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- 5) Use the special jig and tools without fail if they are specified.
- 6) If it is hard to remove a part according to the procedure, do not try it by force but investigate the cause.
- 7) Place the removed parts in order and attach tags to facilitate the reassembling.
- 8) Note the location and quantity of parts commonly applied to multiple locations.

(3) Inspecting parts

- 1) Ensure that the disassembled parts are free from seizure, interference and uneven contact.
- 2) Measure and record wear condition of parts and clearance.
- 3) If the problem is found in a part, repair or replace it with a new one.

(4) Reassembling hydraulic equipment

- 1) Turn ON the ventilation fan or open windows to maintain good ventilation prior to starting the cleaning of parts.
- 2) Perform rough and finish cleaning before assembling.
- 3) Remove washing oil by air and apply clean hydraulic or gear oil for assembling.
- 4) Always replace the removed O-rings, backup rings and oil seals with new ones by applying grease in advance.
- 5) Remove dirt and moisture from and perform degreasing on the surface where liquid gasket to be applied.
- 6) Remove rust preventive agent from the new parts before use.
- 7) Fit bearings, bushings and oil seals using special jigs.
- 8) Assemble the parts utilizing matching marks.
- 9) Ensure all the parts are completely assembled after the work.

(5) Installing hydraulic equipment

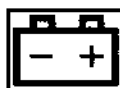
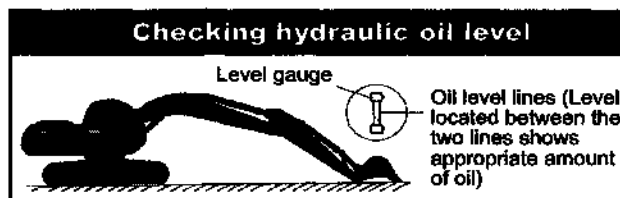
- 1) Ensure hydraulic oil and lubricant are properly supplied.
- 2) Perform air bleeding when:
 - a. Hydraulic oil changed
 - b. Parts of suction side piping replaced
 - c. Hydraulic pump installed
 - d. Slewing motor installed
 - e. Travel motor installed
 - f. Hydraulic cylinder installed

⚠ • Operation of the hydraulic equipment without filling hydraulic oil or lubricant or without performing air bleeding will result in damage to the equipment.

- 3) Perform air bleeding of the hydraulic pump and slewing motor after loosening the upper drain plug, starting the engine and keep it in low idle condition. Complete the air bleeding when seeping of hydraulic oil is recognized, and tightly plug.
- 4) Perform air bleeding of the travel motor and the hydraulic cylinders by running the engine for more than 5 minutes at low speed without load.

⚠ • Do not allow the hydraulic cylinder to bottom on the stroke end just after the maintenance.

- 5) Perform air bleeding of pilot line by performing a series of digging, slewing and travel.
- 6) Check hydraulic oil level after placing the attachment to the oil check position, and replenish oil if necessary.



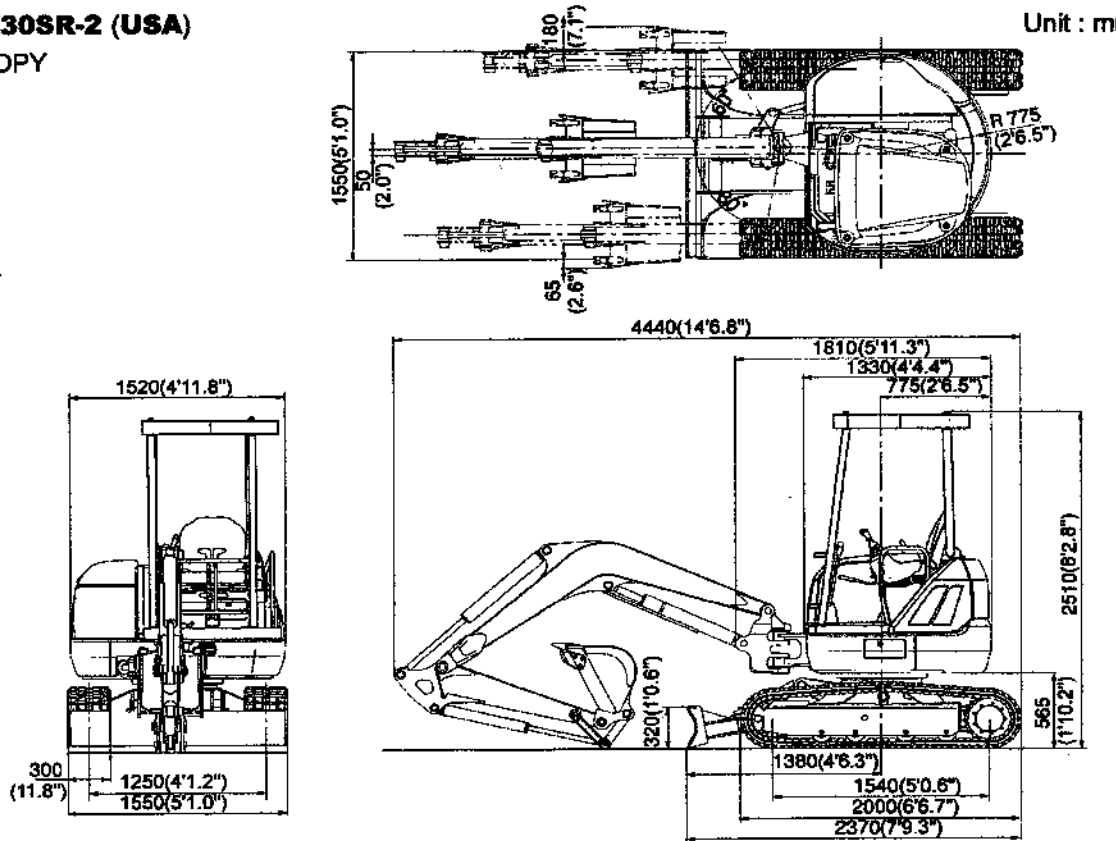
1.4 ELECTRICAL EQUIPMENT

- (1) Do not disassemble electrical equipment.
- (2) Handle it carefully not to drop and give a shock.
- (3) Turn the key OFF prior to connecting and disconnecting work.
- (4) Disconnect the connector by holding it and pressing the lock. Do not pull the wire to apply force to the caulking portion.
- (5) Connect the connector and ensure it is completely locked.
- (6) Turn the key OFF prior to touching the terminal of starter or generator.
- (7) Remove the ground (earth) terminal of battery

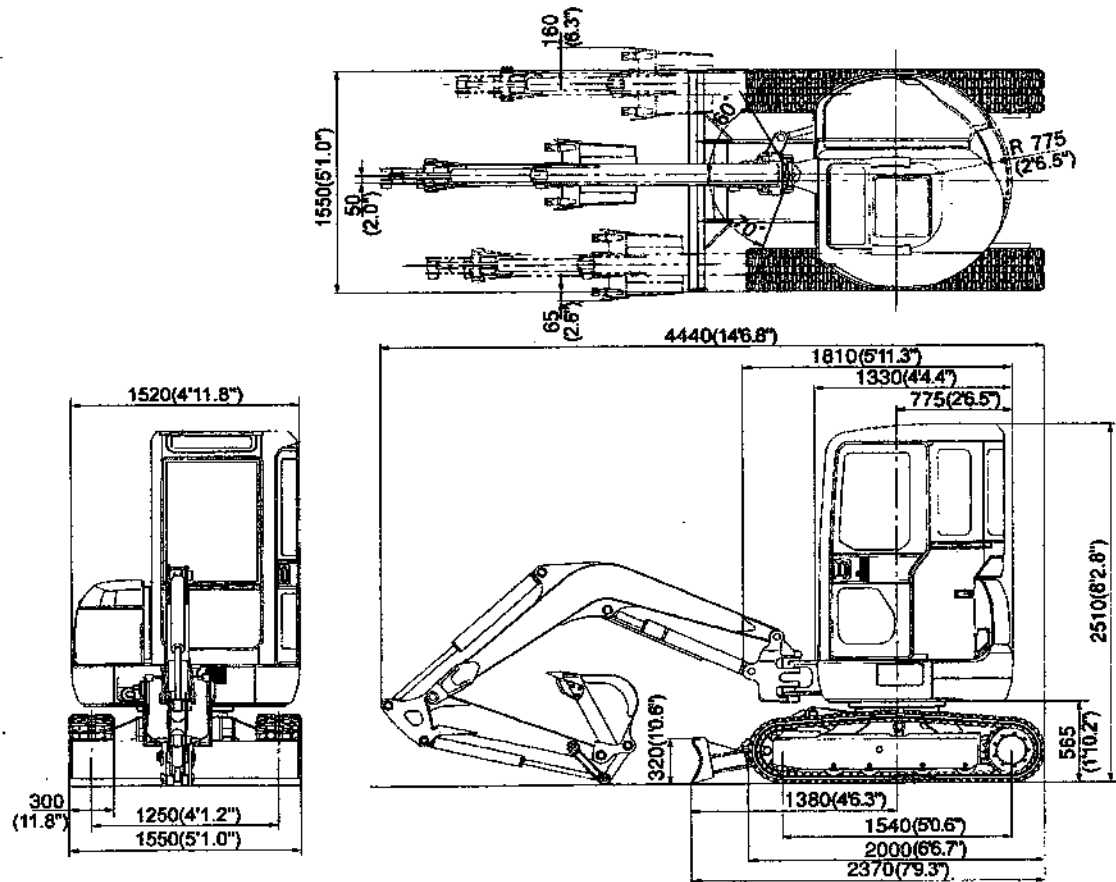
2.3 SK30SR-2 (USA)

■ CANOPY

Unit : mm (ft-in)

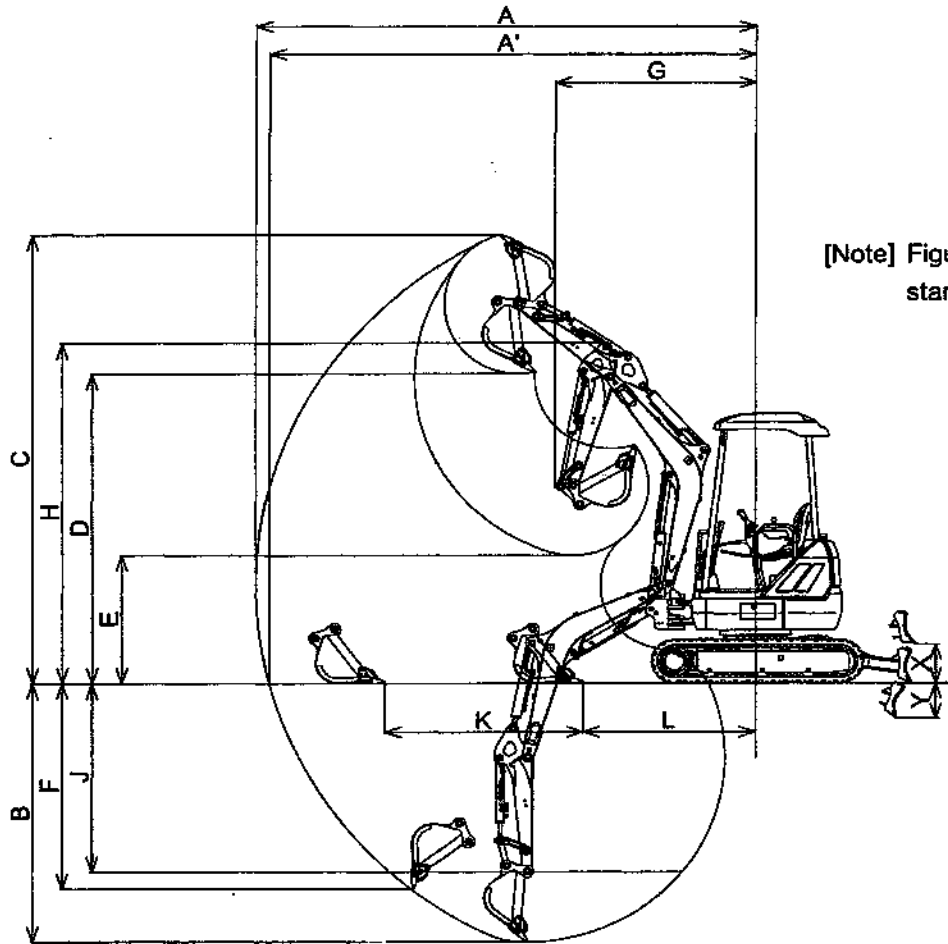


■ CAB



9. WORKING RANGES

■ CANOPY [EU, USA]



[Note] Figure shows the case of standard canopy spec.

Unit ; mm (ft-in)

Model		SK30SR-2	SK35SR-2
Item	Attachment		
	Arm	1,200 (3' 11.2")	1,320 (4' 4.0")
	Bucket	0.09m ³ (0.118 cu.yd)	0.11m ³ (0.144 cu.yd)
A	Max. digging reach	4,920 (16' 1.7")	5,180 (16' 11.9")
A'	Max. digging reach at ground level	4,790 (15' 8.6")	5,060 (16' 7.2")
B	Max. digging depth	2,830 (9' 3.4")	3,100 (10' 2.0")
C	Max. digging height	4,500 (14' 9.2")	4,530 (14' 10.3")
D	Max. dumping clearance	3,160 (10' 4.4")	3,220 (10' 6.8")
E	Min. dumping clearance	1,260 (4' 1.6")	1,230 (4' 0.4")
F	Max. vertical wall digging depth	2,170 (7' 1.4")	2,320 (7' 7.3")
G	Min. front slew radius	2,140 (7' 0.3")	2,310 (7' 6.9")
H	Height at min. slew radius	3,450 (11' 3.8")	3,540 (11' 7.4")
J	8-foot level digging depth	2,320 (7' 7.3")	2,610 (8' 6.8")
K	Horizontal digging stroke at ground level	Stroke	2,150 (7' 0.6")
L		Minimum	1,640 (5' 4.6")
X	Dozer strokes	Above	305 (1' 0.0")
Y		Below	390 (1' 3.4")

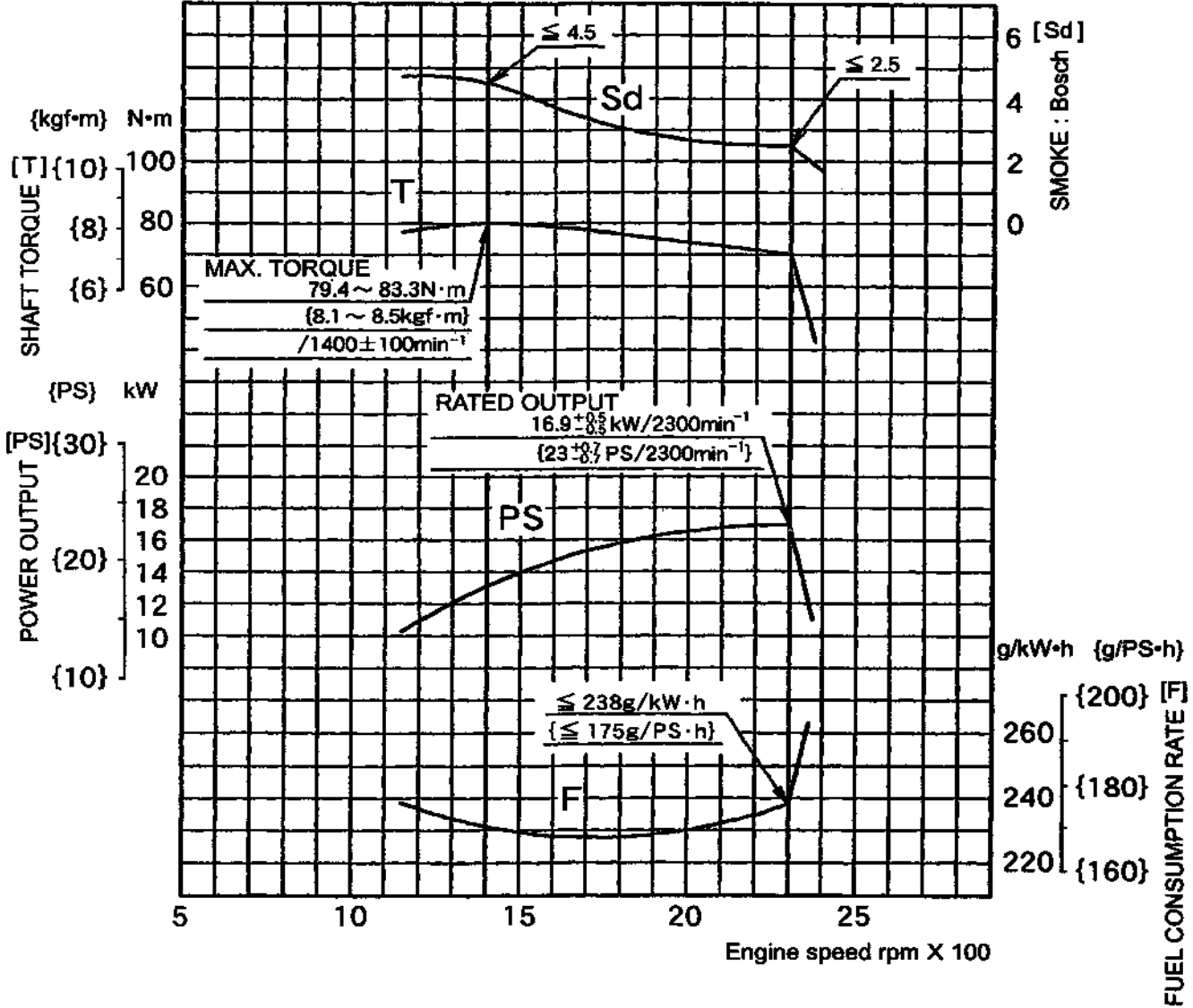
Note : Japanese domestic specification.

11.2 ENGINE PERFORMANCE CURVE

■ SK30SR-2

Model : 3TNE82A-YBC

Rated Output : 23 PS / 2,300 rpm (16.9 kW / 2300min⁻¹)



$$\text{Fuel consumption volume} = \frac{F}{\rho \times 1000} \times P \times \alpha$$

$$= \frac{175}{0.835 \times 1000} \times 23 \times \alpha$$

$$= 4.82 \alpha$$

F : Fuel consumption rate (g / PS·h)

P : Shaft output (ps)

ρ : Specific gravity

α : Standard load factor (0.60 ~ 0.70)

Fuel consumption in normal operation ;

2.89 ~ 3.37 ℓ / h (load factor : (0.60 ~ 0.70))

2. ARM

2.1 ARM DIMENSIONAL DRAWINGS

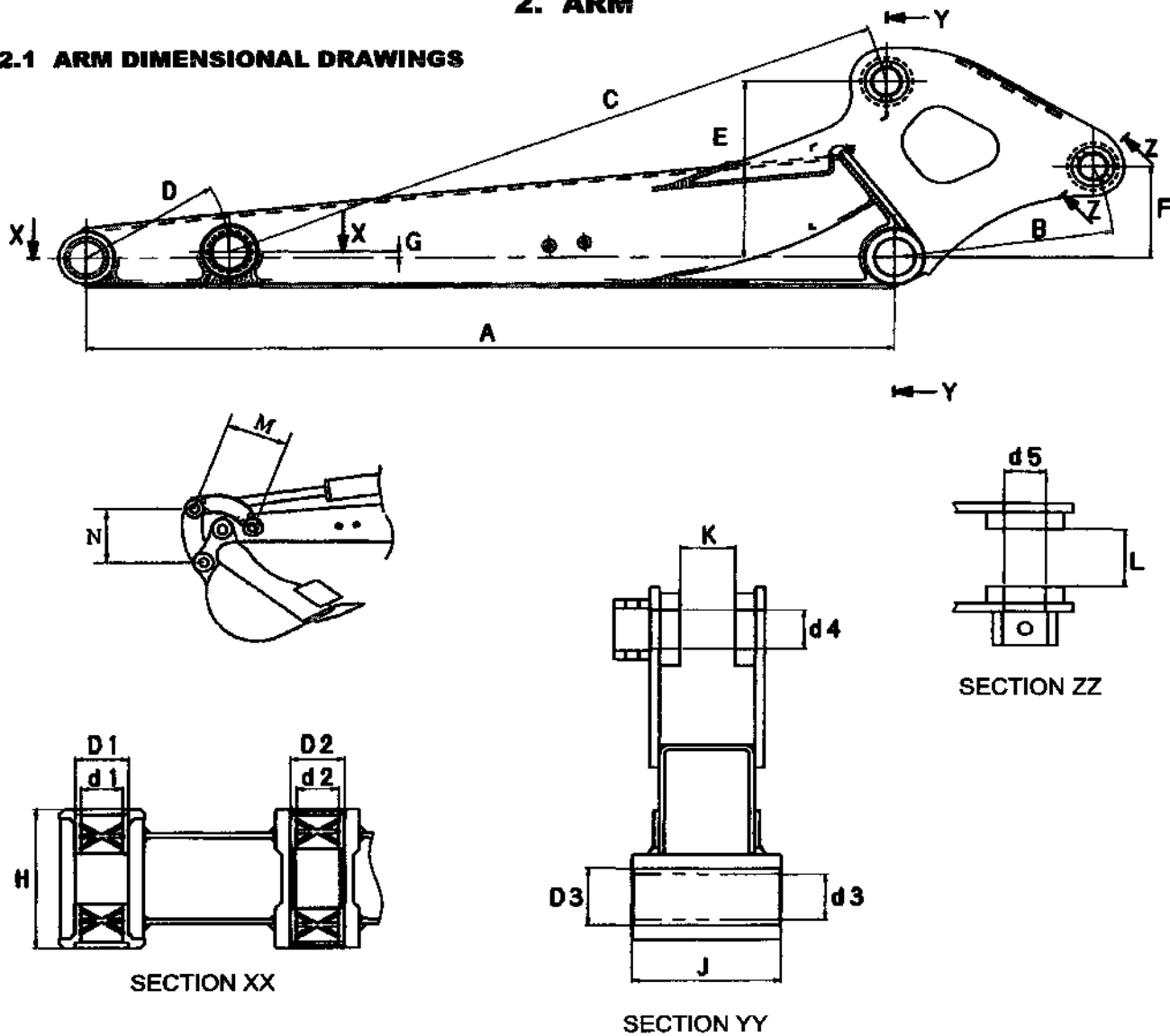


Fig. 2-1 Arm dimensional drawings

■ SK30SR-2

Table 2-1

Unit : mm (ft·in)

No.	Name	Dimensions	No.	Name	Dimensions
A	Arm length	1200 (3'11.24")	M	Link dimension	310 (1'0.20")
B	Distance between pins of boss and bracket	R303 (11.93")	N	Link dimension	285 (11.22")
C	Distance between pins of boss and bracket	R999 (3'3.33")	D1	I.D. of boss	ø50 (1.97")
D	Distance between pins of boss and boss	R195 (7.68")	D2	I.D. of boss	ø50 (1.97")
E	Height between pins of boss and bracket	302.5 (11.91")	D3	I.D. of boss	ø55 (2.17")
F	Height between pins of boss and bracket	155 (6.10")	d1	Pin dia.	ø40 (1.57")
G	Height between pins of boss and center	8 (0.31")	d2	Pin dia.	ø40 (1.57")
H	Boss width	140 (5.51")	d3	Pin dia.	ø45 (1.77")
J	Boss width	150 (5.91")	d4	Pin dia.	ø40 (1.57")
K	Bracket inner width	56 (2.20")	d5	Pin dia.	ø45 (1.77")
L	Bracket inner width	56 (2.20")			

3.3 DETAIL DIMENSIONAL DRAWINGS OF BOSS SECTION

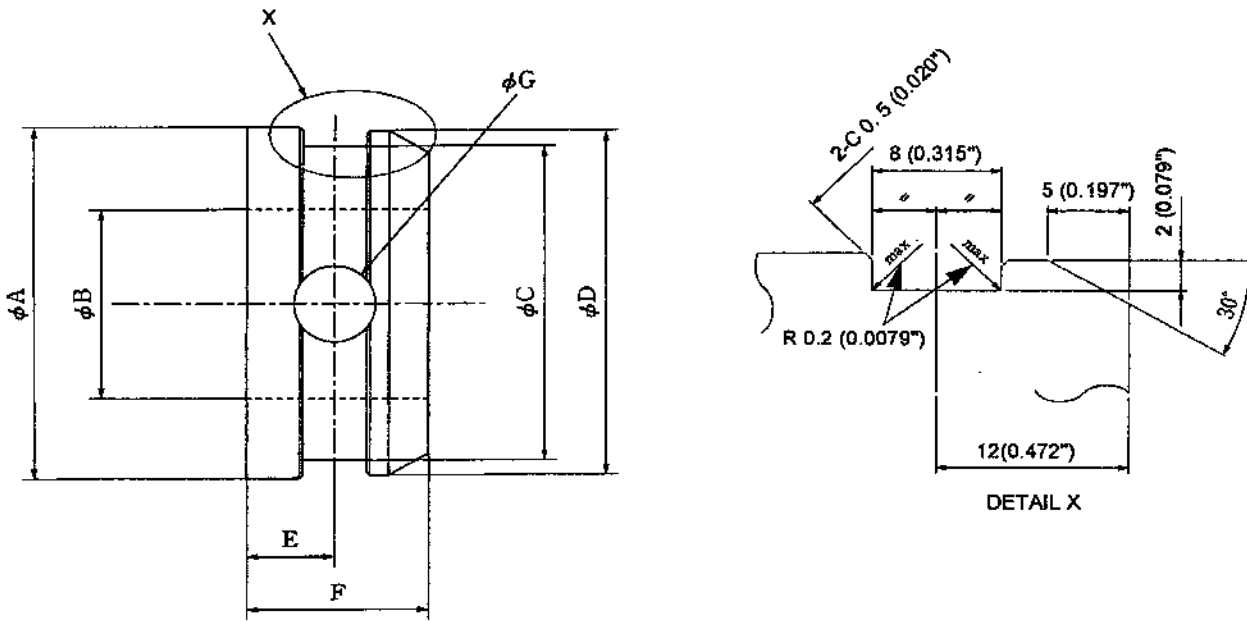


Fig. 3-3 Dimension of boss section

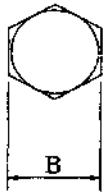
Table 3-3

Unit : mm (in)

Portion Model	ϕA	ϕB	ϕC	ϕD	E	F	ϕG
SK30SR-2	65	43	60	63	12	24	11
SK35SR-2	(2.56)	(1.69)	(2.36)	(2.48)	(0.472)	(0.945)	(0.433)

2. SCREW SIZES TO TOOL SIZES

1) Capscrew



2) Socket bolt

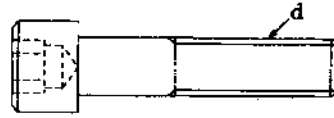
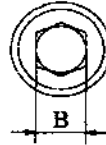


Table 2-1

Nominal screw size (d)	B mm
	Tool size
M6	10
M8	13
M10	17
M12	19
M16	24
M20	30
M24	36
M30	46
M36	55

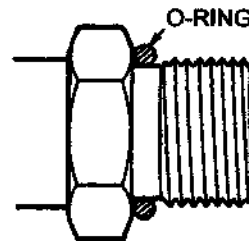
Table 2-2

Nominal screw size (d)	B mm
	Tool size
M6	5
M8	6
M10	8
M12	10
M14	12
M16	14
(M18)	14
M20	17
M24	19
M30	22
M36	27

3. TORQUE SPECIFICATIONS FOR JOINTS AND HOSES

A. JOINTS FOR PIPING (O-RING SEALING TYPE)

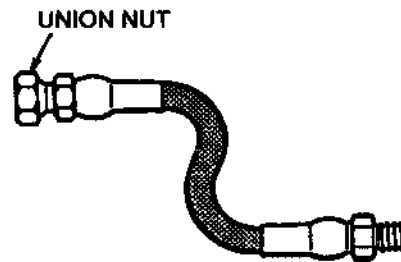
Nominal screw size (PF)	Spanner size (mm)	Tightening torque kg·m(lbf·ft)
1/8	14	1.7 ± 0.2 (12 ± 1)
1/4	19	3.7 ± 0.2 (27 ± 1)
3/8	22	7.5 ± 0.5 (54 ± 4)
1/2	27	11.0 ± 1.0 (80 ± 7)
3/4	36	16.5 ± 1.0 (119 ± 7)
1	41	26.0 ± 1.0 (188 ± 7)



Z2-0081

B. HYDRAULIC HOSE (30° FLARE TYPE)

Nominal screw size (PF)	Spanner size (mm)	Tightening torque kg·m(lbf·ft)
1/8	17	1.5 ± 0.2 (11 ± 1)
1/4	19	3.0 ± 0.5 (22 ± 4)
3/8	22	5.0 ± 0.5 (36 ± 4)
1/2	27	8.0 ± 0.5 (58 ± 4)
3/4	36	12.0 ± 1.0 (87 ± 7)
1	41	14.0 ± 1.5 (101 ± 11)



Z2-0051

NOTE : The application of the tightening torque is subject to a dry condition.

GROUP No.	EQUIPMENT PORTION	WORK TO BE DONE	UNIT	REMARK	UNIT : HOUR	
01 Attachment	27	• Boom assy temporary slinging	Removal / Inst.	1 pc.		0.1
	28	• Boom foot pin	- ditto -	1 pc.	Include stopper pin.	0.1
	29	• Boom assy slinging	- ditto -	1 pc.		0.1
	30	Arm cylinder removing / installing	- ditto -	1 pc.		0.3
	31	• Arm cylinder piping	- ditto -	1 pc.		0.1
	32	• Arm cylinder head pin	- ditto -	1 pc.	Include stopper pin.	0.1
	33	• Arm cylinder slinging	- ditto -	1 pc.		0.1
	40	Boom cylinder removing / installing	- ditto -	1 pc.		0.3
	41	• Boom cylinder piping	- ditto -	1 pc.		0.1
	42	• Boom cylinder head pin	- ditto -	1 pc.		0.1
	43	• Boom cylinder slinging	- ditto -	1 pc.		0.1
	50	Bucket cylinder	O / H	1 pc.		2.5
	51	• Pin bushing	Replace	1 set	Include seal.	1.0
	60	Arm cylinder	O / H	1 pc.		2.5
	61	• Pin bushing	Replace	1 set	Include seal.	1.0
	70	Boom cylinder	O / H	1 pc.		2.5
	71	• Pin bushing	Replace	1 set	Include seal.	1.0
	80	Swing portion			Refer to 32-I item 5	
	81	Swing bracket assy	Removal / Inst.	1 pc.	After removing boom.	0.4
	82	• Swing cylinder rod pin	- ditto -	1 pc.		0.1
	83	• Swing bracket slinging	- ditto -	1 pc.		0.1
	84	• Swing center pin	- ditto -	1 pc.		0.1
	85	Swing cylinder removing / installing	- ditto -	1 pc.	After removing swing bracket.	0.3
	86	• Swing cylinder hose	Removal / Inst.	2 pcs.		0.2
	87	• Swing cylinder head pin	- ditto -	1 pc.		0.1
	88	Swing cylinder	O / H	1 pc.		2.5
	89	• Pin bushing	Replace	1 pc.	Include seal.	1.0
	Other necessary works	Removal / Inst.	1 set	Pannel assy (3)	0.1	
90	Dozer portion			Refer to 32-I item 6		
91	Dozer ASSY	Removal / Inst.	1 pc.		0.6	
92	• Dozer cylinder hose	- ditto -	2 pcs.		0.2	
93	• Dozer cylinder rod pin	- ditto -	1 pc.		0.1	
94	• Dozer installing pin	- ditto -	2 pcs.		0.2	
95	Dozer cylinder	O / H	1 pc.		2.5	
96	• Pin bushing	Replace	1 set	Include seal.	1.0	
02 Canopy & Guard	00	Canopy portion			Refer to 33-I item 1	
	01	Canopyassy	Removal / Inst.	1 pc.		0.2
	02	Hand rail	- ditto -	1 pc.		0.1
	10	Cab portion			Refer to 33-I item 1	
	11	Cab assy	Removal / Inst.	1 pc.		0.4
	12	Harness	- ditto -	1 pc.		0.1
	20	Bonnet & Guard			Refer to 33-I item 2	
	21	Cover assy (1)	Removal / Inst.	1 pc.		0.1
	22	Pannel assy (2)	- ditto -	1 pc.		0.1
	23	Pannel assy (3)	- ditto -	1 pc.		0.1
24	Bonnet assy (4)	- ditto -	1 pc.		0.1	

2.2 STANDARD VALUE TABLE [USA]

Table 2 (1/2) [USA]

Model			SK30SR-2		SK35SR-2			
Applicable machines			PW08-20001~		PX09-08001~			
Div.	Item	Unit	Standard value	Standard value for repair	Standard value	Standard value for repair		
Measuring condition	Hyd. oil cleanliness	Class	8 ± 1	-	8 ± 1	-		
	Hyd. oil temperature (Tank surface)	°C (°F)	50~60 (122~140)	-	50~60 (122~140)	-		
	Coolant temperature (Radiator surface)		60~90 (140~194)	-	60~90 (140~194)	-		
Engine speed	Low idle	rpm	1150 ± 50	-	1150 ± 50	-		
	High idle		2450 ± 50	-	2540 ± 50	-		
	Deceleration (OPT)		1150 ± 50	-	1150 ± 50	-		
Main relief valve pressure	Boom • Bucket • Travel (LH)	P1	kgf/cm ² (psi)	230 ⁺⁵ ₀ (3270 ⁺⁷⁰ ₀)	-	230 ⁺⁵ ₀ (3270 ⁺⁷⁰ ₀)	-	
	Arm • Swing • Travel (RH)	P2		230 ⁺⁵ ₀ (3270 ⁺⁷⁰ ₀)	-	230 ⁺⁵ ₀ (3270 ⁺⁷⁰ ₀)	-	
	Dozer • *1 Slew • Service	P3		180 ⁺⁵ ₀ (2560 ⁺⁷⁰ ₀)	-	200 ⁺⁵ ₀ (2840 ⁺⁷⁰ ₀)	-	
Pilot relief valve pressure	Pilot Line	-	35 ⁺⁵ ₋₃ (500 ⁺⁷⁰ ₋₄₀)	-	35 ⁺⁵ ₋₃ (500 ⁺⁷⁰ ₋₄₀)	-		
Port (Over load) relief valve pressure	Boom	Head Rod	kgf/cm ² (psi)	280 (3980)	-	280 (3980)	-	
	Arm	Head Rod		260 (3700)	-	260 (3700)	-	
	Bucket	Head		260 (3700)	-	260 (3700)	-	
	Dozer	Head		260 (3700)	-	260 (3700)	-	
	* 1 Slew	LH RH		150 ⁺³¹ ₀ (2130 ⁺⁴⁴⁰ ₀)	-	160 ⁺⁴⁴ ₀ (2280 ⁺⁶³⁰ ₀)	-	
Travel	Travel Speed (5 rev.)	Rubber crawler	Low	sec.	30.8 ± 1.5	39	36.2 ^{+1.8} _{-1.4}	46
			High		17.8 ± 0.9	23	20.8 ± 0.9	27
		Steel crawler	Low		31.5 ± 1.5	40	37.0 ^{+1.8} _{-1.4}	47
			High		18.2 ± 0.9	23	21.3 ± 0.9	27
	Travel Speed 10m (32.8 ft)	Rubber crawler	Low	sec.	14.3 ± 1.1	18	15.8 ± 0.8	20
			High		8.3 ± 0.4	11	9.1 ± 0.5	12
		Steel crawler	Low		14.9 ± 1.2	19	16.3 ± 0.8	21
			High		8.7 ± 0.3	11	9.4 ± 0.5	12
	Travel deviation		mm (in)	140 ⁰ ₋₁₄₀ (5.5 ⁰ _{-5.5})	280 (11.0)	140 ⁰ ₋₁₄₀ (5.5 ⁰ _{-5.5})	280 (11.0)	
	Drift due to gravity	w / P.B.		0	-	0	-	

*1 : The pressure for slew is controlled by the relief valve attached to the slew motor.

7. MEASURING ATTACHMENT OPERATING PERFORMANCES

• TEST PROCEDURES

Measure 3-time each.

Apply average data of the above for judgement.

7.1 CYLINDER SPEED

(1) Boom Cylinder Speed

- Engine : High Idle
- Hydraulic Oil Temp. : 50 ~ 60 °C
(122 ~ 140 °F)
- Measurement Posture : Completely retract the arm cylinder, fully extend the bucket cylinder and place the dozer blade on the ground.
- Then measure the time required for the bucket to reach its highest point (lowest point) from its lowest point (highest point) placing on the ground. (Do not include the cushioning time.)

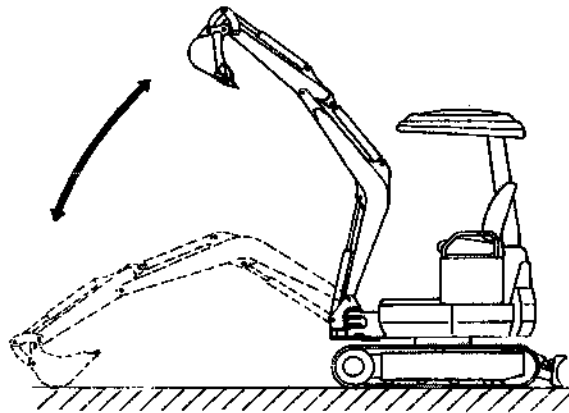


Fig. 7-1

(2) Arm Cylinder Speed

- Engine : High Idle
- Hydraulic Oil Temp. : 50 ~ 60 °C
(122 ~ 140 °F)
- Measurement Posture : Completely retract the arm cylinder, fully extend the bucket cylinder, position the arm horizontally and place the dozer blade on the ground.
- Then measure the time required for the arm cylinder to completely retract (extend) from a fully extended state (retracted state).

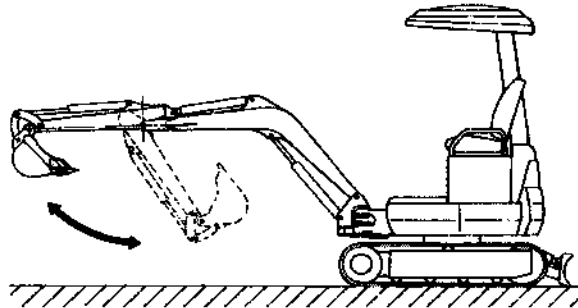


Fig. 7-2

FULLY RETRACTED

(3) Bucket Cylinder Speed

- Engine : High Idle
- Hydraulic Oil Temp. : 50 ~ 60 °C
(122 ~ 140 °F)
- Measurement Posture : Completely retract the arm cylinder, position the arm horizontally and place the dozer blade on the ground.
- Then measure the time required for the bucket cylinder to completely retract (extend) from a fully extended state (retracted state).

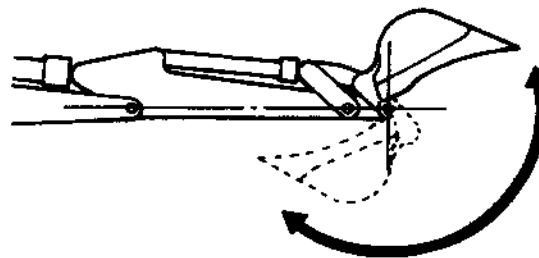


Fig. 7-3

(4) Swing Cylinder Speed

- Engine : High Idle
- Hydraulic Oil Temp. : 50 ~ 60 °C
(122 ~ 140 °F)
- Measurement Posture : Same as that for measuring slew time.
- While swinging the boom left (right) to right (left), measure the time required for a full stroke each way. (Do not include the cushioning time.)

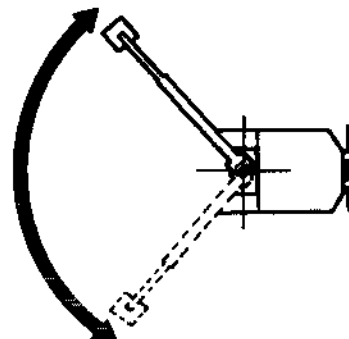


Fig. 7-4

3. HYDRAULIC CIRCUIT OPERATION

3.1 COLOR CODING STANDARD FOR HYDRAULIC CIRCUITS

- Blue Feed, drain circuit, less than
3.5 kgf / cm² (50 psi)
- Green Return, make-up circuit,
3.5 ~ 6 kgf / cm² (50 ~ 85 psi)
- Purple Secondary pilot pressure,
6 ~ 35 kgf / cm² (85 ~ 500 psi)
- Red Primary pilot pressure,
35 ~ 50 kgf / cm² (500 ~ 710 psi)
- Orange Main pump drive pressure,
50 ~ 300 kgf / cm² (710 ~ 4270 psi)
- Blue tone At valve selection
- Red valve When proportionate 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.

3.2 NEUTRAL CIRCUIT

- (1) Pilot Circuit
- 1) Pilot Primary Pressure Circuit
- The oil discharged from the A4 port on pump assy (1) enters into the solenoid valve (13) through the line filter (19). By unlocking the safety lock lever (operating conditions), the pressurized oil discharged from the A2 port on solenoid valve (13) is led to the pilot valve (11) for attachment and P port on pilot valve (12) for travelling.
- While the operating circuit is closed at neutral position, the discharged oil from the pump loses its flowing passage, and returns to the hydraulic oil tank (20) through the relief valve [setting pressure: 35 kg/cm² (500 psi)] in the solenoid valve (13).
- 2) Pilot Secondary Pressure Circuit
- While the pilot valves (11) and (12) are being in neutral, the pilot secondary pressure is not generated. By means of operating the operating lever, the secondary pressure is generated in accordance with its motion and led to the control valve (2) from the pilot valve to shift each spool of shifting valve.
- (2) Main Circuit
- 1) Variable Pump Circuit
- The discharged oil from A1 and A2 ports on variable pump enters into P1 and P2 ports on control valve (2) respectively. All the discharged oil from these two ports finally returns to the hydraulic oil tank (20), through each valve of travel straight, travel left, boom and bucket for the P1 oil, and through each valve of travel straight, travel right, arm, swing and service valve for the P2 oil.
- 2) Third Pump Circuit
- The oil discharged from A3 port on 3rd pump enters into P3 port on control valve (2). The P3 oil joins together with P2 oil, and the all amount of oil returns into the hydraulic oil tank (20) through each shifting valve of dozer and slew.

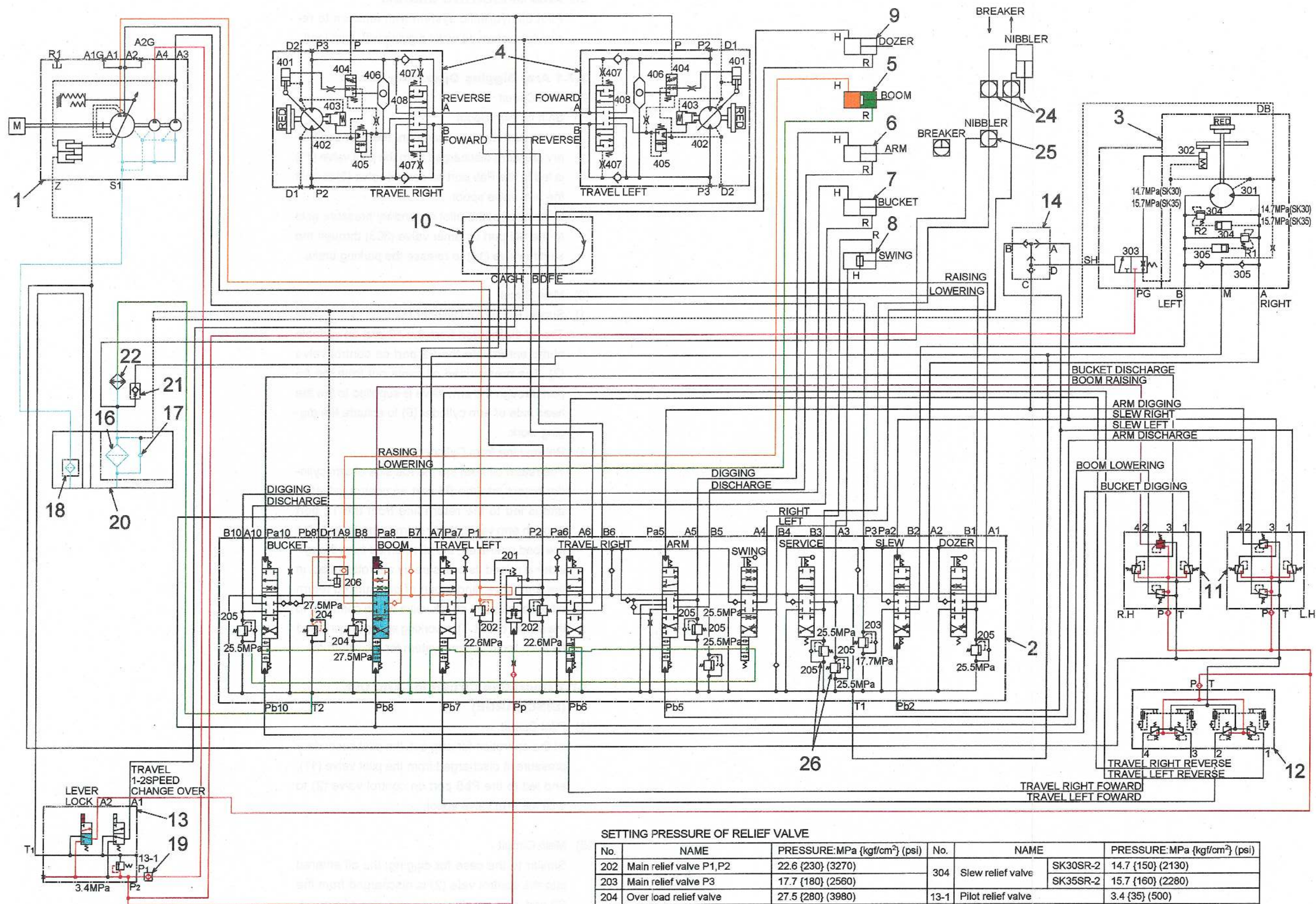


Fig.7 Boom circuit : Boom raising operation

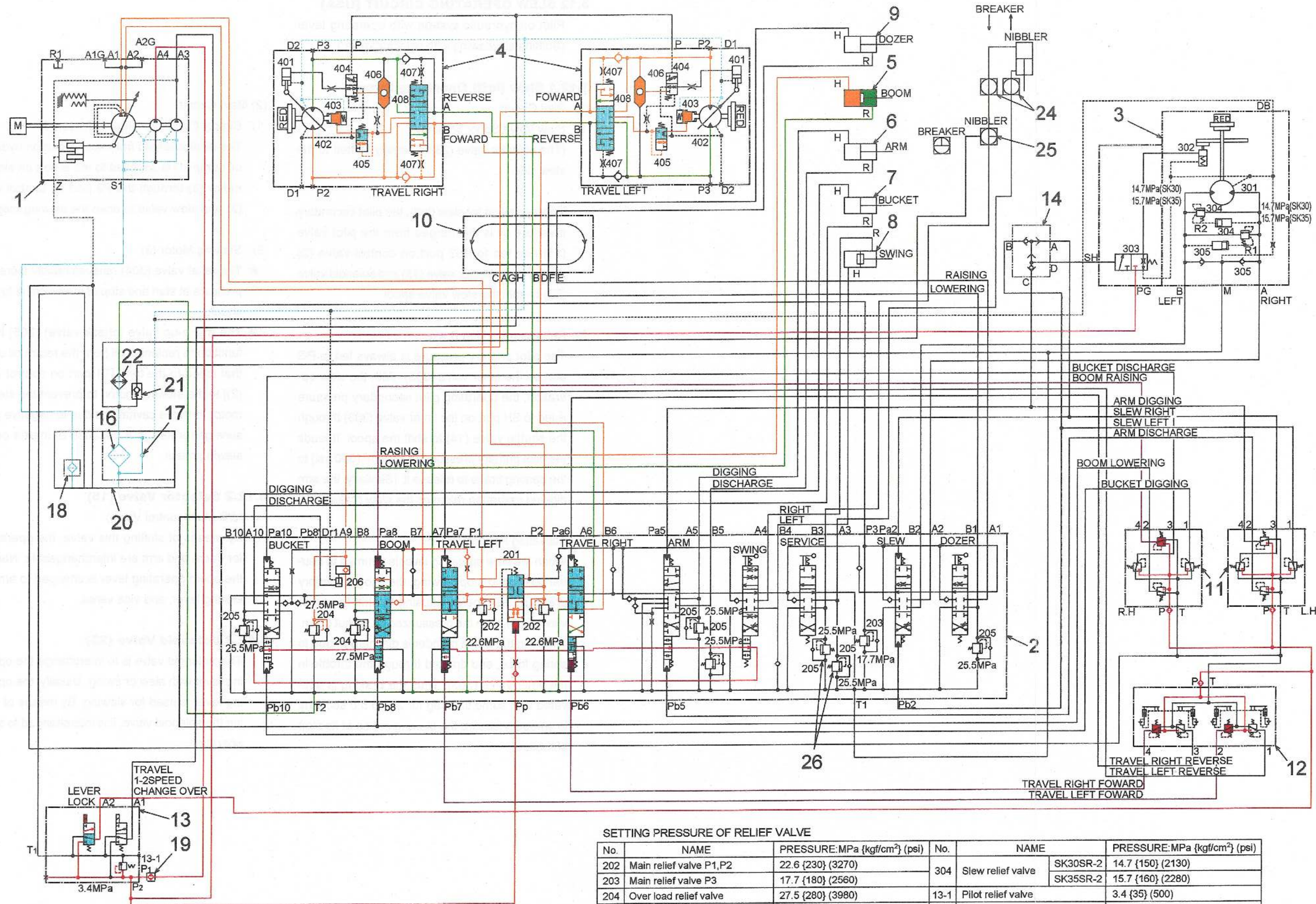


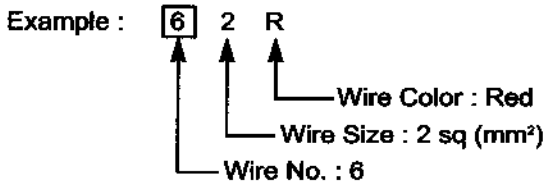
Fig.12 Combined circuit : Travel (forward) 1st / boom raising operation

1. HOW TO READ CIRCUIT DIAGRAM AND HARNESS CONNECTION

1.1 ELECTRIC CIRCUIT DIAGRAM

- (1) In the diagram, the number, size and color of wires are shown on the wiring line.

The size of the wire is to be 0.75 sq (square mm = mm²) unless otherwise specified.

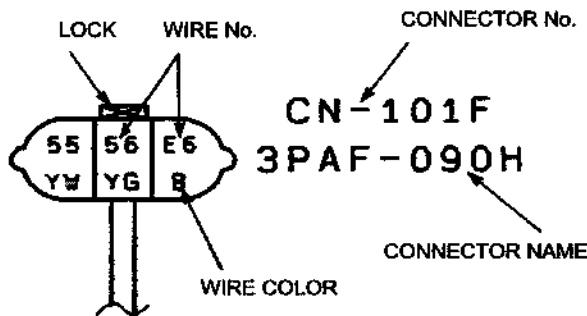


WIRING COLOR TABLE

Symbol	Color	Symbol	Color
B	BLACK	O	ORANGE
G	GREEN	Br	BROWN
L	BLUE	Lg	LIGHT GREEN
R	RED	Gy	GRAY
W	WHITE	Sb	SKY BLUE
Y	YELLOW	V	VIOLET
P	PINK		

1.2 HARNESS CONNECTION

- (1) Indication for Connector



- The figure for the connector pin arrangement is shown by putting the lock (nail) to upper portion, and looking from the fitting face.
- The numbers in the connector show the wire No., and alphabetical letters show the wire color.
- On the side face of connector, the connector name and serial number of the connector No. are indicated.
- At the place indicated as "DOUBLE SPLICE", Two wires are connected to one place.

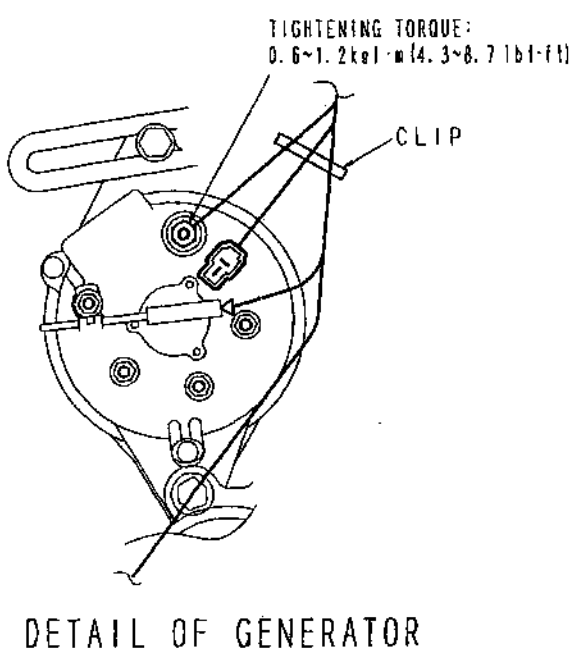
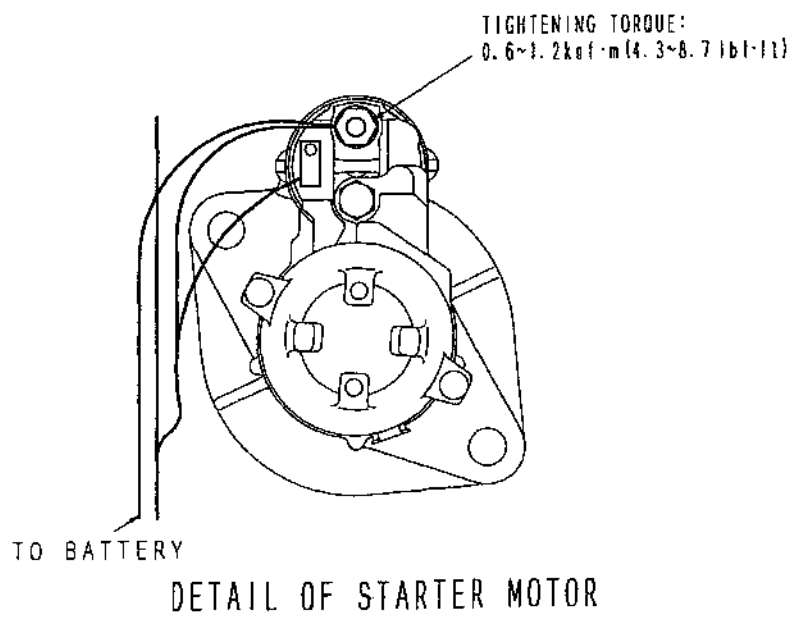
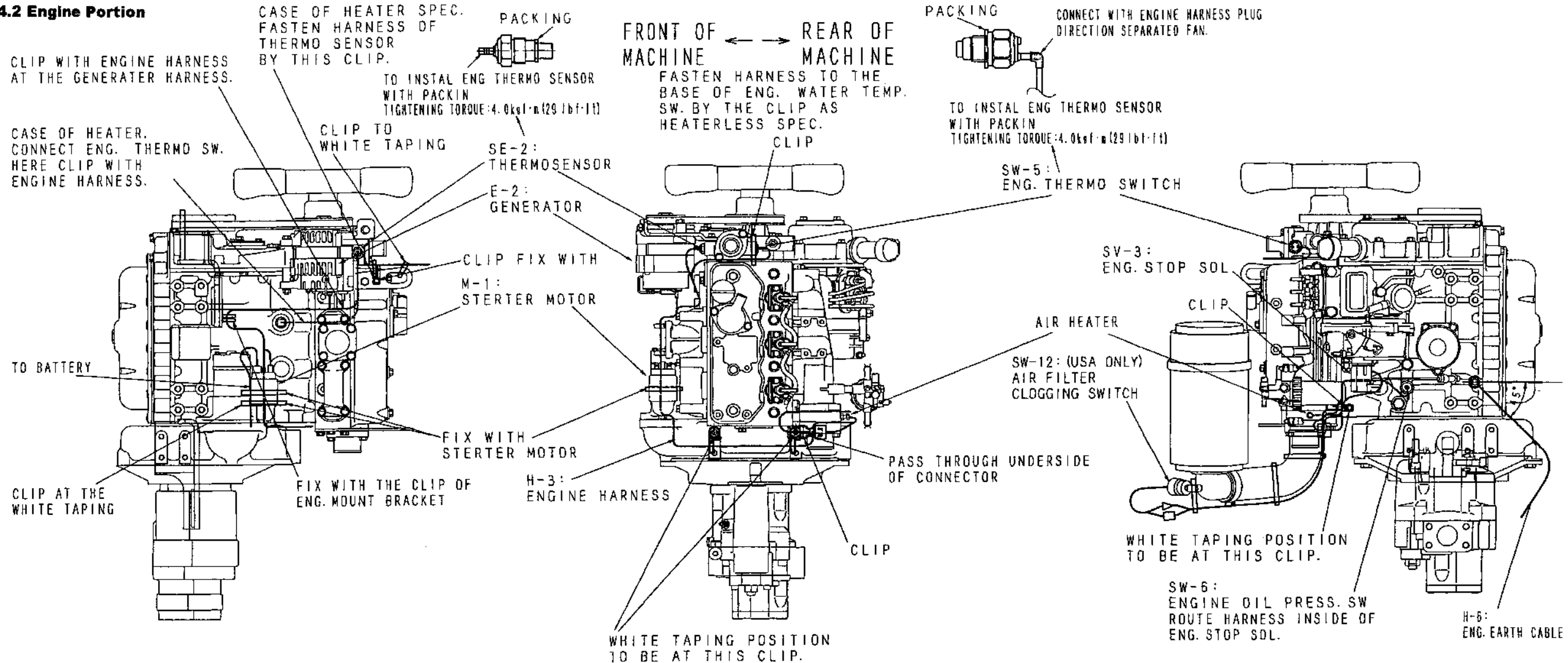
- (2) The connector is to be connected with engaging the male (M) and female (F) connectors of the same number.

Example : CN-101M and CN-101F

Where : M means for Male, and F for Female.

- (3) \leftarrow mark means the connector with diode. The direction for diode is shown by the arrow.
- (4) The AVSS wires are to be used for the size between 0.75 sq and 2 sq. AVS wires between 3 sq and 5 sq and others are AV wires, unless otherwise specified.
- (5) The wire size is 0.75 sq, unless otherwise specified.
- (6) The treatment for the harness end is to be as follows :
- After roughly applying harness taping, wires are installed in a corrugated tube.
 - Harness taping by two plies.
 - No harness treatment for connection.
- (7) The length for the above (6)-3) is to be 30 ± 10 mm. (1.2 ± 0.4 in), and the length includes in the total length of wire shown in the diagram.

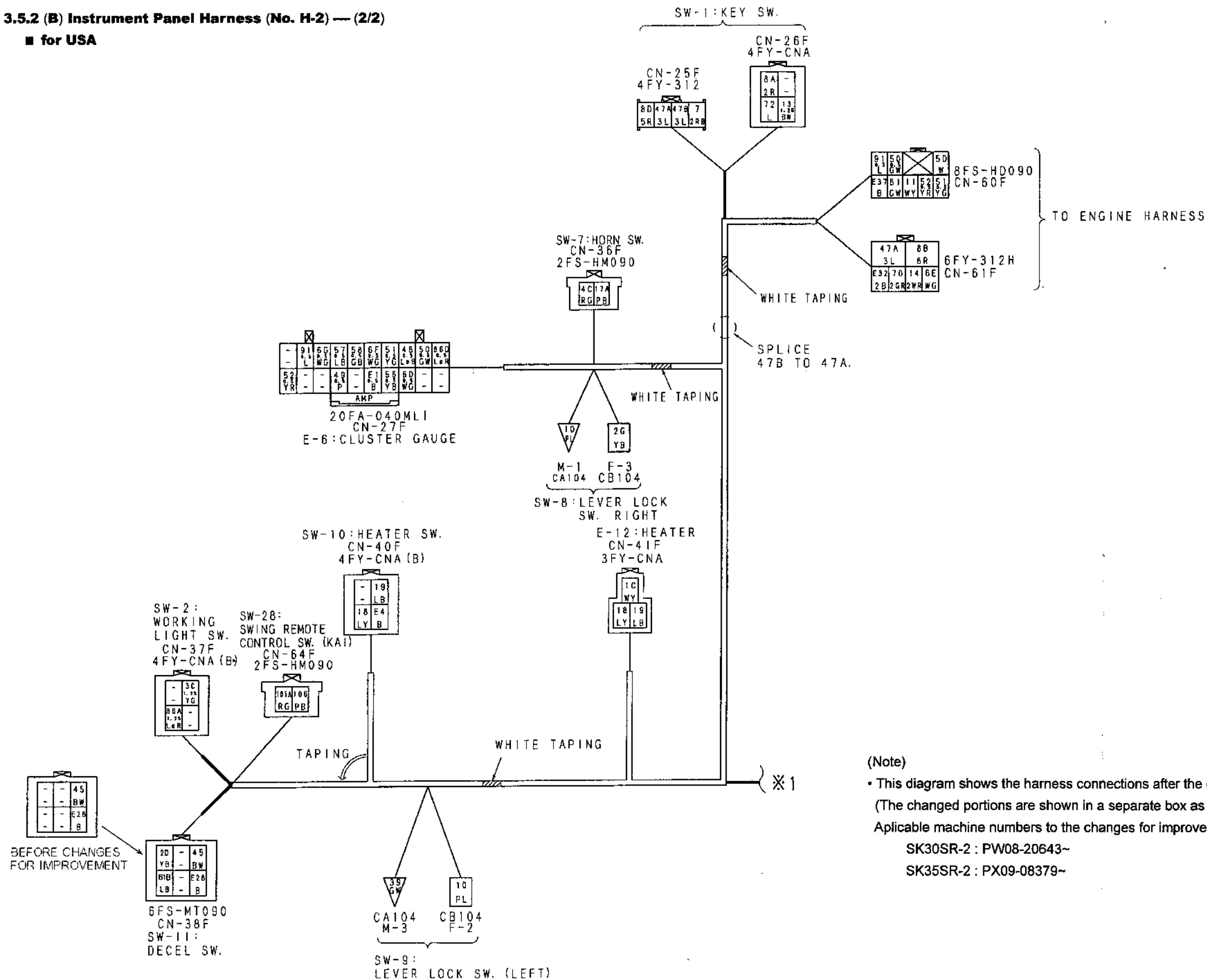
3.4.2 Engine Portion



- NOTES**
- TIGHTENING TORQUE:
- M12: 14.6kpf·m (106 lbf·ft)
 - M10: 6.5kpf·m (47 lbf·ft)
 - M8: 3.6kpf·m (26 lbf·ft)

3.5.2 (B) Instrument Panel Harness (No. H-2) — (2/2)

■ for USA



(Note)

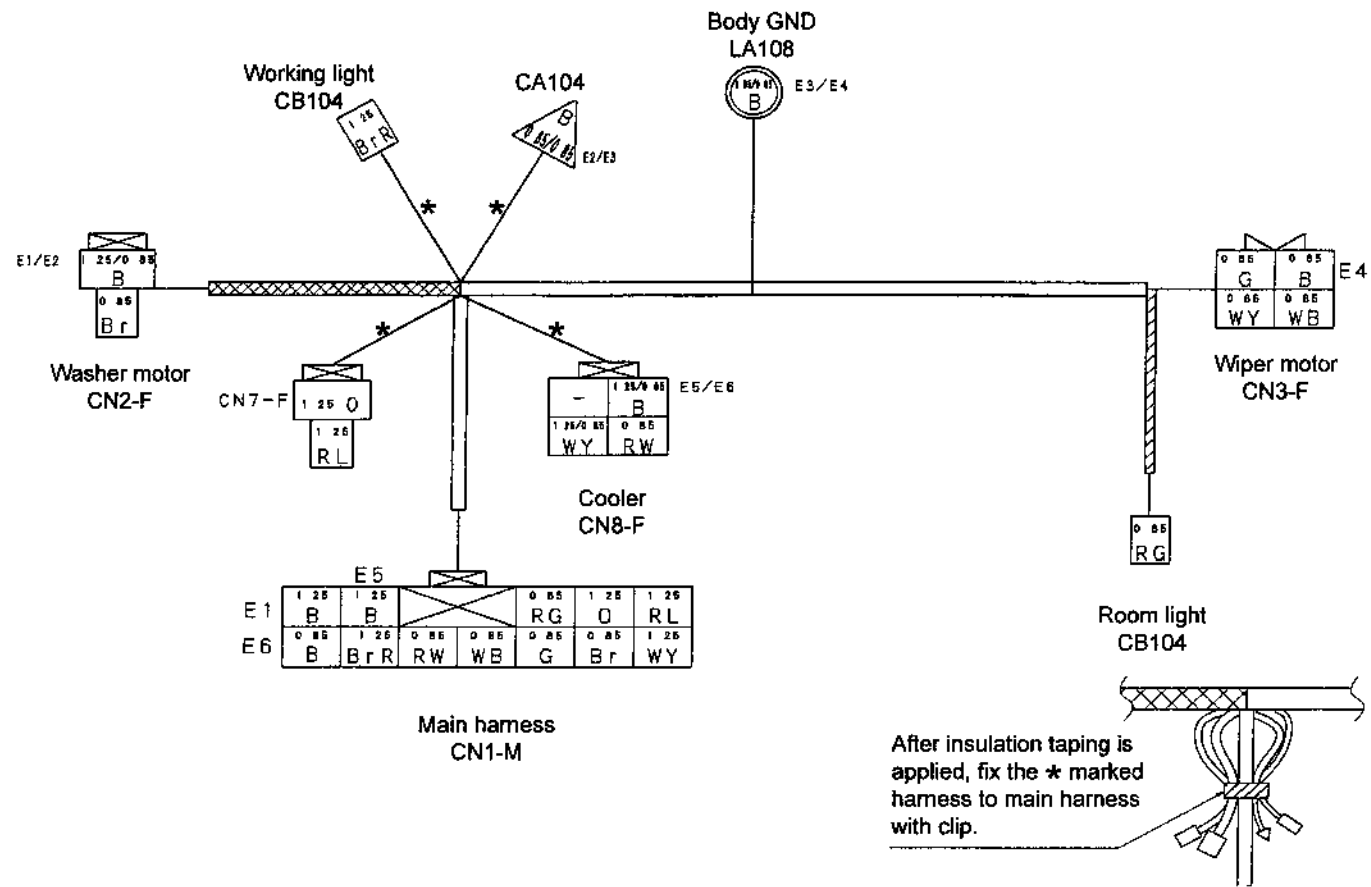
• This diagram shows the harness connections after the changes for improvement.
(The changed portions are shown in a separate box as "Before changes for improvement.")

Applicable machine numbers to the changes for improvement :

SK30SR-2 : PW08-20643~

SK35SR-2 : PX09-08379~

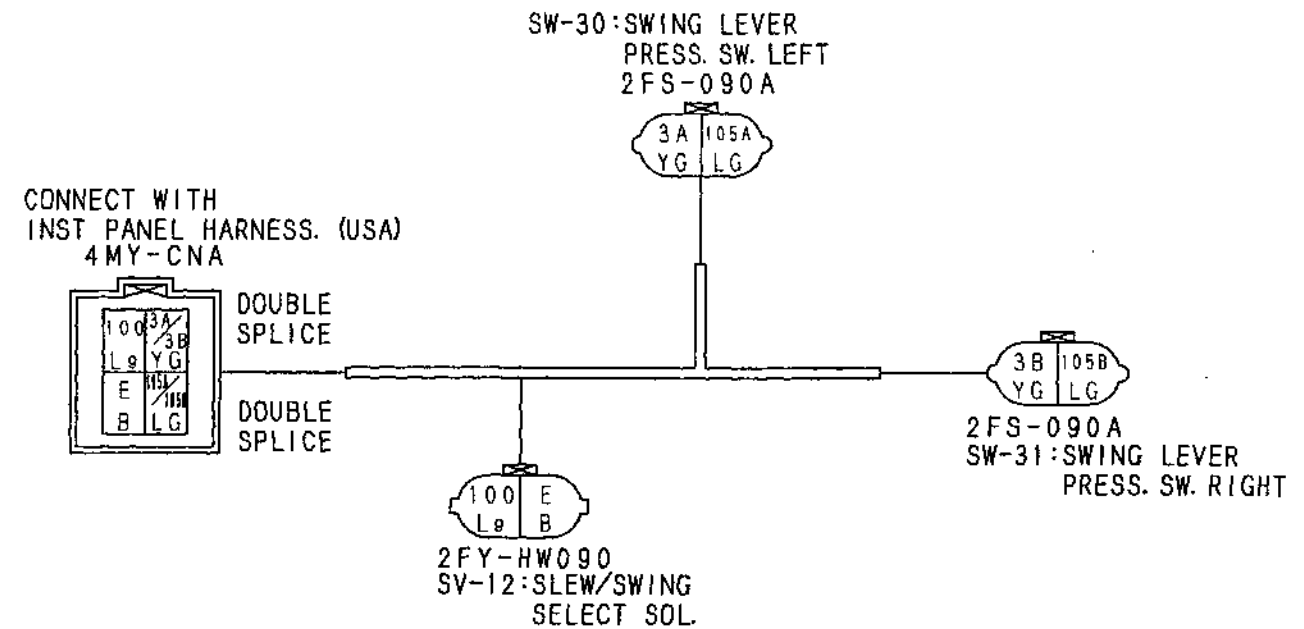
3.5.11 Cab Harness (No. H-11) (OPT.)



E1	B	1.25 ^{mm2}			CN1-F
E2	B	0.85 ^{mm2}	A-3		
E3	B	0.85 ^{mm2}			A-1
E4	B	0.85 ^{mm2}	CN3-F		
E5	B	1.25 ^{mm2}	CN1-M		CN8-F
E6	B	0.85 ^{mm2}	CN1-M		
	RW	0.85 ^{mm2}	CN1-M		CN8-F
	RL	1.25 ^{mm2}	CN1-M		CN7-F
	0	1.25 ^{mm2}	CN1-M		CN7-F
	BrR	1.25 ^{mm2}	CN1-M		A-4
	WB	0.85 ^{mm2}	CN1-M		CN3-F
	WY	1.25 ^{mm2}	CN1-M		CN8-F
	WY	0.85 ^{mm2}	CN3-F		
	RG	0.85 ^{mm2}	CN1-M		A-2
	G	0.85 ^{mm2}	CN1-M		CN3-F
	Br	0.85 ^{mm2}	CN1-M		CN2-F
WIRE COLOR	SIZE	FROM	CONNECTION	TO	

TAPE	STD	08024-01910
CN8-F: CCONNECTOR	STD	YAZAKI: 7123-2446
CN7-F: CCONNECTOR	STD	YAZAKI: 7123-2228
CN3-F: CCONNECTOR	STD	YAZAKI: 7123-2043
CN2-F: CCONNECTOR	STD	YAZAKI: 7123-2228
CN1-F: CCONNECTOR	STD	YAZAKI: 7123-0252
Name		Remarks

3.5.12 Slew/Swing Solenoid Harness (No. H-12) [USA]



CONNECTORS SELECTION TABLE

コネクタ名 (ピン数) CONNECTOR NAME (PIN NUM.)	メーカー MANUFAC.	部品番号 (PART. NUMBER)			
		ハウジング HOUSING	ターミナル TERMINAL	ハーネスシール HARNESS SEAL	リテーナ RETAINER ロックプレート LOCK PLATE
4MY-CNA	YAZAKI	7122-2446	7114-2020		
2FS-HW090	SUMITOMO	6189-0129	1500-0106	7165-0118	6918-0322
2FS-090A	SUMITOMO	6180-2321	1500-0110	7160-8234	

(3) Rotary group

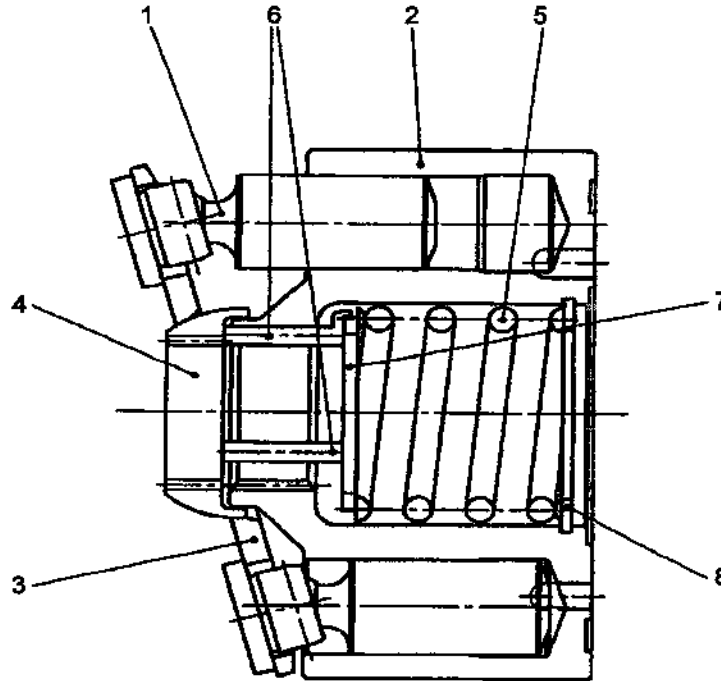


Fig. 1-8

No.	NAME	QTY	No.	NAME	QTY
1	Piston	10	5	Spring	1
2	Cylinder block	1	6	Parallel pin	3
3	Retainer	1	7	Spring seat	1
4	Guide	1	8	Snap ring(for hole)	1

(4) Control spring

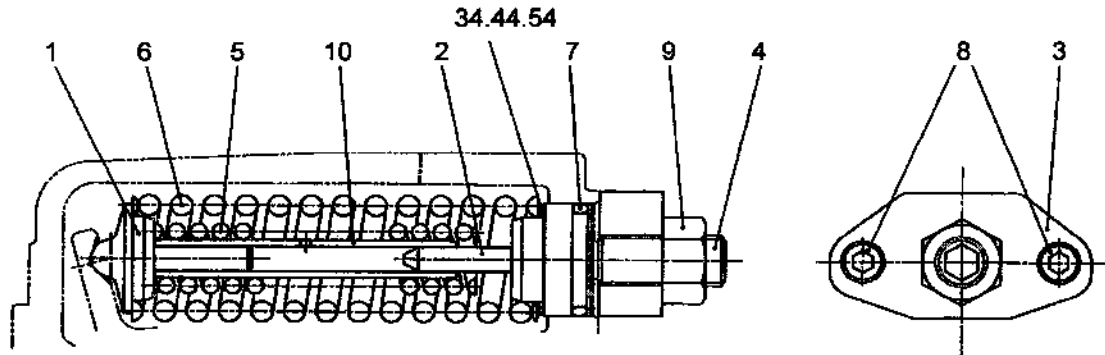


Fig. 1-9

No.	NAME	QTY	No.	NAME	QTY
1	Spring seat	1	8	Capscrew	2
2	Spring seat	1	9	Nut	1
3	Cover	1	10	Spring	1
4	Setscrew	1	34	Shim (t 1.0)	2
5	Spring	1	44	Shim (t 0.5)	2
6	Spring	1	54	Shim (t 0.3)	2
7	O-ring	1			

3. PILOT VALVE (TRAVEL)

3.1 SUMMARY

(1) General view

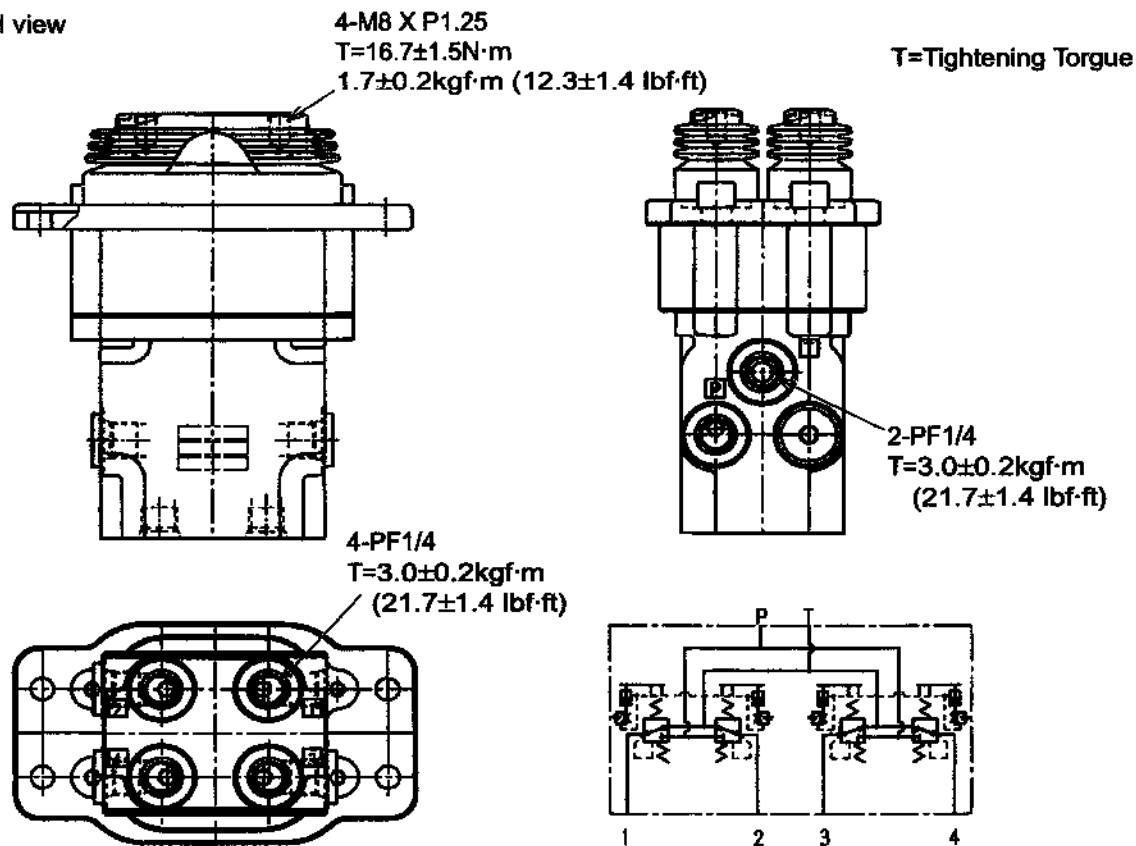


Fig. 3-1

(2) Specifications

ITEM	SPECIFICATIONS
Model(Type)	PVD6P4001
Max. primary pressure	70kgf/cm ² (1000 psi)
Rated flow	10L/min(2.6gal / min)
Weight	3.9kg(8.6 lb)

(3) Performance Characteristics

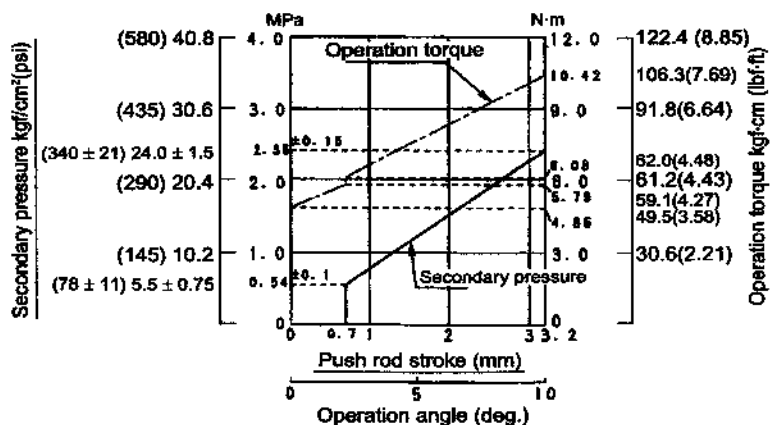


Fig. 3-2

• Required operating torque (damper)
 131±20kgf.cm (9.5±1.45 lbf-ft)
 Push rod speed 0.0275m/s
 (The actual required torque is found by adding the operating torque of the damper in the valve operating torque in the left operating lines.)

(2) Component Parts

The control valve consists of the following four major groups.

- Manual operation : [EU • OCEANIA] Swing, Dozer blade, Service (Nibbler & breaker)
[USA] Dozer blade, Service (Nibbler & breaker)
- Pilot operation : [EU • OCEANIA] Travel straight, Travel left&right, Boom, Arm, Bucket, Slewing
[USA] Travel straight, Travel left&right, Boom, Arm, Bucket, Slewing, Swing
- Accessory : P1, P2 inlet (in common travel straight), P3inlet, Boom overload
- Accessory(Valve) : P1, P2, P3 main relief, Overload relief, Anti cavitation, Boom lock

* For the operating section, some typical examples are described in the below. Refer to the Section for Control Valve in the Chart of Disassembling for the others.

1) Manual operation : Swing (No.5) [EU]

Note) Swing control of [USA] is operated by hyd. pilot line.

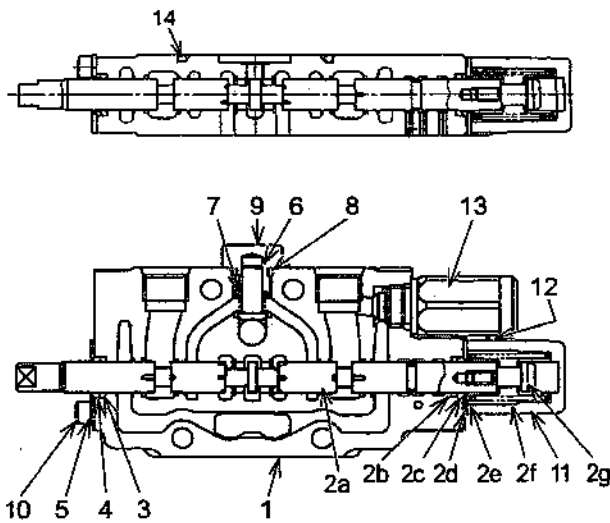


Fig. 4-5

Table. 4-5

No.	NAME	Q'TY
1	Body	1
2a	SPool	1
2b	O-ring 1A P12	1
2c	Dust wiper	1
2d	Oil seat retainer	1
2e	Spring seat	2
2f	Spring	1
2g	Spool end	1
3	O-ring 1A P12	1
4	Dust wiper	1
5	Oil sear retainer	1
6	Load check valve	1
7	Spring(for check valve)	1
8	O-ring 1B P11	2
9	Plug	1
10	Socket bolt M5X10	2
11	Cover	1
12	Socket bolt M5X18	2
13	Anti cavitation valve	1
14	O-ring 1BW G4	1

2) Pilot operation : Slewing (No.2)

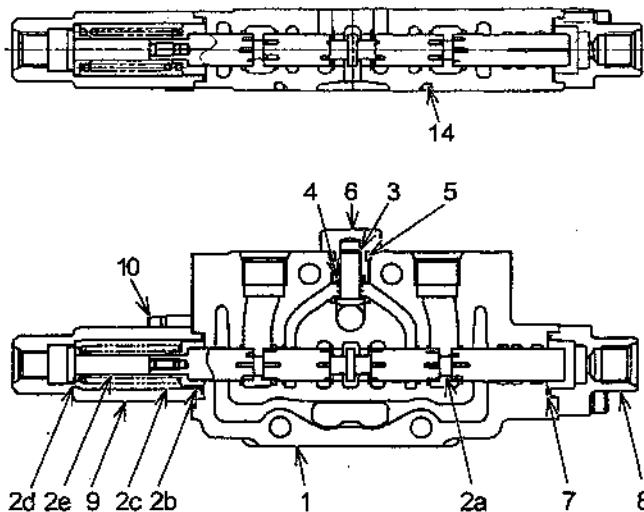


Fig. 4-6

Table. 4-6

No.	NAME	Q'TY
1	Body	1
2a	Spool	1
2b	Spring seat	1
2c	Spring	1
2d	Spring seat	1
2e	Spool end	1
3	Load chack valve	1
4	Spring(for chack valve)	1
5	O-ring 1B P11	1
6	Plug	1
7	O-ring 1BS22	2
8	Pirot cover	1
9	Pirot cover	1
10	Socket bolt M5X20	4
14	O-ribg 1BW G4	1

(2) Suction operation

When the negative pressure is generated in the P port, the oil is supplied through the tank circuit. When the pressure of the tank circuit from the P port rises, the socket is pushed up. Consequently, the space between the body seat and the socket opens, and the oil flows from the tank passage into the P port and the space fills with the oil.

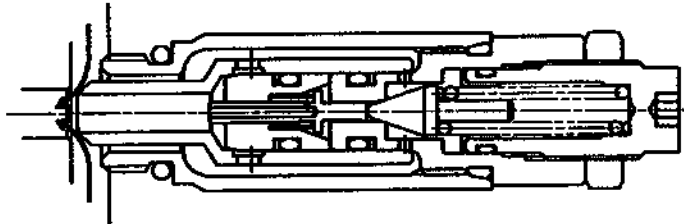


Fig. 4-18

(5) Operation of anti-cavitation valve

When the negative pressure is generated in the P port, the oil is supplied through the tank circuit. When the pressure from the P port rises, the valve is pushed up. Consequently, the space between the body seat and the socket opens, and the oil flows from the tank circuit into the P port and the space fills with the oil.

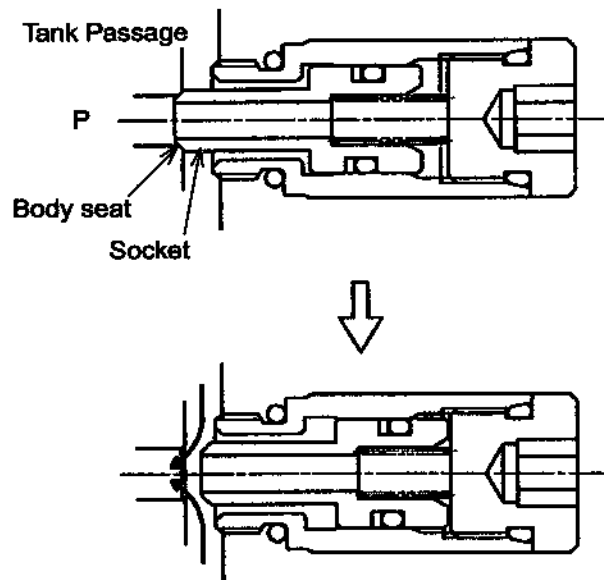


Fig. 4-19

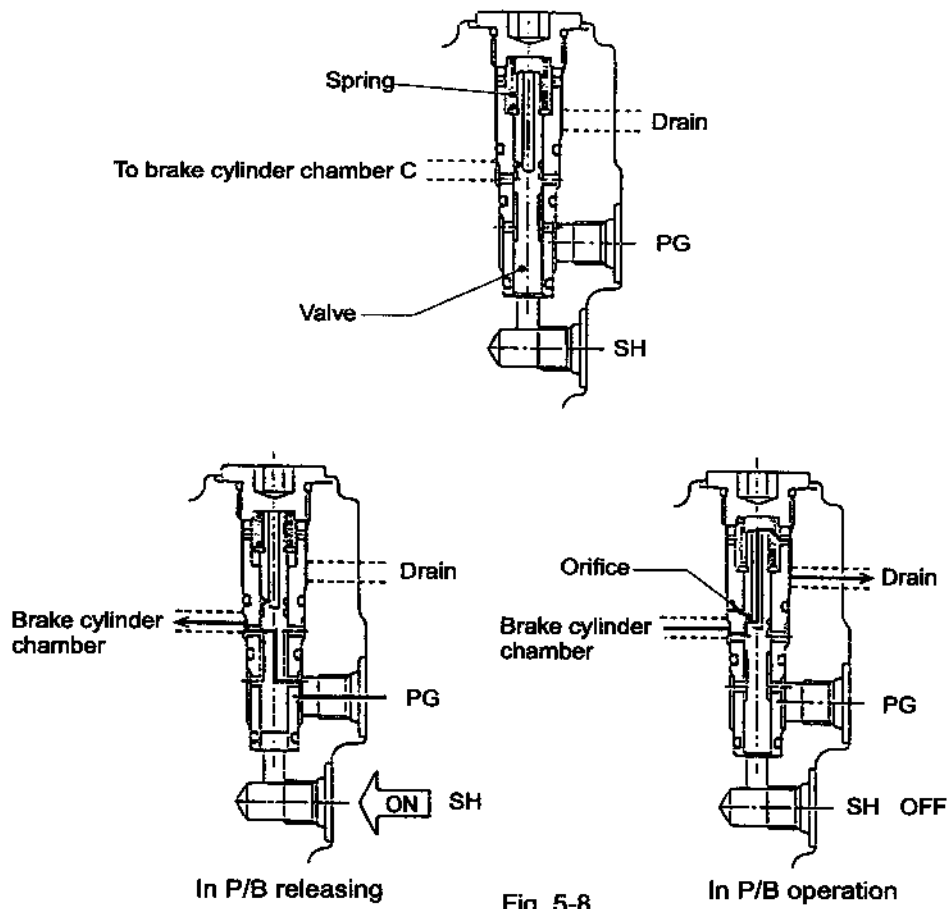
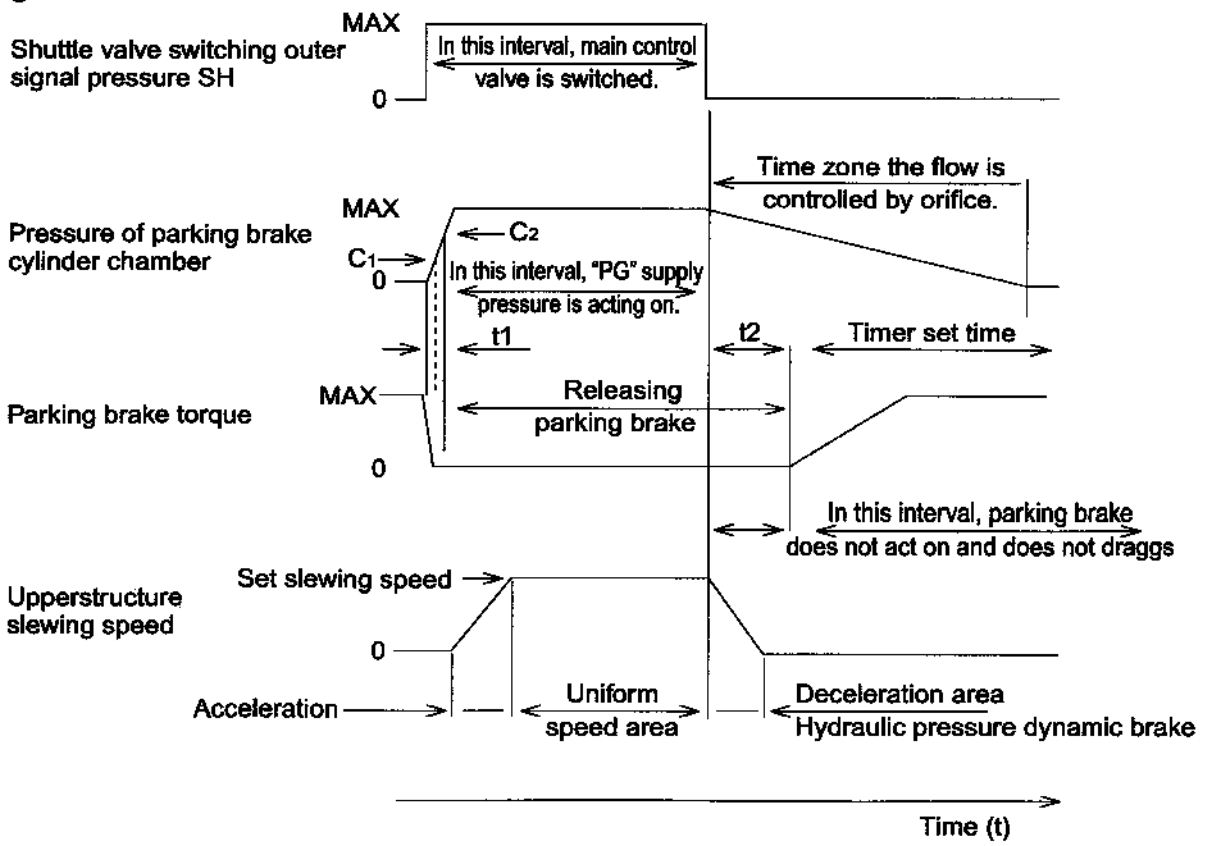


Fig. 5-8

The above function is explained in the diagram shown below.

Diagram



6.3 EXPLANATION OF FUNCTION

6.3.1 Reduction Unit

(1) Function

This reduction unit is equipped with spur gears (Hereinafter referred as 1st reduction gear section) and differential gears (Hereinafter referred as 2nd reduction gear section), reduces the high rotation speed from the hydraulic motor, converts it to low speed large torque and rotates hub (1) (Casing.)

(2) Explanation of function

1) 1st reduction gear section

The rotation of hydraulic motor shaft is transmitted to input gear (6) which is linked with shaft (102) in spline.

Then, the rotation speed of two spur gears (7) which are engaged with input gear is reduced. Also, the reduction rate of 1st reduction gear section is as follows.

$$i_1 = -\frac{Z_S}{Z_I}$$

i_1 = Reduction rate of 1st reduction gear section

Z_I = Number of teeth of input gear

Z_S = Number of teeth of spur gear

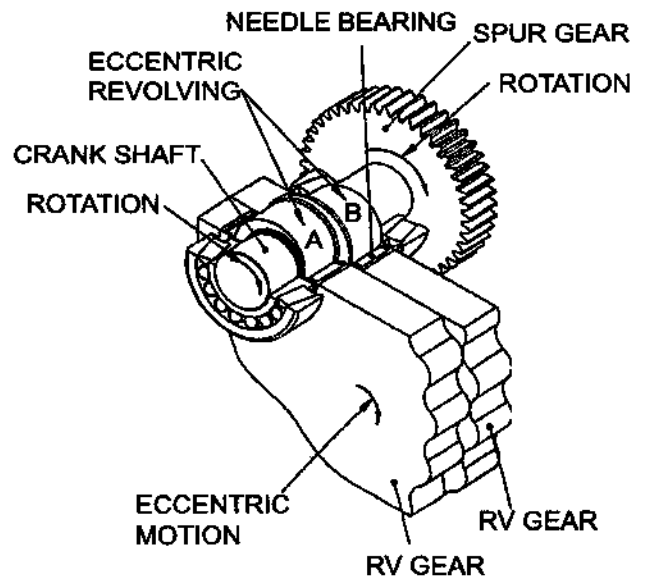
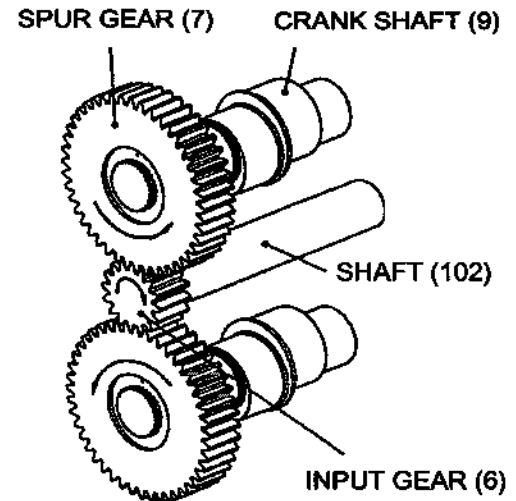
2) 2nd reduction gear section

a) Two spur gears are engaged with crankshaft respectively to transmit the power from the 1st reduction gear section to 2nd reduction gear section.

The eccentric bodies of crankshaft A and B revolve eccentrically (revolution) while rotating on its axis by rotating crankshaft.

Also, these eccentric bodies A and B and RV gears (4) transmit only the eccentric revolution.

And RV gears A and B revolve in the same direction and number of revolutions as spur gear and crankshaft.



8. CYLINDER

8.1 SPECIFICATIONS

(1) General View

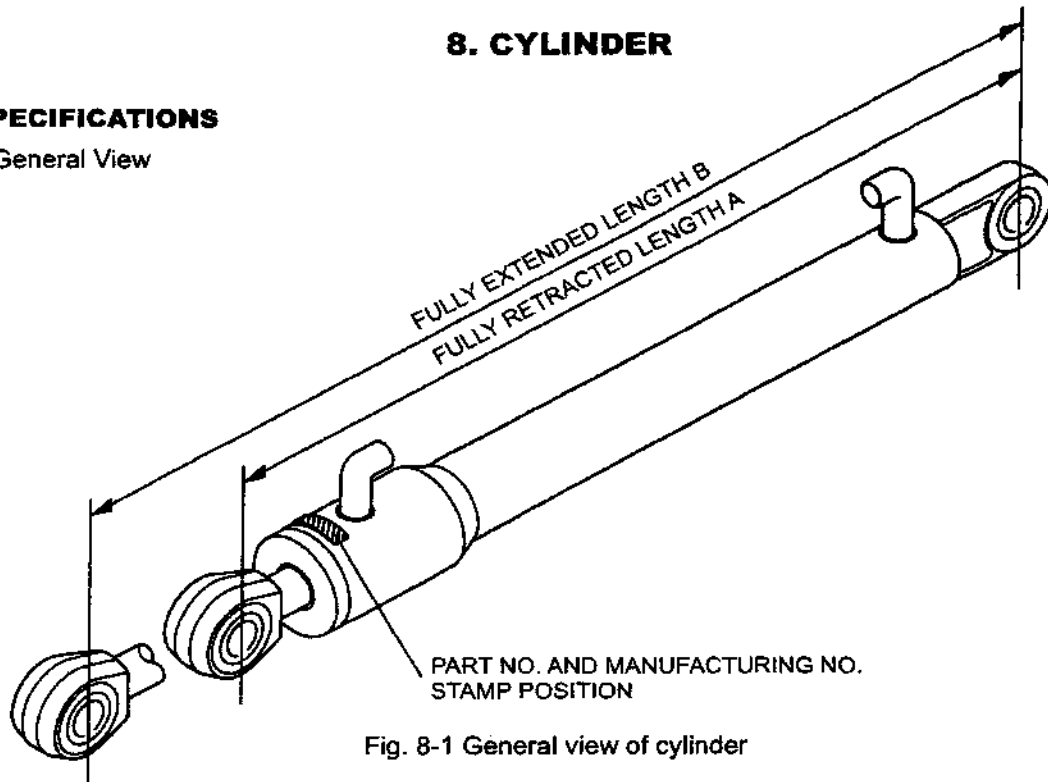


Fig. 8-1 General view of cylinder

(2) Specifications

■ SK30SR-2

Table 8-1

Unit : mm (ft·in)

Cylinder		Cylinder Bore / Rod Dia.	Stroke	Center distance of mounting pins Full extend B / Full retract A	Cushion	Dry weight kg (lb)
Boom	Canopy [OCEANIA]	ø80 / ø45 (3.15" / 1.77")	518 (1'8.4")	1380 / 862 (4'6.3" / 2'9.9")	Rod side	33 (73)
	Cab	[ø80 / ø45 (3.15" / 1.77")]	[538 (1'9.2")]	[1400 / 862 (4'7.1" / 2'9.9")]		[34 (75)]
Arm		ø75 / ø45 (2.95" / 1.77")	541 (1'9.3")	1398 / 857 (4'7.0" / 2'9.7")	None	30 (66)
Bucket		ø65 / ø35 (2.56" / 1.38")	487 (1'7.2")	1240 / 753 (4'0.8" / 2'5.6")	None	20 (44)
Swing		ø80 / ø45 (3.15" / 1.77")	488 (1'7.2")	1331 / 843 (4'4.4" / 2'9.2")	Both sides	37 (82)
Dozer		ø80 / ø45 (3.15" / 1.77")	173 (6.8")	701 / 528 (2'3.6" / 1'8.8")	None	21 (46)

Note) • The dimensions in [] are only applicable for the machines with canopy specification which are delivered for oceania district.

■ SK35SR-2

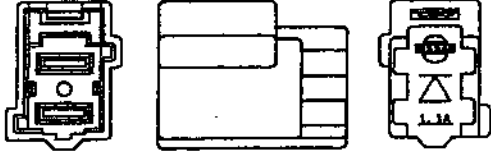
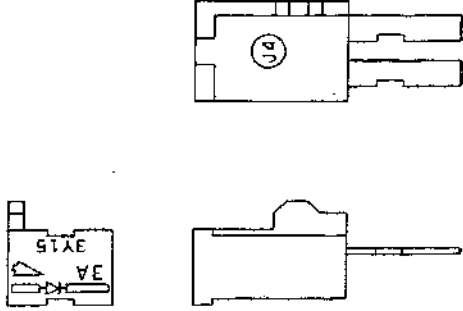
Table 8-2

Unit : mm (ft·in)

Cylinder		Cylinder Bore / Rod Dia.	Stroke	Center distance of mounting pins Full extend B / Full retract A	Cushion	Dry weight kg (lb)
Boom	Canopy [OCEANIA]	ø85 / ø50 (3.35" / 1.97")	531 (1'8.9")	1417 / 886 (4'7.8" / 2'10.9")	Rod side	37 (82)
	Cab	[ø85 / ø50 (3.35" / 1.97")]	[556 (1'9.9")]	[1442 / 886 (4'8.8" / 2'10.9")]		[37 (82)]
Arm		ø80 / ø45 (3.15" / 1.77")	560 (1'10.0")	1432 / 872 (2'8.4" / 2'10.3")	None	34 (75)
Bucket		ø65 / ø35 (2.56" / 1.38")	487 (1'7.2")	1240 / 753 (4'0.8" / 2'5.6")	None	20 (44)
Swing		ø80 / ø45 (3.15" / 1.77")	488 (1'7.2")	1331 / 843 (4'4.4" / 2'9.2")	Both sides	37 (82)
Dozer		ø90 / ø45 (3.54" / 1.77")	150 (5.9")	690 / 540 (2'3.2" / 1'9.3")	None	23 (51)

Note) • The dimensions in [] are only applicable for the machines with canopy specification which are delivered for oceania district.

2.3 SPECIFICATIONS ELECTRICAL EQUIPMENT

Code No. Parts Name Parts No. Use Applicable Machine	Specifications	Description																			
D-1,2,3,7,12 Diode 2475U38 Horn E/G stop solenoid E/G stop relay Working light relay Battery relay PH00101~ PM05-05001~ PV08-20001~ PW08-20001~ PX09-08001~	<table border="1"> <tr> <td>Model</td> <td>PM210-02031</td> </tr> <tr> <td>Rated current</td> <td>1.1A or less</td> </tr> <tr> <td>Breakdown</td> <td>800V or more</td> </tr> </table>	Model	PM210-02031	Rated current	1.1A or less	Breakdown	800V or more	 <p>Mating connector YAZAKI Connector 7123-6026-60 Terminal 7116-2871 Rear holder 7157-6222-50</p>													
Model	PM210-02031																				
Rated current	1.1A or less																				
Breakdown	800V or more																				
D-5, 13 Diode YN02D01001P1 Travel 1,2speed Slew/Swing relay [USA] PM05-05001~ PV08-20001~ PW08-20001~ PX09-08001~	<table border="1"> <tr> <td>Type</td> <td>7321-9822-30</td> </tr> <tr> <td rowspan="2">Max rated</td> <td>Current</td> <td>3A</td> </tr> <tr> <td>Breakdown</td> <td>400V</td> </tr> </table> <p>Mating connector</p> <table border="1"> <thead> <tr> <th></th> <th>Maker</th> <th>Housing</th> <th>Terminal</th> </tr> </thead> <tbody> <tr> <td>2poles</td> <td>YAZAKI SUMITOMO</td> <td>7123-7729-40 6098-001?</td> <td>7116-1181P</td> </tr> <tr> <td>4poles</td> <td>YAZAKI</td> <td>7123-7144</td> <td>7116-1181P</td> </tr> </tbody> </table>	Type	7321-9822-30	Max rated	Current	3A	Breakdown	400V		Maker	Housing	Terminal	2poles	YAZAKI SUMITOMO	7123-7729-40 6098-001?	7116-1181P	4poles	YAZAKI	7123-7144	7116-1181P	
Type	7321-9822-30																				
Max rated	Current	3A																			
	Breakdown	400V																			
	Maker	Housing	Terminal																		
2poles	YAZAKI SUMITOMO	7123-7729-40 6098-001?	7116-1181P																		
4poles	YAZAKI	7123-7144	7116-1181P																		

1. EXPLAINING CHAPTER OF WHOLE DISASSEMBLY & ASSEMBLY

1.1 FORM FOR CHAPTER OF DISASSEMBLY & ASSEMBLY

This chapter is consist of 3-Section as follows.

- (1) ATTACHMENTCode No. ; PW32
Part I ; Removing and Installing Assy
Part II ; Disassembling and Assembling Components
1) Hydraulic cylinder
- (2) UPPER SLEWING STRUCTURECode No. ; PW33
Part I ; Removing and Installing Assy
Part II ; Disassembling and Assembling Components
1) Hydraulic pump 2) Control Valve 3) Pilot Valve (ATT)
4) Pilot Valve (Travel) 5) Slewing Motor 6) Swivel Joint
- (3) TRAVEL SYSTEMCode No. ; PW34
Part I ; Removing and Installing Assy
Part II ; Disassembling and Assembling Components
1) Travel Motor

1.2 INDICATION OF TIGHTENING TORQUE

Tightening torque is indicated as follows, for example;

$$T = 10 \text{ kgf}\cdot\text{m} (72 \text{ lbf}\cdot\text{ft})$$

Tolerance is $\pm 10\%$ unless specified.

- Refer Code No. PW11 TOOLS for standard tightening torque.


4.2 INSTALLATION OF BOOM

Installation is performed in the reverse order of removal, including the following.

▲ • At the alignment of pin bores, never insert your finger into the bores.

• Make sure to align them with visual confirmation.

- (1) Make clean the welded area on each of structure to inspect any cracks there.
- (2) Check the dust seal for damages, and replace the faulty dust seal to new one (referring to Fig. 2-15 for the installing procedures).
- (3) Referring to the Section "ATTACHMENT DIMENSIONS" of Specifications, replace the worn-out pin and bush to new ones.
- (4) Before inserting the pin, apply grease to the shaft area.
- (5) Referring to Fig. 2-16, install the capscrew and nuts to prevent the pin from coming out.

 : 17 mm

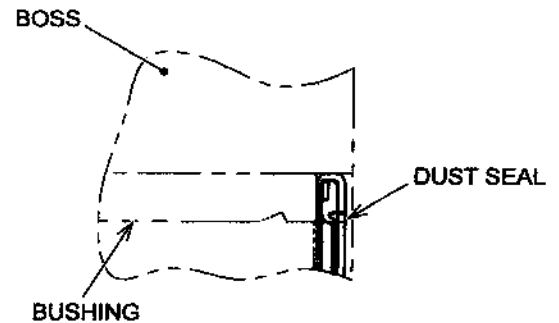


Fig. 2-15 Dust seal installation

- (6) Make sure to provide an appropriate clearance for thrust direction at the installation of pin referring to Fig. 2-16.
- (7) For the adjustment for clearance, insert resin (plastic) shim first, then adjust the clearance with steel shims.

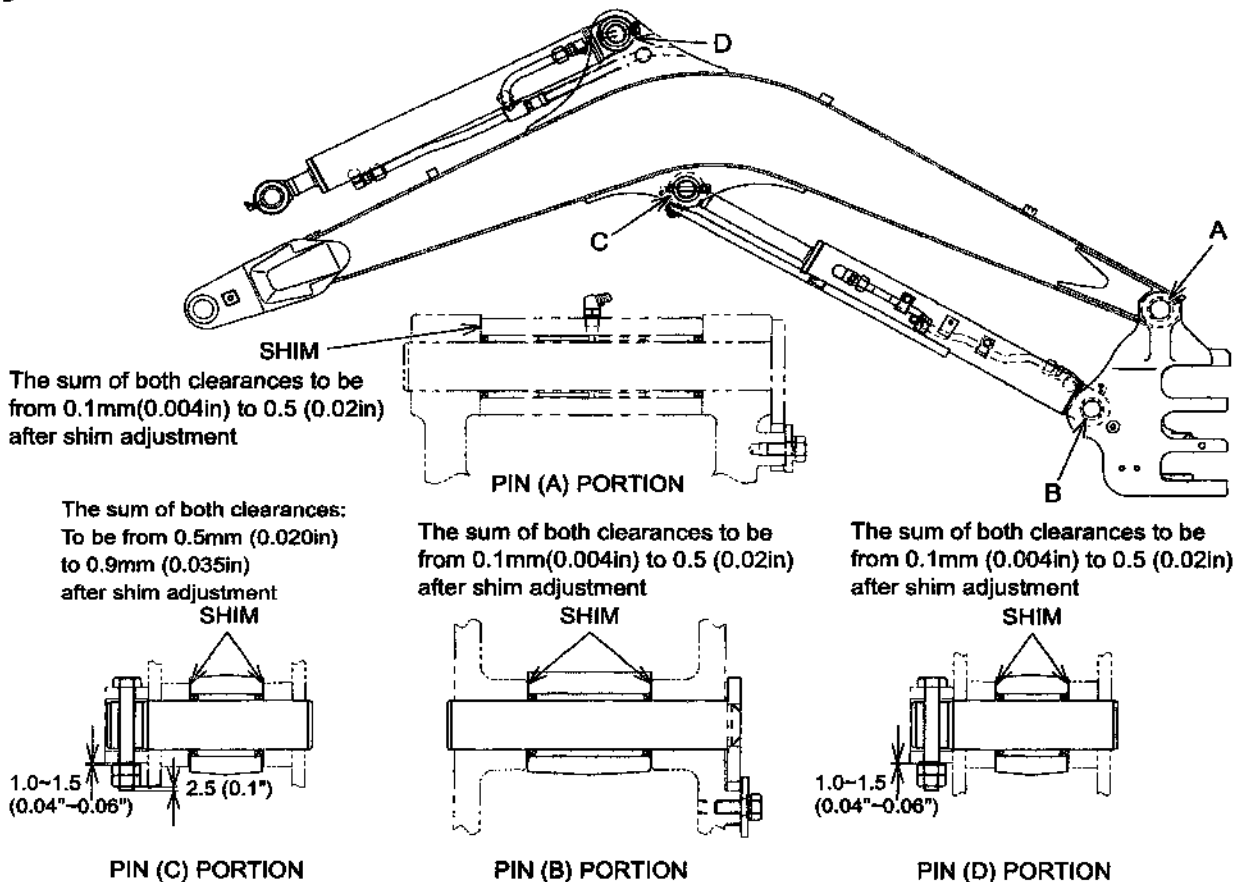


Fig. 2-16 Sectional view of Installing Pin

1.5 ASSEMBLY

(1) Assembling Clevis Portion

- 1) With the installing jig (B) shown Item 1.7, press the bushings (24) into the piston rod assy (2) and tube assy (1).

- Prior to the work, apply hydraulic oil on the surface of parts.

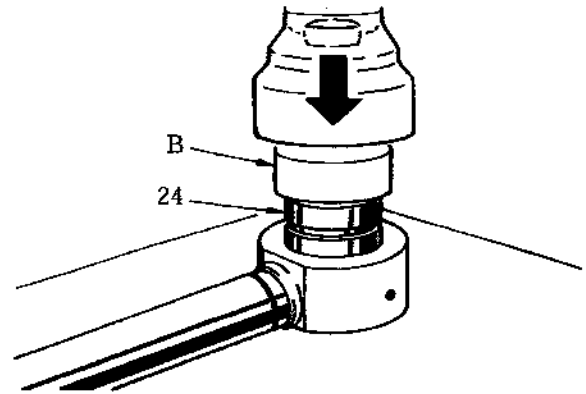


Fig. 1-16 Installing pin bushing

- 2) With the setting tool, install the wiper ring (25).

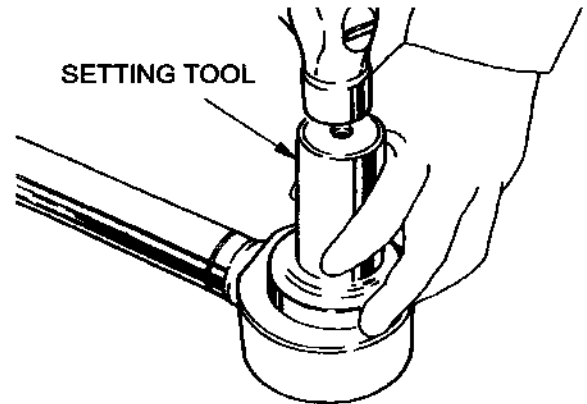


Fig. 1-17 Installing wiper ring

(2) Assembling Cylinder Head

- 1) With installing jig (A) shown Item 1.7, press-fit the bushing (4).

- Prior to the work, apply hydraulic oil on inner periphery of the cylinder head (3).
- At press-fitting the bushing (4) into the cylinder head (3), make the top surfaces of them in level without step.

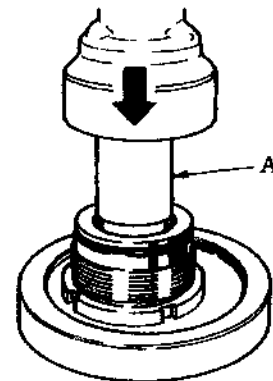


Fig. 1-18 Assembling cylinder head

2) Installing U-Ring

- Install the U-ring (5).

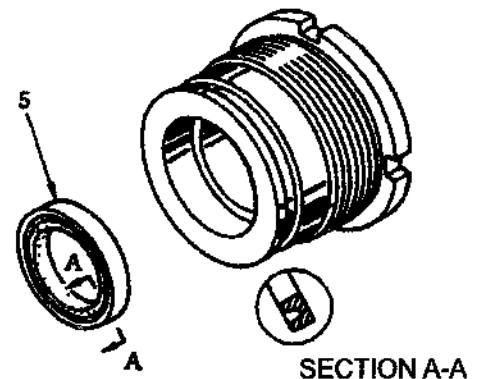
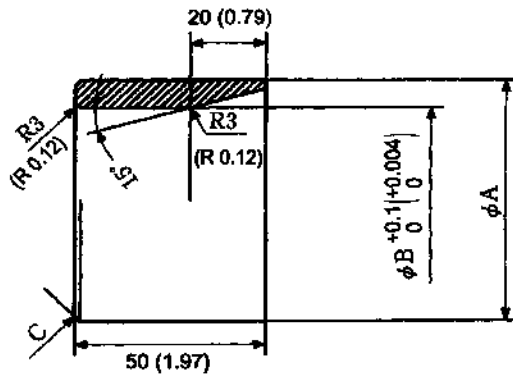


Fig. 1-19 Installing U-ring

(5) Reforming Jig (E) for Seal Ring

Unit : mm (in)



Applicable Cylinder		Dimension	
SK30SR-2	SK35SR-2		
I. D. of Tube ; ø65		A	80.0 (3.15)
Bucket	Bucket	B	65.0 (2.56)
I. D. of Tube ; ø75		A	90.0 (3.54)
Arm	—	B	75.0 (2.95)
I. D. of Tube ; ø80		A	95.0 (3.74)
Swing Boom Dozer	Arm Swing	B	80.0 (3.15)
I. D. of Tube ; ø85		A	100.0 (3.94)
—	Boom	B	85.0 (3.35)
I. D. of Tube ; ø90		A	105.5 (4.15)
—	Dozer	B	90.0 (3.54)

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(9) Removing N&B pedal rod [EU - OCEANIA]

- 1) Loosen 2 nuts (14) and remove rod (4).

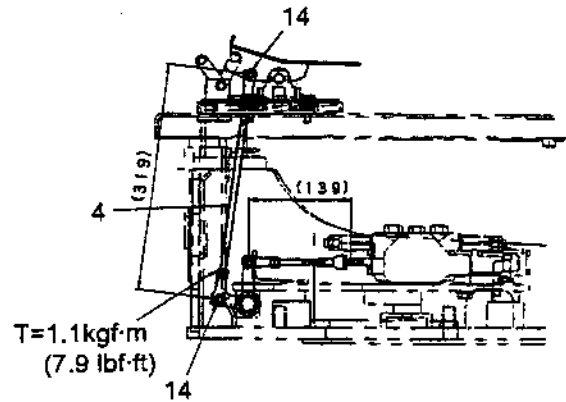


Fig. 3-4 Removing pedal rod

- (10) Removing cover assembly (19) in front of stand
Unscrew two M8X16 SEMS bolts (26) to remove the cover assembly (19).

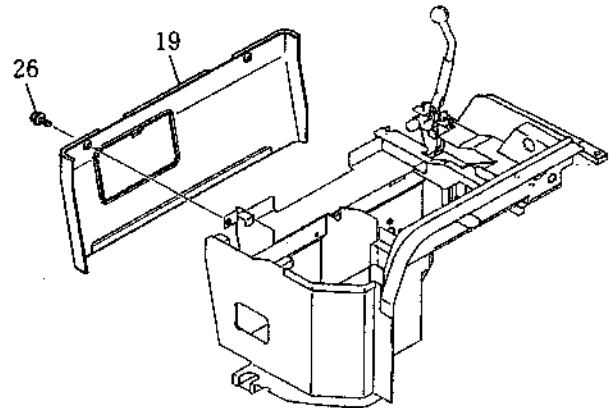
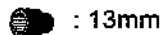


Fig. 3-5 Cover assembly (19) removal

- (11) Remove the left-side rear cover assembly (17)
[see Step 2.1-(10)].

3.2 DISASSEMBLY

- (1) Remove the plate (3).

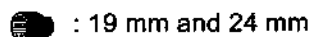


- (2) Remove governor motor cable and the grommet (4A) from the plate (3) (optional).

- (3) Remove dozer lever cable and the grommet (4B) from the floor plate (1).

- (4) Remove cover (36) [see Step 2.1-(8)].

- (5) Unscrew one M12X55 SEMS bolt (43) and one M16X40 capscrews (45) fastened together with the stand.



- (6) Pull out the floor plate (1) forward and remove it.

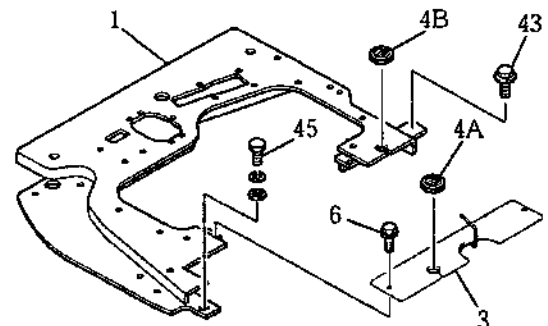


Fig. 3-6 Floor plate (1) removal

3.3 ASSEMBLING FLOOR PLATE

- (1) Assemble the floor plate in reverse order of the disassembly.


9. AIR CLEANER

9.1 DISASSEMBLY PREPARATION

Open the rear bonnet assembly.

9.2 DISASSEMBLY


- (1) Unscrew the SEMS bolt (9) fastening the clip (6).

 : 8 mm

- (2) Loosen the clip (5) to remove the air hoses (2) and (3).

 : Minus screwdriver

- (3) Unscrew two SEMS bolts (7) to remove the air cleaner assembly (1).

 : 13mm

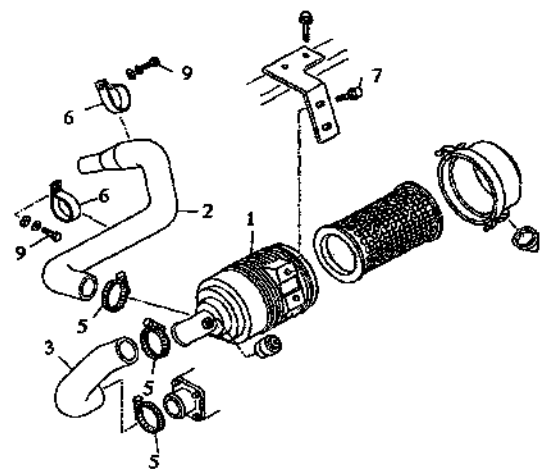


Fig. 9-1 Air cleaner removal

9.3 ASSEMBLY

Assemble the air cleaner in reverse order of the disassembly.

- Tightening torque for SEMS bolt (7): 2.4 kgf·m (17 lbf·ft)

10. GENERATOR


10.1 DISASSEMBLY PREPARATION

- (1) Remove the radiator hose and hydraulic return hose to facilitate to remove the generator (see Sections 8 and 14).
- (2) Disconnect the minus side terminal of the battery.

10.2 DISASSEMBLY

- (1) Disconnect connector (CN-302).

- (2) Remove the capscrews (1), (2), and (3).

 : 13mm

- (3) Remove the V-belt and the generator (1).

10.3 ASSEMBLY

- (1) Assemble the generator in reverse order of the disassembly.

- (2) V-belt tension

Press the middle of the V-belt with a thumb to adjust the deflection within the following range:

Deflection: 10 to 15 mm (0.39 to 0.59 inch)

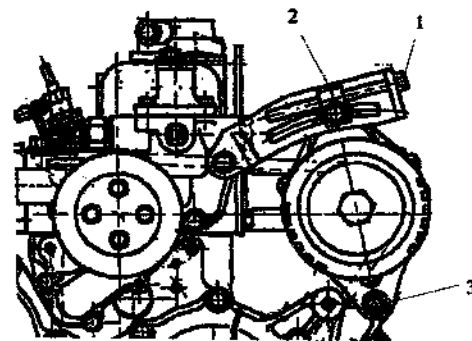


Fig. 10-1 Generator removal

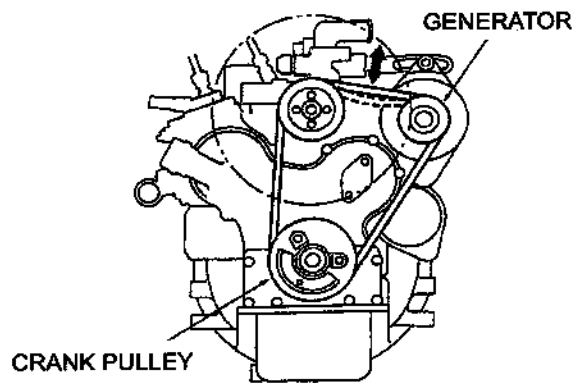


Fig. 10-2 V-belt tension

■ FOR EU • OCEANIA

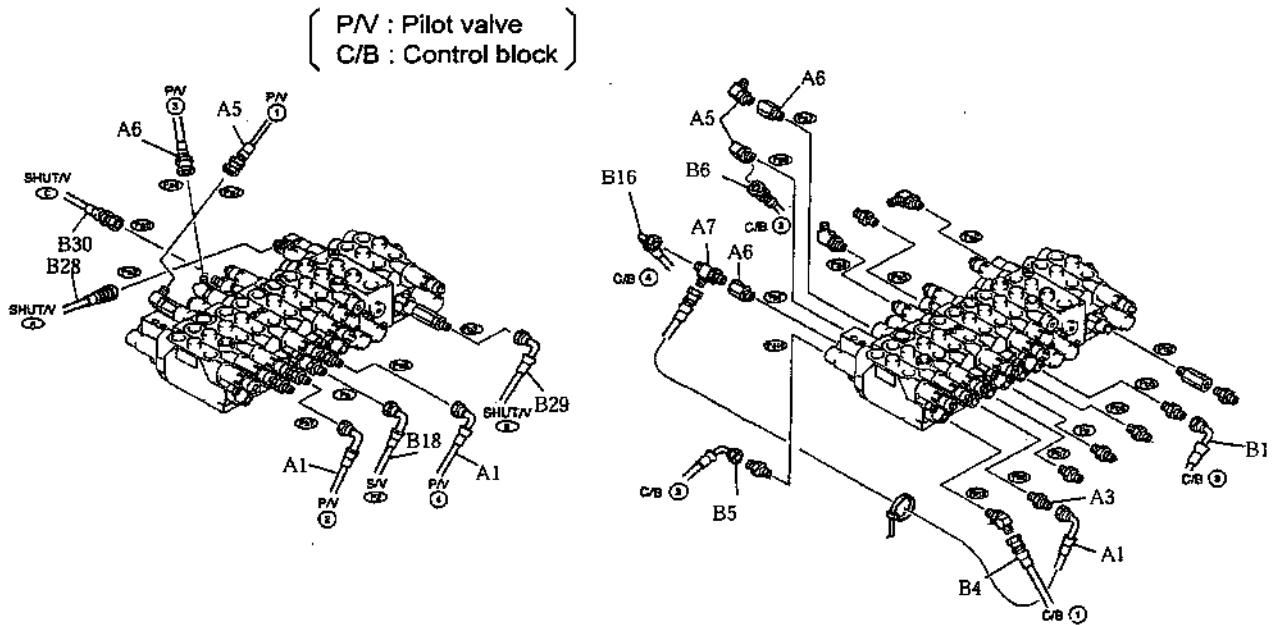


Fig. 16-2A Pilot hydraulic hose disconnection [EU • OCEANIA]

■ FOR USA

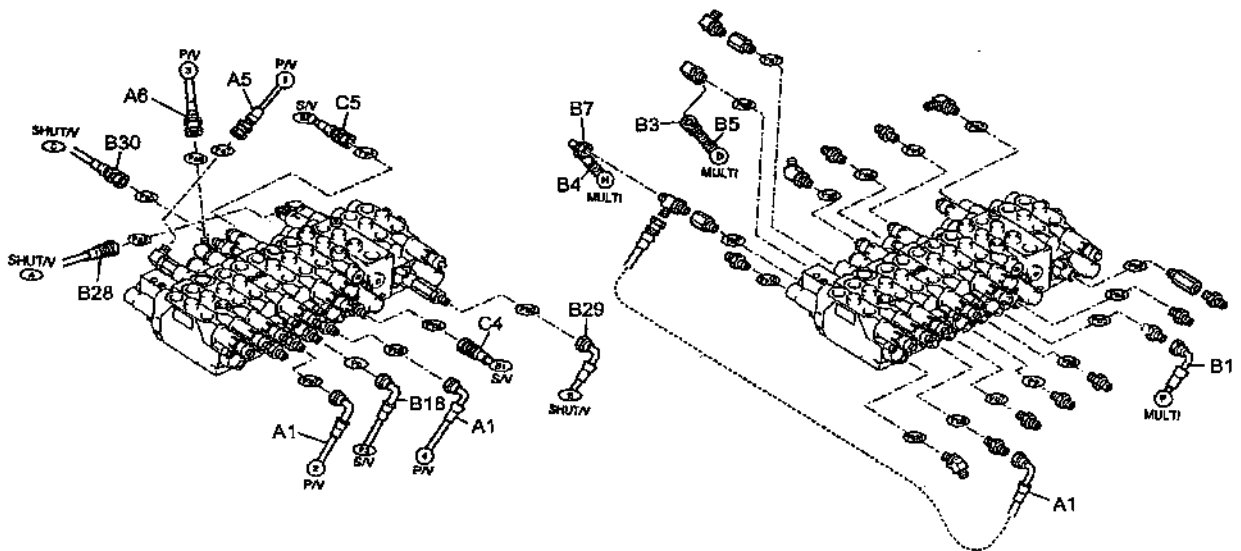


Fig. 16-2B Pilot hydraulic hose disconnection [USA]

(2) Disconnecting cable

Turn the rod end (35) to disconnect the control valve from the cables (22) and (21).

[USA] specification is equipped the cable for N&B in place of the swing cable (22). Remove N&B cable in the same way.

SWING CABLE [EU • OCEANIA]
N&B CABLE [USA]

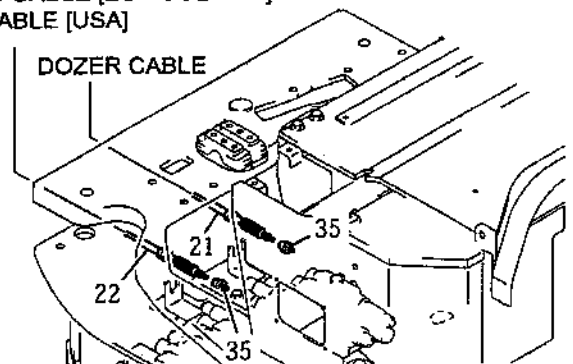
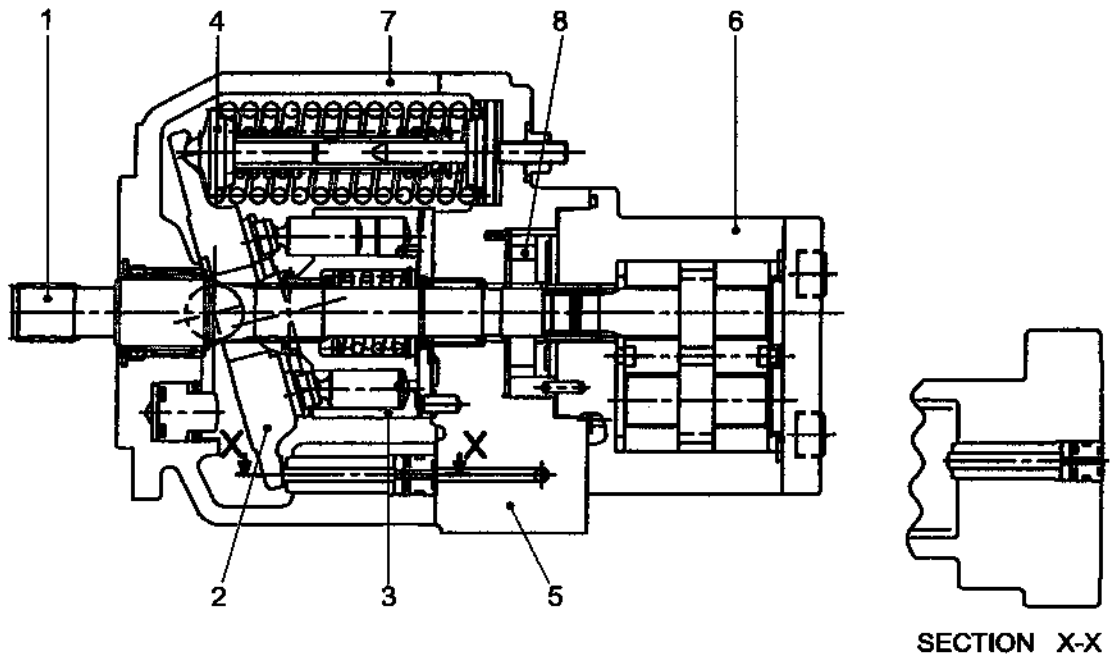


Fig. 16-3 Cable disconnection

Part II : DISASSEMBLING AND ASSEMBLING COMPONENTS

1. HYDRAULIC PUMP

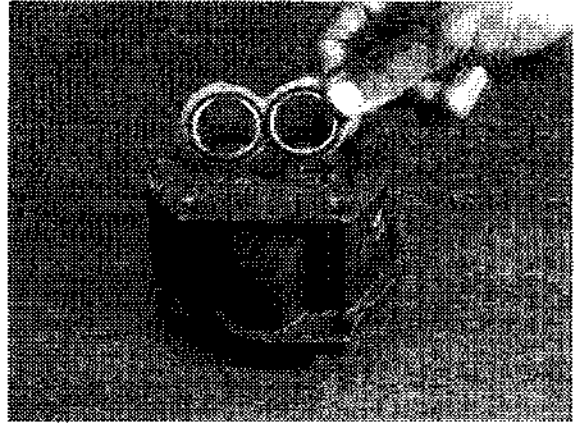
1.1 CONSTRUCTION



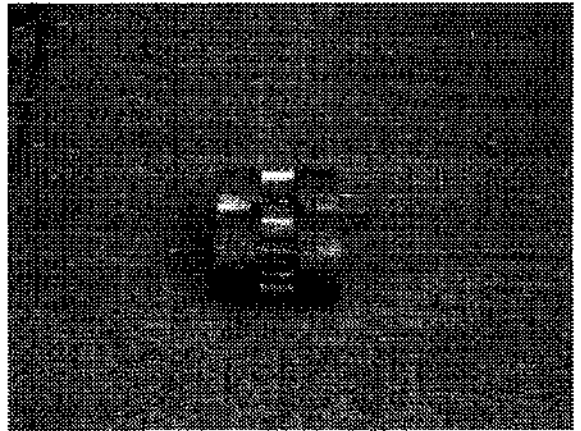
No.	NAME	No.	NAME
1	Shaft assy	7	Gear pump assy
2	Hanger assy	8	Housing assy
3	Rotary group	9	Trochoid pump assy
4	Cover assy		
5	Spring assy		

Note) Refer to section 1.HYDRAULIC PUMP in COMPONENTS SYSTEM PV 24 for detail.

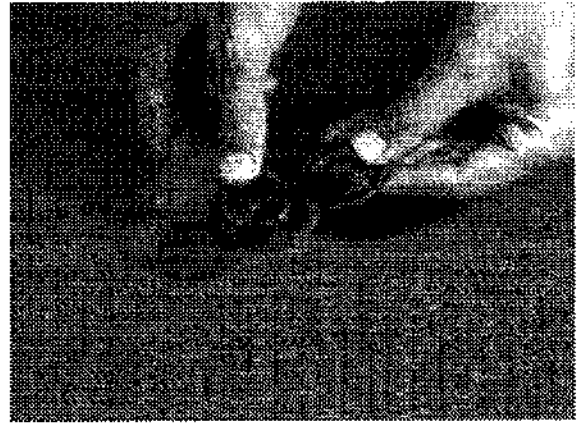
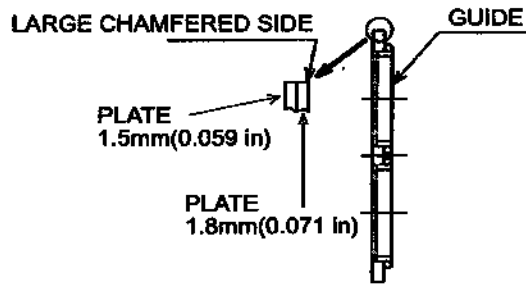
④ Remove 2 plates, guide and O-ring.



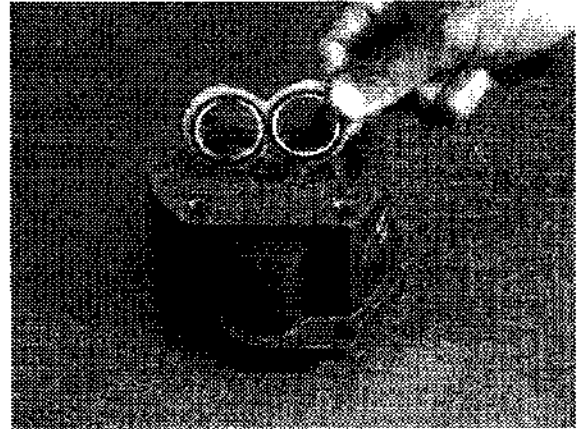
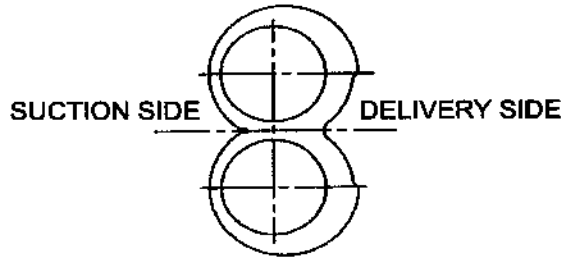
⑤ Remove the drive gear, idle gear and side plate.



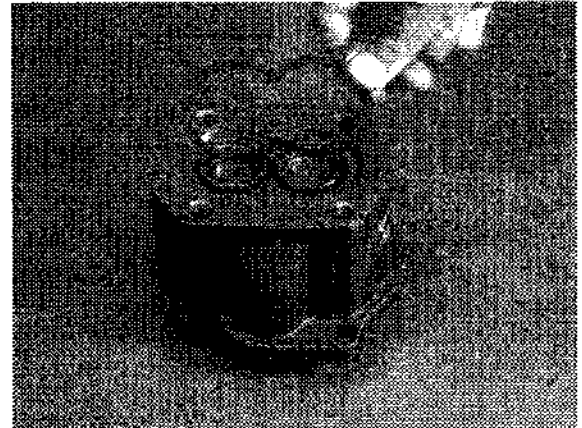
- ④ Insert O-ring into guide, and install it to plate of 1.8mm thickness, then place it on plate of 1.5mm thickness.



- ⑤ Place the plate, guide and O-ring in the housing.
● Then pay attention to the suction and delivery direction.



- ⑥ Fit the square ring.



- ⑦ Combine the cover with the housing.



4) In case of travel straight spool,

(Refer to Fig. 2-9.)

First, loosen and remove 2 washer socket bolts (16) with allen wrench of 4mm. Then, remove pilot cover (15). Spring (11) and stopper (12) are disposed, so remove them. Draw out and take out spool assy(2a-2c) slightly and horizontally (parallel to the spool hole) from the valve holding the end of the travel straight spool.

Then, check that O-ring (13) on the flange bottom installing the pilot cover on the main body side is not separated.

And, Loosen 2 socket bolts (16) on the opposite side with allen wrench, and pilot cover (14) can be removed and also filter case assy (7-10).

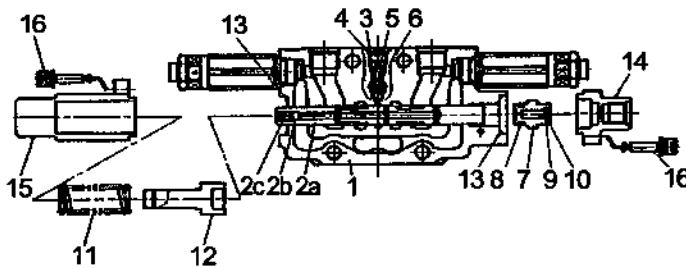


Fig. 2-9 P1 and P2 inlet and travel straight section

(2) Relief valve (Code:RV)

How to remove overload relief valve(Code:ORV)

First, fix the valve on the work bench or ask people to hold down the valve. Then,loosen the hexagonal section (opposing flat,22) of RV and ORV with spanner of22mm. At that time, don't remove the valves applying spanner to the opposing flat, 19. The set pressure of the RV and ORV differs at the position, so tag every valve with respective attaching position. And handle the removed RV and ORV paying attention not to damage the seat section.

The RV and ORV are essential for the performance and safety, but don't disassemble the RV and ORV because it is very difficult to reset the pressure. When there is a failure, replace the assy.

(3) How to disassemble load check valve

First, fix the valve on the work bench, or ask people to hold down the valve in order to keep it from moving. Loosen plug (9) at the center of the valve upper surface with spanner of 19mm (or socket wrench).

It may be difficult to loosen the plug because O-ring gets caught in the thread. Then,don't force it to loosen, but tighten the plug once again and loosen it again. Take out spring (7), load check valve(6) through the hole used to remove the plug with tweezers or magnet. The numbers in Fig. 2-10 corresponds to the number of the dozer section in Fig. 2-3. The form of the travel, P3 inlet, and boom ORV sections differ, but they can be disassembled by the same procedure.

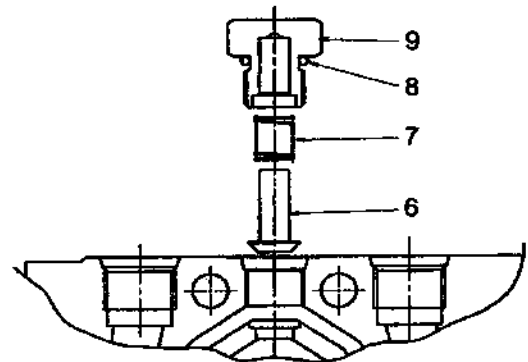


Fig. 2-10 Load check valve
(Dozer, Slewing, Service, Swing,
Arm, Boom, Bucket)

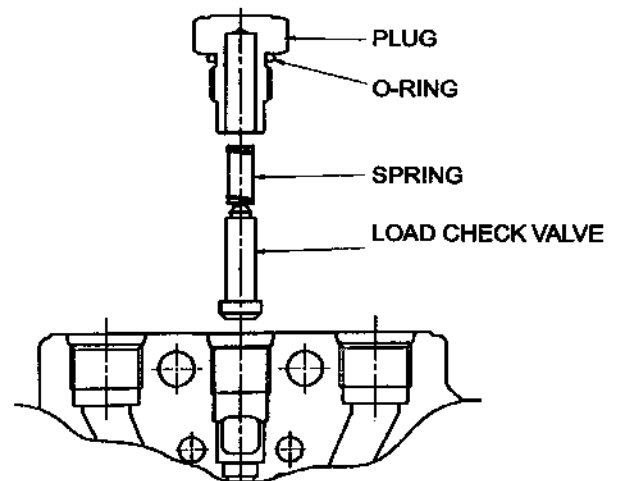


Fig. 2-11 Load check valve
(Travel LH/RH,P3inlet,Boom ORV)

3. PILOT VALVE (Attachment)

3.1 STANDARDS

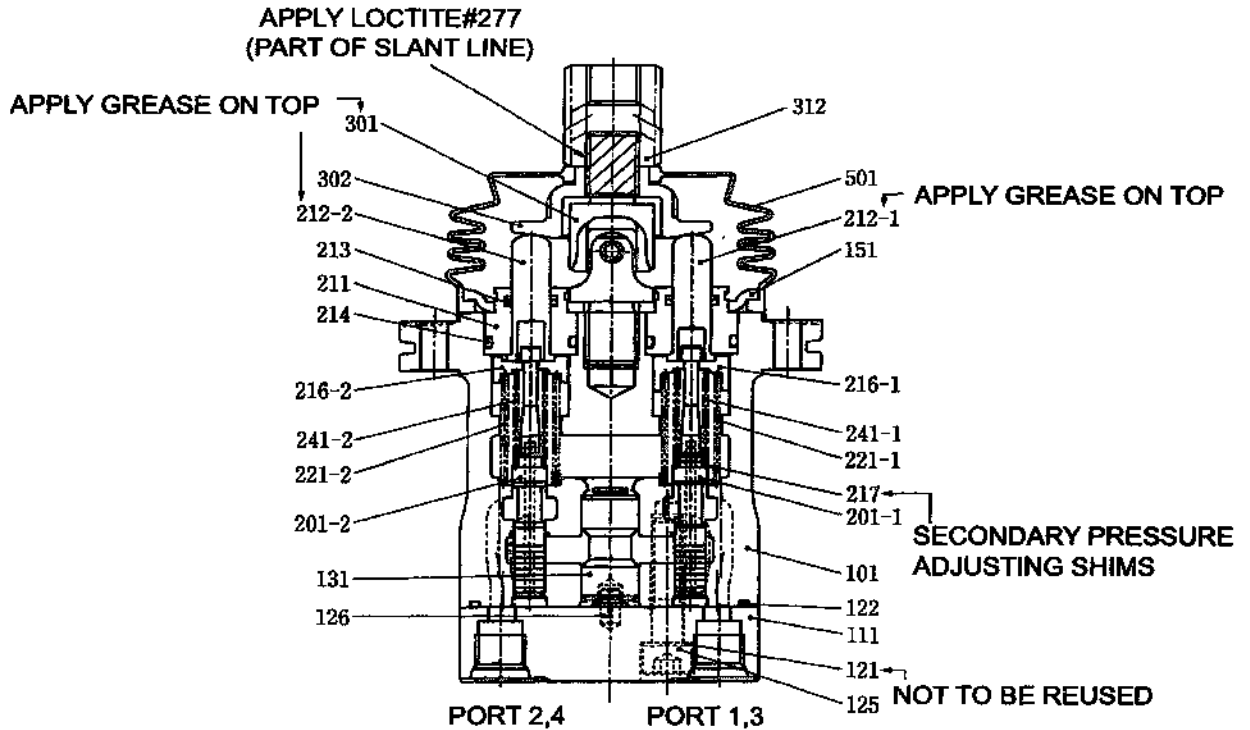


Fig. 3-1 Pilot valve (Attachment)

Unit : kgf·m (lbf·ft)

No.	Thread size	Tightening Torque Table
125	M8	2.1 (15.2)
301	M14	4.8 (34.7)
302,312	M14	7 (50.6)

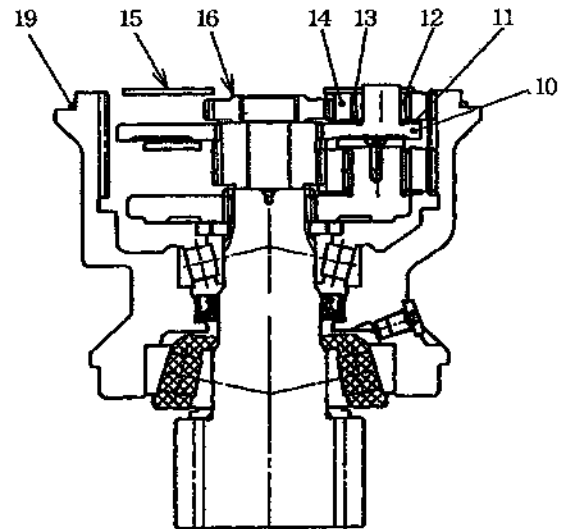
No.	NAME	Q'TY	No.	NAME	Q'TY	No.	NAME	Q'TY
101	CASING	1	201-2	SPOOL	2	221-1	SPRING	2
111	PORT PLATE	1	211	PLUG	4	221-2	SPRING	2
121	SEAL WASHER	2	212-1	PUSH ROD	2	241-1	SPRING	2
122	O-RING	1	212-2	PUSH ROD	2	241-2	SPRING	2
125	SOCKET BOLT	2	213	SEAL	4	301	JOINT ; M14	1
126	SPRING PIN ø 5 X 10	1	214	O-RING ; 1B P20	4	302	DISK	1
131	BUSHING	1	216-1	SPRING SEAT	2	312	ADJUSTING NUT ; M14	1
151	PLATE	1	216-2	SPRING SEAT	2	501	BELLOWS	1
201-1	SPOOL	2	217	WASHER 2	4			

4.4 CAUSE OF FAILURES AND CORRECTIVE ACTION

Phenomenon	Causes	Corrective action
Secondary pressure does not rise.	<ol style="list-style-type: none"> 1) Insufficient primary pressure 2) Permanent set of spring (324) for setting of secondary pressure. 3) The gap between spool and casing is too large. 4) The control section is loosened. 	<ol style="list-style-type: none"> 1) Secure primary pressure. 2) Replace it with new one. 3) Replace it with complete remote control valve. 4) Replace parts of control section.
Secondary pressure is unstable.	<ol style="list-style-type: none"> 1) Sliding part is not smooth. 2) Variation of pressure of tank line 3) Air contamination in piping 	<ol style="list-style-type: none"> 1) Repair unsmooth section. 2) Return oil to oil tank directly. 3) Bleed air by operating several times.
Secondary pressure is high.	<ol style="list-style-type: none"> 1) Pressure of tank line is high. 2) Sliding part is not smooth. 	<ol style="list-style-type: none"> 1) Return oil to oil tank directly. 2) Repair unsmooth section.
Damping does not work.	<ol style="list-style-type: none"> 1) Air is accumulated in piston chamber. 2) Sliding part is not smooth. 3) Permanent set of damping spring (336) 4) Gap between damping piston (224) and casing (damper) (102) is too large. 5) Malfunction of check valve 6) Orifice of damping piston (224) is too large. 	<ol style="list-style-type: none"> 1) Bleed air by operating several times. 2) Repair unsmooth section. 3) Replace it with new one. 4) Replace it with complete remote control valve. 5) Disassemble and check on check valve section. 6) Replace damping piston.
Damping torque is heavy.	<ol style="list-style-type: none"> 1) Sliding part is not smooth. 2) Orifice of damping piston (224) is clogged. 	<ol style="list-style-type: none"> 1) Repair unsmooth section. 2) Repair or replace damping piston.

3. Disassembling reduction unit

3-1. Remove O-ring(19), drive gear (16), thrust plate (15), planetary gear (14), needle bearing (13), inner race (12), thrust washer (11), and holder (10).

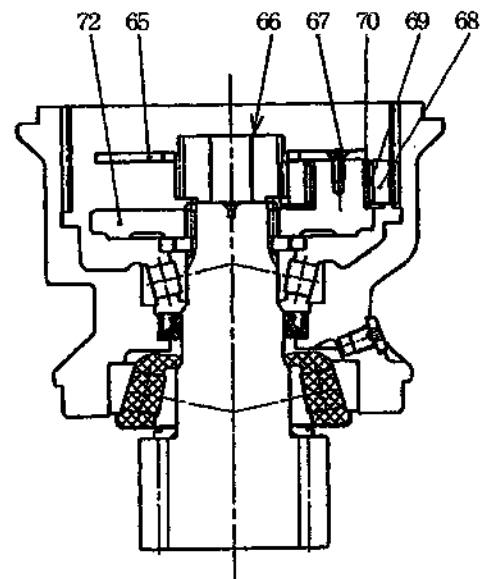


3-2. Remove sun gear (66).

3-3. Remove holder (72) and other related parts.

3-4. Fix holder (72) to a vise, and loosen screw (67) to remove thrust plate (65).

[Note] : Screw is difficult to remove because lock-tight was applied to it at assembling. Warming up screw with a drier is effective for easy removal.



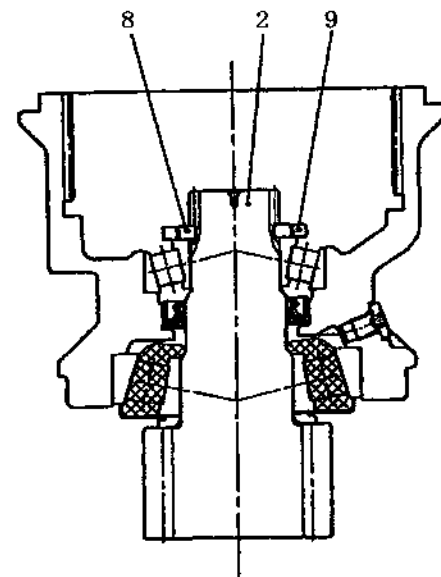
3-5. Remove planetary gear (68), needle bearing (69) and inner race (70).

[Note] : For taper roller bearings (5,7) and collar (3),replace the body assy (Symbol 1 to 9).

3-6. Remove collar (9) and shim (8).

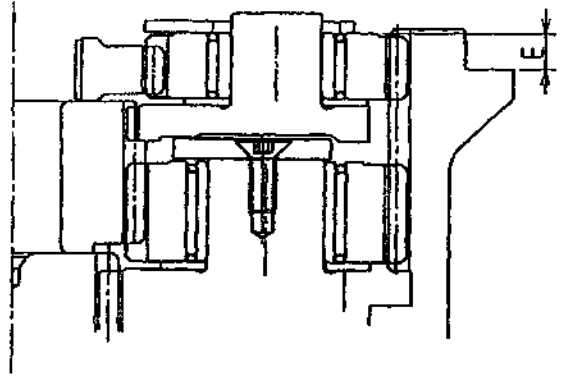
3-7. Remove pinion shaft (2).

[Note] : Be careful not to drop the shaft when removing. When it is difficult to draw it out, remove it tapping by hammer.



[Note] : Selection for thrust plate (15).

When any consisting parts of reduction unit were changed, select and install thrust plate corresponding to the measured valve "E" referring to the below table.

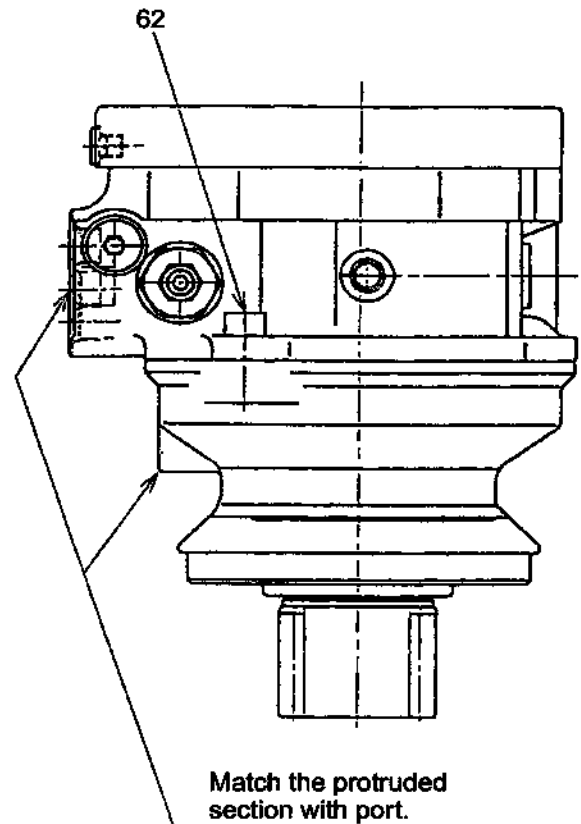


E dimension (measured value)	less than 6.6	6.6 - 7.2	more than 7.2
Part No. of Thrust plate (15)	80841-12020	80841-23019	80841-23018
Plate thickness : mm	3.2	2.8	2.3

3. Assembling motor assy

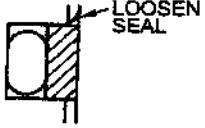
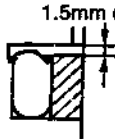
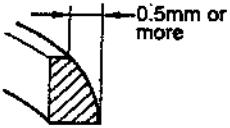
- 3-1. Install the reduction unit on the motor assy, tighten socket bolt (62) temporarily, and tighten it to the specified torque.

T = 13.1kgf.m (95 lbf-ft)


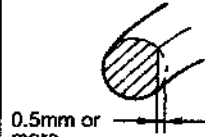


The assembly is now completed.

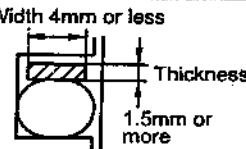
(3) Slipper Seal

	Judgment Criteria	Remedy
	<ul style="list-style-type: none"> Loosen seal from grooves is excessive 	<ul style="list-style-type: none"> Replace
	<ul style="list-style-type: none"> Slipper seal width is 1.5mm (0.059 in) or more smaller than the width of the seal groove. 	<ul style="list-style-type: none"> Replace
	<ul style="list-style-type: none"> Unequal wear of 0.5mm (0.020 in) or more. 	<ul style="list-style-type: none"> Replace

(4) O-ring

	Judgment Criteria	Remedy
	<ul style="list-style-type: none"> Loosen O-ring from seal grooves is excessive. 	<ul style="list-style-type: none"> Replace
	<ul style="list-style-type: none"> Unequal wear of 0.5mm (0.020 in) or more. 	<ul style="list-style-type: none"> Replace

(5) Backup Ring

	Judgment Criteria	Remedy
	<ul style="list-style-type: none"> Thickness of 1.5mm (0.059 in) or less Width of 4mm (0.16 in) or less. 	<ul style="list-style-type: none"> Replace

- 2) Move the machine forward slowly by inserting the bar in the master pin hole on the end of the crawler and assisting so that the sprocket engages with the track link, and also assist so that the crawler catches the normal position and engages with the front idler using bar.

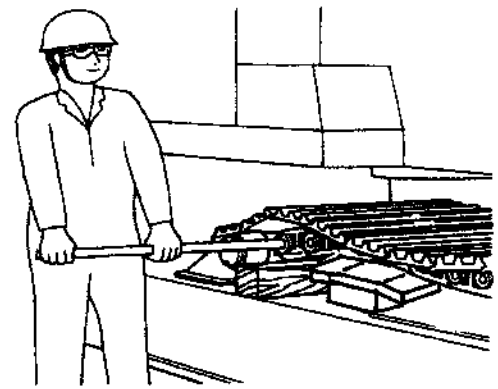


Fig. 2-14 Installing crawler

- 3) Hook chain block to the upper and lower parts of the shoe plate, and align the master pin hole pulling by the chain block.

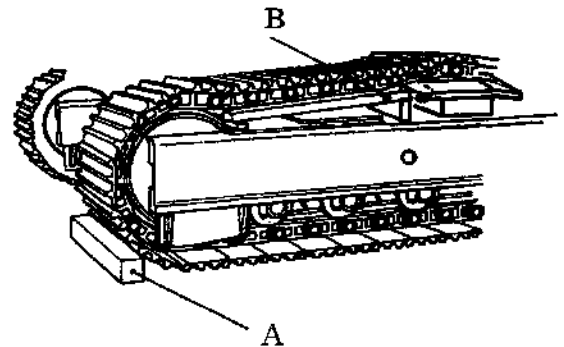


Fig. 2-15 Alignment of pin holes


- 4) Align master link holes on the both ends of the crawler link with the link holes inserting bar, apply master pin drawing out jig (a) used when removed and press fit master pin by hammer.

⚠ When large hammer is used, be careful not to be injured by scattering materials.

- Apply molybdenum grease to the master pin before press fitting.

- 5) After press fitting master pin (6), insert lock pin (8) and bend the top end in advance.

- 6) After completion of installation, adjust the tension of crawler by the same procedure of the rubber crawler.

 :19mm

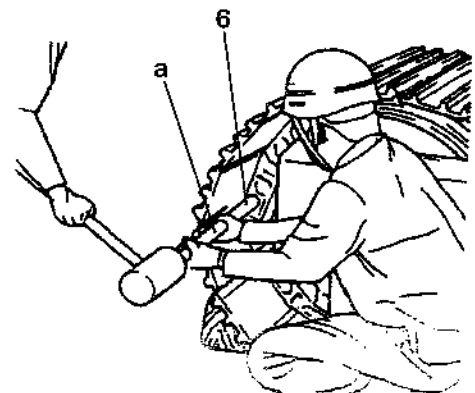


Fig. 2-16 Press fitting master pin

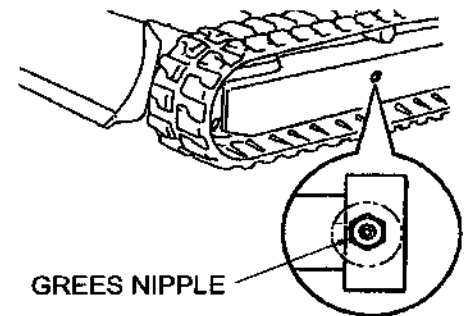



Fig. 2-17 Extension of track link
(Example for rubber crawler)

5. FRONT IDLER

5.1 REMOVAL AND INSTALLATION PROCEDURES

5.1.1 Removing

- (1) Remove the crawler assy.
- (2) Remove idler together with idler adjuster assy, rolling it, using a pry-bar or equivalent.
- (3) Loosen capscrews (c), and separate idler assy (a) from idler adjuster assy (b).

 : 17mm


Weight of idler assy : Approx. 27 kgf (60 lb)

Weight of idler adjuster assy : 16 kgf (35 lb)

- ⚠ • The separated idler assy (a) is easy to fall down. Lay it down so it does not fall down on your feet, utilizing square lumber.

5.1.2 Installing

- (1) Install idler assy (a) to the idler adjuster assy (b) by means of capscrews (c) in the reverse order of removing the idler assy. Coat the threaded part of capscrews (c) with Loctite #262 beforehand.

 : 17mm

T : 6.7 kgf-m (48 lbf-ft)

- (2) The assembly of the idler and idler adjuster is to be installed to the lower frame so that the grease feeding plug (1) is positioned to upside, and the grease nipple (2) is facing to outside.
- (3) Following procedures of section 2, install the crawler assy, and adjust the crawler tension.

- On that occasion, confirm the lubrication through the grease nipple is proper and that grease is not leaking from the grease cylinder.

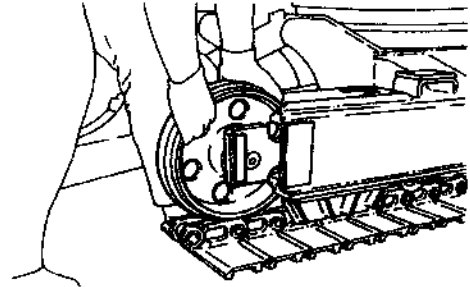


Fig. 5-1 Removing idler

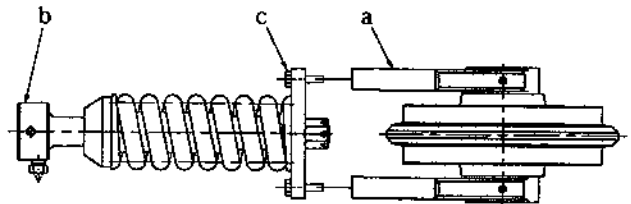


Fig. 5-2 Disassembling idler assy

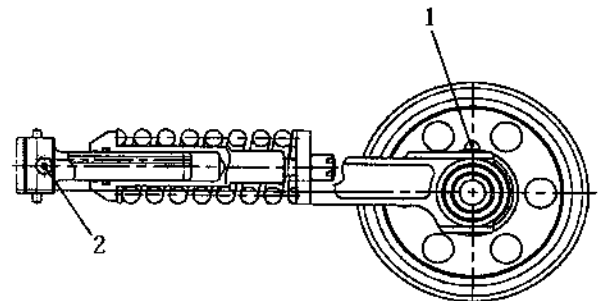


Fig. 5-3 Installing idler


- (3) Reconnect the hydraulic pipings as before, and tighten the joints with specified torque.

Unit : kgf·m (lbf·ft)

Thread size	Spanner (mm)	Tightening torque of joint	
		O-Ring Type	30° Flare Metal Joint
PF 1/4	19	3.7 ± (27)	3.0 ± (22)
PF 3/8	22	7.5 ± (54)	5.0 ± (36)

- (4) Install the covers (A2) (A3) located inside the lower frame, and tighten capscrews (A5).

(See Fig. 8-2)


 : 17 mm

- (5) Remove the square lumber supported the lower frame and install the crawler.

- (6) Check the oil level in the reduction unit of travel motor [See Item (7) mentioned below] and replace or replenish oil as required.

Spec. of oil : GEAR OIL SAE #90

Volume of oil : 750cc (46 cu-in)

 : 8 mm

- (7) Checking oil level in reduction unit

- Stop the machine so the drain plug on reduction unit comes right under the machine.
- Remove the level plug and check the oil level and contamination. The oil level is proper if it is close to the plug bore. Replenish oil when deficient.

8.2 MAINTENANCE STANDARDS

	ITEM	SPEC.
TIGHTENING TORQUE	Sprocket fixing Socket bolt M12	Apply Loctite #262 10.4 kgf·m (75 lbf·ft)
	Travel motor fixing Socket bolt M12	
	Oil	
OIL	Spec. and grade	Gear oil SAE #90
	Volume	750 cc (46 cu·in)

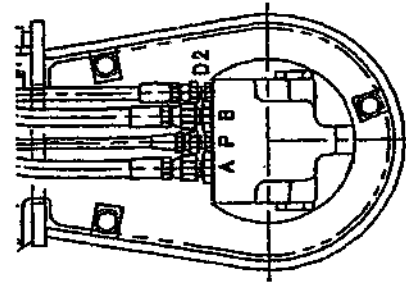


Fig. 8-4 Installing hydraulic pipings (RH-travel motor)

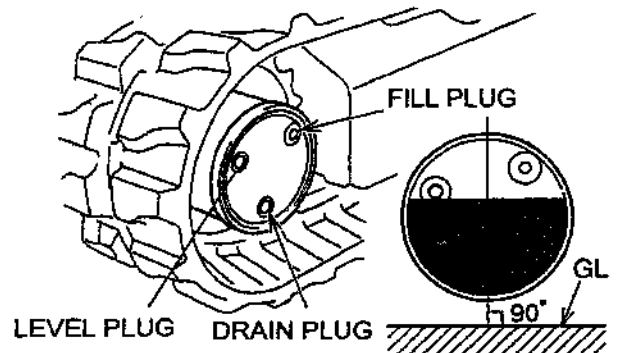


Fig. 8-5 Checking oil level

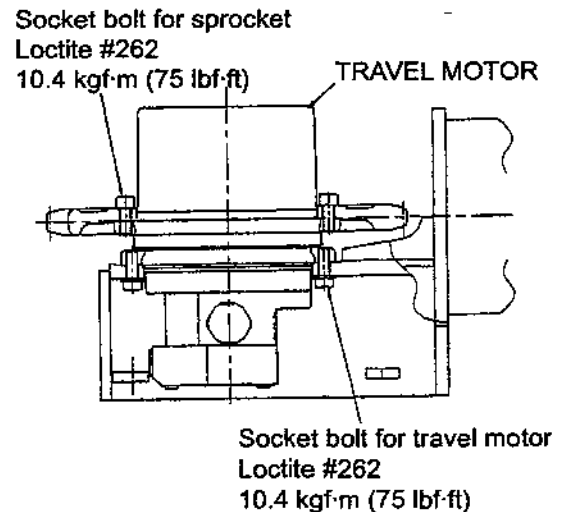



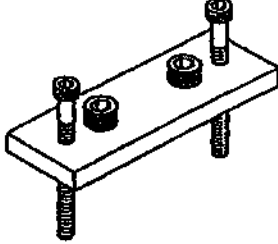

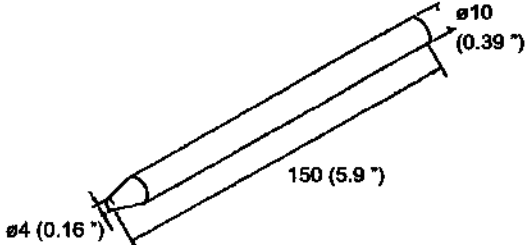


Fig. 8-6 Installing travel motor

No.	NAME	No.	NAME								
9	<p>Lifting eye for PT</p>  <p>This lifting eye is used to remove the cover (8) from the hub (1) with wire and crane.</p>	13	<p>Point punch</p>  <p>This is used to remove the ring (222) in pilot valve.</p>								
10	<p>Long lifting eye</p>  <table border="1" data-bbox="597 764 850 915"> <tr> <td>Application</td> <td>"A"</td> </tr> <tr> <td>Hub</td> <td>M12</td> </tr> <tr> <td>Spindle</td> <td>M12</td> </tr> <tr> <td>Travel motor</td> <td>M12</td> </tr> </table> <p>This lifting eye is used to sling up travel motor, the spindle (2) and the hub (1).</p>	Application	"A"	Hub	M12	Spindle	M12	Travel motor	M12	14	<p>Jig for cover removal</p>  <p>This is used to remove the cover (8) from the hub.</p>
Application	"A"										
Hub	M12										
Spindle	M12										
Travel motor	M12										
11	<p>Spatula</p>  <p>This is used to remove the timing plate (109) from rear flange (201).</p>										
12	<p>Pin punch</p>  <p>This is used to remove the outer race of bearing (21).</p>										

7) Remove the O-ring (237) from the plug (226).

- Do not reuse the removed O-ring (237).

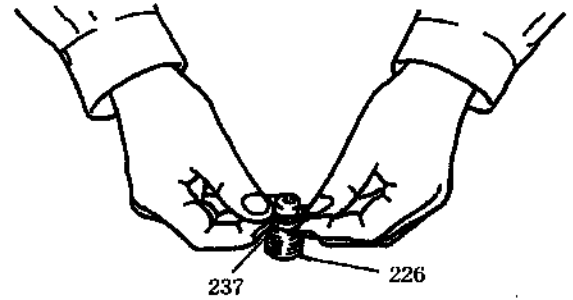


Fig. 1-36 Removing O-ring (237)

(10) Removing two-speed switching spool

1) Remove the plug (221) from the rear flange (201).

2) Remove the O-ring (273) from the plug (221).

- Do not reuse the removed O-ring (273).



Fig. 1-37 Removing plug (221)

3) Remove the spool (263) and spring (266) from the rear flange (201).

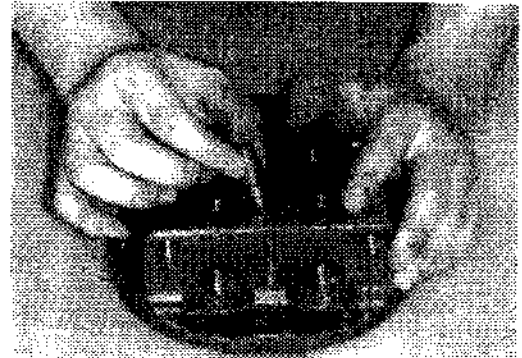


Fig. 1-38 Removing spool (263)

(11) Removing parking brake valve (219)

- Remove the ring (222) only when replacing the valve (219).

1) Place the rear flange (201) inside up on the workbench.

2) While pressing the valve seat (218) with a steel rod, remove the ring (222) from the rear flange (201) by using a sharp-pointed steel rod.

- Smoothly repair the hole portion damaged during the removal of the ring (222).



Fig. 1-39 Removing ring (222)

- 3) Remove the outer races (2 pcs) of the tapered roller bearing (22) from the spindle (2).

- It may be hard to remove the outer race of the tapered roller bearing (22) as the outer race is closely stuck on the mounting surface of the spindle by lubricant film. In this case, tap the center of the mounting hole of the spindle (2) with an aluminum rod. Then the outer race is removed easily as the lubricant is broken.

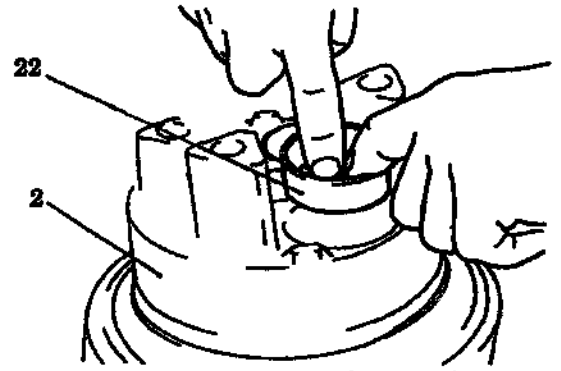


Fig. 1-70 Removing outer race of bearing (22)

(22) Disassembling hold flange

- 1) Remove the outer race of the tapered roller bearing (22) from the hold flange (3).

(23) Rough washing of parts

- 1) Separate the four parts, namely the hub (1), spindle (2), cover (8), and rear flange (201), from the other parts (hereafter referred to as built-in parts).

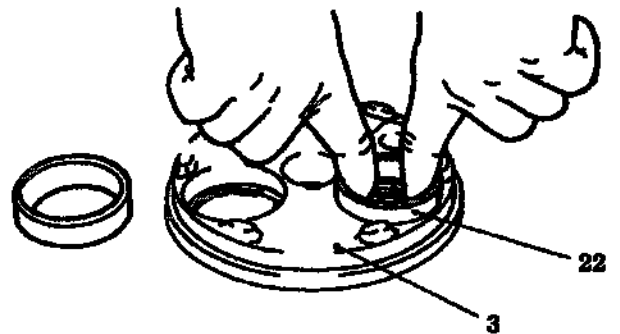


Fig. 1-71 Removing outer race of bearing (22)

- 2) Put the hub, spindle, cover, and rear flange in a cleaning bath and clean them.

- Carefully remove dust accumulated on the surfaces of parts to make them completely clean.



- Kerosene is combustible. Be careful not to cause fire, burns, and injury.

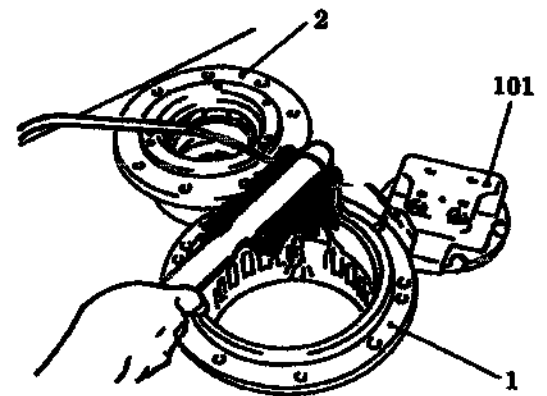


Fig. 1-72 Rough washing of parts

- Before cleaning stained parts, immerse them in kerosene until dust and stain become soft and are floated so as to prevent damage when cleaning.

- 3) Put the built-in parts in a rough cleaning bath containing kerosene and clean them.

5) Insert the spool (223) into the rear flange (201).

- Apply hydraulic oil to the spool and insert the spool into the rear flange.
- To install the spool, align the hole of the rear flange with the spool shaft center so as to prevent the inner surface of the rear flange and the outer surface of the spool from being damaged due to interference.
- Otherwise internal leaks will occur after reassembly, resulting in performance deterioration of the travel motor.

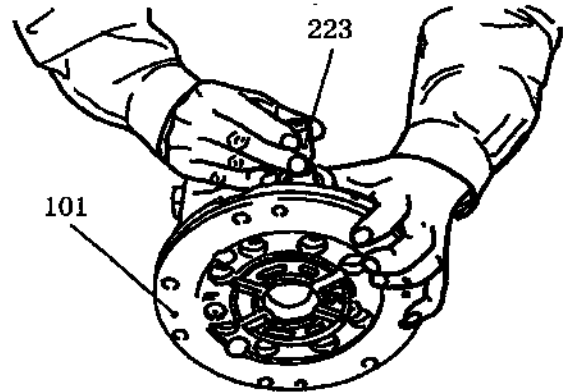


Fig. 1-100 Inserting spool (223)

6) Install the O-ring (236) to the plug (224).

7) Install the spring retainer (225) and spring (228) into the plug (224).

8) Screw two plugs (224) into the rear flange (201).

9) Temporarily tighten two plugs (224) to the rear flange (201) with a wrench.

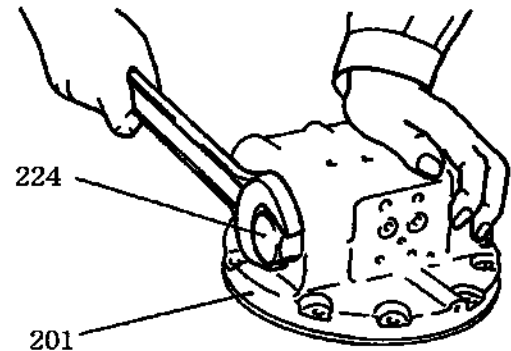


Fig. 1-101 Temporarily tightening plug (224)

(14) Reassembling rear flange fittings

Installing two-speed switching spool inside rear flange

1) Insert the spring (266) and the spool (263) into the rear flange (201).

2) Fix the O-ring (273) to the plug (221).

3) Screw the plug (221) into the rear flange (201).

4) Tighten the plug (221) in the rear flange (201) at the specified torque with a hexagonal wrench key.
Tightening torque : 3 ± 0.5 kgf·m
(22 ± 4 lbf·ft)

5) Coat the ball bearing (150) with hydraulic oil and fit it to the rear flange (201).

6) Put two the parallel pins (241) into the pin holes in the rear flange (201).

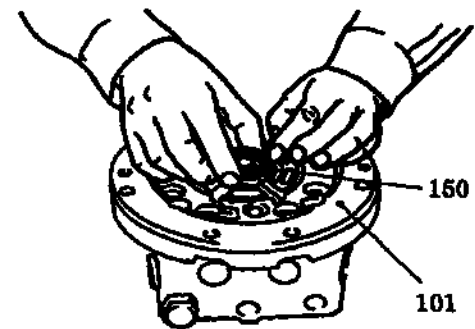


Fig. 1-102 Installing bearing (150)

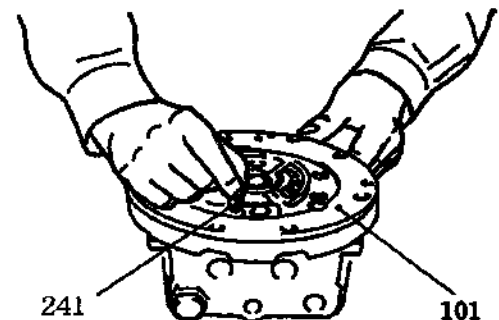


Fig. 1-103 Installing parallel pin (241)

CASE CX31 - CX36

See next page for model cross reference.

TROUBLESHOOTING (HYDRAULIC SYSTEM)

TABLE OF CONTENTS

1. GENERAL PRECAUTIONS	1-1
2. TROUBLE DIAGNOSIS: HYDRAULIC	1-2
3. TROUBLESHOOTING	
1-(1) Attachment operational failure	1-3
1-(2) Attachment speed is slow	1-3
1-(3) Attachment operating power is low	1-3
1-(4) Malfunction of attachment	1-4
2-(1) Travel operation error	1-5
2-(2) Travel speed is slow	1-5
2-(3) Travel operating power is low	1-6
2-(4) It deviates in travel independent operation	1-6
3-(1) Slewing error	1-7
3-(2) Slewing speed is slow	1-7
3-(3) Slewing operating power is low	1-7
3-(4) Slewing operational failure	1-8
4-(1) The engine speed lowers	1-8
4-(2) Malfunction of pump	1-8

CASE CX31 - CX36

See next page for model cross reference.

TROUBLESHOOTING (ELECTRICAL SYSTEM)

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1. TROUBLE DIAGNOSIS	1-1
2. TROUBLESHOOTING	
1-(1) Engine does not start	1-2
1-(2) Horn does not sound	1-4
1-(3) Working light does not light up	1-4
1-(4) Hourmeter does not actuate	1-5
1-(5) Fuel gauge does not actuate	1-5
1-(6) Water temperature does not actuate	1-5
2-(1) All control can not be carried out	1-6
3-(1) Travel 1, 2 speed change can not be carried out	1-7
4-(1) Deceleration switching (OPT) can not be carried out	1-8

CASE CX31 - CX36

See next page for model cross reference.

TROUBLESHOOTING (ENGINE)

TABLE OF CONTENTS

1. TROUBLE DIAGNOSIS: ENGINE	I-1
2. TROUBLESHOOTING	
1-(1) Starter not rotate	I-3
1-(2) Starter rotates but hard to start	I-4
2-(1) Idling trouble	I-5
2-(2) Medium speed trouble	I-5
2-(3) High speed trouble	I-5
3-(1) Engine output not enough	I-6
3-(2) Knocking at high temperature	I-6
4-(1) Exhaust trouble	I-7
4-(2) Excessive oil consumption	I-7
4-(3) Excessive fuel consumption	I-7
4-(4) Engine not stop when key turned OFF	I-8

CASE CX31 - CX36

See next page for model cross reference.

ENGINE

ENGINE MODEL	APPLICABLE MACHINES
3TNE82A-YBC	CX31
3TNE82A-YBD	CX36

TABLE OF CONTENTS

See the attached YANMAR'S SERVICE MANUAL

1-5 3TNE82A

* Output conditions: Intake back pressure ≤ 250 mmAq, Exhaust back pressure ≤ 550 mmAq, other conditions complying with JIS D 1005-1986. After minimum 30 hour's run-in.

Item		Model	3TNE82A								
		Unit									
SPECIFICATIONS	Application	—	CL				VM				
	Type	—	Vertical, 4-cycle water-cooled diesel engine								
	Combustion system	—	Direct injection system								
	No. of cylinders – Bore \times Stroke	mm	3 – 82 \times 84								
	Displacement	ℓ	1,330								
	Firing order	—	1 – 3 – 2 – 1								
	Revolution speed	rpm	1500	1800	2000	2200	2400	2600	2800	3000	
	Output*	Continuous rating	kW(HP)	9.9 (13.3)	12.0 (16.1)	—	—	—	—	—	—
		Max. rating	kW(HP)	11.0 (14.8)	13.2 (17.7)	14.6 (19.6)	16.0 (21.5)	17.5 (23.5)	19.0 (25.5)	20.5 (27.5)	21.9 (29.4)
	Max. revolution speed at no load	rpm	1575 ⁺⁵⁰ ₀	1870 ⁺⁵⁰ ₀	2180 ⁺⁵⁰ ₀	2375 ⁺⁵⁰ ₀	2570 ⁺⁵⁰ ₀	2780 ⁺⁵⁰ ₀	2970 ⁺⁵⁰ ₀	3180 ⁺⁵⁰ ₀	
	Min. revolution speed at no load		≤ 1200	≤ 800							
	Direction of rotation	—	Counterclockwise (viewed from flywheel)								
	Power take off	—	Flywheel								
	Compression ratio	—	18.0								
	Fuel injection timing (FID, b.T.D.C.)	deg	10 \pm 1		12 \pm 1		14 \pm 1		16 \pm 1		
	Compression pressure	MPa (kgf/cm ²)	3.04 \pm 0.1 (31 \pm 1), at 250 rpm								
	Fuel injection pressure	MPa (kgf/cm ²)	19.6 ^{+1.0} ₀ (200 ⁺¹⁰ ₀)								
	Recommended diesel gas oil	—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No. 45 min.)								
	Lubrication system	—	Forced lubrication with trochoid pump								
	Lubricating oil capacity Max/Effective	ℓ	3.6/1.3			5.0/1.7					
	Recommended lubricating oil	—	API grade CC class or higher								
	Cooling system	—	Liquid cooling/Radiator								
	Cooling water capacity	ℓ	1.8 (for engine only)								
	Cooling fan No. of blade \times dia.	mm	Pusher type, 6 \times ϕ 335								
	Crank V-pulley dia./ Fan V-pulley dia.	mm	ϕ 120/ ϕ 90			ϕ 110/ ϕ 110					
	Governor	—	Mechanical centrifugal governor (All speed type)								
Starting system	—	Electrical									
*1 Dimensions L \times W \times H	mm	563 \times 489 \times 565			520.5 \times 489 \times 565 / 528 \times 489 \times 565						
*1 Dry weight	kg	138			112/128						
PERFORMANCE	Governing performance (full speed range)	Transient speed difference	%	≤ 10	≤ 8	≤ 12					
		Steady state speed band	%	≤ 5	≤ 4	≤ 9	≤ 8	≤ 7	≤ 6		
		Recovery time	sec	≤ 5			≤ 6				
		Fluctuation of revolution	rpm	≤ 15			≤ 25				
L.O. press.	Rated operation	MPa (kgf/cm ²)	0.25 \pm 0.05 (2.5 \pm 0.5)	0.29 \pm 0.05 (3.0 \pm 0.5)							
	Idling		≥ 0.06 (≥ 0.6)								

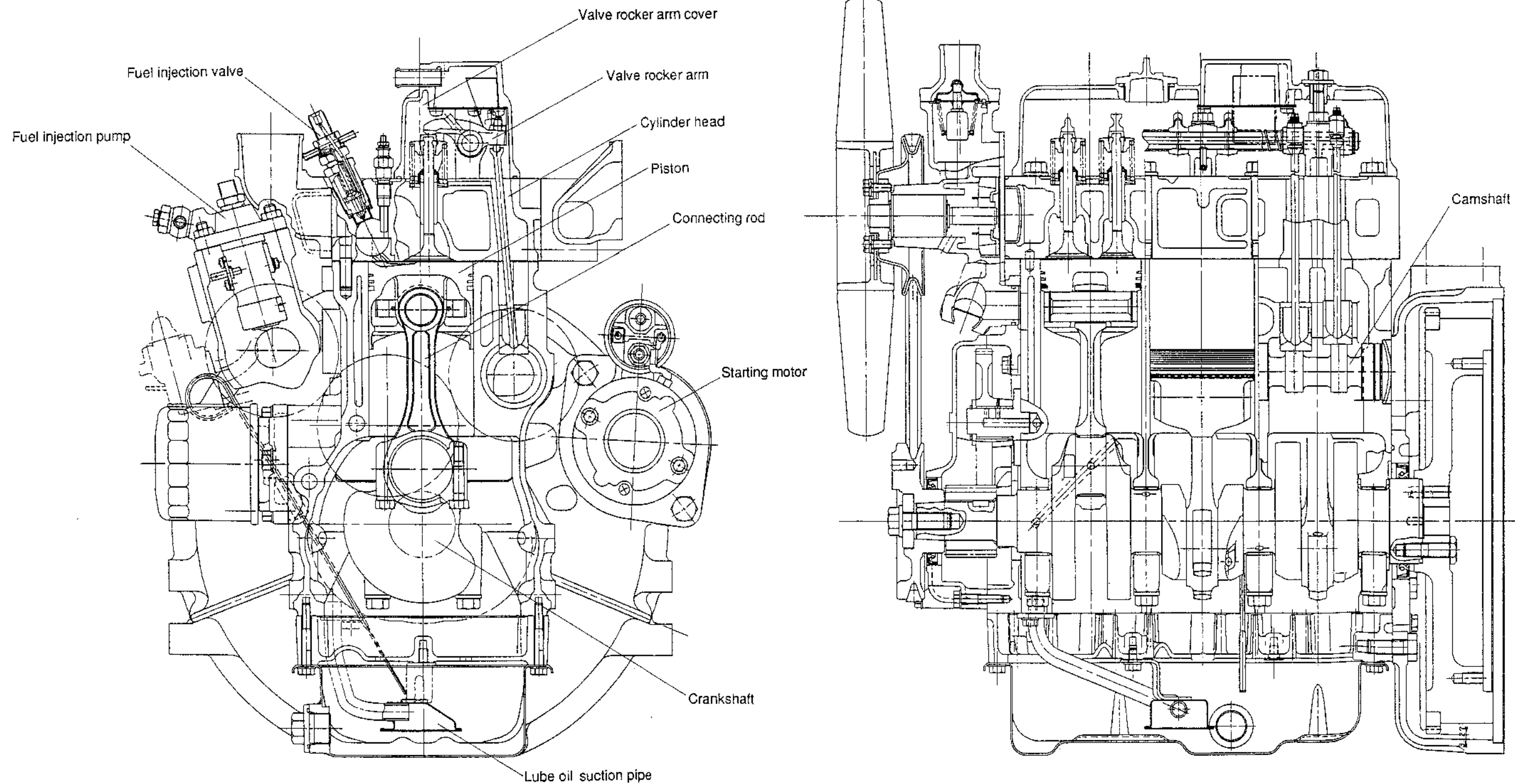
*1. Designation of engine dimension and dry weight in numerals.

CL/CH application: engine with flywheel housing

VM/VH application: engine with back plate/with flywheel housing

2. Cross Sectional Views

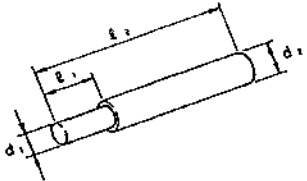
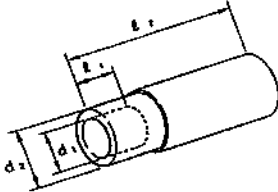
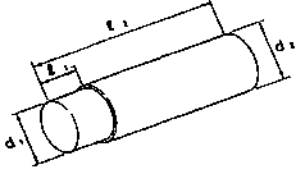
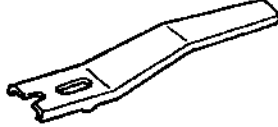
2-1. Special Swirl Pre-combustion Chamber System (Indirect Injection System)



5. Special Service Tools and Measuring Instruments

Although main engine parts can be disassembled and reassembled only with standard service tools, it is recommended to provide the following special service tools and measuring instruments for more efficient and accurate work, correct measurement, diagnosis, and troubleshooting.

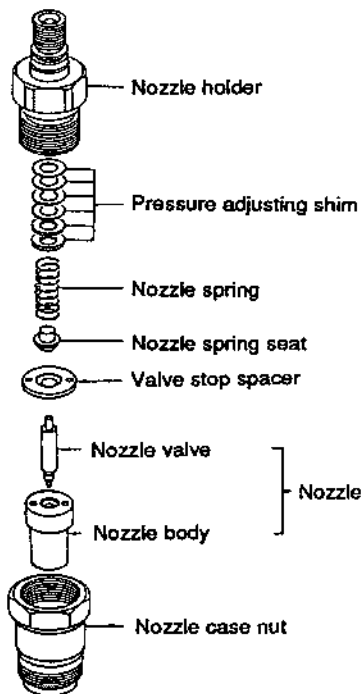
5-1. Special service tools

No.	Tool name	Applicable model and tool dimension	Illustration																									
1	Valve guide extraction tool	<p style="text-align: right;">(mm)</p> <table border="1"> <thead> <tr> <th>Dimension Model</th> <th>l_1</th> <th>l_2</th> <th>d_1</th> <th>d_2</th> </tr> </thead> <tbody> <tr> <td>2/3TNE68</td> <td>20</td> <td>55</td> <td>5</td> <td>8</td> </tr> <tr> <td>3TNE74</td> <td>20</td> <td>75</td> <td>6.5</td> <td>10</td> </tr> <tr> <td>3TNE78A/82A</td> <td>20</td> <td>75</td> <td>6.5</td> <td>10</td> </tr> <tr> <td>3/4TNE82 3/4TNE84(T) 3/4TNE88</td> <td>20</td> <td>75</td> <td>7.5</td> <td>11</td> </tr> </tbody> </table> <p>* Locally manufactured</p>	Dimension Model	l_1	l_2	d_1	d_2	2/3TNE68	20	55	5	8	3TNE74	20	75	6.5	10	3TNE78A/82A	20	75	6.5	10	3/4TNE82 3/4TNE84(T) 3/4TNE88	20	75	7.5	11	
Dimension Model	l_1	l_2	d_1	d_2																								
2/3TNE68	20	55	5	8																								
3TNE74	20	75	6.5	10																								
3TNE78A/82A	20	75	6.5	10																								
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2	Valve guide insertion tool	<p style="text-align: right;">(mm)</p> <table border="1"> <thead> <tr> <th>Dimension Model</th> <th>l_1</th> <th>l_2</th> <th>d_1</th> <th>d_2</th> </tr> </thead> <tbody> <tr> <td>2/3TNE68</td> <td>7</td> <td>60</td> <td>11</td> <td>17</td> </tr> <tr> <td>3TNE74</td> <td>9</td> <td>60</td> <td>13</td> <td>19</td> </tr> <tr> <td>3TNE78A/82A</td> <td>12</td> <td>60</td> <td>13</td> <td>19</td> </tr> <tr> <td>3/4TNE82 3/4TNE84(T) 3/4TNE88</td> <td>15</td> <td>65</td> <td>14</td> <td>20</td> </tr> </tbody> </table> <p>* Locally manufactured</p>	Dimension Model	l_1	l_2	d_1	d_2	2/3TNE68	7	60	11	17	3TNE74	9	60	13	19	3TNE78A/82A	12	60	13	19	3/4TNE82 3/4TNE84(T) 3/4TNE88	15	65	14	20	
Dimension Model	l_1	l_2	d_1	d_2																								
2/3TNE68	7	60	11	17																								
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3TNE78A/82A	12	60	13	19																								
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3	Connecting rod bushing replacer	<p style="text-align: right;">(mm)</p> <table border="1"> <thead> <tr> <th>Dimension Model</th> <th>l_1</th> <th>l_2</th> <th>d_1</th> <th>d_2</th> </tr> </thead> <tbody> <tr> <td>2/3TNE68</td> <td>22</td> <td>62</td> <td>$20_{-0.3}^{-0.6}$</td> <td>$22_{-0.3}^{-0.6}$</td> </tr> <tr> <td>3TNE74</td> <td>20</td> <td>80</td> <td>$21_{-0.3}^{-0.6}$</td> <td>$23_{-0.3}^{-0.6}$</td> </tr> <tr> <td>3TNE78A/82A</td> <td>25</td> <td>85</td> <td>$23_{-0.3}^{-0.6}$</td> <td>$26_{-0.3}^{-0.6}$</td> </tr> <tr> <td>3/4TNE82 3/4TNE84(T) 3/4TNE88</td> <td>20</td> <td>100</td> <td>$26_{-0.3}^{-0.6}$</td> <td>$29_{-0.3}^{-0.6}$</td> </tr> </tbody> </table> <p>* Locally manufactured</p>	Dimension Model	l_1	l_2	d_1	d_2	2/3TNE68	22	62	$20_{-0.3}^{-0.6}$	$22_{-0.3}^{-0.6}$	3TNE74	20	80	$21_{-0.3}^{-0.6}$	$23_{-0.3}^{-0.6}$	3TNE78A/82A	25	85	$23_{-0.3}^{-0.6}$	$26_{-0.3}^{-0.6}$	3/4TNE82 3/4TNE84(T) 3/4TNE88	20	100	$26_{-0.3}^{-0.6}$	$29_{-0.3}^{-0.6}$	
Dimension Model	l_1	l_2	d_1	d_2																								
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3/4TNE82 3/4TNE84(T) 3/4TNE88	20	100	$26_{-0.3}^{-0.6}$	$29_{-0.3}^{-0.6}$																								
4	Valve spring compressor (Replacement of valve spring)	<table border="1"> <thead> <tr> <th>Model</th> <th>Yanmar Code No.</th> </tr> </thead> <tbody> <tr> <td>All model</td> <td>129100-92630</td> </tr> </tbody> </table>	Model	Yanmar Code No.	All model	129100-92630																						
Model	Yanmar Code No.																											
All model	129100-92630																											

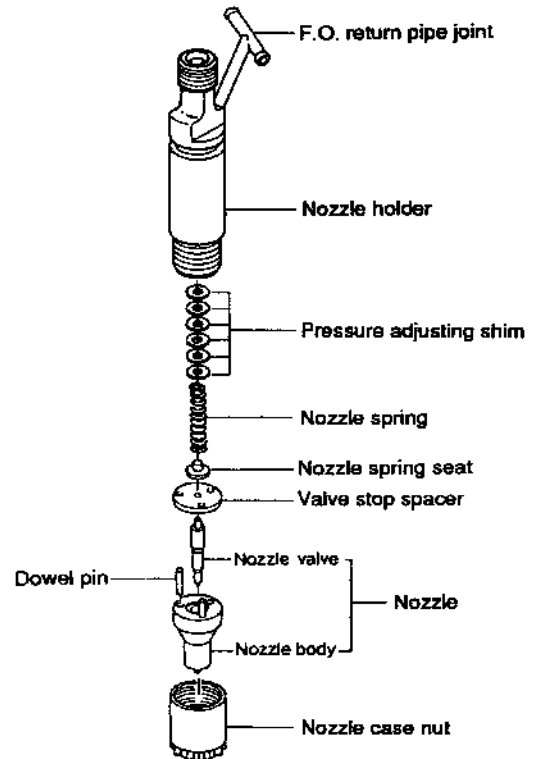
	Type of pressure adjusting shim thickness (mm)	Injection pressure adjustment
Indirect injection system	0.1, 0.2, 0.3, 0.4, 0.5	Increase the pressure adjusting shim the thickness by 0.1 mm and the injection pressure is increased by 7-10 kgf/cm ² .
Direct injection system	0.13, 0.15, 0.18, 0.4, 0.5, 0.8	Increase the pressure adjusting shim thickness by 0.1 mm and the injection pressure is increased by about 19 kgf/cm ² .

[Reference: Structure of fuel Injection valve]

(Indirect injection system)



(Direct Injection system)



2. Checking the spray patterns

While pumping the lever of the nozzle tester 4-6 times per second at the specified injection pressure (Refer to Chapter 1, specifications and performance), check the spray patterns. If the following trouble is found, clean or replace the nozzle.

- (1) Make sure that the pattern is neither stream nor sliver.
- (2) Ensure that fuel is sprayed conically around the nozzle center line and that a fuel injection spreading angle is 5-10° in the indirect injection system or approx. 150° in the direct injection system.

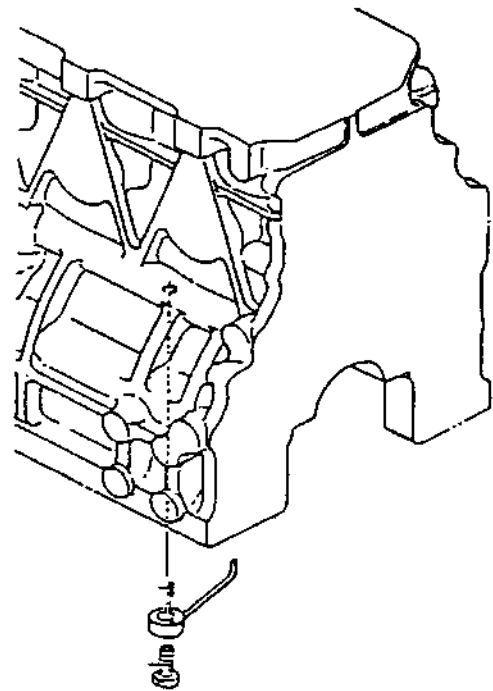
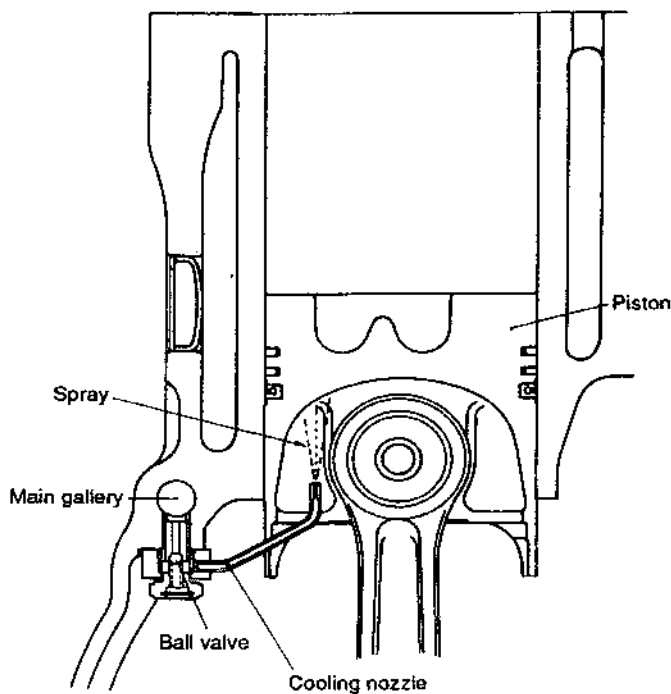
6-11. Checking the Piston Cooling Nozzle

The piston cooling nozzle is installed as a standard component on turbocharged engines in the TNE series.

(1) Piston cooling nozzle function

A nozzle made of a steel pipe is installed below the main gallery in the cylinder body. The lubricating oil from the main gallery is constricted at the nozzle hole ($\phi 1.77$ mm) at the tip end of the steel pipe to be jet-sprayed. This jet spray comes into contact with the rear face of the piston for cooling it.

Jet flow rate	1.3 ℓ / min
Jetting pressure	3.5 kg / cm^2



(2) Checking the piston cooling nozzle

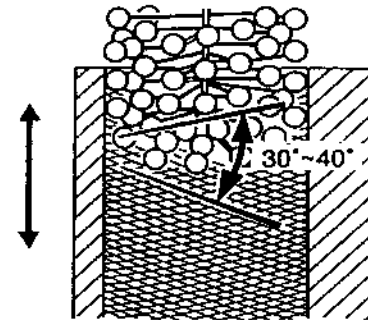
1. Check the nozzle hole at the tip end for clogging with dirt or foreign matter, and clean it.
2. Check the brazed portion of the steel pipe for loosening or freeing by vibration. Replace with a new part if defective.

2. Handling procedure

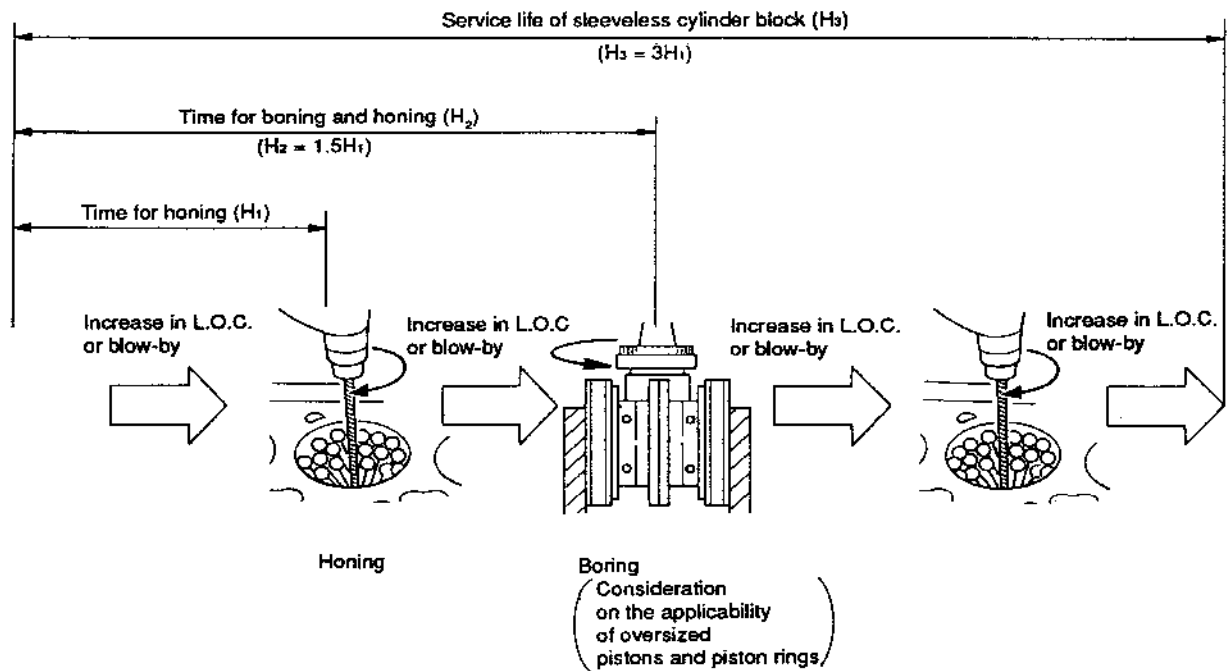
Apply the honing fluid to the Flex-Hone. Insert the Flex-Hone into the cylinder while turning it, move it up and down for about 30 sec for a cross hatch angle of 30–40°. Extract the Flex-Hone while turning it.

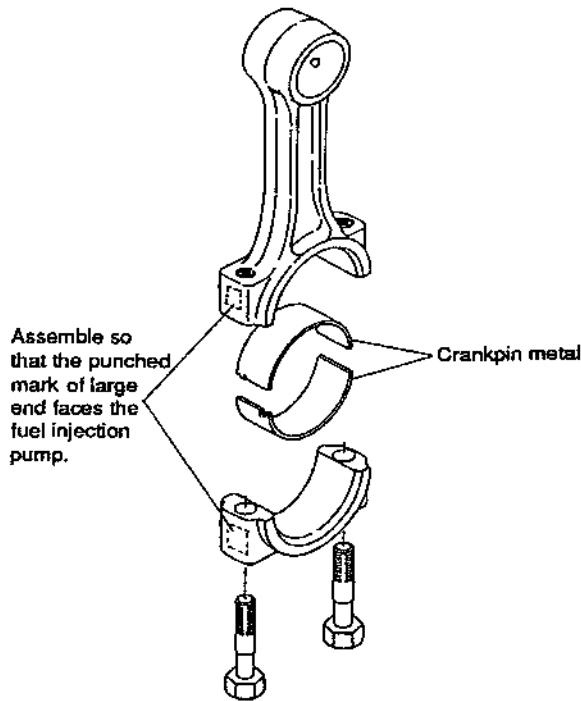
* Use the Flex-Hone at a speed of 300–1200 rpm. Use of the Flex-Hone at a higher speed may be hazardous.

* Never insert into or extract from the cylinder the Flex-Hone, with the power drill left stopped.



4. Overhaul of cylinder (Reference)

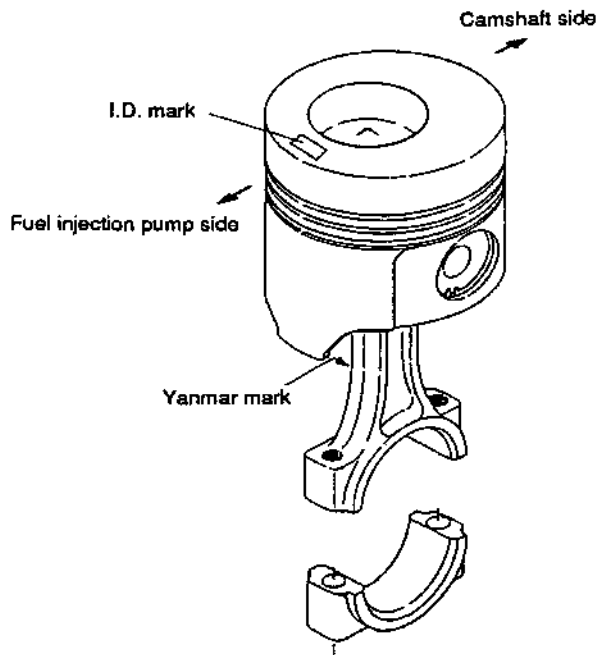




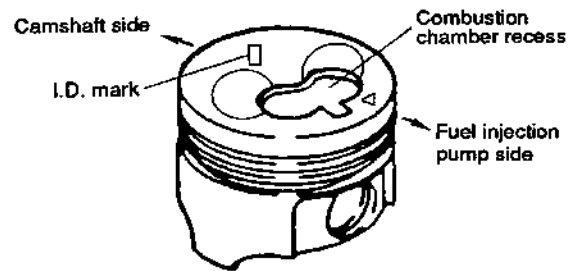
6. Assembling the piston and connecting rod

Assemble the piston with the connecting rod, with the mark at the big end of the connecting rod facing the fuel injection pump. Reassemble the piston so that the recess of the combustion chamber is on the side of the fuel injection pump as seen from the top.

(Direct Injection system piston)



(Indirect Injection system piston)

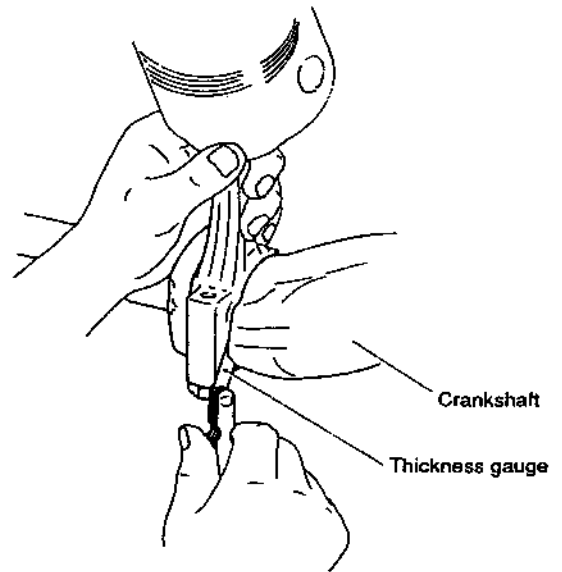


7. Side gap of the connecting rod

After attaching the connecting rod to the crankshaft, tighten the rod bolt to the specified torque (see this section 3). Measure the side gap by inserting a thickness gauge into the side gap. If the standard is exceeded, replace the crankpin metal or connecting rod.

(mm)

	All models
Side gap	0.2~0.4



(Measuring the connecting rod side gap)

8. Disassembly and Reassembly

Peripheral parts such as air cleaner, muffler and radiator differ in installation and types for each application. Therefore, description in this Chapter is started with the steps to be taken just after the peripheral parts have been removed.

Perform the procedure, with reference to the attached drawings, "Engine component Exploded View."

8-1. Disassembly

* For the number following the part name, refer to attached drawing 1 and 2, "Exploded Views of Engine Components"

Step	Removal Parts	Remarks
1	<ol style="list-style-type: none"> 1. Thoroughly remove sand, dust, dirt and soil from the surface of the engine. 2. Drain cooling water and lubricating oil from the engine. 	
2	<ol style="list-style-type: none"> 1. Remove turbocharger ⑦④ and exhaust manifold ①. 2. Remove intake manifold ② and surge tank ⑦⑤. 	
3	<ol style="list-style-type: none"> 1. Close the fuel cock valve of the fuel tank. 2. Remove high-pressure fuel pipe ③. 3. Remove fuel return pipe ④. 4. Loosen the tightening nut on fuel injection nozzle retainer ⑤ and extract the retainer and fuel injection nozzle ⑥. <p>* Fuel injection nozzle for Indirect injection system is screwed type.</p>	<ol style="list-style-type: none"> 1. If nozzle seat ⑦ is left on the cylinder head, remove the cylinder head before extracting nozzle seat ⑦. 2. To prevent dust from entering fuel injection nozzle ⑥, fuel injection pump ⑧ and high-pressure fuel pipe ③, seal their respective threads with a tape or the like. 3. Whenever extracting fuel injection nozzle ⑥, replace nozzle protector ⑨ with a new one.
4	<ol style="list-style-type: none"> 1. Remove bonnet assembly ⑩. 	
5	<ol style="list-style-type: none"> 1. Remove valve rocker arm shaft assembly ⑪. 2. Remove push rod ⑫. 	<ol style="list-style-type: none"> 1. Attach a tag to push rod ⑫ for each cylinder No. to put the push rod in order. 2. Remove valve cap ⑬ from the intake/exhaust valve head. 3. Note that tappet ⑤⑨ of the indirect injection system can be removed at the same time when push rod ⑫ is extracted. 4. Attach a tag to tappet ⑤⑨ for each cylinder No. to put the tappet in order.

9. Service Data

9-1 Cylinder Head

(Unit: mm)

Model			2/3TNE68		3TNE74		3TNE78A 3TNE82A		3/4TNE82, 3/4TNE84(T), 3/4TNE88	
			Standard	Wear limit	Standard	Wear limit	Standard	Wear limit	Standard	Wear limit
Cylinder head combustion surface distortion			0.05 or less	0.15	0.05 or less	0.15	0.05 or less	0.15	0.05 or less	0.15
Valve seat angle	Intake		120°	—	120°	—	120°	—	120°	—
	Exhaust		90°	—	90°	—	90°	—	90°	—
Valve seat width	Intake		1.15	1.65	1.44	1.98	1.36~1.53	1.98	1.07~1.24	1.74
	Exhaust		1.41	1.91	1.77	2.27	1.66~1.87	2.27	1.24~1.45	1.94
Intake valve	Valve stem outside dia.		5.460 ~5.475	5.4	6.960 ~6.975	6.9	6.945 ~6.960	6.9	7.955 ~8.025	7.9
	Valve guide inside dia.		5.500 ~5.515	5.58	7.005 ~7.020	7.08	7.000 ~7.015	7.08	8.010 ~7.975	8.1
	Oil clearance		0.025 ~0.055	0.18	0.030 ~0.060	0.18	0.040 ~0.070	0.18	0.035 ~0.070	0.2
Exhaust valve	Valve stem outside dia.		5.445 ~5.460	5.4	6.945 ~6.960	6.9	6.940 ~6.955	6.9	7.955 ~8.030	7.9
	Valve guide inside dia.		5.500 ~5.515	5.58	7.005 ~7.020	7.08	7.000 ~7.015	7.08	8.015 ~7.970	8.1
	Oil clearance		0.040 ~0.070	0.18	0.045 ~0.075	0.18	0.045 ~0.075	0.18	0.045 ~0.075	0.2
Valve guide projection			7	—	9	—	12	—	15	—
Valve sinking depth	Intake valve		0.3~0.5	1.0	0.4~0.6	1.0	0.296 ~0.496	1.0	0.306 ~0.506	1.0
	Exhaust valve		0.75~0.95		VM: 0.75~0.95 CH: 0.40~0.60 VH: 0.40~0.60		0.3~0.5		0.3~0.5	
Thickness of valve head	Intake valve		0.85~1.15	0.5	0.99~1.29	0.5	1.244 ~1.444	0.5	1.244 ~1.444	0.5
	Exhaust valve		0.95~1.25		0.95~1.25		1.35~1.55		1.35~1.55	
Intake valve timing	Open	b.TDC	5°~15°	—	7°~17°	—	10°~20°	—	10°~20°	—
	Close	a.BDC	37°~47°		35°~45°		40°~50°		40°~50°	
Exhaust valve timing	Open	b.BDC	37°~47°	—	40°~50°	—	51°~60°	—	51°~61°	—
	Close	a.TDC	5°~15°		8°~18°		13°~23°		13°~23°	
Valve spring	Free length		28	—	37.4	—	44.4	—	42	—
	Inclination		—	0.8	—	1.0	—	1.1	—	1.1
	Tension (kg) (when compressed to 1mm length)		1.14 ~1.40	—	2.37 (variable pitch) /1.87	—	3.61 (variable pitch) /2.71	—	2.36 (variable pitch) /3.101	—
Intake & exhaust valve clearance			0.15~0.25	—	0.15~0.25	—	0.15~0.25	—	0.15~0.25	—

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