Service Guide

for

15NX

MINI EXCAVATOR

SERIAL NUMBERS:
WR000001-up

IHI

IHI Construction Machinery Limited

PUB. No.1
C106 CS

HYDRAULIC MINI EXCAVATOR

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1-1-1 GENERAL SPECIFICATIONS

■ BASE MACHINE PERFORMANCE

	Unit	15NX
Swing speed	min^{-1} (rpm)	9.5 (9.5)
Travel speed	km / h	2.1 / 4.0
Gradability	% (deg.)	58 (30)

■ ENGINE

Engine model	–	YANMAR 3TNE68-EIK
Engine type		4cycle, water cooled, over-head, valve, swirl-combustion chamber
No. of cyl.– bore x stroke	mm	3 – 68 x 72
Total piston displecement	L	0.784
Rated output	kW / min^{-1} (ps/ rpm)	9.7 / 2300 (13.2 / 2300) [DIN6271, 9.6 / 2300]
Max. torpue	N•m / min^{-1} (kgf•m / rpm)	47.5 / 1800 (4.84 / 1800)

■ WEIGHT

			STD	with ADD Weight
Machine mass	Rubber shoe	kg	1520	1620
	Steel shoe		1590	1690
Average ground bearing pressure	Rubber shoe	kPa (kgf / cm^2)	25.6 (0.26)	26.0 (0.27)
	Steel shoe		26.0 (0.27)	27.6 (0.28)

■ REFILL CAPACITIES – (APPROXIMATE)

Fuel		L	20
Hydraulic fluid	Oil level	L	19
	Total amount	L	23
Engine oil	Max. level	L	3.0
	Min. level	L	1.0
Coolant	Engine proper	L	0.9
	Total amount	L	3.6

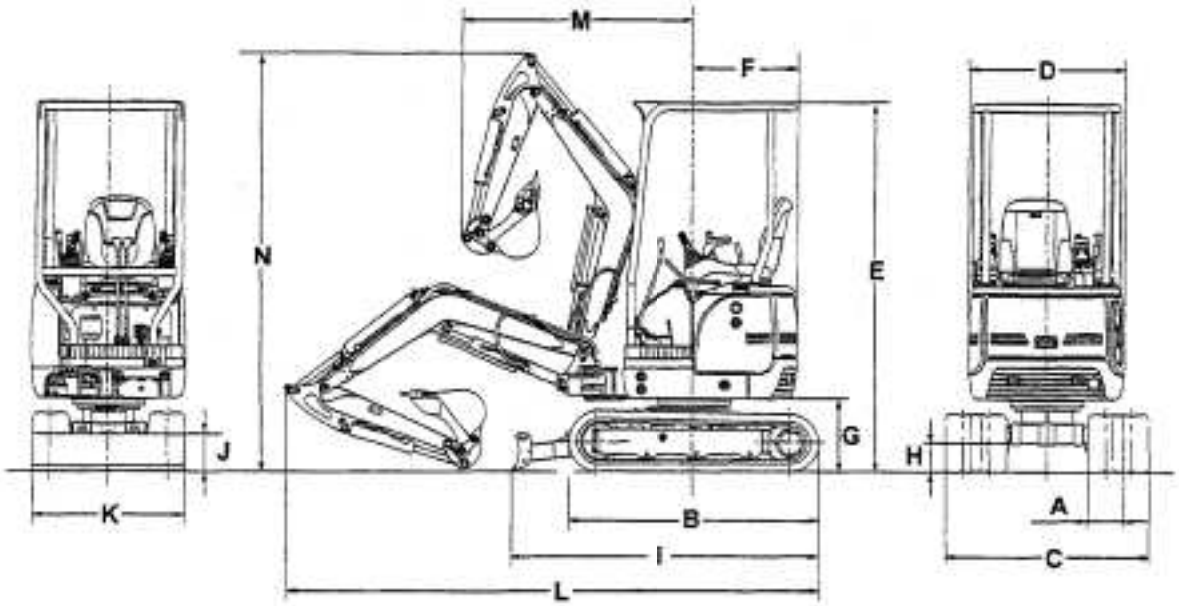
■ BUCKET

◎ : Std. applicable
○ : Applicable
× : Not applicable

Bucket capacity ISO(m³)		Side cutter width (mm)	Number of teeth	Weight (kg)	Combinations		Remarks	Remarks
Heaped	Struck				Std. arm	Long arm		
0.044	0.025	450	3	45	◎	×	Standard	General digging
0.024	0.015	300	2	34	○	○	OPT.	Ditch digging
0.033	0.018	350	3	40	○	◎	OPT.	Long arm
0.055	0.029	500	3	47	○	×	OPT.	Loading

1-2-1 OVERALL DIMENSIONS

1. OVERALL DIMENSIONS

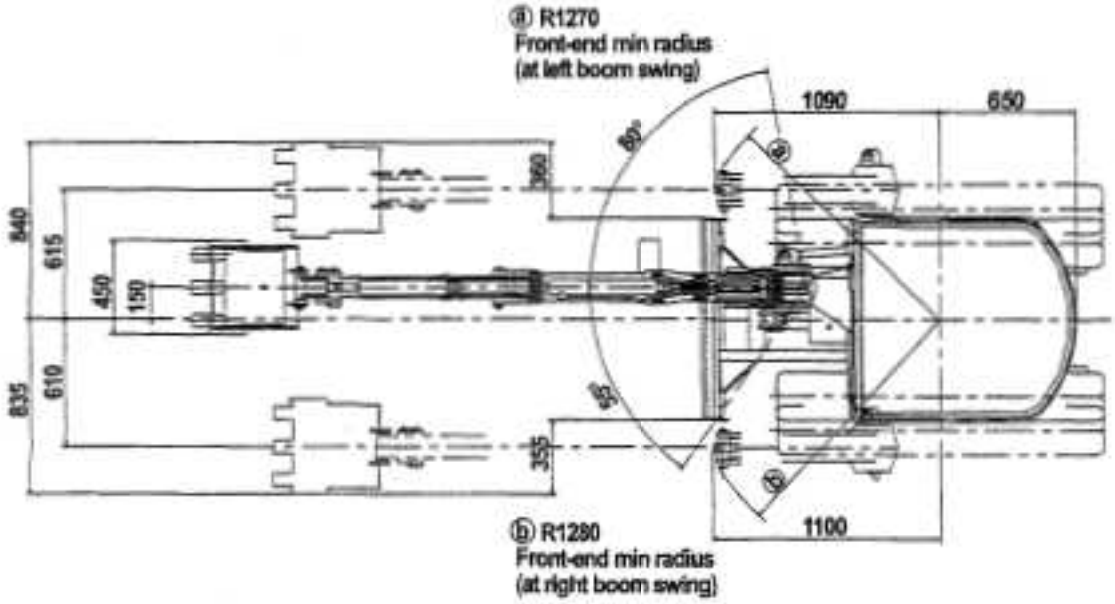


Unit: mm

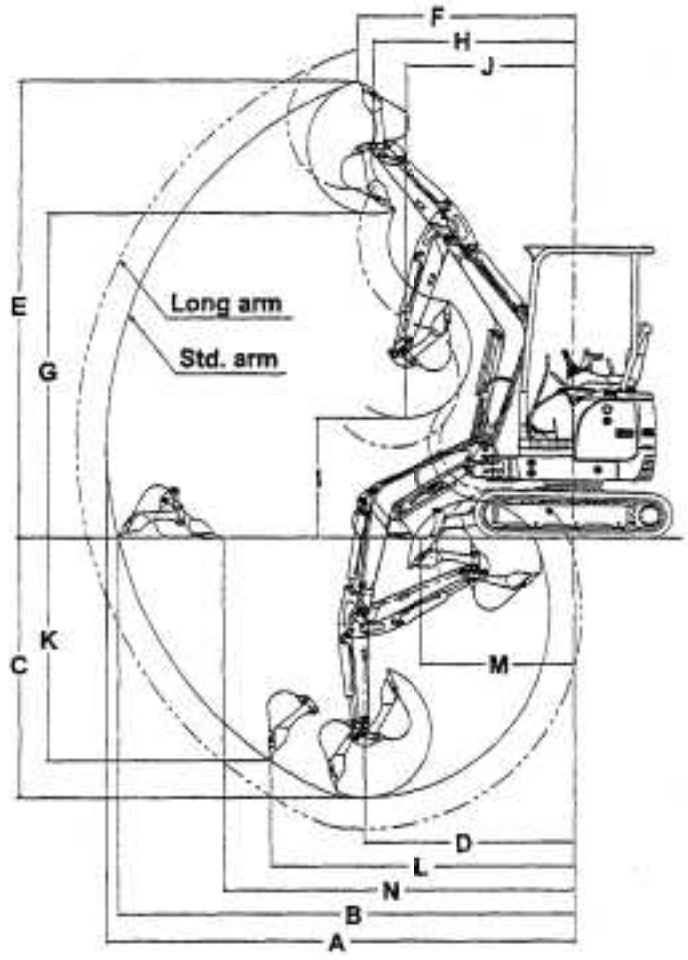
Codes	Description	STD		ADD Weight	
		Rubber shoe	Steel shoe	Rubber shoe	Steel shoe
A	Crawler shoe width	230	230	230	230
B	Overall length of crawler	1570	1540	1570	1540
C	Overall width of crawler	960~1280	960~1280	960~1280	960~1280
D	Canopy width	980	980	980	980
E	Canopy height	2330	2330	2330	2330
F	Rear end swing radius	650	650	720	720
G	Rear end ground clearance	460	460	460	460
H	Mini. ground clearance	175	175	175	175
I	Overall length of undercarriage	1930	1930	1930	1930
J	Blade height	235	235	235	235
K	Blade width	960	960	960	960
L	Overall length Blade in front	3380	3380	3380	3380
	Blade in rear	3750	3750	3750	3750
M	Front end mini. radius at center	1490	1490	1490	1490
N	Arm head clearance	2630	2630	2630	2630

1-3-1 WORKING RANGE

■ BOOM SWING DIGGING WORKING RANGE



■ WORKING RANGE (BACK HOE)



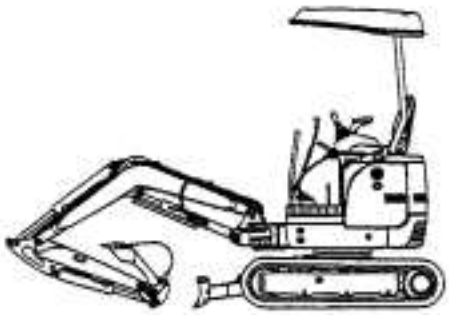
Unit: mm

Key	Description	Std. arm	Long arm
	Std. of bucket capacity (m^3), ISO Heaped	0.044	0.033
A	Max. digging radius	3760	3990
B	Max. bucket outreach at ground level	3660	3910
C	Max. digging depth(Not used blade)	2100	2350
D	Radius of max. digging depth	1680	1680
E	Max. digging height	3610	3810
F	Radius of max. digging height	1740	1900
G	Max. dumping height	2560	2760
H	Radius of max. dumping height	1610	1770
I	Min. dumping height	950	720
J	Radius of min. dumping height	1350	1440
K	Max. vertical digging depth	1770	2010
L	Radius of max. vertical digging depth	2430	2490
M	Radius of min. digging ground level	1220	1120
N	Max. clean-up radius at floor level	2810	3040

1-4-1 WEIGHT BREAKDOWN

WEIGHT BREAKDOWN

1. Total operating weight



Shoe / Cabin Spec.	Weight (kg)
Rubber shoe / Canopy	1520
Steel shoe / Canopy	1590
(With ADD CWT + 100 kg)	

2. Base machine

Shoe / Cabin Spec.	Weight (kg)
Rubber shoe / Canopy	1330
Steel shoe / Canopy	1400
(With ADD CWT + 100 kg)	

This weight is not the mass of the machine body. It includes the weight of water, fuel, blade and others.

3. Upper structure

Specification	Weight (kg)
Canopy	800
(With ADD CWT + 100 kg)	

4. Undercarriage

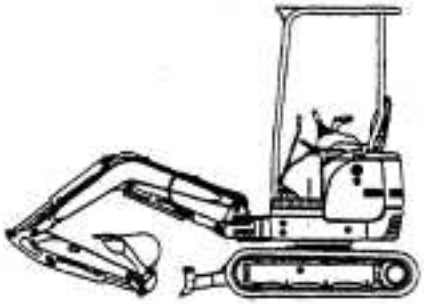
Specification	Weight (kg)
Rubber shoe	530
Steel shoe	600

5. Hoe attachment

Specification	Weight (kg)
Standard arm	190
Long arm	200

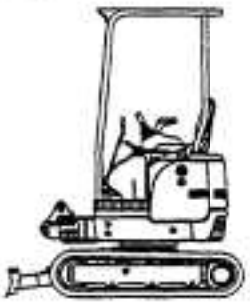
WEIGHT BREAKDOWN (TOPS CANOPY)

1. Total operating weight



Shoe / Cabin Spec.	Weight (kg)
Rubber shoe / Canopy	1530
Steel shoe / Canopy	1600
(With ADD CWT + 100 kg)	

2. Base machine



Shoe / Cabin Spec.	Weight (kg)
Rubber shoe / Canopy	1340
Steel shoe / Canopy	1410
(With ADD CWT + 100 kg)	

This weight is not the mass of the machine body. It includes the weight of water, fuel, blade and others.

3. Upper structure

Specification	Weight (kg)
Canopy	810
(With ADD CWT + 100 kg)	

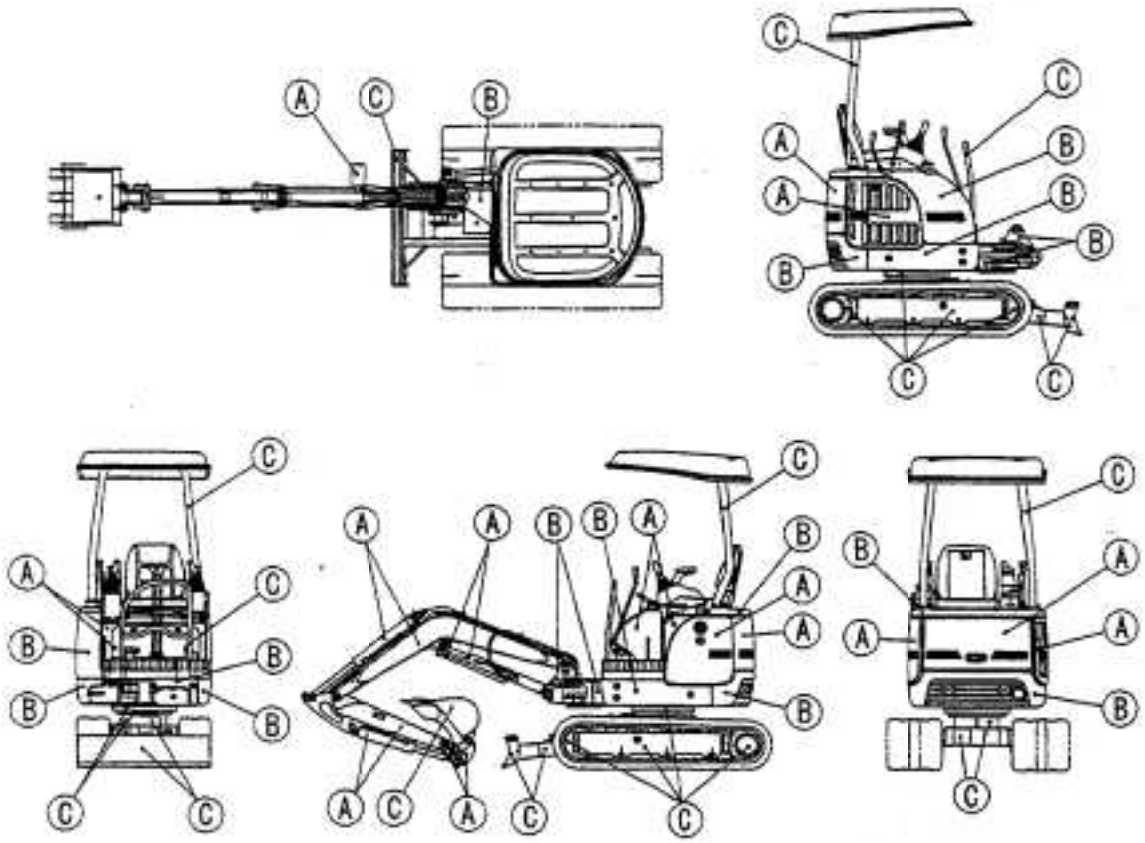
4. Undercarriage

Specification	Weight (kg)
Rubber shoe	530
Steel shoe	600

5. Hoe attachment

Specification	Weight (kg)
Standard arm	190
Long arm	200

1-5-1 PAINTING DIAGRAM



Color code for IHI Standard Color

Code	A	B	C
Name	Light-green	Blue	Dark gray
Munsell No.	2.5BG 6/10	5PB 3/9	N - 3.0

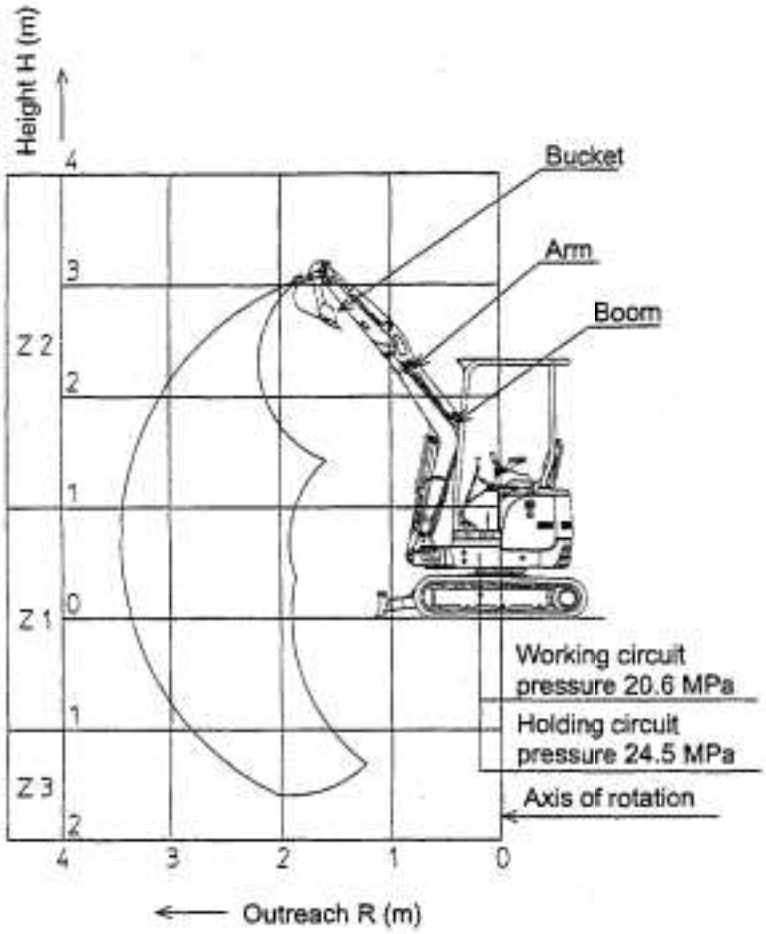
Notes:

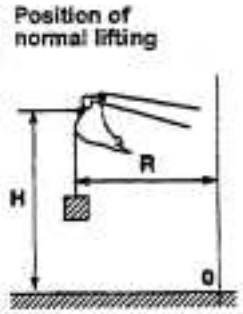
1) Do not coat rubber, sponges, catch metal fixtures, hydraulic hoses, cylinder rods, rod packing, air cleaners, mufflers with paint.
2) Do not coat operating lever, side box, gauges, pedal, handrail, seat or undercover with paint because each of them have already been painted as a single unit.

1-6-1 ENGINE MAIN DATA AND SPECIFICATIONS

item		Data and specifications
Engine model		YANMAR 3TNE68-EIK
Engine type		Four cycle, water cooled, overhead valve (OHV), vertical in-line, swirl chamber type
No. of cylinder-bore × stroke	– ϕxmm	3–68 × 72
Total piston displacement	L	0.784
Compression ratio		23
Compression pressure	MPa (kgf /cm²)	3.24 (33) (Engine : at 250 min⁻¹)
Fuel injection order		1 → 3 → 2
Reted output	kW/min⁻¹ (ps/rpm)	9.7 / 2300 (13.2 / 2300)
Maximum torgue	N·m/min⁻¹ (kgf·m/rpm)	47.5 / 1800 (4.84 / 1800)
Fuel consumption	g/kW·h (g/ps·h)	272 (200)
High idling (No load)	min⁻¹	2460
Low idling (No Load)	min⁻¹	1250
Engine weight (Dry)	kg	81
Limit maximum incline angle	deg.	30° (35°of incline possible in 3 minutes)
Cooling fan		290mm – Pusher type – 5 blades
Alternator	V-A	12 V·20 A
Starter	V-kW	12 V·0.9 kW
Specified fuel		Diesel fuel (ASTM D975 No. 2D)
Lubricating oil		API, CD grade or higher
Lubricating oil capacity	L	Max. 3.0, Min. 1.0 (oil pan)
coolant capacity	L	0.9 (engine proper)
Valve clearances	mm	Intake and exhaust 0.15~0.25 (at cool)
Injection pump		In - line bosch type, YPFR
Oil press. warning switch	KPa (kgf/cm²)	Warning press. 49 (0, 5)
Injection timing	BTDC	14°
Injection starting pressure	MPa (kgf/cm²)	11.8 (120)

1-7-1 LIFTING CAPACITIES TABLE





Working conditions:

– with bucket.

– on a compact horizontal level ground.

– in complete swing of the upperstructure.

These loads are value for the height of the considered zone (Z.) for the intended outreach.

LIFTING CAPACITY

This lifting capacity is applied for operation on a level and firm ground, If the machine is operated on an unleveled or unstable ground, the capacity decreases.

Outreach in m – Loads in kg						
Outreach (m)		3.5	3.0	2.5	2.0	1.5
Boom length 1.65 m Arm length 0.95 m / 1.2 m	Z2	300	300	300	300	
	Z1	300	400	400	500	
	Z3			300	300	500

Multiply the lifting capacity by 2.2 to get figure in lbs.

⚠ CAUTION

There may be some local government regulations regarding the use of excavators to lift heavy objects. Please observe those regulations where they apply.

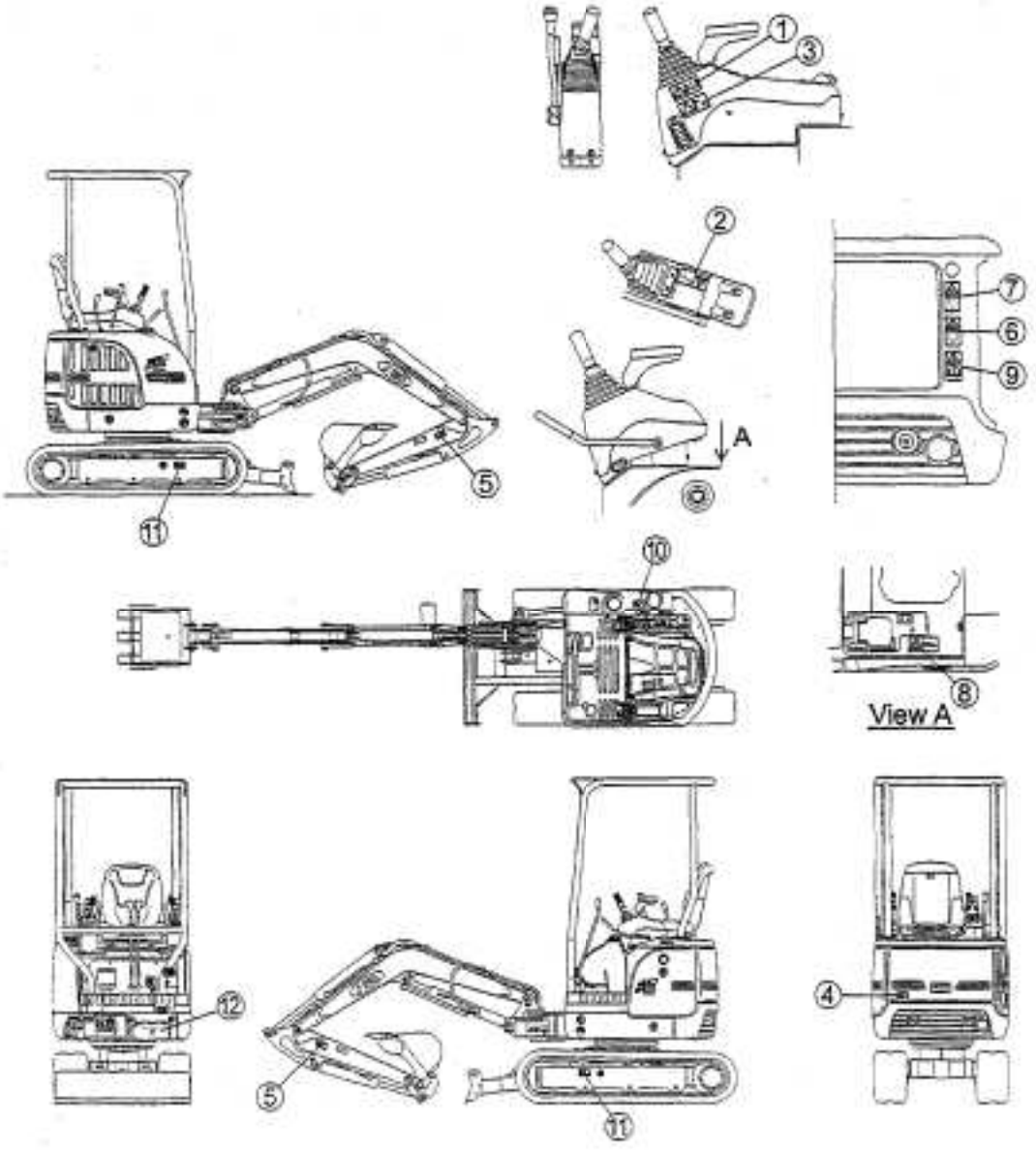
1-8-1 WARNING SIGNS AND LABELS

There are several specific safety signs on your machine. Their exact location and description of the hazard are reviewed in this section.
Please take the time to familiarize yourself with these safety signs.

Wake sure that you can read all safety signs. Clean or replace these if you cannot read the words or see the pictures. When cleaning the labels use a cloth, water and soap. Do not use solvent, gasolin, etc.

You must replace a label if it is damaged, missing or cannot be read. If a label is on a part that is replaced, make sure a new label is installed on the replaced part.
See your **IHI** dealer new labels.

Located warning lavels



Illustrated symbol	Recommended expantion	Illustrated symbol	Recommended expantion

①

Read manual before operation, maintenance, disassembly, assembly and transportaion.

• Part No.: D406 273 00

②

Sign indicates a hazard of being crushed or run over by unexpected mo bing of stopped machine. Lower working device to locke position and remove engine key with you before leabing machine.

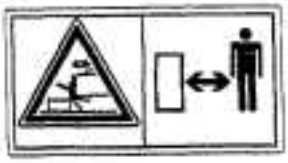
•Part No.: D406 272 00

③

Sign indicates an electroction hazard if machine is broutht too near electric power lines. Keep a safe distance from electric power lines.

•Part No.: D406 271 00

④



Sign indicates a crush hazard by rotation of upper structure of the machine. Keep away frrom swing area of machine.

•Part No.: D406 269 00

⑤ Sign indicates a hazard of being hit by the working device of the machine. Keep away from machine during operation.

•Part No.: D405 668 00

⑥ Sign indicates a hazard of rotating parts, such as belt. Turn off before inspection and maintenance.

•Part No.: D405 366 00

⑦ Sign indicates a hazard of rotating parts, such as fan. Turn off before inspection and maintenance.

•Part No.: D405 509 00

⑧

Do not put your hand in the machine. Otherwise, you might get your hand caught in it.

• Part No.: D406 262 00

Illustrated symbol | Recommended expantion

⑨ Sign indicates an electrical hazard from handing the cable. Read manual for safe and proper handing.
• Part No.: D405 363 00

Illustrated symbol | Recommended expantion

⑩ Sign indicates a burn hazard from spurting hot water or oil if radiator or hydraulic tank is uncapped while hot. allow radiator or hydraulic tank to cool before removing cap.
• Part No.: D405 503 00

⑪ Sign indicates a hazard of flying plug from track adjuster that could cause injury. Read manual before adjusting track for safe and proper handling.
• Part No.: D405 505 00

⑫ **DANGER!**
Attach a DO NOT OPERATE warning tag to start switch or controls before servicining or repeairing the machine.
Do not start the engine or move any of the controls if their is DO NOT OPERATE or similar warning tag attached to the start switch or controls.
Keep in the tool box do not use warning tag.
• Part No.: D405 323 00

SECTION 2 STRUCTURE

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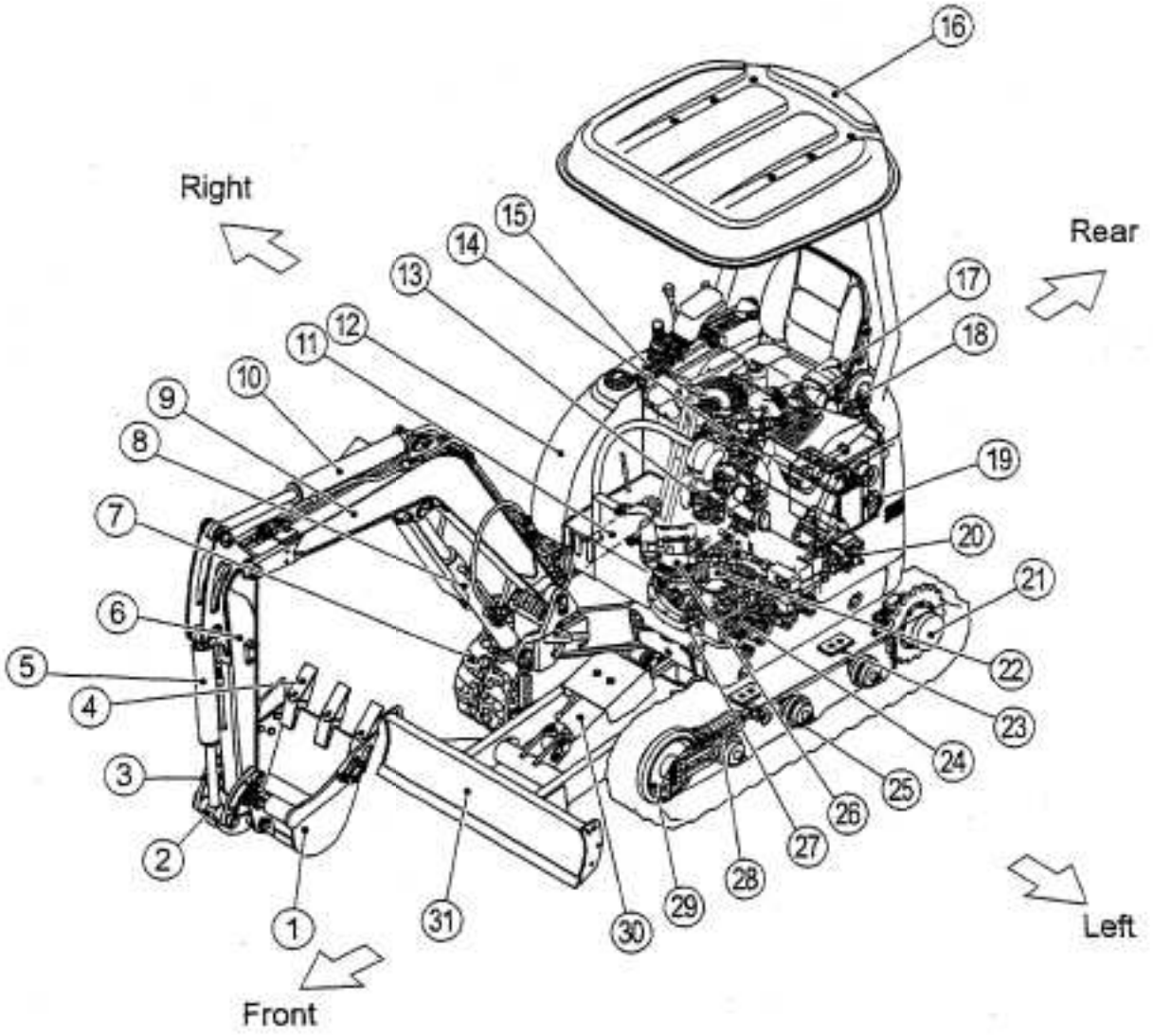
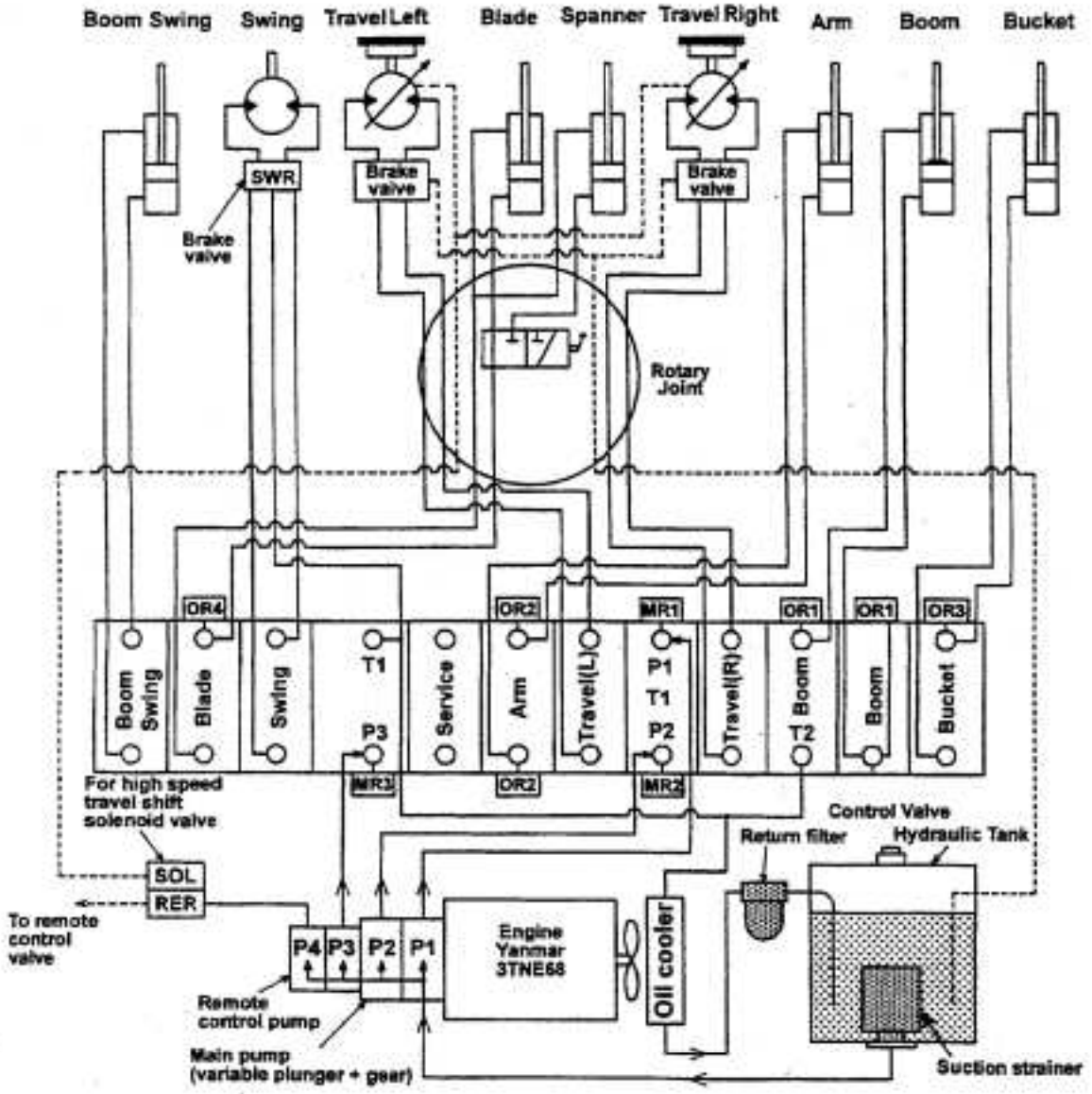
NOMENCLATURE



Typical Example

(1) Bucket
(2) Bucket Link
(3) Arm Link
(4) Tooth
(5) Bucket Cylinder
(6) Arm
(7) Crawler shoe
(8) Boom Cylinder
(9) Boom
(10) Arm Cylinder
(11) Boom Swing Cylinder
(12) Fuel Tank
(13) Muffler
(14) Engine
(15) Radiator
(16) Canopy
(17) Air Cleaner
(18) Return Filter
(19) Hydraulic Tank
(20) Hydraulic Pump
(21)Travel motor
(22) Rotary Joint
(23) Guide plate
(24) Control Valve
(25) Lower roller
(26) Swing Drive (with motor)
(27) Swing Bearing
(28) Track Adjuster
(29) Front Idler
(30) Blade Cylinder
(31) Blade

HYDRAULIC SYSTEM DIAGRAM



Relief valve set pressure

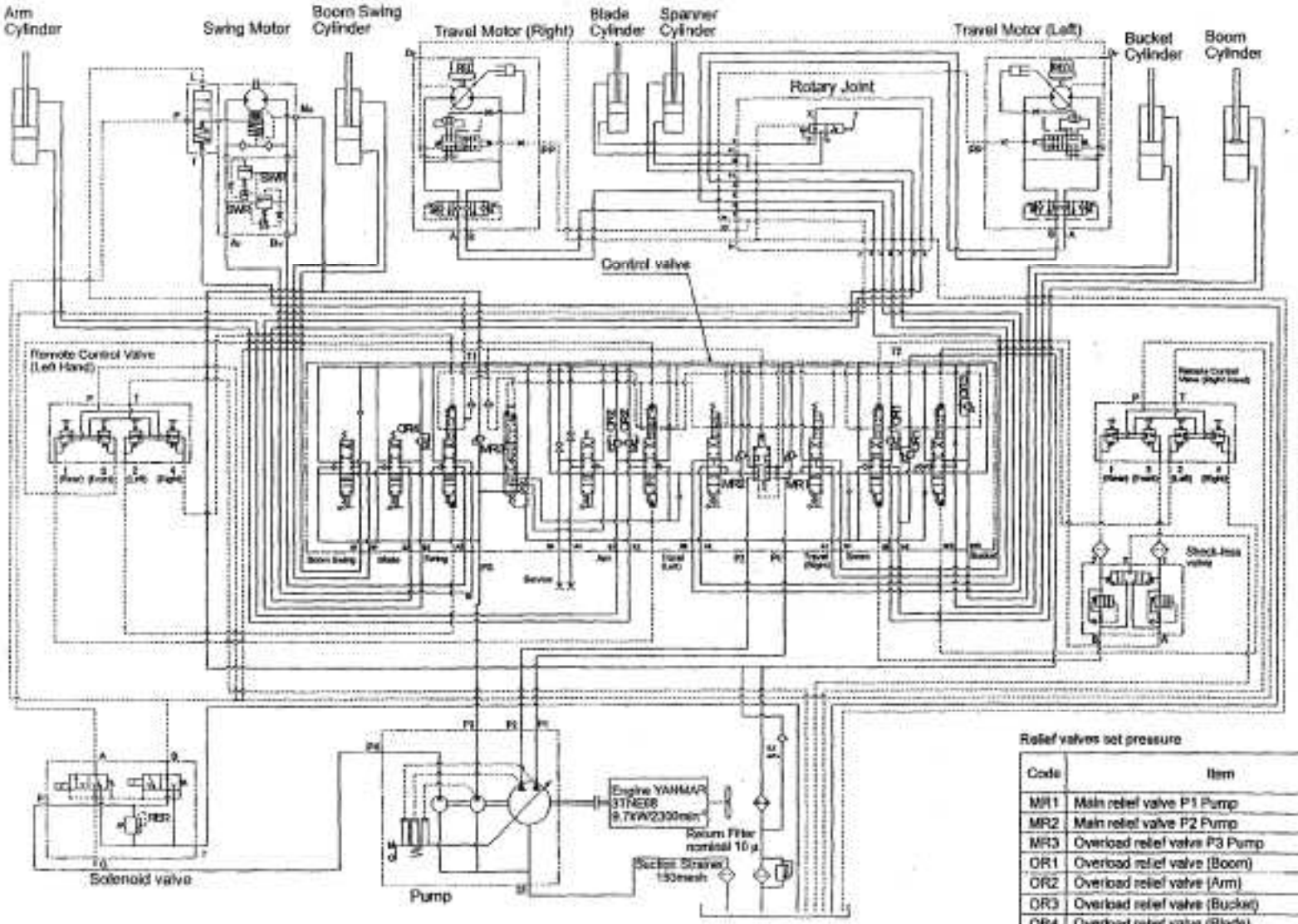
Code	Item	Pressure	
		MPa	kgf/cm²
MR1	Main relief valve P1 Pump	20.6	210
MR2	Main relief valve P2 Pump	20.6	210
MR3	Main relief valve P3 Pump	18.1	185
OR1	Overload relief valve (Boom)	24.5	250
OR2	Overload relief valve (Arm)	24.5	250
OR3	Overload relief valve (Bucket)	24.5	250
OR4	Overload relief valve (Blade)	20.6	210
SWR	Swing relief valve	15.2	155
RER	Remote control relief valve	2.9	30

Tank level capacity
19 liters
Total system volume
23 liters

Pump flow rate (Max.):
P1 ; 17.2 liter/min
P2 ; 17.2 liter/min
P3 ; 12.0 liter/min

The service ports used the flow shared by the P2 and P3 pump.

HYDRAULIC CIRCUIT SCHEMATIC DIAGRAM



Relief valves set pressure

Code	Item	Pressure	
		MPa	kgf/cm²
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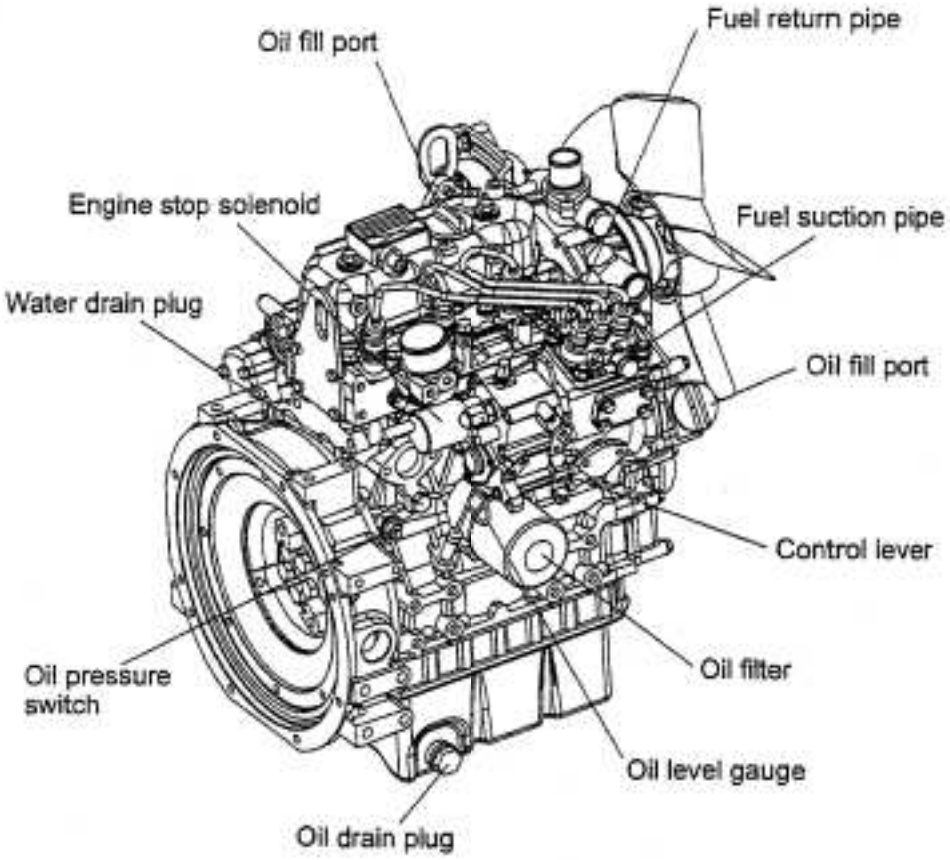
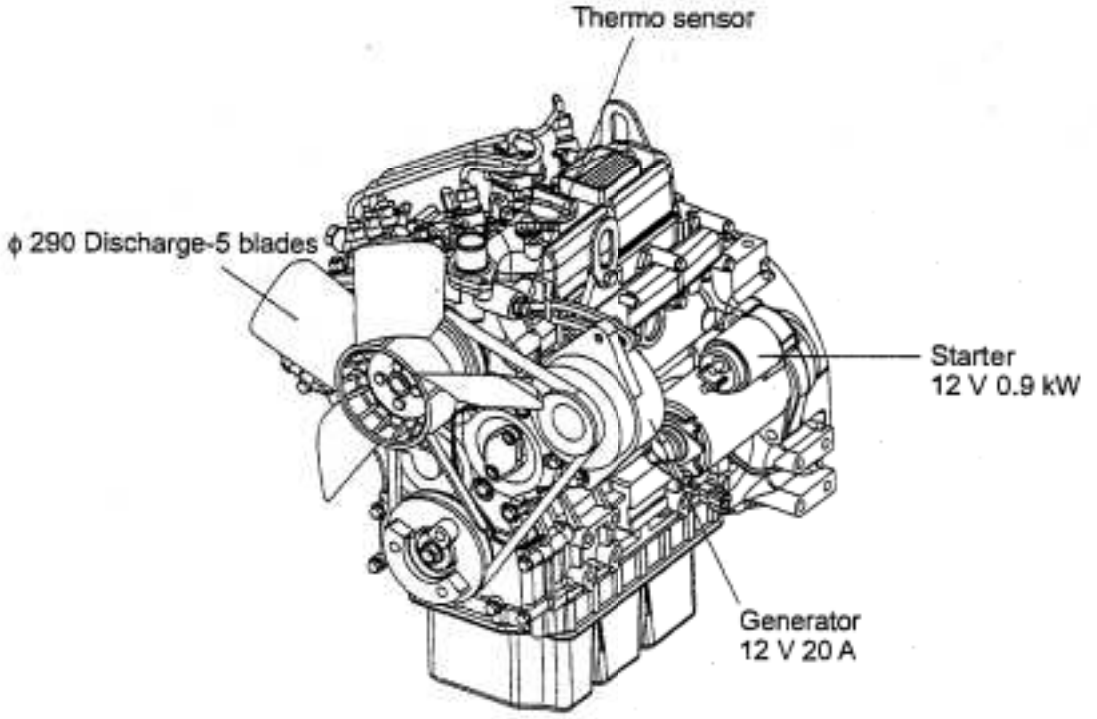
OR1	Overload relief valve (Boom)	24.5	250
OR2	Overload relief valve (Arm)	24.5	250
OR3	Overload relief valve (Bucket)	24.5	250
OR4	Overload relief valve (Blade)	20.6	210
SWR	Swing relief valve	15.2	155
RER	Remote control relief valve	2.94	30

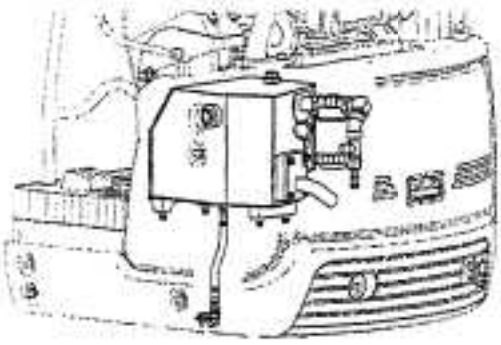
Location of engine installed parts

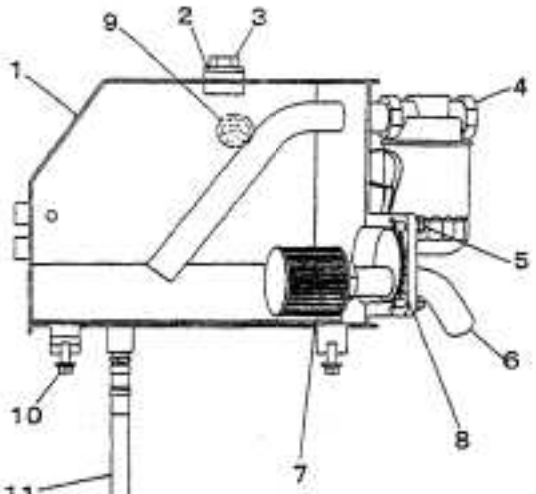
3TNE68-EIK

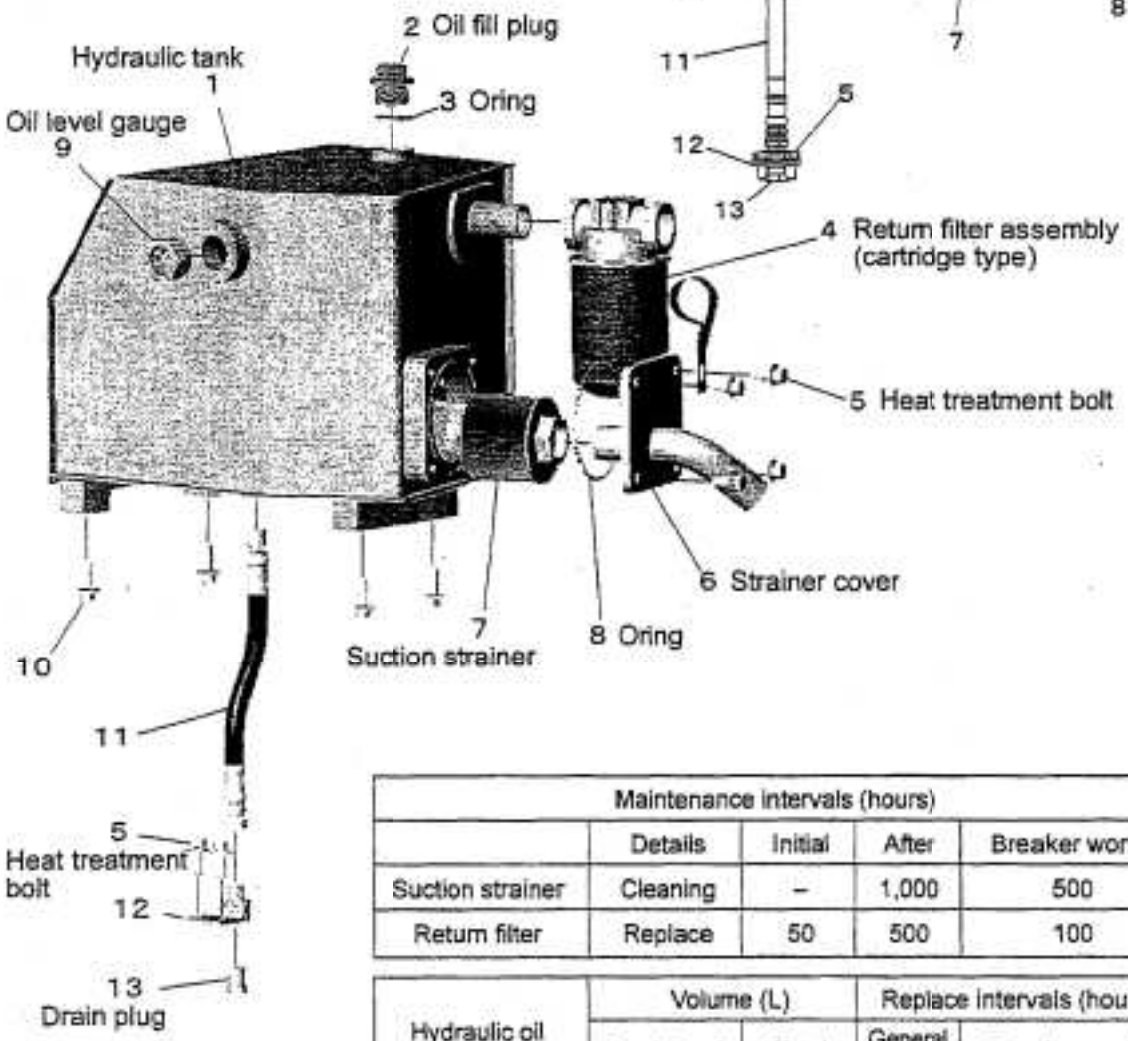




HYDRAULIC TANK ASSEMBLY F340 979 00



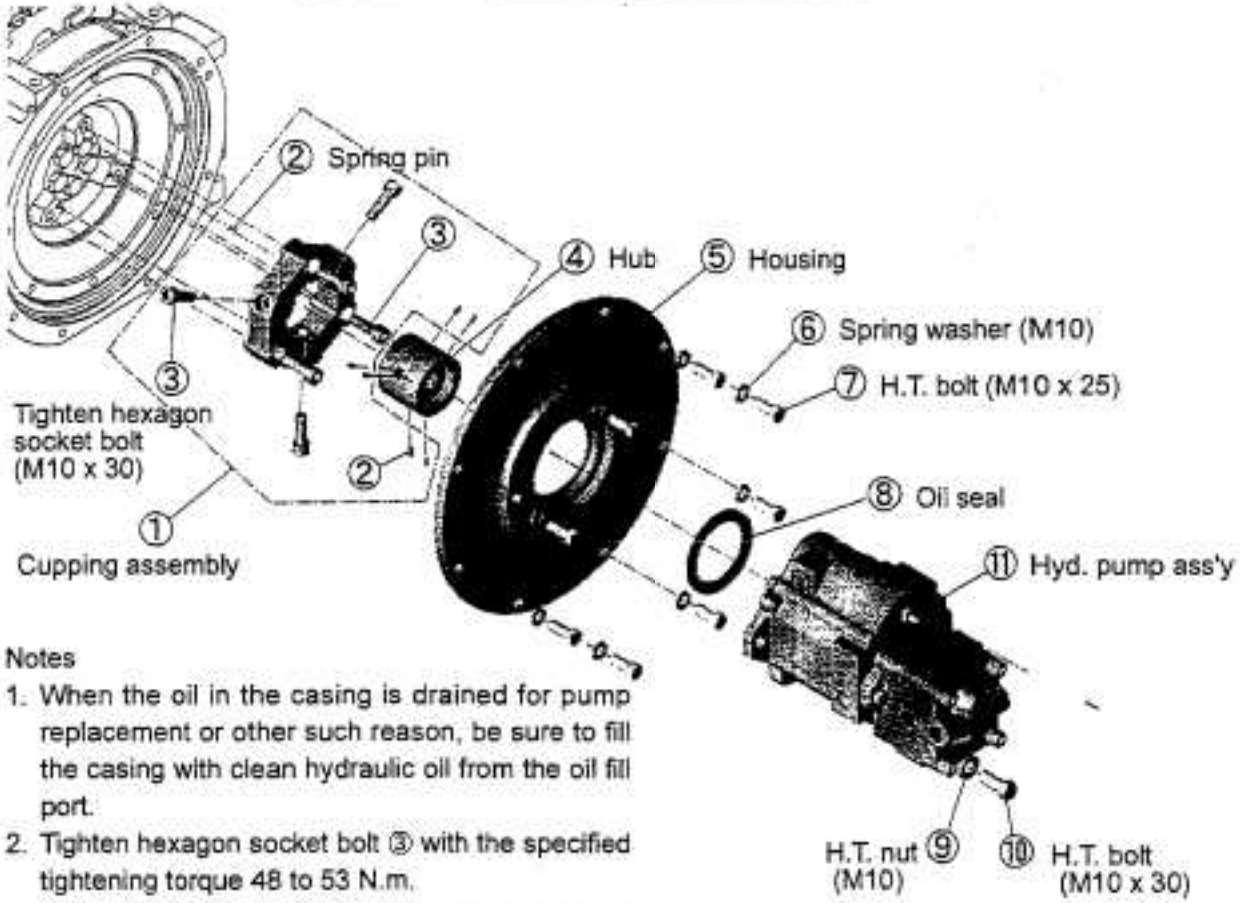




Maintenance intervals (hours)				
	Details	Initial	After	Breaker works
Suction strainer	Cleaning	–	1,000	500
Return filter	Replace	50	500	100

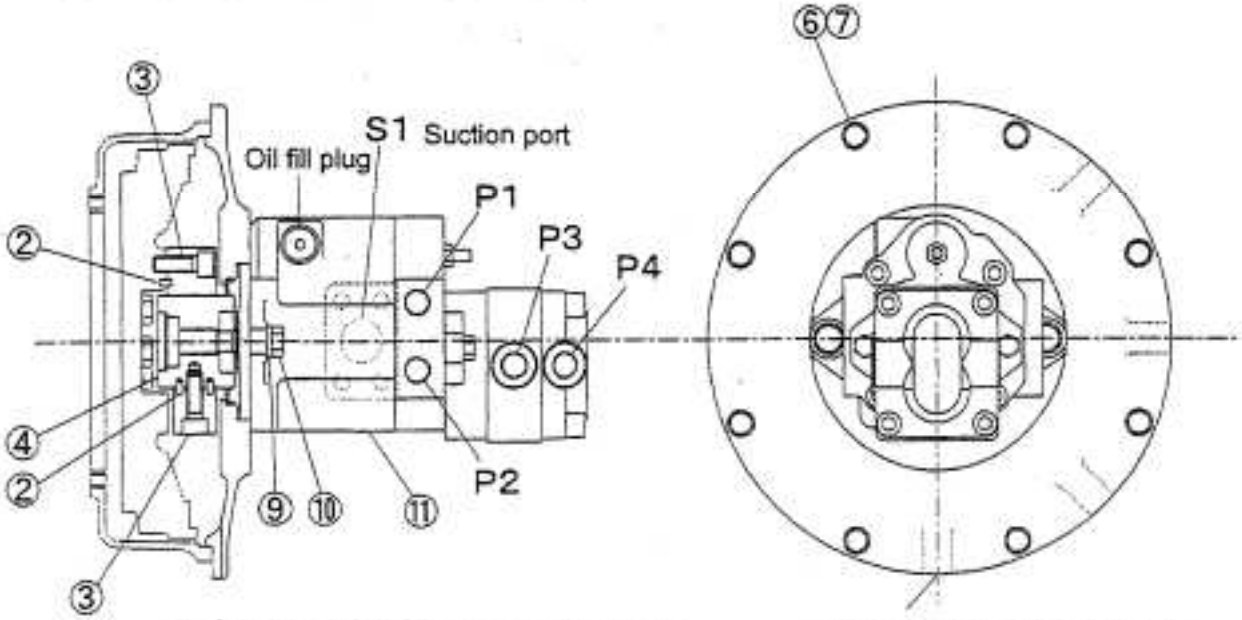
Hydraulic oil	Volume (L)		Replace intervals (hours)	
	Tank level	Total	General operation	Breaker works
Wear proof hydraulic fluid IS-SUPER A	19	23	1,000	500

PUMP DRIVE DEVICE ASSEMBLY F330 274 01



Notes

1. When the oil in the casing is drained for pump replacement or other such reason, be sure to fill the casing with clean hydraulic oil from the oil fill port.
2. Tighten hexagon socket bolt ③ with the specified tightening torque 48 to 53 N.m.
3 Fill up the spline and space with "NEVER-SEIZE" (special grease) when assembling the pump.



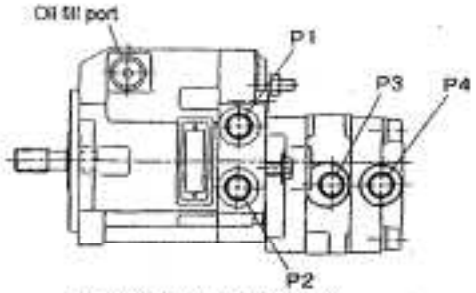
Cross Section of Pump Drive Device

When assembling the housing, be sure to install the housing groove at the place shown in the figure above.

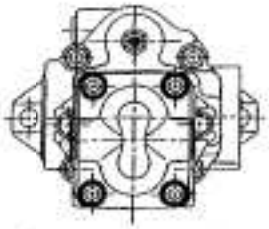
HYDRAULIC PUMP ASSEMBLY

0780 053 UA

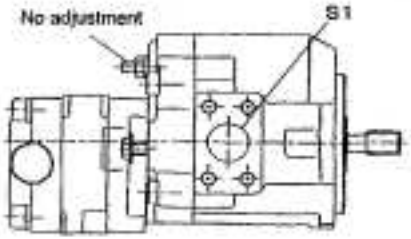
Refer to the Parts Catalog for the names and No. of parts of hydraulic pump.



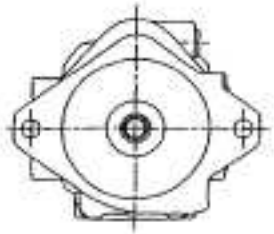
View from pump front side



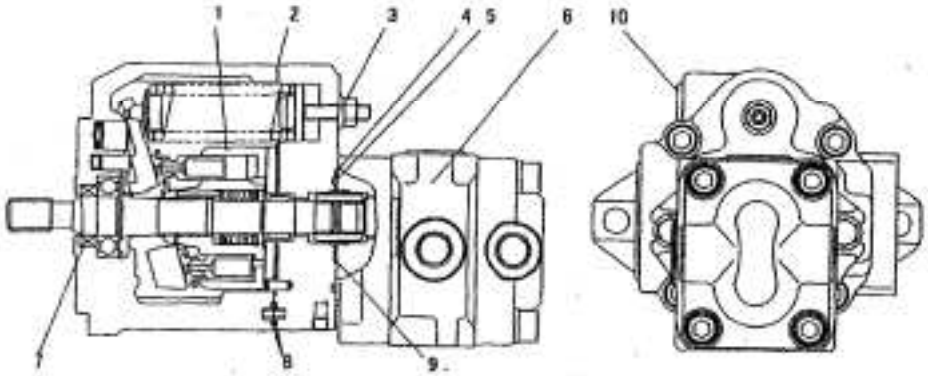
View from gear pump side

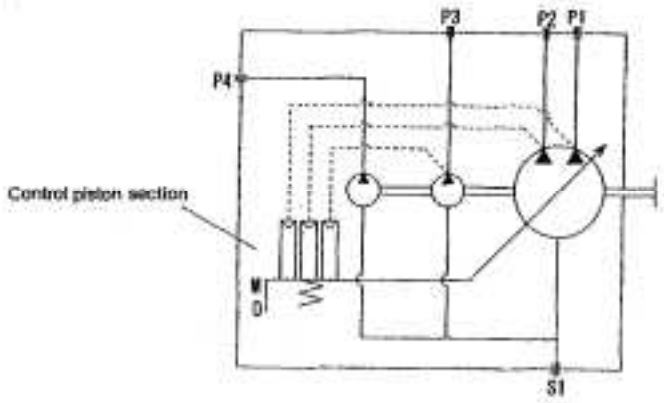


View from pump back side



View from shaft direction





Pump hydraulic circuit diagram

NOTICE

1. Never start the engine before fill the pump casing with hydraulic oil.
2. Fill the pump casing with hydraulic oil after replace hydraulic oil or replace the pump assembly.

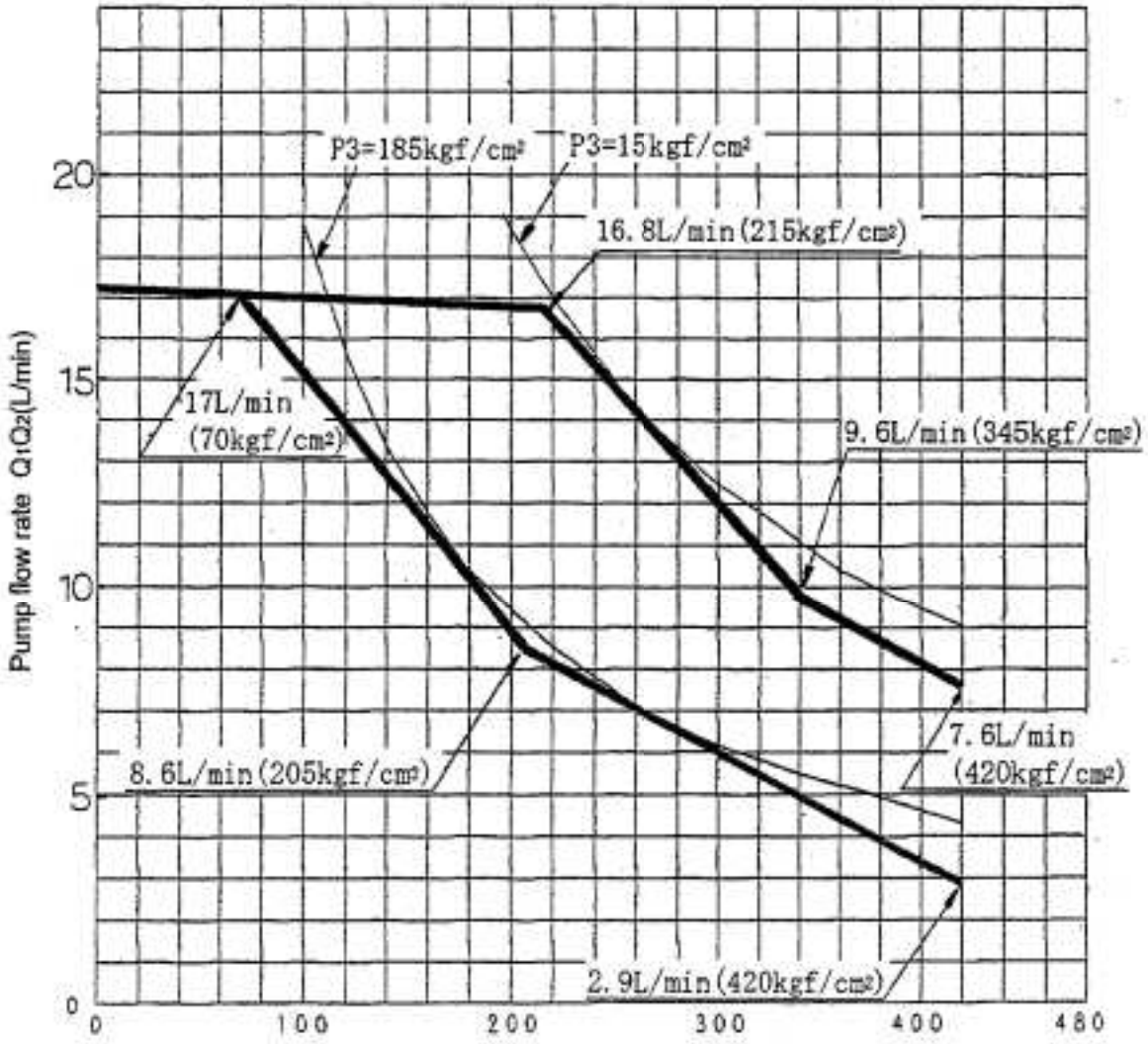
PORT

Port	Port name	Port size
S1	Suction	SAE J518b-1
P1 • P2	Delivery	G3/8
P3 • P4	Delivery	G3/8

Hydraulic Pump Performance

0780 053 UA

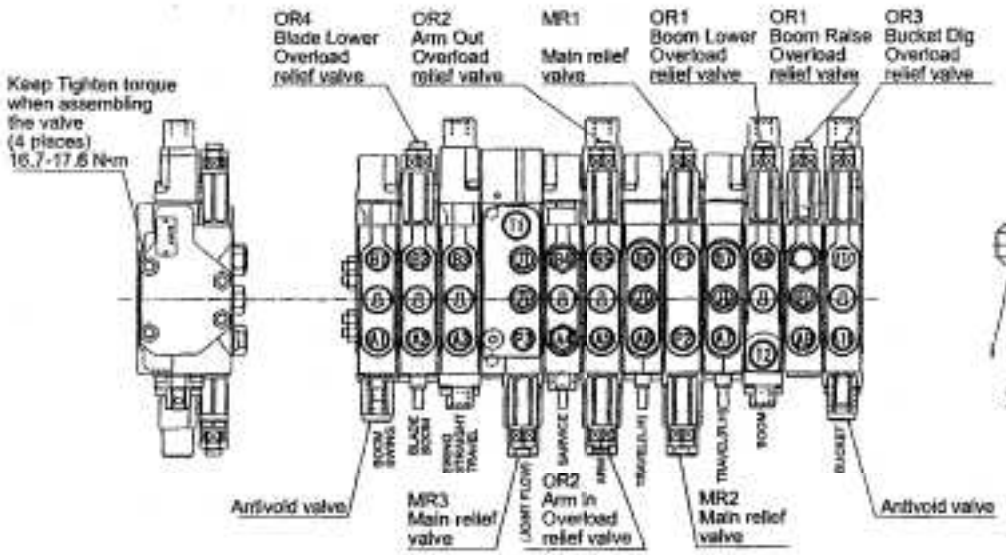
No. of Pump	P1 • P2	P3	P4
Type of pump	Plunger	Gear	Gear
Working pressure: MPa (kgf/cm²)	20.6 (210)	18.1 (185)	3.4 (35)
Delivery rate: cm³/rev	7.5 x 2 ; 1.3 x 2	5.2	2.7
Flow rate: L/min	17.3 x 2 ; 2.9 x 2	12.0	6.2
P3 Shift pressure: MPa (kgf/cm²)	1.47 (15) ; 18.1(185)	1.47 (15) ; 18.1 (185)	
Control system	Total power control with power shift circuit		
Used revolution: min⁻¹	Rated 2,300 (Max. 2,460)		

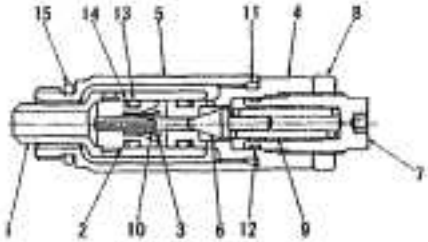


P - Q perfomance

CONTROL VALVE ASSEMBLY

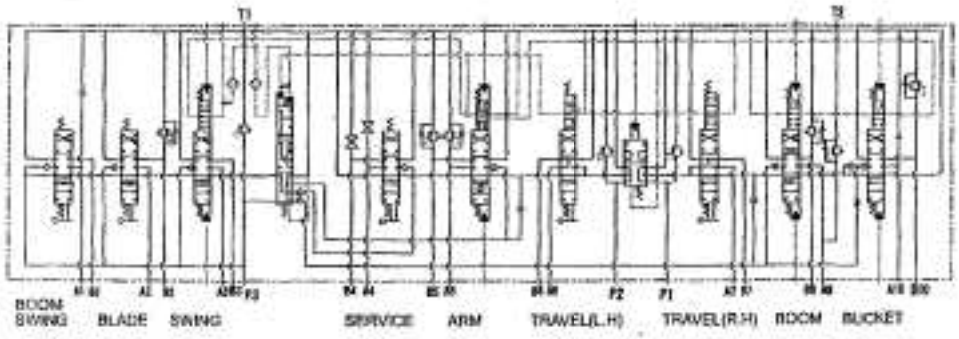
0783 697 UA





Gross-section of relief valve assembly

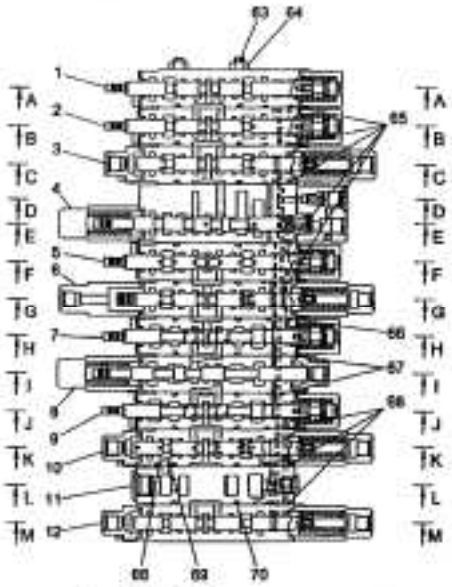
No.	Name	Q'ty
1	Socket	1
2	Regulator	1
3	Piston	1
4	Adjusting part	1
5	Pressure-regulating part	1
6	Regulating valve	1
7	Adjusting screw	1
8	Nut	1
9	Regulating valve spring	1
10	Pressure-regulating valve spring	1
11	O ring	1
12	O ring	1
13	O ring	2
14	Backup ring	2
15	O ring	1

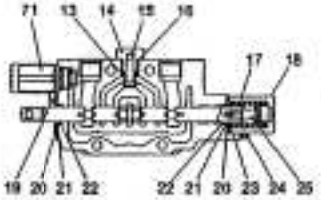


Pump	Main relief valve set pressure MPa (kgf/cm²)	
P1	MR1	20.6 $^{+0.49}_{0}$ (210) at 17.2 L/min
P2	MR2	20.6 $^{+0.49}_{0}$ (210) at 17.2 L/min
P3	MR3	18.1 $^{+0.49}_{0}$ (185) at 12.0 L/min

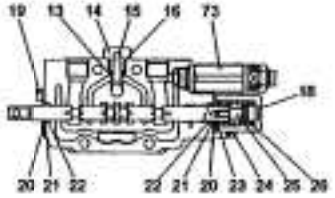
Valve No.	Over load relief valve set pressure MPa (kgf/cm²)	
OR1	Boom	24.5 $^{+0.49}_{0}$ (250) at 5 L/min
OR2	Arm	24.5 $^{+0.49}_{0}$ (250) at 5 L/min
OR3	Bucket Dig	24.5 $^{+0.49}_{0}$ (250) at 5 L/min
OR4	Blade	20.6 $^{+0.49}_{0}$ (210) at 5 L/min

CONTROL VALVE ASSEMBLY 0783 697 UA

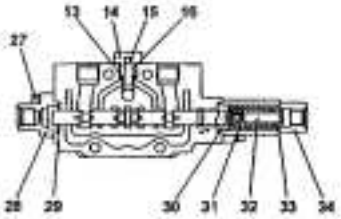




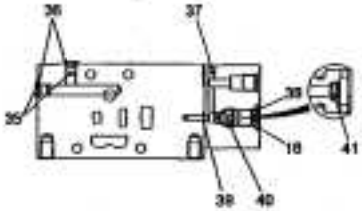
SECTION "A-A"
(BOOM SWING)



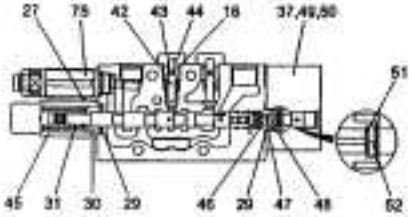
SECTION "B-B"
(BLADE)



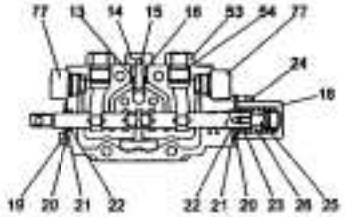
SECTION "C-C"
(SWING)



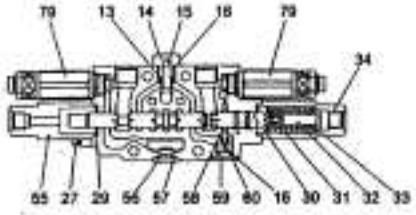
SECTION "D-D"
(STRAIGHT TRAVEL)
(JOINT FLOW)



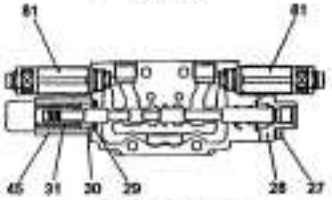
SECTION "E-E"
(STRAIGHT TRAVEL)
(JOINT FLOW)



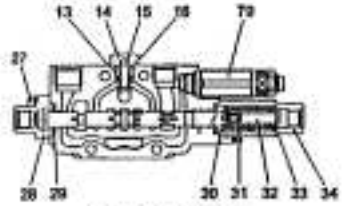
SECTION "F-F"
(SERVICE)



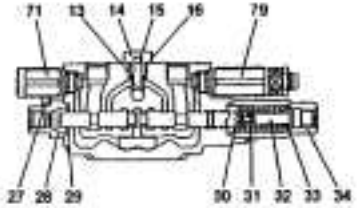
SECTION "G-G"
(ARM)



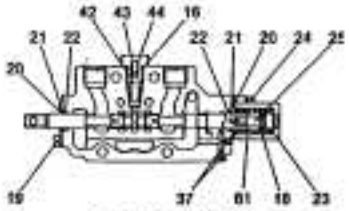
SECTION "I-I"
(SUPPLY)



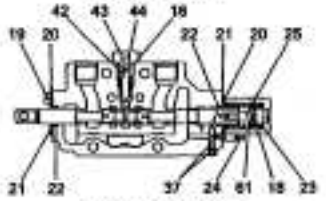
SECTION "K-K"
(BOOM)



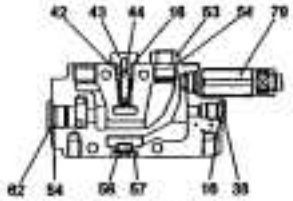
SECTION "M-M"
(BUCKET)



SECTION "H-H"
(TRAVEL L.H)



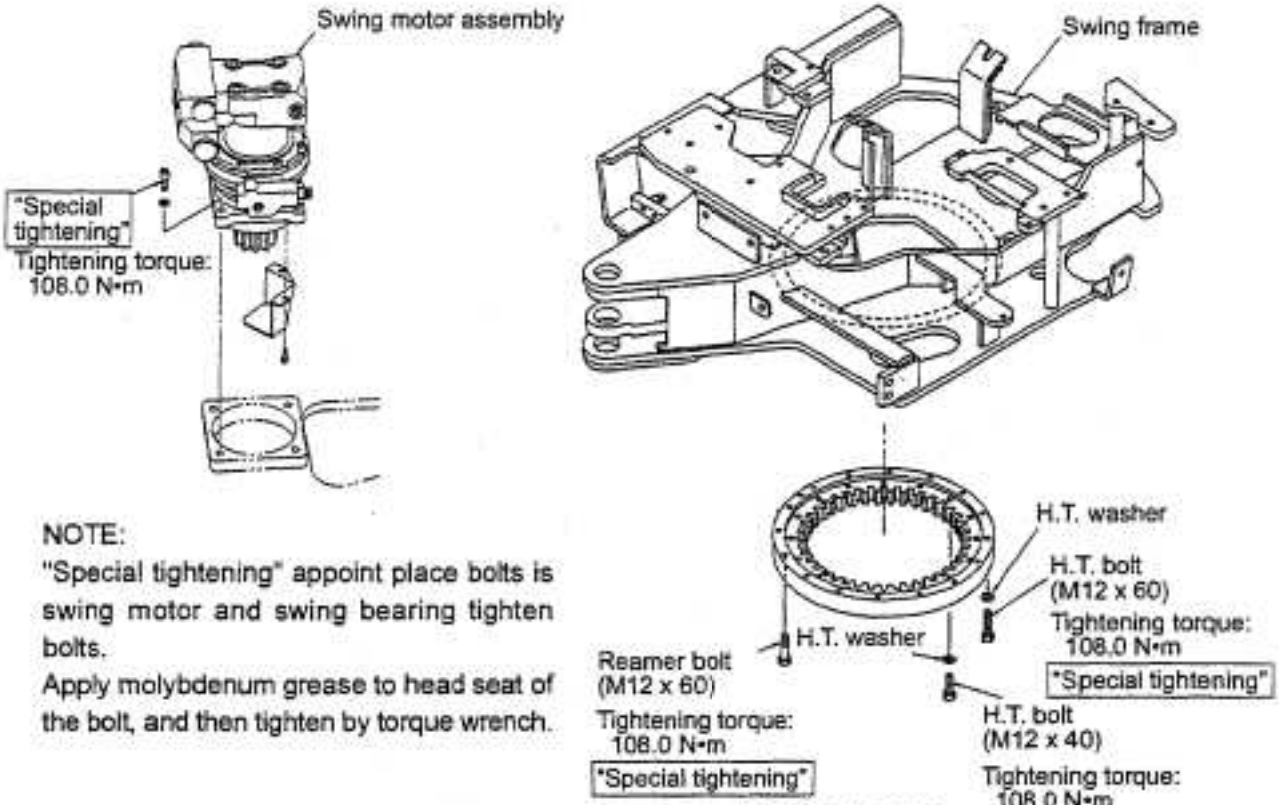
SECTION "J-J"
(TRAVEL R.H)



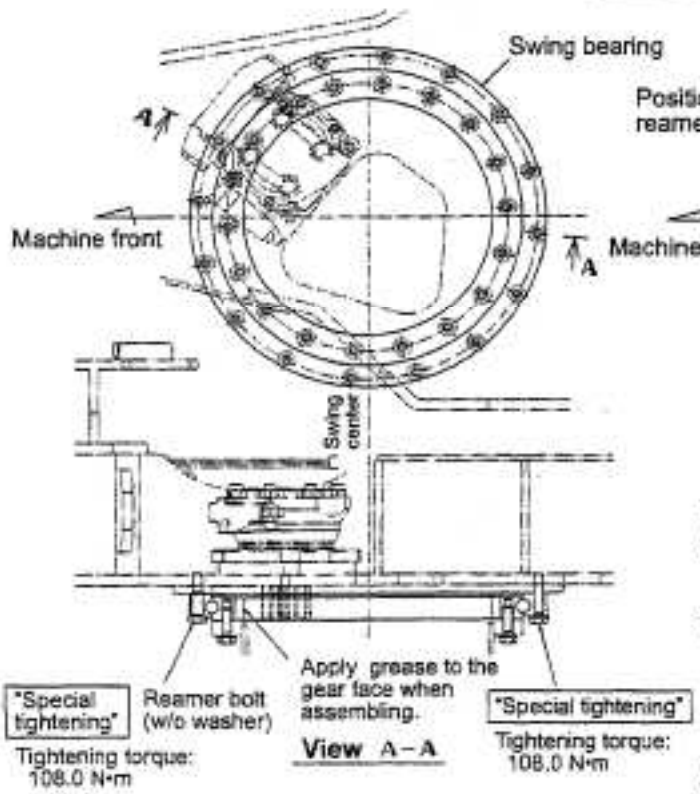
SECTION "L-L"

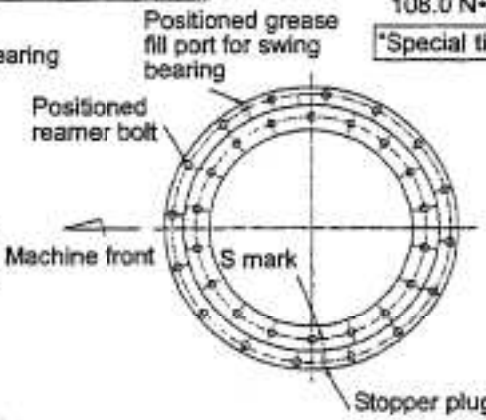
Refer to Control Valve Ass'y in the Hydraulic Instrument section of Parts Catalog.

SWING DRIVE DEVICE & BEARING ASSEMBLY F320 127 00



NOTE:
"Special tightening" appoint place bolts is swing motor and swing bearing tighten bolts.
Apply molybdenum grease to head seat of the bolt, and then tighten by torque wrench.



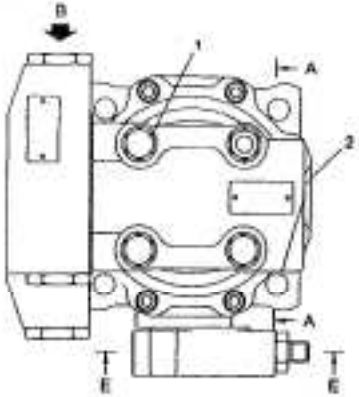


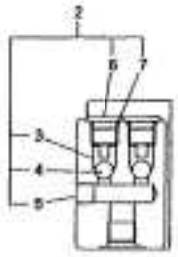
Position of install the bearing

Notes:
1) Assemble the soft zone and oil-fill ports as shown in the figure above.
2) When connecting the upper and lower parts, temporarily assemble the reamer bolt earlier than other bolts, and carry out centering.
3) Tighten the reamer bolt first of all.

SWING MOTOR ASSEMBLY

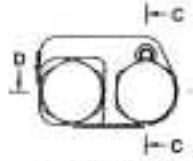
0781 204 UA



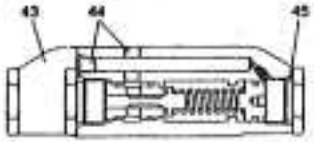


Cross section "A-A"

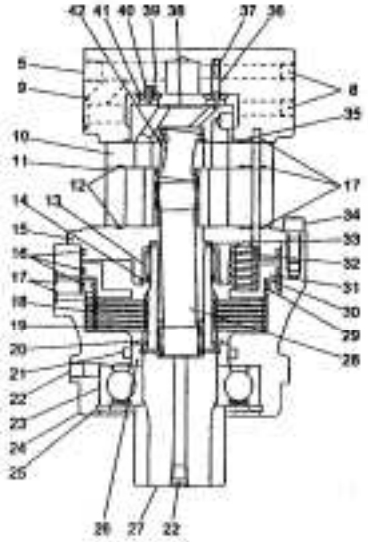
Refer to the Parts Catalog for the names and No. of parts.

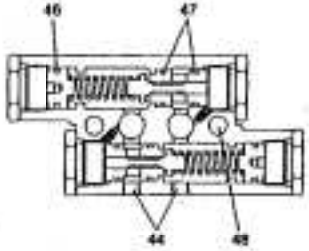


Details of "B" (Relief valve)

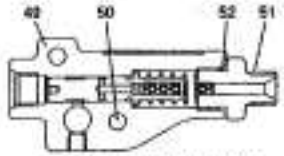


Cross section "C-C" (Relief valve)

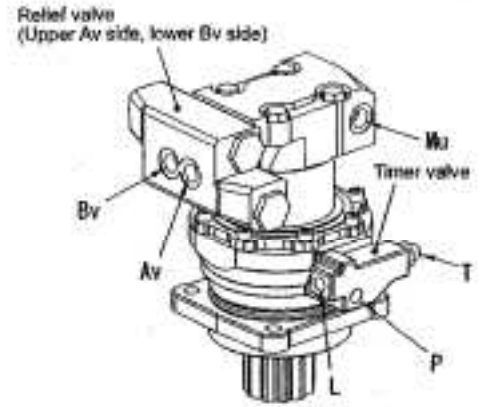


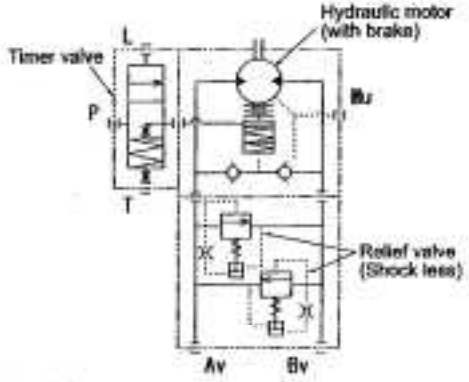


Cross section "D-D" (Relief valve)



Cross section "E-E" (Timer valve)





Hydraulic Symbols

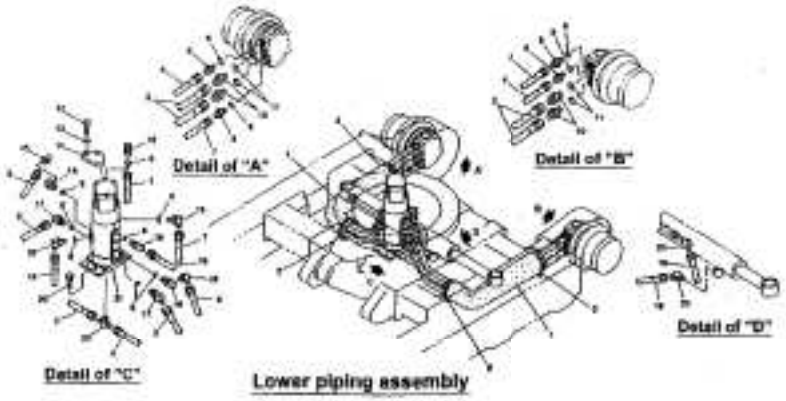
Parking brake	Release pressure (Theoretical)	1.98MPa (20.2kgf/cm²)
Relief valve	Set preesure	15.2Mpa (155kgf/cm²) at 10L/min
Timer valve	Set pressure (Theoretical)	1.37±0.2MPa (14±2kgf/cm²)
	Timer time	4 ±2sec (at VG46 45°C)

ROTARY JOINT & LOWER PIPING ASSEMBLY

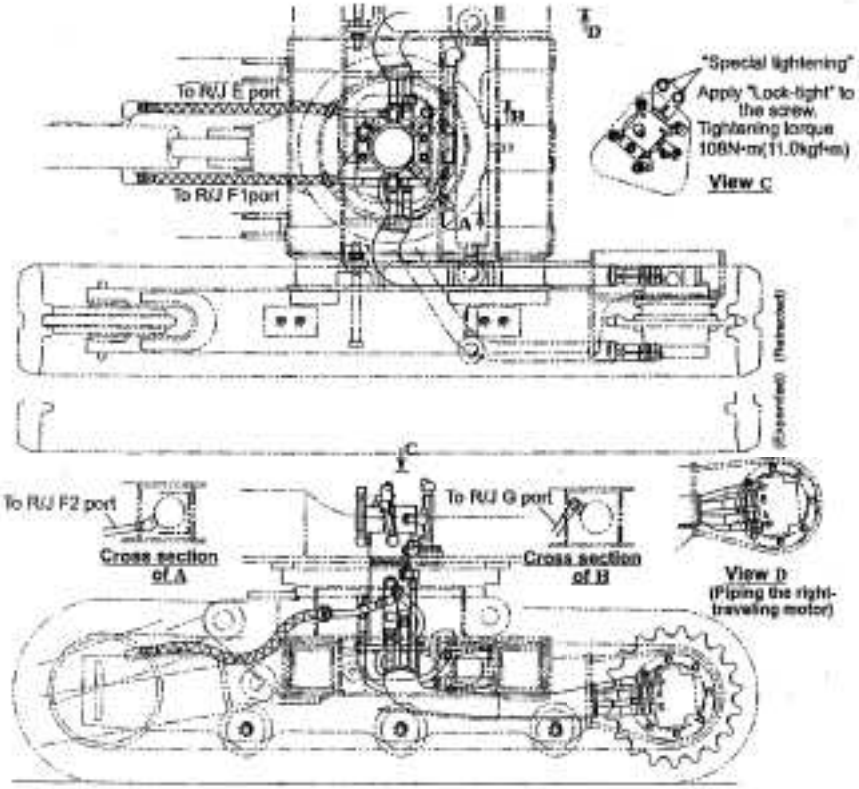
Piping Ass'y: F340 991 00
Rotary joint ass'y:
0755 865 UA

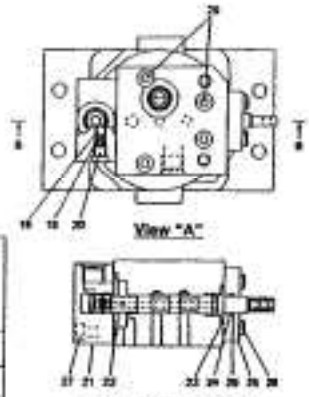
Refer to the Parts Catalog for the names and No. of parts.

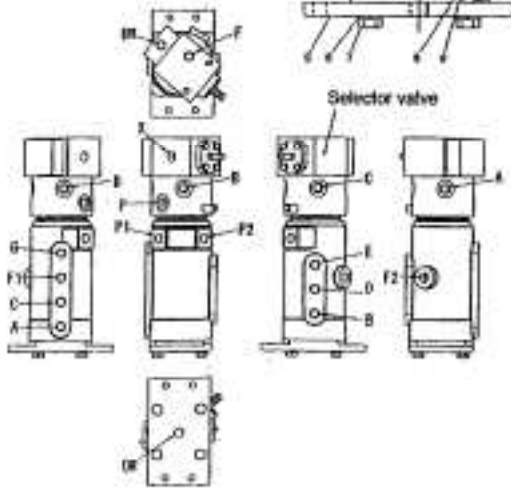
NOTE
Apply coat grease on the seals and shaft surfaces when assembling.

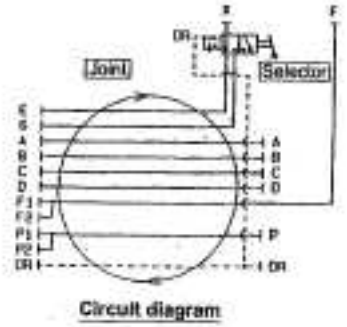


Lower piping assembly





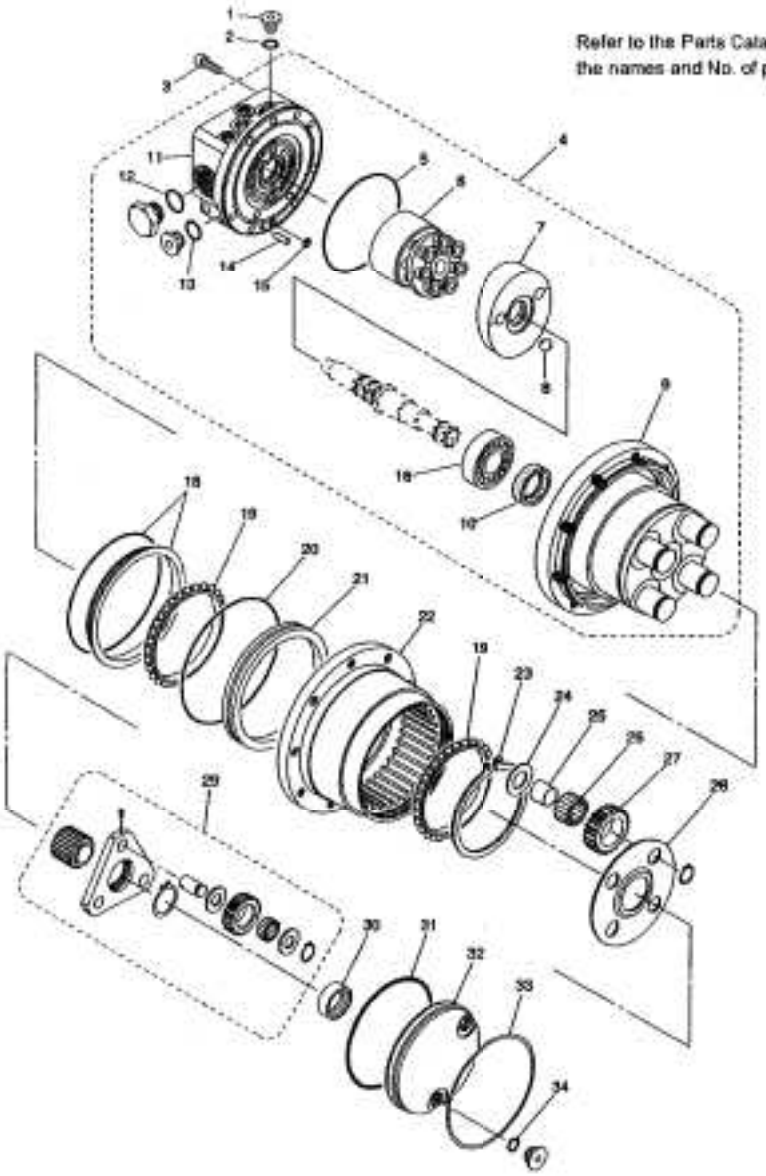




Circuit diagram

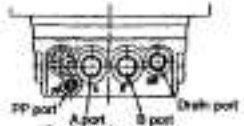
TRAVEL MOTOR & REDUCTION GEAR ASSEMBLY

0781 181 UA
(with 2-speed motor)

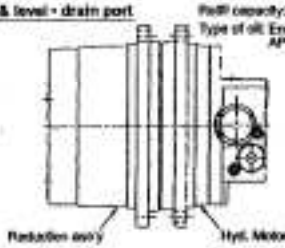


Refer to the Parts Catalog for the names and No. of parts.

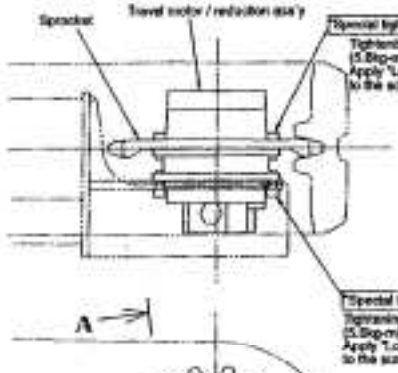
Location of oil fill & level • drain port



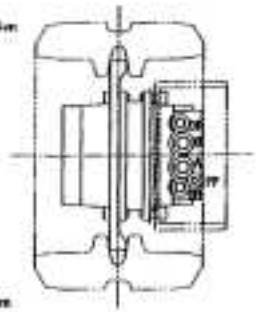
Brake valve section



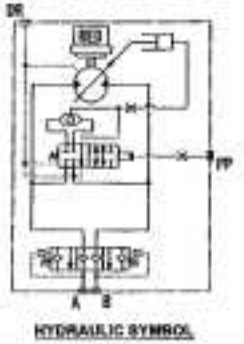
View from brake valve



Installing the travel motor and the sprocket
(Shown right side)

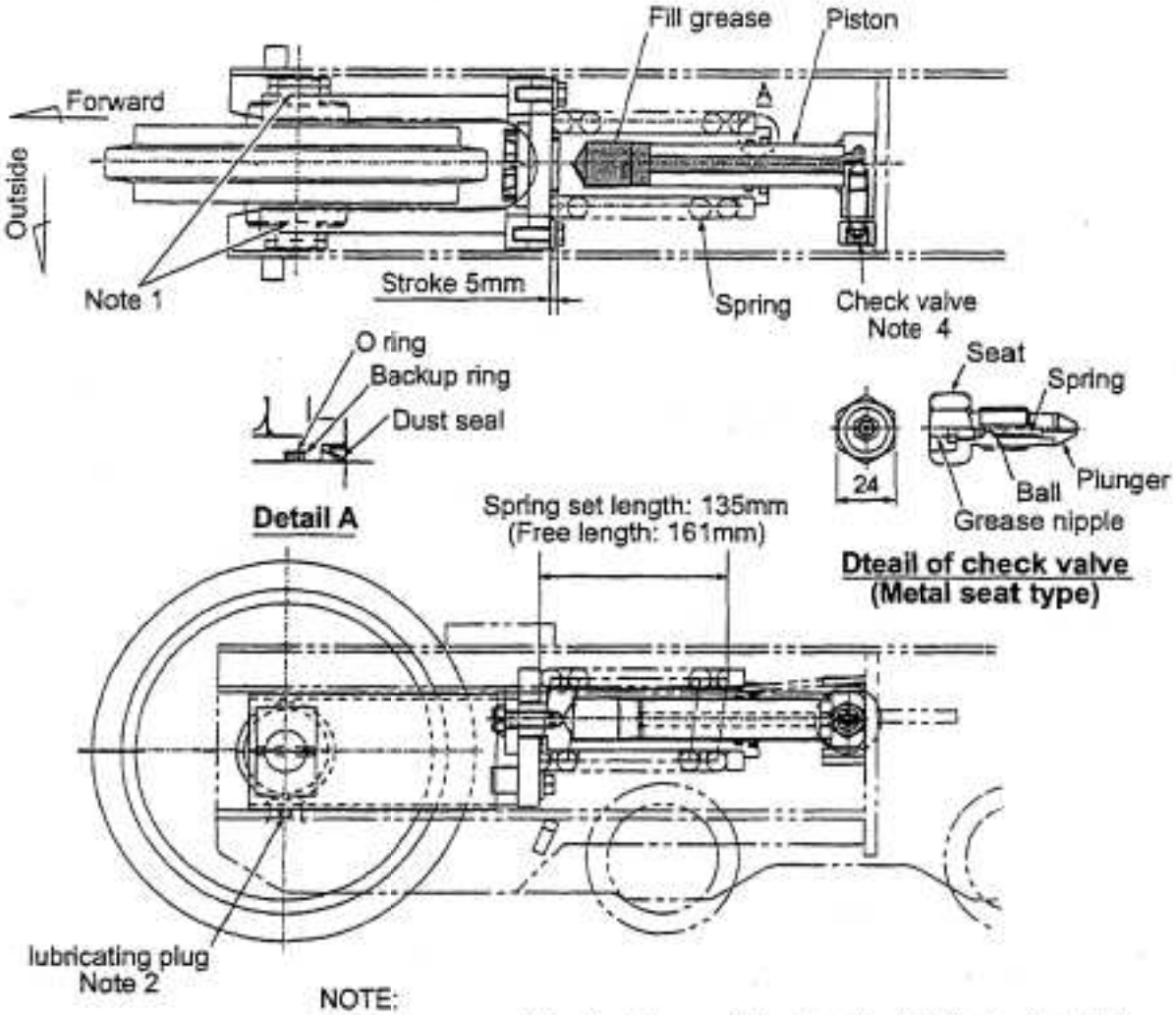


Cross section A-A



HYDRAULIC SYMBOL

CRAWLER SHOE ADJUSTING DEVICE 5301 222 00



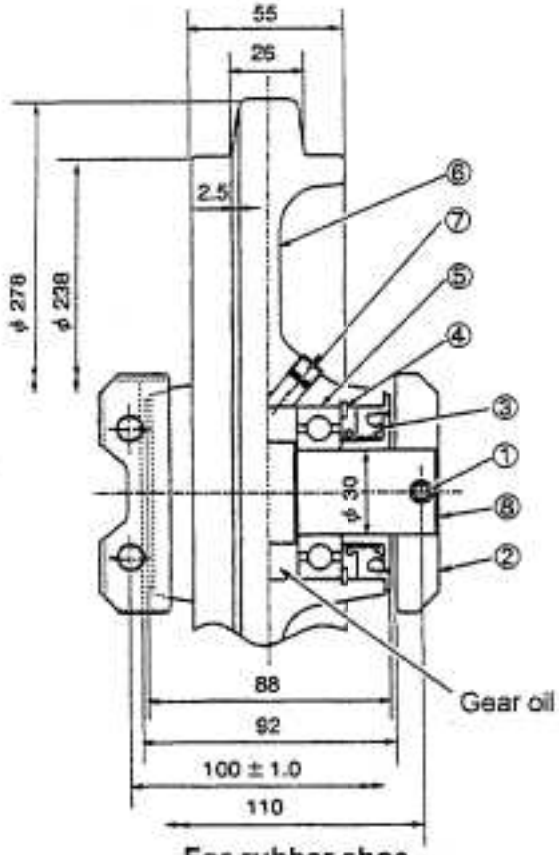
NOTE:

1. Before assembling the idler ass'y bearing block lublicate their side way to the frame with grease.
2. Position the luburicating plug side outward when assembling the idler ass'y to the frame.
3. Install the grease cylinder to position the oil fill port outward.
4. Keep tightening torque to the check valve 55.8 to 68.6 N•m (6 to 7 kgf•m) to prevent breaking it.
5. This figure shows the left side frame. Assemble the right side symmetrically.

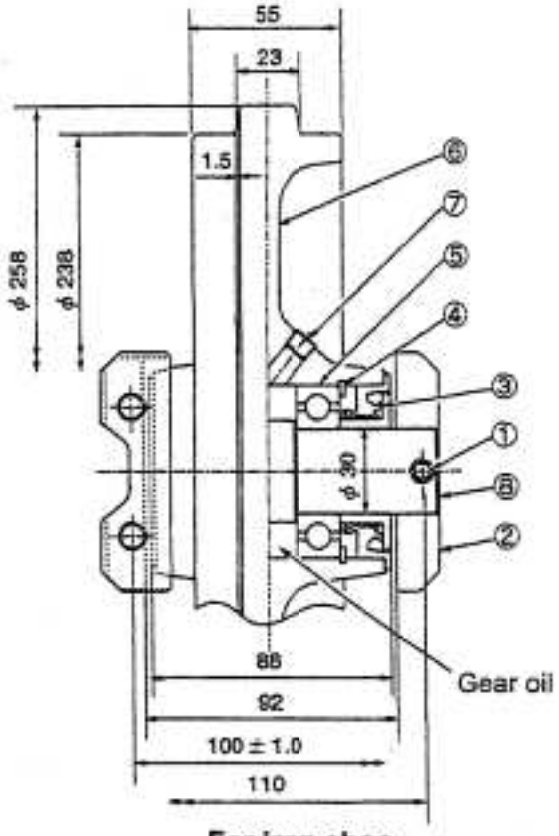
⚠ WARNING

- When the tension of the shoe is high, the grease cylinder internal pressure becomes considerably high.
- The grease can gush out of the cylinder under high pressure. NEVER remove the grease nipple.
- While adjusting, do not move your face or hands closer to the check valves.
- Relieve pressure by opening check valve gradually by 1 turn at maximum.

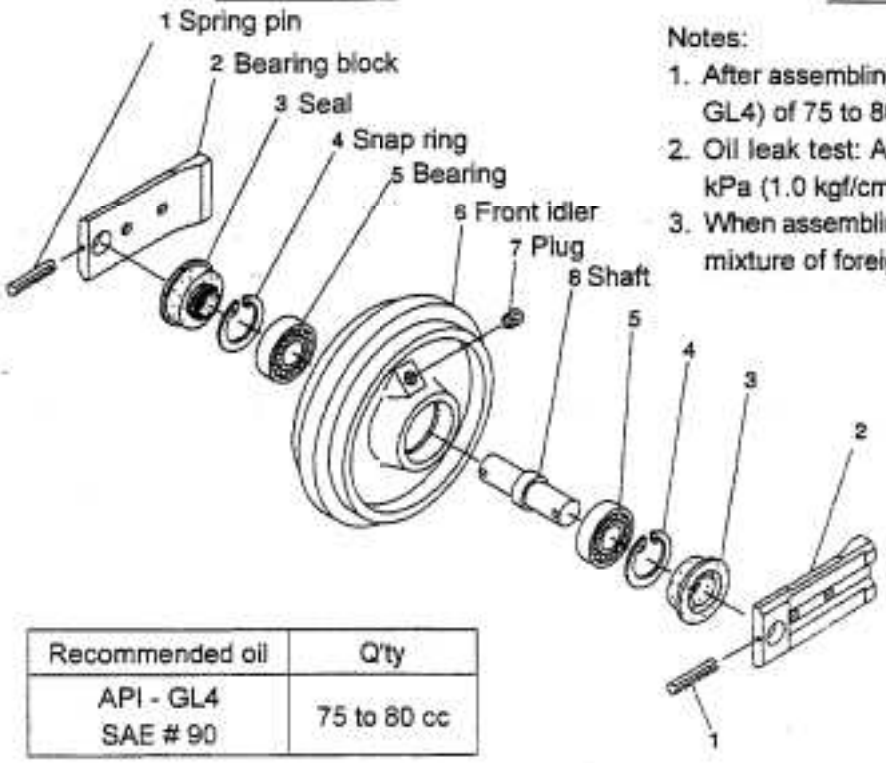
FRONT IDLER ASSEMBLY



For rubber shoe (5301 167 00)



For iron shoe (5301 138 00)



Notes:

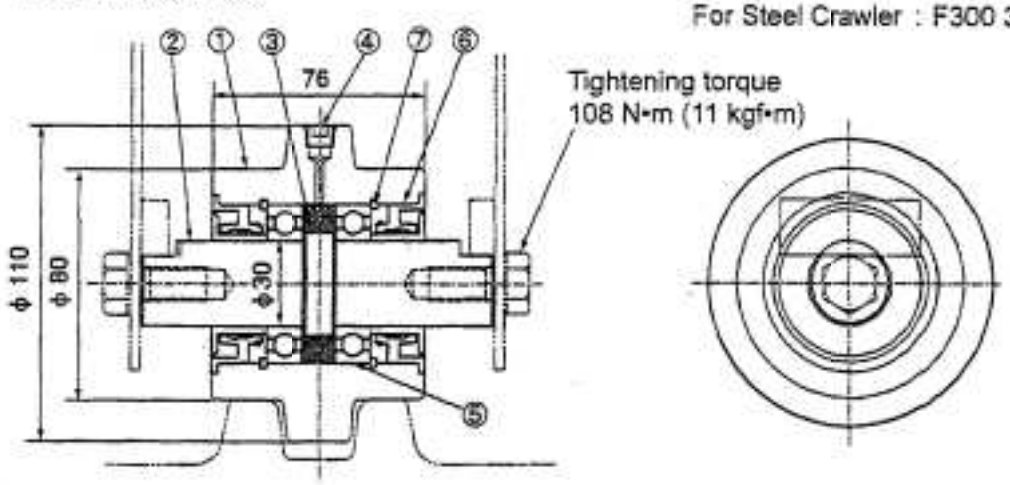
1. After assembling, fill gear oil (SAE#90•API-GL4) of 75 to 80 cc and assemble plug ⑦.
2. Oil leak test: Apply pressurized air of 98 kPa (1.0 kgf/cm²) to check for any oil leak.
3. When assembling, take care to prevent any mixture of foreign matter.

Recommended oil	Q'ty
API - GL4 SAE # 90	75 to 80 cc

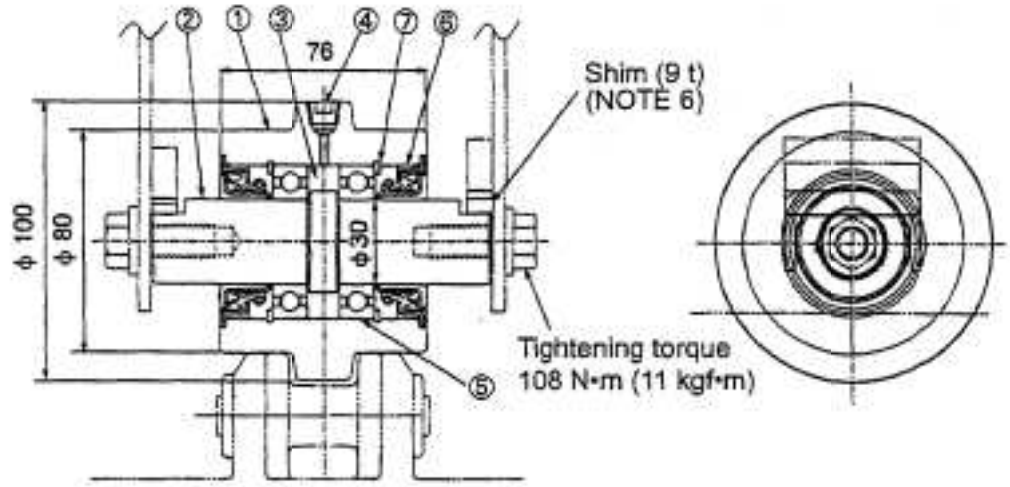
LOWER ROLLER ASSEMBLY

1. For Rubber Shoe:

For Rubber Shoe : 5301 261 00
For Steel Crawler : F300 347 00



2. For Steel Shoe:



NOTE :
1. Clean the roller, collar and shaft inside before assembling to prevent mixture of foreign matter.
2. After assembling snap ring ⑦, place the roller vertically and fill gear oil (SAE#90•API-GL4) of 25cc and install oil seal ⑥.
3. Perform the leak test after assembling. Apply pressurized air of 98 kPa (1.0 kgf/cm²) to the oil fill port ④.
4. Wind a seal tape around plug ④ and install it on the roller.
5. Perform bolting with the crawler frame and lower roller mounting face in close contact with each other.
6. In the case of steel shoe, insert a shim (9mm thick) between the frame and shaft so as to allow bolting with the mounting faces in absolute contact.

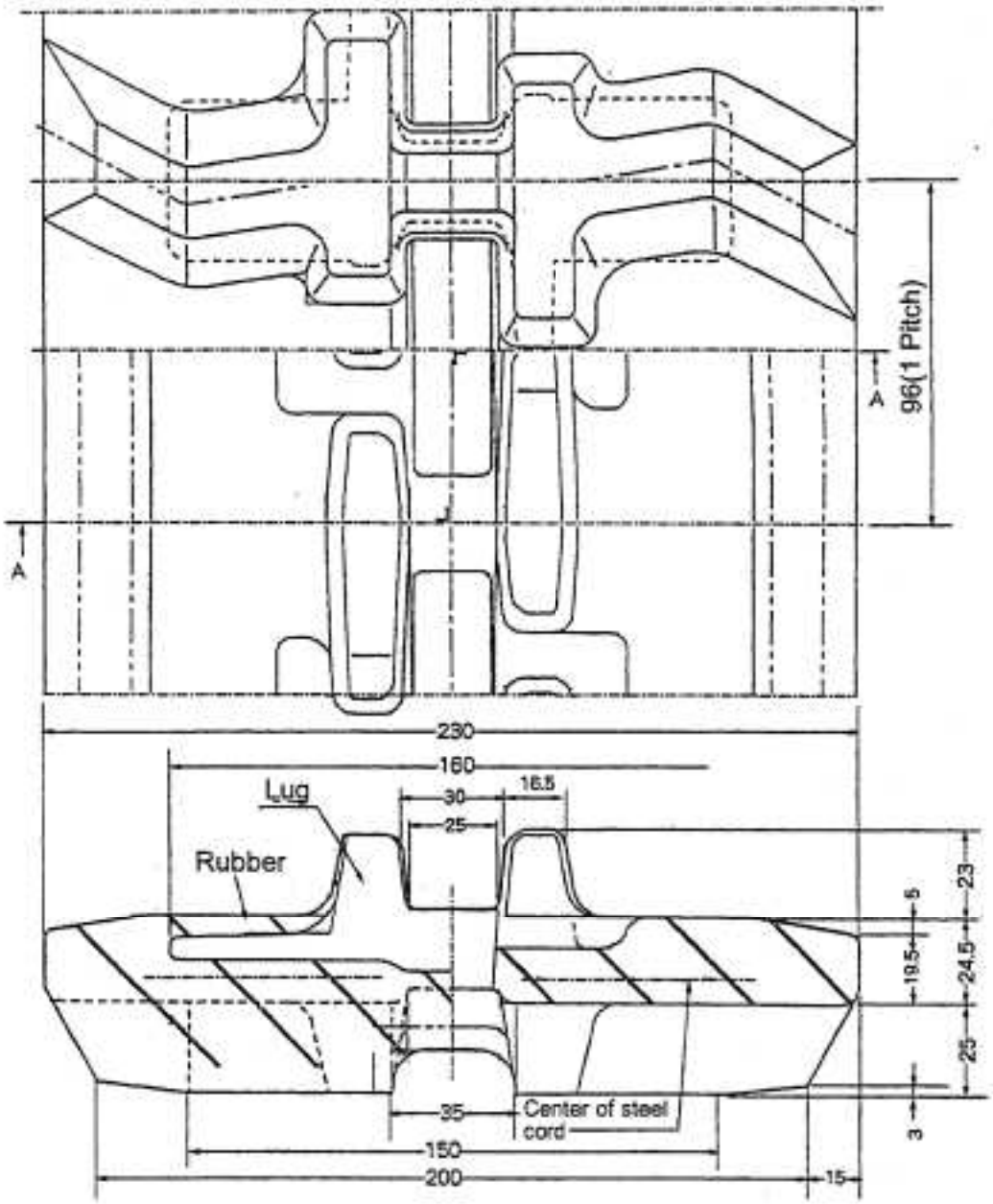
No.	Description	Q'ty	Remarks
1	Guide Roller	1	
2	Shaft	1	
3	Gear Oil	→	25 cc
4	Plug	1	1/8
5	Bearing	2	
6	Oil Seal	2	
7	Snap Ring	2	

Recommended oil	Q'ty
API - GL4 SAE # 90	25 cc

CRAWLER SHOE ASSEMBLY (RUBBER SHOE)

0653 760 UA
(230 × 35 × 96)

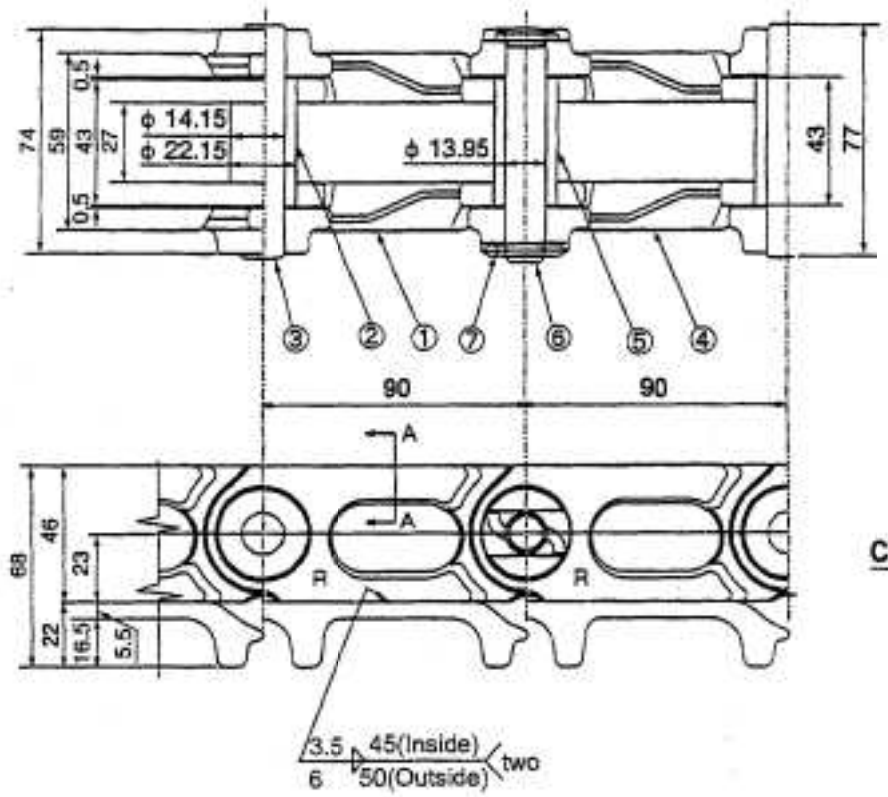
The figure below shows the shape and cross section of rubber shoe.

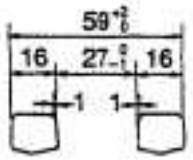


Cross section of rubber shoe

CRAWLER SHOE ASSEMBLY (Steel Shoe)

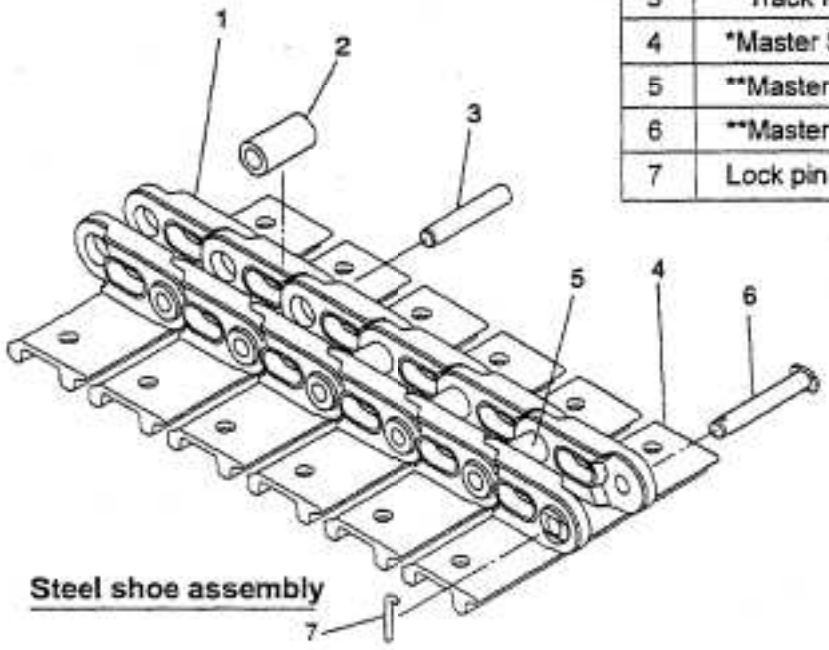
0653 568 UA
(90P × 38L × 250W)





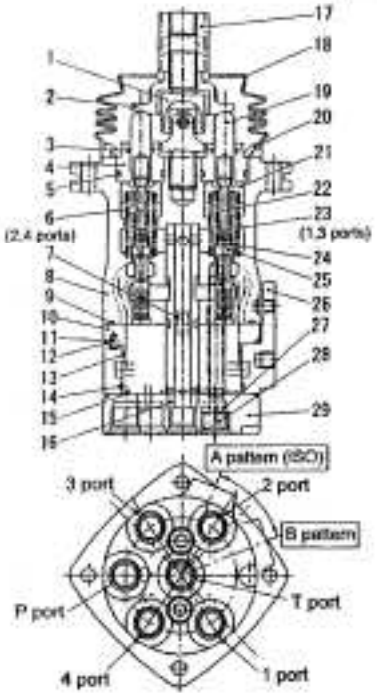
Cross section A-A

Key	Description	Q'ty
1	*Track Shoe Complete	35
2	**Track bushing	1
3	**Track Pin	35
4	*Master Shoe Complete	1
5	**Master bushing	1
6	**Master Pin	1
7	Lock pin	1



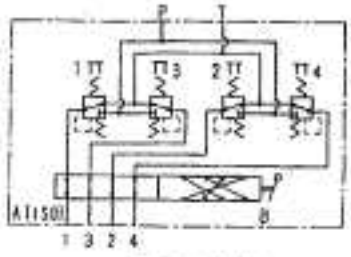
Steel shoe assembly

A/B Quick charge-over type
(0783 701 UA)

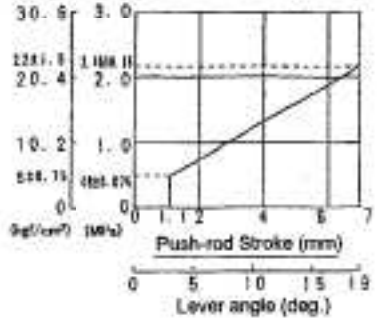


No.	Parts name	Q'ty
1	Joint	1
2	Cam	1
3	Seal	4
4	Plug	4
5	O ring	4
6	Spring	2
7	Spring pin	1
8	Casing	1
9	O ring	1
10	Spool	1
11	Parallel pin	1
12	O ring	2
13	O ring	1
14	O ring	1
15	O ring	1
16	Bushing	1
17	Adjust nut	1
18	Boots	1
19	Push rod	4
20	Plate	1
21	Spring washer	4
22	Spring	4
23	Spring	2
24	Washer	4
25	Spool	4
26	Sleeve	1
27	Seal washer	2
28	Hex. Socket bolt	2
29	Port plate	1

NOTE:
1. Apply coat grease to center of the joint ① when assembling.
2. Apply coat grease to the cam ② and the push rod ⑲ contact areas.
3. Apply coat locktight # 242 to the adj. nut ⑰, and the joint ① when assembling.

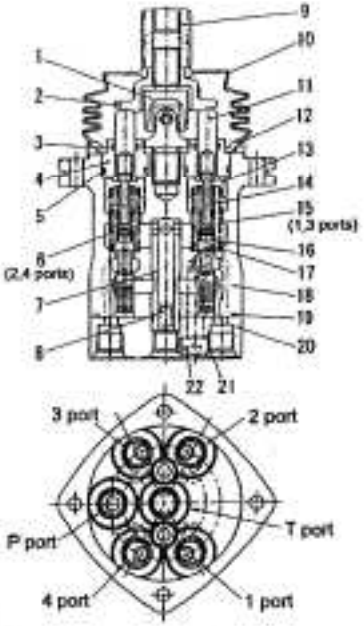


Hyd. symbol



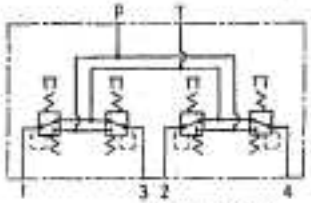
Control Diagram

REMOTE CONTROL VALVE ASSEMBLY
Standard
(0783 700 UA)

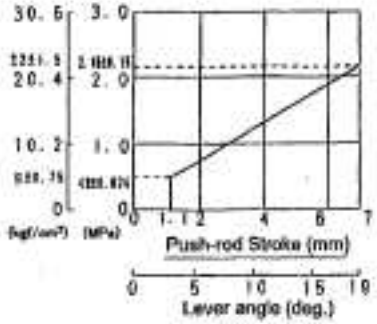


No.	Parts name	Q'ty
1	Joint	1
2	Cam	1
3	Seal	4
4	Plug	4
5	O ring	4
6	Spring	2
7	Bushing	1
8	Spring pin	1
9	Adjusting nut	1
10	Boots	1
11	Push rod	4
12	plate	1
13	Spring washer	4
14	Spring	4
15	Spring	2
16	Washer	4
17	Spool	4
18	Casing	1
19	O ring	1
20	Port plate	1
21	Seal washer	2
22	Hex. Socket bolt	2

NOTE:
1. Apply coat grease to center of the joint ① when assembling.
2. Apply coat grease to the cam ② and the push rod ⑪ contact areas.
3. Apply coat locktight # 242 to the adj. nut ⑨, and the joint ① when assembling.



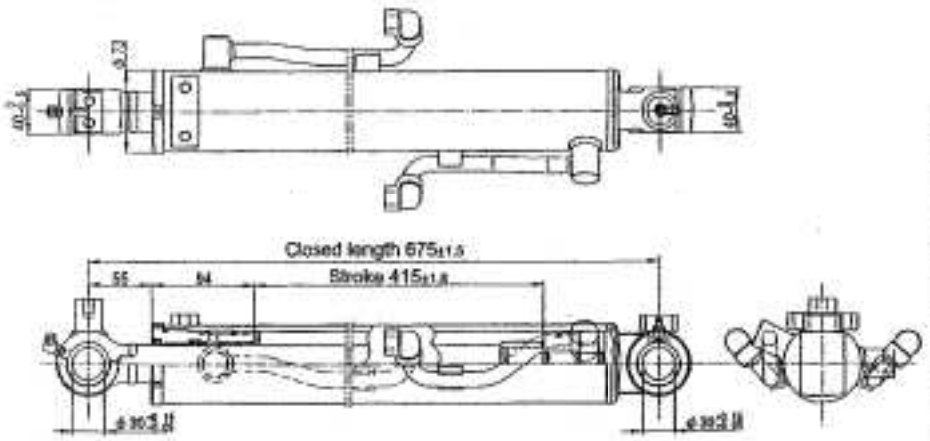
Hyd. symbol

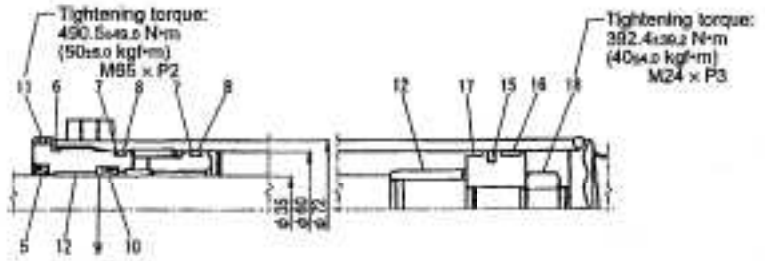


Control Diagram

BOOM CYLINDER ASSEMBLY

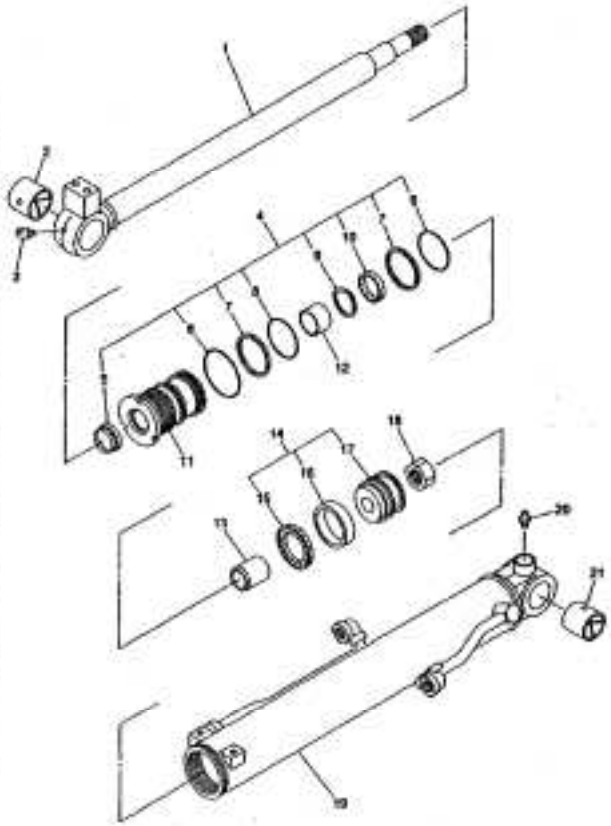
0782344UA
Weight: 14.6kg





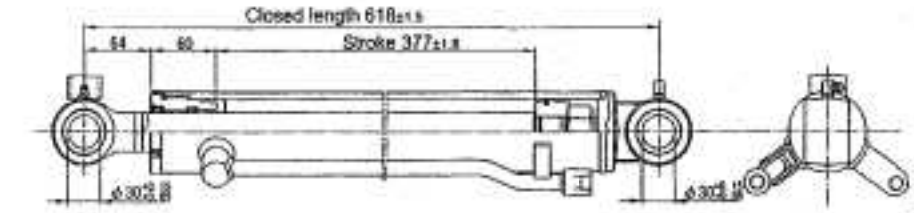
Detail of Cylinder Head **Detail of Piston**

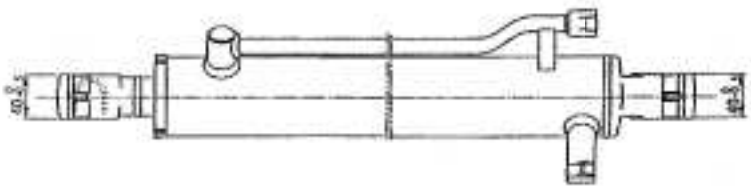
No.	Parts name	Q'ty
1	Piston rod ass'y	1
2	Bushing	1
3	Grease nipple	1
4	Seal kit	1
5	Dust seal	1
6	O ring	1
7	Back up ring	2
8	O ring	2
9	Back up ring	1
10	U ring	1
11	Cylinder head	1
12	Bushing	1
13	Cushion bearing	1
14	Piston ass'y	1
15	Seal ring ass'y	1
16	Slide ring	1
17	Piston	1
18	H.T. nut	1
19	Cylinder tube ass'y	1
20	Grease nipple	1
21	Bushing	1

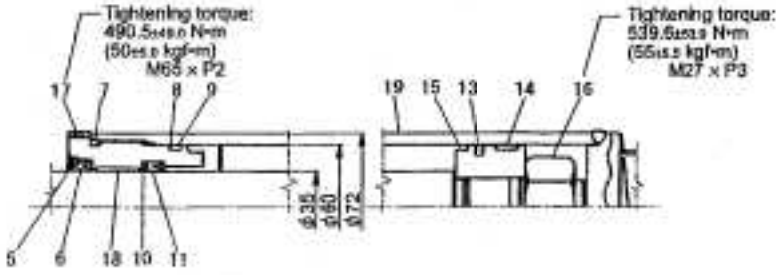


ARM CYLINDER ASSEMBLY

0782324UA
Weight: 14.5kg

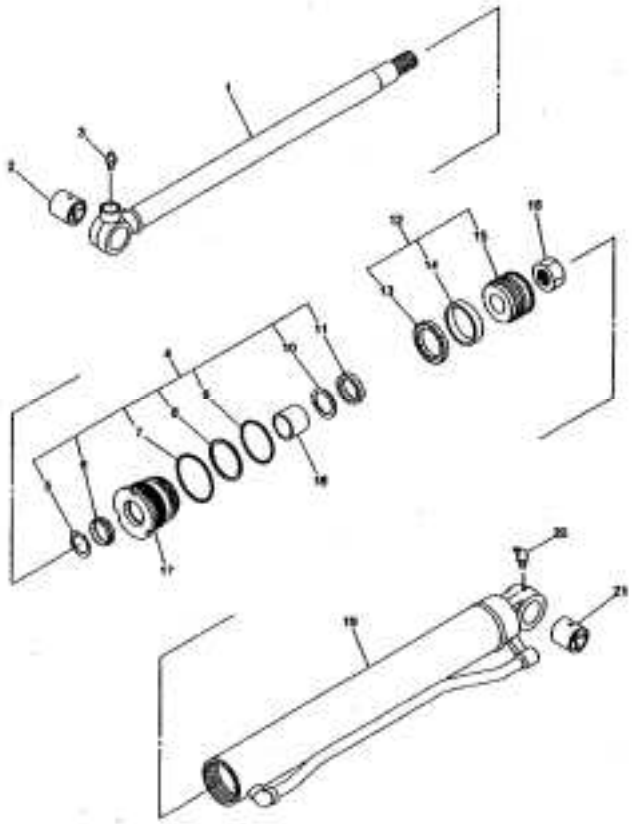






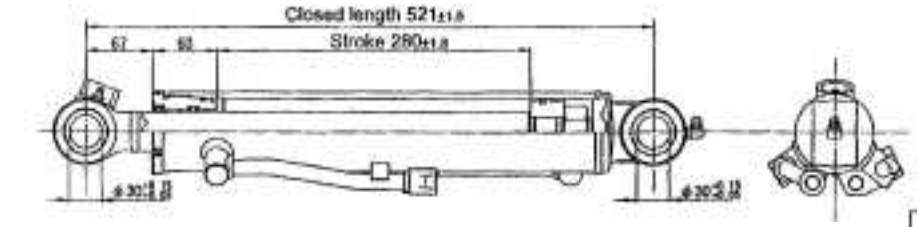
Detail of Cylinder Head **Detail of Piston**

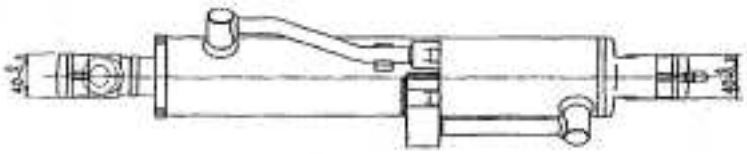
No.	Parts name	Q'ty
1	Piston rod ass'y	1
2	Bushing	1
3	Grease nipple	1
4	Seal kit	1
5	Snap ring	1
6	Dust seal	1
7	O ring	1
8	Back up ring	1
9	O ring	1
10	Back up ring	1
11	U ring	1
12	Piston ass'y	1
13	Seal ring ass'y	1
14	Slide ring	1
15	Piston	1
16	H.T. nut	1
17	Cylinder head	1
18	Bushing	1
19	Cylinder tube ass'y	1
20	Grease nipple	1
21	Bushing	1

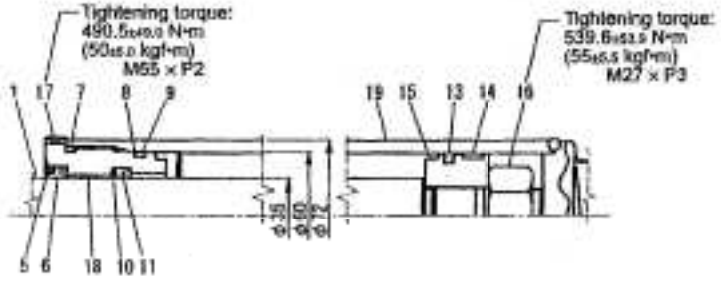


BUCKET CYLINDER ASSEMBLY

0782325UA
Weight: 12.4kg

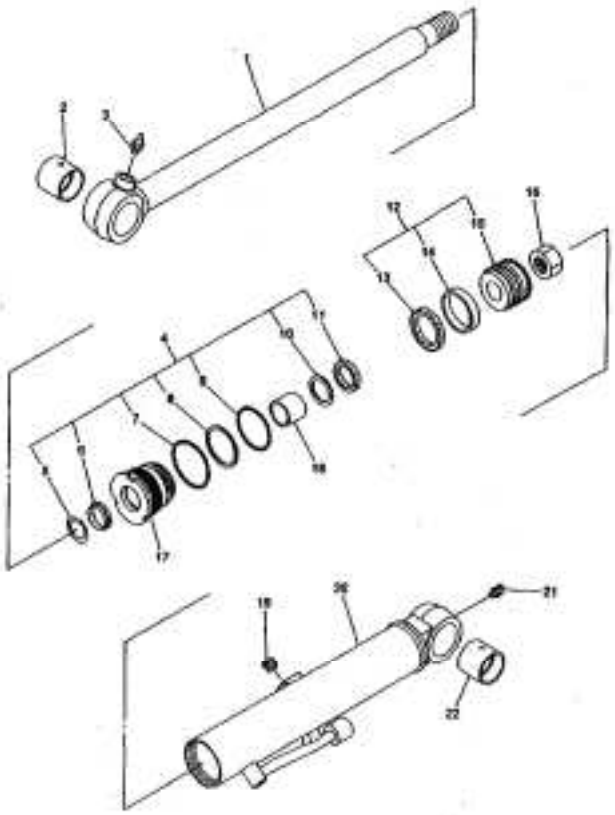






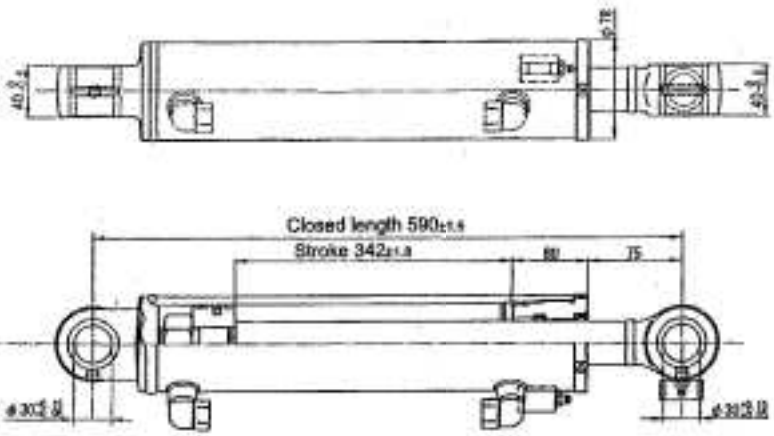
Detail of Cylinder Head **Detail of Piston**

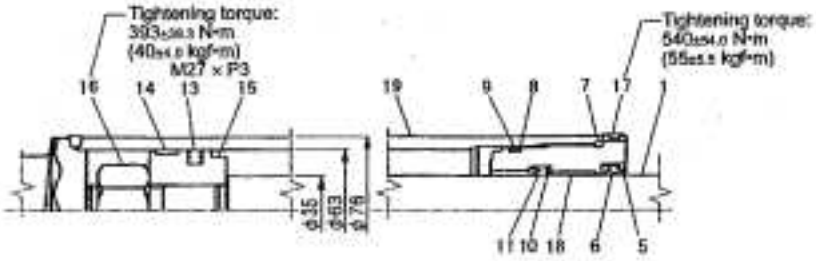
No.	Parts name	Q'ty
1	Piston rod ass'y	1
2	Bushing	1
3	Grease nipple	1
4	Seal kit	1
5	Snap ring	1
6	Dust seal	1
7	O ring	1
8	Back up ring	1
9	O ring	1
10	Back up ring	1
11	U ring	1
12	Piston ass'y	1
13	Seal ring ass'y	1
14	Slide ring	1
15	Piston	1
16	H.T. nut	1
17	Cylinder head	1
18	Bushing	1
19	Plug	1
20	Cylinder tube ass'y	1
21	Grease nipple	1
22	Bushing	1



SWING CYLINDER ASSEMBLY

0782320UA
Weight: 14.2kg

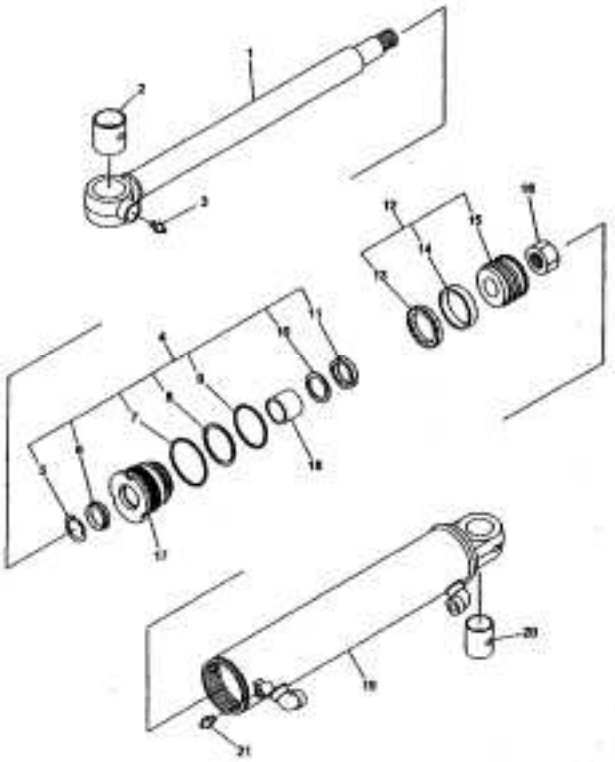




Detail of Piston

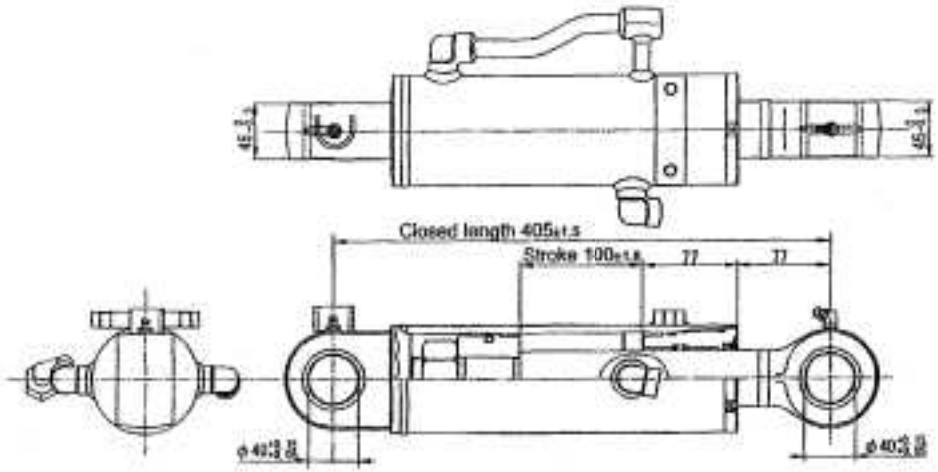
Detail of Cylinder Head

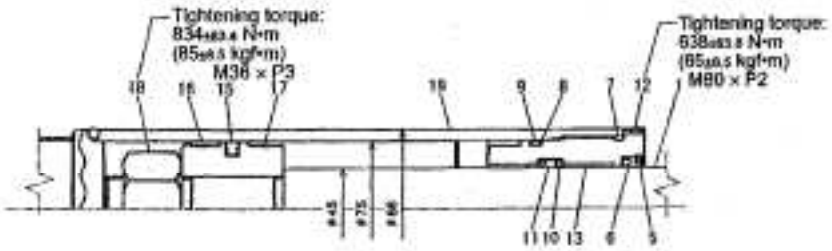
No.	Parts name	Q'ty
1	Piston rod ass'y	1
2	Bushing	1
3	Grease nipple	1
4	Seal kit	1
5	Snap ring	1
6	Dust seal	1
7	O ring	1
8	Back up ring	1
9	O ring	1
10	Back up ring	1
11	U ring	1
12	Piston ass'y	1
13	Seal ring ass'y	1
14	Slide ring	1
15	Piston	1
16	H.T. nut	1
17	Cylinder head	1
18	Bushing	1
19	Cylinder tube ass'y	1
20	Bushing	1
21	Grease nipple	1



BLADE CYLINDER ASSEMBLY

0782345UA
Weight: 13.9kg

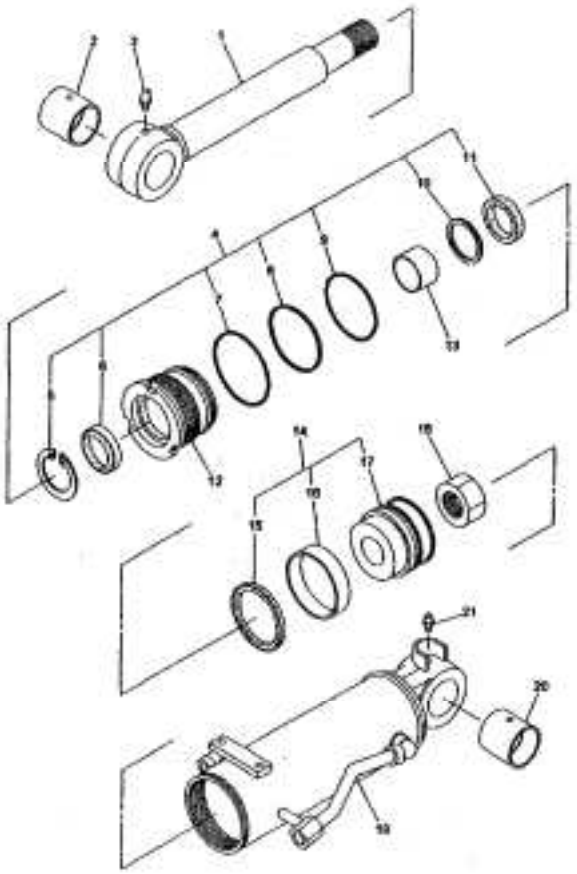




Detail of Piston

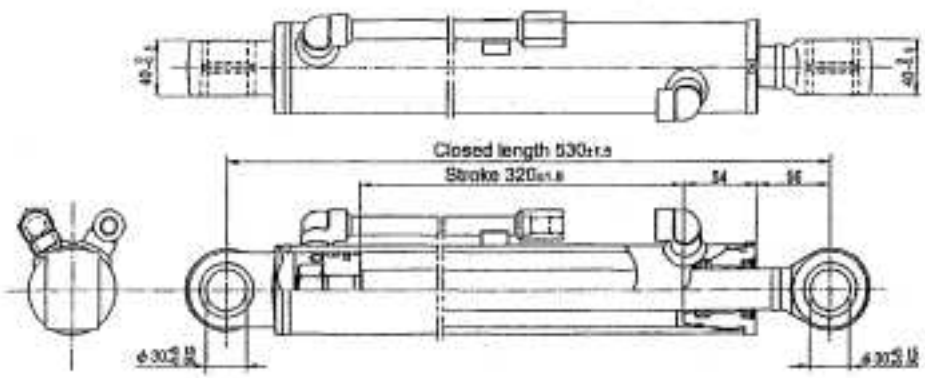
Detail of Cylinder Head

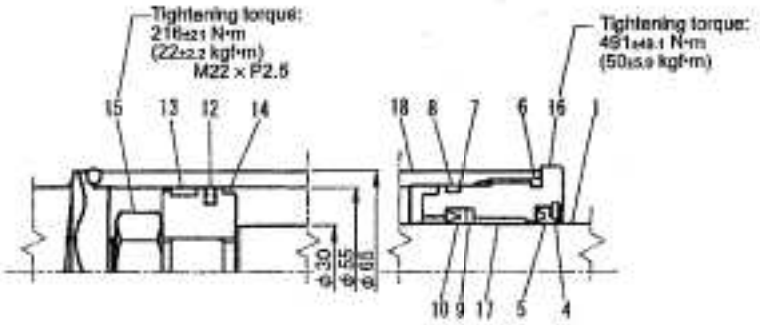
No.	Parts name	Q'ty
1	Piston rod ass'y	1
2	Bushing	1
3	Grease nipple	1
4	Seal kit	1
5	Snap ring	1
6	Dust seal	1
7	O ring	1
8	Back up ring	1
9	O ring	1
10	Back up ring	1
11	U ring	1
12	Cylinder head	1
13	Bushing	1
14	Piston ass'y	1
15	Seal ring ass'y	1
16	Slide ring	1
17	Piston	1
18	Hexagon socket nut (smaller diameter)	1
19	Cylinder tube ass'y	1
20	Bushing	1
21	Grease nipple	1



SPANNER CYLINDER ASSEMBLY

0782346UA
Weight: 9.2kg

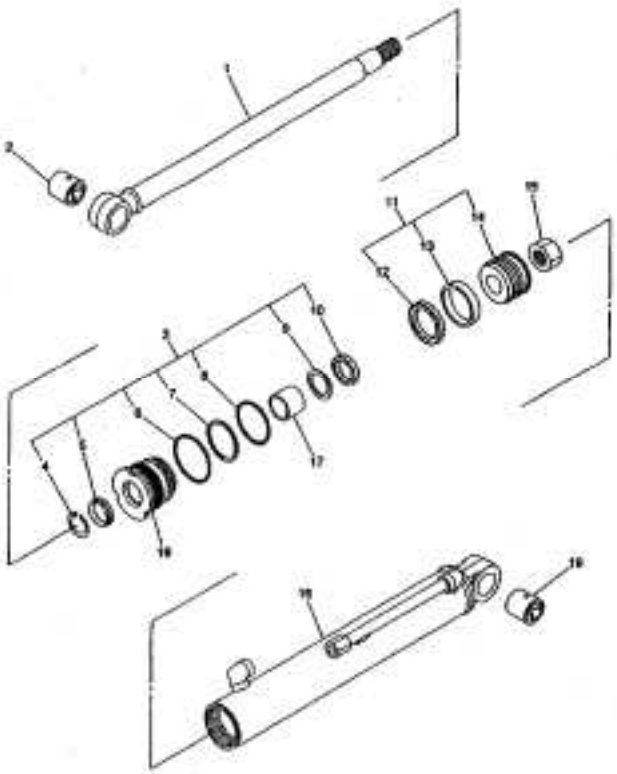




Detail of Piston

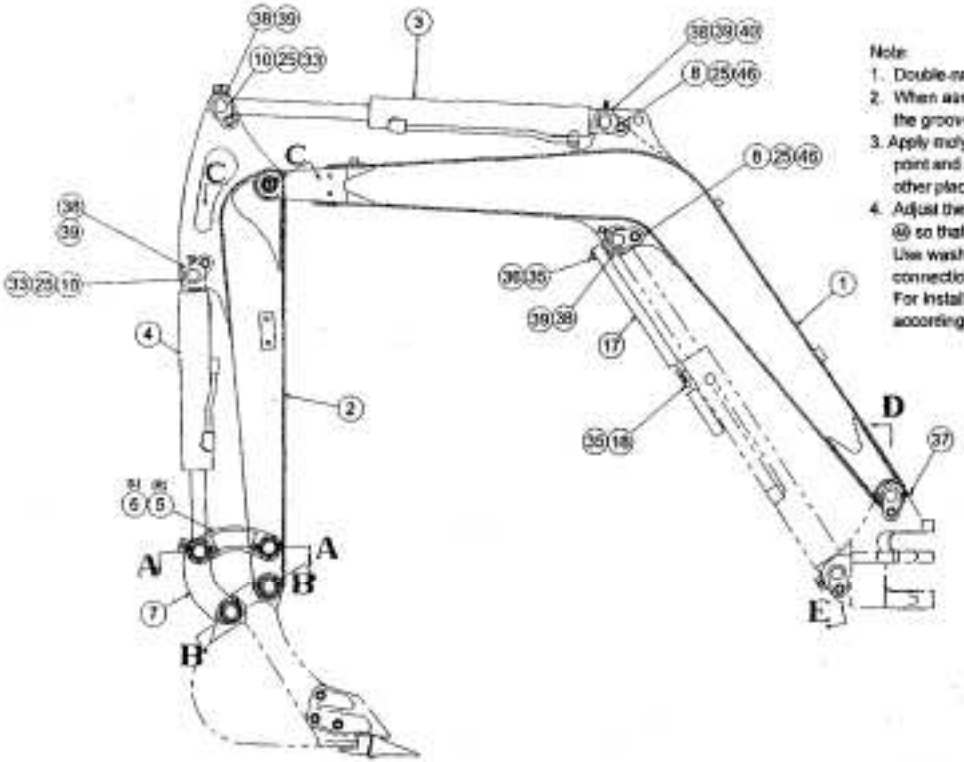
Detail of Cylinder Head

No.	Parts name	Q'ty
1	Piston rod ass'y	1
2	Bushing	1
3	Seal kit	1
4	Snap ring	1
5	Dust seal	1
6	O ring	1
7	Back up ring	1
8	O ring	1
9	Back up ring	1
10	U ring	1
11	Piston ass'y	1
12	Seal ring ass'y	1
13	Slide ring	1
14	Piston	1
15	H.T. nut	1
16	Cylinder head	1
17	Bushing	1
18	Cylinder tube ass'y	1
19	Bushing	1



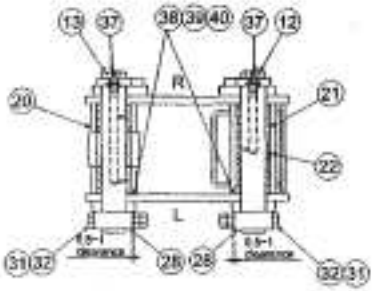
ATTACHMENT ASSEMBLY

F388 159 00

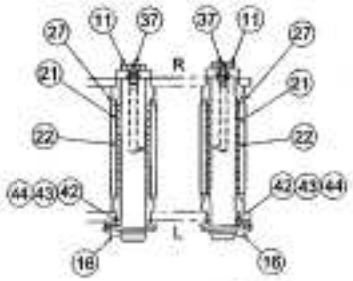


Note:
1. Double-nuts tightening clearance should be 0.5 mm to 1 mm.
2. When assembling bushing No. ㉑ and ㉒, direct inward the side where the groove extends from the end face.
3. Apply molybdenum disulfide grease at three places, the boom foot, boom point and arm point pins when assembling. EP2 grease can be applied at other places.
4. Adjust the pin tightening section using washers No. ㉑ to ㉘ and No. ㊷ to ㊹ so that the clearance will be 1.2 mm or less.
   Use washers No. ㉘ to ㉛ and No. ㊸ to ㊹ to adjust the play at the pin connection section. The number of washers in this for reference only. For installation, the number of washers required should be determined according to the machine used.

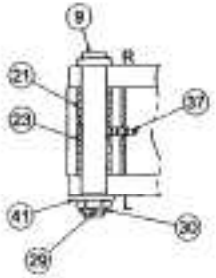
Item	Parts name	Qty	Remarks
1	Boom	1	L=1650
2	Arm STD.	1	L=950
	Arm LONG	1	L=1200
3	Arm cylinder	1	φ60 x φ35 x 377
4	Bucket cylinder	1	φ60 x φ35 x 280
5	Arm link (R.H)	1	
6	Arm link (L.H)	1	
7	Bucket link	1	
8	Wing pin	2	φ30 x 114
9	Head pin	1	φ30 x 197
10	Wing pin	2	φ30 x 98
11	Head pin	2	φ30 x 204
12	Head pin	1	φ30 x 197
13	Head pin	1	φ30 x 187
14	Wing pin	1	φ35 x 253
15	Wing pin	1	φ30 x 148
16	Ring pin	2	027500
17	Cover	1	
18	Stay	1	
19	Steel bushing	2	φ35 x φ45 x 40
20	Steel bushing	2	φ30 x φ40 x 30
21	Steel bushing	8	φ30 x 40
22	Spacer	3	φ38.1 x 2.5 x 24
23	Spacer	1	φ38.1 x 2.5 x 24
24	Bushing	2	φ24 x 13.5
25	Bushing	4	φ24 x 10
26	Spacer	1	φ45 x 99
27	O ring	4	φ55(OD) x 40(ID)
28	Collar	2	48.6 x 8 x 20
29	Cotter pin	1	φ5 x 50
30	Castle nut	1	M24
31	F. HT (S) nut	4	M10(P=1.25)
32	F. HT (S) bolt	2	M10(P=1.25) x 60
33	F. HT (S) bolt	2	M10(P=1.25) x 20
34	HT (S) bolt	2	M10(P=1.5) x 25
35	HT (S) bolt	4	M10(P=1.5) x 16
36	Spring washer	2	10
37	Grease fitting	6	PT1/8 St.
38	Resin washer	7	1 x 60 x 30 - D
39	Resin washer	7	2 x 60 x 30 - D
40	Resin washer	4	3 x 60 x 30 - D
41	Washer	1	6 x 50 x 25 - D
42	Washer	2	2.3 x 41 x 30.5 - D
43	Washer	2	3.2 x 41 x 30.5 - D
44	Washer	2	4 x 41 x 30.5 - D
45	HT (S) bolt	2	M10(P=1.25) x 25



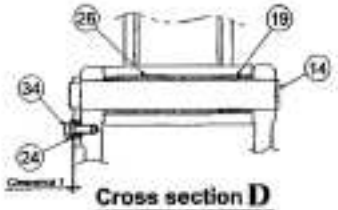
Cross section A-A



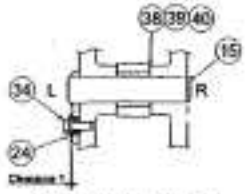
Cross section B-B



Cross section C-C

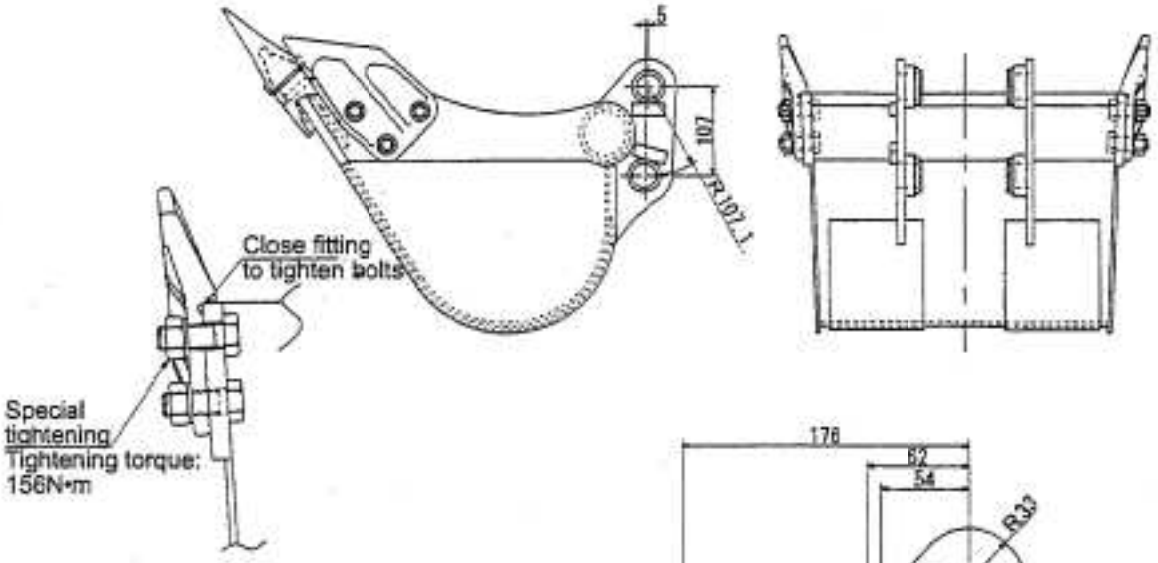


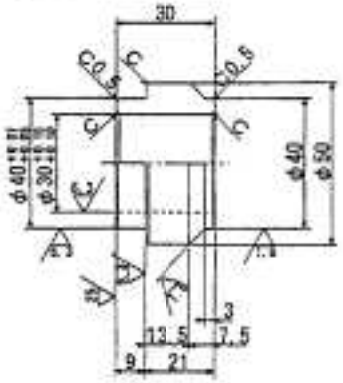
Cross section D



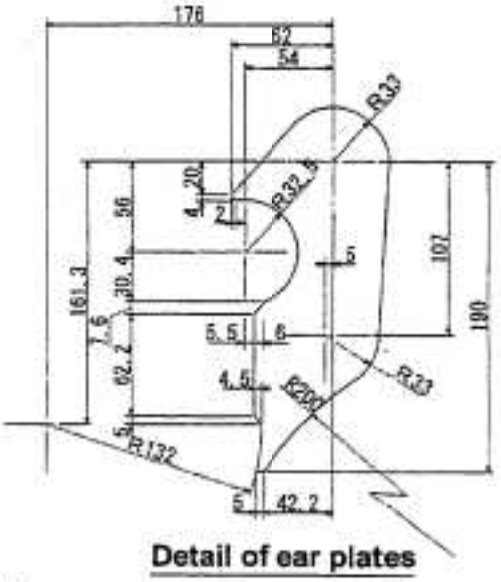
Cross section E

BUCKET ASSEMBLY
(Dimension of ear plates)

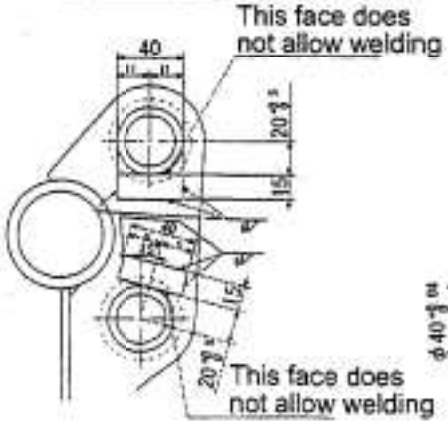


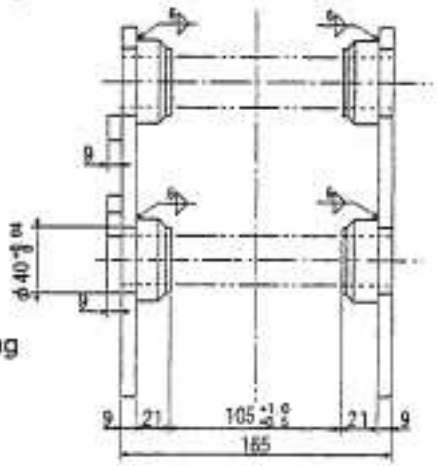


Detail of boss



Detail of ear plates





Detail of installation part

MONITOR ASSEMBLY

0856 203 UA
Common to JX
series NX series

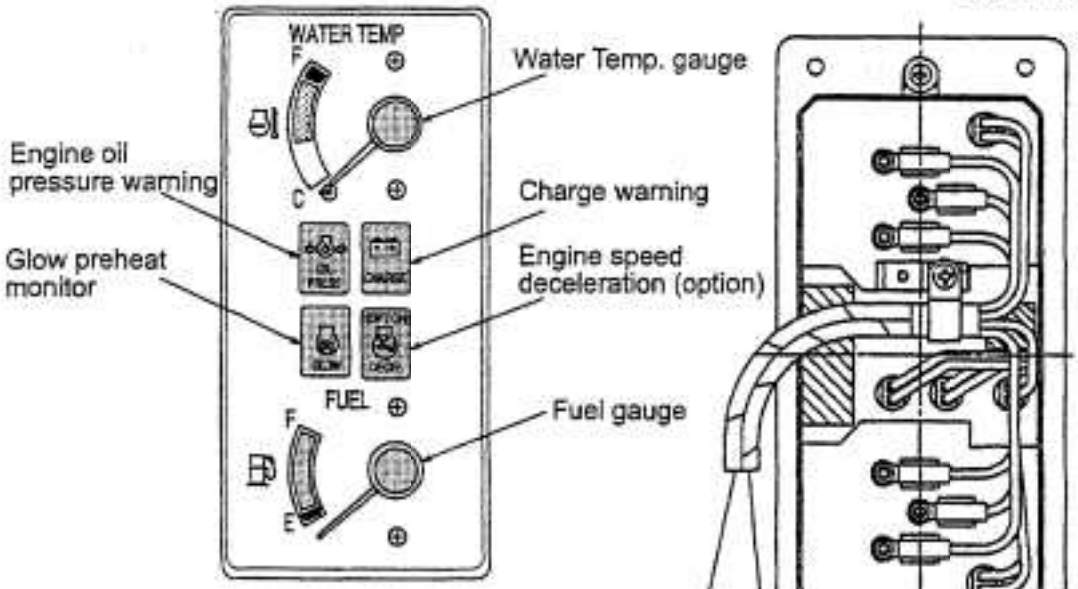


Fig.-1 Monitor panel

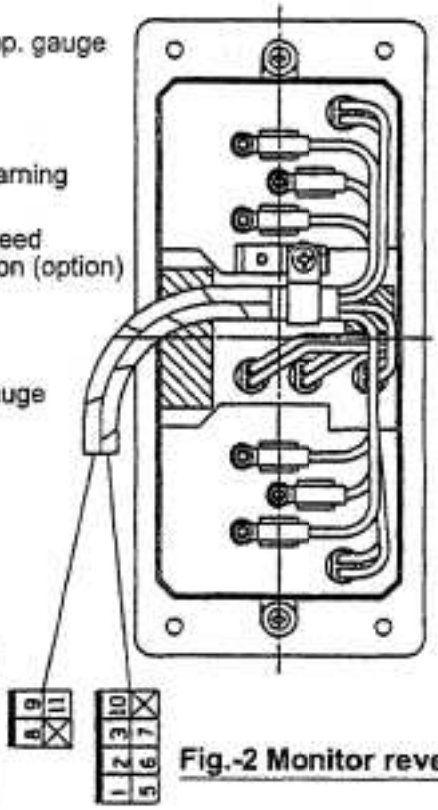


Fig.-2 Monitor reverse side

METER	FUEL		WATER TEMP.	
DIAL	F Green Red E		105°C Red 67°C Green White	
Measurement point	E	F	67°C	105°C
Std. Resistance	80Ω	10Ω	49.8Ω	15.5Ω
Allowance Initial	0 −5	+0 −2	±5°	±3°
Allowance After	±6°		±7°	

Table - 1 Indicator Standards

No.	To connect	Wire dia.	Color
1	12V	AVS0.5	R
2	Light		Y
3	Glow		Y/G
4	Option		P
5	Water temp. sencer		L/W
6	Fuel sencer		W/L
7	Earth		B
8	Bulb		G/W
9	Charge		L/R
10	Decel.		G/R
11	Engine oil press.	AVS0.5	L

Table - 2 Connection of connectors

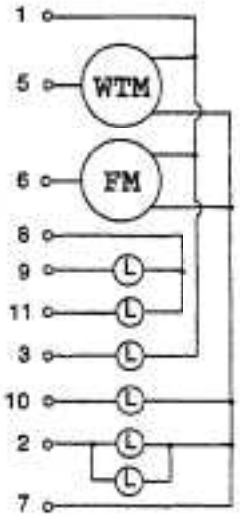
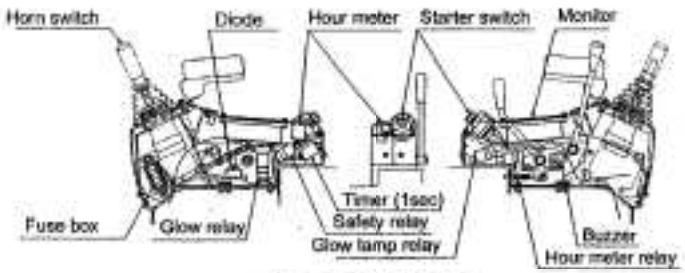


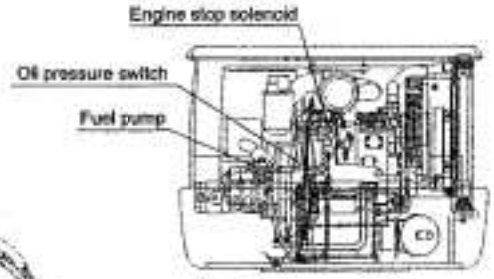
Fig -3 Electrical circuit in monitor

ELECTRICAL WIRING ASSEMBLY F386 269 01

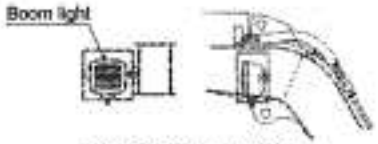
Electrical wiring and device names/arrangement are shown below.



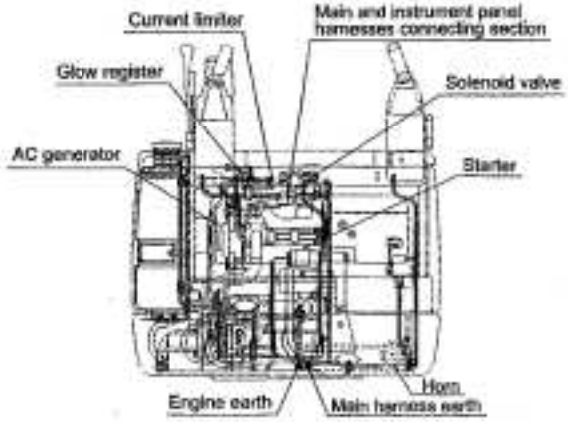
Detail of side box



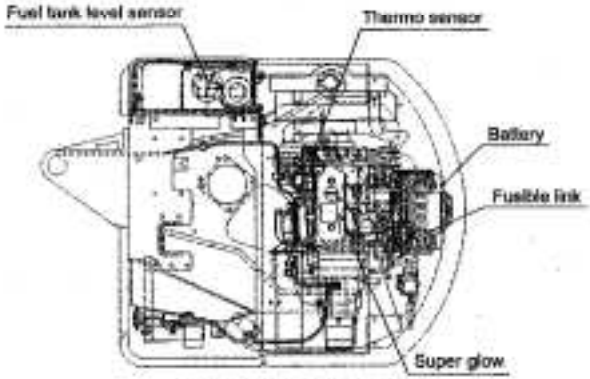
View B from machine rear



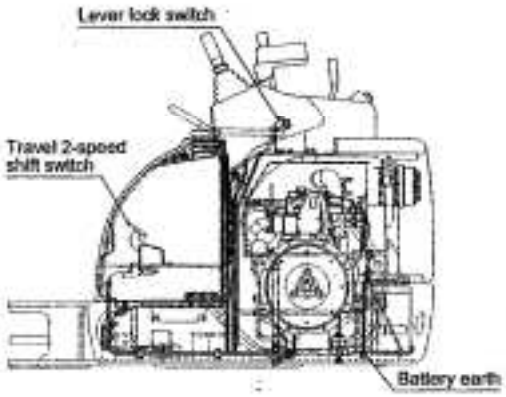
Detail of boom light



View from machine front

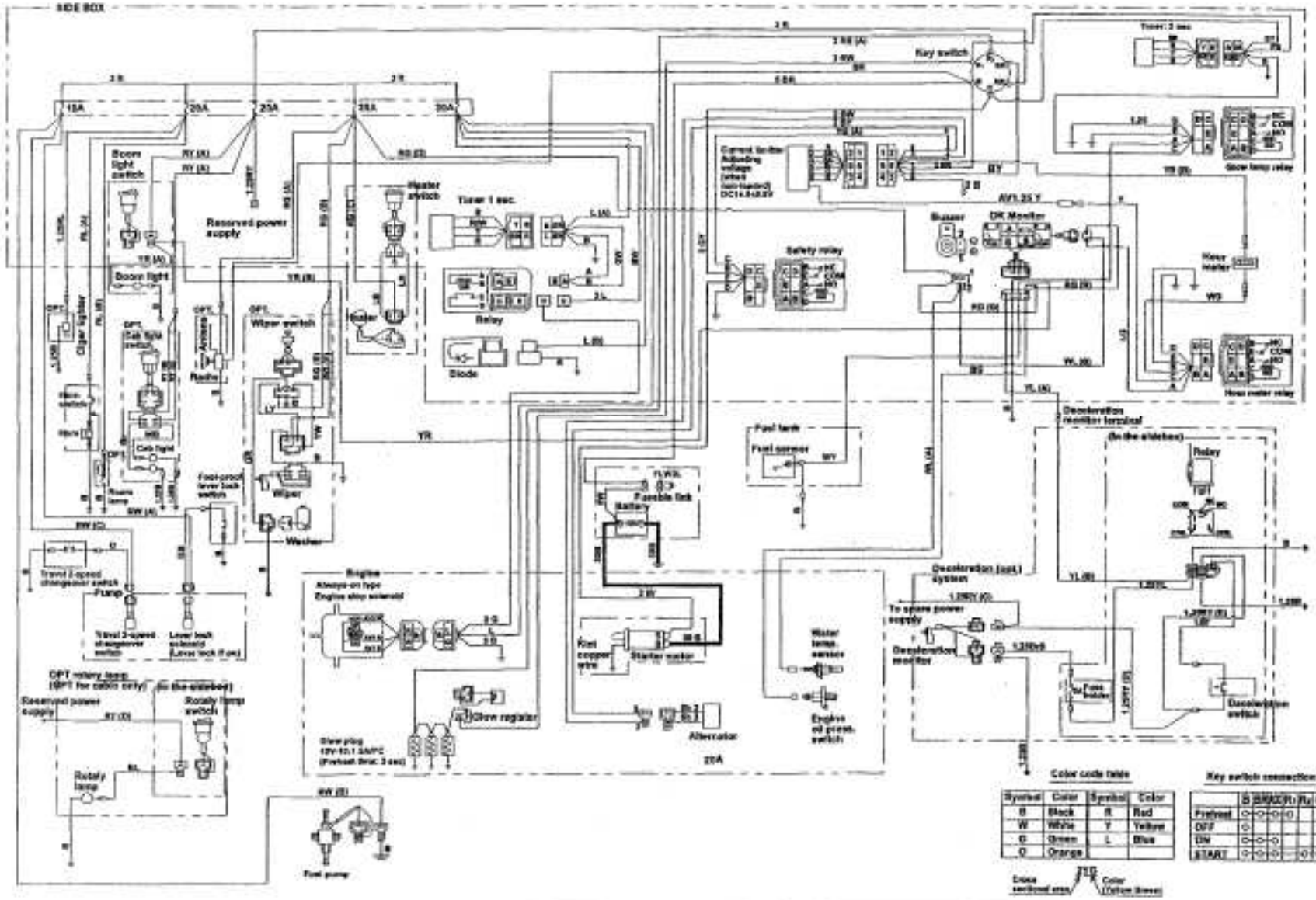


View from machine top



View from machine left side

ELECTRICAL WIRING SYSTEM DIAGRAM



SECTION 3 OPERATION

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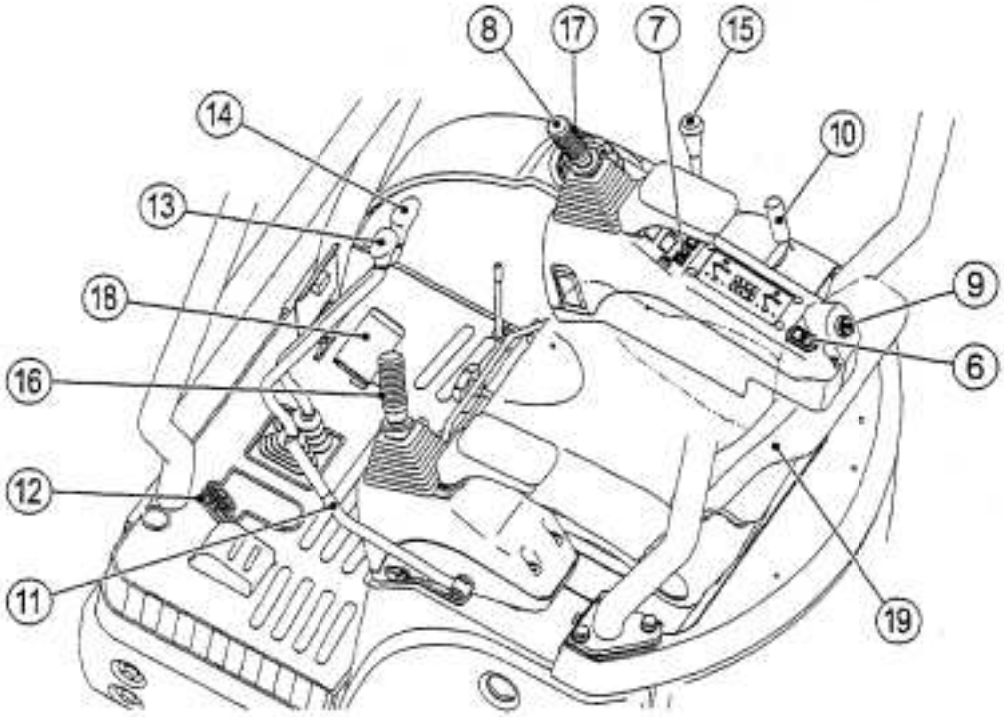
Jumper Cable Starting	3 – 4 – 1
After Starting the Engine	3 – 5 – 1
Break-in" Operation	3 – 5 – 1
Backhoe Operation	3 – 6 – 1~2
Operating the Special Attachments and Actuators	3 – 7 – 1~2
Traveling the Machine	3 – 8 – 1~3
Crawler Extension/Retraction	3 – 9 – 1
Towing	3 – 10 – 1
Lifting the Machine	3 – 11 – 1
Loading and Unloading the Machine	3 – 12 – 1
Precaution on Use Rubber Track Shoe	3 – 13 – 1
Boom Lowering with the Engine Stopped	3 – 14 – 1
Parking the Machine	3 – 15 – 1
Emergency Engine Stop	3 – 15 – 1

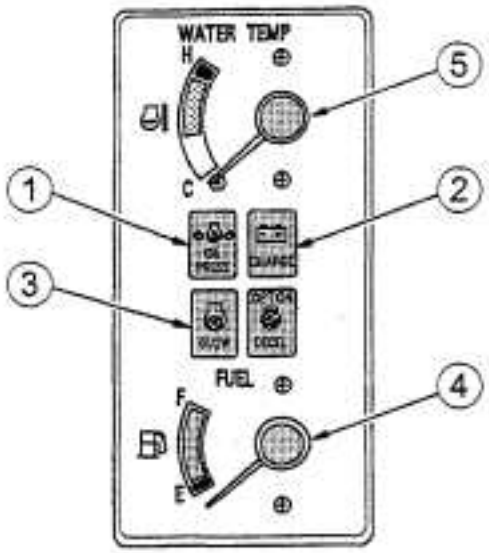
CONTROLS AND INSTRUMENTS



Typical Example

(6) Service Hour Meter
(7) Light Switch
(8) Horn Switch
(9) Engine Start Switch
(10) Engine Throttle Lever
(11) Control Shut-Off Lever
(12) High Speed Travel Pedal
(13) Left Travel Lever
(14) Right Travel Lever
(15) Blade Lever
(16) Left Operating Lever
(17) Right Operating Lever
(18) Boom Swing Pedal
(19) Operator's Seat

ELECTRONIC MONITOR PANEL



(1) Engine Oil Pressure Warninge Lamp
(2) Charge Warning Lamp
(3) Quick Grow Lamp
(4) Fuel Level Gauge
(5) Water Temperature Gauge

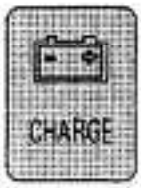
1. MONITOR LAMPS

① Engine Oil Pressure Warning Lamp

When warning lamp comes on and the action alarm sounds with the engine running, stop the engine. This indicates insufficient oil pressure.
Check the engine oil level and have any necessary repairs made before starting the engine.

② Charge Warning Lamp

This indicates a malfunction in the electrical charging system.
If the light comes on while the engine is running, the machine can be operated until repair can be made.



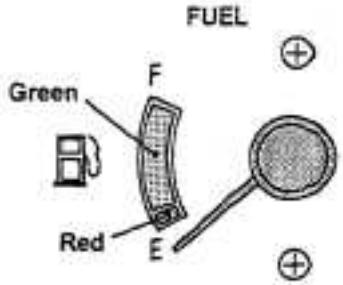
③ Quick Glow Lamp

This lamp indicates preheating status of the engine in its starting period.
It lights when the start switch is turned HEAT and goes out when a preheating stage is over.
Lighting time of this lamp becomes shorter when the engine is already warmed.

2. GAUGES and METER

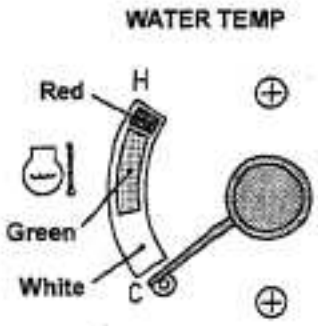
④ Fuel Level Gauge

It indicates the amount of in the fuel tank. Add fuel immediately when the gauge indicates the level is in the E range.
F : The fuel tank is full.
E : Fuel level is too low.



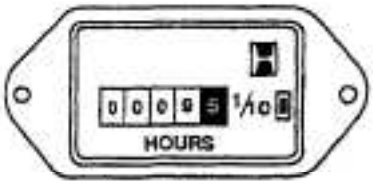
⑤ Water Temperature Gauge

This indicates the engine coolant temperature.
Upon start-up, the lowest "White" range indicates. While running the engine, with out load and low idling warming up.
The "Green" range is the normal operating temperature.
The "Red" range indicates overheating.
If the gauge indicate red range, reduce machine operating speed and keep the engine at low idle until the engine is cooled down. Stop the engine. Check the coolant. Check the fan drive belt. Have any necessary repair made.



⑥ Service Hour Meter

Indicates the total operating hours of the machine.
It should be used to determine service hour maintenance intervals.



3. SWITCHES

⑦ Light Switch

Push down on the [ ] marked of the switch to turn the light on.
Push down on the blank half of switch to turn the working light off.

LIGHT

⑧ Engine Start Switch

⚠ CAUTION

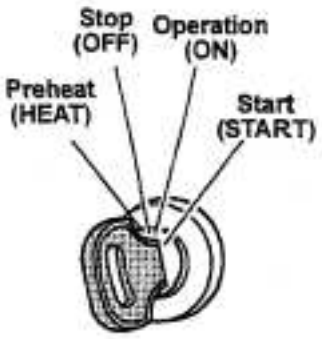
If the the engine does not start after 10 seconds, return the key to **OFF** and wait for two minutes before returning it to **START**.

OFF : The engine must be in the **OFF** position to insert or remove the key. Turn the key switch to the **OFF** position before trying to restart the engine. Turn the key switch to the **OFF** position to stop the engine.

ON : Turn the key clockwise to active the electrical System. The key will return to the **ON** position when released from the **START** position.

START : Turn the key to the **START** position to crank the engine. Release the key as soon as the engine starts.

HEAT : If the engine is hard to start in cold weather, hold the switch in the **HEAT** position to preheat the engine intake air. After approximately 15 seconds the heater indicator on the monitor will turn off.



Engine Start Switch

⑨ Horn switch

Push down on the top of the right operating lever to activate the horn.

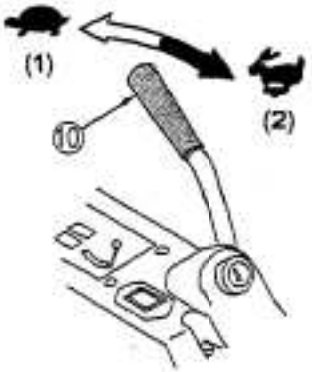
Right operating lever

4. MACHINE CONTROLS

⑩ Engine Throttle Lever

Decrease (1) : Move the lever to forward to decrease the engine speed.

Increase (2) : Move the lever to the rear to increase the engine speed.



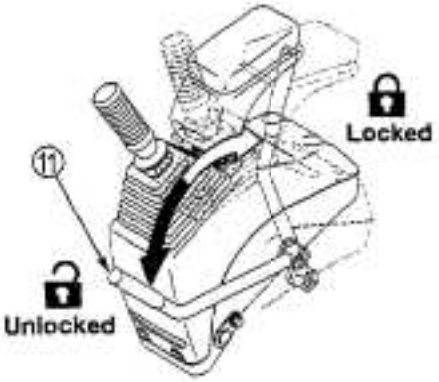
⑪ Control Shut-off Lever (Left Levers) (for all hydraulic activation contorols)

⚠ CAUTION

To mounting and dismounting the machine, be sure to put the shut-off lever in the **LOCKED** position.
If the lever is in the **UNLOCKED** position, upper structure can swing and can result personal injury.

Locked : Move the lever back to the locked position. This makes all hydraulic activation contorols inoperable.

Unlocked : Move the lever forward to the unlocked position. This makes all hydraulic activation controls operable.



⑫ High Speed Travel Pedal

⚠ CAUTION

- **NEVER** high speed travel on a grade or loading and unloading the machine.
- When control shut-off lever is locked, does not change to high speed travel.

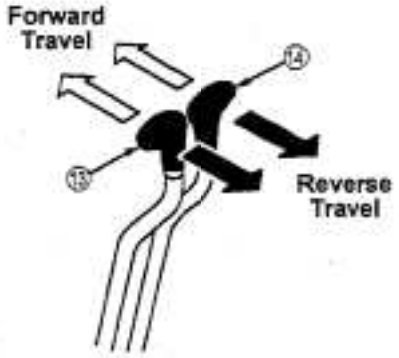
Low Speed Travel
Release the pedal to low speed travel. Select the **LOW** speed travel when driving on rough or soft surface. Low is also recommended for loading or unloading from a truck.

High Speed Travel
During push down the pedal to shift the high speed travel. Select the **HIGH** speed travel when driving on a hard even surface.

⑬ **Left Travel Lever**
⑭ **Right Travel Lever**

⚠ CAUTION

- Normal traveling is when the drive sprocket are under the rear of the machine. Blade are under the front of the cab. Reverse traveling is when the cab is over the sprockets. Both the directional and traveling functions will be reversed.
- Always travel with sprockets under the rear of the machine.

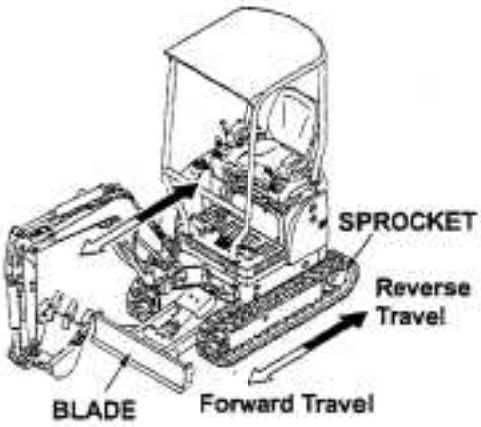


Forward Direction Travel :
Move the both travel levers forward to move the machine forward direction.

Stop :
Release the travel levers to stop the machine and apply the brakes.

Reverse Direction Travel :
Move the both travel levers rear to move the machine reverse direction.

Refer to Traveling the Machine section of this manual.



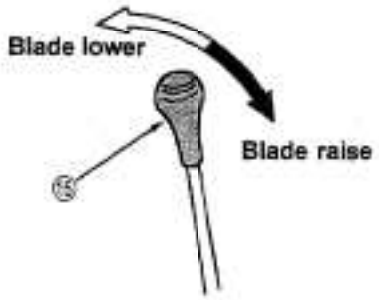
⑮ **Blade Lever**

⚠ CAUTION

The blade falls with its self-weight if pushing this lever to forward when the engine stops. Be careful.

Blade raise : Move the lever back to raise the blade.

Blade lower : Move the lever forward to lower the blade.



⑯ **Left Operating Lever**

[Swing and arm controls]

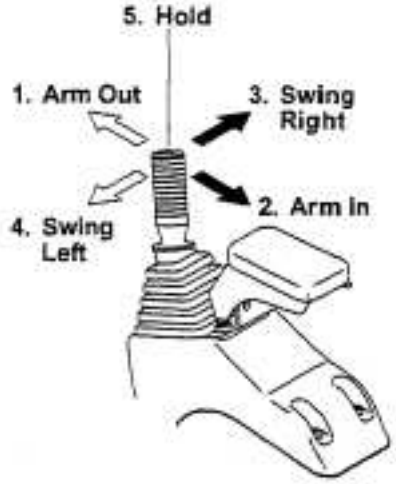
1. **Arm Out :**
   Move the lever forward to move the arm out.

2. **Arm In :**
   Move the lever rear to move the arm in.

3. **Swing Right :**
   Move the lever right to swing the upper structure to the right.

4. **Swing Left :**
   Move the lever left to swing the upper structure to the left.

5. **Hold :**
   When the lever released from any position, the lever will return to hold (center position). Arm or swing movement will stop.



ISO System

⑰ Two Functions may be performed at the same time by moving the lever diagonally.

Right Operating Lever

[Bucket and boom controls]

1. **Boom Lower :**
   Move the lever forward to lower the boom.

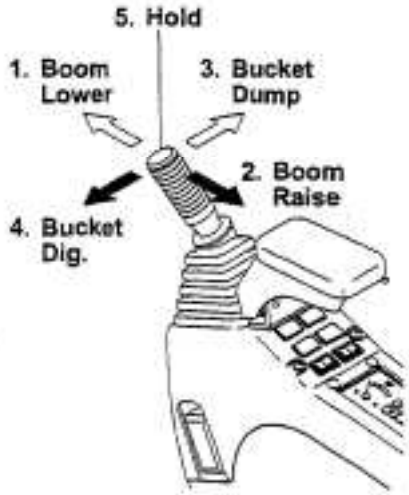
2. **Boom Raise :**
   Move the lever back to raise the boom.

3. **Bucket Dump :**
   Move the lever right to dump the bucket.

4. **Bucket Dig. :**
   Move the lever left to close the bucket.

5. **Hold :**
   When the lever released from any position, the lever will return to hold(center position) . Boom or bucket movement will stop.

   Two Functions may be performed at the same time by moving the lever diagonally.

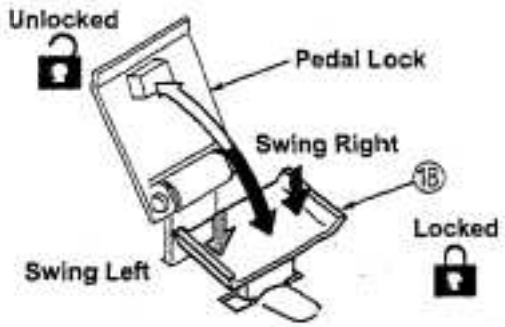


ISO System

⑭ Boom Swing Pedal

CAUTION

ALWAYS locked pedal when is not in use.



Boom swing right :
Push down right on the pedal to swing the boom to the right.
Boom swing left :
Push down left on the pedal to swing the boom to the left.

⑮ Operator's Seat

CAUTION

* Seat adjustment should be checked at the beginning of each shift or when changing operator.
* Lower the bucket on the ground, stop the engine and then make adjustment.

Seat Adjustment
Seat position can be adjusted forward or backward and seat back tilt. Select the desired position to allow full pedal and lever travel.

To Adjust the Seat Forward or Backward.
Pull up and hold lever ① and move the seat to the desired position. Release the lever to hold the seat in the selected position.

To Adjust the Seat Back Tilt.
Pull up and hold lever ② and tilt the seat back to the desired position. Release the lever to hold the seat in the selected position.

To Adjust the Seat Suspension.
Turning nob ③ clockwise increases suspension stiffness and turning it counterclockwise decreases suspension stiffness.

⑳ SEAT BELT

⚠ CAUTION

- **ALWAYS** fasten the seat belt while operating the machine.
- **ALWAYS** check the condition of the seat belt and mounting hardware before operating the machine. Replace if damaged.

To Check the Belt

Check for worn or damaged buckle, extrusion and mounting hardware. Replace them if they worn or damaged.

To Fasten the Belt

With gripper ① held and insert extrusion ② into buckle ③ until correctly latched.
Adjust the seat belt length according to your body size. Slightly pull the belt ④ and confirm the belt is fastened.

To Unfasten the Belt

Push in button ⑤ of buckle ③ and extrusion ② will be released from buckle ③.

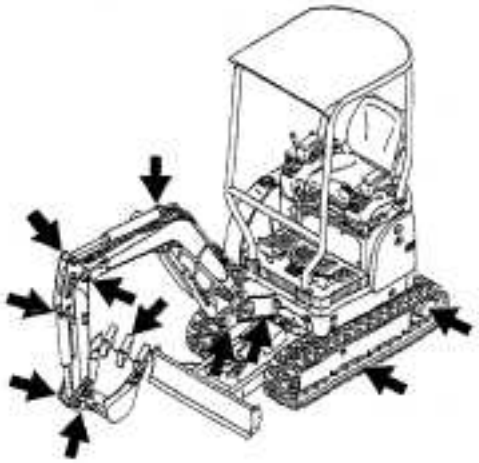
Typical Example

BEFORE STARTING THE ENGINE

The following items should be checked each day before start-up or the start operations.

■ **Walk-Around Inspection**

Inspect the loose bolts, trash build up, oil or coolant leaks, broken or worn parts. Inspect the condition of the attachments and the hydraulic components.



Inspect the operator's compartment for cleanliness. Keep it clean.

Inspect any cracks in boom and arm pivot area and cylinder mounting brackets. Repair if damaged.

Refer to Walk-Around Inspection in the Maintenance Section.

■ **Lubrication**

Perform the daily lubrication as required by the Lubrication Chart.

■ **Pre-start Checks**

Check all of oil, coolant and fuel levels.

Refer to the Daily in the Maintenance Section for more detailed information.

■ **Seat and Seat Belt Checks**

Adjust the seat to allow full travel of the levers and pedals when the operator is seated against the seat back.

Inspect the belt mounting hardware. Replace any damaged or worn hardware. Keep the mounting bolt tight.

Fasten the seat belt before starting the engine.

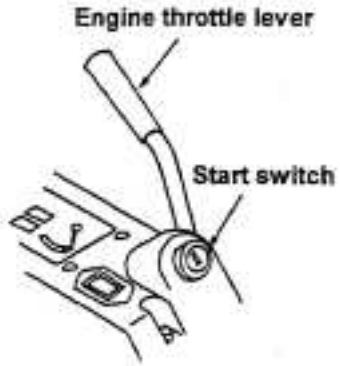
STARTING ENGINE

Once the pre-start inspection has been completed, the engine may be started.

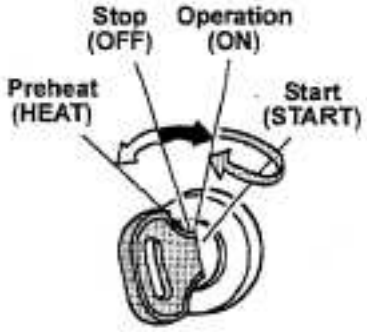
Starting at Normal Temperature

⚠ CAUTION

If the the engine does not start after 15 seconds, return the key to **OFF** and wait for 15 seconds before returning it to **START**.



1. Move Control shut-off lever to the **LOCKED** position.
2. Move all Controls to the **HOLD** position.
3. Move the engine throttle lever above the low to medium position (advance about one-third to one-half).
4. Insert key ① into the switch and turn the switch to the **ON** position.
5. Turn the switch to the **START** position.
   Do not crank the engine for more than 15 seconds.
   Allow the starter to cool for seconds before cranking again.
6. Release the switch key after the engine starts.
7. Move the engine throttle lever to position **LOW** to allow the engine to warm.



Starting In Cold Weather

⚠ WARNING

This engine has an inlet manifold heater for cold weather starting. Do not use other types of starting aids such as ether. Such use could result in an explosion and personal injury.

Heater indicator

1. Repeat steps 1 through 4 in Stating At Normal Temperature.
2. Hold the switch in the **HEAT** position to preheat the engine intake air. After approximately 15 seconds the heater indicator on the monitor will turn off.
   This indicates that the engine is ready to start.
3. Repeat steps 5 through 7 in Stating At Normal Temperature.

JUMPER CABLE STARTING

⚠ WARNING

Battery gives off flammable fumes that can explode.

When starting from another machine, make sure the machines do not touch.
This will prevent damage to engine bearings and electrical circuits.

Always connect the battery **POSITIVE (+)** to battery **POSITIVE (+)** and and the battery **NEGATIVE (–)** to battery **NEGATWE (–)**.

Jump only with a battery source and with the same voltage as the stalled machine. This machine has a **12** volt starting system. Use only equal voltage for lump starting. Use higher voltage will damage the electrical system.

Be sure the start switch is in the **OFF** position **BEFORE** attaching the jumper cables to the machine to be started.

Use of Jumper Cables

1. Move boost start machine near enough to stalled machine for the jumper cables to reach. But, do not allow machines to touch.
2. Lower the bucket to the ground.
   Move all controls to **HOLD**. Stop the engine on boost machine.
3. On stalled machine, turn the start switch key to **OFF**. Turn of all accessories.
4. Connect **POSITIVE (+)** jumper cable (red) **POSITIVE (+)** cable terminal of discharged battery.
   Do not allow positive **(+)** cable clamp to touch any metal other than battery terminals.
5. Connect **POSITIVE (+)** jumper cable (red) **POSITIVE (+)** cable terminal of boost battery.
6. Connect one end of **NEGATIVE (–)** jumper cable (black) to the **NEGATIVE (–)** boost battery terminal.
7. Make final connection of **NEGATIVE (–)** cable to frame of the stalled machine (not **NEGATIVE (–)** post) away from battery or fuel line.
8. Start the engine on the boost machine.
9. Wait a minimum of two minutes for the batteries in the stalled machine to partially charge.
10. Attempt to start the stalled engine.
    Refer to section on Engine Starting.
11. Immediately after starting the engine, disconnect the jumper cables in reverse order.
12. Conclude failure analysis on starting/ charging system of stalled machine as required now that engine is running and charging system is in operation.

AFTER STARTING THE ENGINE

⚠ CAUTION

Keep engine speed low until the engine oil pressure warning lamp goes out. If does not go out within 10 seconds, stop the engine and investigate the cause before starting the engine. Failure to do so, can cause engine damage.

With any piece of hydraulically operated equipment, it is **EXTREMELY IMPORTANT** that the hydraulic fluid be thoroughly warmed fluid-up **BEFORE** any work is begun. A warm-up period is time well spent in preventive maintenance.

Practice the following warm-up procedure before attempting full load operations.

1. Allow the engine to warm up at **LOW IDLE** for at least five minutes.
   Engage and disengage attachment control levers to help speed warm-up of hydraulic components.

2. To warm up the hydraulic oil, move the engine throttle lever to medium engine speed. Run the engine for about five minutes while intermittently holding the bucket control lever in the bucket dump position.
   Operate the bucket control lever for 10 to 15 seconds and then return the control lever **HOLD** position to ten seconds.

3. Move the engine throttle lever to maximum engine speed. Run the engine for an additional five minutes while intermittently holding the bucket dump position.

   This will allow the oil to reach relief pressure, which causes it to warm more rapidly.

Cycle all controls to allow warm oil to circulate through all cylinders and lines.

4. Observe the OK warning monitor frequently during the operation.

Be sure to perform the pro-operation warm-up procedure whenever the hydraulic oil temperature is lower than 20°C at start-up.

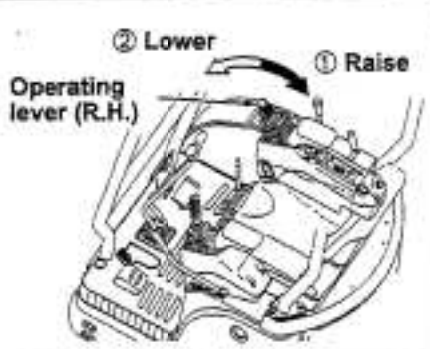
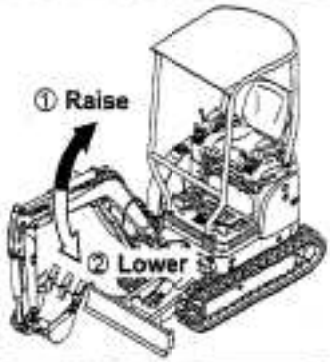
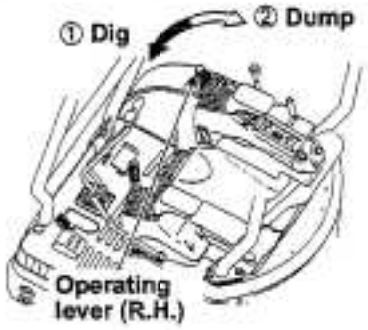
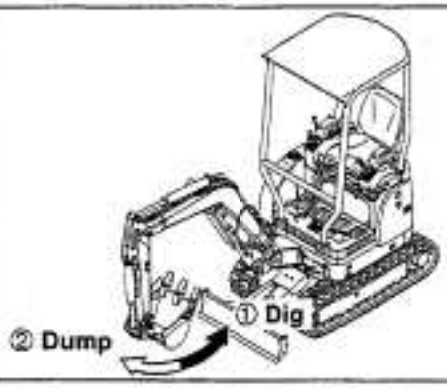
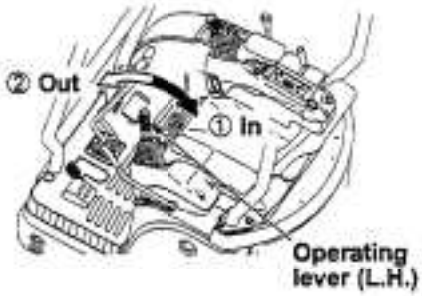
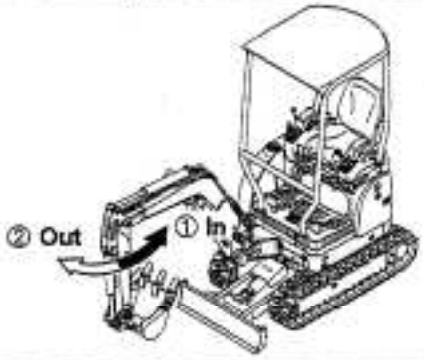
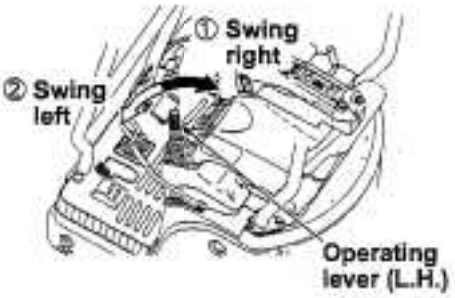
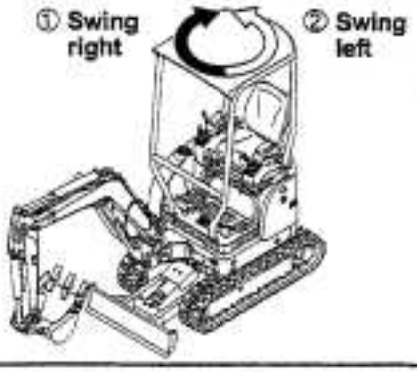
"BREAK-IN" OPERATION

In case of the new machine, as the severe operation from the beginning will have a bad influence upon the machine life, perform the enough break-in operation as described the right table.

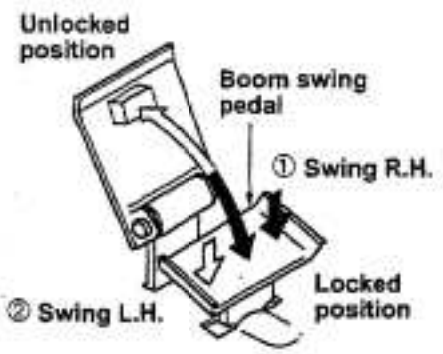
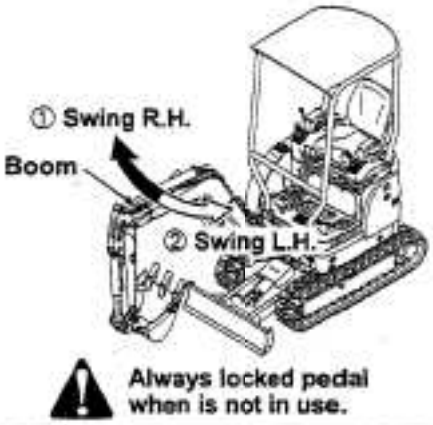
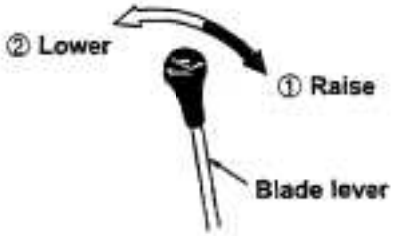
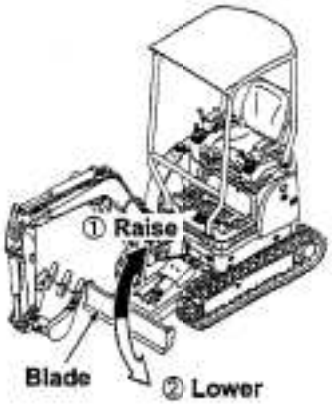
Hour meter	Load
Up to 10 hours	About 60% load
Up to 50 hours	About 80% load
After 50 hours	Full load

BACKHOE OPERATION

Shown lever pattern A (ISO) type operations.

OPERATIONS	DIRECTION OF LEVER	DIRECTION OF MACHINE
BOOM		
BUCKET		
ARM		
SWING		

⚠ When leaving the operator's seat, stop the engine, lower the bucket and the blade on the ground.

OPERATIONS	DIRECTION OF LEVER	DIRECTION OF MACHINE
BOOM SWING		 Always locked pedal when is not in use.
BLADE		

OPERATING THE SPECIAL ATTACHMENTS AND ACTUATORS (If equipped)

⚠ CAUTION

* Select a hydraulic breaker. a wrecking fork and special actuators, etc., which are applicable to the machine body.
  Consult your local IHI dealer to select a special attachment and an actuator.

Precautions on use of special attachment and actuator.

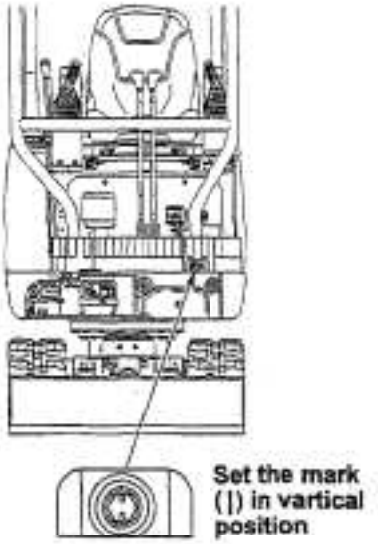
* Before using a special attachment and an actuator, read and understand their instruction manuals issued by a manufacturer to obtain correct operation and maintenance.
* When a special attachment and an actuator are mounted, the machine specifications such as stability, working radius, transport height, etc., should be altered. Before starting operation, confirm each specification to ensure safety of workers and the machine.

1. SINGLE ACTION OPERATION
Hydraulic Breaker and Others Controls

⚠ CAUTION

If the marked (–) of the valve is set in horizontal position, the pressure of returned oil becomes higher and the the breaker does not function efficiently.
ALWAYS set the marked (I) in vertical position.

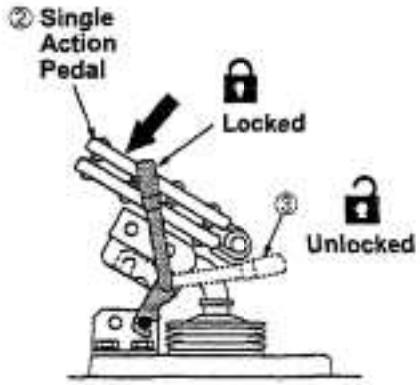
Switching the attachment hydraulic circuit.
Check the marked position on the shift valve ①. Turn the valve with a wrench and set the marked (I) in vertical position, if necessary.



1) Fold the pedal ② into double layers.
2) Move the lock lever ③ to the unlocked position.

Breaker ON : Push down the pedal ② to activate the breaker.
Breaker OFF : Release the pedal ② to deactivate the breaker.

NOTE: When no breaker operation is needed, be sure to lock the pedal ② by lock lever ③ to the **LOCKED** position.

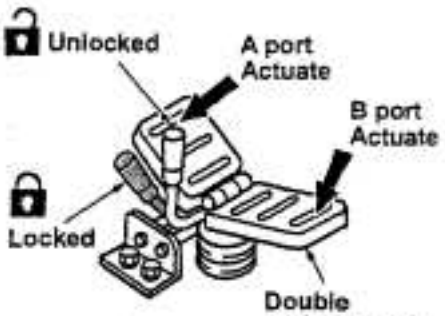


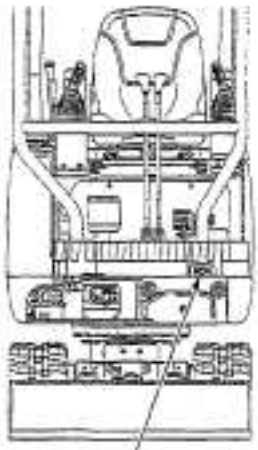
2. DOUBLE ACTION OPERATION
Wrench Fork and Others Controls

> **⚠ CAUTION**
> **ALWAYS** set the marked (–) in horizontal position. If the marked (I) of the valve is set in vertical position, the B port of the double action does not function efficiently.

Switching the attachment hydraulic circuit.
Check the marked position on the shift valve ①. Turn the valve with a wrench and set the marked (–) in horizontal position, if necessary.

1) Unfold the pedal ② into two pedal plates.
2) Move the lock lever ③ to the unlocked position.
   To actuate the port A :
   Push down on the front of the pedal ② to actuate the port A.
   To actuate the port B :
   Push down on the rear of the pedal ② to actuate the port B.



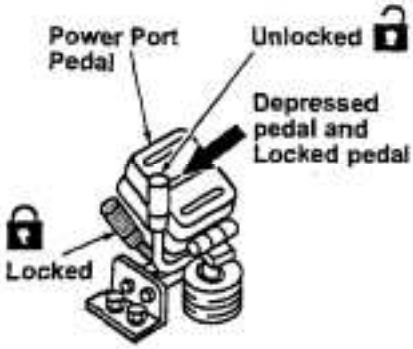


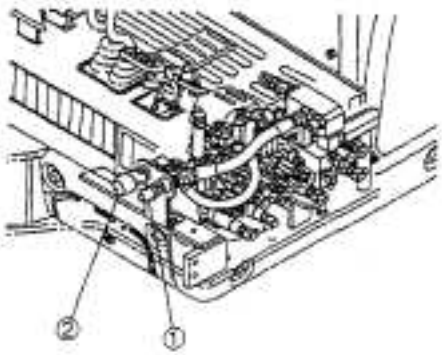
① Shift Valve

3. SINGLE ACTION OPERATION
USED : FOR POWER PORT WORKS

> **⚠ CAUTION**
> The engine cannot be started if the power port is **ON** (locked status with the pedal depressed).
> Be sure to set the pedal at the neutral position before starting the engine.

1) Fold the pedal into double layers.
2) Turn the pedal lock lever to the unlocked position and release the pedal lock.
3) Push down the pedal and turn the pedal lock lever to the locked position.
   This makes it possible to supply the hydraulic pressure to the high-pressure line of the power port.
   The actuator can be operated by the actuator's control valve.
4) When the power port is out of service, **ALWAYS** set the pedal back to the neutral position and pedal lock lever to the locked position.





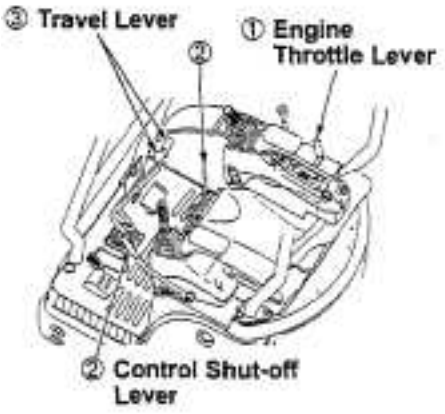
TRAVELING THE MACHINE

STRAIGHT TRAVEL

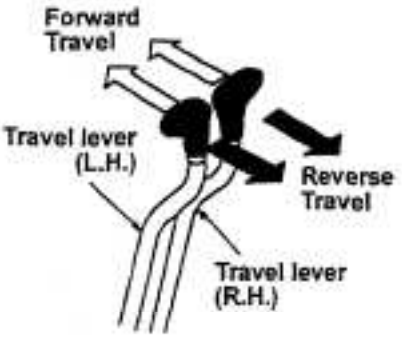
⚠ WARNING

- Be sure no one is working on or near the machine to prevent injury. Keep the machine under control at all times to prevent injury.
- Before control levers, confirm which direction the track frame faces.
- Always travel with sprockets under the rear of the machine.

1. Move engine throttle lever ① to the operating range.
2. Move the control shut-off lever ② to the unlocked position.
3. Raise the boom and the blade enough to provide sufficient ground clearance.
4. Control right and left travel levers ③ as follows.

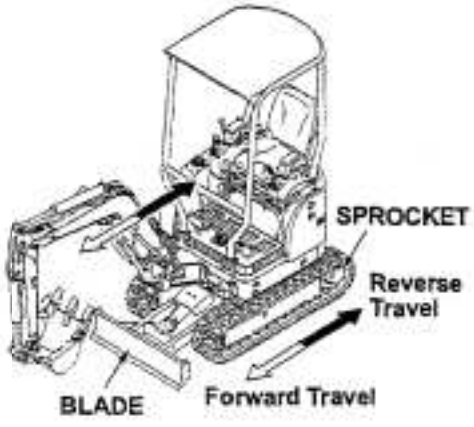


Forward Direction Travel
Move the both travel levers ③ forward to move the machine forward.
The machine will always travel toward the **BLADE.**



Stop
Slowly move both the travel levers ③ to the stop position to stop the machine and apply the brakes.

Reverse Direction Travel
Move the both travel levers ③ rear to move the machine reverse.
The machine will always travel toward the **SPROCKETS.**



STEERING CONTROL

⚠ WARNING

* Be sure no one is working on or near the machine to prevent injury. Keep the machine under control at all times to prevent injury.
* Before control levers, confirm which direction the track frame faces.
* Always travel with sprockets under the rear of the machine.

1. Move engine throttle lever ① to the operating range.
2. Move the travel lever lock and control shut-off lever to the unlocked position.
3. Raise the boom and the blade enough to provide sufficient ground clearance.

STEERING

To make turns, control the travel levers. Control the two travel levers as follows.

Pivot Left Turn

Move the right lever ① forward to travel forward and left, and move it rear to travel reverse and left, pivoting on the left track.

Pivot Right Turn

Move the left lever ② forward to travel forward and right, and move it rear to travel reverse and right, pivoting on the right track.

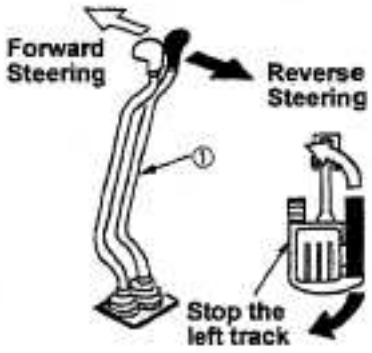
SPOT TURN

Spot Left Turn

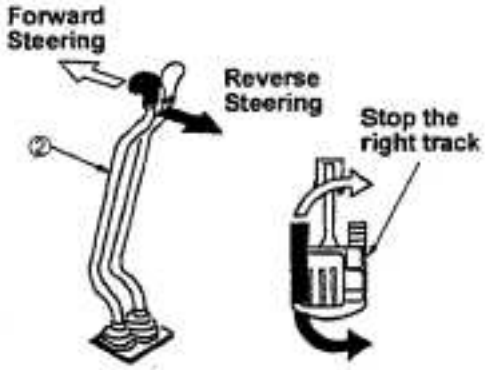
Move the left travel lever ② rear and move the right lever ① forward at the same time. This allows a quick left turn.

Spot Right Turn

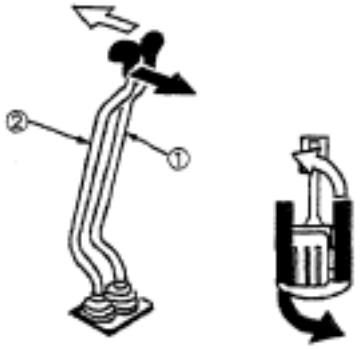
Move the right travel lever ① rear and move the left lever ② forward at the same time, allowing a quick right turn.



PIVOT LEFT TURN



PIVOT RIGHT TURN



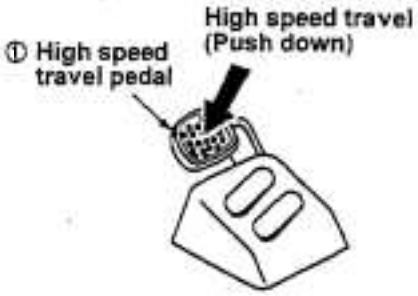
SPOT LEFT TURN

HIGH SPEED TRAVEL

⚠ CAUTION

Do not change travel speed ranges while going downhill.
NEVER high speed travel on a grade or loading and unloading the machine.
When control shut-off lever is locked, does not shift to high speed travel.

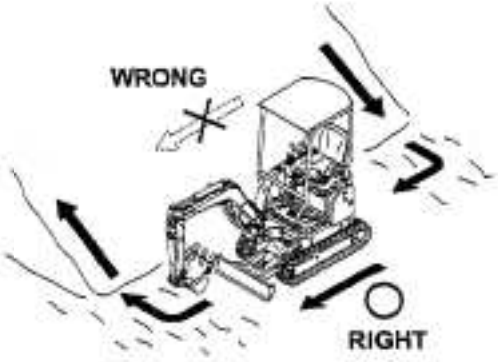
Push down the high speed travel pedal ① shift to the high speed travel.
When released pedal, shift to the low speed travel.



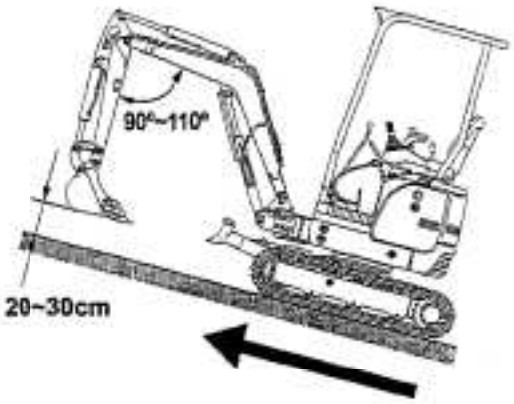
CAUTION ON TRAVEL ON A GRADE

⚠ CAUTION

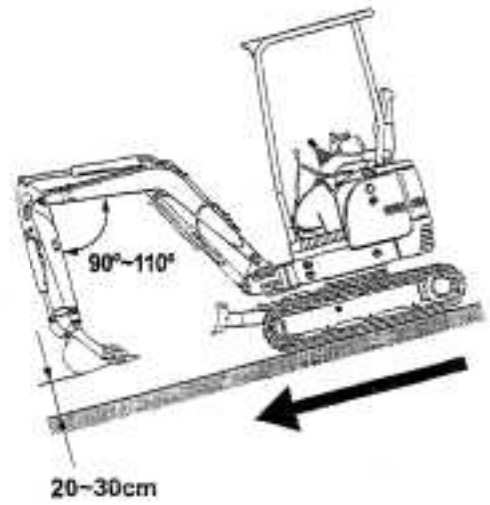
- Reduce engine speed when maneuvering in tight quarters or when breaking over a rise.
- Do not change travel speed ranges while going downhill.
- Work up and down slopes rather then sideways, whenever possible. Do not travel across a grade by all means.
- Avoid changing the direction of travel on a slope, which could result in tipping or side slipping of the machine.
- Keep the arm in and carry the boom in a low position.
- When starting up a steep grade or breaking over a rise, keep the boom lowered as close to the ground as possible.



1. When traveling up on a grade inclining by greater than 15°, keep the position in the right illustration and travel with a low engine speed.

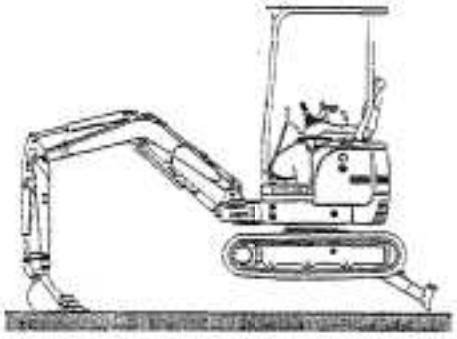


2. When traveling down on a grade inclining by greater than 15°, travel with the position in the right illustration.



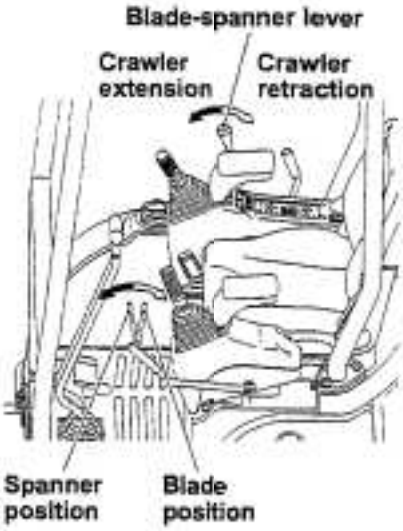
CRAWLER EXTENSION/RETRACTION

This machine is equipped with the spanner mechanism (crawler extension / retraction mechanism). Take the following procedure.



1. **Jack up the main unit.**
   Set the blade to the rear and jack up the main unit with the working device and blade cylinder till the crawler is off from the ground to extend or retract the crawler easily.

2. **Lever selection**
   Set the selector lever to the spanner position.



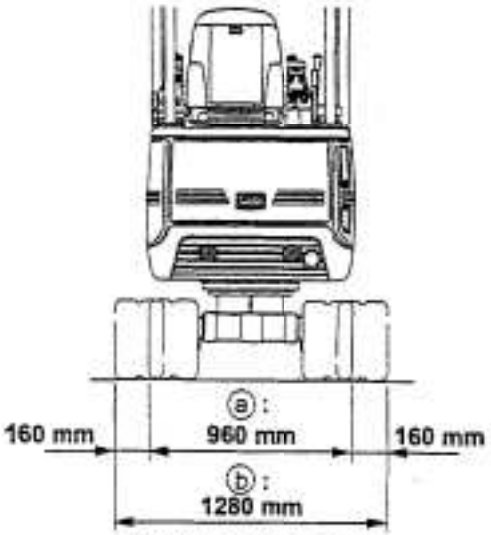
Blade-spanner selector lever

3. **Crawler extension / retraction**
   Set the engine speed at medium or higher.
   Move the blade - spanner lever (blade lever) forward or backward.

   - **Crawler extension :** Push the lever forward.
   - **Crawler retraction :** Pull the lever backward.

⚠ CAUTION

Extend or retract the crawler on a level ground without an obstacle.
Extension or retraction is possible without jacking up the main unit.
If there is an obstacle on the ground beside the crawler, the resistance is larger and extension or retraction is sometimes impossible.



ⓐ : When retracted
ⓑ : When extended

Dimension of crawler extension / retraction

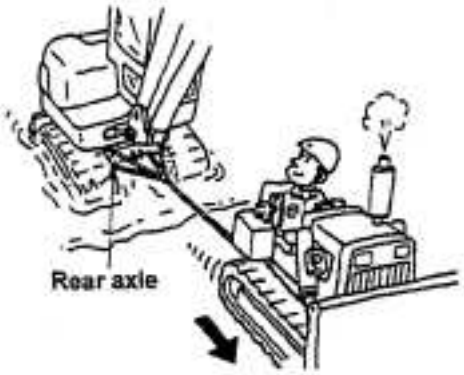
TOWING

⚠ WARNING

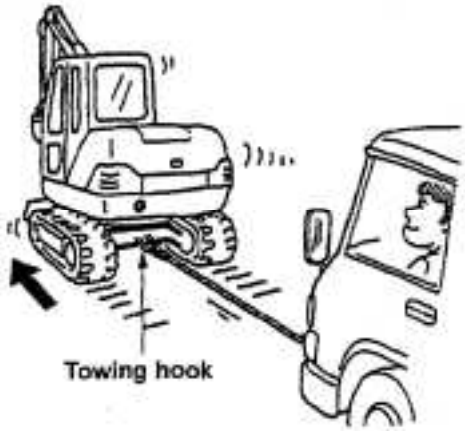
- Personal injury or death could result when towing a disabled machine incorrectry.
- Follow the recommendations below, to properly perform the towing procedure.
- Never use the towing hook at the rear axle to tow the machine.
- During towing operation, **NEVER** allow anyone between the towing machine and the towed machine.
- Quick machine movement could overload the tow line or bar and cause it to break. Gradual and smooth machine movement will work better.
- Keep the tow line angle to a minimum. Do not exceed a 30° angle from the straight ahead position.

1. If the machine sinks down on a soft ground and cannot crawl up by itself,, a wire rope should be attached to the rear axle and the machine must be towed by a towing machine.

   To prevent the damage of the wire rope, be sure to place a protector at the corner of the axle.
   Use the towing wire rope with sufficient strength to tow the machine.



2. Use of the towing hook
   The towing hook is used to tow for lightweight material. The maximum allowable towed weight is 500 kg.
   NEVER tow the machine with the towing hook, which may damage the towing hook and cause a personal injury.



LIFTING THE MACHINE

⚠ WARNING

Improper lifting or tie downs can allow load to shift and cause injury or damage.

- Use proper rated cables and slings for lifting. Lifting cables should have sufficient length to prevent contact with machine.
- Position crane for level machine lift.
- **NEVER** lift the machine loaded with any personnel.
- Use guide or tag lines to prevent the machine from swinging or turning.
- Be sure to use are wire ropes with breaking force of greater than 10 tons.

Lifting Procedures

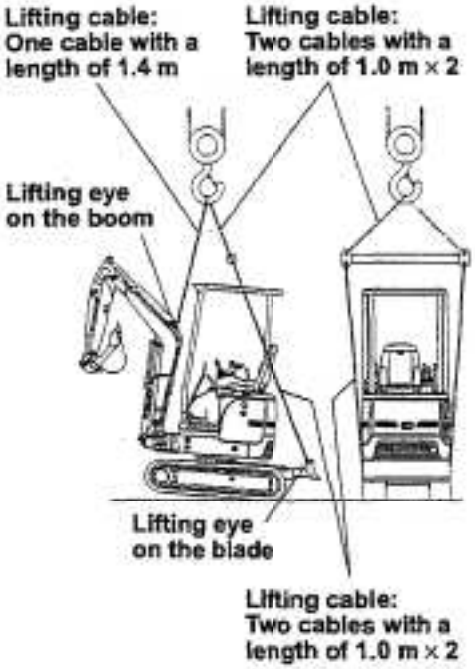
1. Startthe engine and swing the machine to position the blade to rear.
2. Position the machine on the level ground with the boom, arm and bucket cylinders fully extended.
3. Position the boom at the center of the machine with the boom swing pedal.
4. Stop the engine.
5. Instau the cables to the two lifting eyes on the blade with shackles.
   Install the cable to the lifting eye on the boom of the center with shackle.
6. Install the cables to the crane hook.
7. Confirm that no obstacles nor personal are around the machine and have the operator leave the machine.
8. Once the machine is lifted o# the ground, check that the machine is well balanced.

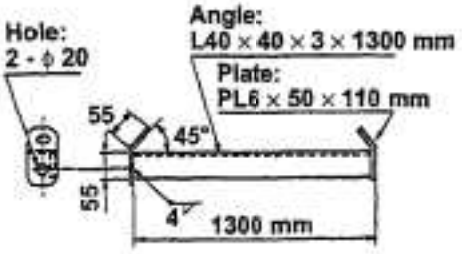
Machine mass (kg)

Shoe type	STD	ADD Weight
Rubber shoe	1,520	1,620
Steel shoe	1,590	1,690

⚠ CAUTION

Selection of the lifting cables: Be sure to use are wire ropes with breaking force of greater than 10.0 tons.





Details of a lifting jig

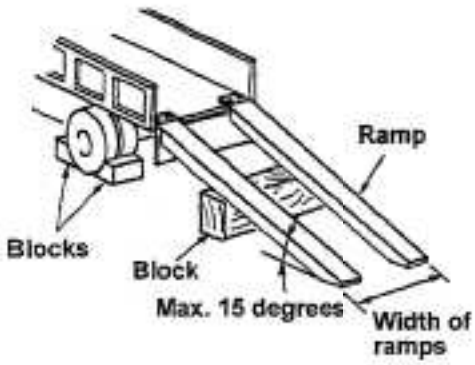
LOADING AND UNLOADING THE MACHINE

⚠ WARNING

- Choose as flat ground as possible for loading the machine.
- When using loading ramps, be sure there is adequate length, width, firmness and slope.
- To prevent the machine from slipping while loading or shifting transit, remove ice, snow or other slippery material from the loading ramps and the truck bed before loading.
- **NEVER** operate the high speed travel switch when loading the machine on a trailer or loading lamps.
- Perform warm-up the machine before loading and unloading under cold weather.
- Do not raise the boom excessively at loading and unloading.
- **NEVER** make a turn on a ramp. To make a turn, get off the machine from the ramp first.

MACHINE LOADING ONTO A TRUCK.

1. Block the truck wheels before loading.
2. Install the loading ramps to the truck securely. Maintain the slope of loading ramps within 15 degrees.
3. Position the machine so that it can be run straight on the loading ramps. Never operate control levers other than the travel lever while machine is on the lading ramps.
4. Maintain the machine balance point while traveling over the loading ramp joint areas.
5. Lower the attachment to the bed of truck.
6. Be sure to chock both tracks.



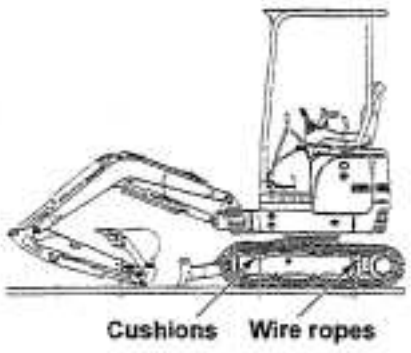
Typical Example

SECURING THE MACHINE

⚠ WARNING

Upper structure movement can cause personal injury or death.

1. Align the upper structure with the truck.
2. Move the control shut-of lever to the **LOCKED** position.
3. Turn the engine start switch of **OFF** to stop the engine and remove the key.
4. Block the tracks and secure the machine with tie-downs. Install and fasten proper rated wire rope cables located on the car body and arm point.



PRECAUTION ON USE OF RUBBER TRACK SHOE

⚠ CAUTION

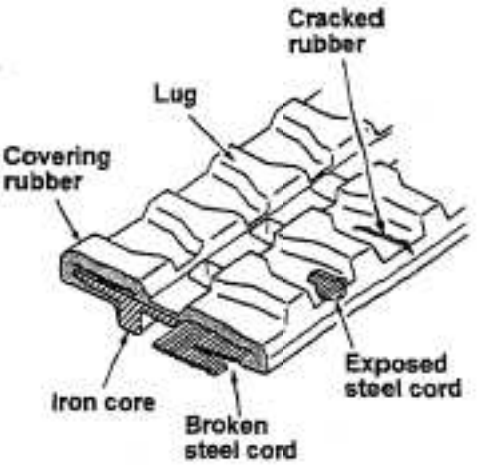
The rubber track shoe may be damaged or worn faster depending on working conditions. Perform working operation properly according to working site conditions and machine operation.

■ Structure of Rubber track Shoe

The right illustrates the structure of rubber track shoe. It consists of steel cord to sustain tension, iron core to support it, and covering rubber to them.

⚠ CAUTION

If a crack reaches the steel cord, it may be rusted and cut off by moisture. When any crack is detected, repair it immediately with vulcanizer.



Typical Example

■ Precaution on Use

1. Adjust the track often enough to keep a proper tension.
   - Insufficient tension slips off the rubber track shoe and wears out the sprocket and iron core extremely.
   - Excessive tension increases travel resistance, which prevents proper travel force and speed. It also causes damages and extreme wear at undercarriage as well as overextension of the rubber track shoe.

2. To prevent damages of the rubber track shoe, avoid the following in travel as much as possible.
   - Pointed rocks or quarry
   - Craggy place such as riverbed or path through woods
   - Steel rods or scraps
   - Steel board or cornered objects of concrete
   - Heat source such as fire
   - Travel in contact with concrete path or wall

3. Immediately wipe off spilt fuel, hydraulic oil, or grease on the rubber track shoe with a cloth.

4. Avoid sudden spot turns or pivot turns. Make slow turns several times at a low speed.

5. Do not use for long (3 months or more). Store it to avoid direct sunlight or rain.

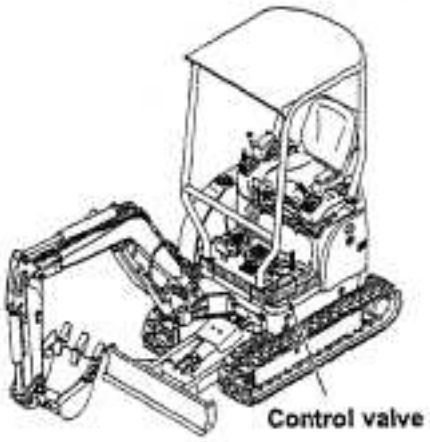
6. Use the rubber track shoe at a temperature between –25°C and +55°C (–13°F and 131°F) because of a rubber's characteristic.

BOOM LOWERING WITH THE ENGINE STOPPED

■ Method of Boom Lowering When Engine Damaged.

⚠ WARNING

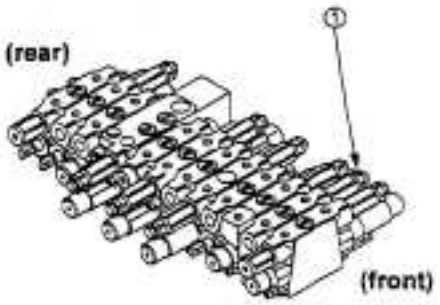
Be sure no one is under or the front implements before manually lowering the boom.
Keep all personnel away from the boom area when lowering the boom with engine stopped.

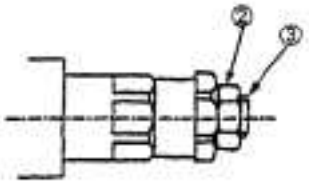


Use the following procedure when it is necessary to lower the boom while engine is shut down or the hydraulic system disabled.

1. Remove the floor cover under the operator's station floor.
2. Remove the lock nut ② of the boom raise relief valve located inside the control valve ①.
3. Slowly loosen adjusting screw ③ until boom start lower. The boom will start to lower slowly.
4. After making sure that the front implement has lowered completely on to the ground, install the lock nut ②.
5. Make any necessary repairs placing the excavator back into service.

NOTE: For further information, contact your IHI dealer.





Boom raise relief valve

PARKING THE MACHINE

At the end of a day's work, following steps should be observed as the established machine shut-down procedure:

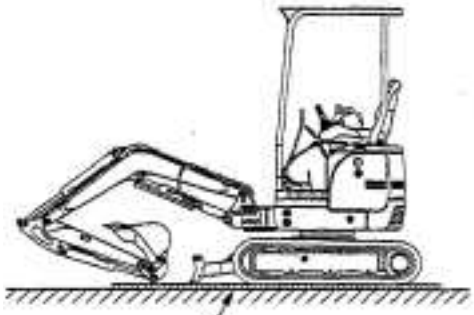
Machine Stopping

Park on a level surface, if necessary to park on a grade, block the tracks securely.

1. Move engine throttle lever forward to reduce the engine speed.
2. Release the travel lever to stop the machine.
3. Lower the bucket to the ground and apply slight down pressure.
4. Move the control shut-off lever to the **LOCKED** position.

Freezing Conditions

If freezing temperature are expected, each crawler frame should be cleaned of mud and dirt and the machine parked on wood planks.



Wood planks

Engine Stopping

1. Operate the engine at **LOW IDLE** for five minutes.
   This gives the engine a chance to cool off gradually before they are stopped.
2. Turn the start switch key to **OFF.** Remove the key.

START SWITCH

Leaving the Machine

1. Use the steps and handhold, use both handles and face the machine, when dismounting.
2. Inspect the entire machine for leaks, loose connections, signs of wear, crack etc. Report any signs of trouble discovered during this inspection.
3. Close and lock the doors.

EMERGENCY ENGINE STOP

To stop the engine in emergency, turn the start switch key to "**OFF**" position.

SECTION 4 MAINTENANCE

TABLE OF CONTENTS

Subject	Page
Maintenance Intervals	4 – 1 – 1
Lubrication Chart Maintenance and Checks	4 – 2 – 1
Recommended Lubrication Table	4 – 3 – 1
When Required Maintenance and Checks	4 – 4 – 1~6
Daily Maintenance and Checks	4 – 5 – 1~4
50 hours Maintenance and Checks	4 – 6 – 1
250 hours Maintenance and Checks	4 – 7 – 1~6
500 hours Maintenance and Checks	4 – 8 – 1~4
1000 hours Maintenance and Checks	4 – 9 – 1~3
2 years hours Maintenance and Checks	4 – 10 – 1~2
Unusual Operating Contions	4 – 11 – 1~3
Long Term Storage	4 – 12 – 1
Hydraulic System Pressure Settings	4 – 13 – 1~6

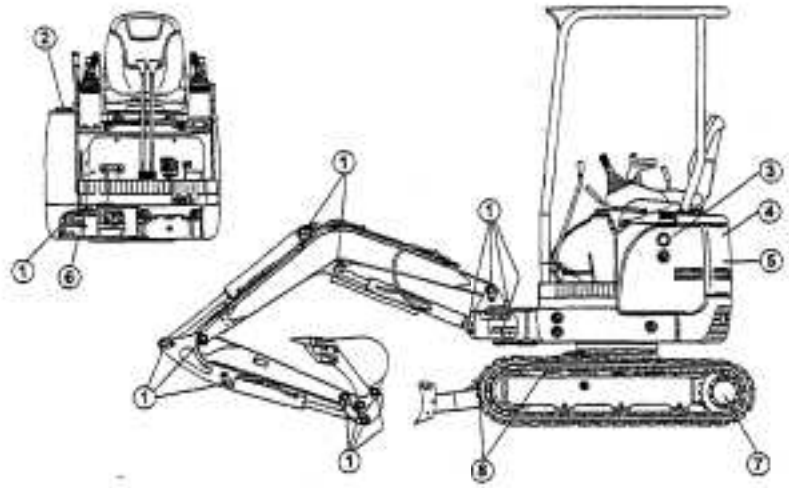
MAINTENANCE INTERVALS

Check Point	Item	Page
When Required		
Tracks	Check and Adjust Tension	4 – 4 – 1
Tracks	Check Rubber Shoes	4 – 4 – 2
Fuses	Replace	4 – 4 – 3
Fusible Link	Replace	4 – 4 – 3
Battery	Clean and Check Electrolyte Level	4 – 4 – 4
Bucket	Change Bucket	4 – 4 – 5
Daily Check (8 Service hours)		
Engine Oil	Check Oil Level	4 – 5 – 1
Engine Coolant	Check Coolant Level	4 – 5 – 1
Hydraulic Tank	Check Hydraulic Oil Level	4 – 5 – 2
Fuel Tank	Check Fuel Level	4 – 5 – 2
Air Cleaner	Check Service Signal	4 – 5 – 2
Water Sedimenter	Check Level and Drain Water	4 – 5 – 3
Every 50 Service Hours (First perform previous service hour items)		
Fuel Tank	Drain Water and Sediment	4 – 6 – 1
Attachment Pins	Lubricate Fitting with Grease	4 – 2 – 1
Swing Bearing	Lubricate Fitting with Grease	4 – 2 – 1
Engine Oil	Change Oil and Finer *	4 – 7 – 1
Hydraulic System	Change Return Filter *	4 – 8 – 2
Every 250 Service Hours (First perform previous service hour items)		
Engine Oil	Change Oil and Filter	4 – 7 – 1
Air Cleaner	Clean or Change Filter Elements	4 – 7 – 2
Fuel Filter	Clean Filter Element	4 – 7 – 5
Fan Belt	Inspect and Adjust	4 – 7 – 6
Engine Coolant	Change Coolant (When not used L.L.C)	4 –10– 1
Every 500 Service Hours (First perform previous service hour items)		
Tighten Bolts	Retightening Bolt	4 – 8 – 1
Return Filter	Change Retuen Filter	4 – 8 – 2
Fuel Filter	Change Filter Element	4 – 8 – 3
Travel Drive	Check Oil Level	4 – 8 – 3
Every 1000 Service Hours (First perform previous service hour items)		
Travel Drive	Change Gear Case Oil	4 – 9 – 1
Hydraulic Tank	Change Hydraulic Oil and Clean Strainer	4 – 9 – 2
Every 2 years Service Hours		
Engine Coolant	Change Coolant (When used L.L.C)	4 –10– 1

* Interval given applies only to initial period of use (Break-in).

LUBRICATION CHART MAINTENANCE AND CHECKS

The interval of lubrication, maintenance and check is the maximum interval indicated by the hour meter. It should be shortened in service operating conditions.



Check points		Check items	Check intervals						
			Initial period of use After 50 hours	Daily	Every 50 hours	Every 250 hours	Every 500 hours	Every 1000 hours	Every 2 years hours
①	Attachment pins	Lubricate with grease "G"			○				
②	Fuel tank	Drain water and Sediment			○				
③	Hydraulic tank	Oil level "H"		○				●	
		Drain water and sediment			○				
		Wash and clean strainer						○	
④	Return filter	Filter	●				●		
⑤	Engine	Engine oil "E"	●	○		●			
		Fuel filter				○	●		
		Oil filter	●			●			
		Air filter		○		○			
		Coolant level "W"		○					●
⑥	Swing bearing	Bearing-lubricate with grease "G"			○				
		Ring gear-lubricate with grease "G"					○		
⑦	Travel drive	Check oil level and change oil "L"	○				○	●	
⑧	Blade	Lubricate with grease "G"			○				

Symbol	G	L	H	E	W	○	●
Remarks	Grease	Gear oil	Hydraulic fluid	Engine oil	Coolant	Check / Maintenance / Supply	Change
	EP-2 Lithium grease	API • GL-4, GL-5 ISO-VG320	Wear-proof hydraulic fluid ISO-VG46	API • CD SAE 10W30			

RECOMMENDED LUBRICANT TABLE

LOCATIONS	REFILL CAPACITIES (APPROXIMATE)	CHANGE INTERVALS	USE	LUBRICANT VISCOSITIES
Diesel Engine	Max. 3.0 liter Min. 1.0 liter	250 Hrs. Initial oil change 50 hours	Cold Regions	API, Class CD SAE20
			General	API, Class CD SAE30
			Tropical Regions	API, Class CD SAE40
Hydraulic Oil	Total Amount 23 liter Tank Capacity 19 liter	1000 Hrs. (600 Hrs. when breaker used)	Ambient Temperature – 5 °C	Wear Proof Hydraulic Fuluid ISO – VG 46
			Ambient Temperature Below – 5 °C	Wear Proof Hydraulic Fuluid ISO – VG 32
Track Rollers	0.025 liter (Each)	Upon occasion	–	API, GL – 4 or GL – 5, ISO – VG 320 (SAE 90) Gear Oil
Front Idlers	0.07 liter (Each)	Upon occasion	–	
Travel Drives	0.33 liter (Each)	1000Hrs.	–	API, Class CD SAE30
Lubricate the Fitting	Swing Bearing, Attachment pins, etc.		–	EP2 Lithium Grease

Note:

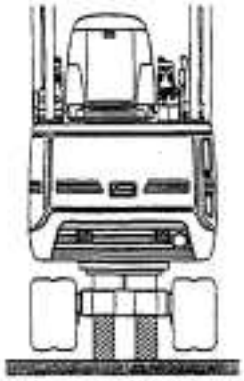
1. Oils in the hydraulic fluid columns marked with *should be use above 0 °C.
2. If the oil becomes dirty or deterioration of the oil's properties are excessive, replace more frequently than described above.
3. Disassemble the track roller and upper roller when replacing the oil in them.

WHEN REQUIRED MAINTENANCE AND CHECKS

TRACKS CHECK / ADJUST

⚠ WARNING

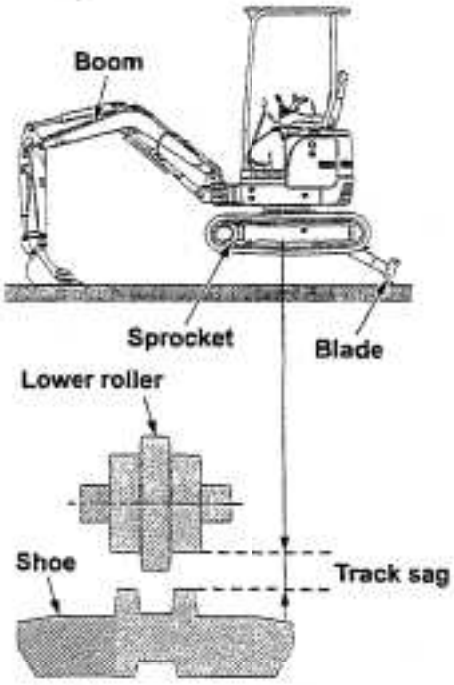
- Grease is under high pressure.
- **NEVER** remove the grease fitting.
- Grease coming out of the check valve under pressure can penetrate the body causing injury or death.
- **DO NOT** watch the check valve to see if grease is escaping. Watch the track or track adjustment cylinder to see if the track is being loosened.
- Loosen the check valve one turn only.



Suported the machine

■ Measuring Track Tension

1. Position bucket to the sprocket side. Use boom and blade down pressure to lift the track on both side off the ground.
2. Measure the maximum amount of the track sag from the shoe upper face to the roller face. Properly adjusted track will have approximately 10 to 20 mm slack with rubber shoes. In case of steel shoes, approximately 30 to 50 mm.



Rubber shoes: 10 to 20 mm
Steel shoes: 30 to 50 mm

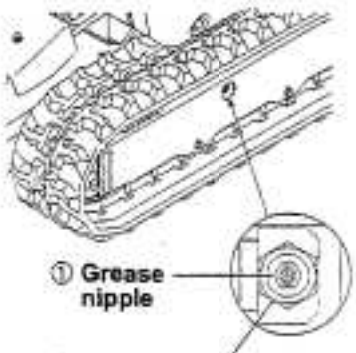
■ Track Tightening

1. Add grease through check valve fitting ① until the correct track tension is reached.
2. Move the tracks forward and reverse to equalize the pressure.
3. Check the the amount of track sag again and adjust as necessary.

■ Track Loosening

1. Remove soil deposited on front idler bearing.
2. Loosen the check valve ② carefully (one turn maximum) until the track begins to loosen.
3. Tighten the check valve ② to 59 to 69 N • m (6 to 7 kgf • m) when the desired track tension is reached. **NEVER** over tighten the check valve.
4. Move the tracks forward and reverse.
5. Check the the amount of track sag again and adjust as necessary.

If the correct adjustment cannot be obtained, consult your IHI dealer.



RUBBER TRACK SHOE MAINTENANCE

⚠ CAUTION

* Rubber track shoe should be repaired or replaced under the next conditions.
* If is necessary to repair or replace it, consult your IHI dealer.

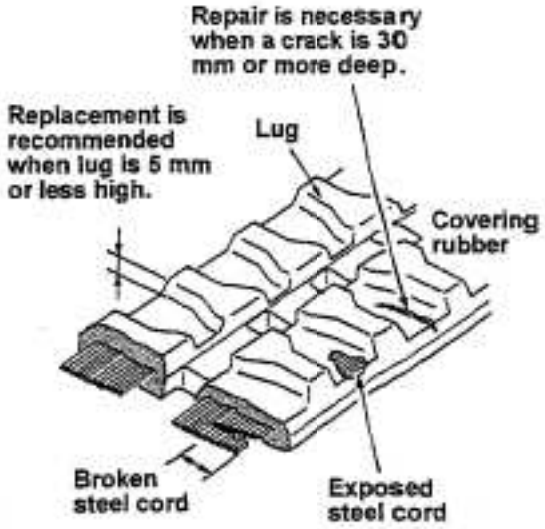
1. **Height of lugs**
   The rubber track shoe can be used even if it is worn, however, if it is excessively worn, the rubber track shoe is likely to be slippery and more travel force is required. If the remaining lug is less than 5 mm high, replace it with brand-new one.

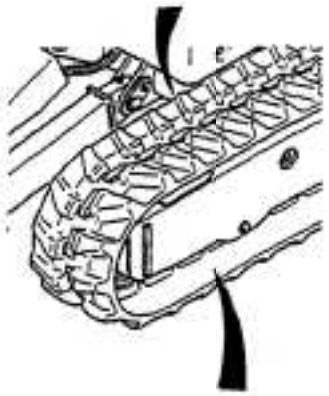
2. **Exposure of Steel Cords**
   If steel cord is exposed because of weary rubber or damage, replace it with brand-new one.

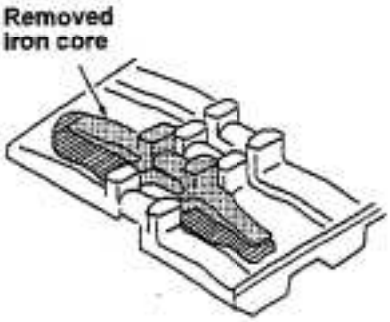
3. **Break of Steel Cords**
   When break of steel cord is detected, replace it immediately. If you leave it as it is, the rubber track shoe can be break without expectation, which causes a serious accident.

4. **Crack of Covering Rubber**
   If a crack is 30 mm or more long and 8 mm or more deep, repair the cover immediately. If Steel cord appears even if a crack is small, repair it immediately. Otherwise, water may come into a crack, which rusts steel cords and break the rubber track shoe.

(Typical Example)



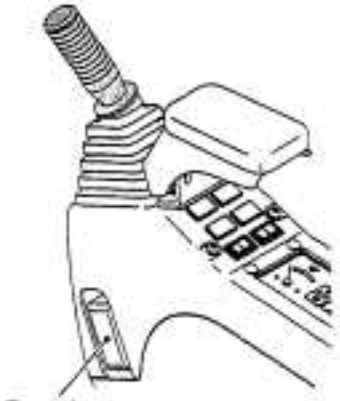




FUSES

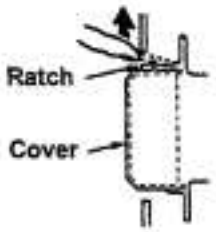
The fuse box is located on the front of the instrument panel.
Fuses will protect the electrical system from damage caused by overloaded circuits.

Replace fuses with the same type and size only.
Otherwise, electrical damage can result.
Change a fuse, have the circuit checked and repaired.

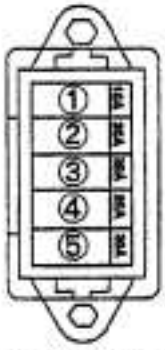


■ **Replace**

1. Pull the latch and remove the cover for fuse access.
2. Change the damaged fuse to new one.



The following circuit protected by each fuse includes the fuse amperage.



Fuse amperage

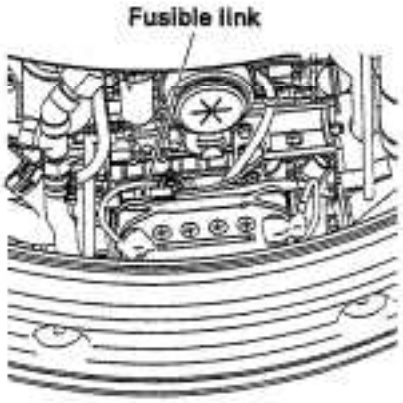
① Fuel pump, Control shut-off and Travel speed shift solenoid – 10 amps

② Horn, Cigeret lighter and Cab dome light – 20 amps

③ Front light – 20 amps

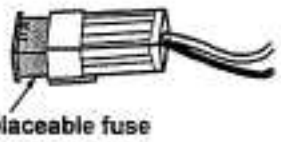
④ Monitor, Radio, Heater and Wiper – 20 amps

⑤ Engine stop and QOS timer, – 30 amps



FUSIBLE LINK

The fusible link is provided between the positive terminal of the battery and the starter switch to prevent electrical circuit wires from being burned because of short circuit. When the power is turned off by short circuit, check the fusible link.
When it is blown out, replace it with new one after repairing the wires.



(Typical Example)

BATTERY MAINTENANCE

⚠ WARNING

- Battery give off flammable fumes that can explode.
- Do not smoke when observing the battery electrolyte levels.
- Electrolyte is an acid and can cause personal injury if it contacts skin or eyes.
- If the electrolyte comes in contact with eyes, wash it away with water and call for emergency medical cure.
- Always wear protective glasses when working with battery.
- Battery post, terminals and related accessories contain lead and lead compounds, chemicals known to cause cancer and reproductive harm. WASH HAND AFTER HANDLING.

1. Cleanliness

Clean the battery surface. Keep the terminals clean and coated with good quality grease.
Install the post cover after coating.

2. Battery Recharge

Battery should not be allowed to stand in a fully discharged condition, but should be recharged as soon as possible. If battery is out of use for a long time, it must not be allowed to run down completely.

The battery should be given a small recharge, sufficient to bring it back to fully charged state about every one or two months.

Trickle charging is not recommend and during charging as before, care must be taken that temperature of electrolyte does not rise above 40 °C for temperate climates and 52 °C for battery using lower gravity acids specified for tropical use.

3. Inspection

Inspect the electrolyte level look at the indicator or sight level line on the battery.

Display of indicator

Shows the standard of charge and electrolyte level.

- Good (Blue)
- Charge is necessary (Red)
- Electrolyte shortage (White)

4. Topping Up

Maintain the level to the upper level of the sight level line with distilled water when required. If any electrolyte is spilled, replace it with fresh sulfuric acid of same specific gravity as that of remaining in cell. Level of electrolyte must never fall below tops of plates.

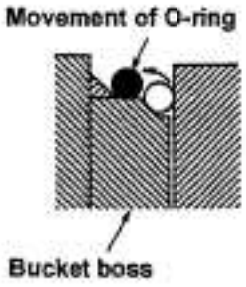
CHANGE THE BUCKET

⚠ CAUTION

- Bucket pins, when struck with force, can fly out and injure nearby persons. Make sure the area is clear of people when driving bucket pins.
- Wear protective glasses when striking a bucket pin to avoid injury to your eyes.
- Chips or other debris can fly off objects when struck. Make sure no one can be injured by flying debris before striking any object.

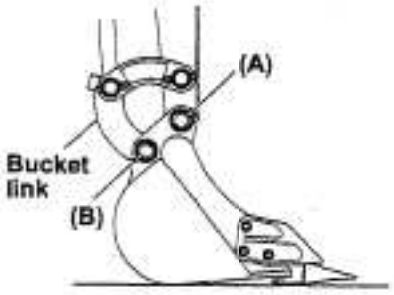
■ Remove the Bucket

1. Place the bucket in a stable position.
2. Move the O-rings from the regular position to the bucket boss.
3. Remove the pins of section A and B, then remove the arm and the bucket.



■ Install the Bucket

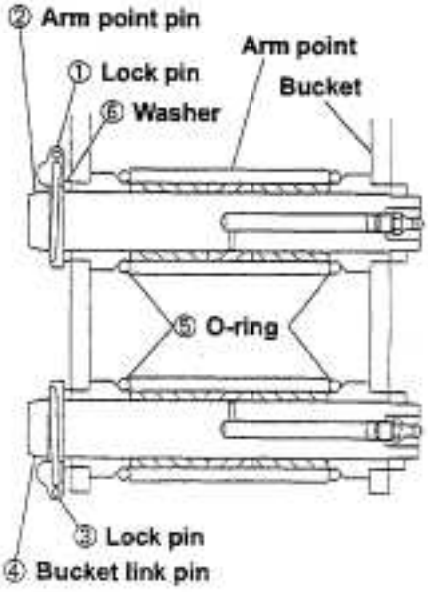
1. Clean the removed pins and pin holes and apply coat the grease to them surface.
2. Place a new bucket in a stable position as illustrated.
3. Connect the arm into the hole A, and the link into the hole B with pins.
4. Install a stopper bolt to each pin securely.
5. Adjust the bucket clearance.
6. Move the O-rings for sealing into the regular position.
7. Lubricate each pins with grease.
8. After install the bucket, start the engine and low speed rotate the bucket to the stroke end. Check if anything interrupts the bucket rotation.



■ Bucket Clearance (If Equipped with a Bucket Capable of Shim Adjustment)

If the bucket installed clearance becomes excessive, adjust clearance to 0.1 to 0.8 mm by remove appropriate number of shims.

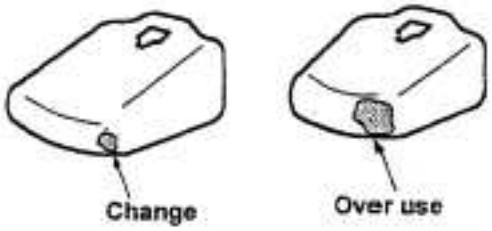
1. Stop the engine.
2. To remove shims, remove bolts, washers and flange.
3. After correct number of shim have been removed, install flange washers and bolt. Tighten bolts.
4. After installation, make sure that clearance is still correct.



REPLACE THE TEETH AND SIDE CUTTERS

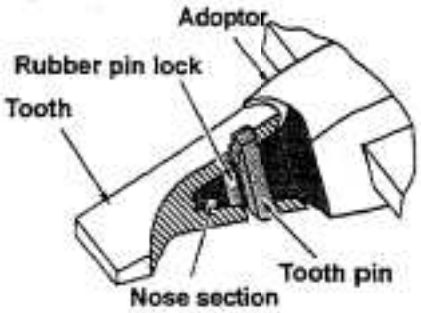
⚠ WARNING

- Personal injury or death can result from bucket falling
- Block the bucket before changing bucket tooth or side cutter.



■ Replacement Period of Tooth

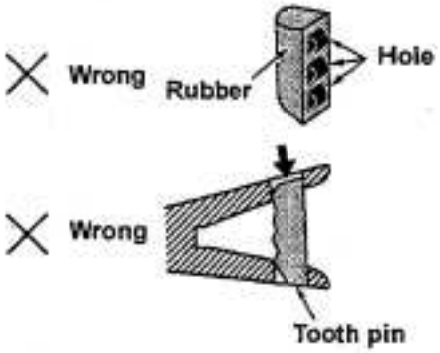
Replace the bucket tooth when a wear hole appears.



■ Replacement of Tooth

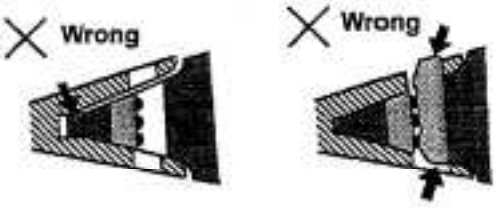
1. Drive the lock pin from the worn tooth. Remove the tooth.
2. Clean the adaptor and pin hole.
3. Install the new rubber pin into the tooth.
4. Install the new tooth over the adaptor.
5. Drive the lock pin through the tooth, until the pin is flush with the tooth surface.

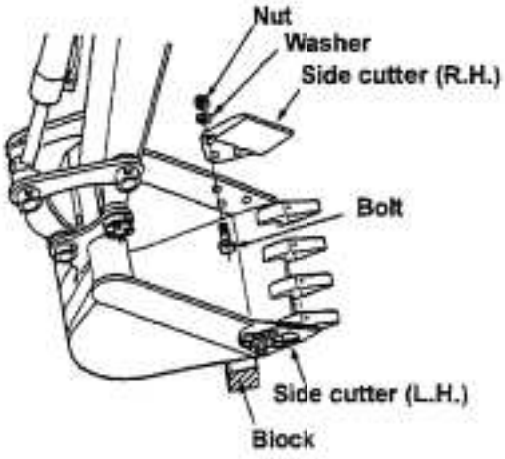
NOTICE:
After driving the lock pin, make sure the lock pin fits snugly into the hole of the tooth.



■ Replacement of Side Cutters

1. Remove the mounting bolts and remove the side cutters.
2. Clean the mounting surfaces. Install the new side cutters.





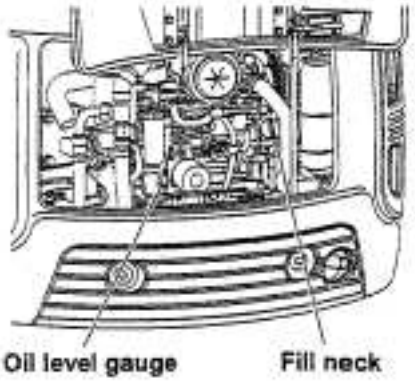
Typical Example

DAILY MAINTENANCE AND CHECKS

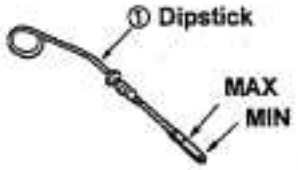
■ Check the Engine Oil Level

⚠ CAUTION

- Check the oil level with the engine stopped. **DO NOT** check the oil level with engine running.
- **DO NOT** overfill the crankcase to avoid engine damaged. Engine damage can result.
- **NEVER** operate the engine when oil level is above **MAX** or **MIN** marks.



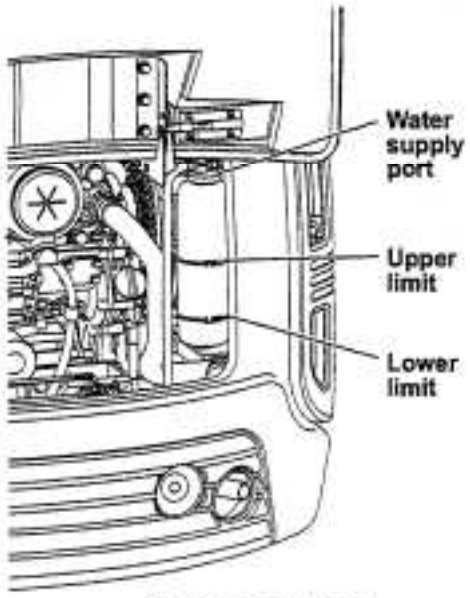
1. Place the machine on level ground. Stop the engine.
2. Remove the dipstick ① and wipe it clean. Insert dipstick ①, then remove it again to read actual oil level. Install dipstick ①.
3. Maintain the oil level to the **MAX** mark on the dipstick ①. Add oil if necessary.
4. Remove the oil fill plug ② and add oil. Clean and install the oil fill plug ②.
5. Close the access door.



■ Check the Coolant Level

⚠ WARNING

- Steam generated by hot fluid under pressure in radiator can cause personal injury.
- Remove filler cap only when cool enough to touch with bare hand.



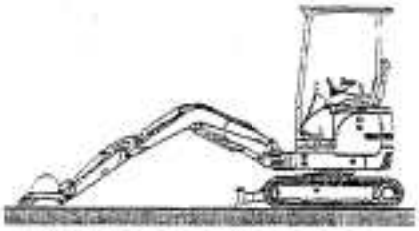
Reserve tank level

1. Open the access door on the rear of the machine.
2. Always check the coolant level in the reserve tank. Maintain the coolant level between the **MAX** and **MIN** marks on the reserve tank.
3. Remove the coolant fill cap ① and add the coolant if necessary.
4. If the reserve tank is empty, check the radiator level with the engine stopped. Add coolant to the radiator and the reserve

■ Hydraulic Oil Level

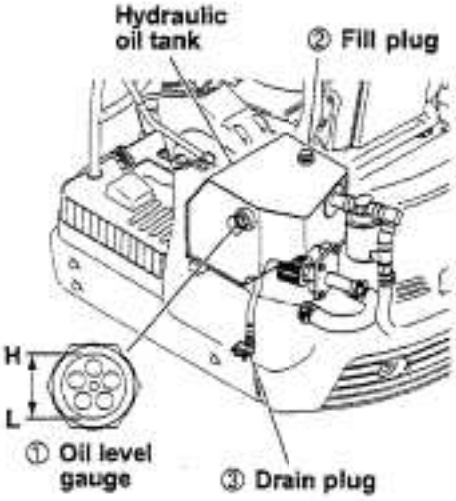
⚠ CAUTION

- Always clean around fill plug before removing.
- **DO NOT OVER FILL.**
- **DO NOT OPERATE** the machine when oil level is above **FULL** or **ADD** marks.



Bucket position at the time of checking the hydraulic oil level.

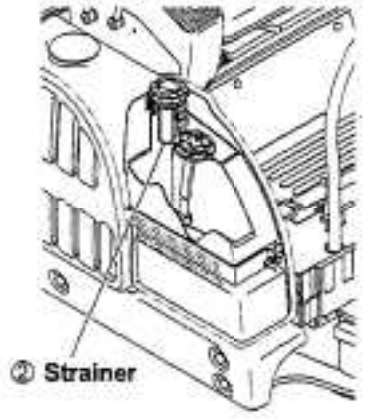
1. Place the machine on level ground and lower the bucket to the ground, with the arm and bucket cylinders fully retracted, as shown.
2. Maintain the oil level between the **FULL** and **ADD** marks on the level gauge.
3. Slowly loosen the fill plug o relieve any and remove it to add oil if necessary.
4. Clean and install the fill plug. To pressurize the hydraulic tank, refer to "Change Hydraulic Oil" section.



■ Fill Fuel Tank

Fuel can be added to the tank by removing the fill cap on top of the fuel tank. Do not remove strainer in the fill port when fill fuel tank.

After completion of refueling, be sure to lock the fuel tank cap to protect against vandalism.

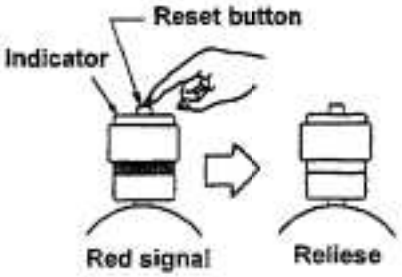


■ Dust Indicator

Check the air filter dust indicator. If the indicator is in the red zone, clean or replace the element.

See Service the Filter Elements.

After servicing, reset the dust indicator pushing in the reset button.



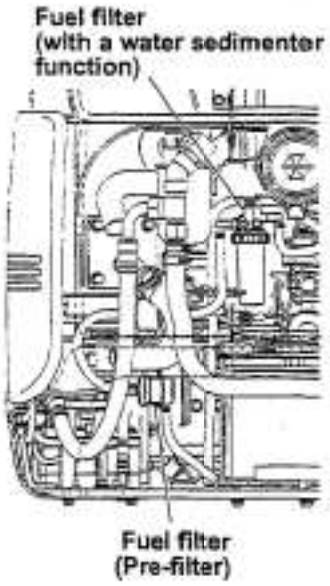
■ Water Sedimenter

Maintenance intervals :
- Check Level: Daily
- Drain the Water and Sediment : When the float floated up to the bottom of the filter in the sedimenter.

⚠ WARNING

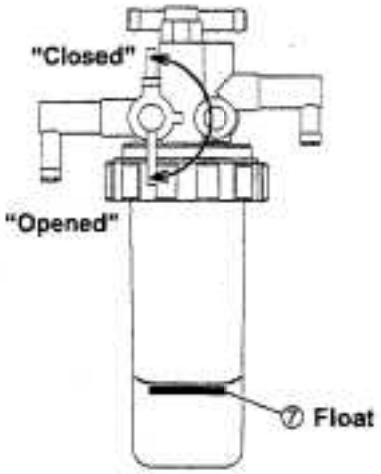
Fuel leaked or spilled onto hot surfaces can cause a fire.

The water sedimenter is located on the rear of the engine.

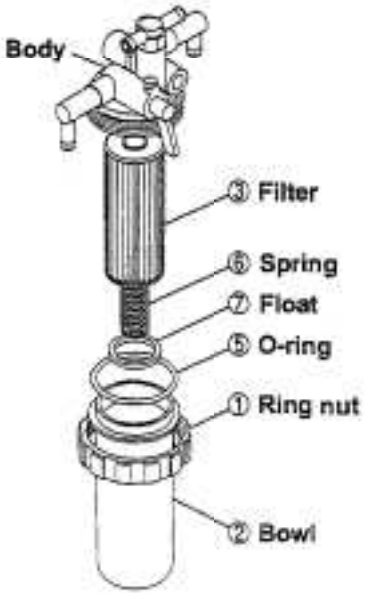


1. Stop the engine.
2. Turn the fuel stop lever to the "closed" position.
3. Loosen the ring nut ① and remove the bowl ② and the filter ③.
4. Drain water and sediment into suitable container.

NOTE: Always dispose of drained fluids as established by local regulations.



5. Clean the inside surfaces of the body ④ and bowl ②.
6. Clean the filter ③.
7. Inspect the O ring ⑤ on bowl. Replace them if they are worn or damaged.
8. Install a filter ③ to the body. Install a spring ⑥ and float ⑦ into the bowl. Install the bowl to the body. Tighten ring nut ①.
9. Turn the fuel stop lever to the "opened" position.
10. Priming the system. There should be enough fuel in the system to allow the engine to start.
    Keep the engine start switch key at ON for a period of 20 seconds, which operates the fuel pump and priming automatically.



NOTE: Do not start the engine until all fuel system service is completed.

■ Walk-Around Inspection

Inspect the operator's compartment for cleanliness. Keep it clean.

Inspect the loose bolts, Tighten any loose bolts. Repair if necessary..

Inspect any cracks in boom and arm pivot area and cylinder mounting brackets. Repair if damaged.

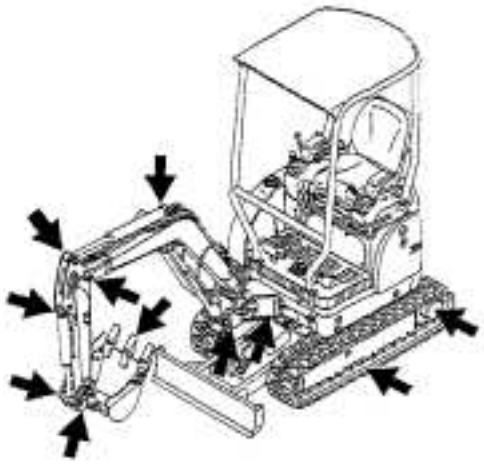
Inspect attachment cylinders, linkage and bucket for damage or excessive wear. Repair if damaged.

Inspect and remove any trash build up in the engine compartment.

Inspect the cooling system for leaks, faulty hose and trash built up. Correct any leaks and remove any trash from the radiator.

Inspect the hydraulic system for leaks. Inspect the tank, cylinder rod seals, tubes, plugs, joints and fittings. Correct any leaks.

Inspect and repair travel drive leaks. Check oil level if leakage is noticed.



■ Daily Lubrication

Perform the daily lubrication as required by the Lubrication Chart.

50 HOURS MAINTENANCE AND CHECKS

First perform previous service hour items

FUEL TANK

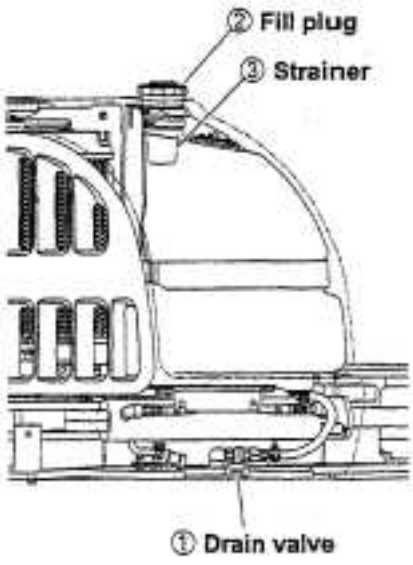
■ **Drain the Water and Sedirnent**

NOTE: Before draining the water and sediment, be sure to fill the tank with fuel. The drain valve located under the fuel tank.

1. Open the drain valve ①.
2. Drain water and sediment into suitable container.

NOTE: Always dispose of drained fluids as established by local regulations.

3. Close the drain valve.



■ **Lubrication**

Perform the 50 hours lubrication as required by the Lubrication Chart. Be sure to lubricate all cylinder mounting bushings and pins.

☆ The following maintenance and checks should be made in 50 hours for the initial time only.
Interval given applies only to period of use (break-in.)

- Return filter replacement.
- Engine oil replacement.
- Engine oil filter replacement.

250 HOURS MAINTENANCE AND CHECKS

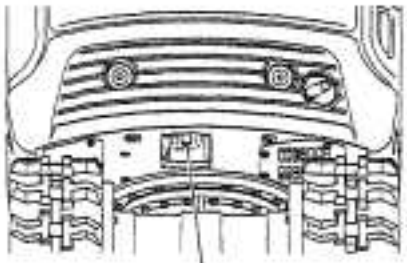
First perform previous service hour items

ENGINE OIL AND FILTER

■ **Change the Oil and Filter**

⚠ CAUTION

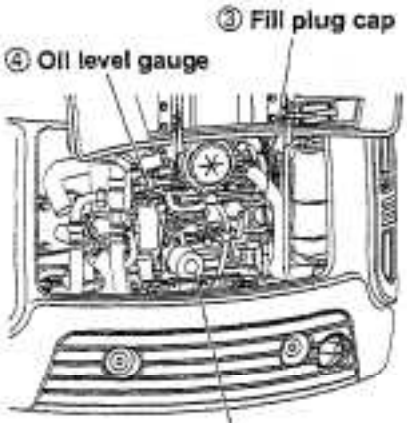
- Hot oil and components can cause personal injury. Do not allow hot oil or components to contact skin.
- **DO NOT** overfill the crankcase to avoid engine damaged. Engine damage can result.
- **NEVER** operate the engine when oil level is above **MAX** or **MIN** marks.



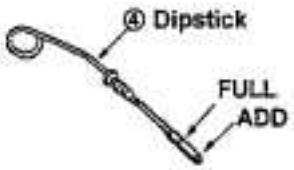
① Drain plug

1. Stop the engine.
2. Remove the crankcase oil drain plug ①. Allow the oil to drain into a container. Install the crankcase drain plug ①.

   NOTE: Always dispose of used oil and filters as established by local regulations.



3. Open the engine cover on the rear of machine.
4. Remove the used filter ② by the filter wrench. Clean the filter housing base.
5. Apply a light coat of engine oil to the gasket of the new filter.
6. Install the new filter by hand. When the seal contacts the base, tighten the filter 3/4 turn more by filter wrench. Do not overtighten.
7. Remove the oil fill plug ③. Fill the crankcase with oil. Refer to "Recommended lubricant table." Clean and install the oil fill plug ③.
8. Before starting the engine, make sure the oil level is between the two notches on dipstick ④.

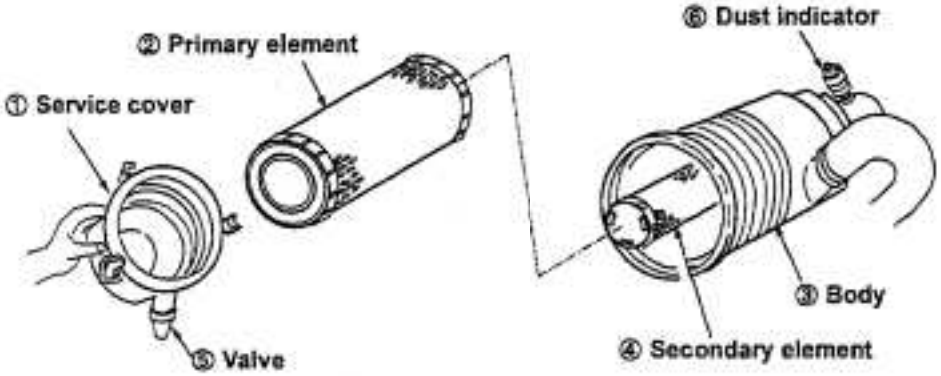


9. Start and run the engine at low idle for two minutes. Inspect for oil leaks. Stop the engine.
10. Wait 10 minutes to allow the oil to drain back into to the crankcase. Check the oil level. Maintain the oil level to the **FULL** mark on dipstick.
11. Close and latch the engine hood.

■ Service the Filter Elements

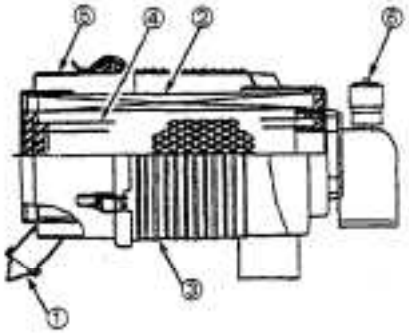
CAUTION

- Service the air cleaner if indicated the red signal in the dust indicator with the engine running at high idle.
- Service the air cleaner only with the engine stopped to prevent engine damage.
- Do not clean the filter elements by bumping or tapping them.
  Do not use filter element with the damaged pleats, gaskets or seals.
  Engine damage could result.
- When using pressure air for cleaning, wear a protective face shield or protective grasses.



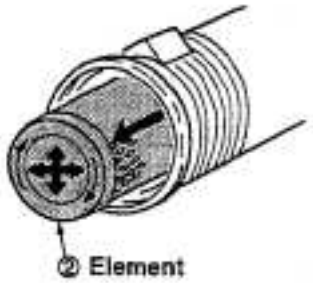
Service the Primary Element

Cleaning : Every 250 hours or when indicated the red signal in the dust indicator.
Replacement : After cleaning five times, after one year or damaged pleats or seals.



1. Stop the engine.
2. Release the three latches and remove the service cover ①.
3. Remove the primary element ② from the air cleaner housing ③. Do not remove the secondary element ④, when service the primary element ② only.

NOTE: Remove the seal unit of element gently. The element is radially sealed by the element seal unit and seal tube. To loose the seal unit, move the outer of element gently up and doun or right and left or turn the element to remove it.
Take out the element not to scatter dust.



4. Clean the inside of the cleaner housing ③ and service cover ①.

NOTE: Clean the seal tube in the cleaner housing. Dust on the seal tube causes dust leak.

5. Primary element ② can be cleaned with compressed air 200 kPa (2 kgf/cm²) maximum.
   Direct air along pleats inside of filter element.

6. Inspect the filter element after cleaning. Do not use a filter element with damaged pleats, gasket or seats.

NOTE: The used element may be useful to find a foreign substance on the seal surface of the filter element, which can cause leak. If the striped dust is seen on the seal surface, it is a symptom of dust leak. If such dust seen, inspect if there are foreign substances, on the inside and outside of the housing seal tube.

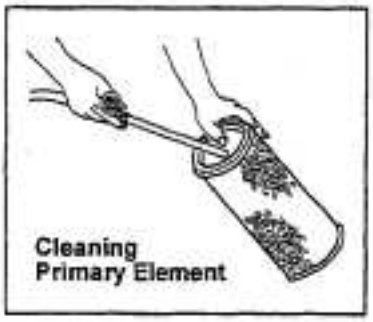
7. Install a clean primary element ②. Install and secure the service cover ① with the valve ⑤ at the bottom.

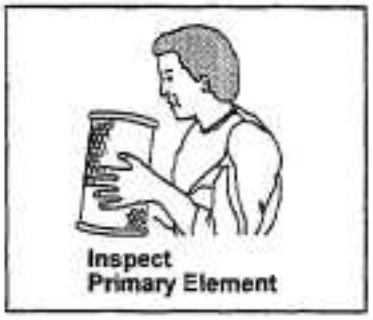
NOTE: Insert a new element correctly. When the element seal unit is inserted into the seal tube, its seal surface is extended uniformly to seal the element. To seal the element more accurately, push securely not the center but the outer of the element end surface.

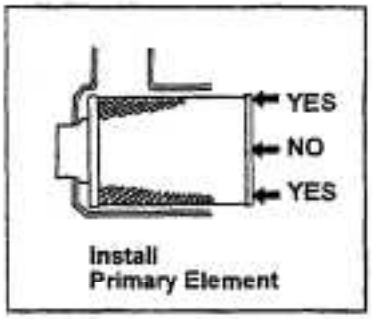
8. Reset the dust indicator ⑥ by pushing in the reset button.

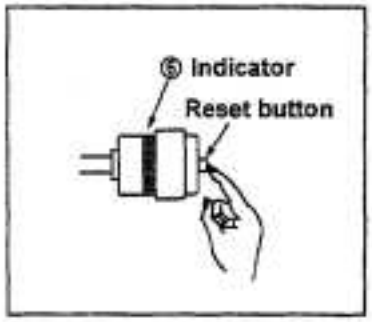
9. If the dust indicator indicated the red signal after starting the engine, change to new element.

NOTE: Normally a filter can be cleaned up to five times. Replace after five cleanings maximum.



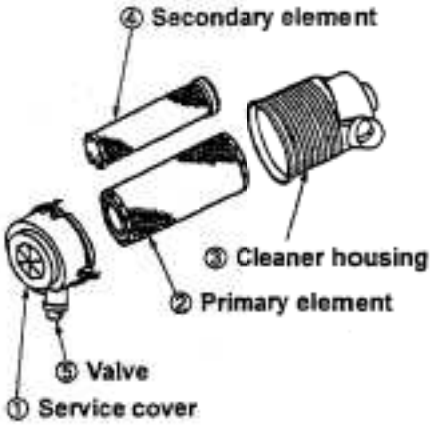






Change the Secondary Element

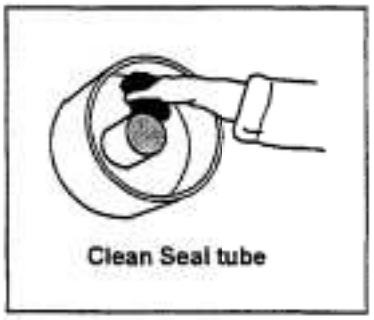
> **⚠ CAUTION**
> * Always replace the secondary filter element.
> **NEVER** attempt to reuse it by cleaning.
> * The secondary filter element should be replaced at the time the primary element is serviced for five time.



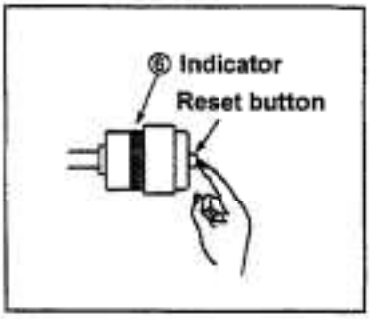
Replacement: When replaced the primary element with the secondary element.

1. Remove the service cover ① and the primary element ② from the air cleaner housing ③.
2. Remove the secondary element ④ from the air cleaner housing ③. Cover the engine intake opening.
3. Clean the inside of the air cleaner housing ③ and service cover ①. Remove the covering from the intake opening.

NOTE: Clean the seal tube in the cleaner housing. Dust on the seal tube causes dust leak.



4. Install the new secondary element ④.
5. Install the primary element ② secure the service cover ①.
6. Reset the dust indicator ⑥ by pushing in the reset button.



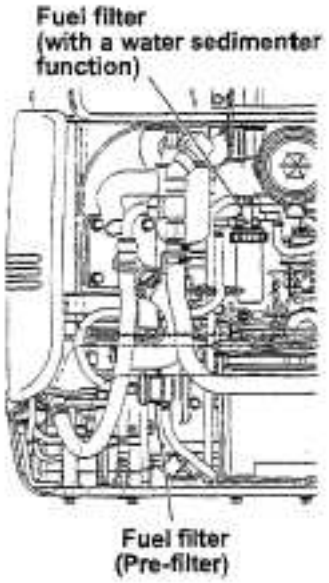
■ Clean the Fuel Filter Element

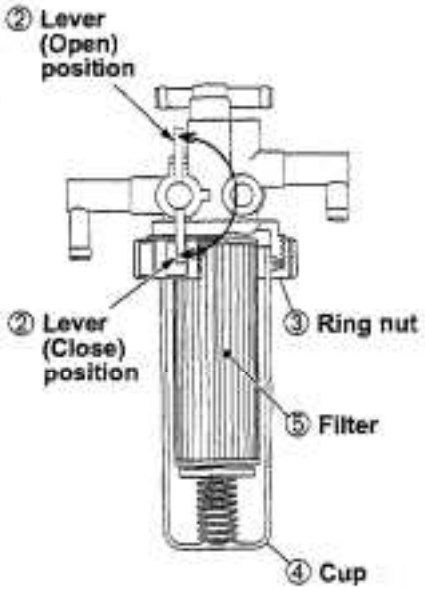
⚠ WARNING

- Hot oil and components can cause personal injury.
- Fuel leaked or Spelled on to hot surfaces can cause a fire.

The fuel filter ① is located rear of the engine.

1. Stop the engine.
2. Turn the fuel stop lever ② to the "closed" (OFF) position.
3. Loosen the ring nut ③.
4. Remove the cup ④ and the element ⑤.
5. Drain water and sediment into a suitable container.
   NOTE: Always dispose of drained fluids as established by local regulations.
6. Clean the inside surface of the cup and the element ⑤.
7. Install the clean element ⑤.
8. Install cup ④.Tighten ring nut ③.
9. Turn the fuel stop lever ② to the "opened" (ON) position.
   NOTE: Do not start the engine until all fuel system service is completed.





■ Priming the system

There should be enough fuel in the system to allow the engine to start. Keep the engine start switch key at ON for a period of 20 seconds, which operates the fuel pump and priming automatically.

■ Change the Coolant

Coolant should be drained and changed every 250 service hours or six months. However, when adding "Long-Life-Coolant", the drain period can be extended to 2 years.

Drain the coolant earlier whenever the coolant is dirty or foaming is observed.

See 4-9. 2 years Maintenance section.

■ Fan and Alternator Belt

⚠ WARNING

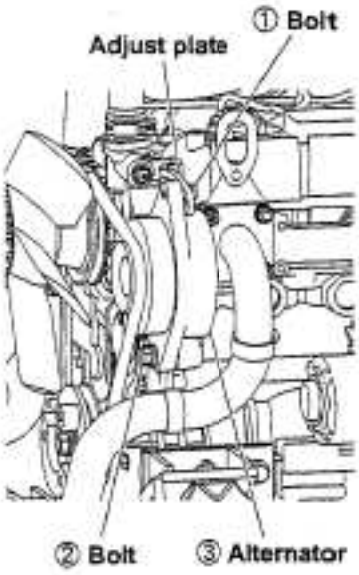
* Hot components can cause personal injury.
* Stop the engine and remove the start switch key.

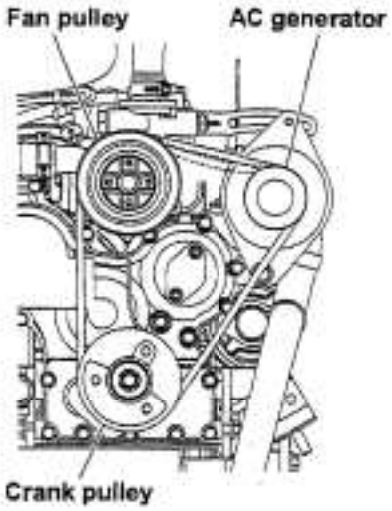
Inspect

Stop the engine. Inspect the belt for wear and cracking. To check the belt tension, Push the belt inward by hand apply 98N (10kg) force midway between the pulleys. Correctly adjusted belt will deflect 10mm.

Adjust

1. To adjust the belt, loosen mounting bolt ① and ②.
2. Move the alternator in or out as required to obtain the correct adjustment.
3. Tighten mounting bolts ① and ②.
4. Check the belt adjustment again after 5 minutes of engine operation at rated speed.



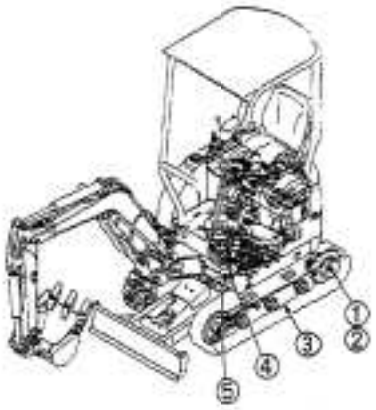


500 HOURS MAINTENANCE AND CHECKS

First perform previous service hour hems

■ Check the Fixed BoltTorque

When loosened bolt or nut is found at daily check, tighten it with torque specifications table.



1. Special torque specifications

Special tighten is applied for main bolts as illustrated below.

When replacing bolts, appbl molybdenum grease to bolts, nuts, and bearing surface of nuts.

Then, tighten them with speciBed torque.

Items	Tighten point	Wrench size metrie	Thread size (mm)	Tighten torque N•m
①	Travel drive	Bar 8	M10	55
②	Sprocket	Bar 8	M10	55
③	Lower roller	19	M12	108
④	Swing bearing	19	M12	108
⑤	Swing motor	Bar 10	M12	108

Newrton meter (N•m) is approximately the same as 0.1 kg•m

2. General torque specifications

Other than above-mentioned, refer the next table for torques.

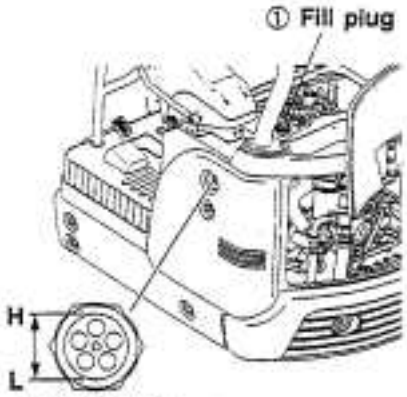
Thread size metric	Wrench size (mm)	Tighten torque	
		Metric coarse H.T.	Metric fine H.T. bolt
		N•m	N•m
M8	13	23	25
M10	17	47	50
M12	19	83	91
M14	22	134	135
M16	24	206	220
M20	30	412	450
M24	36	715	813

High pressure-hose union nut	
Hose size (inch)	Tighten torque
	N•m
1/4"	25
3/8"	49
1/2"	59
3/4"	118
1"	137
1-1/4"	167

■ Change the Retum Filter

⚠ CAUTION

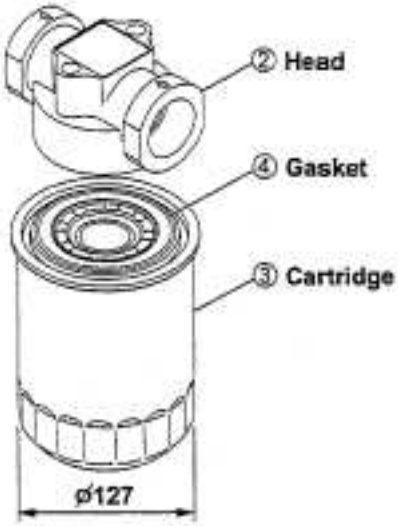
- Hot oil and components can cause personal injury. Do not allow hot oil or components to contact the skin.
- At operating temperature, the hydraulic tank is hot and can be under pressure,
- To relieve the pressure from the hydraulic tank, loosen the oil fill plug ① on the hydraulic tank.
- Remove the retum filter ③ onbl after the engine has been stopped and the retum filter is cool enough to touch with your bare hand.



Level gauge

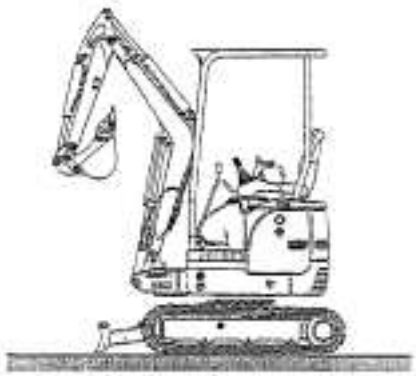
1. Lower the bucket on the ground and stop the engine.
2. Relieve the internal pressure from the hydraulic tank by loosening oil fill plug ①.
3. Clean the area to keep dirt out of the flter base ②.
4. Remove the used filter ③ by filter wrench. Clean the filter base ②.

NOTE: This is a cartridge type element. It cannot be reused.



Return filter

5. Coat the gasket ④ of new filter with clean hydraulic oil.
6. Install the new filter ③ by hand. When the seal contacts the base. tighten an additional 3/4 turn by filter wrench.
7. Start and run the engine to fill the fiPter. Stop the engine. Maintain the oil level between marks on the level gauge. Add oil if necessary.
8. Pressurize the hydraulic tank. After fully extending all the cylinders and loosen oil fill plug ① to supply air to the hydraulic tank, tighten the plug again.
9. Start and operate the engin. Inspect for leaks on the oil filter ③.


Bucket position at the time of sealing off hydraulic tank.

☆ When operation breaker works, replace the retum filter every 100 hours operation.
☆ Replace this filter in 50 hours for the initial time only.

■ Change the Fuel Filter Element

⚠ WARNING

* Hot oil and components can cause personal injury.
* Fuel leaked or spdled on to hot surfaces can cause a fire.

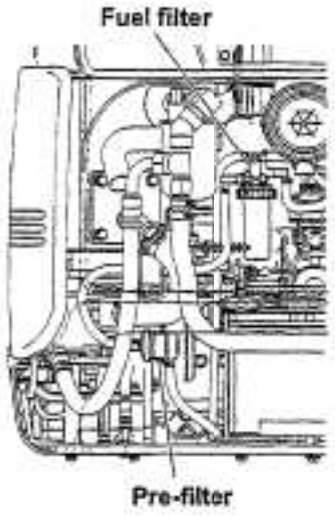
1. Stop the engin
2. Turn the fuel stop lever ② to the "closed"(OFF) position. Loosen the ring nut ③.
3. Remove the cup ④ and the element ⑤.
4. Drain water and sediment into a suitable container.

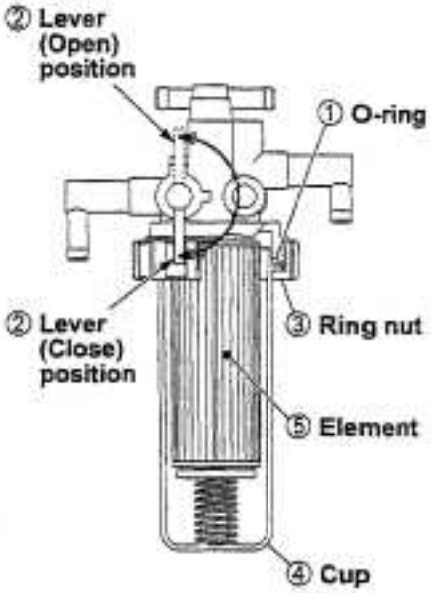
NOTE: Always dispose of drained fluids as estabTished by local regulations.

5. Clean the inside surface of the cup.
6. Install the new element ⑤.
7. Instaii cup ④. Tighten ring nut ③.
8. Turn the fuel stop lever ② to the "opened" (ON) position.

NOTE: Do not start the engine until all fuel system service is completed.

9. There should be enough fuel in the system to allow the enghe to start. Keep the enghe start switch key at ON for a period of 20 seconds. which operates the fuel pump and priming automatically.



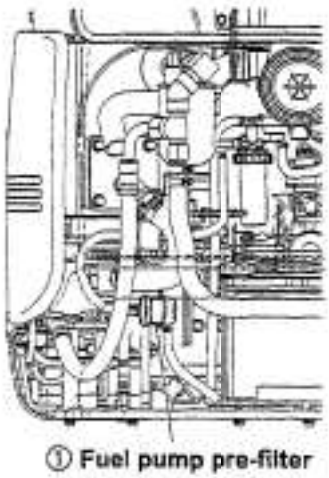


■ Replacement of fuel pump pre-filters

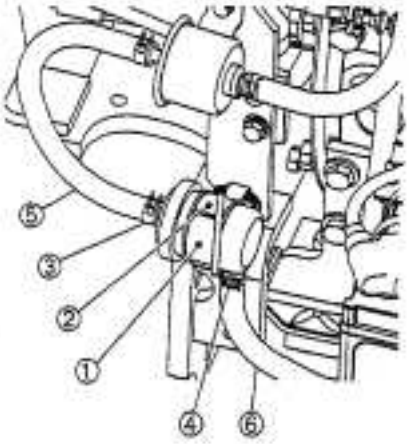
⚠ CAUTION

* Replace fuel pump pre-filters after the engine sections cool down.
* Keep fire away from the pre-filters.
* Wipe out completely split light oil since it may cause a fire.

1. Lower the machine to the ground and stop the engine.
2. Place an oil receiver under pre-filter ①.
3. Remove pre-filter ① from clamp ②.
4. Loosen hose clamps ③ and ④, and remove hoses ⑤ and ⑥ from pre-filter ①.
5. Fit hoses ⑤ and ⑥ to the new pre-filter ①, and fix them tightly with R hose clamps ③ and ④.
6. Fit pre-filter ① and fix it to clamp ②.



7. After replacement, perform air bleeding. The procedure for replacement is the same as that for fuel filter element (4-8-3).

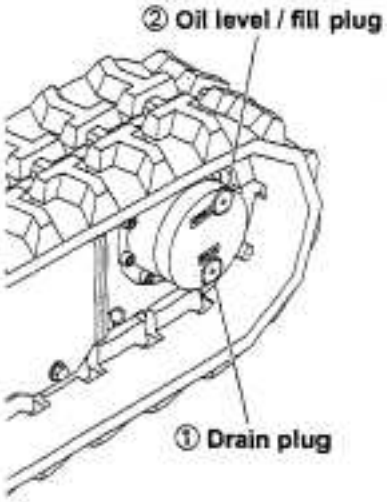


■ Check the TraveT Drives Oil Level

⚠ CAUTION

When the quantity of oil is found to have increased abnormauy, tt is necessary to check the oil seal of the travel motor.
If the seal is leaking, contact a IHI dealer.

1. Position one travel dhve with oil drain plug ① at the bottom.
2. Remove the oil level/fill plug ② Oil should be to the bottom of the level plug opening.
3. Add oil through the opening of oil level/fill plug ② If necessary.
4. Clean the plugs ②. Install the plugs ②.
5. Perform procedure on the other travel drive.



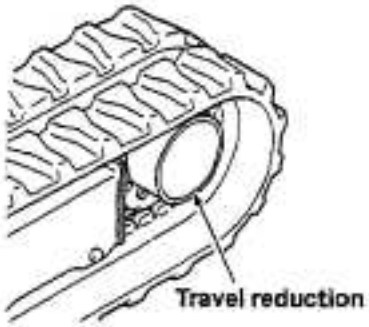
1000 HOURS MAINTENANCE AND CHECKS

■ Change the Travel drive Oil

1. Position one travel drive with drain plug ① at the bottom.

2. Remove drain plug ① and oil level/fill plug ② Allow the oil to drain into a container.

NOTE: Dispose drained material according to local regulation.

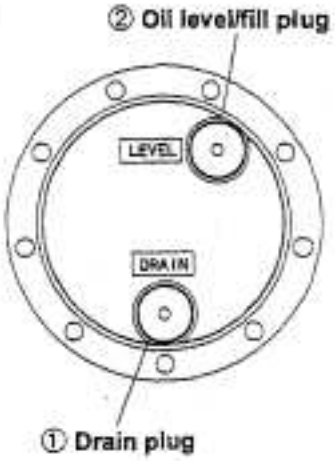


3. Clean the plugs.

4. Install drain plug ①.

5. Fill the travel drive to bottom of level plug opening.

Recomended oil	Refill capacities
Engine oil API CD, SAE30	0.33 Liter



6. Install oil level/fill plug ②.

7. Perform procedure on the other travel reduction.

8. Start the engine and allow the travel drive to turn through several cylcles.

9. Stop the engine, check the oil level.

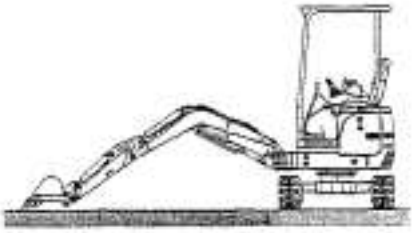
10. Check the drained oil for metal chips or particles. If there are any, consult your IHI dealer.

■ Change Hydraulic Oil and Clean the Strainer

⚠ CAUTION

- Hot oil and components can cause personal injury. Do not allow hot oil or components to contact the skin.
- At operating temperature, the hydraulic tank is hot and can be under pressure.
- To relieve the pressure from the hydraulic tank, loosen the oil fill plug ① on the hydraulic tank.
- Relieve the tank pressure with engine off by removing fill plug slowly to prevent burns from hot oil.

1. Place the machine on level ground, with the arm and bucket cylinder fully retracted and attachments lowered, as shown. Stop the engine.



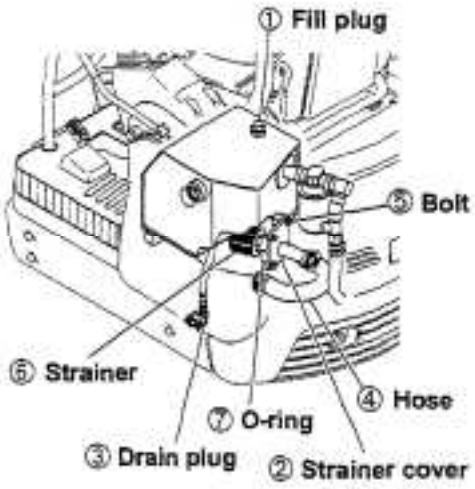
Bucket position at the time of drain the hydraulic oil.

2. Relieve the internal pressure from the hydraulic tank by loosening the fill plug ①.

3. Clean area thoroughly to keep dirt out of strainer cover unit ② and fill plug ①.

4. Remove the oil drain plug ③. Drain oil into a container. Drain oil in all parts of the hydraulic system thereafter.

NOTE: Always dispose of used oil as established by local regulation.



5. Remove the suction hoses ④. Remove the bolts ⑤ and the strainer cover unit ② /strainer ⑥ from the hydraulic tank.

6. Inspect the O ring ⑦ and replace it if damaged.

7. Clean the inside of the tank with the clean oil.

8. Clean and install the strainer cover unit ② / strainer ⑥ and the suction hoses ④.

9. Clean and install the drain plug ③.

10. Fill the hydraulic tank with oil. See Recommended Lubricant Table.

11. Start and operate the engine at idling speed for five minuets.

12. Operate the control levers to allow the hydraulic oil to circulate through all hydraulic circuits.

13. Lower the bucket to the ground with the arm and bucket cylinder fully retracted and stop the engine.

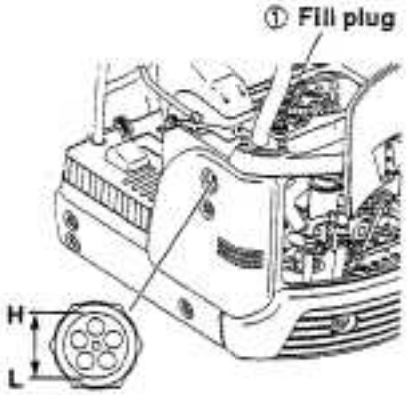
14. Maintain the oil level between **FULL** and **ADD** marks on the level gauge.

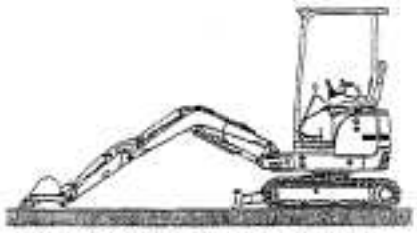
15. Pressurize the hydraulic tank.
    Raise the boom with the arm, boom and bucket cylinder fully extended.
    Remove the fill plug ① and then install fill plug again.

16. Lower the bucket on the ground and stop the engine.

⚠ CAUTION

Hydraulic Oil Change Intervals for Breaker Works.
Hydraulic oil should be changed in every 600 service hours.





Bucket position at the time of checking the hydraulic oil level.

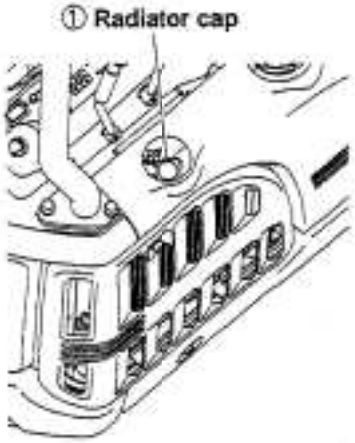
Bucket position at the time of sealing off hydraulic tank.

2 YEARS MAINTENANCE AND CHECKS

COOLING SYSTEM COOLANT

⚠ WARNING

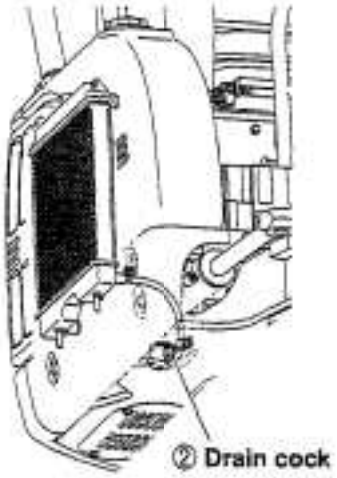
- At operating temperature, the engine coolant is hot and under pressure.
- Steam can cause personal injury.
- Change the coolant only after the engine has been stopped and radiator cap is cool enough to touch with your bare hand.
- Remove the radiator cap slowly to relieve Pressure.



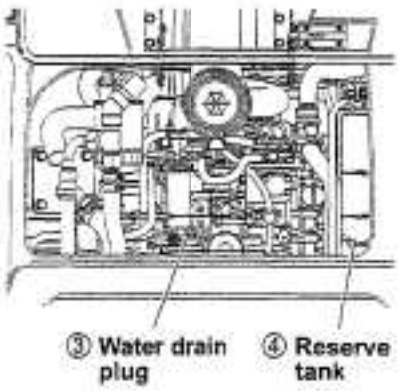
■ **Change the Coolant**

Coolant should be drained and replaced every 250 service hours or six months. However, when adding "long-Life-Coolant", the drain period can be extended to 2 years.

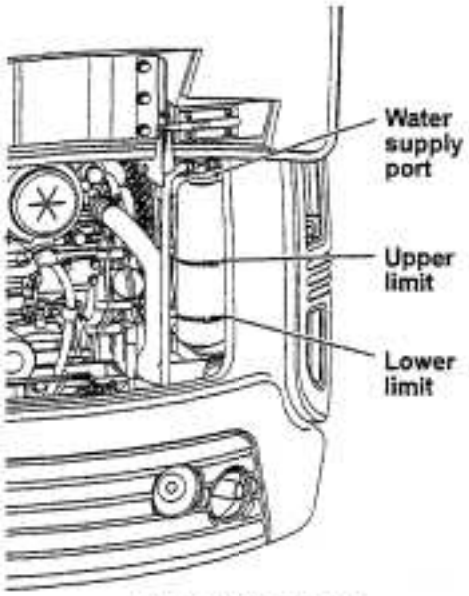
Drain the coolant earlier whenever the coolant is dirty or foaming is observed.



1. Place the machine on the firm and level ground.
2. Loosen the radiator cap ① slowly to relieve pressure, and remove the cap.
3. Open the radiator drain valve ② and allow the coolant to drain into a container.
4. Remove the drain plug ③ allow the coolant to drain into a container. Drain plug is located under the injection pump on the front side of cylinder body.
5. Close the drain valve ② and drain plug ③. Fill the system with clean water and cleaning solution.
6. Start and operate the engine for 1/2 hour. Stop the engine and drain the cleaning solution.
7. Flush the system with water, with the engine stopped, until the draining water becomes clear.
8. Close the drain valve ② and drain plug ③. Fill the system with clean water and operate the engine for five minutes. Stop the engine and drain the water.
9. Repeat step 7 several times, if necessary, until the drained water becomes clear.
10. Add the coolant solution. See next page.
11. Operate the engine for five minutes with the radiator cap ① off.



12. Maintain the coolant level to the fill port neck.
13. Replace the cap gasket if the gasket is damaged. Install the radiator cap ②.
14. Maintain the coolant level between the MAX and MIN marks on the reserve tank.



Reserve tank level

■ Clean the Outside of the Radiator Core

When the radiator core is clogged, the cooling air flow is interrupted lowering the cooling efficiency.

Remove dust or debris from the radiator fins. Clean the radiator with a pressurized air, high pressure water or steam at 500 hours interval. Whenever the radiator is found to be closed, clean it at any time.

■ Selection of coolant

Long-Life-Coolant (LLC) is supplied to this machine before shipment.

This is a coolant provided with proper ties of Antifreeze, corrosion-proof and fouling-proof. Its long lasting effects will maintain the machine free from coolant exchange for 2 years through summer and winter seasons. The Long -Life-Coolant is therefore recommended for use with this machine when exchanging its coolant.

■ Mixing Rate of Long-Life-Coolant

The mixing ratio of Long-Life-Coolant with water determines the freezing point.

Select the mixing ratio for a freezing point lower by 5° than the expected lowest atmospheric temperature.

Normally, the Long-Life-Coolant is used under a mixing ratio of 30 to 50%.

If the mixing ratio is less than 30%, occurrence of rust is feared and when it is over 50%, overheating is feared and sealing components may be deteriorated quicker than usual.

Meanwhile, use city water to mix with Long-Life-Coolant.

Freezing point (°C)	–15	–25	–35
Mixing ration (%)	30	40	50
Quantity of LLC (L)	1.1	1.4	1.8
Quantity of water (L)	2.5	2.2	1.8
Coolant Total amount: 3.6L	Engine proper: 0.9 L Radiator and other proper : 1.9 L Reserve tank : 0.8 L		

UNUSUAL OPERATING CONDITIONS

Special problems in maintenance and operation are caused by unusual conditions such as extremes in heat, cold and humidity, high altitude, salt water, and dusty or sandy work sites. When operating under such conditions, special precautions must be taken to prevent machine damage, minimize wear, and avoid component deterioration.

■ Extreme Cold

In periods of extreme cold, the problems of freeze damage, inadequate lubrication and battery failure may become particularly trouble - some. With the onset of very cold weather, it is advisable to "winterize" the machine by servicing the cooling system and switching to the lubricants recommended for cold weather usage.
Follow the recommendations below when the machine must be operated in very cold conditions.

1. To prevent freeze damage to the cooling system and cracking of the engine block or head, drain and flush the cooling system. Clean the radiator exterior, making certain the air passages through the core and the cooling fins are free of foreign matter.

   Refill the cooling system, adding an antifreeze solution recommended by the engine manufacturer in an amount and strength appropriate to the anticipated temperatures. A corrosion inhibitor is recommended.

   Never use a chromatic base corrosion inhibitor when the coolant contains ethyl-line glycol. Use only non-chromatic base inhibitors.

   Inspect the thermostat, clamps, radiator hoses and radiator core for proper condition. Replace or repair any cooling system component found to be defective.

2. Condensation in the fuel tank contaminates the fuel supply with water, which can freeze in the fuel lines and block the fuel flow to the engine. To minimize this possibility, keep the tank as full as is practical during cold weather.
   This may entail refilling the tank more frequently than usual, but the inconvenience is small compared to clearing a blocked fuel line.
   If water should be noticed in the fuel supply, drain the tank and refill it with uncontaminated fuel.

3. Lubricate the machine with the lubricants recommended for cold weather operation in the Lubrication Section. If necessary, change the engine oil and other lubricants in order to conform to the recommendations.

4. The battery is more likely to sustain freeze damage if not kept fully charged because its electrolyte will freeze at a higher temperature than that in a fully charged battery. Be certain the battery is charging when the engine is running and use an external charger to restore full charge when the machine is not being operated.
   The battery can discharge if snow or ice short circuits the terminals. Keep the battery posts and cable connectors clean and dry. Remove any corrosion with a solution of soda and water.
   During extremely cold weather, it is advisable to remove and store the battery in a heated area when the machine is to remain idle overnight or for any extended period.

⚠ CAUTION

Water added to the battery can freeze before it mixes with the electrolyte.
During very cold weather, add water to the battery just prior to, or during operation of the machine.
If the machine is not to be run, water may be added if an external charger is connected to the battery.

5. Special attention must be given to the hydraulic oil during very cold weather.

> **⚠ CAUTION**
>
> **BEFORE** attempting any working operations, warm up the hydraulic oil as described in "After Starting the Engine on Sheet No.3-6".

6. At the end of the work period, or whenever the machine is to be left idle for extended periods, prevent it from being frozen to the ground by parking it on wood, concrete, asphalt or mat surface.

■ **Extreme Heat.**

Like extreme cold, extreme heat requires that precautions be taken with respect to the cooling system, the battery and lubrication. Protect the machine by performing the following recommended procedures:

1. High temperatures necessitate the use of lubricants which are both more viscous and which resist deterioration at higher operating temperatures. Refer to the Lubrication Section and lubricate the machine using the lubricants recommended for the expected temperatures.
   Crankcase oil is particularly important because it helps dissipate heat. Check the oil level frequently and add oil as required to maintain required level. Too little oil will hinder heat dissipation.

2. To ensure proper coolant circulation, drain and flush the cooling system, clean any foreign matter from the radiator cooling fins and through-core air passages, replace defective hoses, tighten hose clamps, tension the water pump drive belt properly. eliminate any leaks detected and fill the system with a 50% solution of ethylene glycol.
   A corrosion inhibitor is recommended.
   Engine overheating due to loss of coolant will most often be corrected by **SLOWLY** adding coolant while the engine is running at **FAST IDLE**. Should this fail to correct the problem, drain and flush the system and refill with fresh coolant (50% solution of ethylene glycol) and a corrosion inhibitor.

   Allow the engine to cool before draining and flushing the cooling system.
   Water containing more than small concentrations of salt or minerals should not be used in the cooling system. Salt facilitates corrosion and minerals deposit on the coolant passage walls.
   Both processes inhibit proper cooling.

3. Increased evaporation rates will cause the battery electrolyte level to fall more rapidly during very hot weather. Check the level frequently and add distilled water as required to maintain the proper level.

4. Air circulation around the engine and battery must not be restricted. Keep air intake and exhaust openings clear of leaves, paper or other foreign matter which may restrict air flow.

5. Keep the engine clean of dirt, grease and other substance s which inhibit heat dissipation.

6. Operate engine at full throttle when digging or tracking machine.
   Run the engine only when engaged in work operations or when traveling the machine. Avoid prolonged periods at idle and shut the engine down if operations are interrupted.

■ **Sandy or Dusty Work Sites**

The presence of large amounts of sand or dust at the work site can contribute to accelerated component weather. Either substance will act as an abrasive when deposited on moving parts of the machine. This problem can be alleviated by increasing the schedule of lubrication and by servicing breathers and fillers at more frequent intervals. Follow the recommendations below when operating in sand or dust on a regular bases.

1. Keep sand and dust out of the hydraulic system by keeping the reservoir filler cap tight and servicing the hydraulic system filters frequently.

2. The fuel system should be kept free of sand and dust by keeping the tank filler cap tight and servicing the fuel filters frequently.

3. The engine breathers and air cleaner should also be serviced frequently to prevent sand and dust from entering the engine. The engine oil and oil filter should be changed at shorter than normal intervals to ensure a clean oil supply to the engine's moving parts.

4. When lubricating the machine, thoroughly clean each grease fitting before attaching the grease gun. Pump generous amounts of grease into all lubrication points, using the fresh grease to pump out old.

5. Adequate ground bearing support may be required for the tracks when operating in soft sand. Be alert for signs of track digging into sand during operations. It may be necessary to back off and fill in area where tracks dig in.
   The increased frequency of lubrication and service discussed above should be determined by observations made at the work site. Inspection will determine how long it takes for lubricants, breathers and filters to accumulate unacceptable amounts of sand or dust. The frequency of lubrication and service should be adjusted accordingly.

■ High Humidity or Saltwater

In some locations, such as coastal areas, the machine may be exposed to the deteriorating effects of salt, moisture, or both. To protect exposed metallic surfaces, wiring, paint and other items, keep them dry and well lubricated where salt or high humidity are encountered. Follow the recommendations below when operating in these conditions.

1. Make frequent inspections for rust and corrosions and remove them as soon as they are detected. Dry and paint exposed surfaces after rust and corrosion have been removed.

2. Where paint may not be applied, such as on polished or machined surfaces, coat the area with grease or lubricant to repel water.

3. Keep bearings and their surrounding surfaces well lubricated to prevent the entry of water.

4. Never use saltwater in the cooling system. Internal corrosion will occur and all parts will have to be replaced.

5. Hose down the machine periodically when working in saltwater. If necessary, use an oil soaked cloth to clean moving parts.

6. If the machine is submerged, be sure it is never submerged in water deeper than upper crawler belt.
   If the machine exceeds this limit, disassemble, clean and lubricate the lower.

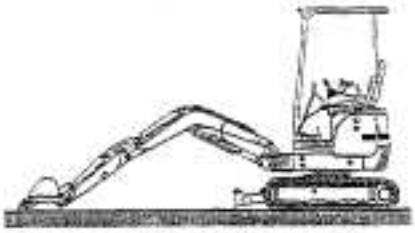
■ High Altitudes

Variations in altitude alter the fuel-air mixture burned in the engine and affect the engine's performance. At high altitudes, atmospheric pressures are lower and less oxygen is available for combustion of the fuel. Above 1500 meter, the engine fuel setting may have to be changed to ensure proper performance. Consult engine manufacturer should this problem answer.
Keeping the air cleaner clean and free of obstructions will help alleviate high altitude problems.
At high altitudes, closely monitor the engine temperature for overheating.

LONG TERM STORAGE

■ Before Storage

To protect the cylinder rods, set the machine position in the right illustration.
(To prevent the cylinder rods from being rusted)



Bucket position at the time of long term storage.

To store the machine from long term, follow the next procedures.

- Clean parts of the machine and store indoors.
  If you have to place the machine outdoors, choose a flat place and cover the machine.
- Be sure to perform fill the fuel, lubrication, and oil change.
- Apply grease on the exposed part of the hydraulic cylinder piston rods.
- Store the battery after move the negative terminal and covering it or dismounting the battery from the machine.
- Lock the control levers and pedals with the lock lever and pedal lock.

■ During Storage

⚠ WARNING

If you have to operate the machine indoors to prevent rust, keep good ventilation and gas poisoning by window or entrance.

During storage, operate the machine once a month to maintain films of oil at the lubrication section and charge the battery at the same time.

■ After Storage

After long term storage, follow the next procedures before operating the machine.

- Wipe away grease on the hydraulic cylinder rods.
- Be sure to perform fill the fuel and lubrication.

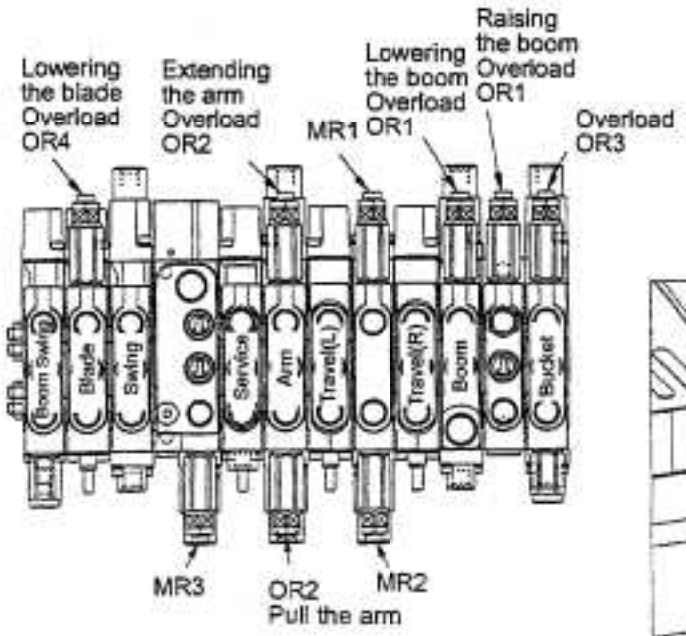
HYDRAULIC SYSTEM PRESSURE SETTINGS

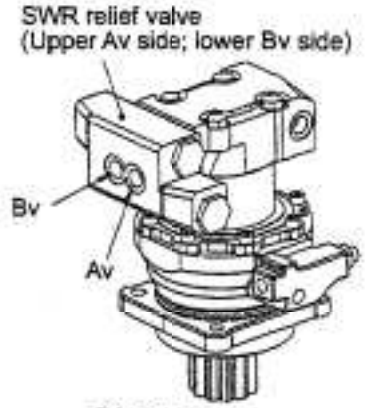
1. SET PRESSURE

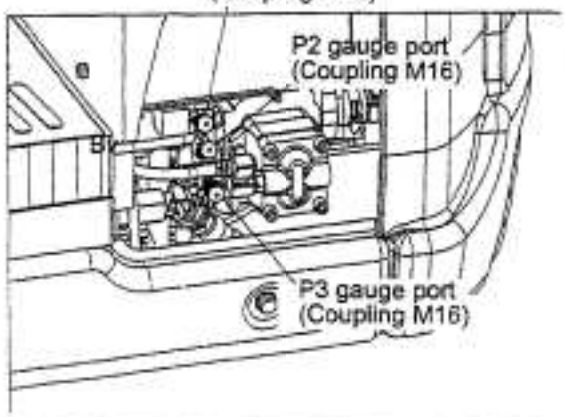
Hyd. Oil Temp. : 50 to 60°C

Relief Valves		Gauge Ports	Valve Locations	Maintenance Std. MPa (kgf/cm2)	Note
Main	Boom Bucket Travel (R.H)	P1	MR1	20.6 $^{+0.49}_{0}$ (210 $^{+5}_{0}$)	Max. Engine RPM
Main	Arm Travel (L.H) Service	P2	MR2	20.6 $^{+0.49}_{0}$ (210 $^{+5}_{0}$)	Max. Engine RPM
Main	Swing, Blade Boom Swing	P3	MR3	18.1 $^{+0.49}_{0}$ (185 $^{+5}_{0}$)	Max. Engine RPM
Load Over	Boom (Raise)	P1	OR1	24.5 $^{+0.49}_{0}$ (250 $^{+5}_{0}$) at 5L / min	Min. Engine RPM
Load Over	Boom (Lower)		OR1		
Load Over	Arm (In)	P2	OR2		
Load Over	Arm (Out)		OR2		
Load Over	Bucket (Dig)	P1	OR3		
Load Over	Blade (Lower)	P3	OR4	20.6 $^{+0.49}_{0}$ (210 $^{+5}_{0}$) at 5L / min	
Brake	Swing	P3	SWR	15.2 (155)	Min. Engine RPM
Brake	Travel	P1 (LH) P2 (RH)	Not Equipped		
Remote Control		P4	PP	2.94 $^{+0.2}_{0}$ (30 $^{+2}_{0}$)	Max. Engine RPM

2. GAUGE PORTS & RELIEF VALVE LOCATIONS

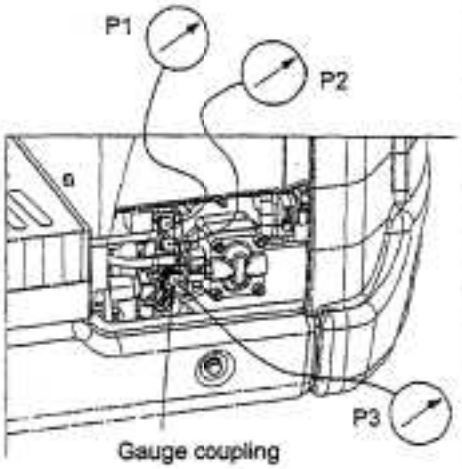
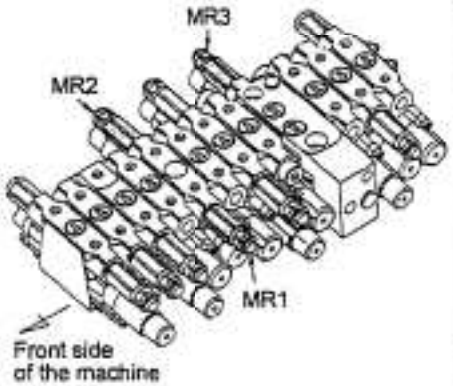






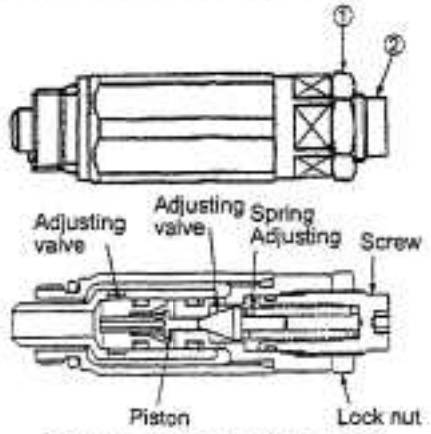
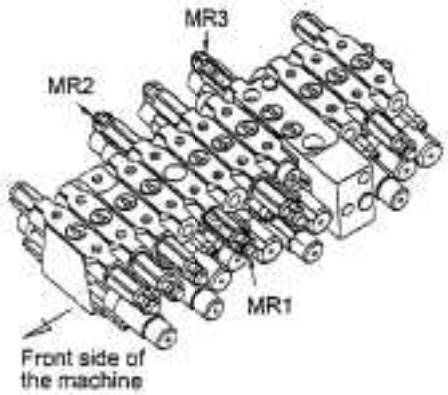
3. Main Relief Valve.

3-1 Measuring procedures.

	Procedures	Note
Condisions	1. Engine speed: Maximum 2. Oil temperature: 45 - 55°C 3. Installation of a gauge: Remove the cap for the coupling assembly, and install a gauge coupling. For the gauge coupling, see page 4-13-4. • When no gauge coupling is available, stop the engine to release the pressurized air from the hydraulic tank. Then remove the coupling assembly and mount the gauge. After installation of the gauge, pressurize the air in the hydraulic tank.	**⚠ WARNING** Do not remove the gauge port plug until air pressure has been relieved in hydraulic tank.
Measuring procedures	A. MR1 (P1) Main relief valve 1. Start the engine and move the boom or bucket cylinder to the stroke end. 2. Set the engine speed to the maximum. 3. Operate the boom or bucket cylinder at the full stroke and hold it there. 4. Read out the pressure indicated on the gauge during air release. * If the pressure is 20.6 MPa (210 kgf/cm²) or lower, pressure adjustment is required. B. MR2 (P2) Main relief valve 1. Start the engine and move the arm cylinder to the stroke end. 2. Set the engine speed to the maximum. 3. Operate the arm lever at the full stroke and hold it there. 4. Read out the pressure indicated on the gauge during air release. * If the pressure is 20.6 MPa (210 kgf/cm²) or lower, pressure adjustment is required. C. MR3 (P3) Main relief valve 1. Start the engine and move the boom swing cylinder to the stroke end. 2. Run the engine at the maximum speed. 3. Operate the boom swing pedal at the full stroke and hold it there. 4. Read out the pressure indicated on the gauge during air release. * If the pressure is 18.1 MPa (185 kgf/cm²) or lower, pressure adjustment is required. [Caution] If the cylinder internal leakage is severe, the relief pressure will decline. In such a case, release the air at the both sides of the cylinder. Also check other cylinders. (P1 for the boom and bucket; P2 for the arm; and P3 for the blade or swing).	 

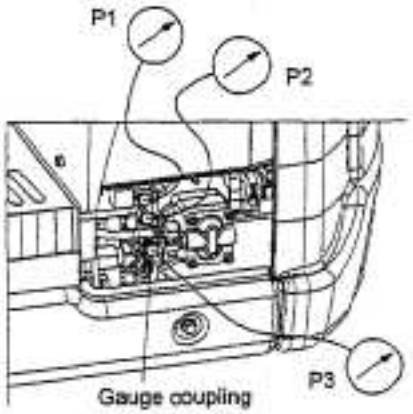
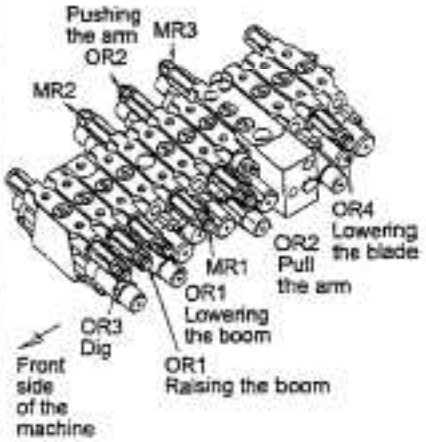
3. Main Relief Valve.

3-2 Adjusting procedures.

	Procedures	Note
Condisions	1. Engine speed: Maximum 2. Oil temperature: 45 - 55°C 3. Installation of a gauge: For coupling assembly M16, a sheet-type adaptor is used. For pressure measurement, the parts shown on the right column are required. • When no gauge coupling is available, stop the engine to release the pressurized air from the hydraulic tank. Then, remove the coupling assembly and mount the gauge.	**⚠ WARNING** Do not remove the gauge port plug until air pressure has been relieved in hydraulic tank. Gauge connector : 300 - 42.000 Hose (Gauge coupling) 1-m type: 200 - 16,100 4-m type: 200 - 16,400 (Gauge)  The parts for gauge connection shown above are handled as parts.
Adjusting procedures	Take the same adjusting procedures for MR1, MR3, and MR3. 1. Loosen Lock Nut ①. 2. Turn adjusting screw ② using a hexagon wrench to adjust the screw. * When the screw is tightened: the pressure will increase. * When the screw is loosened: the pressure will decrease. (The amount of pressure change for one turn of the adjusting screw: approx. 9.8 MPa (100 kgf/cm²) 3. Fix adjusting screw ② using a hexagon wrench and tighten lock nut ①. 4. Measure the pressure. Take the above procedures 1 to 4 until the specified pressure is obtained. * When there is no change in the pressure even after adjustment: 1. This is caused not by the wear-out of the spring, but by the biased wear of the adjusting valve and the pressure regulating valve, the inclusion of dust or clogging. Therefore, remove the valve to disassemble and check it.  Cross section of the relief	

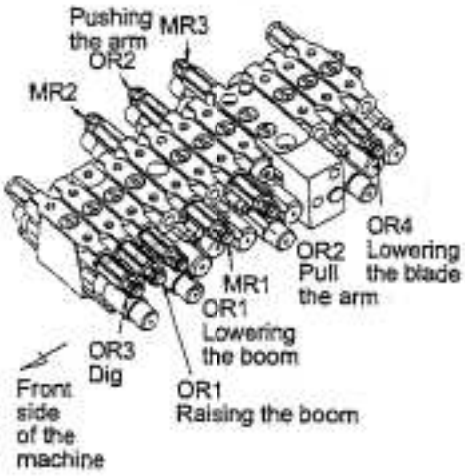
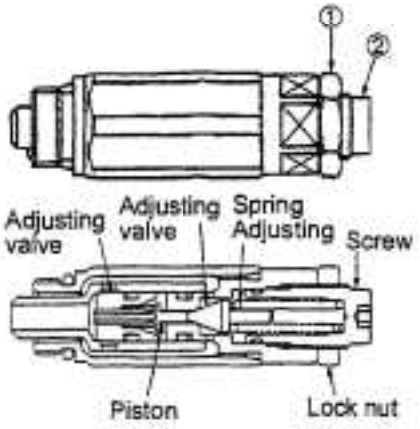
4. Over load Relief Valve.

4-1 Measuring procedures.

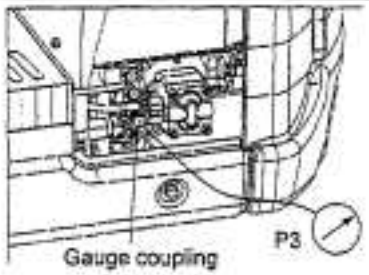
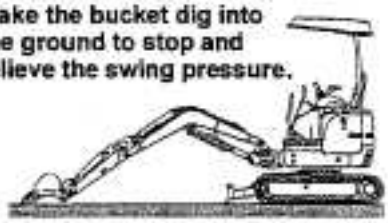
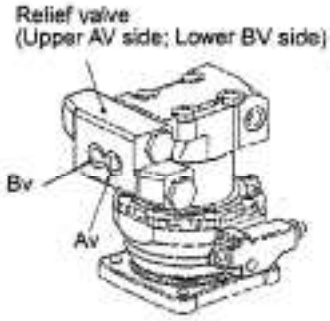
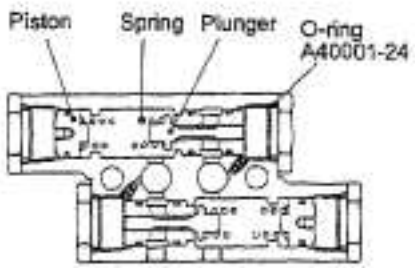
	Procedures	Note
Condisions	1. Engine speed: Low idling The set flow rate of this valve is 5 liters/min, and the flow rate becomes higher than the set value at a high engine speed, in which case higher pressures are indicated. Be sure to run the engine at a low speed. 2. Oil temperature: 45 - 55°C 3. Installation of a gauge: Remove the cap for the coupling assembly, and install a gauge coupling. • When no gauge coupling is available, stop the engine to release the pressurized air from the hydraulic tank. Then, remove the coupling assembly and mount the gauge. After installation of the gauge, pressurize the air in the hydraulic tank. 4. Set pressures: See the table for the set pressures. 5. Set the main relief pressure temporarily. The overload relief pressure is set higher than the main relief pressure. Therefore, the main relief pressure needs to be set higher than the overload relief pressure. Temporary setting of the main relief pressure 1) Loosen the lock nut for main relief pressure and tighten the adjusting screw by 180° to tighten the tightening lock nut. 2) After adjusting the overload relief pressure, loosen the lock nut for main relief pressure, loosen the adjusting screw by 180° or more. Return the pressure to the set value or less and thereafter make adjustments at the tightening side.	**⚠ WARNING** Do not remove the gauge port plug until air pressure has been relieved in hydraulic tank. 
Measuring procedures	Overload relief for raising the boom (OR1) is explained below. Take the same procedures also for other valves. 1. Set the main relief pressure temporarily. 2. Start the engine and run it at a low speed. 3. Raise the boom to the stroke end of the cylinder and operate the control lever at the full stroke. Hold the lever with the pressure relieved and read the gauge. 4. When the pressure is 22.6 MPa (230 kgf/cm²) or lower, pressure adjustment is required. (See the next page) • The pressure is 24.5 MPa (250 kgf/cm²) only for the bucket. 5. When the pressure is normal, return the main relief pressure to the set value. (For the adjusting procedures, see the above-mentioned item for Conditions. 6. Remove the gauge coupling, and fix the cap on the coupling assembly. • In the case of a gauge adaptor, stop the engine and remove the pressurized air from the hydraulic tank. Remove the gauge adaptor and wind a seal tape around the thread portion of the coupling assembly. After installation, pressurize the air in the hydraulic tank. (See Page 4-8-2.)	

4. Over load Relief Valve.

4-2 Adjusting procedures.

	Procedures	Note
Adjusting procedures	1. Set the main relief pressure temporarily. 2. Start the engine and run it at a low speed. 3. Operate the control lever of the valve to be measured at the full stroke. Hold the lever when the cylinder comes to the stroke end (relief). 4. Loosen lock nut ① of the overload relief valve. Using a hexagon spanner, adjust adjusting screw ② to the set pressure at the tightening side (the pressure increasing side). If the pressure is higher than the set value, or when the adjusting screw is tightened more than the set pressure, loosen it until the pressure becomes the set value or lower. Then, adjust it again at the tightening side. 5. After adjustment, fixing adjusting screw ② by a hexagon spanner, tighten the lock nut. 6. After locking, check the pressure. 7. Repeat the procedures starting from item 3 above until the set pressure is obtained. 8. When the pressure is normal, return the main relief pressure to the set value. (For the adjusting procedures, see the item for Conditions.) 9. Remove the gauge coupling and fix the cap to the coupling assembly. • In the case of gauge adaptor, stop the engine and remove the pressurized air from the hydraulic tank. Remove the gauge adaptor and wind a seal tape around the thread portion of the coupling assembly. After installation, pressurize the air in the hydraulic tank.	**⚠ WARNING** Do not remove the over load relief valve until air pressure has been relieved in hydraulic tank and lowered the bucket to the ground.   **Cross section of the relief**

5. Swing Relief Valve pressure Measuring & Adjusting Procedures.

	Procedures	Note
Condisions	1. Engine speed: Low 2. Oil temperature: 45 - 55°C 3. Installation of a gauge: Remove the cap for the coupling assembly P3, and install a gauge coupling. • When no gauge coupling is available, stop the engine to release the pressurized air from the hydraulic tank. Then, remove the coupling assembly and mount the gauge. After installation of the gauge, pressurize the air in the hydraulic tank.	**⚠ WARNING** Upper structure movement can cause personal injury or death. To prevent structure movement. Do not remove the gauge port plug until air pressure has been relieved in hydraulic tank.
Measureing procedures	1. Make the bucket dig into the ground in the posture shown in the right column. Then, operating the swing lever slowly, relieve the pressure and hold it. Make measurements by performing right or left swing. [Notes] 1. Confirm beforehand that the pressure of the main relief valve is normal. 2. The pressure changes depending on the engine speed. • When the engine runs idling: the pressure is nearly the set value. • When the engine runs at the maximum speed: a pressure higher by 5 – 15 kgf/cm² is detected. (This also differs depending on the oil temperature.)	 **Make the bucket dig into the ground to stop and relieve the swing pressure.**  **Posture taken when the swing pressure is being measured**
Adjusting procedures	1. Any occurrence of biased wear of the plunger, inclusion of dust, or clogging of the holes will lead to a decline in the pressure. Disassembling and checking are therefore required. 2. When the pressure is still lower, replace the relief valve assembly with a new one.	 **Relief valve position**  **Relief valve assembly**

SECTION 6 PERFORMANCE STANDARDS

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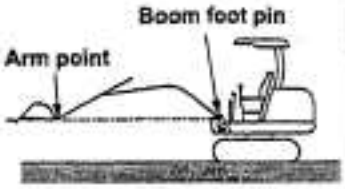
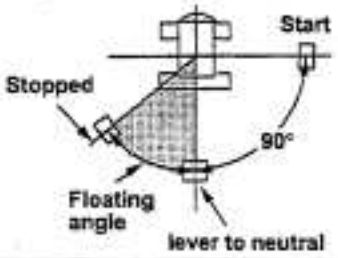
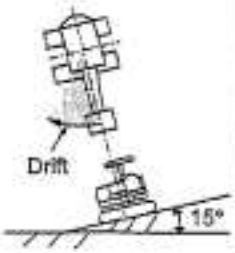
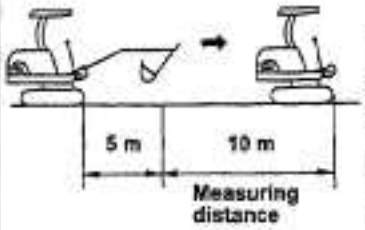
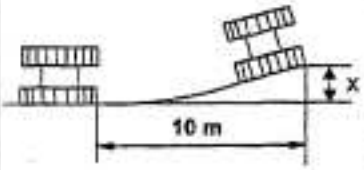
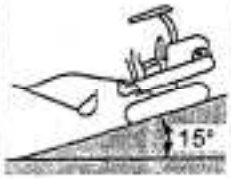
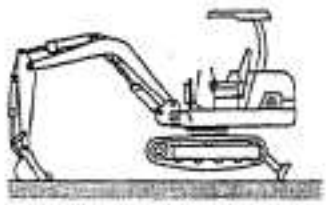
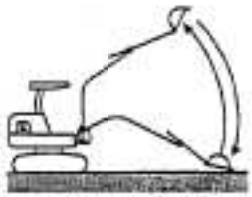
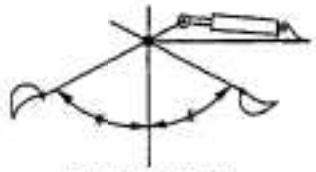
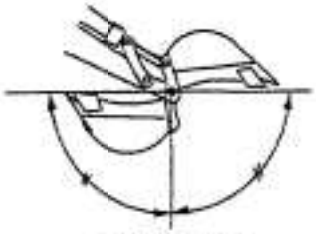
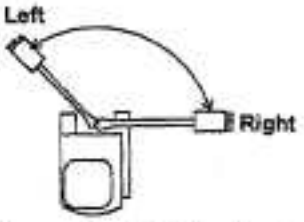
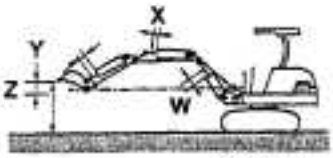
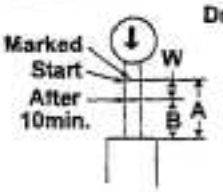
	ITEM	UNIT	15NX STANDARD	15NX ALLOW			NOTE
ENGINE	Rated R.P.M.	min^{-1} (rpm)	2300	–			
	Rated Output	kw (ps)	9.7 (13.2)	–5%			
	Max. Torque	N•m (kgf•m)	47.5/1800 (4.84/1800)	–5%			
	High Idle (No load)	min^{-1} (rpm)	2460 $^{+0}_{-50}$	2460±50			
	Low Idle (No load)	min^{-1} (rpm)	1250 $^{+0}_{-50}$	1250±50			
HYDRAULIC PRESSURE	Boom	MPa (kgf/cm^2)	20.6 $^{+0.5}_{-0}$ (210 $^{+5}_{-0}$)	20.6 $^{+0.5}_{-1.5}$ (210 $^{+5}_{-15}$)			• At hydraulic temperature 50 to 60 °C
	Arm		↑	↑			
	Bucket		↑	↑			
	Swing		15.2 $^{+0.5}_{-0}$ (155 $^{+5}_{-0}$)	15.2 $^{+0.5}_{-1.5}$ (155 $^{+5}_{-15}$)			
	Travel		20.6 $^{+0.5}_{-0}$ (210 $^{+5}_{-0}$)	20.6 $^{+0.5}_{-1.5}$ (210 $^{+5}_{-15}$)			
	Boom Swing		18.1 $^{+0.5}_{-0}$ (185 $^{+5}_{-0}$)	18.1 $^{+0.5}_{-1.5}$ (185 $^{+5}_{-15}$)			
	Blade		↑	↑			
LEVER FORCE	Boom: Raise/Lower	kg	1.2±0.3	1.2±0.5			• At engine stopped
	Arm:In/Out		1.2±0.3	1.2±0.5			
	Bucket		1.0±0.3	1.0±0.5			
	Swing:Right/Left		1.0±0.3	1.0±0.5			
	Travel: Forward/Reverse		1.8±0.4	1.8±0.7			
	Boom Swing: Right/Left		9.0±0.5	9.0±1.0			
	Blade: Raise/Lower		2.3±0.4	2.3±1.0			
	Throttle		4.0±0.4	4.0±1.0			
SPOOL STROKE	Boom	mm	7.0	←			• Measurement from the outside is not allowable due to the hydraulic remote control type. (For measurement, remove the spool case.)
	Arm						
	Bucket						
	Swing						
	Boom Swing		7.0	←			• Mechanical type Check and adjust the control lever beforehand.
	Travel						
	Service						
	Blade						

Item	CONDITION	15NX			
		STANDARD	ALLOW.	STANDARD	ALLOW.
SWING	Engine : Rated R.P.M. Oil temp. : 50° to 60°C				
Upper floats when swing operation is stopped. (Brake working angle)	Fully retracted bucket cylinder and arm cylinder. Arm point pin positioned to be horizontal with boom foot pin.  Return lever to neutral after rotating 90° with no load. Measure floating angle after stop the machine. 	20 ± 10°	Below 35°		
Swing Operating Speed	Engine : Rated R.P.M. Oil temp. : 50° to 60°C Fully retracted bucket cylinder and arm cylinder. Arm point pin positioned to be horizontal with boom foot pin. Measure time required for two turns after one turn is made.	12.6 sec ± 0.5 sec	Below 14 sec		
Natural Drift 	Engine:Low idling Oil temp.:50° to 60°C Incline angle:15 Fully retracted bucket cylinder and arm cylinder. Arm point pin positioned to be horizontal with boom foot pin. Slant surface crosswise. Measure drift angle after 5 minutes.	Below 0	Below 0		

Item	CONDITION	15NX			
		STANDARD	ALLOW.	STANDARD	ALLOW.
TRAVEL **Travel Speed**	Engine : Rated R.P.M. Oil temp. : 50° to 60°C Level solid ground Time required for 10 m travel after 5 m take off.  	Rubber shoe		Rubber shoe	
		High Speed 9.3 sec ± 1.0 sec Low Speed 17.0 sec ± 1.0 sec	High Speed below 11 sec Low Speed below 19 sec		
		Steel shoe		Steel shoe	
		High Speed 9.3 sec ± 1.0 sec Low Speed 17.5 sec ± 1.0 sec	High Speed below 11 sec Low Speed below 20 sec		
Travel Alignment	Engine : Rated R.P.M. Oil temp. : 50° to 60°C Measure turning distance (x) after 10m travel.  	Below 500 mm	Below 700 mm		
Natural Drift  	Engine : Low idling Oil temp. : 50° to 60°C Measure drift gravity in 5 mimutes.	100 mm /5 min	300 mm /5 min		
Time for Crawler belt	Engine : Rated R.P.M. Oil temp. : 50° to 60°C Measure time required for five turns after one turn. 	High Speed 15.0 sec ± 1.0 sec Low Speed 28.5 sec ± 1.0 sec	High Speed below 18.0 sec Low Speed below 32.0 sec		

Item	CONDITION	15NX			
		STANDARD	ALLOW.	STANDARD	ALLOW.
BOOM CYLINDER SPEED	Engine : Rated R.P.M. Oil temp. : 50° to 60°C  Arm and bucket cylinder fully retracted. Without measure cushion stroke. 1. Measure time to raise boom from ground level to maximum height. 2. Measure time to lower boom from maximum height to ground level.	With canopy		With canopy	
		Raise 2.8 sec ± 0.5 sec	Below 3.5 sec		
		Lower 2.6 sec	Below 3.3 sec		
		With cabin		With cabin	
		—	—		
ARM CYLINDER SPEED	Engine : Rated R.P.M. Oil temp. : 50° to 60°C  **Divided Equally** Measure time for full extension or retraction of cylinder. Without measure cushion stroke.	Arm In 2.5 sec ± 0.5 sec	Below 3.4 sec		
		Arm Out 2.5 sec ± 0.5 sec	Below 3.4 sec		
BUCKET CYLINDER SPEED	Engine : Rated R.P.M. Oil temp. : 50° to 60°C  **Divided Equally** Measure time for full extension or retraction of cylinder.	Dig 2.8 sec ± 0.3 sec	Below 3.5 sec		
		Dig 2.1 sec ± 0.3 sec	Below 2.6 sec		

Item	CONDITION	15NX			
		STANDARD	ALLOW.	STANDARD	ALLOW.
BLADE CYLINDER SPEED	Engine : Rated R.P.M. Oil temp. : 50° to 60°C  Measure time for full	Hoist 1.8 sec ± 0.5 sec Lower 2.5 sec ± 0.5 sec	Below 2.4 sec Below 3.1 sec		
BOOM SWING CYLINDER SPEED	Engine : Rated R.P.M. Oil temp. : 50° to 60°C  Measure time for full extension or retraction of cylinder. Without measure cushion stroke.	Left 5.3 sec ± 0.6 sec Right 4.0 sec ± 0.6 sec	Below 6.4 sec Below 5.1 sec		
CYLINDER DRIFT	Engine : Stopped Oil temp. : 50° to 60°C Bucket load:Non load Fully retracted bucket cylinder and arm cylinder. Arm point pin positioned to be horizontal with boom foot pin. Measure the variation of rod length in 10 minutes,  Drift W=A – B 	Boom Cylinder: below 10 mm Arm Cylinder: below 10 mm Bucket Cylinder: below 5 mm Bucket Tooth Point: below 200 mm	Below 20 mm Below 20 mm Below 10 mm Below 300 mm		