HYDRAULIC EXCAVATOR

SHOP MANUAL model SK70SR-1E(S)

INDEX

KOBELCO

Book Code No.S5YT0003E01

(8) Do not splash water on the electrical equipment and connectors during machine washing.

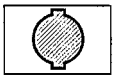
(9) Check for moisture adhesion inside the waterproof connector after pulling it out, since it is hard to remove moisture from the connector.
If moisture adhesion is found, dry it completely before the connection.

⚠ WARNING

Battery electrolyte is hazardous.
Battery electrolyte is dilute sulfuric acid. Exposure of skin or eyes to this liquid will cause burning or loss of eyesight.
If the exposure occurs, take the following emergency measures and seek the advice of a medical specialist.

- **When skin exposed:**
  Wash with water and soap sufficiently.
- **When eyes exposed:**
  Immediately wash away with city water continuously for more than 10 minutes.
- **When a large amount of the liquid flows out:**
  Neutralize with sodium bicarbonate or wash away with city water.
- **When swallowed:**
  Drink a large amount of milk or water.
- **When clothes exposed:**
  Immediately undress and wash.

1.1.5 HYDRAULIC PARTS



(1) O-ring
- Ensure O-rings have elasticity and are not damaged before use.
- Use the appropriate O-rings. O-rings are made of various kinds of materials having different hardness to apply to a variety of parts, such as the part for moving or fixed portion, subjected to high pressure, and exposed to corrosive fluid, even if the size is same.
- Fit the O-rings without distortion and bend.
- Always handle floating seals as a pair.

(2) Flexible hose (F hose)
- Use the appropriate parts. Different parts are used depending on the working pressure even the size of fitting and the total length of the hose is same.
- Tighten the fitting at the specified torque. Ensure no kink, tension, interference nor oil leakage is recognized.

1.1.6 WELDING REPAIR

(1) Refer repair welding to qualified personnel according to the appropriate procedure.

(2) Disconnect the ground (earth) cable of the battery before starting the repair.
Failure to do so will cause damage to the electrical equipment.

(3) Move away the articles in advance that may cause fire if exposed to sparks.

(4) Before starting the repair of the attachment, do not fail to cover the plated surface of the piston rod with flameproof sheet to prevent it from being exposed to sparks.

1.1.7 ENVIRONMENTAL MEASURE

(1) Run the engine at the place that is sufficiently ventilated.

(2) Industrial waste disposal
Dispose of the following parts according to the relevant regulations:
Waste oil and waste container
Battery

(3) Precautions for handling hydraulic oil
Exposure of eyes to hydraulic oil will cause inflammation. Wear protective glasses before handling to avoid an accident. If an eye is exposed to the oil, take the following emergency measures:
- When an eye exposed:
  Immediately wash away with city water sufficiently till stimulative feeling vanishes.
- When swallowed:
  Do not let vomit, and receive medical treatment immediately.
- When skin exposed:
  Wash with water and soap sufficiently.

(4) Others
Use replacement parts and lubricants authorized as the manufacturer's genuine parts.

2.4 TRANSPORTATION DIMENSION AND WEIGHT

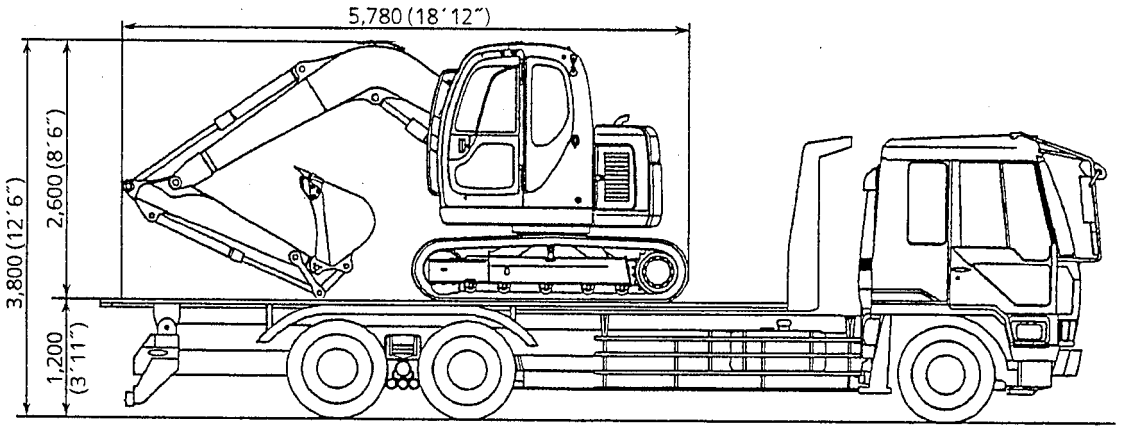
OVERALL DIMENSIONS OF MACHINE ON A TRAILER

OVERALL DIMENSIONS OF A COMPLETE MACHINE ON A TRAILER

Item	Type	2.07 M (6 ft-9 in) Arm + 600 mm (23.6 in) shoes	2.07 M (6 ft-9 in) Arm + 450 mm (17.7 in) shoes
Width	m (ft-in)	2,470 (8'1")	2,320 (7'7")
Weight	kg (lb)	6,920 (15,260)	6,700 (14,770)

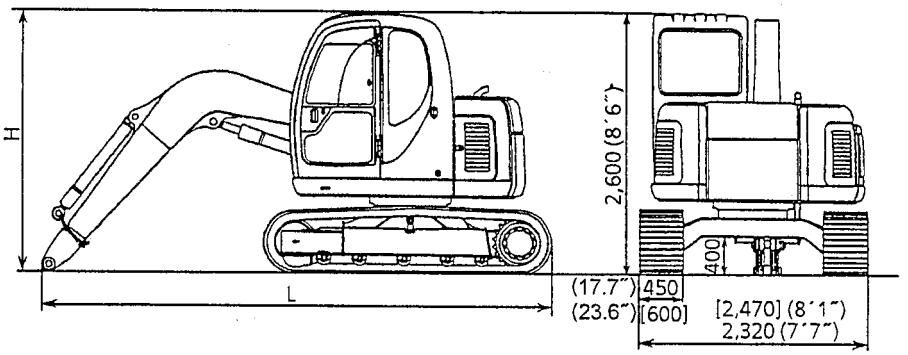
Specification :

- The parenthesis shows 2.07m arm model.
- Regarding 2.07m arm machine, put the arm cylinder rod in a transport position (B) by referring to the outside dimensions in 2.2 MACHINE DIMENSIONS.



OVERALL DIMENSIONS OF WITHOUT ARM AND BUCKET

Type / Combination	A : Shoe width mm (ft-in)	L : Length mm (ft-in)	H : Height mm (ft-in)	W : Width mm (ft-in)	Weight mm (ft-in)
Without arm and bucket	600 (23.6")	5,670 (18'7")	2,600 (8'6")	2,470 (8'1")	6,440 (14,200)
	450 (17.7")	5,670 (18'7")	2,600 (8'6")	2,320 (7'7")	6,220 (13,715)



3. ATTACHMENT DIMENSIONS

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(4) Loader bucket

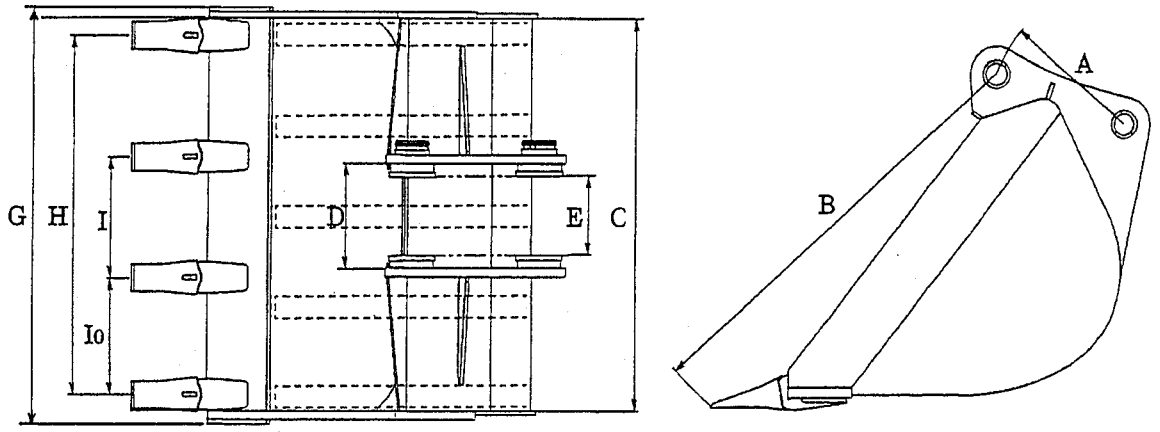


Fig. 3-7 Bucket dimensional drawing (2 / 2)

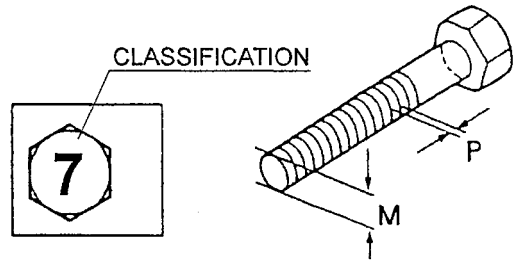
Code	Name
A	Distance between pin and bracket
B	Distance between bucket pin and tooth end
C	Inner width of bucket top end
D	Inner width of lug
E	Inner width of bracket
F	Outer width of side cutter
G	Outer width of bucket bottom
H	Tooth outer width
I	Pitch between teeth
Io	Pitch between teeth
J	finishing plate depth
d1	Pin dia.
d2	Pin dia.

11.1 TORQUE SPECIFICATIONS FOR CAPSCREWS & NUTS

The following Torque Specifications are provided for use when actual torque value of a fastener is not known. Check the capscrews and nuts for their looseness and dropping off before the start of daily work and at the periodical maintenance. Retighten the loosened ones, and install new ones for the dropped off. For the new machine, the check and retightening of them must be carried out at first 50 hours operation. For the replacement of them, make sure to use the same size of manufacturer's genuine parts.

Refer to the table below for the tightening and retightening of capscrews.

- The table below is not applicable for the capscrews to fix the cover, etc., made of plastic. For the tightening torque for such capscrews, consult with an authorized our Distributor. Over-tightening may cause damages on the parts to be fixed.
- In case that the tightening torque is specified in the manual, use such torque values regardless to the table below.
- Numerical indication on the capscrew head shows the classification for strength (e.g., 7 = 7 T). No indication is provided for smaller size of capscrews, M 5 or less.



11.1.1 Metric Coarse Thread Standard Tightening Torque Values. Make Certain to tighten all Capscrews & Nuts to proper torque values.

Torque value Unit : N•m (lbf•ft)

Classification		4.8T		7T		10.9T	
Nominal size		No lubrication	Oil lubrication	No lubrication	Oil lubrication	No lubrication	Oil lubrication
M6	P=1	4.4±0.5 (3.2±0.4)	3.7±0.4 (2.7±0.3)	9.6±1.0 (7.1±0.7)	8.1±0.8 (6.0±0.6)	17.4±1.8 (12.8±1.3)	14.7±1.5 (10.8±1.1)
M8	P=1.25	10.7±1.1 (7.9±0.8)	9.0±0.9 (6.6±0.7)	23.5±2.0 (17.3±1.5)	19.6±2.0 (14.5±1.5)	42.2±3.9 (31.1±2.9)	35.3±3.9 (26.0±2.9)
M10	P=1.5	21.6±2.0 (15.9±1.4)	17.9±1.8 (13.2±1.3)	46.1±4.9 (34.0±3.6)	39.2±3.9 (28.9±2.9)	83.4±8.8 (61.5±6.5)	70.6±6.9 (52.1±5.1)
M12	P=1.75	36.3±3.9 (26.8±2.9)	31.4±2.9 (23.2±2.1)	79.4±7.8 (58.6±5.8)	66.7±6.9 (49.2±5.1)	143±15 (105±11)	121±12 (89.2±8.9)
M14	P=2	57.9±5.9 (42.7±4.4)	49.0±4.9 (36.1±3.6)	126±13 (92.9±9.6)	106±10 (78.2±7.4)	226±20 (167±15)	191±19 (141±14)
M16	P=2	88.3±8.8 (65.1±6.5)	74.5±6.9 (55.0±5.1)	191±20 (141±15)	161±16 (119±12)	343±39 (253±29)	284±29 (209±21)
M18	P=2.5	122±12 (90.0±8.9)	103±10 (75.8±7.2)	265±29 (195±21)	226±20 (167±15)	481±49 (355±36)	402±39 (297±29)
M20	P=2.5	172±17 (127±13)	144±14 (106±10)	373±39 (275±29)	314±29 (232±21)	667±69 (492±51)	559±59 (412±44)
M22	P=2.5	226±20 (167±15)	192±20 (142±15)	500±49 (369±36)	422±39 (311±29)	902±88 (665±65)	755±78 (557±58)
M24	P=3	294±29 (217±21)	235±29 (173±21)	637±69 (470±51)	520±49 (383±36)	1160±118 (856±87)	941±98 (694±72)
M27	P=3	431±39 (318±29)	353±39 (260±29)	941±98 (694±72)	765±78 (564±58)	1700±167 (1250±123)	1370±137 (1010±101)

11.9 SUCTION STOPPER

11.9.1 COMPONENTS

NO.	NAME	PARTS No.	Q'ty
	Suction Stopper Assy	24100P978F4	
1	Rod	2420T4660D1	1
2	Nut	ZN16C08007	1
3	Cover	2414T2123D4	1
4	O-Ring	45Z91D8	1

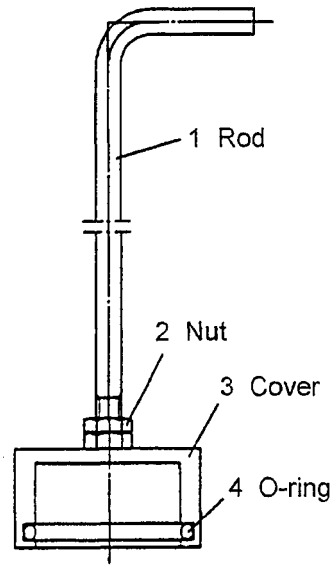


Fig. 11-1 Components of suction stopper

11.9.2 DIMENSION

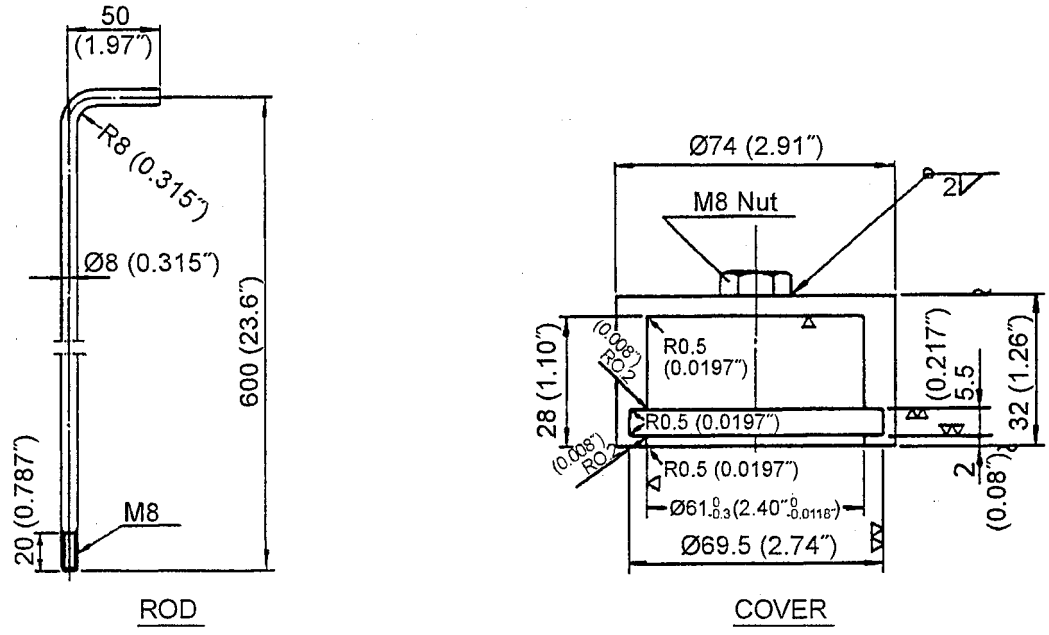


Fig. 11-2 Dimension of suction stopper

11.9.3 APPLICABLE MODEL

Part No. \ Applicable model	SK75UR	SK60-2	SK60-3	SK60SR	SK60SR-1E	SK70SR-1E(S)	SK70SR	SK80MSR	SK80MSR-1E	SK80MSR-1E(S)
24100P978F4	○	○	○	○	○	○	○	○	○	○

GROUP No.		LOCATION	WORK TO BE DONE	UNIT	REMARK	UNIT: HOUR
01 Attachment	00	Bucket relation			Reference for 2. Bucket	
	01	Bucket ASSY	Detach/attach	1 pc.	Include adjustment	0.5
	02	• Bucket attaching and detaching position	Preparation	1 pc.		0.1
	03	• Bucket attaching pin	Detach/attach	1	Include omission of pin.	0.1
	04	• Bucket drive pin	Detach/attach	1		0.1
	05	• Bucket sling and movement	Preparation	1 pc.		0.1
	06	Bucket (Single)	O/H	1 pc.	Not include attaching and detaching.	2.0
	07	• Tooth	Replace	1 pc.		0.5
	08	• Side cutter	Replace	1 pc.		1.0
	09	• Bushing	Replace	1 pc.		0.5
	10	Arm relation			Reference for 3. Arm	
	11	Arm ASSY	Detach/attach	1 pc.		1.0
	12	• Bucket cylinder attaching and detaching position and piping	Preparation	1 pc.		0.3
	13	• Bucket cylinder rod pin	Detach/attach	1 pc.	Include omission of pin.	0.1
	14	• Bucket cylinder head pin	Detach/attach	1 pc.	Include omission of pin.	0.1
	15	• Bucket cylinder assy	Detach/attach	1 pc.		0.1
	16	• Arm cylinder rod pin	Detach/attach	1 pc.	Include omission of pin.	0.1
	17	• Boom top pin	Detach/attach	1 pc.		0.1
	18	• Arm sling and movement	Detach/attach	1 pc.		0.1
	30	Boom relation			Reference for 4. Boom	
	31	• Boom ASSY	Detach/attach	1 pc.		1.0
	32	• Boom attaching and detaching position	Preparation	1 pc.		0.1
	33	• Boom cylinder temporary slinging	Preparation	1 pc.		0.1
	34	• Boom cylinder rod pin	Detach/attach	1	Include omission of pin.	0.1
	35	• Boom cylinder piping	Detach/attach	1 pc.		0.1
	36	• Arm & bucket piping	Detach/attach	1 pc.		0.2
	37	• Boom assy temporary slinging	Detach/attach	1 pc.		0.1
	38	• Boom foot pin	Detach/attach	1	Include omission of pin	0.2
	39	• Boom assy slinging	Detach/attach	1 pc.		0.1
	40	Arm cylinder attaching and detaching	Detach/attach	1 pc.		0.3
	41	• Arm cylinder piping	Detach/attach	1 pc.		0.1
	42	• Arm cylinder head pin	Detach/attach	1	Include omission of pin	0.1
	43	• Arm cylinder slinging	Detach/attach	1 pc.		0.1
	50	Boom cylinder attaching and detaching	Detach/attach	1 pc.		0.3
	51	• Boom cylinder piping	Detach/attach	1		0.1
	52	• Boom cylinder head pin	Detach/attach	1 pc.		0.1
	53	• Boom cylinder slinging	Detach/attach	1		0.1
	60	Bucket cylinder	O/H	1		3.0
	61	• Pin bushing	Preparation	1	Include seal	1.0
	70	Arm cylinder	O/H	1		3.0
	71	• Pin bushing	Preparation	1 set	Include seal	1.0
	75	Boom cylinder	O/H	1		3.0
	76	• Pin bushing	Preparation	1	Include seal	1.0

12.2 STANDARD WORKING TIME TABLE FOR THE MAINTENANCE OF ENGINE

Introduction

This standard working time table provides time required for maintenance (if the work is carefully carried out) under the following condition :

- Tools designated by us are used.
- Genuine parts are prepared.
- Correct working procedures are observed.
- The engine is mounted correctly to the machine.

(1) The working hours given in this table can not be applied because of special machine construction.

(2) Special equipments not listed in this table may be used for operation.
If such operations are performed, fill out reasons in the Claim Application Sheet in detail and submit it to us.

Note

- Unit of maintenance time :
  The maintenance time is given in 6 minutes = 0.1 hour in the decimal system.
- Applicable models :
  CC-4JG1.....SK70SR-1E(S), SK80MSR-1E(S), SK80CS-1E

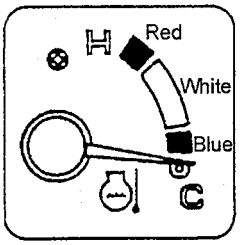
LOCATION OF WORK	WORK TO BE DONE	MAINTENANCE TIME (Hr)
Engine body		
Flywheel assy	Detach & attach	0.9
• Including replacing of ring gear, etc.		
Engine cushion rubber (both sides)	Replace	0.4
Drain plug	Replace	0.1
Engine assy	Detach & attach	21.6
• Incl. overhaul of engine and cylinder body		
Sealing plug	Replace	0.2
Cylinder block drain cock assy	Replace	0.1
Piston & conn rod (2 cycle)	Detach & attach	11.2
Incl. Replacing parts (4 cycle)		13.9
Crank shaft rear oil seal	Replace	0.2
Crank shaft pulley	Detach & attach	0.8
• Incl. replacement of front oil seal		
Oil pan	Retighten	0.3
Oil pan	Detach & attach	0.9
• Incl. overhaul of oil pump		
Crank casing & oil pan	Detach & attach	2.3
Incl. overhaul of oil pump and replacement of other parts		
Oil pan level gauge guide tube	Replace	0.1
Cylinder head		
Valve clearance	Adjust	0.5
Cylinder head cover	Detach & attach	0.5
• Incl. retightening cylinder head		
Cylinder head assy	Detach & attach	7.9

13.3 MEASUREMENT OF ENGINE SPEED

13.3.1 MEASUREMENT OF ENGINE SPEED

(1) Warming up of engine
Start engine to raise the coolant temperature of engine to 40° to 80°C (104° to 176°F).
The E/G coolant temperature gauge is used to measure. The range in white color shows the temperature of approx. 40° to 100°C (104° to 212°F), so confirm that the measured value indicates the temperature within the range of white color.

Engine water
temperature gauge



(2) Measuring with diesel engine speed meter
1) Install diesel engine speed meter pickup on and of injection pipes on which the pickup can be easily installed. (See Fig. 13-1)
2) Check E/G speed shown in Table Table 13-1 in idling speed.

(3) Engine speed measured value through service diagnosis
Insert precision driver (-) into convex place indicated by arrow of hard check SW **A** , **B** in C-1 controller., then direct the arrow to **A** = 0, **B** = 2, and 3 digits in unit of 10 rpm are displayed on service diagnostic display of controller,
Example : 2100 rpm→210 in display

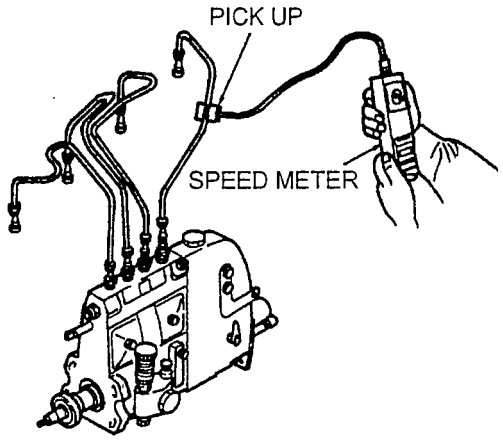


Fig. 13-1 Measurement of E/G speed

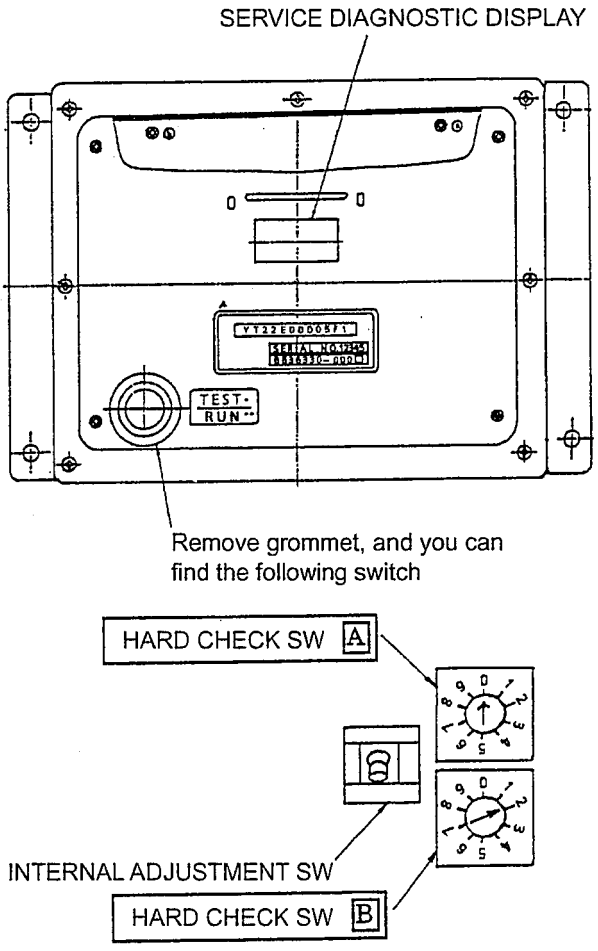


Fig. 13-2 E/G speed measuring hard check SW

(3) Preparation
Put the angle meter on the shoe plate and make sure that the angle is more than 15 deg.
Put a matching mark over the outer circumference of the swing bearing on the upper frame side and on the track frame side.

(4) Measurement
When five minutes has passed after the engine stops, measure the length of the movement of the matching marks.

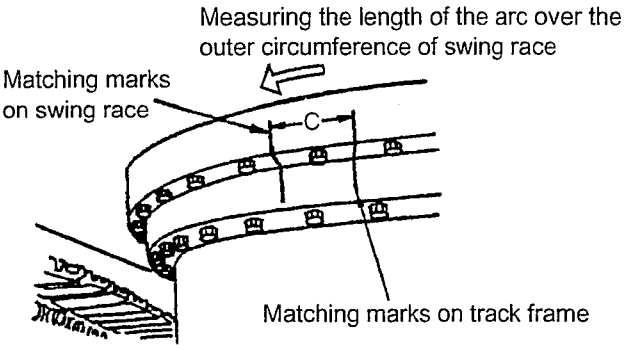


Fig. 13-26 Measuring position of swing brake performances

Performance of swing Parking brake — Unit : mm/5min

Measuring position	Standard value	Repairable level	Service limit
C	0	1 (0.4 in)	2 (0.08 in)

13.6.4 DRAIN RATE OF SWING MOTOR

(1) Purpose
Measure the drain rate of the swing motor and confirm the performances of the swing motor.

(2) Conditions
Hydraulic oil temperature : 45~55°C (113~ 131°F)
Engine revolution : Hi idle

(3) Preparation
1) Stop the engine.
2) Vent air from inside the hydraulic oil tank.
3) Disconnect the swing motor drain hose from its end returning to the hydraulic oil tank and take oil in a container.
4) Put a plug to the tank side.

(4) Measurement ; at Swing Lock
1) Start the engine and put the side faces against the inside of the right or left shoe plate.
2) Relieve the swing motor at full stroke of the swing motion.
3) Receive in a container the amount of drain accumulated in 30 seconds of relieving.

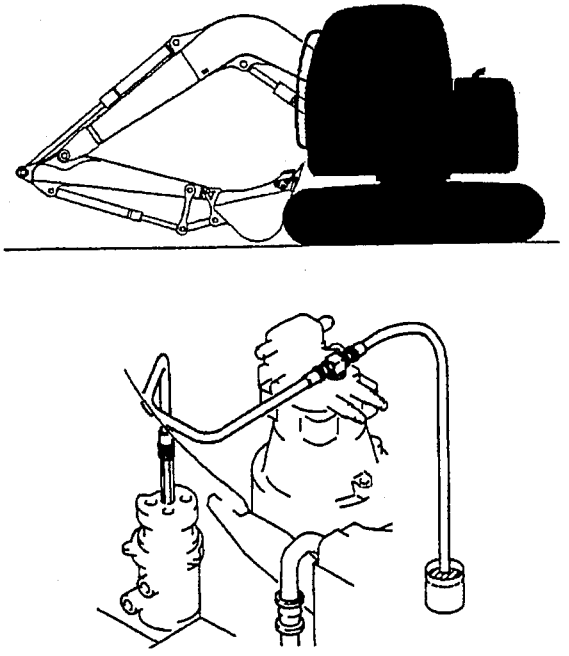


Fig. 13-27

Drain rate of swing motor — Unit : L/30sec

Measuring position	Standard value	Repairable level	Service limit
Drain rate	5.0 (1.3 gal)	7.5 (2.0 gal)	10 (2.6 gal)

21. MECHATRO CONTROL SYSTEM

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TRAVEL STRAIGHT SYSTEM

(1) Start ATTs work operations (boom, arm, bucket, swing) in travel operation (right and left), and the pressure switches respective spools, and is input into respective low pressure sensors.

Note

Boom raise operation is explained here.

(2) If mechatro controller receives the input satisfying the following combination shown in Figure, the controller determines it as travel straight, and the travel straight signal turns on.

(3) After the travel straight signal has turned on, the signal is input to respective proportional valve corresponding to the following commands.

Travel straight proportional command

Outputs switching command corresponding to boom raise pilot pressure
(ATT pilot pressure in high priority in operation)

P1 by-pass cut valve command

Outputs switching command corresponding to boom raise pilot pressure (Att pilot pressure in high priority in operation) and the pressure selected by travel left pilot pressure as high priority.

P2 by-pass cut vale command

Outputs switching command corresponding to boom raise pilot pressure (ATT pilot pressure in high priority in operation)and the pressure selected by travel right pilot pressure as high priority.

(Reference) Operating condition where travel straight signal turns on

	Boom	Bucket	Arm	Swing
In travel right operation	O	O	—	O
In travel left operation	—	—	O	O

22. HYDRAULIC SYSTEM

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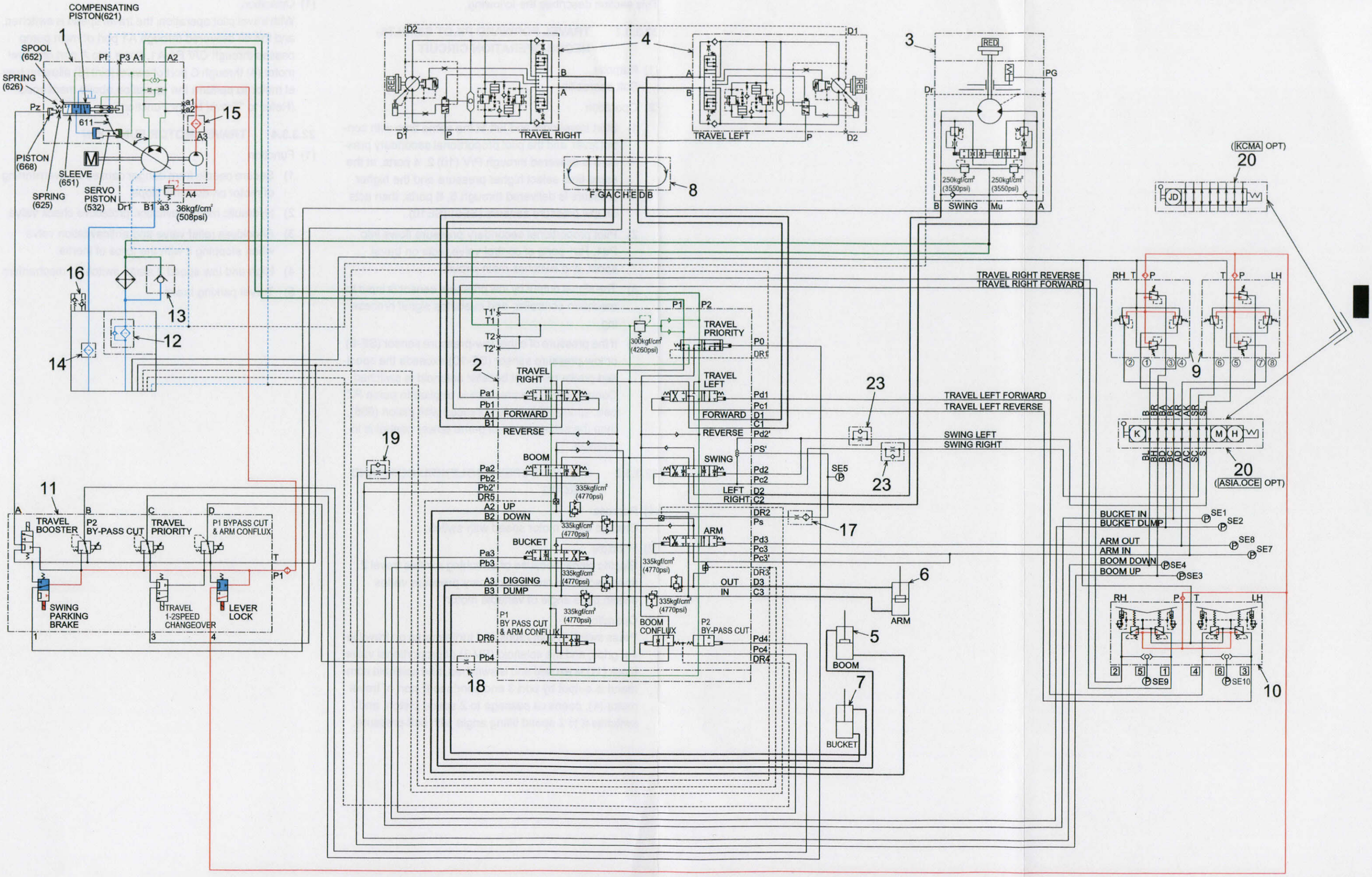
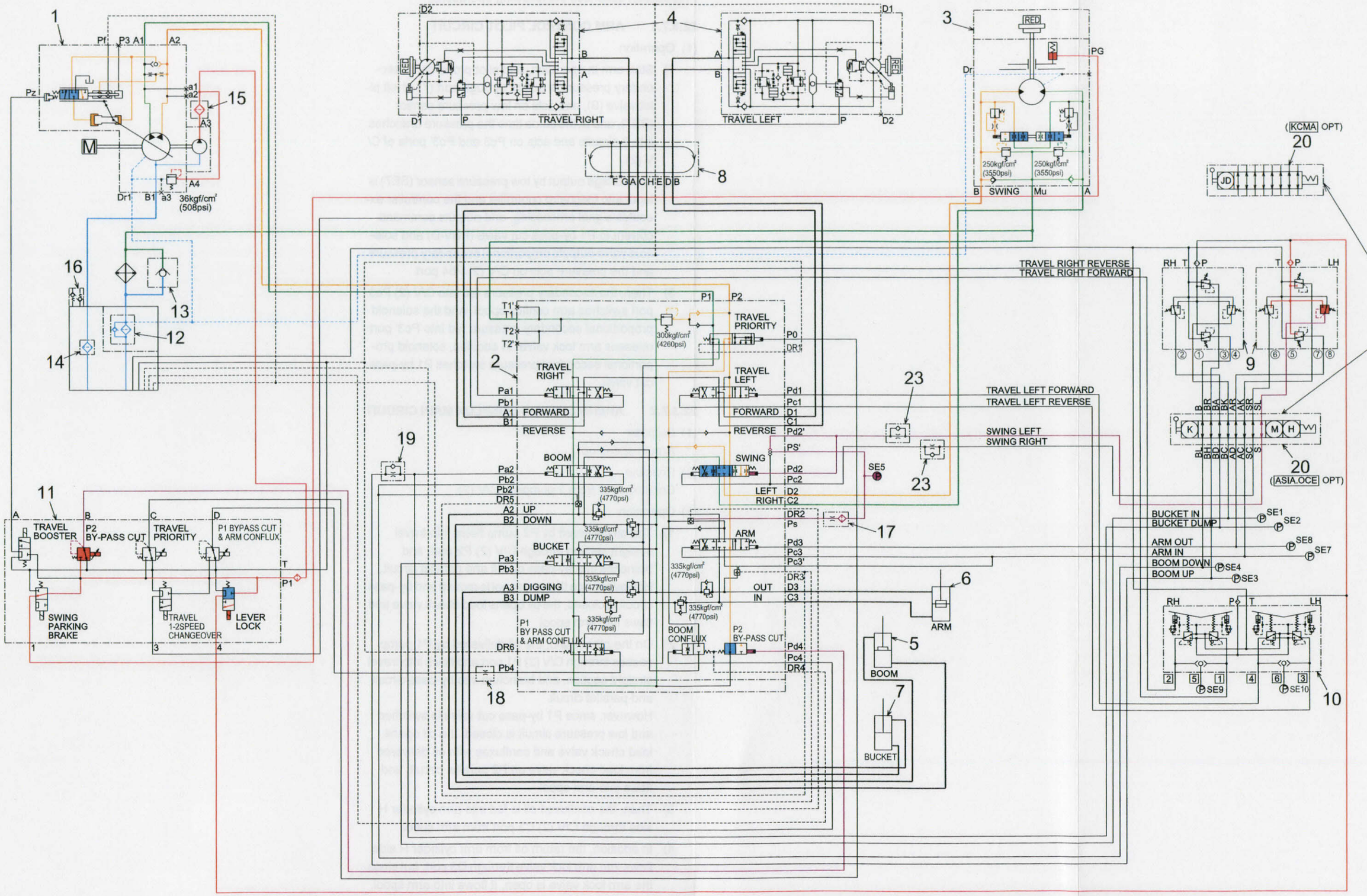


Neutral circuit safety lock lever ON



Swing circuit : Swing operation (Left)

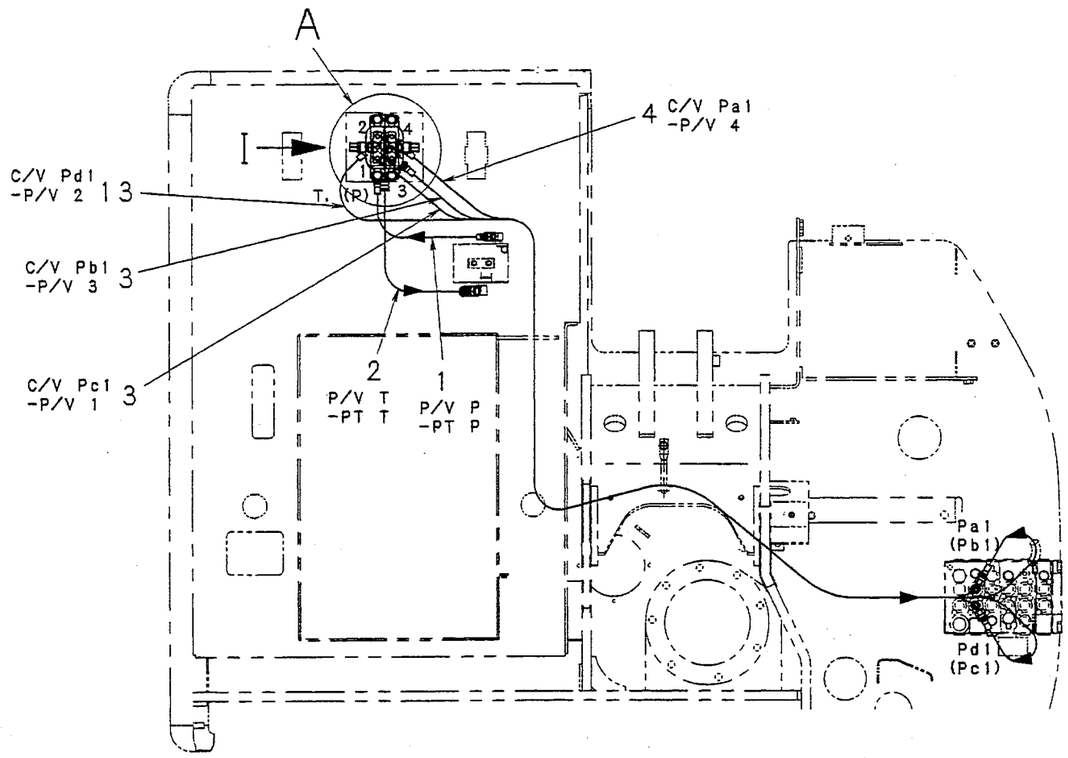
No.	PARTS	Q'ty		PEMARKS
(10)	YT06H00022F6			CONTROL VALVE CONT. KCME
(11)	YT06H00022F9			CONTROL VALVE CONT. BREAKER KCME OPT.
1	ELBOW	11	14	PF 1/4
2	TEE	3	3	PF 1/4
3	CONNECTOR	12	15	PF 1/4
4	CONNECTOR	4	4	PF 1/4 L=38
6	CONNECTOR	1	1	PF 1/4 - PF 3/8
7	HOSE : L=1000	1	1	DRAIN
8	HOSE : L=1200	1	1	DRAIN
9	HOSE : L=700	1	1	DRAIN
10	HOSE : L=1600	1	1	DRAIN
11	HOSE : L=750	2	2	PC3' : ARM LOCK VALVE RELEASE COMMAND PS : SWING PRIORITY HIGH PRESSURE SELECTION COMMAND
12	HOSE : L=1050	1	1	BOOM CONFLUX VALVE SWITCHING COMMAND
13	HOSE : L=900	2	2	Pb2' : BOOM LOCK RELEASE COMMAND Pd2' : SWING PRIORITY COMMAND AT SWING LEFT
14	CONNECTOR	3	3	PF1/4 L=23
15	CONNECTOR	1	1	PF 1/4 L=60
16	HYD.VALVE ASSY	1	1	YT20V00002F1
17	CLIP	2	2	
18	ELBOW	2	2	PF 1/4
19	ELBOW	4	4	PF 1/4
20	ELBOW	1	1	PF 3/8
21	ELBOW	3	2	PF 1/4 - PF 3/8
22	HOSE : L=450	—	1	DRAIN
23	CHECK VALVE (SLOW RETURN)	1	1	YT21V00002P1
24	PRESSURE SENSOR	4	4	LC52S00011P1
26	CONNECTOR	1	1	PF 1/4 RESTRICTION Ø 0.8
27	CONNECTOR	1	1	RESTRICTION Ø 0.6 WITH FILTER
28	TEE	1	2	PF 3/8 - PF 1/4
29	HOSE : L=900	2	2	DRAIN
31	HOSE : L=1500	—	1	DRAIN
34	CONNECTOR	3	3	PF 1/4 WITH FILTER
35	CHECK VALVE	1	1	PF21V00004P1
36	CONNECTOR	1	1	PF 1/4
37	ELBOW	1	1	PF 1/4
38	TEE	1	1	PF 1/4
39	TEE	1	1	PF 1/4
40	ELBOW	1	1	PF 1/4
41	TEE	5	6	PF 1/4
42	TEE	1	1	PF 1/4
(12)	YT62H00003F1			TRAVEL REMOTE CONT
1	HOSE : L=400	1		PRIMARY PRESSURE OF PILOT
2	HOSE : L=450	1		DRAIN
3	HOSE : L=2300	2		1 : TRAVEL LEFT REVERSE 3 : TRAVEL RIGHT REVERSE
4	HOSE : L=3000	1		4 : TRAVEL RIGHT FORWARD
5	ELBOW	4		PF 1/4
7	CONNECTOR	1		PF 1/4 (WITH FILTER)
8	CONNECTOR	1		PF 3/8 - PF 1/4
9	PRESSURE SENSOR	2		LC52S00011P1
10	CAPSCREW	4		M8 X 25
11	WASHER	4		M8
12	PILOT VALVE	1		YN30V00070F1
13	HOSE : L=3200	1		2 : TRAVEL LEFT FORWARD

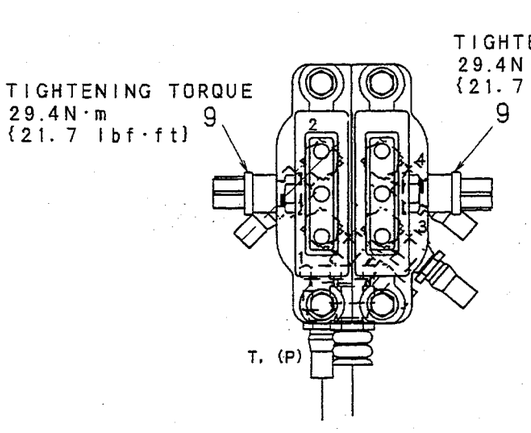
No.	PARTS	Q'ty		PEMARKS
(13)	YT64H00036F1 (STD)			BLOCK CONTROL ASIA. OCE KCMA KCME
(14)	YT64H00036F2 (OPT)			BLOCK CONTROL
1	BLOCK	1	1	
2	CONNECTOR	1	1	PF 3/8
3	ELBOW	3	3	PF 3/8
4	ELBOW	3	3	PF 1/4
5	CAPSCREW	2	2	M8 X 40
6	WASHER	2	2	M8
8	CONNECTOR	—	1	PF 1/4
9	PLUG	1	—	PF 3/8
10	ELBOW	1	1	PF 3/8
11	ELBOW	—	1	PF 3/8 - 1/4
12	CONNECTOR	1	1	PF 1/4 L=23
13	PLUG	1	—	PF 1/4
16	CONNECTOR	1	1	PF 3/8
(15)	YT64H00044F2			BLOCK CONTROL KCME
1	HOSE : L=1000	1		
2	HOSE : L=500	1		
3	HOSE : L=900	2		
4	ELBOW	7		
5	PRESSURE SENSOR	3		LC52S00011P1
6	BLOCK	1		
7	BRACKET	1		
8	CAPSCREW	2		M10 X 25
9	CAPSCREW	2		M8 X 25
10	WASHER	2		M10
11	WASHER	2		M8
12	ELBOW	1		PF 1/4
13	CONNECTOR	1		PF 1/4 L=25
14	HYD.VALVE ASSY	1		YT20V00002F1
15	ELBOW	1		PF1/4 WITH FILTER
16	CONNECTOR	1		PF1/4 WITH FILTER
17	PLUG	1		PF 1/4
(16)	YT64H00046F2			BLOCK CONTROL KCMA
1	HOSE : L=1000	1		
2	HOSE : L=500	1		
3	HOSE : L=900	2		
4	ELBOW	8		
5	PRESSURE SENSOR	3		LC52S00011P1
6	BLOCK	1		
7	BRACKET	1		
8	CAPSCREW	2		M10 X 25
9	CAPSCREW	2		M8 X 25
10	WASHER	2		M10
11	WASHER	2		M8
12	PLUG	1		PF 1/4

No.	PARTS	Q'ty		PEMARKS

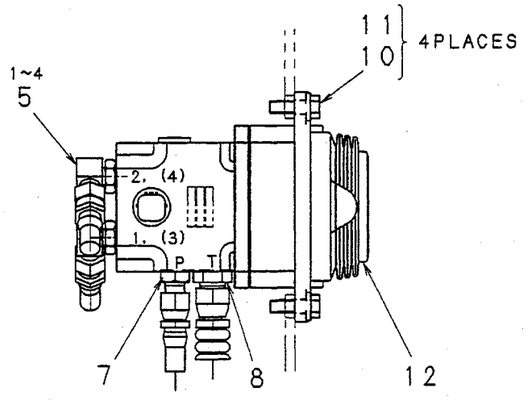
No.	PARTS	Q'ty		PEMARKS

(12) TRAVEL REMOTE CONTROL : YT62H00003F1





DETAIL A



VIEW I

NOTE 1. PORTS IN( ) INDICATE LOWRE SIDE ONE ON THE PILOT VALVE

	CAPSCREW (10T)
SCREW	TORQUE N·m {lbf·ft}
M8	35.3 {26.0}

CONNECTOR ATTACHING TO P/V

		O-RING TYPE JOINT
SCREW PF	TOOL mm	TORQUE N·m {lbf·ft}
1/4	19	29.4 {21.7}

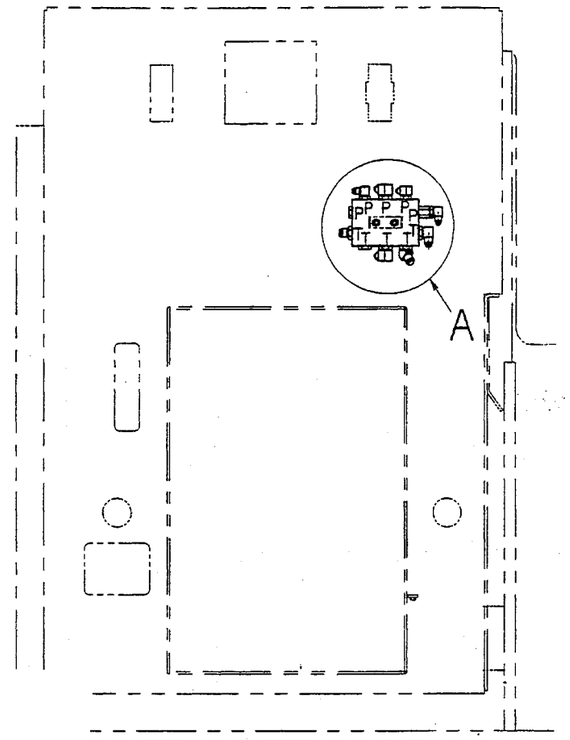
		HYD. HOSE (30° FLARED)
SCREW PF	TOOL mm	TORQUE N·m {lbf·ft}
1/4	19	29.4 {21.7}
3/8	22	49.0 {36.1}

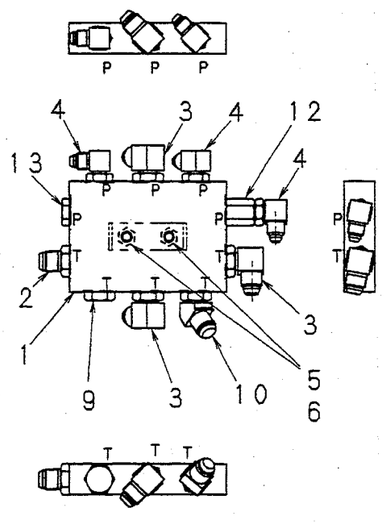
(13) BLOCK CONTROL : YT64H00036F1 **ASIA, OCE , KCMA , KCME** (STD)

(14) BLOCK CONTROL : YT64H00036F2 (OPT)

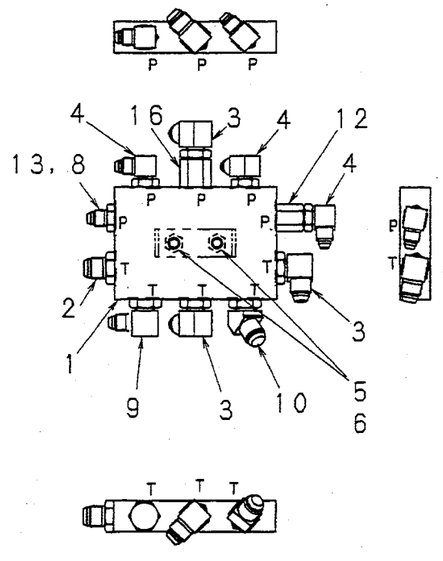
	CAPSCREW (10T)
SCREW	TORQUE N·m {lbf·ft}
M8	35.3 {26.0}

		O-RING TYPE JOINT
SCREW PF	TOOL mm	TORQUE N·m {lbf·ft}
1/4	19	36.3 {26.8}
3/8	22	73.5 {54.2}



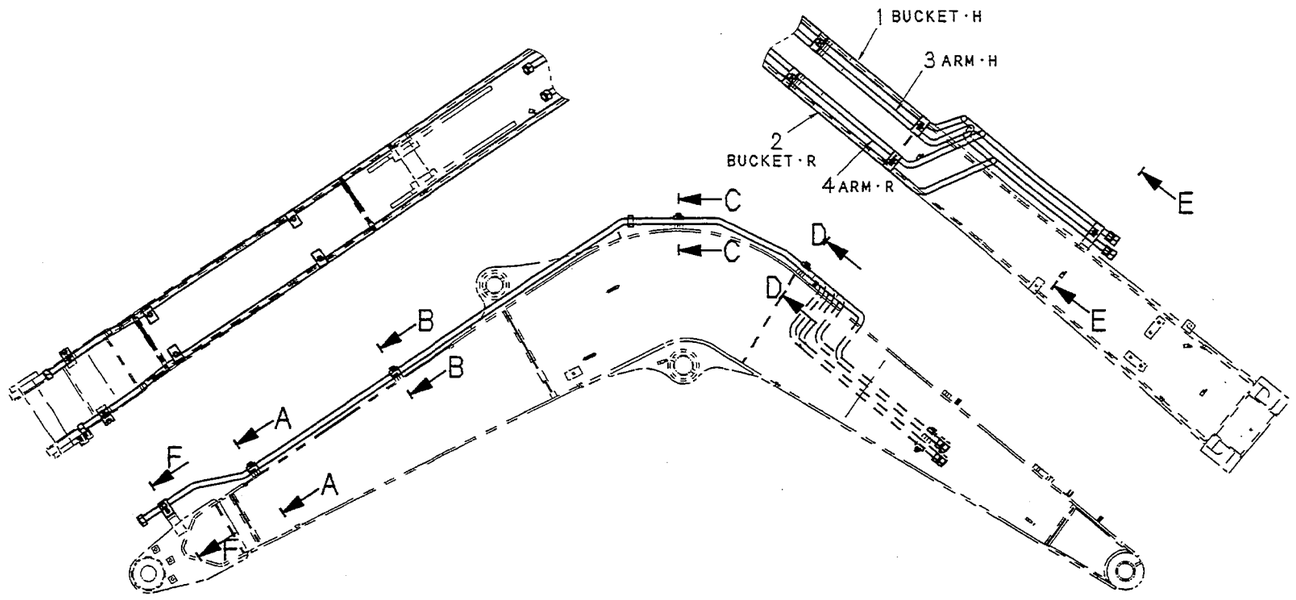


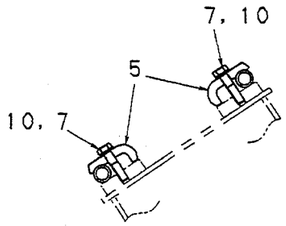
DETAIL A (F1)



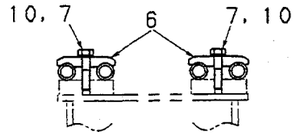
DETAIL A (F2)

(14) BOOM HYDRAULIC LINES : YT42H00055F1

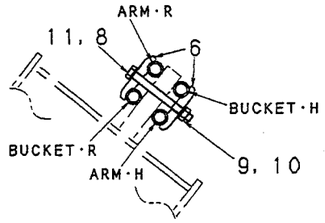




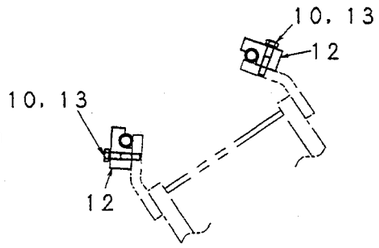
SECTION AA, BB



SECTION CC, DD

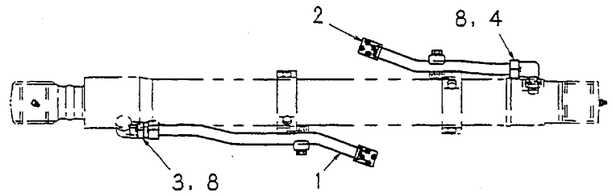


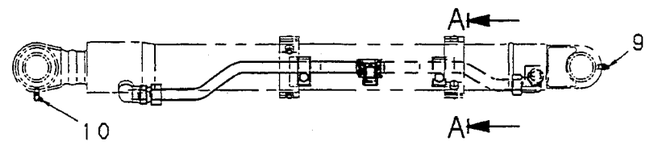
SECTION EE

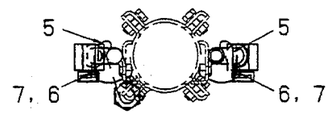


SECTION FF

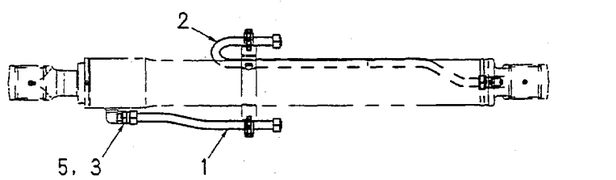
(17) BUCKET CYL. HYDRAULIC LINES : YT43H00005F1

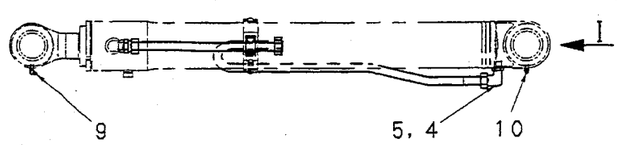


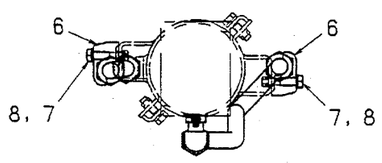




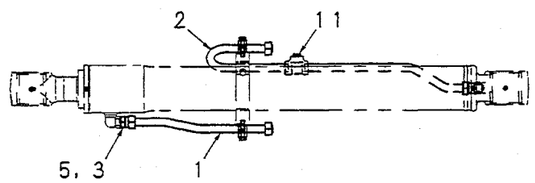
SECTION AA

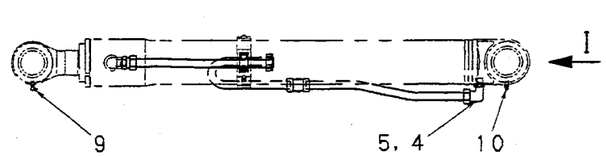


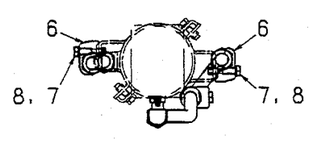




VIEW I







VIEW I

NOTE

1. TIGHTENING TORQUES FOR M-THREADS

THREADS SIZE	TORQUES
M10	31.5N·m{23.2 lbf·ft}

2. TIGHTENING TORQUES FOR NUTS AND SLEEVES

TUBE SIZE	TORQUES
ø22×3.0	216N·m{159 lbf·ft}

3. TIGHTENING TORQUES FOR PF. PT-THREADS

THREADS SIZE	TORQUES
1/8	16.7N·m{12.3 lbf·ft}
1/4	36.3N·m{26.8 lbf·ft}
1/2	108N·m{79.7 lbf·ft}

5. APPLY LOCTITE #242 AT THE SETTING BOLTS OF CLAMP

23. ELECTRICAL SYSTEM

TABLE OF CONTENTS

Book Code No. S5YT2303E01

23.2 HARNESS

23.2.1 HARNESS & CABLE LIST

Index No.		ASIA	OCEANIA	KCMA	KCME	DWG. No.		HARNESS				
Device	Item					Name	Assy No.	No.	Name	Part No. ASIA, OCEANIA	Part No. KCMA	Part No. KCME
Upper frame	2.3	●				Controller assy	YT22E00032F4	46-9-1	Harness	YT14E01073P1	——	——
			●				YT22E00032FA	——		——	——	——
				●			YT22E00033F2	19-7-1	Harness	——	YT14E01068P1	——
					●		YT22E00032F5	18-6-1	Harness	——	——	YT14E01069P1
	2.4	●				Instrument panel assy	YT17M00009F1					
			●				YT17M00009F8					
				●			YT17M00010F6					
					●		YT17M00012F1					
					●		YT17M00013F1					
					●		YT17M00013F5					
	2.5	●	●			Upper electric assy	YT03E00006F1	10	Harness	——	——	YT13E01079P1
				●			YT03E00006F3					
					●		YT03E00006F2					
	2.6	●	●			Upper harness assy (Dozer)	YT13E00036F1	1	Starter cable	YT13E01026D2	←	←
		●	●				YT13E00036F4	2	Battery relay cable	2486R89D4	←	←
				●	●	(Dozer)	YT13E00035F1	3	Battery cable	YN13E01071D1	←	←
				●	●		YT13E00035F2	4	Battery ground cable	2486R87D1	←	←
								5	Right guard harness	YT13E01059P1	←	←
								6	Main harness	YT13E01109P1	YT13E01106P1	←
								8	Frame ground cable	LE13E01006P1	←	←
								13	P3 pump harness	YT16E01017P1	←	←
	2.7	●	●	●	●	E/G Harness	YT16E00004F1	1	E/G Sub harness	YT16E01013P2	←	←
	2.8	●	●	●	●	Floor plate harness assy	YT13E00034F1	1	Harness	YT13E01108P1	←	←
								3	Cable	LE13E01005P1	←	←
Cab	2.9	●	●			Cab harness assy	YT14E00019F2	1or2or9	Left instrument panel harness	YT14E01036P1	YT14E01048P1	YT14E01065P1
				●			YT14E00015F6	7 or 15	Right instrument panel harness	YT14E01061P1	YT14E01070P1	YT14E01061P1
					●		YT14E00019F1	1 or 3	Cab right front harness	YT14E01062P1	YT14E01043P1	YT14E01062P1
	2.10	●	●			Battery	2484U179					
				●	●		2411U25					
	2.11	●	●		●	Cab	YT02C00030F1	2-37	Wiper harness	YT02C01106P1	←	←
				●			YT02C00030F9	61	Curl code harness	YT02C01104P1	←	←
								64	Cab harness	YT02C01216P3	←	←
								65	Antenna	YT54S00018F1	←	←
								189	Room lamp harness	YT02C01513P1	←	←
	2.12	●	●	●	●	Mounting cab	YT02C00002F1					
Light	2.13	●	●	●	●	Mounting deck light	YT80E00001F1					
	2.14	●	●	●		Mounting boom work light	LE80E00002F1	2	Boom light Harness	YN15E01005D5	←	YT15E01001D1
					●		LE80E00002F2					
	2.15				●	Mounting cab work light	YT80E00006F3	18	Fore light harness	——	——	YT80E01002P1
A/C	2.16	●	●	●	●	A/C Conditioner	YT20M00008F3					
Upper frame	2.17				●	Mounting fuel pump	YT22P00003F1					
	2.18	●			●	Name plate instal (Electric component for AIS)	YT22T00081F2					

Notes : 1. The Part numbers and serial numbers of machine may be changed due to modification, so use only the numbers for reference.
2. AIS=AUTO IDLE STOP

Fig. 23-9

23.2.3B-46-9-1 INSTRUMENT PANEL HARNESS : YT14E01073P1 **ASIA, OCE** (1/4)

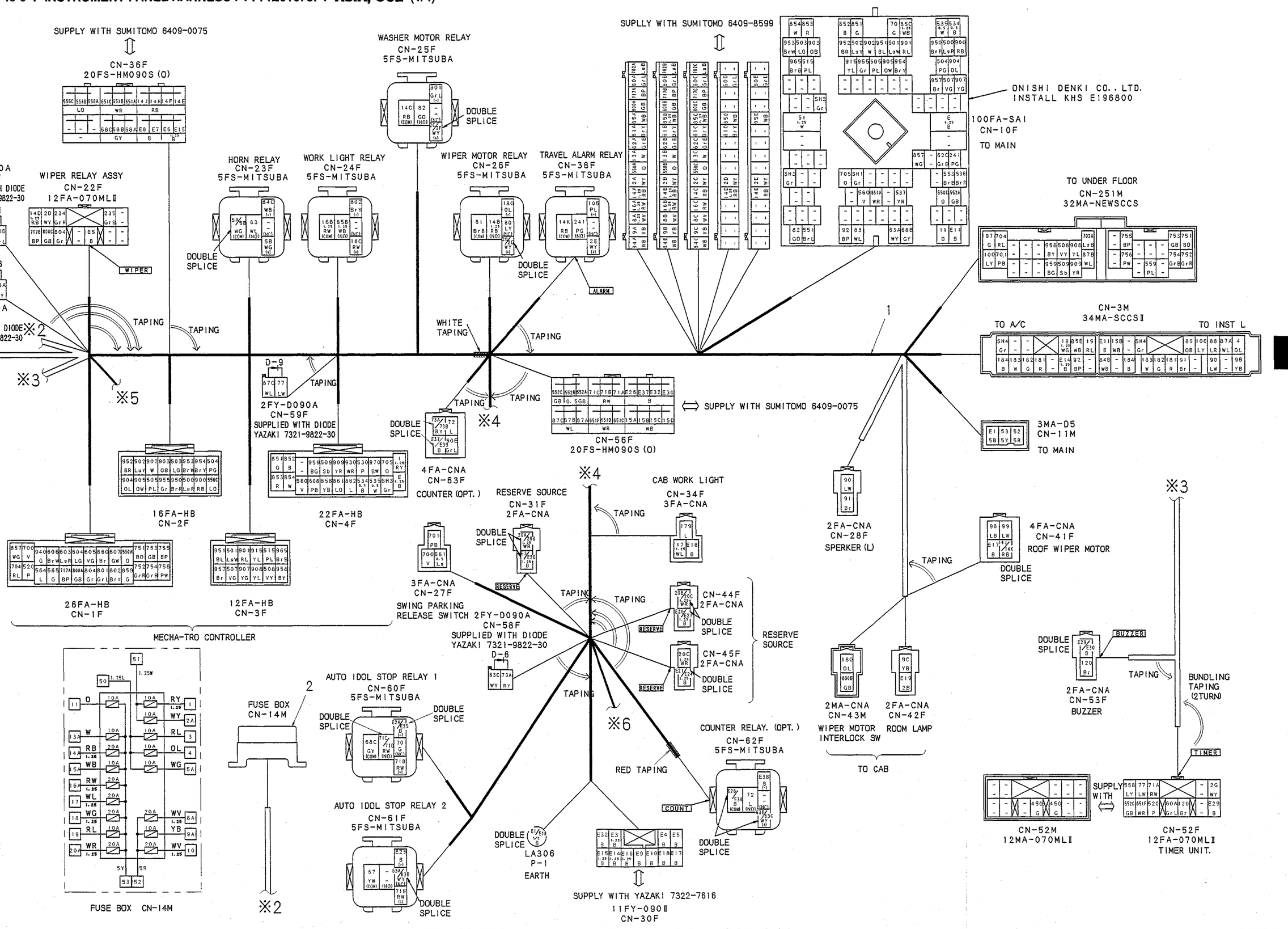
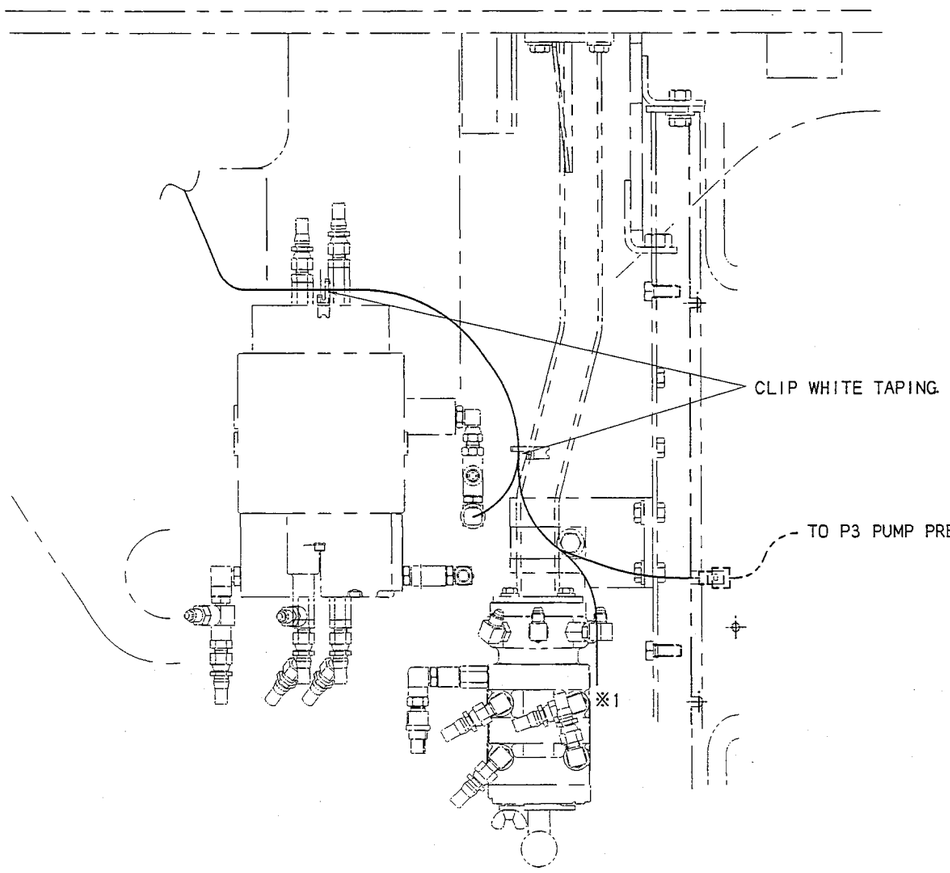
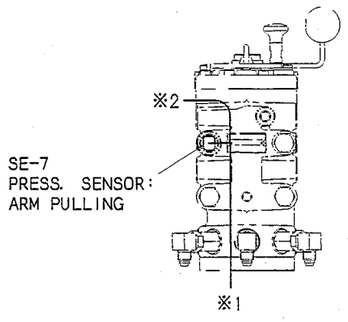


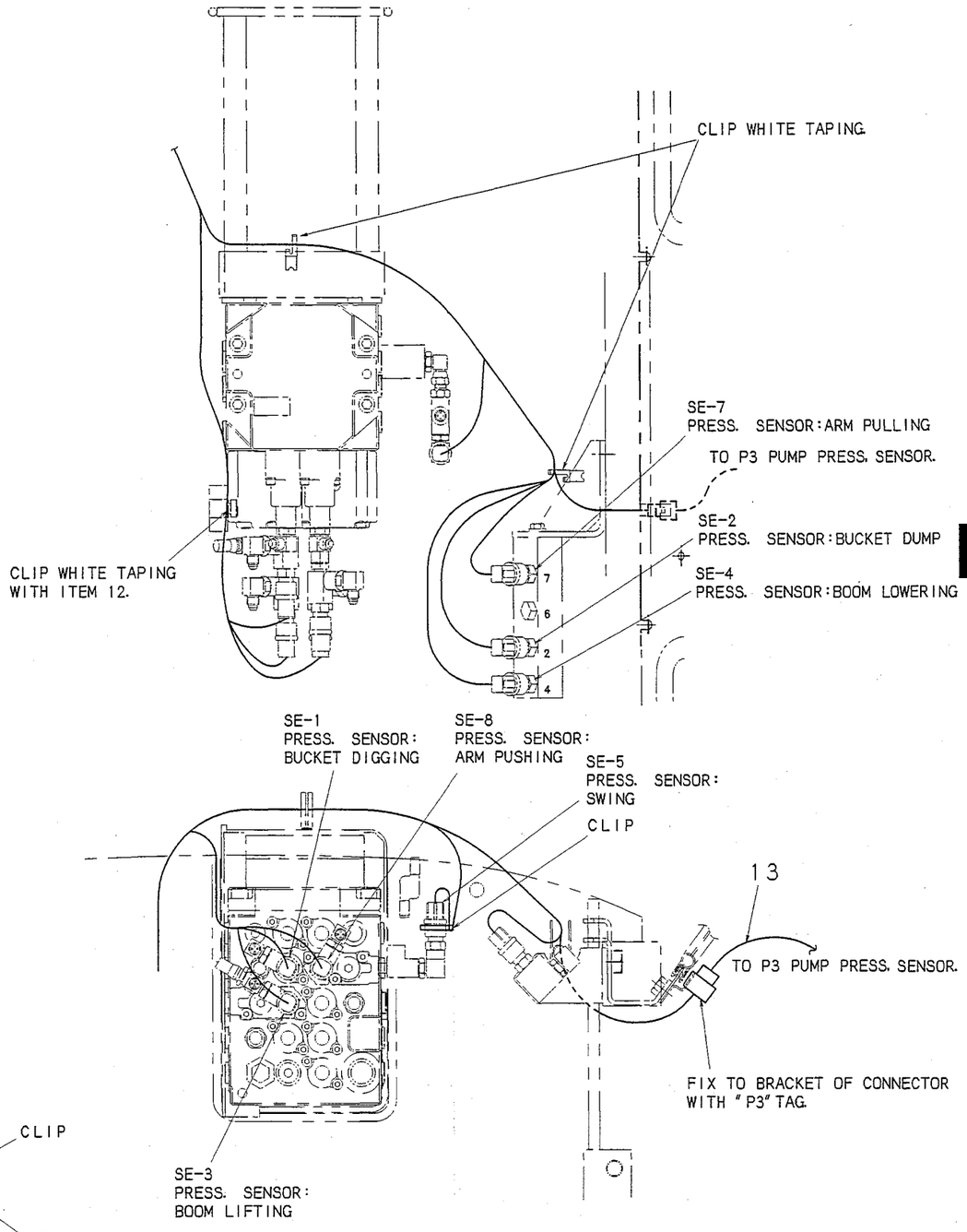
Fig. 23-15 Instrument panel harness **ASIA, OCE** (1/4)

A. FOR **ASIA, OCE** (3/3)

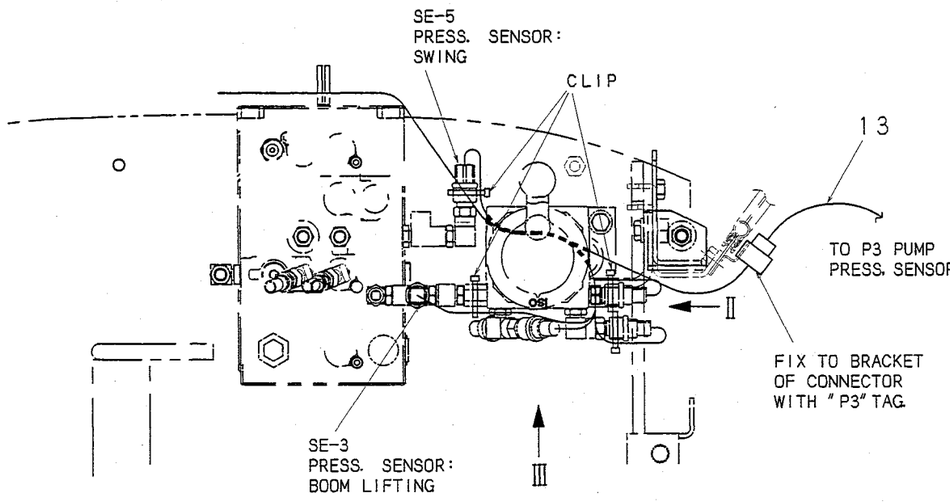




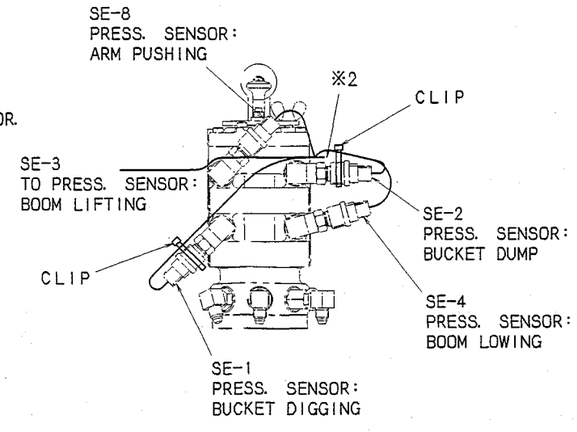
VIEW Ⅱ



DETAIL OF PRESS. SENSOR
(CASE OF WITHOUT MULTI)



DETAIL OF PRESS. SENSOR
(CASE OF NEW MULTI)



VIEW Ⅲ

Fig. 23-19 Upper harness assy (3/3)

23.2.6-1 STARTER CABLE : YT13E01026D2

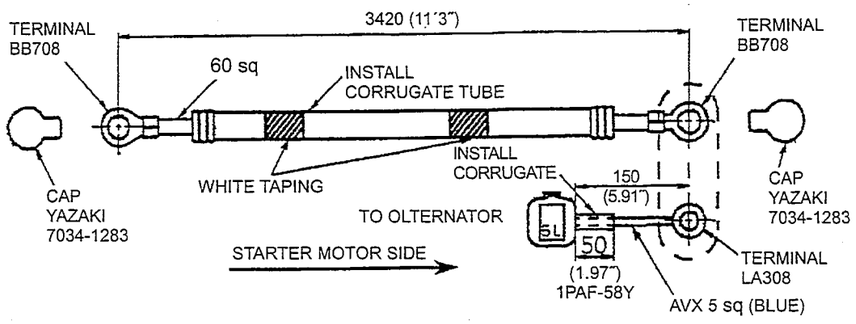


Fig. 23-24

23.2.6-2 BATTERY RELAY CABLE : 2486R89D4

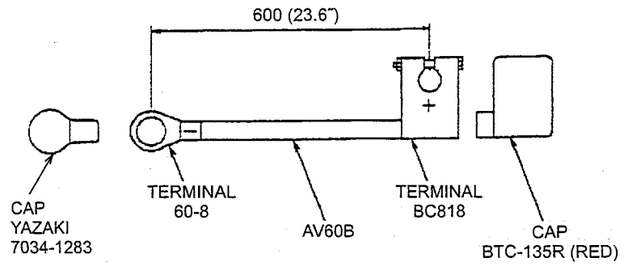


Fig. 23-25

23.2.6-3 BATTERY CABLE : YT13E01071D1

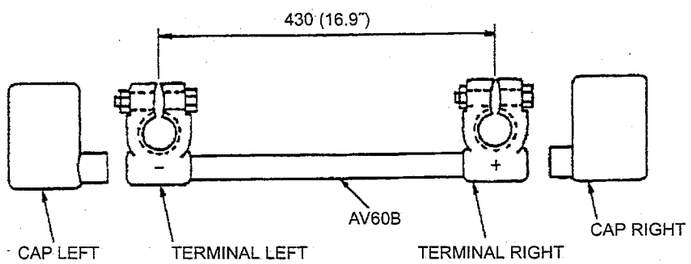


Fig. 23-26

23.2.6-4 BATTERY GROUND CABLE : 2486R87D1

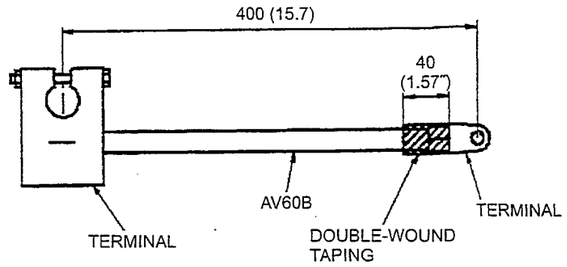
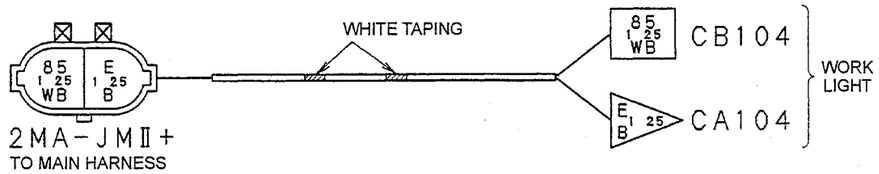


Fig. 23-27

23.2.6-5 RIGHT GUARD HARNESS : YT13E01059P1



CONNECTORS SELECTION TABLE

CONNECTOR NAME (PIN NUM.)	MANUFUC.	PART NUMBER	
		HOUSING	TERMINAL
2MA-JMII+	AMP	174354-2	171661-1
CA104	AMP	170002-5	170887-1
CB104	AMP	170003-5	170233-1

Fig. 23-28

23.2.6-6 FRAME GROUND CABLE : LE13E01006P1

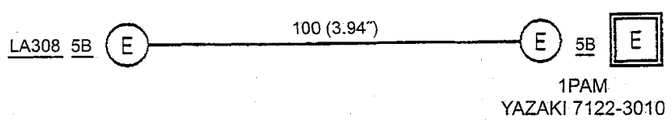
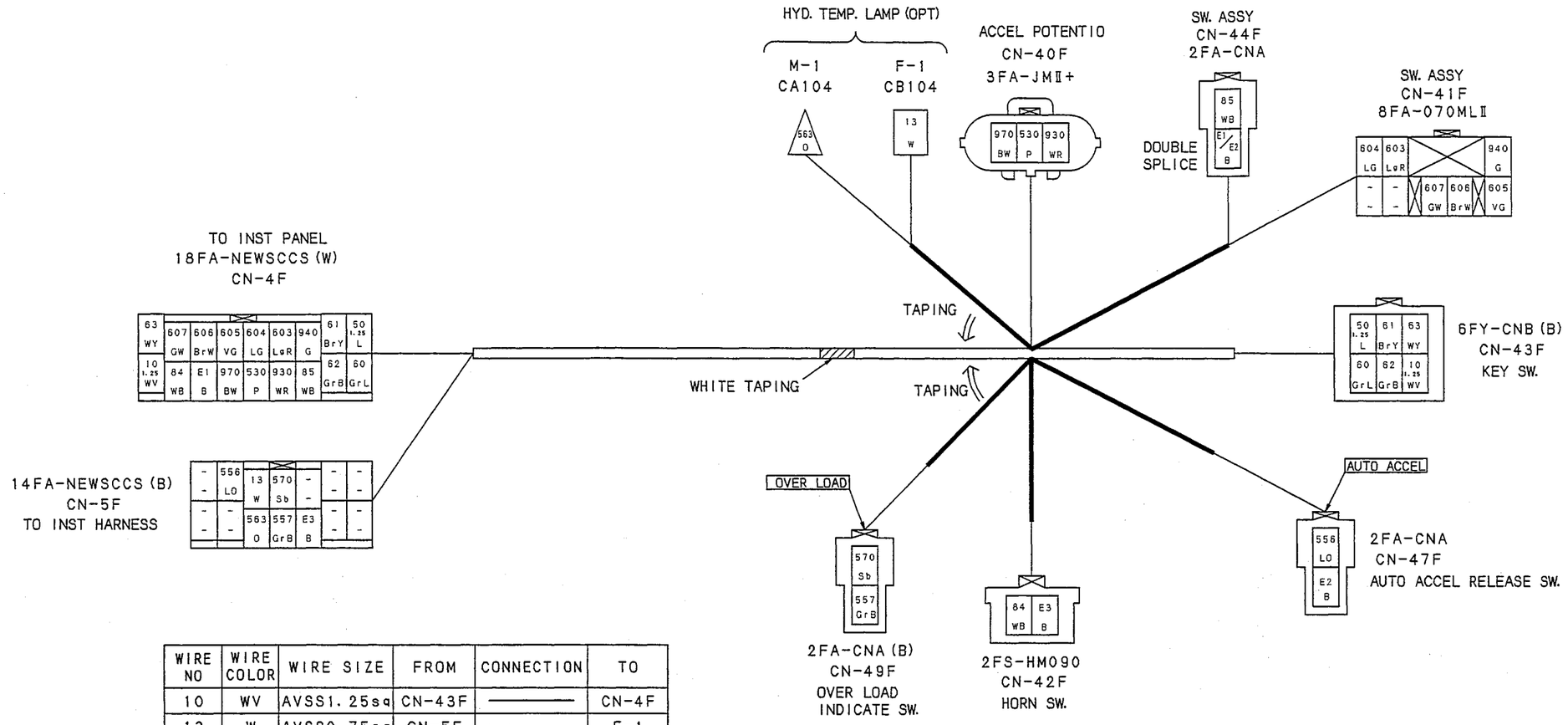


Fig. 23-29

23.2.9A-15 RIGHT INSTRUMENT PANEL HARNESS : YT14E01070P1 **KCMA**



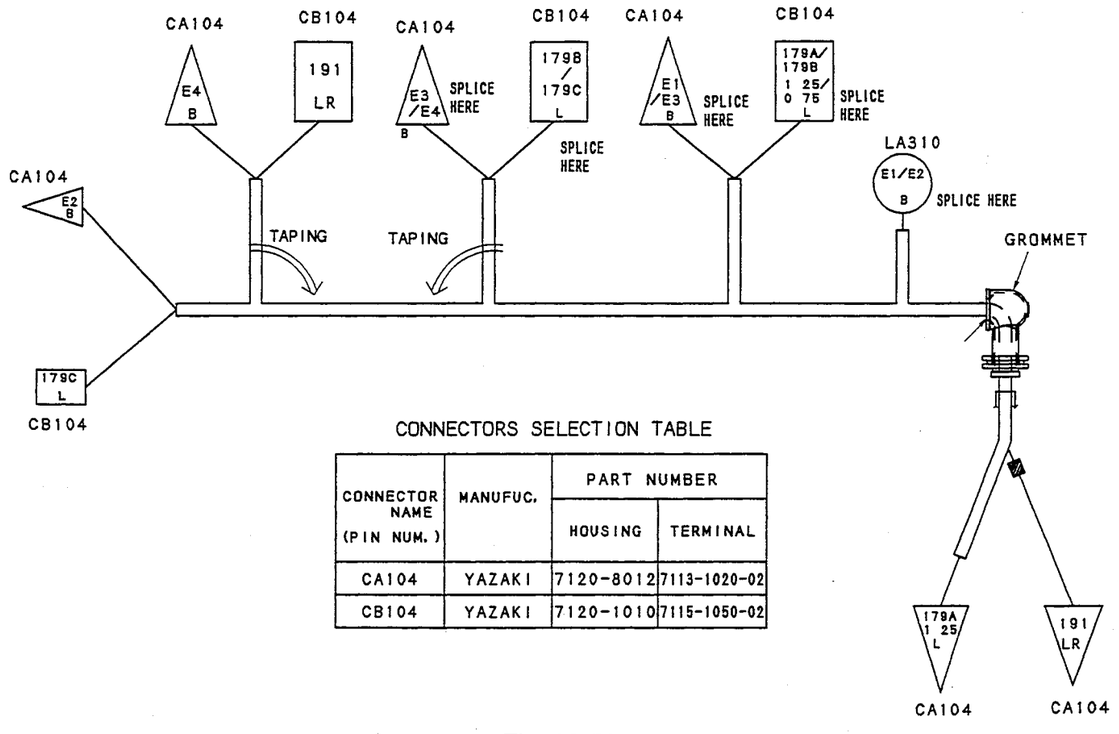
WIRE NO	WIRE COLOR	WIRE SIZE	FROM	CONNECTION	TO
10	WV	AVSS1.25sq	CN-43F	———	CN-4F
13	W	AVSS0.75sq	CN-5F	———	F-1
50	L	AVSS1.25sq	CN-43F	———	CN-4F
60	GrL	AVSS0.75sq	CN-43F	———	CN-4F
61	BrY	AVSS0.75sq	CN-43F	———	CN-4F
62	GrB	AVSS0.75sq	CN-43F	———	CN-4F
63	WY	AVSS0.75sq	CN-43F	———	CN-4F
84	WB	AVSS0.75sq	CN-42F	———	CN-4F
85	WB	AVSS0.75sq	CN-44F	———	CN-4F
530	P	AVSS0.75sq	CN-40F	———	CN-4F
556	LO	AVSS0.75sq	CN-5F	———	CN-47F
557	GrB	AVSS0.75sq	CN-5F	———	CN-49F
563	O	AVSS0.75sq	CN-5F	———	M-1
570	Sb	AVSS0.75sq	CN-49F	———	CN-5F
603	LgR	AVSS0.75sq	CN-41F	———	CN-4F
604	LG	AVSS0.75sq	CN-41F	———	CN-4F
605	VG	AVSS0.75sq	CN-41F	———	CN-4F
606	BrW	AVSS0.75sq	CN-41F	———	CN-4F
607	GW	AVSS0.75sq	CN-41F	———	CN-4F
930	WR	AVSS0.75sq	CN-40F	———	CN-4F
940	G	AVSS0.75sq	CN-41F	———	CN-4F
970	BW	AVSS0.75sq	CN-40F	———	CN-4F
E1	B	AVSS0.75sq	CN-44F	DOUBLE SPLICE	CN-4F
E2	B	AVSS0.75sq	CN-44F	DOUBLE SPLICE	CN-47F
E3	B	AVSS0.75sq	CN-42F	———	CN-5F

CONNECTORS SELECTION TABLE

CONNECTOR NAME (PIN NUM.)	MANUFUC	PART. NUMBER	
		HOUSING	TERMINAL
18FA-NEWSCCS (W)	AMP	178690-1	175266-2 (040 GOLD PLATING) 175269-1 (070M PLATING)
8FA-070MLII	AMP	176113-6	173631-2 (GOLD PLATING)
3FA-JMII+	AMP	174357-2	171662-1
2FA-CNA	AMP	172130-1	170032-2
2FA-CNA (B)	AMP	172130-2	170032-2
6FY-CNB (B)	AMP YAZAKI	7123-2865-30	170032-2
2FS-HM090	SUMITOMO	6090-1001	8240-4422
14FA-NEWSCCS (B)	AMP	178689-2	175266-2 (040 GOLD PLATING) 175269-1 (070M PLATING)
CB104	AMP	180889-1	170003-4
CA104	AMP	180887-1	170002-4

Fig. 23-39 Right instrument panel harness **KCMA**

23.2.15-18 FOUR LIGHT HARNESS : YT80E01002P1



CONNECTORS SELECTION TABLE

CONNECTOR NAME (PIN NUM.)	MANUFUC.	PART NUMBER	
		HOUSING	TERMINAL
CA104	YAZAKI	7120-8012	7113-1020-02
CB104	YAZAKI	7120-1010	7115-1050-02

Fig. 23-59

24.1.1.3 FUNCTION

(1) This pump is of split flow double-pump type capable of obtaining two independent delivery lines by branching off the oil delivered from single cylinder block (141) to two delivery ports by the action of the valve plate (313). Further, the pump has a common suction construction that integrates the suction of the gear pump at the rear end and the suction of the main pump. The pump contains a relief valve for the gear pump for pilot pressure.
The pump consists mainly of :
The rotary group that makes rotary-movements, The swash plate group that changes the delivery rate, and the regulator group that controls the tilting angle.

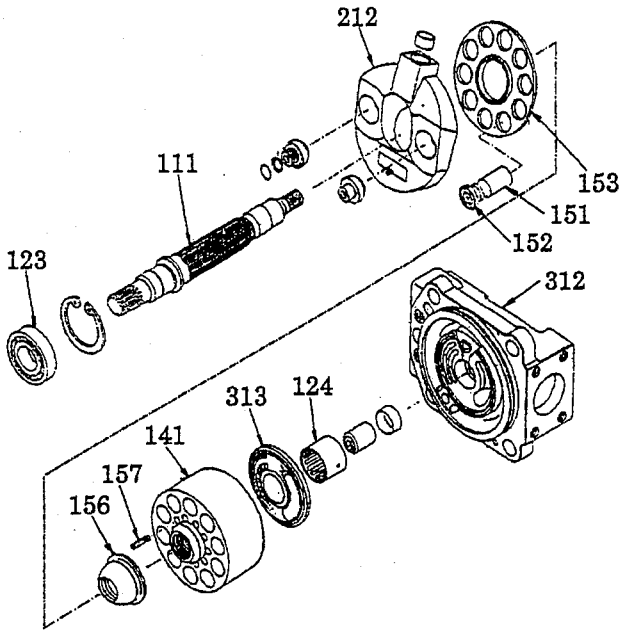


Fig. 24-4 Rotary group

(2) Rotary group (See Fig. 24-4)
The rotary group consists of shaft (111), cylinder block (141), piston (151), shoe (152), plate (153), spherical bushing (156), and spring (157). The shaft is supported by bearings (123, 124) at its both ends. The shoe makes a spherical joint caulked to the piston and relieves thrust load occurring by load pressure. Since the shoe slides lightly on swash plate (212), it has a pocket that achieves hydraulic balance. The subgroup consisting of the piston and the shoe is pressed against swash plate (212) by spring (157) via the plate that slides smoothly on swash plate (212). Likewise, the cylinder block is pressed against valve plate (313) by a spring.
Now, if the shaft is driven by the engine, the cylinder block (141) is driven (rotates) via a spline joint. If the swash plate is tilted, the pistons arranged in the cylinder block make reciprocating motion relative to the cylinder while rotating with the cylinder block. Now let us take a lock at a single piston : While the cylinder block makes one turn, the piston moves away from valve plate (313) (the process of sucking oil) in 180° and moves close to valve plate (313) (the process of deliverying oil) in the remaining 180°. The valve plate is provided with one suction port and two delivery ports that are arranged in valve cover (312). The oil sucked into the cylinder block via the suction port is branched off to two delivery ports of the valve plate and is connected to the external piping past valve cover (312).

24.1.3 PILOT VALVE (TRAVEL)

24.1.3.1 OUTLINE

(1) General view

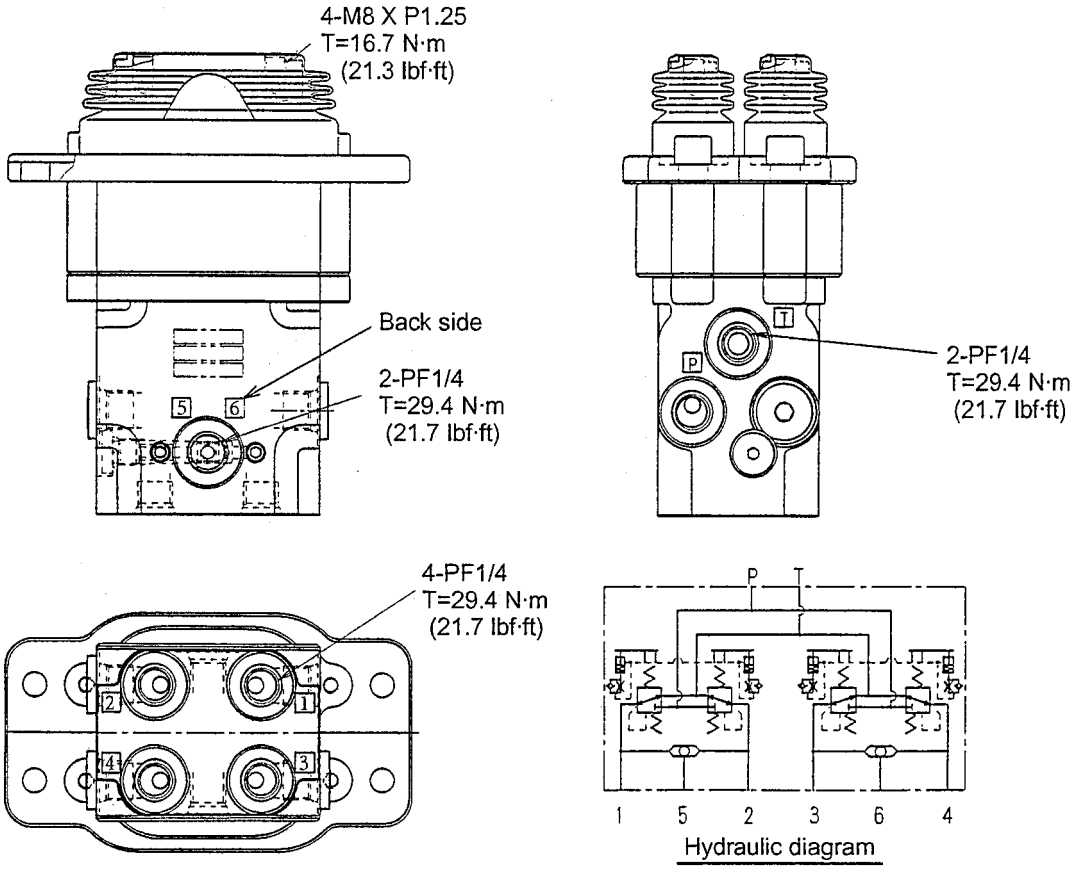
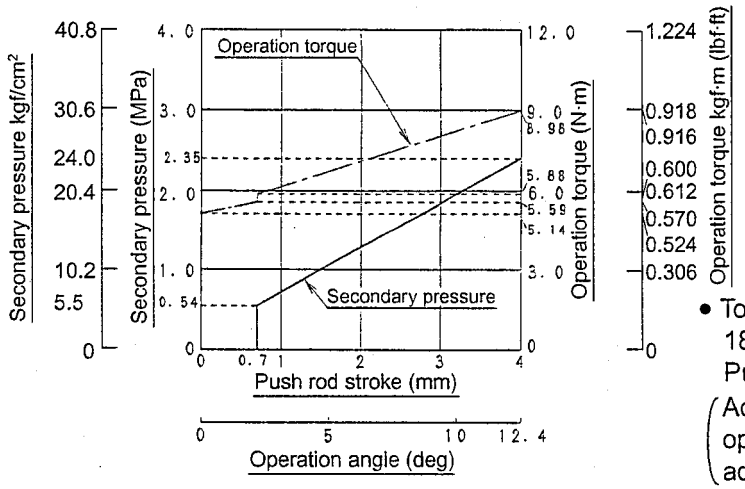


Fig. 24-18

(2) Specifications

Parts No.	YN30V00070F1
Type	PVD6PC4017A
Max.primary pressure	6.9MPa (1000 psi)
Rated flow	10 L/min (2.64 gal/min)
Weight	3.9 kg (8.6 lbs)

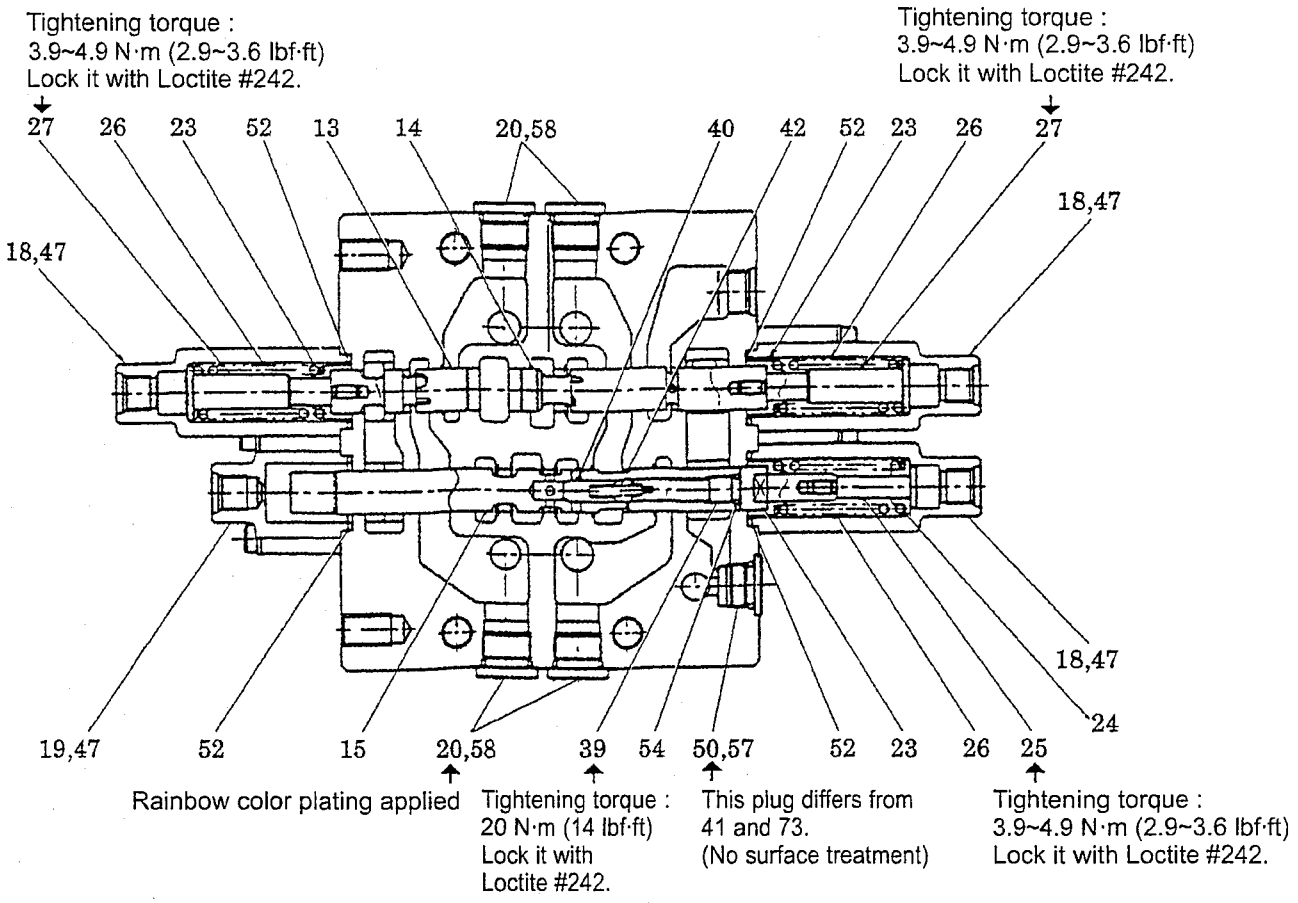
(3) Performance characteristics



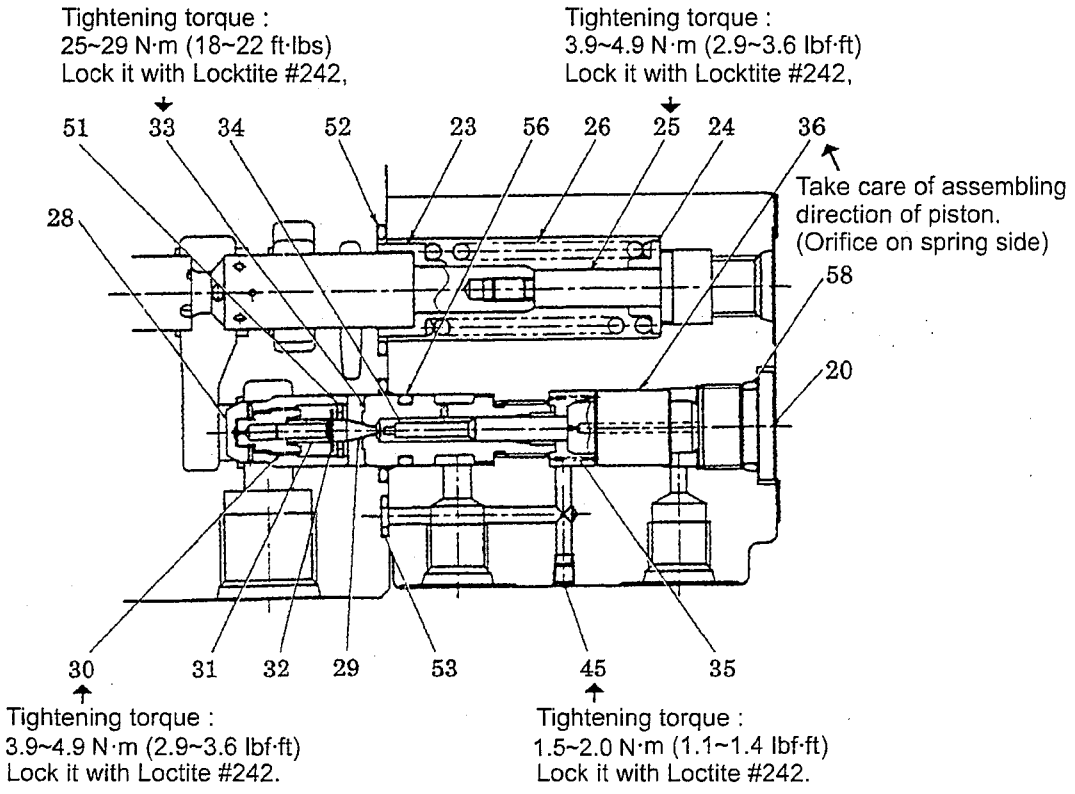
- Torque required (Damper)
  18.9~2.8 N·m (13.9~2.07 lbf·ft)
  Push rod speed 0.0275 m/s

(Actual required torque is the valve operation torque shown in left diagram adding to damper operation torque.)

Fig. 24-19



SECTION EE Bypass cut valve and boom conflux valve, P1 bypass cut valve



Detail of lock valve (boom)

Fig. 24-28 Construction of control valve (4/6)

2) Bucket dump operation

If the bucket dump operation is performed, the secondary pilot pressure enters the opposite side of the spring chamber of the Pb3 port of the C/V from the pilot valve and shifts the bucket spool (12).

If the spool is shifted, the P1 bypass path (52) is shut off by the bucket spool (12). Therefore, the oil which has flowed in from the P1 port flows into the P1 parallel path (53) provided in the travel straight spool.

When the bucket spool (12) is shifted, the line between the B3 port and the bridge path is opened. Therefore, the oil which flows into the P1 parallel path (53) passes through the load check valve (21) of the bucket select part, and is fed to the rod of the bucket cylinder by way of the bridge path and the B3 port.

In the meantime, the oil returning from the cylinder head flows into the A3 port and flows out to the tank passage (60) which is now open as the bucket spool (12) has been shifted. Therefore, the bucket cylinder operates in the contracting direction in order to dump the bucket.

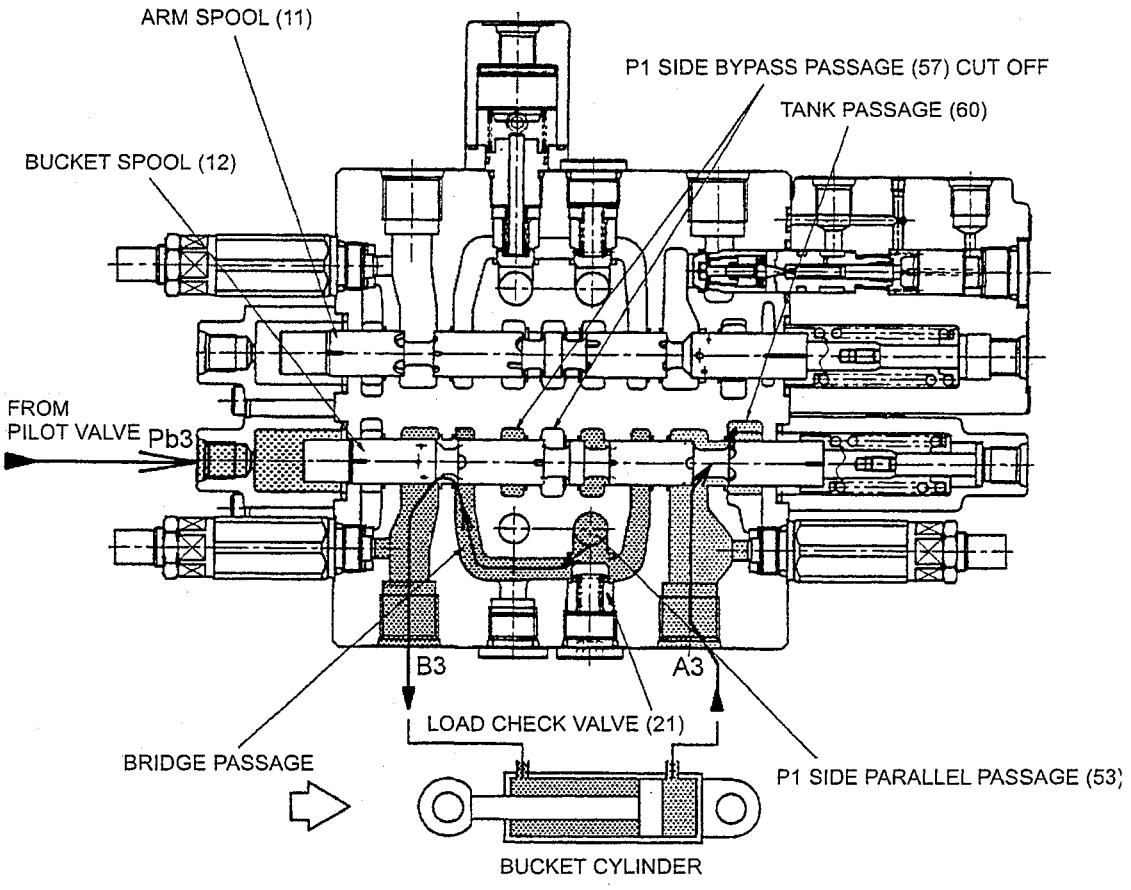


Fig. 24-37 Function at bucket dump operation

In the meantime, the electromagnetic proportional secondary pilot pressure created by the mechatro control system enters the spring chamber of the P1 bypass cut spool (15). (Fig. 24-48)
Since the P1 bypass path (52) is cut off by the shifted P1 bypass cut spool (15), the oil which has flowed in from the P1 port flows into the check valve built in the P1 bypass cut spool (15) and into the P1 parallel path (53) provided upstream of the P1 bypass path (52).
The oil which has flowed into the check valve and the P1 parallel path (53) flows into the arm conflux path (59) which is now opened by the shifted P1 bypass cut spool (15). (Fig. 24-48)
The oil which has flowed into the arm conflux path (59) passes through the load check valve (21) in the arm select section and is fed to the arm cylinder rod from the D3 port. (Fig. 24-47)
As the result, the arm cylinder rod is subject to the combination of the stream of the P1 port and the stream of the P2 port. In the meantime, the oil returning from the cylinder head flows into the C3 port and flows out to the tank path (60) which is now open by the shifted arm spool (11).
Consequently, the arm cylinder operates in the retracting direction to cause the arm to out.

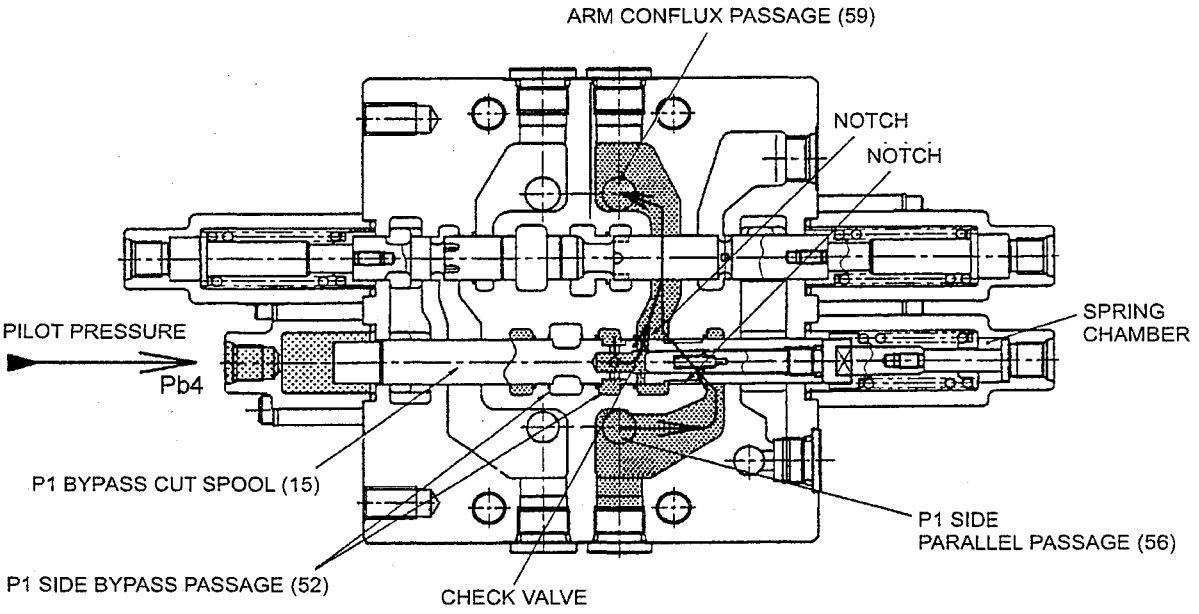


Fig. 24-48 Functions of P1 bypass cut spool

1) Relief & check valve assy (70)

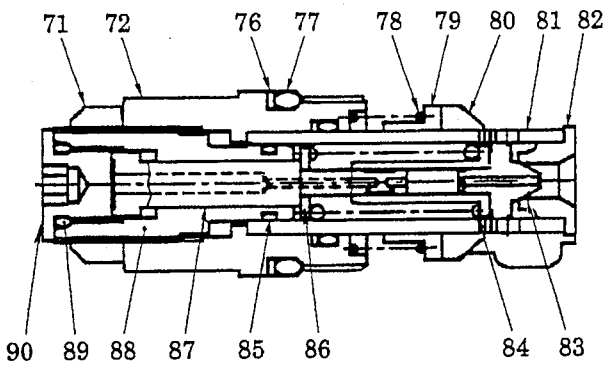


Fig. 24-61 Detail of Relief & check valve assy

No.	Parts	Q'ty	No.	Parts	Q'ty
70	RELIEF& CHECK VALVE ASSY	2	82	SEAT	2
71	LOCK NUT	2	83	POPPET	2
72	CAP	2	84	SPRING	2
76	BACKUP RING	2	85	O-RING	2
77	O-RING : 1B P26	2	86	SHIM	2
78	SPRING	2	87	PISTON	2
79	BUSHING	2	88	SLEEVE	2
80	CHECK	2	89	O-RING	2
81	SLEEVE	2	90	CAP	2

2) By-pass valve assy (100)

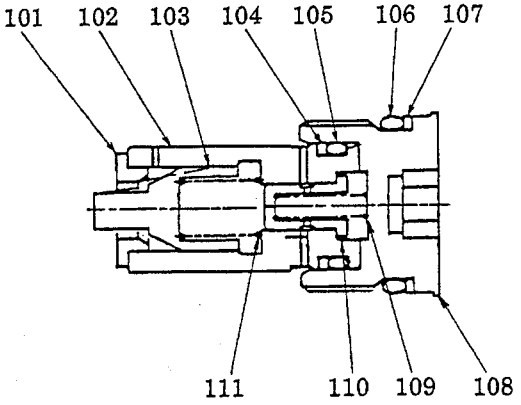


Fig. 24-62 Detail of by-pass valve assy (swing shockless valve)

No.	Parts	Q'ty	No.	Parts	Q'ty
100	BY-PASS VALVE ASSY	2	106	O-RING : 1B P21	2
101	SEAT	2	107	BACKUP RING	2
102	SLEEVE	2	108	CAP	2
103	POPPET	2	109	SPRING	2
104	BACKUP RING	2	110	POPPET	2
105	O-RING : 1B P14	2	111	SPRING	2

(3) Parts list

Table 24-7

No.	Parts	Q'ty	No.	Parts	Q'ty
1	HUB	1			
				PISTON KIT	1
	SPINDLE KIT			•PISTON ASSEMBLING PARTS	9
	•SPINDLE ASSY	1	105	••PISTON	1
2	••SPINDLE	1	106	••SHOE	1
3	••HOLD FLANGE	1			
19	•REAMER BOLT	3		•PISTON ASSEMBLING PARTS	1
			161	••PISTON	1
	RV GEAR ASSEMBLING PARTS	1	162	••SHOE	1
	•RV GEAR KIT	1			
4	••RV GEAR A	1	102	SHAFT	1
5	••RV GEAR B	1	103	SWASH PLATE	1
9	•CRANK SHAFT	3	104	CYLINDER BLOCK	1
12	•SPACER	6	107	RETAINER PLATE	1
22	•BEARING	6	108	THRUST BALL	1
23	•BEARING	6	109	TIMING PLATE	1
			110	WASHER	2
6	INPUT GEAR	1	112	PISTON	1
			113	SPRING	8
	SPUR GEAR KIT	1	114	SPRING	1
7	•SPUR GEAR	3	115	FRICTION PLATE	2
			116	SEPARATOR PLATE	2
	FLOATING SEAL KIT	1	132	OIL SEAL	1
31	•FLOATING SEAL	2	135	O-RING	1
			141	O-RING	1
8	COVER	1	146	SNAP RING	1
15	SHAFT	1	149	BEARING	1
17	PIN	28	150	BEARING	1
18	RING	1	151	BEARING (ROLLER)	3
20	SNAP RING	3	176	PIVOT	2
21	BEARING	2	177	PARALLEL PIN	2
24	SNAP RING	1	185	SPRING	1
25	SNAP RING	6			
28	O-RING	2		REAR FLANGE ASSEMBLING PARTS	1
29	O-RING	1		•REAR FLANGE KIT	1
30	O-RING	1	201	••REAR FLANGE	1
33	PLUG (WITH FLANGE)	1	223	••SPOOL	1
34	PLUG	2	252	••SOCKET PLUG	2
35	O RING	3	268	••STEEL BALL	1
36	STEEL BALL	1	275	••SOCKET PLUG	10
43	PARALLEL PIN	2	279	••FILTER	1

(4) Parking Brake

1) Machine is running:

If the pressure from the pumps is supplied to port A or B, the spool (223) of the brake valve moves to the right or the left. Port E opens, and the pressure is led from port E to cylinder chamber C. When the pressure reaches 0.47 MPa (68psi) or over, the thrust of piston (112) overcomes the force of spring (113). The piston (112) moves toward rear flange (201). If the piston (112) loses its pressing force against separator plate (116) and friction plate (115), the friction plate (115) is let free.

The friction plate (115) is engaged with cylinder block (104) of the hydraulic motor. The result is that the cylinder block (104) is freed from the braking force. The hydraulic motor is freed to run.

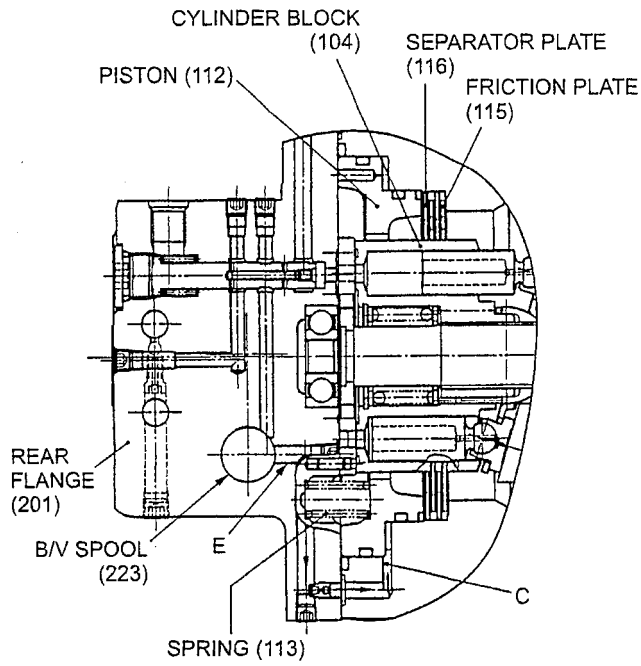


Fig. 24-83

2) Machine is not running:

If the pressure to port A or B is suspended, the spool (223) of the brake valve moves to neutral. Port E is shut off, and the pressure in cylinder chamber C falls. When the pressure falls below 0.47 MPa (68psi), the hydraulic force of piston (112) decreases below the force of spring (113). Then the action of spring (113) causes the piston (112) to be pressed against the separator plate (116) and the friction plate (115). This pressing force creates frictional force that makes braking power. The friction plate (115) meshes with the cylinder block (104) of the hydraulic motor. The cylinder block (104) meshes with shaft (102) of the hydraulic motor.

In this way, the hydraulic motor undergoes braking torque while the machine is at rest.

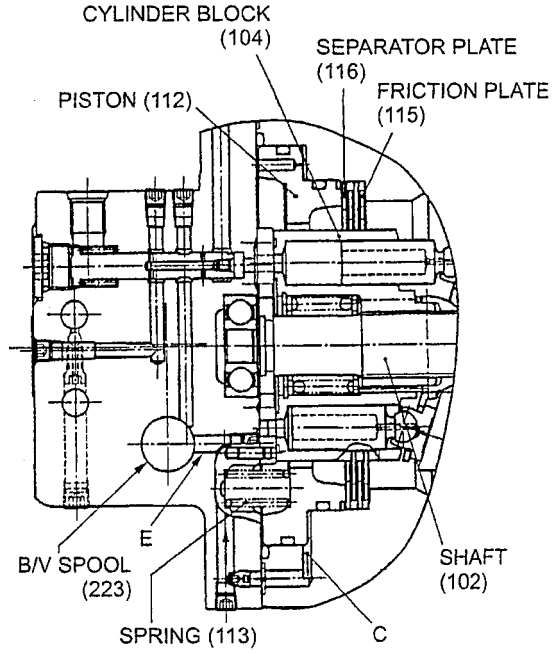
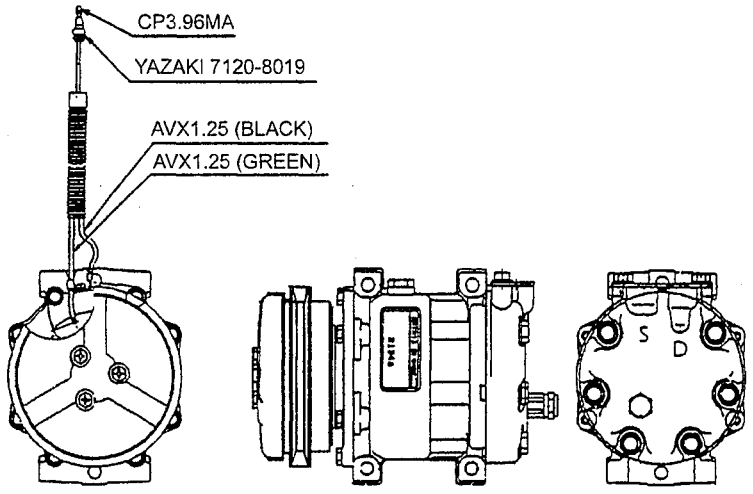
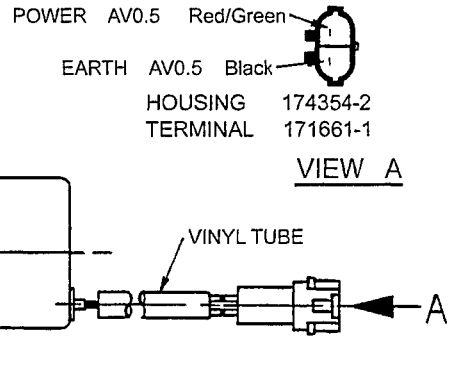
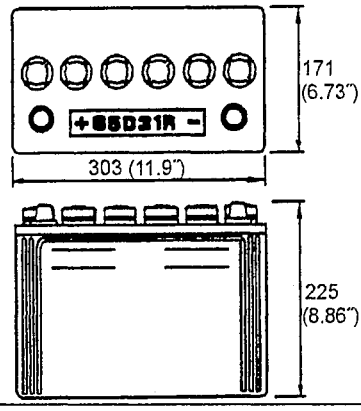


Fig. 24-84

24.2 ELECTRIC EQUIPMENT

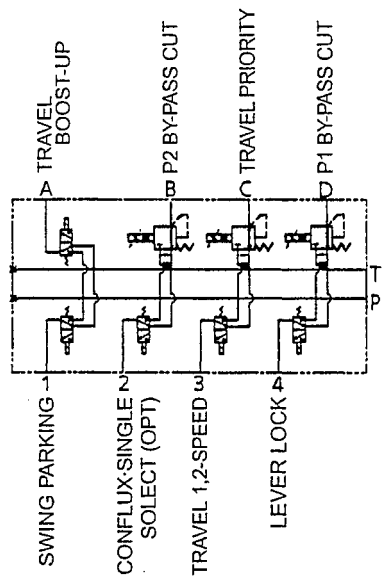
24.2.1 ELECTRIC EQUIPMENT LIST FOR KCMA

Group	Code	Name	Part No.
CONTROLLER	C-1	MECHATRO CONTROLLER	YT22E00031F2
	C-2	GAUGE CLUSTER	YT59S00003F6
	C-4	AIR CONDITIONER CONTROLLER	YT20M00004S36
DIODE	D-1	DIODE	YN02D01001P1
	D-2	↑	↑
	D-3	↑	↑
	D-4	↑	↑
	D-5	↑	2475R132
ELECTRIC FITTINGS	E-1	FUSE BOX	YT73E00003F2
	E-2	ALTERNATOR	897182-2892
	E-3	HOUR METER	YT58S00006P1
	E-5	HORN	CM53S00002F1
	E-6	CIGALETTE LIGHTER	2421R180F1
	E-7	TUNER AM & FM	LB54S00001P1
	E-8	SPEAKER LEFT	YN54S00006P1
	E-9	SPEAKER RIGHT	↑
	E-10	RECEIVER DRIER	YT54S00002P1
	E-11	AIR COMMPRESSOR CLUTCH	YT91V00001F1
	E-13	TRAVEL ALARM	YN53S00002F1
	E-14	BATTERY	2411U25
	E-15	POWER SOCKET	YN81S00001P1
	E-16	HYD.FLUID TEMPERATURE ALARM LAMP	2456U168
	E-17	CONVERTER	YT77S00001P1
LIGHT	L-1	BOOM WORKING LIGHT LEFT	YN80S00012F1
	L-2	WORKING LIGHT RIGHT	YT80S00002F1
	L-3	ROOM LIGHT	2456Z322F1
	L-4	CAB WORKING LIGHT FRONT (OPT.)	INSTALLED ON THE SPOT
	L-5	CAB WORKING LIGHT FRONT (OPT.)	↑
MOTOR	M-1	STARTER MOTOR	897137-4781
	M-2	GOVERNOR MOTOR	YN20S00002F1
	M-3	WIPER MOTOR	YT53C00011F1
	M-4	WASHER MOTOR	24100U157F1
	M-8	ROOF WIPER MOTOR (OPT.)	YT76S00001P1

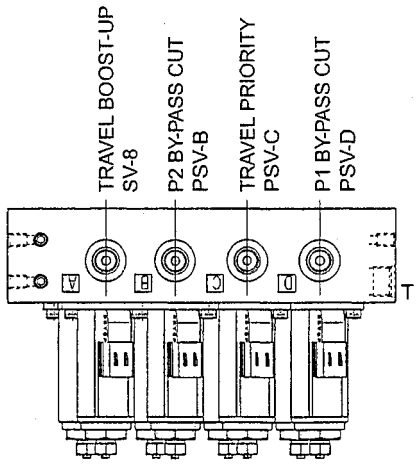
Code No. Parts Name Parts No. Use Applicable Machine	Specifications	Description
E-11 Air compressor YT91V00001F1 Air conditioner YT00101~ YT02-04001~ YT03-05432~ YT04-07001~	Maker's part No. 7361-6000 Rated voltage DC 24 V Max. revolution 4000 rpm V belt A type Cooling R-134 a Oil SP-20 : 135 cc Cover (clutch)	
E-13 ALARM YN53S00002F1 TRAVEL ALARM **KCMA, AUSTRALIA** YT02-04001~ YT03-05432~ YT04-07001~	Type BA3111A Rated voltage DC 12 V~36 V	
E-14 Battery 2484U179 **ASIA, OCE** 2411U25 **KCMA, KCME** POWER YT00101~ YT02-04001~ YT03-05432~ YT04-07001~	ASIA, OCE Type 65D31R-N70 Capacity 12V 56 Ah (5 h) 70 Ah (20 h) Weight About 19 kg (42 lb) KCMA, KCME Type 95D31R Capacity 12 V 64 Ah (5 h) Weight About 20.5 kg (45 lb) (Part No. 2411U25 is with handle)	

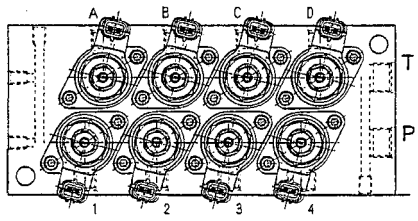
Code No. Parts Name Parts No. Use Applicable Machine	Specifications	Description
SV-1~4, 8 Solenoid valve assy YT35V00017F1 (7-spool) YT35V00018F1 (8-spool) Refer to hydraulic symbol YT04-07001~		
PSV-B, C, D Solenoid valve assy YT35V00017F1 (7-spool) YT35V00018F1 (8-spool) Refer to hydraulic symbol YT04-07001~		

Operating pressure	35 kgf/cm² (500 psi)
Solenoid selector valve	Rated voltage DC 24 V
	Coil resistance 34 ± 2Ω (at 20°C)
Solenoid proportionate valve	Dither current 100 Hz,300 mA P-P
	Coil resistance 17.5 Ω (at 20°C)
Connector specification	AMP Econoseal J Mark II Housing 174354-2 Terminal 173706-1

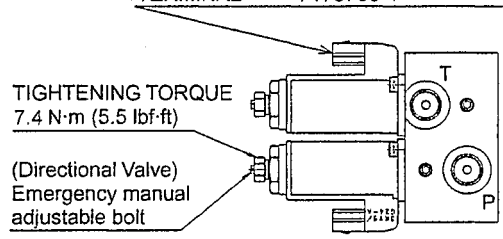


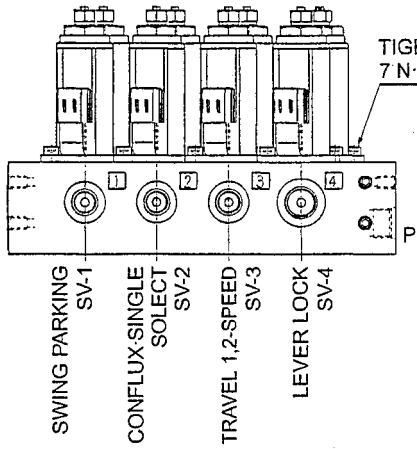
Note : This drawing shows YT35V00018F1.

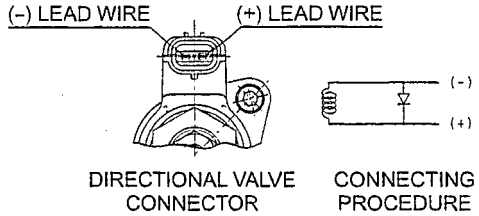




CONNECTOR : AMP Econoseal J Mark II(+)
CAP HOUSING : 174354-2
TERMINAL : 173706-1







Tightening torque N•m (lbf•ft)	No.	Part name	Q'ty	Tightening torque N•m (lbf•ft)	No.	Part name	Q'ty
	1	SUPPORT	1		20	WASHER	8
	2	BRACKET	1		21	WASHER	3
	3	PULLEY	1		22	LOCK WASHER	6
	4	HOSE : L=2500	1		23	LOCK WASHER	6
	5	HOSE : L=1950	1	46 (34)	24	NUT	2
	6	TUBE : L=1400	1	24.5 (18)	25	CONNECTOR	1
	7	TUBE : L=1500	1		26	TUBE : L=2100	1
	8	TUBE : L=400	1		27	CLIP	4
	9	TUBE : L=1900	1		28	GROMMET	1
	10	TUBE : L=1250	1		29	GROMMET	1
	11	CLIP	3		30	V-BELT	1
	12	CLIP	1		31	CLIP	1
10.7 (8.0)	13	CAPSCREW : M8 X 100	4	46 (34)	32	CAPSCREW : M10 X 16	1
39 (29)	14	SEMS BOLT : M8 X 25	2	9.8 (7.2)	33	CLIP	1
10.7 (8.0)	15	CAPSCREW : M8 X 16	4		34	PIPE	1
4.4 (3.3)	16	CAPSCREW : M6 X 50	3		35	HOSE : L=150	1
4.4 (3.3)	17	NUT : M6	3		36	TUBE : L=100	1
	18	CAPSCREW : M6 X 20	2		37	CLIP	2
	19	WASHER	7		38	CLIP	1

(5) Receiver Dryer (See Fig. 25-13)

1) Receiver Tank

On the air-conditioner, the revolution of the compressor varies greatly which cause the proper flow of refrigerant in the cooling circuit to vary. It is the receiver tank that receives the variations. When the cooling circuit the variations. When the cooling circuit does not need much refrigerant, the receiver tank stores extra refrigerant temporarily and supplies it when the cooling circuit needs much refrigerant. The receiver tank also stores an extra amount of refrigerant to be used for filling balance and supplement small amounts of leakage of the refrigerant through penetration into rubber hoses.

2) Dryer

If water is mixed in the cooling circuit, it deteriorates the compressor valves and oil, corrodes the metallic parts of the circuit or clogs the circuit as the water freezes in the expansion valve. It is desirable that the amount of water mixed in the refrigerant should be held below a concentration of 30 ppm. The air-conditioner uses a molecular sieve as desiccant suited for the circuit, in order to absorb water content that intrudes into the circuit when the dryer is installed or when refrigerant is charged.

3) Sight Glass

This is a window with which the refrigerant level in the circuit is determined, the only means of confirming the inside of the circuit visually.

4) Filter

5) Pressure Switch

This machine employs pressure switches of high/low pressure type.

The pressure switch protects the circuit by cutting off the power supply to the compressor when high pressure increases abnormally high [more than 3.1 MPa (460 psi)].

The pressure switch also detects the leakage of refrigerant by cutting the power supply to the compressor when the pressure of the circuit falls below 0.2 MPa (28 psi).

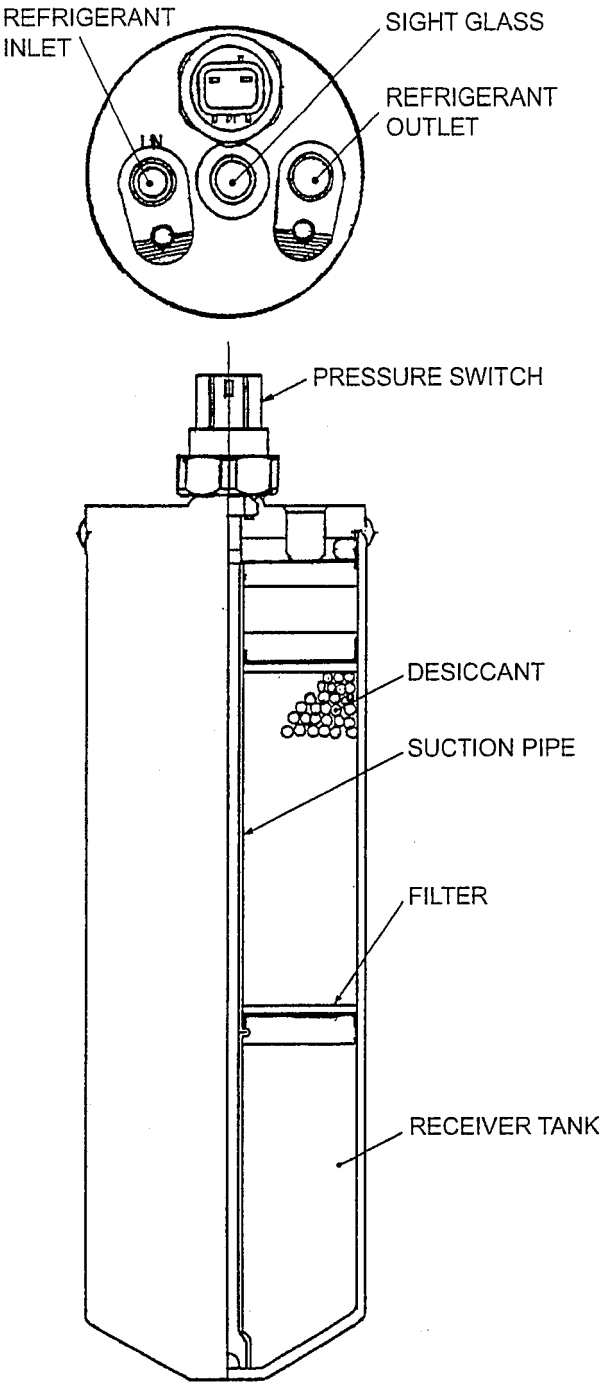


Fig. 25-13 Receiver dryer

25.5.3.2 GAS CHARGING OPERATION

(1) Charging from High Pressure Side (See Fig. 25-28.)

1) After making vacuum repeatedly, change the charging hose (yellow) of the gauge manifold from the vacuum pump to the service can. Open the service can valve. (However, close the high and low pressure valves of the gauge manifold.) Then push the mini core valve of the side service port on the low pressure side of the gauge manifold, using a screwdriver or something, in order to let out the air in the charging hose by the pressure of the refrigerant. (See Fig. 25-28.) (The operation ends when a hissing sound is heard.)

2) Open the high pressure valve of the gauge manifold and charge in refrigerant. [Charge in gaseous refrigerant to a gauge pressure of 0.1 MPa (14 psi).]
After charging, close the high pressure valve of the gauge manifold and the service can valve. (See Fig. 25-29.)

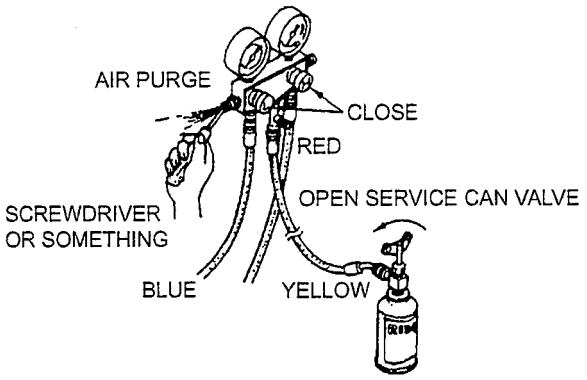


Fig. 25-28 Gas charging operation

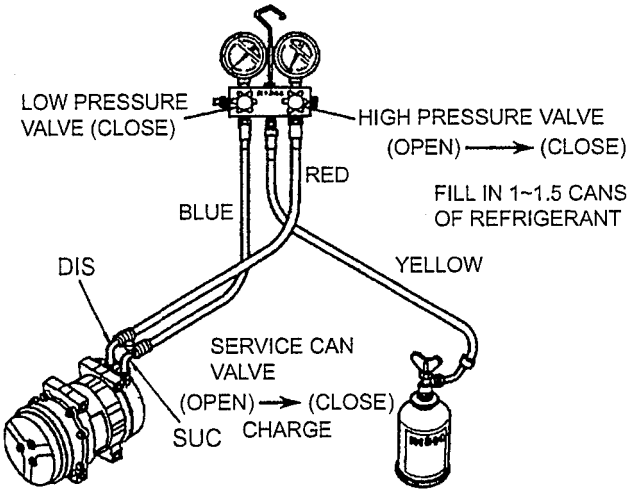


Fig. 25-29 Gas charging operation (High pressure side)

WARNING

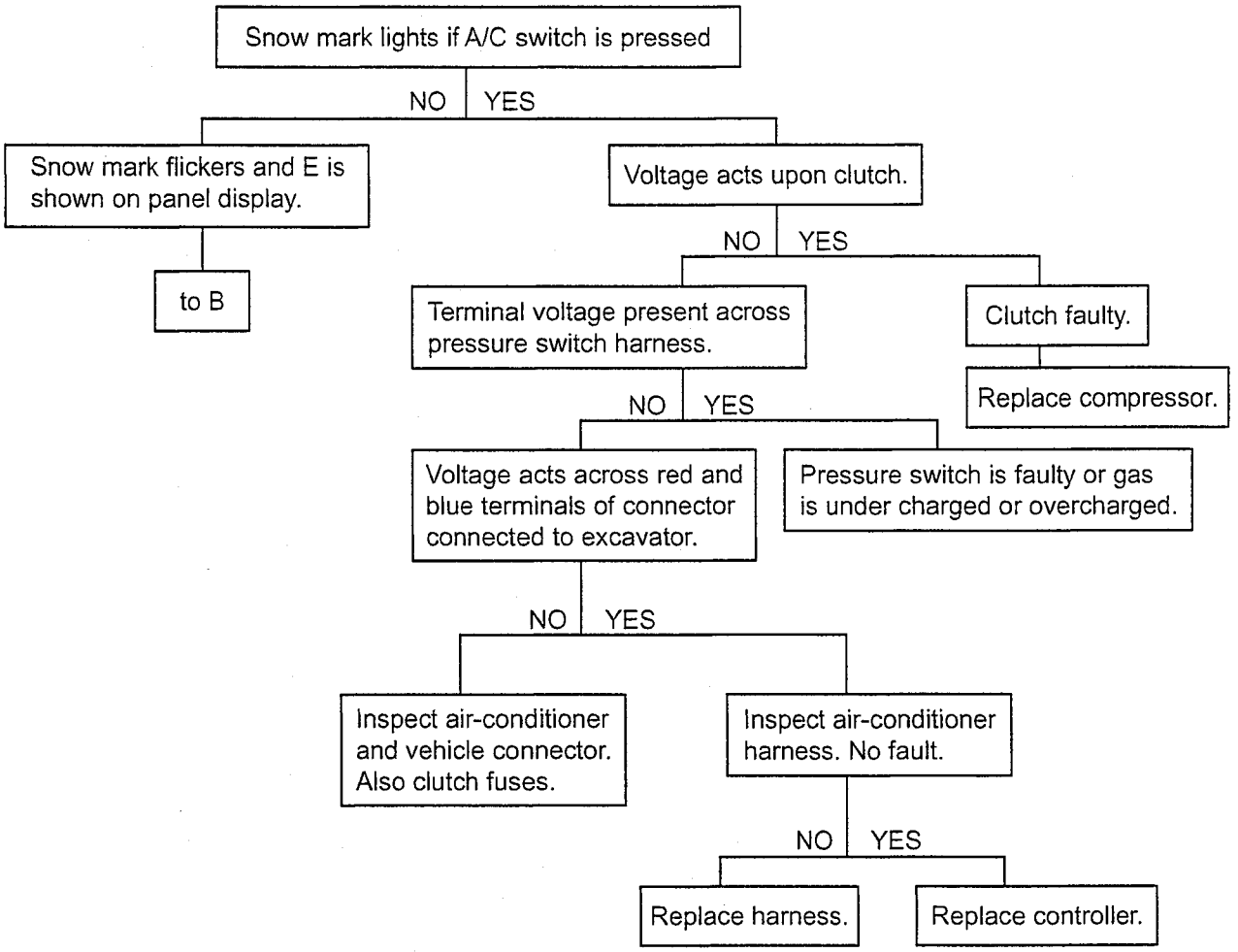
- **Do not run the compressor in any case, (Otherwise the refrigerant flow in reverse direction which causes the service can and the hoses to rupture. This is very dangerous.)**

(2) Checking for Gas Leakage
Check for gas leakage in the cycle, using a gas leak detector (electric type). Retighten and correct leaking points.

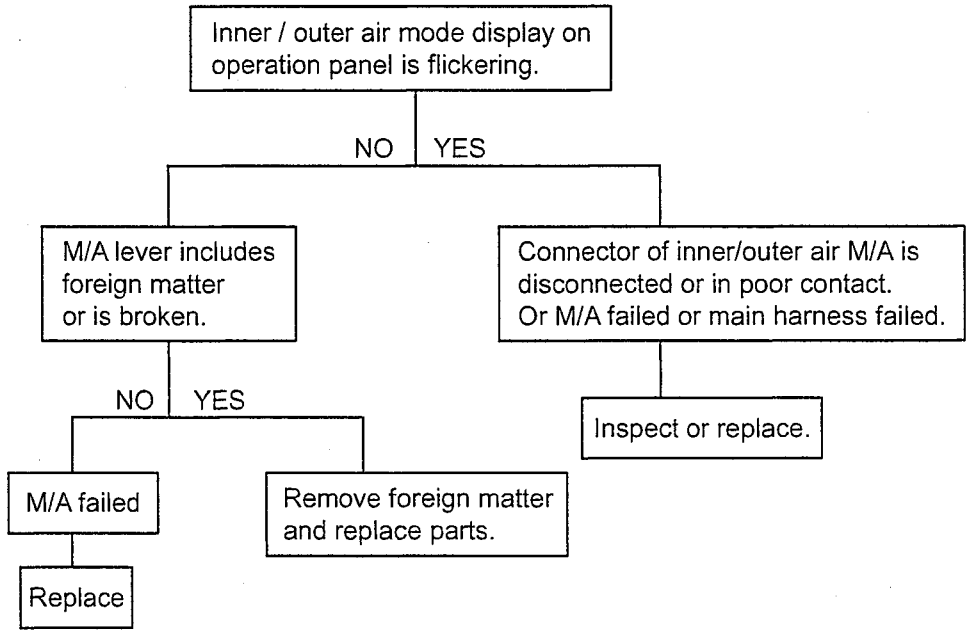
WARNING

- **Always use R134a for the leak tester. (The presently used from gas affects the sensitivity adversely.)**

[Magnet clutch does not engage.]



[Inner air and outer air do not change over.]



32.1 REMOVING AND INSTALLING

32.1.1 ATTACHMENT AND COMPONENT

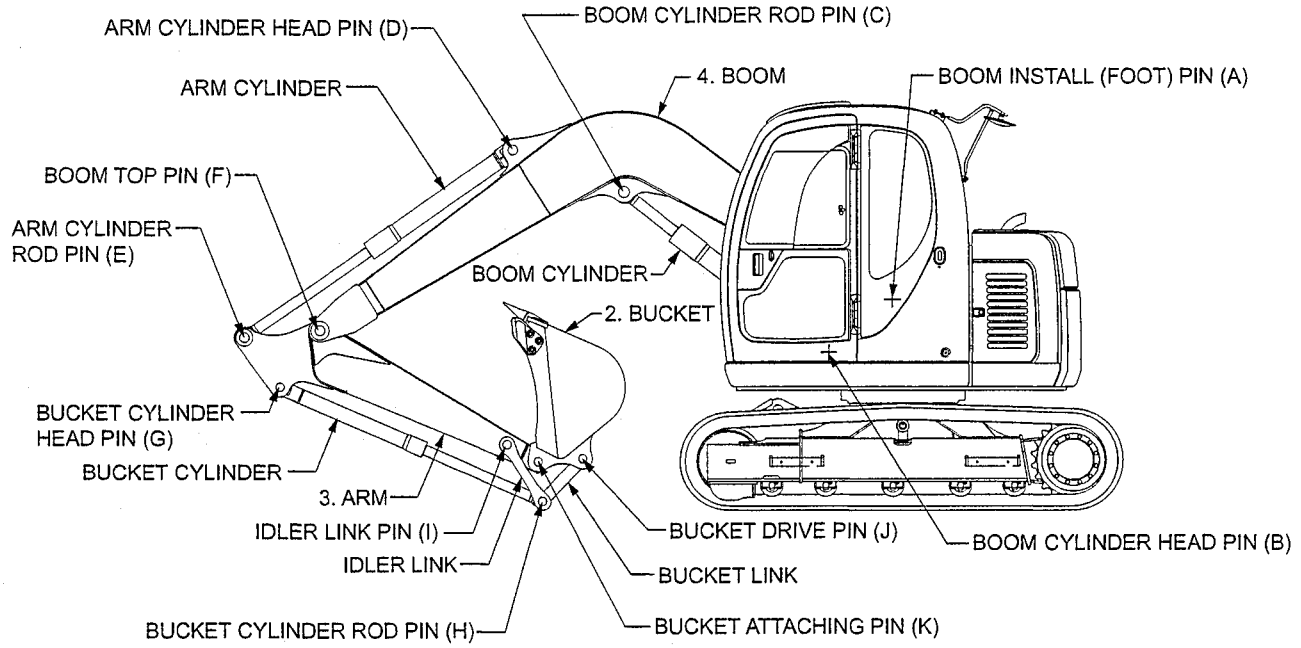


Fig. 32-1 Front attachment and position

32.1.2 BUCKET

32.1.2.1 REMOVING BUCKET

(1) Put the machine in position to remove bucket.

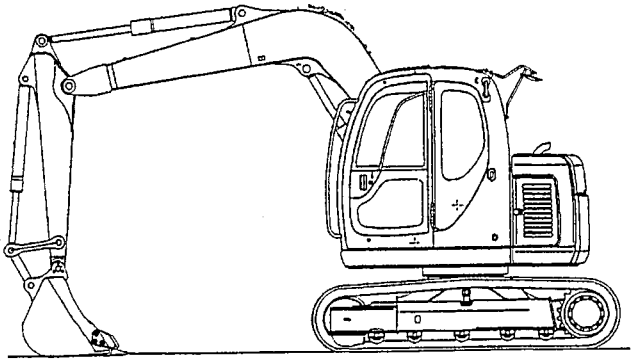


Fig. 32-2 Position to remove bucket

(2) Removing pin (2)
Expand slit of ring (1) with driver, and remove it.
Push out the pin (2) with driver (–).

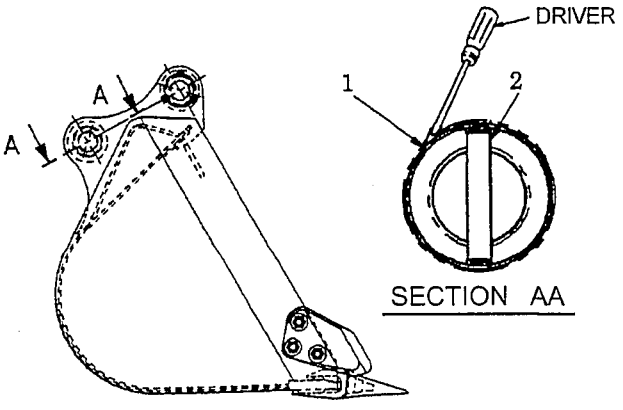


Fig. 32-3 Removing pin (2)

32.2 DISASSEMBLING AND ASSEMBLING

32.2.1 CYLINDER

32.2.1.1 PREPARATION BEFORE DISASSEMBLE

Before disassembly, it is necessary to keep a dustfree workshop and facilities.

32.2.1.1.1 WORK AREA

The following working area is required for disassembly :

(1) Ample space

For disassembly of the hydraulic cylinder, the cylinder tube and the piston rod must be extracted. Therefore, the first prerequisite is that the working area must have sufficient space for such work. It is also necessary that the space have amply space widthwise to accommodate disassembly, cleaning and measuring facilities.

(2) Suitable working environment

The hydraulic cylinder is a precision-machined product incorporating seals and packings made of rubber and plastic materials. For this reason, care should be used so that the hydraulic cylinder is free from dust, dirt, sand, metal chips weld slag and other hard substance. If the hydraulic cylinder is assembled without being aware of hard particles stuck on the cylinder tube and the piston rod, the tube inner surface and the rod surface may be scratched as the cylinder operates, thereby disabling it in worst cases. Damage to the piston seals and the rod seals will result in oil leaks. For this reason, grinding and welding operation should be avoided near the working area to keep it clean.

32.2.1.1.2 APPARATUS

The following equipment are required for disassembly :

(1) Hoist or crane

The hoist or crane must be capable of carrying the cylinder in an assembled condition. It must also be capable of marking level and liner movement under load for inserting and extracting the piston rod and the tube.

(2) Work bench

The work bench must have strength and rigidity capable of accommodating the total length of the cylinder in its most retracted condition and of withstanding the repulsive force of the tightening torques of the cylinder head and the piston nut. Since a vise is attached to the bench, the width of the work bench must be sufficiently large.

(3) Support stand

If the clevis part of the piston rod is fully extended in a free condition, the bushing and the seals may be damaged as the rod bushing and the piston are twisted due to the weight of the rod. A stand is required to support the rod to prevent such.

(4) Hydraulic source

A Hydraulic source is required for disassembly and assembly of the cylinder head and piston nut and for oil leak tests after completion of assembly.

(5) Jet air source

It is used for drying after oil draining and cleaning of the cylinder.

(6) Cleaning bath, cleaning oil and detergent

(7) Oil pan and oil reservoir

An oil pan is necessary to contain oil drained from the cylinder and oil spilt during work.
An oil reservoir is required to collect oil spilt on the floor and waste oil.

(8) Others

Oil extracting hoses, wooden skids, rag and sawdust in which oil soaked are also necessary.

32.2.1.4.2 ASSEMBLING ROD COVER ASSY

(1) Press fit bushing (4) in rod cover (3) applying plate on the section. After press-fitting, check that the bushing is not projected from the end surface (A). (See Fig. 32-46)

(2) Fit snap ring (5).

(3) Fit backup ring (8) on U-ring groove.

(4) Apply hydraulic oil on U-ring (7) and fit it on the U-ring groove.

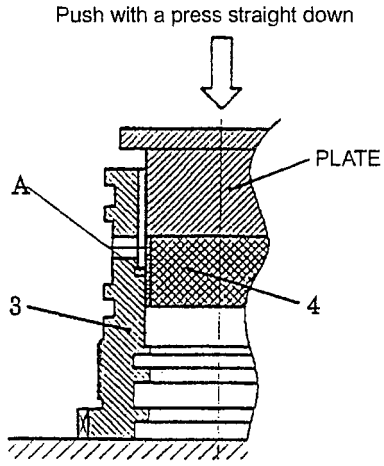


Fig. 32-46 Pressing in bushing

Note

- The U-ring is harder than other seals, so fit it in the groove by hand first, then press in with pushing bar until it is fitted with a click.
- Fitting U-ring paying attention to the direction.
- After fitting backup ring (8) and U-ring (7), check that they are free from the permanent set.

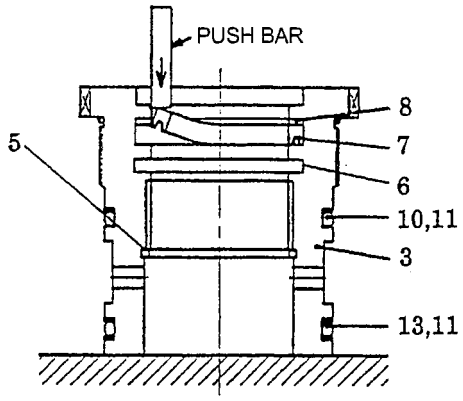


Fig. 32-47 Fitting U-ring

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

1) Fit square ring on the groove.

2) Depress slide ring in U shape by hand to house it in groove, and fit it pushing out to periphery.

Note

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

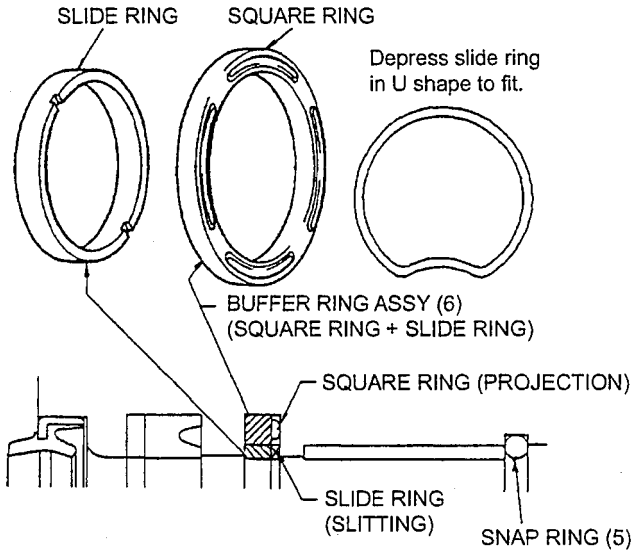


Fig. 32-48 Installing buffer ring assy (6)

(5) Seal ring straightening jig

Material : Mild steel

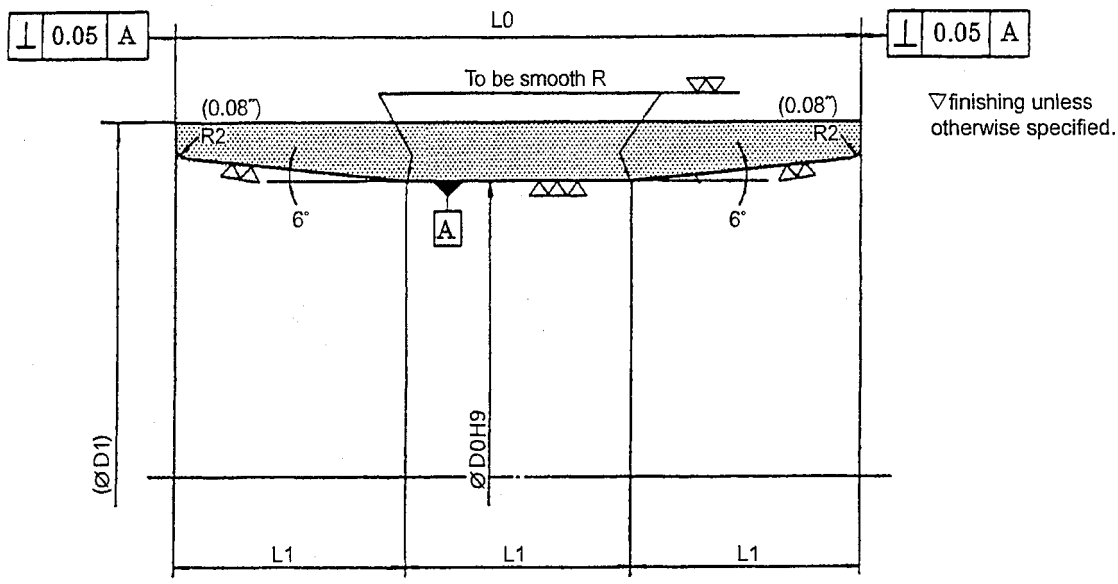


Fig. 32-72

Table 32-9

Unit : mm (in)

Applicable cylinder	D0	(D1)	L0	(L1)
Boom	110 (4.3307)	130 (5.12)	120 (4.72)	40 (1.57)
Arm	95 (3.7401)	115 (4.53)	120 (4.72)	40 (1.57)
Bucket	80 (3.1496)	100 (3.94)	120 (4.72)	40 (1.57)
Dozer	120 (4.72)	140 (5.51)	120 (4.72)	40 (1.57)

(6) Piston insert jig

Material : Mild steel

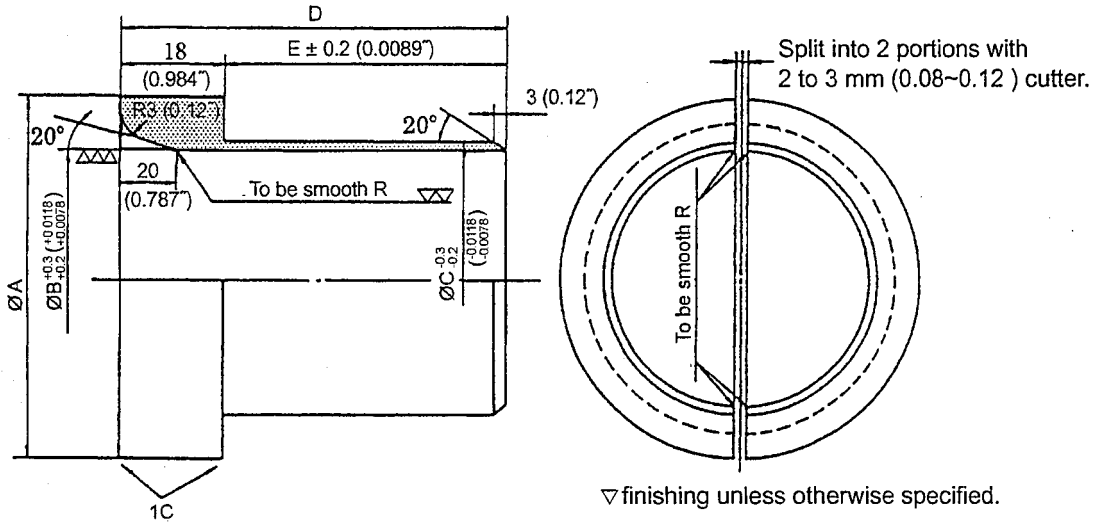


Fig. 32-73

Table 32-10

Unit : mm (in)

Applicable cylinder	ØA	ØB	ØC	D	E
Boom	122 (4.80)	110 (4.3307)	113 (4.4488)	67 (2.64)	42 (1.65)
Arm	107 (4.21)	95 (3.7401)	98 (3.8583)	67 (2.64)	42 (1.65)
Bucket	92 (3.62)	80 (3.1496)	83 (3.2677)	62 (2.44)	37 (1.46)
Dozer	132 (5.20)	120 (4.7244)	123 (4.8425)	62 (2.44)	37 (1.46)

33.1.2 OPERATOR SEAT

- The following explanation shows those for ASIA.
  KCME•KCMA and OCE differs in the shape of a seat part from those for ASIA.

33.1.2.1 REMOVAL

(1) Remove seat. (Include upper slide.)
  1) Remove 4 sems-bolts (A17) M6.
  2) Remove bracket (A8).
  3) Remove 4 capscrews (A16) M8 of bracket (A5).
  4) Remove seat
     [Approx.22 kg (49 lbs) with bracket]

     : 8 mm, 13 mm

Note

When required to disassemble seat lower section, remove control box referring to 33.1.4.2 REMOVAL.

(2) Remove slide on lower side of seat.
  1) Remove 4 socket bolts (A15) M8.
  2) Remove support (A4).
  3) Remove 4 socket bolts (A15) M8.
  4) Remove rail (A3).

     : 6 mm

(3) Remove seat stand
  1) Remove 4 socket bolts (A18) M8.
     Support the controller assy by inserting wood block under the support (A2).
  2) Remove 4 socket bolts (A9) M10.
  3) Remove seat stand (1).

     : 8 mm

     Weight of seat stand : 17 kg (37 lbs)

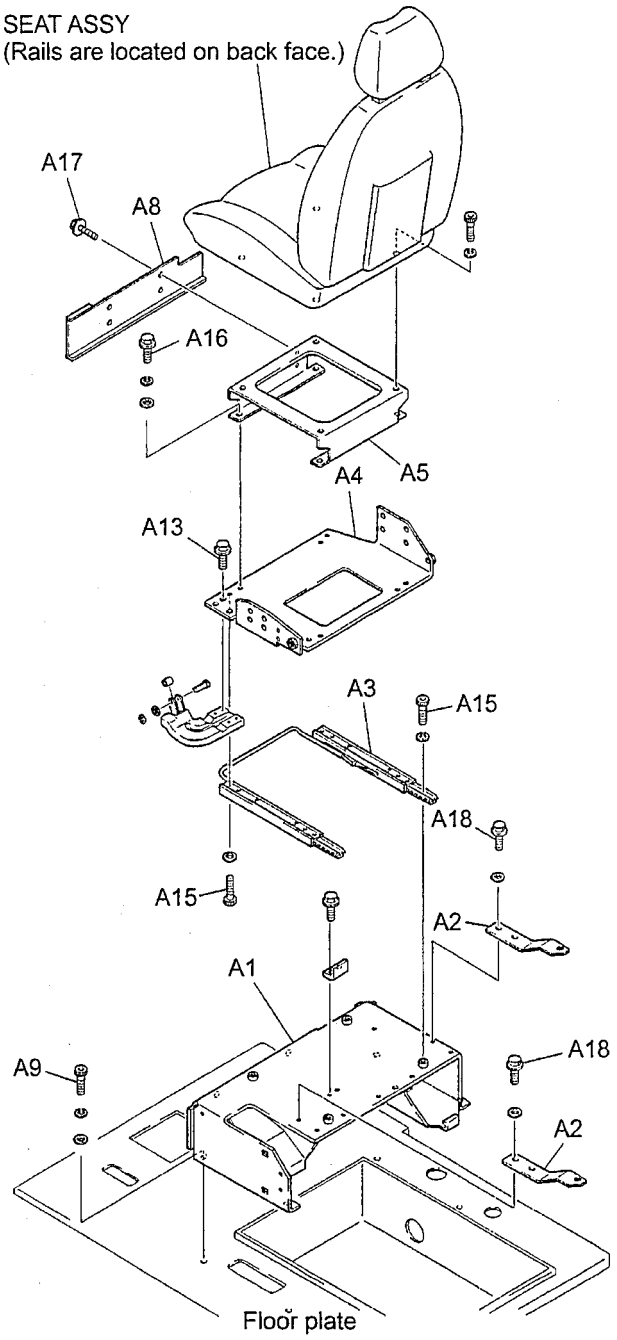


Fig. 33-4 Dismounting and mounting seat

33.1.2.2 INSTALLATION

Install it in reverse procedure of removing according to the tightening torque table.

Tightening position	Tool	Tightening torque N·m (lbf·ft)
Socket bolt (A9)	8	46 (34)
Socket bolt (A15)	6	24 (17)
Capscrew (A16) (A18)	13	42 (31)
Sems bolt (A17)	10	9.6 (7.2)

33.1.8 AIR CLEANER

33.1.8.1 PREPARATION FOR REMOVAL

(1) Opening bonnet assy (5)
  1) Unlock it with starter key.
  2) Open bonnet (5) and support it with stay (15).

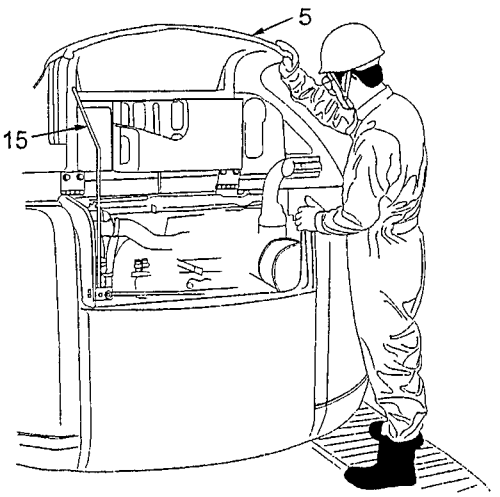


Fig. 33-28 Opening bonnet assy (5)

(2) Opening cover assy (4)

(3) Unplug terminals on indicator lines (5-5)
  (See Fig. 33-31)

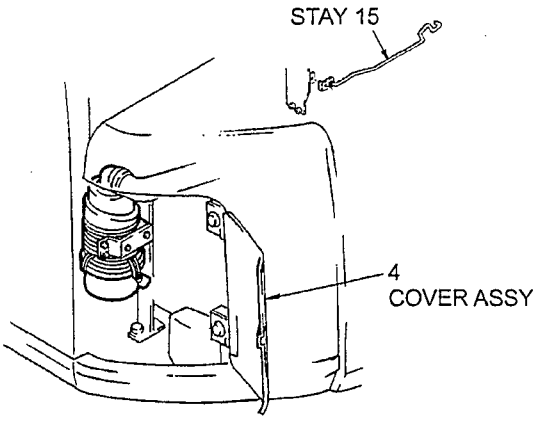


Fig. 33-29 Opening cover assy (4)

33.1.8.2 REMOVAL

(1) Pulling out hose (2)
  1) Loosen clip (8) on air cleaner side.
  2) Pulling out hose (2)

: Flat-blade screw driver

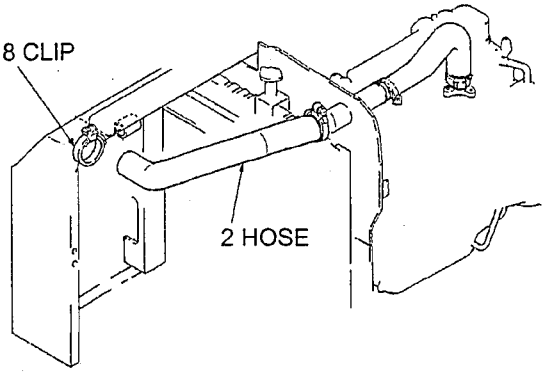


Fig. 33-30 Pulling out hose (2)

33.1.12.3 INSTALLATION

Installing pump in the reverse procedure of removal following the specification for tightening torque and sealant.

(1) Apply grease on spline of input shaft.
Grease ; Shell Retinax AM (General-purpose extreme-pressure molybdenum disulfide grease)

(2) Hook wire to eye bolts (M8) on upper surface of pump and lift it.

(3) Insert pump spline section.

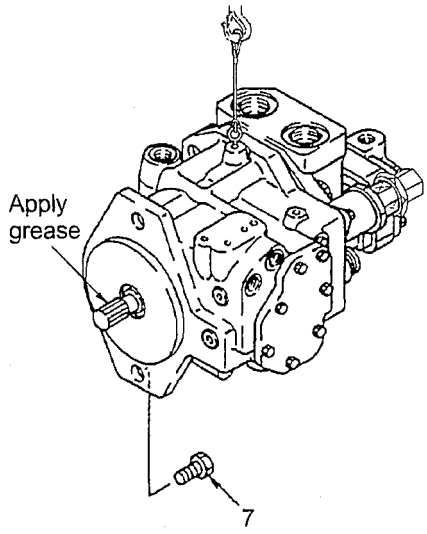


Fig. 33-54 Installing pump

(4) Apply sealant on suction port (B2) for dozer and fix it with hose connecting clip.
Sealant : Permatex
Socket screw driver 7 mm
Tightening torque : 4.4 N•m (3.3 lbf•ft)

(5) Apply sealant on socket bolt (7) and mount pump with it.
Sealant : Loctite #262
: 14 mm
(* Special service tool No.6-2)
Tightening torque =191 N•m (140 lbf•ft)

(6) Install the suction flange mounting socket bolts (10) M12 (4 pcs.)
: 10 mm
(* Special service tool No.6-1)
Tightening torque =98 N•m (72 lbf•ft)

(7) Installation

Tightening position	Tool	Tightening torque N·m (lbf·ft)
Cap nut A1, A2	36	118 (87)
Cap nut Dr1	27	78 (58)
Cap nut Pf, Pz	19	29 (22)
Cap nut A3	22	49 (36)
Cap nut A4	22	49 (36)
Cap nut *A5	27	78 (58)

(8) Install a water drain pipe under the engine muffler.

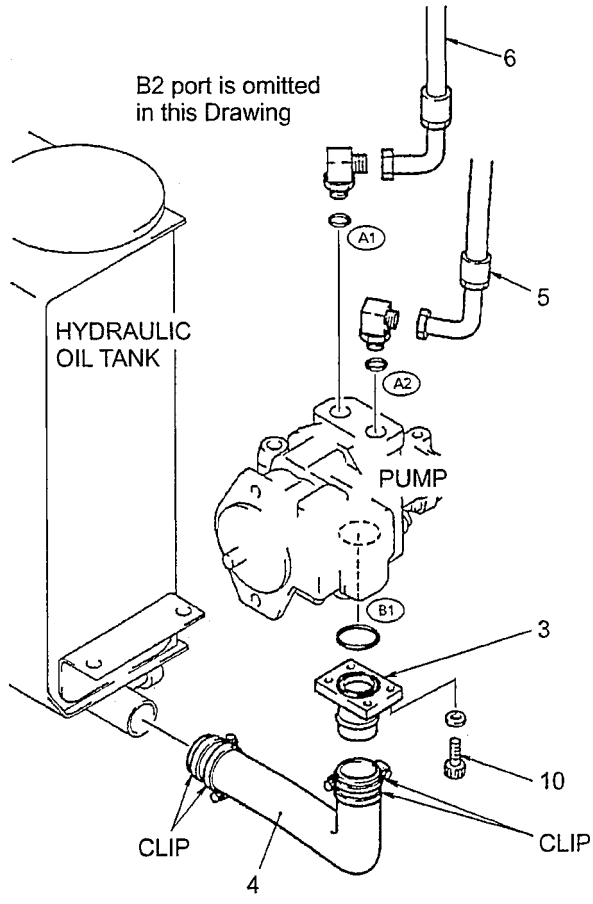


Fig. 33-55 Hose installing

33.1.15 MULTI CONTROL VALVE

33.1.15.1 PREPARATION FOR REMOVAL

(1) Bleed pressure air in hydraulic oil tank (See Fig. 33-40.)

(2) Remove cover assy (1) (See Fig. 33-15)

(3) Remove cover assy (2) (See Fig. 33-16)

(4) Remove cover assy (6) (See Fig. 33-17)

(5) Shift bracket (1) for multi control valve if necessary. (See Fig. Fig. 33-68)

(6) Tag harness and remove it.

(7) Attach tag to hose between multi control valve and main C/V, and write numbers C1 to C8 on it. Remove hose on multi control valve side, and plug connection. Plug No. 4-3

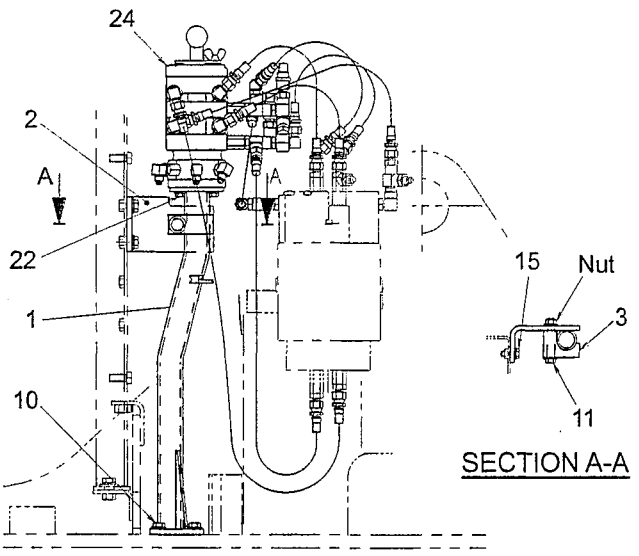


Fig. 33-68 Removing bracket for multi control valve

33.1.15.2 REMOVAL

(1) Attach tag on which hose name is entered to the remote control hoses between multi control valve and pilot V, and write numbers P1 to P8 on it.

(2) Remove hoses P1 to P8 on multi control valve side and plug connection, Plug No.4-3

(3) Remove four capscrews (22) M8 × 20.

(4) Remove multi control valve (24).

: 13 mm

(5) Removing and shifting bracket (1) for multi control valve.

1) Remove two capscrews (11) M12 × 85 and remove clamp (3).

: 19 mm

2) Remove two capscrews (15) M10 × 25 and bracket (2).

3) Remove three capscrews (10) M10 × 30.

: 17 mm

4) Move bracket (1).

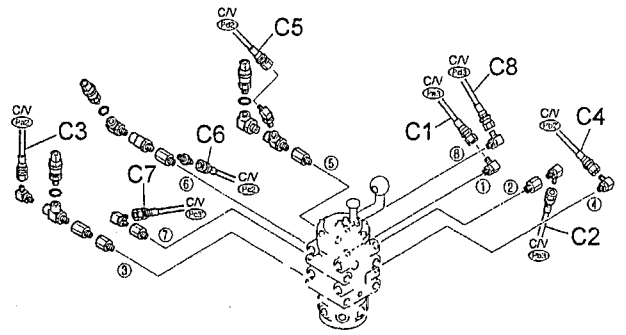


Fig. 33-69 Connection between multi control valve and main C/V

(8) Remove socket bolt for installation
Attach eye bolt on pipe (6), lift it up temporarily, and remove three (3) socket bolts (2) M8 × 20.

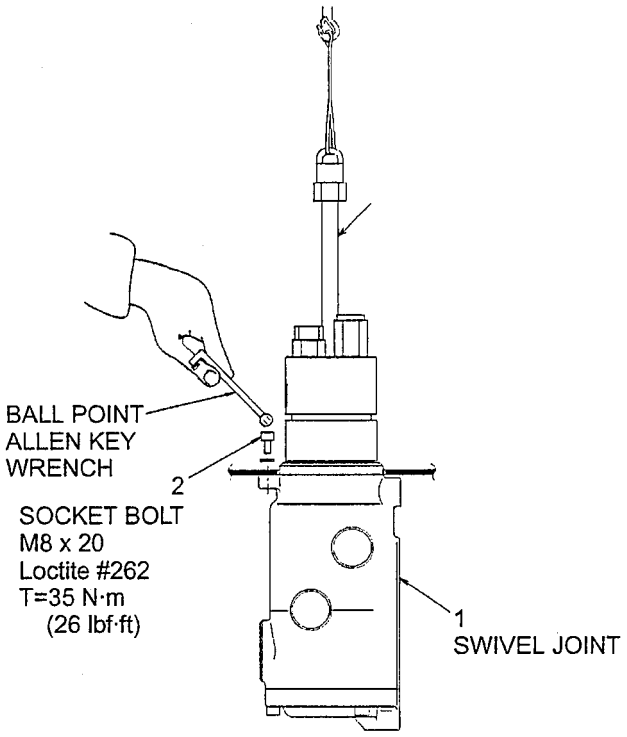


Fig. 33-84 Removing socket bolt for installation

(9) Slinging the swivel joint
Weight : Approx. 21kg (46 lbs)

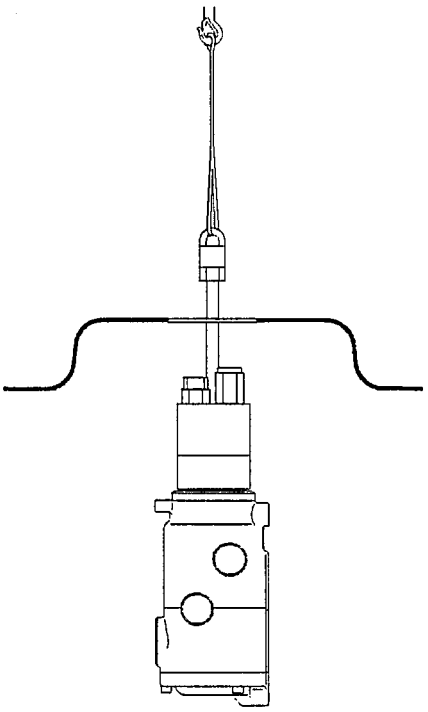


Fig. 33-85 Slinging swivel joint

13) Remove valve cover (312)
If necessary, remove relief valve lock nut (661), adjusting screw (660), spring seat (662), spring (663), poppet (664), seat (665) and needle bearing (124).

: 22 mm

- Relief valve are not allowed to be removal unnecessarily. A set pressure relief rate changes.
- Strictly prohibited to pull out needle bearing other than when the life time is exceeded.

14) Remove check valve sub and orifice thread (508)
Remove check valve sub (541), (543), (545) and orifice thread (508) from casing (271)

: 4 mm

- Use wrench taking care not to damage orifice thread (508) when remove.

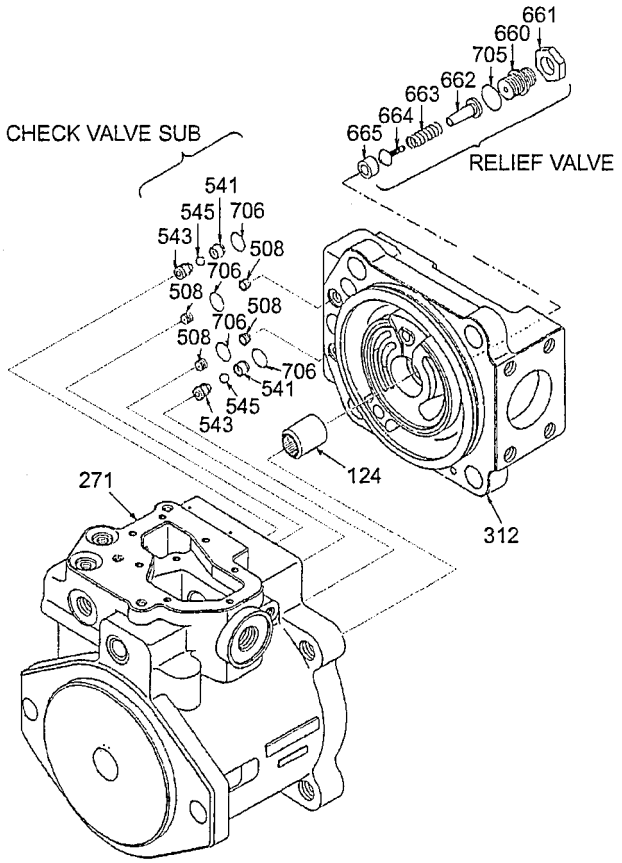
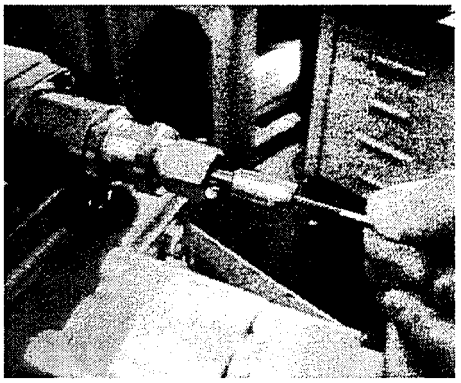


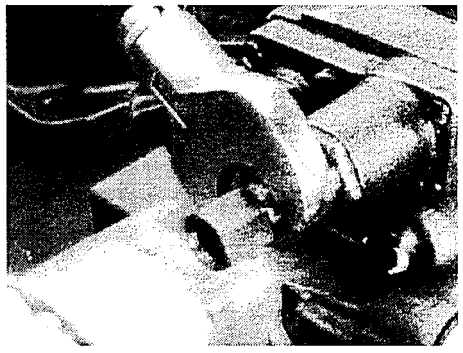
Fig. 33-103 Remove valve cover (312), and remove check valve sub-assy and orifice thread (508).

15) Power up port (Pz port)

a. Pull pistion of power up using M4 thread. Put a match mark on set position of lock nut etc. for convenience of reassembly.



b. Lossen hexagon nut (803). This nut is tightened by torque 98N•m (72lbf•ft).



(4) Pulling out arm spool (11) (See Fig. 33-122.)
Same procedure as boom spool (10).

1) Remove three (3) socket bolts (48).

: 5 mm

2) Remove pilot cover D (16). Since pilot cover D is equipped with piston guide (33), piston A (34), piston C (36), and lock valve spring A (35), remove as equipped-pilot cover D.

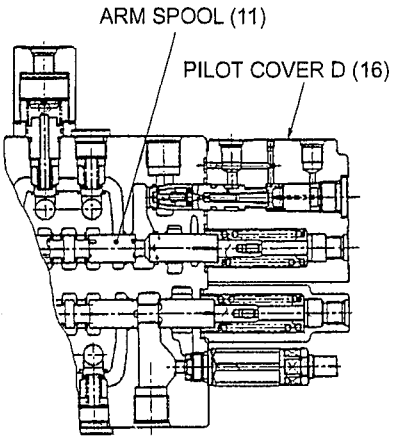


Fig. 33-122 Pulling out arm spool

(5) Disassembling lock valve pilot cover D (16) (SeeFig. 33-123.)

1) Remove pilot cover D (16).

Note

Keep poppet (29) carefully because it is slipped out easily.

---

2) Hold pilot cover D (16) with vise, and remove plug (20).

: 8 mm

Note

- Don't hold on port surface with vise.
- Take care not to damage piston guide (33) projected from the bottom of pilot cover D (16).

---

3) Take out piston C (36), spring A (35) and piston A (34) with pin set or magnet through the plug hole where it has been removed.

Note

- Record the direction Piston C (36) has been installed.
- Don't disassemble piston guide C (33). If it is damaged, replace a set of pilot cover D (16).

---

4) Take out a set of lock valve (28), restrictor (30), spring B (31) spring holder (32) and retainer ring (51) from control valve body with magnet.

Note

Don't disassemble lock valve (28). If it is damaged, replace a set of lock valve body.

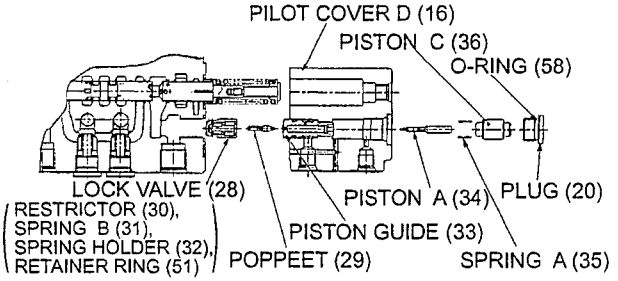


Fig. 33-123 Disassembling lock valve pilot cover D (16)

33.2.3 PILOT VALVE (ATT)

33.2.3.1 CONSTRUCTION

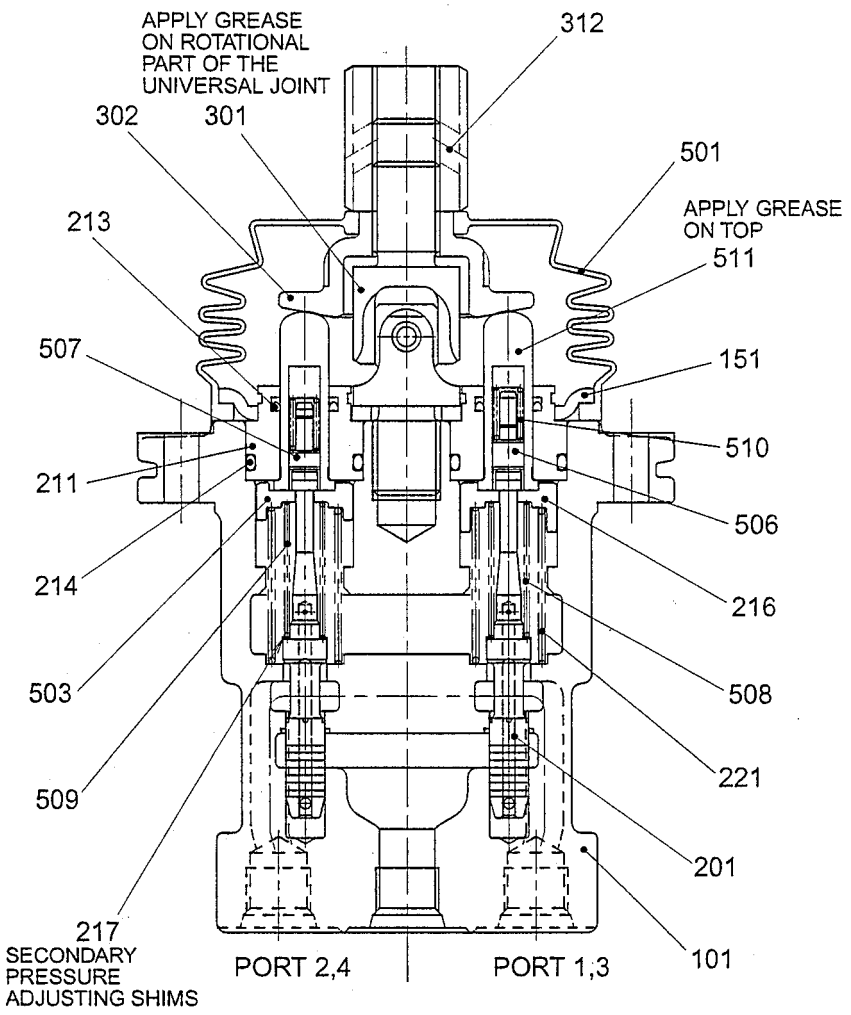


Fig. 33-130 Pilot valve (ATT)

Table 33-3

Item	Thread size	Tightening Torque Table N•m (lbf•ft)
301	M14	47.1 (34.7)
302, 312	M14	68.6 (50.6)

Table 33-4

No.	NAME	Q'TY	No.	NAME	Q'TY	No.	NAME	Q'TY
101	CASING	1	217	WASHER 2	4	506	SPRING SEAT	2
151	PLATE	1	221	SPRING	4	507	SPRING SEAT	2
201	SPOOL	4	301	JOINT; M14	1	508	SPRING	2
211	PLUG	4	302	DISK	1	509	SPRING	2
213	SEAL	4	312	ADJUSTING NUT; M14	1	510	SPRING	4
214	O-RING; 1B P20	4	501	BELLOWS	1	511	PUSH ROD	4
216	SPRING SEAT	2	503	SPRING SEAT	2			

33.2.4 PILOT VALVE (TRAVEL)

33.2.4.1 CONSTRUCTION

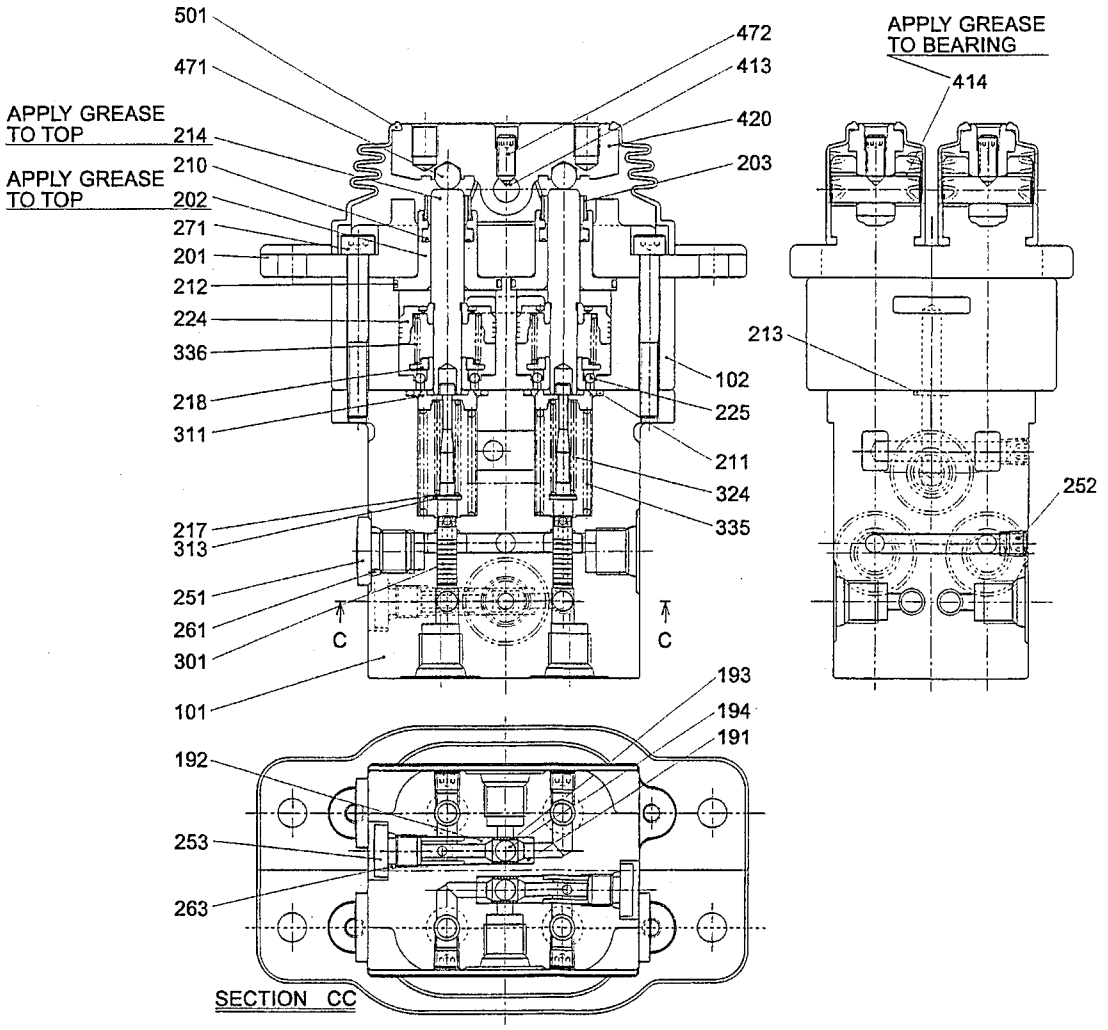


Fig. 33-156 Pilot valve (Travel)

Torque N•m (lbf•ft)	No.	Name	Q'ty	Torque N•m (lbf•ft)	No.	Name	Q'ty
	101	CASING	1	29.4 (22)	251	RO PLUG	3
	102	CASING (DAMPER)	1	6.9 (5.1)	252	PLUG	6
	191	SEAT 1	2		253	RO PLUG	2
	192	SEAT 2	2		261	O-RING	3
	193	BUSHING 2	2		263	O-RING	2
	194	STEEL BALL	2	8.8 (6.5)	271	SOCKET BOLT	4
	201	COVER	2		301	SPOOL	4
	202	PLUG	4		311	SPRING SEAT	4
	203	GREASE CUP	4		313	WASHER	4
	210	PACKING	4		324	SPRING	4
	211	O-RING	4		335	SPRING	4
	212	O-RING	4		336	SPRING	4
	213	O-RING	2		413	CAM SHAFT	2
	214	PUSH ROD	4		414	BUSHING	4
	217	SHIM	4		420	CAM	2
	218	SPRING SEAT	4		471	STEEL BALL	4
	224	PISTON	4	6.9 (5.1)	472	SET SCREW	2
	225	STEEL BALL	12		501	BELLOWS (BOOTS)	2

6) Remove snap ring (5) with plier.

7) Remove inner race of needle bearing (6).

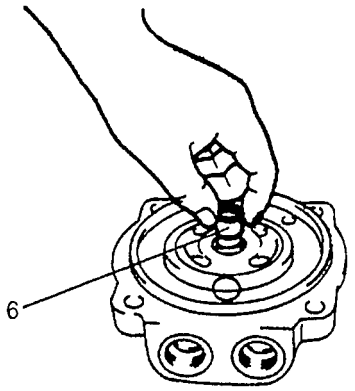


Fig. 33-167 Removing bearing (6) inner race

8) Remove the O-ring (9).

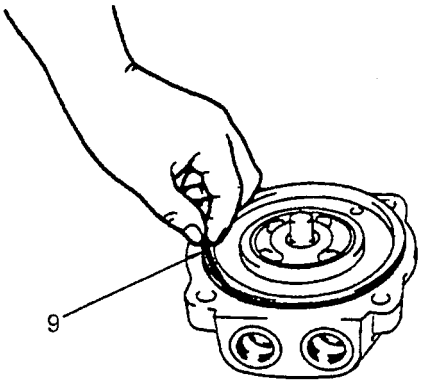


Fig. 33-168 Removing O-ring (9)

9) Remove the balance plate (10).

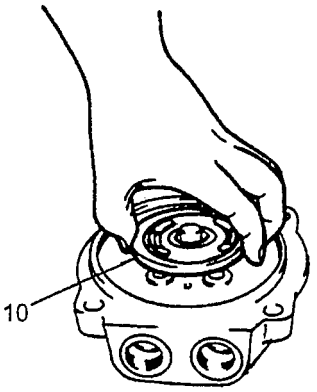


Fig. 33-169 Removing balance plate

10) Remove the bushing (14) with a teflon ring (16) on it, and the scroll wave (15).

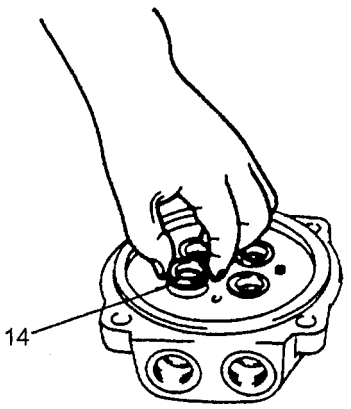


Fig. 33-170 Removing bushing (14) and scrollwave (15)

33.2.6 SWIVEL

33.2.6.1 CONSTRUCTION

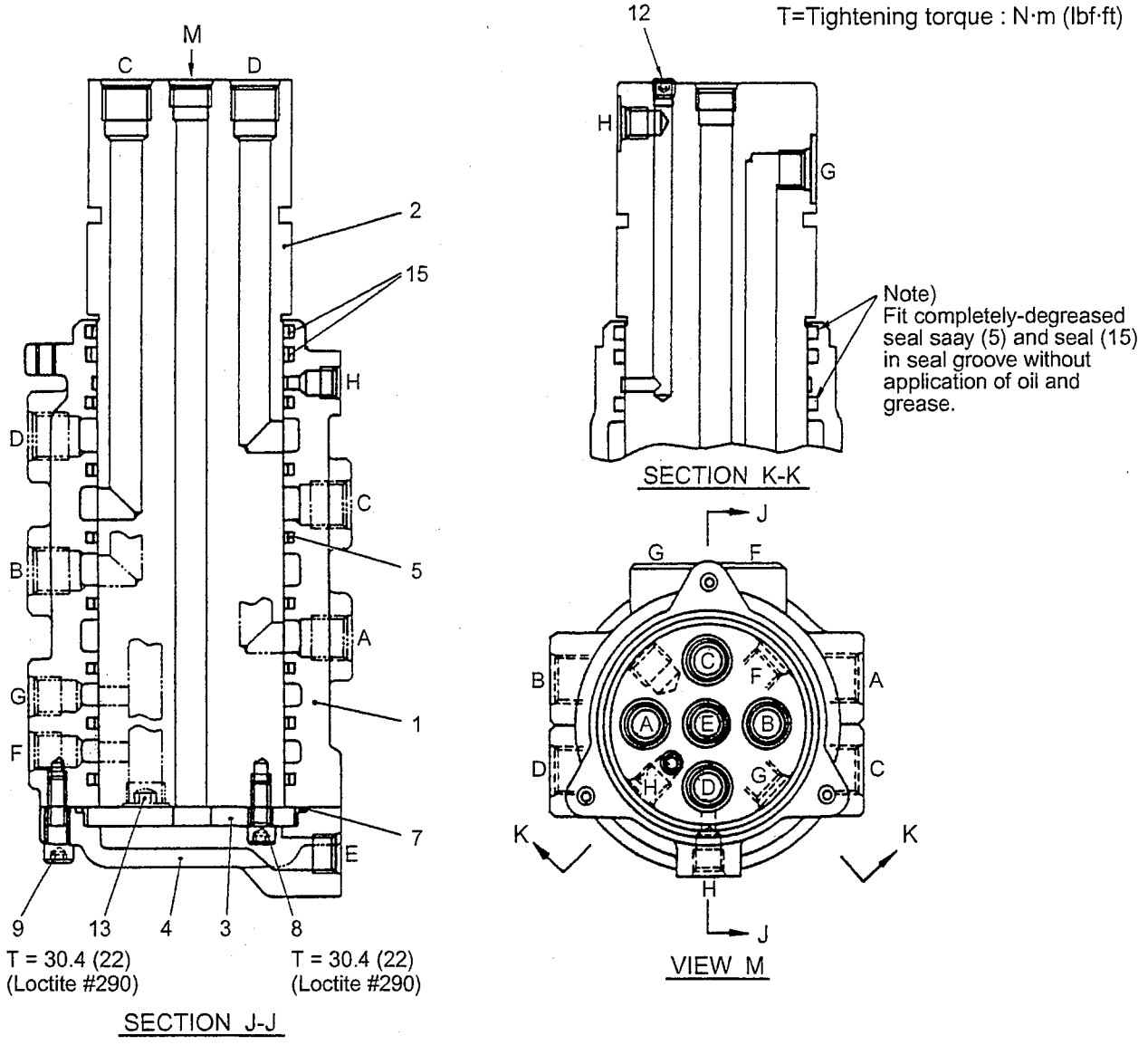


Fig. 33-198 Construction

Table 33-5

No.	Parts	Q'ty	No.	Parts	Q'ty	No.	Parts	Q'ty
1	BODY	1	5	SEAL ASSY	7	12	PLUG : PT1/8	1
2	STEM	1	7	O-RING ; 1A G95	1	13	PLUG : PT3/8	2
3	THRUST PLATE	1	8	SOCKET BOLT : M8 × 20	2	15	SEAL	2
4	COVER	1	9	SOCKET BOLT : M8 × 30	3			

34. TRAVEL SYSTEM

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34.1.3.6 MAINTENANCE STANDARD

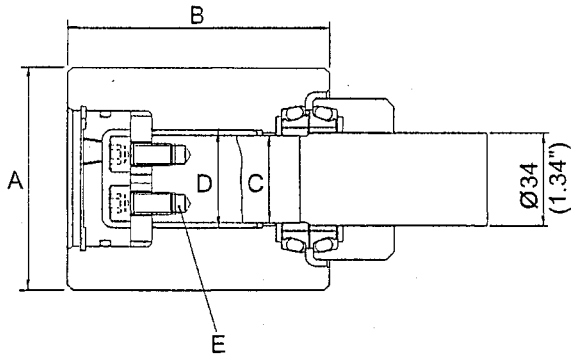


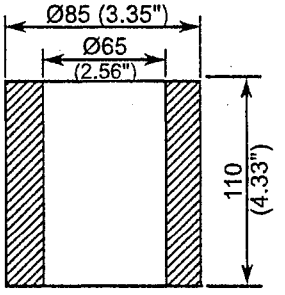
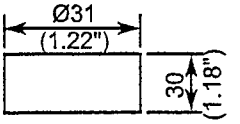
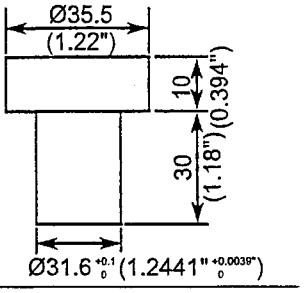
Fig. 34-27 Upper roller

Unit : mm (in)

No.	ITEM	STANDARD VALUE			REPAIR-ABLE LEVEL	SERVICE LIMIT	REMEDY
A	Tread dia.	Ø82 (3.23)			Ø73 (2.87)	Ø70 (2.76)	Replace
B	Tread width	102 (4.02)			95 (3.74)	92 (3.62)	
C	Clearance between shaft and bushing	Basic di-mension	Tolerance		Fit	Fit	
		Ø32 (1.2598)	Shaft	-0.025 (-0.00098) -0.050 (-0.00197)	Clearance 0.7 (0.028)	Clearance 1.0 (0.04)	Replace bushing
D	Interference between roller and bushing	Ø36 (1.4173)	Hole	0 -0.03 (-0.0012)	Interfer-ence 0	Clearance 0.01 (0.0004)	
E	Tightening torque of socket bolt	33 N•m (25 lbt•ft)					Apply Loctite #242
	Oil	Engine oil API grade CD #30, 20 cc (1.22 cu•in)					Replenish.
	Roller rotation	Roller rotates smoothly by hand.					Reassembly.

34.1.3.7 TOOL AND JIGS

Unit : mm (in)

No.	JIGS	SHAPE	No.	JIGS	SHAPE
f	Stand jig		g	For extruding shaft	
			h	Bushing fixing jig	

5) Removing bushing (4)
With idler (1) mounted on the stand, tap bushing (4) lightly by hammer, while placing the bushing drawing rod (T) against the end face of bushing (2) evenly all round, till it comes out.

6) Removing floating seals (6)
Take out floating seals (6) from idler (1), collar (3). If you intend to re-use floating seals (6), confirm that there is no scoring and rusting on the contact surface and store the floating seals in pairs by placing thick paper between the sealing faces.

7) Removing O-ring (7)
Separate O-ring (7) from shaft (2).

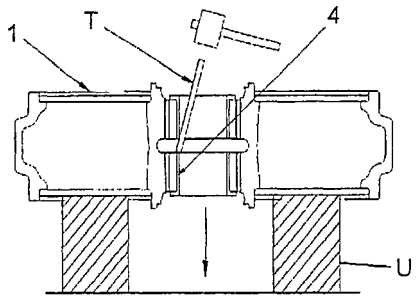


Fig. 34-52 Removing bushing

(2) Assembly

1) Pressing in bushing (4)
Align inner hole of idler (1) and bushing (4) and press-fit it vertically with press so that jig (V) for bushing press-fitting jig (V) is inserted into bushing (4).

2) Installing O-ring (7)
Fit O-ring (7) to O-ring groove on shaft (2).

- Apply grease to O-ring.

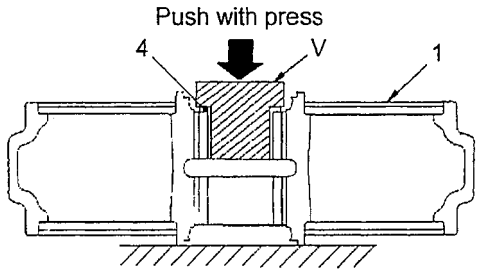


Fig. 34-53 Pressing in bushing (4)

3) Installing collar (3) (See Fig. 34-54)
Press-fit the O-ring installed side of shaft into collar (3), and drive pin (5).

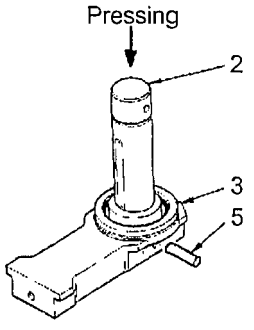


Fig. 34-54 Installing collar (3), shaft (2)

4) Installing floating seal (6)
Fit one piece of two (2) pieces type floating seal (6) on each side of collar (3).

5) Inserting idler (1)
Insert floating seal (6) fitted side of idler (1) into shaft (2).

6) Installing floating seal (6)
Fit floating seal (6) on the other side of idler (1).

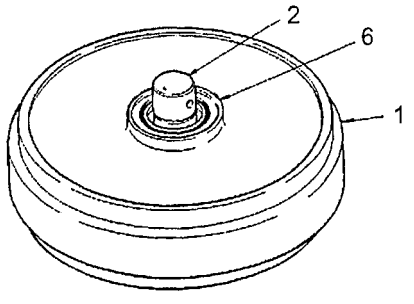


Fig. 34-55 Inserting idler (1) and installing floating seal (6)

(3) Preparation of oil pan

(4) Removing hydraulic pipe
Bleed air in hydraulic oil tank, remove all pipes connecting to travel motor. Then plug up all pipes and joint section to protect them from entry of dust.

: 19 mm, 22 mm, 24 mm, 27 mm, 32 mm
Plug 4-1

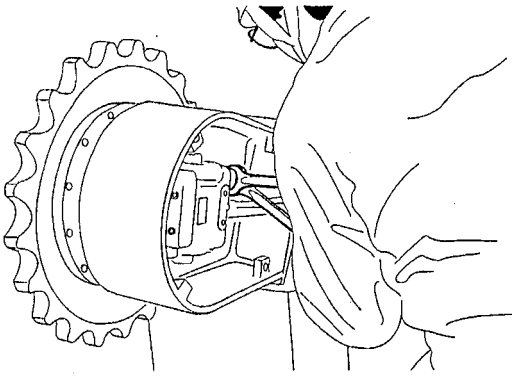


Fig. 34-77 Removing and installing hydraulic pipe

(5) Removing sprocket
Removing twenty four capscrews (2) M14 X 35.

: 22 mm

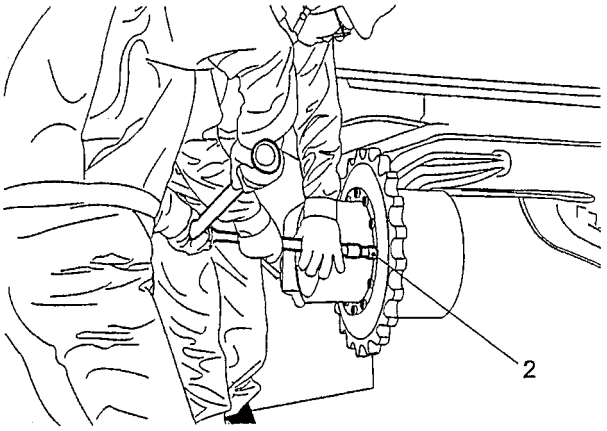


Fig. 34-78 Removing and installing sprocket

(6) Loosening travel motor mounting bolts
Apply match marks on travel motor and lower frame, and remove twenty four capscrews (3) M16 X 40.

: 24 mm

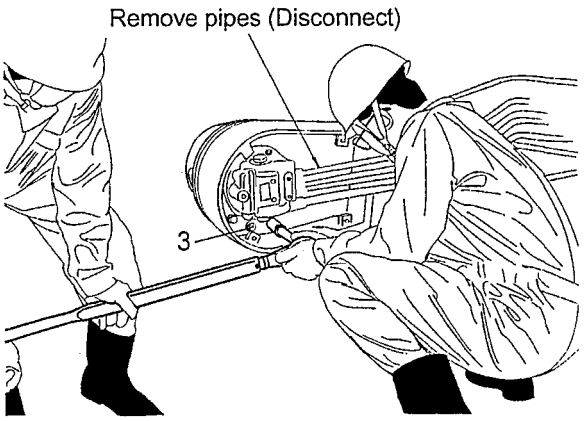


Fig. 34-79 Removing and installing travel motor mounting bolts

(7) Slinging travel motor assy
Sling travel motor with nylon sling applied on the the side close to sprocket installing section and remove the motor.

Weight of motor Approx.90 kg (198 lbs)

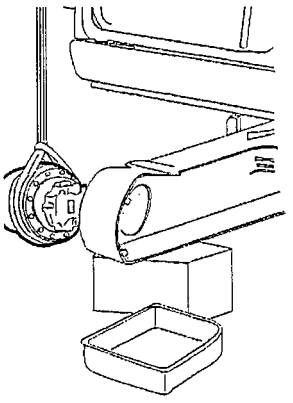


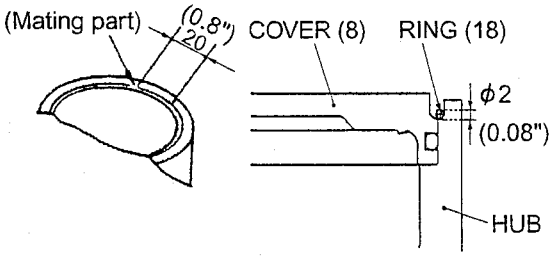
Fig. 34-80 Slinging travel motor

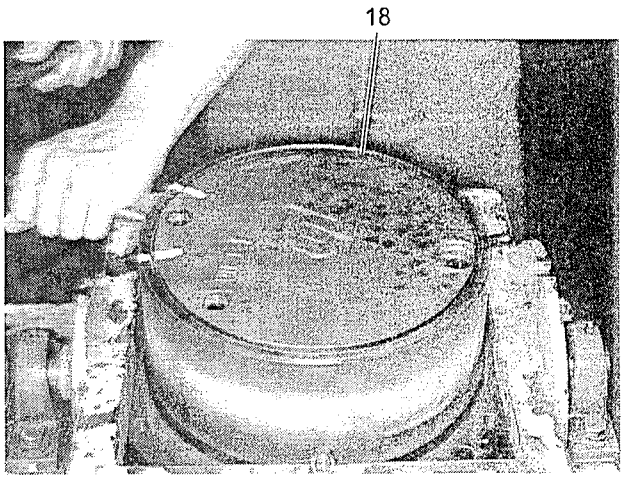
34.2.1.2 TOOLS AND JIGS

(1) Standard tools

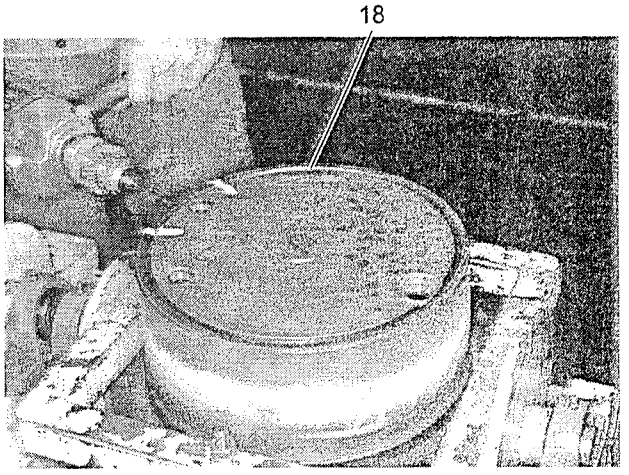
Tools	Size	Q'ty	Application item (No.)
Torque wrench	Nominal 450 Dial type	1	284
Torque wrench	Nominal 1800 Dial type	1	33, 34, 221, 245, 282, 289
Torque wrench	Nominal 5500 Dial type	1	19, 224
Allen wrench	Nominal 5	1	284
Allen wrench	Nominal 6	1	34
Allen wrench	Nominal 8	1	33, 34, 221
Allen wrench	Nominal 10	1	245, 282
Socket	Nominal 5 Inset square 12.7	1	284
Socket	Nominal 8 Inset square 12.7	1	33, 34, 221
Socket	Nominal 10 Inset square 12.7	1	245, 282
Socket	Nominal 22 Inset square 12.7	1	289
Socket	Nominal 36 Inset square 12.7	1	19, 224
Extention bar	Inset square 12.7	1	19
Spanner	Round shaped powerful spanner 36	1	224
Hammer	Nominal 12	1	1, 21
Plastic hammer	L=300 (12") or so	1	8, 102
Snap ring pliers	For shaft	1	24, 25
Snap ring pliers	For bore	1	20, 145
Center punch	Ø9.5 X 100 (0.374" X 4")	1	1
Pin punch	Ø3 X 150 (0.127" X 6")	1	21
Lifting tool	Hook, wire rope	1 Set	1,2 for lifting
Car washing brush		1	Cleaning the parts
Wire brush		1	Cleaning the parts
Container	Vat for general use W450 X D300 X H120 (W18" X D12" X H5")	3	Lubricant, draining hydraulic oil ball (36, 268, 296) retainer
Paint marker	Oil base white	1	For matching mark
Metal screen basket		1	17
Rubber mat		1	
Leather gloves		1 Pair	149
Jug	For hydraulic oil, For lubricant.	2	Oil filling

3. Find the mating part of ring (18), and punch at a point of the outside of the hub, approximately 20 mm (0.8 in) inward from the tip of ring (18) for drilling purpose.





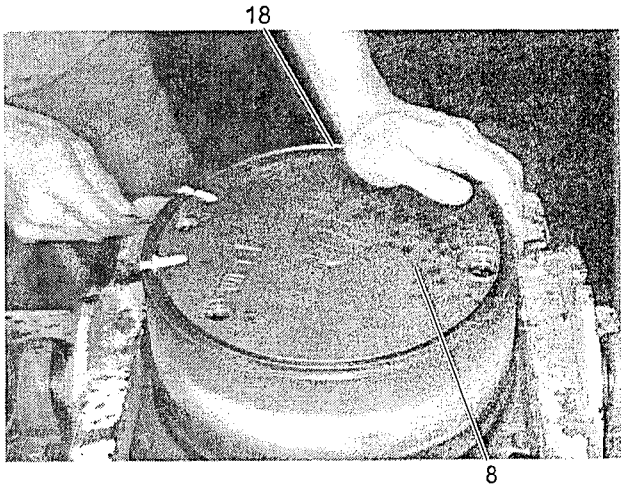
4. Drill through a 2mm (0.08 in) hole from the outside of hub (1) toward ring (18) using electric drill.



Note

- Put a drill against the punched hole and drill it through so the ring takes off the cover as it is pushed by the drill.
- Wipe off the metal chips produced by drilling so they do not score the parts to be removed.

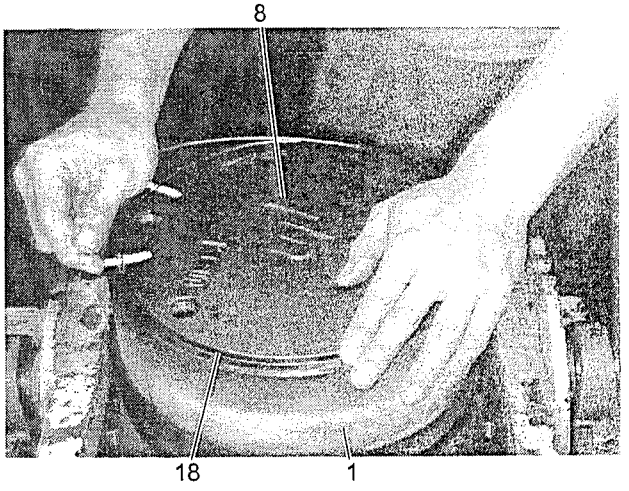
5. Put a steel bar into the hole and push ring (18).



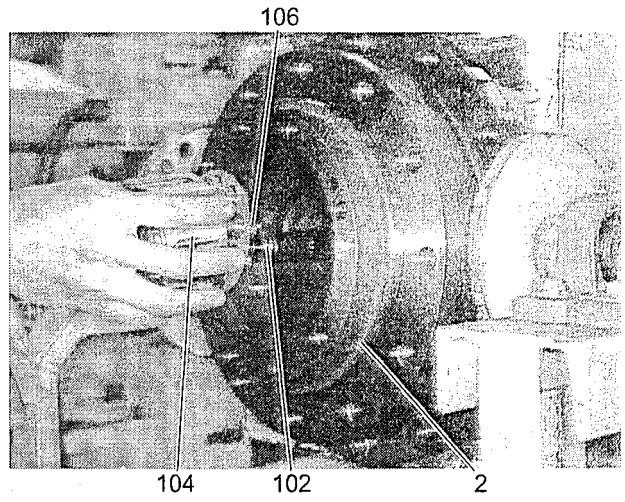
Note

- In that case, the tip of the ring (18) stands out above the cover (8) as pressed by a steel bar.

6. Hold the tip of ring (18) sticking out of the cover (8) and draw the ring (18) out of the ring groove of the hub (1).



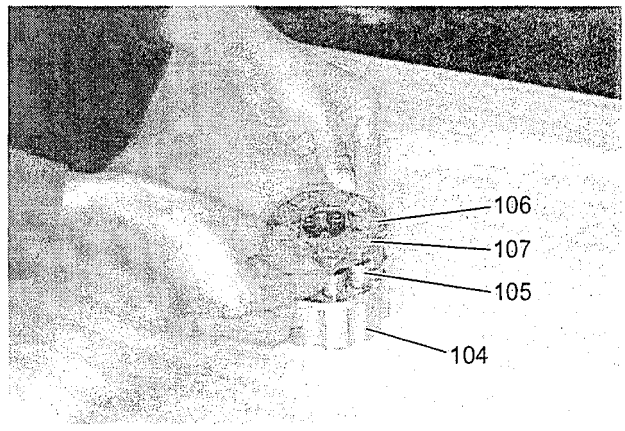
4. Hold cylinder block (104) by hand, remove shoe (106) adhered on swash plate (103) turning 2 or 3 times alternately.



Note

- If the cylinder block is pulled out without separating shoe, the shoe (106) remained on swash plate (103) (piston, shoe) may drop in spindle (2).

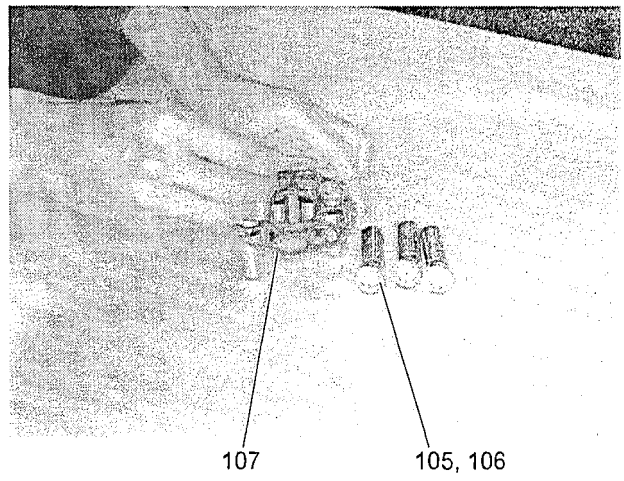
5. Remove cylinder block (104) from shaft (102).
6. Remove piston assy [piston (105) and shoe (106)] and retainer plate (107) from cylinder block (104).



Note

- When removing the cylinder block, hold the retainer plate (107) by both hands and remove it with the piston assy.
- The piston (105) and the shoe (106) are made in one piece as they are caulked by the spherical surface of the piston. It is not possible to remove the piston from the shoe without damaging the shoe. When replacement is required, replace 9 sets of piston (105) and shoe (106). (Hereafter called piston assy.)

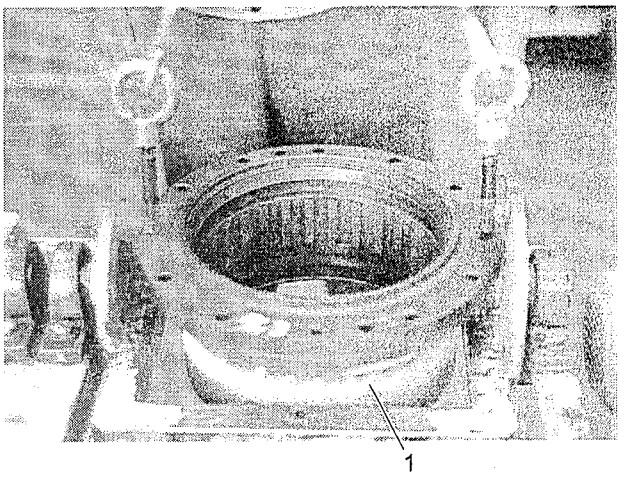
7. Remove the piston assy (105), (106) from retainer plate (107). [Nine pistons]



1) Installing hub (1).

1. Install two eye bolts into the tapped holes of hub (1) so they are located in diagonally opposite positions.
2. Hook eye bolt of hub (1), and lift up and place it on working bench.

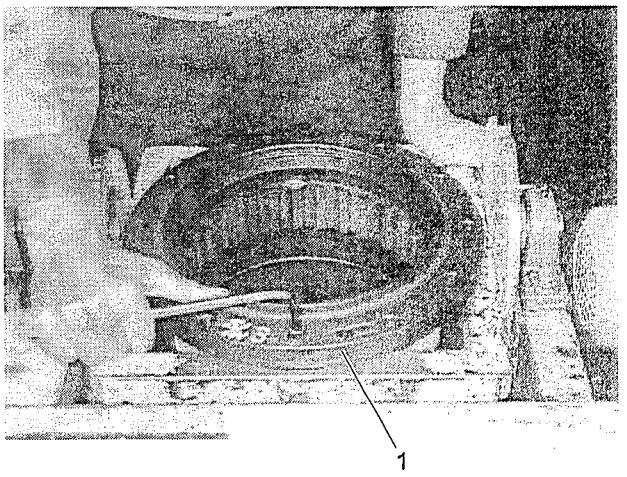
- Align hub (1) to the mounting holes of the work bench, while matching the holes in hub (1) with those in the work bench.



3. Install hub (1) to the work bench and fasten socket bolts so they are located in diagonal positions.

⚠CAUTION

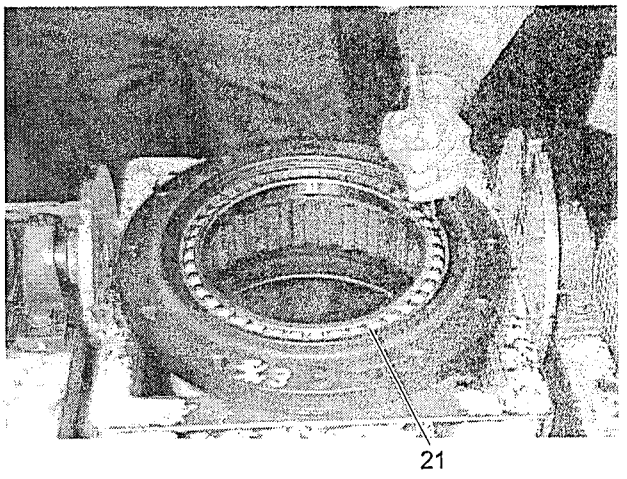
Fasten the socket bolts securely. If the bolts are not tightened sufficiently, the travel motor may fall when turned over, which is dangerous.



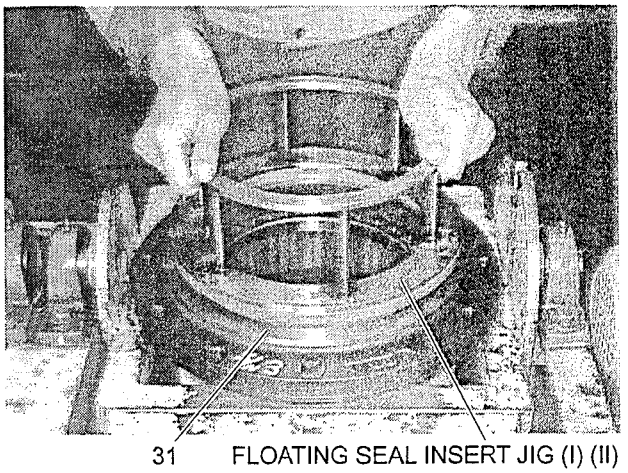
4. Insert bearing (21) in hub (1).

Note

- Place a pin punch against the outer race of bearing (21), hammer it lightly all around and press in the bearing little by little.

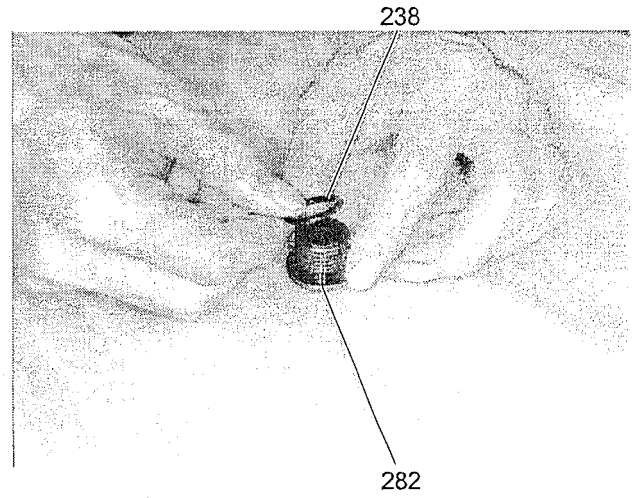


5. Assemble floating seal (31) to hub (1), using the assembling jigs (I), (II).



13) Installing the brake valve parts into rear flange

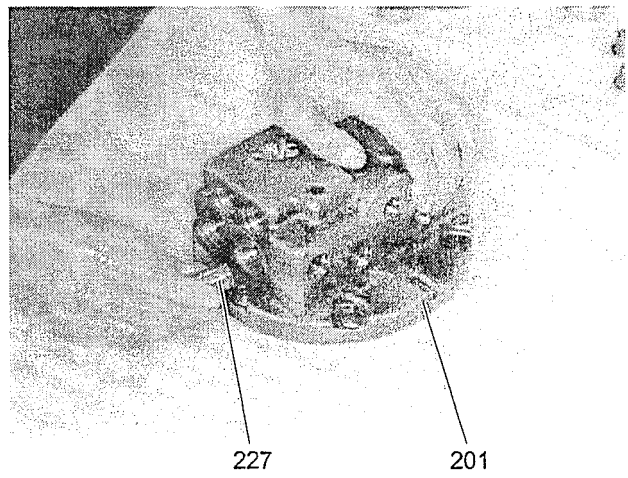
1. Fit two O-rings (238) to two plugs (282).



Note

- Coat O-ring (238) with grease.

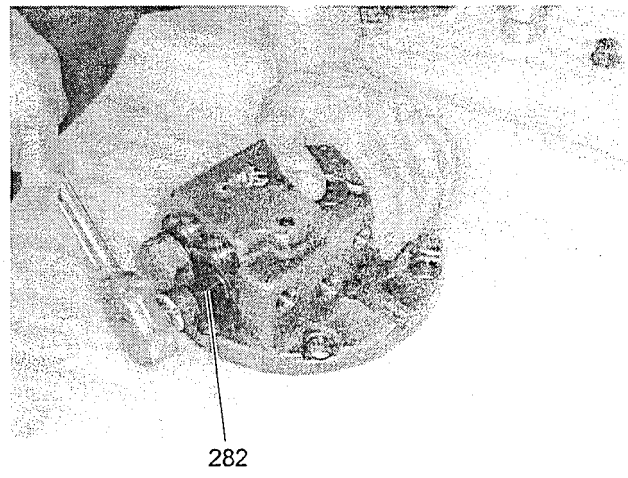
2. Install valve (227) and spring (230) on rear flange (201). Apply grease on valve and spring in order to adhere them to rear flange (201).
3. Install the plug (282) in rear flange (201).



Note

- Place on the work bench by directing rear flange (201) with its plug attaching face up. Align the center of threaded hole with the plug 282) center.
- Prevent spring (230) from falling from valve 227). Note that if spring (230) falls from valve 227), the valve does not contact with the seat surface of rear flange (201) properly, causing oil leaks.

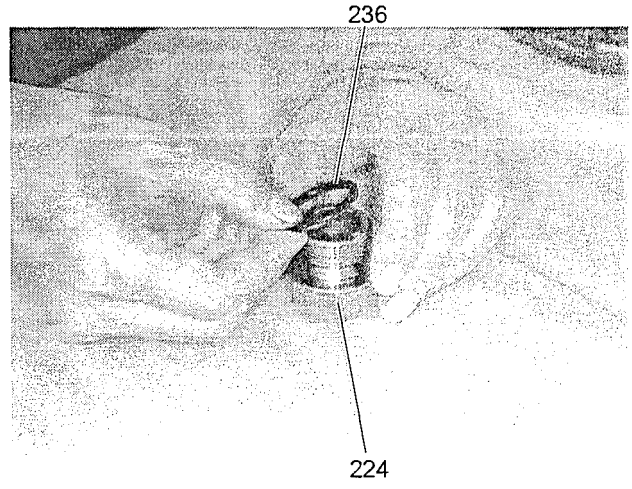
4. After installing two plugs (282), temporarily fasten rear flange (201) by means of allen wrench.
5. Install spool (223) into rear flange (201).



Note

- Coat the spool with hydraulic oil and insert the spool into the rear flange.
- Attach the spool by aligning the hole of the rear flange with the spool and prevent the inner surface of the rear flange and the outer surface of the spool from being damaged by mutual interference.
- In case damage resulting from inter-ference should occur to the holes in the rear flange and the outer surface of the spool, internal leaks will occur after assembly, ultimately deteriorating the performances of the travel motor.

6. Fit O-ring (236) to plug (224).



Note

- Coat O-ring (236) with grease.

7. Fit spring retainer (225) and spring (228) to plug (224).

21) Procedure of axial clearance adjustment of bearing (22)

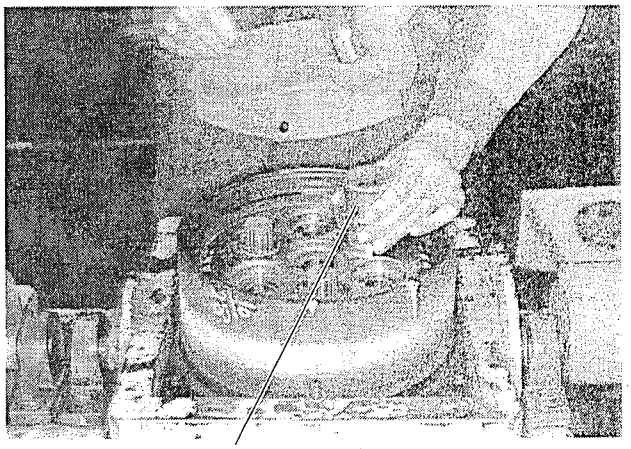
Note

- When the following parts have been replaced, it is necessary to adjust the axial clearance of taper roller bearing (22) to a specified value by adjusting the thickness of snap ring (20). If it is installed without adjustment, malfunction of hydraulic motor may be caused and the life may be shortened.

  Spindle (2), hold flange (3),
  crankshaft (9), spacer (12),
  bearing (22).

- When the above parts are not replaced, the adjustment of thickness of snap ring is unnecessary. Proceed to the regular assembly shown in Item 6) " 1 " in this section.
- The clearance adjustment is described below.

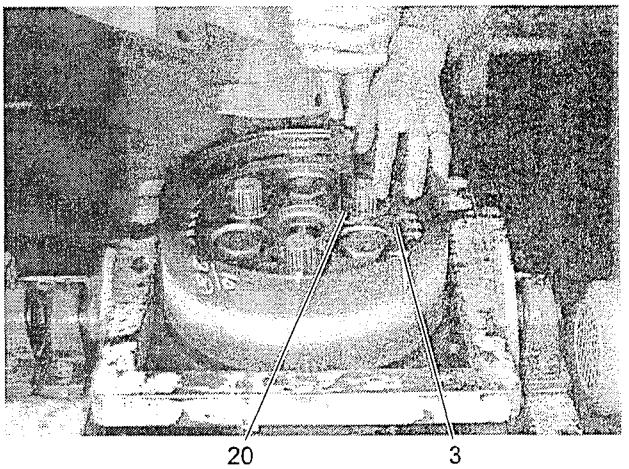
1. Lightly tap the outer race with mallet and jig (IV) of bearing (22) attached to crankshaft (9).


RETAINER METAL (IV)

Note

- Put the RV gear assy in spindle (2) securely.

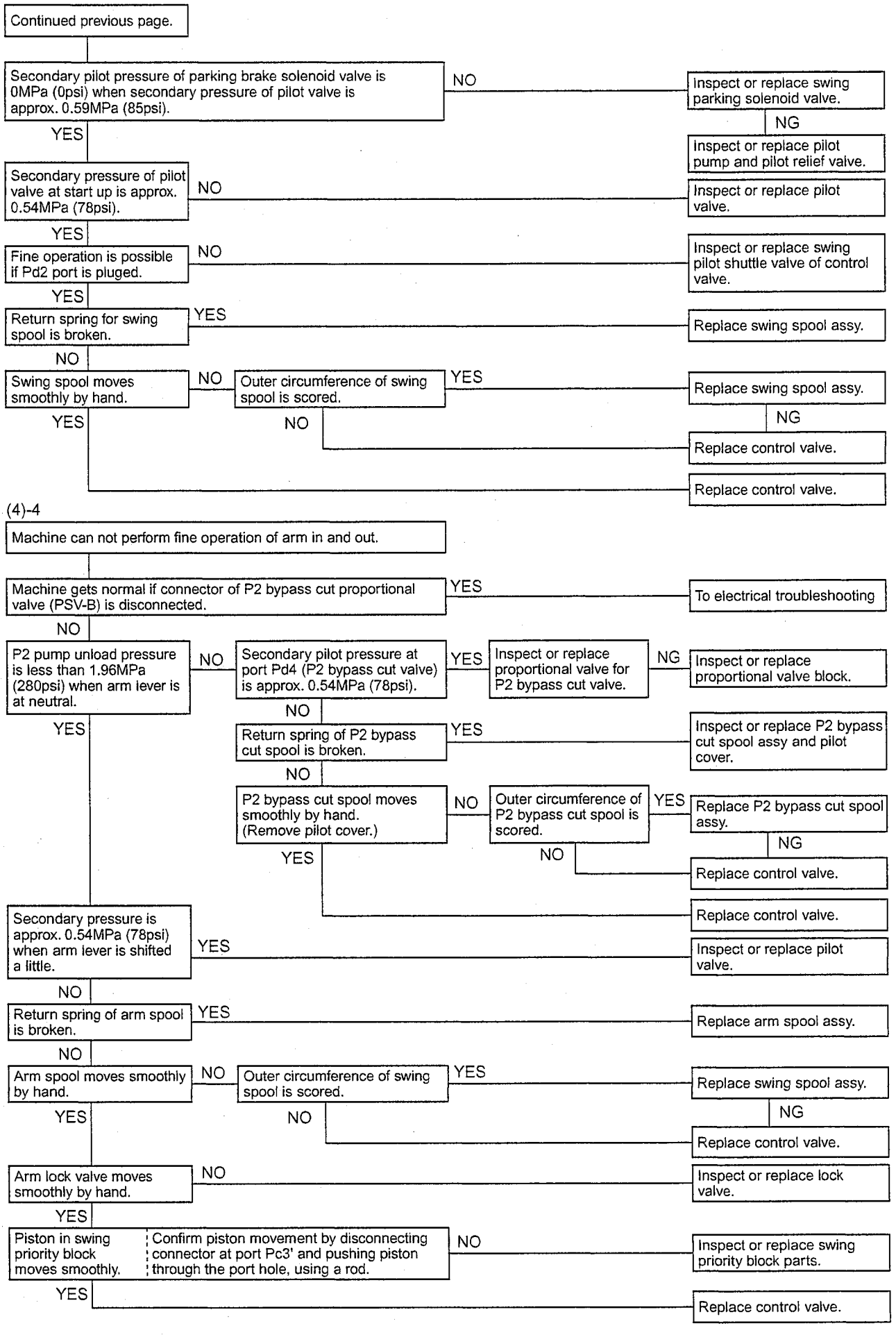
2. Fix the thinnest snap ring (20) into the snap ring groove in hold flange (3).



41.2 TABLE OF ACTUATOR FOR TROUBLESHOOTING : MECHATRO CONTROL

Opeating condition \ Actuator		Electric								Hydraulic	
		Low pressure sensor	P2 bypass cut proportional valve	Travel straight proportional valve	P1 bypass cut proportional valve	Swing P / B solenoid valve	Travel 1-2speed solenoid valve	Safety lock lever solenoid valve	Travel boost-up solenoid valve		
		SEN 1 ~ 10	PSV-B	PSV-C	PSV-D	SV-1	SV-3	SV-4	SV-8	P1 pump	P2 Pump
Indenpendent operation	Boom up inching operation	○						○		○	
	Boom up full lever operation	○	○					○		○	○
	Boom down operation	○						○		○	
	Arm out inching operation	○						○			○
	Arm out full lever operation	○			○			○		○	○
	Arm in inching operation	○				○		○			○
	Arm in full lever operation	○			○	○		○		○	○
	Bucket digging	○						○		○	
	Bucket dump	○						○		○	
	Swing operation	○	○			○		○			○
	Travel LH / RH operation (1st. speed)	○						○	○	○	○
	Travel LH / RH operation (2nd. speed)	○					○	○	○	○	○
Combined operation	Travel right operation + Boom operation	○	○	○				○	○	○	○
	Travel right operation + Bucket operation	○	○					○	○	○	○
	Travel right operation + Arm operation	○			○			○	○	○	○
	Travel right operation + Swing operation	○	○			○		○	○	○	○
	Travel left operation + Boom operation	○	○					○	○	○	○
	Travel left operation + Bucket operation	○						○	○	○	○
	Travel left operation + Arm operation	○		○	○	○		○	○	○	○
	Travel left operation + Swing operation	○	○	○	○	○		○	○	○	○
	Travel LH / RH operation + Boom up operation	○	○	○	○			○	○	○	○

Classification		Group No.	Trouble		Component / Device No.	Hydraulic: Proportional valve block: Swing parking sol. valve	Travel 1-2speed sol. valve	Safety lock lever sol. valve	Travel booster sol. valve	P2 bypass cut proportional valve	Travel straight proportional valve	P1 bypass cut proportional valve	Filter: Inline filter	Suction strainer	Bypass check	Return filter	Breather
					11								13	14	15	16	17
Hydraulic systems	Attachment operation	1	No operation is possible.					○					○				
			Machine operates freely even though lever is in neutral.							○	○	○					
		2	Speed is low.	All actions									○				
				Bucket digging and dump						○							
				Boom raise conflux	Lower					○							
					Raise					○	○						
				Arm in conflux							○	○					
				Arm out conflux							○	○					
		3	Power lacks.	All motions									○				
				Bucket digging and dump						○	○						
				Boom	Lower					○	○						
					Raise					○	○						
				Arm in and out							○	○					
		4	Fine operation impossible.	Bucket digging						○		○					
				Boom	Lower					○							
					Raise					○		○					
				Swing left, right													
				Arm in and out						○		○					
	Travel operation	5	Travel 1,2 speed change impossible				○						○				
		6	Travel speed is low.				○				○						
		7	Travel power is low.				○		○		○						
		8	Machine cannot travel straight or deviates in one direction or zigzags.								○						
		9	Machine drifts on a downhill and does not stop still on a slope.														
	Swing operation	10	Swing motion does not work.			○											
		11	Swing speed is low.			○				○							
		12	Swing power is poor.			○				○							
			Swing motion drifts very large.														
		13	Machine is not held still on a slope.			○											
			An unusual sound is heard during swing motion.							○							


Continued previous page.
Secondary pilot pressure of parking brake solenoid valve is 0MPa (0psi) when secondary pressure of pilot valve is approx. 0.59MPa (85psi).
NO
Inspect or replace swing parking solenoid valve.
NG
Inspect or replace pilot pump and pilot relief valve.
YES
Secondary pressure of pilot valve at start up is approx. 0.54MPa (78psi).
NO
Inspect or replace pilot valve.
YES
Fine operation is possible if Pd2 port is pluged.
NO
Inspect or replace swing pilot shuttle valve of control valve.
YES
Return spring for swing spool is broken.
YES
Replace swing spool assy.
NO
Swing spool moves smoothly by hand.
NO
Outer circumference of swing spool is scored.
YES
Replace swing spool assy.
NG
YES
NO
Replace control valve.
Replace control valve.
(4)-4
Machine can not perform fine operation of arm in and out.
Machine gets normal if connector of P2 bypass cut proportional valve (PSV-B) is disconnected.
YES
To electrical troubleshooting
NO
P2 pump unload pressure is less than 1.96MPa (280psi) when arm lever is at neutral.
NO
Secondary pilot pressure at port Pd4 (P2 bypass cut valve) is approx. 0.54MPa (78psi).
YES
Inspect or replace proportional valve for P2 bypass cut valve.
NG
Inspect or replace proportional valve block.
NO
YES
Return spring of P2 bypass cut spool is broken.
YES
Inspect or replace P2 bypass cut spool assy and pilot cover.
NO
P2 bypass cut spool moves smoothly by hand. (Remove pilot cover.)
NO
Outer circumference of P2 bypass cut spool is scored.
YES
Replace P2 bypass cut spool assy.
NG
YES
NO
Replace control valve.
Replace control valve.
Secondary pressure is approx. 0.54MPa (78psi) when arm lever is shifted a little.
YES
Inspect or replace pilot valve.
NO
Return spring of arm spool is broken.
YES
Replace arm spool assy.
NO
Arm spool moves smoothly by hand.
NO
Outer circumference of swing spool is scored.
YES
Replace swing spool assy.
NG
YES
NO
Replace control valve.
Arm lock valve moves smoothly by hand.
NO
Inspect or replace lock valve.
YES
Piston in swing priority block moves smoothly.
Confirm piston movement by disconnecting connector at port Pc3' and pushing piston through the port hole, using a rod.
NO
Inspect or replace swing priority block parts.
YES
Replace control valve.

43. TROUBLESHOOTING (ELECTRIC)

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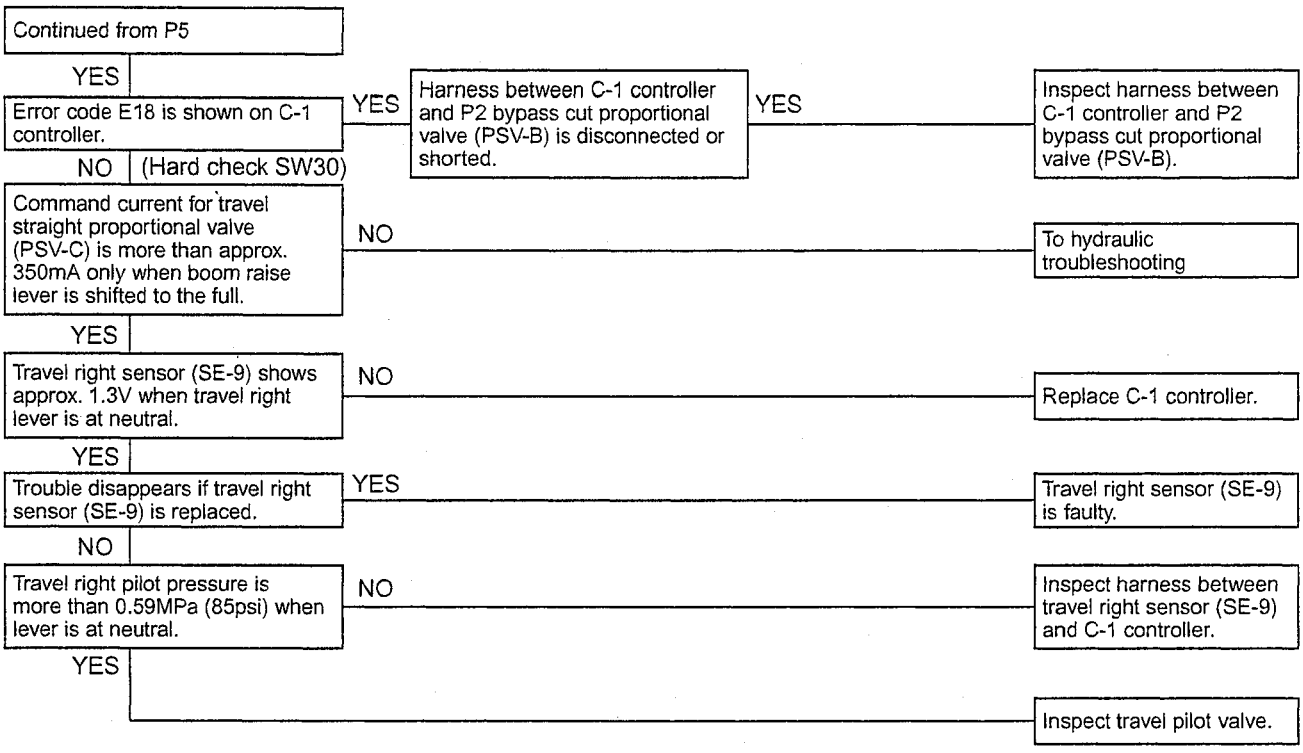
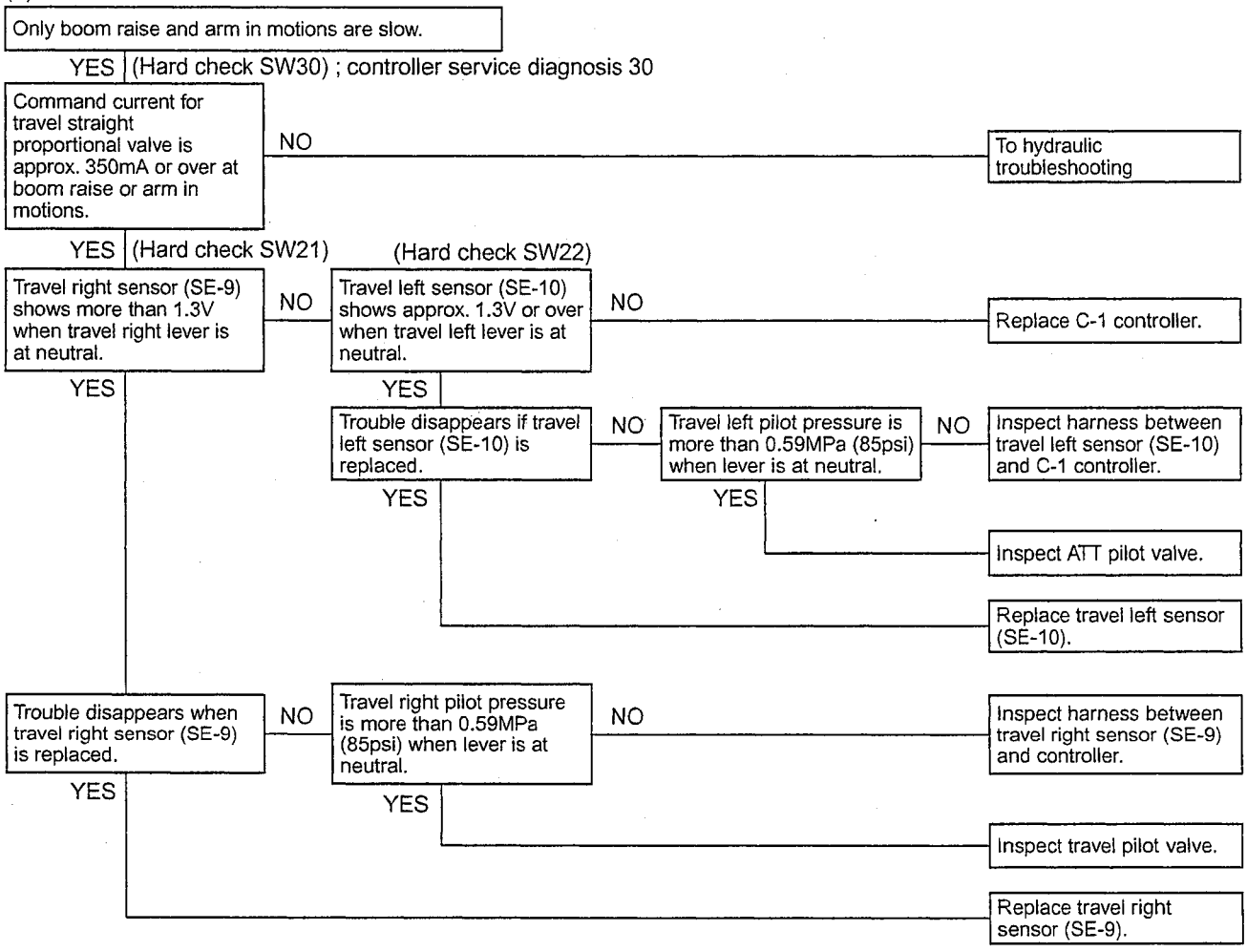
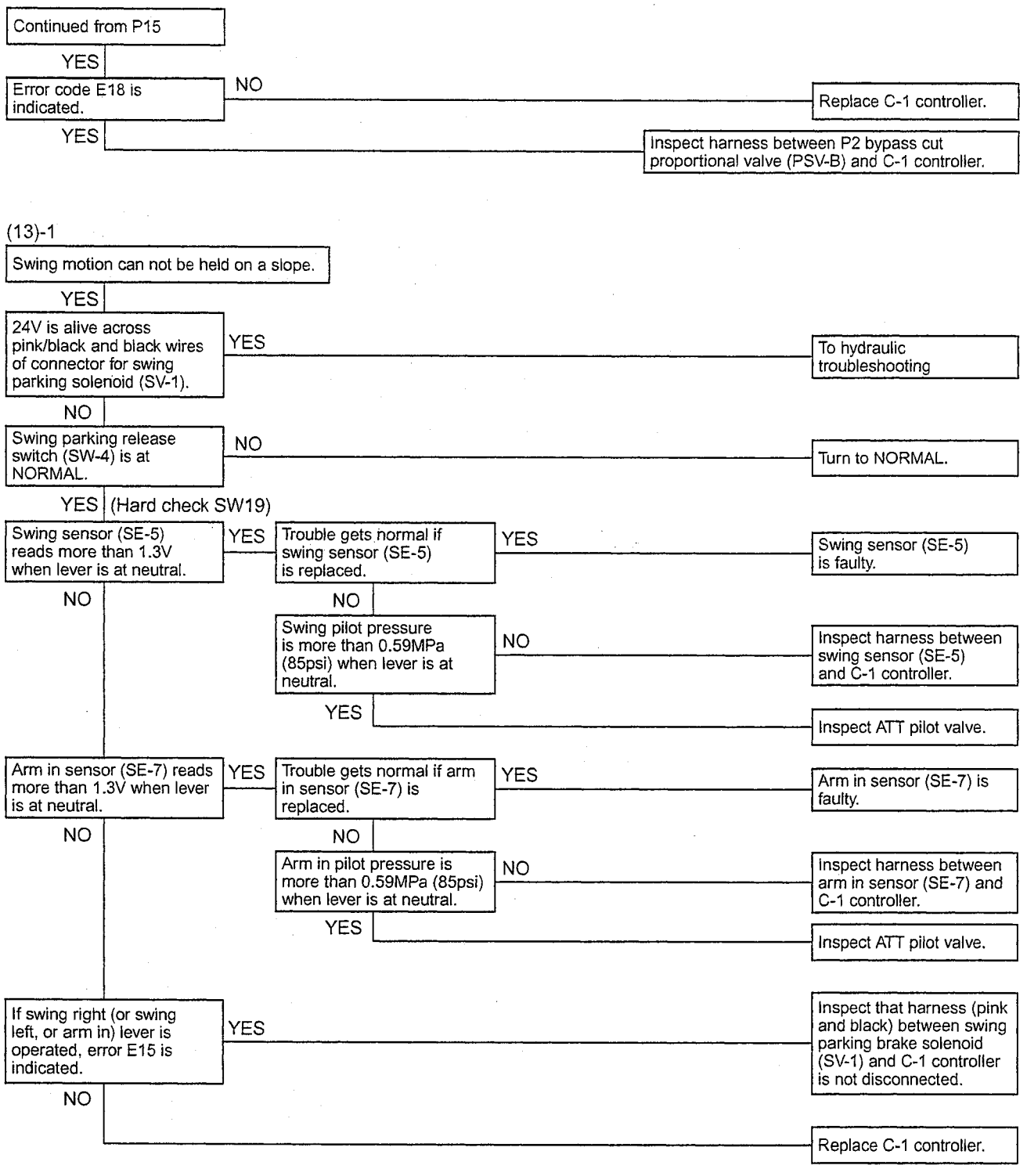
43

Book Code No. S5YT4303E01

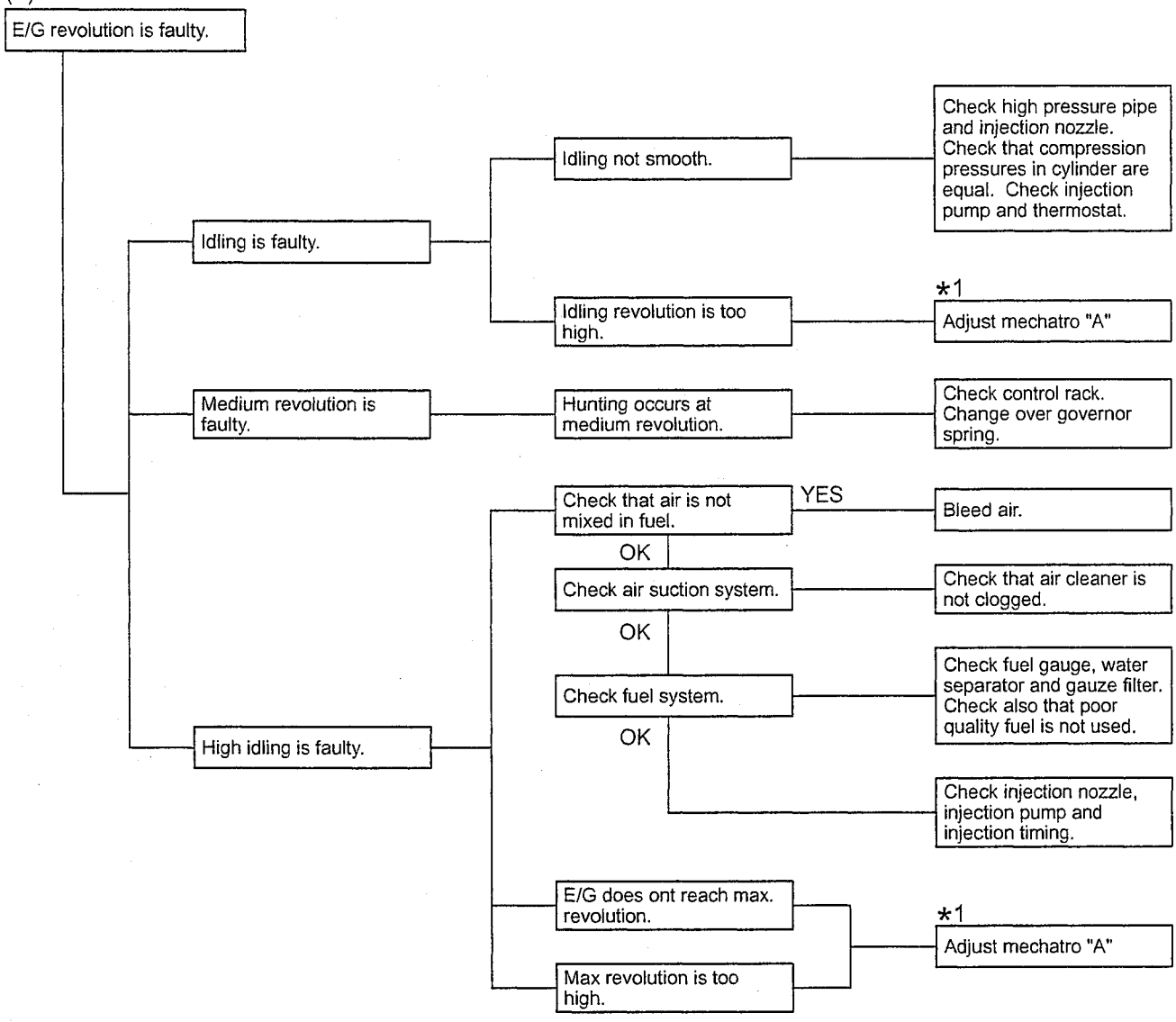

Continued from P5
YES
Error code E18 is shown on C-1 controller.
YES
Harness between C-1 controller and P2 bypass cut proportional valve (PSV-B) is disconnected or shorted.
YES
Inspect harness between C-1 controller and P2 bypass cut proportional valve (PSV-B).
NO
(Hard check SW30)
Command current for travel straight proportional valve (PSV-C) is more than approx. 350mA only when boom raise lever is shifted to the full.
NO
To hydraulic troubleshooting
YES
Travel right sensor (SE-9) shows approx. 1.3V when travel right lever is at neutral.
NO
Replace C-1 controller.
YES
Trouble disappears if travel right sensor (SE-9) is replaced.
YES
Travel right sensor (SE-9) is faulty.
NO
Travel right pilot pressure is more than 0.59MPa (85psi) when lever is at neutral.
NO
Inspect harness between travel right sensor (SE-9) and C-1 controller.
YES
Inspect travel pilot valve.

(2)-3


Only boom raise and arm in motions are slow.
YES
(Hard check SW30) ; controller service diagnosis 30
Command current for travel straight proportional valve is approx. 350mA or over at boom raise or arm in motions.
NO
To hydraulic troubleshooting
YES
(Hard check SW21)
(Hard check SW22)
Travel right sensor (SE-9) shows more than 1.3V when travel right lever is at neutral.
NO
Travel left sensor (SE-10) shows approx. 1.3V or over when travel left lever is at neutral.
NO
Replace C-1 controller.
YES
YES
Trouble disappears if travel left sensor (SE-10) is replaced.
NO
Travel left pilot pressure is more than 0.59MPa (85psi) when lever is at neutral.
NO
Inspect harness between travel left sensor (SE-10) and C-1 controller.
YES
YES
Inspect ATT pilot valve.
Replace travel left sensor (SE-10).
Trouble disappears when travel right sensor (SE-9) is replaced.
NO
Travel right pilot pressure is more than 0.59MPa (85psi) when lever is at neutral.
NO
Inspect harness between travel right sensor (SE-9) and controller.
YES
YES
Inspect travel pilot valve.
Replace travel right sensor (SE-9).


Continued from P15
YES
Error code E18 is indicated.
NO
Replace C-1 controller.
YES
Inspect harness between P2 bypass cut proportional valve (PSV-B) and C-1 controller.
(13)-1
Swing motion can not be held on a slope.
YES
24V is alive across pink/black and black wires of connector for swing parking solenoid (SV-1).
YES
To hydraulic troubleshooting
NO
Swing parking release switch (SW-4) is at NORMAL.
NO
Turn to NORMAL.
YES (Hard check SW19)
Swing sensor (SE-5) reads more than 1.3V when lever is at neutral.
YES
Trouble gets normal if swing sensor (SE-5) is replaced.
YES
Swing sensor (SE-5) is faulty.
NO
NO
Swing pilot pressure is more than 0.59MPa (85psi) when lever is at neutral.
NO
Inspect harness between swing sensor (SE-5) and C-1 controller.
YES
Inspect ATT pilot valve.
Arm in sensor (SE-7) reads more than 1.3V when lever is at neutral.
YES
Trouble gets normal if arm in sensor (SE-7) is replaced.
YES
Arm in sensor (SE-7) is faulty.
NO
NO
Arm in pilot pressure is more than 0.59MPa (85psi) when lever is at neutral.
NO
Inspect harness between arm in sensor (SE-7) and C-1 controller.
YES
Inspect ATT pilot valve.
If swing right (or swing left, or arm in) lever is operated, error E15 is indicated.
YES
Inspect that harness (pink and black) between swing parking brake solenoid (SV-1) and C-1 controller is not disconnected.
NO
Replace C-1 controller.

(3)



Checking condition ; E/G water temperature is more than 50°C (122°F).

*1 ; Refer to Electric Troubleshooting.

FOREWORD

This Workshop Manual is designed to help you perform necessary maintenance, service, and repair procedures on applicable Isuzu industrial engines.

Information contained in this Workshop Manual is the latest available at the time of publication.

Isuzu reserves the right to make changes at any time without prior notice.

This Workshop Manual is applicable to 1999 and later models.

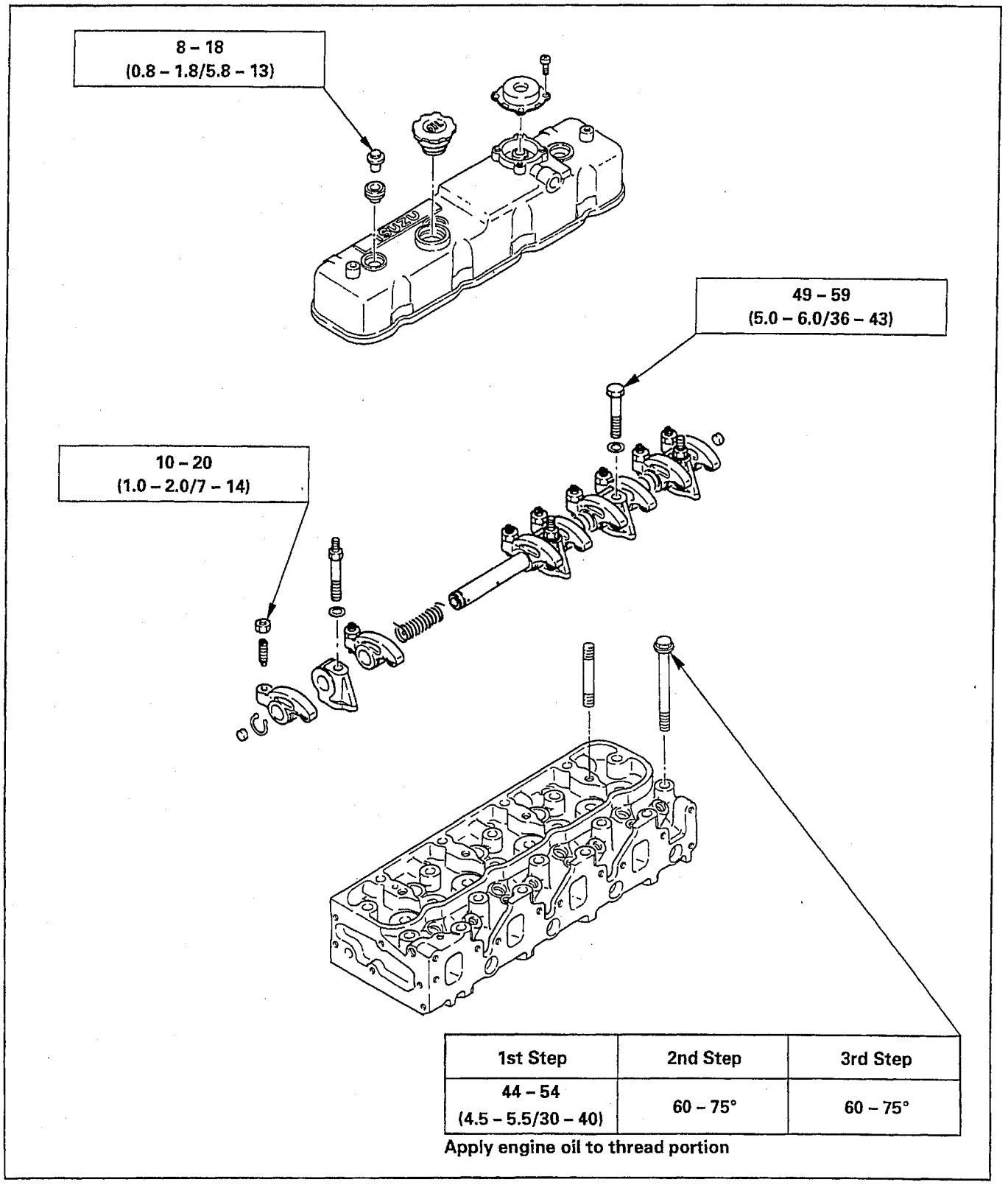
NOTICE

Before using this Workshop Manual to assist you in performing engine service and maintenance operations, it is recommended that you carefully read and throughly understand the information contained in Section - 1 under the headings "General Repair Instruction" and "Notes on The Format of This Manual"

SPECIAL PARTS FIXING NUTS AND BOLTS

Cylinder Head Cover, Cylinder Head, and Rocker Arm Shaft Bracket

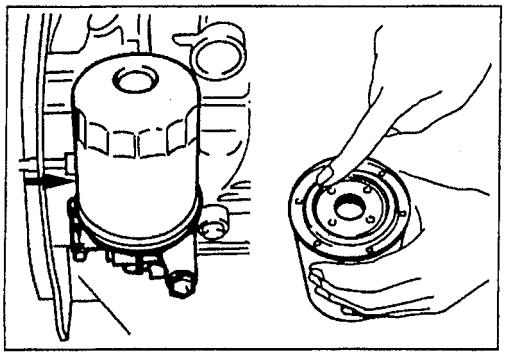
N·m (kgf·m/lb.ft)



1st Step	2nd Step	3rd Step
44 – 54 (4.5 – 5.5/30 – 40)	60 – 75°	60 – 75°

Apply engine oil to thread portion

4. Clean the oil cooler fitting face.
   This will allow the new oil filter to seat properly.
5. Apply a light coat of engine oil to the O-ring.
6. Turn in the new oil filter until the filter O-ring is fitted against the sealing face.

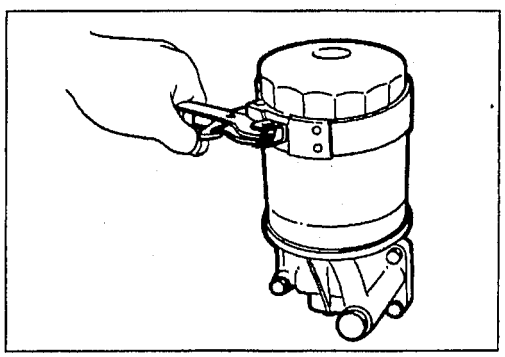


7. Use a filter wrench to turn in the filter an additional 1 and 1/4 of a turn.
   Filter Wrench
8. Check the engine oil level and replenish to the specified level if required.
9. Start the engine and check for oil leakage from the main oil filter.

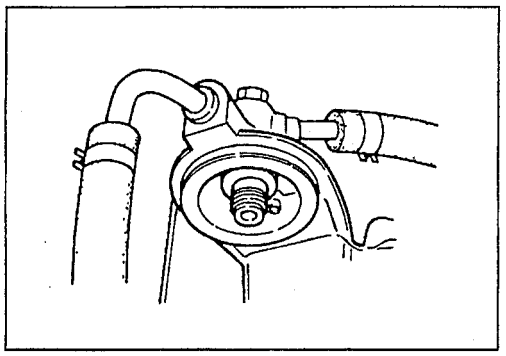
FUEL SYSTEM

Fuel Filter

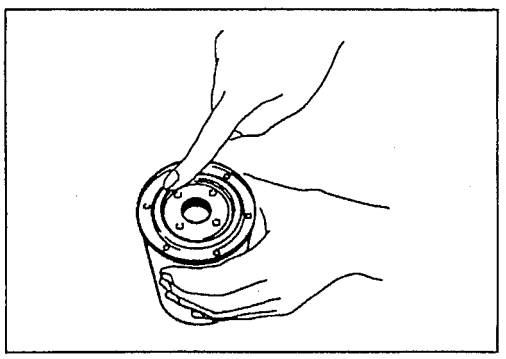
Replacement Procedure



1. Loosen the used fuel filter by turning it counterclockwise with the filter wrench.
   Filter Wrench



2. Clean the upper cover fitting face.
   This will allow the new fuel filter to seat properly.



3. Apply a light coat of engine oil to the O-ring.
4. Supply fuel to the new fuel filter to facilitate bleeding.
5. Turn in the new fuel filter until the filter O-ring is fitted against the sealing face.
   Be very careful to avoid fuel spillage.
6. Use a filter wrench to turn in the fuel filter an additional 1/3 to 2/3 of a turn.

SECTION 3

ENGINE ASSEMBLY (1)

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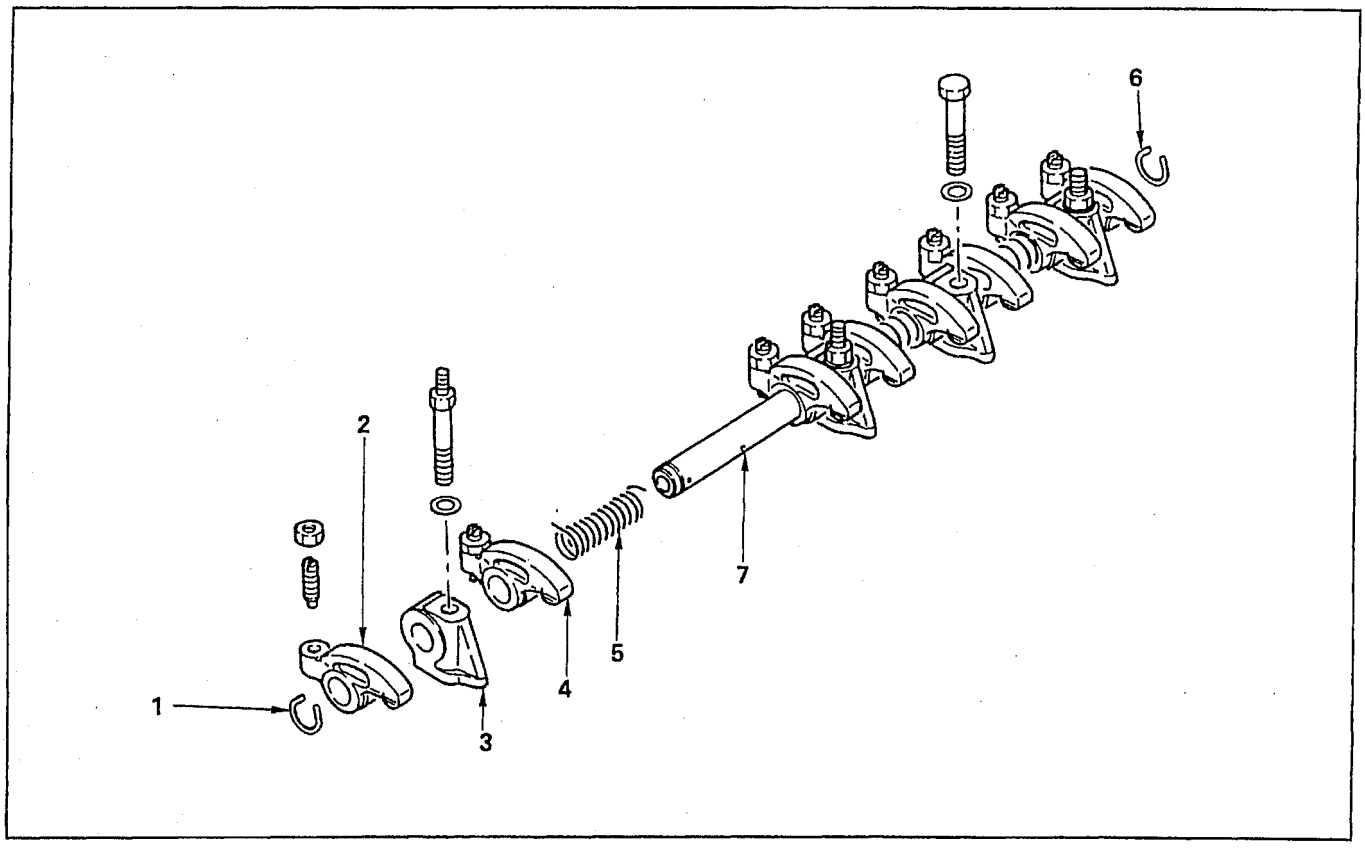
DISASSEMBLY

SINGLE UNIT

ROCKER ARM SHAFT AND ROCKER ARM

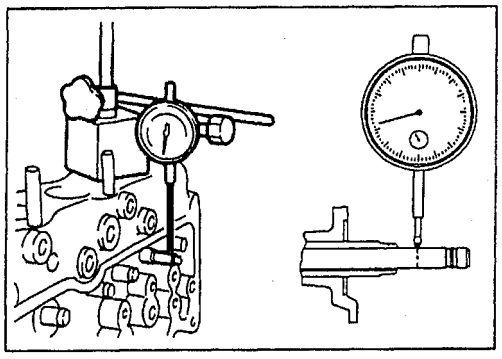


Disassembly Steps

▲ 1. Rocker arm shaft snap ring
▲ 2. Rocker arm
▲ 3. Rocker arm shaft bracket
4. Rocker arm
5. Rocker arm shaft spring
6. Rocker arm shaft snap ring
7. Rocker arm shaft

Manifold Fitting Face Warpage mm (in)

Standard	Limit	Maximum Grinding Allwance
0.05 (0.002) or less	0.2 (0.008)	0.4 (0.016)



VALVE GUIDE

Valve Stem and Valve Guide Clearance

Measuring Method - I

1. With the valve stem inserted in the valve guide, set the dial indicator needle to "0".
2. Move the valve head from side to side.

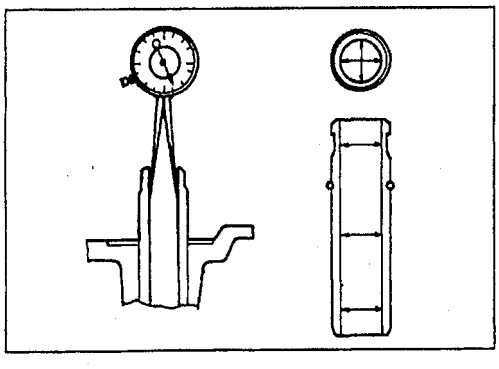
   Read the dial indicator.

   Note the highest dial indication.

   If the measured values exceed the specified limit, the valve and the valve guide must be replaced as a set.

Valve Stem Clearance mm(in)

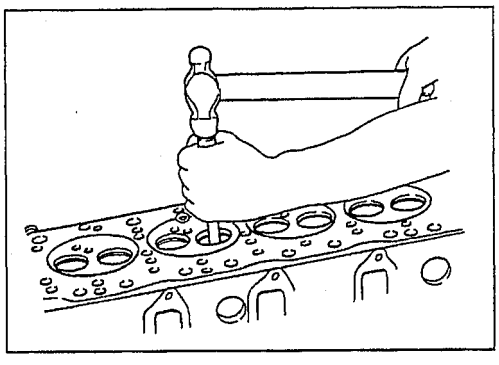
	Standard	Limit
Intake Valve	0.039 – 0.071 (0.0015 – 0.0028)	0.20 (0.008)
Exhaust Valve	0.064 – 0.096 (0.0025 – 0.0037)	0.25 (0.0098)



Measuring Method - II

1. Measure the valve stem outside diameter.

   Refer to the Item "Valve Stem Outside Diameter".
2. Use a caliper calibrator or a telescoping gauge to measure the valve guide inside diameter.



Valve Guide Replacement

Valve Guide Removal

Use a hammer and the valve guide replacer to drive out the valve guide from the cylinder head lower face.

Valve Guide Replacer: 9-8523-1212-0

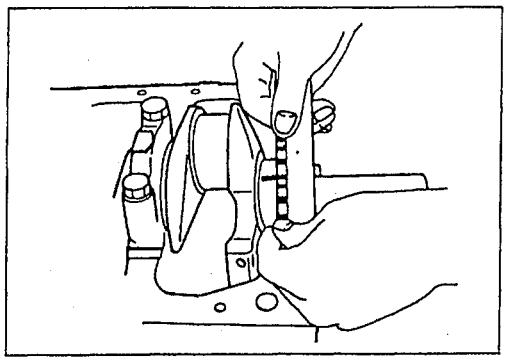
WARNING:

DRY ICE MUST BE USED WITH GREAT CARE. CARELESS HANDLING OF DRY ICE CAN RESULT IN SEVERE FROSTBITE.

Piston Selection

Select the same grade number as the one for the cylinder liner inside diameter.

Grade of cylinder inside diameter	Grade of piston	Combination
AX	AX	OK
CX	CX	OK
AX	CX	NG
CX	AX	NG



9. Compare the width of the Plastigage attached to either the crankshaft or the bearing against the scale printed on the Plastigage container.

   If the measured value exceeds the limit, perform the following additional steps.

   1) Use a micrometer to measure the crankshaft outside diameter.
   2) Use an inside dial indicator to measure the bearing inside diameter.

      If the crankshaft journal and bearing clearance exceeds the limit, the crankshaft and/or the bearing must be replaced.

Crankshaft Journal and Bearing Clearance mm(in)

Standard	Limit
0.031 – 0.063	0.11 (0.0043)

Crankpin and Bearing Clearance

1. Clean the crankshaft, the connecting rod, the bearing cap, and the bearings.
2. Install the bearing to the connecting rod and the bearing cap.

   Do not allow the crankshaft to move when installing the bearing cap.
3. Prevent the connecting rod from moving.
4. Attach the Plastigage to the crankpin.

   Apply engine oil to the Plastigage to keep it from falling.
5. Install the bearing cap and tighten it to the specified torque.

   Do not allow the connecting rod to move when installing and tightening the bearing cap.

Connecting Rod Bearing Cap Bolt Torque N·m(kgf·m/lb.ft)

27 – 31 (2.8 – 3.2/20 – 23)→45° – 60°

6. Remove the bearing cap.
7. Compare the width of the Plastigage attached to either the crankshaft or the bearing against the scale printed on the Plastigage container.

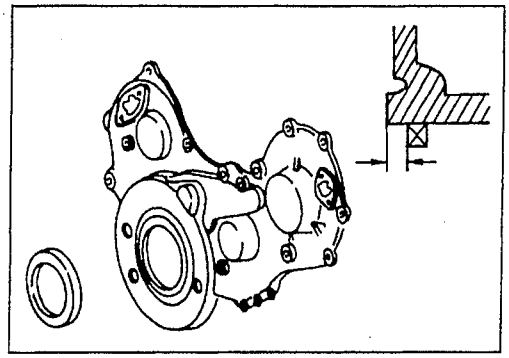
   If the measured value exceeds the specified limit, perform the following additional steps.

   1) Use a micrometer to measure the crankpin outside diameter.
   2) Use an inside dial indicator to measure the bearing inside diameter.

      If the crankpin and bearing clearance exceeds the specified limit, the crankshaft and/or the bearing must be replaced.

Crankpin and Bearing Clearance mm(in)

Standard	Limit
0.029 – 0.066 (0.0011 – 0.0026)	0.10 (0.0039)

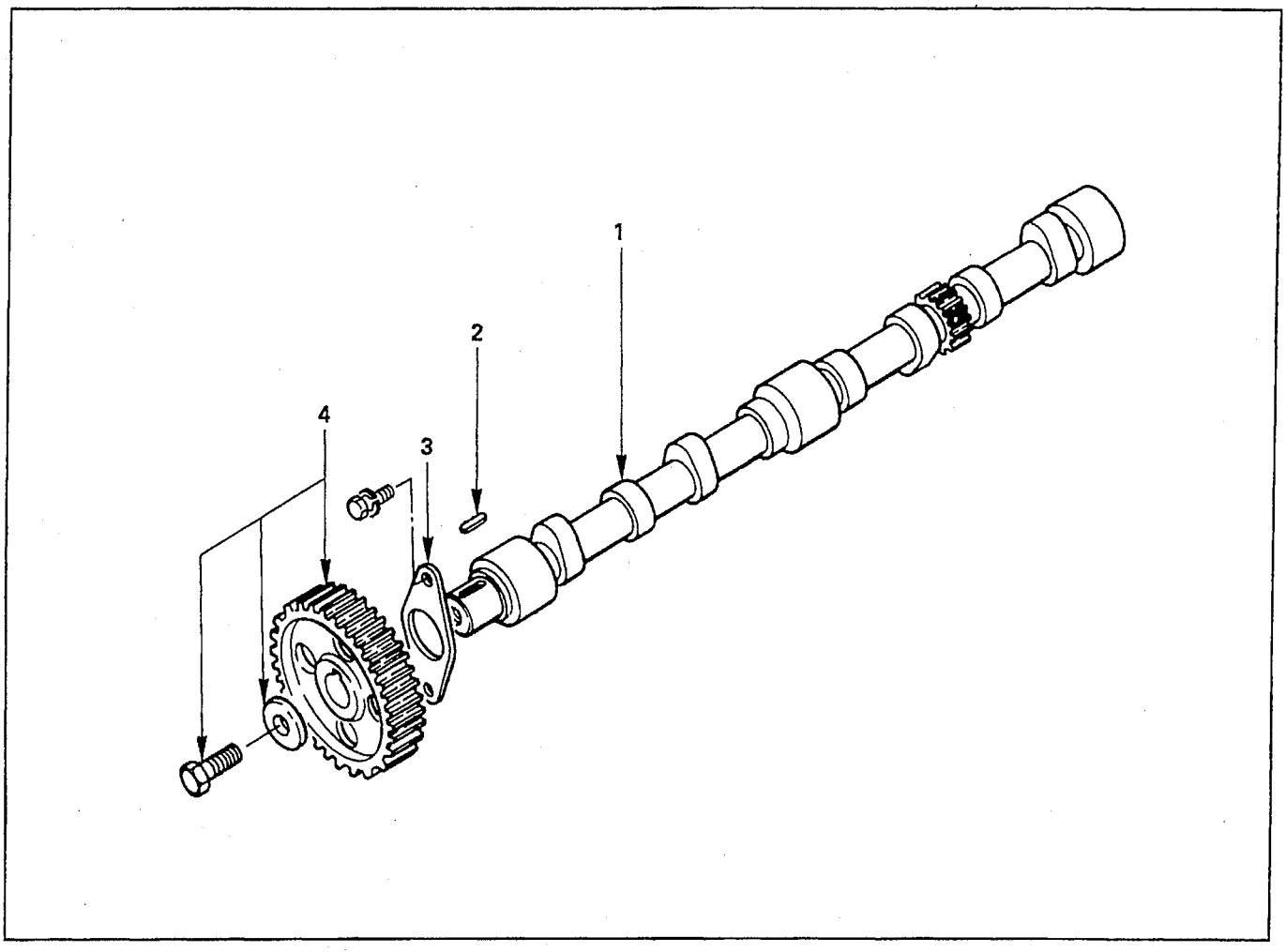


Oil Seal Installation

1. Apply a coat of engine oil to the oil seal lip circumference.
2. Use the oil seal installer and the installer grip to insert the oil seal 1 mm (0.039 in) into the front portion of the timing gear case.

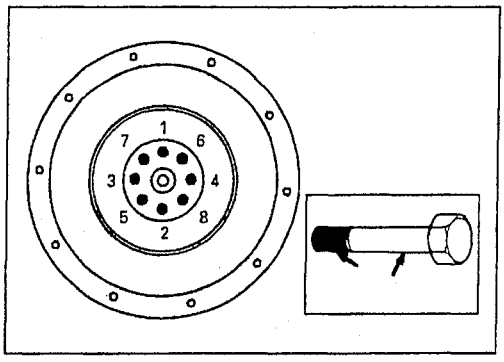
   Oil Seal Installer: 5-8840-2061-0

CAMSHAFT, CAMSHAFT TIMING GEAR, AND THRUST PLATE



Reassembly Steps

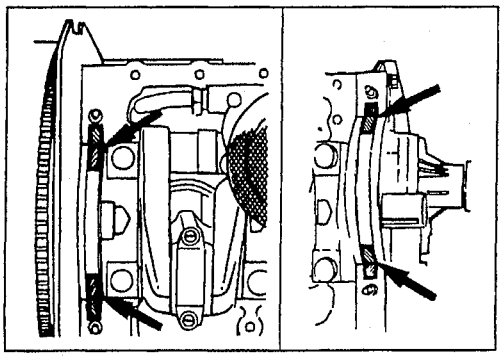
1. Camshaft
2. Feather key
3. Thrust plate
▲ 4. Camshaft timing gear



14. Flywheel

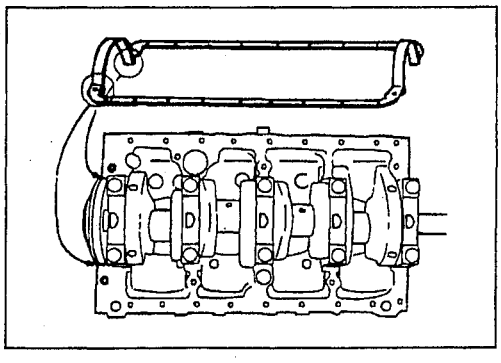
1) Block the flywheel with a piece of wood to prevent it from turning.
2) Apply a coat of engine oil to the threads of the flywheel bolts.
3) Tighten the flywheel bolts in the numerical order shown in the illustration.

Flywheel Bolt Torque	N·m(kgf·m/lb.ft)
113 – 123 (11.5 – 12.5/83 – 90)	



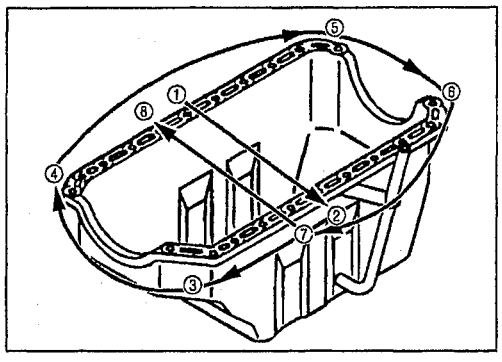
15. Oil Pan

1) Apply sealant TB – 1207B or equivalant to the No. 5 bearing cap arches, the bearing grooves, and the timing gear case arches at the positions shown in the illustration.



2) Fit the gasket rear lipped portion into the No. 5 bearing cap groove.

   Be absolutely sure that the lipped portion is fitted snugly in the groove.



3) Tighten the oil pan bolts to the specified torque a little at a time in the sequence shown in the illustration.

Oil Pan Bolt Torque	N·m(kgf·m/lb.ft)
14 – 24 (1.4 – 2.4/10 – 17)	

SECTION 6

LUBRICATING SYSTEM

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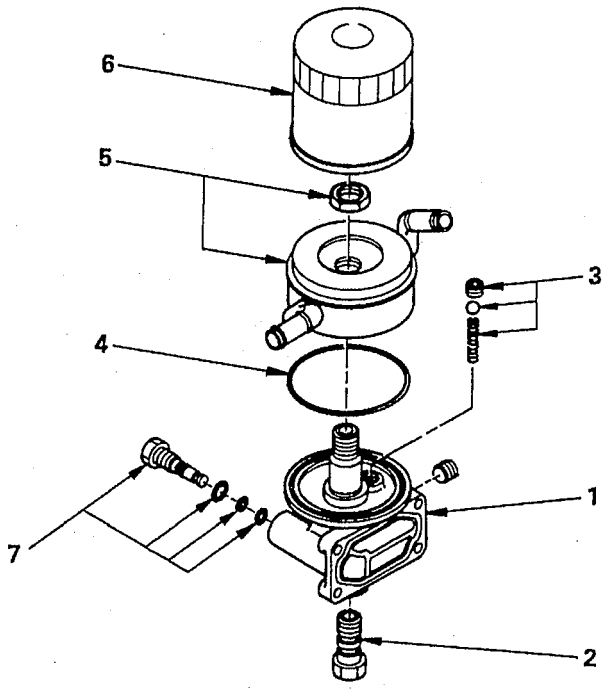
REASSEMBLY

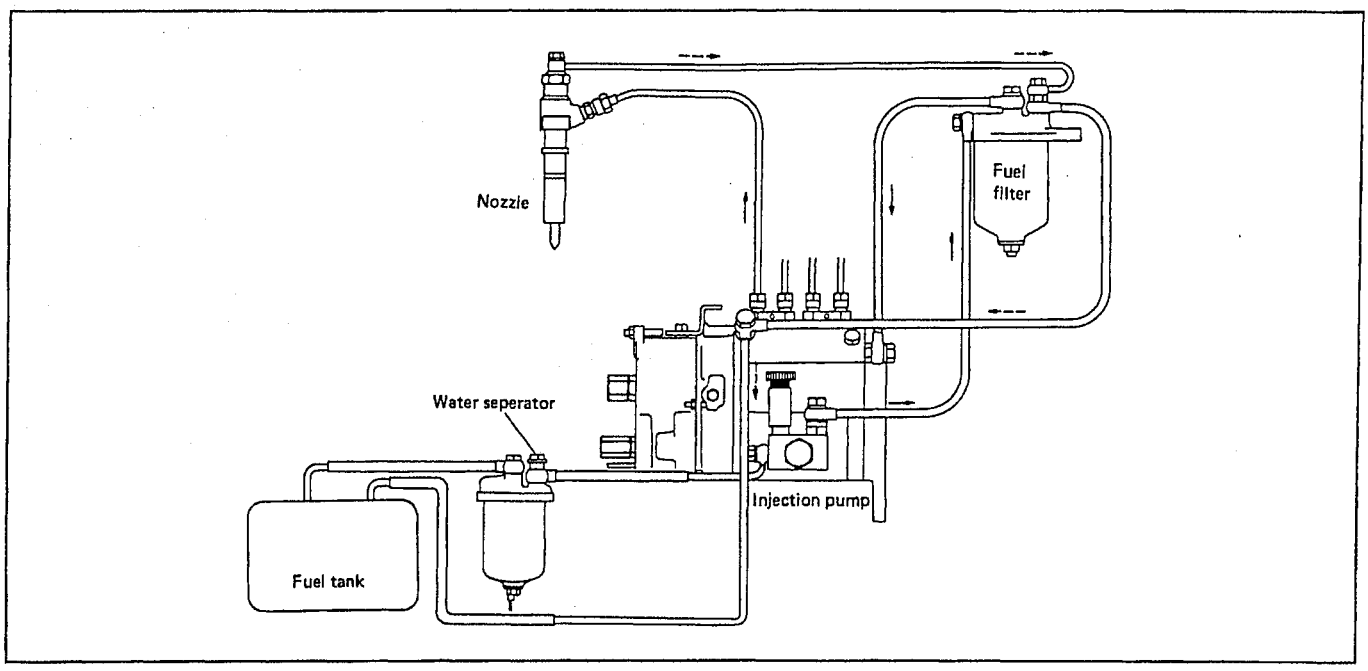


Reassembly Steps

1. Oil filter body
▲ 2. Relief valve
▲ 3. Safety valve
4. O-ring
▲ 5. Oil cooler
▲ 6. Oil filter cartridge
▲ 7. Drain plug

GENERAL DESCRIPTION

FUEL FLOW



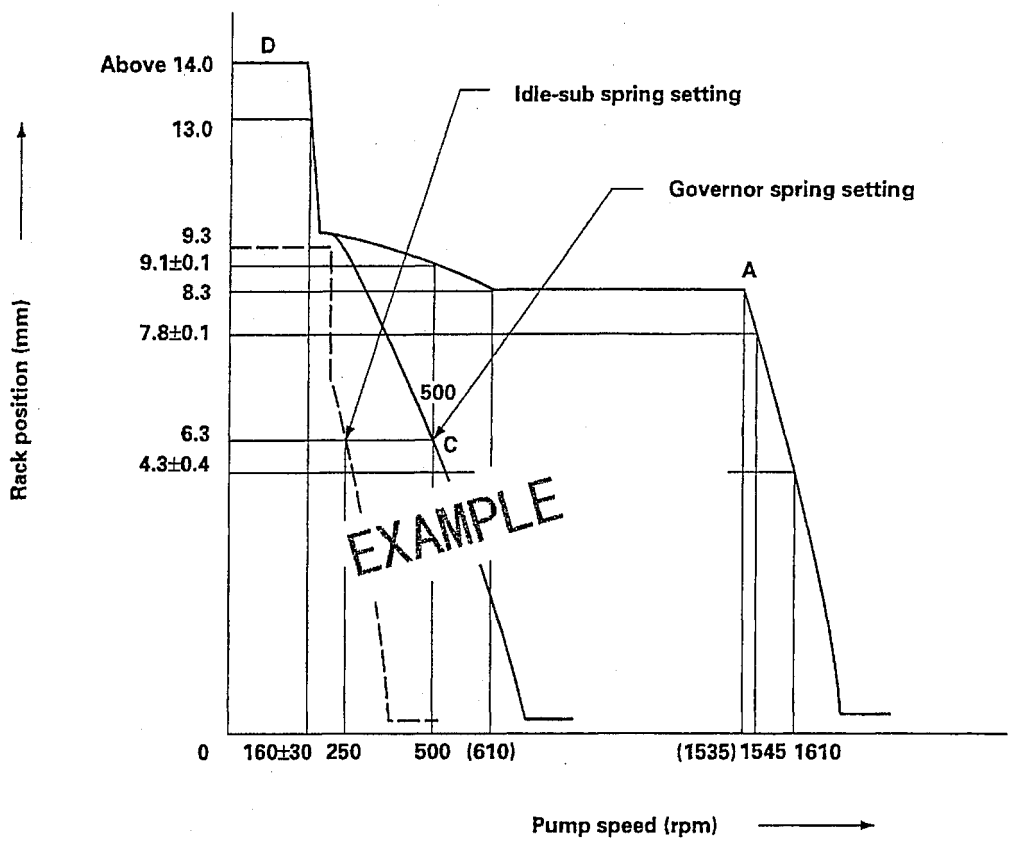
The fuel system consists of the fuel tank, the water separator (if so equipped), the fuel filter, the injection pump, and the injection nozzle.

The fuel from the fuel tank passes through the water separator and the fuel filter where water particles and other foreign material are removed from the fuel.

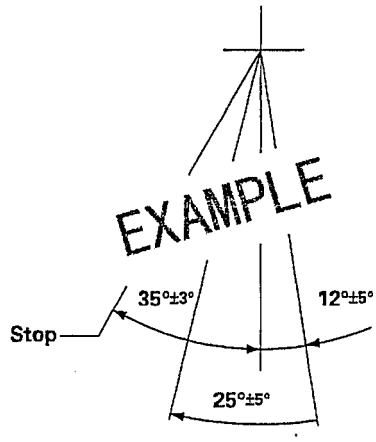
Fuel, fed by the injection pump plunger, is delivered to the injection nozzle in the measured volume at the optimum timing for efficient engine operation.

GOVERNOR ADJUSTMENT

Full Adjustment

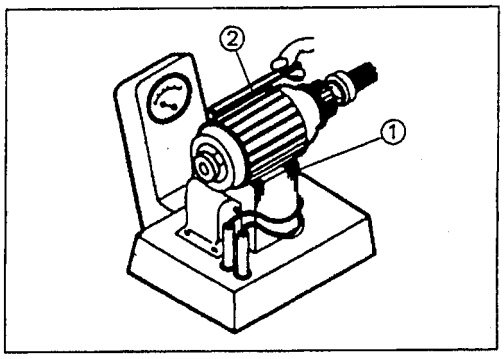


Speed Lever Angle



INSPECTION AND REPAIR

Make the necessary adjustments, repairs, and part replacements if excessive wear or damage is discovered during inspection.



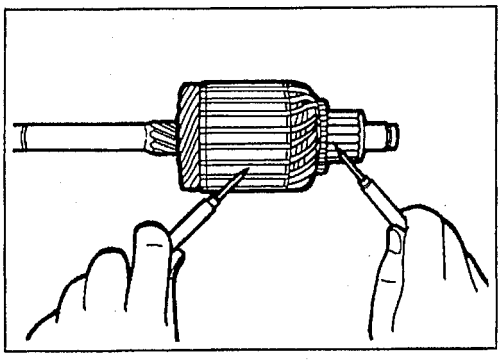
ARMATURE

Armature Short Circuit Test

1. Place the armature on a growler tester ①.
2. Hold a hack saw blade ② against the armature core while slowly rotating the armature.

   If the armature is short circuited, the hack saw blade will vibrate and will be attracted to the armature core.

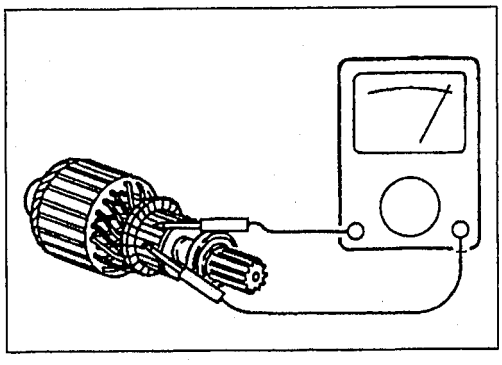
   A short circuited armature must be replaced.



Armature Winding Ground Test

Check for continuity across the commutator segments and the core.

If there is continuity, the armature is internally grounded due to insulation failure and must be replaced.

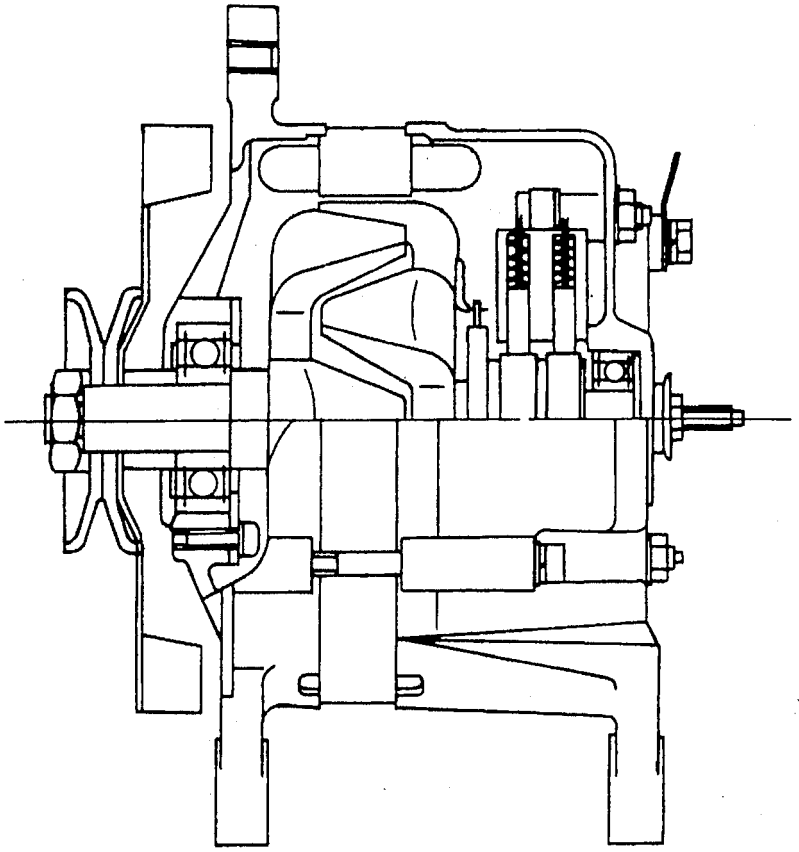


Armature Winding Continuity Test

Check for continuity across the commutator segment.

If there is no continuity, the armature coil is open and must be replaced.

GENERAL DESCRIPTION



Based on LR240

The alternator consists of the front cover, the rotor, the stator, the built-in IC regulator (some engines use a Tirrell alternator with separate regulator), and the rear cover.

This small size and light weight alternator provides excellent reliability. Its simple construction makes it very easy to service. The built-in IC regulator minimizes circuit wiring.

SECTION 10

TROUBLESHOOTING

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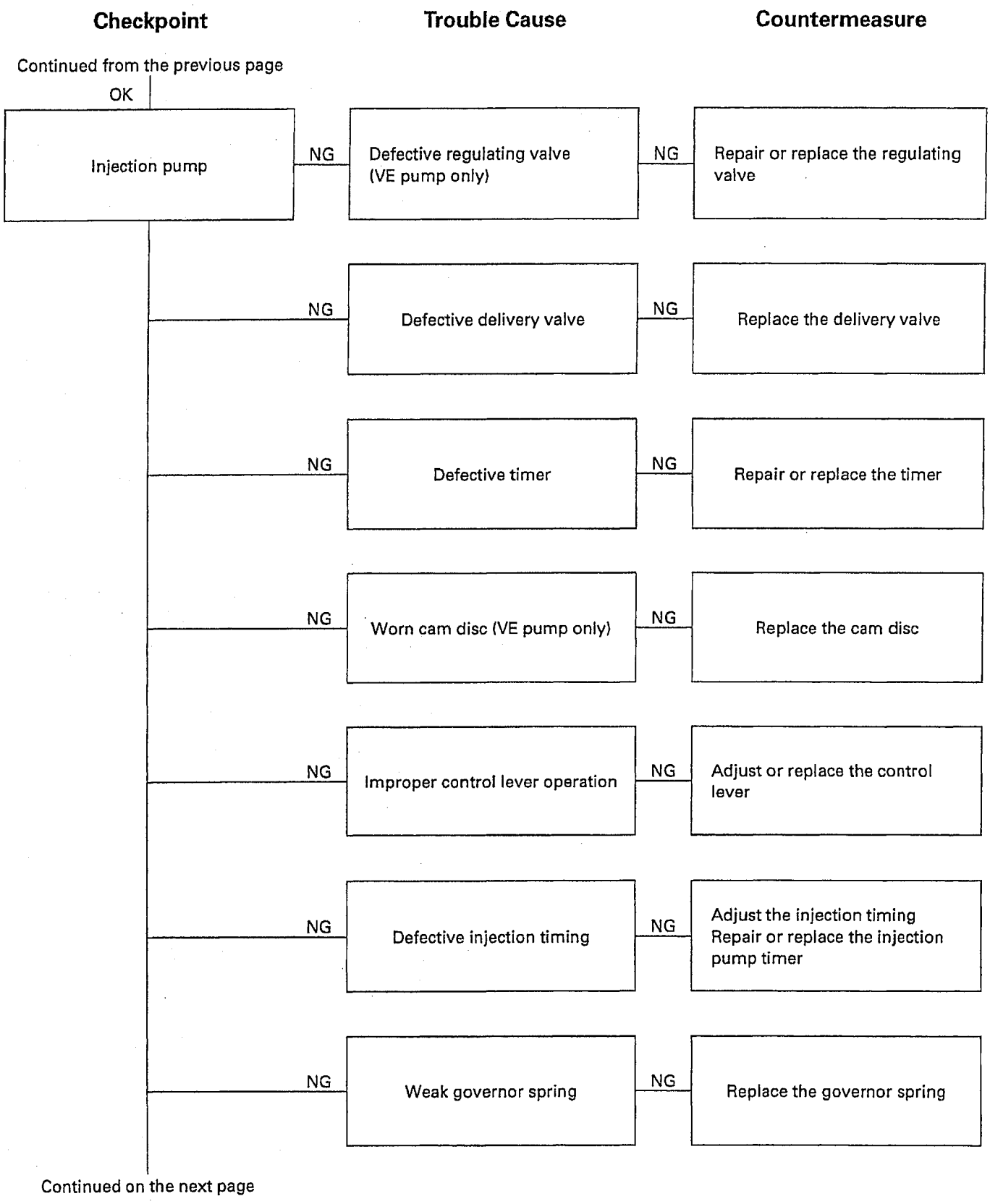
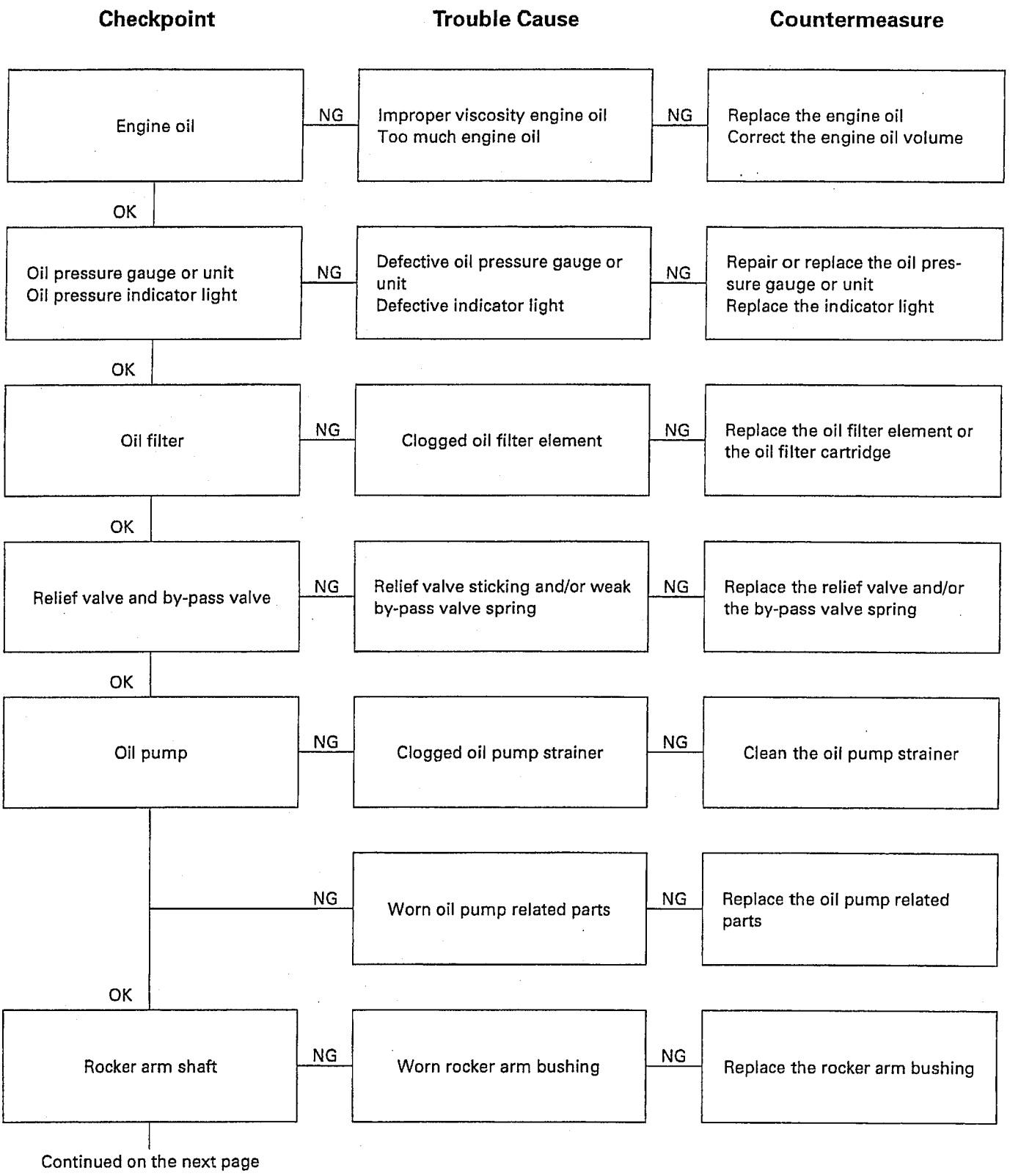
3. INSUFFICIENT POWER



9. OIL PRESSURE DOES NOT RISE



Continued on the next page

SECTION 12

REPAIR STANDARDS

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General Rules

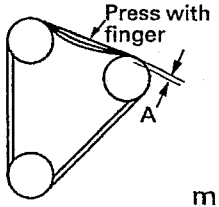
1. These tables provide standards relating the repair of the following diesel engine;

   Model A-4JG1

2. These Repair Standards are based on inspection items, together with dimensions, assembly standards, limit values, and repair procedures.
   (1) Nominal dimensions are the standard production values.
   (2) Assembly standards considered to be the values used as objectives during the assembly procedures which follow repairs; as a result, they may be somewhat at variance with the assembly dimensions of a new engine.
   (3) Limit values refer to the measured values resulting from wear, etc., beyond which a part must not be used. If a measured value falls beyond the limit value, the part involved must be repaired or replaced.
   (4) "Repair Procedures" indicates normal repair methods.
   (5) Unless otherwise stated, the unit of numerical values in tables should be taken to refer to millimeters, mm (in).

3. Explanation of Terms Used in Tables
   (1) The dimension of "wear" refers to the difference between the dimensions of a part which is not worn (or the "nominal dimension" of a part without wear) and the dimension of the part suffering from the most wear (the dimension of the worn part).
   (2) Uneven wear means the difference between the maximum and minimum wear values.

4. When repairs are requested on the overall engine, first perform bench tests to determine what parts require repairs, then perform the minimum disassembly and repairs required to correct the problems. When repairs on a specific engine part are requested, repairs to be made in reference to the relevant items in accordance with the repair standards listed in this manual.

Major Category	Name of Part	Inspection Item	Nominal Dimension	Assembly Standard Value	Limit	Repair Procedure	Comments
Cooling System	Water pump	Water pump ball bearing chatter (radial direction)			0.2 (0.0079)	Replace	
		Pumping rate L/min (pumping speed 3000 rpm, water temp 30°C (86°F) Total head 60 kPa or more)		100			
		Clearance between pump impeller and pump body mm		0.3 – 1.3 (0.0118 – 0.0512)		Repair or replace if impeller and pump body are touching	
		Fan belt deflection  mm(in)		8 – 12 (0.31 – 0.47)		Adjust	(Reference) 10 kgf (22.0 lb/98N) each
		Initial thermostat operating temperature (at sea level)	82°C (180°F)	80 – 84°C (176 – 183°F)			Replace thermostat if operation is incorrect.
		Thermostat full-open temperature (at sea level)		95°C (203°F)		Temperature at whic thermostat lift reaches 8mm(0.315in) or more.	
Fuel System	Piping, etc.	Clogged, cracked, loose fuel pipes, injection pipes, nozzle holders; defective seals.				Repair or replace	
		Fuel filter element clogging or damage				Replace	Cartridge type

TORQUE

FOOT POUNDS TO KILOGRAMMETERS

ft. lbs.	0	1	2	3	4	5	6	7	8	9	ft lbs.
	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	
—	—	0.138	0.277	0.415	0.553	0.691	0.830	0.968	1.106	1.244	—
10	1.383	1.521	1.659	1.797	1.936	2.074	2.212	2.350	2.489	2.627	10
20	2.765	2.903	3.042	3.180	3.318	3.456	3.595	3.733	3.871	4.009	20
30	4.148	4.286	4.424	4.562	4.701	4.839	4.977	5.115	5.254	5.392	30
40	5.530	5.668	5.807	5.945	6.083	6.221	6.360	6.498	6.636	6.774	40
50	6.913	7.051	7.189	7.328	7.466	7.604	7.742	7.881	8.019	8.157	50
60	8.295	8.434	8.572	8.710	8.848	8.987	9.125	9.263	9.401	9.540	60
70	9.678	9.816	9.954	10.093	10.231	10.369	10.507	10.646	10.784	10.922	70
80	11.060	11.199	11.337	11.475	11.613	11.752	11.890	12.028	12.166	12.305	80
90	12.443	12.581	12.719	12.858	12.996	13.134	13.272	13.411	13.549	13.687	90
100	13.826	13.964	14.102	14.240	14.379	14.517	14.655	14.793	14.932	15.070	100

KILOGRAMMETERS TO FOOT POUNDS

kgf-m	0	1	2	3	4	5	6	7	8	9	kgf-m
	ft. lbs.	ft. lbs.	ft. lbs.	ft. lbs.	ft. lbs.	ft. lbs.	ft. lbs.	ft. lbs.	ft. lbs.	ft. lbs.	
—	—	7.23	14.47	21.70	28.93	36.17	43.40	50.63	57.86	65.10	—
10	72.33	79.56	86.80	94.03	101.26	108.50	115.73	122.96	130.19	137.43	10
20	144.66	151.89	159.13	166.36	173.59	180.83	188.06	195.29	202.52	209.76	20
30	216.99	224.22	231.46	238.69	245.92	253.16	260.39	267.62	274.85	282.09	30
40	289.32	296.55	303.79	311.02	318.25	325.49	332.72	339.95	347.18	354.42	40
50	361.65	368.88	376.12	383.35	390.58	397.82	405.05	412.28	419.51	426.75	50
60	433.98	441.21	448.45	455.68	462.91	470.15	477.38	484.61	491.84	499.08	60
70	506.31	513.54	520.78	528.01	535.24	542.48	549.71	556.94	564.17	571.41	70
80	578.64	585.87	593.11	600.34	607.57	614.81	622.04	629.27	636.50	643.74	80
90	650.97	658.20	665.44	672.67	679.90	687.14	694.37	701.60	708.83	716.07	90
100	723.30	730.53	737.77	745.00	752.23	759.47	766.70	773.93	781.16	788.40	100

KILOGRAMMETERS TO NEWTONMETERS

kgf-m	0	1	2	3	4	5	6	7	8	9	kgf-m
	N-m	N-m	N-m	N-m	N-m	N-m	N-m	N-m	N-m	N-m	
—	—	9.81	19.61	29.42	39.23	49.03	58.84	68.65	78.45	88.26	—
10	98.07	107.87	117.68	127.49	137.29	147.10	156.91	166.71	176.52	186.33	10
20	196.13	205.94	215.75	225.55	235.36	245.17	254.97	264.78	274.59	284.39	20
30	294.20	304.01	313.81	323.62	333.43	343.23	353.04	362.85	372.65	382.46	30
40	392.27	402.07	411.88	421.69	431.49	441.30	451.11	460.91	470.72	480.53	40
50	490.33	500.14	509.95	519.75	529.56	539.37	549.17	558.98	568.79	578.59	50
60	588.40	598.21	608.01	617.82	627.63	637.43	647.24	657.05	666.85	676.66	60
70	686.47	696.27	706.08	715.89	725.69	735.50	745.31	755.11	764.92	774.73	70
80	784.53	794.34	804.15	813.95	823.76	833.57	843.37	853.18	862.99	872.79	80
90	882.60	892.41	902.21	912.02	921.83	931.63	941.44	951.25	961.05	970.86	90
100	980.67	990.47	1000.28	1010.08	1019.89	1029.70	1039.51	1049.31	1059.12	1068.93	100

NEWTONMETERS TO KILOGRAMMETERS

N-m	0	10	20	30	40	50	60	70	80	90	N-m
	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	kgf-m	
—	—	1.020	2.039	3.059	4.079	5.099	6.118	7.138	8.158	9.177	—
100	10.197	11.217	12.236	13.256	14.276	15.296	16.315	17.335	18.355	19.374	100
200	20.394	21.414	22.433	23.453	24.473	25.493	26.512	27.532	28.552	29.571	200
300	30.591	31.611	32.630	33.650	34.670	35.690	36.709	37.729	38.749	39.768	300
400	40.788	41.808	42.827	43.847	44.867	45.887	46.906	47.926	48.946	49.965	400
500	50.985	52.005	53.024	54.044	55.064	56.084	57.103	58.123	59.143	60.162	500
600	61.182	62.202	63.221	64.241	65.261	66.281	67.300	68.320	69.340	70.359	600
700	71.379	72.399	73.418	74.438	75.458	76.478	77.497	78.517	79.537	80.556	700
800	81.576	82.596	83.615	84.635	85.655	86.675	87.694	88.714	89.734	90.753	800
900	91.773	92.793	93.812	94.832	95.852	96.872	97.891	98.911	99.931	100.950	900
1000	101.970	102.990	104.009	105.029	106.049	107.069	108.088	109.108	110.128	111.147	1000

No.	Part No.	Parts name	Q'ty	Remarks	Applicable Machines
	YT64H00036F2	● CONTROL BLOCK PIPING			
B8	ZH22X04000	•• CONNECTOR	1		
B11	ZH32X04006	•• ELBOW	1		
	YT03H00025F3	● UPPER HYDRAULIC PIPING			
1	ZA23F18008	•• CONNECTOR	1		
3	ZD12P01800	•• O-RING	1		
4	YT32H01030P1	•• BUSHING	2		
5	YT03H01018P1	•• ROD BOLT	1		
6	ZW16H12000	•• WASHER	1		
7	ZN18C12010	•• NUT	6		
8	YT03H01039D1	•• HOSE	1		
9	YT03H01022P1	•• CLAMP	2		
11	YT32H01016P1	•• BUSHING	2		
12	ZE72X08000	•• PLUG	1		
	YT32H00009F5	● RETURN HYDRAULIC PIPING			
12	ZH42X12000	•• ELBOW	1		
16	2414Z199D5	•• HOSE	1		
26	YT32H01031D5	•• HOSE	1		
29	PY01P01043D8	•• CLIP	1		
35	YT32H01021P1	•• GROMMET	1		

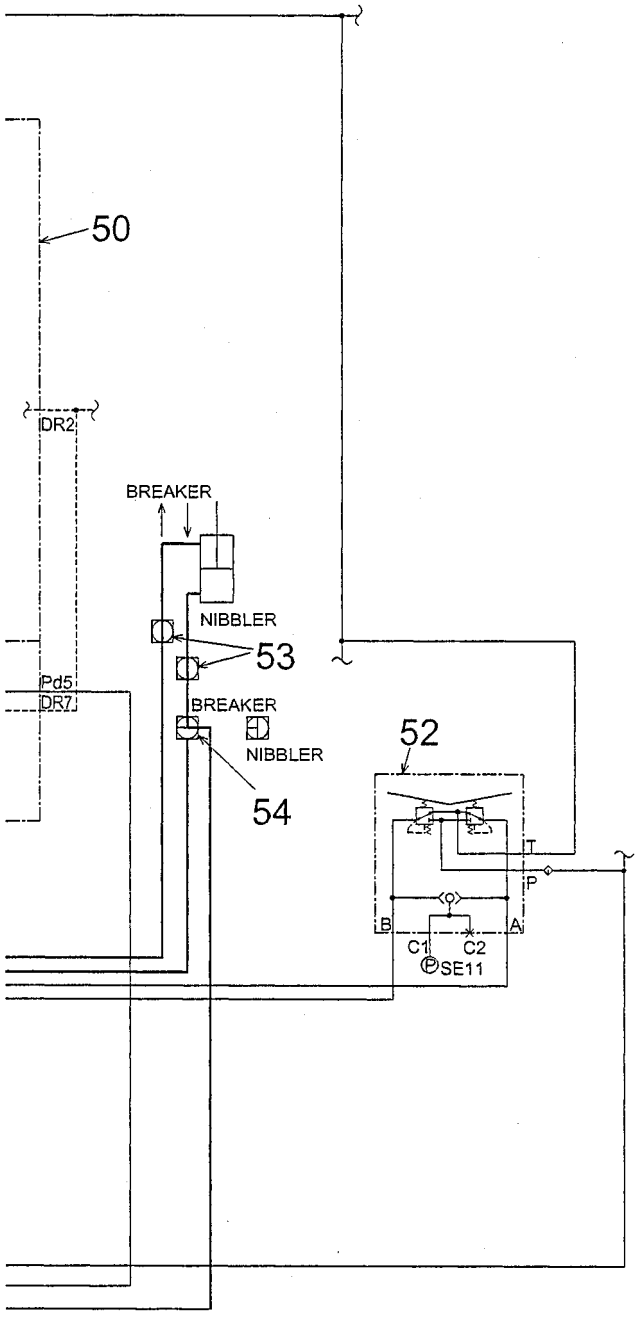
63.1.1.3 BOOM [BREAKER]

No.	Part No.	Parts name	Q'ty	Remarks	Applicable Machines
	YT32T01060F5	Boom modification kit No.(BREAKER)		ASIA, OCE	YT04-07001~
	YT32T01060F6	Boom modification kit No.(BREAKER)		KCMA	YT04-07001~
	YT32T01060F7	Boom modification kit No.(BREAKER)		KCME	YT04-07001~
	YT02B00056F2	● BOOM ASSY		ASIA, OCE	
	YT02B00063F4	● BOOM ASSY		KCME	
1A	YT02B00056F1	•• BOOM ASSY	(1)	ASIA, OCE	
1B	YT02B00063F3	•• BOOM ASSY	(1)	KCME	
2	HY35B10032G1	•• TAPPED BLOCK	6		
3	YR02B01274P1	•• TAPPED BLOCK	1		
4	YT02B01022P1	•• PLATE	1		
	YT02B00063F2	● BOOM ASSY	(1)	KCMA Usable as it is.	

No.	Part No.	Parts name	Q'ty	Remarks	Applicable Machines
	YT43H00052F1	● 1.65 M (5'5") ARM HYDRAULIC PIPING		KCME	
1	YT43H01056P1	•• TUBE	2		
2	YT43H01013DD	•• HOSE	2		
3	24100P1006F1	•• STOP VALVE	2		
4	ZC26X22011	•• CLAMP	2		
5	ZA23F22012	•• CONNECTOR	2		
6	ZD12P02400	•• O-RING	2		
7	ZS18C08025	•• CAPSCREW	8		
8	ZS18C10045	•• CAPSCREW	2		
9	ZW26X08000	•• LOCK WASHER	8		
10	ZW26X10000	•• LOCK WASHER	2		
	YT12B01025P1	● IDLER LINK (L.H)			
	YT12B01024P1	● IDLER LINK (R.H)			
0	YT12B01017P1	•• IDLER LINK (L.H)	(1)	For STD machine	
0	YT12B01016P1	•• IDLER LINK (R.H)	(1)	For STD machine	
1	YT12B01025P1002	•• PLATE	2		

63.1.2.4 LONG ARM [NIBBLER & BREAKER]

No.	Part No.	Parts name	Q'ty	Remarks	Applicable Machines
	YT32T01060FR	Long arm modification kit No. (NIBBLER & BREAKER)		ASIA, OCE	YT04-07001~
	YT32T01060FS	Long arm modification kit No. (NIBBLER & BREAKER)		KCMA	YT04-07001~
	YT32T01060FT	Long arm modification kit No. (NIBBLER & BREAKER)		KCME	YT04-07001~
	YT12B00071F2	● 2.07 M (6'9") ARM ASSY		ASIA, OCE	
	YT12B00080F2	● 2.07 M (6'9") ARM ASSY		KCME	
1A	YT12B00071F1	•• LONG ARM ASSY	(1)	ASIA, OCE	
1B	YT12B00080F1	•• LONG ARM ASSY	(1)	KCME	
2	YT12B01114P1	•• PLATE	1		
3	YT12B01115P1	•• PLATE	1		
4	YT12B1110P1	•• PLATE	1		
5	2416T24666	•• BRACKET	2		
6	YT12B01095P1	•• TAPPED BLOCK	1		
	YT12B00080F2	● 2.07 M (6'9") ARM ASSY		KCMA Usable as it is.	



- Hydraulic breaker operating

Foot pedal depressing section	Operating condition
Pedal in neutral position	Breaker stops operating.
Depress heel section	Breaker starts operating

(2) When the Breaker Used

When the breaker is used, the selector valve (54) and the stop valve (53) are shifted to the illustrated position. The pressurized oil which enter port (P1) of the control valve (50) from the port (A1) of the hydraulic pump flows into the nibbler & breaker spool of the option valve (50-1). In the meantime, the pressurized oil which enters port (P2) of the control valve (50) from port (A2) of the hydraulic pump flows into the single / conflux switch spool of the option vlave (50-1). If the single / conflux selector switch on the rear panel is turned on, the solenoid valve (SV-2) in the solenoid valve assy (51) operates. This causes the pilot pressure to shift the single / conflux switch spool. The result is that the hydraulic oil from port (A2) combines with that from port (A1) and flows into the nibbler & breaker spool. If the single / conflux selector switch is turned off, the oil pressure from the pump port (A2) is shut off, with the result that only the single flow from the pump port (A1) flows into the nibbler & breaker spool. Now, if you depress the heel of the pilot valve (52), the secondary pilot pressure from port (A) shifts the nibbler & breaker spool, cause the oil pressure from the pump port to the breaker and actuates the breaker. The oil which returns from the breaker returns directly to the hydraulic oil tank through the selector valve (54) and the return filter (12).

Table 63-4

MAIN CONTROL PIPING		YT06H00016F9	Q'ty	**ASIA, KCMA, AUST**
		YT06H00029F9		**New Zealand**
		YT06H00022F9		**KCME**
No.	Part No.	Name	Q'ty	Remarks
1	ZH32X04000	ELBOW	3	PF1/4
3	ZH22X04000	CONNECTOR	3	PF1/4
22	2444R1120D045	HOSE	1	PF1/4, L=450
28	HH55Q06004G3	TEE	1	PF3/8-PF1/4
31	2444R1120D150	HOSE	1	PF1/4, L=1500
38	2444Z2461	TEE	1	PF1/4

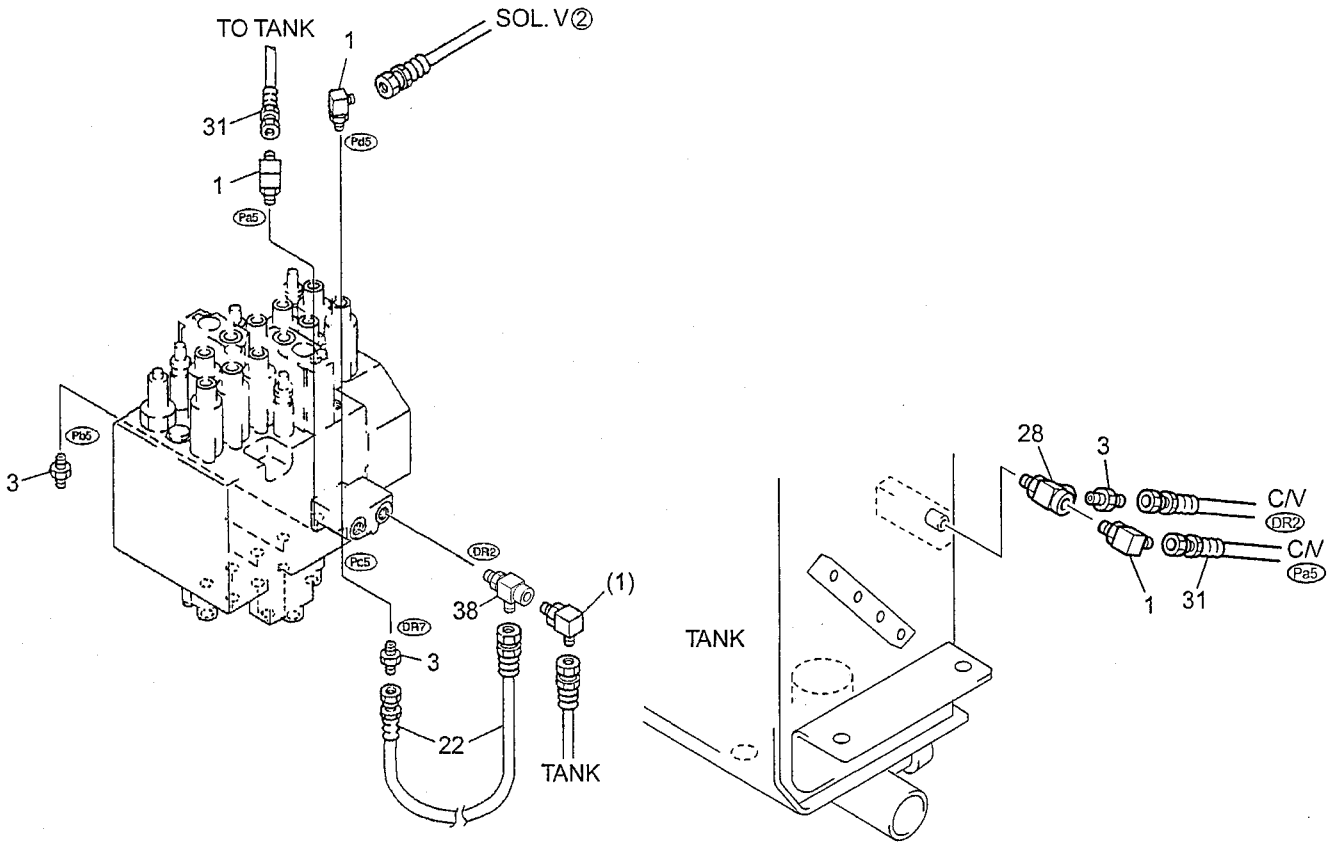


Fig. 63-9 Main control piping [Breaker]