# CONTENTS

**TEMPERATURE**

Fahrenheit-Centigrade Conversion.

A simple way to convert a fahrenheit temperature reading into a centigrade temperature reading or vice verse is to enter the accompanying table in the center or boldface column of figures.

These figures refer to the temperature in either Fahrenheit or Centigrade degrees.

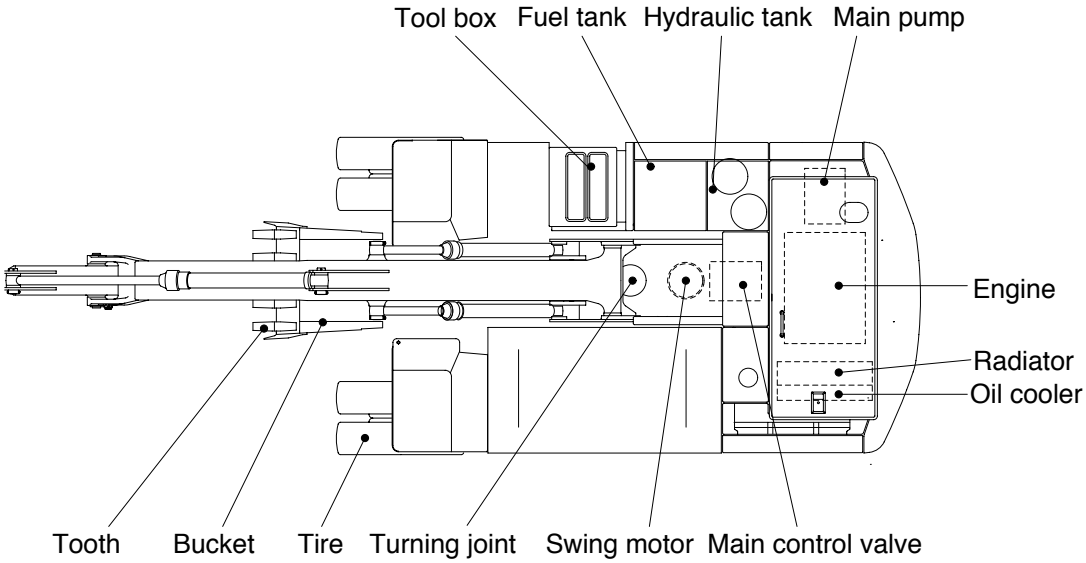
If it is desired to convert from Fahrenheit to Centigrade degrees, consider the center column as a table of Fahrenheit temperatures and read the corresponding Centigrade temperature in the column at the left.

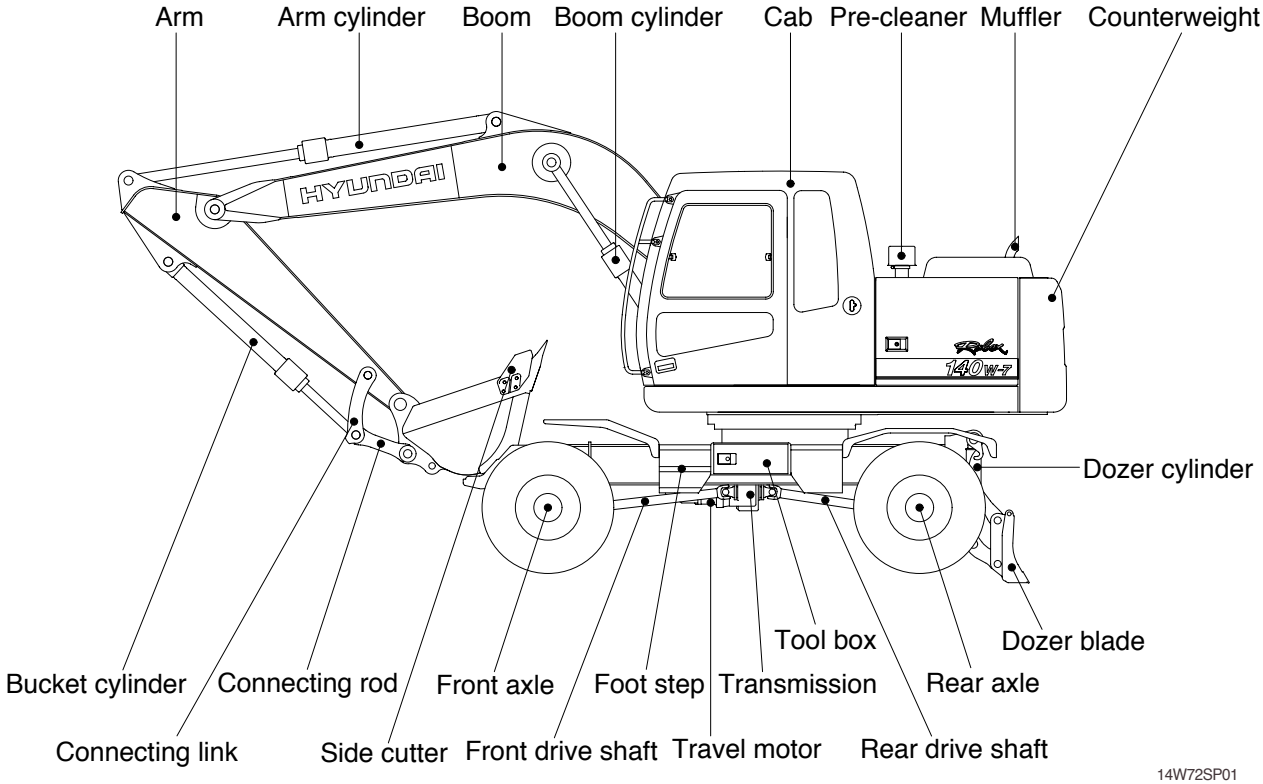
If it is desired to convert from Centigrade to Fahrenheit degrees, consider the center column as a table of Centigrade values, and read the corresponding Fahrenheit temperature on the right.

| ℃ | | ℉ | ℃ | | ℉ | ℃ | | ℉ | ℃ | | ℉ |
|---|---|---|---|---|---|---|---|---|---|---|---|
| -40.4 | -40 | -40.0 | -11.7 | 11 | 51.8 | 7.8 | 46 | 114.8 | 27.2 | 81 | 117.8 |
| -37.2 | -35 | -31.0 | -11.1 | 12 | 53.6 | 8.3 | 47 | 116.6 | 27.8 | 82 | 179.6 |
| -34.4 | -30 | -22.0 | -10.6 | 13 | 55.4 | 8.9 | 48 | 118.4 | 28.3 | 83 | 181.4 |
| -31.7 | -25 | -13.0 | -10.0 | 14 | 57.2 | 9.4 | 49 | 120.2 | 28.9 | 84 | 183.2 |
| -28.9 | -20 | -4.0 | -9.4 | 15 | 59.0 | 10.0 | 50 | 122.0 | 29.4 | 85 | 185.0 |
| -28.3 | -19 | -2.2 | -8.9 | 16 | 60.8 | 10.6 | 51 | 123.8 | 30.0 | 86 | 186.8 |
| -27.8 | -18 | -0.4 | -8.3 | 17 | 62.6 | 11.1 | 52 | 125.6 | 30.6 | 87 | 188.6 |
| -27.2 | -17 | 1.4 | -7.8 | 18 | 64.4 | 11.7 | 53 | 127.4 | 31.1 | 88 | 190.4 |
| -26.7 | -16 | 3.2 | -6.7 | 20 | 68.0 | 12.8 | 55 | 131.0 | 32.2 | 90 | 194.0 |
| -26.1 | -15 | 5.0 | -6.7 | 20 | 68.0 | 12.8 | 55 | 131.0 | 32.2 | 90 | 194.0 |
| -25.6 | -14 | 6.8 | -6.1 | 21 | 69.8 | 13.3 | 56 | 132.8 | 32.8 | 91 | 195.8 |
| -25.0 | -13 | 8.6 | -5.6 | 22 | 71.6 | 13.9 | 57 | 134.6 | 33.3 | 92 | 197.6 |
| -24.4 | -12 | 10.4 | -5.0 | 23 | 73.4 | 14.4 | 58 | 136.4 | 33.9 | 93 | 199.4 |
| -23.9 | -11 | 12.2 | -4.4 | 24 | 75.2 | 15.0 | 59 | 138.2 | 34.4 | 94 | 201.2 |
| -23.3 | -10 | 14.0 | -3.9 | 25 | 77.0 | 15.6 | 60 | 140.0 | 35.0 | 95 | 203.0 |
| -22.8 | -9 | 15.8 | -3.3 | 26 | 78.8 | 16.1 | 61 | 141.8 | 35.6 | 96 | 204.8 |
| -22.2 | -8 | 17.6 | -2.8 | 27 | 80.6 | 16.7 | 62 | 143.6 | 36.1 | 97 | 206.6 |
| -21.7 | -7 | 19.4 | -2.2 | 28 | 82.4 | 17.2 | 63 | 145.4 | 36.7 | 98 | 208.4 |
| -21.1 | -6 | 21.2 | -1.7 | 29 | 84.2 | 17.8 | 64 | 147.2 | 37.2 | 99 | 210.2 |
| -20.6 | -5 | 23.0 | -1.1 | 35 | 95.0 | 21.1 | 70 | 158.0 | 51.7 | 125 | 257.0 |
| -20.0 | -4 | 24.8 | -0.6 | 31 | 87.8 | 18.9 | 66 | 150.8 | 40.6 | 105 | 221.0 |
| -19.4 | -3 | 26.6 | 0 | 32 | 89.6 | 19.4 | 67 | 152.6 | 43.3 | 110 | 230.0 |
| -18.9 | -2 | 28.4 | 0.6 | 33 | 91.4 | 20.0 | 68 | 154.4 | 46.1 | 115 | 239.0 |
| -18.3 | -1 | 30.2 | 1.1 | 34 | 93.2 | 20.6 | 69 | 156.2 | 48.9 | 120 | 248.0 |
| -17.8 | 0 | 32.0 | 1.7 | 35 | 95.0 | 21.1 | 70 | 158.0 | 51.7 | 125 | 257.0 |
| -17.2 | 1 | 33.8 | 2.2 | 36 | 96.8 | 21.7 | 71 | 159.8 | 54.4 | 130 | 266.0 |
| -16.7 | 2 | 35.6 | 2.8 | 37 | 98.6 | 22.2 | 72 | 161.6 | 57.2 | 135 | 275.0 |
| -16.1 | 3 | 37.4 | 3.3 | 38 | 100.4 | 22.8 | 73 | 163.4 | 60.0 | 140 | 284.0 |
| -15.6 | 4 | 39.2 | 3.9 | 39 | 102.2 | 23.3 | 74 | 165.2 | 62.7 | 145 | 293.0 |
| -15.0 | 5 | 41.0 | 4.4 | 40 | 104.0 | 23.9 | 75 | 167.0 | 65.6 | 150 | 302.0 |
| -14.4 | 6 | 42.8 | 5.0 | 41 | 105.8 | 24.4 | 76 | 168.8 | 68.3 | 155 | 311.0 |
| -13.9 | 7 | 44.6 | 5.6 | 42 | 107.6 | 25.0 | 77 | 170.6 | 71.1 | 160 | 320.0 |
| -13.3 | 8 | 46.4 | 6.1 | 43 | 109.4 | 25.6 | 78 | 172.4 | 73.9 | 165 | 329.0 |
| -12.8 | 9 | 48.2 | 6.7 | 44 | 111.2 | 26.1 | 79 | 174.2 | 76.7 | 170 | 338.0 |
| -12.2 | 10 | 50.0 | 7.2 | 45 | 113.0 | 26.7 | 80 | 176.0 | 79.4 | 172 | 347.0 |

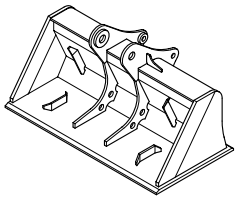
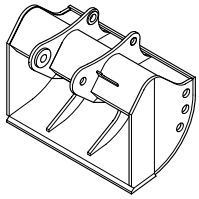
# GROUP 2 SPECIFICATIONS

## 1. MAJOR COMPONENT



### 2) SPECIAL BUCKET

| Slope finishing bucket | Ditch cleaning bucket |
|---|---|
|  |  |
| 铗0.55m³ SAE heaped bucket | ★0.45m³ SAE heaped bucket |

| Capacity | | Width | | Weight | Recommendation | | | |
|---|---|---|---|---|---|---|---|---|
| | | | | | 4.6m (15' 1") boom | | | |
| SAE heaped | CECE heaped | Without side cutter | With side cutter | | 1.9m arm (6' 3") | 2.1m arm (6'11") | 2.5m arm (8' 2") | 3.0m arm (9'10") |
| ★0.45m³ (0.59yd³) | 0.40m³ (0.52yd³) | 1520mm (59.8") | - | 410kg (900lb) | | | | |
| 铗0.55m³ (0.72yd³) | 0.45m³ (0.59yd³) | 1800mm (70.9") | - | 585kg (1290lb) | | | | |

铗 : Slope finishing bucket
★ : Ditch cleaning bucket

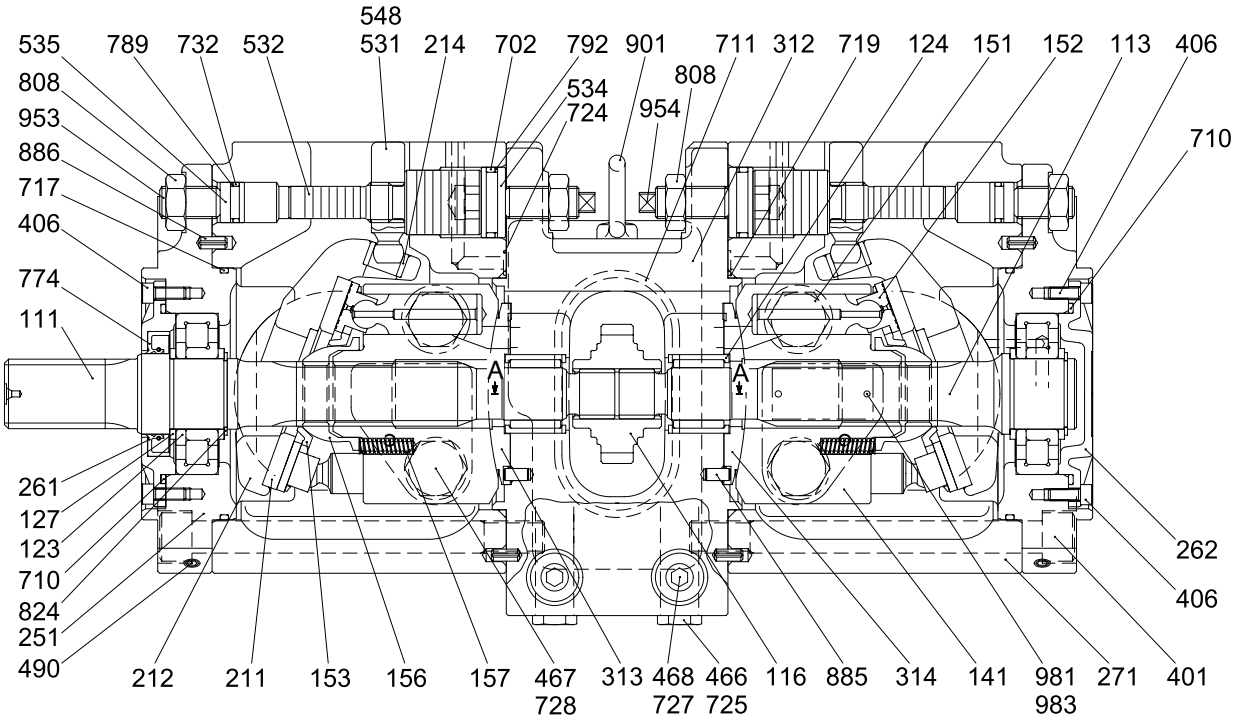
Applicable for materials with density of 2000kgf/m³ (3370lbf/yd³) or less

Applicable for materials with density of 1600kgf/m³ (2700lbf/yd³) or less

Applicable for materials with density of 1100kgf/m³ (1850lbf/yd³) or less

### 1) MAIN PUMP(1/2)

The main pump consists of two piston pumps(front & rear) and valve block.

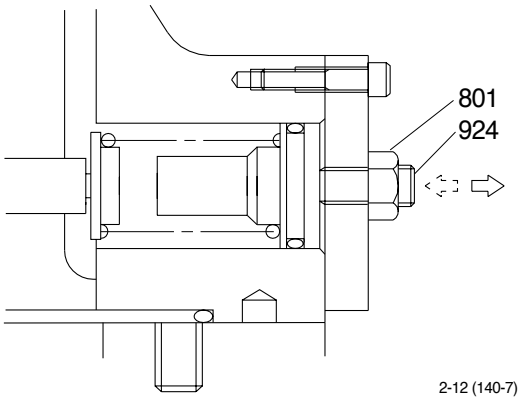



14W72SF02

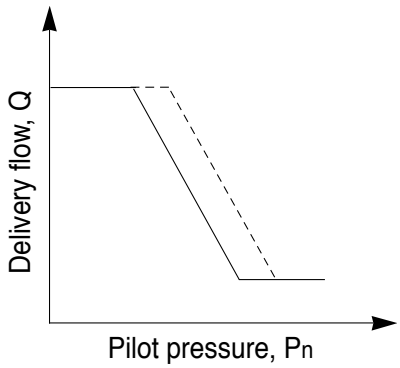
| | | | | | |
|---|---|---|---|---|---|
| 111 | Drive shaft(F) | 271 | Pump casing | 724 | O-ring |
| 113 | Drive shaft(R) | 313 | Valve plate(R) | 725 | O-ring |
| 116 | Gear | 314 | Valve plate(L) | 727 | O-ring |
| 123 | Roller bearing | 401 | Hexagon socket bolt | 728 | O-ring |
| 124 | Needle bearing | 406 | Hexagon socket bolt | 732 | O-ring |
| 127 | Bearing spacer | 466 | VP Plug | 774 | Oil seal |
| 141 | Cylinder block | 467 | VP Plug | 789 | Back up ring |
| 151 | Piston | 468 | VP Plug | 792 | Back up ring |
| 152 | Shoe | 490 | Plug | 808 | Hexagon head nut |
| 153 | Push-plate | 531 | Tilting pin | 824 | Snap ring |
| 156 | Bushing | 532 | Servo piston | 885 | Pin |
| 157 | Cylinder spring | 534 | Stopper(L) | 886 | Spring pin |
| 211 | Shoe plate | 535 | Stopper(S) | 901 | Eye bolt |
| 212 | Swash plate | 548 | Pin | 953 | Set screw |
| 214 | Bushing | 702 | O-ring | 954 | Set screw |
| 251 | Support | 710 | O-ring | 981 | Plate |
| 261 | Seal cover(F) | 717 | O-ring | 983 | Pin |
| 262 | Seal cover(R) | 719 | O-ring | | |

### ③ Adjustment of flow control characteristic

The flow control characteristic can be adjusted with the adjusting screw.
Adjust it by loosening the hexagon nut(801) and by tightening(or loosening) the hexagonal socket head screw(924).
Tightening the screw shifts the control chart to the right as shown in the figure.

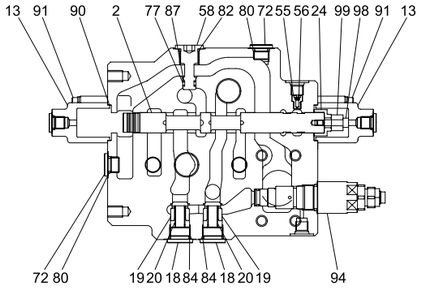



2-12 (140-7)

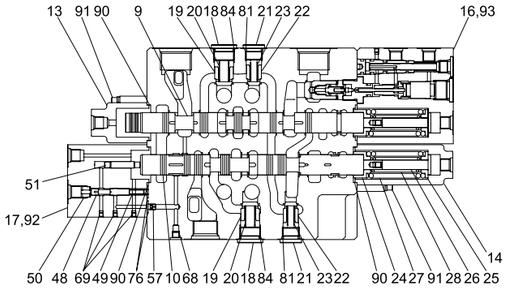



**※ Adjusting values are shown in table.**

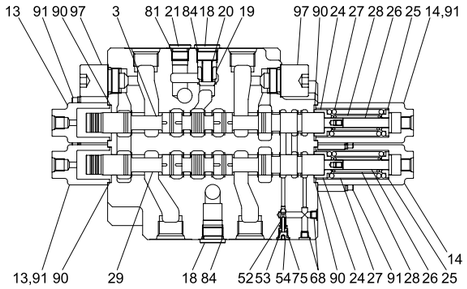
| Speed | Adjustment of flow control characteristic | | |
|---|---|---|---|
| | Tightening amount of adjusting screw(924) | Flow control starting pressure change amount | Flow change amount |
| (min $^{-1}$) | (Turn) | (kgf/cm$^2$) | ( ℓ /min) |
| 2100 | +1/4 | +1.5 | +7.9 |



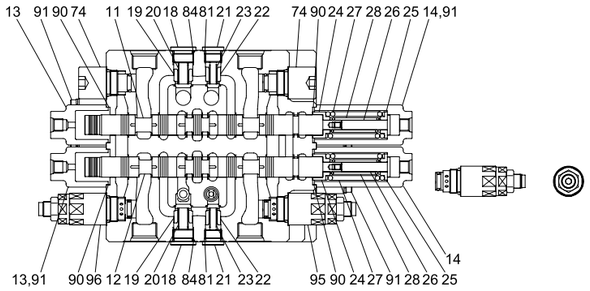

A - A( SUPPLY)



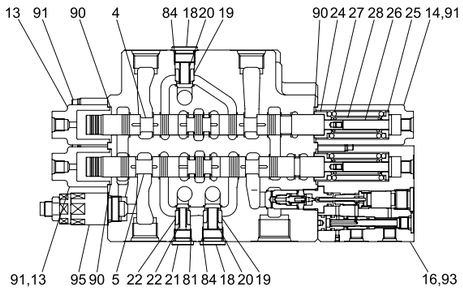

E - E(ARM & ARM REGENERATION /BREAKER)



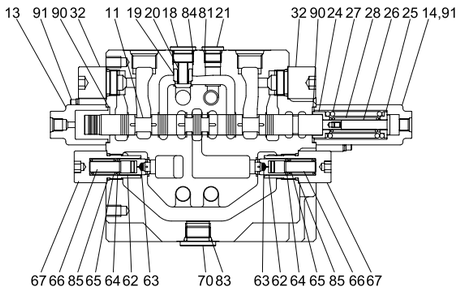

B - B(TRAVEL RIGHT & LEFT)



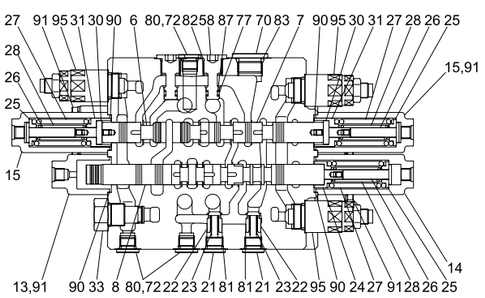

F - F(OPTION & BUCKET)



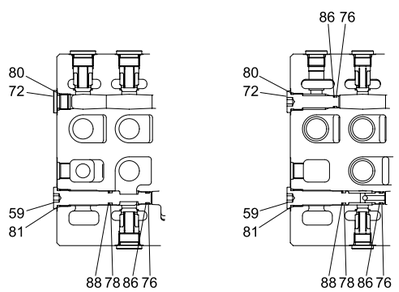

C - C(SWING & BOOM)

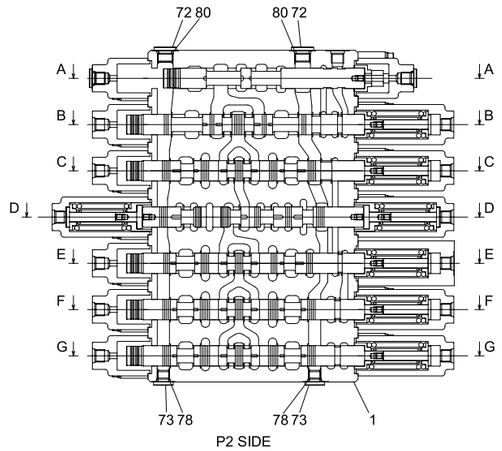



G - G(OPTION & NEGATIVE CONTROL)

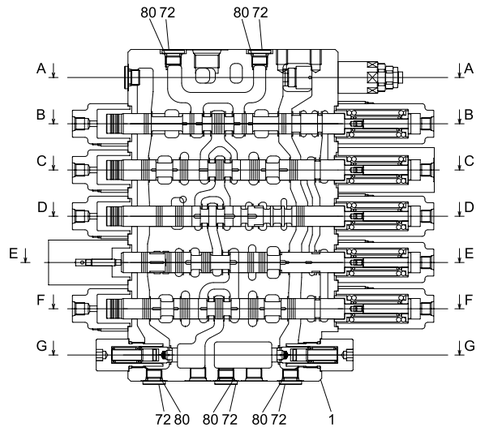



D - D(SWING PRIORITY & BOOM2 & ARM)

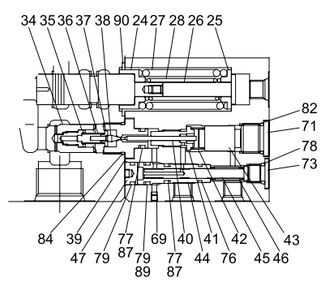



P2 SIDE




P1 SIDE



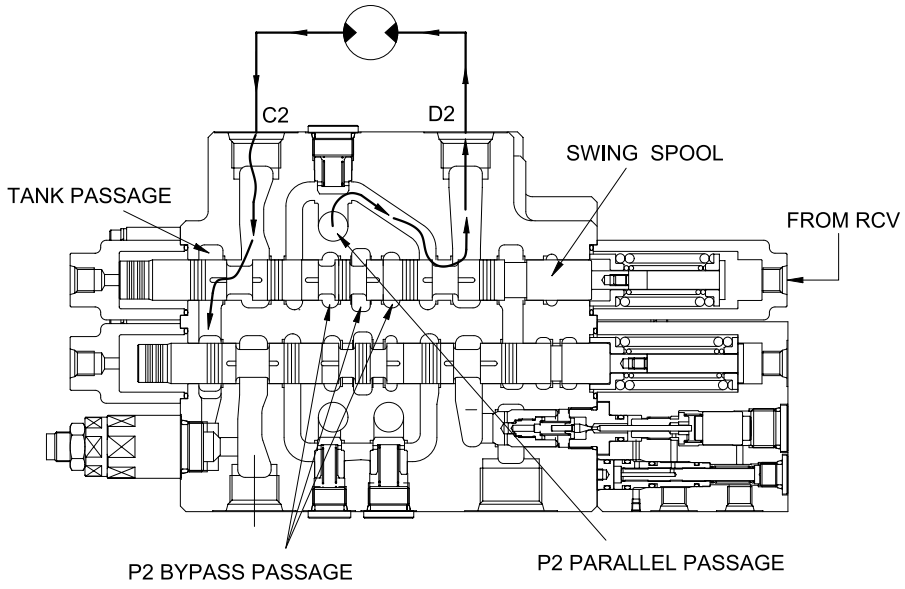

DETAIL OF LOCK VALVE(BOOM & ARM)

| | | | |
|---|---|---|---|
| 1 | Body | 50 | Stopper-regeneration |
| 2 | Spool | 51 | Piston-cut off |
| 3 | Spool-travel | 52 | Poppet-signal |
| 4 | Spool-swing | 53 | Spring-signal |
| 5 | Spool-boom | 54 | Plug |
| 6 | Spool-swing priority | 55 | Orifice-signal |
| 7 | Spool-boom2 | 56 | Coin type filter |
| 8 | Spool-arm2 | 57 | Orifice-plug |
| 9 | Spool-arm | 58 | Plug |
| 10 | Spool-arm regeneration | 59 | Plug |
| 11 | Spool-option | 60 | Plug |
| 12 | Spool-bucket | 61 | Plug-orifice |
| 13 | Cover-pilot A | 62 | Poppet-negative control |
| 14 | Cover-pilot B1 | 63 | Coin type filter |
| 15 | Cover-Pilot B2 | 64 | Spring seat |
| 16 | Block-holding | 65 | Spring-negative control |
| 17 | Block-regeneration | 66 | Piston-negative control |
| 18 | Plug | 67 | Socket-negative control |
| 19 | Poppet1-check valve | 68 | Plug |
| 20 | Spring-check valve | 69 | Plug |
| 21 | Plug | 70 | Plug |
| 22 | Poppet2-check valve | 71 | Plug |
| 23 | Spring-check valve | 72 | Plug |
| 24 | Spring seat1 | 73 | Plug |
| 25 | Spring seat3 | 74 | Plug-relief valve |
| 26 | Spacer bolt | 75 | O-ring |
| 27 | Spring-return(L) | 76 | O-ring |
| 28 | Spring-return(S) | 77 | O-ring |
| 29 | Stopper1-TS | 78 | O-ring |
| 30 | Stopper2-priority | 79 | O-ring |
| 31 | Spring seat2 | 80 | O-ring |
| 32 | Plug-relief valve | 81 | O-ring |
| 33 | Plug-relief valve | 82 | O-ring |
| 34 | Poppet-lock valve | 83 | O-ring |
| 35 | Restrictor-lock valve | 84 | O-ring |
| 36 | Spring-lock valve pilot | 85 | O-ring |
| 37 | Guide poppet | 86 | Back-up ring |
| 38 | Poppet-pilot | 87 | Back-up ring |
| 39 | Seat-poppet | 88 | Back-up ring |
| 40 | Piston1 | 89 | Back-up ring |
| 41 | Guide-piston | 90 | O-ring |
| 42 | Spring1-lock valve | 91 | Bolt with washer |
| 43 | Piston2 | 92 | Socket head bolt |
| 44 | Socket-lock valve | 93 | Socket head bolt |
| 45 | Spool-lock valve | 94 | Main relief valve |
| 46 | Spring2-lock valve | 95 | Over load relief valve |
| 47 | Stopper-lock valve | 96 | Over load relief valve |
| 48 | Spool-regen selector | 97 | Make-up check valve |
| 49 | Spring-regeneration | | |

14W72SF11

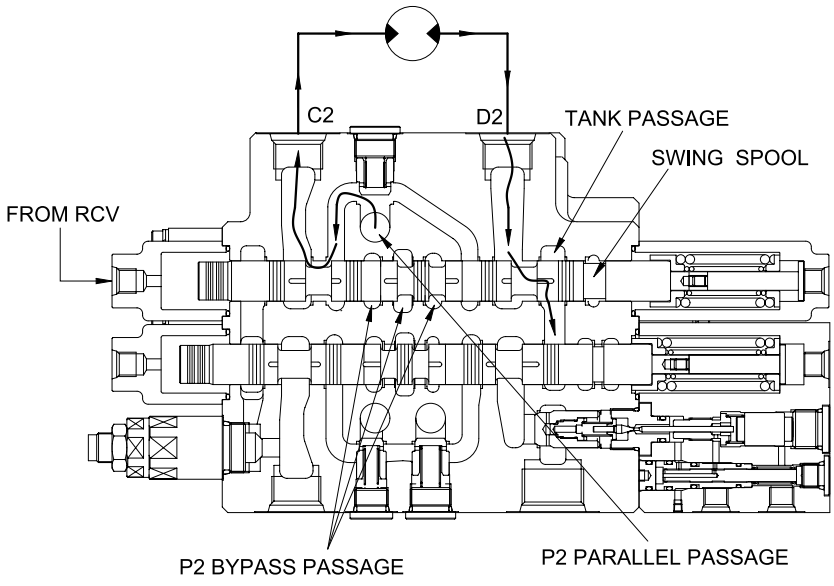
### (5) SWING OPERATION

#### ① Swing left operation




14072SF32

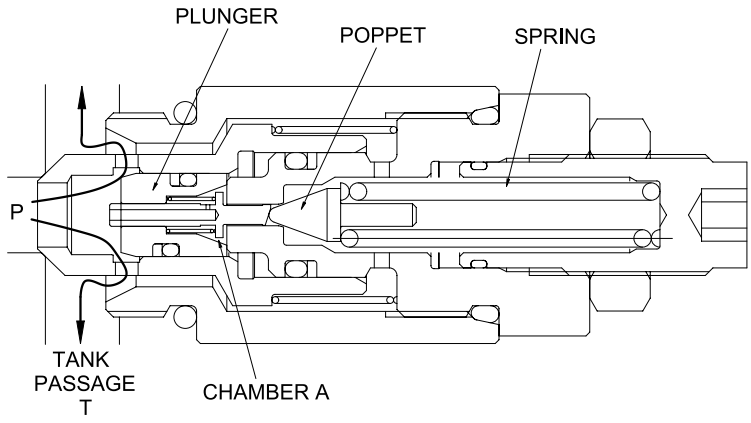
#### ② Swing right operation




14072SF33

The pilot pressure from the RCV is supplied to the Pd2 and shift the swing spool in left direction. The hydraulic fluid from pump P2 flows into swing spool through the parallel passage. Then it is directed to swing motor through the port D2. As the result, swing motor turns and flow from the swing motor returns to the hydraulic oil tank through the port C2, swing spool and the tank passage .
In case of swing right operation, the operation is similar.

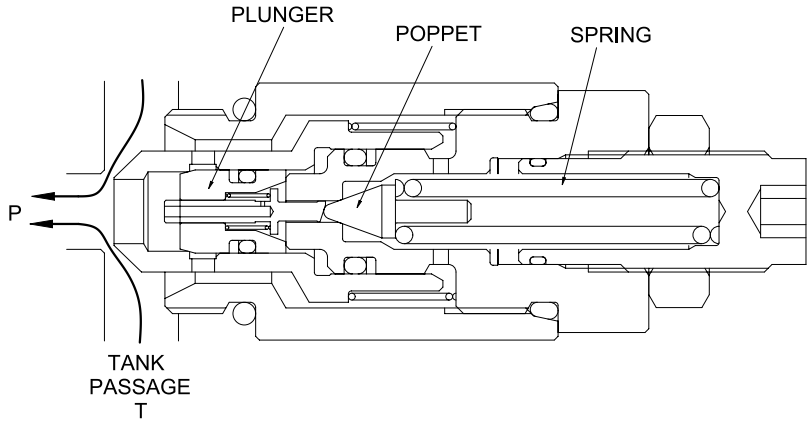
ⓒ Opening of the poppet causes the pressure in chamber A to fall and the plunger to open. As the result the pressurized oil at port P runs into tank passage (T).




14072SF41

② **Make-up function**

When negative pressure exists at port P, the oil is supplied through tank passage (T). When the pressure at tank passage (T) becomes higher than that at port P, the socket moves in the right direction. Then, sufficient oil passes around the socket from tank passage (T) to port P and fills up the space.

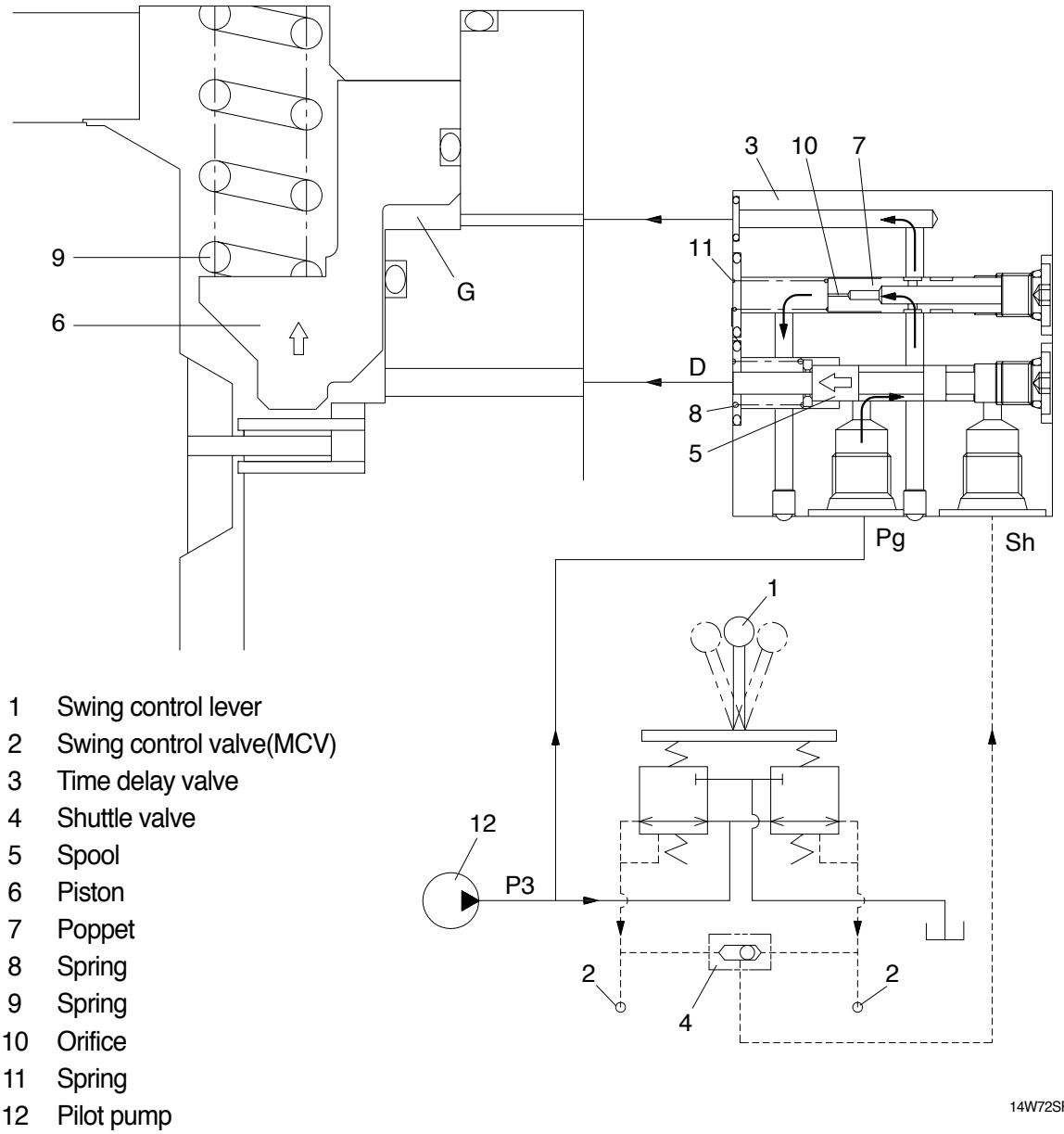



14072SF42

② **Operating principle**

a. When the swing control lever(1) is set to the swing position, the pilot oil go to the swing control valve(2) and to $S_h$ of the time delay valve(3) via the shuttle valve(4), this pressure move spool(5) to the leftward against the force of the spring(8), so pilot pump charged oil($P_3$) goes to the chamber G.

This pressure is applied to move the piston(6) to the upward against the force of the spring(9). Thus, it releases the brake force.




1 Swing control lever
2 Swing control valve(MCV)
3 Time delay valve
4 Shuttle valve
5 Spool
6 Piston
7 Poppet
8 Spring
9 Spring
10 Orifice
11 Spring
12 Pilot pump

14W72SF07

**CROSS SECTION**

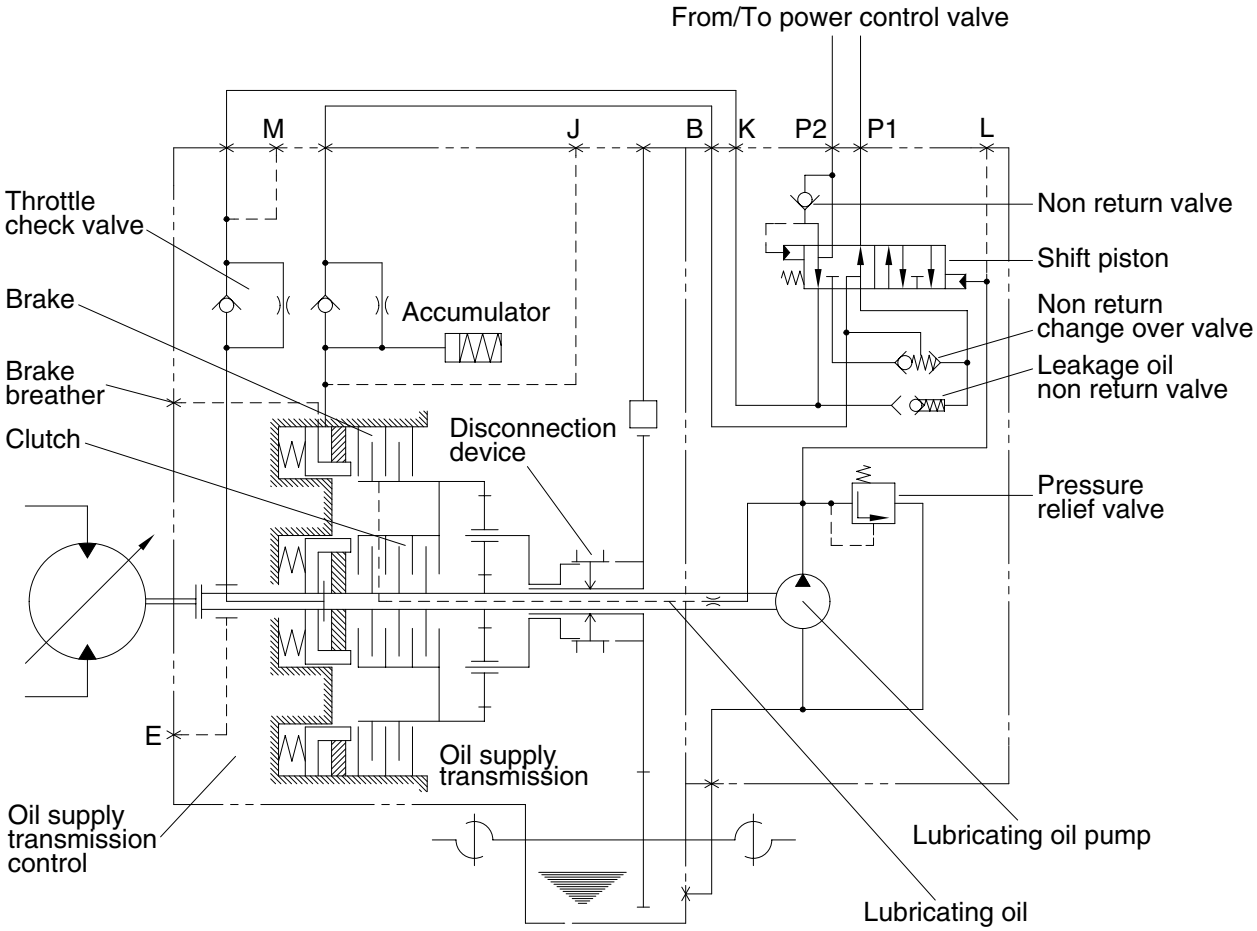
The construction of the pilot valve is shown in the attached cross section drawing. The casing has vertical holes in which reducing valves are assembled.

The pressure reducing section is composed of the spool(5), spring(7) for setting secondary pressure, return spring(10), stopper(9), spring seat(8) and shim(6). The spring for setting the secondary pressure has been generally so preset that the secondary pressure is 5 to 20.5kgf/cm$^2$(Depending on the type). The spool is pushed against the push rod(14) by the return spring.

When the push rod is pushed down by tilting the handle, the spring seat comes down simultaneously and changes setting of the secondary pressure spring.

| | | | | | |
|---|---|---|---|---|---|
| 1 | Case | 11 | Plug | 21 | O-ring |
| 2 | Plug | 12 | Rod seal | 22 | Handle connector |
| 3 | Plug | 13 | O-ring | 23 | Nut |
| 4 | O-ring | 14 | Push rod | 24 | Insert |
| 5 | Spool | 15 | Plate | 25 | Boot |
| 6 | Shim | 16 | Bushing | 26 | Handle |
| 7 | Spring | 17 | Joint assembly | 27 | Switch assembly |
| 8 | Spring seat | 18 | Swash plate | 28 | Screw |
| 9 | Stopper | 19 | Adjusting nut | 29 | Switch assembly |
| 10 | Spring | 20 | Lock nut | 30 | Switch cover |
| | | | | 40 | Boot |

## 2. TRANSMISSION DIAGRAM

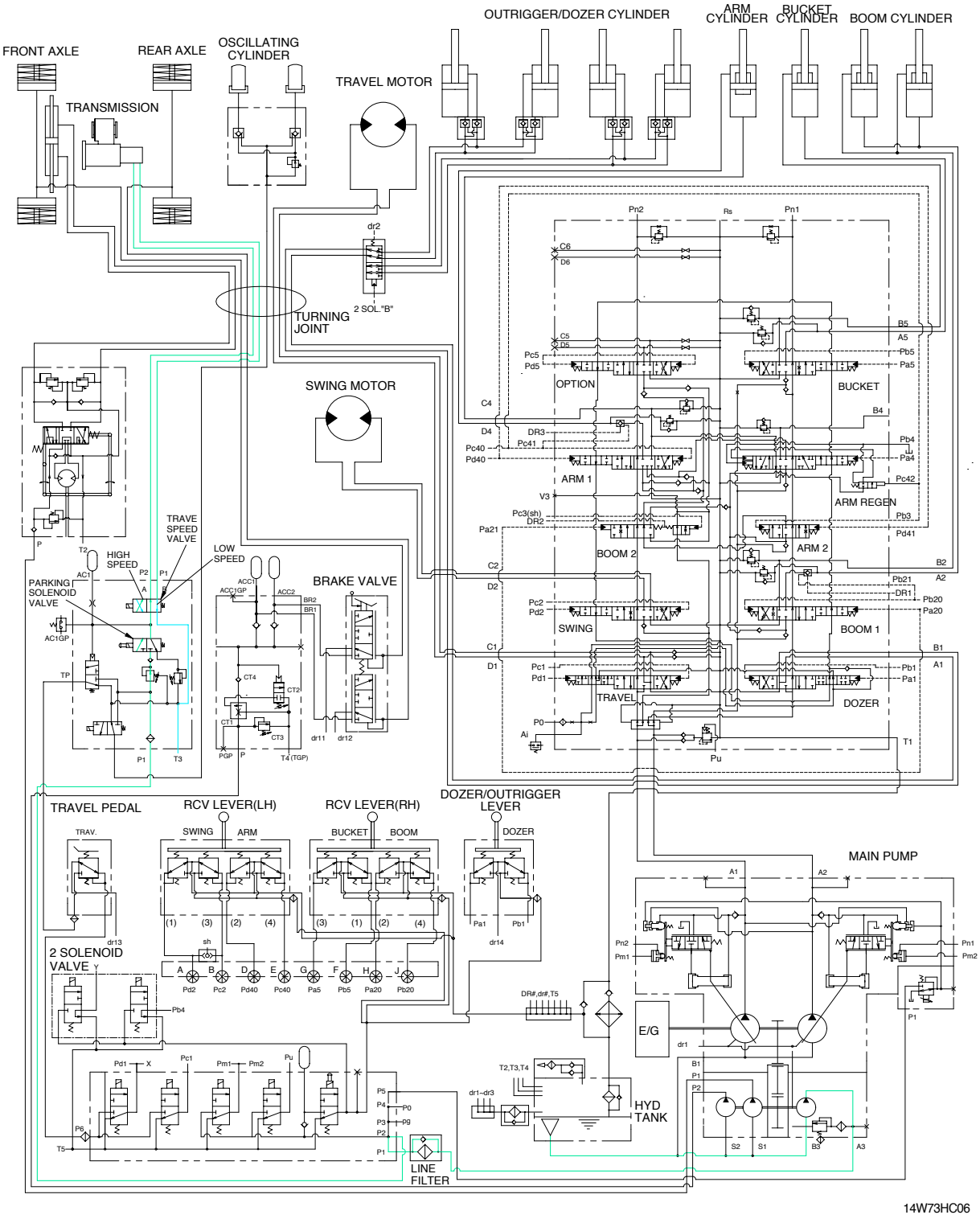



17032TM02

| Port | Name | Size | Port | Name | Size |
|---|---|---|---|---|---|
| P1 | Shift pressure, High speed | M16×1.5 | M | Gauge port, Low speed | M14×1.5 |
| P2 | Shift pressure, Low speed | M16×1.5 | L | Gauge port, Shift interlock | M12×1.5 |
| J | Gauge port, High speed | M14×1.5 | E | Leakage oil | M14×1.5 |

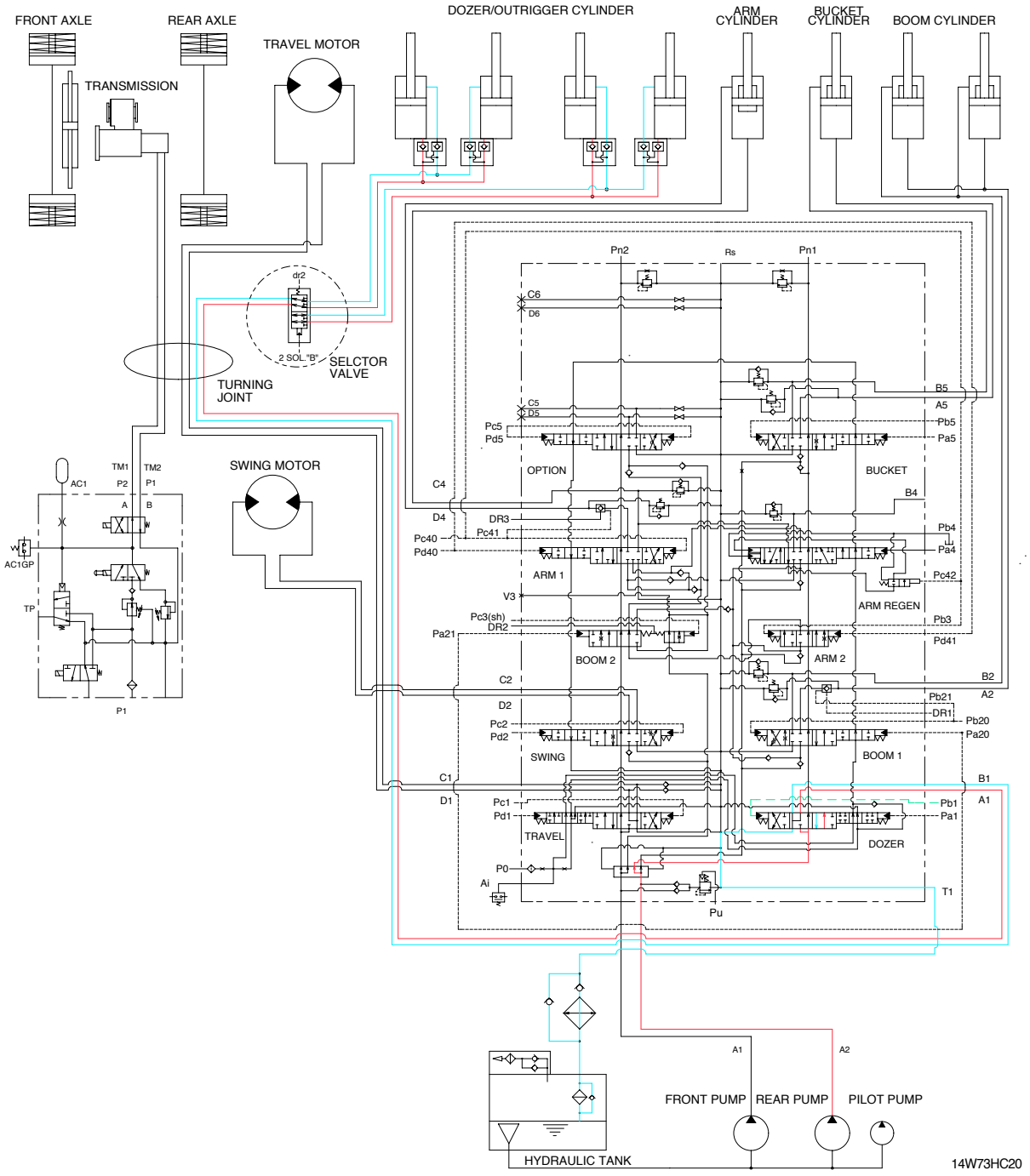
# SECTION 3 HYDRAULIC SYSTEM

## 5. TRAVEL SPEED SELECTION SYSTEM



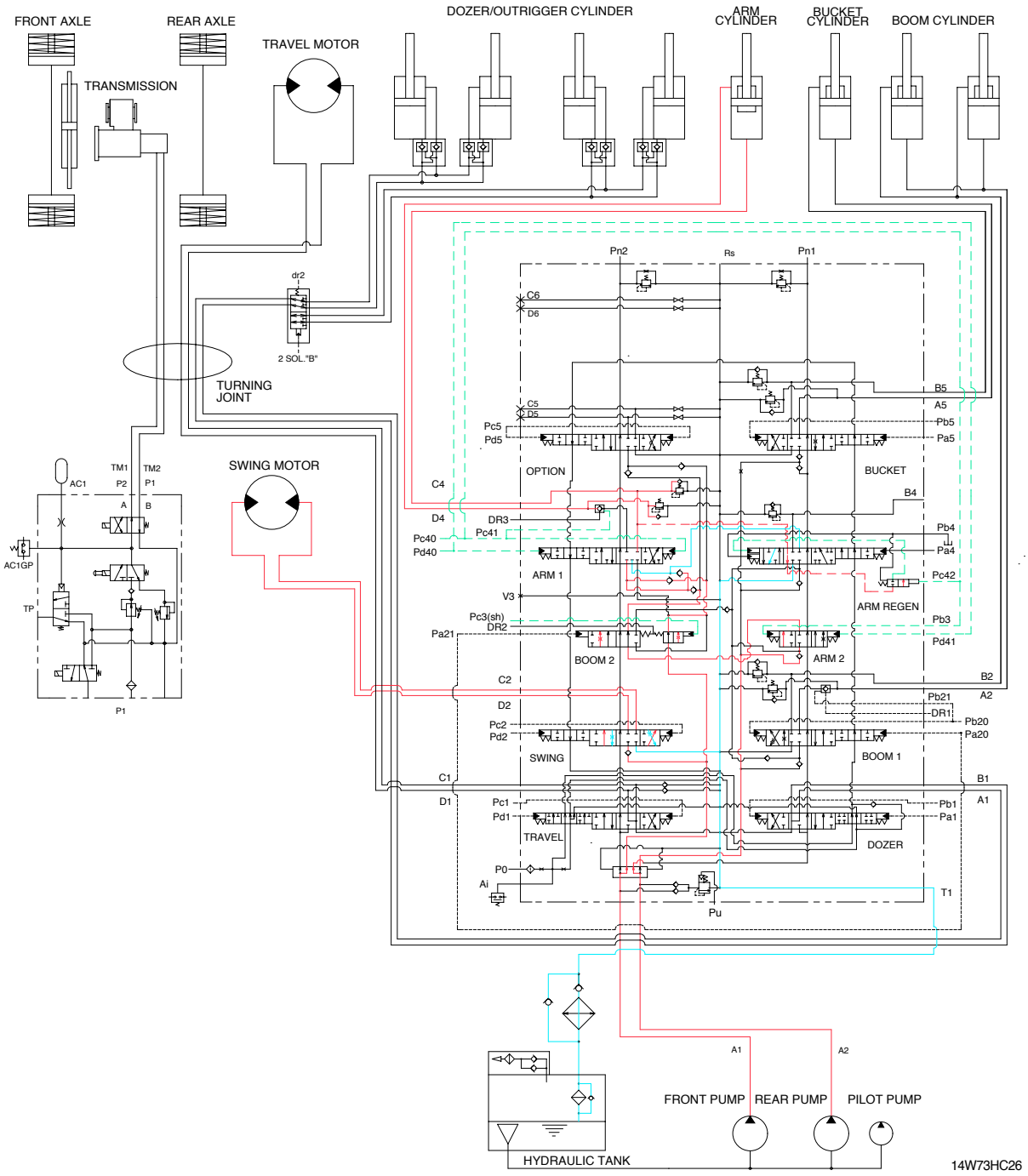

When RH multifunction switch was placed in high or low position, the pressure oil from pilot pump flows through parking solenoid valve of transmission control valve to travel speed solenoid valve, thus the transmission is changed into high or low speed condition.

## 8. DOZER/OUTRIGGER DOWN OPERATION




When the dozer control lever is pushed forward, the dozer spool in the main control valve is moved to the dozer down position by the pilot oil pressure from the remote control valve.
The oil from the rear pump flows into the main control valve and then goes to the selector valve.
Then, the selector switch on the switch panel is selected to rear actuator position, the oil from the main control valve flows into the large chamber of rear actuator cylinder(dozer or outrigger).
The other case, the oil flows into the large chamber of front actuator cylinder(dozer or outrigger).
At the same time, the oil from the small chamber of dozer(outrigger) cylinders returns to the hydraulic oil tank through the dozer spool in the main control valve. When this happens, the dozer(outrigger) goes up.

## 3. COMBINED SWING AND ARM OPERATION




When the swing and arm functions are operated, simultaneously the swing spool and arm spools in the main control valve are moved to the functional position by the pilot oil pressure from the remote control valve.

The oil from the front pump flows into the swing motor through swing spool and the arm cylinder through arm1 spool.

The oil from the rear pump flows into the arm cylinder through the arm2 spool of the right control valve.

The superstructure swings and the arm is operated.

## 2. STARTING CIRCUIT

### 1) OPERATING FLOW

Battery(+) terminal → Battery relay〔CR-1〕 → Fusible link〔CN-60〕 → Fuse box〔No.1〕
→ I/conn〔CN-8(12)〕 → Start switch〔CS-2(1)〕

**(1) When start key switch is in ON position**

→ Start switch ON〔CS-2(2)〕 → I/conn〔CN-8(11)〕 → Battery relay〔CR-1〕
→ Battery relay operating (All power is supplied with the electric component)
→ Start switch ON〔CS-2(3)〕 → I/conn〔CN-8(10)〕 → Power relay〔CR-35(86) → (87)〕
→ Fuse box〔No.10〕

**(2) When start key switch is in START position**

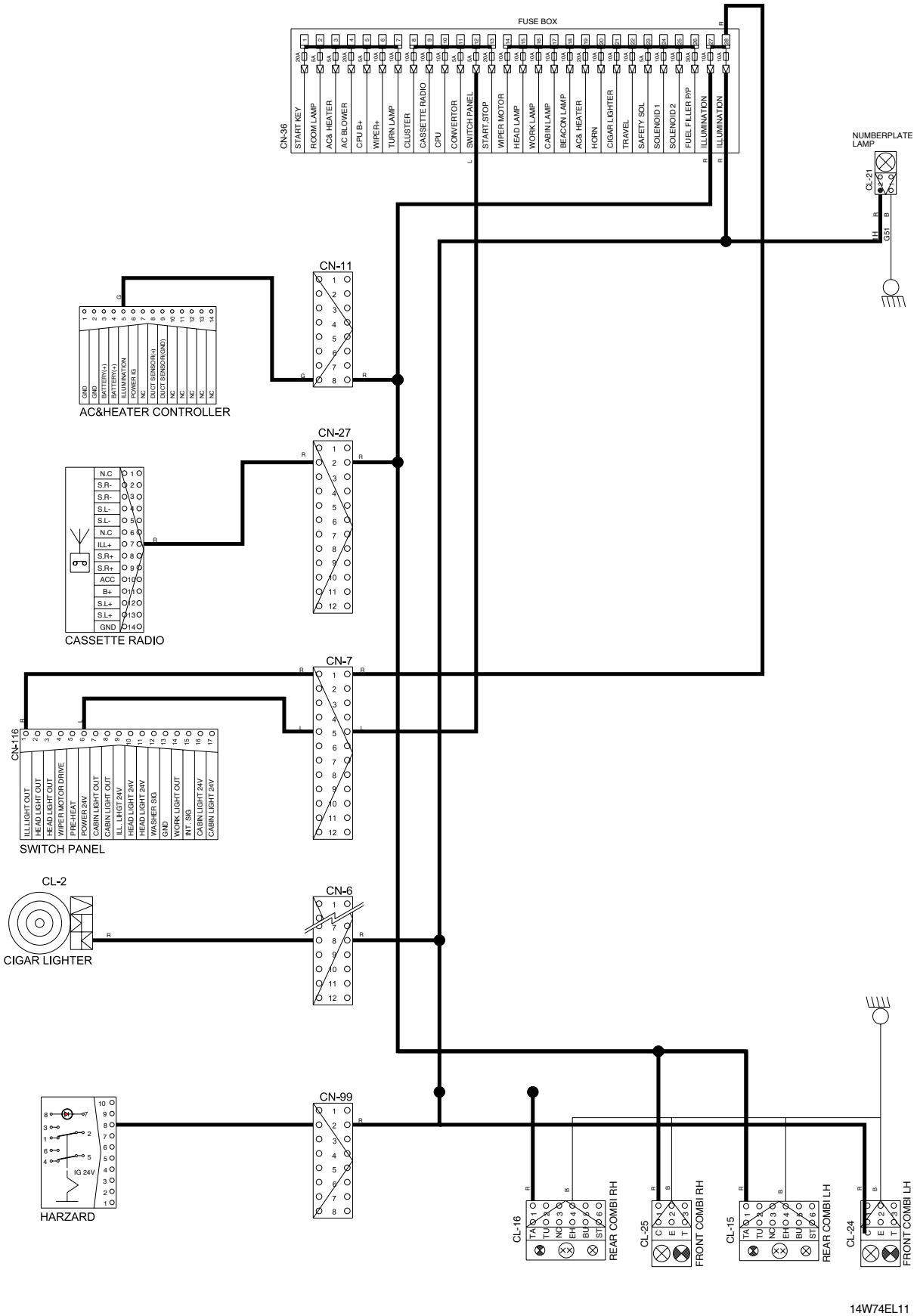
Start switch START〔CS-2(5)〕 → I/conn〔CN-8(9)〕 → Anti restart relay〔CR-5(30) → (87)〕
→ I/conn〔CN-3(2)〕 → Start relay〔CN-23〕

### 2) CHECK POINT

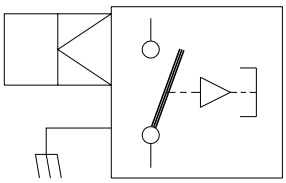
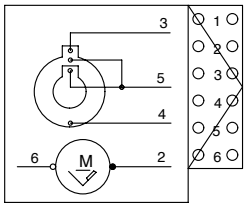
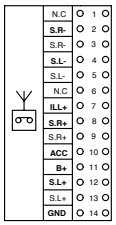
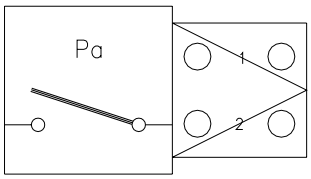
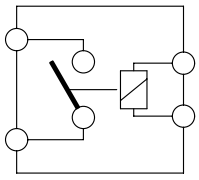
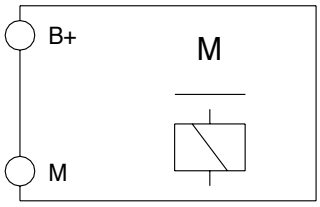
| Engine | Start switch | Check point | Voltage |
|---|---|---|---|
| OPERATING | START | ① - GND(Battery)<br>② - GND(Start key)<br>③ - GND(Battery relay M4)<br>④ - GND(Starter $B^+$)<br>⑤ - GND(Starter M)<br>⑥ - GND(Start relay)<br>⑦ - GND(Battery relay M8) | 20~25V |

※ GND : Ground

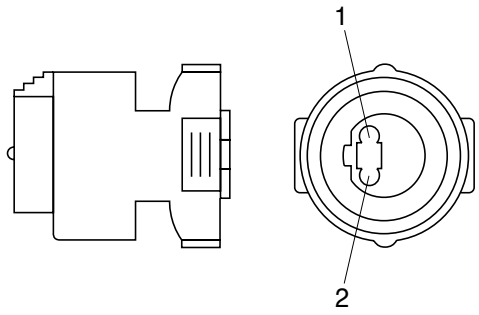
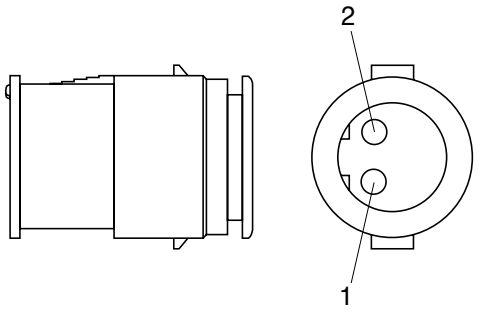
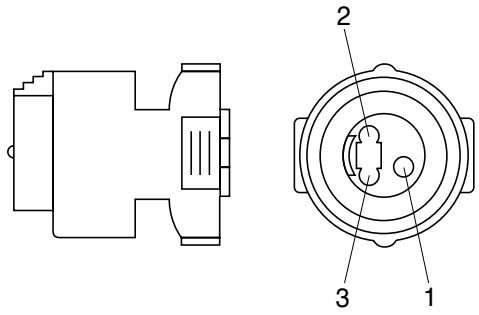
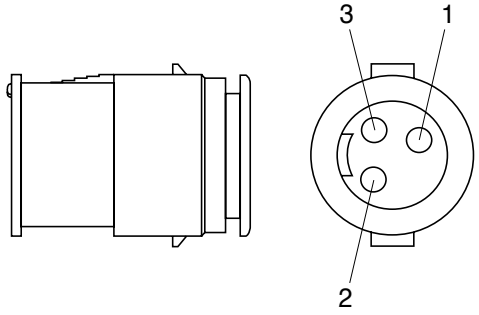
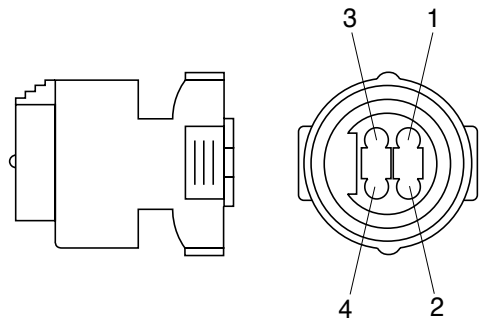
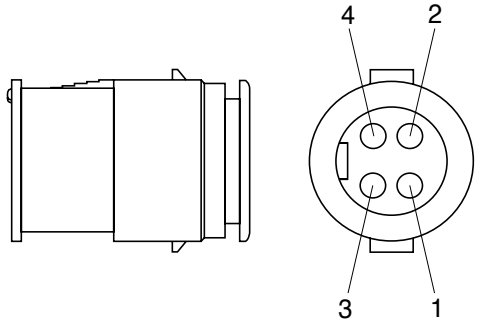
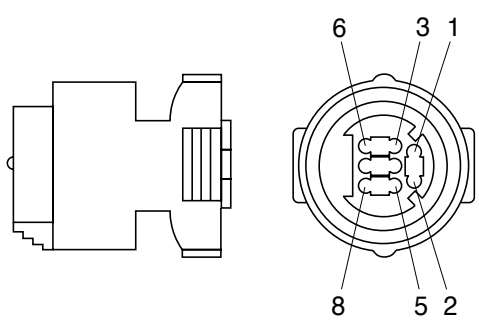
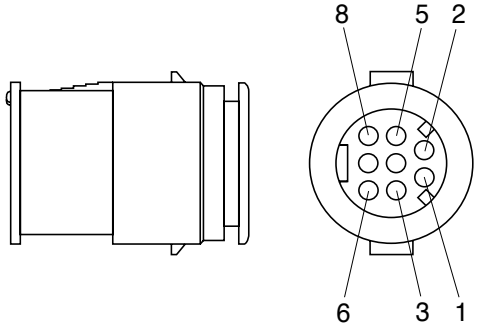
# ILLUMINATION CIRCUIT

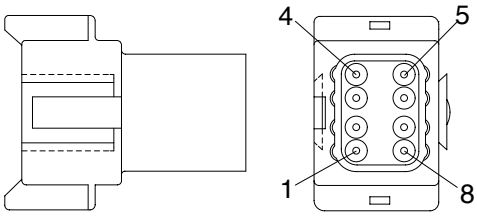
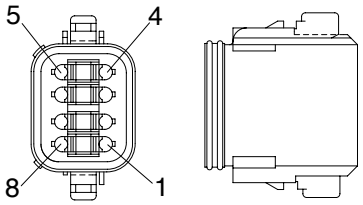
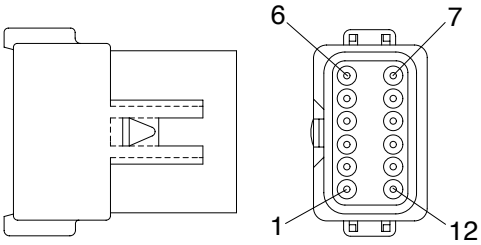
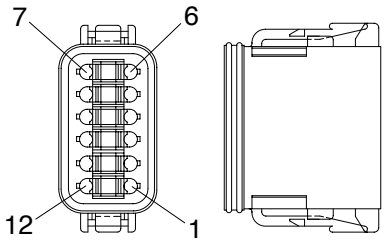



14W74EL11

| Part name | Symbol | Specification | Check |
|---|---|---|---|
| Door switch |  CS-1 | 24V 2W | ※Check resistance<br>Normal : About 5MΩ |
| Wiper motor |  CN-21 | 24V 2A | ※Check contact<br>Normal : 7Ω(For terminal 2-6) |
| Cassette radio |  CN-27 | 24V 2A | ※ Check voltage<br>20 ~ 25V<br>(For terminal 10-14,11-14) |
| Receiver dryer |  CN-29 | 24V 2.5A | ※ Check contact<br>Normal : 0Ω |
| Start relay |  CR-23 | 24V 300A | ※ Check contact<br>Normal : 0.94Ω(For terminal 1-2) |
| Starter |  CN-45 | Delco Remy<br>28MT 24V | ※ Check contact<br>Normal : 0.1Ω |

**2) J TYPE CONNECTOR**

| No. of pin | Receptacle connector(Female) | Plug connector(Male) |
|---|---|---|
| 2 |  S816-002001 |  S816-102001 |
| 3 |  S816-003001 |  S816-103001 |
| 4 |  S816-004001 |  S816-104001 |
| 8 |  S816-008001 |  S816-108001 |

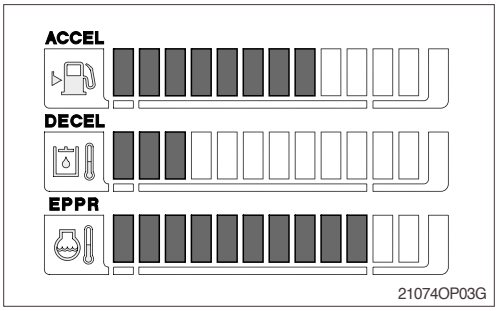
| No. of pin | Receptacle connector(Female) | Plug connector(Male) |
|---|---|---|
| 8 |  DT06-8S |  DT04-8P |
| 12 |  DT06-12S |  DT04-12P |

## 3. USER MODE SELECTION SYSTEM

An operator can change the engine and pump power and memorize it for his preference.

| Mode | Operation |
|---|---|
| U | High idle rpm, auto decel rpm and<br>EPPR pressure can be modulated and memorized separately |

### HOW TO MODULATE THE MEMORY SET

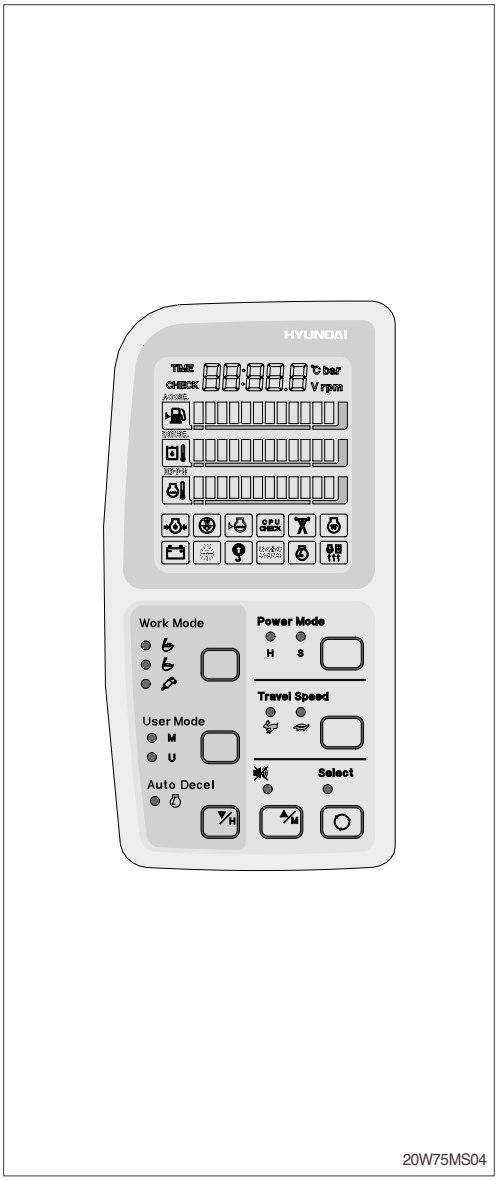



1) U mode has a initial set which are mid-range of max engine speed, auto decel rpm, and EPPR valve input current. When you select U, cluster LCD displays.

2) To change the engine high idle speed, press the USER mode switch and SELECT switch at the same time and then ACCEL blinks at 0.5 seconds interval.
   - By pressing ▲ or ▼ switch, ▮ will increase or decrease.

3) To change DECEL rpm, press the USER mode switch and SELECT switch once more and then DECEL blinks at 0.5 seconds interval.
   - By pressing ▲ or ▼ switch, ▮ will increase or decrease.

4) To change EPPR current, press the USER mode switch and SELECT switch one more and then EPPR blinks at 0.5 seconds interval.
   - By pressing ▲ or ▼ switch, ▮ will increase or decrease.



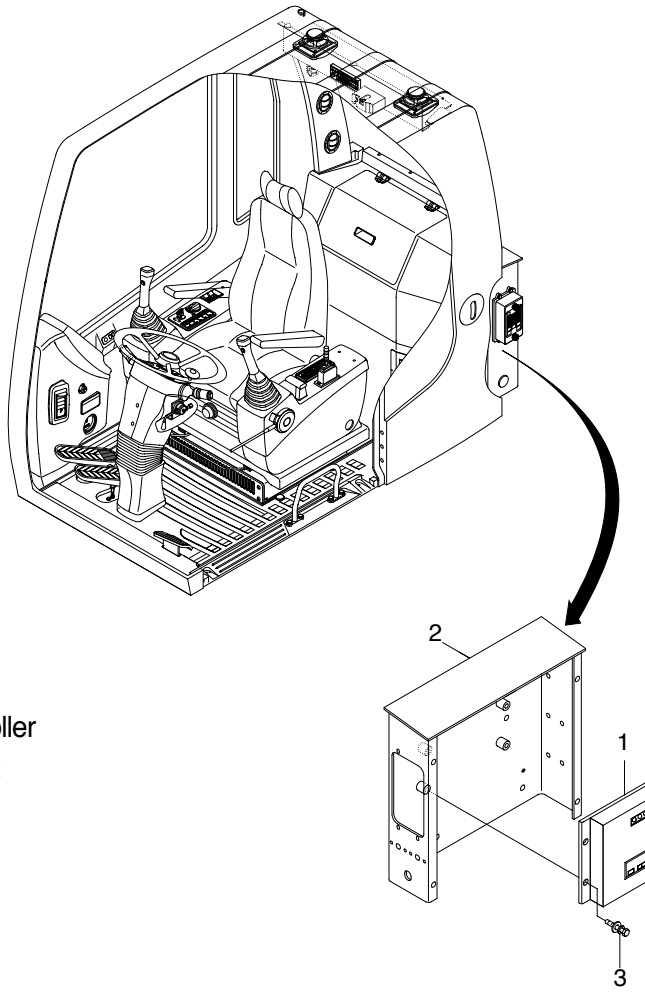

**· LCD segment vs parameter setting**

| Segment (▮) | ACCEL (rpm) | DECEL (rpm) | EPPR (mA) |
|---|---|---|---|
| 1 | High idle-900 | Low idle<br>950 | 150 |
| 2 | High idle-800 | 1050 | 200 |
| 3 | High idle-700 | 1100 | 250 |
| 4 | High idle-600 | 1150 | 300 |
| 5 | High idle-500 | Decel rpm<br>1200 | 350 |
| 6 | High idle-400 | 1250 | 400 |
| 7 | High idle-300 | 1300 | 450 |
| 8 | High idle-200 | 1350 | 500 |
| 9 | High idle-100 | 1400 | 550 |
| 10 | High idle | 1500 | 600 |

5) To memorize the final setting, press the USER mode switch and SELECT switch one more time.

# GROUP 10 ENGINE CONTROL SYSTEM

## 1. CPU CONTROLLER




1 CPU controller
2 Electric box
3 Bolt(M8)

20W75MS11

## 2. CPU CONTROLLER ASSEMBLY

1) Remove four pieces of bolt(3) of electric box(2).
2) Disconnect 2 connectors from CPU controller.
3) Remove 6 pieces of screw and open the cover of CPU controller.
4) Inspection : Check PCB(Printed Circuit Board)
   (1) If any damage is found, replace CPU controller assembly.
   (2) If not, but CAPO system does not work please report it to HHI dealer or A/S department.

# GROUP 12 MONITORING SYSTEM

## 1. OUTLINE

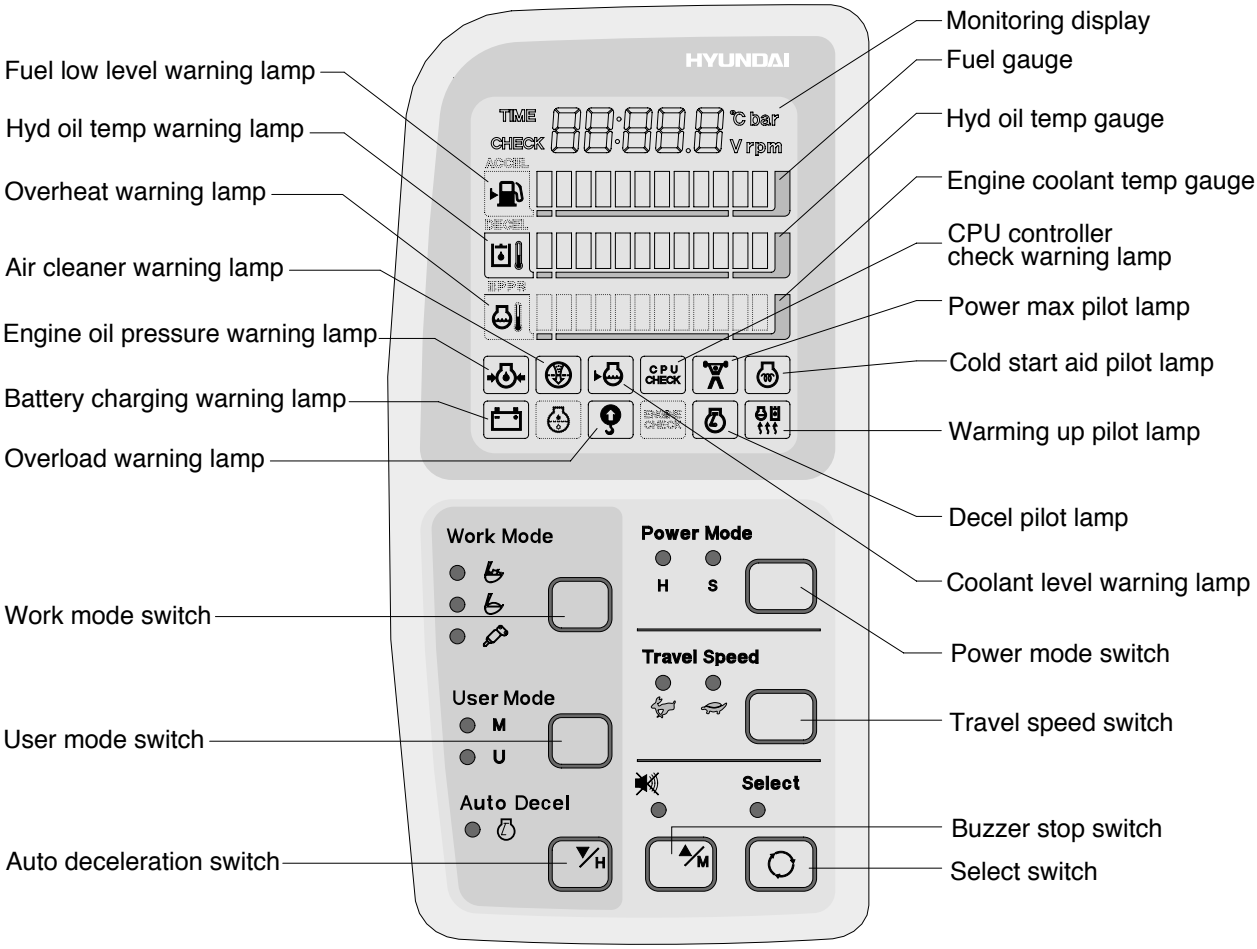
Monitoring system consists of the monitor part and switch part.

The monitor part gives warnings when any abnormality occurs in the machine and informs the condition of the machine.

Various select switches are built into the monitor panel, which act as the control portion of the machine control system.

## 2. CLUSTER

### 1) MONITOR PANEL

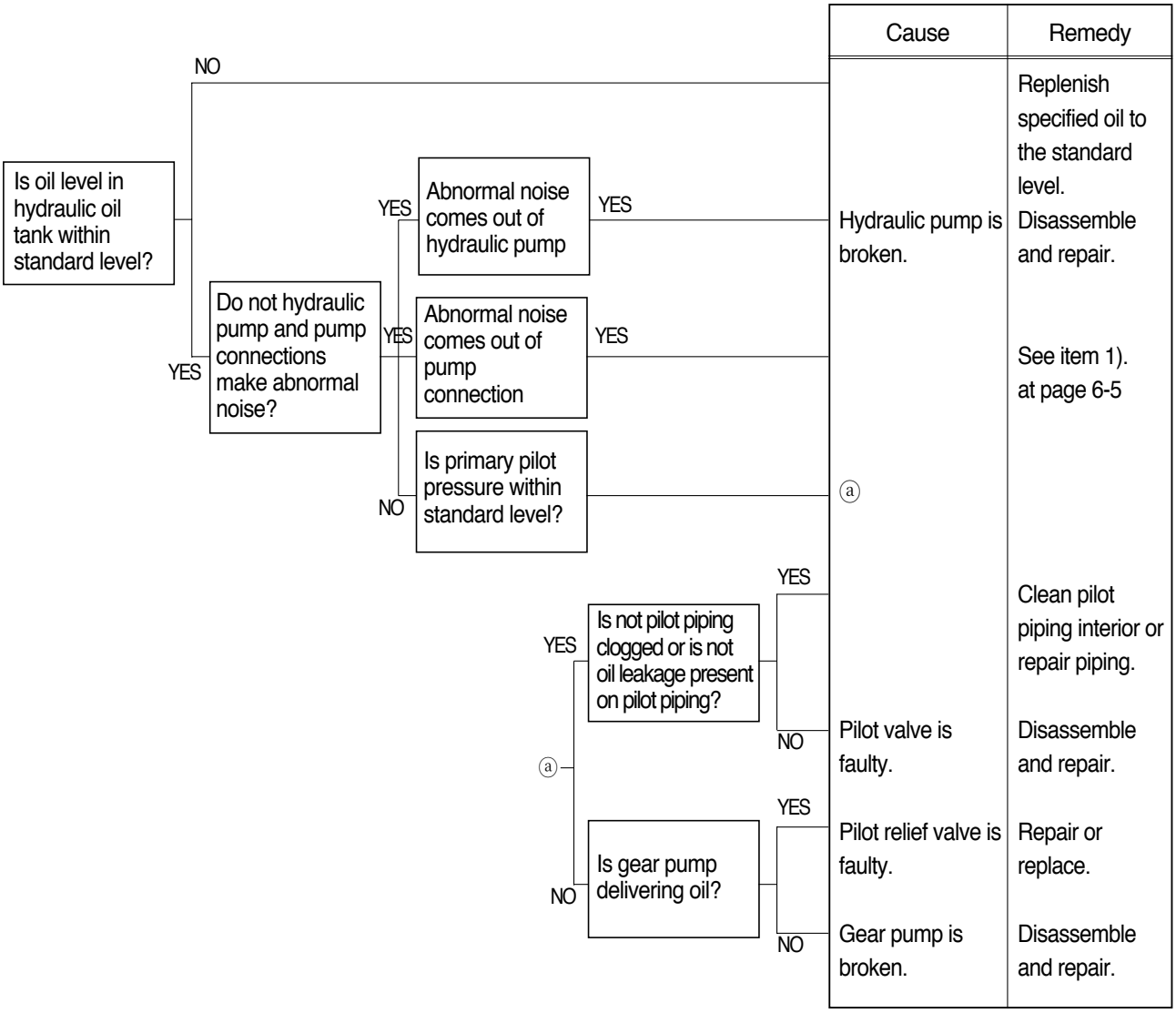



20W75MS09

| Display group | How to select display mode | | Name | Display on the cluster |
|---|---|---|---|---|
| | Group selection | Display mode selection | | |
| **Group 4** (Output) | Touch **SELECT** switch **4 times** while pressing **BUZZER STOP.** In this group **SELECT** LED blinks at 1sec interval | Default | Hourmeter | Ho:on or oFF |
| | | Touch **SELECT** 1 time | Neutral relay (Anti-restart relay) | nr:on or oFF |
| | | Touch **SELECT** 2 times | Travel speed solenoid | tS:on or oFF |
| | | Touch **SELECT** 3 times | Power boost solenoid (2-stage relief solenoid) | PS:on or oFF |
| | | Touch **SELECT** 4 times | Arm regeneration cut-off solenoid | bS:on or oFF |
| | | Touch **SELECT** 5 times | Travel alarm | AU:on or oFF |
| | | Touch **SELECT** 6 times | Max flow cut off solenoid | FS:on or oFF |
| | | Touch **SELECT** 7 times | Preheat relay | PA:on or oFF |

※By touching **SELECT** switch once while pressing **BUZZER STOP**, display group shifts.
Example : Group 0 → 1 → 2 → 3 → 4 → 0

## 2) ENGINE STARTS BUT MACHINE DOES NOT OPERATE AT ALL




| Cause | Remedy |
|---|---|
| Hydraulic pump is broken. | Disassemble and repair. |
| ⓐ | See item 1). at page 6-5 |
| Pilot valve is faulty. | Disassemble and repair. |
| Pilot relief valve is faulty. | Repair or replace. |
| Gear pump is broken. | Disassemble and repair. |

### 5) IT IS NOT POSSIBLE TO REDUCE THE MOTOR SMOOTHLY

It is not possible to reduce the motor smoothly

| Cause | Remedy |
|---|---|
| The orifice for closing the counterbalance is clogged. The opening of the neutral position of the spool is clogged. | Remove the foreign matter by disassembling and cleaning. |
| Wrong setting of pressure of the relief valve. | Adjust at the correct value. If the relief valve turns out to be out of order, the new one should be used. |

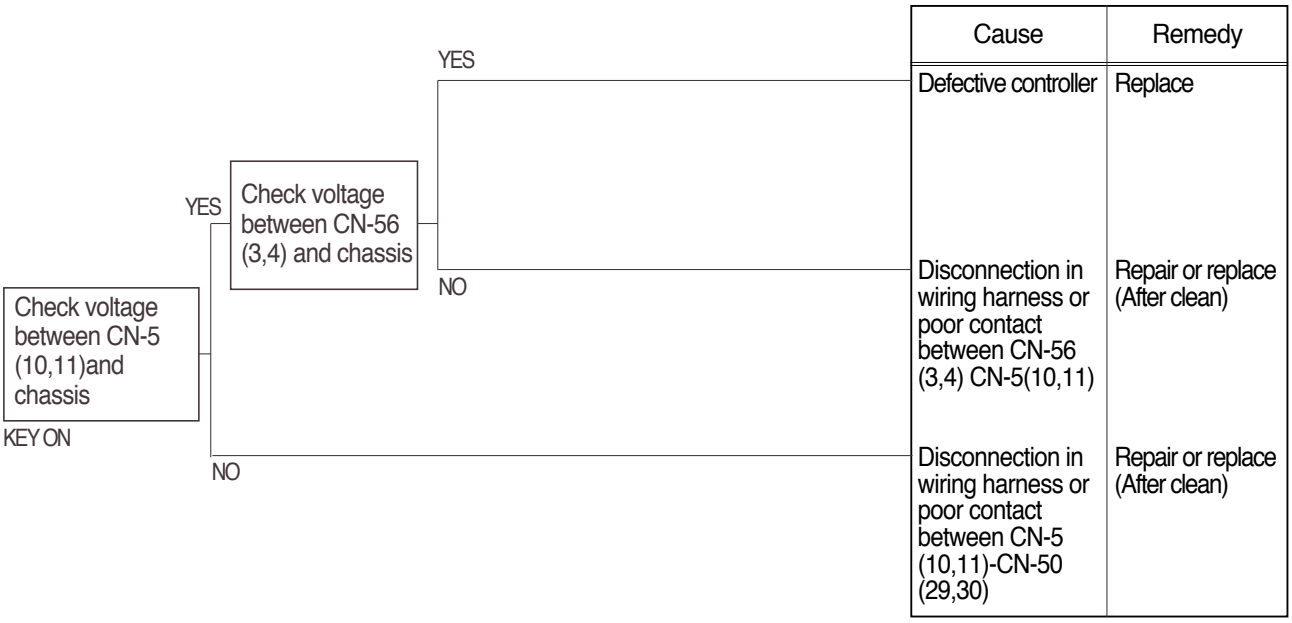
### 6) EXTRAORDINARY NOISE IS HEARD WHEN SUDDENLY REDUCING THE SPEED FROM THE HIGH-SPEED MODE

It takes time to accelerate the motor

| Cause | Remedy |
|---|---|
| The anti-cavitation valve does not not work properly. | Screw the fitting bolts one more time with correct tightening torque. If the valve turns out to be damaged, is should be repaired. |

## 2. COMMUNICATION ERROR "Co : Err" FLASHES ON THE CLUSTER

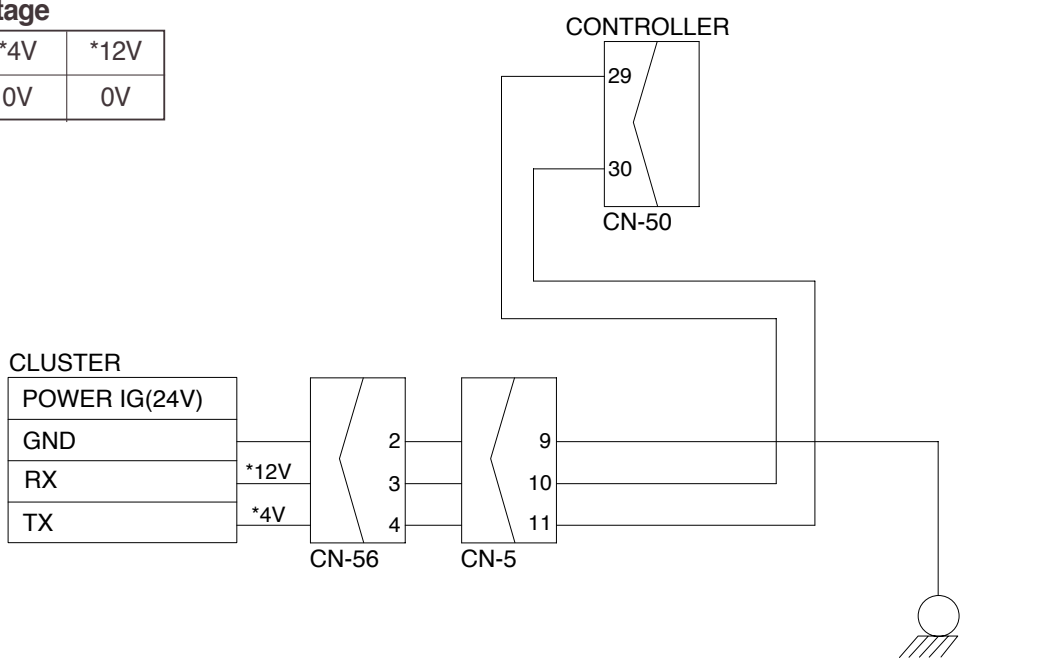
· Before disconnecting the connector, always turn the starting switch OFF.
· Before carrying out below procedure, check all the related connectors are properly inserted.
· After checking, insert the disconnected connectors again immediately unless otherwise specified.




| Cause | Remedy |
|---|---|
| Defective controller | Replace |
| Disconnection in wiring harness or poor contact between CN-56 (3,4) CN-5(10,11) | Repair or replace (After clean) |
| Disconnection in wiring harness or poor contact between CN-5 (10,11)-CN-50 (29,30) | Repair or replace (After clean) |

**Check voltage**

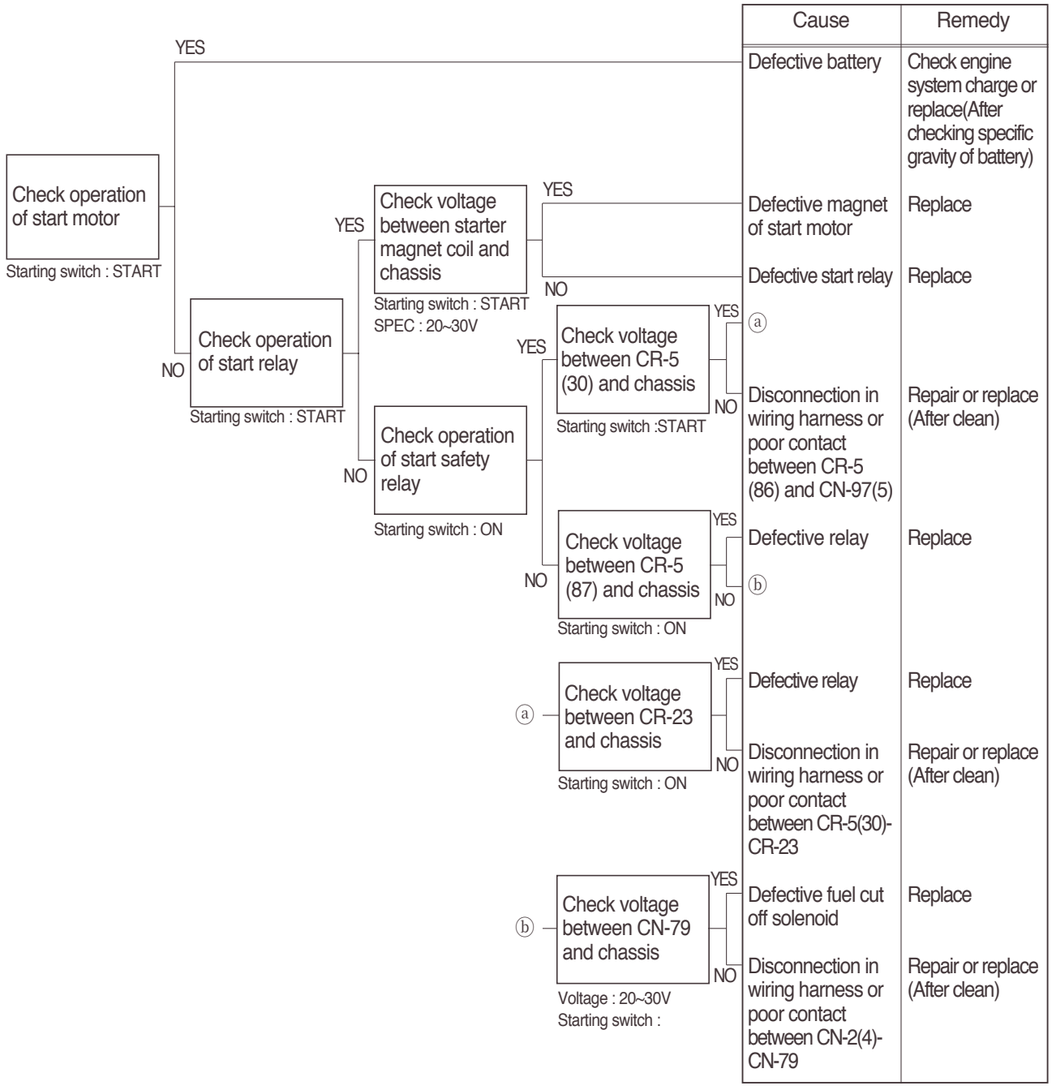
| | | |
|---|---|---|
| YES | *4V | *12V |
| NO | 0V | 0V |

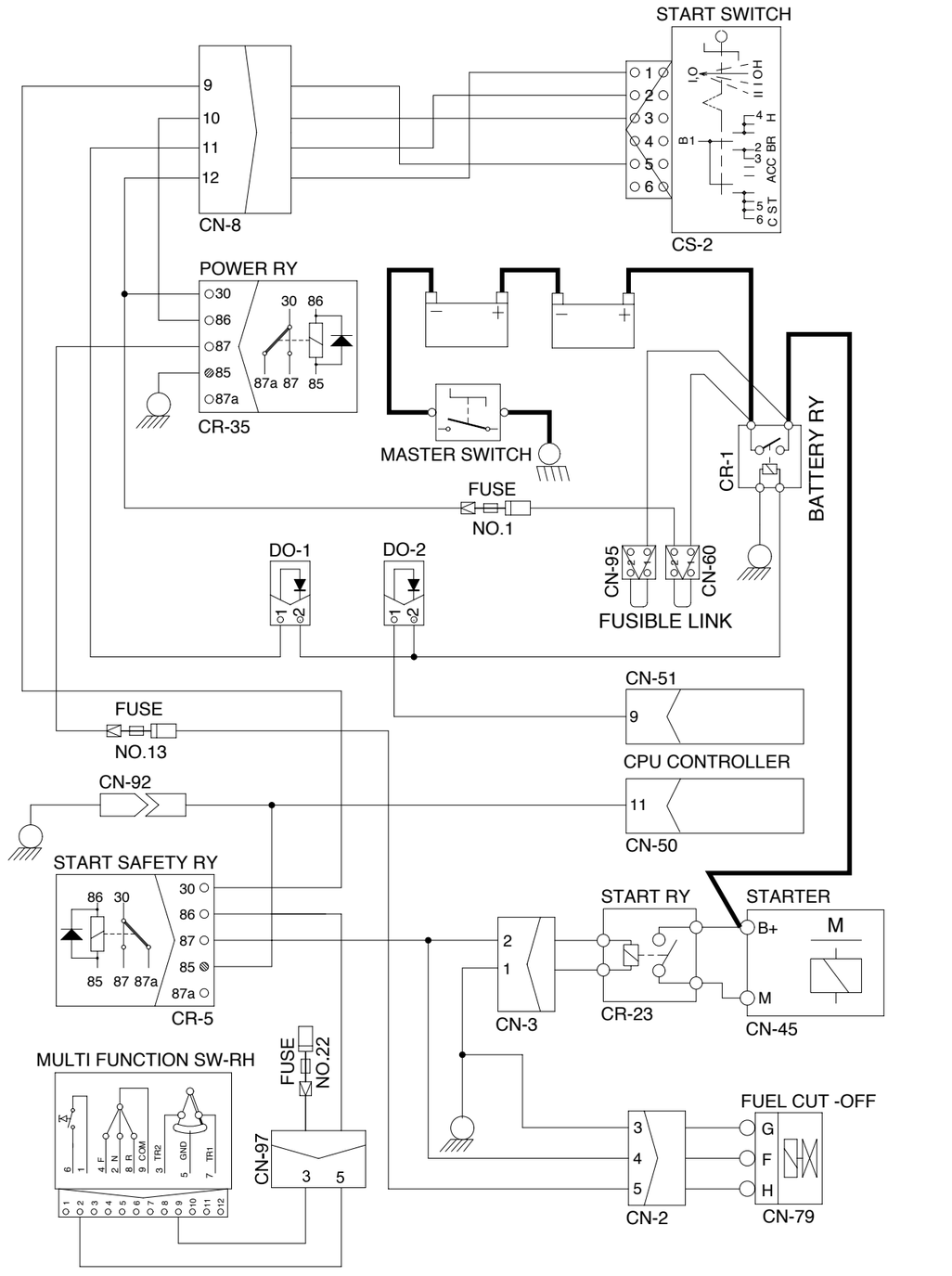



29076ES02

## 12. WHEN ENGINE DOES NOT START

- Check supply of the power at engine stop solenoid while starting switch is ON.
- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted.
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



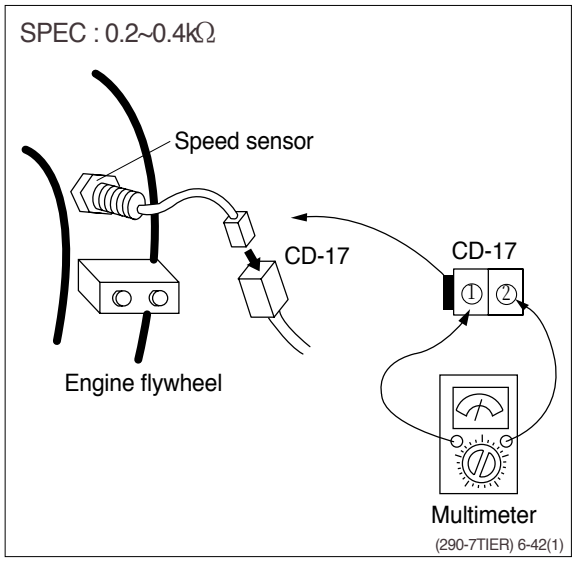

14W76TS06

(4) **Test 8 :** Check resistance at speed sensor.

① Starting key OFF.

② Disconnect connector CD-17 of speed sensor at engine flywheel housing.

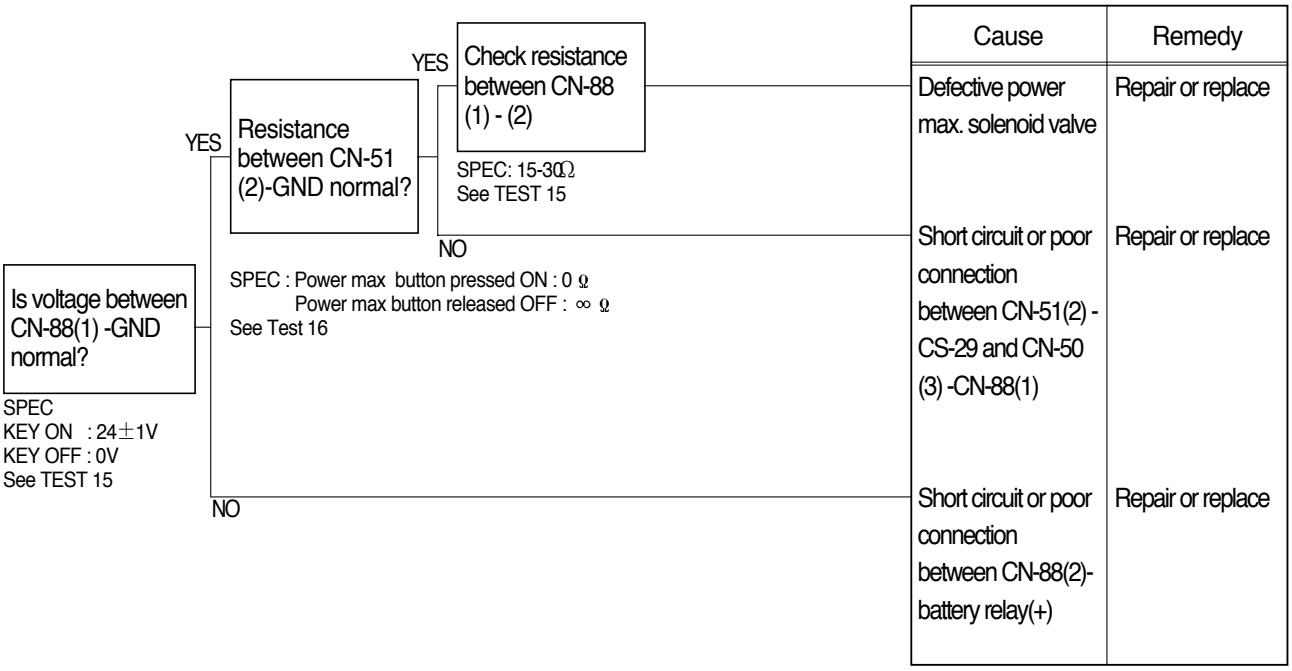
③ Check resistance as figure.



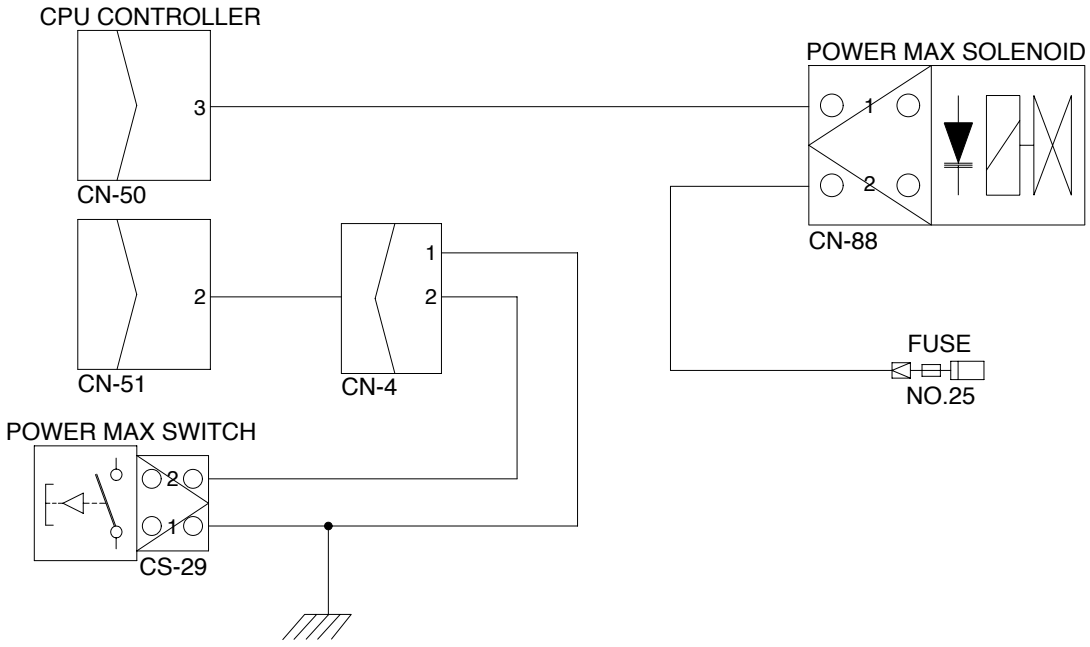
## 8. MALFUNCTION OF POWER MAX

※ Before carrying out below procedure, check all the related connectors are properly inserted.

### 1) INSPECTION PROCEDURE



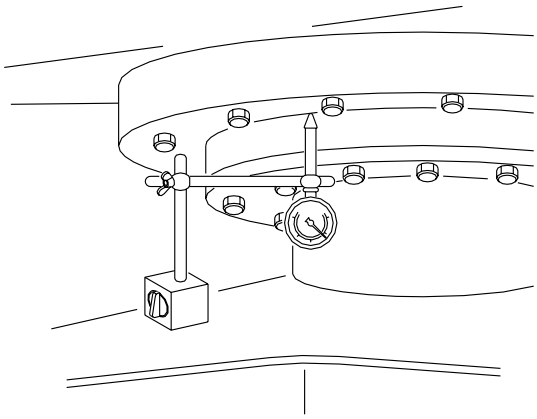

**Wiring diagram**




20W76MS06

### 6) SWING BEARING PLAY

(1) Measure the swing bearing play using a dial gauge to check the wear of bearing races and balls.



7-10(1) 140-7

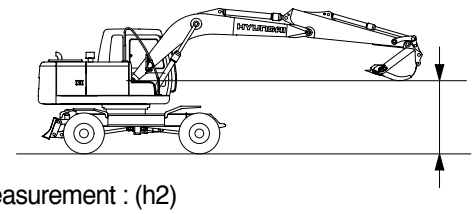
**(2) Preparation**

① Check swing bearing mounting cap screws for loosening.
② Check the lubrication of the swing bearing. Confirm that bearing rotation is smooth and without noise.
③ Install a dial gauge on the track frame as shown, using a magnetic base.
④ Position the upperstructure so that the boom aligns with the tracks facing towards the front idlers.
⑤ Position the dial gauge so that its needle point comes into contact with the bottom face of the bearing outer race.
⑥ Bucket should be empty.

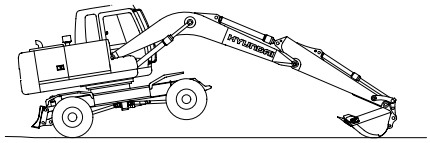
**(3) Measurement**

① With the arm rolled out and bucket rolled in, hold the bottom face of the bucket to the same height of the boom foot pin. Record the dial gauge reading(h1).
② Lower the bucket to the ground and use it to raise the front idler 50㎝. Record the dial gauge reading(h2).
③ Calculate bearing play(H) from this data(h1 and h2) as follows.
H=h2-h1

Measurement : (h1)



Measurement : (h2)



14W77MS08

**(4) Evaluation**

The measured drift should be within the following specifications.

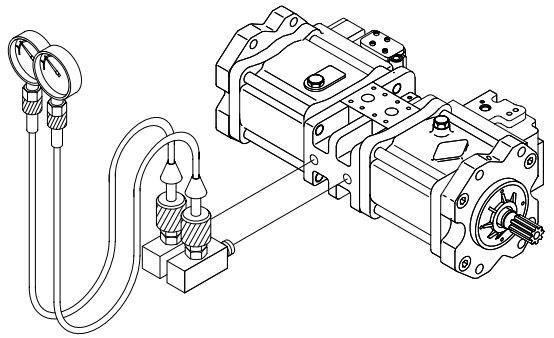
Unit : mm

| Model | Standard | Maximum allowable | Remarks |
|---|---|---|---|
| R140W-7 | 0.5 ~ 1.5 | 3.0 | |

## 15) SYSTEM PRESSURE REGULATOR RELIEF SETTING

### (1) Preparation

① Stop the engine.
② Remove the top cover of the hydraulic tank oil supply port with a wrench.
③ Push the pressure release button to bleed air.
④ To measure the system relief pressure. Install a connector and pressure gauge assembly to main pump gauge port, as figure.
⑤ Start the engine and check for oil leakage from the port.
⑥ Keep the hydraulic oil temperature at 50±5°C.



290LC7MS07

### (2) Measurement

① Select the following switch positions.
- Mode selector : M mode
- Auto decel switch : OFF

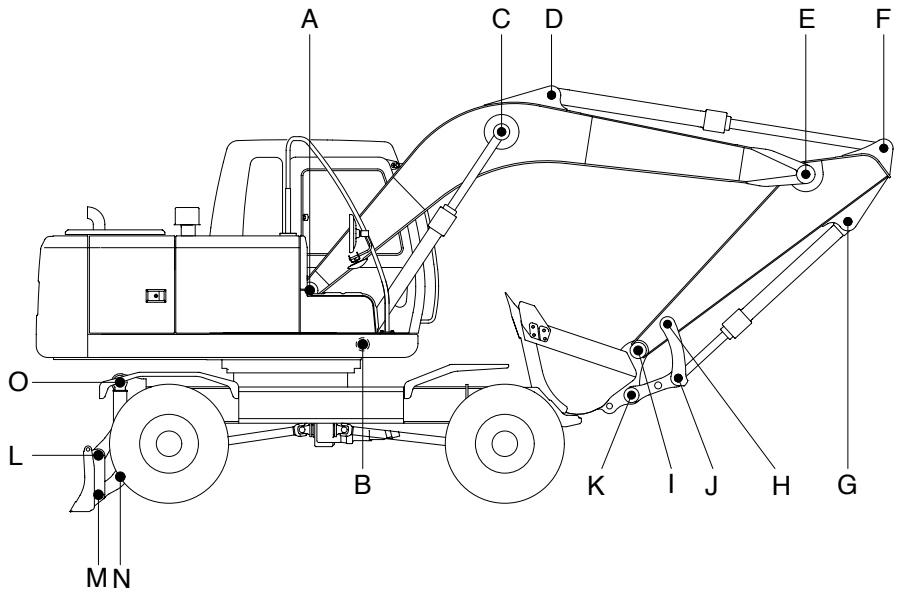
② Slowly operate each control lever of boom, arm and bucket functions at full stroke over relief and measure the pressure.
③ In the swing function, place bucket against an immovable object and measure the relief pressure.
④ In the travel function, lock tires with an immovable object and measure the relief pressure.

### (3) Evaluation

The average measured pressure should be within the following specifications.

Unit : kgf / cm$^2$

| Model | Function to be tested | Normal | Power boost | Overload |
|---|---|---|---|---|
| R140W-7 | Boom, Arm, Bucket | 330±10 | 360±10 | 380 |
| | Travel | 330±10 | 360±10 | - |
| | Swing | 240 | 240 | - |



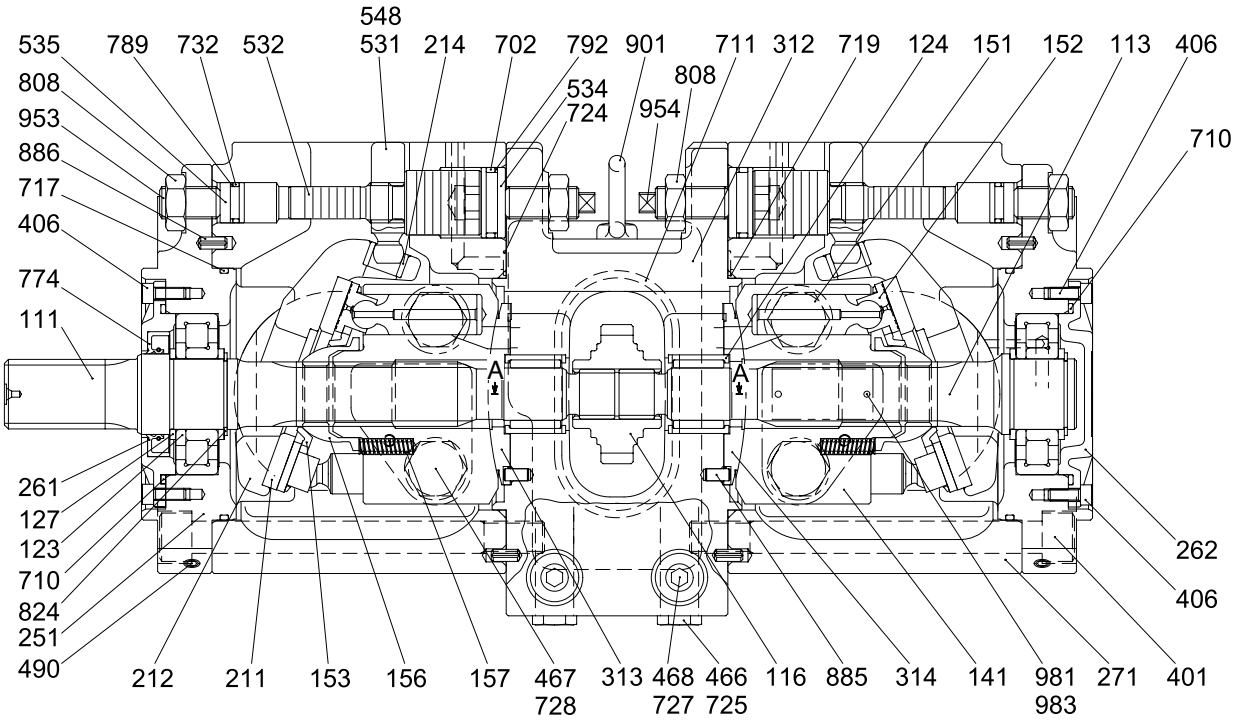

140W77MS14

Unit : mm

| Mark | Measuring point (Pin and bushing) | Normal value | Pin | | Bushing | | Remedy & Remark |
|---|---|---|---|---|---|---|---|
| | | | Recomm. service limit | Limit of use | Recomm. service limit | Limit of use | |
| A | Boom rear | 70 | 69 | 68.5 | 70.5 | 71 | Replace |
| B | Boom cylinder head | 70 | 69 | 68.5 | 70.5 | 71 | 〃 |
| C | Boom cylinder rod | 70 | 69 | 68.5 | 70.5 | 71 | 〃 |
| D | Arm cylinder head | 70 | 69 | 68.5 | 70.5 | 71 | 〃 |
| E | Boom front | 70 | 69 | 68.5 | 70.5 | 71 | 〃 |
| F | Arm cylinder rod | 70 | 69 | 68.5 | 70.5 | 71 | 〃 |
| G | Bucket cylinder head | 70 | 69 | 68.5 | 70.5 | 71 | 〃 |
| H | Arm link | 65 | 64 | 63.5 | 65.5 | 66 | 〃 |
| I | Bucket and arm link | 65 | 64 | 63.5 | 65.5 | 66 | 〃 |
| J | Bucket cylinder rod | 70 | 69 | 68.5 | 70.5 | 71 | 〃 |
| K | Bucket link | 65 | 64 | 63.5 | 65.5 | 66 | 〃 |
| L | Dozer link(B) | 55 | 54 | 53.5 | 55.5 | 56 | 〃 |
| M | Dozer link(A) | 55 | 54 | 53.5 | 55.5 | 56 | 〃 |
| N | Dozer cylinder rod | 65 | 64 | 63.5 | 65.5 | 66 | 〃 |
| O | Dozer cylinder head | 65 | 64 | 63.5 | 65.5 | 66 | 〃 |

## 2. MAIN PUMP(1/2)

### 1) STRUCTURE

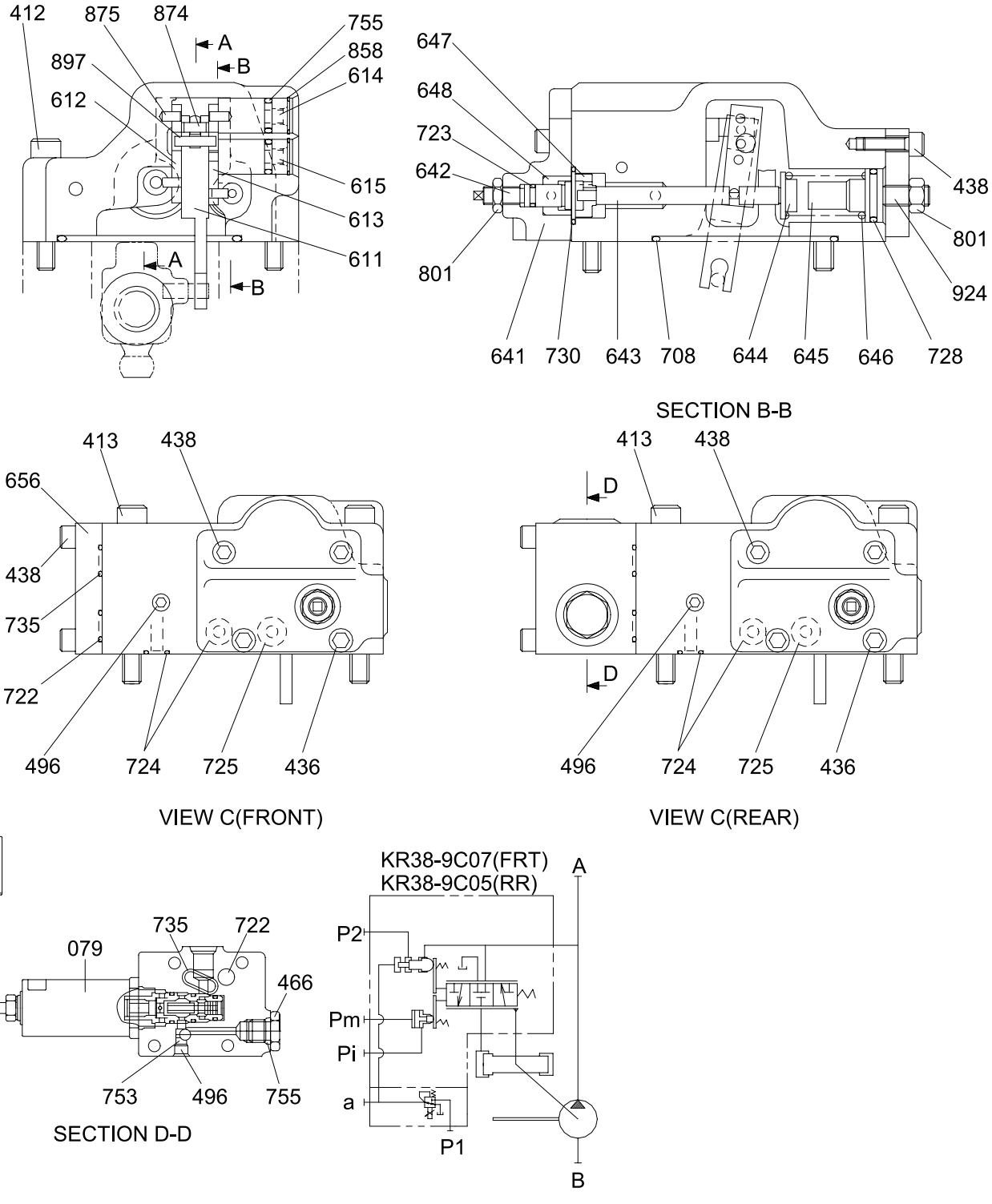



14W72SF02

| | | | | | |
|---|---|---|---|---|---|
| 111 | Drive shaft(F) | 271 | Pump casing | 724 | O-ring |
| 113 | Drive shaft(R) | 313 | Valve plate(R) | 725 | O-ring |
| 116 | Gear | 314 | Valve plate(L) | 727 | O-ring |
| 123 | Roller bearing | 401 | Hexagon socket bolt | 728 | O-ring |
| 124 | Needle bearing | 406 | Hexagon socket bolt | 732 | O-ring |
| 127 | Bearing spacer | 466 | VP Plug | 774 | Oil seal |
| 141 | Cylinder block | 467 | VP Plug | 789 | Back up ring |
| 151 | Piston | 468 | VP Plug | 792 | Back up ring |
| 152 | Shoe | 490 | Plug | 808 | Hexagon head nut |
| 153 | Push-plate | 531 | Tilting pin | 824 | Snap ring |
| 156 | Bushing | 532 | Servo piston | 885 | Pin |
| 157 | Cylinder spring | 534 | Stopper(L) | 886 | Spring pin |
| 211 | Shoe plate | 535 | Stopper(S) | 901 | Eye bolt |
| 212 | Swash plate | 548 | Pin | 953 | Set screw |
| 214 | Bushing | 702 | O-ring | 954 | Set screw |
| 251 | Support | 710 | O-ring | 981 | Plate |
| 261 | Seal cover(F) | 717 | O-ring | 983 | Pin |
| 262 | Seal cover(R) | 719 | O-ring | | |

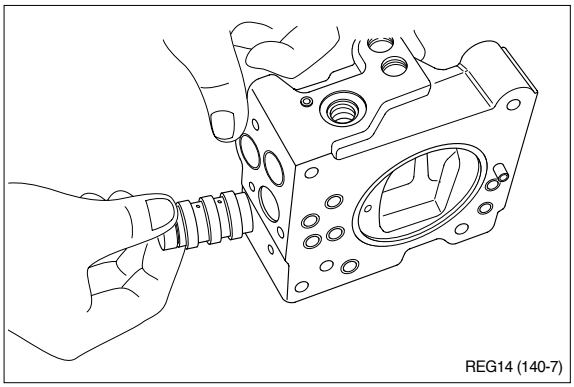
## 3. REGULATOR

### 1) STRUCTURE(1/2)



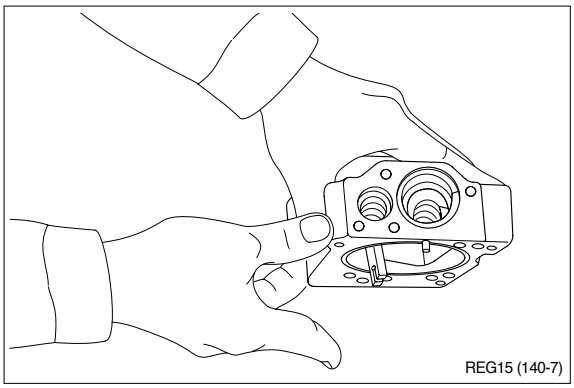

14072SF03

(11) Fit set spring(655) to spool hole and put compensating piston(621) and piston case(622) into compensating hole.
Fit pilot cover(641) and tighten it with hexagonal socket head screws(436, 438).


REG14 (140-7)

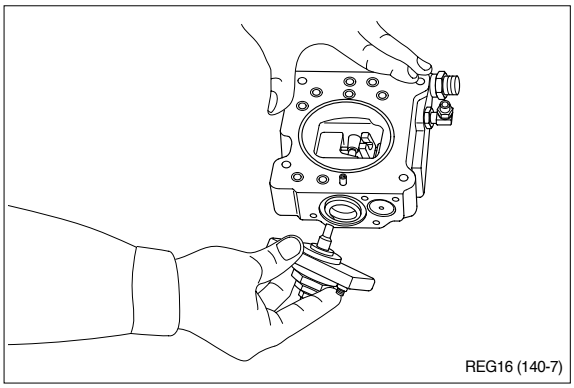
(12) Put spring seat(644), pilot spring(646) and adjusting ring(Q, 645) into pilot hole.
Then fix spring seat(624), inner spring (626) and outer spring(625) into compensating hole.

※ When fitting spring seat, take care not to mistake direction of spring seat.


REG15 (140-7)

(13) Install cover(C, 629) fitted with adjusting screws(628, 925), adjusting ring(C, 627), lock nut(630), hexagon nut(801) and adjusting screw(924).
Then tighten them with hexagonal socket head screws(438).

This completes assembly.


REG16 (140-7)

### (4) Disassembly of the load check valve and the negative relief valve

① **The load check valve**

a. Fix the body to suitable work bench.

※ Pay attention not to damage the body.

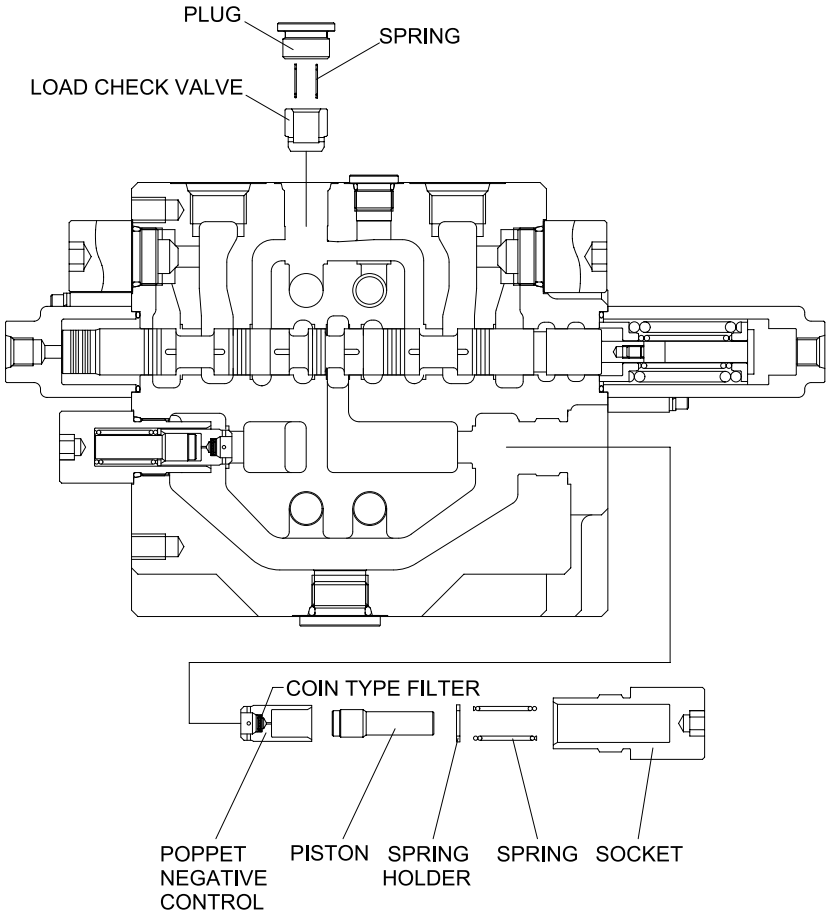
b. Loosen the plug (Hexagon wrench : 10㎜).

c. Remove the spring and the load check valve with pincers or magnet.

② **The negative relief valve**

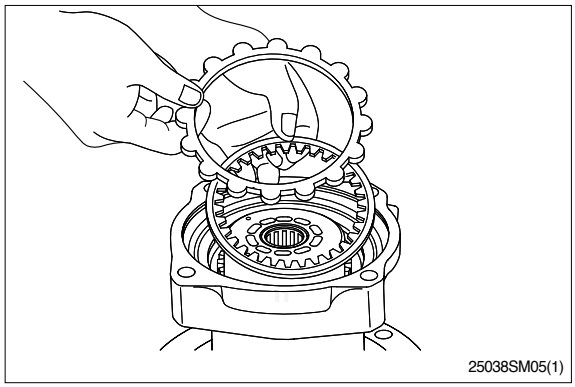
a. Loosen the socket (Hexagon wrench : 12㎜).

b. Remove the spring, the spring holder, the piston and the negative control poppet.




1408DA21

(13) Remove friction plate(9) and lining plate (8) from housing(25).


25038SM05(1)

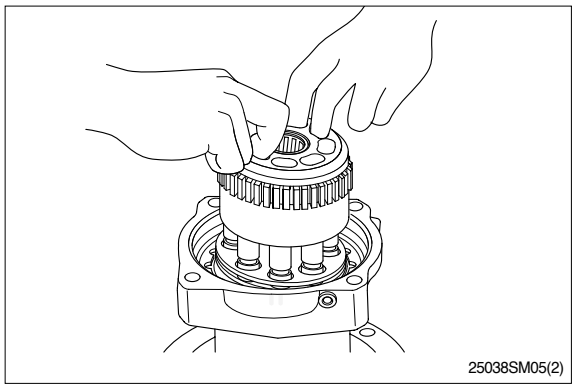
**(14) Removal of cylinder assembly**

Holding end of cylinder assembly(24) with hand, draw out cylinder assembly from housing.

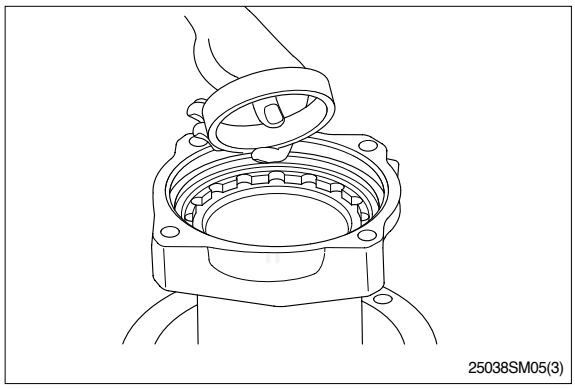
※ Oil seal(2) and outer race of taper roller bearing(3) are left inside of housing.

※ End surface of cylinder(24) is sliding face . So, protect the surface with a scrap of cloth against damage.

※ Make a matching mark on piston hole of cylinder(24) and piston assembly(7) to fit piston into the same hole when reassembling.


25038SM05(2)

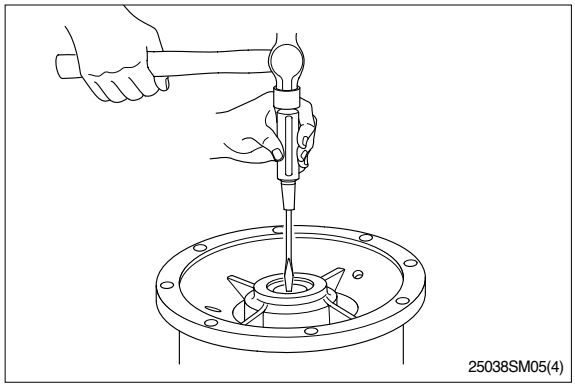
(15) Separate outer race of taper roller bearing(3) from housing.


25038SM05(3)

**(16) Removal of oil seal**

Remove oil seal(2) from housing(25) with driver and hammer.

※ Do not reuse oil seal after removal.


25038SM05(4)

## 3. REMOVAL AND INSTALL OF REDUCTION GEAR

### 1) REMOVAL

(1) Remove the swing motor assembly.
For details, see **removal of swing motor assembly**.

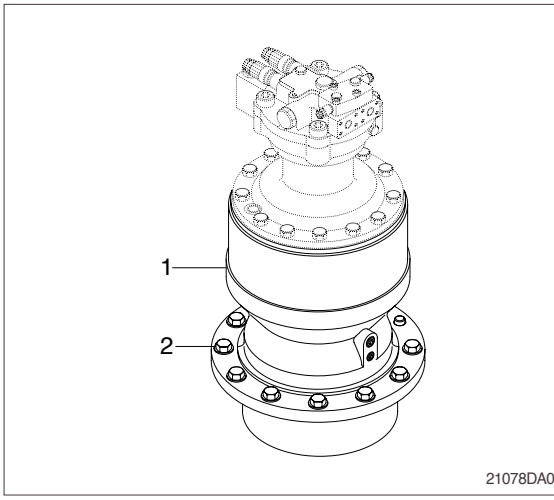
(2) Sling reduction gear assembly(1) and remove mounting bolts(2).

(3) Remove the reduction gear assembly.
· Reduction gear device weight : 95kg (209lb)


13031GE18

### 2) INSTALL

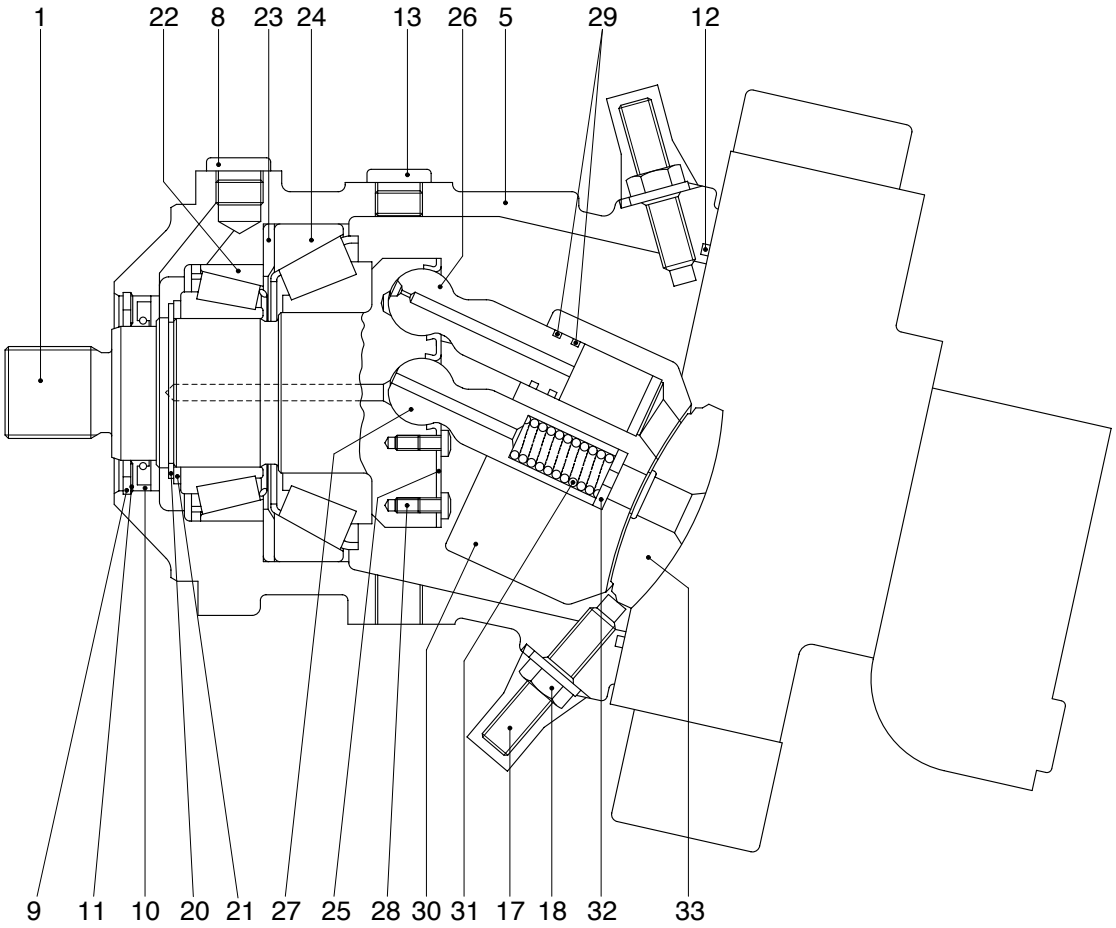
(1) Carry out installation in the reverse order to removal.
· Tightening torque : 29.7±4.5kgf · m (215±32.5lbf · ft)



21078DA05

## 2. STRUCTURE

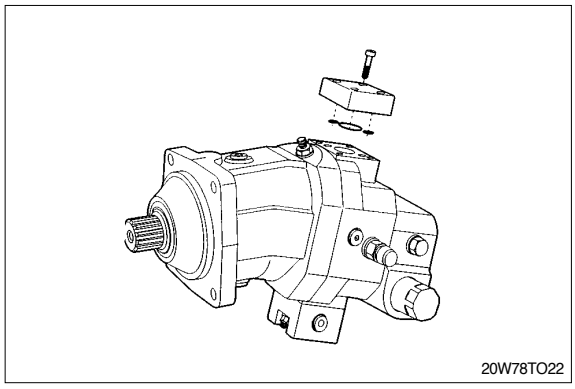
### 1) MOTOR UNIT



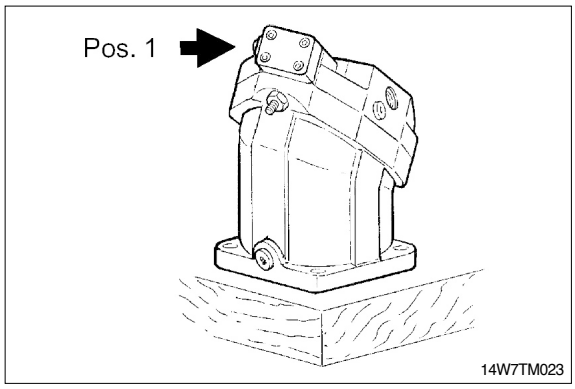

200W34TO02

| | | | | | |
|---|---|---|---|---|---|
| 1 | Drive shaft | 17 | Threaded pin | 26 | Piston |
| 5 | Housing | 18 | Seal lock nut | 27 | Center pin |
| 8 | Locking screw | 20 | Retaining ring | 28 | Pan head screw |
| 9 | Retaining ring | 21 | Back up plate | 29 | Steel sealing ring |
| 10 | Shaft seal ring | 22 | Taper roller bearing | 30 | Cylinder block |
| 11 | Back up plate | 23 | Shim | 31 | Pressure spring |
| 12 | O-ring | 24 | Taper roller bearing | 32 | Adjustment shim |
| 13 | Locking screw | 25 | Retaining plate | 33 | Control lens |

### 5) SEALING OF THE CONTROL PARTS

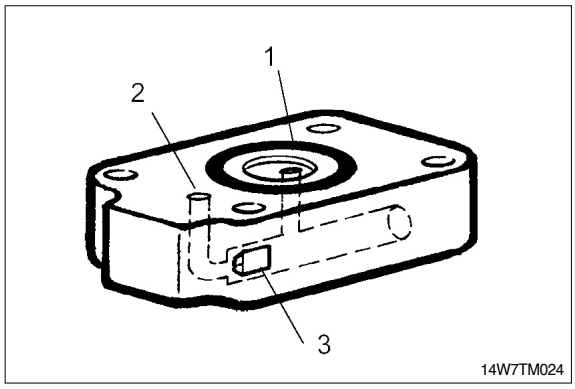



(1) Disassembly position
Remove cover 1.

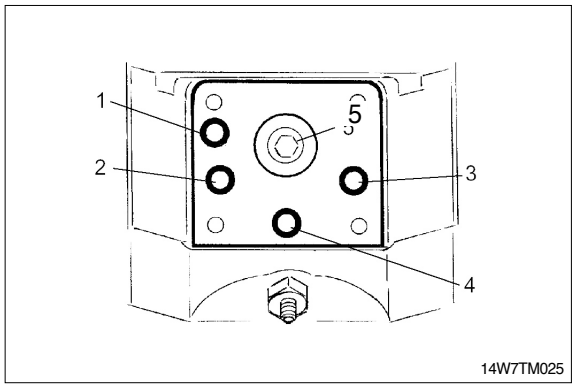



1 O-ring
2 Input flow of oil control
3 Throttle pin

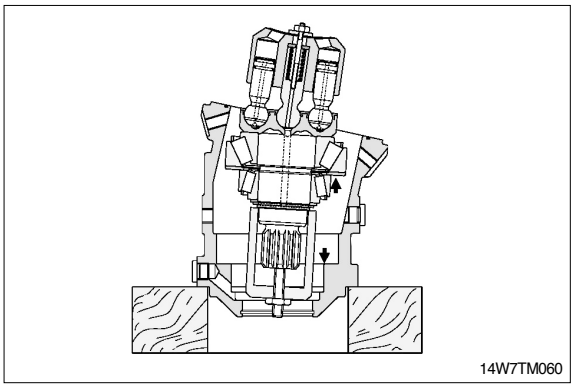
※ Installation position differs according to the control components.



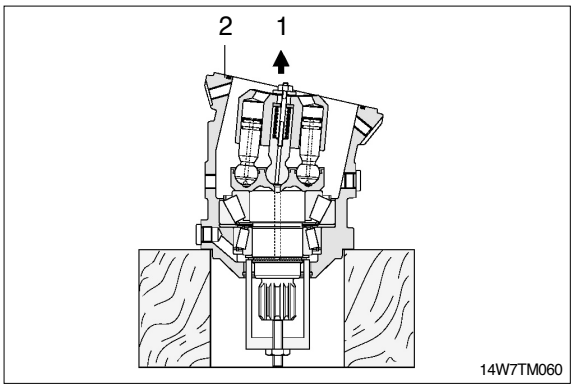

1 Input flow of oil control
2 High pressure / Low pressure
3 High pressure / Low pressure
4 Leckage oil
5 Control piston



(5) Insert rotary group into housing to seat position.

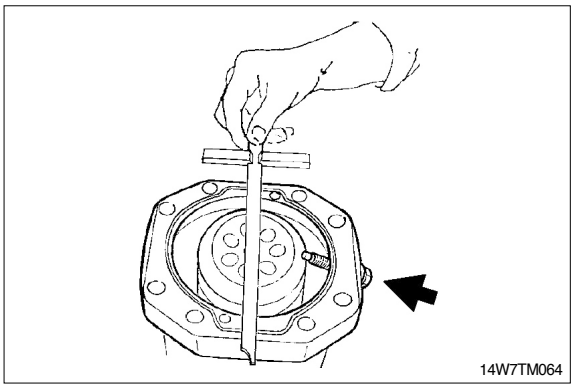



(6) Fix zero position of cylinder with $Q_{max}$ screw.
1 Disassemble cylinder fixing screw
2 Insert O-ring

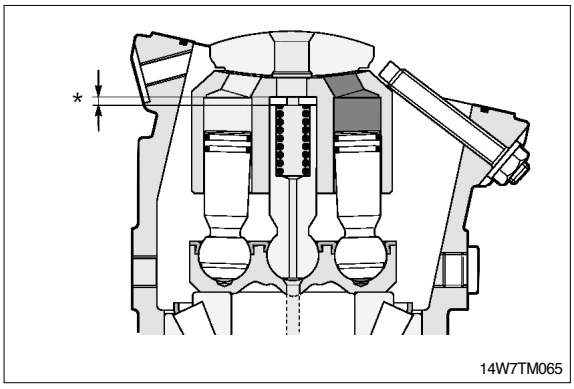



**13) ROTARY GROUP ADJUTMENT**

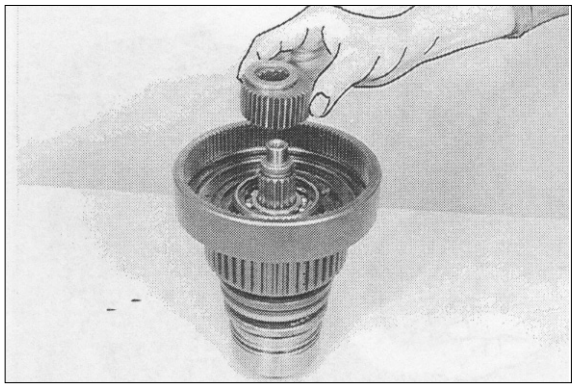
(1) Determine cylinder swivel range to max angle with screw.




(2) * Disc

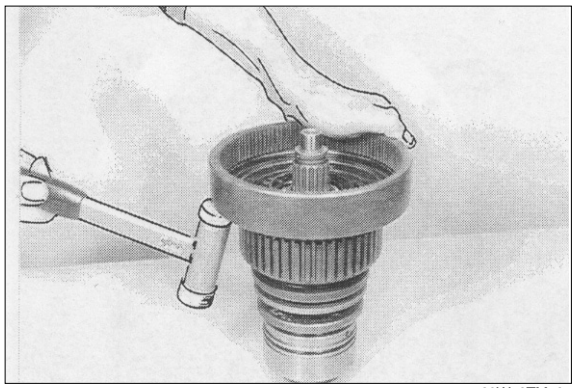


(17) Remove released disk and sun gear.



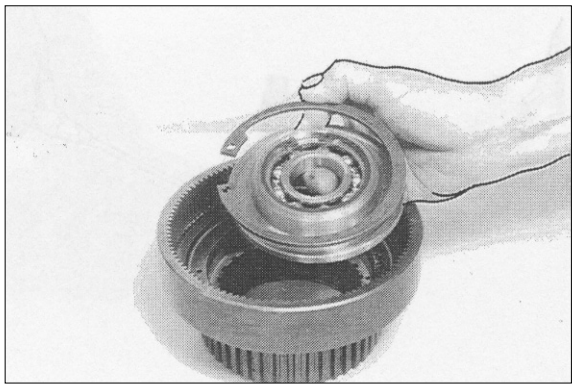
20W78TM17

(18) Separate internal gear from drive shaft.



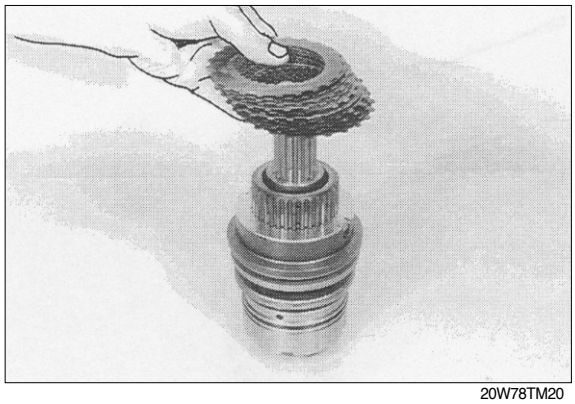
20W78TM18

(19) Squeeze out circlip and remove centering disk.



20W78TM19

(20) Remove plate pack.



20W78TM20

**4) DISASSEMBLE FINAL DRIVE**(Separate gearbox installation)

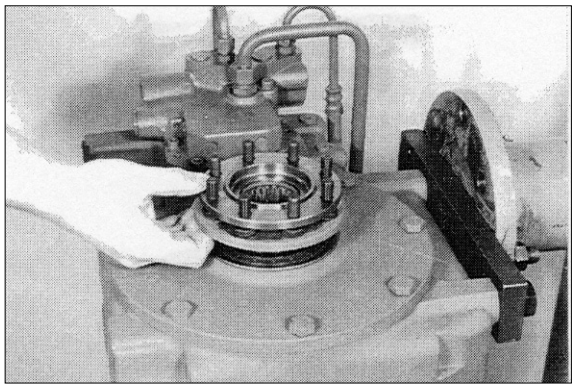
(1) Unlock and loosen hex head screws and remove output flange.

20W78TM53

(2) Pry shaft out of the housing bore.

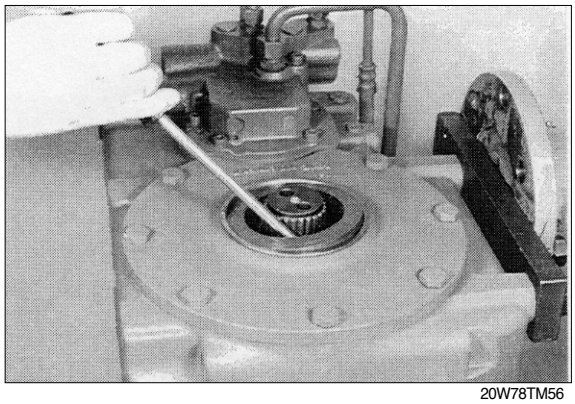
20W78TM54

(3) Tilt housing 180°.
Unlock and loosen hex head screws and remove output flange.



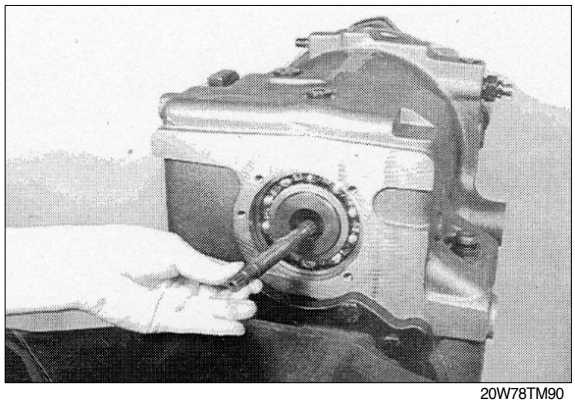
20W78TM55

(4) Remove shaft seal.



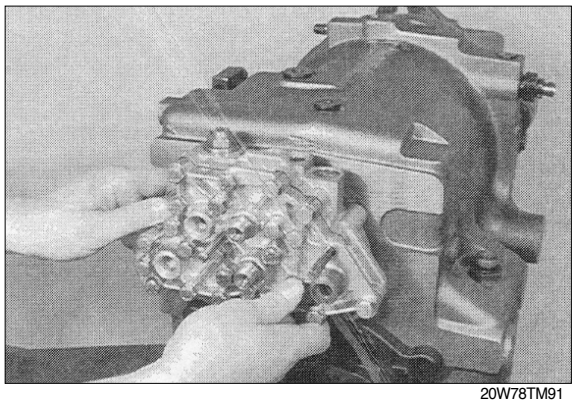
20W78TM56

(14) Introduce pump shaft until the splines are engaged.



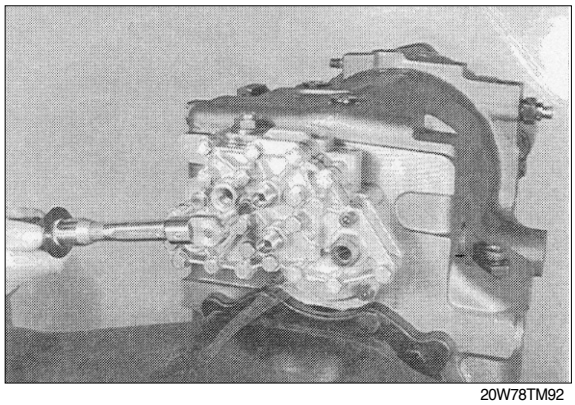
20W78TM90

(15) Install two adjusting screws and place the shift lock against the transmission case until contact is obtained.
Adjusting screw(M8).



20W78TM91

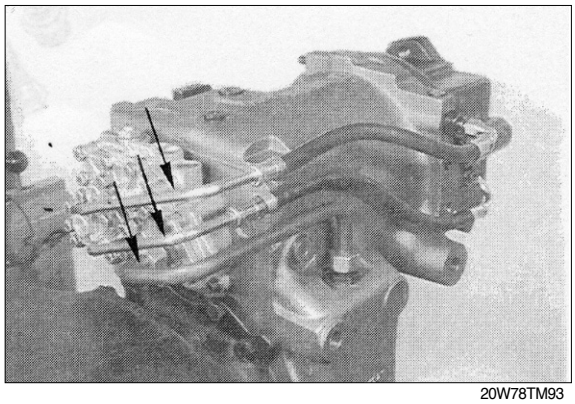
(16) Fasten the shift lock on the transmission case, using socket head screws(mount flat washers).
· Tighten torque : 2.3kgf · m(17.0lb · ft)



20W78TM92

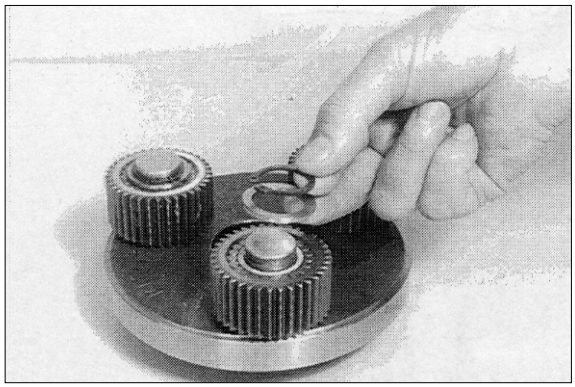
(17) Install oil pipe as well as hose lines (Arrows) according to the figure.

※ Before the unit is put into service, pay attention to the instructions for operation and maintenance.



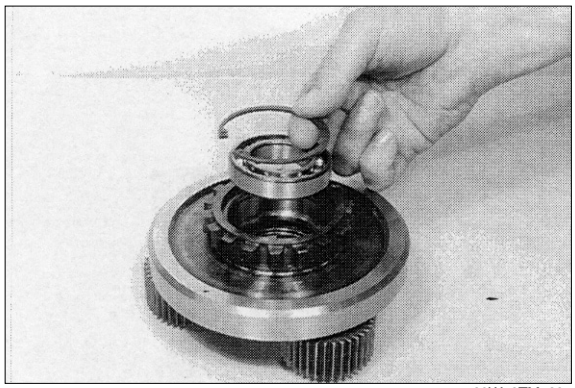
20W78TM93

(3) Install collar shim and circlip.



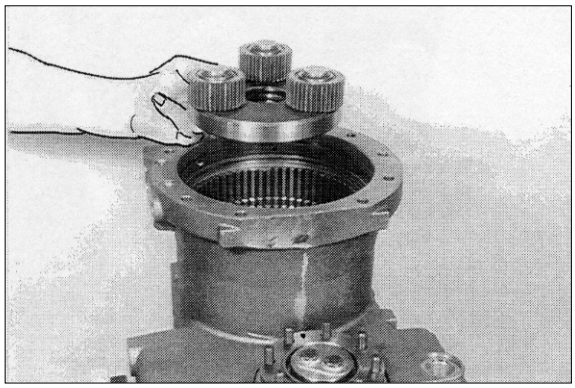
20W78TM128

(4) Insert ball bearing firmly against shoulder and fix with circlip.



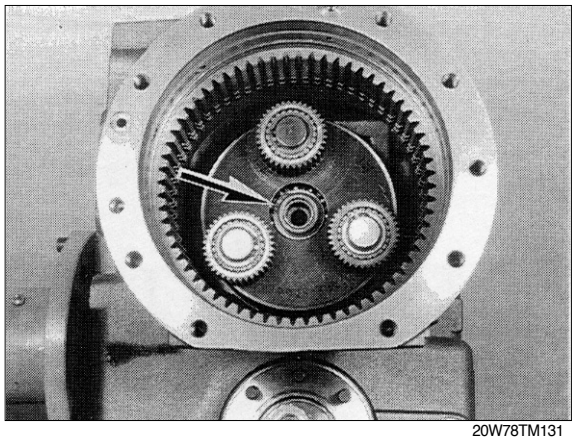
20W78TM129

(5) Heat ball bearing and mount planetary carrier until contact is obtained.



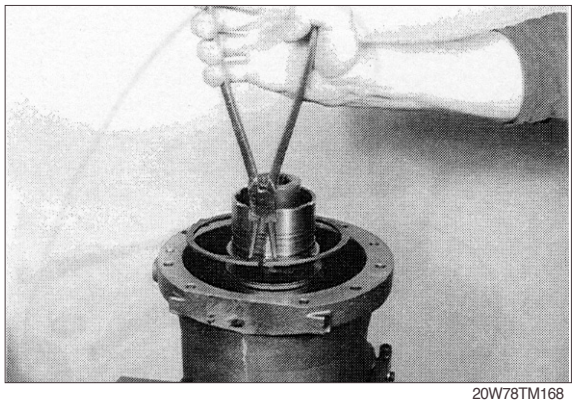
20W78TM130

(6) Fix planetary carrier with circlip(Arrow).



20W78TM131

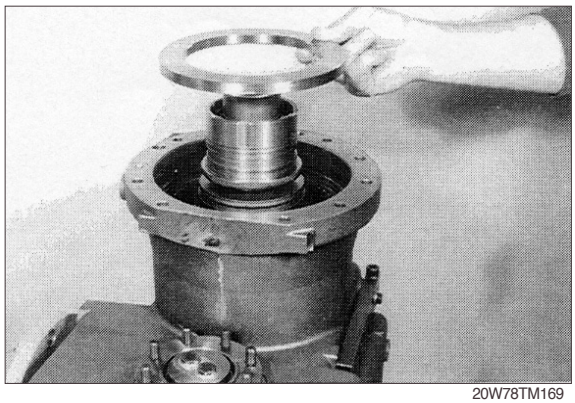
(33) Squeeze in circlip(190×4).



20W78TM168

**6) INSTALL BRAKE**(Cross-country gear)

(1) Insert backing plate.

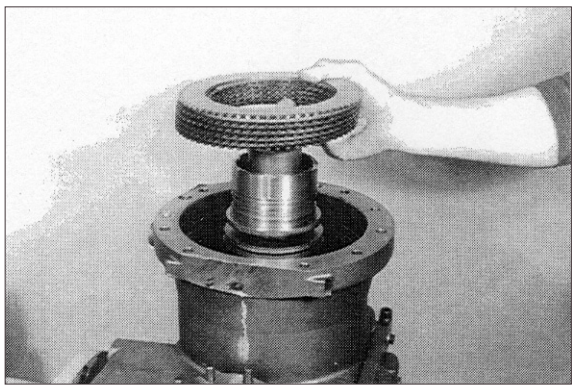


20W78TM169

**Determine adjustment dimension "A = 1.4 +0.2mm" following (2) to Example "E".**

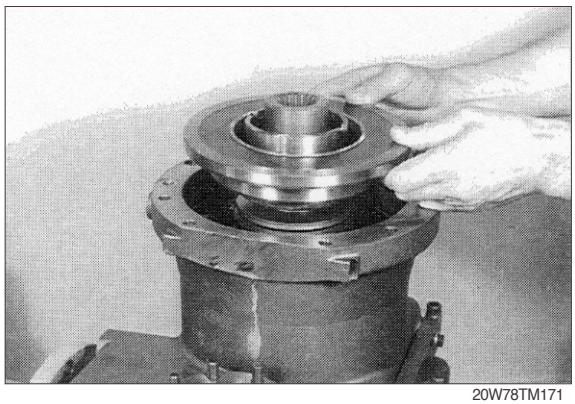
(2) Assemble alternating plate pack, starting with one outer plate.

※ Number of outer and inner plates, see corresponding parts manual.
Oil the plates.



20W78TM170

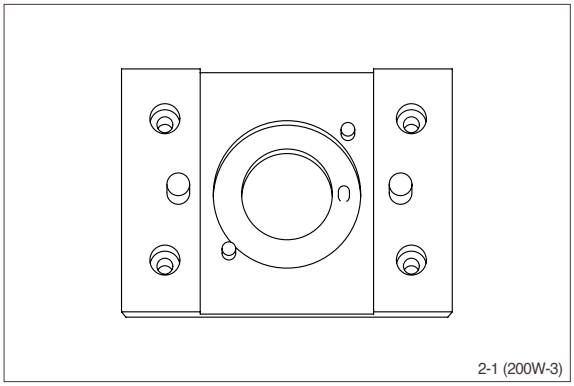
(3) Insert piston firmly against shoulder.



20W78TM171

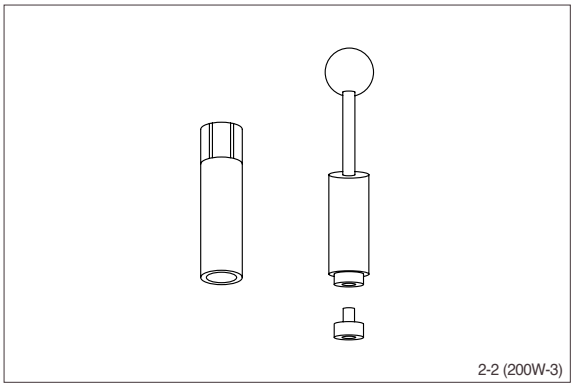
**2) TOOLS**

(1) Holding tool.



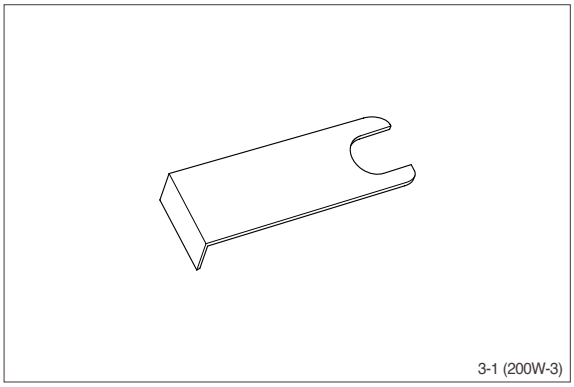
2-1 (200W-3)

(2) Assembly tool for O-ring(5,13,16) and kin-ring(6).



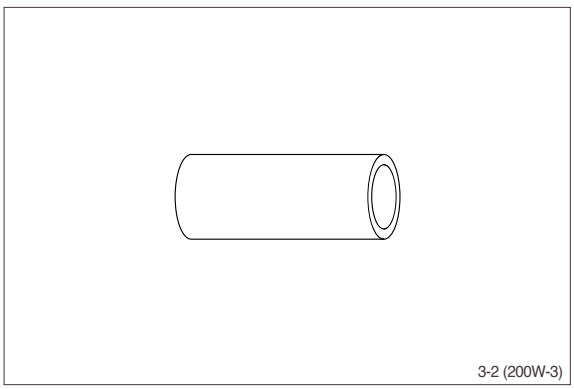
2-2 (200W-3)

(3) Assembly tool for cardan shaft(11).



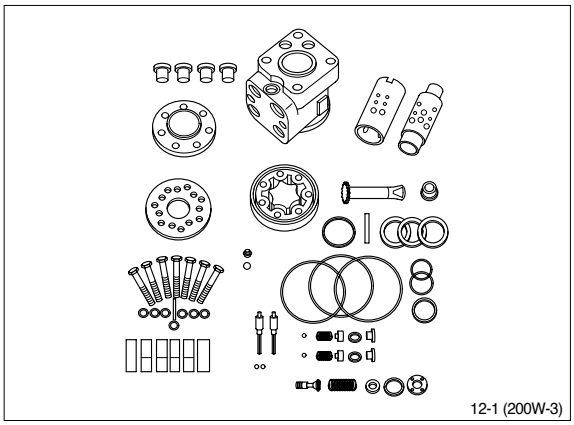
3-1 (200W-3)

(4) Assembly tool for dust seal(1).



3-2 (200W-3)

⑤ The steering valve is now completely disassembled.



12-1 (200W-3)

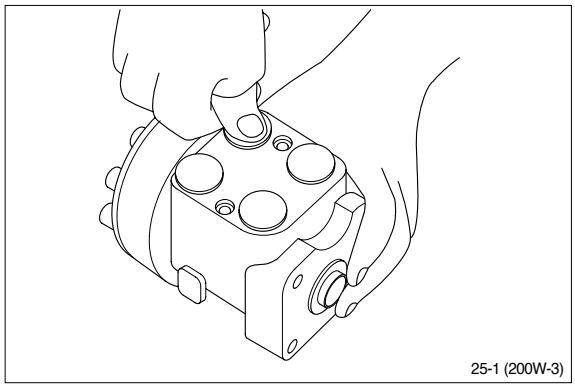
※ **Cleaning**
Clean all parts carefully in shellsol K or the like.

※ **Inspection and replacement**
Replace all seals and washers. Check all parts carefully and make any replacements necessary.

※ **Lubrication**
Before assembly, lubricate all parts with hydraulic oil.

(34) Press the plastic plugs into the connection ports.

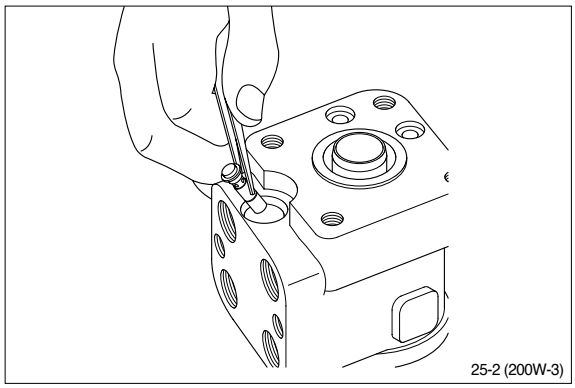
※ Do not use a hammer!



25-1 (200W-3)

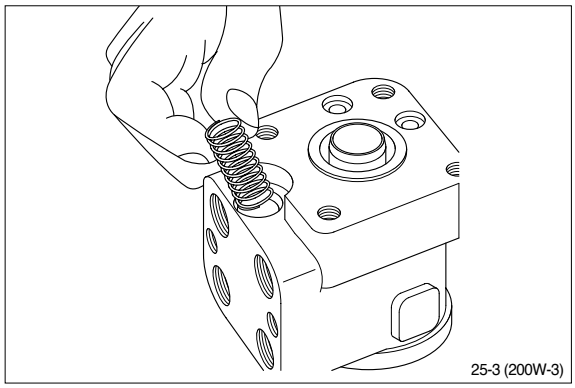
**Assembly of the pressure relief valve**

(35) Fit the piston.



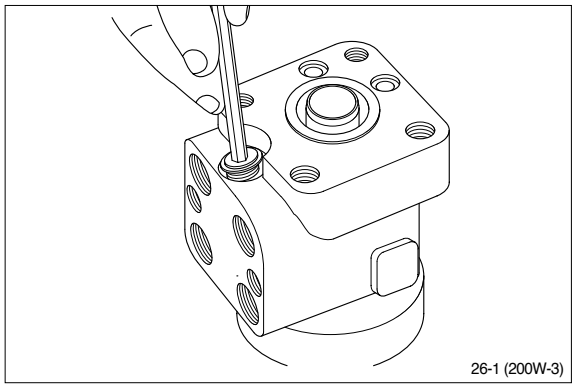
25-2 (200W-3)

(36) Fit the spring.



25-3 (200W-3)

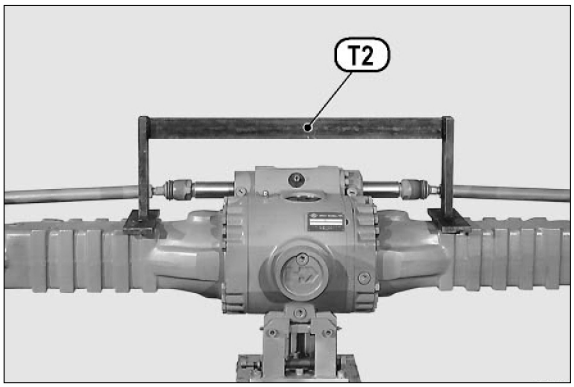
(37) Screw in the setting screw with an 8㎜ hexagon socket spanner. Make the pressure setting on a panel or the machine.



26-1 (200W-3)

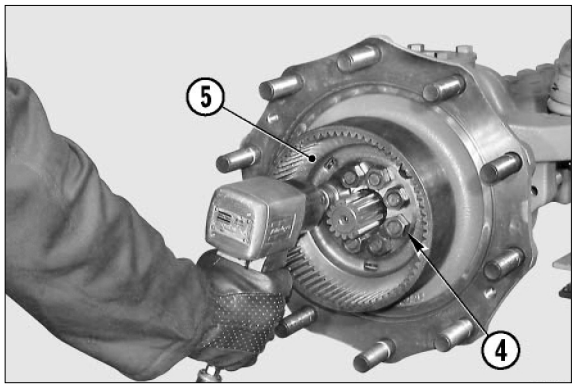
(9) Check the flatness of the arms using tool T2 and finally lock the arms with the screws(4) and the washer(5) using the cross-tightening methed.

· Torque wrench setting : 30kgf · m(219lbf · ft)



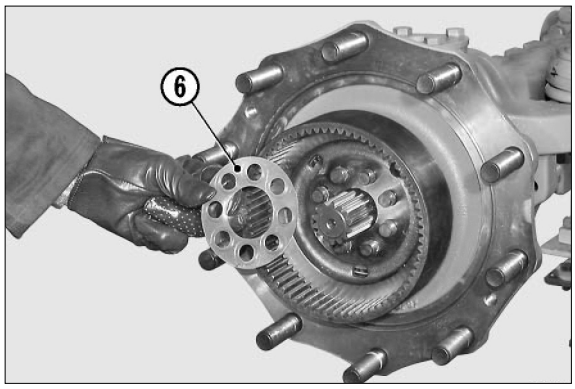

14W7FA021

(5) Unloose and remove the tightening nuts(4) from the crown flange(5).



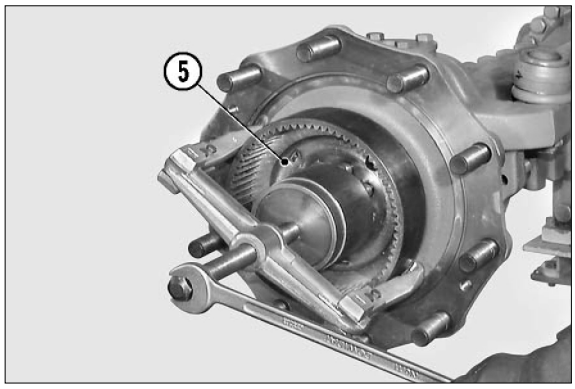
14W7FA061

(6) Remove the safety flange(6).



14W7FA062

(7) Using a puller, remove the complete crown flange(5) by acting on the stud bolts.

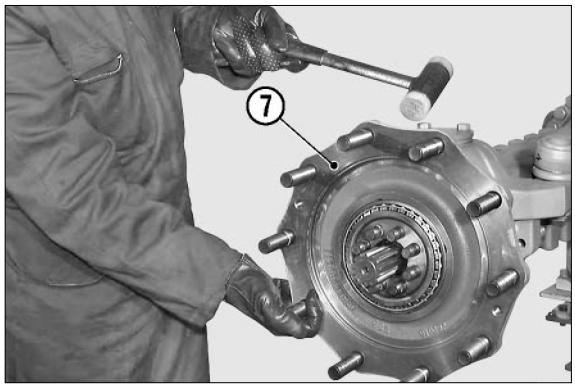


14W7FA063

(8) Partially extract the hub(7) using a plastic hammer.

**NOTE**

Alternately hammer on several equidistant points.



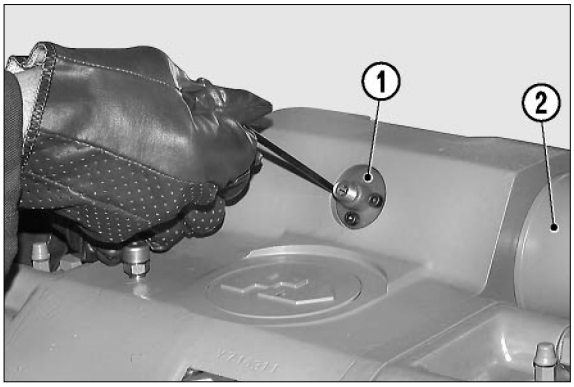
14W7FA064

## 8. THE STEERING CYLINDER

※ **FRONT AXLE ONLY**

### 1) HOW TO REMOVE THE STEERING CYLINDER

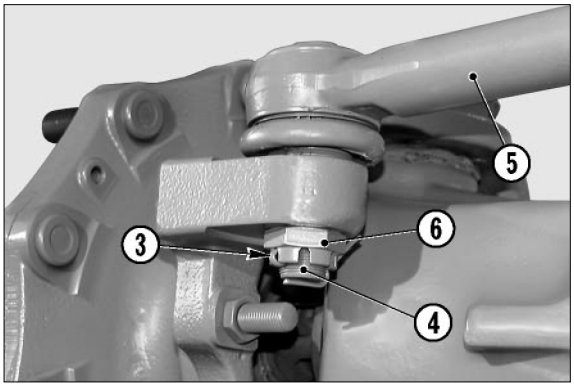
(1) Remove the centring sensor(1) of the steering piston(2), if supplied.



14W7FA099

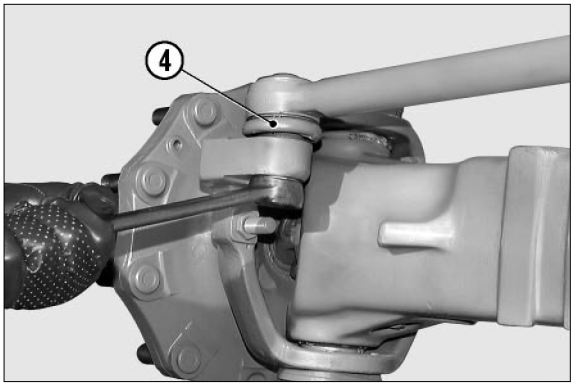
(2) Remove the safety cotter pins(3) from the articulation pins(4) of the steering bars(5).

※ **Dispose of used cotter pins.**



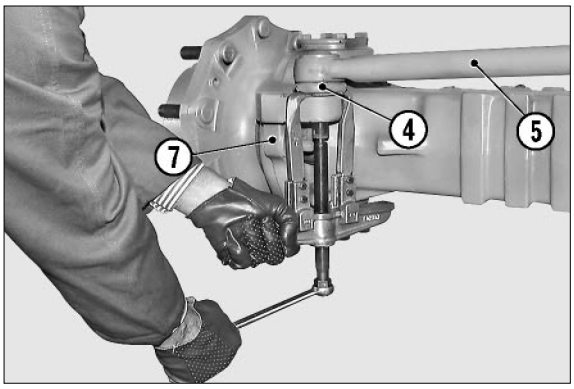
14W7FA100

(3) Remove the castellated nuts(6) that lock the articulation pins(4).



14W7FA101

(4) Disconnect the tapered pins of the articulation (4) from the steering case(7) by means of a puller.

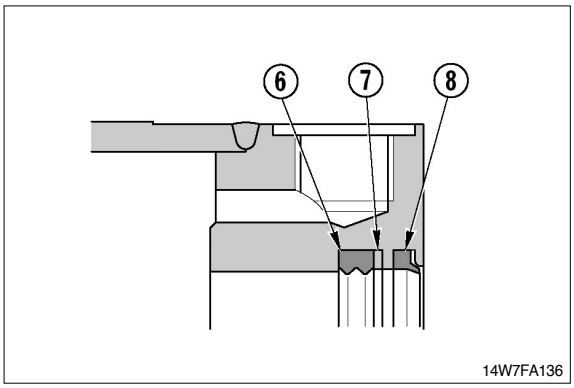


14W7FA102

#### 4) HOW TO ASSEMBLE THE STEERING CYLINDER

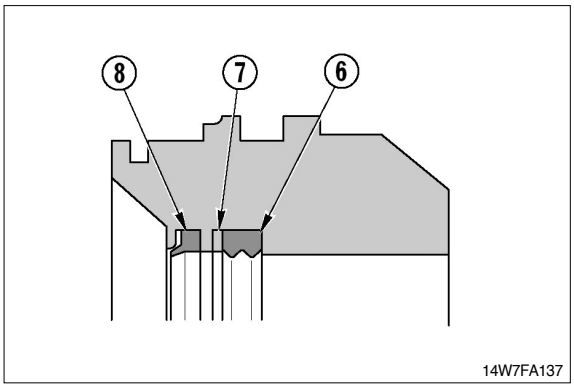
(1) After applying grease, install the sealing ring(6) of the shaft, the anti-extrusion ring(7) and the scraper ring(8) inside the cylinder(3).

※ **Thoroughly check that positioning of the anti-extrusion ring(7) is correct.**




(2) After applying grease, install the sealing ring(6) of the shaft, the anti-extrusion ring(7) and the scraper ring(8) in the head(2).

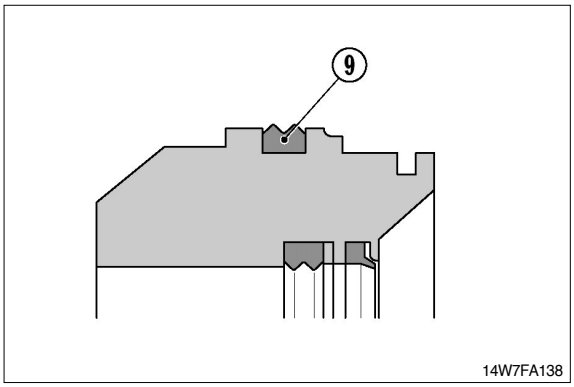
※ **Thoroughly check that positioning of the anti-extrusion(7) ring is correct.**




(3) Fit the seal(9) onto the outside of the head(2).

※ **In order to facilitate assembly, apply grease to the outer surface of the piston.**

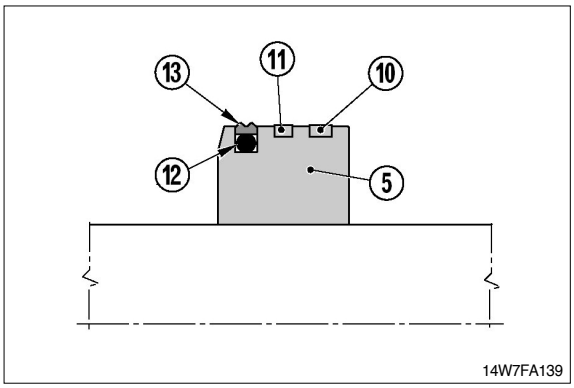
※ **Do not roll the seal(9) up.**



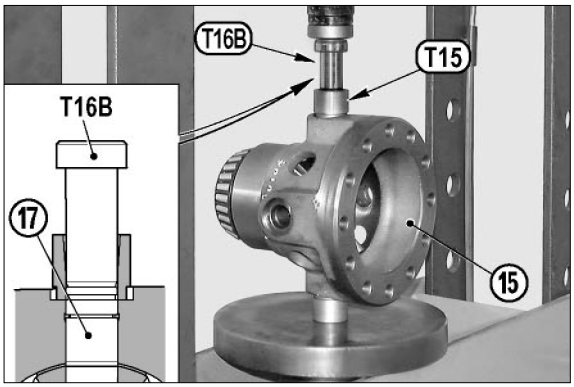

(4) Prepare the piston(5) fitting it with the guide ring(10), the magnetic ring(11), the O-ring(12) and the seal(13).

※ **In order to facilitate assembly, apply grease.**

※ **If a centering sensor is not fitted, then the magnetic ring(11) should be replaced by another guide ring(10).**



(9) Press T16B pin all the way down.

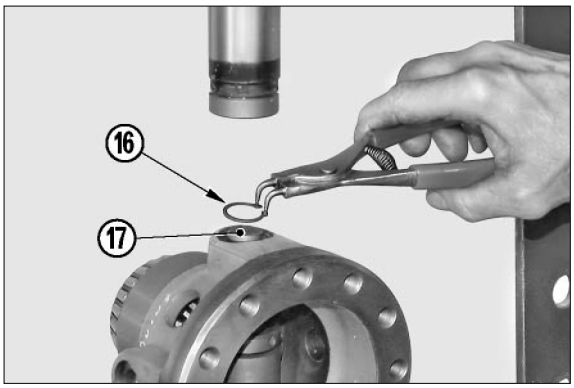


14W7RA139

(10) Remove gudgeon T16B, bush T15 and fit the snap ring(16) on the pin(17).

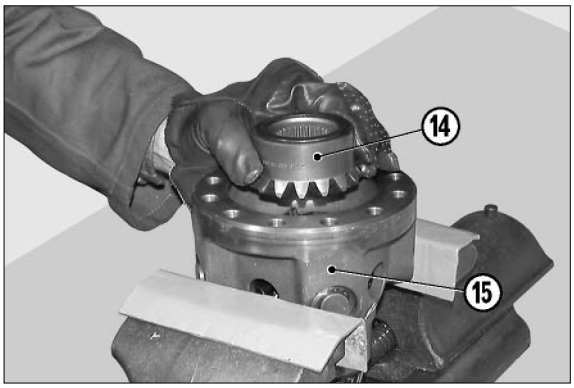
※ **Make sure that the snap ring centres the seat and that it rests on the surface of the differential carrier.**

**Repeat the operations on the other planet wheel pin or planet wheel axle.**



14W7RA140

(11) Position the second planetary gear(14) in the differential carrier(15).

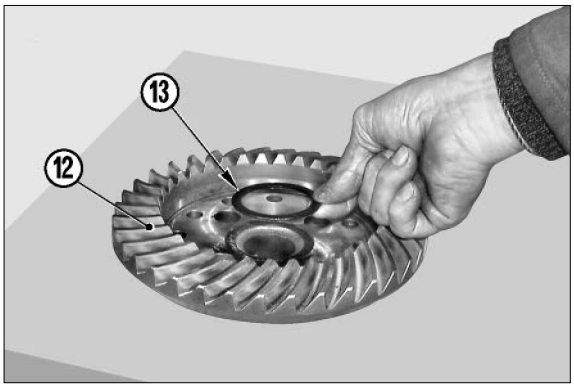


14W7RA141

(12) Position the shim washer(13) on the crown(12).

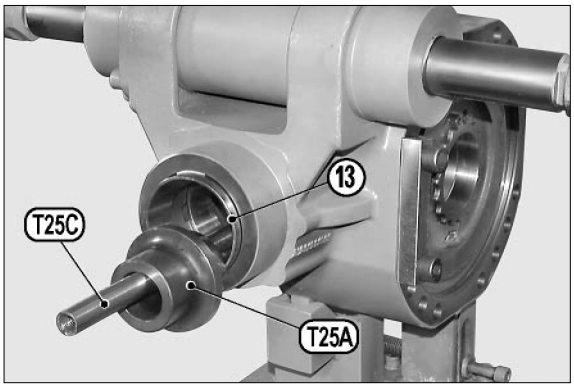
**NOTE**

In order to hold the shim washer(13) in position, apply grease to it.



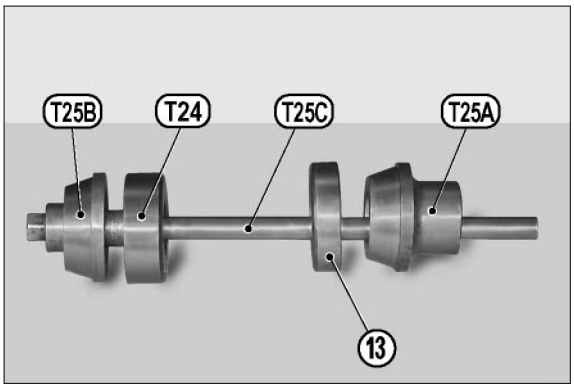
14W7RA142

(5) Partially insert the thrust block of the external bearing(13).



14W7RA080

(6) Install tension rod T25C, measurement ring T24 and front guide tool T25A on the thrust block of the external bearing(13).

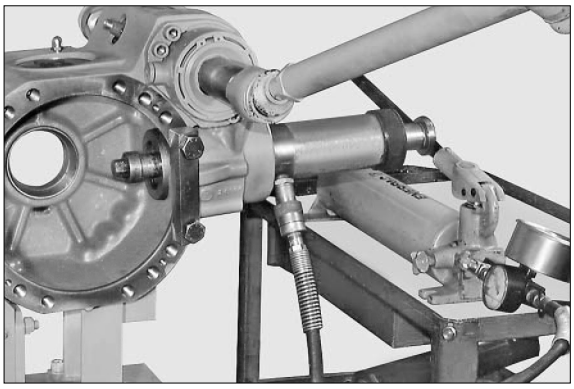


14W7RA081

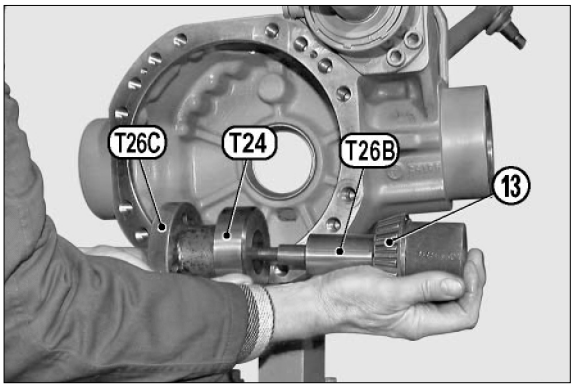
(7) Connect the tension rod to the press and move the thrust block of the external bearing(13) into its seat. Disconnect the press and remove the tension rod.

**NOTE**

Before starting the next stage, make sure that the thrust block has been completely inserted into its seat.

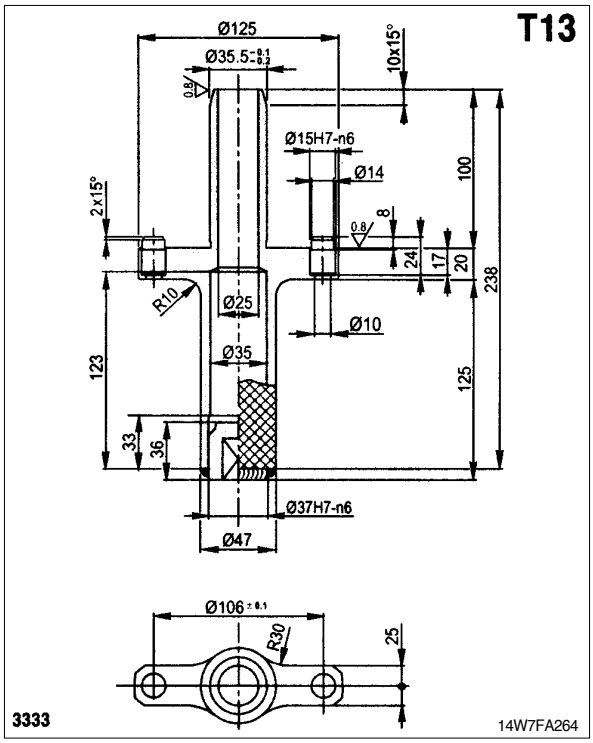

14W7RA082

(8) Insert tool T26B complete with external bearing(13), measurement ring T24 and gauged ring nut T26C.
Manually tighten.



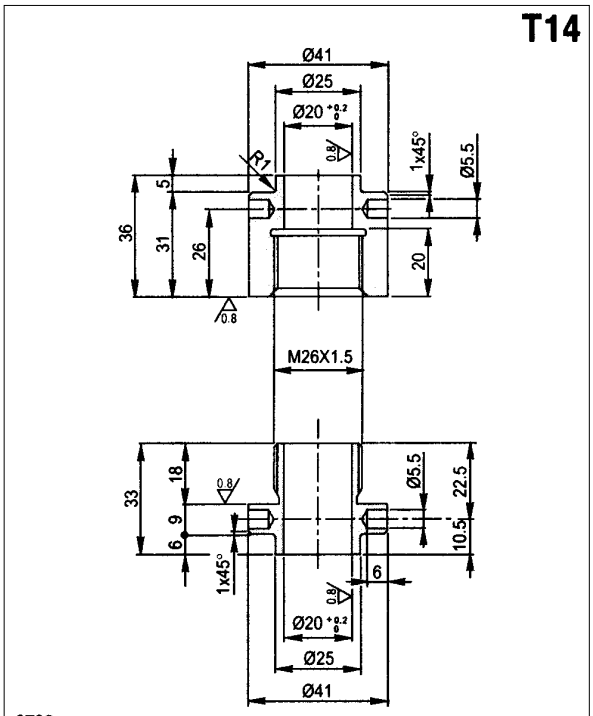
14W7RA083

## T13



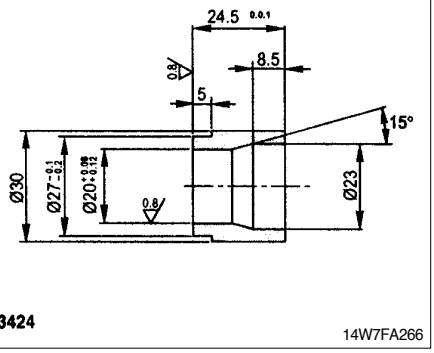

3333 14W7FA264

## T14



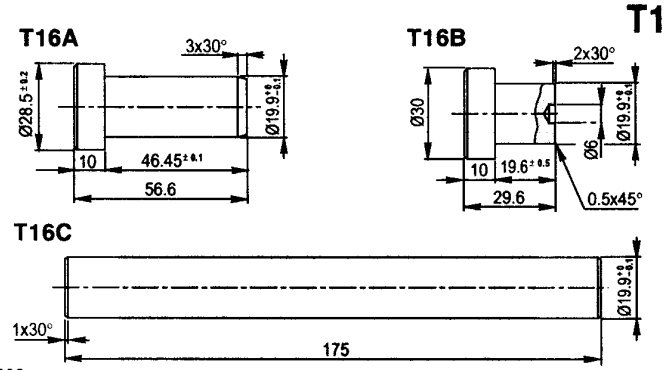

3708 14W7FA265

## T15



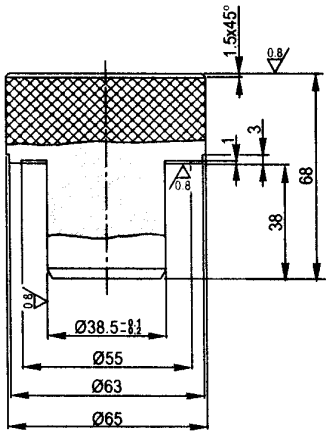

3424 14W7FA266

## T16



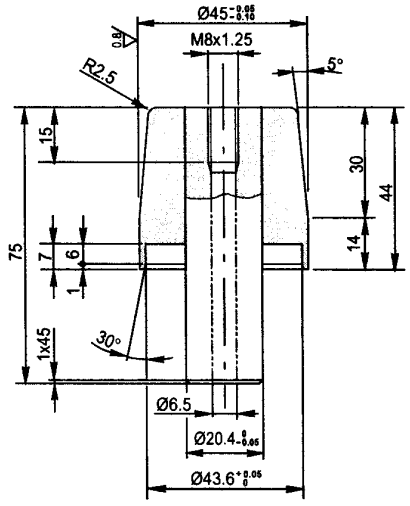

2306 14W7FA267

## T17



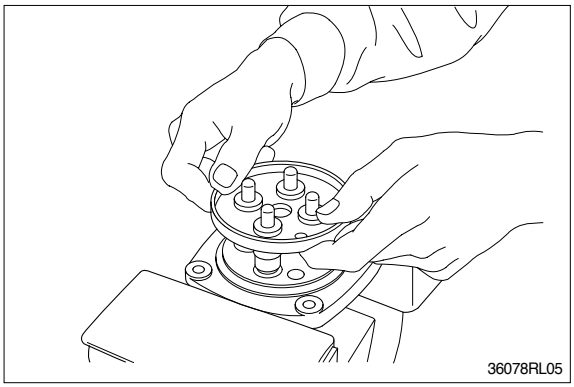

3332 14W7FA268

## T18




2724 14W7FA269

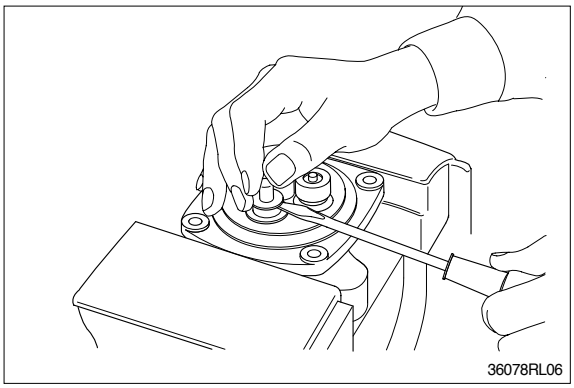
(8) Remove plate(15).




(9) When return spring(10) is weak in force, plug(11) stays in casing because of sliding resistance of O-ring.

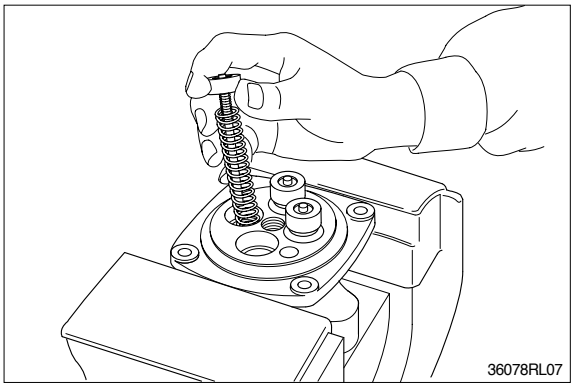
※ Take it out with minus screwdriver.
Take it out, utilizing external periphery groove of plug and paying attention not to damage it by partial loading.

※ During taking out, plug may jump up due to return spring(10) force.
Pay attention to this.

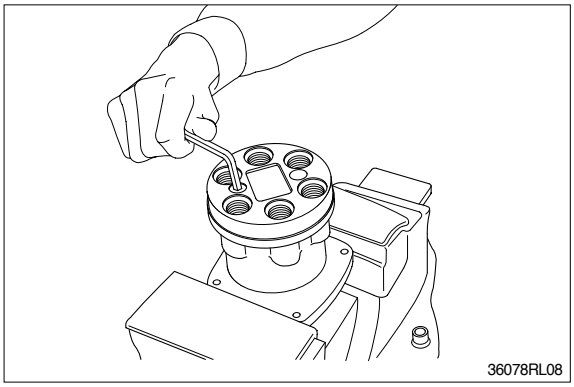



(10) Remove reducing valve subassembly and return spring(10) out of casing.

※ Record relative position of reducing valve subassembly and return springs.

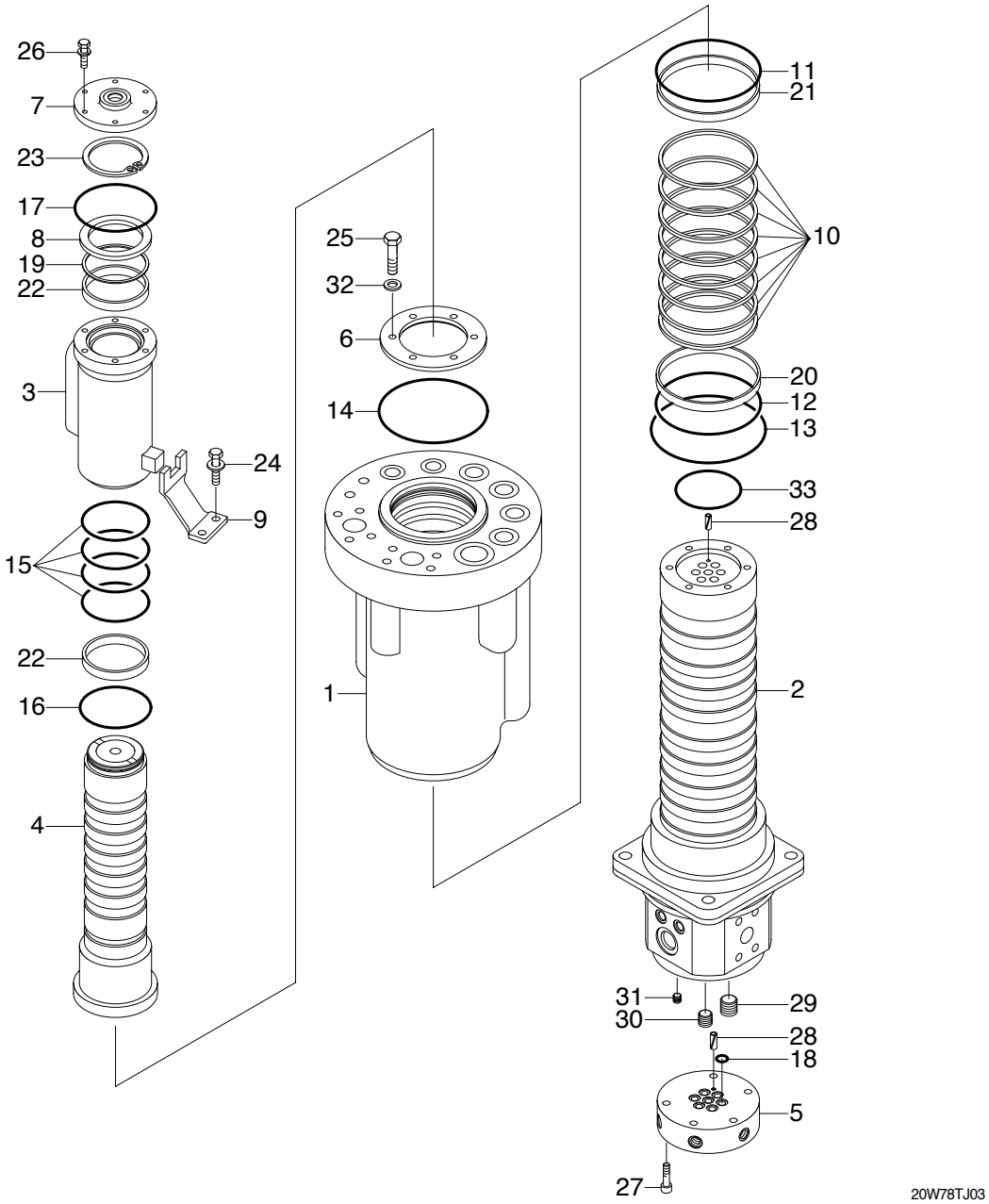



(11) Loosen hexagon socket head plug(2) with hexagon socket screw key.



## 2. DISASSEMBLY AND ASSEMBLY

### 1) STRUCTURE




| | | | | | |
|---|---|---|---|---|---|
| 1 | Main hub | 12 | O-ring | 23 | Retainer ring |
| 2 | Main shaft | 13 | O-ring | 24 | Bolt-w/washer |
| 3 | Top hub | 14 | O-ring | 25 | Hex bolt |
| 4 | Top shaft | 15 | O-ring | 26 | Bolt-w/washer |
| 5 | Adaptor | 16 | O-ring | 27 | Socket bolt |
| 6 | Main cover | 17 | O-ring | 28 | Spring pin |
| 7 | Top cover | 18 | O-ring | 29 | Plug |
| 8 | Spacer | 19 | Back up ring | 30 | Plug |
| 9 | Bracket | 20 | Wear ring | 31 | Plug |
| 10 | Slipper seal | 21 | Wear ring | 32 | Plain washer |
| 11 | O-ring | 22 | Wear ring | 33 | O-ring |

### 3) BOOM CYLINDER

**(1) Removal**

※ Expand the arm and bucket fully, lower the work equipment to the ground and stop the engine.

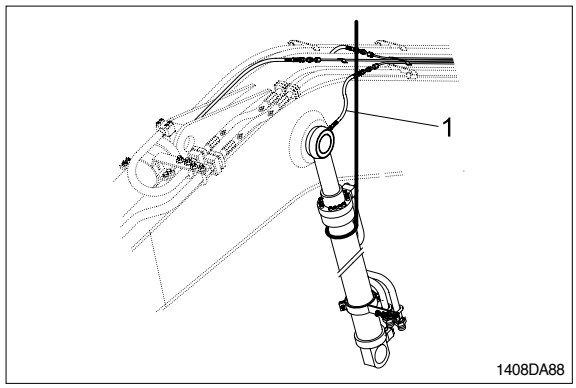
※ Operate the control levers and pedals several times to release the remaining pressure in the hydraulic piping.

⚠ Loosen the breather slowly to release the pressure inside the hydraulic tank.

※ Escaping fluid under pressure can penetrate the skin causing serious injury.
Fit blind plugs in the hoses after disconnecting them, to prevent dirt or dust from entering.

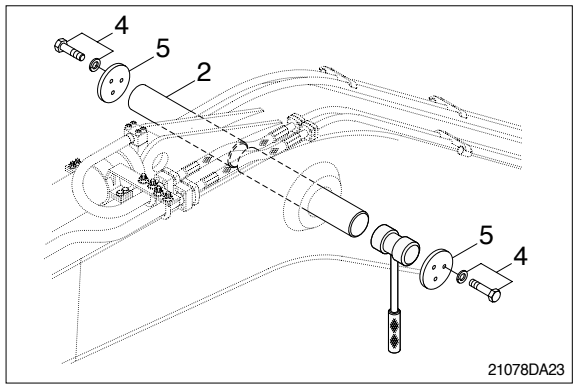
① Disconnect greasing hoses(1).

② Sling boom cylinder assembly.

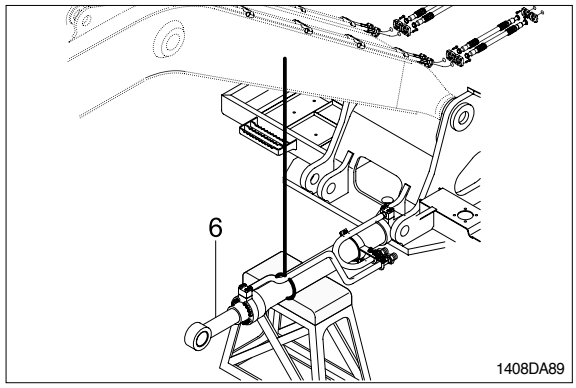




③ Remove bolt(4), stop plate(5) and pull out pin(2).

※ Tie the rod with wire to prevent it from coming out.

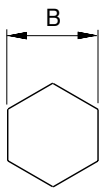



④ Lower the boom cylinder assembly(6) on a stand.



## 2) TOOLS AND TIGHTENING TORQUE

### (1) Tools

| | | |
|---|---|---|
| Allen wrench | 6 |   |
| | 8 | |
| | 14 | |
| | 17 | |
| Spanner | 7 | |
| | 8 | |
| (-) Driver | Small and large sizes | |
| Torque wrench | Capable of tightening with the specified torques | |

### (2) Tightening torque

| Part name | | Item | Size | Torque | |
|---|---|---|---|---|---|
| | | | | kgf · m | lbf · ft |
| Socket head bolt | Bucket cylinder | 22 | M16 | 23±2.0 | 166±14.5 |
| | Boom cylinder | | M16 | 23±2.0 | 166±14.5 |
| | Arm cylinder | 26 | M18 | 32±3.0 | 232±21.7 |
| | Dozer cylinder | 18 | M16 | 23±2.0 | 166±14.5 |
| | Outrigger cylinder | | | | |
| | Bucket cylinder | 27 | M10 | 5.4±0.5 | 39.1±3.6 |
| | Boom cylinder | 27 | | | |
| | Arm cylinder | 33 | | | |
| | Dozer cylinder | 23 | M8 | 2.7±0.3 | 19.5±2.2 |
| | Outrigger cylinder | | | | |
| | Dozer cylinder | 24 | M10 | 5.4±0.5 | 39.1±3.6 |
| | Outrigger cylinder | | | | |
| Hexagon head bolt | Bucket | 26 | M10 | 3.2±0.3 | 23.1±2.2 |
| | Boom | 25 | | | |
| | Arm | 29 | | | |
| Lock nut | Bucket cylinder | 21 | M60 | 100±10.0 | 723±72.3 |
| | Boom cylinder | 21 | M60 | | |
| | Arm cylinder | 25 | M70 | | |
| | Dozer cylinder | 17 | M56 | 400±40 | 2893±289 |
| | Outrigger cylinder | | M52 | 300±30 | 2170±217 |
| Piston | Bucket cylinder | 14 | - | 150±15.0 | 1085±109 |
| | Boom cylinder | | | | |
| | Arm cylinder | | | | |
| | Dozer cylinder | 12 | | 100±10 | 723.3±72.3 |
| | Outrigger cylinder | | | | |

## 2) ARM ASSEMBLY

### (1) Removal

※ Loosen the breather slowly to release the pressure inside the hydraulic tank.

⚠ Escaping fluid under pressure can penetrated the skin causing serious injury.

① Remove bucket assembly.
For details, see **removal of bucket assembly.**

② Disconnect bucket cylinder hose(1).

⚠ Fit blind plugs(5) in the piping at the chassis end securely to prevent oil from spurting out when the engine is started.

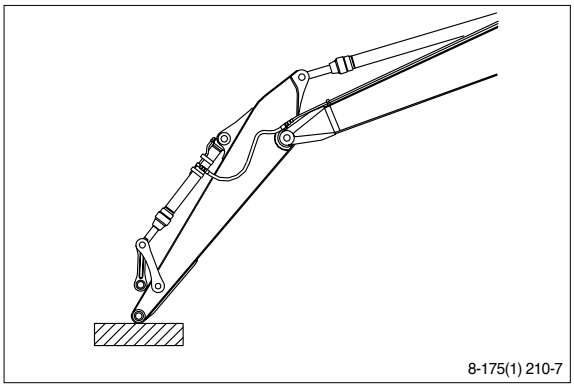
③ Sling arm cylinder assembly, remove spring, pin stopper and pull out pin.

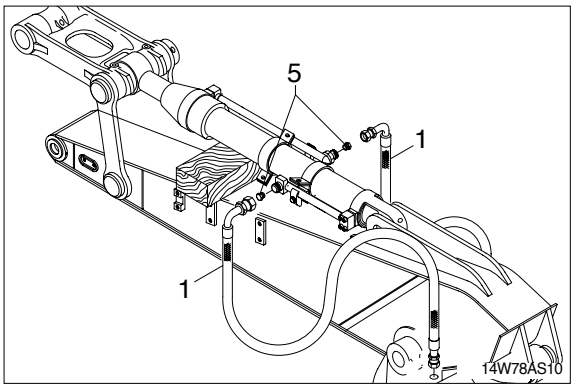
※ Tie the rod with wire to prevent it from coming out.

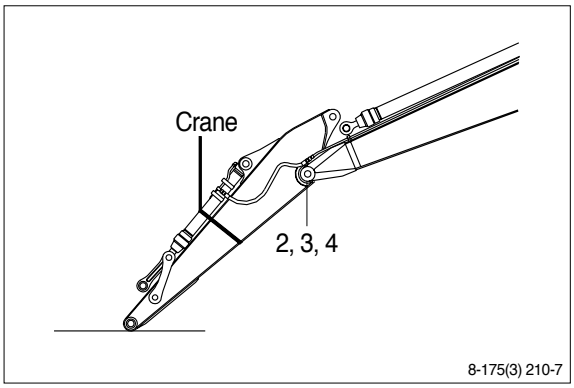
④ For details, see **removal of arm cylinder assembly.**
Place a wooden block under the cylinder and bring the cylinder down to it.

⑤ Remove bolt(2), plate(3) and pull out the pin(4) then remove the arm assembly.
· Weight : 570kg(1260lb)

※ When lifting the arm assembly, always lift the center of gravity.




### (2) Install

① Carry out installation in the reverse order to removal.

⚠ When lifting the arm assembly, always lift the center of gravity.

※ Bleed the air from the cylinder.