

Service Guide

for

9NX

SERIAL NUMBERS:
BB000011 and up

IHI

IHI Construction Machinery Limited

PUB. No.1
0404

HYDRAULIC MINI EXCAVATOR

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SECTION 1 SPECIFICATIONS

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GENERAL SPECIFICATIONS

■ **BASE MACHINE PERFORMANCE**

	Unit	9NX
Swing speed	min ⁻¹ (rpm)	8.7 (8.7)
Travel speed	km / h	1.7 / 3.5
Gradability	% (deg.)	58 (30)

■ **ENGINE**

Engine model	–	YANMAR 2TNE68-EIK
Engine type		4cycle, water cooled, over head valve, swirl-combustion chamber
No. of cyl. – bore × stroke	mm	2 – 68 × 72
Total piston displacement	L	0.522
Rated output	kW / min ⁻¹ (ps / rpm)	6.8 / 2400 (9.3 / 2400) [DIN6271, 6.7 / 2400]
Max. torque	N•m / min ⁻¹ (kgf•m / rpm)	31.9 / 1800 (3.25 / 1800)

■ **WEIGHT**

Machine mass	kg	890
Average ground bearing pressure	kPa (kgf / cm ²)	26 (0.27)

■ **REFILL CAPACITIES - (APPROXIMATE)**

Fuel		L	8.5
Hydraulic fluid	Oil level	L	8.2
	Total amount	L	14
Engine oil	Max. level	L	1.6
	Min. level	L	0.6
Coolant	Engine proper	L	0.6
	Total amount	L	2.2

■ BUCKET

◎: Std. applicable

○: Applicable

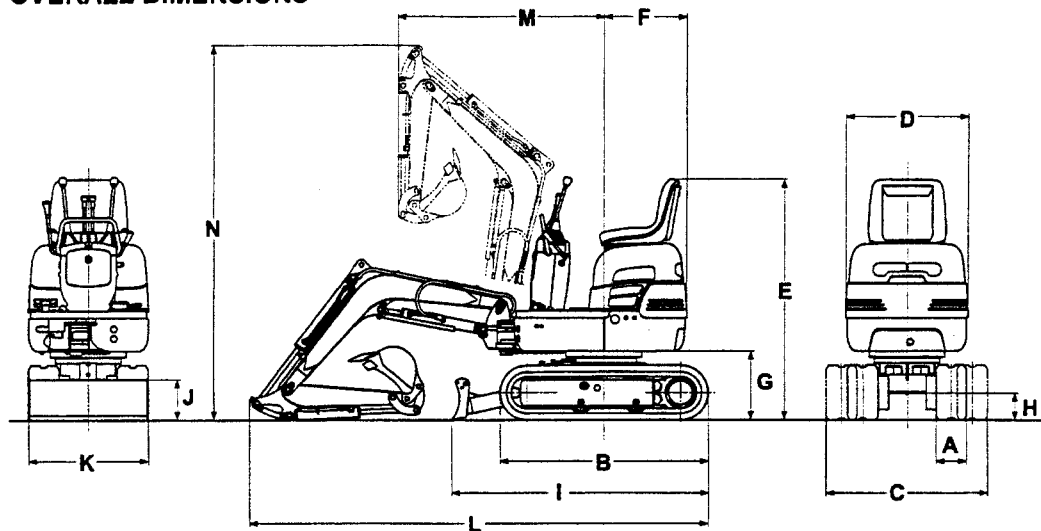
×: Not applicable

[Applicable Machine]

Bucket capacity		Side cutter width (mm)	Number of teeth	Weight (kg)	Combinations		Remarks	Remarks
ISO (m³)					Std. arm	Long arm		
Heaped	Struck							
0.022	0.015	370	4	17.6	◎	×	Standard	General digging
0.017	0.013	320	3	16.0	○	◎	OPT.	Long arm Ditch digging
0.011	0.008	220	2	13.0	○	○	OPT.	Ditch digging

OVERALL DIMENSIONS

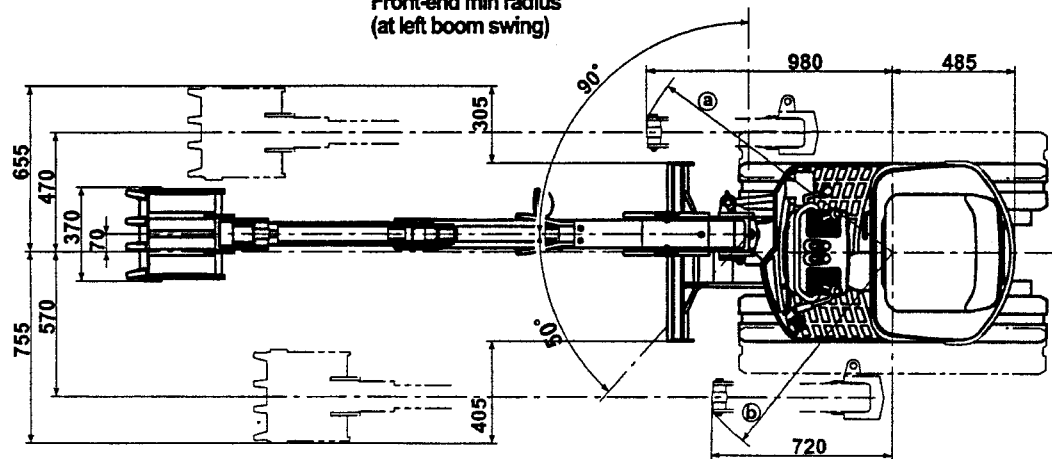
1. OVERALL DIMENSIONS



Unit: mm

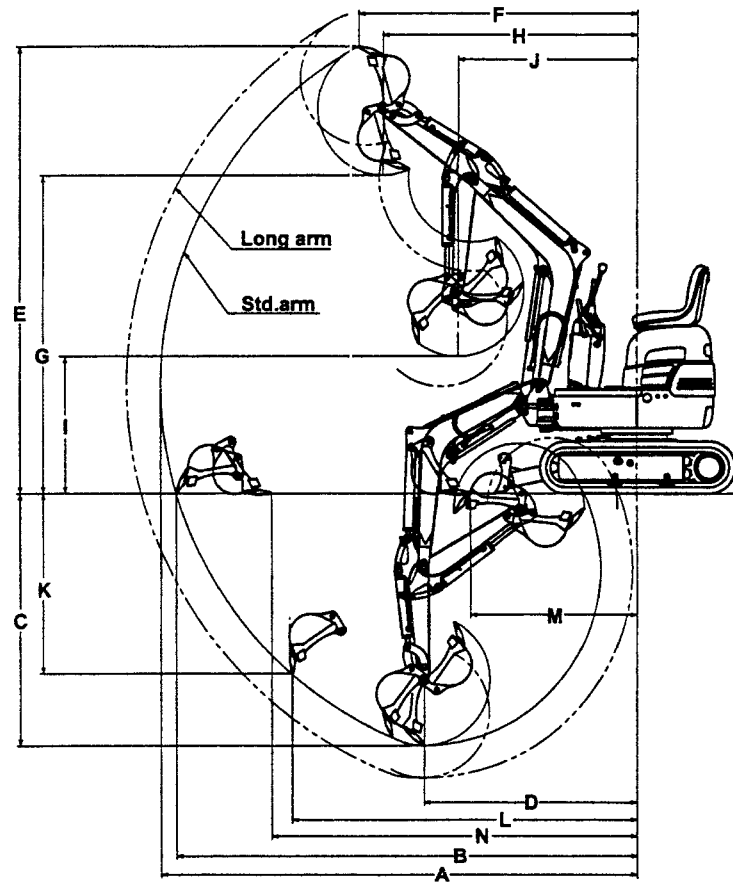
Codes	Description	STD
A	Crawler shoe width	180
B	Overall length of crawler	1220
C	Overall width of crawler	700 ~ 950
D	Width	720
E	Height	1405
F	Rear end swing radius	485
G	Rear end ground clearance	405
H	Mini. ground clearance	160
I	Overall length of undercarriage	1500
J	Blade height	240
K	Blade width	700
L	Overall length	Blade in front 2700
		Blade in rear 2980
M	Front end mini. radius at center	1220
N	Arm head clearance	2180

③ R1105
Front-end min radius
(at left boom swing)



④ R950
Front-end min radius
(at right boom swing)

■ WORKING RANGE (BACK HOE)

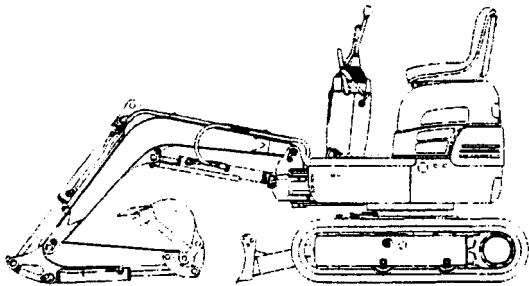


Unit: mm

Key	Description	Std. arm	Long arm
	Std. of bucket capacity (m ³), ISO Heaped	0.022	0.017
A	Max. digging radius	2980	3190
B	Max. bucket outreach at ground level	2880	3100
C	Max. digging depth (Not used blade)	1570	1770
D	Radius of max. digging depth	1330	1340
E	Max. digging height	2755	2950
F	Radius of max. digging height	1740	1820
G	Max. dumping height	1970	2150
H	Radius of max. digging height	1590	1700
I	Min. dumping height	850	660
J	Radius of min. dumping height	1120	1220
K	Max. vertical digging depth	1175	1400
L	Radius of max. vertical digging depth	2160	2140
M	Radius of min. digging ground level	1040	990
N	Max. clean-up radius at floor level	2290	2500

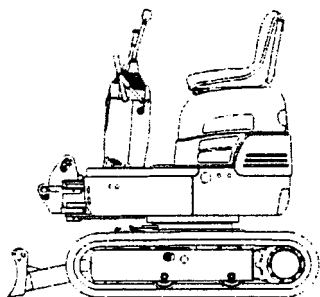
WEIGHT BREAKDOWN

1. Total operating weight



Shoe/Cabin Spec.	Weight (kg)
Rubber shoe	890

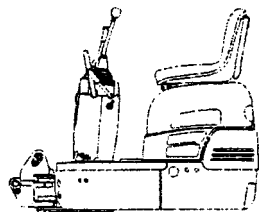
2. Base machine



Shoe/Cabin Spec.	Weight (kg)
Rubber shoe	785

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

3. Upper structure



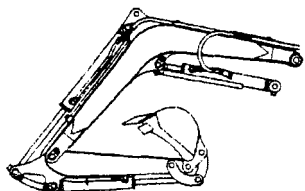
Specification	Weight (kg)
	445

4. Under carriage



Specification	Weight (kg)
Rubber shoe	340

5. Hoe attachment



Specification	Weight (kg)
Standard arm	105
Long arm	105

ENGINE MAIN DATA AND SPECIFICATIONS

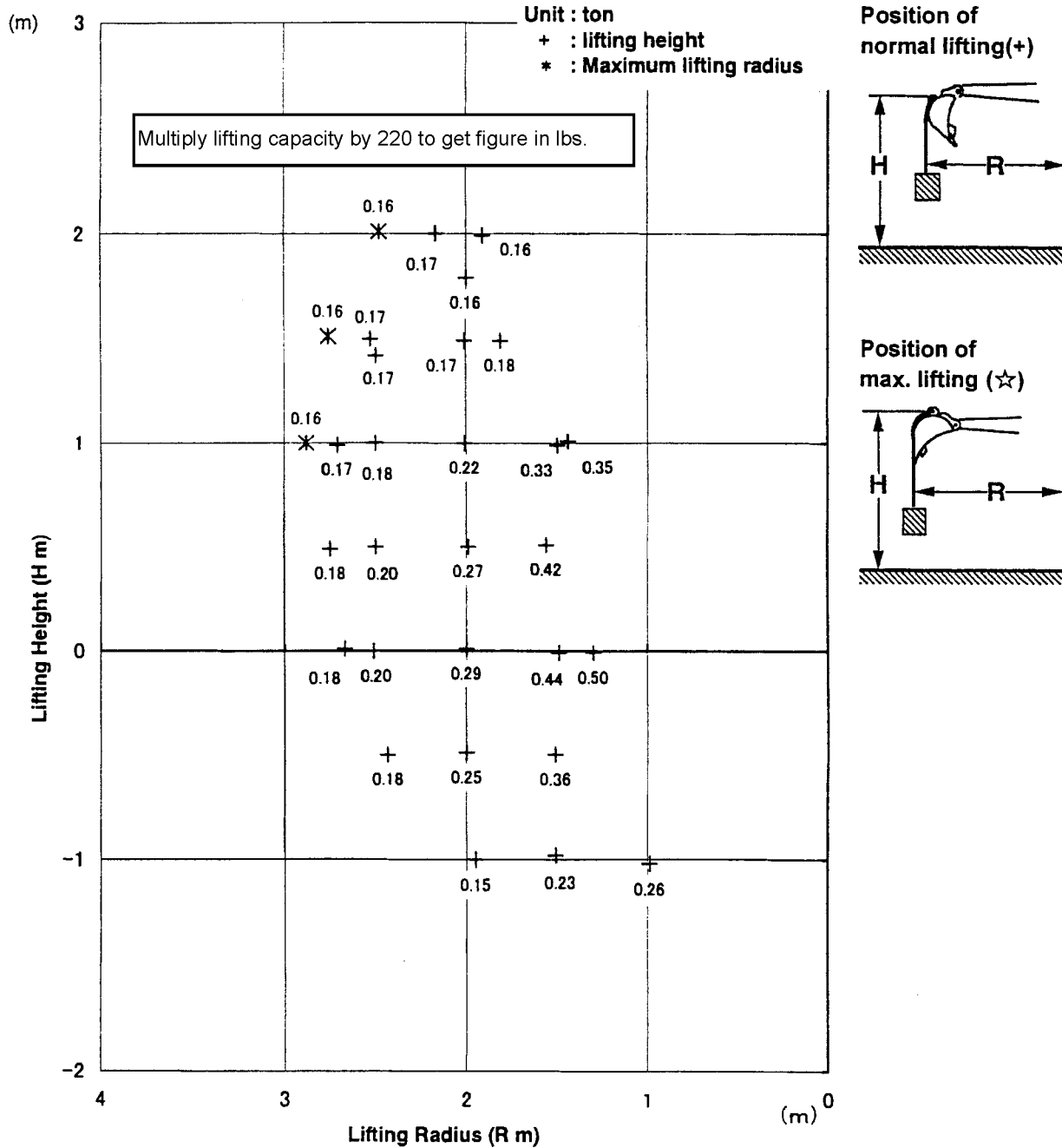
Item	Data and specifications
Machine model	9NX #WB000011 and up
Name of engine	2TNE68-EIK
Type of engine	4-cycle upright water-cooled serial 2-cylinder type
Number of cylinders - Diameter xStroke	2-68 x 72
Total stroke capacity	0.522 ℓ
Compression ratio	23.0 (effective: 21.0)
Rated output	6.8 kW (9.3 PS) ±3% / 2400 min ⁻¹
Maximum torque	30.4~33.3 N · m (3.10~3.4 kg · m) / 1800±100 min ⁻¹
Fuel consumption	272 g/kW · h(200 g/PS · h) or lower
Atmospheric condition	Atmospheric pressure: 100 kPa (750 mmHg), Atmospheric temperature: 25°C, Humidity: 30%
Unloaded maximum rotational speed	Maximum: 2580±25 min ⁻¹ , Minimum: 1100±50 min ⁻¹
Speed variation rate	Momentary: 12% or lower, Set: 7% or lower
Setting time	6 seconds or shorter
Rotational variation	30 min ⁻¹ or smaller
Permissible tilt angle	Continuous: 25 degrees (forward/backward, right/left), Momentary (3 minutes): 30 degrees (forward/backward, right/left)
Rotational direction	Left (when viewed from the flywheel)
Weight in dry state	65 ⁺⁵ ₀ kg
Fuel system	
Applicable fuel	Diesel light oil
Fuel injection pump	Bosch type (YPER)
Filtration system	Full-flow filtration (water trap integrated)
Governor	Centrifugal all-speed type
Lubrication system	
Applicable lubricant	New SAE type, class CD, 10W30
Lubrication pump	Tocolois pump
Filtrtion system	Filter paper type
Cooling system	
Cooling system	Forced circulation, radiator cooling
Radiator	Pressurized type: 90 kPa (with 0.9 kg/cm ² pressure cap)
Fan	7 resin fans - 230 mm dia, (suction), Seat for fans T=8 (crank pulley/fan pulley=95/85 mm dia.)
Air cleaner	Cyclone type (4-inch)
Start-up system	Electrical
Starter	12 V - 0.8 kW
Generator	12 V - 20 A
Battery (recommended value)	44B19L
Auxiliary start-up unit	Glow plug (immediately heater 3-second type)
Engine stop unit	Stop solenoid (waterproof coupler)
Coolnat volume	Engine: 0.6 ℓ
Lubricant volume	Full: 1.6 ℓ, Effective: 0.6 ℓ (shallow oil pan)
Engine paint color	Yammar black

LIFTING CAPACITIES 9NX

LOAD RATING CHART (SAE METHOD)

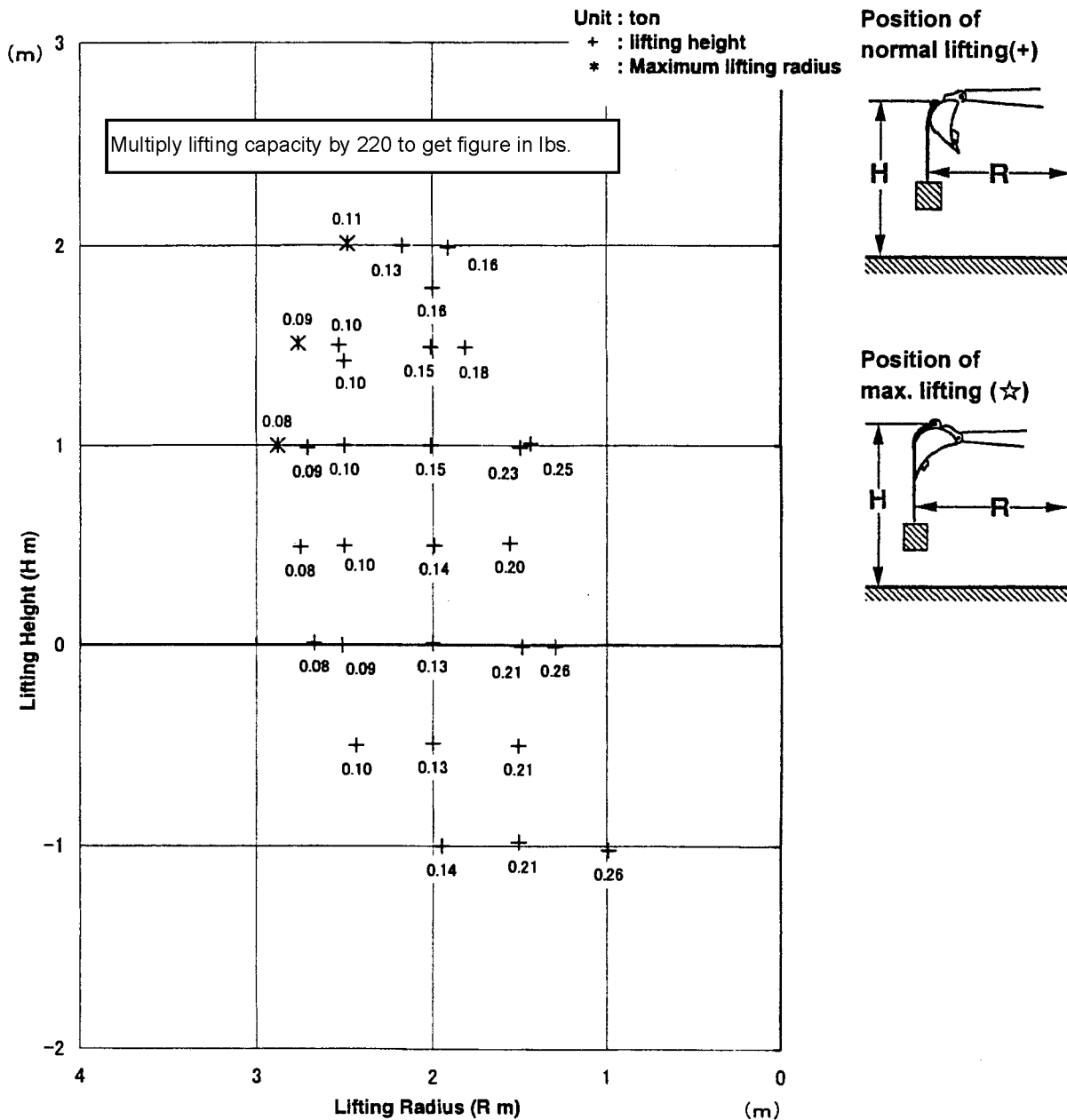
Note : At front over end and the Blade fulcrum with equipped standard arm.

Rated loads do not exceed 87% of hydraulic capacity or 75% stability.



LOAD RATING CHART (SAE METHOD)

Note : At front over end and the Blade fulcrum with equipped standard arm.
 Rated loads do not exceed 87% of hydraulic capacity or 75% stability.

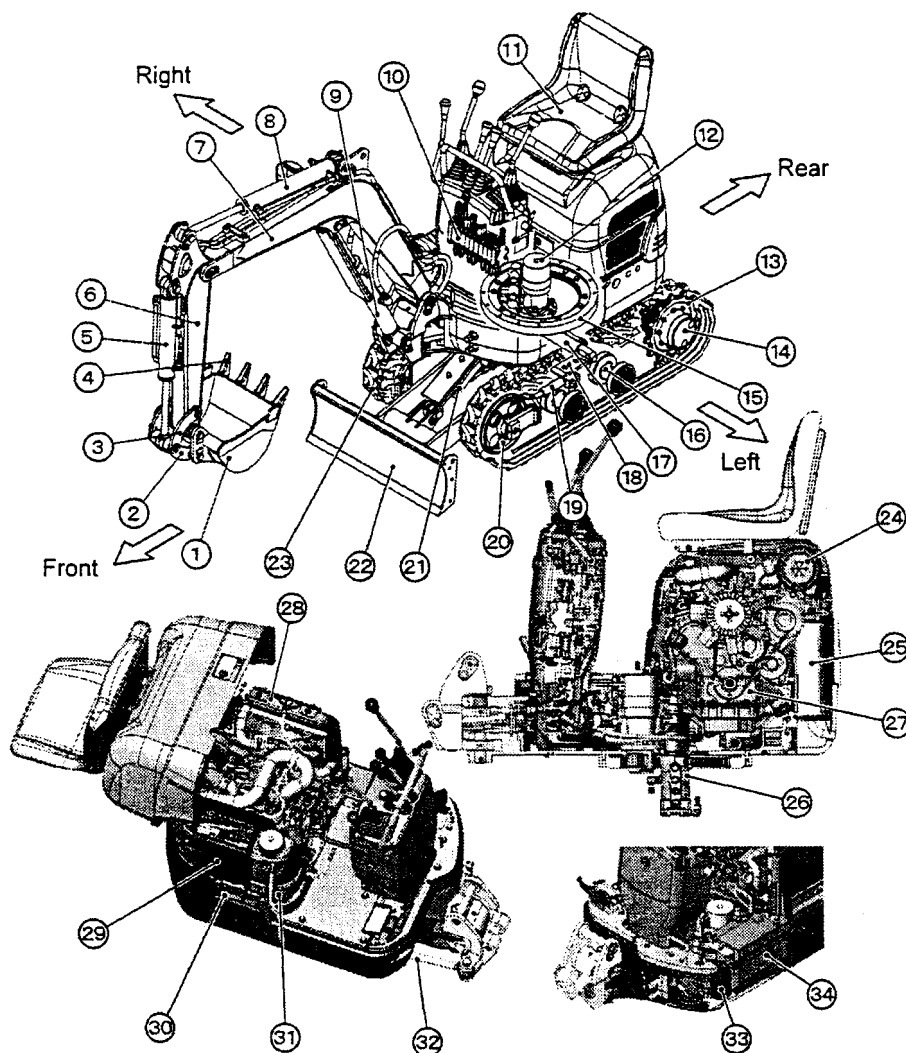


SECTION 2 STRUCTURE · FUNCTION

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NOMENCLATURE



Typical Example

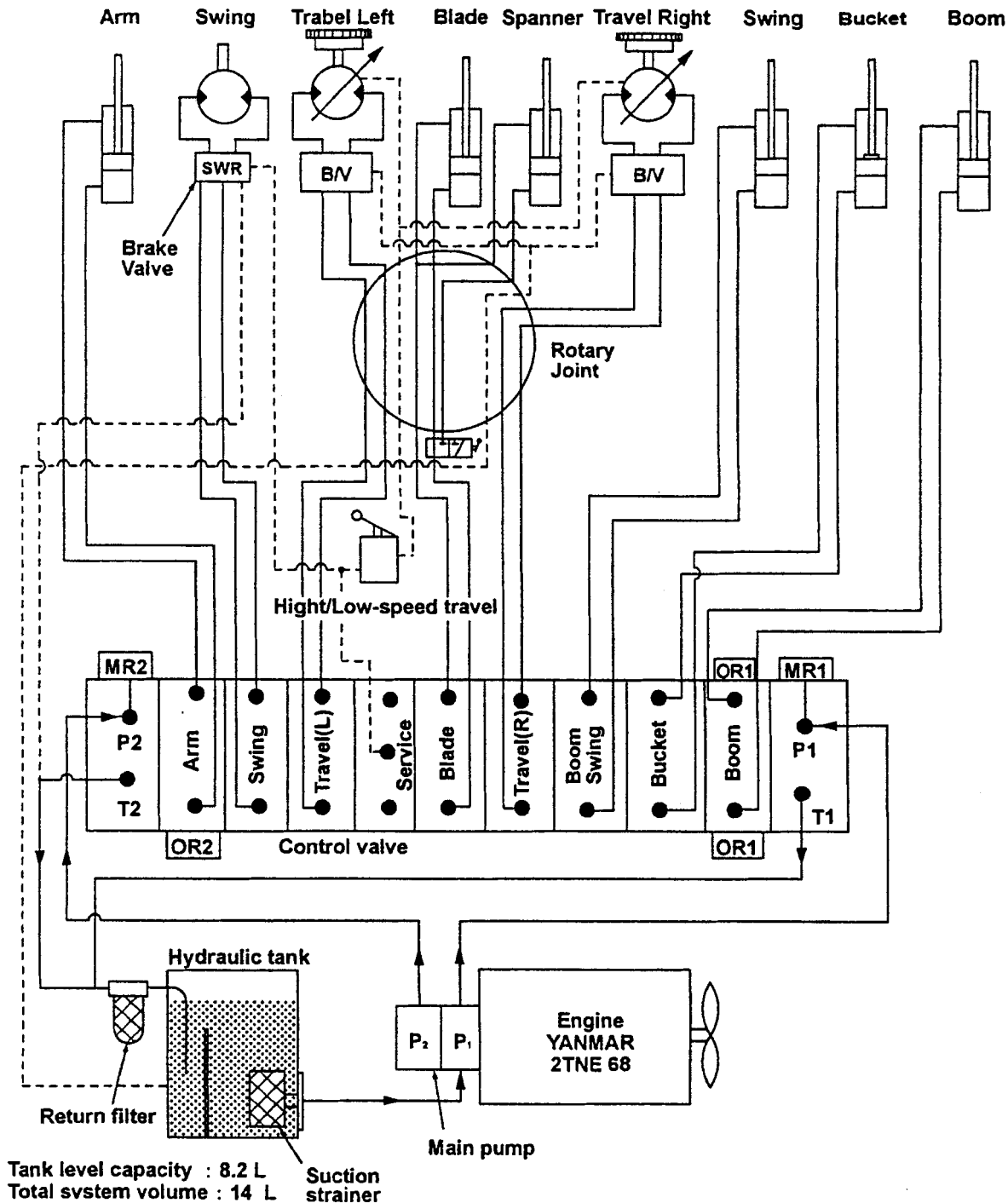
- (1) Bucket
- (2) Bucket Link
- (3) Arm Link
- (4) Tooth
- (5) Bucket Cylinder
- (6) Arm
- (7) Boom
- (8) Arm Cylinder
- (9) Boom Cylinder
- (10) Control Valve
- (11) Operator's Seat

- (12) Swing Drive (with motor)
- (13) Sprocket
- (14) Travel Drive (with motor)
- (15) Swing Bearing
- (16) Track Roller
- (17) Spanner Cylinder
- (18) Guide Plate
- (19) Track Adjuster
- (20) Front Idler
- (21) Blade Cylinder
- (22) blade
- (23) Track Shoe

- (24) Air Cleaner
- (25) Muffler
- (26) Rotary joint
- (27) Engine
- (28) Radiator
- (29) Battery
- (30) Hydraulic Pump
- (31) Fuel Tank
- (32) Boom Swing Cylinder
- (33) Return Filter
- (34) Hydraulic tank

HYDRAULIC SYSTEM DIAGRAM

HYDRAULIC SYSTEM DIAGRAM



Relief valve set pressure

Code	Item	Pressure	
		MPa	kgf/cm ²
MR1	Main relief valve P1 Pump	16.2	165
MR2	Main relief valve P2 Pump	16.2	165
OR1	Overload relief valve (Boom)	18.6	190
OR2	Overload relief valve (Arm)	18.6	190
SWR	Swing relief valve	6.9	70

Pump flow rate (Max.):

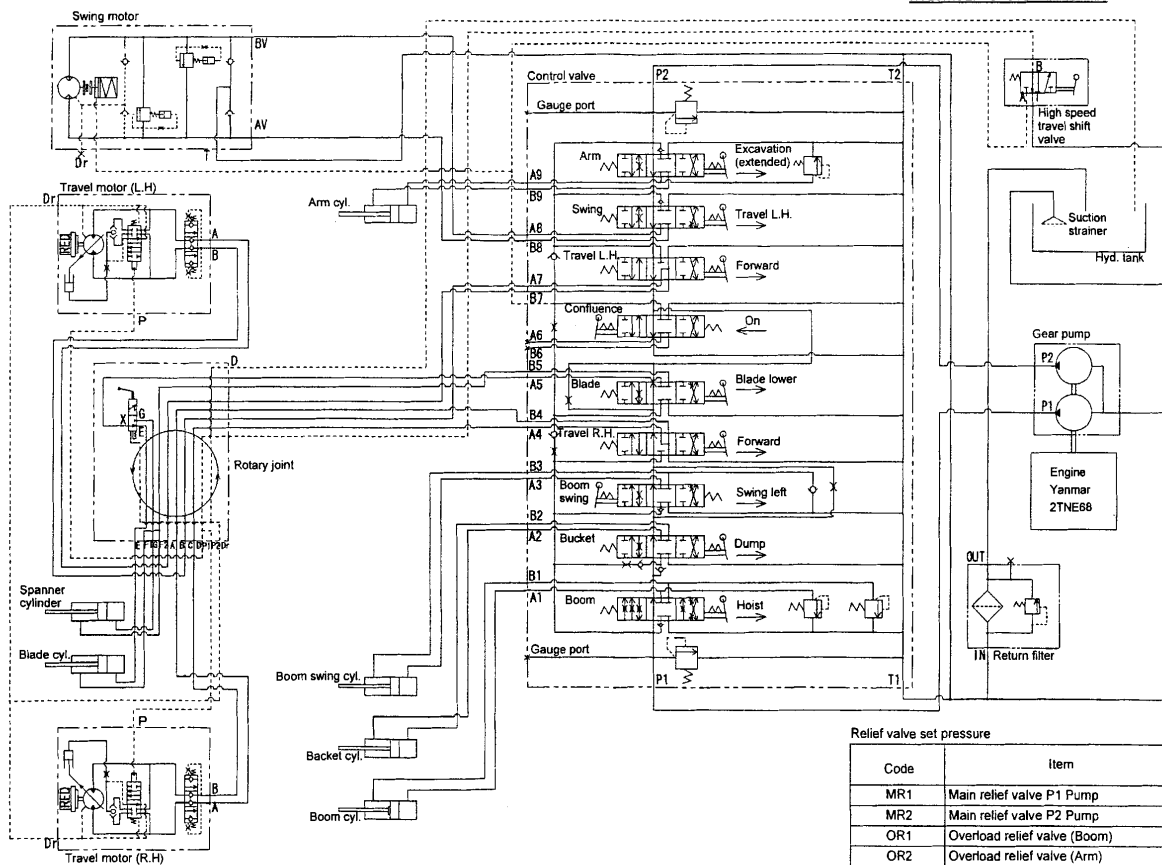
P1 ; 11. L/min
P2 ; 11.1 L/min

The service ports use the flow shared by the P1 and P2 pumps.

STRUCTURE & FUNCTION

9

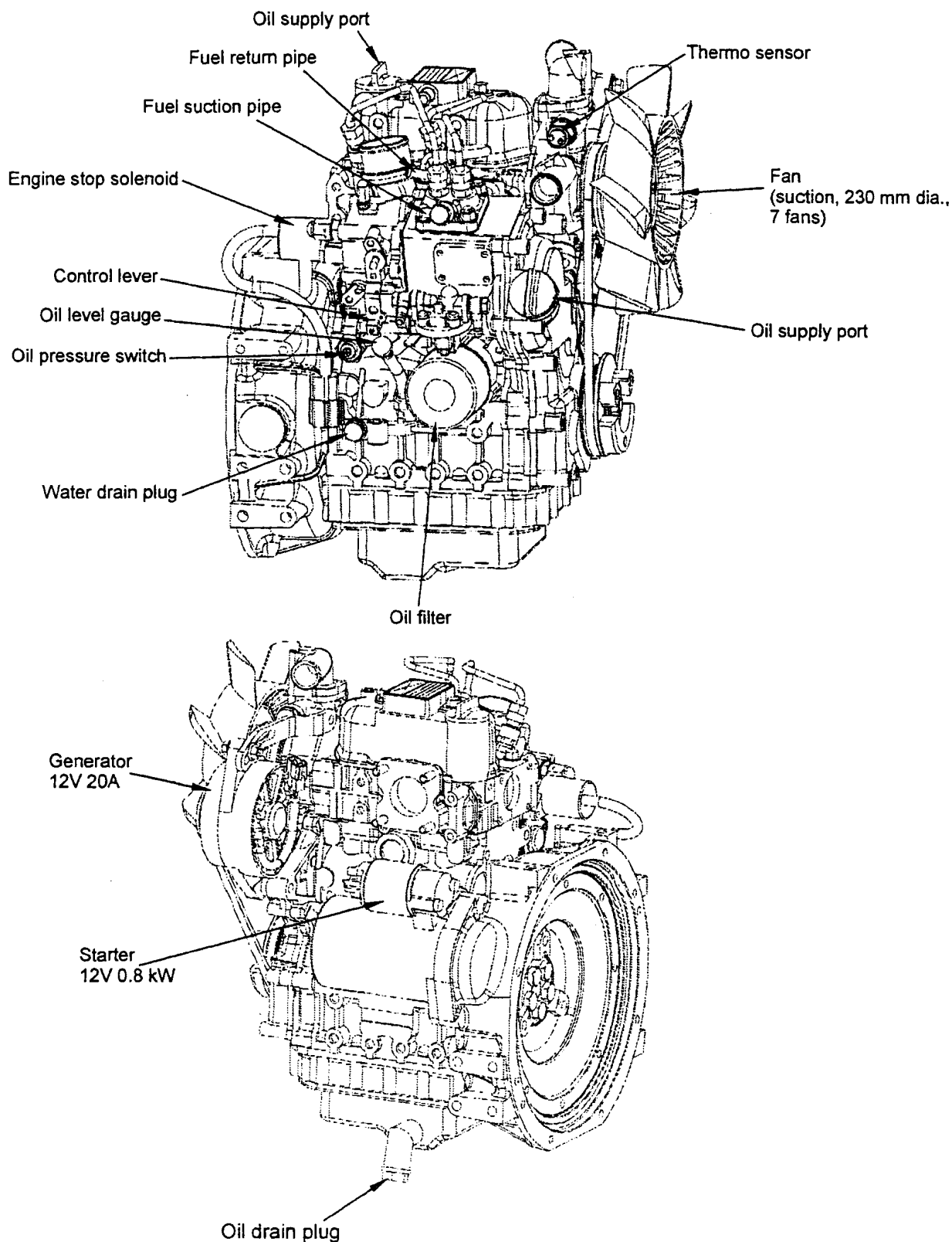
HYDRAULIC SYSTEM DIAGRAM



ENGINE AND AUXILIARY COMPONENTS

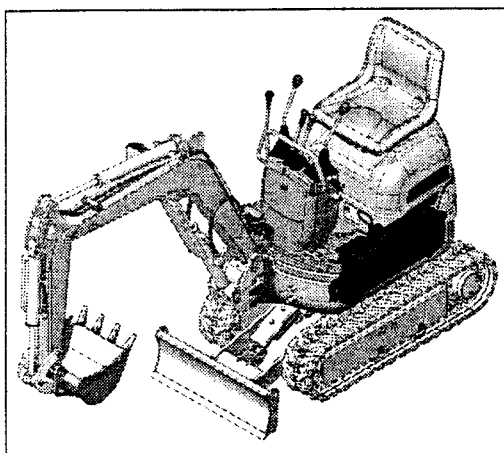
2TNE68-EIK

(engine component names, layout)

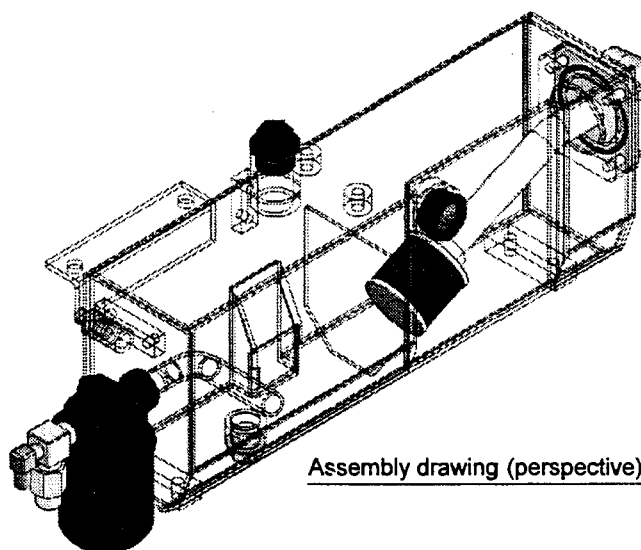


HYDRAULIC TANK ASS'Y

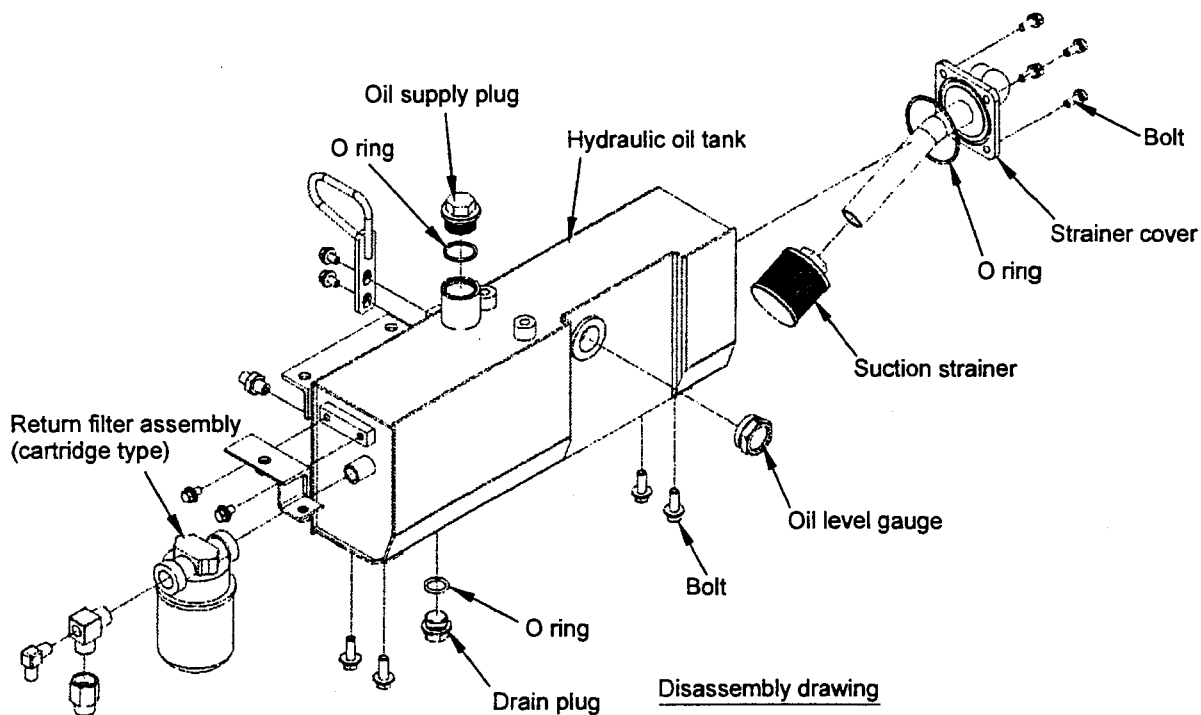
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Layout



Assembly drawing (perspective)



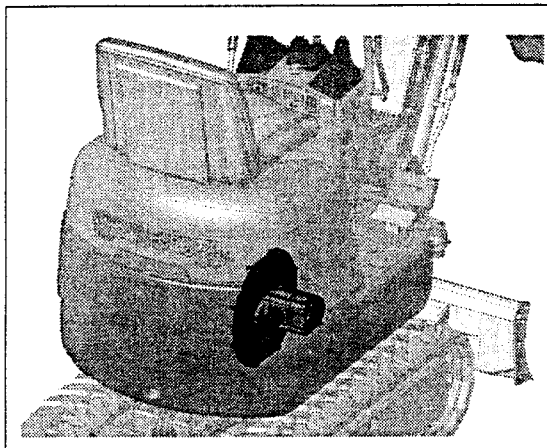
Disassembly drawing

Maintenance Intervals (Every Hours)				
	Contents	Initial	After	Breaker works
Suction strainer	Cleaning	—	1,000	500
Return filter	Replace	50	500	100

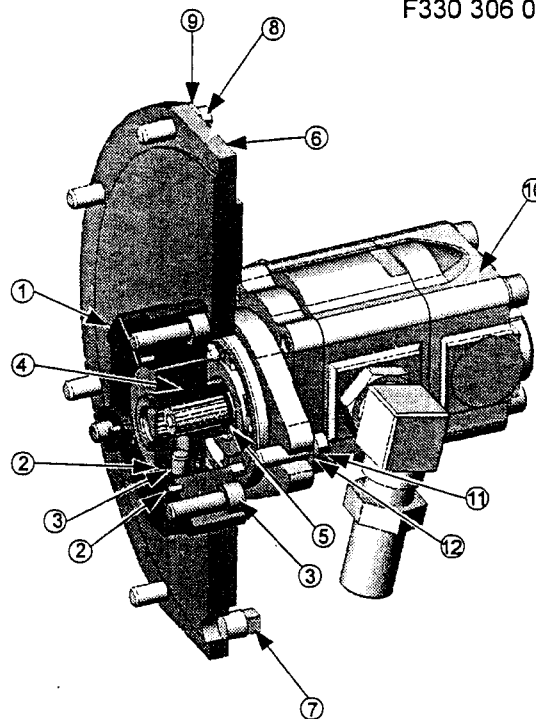
Specifield strainer	Fluid Volume (ℓ)		Replace Intervals	
	Tank level	Total system	General operation	Breaker works
IS-SUPER A Genuine hydraulic oil (wear-resistance hydraulic oil)	8.2	14	1,000	500

PUMP DRIVE DEVICE

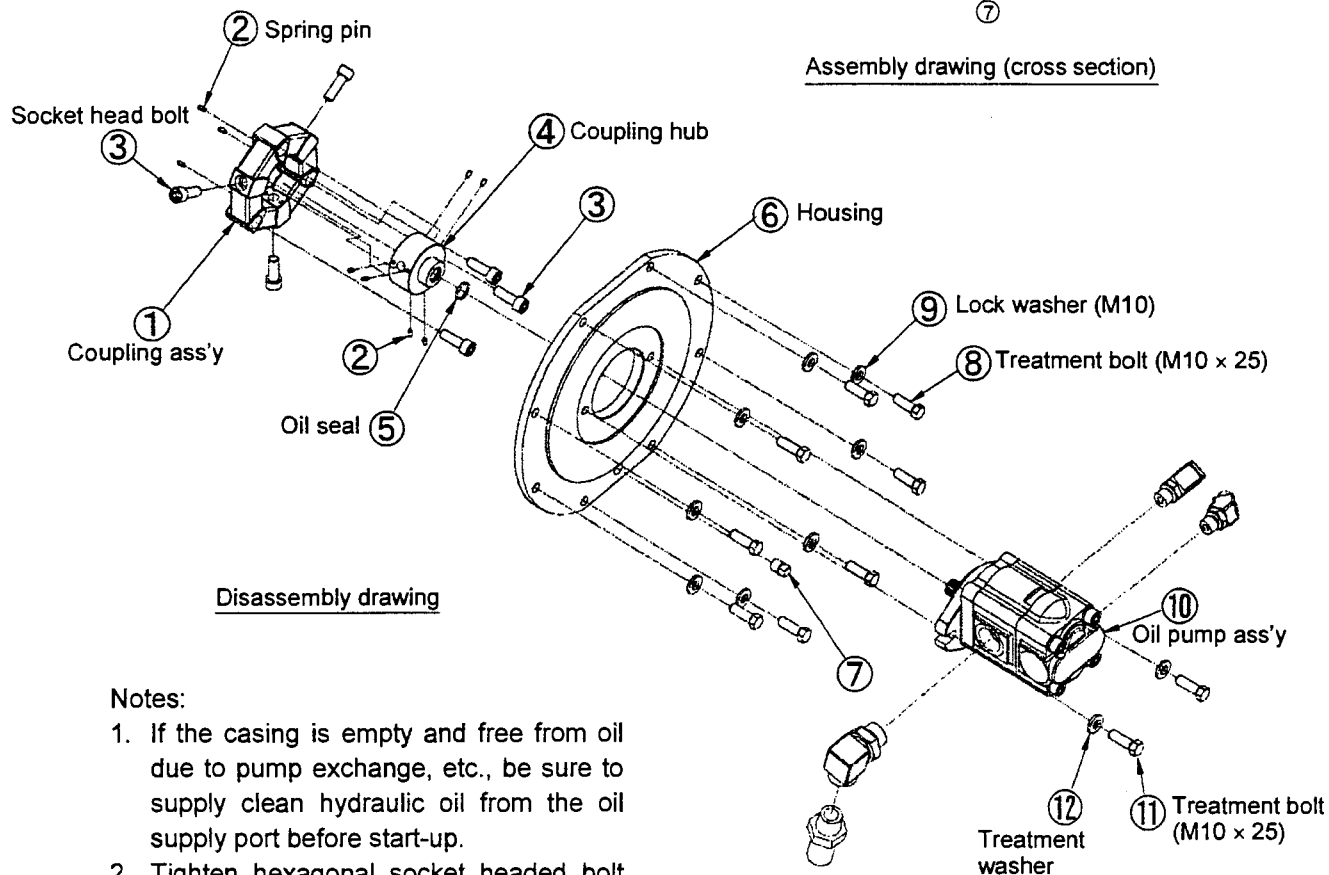
F330 306 00



Layout



Assembly drawing (cross section)



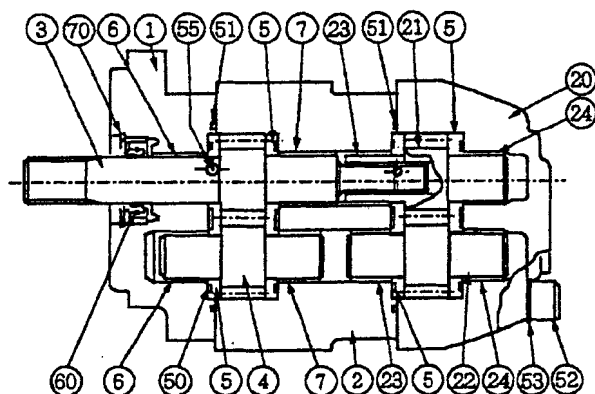
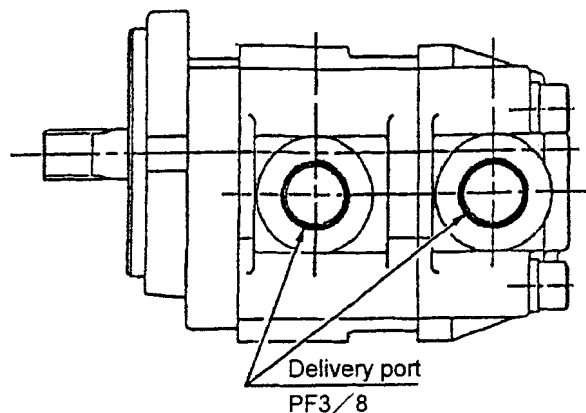
Disassembly drawing

Notes:

1. If the casing is empty and free from oil due to pump exchange, etc., be sure to supply clean hydraulic oil from the oil supply port before start-up.
2. Tighten hexagonal socket headed bolt (3) with the specified tightening torque of 48 to 53 N-m.
3. Before assembling the pump, coat the Never-Seize (special grease) on the spline and fill the space with it.

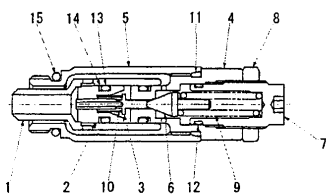
HYDRAULIC PUMP

0750 062 UA



Key	Description	Q'ty
1	Front Cover	1
2	Body	1
3	Drive Gear	1
4	Driven Gear	1
5	Side plate	4
6	Bushing	2
7	Bushing	2
20	Body	1
21	Drive Gear	1
22	Driven Gear	1
23	Bushing	2
24	Bushing	2
50	Gasket	4
51	Gasket	2
52	Socket head bolt	4
53	Treatment washer	4
55	Steel Ball	4
60	Oil Seal	1
70	C-shaped stop ring	1

Logical delivery volume : No.1 pump 4.64 cm³
 No.2 pump 4.64 cm³
 Rated pressure : 18.6 MPa (190 kgf/cm²)



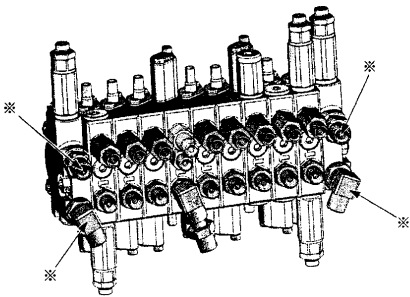
Relief valve assembly drawing cross section

No.	Description	Q'ty
1	Socket	1
2	Super pressure valve	1
3	Piston	1
4	Adjustment section body	1
5	Super pressure section body	1
6	Adjustment valve	1
7	Adjustment spring	1
8	Nut	1
9	Adjustment valve spring	1
10	Super pressure valve spring	1
11	O-ring	1
12	O-ring	1
13	O-ring	2
14	Backup ring	2
15	O-ring	1

Upon assembling the valve block
Observe the tightening torque (3 positions).
13.7-14.7N · m

Pump		Main relief valve setting pressure MPa (kgf/cm ²)
P1	MR1	$16.2^{+0.3}_{-0.2}$ ($165^{+0.3}_{-0.2}$) at 12.5 L/min
P2	MR2	$16.2^{+0.3}_{-0.2}$ ($165^{+0.3}_{-0.2}$) at 12.5 L/min

Symbol		Overload relief valve setting pressure MPa (kgf/cm ²)
OR1	Boom up	$18.6^{+0.48}_{-0}$ (190^{+5}_{-0}) at 5 L/min
OR2	Boom down	$18.6^{+0.48}_{-0}$ (190^{+5}_{-0}) at 5 L/min
OR3	Arm pull-off	$18.6^{+0.48}_{-0}$ (190^{+5}_{-0}) at 5 L/min



Notes on damages due to over-tightening

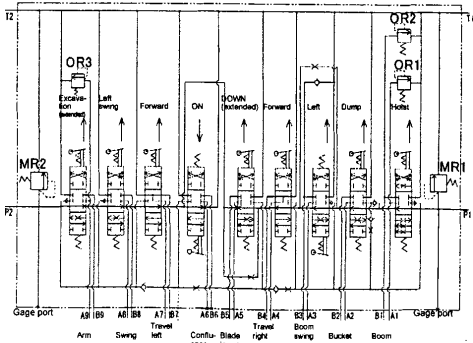
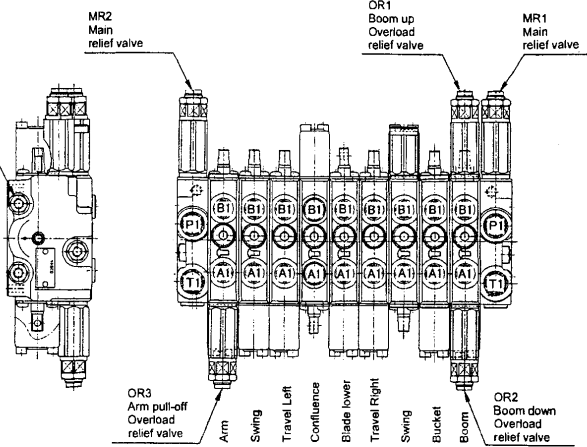
- Piping adapter on P/T port marked ※
Tightening torque: 69±0N · m (7±1kgf · m)~
- Other piping adapters
Tightening torque: 34-44N · m (3.5-4.5kgf · m)

STRUCTURE & FUNCTION

9NX

CONTROL VALVE (1)

0783 767 UA



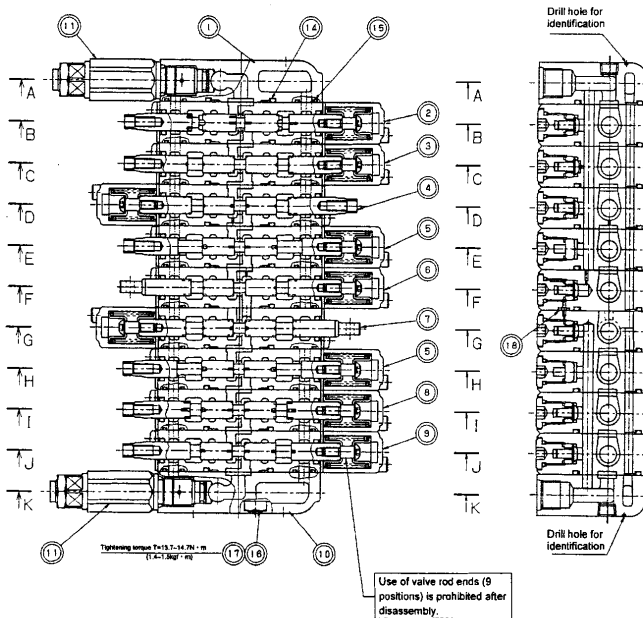
Circuit diagram

STRUCTURE & FUNCTION

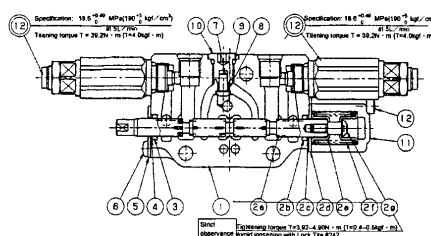
9NX

CONTROL VALVE (2)

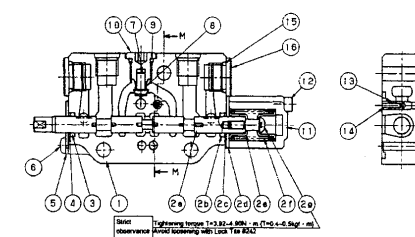
0783 767 UA



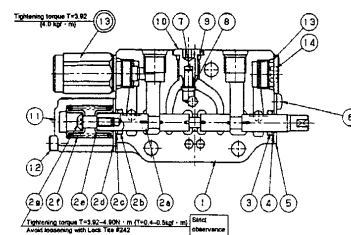
Boom switching part assembly B-B



Bucket switching part assembly C-C



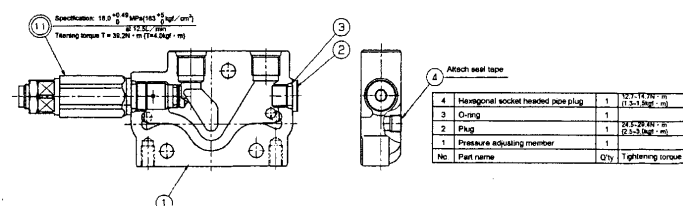
Swing switching part assembly D-D



12	Hexagonal socket headed bolt M5x45	2	3.18-3.360" in (8.0-8.5kgf · cm)
11	Return spring lid	1	24.1-2.680" in (6.0-6.8kgf · cm)
10	Check valve support	1	24.1-2.680" in (6.0-6.8kgf · cm)
9	O-ring 1B P11	1	24.1-2.680" in (6.0-6.8kgf · cm)
8	Check valve spring	1	24.1-2.680" in (6.0-6.8kgf · cm)
7	Check valve	1	24.1-2.680" in (6.0-6.8kgf · cm)
6	Cross socket headed small pan screw M5x10	2	1.95-2.360" in (5.0-6.0kgf · cm)
5	O-ring retainer	1	24.1-2.680" in (6.0-6.8kgf · cm)
4	Backup ring T3P10A	1	24.1-2.680" in (6.0-6.8kgf · cm)
3	O-ring 1A P10A	1	24.1-2.680" in (6.0-6.8kgf · cm)
2	Valve rod end	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
1	Return spring	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
a	Return spring support	(2)	24.1-2.680" in (6.0-6.8kgf · cm)
d	O-ring retainer	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
c	Backup ring T3P10A	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
b	O-ring 1A P10A	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
a	Valve rod (boom)	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
2	Valve rod assembly (boom)	1	24.1-2.680" in (6.0-6.8kgf · cm)
1	Switching part body M5	1	24.1-2.680" in (6.0-6.8kgf · cm)
No.	Part name	Qty	Tightening torque

16	PF3B Plug	2	3.18-3.360" in (8.0-8.5kgf · cm)
15	O-ring 1B P14	2	3.18-3.360" in (8.0-8.5kgf · cm)
14	Check valve spring	1	24.1-2.680" in (6.0-6.8kgf · cm)
13	Check valve	1	24.1-2.680" in (6.0-6.8kgf · cm)
12	Hexagonal socket headed bolt M5x45	2	3.18-3.360" in (8.0-8.5kgf · cm)
11	Return spring lid	1	24.1-2.680" in (6.0-6.8kgf · cm)
10	Check valve support	1	24.1-2.680" in (6.0-6.8kgf · cm)
9	O-ring 1B P11	1	24.1-2.680" in (6.0-6.8kgf · cm)
8	Check valve spring	1	24.1-2.680" in (6.0-6.8kgf · cm)
7	Check valve	1	24.1-2.680" in (6.0-6.8kgf · cm)
6	Cross socket headed small pan screw M5x10	2	1.95-2.360" in (5.0-6.0kgf · cm)
5	O-ring retainer	1	24.1-2.680" in (6.0-6.8kgf · cm)
4	Backup ring T3P10A	1	24.1-2.680" in (6.0-6.8kgf · cm)
3	O-ring 1A P10A	1	24.1-2.680" in (6.0-6.8kgf · cm)
2	Valve rod end	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
1	Return spring	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
a	Return spring support	(2)	24.1-2.680" in (6.0-6.8kgf · cm)
d	O-ring retainer	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
c	Backup ring T3P10A	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
b	O-ring 1A P10A	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
a	Valve rod (bucket)	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
2	Valve rod assembly (bucket)	1	24.1-2.680" in (6.0-6.8kgf · cm)
1	Switching part body M5	1	24.1-2.680" in (6.0-6.8kgf · cm)
No.	Part name	Qty	Tightening torque

Pressure adjusting part assembly

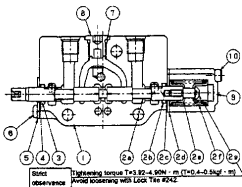


14	PF3B Plug	1	3.18-3.360" in (8.0-8.5kgf · cm)
13	O-ring 1B P14	1	3.18-3.360" in (8.0-8.5kgf · cm)
12	Hexagonal socket headed bolt M5x45	2	3.18-3.360" in (8.0-8.5kgf · cm)
11	Return spring lid	1	24.1-2.680" in (6.0-6.8kgf · cm)
10	Check valve support	1	24.1-2.680" in (6.0-6.8kgf · cm)
9	O-ring 1B P11	1	24.1-2.680" in (6.0-6.8kgf · cm)
8	Check valve spring	1	24.1-2.680" in (6.0-6.8kgf · cm)
7	Check valve	1	24.1-2.680" in (6.0-6.8kgf · cm)
6	Cross socket headed small pan screw M5x10	2	1.95-2.360" in (5.0-6.0kgf · cm)
5	O-ring retainer	1	24.1-2.680" in (6.0-6.8kgf · cm)
4	Backup ring T3P10A	1	24.1-2.680" in (6.0-6.8kgf · cm)
3	O-ring 1A P10A	1	24.1-2.680" in (6.0-6.8kgf · cm)
2	Valve rod end	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
1	Return spring	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
a	Return spring support	(2)	24.1-2.680" in (6.0-6.8kgf · cm)
d	O-ring retainer	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
c	Backup ring T3P10A	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
b	O-ring 1A P10A	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
a	Valve rod (swing)	(1)	24.1-2.680" in (6.0-6.8kgf · cm)
2	Valve rod assembly (swing)	1	24.1-2.680" in (6.0-6.8kgf · cm)
1	Switching part body M5	1	24.1-2.680" in (6.0-6.8kgf · cm)
No.	Part name	Qty	Tightening torque

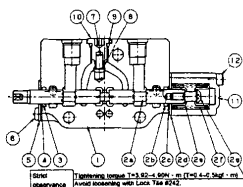
STRUCTURE & FUNCTION

9NX

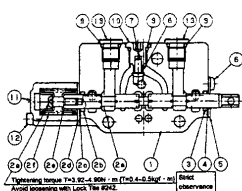
Travel to right switching part assembly E-E



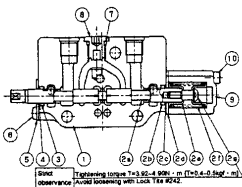
Soil discharging plate switching part F-F



Merge switching part assembly G-G



Travel to left switching part assembly H-H

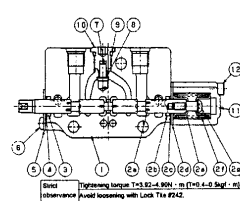


10	Hexagonal socket headed bolt M5x45	2	1.9E-2 Nm (1.9E-2 kgf-m)
9	Return spring lid	1	2.1E-2 Nm (2.1E-2 kgf-m)
8	Check valve support	1	2.1E-2 Nm (2.1E-2 kgf-m)
7	O-ring 1B P11	1	2.1E-2 Nm (2.1E-2 kgf-m)
6	Cross socket headed small pan screw M5x10	2	1.9E-2 Nm (1.9E-2 kgf-m)
5	O-ring retainer	1	1.9E-2 Nm (1.9E-2 kgf-m)
4	Backup ring TSP 10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
3	O-ring 1A P10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
2	Valve rod and	(1)	
1	Return spring	(1)	
11	Return spring support	(2)	
10	O-ring retainer	(1)	
9	Backup ring	(1)	
8	O-ring 1A P10A	(1)	
7	Valve rod (Travel)	(1)	
6	Valve rod assembly (Travel)	(1)	
5	Switching part body 2A	(1)	
No.	Part name	Qty	Tightening torque
12	Hexagonal socket headed bolt M5x45	2	1.9E-2 Nm (1.9E-2 kgf-m)
11	Return spring lid	1	2.1E-2 Nm (2.1E-2 kgf-m)
10	Hexagonal socket headed bolt	1	2.1E-2 Nm (2.1E-2 kgf-m)
9	O-ring 1B P11	1	2.1E-2 Nm (2.1E-2 kgf-m)
8	Check valve support	1	2.1E-2 Nm (2.1E-2 kgf-m)
7	Check valve	1	2.1E-2 Nm (2.1E-2 kgf-m)
6	Cross socket headed small pan screw M5x10	2	1.9E-2 Nm (1.9E-2 kgf-m)
5	O-ring retainer	1	1.9E-2 Nm (1.9E-2 kgf-m)
4	Backup ring TSP 10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
3	O-ring 1A P10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
2	Valve rod and	(1)	
1	Return spring	(1)	
11	Return spring support	(2)	
10	O-ring retainer	(1)	
9	Backup ring	(1)	
8	O-ring 1A P10A	(1)	
7	Valve rod (Travel)	(1)	
6	Valve rod assembly (Travel)	(1)	
5	Switching part body 2A	(1)	
No.	Part name	Qty	Tightening torque
13	PF1/4 plug	2	2.1E-2 Nm (2.1E-2 kgf-m)
12	Hexagonal socket headed bolt M5x45	2	1.9E-2 Nm (1.9E-2 kgf-m)
11	Return spring lid	1	2.1E-2 Nm (2.1E-2 kgf-m)
10	Hexagonal socket headed bolt	1	2.1E-2 Nm (2.1E-2 kgf-m)
9	O-ring 1B P11	1	2.1E-2 Nm (2.1E-2 kgf-m)
8	Check valve support	1	2.1E-2 Nm (2.1E-2 kgf-m)
7	Check valve	1	2.1E-2 Nm (2.1E-2 kgf-m)
6	Cross socket headed small pan screw M5x10	2	1.9E-2 Nm (1.9E-2 kgf-m)
5	O-ring retainer	1	1.9E-2 Nm (1.9E-2 kgf-m)
4	Backup ring TSP 10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
3	O-ring 1A P10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
2	Valve rod and	(1)	
1	Return spring	(1)	
11	Return spring support	(2)	
10	O-ring retainer	(1)	
9	Backup ring	(1)	
8	O-ring 1A P10A	(1)	
7	Valve rod (Travel)	(1)	
6	Valve rod assembly (Travel)	(1)	
5	Switching part body 2A	(1)	
No.	Part name	Qty	Tightening torque
10	Hexagonal socket headed bolt M5x45	2	1.9E-2 Nm (1.9E-2 kgf-m)
9	Return spring lid	1	2.1E-2 Nm (2.1E-2 kgf-m)
8	Check valve support	1	2.1E-2 Nm (2.1E-2 kgf-m)
7	O-ring 1B P11	1	2.1E-2 Nm (2.1E-2 kgf-m)
6	Cross socket headed small pan screw M5x10	2	1.9E-2 Nm (1.9E-2 kgf-m)
5	O-ring retainer	1	1.9E-2 Nm (1.9E-2 kgf-m)
4	Backup ring TSP 10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
3	O-ring 1A P10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
2	Valve rod and	(1)	
1	Return spring	(1)	
11	Return spring support	(2)	
10	O-ring retainer	(1)	
9	Backup ring	(1)	
8	O-ring 1A P10A	(1)	
7	Valve rod (Travel)	(1)	
6	Valve rod assembly (Travel)	(1)	
5	Switching part body 2A	(1)	
No.	Part name	Qty	Tightening torque

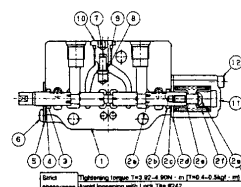
CONTROL VALVE (3)

0783 767 UA

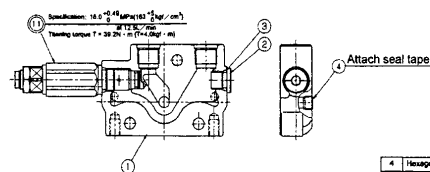
Swing switching part assembly I-I



Arm switching part assembly J-J



Pressure adjusting part assembly K-K



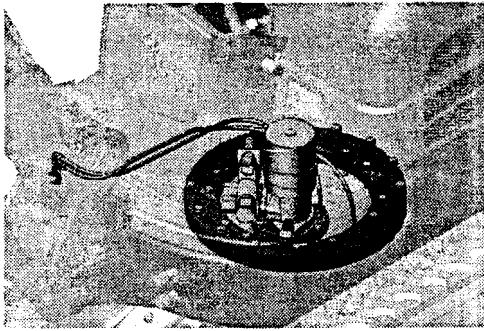
The relief valve, anti-cavitation valve, and overload relief valve shown in the partial assembly drawings in the left frame are not included as components of partial assemblies.

12	Hexagonal socket headed bolt M5x45	2	1.9E-2 Nm (1.9E-2 kgf-m)
11	Return spring lid	1	2.1E-2 Nm (2.1E-2 kgf-m)
10	Hexagonal socket headed bolt	1	2.1E-2 Nm (2.1E-2 kgf-m)
9	O-ring 1B P11	1	2.1E-2 Nm (2.1E-2 kgf-m)
8	Check valve support	1	2.1E-2 Nm (2.1E-2 kgf-m)
7	Check valve	1	2.1E-2 Nm (2.1E-2 kgf-m)
6	Cross socket headed small pan screw M5x10	2	1.9E-2 Nm (1.9E-2 kgf-m)
5	O-ring retainer	1	1.9E-2 Nm (1.9E-2 kgf-m)
4	Backup ring TSP 10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
3	O-ring 1A P10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
2	Valve rod and	(1)	
1	Return spring	(1)	
11	Return spring support	(2)	
10	O-ring retainer	(1)	
9	Backup ring	(1)	
8	O-ring 1A P10A	(1)	
7	Valve rod (Travel)	(1)	
6	Valve rod assembly (Travel)	(1)	
5	Switching part body 2A	(1)	
No.	Part name	Qty	Tightening torque
14	PF3/8 Plug	1	3.0E-2 Nm (3.0E-2 kgf-m)
13	O-ring 1B P14	1	3.0E-2 Nm (3.0E-2 kgf-m)
12	Hexagonal socket headed bolt M5x45	2	1.9E-2 Nm (1.9E-2 kgf-m)
11	Return spring lid	1	2.1E-2 Nm (2.1E-2 kgf-m)
10	Check valve support	1	2.1E-2 Nm (2.1E-2 kgf-m)
9	O-ring 1B P11	1	2.1E-2 Nm (2.1E-2 kgf-m)
8	Check valve support	1	2.1E-2 Nm (2.1E-2 kgf-m)
7	Check valve	1	2.1E-2 Nm (2.1E-2 kgf-m)
6	Cross socket headed small pan screw M5x10	2	1.9E-2 Nm (1.9E-2 kgf-m)
5	O-ring retainer	1	1.9E-2 Nm (1.9E-2 kgf-m)
4	Backup ring TSP 10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
3	O-ring 1A P10A	1	1.9E-2 Nm (1.9E-2 kgf-m)
2	Valve rod and	(1)	
1	Return spring	(1)	
11	Return spring support	(2)	
10	O-ring retainer	(1)	
9	Backup ring	(1)	
8	O-ring 1A P10A	(1)	
7	Valve rod (Travel)	(1)	
6	Valve rod assembly (Travel)	(1)	
5	Switching part body 2A	(1)	
No.	Part name	Qty	Tightening torque

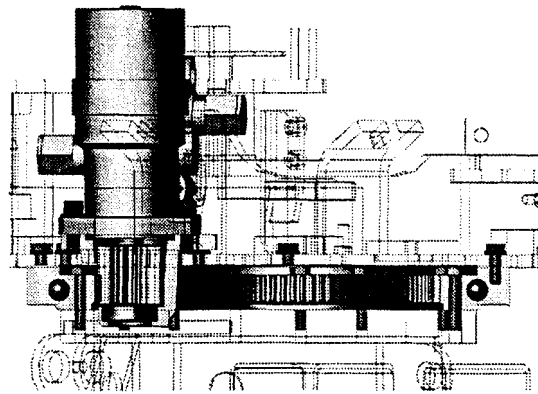
SWING DRIVE DEVICE & BEARING

F320 130 01

F320 129 01



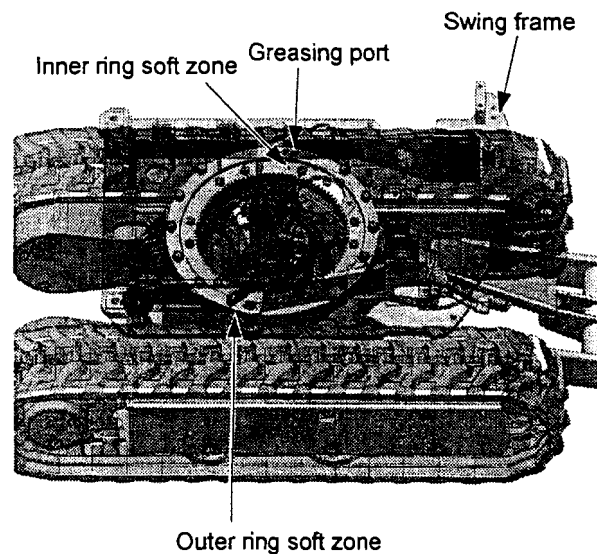
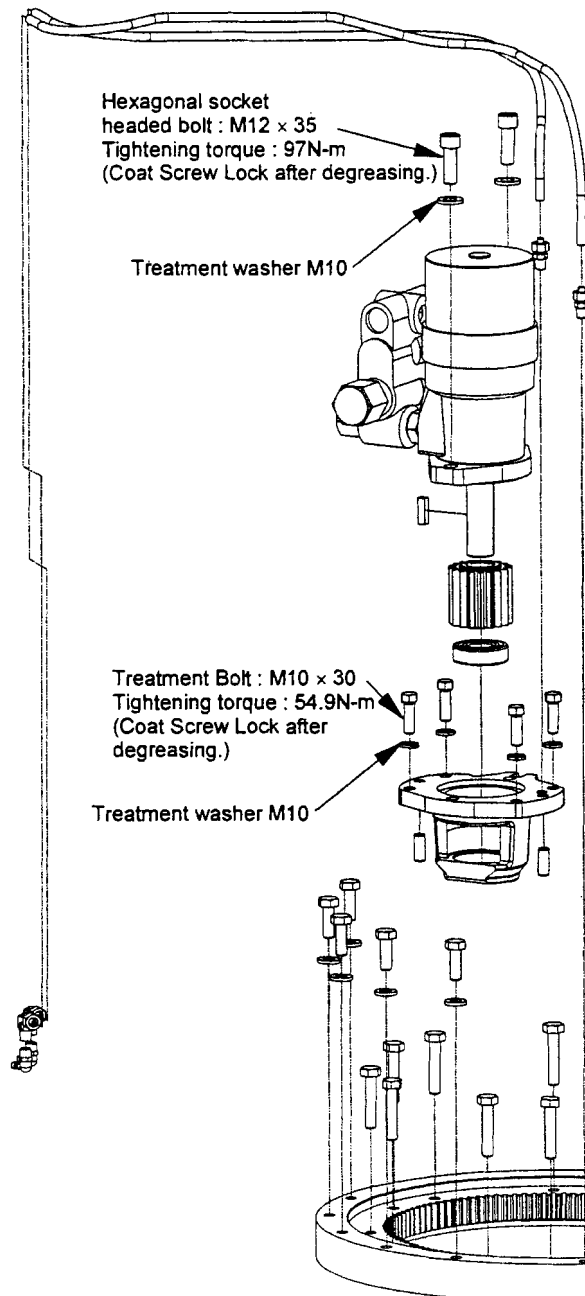
Layout



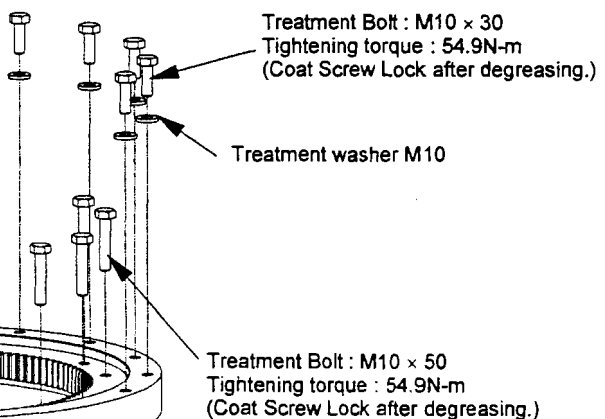
Assembly drawing (cross-sectional)

Note:

For bolts of the swing motor and swing bearing, "special tightening" is designated in place.



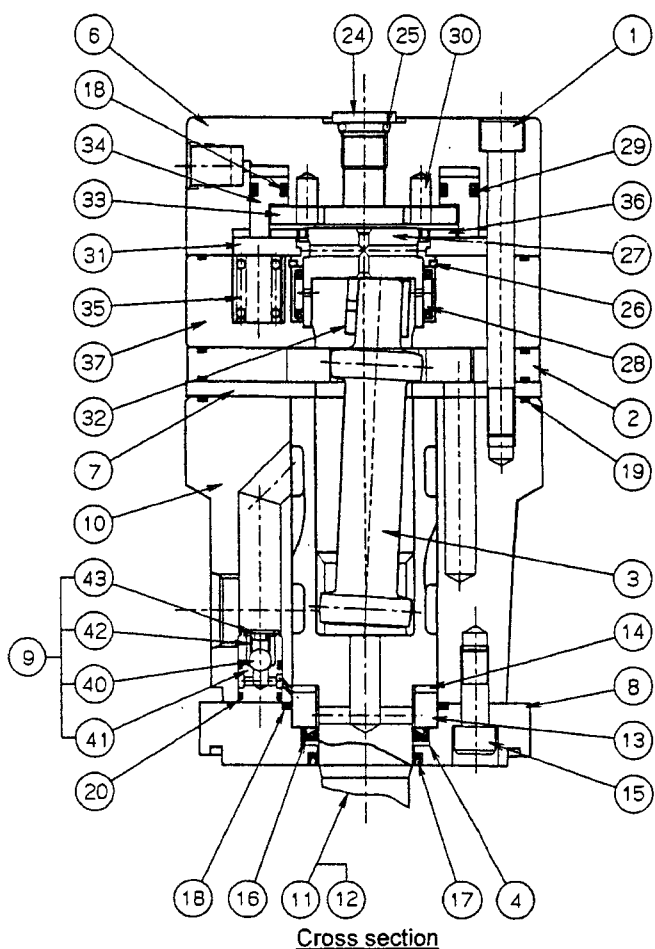
Note: Assemble the swing bearing soft zone and greasing port as shown above.



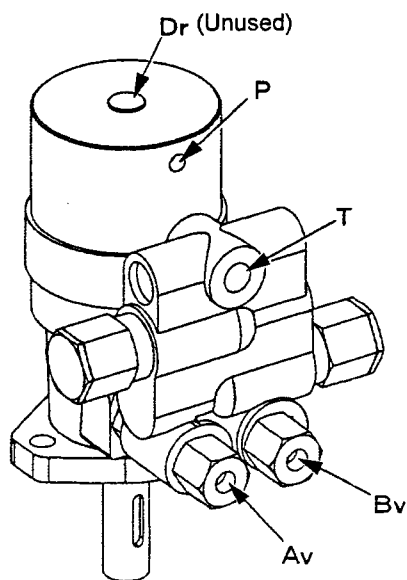
Disassembly drawing

SWING MOTOR ASS'Y

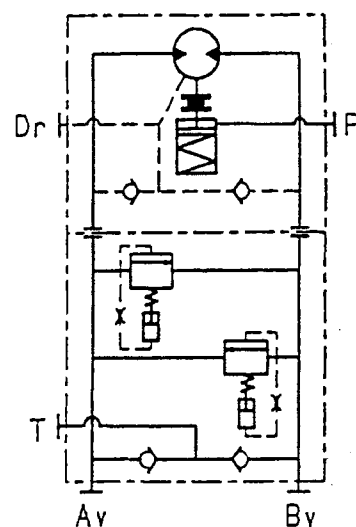
0781 195 UA



No.	Part name	Q'ty	No.	Part name	Q'ty
1	Screw	7	21	Nameplate	1
2	Di-roller assembly		22	Rivet	2
3	Drive		24	Plug end cap	1
4	Backup washer	1	25	O-ring	1
			26	Stop ring	1
6	End cap	1	27	Wheel gear	1
7	Spacer plate	1	28	Needle bearing	1
8	Flange mount	1	29	O-ring	1
9	Ball check sub-assembly	2	30	Spring pin	2
10	Housing	1	31	Bushing plate	1
11	Shaft output		32	Bushing	1
12	Key	1	33	Mating plate	1
13	Thrust bearing race	1	34	Piston	1
14	Bearing thrust needle	1	35	Coil spring	7
15	Screw	4	36	Friction plate	1
16	Oil seal		37	Bearing housing	1
17	Dust seal	1	40	Ball	(2)
18	O-ring	2	41	Body	(2)
19	O-ring	4	42	Spring	(2)
20	O-ring	(4)	43	Washer	(2)



External view



Hydraulic symbols

STRUCTURE & FUNCTION

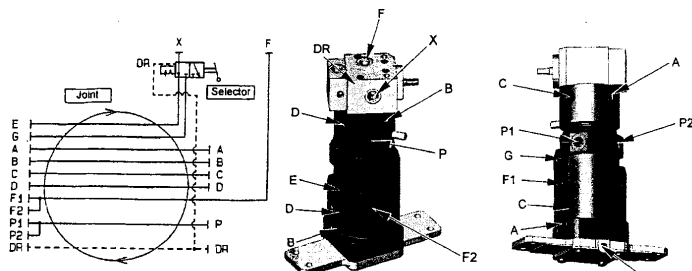
9NX

Piping assembly: F34 220 01

Rotary joint assembly - Lower piping assembly

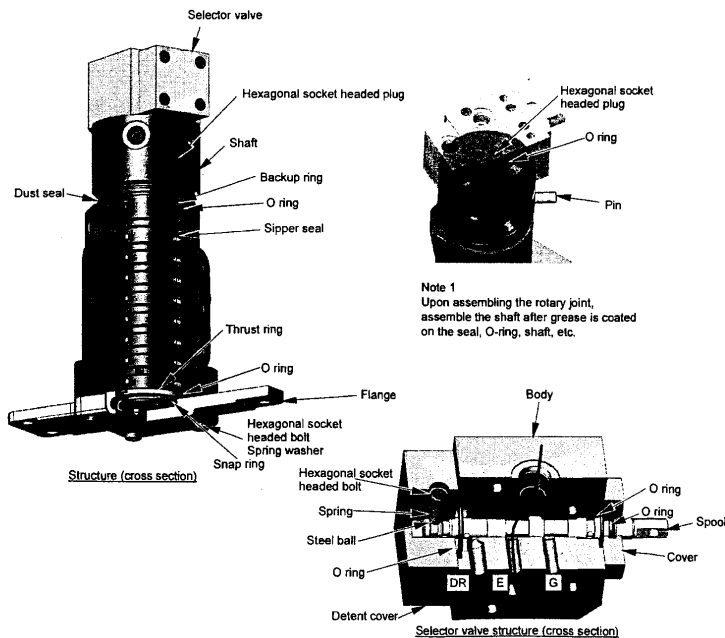
Rotary joint assembly:

0713 434 UA



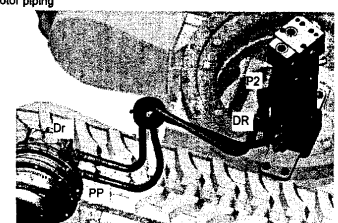
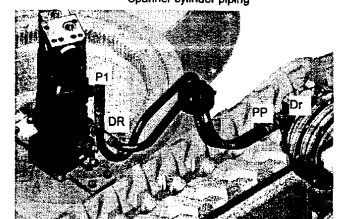
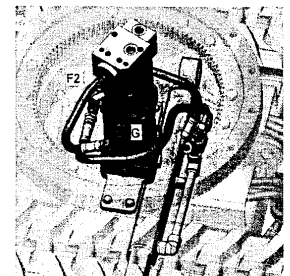
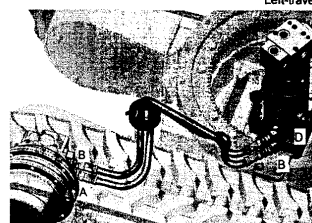
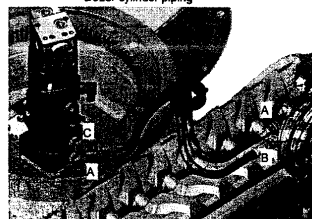
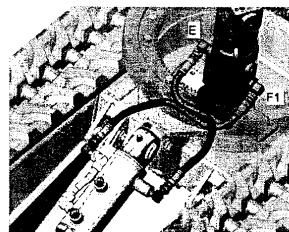
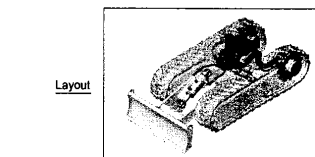
Circuit diagram

Rotary joint external view



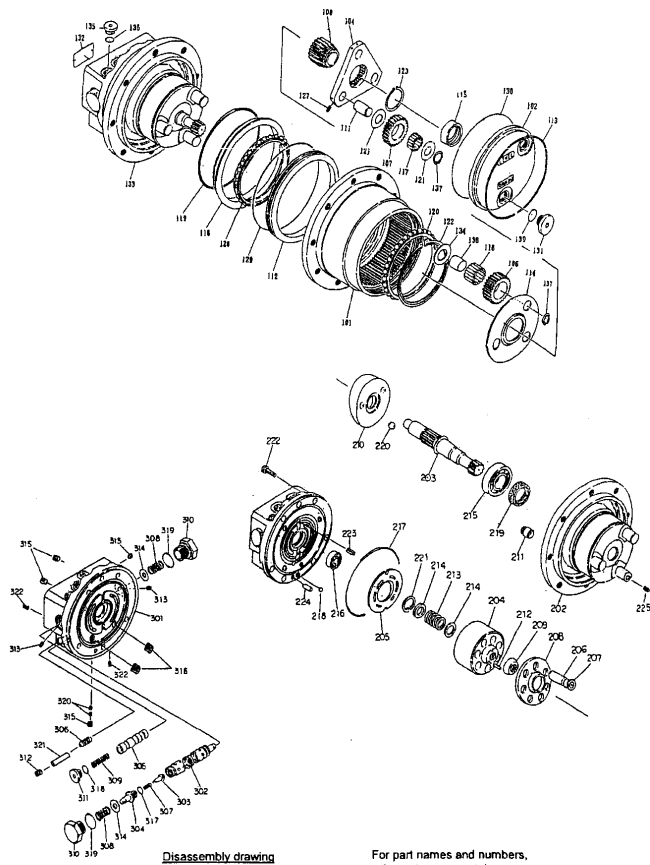
Note 1
Upon assembling the rotary joint,
assemble the shaft after grease is coated
on the seal, O-ring, shaft, etc.

Layout



STRUCTURE & FUNCTION

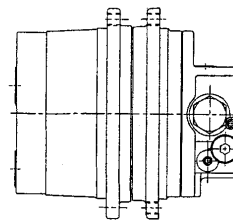
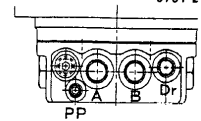
91



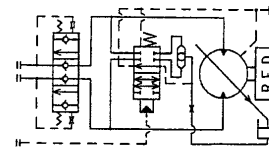
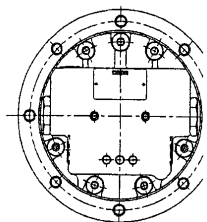
TRAVEL MOTOR

0781 2

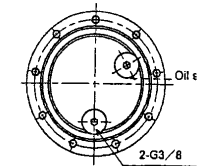
Specified oil	Gear oil, API type, class CD, SAE30
Volume	0.33L



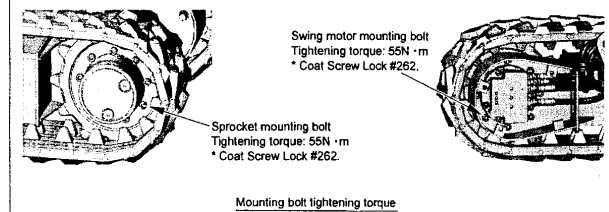
External view



Hydraulic circuit diagram

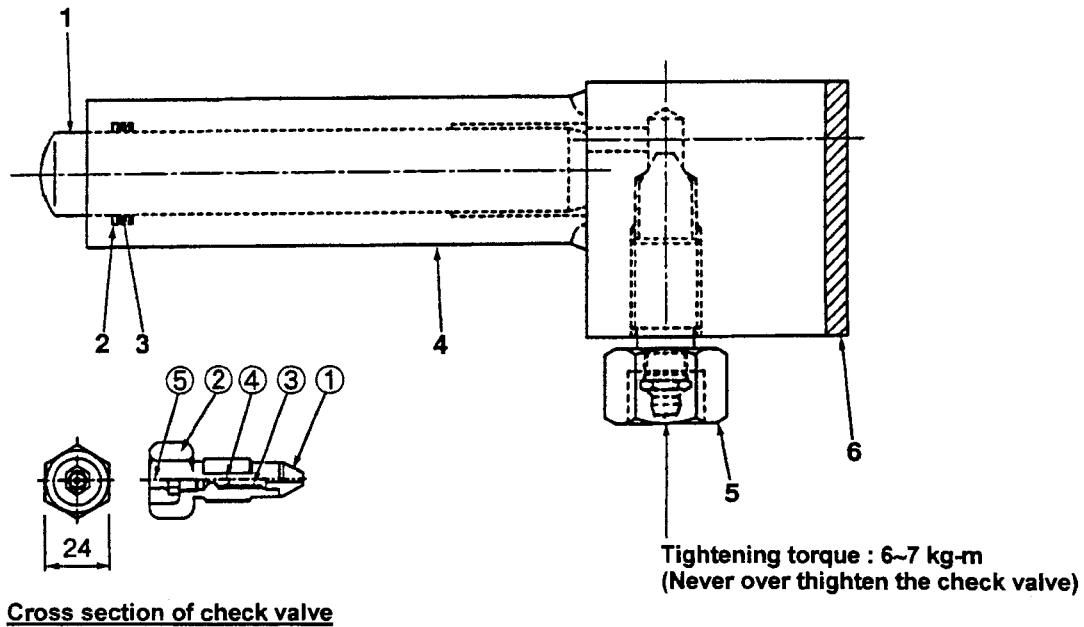


Lubricant supply/drain port



CRAWLER SHOE ADJUSTING DEVICE

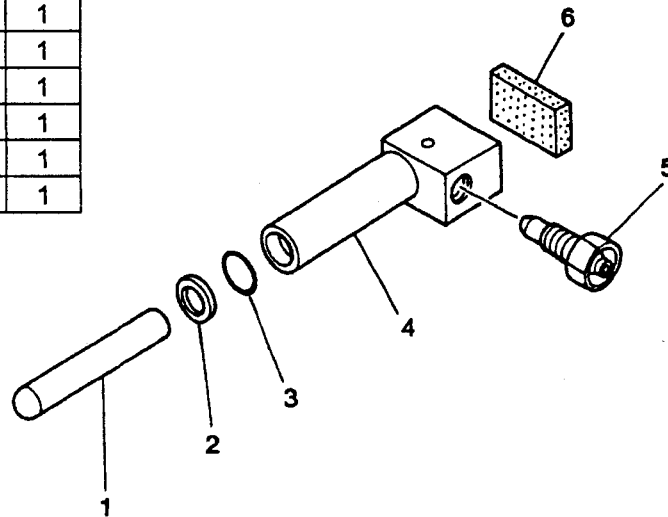
5301 234 00



Notes

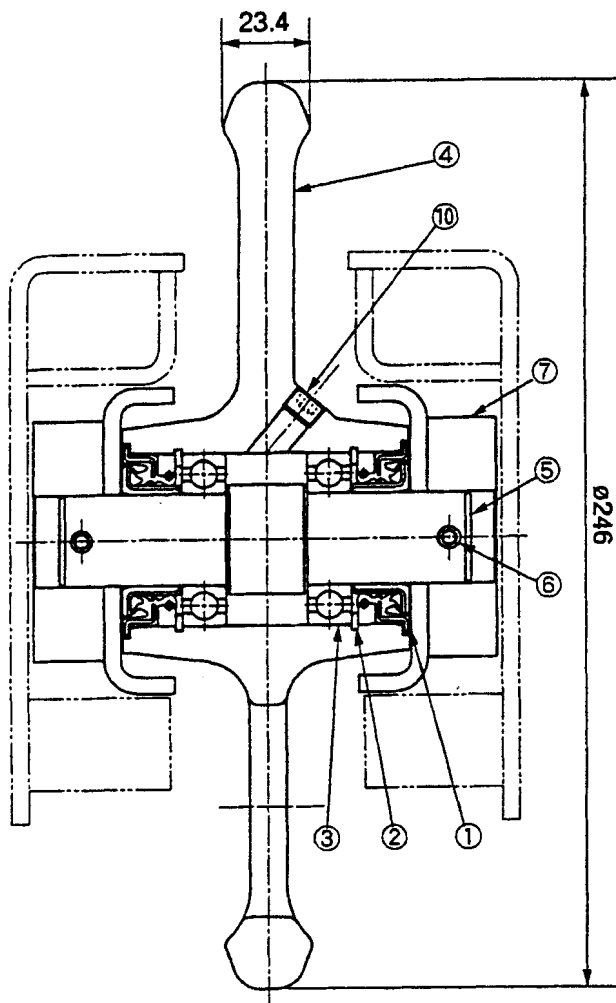
- 1) Position the check valve to outside the crawler frame with install the desrice.
- 2) Loosen the check valve (one turn maximum) and escap the internal grease when loosening the shoe. Never loosen the grease fitting. Do not watch the check valve to see if grease is escaping.

Key	Description	Q'ty
1	Piston	1
2	Back-up Ring	1
3	"O" Ring	1
4	Grease Cylinder	1
5	Check Valve	1
6	Rubber Plate	1



FRONT IDLER ASS'Y

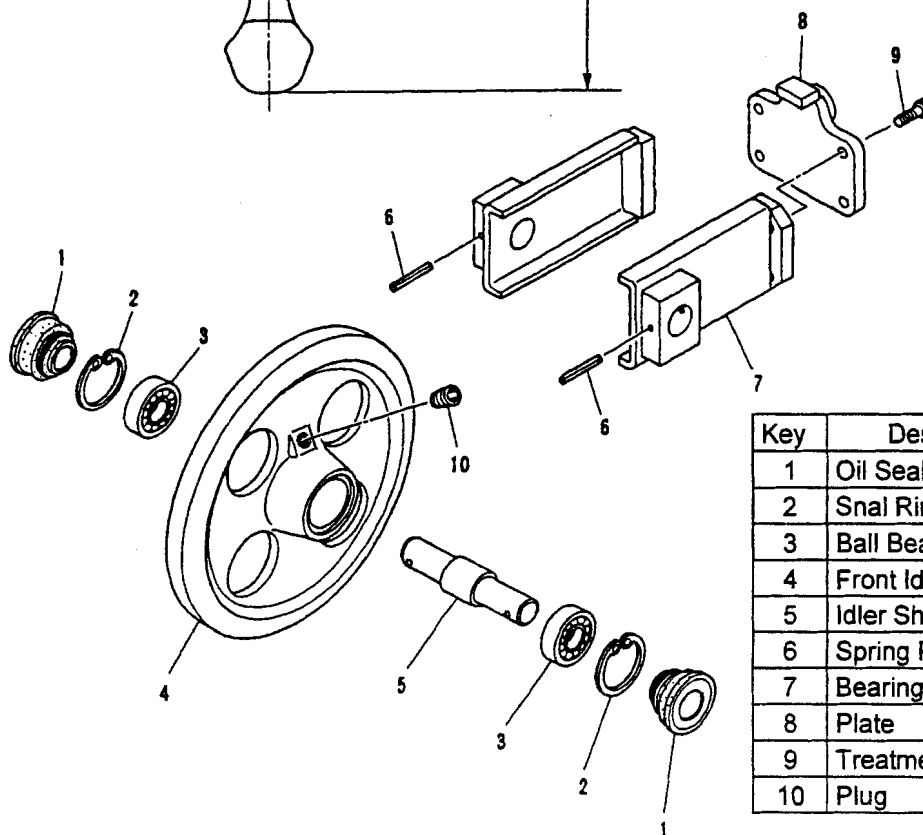
F320 130 01



Notes:

1. Install the plug after fill gear oil (SAE#90-API-GL4) 20CC
2. Inspect oil leak : Apply air press 1.0 kgf/cm² to oil gill hole ⑩ after assembly.

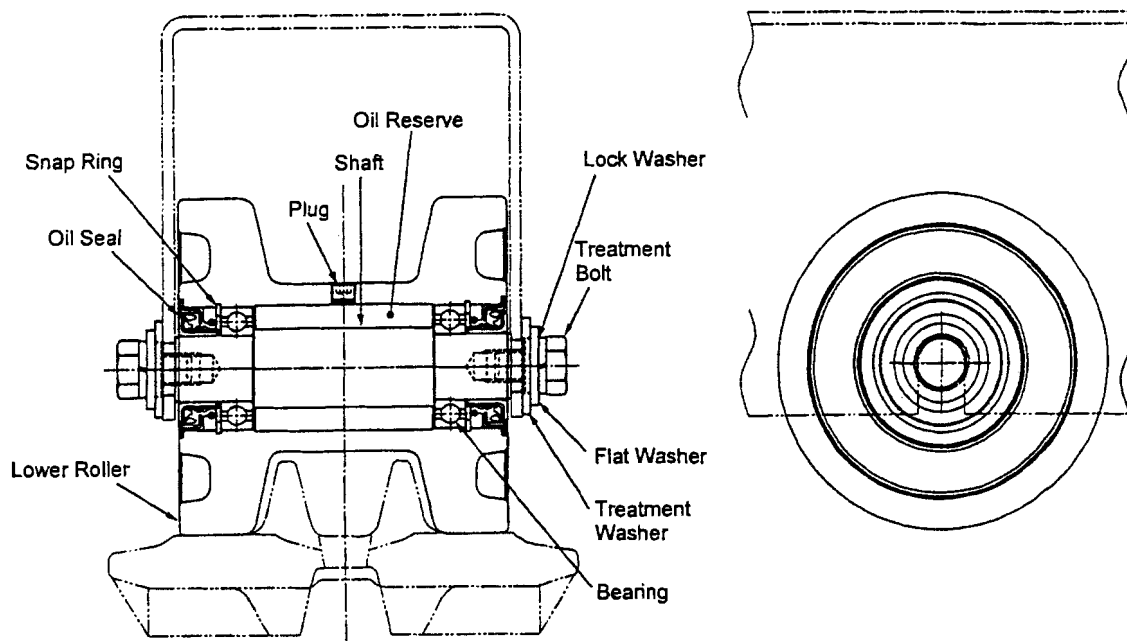
Recommended oil	Q'ty
API — GL4 SAE#90	20 cc



Key	Description	Q'ty
1	Oil Seal	2
2	Snal Ring	2
3	Ball Bearing	2
4	Front Idler	1
5	Idler Shift	1
6	Spring Pin	2
7	Bearing Block	2
8	Plate	1
9	Treatment Bolt	4
10	Plug	1

LOWER ROLLER ASS'Y

F300 007 00



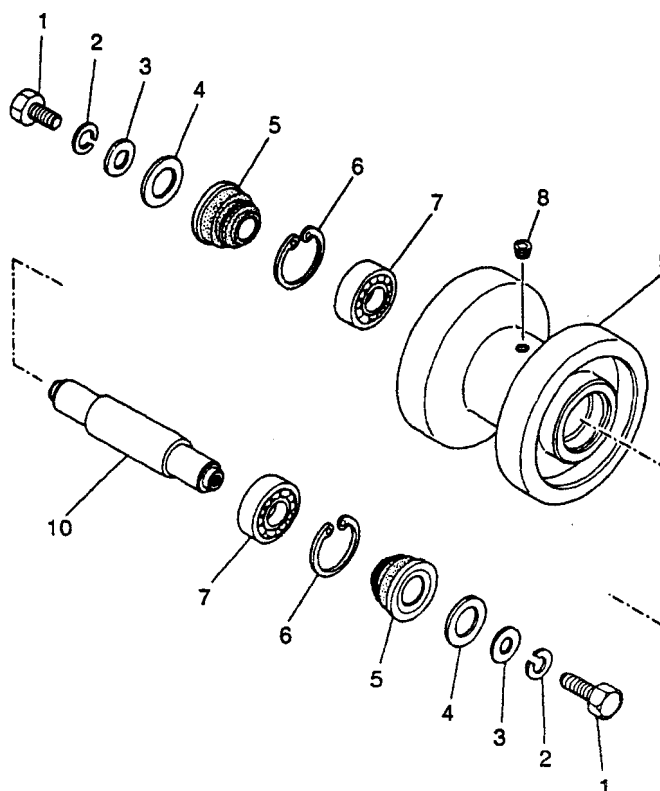
Cross Section of Lower Roller

Notes:

1. Install the plug after fill gear oil (SAE#90-API-GL4) 70CC
2. Inspect oil leak : Apply air press 1.0 kgf/cm² to oil gill hole ① after assembly.

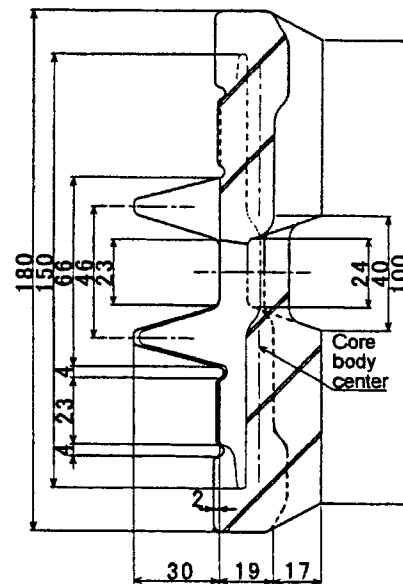
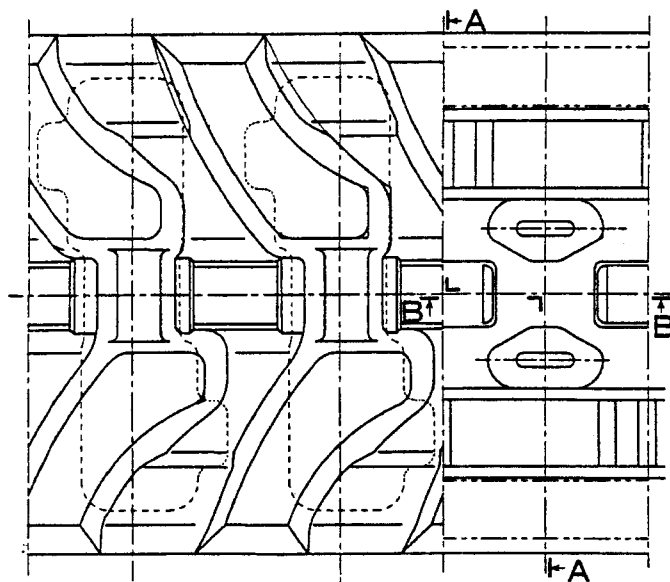
Rubricating oil	Q'ty
API - GL4 SAE#90	70 cc

Key	Description	Q'ty
1	Treatment Bolt	2
2	Lock Washer	2
3	Flat Washer	2
4	Treatment Washer	2
5	Oil Seal	2
6	Snap Ring	2
7	Bearing	2
8	Plug	1
9	Lower Roller	1
10	Shaft	1

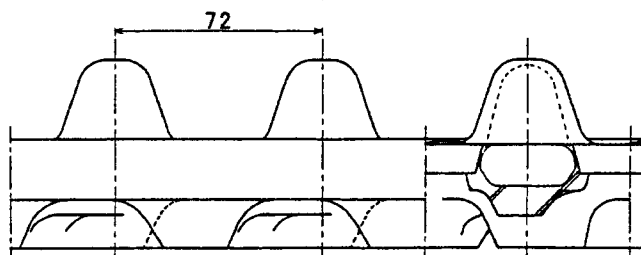


RUBBER CRAWLER SHOE ASSEMBLY

0653 957 UA
 (180 × 37 × 72)



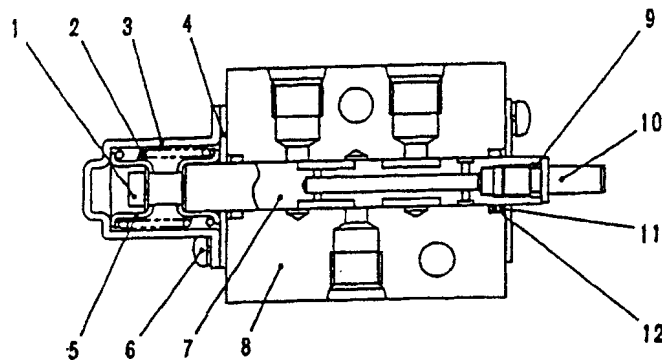
Sec. A-A



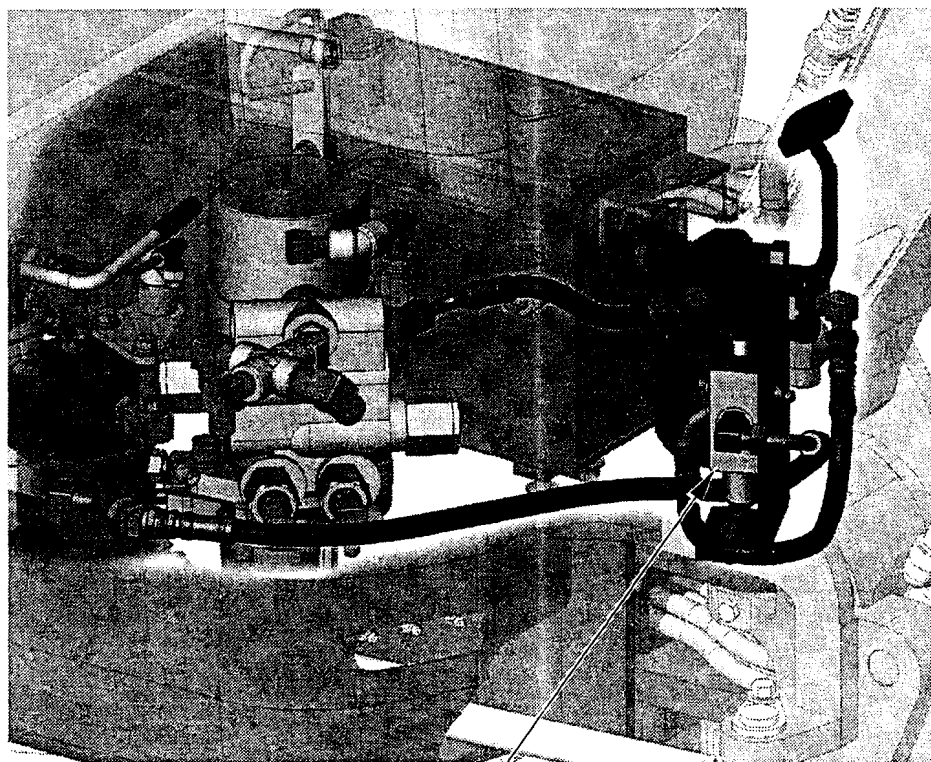
Sec. B-B

TRAVEL SPEED SHIFT VALVE ASS'Y

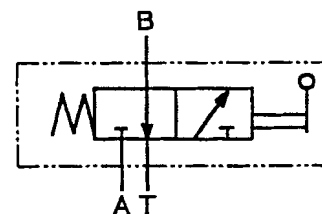
0756 905 UA



Key	Description	Q'ty
1	Bolt	1
2	Spring	1
3	Spring Cover	1
4	Seal Retainer	2
5	Spring Holder	2
6	Pan Head Screw (W/L.W)	4
7	Spool	1
8	Body	1
9	"O" Ring	1
10	Spool Head	1
11	Back-up Ring	2
12	"O" Ring	2



Travel Speed Shift Valve



Hydraulic symbol

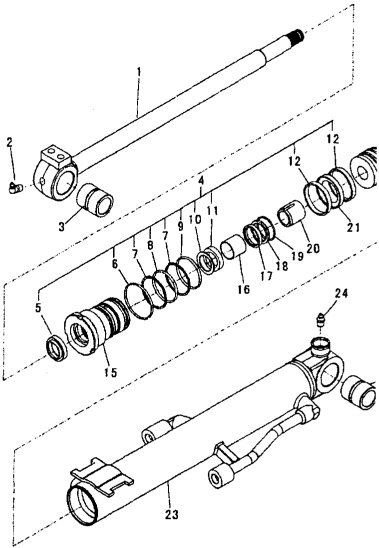
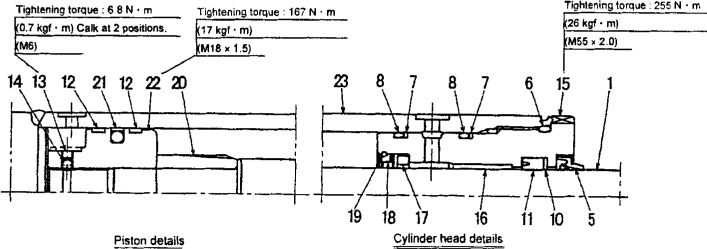
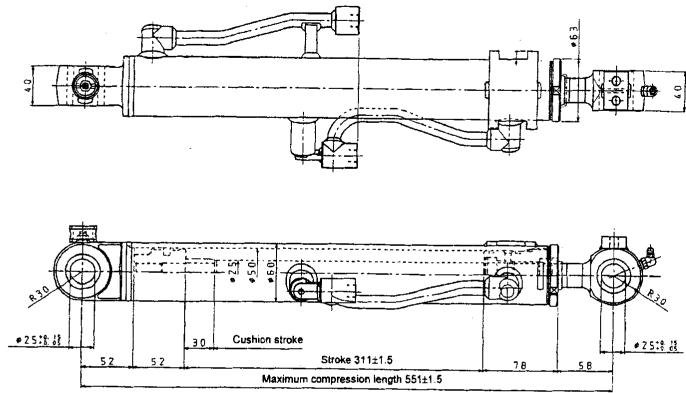
STRUCTURE & FUNCTION

0782
Weight

Boom

BOOM CYLINDER ASS'Y

Key	Description	Qty
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	1
9	"O" Ring	1
10	Back-up Ring	1
11	"U" Ring	1
12	Back-up Ring	2
13	Set Screw	1
14	Steel Ball	1
15	Cylinder Head	1
16	Bushing	1
17	Cushion Bearing	1
18	Spacer	1
19	Stopper	1
20	Cushion Bearing	1
21	Wear Ring	1
22	Piston	1
23	Cylinder Tube Ass'y	1
24	Grease Nipple	1
25	Bushing	1



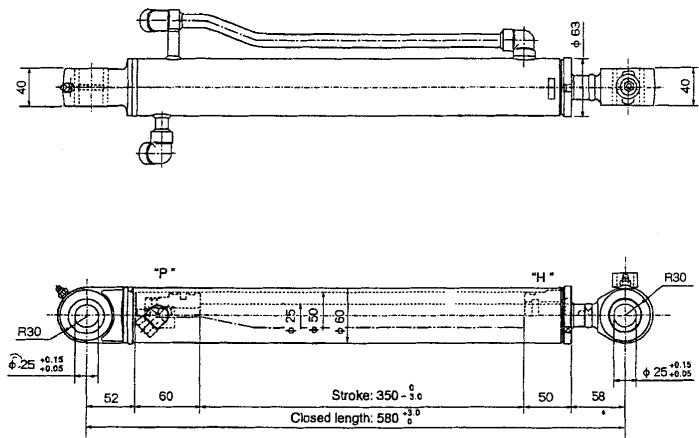
STRUCTURE & FUNCTION

91

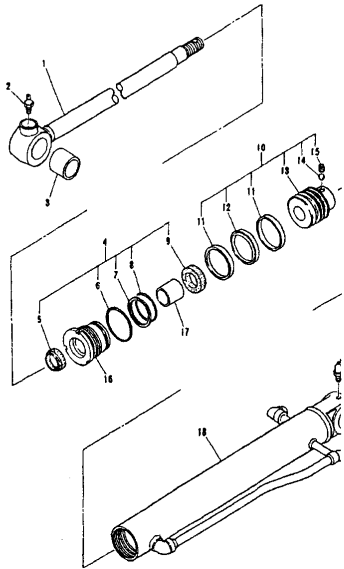
Am

ARM CYLINDER ASS'Y

0759

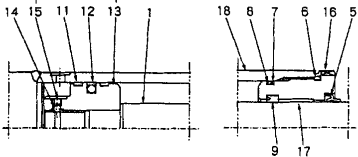


Key	Description	Q'ty
1	Piston Rod Ass'y	1
2	Grease Nipple	1
3	Bushing	1
4	Seal Kit	1
5	Wear Ring	1
6	*O* Ring	1
7	Back-up Ring	1
8	*O* Ring	1
9	*U* Ring	1
10	Piston Ass'y	1
11	Slide Ring	2
12	Seal Ring ass'y	1
13	Piston	1
14	Steel Ball	1
15	Set Screw	1
16	Cylinder Head	1
17	Bushing	1
18	Cylinder tube Ass'y	1
19	Grease Nipple	1
20	Bushing	1



Tightening torque: 9.8 N·m
1.0 kgf·m (M6 × 1.0)
Locking 2 points with punch

Tightening torque: 147 N·m
15 kgf·m (M16 × 1.5)



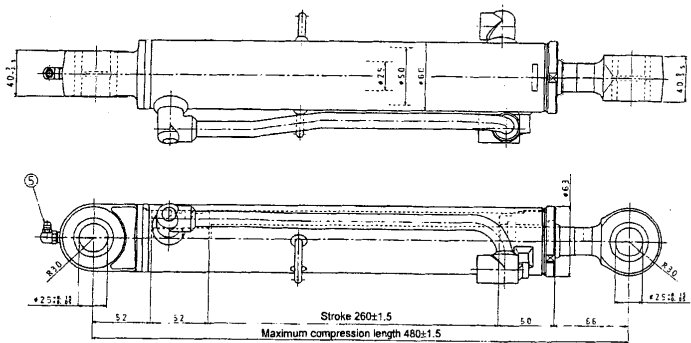
DETAIL "P"

DETAIL "H"

STRUCTURE & FUNCTION

9NX

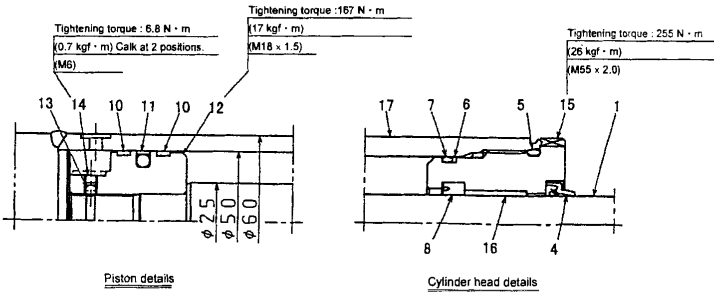
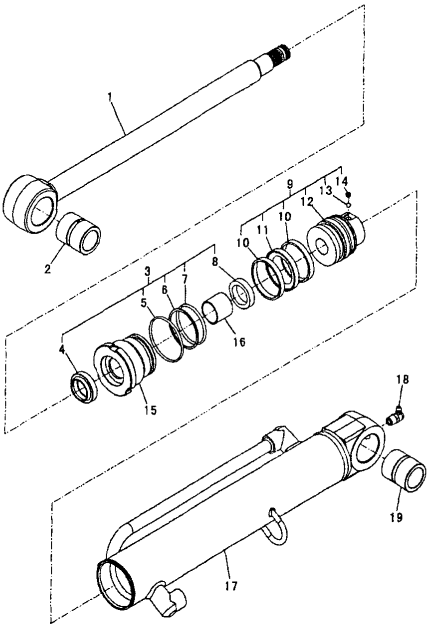
Bucket



Key	Description	Q'ty
1	Piston Rod Ass'y	1
2	Bushing	1
3	Seal Kit	1
4	Dust Seal	1
5	"O" Ring	1
6	Back-up Ring	1
7	"O" Ring	1
8	"U" Ring	1
9	Piston Ass'y	1
10	Slide Ring	2
11	Seal Ring Ass'y	1
12	Piston	1
13	Steel Ball	1
14	Set Screw	1
15	Cylinder Head	1
16	Bushing	1
17	Cylinder Tube Ass'y	1
18	Grease Nipple	1
19	Bushing	1

BUCKET CYLINDER ASS'Y

0782 359 UA
Weight : 7.5 kg



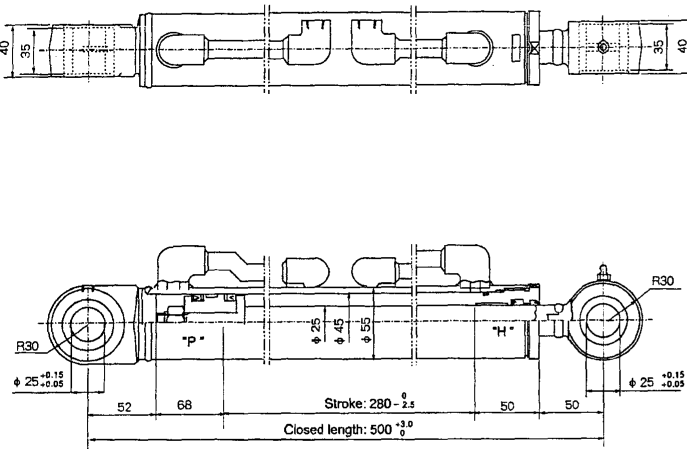
STRUCTURE & FUNCTION

9NX

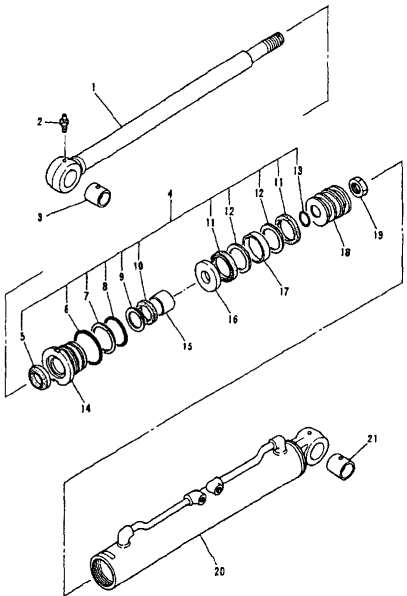
Boom Swing

BOOM SWING CYLINDER ASS'Y

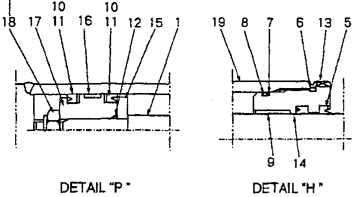
0752 361 UA



Key	Description	Q'ty
1	Piston Rod Ass'y	1
2	Grease Nipple	1
3	Bushing	1
4	Seal Kit	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	"U" Ring	2
12	Back-up Ring	2
13	"O" Ring	1
14	Cylinder Head	1
15	Bushing	1
16	"U" Ring Holder	1
17	Wear Ring	1
18	Piston	1
19	"U" Nut	1
20	Cylinder Tube Ass't	1
21	Bushing	1



Tightening torque: 176 N·m
16 kgf·m (M16 x 1.5)



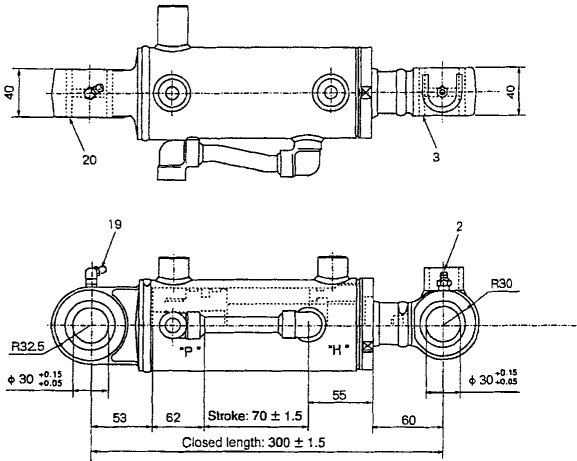
STRUCTURE & FUNCTION

9NX

0759 046 UA

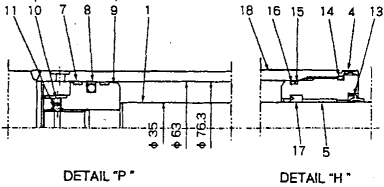
Blade

BLADE CYLINDER ASS'Y

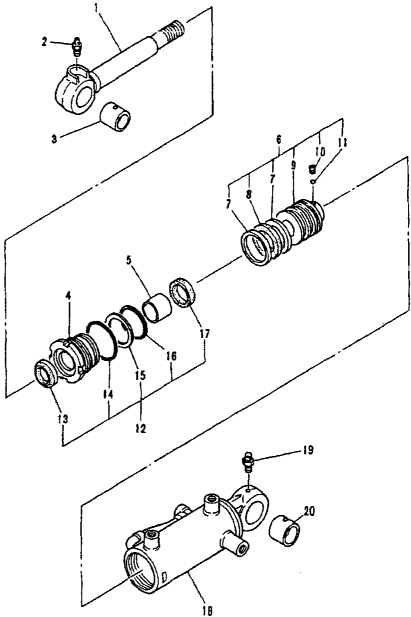


Tightening torque: 9.8 N·m
1.0 kgf·m (M6 × 1.0)
Locking 2 points with punch

Tightening torque: 397 N·m
40 kgf·m (M24 × 1.5)



Key	Description	Q'ty
1	Piston Rod Ass'y	1
2	Grease Nipple	1
3	Bushing	1
4	Cylinder Head	1
5	Bushing	1
6	Piston Ass'y	1
7	Slide Ring	2
8	Seal Ring Ass'y	1
9	Piston	1
10	Set Screw	1
11	Steel Ball	1
12	Seal Kit	1
13	Wiper Ring	1
14	"O" Ring	1
15	Back-up Ring	1
16	"O" Ring	1
17	"U" Ring	1
18	Cylinder Tube Ass'y	1
19	Grease Nipple	1
20	Bushing	1

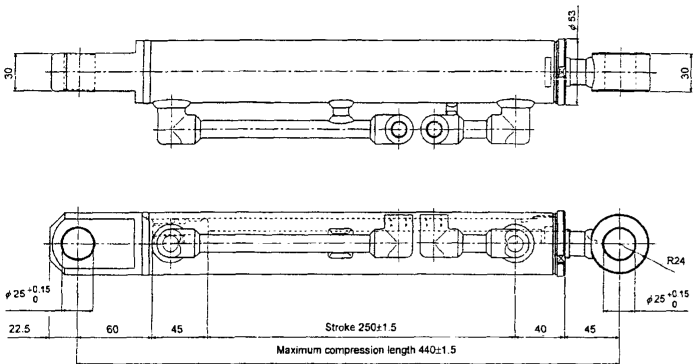


STRUCTURE & FUNCTION

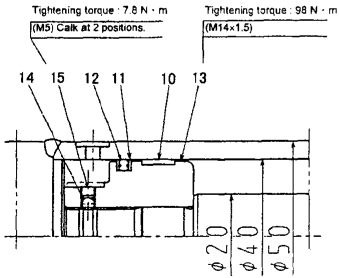
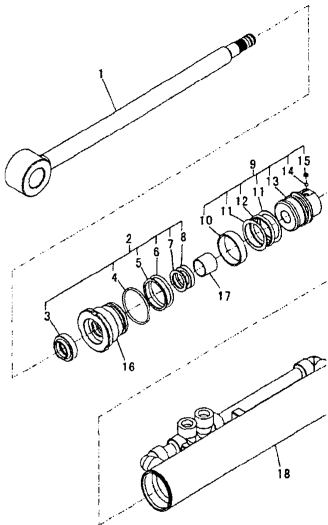
9

SPANNER CYLINDER ASS'Y

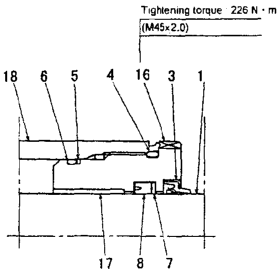
0782 3
Weigh



Key	Description	Q'ty
1	Piston Rod Ass'y	1
2	Seal Kit	1
3	Dust Seal	1
4	"O" Ring	1
5	Back-up Ring	1
6	"O" Ring	1
7	Back-up Ring	1
8	"U" Ring	1
9	Piston Ass'y	1
10	Wear Ring	1
11	Back-up Ring	2
12	Seal	1
13	Piston	1
14	Steel Ball	1
15	Set Screw	1
16	Cylinder Head	1
17	Bushing	1
18	Cylinder Tube Ass'y	1



Piston details

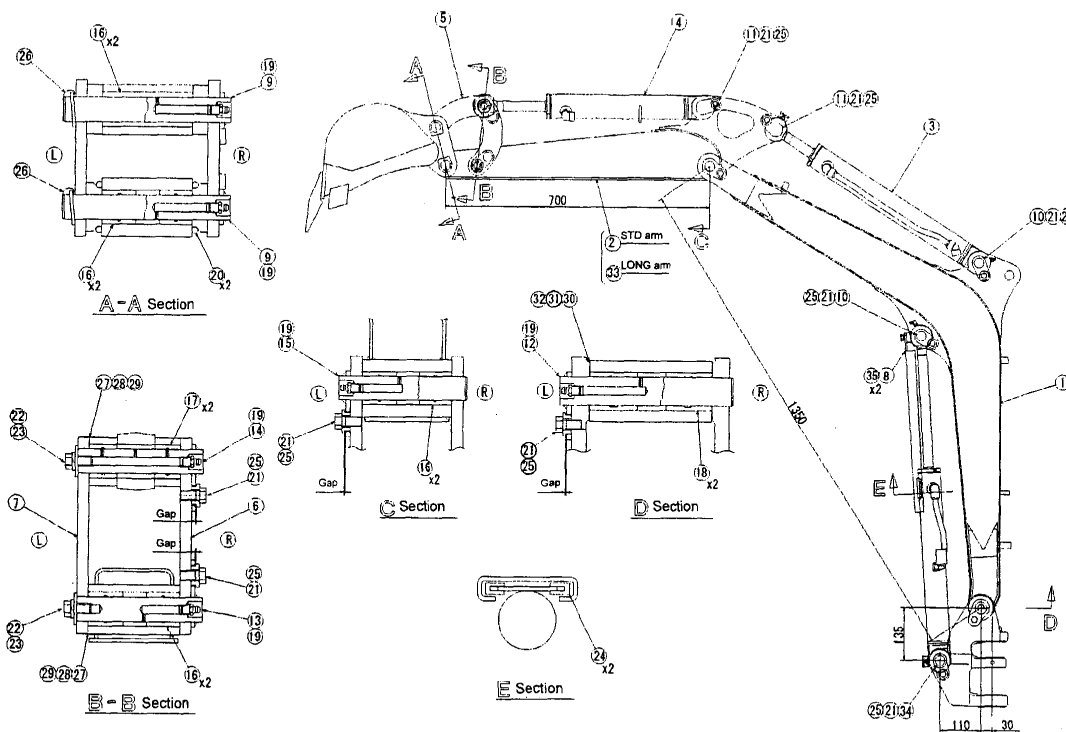


Cylinder head details

STRUCTURE & FUNCTION

F38E

ATTACHMENT ASS'Y



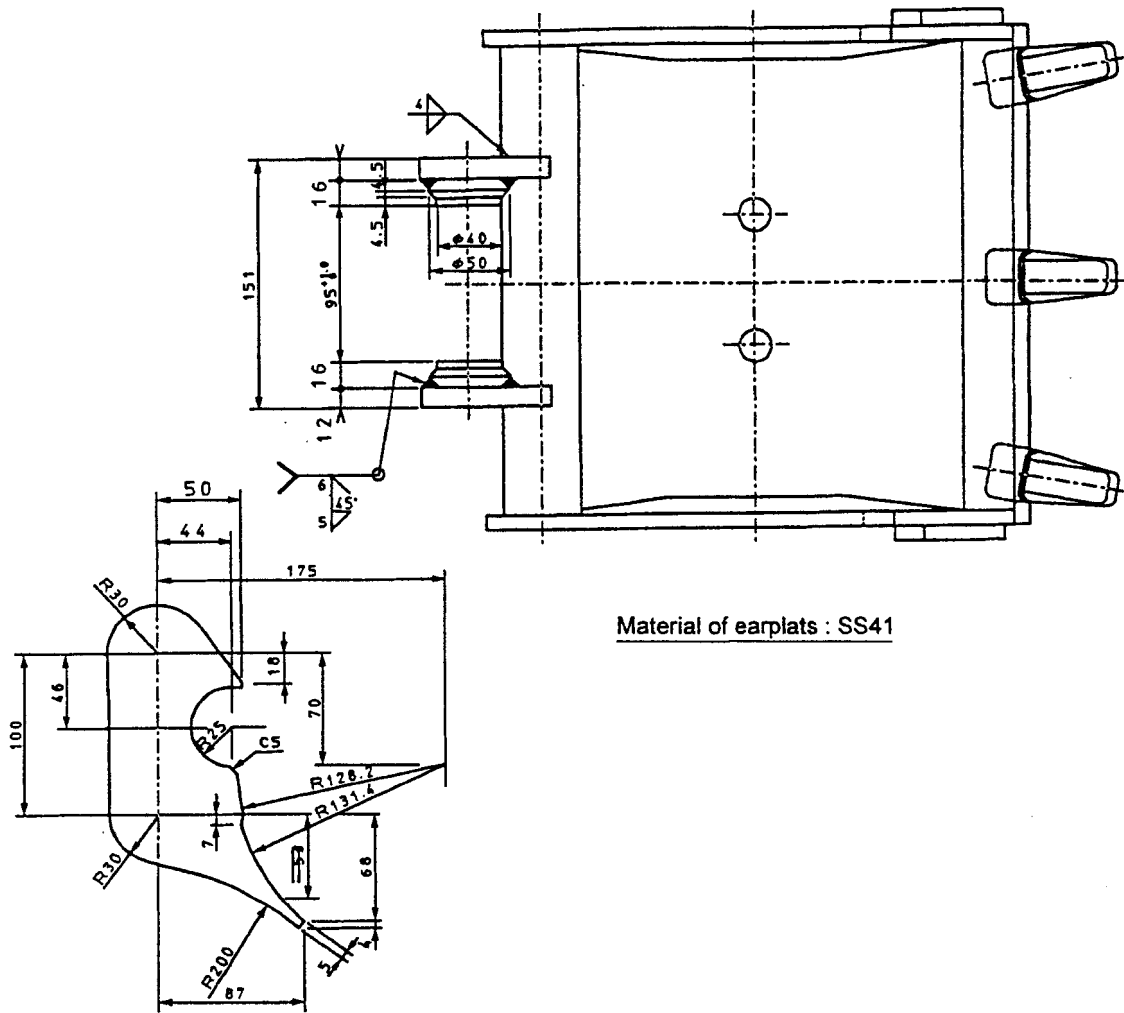
Key	Description	Q'ty	Spec
35	Bolt, F - SEMS (SW)	2	M0×16 F
34	Pin, Wing	1	φ25×144
33	Arm LONG	1	LONG L
32	Washer	1	1.6t φ30
31	Washer	2	1.2t φ30
30	Washer	2	0.8t φ30
29	Washer	7	1.6t φ25
28	Washer	10	1.2t φ25
27	Washer	10	0.8t φ25
26	Pin, Ring	2	
25	Bushing	9	φ24×8.5
24	Stay	2	
23	Washer filler	2	M10
22	Bolt, F - SEMS (SW)	2	M10×20
21	Bolt, F - HT (S)	9	M10×20
20	Ring, O	2	
19	Fitting	6	JIS-B15
8	Bushing	2	φ40×50
7	Bushing	2	φ35×27
16	Bushing	8	φ35×35
15	Pin, Wing	1	φ25×135
14	Pin, Wing	1	φ25×13
13	Pin, Wing	1	φ25×13
12	Pin, Wing	1	φ30×18t
11	Pin, Wing	2	φ25×93
10	Pin, Wing	2	φ25×10t
9	Pin, Wing	2	φ25×17t
8	Cover	1	
7	Link, Arm (L)	1	
6	Link, Arm (R)	1	
5	Link, Bucket	1	
4	Bucket CYL	1	F60163
3	Arm CYL	1	584956
2	Arm	1	STD L=
1	Boom	1	

Note:
Washers # 27 through 32 are used for looseness adjustment and the quantities are for reference only.
Use the necessary quantity for assembly according to field adjustment.
The gap should be 0.5 mm or smaller.

BUCKET ASS'Y

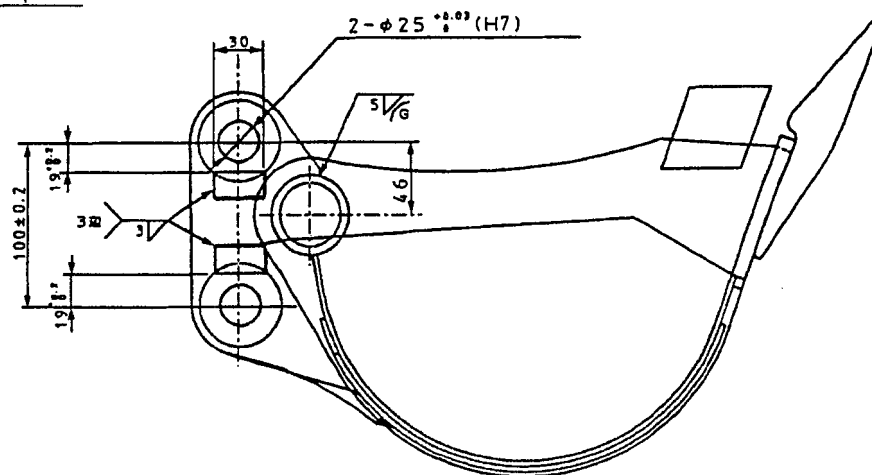
4271 092

(Dimension of the ar plates)



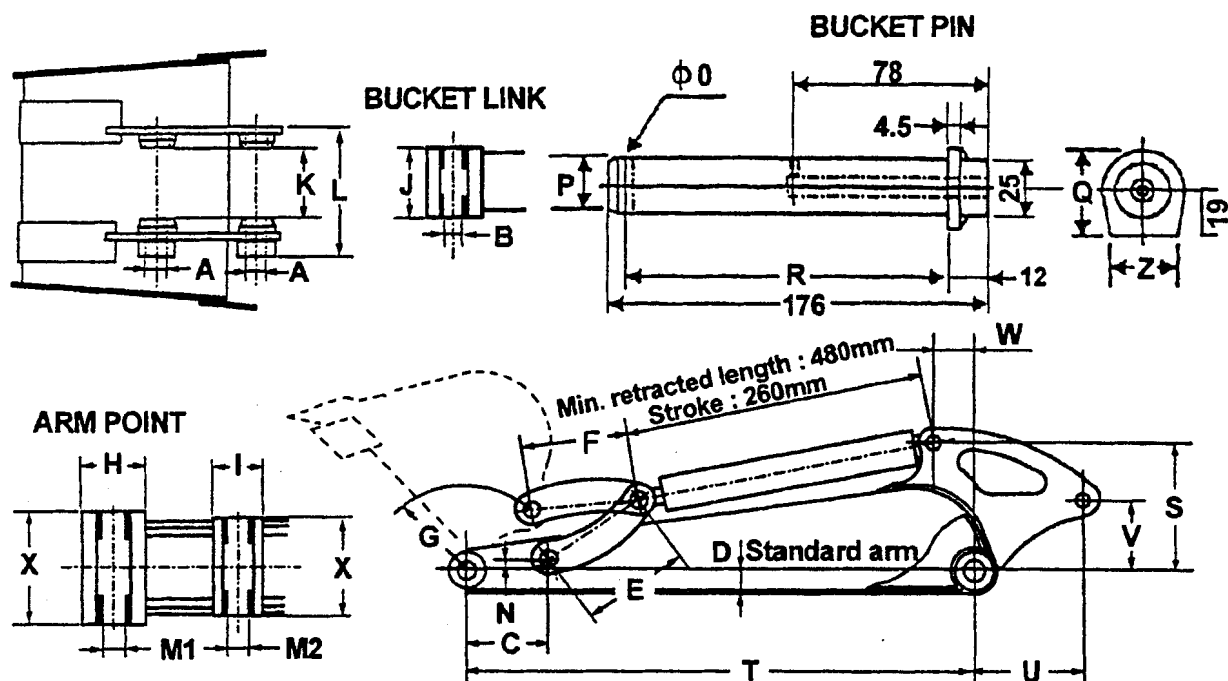
Material of earplates : SS41

Detail of ear plates



ATTACHMENT DATA

ATTACHMENTS INSTALLATION DATA



Key	A(hole)	B(hole)	C	D	E	F	G	H	I
Dimensions (mm)	φ25	φ25	85	34.5	52.5	140	100	φ60	φ50.8
Key	J	K	L	M1(hole)	M2(hole)	N	O	P	Q
Dimensions (mm)	95	95	151	φ25	φ25	0	φ6.7	φ25	36.5
Key	R	S	T	U	V	W	X	Z	
Dimensions (mm)	157	150	700	177.5	95	-20	95	30	

HYDRAULIC SYSTEM (when details are request, see for SERVICE GUIDE)

1	Type of pump		Fixes gear
2	Max. flow	L/min	11.1 × 2
3	Relief set pressure	MPa (kgf/cm ²)	16.2 (165)
4	Type of hyd. tank		Pressurized totally enclosed type
5	Oil cooler		Non cooler
6	Service ports		Std. equipped

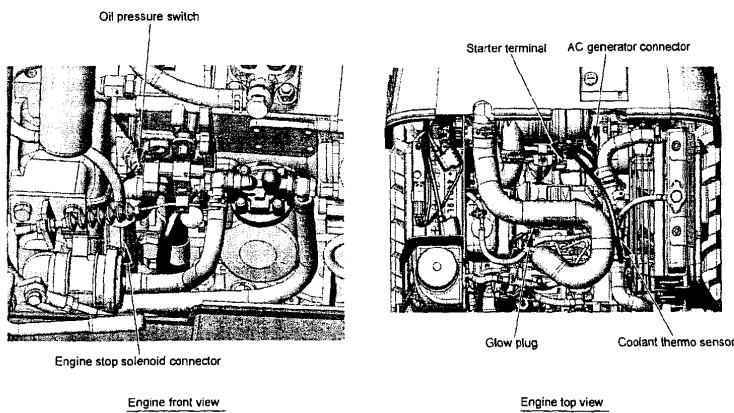
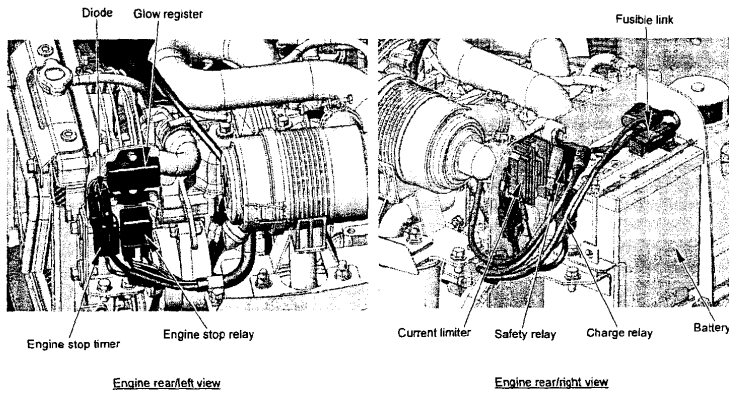
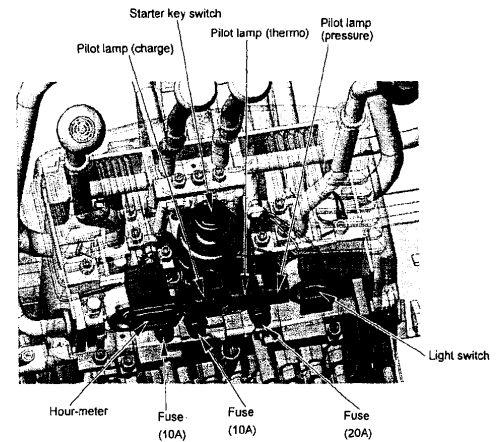
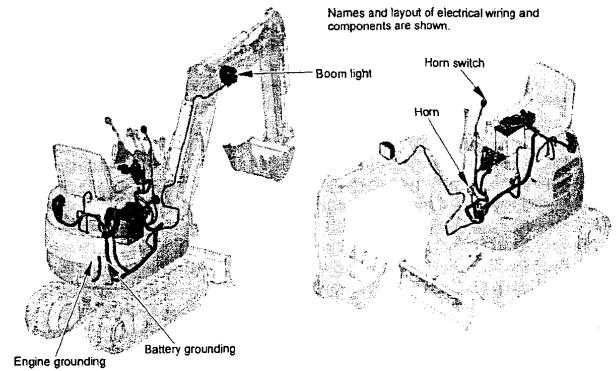
STRUCTURE & FUNCTION

9NX

F366 338 0*

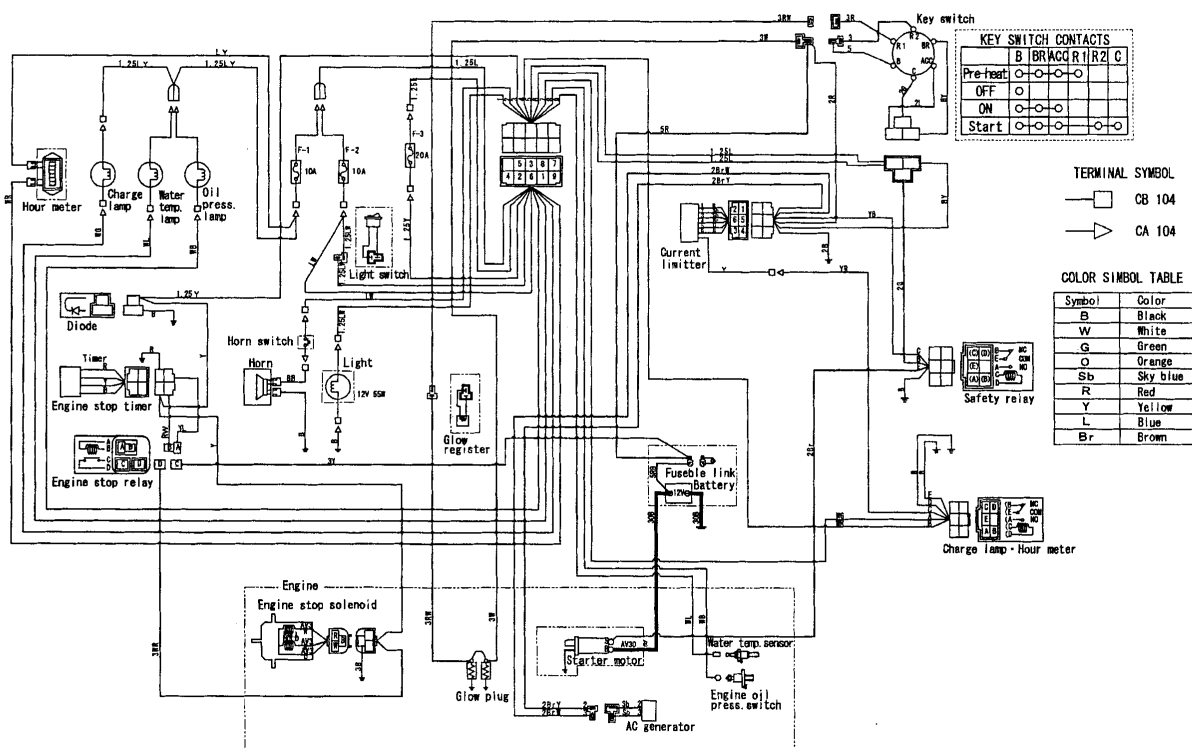
ELECTRICAL WIRING & LOCATIONS

Names and layout of electrical wiring and components are shown.



STRUCTURE & FUNCTION

ELECTRICAL WIRING SYSTEM DIAGRAM

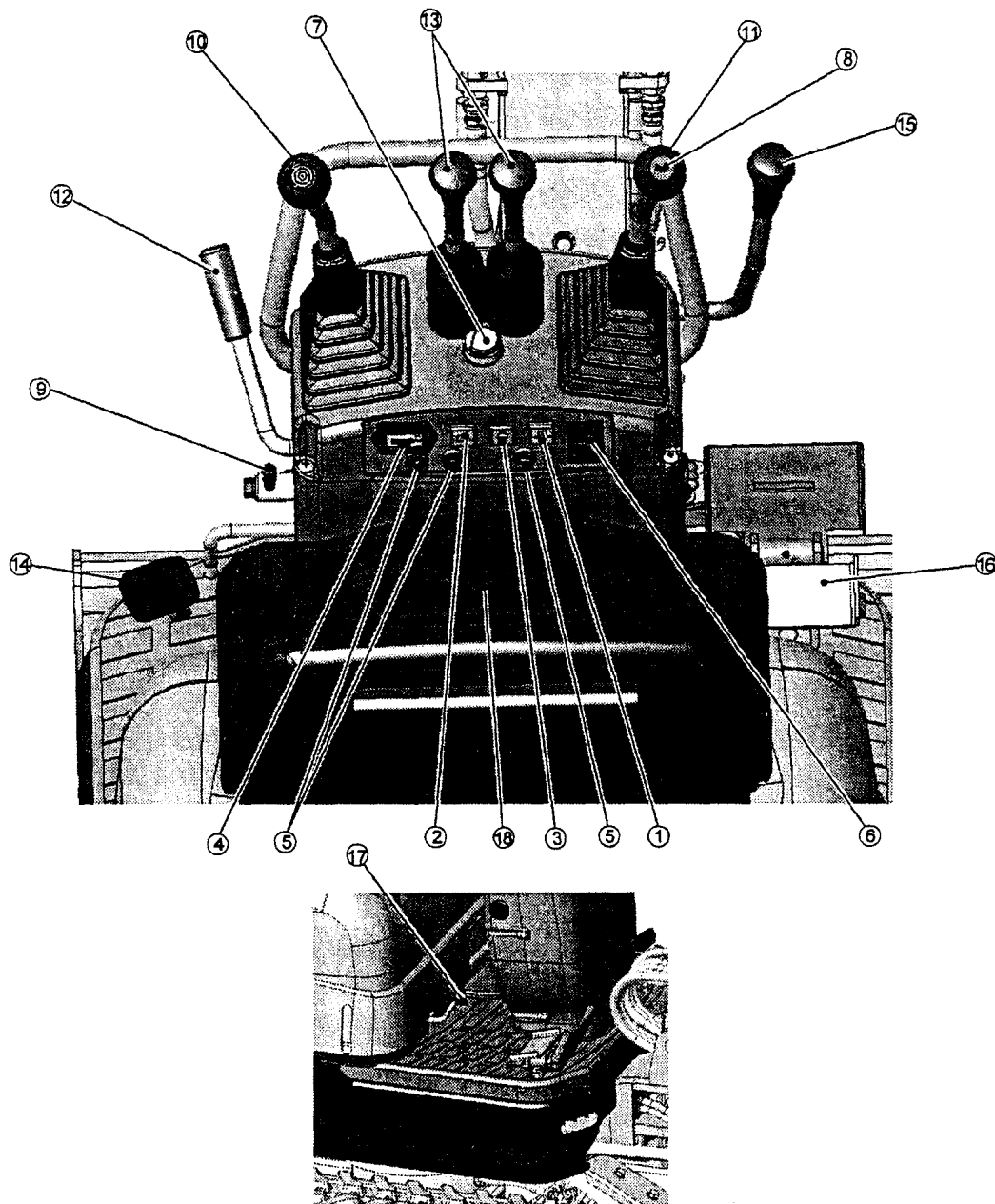


SECTION 3 OPERATION

TABLE OF CONTENTS

Subject	Page
Controls and instruments	3-1-1
Before starting the engine	3-2-1
Starting engine	3-3-1
Jumper cable starting	3-4-1
After starting the engine	3-5-1
"Break-in" operation	3-5-1
Backhoe operation	3-6-1
Operating the special attachments and actuators	3-7-1
Traveling the machine	3-8-1
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 of rubber crawler shoe	3-13-1
Parking the machine	3-14-1
Emergency engine stop	3-14-1

CONTROLS AND INSTRUMENTS



Typical Example

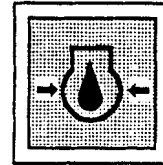
- | | | |
|--------------------------------------|----------------------------|-----------------------------------|
| (1) Engine Oil Pressure Warning Lamp | (6) Light Switch | (13) Travel Lever |
| (2) Charge Warning Lamp | (7) Engine Start Switch | (14) High speed Travel Pedal |
| (3) Water Temperature Warning Lamp | (8) Horn Switch | (15) Blade Lever |
| (4) Service Hour Meter | (9) Control shut-Off Lever | (16) Boom Swing Pedal |
| (5) Fuses | (10) Left Operating Lever | (17) Blade-Spanner Exchange Lever |
| | (11) Right Operating Lever | (18) Operator's Seat |
| | (12) Engine Throttle Lever | |

1. MONITOR LAMPS

① Engine Oil Pressure Warning Lamp

This warning lamp indicates that engine oil pressure has fallen.

If it lights during operation, stop the engine immediately and check the cause of engine oil pressure's falling.

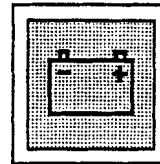


② Charge Warning Lamp

This warning lamp indicates abnormal condition in battery charging circuit.

Light turns **ON** during engine operation.

the charge indicator light should be **OFF** when engine is started.

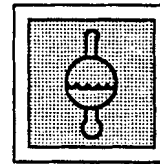


③ Engine Coolant Temperature Warning Lamp

The lamp should be turned off during operation.

The lamp comes on, the engine has overheated.

DO NOT continue operating machine.



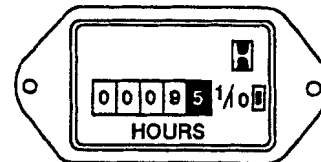
2. METER

④ Service Hour Meter

Indicates the total service hours on the engine.

use it to determine the service intervals.

While the engine is running, the hour meter is operated.

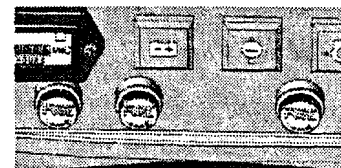


3. FUSES

⑤ Fuses

The fuse box is located on the lever stand.

Fuses will protect the electrical system from damage caused by overloaded circuits.



10A	10A	20A
Warning lamp meter Fuel pump	Working lamp Horn	Engine stop solenoid

4. SWITCHES

⑥ 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.



⑦ Engine Start Switch

⚠ CAUTION

If 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.

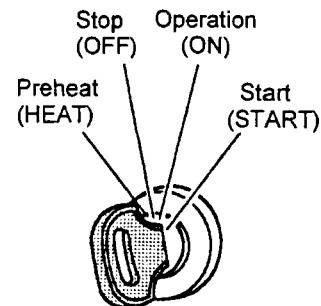
ON : Turn the key clockwise to active the electrical System. The key will return to the **ON** position when released from the **START** position.

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

HEAT : In cold season, preheating is performed to facilitate engine start. (This operation is unnecessary if the engine is warm.) Setting the key to the Preheat position starts heating the glow integrated into the engine.

The preheating time should be 10 seconds or shorter. (The glow may be burnt if preheating is performed for more than 10 seconds.)

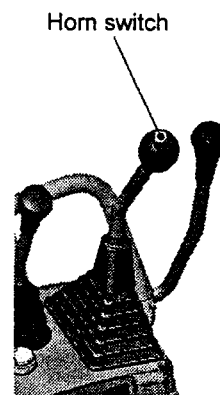
Turn the key to the Start position to start the engine immediately after preheating.



Engine Start Switch

⑧ Horn switch

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



5. MACHINE CONTROLS

⑨ Control Shut-off Lever

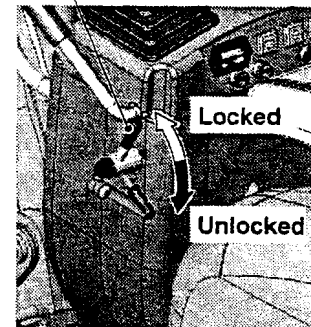
Locked : Pull the lever up and two operating levers ⑩ and ⑪ are inoperable.

Unlocked : Push the lever down and ⑩ and ⑪ are operable.

CAUTION

ALWAYS have shut-off lever **UP** to locked position when getting into or out of operator's seat.

Lever lock



⑩ Left Operating Lever

[Swing and boom controls]

1. Arm Out:

Move the lever forward to move the arm out.

2. Arm In:

Move the lever back to move the arm in.

3. Swing Right:

Move the lever right to swing the upper structure to the right.

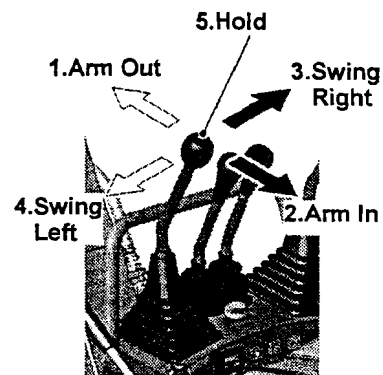
4. Swing Left:

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.

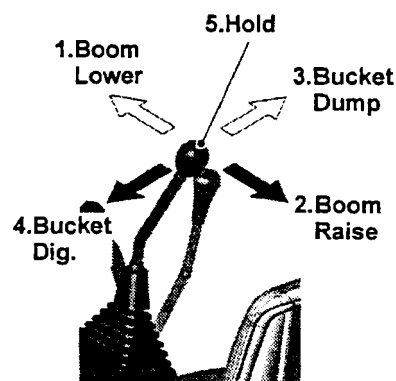
Two Functions may be performed at the same time by moving the lever diagonally.



① Right Operating Lever

[Bucket and arm controls]

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



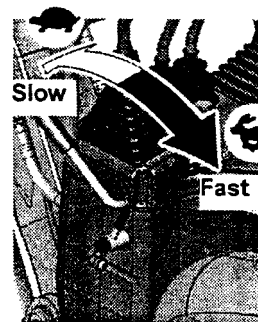
5. **Hold:**
When the lever released from any position, the lever will return to hold(center position) . Boom or bucket movement will stop.

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

② Engine Throttle Lever

Slow (🐢) : Move the lever to forward to decrease the engine speed.

Fast (🐘) : Move the lever to the rear to increase the engine speed.



⑬ 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.

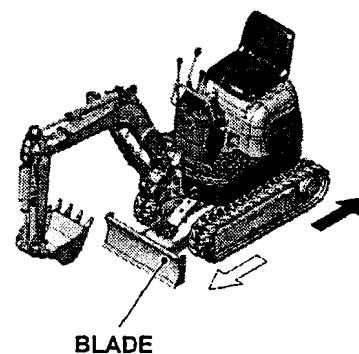
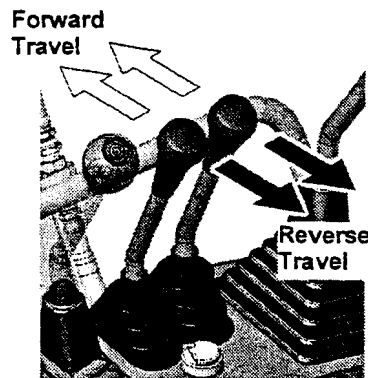
Stop :

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.



⑭ High Speed Travel Pedal

CAUTION

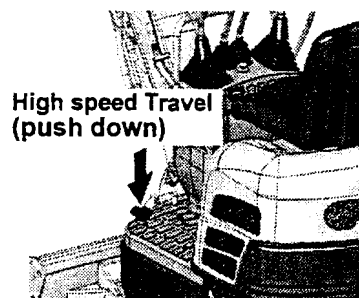
- * **NEVER** high speed travel on a grade or loading and unloading the machine.
- * When control shut-off lever is locked, does not change to high speed travel.

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.



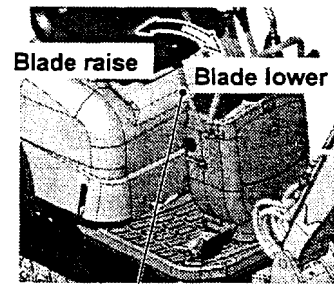
⑮ Blade Lever

⚠ 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.



Blade lever

⑯ Boom Swing Pedal

⚠ CAUTION

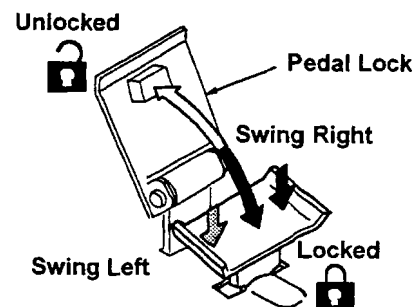
ALWAYS locked pedal when is not in use.

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.



BEFORE STARTING THE ENGINE

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

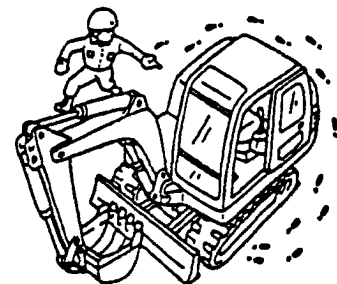
■ Walk-Around Inspection

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.

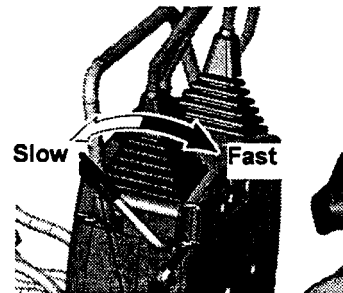
Refer to the Daily in the Maintenance Section for more detailed information.

STARTING ENGINE

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

1. Move all attachment Controls to the **HOLD** position before starting the engine.
2. Move the engine throttle lever above the **LOW IDLE** position (advance about one-third to one-half).
3. Turn the start switch key to the **START** position.

NOTE : Under low temperature conditions, turn the start switch to **PRE-HEAT** for 10 seconds **BEFORE** turning to **START** position.

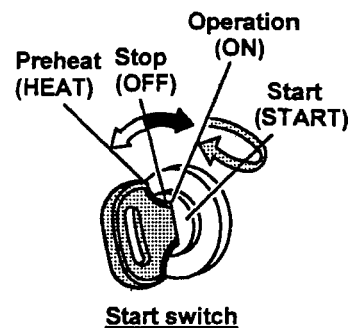


Engine throttle lever

4. Release the start switch key when the engine starts.

CAUTION

1. Do not engage the starter motor for more than 10 seconds at a time. Should the engine fail to start within 10 seconds, allow the starter motor to cool for 2 minutes, before attempting to start the engine again. Turn the key to **OFF** before trying to restart the engine.
2. Allow the engine to warm up until operating temperature and required oil pressure are obtained.
3. Before attempting any working operations, warm up the hydraulic oil as described in "reoperation Warm-Up"



Start switch

DANGER

DO NOT USE ETHER
FOR STARTING AID

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 the battery **NEGATIVE (-)** to battery **NEGATIVE (-)**.

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.

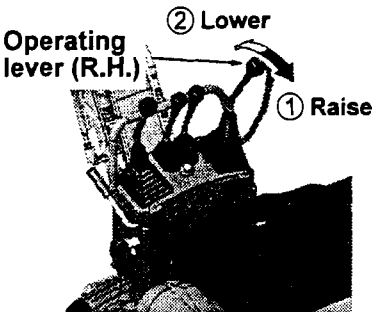
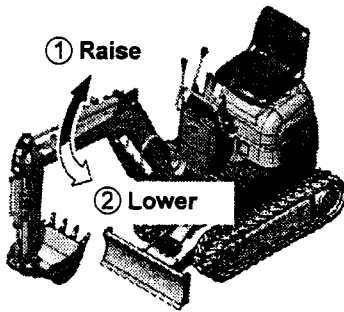
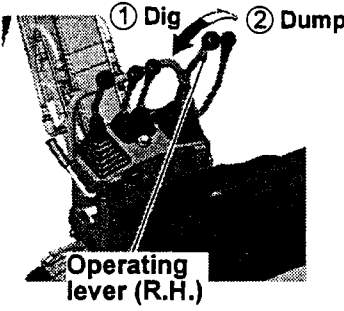
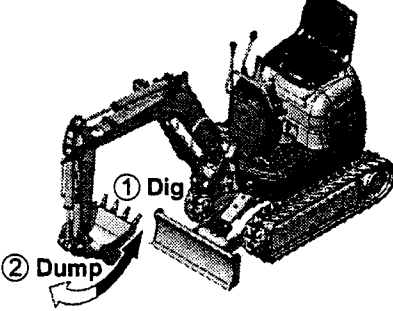
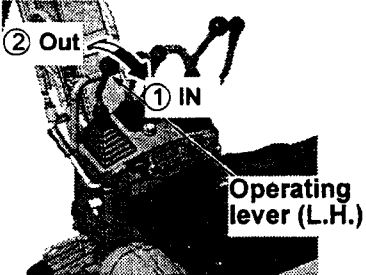
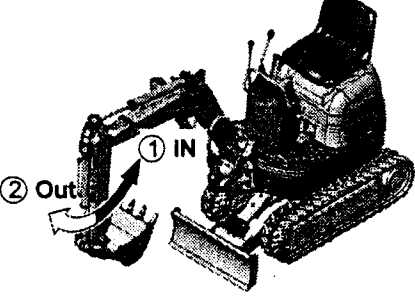
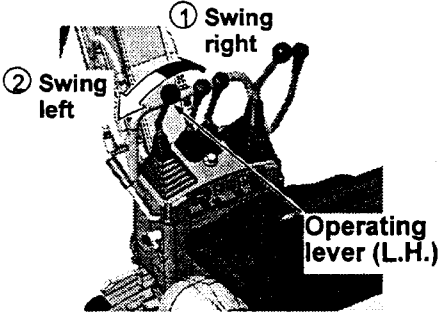
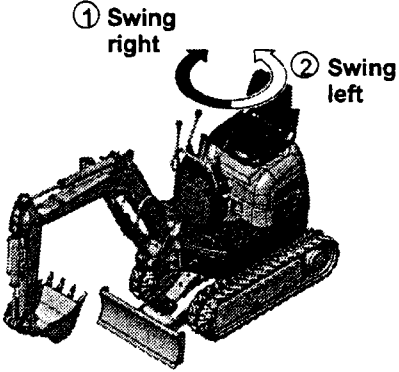
"BREAK-IN" OPERATION

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

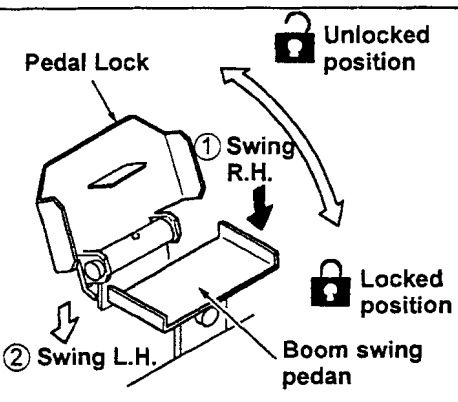
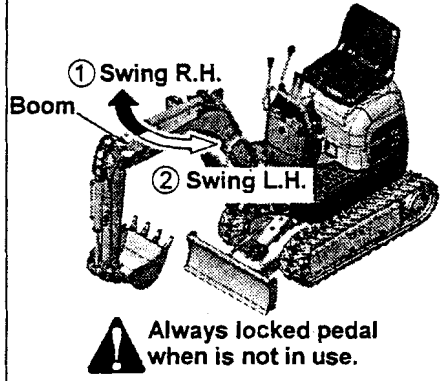
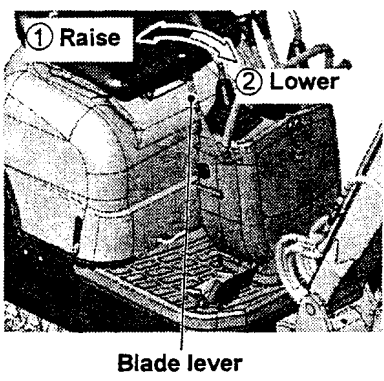
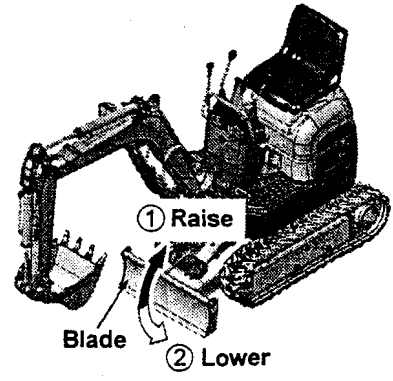
BACKHOE OPERATION

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		
BLADE		

OPERATING THE SPECIAL ATTACHMENTS AND ACTUATORS (If equipped)

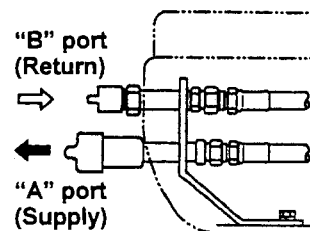
CAUTION

- * 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.
- * Before using a special attachment and an actuator, read and understand their instruction manuals issued by a manufacturer to obtain correct operation and maintenance.

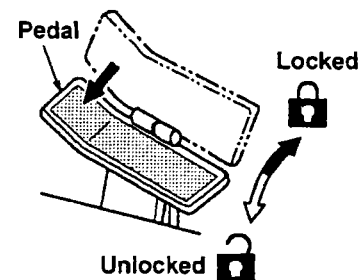
1. SINGLE ACTION OPERATION

USED : FOR BREAKER AND OTHERS

- 1) Install the hydraulic hoses, supply hose to "A" port, and return hose to "B" port.
- 2) Open the pedal into unlocked position.
- 3) Push down the pedal, to work the actuator.
- 4) When the power port is out of service, **ALWAYS** set the pedal back to the neutral position and pedal to the locked position.

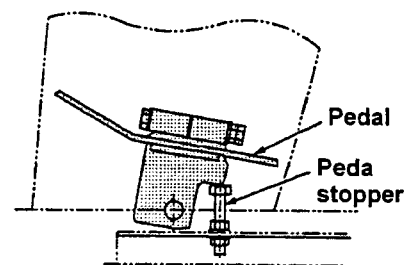


Hose connection for the single action



■ ADJUSTMENT OF THE PEDAL STOPPER

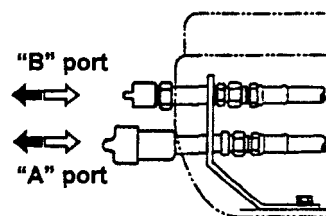
- Adjustment of the pedal stopper when installing the pedal or changing from the double action type, adjust the pedal stopper as follows.
- When the pedal is neutral, adjust the stopper's length so that the pedal and pedal stopper contact.



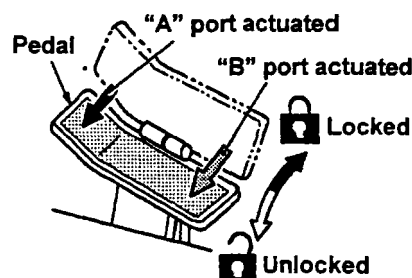
Stopper setting position

2. DOUBLE ACTION OPERATION USED : WRECKING FORK AND OTHERS

- 1) Install the hydraulic hoses to "A" port and "B" port which are in front of the machine.
- 2) Open the pedal into unlocked position.
- 3) To actuate the A port, push down the tip of the pedal, and to actuate the B port, push down the heel of the pedal.
- 4) When the power port is out of service, turn the pedal to the locked position.



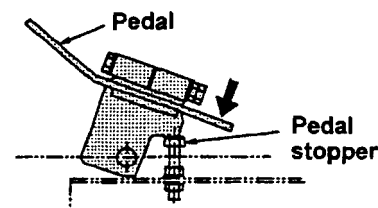
Hose connection for double action



■ ADJUSTMENT OF THE PEDAL STOPPER

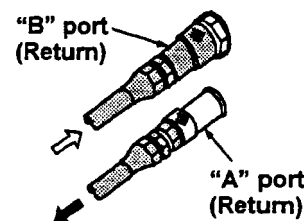
Adjustment of the pedal stopper when installing the pedal or changing from the single action type, adjust the pedal stopper as follows.

- 1) Push down the heel of the pedal.
- 2) Adjust the stopper length so that the pedal and pedal stopper contact.

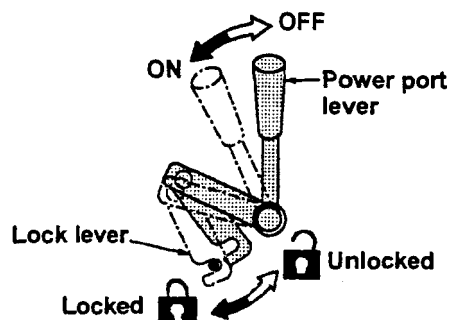


3. SINGLE ACTION OPERATION USED : FOR POWER PORT WORKS

- 1) Install the hydraulic hoses to "A" port and "B" port which are in front of the machine.
- 2) Move the power port lever to **ON** position and lock lever in 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.
- 3) When the power port is out of service, **ALWAYS** set the lever back into the neutral position.



Hose connection for power ports



⚠ CAUTION

The engine cannot be started if the power port is **ON**.

Be sure to set the lever in the neutral position before starting the engine.

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**.

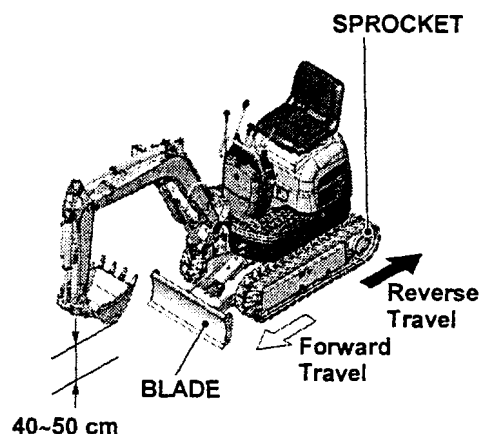
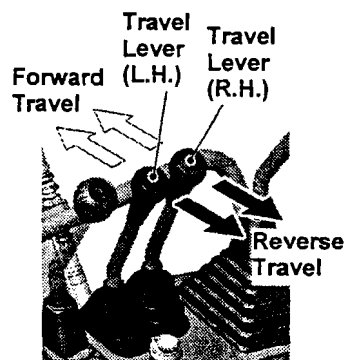
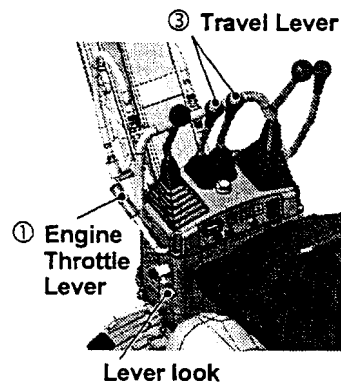
Stop

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 CONTRTROL

⚠ 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.

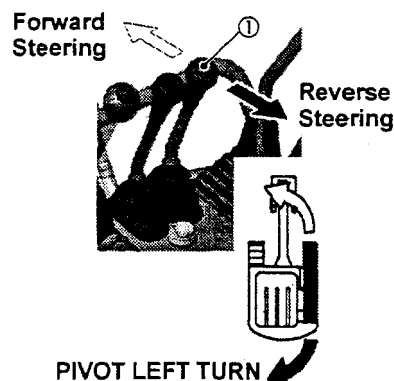
1. Move engine throttle lever to the operating range.
2. Raise the boom and the blade enough to provide sufficient ground clearance.

STEERING

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

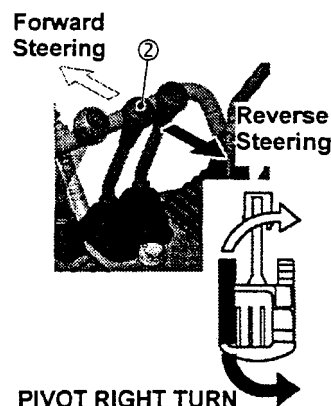
Pivot Left Turn

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.



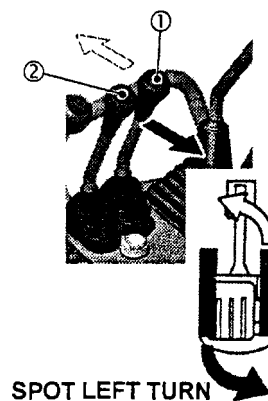
SPOT TURN

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.



HIGH SPEED TRAVEL

CAUTION

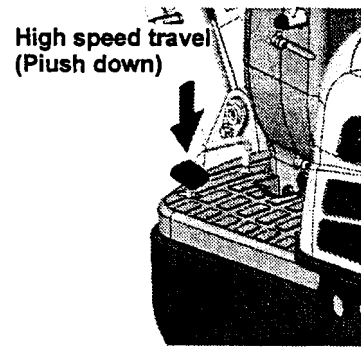
Do not change travel speed ranges while going downhill.

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 shift to the high speed travel.

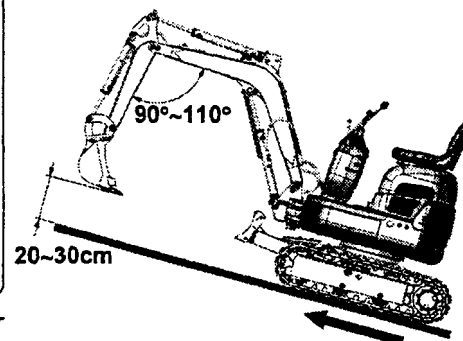
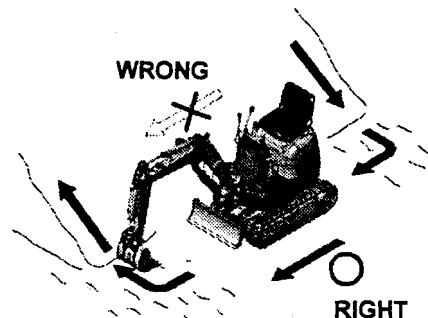
When released pedal, shift to the low speed travel.



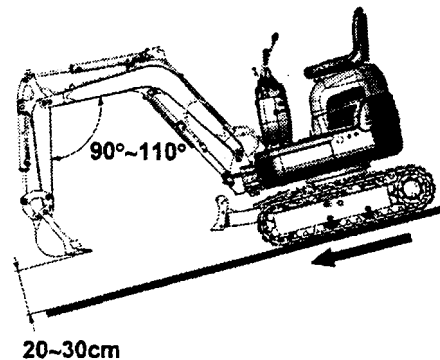
CAUTION ON TRAVEL ON A GRADE

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 than 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.

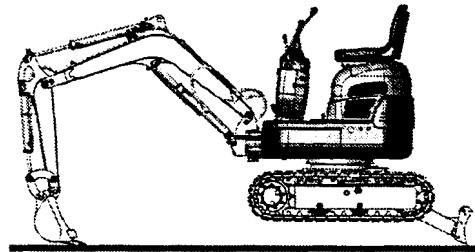


CRAWLER EXTENSION/RETRACTION

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

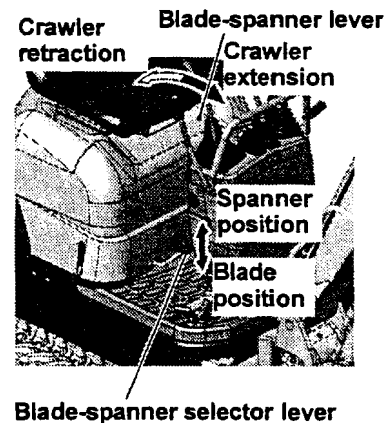
Set the selector lever to the spanner position.

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.

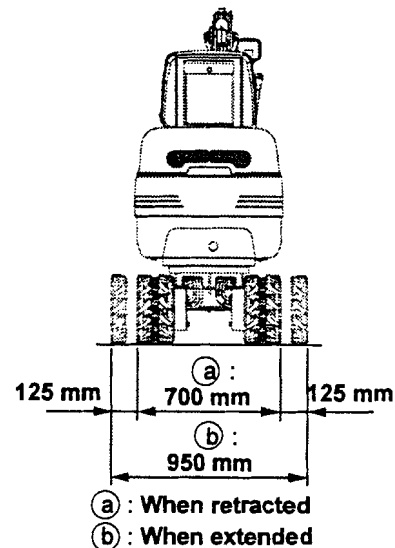
Extension or retraction is possible without jacking up the main unit.

If there is an obstacle on the ground beside the crawler, the resistance is larger and extension or retraction is sometimes impossible.

CAUTION

The crawler may slightly shrink due to leak from the hydraulic circuit during the work with the crawler extended.

Sometimes extend the crawler to the end by the spanner operating lever.



Dimension of crawler extension / retraction

TOWING

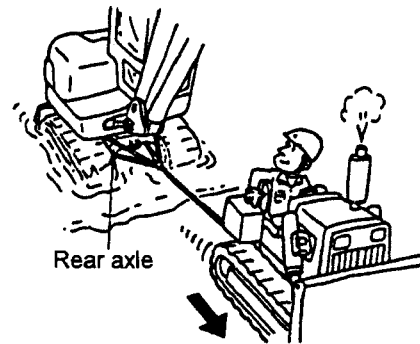
WARNING

- * Personal injury or death could result when towing a disabled machine incorrectly.
- * 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.

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 should 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.



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.
- * 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.
- * Make sure the lifting cables and other lifting devices are strong enough to support the machine.
- * Use a crane whose lifting capacity meets the weight of the machine.

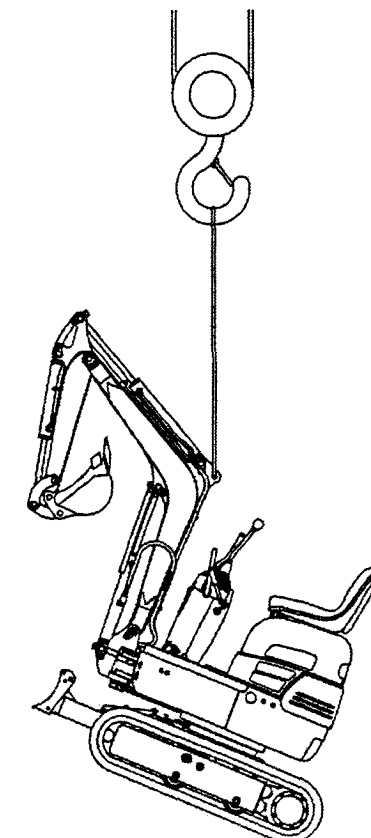
⚠ CAUTION

Lifting Procedures

1. Start the engine and swing the machine to position the blade to front.
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. 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 off the ground, check that the machine is well balanced.

Wire: 6FI(29) IWRC 10A dia. Or above

Shackle: JIS ·B ·2801 BC 16 or above



Machine mass (kg)	890
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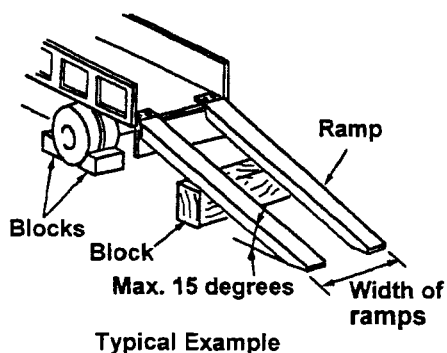
LOADING AND UNLOADING THE MACHINE

⚠ 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 unloading 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 ramps.
- * 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 loading 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.

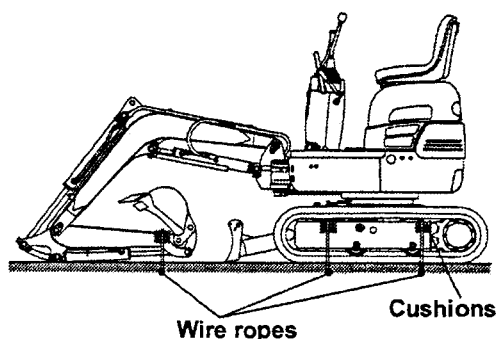


SECURING THE MACHINE

⚠ WARNING

Upper structure movement can cause personal injury or death.

1. Align the upper structure with the truck.
2. Move the control shut-off 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

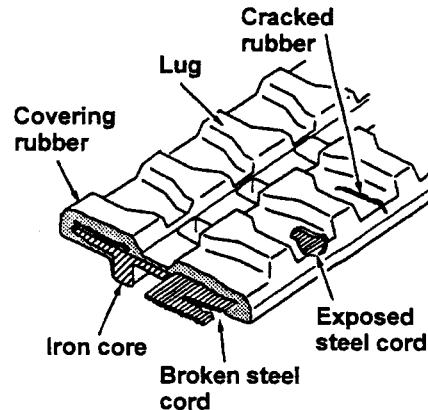
The rubber track shoe may be damaged or worn faster depending on working conditions. Perform working operation properly according to working site conditions and machine operation.

■ 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 $+55^{\circ}\text{C}$ (-13°F and 131°F) because of a rubber's characteristic.

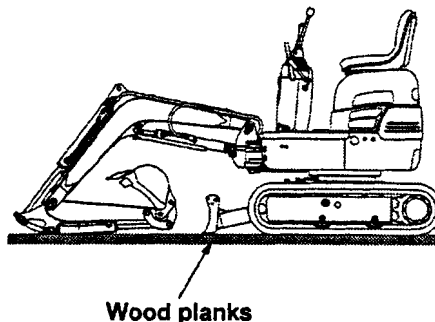
PARKING THE MACHINE

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.

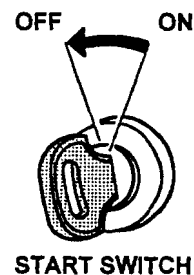


Freezing Conditions

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

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.



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.

EMERGENCY ENGINE STOP

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

SECTION 4 MAINTENANCE

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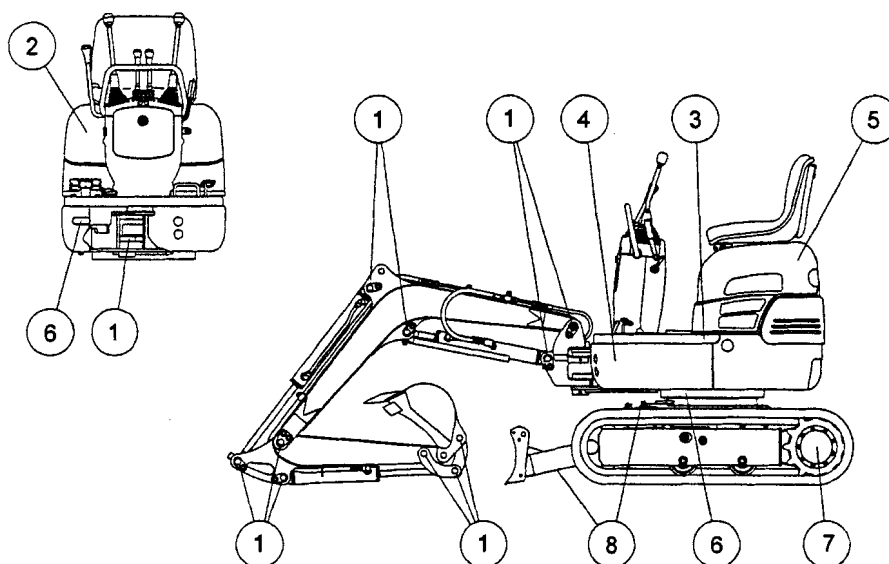
MAINTENANCE INTERVALS

Check Point	Item
When Required	
Tracks	Check and Adjust Tension
Track	Check Rubber Shoes
Fuses	Replace
Fusible Link	Replace
Battery	Clean and Check Electrolyte Level
Bucket	Change Bucket
Daily Check (8 Service hours)	
Engine Oil	Check Oil Level
Engine Coolant	Check Coolant Level
Hydraulic Tank	Check Hydraulic Oil Level
Fuel Tank	Check Fuel Level
Water Sedimenter	Check Level and Drain Water
Every 50 Service Hours (First perform previous service hour items)	
Fuel Tank	Drain Water and Sediment
Attachment Pins	Lubricate Fitting with Grease
Swing Bearing	Lubricate Fitting with Grease
Engine Oil	Change Oil and Filter*
Hydraulic System	Change Return Filter*
Every 250 Service Hours (First perform previous service hour items)	
Engine Oil	Change Oil and Filter
Air Cleaner	Clean or Change Filter Elements
Fuel Filter	Clean Filter Element
Fan Belt	Inspect and Adjust
Engine Coolant	Change Coolant (When not used L.L.C)
Every 500 Service Hours (First perform previous service hour items)	
Tighten Bolts	Retightening Bolt
Return Filter	Change Return Filter
Fuel Filter	Change Filter Element
Pre-filter	Replacement of fuel pump pre-filters
Travel Drive	Check Oil Level
Every 1000 Service Hours (First perform previous service hour items)	
Travel Drive	Change Gear Case Oil
Hydraulic Tank	Change Hydraulic Oil and Clean Strainer
Every 2 years Service Hours	
Engine Coolant	Change Coolant (When used L.L.C)

* 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 service hour meter. It should be shortened in service operating conditions.



Component	Servicing item	Interval					
		First 50 Hr.	Daily	50 Hr.	250 Hr.	500 Hr.	1000 Hr.
1	Attachment pin	Pin lubricate "G"		○			
2	Fuel Tank	Water sediment drain		○			
3	Hydraulic oil Tank	Hydraulic oil "H"	○				●
		Water sediment drain		○			
		Suction strainer cleaning					○
4	Return filter	Cartridge	●			●	
5	Engine	Engine oil "E"	●	○	●		
		Fuel filter				●	
		Oil filter	●		●		
		Radiator "W"		○			
6	Swing bearing	Bearing lubricate "G"			○		
		Ring gear lube "G"			○		
7	Traction	Gear lubricate "L"	○			○	●
8	Blade	Pin lubricate "G"			○		

Symbol	G	L	H	E	W	○	●
Kind of lubricant and grade	Grease EP- 2 Lithium	Gear oil API- GL- 4, L-5,SAE90	Hydraulic fluid Anti-wear (VG-46) hydraulic oil	Engine oil API-CD SAE10W30	Water	Inspection and maintenance Supply	Change

RECOMMENDED LUBRICATION TABLE

LOCATION	REFILL CAPACITIES (APPROXIMATE)	CHANGE INTERVALS	USE	LUBRICANT VISCOSITIES
Diesel Engine	Max. 1.6 liter	250 Hrs.	Cold Regions	API, Class CD SAE20
	Min. 0.6 liter	Initial oil change 50 hours	General	API, Class CD SAE30
			Tropical Regions	API, Class CD SAE40
Hydraulic Oil	Total amount 14 liter	1000 Hrs.	Ambient Temperature -5°C	Wear Proof Hydraulic Fluid ISO - VG46
	Tank Capacity 8.2 liter	(500 Hrs. when breaker used)	Ambient Temperature Below -5°C	Wear Proof Hydraulic Fluid ISO - VG32
Track Rollers	0.05 liter (Each)	Upon occasion	—	API, GL-4 or GL-5, ISO-VG320 (SAE90) Gear Oil
Front Idlers	0.02 liter (Each)	Upon occasion	—	
Travel Drives	0.33 liter (Each)	1000 Hrs.	—	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.

■ 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.

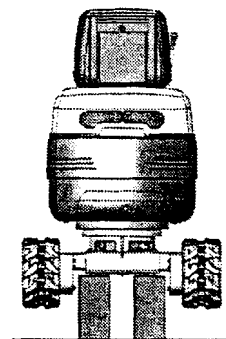
■ Track Tightening

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.

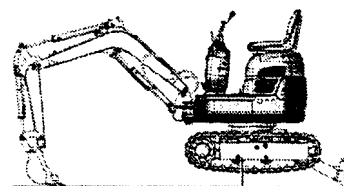
■ Track Loosening

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.

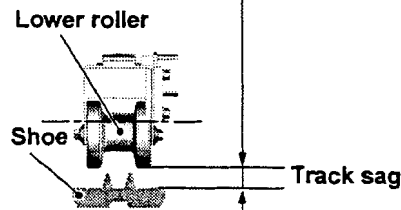
If the correct adjustment cannot be obtained, consult your IHI dealer.



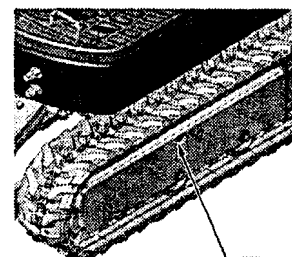
Supported the machine



Jack up until the shoe leaves the ground surface



Rubber shoes: 10 to 20 mm



- ① Grease nipple
- ② Check valve (Width across flat: 24 mm)

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

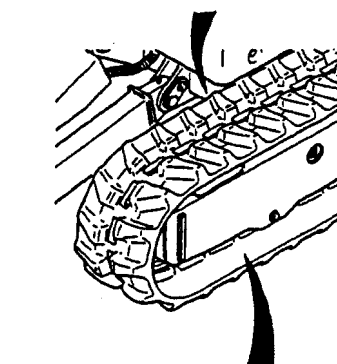
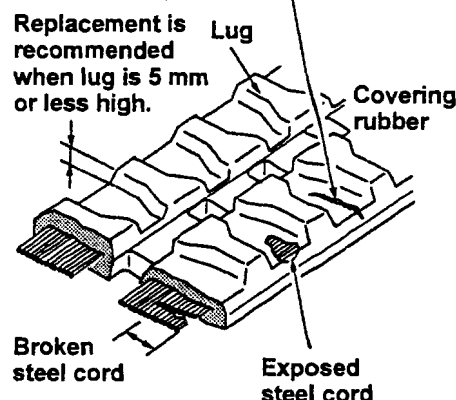
When break of steel cord is detected, replace it immediately. If you leave it as it is, the rubber track shoe can be break without expectation, which causes a serious accident.

4. Crack of Covering Rubber

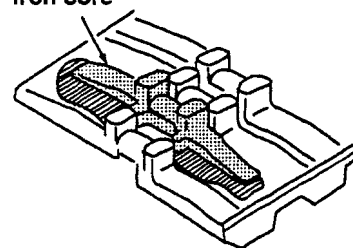
If a crack is 30 mm or more long and 8 mm or more deep, repair the cover immediately. if Steel cord appears even if a crack is small, repair it immediately. Otherwise, water may come into a crack, which rusts steel cords and break the rubber track shoe.

(Typical Example)

Repair is necessary when a crack is over 30 mm length, or over 8 mm depth.



Removed iron core



FUSES

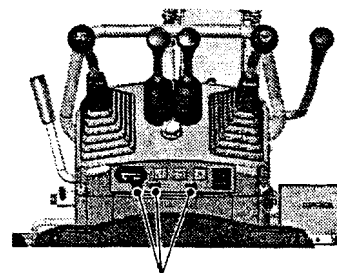
The fuse case is located on the front of the instrument panel.

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.

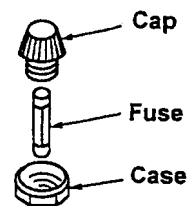
Change a fuse, have the circuit checked and repaired.



Fuse case

■ Replace

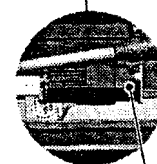
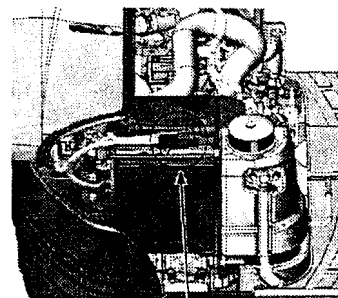
1. Remove the cap for fuse access.
2. Change the damaged fuse to new one.



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.



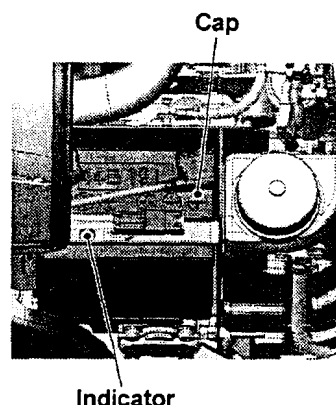
Fusible link (65A)

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

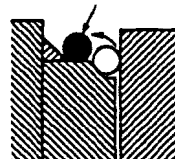
CAUTION

- * 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.

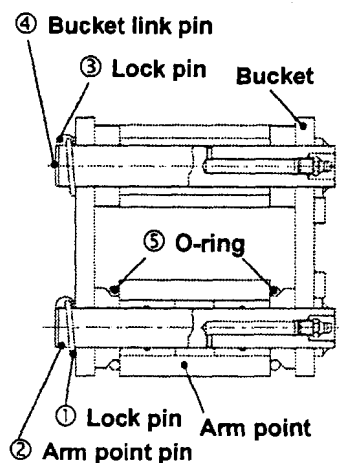
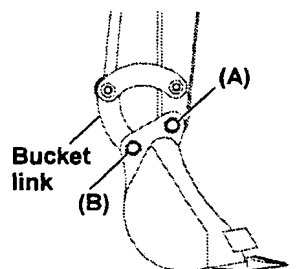
Movement of O-ring



Bucket boss

■ 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. Move the O-rings for sealing into the regular position.
6. Lubricate each pins with grease.
7. After install the bucket, start the engine and low speed rotate the bucket to the stroke end. Check if anything interrupts the bucket rotation.



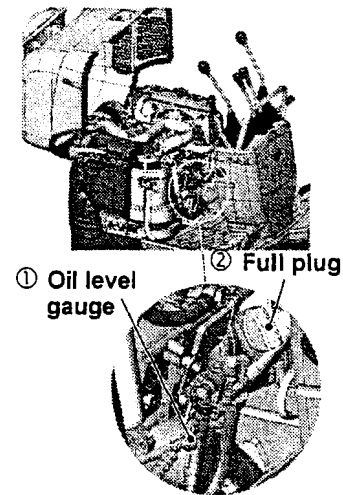
DAILY MAINTENANCE AND CHECKS

■ 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 oil level gauge ① and wipe it clean. Insert oil level gauge ①, then remove it again to read actual oil level. Install oil level gauge ①.
3. Maintain the oil level to the **MAX** mark on the oil level gauge 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.

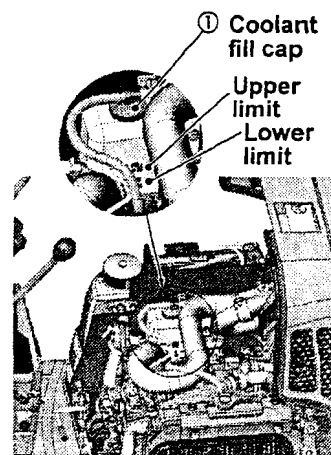
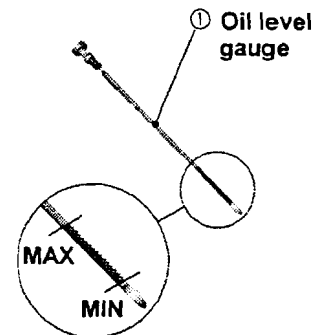


■ Check the Coolant Level

⚠ 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.

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 tank.
5. Close the access door.



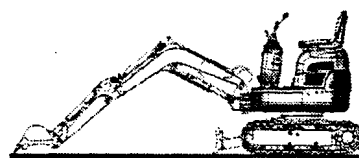
Reserve tank level

■ Hydraulic Oil Level

⚠ CAUTION

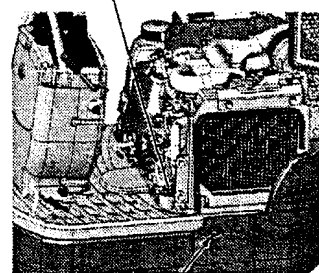
- * Always clean around fill plug before removing.
- * **DO NOT OVER FILL.**
- * **DO NOT OPERATE** the machine when oil level is above **FULL** or **ADD** marks.

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 to relieve pressure 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.



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

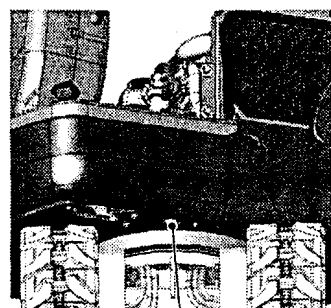
② Fill plug



■ Fill Fuel Tank

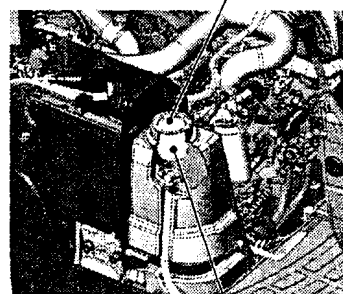
Fuel can be added to the tank by removing the fill cap on top of the fuel tank. Do not remove strainer in the fill port when fill fuel tank.

After completion of refueling, be sure to close and lock the engine cover to protect against vandalism.



③ Drain plug

① Fill plug



② Strainer

■ Water Sedimeter

Maintenance intervals :

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

⚠ WARNING

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

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

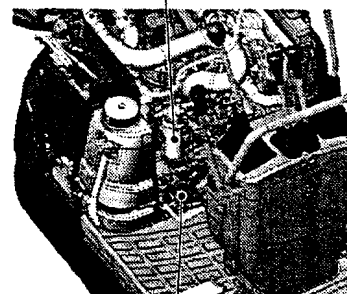
1. Stop the engine.
2. Turn the fuel stop lever to the "closed" position.
3. Loosen the ring nut ① and remove the bowl ② and the filter ③.
4. Drain water and sediment into suitable container.

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

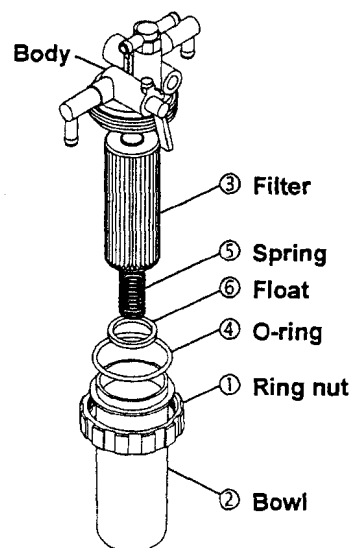
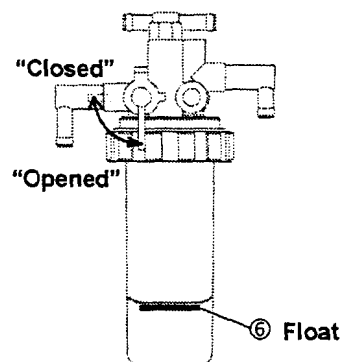
5. Clean the inside surfaces of the body and bowl ②.
6. Clean the filter ③.
7. Inspect the O ring ④ on bowl. Replace them if they are worn or damaged.
8. Install a filter ③ to the body. Install a spring ⑤ and float ⑥ into the bowl. Install the bowl to the body. Tighten ring nut ①.
9. Turn the fuel stop lever to the "opened" position.
10. Purge air from the water sedimeter. Press down lever ⑧ of fuel pump ⑦ several times to fill fuel in bowl ② of the fuel filter.

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

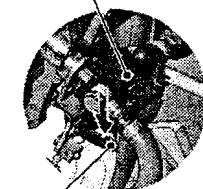
Fuel filter
(with a water sedimeter
function)



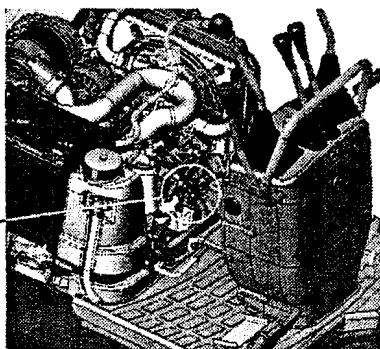
Pre-filter
(Fuel filter)



⑦ Fuel pump



⑧ Lever



■ 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.

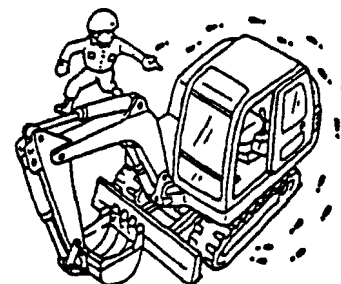
Inspect attachment cylinders, linkage and bucket for
damage or excessive wear. Repair if damaged.

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

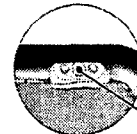
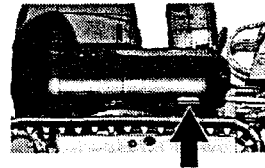
■ Drain the Water and Sediment

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

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

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

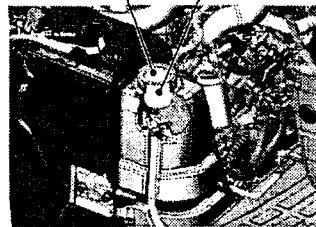
4. Close the drain valve.



① Drain valve

Arrow view

- ② Fill plug ③ Strainer

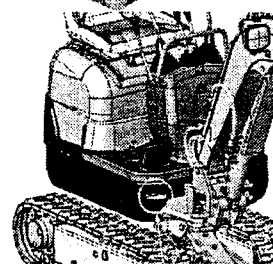
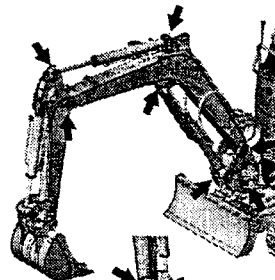


■ Lubrication

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.



- Ring gear grease nipple
Boom swing cylinder grease nipple
Swing bearing grease nipple

250 HOURS MAINTENANCE AND CHECKS

First perform previous service hour items

ENGINE OIL AND FILTER

■ Change the Oil and Filter

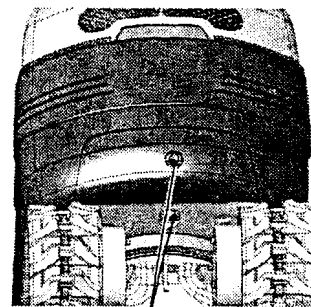
⚠ CAUTION

- * 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. 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.

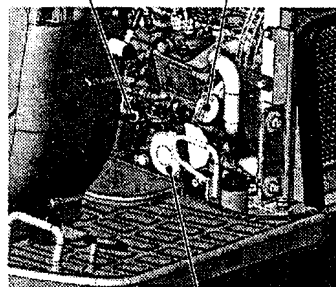
NOTE: Always dispose of used oil and filters as established by local regulations.

3. Open the engine cover on the rear of machine.
4. Remove the used filter ② by the filter wrench. Use a filter wrench with the type shown at right. 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 oil level gauge 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 the crankcase. Check the oil level. Maintain the oil level to the FULL mark on dipstick.
11. Close and latch the engine hood.

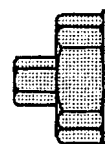


① Drain plug

③ Fill plug cap
④ Oil level gauge

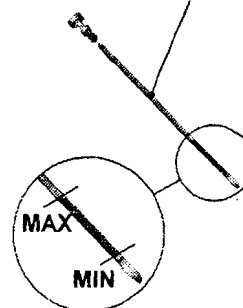


② Filter cartridge



Filter wrench

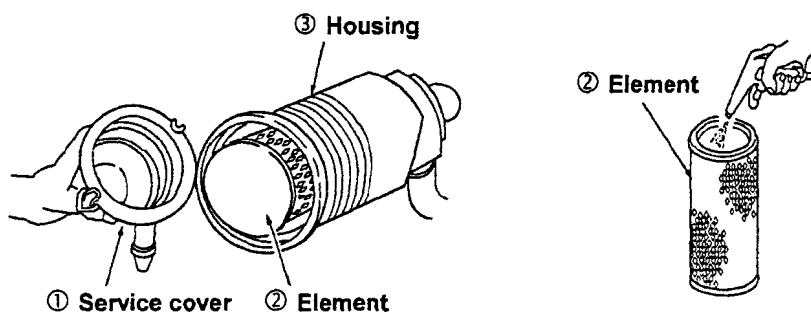
④ Oil level gauge



■ Service the Filter Elements

⚠ CAUTION

- * 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 glasses.



1. Stop the engine.
2. Release the two latches and remove the service cover ①.
3. Remove the element ② from the air cleaner housing ③.

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 down 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.

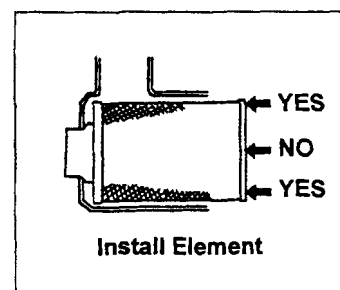
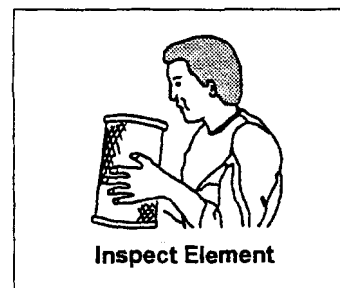
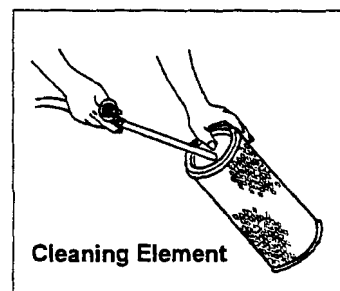
NOTE: Clean the seal tube in the cleaner housing.
Dust on the seal tube causes dust leak.

5. 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 element ②. Install and secure the service cover ①.

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.



■ Clean the Fuel Filter Element

⚠ WARNING

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

1. Stop the engine.
2. Turn the fuel stop lever ① to the "closed" (OFF) position.
3. Loosen the ring nut ②.
4. Remove the cup ③ and the element ④.
5. Drain water and sediment into a suitable container.
6. Clean the inside surface of the cup and the element ④.
7. Install the clean element ④.
8. Install cup ③. Tighten ring nut ②.
9. Turn the fuel stop lever ① to the "opened" (ON) position.

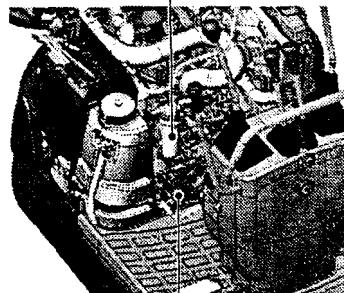
NOTE: Do not start the engine until all fuel system service is completed.

■ Air purge method

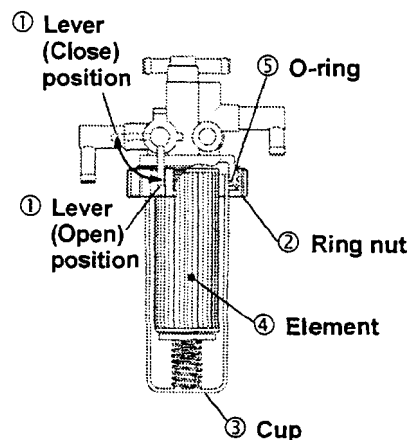
Purge air after maintenance of the fuel filter is performed or the fuel tank is emptied.

- (1) Fill the fuel tank with fuel.
- (2) Press down lever ⑦ of fuel pump ⑥ several times to fill fuel in cup ③ of the fuel filter.

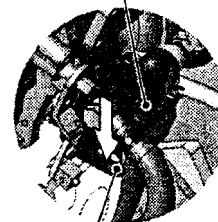
Fuel filter
(with a water sedimentor
function)



Pre-filter
(Fuel filter)



⑥ Fuel pump



⑦ Lever

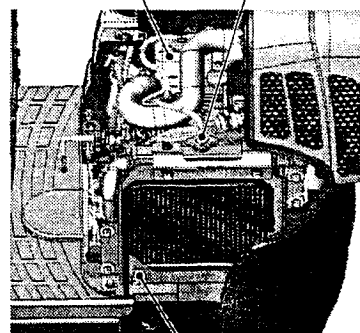
■ Change the Coolant

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 3-9. 2 years Maintenance section.

④ Reserve tank ① Radiator cap



② Drain cock

■ Fan and Alternator Belt

⚠ WARNING

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

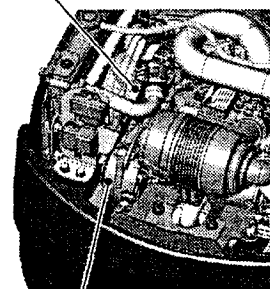
Inspect

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

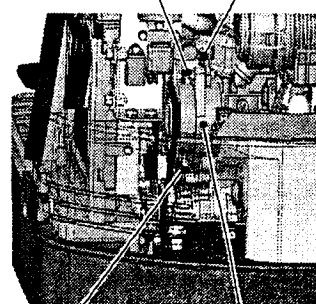
1. To adjust the belt, loosen mounting bolt ① and ②.
2. Move the alternator in or out as required to obtain the correct adjustment.
3. Tighten mounting bolts ① and ②.
4. Check the belt adjustment again after 5 minutes of engine operation at rated speed.

Fan pulley



AC generator

① Bolt Adjust plate



② Bolt

③ AC generator

500 HOURS MAINTENANCE AND CHECKS

First perform previous service hour items

■ **Check the Fixed Bolt Torque**

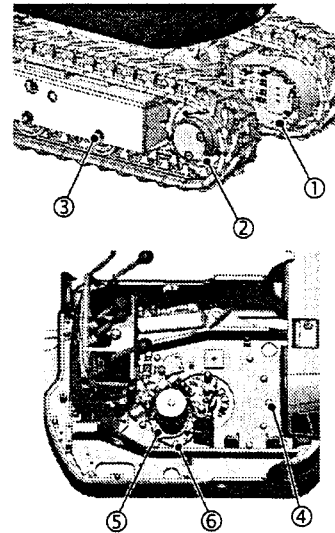
When loosened bolt or nut is found at daily check, tighten it with torque specifications table.

1. Special torque specifications

Special tighten is applied for main bolts as illustrated below.

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

Then, tighten them with specified torque.



Items	Tighten point	Wrench Size metric	Thread Size	Tightening Torque (N·m)
①	Travel drive	Bar 8	M10	54
②	Sprocket	Bar 8	M10	54
③	Lower roller	19	M12	97
④	Swing bearing	17	M10	55
⑤	Swing motor	Bar 10	M12	97
⑥	Swing gear case	14	M10	55

Newtonmeter (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.

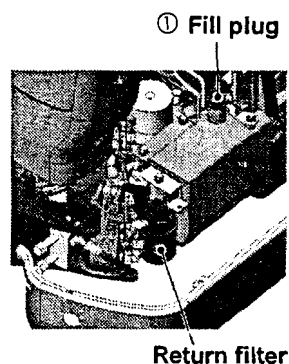
Thread Size metric	Wrench size (mm)	Tighten torque	
		Metric coarse H.T.	Metric fine H.T. bolt
		N · m	N · m
M8	13	23	25
M10	17	47	50
M12	19	83	91
M14	22	134	35
M16	24	206	220
M20	30	412	450
M24	36	715	813

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 Return 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 return filter ② only after the engine has been stopped and the return filter is cool enough to touch with your bare hand.

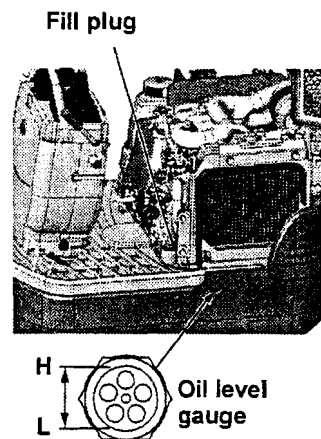
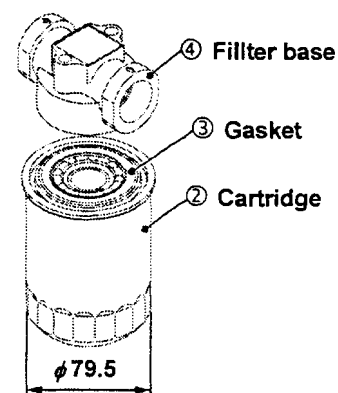


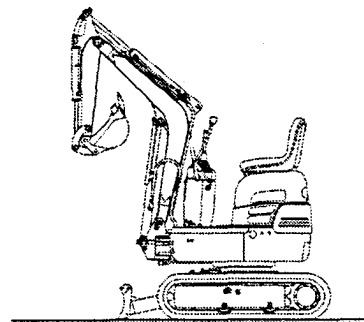
1. Lower the bucket on the ground and stop the engine.
2. Relieve the internal pressure from the hydraulic tank by loosening oil fill plug ①.
3. Clean the areato keep dirt out of the filter base ④.
4. Remove the used filter ② by filter wrench. Clean the filter base ④.

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

5. Coat the gasket ③ of new filter with clean hydraulic oil.
6. Install the new filter ② 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 filter. 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 engine. Inspect for leaks on the oil filter ②.

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





Bucket position at the time of sealing off hydraulic tank.

■ Change the Fuel Filter Element

⚠ WARNING

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

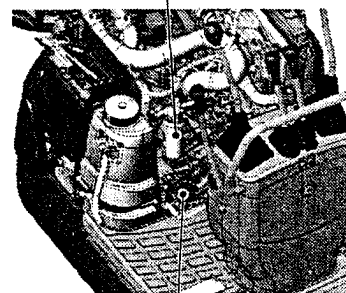
1. Stop the engine
2. Turn the fuel stop lever ① to the "closed"(OFF) position.
3. Loosen the ring nut ②.
4. Remove the cup ③ and the element ④.
5. Drain water and sediment into a suitable container.

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

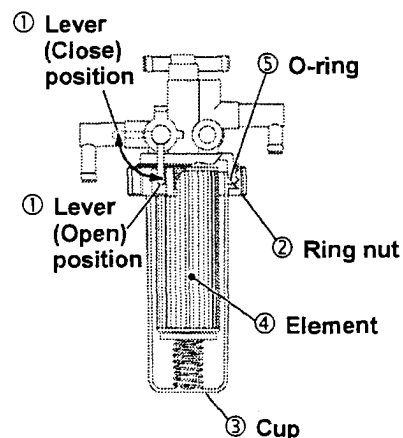
6. Clean the inside surface of the cup.
7. Install the new element ④.
8. Install cup ③. Tighten ring nut ②.
9. Turn the fuel stop lever ① to the "opened" (ON) position.

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

Fuel filter
(with a water sediment function)



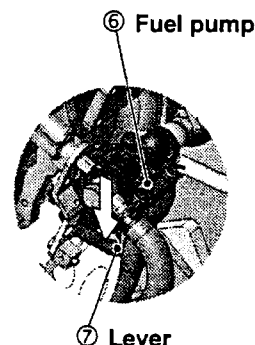
Pre-filter
(Fuel filter)



■ Air purge method

Purge air after maintenance of the fuel filter is performed or the fuel tank is emptied.

- (1) Fill the fuel tank with fuel.
- (2) Press down lever ⑦ of fuel pump ⑥ several times to fill fuel in cup ③ of the fuel filter.

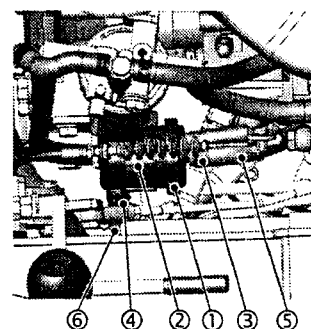


■ Replacement of fuel pump pre-filters

⚠ 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.



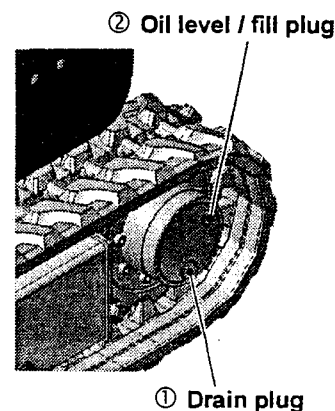
Details of pre-filter

■ Check the Travel Drives Oil Level

⚠ CAUTION

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

1. Position one travel drive 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**

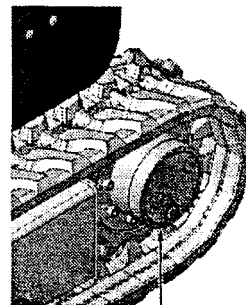
1. Position one travel drive with drain plug ① at the bottom.
2. Remove drain plug ① and oil level/fill plug ②. Allow the oil to drain into a container.

NOTE: Dispose drained material according to local regulation.

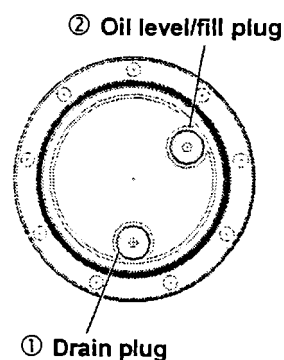
3. Clean the plugs.
4. Install drain plug ①.
5. Fill the travel drive to bottom of level plug opening.

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 cycles.
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.



Travel reduction



■ Change Hydraulic Oil and Clean the Strainer

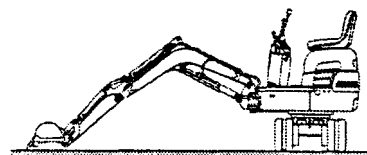
⚠ CAUTION

- * 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.

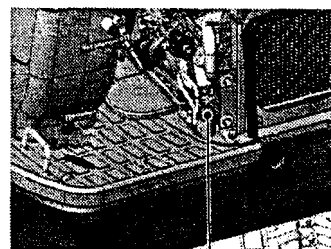
1. Place the machine on level ground, with the arm and bucket cylinder fully retracted and attachments lowered, as shown. Stop the engine.
2. Relieve the internal pressure from the hydraulic tank by loosening the fill plug ①.
3. Clean area thoroughly to keep dirt out of strainer cover unit ⑤ and fill plug ①.
4. Remove the oil drain plug ②. 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 ③. Remove the bolts ④ and the strainer cover unit ⑤/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 ⑤/ strainer ⑥ and the suction hoses ③.
9. Clean and install the drain plug ②.



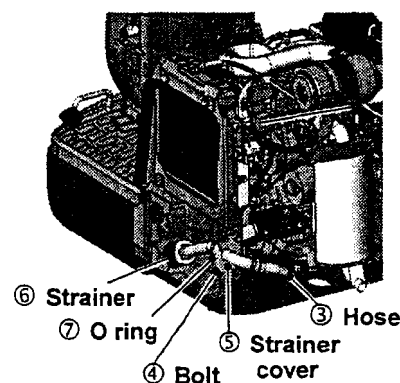
Bucket position at the time of drain the hydraulic oil.



① Fill plug

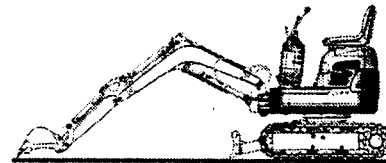
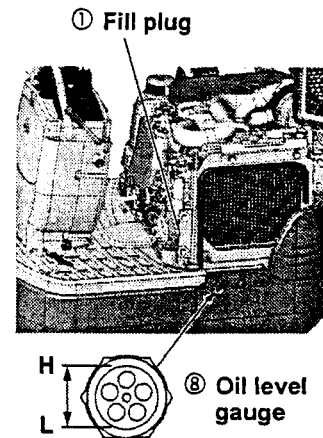


② Drain plug

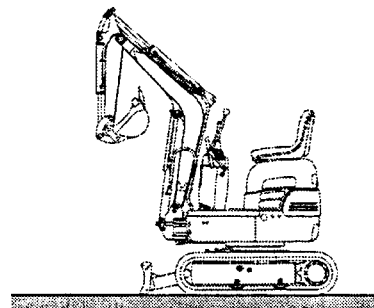


⑥ Strainer
⑦ O ring
④ Bolt
⑤ Strainer cover
③ Hose

10. Fill the hydraulic tank with oil. See Recommended Lubricant Table.
11. Start and operate the engine at idling speed for 2~3 minutes.
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 ⑧.
15. Pressurize the hydraulic tank.
Raise the boom with the arm, boom and bucket cylinder fully extended.
16. Remove the fill plug ① and then install fill plug again.
17. Lower the bucket on the ground and stop the engine.



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



Bucket position at the time of sealing off hydraulic tank.

CAUTION

Hydraulic Oil Change Intervals for Breaker Works.

Hydraulic oil should be changed in every 500 service hours.

2 YEARS MAINTENANCE AND CHECKS

COOLING SYSTEM COOLANT

⚠ WARNING

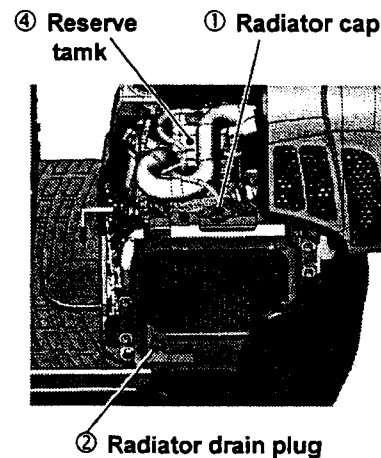
- * At operating temperature, the engine coolant is hot and under pressure.
- * Steam can cause personal injury.
- * Change the coolant only after the engine has been stopped and radiator cap is cool enough to touch with your bare hand.
- * Remove the radiator cap slowly to relieve Pressure.

■ **Change the Coolant**

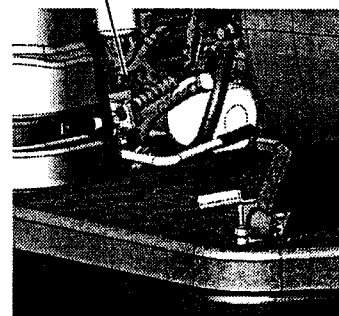
Coolant should be drained and replaced every 250 service hours or six months. However, when adding "Long-Life-Colant", the drain period can be extended to 2 years.

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 plug ② and allow the coolant to drain into a container.
4. Remove the radiator 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 radiator drain plug 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 radiator drain plug 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.



③ Drain plug



12. Maintain the coolant level to the fill port neck.
13. Replace the cap gasket if the gasket is damaged.
Install the radiator cap ①.
14. Maintain the coolant level between the MAX and MIN marks on the reserve tank.

■ 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

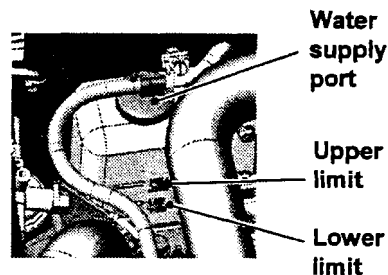
The mixing ratio of Long-Life-Coolant with water determines the freezing point.

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.



Reserve tank level

Freezing point (°C)	-15	-25	-35
Mixing ration (%)	30	40	50
Quantity of LLC (L)	0.7	0.9	1.1
Quantity of water (L)	1.5	1.3	1.1
Coolant total amount: 2.2L	Engine proper: 0.6 L Radiator and other proper : 1.2 L Reserve tank : 0.4 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 ethylene 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.2-6".

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 substances 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 wear. 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 basis.

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

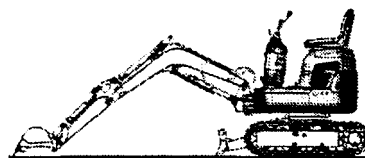
■ Before Storage

To protect the cylinder rods, set the machine position in the right illustration.

(To prevent the cylinder rods from being rusted)

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.



Bucket position at the time of long term storage.

■ 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.

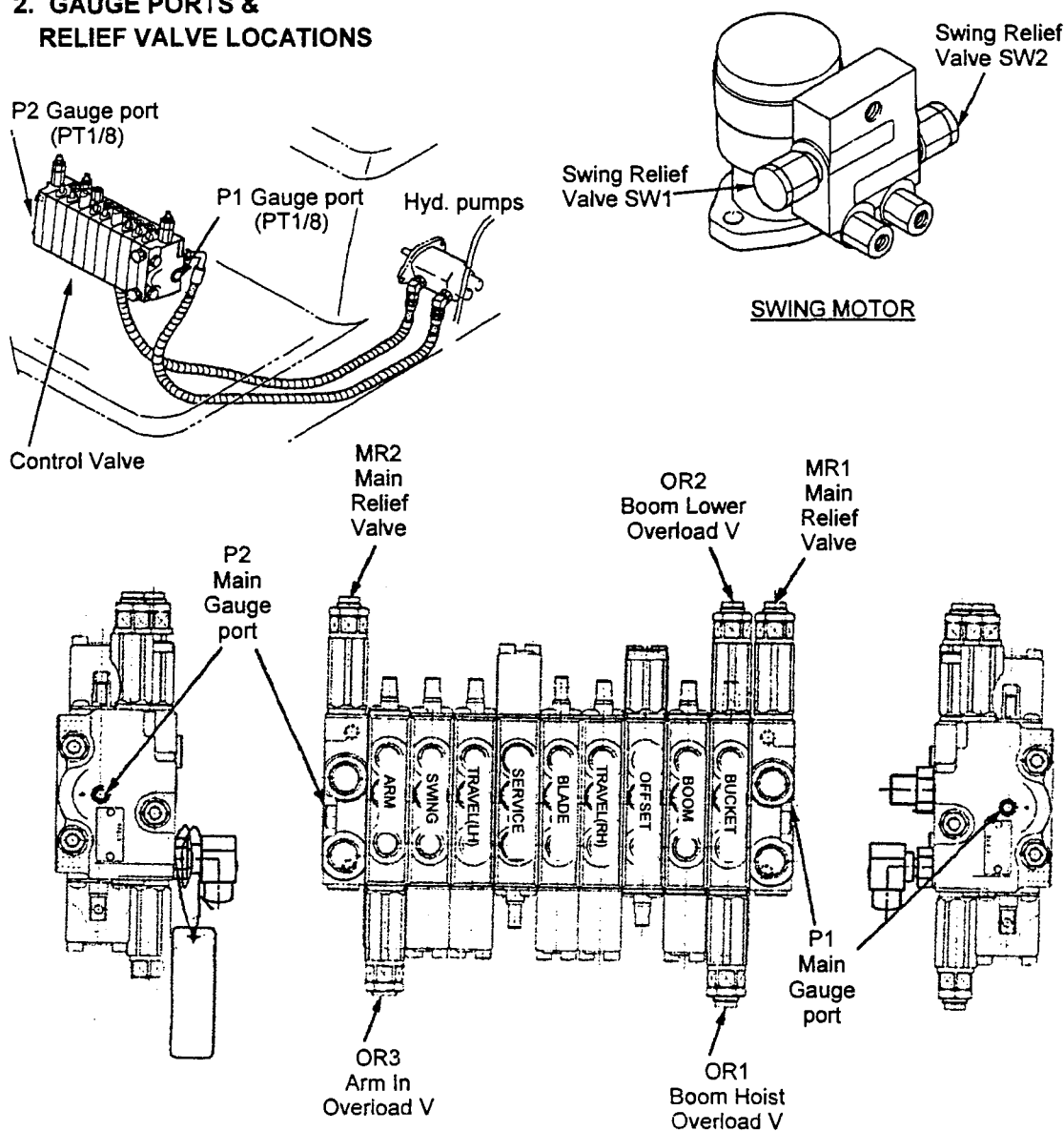
HYDRAULIC SYSTEM PRESSURE SETTINGS

1. SET PRESSURE

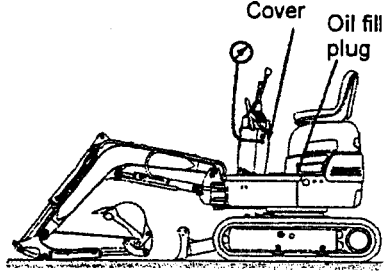
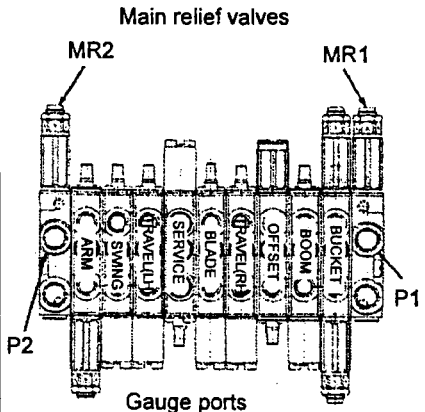
Hyd. Oil Temp.: 50 to 60°C

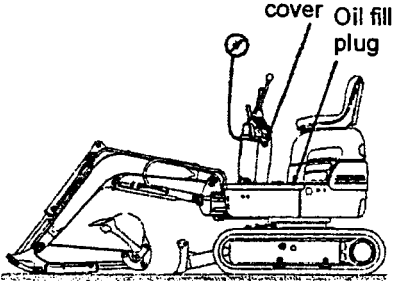
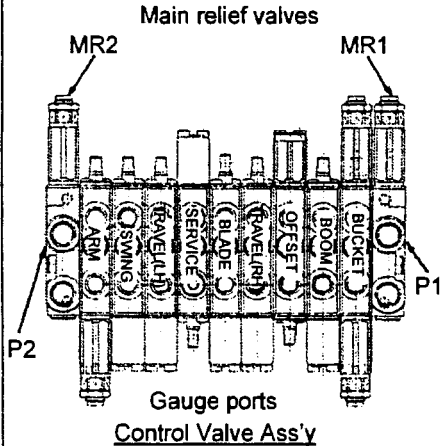
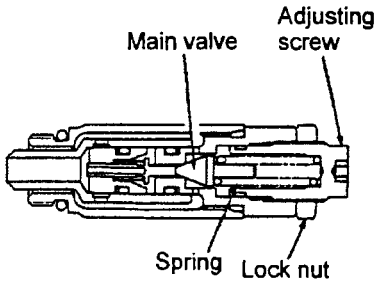
Relief Valves		Gauge Ports	Valve Location	Maintenance Std. MPa (kgf/cm ²)	Note
Main	Bucket, Boom, Travel (RH), Boom swing, Service	P1	MR1	16.2 ^{+0.3} _{-0.2} (165 ⁺³ ₋₂)	Rated Engine RPM
	Arm, Swing, Travel (LH), Service	P2	MR2	16.2 ^{+0.3} _{-0.2} (165 ⁺³ ₋₂)	Rated Engine RPM
Overload	Boom (Hoist)	Install Gauge Adapter in Att. Line	OR1	18.6 ^{+0.5} ₀ (190 ⁺⁵ ₀)	Refer to Pressure Measuring Procedure
	Arm (In)		OR2		
			OR3		
Brake	Swing	P2	SW1, SW2	6.4 ^{+0.5} ₀ (65 ⁺⁵ ₀)	Low Idle Engine RPM
	Travel	P1(LH) P2(RH)	Not Equipped		Relief the main relief valves

2. GAUGE PORTS & RELIEF VALVE LOCATIONS

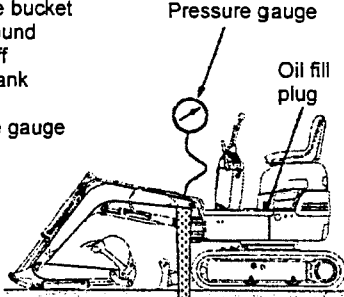
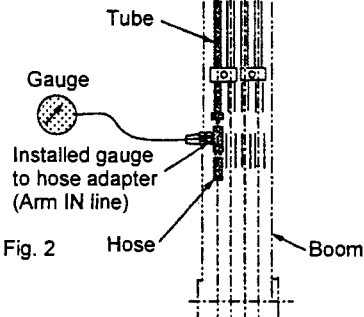
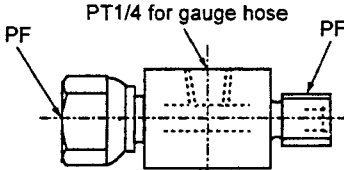
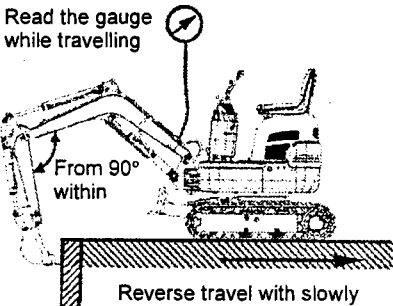


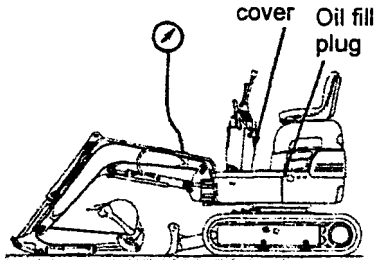
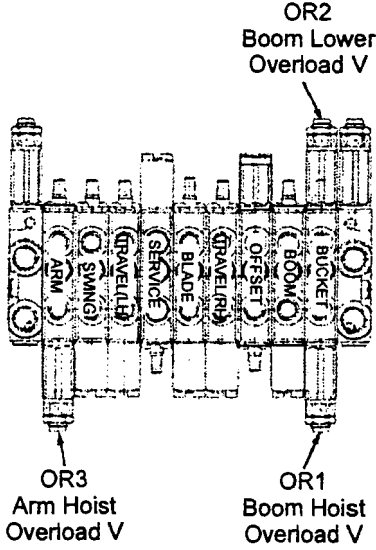
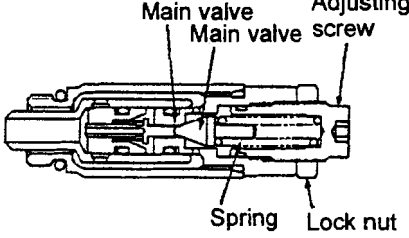
3. Main Relief Valve Pressure Measuring and Adjusting Procedure

	Procedures	Note
Conditions	1. Engine speed : Maximum revolution 2. Hyd. oil Temp. : 45 to 55°C 3. Install of pressure gauge : Install the pressure gauge (300 kgf/cm²) to gauge ports P1, P2 or P3 on the control valve.	 WARNING Do not remove the gauge port plug until air pressure has been relieved in hydraulic tank and engine off.
Measuring procedures	1. Stop the engine. Remove the oil fill plug on the hydraulic tank. Remove the cover and install the pressure gauge to measure port on the control valve. Install the fill plug. 2. Measure the MR1 Main relief valve (Operation for Boom, Bucket, Travel R.H. and Service) (1) Start the engine, move the bucket or boom cylinder fully stroked. (2) Move the engine throttle lever to high idle. Move the bucket or boom lever fully stroke to hold it, and measure the pressure. 3. Measure the MR2 Main relief valve (Operation for Arm, Travel L.H. and Service) (1) Start the engine, move the arm cylinder fully stroked. (extend or retract) (2) Move the engine throttle lever to high idle. Move the arm lever fully stroke to hold it, and measure the pressure. 5. Remove the pressure gauge. Apply pipe sealant to the plug. Install the fill plug on the hydraulic tank. Install the cover.	 Cover Oil fill plug  Main relief valves MR2 MR1 P2 P1 Gauge ports Control valve Ass'y

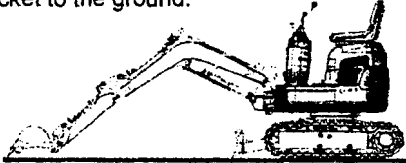
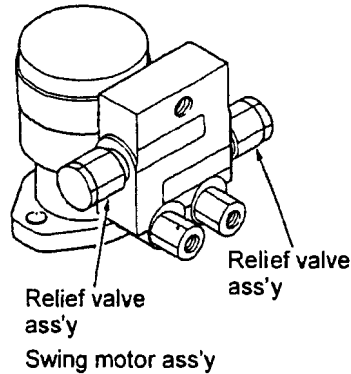
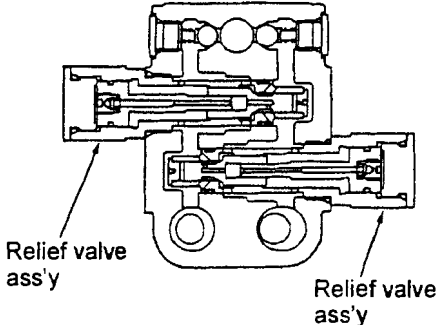
	Procedures	Note
Adjusting procedures	Adjusting the Main relief valve If the pressure is lower than the specified value, adjust it according to the following procedure. (Same procedures as MR1, MR2) 1. Remove the cap nut. 2. Start the engine and the engine throttle lever to high idle. 3. Move the lever for measuring main relief valve, fully pull to hold it, and adjust the pressure by turning the adjusting screw with a hexagon bar spanner, while measuring the pressure. Adjusting screw turn to clockwise to raise the pressure. (Adjusting screw 1 turn approx. 100 kgf/cm² change pressure) 4. Install and tighten the cap nut. 5. After locking, measure the pressure again. 6. Stop the engine. Remove the fill plug on the hydraulic tank. 7. Remove the pressure gauge. Apply pipe sealant to the plug. Install the plug. Install the fill plug on the hydraulic tank.	WARNING Do not remove the gauge port plug until air pressure has been relieved in hydraulic tank.    Cross section of Main relief valve

4. Over load Relief Valve Pressure Measuring and Adjusting Procedure

	Procedures	Note
Conditions	1. Engine speed : Low idle 2. Hyd. oil Temp. : 45 to 55°C 3. Install of pressure gauge : Install the pressure gauge (300 kgf/cm²) to the arm dig line with hose adapter.	WARNING Do not remove the gauge port plug until air pressure has been relieved in hydraulic tank.
Measuring procedures	Since the over load relief valve has a little of flow, 2ℓ/min, at the pressure setting, no measurement can be made with the pump flow. Measure the pressure following procedure to relieve over load relief valve by setting the arm cylinder with TRAVEL. 1. Lower the bucket to the ground. Stop the engine. Remove the fill plug on the hydraulic tank. Install the pressure gauge to the arm IN line with hose adapter. Install the fill plug. (Fig 1 & 2) 2. Measure the over load relief valve. (For arm IN line) (1) Start the engine, move the bucket contact to the hard wall. (Fig. 4) (2) Move the engine throttle lever to low idle. Pull the travel levers fully stroke to hold it, and measure the pressure while travelling. (Fig. 4) (3) For the boom over load relief valves, replace the arm IN over load relief valve with it to measure the pressure. 3. Lower the bucket to the ground. Stop the engine. Remove the fill plug on the hydraulic tank. 4. Remove the pressure gauge and hose adapter. Install the arm IN line hose to tube. Install the fill plug on the hydraulic tank.	1. Lower the bucket to the ground 2. Engine off 3. Relieve tank pressure 4. install the gauge  Fig. 1  Fig. 2  Fig. 3 Hose adapter 1/4 : 0472 953 01 3/8 : 0472 953 02 Read the gauge while travelling  Fig. 4

	Procedures	Note
Adjusting procedures	Adjusting the over load relief valve If the pressure is lower than the specified value, adjust it according to the following procedure. (Same procedures for OR1 thru OR3) 1. Remove the nut. 2. Adjust the pressure by turning the adjusting screw with a hexagon bar spanner. Adjusting screw turn to clockwise to raise the pressure. (Adjusting screw 1 turn approx. 100 kgf/cm² change pressure) 4. Install and tighten the nut. 5. After locking, measure the pressure again. 6. Lower the bucket to the ground. Stop the engine. Remove the fill plug on the hydraulic tank. 7. Remove the pressure gauge and hose adapter. Install the arm IN line hose to tube. Install the fill plug on 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.  cover Oil fill plug  OR2 Boom Lower Overload V OR3 Arm Hoist Overload V OR1 Boom Hoist Overload V  Main valve Main valve screw Spring Lock nut <u>Cross section of over load relief valve Ass'y</u>

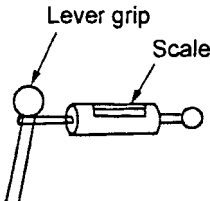
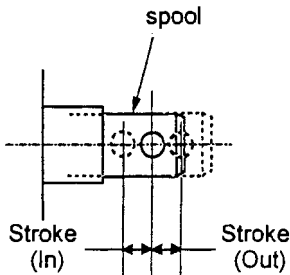
5. Swing Relief Valve Pressure Measuring and Adjusting Procedure

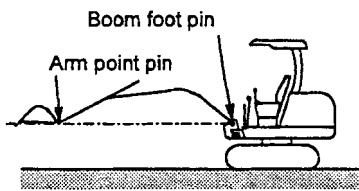
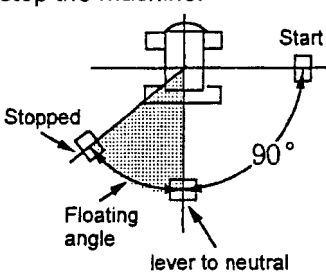
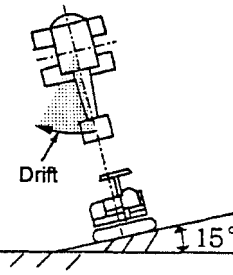
	Procedures	Note
Conditions	1. Engine speed : Low idli 2. Hyd. oil Temp. : 45 to 55°C 3. Install of pressure gauge : Install the pressure gauge (300 kgf/cm²) to the P2 gauge port.	 Upper structure movement can cause personal injury or death. To prevent structure movement, visually inspect to be sure the pin is engaged.
Measuring procedures	1. Align the upper structure with the track and engage the swing lock pin and lower the bucket to the ground. 2. Stop the engine. Remove the fill plug on the hydraulic tank. Install the pressure gauge on the control valve to P2 gauge port. Install the fill plug. 3. Start the engine, move the engine throttle lever to low idle. Move the swing lever right or left fully stroke to hold it, and measure the pressure. 3. Stop the engine. Remove the fill plug on the hydraulic tank. 4. Remove the pressure gauge. Apply pipe sealant to the plug. Install the fill plug on the hydraulic tank.	Do not remove the gauge port plug until air pressure has been relieved in hydraulic tank. Align the upper structure with the track and engage the swing lock pin and lower the bucket to the ground. 
Adjusting procedures	This swing relief valve not equipped pressure adjusting device. Do not adjust the pressure. If the pressure is lower than the specified value, replace the swing relief valve ass'y. 1. Stop the engine. Remove the fill plug on the hydraulic tank. 2. Remove the swing relief valve and install the new swing relief valve. 3. Install the fill plug on the hydraulic tank.	  <u>Cross section of swing relief valve</u>

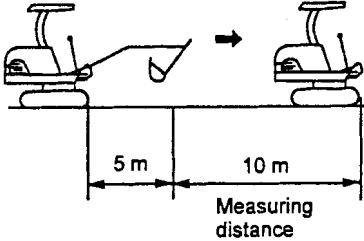
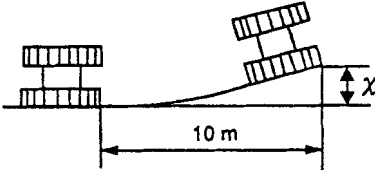
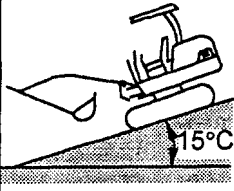
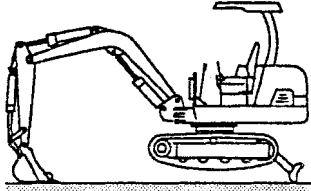
SECTION 6 PERFORMANCE STANDARDS

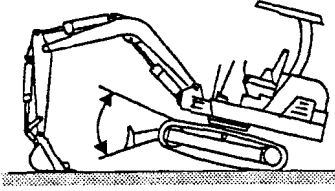
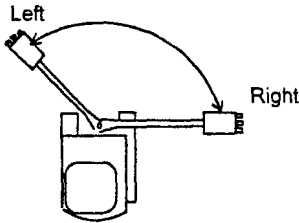
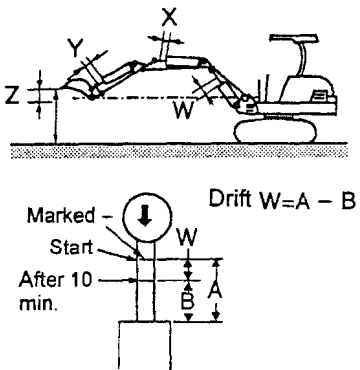
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ITEM	CONDITION				
		STANDARD	ALLOW.		
HYDRAULIC PRESSURE	Engine : Rated r.p.m. Oil temp : 50° – 60°C	kgf / cm ²	kgf / cm ²		
Boom		16.2 ^{+0.5} ₋₀ (165 ⁺⁵ ₋₀)	16.2 ^{+0.5} ₋₀ (165 ⁺⁵ ₋₀)		
Arm		↑	↑		
Bucket		↑	↑		
Swing		6.9 ^{+0.5} ₋₀ (70 ⁺⁵ ₋₀)			
Travel		16.2 ^{+0.5} ₋₀ (165 ⁺⁵ ₋₀)			
Boom Swing		↑	↑		
Blade		↑	↑		
LEVER FOCE	Engine : Low speed Oil temp : 50° – 60°C Measuring Position : Use spring balance scale and hook under grip. 	kg	kg		
Boom		1.3 ± 0.5	←		
Arm		1.3 ± 0.5	←		
Bucket		1.3 ± 0.5	←		
Swing		1.3 ± 0.5	←		
Travel		2.0 ± 0.5	←		
Boom Swing		6.0 ± 0.5	←		
Blade		1.4 ± 0.5	←		
Throttle		± 0.5	←		
SPOOL STROKE (CONTROL VALVE)					
Boom Arm Bucket Swing		(6 mm)	←		
Travel Boom Swing Blade		6 mm	←		

ITEM	CONDITION				
		STANDARD	ALLOW.		
SWING	Engine : Rated r.p.m. Oil temp : 50° – 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. 	10 ± 5°	Below 35°		
Swing Operating Speed	Engine : Rated r.p.m. Oil temp : 50° – 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.	13.8 sec ± 0.5° sec	Below 16.0 sec		
Natural Drift 	Engine : Low idling Oil temp : 50° – 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	STANDARD		ALLOW.	
		Rubber shoe		Steel shoe	
TRAVEL	Engine : Rated r.p.m. Oil temp : 50° – 60°C	High Speed 16.2 sec ± 0.5 sec	High Speed below 12.5 sec		
Travel Speed	Level solid ground Time required for 10 m travel after 5 m take off.	Low Speed 21.2 sec ± 1.0 sec	Low Speed below 23.2 sec		
		High Speed sec ± sec	High Speed sec ± sec		
		Low Speed sec ± sec	Low Speed sec ± sec		
Travel Alignment	Engine : Rated r.p.m. Oil temp : 50° – 60°C	Below 700 mm	Below 1000 mm		
	Measure turning distance (x) after 10 m travel.				
					
Natural Drift	Engine : Low idling Oil temp : 50° – 60°C	100 mm /5 min	500 mm /5 min		
	Measure drift gravity in 5 minutes.				
					
Time for Crawler belt	Engine : Rated r.p.m. Oil temp : 50° – 60°C	High Speed 13.6 sec ± 1.0 sec	High Speed below 16.7 sec		
	Measure time required for five turns after one turn.	Low Speed 28.2 sec ± 1.0 sec	Low Speed below 32.4 sec		
					

ITEM	CONDITION				
		STANDARD	ALLOW.		
BLADE CYLINDER SPEED	Engine : Rated r.p.m. Oil temp : 50° – 60°C  Measure time for full extention or retraction of cylinder.	Hoist 2.3 sec ±0.5 sec Lower 2.8 sec ±0.5 sec	Below 3.1 sec Below 3.7 sec		
BOOM SWING CYLINDER SPEED	Engine : Rated r.p.m. Oil temp : 50° – 60°C  Measure time for full extention or retraction of cylinder. Without measure cusion stroke.	Left 4.6 sec ±0.5 sec Right 4.7 sec ±0.5 sec	Below 6.0 sec Below 6.0 sec		
CYLINDER DRIFT	Engine : Stopped Oil temp : 50° – 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. 	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 400 mm		