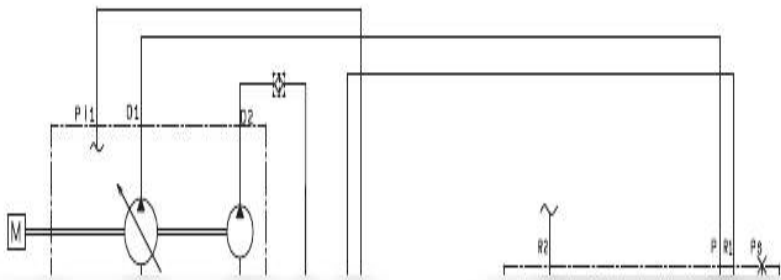


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22.2.2 E80BMSR:STANDARD SPECIFICATION



OFFSET SPECIFICATION		YT01Z00091P1	
No.	NAME	PART No.	MODEL No.
50	CONTROL VALVE ASSY	LF30V00005F4	ik18-9508
51	CONTROL VALVE	YT01Z00010F4	ik18-9508

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2. SPECIFICATIONS

2.5 SPECIFICATIONS AND PERFORMANCE

2.5.1 SPEED AND CLIMBING CAPABILITY

Item / Model	E80BMSR
Swing speed : min-1 {rpm}	11.5 {11.5}
Travel speed (1-speed/2-speed) : km/h	2.8 / 5.3
Gradeability : % (degree)	70 (35)

2.5.2 ENGINE

Engine model	ISUZU AU-4LE2X
Type	Water-cooled, 4-cycle, direct injection type diesel engine with intercooler turbo-charger
Number of cylinders-BoreXStroke	4-85 mm X 96 mm (3.35 in X 3.78 in)
Total displacement	2,179 cc (133 cu-in)
Rated output / Engine speed	net 41 kW / 2,200 min ⁻¹ (56 PS / 2,200 rpm) (ISO 9249) net 42 kW / 2,200 min ⁻¹ (57 PS / 2,200 rpm) (ISO 14396)
Maximum torque / Engine speed	net 200 N-m (148 lbs-ft) / 1,600 min ⁻¹ (ISO 9249) net 211 N-m (156 lbs-ft) / 1,600 min ⁻¹ (ISO 14396)
Starter	24 V / 3.2 kW
Alternator	24 V / 0.72 kW

2.5.3 HYDRAULIC COMPONENTS

Hydraulic pump	Variable displacement axial piston + gear pump
Hydraulic motor (swing)	Axial piston motor
Hydraulic motor (travel)	2-speed axial piston motor
Control valve	8-spool control valve
Cylinder (Boom, arm, Bucket and Dozer)	Double action cylinder
Oil cooler	Air-cooled type

2.5.4 WEIGHT

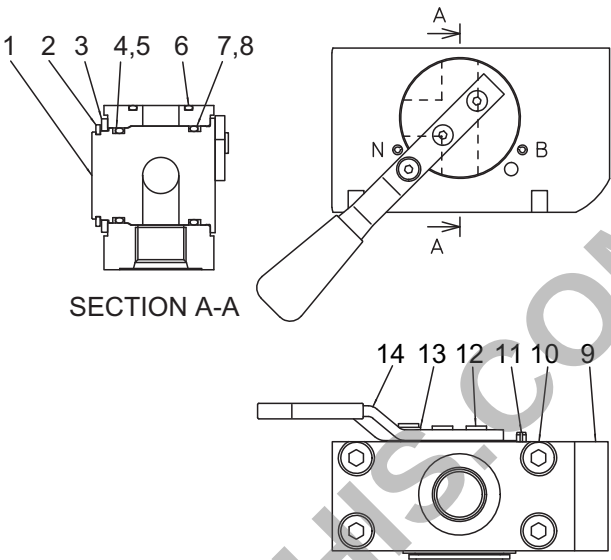
Unit : kg (lbs)

Fully equipped weight	8,730 (19,250)
Upper structure	4,470 (9,860)
Lower machinery (With 450 mm (17.7 in) grouser shoe)	2,830 (6,240)
Attachment [Boom + 2.13m (7ft-0in) Arm + 0.22m ³ (0.29 cu-yd) bucket]	1,200 (2,650)

24. COMPONENTS SYSTEM

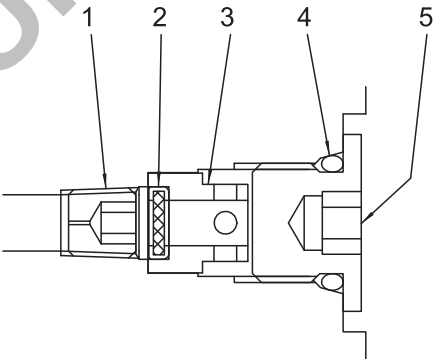
3. Selector valve

No.	PARTS	Q'TY
1	ROTER SPOOL	1
2	RETAINING RING	1
3	SPACER	1
4	BACKUP RING	1
5	O-RING	1
6	O-RING	1
7	O-RING	1
8	BACKUP RING	1
9	MANIFOLD	1
10	SOCKET BOLT	4
11	SPRING PIN	2
12	SOCKET BOLT	3
13	WASHER	1
14	LEVER	1



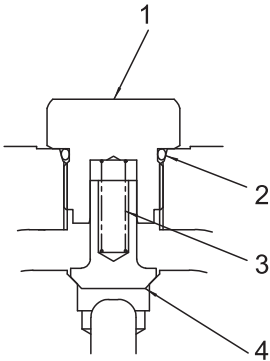
4. LS orifice

No.	PARTS	Q'TY
1	ORIFICE	1
2	FILTER	1
3	FILTER GUIDE	1
4	O-RING	1
5	CAP	1



5. Load check valve

No.	PARTS	Q'TY
1	CAP	1
2	O-RING	1
3	SPRING	1
4	CHECK	1

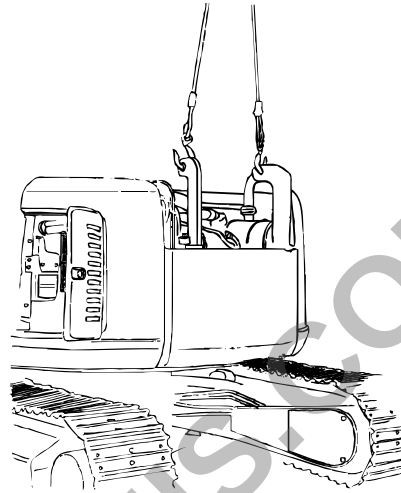


33. UPPER SLEWING STRUCTURE

33.1.11 COUNTERWEIGHT

33.1.11.1 PREPARATION FOR REMOVAL

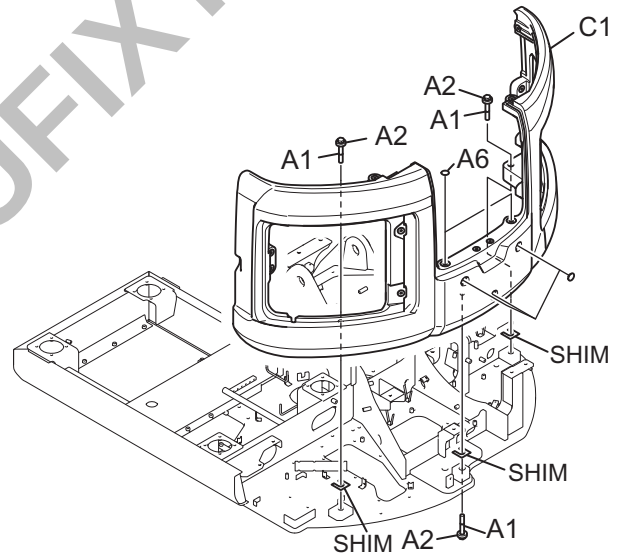
- (1) Removing bonnet assy (3-2).
Remove bonnet on engine. (See 33.1.4.2(7))
- (2) Removing bonnet assy (3-1). (33.1.4.2(8))
- (3) Preparing slinging jig
Remove plug (A6), and attach weight slinging jig
(See Chapter Tools.) to counterweight.
Tools: Spanner: 36mm



Lifting up counterweight

33.1.11.2 REMOVAL

- (1) Lifting up counterweight temporarily
Hook wire rope to slinging jig, and lift it and stretch wire rope to the degree where it is providing no slack temporarily.
Weight of counterweight : Approx. 840 kg (1850 lbs)
Wire more than $\varnothing 10$ (0.394") : 1.5 m (4 ft 11 in) X 2 pcs.
- (2) Removing counterweight
 1. Remove 3 capscrews (A1) M20X130.
Tools: Socket: 30mm
 2. Remove shim.



Removing counterweight

33.1.11.3 INSTALLATION

- (1) Install counterweight in the reverse procedure of removing.
- (2) Install shim as it was
- (3) Slinging counterweight
Check that 3 attaching bolts can be screwed in by hand.
- (4) Apply Loctite #262 on capscrews (A1), and tighten them with washers (A2).
Tools: Socket: 30mm
Tightening torque : 490 N-m (361 lbf-ft)
- (5) Remove slinging tools, and attach plugs (A6).



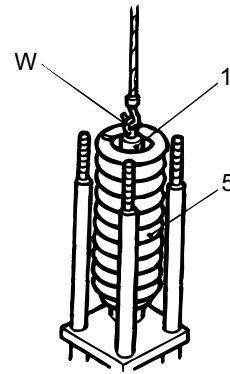
Attaching bolts counterweight

34. TRAVEL SYSTEM

9. Removing spring (5), grease cylinder (1)

Hook lifting eye nut (W) to screw M36 X P3 on grease cylinder (1) top end and hoist it. Then, remove the set of grease cylinder (1) and spring (5) using crane from the jig.

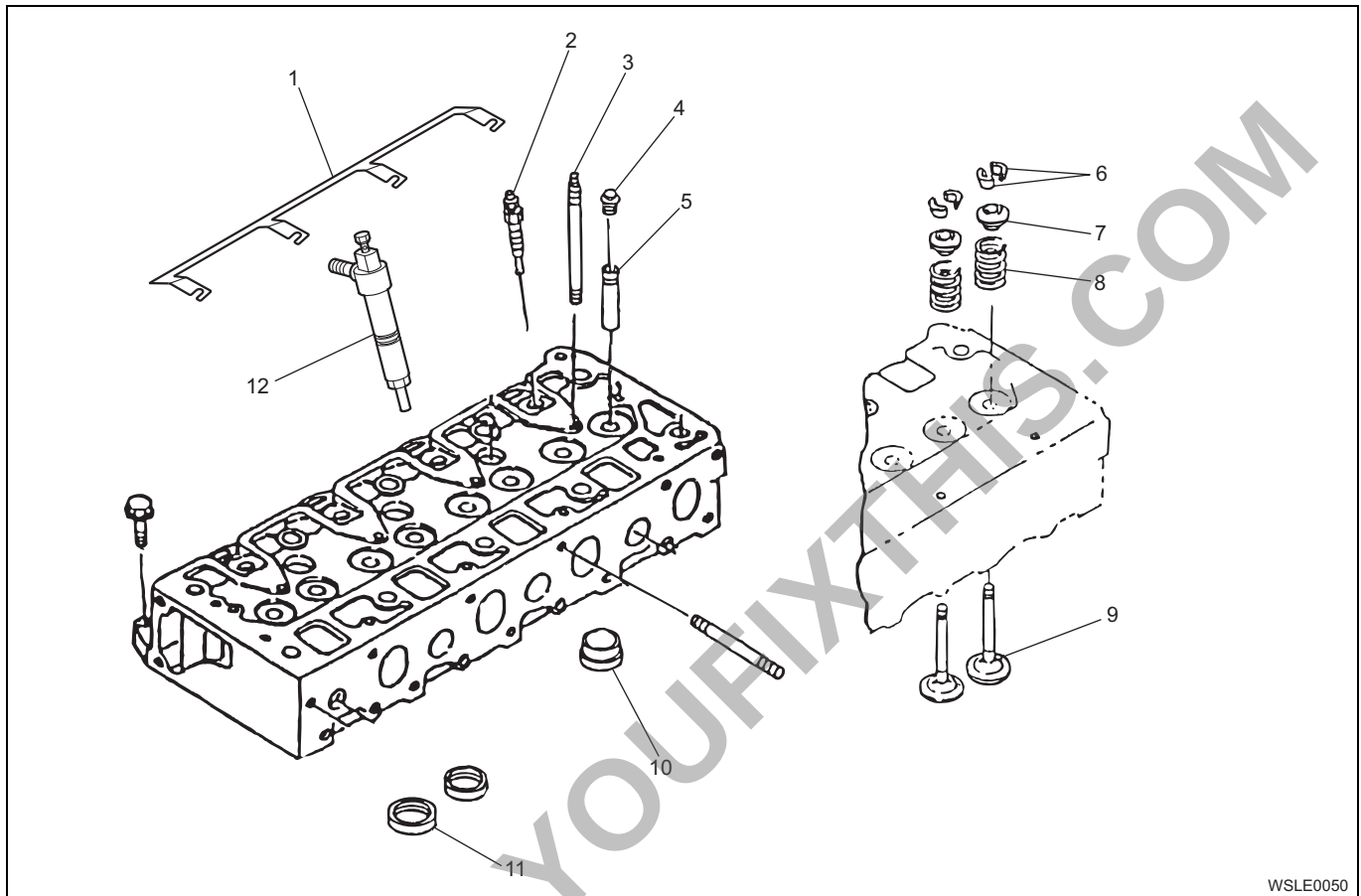
Remove spring (5) and grease cylinder (1), in that order.



Removing spring (5), grease cylinder (1)

Cylinder Head

Components



WSLE0050

Name

- | | |
|--|-----------------------|
| 1. Connector | 7. Spring Seat |
| 2. Glow Plug | 8. Valve Spring |
| 3. Do not extract the five stud bolts since the sealant is attached to them. | 9. Valve |
| 4. Valve Seal | 10. Hot Plug |
| 5. Valve Guide | 11. Valve Seat Insert |
| 6. Split Collar | 12. Nozzle Holder |

AVOID ACCIDENTS

Most accidents, whether they occur in industry, on the farm, at home or on the highway, are caused by the failure of some individuals to follow simple and fundamental safety rules or precautions. For this reason **MOST ACCIDENTS CAN BE PREVENTED** by recognising the real cause and doing something about it before the accident occurs.

Regardless of the care used in the design and construction of any type of equipment there are conditions that cannot be completely safeguarded against without interfering with reasonable accessibility and efficient operation.

Carefully read indications, cautions and safety warning quoted in the "SAFETY RULES" section.

A careful operator is the best insurance against an accident.

The complete observance of one simple rule would prevent many thousand serious injuries each year.

That rule is:

Never attempt to clean, oil or adjust a machine while it is in motion.

ATTENTION

On machines having hydraulically, mechanically and/or cable controlled equipment (such as shovels, loaders, dozers, scrapers etc.) be certain the equipment is lowered to the ground before servicing, adjusting and/or repairing.

If it is necessary to have the equipment partially or fully raised to gain access to certain items, be sure the equipment is suitably supported by means other than the hydraulic lift cylinders, cable and/or mechanical device used for controlling the equipment.

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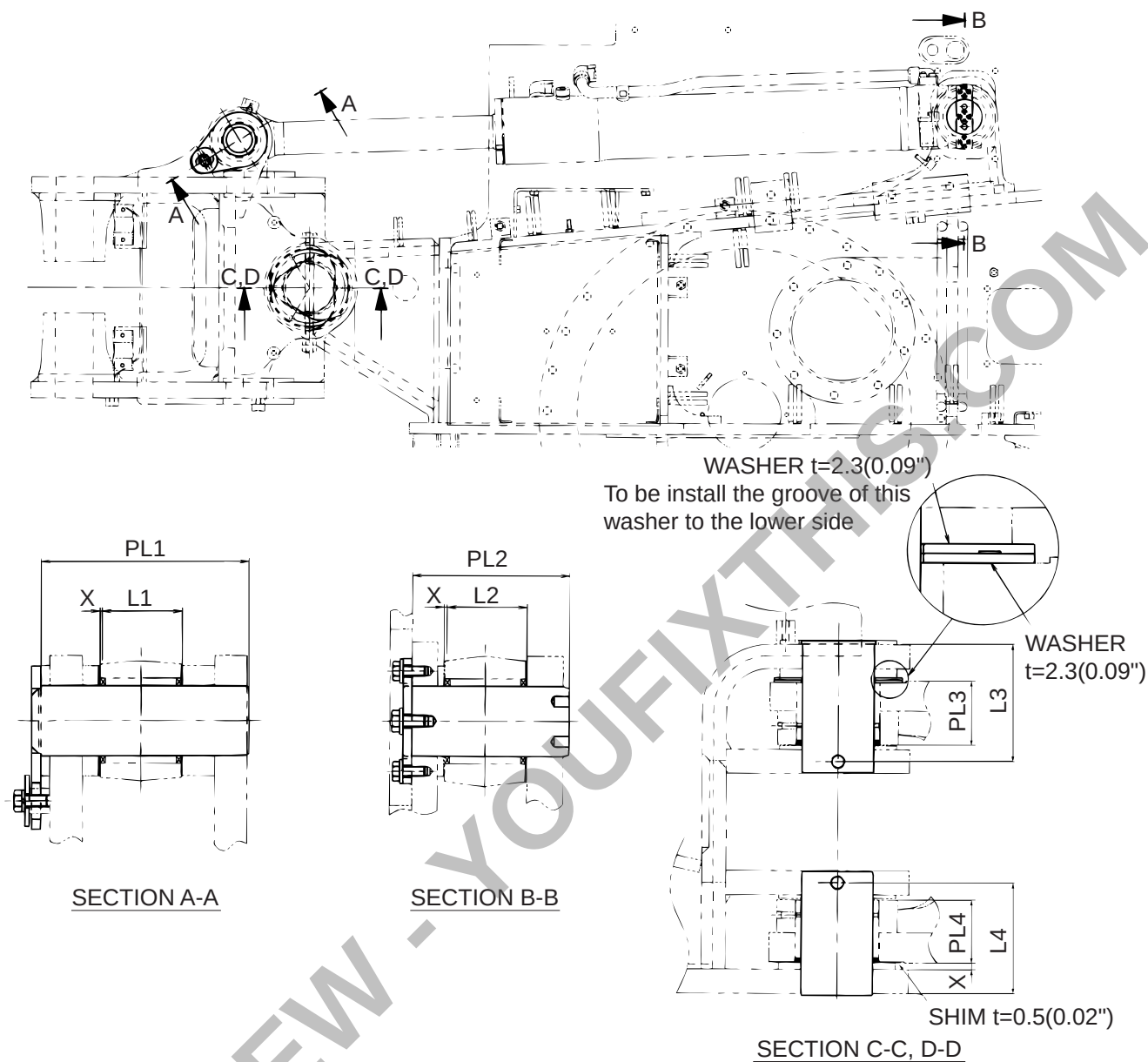
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3. ATTACHMENT DIMENSIONS

(2) Clearance in thrust direction



Clearance in thrust direction

13. MAINTENANCE STANDARD AND TEST PROCEDURE

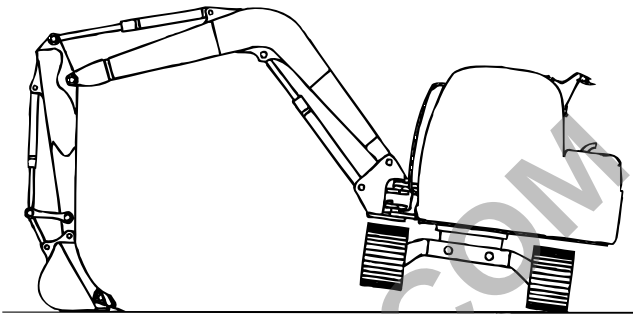
13.5 MEASURING TRAVEL PERFORMANCES

13.5.1 TRAVEL SPEED

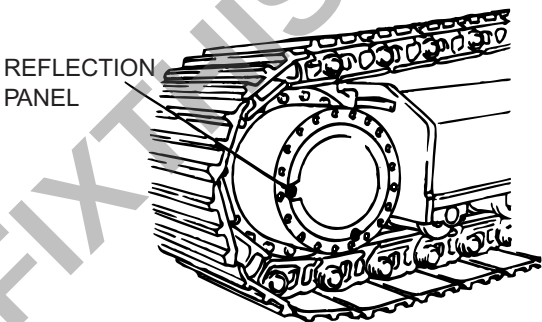
(1) Purposes
Measure the travel sprocket revolution and confirm the performances between the hydraulic pump and the travel motor of the travel drive system.

(2) Conditions
Hydraulic oil temperature;
45 to 55C degrees (113 to 131F degrees)
Crawler on the right and left sides are tensioned evenly.

(3) Preparation
Attach the reflection panel with a magnet to the travel motor cover.
Swing the swing frame through 90 degrees as shown in upper right Fig. and make the crawler on one side take off the ground, using the attachment.



One side lifted position



Adhering position of reflection panel

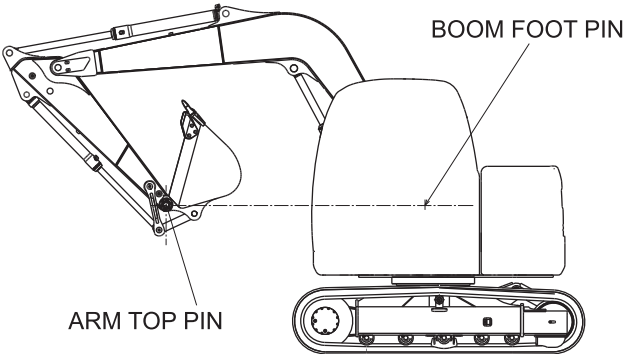
(4) Measurement
Engine revolution; Hi idle
2-speed travel switch; 1st speed and 2nd speed
Measuring points; Right and left
Method, example 1;
Measure revolution with a stroboscope
Method, example 2;
Measure the revolutions per minute visually.

Sprocket revolution				Unit : rpm
Measurement item		Standard value	Repairable level	Service limit
RH & LH	H1	33.0~28.0	25.7~21.8	20.4or less
	H2	62.5~52.5	48.8~41.0	38.5or less

13.5.2 DEVIATION OF TRAVEL

(1) Purpose
Measure the amount of deviation at 20 (66 t) travel and confirm the horizontal balance between the hydraulic pump and the travel motor of the travel drive system.

(2) Condition
Hydraulic oil temperature;
45 to 55C degrees (113 to 131F degrees)
RH and LH crawler are tensioned evenly.
Firm, level ground
Engine revolution; Hi idle



Travel position

22.3 HYDRAULIC CIRCUIT OPERATION

22.3.1 COLOR CODING STANDARD FOR HYDRAULIC

Blue :
Feed, drain circuit
less than 0.34 MPa(50 psi)

Green :
Return, make-up circuit,
0.34~0.59 MPa(50~85 psi)

Purple :
Secondary pilot pressure,
0.59~3.5 MPa(85~508 psi)

Red :
Primary pilot pressure,
3.5~5.0 MPa(508~ 725 psi)

Orange :
Main pump drive pressure,
3.5~29.4 MPa(508~4270 psi)

Brown :
Load sensing pressure, 0~29.4 MPa(0~4270 psi)

Blue tone :
At valve selection

Red valve :
When proportional valve (reducing) is operating

Red solenoid :
In active and exciting

Displaying the flow circuit and standby circuit when operating.

Regarding the electrical symbols in this manual, refer to the electric circuit diagram.

22.3.2 NEUTRAL CIRCUIT

22.3.2.1 SAFETY LOCK LEVER AND PILOT CIRCUIT

- (1) Purpose
To protect attachment from unexpected operation for safety.
- (2) Principle
Cut pressure source of pilot valve for operation.
- (3) Operation
After engine starts, push down the safety lock lever, the solenoid valve (SV-4) of the proportional valve block (13) is functioned, and the pilot operation circuit is actuated.

22.3.2.2 PUMP CONTROL

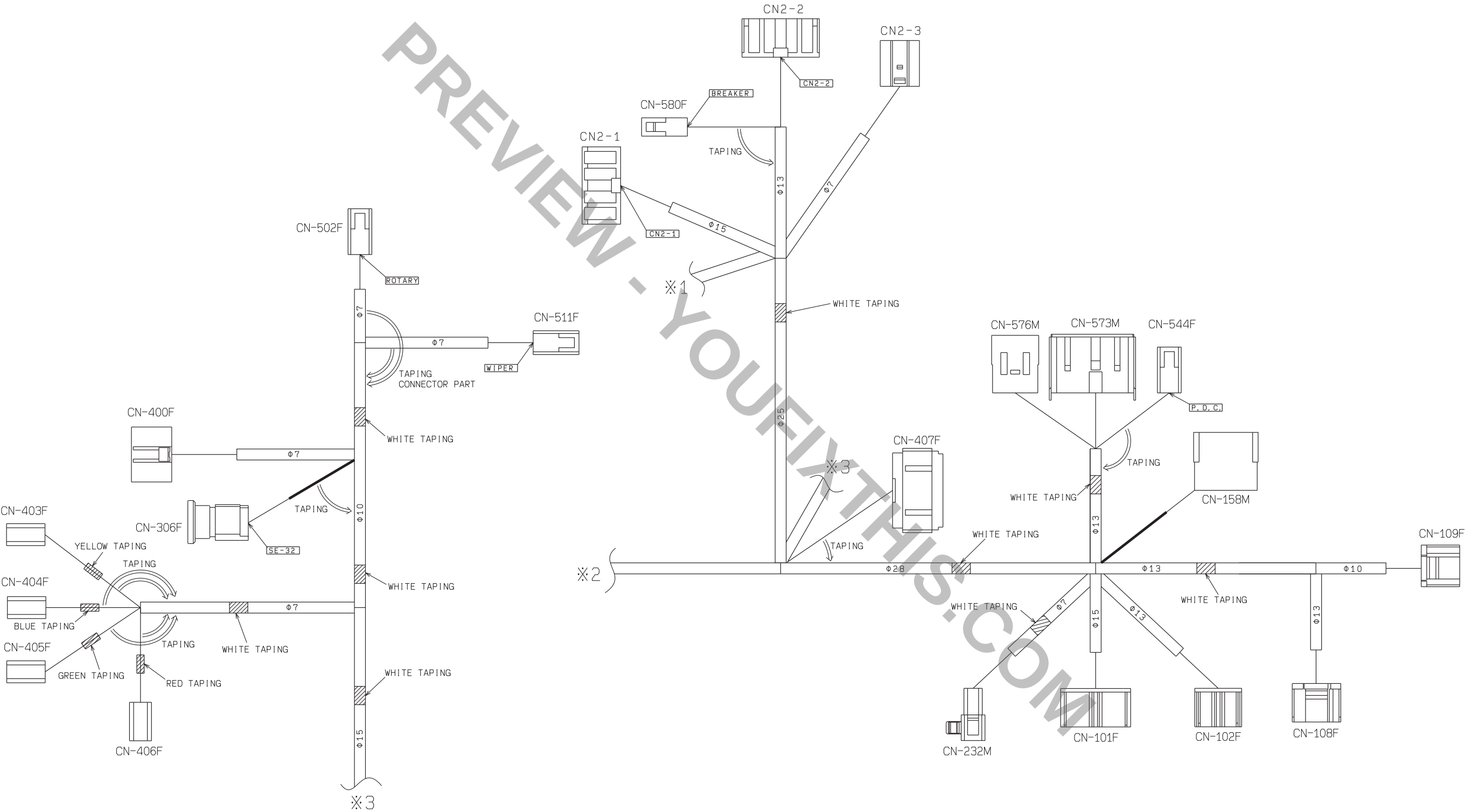
- (1) Operation
1. Pump delivery oil is delivered from D1 port and flows into P port of C/V (2). This oil branches off to the flow control valve (A-1) and to P-T passage of each spool, and return to the tank.
This return oil flows via negative control orifice (A-2), and the negative control pressure is generated, and the oil flows from Pn port to Pi1 port of the pump. Consequently, the negative control pressure pushes the piston U (A-3). On the other hand, tank pressure is led from Pr port to Pb port of the pump, this pressure pushes piston (back pressure compensation) to the reverse direction of piston U (A-3).
The difference of thrust between two pistons pushes the piston rod (A-5). And the self pressure leads the power piston (A-6) to the power piston chamber (A-7). This motion of piston adjusts the tilting angle of swash plate in accordance with negative control pressure.

22.3.2.3 FLOW CONTROL VALVE

- (1) When the actuator is operated, the pressurized delivery oil from the pump flows via the opening of the meter-in of spool, and is fed to the actuator.
- (2) Simultaneously, the working pressure of actuator, namely the load sensing pressure (hereinafter called LS pressure), is generated.
This LS pressure acts on the spring chamber of the flow control valve (A-1).
- (3) Simultaneously, the pump delivery pressure is led to the opposite side of the spring chamber of the flow control valve.

- (4) The pump pressure is regulated to become the "Load sensing pressure + spring force" with the flow control valve. In this way the differential pressure between the pump pressure and the LS pressure is kept constant. And the before and after differential pressure of meter-in and meter-out are kept constant.
Consequently, the flow rate in accordance with the opening area is fed to the actuator.

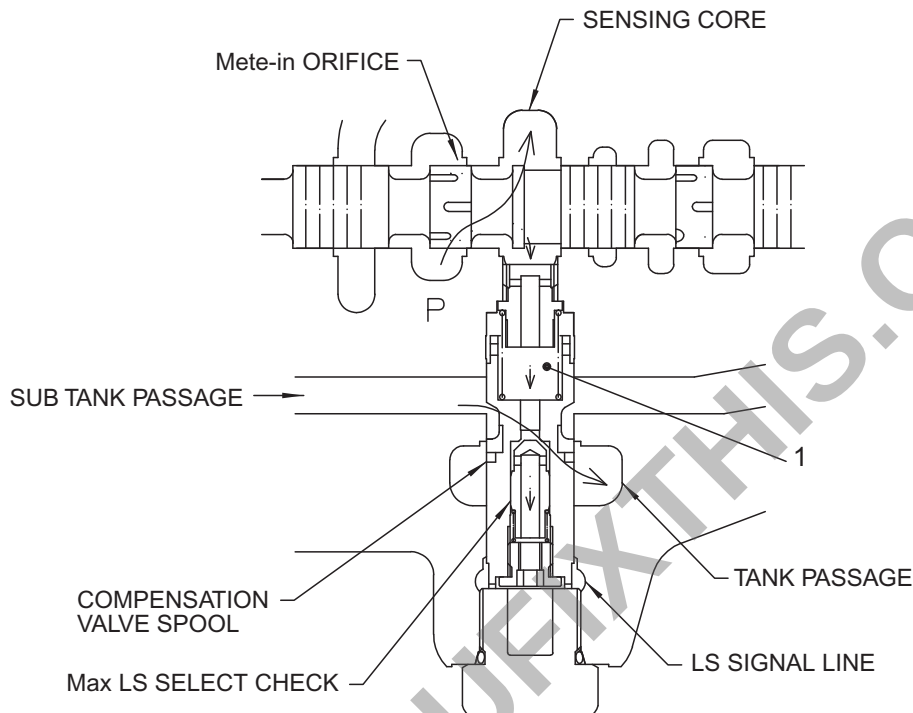
23.3.7.1 FLOOR HARNESS (1/3) : LF13E01057P2



4) Pressure compensation valve (Dozer, Boom, Bucket)**a. In single operation**

The pressure of sensing core (Pressure oil of the downstream from Meter-IN orifice) opens LS select check valve inside of compensation valve spool and flows into LS signal line.

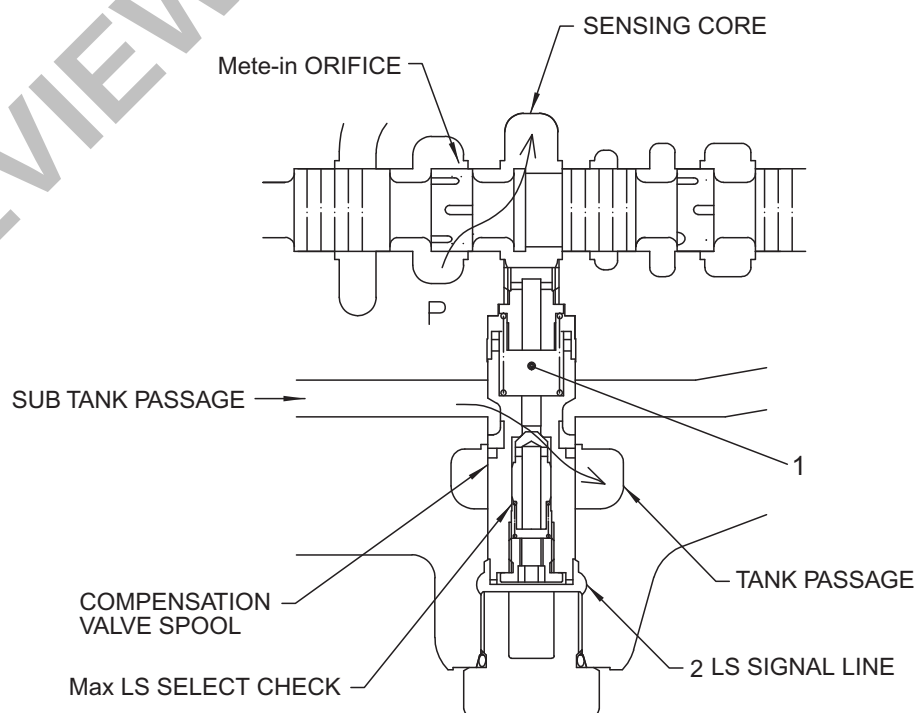
The compensation valve spool is pushed to lower position by the spring force of chamber 1 and therefore the opening between sub tank passage and tank passage is maximized.

**b. In combined operation (In light load section)**

When Max. LS pressure (Max. load pressure in other section) flows into chamber 2, LS select check valve closes, and compensation valve spool moves upward and controls the opening between sub tank passage and tank passage.

The compensation valve spool is held so that the pressure of chamber 1 and chamber 2 is equal.

The delivery oil from pump is distributed to each section regardless of each load pressure.



HYDRAULIC CYLINDER CONSTRUCTION (See construction of arm cylinder Fig.)

The hydraulic cylinder is composed of three sections, cylinder tube assy (1), piston rod assy to transmit the motion of piston (16) stroke in the tube, a rod cover (3) which serves as the cover and guide. Also, the cylinder tube assy and piston rod assy (2) have piston mounting section (clevis) which are used to connect the other device. And, in addition to these principal parts, seal ring assy (17), slide ring (18) and piston rod assy (2), buffer ring (6), U-RING (7), and wiper ring (8) between piston rod assy (2) and rod cover (3), and O ring and backup ring between cylinder tube assy (1) and rod cover (3).

24.1.8.2.2 OPERATION

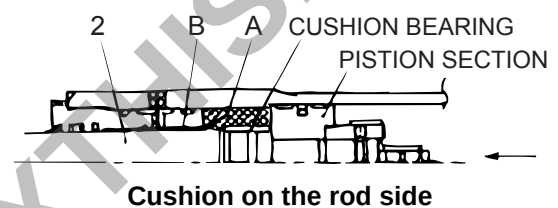
By feeding pressure oil through oil inlet and outlet on cylinder alternately, the oil pressure exerts on the piston, and piston rod assy (2) starts moving the telescopic motion (stroke).

(1) Operation of cylinder with cushion

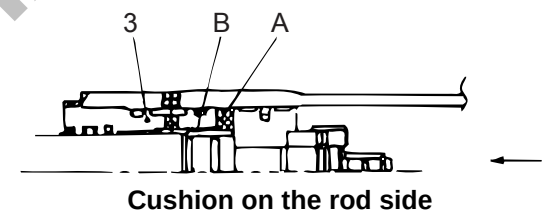
The hydraulic cylinder contains a shock absorber to shock generated when the moving piston rod assy (2) strikes rod cover (3) without speed reduction.

(Cushion on rod side)

When pressurizing the rod cover side, the oil in (A) chamber returns to the tank in constant speed through passage (B) in the midway of stroke. (See the right Fig.)

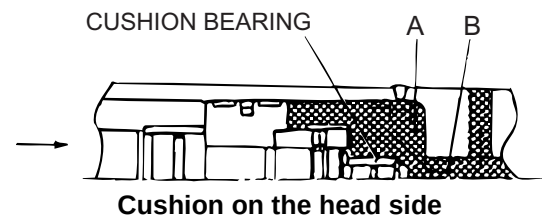
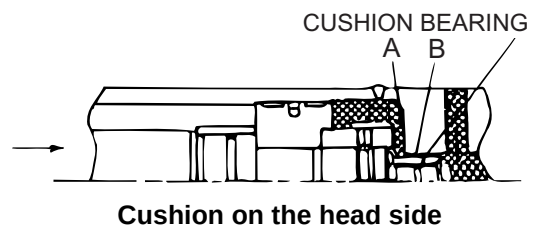


As the end of the stroke approaches, the cylinder bearing enters into passage (B), and the passage (B) is throttle reducing oil quantity. As a result, the speed of piston rod is also lowered. (See the right Fig.)



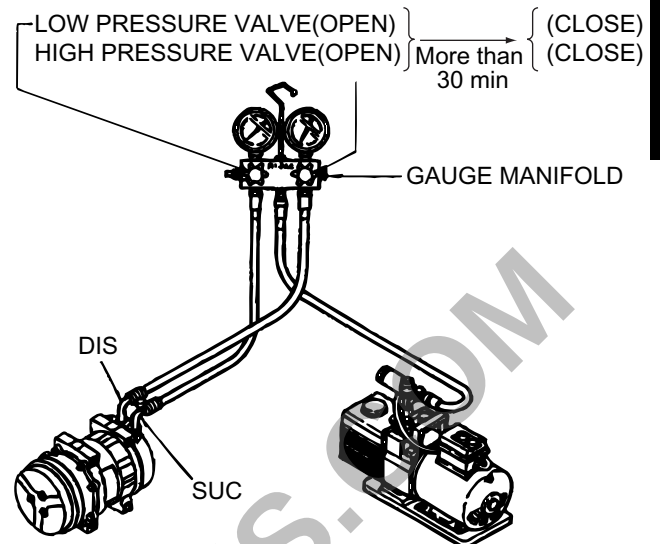
(Cushion on head side)

Like the cushion on the rod side, the piston end of the piston rod enters into the cushion bearing, and passage (B) is throttled. As a result, as the return oil level for (A) chamber lowers, the speed of piston rod lowers, obtaining the effect of cushion. (See the right Fig.)



(2) Vacuum making (See right Fig.)

1. Open the high pressure valve (HI) and the low pressure valve (LO) of the gauge manifold.
2. Turn on the switch of the vacuum pump and make vacuum for more than 30 minutes.
3. When vacuum making for a specified duration is over (degree of vacuum : less than - 750 mmHg), close the high pressure valve and the low pressure valve of the gauge manifold.
4. Then turn off the vacuum pump.

**Vacuum making operation****(3) Air-tightness Check**

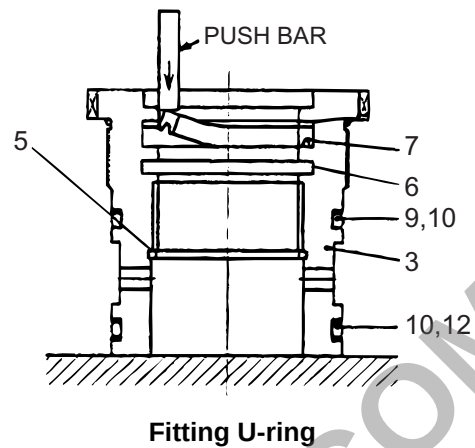
Close the high pressure valve and the low pressure valve of the gauge manifold, leave it as it is for more than five minutes and make sure that the gauge indication does not return toward 0.

CAUTION

If the gauge indication goes toward 0, there is somewhere that is leaking. Retighten pipe joints, make vacuum again and make sure of no leakage.

32. ATTACHMENTS

- (2) Fit snap ring (5).
- (3) Apply hydraulic oil on U-ring (7) and fit it on the U-ring groove.



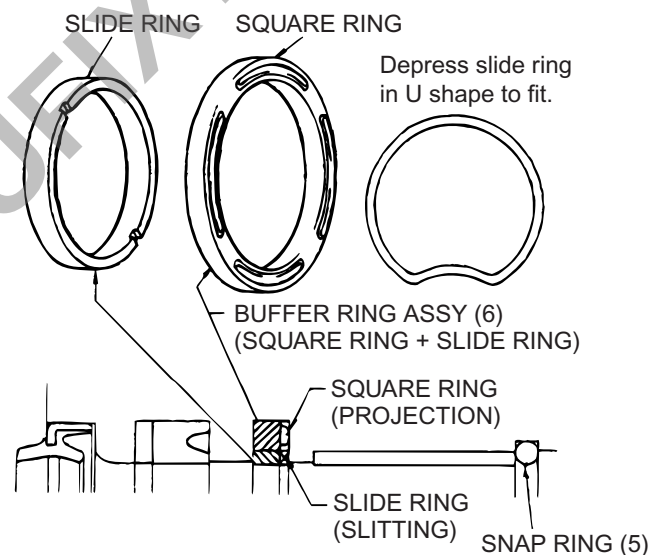
Note

- The U-ring is harder than other seals, so fit it in the groove by hand first, then press in with pushing bar until it is fitted with a click.
- Fitting U-ring paying attention to the direction.
- After fitting U-ring (7), check that they are free from the permanent set.

(4) Installing buffer ring assy

Buffer ring assy (6) is equipped with square ring and slide ring.

1. Fit square ring on the groove.
2. Depress slide ring in U shape by hand to house it in groove, and fit it pushing out to periphery.



Installing buffer ring assy (6)

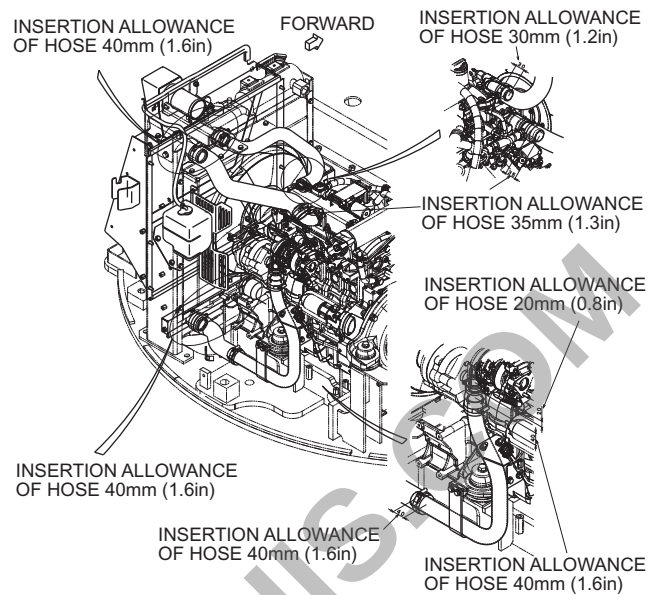
Note

- Depress it R 6 mm (0.24 in) or more, because if the depressed R is too small, it may remain wrinkled.
- After fitting, check that it is free from wrinkles.
- Fit it giving attention to the seal fitting direction. Reverse fitting produces high pressure between U-ring and seal and may cause the deformation of rod cover.
- Fit slide ring so that the groove matches to the root section of square ring.

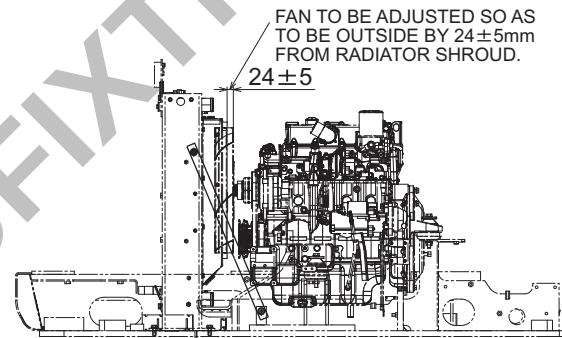
33. UPPER SLEWING STRUCTURE

33.1.12.3 INSTALLATION

- (1) Installing is done in the reverse order of removing.
And removed clips of hose should be clamped at original position.
- (2) Install radiator assy
Place a wire sling in the lifting eyes of the radiator and move it to original position temporally. And install hydraulic hose, radiator hose and hose of inter-cooler. Regarding Inserting width of hose. (See right Fig.)
- (3) Radiator attaching bolt
Apply Loctite #262 on 4 semsbolts (A2) M12X30.
Tools: Socket: 19mm
Tightening torque : 121 N-m (89 lbf-ft)
- (4) Adjust the clearance between the fan and the radiator shroud all around the circumference, as below :
Full circumference:
 $20 \pm 5 \text{ mm}$ ($0.8 \text{ in} \pm 0.2 \text{ in}$)
- (5) Clean the plastering area of the insulation thoroughly before plastering it.
- (6) Making up hydraulic oil and LLC (Long Life Coolant)
After completion of other installation, make up hydraulic oil and water.
Coolant volume of engine body : 2.8 L (0.7gal)
Coolant capacity of radiator : 4.0 L (1.1gal)
Hydraulic oil capacity of oil cooler : 4.1 L (1.1gal)



Inserting width of hose



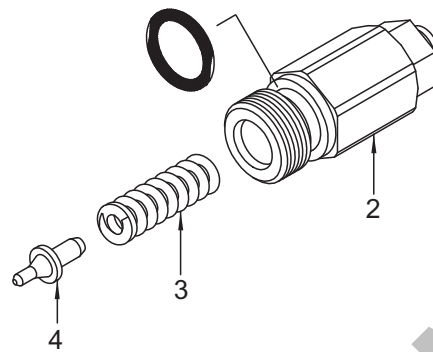
Back-and-forth adjusting position of radiator

33. UPPER SLEWING STRUCTURE

2. Remove cap (2) as a sub-assembly and remove spring (3) and pilot poppet (4).

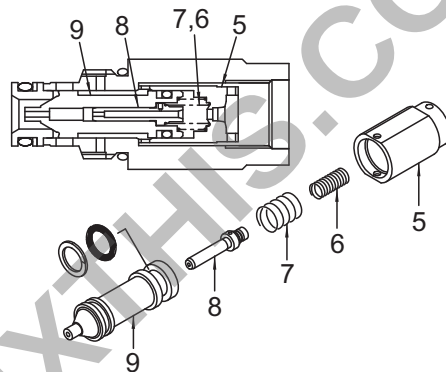
Tools: Allen wrench: 17mm

Tightening torque : 50 N-m (37 lbf-ft)



Removing of cap (2)

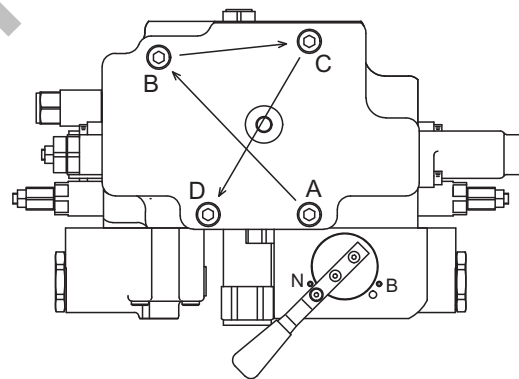
3. Remove pilot seat (5), spring (6) (7), piston (8), and main poppet (9).



(15) Addition of option valve

1. Loosen socket bolt and remove it.

Tools: Allen wrench: 8mm

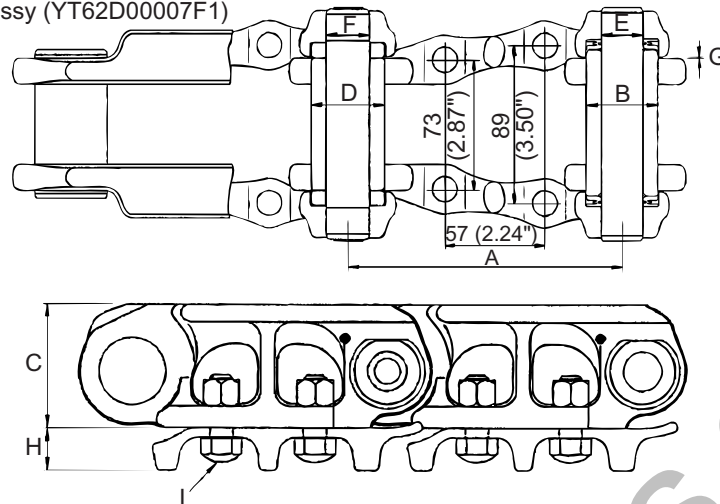


Note

Loosen socket bolts in order of D, C, B, and A.

34.1.2.4 MAINTENANCE STANDARDS

Track link assy (YT62D00007F1)



Unit : mm (in)

No.	ITEM	STANDARD VALUE		REPAIRABLE LEVEL	SERVICE LIMIT	REMEDY	
A	Link pitch	155.6–0.1(6.126–0.0039)		160 (6.30)	164 (6.46)	Replace the link assy if the service limit is exceeded.	
B	O.D. of bushing	□41 ^{+0.214} _{+0.174} (1.6142 ^{+0.0084} _{+0.0069})		□37 (1.46)	□36 (1.42)		
C	Height of link	75–0.15 (2.9528–0.0059)		69 (2.72)	67 (2.64)		
D	Interference between bushing and link	Basic dimension	Tolerance		Fit	Fit	Replace
		□41 (1.6142)	Shaft	+0.214 (+0.0084) +0.174 (+0.0069)	Interference 0.05 (0.0020)	Interference 0	
E	Interference between track pin and link	□24 (0.9449)	Shaft	+0.15 (+0.008) 0 (0)	Interference 0.05 (0.0020)	Interference 0	
F	Interference between master pin and link	□24 (0.9449)	Shaft	-0.05 (-0.0020) -0.08 (-0.0032)	Interference 0.05 (0.0020)	Interference 0	Replace Link
G	Clearance between links (both sides)	1.6 (0.06)		8 (0.32)	10 (0.39)	Replace	
H	STD shoe plate	26 (1.02)		15 (0.59)	13 (0.51)	Replace	
I	Tightening torque of shoe bolt	294 N□m □20 lbt□ft				Retighten	

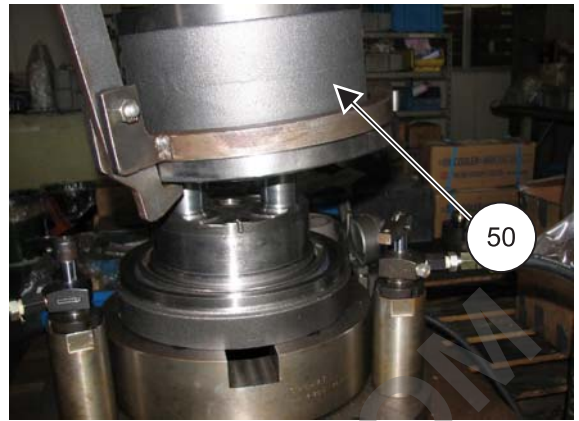
34.1.2.5 TOOLS AND JIGS

(1) Tightening tools

(2) Jig

No.	JIGS	SHAPE
a	Master pin fixing jig	

41. Using a crane, remove the gear casing (50) from the body casing.

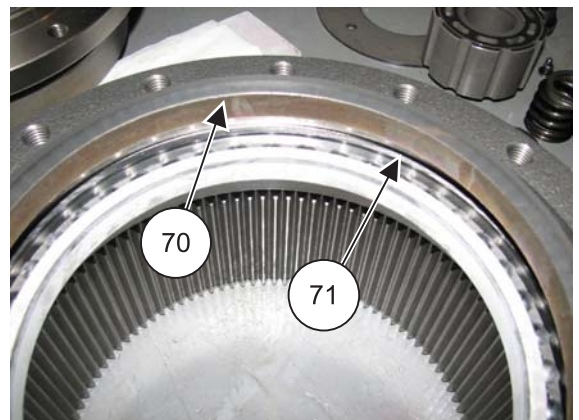


34

42. Remove one of the angular bearings (69) from the gear casing.



43. Turn the gear casing over. Remove the floating seal (72) and the other angular bearings (69) from the gear casing.



44. Remove another floating seal (72) from the body casing (73).

To remove them from the body casing, strike the shaft (74) and the bearing (75) with plastic hammer and suitable jig in direction shown in the figure.

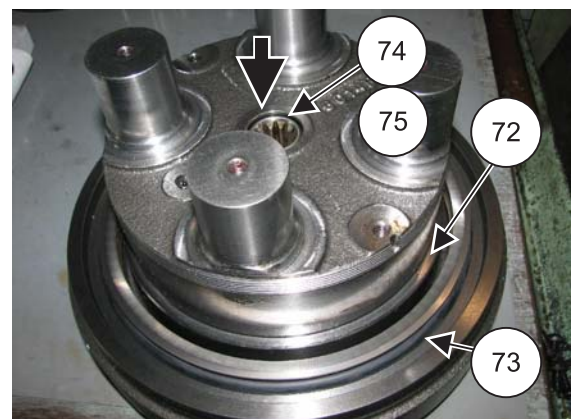


Table46-54

Error code	R034		
Trouble	Wiper motor reverse rotation relay error		
Judging condition	The mechatro controller output line to wiper motor reverse rotation relay is short-circuited with the power source.		
Symptom	Wiper does not move after forward rotation.		
Control in the event of failure	Relay output is stopped.		
Returned in normal condition	When the power is OFF		
Service diagnosis checking screen	Screen No.	25	CCW MOTOR RLY
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Wiper motor reverse rotation relay R-30	<p>When error is cancelled after removing wiper motor reverse rotation relay, check relay unit for failure, replace it with new one if failed.</p> <p>When resistance between relays (1) and (2) is 0 Ω, it is in abnormal condition.</p> 	
2	• Wiring between wiper motor forward rotation relay and controller CN-109F, CN2-1 • Fuse & relay box E-1	<p>When R034 is left displayed with the relay removed</p> <p>Check that no power 24V is produced on relay (-) line according to the wiring checking procedure and replace it if necessary.</p> <p>When no failure found after checking on wiring and R034 is left displayed</p> <p>Replace fuse/relay box.</p>	
3	• Mechatro controller	Check that the error is corrected after replacement of controller.	

Table46-55

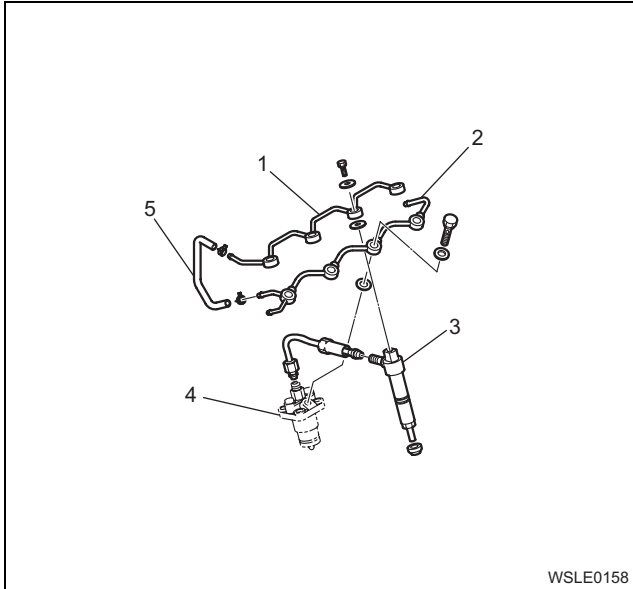
Error code	R044		
Trouble	Washer motor relay error		
Judging condition	The mechatro controller output line to washer motor relay is short-circuited with the power source.		
Symptom	Washer motor does not move.		
Control in the event of failure	Relay output is stopped.		
Returned in normal condition	When the power is OFF		
Service diagnosis checking screen	Screen No.	25	MOTOR RELAY
	Screen No.		
	Screen No.		
Checking object		Checking contents and remedy	
1	• Washer motor relay R-32	<p>When error is cancelled after removing washer motor relay, check relay unit for failure, replace it with new one if failed.</p> <p>When resistance between relays (1) and (2) is 0 Ω, it is in abnormal condition.</p> 	
2	• Wiring between washer motor relay and controller CN-112F, CN2-1 • Fuse & relay box E-1	<p>When R044 is left displayed with the relay removed</p> <p>Check that no power 24V is produced on relay (-) line according to the wiring checking procedure and replace it if necessary.</p> <p>When no failure found after checking on wiring and R044 is left displayed</p> <p>Replace fuse/relay box.</p>	
3	• Mechatro controller	Check that the error is corrected after replacement of controller.	

N·m {kgf·m}				
Strength classification	8.8		9.8 9T	
Shape of bolt head	Hexagon head bolt	Flange bolt	Hexagon head bolt	Flange bolt
M6 × 1	5.6 — 11.2 {0.6 — 1.1}	6.6 — 12.2 {0.6 — 1.2}	—	—
M8 × 1.25	13.4 — 25.7 {1.4 — 2.6}	15.3 — 28.4 {1.6 — 2.9}	16.7 — 30.4 {1.7 — 3.1}	18.1 — 33.6 {1.9 — 3.4}
M10 × 1.25	31.3 — 52.5 {3.2 — 5.4}	35.4 — 58.9 {3.6 — 6.1}	37.3 — 62.8 {3.8 — 6.4}	42.3 — 70.5 {4.3 — 7.2}
*M10 × 1.5	31.3 — 51.4 {3.2 — 5.2}	34.5 — 57.5 {3.5 — 5.8}	36.3 — 59.8 {3.7 — 6.1}	40.1 — 66.9 {4.1 — 6.8}
M12 × 1.25	69.3 — 104.0 {7.1 — 10.6}	77.7 — 116.5 {7.9 — 11.9}	75.5 — 113.8 {7.7 — 11.6}	85.0 — 127.5 {8.7 — 13.0}
*M12 × 1.75	64.8 — 96.1 {6.6 — 9.8}	71.4 — 107.2 {7.3 — 10.9}	71.6 — 106.9 {7.3 — 10.9}	79.5 — 119.2 {8.1 — 12.2}
M14 × 1.5	106.2 — 158.8 {10.8 — 16.2}	114.9 — 172.3 {11.7 — 17.6}	113.8 — 170.6 {11.6 — 17.4}	123.4 — 185.1 {12.6 — 18.9}
*M14 × 2	100.6 — 149.8 {10.3 — 15.3}	108.2 — 162.2 {11.1 — 16.6}	106.9 — 160.0 {10.9 — 16.3}	115.5 — 173.3 {11.8 — 17.7}
M16 × 1.5	154.3 — 232.5 {15.7 — 23.7}	171.1 — 256.7 {17.4 — 26.2}	160.0 — 240.3 {16.3 — 24.5}	176.9 — 265.3 {18.0 — 27.1}
*M16 × 2	147.6 — 221.4 {15.0 — 22.6}	162.5 — 243.8 {16.6 — 24.9}	153.0 — 229.5 {15.6 — 23.4}	168.5 — 252.7 {17.2 — 25.8}
M18 × 1.5	222.5 — 334.3 {22.7 — 34.1}	—	229.5 — 345.2 {23.4 — 35.2}	—
*M18 × 2.5	223.6 — 335.4 {22.8 — 34.2}	—	230.5 — 346.2 {23.6 — 35.3}	—
M20 × 1.5	307.4 — 461.7 {31.4 — 47.1}	—	316.8 — 475.6 {32.3 — 48.5}	—
*M20 × 2.5	284.0 — 472.1 {29.0 — 43.5}	—	293.2 — 440.3 {29.2 — 44.9}	—
M22 × 1.5	413.6 — 620.5 {42.2 — 63.3}	—	424.6 — 636.5 {43.3 — 64.9}	—
*M22 × 2.5	385.7 — 578.0 {39.3 — 58.9}	—	394.2 — 592.3 {40.0 — 60.4}	—
M24 × 2	490.8 — 810.5 {50.0 — 82.7}	—	554.1 — 830.6 {56.5 — 84.7}	—
*M24 × 3	462.8 — 693.1 {47.2 — 70.7}	—	520.7 — 781.6 {53.1 — 79.7}	—

The * mark indicates where soft materials have been used for internal thread sections, such as castings.

1A-30 4LE2 Engine Mechanical

13. Connect the fuel pipe and the leak-off pipe with the fuel hose and fix it with a clip.



Name

1. Leak-off Pipe
2. Fuel Pipe
3. Nozzle Holder
4. Injection Pump
5. Fuel Hose

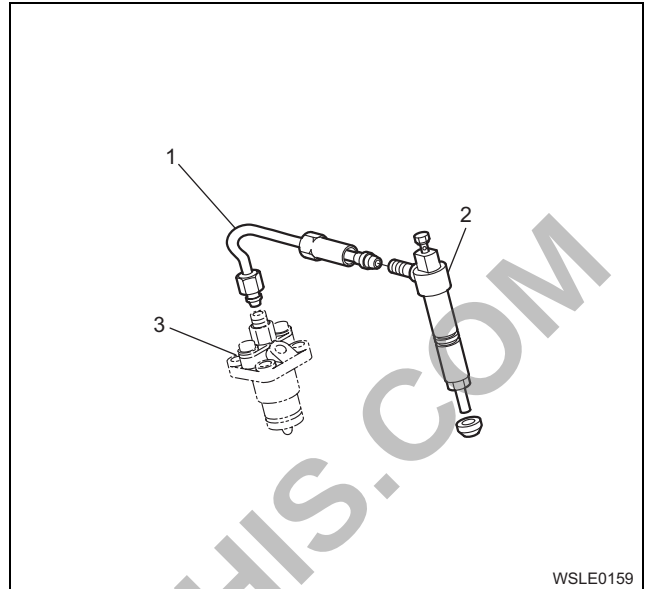
14. Install the injection pipe to the injection pump and the nozzle holder, and tighten it with the sleeve nut.
- a. Screw the thread portion of the sleeve nut two or three turns by your hand.
 - b. Hold the delivery valve holder of the injection pump with a wrench and tighten the sleeve nut securely.

Tightening torque:

14.7 — 24.5 N·m {1.5 — 2.5 kgf·m/10.8 — 18.1 lb·ft}

Important:

If over-tightening the delivery valve holder, the rack cannot move smoothly as the plunger and the housing are compressed. Therefore, when tightening the sleeve nuts of the injection pipe, hold the delivery valve holder with a wrench to prevent rotation.



Name

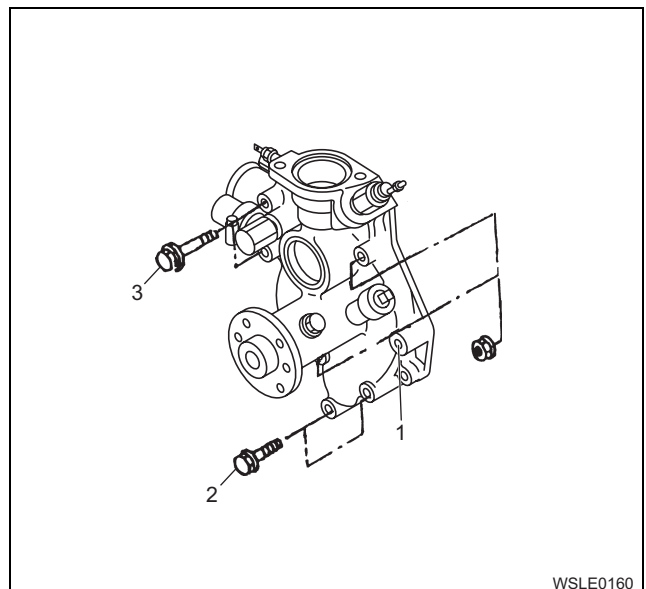
1. Injection Pipe
2. Nozzle Holder
3. Injection Pump

15. Install the water pump ASM.

- Install the water pump ASM and the gasket to the cylinder block and the cylinder head, and tighten it to the specified torque.

Tightening torque:

18.6 — 28.4 N·m {1.9 — 2.9 kgf·m/13.7 — 20.9 lb·ft}

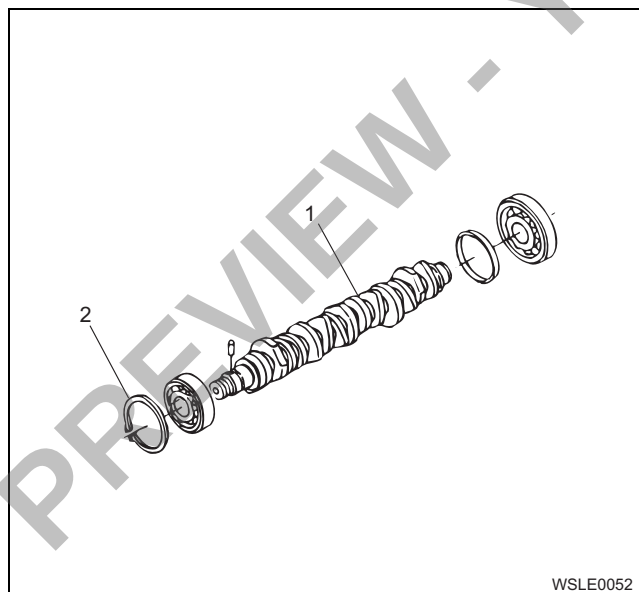


Name

1. Tighten adjusting plate together.
2. Bolt: L = 40
3. Bolt: L = 60

Removal

1. Remove the EGR cooler and the bracket.
Refer to 1A-20, "Removal, Engine Exterior Equipment".
2. Remove the cylinder head cover.
Refer to 1A-20, "Removal, Engine Exterior Equipment".
3. Remove the rocker arm bracket.
Refer to 1A-37, "Removal, Rocker Arm Shaft".
4. Remove the cylinder head.
Refer to 1A-43, "Removal, Cylinder Head".
5. Remove the tappet.
Refer to 1A-43, "Removal, Cylinder Head".
6. Remove the timing gear case.
Refer to 1A-69, "Removal, Crankshaft Front Oil Seal".
7. Remove the camshaft gear.
 - a. Pull out the sleeve from the end of the camshaft.
 - b. Remove the lock nut from the camshaft gear, and remove the flyweight ASM and the camshaft gear.
8. Remove the camshaft.
 - a. Remove the snap ring which holds the front bearing of the camshaft from the ring groove of the cylinder block.
 - b. Pull out the camshaft with the bearing from the cylinder block.



Name

1. Camshaft
2. Snap Ring

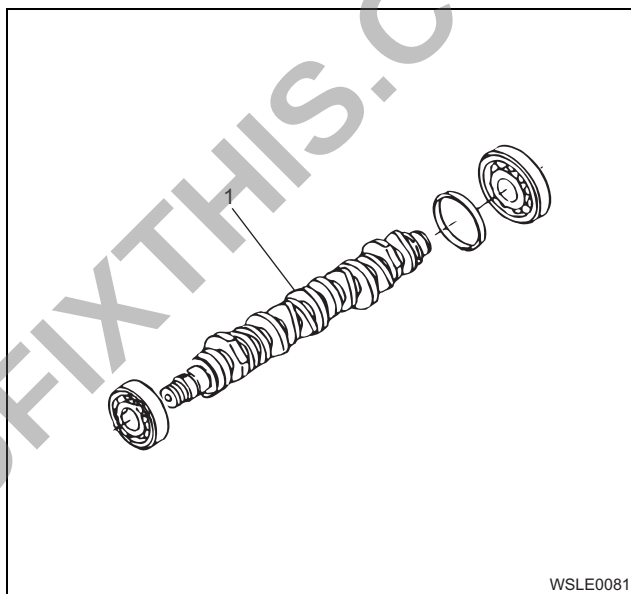
Inspection

Inspection of camshaft

Check the journal portion and the cam portion for wear, damage, and other abnormality.

CAUTION:

The ball bearings are fitted to the front and rear parts of the camshaft. Also, the roller bearing is press-fitted to the cylinder block at the center part. Check that each bearing has no rattle and rotates smoothly with this condition.



Name

1. Camshaft

Inspection of journal and cam

1. Height of the cam (A – B)

mm {in}			
	Standard value	Service limit	Repairing procedure
Inlet	6.13 {0.241}	5.83 {0.230}	Replace.
Exhaust	6.43 {0.253}	6.13 {0.241}	

2. Center journal diameter (the dimensions in X – X and Y – Y directions)

mm {in}		
Nominal dimension	Service limit	Repairing procedure
φ52 {2.047}	φ51.92 {2.044}	Replace.

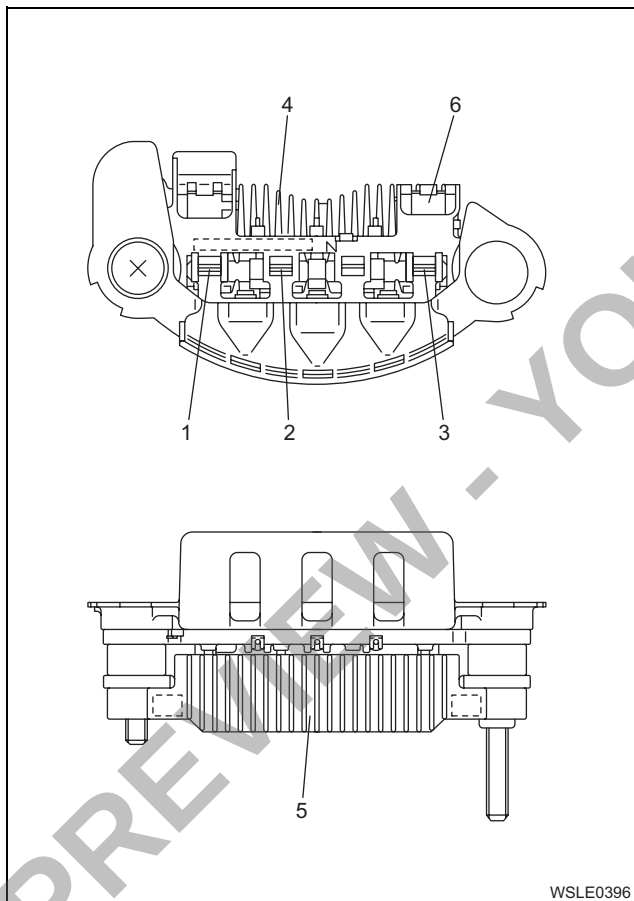
Rectifier assembly

- Check that the diode inside of the rectifier operates properly with a circuit tester.
- Check the diode in both directions by exchanging (+) side and (–) side. If abnormality is found, replace the rectifier assembly.
If resistance value is infinity in both directions, the diode is open.
If resistance value is almost the same as 0 Ω in both directions, the diode is short.

Note:

As normally the current flowing to the rectifier is low, tester may indicate the resistance value that is not clear.

Also, this is more likely to occur as smaller range is used for the tester. Use range as large as possible.



Name

- 1-3. Connection of Lead Wire of Stator Coil
4.5. Heat Sink
6. Connection of Regulator

Front bearing

Check the bearings for noise, rattle or grease leakage (wipe off if tiny amount of grease). Replace them if faulty. It is easier to check for noise and rattle when the bearing is press-fitted into bracket than when it is a single unit.

Regulator

The regulator cannot be checked with a circuit tester. After re-assembling the generator, check it to make sure that regulator controls the voltage for generator.

Reassembly

Assembly can be performed in the reverse order of disassembly. However, be careful with the following.

1. Lubrication is not necessary. Bearing is filled with grease and is sealed.

CAUTION:

Keep a bearing with resin band for rotor shaft away from oil. Wipe off oil on bearing box area of rear bracket. Oil may cause creep.

2. Use a high temperature solder (melting point: 230°C {446°F}).
Using a soldering iron (with 180 — 270 watt), soldering must be performed quickly (within five seconds) not to heat the rectifier.

3. Tightening torque

- Pulley fixing nut:
98 — 137 N·m {10.0 — 14.0 kg·m/72 — 101 lb·ft}
- Through bolt:
3.4 — 5.4 N·m {34.7 — 55.1 kg·cm/30 — 48 lb·in}
- Bearing retainer fixing screw:
2.9 — 4.9 N·m {29.6 — 50.0 kg·cm/26 — 43 lb·in}
- Rectifier fixing screw:
2.9 — 4.9 N·m {29.6 — 50.0 kg·cm/26 — 43 lb·in}
- Regulator fixing screw:
2.9 — 4.9 N·m {29.6 — 50.0 kg·cm/26 — 43 lb·in}
- Nut for B terminal bolt:
4.9 — 8.8 N·m {50.0 — 89.8 kg·cm/43 — 77 lb·in}

4. Assembly of rear bracket to stator assembly and front bracket to rotor assembly

- The rotor bearing and rear bracket are engaged tightly. Heat the bearing box area of rear bracket to 50 — 60°C {122 — 140°F} prior to assembly.
- After re-assembling the generator, rotate the pulley to confirm that the rotor rotates smoothly.

Bench Test

Bench test is performed as follows.

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