3. SPECIFICATIONS AND PERFORMANCE

■ SPEED AND GRADEABILITY

SK40SR-2

Model		SK40SR-2 (with Rubber Shoe)	
Serial No		PH03-02001~	
Item			
Slewing Speed	min^{-1} {rpm}	9.3 {9.3}	
Travel Speed	km/h (mph)	Low (1st.)	High (2nd.)
		2.5 (1.5)	4.5 (2.8)
Gradeability	%(degree)	58 (30)	

■ ENGINE

Model (YANMAR)		[4TNE84] 4TNE84-EYB
Type		Vertical,4-cycle,water cooled diesel engine
Number of cylinders-Bore X Stroke		4-Ø84 mm X 90 mm
Total Displacement	L	1.99
Rated Output	kW/min^{-1} {PS/rpm}	22.8 / 2,100 {31.0 / 2,100}
Maximum Torque	N·m/min^{-1} {kgf·m/rpm}	118 / 1,400 {12 /1,400}
Starter	V X kW	12 X 2.0
Generator (Dynamo)	V X A	12 X 40

Note) ● The model name in [ ] is for the earlier one before the improvement / change.

■ HYDRAULIC COMPONENTS

Hydraulic Pump	Variable displacement axial piston + gearpump
Slewing Motor	Axial piston
Travel Motor	Axial psiton, 2 speed motor
Control Valve	10 spool multiple control valve
Cylinder (Boom,Arm,Swing Bucket,Dozer)	Double acting cylinder
Return filter	Paper filter with safety valve (30μ)

■ OFFSET DIGGING · DOZER

Mechanism		Boom swing operation by cylinder stroke
Boom swing angle degree	Right	Approx.58
	Left	Approx.83 (Cab spec : 73)
Stroke of dozer (Up / Down) mm (in)		360 /320 (14.2 / 12.6)

■ WEIGHT

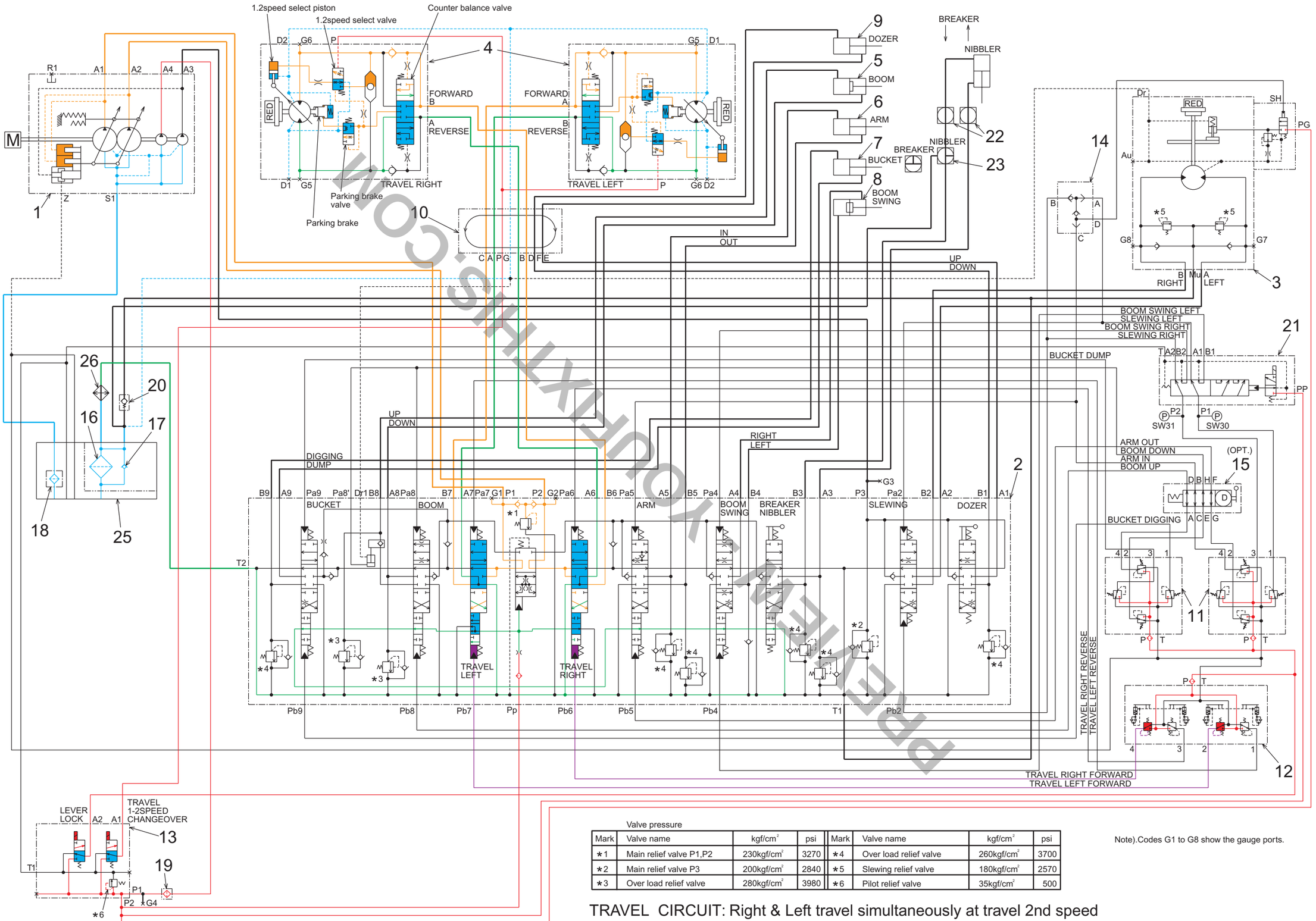
Unit : kg (lb)

Machine Weight	Rubber shoe, Canopy
	4,060 (8,950)
Upper slewing body	1,770 (3,900)
Travel system	1,660 (3,660)
Attachment (Boom+STD Arm+STD Bucket)	450 (990)
Oil & Water	104 (230)

Note) This figure is calculated with Japanese standard bucket.
Bucket weight 100 kg (220 lb)

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Valve pressure

Mark	Valve name	kgf/cm²	psi	Mark	Valve name	kgf/cm²	psi
∗1	Main relief valve P1,P2	230kgf/cm²	3270	∗4	Over load relief valve	260kgf/cm²	3700
∗2	Main relief valve P3	200kgf/cm²	2840	∗5	Slewing relief valve	180kgf/cm²	2570
∗3	Over load relief valve	280kgf/cm²	3980	∗6	Pilot relief valve	35kgf/cm²	500

Note).Codes G1 to G8 show the gauge ports.

TRAVEL CIRCUIT: Right & Left travel simultaneously at travel 2nd speed

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2. ELECTRIC CIRCUIT DIAGRAM (1 / 2)

Applicable machines : PH03-02001~
: PJ02-00101~

INST-PANEL AND RELAY ASSY

EXAMPLE OF WIRE COLOR

W L
- L: STRIPE COLOR (BLUE)
- W: BASE COLOR (WHITE)

WIRE COLOR TABLE

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

STANDARDS OF WIRE COLOR

- ELECTRIC POWER SOURCE CIRCUIT
- POWER AND CONTROL CIRCUIT
- GROUND CIRCUIT

ENGINE

E-13: BATTERY

20B

M-1: STARTER MOTOR

E-2: GENERATOR

E-8: AIR HEATER

SV-3: ENG. STOP SOL.

HOLD / PULL

D-14

TO (2/2)

1 RADIO, HEATER, WIPER WY 1.25
2 RELAY, SOL. YB
3 WORK LIGHT YG 1.25
4 HORN, ROOM LAMP 2RG 1.25
5 TIMER, RELAY 2W
6 GAUGE CLUSTER WG

E-1 FUSE BOX
30A / 10A / 30A / 30A / 30A / 10A

8 2R
71 3Y
7 2RB
72 L

R-1: BATTERY RELAY
(D-12)

6 WG
8 3R
8 5R
13 BW 1.25

R-2: SAFETY RELAY
B S C P AC E

14 2WR
8 8R
11 WY
6 WG

E-4: FUSIBLE LINK

R-8: CHARGE INDICATOR RELAY
1

9 8R
11 WY
81 GW
6 WG

BAT P L IG
IC REG

47 3L

SW-1: KEY SW.

POSITION

TERMINAL	HEAT	OFF	ON	START
B			●	●
R1				●
R2				●
ACC			●	●
BR			●	
C	●			

47 3L
47 3L
7 2RB
72 L
13 BW 1.25

5 2W
5 W
5 2W
15 YG
16 RW
R-6: TIMER UNIT
B
(D-3)
R-7: ENG. STOP RELAY
2B
(D-2)
E 2B
5 W
70 2GR

4 RG
17 PB
SW-7: HORN SW.
(D-1)
E-3: HORN
L-1: ROOM LAMP (FOR CAB)

1 WY
E-10: RADIO (FOR CAB)

SW-10: HEATER SW.

TERMINAL	OFF	LO	HI
E		●	●
L		●	
M			●

18 LY
19 LB

SW-4: WIPER WASHER SW. (FOR CAB)

TERMINAL	WASHER	OFF	ON	WASHER
L		●	●	●
E				
H		●	●	
M	●			●

20 G
22 Br
21 WB

M-2: WIPER MOTOR (FOR CAB)
LW LB B L
E-12: HEATER
M-3: WASHER MOTOR (FOR CAB)

TO (2/2)

SW-23: Travel alarm select sw.
1 WY 54 PL

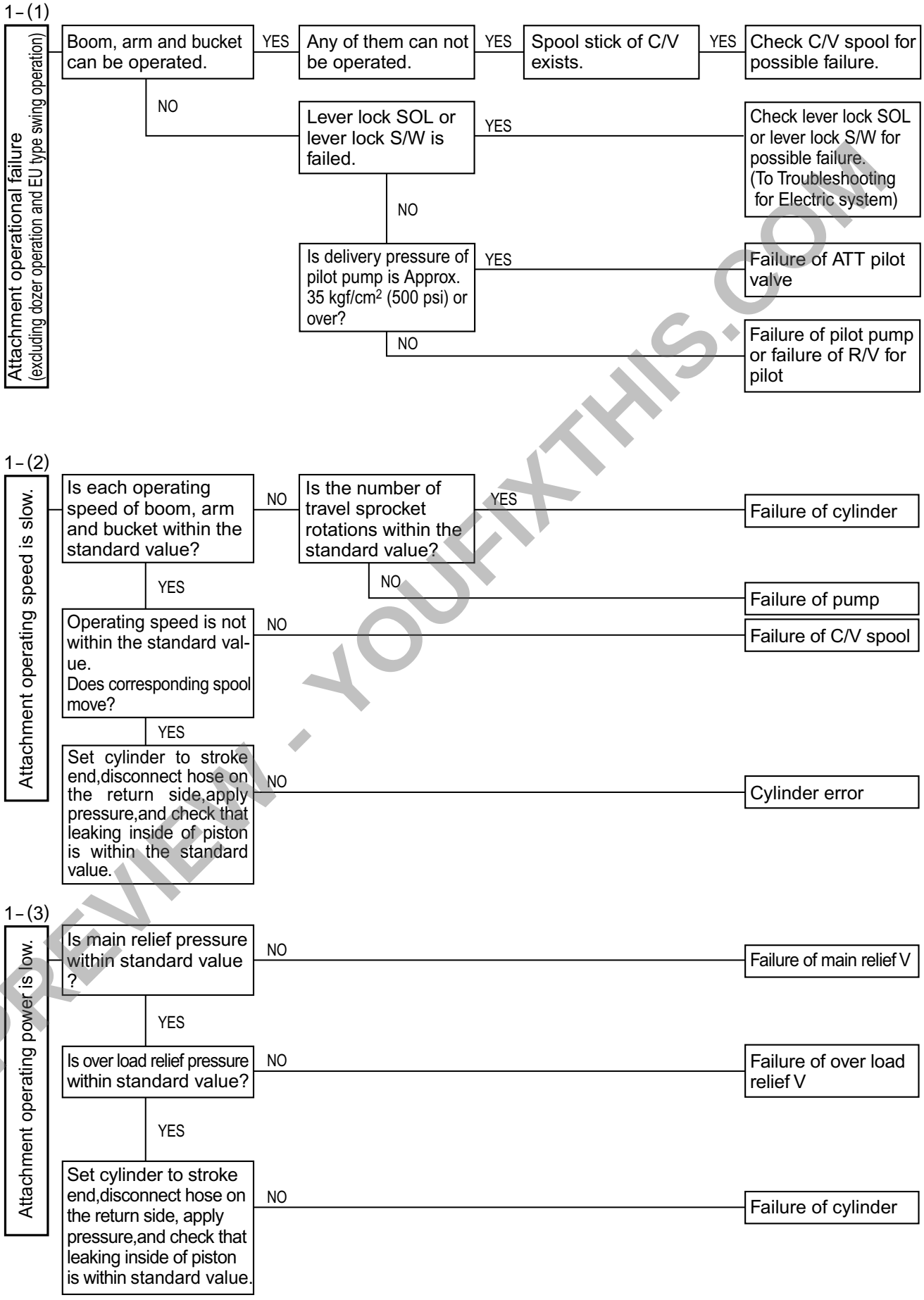
SW-24: Travel right (forward)press.sw.
55 YL
E-20 Travel alarm

SW-25: Travel right(backward) press.sw.
SW-26: Travel left(forward) press.sw.
SW-27: Travel left(backward) press.sw.

EU OPT.
OCEANIA STD.

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Part I : REMOVING AND INSTALLING

1. REMOVAL&INSTALLATION CANOPY OR CAB

[A] before BU
SK40SR-2 : PH03-02001~
SK45SR-2 : PJ02-00101~

A.1.1 REMOVAL OF CANOPY

(1) Remove floor mat (A15).

(2) Removing cover (A7).
Loosen sems bolt (A6) M8 X 20 and (A10) M8 X 25 one each and remove the cover.
However, the removal of the cover (A7) is required only when the handrail shown in Par.(4) is removed.

: 13 mm

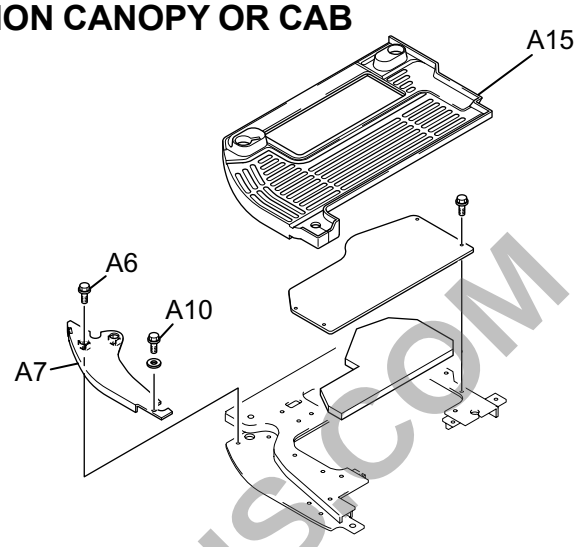


Fig. 1-1
Removing floor mat
Removing cover (A7)

(3) Removing canopy assy
Loosen two capscrews (19) M16X60 and 2 capscrews (9) M20 X100, and remove support (2,7) and canopy (1) together.
: 24 mm
Canopy weight: 79 kg (174 lb)

(4) Removing handrail (11)
Loosen one sems bolt (4) M10 X 40 and 2 sems bolts (16) M10 X 25, and remove the handrail (11).
: 19 mm

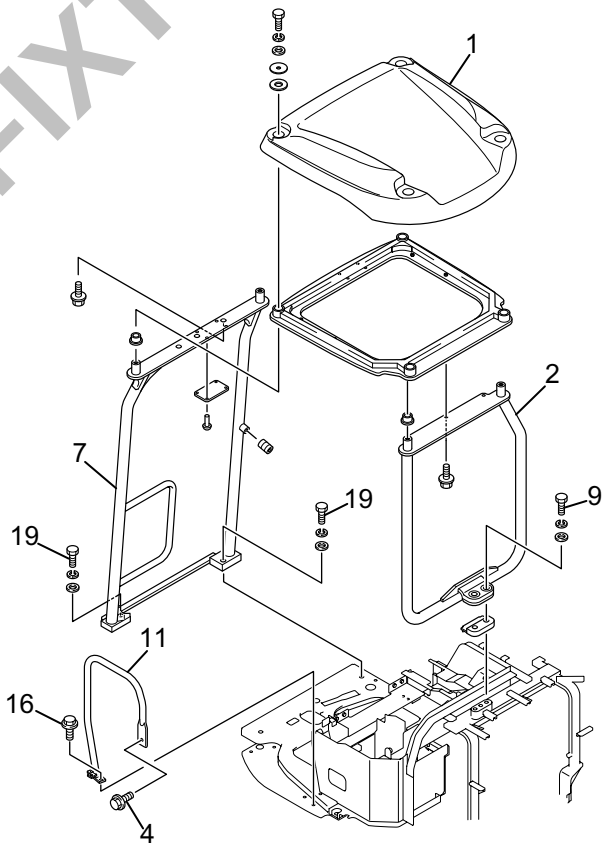


Fig.1-2
Removing canopy assy
Removing hand rail (11)

(5) Install it by the procedure reverse of the removal.

A.1.2 REMOVAL OF CAB (OPT)

A.1.2.1 Removing cab

(1) Remove floor mat(A13).

(2) Removing cab harness connector.

1) Remove the cab harness and 12P connector for the harness connecting to the cab at the control stand on the right rear side. (For details, refer to the chapter “Electric System”.)

2) Remove coupler 3P for radio at the control stand on the left rear side.(OPT)

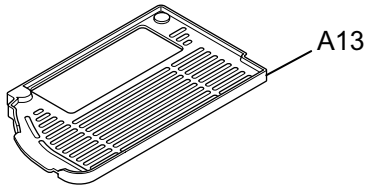


Fig. 1-3 Removing floor mat (A13)

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TABLE OF CONTENTS

Book Code No. and Distribution Month/Year			Section	Chapter Title	Chapter Number
			Section 1 **SPECIFICATIONS**		
S5PJ0102E-00 Oct 2001	S5PJ0102E-01 Jan 2003			Preliminary Remarks	S5**PJ01**02E
S5PJ0202E-00 Oct 2001	S5PJ0202E-01 Jan 2003			Specifications	S5**PJ02**02E
S5PJ0302E-00 Oct 2001	S5PJ0302E-01 Jan 2003			Attachment Dimensions	S5**PJ03**02E
S5PJ1102E-00 Oct 2001	S5PJ1102E-01 Dec 2002		Section 2 **MAINTENANCE**	Tools	S5**PJ10**02E
S5PJ1202E-00 Oct 2001	S5PJ1202E-01 Jan 2003			Standard Maintenance Time Table	S5**PJ12**02E
S5PJ1302E-00 Oct 2001	S5PJ1302E-01 Jan 2003			Maintenance Standard and Test Procedures	S5**PJ13**02E
			Section 3 **SYSTEM**		
S5PJ2202E-00 Oct 2001	S5PJ2202E-01 Jan 2003			Hydraulic Systems	S5**PJ22**02E
S5PJ2302E-00 Jan 2001	S5PJ2302E-01 Jan 2003			Electric System	S5**PJ23**02E
S5PJ2402E-00 Oct 2001	S5PJ2402E-01 Jan 2003			Components System	S5**PJ24**02E
S5PJ3102E-00 Oct 2001	S5PJ3102E-01 Jan 2003		Section 4 **DISASSEMBLY and ASSEMBLY**	Disassembling and Assembling	S5**PJ31**02E
S5PJ3202E-00 Jan 2001	S5PJ3202E-01 Jan 2003			Attachments	S5**PJ32**02E
S5PJ3302E-00 Oct 2001	S5PJ3302E-01 Jan 2003			Upper Structure	S5**PJ33**02E
S5PJ3402E-00 Oct 2001	S5PJ3402E-01 Jan 2003			Travel System	S5**PJ34**02E
			Section 5 **TROUBLESHOOTING**		
S5PJ4202E-00 Oct 2001	S5PJ4202E-01 Jan 2003			Troubleshooting (Hydraulic)	S5**PJ42**02E
S5PJ4302E-00 Oct 2001	S5PJ4302E-01 Jan 2003			Troubleshooting (Electrical)	S5**PJ43**02E
S5PJ4402E-00 Oct 2001	S5PJ4402E-01 Jan 2003			Troubleshooting (Engine)	S5**PJ44**02E
S5PJ5102E-00 Oct 2001	S5PJ5102E-01 Jan 2003		Section 6 **ENGINE**	Engine	S5**PJ51**02E
			Section 7 **MISCELLANEOUS**		

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1.1 GENERAL SAFETY INFORMATION

WARNING

Do Not operate or perform any maintenance on this machine until all instructions found in the OPERATOR'S MANUAL have been thoroughly read and understood.

Improper operation or maintenance of this machine may cause accidents and could result in serious injury or death.

Always keep the manual in the operator's seat pocket.

If it is missing or damaged, place an order with an authorized Distributor for a replacement.

If you have any questions, please consult an authorized Distributor.

1. Most accidents, which occur during operation, are due to neglect of precautionary measures and safety rules. Sufficient care should be taken to avoid these accidents. Erroneous operation, lubrication or maintenance services are very dangerous and may cause injury or death of personnel. Therefore all precautionary measures, **NOTES, DANGERS, WARNINGS** and **CAUTIONS** contained in this manual and on the machine should be read and understood by all personnel before starting any work with or on the machine.
2. Operation, inspection, and maintenance should be carefully carried out, and safety must be given the first priority. Messages of safety are indicated with marks. The safety information contained in this manual is intended only to supplement safety codes, insurance requirements, local laws, rules and regulations.
3. Messages of safety appear in this manual and on the machine. All messages of safety are identified by the words **DANGER**, **WARNING** and **CAUTION**.
   a. **DANGER** – Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury and is represented as follows:

DANGER

   b. **WARNING** – Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury and is represented as follows:

WARNING

   c. **CAUTION** – Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against possible damage to the machine and its components and is represented as follows:

CAUTION

4. It is very difficult to forecast every danger that may occur during operation. However, safety can be ensured by fully understanding proper operating procedures for this machine according to methods recommended by the manufacturer.
5. While operating the machine, be sure to perform work with great care, so as not to damage the machine, or allow accidents to occur.
6. Continue studying this manual until all Safety, Operation and Maintenance procedures are completely understood by all persons working with the machine.

WARNING

The proper and safe lubrication and maintenance for this machine, recommended by the manufacturer, is outlined in the OPERATOR'S MANUAL for this machine.

Improper performance of lubrication or maintenance procedures are dangerous and could result in injury or death. Read and understand the OPERATOR'S MANUAL before performing any lubrication or maintenance.

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1. BOOM

1.1 BOOM DIMENSION

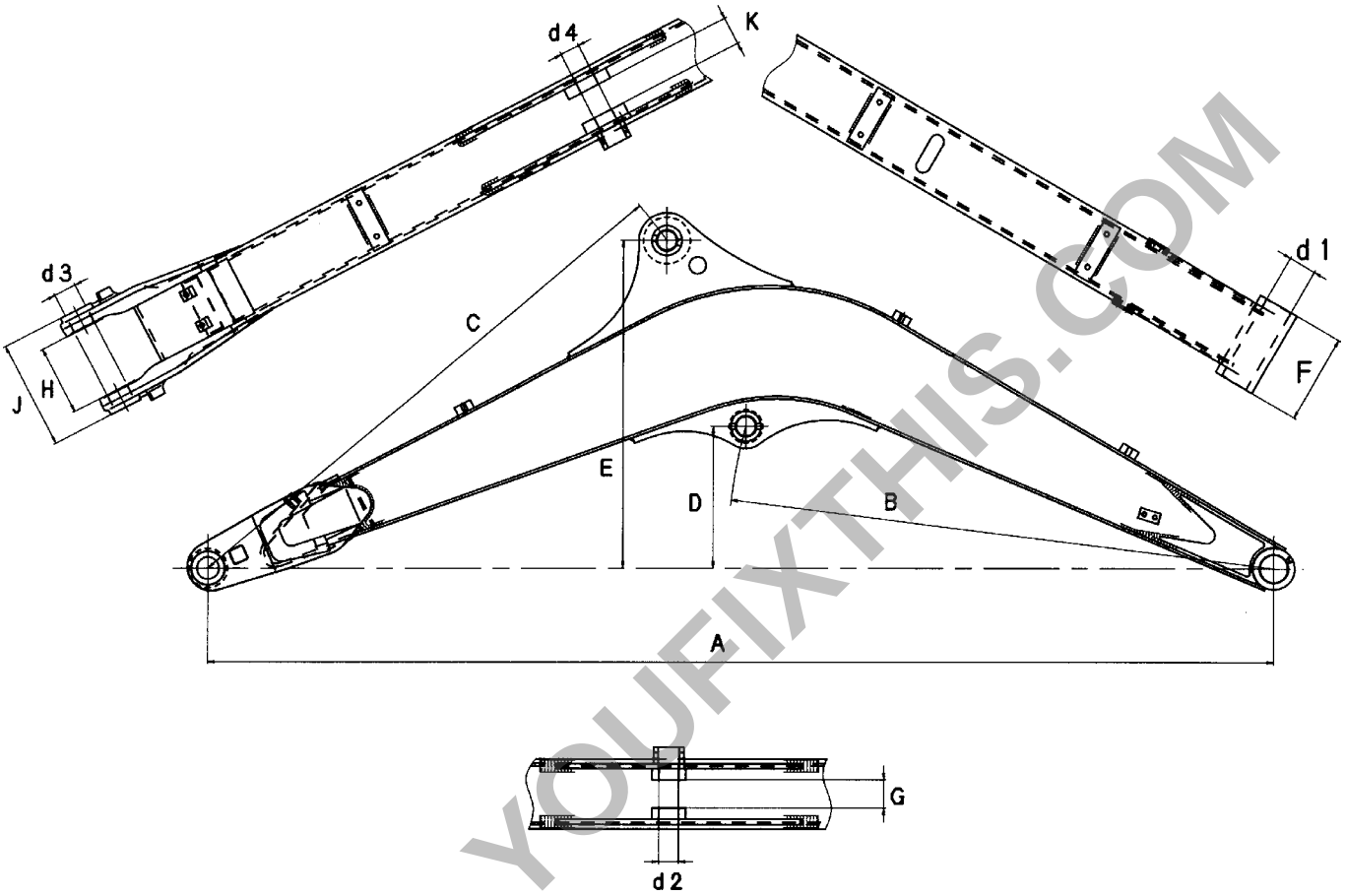


Fig. 1-1 Boom dimension

Table 1-1

Unit : mm (ft-in)

Code	Item	DIMENSIONS	
		SK40SR-2	SK45SR-2
A	Boom length	2669 (8´9.1″)	2900 (9´6.2″)
B	Distance between pins of boss	R1393.5 (4´6.9″)	R1407.5 (4´7.4″)
C	Distance between pins of bracket	R1475 (4´10.1″)	R1487.5 (4´10.6″)
D	Height of boom cylinder rod pin	467.5 (1´6.4″)	513.5 (1´8.2″)
E	Height of arm cylinder (head side) pin	893 (2´11.2″)	909 (2´11.8″)
F	Boom foot width	250 (9.84″)	⟵
G	Bracket inner width for boom cylinder (rod side)	71 (2.80″)	76 (2.99″)
H	Boom end inner width	175 (6.89″)	⟵
J	Boom end outer width	265 (10.43″)	⟵
K	Bracket inner width for arm cylinder (head side)	66 (2.60″)	⟵
d1	Boom foot pin dia.(O.D of bushing)	ø50 (1.9″) OD: ø60 (2.4″)	⟵
d2	Boom cylinder (rod side) pin dia.	ø50 (1.9″)	⟵
d3	Pin dia. of arm end	ø60 (2.4″)	⟵
d4	Arm cylinder (head side) pin dia.	ø45 (1.8″)	⟵

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SK40SR-2

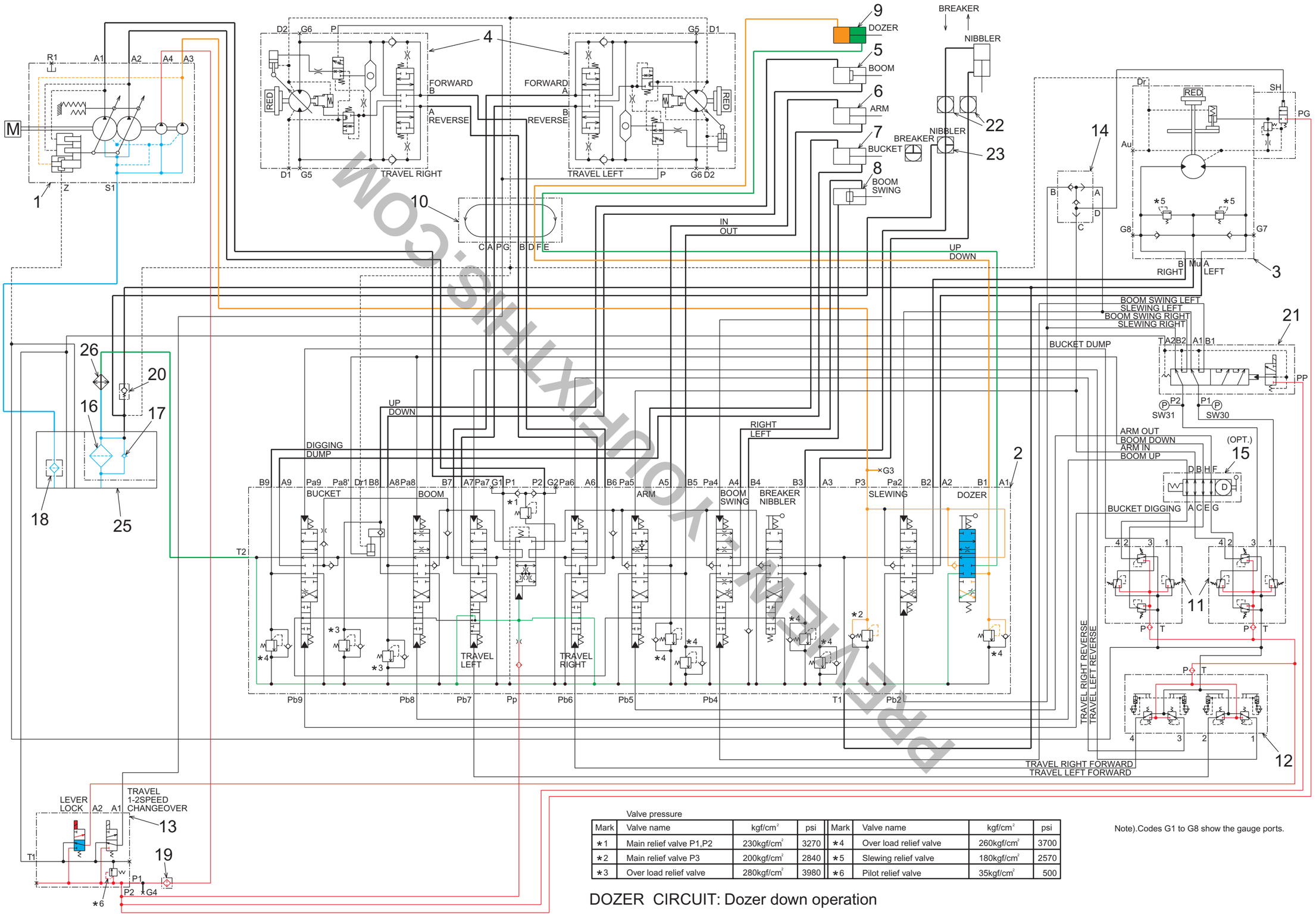
Table. 1 (2 / 2)

Model						SK40SR-2	
Applicable machine						PH03-02001~	
Div	Item				Unit	Standard value	Repairable level
Slew	Slew time per 2-revolution				sec	12.9 ± 1.0	17
	Drift when slewing stops				mm (in)	120 ± 35 (4.72 ± 6.7)	170
	Drift due to gravity					0	—
Cylinders	Cylinder speed	Boom	Canopy	Ext.	sec	3.3 ± 0.3	4.2
				Ret.		2.5 ± 0.3	3.2
			Cab	Ext.		—	—
				Ret.		—	—
		Arm		Ext.		3.4 ± 0.3	4.4
				Ret.		3.1 ± 0.3	4.0
		Bucket		Ext.		3.4 ± 0.3	4.4
				Ret.		2.5 ± 0.3	3.2
		Swing		Ext.		$5.9\ ^{+0.3}_{-0.6}$	7.6
				Ret.		$4.5\ ^{+0.3}_{-0.6}$	5.8
		Dozer		Ext.		2.0 ± 0.3	2.6
				Ret.		1.5 ± 0.3	1.9
		—				—	—
						—	—
	Cylinder drift	(10 min)	Boom		mm (in)	$6\ ^{0}_{-6}$ $(0.24\ ^{0}_{-0.24})$	12 (0.47)
			Arm			—	—
			Bucket			—	—
			Dozer			$6\ ^{0}_{-6}$ $(0.24\ ^{0}_{-0.24})$	12 (0.47)
			Bucket tip			$83\ ^{0}_{-83}$ $(3.27\ ^{0}_{-3.27})$	170 (6.69)
		(5 min)	Swing			$6\ ^{0}_{-6}$ $(0.24\ ^{0}_{-0.24})$	12 (0.47)
Slew bearing	Bucket tip play				mm (in)	$40\ ^{20}_{-10}$ $(1.57\ ^{0.79}_{-0.39})$	80 (3.15)
	Slew bearing play					0.5~1.5 (0.02~0.06)	2.6 (0.10)
Crawler	Crawler tension		Rubber		mm (in)	80~90 (3.15~3.54)	—
			Iron			160~180 (6.30~7.09)	—

Note) Ext : Extension R : Rod side
Ret : Retraction H : Head side

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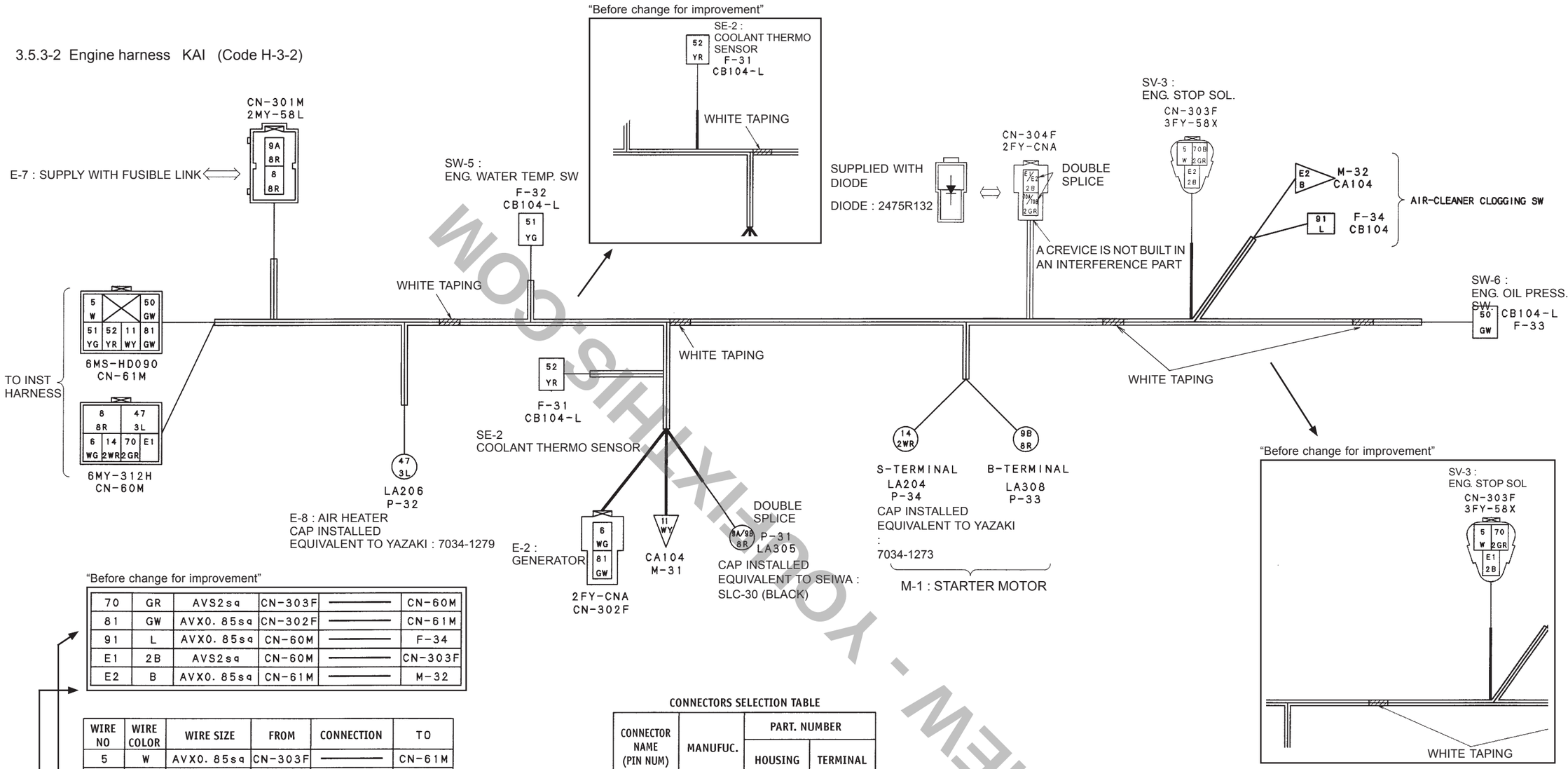
Valve pressure

Mark	Valve name	kgf/cm²	psi	Mark	Valve name	kgf/cm²	psi
*1	Main relief valve P1,P2	230kgf/cm²	3270	*4	Over load relief valve	260kgf/cm²	3700
*2	Main relief valve P3	200kgf/cm²	2840	*5	Slewing relief valve	180kgf/cm²	2570
*3	Over load relief valve	280kgf/cm²	3980	*6	Pilot relief valve	35kgf/cm²	500

Note).Codes G1 to G8 show the gauge ports.

DOZER CIRCUIT: Dozer down operation

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"Before change for improvement"

70	GR	AVS2sq	CN-303F	———	CN-60M
81	GW	AVX0.85sq	CN-302F	———	CN-61M
91	L	AVX0.85sq	CN-60M	———	F-34
E1	2B	AVS2sq	CN-60M	———	CN-303F
E2	B	AVX0.85sq	CN-61M	———	M-32

WIRE NO	WIRE COLOR	WIRE SIZE	FROM	CONNECTION	TO
5	W	AVX0.85sq	CN-303F	———	CN-61M
6	WG	AVX0.85sq	CN-302F	———	CN-60M
8	R	AVS8sq	CN-60M	———	CN-301M
9A	R	AVS8sq	P-31	DOUBLE SPLICE	CN-301M
9B	R	AVS8sq	P-31		P-33
11	WY	AVX0.85sq	M-31	———	CN-61M
14	WR	AVS2sq	P-34	———	CN-60M
47	L	AVS3sq	P-32	———	CN-60M
50	GW	AVX0.85sq	F-33	———	CN-61M
51	YG	AVX0.85sq	F-32	———	CN-61M
52	YR	AVX0.85sq	F-31	———	CN-61M
70A	GR	AVS2sq	CN-304F	DOUBLE SPLICE	CN-60M
70B	GR	AVS2sq	CN-304F		CN-303F
81	GW	AVX0.85sq	CN-302F	———	CN-61M
91	L	AVX0.85sq	CN-61M	———	F-34
E1	B	AVS2sq	CN-304F	DOUBLE SPLICE	CN-60M
E2	B	AVS2sq	CN-304F		CN-303F
E3	B	AVX0.85sq	CN-61M	———	M-32

CONNECTORS SELECTION TABLE

CONNECTOR NAME (PIN NUM)	MANUFUC.	PART. NUMBER	
		HOUSING	TERMINAL
2FY-CNA	YAZAKI	7123-2228	7116-2090
2MY-58L	YAZAKI	7122-4125-50	7114-3250
3FY-58X	YAZAKI	7123-6234-40	7116-2873
CA104	YAZAKI	7120-8012	7113-1020-02
CB104	YAZAKI	7120-1010	7115-1050-02
CB104-L	YAZAKI	7120-2010	7115-2020
		7120-3011	7116-2270
6MY-312H	YAZAKI	7282-1064	7114-6042
			7114-6041
			7114-4022
			7114-4021
6MS-HD090	SUMITOMO	6098-0246	8230-4282

(Note) ● This diagram shows the harness connections after the changes for improvement.
(The changed portions is shows in a separate box as "Before changes for improvement")

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(3) Rotary group

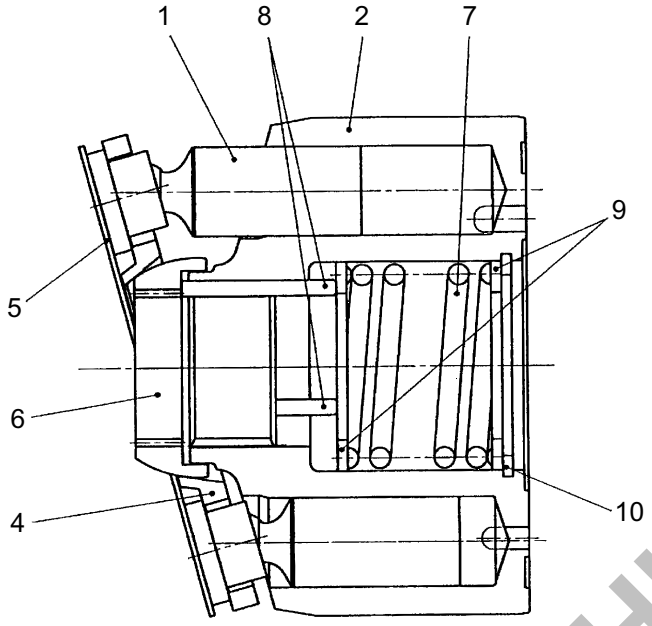


Fig. 1-8

No.	Parts name	Q'ty	No.	Parts name	Q'ty
1	Piston	10	7	Spring	1
2	Cylinder block	1	8	Parallel pin	3
4	Retainer	1	9	Spring seat	2
5	Plate	1	10	Snap ring (for hole)	1
6	Guide	1			

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(8) Operation of relief valve

1) Operation at relief condition

1. The pressure oil passes through the inside of the piston placed in the pressure regulating valve(main valve) and fills in “A” chamber inside of the piston through the orifice “B” to securely seat the pressure regulating valve and the socket, and the socket and the seat.

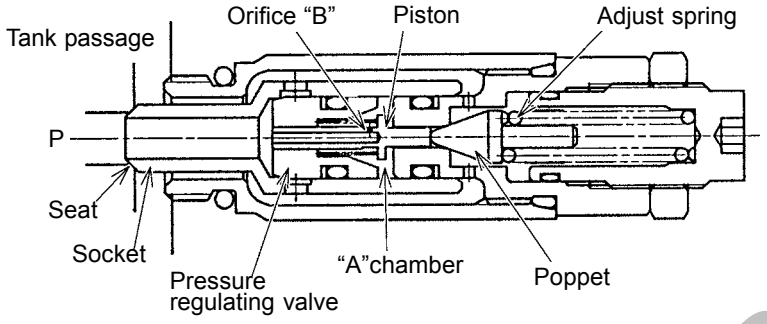


Fig. 4-22

2. When the pressure of the oil in the “P” port reaches to the set pressure of the spring, the pressure oil acts on the poppet valve through the piston and opens the poppet.
   Then, the pressure oil passes through the inside of the piston, orifice “B”, “A” chamber, ring-shaped restriction “C”, and drilled hole “D” in order, and flows out to the tank circuit around the socket.

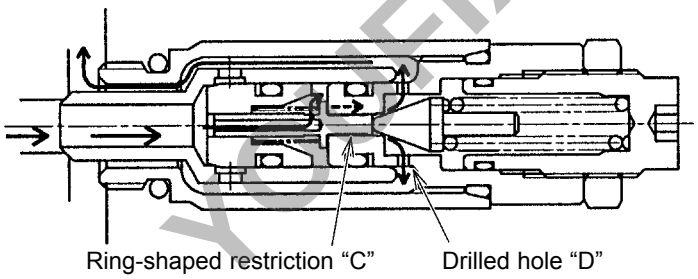


Fig. 4-23

3. The pressure in “A” chamber drops because the poppet is open, consequently the pressure oil in the “P” port flows out to the tank circuit through the drilled hole “E”.

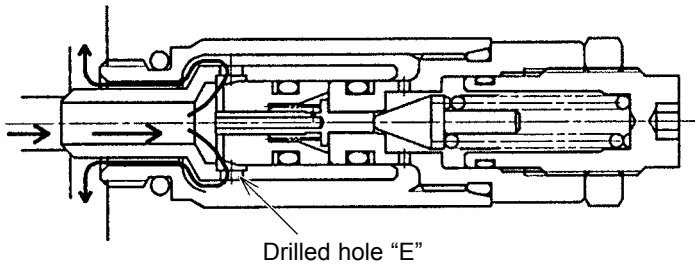


Fig. 4-24

4. When the pressure on the “P” port drops lower than the adjust spring set pressure, the poppet is pushed against the seat by the adjust spring force and the pressure in “A” chamber is equal to the pressure in the “P” port, consequently the pressure regulating valve is also pushed against the seat and returns to the original condition(Fig. 4-22).

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2.1b ELECTRICAL EQUIPMENT LIST

(Applicable machines SK40SR-2 : PH04-02801~
SK45SR-2 : PJ03-01001~)

Group	Code	Part Name	Part No.
Diode	D-1	DIODE	YN02DO1001P1
	D-2	DIODE	↑
	D-3	DIODE	↑
	D-4	DIODE	↑
	D-12	DIODE	↑
	D-13	DIODE (KCMA only)	↑
	D-14	DIODE	YN02D01001P1
Electrical Fittings	E-1	FUSE BOX	PM73E00004F6
	E-2	GENERATOR (ALTERNATOR)	E/G accessory (119836-77201)
	E-3	HORN	PH53S00001P1
	E-4	FUSIBLE LINK	PH73S0001P1
	E-6	GAUGE CLUSTER KCME,OCE	PM59S00002F2
		KCMA	PV59S00001F2
	E-7	POWER SOCKET [KCME]	PF81S01001P1
	E-8	AIR HEATER	E/G accessory (129100-77500)
	E-10	RADIO (OPT)	Cab accessory (PY54S00001P1)
	E-12	HEATER (OPT)	PM21M00005F1
	E-13	BATTERY	PH72S00005P1
	E-14	SEQUENCE BOX	PA24S00002P3
	E-15	FUSE BOX (OPT) (FOR COOLER)	PH73E00004F1
	E-20	TRAVEL ALARM [OCE]	PM53S00001F2
Light	L-1	ROOM LAMP	Cab accessory (2456U114)
	L-2	BOOM WORKING LIGHT (LH)	PM80S00005F1
Motor	M-1	STARTER MOTOR	E/G accessory (129400-77012)
	M-2	WIPER MOTOR	Cab accessory (PM76S00001F1)
	M-3	WASHER MOTOR	PE54C00002S002
	M-4	DECELERATION MOTOR	PH20S00004F1
	M-6	FUEL PUMP (OPT) (AUTO AIR BLEED)	PM22P00001P1
Relay	R-1	BATTERY RELAY	PH24S00001P1
	R-2	SAFETY RELAY	PH24S00002P1
	R-3	DECELERATION RELAY	PM24S00001P1
	R-6	TIMER UNIT	PH25S00002P1
	R-7	E/G STOP RELAY	PH24S00001P1
	R-8	CHARGE INDICATOR RELAY	PA24E01001P1
	R-9	OPT.WORK LIGHT RELAY	PA24E01001P1
	R-14	SLEW / SWING SELECT RELAY [KCMA]	↑
	R-22	S.V.SELECT RELAY [KCMA]	PM24S00001P1
	R-23	SLEW/SWING PRESER-VATION RELAY [KCMA]	PA24E01001P1

Group	Code	Part Name	Part No.
Sensor	SE-1	FUEL SENSOR	PH52S00002P1
	SE-2	ENGINE THERMO SENSOR	PA24S00003P1
Solenoid	SV-1	LEVER LOCK SOL.	PH35V00001F2
	SV-2	2 SPEED SELECT SOL.	
	SV-3	E/G STOP SOL.	E/G accessory (119233-77931)
	SV-5	POWER SHIFT SOL. (Cooler Spec)	YJ35V00004F1
	SV-8	TILT ANGLE SOL.	YJ35V00004F1
	SV-12	SLEW / SWING SELECT SOL. [KCMA]	PE35V00001F1
Switch	SW-1	KEY SWITCH	PH50S00007S001
	SW-2	WORKING LIGHT SW.	PV24E01001P1
	SW-3	2 SPEED SELECT SW.	YN03M01286S002
	SW-4	WIPER WASHER SW.	PY50S00004P1
	SW-5	E/G COOLANT TEMP.SW.	PM50S00006P1
	SW-6	E/G OIL PRESSURE SW.	E/G accessory (114250-39450)
	SW-7	HORN SW. KCME,OCE	YN50E01001P1
		KCMA	LF03M01005F1
	SW-9	LEVER LOCK SW. (LH)	PA50S00001P1
	SW-10	HEATER SW. (OPT)	PY50S00003P1
	SW-11	DECELERATION SW.	PM50S00005P1
	SW-12	AIR FILTER CLOGGING SW. KCME,OCE	2446U336S8
		KCMA	YR11P00008S005
	SW-17	TILT ANGLE SELECT SW.	PW03M01225F1
	SW-23	TRAVEL ALARM SELECT SW.	2479U1190F16
	SW-24	TRAVEL RIGHT (FORWARD) PRESS.SW.	GB50S00049F1
	SW-25	TRAVEL RIGHT (REVERSE) PRESS.SW.	↑
	SW-26	TRAVEL LEFT (FORWARD) PRESS.SW.	↑
	SW-27	TRAVEL LEFT (REVERSE) PRESS.SW.	↑
	SW-28	SLEW / SWING SELECT SW. [KCMA]	LF03M01005F3
	SW-30	SLEW/SWING LEVER PRESSURE SW. (LH) [KCMA]	GB50S00049F1
	SW-31	SLEW/SWING LEVER PRESSURE SW. (RH) [KCMA]	↑

Note)

- This is for reference only, because the part No. might be change due to improvement.

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2) Disassembly of holder
(Boom and swing cylinder)

a. Remove collar (12).
b. Remove cushion seal (11).
c. Remove spacer (32).
d. Remove O-ring (7) and back-up ring (13).

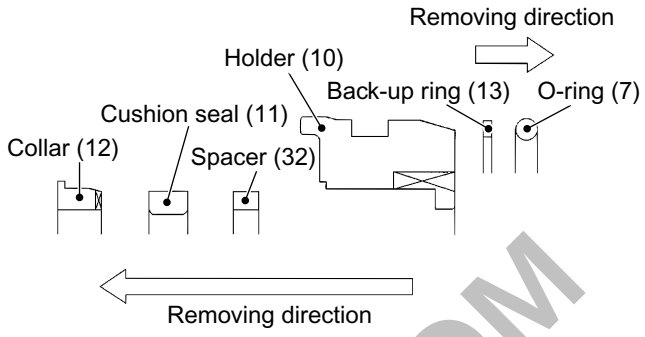


Fig. 1-11 Disassembling holder

3) Remove the U-ring (5).

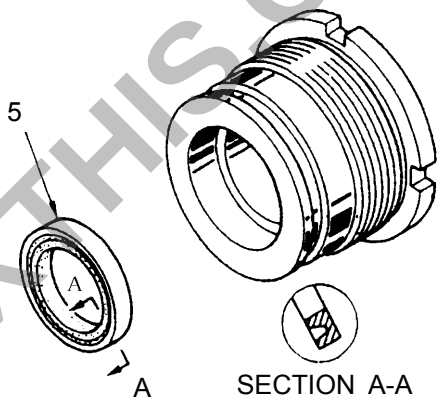


Fig. 1-12 Removing U-ring

4) Remove the wiper ring (6).

- Alternately tap inside of the metal ring of wiper ring at several positions, as shown in the figure, to push it out step by step from the cylinder head.

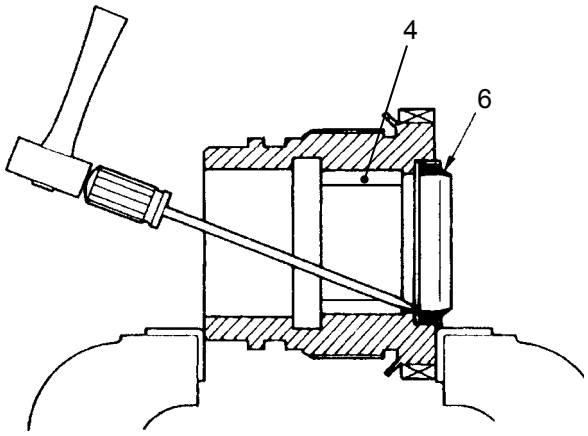


Fig. 1-13 Removing wiper ring

5) Remove the bushing (4) using a removal jig.

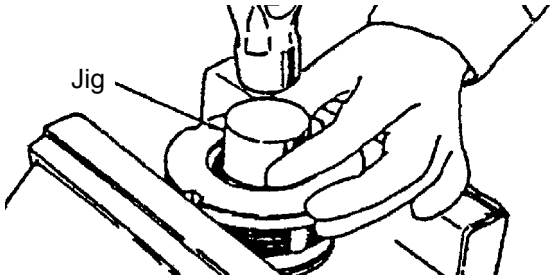


Fig. 1-14 Removing bushing

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(4) Connect main pump delivery oil hoses (2) (3) (4), pilot delivery oil hose (B16) and drain hose (B2). (See Fig. 13-1.)

		Tightening torque kgf·m (lbf·ft)	
Thread size (PF)	Spanner in use (mm)	O-ring type joint	30˚flare type
1/4	19	3.7 (27)	3.0 (22)
3/8	22	7.5 (54)	5.0 (36)
1/2	27	11.0 (80)	8.0 (58)

(5) Tighten capscrew (14) and connect suction tube (12).

: 10 mm

T=11.0 kgf·m (80 lbf·ft)

(6) Apply sealant to the tube on the suction hose (5) inserting section and fix clip (11).

: Screwdriver (–)

T=0.55 kgf·m (4.0 lbf·ft)

(7) Return all equipment removed during the preparation.

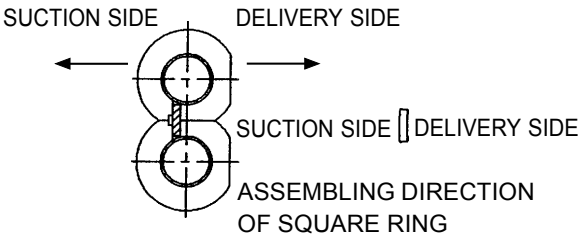
(8) After supply of hydraulic oil {approx.48 L (13 gal)}, bleed the air in circuit. (See section 8.3)

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3) Assembling gear pump

1. Fit the square ring to the plate on the assembling side of gear pump.
   - Then pay attention to the suction and delivery direction.

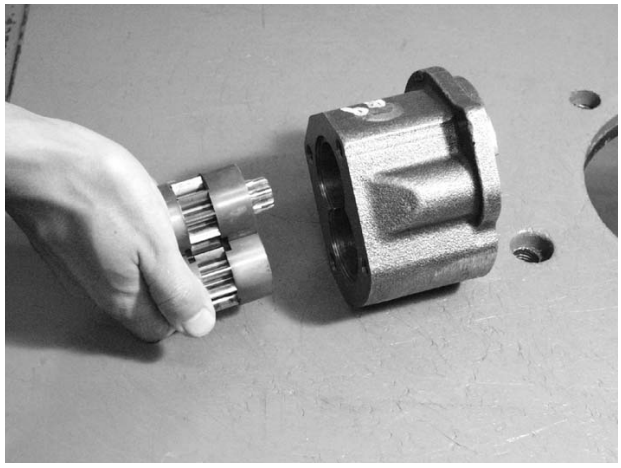




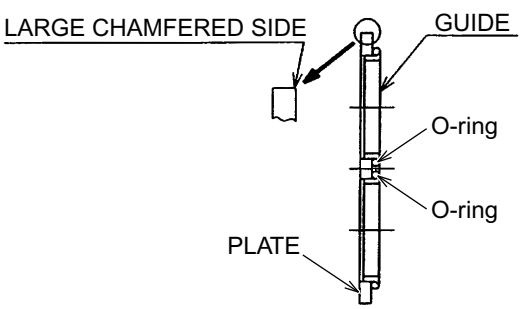
2. Install the drive gear and idle gear on the side plate.



3. Place the drive gear , idle gear and the side plate in the housing.



4. Insert the O-ring in the guide and then insert it in the plate.





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(3) Relief valve

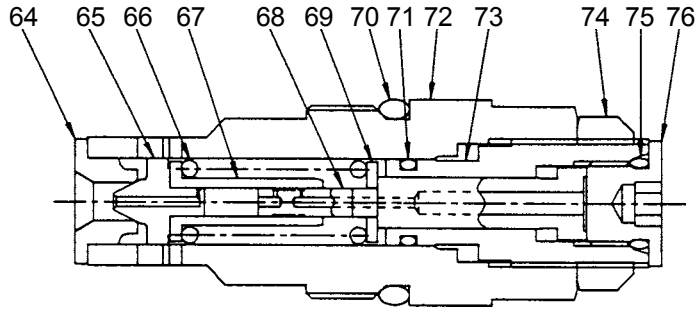


Fig. 5-4

Table. 5-4

No.	Parts name	Q'ty	No.	Parts name	Q'ty	No.	Parts name	Q'ty
64	Seat	1	69	Spacer	1	74	Nut	1
65	Poppet	1	70	O-ring	1	75	O-ring	1
66	Spring	1	71	O-ring	1	76	Cap	1
67	Sleeve	1	72	Sleeve	1			
68	Piston	1	73	Sleeve	1			

(4) Hydraulic timer

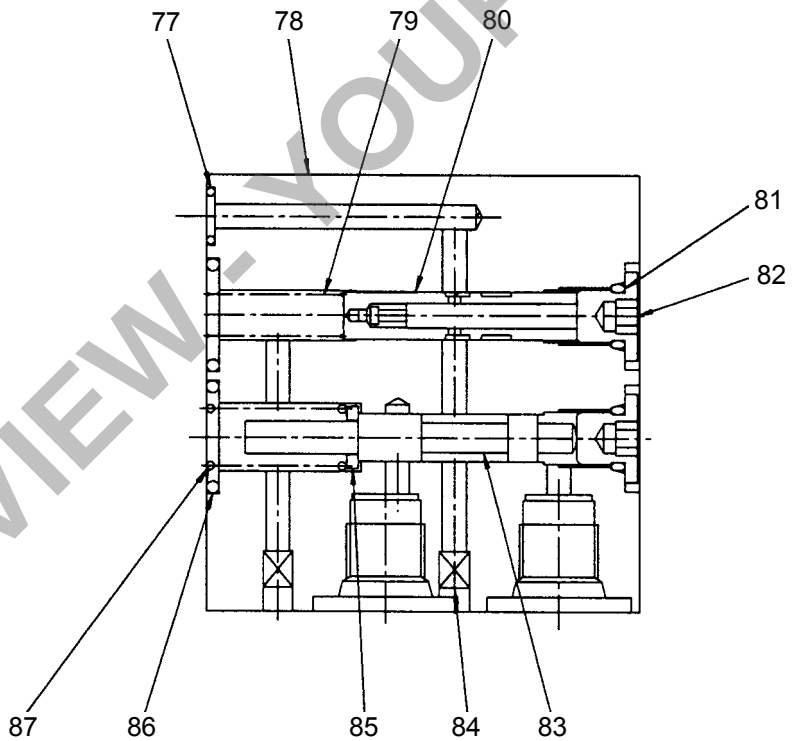


Fig. 5-5

Table. 5-5

No.	Parts name	Q'ty	No.	Parts name	Q'ty	No.	Parts name	Q'ty
77	O-ring	1	81	O-ring	2	85	Stopper	1
78	Manifold	1	82	Cap	2	86	O-ring	2
79	Spring	1	83	Spool	1	87	Spring	1
80	Poppet	1	84	Plug	2			

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6.2 DISASSEMBLY AND ASSEMBLY

6.2.1 General precautions

- For disassembly and assembly, select the clean area and prepare clean containers to put the removed parts.
- Clean around the port and remove the paints of the joint with wire brush.
- Clean the removed parts with cleaning solvent, like light oil, etc.
- Replace seals with new ones every disassembly, and apply grease lightly.
- Check every part for severe wear and seizure, and remove burr, etc. with emery paper.
- Check that seal groove is free from foreign matter, dust, etc.

6.2.2 Disassembly

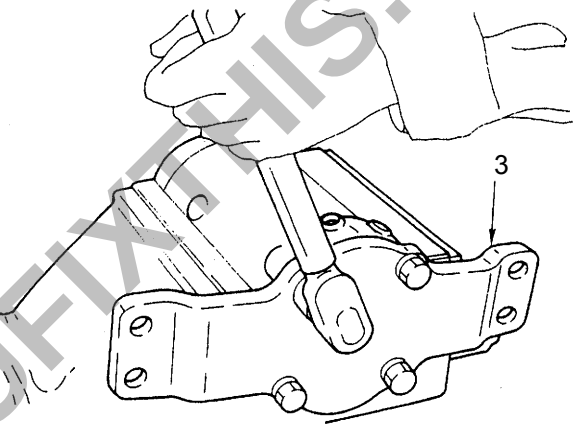
Fix the body with vise.

(1) Loosen bolt and remove flange (3).

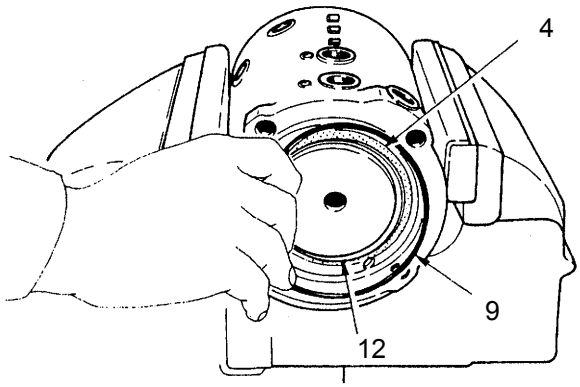
:13 mm

or

:13 mm

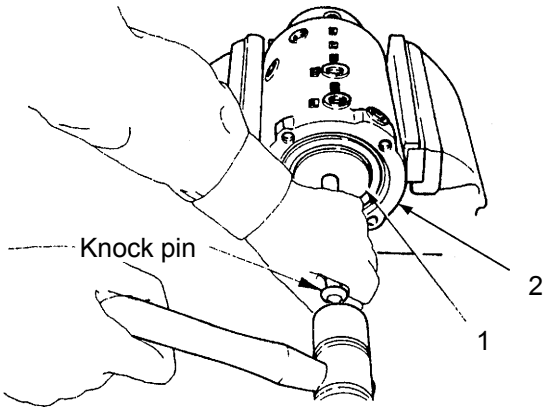


(2) Take out O-ring (9) , snap ring (12) and spacer (4).



(3) Remove stem(1) from the body (2).

- Apply the knock pin to the end face of the shaft, and strike it with hammer.
- Choose the knock pin in copper, plastic, etc.



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7. SPROCKET

7.1 REMOVAL AND INSTALLATION

7.1.1 Removing

(1) Remove the crawler assy.

(2) Place wood block under the lower frame so the sprocket is off the ground.

(3) Loosen socket bolts (M10) for the attaching of the sprocket by means of allen wrench and remove the sprocket.

: 8 mm

Single weight of sprocket : 15 kg (33 lb)

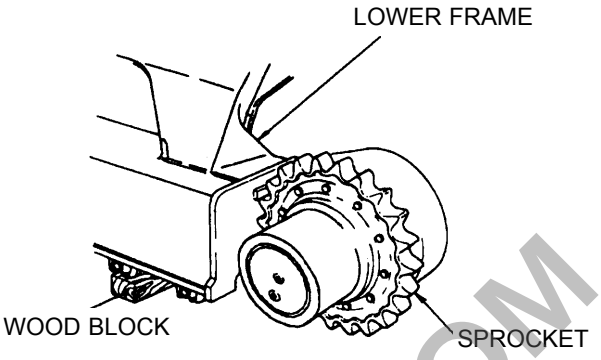


Fig. 7-1 Free sprocket from load

7.1.2 Installing

(1) Check the fixing parts of the travel motor and the sprocket, eliminate burrs and dirt thoroughly, and install the sprocket.

(2) Apply Loctite #262 to the sprocket attaching socket bolts and fasten the sprocket temporarily.

(3) Remove the wood block under the lower frame and tighten socket bolts with specified torque to fix sprocket and travel motor.

: 8mm

T= 18.5 kgf·m (134 lbf·ft)

(4) Install crawler

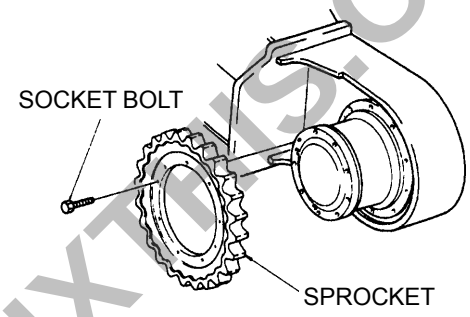


Fig. 7-2 Removing sprocket

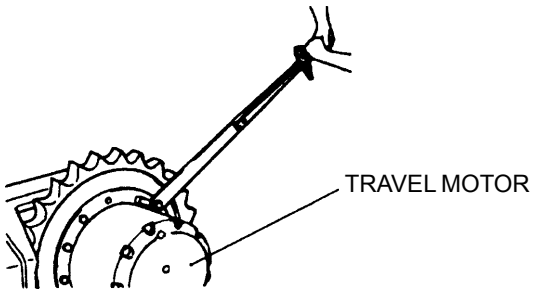


Fig. 7-3 Tightening socket bolts

7.2 MAINTENANCE STANDARD

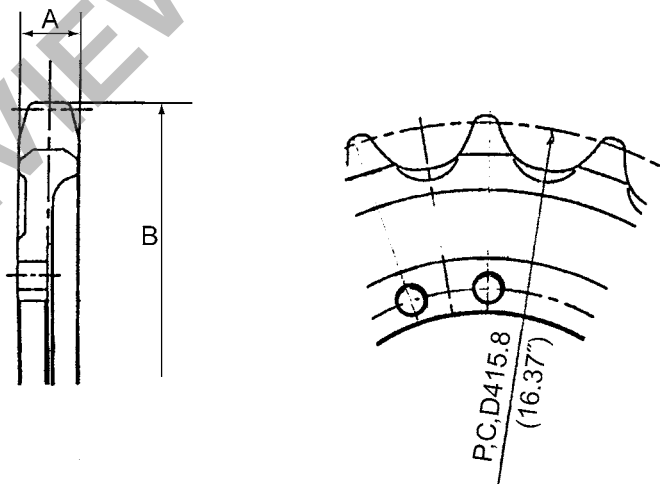


Fig. 7-4 Sprocket

Unit : mm (in)

Code	Item	Standard value	Repairable level	Service limit	Remedy
A	Width of sprocket teeth	32	29	27	Replace
B	O.D. of sprocket	ø435.8	ø429	ø427	Welded repair, or replace

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1.6 ASSEMBLY

(1) Preparation of tools and apparatus

Preparation of tools and apparatus listed under Article 1.5 DISASSEMBLY.

(2) General precaution

1) Assembly it by reversing the procedure of disassembly.
2) Assemble it in clean air condition.
3) Do not use cloth gloves during assembly.
4) Replace or repair the damaged parts during disassembly according to the instructions in the “Maintenance standard”. Replace O-ring, oil seal, etc. with new one.
5) Clean every part sufficiently, and blow them with compressed air do not use rag.
6) Prior to assembling, apply clean hydraulic oil to moving and sliding portions of hydraulic motor valve.
7) Tighten bolt and plug to the specified torque using torque wrench.
8) Replace reamer bolt with new ones. If it is unavoidably reused, remove completely the adhesive agent on reamer bolt, repair flaws on bolt seat surface with oilstone, and degrease it.
9) Prior to assembling, apply grease to lip portions of O-ring, oil seal, and floating seal to protect it from being damaged, and to moving section and sliding section.
10) After assembly, plug every port to protect the entry of dust, etc.
11) Photos and illustrations shown are typical models. Although they may differ from those in use, they do not affect the assembly procedure.

(3) Preparatory arrangement for assembly

⚠ After replacing parts with new ones, adjust the pre-load of bearing and thickness of snap ring without fail.

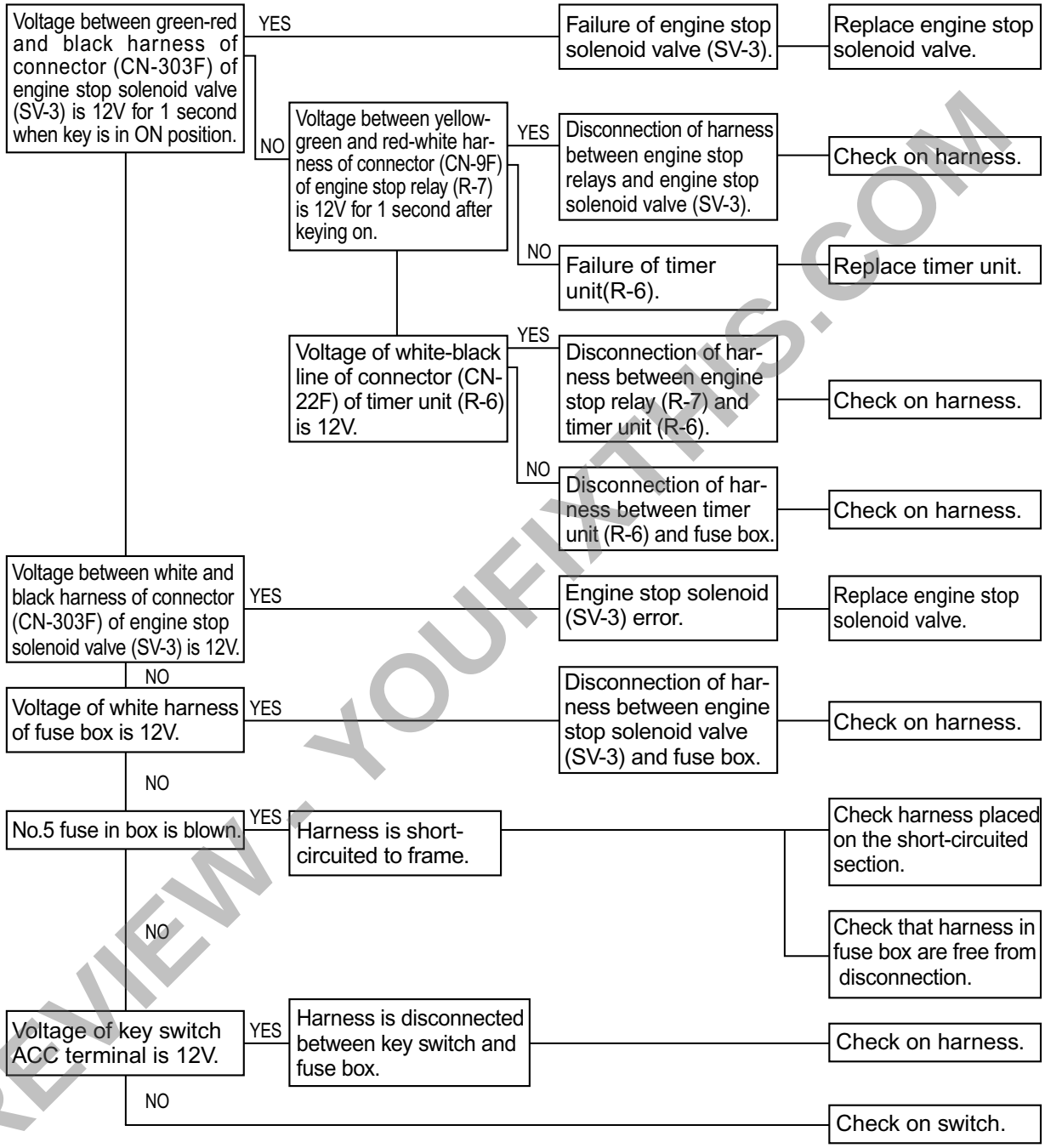
1. When the following parts are replaced, the pre-load adjustment of bearing is required :
   Hub (1), Spindle (2), Hold flange (3), Bearing (21)
2. When the following parts are replaced, the snap ring thickness adjustment is required :
   Spindle kit (2), Hold flange (3), Crankshaft (9), Spacer (12), Bearing (22)

⚠ Where replacing the above parts, the previously adjusted parts should be used. If unadjusted parts are used, the travel motor moves abnormally, causing early breakage.

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Starter functions, but engine does not start. (When key is in ON position,)



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1-13. 4TNE84T

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

Item			Model / Unit	4TNE84T												
SPECIFICATIONS	Application		—	CL		VM						CH		VH		
	Type		—	Vertical, 4-cycle water-cooled diesel engine												
	Combustion system		—	Direct injection system												
	No. of cylinders – Bore × Stroke		mm	4 – 84 × 90												
	Displacement		ℓ	1.995												
	Firing order		—	1 – 3 – 4 – 2 – 1												
	Revolution speed		rpm	1500	1800	2000	2200	2400	2600	2800	3000	3000	3600	3200	3400	3600
	Output*	Continuous rating	kW(HP)	19.1 (25.6)	24.3 (32.6)	—	—	—	—	—	—	37.1 (49.8)	40.8 (54.7)	—	—	—
		Max. rating	kW(HP)	21.3 (28.6)	26.9 (36.1)	28.0 (37.5)	30.5 (40.9)	33.5 (44.9)	35.7 (47.9)	38.6 (51.8)	41.2 (55.3)	41..2 (55.3)	45.6 (61.2)	42.7 (57.3)	44.1 (59.1)	45.6 (61.2)
	Max. revolution speed at no load		rpm	1600^{+50}_{0}	1900^{+50}_{0}	2175^{+50}_{0}	2375^{+50}_{0}	2600^{+50}_{0}	2800^{+50}_{0}	3000^{+50}_{0}	3225^{+50}_{0}	—	—	—	—	—
	Min. revolution speed at no load			1200^{+50}_{0}		800^{+50}_{0}						—		——		
	Direction of rotation		—	Counterclockwise (viewed from flywheel)												
	Power take off		—	Flywheel												
	Compression ratio		—	18.0												
	Fuel injection timing (FID, b.T.D.C.)		deg	10±1		12±1		14±1		16±1		—		—	—	—
	Compression pressure		MPa (kgf/cm²)	2.94±0.1 (30±1), at 250 rpm												
	Fuel injection pressure		MPa (kgf/cm²)	$19.6^{+1.0}_{0}$ (200^{+10}_{0})						$19.6^{+1.0}_{0}$ (200^{+10}_{0})						
	Recommended diesel gas oil		—	ISO 8217 DMA, BS 2869 A1 or A2 (Cetane No. 45 min.)												
	Lubrication system		—	Forced lubrication with trochoid pump												
	Lubricating oil capacity Max/Effective		ℓ	5.8/2.3								——				
	Recommended lubricating oil		—	API grade CC class or higher												
	Cooling system		—	Liquid cooling/Radiator												
	Cooling water capacity		ℓ	2.7 (for engine only)												
	Cooling fan No. of blade × dia.		mm	Discharge type, 6 × ϕ370												
	Crank V-pulley dia./ Fan V-pulley dia.		mm	ϕ110/ϕ90		ϕ110/ϕ110										
	Governor		—	Mechanical centrifugal governor (All speed type)												
	Starting system		—	Electrical												
	*1 Dimensions L × W × H		mm	674 × 498.5 × 713		641 × 498.5 × 713 / 649 × 498.5 × 713						—		—		
	*1 Dry weight		kg	184		165 / 175						—		—		
PERFORMANCE	Governing perform-ance (full speed range)	Transient speed difference	%	≤10	≤8	≤12						—	—	—		
		Steady state speed band	%	≤5	≤4	≤9		≤8		≤7		—	—	—		
		Recovery time	sec	≤5		≤6						—		—		
		Fluctuation of revolution	rpm	≤15		≤22						——				
	L.O. press.	Rated operation	MPa (kgf/cm²)	0.29±0.05 (3.0±0.5)		0.34±0.05 (3.5±0.5)										
		Idling		≥0.06 (≥0.6)												

*1. Designation of engine dimension and dry weight in numerals.
CL/CH application: engine with flywheel housing
VM/VH application: engine with back plate/with flywheel hausing

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[Replacing the Valve Guide]

(1) Extract the valve guide from the cylinder head using the valve guide extraction tool.

* *For the valve guide extraction tool, refer to Chapter 5, 5-1.*

(2) In a container containing liquefied nitrogen, ether or alcohol together with dry ice, put the valve guide to cool it. Then hit the sufficiently cooled valve guide to fit into the cylinder head using the valve guide insertion tool.

* *For the valve guide insertion tool, refer to Chapter 5, 5-1.*

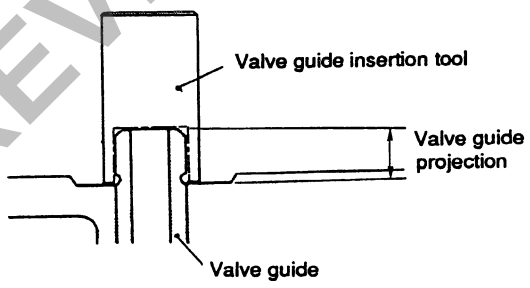
(3) After inserting the valve guide, finish the inside of the valve guide with a reamer.

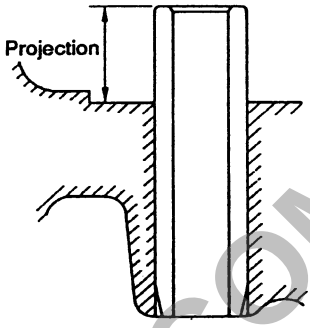
(4) Check the projection of the valve guide.

(mm)

	2/3TNE68		3TNE74	
	Standard	Wear limit	Standard	Wear limit
Valve guide projection	7	—	9	—

	3TNE78A 3TNE82A		3/4TNE82, 3/4TNE84(T), 3/4TNE88	
	Standard	Wear limit	Standard	Wear limit
Valve guide projection	12	—	15	—





(Valve guide projection)

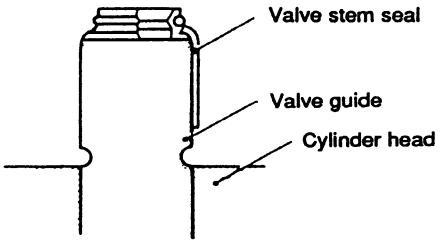
4. Valve stem seal

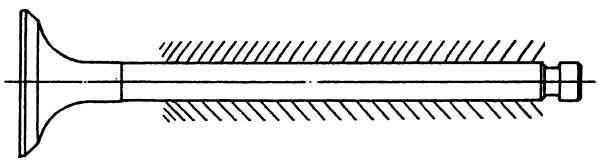
[Time of Replacement]

(1) When oil loss is found excessive
(2) When the valve stem seal is removed
(3) When intake/exhaust valves are removed

[Precautions on Installation]

Make sure that the entire surface of valve stem is smooth, and sufficiently apply lubricating oil to the valve stem before reassembling intake/exhaust valves.





(Hatched portion indicates where to apply lubricating oil.)

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