Compact Excavator

TB014
TB016

BOOK No. CC4E002

WORKSHOP MANUAL

Serial No.
TB014: 11410001~
TB016: 11610001~

TAKEUCHI

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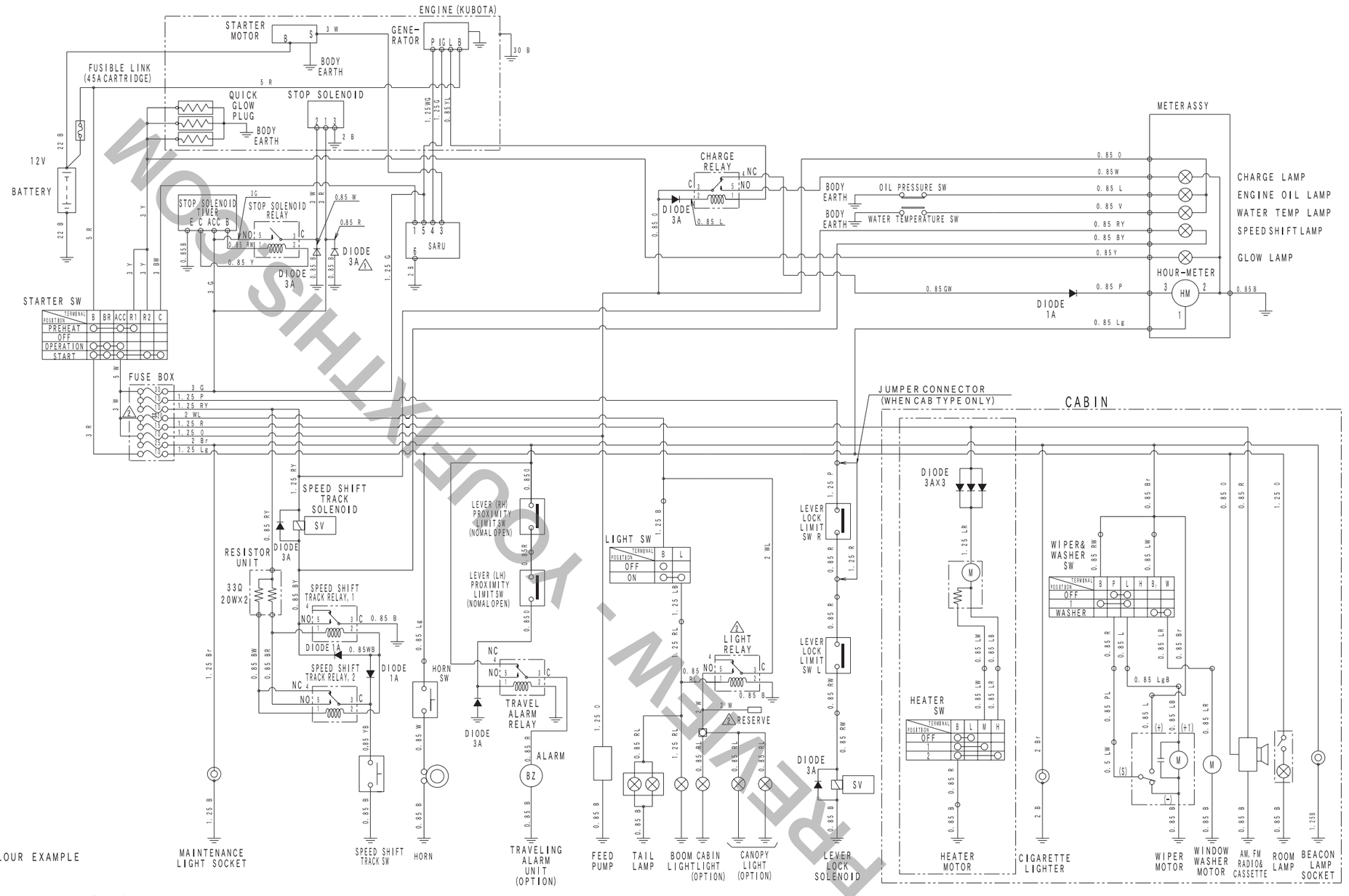
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ELECTRICAL SYSTEM

ELECTRICAL WIRING DIAGRAM

■ TB014



WIRING COLOUR EXAMPLE

W L
- WIRING COLOUR (BLUE)
- GROUND COLOUR (WHITE)

WIRING COLOUR TABLE

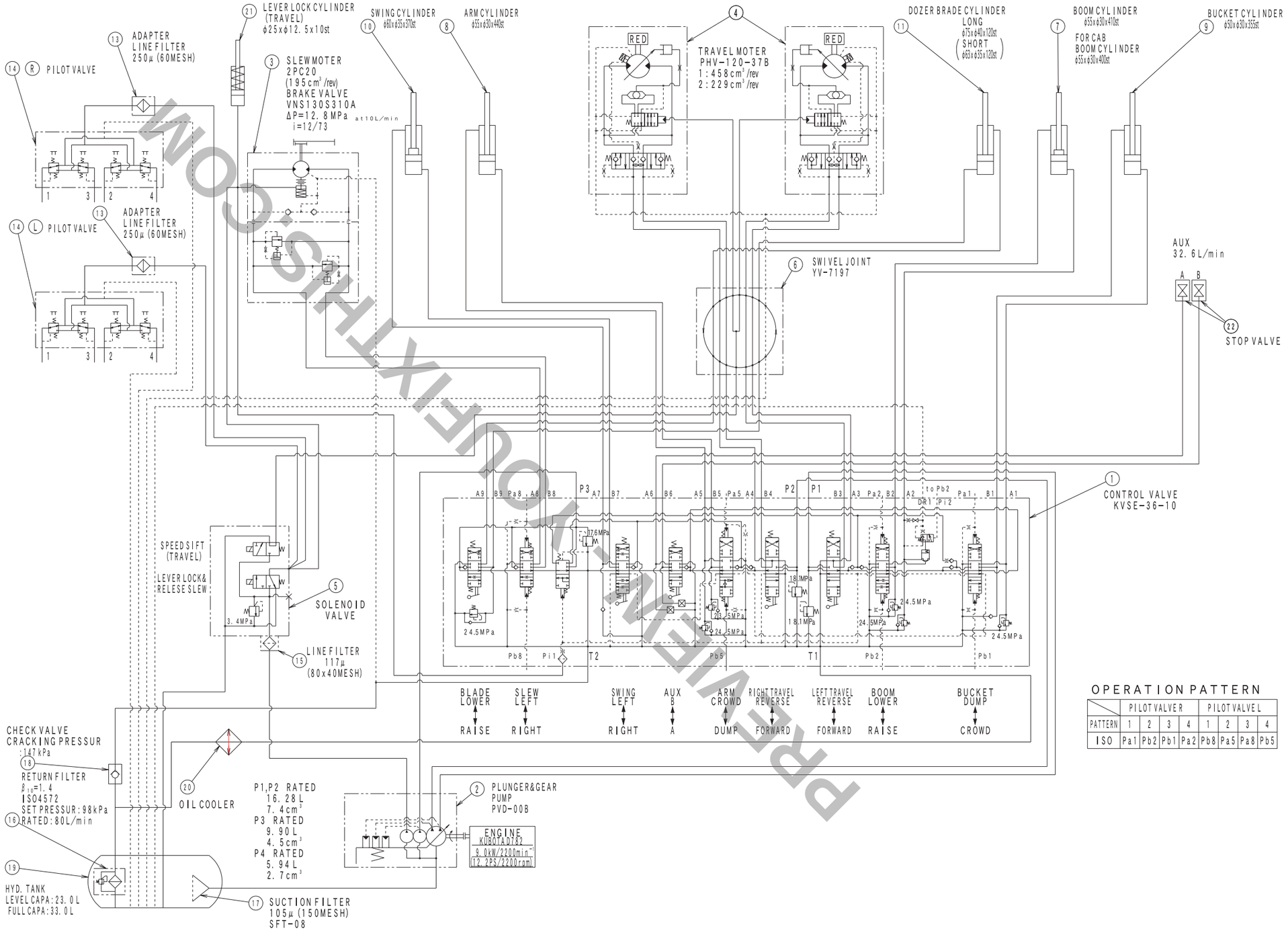
CODE	COLOUR	CODE	COLOUR	CODE	COLOUR
B	BLACK	W	WHITE	Br	BROWN
G	GREEN	Y	YELLOW	Lg	LIGHT GREEN
L	BLUE	P	PINK	Gr	GREY
R	RED	O	ORANGE	Sb	SKY BLUE
V	VIOLET	Dg	DARK GREEN	Ch	CHOCOLATE

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HYDRAULIC SYSTEM

HYDRAULIC CIRCUIT DIAGRAM

■ TB014



OPERATION PATTERN

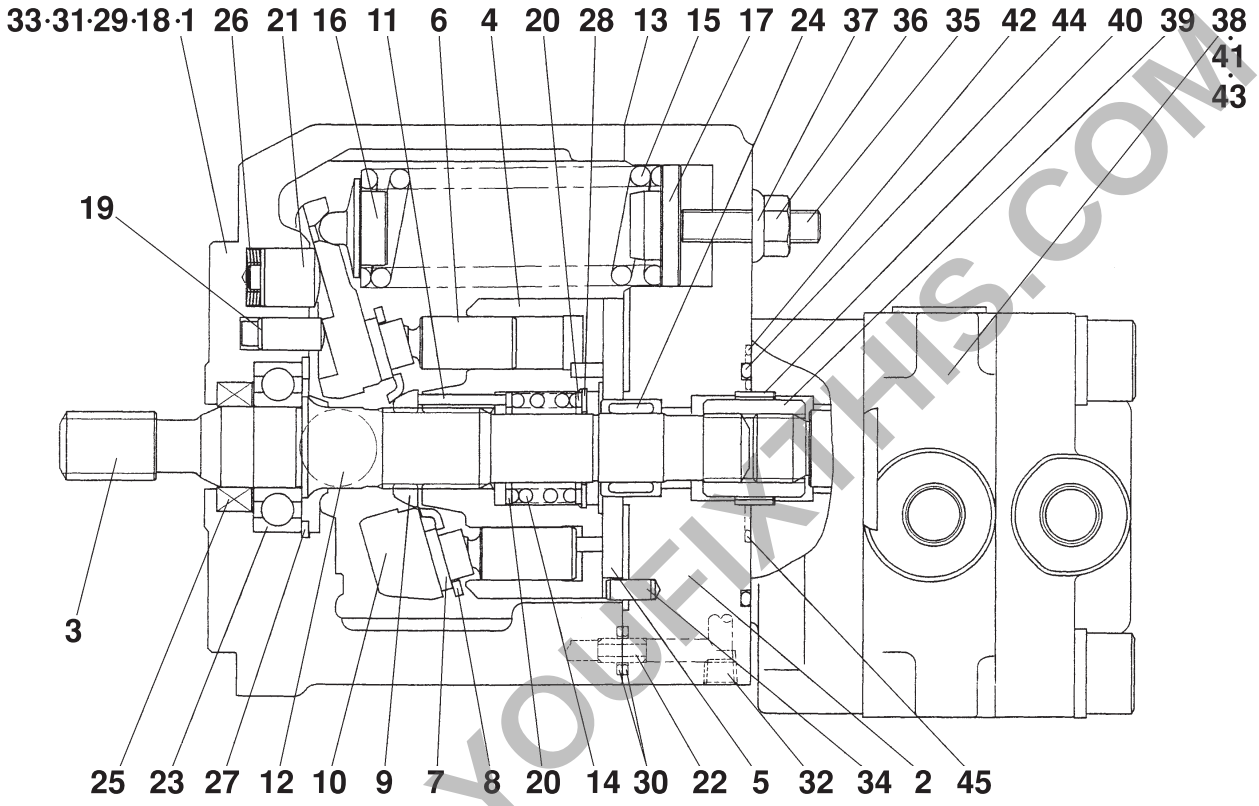
	PILOT VALVE R				PILOT VALVE L			
PATTERN	1	2	3	4	1	2	3	4
ISO	Pa1	Pb2	Pb1	Pa2	Pb8	Pa5	Pa8	Pb5

C4C709

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HYDRAULIC PUMP

CONSTRUCTION



1. Body S
2. Body H
3. Shaft
4. Cylinder Block
5. Valve Plate
6. Piston
7. Shoe
8. Shoe Holder
9. Guide
10. Swash Plate
11. Needle
12. Pin
13. Packing
14. Spring C
15. Spring T
16. Spring Holder
17. Spring Guide
18. Pin
19. Piston
20. Retainer
21. Stopper Pin A
22. Pin
23. Ball Bearing
24. Needle Bearing
25. Oil Seal
26. Conical Spring Washer
27. Snap Ring
28. Snap Ring
29. O-ring
30. O-ring
31. Cap Screw
32. Plug
33. Plug
34. Spring Pin
35. Set Screw
36. Nut
37. Seal Washer
38. Gear Pump
39. Coupling
40. Collar
41. Bolt
42. O-ring
43. Washer
44. O-ring
45. O-ring

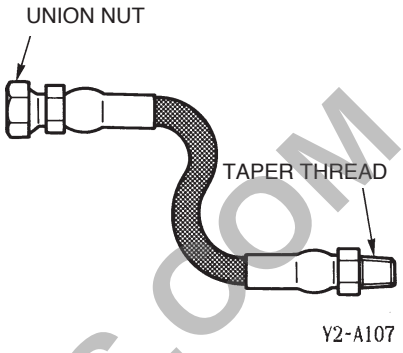
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TIGHTENING TORQUES

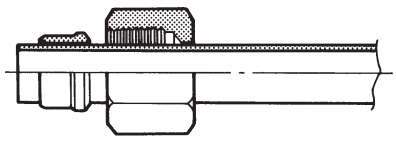
Hydraulic Hoses

Hose Fitting Size	Torque			
	Union Nut (G)		Taper Thread (R)	
	N·m	ft-lb	N·m	ft-lb
1/8	9.8 $^{+4.9}_{0}$	7.3 $^{+3.5}_{0}$	11.8 ±1.2	8.7 ±0.8
1/4	24.5 $^{+4.9}_{0}$	18.1 $^{+3.5}_{0}$	29.4 ±2.9	21.7 ±2.1
3/8	49 $^{+4.9}_{0}$	36.2 $^{+3.5}_{0}$	53.9 ±5.4	39.8 ±3.9
1/2	58.8 $^{+4.9}_{0}$	43.4 $^{+3.5}_{0}$	88.3 ±8.8	65.1 ±6.4
3/4	117.7 $^{+4.9}_{0}$	86.8 $^{+3.5}_{0}$	147.1 ±14.7	108.5 ±10.7
1	137.3 $^{+4.9}_{0}$	101.3 $^{+3.5}_{0}$	196.1 ±19.6	144.7 ±14.3



Bite Type Pipe Fitting for Steel Pipe

Pipe Outer Diameter (mm)	Torque	
	N·m	ft-lb
8	34.3 ±4.9	25.3 ±3.5
10	41.7 ±2.5	30.7 ±1.7
12	58.8 ±4.9	43.4 ±3.5
15	88.3 ±4.9	65.1 ±3.5
16	93.2 ±4.9	68.7 ±3.5
18	132.4 ±4.9	97.6 ±3.5
22	205.9 ±9.8	151.8 ±7.2
27.2	245.2 ±9.8	181.0 ±7.2
28	313.8 ±19.6	231.4 ±14.3
32	313.8 ±19.6	231.4 ±14.3
35	411.9 ±19.6	303.7 ±14.3



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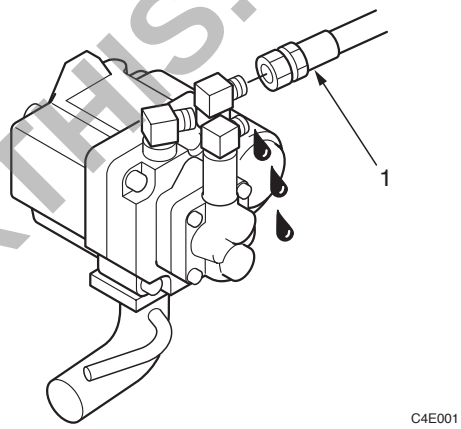
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NO OPERATIONS CAN BE DONE.

1	Inspect the hydraulic oil level.	Insufficient →	2	Replenish the hydraulic oil.
	↓ Proper Amount			
3	Pump or coupling is faulty.	→		• Repair the pump or replace the pump. • Replace the coupling.

1. Inspect the hydraulic oil level.
   ☞ "III. Machine Configuration, Hydraulic Tank"

2. Replenish the hydraulic oil.
   Take out the plug and replenish the hydraulic oil.
   - The hydraulic oil supplied should be the same brand as the oil currently in the tank.
     ☞ "II. Specifications, Fluid Capacities"
   - After replenishing the hydraulic oil, be sure to pressurize the Hydraulic Tank.
     ☞ "III-60"

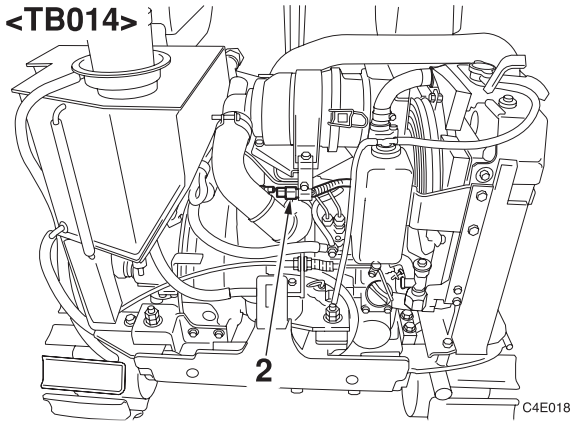


C4E001

3. Pump or coupling is faulty.
   a. Disconnect the discharge hose (1) from the pump side.
      Also fit a plug in the disconnected hose to keep the hydraulic oil from pouring out.
   b. Disconnect the electrical wiring (2) to the engine stop solenoid.
   c. Turn the engine over using the starting motor and inspect if hydraulic oil is discharged by the pump.
      - The throttle lever should be in the engine stop position.

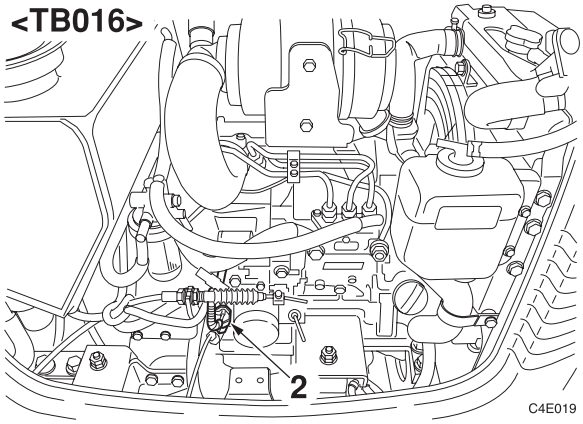
   If the pump is normal, hydraulic oil will be discharged from it. If hydraulic oil is not discharged, the pump or the coupling is faulty.

<TB014>



C4E018

<TB016>



C4E019

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SPECIFICATION TABLES

SPECIFICATIONS

Machine Model		TB014	
Serial Number		11410001~	
Machine Type		Canopy	Cab
Machine Mass (not including operator)			
Rubber Crawler	kg	1410	1525
Steel Crawler	kg	1460	1575
Engine Rated Output	kW/min^{-1}	9/2200	←
Bucket Capacity (Standard Bucket)			
Rated Capacity	m^3	0.038	←
Struck Capacity	m^3	0.028	←
Performance			
Slew Speed	min^{-1}	9.0	←
Travel Speed: Rubber 1st / 2nd	km/h	2.0/3.9	←
: Steel Crawler 1st / 2nd	km/h	1.9/3.7	←
Gradeability	% (degree)	47 (25)	←
Ground Pressure: Rubber Crawler	kPa	27.8	29.9
Steel Crawler	kPa	28.9	31.1
Noise Level: Sound-power	dB (A)	LWA93	←
Sound-pressure level	dB (A)	LpA77	LpA78
Auxiliary Hydraulic Flow Rate	L/min	32.6	←
Dimensions			
Overall Length in Transport Position	mm	3560	←
Overall Width	mm	980	1030
Overall Height	mm	2280	2365
Dimensions of Base Machine			
Tail Swing Radius	mm	1085	←
Distance of Rearmost Upper Structure from Axis of Rotation	mm	1065	←
Clearance Height under Upper Structure	mm	470	←
Crawler Base: Rubber Crawler	mm	1015	←
Steel Crawler	mm	1000	←
Crawler Overall Length: Rubber Crawler	mm	1380	←
Steel Crawler	mm	1370	←
Crawler Overall Width	mm	980	←
Crawler Overall Width (When Retracted)	mm	—	—
Crawler Shoe Width	mm	230	←
Minimum Ground Clearance	mm	220	←

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TYPES OF CRAWLER BELTS

Machine Model	Type	Shoe Width (mm)	Number of Links	Overall Crawler Width (mm)	Ground Pressure kPa		Overall Mass (kg)
					Canopy	Cab	
TB014	Rubber	230	—	980	27.8	29.9	50
	Steel	230	32	980	28.9	31.1	74
	Steel*	230	32	980	33.3	35.6	125
TB016	Rubber	230	—	980/1300	26.2	28.0	55
	Steel	230	35	980/1300	27.4	29.3	81
	Steel*	230	35	980/1300	31.3	33.4	137

*: With Rubber Pads.

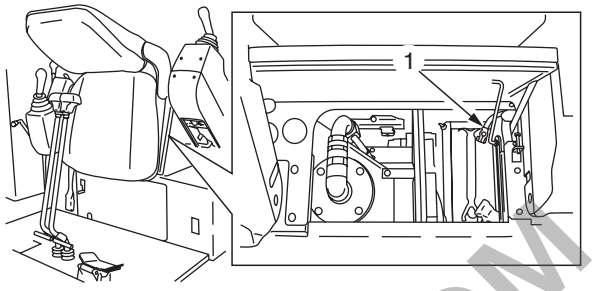
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DISASSEMBLY AND ASSEMBLY

Removing the Engine

1. Disconnect the battery ground cable (1) from the battery.



C4C106

2. Remove the canopy or cab.
   ☞ "Removing the Cab"

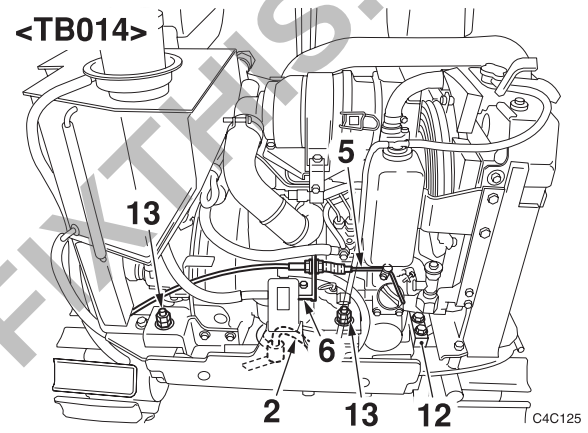
3. Remove the engine hood, engine cover, and counterweight.
   ☞ "Removing the Covers"

4. Remove the radiator oil cooler.
   ☞ "Removing the Radiator Oil Cooler"

5. Disconnect the coolant drain hose (2).

6. Remove the fuel tank.
   ☞ "Removing the Fuel Tank"

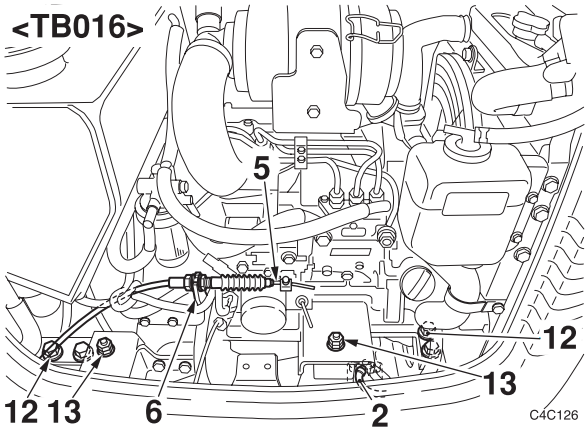
7. Remove the hydraulic pump.
   ☞ "Removing the Hydraulic Pump"



C4C125

8. Disconnect the accelerator wire (5) from the engine, and remove the bracket (6) with the wire still attached.

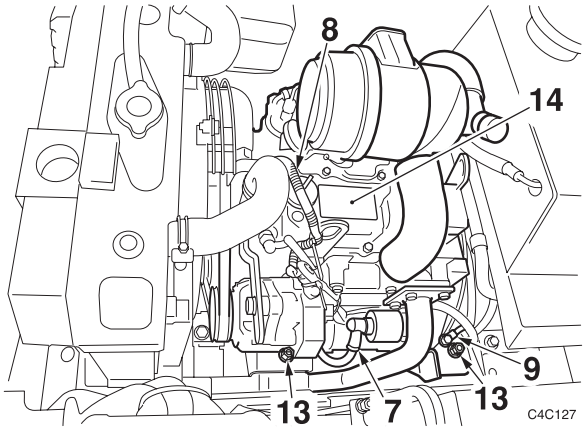
9. Disconnect the battery cable (7) and all the connections on the engine side of the electric wirings (8).
   - Attach identification labels to individual wirings.
   - Disconnect the wirings from the clamp and the band.



C4C126

10. Disconnect the engine ground cable (9).

11. Remove the muffler pipe (10).



C4C127

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FOREWORD

This manual is intended for persons who engage in maintenance operations, and explains procedures for disassembly and reassembly of the machine, check and maintenance procedures, maintenance reference values, troubleshooting and outline specifications, etc. Please use this manual as a reference in service activities to improve maintenance techniques.
Further, please be advised that items contained in this manual are subject to change without notice due to design modifications, etc.

MACHINE FRONT AND REAR, LEFT AND RIGHT

The end where the dozer blade is mounted is the front and the end with the travel motors is the rear. Also the right and left sides of the operator when he is seated in the operator's seat are the right and left sides of the machine.

MACHINE SERIAL NUMBER

The machine serial number is stamped on the identification plate. When sending reports and inquiries, and when ordering parts, etc., be sure to include this number.

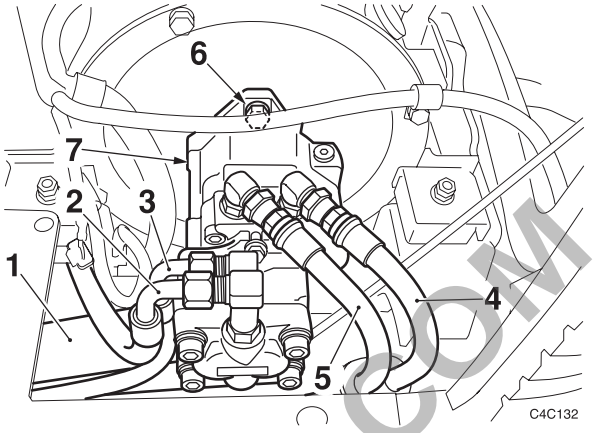
MANUAL CONTROL

Information on those to whom this manual is distributed is recorded in the ledger in the section in charge at this company, so please decide on a person to be in charge of it and control it. When there are updates or additions, etc., we will notify the person in charge.

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Removing the Hydraulic Pump



1. Remove the canopy or cab.
   ☞ "Removing the Cab"

2. Remove the engine hood and engine cover.
   ☞ "Removing the Covers"

3. Remove the fuel tank.
   ☞ "Removing the Fuel Tank"

4. Drain out the oil from the hydraulic tank.
   ☞ "Removing the Hydraulic Tank"

5. Disconnect the suction hose (1) from the pump.

6. Disconnect the discharge hoses (2), (3), (4) and (5) from the pump.

7. Remove the fixing bolts (6) and take out the hydraulic pump (7).
   ⇐ Bolt: 102 N·m
   - Apply molybdenum disulfide grease to the spline section.

Installing the Hydraulic Pump

Follow the same procedure as for removal in the reverse order.

Cautions when starting the hydraulic pump

1. Fill the pump housing with clean hydraulic oil before starting the pump.
   - Loosen the air release plug (8), fill in the oil through the opening until the oil overflows, and fasten the plug.

2. After starting the engine, let it run at a low idling speed for a while to completely bleed out the air within the circuit.

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Removing the Boom

- Lower the front end of the boom so that it is in full contact with the ground.

1. Disconnect the hydraulic hoses (1) from the arm cylinder (2).

2. Suspend the arm cylinder (2) temporarily, then take out the pin (3) and remove the arm cylinder.
   Arm Cylinder: 12 kg

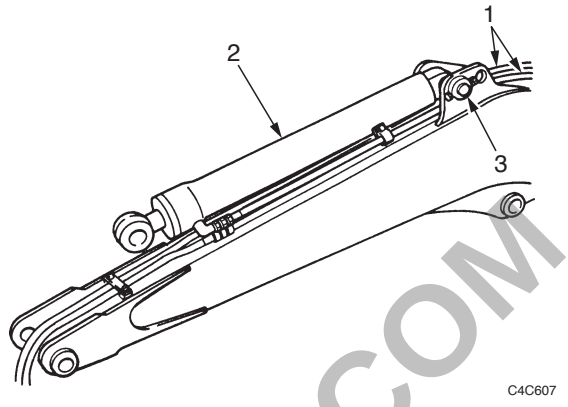
3. Remove the clamp (4) from the boom (5), and disconnect the hydraulic hose (6) from the boom cylinder (7).

4. Suspend the boom cylinder (7) temporarily and take out the pin (8).

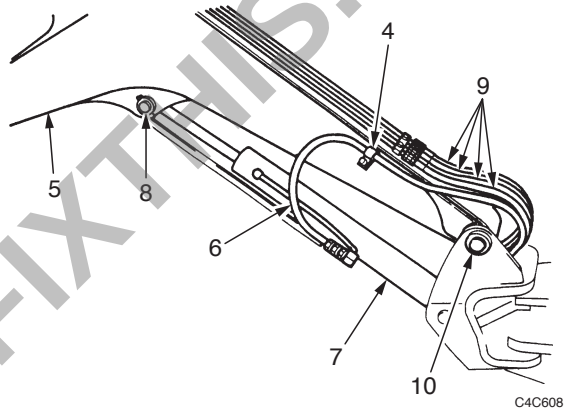
5. Disconnect the wiring to the boom light.

6. Disconnect the hydraulic hoses (9) from the pipes.

7. Suspend the boom (5) temporarily, take out the pin (10) and remove the boom.
   Boom: 45 kg



C4C607



C4C608

Installing the Boom

Follow the procedure used for removal in reverse order.

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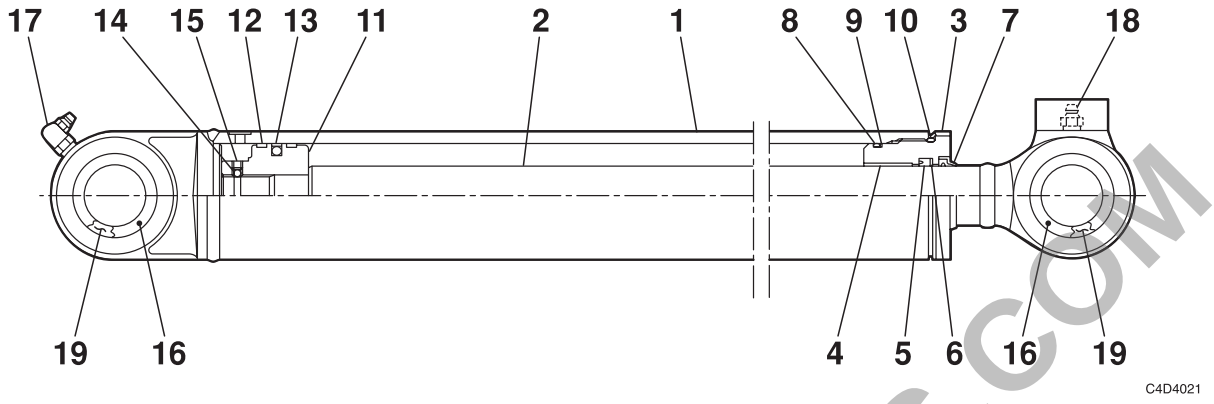
TROUBLESHOOTING

Symptom	Probable Causes	Remedy
Noise is loud. Abnormal noise is generated.	• The suction hose is pinched or the suction filter is clogged. • The suction side joint is loose and air is being sucked in. • The hydraulic oil's viscosity is too high and cavitation is occurring. • The pump is off center with respect to the engine. • There are bubbles in the hydraulic oil. • The engine's speed is higher than the specified speed. • The drain back pressure is higher than the specified pressure. • The bearing, etc. is mechanically damaged.	• Remove the dirt or eliminate the pinched condition of the hose. • Retighten each joint. • Replace the hydraulic oil with oil of the proper viscosity. • Center the pump with respect to the engine. • Investigate the cause of the bubbles and repair it. • Operate the engine at the specified speed. • Check and replace the drain piping. • Replace the damaged parts or replace the pump.
Discharge is insufficient.	• The engine's speed is too low. • The oil temperature is abnormally high. • The hydraulic oil's viscosity is too high. • The pump's volumetric efficiency has dropped. • The horsepower setting adjustment screw is loose. • The oil level in the tank is low. • The suction side pipe or the suction filter is clogged. • The amount of leakage from hydraulic devices other than the pump is increasing.	• Operate the engine at the specified speed. • Stop the machine and let the oil cool off, then check again. • Replace the hydraulic oil with oil of the proper viscosity. • Replace the pump. • Reset the screw and lock it. • Replenish the tank with hydraulic oil to the specified level. • Clean the piping. • Repair the hydraulic device or replace it.
Pressure doesn't rise.	• The relief valve setting has dropped. • The amount of leakage from hydraulic devices other than the pump is increasing. • The pump's volumetric efficiency has dropped.	• Reset the relief valve setting. • Repair the hydraulic device or replace it. • Replace the pump.
The rotational speed drops when there is a dynamic load.	• The peak pressure is generated due to a drop in the relief valve's response. • There is foreign matter trapped in the pilot line or foreign matter is caught in the sliding parts of the control equipment.	• Repair the relief valve or replace it. • Remove the foreign matter and repair or replace the scratched parts.
Abnormal heat is generated.	• Leakage from the pump is increasing. • The bearings, etc. are mechanically damaged. • There is seizing of sliding parts.	• Replace the pump. • Replace the damaged parts or replace the pump. • Replace the damaged parts or replace the pump.
Hydraulic oil is leaking.	• Seals are damaged. • The shaft surface which slides against the oil seal is worn. • The plug or bolts are loose.	• Replace the seals. • Replace the shaft or replace the pump. • Tighten them or replace the seals.

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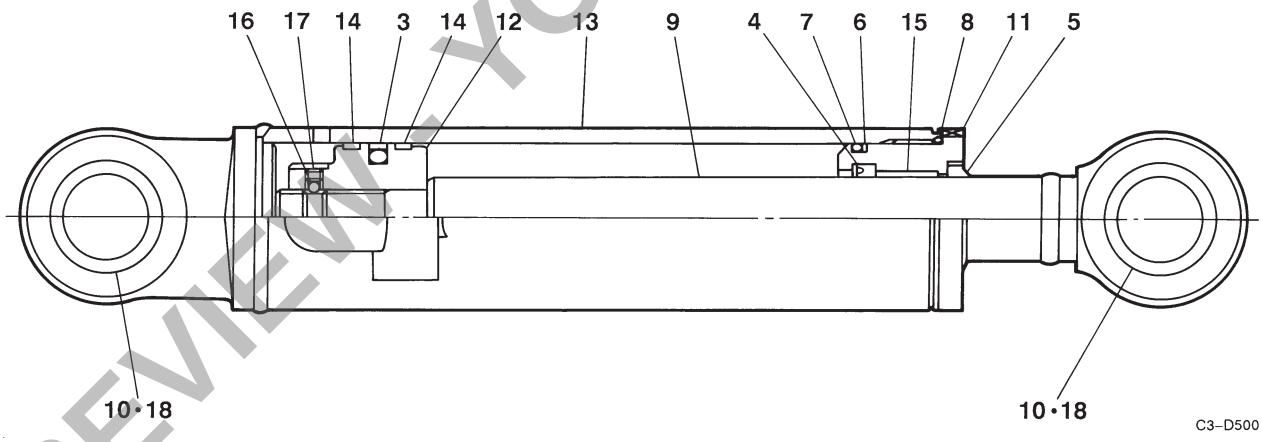
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Bucket Cylinder



1. Tube
2. Piston Rod
3. Rod Cover
4. Bushing
5. Rod Packing
6. Backup Ring
7. Dust Seal
8. O-ring
9. Backup Ring
10. O-ring
11. Piston
12. Wear Ring
13. Piston Packing
14. Ball
15. Set Screw
16. Dust Seal
17. Grease Nipple
18. Grease Nipple
19. Bushing

Dozer Blade Cylinder



1. Cylinder Assembly
2. Seal Kit
3. Piston Packing
4. Rod Packing
5. Dust Seal
6. Backup Ring
7. O-ring
8. O-ring
9. Piston Rod
10. Bushing
11. Rod Cover
12. Piston
13. Tube
14. Wear Ring
15. Bushing
16. Ball
17. Set Screw
18. Dust Seal

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Hydraulic Motor 2.

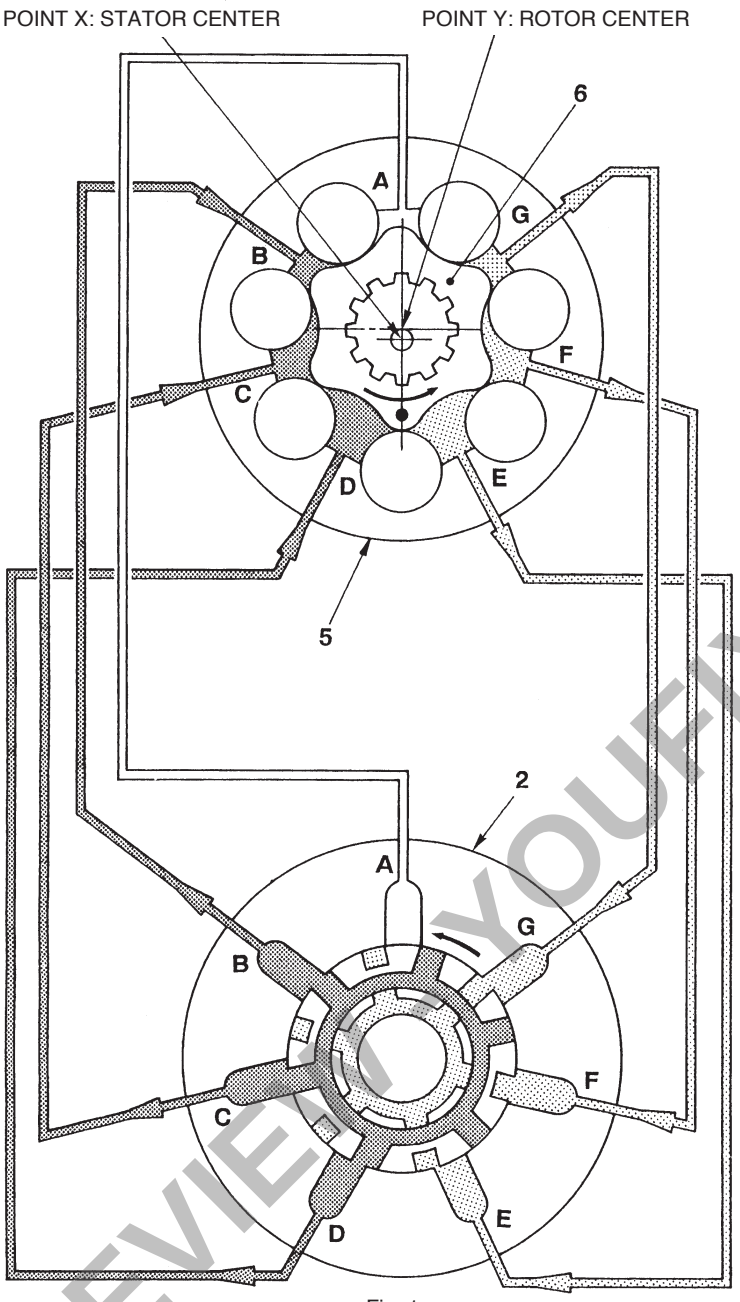


Fig. 1

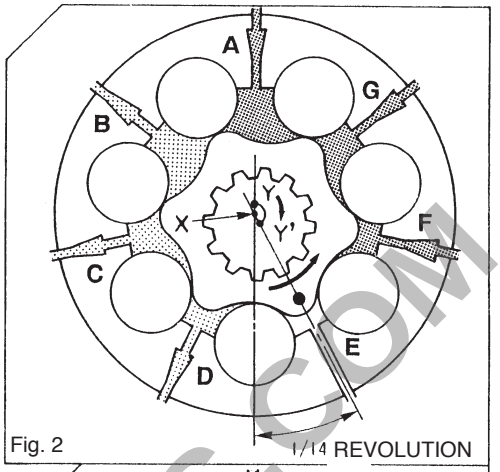


Fig. 2 1/14 REVOLUTION

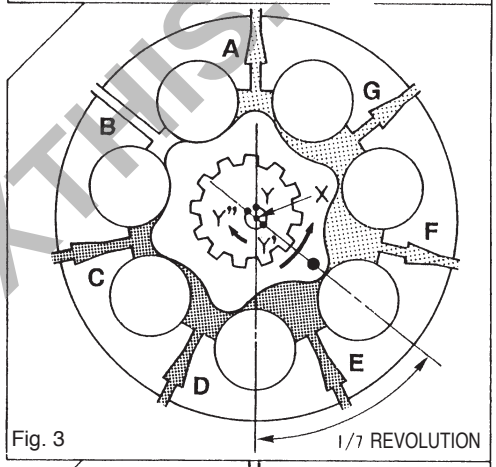


Fig. 3 1/7 REVOLUTION

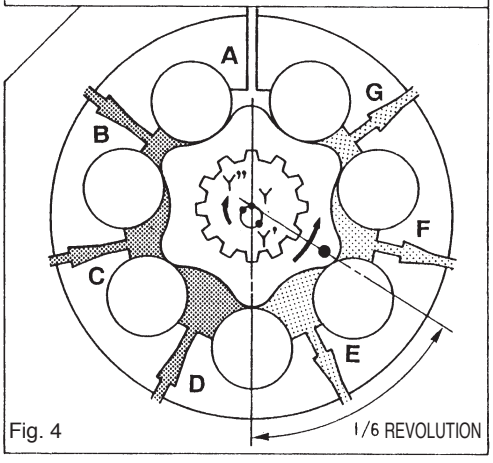


Fig. 4 1/6 REVOLUTION

Y2-D603

In Fig. 1, when high pressure oil is introduced into chambers B, C and D, the rotor (6) rotates in the arrow direction while making contact with the inside of the stator (5). The valve (2) rotates along with this, so the chambers in which high pressure oil is introduced also shift sequentially, but in the direction opposite the arrow direction. In Fig. 2, the rotor (6) has turned 1/14 revolution. This cause the chambers where high pressure oil is introduced to shift to A, G and F. At this time, the center of the rotor Y shifts in a circle about point X to point Y'. In Fig. 3, Y' shifts to Y".

That is, the center of the rotor (6) rotates in a circle around point X, 6/7 revolution, from Y to Y' to Y". In Fig. 4, point Y" has returned to point Y, making 1 cycle of shifting the chambers where high pressure oil is introduced.

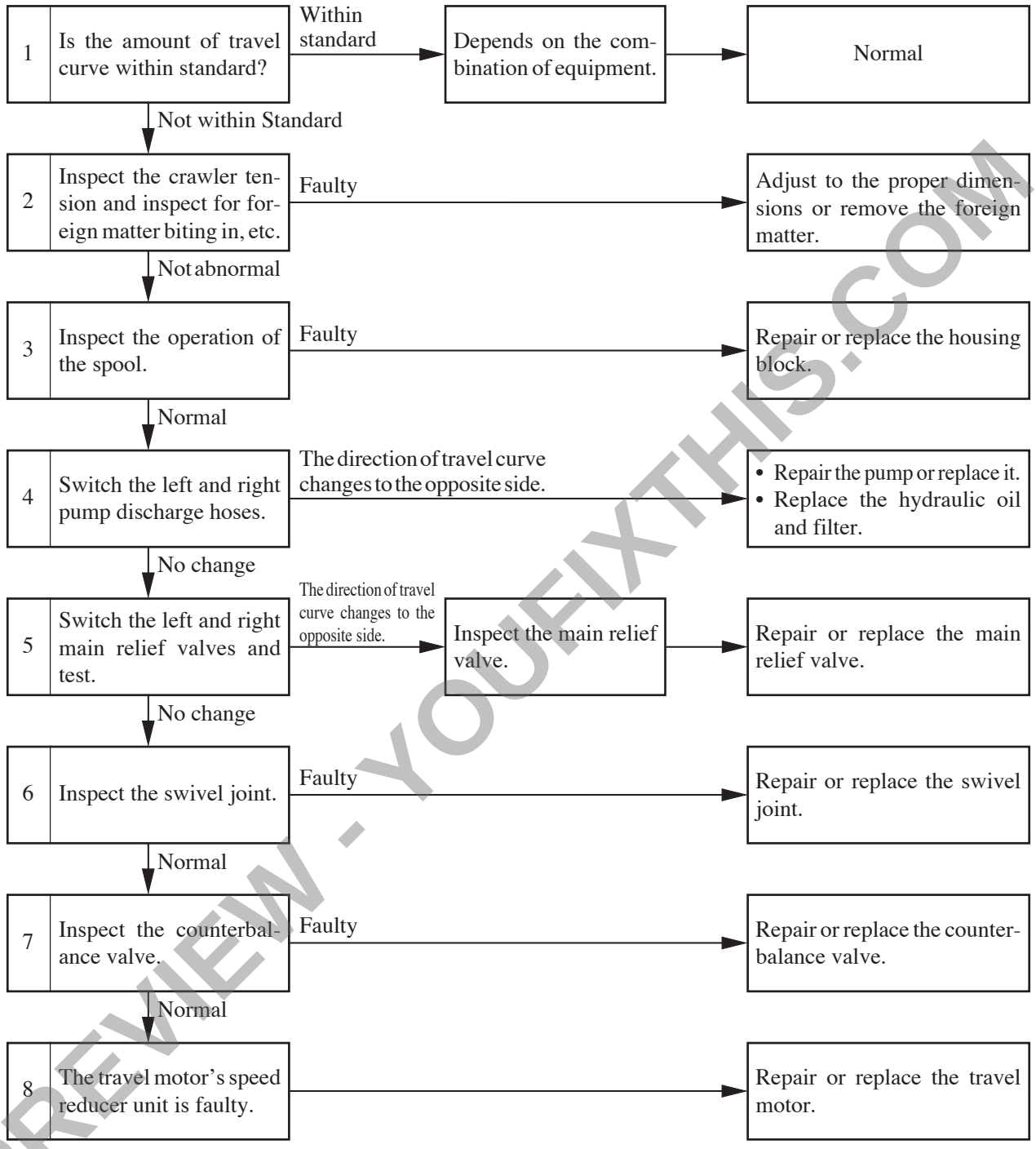
At this time, the • mark on the rotor (6) rotates 1/6 revolution in the reverse direction.

From this, we can see that 1 revolution of the output shaft is achieved by introduction of high pressure oil into 42 chambers, that is, 7 chambers × 6 cycles = 42 chambers.

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SPEED DROPS IN THE LEFT OR RIGHT TRAVEL, CAUSING THE MACHINE TO TRAVEL IN A CURVE.



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⚠ 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.**

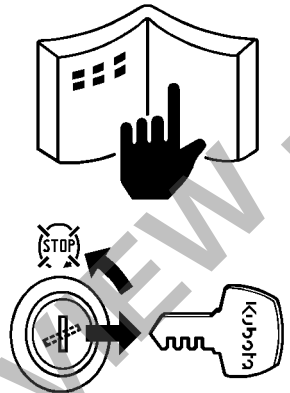
⚠ WARNING
- **Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.**

⚠ 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.**

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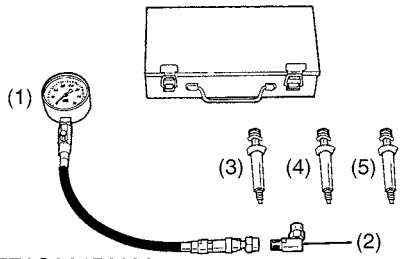
BEFORE SERVICING AND REPAIRING

- 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

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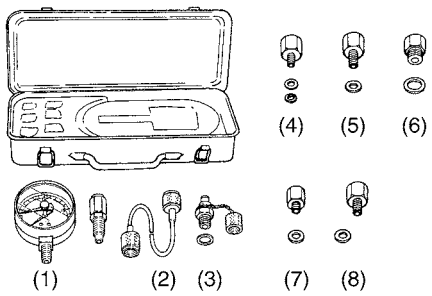
Diesel Engine Compression Tester (for Glow Plug)

Code No : 07909-39081 (Assembly) 07909-31301 (L)
07909-31291 (K) 07909-31311 (M)

Application : Use to measure diesel engine compression and diagnostics of need for major overhaul.

(1) Gauge
(2) L Joint
(3) Adaptor **K**
(4) Adaptor **L**
(5) Adaptor **M**

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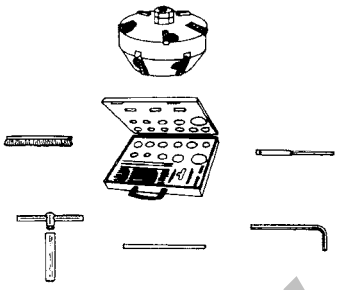
Oil Pressure Tester

Code No : 07916-32032

Application : Use to measure lubricating oil pressure.

(1) Gauge
(2) Cable
(3) Threaded Joint
(4) Adaptor **1**
(5) Adaptor **2**
(6) Adaptor **3**
(7) Adaptor **4**
(8) Adaptor **5**

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Valve Seat Cutter

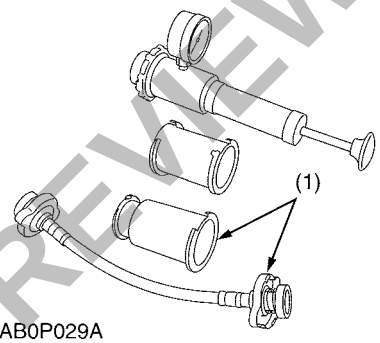
Code No : 07909-33102

Application : Use to reseat valves.

Angle : 0.785 rad (45°)
0.262 rad (15°)

Diameter : 28.6 mm (1.126 in.) 38.0 mm (1.496 in.)
31.6 mm (1.244 in.) 41.3 mm (1.626 in.)
35.0 mm (1.378 in.) 50.8 mm (2.000 in.)

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Radiator Tester

Code No : 07909-31551

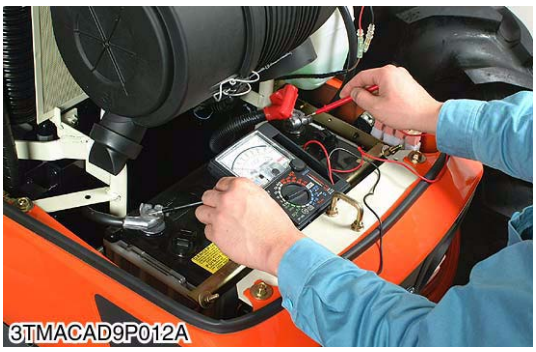
Application : Use to check of radiator cap pressure, and leaks from cooling system.

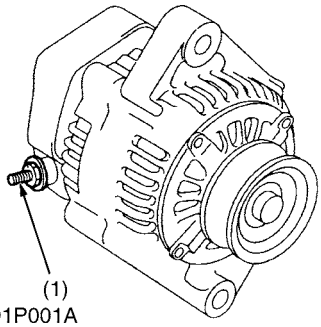
Remarks : Adaptor (1) BANZAI Code No. RCT-2A-30S.

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Alternator on Unit Test

- Before alternator on unit test, check the battery terminal connections, circuit connection, fan belt tension, charging indicator lamp, fuses on the circuit, and abnormal noise from the alternator.
- Prepare full charged battery for the test.

■ **NOTE**

- **Be careful not to touch the rotating engine parts while engine is running.**
  Keep safety distance from the engine rotating parts.

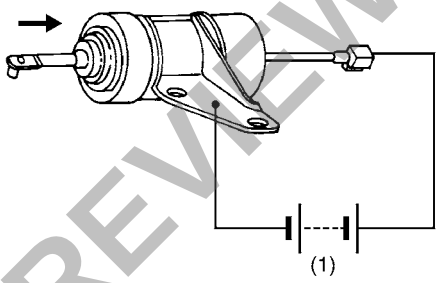
1. Start the engine.
2. Increase the engine speed to the rated speed and check the battery terminal voltage between + and - at no load.
3. Turn on the all accessories (lights, heater, and so on) if without any accessory, temporally put an electrical load, and check the output current at the cable connected with alternator terminal **B**.
4. If the results of alternator on unit test are not within the specifications, disassemble the alternator and check the each component part for finding out the failure. See the "Disassembling and Assembling", and "Servicing" for alternator.

Regulating voltage at no load	Factory spec.	13.8 to 14.8 V at 25 ℃ (77 ℉)
Output current	Factory spec.	Approx. 30 A at 25 ℃ (77 ℉)*

*The output of alternator might be different depending on OEM engine model.

(1) Alternator Terminal **B**

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Engine Stop Solenoid Test (Energize to Stop Type)

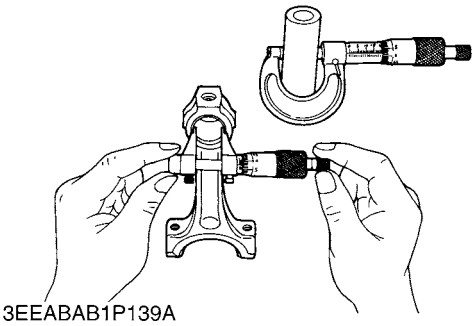
1. Disconnect the **1P** connector from the engine stop solenoid.
2. Remove the engine stop solenoid from the engine.
3. Connect the jumper leads from the battery positive terminal to the **1P** connector, and from the battery negative terminal to the engine stop solenoid body.
4. If the solenoid plunger is not attracted, the engine stop solenoid is faulty.

(1) Battery (12 V)

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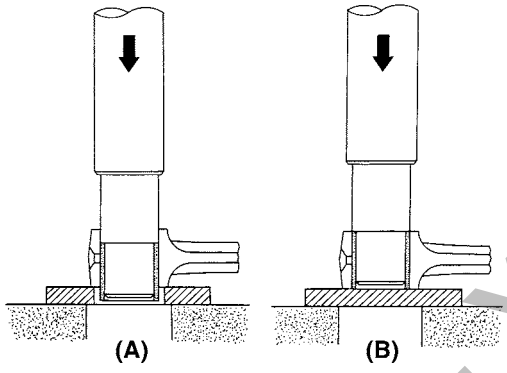
Oil Clearance between Piston Pin and Small End Bushing

1. Measure the piston pin O.D. where it contacts the bushing with an outside micrometer.
2. Measure the small end bushing I.D. with an inside micrometer, and calculate the oil clearance.
3. If the oil clearance exceeds the allowable limit, replace the bushing. If it still exceeds the allowable limit, replace the piston pin.

Oil clearance between piston pin and small end bushing	Factory spec.	0.014 to 0.038 mm 0.00055 to 0.00150 in.
	Allowable limit	0.10 mm 0.0039 in.

Piston pin O.D.	Factory spec.	20.002 to 20.011 mm 0.78748 to 0.78783 in.
Small end bushing I.D.	Factory spec.	20.025 to 20.040 mm 0.78839 to 0.78897 in.

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Replacing Small End Bushing

(When removing)

1. Press out the used bushing using a small end bushing replacing tool. (Refer to "SPECIAL TOOLS".)

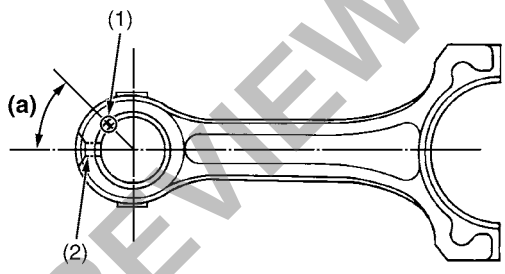
(When installing)

1. Clean a new small end bushing and small end hole, and apply and engine oil to them.
2. Using a small end bushig replacing tool, press in a new bushing (service parts) taking due care to see that the connecting rod hole matches the bushing hole.

[Servicing parts dimension]

Oil clearance between piston pin and small end bushing (Spare parts)	Factory spec.	0.015 to 0.075 mm 0.00059 to 0.00295 in.
	Allowable limit	0.15 mm 0.0059 in.

Small end bushing I.D. (Spare parts)	Factory spec.	20.026 to 20.077 mm 0.78845 to 0.79043 in.



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(1) Seam
(2) Oil Hole

(A) When removing
(B) When installing
(a) 0.785 rad (45 °)

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(3) 3TNV76

Engine name		Unit	3TNV76							
Engine specification class		-	CH		VH					
Type		-	Vertical, in-line, 4-cycle water-cooled diesel engine							
Combustion chamber		-	Indirect injection							
Number of cylinders		-	3							
Cylinder bore × stroke		mm × mm	76 × 82							
Displacement		L	1.115							
Continuous rating	Revolving speed		3000	3600	-					
	Output (NET)	kW (ps)	15.1 (20.5)	17.7 (24.1)	-					
Rated output	Revolving speed	min^{-1}	3000	3600	3100	3200	3300	3400	3500	3600
	Output (NET)	kW (ps)	16.5 (22.5)	19.5 (26.5)	17.7 (24.0)	18.2 (24.8)	18.7 (25.4)	19.3 (26.2)	19.3 (26.3)	19.5 (26.5)
Max. no-load speed (± 25)		min^{-1}	-	3800	3290	3400	3500	3600	3710	3815
Ignition order		-	1-3-2-1 (No.1 cylinder on flywheel side)							
Power take off		-	Flywheel							
Direction of rotation		-	Counterclockwise (viewed from flywheel)							
Cooling system		-	Radiator							
Lubrication system		-	Forced lubrication with trochoid pump							
Starting system		-	Electric							
Applicable fuel		-	Diesel oil, BS 2869 A1 or A2 (Cetane No.45 min.)							
Applicable lubricant		-	API grade class CD or CF							
Lubricant capacity (oil pan) *	Total	L	4.4		3.5					
	Effective	L	2.1		1.6					
Cooling water capacity (engine only)		L	0.9							
Engine Dimensions (with flywheel housing) * **	Overall length	mm	485							
	Overall width	mm	436							
	Overall height	mm	559		535					
Engine mass (dry) * ** (with flywheel housing)		kg	112							
Cooling fan (std.) *		mm	335 mm O/D, 5 blades pusher type F							
Crankshaft V pulley diameter* & Fun V pulley diameter (std.)		mm	ø 110 & ø 100							

* Items marked * may differ from the above depending on an engine installed on a machine unit.
** Engine mass and dimensions without radiator

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3. Troubleshooting

3.1 Preparation before troubleshooting

If the signs of a trouble appear, it is important to lecture on the countermeasure and treatment before becoming a big accident not to shorten the engine life.
When the signs of a trouble appear in the engine or a trouble occurs, grasp the trouble conditions fully by the next point and find out the cause of sincerity according to the troubleshooting. Then repair the trouble, and prevent the recurrence of the trouble.

1)What's the occurrence phenomenon or the trouble situation? ····· (e.g. Poor exhaust color)
2)Investigation of the past records of the engine
Check a client control ledger, and examine the history of the engine.

- Investigate the engine model name and the engine number. (Mentioned in the engine label.)
  Examine the machine unit name and its number in the same way.
- When was the engine maintained last time?
- How much period and/or time has it been used after it was maintained last time?
- What kind of problem was there on the engine last time, and what kind of maintenance was done?

3)Hear the occurrence phenomenon from the operator of the engine in detail.
5W1H of the occurrence phenomenon : the investigation of when (when), where (where), who (who), what (what), why (why) and how (how)

- When did the trouble happen at what kind of time
- Was there anything changed before the trouble?
- Did the trouble occur suddenly, or was there what or a sign?
- Was there any related phenomenon
  ·····.(e.g. Poor exhaust color and starting failure at the same time)

4)After presuming a probable cause based on the above investigation, investigate a cause systematically by the next troubleshooting guide, and find out the cause of sincerity.

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(c)Crankpin and journal measurement

Measure the outside diameter, roundness and taper at each crankpin and journal.

Correct by grinding if unevenly wear, roundness exceeding the limit or insufficient outside diameter is found. Replace if the defect is excessive.

Crankpin

If a clearance is necessary, measure the inside diameter by following (5) d) " Rod big end measurement ", and calculate it.

mm

Item	Standard	Limit
Pin outside diameter	41.952 to 41.962	41.902
Oil clearance	0.020 to 0.050	0.110
Roundness	0.01 or less	0.02

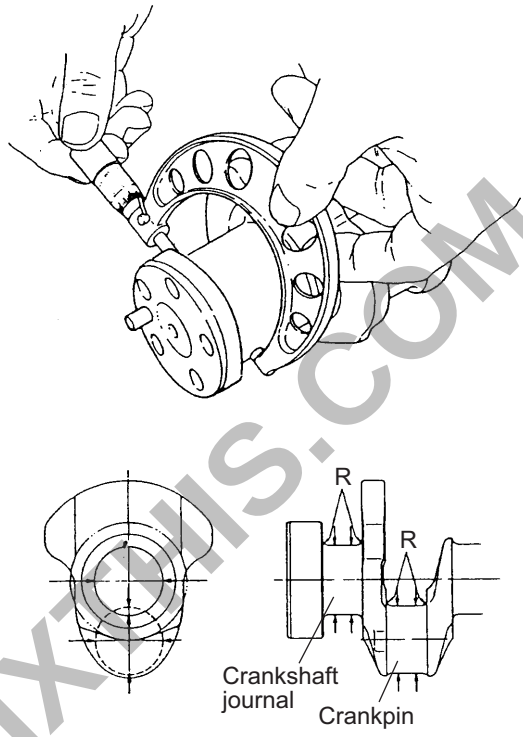
If the oil clearance exceeds the limit, use an undersized bearing.

Undersized bearing (0.25 mm)

Code No.(assy)
119717-23610

Pin machining dimension mm

Pin machining dimension
ø 41.702 to 41.712



Measuring position of the crankpin and crank journal

Crank journal

mm

Item	Standard	Limit
Journal O.D.	46.952 to 46.962	46.902
Oil clearance	0.020 to 0.050	0.120
Roundness	0.01 or less	0.02

If the clearance limit is exceeded, use an undersized bearing and machine the crank journal into the value of the below table.

Undersized bearing (0.25 mm)

Code No. (assy)
119717-02870

Crankshaft Journal machining dimension

mm

Journal machining dimension
ø 46.702 to 46.712

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