

## 1. STRUCTURE

This service manual has been prepared as an aid to improve the quality of repairs by giving the serviceman an accurate understanding of the product and by showing him the correct way to perform repairs and make judgements. Make sure you understand the contents of this manual and use it to full effect at every opportunity.

This service manual mainly contains the necessary technical information for operations performed in a service workshop.

For ease of understanding, the manual is divided into the following sections.

### SECTION 1 GENERAL

This section explains the safety hints and gives the specification of the machine and major components.

### SECTION 2 STRUCTURE AND FUNCTION

This section explains the structure and function of each component. It serves not only to give an understanding of the structure, but also serves as reference material for troubleshooting.

### SECTION 3 HYDRAULIC SYSTEM

This section explains the hydraulic circuit, single and combined operation.

### SECTION 4 ELECTRICAL SYSTEM

This section explains the electrical circuit, monitoring system and each component. It serves not only to give an understanding electrical system, but also serves as reference material for trouble shooting.

### SECTION 5 MECHATRONICS SYSTEM

This section explains the computer aided power optimization system and each component.

### SECTION 6 TROUBLESHOOTING

This section explains the troubleshooting charts correlating **problems** to **causes**.

### SECTION 7 MAINTENANCE STANDARD

This section gives the judgement standards when inspecting disassembled parts.

### SECTION 8 DISASSEMBLY AND ASSEMBLY

This section explains the order to be followed when removing, installing, disassembling or assembling each component, as well as precautions to be taken for these operations.

### SECTION 9 COMPONENT MOUNTING TORQUE

This section shows bolt specifications and standard torque values needed when mounting components to the machine.

The specifications contained in this shop manual are subject to change at any time and without any advance notice. Contact your HYUNDAI distributor for the latest information.

Millimeters to inches

1mm = 0.03937in

	0	1	2	3	4	5	6	7	8	9
0		0.039	0.079	0.118	0.157	0.197	0.236	0.276	0.315	0.354
10	0.394	0.433	0.472	0.512	0.551	0.591	0.630	0.669	0.709	0.748
20	0.787	0.827	0.866	0.906	0.945	0.984	1.024	1.063	1.102	1.142
30	1.181	1.220	1.260	1.299	1.339	1.378	1.417	1.457	1.496	1.536
40	1.575	1.614	1.654	1.693	1.732	1.772	1.811	1.850	1.890	1.929
50	1.969	2.008	2.047	2.087	2.126	2.165	2.205	2.244	2.283	2.323
60	2.362	2.402	2.441	2.480	2.520	2.559	2.598	2.638	2.677	2.717
70	2.756	2.795	2.835	2.874	2.913	2.953	2.992	3.032	3.071	3.110
80	3.150	3.189	3.228	3.268	3.307	3.346	3.386	3.425	3.465	3.504
90	3.543	3.583	3.622	3.661	3.701	3.740	3.780	3.819	3.858	3.898

Kilogram to Pound

1kg = 2.2046lb

	0	1	2	3	4	5	6	7	8	9
0		2.20	4.41	6.61	8.82	11.02	13.23	15.43	17.64	19.84
10	22.05	24.25	26.46	28.66	30.86	33.07	35.27	37.48	39.68	41.89
20	44.09	46.30	48.50	50.71	51.91	55.12	57.32	59.5	61.73	63.93
30	66.14	68.34	70.55	72.75	74.96	77.16	79.37	81.57	83.78	85.98
40	88.18	90.39	92.59	94.80	97.00	99.21	101.41	103.62	105.82	108.03
50	110.23	112.44	114.64	116.85	119.05	121.25	123.46	125.66	127.87	130.07
60	132.28	134.48	136.69	138.89	141.10	143.30	145.51	147.71	149.91	152.12
70	154.32	156.53	158.73	160.94	163.14	165.35	167.55	169.76	171.96	174.17
80	176.37	178.57	180.78	182.98	185.19	187.39	189.60	191.80	194.01	196.21
90	198.42	200.62	202.83	205.03	207.24	209.44	211.64	213.85	216.05	218.26

## 9. RECOMMENDED OILS

Use only oils listed below or equivalent.  
Do not mix different brand oil.

Service point	Kind of fluid	Capacity l (U.S. gal)	Ambient temperature °C (°F)								
			-20 (-4)	-10 (14)	0 (32)	10 (50)	20 (68)	30 (86)	40 (104)		
Engine oil pan	Engine oil	38(10)					SAE 30				
			SAE 10W								
			SAE 10W-30								
			SAE 15W-40								
Swing drive	Gear oil	5.0 × 2 (1.3 × 2)		SAE 85W-140							
Final drive		5.0 × 2 (1.3 × 2)									
Hydraulic tank	Hydraulic oil	Tank; 250(66) System; 380(100)	ISO VG 32								
			ISO VG 46								
			ISO VG 68								
Fuel tank	Diesel fuel	610(161)	ASTM D975 NO.1								
			ASTM D975 NO.2								
Fitting (Grease nipple)	Grease	As required	NLGI NO.1								
			NLGI NO.2								
Radiator (Reservoir tank)	Mixture of antifreeze and water 50 : 50	50(13.2)	Ethylene glycol base permanent type								

**SAE** : Society of Automotive Engineers

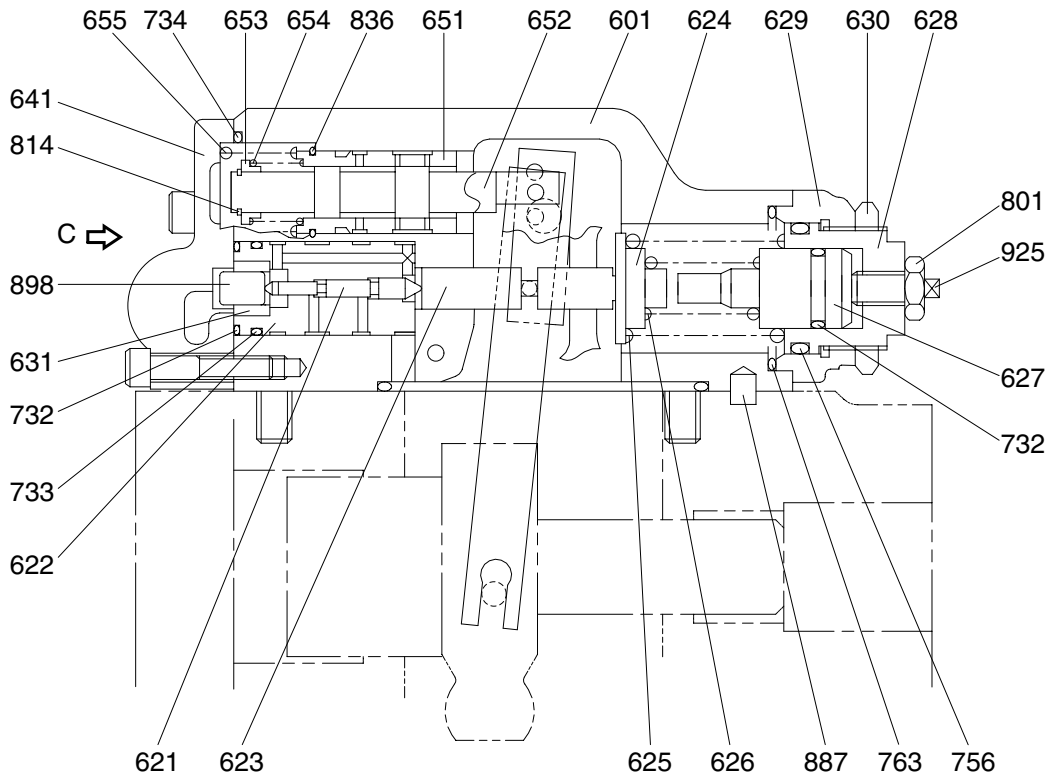
**API** : American Petroleum Institute

**ISO** : International Organization for Standardization

**NLGI** : National Lubricating Grease Institute

**ASTM** : American Society of Testing and Material

## FRONT REGULATOR(2/2)



### SECTION A-A

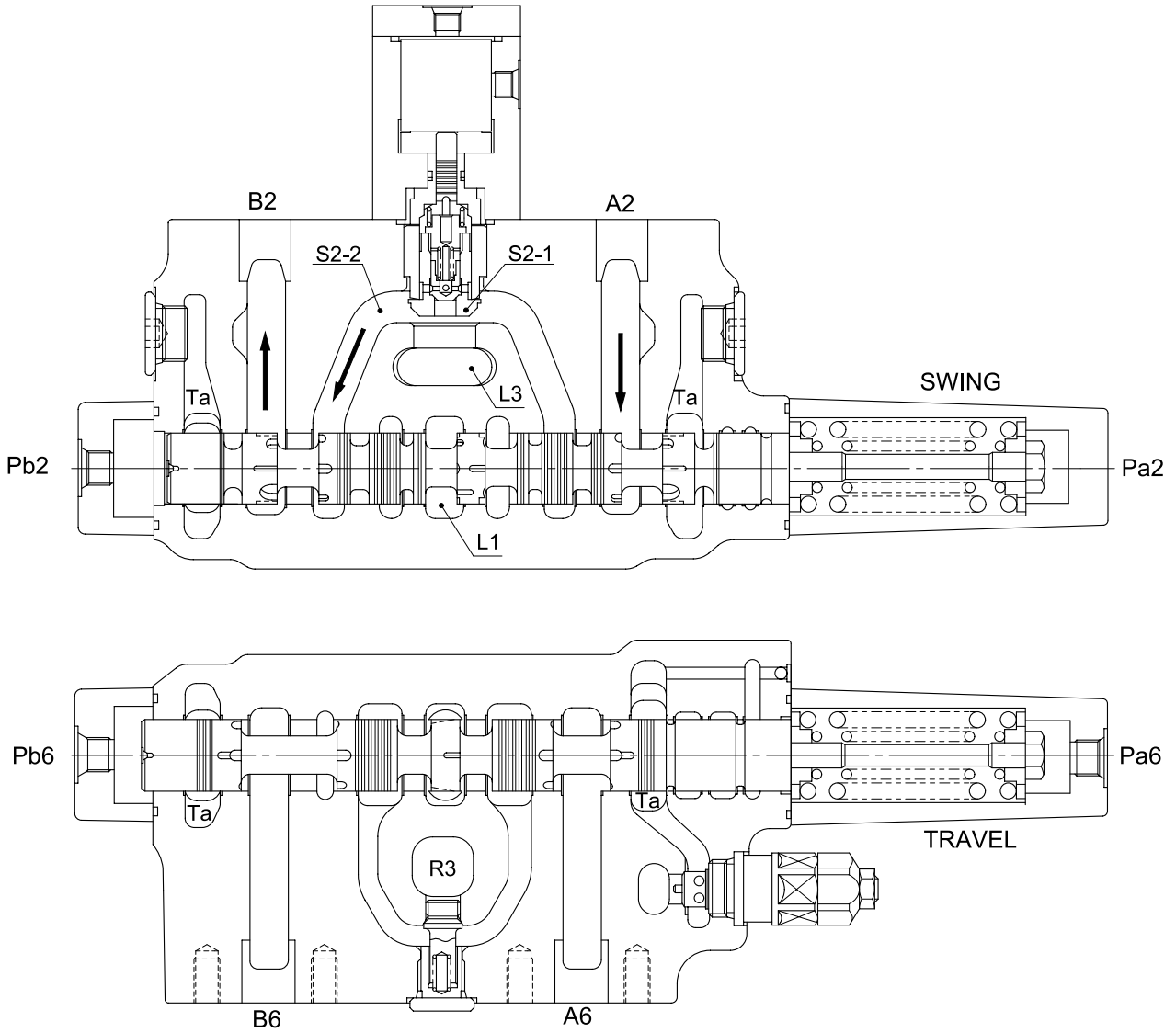
470072RG02

408 Hexagon socket screw	628 Adjust screw(C)	725 O-ring
412 Hexagon socket screw	629 Cover(C)	728 O-ring
413 Hexagon socket screw	630 Lock nut	730 O-ring
436 Hexagon socket screw	631 Sleeve, pf	732 O-ring
438 Hexagon socket screw	641 Pilot cover	733 O-ring
466 Plug	642 Adjust screw(QMC)	734 O-ring
496 Plug	643 Pilot piston	735 O-ring
541 Seat	644 Spring seat(Q)	755 O-ring
543 Stopper	645 Adjust stem(Q)	756 O-ring
545 Steel ball	646 Pilot spring	763 O-ring
601 Casing	647 Stopper	801 Nut
611 Feed back lever	648 Piston(QMC)	814 Snap ring
612 Lever(1)	651 Sleeve	836 Snap ring
613 Lever(2)	652 Spool(A)	858 Snap ring
614 Center plug	653 Spring seat	874 Spring pin
615 Adjust plug	654 Return spring	875 Pin
621 Compensator piston	655 Set spring	876 Pin
622 Piston case	696 Port cover	878 Pin
623 Compensator rod	697 Check valve plate	887 Pin
624 Spring seat(C)	708 O-ring	897 Pin
625 Outer spring	722 O-ring	898 Pin
626 Inner spring	723 O-ring	924 Set screw
627 Adjust stem(C)	724 O-ring	925 Adjust screw(QI)

## (2) Swing spool

When the swing spool is pushed to the right by the pilot pressure of port Pb2, the neutral passage(L1) is closed, the oil discharged from pump P1 pushes up the load check valve(S2-1), passage(S2-2) via parallel passage(L3) and then flows into port B2.

The oil from port A2 return to the tank via the tank passage(Ta).



45071MC05

## 2. FUNCTIONS

### 1) FUNDAMENTAL FUNCTIONS

The pilot valve is a valve that controls the spool stroke, direction, etc of a main control valve. This function is carried out by providing the spring at one end of the main control valve spool and applying the output pressure(Secondary pressure) of the pilot valve to the other end.

For this function to be carried out satisfactorily, the pilot valve is composed of the following elements.

- (1) Inlet port(P) where oil is supplied from hydraulic pump.
- (2) Output ports(1, 2, 3 & 4) to apply pressure supplied from inlet port to ends of control valve spools.
- (3) Tank port(T) necessary to control the above output pressure.
- (4) Spool to connect output port to inlet port or tank port.
- (5) Mechanical means to control output pressure, including springs that work on the above spools.

### 2) FUNCTIONS OF MAJOR SECTIONS

The functions of the spool(5) are to receive the supply oil pressure from the hydraulic pump at its port P, and to change over oil paths to determine whether the pressure oil of port P is led to output ports 1, 2, 3 & 4 or the output port pressure oil to tank port T.

The spring(7) works on this spool to determine the output pressure.

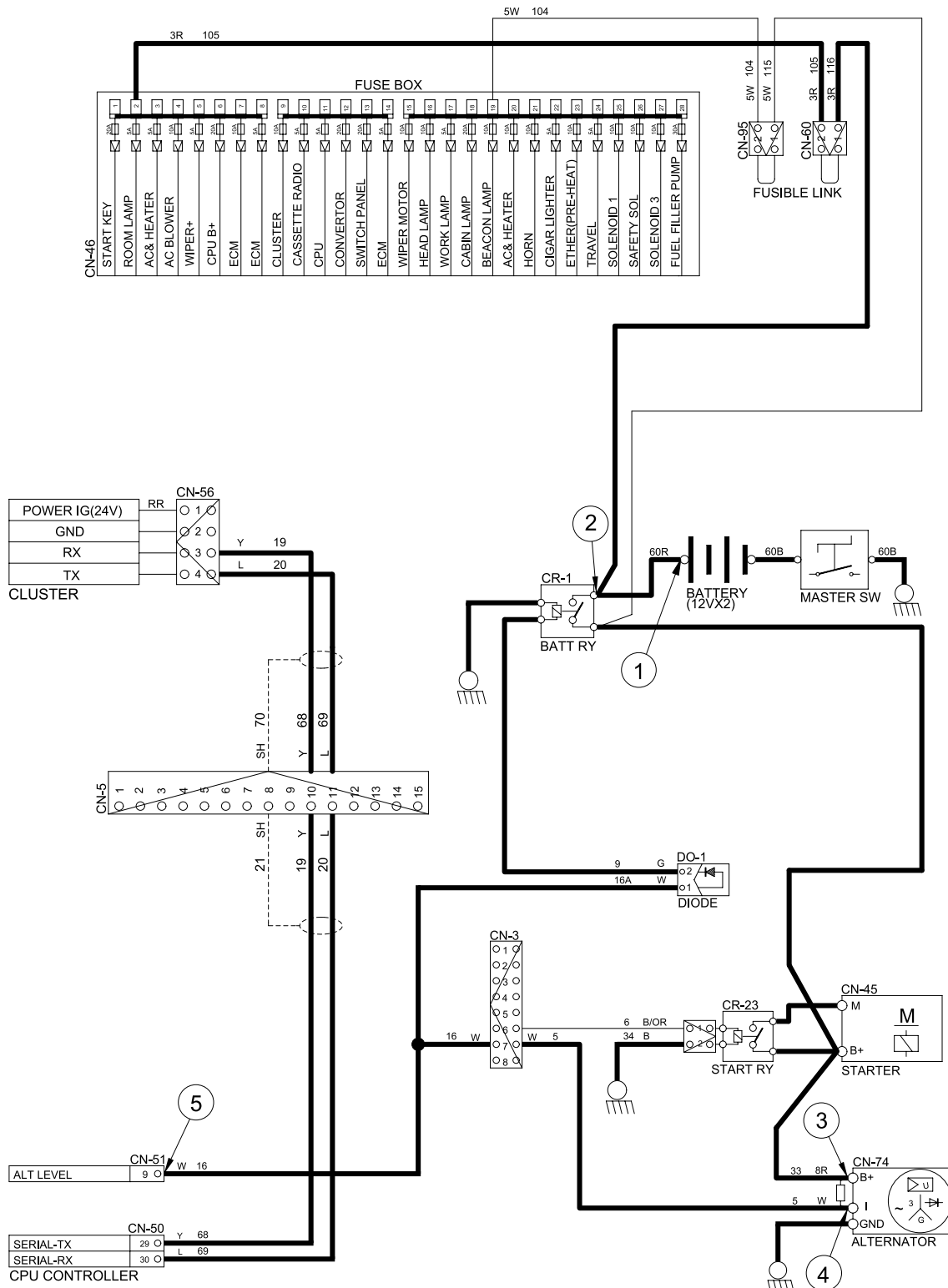
The change the deflection of this spring, the push rod(14) is inserted and can slide in the plug(11).

For the purpose of changing the displacement of the push rod through the switch plate(19) and adjusting nut(20) are provided the handle(27) that can be tilted in any direction around the fulcrum of the universal joint(18) center.

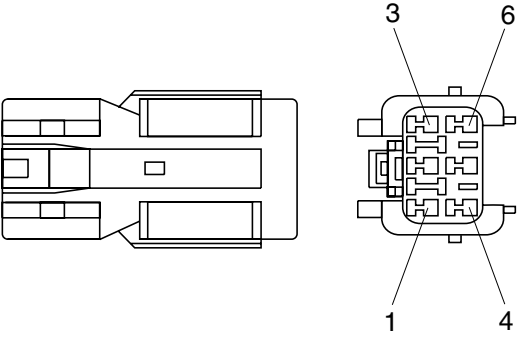
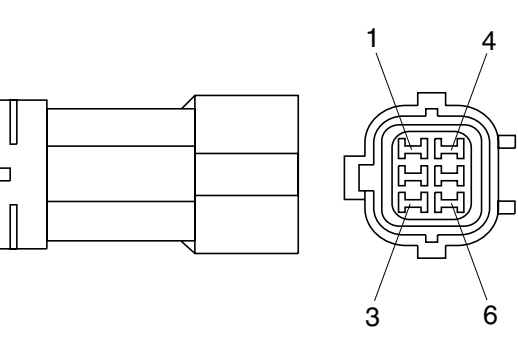
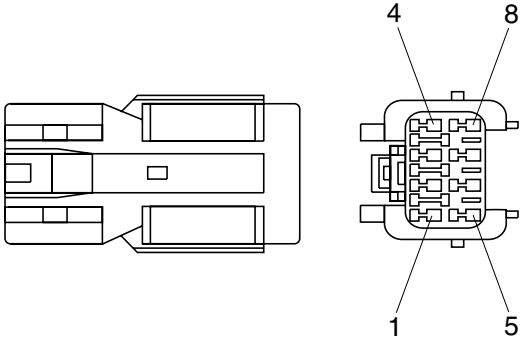
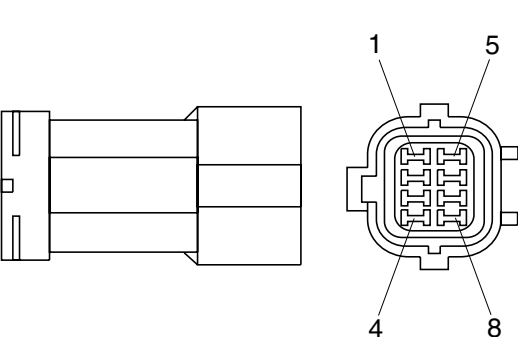
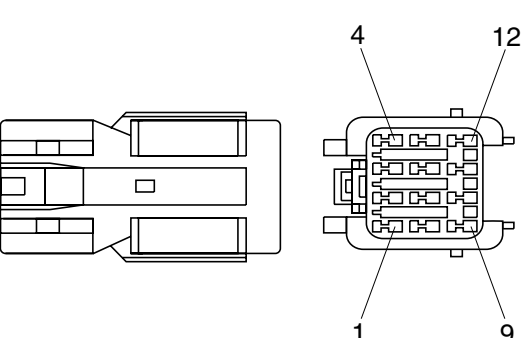
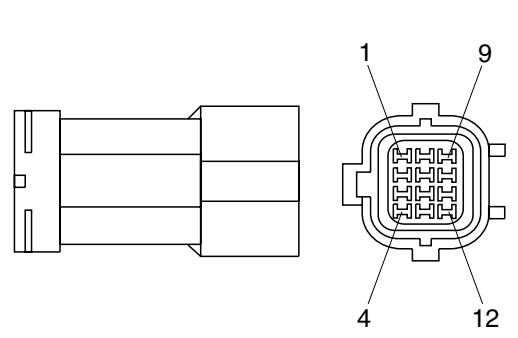
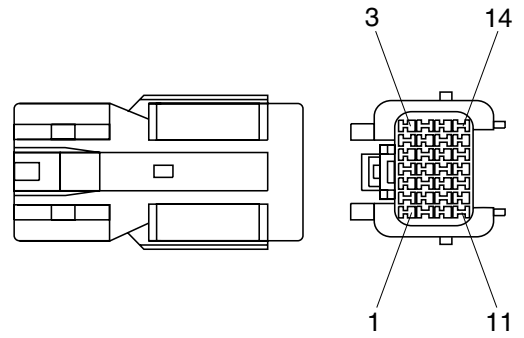
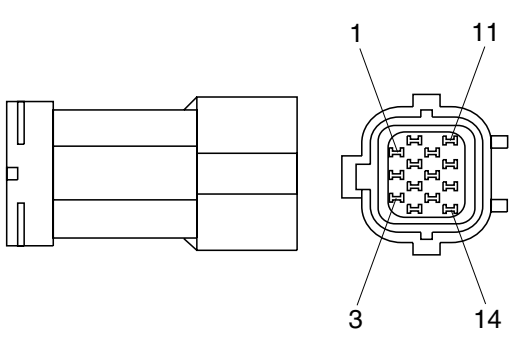
The spring(10) works on the case(1) and spring seat(8) and tries to return the push rod(14) to the zero-displacement position irrespective of the output pressure, securing its resetting to the center position.

This also has the effect of a reaction spring to give appropriate control feeling to the operator.

# CHARGING CIRCUIT



45074EL07

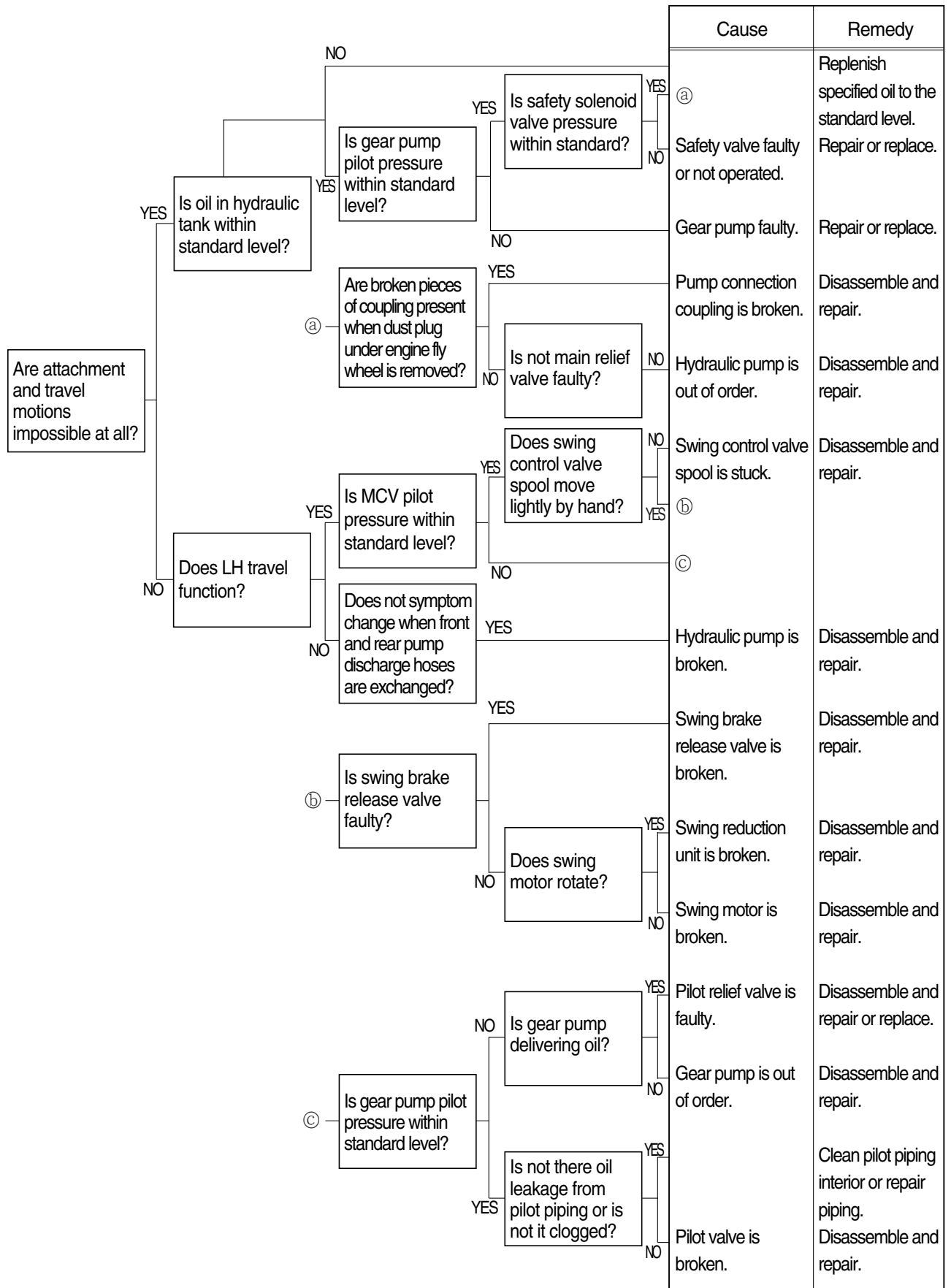
No. of pin	Receptacle connector(Female)	Plug connector(Male)
6	 <p>S814-006000</p>	 <p>S814-106000</p>
8	 <p>S814-008000</p>	 <p>S814-108000</p>
12	 <p>S814-012000</p>	 <p>S814-112000</p>
14	 <p>S814-014000</p>	 <p>S814-114000</p>



Fault code No.	Reason	Effect(only when fault code is active)
386	High voltage detected on the ECM voltage supply line to some sensors (VSEN 1 supply).	Engine is derated to no air setting.
387	High voltage detected on the ECM voltage supply line to the throttle(VTP supply).	Engine will only idle.
415	Oil pressure signal indicates oil pressure below the very low oil pressure engine protection limit.	Progressive power derate with increasing time from alert. If engine protection shutdown feature is enabled, engine will shut down 30 seconds after red lamp starts flashing.
418	Water has been detected in the fuel filter.	Possible white smoke, loss of power, or hard starting.
419	An error in the intake manifold pressure sensor signal was detected by the ECM.	Engine is derated to no air setting.
422	Voltage detected simultaneously on both the coolant level high and low signal circuits OR no voltage detected on both circuits.	No engine protection for coolant level.
426	Communication between the ECM and the J1939 data link has been lost.	None on performance. J1939 devices may not operate.
428	High voltage detected at water-in-fuel sensor.	None on performance.
429	Low voltage detected at water-in-fuel sensor.	None on performance.
431	Voltage detected simultaneously on both the idle validation off-idle and on-idle circuits.	None on performance.
432	Voltage detected at idle validation on-idle circuit when voltage at throttle position circuit indicates the pedal is not at idle OR voltage detected at idle validation off-idle circuit when voltage at throttle position circuit indicates the pedal is at idle.	Engine will only idle.
433	Voltage signal at intake manifold pressure circuit indicates high intake manifold pressure but other engine characteristics indicate intake manifold pressure must be low.	Derate to no air setting.
434	Supply voltage to the ECM fell below 6.2 VDC for a fraction of a second OR the ECM was not allowed to power down correctly (retain battery voltage for 30 seconds after key off).	Possible no noticeable performance effects OR possibility of engine dying OR hard starting. Fault information, trip information and maintenance monitor data may be inaccurate.
435	An error in the oil pressure sensor signal was detected by the ECM.	None on performance. No engine protection for oil pressure.
441	Battery voltage below normal operating level.	Possible no noticeable performance effects OR possibility of rough idle.
442	Battery voltage below normal operating level.	None on performance.
443	Low voltage detected on the ECM voltage supply line to the throttle(s) (VTP supply).	Engine will only idle.
489	Auxiliary speed frequency on input pin indicated that the frequency is below a calibration dependent threshold.	Engine will only idle.
527	Less than 17.0 VDC detected at the dual output A signal pin of the 31-pin machine connector.	No action taken by the ECM.
528	Less than 17.0 VDC detected at the dual output B signal pin of the 31-pin machine connector.	No action taken by the ECM.
529	Less than 17.0 VDC detected at the dual output B signal pin at the ECM.	No action taken by the ECM.
551	No voltage detected simultaneously on both the idle validation off-idle and on-idle circuits.	Engine will only idle.
581	High voltage detected at the fuel inlet restriction sensor signal pin.	Fuel inlet restriction monitor deactivated.

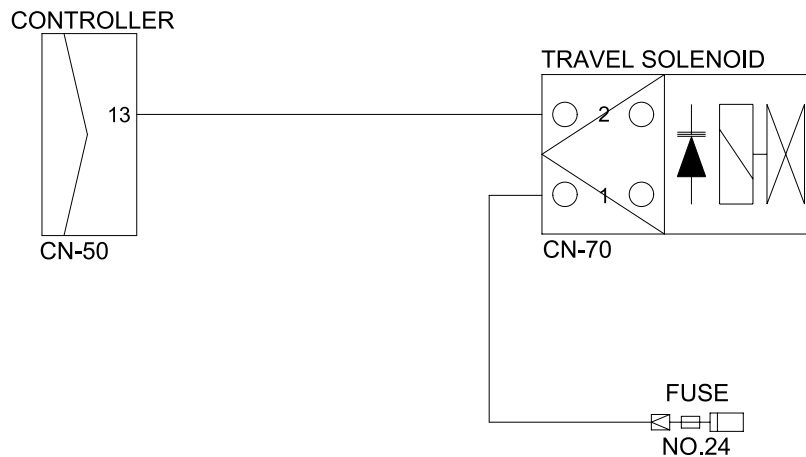
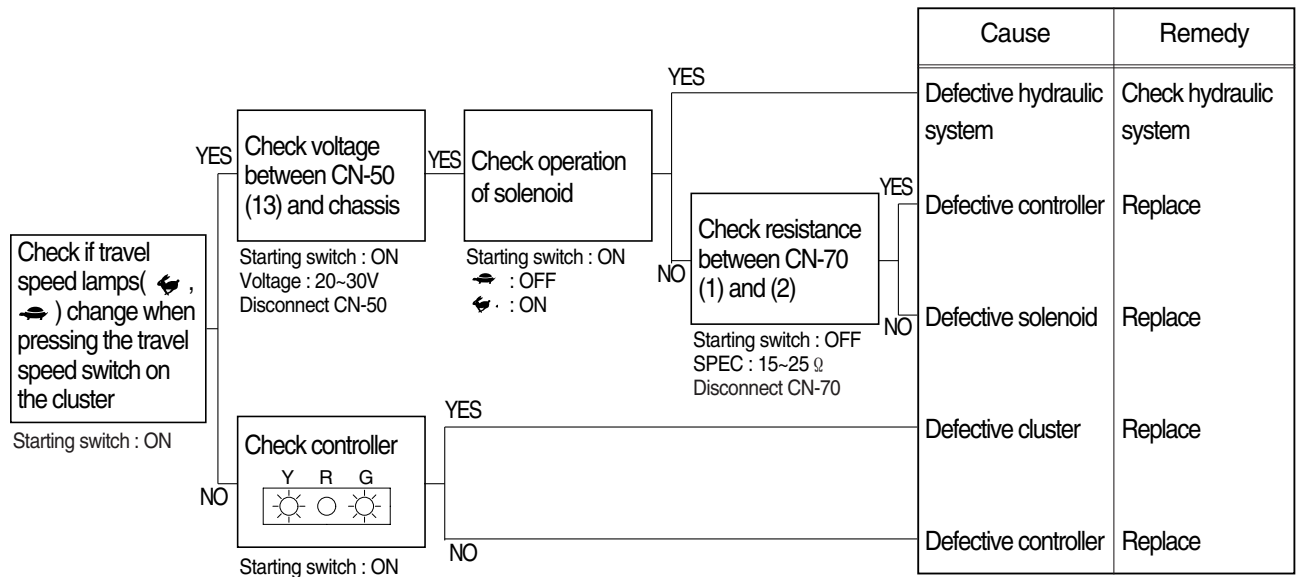
## 4. SWING SYSTEM

### 1) BOTH LH AND RH SWING ACTIONS ARE IMPOSSIBLE



## 11. WHEN TRAVEL SPEED 1, 2 DOES NOT OPERATE

- Before disconnecting the connector, always turn the starting switch OFF.
- Before carrying out below procedure, check all the related connectors are properly inserted and short of fuse No.24 .
- After checking, insert the disconnected connectors again immediately unless otherwise specified.



45076ES03

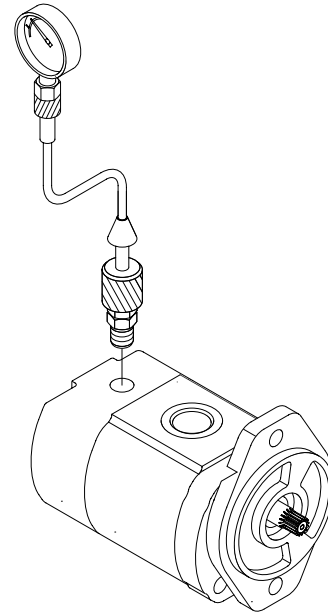
### 13) PILOT PRIMARY PRESSURE(#0464~)

#### (1) Preparation

- ① Stop the engine.
- ② Remove the top cover of the hydraulic tank oil supply port with a wrench.
- ③ Loosen and remove plug on the pilot pump delivery port and connect pressure gauge.
- ④ Start the engine and check for oil leakage from the port.
- ⑤ Keep the hydraulic oil temperature at  $50 \pm 5^{\circ}\text{C}$ .

#### (2) Measurement

- ① Select the following switch positions.
  - Mode selector : M mode
  - Auto decel switch : OFF
- ② Measure the primary pilot pressure in the H mode.



50077MS01

#### (3) Evaluation

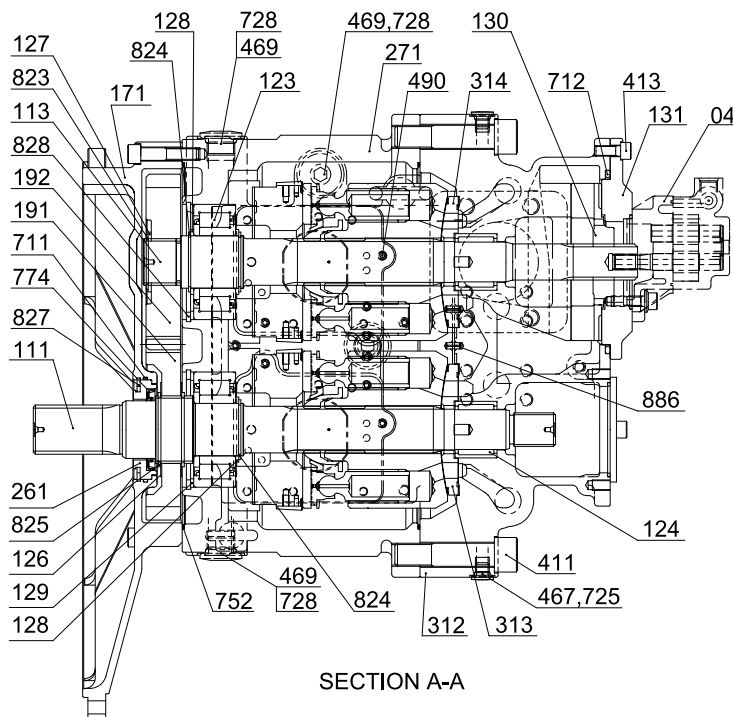
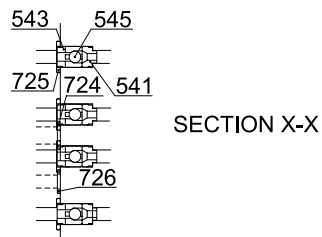
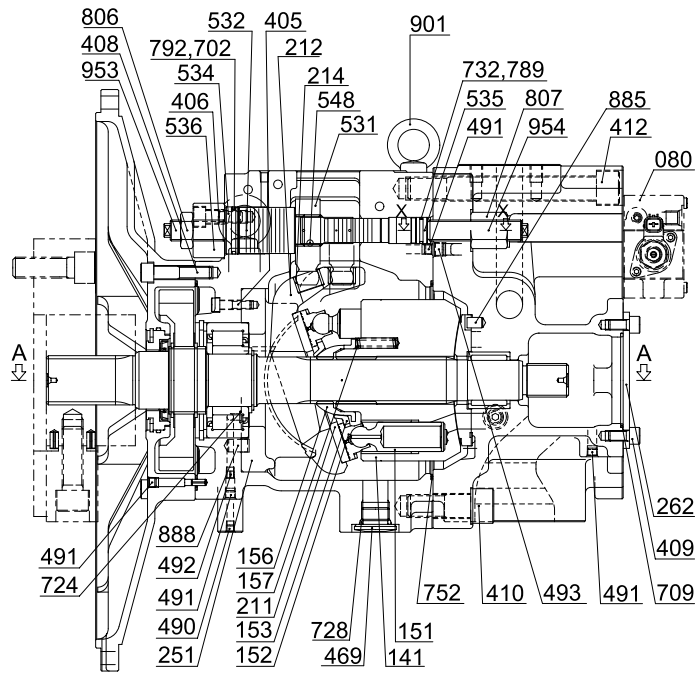
The average measured pressure should meet the following specifications:

Unit :  $\text{kgf} / \text{cm}^2$

Model	Engine speed	Standard	Allowable limits	Remarks
R450LC-7	M mode	$35 \pm 5$	-	

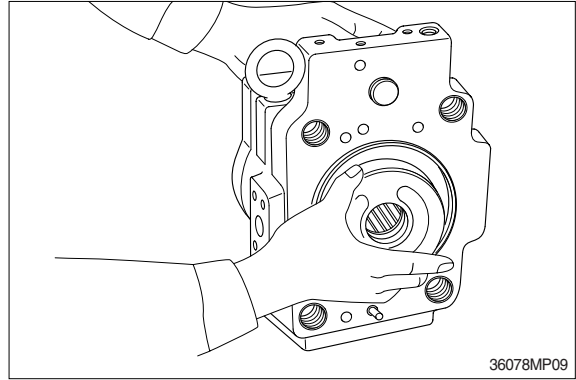
## 2. MAIN PUMP(1/2)

### 1) STRUCTURE



(14) Remove valve plates(313, 314) from valve cover(311, 312).

- ※ These may be removed in work 7, 9.

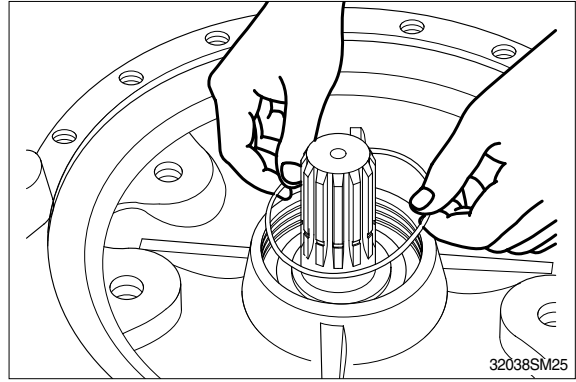


(15) If necessary, remove stopper (L, 534), stopper(S, 535), servo piston(532) and tilting pin(531) from pump casing(271), and needle bearing(124) from valve cover(311, 312).

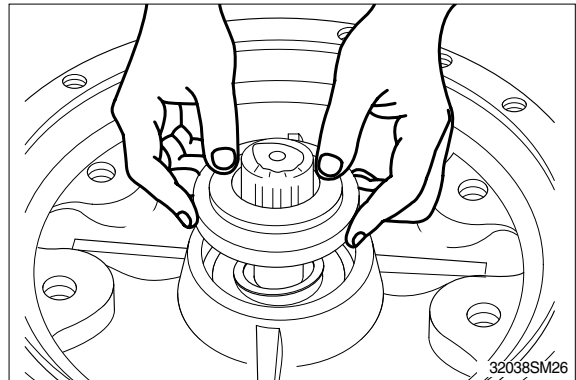
- ※ In removing tilting pin, use a protector to prevent pin head from being damaged.
- ※ Since loctite is applied to fitting areas of tilting pin and servo piston, take care not to damage servo piston.
- ※ Do not remove needle bearing as far as possible, except when it is considered to be out of its life span.
- ※ Do not loosen hexagon nuts of valve cover and swash plate support.  
If loosened, flow setting will be changed.

(16) This is the end of disassembling procedures.

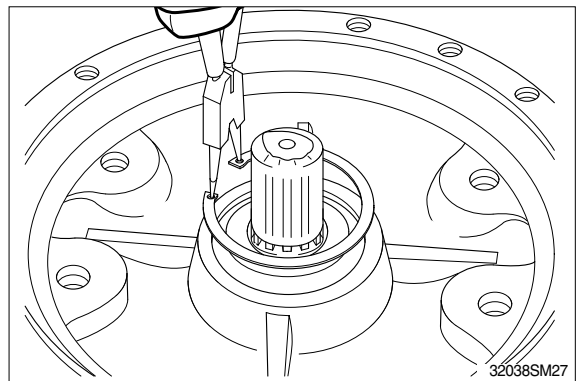
(4) Tack O-ring(471) to the casing(301).



(5) Reassemble the front cover(304) to the casing(301).  
※ Apply grease to the rib of oil seal to avoid damage to the rib.



(6) Install the snap ring(437) to the casing (301).



(7) Insert the shoe plate(124) with the casing (301) position horizontally.

