SERVICE MANUAL

EXCAVATOR

ViO50-6B

YANMAR

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CHAPTER 1

GENERAL CAUTIONS FOR MAINTENANCE WORK

1-1 Correct Work....1-1
1-2 Safety Precautions....1-1
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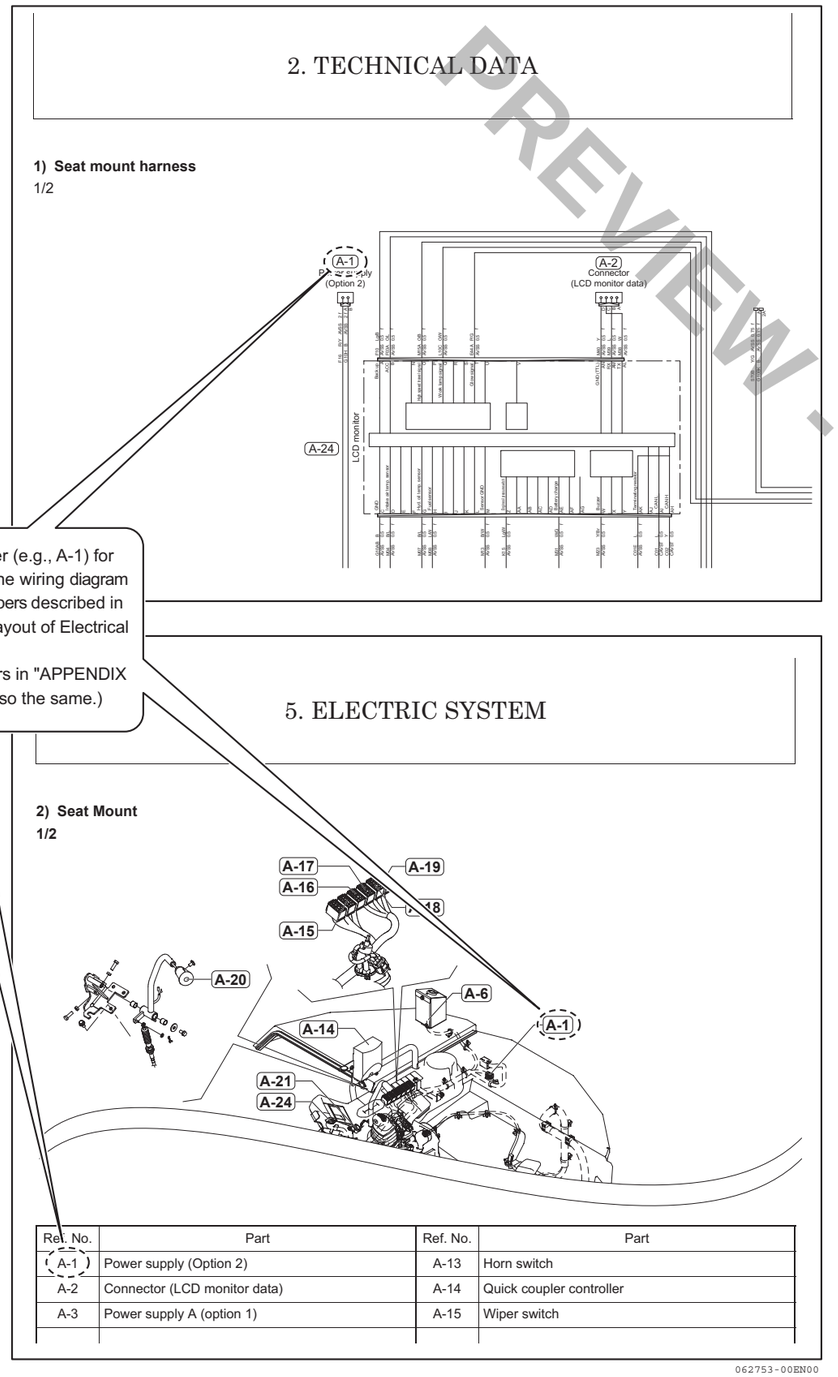
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2-9 Wiring Diagram

● Reference numbers

<Example>



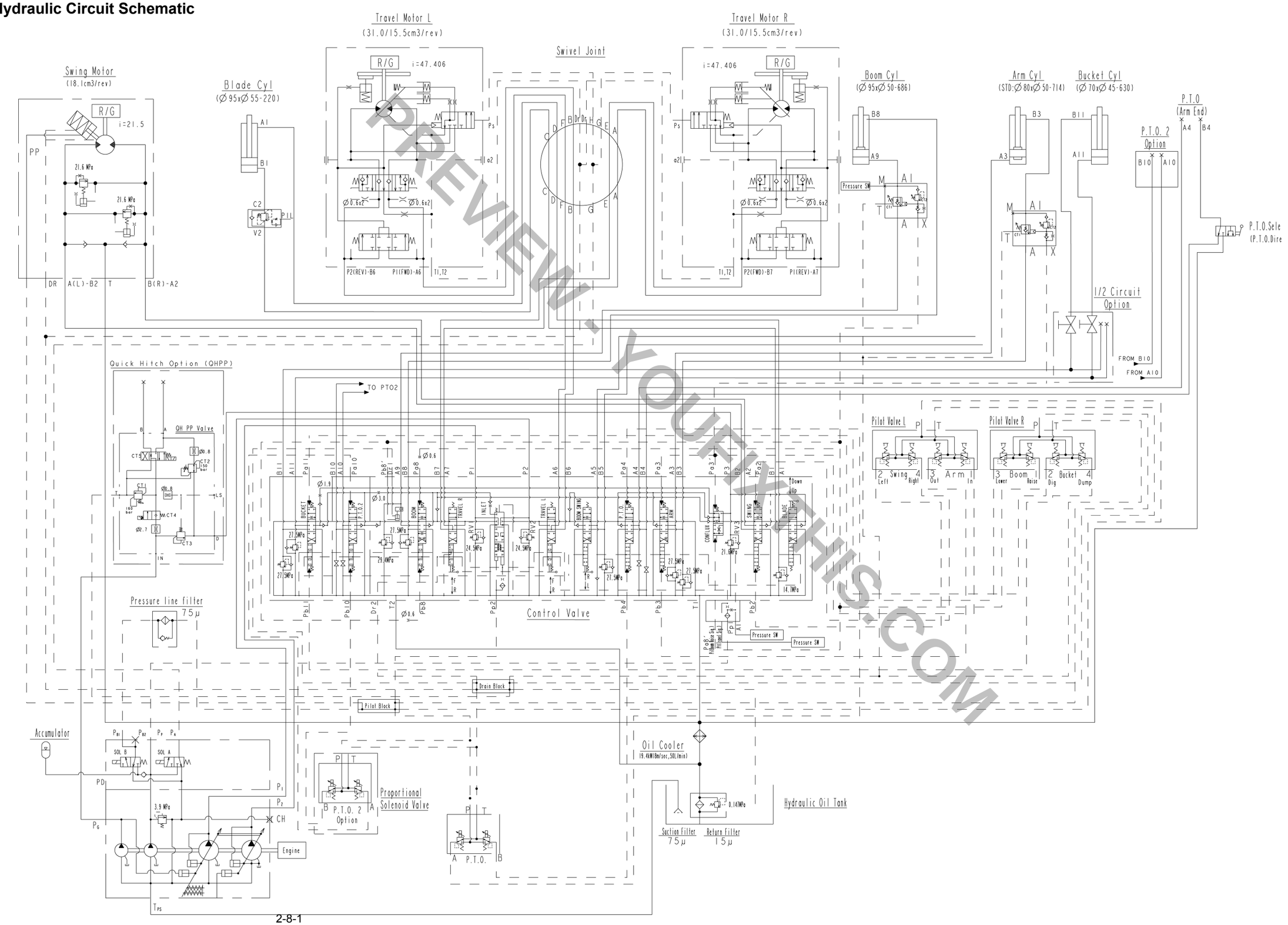
Each reference number (e.g., A-1) for electric equipment in the wiring diagram corresponds to the numbers described in Section "5-1-1 Parts Layout of Electrical Equipment".
(The reference numbers in "APPENDIX Wiring Diagram" are also the same.)

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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2. TECHNICAL DATA

2-8 Hydraulic Circuit Schematic



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4-2-5 Cylinder Head

Cylinder Head Components

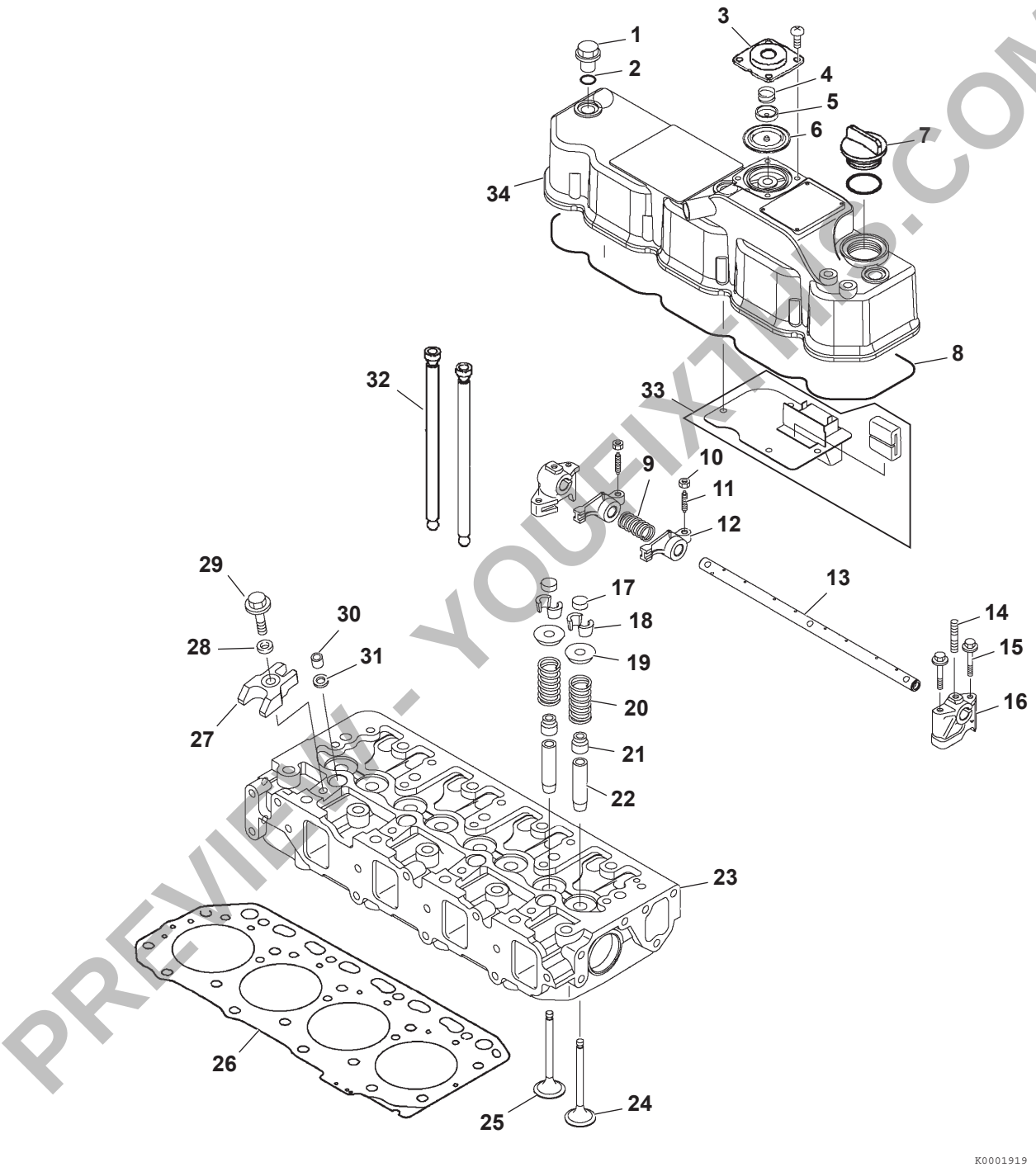


Figure 4-2-1

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3-7 List of Tightening Torque

3-7-1 Machine

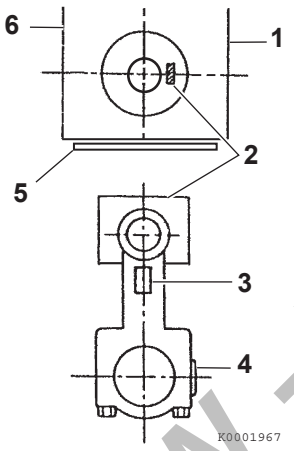
Applicable model			ViO50-6B		
Equipment No		Tightening part	Thread size	Tightening torque N•m	Adhesive
Engine / Electrical equipment					
	1	Engine mount vibroisolating rubber	M16 × 150 (10.9T)	291 to 339	ThreeBond 1324
	2	Engine × Engine mount L <Fan side>	M10 × 40 (10.9T)	67 to 79	ThreeBond 1324
	3	Engine × Engine mount R <Flywheel side>	M10 × 30 (10.9T)	67 to 79	ThreeBond 1324
	4	Air cleaner intake hose	Hose clip 80	2,6 to 2,7	
	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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Piston assembly - all TNV models

When correctly assembled, the piston identification mark **(Figure 4-2-86, (2))** stamped into the top of the piston will be on the same side of the connecting rod as the match marks **(Figure 4-2-86, (4))** stamped into the connecting rod and connecting rod cap.

When installed in the cylinder, the piston identification mark **(Figure 4-2-86, (2))** stamped on the top of the piston must face the fuel injection pump side **(Figure 4-2-86, (1))** of the engine and the embossed mark on the connecting rod **(Figure 4-2-86, (3))** must face the flywheel end **(Figure 4-2-86, (5))** of the engine.



1 – Fuel injection pump side of engine
2 – Piston identification mark
3 – Embossed mark on connecting rod
4 – Rod and cap match marks
5 – Flywheel end of engine
6 – Camshaft side of engine

Figure 4-2-86

4. Lubricate and reinstall the wrist pin **(Figure 4-2-88, (6))** through the piston and connecting rod.
5. Reinstall the second circlip **(Figure 4-2-88, (5))** and ensure it is securely seated in the groove.

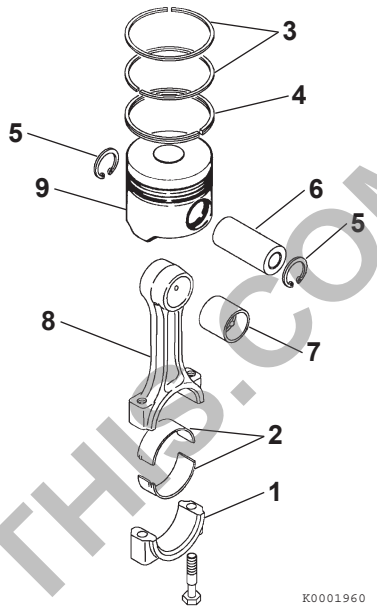


Figure 4-2-87

Note:

- *If installing new piston rings the end gap must be checked and adjusted as necessary. See Inspection of pistons, piston rings and wrist pin on page 4-2-35 for specifications. Use a piston ring end gap filing tool to adjust the piston ring end gap on new piston rings.*
- *Reinstall the top and second piston rings with the stamped "makers mark" **(Figure 4-2-89, (1))** facing the top of the piston. The "makers mark" may vary in appearance but will always be located on the top surface of the piston ring adjacent to the piston ring gap. The oil ring and oil ring expander can be installed either side up.*

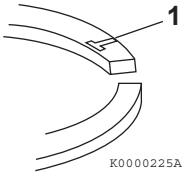


Figure 4-2-88

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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))**.

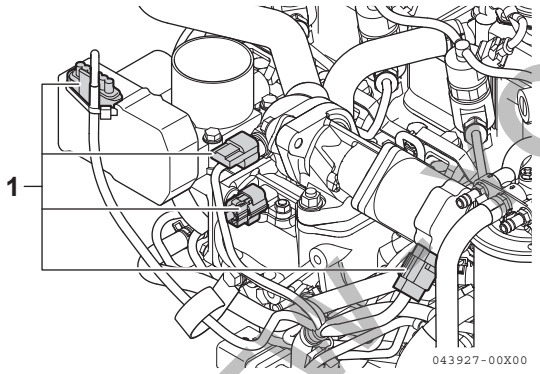


Figure 4-2-3

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))**.

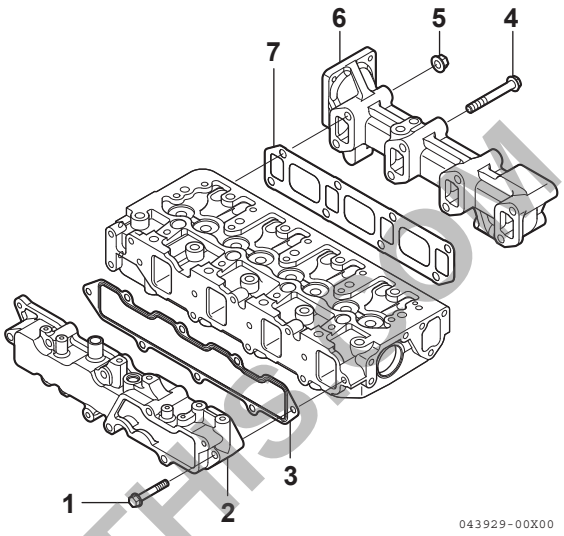


Figure 4-2-4

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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3. SERVICE STANDARDS

Applicable model			ViO50-6B		
Equipment No		Tightening part	Thread size	Tightening torque N•m	Adhesive
Rigging					
	1	2-pole canopy × Canopy mount	M16 × 70 (10.9T)	291 to 339	
	2	4-pole canopy × Canopy mount	M16 × 50 (10.9T)	291 to 339	ThreeBond 1324
	3	4-pole canopy × Turning frame	M16 × 40 (10.9T)	291 to 339	ThreeBond 1324
	4	Cabin × Canopy mount	M16 × 55 (10.9T)	291 to 339	ThreeBond 1324
	5	Cabin × Turning frame	M16 × 70 (10.9T)	291 to 339	ThreeBond 1324
	6	Under cover × Track frame	M12 × 30	78,4 to 98	ThreeBond 1324
	7	Handle lock × Bonnet A	M6 × 16 (Tapping screw)	3 to 4	
	8	Key lock plate × Key cylinder	U nut 10	7,9 to 11,8	
	9	Bonnet B × Turning frame	M10 × 25	46 to 54	
Hydraulic equipment					
	1	CF coupling	M12 × 40 (Allen head screw)	79 to 93	ThreeBond 1324
	2	Swivel joint × Track frame	M10 × 30	46 to 54	Locktite 262 or K-965
	3	Elbow fitting × Swivel joint	G 3/8	45,5 to 49,5	
	4	Connector × Swivel joint	G 1/4	24,5 to 28,5	
	5	Nipple 02 × Swivel joint	R 1/4	7 to 9	
	6	Travel motor × Track frame	M14 × 35 (10.9T)	187 to 219	Locktite 262 or K-965
	7	Swing motor × Turning frame	M16 × 45 (10.9T)	291 to 339	ThreeBond 1324
	8	Hydraulic oil tank × Turning frame	M14 × 35	127 to 149	ThreeBond 1324
	9	Hydraulic oil level gauge × Hydraulic oil tank	M10 × 30	14,7 to 15,7	
	10	Drain plug × Hydraulic oil tank	M24	107,9 to 119,3	
	11	Water temp sensor (w/seal washer) × Hydraulic oil tank	M12 × 1.5 (pitch) (Fine Thread)	20 to 24	
	12	Suction hose × Tube	Hose clip 60	4,5 to 5,9	
	13	Breather × Hydraulic oil tank	G 1	7,8 to 9,8	
	14	Fitting (oil cooler return hose) × Hydraulic oil tank	R 1	68,6 to 88,3	Loctite 577
	15	Fitting (Swing motor drain hose) × Hydraulic oil tank	R 1/2	39,2 to 49	
	16	90° elbow (Drain block) × Hydraulic oil tank	R 3/8	29,4 to 39,2	

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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.

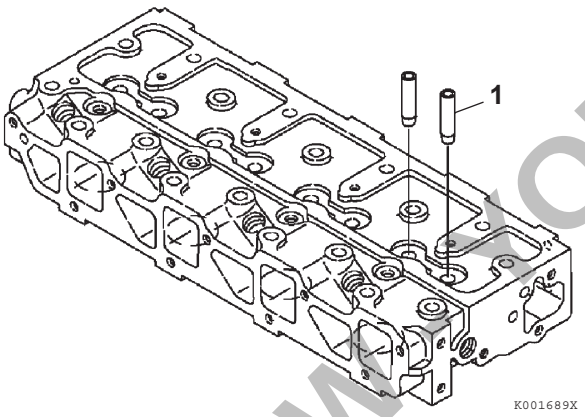


Figure 4-2-13

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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2. TECHNICAL DATA

2. Technical Data

2-1 Specifications

Item					Unit	ViO50-6B
Main specifications of machine						
Dimensions						
	Overall length (Transportation position)				mm	5230 (Long arm : 5335)
	Cabin	Overall height	Transportation position		mm	2540
			Traveling position		mm	2540
		Overall width	Full machine width		mm	1970
	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	2,4
			High speed (Forward/Reverse)		km/hr	4,6
		Rubber crawler	Low speed (Forward/Reverse)		km/hr	2,4
			High speed (Forward/Reverse)		km/hr	4,6
	Permissible water depth limit				mm	500
Work performance						
	Bucket	Width (Standard) *including side cutter			mm	500
		[Standard. JIS heaped capacity]			m^3	0,11
		Number of teeth / Installation method			pcs.	4 / rubber pin lock type
	Maximum digging depth	With blade raised			mm	3520
		With blade on the ground			mm	3310
	Maximum depth of vertically digging				mm	1065
	Maximum dumping height				mm	3910
	Minimum front swing radius (with boom in front)				mm	2185
	Minimum front swing radius (at boom swing)			Cabin	mm	1760
	Rear end swing radius				mm	970
	Boom swing angle		Cabin	Left	degrees	70
				Right	degrees	70
	Maximum digging force		Bucket		k•N	36,5
			Arm		k•N	22,7 (Long arm : 21)

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3. SERVICE STANDARDS

3-2 Engine

3-2-1 Nominal and Allowable Values

Applicable model				4TNV88C-PBV	
Item			Unit	Standard	Allowable limit
Cylinder head					
Adjustment of valve clearance			mm	0,15 to 0,25	-
Cylinder head distortion (Flatness)			mm	0,05 or less	0,15
Valve sinkage		Intake	mm	0,3 to 0,5	0,8
		Exhaust	mm	0,3 to 0,5	0,8
Valve seat angle		Intake	degrees (°)	120	-
		Exhaust	degrees (°)	90	-
Valve seat correction angle			degrees (°)	40, 150	-
Intake valve		Guide inside diameter	mm	8,010 to 8,025	8,10
		Valve stem outside diameter	mm	7,955 to 7,975	7,90
		Valve stem bend	mm	0,035 to 0,070	0,18
Exhaust valve		Guide inside diameter	mm	8,015 to 8,030	8,10
		Valve stem outside diameter	mm	7,955 to 7,960	7,90
		Valve stem bend	mm	0,045 to 0,075	0,18
Valve guide		Projection from cylinder head	mm	14,71 to 15,00	-
		Insertion method	mm	Cold-fitted	-
Valve stem seal projection from cylinder head			mm	18,7 to 19,0	-
Push rod bend			mm	0,03	0,03
Rocker arm and shaft		Arm shaft hole diameter	mm	16,000 to 16,020	16,07
		Shaft outside diameter	mm	15,966 to 15,984	15,94
		Oil clearance	mm	0,016 to 0,054	0,13
Valve spring		Free length	mm	42,0	41,5
		Squareness	mm	-	1,4

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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

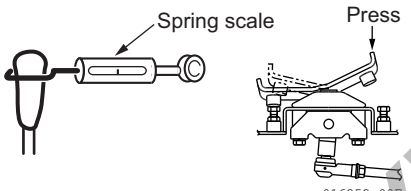
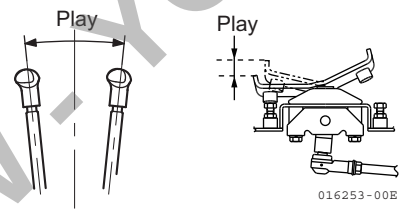
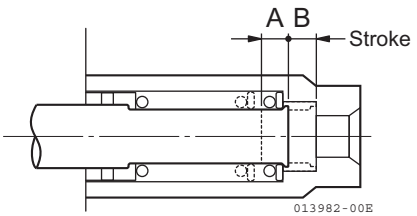
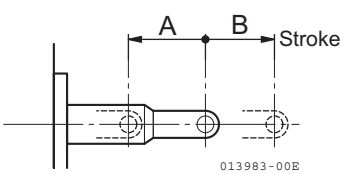
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2-7 Fuel, Lube Oil and Grease Recommended

Components	Fluid	Temperatures °C								Quantity prescribed (L)	
		-	-20	-10	0	10	20	30	+		
Thermal engine	Engine oil		SAE 10W CJ-4							7,4	–
			SAE 10W-30 CJ-4								
			SAE 15W-40 CJ-4								
Travel gears	Box oil	SAE 90 (GL-4)								1,2	by reducer
Hydraulic circuit	Hydraulic oil	ISO VG46								38,0	in the tank
										36,0	the rest
Fuel tank	Diesel	N° 2-D								66,0	–
		N° 3-D									
		N° 3-D (S)									
Cooling system	Long-life cooling fluid YANMAR POWER COOLANT B–36									7,0	radiator
										0,4	the expansion flask

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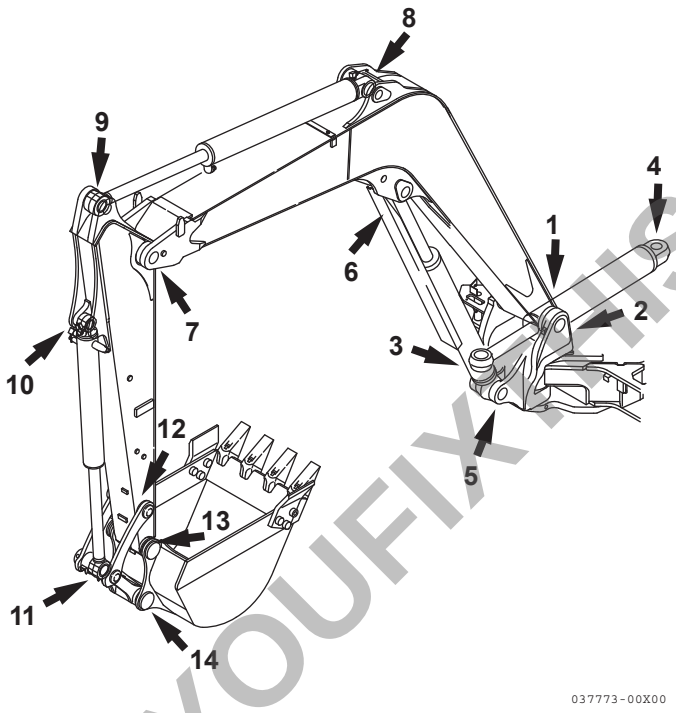
3-4 Controls

Applicable model			ViO50-6B		
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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3-6 Implement

3-6-1 Front Attachments



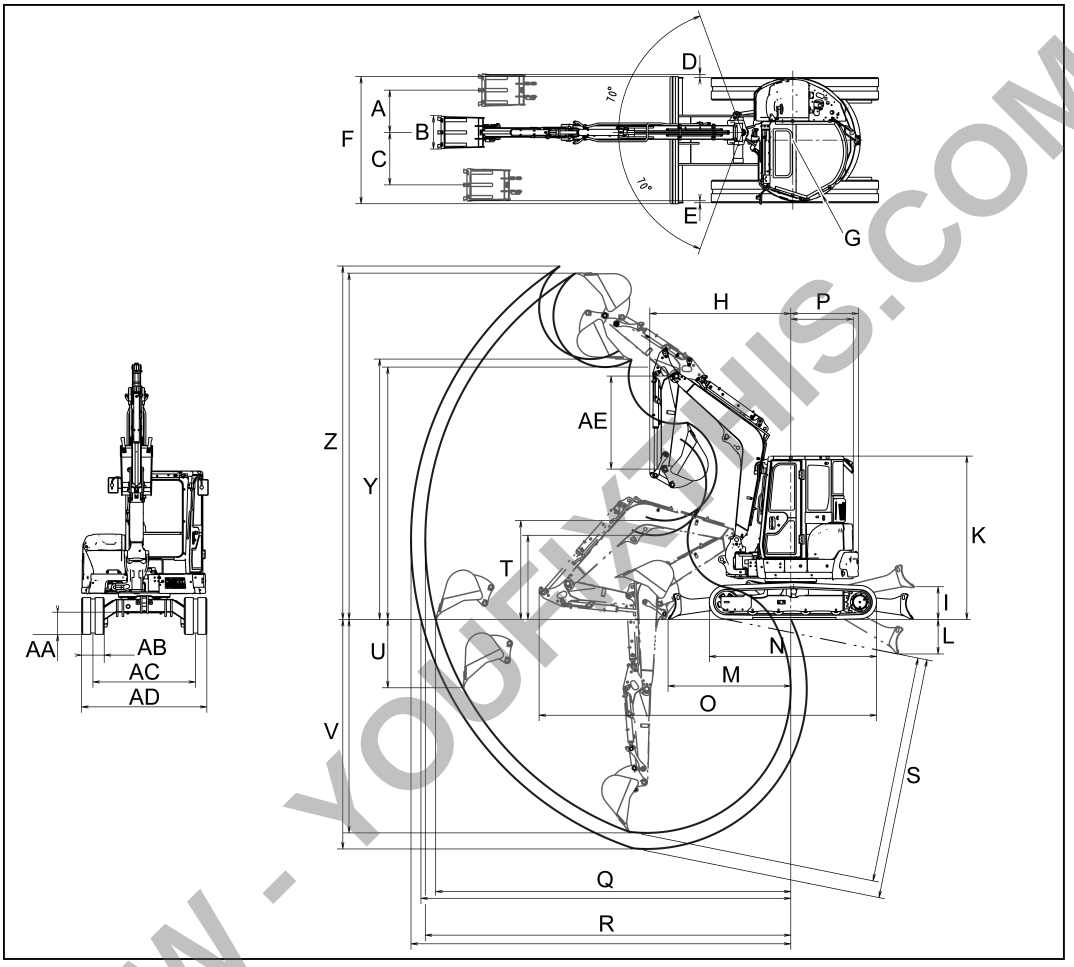
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Unit : mm

No.	Measuring point	Standard	Wear limit	
		ViO50-6B	Pin	Bore of bush or hole
1	Boom swing fulcrum	Ø90	-0,5	+0,5
2	Boom fulcrum	Ø60		
3	Boom swing cylinder, rod	Ø40		
4	Boom swing cylinder, bottom	Ø40		
5	Boom cylinder, bottom	Ø50		
6	Boom cylinder, rod	Ø50		
7	Arm fulcrum	Ø60		
8	Arm cylinder, bottom	Ø50		
9	Arm cylinder, rod	Ø50		
10	Bucket cylinder, bottom	Ø45		
11	Bucket cylinder, rod	Ø45		
12	Link "A" arm	Ø45		
13	Bucket fulcrum	Ø45		
14	Bucket "link A"	Ø45		

Note : *Allowable clearance is 1,0 mm*

2-2 Outline Drawing and Working Area



Unité : mm		
A	655	
B	500	
C	813	
D	50	
E	30	
F	1970	
G	970	
H <swing>	2185 <1780>	
I	510	
K	2540	
L	535	
M	1900	
N	2590	
O	5230	5335
P	970	1050

Unité : mm		L++
Q	5500	5730
R	5665	5885
S	3520	3760
T	1530	1305
U	1065	1065
V	3310	3555
Y	3910	4035
Z	5365	5475
AA	345	
AB	350	
AC	1590	
AD	1940	
AE	1450	1700

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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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2. Remove the cylinder head bolts **(Figure 4-2-10, (1))**.
3. Lift the cylinder head away from the cylinder block. Discard the cylinder head gasket **(Figure 4-2-10, (2))**. Position the cylinder head on the work bench to prevent damage to the combustion surface.

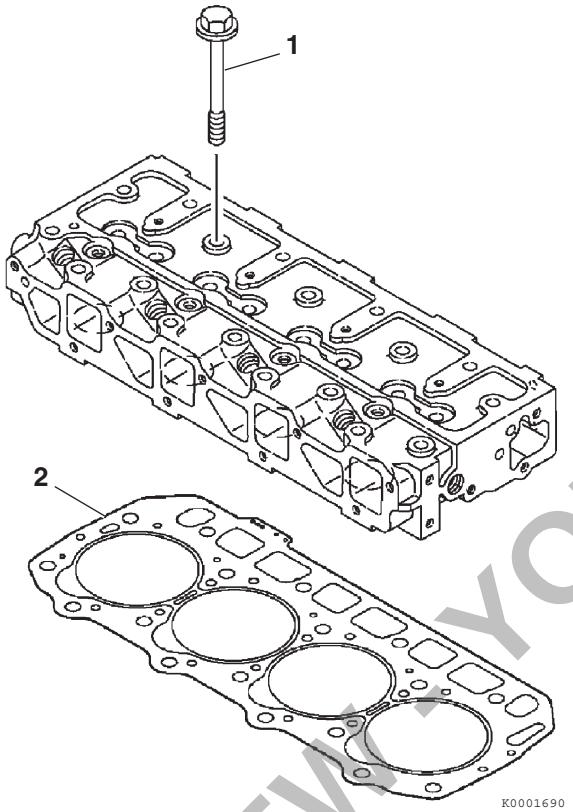


Figure 4-2-10

■ Removal of intake/exhaust valves

1. Place the cylinder head on the work bench with the combustion side down.
2. Remove the valve cap **(Figure 4-2-12, (1))** and keep with the valve it was installed on.
3. Using the valve spring compressor tool, compress one of the valve springs **(Figure 4-2-11)**.

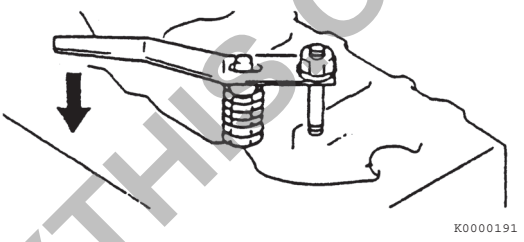


Figure 4-2-11

4. Remove the valve keepers **(Figure 4-2-12, (2))**.
5. Slowly release the tension on the valve spring.
6. Remove the spring retainer **(Figure 4-2-12, (3))** and valve spring **(Figure 4-2-12, (4))**.

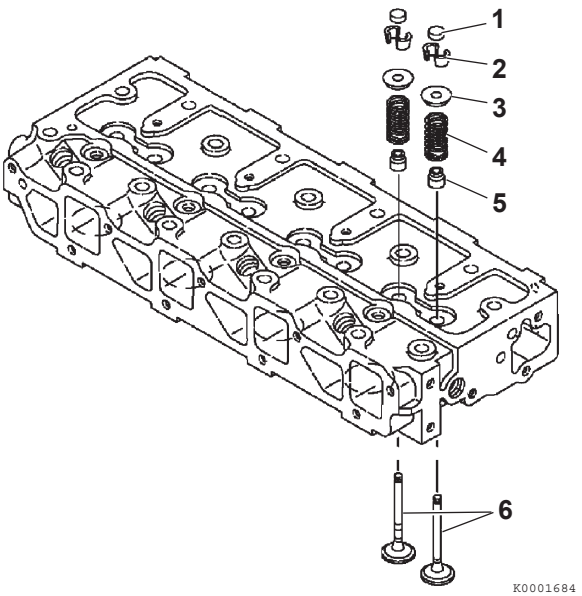


Figure 4-2-12

7. Repeat the procedure with all remaining valves.

   Note: If the valves are to be reused, identify them so they can be installed in their original location.

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INTRODUCTION

None of the components of the electronic control system can be individually repaired. When any component is faulty and needs repair, the entire assembly must be replaced.

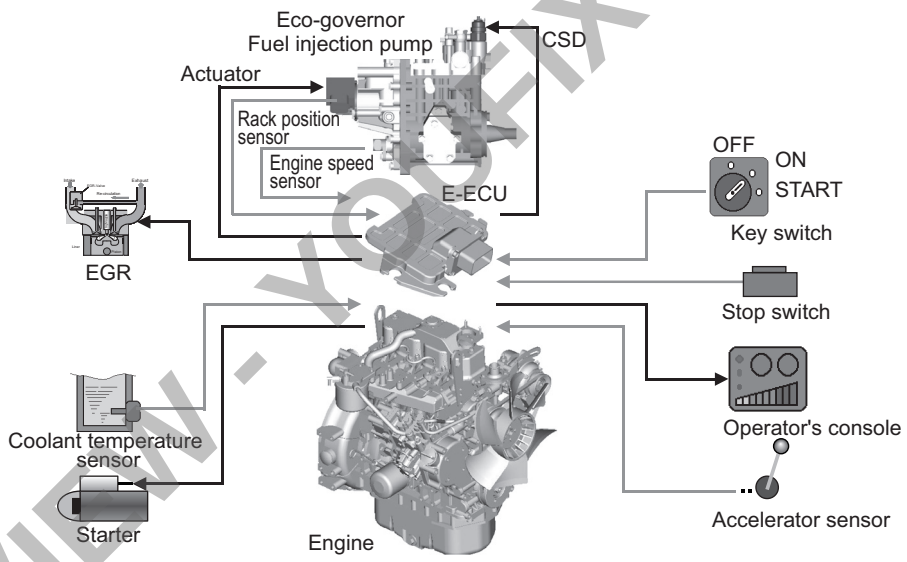
ELECTRONIC CONTROL SYSTEM

The electronic controlled engine come with the Exhaust Gas Recirculation (EGR) system to conform to the engine emission regulations (EPA 2008 rules). The EGR system and an electronic governor (Eco-governor) constitute an electronic engine control system.

The electronic engine control system regulates the exhaust gas recirculation flow rate and the fuel injection volume depending on the engine load and speed signals from the engine controller (E-ECU), so that the exhaust gas is kept clean according to the emission control regulations. **Figure 4-8-1** illustrates the electronic engine control system.

Features of the electronic engine control system include:

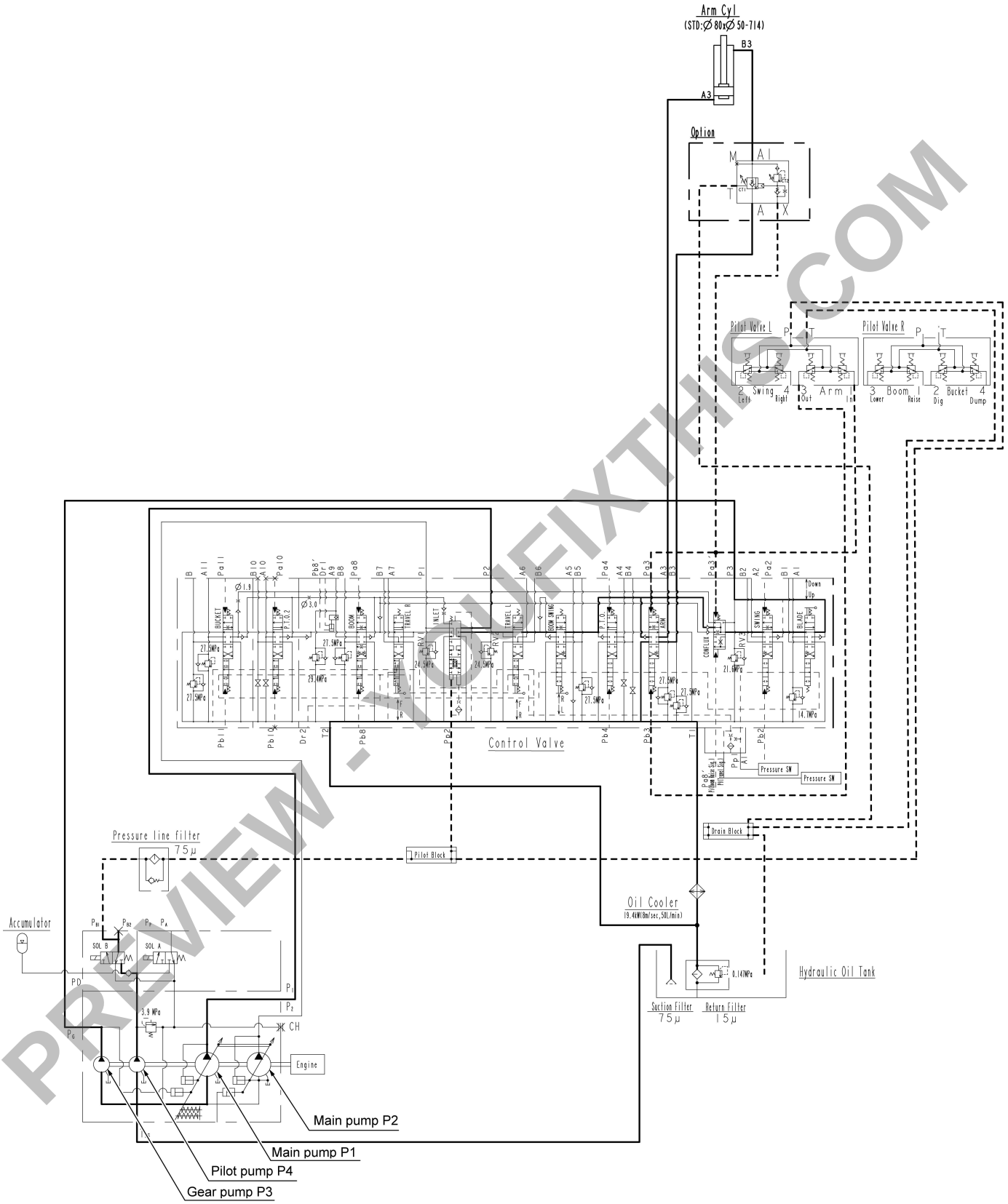
- Engine speed control schemes
  Droop control / Auto deceleration / Black smoke suppression
- Engine failure detection



Note: Equipped devices vary depending on the model.

Figure 4-8-1

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3)-3. Disassembly of anti-drift valve

When the anti-drift valve malfunctions, replace it as an anti-drift valve assembly. For reference, the disassembly procedure for examination is shown below.

[1] Remove the two hexagon socket head bolts **A** with a hexagon bar wrench (5 mm).

[2] Remove the anti-drift valve case **B**.

[3] Take care not to drop the two dowel pins **C** on the anti-drift valve body side.

Note :

Take care not to lose and damage the pins.

[4] Remove the anti-drift valve **1** and the needle valve **9**.

Notes :

- *Remove the needle valve **9** first and keep it as it is easily removed.*
- *The anti-drift valve should not be disassembled but it should be kept as an anti-drift valve assembly (**1**-**7**, **10**).*

[5] Hold the anti-drift valve case with a vice and remove the bush **17** with a wrench or socket wrench (26 mm).

Note :

Set the vice on any side face other than the port side to hold the anti-drift valve.

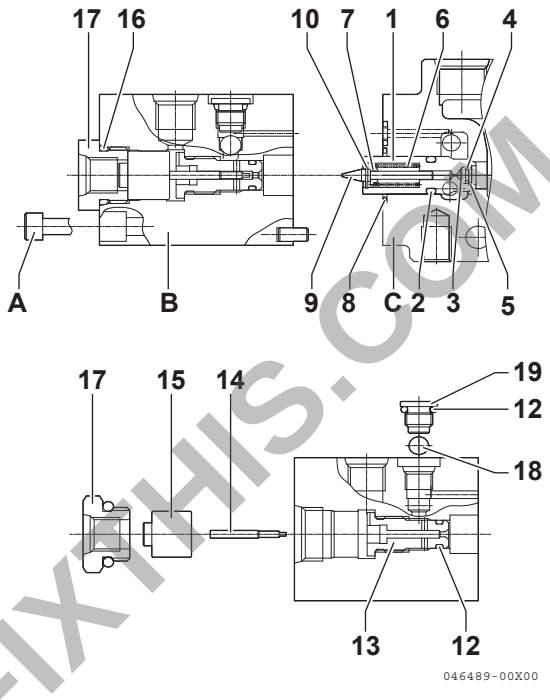
[6] Remove the piston B **15** and piston A1 **14** in the bore, which the bush has been removed from, with tweezers or a magnet.

Notes :

- *Make marks on the piston B and the piston A1 so that they can be reassembled in the same direction as it was before.*
- *The piston guide **13** should not be disassembled, but it should be kept together with the anti-drift valve case B.*

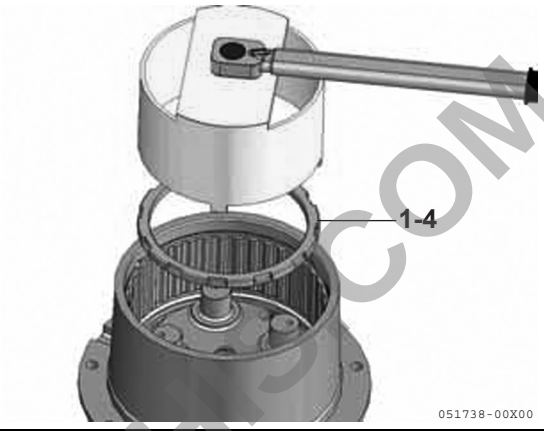
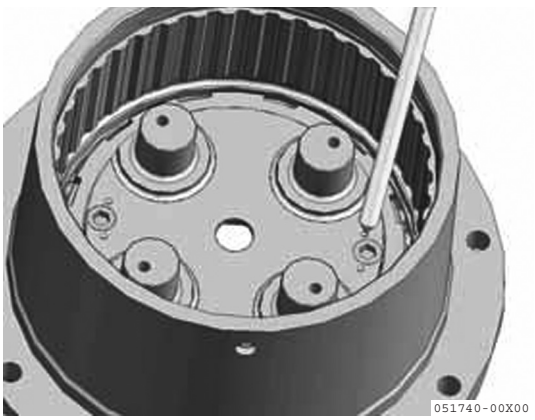
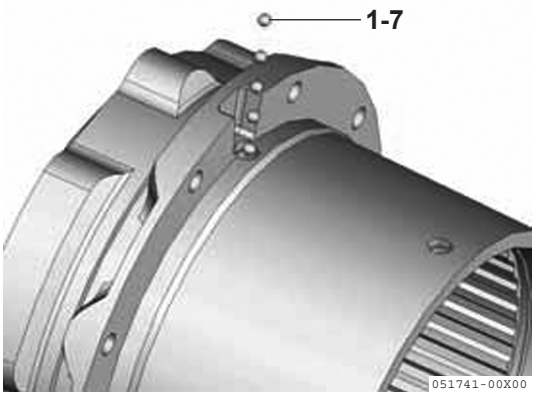
[7] Remove the ball retainer **19** with a hexagon bar wrench (4 mm).

[8] Remove the steel ball **18** of Ø 7 mm from the bore, which the ball retainer has been removed from, using a magnet.



No.	Part
1	Anti-drift valve
2	Cap seal 1 BE10
3	Filter
4	Spacer
5	Snap ring AR7
6	Anti-drift valve spring A
7	Spring holder
8	O-ring AS 1B17
9	Needle valve
10	Internal snap ring 9
11	O-ring 1A P6
12	O-ring 1B P8
13	Piston guide
14	Piston A1
15	Piston B
16	O-ring 1B P18
17	Bush PF1/2×1/4
18	Steel ball Ø 7 mm
19	Ball retainer

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Procedure	
(5) Tighten angular bearing **1-3** with ring nut **1-4**. **Tools:** • Torque wrench 3 • Ring nut tightening jig S-6 **Tightening torque:** **225,5 to 245,0 N·m** ***CAUTION*** *Do not reuse the removed ring nut. Replace it with a new one.*	
(6) Tighten plugs **1-5**. Do not wrap the plugs with seal tape. **Tools:** • Torque wrench 1 • Hexagon bit 7 or 8 for above **Tightening torque: 29,4 to 39,2 N·m**	
(7) After tightening plugs **1-5**, swage each plug at two points to prevent the plug from loosening. **Tools:** • Hammer 13 • Punch 17	
(8) Install the required number of steel balls **1-7**. ***Note:*** *When the steel balls are hard to install, lightly tap around the outside surface of housing **1-6** with a plastic hammer while installing them.*	

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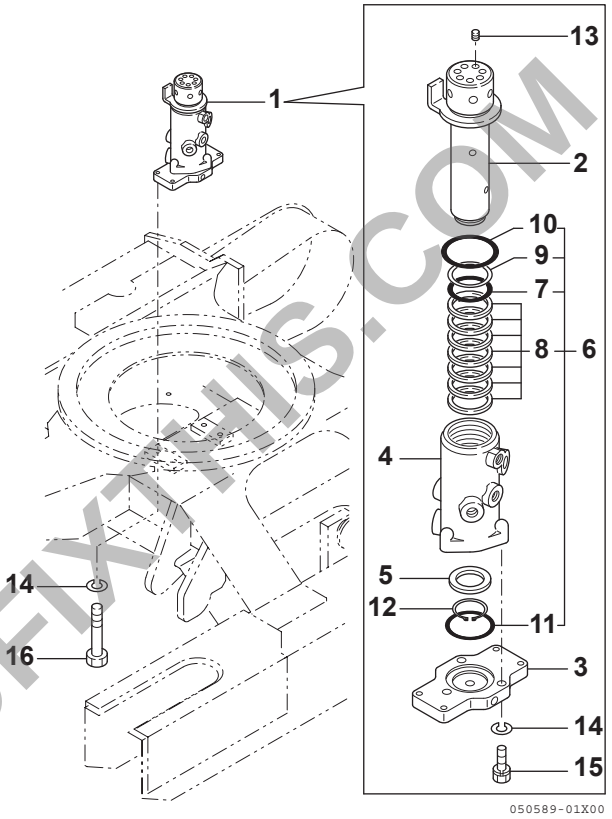
2) Disassembly and Reassembly of Swivel Joint

• Disassembly

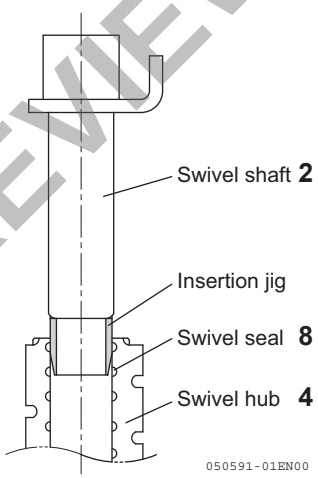
(1) Remove the bolts **15**.
(2) Remove the swivel flange **3** and the O-ring **11**.
(3) Remove the external snap ring C **12** and the swivel spacer **5** from the swivel shaft **2**.
(4) Pull the swivel shaft **2** out of the swivel hub **4** and remove O-ring **10**.
(5) Remove the swivel seals **8**, O-ring **7** and back-up ring **9** from the swivel hub **4**.

• Reassembly

(1) Install swivel seals **8,** O-ring **7** and back-up ring **9** into swivel hub **4**.
(2) Apply multi-purpose grease to the inner surface of swivel hub **4**.
(3) Install the O-ring **10** on the swivel shaft **2** and insert the shaft into the swivel hub **4** slowly.
• Use a jig E-004B
• Apply multi-purpose grease to the outer surface of the shaft.
(4) Install the swivel spacer **5** and the external snap ring **12** to the swivel shaft **2**.
(5) Install the swivel flange **3** with O-ring **11**, on the swivel hub **4** in this order and tighten bolts **15**.

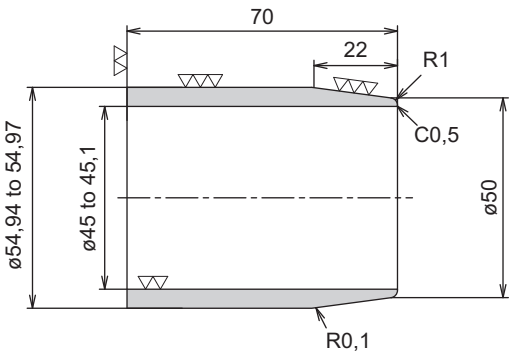


Insertion of shaft



Shaft insertion jig No.E-004B

Unit : mm



Note : The ▽▽▽ areas must be hard chromium plated.

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