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Revision History			
Issue	Issue Date	Applicable Machine	Remarks
First Edition	Issued 06-2008	ED150 BLADE RUNNER ACERA SR	EXCAVATOR DOZER

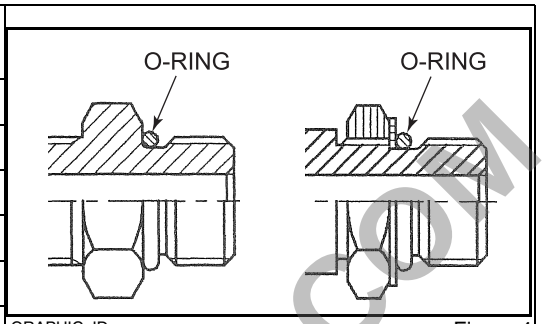
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TIGHTENING TORQUE FOR HOSE AND FITTING

JOINT (O-RING TYPE)

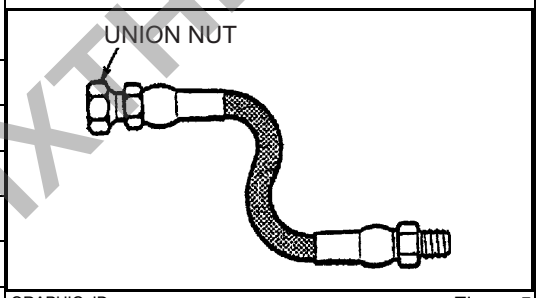
Size (PF)	Wrench (mm)	Tightening torque Nm (pound-ft)
1 / 8	14	17±2 (13±1.5)
1 / 4	19	36±2 (27±1.5)
3 / 8	22	74±5 (55±4)
1 / 2	27	108±9.8 (80.0±7)
3 / 4	36	162±9.8 (119±7)
1	41	255±9.8 (188±7)



GRAPHIC_ID Figure 4

HYDRAULIC HOSE (30° FLARE TYPE)

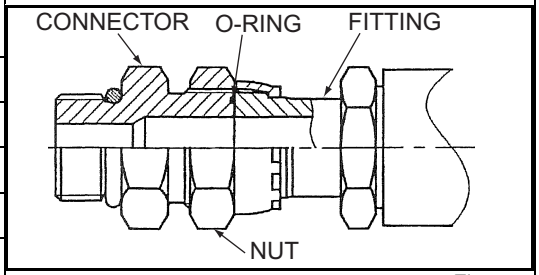
Size (PF)	Wrench(mm)	Tightening torque Nm (pound-ft)
1 / 8	17	15±2.0 (11±1.5)
1 / 4	19	29±4.9 (21±3.6)
3 / 8	22	49±4.9 (36±3.6)
1 / 2	27	78±4.9 (58±3.6)
3 / 4	36	118±9.8 (87±7.2)
1	41	137±15 (101±11)



GRAPHIC_ID Figure 5

JOINT (ORS TYPE)

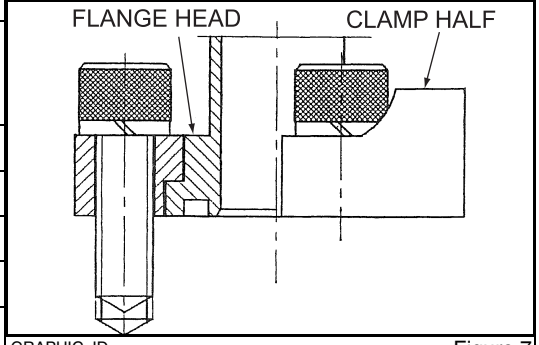
Unified screw size	Opposing flats	Tightening Torque Nm (pound-ft)
1-14 UNS	30, 32	137±14 (101±10)
1 3 / 16-12 UN	36	177±18 (131±13)
	41	206±26 (152±15)
1 7/ 16-12 UN	41	206±26 (152±15)
	46	206±26 (152±15)



GRAPHIC_ID Figure 6

SPLIT FLANGE

Size	Tightening torque Nm (pound-ft)			
	Standard pressure series 20.6 MPa	Bolt size	Hi pressure series 41.2 MPa	Bolt size
3 / 4	33.9±5.6 (25±4)	M10	39.5±5.6 (29±4)	M10
1	42.4±5.6 (31±4)	M10	62.2±5.6 (46±4)	M12
1 1 / 4	55.1±7.1 (41±5)	M10	93.3±8.4 (69±6)	M14
1 1 / 2	70.6±8.4 (52±6)	M12	169±11 (125±8)	M16
2	81.9±8.4 (60±6)	M12	282±11 (208±8)	M20



GRAPHIC_ID Figure 7

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SERVICE MANUAL - SECTION 3

ED150 BLADE RUNNER ACERA SR
EXCAVATOR DOZER
TIER 3

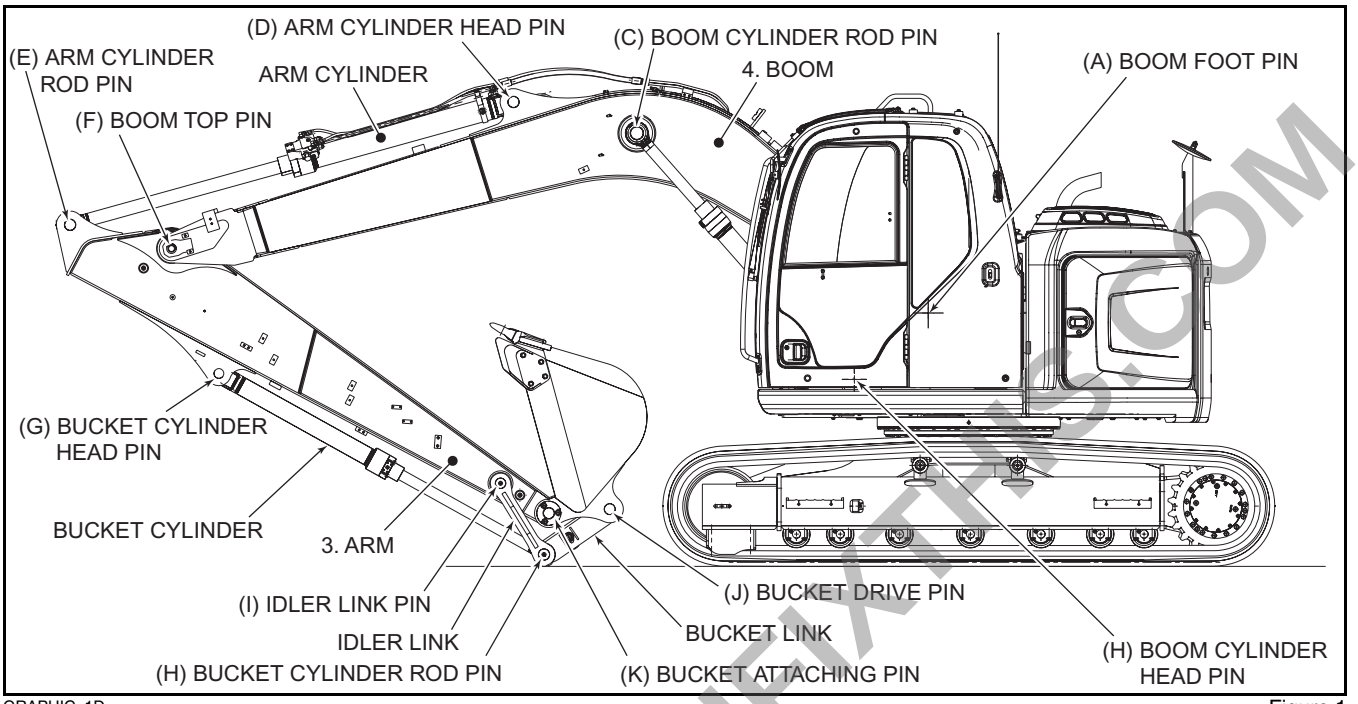
SYSTEMS

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REMOVING AND INSTALLING

ATTACHMENT ASSEMBLY



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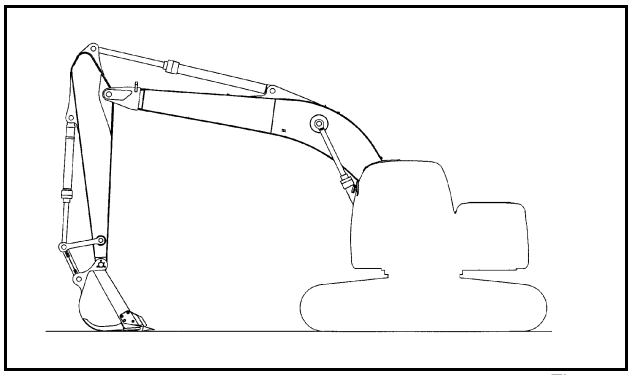
Figure 1

1	Bucket Link		D	Arm Cylinder Head Pin
2	Idler Link		E	Arm Cylinder Rod Pin
3	Arm		F	Boom Top Pin
4	Boom		G	Bucket Cylinder Head Pin
5	Arm Cylinder		H	Bucket Cylinder Rod Pin
6	Bucket Cylinder		I	Idler Link Pin
A	Boom Foot Pin		J	Bucket Drive Pin
B	Boom Cylinder Head Pin		K	Bucket Attaching Pin
C	Boom Cylinder Rod Pin			

BUCKET

Removing Bucket

1. Put the machine in position to remove bucket.



GRAPHIC_ID

Figure 2

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TROUBLESHOOTING OUTLINE

Troubleshooting provides process locating for the cause of trouble in the order that trouble occurred. This manual describes how to solve the specific phenomenon systematically as early as possible. For troubleshooting concerning the inside of equipment, refer to troubleshooting for each manual of equipment.

JUDGMENT OF ACTUAL EQUIPMENT AT SITE

Get to the Site as Quickly as Possible

Verify model, serial number, situation of trouble and field, and notify person of arrival time.



GRAPHIC_ID Figure 1

ATTENDING THE FIELD TO VERIFY ACTUAL THING

Verify Background of Trouble Occurred

1. Model name and serial number
2. Kind of attachment.

   Check that the combination of attachment is proper or that the operating method is not unreasonable.
3. Operating time by hour-meter
4. History of trouble occurred and additional works.
5. Recurrence of past trouble, or problems on the additional works.

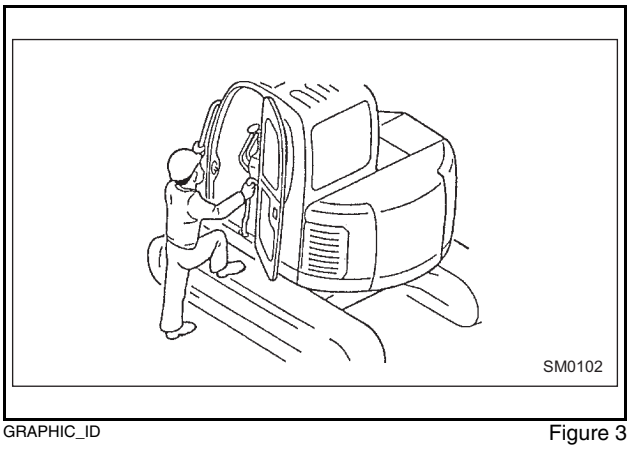


GRAPHIC_ID Figure 2

VERIFYING BACKGROUND OF TROUBLE OCCURRED

How to Diagnose Trouble

1. Verify defective part
2. Make the condition of trouble again
3. Where defective parts can not be verified, surmise causes systematically.
4. Verify reasons for surmise
5. Report methods, procedure, and period for repairing to user.



GRAPHIC_ID Figure 3

CONFIRM THE SYMPTOMS OF THE TROUBLE

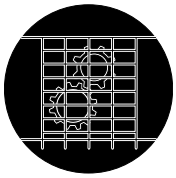
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⚠ WARNING

Stay clear of all rotating and moving parts

Install protective covers on rotating parts



Make sure the protective covers for engine rotating parts are properly installed as intended. Repair loose or damaged protective covers as necessary.

Never remove the covers guarding personnel from rotating parts, when the engine is operating.

When combining the engine with the engine-driven machine or radiator, always provide a cover on every exposed moving part such as driving belt and coupling.

Never remove protective covers.

Ensure safety of neighboring people before starting engine

Before starting the engine, ensure that there is nobody in the neighborhood and that no tools are left on or near the engine. Verbally notify people around the engine or in the work area when starting the engine.

When the starter device is posted with a sign that prohibits startup operation, do not operate the engine.

Stay clear of moving parts during engine running



Do not approach rotating or sliding parts of the engine when the engine is in operation.

Keep objects likely to be caught by rotating parts away from such parts.

If any part of the clothing or outfitting is caught by a rotating part, serious bodily injuries could result.

Lockout and Tagout

Be sure to lockout and tagout before starting inspection and maintenance.

Lockout and tagout are effective methods of cutting off machines and equipment from energy sources.

To accomplish the lockout/tagout, remove the starter switch key, set the battery switch to OFF and attach a "Do Not Run" or similar caution tag to the starter switch.

The starter switch key must be kept by the person who performs inspection and maintenance during the work.

In the case of pneumatic starting type, close the main valve of the air tank and post a tag saying "Do Not Open the Valve" or the like.

Keep engine stopped during servicing

Be sure to stop the engine before proceeding to inspection and service procedure. Never attempt to make adjustments on the engine parts while the engine is running. Rotating parts such as belt can entangle your body and cause serious injuries.

Always restore engine turning tools after use

Do not forget to remove the tools which have been used for turning the engine during inspection or servicing, after the procedure is finished. Remember also that the turning gear must be returned to the operating condition before starting the engine.

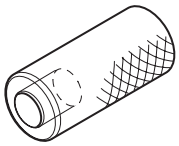
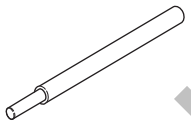
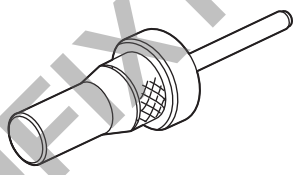
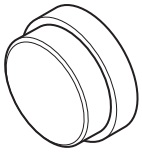
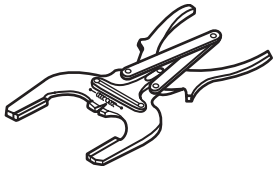
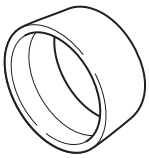
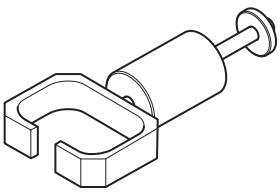
Starting the engine with the turning tools inserted or with the turning gear in engagement can lead to not only engine damage but also personal injuries.

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1. Special tools

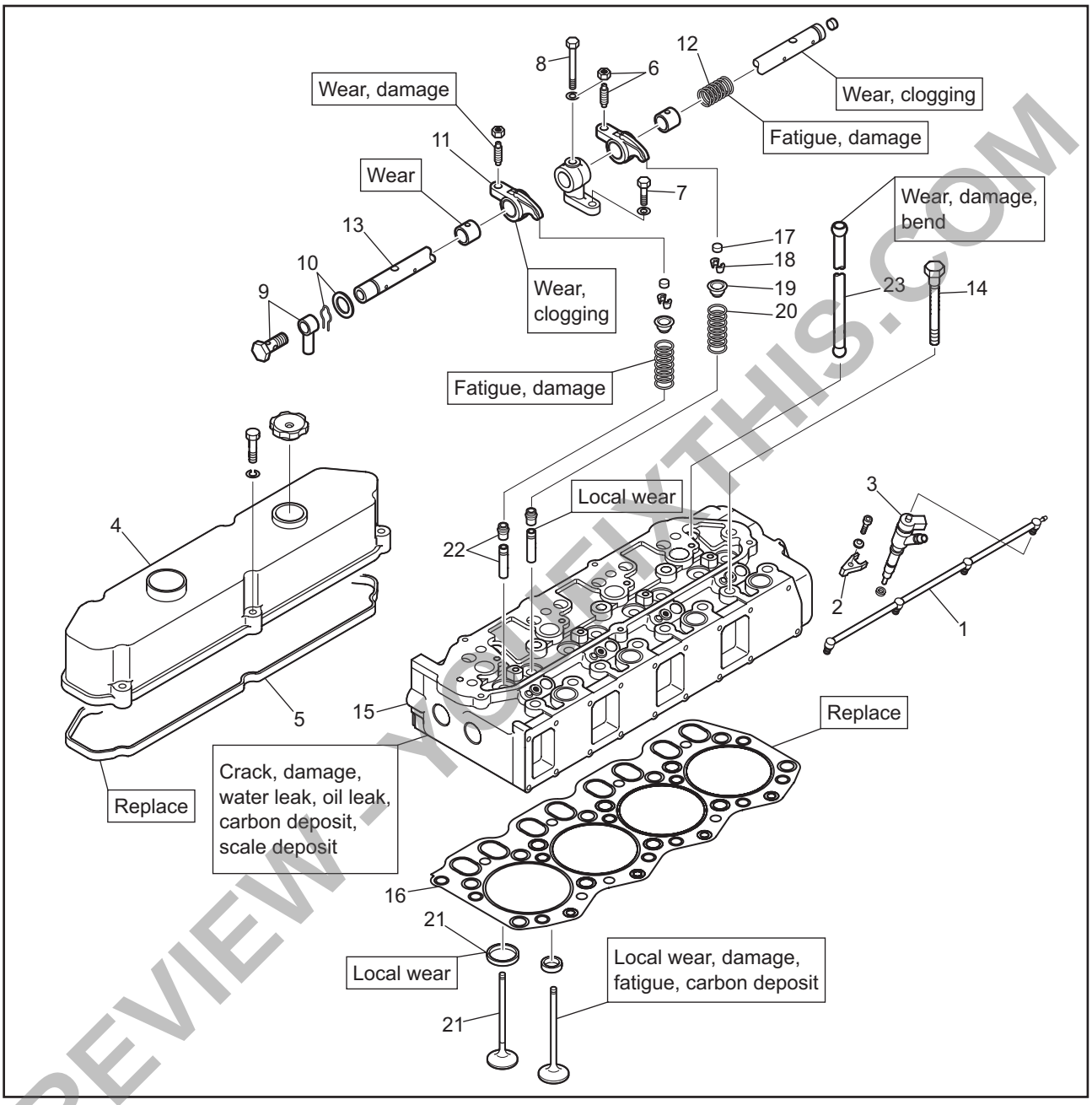
Table 3-1 Special tool list (1 / 3)

Tool name	Part number	Illustration	Use
Valve guide installer	32F91-00400		Valve guide installation
Valve guide remover	31391-10500		Valve guide removal
Insert caulking tool	36791-00200 (Inlet) 36791-00300 (Exhaust)		Valve seat installation
Sleeve installer	34291-00200		Cylinder sleeve installation
Piston ring pliers	30091-07100		Piston ring removal/ installation
Piston guide	34291-00100		Piston installation
Injector remover	32G91-00100		Injector removal

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1. Disassembling and inspecting cylinder head and valve mechanism



Disassembling and inspecting cylinder head and valve mechanism

Disassembling sequence

1 Leak off hose
2 Nozzle ground
3 Injector
4 Rocker cover
5 Rocker cover gasket
6 Adjusting screw
7 Bolt (short)
8 Bolt (long)
9 Eye bolt, oil pipe
10 Snap ring, spacer
11 Rocker arm
12 Rocker shaft spring
13 Rocker shaft
14 Cylinder head bolt
15 Cylinder head
16 Cylinder head gasket
17 Valve cap
18 Valve cotter
19 Valve retainer
20 Valve spring
21 Valve, valve seat
22 Valve guide, stem seal
23 Push rod

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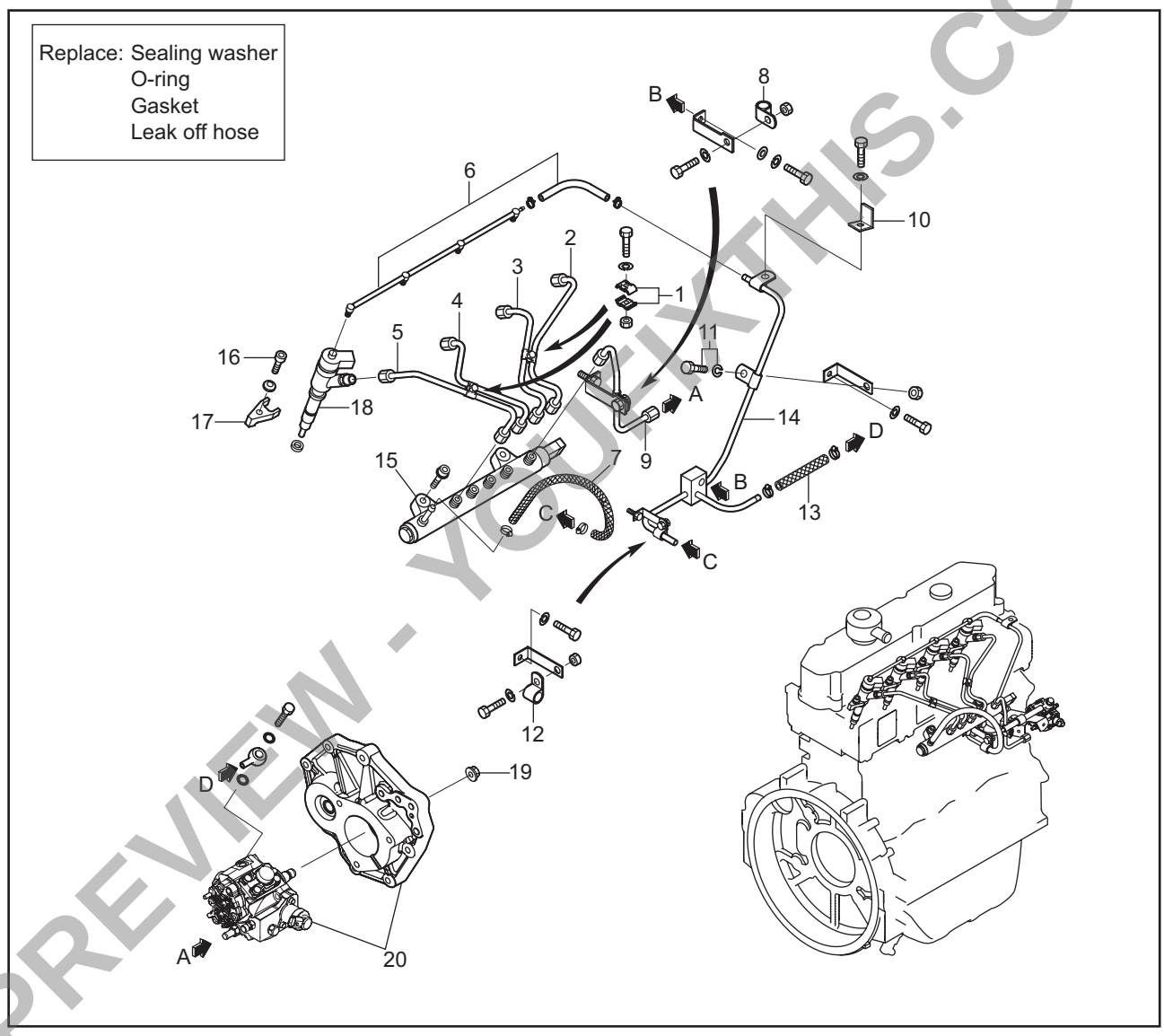
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1. Removing fuel system

CAUTION

(a) Keep open flame or heat away from fuel system before conducting the removal work. It could cause a fire.
(b) Wipe off any spilled fuel. Spilled fuel could cause a fire.
(c) Cover or plug any inlet and outlet openings to prevent dust from entering the fuel system.
(d) For fuel pump, common rail, and injector, have a specialized maintenance shop do the maintenance work.

1.1 Removing fuel system (Part 1)



Removing fuel system (Part 1)

Removing sequence

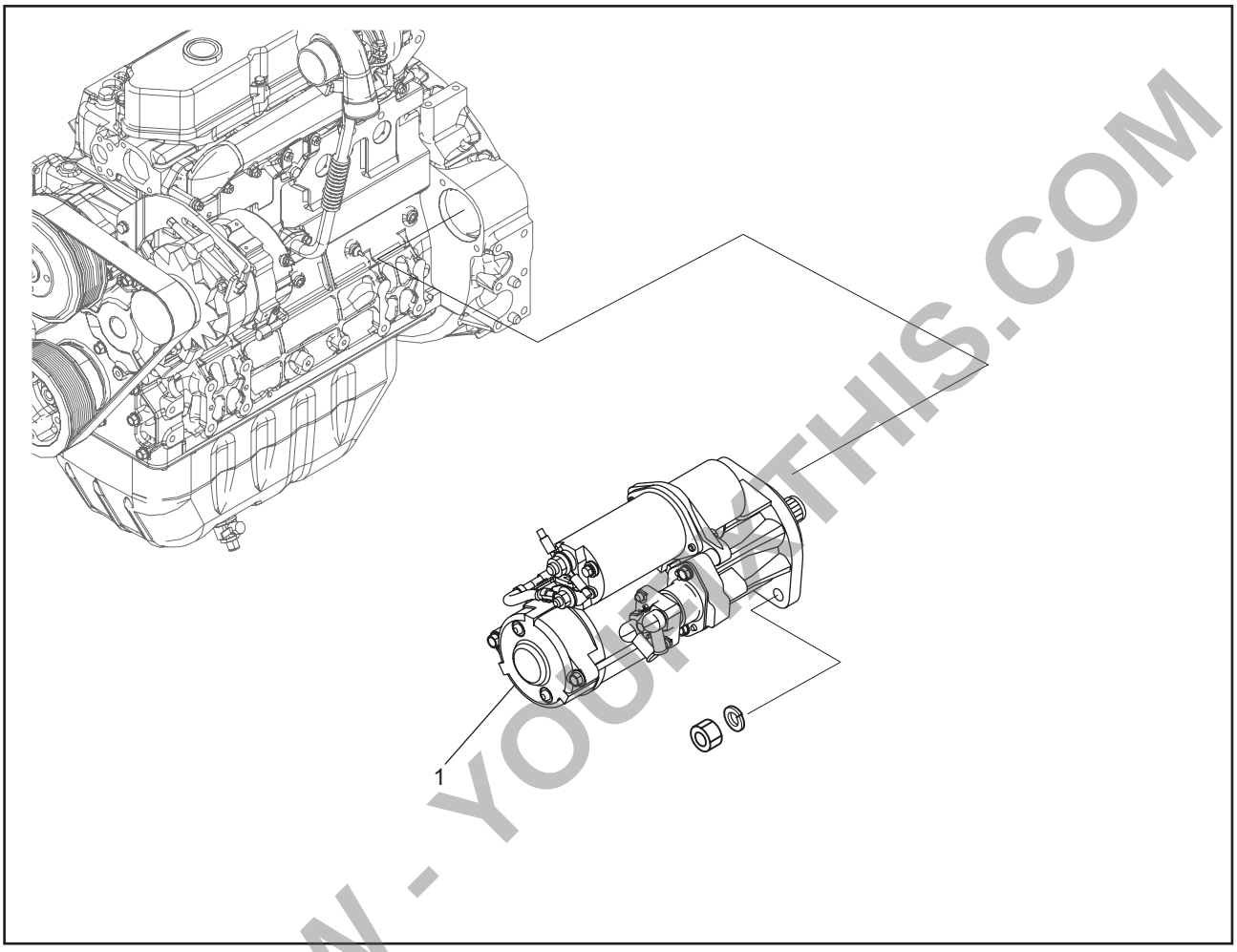
1 Pipe clamp
2 No.1 injection pipe
3 No.2 injection pipe
4 No.3 injection pipe
5 No.4 injection pipe
6 Leak off hose
7 Fuel hose
8 Pipe cramp
9 Fuel pipe
10 Bracket
11 Bolt
12 Hose cramp
13 Fuel hose
14 Fuel return pipe
15 Common rail
16 Hexagon bolt
17 Nozzle ground
18 Injector
19 Fuel pump nut
20 Fuel pump flange, fuel pump

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1. Removing electrical system

1.1 Removing starter



Removing starter

Removing sequence

1 Starter

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1. Adjusting engine

1.1 Inspecting and adjusting valve clearance

Inspect and adjust the valve clearance.

The valve clearance should be inspected and adjusted when the engine is cold.

Note: (a) The inlet values are on the left side and the exhaust values are on the right side when the cylinder head is viewed from the camshaft gear side.

(b) The valve clearance standard values are indicated on the caution plate on the No.1 cylinder rocker cover.

Item		Standard
Valve clearance	Inlet	0.25 mm [0.0099 in.]
	Exhaust	0.40 mm [0.0157 in.]

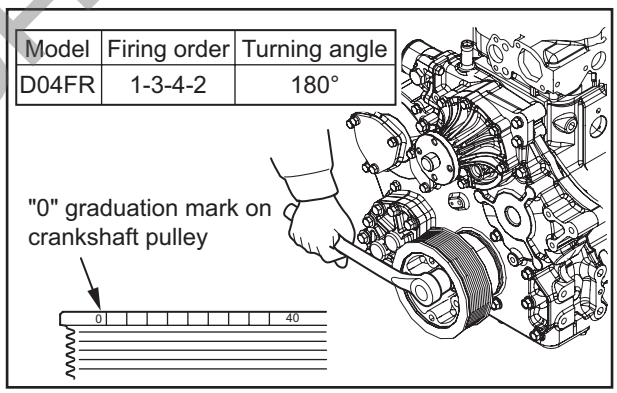
1.1.1 Inspecting valve clearance

(1) Inspect the valve clearance for all cylinders in the firing order by turning the crankshaft to the specified degrees in the normal direction (clockwise when viewed from engine front side) to bring each piston to the top dead center on the compression stroke.

Note: To turn the crankshaft, fit a socket and ratchet handle on the crankshaft pulley nut.

(2) When the No. 1 piston is at the top dead center on the compression stroke, the "0" graduation mark on the periphery of the crankshaft pulley is aligned with the pointer on the timing gear case, and neither the inlet valve nor the exhaust valve is not lifted off its seat by the push rod.

(3) Insert a thickness gauge between the rocker arm and valve cap to inspect the clearance.

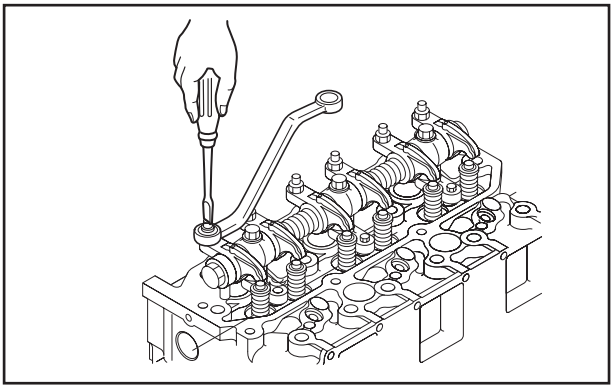


Inspecting valve clearance

1.1.2 Adjusting valve clearances

(1) Insert the feeler gauge of the specified thickness between the rocker arm and bridge cap, then adjust the clearance by turning the screw in either direction so that the gauge is gripped softly between the rocker arm and bridge cap.

(2) After adjusting the clearance, tighten the lock nut firmly, and inspect the clearance again.



Adjusting valve clearance

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ED150 BLADE RUNNER ACERA SR SERVICE MANUAL

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STANDARD MAINTENANCE TIME TABLE

PREFACE

Working Conditions

1. Workers :
   More than one worker shall be 1st class service technician (having five years or more of field experience and having received training in the operation).
2. Equipment :
   Jigs, tools, apparatuses and testers used in field service work shall be available commercially. The maintenance plant shall be equipped with a service shop, a crane and inspection apparatuses necessary for specific self inspection activities.
3. Place :
   A flat land where work may be performed and to which a service car or a truck crane is accessible.

Range of standard maintenance time

1. Standard maintenance time=Direct maintenance time+Preparation time
2. Direct maintenance time : Net time actually spent for maintenance
3. Spare time :
   Time needed to move machines for service, prepare safety operations, discuss work, and process the needs of the body.

Extra time (not included in the standard service time)

1. Repair time :
   Machining, sheet metal, welding, melt cutting, folding and extracting bolts, servicing parts, and painting.
2. Items excluded from service time because of uncertainty in time :
   Receiving a vehicle into shop, transfer, delivery, inspection on completion, investigation of causes of faults, diagnosis, and inspection.
3. Indirect time :
   Time for ; field work, preparation of necessary parts before leaving for work, return for field work, waiting time because of user's convenience in the field, paper work after returning to shop, and preparation of bills.
4. Special time : Work at early morning, at midnight and on holidays are to be calculated separately.
5. Separate calculation : The operating time for service cars, trucks with a crane and crane trucks.

Applicable machine for estimation of standard maintenance time

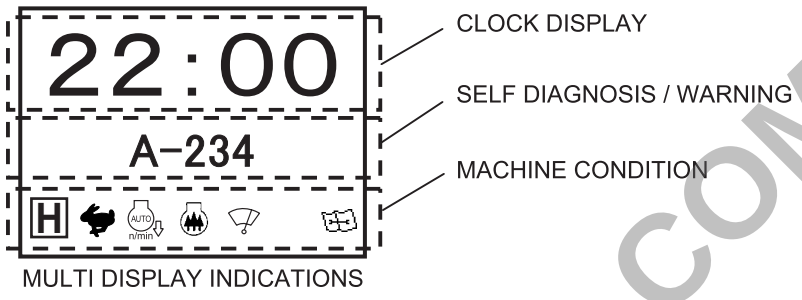
1. Standard machine
2. A well maintained and controlled machine with a standard combination of attachments which is used in a general environment.

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Gauge Cluster Display

After key is switched on and logo mark display disappears, screen for operator is displayed on multi screen. The display functions of multi display are explained below.



GRAPHIC_1D

Figure 33

1. Display function for operator .... Screen usually displayed during operation
   Clock display function .... Current time is displayed.
   Self-diagnosis display .... When abnormality is detected on mechatro system like sensor, proportional valve, etc., this displays error code.
   Warning display ..... When machine was thrown into dangerous state, or was failed, displays warning contents with the symbol (statement). (For warning contents, see items shown below.)
   Machine condition display .... Displays machine operating condition.
2. Display function for maintenance .. .. Displays remaining time up to replacement/change of following items. (1) Engine oil (2) Fuel filter (3) Hydraulic oil filter (4) Hydraulic oil
3. Failure history display function .... Stores abnormality occurred on mechatro system in the past and displays in order of recent occurrence.
4. Mechatro adjustment display ..... Displays procedure for adjustment of mechatro system like output adjustment and unload adjustment, etc.
5. Service diagnosis display ..... Displays information like pressure sensor sensed value, proportional valve command, etc. output by mechatro controller
6. Failure diagnosis mode display function ..... Specifies failed section automatically for failures which are not detected by self diagnosis and displays the results.

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SECTION 3 - SYSTEMS
CHAPTER 3 - ELECTRIC SYSTEM

HARNESS

Harness List

DIVISION		DRAWING No.		HARNESS			REMARKS
POSITION	ITEM	NAME	ASSEMBLY No.	CODE No.	NAME	DRAWING No.	
UPPER FRAME	3.2	INSTRUMENT PANEL ASSY	YB17M00020F1				
	3.3	CONTROLLER INSTALL	YY22E00101F1				
	3.4	OPERATORS CONTROL (SWITCH INSTALL)	YY03M00066F1				
	3.5	UPPER ELEC ASSY	YY03E00006F1				
	3.6	UPPER HARNESS ASSY	YY13E00057F1	1-1	HARNESS	YY13E01172P1	UPPER
				1-2	CABLE	YY13E01144P1	BATTERY TO BATTERY
				1-3	CABLE	YY13E01130P1	BATTERY TO GROUND
				1-4	CABLE	YY13E01139P1	BATTERY TO RELAY
				1-5	CABLE	YY13E01138P1	STARTER
				1-6	HARNESS	YY13E01148P1	SUB HARNESS (ECU)
				1-7	CABLE	LE13E01006P1	FLOOR GROUND
				2-1	HARNESS	YY13E01162P1	OVER LOAD ALARM
	3.7	UPPER HARNESS ASSY (FLOOR PLATE)	YY13E00050F1	1-1	HARNESS	YY13E01167P1	FLOOR
				1-3	CABLE	LE13E01005P1	FLOOR GROUND
				1-4	HARNESS	YB13E01054P1	CAB SUB
				2-1	HARNESS	YB13E01072P1	TUNER 12V
	3.8	ENGINE HARNESS ASSY	YY16E00005F1	1	HARNESS	YY16E01009P1	ENGINE SUB
CAB	3.9	CAB INSTAL	YY02C00018F1	1-1-49	HARNESS	YN02C03098P1	ROOM LAMP
	3.10	WASHER TANK ASSY	YY54C00001F1				
	3.11	CAB HARNESS	YB14E00018F1	1	HARNESS	YB14E01027P2	CAB
				5	HARNESS	YN14E01106P1	KEY SWITCH GROUND
BOOM	3.12	BOOM HARNESS ASSY	YY15E00015F1	1	HARNESS	YY15E01028P1	BOOM LIGHT
LIGHT	3.13	BOOM LIGHT INSTALL	LC80E00004F1				
	3.14	UPPER LIGHT INSTALL	YY80E00008F1				UPPER LIGHT
	3.15	LAMP INSTALL (ENGINE ROOM)	YY80E00010F1	2	HARNESS	YY80E01010P1	

GRAPHIC_1D

Figure 8

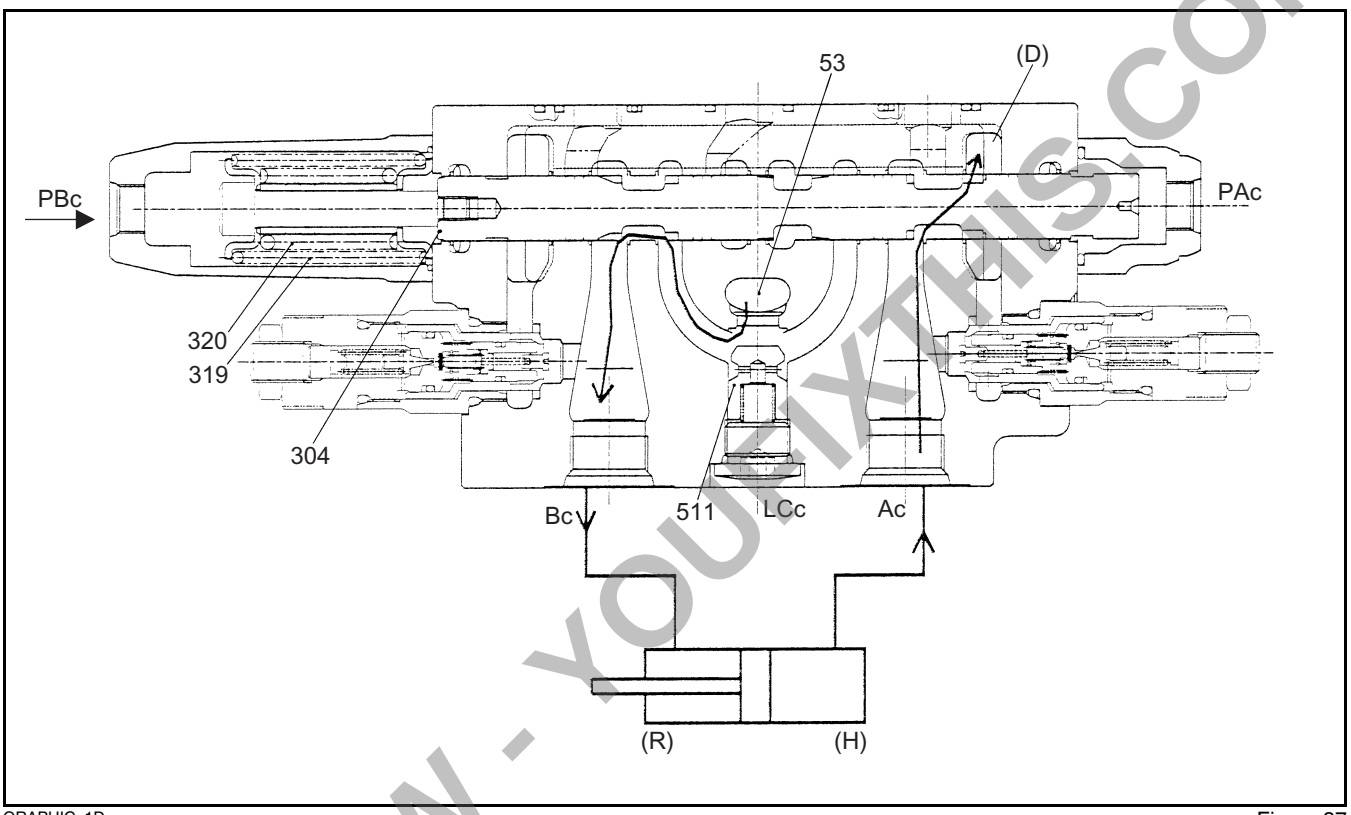
NOTE: *The parts number may be changed due to the improvement of machine, so use the number for reference only.*

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B. In bucket dumping operation

On starting bucket dumping operation, the pilot pressure enters port PBc and bucket spool (304) moves rightward the force of springs (319)(320), and simultaneously the secondary pressure of solenoid proportional valve [XI] acts on port PCb and switches unloading spool (309). The hydraulic oil delivered by hydraulic pump P1 flows into parallel passage (53), pushes and opens load check valve LCc (511), and flows through between the perimeter of bucket spool (304) and casing through U-shaped passage, and supplied to bucket cylinder rod side (R) through port (Bc).

In the meantime, the return oil from bucket cylinder head side (H) passes through between the perimeter of bucket spool (304) and casing and flows through low pressure circuit (D'), boost check valve (517) and returns to the hydraulic tank through tank port T1.



GRAPHIC_1D

Figure 37

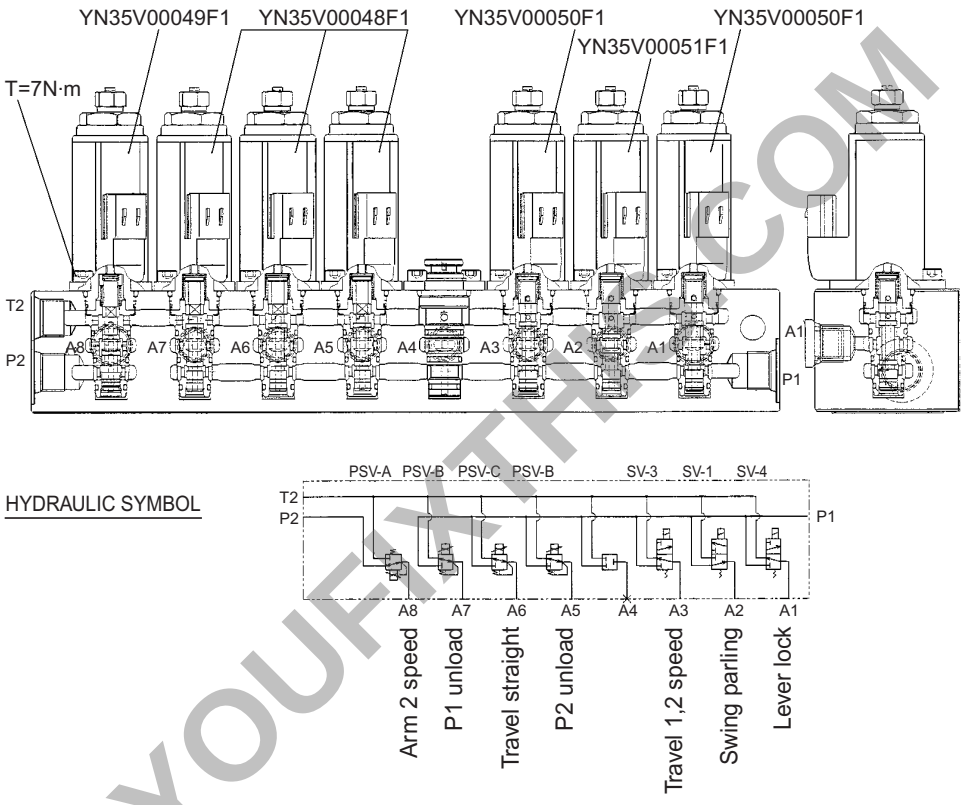
IN BUCKET DUMPING OPERATION

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File No. Name of part Part No. Use Applicable Machine	Specification	Description

PSV - A, B, C, D
Proportional solenoid valve
Hydraulic solenoid valve
Hydraulic symbol A5 to A8

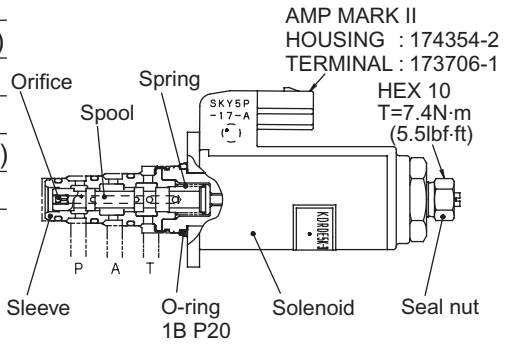


GRAPHIC_1D

Figure 141

PSV - P1, P2
Solenoid
Pump P1, P2 proportional valve

Type	KDRDE-5K
Max. feed press	13.7MPa (1987 psi)
Rated feed press	5.0MPa (725 psi)
Allowable back press	1MPa (145 psi)
Control pressure range	0~2.7MPa (392 psi)
Rated voltage	DC 24V



GRAPHIC_1D

Figure 142

SV - 1, 2, 3, 4
Solenoid directional valve (7 spool) assy
Hydraulic symbol A1 to A3

Rated pressure	5.0 MPa (725 psi)
Solenoid directional pressure	Rated voltage DC 24V
Solenoid proportional valve	Dither current 100Hz,200mA P-P
	Coil resistance 17.5Ω (at 20C)
Connector specification	AMP MARK II HOUSING 174354-2 TERMINAL 173706-1

P1, P2, T, A1, A8 port PF3/8
A2~A7 port PF1/4
AMP MARK II

GRAPHIC_1D

Figure 143

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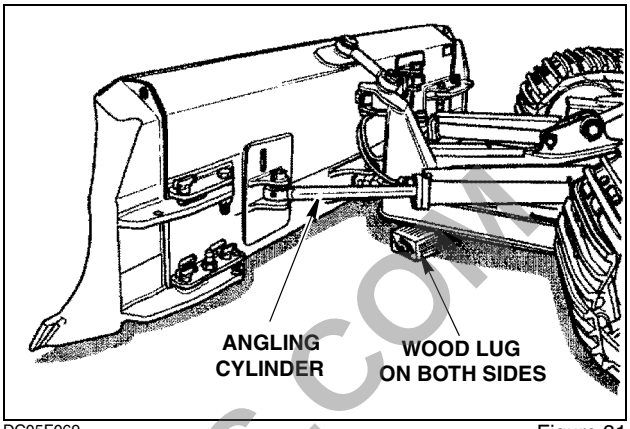
DOZER BLADE

Dozer Blade Removal

NOTE: *The Dozer Blade can be removed in the field using the attachment or inside a shop using crane. The following procedures is for removing the blade in the field using the attachment.*

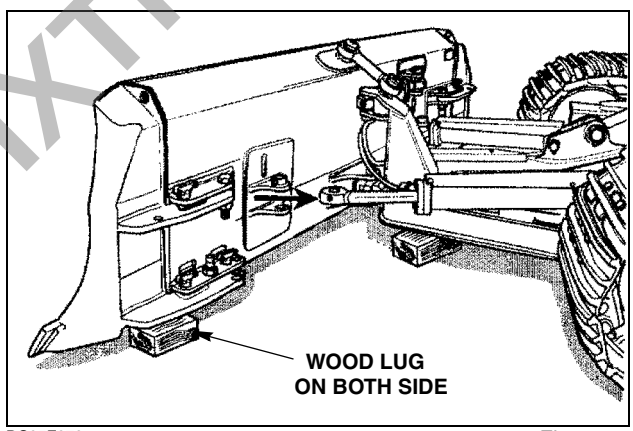
To remove the dozer blade in the field, proceed as follows:

1. Move the machine to a firm level surface. Place a wood lugs under the dozer frame on both sides.
2. Disconnect the angling cylinder rod from the blade on both sides.



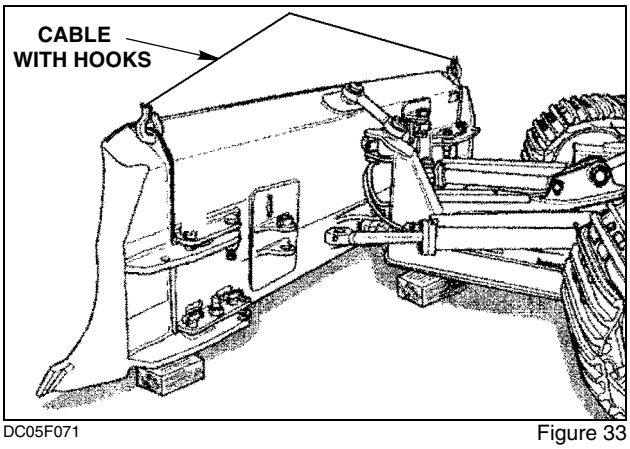
DC05F069 Figure 31

3. Manually push the blade out as far as it can go on one side to obtain sufficient access to the trunnion cap bolts.
4. Use a drive socket and breaker to loosen the trunnion cap bolts on this side. **DO NOT REMOVE THE TRUNNION BOLTS YET.**
5. Manually push back the dozer blade out as far as it can toward the other side to obtain sufficient access to the trunnion cap bolts.
6. Use a drive socket and breaker to loosen the trunnion cap bolts on this side. **DO NOT REMOVE THE TRUNNION BOLTS YET.**
7. Manually place the blade in a straight position. Place wood lug under the blade wing frame on both sides to stabilize the blade.



DC05F070 Figure 32

8. Install hooks of cable through the top bracket located on both sides of the dozer blade.



DC05F071 Figure 33

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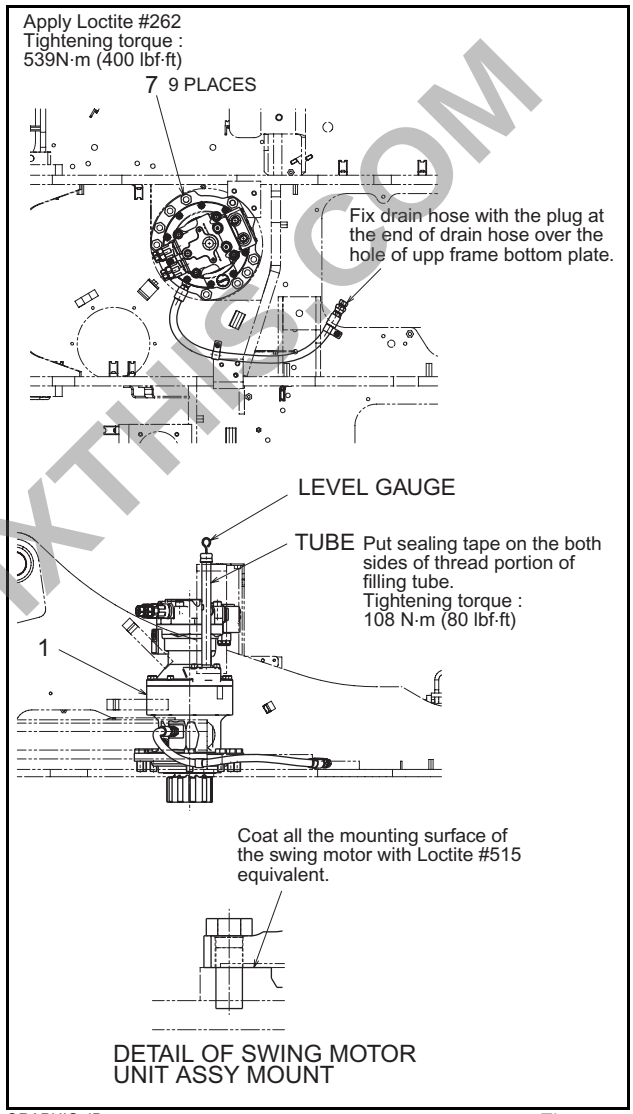
Preparation For Install

1. Clean mating surfaces of swing motor unit and upper frame.
   Tools : spatula, wash oil
2. Apply Loctite #515 on entire mounting surface of swing motor unit.

Installation

Install the swing motor unit in the reverse order of disassembly, confirming the orientation of the swing motor unit.

1. Tighten 9 capscrews (7) M20×55.
   Tightening torque : 539Nm (400 pound-ft) Apply Loctite #262
2. Fill inside from motor drain port to casing with hydraulic oil before piping for drain.



GRAPHIC_ID

Figure 81

Preparation For Drive

1. Before starting operation, check that gear oil #90 (API grade GL-4) level of swing reduction is sufficient.
   Amount of oil : 1.65L (0.44gal)
2. When starting operation, operate motor in low idling and at low speed for several minutes, and check it for possible oil leak and noise.

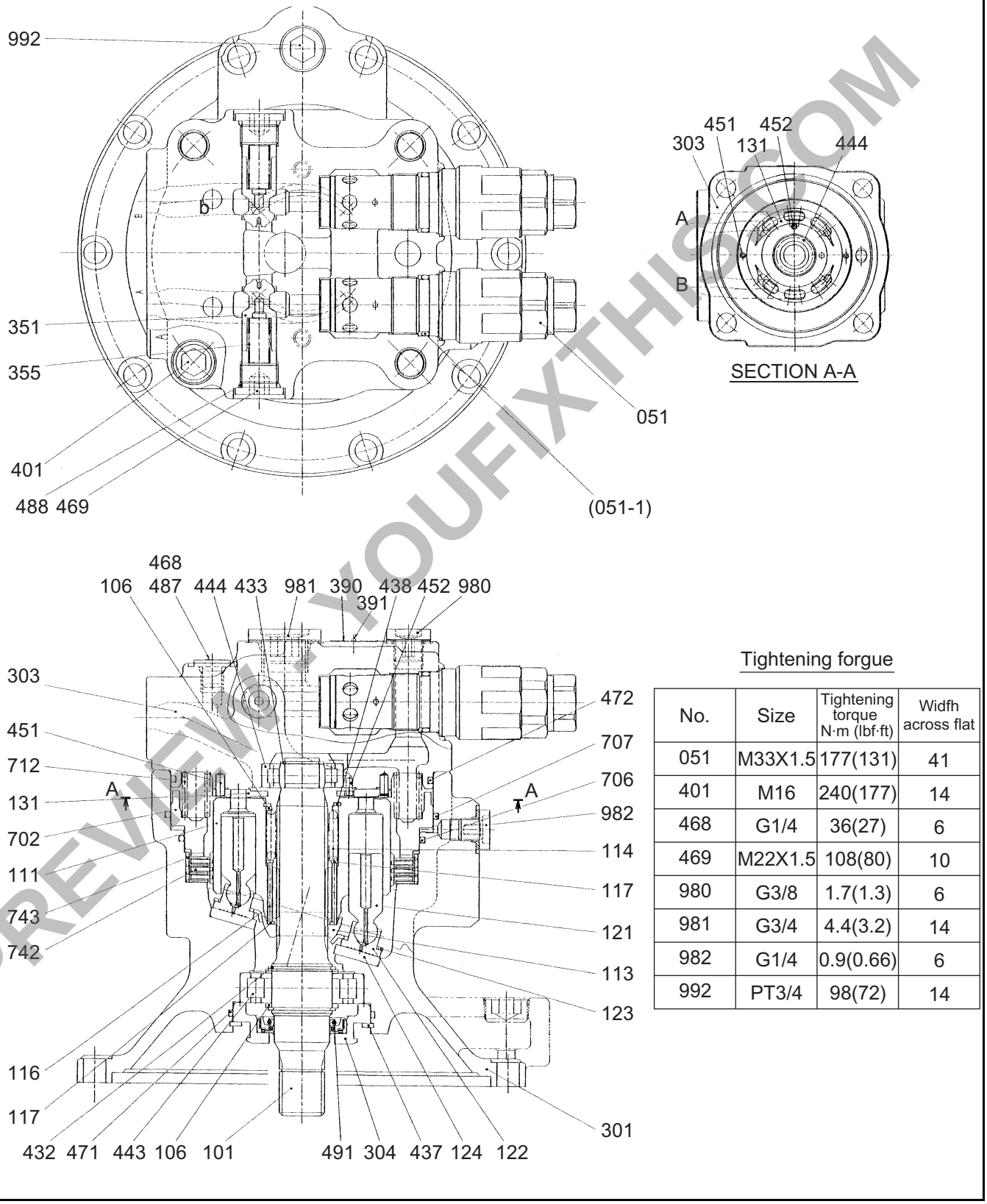
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SWING MOTOR UNIT

Construction

Swing motor



Tightening forgue

No.	Size	Tightening torque N·m (lbf·ft)	Widfh across flat
051	M33X1.5	177(131)	41
401	M16	240(177)	14
468	G1/4	36(27)	6
469	M22X1.5	108(80)	10
980	G3/8	1.7(1.3)	6
981	G3/4	4.4(3.2)	14
982	G1/4	0.9(0.66)	6
992	PT3/4	98(72)	14

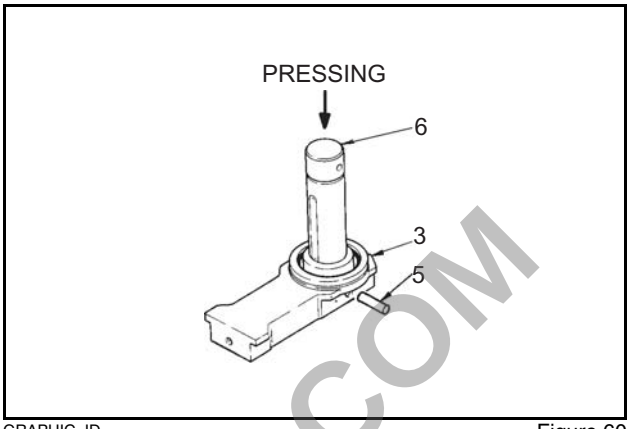
GRAPHIC_1D

Figure 221

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3. Installing collar (3)
   Press fit the O-ring (7) installed side of shaft (6) into collar (3), and drive pin (5).

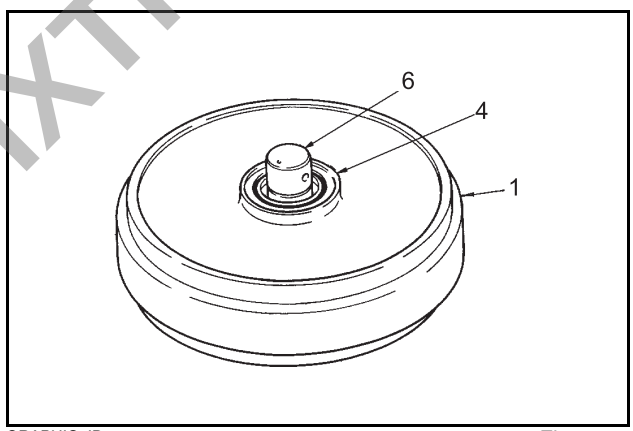
4. Installing floating seal (4)
   Fit the half of floating seal (4) on each side of collar (3) and idler (1).



GRAPHIC_ID Figure 60

5. Inserting idler (1)
   Insert floating seal (4) fitted side of idler (1) into shaft (6).

6. Installing floating seal (4)
   Fit floating seal (4) on the other side of idler (1).

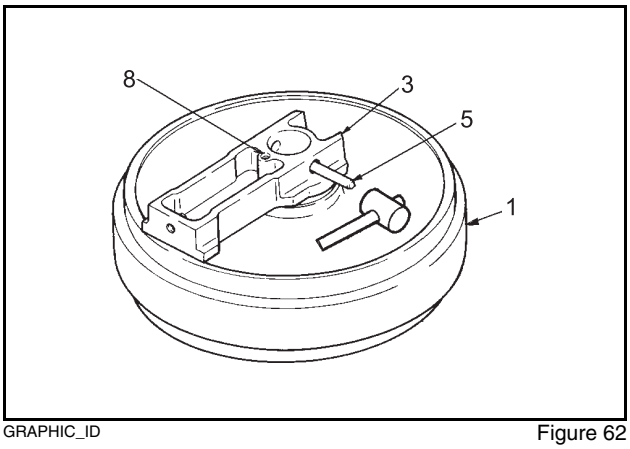


GRAPHIC_ID Figure 61

7. Installing collar (3)
   Fit the half of floating seal (4) on the other collar (3), press fit it in shaft (6), and drive pin (5) in with hummer.

8. Filling oil and Inspection
   Fill in 200cc (12.2cu/in) of engine oil API grade CD #30 through the plug hole of collar (3), wind seal tape and tighten plug (8).

   After installing the idler assy to the idler adjuster assy, make certain that no oil leaks from floating seal and plug (8) and that idler (1) rotates smoothly.



GRAPHIC_ID Figure 62

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Table 31

Error code	B094		
Trouble	Travel right pressure sensor's power source is shortcut.		
Judging condition	The input voltage from Travel right pressure sensor is 4.7V or more.		
Symptom	All operation speed slows down.		
Control in the event of failure	Set proportional valve output rate of P1 and P2 pumps to constant current. (Current value in all operation is neutral.) Set output of P1 unload proportional valve to 0mA. (Valve emergency mode)		
Returned in normal condition	It returns automatically in normal condition.		
Service diagnosis checking screen	Screen No.	6	B-9 TRAVEL (R)
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	Travel right pressure sensor SE-9	When B094 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	Wiring between travel right pressure sensor and controller CN-301F CN-102F	When B094 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	Mechatro controller	Check that the error is corrected after replacement of controller.

Table 32

Error code	B102		
Trouble	Travel left pressure sensor outputs error		
Judging condition	After starter switch ON and engine does not start yet. And the input voltage from the travel left pressure sensor after starter switch ON is in the range of 1.4V or more to less than 4.7V.		
Symptom	The travel left operability becomes poor.		
Control in the event of failure	Normal control		
Returned in normal condition	Not returned automatically under normal condition. Switch the power OFF once and turns on it again.		
Service diagnosis checking screen	Screen No.	6	B-10 TRAVEL (L)
	Screen No.		
	Screen No.		

Checking object		Checking contents and remedy
1	Travel left pressure sensor SE-10	When B102 is cancelled and other error occurs by turning starter switch on after exchanging the connector with other sensor. Check sensor unit for possible failure. If failure found, replace it.
2	Wiring between travel left pressure sensor and controller CN-302F CN-102F	When B102 is displayed after turning the starter switch on after the connector is exchanged with other sensor. Check wiring for possible failure according to the wiring checking procedure and repair it if necessary.
3	Mechatro controller	Check that the error is corrected after replacement of controller.

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Trouble	Factors	Checking: Shovel side: Loose mounting bolts, damage of mounting rubber	Checking: Shovel side: Failure of radiator pressure cap	Checking: Shovel side: Radiator core clogged/fin clogged and crushed	Checking: Shovel side: Peeling of space insulation around radiator	Checking: Shovel side: Failure of hydraulic system	Electric equipment: Shovel side: Startup circuit wiring	Electric equipment: Shovel side: Starter key switch	Electric equipment: Shovel side: Loose connection of battery cable terminal	Electric equipment: Shovel side: Battery relay	Electric equipment: Engine side: Alternator	Electric equipment: Engine side: Glow plug	Electric equipment: Engine side: Glow relay	Electric equipment: Engine side: Starter motor	Electric equipment: Engine side: Safety relay	Electric equipment: Engine side: Hydraulic switch	
Faulty starting	Poor start ability (Takes a long time).											X	X	X			
	Faulty engine starting/engine does not rotate.						X	X	X	X	X			X	X		
	Faulty engine starting/engine rotates but no exhaust gas (No fuel injection).																
	Faulty engine starting/exhaust gas is emitted but engine does not start (with fuel injection).											X	X				
Insufficient rotation	Engine poor run-up (Low follow-up ability)																
	Rotation in bad condition (hunting)																
Poor output	Engine stalled during operation					X											
	Output is lowered					X											
	Overheating		X	X	X												
Other failures	Exhaust smoke is black																
	Exhaust smoke is white																
	Larger oil consumption (or blue exhaust gas)																
	Early contamination of oil																
	Larger fuel consumption																
	Intruding of oil in coolant, back flow, reduction of coolant quantity.																
	Hydraulic pressure down (Monitor lights up)															X	
	Oil quantity increased. (Intruding of water and fuel)																
	Vibration	X															

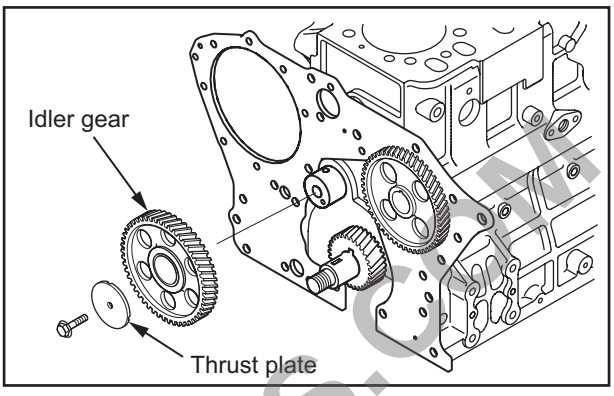
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3.5 Removing idler gear

(1) Remove the thrust plate bolt.

(2) Remove the idler gear while turning the gear.



Removing idler gear

3.6 Removing camshaft

CAUTION

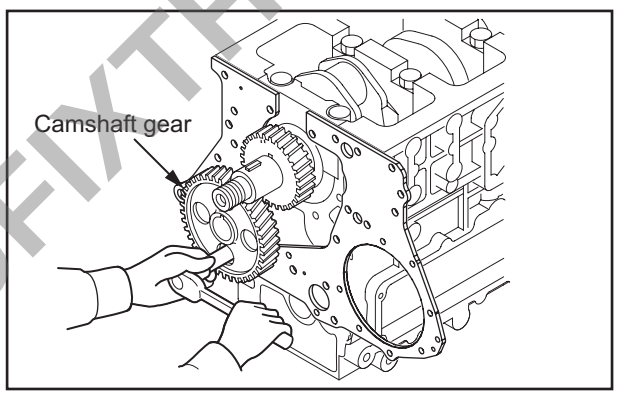
Be careful not to damage the cams of camshaft and the bushings.

(1) Reverse the crankcase.

(2) Remove the thrust plate bolt.

(3) Remove the camshaft from the crankcase.

(4) Remove the tappet.

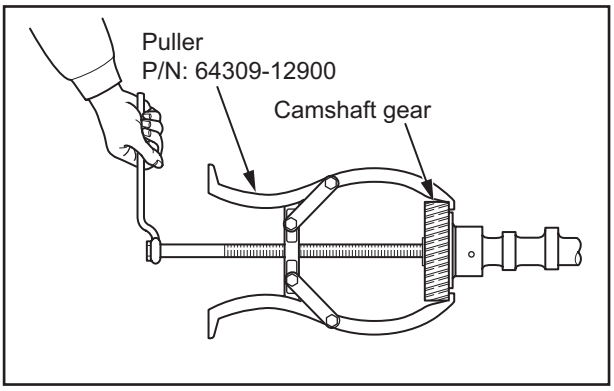


Removing camshaft

3.7 Separating camshaft gear

Using a puller, remove the camshaft gear and thrust plate from the camshaft.

Note: Do not remove the camshaft gear from the camshaft unless the camshaft gear or the thrust plate is defective.



Separating camshaft gear

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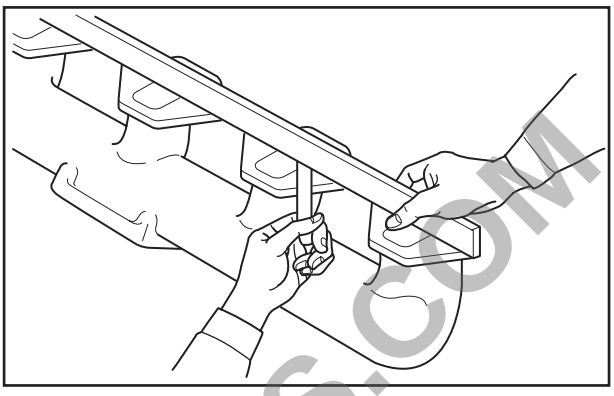
2. Disassembling, inspecting and reassembling inlet and exhaust system

2.1 Measuring exhaust manifold distortion

(1) Check the flange for crack.

(2) Check the flange suface for distortion. If the distortion exceeds the standard, retouch the surface.

Item	Standard
Exhaust manifold distortion	Less than 0.2 mm [0.008 in.]



Measuring exhaust manifold distortion

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