WSM

WORKSHOP MANUAL
KUBOTA EXCAVATOR

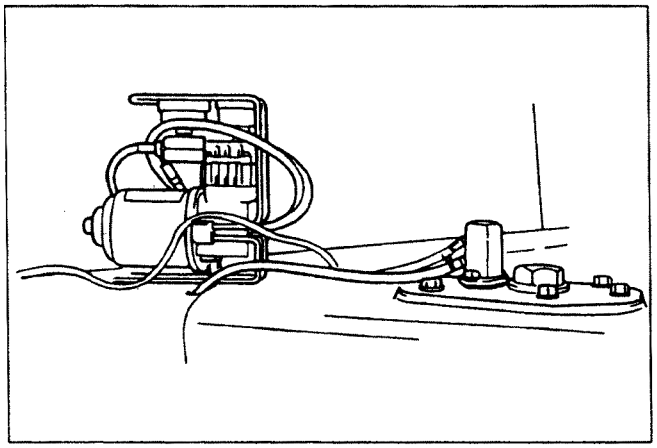
KX91-3
KX101-3

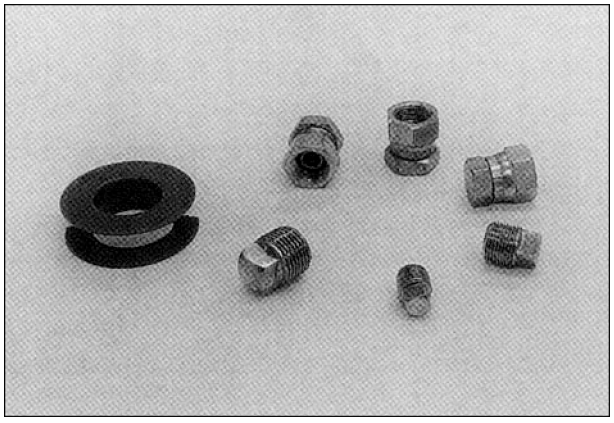
Kubota

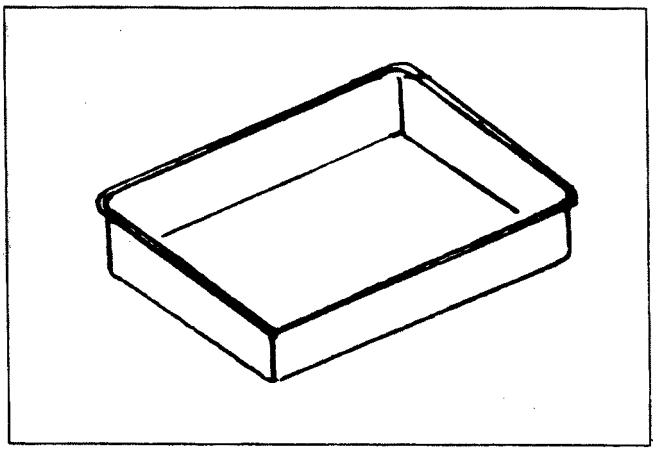
Code No.97899-60520

E.SERVICING FUNDAMENTALS

Locking adhesive







a.Items for Servicing

1) Tighten bolts, nuts, adapters,and similar parts to their specified torques which are given in the list of tightening torques and adhesive as well as in this manual. Be sure to observe the specified torques for important tightened parts and components.
2) Wipe out water, oil and grease off the screws on which loctite adhesive is to be applied. Be sure to apply the adhesive to specified locations.

Liquid color	Feature
Red	Heavy-duty
Blue	Medium-duty

The word “LOCTITE“ in this manual denotes the red-color type.

3) Precautions in disassembling the hydraulic equipment
   - Use a vacuum pump, pulgs, oil pans, waste cloth and the like to prevent oil from running out or splashing.
   - Wipe out leaking oil completely first and then add oil as required.
   - Protect the openings with plugs, covers or the like to keep off foreign matters. Most of hydraulic system troubles are caused by the entry of foreign matters.
   - Before reassembling, clean up the parts and components and apply hydraulic oil on them.
   - The system consists of precision parts. Be careful not to scratch them and apply excessive force on them.

A.Front attachment

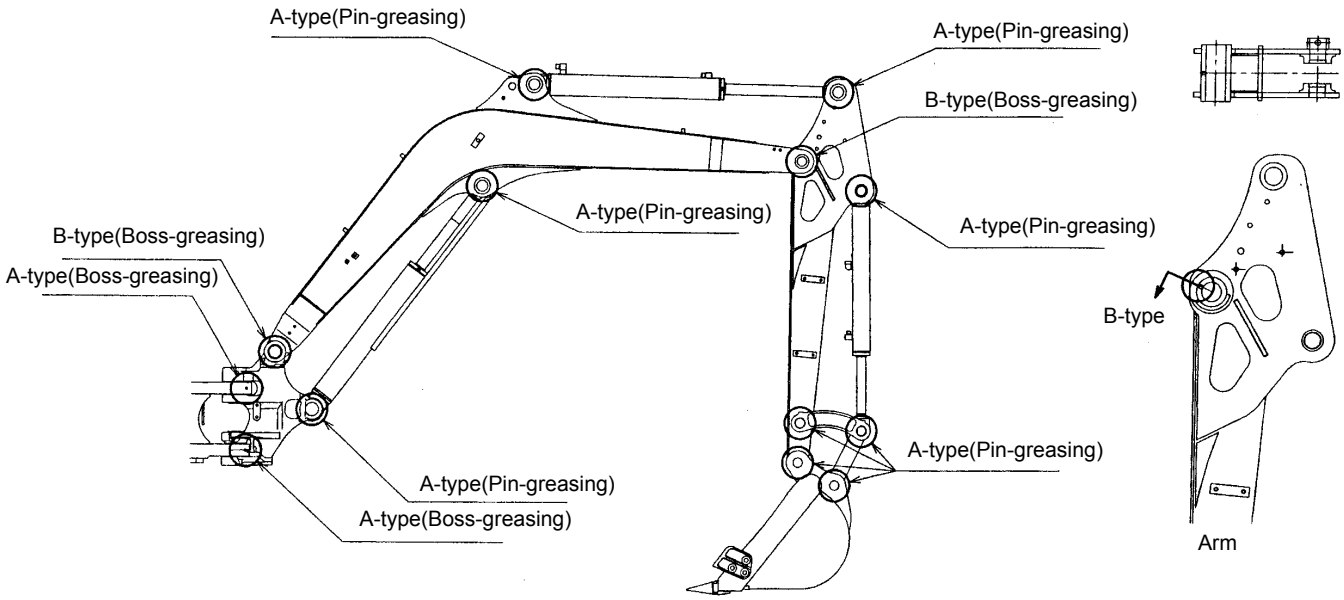
a. Greasing points

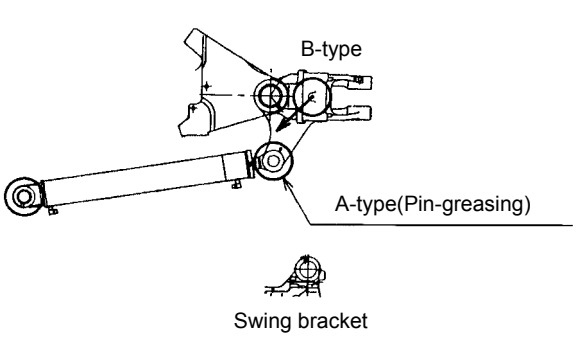
(1) Keep applying grease until it comes out of the circumference at the other end surface of each rotating part.
(2) Apply grease to the end surfaces of all the rotating parts and their related shims.

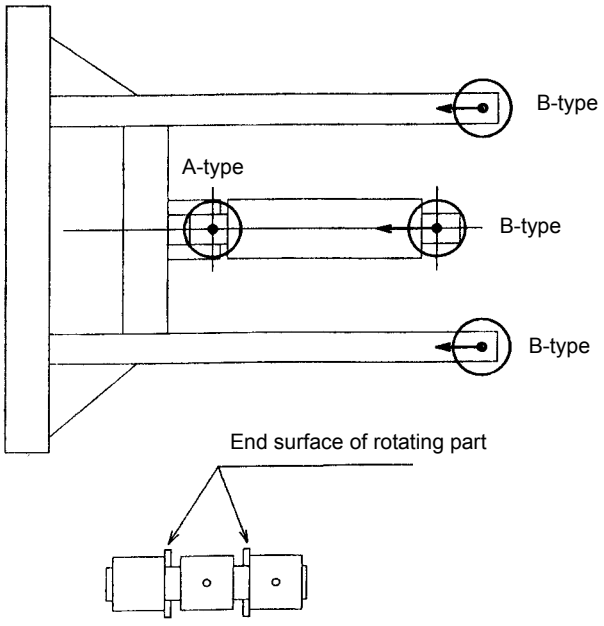

A-type: Straight type
(06611-15010)


B-type: 67°C
(06616-25010)


C-type: 90°C
(06616-35010)

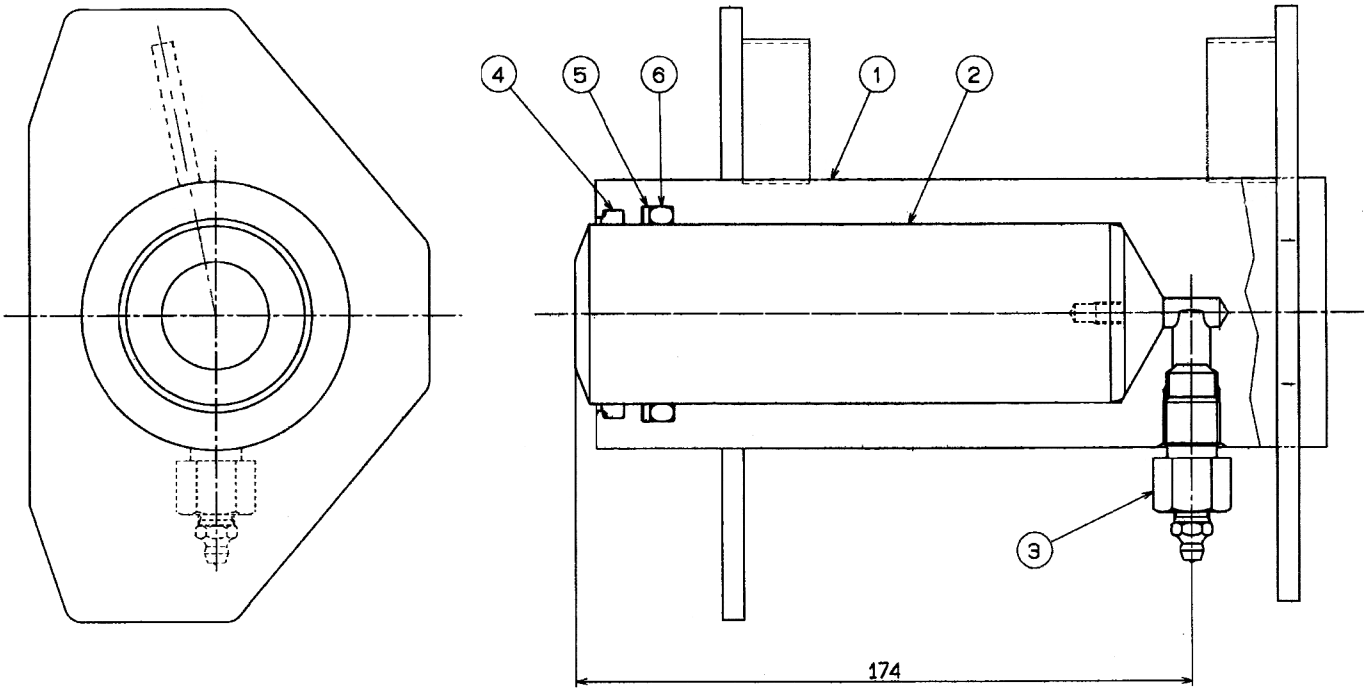






d. Grease tension cylinder, L

P/N = RC411-21503



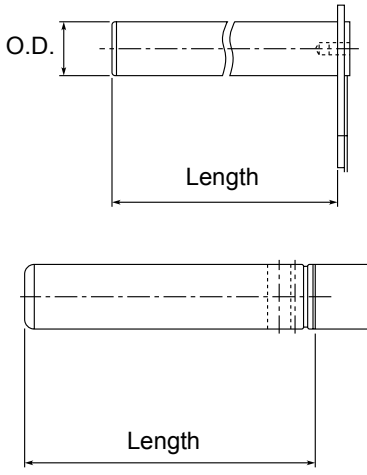
(1)	Cylinder tube, L	(3)	Nipple, assy	(5)	Bulk up ring 60
(2)	Rod	(4)	Dust seal	(6)	O-ring

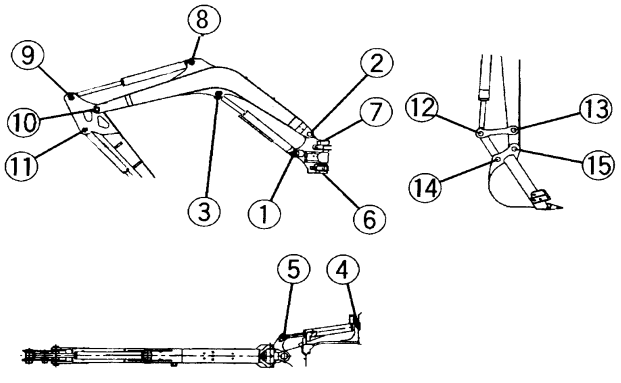
1. Durable pressure = 44.1 MPa (450 kgf/cm^2)
   No pressure leakage is allowed at peak pressure of 98.1 MPa (1000 kgf/cm^2)
2. Tightening torque of grease nipple = 98~107.8 N·m (1~11 kgf·m)

d. Dimensions of Parts

(1) Front pins

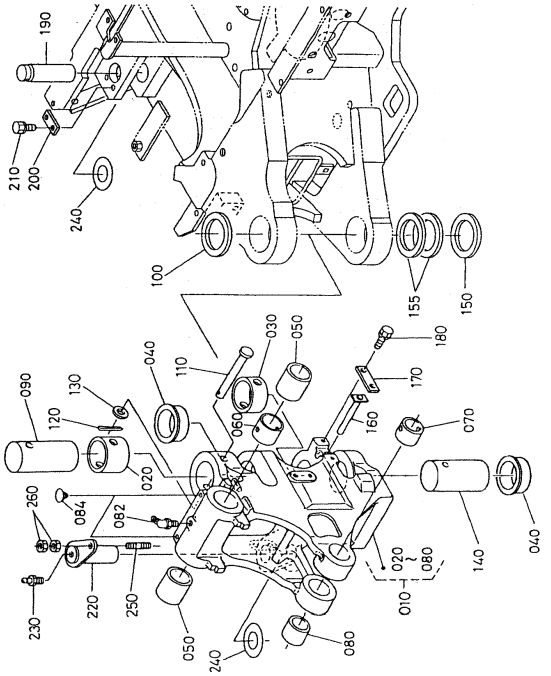
No.		Unit	KX91-3	KX101-3		Allowable wear limit
1	Pin diameter × length	mm in.	ϕ40 × 160 ϕ1.57 ×6.30	←		
2	Pin diameter × length	mm in.	ϕ50 × 278 ϕ1.97 × 10.94	←		
3	Pin diameter × length	mm in.	ϕ40 × 155 ϕ1.57 × 6.10	←		
4	Pin diameter × length	mm in.	ϕ40 × 132 ϕ1.57 × 5.20	←		
5	Pin diameter × length	mm in.	ϕ40 × 114 ϕ1.57 × 4.49	←		
6	Pin diameter × length	mm in.	ϕ70 × 141.5 ϕ2.76 × 5.57	←		
7	Pin diameter × length	mm in.	ϕ70 × 155 ϕ2.76 × 6.10	←		
8	Pin diameter × length	mm in.	ϕ45 × 172 ϕ1.77 × 6.77	←		
9	Pin diameter × length	mm in.	ϕ45 × 172 ϕ1.77 × 6.77	←		
10	Pin diameter × length	mm in.	ϕ40 ×239 ϕ1.57 × 9.41	←		
11	Pin diameter × length	mm in.	ϕ40 × 155 ϕ1.57 × 6.10	←		
12	Pin diameter × length	mm in.	ϕ40 × 193 ϕ1.57 × 7.60	←		
13	Pin diameter × length	mm in.	ϕ40 × 193 ϕ1.57 × 7.60	←		
14	Pin diameter × length	mm in.	ϕ40 × 233 ϕ1.57 × 9.17	←		
15	Pin diameter × length	mm in.	ϕ40 × 233 ϕ1.57 × 9.17	←		

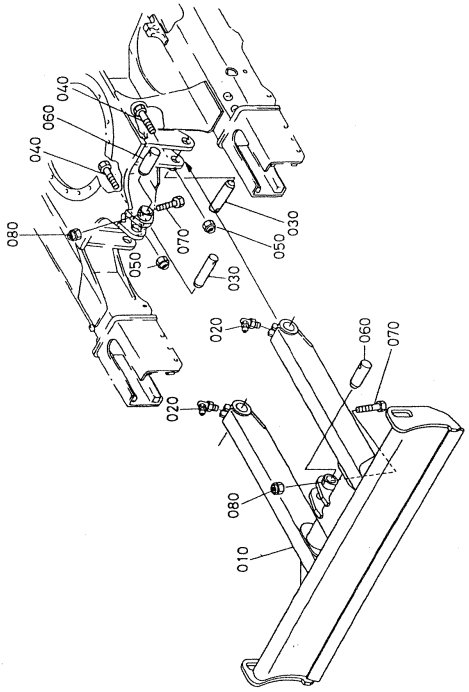


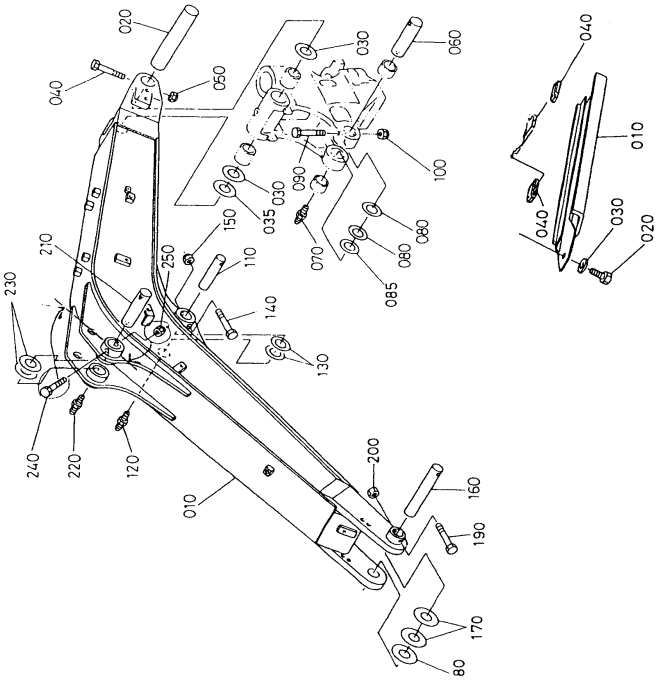


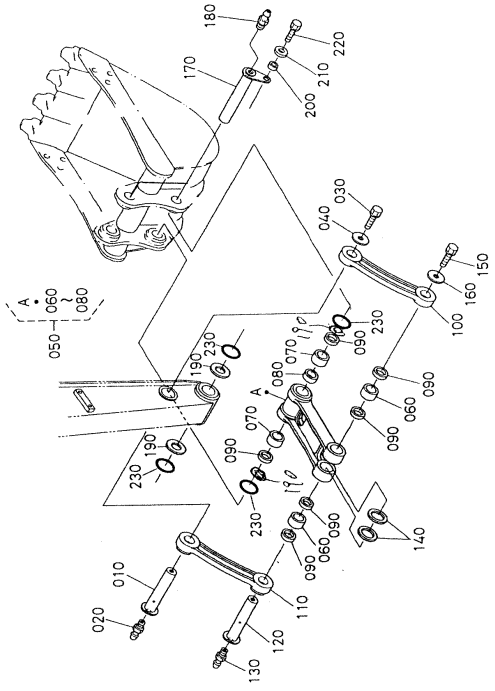
B.Front attachment

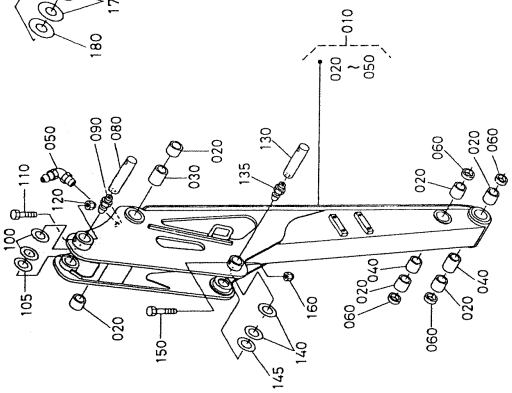
a. Parts designation











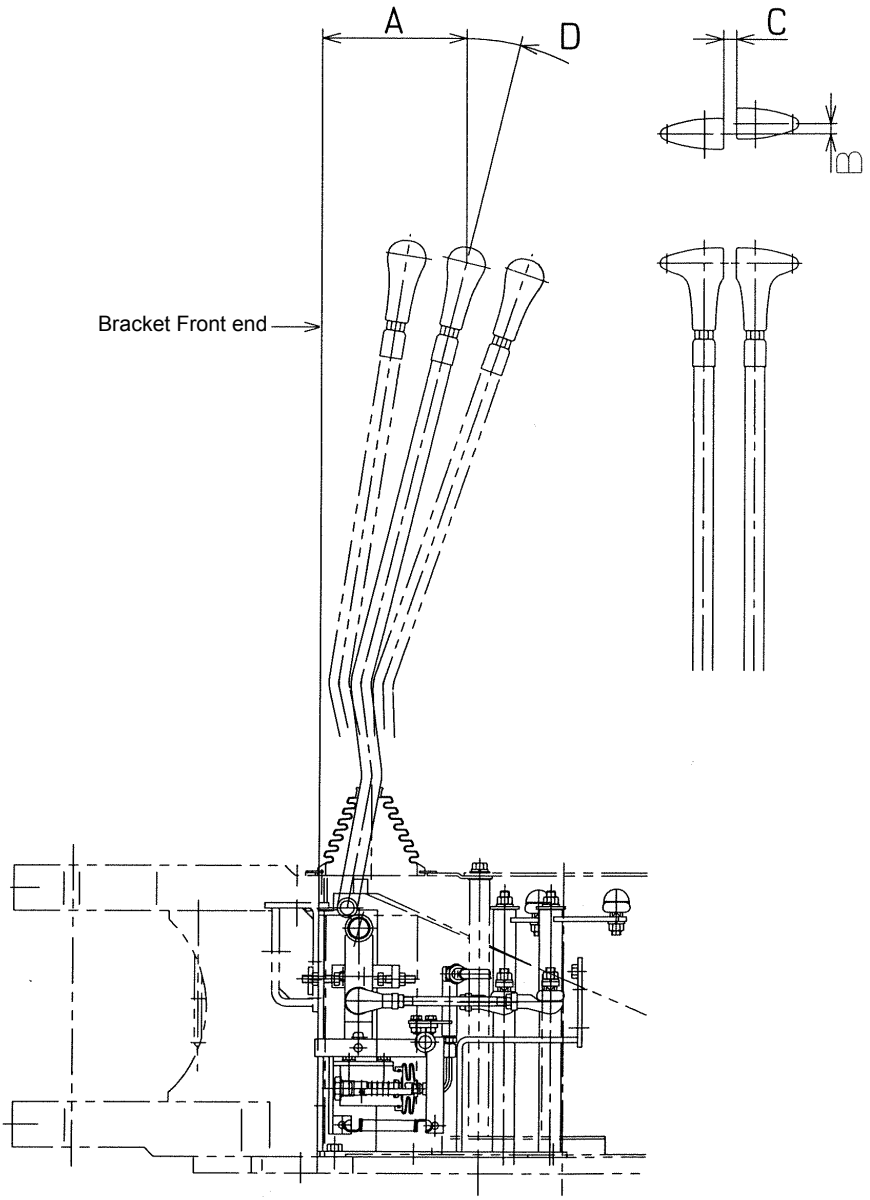
10. Undo the front hose clamp from the swing bracket.

11. Remove the boom hose clamp itself from the swing bracket.

12. Remove the boom cylinder hose clamp lock nut. Remove the double nut from the swing cylinder rod pin and pull out the pin.

13. Using the hoist, lift the swing bracket.

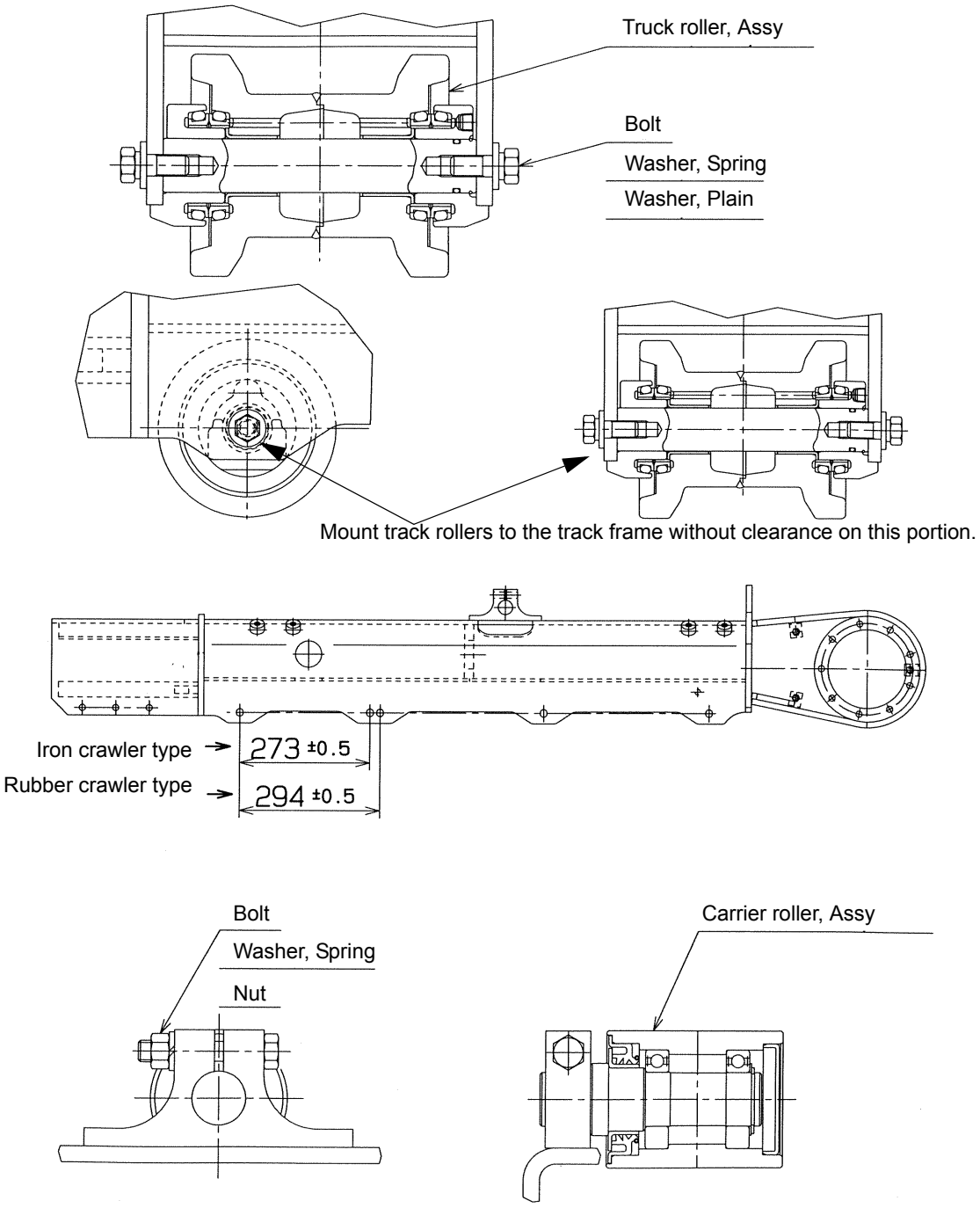
d. Traveling lever adjustment



Adjust the traveling lever as shown below table.

No.	Items	Dimensions	Remarks
A.	Distance beween bracket front end and newtral position center of Traveling lever grip.	160 mm 6.30 in	Reference valve
B.	Gap between left and right lever to longitudinal direction.	under 2 mm under 0.08 in	
C.	Clearance between left and right lever.	11 ~ 17 mm 0.43 ~ 0.67 in	
D.	Angle of trabeling lever at newtral position.	14 deg	

c. Track Roller and Upper Roller installation



1. Remove the stuck oil and paint on the track roller and track frame for mounting track roller.
2. Tightening torque for mounting track roller.
   - 103 ~ 117.7 N·m
   - 10.5 ~ 12.0 kgf·m
   - 76.0 ~ 86.8 ft·lbf

   Apply threebond #1305 on the femail thread.
3. Tightening torque for mounting upper roller.
   - 77.5 ~ 90.2 N·m
   - 7.9 ~ 9.2 kgf·m
   - 57.2 ~ 66.5 ft·lbf

   Apply locktite #271.

C.Radiator fan & coupling flange

a. Fan belt tension adjustment

Push fan belt with the amount of force, 58.8 ~ 68.6 N·m(6 ~ 7kgf).

b. Alternator mounting bolt torque:

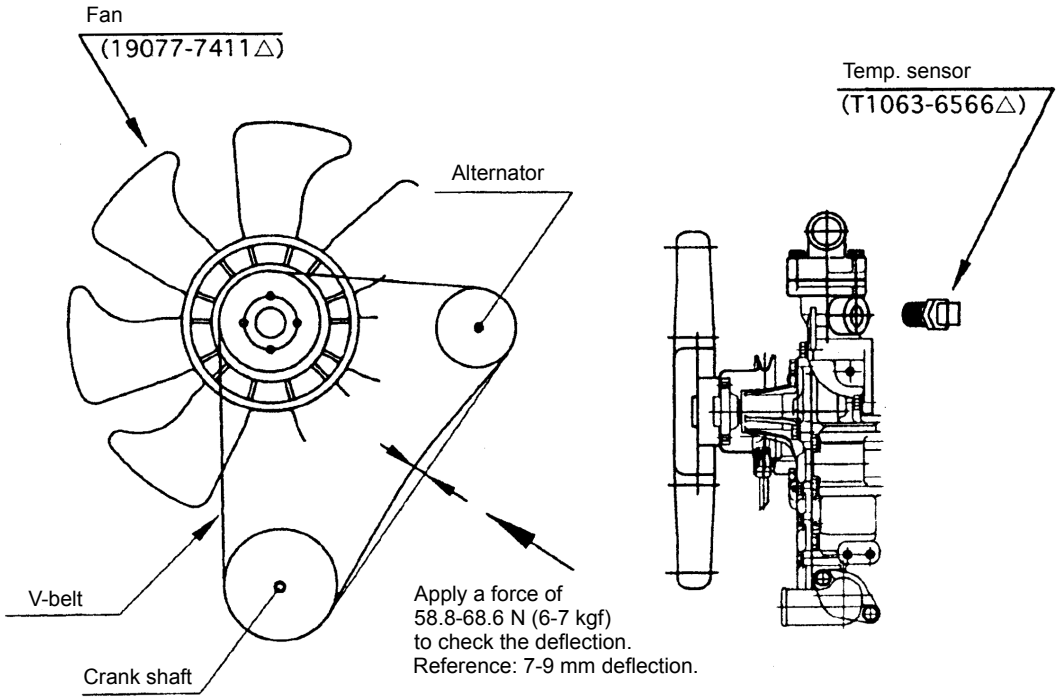
39.2 ~ 44.1N·m(4.0 ~ 4.5kgf·m)

c. Temp. sensor tightning torque:

62.7 ~ 72.5N·m(6.4 ~ 7.4kgf·m)

d. Fan flange bolt tightning torque:

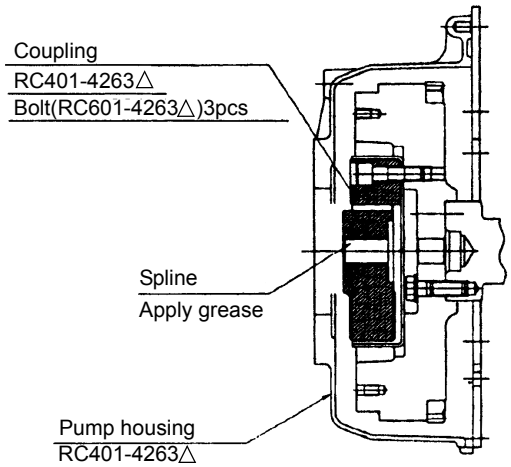
7.8 ~ 8.8N·m(0.8 ~ 0.9kgf·m)



e. Bolt tightning torque of coupling flange

107 ~ 117N·m(11 ~ 12kgf·m)

* Mec-processed.
* Never use screw lock agent



SAFETY FIRST

This symbol, the industry's "Safety Alert Symbol", is used throughout this manual and on labels on the machine itself to warn of the possibility of personal injury. Read these instructions carefully.

It is essential that you read the instructions and safety regulations before you attempt to repair or use this unit.

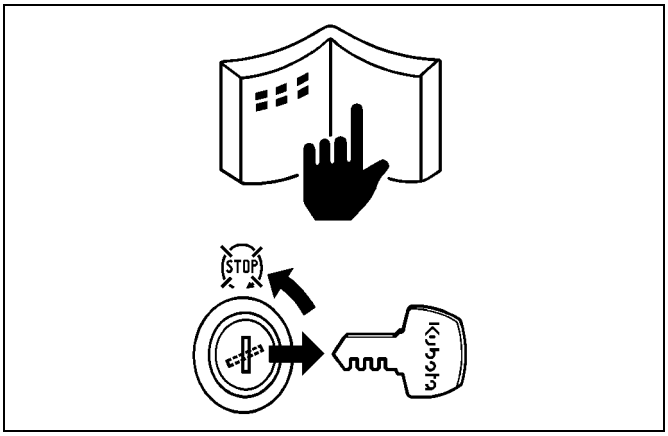
DANGER : Indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury.

WARNING : Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION : Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

■ IMPORTANT : Indicates that equipment or property damage could result if instructions are not followed.

■ NOTE : Gives helpful information.

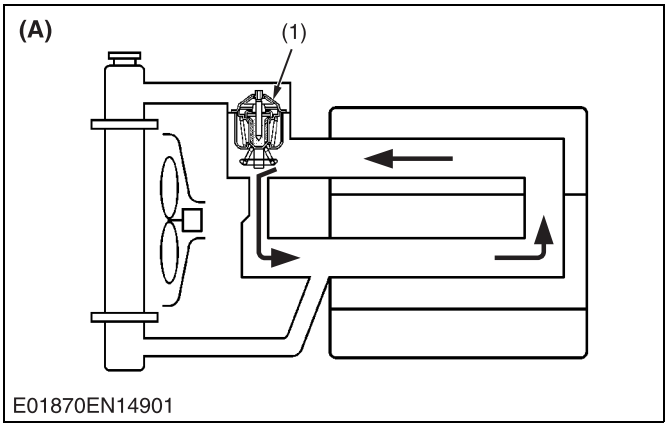


BEFORE SERVICING AND REPAIRING

- Read all instructions and safety instructions in this manual and on your engine safety decals.
- Clean the work area and engine.
- Park the machine on a firm and level ground.
- Allow the engine to cool before proceeding.
- Stop the engine, and remove the key.
- Disconnect the battery negative cable.

2. COOLING SYSTEM

[1] BOTTOM BYPASS SYSTEM



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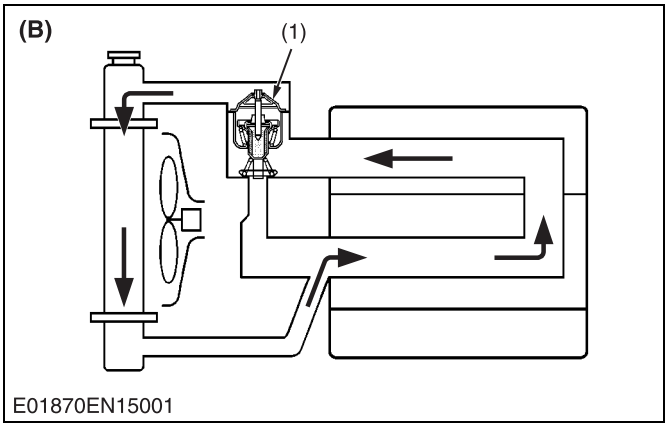


E01870EN15001

Bottom bypass system is introduced in 03-M Series for improving the cooling performance of the radiator.

While the temperature of coolant in the engine is low, the thermostat is held closed and the coolant is allowed to flow through the bypass pipe and to circulate in the engine.

When the temperature exceeds the thermostat valve opening level, the thermostat fully opens itself to prevent the hot coolant from flowing through the bypass into the engine.

In this way, the radiator can increase its cooling performance.

(1) Thermostat

(A) Thermostat Closed
(B) Thermostat Open

W1013406

[4] TROUBLESHOOTING

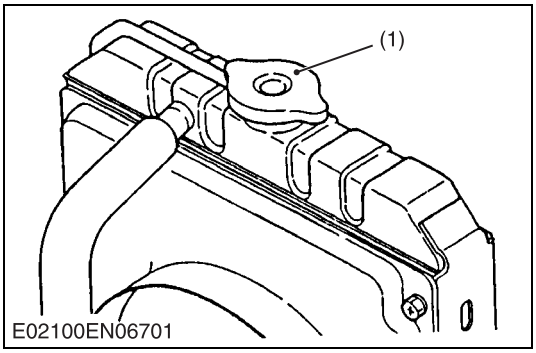
Symptom	Probable Cause	Solution	Reference Page
Engine Does Not Start	• No fuel	Replenish fuel	–
	• Air in the fuel system	Vent air	S-19
	• Water in the fuel system	Change fuel and repair or replace fuel system	S-19, 20, 24
	• Fuel pipe clogged	Clean	
	• Fuel filter clogged	Clean or change	S-20, 24
	• Excessively high viscosity of fuel or engine oil at low temperature	Use specified fuel or engine oil	–
	• Fuel with low cetane number	Use specified fuel	–
	• Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	–
	• Incorrect injection timing	Adjust	S-81
	• Fuel camshaft worn	Replace	S-50
	• Injection nozzle clogged	Replace	S-83
	• Injection pump malfunctioning	Replace	S-47
	• Seizure of crankshaft, camshaft, piston, cylinder or bearing	Repair or replace	–
	• Compression leak from cylinder	Replace head gasket, tighten cylinder head screw, glow plug and nozzle holder	–
	• Improper valve timing	Correct or replace timing gear	S-49
	• Piston ring and cylinder worn	Replace	S-41, 52, 67, 74
	• Excessive valve clearance	Adjust	S-30
(Starter Does Not Run)	• Battery discharged	Charge	S-28
	• Starter malfunctioning	Repair or replace	S-84, 88, 91
	• Key switch malfunctioning	Repair or replace	–
	• Wiring disconnected	Connect	-
Engine Revolution Is Not Smooth	• Fuel filter clogged or dirty	Clean or change	S-20, 24
	• Air cleaner clogged	Clean or change	S-20
	• Fuel leak due to loose injection pipe retaining nut	Tighten retaining nut	–
	• Injection pump malfunctioning	Replace	S-47
	• Incorrect nozzle injection pressure	Replace	S-83
	• Injection nozzle stuck or clogged	Replace	S-83
	• Governor malfunctioning	Repair	S-48, 50
Either White or Blue Exhaust Gas Is Observed	• Excessive engine oil	Reduce to specified level	S-18
	• Piston ring and liner worn or stuck	Repair or replace	S-41, 52, 67, 74
	• Incorrect injection timing	Adjust	S-81
	• Deficient compression	Check the cylinder compression pressure and top clearance	S-41

ELECTRICAL SYSTEM

Item		Factory Specification	Allowable Limit
Starter			
Commutator	O.D.	30.0 mm 1.181 in.	29.0 mm 1.142 in.
Mica	Under Cut	0.50 to 0.80 mm 0.0197 to 0.0315 in.	0.20 mm 0.0079 in.
Brush	Length	15.0 mm 0.591 in.	11.0 mm 0.433 in.
Brush Holder and Holder Support	Resistance	Infinity	–
Alternator	No-load voltage	More than 13.5 V	–
Stator	Resistance	Less than 1.0 Ω	–
Rotor	Resistance	2.9 Ω	–
Slip Ring	O.D.	14.4 mm 0.567 in.	12.8 mm 0.504 in.
Brush	Length	10.5 mm 0.413 in.	8.4 mm 0.331 in.
Glow Plug	Resistance	Approx. 0.9 Ω	–
Stop Solenoid			
Pulling Coil	Resistance	Approx. 0.375 Ω	–
Holding Coil	Resistance	Approx. 15.6 Ω	–

W1094286

(8) Check Points of 500 Hours



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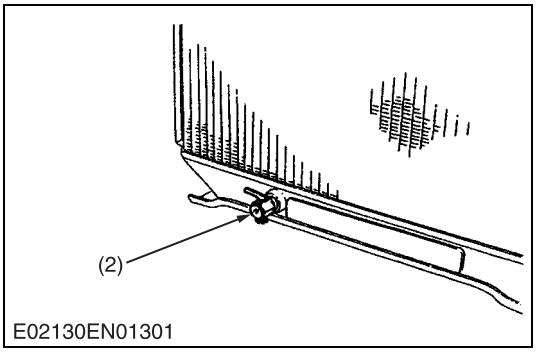

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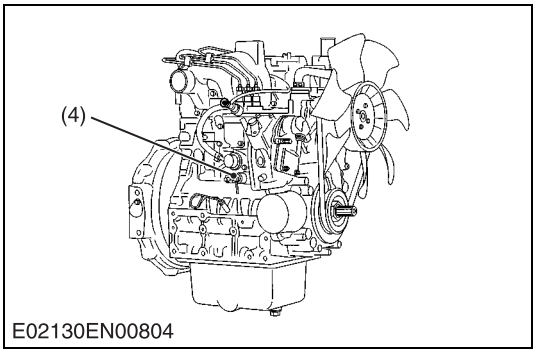

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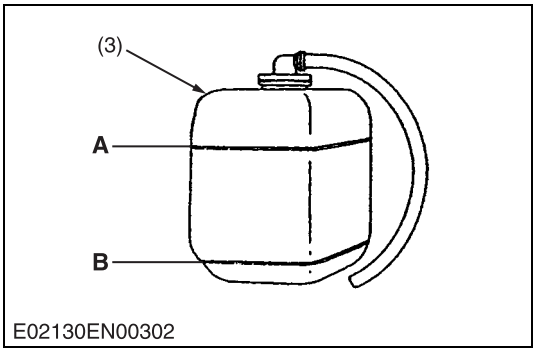


E02130EN00302

Cleaning Fuel Tank Inside

W1051414

Cleaning Water Jacket and Radiator Interior

CAUTION

- **Do not remove the radiator cap when the engine is hot. Then loosen cap slightly to the stop to relieve any excess pressure before removing cap completely.**

1. Stop the engine and let cool down.
2. To drain the coolant, open the radiator drain plug (2) and remove the radiator cap (1). Then radiator cap (1) must be removed to completely drain the coolant
3. After all coolant is drained, close the drain plug.
4. Fill with clean water and cooling system cleaner.
5. Follow directions of the cleaner instruction.
6. After flushing, fill with clean water and anti-freeze until the coolant level is just below the port. Install the radiator cap (1) securely.
7. Fill with coolant up to “FULL” mark on the recovery tank (3).
8. Start and operate the engine for few minutes.
9. Stop the engine and let cool. Check coolant level of recovery tank (3) and add coolant if necessary.

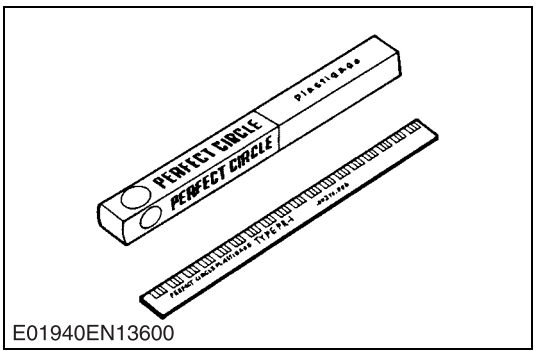
■ **IMPORTANT**

- **Do not start engine without coolant.**
- **Use clean, fresh, soft water and anti-freeze to fill the radiator and reserve tank.**
- **When the anti-freeze is mixed with fresh, soft water, the anti-freeze mixing ratio must be less than 50 %.**
- **Securely tighten radiator cap. If the cap is loose or improperly fitted, water may leak out and the engine could overheat.**

(1) Radiator Cap
(2) Drain Plug
(3) Reserve Tank
(4) Drain Cock

A : Full
B : Low

W1038102



E01940EN13600

Plastigage

Code No: 07909-30241
Application: Use to check the oil clearance between crankshaft and bearing, etc.
Measuring range: Green .... 0.025 to 0.076 mm (0.001 to 0.003 in.)
Red ..... 0.051 to 0.152 mm (0.002 to 0.006 in.)
Blue ..... 0.102 to 0.229 mm (0.004 to 0.009 in.)

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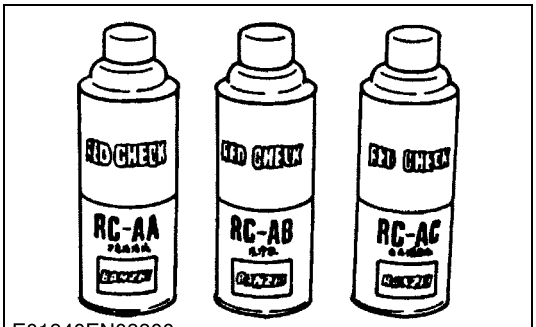

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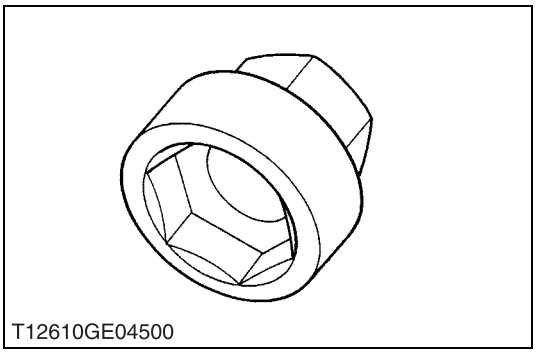
Red Check

Code No: 07909-31371
Application: Use to check cracks on cylinder head, cylinder block, etc.

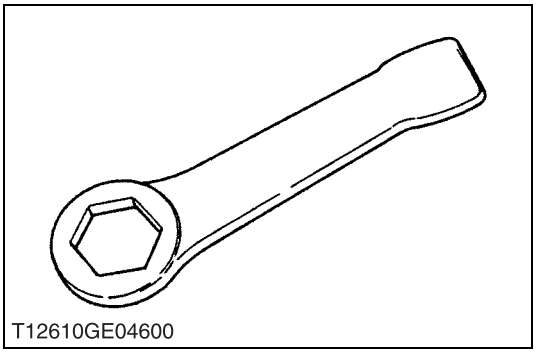
W1024909


T12610GE04500

Crankshaft Nut Socket 46

Code No: 07916-30821
Application: Use exclusively for removing or installing the crankshaft nut.

W1044361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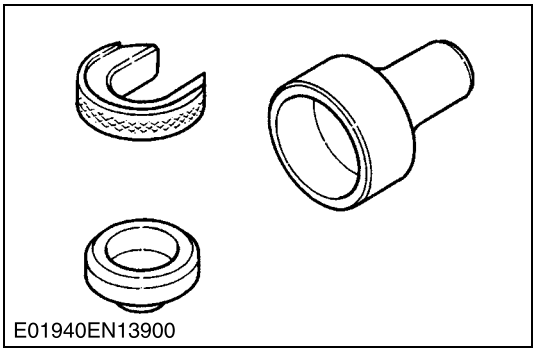
Socket Wrench 46

Code No: 07916-30901
Application: Use exclusively for removing or installing the crankshaft nut.

W1044460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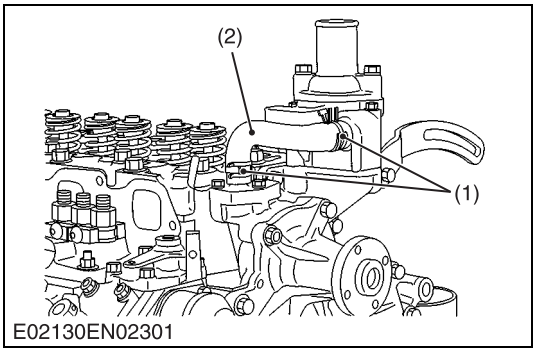
Auxiliary Socket For Fixing Crankshaft Sleeve

Code No: 07916-32091
Application: Use to fix the crankshaft sleeve of the diesel engine.

W1077114



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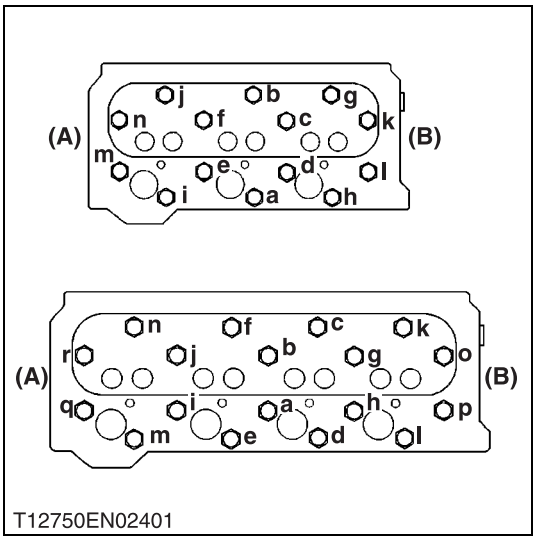

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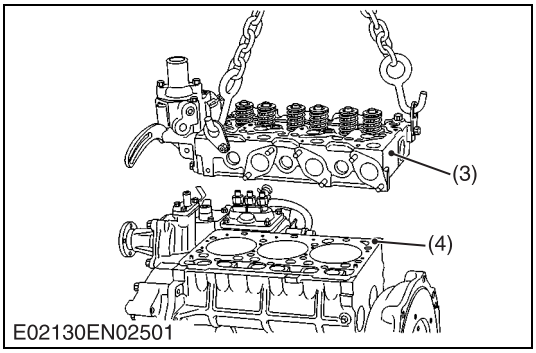

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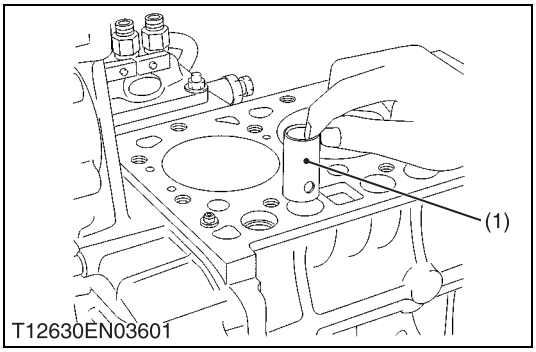

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Cylinder Head

1. Loosen the pipe clamp (1), and remove the water return pipe (2).
2. Remove the cylinder head screw in the order of **(r or n)** to **(a)**.
3. Lift up the cylinder head (3) to detach.
4. Remove the cylinder head gasket (4).

(When reassembling)

- Replace the cylinder head gasket with a new one.
- Tighten the cylinder head screws after applying sufficient oil.
- Tighten the cylinder head screws in diagonal sequence starting from the center in the order of **(a)** to **(n or r)**.
- Tighten them uniformly, or the head may deform in the long run.

Tightening torque	Cylinder head screw	93.1 to 98.0 N·m 9.5 to 10.0 kgf·m 68.7 to 72.3 ft-lbs

(1) Pipe Clamp
(2) Return Pipe
(3) Cylinder Head
(4) Cylinder Head Gasket

(r or n) to (a): To Loosen
(a) to (n or r): To Tighten
(A) Gear Case Side
(B) Flywheel Side

W1021755

Tappets

1. Remove the tappets (1) from the crankcase.

(When reassembling)

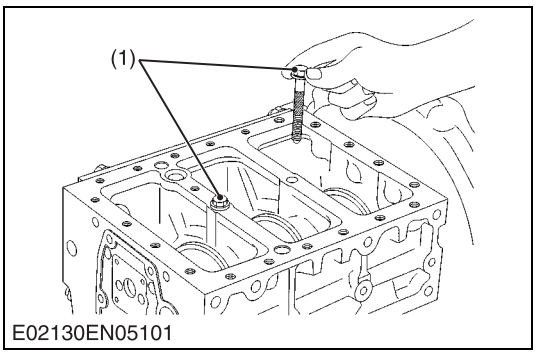
- Visually check the contact between tappets and cams for proper rotation. If defect is found, replace tappets.
- Before installing the tappets, apply engine oil thinly around them.

■ **IMPORTANT**

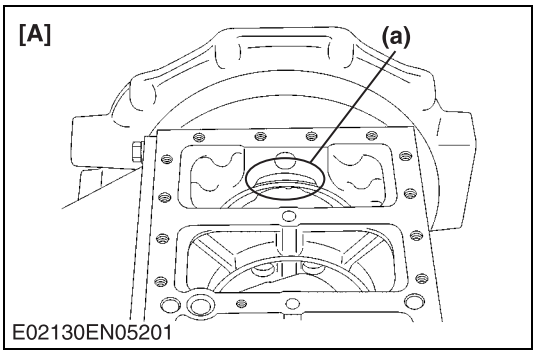
- **Do not change the combination of tappet and tappet guide.**

(1) Tappet

W1022001



E02130EN05101



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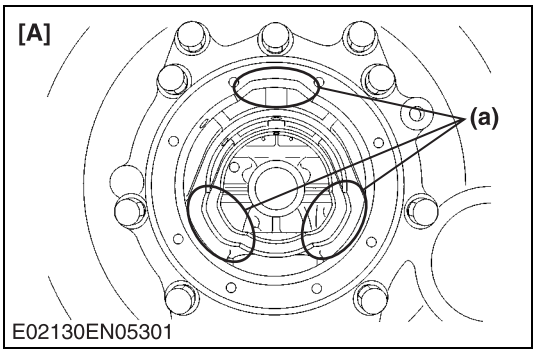

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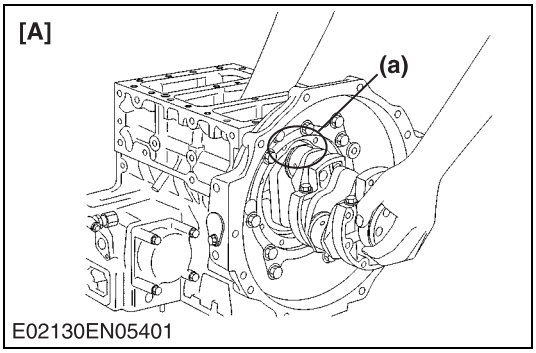


E02130EN05401

Crankshaft

■ **NOTE**

- **Before disassembling, check the side clearance of crankshaft. Also check it during reassembling.**

For D1503-M, D1703-M and V2203-M

1. Remove the main bearing case screw 2 (1).
2. Pull out the crankshaft assembly, taking care not to damage the crankshaft bearing 1.

For D1803-M

1. Remove the main bearing case screw 2 (1).
2. Turn the crankshaft to set the crank pin of the third cylinder to the bottom dead center. Then draw out the crankshaft until the crank pin of the second cylinder comes to the center of the third cylinder.
3. Turn the crankshaft by 2.09 rad. (120 °) counterclockwise to set the crank pin of the second cylinder to the bottom dead center. Draw out the crankshaft until the crank pin of the first cylinder comes to the center of the third cylinder
4. Repeat the above steps to draw out all the crankshaft.

For V2403-M

1. Remove the main bearing case screw 2 (1).
2. Turn the crankshaft to set the crank pin of the 4th cylinder to the horizontal directions (Right or Left). Then draw out all the crankshaft, holding the crank pins to the horizontal directions (Right or Left).

(When reassembling)

■ **IMPORTANT**

- **Install the crankshaft sub assembly, aligning the screw hole of main bearing case 2 with the screw hole of cylinder block.**
- **When tightening the main bearing case screw 2, apply oil to the screw and screw by hand before tightening the specific torque.**
  If not smooth to screw by hand, align the screw holes between the cylinder block and the main bearing case.

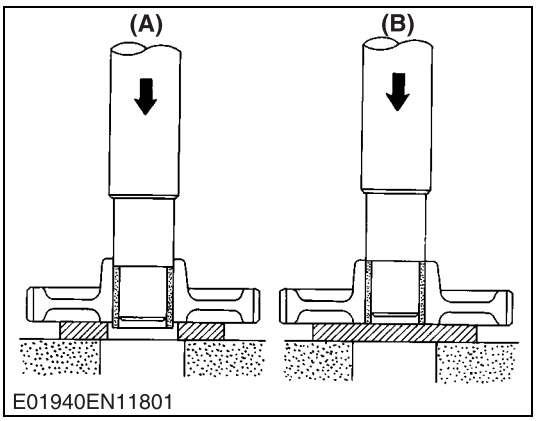
Tightening torque	Main bearing case screws 2	68.6 to 73.5 N·m 7.0 to 7.5 kgf·m 50.6 to 54.2 ft-lbs

(1) Main Bearing Case Screw 2

(a) Cut place for removing and installing the crankshaft

[A] D1803-M

W1066311



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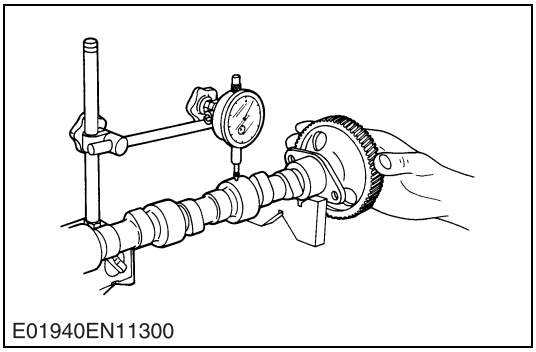
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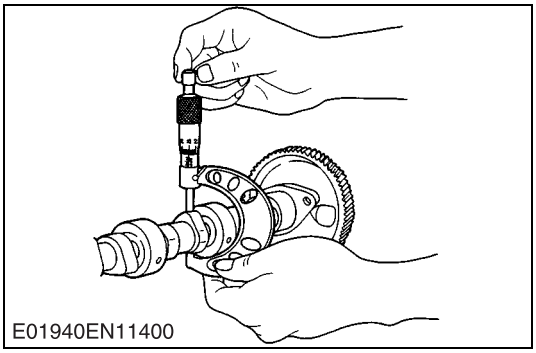

E01940EN11400

Replacing Idle Gear Bushing

(A) (When removing)

1. Using an idle gear bushing replacing tool, press out the used bushing.

(B) (When installing)

1. Clean a new idle gear bushing and idle gear bore, and apply engine oil to them.
2. Using an idle gear bushing replacing tool, press in a new bushing (service parts) to the specified dimension. (See figure.)

W1031083

Camshaft Alignment

1. Support the camshaft with V blocks on the surface plate at both end journals.
2. Set a dial indicator with its tip on the intermediate journal.
3. Measure the camshaft alignment.
4. If the measurement exceeds the allowable limit, replace the camshaft.

Camshaft alignment	Allowable limit	0.01 mm 0.0004 in.

W1031413

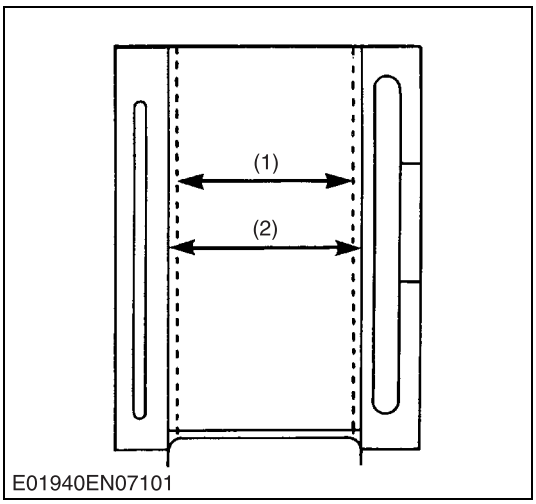
Cam Height

1. Measure the height of the cam at its highest point with an outside micrometer.
2. If the measurement is less than the allowable limit, replace the camshaft.

Cam height of intake	Factory spec.	33.90 mm 1.3346 in.
	Allowable limit	33.85 mm 1.3327 in.

Cam height of exhaust	Factory spec.	33.90 mm 1.3346 in.
	Allowable limit	33.85 mm 1.3327 in.

W1031532



E01940EN07101

Correcting Cylinder (Oversize +0.25 mm)

1. When the cylinder is worn beyond the allowable limit, bore and hone it to the specified dimension.

Oversize cylinder I.D.	Factory spec.	D1503-M	83.250 to 83.272 mm 3.2776 to 3.2784 in.
		D1703-M D1803-M V2203-M V2403-M	87.250 to 87.272 mm 3.43503 to 3.43590 in.
Maximum wear	Allowable limit	D1503-M	+0.15 mm +0.0059 in.
		D1703-M D1803-M V2203-M V2403-M	+0.15 mm +0.0059 in.
Finishing	Hone to 2.2 to 3.0 mm μR max. ∇∇∇ (0.00087 to 0.00118 in. μR max.)		

2. Replace the piston and piston rings with oversize (+0.25 mm) ones.

Parts Name	Model	Code Number	Marking
Piston	D1503-M	1A021-21900	0.25 OS
	D1703-M D1803-M V2203-M V2403-M	1A091-21901	0.25 OS
Piston ring assembly	D1503-M	1A021-21090	0.25 OS
	D1703-M D1803-M V2203-M V2403-M	1A091-21091	0.25 OS

■ **NOTE**

- **When the oversize cylinder is worn beyond the allowable limit, replace the cylinder block with a new one.**

(1) Cylinder I.D. (Before Correction) (2) Oversize Cylinder I.D.

W1034448

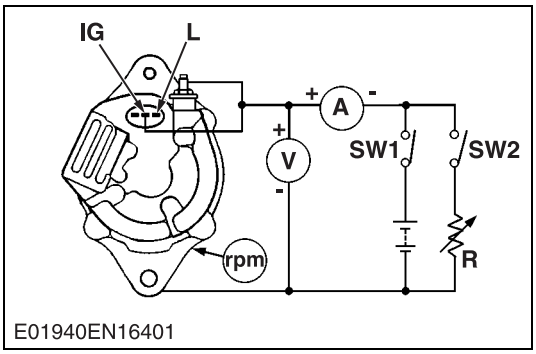
(2) Alternator

(Precaution when checking)

- If disconnect the **B** terminal or coupler, engine will stop by emergency device.
- Do not directory connect the **L** terminal with the **B** terminal. Otherwise the three exciting diodes may be damaged. When connecting the **L** terminal, insert a 3.4 W lamp between the **L** and **B** terminals.
- Always use a full charged battery.
- Be careful to observe the proper polarity of the battery. Never install the battery in the wrong direction.
- Never disconnect the battery while the alternator is operating.

■ **NOTE**

- **Check the alternator with alternator test bench.**



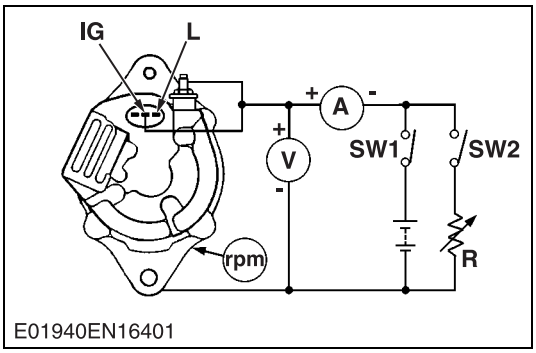
E01940EN16401

Regulating Voltage

1. Make the connections as shown in the figure, and turn on switch **SW1.**
2. Increase the alternator speed to 83.3 s^{-1} (5000 rpm).
3. Turn on switch **SW2**. Adjust load resistance **R** so that the ammeter shows 10 A.
4. Check that the voltage reading on the voltmeter is within the factory specifications.

Regulating voltage	Factory spec.	14.2 to 14.8 V

W1150547



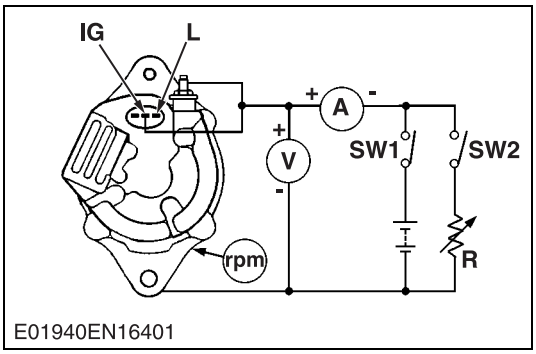
E01940EN16401

No-load Characteristics

1. Make the connection as shown in the figure, and turn on switch **SW1**.
2. Increase the alternator speed so that the pointer of the ammeter swings to the plus side.
3. Turn on switch **SW1** to decrease the speed, and read the speed at which the voltage is equal to the factory specifications.
4. The speed must be below the factory specifications.

No-load characteristics	Factory spec.	19.2 s^{-1} (1150 rpm) or less at 13.5 V

W1150876



E01940EN16401

Output Characteristics

1. Make the connection as shown in the figure, and turn on switch **SW1** and **SW2**.
2. Increase the alternator speed while adjusting the load resistance so that the voltage complies with the factory specifications.
3. Read the speed at which the current is equal to the factory specifications.
4. The speed must be below the factory specifications.
5. Decrease the speed so that the current approaches zero, the turn off switches **SW1** and **SW2**.

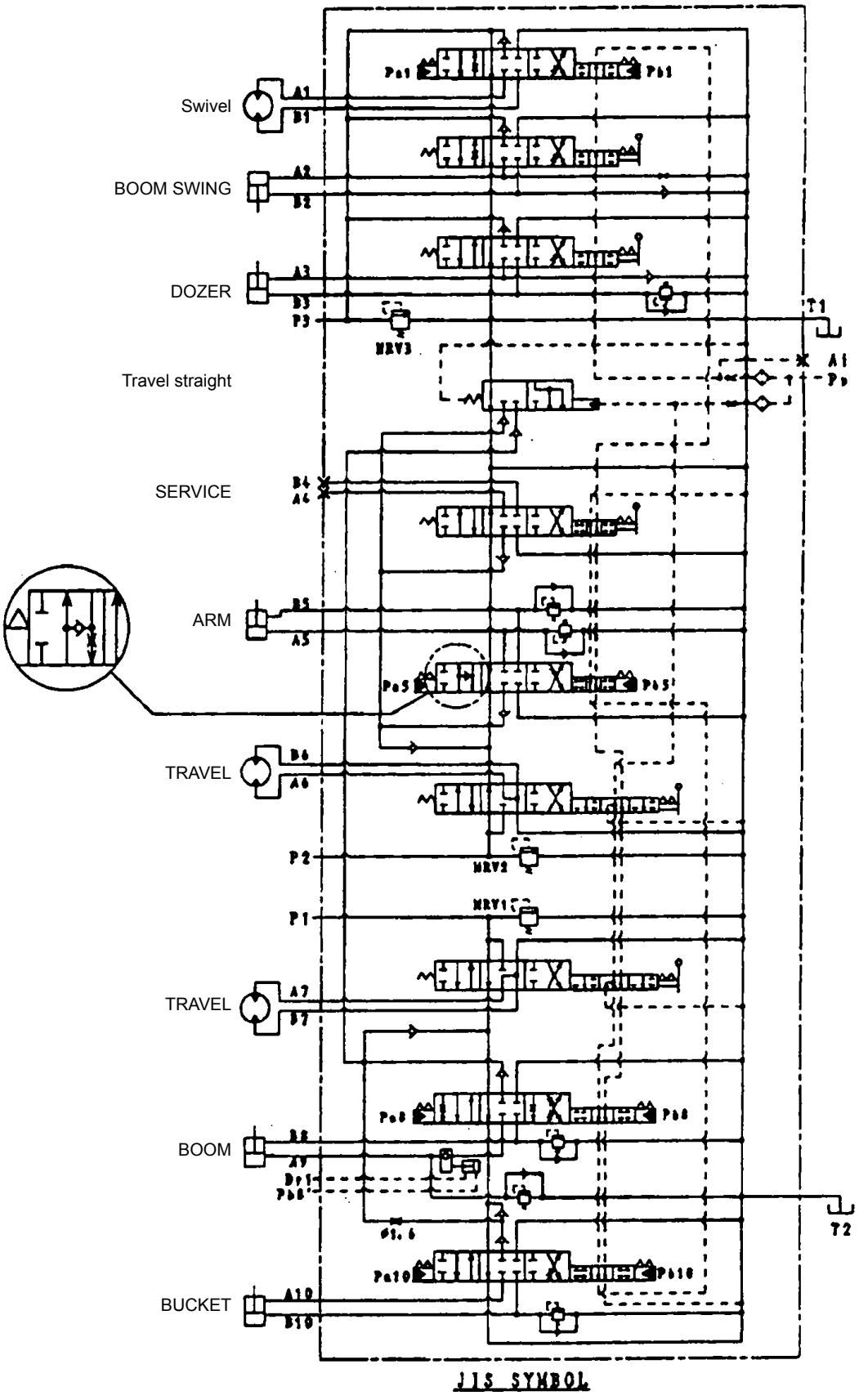
Output characteristics	Factory spec.	40 A or more at 13.5 V, 83.3 s^{-1} (5000 rpm)

W1151013

IV.Hydraulic system(Mechanism section)

c. Control valve circuit diagram

(KX91-3 assy code No.=RC411-61133)



(2) Boom operation

1) Boom-up operation

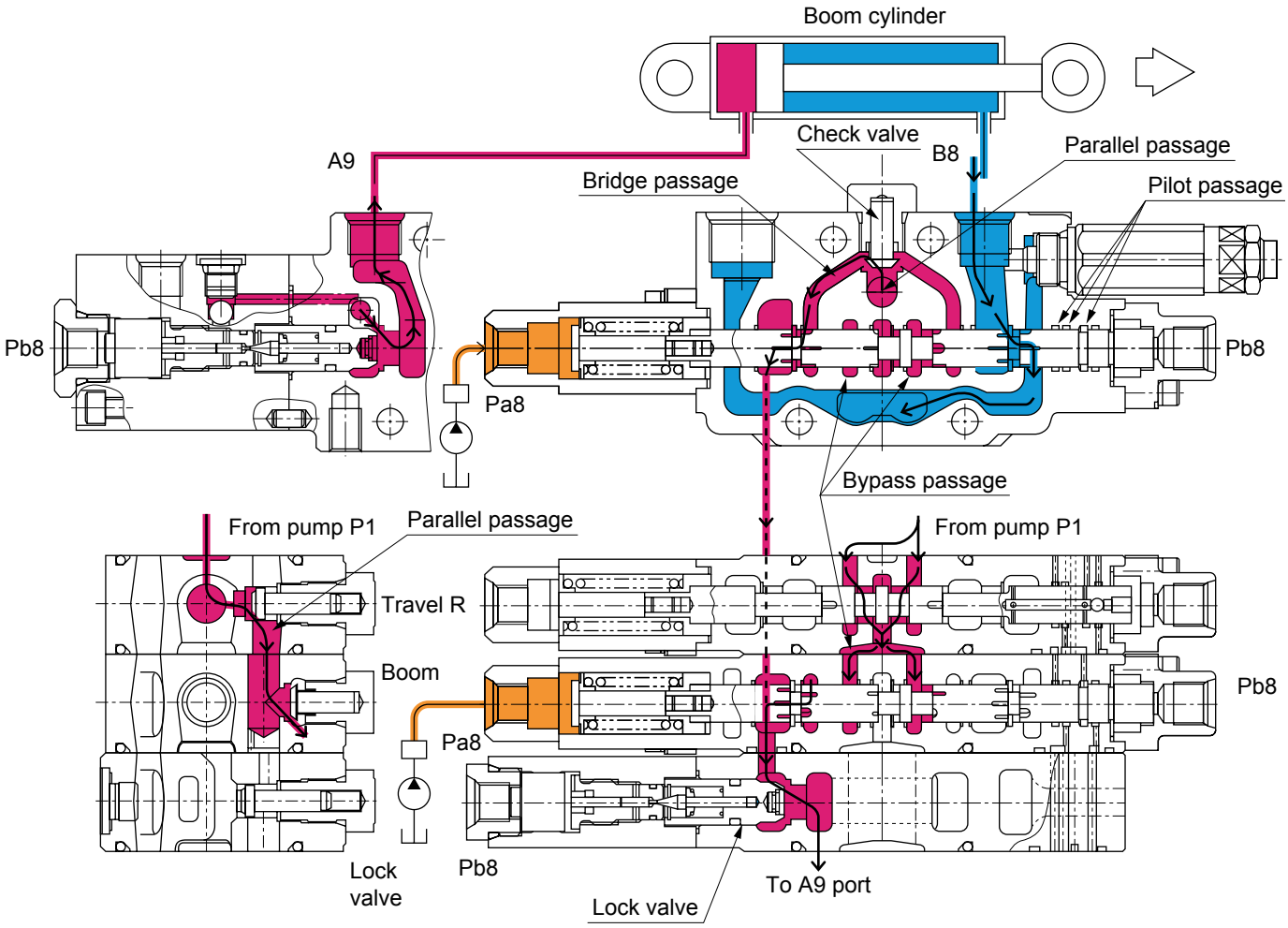
When the boom-up action is taken, the secondary pressure from the pilot control valve is conducted to the port “Pa8”, shifting the boom spool.

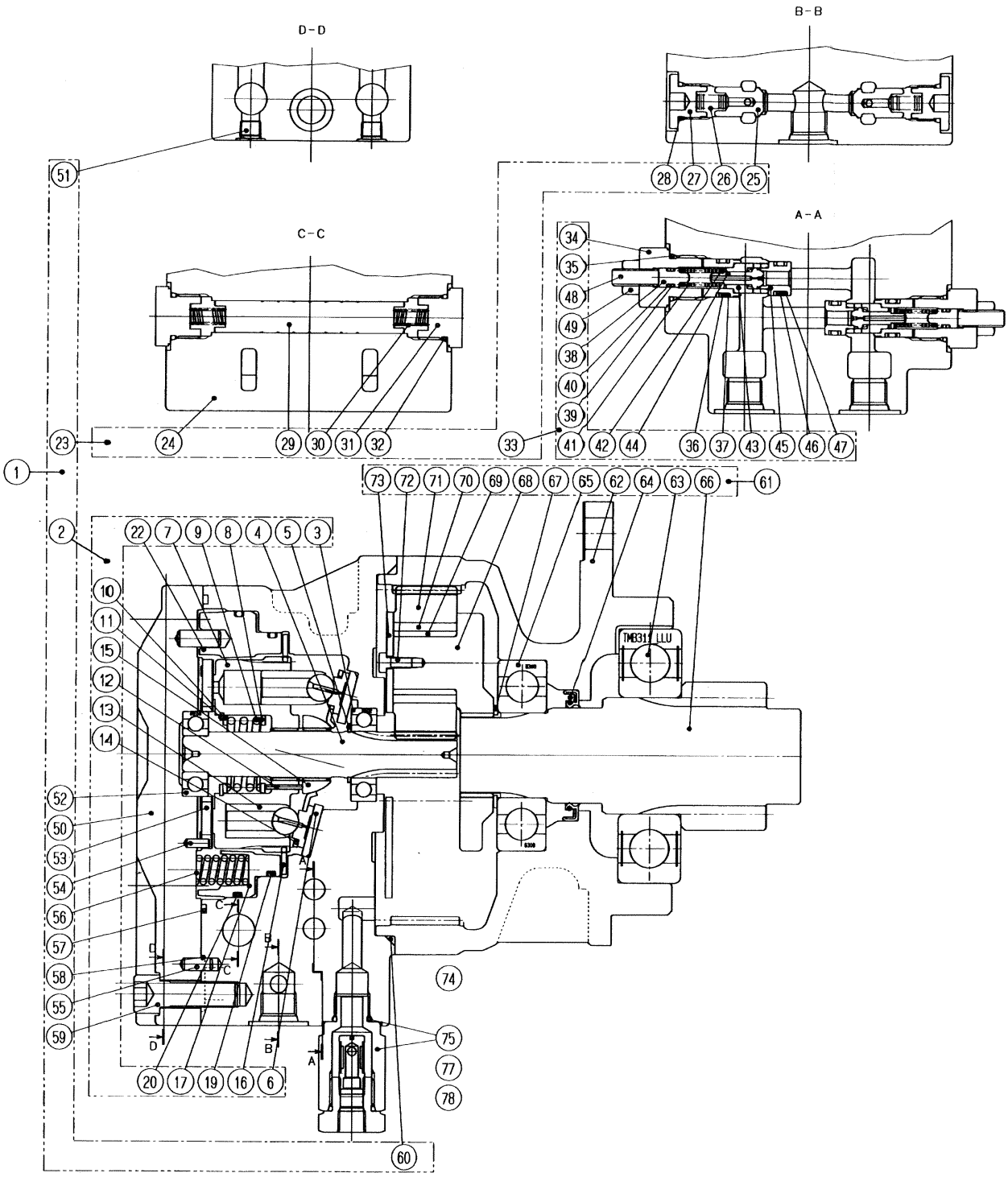
Because the bypass passage is now blocked at the boom switching section, the hydraulic oil coming from the port “P1” flows through the parallel passage via the check valve located above the travel spool bypass passage to the parallel passage in the boom switching section.

Because the passage leading to the lock valve is connected to the bridge passage as a result of the spool being shifted, the hydraulic oil in the parallel passage passes through the load check valve in the boom switching section, flows through the bridge passage, and pushes the lock valve open (free flow state). Then, after flowing into the port “A9”, it is supplied to the boom cylinder head.

The return hydraulic oil from the boom cylinder rod side, on the other hand, flows into the port “B8” and flows to the tank passage via the notch of the spool.

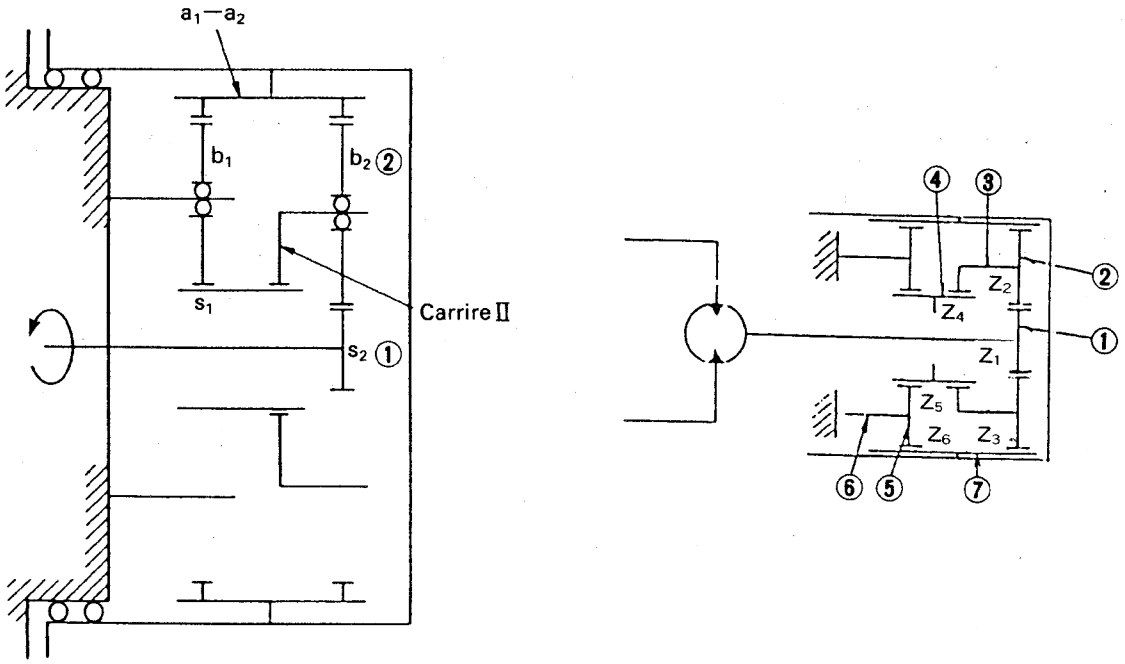
As a result, the boom cylinder gets extended to move up the boom.





(3)	Ball bearing	(17)	Brake piston	(38)	Spring guide
(4)	Shaft	(23)	Valve assy	(43)	Poppet guide
(5)	Circlip	(24)	Valve housing	(61)	Gear case assy
(6)	Thrust plate	(25)	Poppet	(66)	Pinion shaft
(7)	Cylinder block	(29)	Shockless piston	(71)	Planetary gear
(13)	Piston plate	(33)	Relief valve assy	(73)	Thrust plate
(15)	Retainer holder	(34)	Volve housing	(75)	Filter
(16)	Frictio plate				

Pranetary reduction gear case.
This speed reducer consists of a two-stage planetary gear mechanism.



Drive gear (1) intermeshes with the first-stage planetary gear (2); the second-stage sun gear (4), the second-stage planetary gear (5). And the second-stage planetary carrier is fixed to the body. Planetary gears (2) & (5) intermesh with ring gear (7) (housing). A driving force from a piston motor is transmitted to the drive gear (1) and then reduced in speed by the respective gears. Driving force reduced in speed is transmitted to the ring gear (7) through the planetary gear (5) of planetary carrier (6) which is fixed to the final-stage body. (A driving force is transmitted also from the first-stage planetary gear (2).) Incidentally, input rotation is reverse to the output rotation, vice versa.
Reduction gear ratio i becomes as follows according to the first-stage and second-stage reduction gear ratios i_1 & i_2:

Reduction gear ratio (i)

$$T = -(i_1 \times i_2 - 1) = -\left(\frac{Z_1+Z_3}{Z_1} \times \frac{Z_4+Z_6}{Z_4} - 1\right)$$

Z_1 : Drive gear (1) teeth No.
Z_3 : Drive gear (7) teeth No.
Z_4 : Drive gear (4) teeth No.
Z_6 : Drive gear (7) teeth No.

Reduction gear case output torque (T)

$$T = T_M \times i \times \eta_m$$

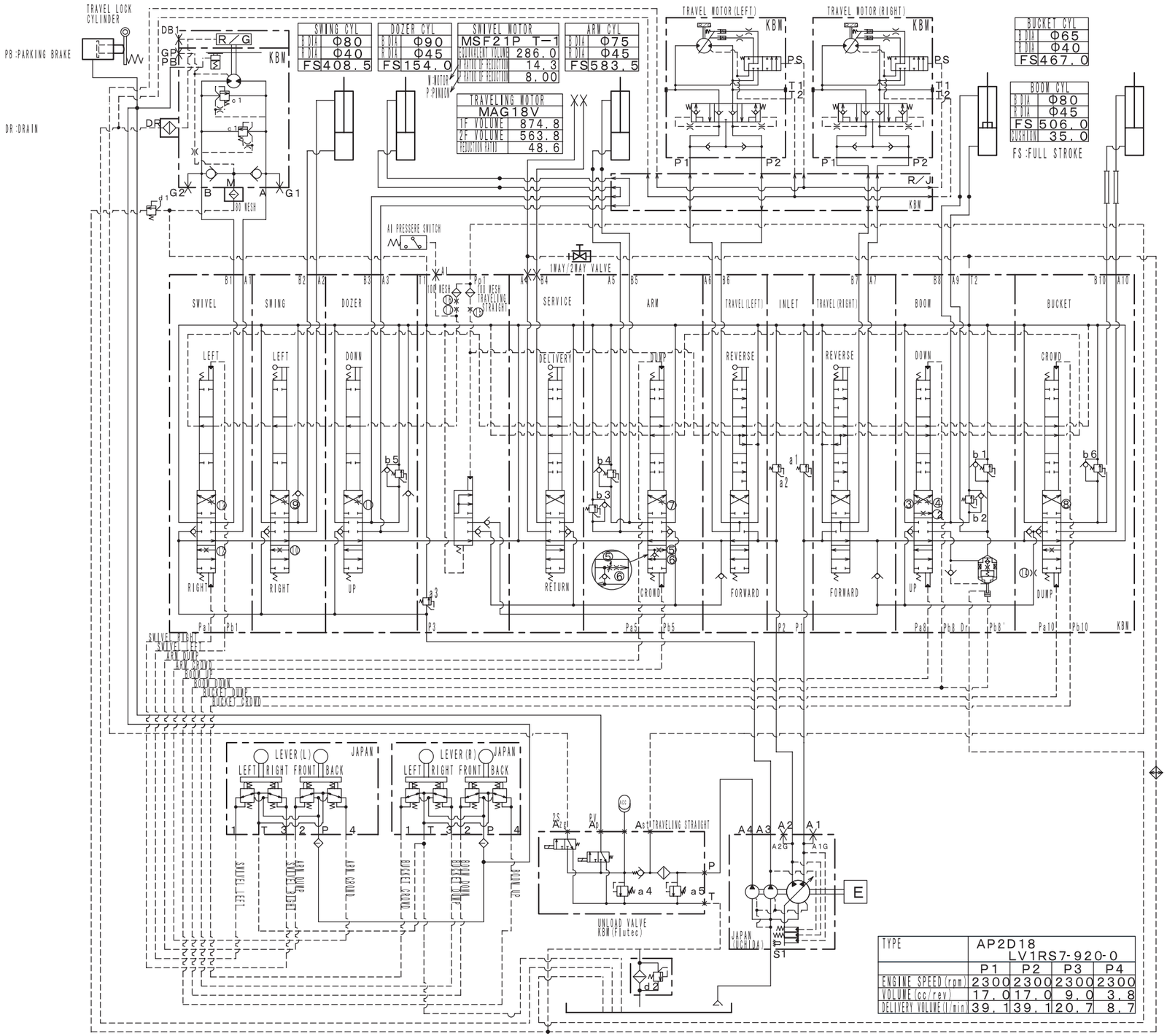
T_M : Input torque (Motor output torque)
i : Reduction gear ratio
η_m : Mechanical efficiency

Reduction gear case output speed (N)

$$T = \frac{N_M}{i}$$

N_M : Input rotation speed (Motor output speed)

b. KX101-3 European - version



SIZE OF NOTCHES AND ORIFICES

LIST OF ORIFICE DIA.		REMARKS	
①			
②	Φ1.1 EQUIV.	BOOM DOWN	P→T
③	Φ2.1 EQUIV.		P→C
④	Φ3.2 EQUIV.		C→T
⑤	Φ4.3 EQUIV.	ARM CROWD	C→T
⑥	Φ2.0 EQUIV.	ARM CROWD	FIX-TYPE
⑦	Φ4.0 EQUIV.	ARM DUMP	C→T
⑧	Φ3.6 EQUIV.	BUCKET CROWD	C→T
⑨	Φ2.3 EQUIV.	SWING LEFT	C→T
⑩	Φ2.1 EQUIV.	SWING RIGHT	C→T
⑪	Φ2.3 EQUIV.	DOZER DOWN	C→T
⑫	Φ2.9 EQUIV.	SWIVEL	C→T
⑬	Φ0.5 EQUIV.	AIR BLEEDING AFTER 6mm stroke	
⑭	Φ1.6 EQUIV.	BOOM PRIORITY ORIFICE	
⑮	Φ0.3 EQUIV.	TRAVEL STRAIGHT SENSING ORIFICE	
⑯	Φ0.37 EQUIV.	A1 SIGNAL ORIFICE	
⑰	Φ0.3 EQUIV.	A1 SIGNAL ORIFICE	

BENCH SET PRESSURE VALUE

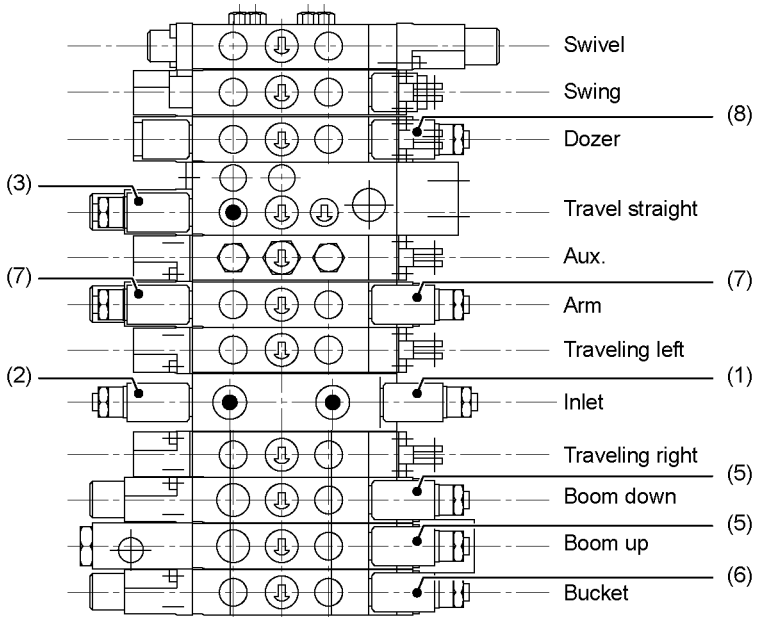
RELIEF PRESSURE(kgf/cm2)		
a1	250.0	P1
a2	250.0	P2
a3	200.0	P3
a4	40.0	P4
a5	70.0	FILLTER
b1	280.0	BOOM(BOTTOM)
b2	280.0	BOOM(ROD)
b3	285.0	ARM(BOTTOM)
b4	285.0	ARM(ROD)
b5	245.0	DOZER(BOTTOM)
b6	285.0	BUCKET(BOTTOM)
c1	205.0	SWIVEL MOTOR
d1	2.0	CHECK VALVE
d2	1.0	RETURN FILTTER

SPECIFICATION OF OIL COOLER	
AMOUNT OF A RADIATION	8900 kcal/h
	V = 15 l/min
	Δt= 75 ℃
	tol=10 ℃
CORE TYPE	CORRUGATE TYPE WITH LOUVER
CORE SIZE	300×225.6×32
CORE TIER	15 TIERS
FIN PITCH	fp=4.0/2

IV.Hydraulic system(Service section)

B.Specifications

a. Relief valve pressure setting



Main relief valve (bench data) All-version

No.	Valve location	Operating work	Unit	KX91-3	KX101-3		Remarks
1	P1 Control valve	Travel right, Boom, Bucket	Mpa kgf/cm2 psi	23.5 240 3414	25.0 255 3627		
2	P2 Control valve	Travel left, Arm, Auxiliary	Mpa kgf/cm2 psi	23.5 240 3414	25.0 255 3627		
3	P3 Control valve	Dozer, Swing, Swivel	Mpa kgf/cm2 psi	19.6 200 2845	←		
4	P4 Change valve	Control valve spool	Mpa kgf/cm2 psi	3.9 40 569	←		

Main relief valve (at the measurement port on the machine) KE, KDG, KUK version

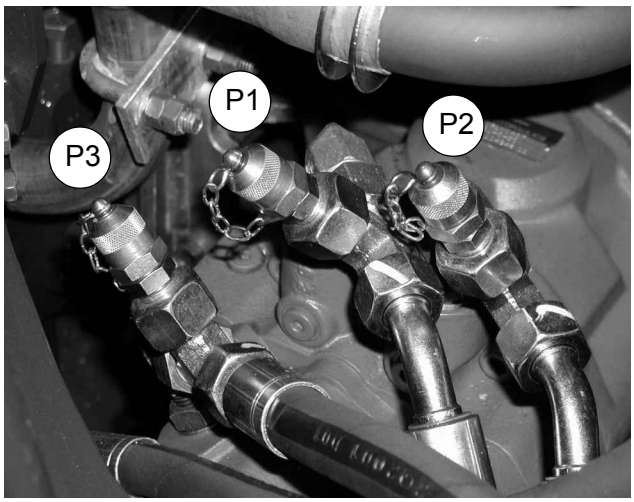
No.	Valve location	Operating work	Unit	KX91-3	KX101-3		Remarks
1	P1 Control valve	Travel right, Boom, Bucket	Mpa kgf/cm2 bar	$24.0^{+1.0}_{-0.5}$ 245^{+10}_{-5} 240^{+10}_{-5}	$25.0^{+1.0}_{-0.5}$ 255^{+10}_{-5} 250^{+10}_{-5}		
2	P2 Control valve	Travel left, Arm, Auxiliary	Mpa kgf/cm2 bar	$24.0^{+1.0}_{-0.5}$ 245^{+10}_{-5} 240^{+10}_{-5}	$25.0^{+1.0}_{-0.5}$ 255^{+10}_{-5} 250^{+10}_{-5}		
3	P3 Control valve	Dozer, Swing, Swivel	Mpa kgf/cm2 bar	$21.0^{+1.0}_{-0.5}$ 205^{+10}_{-5} 201^{+10}_{-5}	←		
4	P4 Change valve	Control valve spool	Mpa kgf/cm2 bar	$4.4^{+0.5}_{-0.2}$ 45^{+5}_{-2} 44^{+5}_{-2}	←		

(2) KTC, KCL, KTA version

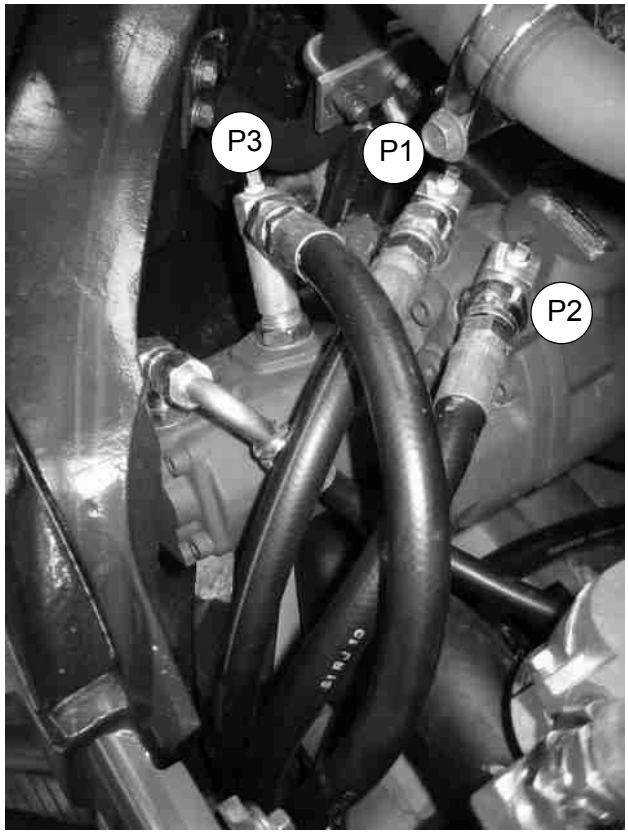
			KX91-3		Remarks
Manufacturer			Kubota		
Model			WM18NL		
Capacity		cc/rev in^3/rev	18 1.10		
Relief valve pressure		Mpa kg/cm^2 psi	24.5 250 3553		
Climbing ability		deg.	30		
Max. traction force	1F	N kgf lbf	24.9 2543 5605		Reference value
	2F	N kgf lbf	15.2 1550 3417		
Traveling block performance		mm/10min ft/10min	300 1		Allowable value of new machine Testing angle : 20deg
Traveling speed	1F	km/h mph	3.0 1.88		
	2F	km/h mph	4.8 3.0		
10m traveling time	1F	sec./10m sec./32.8ft	10.9 ~ 13.3		Reference value
	2F	sec./10m sec./32.8ft	6.8 ~ 8.4		
Crawler rotation speed	1F 2F	sec/ 1 rev	4.8 3.1		Reference value
Straight travel performance	1,2F	mm/10mm ft/32.8ft	600≧ 1.97≧		
Drain amount at lock	1F	cc/min in^3/min	83 5.06		Reference value
	2F	cc/min in^3/min	82 5.00		
Drain amount while rotating	1F	cc/min in^3/min	8 0.49		Reference value
	2F	cc/min in^3/min	13 0.79		

f. Swivel brake valve pressure

- Measurement method



KE, KDG, KUK version



KTC, KCL, KTA version

1. Set the pressure gauge to the coupler at the main pump discharge side. Or remove the plug off the main pump discharge side and set the pressure gauge there.
2. Bring the bucket in contact with a solid block. Slowly move the bucket toward the block. With the engine at the maximum speed, measure the relief pressure.
3. Hydraulic oil tempreture must be 50 ± 5°C, 122 ± 8°F.

p. Specification sheet : Drain amount, Swivel motor

Following data is the factry's specifications for new components.
Testing data for the machine in the market varies depending on the operation and maintenance conditions.

Sub assy code No.

Machine model	Swibel motor assy	Motor assy	Swivel valve assy	Relief valve assy	Swibel gear case
KX91-3	RC411-6170△	RC411-7330△	RC411-7220△	RC411-7230△	RC411-1710△

1.Swivel motor assy : RC411-6170△

Test item		Test condition			Quality	
		rpm	Oil temp. (°C)	MPa (kgf/cm^2)	Unit	Specification
Rotationg performance	Volumetric efficiency	600	50 ±5	10.8(110)	%	93≦
	Mechanical efficiency				%	82≦
	Drain amount				ℓ/min	0.5≧
Start-up performance	Mechanical efficiency	0		16.7(170)	%	65≦
	Drain amount				ℓ/min	4≧
Slippage		–		6.9(70)	rpm	1.0≧

Above data is only for swivel motor unit only excluding the reduction gear case.

2.Relief valve assy : RC411-7230△

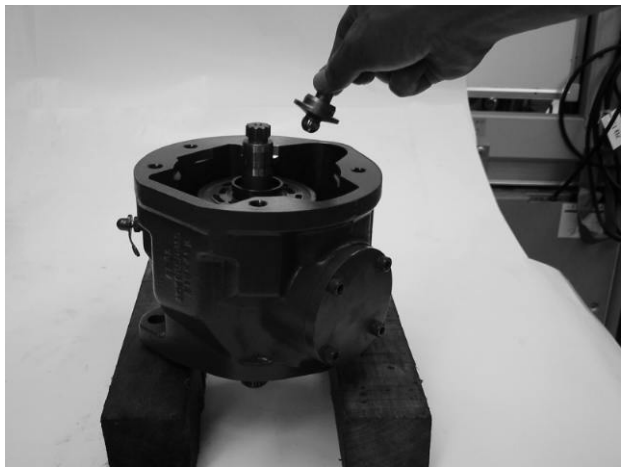
Test item	Test condition			Unit	Specification
	ℓ/min	Oil temp. (°C)	MPa (kgf/cm^2)		
Set pressure	20.9	50 ±5	–	MPa (kgf/cm^2)	16.7 ±0.3 (170 ±3)
Cracking pressure	2.0		–	MPa (kgf/cm^2)	12.3≦ (125≦)
Reseat pressure	0.7		–	MPa (kgf/cm^2)	11.8≦ (120≦)
Leak amount	–		6.9 (70)	cc / min	10≧

3.Swivel valve assy : RC411-7220△

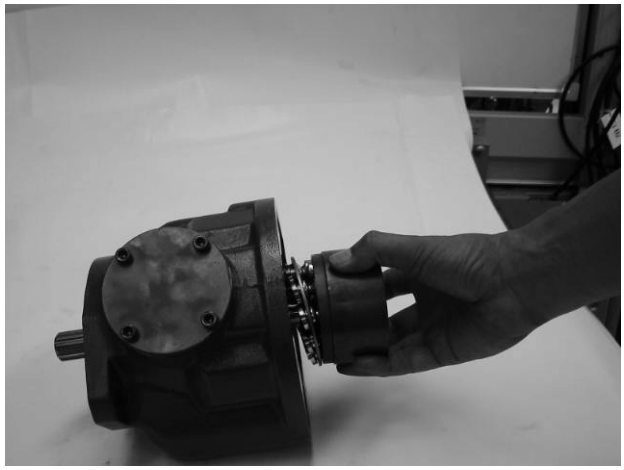
Test item		Test condition			Quality	
		ℓ/min	Oil temp. (°C)	MPa (kgf/cm^2)	Unit	Specification
Leak amount	Make-up valve	20	50 ±5	6.9(70)	cc / min	1≧
	P1→P2 Make-up valve	20		6.9(70)	cc / min	11≧
	P2→P1 Make-up valve	20		6.9(70)	cc / min	11≧

Following data is the factory's specifications for new components.
Testing data for the machine in the market varies depending on the operation and maintenance conditions.

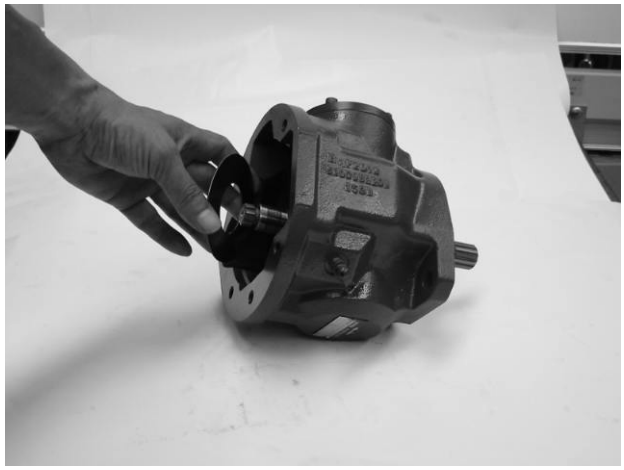
16. Remove the spring seats.



17. Detaching the rotary group
    Place the pump sideways and take the rotary group from the shaft.



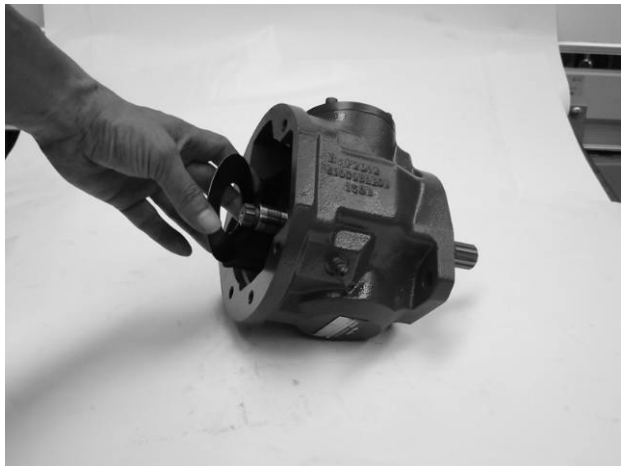
18. Take out the plate.



19. Pulling out the shaft
    Remove the circlip.

17. Place the guide between the retainer and the cylinder block, and put the piston in the cylinder block hole.

18. Fitting the rotary group
    For anti-fall measure, apply grease over the back of the plate and fit it onto the hanger.
    Apply grease over the sliding surface of the piston shoe as well as the sliding surface between the cylinder block and control plate.



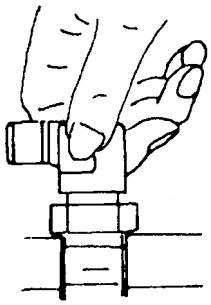
19. Fitting the control piston
    Apply grease to the round part of the spring seat, and fit the piston into position.

20. Fit the 2 springs (inner and outer) into place.

Control valve tie-rod nuts tightening torque

Model	C/V Assy. No.	M8 nut
KX91-3	RC411-6113-0	16.7 ~ 17.7 N·m 1.7 ~ 1.8 kg·m 12.3 ~ 13.1 ft·lbf
KX101-3	RC511-6113-0	

Above tightening torque is basically on dry condition.



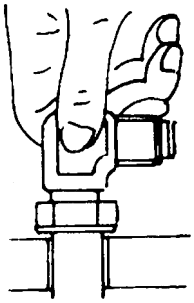
Tightening the washer-equipped elbow

1) Connecting with the valve
 • Screw in the elbow by hand until the washer comes into contact.

Note:Clean up the mating seal beforehand.

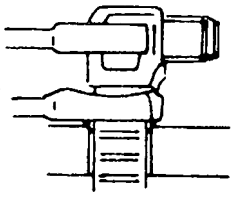
2) Positioning
 • Turn the elbow back to its set position.

Note:Do not make any more than one turn back.



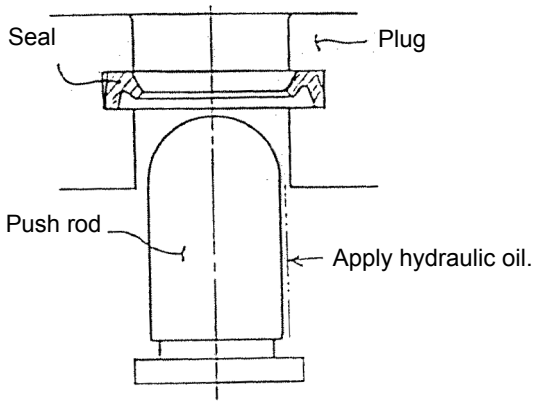
3) Fixing
 • Tighten up the lock nut with a wrench.
 • Lock nut tightening torque.

1/4:25 ~ 30 N·m	2.5 ~ 3.0 kg·m	18.1 ~ 21.7 ft·lbf
3/8:50 ~ 55 N·m	5.0 ~ 5.5 kg·m	36.2 ~ 39.8 ft·lbf
1/2:60 ~ 65 N·m	6.0 ~ 6.5 kg·m	43.4 ~ 47.0 ft·lbf
3/4:120 ~ 130 N·m	12.0 ~ 13.0 kg·m	86.8 ~ 94.0 ft·lbf



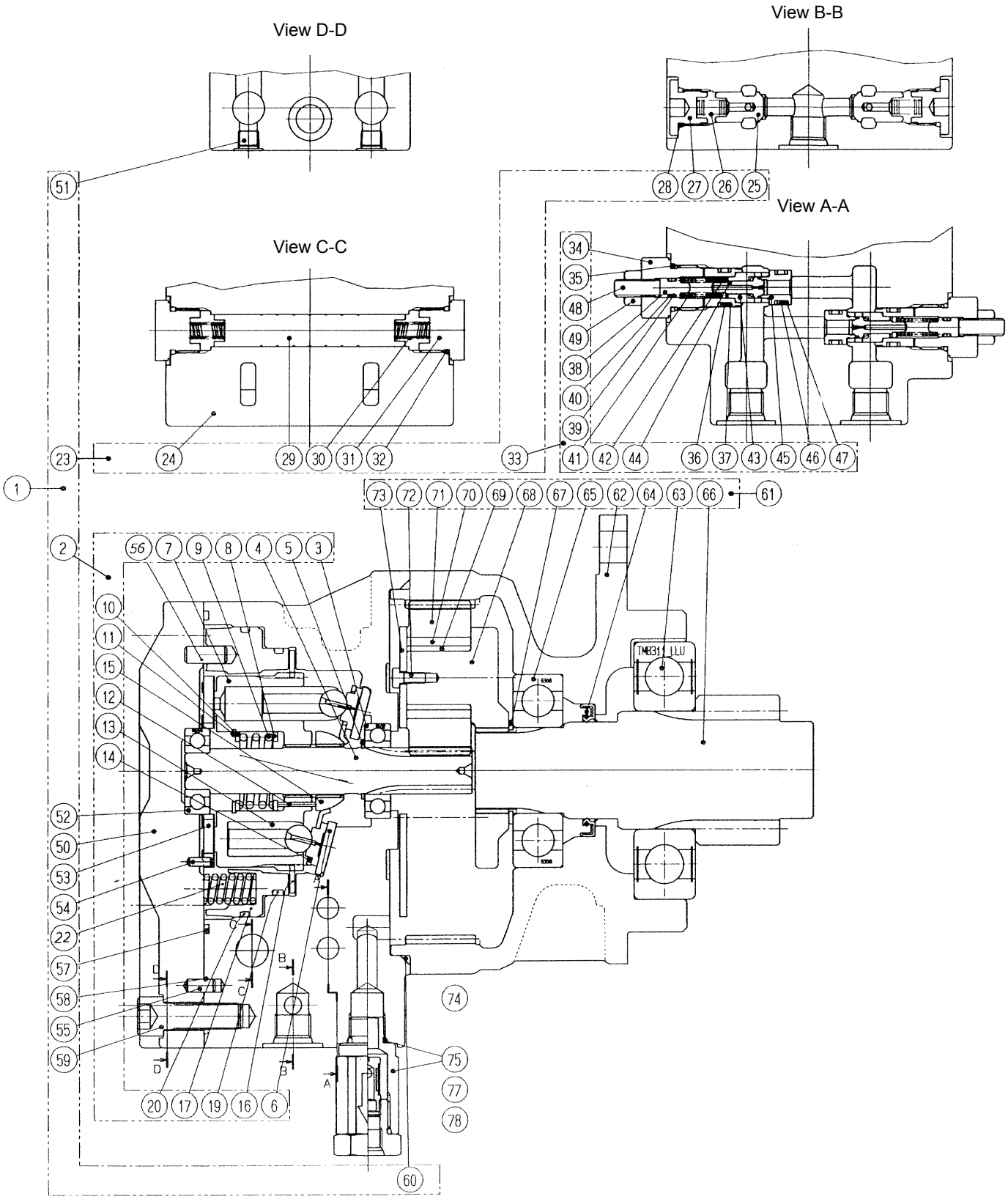
4) Assembling

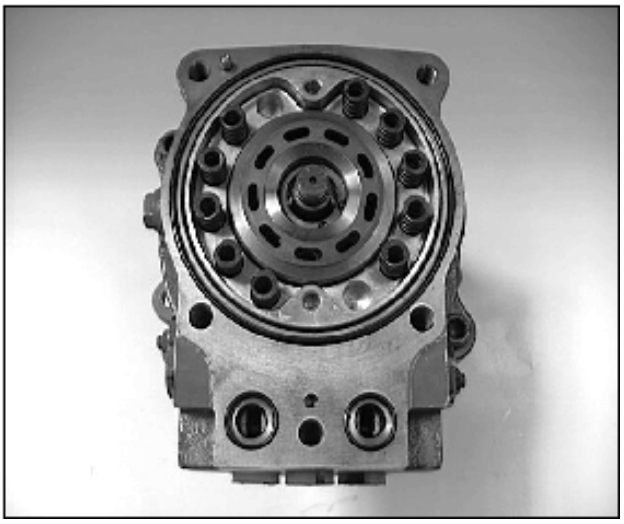
1. Preparations
   (1) As in the case of disassembling, prepare the specified workbench, tools and materials.
2. General precautions
   (1) Take the same general precautions as in disassembling.
   (2) Before reassembling, remove metal chippings and foreign matters from all the parts. Make sure the parts are free of burrs, hit marks and other problems. If a burr or hit mark is found, get rid of it with an oilstone.
   (3) In principle, replace the O-rings and backup rings with new ones.
   (4) When fitting the O-rings and backup rings, handle them with care not to damage it. (Apply a small amount of grease for smooth fitting.)
   (5) When fitting the parts in place, preferably use grease to avoid accidental drop.
   (6) Tighten the bolts and the like to the their specified torques listed in "7-1 Tightening Torque Chart". Measure the tightening torques with a torque wrench.
   (7) Finally apply blind plugs to all the open ports to avoid entry of dust.
3. Reassembling procedure

	Procedure	Precautions
1	Fit the bushing (131) and O-ring (122) to the casing (101). [Photo 7-20]	
2	Install the port plate (111), with the hex socket bolt (125) and seal washer (121) in between, on the casing (101). [Photos 7-21 and 7-22]	* Carefully position the spring pin (126) in the casing hole. * Replace the seal washer (121) with new one.
3	Tighten the hex socket bolt (125) to the specified torque. [Photo 7-23]	* Alternately tighten the two bolts.
4	Install the washer 2 (217), secondary-pressure spring (241) and spring seat (216) in this order on the spool (201). [Photo 7-24] Then press in the spring seat (216) to get the secondary-pressure spring (241) warped. Now slide this spring seat sideways and pass it through the larger hole and onto the spool (201). [Photo 7-25]	* Do not allow the spring seat (216) 6 mm or lower than specified.
5	Fit the return spring (221) in the casing (101). Also fit the reducing valve assembly to the casing (101). [Photo 7-26]	* Place these parts back in their original positions.
6	Fit the O-ring (214) to the plug (221). [Photo 7-27]	
7	Fit the seal (213) to the plug (211). [Photo 7-28]	* Place the seal (213) with its lip positioned as shown below.
8	Fit the push rod (212) into the plug (211). [Photo 7-29] Fit the folding-purpose spring (246) and spring seat (218) into the push rod (212). [Photo 7-30]	* Apply hydraulic oil over the surface of the push rod. 

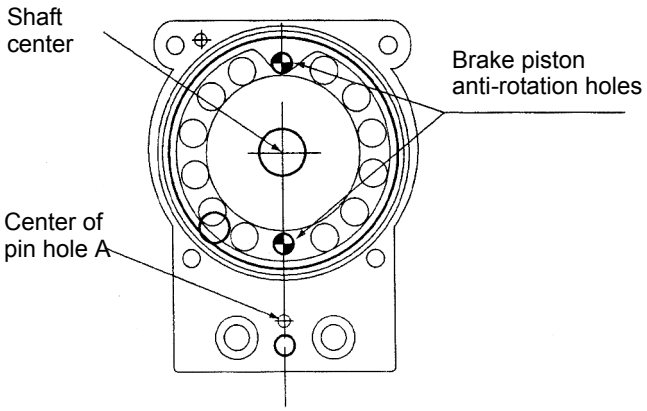
e. Swivel motor (KTC, KCL, KTA version)

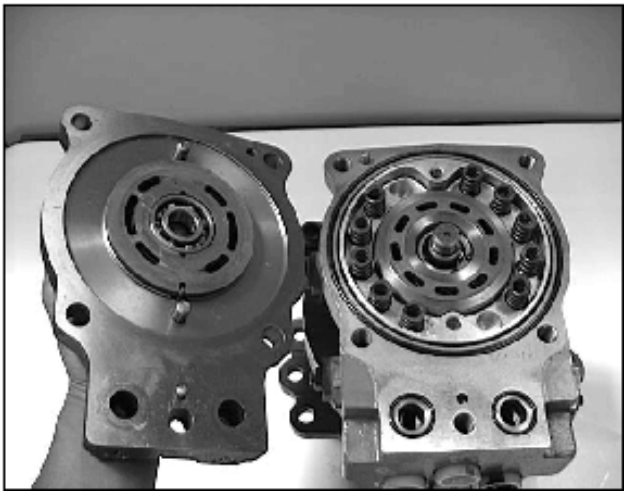
(1) Components of the swivel motor



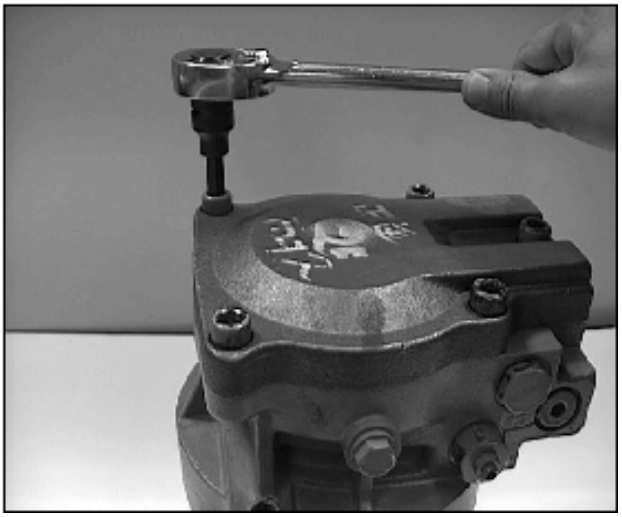


9) Fit the spring to the brake piston holes.

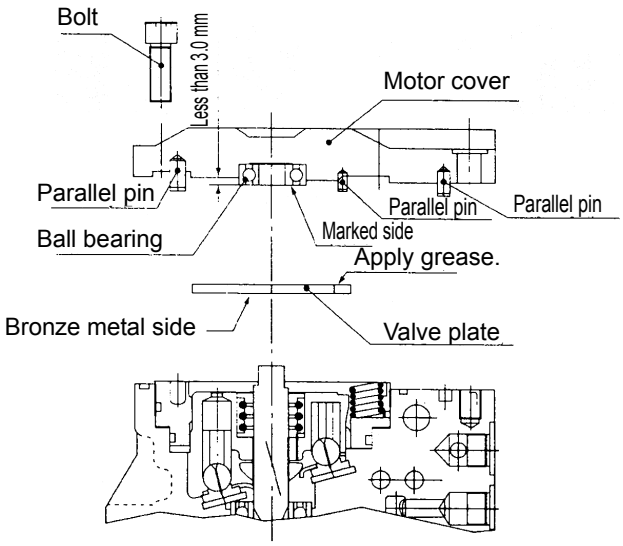


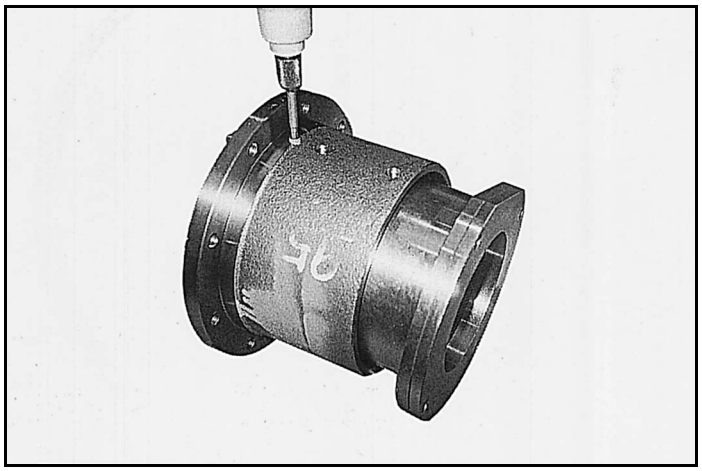


10) Using the specified jig, tap the ball bearing into position, paying attention to the marked side.
Apply grease over the surface to be in close contact with the motor cover. Then install the valve plate.

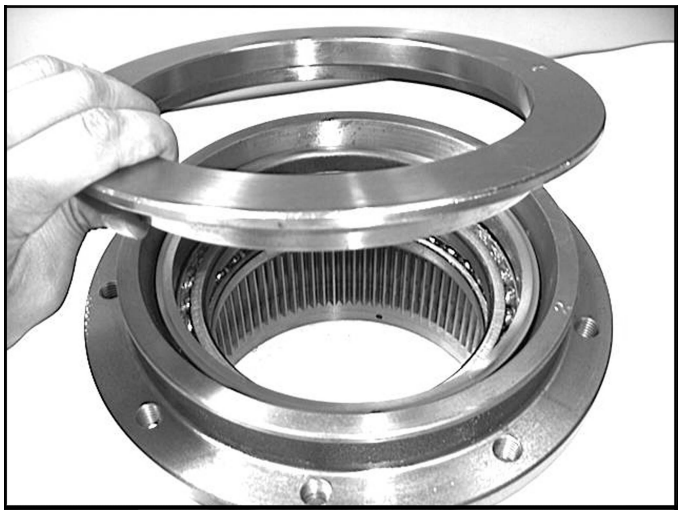


11) Fit the motor cover on the housing (motor, valve). Apply the five hex socket bolts (M12).

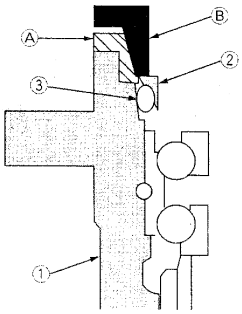




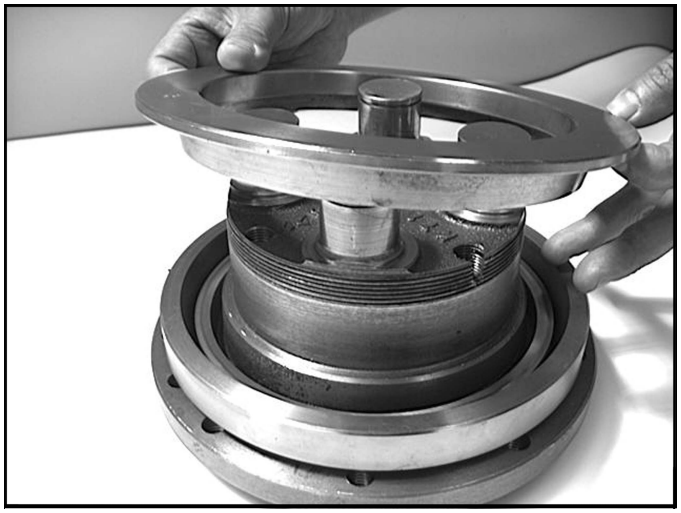
5. Wind sealing tape around the plug with the two end threads exposed. Apply and tighten this plug.
   Plug (R1/8) tightening torque:
   9.8 ~ 14.7 N·m
   1.0 ~ 1.5 kg·m



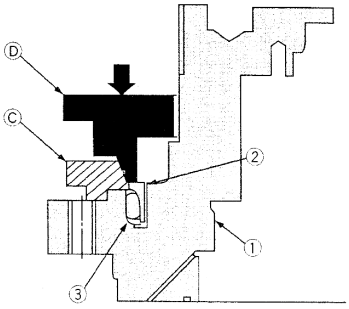
6. Place the guide jig on the housing. Apply grease to the O-ring and temporarily place the floating seal. Using the specified press-fitting jig, evenly press-fit the floating seal with care not to twist or tilt the O-ring.



(1) Housing
(2) Floating seal
(3) O-ring
A. Guide (Jig 10)
B. Press-fitting jig (Jig 11)



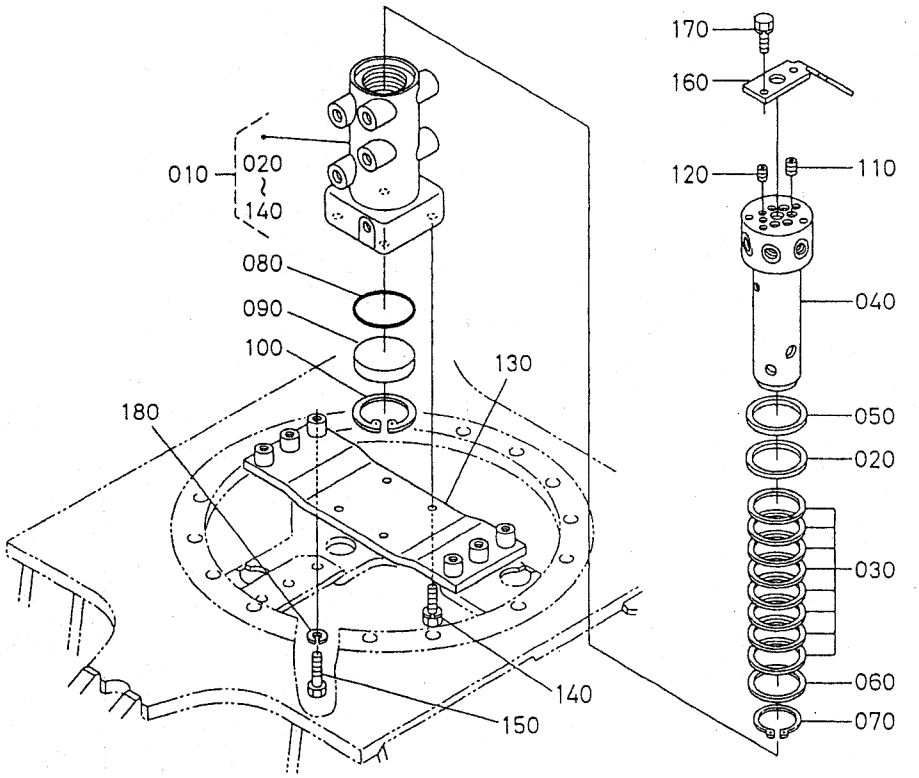
7. Place the guide jig on the flange holder. Apply grease to the O-ring and temporarily place the floating seal. Using the specified press-fitting jig, evenly press-fit the floating seal with care not to twist or tilt the O-ring.



(1) Flange holder
(2) Floating seal
(3) O-ring
A. Guide (Jig 12)
B. Press-fitting jig (Jig 13)

g. Rotary joint

(1) Inner parts of the rotary joint



010	Assy joint, Swivel	070	Circlip, Internal	130	Stay
020	Gasket	080	O-ring	140	Bolt
030	Gasket	090	Cover	150	Bolt
040	Shaft, Swivel joint	100	Circlip, Internal	160	Stopper
050	Collar	110	Plug	170	Bolt
060	Collar	120	Plug	180	Washer, Spring

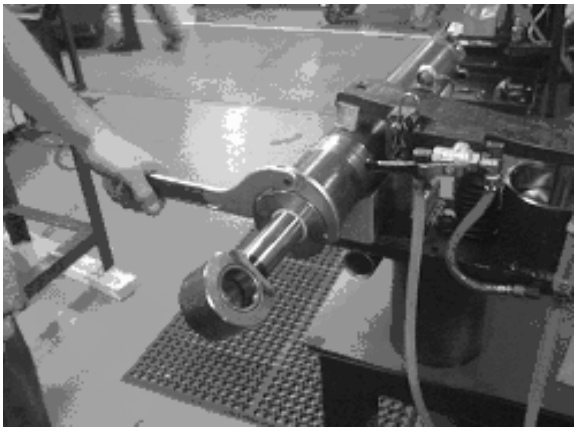
(3) Disassembling and assembling

1) Proceeding Disassembly and Reassembly of BOOM-Cylinders. (EX. Boom Cylinder)

DISASSEMBLY

Place the cylinder into a vice fitted out with soft jaws. Clamp moderately to avoid deformations of the cylinder tube. Buckle out the collar of the notch and unscrew the cylinder head (mark16) with the help of a hook wrench. When the cylinder head is mounted with glue (never on first mounting) and difficult to unscrew, you have to warm up the cylinder head about 250ÅãC. Prefer a pistol pipe oven instead of a blowpipe. Unscrew completely the cylinder head and take out carefully the kit cylinder rod.

CONTROL

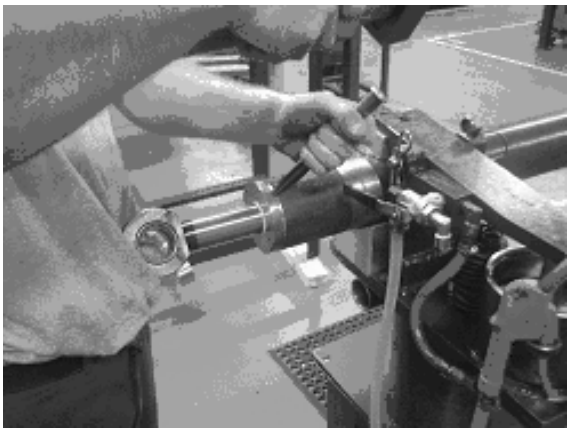


Make a visual control of the whole cylinder. Degrease and clean up the inside of the cylinder tube. Be sure that the inside is free of technical pollution like oxydation or stripes.

REASSEMBLY

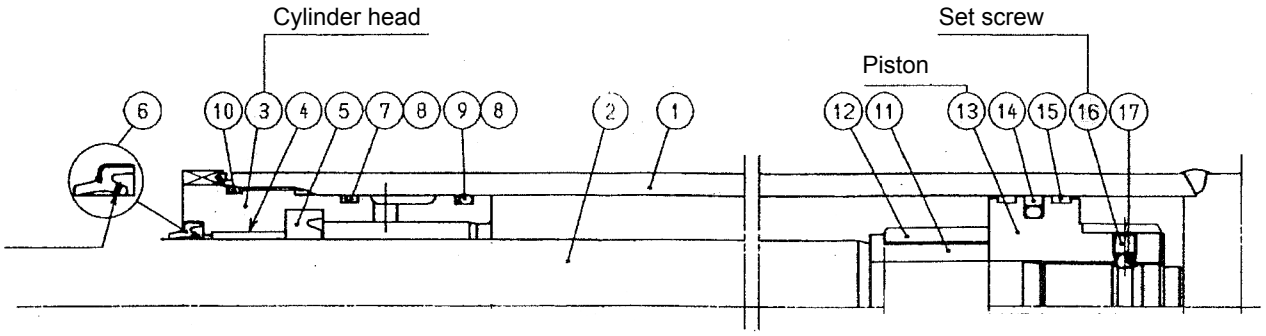
Apply hydraulic oil on the piston seals with a paint brush. Move the kit cylinder rod 2/3 of his length into the cylinder tube (mark9). ← Assure a well alignement to the axe of the cylinder tube.
Apply hydraulic oil on cylinder head seals and engage the cylinder head . ← Be sure that the seals are not degraded when you engage the cylinder head into the locked zone.
Block it up with the tightening torque mentioned on drawing.
Save the cylinder head by buckling the collar in one notch.
Enter the whole rod to abutment.

PRECAUTIONS



- Use only non-agressive solvants like AXETHANE 212, cold degreaser.
- Try to protect all openings and components when not in use.
- If possible, test the cylinder before mounting on machine.

(2) Tightening torque



1) Boom cylinder

	Tightening torque	Adhesive	Remarks
Cylinder head	451 N·m 46 kgf·m 333 ft·lbf	Threebond #1901	Thread size:M85 × 2
Piston	932 N·m 95 kgf·m 687 ft·lbf	-	Thread size:M36 × 2
Set screw	16.2 N·m 1.65 kgf·m 11.9 ft·lbf	-	Thread size:M8 × 1.25 Punch at two positions on the other of the set screw.

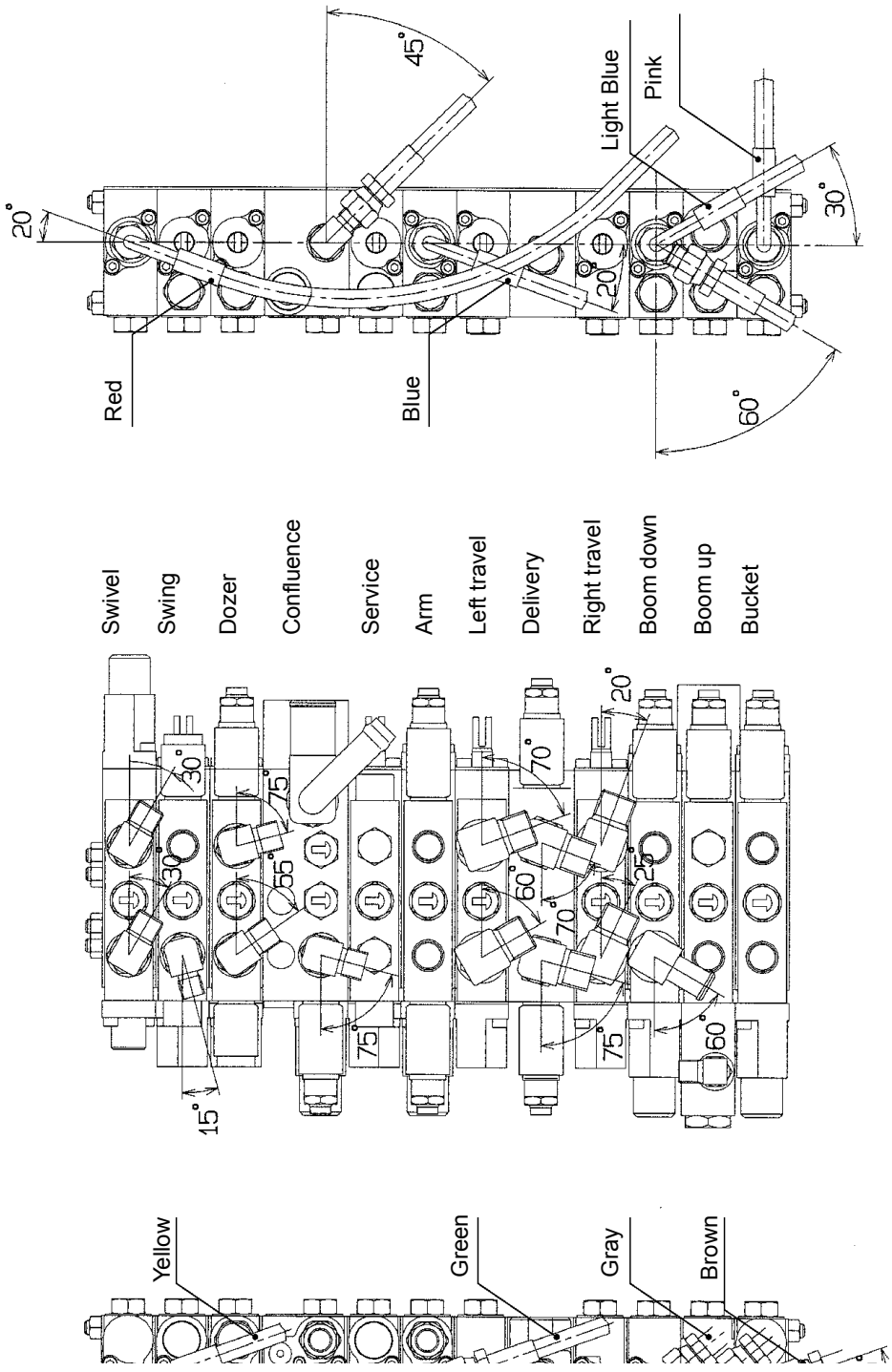
2) Arm cylinder

	Tightening torque	Adhesive	Remarks
Cylinder head	422 N·m 43 kgf·m 311 ft·lbf	Threebond #1901	Thread size: M80 × 2
Piston	1079 N·m 110 kgf·m 796 ft·lbf	-	Thread size: M33 × 2
Set screw	16.2 N·m 1.65 kgf·m 11.9 ft·lbf	-	Thread size: M8 × 1.25 Punch at two positions on the other of the set screw.

3) Bucket cylinder

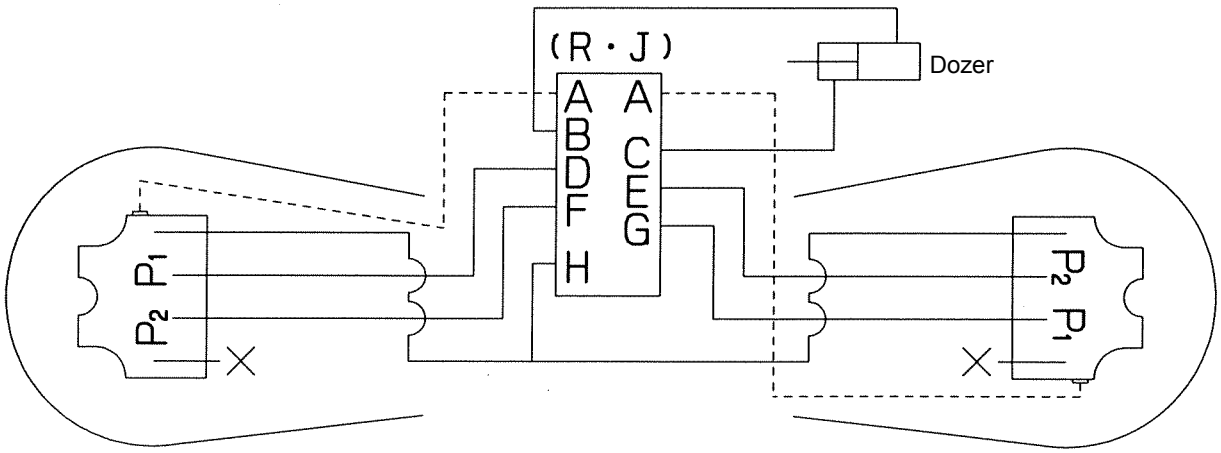
	Tightening torque	Adhesive	Remarks
Cylinder head	343 N·m 35 kgf·m 253 ft·lbf	Threebond #1901	Thread size: M70 × 2
Piston	637 N·m 65 kgf·m 470 ft·lbf	-	Thread size: M30 × 1.5
Set screw	16.2 N·m 1.65 kgf·m 11.9 ft·lbf	-	Thread size: M8 × 1.25

2) Pilot hose connection angle (KTC, KCL, KTA version)

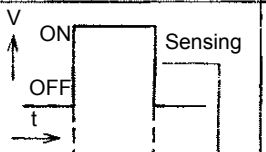
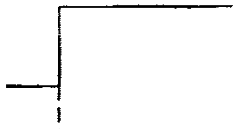
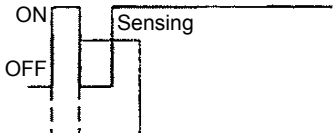
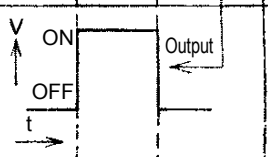
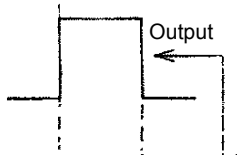
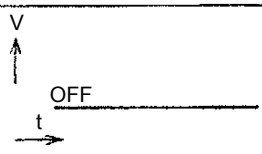
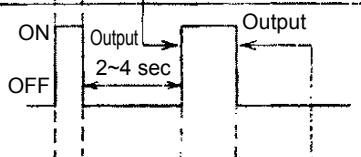
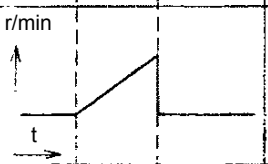
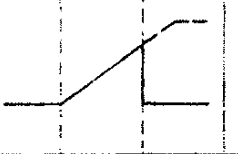
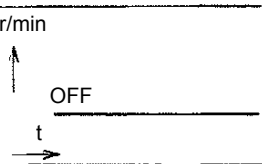
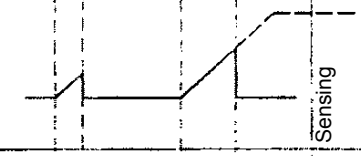
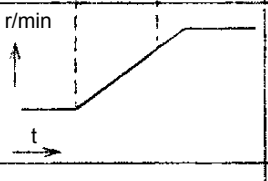
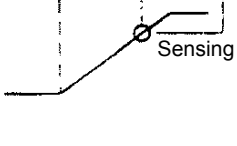
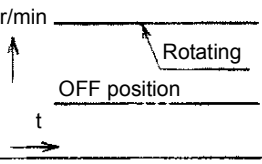
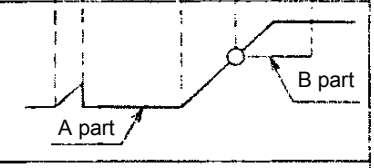


(7) Traveling motor and dozer

.	Rotary Joint side	Motor & Cylinder side
A	Travel High Speed	Travel high speed
B	Dozer, Down	Cylinder, Bottom
C	Dozer, Up	Cylinder, Rod
D	Travel, LH, Forward	Travel, LH, P1
E	Travel, RH, Forward	Travel, RH, P2
F	Travel, LH, Backward	Travel, LH, P2
G	Travel, RH, Backward	Travel, RH, P1
H	Drain	Drain



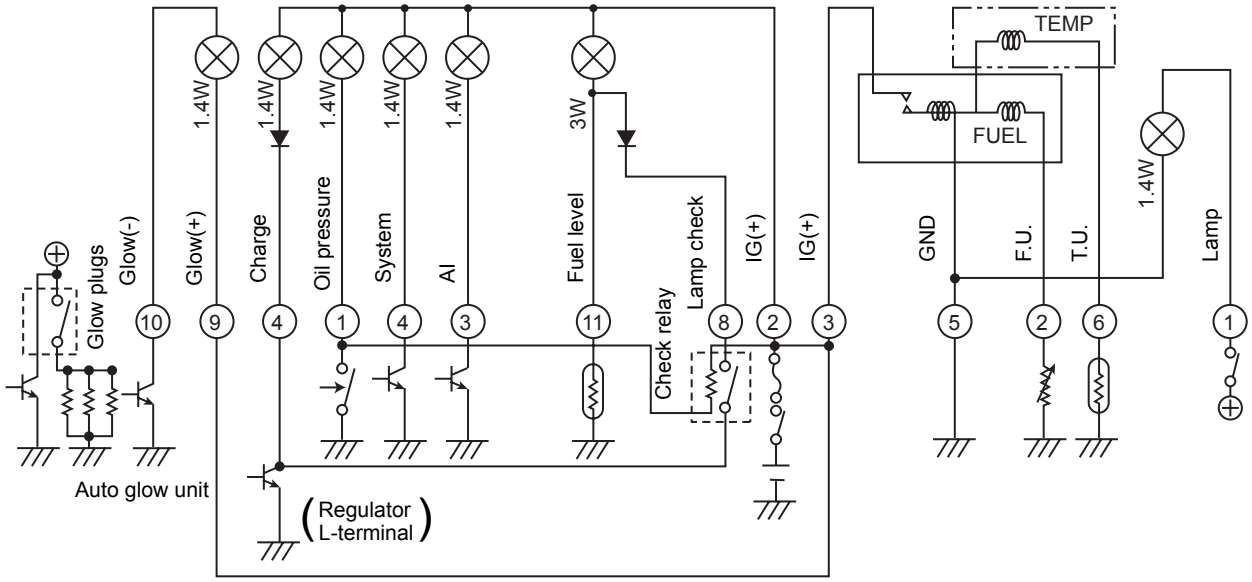
(2) Function chart of auto release controller

Operation	Engine starts and key switch returns to ON position (Normal operation)	Key switch is stuck to start position	Turn key switch to ON-OFF position while engine is running	Engine failed to start and try again quickly, Engine started
Key SW				
Safty relay contact motion				
Starter motor				
Engine				
Aim & function of safty relay		Prevention of overrun	Re-entry prevention of starter motor while engine is running	Re-entry prevention of starter motor. (A part) Overrun prevention (B part)

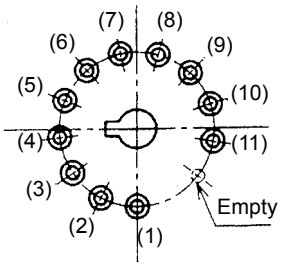
V=voltage, r/min=revolution per minute, t= time

h. Meter panel (Standard-version)

Circuit diagram

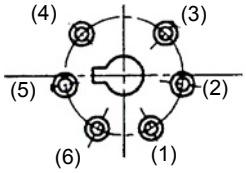


12p connector



No	Connection
1	Engine Pressure
2	IG(+)
3	AI
4	Charge
5	-
6	-
7	-
8	Check SW
9	Glow (+)
10	Glow(-)
11	Fuel level

6p connector



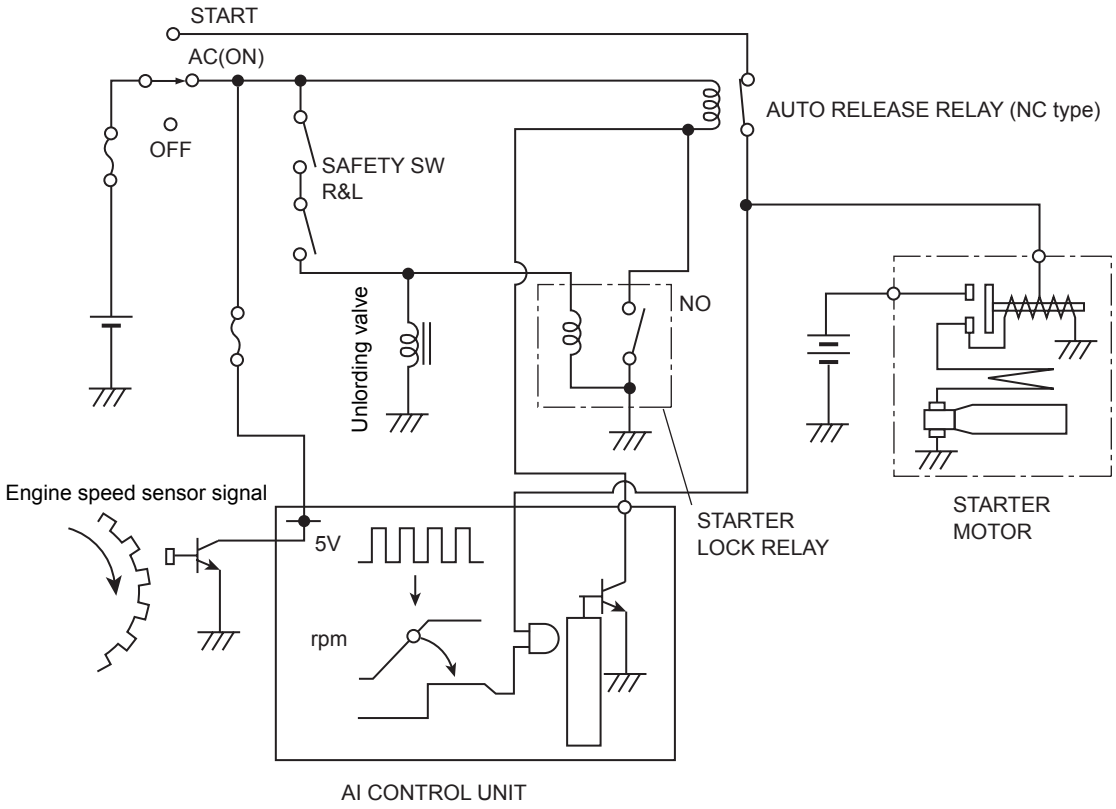
No	Connection
6	Temp. unit
1	Lamp(+)
2	Fuel unit
3	IG(+)
4	System lamp
5	GND

1. Turn the key switch to the ON position, and the battery current starts flowing as shown in the figure. Because the engine oil pressure switch is of NC type, the check relay comes on too and all the warning lamps light up.(The regulator terminal L also lights up when the key switch is turned to the ON position.)

2. When the engine has started and reached the specified speed, the engine oil pressure rises too and the switch is turned off. The charge voltage also rises, which discontinues the current flow to the terminal L. Thus the check relay turns itself off and all the warning lamps go out.

3. During usual operation, the indicator lamps are ready to light up according to their respective circuits. Let's take some examples. The glow lamp stays on while the current is flowing to the glow plug. The AI lamp is kept on during the AI function. The charge lamp lights up if the charge voltage drops below the specified level. The fuel level lamp lights up if the fuel runs short.

m.Starter lock relay & auto release relay (AI-version)



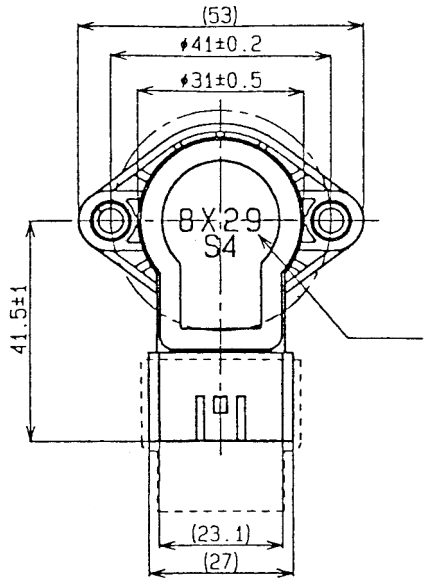
(1) Safety start system

1) The starter lock relay is deactivated only when the right or left safety switches on the safety lock lever is off. Because the automatic release relay is of NC type, the starter motor can be activated just by turning the key switch to the START position.
2) When the safety lock lever switch turns on, the starter lock relay is activated and then the automatic release relay is deactivated. By this, the starter motor is powered off to keep the engine from getting started.
   (Raise the safety lock lever, and the safety switch turns off. Lower it, and the safety switch turns on.)

The automatic release relay is of NC (Normally Closed) type.

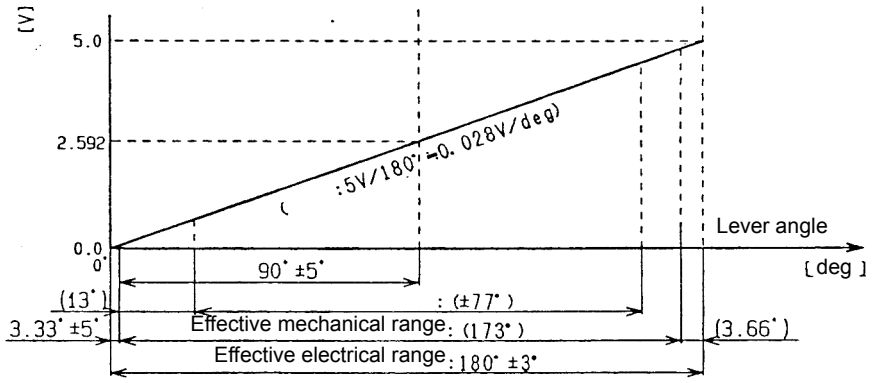
f. Accel sensor, governor sensor

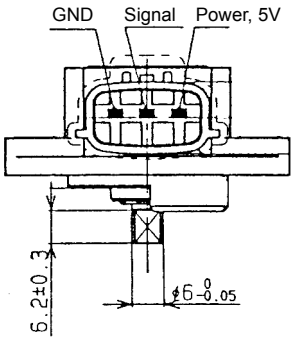
Code No.:RP421-5371-1



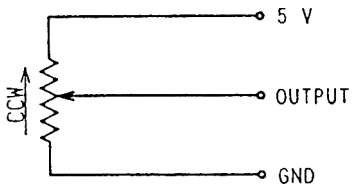
Specifications

1.	Rated voltage	:DC5V
2.	Total resistance	:2KΩ ± 20%
3.	Insulasion resistance	:100MΩ or more
4.	Output performance	:

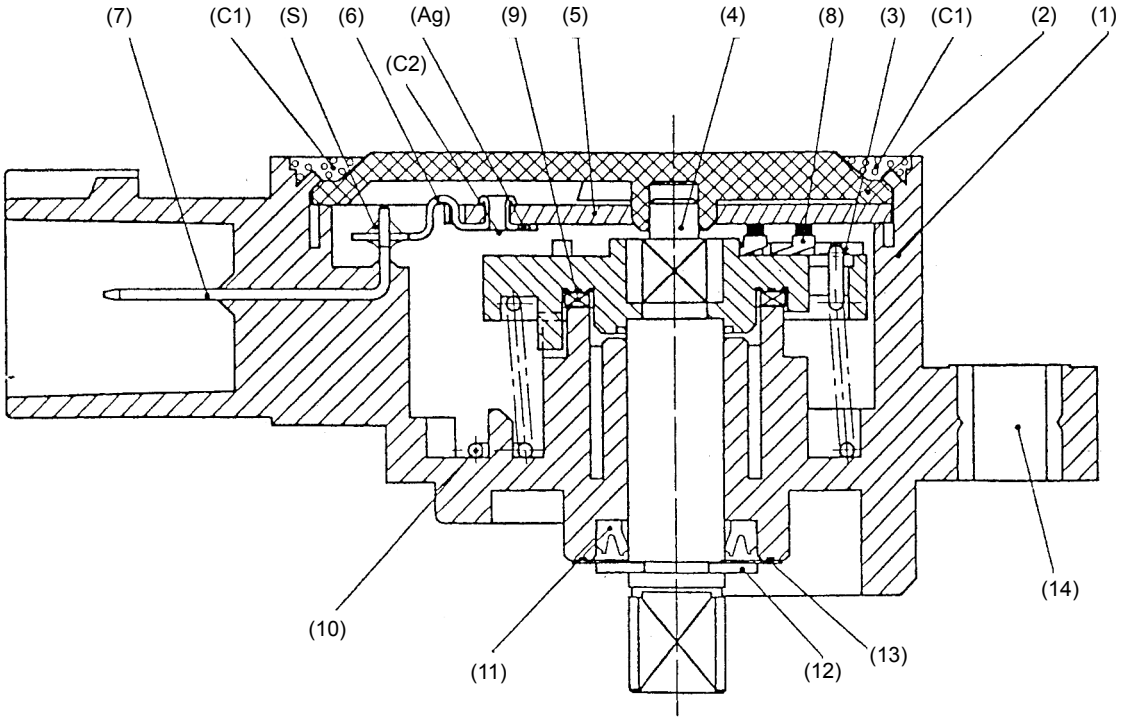




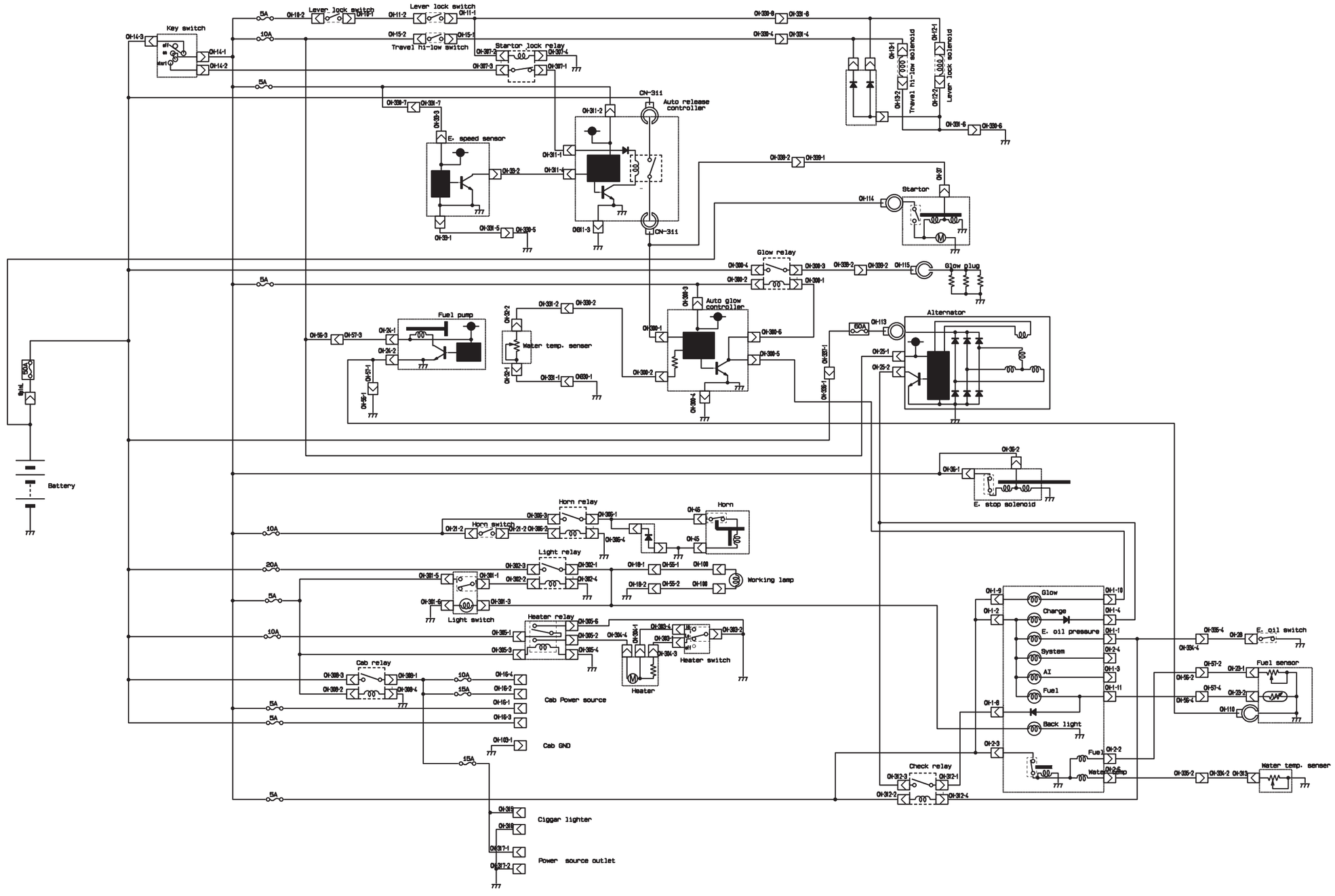
Circuit diagram



(1) Case
(2) Cover
(3) Roter
(4) Shaft
(5) Resistance
(6) Element terminal
(7) Connector terminal
(8) Slider
(9) Wave washer
(10) Return spring
(11) Rubber seal
(12) E-ring
(13) Washer
(14) Sleeve
C1, C2:Adhesive



b. Functional Electric Circuit Diagram: KX91-3, 101-3 (Standard-version)



V. Electrical system(Service section)

b. Front attachment

(1) Working lamp failure

1) Check for continuity to make sure the working lamp's 10A fuse is not blown out.

2) Check for continuity to make sure the working lamp's bulb is not broken.

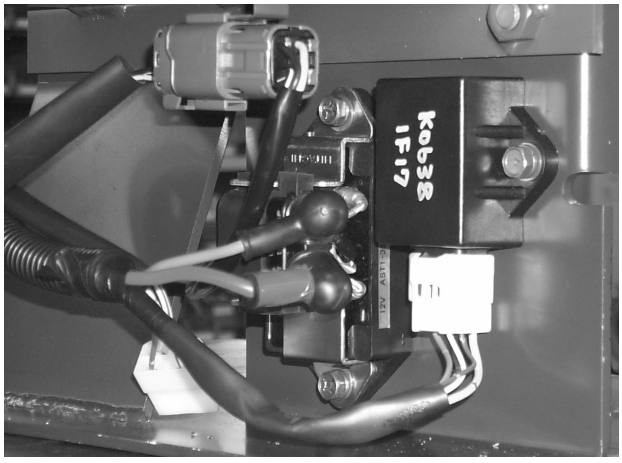
3) Pull the harness to see if the working lamp terminal and the relay couplers are not out of position. Be sure that the coupler harness is tightly connected. (Pull by a 3 kg or less force.)

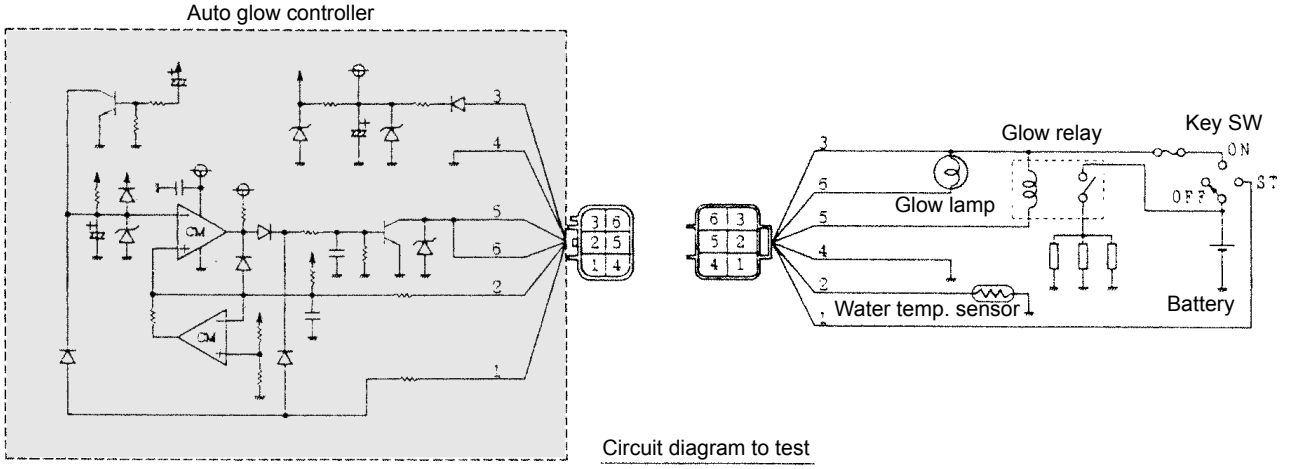
4) Battery voltage check
   1. Disconnect coupler of working light.
   2. Turn on key switch.
   3. Check if batteryvoltage is at (+) terminal.

(6) Auto glow controller

(C/N RC417-53791)

1) If the automatic glow controller seems to malfunction, take it out of the machine, as shown at left, and check the performance of the controller itself referring to the circuit diagram below.
2) The circuit diagram below shows the actual connections. In practice, apply the battery voltage between the coupler pin 3, and ground the coupler pin 4.
3) When the coupler pins 5 and 6 are connected as shown in the diagram, the glow lamp stays on for a certain period of time, and the relay gets activated, it means that the automatic glow controller functions well.
4) If the water temperature sensor signal is not fed to the coupler pin 2, the controller will be in action for about 12 seconds the same way as for the -20 °C condition.





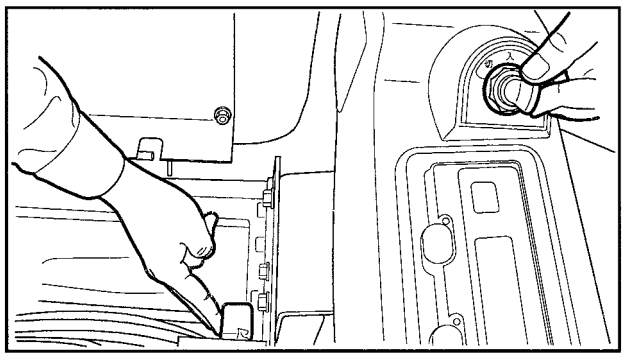
Circuit diagram to test

Note: If a test-purpose glow lamp is not available, set the circuit tester to the V range and watch the tester's pointer movement.

(6) Auto glow circuit

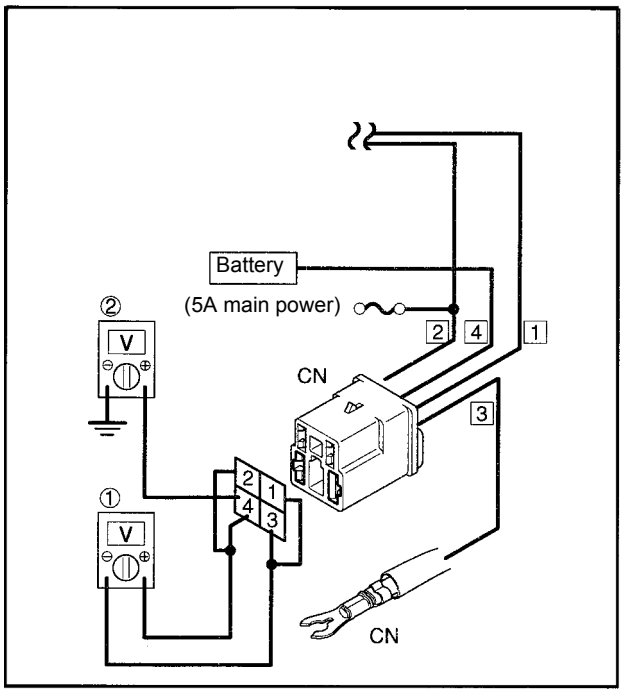
1) Water temperature sensor circuit check
When the water temperature sensor and its wiring function, the engine's water temperature is detected and the glow plug is preheated for a time required to get the engine started.

2) First make sure the water temperature sensor functions. Disconnect the water temperature sensor coupler and put your fingers in slight contact with the glow relay. Now turn the key switch to the ON position and feel the glow relay clicking.
   - When it clicks, check the glow plug coupler as well as the glow relay.
   - If it does not click, measure the voltage, check for continuity (Fig. 4), and check the glow relay (Fig. 5).



3) Voltage check
   - Keep the glow relay coupler in position.
   - Turn the key switch to the ON position.

   1. Measure the voltage between the auto glow relay coupler terminals [3] and [4] as well as between [1] and [2] to see if it is 12 V.
      - 12 V reading for both: Check the glow relay.
      - Other reading: Measure the voltage in Step (2) below. Also check for continuity.
   2. Measure the voltage between the glow relay coupler terminal [4] and the body ground to see if it is 12 V.



(6) Working on the AI motor drive menus in the service mode

Key switch is ON position

(1) Top menu | The red and green lamps blink alternately.

Turn the AI operation switch to ON first and then to OFF.

1) Take this action within 2 seconds, and the green lamp stays on and the menu (2) is called up.
2) Take this action within 3-40 seconds, and the red and green lamps start blinking slowly and the menu (6) is called up.
3) Take this action over 40 seconds, and the red and green lamps start blinking quickly and the menu (9) is called up.

(9) AI motor drive menu | Lamps blink as in the following sequence. Red, green, red, green, red, red & green and repeat.

The AI operation switch is used to run the AI motor directly. Keep in mind that the AI motor must run no longer than 3 seconds.

1) Turn on the AI operation switch an odd-numbered time, and the AI motor runs in the normal direction. The green lamp lights up and the red lamp goes out.
2) Turn on the AI operation switch an even-numbered time, and the AI motor runs in the reverse direction. The green lamp goes out and the red lamp lights up.
3) AI motor runs while AI operation switch is,on.
   Every time AI operation switch turn ON-OFF, AI motor's rotating direction changes.
4) Turn off the AI operation switch, and the AI motor stops. Both the green and lamps go out.
5) Finally Key OFF.

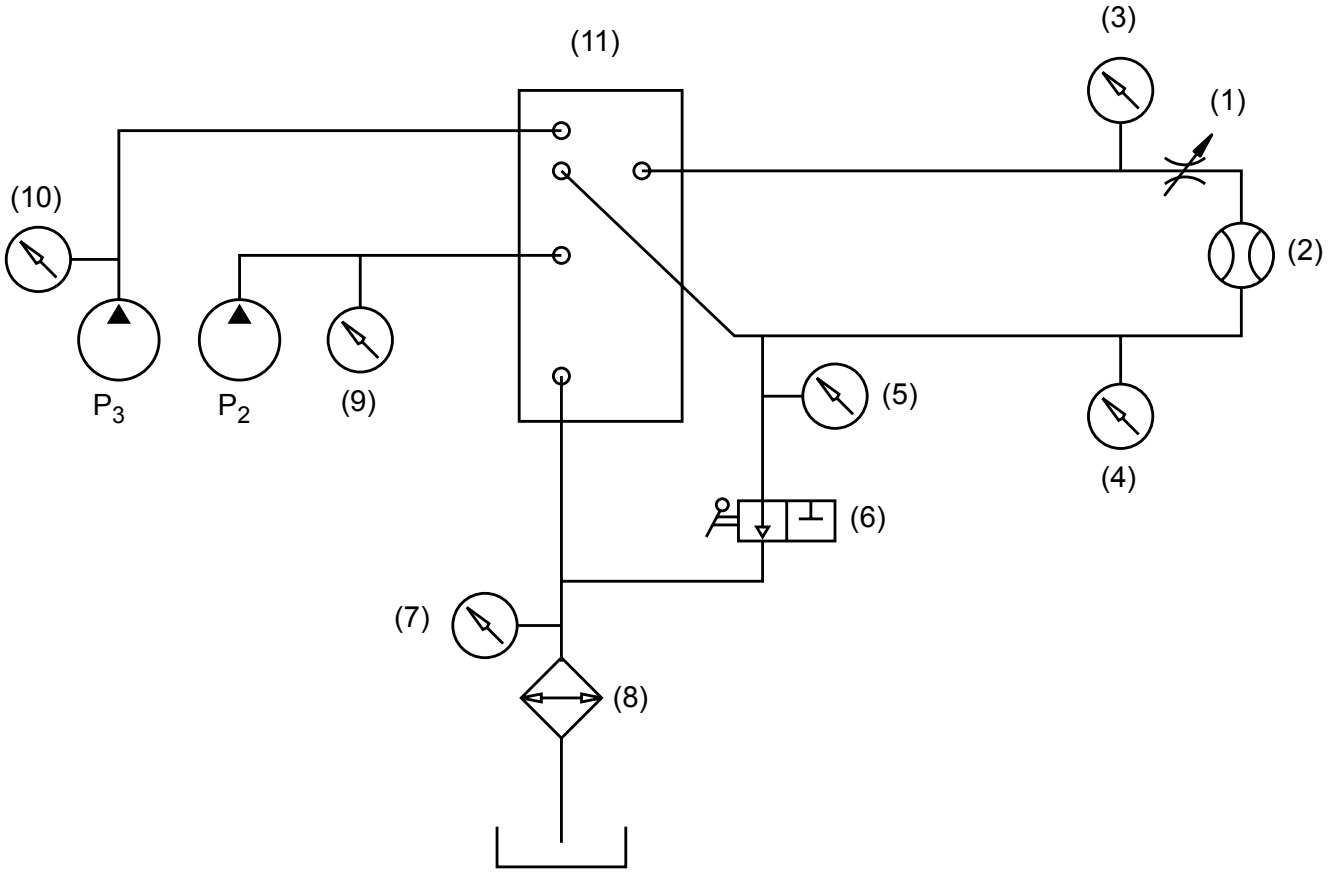
Note: The AI motor runs very fast. To stop it at a desired position, turn the AI operation switch on and off very quickly.

A.KTA-version
a. Actual service port flow : KX91-3 KTA-version only

KX91-3 KTA-version has two pump confluence system of P_2+P_3.
Theoretical pump delivery flow at no load is
P_2+P_3=41.4+21.9=63.3 l/min. (16.7 us gal/min)
Then how about in the loaded condition ?
At loaded condition at 160 kgf/cm^2 of pump gauge port,
P_2+P_3= 50 ~ 55 l/min (13.2 ~ 14.5 us gal/min)
Now, let's see the theory inside.

At load condition, variable displacement pump controls its swash plate angle to make balance engine horse power to hydraulic power output.

1. Test method ; Testing circuit



(1) Service port at arm
(2) Flow meter
(3) Pressure gauge, In side.
(4) Pressure gauge, Out side.
(5) Third line pressure gauge
(6) Third line change valve
(7) Oil cooler pressure gauge
(8) Oil cooler
(9) P_2 pump pressure
(10) P_3 pump pressure
(11) Main control valve assy

7. Krupp breaker information

Attachment specifications

“Eco line” hydraulic hammers,
“Vibrosilenced”

Eco line		HM60	HM90	HM140	HM170
Carrier weight class	t	1-3	1.5-4	2.5-9	5-12
Service weight *	kg	75	128	212	243
Oil flow rate	l/min	15-35	25-45	35-55	50-75
Operating pressure	bar	90-120	90-130	120-140	120-140
Impact rate	bpmin	570-1700	500-1150	500-1150	500-1000
Working tool dia.	mm	48	62	65	75
Useful length of tool	mm	340	435	500	500

“Vibrosilenced Plus” (Add. Noise protection)

Eco line		HM60	HM90	HM140	HM170
Carrier weight class	t	1.2-3	1.9-4	2.5-9	5-12
Service weight *	kg	102	164	243	300
Oil flow rate	l/min	15-35	25-45	35-55	50-75
Operating pressure	bar	90-120	90-130	120-140	120-140
Impact rate	bpmin	570-1700	500-1150	500-1150	500-1000
Working tool dia.	mm	48	62	65	75
Useful length of tool	mm	300	695	450	450

*Hammer and hammer holder plus working tool, or hammer box with standard adaptor plus working tool.

Old model HM140 has operating pressure from 140-180 bar, the rest of the hammer is the same as the new HM140.
New HM140 operating pressure is 120-140 bar.

Old HM140 is the same as HM135 has a working pressure of 140-180 bar.

“V” as in HM90V, HM140V is standing for Vibrosilenced plus, extra noise, vibration protection and also these hammer weigh more.
The second table is all V models, but the performance is the same as the hammers in the first table it’s just extra noise protection.

KX91-3 oil flow is 62.3 l/min. but also uses a variable displacement pump and when pressure is used of 120 bar the flow will be less as 62.3 l/min.
Krupp breaker requires less than 10 kgf/cm^2 of back pressure in return line.

c. Working Light Installation Manual

Model: KX91-3, KX121-3

1. Introduction

This is the installation instruction for canopy light kit.
Read and understand completely the installation manual before you start to install this kit.

	Kit name	KIT LIGHT, CANOPY
KX91-3 KX121-3	W/G No.	K9919

2. Item list of light kit

No.	Part Name	QTY	Port code	
			KX91-3	KX121-3
①	BRACKET, LIGHT	2	RC418-9451△	←
②	LIGHT, WORK	2	T0270-7530△	←
③	WIRE HARNESS, LIGHT	1	RC418-5338△	←
④	WIRE HARNESS, ELECTRIC SOURCE	1	RC418-5339△	←
⑤	BOLT	4	01123-60816	←
⑥	BOLT	2	01023-60660	←
⑦	WASHER PLAIN	2	04013-60060	←
⑧	NUT	2	02014-60060	←
⑨	INSTALLATION MANUAL, LIGHT	1	RC418-9459△	←

3. Installation instruction
   (1) Park the excavator on flat ground, place the bucket to the ground, shut off the engine and remove the key.
   (2) Disconnect ⊖ terminal of the battery cable and insulate it for safety.
   (3) Remove the floor rubber mat and foot panels(Refer to Fig.1, Fig.2)
   (4) First, install the lights on the provided brackets. Second, install the light assembly bracket on the top edge of the canopy.(Refer to Fig.3)
   (5) Wire and connect the wire harnesses with following the figures. (Refer to Fig. 4-12)
   (6) Connect the both battery cables.
   (7) Turn engine start key and turn the light switch on. And if the lights are on, the installation is completed.

d)Replacement the seal rubbers

- First, peel off the seal rubbers attached to the bonnet behind the seat carefully. (Fig.5)
- Secondly, attach the seal rubbers to the ROPS cabin and the bonnet. (Fig.6,Fig.7)

i)After set the rubbers⑫ to base frame of the ROPS cabin first of all, touch the edge face of seal rubbers (1)(2)(3)(4) to them without fail.(A) Also, align face of the seal rubbers with the front line of the base frame of the ROPS cabin.(B)

ii)Align face of the seal rubber (6) with the inside line of the corner pipe. (C)

iii)Touch the edge face of seal rubber (7) to the wall of the ROPS cabin.(D) And attach the seal rubber (8) into the ditch of the base frame of the ROPS cabin.

iv)Attach the seal rubber (9) as the soft side comes upward.(E) And touch other edge face of it to the left swing cover. (F)

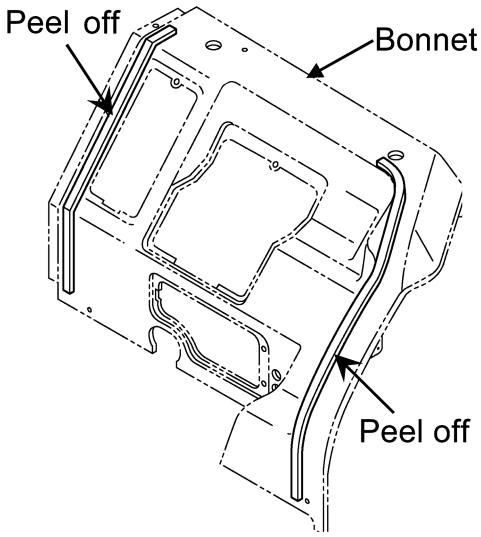
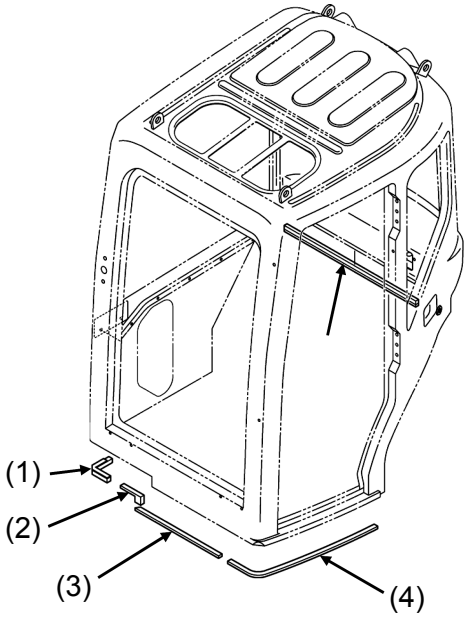
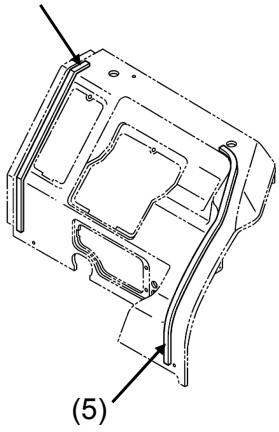


Fig.5

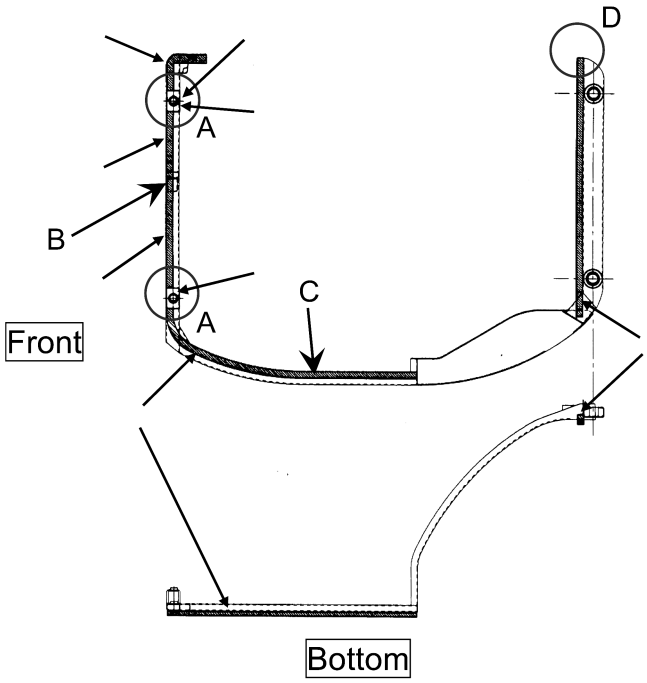


Base frame of ROPS



Bonne measure:inch

Fig.6



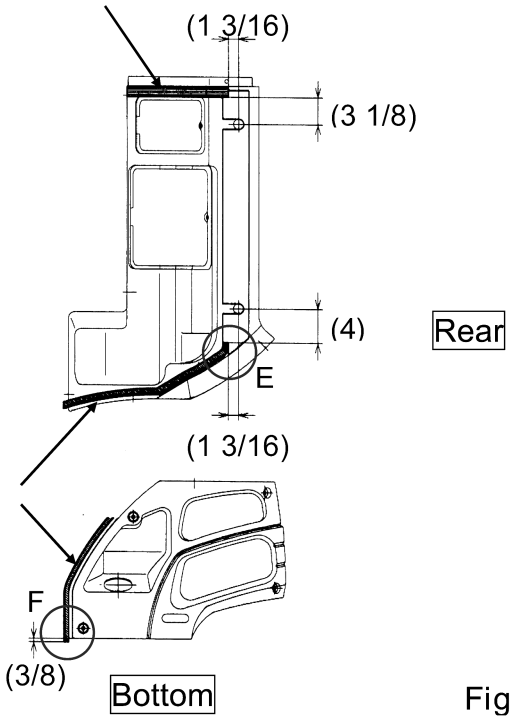


Fig.7

- Tightening Torque -

Bolt	Torque
ⓐ (M6 size) [7T]	7.2 ~ 8.3 ft•lbs.(9.8 ~ 11.3 N•m)
⑭ (M14 size) [6T]	79.6 ~ 92.6 ft•lbs.(107.9 ~ 125.5 N•m)
㉑ (M16 size) [6T]	144.7 ~ 166.5 ft•lbs.(196.1 ~ 255.6 N•m)

- Finally, connect the connectors of main harness and cabin harness. And connect ⊖terminal of the battery cable.

6 Relief valve Pressure setting

a) Machine set relief valve pressure

With big thumb attachment installed on the machine, relief pressure valve at the pump delivery port is shown in the below table.

	MPa	psu	kgf/cm^2	Relief valve code No.
KX91-3	18.5~19.2	2680~2780	188~195	RC418-7085△
KX121-3	20.8~21.3	3000~3100	212~218	RD118-7085△
KX161-3	20.1~20.6	2900~3000	205~210	

Conditions:
Oil temp 50°C(F)
Test port : pump delivery port
Engine : Max. RPH

b) FYI(For your information)

1) Bench set relief valve pressure

KX91-3	RC418-7085△	17.2~17.69 MPa at 5 L/min
KX121-3	RD118-7085△	17.2~17.7 MPa at 5 L/min

2) Test sample data comparison

Relief valve code No. RD118-7085△(17.2$^{+0.5}_{0}$MPa, at 5 L/min)
Pressure setting at bench : 17.7MPa

KX121-3
Engine speed ,no load : Hi : 2420rpm ,Lo : 1100rpm
Service port flow (catalogue) : 65L/min

Tank oil temp. [°C]	Engine speed Hi or Low	Pressure at pump delivery port			Pressure at service port		
		kgf/cm^2	MPa	PSI	kgf/cm^2	MPa	PSI
35	Hi	217.5	21.3	3093	190	18.6	2702
50	Hi	217.5	21.3	3093	190	18.6	2702
50	Low	195	19.1	2773	182.5	17.9	2596
80	Hi	217.5	21.3	3093	190	18.6	2702

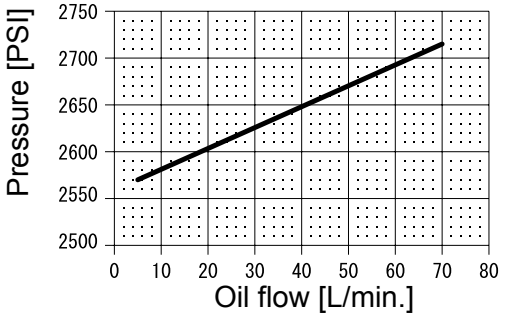
KX161-3
Engine speed ,no load : Hi : 2430rpm ,Lo : 1120rpm
Service port flow (catalogue) : 70L/min

Tank oil temp. [°C]	Engine speed Hi or Low	Pressure at pomp delivery port			Pressure at service port		
		kgf/cm^2	MPa	PSI	kgf/cm^2	MPa	PSI
37	Hi	215	21.1	3058	190	18.6	2702
37	Low	190	18.6	2702	185	18.1	2631
50	Hi	210	20.6	2987	187.5	18.4	2667
80	Hi	210	20.6	2987	187.5	18.4	2667

3) Relief valve override characteristic

Q [L/min]	P [kgf/cm^2]	P [Mpa]	P [PSI]
5	180.6	17.7	2568
37	185.7	18.2	2641

Override characteristic curve



i. STEEL CRAWLER KIT (Convert tracks from rubber to steel) INSTALLATION INSTRUCTION FOR MOUNTING STEEL TRACKS

Model:

KX91-3, U35

1. Removing rubber tracks

Caution

To avoid personal injury :

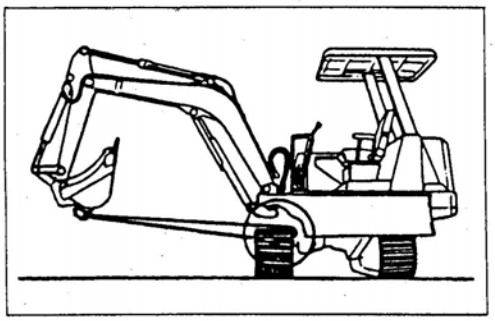
- Do not loosen the grease nipple completely or too quickly. Otherwise grease under high pressure in the tension cylinder could squirt out.
- Make sure that no obstacles, such as stones are caught in the crawler. Remove such obstacles before adjusting the tension.

1 Loosen the bolt of cover and remove the cover. (Fig.1)

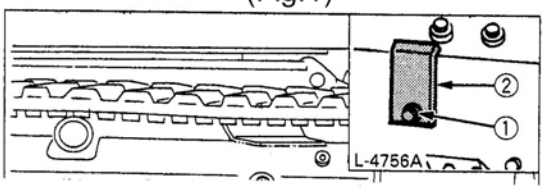
2 Using a socket wrench, loosen the tension cylinder grease nipple to let grease come out until track shoe become fully loose. (Fig.2)

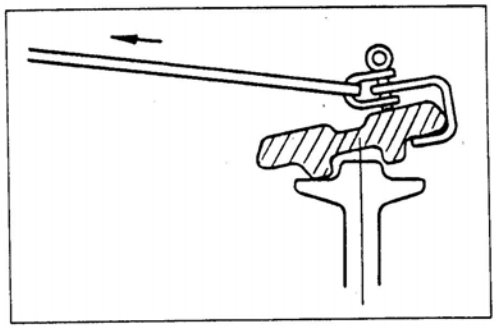
3 Position the front attachment and install the nylon sling and special fook as shown in (Fig.3).

4 Pull the nylon sling horizontally and rotate the rubber track forward until track link comes off the idler.

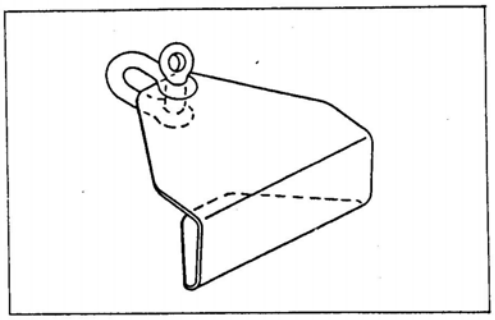


(Fig.1)





(Fig.2)



(Fig.3)