Z45 GEN:2
450Z NXT2

Compact Excavator



Form No.
50940272
Revision A
Oct. 2014

Service Manual

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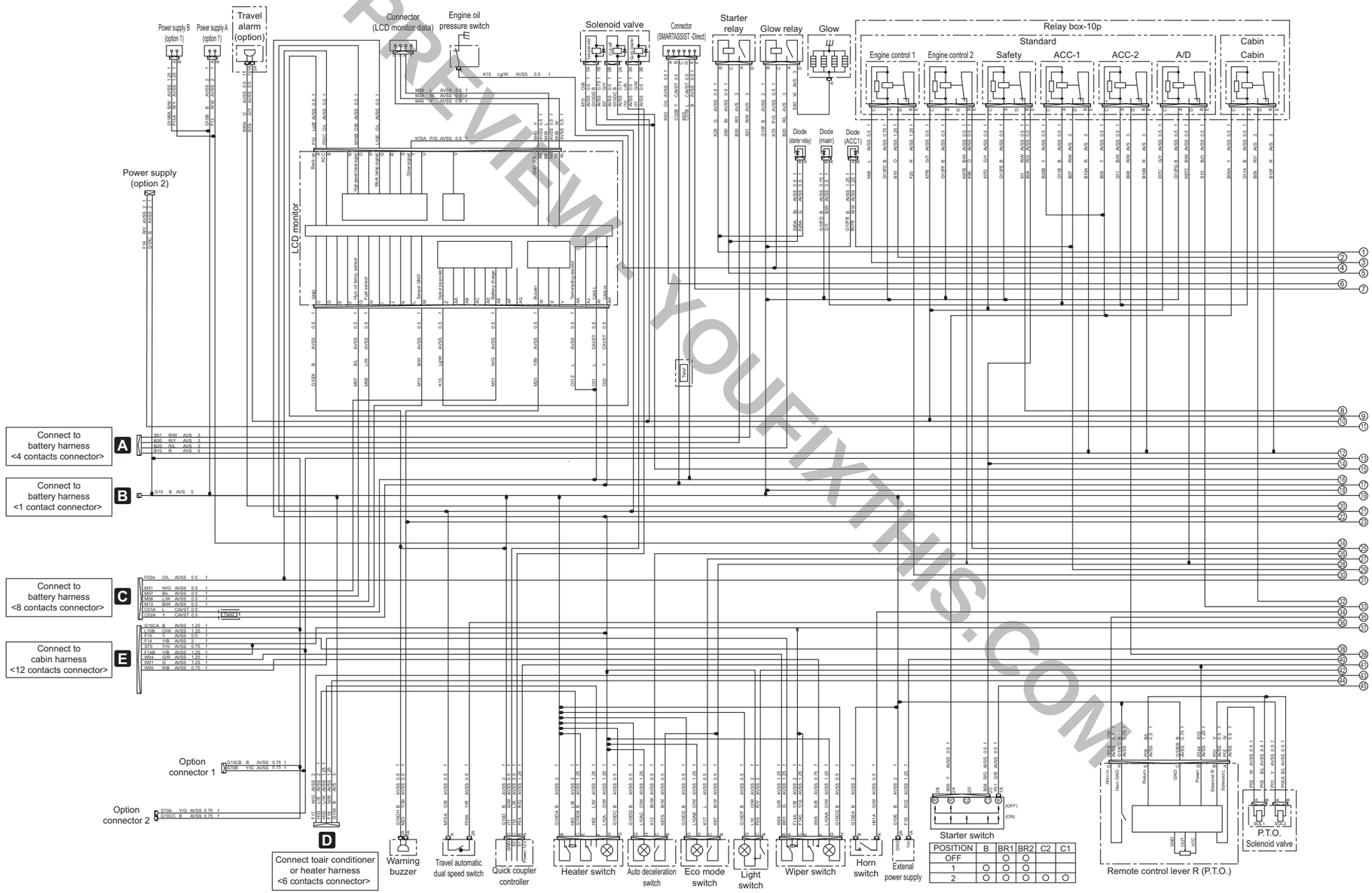
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1) Seat mount harness

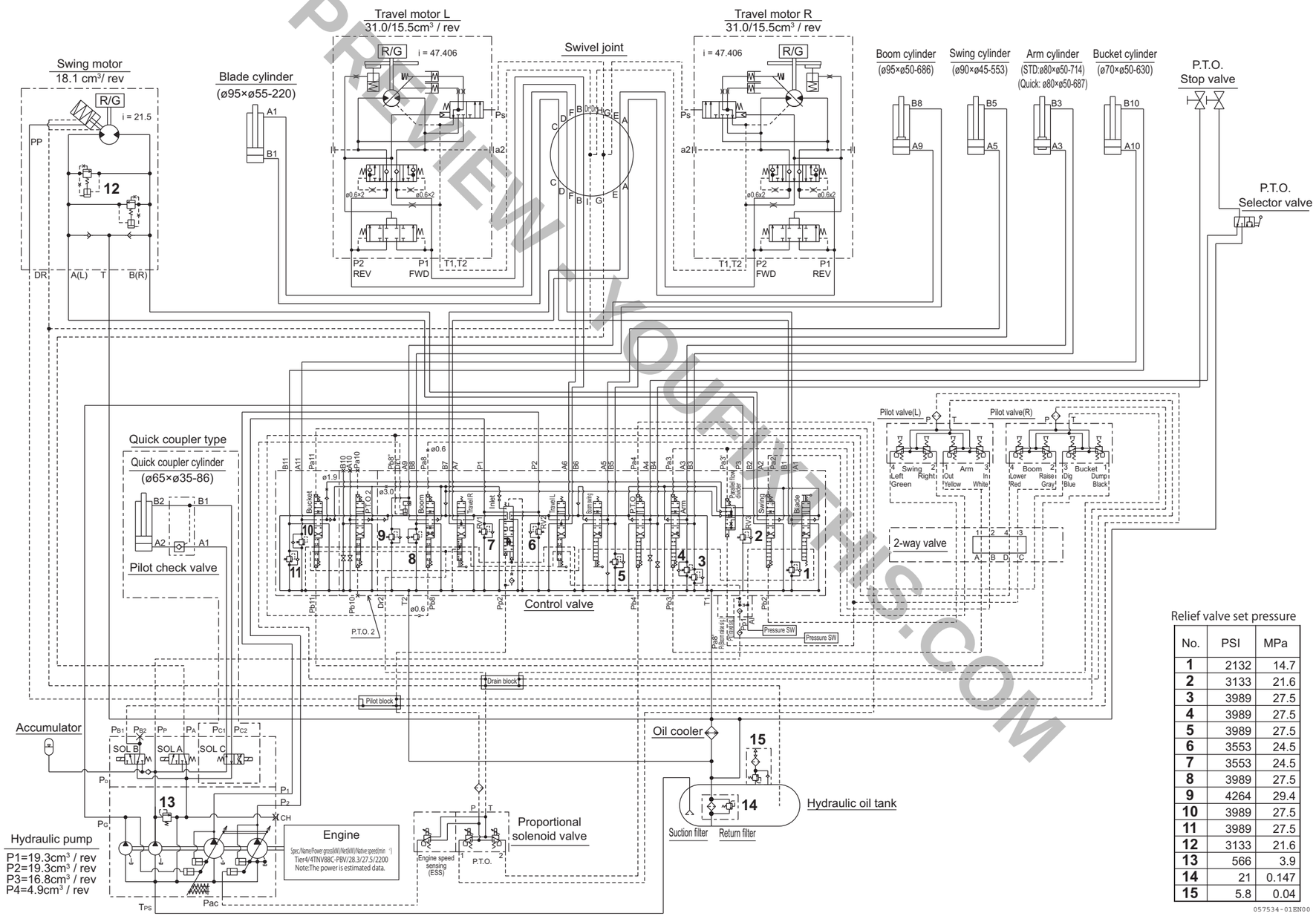
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2-8 Hydraulic Circuit Schematic



Relief valve set pressure

No.	PSI	MPa
1	2132	14.7
2	3133	21.6
3	3989	27.5
4	3989	27.5
5	3989	27.5
6	3553	24.5
7	3553	24.5
8	3989	27.5
9	4264	29.4
10	3989	27.5
11	3989	27.5
12	3133	21.6
13	566	3.9
14	21	0.147
15	5.8	0.04

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4-2-5 Cylinder Head

Cylinder Head Components

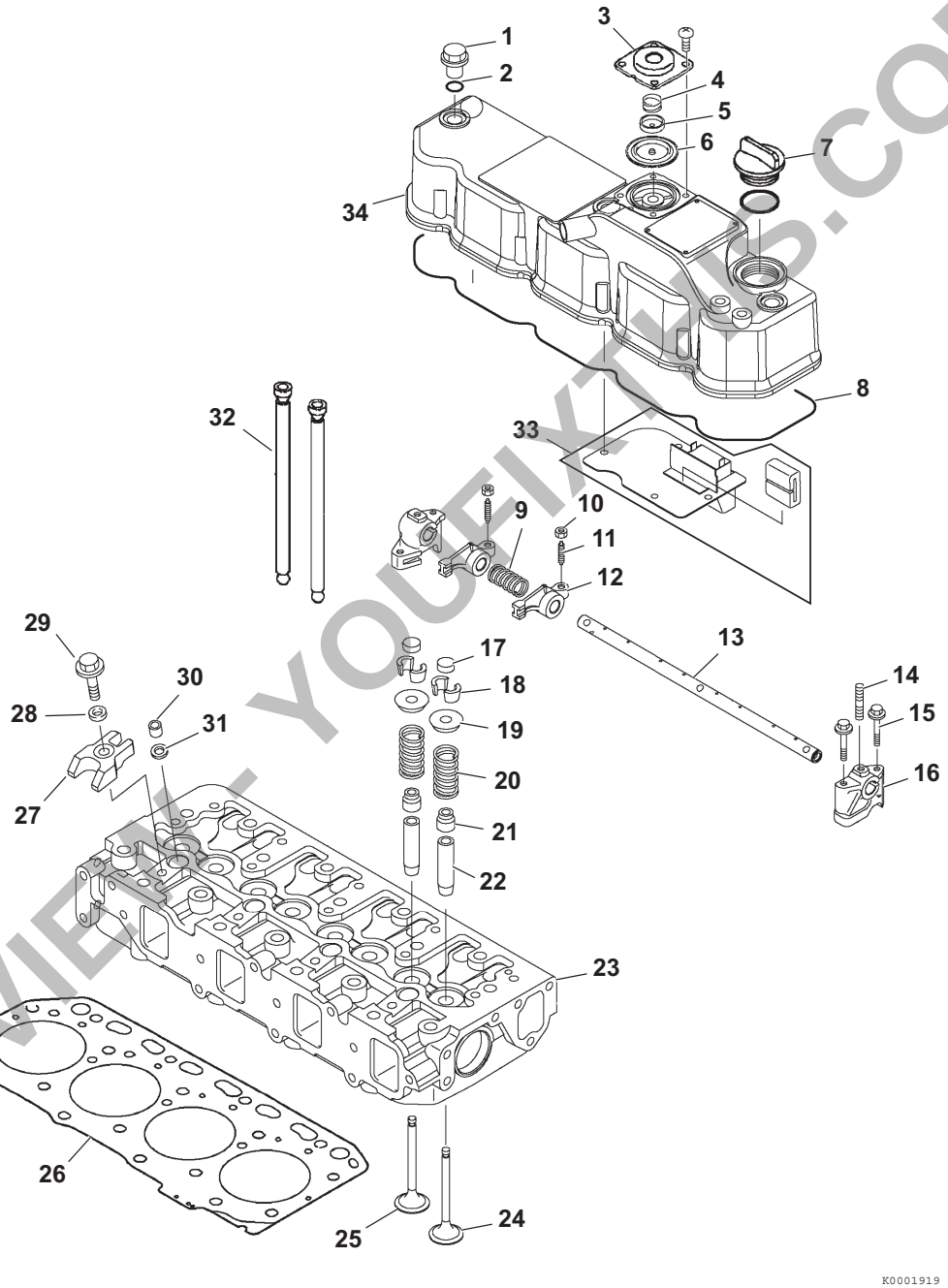


Figure 4-2-1

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3-7 List of Tightening Torque

3-7-1 Machine

Equipment No	Tightening part	Thread size	Tightening torque ft•lbf (N•m)	Adhesive
Engine / Electrical equipment				
1	Engine mount vibro isolating rubber	M16 × 150 (10.9T)	151.9 to 173.6 (205.8 to 235.2)	ThreeBond 1324
2	Engine × Engine mount L <Fan side>	M10 × 40 (10.9T)	47.0 to 54.2 (63.4 to 73.5)	ThreeBond 1324
3	Engine × Engine mount R <Flywheel side>	M10 × 30 (10.9T)	47.0 to 54.2 (63.4 to 73.5)	ThreeBond 1324
4	Air cleaner intake hose	Hose clip 70	1.9 to 2.5 (2.5 to 3.4)	
5	Cooling water hose	Hose clip 41	2.9 to 3.6 (3.9 to 4.9)	
6	Cooling water hose	Hose clip 48	3.6 to 4.3 (4.9 to 5.9)	
7	Fuel level gauge unit	M5 × 12 (Pan head screw)	0.87 to 1.08 (1.18 to 1.47)	
8	Fuel tank holding band	Nut 10	1.81 to 2.17 (2.45 to 2.94) <Tank holding side>	18.1 to 23.8 (24.5 to 32.3) <Lock nut side>
9	Bracket (SWP20-M)	M8 × 16	9.4 to 12.3 (12.8 to 16.7)	
10	Fuel drain valve	R 3/8	14.5 to 21.7 (19.6 to 29.4)	Loctite 577
11	Canopy mount CMP A ×Turning frame	M16 × 70 (10.9T)	123.0 to 151.9 (166.7 to 206.0)	ThreeBond 1324
12	Canopy mount CMP A × Canopy mount CMP B	M10 × 30 (10.9T)	47.0 to 54.2 (63.7 to 73.5)	ThreeBond 1324
13	Canopy mount CMP B ×Turning frame	M12 × 45 (10.9T)	79.6 to 94.0 (107.9 to 127.5)	ThreeBond 1324
14	Air cleaner	M8 × 25	17.4 to 20.3 (23.5 to 27.5)	
15	Fuel level gauge hose	Hose clip 13	0.72 to 1.08 (0.98 to 1.47)	
16	LCD monitor × Panel cover	M5 × 20	1.88 to 2.43 (2.55 to 3.30)	
17	Safety switch (High speed travel pedal)	Locknut (Fine thread) 18	21.7 to25.3 (29.4 to 34.3)	
18	Safety switch (Cut-off lever)	Locknut (Fine thread) 18	21.7 to25.3 (29.4 to 34.3)	
19	Accelerator dial (holding nut)	Nut (Fine thread) M9	1.01 to 1.08 (1.33 to 1.47)	
20	Panel cover (lower) × Panel cover (upper)	M5 × 14 (Tapping screw)	1.88 to 2.43 (2.55 to 3.30)	
21	Battery holding rod	Nut 8	1.45 to 2.17 (1.96 to 2.94) (Lower <holding>)	3.61 to 4.34 (4.90 to 5.88) (Upper <Locknut>)
22	Harness × Starter motor terminal	Nut 8	5.5 to 7.2 (7.4 to 9.8)	
23	Air conditioner hoses	Hose clip 22 - 41	2.9 to3.6 (3.9 to 4.9)	

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5-5 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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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))**.

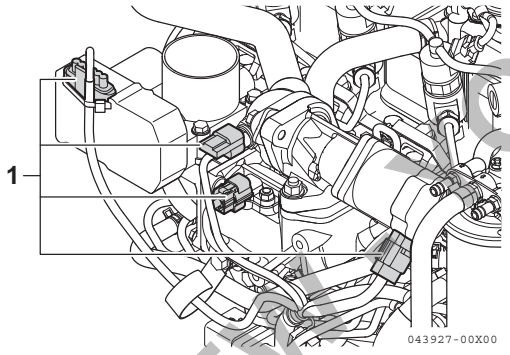


Figure 4-2-3

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))**.

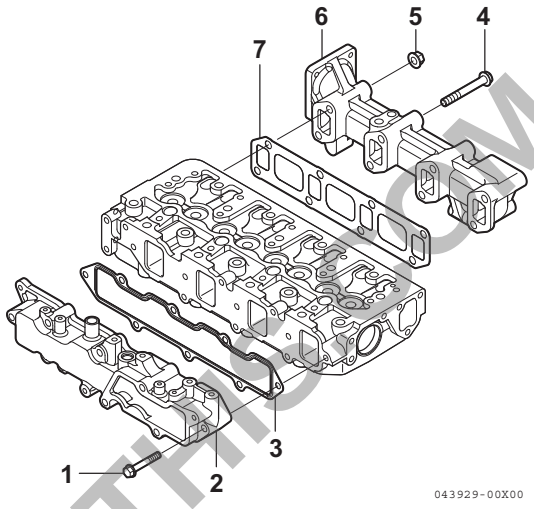


Figure 4-2-4

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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Failure Diagnostic List

Cause	Symptoms and conditions of failures: 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 than 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: 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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2. Technical Data

2-1 Specifications

Item					Unit	W/O Quick coupler	Quick coupler
Main specifications of machine							
Dimensions							
	Overall length (Transportation position)				in. (mm)	205.9 (5230)	209.4 (5320)
	Cabin	Overall height	Transportation position		in. (mm)	100.0 (2540)	
			Traveling position		in. (mm)	100.0 (2540)	
		Overall width	Full machine width		in. (mm)	77.6 (1970)	
	Canopy	Overall height	Transportation position		in. (mm)	100.0 (2540)	
			Traveling position		in. (mm)	100.0 (2540)	
		Overall width	Full machine width		in. (mm)	77.6 (1970)	
	Tumbler center distance				in. (mm)	81.5 (2070)	
	Track gauge				in. (mm)	62.6 (1590)	
	Minimum ground clearance				in. (mm)	13.6 (345)	
Traveling performance							
	Travel speed	Rubber crawler	Low speed (Forward/Reverse)		MPH (km/hr)	1.5 (2.4)	
			High speed (Forward/Reverse)		MPH (km/hr)	2.9 (4.6)	
	Permissible water depth limit				in. (mm)	19.7 (500)	
Work performance							
	Bucket	Width (Standard) *including side cutter			in. (mm)	25.6 (650)	
		[Standard. JIS heaped capacity]			cu.ft. (cu.m)	4.94 (014)	
		Number of teeth / Installation method			pcs.	4 / rubber pin lock type	
	Maximum digging depth	With blade raised			in. (mm)	132.3 (3360)	139.8 (3550)
		With blade on the ground			in. (mm)	139.4 (3540)	147.2 (3740)
	Maximum depth of vertically digging				in. (mm)	105.9 (2690)	93.7 (2380)
	Maximum dumping height				in. (mm)	152.4 (3870)	144.9 (3680)
	Minimum front swing radius (with boom in front)				in. (mm)	86.2 (2190)	93.7 (2380)
	Minimum front swing radius (at boom swing)			Cabin	in. (mm)	76.8 (1950)	83.5 (2120)
				Canopy	in. (mm)	76.8 (1950)	83.5 (2120)
	Rear end swing radius				in. (mm)	38.2 (970)	
	Boom swing angle		Cabin	Left	degrees	68	
				Right	degrees	68	
			Canopy	Left	degrees	68	
				Right	degrees	68	
	Maximum digging force		Bucket		lbs. (k•N)	8206 (36.5)	6497 (28.9)
			Arm		lbs. (k•N)	5103 (22.7)	4676 (20.8)

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2-6 Periodic Inspection and Servicing

◇ : Check ○ : Supply ● : Replace □ : Adjust (clean) ■ : Oil & grease

Check & service items			Daily	Every 50 hrs	Every 100 hrs	Every 250 hrs	Every 500 hrs	Every 1000 hrs	Every 1500 hrs	Every 2000 hrs	Every 3000 hrs
General	Check falling off, breakage of parts		◇								
	Check loosened bolts & nuts, retighten		◇								
	Check engine condition		◇								
	Clean		□								
Fuel oil	Check & supply of oil to the tank		◇(○)								
	Drain the fuel tank			□							
	Water separator	Check, drain	◇								
		Replace					●				
	Replace the fuel filter element						●				
Lube oil	Engine oil	Check, resupply	◇								
		Replace		● 1st time		●					
	Replace the engine oil filter element			● 1st time		●					
	Travel reduction gear oil	Check, resupply				○					
		Replace			● 1st time			●			
Cooling water	Check & supply of cooling water		◇								
	Check cooling water leakage		◇								
	Check & clean radiator fins					□					
	Check & adjust the fan-belt tension		◇(□)								
	Clean & check the cooling water system, and replace the cooling water							●within one year			
Rubber hose	Check & replace fuel oil pipe, cooling water pipe		◇							●within two years	
Air cleaner	Clean air cleaner					□					
	Replace air cleaner element						●				
Hydraulic system	Hydraulic oil	Check, resupply	◇								
		Replace						●			
	Clean suction filter					□ 1st time		□			
	Replace return filter					● 1st time	●				
	Check for abnormality of hydraulic pump		◇								
	Check function of accumulator									◇	
Grease	Check grease-up positions, grease		■								
	Greasing the swing gears and the swing bearings			■							
Undercar-riage	Check, adjust track tension		◇								
Control equipment	Check performance, play of travel lever (pedal)		◇								
	Check performance, play of control levers		◇								
	Check performance, play of blade lever		◇								
	Check performance, play of boom swing pedal		◇								
	Check performance of engine control dial		◇								

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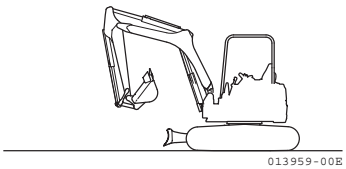
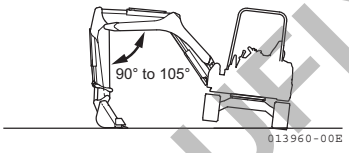
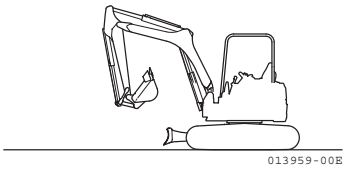
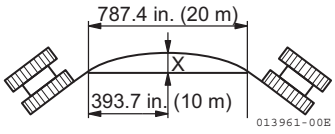
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ENGINE

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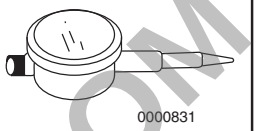
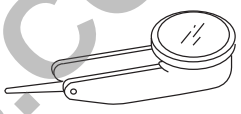
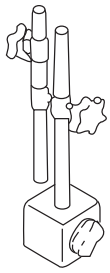
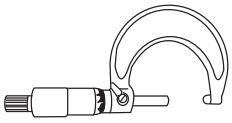
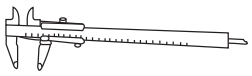
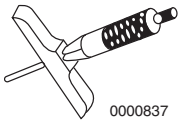
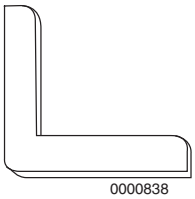
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Applicable model				
Item	Measuring condition	Unit	Standard	Allowance
Machine performance				
Travel speed	Machine position  013959-00E • Engine: Rated speed • Hydraulic oil temp.: 122 to 140 °F (50 to 60 °C) • Traveling time for 787.4 in. ft. (20 m) after an approach run of 196.9 in. ft. (5 m) or more.	sec.	15.7	17.2
			30.0	33.0
Track speed	Machine position  013960-00E • Engine: Rated speed • Hydraulic oil temp.: 122 to 140 °F (50 to 60 °C) • Site: Firm, flat ground • Travel lever: Full throttle (Floating crawler side) • Float one side of the crawler. Make a mark on the crawler. After turning the floating crawler side more than once, measure the time needed for 3 turns of the crawler.	sec.	13.0	15.0
			25.2	29.2
Track deviation	Machine position  013959-00E • Engine: Rated speed • Hydraulic oil temp.: 122 to 140 °F (50 to 60 °C) • Site: Firm, flat ground • Measure the deviation (x) in a travel distance of 787.4 in. ft. (20 m) after an approach run of 196.9 in. ft. (5 m) or more.  013961-00E	in. (mm)	7.9 (200) or less	19.7 (500) or less

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4-2-4 Measuring Instruments

No.	Instrument Name		Application	Illustration
1	Dial Indicator	Locally Available	Measure shaft bend and end play	 0000831
2	Test Indicator	Locally Available	Measurements of narrow or deep portions that cannot be measured by dial gauge	 0000832
3	Magnetic Stand	Locally Available	For holding the dial gauge when measuring	 0000833
4	Micrometer	Locally Available	For measuring the outside diameters of crankshaft, pistons, piston pins, etc.	 0000834
5	Cylinder Bore Gauge	Locally Available	For measuring the inside diameters of cylinder liners, bearing bores, etc.	 0000835
6	Calipers	Locally Available	For measuring outside diameters, depth, thickness and width	 0000836
7	Depth Micrometer	Locally Available	For measuring of valve recession	 0000837
8	Square	Locally Available	For measuring valve spring inclination and straightness of parts	 0000838

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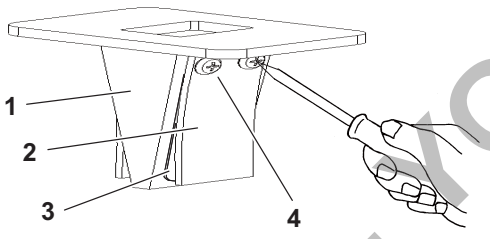
■ Precautions for cleaning

- Do not disassemble the EGR valve.
- Do not use wash fluid.
- Do not use a hard brush made of metal.
- Clean entire circumference of the valve and the valve seat, and blow with the compressed air.
- Do not put your fingers into the valve portion.

Clean Lead Valves

Similarly to the EGR valves, the lead valves must be periodically cleaned every 3000 hours because, as exhaust gas circulates through them for a prolonged time, carbon is deposited on their inner surfaces, possibly deteriorating the EGR ratio.

To remove carbon deposited inside the lead valves, disassemble and clean them.



1 – Case
2 – Stopper
3 – Valve
4 – Machine screw

Figure 4-2-109

To remove deposited carbon, use carbon cleaner, kerosene, or some other liquid capable of removing carbon as well as a soft brush or cloth to clean the valves, taking care not to damage their parts.

Upon completion of carbon removal, wipe off water and liquid, make sure that the case, valve, and stopper are free of foreign matter, and then reinstall the valve and related parts.

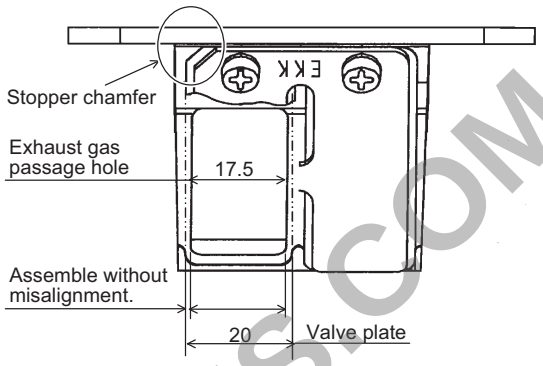


Figure 4-2-110

Precautions for Installation

1. The valve and stopper must be installed in their specific orientations. As shown in the figure above, install the valve and stopper so that they are located on the left-hand side of the lead valve.
2. Install the valve by tightening the machine screw while ensuring that it is evenly positioned inside the case window.
3. The machine screw must be tightened with torque of 1.37 ± 0.2 N·m (14 ± 2 kgf·cm).
4. After tightening the machine screw, mark it with a marker to indicate that it has already been tightened.

Clean EGR Cooler

The EGR cooler must be periodically cleaned every 3000 hours because the exhaust gas passage is subject to carbon deposition and the cooling water transit portion to scale deposition and these depositions gradually deteriorate the cooling of recirculated gas, thus resulting in higher gas temperatures and lower effective circulation amounts (EGR ratio).

To remove deposited carbon from the gas passage, use compressed air (0.19 MPa (2 kg/cm^2) or lower). Then dip the gas passage in carbon cleaner, kerosene, or some other liquid capable of removing carbon; leave it dry and blow it with compressed air again.

To clean the water transit portion, dip it in a solution of descaling detergent diluted with water and wash it.

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4-7-8 Alternator

⚠ WARNING

Shock Hazard!



- **Turn off the battery switch (if equipped) or disconnect the negative battery cable before servicing the electrical system.**
- **Check the electrical harnesses for cracks, abrasions, and damaged or corroded connectors. Always keep the connectors and terminals clean.**
- **Failure to comply could result in death or serious injury.**

Removal of Alternator

1. Disconnect the electrical wires from the alternator.
2. Loosen the V-belt.

⚠ CAUTION

Pinch Hazard!



Carefully rotate the alternator toward the cylinder block while loosening the V-belt. Failure to comply may result in minor or moderate injury.

3. Remove the V-belt adjuster from the alternator bolt **(Figure 4-7-4, (1))**.
4. Remove the nut **(Figure 4-7-4, (2))** from the gear case stud. Remove the alternator.

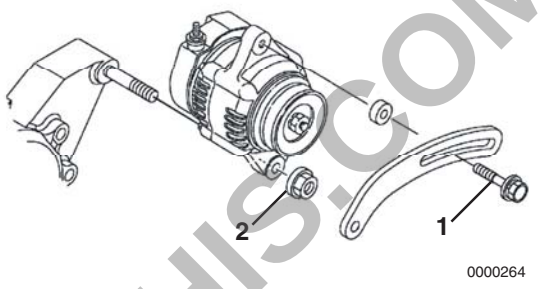


Figure 4-7-4

Disassembly of Alternator

1. Remove the nut **(Figure 4-7-5, (1))** from the shaft of the rotor assembly. Remove the pulley **(Figure 4-7-5, (2))**.

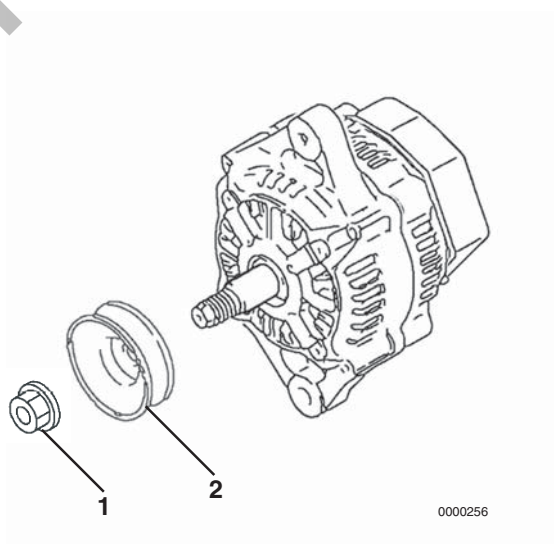


Figure 4-7-5

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Cause \ Symptoms and conditions of failures		Defective start					Engine stall after start			Defective rotation control					Insufficient engine output			Noise/vibration				Lubricant				Cooling water		Intake		Exhaust				Fuel			Electrics/electronics					Action	Referenced page number
		Starter not rotate		Starter rotates			Exhaust fume			Speed change by accelerator not available (constant speed)	Without load			At work	Exhaust color			Knocking noise at combustion too high	Combustion noise uneven	Noise other than combustion from engine	Engine vibration too big	Lubricant consumption too much	Lubricant diluted with fuel	Lubricant mixed with water	Oil pressure too low (oil pressure lamp on)	Overheated (water temperature lamp on)	Water temperature too low	Pressure down (air cleaner lamp on)	Pressure up	At work		Blow-by too much	Exhaust temperature up	Fuel consumption too much	Fuel mixed with water (oil-water separator lamp on)	Fuel filter contaminated too early	Battery charge defect (charge lamp on)	ECU indicator lamp flashing	ECU indicator lamp not on just after key-on (2 seconds)	Prescribed ECU control function not operate	Fuse meltdown, disconnection (repeated)		
		ECU indicator lamp not on just after key-on	ECU indicator lamp on just after key-on (2 seconds)	Engine not start (not even initial combustion)	Engine not start (stall after serial combustion)	Engine starts later then ever	None	Little	Much		Specified speed setting not available	Poor acceleration	Return to low speed not smooth	Hunting	Hunting	Normal	White	Black												White exhaust color	Black exhaust color														
Cooling water system	Radiator super cooled																										○			○				○								Thermostat replacement	*See Disassembly of Engine Coolant Pump on page 4-4-5.*
	Insufficient radiator cooling																○									○					○										Thermostat replacement or check for fan belt loose	*See Disassembly of Engine Coolant Pump on page 4-4-5.*
	Insufficient cooling water quantity																○									○					○										Water leak inspection of cooling water system	*See Engine Coolant System Check on page 4-4-4.*
	Water jacket cracks																							○	○	○															Repair or replacement	*See Disassembly of Engine Coolant Pump on page 4-4-5.*
	Fan belt elongation																○									○					○										Adjustment of belt tension	
	Thermostat fault																○									○	○			○											Inspection or replacement	*See Disassembly of Engine Coolant Pump on page 4-4-5.*
Lubricant system	Incorrect lubricant			○			○								○							○				○					○										Usage of correct lubricant	
	Lubricant system leakage																					○				○															Repair	*See Disassembly of Oil Pump on page 4-5-3.*
	Insufficient discharge rate of trochoid pump																									○															Inspection and repair	*See Disassembly of Oil Pump on page 4-5-3.*
	Lubricant filter clogged																									○					○										Cleaning or replacement	
	Regulator valve fault																									○															Cleaning, adjustment or replacement	*See Disassembly of Oil Pump on page 4-5-3.*
	Insufficient lubricant quantity						○																			○															Replenishment of correct lubricant	
	Excess filling into crankcase																					○				○				○											Engine oil check	
Fuel system	Incorrect fuel														○	○	○		○											○	○		○	○							Usage of correct fuel	
	Water entered into fuel system			○	○				○				○	○		○			○											○			○								Drainage of fuel filter	
	Fuel filter clogged			○		○	○					○			○																									Cleaning or replacement	
	Air entered into fuel system			○	○		○						○	○	○																									Bleeding	
	Fuel pipe clogged, cracked			○			○								○																									Cleaning or replacement	
	Insufficient fuel feeding to fuel supply pump			○	○		○					○			○																									Check of fuel tank cock, fuel filter, fuel pipe, fuel feed pump	
	Priming not available			○																																			Valve in priming pump pinched dust (disassembled cleaning)	*See Fuel System Components on page 4-3-6.*
	Strainer at feed pump inlet clogged					○						○			○																									Cleaning of strainer	
	Sealing defect of fuel tank																																○	○							Check of fuel tank and cap, as well as installation of genuine parts	
Intake	Air filter clogged							○				○					○		○			○						○			○		○								Cleaning of air filter	
	Engine operation at high temperature or high land																○									○		○			○			○							Consideration of matching output reduction with load	
	Exhaust pipe clogged							○				○					○		○											○		○										Cleaning of exhaust pipe	

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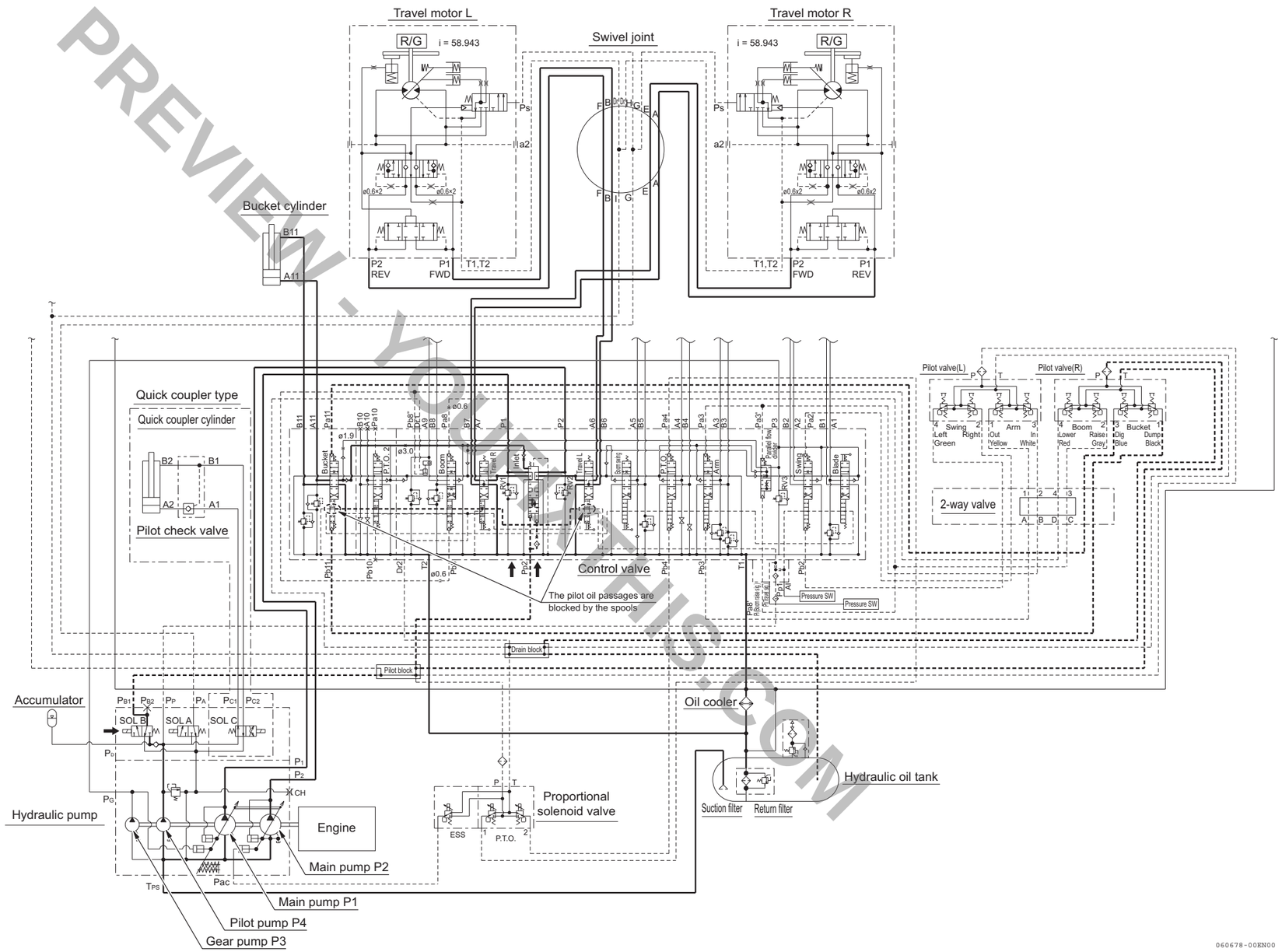
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6-2-9 Non-Deviation Travel (with Bucket Operation)

When the bucket is operated while traveling, the spools of travel and bucket sections are moved, so that the pilot oil passages are blocked at the sections. Consequently, the pilot oil pressure at the port Pp2 of the inlet section raises to move the spool of the inlet section.

Oil Flow from Hydraulic Pump

The oil from the piston pump P1 and that from the piston pump P2 flow through the ports P1 and P2 of the inlet section to the inlet section to dived to the right and left travel sections and bucket section. Therefore, the machine can travel with no deviation even when the bucket control lever is moved while the machine is traveling.



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3. Operation of Directional Control Valves

1) Travel Operation

When the left [right] control lever is pushed forward, the spool is pulled up. The oil from the port P2 [P1] flows to the by-pass passage of the left [right] travel spool through the inlet spool land.

The oil in the by-pass passage of the left [right] travel spool flows to the port A6 [A7], which is opened as the spool has been moved, and is fed to the travel motor.

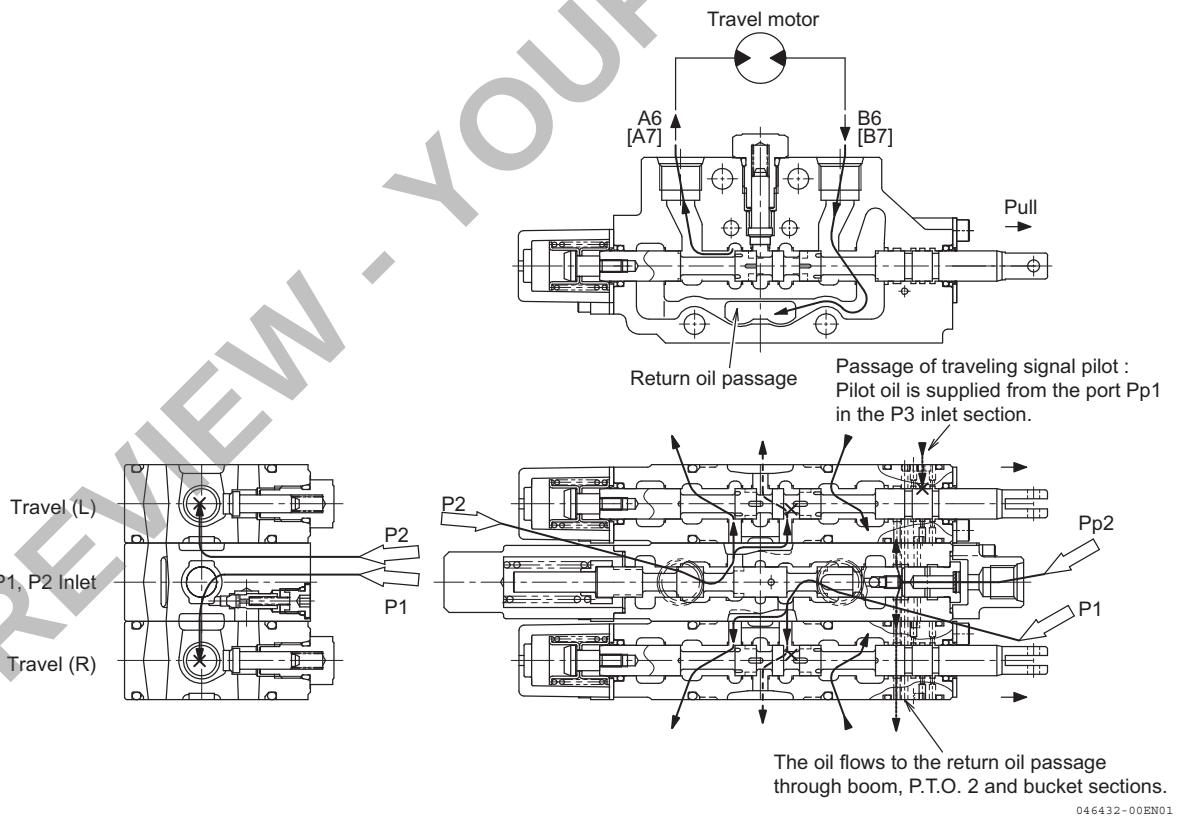
Meanwhile, the return oil from the travel motor flows into the control valve through the port B6 [B7] and flows to the return passage, which is opened as the spool has been moved.

The oil from the port Pp2 flows to the passage of traveling signal pilot through the orifice of the piston in the P1 and P2 inlet section.

The passage opened when the travel section spool is in the neutral position is blocked by its movement, but as long as the bucket section spool is not moved, the pressure in the passage of traveling signal pilot equals to that in the return oil passage because both the passages are connected in the bucket section and the P1, P2 inlet section spool does not move.

Note :

The words in brackets are for the right travel operation.



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4)-3. Reinstallation of relief valves

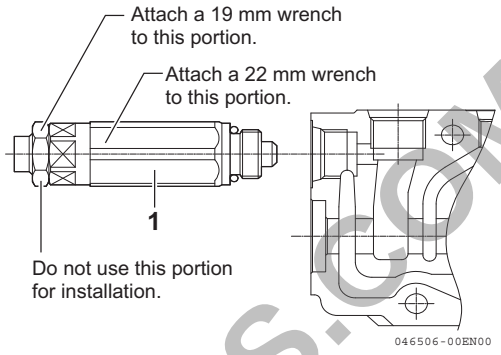
(1) Reinstallation of circuit relief valves and system relief valves

Taking the arm section as an example, the relieve valve installation procedure is described below.

[1] Install and tighten circuit relief valve **1** to the specified torque with a wrench or a socket wrench (22 mm).

Note:

- *Attach a wrench (or socket wrench) to the 22 mm hexagonal portion of the body.*
- *If a 22 mm wrench (or socket wrench) is not available, use a 19 mm wrench on the hexagonal portion shown in the figure on the right to tighten the valve.*



Installation of circuit relief valve

WARNING:

Be careful not to damage the seat portion of the socket protruding from the end face of the circuit relief valve when installing it into the valve body.

If the seat portion is damaged, internal leaks can occur and the corresponding attachment may not be held in place.

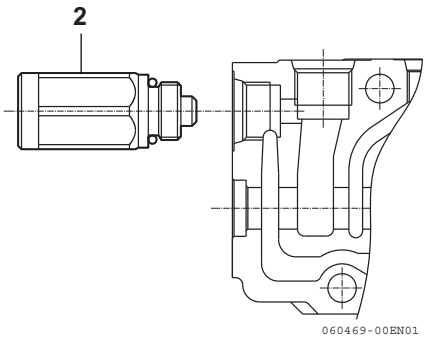
When installing the relief valve using a 19 mm wrench, be sure not to attach it on the lock nut.

If the lock nut is turned, the adjust screw is turned with it resulting in changes in the preset value and this may cause a decrease in performance or breakage of the machine.

(2) Reinstallation of anti-cavitation valve

Taking the boom swing section as an example, the anti-cavitation valve installation procedure is described below.

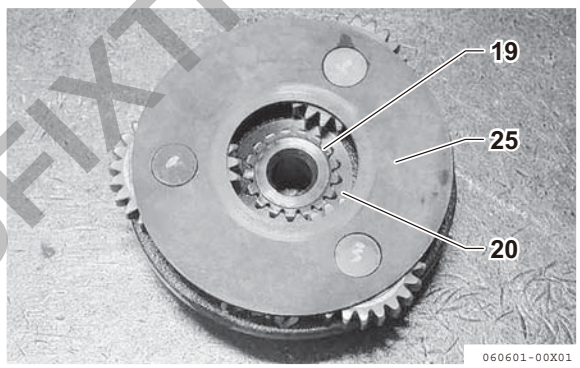
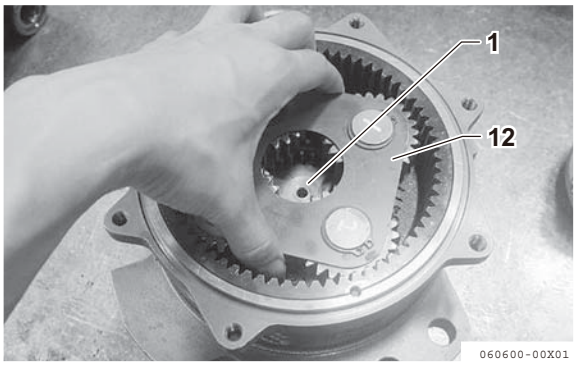
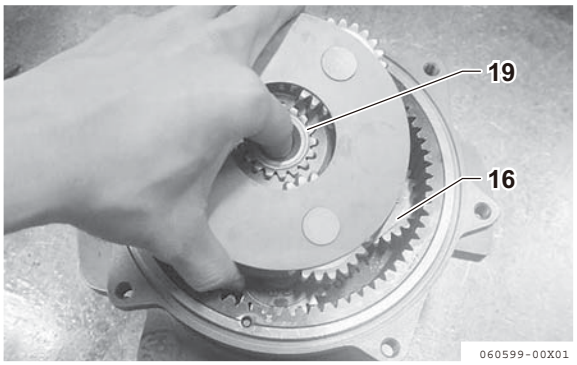
[1] Install and tighten anti-cavitation valve **2** with a wrench (22 mm) or hexagon bar wrench (8 mm).



Installation of anti-cavitation valve

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Procedure	
(22) Install gears b2 **24** and rollers 2 **23** in this order on carrier 2 **20**. ***Note:*** • *Gears b2 **24**: 3 pcs* • *Rollers 2 **23**: 24 pcs per gear b2*	
(23) Install gears S1 **19** and thrust plates 2 **25** onto carrier 2 **20** to form carrier 2 assembly.	
(24) Align carrier 1 assembly **12** to spline of pinion shaft **1** in this order to assemble them.	
(25) Install carrier 2 assembly so as for gear S1 **19** to engage gears b1 **16**.	

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6. Servicing Standards

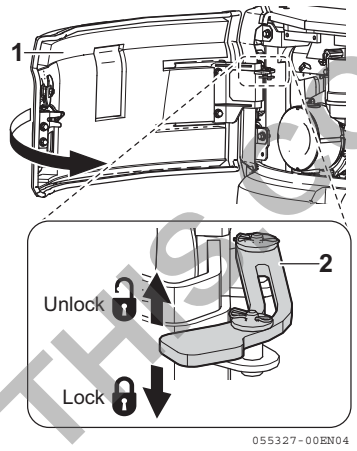
Clean all disassembled parts with cleaning oil and dry them with compressed air. Then, inspect them based on the criteria shown below and take necessary corrective actions such as replacement or repair.

No.	Part	Inspection Item	Criteria [Recommended value for replacement]	Measures
1	Floating seal **1-2**	Sliding surface	No excessive flaws, wear or seizure	Replace.
2	Angular bearing **1-3**	Rolling surface	No excessive flaws, wear or flaking in ball or race	Replace.
3	Housing **1-6**	Gear tooth surface	No excessive flaws, wear or flaking on tooth surface. [More than 10 % pitting in the engaged area of a tooth surface]	Replace.
4	Planetary gears A **1-18** and B **1-9**	Gear tooth surface Rolling surface of needle bearing	Same as No. 3. No excessive flaws, wear or flaking on rolling surface	Replace.
5	Needle bearings **1-10**, **1-19**	Needle bearing surface	No excessive flaws, wear or flaking	Replace.
6	Inner races **1-11**, **1-20**	Needle bearing surface	No excessive flaws, wear or flaking	Replace.
7	Thrust washers **1-12**, **1-16**	Sliding surface	No excessive flaws, wear or seizure	Replace.
8	Thrust plates **1-13**, **1-23**	Sliding surface	No excessive flaws, wear or seizure	Replace.
9	Sun gears **1-15**	Gear tooth surface	Same as No. 3.	Replace.
10	Holder **1-17**	Sliding surface against planetary gear A	No excessive flaws, wear or seizure	Replace the planetary gear A and the holder together.
11	Drive gear **1-22**	Gear tooth surface	Same as No. 3.	Replace.
12	O-rings **1-25**, **1-28**, **28**, **29**, **31-5**, **39**, **44**, **50-5**, **50-6**, **50-7**, **57**, **65**, **66**, **74**	Surface condition and hardness	No flaws or distortion Not hardened.	Rubber seal members deteriorate with the lapse of time. Replacement with new seals is recommended every time they are reassembled.
13	Shaft **2**	Oil seal surface	No flaws or excessive wear	Replace.
14	Ball bearing **3**, **27**	Same as No. 2.	Same as No. 2.	Replace.
15	Oil seal **4**	Lip surface and hardness	No flaws, distortion or excessive wear Not hardened.	Replace.
16	Swash plate **5**	Sliding surface against piston ASSY Surface roughness	No excessive flaws [over 0.00079 in. (0.02 mm)], wear or seizure 0.4a [0.8a]	When the sliding surface has been roughened, repair it by lapping (#1000). Replace if the damage is beyond repair.

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

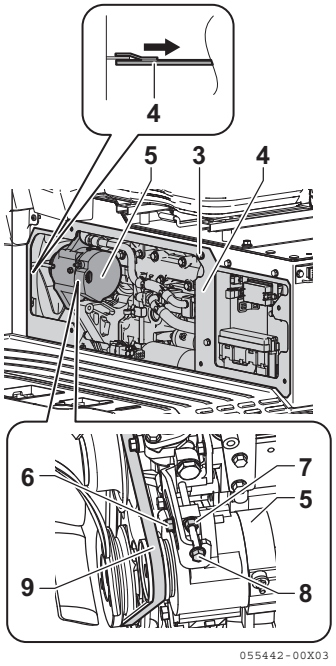
1) Removal

Procedure	
(1) Open engine hood rear cover **1** and secure it with stopper **2**.	

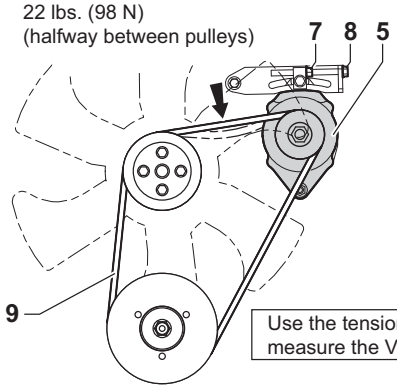
(2) Open seat mount cover, remove six bolts **3** and remove cover **4** by moving it slightly to right.

(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**.



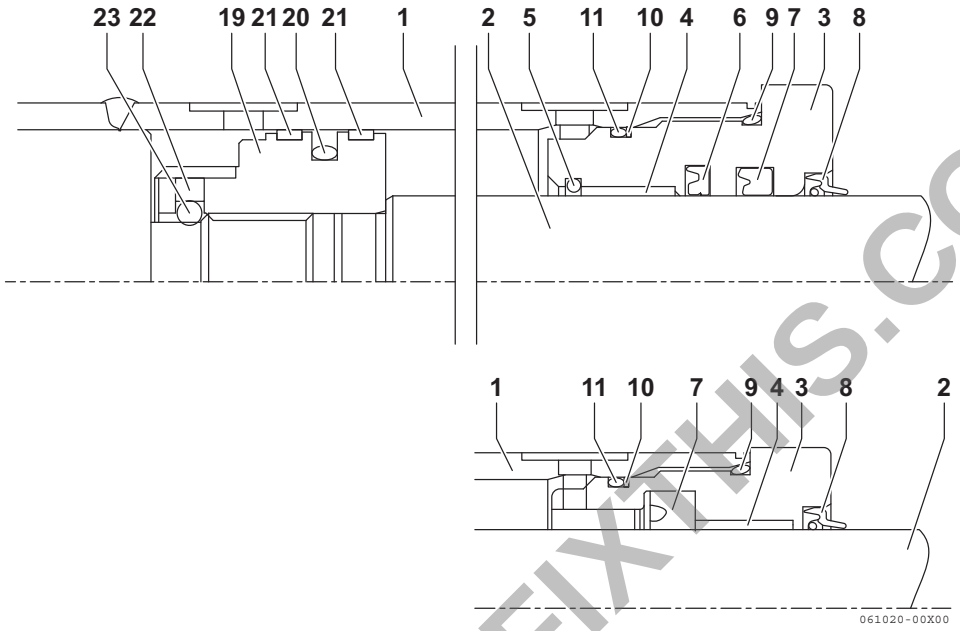
Pressing force:
22 lbs. (98 N)
(halfway between pulleys)



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Bucket cylinder, boom swing cylinder and blade cylinder



No.	Part	Bucket	Boom Swing	Blade
1	Cylinder tube	○	○	○
2	Cylinder rod	○	○	○
3	Head	○	○	○
4	Head bushing	○	○	○
5	Snap ring	○	—	—
6	Buffer ring	○	—	—
7	U-ring	○	○	○
8	Dust wiper ring	○	○	○
9	O-ring	○	○	○
10	Back-up ring	○	○	○
11	O-ring	○	○	○
19	Piston	○	○	○
20	Seal ring	○	○	○
21	Slide ring	○	○	○
22	Plug screw	○	○	○
23	Steel ball	○	○	○

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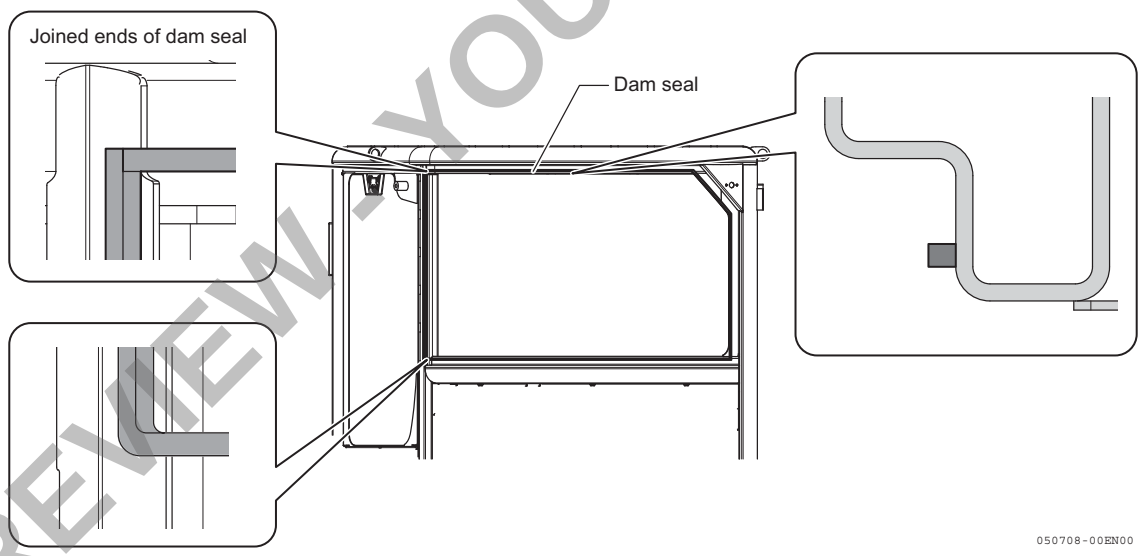
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5. Attachment of glass (Rear glass)

1) Installation of dam seal and application of primer

Key points for procedure

- Clean the surface where the dam seal is to be installed using white gasoline to remove grease and foreign matter such as dust.
- Join both ends of the dam seal in the upper left corner.
- Install the dam seal on the upper and lower pipes and left-side pipe along the starting point of the rounded corner's curve of each pipe to leave a sufficient area for applying adhesive. (See the enlarged view shown to the right of the figure below.)
- For other parts of the dam seal installation area, install the seal on the frame along the outer edge.
- During installation of the dam seal, be careful not to touch the surface of the frame where the primer is to be applied to prevent contamination.
- Do not stretch the dam seal too much during installation because it can become loose over time and come off the cabin frame easily.
- Use SUNSTAR Paint Primer 435-95.
- Apply the primer to the surface of the frame along the dam seal with a cotton swab or the like. The primer application width should be approximately 0.4 in. (10 mm).
- Be careful that the primer does not protrude outside the application area and that excess primer does not drip off.



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