SEBM016602

# SHOP MANUAL

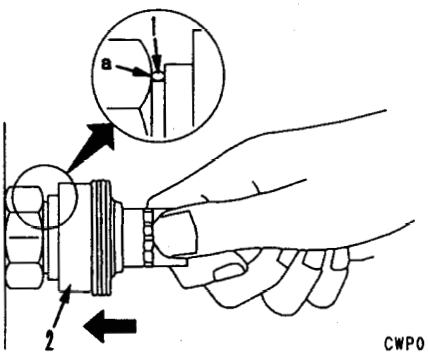
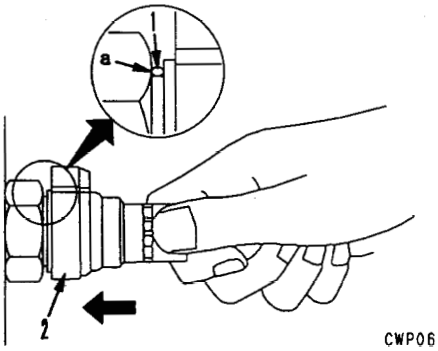
KOMATSU

# PC20MRX-1

| MACHINE MODEL | SERIAL NUMBER |
|---|---|
| **PC20MRX-1** | **10001 and up** |

- This shop manual may contain attachments and optional equipment that are not available in your area. Please consult your local Komatsu distributor for those items you may require. Materials and specifications are subject to change without notice.
- PC20MRX-1 mount the 3D74E-N3A engine.
  For details of the engine, see the 68E-88E Series Engine Shop Manual.


Printed in Japan 09-00(02)

| | Type 1 | Type 2 |
|---|---|---|
| Connection | • Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end to connect it.<br>  <br>CWP06391 | • Hold the mouthpiece of the tightening portion and push body (2) in straight until sliding prevention ring (1) contacts contact surface a of the hexagonal portion at the male end to connect it.<br>  <br>CWP06392 |

**kgm to ft. lb**

1 kgm = 7.233 ft. lb

| | 0 | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|---|---|---|---|---|---|---|---|---|---|---|
| 0 | 0 | 7.2 | 14.5 | 21.7 | 28.9 | 36.2 | 43.4 | 50.6 | 57.9 | 65.1 |
| 10 | 72.3 | 79.6 | 86.8 | 94.0 | 101.3 | 108.5 | 115.7 | 123.0 | 130.2 | 137.4 |
| 20 | 144.7 | 151.9 | 159.1 | 166.4 | 173.6 | 180.8 | 188.1 | 195.3 | 202.5 | 209.8 |
| 30 | 217.0 | 224.2 | 231.5 | 238.7 | 245.9 | 253.2 | 260.4 | 267.6 | 274.9 | 282.1 |
| 40 | 289.3 | 296.6 | 303.8 | 311.0 | 318.3 | 325.5 | 332.7 | 340.0 | 347.2 | 354.4 |
| 50 | 361.7 | 368.9 | 376.1 | 383.4 | 390.6 | 397.8 | 405.1 | 412.3 | 419.5 | 426.8 |
| 60 | 434.0 | 441.2 | 448.5 | 455.7 | 462.9 | 470.2 | 477.4 | 484.6 | 491.8 | 499.1 |
| 70 | 506.3 | 513.5 | 520.8 | 528.0 | 535.2 | 542.5 | 549.7 | 556.9 | 564.2 | 571.4 |
| 80 | 578.6 | 585.9 | 593.1 | 600.3 | 607.6 | 614.8 | 622.0 | 629.3 | 636.5 | 643.7 |
| 90 | 651.0 | 658.2 | 665.4 | 672.7 | 679.9 | 687.1 | 694.4 | 701.6 | 708.8 | 716.1 |
| 100 | 723.3 | 730.5 | 737.8 | 745.0 | 752.2 | 759.5 | 766.7 | 773.9 | 781.2 | 788.4 |
| 110 | 795.6 | 802.9 | 810.1 | 817.3 | 824.6 | 831.8 | 839.0 | 846.3 | 853.5 | 860.7 |
| 120 | 868.0 | 875.2 | 882.4 | 889.7 | 896.9 | 904.1 | 911.4 | 918.6 | 925.8 | 933.1 |
| 130 | 940.3 | 947.5 | 954.8 | 962.0 | 969.2 | 976.5 | 983.7 | 990.9 | 998.2 | 1005.4 |
| 140 | 1012.6 | 1019.9 | 1027.1 | 1034.3 | 1041.5 | 1048.8 | 1056.0 | 1063.2 | 1070.5 | 1077.7 |
| 150 | 1084.9 | 1092.2 | 1099.4 | 1106.6 | 1113.9 | 1121.1 | 1128.3 | 1135.6 | 1142.8 | 1150.0 |
| 160 | 1157.3 | 1164.5 | 1171.7 | 1179.0 | 1186.2 | 1193.4 | 1200.7 | 1207.9 | 1215.1 | 1222.4 |
| 170 | 1129.6 | 1236.8 | 1244.1 | 1251.3 | 1258.5 | 1265.8 | 1273.0 | 1280.1 | 1287.5 | 1294.7 |
| 180 | 1301.9 | 1309.2 | 1316.4 | 1323.6 | 1330.9 | 1338.1 | 1345.3 | 1352.6 | 1359.8 | 1367.0 |
| 190 | 1374.3 | 1381.5 | 1388.7 | 1396.0 | 1403.2 | 1410.4 | 1417.7 | 1424.9 | 1432.1 | 1439.4 |

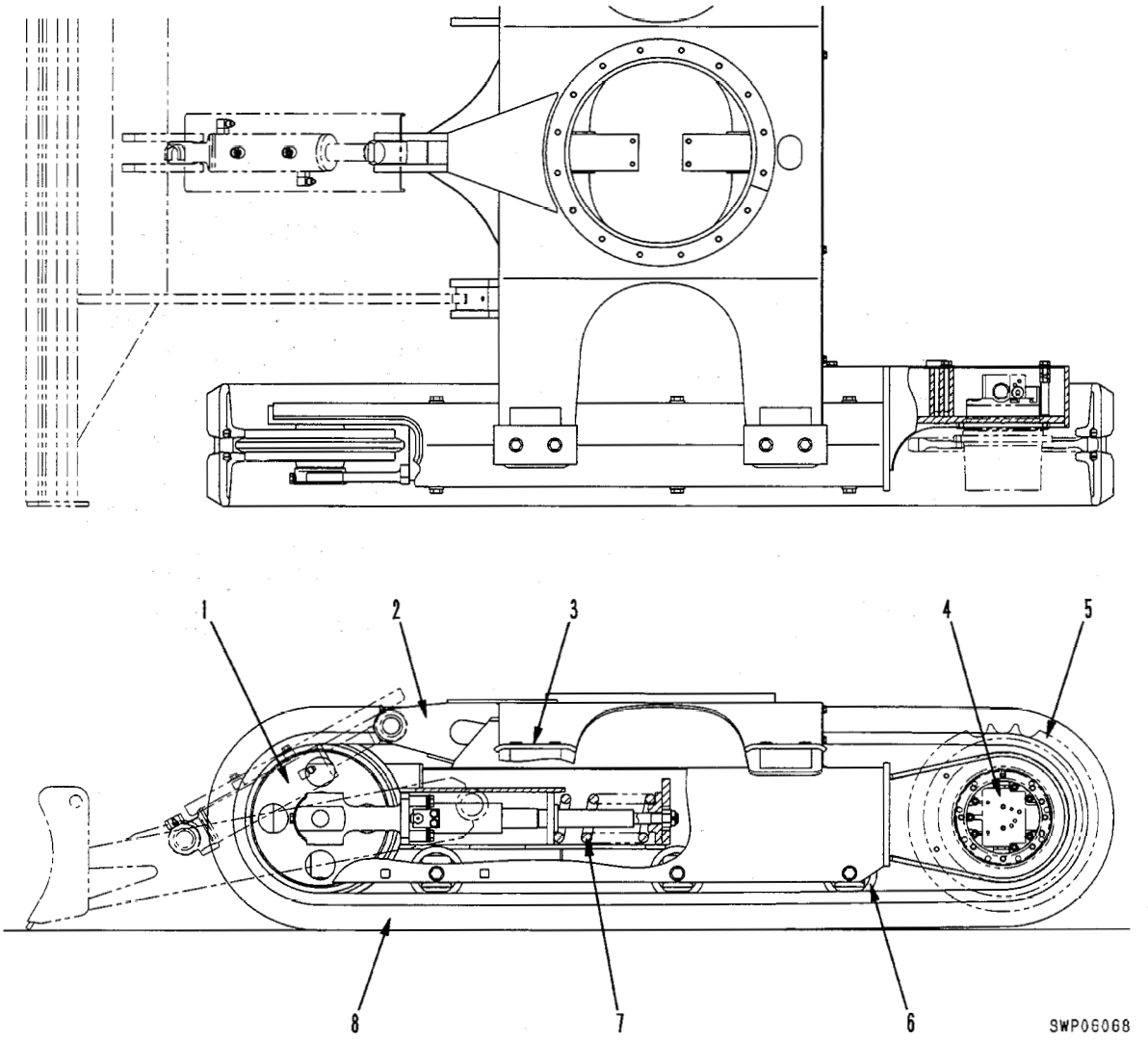
# WEIGHT TABLE

⚠ This weight table is a guide for use when transportiong or handing components.

Unit: kg

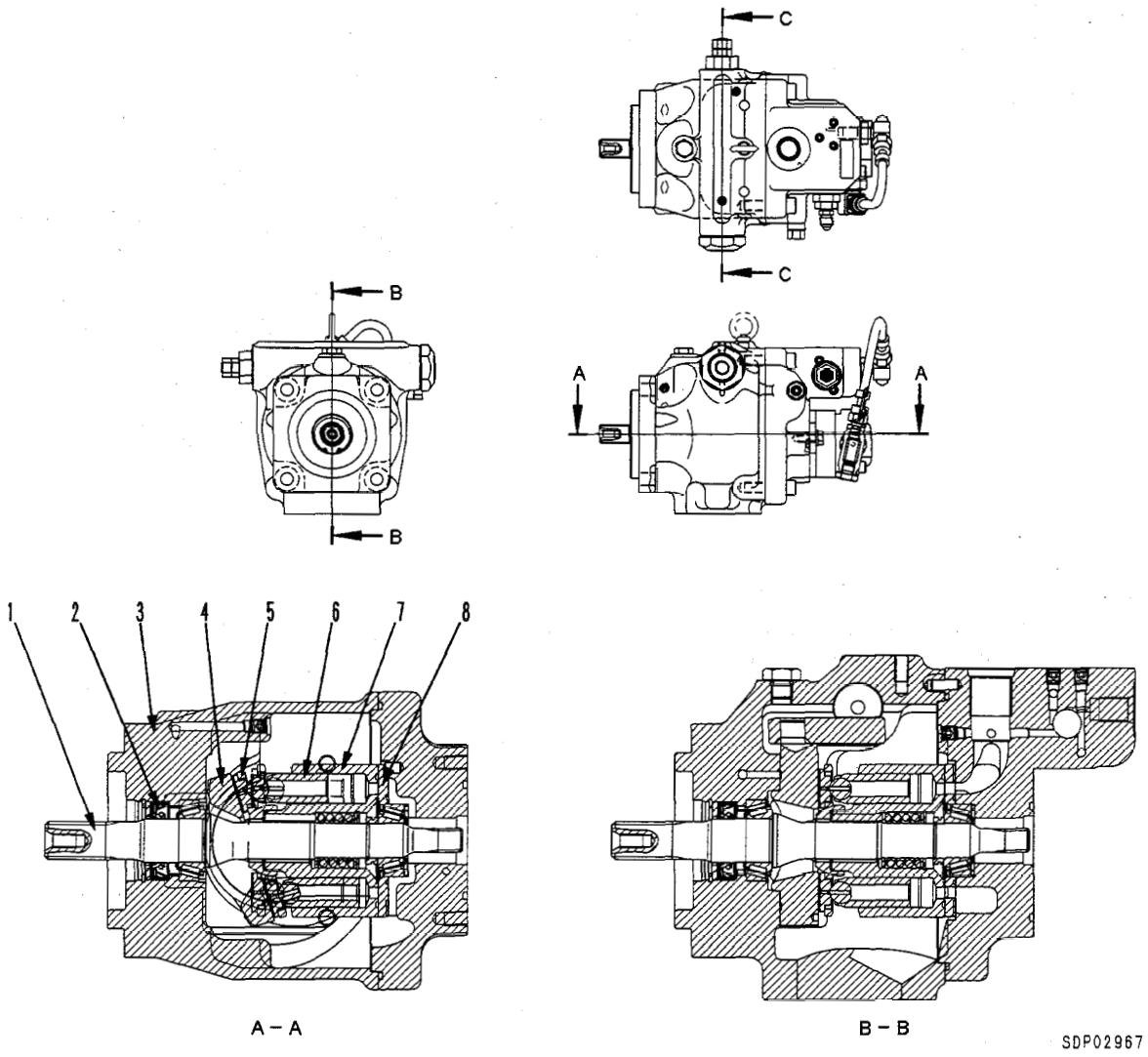
| Machine model | PC20MRX-1 | |
|---|---|---|
| | Canopy specification | Cab specification |
| Serial number | 10001 and up | |
| Engine assembly | | |
| • Engine | 115 | 115 |
| • Engine mount | 7 | 7 |
| • P.T.O | 5.5 | 5.5 |
| • Hydraulic pump | 19 | 19 |
| Radiator assembly | 14.4 | 14.4 |
| Revolving frame | 195.3 | 195.3 |
| Operator's cab | — | 130 |
| Canopy assembly | 70.3 | — |
| Operator's seat | 10.7 | 10.7 |
| Fuel tank | 3.2 | 3.2 |
| Hydraulic tank | 23.6 | 23.6 |
| Main control valve assembly | 33.2 | 33.2 |
| Counterweight (with x-type weight) | 355 | 355 |
| Swing motor, swing machinery | 28 | 28 |
| Center swivel joint | 7 | 7 |

# TRACK FRAME




1. Idler
2. Track frame
3. Shoe plate
4. Travel motor
5. Sprocket
6. Track roller
7. Idller cushion
8. Track shoe

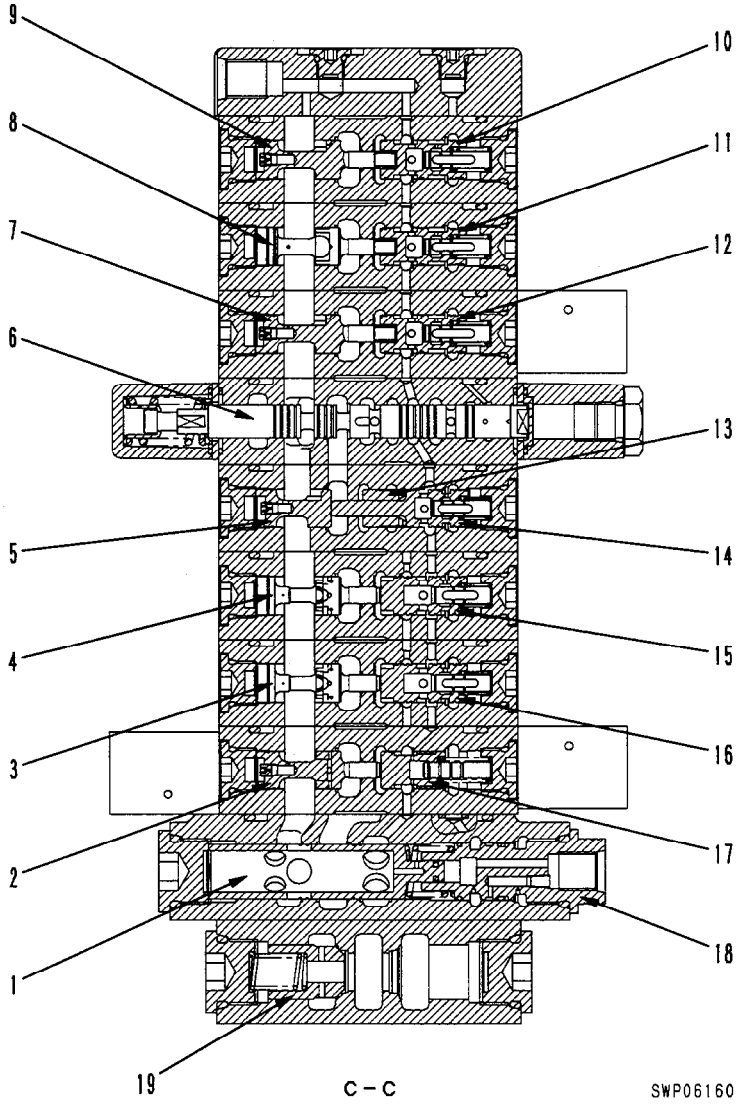
## 1. MAIN PUMP




1. Shaft
2. Oil seel
3. Case (acts also as cradle)
4. Rocker cam
5. Shoe
6. Piston
7. Cylinder block
8. Valve plate
9. Spring
10. Servo piston (acts also as TCC valve)

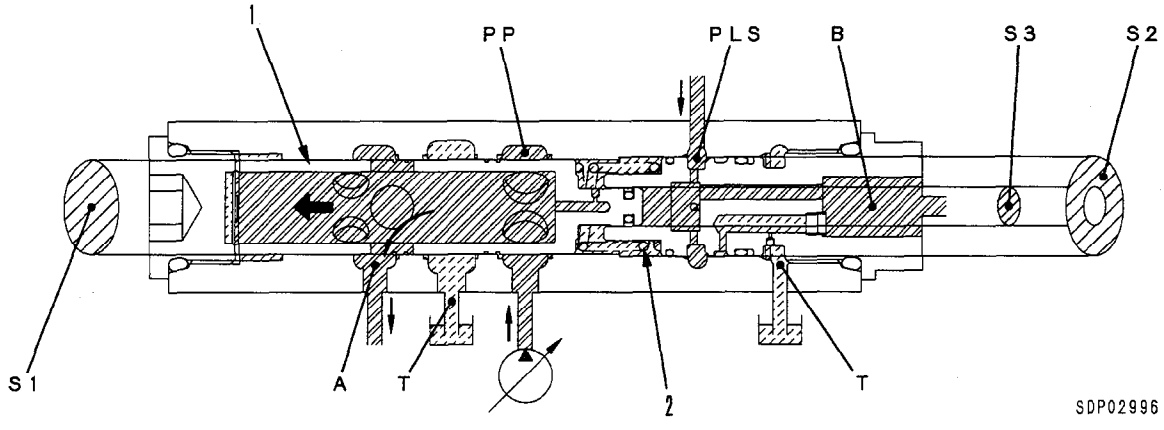
- For example, after balancing at an area of opening 1/4 of the control valve, if the system is operated to 3/4 of the area of opening of the control valve, LS differential pressure **ΔPLS** will drop momentarily.
  As a result, the LS valve is actuated and the pump discharge amount is increased, but when the pump swash plate angle rises to 3/4, the LS differential pressure **ΔPLS** rises to 1.6 MPa {16 kg/cm$^2$}, so it is balanced in this position.

(4/7)




1. Unload valve
2. Pressure compensation valve F (swing)
3. Pressure compensation valve F (R.H. travel)
4. Pressure compensation valve F (L.H. travel)
5. Pressure compensation valve F (boom swing, blade)
6. Spool (breaker)
7. Pressure compensation valve F (arm)
8. Pressure compensation valve F (boom)
9. Pressure compensation valve F (bucket)
10. Pressure compensation valve R (bucket)
11. Pressure compensation valve R (boom)
12. Pressure compensation valve R (arm)
13. Pressure compensation valve piston (boom swing, blade)
14. Pressure compensation valve R (boom swing, blade)
15. Pressure compensation valve R (L.H. travel)
16. Pressure compensation valve R (R.H. travel)
17. Pressure compensation valve R (swing)
18. LS bypass plug
19. Back-pressure check valve

3) When the control valve is being operated and the demand flow for the actuator becomes greater than the pump discharge from the minimum swash plate angle, the flow of the oil out to tank circuit **T** is shut off, and all the pump discharge amount **Q** flows to the actuator circuit.




**OPERATION**

**Control valve operated**

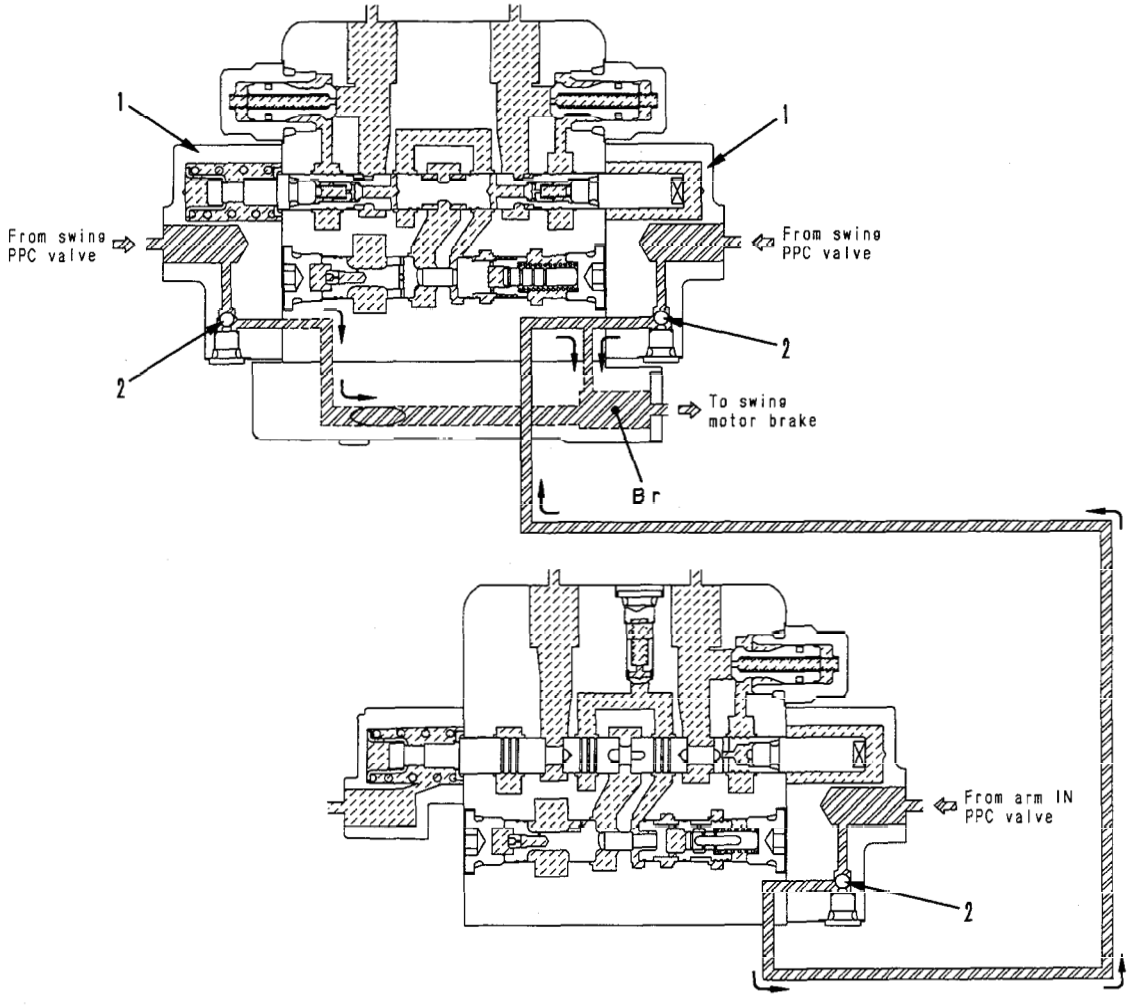
- When the control valve is operated to a larger stroke, LS pressure **PLS** is generated and acts on area **S3** at the right end of spool (1). When this happens, the area of the opening of the control valve spool is large, so the difference between LS pressure **PLS** and pump discharge pressure **PP** is small.
- For this reason, the difference in pressure between pump discharge pressure **PP** and LS pressure **PLS** does not reach the load of spring (2) (2.9 MPa {30 kg/cm²}), so spool (1) is pushed to the left by spring (2).
- As a result, pump circuit **PP** and tank circuit **T** are shut off, and all the pump discharge amount **Q** flows to the actuator circuit.

**PP**: Pump circuit
**PLS**: LS circuit
**T**: Tank circuit
**A**: To valves
**B**: To pump LS valve

## 8. Swing holding brake cancel system

**Function**

- The system uses the swing PPC pressure and the arm IN PPC pressure as a signal to cancel the shaft brake of the swing motor.

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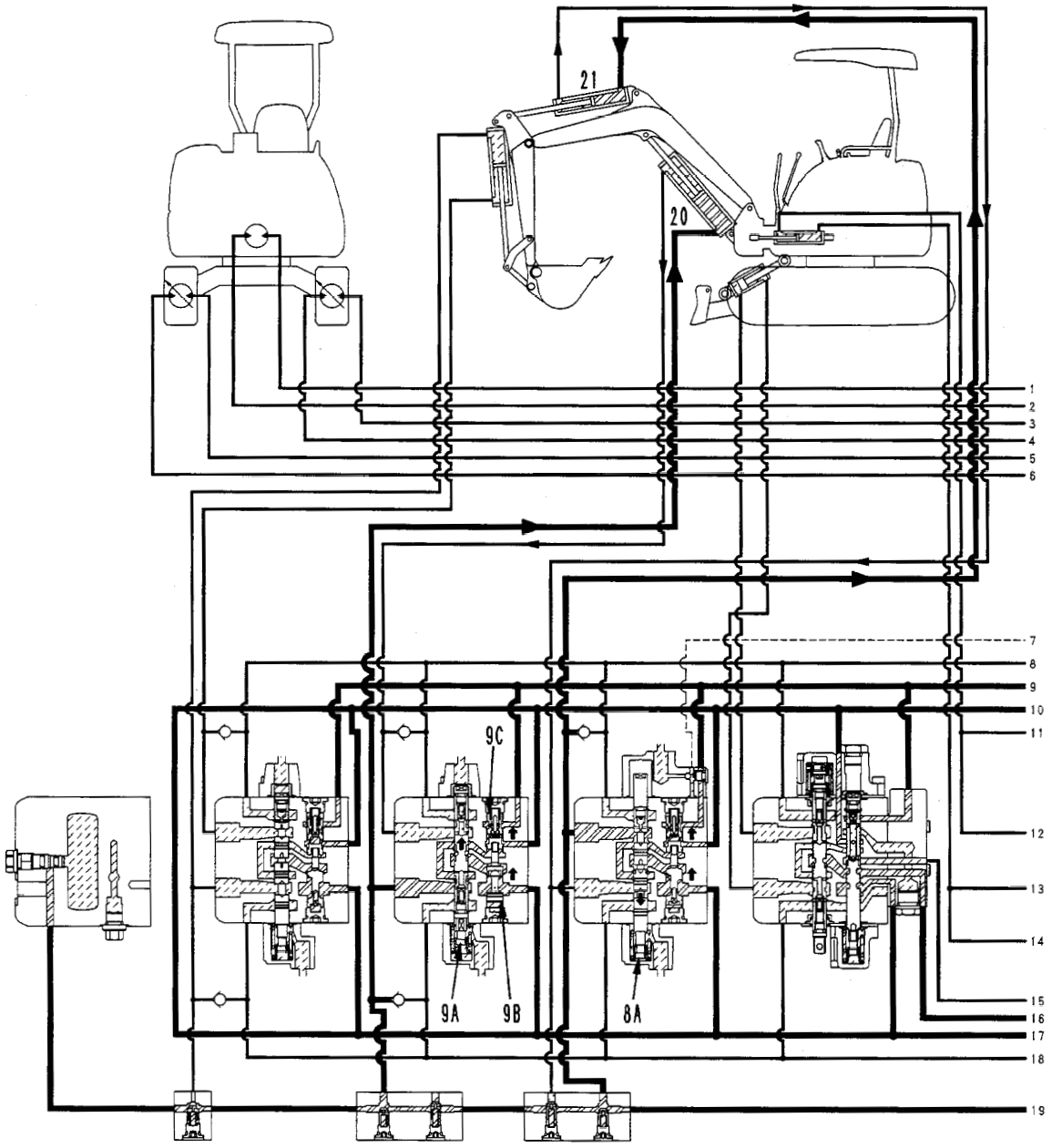
**Operation**

- The left and right swing PPC pressure and the arm IN PPC pressure each pass through check valve (2) inside spring case (1), are output to port **Br**, and the swing holding brake is canceled. (The highest pressure is output to port **Br**.)
- The arm and swing are connected by the pilot circuit inside the control valve.

**4) When actuators are operated simultaneously (example: boom and arm)**

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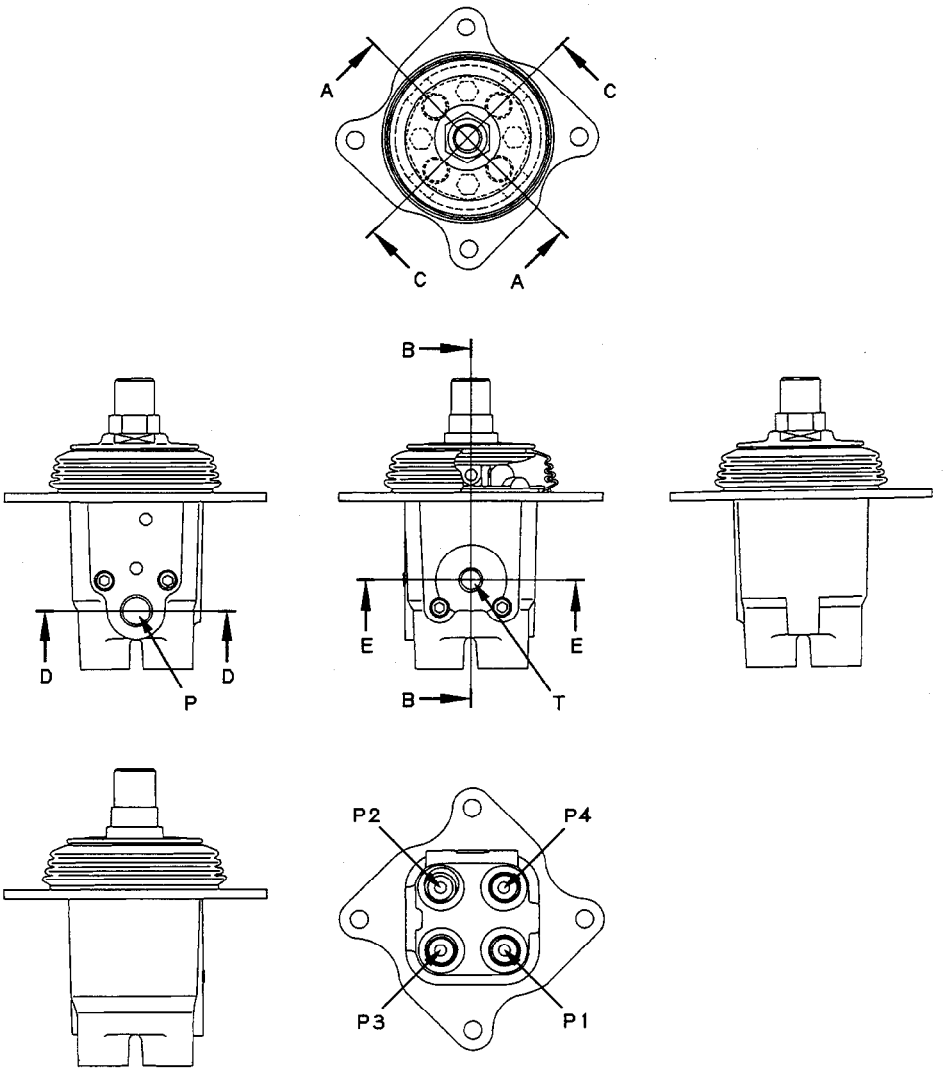
# PPC VALVE

## FOR BOOM, ARM, BUCKET, SWING

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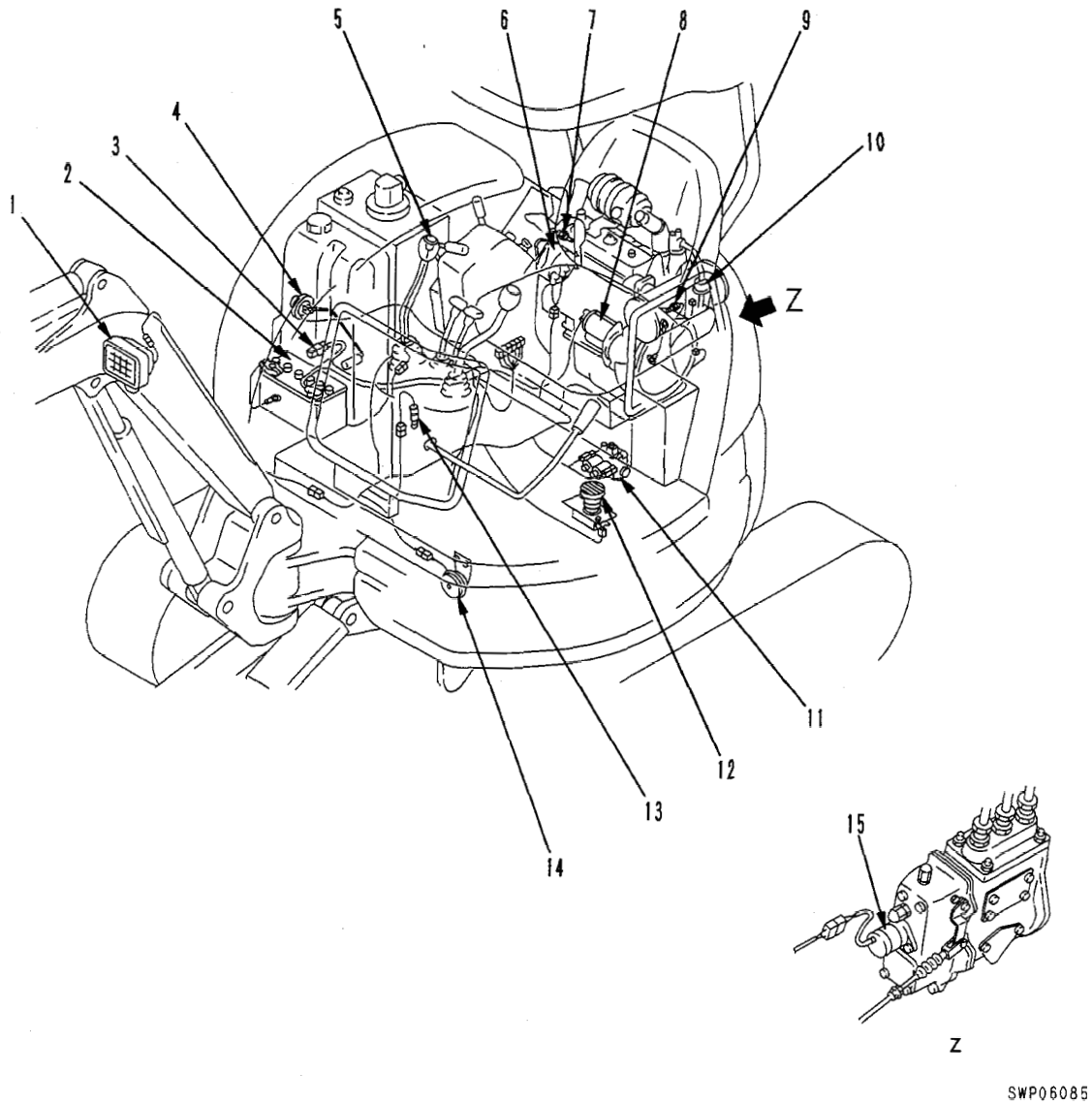
**P**: From PPC control valve
**T**: To tank

**P1**. Left: Arm IN / Right: Boom RAISE
**P2**. Left: Arm OUT / Right: Boom LOWER
**P3**. Left: Swing right / Right: Bucket DUMP
**P4**. Left: Swing left / Right: Bucket CURL

# ELECTRICAL WIRING DIAGRAM



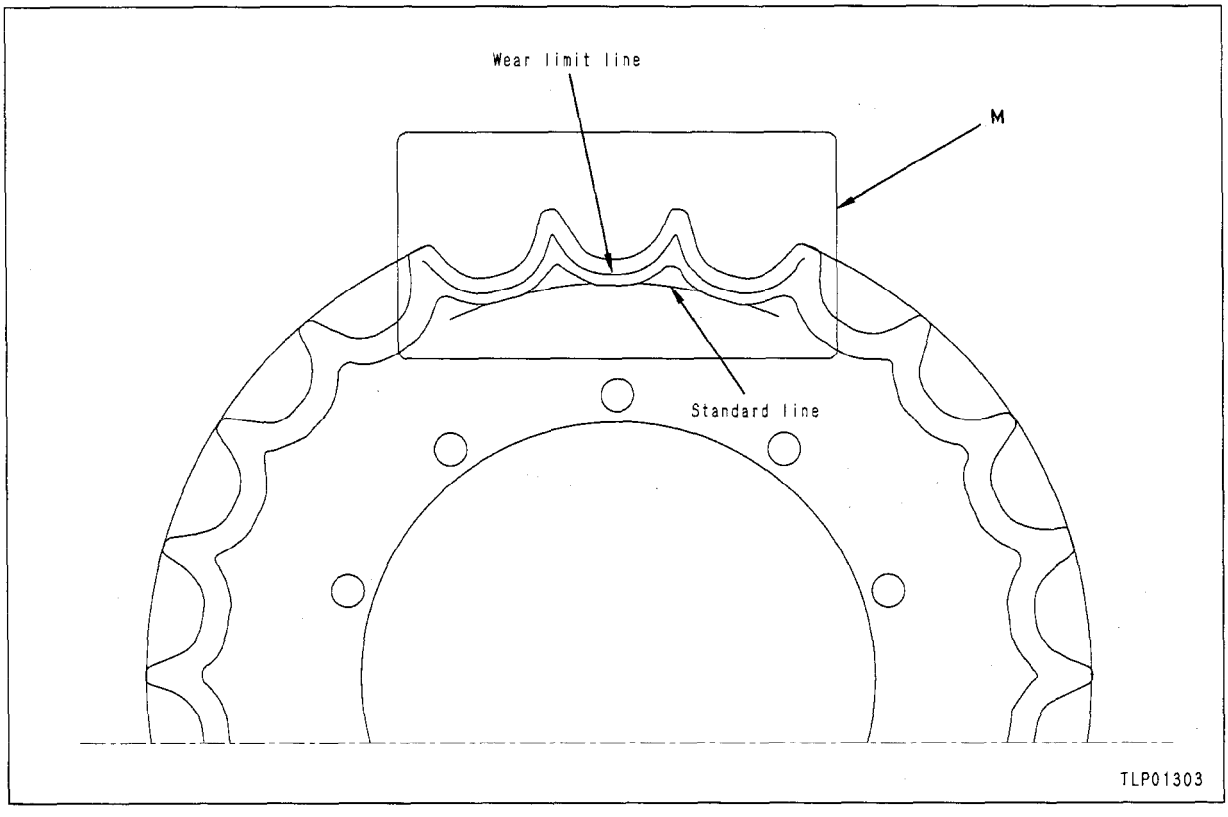

1. Working lamp
2. Battery
3. Fusible link
4. Fuel level sensor
5. Horn switch
6. Alternetor
7. Engine water temperature sensor
8. Starting motor
9. Engine oil pressure switch
10. Fuel feed pump
11. 2-spool solenoid valve
12. Boost pedal
13. PPC lock switch
14. Horn
15. Engine stop solenoid

| Applicable model | | | | | PC20MRX-1 | |
|---|---|---|---|---|---|---|
| Category | Item | | Measurement conditions | Unit | Standard value for new machine | Service limit value |
| Operating effort of control levers | Boom control lever | | • Engine at full throttle<br>• Oil temperature: 45 – 55°C<br>• Fit push-pull scale to center of control lever knob to measure<br>• Fit push-pull scale to tip of pedal to measure<br>• Measure max. value to end of travel | N {kg} | 13.7 ± 2.94 {1.4 ± 0.3} | 13.7 ± 2.94 {1.4 ± 0.3} |
| | Arm control lever | | | | 13.7 ± 2.94 {1.4 ± 0.3} | 13.7 ± 2.94 {1.4 ± 0.3} |
| | Bucket control lever | | | | 12.7 ± 2.94 {1.3 ± 0.3} | 12.7 ± 2.94 {1.3 ± 0.3} |
| | Swing control lever | | | | 12.7 ± 2.94 {1.3 ± 0.3} | 12.7 ± 2.94 {1.3 ± 0.3} |
| | Boom swing control lever | | | | 41.2 ± 14.7 {4.2 ± 1.5} | 41.2 ± 29.4 {4.2 ± 3.0} |
| | Blade control lever | | | | 32.4 ± 14.7 {3.3 ± 1.5} | 32.4 ± 29.4 {3.3 ± 3.0} |
| | Travel control lever | | | | 14.7 ± 4.90 {1.5 ± 0.5} | 12.7 ± 2.94 {1.3 ± 0.3} |
| | Fuel control lever | Min. → Max. | | | 22.6 ± 4.9 {2.3 ± 0.5} | 22.6 ± 4.9 {2.3 ± 0.5} |
| | | Max. → Min. | | | 22.6 ± 4.9 {2.3 ± 0.5} | 22.6 ± 4.9 {2.3 ± 0.5} |
| Hydraulic pressure | Unload pressure | | • Oil temperature: 45 – 55°C<br>• Engine at full throttle<br>• All levers at neutral<br>• Pump outlet port pressure | MPa {kg/cm²} | Max. 3.4 {Max. 35} | Max. 3.4 {Max. 35} |
| | Boom | | • Oil temperature: 45 – 55°C<br>• Engine at full throttle<br>• Pump outlet port pressure<br>• Relieve only circuit to be measured | | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} |
| | Arm | | | | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} |
| | Bucket | | | | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} |
| | Swing | | | | 12.75 $^{+0.49}_{0}$ {130 $^{+5}_{0}$} | 12.75 $^{+0.49}_{0}$ {130 $^{+5}_{0}$} |
| | Boom swing | | | | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} |
| | Blade | | | | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} |
| | Travel | | | | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} | 20.59 $^{+0.49}_{0}$ {210 $^{+5}_{0}$} |
| | Control pump | | | | 2.94 $^{+0.49}_{0}$ {30 $^{+5}_{0}$} | 2.94 $^{+0.49}_{0}$ {30 $^{+5}_{0}$} |
| | LS differential pressure | | • Oil temperature: 45 – 55°C<br>• Engine at full throttle<br>★ LS differential pressure = Pump outlet port pressure – LS pressure | All levers at hold | Max. 3.4 {Max. 35} | Max. 3.4 {Max. 35} |
| | | | | Travel under no load, travel lever at half-way position | 1.57 {16} | 1.57 {16} |

# TOOLS FOR TESTING, ADJUSTING, AND TROUBLESHOOTING

| Check or measurement item | Symbol | | Part No. | Part Name | Remarks |
|---|---|---|---|---|---|
| Engine speed | A | 1 | 799-203-9000 | Multi-tachometer | Digital display L: 60 – 2,000 rpm H: 60 – 19,999 rpm |
| | | 2 | • 799-203-8901 | • Clamp set | |
| Coolant and oil temperatures | B | | 799-101-1502 | Digital temperature gauge | –99.9 — +1,299°C |
| Oil pressure | C | 1 | 799-101-5002 | Hydraulic tester | Pressure gauge: 2.5,5.9,39.2,58.8 MPa {25,60,400,600 kg/cm²} |
| | | | 790-261-1203 | Digital hydraulic tester | Pressure gauge: 68.6MPa{700 kg/cm²} |
| | | 2 | • 799-101-5160 | • Nipple | PT1/8 |
| | | | 799-101-5220 | Nipple | 10 × 1.25 |
| | | | 07002-11023 | O-ring | |
| | | 3 | • 790-261-1340 | • Adapter | 10 x 1.25 (female PT 1/8) for both male and female |
| | | | • 790-261-1311 | | 14 x 1.5 (female PT 1/8) for both male and female |
| | | | • 790-261-1321 | | 18 x 1.5 (female PT 1/8) for both male and female |
| | | | • 790-261-1331 | | 22 x 1.5 (female PT 1/8) for both male and female |
| | | 4 | 790-401-2320 | Hydraulic gauge | 1.0 MPa {10 kg/cm²} |
| | | 5 | 799-401-2701 | Differential pressure gauge | |
| Compression pressure | D | 1 | 795-502-1205 | Compression gauge | 0 – 6.9 MPa {0 – 70 kg/cm²} |
| | | 2 | 795-111-1120 | Adapter | |
| | | | 795-111-1110 | | |
| | | 3 | • 795-101-1571 | • Joint | |
| Valve clearance | E | | Commercially available | Feeler gauge | |
| Exhaust color | F | 1 | 799-201-9000 | Handy Smoke Checker | Discoloration 0 – 70% (with standard color) (Discoloration % × 1/10 ≒ Bosch index) |
| | | 2 | Commercially available | Smoke meter | |
| Operating effort | G | | Commercially available | Push-pull scale | |
| Stroke, hydraulic drift | H | | Commercially available | Scale | |
| Work equipment speed | J | | Commercially available | Stop watch | |
| Measuring voltage and resistance values | K | | Commercially available | Tester | |
| Troubleshooting of wiring harnesses and sensors | L | | 799-601-8000 | T-adapter kit | |
| Measuring wear of sprocket | M | | 796-127-1111 | Wear gauge | |

# MEASURING SPROCKET WEAR




1. Remove the track shoe assembly.
   ★ For details, see DISASSEMBLY AND ASSEMBLY, REMOVAL OF RUBBER SHOE ASSEMBLY or REMOVAL OF STEEL SHOE ASSEMBLY.

2. Align wear gauge **M** with the sprocket.
   ★ Align the standard line, then align the wave shape of the sprocket with the wave shape of the wear gauge.

3. Judge the sprocket wear.
   ★ If the wave shape of the sprocket is above the wear limit line: It is possible to continue to use the sprocket.
   ★ If the wave shape of the sprocket has reached the wear limit line: Replace the sprocket with a new part.

# RELEASING REMAINING PRESSURE FROM HYDRAULIC CIRCUIT

⚠ There is no accumulator installed, so the remaining pressure in the piping between the control valve and hydraulic cylinder or swing motor cannot be released by operating the control levers.
When the above piping is removed, be careful of the following points.

1. Run the engine at low idling, operate the hydraulic cylinders so that as far as possible the pressure is not relieved at the end of the stroke, lower the work equipment to the ground, then stop the engine.
   ★ If the engine is stopped with the hydraulic circuit relieved and the hydraulic cylinder at the end of its stroke, do not carry out any work for 5 to 10 minutes.

2. When removing the piping, loosen the piping sleeve nut gradually to release the pressure remaining in the piping slowly, then remove the piping after the oil stops spurting out.

# RELEASING REMAINING PRESSURE FROM HYDRAULIC TANK

⚠ The hydraulic tank is a sealed type, so it is pressurized.
When removing the hoses or plugs installed to the hydraulic tank, release the remaining pressure in the hydraulic tank as follows.

1. Lower the work equipment to the ground and stop the engine.

2. Loosen the hydraulic tank oil filler plug slowly to release the pressure inside the hydraulic tank.

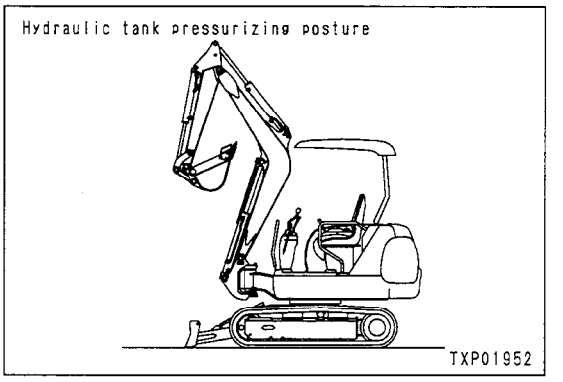
# PRESSURIZING HYDRAULIC TANK

★ If the oil filler plug of the hydraulic tank has been removed, pressurize the hydraulic tank as follows.

1. Run the engine at low idling and set the work equipment to the pressurizing posture.

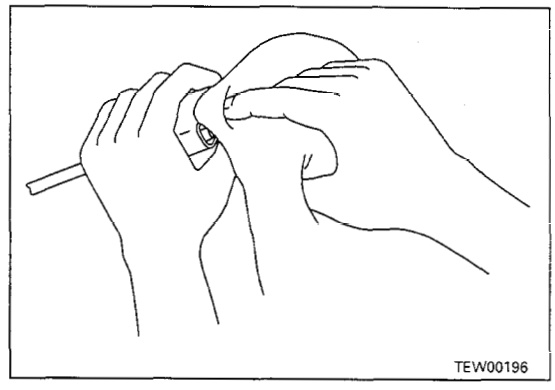
2. Stop the engine, open the hydraulic tank oil filler plug, then tighten it again.
   ★ This operation pressurizes the hydraulic tank.

3. Start the engine and lower the work equipment to the ground.

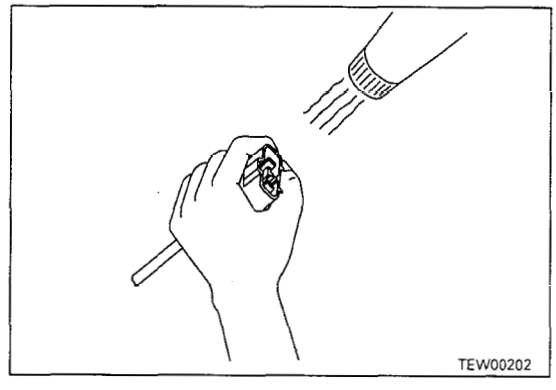


- **Drying wiring harness**
  If there is any oil or dirt on the wiring harness, wipe it off with a dry cloth. Avoid washing it in water or using steam. If the connector must be washed in water, do not use high-pressure water or steam directly on the wiring harness.

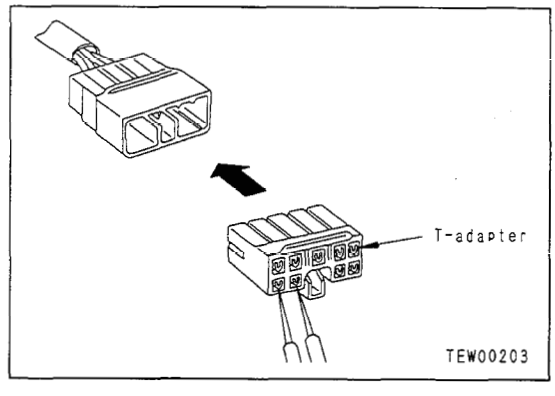
  If water gets directly on the connector, do as follows.
  ① Disconnect the connector and wipe off the water with a dry cloth.
  ★ If the connector is blown dry with compressed air, there is the risk that oil in the air may cause defective contact, so remove all oil and water from the compressed air before blowing with air.

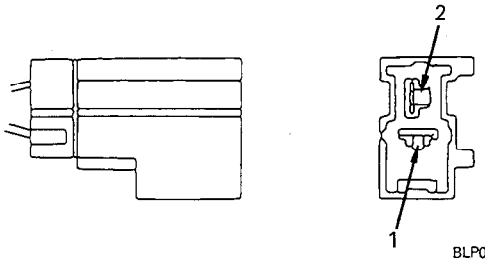
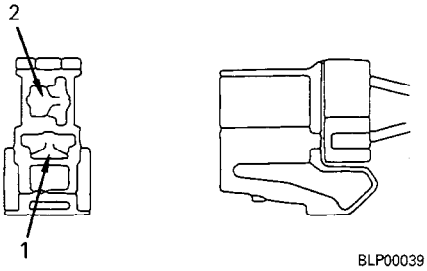
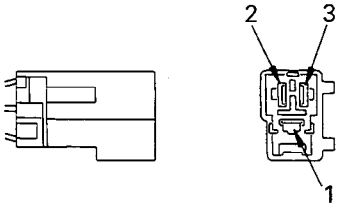
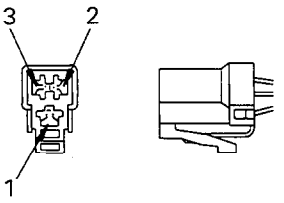
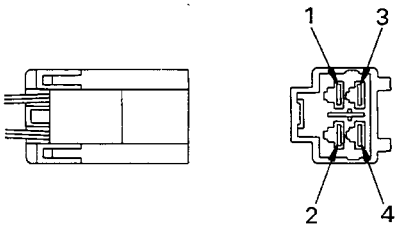
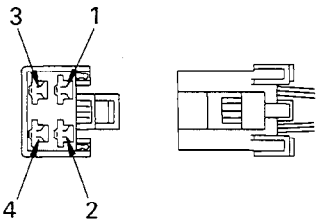
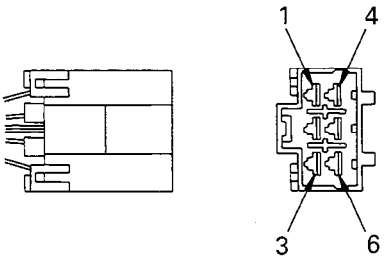
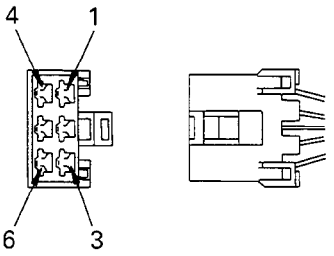
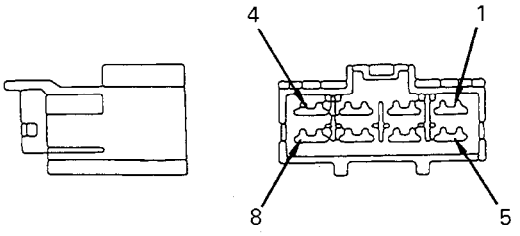
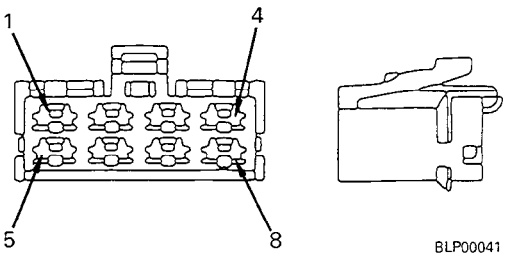



② Dry the inside of the connector with a dryer. If water gets inside the connector, use a dryer to dry the connector.
★ Hot air from the dryer can be used, but regulate the time that the hot air is used in order not to make the connector or related parts too hot, as this will cause deformation or damage to the connector.




③ Carry out a continuity test on the connector. After drying, leave the wiring harness disconnected and carry out a continuity test to check for any short circuits between pins caused by water.
★ After completely drying the connector, blow it with contact restorer and reassemble.

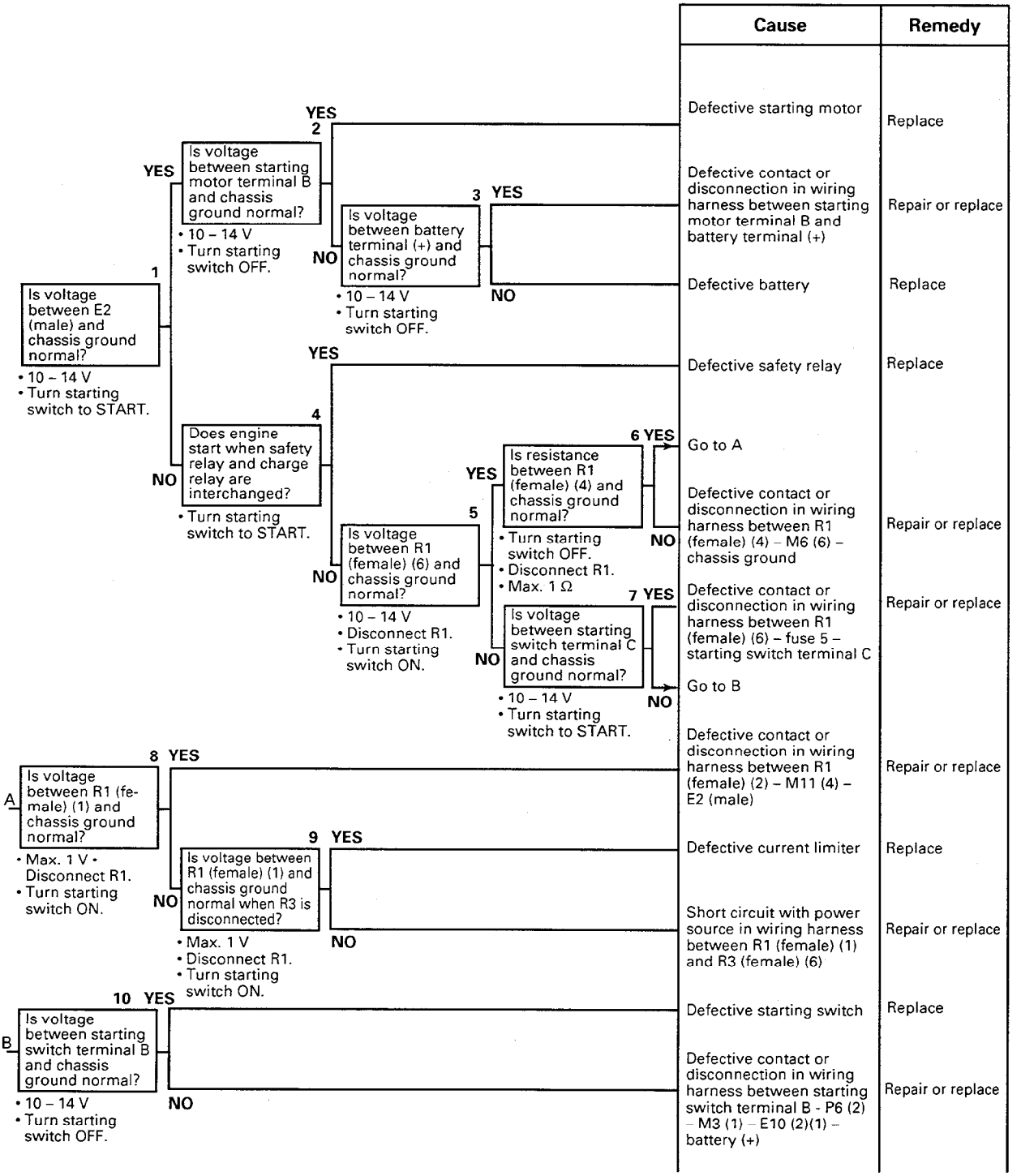


| No. of pins | M type connector | |
|---|---|---|
| | Male (female housing) | Female (male housing) |
| 2 |  BLP00038 |  BLP00039 |
| 3 |  TEW00243 |  TEW00244 |
| 4 |  TEW00245 |  TEW00246 |
| 6 |  TEW00247 |  TEW00248 |
| 8 |  BLP00040 |  BLP00041 |

# E-1 Engine does not start

### a) When starting motor does not turn (starting system)

★ Check that fuse 5 is normal (if it is blown, check for a short circuit with the ground in the circuits related to fuse 5).
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.



# TABLE OF FAILURE MODES AND CAUSES

| Failure mode \ Parts causing failure | | | Damper | Strainer | Hydraulic pump: PC valve | Hydraulic pump: LS valve | Hydraulic pump: Servo piston | Hydraulic pump: Piston pump | Hydraulic pump: Gear pump | Control valve: Spool | Control valve: Unload valve | Control valve: Main relief valve | Control valve: Self pressure reducing valve | Control valve: Sequence valve |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| All work equipment, travel, swing | Speeds of all work equipment, swing, travel are slow or lack power | | | | ● | | ● | ● | | | ● | ● | ● | ● |
| | There is excessive drop in engine speed, or engine stalls | | | | ● | | ● | ● | | | | ● | | |
| | No work equipment, travel, swing move | | ● | | | | | ● | ● | | | | ● | |
| | Abnormal noise generated (around pump) | | | ● | | | | ● | | | | | | |
| | Fine control ability is poor or response is poor | | | | ● | ● | ● | ● | | | ● | | | |
| Work equipment | Boom is slow or lacks power | | | | | | | | | ● | | | | |
| | Arm is slow or lacks power | | | | | | | | | ● | | | | |
| | Bucket is slow or lacks power | | | | | | | | | ● | | | | |
| | Boom swing is slow or lacks power | | | | | | | | | ● | | | | |
| | Blade is slow or lacks power | | | | | | | | | ● | | | | |
| | Boom does not move | | | | | | | | | ● | | | | |
| | Arm does not move | | | | | | | | | ● | | | | |
| | Bucket does not move | | | | | | | | | ● | | | | |
| | Excessive hydraulic drift | Boom | | | | | | | | ● | | | | |
| | | Arm | | | | | | | | ● | | | | |
| | | Bucket | | | | | | | | ● | | | | |
| | | Boom swing | | | | | | | | ● | | | | |
| | | Blade | | | | | | | | ● | | | | |
| | Excessive time lag | | | | | | | | | | | | | |
| | In compound operations, work equipment with larger load is slow | | | | | | | | | | | | | |
| Travel system | Travel deviation | Deviation during normal travel | | | | | | | | ● | | | | |
| | | Deviation when starting | | | | | | | | | | | | |
| | Travel speed is slow or lacks power | | | | ● | | ● | | | | | ● | | |
| | Steering does not turn easily | | | | | | | | | ● | | | | |
| | Travel speed does not switch | | | | | | | | | | | | | |
| | Travel does not move (one side only) | | | | | | | | | | | | | |
| Swing system | Swing speed is slow or lacks power | Both left and right | | | | | | | ● | | | | | |
| | | One direction only | | | | | | | | ● | | | | |
| | Does not swing | Both left and right | | | | | | | ● | | | | | |
| | | One direction only | | | | | | | | ● | | | | |
| | Swing acceleration is poor | Both left and right | | | | | | | | | | | | |
| | | One direction only | | | | | | | | ● | | | | |
| | Excessive overrun when stopping swing | Both left and right | | | | | | | | | | | | |
| | | One direction only | | | | | | | | ● | | | | |
| | Excessive shock when stopping swing (one direction only) | | | | | | | | | ● | | | | |
| | Excessive abnormal noise when stopping swing | | | | | | | | | | | | | |
| | Excessive hydraulic drift of swing | | | | | | | | | | | | | |

## H-13 Excessive time lag (engine at low idling)

★ When the work equipment speed is normal.

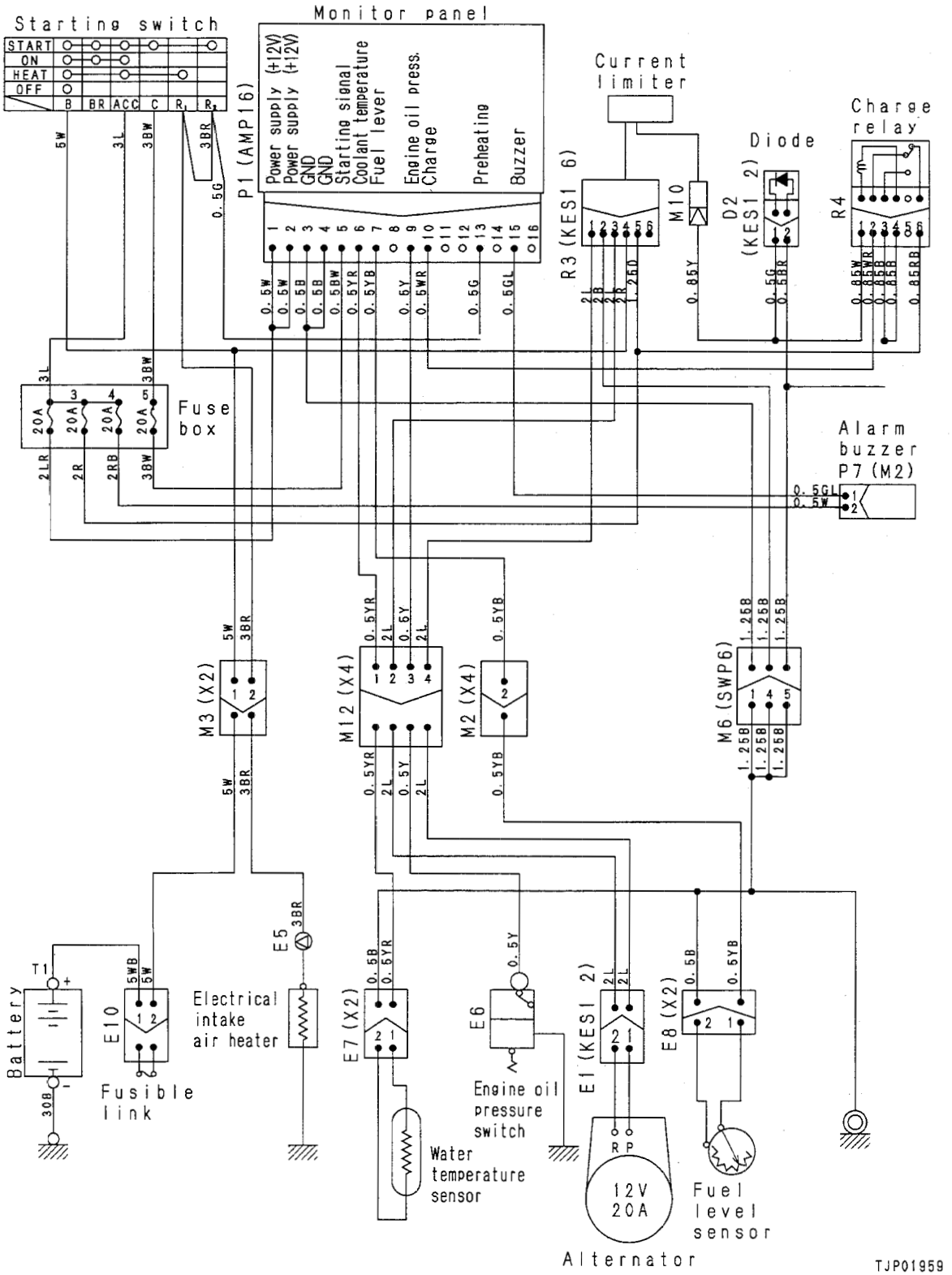
| Cause | Remedy |
|---|---|
| Defective suction valve | Repair or replace |

## H-14 In compound operations, work equipment with larger load is slow

| Cause | Remedy |
|---|---|
| Defective operation of pressure compensation valve on side where load is light | Replace |

| | Combination for compound operation | Side with larger load | Side with lighter load |
|---|---|---|---|
| 1 | Boom RAISE + arm IN | Boom RAISE | Arm IN |
| 2 | Boom RAISE + arm OUT | Arm OUT | Boom RAISE |
| 3 | Boom RAISE + bucket CURL | Boom RAISE | Bucket CURL |
| 4 | Arm OUT + bucket CURL | Arm OUT | Bucket CURL |
| 5 | Boom LOWER + arm OUT | Arm OUT | Boom LOWER |

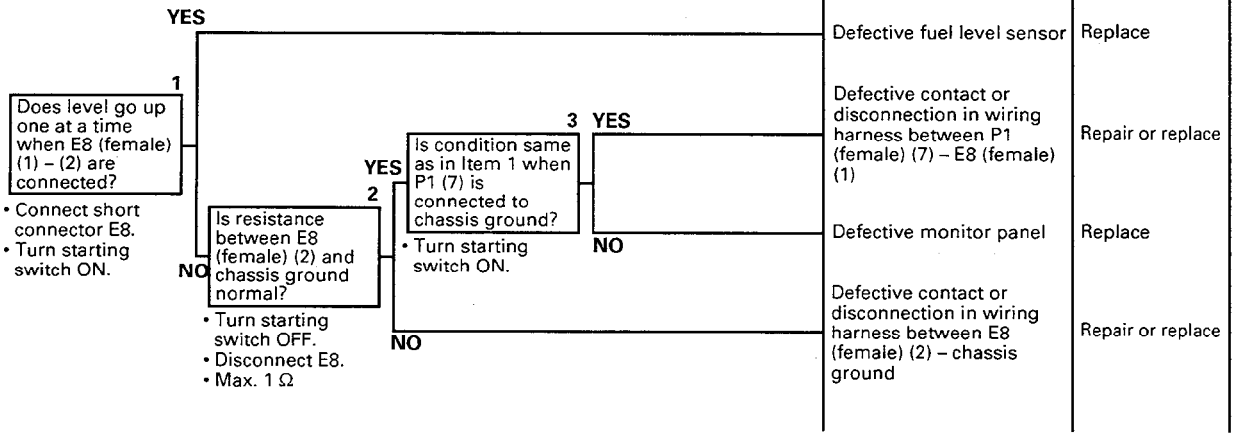
# ELECTRICAL CIRCUIT DIAGRAM FOR M MODE RELATED PARTS



# M-11 Abnormality in fuel gauge

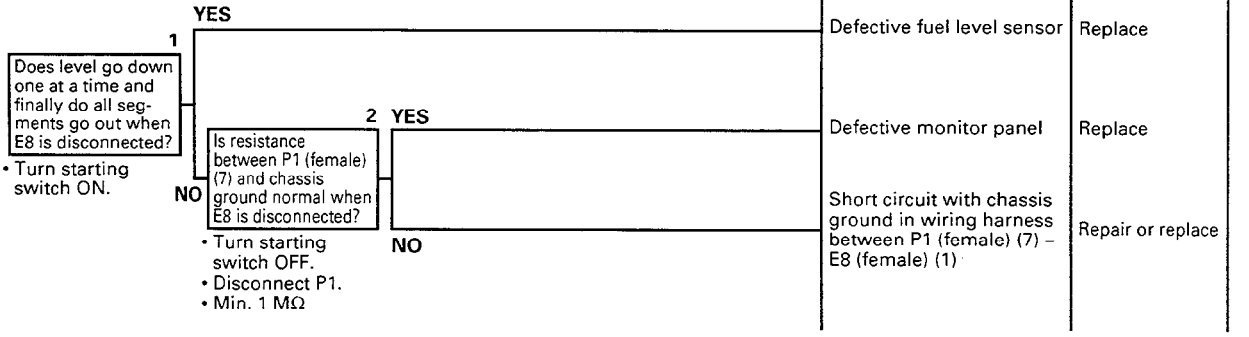
★ When the fuel level is normal.
★ Before carrying out troubleshooting, check that all the related connectors are properly inserted.
★ Always connect any disconnected connectors before going on the next step.

### a) Level does not rise from segment E or all segments go out




| Cause | Remedy |
|---|---|
| Defective fuel level sensor | Replace |
| Defective contact or disconnection in wiring harness between P1 (female) (7) – E8 (female) (1) | Repair or replace |
| Defective monitor panel | Replace |
| Defective contact or disconnection in wiring harness between E8 (female) (2) – chassis ground | Repair or replace |

### b) Level does not go down from segment F




| Cause | Remedy |
|---|---|
| Defective fuel level sensor | Replace |
| Defective monitor panel | Replace |
| Short circuit with chassis ground in wiring harness between P1 (female) (7) – E8 (female) (1) | Repair or replace |

# SPECIAL TOOL LIST

★ Necessity: ■..... Cannot be substituted, should always be installed (used)
●..... Extremely useful if available, can be substituted with commercially available part

| Device | Symbol | | Part No. | Part Name | Necessity | Q'ty | New/ Modified | Sketch | Details of work, Remarks |
|---|---|---|---|---|---|---|---|---|---|
| Disassembly and assembly of idler assembly | L | 1 | 790-101-5201 | Push took kit B | ● | 1 | | | Press-fitting of bearing |
| | | | • 790-101-5231 | • Plate | | 1 | | | |
| | | | • 790-101-5221 | • Grip | | 1 | | | |
| | | | • 01010-51225 | • Bolt | | 1 | | | |
| | | 2 | 790-201-2720 | Spacer | ● | 1 | | | Press-fitting of oil seal |
| Disassembly and assembly of track roller assembly | | 3 | 790-101-5001 | Push tool KIT A | ● | 1 | | | Press-fitting of bushing |
| | | | • 790-101-5051 | • Plate | | 1 | | | |
| | | | • 790-101-5021 | • Grip | | 1 | | | |
| | | | • 01010-50816 | • Bolt | | 1 | | | |
| | | 4 | 790-434-1660 | Installer | ■ | 1 | | | Press-fitting of floating seal |
| Disassembly and assembly of recoil spring | M | | 792-371-1400 | Sleeve | ■ | 1 | | | |
| Disassembly and assembly of hydraulic cylinder assembly | U | 1 | 790-502-1003 | Unit repair stand | ■ | 1 | | | Disassembly and assembly of hydraulic cylinder |
| | | | 790-101-1102 | Hydraulic pump | ■ | 1 | | | |
| | | 2 | 790-330-1100 | Wrench assembly | ■ | 1 | | | Fastening and unfastening of cylinder head |
| | | 3 | 790-302-1480 | Socket (Width across flats : 41mm) | ■ | 1 | | | Fastening and unfastening of boom and blade cylinder piston nut |
| | | | 790-102-1520 | Adapter | ■ | 1 | | | |
| | | | Commercial item | Socket (Width across flats : 36mm) | ■ | 1 | | | Fastening and unfastening of bucket cylinder piston nut |
| | | | 790-102-1520 | Adapter | ■ | 1 | | | |
| | | | 790-302-1390 | Socket (Width across flats : 46mm) | ■ | 1 | | | Fastening and unfastening of arm and swing cylinder piston nut |
| | | | 790-102-1520 | Adapter | ■ | 1 | | | |
| | | | 790-102-1500 | Push tool KIT | ■ | 1 | | | INSTALLATION of dust seal, Boom, arm, cylinder, bucket, blade cylinder, offset cylinder |
| | | | • 790-102-1550 | • Plate | | 1 | | | |
| | | | • 790-201-1540 | • Plate | | 1 | | | |
| | | | • 790-201-1530 | • Plate | | 1 | | | |
| | | | • 790-101-5021 | • Grip | | 1 | | | |
| | | | • 01010-50816 | • Bolt | | 1 | | | |
| | | 4 | 790-720-1000 | Expander | ● | 1 | | | Installation of piston ring |
| | | 5 | 796-720-1630 | Ring | ● | 1 | | | Offset, bucket cylinder |
| | | | 07281-00709 | Clamp | ● | 1 | | | |
| | | | 796-720-1740 | Ring | ● | 1 | | | Boom, arm, blade cylinder |
| | | | 07281-00809 | Clamp | ● | 1 | | | |

# INSTALLATION OF ENGINE REAR SEAL

- When installation the engine rear seal, reverse the removal procedures.

※ 1

Seal mounting face of seal case and oil seal lip : **Engine oil (EO30-CD)**

★ Press fit the oil seal until it comes to the same level as the seal case.

※ 2

Seal case mounting face : **Gasket sealant (LG-7)**

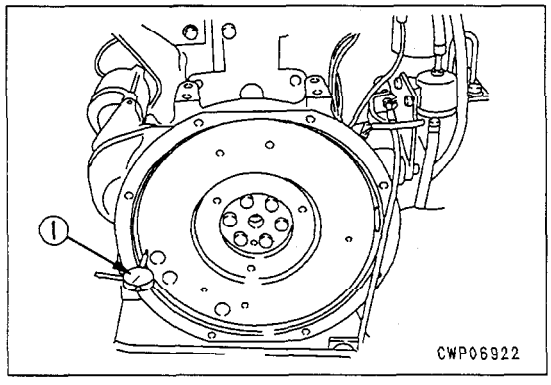
※ 3

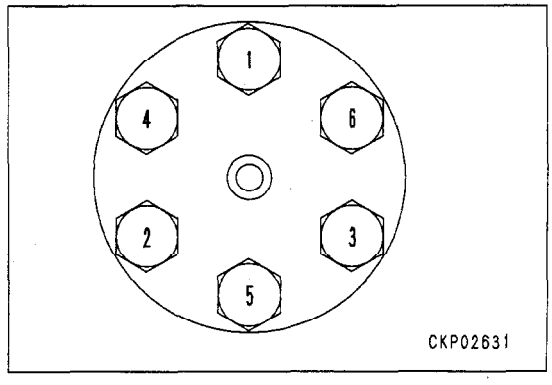
★ Tighten the flywheel mounting bolts in the order shown in the drawing on the right.

Flywheel mounting bolt : **85.75±2.45 Nm {8.75±0.25 kgm}**

After mounting the flywheel, measure facial runout and radial runout of the flywheel using with dial gauge ①.

- Facial runout : max 0.20mm.
- Radial runout: max 0.20mm.

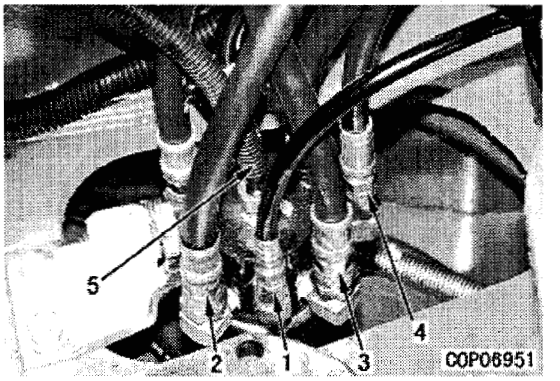


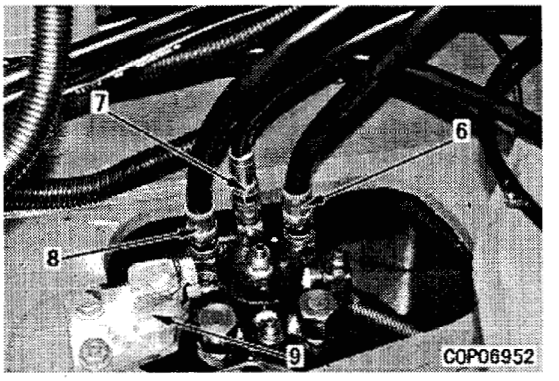



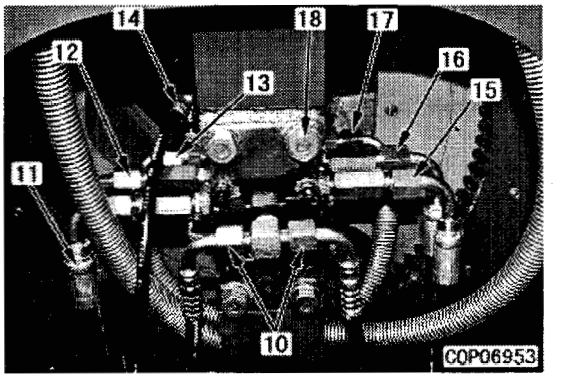
# REMOVAL OF CENTER SWIVEL JOINT ASSEMBLY

⚠ Stop the machine on a flat ground, lower the work equipment completely to the ground and disconnect the negative (–) terminal of the battery.

1. Remove the swing motor and swing machinery assembly. For details, see REMOVAL OF SWING MOTOR AND SWING MACHINERY ASSEMBLY.
2. Drain hydraulic oil.
   Hydraulic oil : **approx 25 ℓ.**
3. Disconnect the hose (1) between the solenoid valves.
4. Disconnect the hoses (2) (right travel), (3) (left travel) and (4) (blade) between the control valves.
5. Disconnect the tube (5) between the hydraulic tanks.
6. Disconnect the hoses (6) (right travel), (7) (blade) and (8) (left travel) between the control valves.
   ★ Attach tags to removed hoses.
7. Remove the stopper (9).
8. Disconnect the hose (10) (return) between the right and left travel motors.
9. Disconnect the hoses (11) and (12) between the left travel motors.
10. Disconnect the hose (13) between the blade cylinders.
11. Disconnect two pieces of the hose (14) (acceleration) between the right and left travel motors.
12. Disconnect the hoses (15) and (16) between the right travel motors.
13. Disconnect the hose (17) between the blade cylinders.
14. Remove 4 pieces of the mounting bolt (18) and then the swivel joint assembly (19).

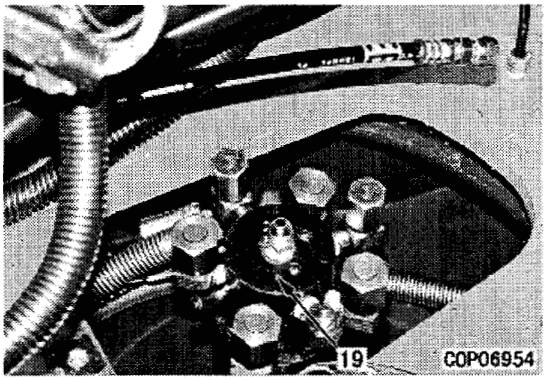


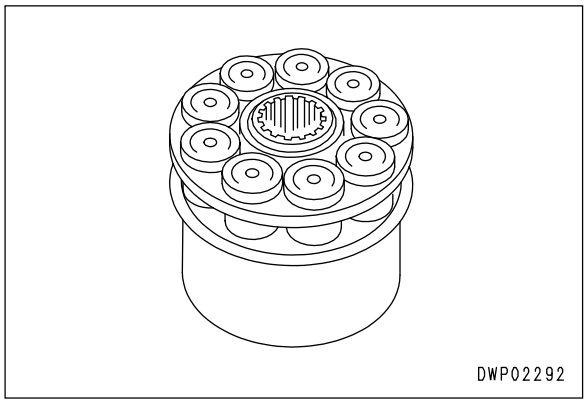



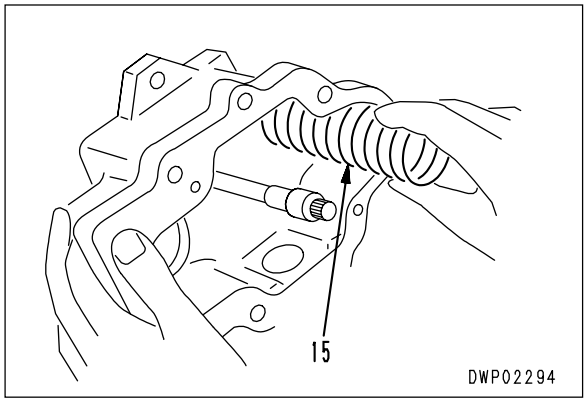

# INSTALLATION OF CENTER SWIVEL JOINT ASSEMBLY

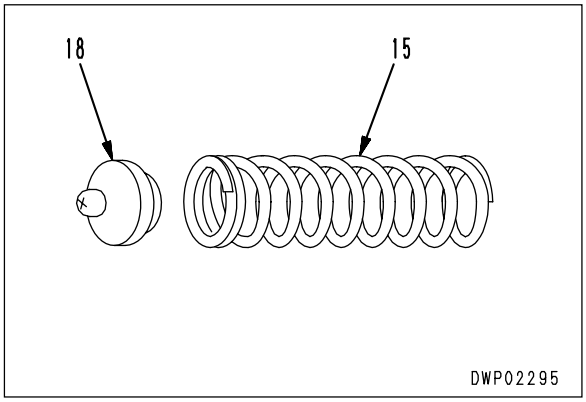
- When installing the assembly, reverse the removal procedures.
- **Refilling with oil (Hydraulic Tank)**
  Supply oil to the specified level, start the engine to circulate the oil in the pipe and check the oil level again.
  Hydraulic oil : **25 ℓ (EO10-W-CD)**
- **Bleeding air**
  Bleed the air from the hydraulic circuit. For details, see TESTING AND ADJUSTING, Bleeing air.



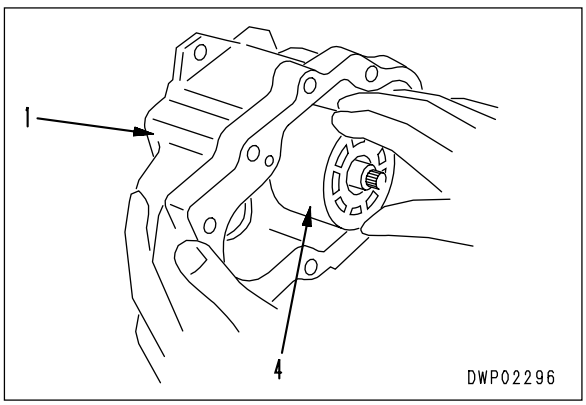



10. Install spring (15) and spring holder (18).
    ★ Install the sperical portion of the spring holder in the swash plate hole.




11. Assemble cylinder barrel assembly (4) to body S (1).

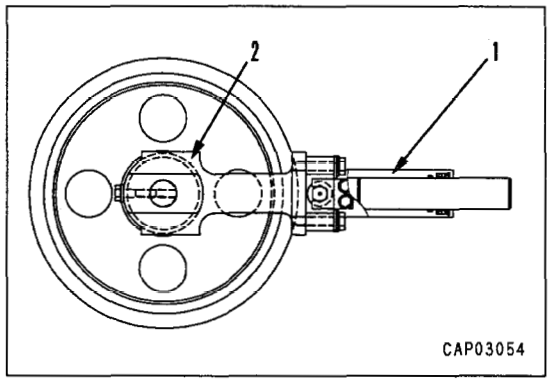


# DISASSEMBLY OF IDLER ASSEMBLY

**1. Idler**

1) Remove the cylinder assembly (1).

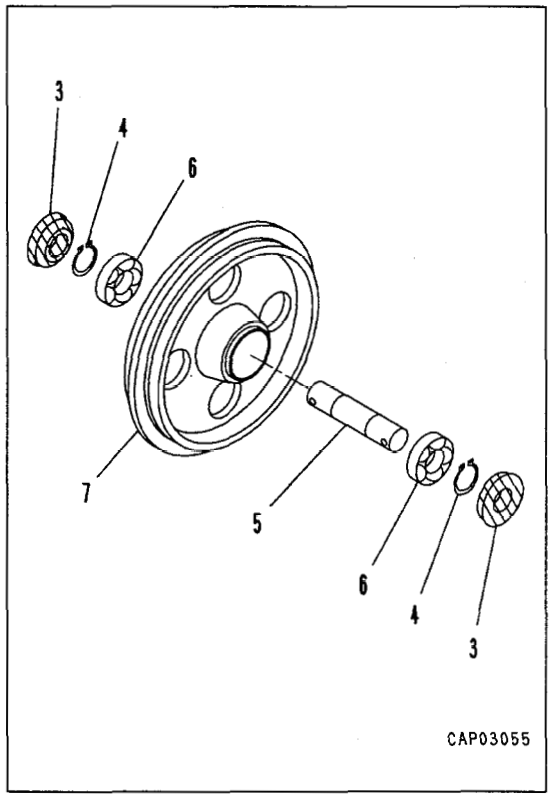
2) Remove the support (2).




3) Remove the oil seal (3).

4) Remove the snap ring (4) and then the shaft (5).

5) Remove two pieces of the bearing (6) from the idler (7).

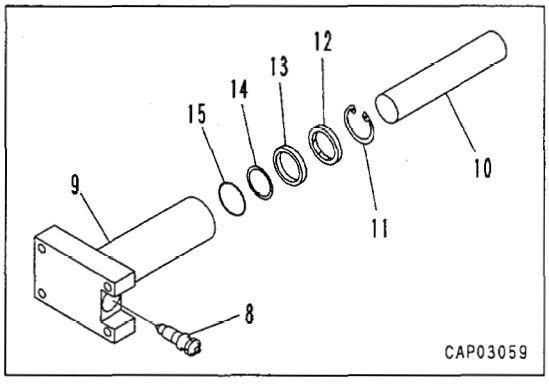



**2. Cylinder**

1) Remove the valve (8) from the cylinder (9).

2) Remove the piston (10) from the cylinder.

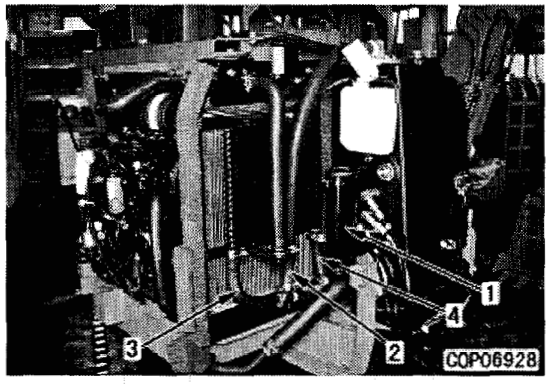
3) Take off the snap ring (11) and then remove the spacer (12), the dust seal (13), the backup ring (14) and the O-ring (15) in this order.

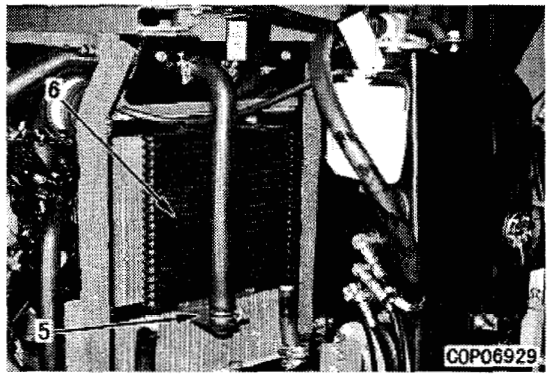


# REMOVAL OF HYDRAULIC OIL COOLER ASSEMBLY

⚠ Stop the machine on a flat ground, lower the work equipment completely to the ground and disconnect the negative (–) terminal of the battery.

1. Remove the machine cover and the counterweight. For details, see REMOVAL OF ENGINE AND HYDRAULIC PUMP ASSEMBLY.
2. Drain hydraulic oil.
   Hydraulic oil : **25** ℓ
3. Remove the grease gun holder (1).
4. Disconnect the hose (2) to the hydraulic oil filter.
5. Disconnect the hose (3) between the check valve and the assembly and the hose (4) from the control valve.
6. Remove the air intake hose bracket (5).
   ★ The bracket has been tightened together with the hydraulic oil cooler.
7. Remove the hydraulic oil cooler assembly (6).
   ★ Lift the assembly and disconnect it from the hose (4).

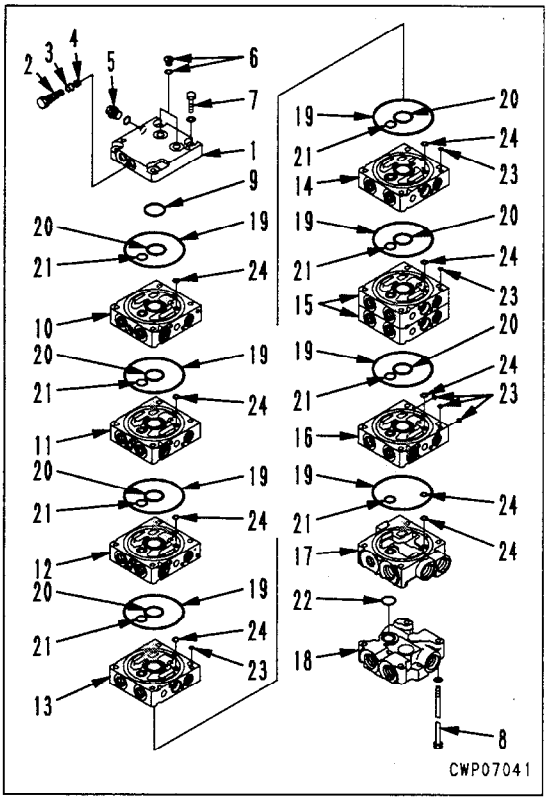



# INSTALLATION OF HYDRAULIC OIL COOLER ASSEMBLY

- When installing the assembly, reverse the removal procedures.
- **Refilling with oil (Hydraulic Tank)**
  Supply oil to the specified level, start the engine to circulate the oil in the pipe and check the oil level again.
  Hydraulic oil : **25** ℓ **(EO10-W-CD)**
- **Bleeding air**
  Bleed the air from the hydraulic circuit. For details, see TESTING AND ADJUSTING, Bleeing air.

# ASSEMBLY OF CONTROL VALVE ASSEMBLY




1. Set the O-ring (24) to each block valve.
2. Set the O-ring (23) to the block valves (16) (swing), (15) (right/left travel), (14) (swing) and (13) (blade).
3. Set the O-ring to the block (18).
4. Set the O-rings (21), (20) and (19) to the block valve (17) (body valve), (16) (swing), (15) (right/left travel), (14) (swing), (13) (blade), (12) (arm), (11) (boom) and (10) (bucket).
   ★ The O-ring (20) is not necessary to the valve body (17).
5. Set the ring (9) to the block valve (10) (bucket).
6. Assemble the valve body and tighten the bolts (8) and (7).
   kgm Mounting bolts (8) and (7) : **29.4 – 34.3Nm {3.0 – 3.5kgm}**
7. Set the O-ring to the plug (6) and screw the plug in the cover (1).
   kgm Plug (6) : **19.6 – 24.5Nm {2.0 – 2.5kgm}**
8. Set the O-ring to the plug (5) and screw the plug in the cover (1).
   kgm Plug (5) : **34.3 – 44.1Nm {3.5 – 4.5kgm}**
9. Set the O-ring backup rings (4) and (3) to the plug (2) and screw the plug in the cover (1).
   kgm Plug (2) : **34.3 – 44.1Nm {3.5 – 4.5kgm}**

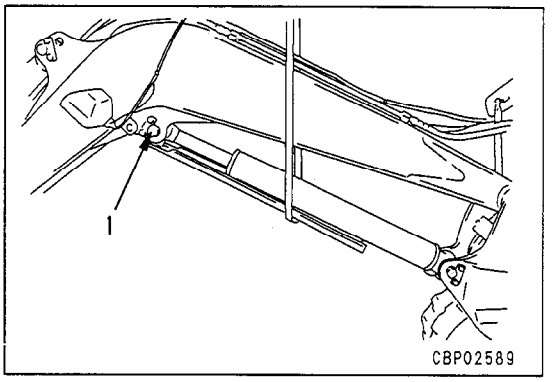
# REMOVAL OF BOOM CYLINDER ASSEMBLY

⚠ Start the engine, extend the arm cylinder and the bucket cylinder fully and lower the work equipment completely to the ground.

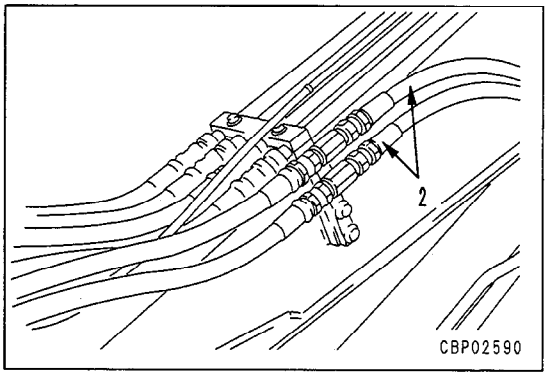
1. Sling the boom cylinder assembly and remove the pin (1) from the head side. ※ 1
   ★ When shims are used, check the number and the positions beforehand.

   ⚠ Start the engine, retract the piston rod and tie the piston rod with wire so that it does not come off.

   ⚠ Relieve remaining pressure from the hydraulic circuit. For details, see TESTING AND ADJUSTING, releasing remaining pressure from hydraulic circuit.

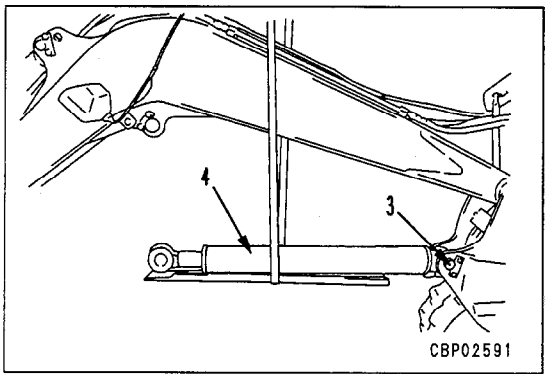



2. Disconnect two pieces of the hose (2).

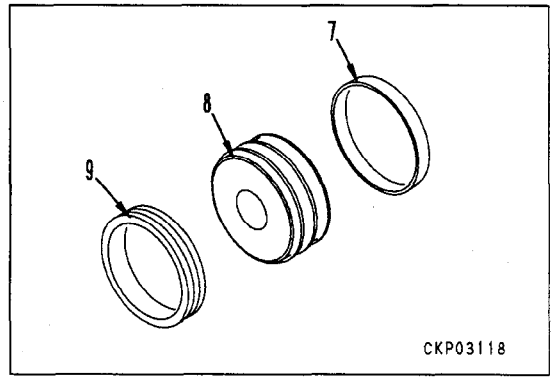



3. Remove the pin (3) from the bottom side and lift the boom cylinder assembly (4) to remove it. ※ 2
   ★ When shims are used, check the number and the positions beforehand.

   kg Boom cylinder assembly : **20kg**

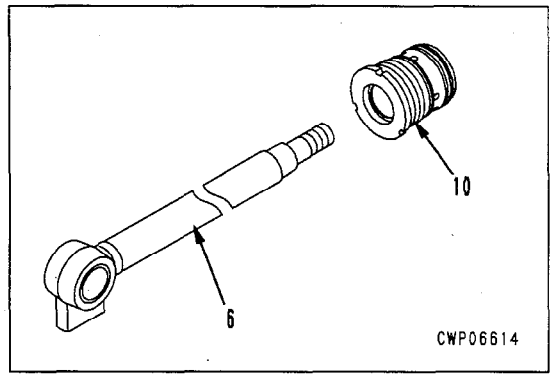


4) Disassemble the piston assembly as per the procedures below:
   i) Remove the wear ring (7) from the piston (8).
   ii) Remove the piston ring (9).

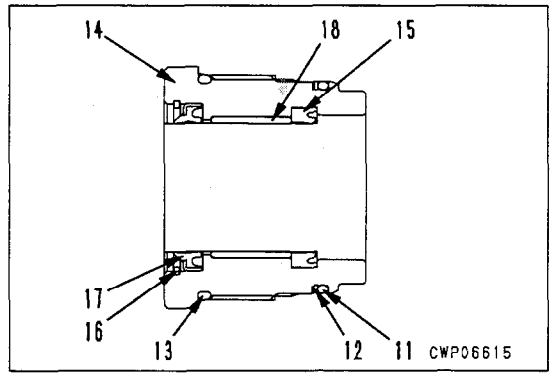


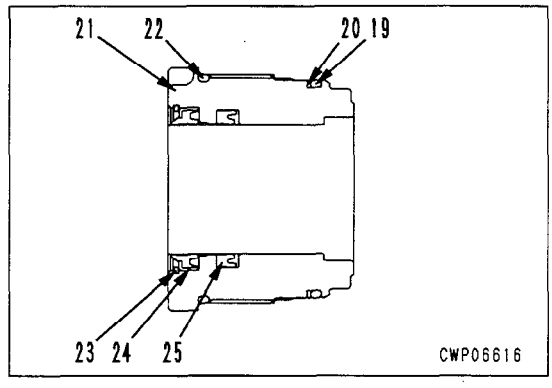

**4. Cylinder Head Assembly**

1) Remove the cylinder head assembly from the piston rod (6).




2) Disassemble the cylinder head assembly as per the procedures below:
   i) Take off the O-ring (11) and the backup ring (12) from the cylinder head (14).
   ii) Take off the O-ring (13).
   iii) Rake off the rod packing (15).
   iv) Take off the snap ring (16) using the snap ring pliers.
   v) Take off the dust seal (17).
   vi) Take off the bushing (18) using the tool **U4**.
3) Disassemble the boom, arm, blade and off-set cylinder assembly as per the procedures below:
   i) Take off the O-ring (19) and the backup ring (20) from the cylinder head (21).
   ii) Take off the O-ring (22).
   iii) Take off the snap ring (24) using the snap ring pliers.
   iv) Take off the dust seal (24).
   v) Take off the rod packing (25).



# INSTALLATION OF ARM ASSEMBLY

- Carry out installation in the reverse order to removal.

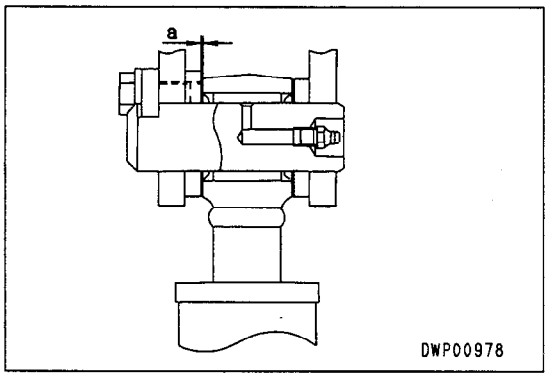
※ 1

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling : **Molybdenum disulphide grease (LM-P)**

Greasing after assembling pin : **Molybdenum disulphide grease (LM-G)**

★ Adjust the shim thickness so that the clearance "**a**" between the head of arm cylinder and arm is below 1 mm.
  - Shim thickness : 1 mm



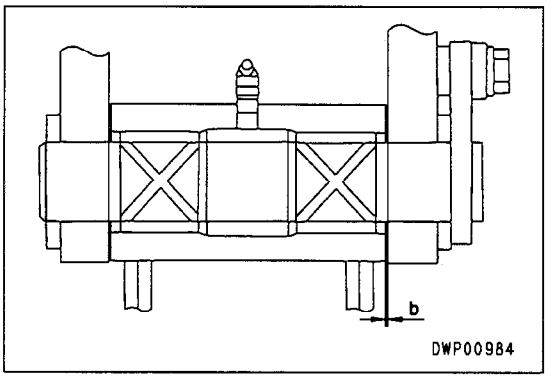

※ 2

⚠ When aligning the position of the pin hole, never insert your fingers in the pin hole.

Pin, sliding surface when assembling : **Molybdenum disulphide grease (LM-P)**

Greasing after assembling pin : **Molybdenum disulphide grease (LM-G)**

★ Adjust the shim thickness so that the clearance "**b**" between arm and boom is below 1 mm.
  - Shim thickness : 1 mm



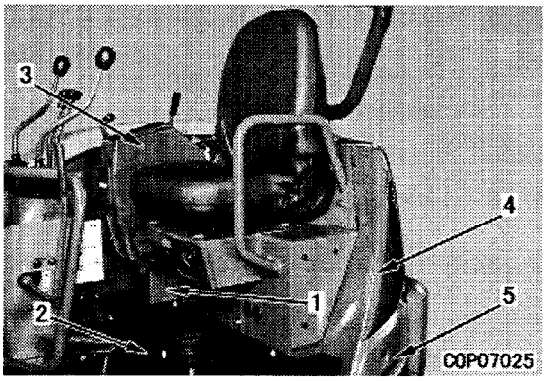

- **Refilling with oil (hydraulic tank)**
  Add oil through the oil filler to the specified level.
  ★ Run the engine to circulate the oil through the system. Then check the oil level again.

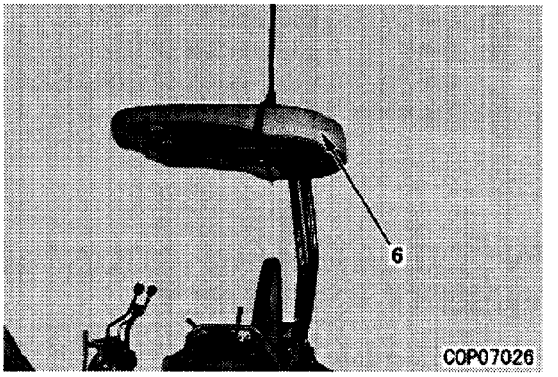
- **Bleeding air**
  Bleed the air from the bucket cylinder.
  For details, see TESTING AND ADJUSTING, Bleeding air.

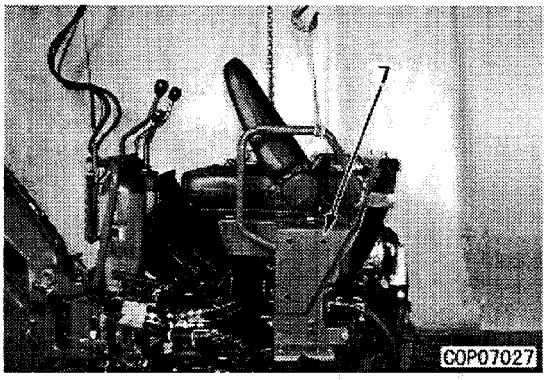
# REMOVAL OF SEAT AND BRACKET ASSEMBLY

⚠ Stop the machine on a flat ground, lower the work equipment completely to the ground and disconnect the negative (–) terminal of the battery.

1. Remove the exterior parts referring to the Paragraph REMOVAL OF COUNTERWEIGHT ASSEMBLY.
2. Remove the wiring connector cover (1).
3. Remove two pieces of the floor plate (2).
4. Remove the console box (3) and place it in front of the machine.
5. Remove the side covers (4) and (5).
6. Sling the canopy assembly (6), remove the mounting bolts and lift the assembly to remove it.
   kg Canopy assembly : **23kg**
7. Sling the seat and bracket assembly (7).
8. Remove the mounting bolts and lift the assembly to remove it.
   kg Seat and bracket assembly : **67 kg**



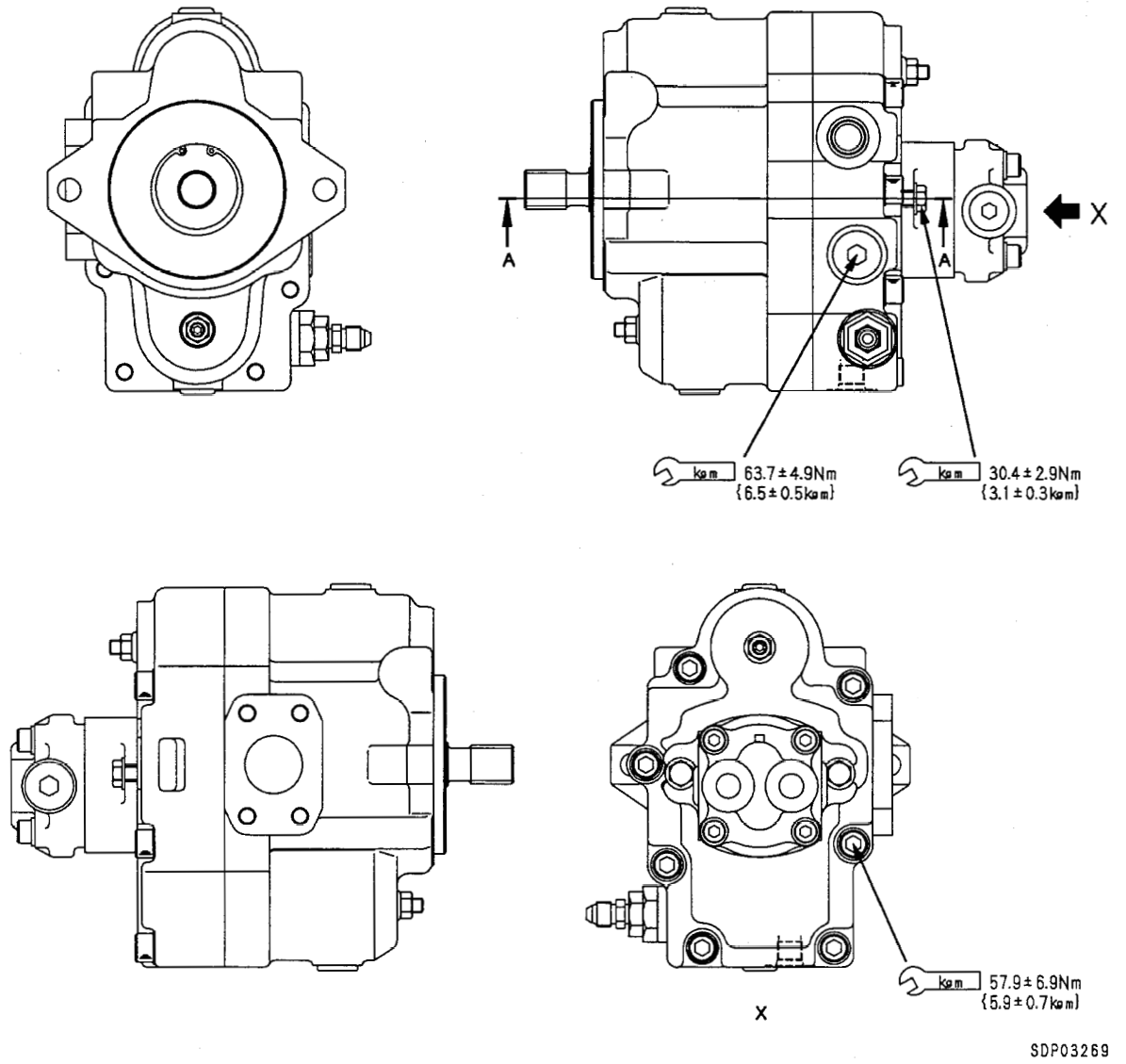




# INSTALLATION OF SEAT AND BRACKET ASSEMBLY

- When installing the assembly, reverse the removal procedures.

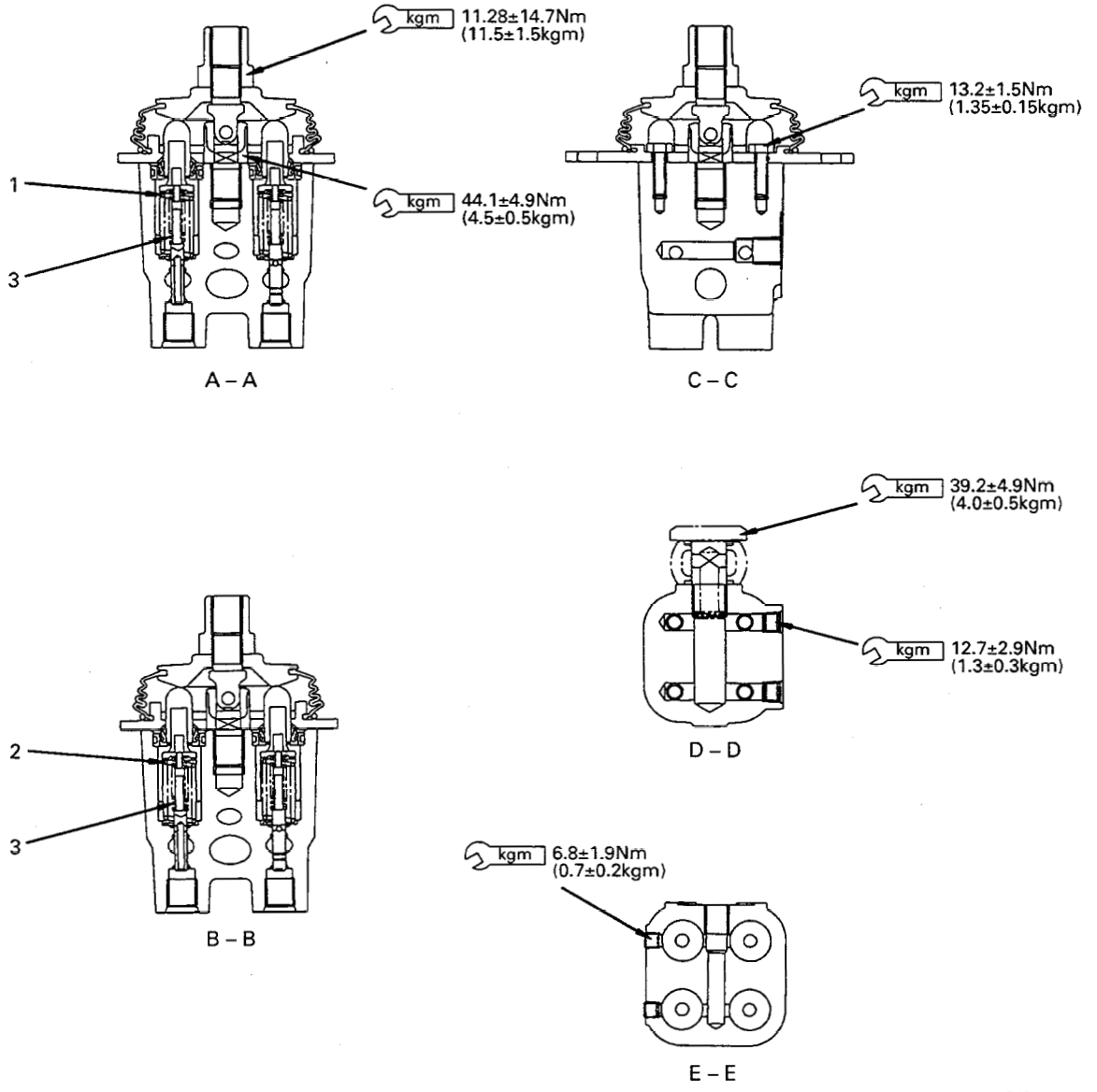
# HYDRAULIC PUMP

## PVK-0B-22



# PPC VALVE

## FOR BOOM, ARM, BUCKET, SWING




SBP00434

Unit: mm

| No. | Check item | Criteria | | | | | Remedy |
|---|---|---|---|---|---|---|---|
| | | Standard size | | | Repair limit | | |
| | | Free length × O.D. | Installed length | Installed load | Free length | Installed load | |
| 1 | Centering spring (for P3, P4) | 50.4 × 15.5 | 34 | 55.9 N {5.7 kg} | — | 45.1 N {4.6 kg} | When damage or deformation is found, replace the spring |
| 2 | Centering spring (for P1, P2) | 44.4 × 15.5 | 34 | 29.4 N {3.0 kg} | — | 23.5 N {2.4 kg} | |
| 3 | Metering spring | 26.5 × 8.2 | 24.9 | 16.7 N {1.7 kg} | — | 13.7 N {1.4 kg} | |

# 90 OTHERS