YANMAR

SERVICE MANUAL

EXCAVATOR

SV100-2A (YCEE)

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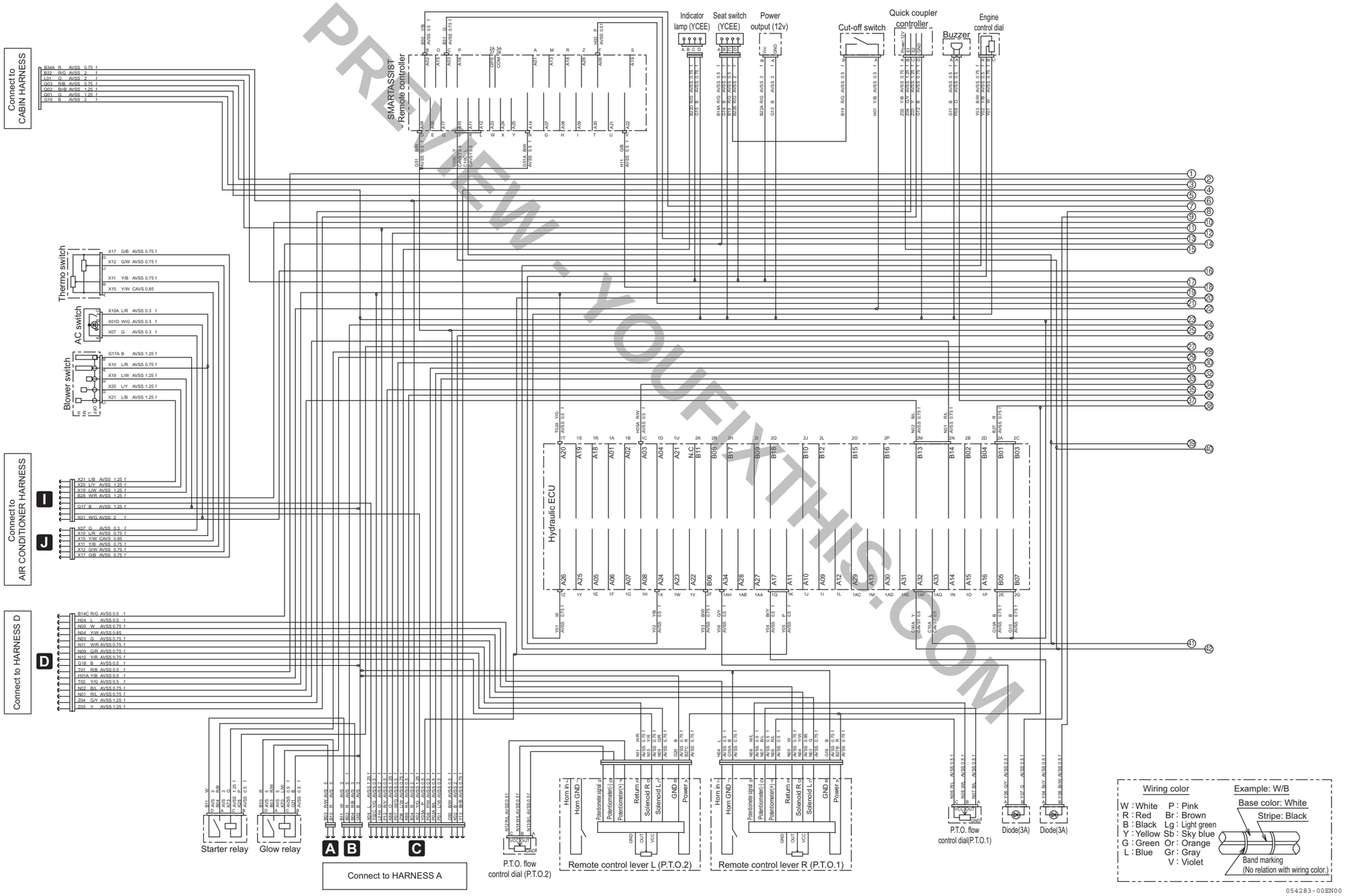
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1) Harness B

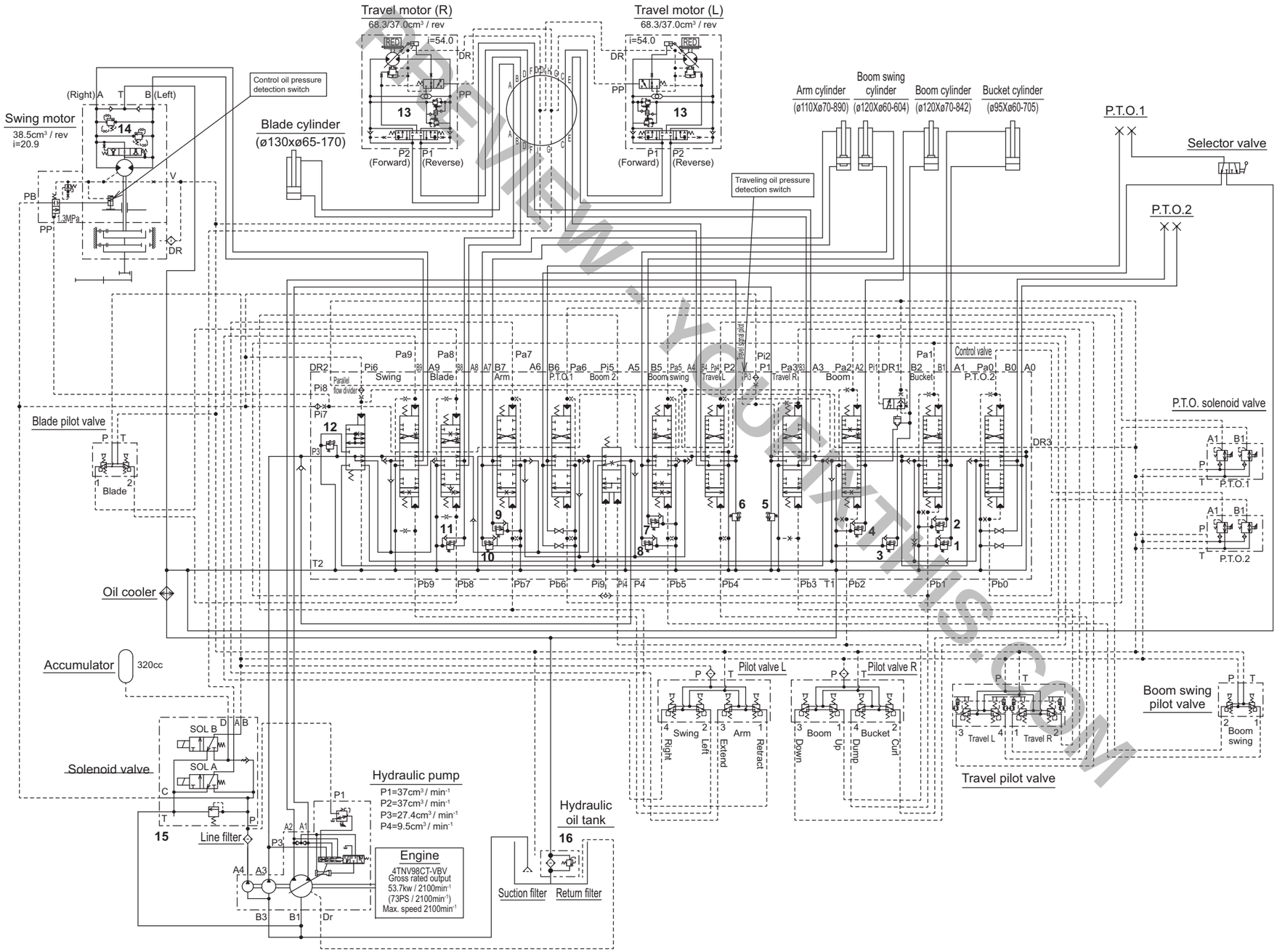
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2-8 Hydraulic Circuit Schematic



Relief valve set pressure

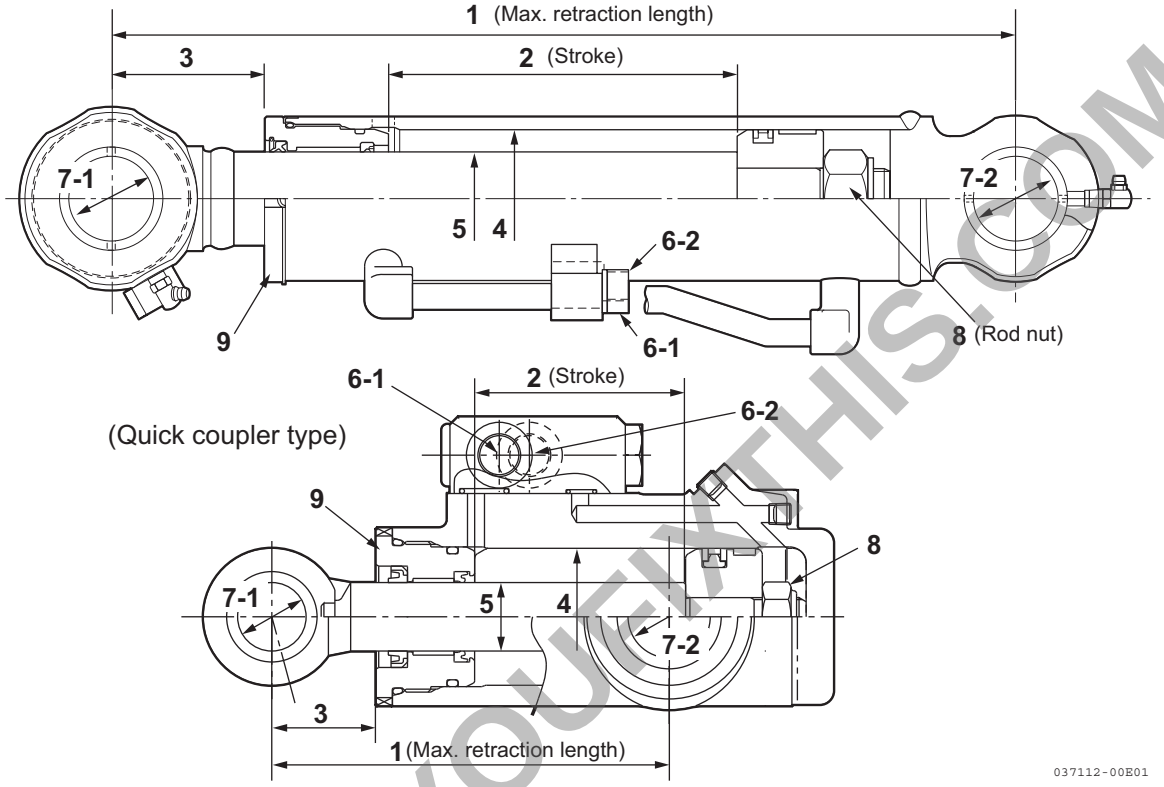
No.	PSI	MPa
1	4496	31.0
2	4496	31.0
3	4496	31.0
4	4496	31.0
5	3989	27.5
6	3989	27.5
7	4496	31.0
8	4496	31.0
9	4496	31.0
10	4496	31.0
11	2176	15.0
12	3481	24.0
13	3989	27.5
14	3553	24.5
15	426	2.94
16	21	0.147

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3-5 Hydraulic Equipment

3-5-1 Hydraulic Cylinders



Unit : in. (mm)

No. \ Cylinder		Boom	Arm	Bucket	Boom swing	Blade	Quick coupler
1		51.6 (1310)	52.2 (1326)	42.8 (1087)	42.2 (1071)	32.7 (831)	9.1 (232)
2		33.1 (842)	35.0 (890)	27.8 (705)	23.8 (604)	6.69 (170)	3.22 (82)
3		4.21 (107)	4.45 (113)	4.02 (102)	5.77 (146.5)	14.4 (365.5)	2.24 (57)
4		Ø4.72 (Ø120)	Ø4.33 (Ø110)	Ø3.74 (Ø95)	Ø4.72 (Ø120)	Ø5.12 (Ø130)	Ø3.15 (Ø80)
5		Ø2.76 (Ø70)	Ø2.76 (Ø70)	Ø2.36 (Ø60)	Ø2.36 (Ø60)	Ø2.56 (Ø65)	Ø1.77 (Ø45)
6-1 (Rod side)		G1/2	G1/2	G1/2	G3/8	G3/8	G1/4
6-2 (Bottom side)		G1/2	G3/4	G3/4	G3/8	G1/2	G1/4
7-1	Standard	Ø2.76 (Ø70)	Ø2.36 (Ø60)	Ø2.36 (Ø60)	Ø2.36 (Ø60)	Ø2.36 (Ø60)	Ø1.77 (Ø45)
	Allowable limit	Ø2.80 (Ø71)	Ø2.40 (Ø61)	Ø2.40 (Ø61)	Ø2.40 (Ø61)	Ø2.40 (Ø61)	Ø1.81 (Ø46)
7-2	Standard	Ø2.76 (Ø70)	Ø2.36 (Ø60)	Ø1.97 (Ø50)	Ø2.36 (Ø60)	Ø2.36 (Ø60)	Ø1.77 (Ø45)
	Allowable limit	Ø2.80 (Ø71)	Ø2.40 (Ø61)	Ø2.01 (Ø51)	Ø2.40 (Ø61)	Ø2.40 (Ø61)	Φ1.81 (Φ46)
8	Thread size (mm)	M55	M52	M45	M42	M48	M27
	Width across flat	3.35 (85)	3.15 (80)	2.76 (70)	2.56 (65)	2.95 (75)	1.61 (41)
	Tightening torque ft•lbf (N•m)	2441 to 2744 (3310 to 3720)	2921 to 3267 (3960 to 4430)	1822 to 2043 (2470 to 2770)	1775 to 1847 (2404 to 2502)	2607 to 2680 (3532 to 3630)	542 to 615 (735 to 833)
	Screw locking agent	-	-	-	Three Bond 1324	Three Bond 1324	Three Bond 1324
9	Thread size (mm)	M127	M117	M102	M125	M135	M85
	Tightening torque ft•lbf (N•m)	603 to 961 (817 to 1303)	474 to 756 (643 to 1025)	603 to 961 (817 to 1303)	1033 to 1048 (1400 to 1470)	1180 to 1239 (1600 to 1680)	590 to 620 (800 to 840)
	Screw locking agent	Three Bond 1901	Three Bond 1901	Three Bond 1901	-	-	-

Symbol	Name
G (PF)	Straight pipe thread
R (PT)	Taper pipe thread (male)
Rc (PT)	Taper pipe thread (female)

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3-7 List of Tightening Torque

3-7-1 Machine

Applicable model			SV100-2A		
Equipment			Thread size	Tightening torque ft•lbf (N•m)	Adhesive
	No	Tightening part			
Engine / Electrical equipment					
	1	Engine mount vibroisolating rubber	M16 × 130	195.3 to 224.2 (264.8 to 304)	Three Bond 1324
	2	Engine × Engine mount F (Radiator side)	M10 × 35 (11T)	61.4 (83.3)	Three Bond 1324
	3	Engine × Engine mount R (Flywheel side)	M12 × 30 (10.9)	79.7 to 94.4 (108 to 128)	Three Bond 1324
	4	Air cleaner	M8 × 20	14.5 to 16.7 (19.6 to 22.6)	-
	5	Air cleaner intake hose (Engine side)	Hose clip 70	1.8 to 2.5 (2.5 to 3.4)	-
	6	Air cleaner intake hose (Air cleaner side)	Hose clip 90	1.8 to 2.5 (2.5 to 3.4)	-
	7	Air cleaner intake hose (Air cleaner intake side)	Hose clip 90	0.9 to 1.1 (1.2 to 1.5)	-
	8	Cooling water hose	Hose clip 48	1.8 to 2.5 (2.5 to 3.4)	-
	9	Fuel gauge unit	M5×12 (Pan-head machine screw)	0.87 to 1.08 (1.18 to 1.47)	-
	10	Fuel tank × Bracket SWP × Clamp	M8 × 16	9.4 to 12.3 (12.8 to 16.7)	-
	11	Fuel drain valve	R3/8	14.5 to 21.7 (19.6 to 29.4)	Sealing tape Loctite 577
	12	Fuel tank holding band (Tank holding (upper) side)	Nut 10	1.8 to 2.1 (2.5 to 2.9)	-
	13	Fuel tank holding band (Lock nut (lower) side)	Nut 10	18.1 to 23.9 (24.5 to 32.4)	-
	14	Fuel tank bracket L × Frame	M10 × 30	32.5 to 43.4 (44.1 to 58.9)	Three Bond 1324
	15	Battery holding rod (Battery holding side)	Nut 8	2.2 (2.94)	-
	16	Battery holding rod (Lock nut side)	Nut 8	9.4 to 12.3 (12.8 to 16.7)	-
	17	LCD monitor × Panel	M5 × 20	1.88 to 2.43 (2.55 to 3.3)	-
	18	Air conditioner hose joint	M6 × 20	5.9 to 8.9 (8 to 12)	-
	19	Air conditioner hose × Receiver dryer	M6 × 25	5.9 to 8.9 (8 to 12)	-
	20	Air conditioner hose × Condenser (Condenser upper side)	M22 × 1.5(Hose joint)	14.8 to 18.4 (20 to 25)	-
	21	Air conditioner hose × Condenser (Condenser lower side)	M16 × 1.5(Hose joint)	8.9 to 11.1 (12 to 15)	-
	22	Air conditioner hose × Compressor	M8 × 25	14.8 to 18.4 (20 to 25)	-
	23	Safety switch (Cut-off lever)	Nut 18 (Fine thread)	21.7 to 25.3 (29.4 to 34.3)	-
	24	Engine control dial	Nut 9 (Fine thread)	1.08 or less (1.47 or less)	-

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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 4-2-2, (1))**.

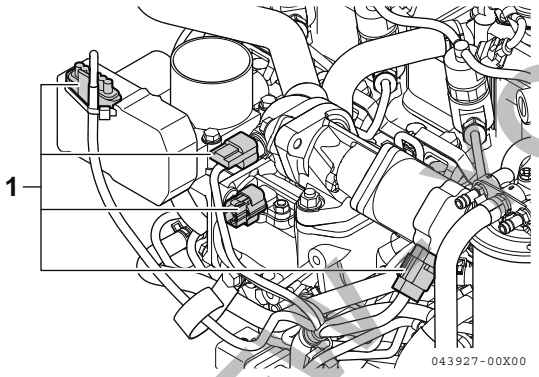


Figure 4-2-2

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 4-2-3, (1))**. Remove the intake manifold **(Figure 4-2-3, (2))**. Discard the intake manifold gasket **(Figure 4-2-3, (3))**.

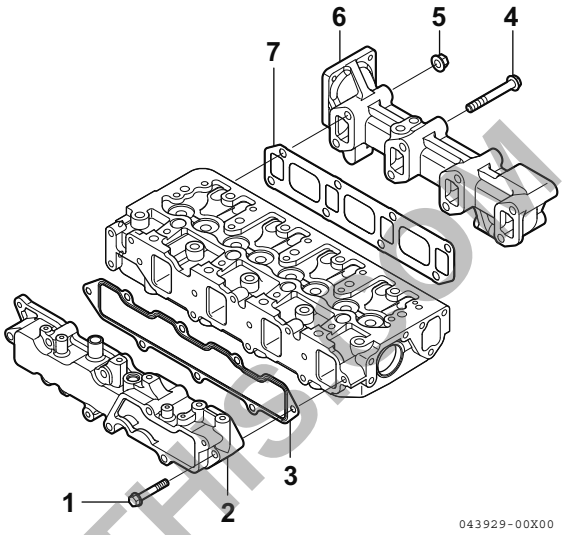


Figure 4-2-3

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 4-2-3, (4))** and nuts **(Figure 4-2-3, (5))**. Remove the exhaust manifold **(Figure 4-2-3, (6))** and the exhaust manifold gasket **(Figure 4-2-3, (7))**.
9. Remove the coolant pump. *See Disassembly of Engine Coolant Pump on page 4-4-6.*
10. Remove the high-pressure lines and fuel injectors from the cylinder head. *See Removal of Injector on page 4-3-8.*

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8-2 Quick Reference Table for Troubleshooting

The following table summarizes the general trouble symptoms and their causes.
If any trouble symptom occurs, take corrective action before it becomes a serious problem.

Trouble symptoms are shown in columns and their causes are shown in rows.

Whether boxes where the column and rows intersect are marked with a circle should be checked.

Example: When the bucket does not move at all

Trouble symptom: Implement does not move at all. (Bucket)

Items relevant to causes whose corresponding boxes are marked with a circle must be inspected and repaired.

Symptoms and conditions of failures / Cause		Implement does not move at all										Implement's force			
		All implements	Boom	Arm	Bucket	Boom swing	Swing	Blade	Travel R	Travel L	P.T.O.	Boom	Arm	Bucket	Boom swing
1. Hydraulic pump	Hydraulic pump ASSY	○													
	Piston pump P1			○		○				○	○		○		○
	Piston pump P2		○		○				○			○		○	
	Gear pump P3						○	○							
	Pilot pump P4		○	○	○	○	○		○	○	○	○	○	○	○
	Cut-off valve	○	○	○	○	○	○		○	○	○	○	○	○	○
	Travel speed switch valve														
2. Control valve	Sections related to P1 flow														
	Sections related to P2 flow														
	Sections related to P3 flow														
	Boom section		○									○			
	Arm section			○									○		
	Bucket section				○									○	
	Boom swing section					○									○
	Blade section							○							
	Swing section						○								
	Travel R section								○						

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2. TECHNICAL DATA

2. Technical Data

2-1 Specifications

Item				Unit	SV100-2A
Main specifications of machine					
Dimensions					
Overall length (Transportation position)				in. (mm)	251.6 (6390)
Cabin		Overall height	Transportation position	in. (mm)	110.6 (2810)
			Traveling position	in. (mm)	110.6 (2810)
		Overall width	Full machine width	in. (mm)	91.3 (2320)
Canopy		Overall height	Transportation position	in. (mm)	-
			Traveling position	in. (mm)	-
		Overall width	Full machine width	in. (mm)	-
Tumbler center distance (steel / rubber)				in. (mm)	93.0 (2362) / 92.7 (2354)
Track gauge				in. (mm)	73.6 (1870)
Minimum ground clearance				in. (mm)	17.7 (450)
Traveling performance					
Travel speed		Steel crawler	Low speed (Forward/Reverse)	MPH (km/hr)	1.4 (2.2)
			High speed (Forward/Reverse)	MPH (km/hr)	2.5 (4.0)
		Rubber crawler	Low speed (Forward/Reverse)	MPH (km/hr)	1.6 (2.5)
			High speed (Forward/Reverse)	MPH (km/hr)	2.7 (4.4)
Permissible water depth limit				in. (mm)	23.6 (600)
Work performance					
Bucket		Width (Standard) *including side cutter		in. (mm)	31.50 (800)
		[Standard. JIS heaped capacity]		cu.ft. (cu.m)	10.6 (0.30)
		Number of teeth / Installation method		pcs.	4 / rubber pin lock type
Maximum digging depth		With blade raised		in. (mm)	168.9 (4290)
		With blade on the ground		in. (mm)	179.9 (4570)
Maximum depth of vertically digging				in. (mm)	152.4 (3870)
Maximum dumping height				in. (mm)	202.4 (5140)
Minimum front swing radius (with boom in front)			Cabin	in. (mm)	97.6 (2480)
			Canopy	in. (mm)	-
Minimum front swing radius (at boom swing)			Cabin	in. (mm)	83.1 (2110)
			Canopy	in. (mm)	-
Rear end swing radius				in. (mm)	52.4 (1330)
Boom swing angle		Cabin	Left	degrees	60
			Right	degrees	60
		Canopy	Left	degrees	-
			Right	degrees	-
Maximum digging force			Bucket	lbs. (k•N)	15388 (68.5)
			Arm	lbs. (k•N)	10296 (45.8)
Maximum tractive force			steel	lbs. (k•N)	16928 (75.3)
			rubber	lbs. (k•N)	16838 (74.9)
Maximum swing inclination angle (with standard bucket)				degrees	18.2
Swing speed				rpm	9.1
Fuel consumption in practical operation			Maximum idling speed	Gals/h (L/h)	2.4 (8.9)
			Eco mode	Gals/h (L/h)	2.0 (7.6)

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2-7 Fuel, Lube Oil and Grease Recommended

Item	Recommended type	Capacity
Fuel oil	Diesel fuel oil (Ultra low sulfur)	30.4 Gals. (115 L)
Engine oil	SAE 10W30, CJ-4 class	11.8 Qts. (11.2 L)
Hydraulic oil	ISO VG46	In the tank: 15.8 Gals. (60 L) Other parts: 14.5 Gals. (55 L)
Travel reduction gear oil	Gear oil SAE90 (GL-4)	2.22 Qts. (2.1 L) each
Idler	Engine oil SAE 30, CC class	0.159 Qts. (0.15 L)
Track roller		0.159 Qts. (0.15 L)
Carrier roller	Lithium soap group (extreme pressure type) multi-purpose grease NLGI No.2	0.11 Qts. (0.1 L)
Cooling water	YANMAR genuine long-life coolant (LLC) 51 % added water	Radiator: 10.7 Qts. (10.2 L) Subtank: 0.4 Qts. (0.4 L)
Grease	Lithium soap group (extreme pressure type) multi-purpose grease NLGI No.2	

Mixture ratio of cooling water and antifreeze

Lowest temperature		°F (°C)	5 (-15)	-4 (-20)	-13 (-25)	-22 (-30)	-31 (-35)	-40 (-40)
SV100-2A	Amount of anti-freeze	Qts. (L)	3.38 (3.2)	3.91 (3.7)	4.44 (4.2)	5.07 (4.8)	5.60 (5.3)	6.13 (5.8)
	Amount of water	Qts. (L)	7.82 (7.4)	7.29 (6.9)	6.76 (6.4)	6.13 (5.8)	5.60 (5.3)	5.07 (4.8)

Note :

At the delivery, water and antifreeze are mixed at the ratio for -31 °F (-35 °C) temperature above.

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2-6 Periodic Inspection and Servicing

List of 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		◇	◇ 1st time		◇					
	Clean & check the cooling water system, and replace the cooling water							● within one year			
Rubber hose	Check & replace fuel oil pipe, cooling water pipe		◇							●	
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	●				
	Replace line filter							●			
	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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1. GENERAL CAUTIONS FOR MAINTENANCE WORK

1. General Cautions for Maintenance Work

1-1 Correct Work

Correct work means the quickest possible completion of according to the correct procedures and the specified standards.

It is important when conducting certain operations always to bear in mind the equipment, tools, gauges, materials, oil and grease, etc. that you must have ready, as well as items to be checked, adjusted, or disassembled, and cautions to watch out for.

1-2 Safety Precautions

(1) Never attempt servicing while engine is running or immediately after stopping operation.
(2) Wear work cloths, safety shoes and helmet.
(3) Check the equipment and tools before use. Especially, be sure to check the crane, lifting equipment and tools.
(4) When working together with other persons, allocate everyone's share of job, arrange the signals and act in concert with the other persons.
(5) The operation of the crane and slinging work must be performed by qualified persons.
(6) Do not enter or pass under the raised load.
(7) Lift and support the massive parts by crane before removing the installation bolts.
(8) Disconnect cables from battery before repairing the electric system.
(9) Remove the battery when welding the machine.

1-3 Preparations

(1) Check the service record of the machine. (That is, check how many months or hours the machine has been used since the preceding overhaul, what was the trouble then and what parts were replaced.)
(2) Have all servicing tools ready, i.e., tools, measuring devices (which have received periodic maintenance), containers, oil & grease, etc.
(3) Have the service literature (operation manual, parts catalog, etc.) ready.

1-4 Cautions for Disassembly and Reassembly

(1) Clean the machine before disassembly.
(2) Check and record the condition of the machine before disassembly :
  • Model, machine number, operation hours
  • Reasons for repair, history of repair
  • Contamination of filters
  • Fuel and oil condition
  • Damage to parts, etc.
(3) Place alignment marks on the necessary parts to facilitate reassembly.
(4) Clean all the removed parts and new replacement parts and put them in order.
(5) Use new seals, split pins, etc. for reassembly.

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Applicable model				4TNV98CT-VBV	
Item			Unit	Standard	Allowable limit
Others					
	Thermostat	Valve opening temperature	degree F (degree C)	157 to 163 (70 to 73)	-
		Full opening lift temperature	in. (mm)	0.32 (8) or above [at 185 degree F (85 degree C)]	-

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1 – Cylinder block
2 – Camshaft bushing
3 – Gear case
4 – Gear case cover
5 – Front crankshaft seal
6 – Tappets
7 – Camshaft
8 – Camshaft gear key
9 – Camshaft end plate
10 – Camshaft gear
11 – Idler gear shaft (A)
12 – Idler gear (A)
13 – Idler gear bushing (A)
14 – Idler gear plate (B)
15 – Idler gear shaft (B)
16 – Idler gear (B)
17 – Idler gear bushing (B)
18 – Oil pickup gasket
19 – Oil pickup
20 – Crankshaft
21 – ball
22 – Crankshaft gear key
23 – Crankshaft gear
24 – Crankshaft pulley
25 – Main bearing inserts
26 – Main bearing cap
27 – Oil pan spacer
28 – Oil pan
29 – Thrust bearings
30 – Flywheel
31 – Connecting rod cap
32 – Connecting rod bearing inserts
33 – Connecting rod
34 – Wrist pin bushing
35 – Circlip
36 – Wrist pin
37 – Piston
38 – Oil ring
39 – Second compression ring
40 – Top compression ring
41 – Crankshaft rear seal housing
42 – Crankshaft rear seal

Disassembly of Engine

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

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.

If the engine will be completely disassembled, the following preliminary steps should be performed:

1. Disconnect the battery cables at the battery. Always disconnect the negative (-) cable first.
2. Remove the throttle cable, electrical connections, intake and exhaust system connections, and fuel supply lines from the engine.
3. Remove the alternator. *See Removal of Alternator on page 4-8-7.*
4. Drain the engine coolant from the radiator and cylinder block. Remove the cooling system components from the engine.
5. Remove the engine from the machine. Mount the engine to a suitable engine repair stand having adequate weight capacity.

   NOTICE

   Be sure to secure the engine solidly to prevent injury or damage to parts due to the engine falling during work on the engine.

   ---

6. Clean the engine by washing with solvent, air or steam cleaning. Carefully operate so as to prevent any foreign matter or fluids from entering the engine or any fuel system or electrical components remaining on the engine.
7. Drain the engine oil into a suitable container. Remove the oil filter.
8. Remove the cylinder head. *See Cylinder Head on page 4-2-7*.

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4-5-3 Lubrication System Diagram

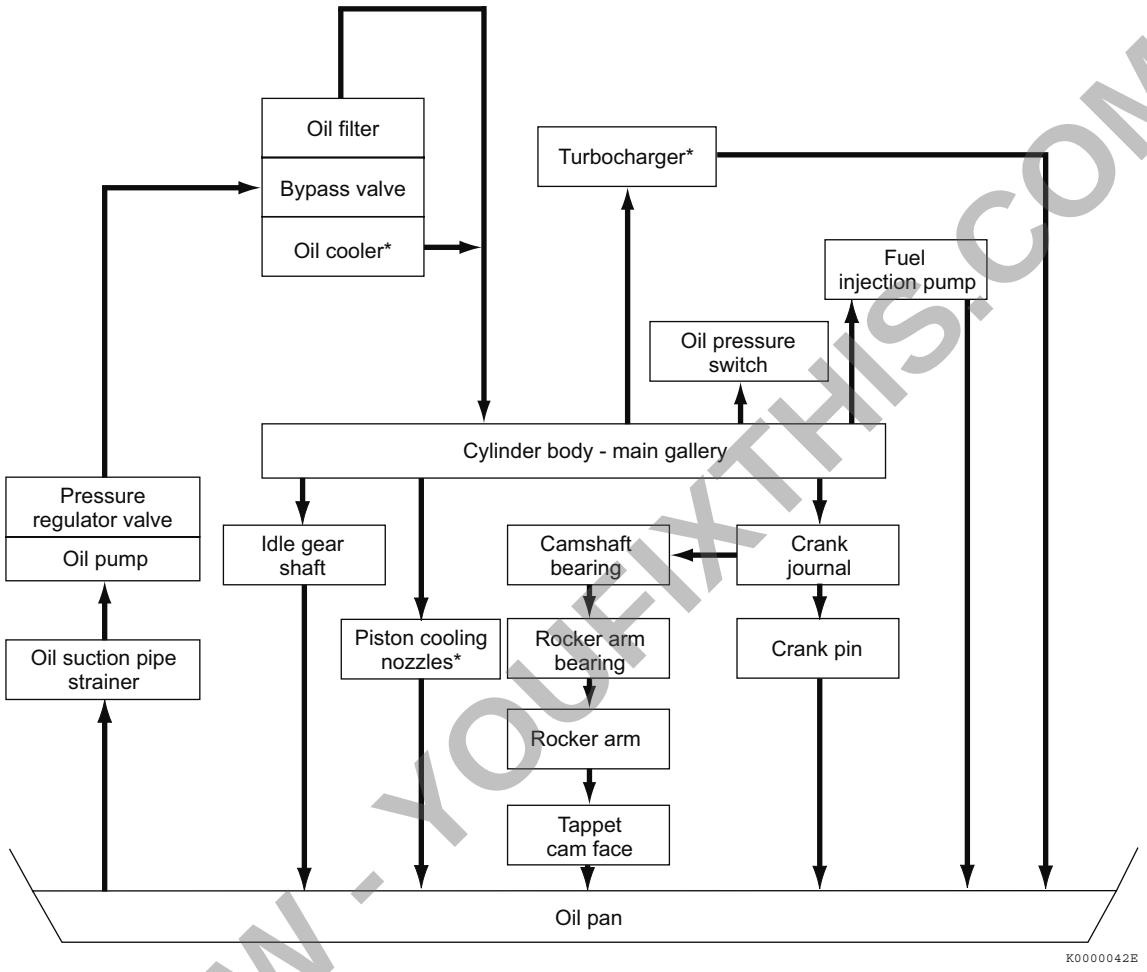


Figure 4-5-1

Note: Items marked are not standard equipment on all models.*

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■ How to reattach the DPF

DPF flywheel housing-mounted type

This procedure shows how to install a new DPF assembly. In principle, the procedure is the reverse of that for removal. First, reattach the removed sensor unit to the DPF assembly.

1. Reattachment of the exhaust temperature sensor

- On two locations on the removed exhaust temperature sensor, attach the 17 mm bolt in one location, and the 13 mm bolt in the other.

Tightening torque	40 ± 5 N·m

- Tighten the 2 loosened exhaust temperature sensor harness bands.

2. Reattachment of the exhaust pressure pipe

- Reattach the removed exhaust pressure pipe (2 pcs.). At this time, replace the pipe joint bolt, the gasket, and the hose with new ones. As a guideline, replace the exhaust pressure hose every 3000 hours.
- When tightening the pipe joint bolt, apply anti-seize compound to the threaded sections.

M12 pipe joint bolt tightening torque	29.4 ± 5 N·m

3. Reattachment of the sensor bracket

- Reattach the removed sensor bracket to the SF stiffener. (M8 flange bolts (2 pcs.))

This completes the DPF unit.

Repair parts required for reinstallation of the exhaust differential pressure sensor are shown on *page 4-9-20*.

4. Reattachment of the DPF unit

- First, slightly loosen the flange bolts (2 pcs.) **(Figure 4-9-28, (2))** that attach the DPF stay **(Figure 4-9-28, (1))** and the stiffener so that these have some play.
- Replace the exhaust manifold flange gasket with a new one, and attach the DPF unit to the exhaust manifold stud bolt.
- Temporarily tighten the DPF assembly central stay M10 bolts (2 pcs.) **(Figure 4-9-28, (3))**.
- Seat the exhaust manifold flange **(Figure 4-9-28, (4))** using M8 flange nuts (4 pcs.), and temporarily tighten.
- Fully tighten the central stay M10 bolts **(Figure 4-9-28, (3))**.
- Fully tighten the flange nuts (4 pcs.) on the exhaust manifold flange.
- Fully tighten the M10 flange bolts (2 pcs.) **(Figure 4-9-28, (5))** of the DPF stay on the flywheel housing side.
- Fully tighten the DPF stay M8 flange bolts (2 pcs.) **(Figure 4-9-28, (2))**.

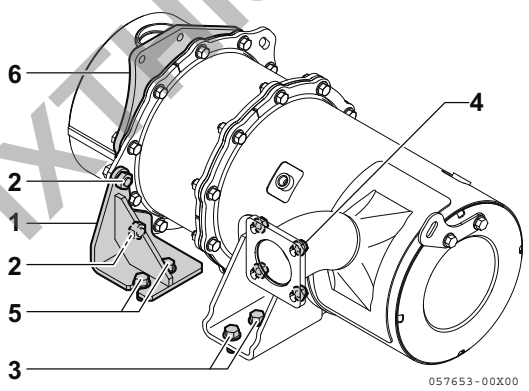


Figure 4-9-28

M8 tightening torque	26 ± 5 N·m (Nut: 16 ± 5 N·m)
M10 tightening torque	49 ± 5 N·m

5. Driven machine wiring

- Connect the exhaust pressure sensor to the sensor bracket and the wiring from the engine or driven machine to the exhaust temperature sensor couplers (2 pcs.).

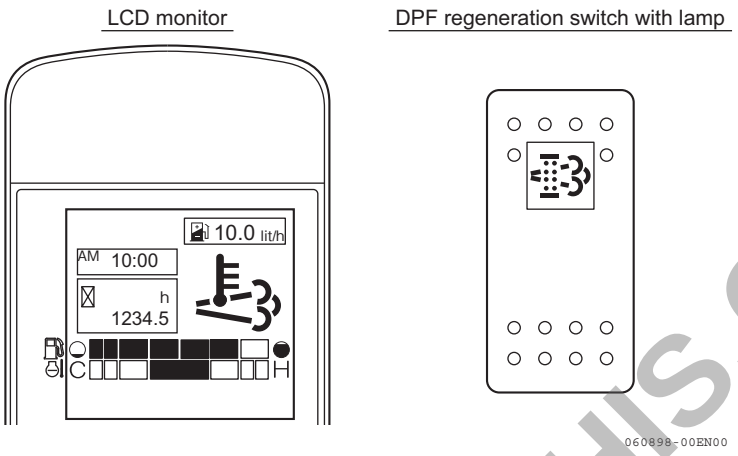
This completes reattachment of the DPF unit.

If only the DOC has been replaced, then first affix the DOC and SF using M8 bolts and nuts (8 or 10 of each), and with the DPF assembly, proceed as above.

- Replace the M8 flange bolts and nuts with new ones.
- Replace the gasket with a new one.

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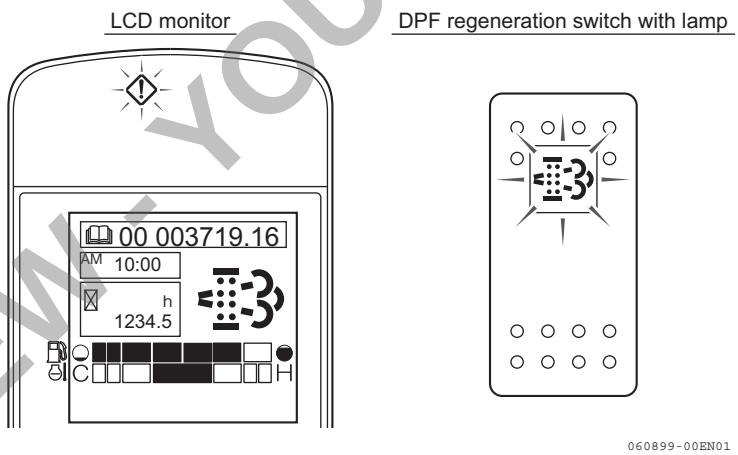
[3] Reset regeneration operating (Elapsed time since last reset: 100 hours)



Description

- The reset regeneration is completed in approximately 25 to 30 minutes. (After the reset regeneration completion, DPF transfers to [1] described before.)
- As in [2] described before, setting the interlock switch to lock position and holding the DPF regeneration switch to “ON” state for 10 seconds or more causes DPF to transfer to the stationary regeneration standby state ([4] de-scribed later).

[4] Stationary regeneration standby



Description

- An operator intervention ([2], [3] above) (hereinafter referred to as “Allow state”) or detection of certain PM deposit amount or more (hereinafter referred to as “Emergency state”) causes DPF to transfer to the stationary regeneration standby.
- When the transition is made from the above “Allow” condition to the stationary regeneration standby, only the DPF regeneration request icon is displayed on LCD monitor. When the transition is made from the above “Emergency” condition, the regeneration request icon is displayed and the caution lamp blinks, and error code "00 003719.16" is displayed.
- Make sure to refer to operation manual and confirm the operation procedures and precautions for the DPF stationary (manual) regeneration before starting stationary regeneration (transfer to [5] de-scribed later).
- If a certain length of time elapses and/or the PM deposit amount reaches to or above a certain level, DPF automatically transfers to the backup mode ([6] described later).

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■ Overloading of prime mover

Cause	Corrective Measures	Remarks
Tilt control failure due to seizure or breakage of pump internal parts	Replace damaged parts.	Check filters and drained oil for excessive amounts of metal wear particles.
Incorrect connection of the hose to regulator port Pf	Connect the correct hose to the port.	-
Malfunction of the gear pump	If the gear pump is defective, replace it.	-

■ Abnormal decrease in pump flow rate/Failure of discharge pressure to rise

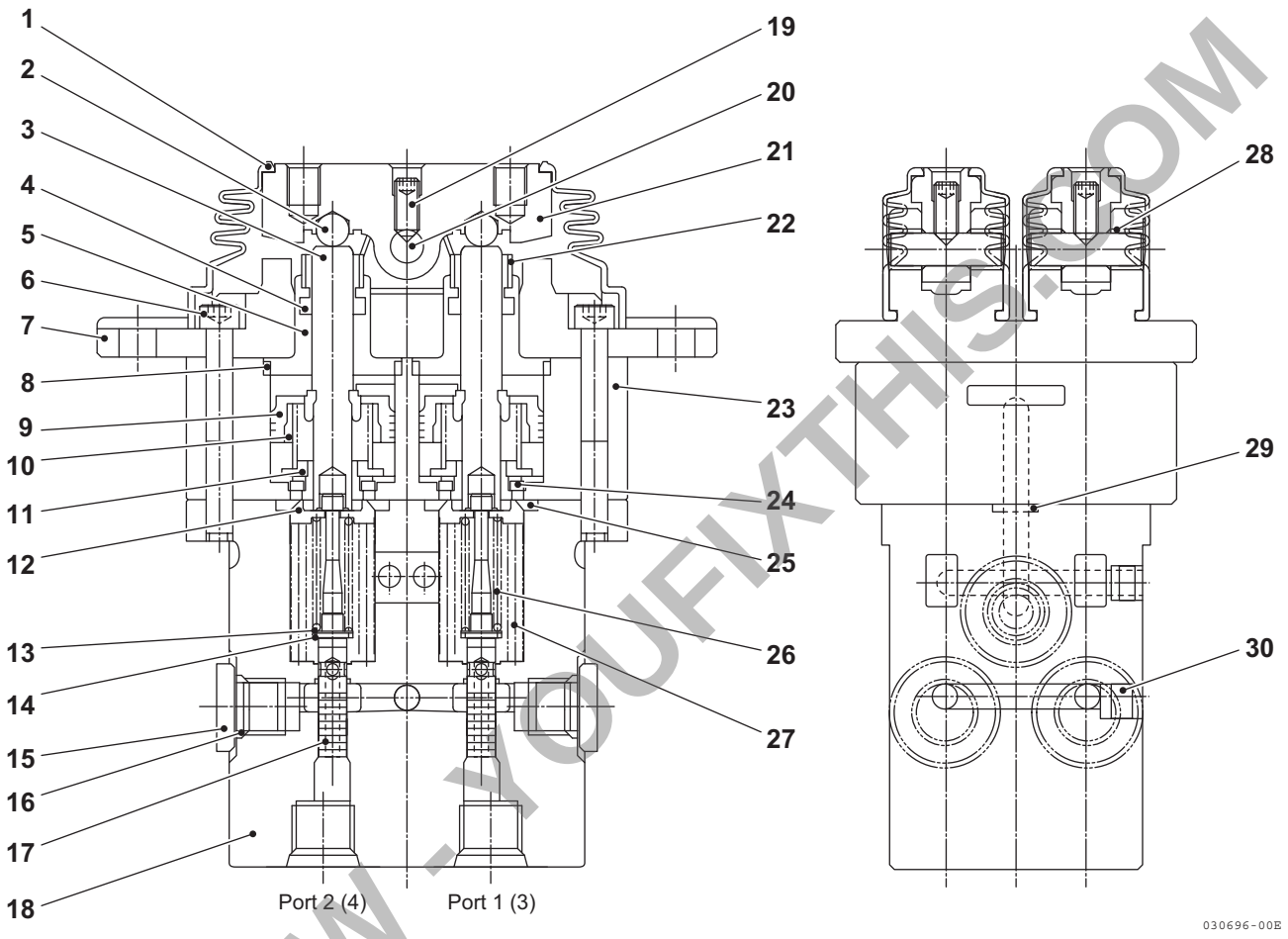
Cause	Corrective Measures	Remarks
Malfunction of the regulator group	Inspect and repair the regulator group (by disassembling it and cleaning the parts).	-
Seizure or breakage of pump internal parts	Replace damaged parts.	Check filters and drained oil.
Incorrect hose connections	Connect hoses correctly.	-

■ Abnormal noise and vibration

Cause	Corrective Measures	Remarks
Cavitation	Take measures to prevent cavitation. Measure the intake pressure and check whether the hydraulic oil has become cloudy.	• The intake pressure is low. • Air is sucked from the suction hose. • The resistance of the suction hose is high.
Damage to shoe swaged portions	Replace the damaged piston-shoe assemblies, swash plate and related parts.	-
Cracks in cylinders	Replace the cracked cylinders.	-
Incorrect pump installation	Install the pump correctly.	-
Hunting of the regulator	Repair the regulator.	-
Malfunction of the gear pump	Replace the gear pump.	-

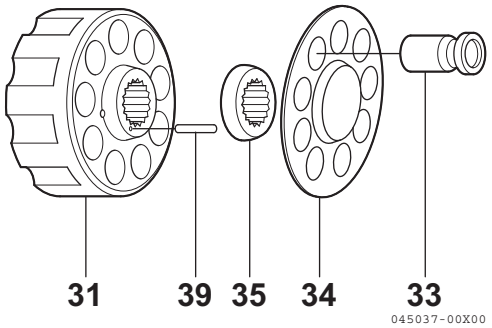
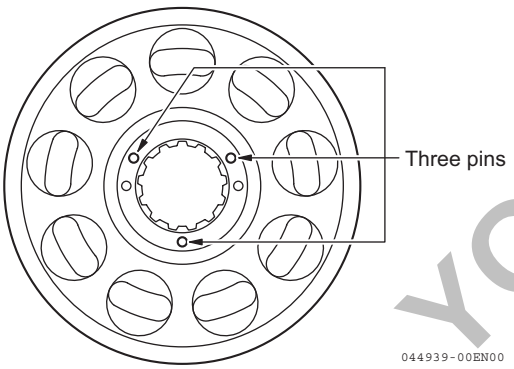
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3. Cross Section Drawing and Component Parts



No.	Description	Q'ty	No.	Description	Q'ty
1	Bellows	2	16	O-ring	3
2	Steel ball	4	17	Spool	4
3	Push rod	4	18	Casing	1
4	Packing	4	19	Set screw	2
5	Plug	4	20	Cam shaft	2
6	Allen screw	4	21	Cam	2
7	Cover	2	22	Grease cap	4
8	O-ring	4	23	Casing damper	1
9	Piston	4	24	Steel ball	12
10	Spring	4	25	O-ring	4
11	Spring seat	4	26	Spring	4
12	Spring seat	4	27	Spring	4
13	Shim	4	28	Bush	4
14	Washer	4	29	O-ring	2
15	RO plug	3	30	Plug	2

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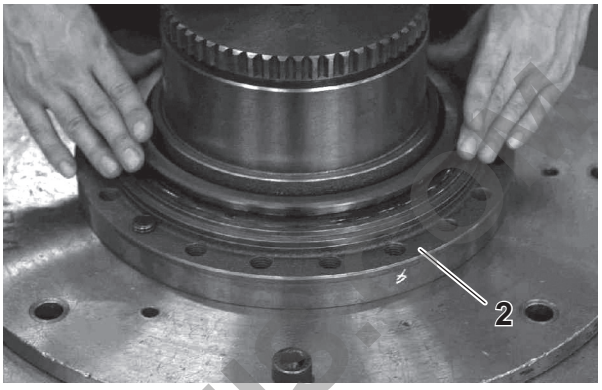
Procedure	
(8) Install pins **39**, barrel holder **35** and the shoe holder assembly to cylinder barrel **31**.  Pin mounting positions  	

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Procedure

(3) Fix spindle **2** on workbench with two hexagon socket bolts, which should locate symmetrically.

CAUTION
Tighten the hexagon bolts securely.
Failure to do so could result in injury if motor Is inverted and falls.



3. Clearance adjustment procedure for angular ball bearing

Note:
*If any of hub **1**, angular ball bearing **24** or spindle **2** is replaced, clearance adjustment should be conducted.*
*If not, angular ball bearings **24** could break in short period.*

(1) Insert lock washers **22** for measuring the dimensions, and measure the distance **C**.

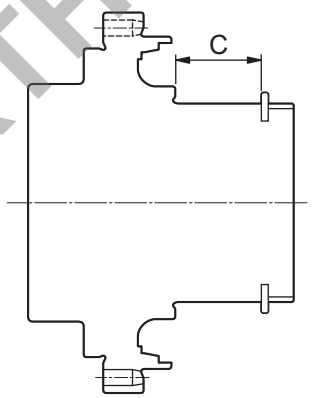
(2) Measure the distance **D**.

Note:
*Rotate hub assembly for stabilizing the distance **D**.*

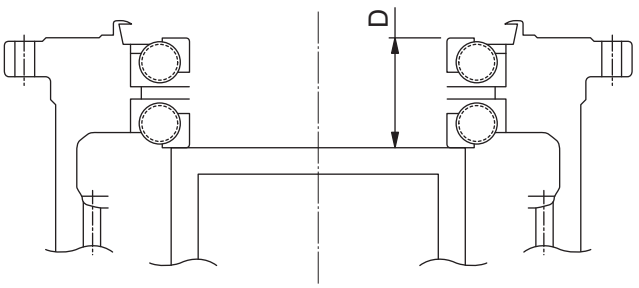
(3) Select one of the classified shim **23** which makes the distance "C–D" from -0.007 to -0.005 in. (-0.17 to -0.13 mm).

Shim **23** thickness shall be refer to the following table.

Mark	Tin [in (mm)]	Mark	Tin [in (mm)]
A	0.035 (0.9)	G	0.059 (1.5)
B	0.039 (1.0)	H	0.063 (1.6)
C	0.043 (1.1)	I	0.067 (1.7)
D	0.047 (1.2)	J	0.071 (1.8)
E	0.051 (1.3)	K	0.075 (1.9)
F	0.055 (1.4)	L	0.079 (2.0)

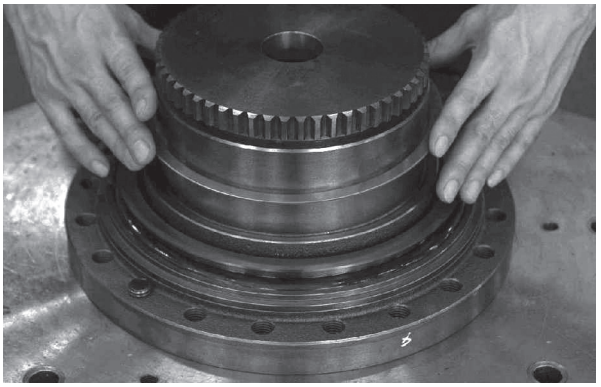


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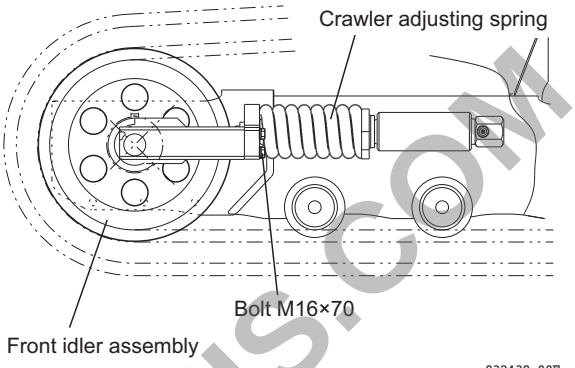
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(4) Attach shim **23** to spindle **2**.



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2) Disassembly

Procedure	
(1) Remove the crawler adjusting spring. Installation bolt (M16) for crawler adjusting spring Adhesive: Loctite 262 or its equivalent Tightening torque: 123.0 to 151.9 ft•lbf (166.7 to 205.9 N•m)	

(2) Remove screw plug R(PT)1/4 **4** from idler **5** and drain the oil.

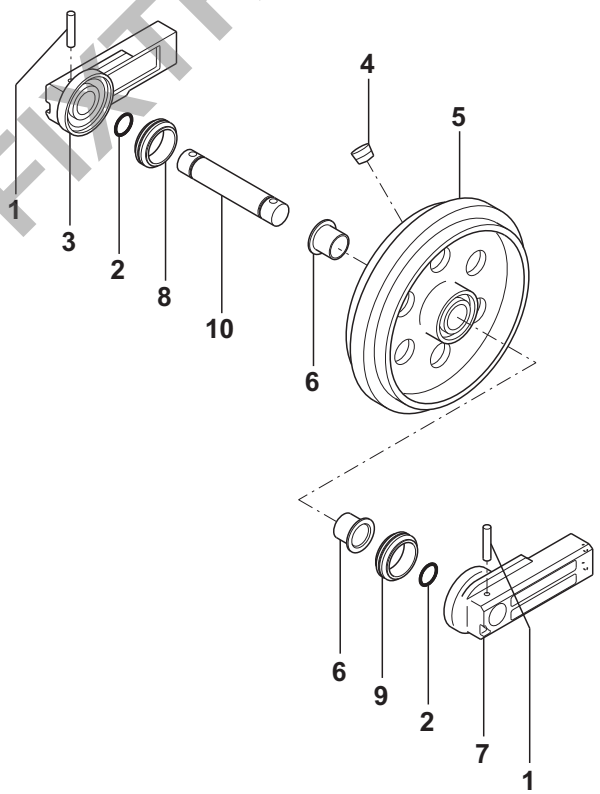
(3) Remove spring pin **1** from shaft **10** and remove idler seal cover B **7**.

(4) Pull shaft **10** (with idler seal cover A **3**) out of idler **5** and remove floating seals **8** and **9**.

Notes :
- *Since shaft **10** and idler seal cover A **3** are fixed by spring pin **1**, do not disassemble them unless necessary.*
- *Measure the bore of bush **6**. if the measured value is within the allowable wear limit, do not remove the bush.*

Type	Engine oil SAE 30
Q'ty	0.159 Qts. (0.15 L)

Screw plug R(PT)1/4	
Tightening torque	6.5 to 7.2 ft•lbf (8.8 to 9.8 N•m)

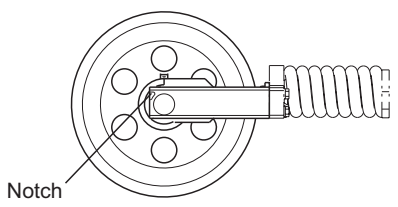


3) Reassembly

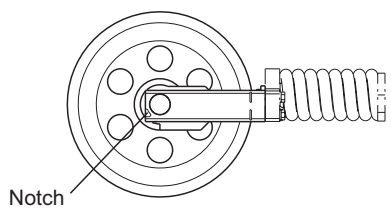
Reassemble the front idler in the reverse order of the disassembly procedure.

Note :

Apply the heavy duty grease to sliding portion of the idler.



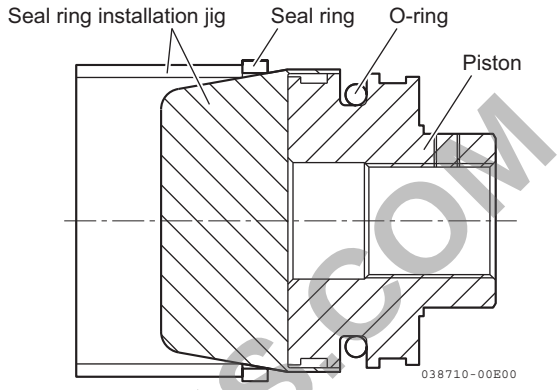
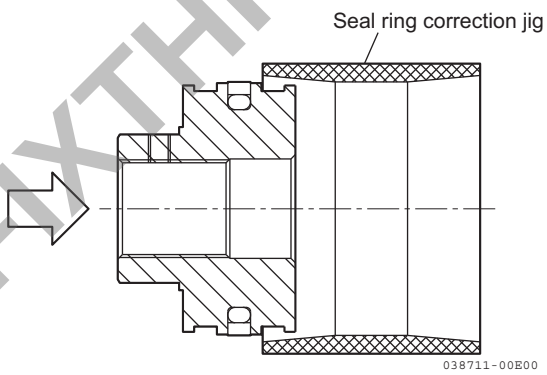
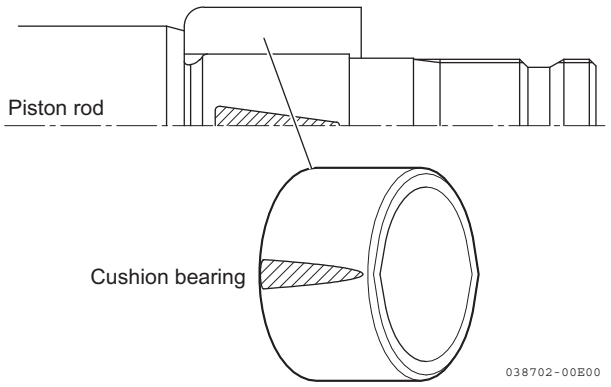
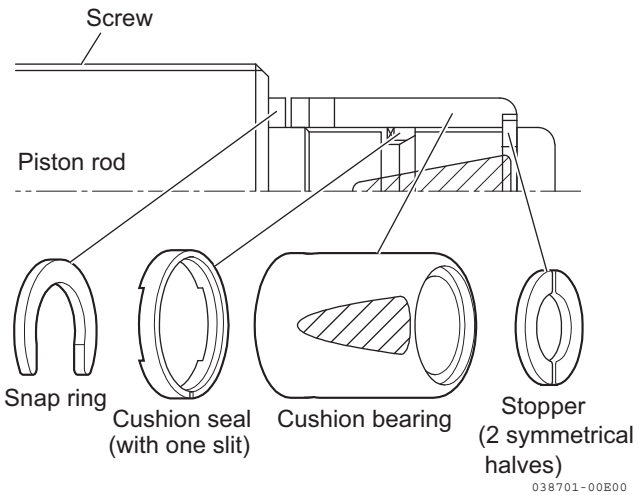
Rubber crawler type (with notch side up)



Steel crawler type (with notch side down)

032440-00E

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Procedure	
(7) Install the O-ring onto the piston taking care not to twist it and install the seal ring using a jig.	
(8) Because the seal ring is stretched when installed, correct the deformed seal ring using a correction jig. (9) Widen the gap cut in the slide ring with both hands and install it onto the piston. Take care not to widen the gap too much.	
Extension-side Cushion (10) Install the cushion bearing in the correct direction with its flattened face put in the position as shown in the figure on the right.	
Retraction-side Cushion (11) Install the cushion seal onto the piston rod with the slit facing the screw, and then, install the cushion bearing, stopper and snap ring.	

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