YANMAR

SERVICE MANUAL

EXCAVATOR

ViO33U

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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 (the word "DANGER" is in white letters with a red rectangle behind it) - indicates an imminently hazardous situation which, if not avoided, will result in death or serious injury. Danger is limited to the most extreme situations.

⚠ WARNING

Warning (the word "WARNING" is in black letters with an orange rectangle behind it) – indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

⚠ CAUTION

Caution (the word "CAUTION" is in black letters with a yellow rectangle behind it) – indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury.

NOTICE

Caution without the safety alert symbol indicates a potentially hazardous situation that can cause damage to the machine, personal property and / or the environment or cause the machine to operate improperly.

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2. TECHNICAL DATA

2. Technical Data

2-1 Specifications

Item				Unit	ViO33U
Main specifications of machine					
Dimensions					
Overall length (Transportation position)				mm	4430
Cabin	Overall height	Transportation position		mm	2545
		Traveling position		mm	2545
	Overall width	Full machine width		mm	1550
Tumbler center distance (steel/rubber)				mm	1558 / 1564
Track gauge				mm	1310
Minimum ground clearance				mm	330
Traveling performance					
Travel speed	Steel crawler	Low speed (Forward/Reverse)		km/hr	2,7
		High speed (Forward/Reverse)		km/hr	4,5
	Rubber crawler	Low speed (Forward/Reverse)		km/hr	2,7
		High speed (Forward/Reverse)		km/hr	4,5
Permissible water depth limit				mm	500
Work performance					
Bucket	Width (Standard) *including side cutter			mm	500
	(Standard. JIS heaped capacity)			cm3	0,09
	Number of teeth / Installation method			pcs.	3 / bolt lock type
Maximum digging depth	With blade raised (Std Arm / Long Arm)			mm	2760 / 3010
	With blade on the ground (Std Arm / Long Arm)			mm	2890 / 3140
Maximum depth of vertically digging				mm	900
Maximum dumping height (Std Arm / Long Arm)				mm	3240 / 3390
Minimum front swing radius (with boom in front)				mm	1965
Minimum front swing radius (boom swing)				mm	1670
Rear end swing radius				mm	770
Boom swing angle		Cabin	Left	degrees	45
			Right	degrees	75
Maximum digging force		Bucket		k•N	30,4
		Arm		k•N	16,4

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3-7 List of Tightening Torque

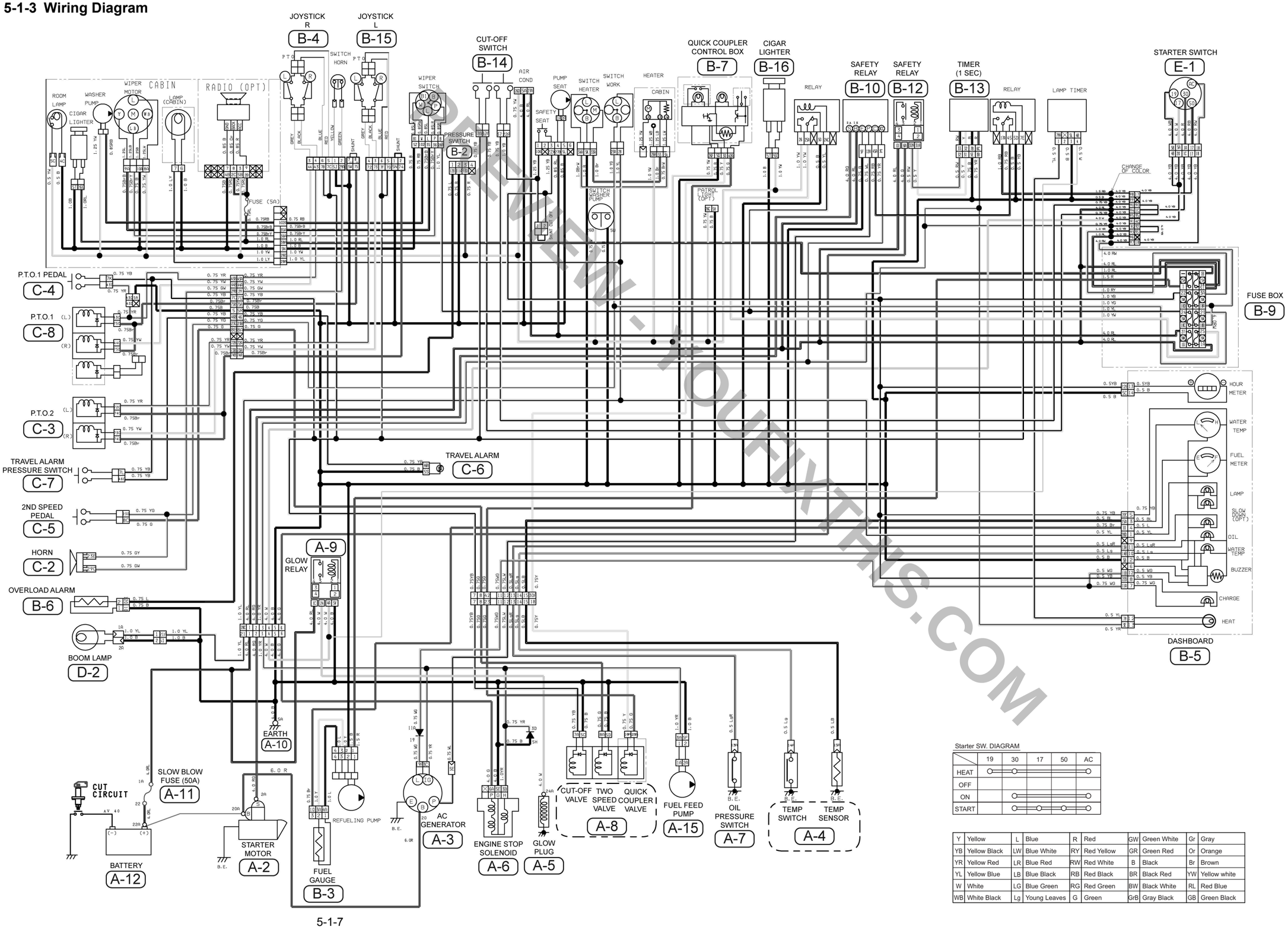
3-7-1 Machine

Unit : N•m

Applicable model:			ViO33U		
Equipment No.		Tightening part	Thread size	Tightening torque	Adhesive
Engine / Electrical equipment					
	1	Engine mount vibroisolating rubber	Nut 12	79 to 93	
	2	Engine × Engine mount (Flywheel side)	M10x30 (10.9)	67 to 79	Three Bond 1324
	3	Engine × Engine mount (Radiator side)	M10x30 (10.9)	67 to 79	Three Bond 1324
	4	Air cleaner	M8x20	23 to 27	
	5	Air cleaner hose in side	Hose clip 80	2,5 to 3,5	
	6	Air cleaner hose out side	Hose clip 80	2,5 to 3,5	
	7	Water cooler inlet & outlet	Hose clip 35	2,5 to 3,5	
	8	Oil cooler inlet & outlet	Hose clip 25	2,5 to 3,5	
	9	Oil cooler drain hose	Hose clip 16	2,5 to 3,5	
	10	Oil cooler drain plug	Hex.19	15 to 20	
	11	Heater hose	Hose clip 19	2,5 to 3,5	
	12	Fuel gauge hose	Hose clip 16	2,5 to 3,5	
	13	Fuel tank band	Nut M10	2,5 to 3 (Tank tightening side)	(24.5 to 29.4) (Lock nut side)
	14	Battery holding plate	M8x30	23 to 27	
	15	Safety starter switch (2-speed pedal)	Lock nut M18 (Fine)	29 to 35	
	16	Safety starter switch (Cut-off lever)	Lock nut M18 (Fine)	29 to 35	
Driving system					
	1	Idler screw plug	R1/8	9 to 10	Loctite 572
	2	Nipple valve	M16	50	
	3	Sprocket	CHC M12x35 (10.9)	116 to 138	Three Bond 1324
	4	Idler seal cover × Track adjusting spring	M10x40	46 to 54	Three Bond 1324
	5	Track roller	M16x35 (10.9)	291 to 339	Three Bond 1324

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5-1-3 Wiring Diagram



Starter SW. DIAGRAM

	19	30	17	50	AC
HEAT	○				○
OFF					
ON		○			○
START		○		○	○

Y	Yellow	L	Blue	R	Red	GW	Green White	Gr	Gray
YB	Yellow Black	LW	Blue White	RY	Red Yellow	GR	Green Red	Or	Orange
YR	Yellow Red	LR	Blue Red	RW	Red White	B	Black	Br	Brown
YL	Yellow Blue	LB	Blue Black	RB	Red Black	BR	Black Red	YW	Yellow white
W	White	LG	Blue Green	RG	Red Green	BW	Black White	RL	Red Blue
WB	White Black	Lg	Young Leaves	G	Green	GrB	Gray Black	GB	Green Black

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4-2-4 Cylinder Head

Cylinder Head Components

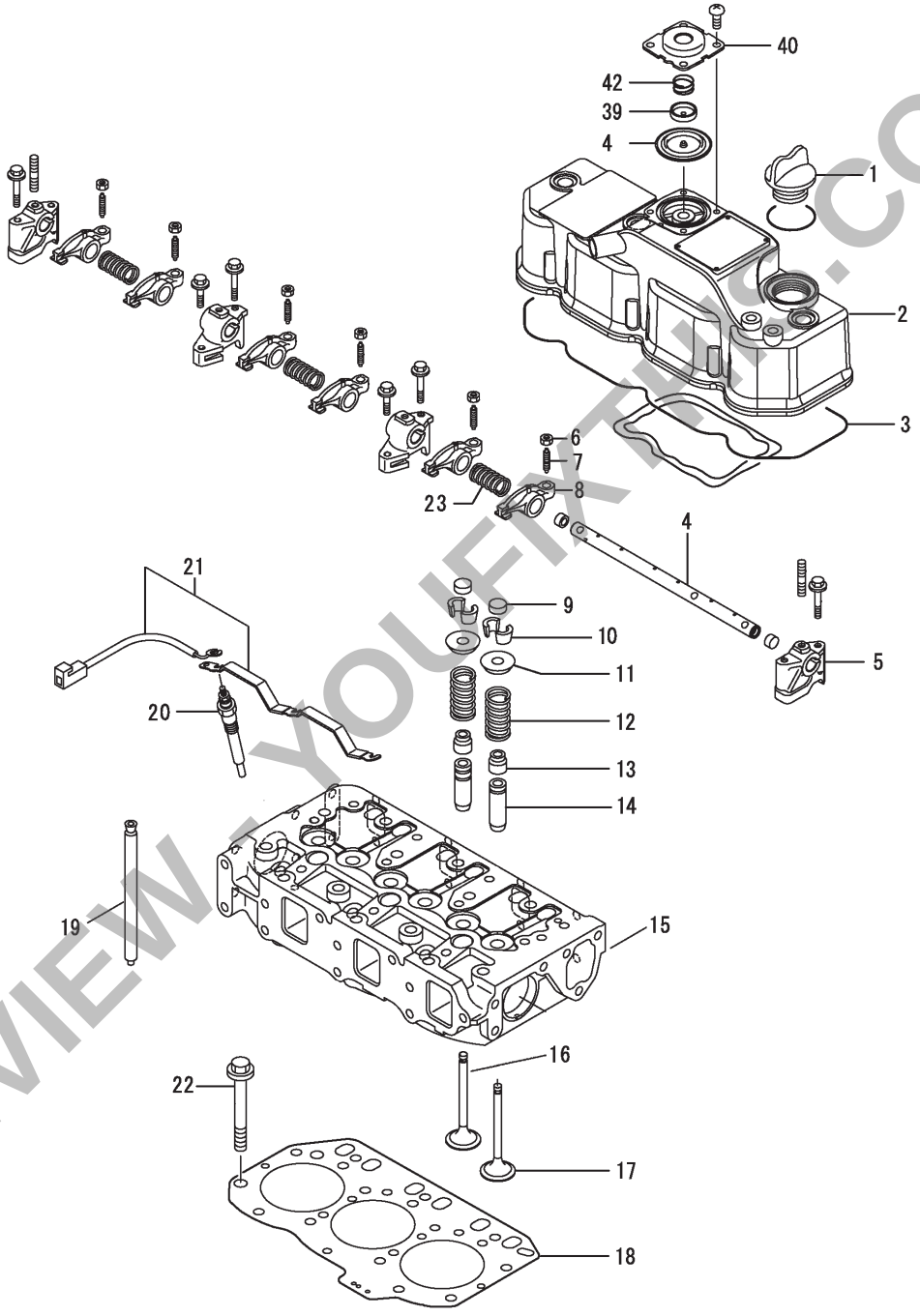


Figure 4-2-1

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Measured Value and Troubleshooting

When the measured compression pressure is below the limit value, inspect each part by referring to the table below.

No.	Item	Cause	Corrective Action
1	Air Cleaner Element	Clogged element	Clean the element.
		Broken element	Replace the element.
		Defect at element seal portion	
2	Valve Clearance	Excessive or no clearance	Adjust the valve clearance.
3	Valve Timing	Incorrect valve clearance	Adjust the valve clearance.
4	Cylinder Head Gasket	Gas leak from gasket	Replace the gasket.
			Retighten the cylinder head bolts to the specified torque.
5	Intake / Exhaust Valve	Sticking valve	Replace the intake / exhaust valve.
	Valve Seat	Gas leak due to worn valve seat or foreign matter trapped in valve	Lap the valve seat.
6	Piston	Gas leak due to scratching or wear	Perform honing and use an oversized part.
	Piston Ring		
	Cylinder		

4-9-3 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 so as not to shorten the engine service life.

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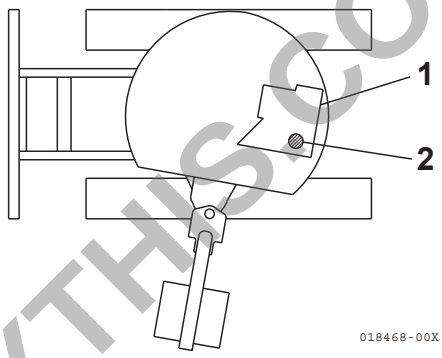
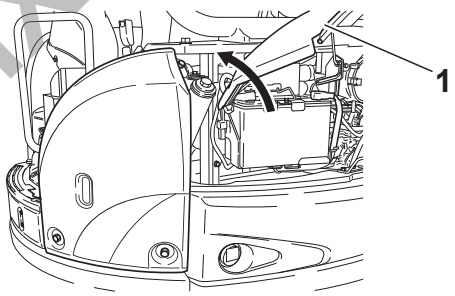
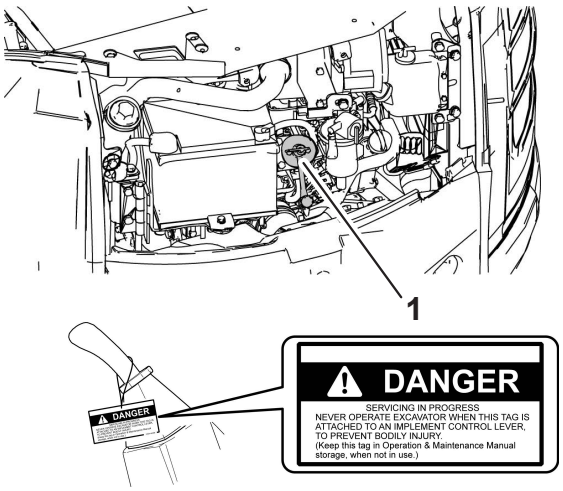
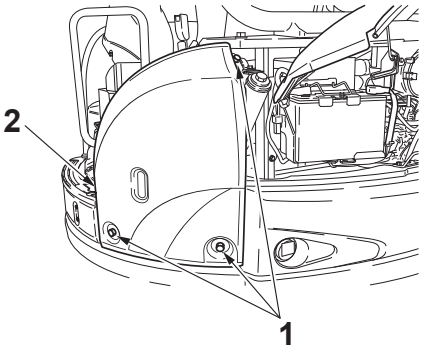
7. ADJUSTMENT AND REPAIR

7 Adjustment and repair

7-1 Engine and Electric Equipment

7-1-1 Removal and Reinstallation of Engine

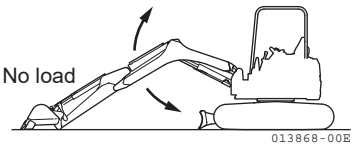
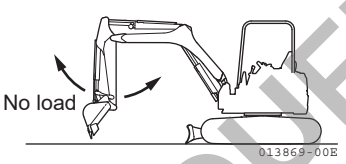
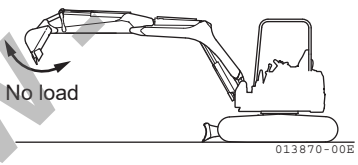
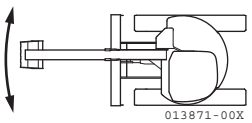
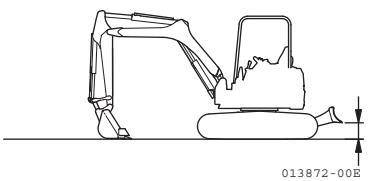
1) Removal

Procedure	
(1) Swing the upperstructure so that the drain plug **2** of hydraulic oil reservoir **1** can position in the middle of the tracks. Then lower the bucket to the ground and stop the engine.	
(2) Open the bonnet B **1** and remove it.	
(3) Disconnet the battery of the machine. - Turn the main switch **1** on OFF position. Note : Place a MAINTENANCE IN PROGRESS label on the machine.	
(4) Loosen three cap screws **1** to remove the side cover **2**.	

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3. Service Standards

3-1 Machine Performance

Applicable model				ViO33U	
Item	Measuring condition		Unit	Standard	Allowance
Machine performance					
Working speed					
Boom speed Max. cylinder extension ⇕ Bucket teeth grounded	Machine position  • Engine : rated speed •Hydraulic oil temp. : 50 to 60 °C • Site : Firm, flat ground	Up	sec.	2,1	2,4
		Down		2,6	2,9
Arm speed Max. cylinder retraction ⇕ Max. cylinder extension	Machine position  • Engine : rated speed •Hydraulic oil temp. : 50 to 60 °C • Site : Firm, flat ground	Extend	sec.	1,9	2,2
		Retract		2,9	3,2
Bucket speed Max. cylinder retraction ⇕ Max. cylinder extension	Machine position  • Engine : rated speed • Hydraulic oil temp. : 50 to 60 °C • Site : Firm, flat ground	Dump	sec.	2,1	2,4
		Curl		3	3,3
Boom offset speed Max. cylinder retraction ⇕ Max. cylinder extension	Machine position  • Engine : rated speed • Hydraulic oil temp. : 50 to 60 °C • Site : Firm, flat ground	Right swing	sec.	4,8	5,2
		Left swing		5,1	5,5
Blade speed Max. cylinder retraction ⇕ Blade grounded	Machine position  • Engine : rated speed • Hydraulic oil temp. : 50 to 60 °C	Up	sec.	2,2	2,5
		Down		2,7	3

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3. SERVICING STANDARDS

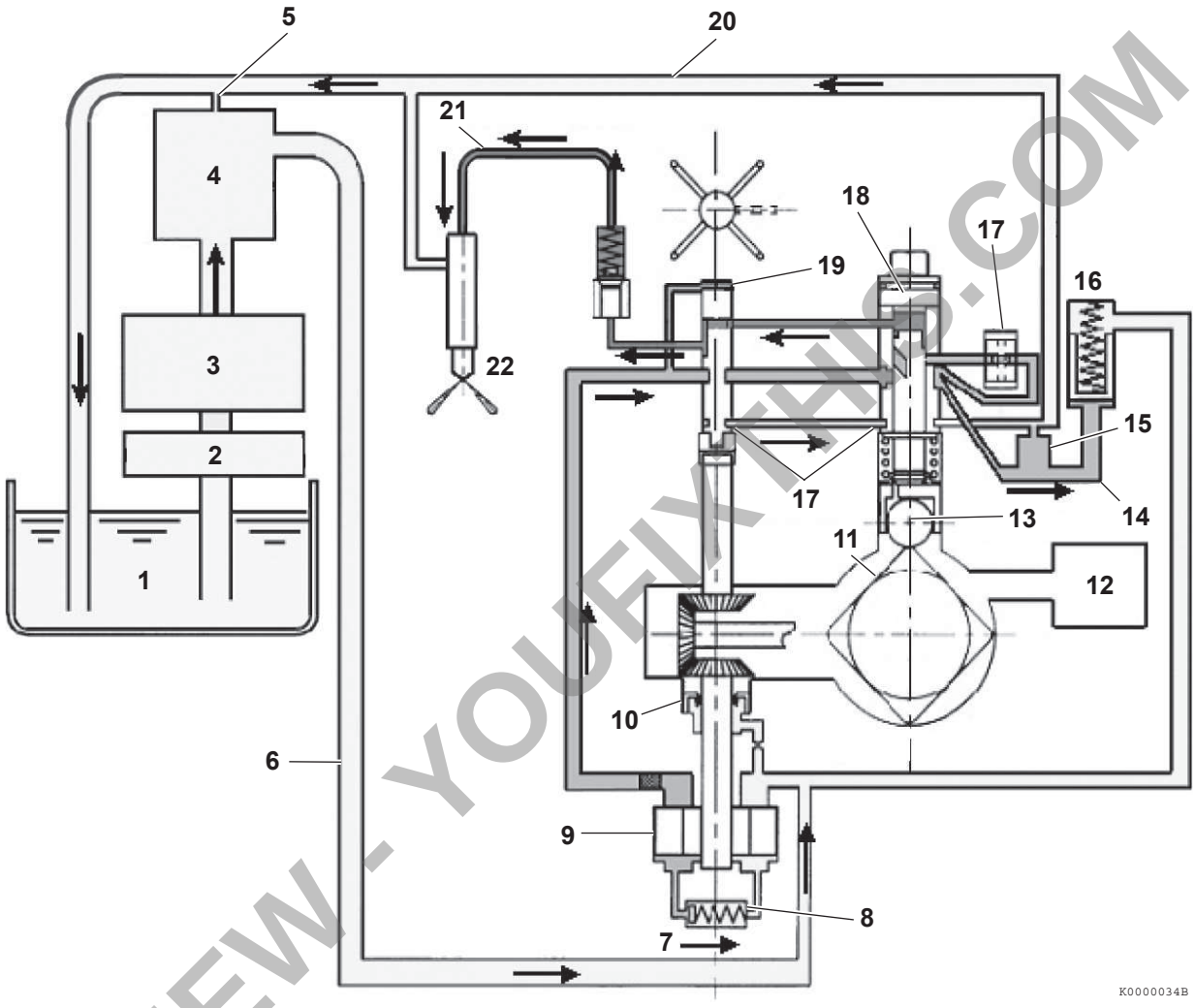
3-2 Engine

1) Nominal and Allowable Values

Applicable model				3TNV82A-NBV2A	
Item			Unit	Standard	Wear limit
Cylinder head					
Cylinder head distortion			mm	0,05 or less	0,15
Valve seat angle	Intake		degrees (°)	120	–
	Exhaust			90	–
Valve seat width	Intake		mm	–	
	Exhaust			–	
Intake valve	Stem outside dia.		mm	6,945 to 6,960	6,9
	Guide inside dia.			7,000 to 7,015	7,08
	Oil clearance			0,04 to 0,07	0,18
Exhaust valve	Stem outside dia.		mm	6,94 to 6,955	6,9
	Guide inside dia.			7,000 to 7,015	7,08
	Oil clearance			0,045 to 0,075	0,18
Valve guide projection			mm	11,7 to 12,0	–
Valve sinkage	Intake		mm	0,35 to 0,55	0,8
	Exhaust			0,3 to 0,5	
Valve head thickness	Intake		mm	1,24 to 1,44	0,8
	Exhaust			1,35 to 1,55	
Intake valve operating timing	Open	b. TDC	degrees (°)	10 to 20	–
	Close	a. BDC		40 to 50	–
Exhaust valve operating timing	Open	b. BDC	degrees (°)	51 to 61	–
	Close	a. TDC		13 to 23	–
Valve spring	Free length		mm	44,4	43,9
	Inclination		mm	–	1,4
	Tension (1 mm) compressed		kg	–	–
Intake / exhaust valve clearance			mm	0,195 to 0,205	–
Cylinder block					
Cylinder bore dia.			mm	82,00 to 82,03	88,2
Cylinder bore dia.		L mark		–	
		M mark		–	
		S mark		–	
Roundness of cylinder				0,01 or less	0,03
Cylindricity of cylinder				0,01 or less	0,03

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4-3-5 FUEL SYSTEM DIAGRAM



1 – Diesel fuel tank
2 – Fuel filter/water separator
3 – Electric fuel pump
4 – Fuel filter
5 – Air bleed orifice
6 – Fuel supply line
7 – Low pressure gallery
8 – Pressure control valve
9 – Trochoid pump
10 – Oil seal
11 – Fuel injection pump cam
12 – Engine crankcase
13 – Tappet
14 – High pressure gallery
15 – Overflow orifice
16 – Accumulator
17 – Timer piston
18 – Mono-plunger
19 – Distributor shaft
20 – Fuel return line
21 – High-pressure fuel injection lines
22 – Fuel injector

Figure 4-3-4

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Inspection of Rocker Arm Assembly

Rocker Arm Shaft Hole Diameter

Use a telescoping gauge and micrometer to measure the inside diameter of all the rocker arm support brackets and the rocker arms **(Figure 4-2-12)**. Record the measurements. *See "3-2 Engine Service Standard" section for the service limit.*

Inspect contact areas **(Figure 4-2-12, (1))** for excessive wear or damage.

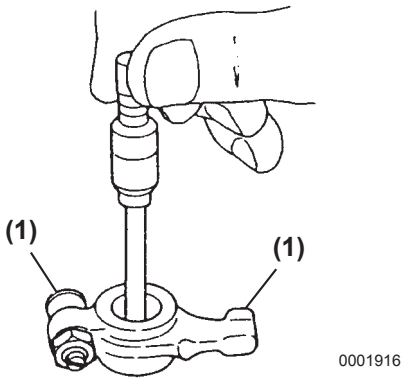


Figure 4-2-12

Rocker Arm Shaft Outside Diameter

Use a micrometer to measure rocker arm shaft diameter. Measure at each rocker arm location in two directions 90° apart **(Figure 4-2-13)**. Record the measurements. *See "3-2 Engine Service Standard" section for the service limit.*

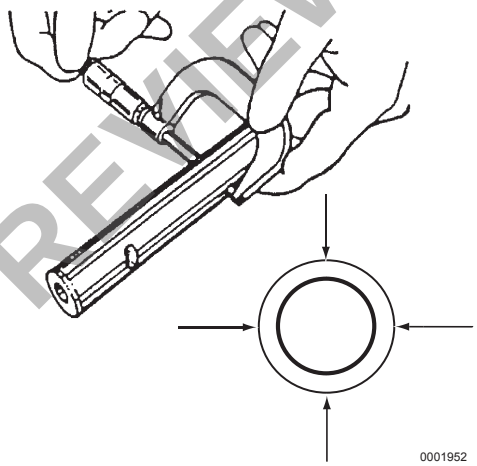


Figure 4-2-13

Inspection of Valve Guides

Visually inspect the valve guides for distortions, scoring or other damage.

Note: Measure valve guides while they are installed in cylinder head.

Use a telescoping gauge and micrometer to measure the inside diameter of the valve guide. Measure in three places and 90° apart **(Figure 4-2-14)**. Record the measurements. *See "3-2 Engine Service Standard" section for the service limit.* Replace valve guides if not within specification.

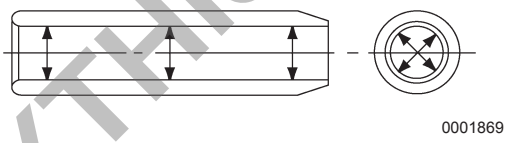


Figure 4-2-14

Inspection of Cylinder Head

Cylinder Head Distortion

Put the cylinder head flat and inverted (combustion side up) on the bench. Use a straightedge and feeler gauge to measure cylinder head distortion **(Figure 4-2-15)**. Measure diagonally and along each side. Record the measurements. *See "3-2 Engine Service Standard" section for the service limit.*

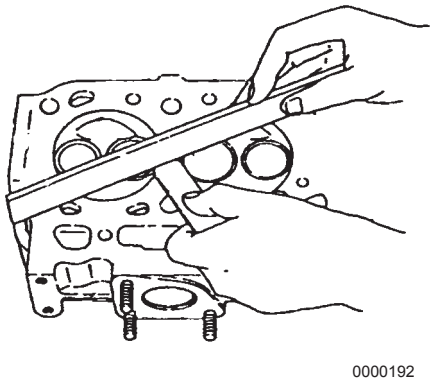


Figure 4-2-15

If distortion exceeds the service limit, resurface or replace the cylinder head. Remove only enough material to make the cylinder head flat, but do not remove more than 0.008 in. (0.20 mm).

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■ Rotor shaft clearance <Trochoid type 3TNV82A-B - 4TNV88-B, 4TNV94L - 4TNV106T>

Model	Inspection item	Standard	Limit	Reference page
3TNV82A-B, 3TNV88-B, 3TNV88-U, 4TNV88-B, 4TNV88-U, 3TNV84T-Z, 4TNV84T-Z	Plate bearing I.D.	10.000 - 10.015 mm	10.040 mm	*Check rotor shaft clearance on page 4-5-7*
	Rotor shaft O.D.	9.955 - 9.967 mm	9.940 mm	
	Rotor clearance	0.033 - 0.060 mm	0.100 mm	

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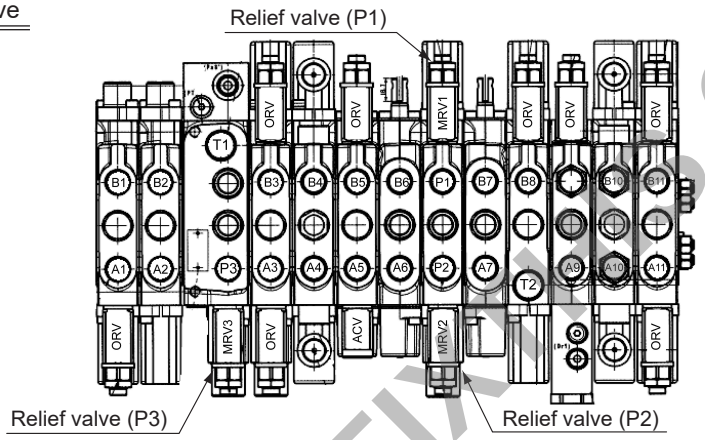
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(3) To check the pressure of the system relief valve MRV1 (for the piston pump P1) in the control valve, retract the bucket cylinder to its stroke end, hold the lever and read the gauge. Adjust the pressure if necessary.

(4) To check the pressure of the system relief valve MRV2 (for the piston pump P2), retract the arm cylinder to its stroke end, hold the lever and read the gauge. Adjust the pressure if necessary.

(5) To check the pressure of the system relief valve MRV3 (for the gear pump P3), extend the blade cylinder to its stroke end, hold the lever and read the gauge. Adjust the pressure if necessary.

System relief valve



Note :

In case of pressure adjustment, take care to lock the adjust screw when the specified pressure of the circuit relief valve is obtained.

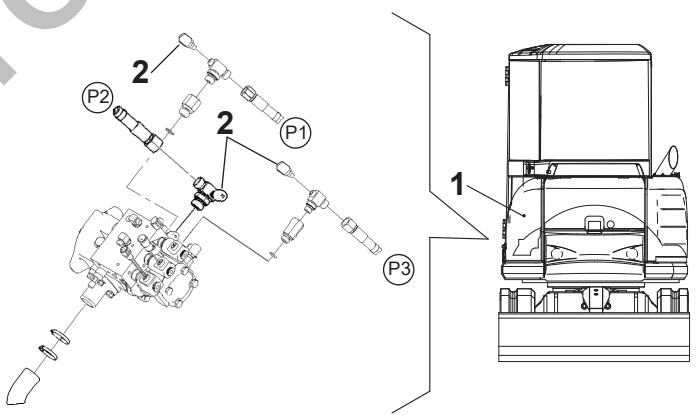
Tightening torque for counter nut : 37 to 41 Nm

4) Checking of Circuit relief valve

a) Measuring Points

(1) Remove the bonnet L **1**.

(2) Remove the cap from the pressure port **2.**



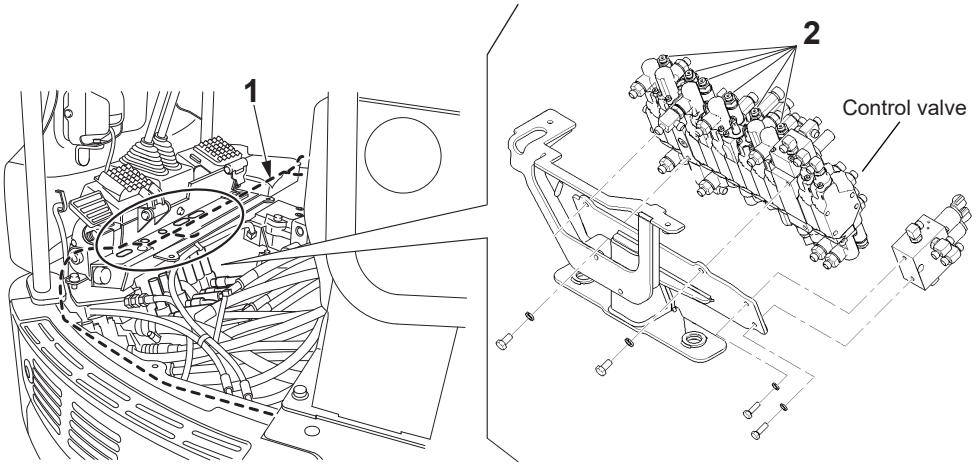
b) Adjustment Procedure

The pressure of the hydraulic circuit sets through the primary relief valve of the control valve.

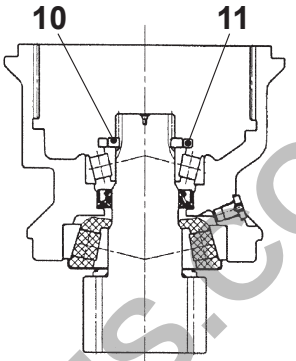
WARNING
The pressure is factory setting, all necessary adjustment must be done by YANMAR dealer.

(1) Remove the floor mat and floor step **1**.

(2) Use hex bar wrench through the holes in the circled area to adjust pressure for the relief valves near the floor.

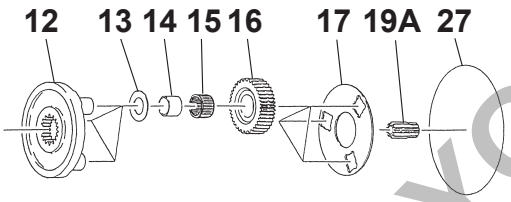


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Procedure	
(25) Install the collar **11** and the plates **10**.	

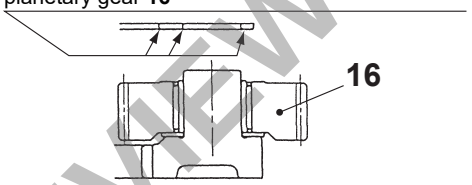
(26) Install the thrust washers **13**, the inner races **14**, the needle bearings **15**, the planetary gears **16**, the thrust plate **17** and the drive gear **19A** into the holder B **12**.

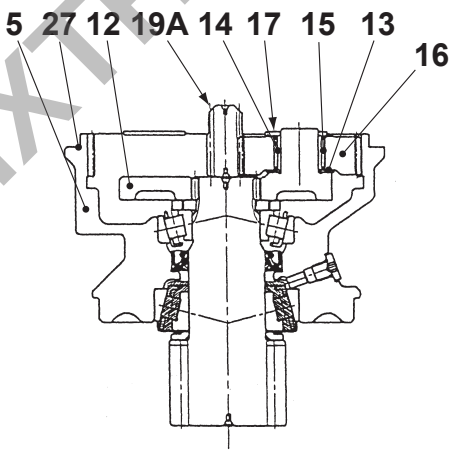
(27) Apply grease to the O-ring **27** and install it into the housing **5**.



Note :
The thrust plate has direction..

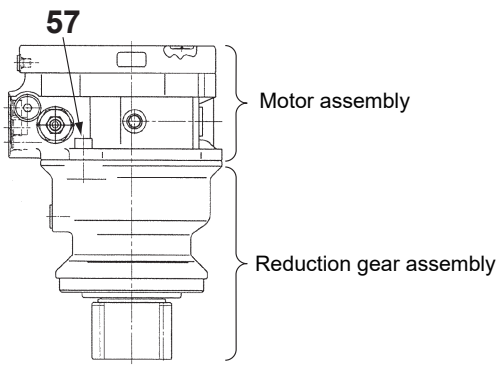
Install the thrust plate with the taper side toward planetary gear **16**



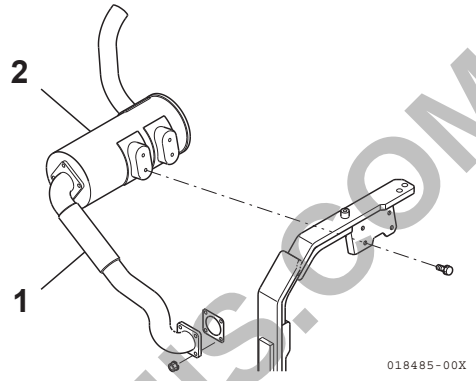
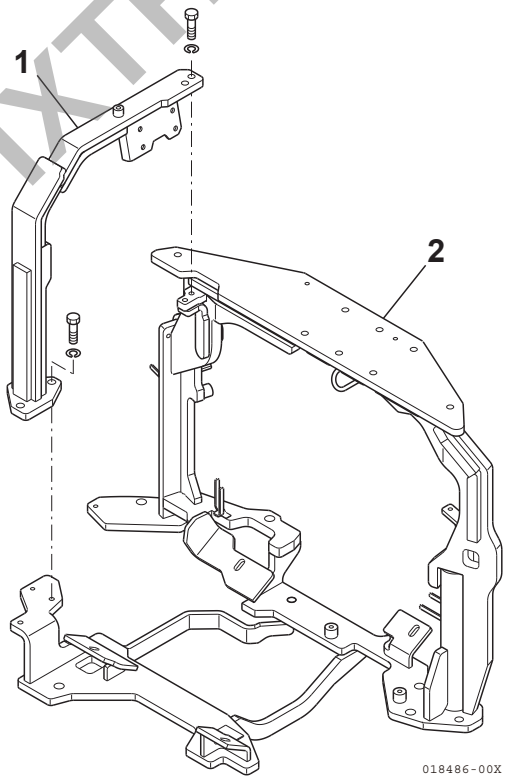
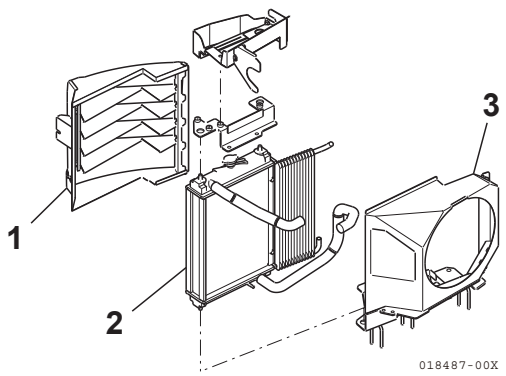


(28) Put the motor assembly onto the reduction gear assembly, and then temporarily tighten two socket head bolts **57** and retighten them at the specified torque.

Tightening torque : 121,5 to 135,5 N m



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Procedure	
(27) Loosen four nuts to remove exhaust gas tube **1** from the engine. (28) Loosen four cap screws to remove exhaust gas silencer **2** from the silencer bracket.	
(29) Remove the silencer bracket **1** from the engine mount. **2**	
(30) Remove the duct **1**, radiator **2** and shroud **3**.	

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