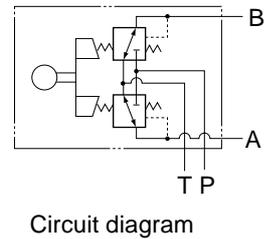
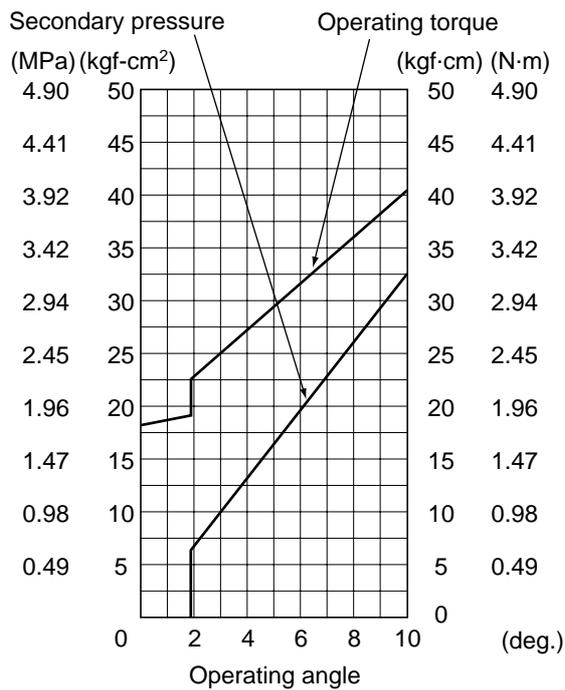
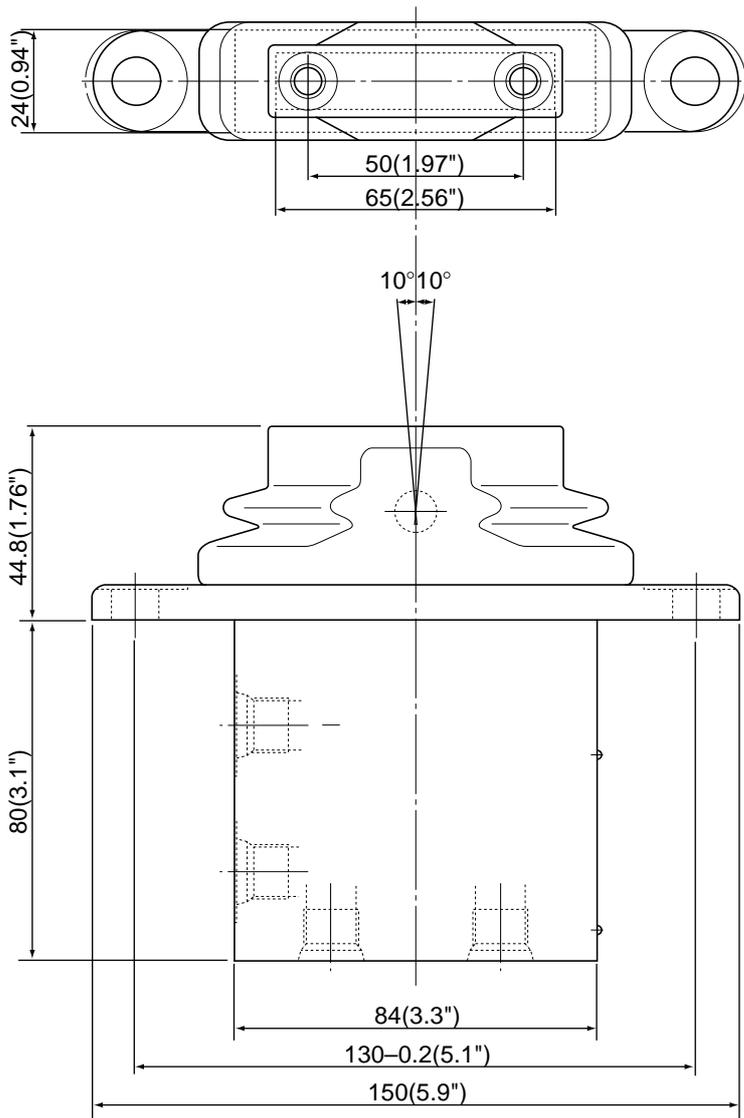
10 PILOT VALVE(2) (SWING · PTO)

CONTENTS

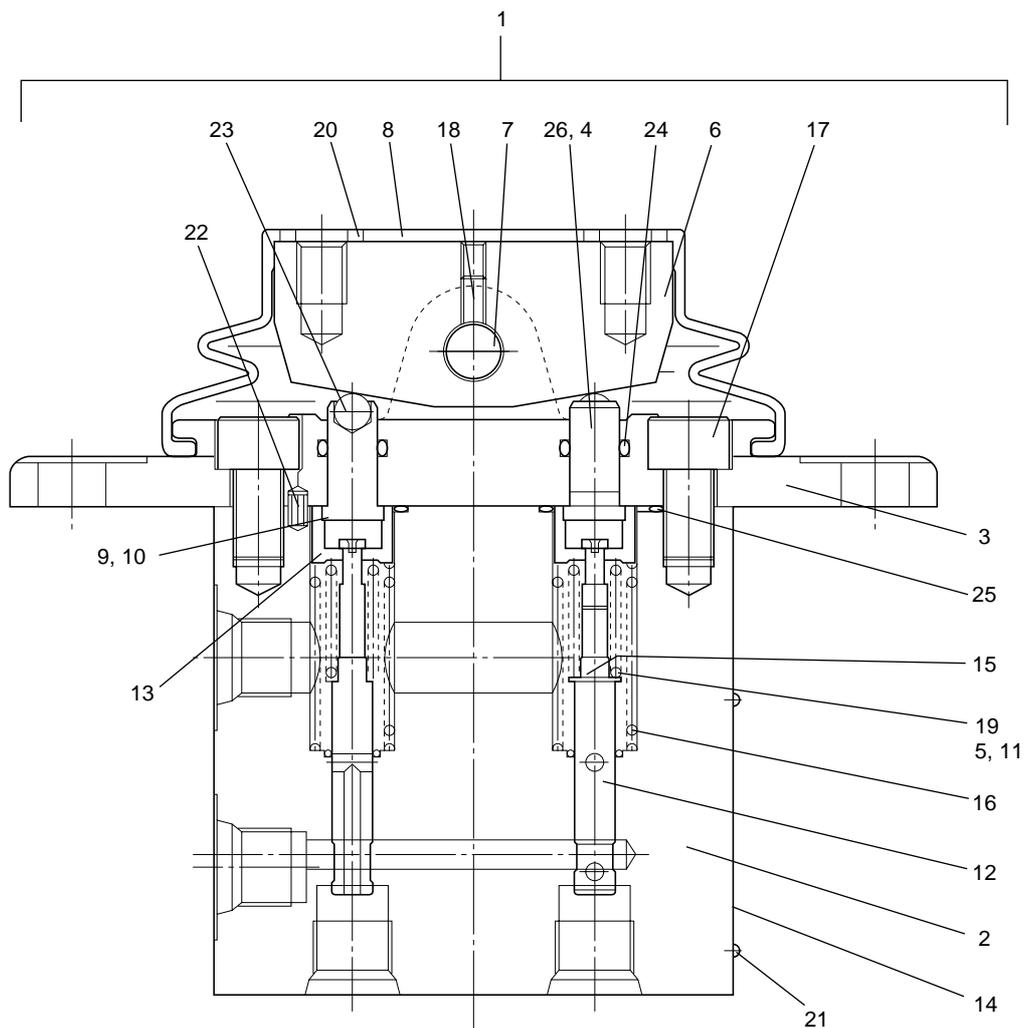
10-1 Specification

10-2 Structure

10-1 Structure



10-2 Structure



- | | | | |
|----|----------------|----|--------------|
| 1 | PILOT VALVE | 14 | PLATE, NAME |
| 2 | BODY | 15 | SPRING, COMP |
| 3 | COVER | 16 | SPRING, COMP |
| 4 | PUSHER | 17 | BOLT |
| 5 | SHIM | 18 | SCREW |
| 6 | CAM | 19 | WASHER |
| 7 | PIN | 20 | WASHER |
| 8 | BOOT | 21 | SCREW |
| 9 | SHIM | 22 | PIN, SPRING |
| 10 | SHIM | 23 | STEEL BALL |
| 11 | SHIM | 24 | O-RING |
| 12 | SPUR | 25 | O-RING |
| 13 | HOLDER, SPRING | 26 | PUSHER ASS'Y |

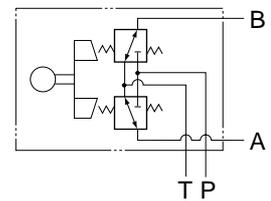
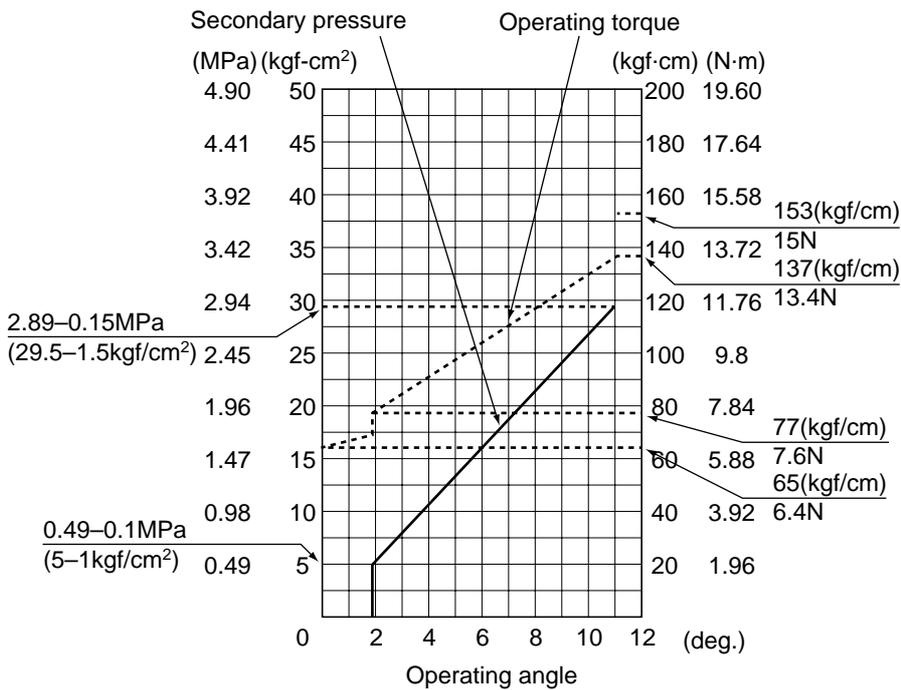
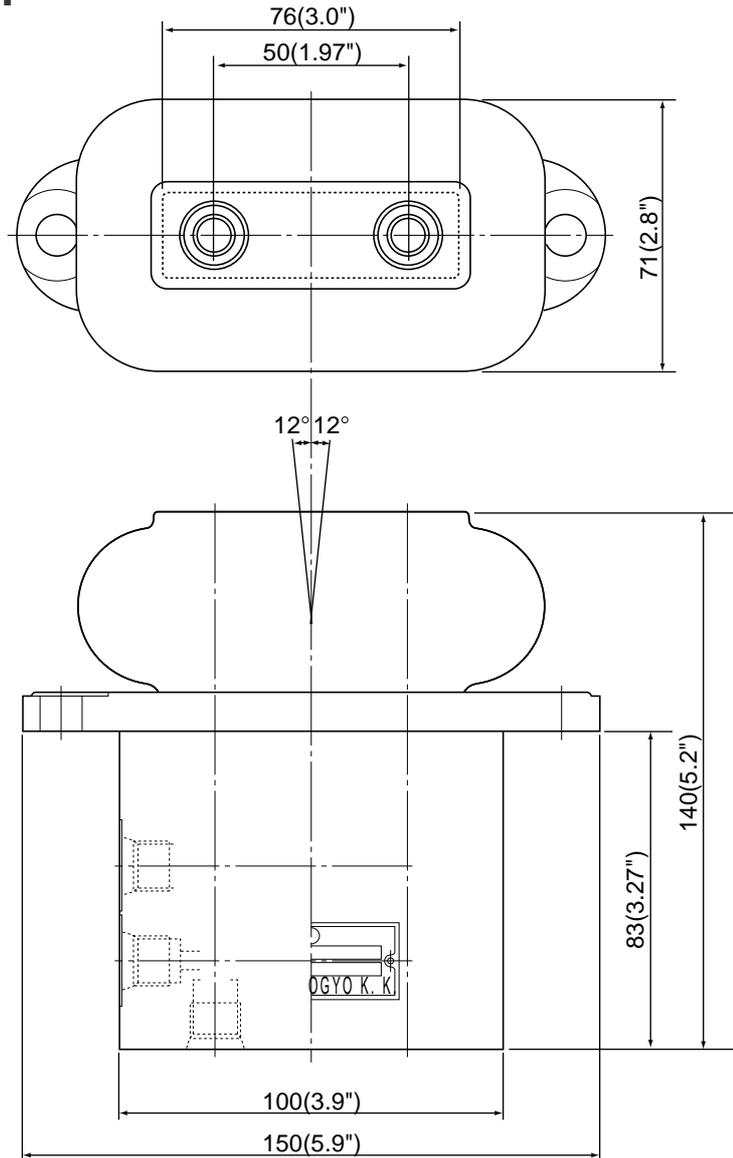
11 PILOT VALVE(3) (DOZER)

CONTENTS

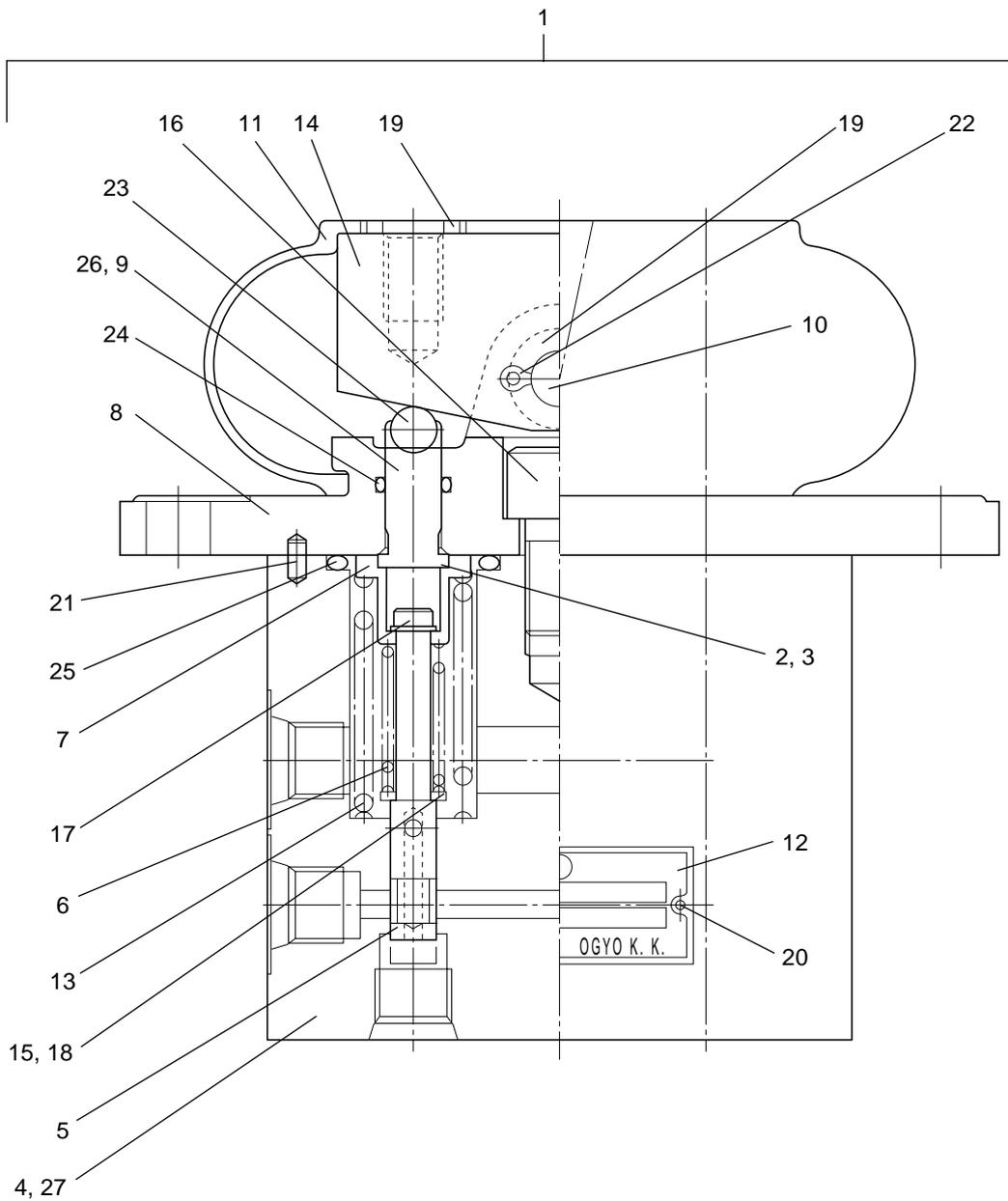
11-1 Specification

11-2 Structure

11-1 Specification



11-2 Structure



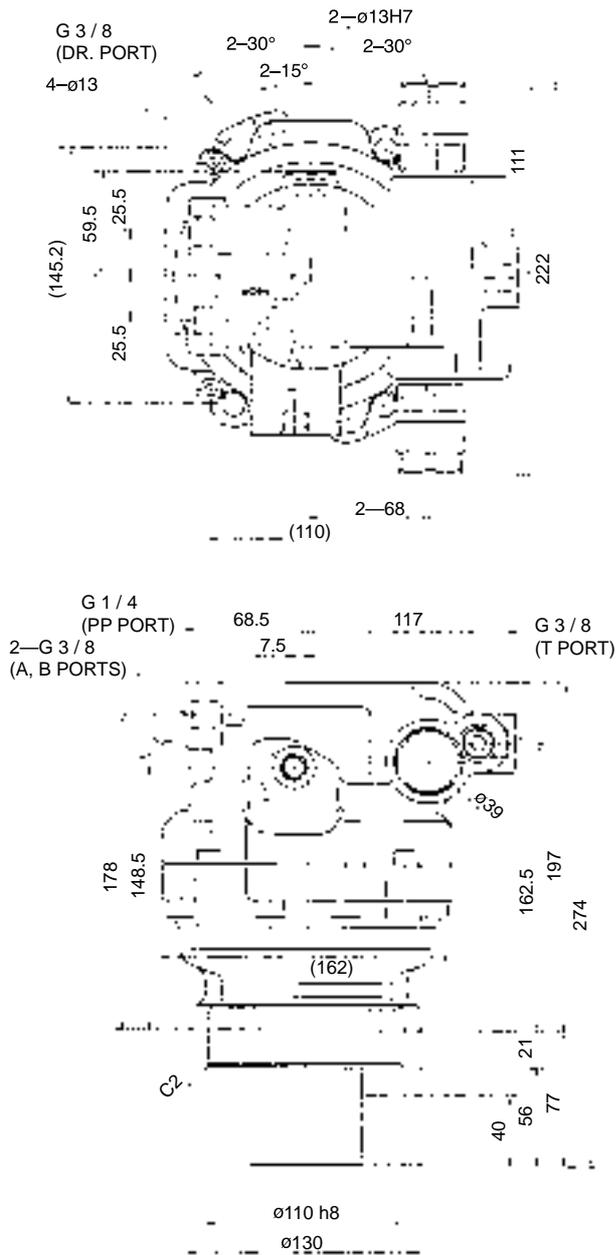
- | | | | |
|----|-------------------|----|--------------|
| 1 | DOZER PILOT VALVE | 15 | SHIM |
| 2 | SHIM | 16 | BOLT |
| 3 | SHIM | 17 | BOLT |
| 4 | BODY | 18 | WASHER |
| 5 | SPOOL | 19 | WASHER |
| 6 | SPRING COMP | 20 | SCREW |
| 7 | SLEEVE | 21 | SPRING PIN |
| 8 | COVER | 22 | PIN |
| 9 | PUSHER | 23 | STEEL BALL |
| 10 | PIN | 24 | O-RING |
| 11 | BOOT | 25 | O-RING |
| 12 | PLATE, NAME | 26 | PUSHER ASS'Y |
| 13 | SPRING COMP | 27 | BODY ASS'Y |
| 14 | CAM | | |

12 SLEW MOTOR

CONTENTS

- 12-1 Specification
- 12-2 Structure
- 12-3 Standard of maintenance
 - 12-3-1 Slew bearing & slew case
- 12-4 Inspection and adjustment
 - 12-4-1 Measuring the natural slew distance
 - 12-4-2 Measuring the over slew distance after stopping
 - 12-4-3 Measuring the required time for slewing

12-1 Specification

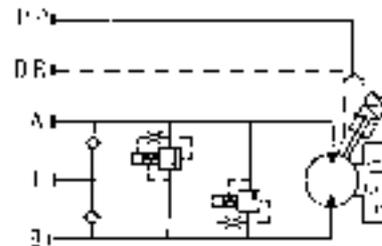


Direction of rotation
(seen from the output shaft)

| Direction of rotation | Oil inlet | Oil outlet |
|-----------------------|-----------|------------|
| Clockwise | A | B |
| Counterclockwise | B | A |

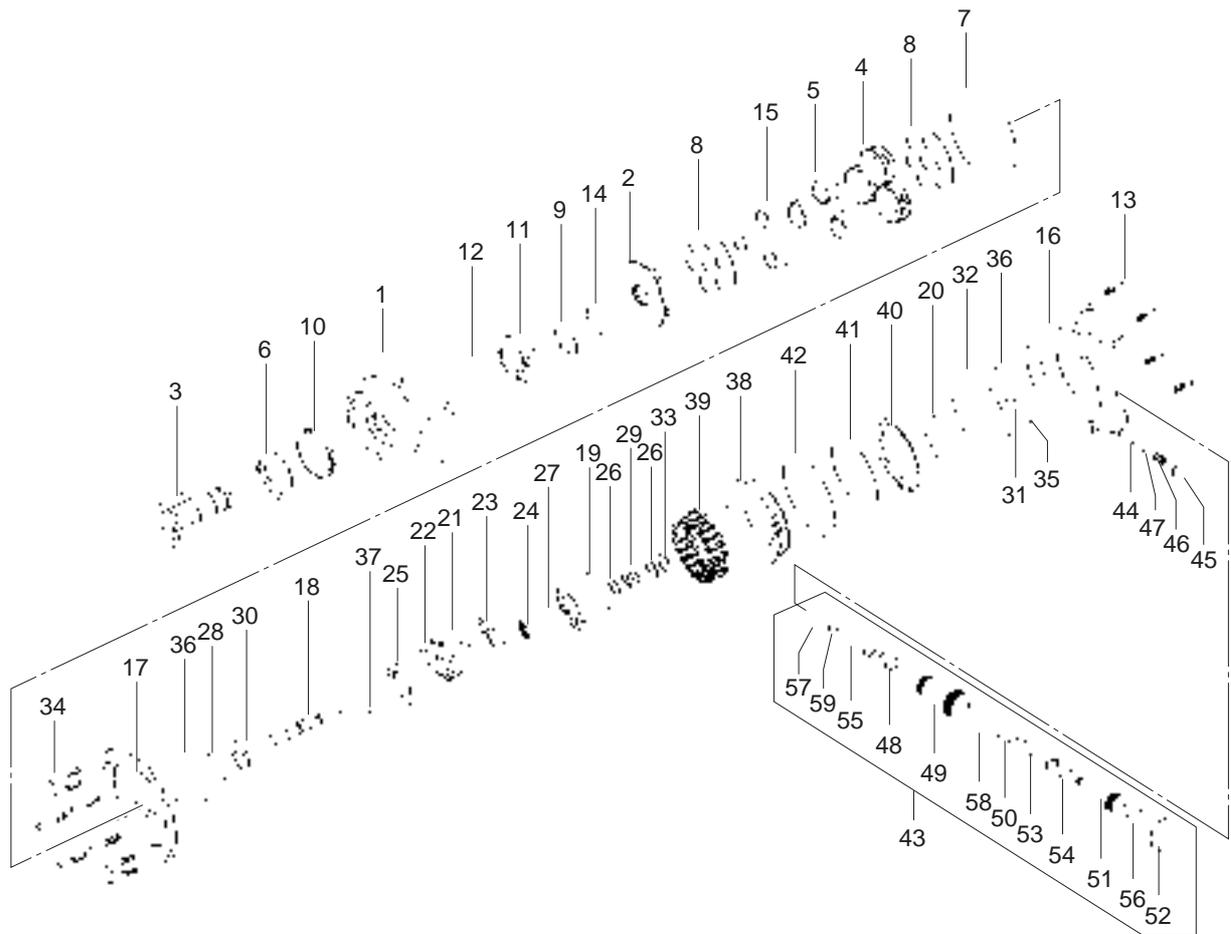
| Port | Port size |
|------|-----------|
| A | PF 3/8 |
| B | PF 3/8 |
| T | PF 3/8 |
| Dr | PF 3/8 |

| | |
|--------------------------|---------|
| Initial oil replace | 500Hr |
| Second and later replace | 1,000Hr |



| Type | | PCR-1B-05A-P-8446Z1 |
|-----------------|------------------------------|----------------------------|
| Reduction | Output torque | 423 N·m |
| | Output speed | 70 min ⁻¹ |
| | Reduction ratio | 1 / 10 |
| Hydraulic motor | Capacity | 23.6 cm ³ / rev |
| | Maximum speed | 702 min ⁻¹ |
| | Flow rate | 17.08 ℓ / min |
| | Overload relief set pressure | 13.2 MPa at 17 ℓ / min |
| Pinion gear | Module | 4 |
| | No. of threads Z | 13 |
| Weight | | 23 kg |

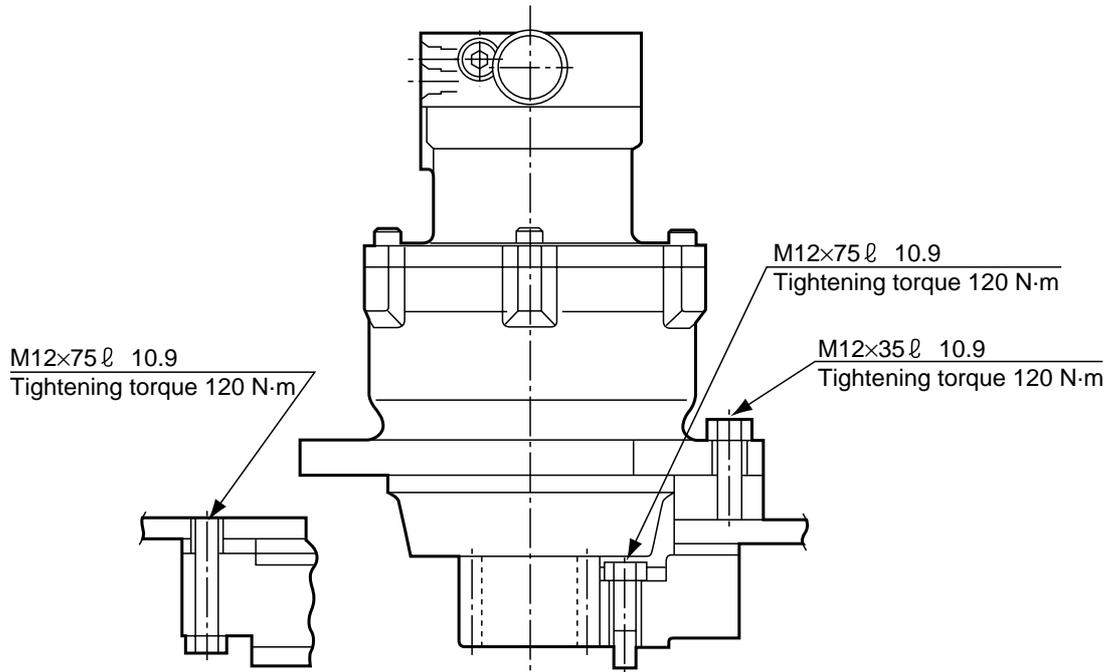
12-2 Structure



- | | | |
|---------------------|-------------------|------------------|
| 1. Body | 21. Piston | 41. O-ring |
| 2. Carrier 1 | 22. Shoe | 42. O-ring |
| 3. Pinion shaft | 23. Shoe holder | 43. Relief valve |
| 4. B1 gear | 24. Barrel holder | 44. Check valve |
| 5. Needle | 25. Swash plate | 45. Plug |
| 6. Ring seal | 26. Retainer | 46. Spring |
| 7. O-ring | 27. Pin | 47. O-ring |
| 8. Thrust plate | 28. Filter | 48. Seat |
| 9. Pre-load collar | 29. Spring C | 49. Retainer |
| 10. Bearing | 30. Bearing | 50. Poppet |
| 11. Bearing | 31. Bearing | 51. Piston |
| 12. Oil seal | 32. O-ring | 52. Cap |
| 13. Screw | 33. Snap ring | 53. Spring |
| 14. Ring | 34. Screw | 54. Spacer |
| 15. Ring | 35. Spring pin | 55. O-ring |
| 16. Body H | 36. Pin | 56. O-ring |
| 17. Plate S | 37. Pin | 57. O-ring |
| 18. Shaft | 38. Brake piston | 58. O-ring |
| 19. Cylinder barrel | 39. Spring Ass'y | 59. Back up ring |
| 20. Valve plate | 40. Disk plate | |

12-3 Standard of maintenance

12-3-1 Slew bearing and slew case

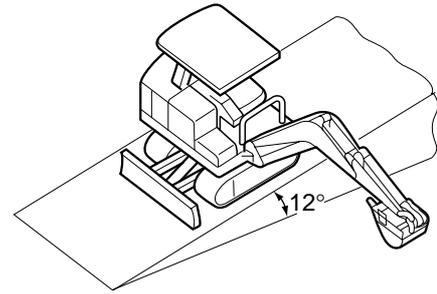


12-4 Inspection and adjustment

12-4-1 Measuring the natural slew distance

1. Position of the machine

Maintain the hydraulic oil temperature at $50\pm 5^{\circ}\text{C}$. Make a slope or use a sleeper to incline the machine by 12° . Set the attachment diagonally, put a weight (W) in the bucket (filling the bucket with soil), retract the arm cylinder to the minimum length, make the boom parallel to the slope and stop engine.



2. Measurement

Put a mark on the slew bearing outer race and the truck frame and measure the flow rate (deviation rate) of 3 minutes. (Moving distance of slew bearing outer race)Valid gear length

Unit mm or less

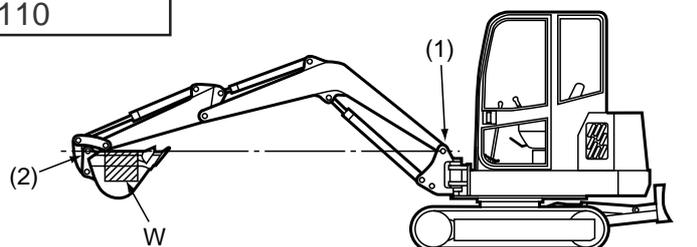
| Standard value | Allowance | Weight (W) kg |
|----------------|-----------|---------------|
| 30(1.2") | 60(2.4") | 110 |

12-4-2 Measuring the over slew distance after stopping

Maintain the oil temperature at $50\pm 5^{\circ}\text{C}$ while the engine is running at full speed. Stretch the arm to the maximum length on a flat place. Make the boom joint pin (1) and arm bucket pin (2) put on a horizontal line, put a weight(W) in the bucket (filling the bucket with soil), slew the Machine by one turn and measure the over slew length (at bucket edge) after stopping.

Unit : deg

| Standard value | Weight W (kg) |
|----------------|---------------|
| 45 | 110 |



12-4-3 Measuring the required time for slewing

Extend the bucket cylinder to maximum length, empty the bucket and measure the required time for slewing 5 turns following the first turn.

Unit : sec

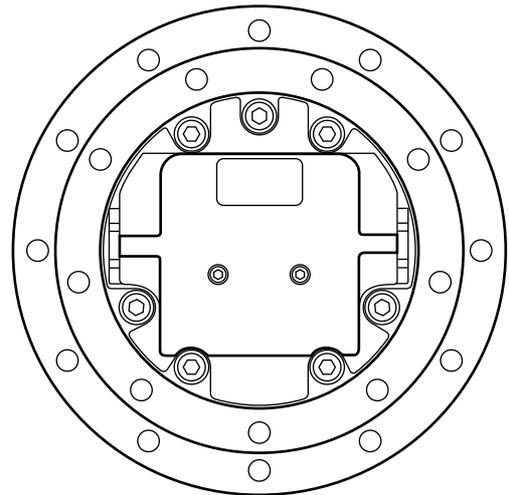
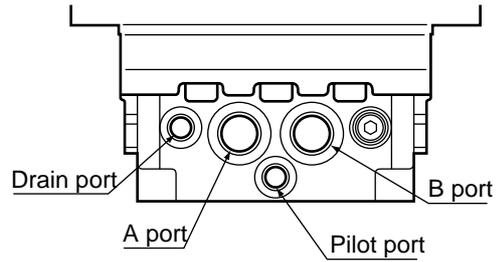
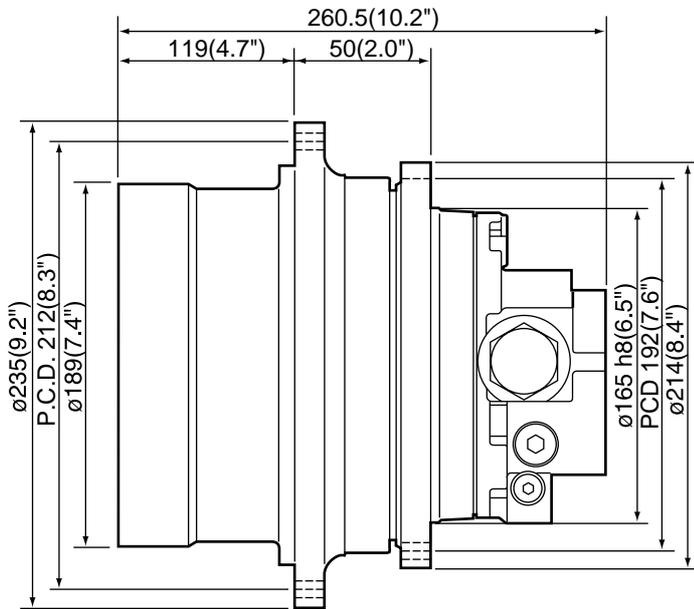
| Standard value | Allowance |
|----------------|-----------|
| 29 ± 4 | 42 |

13 TRAVEL MOTOR

CONTENTS

- 13-1 Specification
- 13-2 Structure
- 13-3 Handling the travel motor
- 13-4 Measuring travel motor idling
and travelling time
- 13-5 Inspection and adjustment

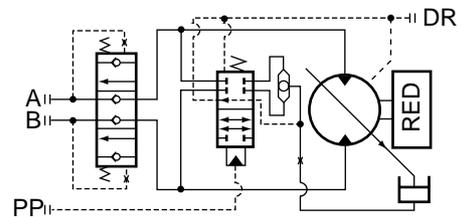
13-1 Specification



Direction of rotation (viewing from output axis)

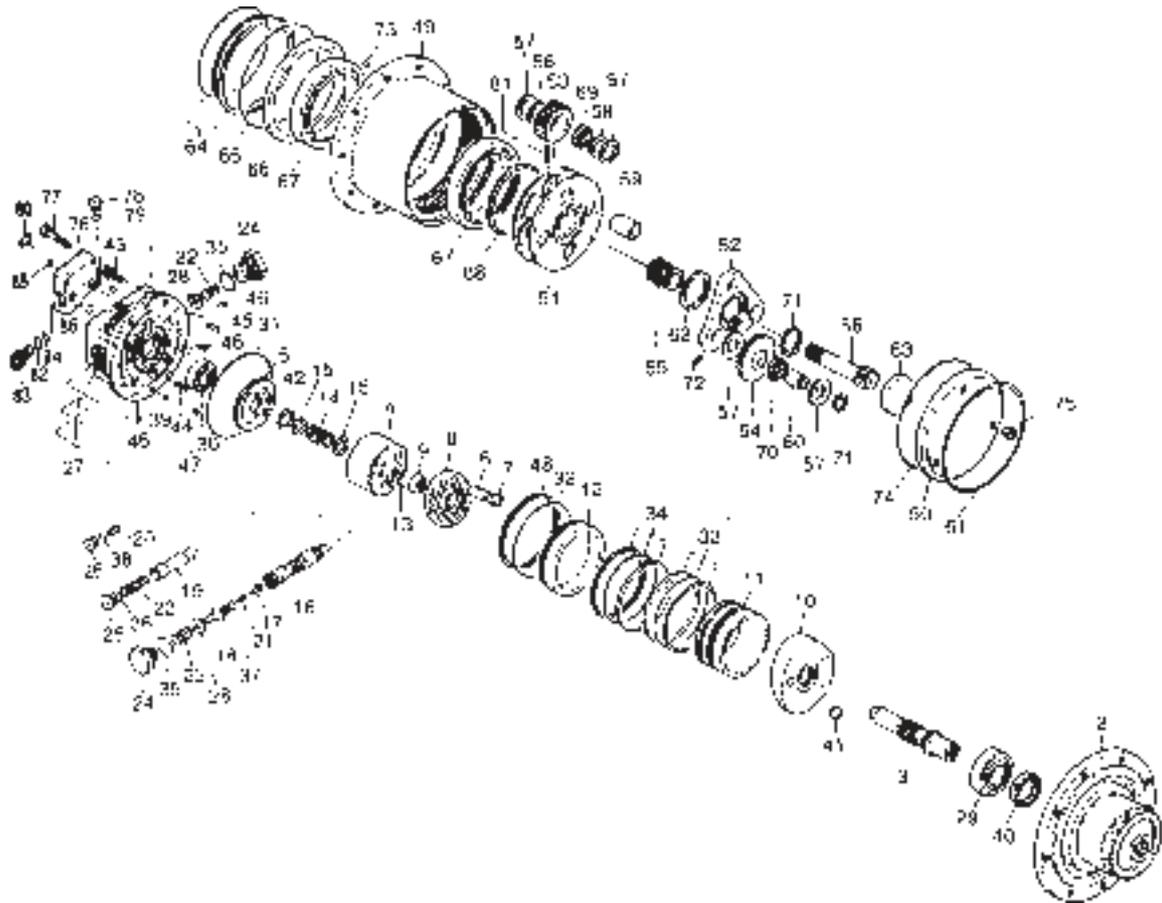
| Direction of rotation | Oil pouring port | Oil discharging port |
|-----------------------|------------------|----------------------|
| Clockwise | B | A |
| Counterclockwise | A | B |

| Port | Port size |
|-------|-----------|
| A,B | PF1/2 |
| Pilot | PF1/4 |
| Dr | PF1/4 |



| Item | | Item | | | |
|-----------------|--|-------------|------------------------------|---------------------|-----------|
| Reduction gear | Output torque N·m | 240 | Equivalent capacity cc / rev | 861.6 / 573.2 | |
| | Output speed (min ⁻¹) | 25.3/37.7 | | Oil | ISO-VG46 |
| | Reduction ratio | 1/36.5 | | Oil temperature(°C) | -20~100 |
| Hydraulic motor | Capacity cc / rev | 23.6 / 15.7 | Others | Filtering (μM) | 10 |
| | Working pressure MPa | 20.6 | | Lubricating oil | SAE-30-CD |
| | Output speed of hydraulic motor (min ⁻¹) | 926 / 1,378 | | | 600cc |
| | Flow rate ℓ/min | 22.3 | | Weight kg | 36 |

13-2 Structure

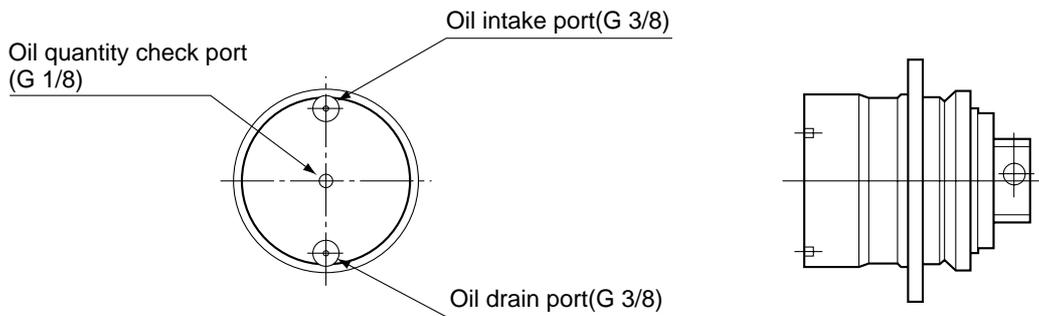


- | | | |
|----------------------|-------------------------|-------------------------|
| 1. Body-1 | 31. O-ring (IB-G125) | 61. Thrust collar |
| 2. Body-2 | 32. O-ring (IB-G100) | 62. Floating seat |
| 3. Shaft | 33. Piston seal | 63. O-ring |
| 4. Cylinder barrel | 34. Piston seal | 64. Bearing |
| 5. Valve plate | 35. O-ring (IB-P25) | 65. Needle |
| 6. Piston | 36. O-ring (IB-P14) | 66. Needle |
| 7. Shoe | 37. O-ring (IA-P12.5) | 67. Thrust washer |
| 8. Shoe holder | 38. O-ring (IB-P8) | 68. Snap ring |
| 9. Barrel holder | 39. O-ring (IB-P7) | 69. Snap ring (S-35) |
| 10. Swash plate | 40. Oil seal | 70. Snap ring (S-25) |
| 11. Control cylinder | 41. Ball | 71. Snap ring (S-13) |
| 12. Stopper ring | 42. Snap ring (H-28) | 72. Spring pin (4×20AW) |
| 13. Pin | 43. Screw (M10×25) | 73. O-ring |
| 14. Spring C | 44. Spring pin (5×12AW) | 74. O-ring |
| 15. Retainer | 45. Pin (h7 A8×15) | 75. Plug |
| 16. Spur | 46. Plug | 76. Thrust washer |
| 17. Check valve | 47. Choke | 77. Snap ring (S-30) |
| 18. Spring guide | 48. Backup ring | 78. Screw (M8×40) |
| 19. Sloop | 49. Body | 79. Plug |
| 20. Shuttle spool | 50. Cover | 80. O-ring (IB-P11) |
| 21. Spring V1 | 51. Carrier I | 81. Name plate |
| 22. Spring V2 | 52. Carrier II | 82. Pin (h7 B4×6) |
| 23. Spring V3 | 53. B1 gear | 83. Thrust washer |
| 24. Plug | 54. B2 gear | |
| 25. Plug | 55. S1 gear | |
| 26. Plug | 56. S2 gear | |
| 27. Choke | 57. B1 pin | |
| 28. Ring | 58. B2 pin | |
| 29. Bearing (6204) | 59. Seal ring | |
| 30. Bearing (6201) | 60. Snap ring | |

13-3 Handling the travel motor

Add lubricating oil according to the following procedure.

1. The cover has three plugs. Turn the motor so the plugs are at right angle to the floor. Use them as the oil intake port, oil quantity check and oil drain ports, starting from the top in that order.



2. First, remove the plugs from the oil intake and oil quantity check port with an Allen wrench.
3. Add lubricating oil through the oil intake until the oil comes out of the intake port.
4. Plug the oil intake and oil quantity check port, then wind seal tape around the plug before tightening.

| | |
|---------------------------|-------|
| Amount of lubricating oil | 600cc |
|---------------------------|-------|

Schedule for replacing lubricating oil:

- First: After the first 200 service hours or 2 months
- Second and later times : Every 1,000 service hours or 1 year

Standard maintenance

Tightening torque

| | |
|----------------------------|---------|
| Sprocket tightening torque | 110 N·m |
| Motor tightening torque | 110 N·m |

13-4 Measuring travel motor idling and travelling time

1. Idle crawler for ten turns and measure the required time.

Unit : sec

| Standard value | |
|----------------|---------|
| Low | 17±0.8 |
| High | 9.6±0.8 |

(Engine running at full speed and oil temperature of 50±5°C)

2. After travelling 3m on ground level, measure the required time to travel 20m.

| Standard value | |
|----------------|--------|
| Low | 25.5±2 |
| High | 18±2 |

(Engine running at full speed and oil temperature of 50±5°C)

13-5 Inspection and adjustment

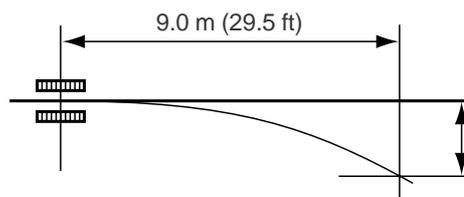
1. Measuring meander distance in travelling

Measure the meandering distance by travelling on hard ground.

Unit : mm or less

| Standard value | Max. |
|----------------|------------|
| 200(7.9") | 500(19.7") |

(Engine running at full speed and oil temperature of 50 ± 5°C)



14 HYDRAULIC CYLINDER

CONTENTS

14-1 Structure

14-2 Disassembly and assembly

14-2-1 Disassembly procedure

14-2-2 Procedure for disassembling inner parts

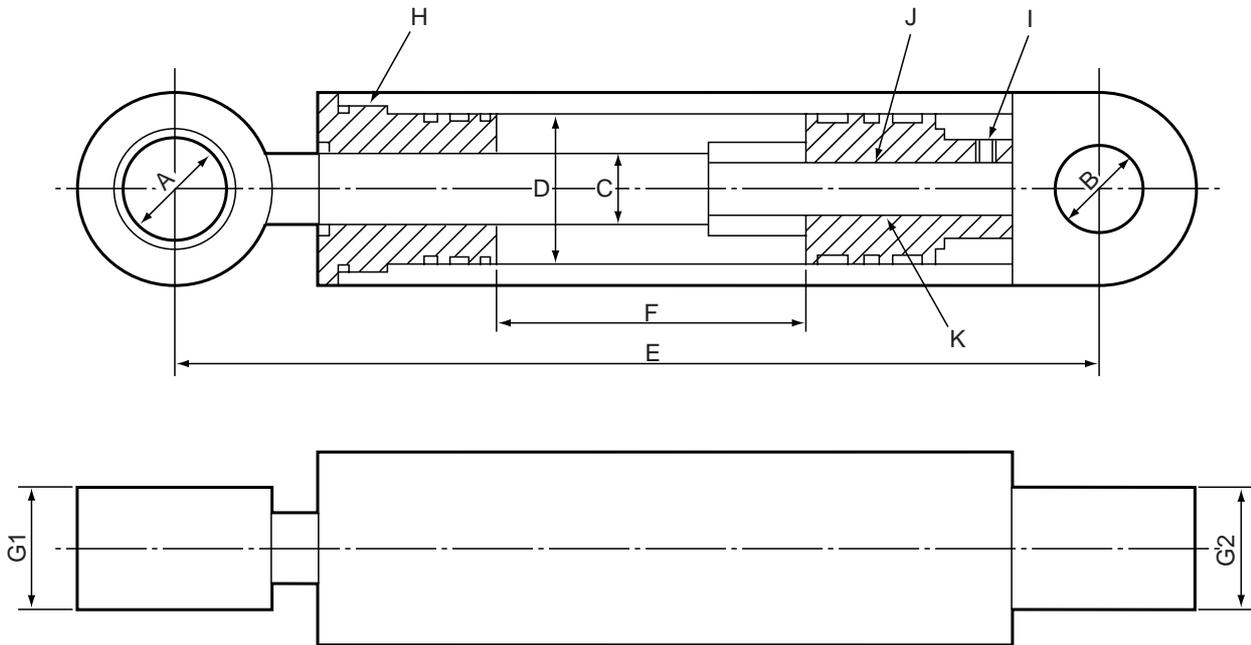
14-3 Assembly

14-3-1 Assembly procedure

14-3-2 Inspection procedure

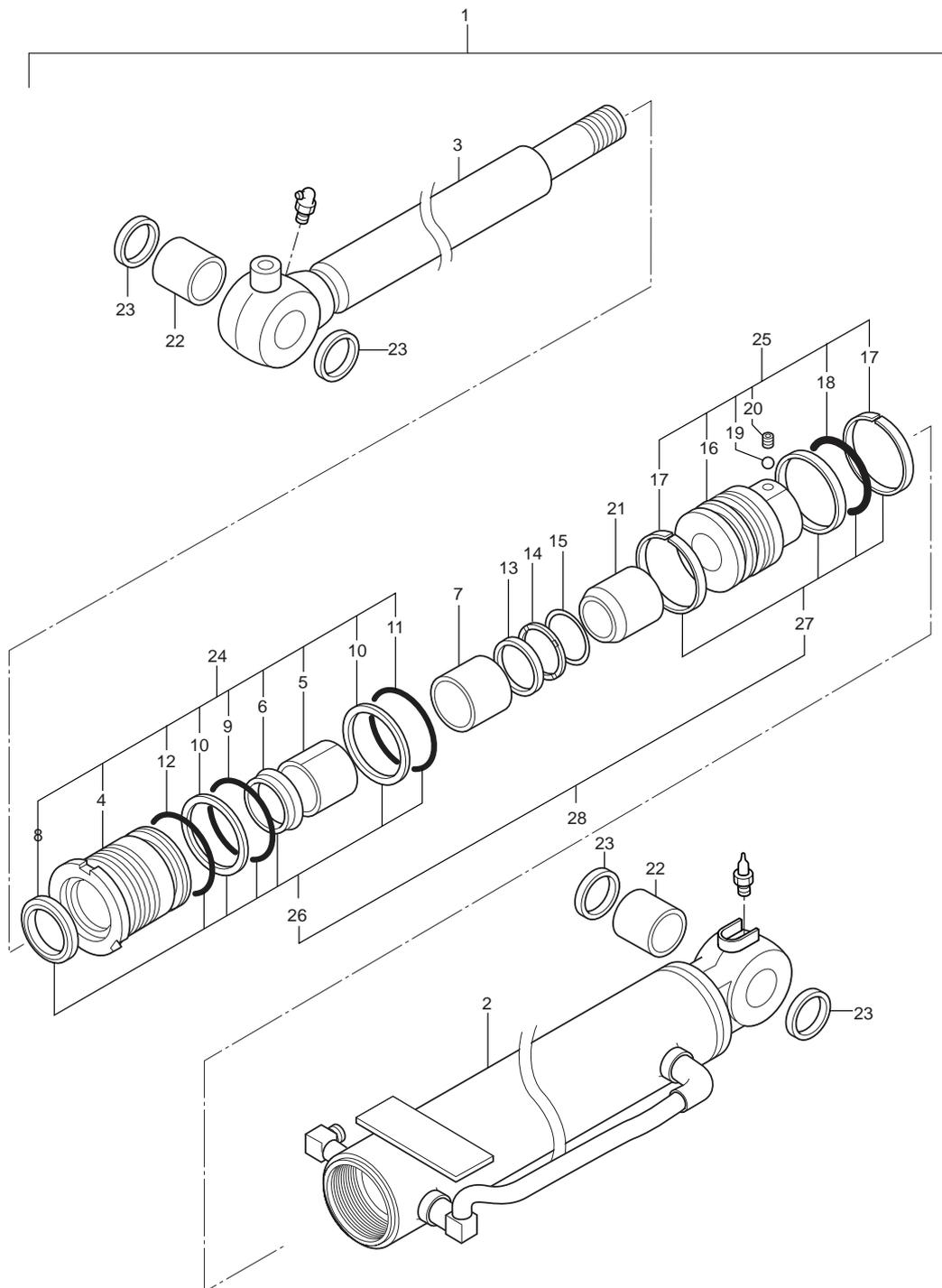
14-3-3 Precautions for assembly

14-1 Structure



| | | Cylinder | Boom | Arm | Bucket | Swing | Dozer |
|-----------------------|-------------------------------------|----------|--------------|--------------|--------------|---------------|-------------|
| Item | | | | | | | |
| Weight kg | | | 28 | 28 | 23 | 22 | 18 |
| Trust force* | Pushing | ton | 9.2 | 9.2 | 8.0 | 6.9 | 9.2 |
| | Pulling | ton | 6.6 | 6.6 | 4.7 | 4.3 | 6.6 |
| A | Pin diameter (rod) | mm | ø40 (1.6") | ø35 (1.4") | ø35 (1.4") | ø35 (1.4") | ø35 (1.4") |
| B | Pin diameter (head) | mm | ø40 (1.6") | ø35 (1.4") | ø35 (1.4) | ø35 (1.4") | ø35 (1.4") |
| C | Rod diameter | mm | ø40 (1.6") | ø40 (1.6") | ø45 (1.8") | ø40 (1.6") | ø40 (1.6") |
| D | Cylinder bore | mm | ø75 (2.9") | ø75 (2.9") | ø70 (2.7") | ø65 (2.6") | ø75 (2.9") |
| E | Maximum extended length | mm | 1432 (56.4") | 1315 (52.4") | 1105 (43.5") | 1551 (61.1") | 595 (23.4") |
| | Maximum contracted length | mm | 868 (34.2") | 805 (31.7") | 686 (27.0") | 924.5 (36.4") | 470 (18.5") |
| F | Stroke | mm | 564 (22.2") | 510 (20.1") | 419 (16.5") | 626.5 (24.7") | 125 (4.9") |
| G1 | Clevis width | mm | 50 (2.0") | 50 (2.0") | 50 (2.0") | 50 (2.0") | 50 (2.0") |
| G2 | | | 50 (2.0") | 50 (2.0") | 50 (2.0") | 50 (2.0") | 50 (2.0") |
| H | Tightening torque | N·m | 430 | 430 | 390 | 350 | 430 |
| I | Tightening torque | N·m | 10 | 10 | 10 | 10 | 10 |
| J | Tightening torque | N·m | 700 | 700 | 680 | 530 | 700 |
| K | Size of piston screw (size × pitch) | | M27 × 1.5 | M27 × 1.5 | M30 × 1.5 | M27 × 1.5 | M27 × 1.5 |
| *Main relief pressure | | MPa | 20.6 | 20.6 | 20.6 | 20.6 | 17.2 |

14-2 Disassembly and assembly



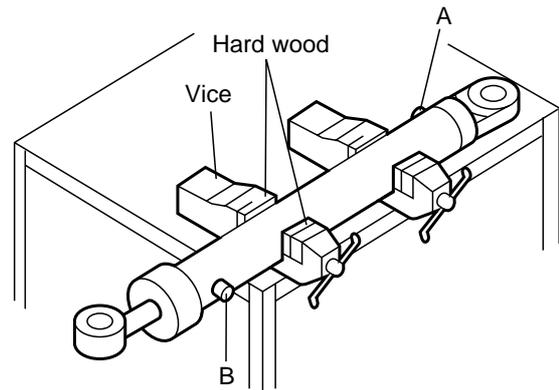
The illustration shows a boom cylinder.

- | | | |
|----------------------|------------------------|-----------------------------|
| 1. Cylinder assembly | 11. O-ring | 21. Cushion bearing |
| 2. Tube | 12. O-ring | 22. Pin bush |
| 3. Rod | 13. Cushion ring | 23. Dust seal |
| 4. Rod cover | 14. Spacer | 24. Cylinder head assembly |
| 5. Rod bush | 15. Stopper | 25. Piston assembly |
| 6. U-ring | 16. Piston | 26. Rod packing assembly |
| 7. Retainer | 17. Slide ring | 27. Piston packing assembly |
| 8. Wiper ring | 18. Seal ring assembly | 28. Packing assembly |
| 9. O-ring | 19. Steel ball | |
| 10. Backup ring | 20. Set screw | |

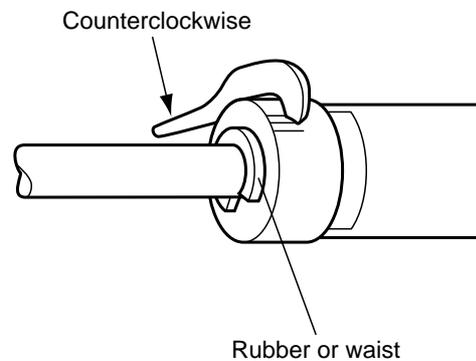
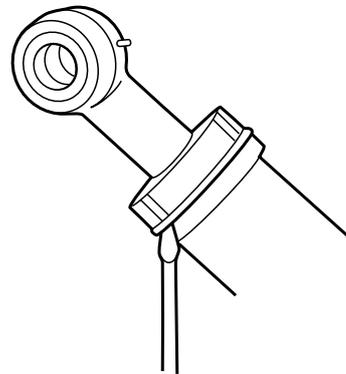
14-2-1 Disassembly procedure

1. Hold the cylinder with the vice.

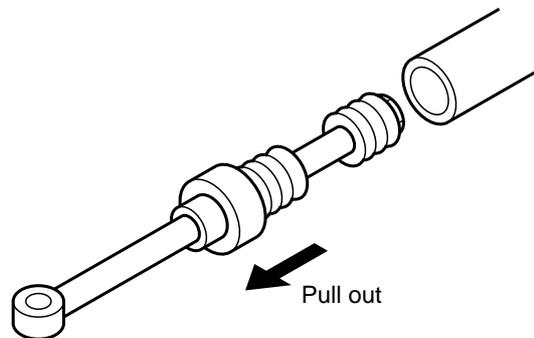
Tighten the vice carefully; do not deform the cylinder. Blow air alternately from ports A and B and operate the piston rod to drain oil from the cylinder inside. To remove the piston, pull the piston rod about a third of the length.



2. Loosen and remove the rod cover from the cylinder tube assembly with a hook wrench.



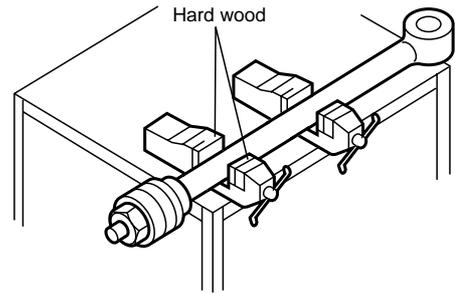
3. Disassembling the piston rod assembly
Slowly turn the piston rod assembly to remove it from the cylinder tube assembly. Place the removed piston rod assembly on a wooden bench or a waste to prevent damage.



4. Disassembling the piston assembly

Hold the piston rod assembly with a vice.

 - Put the waste between hard wood and the piston to prevent the surface sliding from being damaged.
 - Set the piston rod assembly on a level block so that it becomes parallel to the level block. Be careful because the piston rod assembly may come out of the vice and be damaged if it is set diagonally.



14-2-2 Procedure for disassembling inner parts

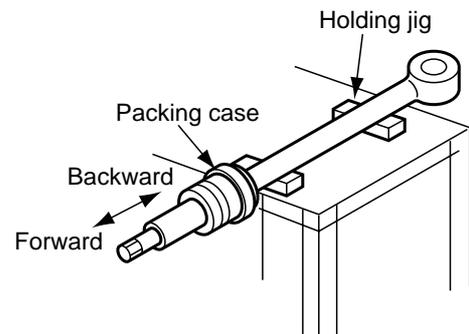
1. Remove the piston assembly from the piston rod assembly (after removing the set bolts). Then remove the cushion bearing in the direction of the arrow.

2. Disassembling rod cover

Put piston rod assembly on a holding jig on the work bench.

Make a working face for the rod cover assembly on the workbench and move the rod cover to and fro to remove it.

Remove the backup ring then the O ring with a screwdriver. If they are to be reused, be careful not to damage them.

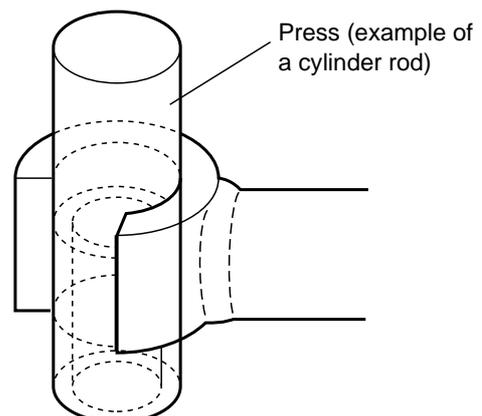


3. Disassembling the packing assembly

Remove the packing by prying it with an eyelet or a screwdriver. Be careful not to damage the groove of the cover and piston. Because it is difficult to remove the dust seal and rod packing without damaging them, remove them by inserting a eyelet or a similar tool and prying them out. Be careful not to damage the groove on the cover and piston.

4. Disassembling the piston rod and cylinder tube assembly

As the bushes are pressed fit to the rod head, press them out with a pressing machine to remove them. For a spherical bearing, the snap ring must be removed first.



14-3 Assembly

14-3-1 Assembly procedure

1. The assembly procedure is the reverse of disassembly.
2. Before assembly, check whether metallic powder or other foreign matter is not sticking to any of the parts and whether the parts can be reused.
3. Coat hydraulic oil on each part before assembling them.
4. Assemble beforehand the parts into the following assemblies.

- Cylinder tube assembly
- Rod cover assembly
- Piston rod
- Piston assembly

14-3-2 Inspection procedure

Clean each disassembled part with light oil or treated oil except for the packings. Packings are cleaned with petroleum hydraulic oil.

Other types of oil will remarkably shorten the life of the packing.

Thoroughly clean the sliding surface, oil hole, O ring, packing groove, etc. If the part is not used for a long time after being cleaned, execute a rust proof treatment.

(Coating hydraulic oil is effective for rust prevention to a certain degree.)

1. Check all parts for flaws, cracks, deformation, rust, or burrs which may affect the operation. (Inside of the tube, rod, etc.)
2. Check each part for metallic powder or other foreign matter sticking to it.
3. Check the sliding surface of piston rod for damage, uneven abrasion, discoloring, or any defect which may affect its operation.
4. Packings and seals are usually replaced with new one. If you must reuse them, check that there are no tears, cuts or foreign matter sticking to the packing.

14-3-3 Precautions for assembly

Assemble the cylinder while paying attention to the following matters.

1. Replace the packings with new ones before assembly.
2. Execute assembly work paying attention to the direction of cushion bearings (boom, arm, bucket and swing) and seal rings (arm and swing).
3. Replace the set bolts with new ones.
In assembling, after tightening the set bolts, further tighten and firmly fix them by hitting with punch at two points on the periphery.
4. Tighten the rod cover, piston and nuts with a specified tightening torque shown in the attached table (page 14-1).
5. Check fully before starting assembly work.

15 SWIVEL JOINT

CONTENTS

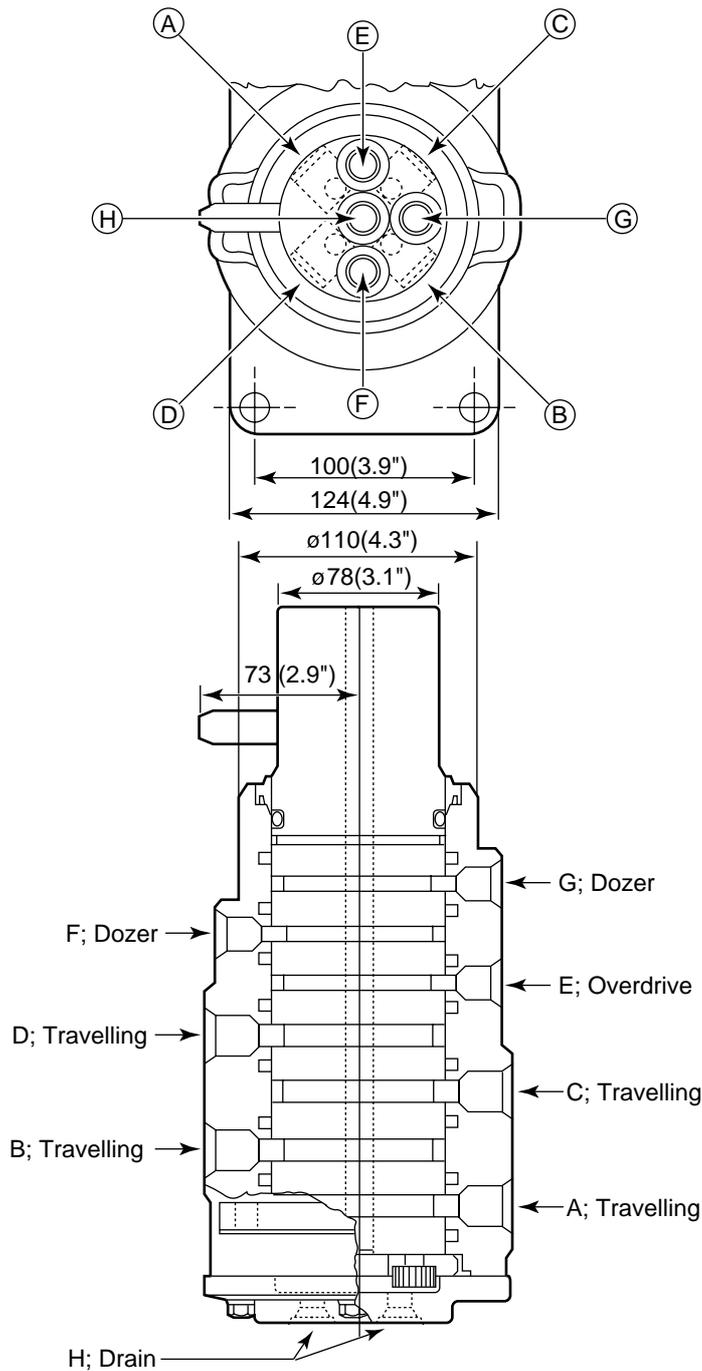
15-1 Specification and Structure

15-2 Structure, disassembly and assembly

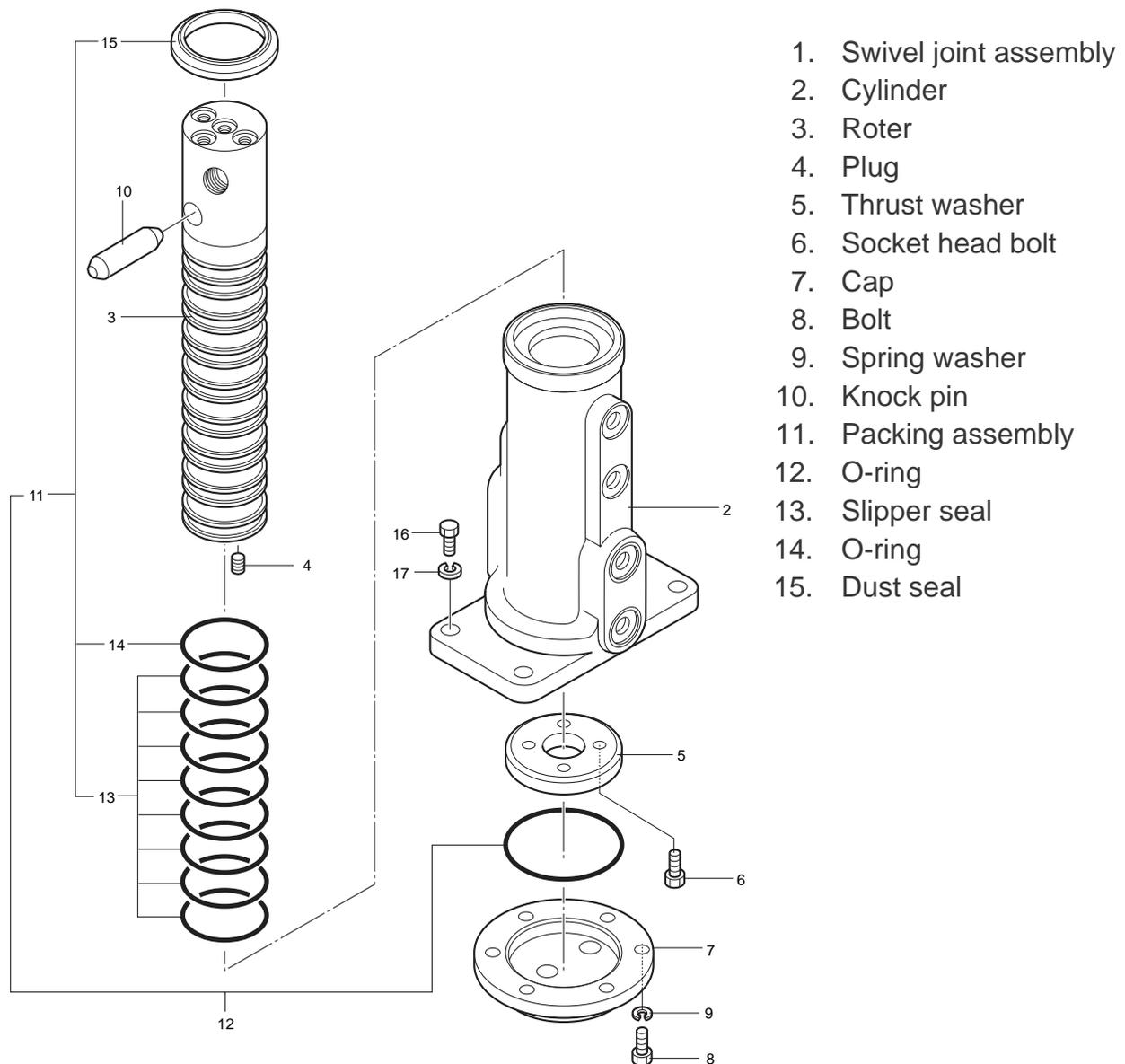
15-1 Specification and Structure

| | | |
|------------------|-----------|----------------------|
| Working pressure | H | 0.5 MPa |
| | E | 0.98 MPa |
| | A~D, F, G | 20.5 MPa |
| Port size | E~H | PF 1/4 |
| | A~D | PF 3/8 |
| Working speed | | 10 min ⁻¹ |

*A to H and D rain denote the position of the port.



15-2 Structure, disassembly and assembly



Disassembly:

1. Remove bolt (8) and cap(7).
2. Remove the bolts (6) and thrust washer (5).
3. Remove the shaft (3) from the hub (2) upward. Because the shaft is tightened by the tension of the O ring, tap a hammer on the shaft by rotating it and pull it up.
* Be careful so that O ring does not become trapped.

Assembly:

1. Before assembly, check the O ring and sliding part for flaws and other defects.
2. Assembly is usually executed in the opposite order of disassembly.
Coat a little hydraulic oil or grease on the O rings before assembly.

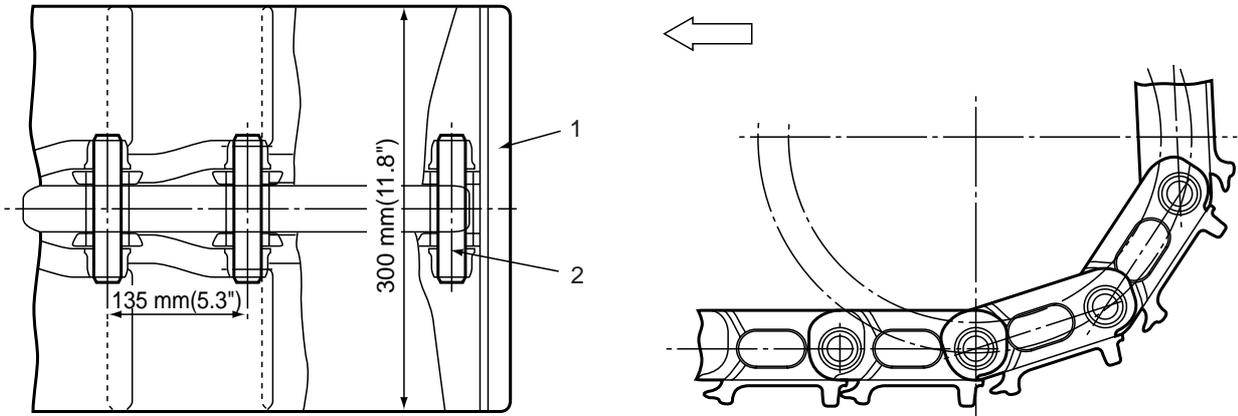
16 CRAWLER

CONTENTS

- 16-1 Structure and operation
 - 16-1-1 Crawler (Steel)
 - 16-1-2 Track frame
- 16-2 Standard of maintenance
 - 16-2-1 Crawler (Steel)
- 16-3 Disassembly and assembly
 - 16-3-1 Installing the crawler
 - 16-3-2 Removing the crawler
 - 16-3-3 Track frame spring
 - 16-3-4 Life of the rubber crawler
 - 16-3-5 Handling the rubber crawler

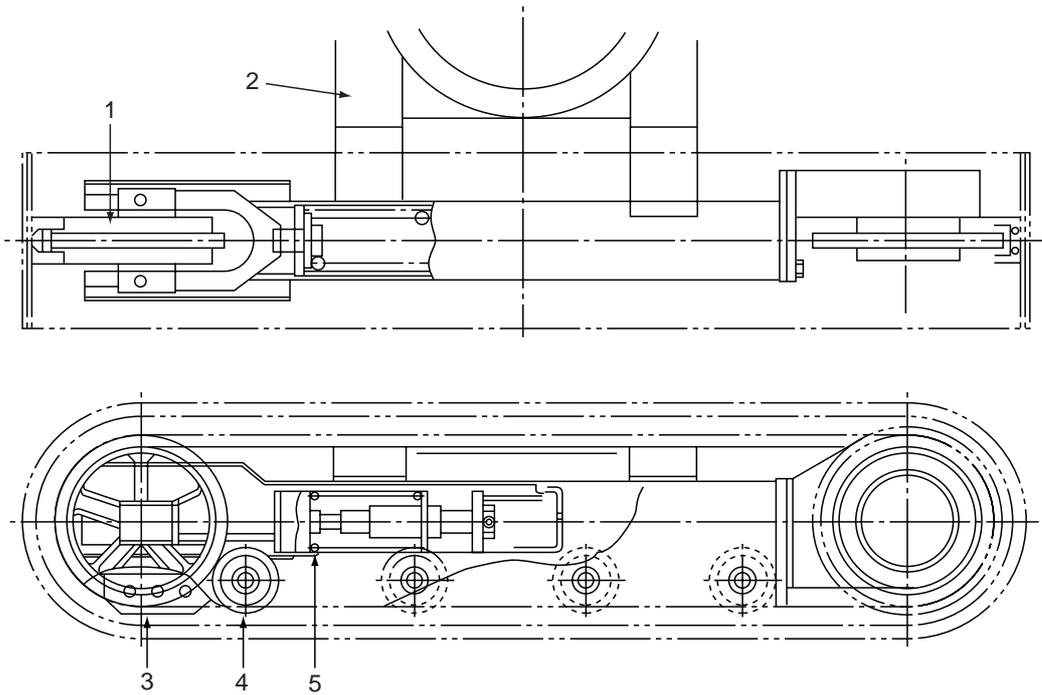
16-1 Structure and operation

16-1-1 Crawler (steel)



- 1. Shoe
- 2. Pin

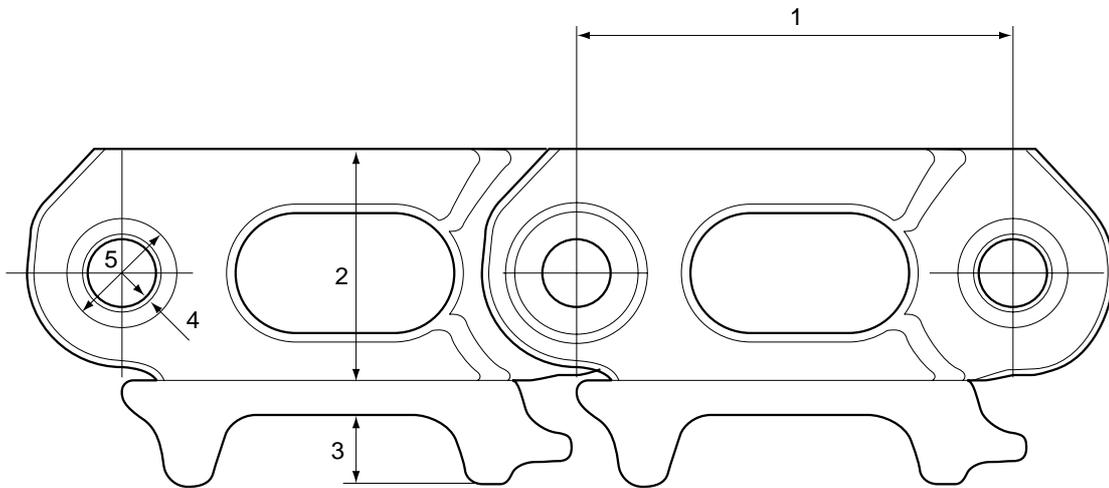
16-1-2 Track frame



- 1. Idler
- 2. Track frame
- 3. Guard (for steel crawler)
- 4. Track roller
- 5. Spring

16-2 Standard of maintenance

16-2-1 Crawler (steel)



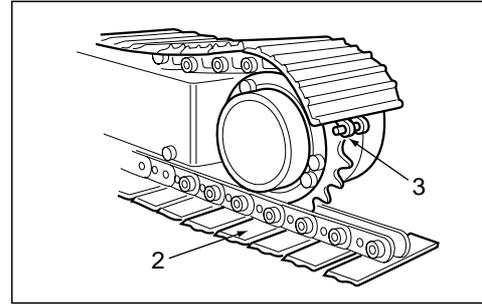
| No. | Item | Unit | Standard value | Allowance | Remarks |
|-----|---------------------|------|----------------------------------|------------|--|
| 1 | Link pitch | mm | 101.6(4.0") | 104(4.1") | Measure by stretching 5 links except for the master link |
| 2 | Link height | | 61(2.4") | 58.5(2.3") | Pad or replace |
| 3 | Grouser height | | $16.5 \pm 1.5(0.6'' \pm 0.06'')$ | 7(0.3") | Pad or replace |
| 4 | Pin clearance | | 0.33(0.012") | 2(0.08") | Replace |
| 5 | Bush outer diameter | | 32.2(1.26") | 29(1.14") | Replace |

16-3 Disassembly and assembly

16-3-1 Installing the crawler

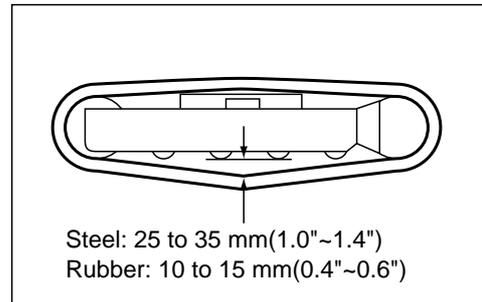
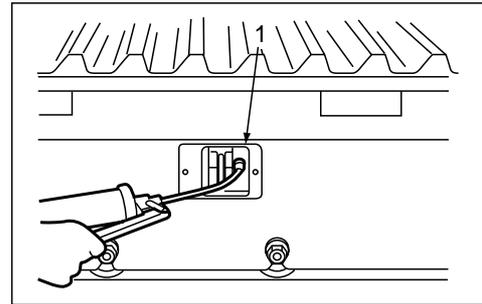
1. Crawler

After the sprocket put on the crawler (2), drive motor to bring it above the idler and for steel crawler, fix the master pin (3) into the hole. For a rubber crawler, the crawler by using the idler as it is. Install steel bar and heavy duty hammer into the undercarriage.



2. Tension the crawler

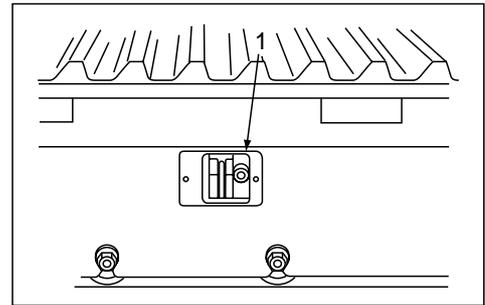
Tighten the cartridge valve (1) of the adjust cylinder, grease and adjust the tension.



16-3-2 Removing the crawler

1. Loosen the crawler.

By loosen the cartridge valve (1) of the adjust cylinder, drain grease and loosen the crawler (2).

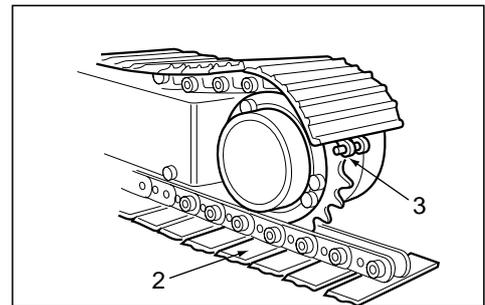


2. Crawler

1) Lift the main frame with attachment and put blocks under to lift the machine.

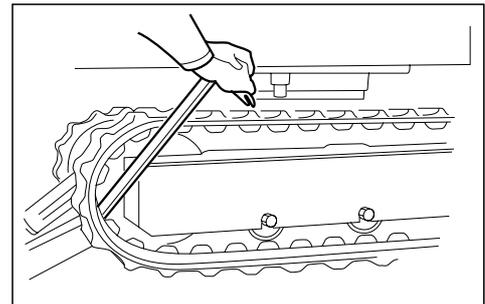
2) Turning in the direction of the idler side, remove crawler master pin (3) and then the crawler (2) from track frame.

Weight (steel crawler): 312 kg (156×2)

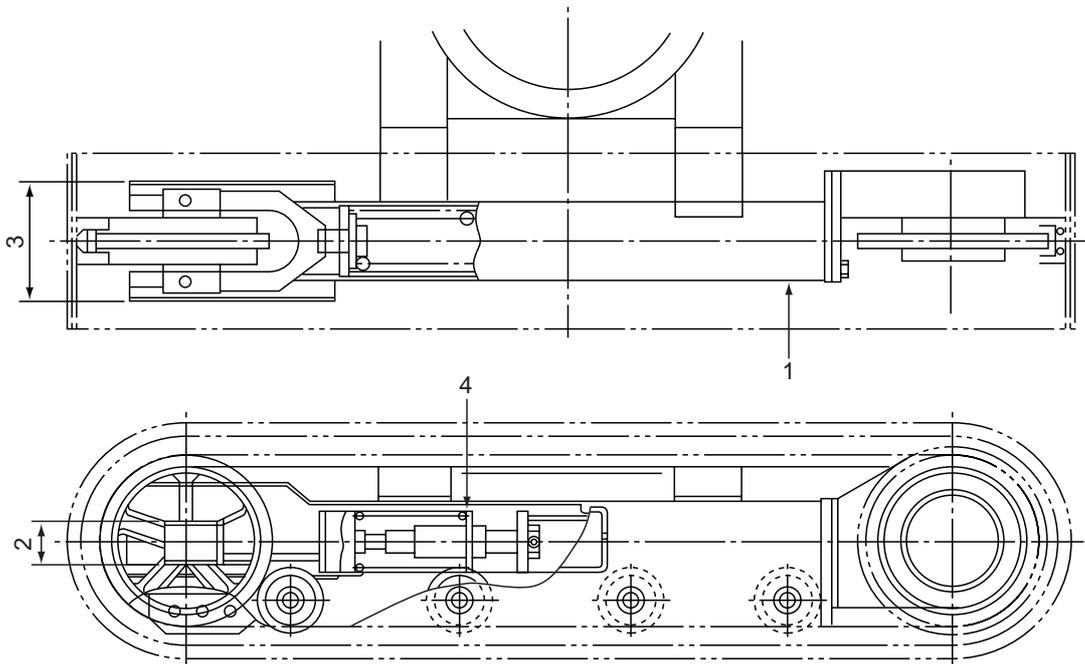


3) As rubber crawler is endless and of solid material, push the idler to the end and remove the rubber crawler by using steel bar from the idler.

Weight (rubber crawler): 276 kg (138×2)



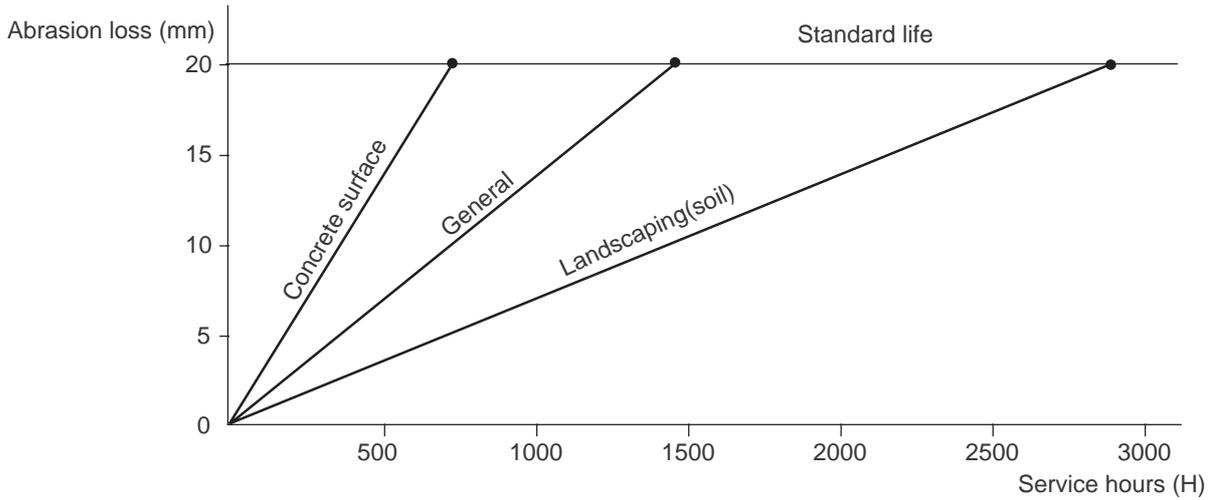
16-3-3 Track frame spring



Unit: mm

| No. | Item | Standard | | Remedy | |
|-----|---|-------------------|---|-----------------|----------------|
| | | | Allowable limit | | |
| 1 | Deformation of frame | Bend | 5 (0.2") (Overall length of track frame) | Correct | |
| | | Twist | 10 (0.4") (Twist between left and right crawler frames) | | |
| | | Opening of idler | 5 (0.2") | | |
| 2 | Distance between upper and lower faces of idler guide | | Standard value | Allowable limit | Pad or replace |
| | | 2-1 Track frame | $126^{+1.0}_{-0}$ (5.0" $^{+0.04}_{-0}$) | 131 (5.2") | |
| 3 | Distance between left and right faces of idler guide | 2-2 Idler frame | $124^{+0}_{-0.5}$ (4.9" $^{+0}_{-0.02}$) | 119 (4.7") | Replace |
| | | 3-1 Track frame | $166^{+1.0}_{-2.0}$ (6.5" $^{+0.04}_{-0.08}$) | 171 (6.7") | |
| 4 | Spring (free length) | 3-2 Idler support | 162 ± 1.0 (6.4" ± 0.04 ") | 157 (6.2") | Replace |
| | | Standard value | Allowable limit | | |
| | | Set length | 203.5 (8.0") | | |

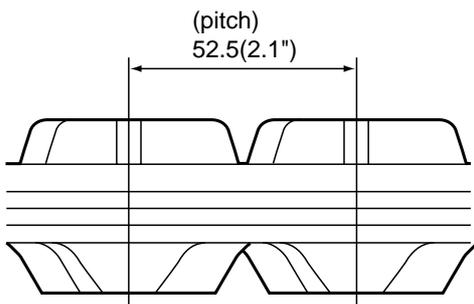
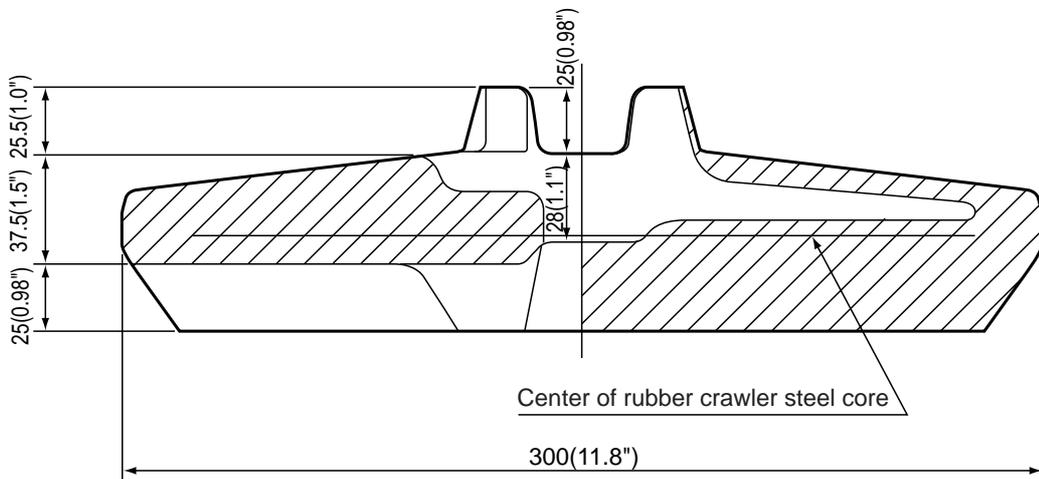
16-3-4 Life of the rubber crawler



Check the remaining life of the rubber crawler by the abrasion loss in the rubber crawler height as shown in the figure below. Note that the life slightly differs depending on the conditions of site and the operation of the machine.

PRECAUTIONS:

- (1) Wipe immediately if fuel or hydraulic oil sticks to rubber crawler.
- (2) Check that there are no sharp edges protruding on the ground.
- (3) Avoid using on beach. (This may affect the adhesion of the core metal.)
- (4) If the machine is going to be stored for a long time, never store it where it will be directly exposed to sunlight.



| Description | | Value |
|--------------------------------|--------------|---------------------|
| Total length of rubber crawler | | 3,960±12(156"±0.5") |
| Steel cord | Tension | 400 kg / piece |
| Steel cord | No. of cords | 60±4 |
| Range of working temperature | | -25°C~55°C |
| Width × pitch | | 300×52.5 |

16-3-5 Handling the rubber crawler

1. Do not run over or turn on a sharp edge

If you run over or turn on a projecting sharp edge or a stepped grade, the machine will partially load on the rubber crawler and split it or cut the threads of the rubber crawler and the inner steel cord.

2. Prevent foreign matter from entering the rubber crawler

Foreign matter will strain the crawler and cut it.

3. No sharp turns

Do not turn sharply on a road with a high-friction factor (such as a concrete road).

4. Keep oil products away from the rubber crawler

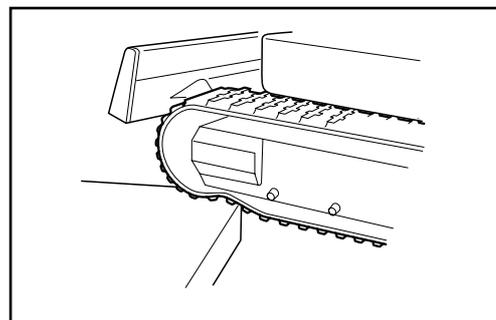
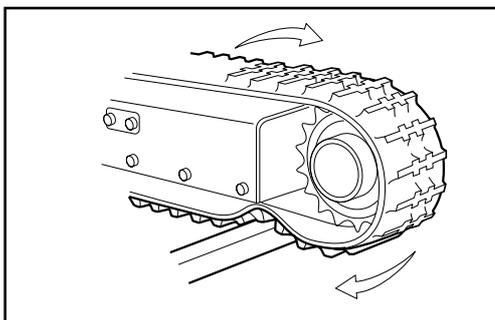
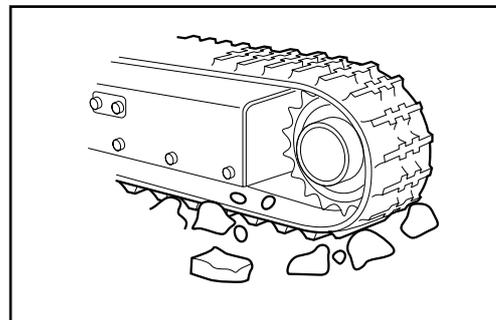
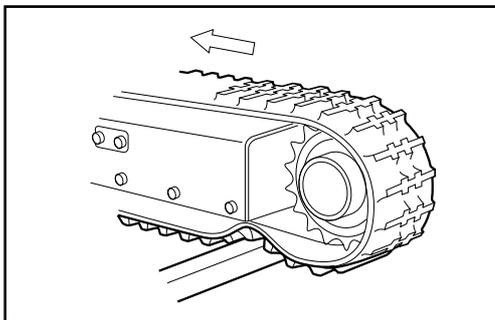
If you spill fuel or hydraulic fluid on the rubber crawler, clean it promptly.

5. Protect from salt

Do not operate on beach (Core metal will rust due to salt corrosion).

6. Store indoors

If the machine is not used for a long time, keep it indoors to prevent exposure to direct sunlight and rain.



17 SPRING CASE AND GREASE CYLINDER

CONTENTS

17-1 Structure

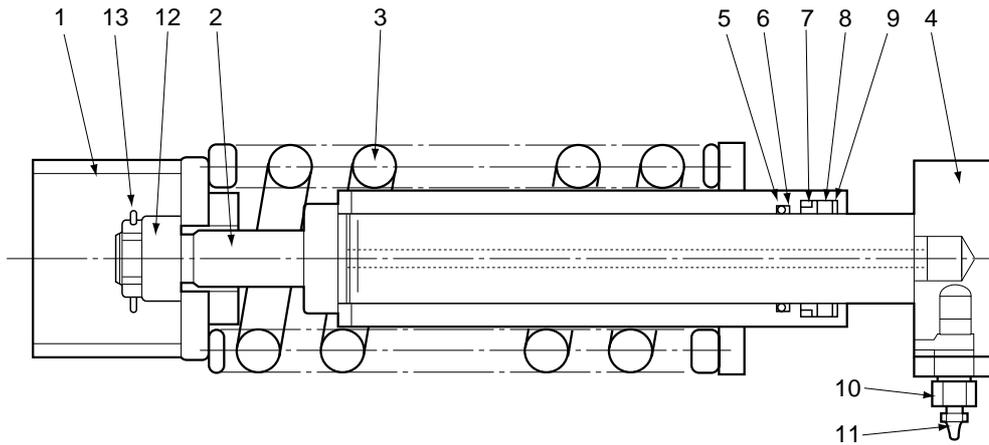
17-2 Specification of spring

17-3 Disassembly and assembly

17-3-1 How to disassemble and assemble the ad
just cylinder

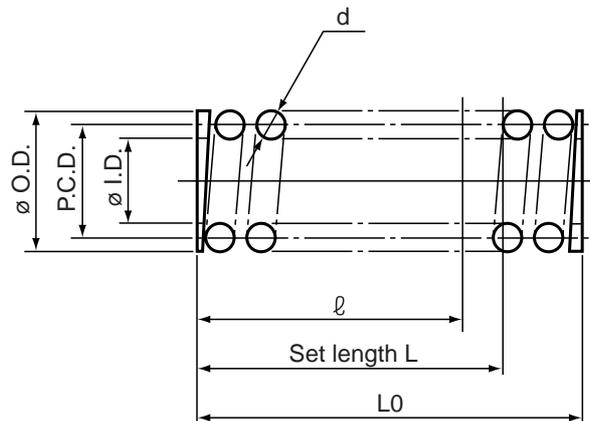
17-3-2 How to disassemble and assemble the
spring case

17-1 Structure



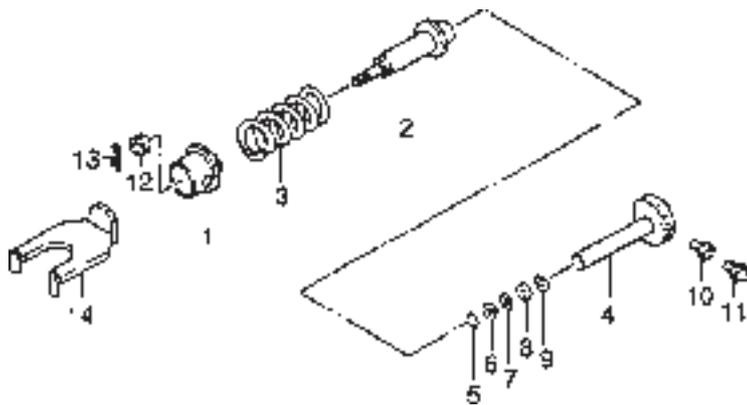
- | | |
|-------------------------|-----------------------------|
| 1. Plate | 8. Spacer |
| 2. Cylinder | 9. Snap ring (H-52) |
| 3. Spring | 10. Cartridge valve |
| 4. Rod | 11. Grease nipple (PT1/8-A) |
| 5. O-ring (IB-P40) | 12. Castle nut |
| 6. Backup ring (T2-P40) | 13. Split pin |
| 7. Dust seal (DKR-40) | |

17-2 Specification of spring



| Name | Value | Name | Value |
|------------------------------|--------------|--|-------------|
| No. of active coils | 7.5 | l Length at max. shrinkage (mm) | 195.1(7.7") |
| Total number of coils | 9 | \varnothing O.D. (outer diameter)(mm) | 107(4.2") |
| Spring constant (kgf/mm) | 50.9 (2.0") | P.C.D. (Center diameter) (mm) | 85(3.3") |
| Set force (kg) | 2,698 | \varnothing I.D. (Inner diameter) (mm) | 63(2.5") |
| Force at max. shrinkage (kg) | 4,650 | Wire diameter d (mm) | 22(0.9") |
| Lo Free length (mm) | 286.5(11.3") | L set length (mm) | 233.5(9.2") |

17-3 Disassembly and assembly



- | | |
|-------------------------|---------------------|
| 1. O-ring (IB-P30) | 8. Spacer |
| 2. Cylinder | 9. Split pin |
| 3. Backup ring (T2-P40) | 10. Cartridge valve |
| 4. Rod | 11. Spring |
| 5. Scraper (DSI) | 12. Castle nut |
| 6. Backup ring (T2-P40) | 13. Split pin |
| 7. Castle nut | 14. Idler yoke |

Cylinder effective stroke: 150 mm(5.9")

17-3-1 How to disassemble and assemble the adjust cylinder

1. Disassembly

- Remove the cartridge valve from the adjust cylinder rod.
- Remove the cylinder rod from the adjust cylinder tube.
- Remove the snap ring, spacer, dust seal, backup ring and O-ring.

2. Assembly

The assembly procedure is the reverse of the disassembly procedure.

- Attach the O-ring, backup ring and spacer to adjust cylinder tube.
*Coat grease on the O-ring and dust seal before assembly.
- Attach the adjust cylinder rod to adjust the cylinder tube carefully so that the seals are not damaged. Apply grease before hand in the adjust cylinder tube. Attach the cartridge valve to the adjust cylinder rod so that the screw on the second step reaches the tapped hole. When attaching the adjust cylinder rod, tighten the cartridge valve after checking that grease comes out of the grease drain hole.

Note:

- Adjust and assemble carefully so that air does not remain in the adjust cylinder tube.
- Coat grease on the piston of the cylinder tube rod before assembly.
Tightening torque of the cartridge valve: 187 to 210 N·m

17-3-2 How to disassemble and assemble the spring case

1. Disassembly

Lower the spring force between the front idler and adjust cylinder tube using a pressing machine and the special purpose tool.

- a. Remove the castle nut for the mounting spring.
- b. Remove the spring from adjust cylinder tube.

Note:

- Be careful when using the tool when removing the spring. Also, be careful during assembly.

2. Assembly

The assembly procedure is the reverse of disassembly.

Attach the spring to adjust cylinder tube using the special tool and set the spring to the specified position with the castle nut.

After adjustment, completely bend the split pin.

Spring set length: 233.5mm(9.2")

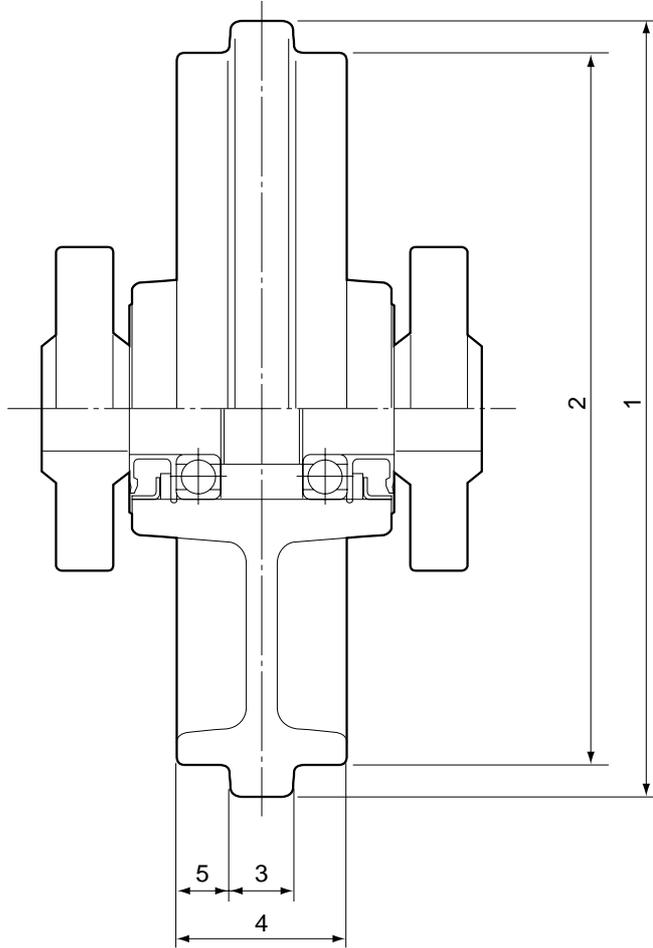
18 IDLER

CONTENTS

- 18-1 Standard of maintenance
 - 18-1-1 Idler

18-1 Standard of maintenance

18-1-1 Idler



| No. | Item | Unit | Standard value | Allowance | Remark |
|-----|----------------------------------|------|----------------|--------------|------------------------|
| 1 | Outer diameter of projected part | mm | ø311(12.2") | ø307(12.1") | Pad or replace |
| 2 | Outer diameter of tread | mm | ø269 (10.6") | ø265 (10.4") | Pad or replace |
| 3 | Width of projected part | mm | 25 (1.0") | 21 (0.8") | Pad or replace |
| 4 | Overall width | mm | 65 (2.6") | 60 (2.4") | Pad or replace |
| 5 | Width of tread | mm | 20 (0.8") | 24 (0.9") | Pad or replace |
| 6 | Quality of lubricating oil | cc | 80 | | Gear oil or engine oil |

19 SPROCKET

CONTENTS

- 19-1 Disassembly and assembly
 - 19-1-1 Removing the sprocket
 - 19-1-2 Installing the sprocket
- 19-2 Standard of maintenance
 - 19-2-1 Sprocket

19-1 Disassembly and assembly

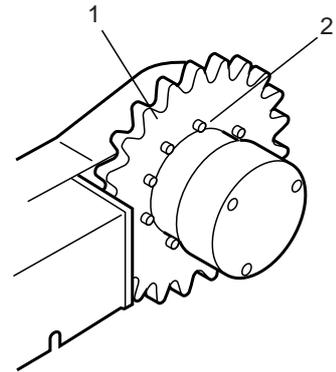
19-1-1 Removing the sprocket

1. Crawler

Refer to the explanation on crawler removal.

2. Sprocket

Remove sprocket mounting bolts (1) and then sprocket (2) from the travelling motor assembly.



19-1-2 Installing the sprocket

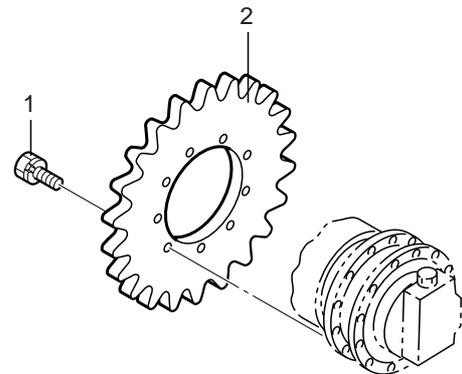
1. Sprocket

Attach the sprocket to travelling motor assembly and tighten the mounting bolts (1).

Tightening torque: 100 N·m~110 N·m (72.3~80 lb-ft)

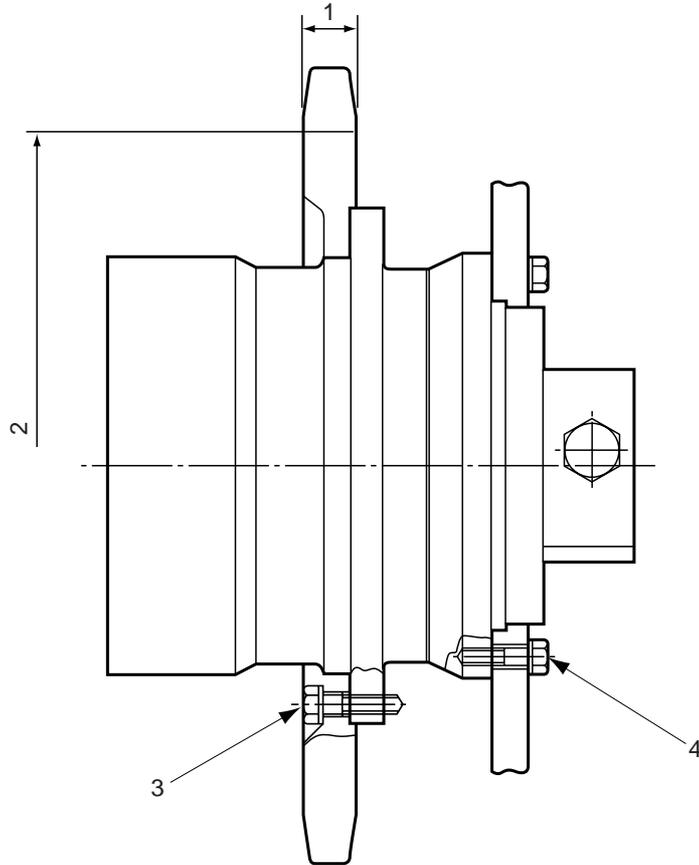
2. Crawler

Refer to the explanation of crawler installation.



19-2 Standard of maintenance

19-2-1 Sprocket



| No. | Item | Unit | Standard value | Allowance | Remarks |
|-----|---|------|----------------|---------------|-------------------------------|
| 1 | Width of sprocket teeth | mm | 25(1.0") | 19(0.07") | Pad or replace |
| 2 | Minor diameter of sprocket | mm | ø313.8(12.4") | ø305.8(12.0") | Pad or replace |
| 3 | Tightening torque of sprocket mounting bolt | N·m | 100~110 | — | Tighten some more. (M10 P1.5) |
| 4 | Tightening torque of motor mounting bolt | N·m | 100~110 | — | Tighten some more. (M10 P1.5) |

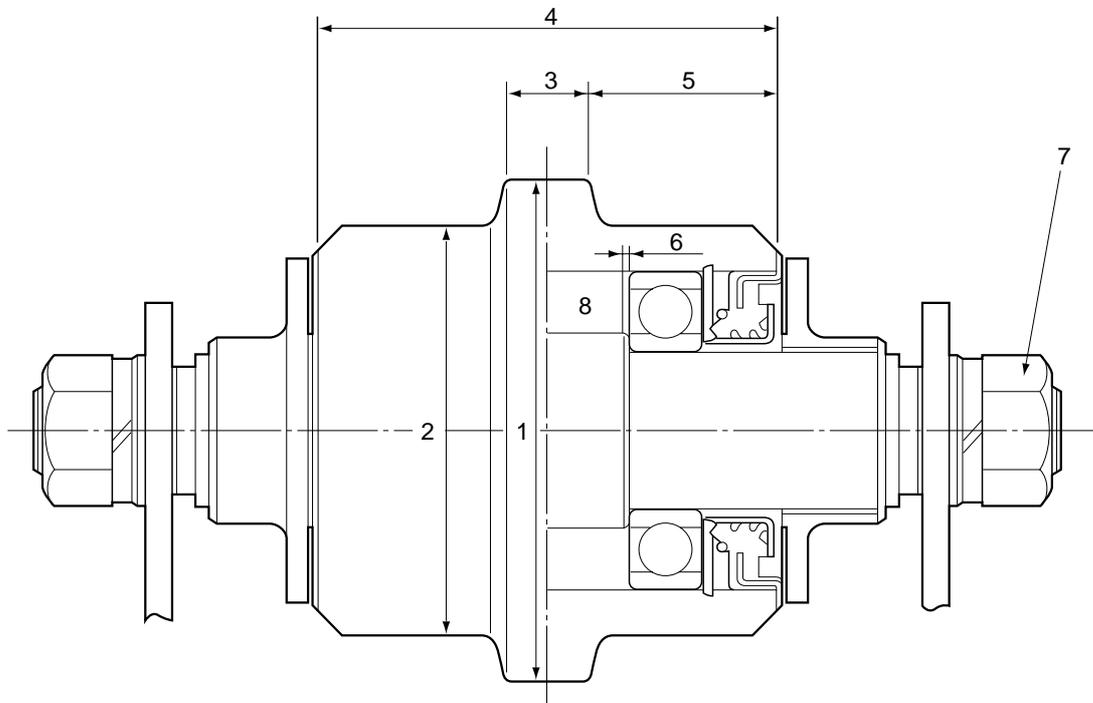
20 TRACK ROLLER

CONTENTS

- 20-1 Standard of maintenance
 - 20-1-1 Track roller

20-1 Standard of maintenance

20-1-1 Track roller



| No. | Item | Unit | Standard value | Allowance | Remarks |
|-----|---------------------------------------|------|----------------|------------|----------------------------|
| 1 | Outer diameter of projected part | mm | ø115(4.5") | — | Pad or replace |
| 2 | Outer diameter of tread | mm | ø95(3.7") | ø92(3.6") | Pad or replace |
| 3 | Width of projected part | mm | 24(0.9") | 21(0.8") | Pad or replace |
| 4 | Overall width | mm | 108(4.3") | — | Pad or replace |
| 5 | Width of tread | mm | 42(1.7") | — | Pad or replace |
| 6 | Roller side clearance | mm | 0.2±0.1 | 1.5(0.06") | Replace bush |
| 7 | Tightening torque for mounting roller | N·m | 325 | | Tighten some more.(M24 P3) |
| 8 | Quantity of lubricating oil | cc | 100 | | Gear oil or engine oil |

21 CARRIER ROLLER

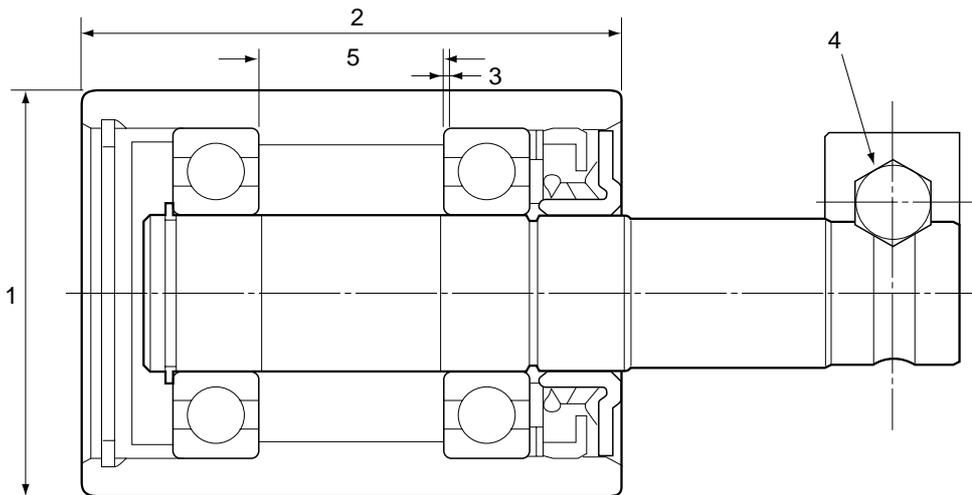
CONTENTS

21-1 Standard of maintenance

21-1-1 Carrier roller

21-1 Standard of maintenance

21-1-1 Carrier roller



| No. | Item | Unit | Standard value | Allowance | Remarks |
|-----|---------------------------------------|------|-------------------------|-------------|----------------------------------|
| 1 | Outer diameter of projected part | mm | ø76 (3.0") | ø73 (2.9") | Pad or replace |
| 2 | Overall width | mm | 100 (3.9") | — | Pad or replace |
| 3 | Roller side clearance | mm | 0.2±0.1 (0.008"±0.004") | 1.5 (0.06") | Replace bush |
| 4 | Tightening torque for mounting roller | N·m | 22 | | Tighten some more. (M8 P1.25) |
| 5 | Quantity of lubricating oil | cc | 70 | | Gear oil engine oil |

22 ELECTRICAL EQUIPMENT

CONTENTS

22-1 Structure and function

19-1-1 Electric circuit diagram

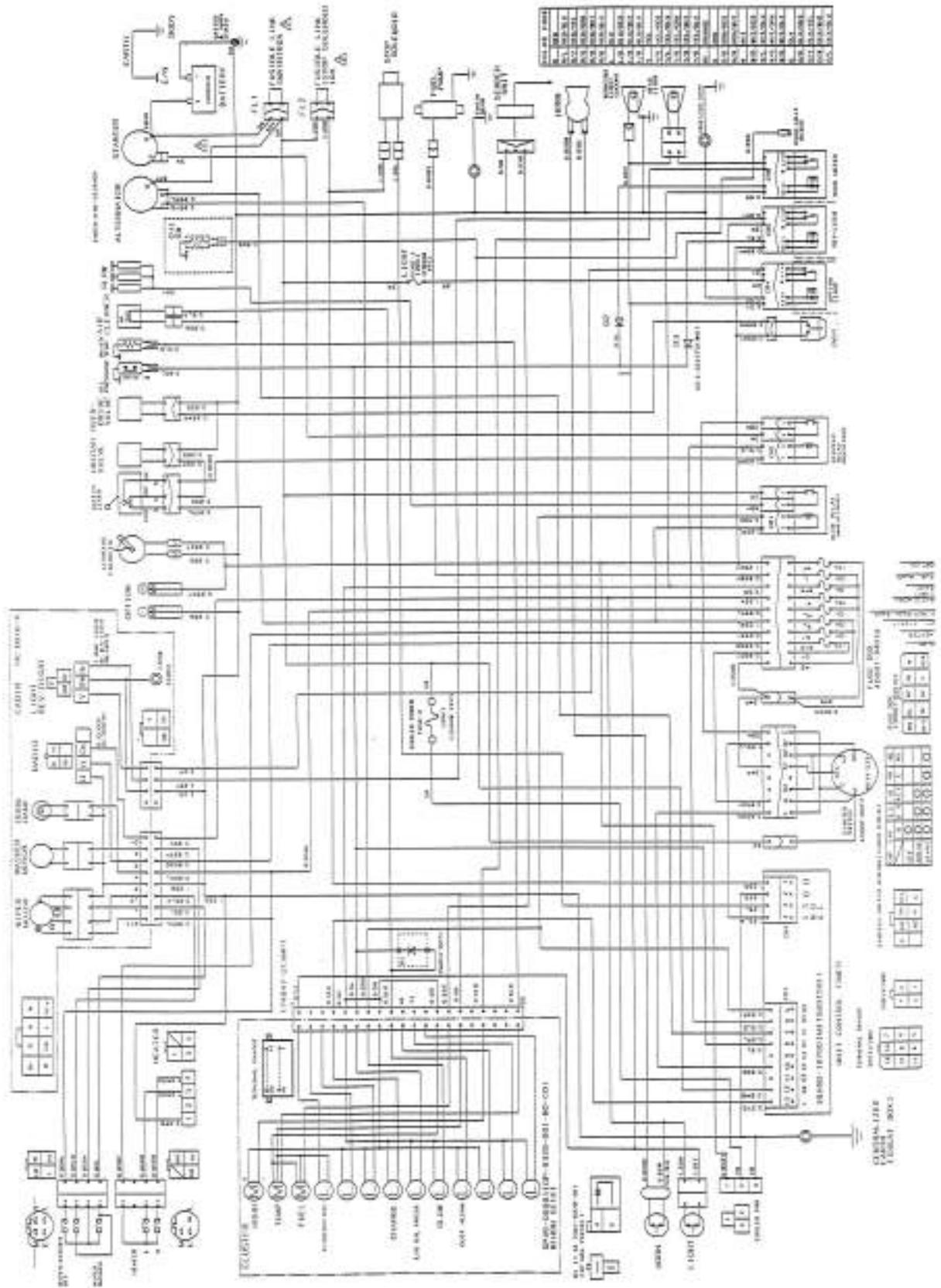
22-2 Failure and remedy

22-2-1 Starter system

22-2-2 Alter nator system

22-1 Structure and function

22-1-1 Electric circuit diagram



22-2 Failure and remedy

22-2-1 Starter system

| Failure | Cause | Remedy |
|--|--|--|
| Pinion does not come out even when the starter switch is pressed. | <ul style="list-style-type: none"> - Disconnection of the wire harness, loose connection of the battery or switch terminal. - Spline which engaged with the pinion of armature shaft is caught and the pinion cannot move. - Malfunction of the plunger of magnetic switch, disconnection or the short-circuit of coil | <p>Reconnect and tighten connections.</p> <p>Free the spline</p> <p>Correct or replace</p> |
| Starter does not rotate even when the pinion engages with the ring gear. | <ul style="list-style-type: none"> - Disconnection of the cable between the battery and the magnetic switch, loosening (bad earth) of the connecting wire between magnetic switch and motor terminals - Improper engagement of pinion and ring gear - Wrong installation - Brush is worn out or brush spring is touching. - Commutator is dirty. - Malfunction of armature or field coil - Loosening of field coil and brush - Loose connection of contractor - Contact surface of contractor is rough. | <p>Reconnect cable, tighten connections (make good earth).</p> <p>Correct the engagement.</p> <p>Reinstall Replace or adjust.</p> <p>Clean commutator. Correct or replace</p> <p>Tighten coil and brush. Tighten connections. Correct or replace</p> |
| Starter rotates at its full speed before the pinion engages with the ring gear. | <ul style="list-style-type: none"> - Wrong adjustment of plunger gap (distance l) - Permanent set of pinion sleeve spring. | <p>Adjust</p> <p>Replace</p> |
| Engine does not start even when the pinion engages with the ring gear and the starter rotates. | <ul style="list-style-type: none"> - Malfunction of overrun clutch | <p>Replace</p> |
| Starter does not stop even when starter switch is turned off. | <ul style="list-style-type: none"> - Short-circuit inside switch - Contractor drops and is always connected. | <p>Replace switch</p> <p>Replace</p> |

22-2-2 Alternator system

| Failure | Cause | Remedy |
|---------------------|--|---|
| Cannot be charged. | <ul style="list-style-type: none"> - Cords between terminals are disconnected or connectors are in loose connection. - Improper earth connection - Brush and slip ring do not contact. - Coil is disconnected or burnt. - Diode is damaged. | <p>Reconnect cord-tighten connections.</p> <p>Make good earth connections. Connect or replace Replace Replace</p> |
| Insufficient charge | <ul style="list-style-type: none"> - Loose connection of cords between each terminal - Fan belt slips. - Improper contact or insufficient movement of brush and slip ring - Short-circuit of coil - Defective diode | <p>Tighten connections.</p> <p>Adjust. Clean slip ring and brush holder.</p> <p>Replace Replace</p> |
| Overcharge | <ul style="list-style-type: none"> - Defective alternator | Replace |
| Noise | <ul style="list-style-type: none"> - Wrong installation - Defective fan belt - Defective bearing | <p>Connect. Replace. Replace.</p> |
| Fuse melts. | <ul style="list-style-type: none"> - Diodes on (+) and (-) sides broke down. - Capacitor broke down. - Alternator internal short-circuited | Replace. |

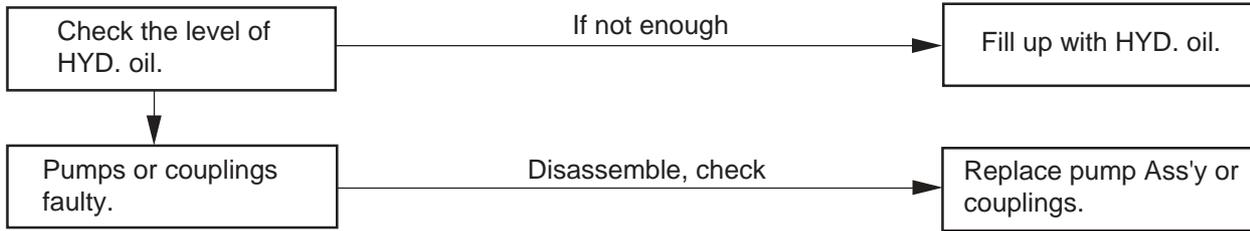
23 TROUBLESHOOT- ING

CONTENTS

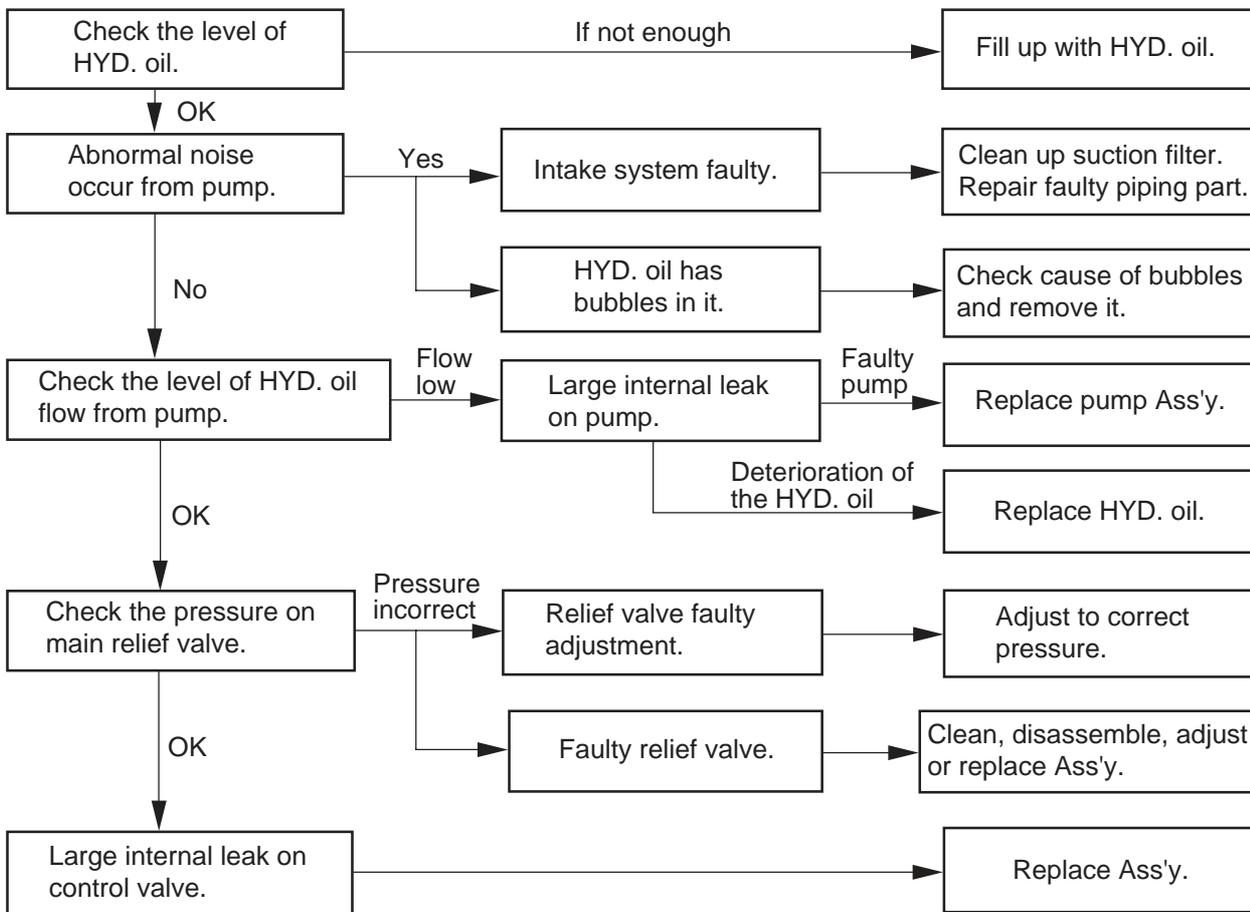
23-1 Troubleshooting

23-1 Troubleshooting

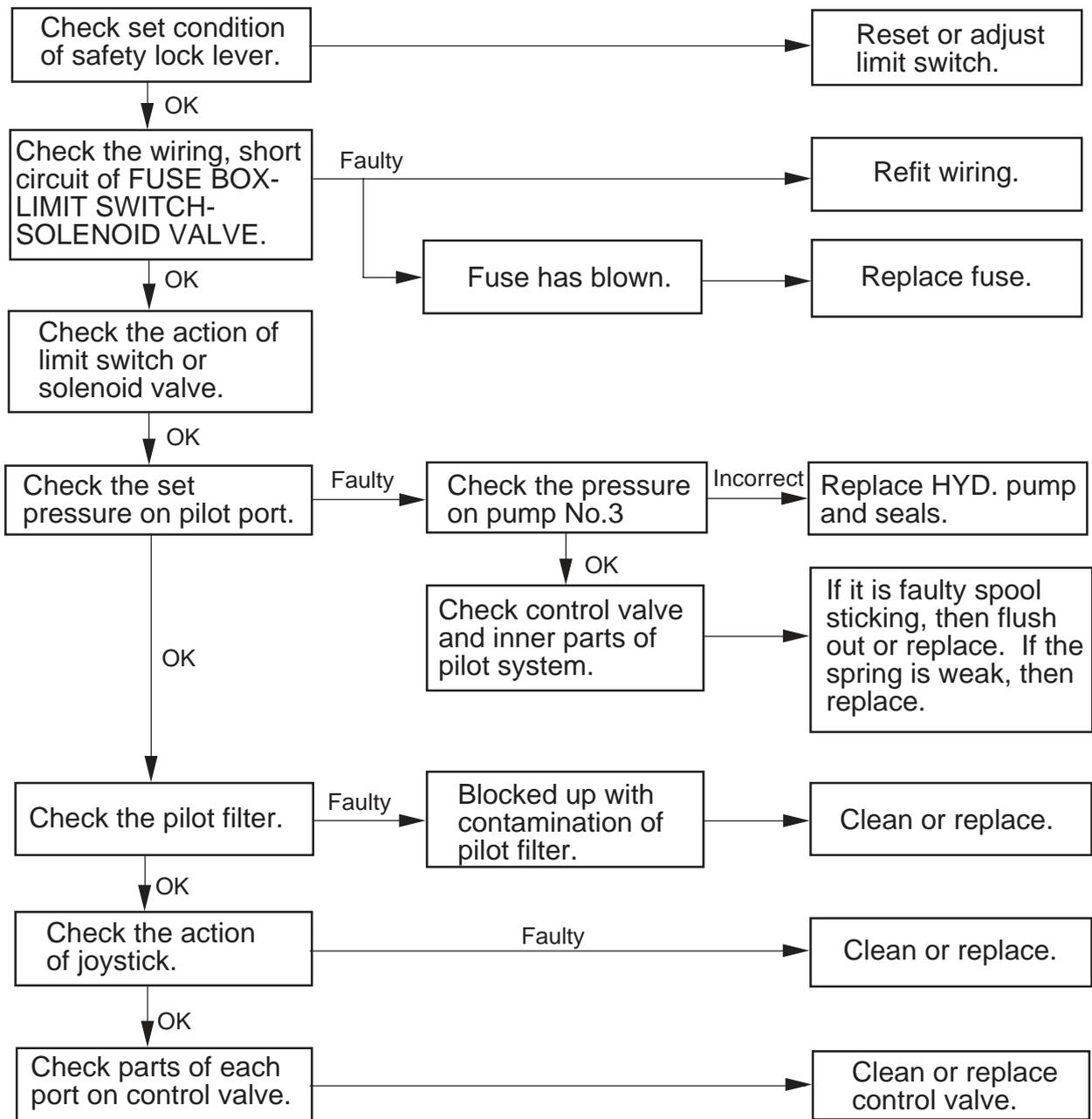
23-1-1 All functions not operational



23-1-2 Operation power is weak

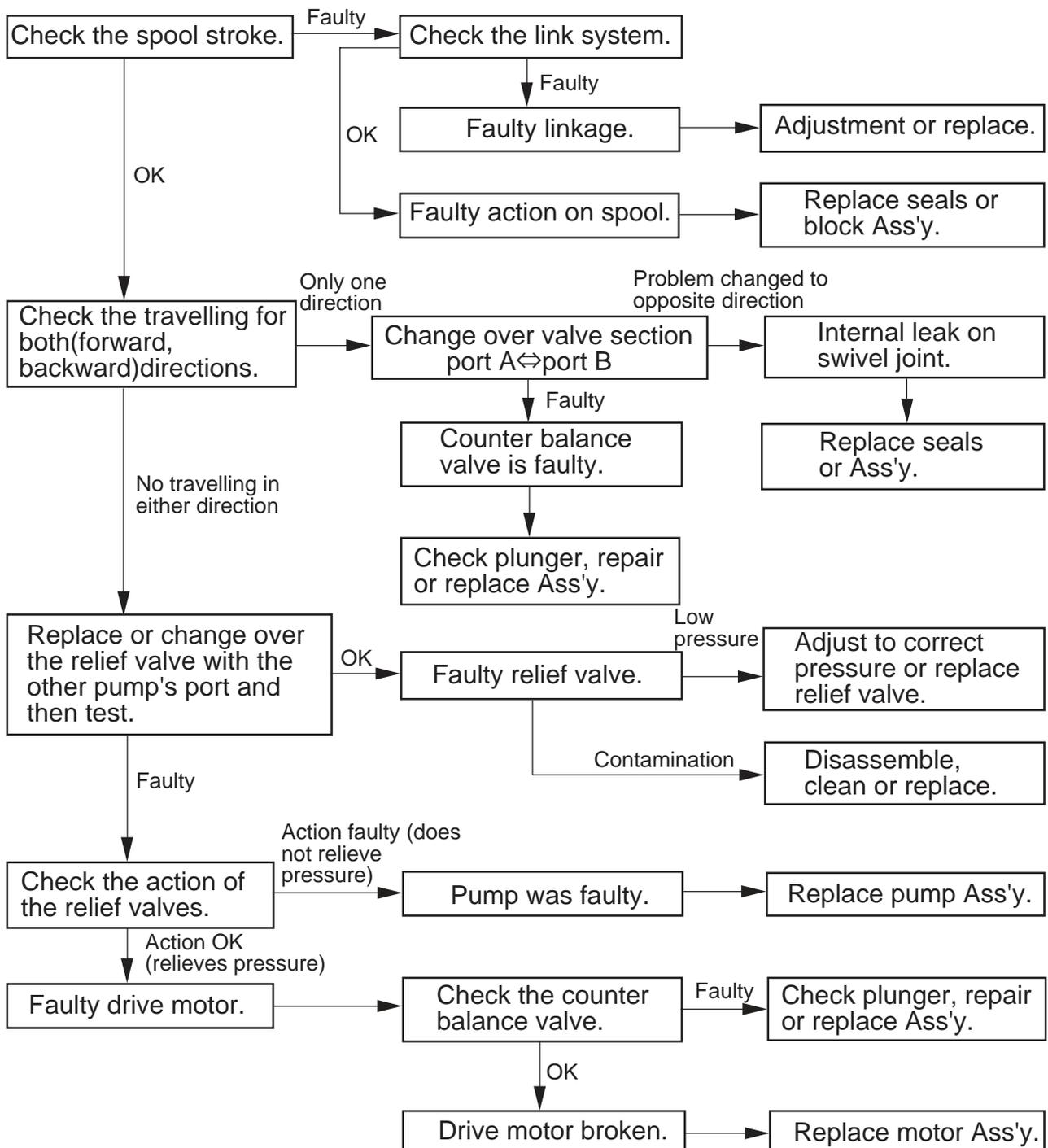


23-1-3 No operation on boom, arm, bucket & slewing

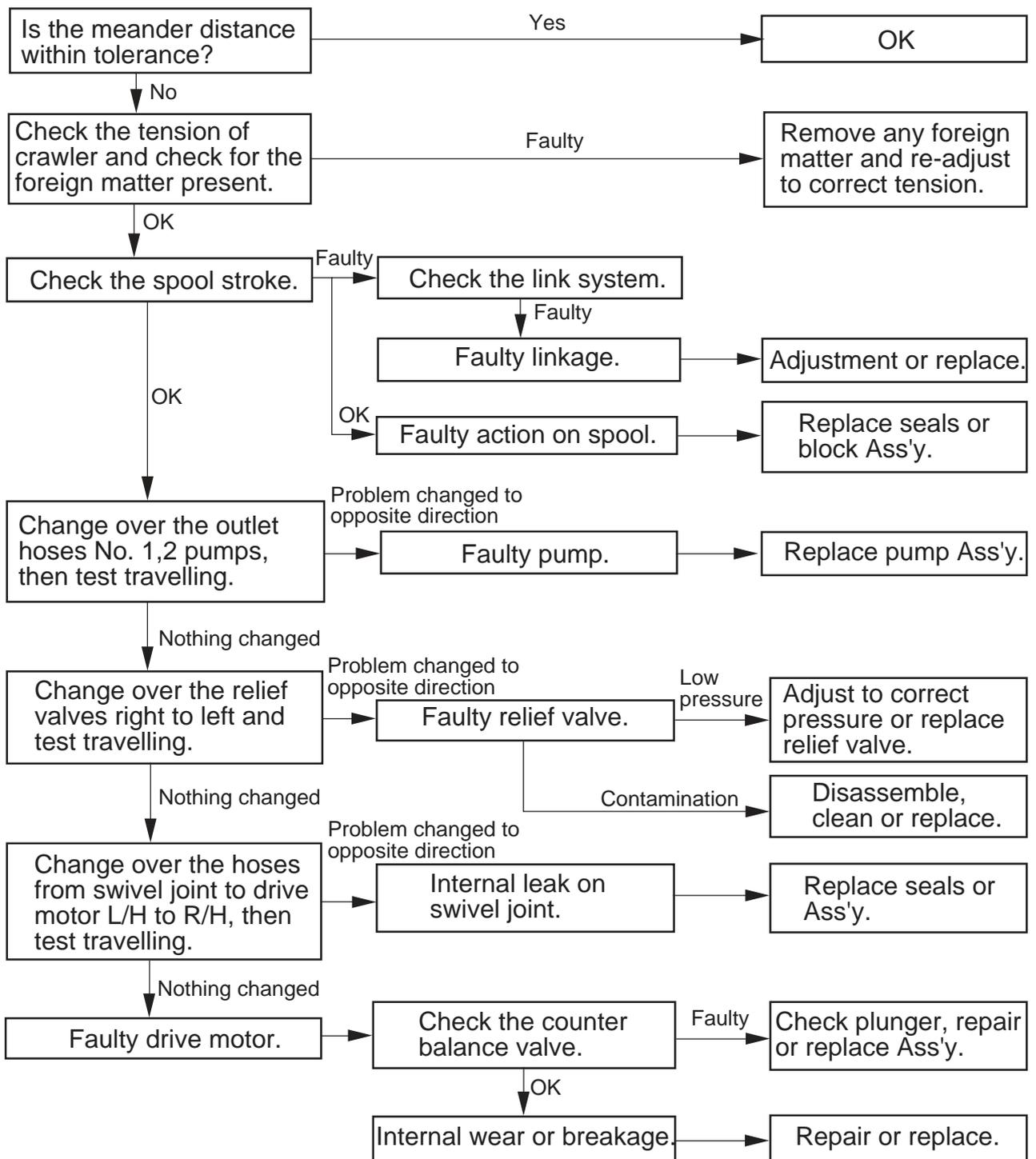


23-2 Travelling system

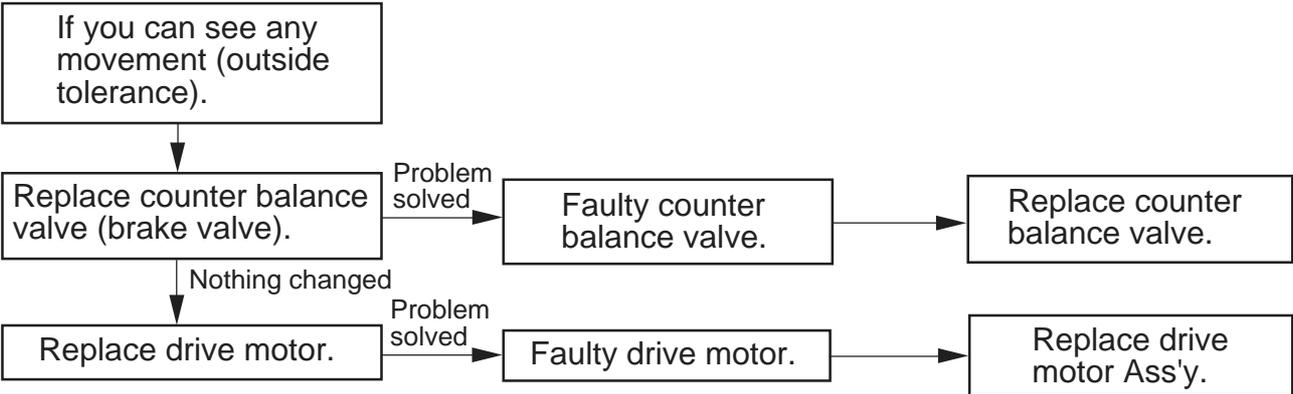
23-2-1 Right (or left) hand side of crawler does not work correctly



23-2-2 Travelling meander by slow speed on only right (left) hand side.

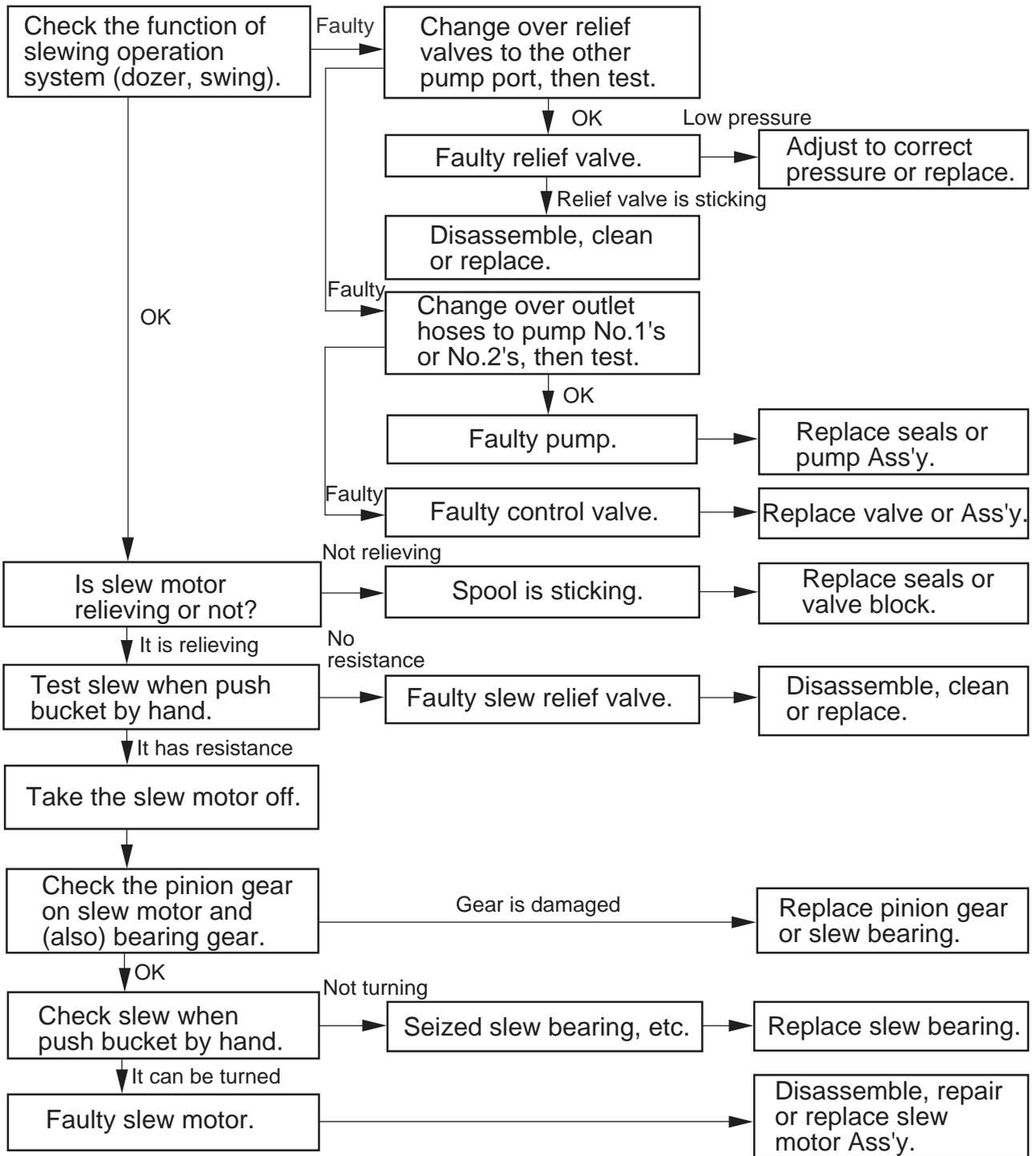


23-2-3 Machine fails to hold on incline

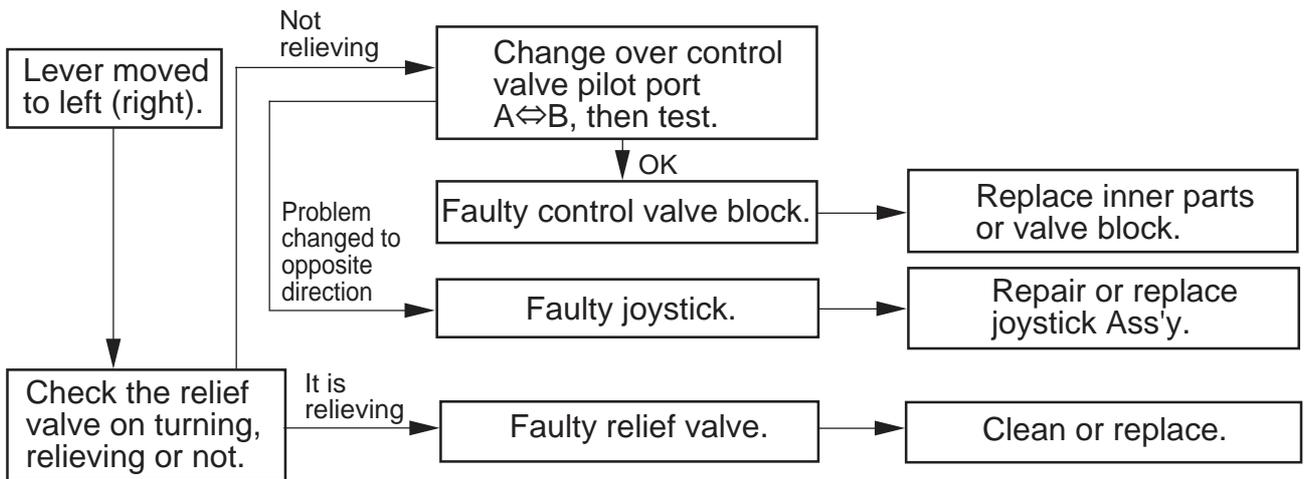


23-3 Slewing system

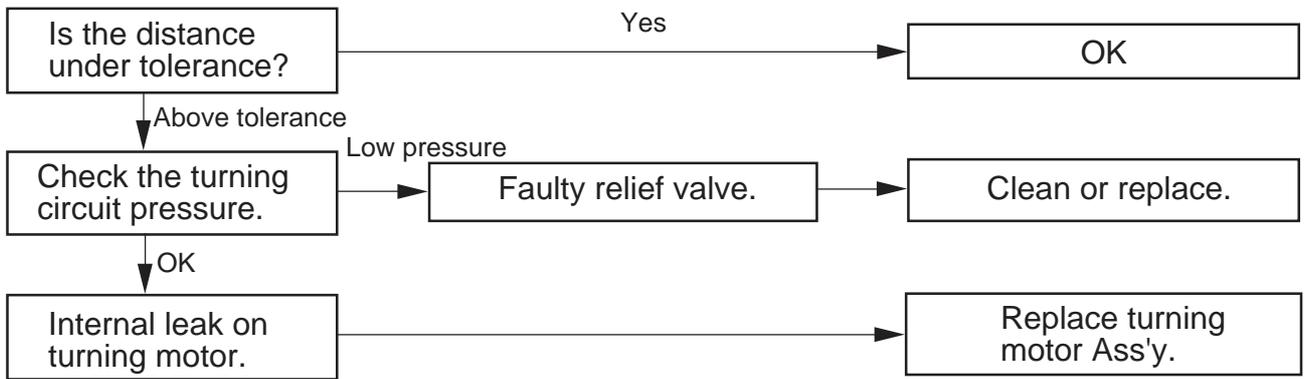
23-3-1 No operation both (right/left) slewing.



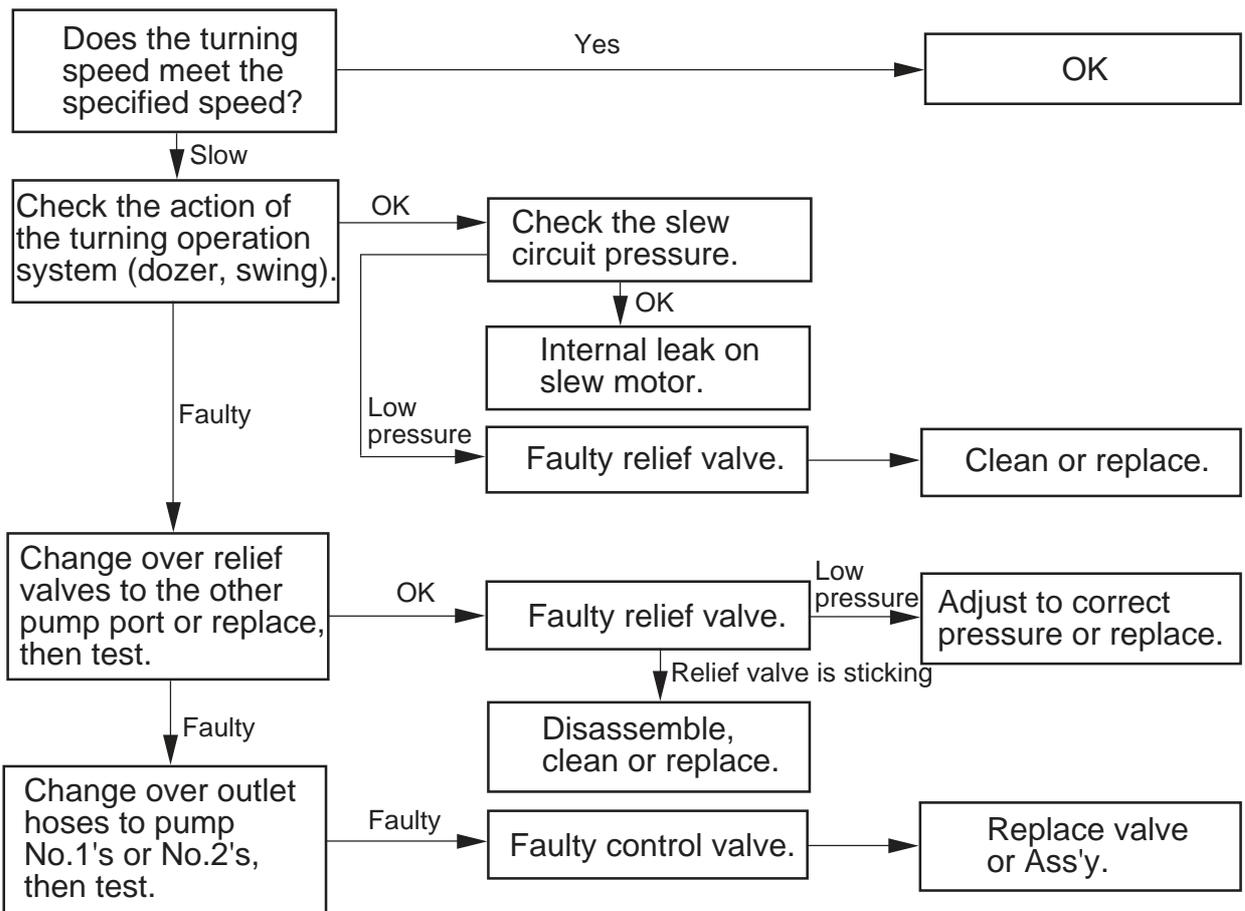
23-3-2 It is possible to turn right (left) but not left (right)



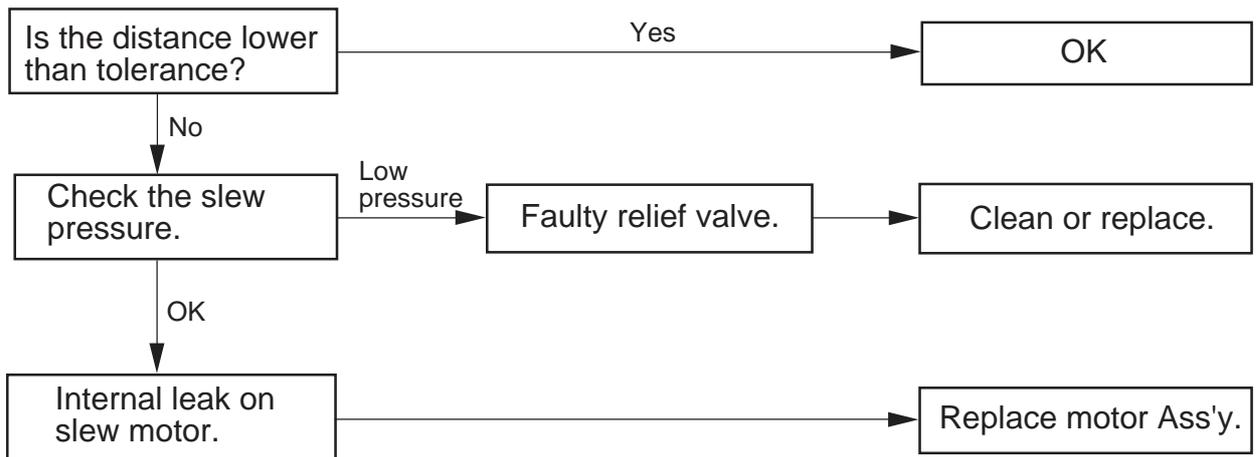
23-3-3 Turning acceleration slow, the overturn is higher than tolerance



23-3-4 Extreme slow slew speed

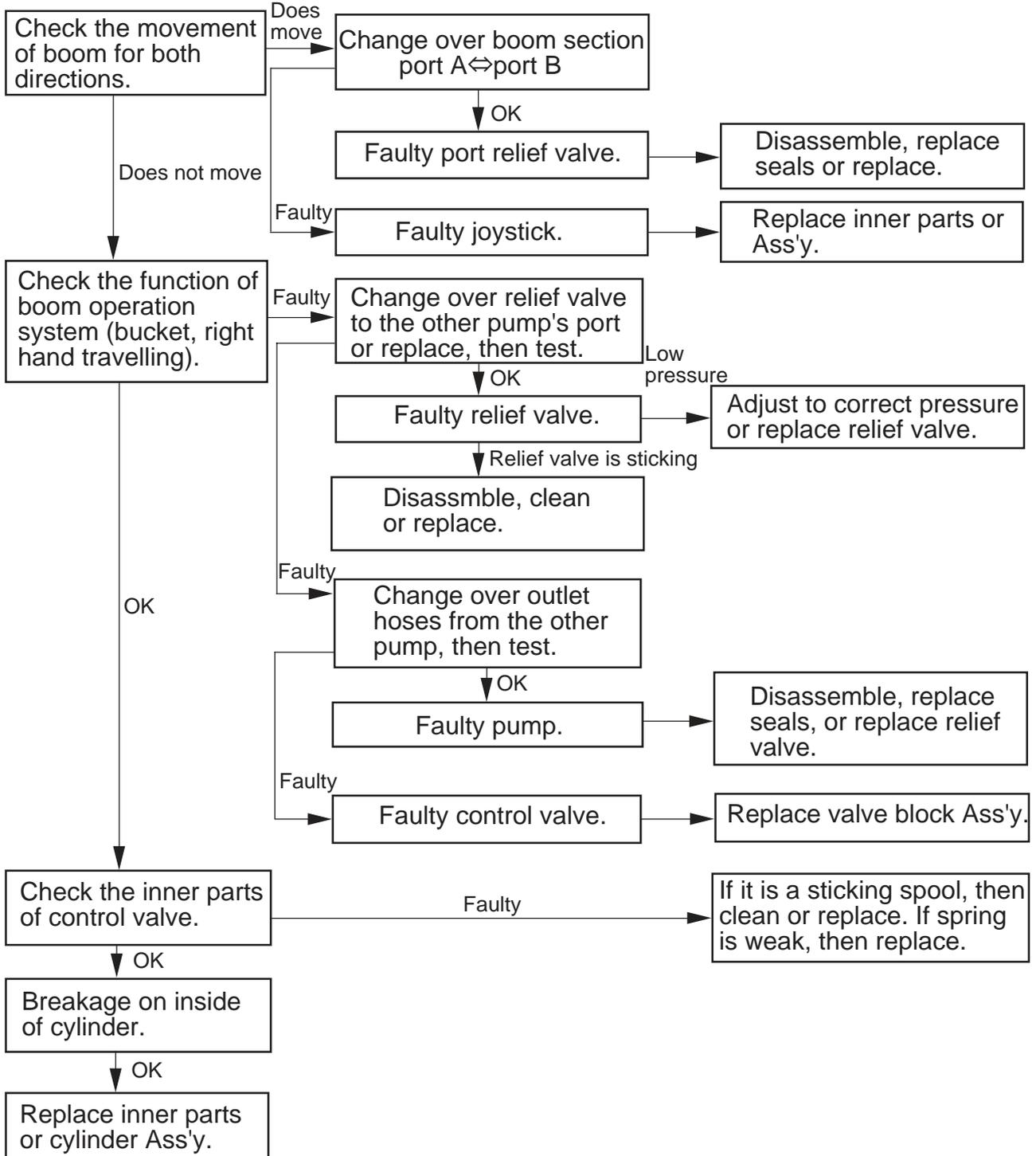


23-3-5 Turning movement when the machine is parked on a slope

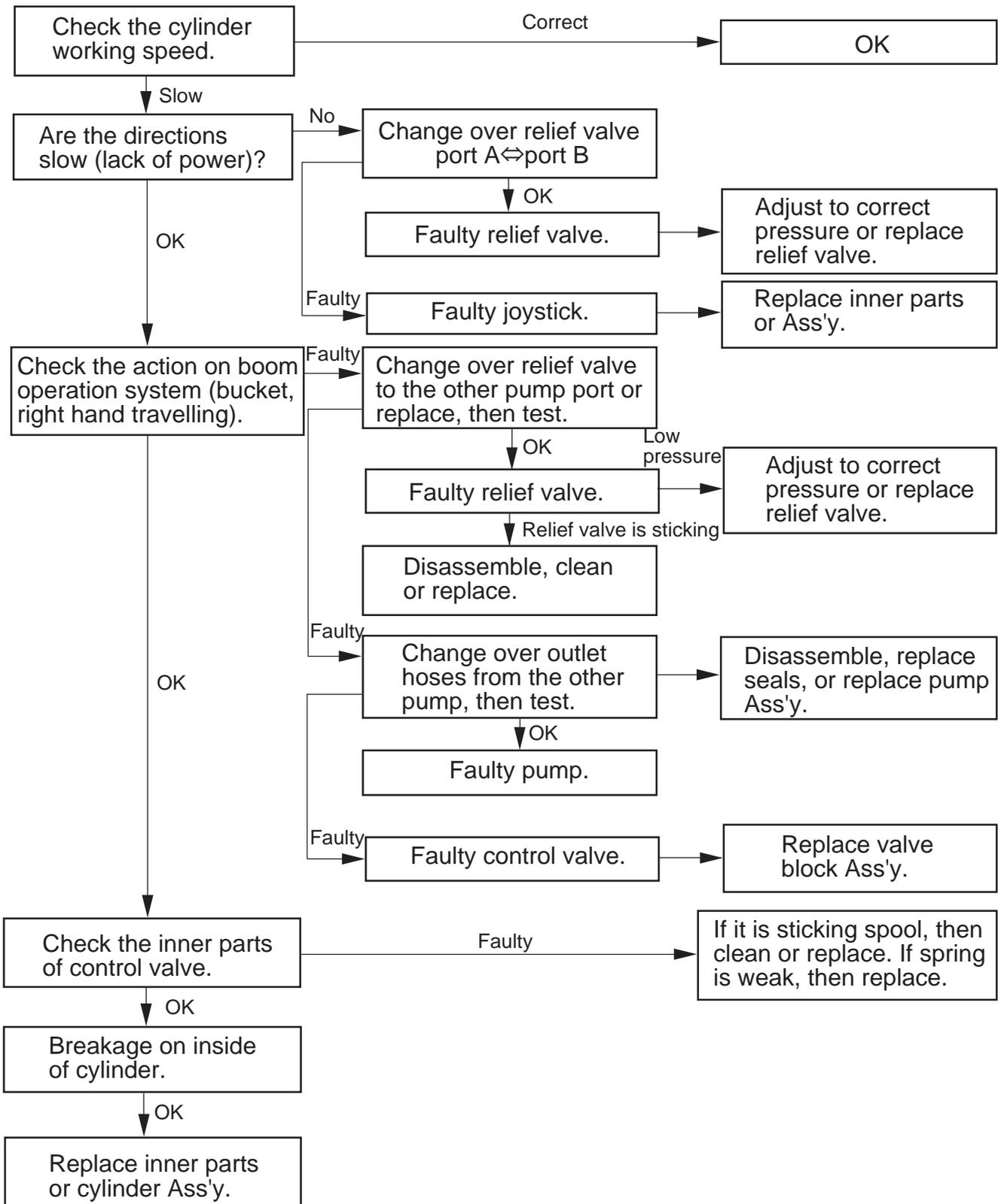


23-4 Boom system(for arm and bucket cylinders the same method as follows)

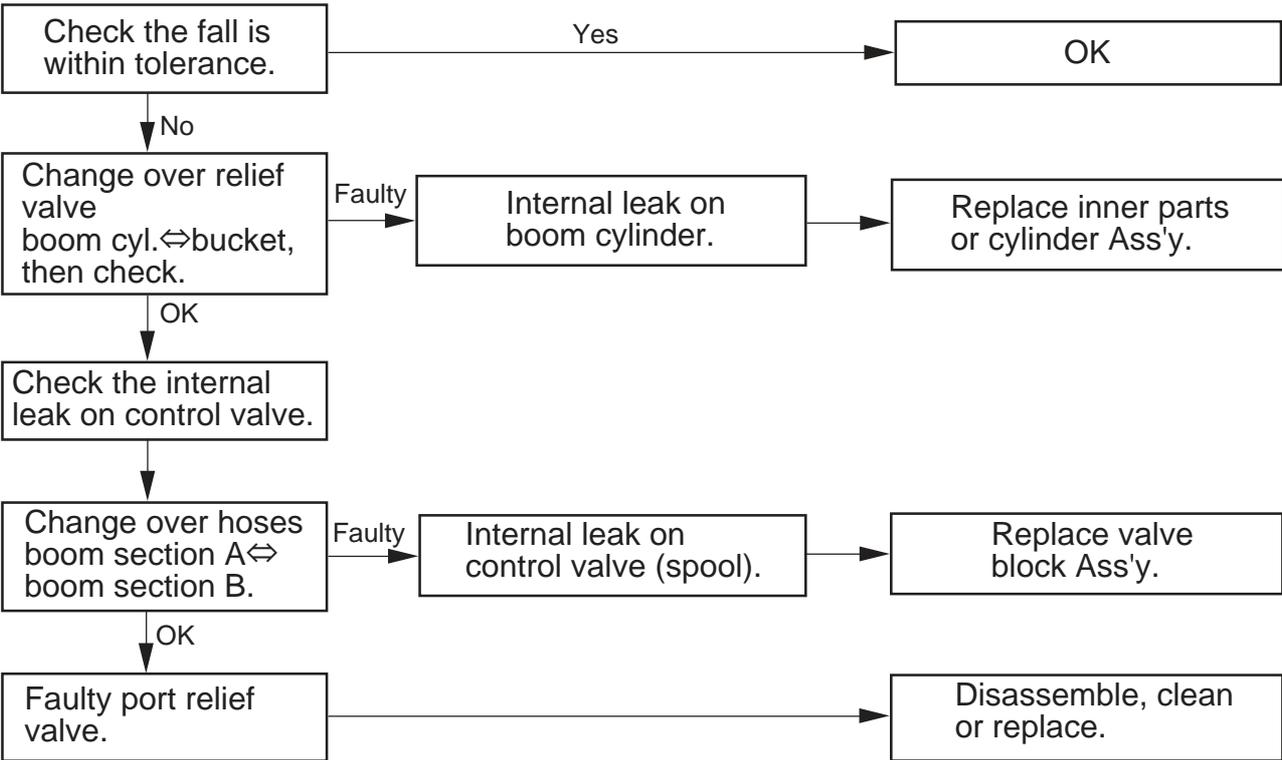
23-4-1 No movement on boom cylinder



23-4-2 Slow action or lack of power on boom cylinder

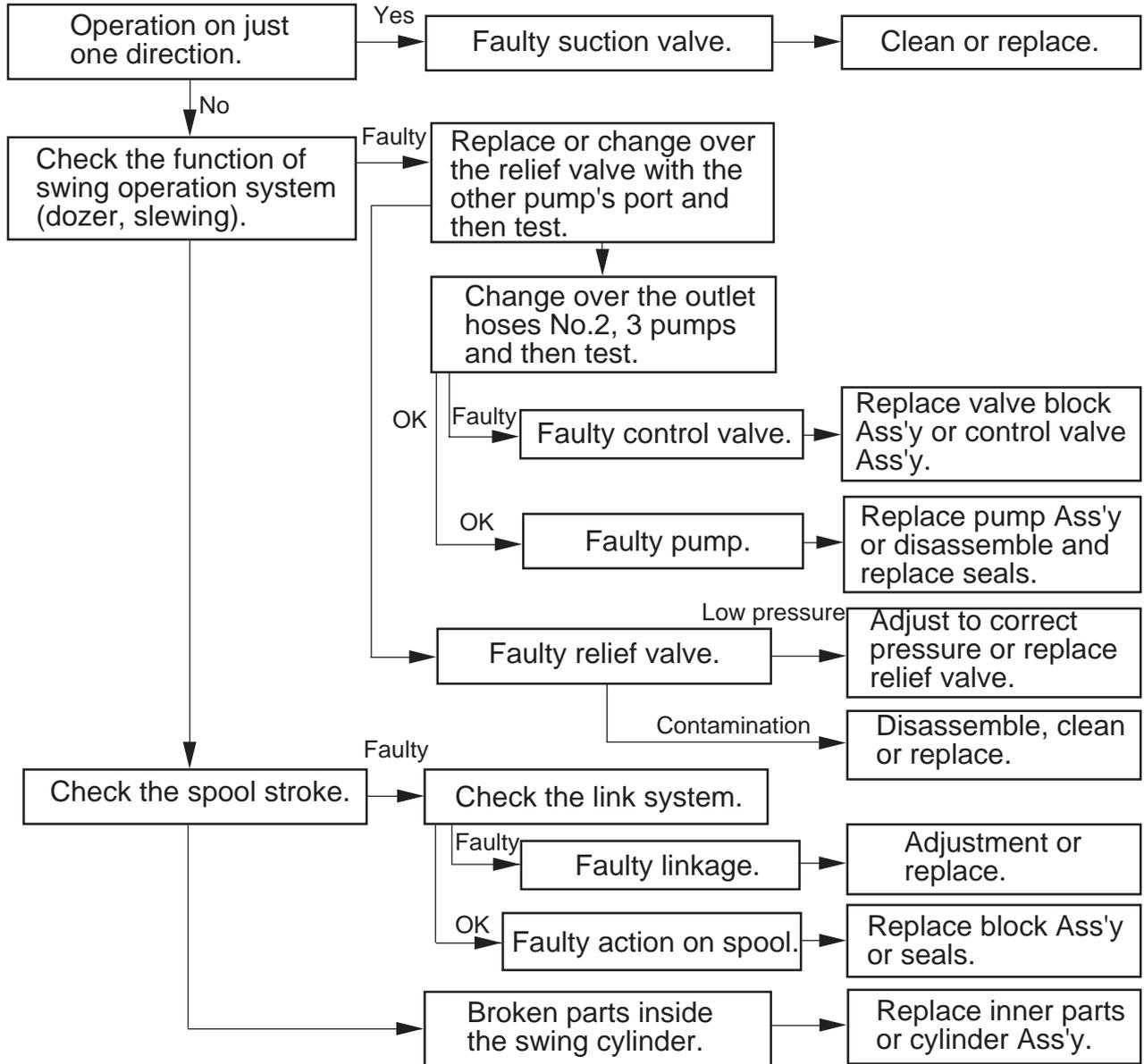


23-4-3 Natural fall of boom



23-5 Swing system

23-5-1 No movement on swing system



23-5-2 Drifting swing cylinder

