SERVICE MANUAL

EXCAVATOR

ViO57-6B

YANMAR

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2. TECHNICAL DATA

2. Technical Data

2-1 Specifications

Item					Unit	ViO57-6B
Main specifications of machine						
Dimensions						
	Overall length (Transportation position)				mm	5515 (Long arm : 5595)
	Cabin	Overall height	Transportation position		mm	2540
			Traveling position		mm	2540
		Overall width	Full machine width		mm	1990
	Tumbler center distance (steel / rubber)				mm	2070
	Track gauge				mm	1590
	Minimum ground clearance				mm	345
Traveling performance						
	Travel speed	Steel crawler	Low speed (Forward/Reverse)		km/hr	2,2
			High speed (Forward/Reverse)		km/hr	4,4
		Rubber crawler	Low speed (Forward/Reverse)		km/hr	2,2
			High speed (Forward/Reverse)		km/hr	4,4
	Permissible water depth limit				mm	500
Work performance						
	Bucket	Width (Standard) *including side cutter			mm	500
		[Standard. JIS heaped capacity]			cm^3	0,11
		Number of teeth / Installation method			pcs.	4 / rubber pin lock type
	Maximum digging depth	With blade raised			mm	3650
		With blade on the ground			mm	3900
	Maximum depth of vertically digging				mm	1090
	Maximum dumping height				mm	4280
	Minimum front swing radius (with boom in front)				mm	2160
	Minimum front swing radius (at boom swing)				mm	1760
	Rear end swing radius				mm	995
	Boom swing angle			Left	degrees	70
				Right	degrees	70
	Maximum digging force	Bucket			k•N	41,9
		Arm			k•N	24,4 (Long arm : 22,2

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2-6 Periodic Inspection and Servicing

○: Verification and adjustment ●: Replacement □: Cleaning ■: Greasing

Parts & Operations		Daily	Every 50h	Every 500h	Every 1000h / Every year	Every 2000h / Every two years
General	Missing or broken parts	○				
	Tightening of nuts and bolts	○				
	Engine and battery in good condition	○				
	Machine	□				
Transmissions	Travel gears		● 1st time	○	●	
Hydraulic circuit	Hydraulic oil	○			●	
	Aspiration filter				□	
	Hydraulic oil return filter		● 1st time	●		
	Control filters				●	
	Operation of the accumulator	○				
Greasing	Greasing points	■				
	Rotation pin and crown		■			
Chassis	Bearing rollers and bearings, idler wheels	○			■	
	Track tension	○				
Electrical equipment	Headlights, horn, travel alarm	○				
	Dashboard and indicators	○				
	System state	○				
Engine	Water separator	○				
	GO filter			●		
	Air filter (dusty atmosphere every 250 h)			●		
	Engine oil	○	● 1st time	●[1]		
	Oil filter		● 1st time	●[1]		
	Cooling fluid	○				●
	Belt	○			●	
	Radiator vents	○		□		
	Fuel hose, coolant hose					●
	Intake and exhaust valves				○	
	Injectors and injection pressure					○
	EGR valve				□	
Air conditioning					○	

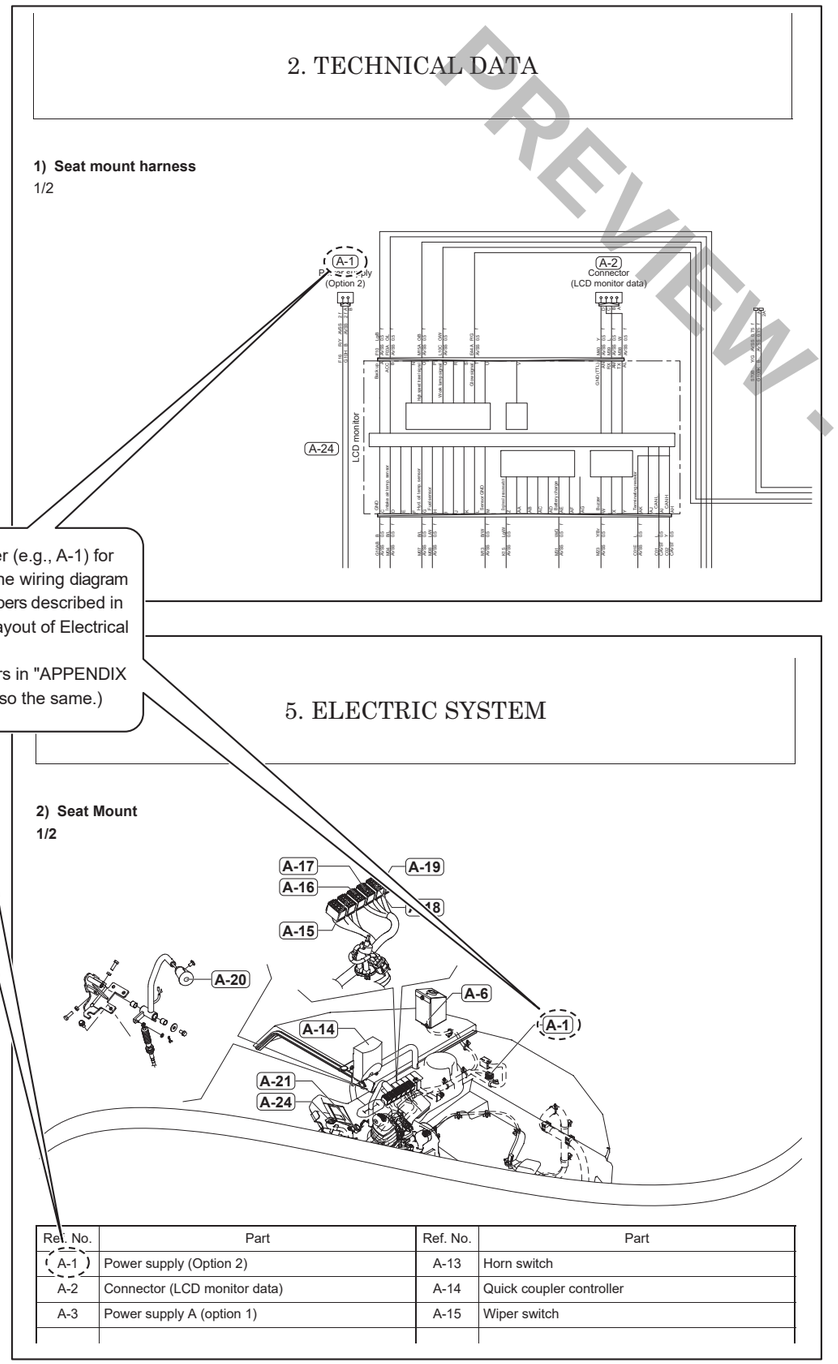
1. Every 500h / Every year

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2-9 Wiring Diagram

● Reference numbers

<Example>



Each reference number (e.g., A-1) for electric equipment in the wiring diagram corresponds to the numbers described in Section "5-1-1 Parts Layout of Electrical Equipment".
(The reference numbers in "APPENDIX Wiring Diagram" are also the same.)

Ref. No.	Part	Ref. No.	Part
A-1	Power supply (Option 2)	A-13	Horn switch
A-2	Connector (LCD monitor data)	A-14	Quick coupler controller
A-3	Power supply A (option 1)	A-15	Wiper switch

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3-7 List of Tightening Torque

3-7-1 Machine

Applicable model			ViO57-6B		
Equipment No		Tightening part	Thread size	Tightening torque N•m	Adhesive
Engine / Electrical equipment					
	1	Engine mount vibroisolating rubber	M16 × 150 (10.9T)	291 to 339	ThreeBond 1324
	2	Engine × Engine mount L <Fan side>	M10 × 40 (10.9T)	67 to 79	ThreeBond 1324
	3	Engine × Engine mount R <Flywheel side>	M10 × 30 (10.9T)	67 to 79	ThreeBond 1324
	4	Air cleaner intake hose	Hose clip 70	2,5 to 3,5	
	5	Cooling water hose	Hose clip 41	2,5 to 3,5	
	6	Cooling water hose	Hose clip 48	2,5 to 3,5	
	7	Fuel level gauge unit	M5 × 12 (Pan head screw)	1,18 to 1,47	
	8	Fuel tank holding band	Nut 10	2,45 to 2,94 <Tank holding side>	46 to 54 <Lock nut side>
	9	Fuel tank, Plate R1/2	M8 × 30	12,8 to 16,7	
	10	Fuel drain valve	R 3/8	19,6 to 29,4	Loctite 577
	11	Canopy mount CMP A ×Turning frame	M16 × 70 (10.9T)	291 to 339	ThreeBond 1324
	12	Canopy mount CMP A × Canopy mount CMP B	M10 × 30 (10.9T)	67 to 79	ThreeBond 1324
	13	Canopy mount CMP B ×Turning frame	M12 × 45 (10.9T)	116 to 138	ThreeBond 1324
	14	Air cleaner	M8 × 25	23 to 27	
	15	Fuel level gauge hose	Hose clip 16	2,5 to 3,5	
	16	LCD monitor × Panel cover	M5 × 16	2,5 to 3	
	17	Safety switch (High speed travel pedal)	Locknut (Fine thread) 18	29,4 to 34,3	
	18	Safety switch (Cut-off lever)	Locknut (Fine thread) 18	29,4 to 34,3	
	19	Accelerator dial (holding nut)	Nut (Fine thread) M9	1,33 to 1,47	
	20	Panel cover (lower) × Panel cover (upper)	M5 × 14 (Tapping screw)	2,8 to 3,5	
	21	Battery holding rod	Nut 8	2 to 3 (Lower <holding>)	5 to 6 (Upper <Locknut>)
	22	Harness × Starter motor terminal	Nut 8	7,5 to 10	
	23	Air conditioner hoses	Hose clip 22 - 41	4 to 5	

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Disassembly of Cylinder Head

Prepare a clean, flat working surface on a workbench large enough to accommodate the cylinder head assembly. Discard all gaskets, O-rings and seals. Use new gaskets, O-rings and seals on reassembly of the cylinder head.

1. Drain the coolant from the engine into a suitable container.

NOTICE

Identify all parts and their location using an appropriate method. It is important that all parts are returned to the same position during the reassembly process.

2. Disconnect the electrical wire from the glow plug, injector, intake throttle, EGR valve and sensors **(Figure 4-2-3, (1))**.

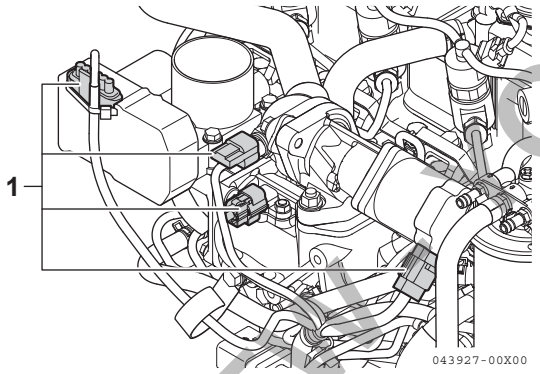


Figure 4-2-3

3. Disconnect the fuel pipes from the fuel filter, if the fuel filter is mounted on the intake manifold.
4. Remove the intake throttle, EGR valve and fuel filter on the intake manifold if required (discard the all gasket).
5. Remove the intake manifold bolts **(Figure 4-2-4, (1))**. Remove the intake manifold **(Figure 4-2-4, (2))**. Discard the intake manifold gasket **(Figure 4-2-4, (3))**.

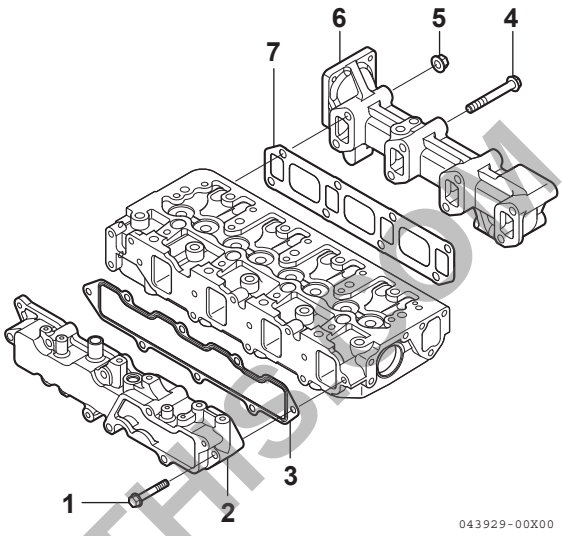


Figure 4-2-4

6. Disconnect the electrical wire from the diesel particulate filter if mounted.
7. Remove the diesel particulate filter from the engine (discard the all gasket).
8. Remove the exhaust manifold bolts **(Figure 4-2-4, (4))** and nuts **(Figure 4-2-4, (5))**. Remove the exhaust manifold **(Figure 4-2-4, (6))** and the exhaust manifold gasket **(Figure 4-2-4, (7))**.
9. Remove the coolant pump. *See Disassembly of Engine Coolant Pump on page 4-4-5.*
10. Remove the high-pressure lines and fuel injectors from the cylinder head. *See Removal of Injector on page 4-3-9.*

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4. Engine

4-1 Safety

4-1-1 Safety Statements

Yanmar is concerned for your safety and your machine's condition. Safety statements are one of the primary ways to call your attention to the potential hazards associated with Yanmar TNV engine operation. Follow the precautions listed throughout the manual before operation, during operation and during periodic maintenance procedures for your safety, the safety of others and to protect the performance of your engine. Keep the labels from becoming dirty or torn and replace them if they are lost or damaged. Also, if you need to replace a part that has a label attached to it, make sure you order the new part and label at the same time.



This safety alert symbol appears with most safety statements. It means attention, become alert, your safety is involved! Please read and abide by the message that follows the safety alert symbol.

⚠ DANGER

DANGER indicates a hazardous situation which, if not avoided, *will* result in death or serious injury.

⚠ WARNING

WARNING indicates a hazardous situation which, if not avoided, *could* result in death or serious injury.

⚠ CAUTION

CAUTION indicates a hazardous situation which, if not avoided, *could* result in minor or moderate injury.

NOTICE

NOTICE indicates a situation which can cause damage to the machine, personal property and/or the environment or cause the equipment to operate improperly.

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4-2-5 Cylinder Head

Cylinder Head Components

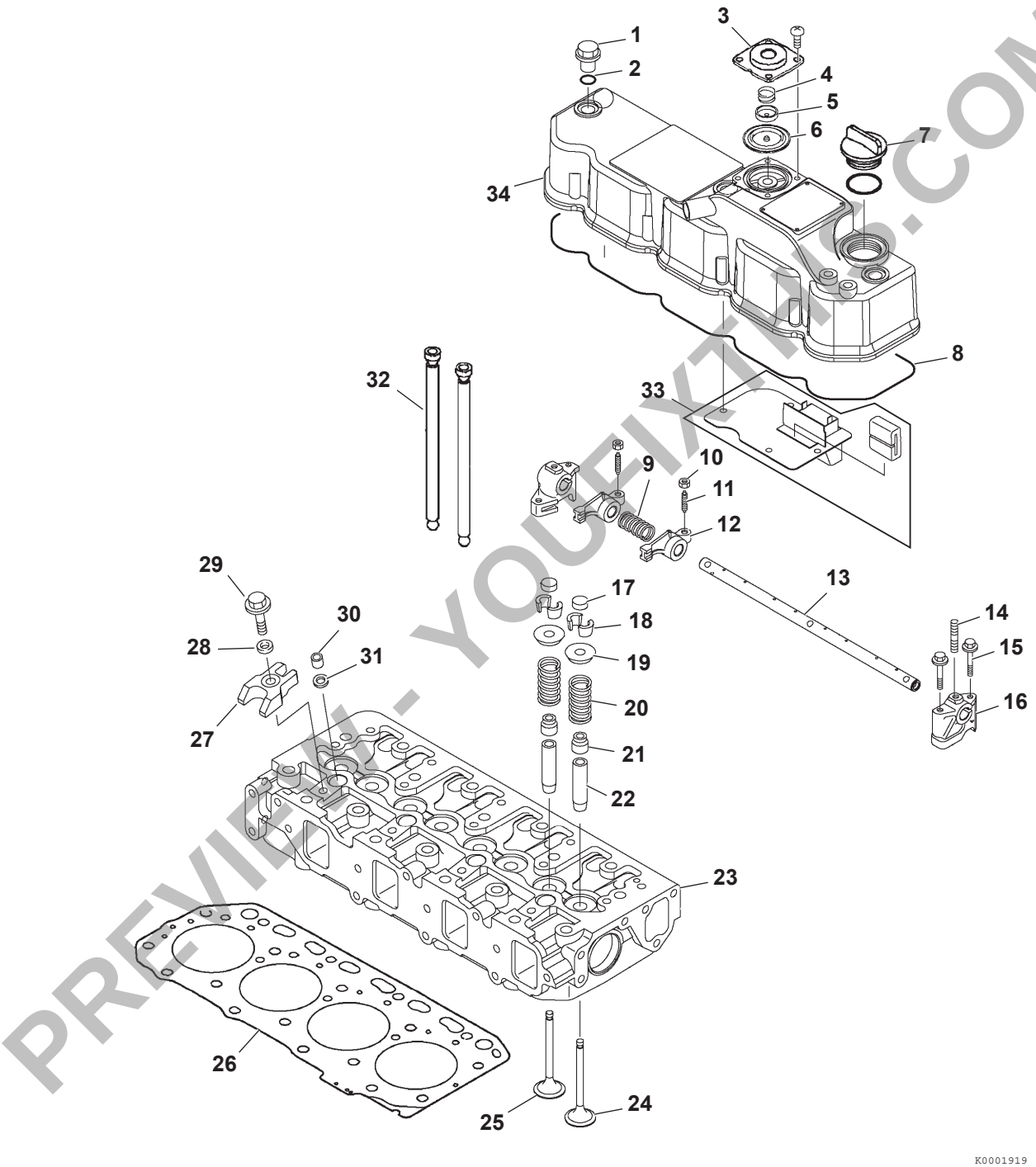


Figure 4-2-1

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■ Reassembly of the valve cover

1. Lightly grease a new valve cover gasket **(Figure 4-2-36, (4))**. Place the gasket in the groove of the valve cover **(Figure 4-2-36, (3))**.
2. Place the valve cover on the cylinder head.
3. Be sure new O-rings **(Figure 4-2-36, (2))** are installed on the valve cover nuts. Reinstall and tighten the valve cover nuts **(Figure 4-2-36, (1))**.
4. Reinstall the exhaust manifold using a new gasket. Tighten the bolts to the specified torque.

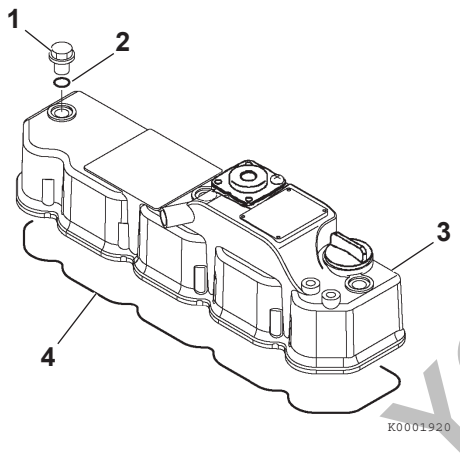


Figure 4-2-36

5. Reinstall the intake manifold using a new gasket. Tighten the bolts to the specified torque.
6. Install each glow plug **(Figure 4-2-37, (1))**, and tighten it with the specified torque. Install each electrical harness **(Figure 4-2-37, (1))**, and tighten it with the specified torque.

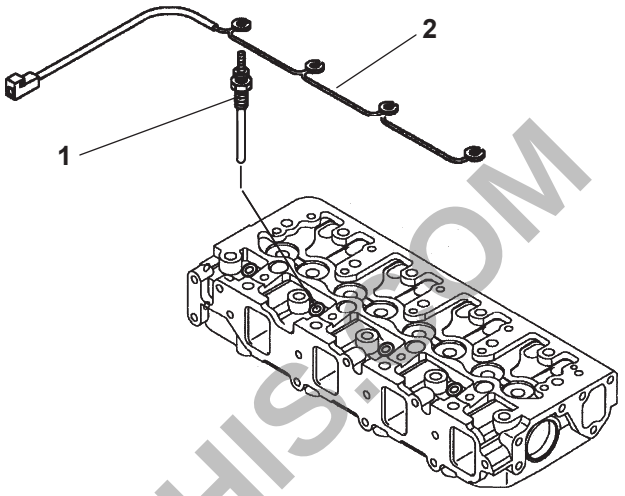


Figure 4-2-37

7. Reinstall the fuel injectors. *See Reassembly of injector on page 4-3-10.*
8. Reinstall the high pressure and the return fuel injection lines. *See Removal of Common Rail on page 4-3-7*
9. Reinstall the engine coolant pump. *See Reassembly of Engine Coolant Pump on page 4-4-7.*

⚠ CAUTION

For high-pressure pipe, use a new one. If you reuse it, the displacement of the working face may occur, causing the fuel leaks.

10. Reinstall the coolant hoses on the cold start device on the fuel injection pump.
11. Reinstall the alternator. *See Installation of Alternator on page 4-8-11.*

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5-4 Error Code List

Error code	Classification	Error description	Detection condition	Causes	Corrective measures
00 000051.03	Caution	Intake throttle position sensor malfunction: High voltage	The sensor voltage is higher than 4.8 V when the engine is not cranking.	1. Improper connector engagement, 2. Faulty wire harness, 3. Intake throttle position sensor failure, 4. Engine ECU internal circuit failure	Check the connector, wire harness, intake throttle position sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000051.04	Caution	Intake throttle position sensor malfunction: Low voltage	The sensor voltage is lower than 0.2 V when the engine is not cranking.	1. Improper connector engagement, 2. Faulty wire harness, 3. Intake throttle position sensor failure, 4. Engine ECU internal circuit failure	Check the connector, wire harness, intake throttle position sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000091.03	Caution	Accelerator sensor malfunction: High voltage	The sensor voltage is higher than 4.6 V.	1. Improper connector engagement, 2. Faulty wire harness, 3. Accelerator sensor failure, 4. Engine ECU internal circuit failure	Check the connector, wire harness, accelerator sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000091.04	Caution	Accelerator sensor malfunction: Low voltage	The sensor voltage is lower than 0.2 V.	1. Improper connector engagement, 2. Faulty wire harness (Sensor 5V disconnection or short to ground), 3. Accelerator sensor failure, 4. Engine ECU internal circuit failure	Check the connector, wire harness, accelerator sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000100.01	Warning	Low engine oil pressure alarm	After the engine starts, the engine oil pressure switch stays on for a specific period of time at an engine speed of 600 min^{-1} or more and at a battery voltage of 9V or more.	1. Low engine oil pressure, 2. Engine lubrication system failure, 3. Faulty wire harness (Engine oil pressure switch wire short to ground), 4. Engine oil pressure switch failure (Short to ground on a wire inside the engine oil pressure switch), 5. Engine ECU internal circuit failure	Check the amount of engine oil, engine lubrication system, wire harness, engine oil pressure switch and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000100.04	Warning	Engine oil pressure switch disconnection	Before the engine starts with the starter switch in the "ON" position, the engine oil pressure switch stays off for one second at a battery voltage of 9 V or more.	1. Improper connector engagement, 2. Faulty wire harness (Engine oil pressure switch wire disconnection or short to power), 3. Engine oil pressure switch failure (Wire disconnection or short to power on a wire inside the engine oil pressure switch), 4. Engine ECU internal circuit failure	Check the connector, wire harness, engine oil pressure switch and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000102.03	Warning	EGR low pressure-side sensor malfunction: High voltage	The sensor voltage is higher than 4.8 V when the engine is not cranking.	1. Improper connector engagement, 2. Faulty wire harness (Sensor signal wire short to ground), 3. EGR pressure sensor failure (Improper sensor output due to short to ground on a wire inside the EGR pressure sensor), 4. Engine ECU internal circuit failure	Check the connector, wire harness, EGR pressure sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000102.04	Warning	EGR low pressure-side sensor malfunction: Low voltage	The sensor voltage is lower than 0.2 V when the engine is not cranking.	1. Improper connector engagement, 2. Faulty wire harness, 3. EGR pressure sensor failure, 4. Engine ECU internal circuit failure	Check the connector, wire harness, EGR pressure sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000102.13	Warning	EGR low pressure-side sensor malfunction: Abnormal learning value	The final offset value for the intake manifold pressure is lower than the threshold value or higher than the threshold value.	1. Improper connector engagement, 2. Faulty wire harness, 3. EGR pressure sensor failure, 4. Engine ECU internal circuit failure	Check the connector, wire harness, EGR pressure sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000105.03	Warning	Intake manifold temperature sensor malfunction: High voltage	The sensor voltage is higher than 4.8 V when the engine is not cranking.	1. Improper connector engagement, 2. Faulty wire harness, 3. Intake manifold temperature sensor failure, 4. Engine ECU internal circuit failure	Check the connector, wire harness, intake manifold temperature sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000105.04	Warning	Intake manifold temperature sensor malfunction: Low voltage	The sensor voltage is lower than 0.2 V when the engine is not cranking.	1. Improper connector engagement, 2. Faulty wire harness, 3. Intake manifold temperature sensor failure, 4. Engine ECU internal circuit failure	Check the connector, wire harness, intake manifold temperature sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000108.03	Caution	Atmospheric pressure sensor malfunction: High voltage	The sensor voltage is higher than 4.8 V when the engine is not cranking.	1. Failure of atmospheric pressure sensor inside engine ECU, 2. Engine ECU internal circuit failure	Check the atmospheric pressure sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000108.04	Caution	Atmospheric pressure sensor malfunction: Low voltage	The sensor voltage is lower than 0.2 V when the engine is not cranking.	1. Failure of atmospheric pressure sensor inside engine ECU, 2. Engine ECU internal circuit failure	Check the atmospheric pressure sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000108.10	Caution	Abnormal atmospheric pressure sensor characteristics	The final offset values for both the intake manifold pressure and the exhaust manifold pressure remain at 5 kPa or higher for 600 ms.	1. Failure of atmospheric pressure sensor inside engine ECU, 2. Engine ECU internal circuit failure, 3. Abnormal characteristics of both EGR high pressure-side and low pressure-side sensors, 4. Obstruction due to foreign matter in the sensor area or frozen sensor	Check the atmospheric pressure sensor and engine ECU. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.
00 000110.00	Warning	Abnormally-high coolant temperature (Overheating)	60 seconds after the engine starts, the coolant temperature remains at 110°C or higher for 20 seconds.	1. Engine overheating, 2. Insufficient engine coolant, 3. Engine cooling system failure, 4. Coolant temperature sensor system failure	Check the amount of engine coolant, engine cooling system and coolant temperature sensor system. Turn the starter switch to the "OFF" position and then to the "ON" position to check if the error code is displayed again.

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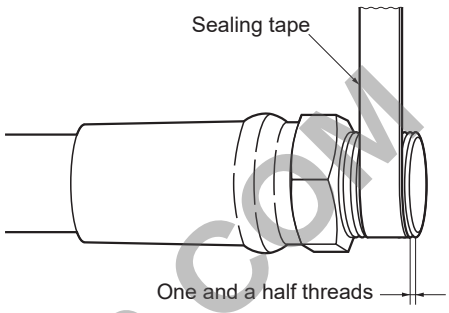
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(6) Keep the parts apt to be damaged by water or oil apart from the oily or wet parts.
e.g.: Electrical parts, rubber parts, V-belts, etc.

(7) Use the jig for press-fitting the bearings, bushes and oil seals. When using a hammer, use a pad block.

(8) Clean the joint surface of all parts and keep them free from dust.

(9) Wind the sealing tape securely, leaving a space of one or two threads from the tip of the male screw. The tape should have an overlap of about 10 mm.



1-5 Cautions for Removal and Installation of Hydraulic Equipment

(1) Check that the hydraulic oil temperature is low enough.

(2) Release air from the hydraulic tank to prevent the hydraulic oil from flowing out.

(3) Be sure to plug open the ends of hydraulic components to prevent dust from entering.

(4) Be sure to wipe hydraulic oil from the hydraulic components so that it will not be mistaken for an oil leak.

(5) Take care not to damage the plating on the cylinder rod.

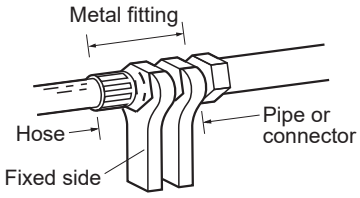
(6) Remove or install cylinders with rods fully retracted.

(7) Be sure to release air after installing the hydraulic cylinders.
- Run the engine at a low speed. Extend and retract the cylinders 4 to 5 times up to 50 to 100 mm from the end of the stroke. Then, fully extend and retract.

(8) Be sure to pressurize the hydraulic tank after installing the hydraulic components (in the case of the sealed hydraulic tank). Otherwise, hydraulic pumps might suffer cavitation and their life will be shortened.
- To pressurize the hydraulic tank, fully extend each cylinder and tighten the oil filter port plugs.

1-6 Cautions for Removal and Installation of Hydraulic Piping

(1) Installation of hydraulic hose
Take care not to twist the hoses. (Judge whether or not the hose is twisted by the hose mark.) For hoses with a metal fitting, use two wrenches to prevent twisting.
Use one to fix the hose, and the other to tighten the fitting to the specified tightening torque. Carefully check that the hoses do not come in contact after tightening. If any contact is found, correct it or use tubes.



(2) When installing hoses, first tighten to the specified torque and then loosen them a little. Then retighten to the specified torque.
- Break in the installed parts before tightening (except those using seal tapes).

(3) When installing pipes, turn the nuts more 1/4 to 1/2 turn after they reach the sharp torque rise point.

(4) When installing or removing hoses, use two wrenches, one to fasten the hose and the other to tighten or loosen the hose to prevent twisting.

(5) Check for oil leakage by applying max. pressure 5 to 6 times after attaching hydraulic hoses or pipes.

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CHAPTER 1

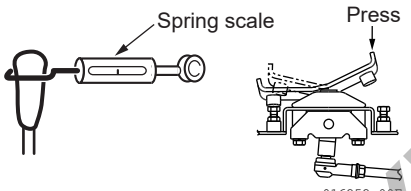
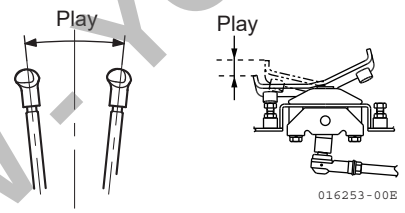
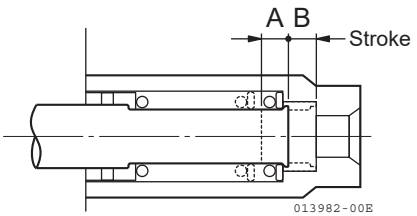
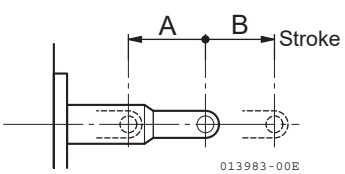
GENERAL CAUTIONS FOR MAINTENANCE WORK

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3-4 Controls

Applicable model			ViO57-6B		
Item		Measuring conditions	Unit	Standard	Allowable limit
Controls					
Operating force					
	Right control lever (Boom & Bucket)	• Engine : stopped • Hydraulic oil temp. : 50 to 60 °C • Lever operating force : Measure the force by hanging the spring scale on the lever grip. • Pedal operating force : Measure the force by applying load as shown below. 	N	12,8	17,7
	Left control lever (Arm & Swing)			12,8	17,7
	Blade lever			31,4	41,2
	Travel levers			Forward: 20,6 Reverse: 19,6	Forward: 25,5 Reverse: 24,5
	-			–	–
	Boom swing pedal			83,4	93,2
	-			–	–
Play of control lever & pedal					
	Right control lever (Front & rear / left & right)	• Engine : stopped • Hydraulic oil temp. : 50 to 60 °C • Play of each control lever and pedal : Measure the total play (front, rear, left and right) at the lever grip end or the pedal end. 	mm	–	–
	Left control lever (Front & rear / left & right)			–	–
	Blade lever			15 or less	–
	Travel levers			10 or less	–
	Boom swing pedal			5 or less	–
	-			–	–
Control valve					
Spool stroke					
	Boom		mm	7	–
	Bucket				
	Arm				
	Swing				
	Parallel-flow divider				
	Inlet				
	Right travel		mm	7	–
	Left travel				
	Blade				
	Boom swing				
	-			–	

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8. Turn the cylinder head so the exhaust port side faces down. Remove the intake and exhaust valves **(Figure 4-2-12, (6))** from the cylinder head.
9. Remove the valve stem seals **(Figure 4-2-12, (5))**.

■ Removal of valve guides

Note: Removal of the valve guides should be postponed until inspection and measurement procedures have been performed. See Inspection of valve guides on page 4-2-16.

1. If the valve guides were not within specifications, use a drift pin and hammer to drive the valve guides **(Figure 4-2-13, (1))** out of the cylinder head.

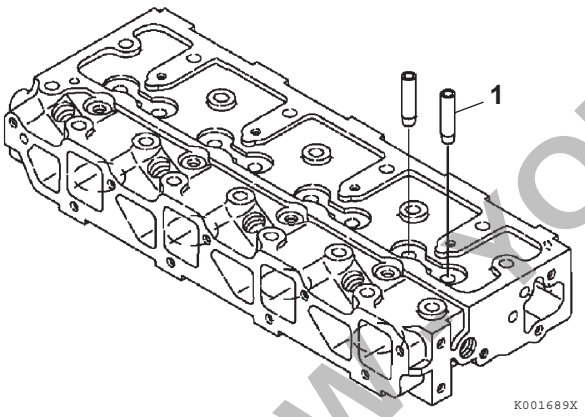


Figure 4-2-13

Cleaning of Cylinder Head Components

⚠ WARNING

Fume/Burn Hazard!



- **Always read and follow safety related precautions found on containers of hazardous substances like parts cleaners, primers, sealants and sealant removers.**
- **Failure to comply could result in death or serious injury.**

Thoroughly clean all components using a non-metallic brush and an appropriate solvent. Each part must be free of carbon, metal filings and other debris.

Inspection of Cylinder Head Components

Visually inspect the parts. Replace any parts that are obviously discolored, heavily pitted or otherwise damaged. Discard any parts that do not meet its specified limit.

NOTICE

Any part which is found defective as a result of inspection or any part whose measured value does not satisfy the standard or limit must be replaced.

NOTICE

Any part determined to not meet the service standard or limit before the next service, as determined from the state of current rate of wear, should be replaced even though the part currently meets the service standard limit.

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Removal of Common Rail

1. Remove the wiring of the injector coupler on the injector.

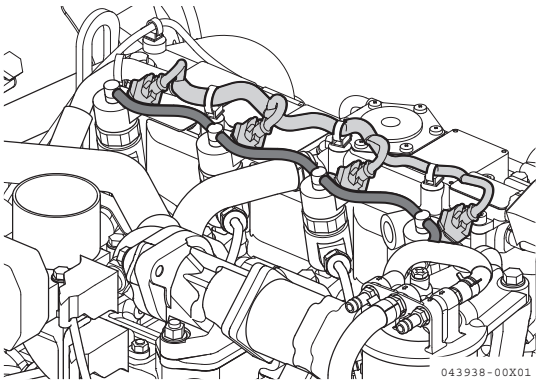


Figure 4-3-4

2. Remove the wiring coupler of the pressure sensor **(Figure 4-3-6, (3))**.

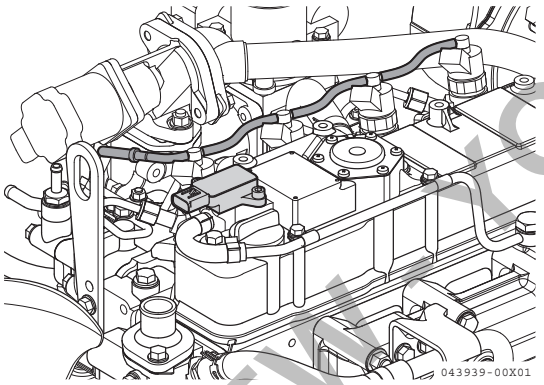


Figure 4-3-5

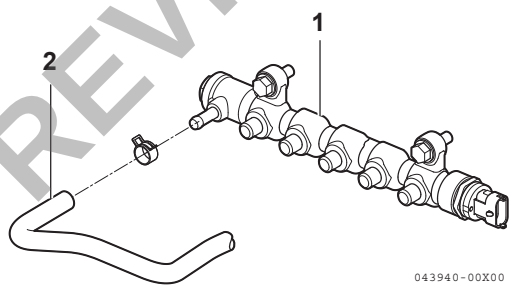


Figure 4-3-6

3. Remove the leak piping **(Figure 4-3-6, (2))** from the pressure limiter **(Figure 4-3-6, (1))**.

4. Remove the fuel return hose from the injector. Pull out the fuel return hose connector (back leak rail connector) **(Figure 4-3-7, (2))** vertically while fully pressing the retaining ring (clip) **(Figure 4-3-7, (1))** attached on the top of the injector in the direction of the arrow A **(Figure 4-3-7)**. Do not hold the hose. This may damage the hose. Do not reuse the removed clips.

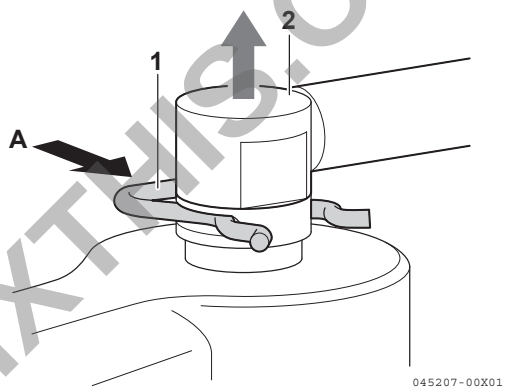


Figure 4-3-7

5. Removal of engine valve cover
Loosen the nuts and remove the engine valve cover.

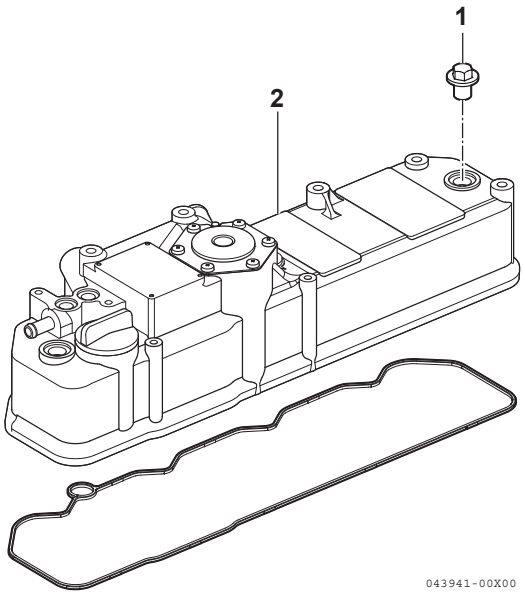


Figure 4-3-8

6. Removal of high-pressure pipe (1) (Common rail - injector)

   1- Clean around the cap nuts on both the injector and rail sides, using a brush or aspirator.

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4-8-7 Alternator Standard Output

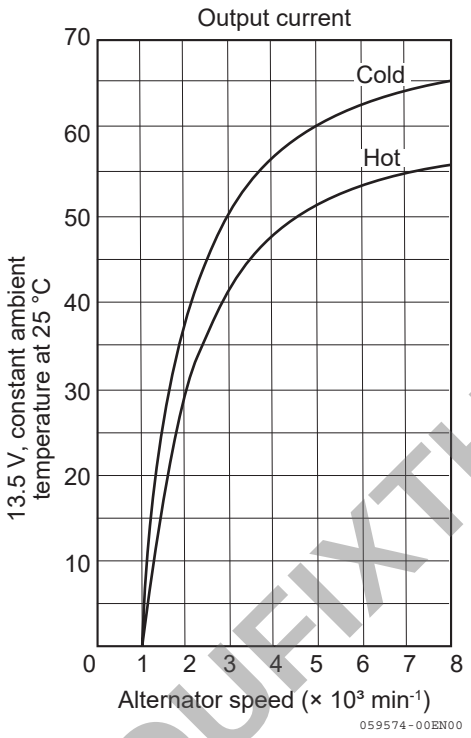


Figure 4-8-3

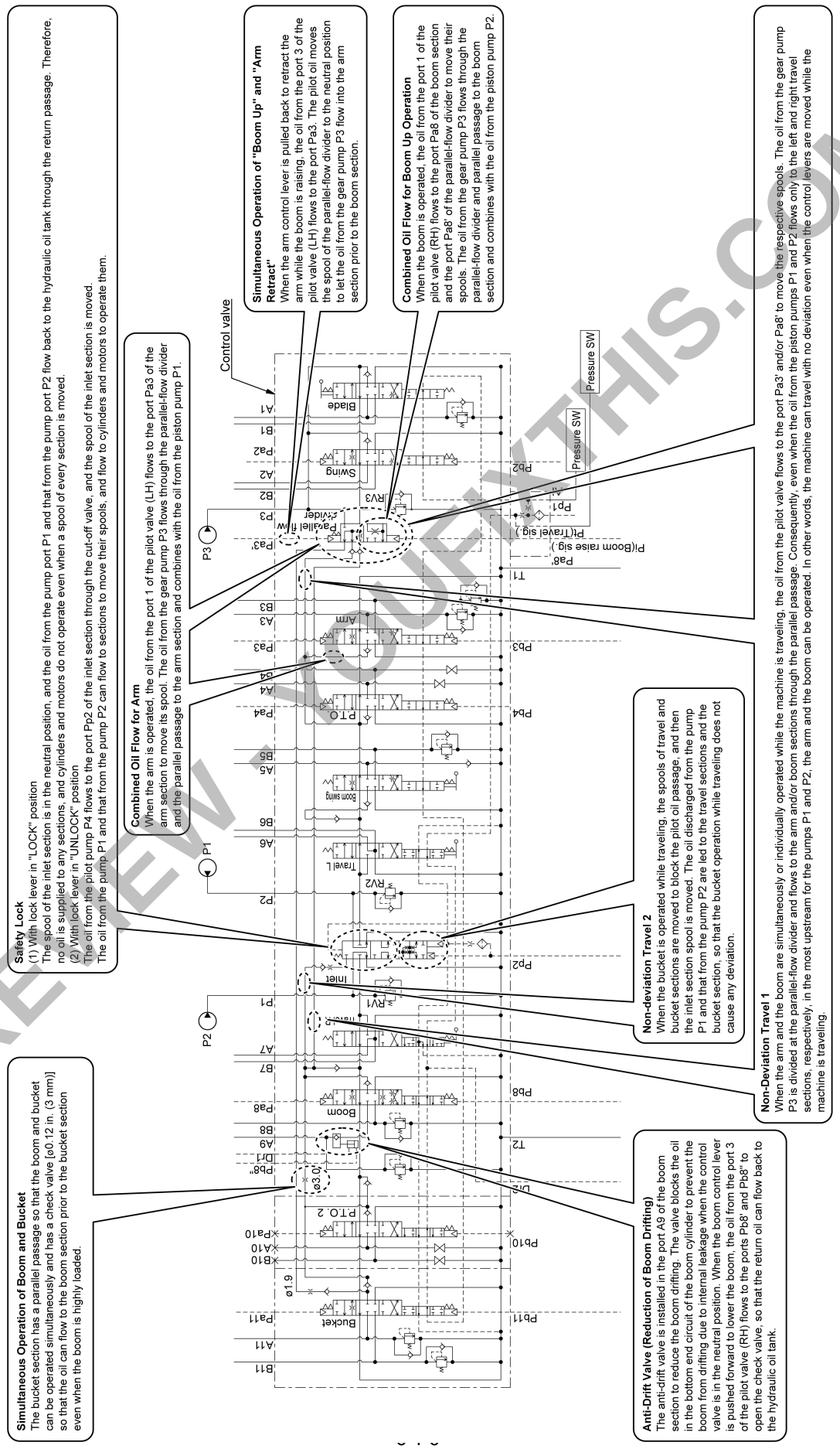
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Failure Diagnostic List

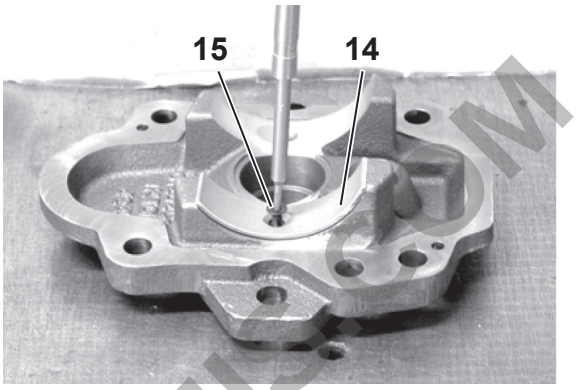
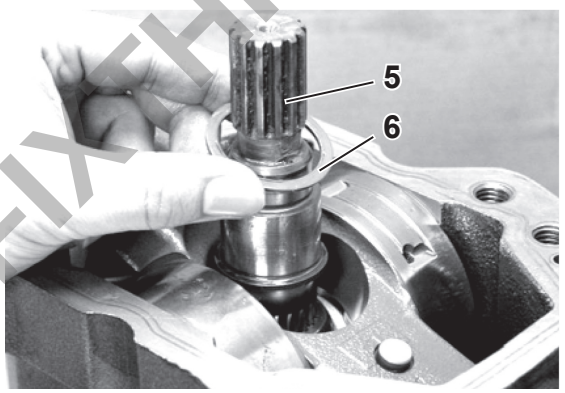
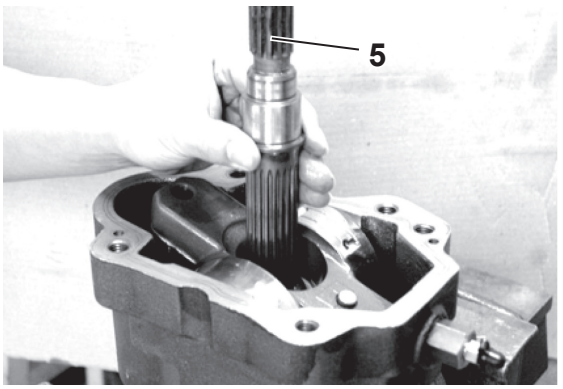
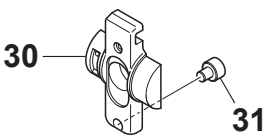
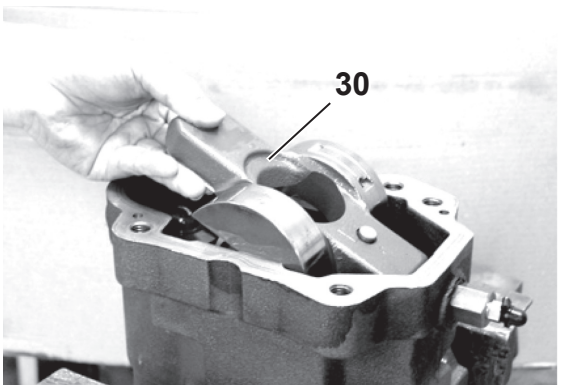
Symptoms and conditions of failures / Cause		Defective start: Starter not rotate: ECU indicator lamp not on just after key-on	Defective start: Starter not rotate: ECU indicator lamp on just after key-on (2 seconds)	Defective start: Starter rotates: Engine not start (not even initial combustion)	Defective start: Starter rotates: Engine not start (stall after serial combustion)	Defective start: Starter rotates: Engine starts later then ever	Engine stall after start: Exhaust fume: None	Engine stall after start: Exhaust fume: Little	Engine stall after start: Exhaust fume: Much	Defective rotation control: Without load: Speed change by accelerator not available (constant speed)	Defective rotation control: Without load: Specified speed setting not available	Defective rotation control: Without load: Poor acceleration	Defective rotation control: Without load: Return to low speed not smooth	Defective rotation control: Without load: Hunting	Defective rotation control: At work: Hunting	Insufficient engine output: Exhaust color: Normal	Insufficient engine output: Exhaust color: White	Insufficient engine output: Exhaust color: Black	Noise/vibration: Knocking noise at combustion too high	Noise/vibration: Combustion noise uneven	Noise/vibration: Noise other than combustion from engine	Noise/vibration: Engine vibration too big	Lubricant: Lubricant consumption too much	Lubricant: Lubricant diluted with fuel	Lubricant: Lubricant mixed with water	Lubricant: Oil pressure too low (oil pressure lamp on)	Cooling water: Overheated (water temperature lamp on)	Cooling water: Water temperature too low	Intake: Pressure down (air cleaner lamp on)	Intake: Pressure up	Exhaust: At work: White exhaust color	Exhaust: At work: Black exhaust color	Exhaust: Blow-by too much	Exhaust: Exhaust temperature up	Fuel: Fuel consumption too much	Fuel: Fuel mixed with water (oil-water separator lamp on)	Fuel: Fuel filter contaminated too early	Electrics/electronics: Battery charge defect (charge lamp on)	Electrics/electronics: ECU indicator lamp flashing	Electrics/electronics: ECU indicator lamp not on just after key-on (2 seconds)	Electrics/electronics: Prescribed ECU control function not operate	Electrics/electronics: Fuse meltdown, disconnection (repeated)	Action	Referenced page number
Engine system	Intake/exhaust valve clearance incorrect			○			○									○					○							○					○										Valve clearance adjustment	*See Measuring and Adjusting Valve Clearance on page 4-2-23*
	Compression failure at valve seat			○												○		○			○							○			○	○	○	○	○							Valve seat facing	*See Valve face and valve seat on page 4-2-17.*
	Intake/exhaust valve seizure			○					○						○	○		○			○	○		○				○			○	○										Correction or replacement of intake/exhaust valve	*See Removal of intake/exhaust valves on page 4-2-13.*
	Cylinder head gasket blow-out															○								○		○																Gasket replacement	*See Removal of cylinder head on page 4-2-12.*
	Piston ring sticking or breakage			○					○					○			○			○	○	○	○			○			○		○	○										Piston ring replacement	*See Reassembly of pistons on page 4-2-41.*
	Wear of piston ring, piston or cylinder			○					○								○					○	○					○			○										Horning work and usage of over-sized parts	*See Honing and Boring on page 4-2-40.*
	Seizure of crank pin metal or bearing parts			○			○					○	○						○	○										○										Repair or replacement	*See Inspection of crankshaft on page 4-2-38.*
	Closed gap position fault of piston ring						○								○						○										○										Correction of closed gap position	*See Reassembly of pistons on page 4-2-41.*
	Reverse assembling of piston ring														○						○								○	○										Correction of assembling	*See Reassembly of pistons on page 4-2-41.*
	Wear of crank pin metal and journal metal											○	○	○					○	○			○																		Measurement and replacement	*See Inspection of crankshaft on page 4-2-38.*
	Connecting rod bolt loose																		○	○			○																		Tightening at specified torque	
	Foreign material entered into combustion chamber			○															○		○										○										Disassembling and repair	*See Disassembly of Engine on page 4-2-26.*
	Gear backlash too big																		○																						Gear mesh adjustment	*See Checking timing gear backlash on page 4-2-27.*
	Wear of intake/exhaust valve guide																○					○																			Measurement and replacement	*See Inspection of valve guides on page 4-2-16.*
	Open/close timing failure of intake/exhaust valve			○													○	○			○									○	○										Valve clearance adjustment	*See Measuring and Adjusting Valve Clearance on page 4-2-23.*
	Engine vibration isolating support loose, damage												○	○							○	○																			Repair or replacement of faulty parts	
Turbocharger	Blower contamination																	○													○		○								Floor cleaning	*See Washing Procedure on page 4-6-7.*
	Operation defect of waste gate																	○													○		○								Disassembling and inspection	*See Waste Gate Valve Test on page 4-6-10.*
	Wear of radial metal																○					○									○										Disassembling and inspection	*See Radial bearing on page 4-6-6.*

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6-1-2 Additional Operation of Control Valve



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Procedure	
(13) Remove the screws **15** to remove the bushes **14**.	
(14) Remove the thrust washer **6** from the shaft **5**.	
(15) Remove the shaft **5**.	
(16) Remove the swash plate **30** and the holder **31**. ***Note :*** *When removing the swash plate, take care not to drop the holder. It may damage the internal parts, such as pistons.* 	

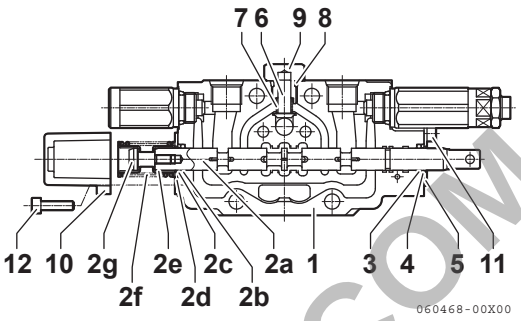
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(2) Manual operated type (blade, boom swing and travel)
Remove the spool of the boom swing section following the procedure below.

[1] Remove the two hexagon socket head bolts **12** with a hexagon bar wrench (4 mm).
[2] Remove the return spring case **10**.
[3] Slowly pull the boom swing spool assembly (**2a-2g**) out of the valve holding it by the spring part in the level direction with the spool bore.

Note :

*Take care in pulling out of the spool assembly, otherwise the spool seal [dust wiper (**2c**) and O-ring (**2b**)] can move to a spool edge and the rip area can be damaged.*

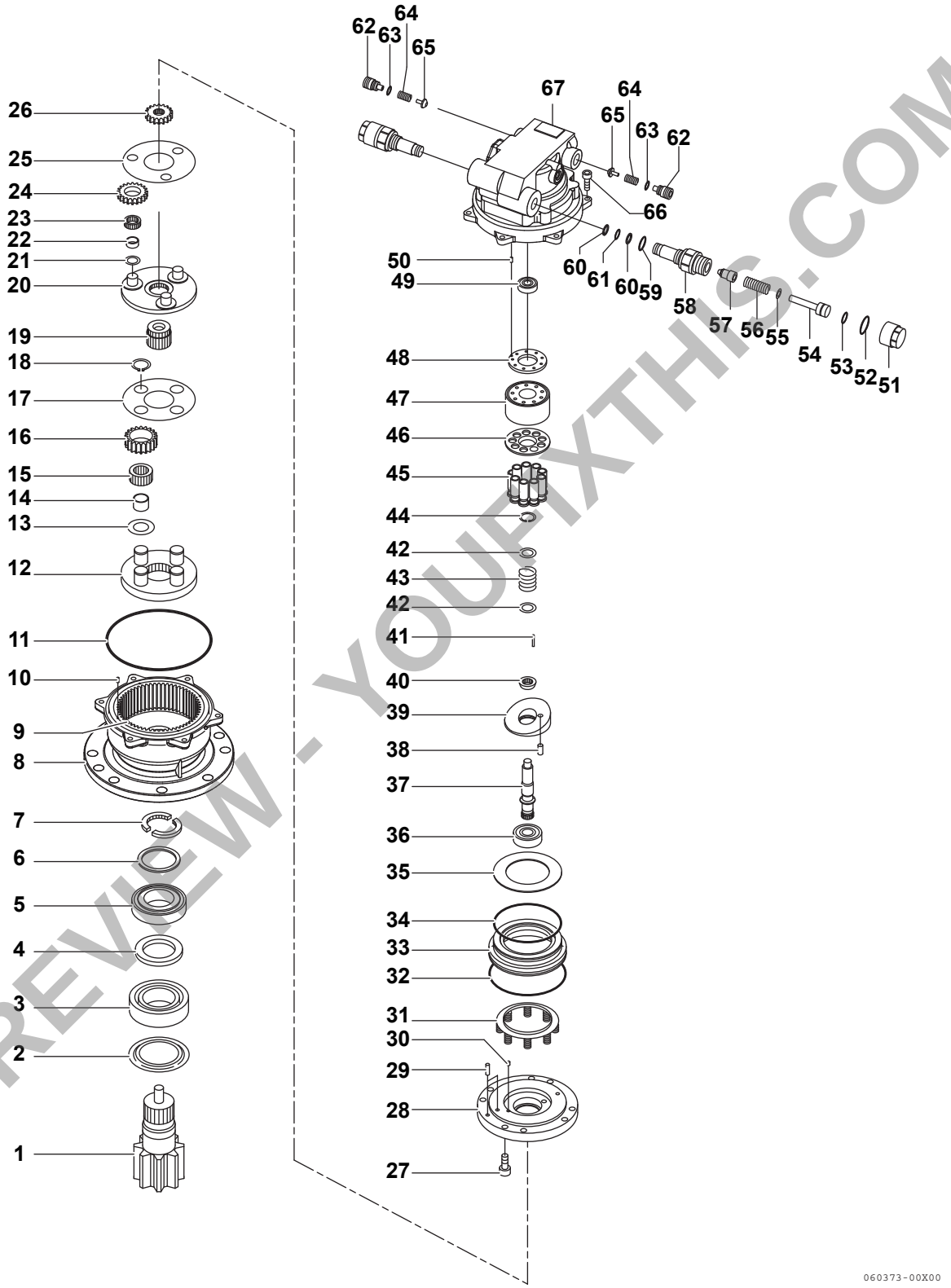


Manual operated type

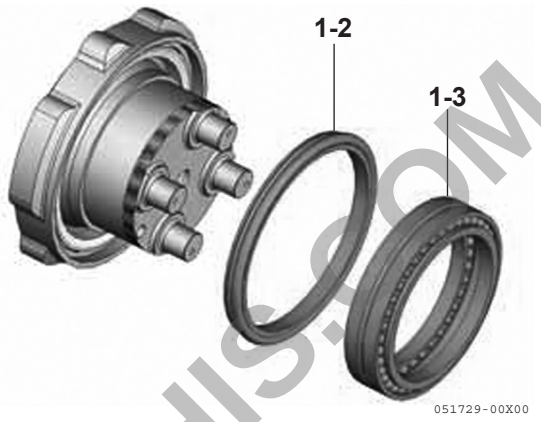
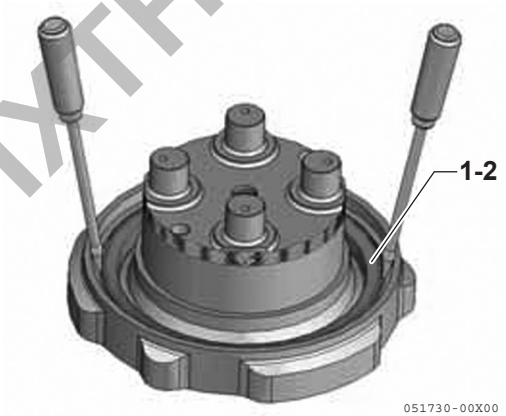
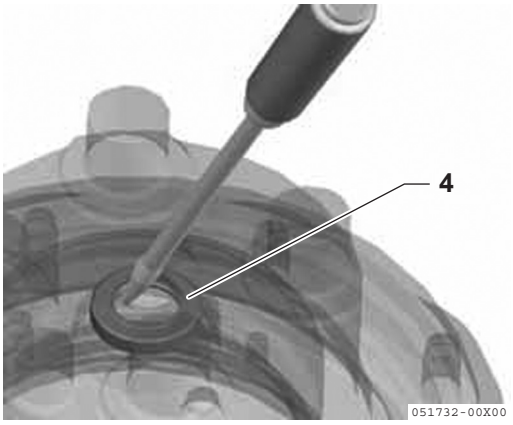
No.		Part
1		Body
2		Boom swing spool assembly
	a	Spool
	b	O-ring 1A P12
	c	Dust wiper
	d	Seal plate
	e	Return spring retainer
	f	Return spring
	g	Spool end
3		O-ring 1A P12
4		Dust wiper
5		Seal plate
6		Check valve
7		Check valve spring
8		O-ring 1B P11
9		Check valve retainer
10		Return spring cap
11		Hexagon socket head bolt M5×10
12		Hexagon socket head bolt M5×18

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3) Exploded View and Component Parts



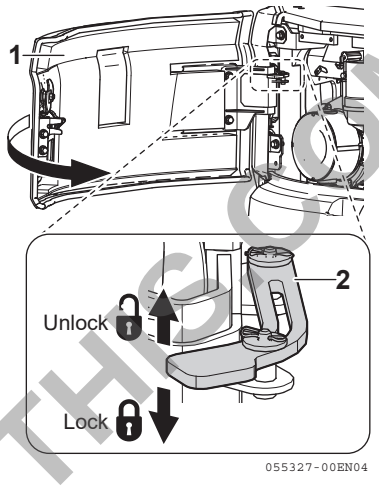
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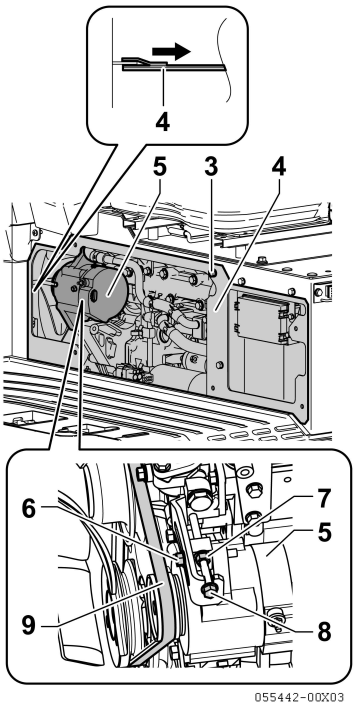
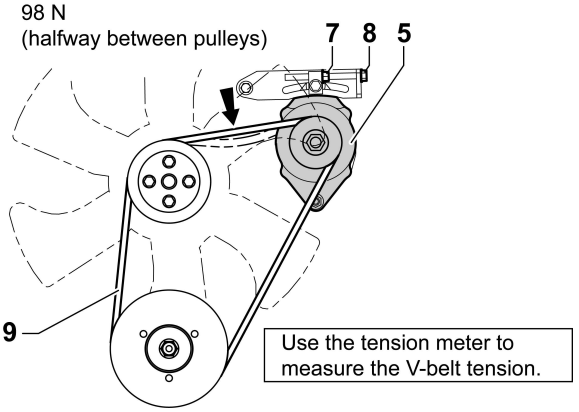
Procedure	
(28) Remove floating seal **1-2** and angular bearing **1-3**.	
(29) Remove the other floating seal using two screwdrivers. **Tools:** • Screwdrivers 12 ***CAUTION*** *Be careful not to damage the sliding surface of floating seal **1-2** when removing it.*	
(30) Put one end of a round bar on shaft **2** through the hole for the drive gear spline in the flange holder and tap the other end of the round bar lightly with a hammer to remove the shaft. **Tools:** • Hammer 13 • Round bar S-7	
(31) Remove oil seal **4**. **Tools:** • Screwdriver 12 • Hammer 13 ***CAUTION*** *Do not reuse removed oil seal **4**.*	

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7-1-4 Removal and Reinstallation of Fan Belt and Compressor Driving Belt

1) Removal

Procedure	
(1) Lower bucket to ground and stop engine, disconnect the battery and place a "MAINTENANCE IN PROGRESS" label on the machine and on the joysticks. Open engine hood rear cover **1** and secure it with stopper **2**.	

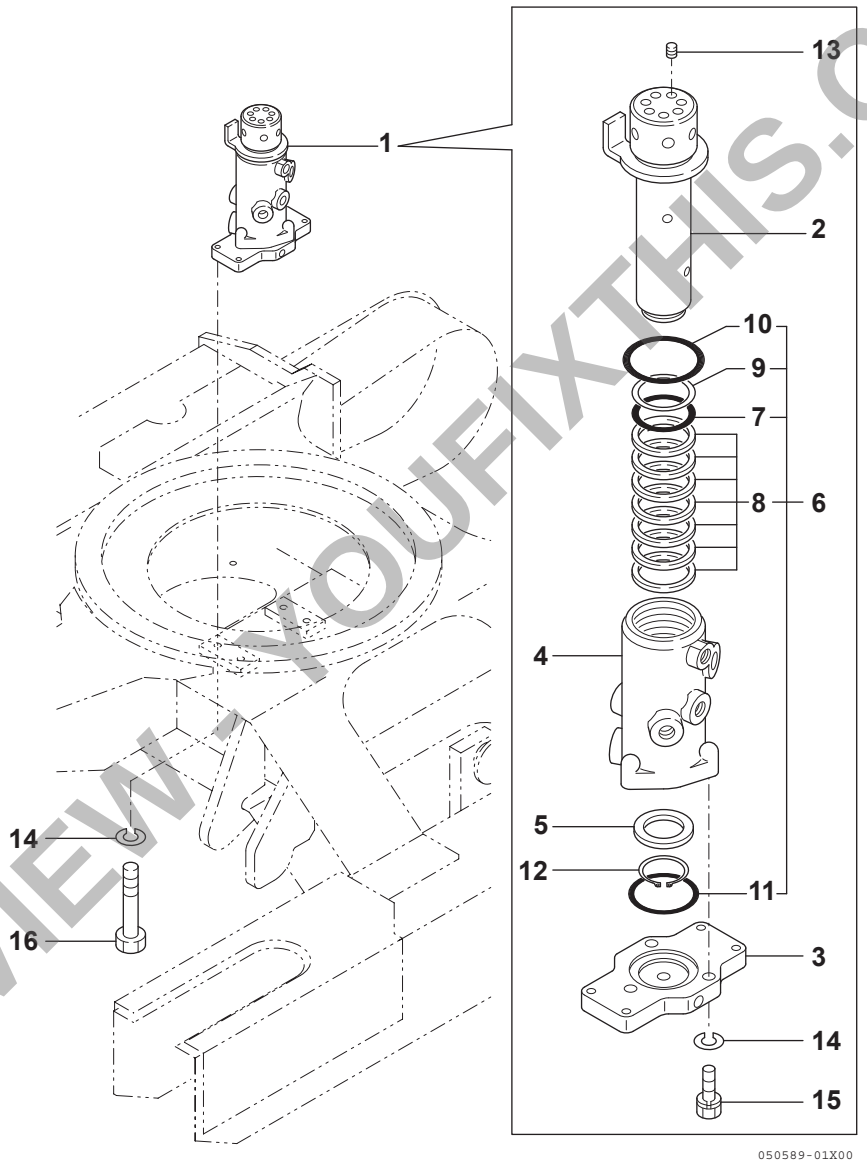
(2) Open seat mount cover, remove six bolts **3** and remove cover **4** by moving it slightly to right. (3) Loosen mounting bolts **6** for generator **5**. (4) Loosen lock nut **7** for adjusting bolt **8**, turn adjusting bolt **8** counter-clockwise to loosen fan belt tension and then, remove fan belt **9**.	 Pressing force: 98 N (halfway between pulleys) 

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7-5-6 Disassembly and Reassembly of Swivel Joint

1) Swivel Joint

The swivel joint is used to prevent the hydraulic piping from twisting when the upperstructure swings. The swivel joint consists of the shaft, hub and seal kit. The shaft and hub have holes and grooves, and the oil supplied from the port of the shaft, passing through the hub groove, is fed to the actuators of the undercarriage.



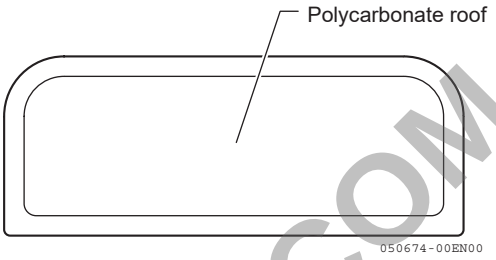
No.	Part	Q'ty	No.	Part	Q'ty
1	Swivel joint assembly	1	9	Back-up ring (T3 55)	1
2	Swivel shaft	1	10	O-ring 1B P 75.0	1
3	Swivel flange (with spring washer 10×40)	4	11	O-ring 1B G 70.0	1
			12	External snap ring	1
4	Swivel hub	1	13	Screw plug R02	7
5	Swivel spacer	1	14	Spring washer	7
6	Seal kit	1	15	Bolt M 10	3
7	O-ring 1B P56.0	1	16	Bolt M 10	4
8	Seal	7			

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2) Application of primer to sunroof

Key points for procedure

- Identify the surface where the primer is to be applied. (The surface where the primer is to be applied is opposite to the side on which the stamped characters can be read normally.)
- Clean the surface where the primer is to be applied using isopropyl alcohol to remove grease and foreign matter such as dust.
- Use SUNSTAR Glass Primer 435-41.
- Make sure that there are no places where the primer is not applied or it is applied too thinly or thickly in the entire application area and that the primer does not drip off.
- Be careful not to put too much primer on the brush to prevent the primer from flowing to the other side of the sunroof.
- Do not over-apply the primer to the same place excessively. Apply the primer to the entire application area in a continuous manner to avoid melting of the silk-screen print by the primer solvent.



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