

SERVICE MANUAL

CX50 Forklift Truck, EPA/CARB 2010 Compliant

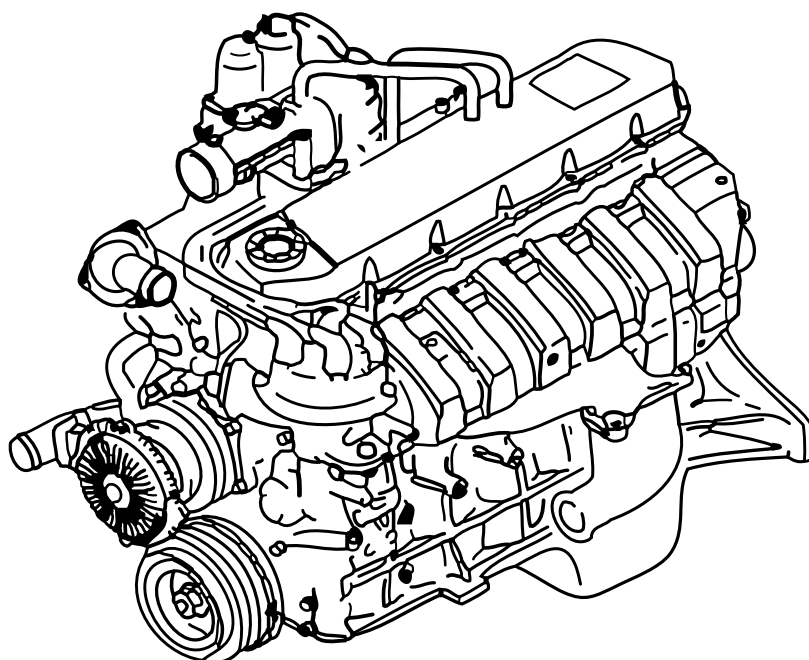
Gasoline/LPG

FG40ZTU/40TU/45TU/50ATU-10

S/N 134756~

FG40Z/35/40/45/50A-10

TB45 GASOLINE ENGINE (ECU)



WARNING

Read and observe all warnings on this unit before operating it.

DO NOT operate this equipment unless all factory-installed guards and shields are properly secured in place.

KOMATSU®

Komatsu Forklift U.S.A., LLC

ISSUED: JUNE 2011

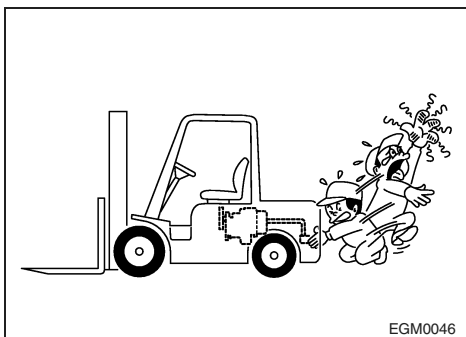
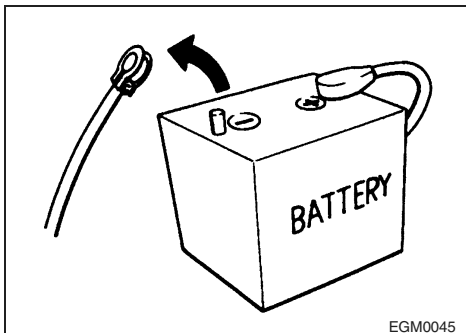
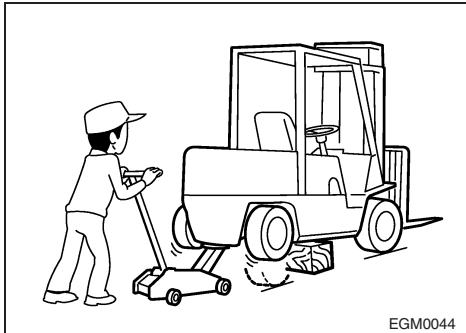
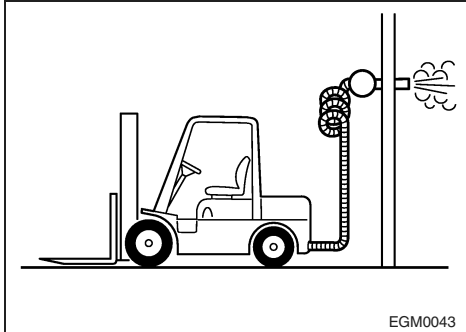
PRECAUTIONS FOR SAFETY AND QUALITY

Description

- Observe the following precautions for safe and proper maintenance.
- Only qualified and appointed persons shall inspect, repair, or adjust the vehicle.
- Keep the workplace and tools clean.

Safe Work

- Do not run the engine in a place which has no exhaust ducts and which is poorly ventilated.
- Ventilate the workplace well and do not place a combustible thing there. Take extreme care when handling a combustible thing or a hazardous material such as gasoline.
- Dispose of the replaced oil, parts washing oil, etc. according to laws.
- When working on parts which become hot, rotary parts, or sliding parts, take care not to burn or injure yourself.
- When working in a pit or a closed place, ventilate it to discharge harmful materials in advance.
- Do not work on the vehicle jacked up. When working on it, support it by the specified parts on wood blocks, etc.
- When lifting up the vehicle, support it by the specified parts and apply a safety device.
- When removing a heavy part such as the engine, vehicle body, etc. take care not to drop it by unbalancing it.
- Do not smoke while maintaining the vehicle.
- When maintaining the vehicle, take off rings and necklace to prevent a short circuit in the electrical system.
- Before starting repair which does not need the battery power, turn the key switch OFF and disconnect the negative (–) terminal of the battery.



- Take care not to touch the hot metal parts just after stopping the engine. While the engine is still hot, do not remove the radiator cap or another part of the coolant system.
- Use the specified proper common tools or special tools for safe and efficient repair.

PRECAUTIONS FOR SAFETY AND QUALITY

Correct Work

- Grasp the contents of each trouble, and then troubleshoot and work efficiently.
- When removing and disassembling parts, check their normal assembly condition in advance. Make match marks on places which do not affect the function, if necessary.
- If an oil seal, gasket, packing, O-ring, lock washer, cotter pin, self-lock nut, etc. are removed, replace them according to the directions in their sections (Parts which must not be reused).
- When a tapered roller bearing or a needle roller bearing needs to be replaced, replace its inner race and outer race as a set.
- Arrange the removed parts in order so that they will not be mixed up.
- Before checking or assembling the disassembled parts, clean them.
- When replacing a part, install a NISSAN genuine part.
- Use the specified oil, grease, sealant, etc.
- Before removing a pressurized pipe, hose, etc., release the pressure.
- After repairing the fuel, oil, coolant, exhaust, or vacuum system, check it for leakage securely.

Precautions for Radio Equipment Installation

Check the following when installing a commercial/ham radio or mobile phone. If mounting position is not chosen carefully, the unit may interfere with the electronic control system.

- Separate the antenna as far from the ECM as possible.
- Route an antenna feeder line at least 20 cm (7.87 in) apart from the control unit harness.
- Adjust an antenna and feeder line to eliminate radio wave interference.

HOW TO READ THIS MANUAL

Outline

This chapter explains how to read the procedures of "removal, disassembly, assembly, inspection, and adjustment" and "trouble-shooting".

Definition of Terms

⚠ CAUTION:

- An item or a work procedure, neglect of which can cause a death or a serious injury if neglected.
- An item or a work procedure to be observed especially among those, neglect of which can cause an injury, an accident, or a damage of the vehicle or component parts.

Reference : Supplementary explanation for the ease of work.

Standard value : Permissible deviation of a value at inspection or adjustment.

Limit value : The maximum or minimum which a value must not exceed at inspection or adjustment.

Definition of Units

In this manual, tightening torque, pressure, etc. are indicated by the "SI unit" (International unit) first, then by the "metric unit" in { }.

Example) Tightening torque: 59 - 78 Nm {6.0 - 8.0 kgf•m}
SI unit {Metric unit}

CONVERSION OF MAJOR UNITS

Quantity	SI unit	Conventional unit	Coefficient of conversion into SI
Acceleration	m/s ²	G	9.80665
Torque and moment	Nm	kgf•m	9.80665
Force	N	kgf	9.80665
Pressure	MPa	kgf/cm ²	0.09809665
	kPa	mmHg	0.133322
Power/Power efficiency	kW	PS	0.735499
	W	kcal/h	1.16279
Volume	cm ³	cc	1
Spring constant	N/mm	kgf/mm	9.80665
Fuel consumption	g/kW•h(*1)	g/PS•h	1.3596

*1. Conventional unit may be used in SI.

HOW TO READ THIS MANUAL

Description

CAUTION : At the beginning of each section, the precautions exclusive to the section are described.

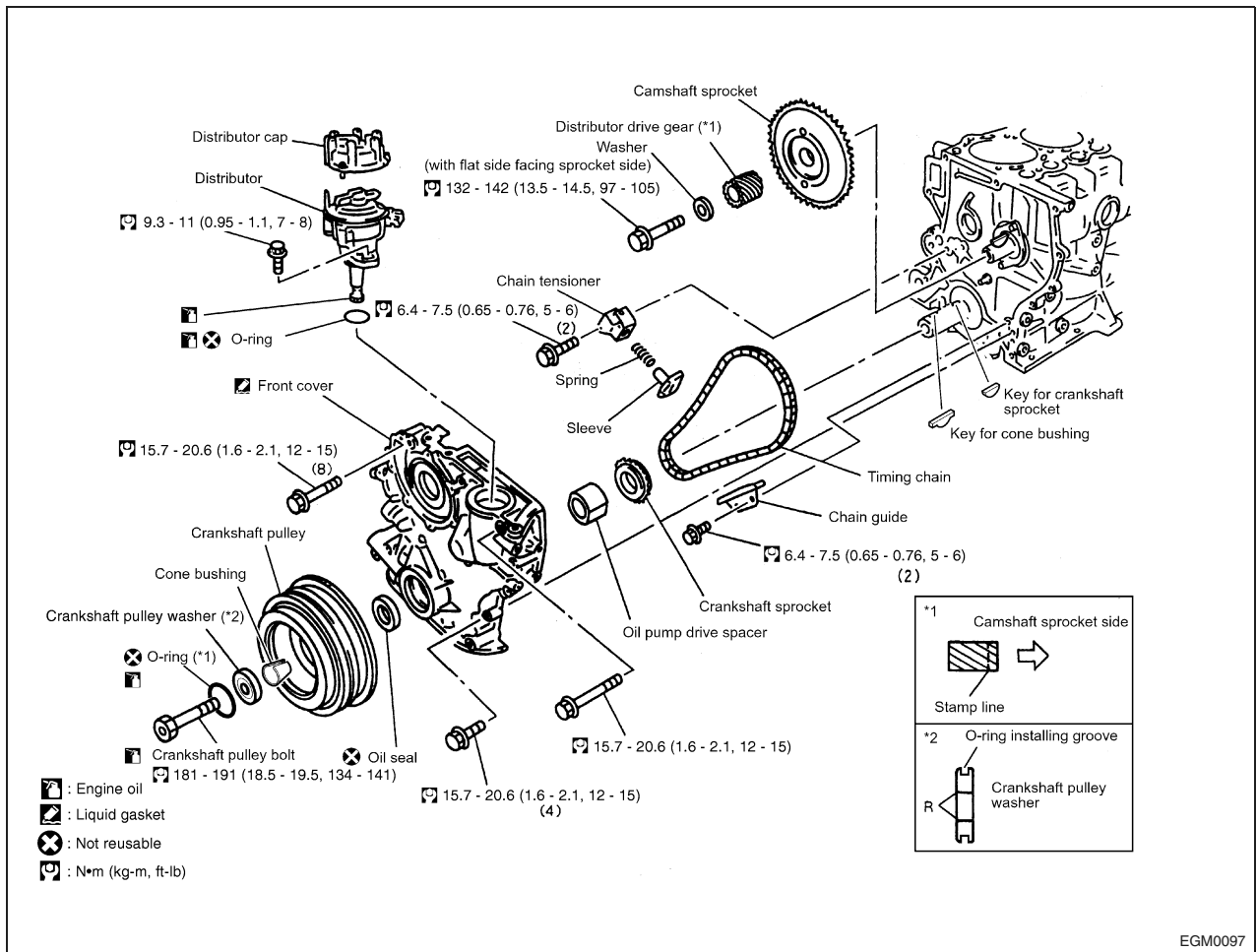
Preparation: At the beginning of each section and during the trouble diagnosis items, the SSTs, gauges, and other tools to be prepared before operation are described. Some commercial service tools, assumed to be available in any workshop, are omitted.

Description : To perform correct operations, operational procedures, notes, SSTs, and other service information are described.

CAUTION : Descriptions of visual inspections and cleaning of removed parts are generally omitted. Please remember that actual operations require these processes.

Component Parts Location






The "Component Parts Location" diagram (refer to the figure) includes information for removal, installation, disassembly, and assembly (tightening torque, grease points, non-reusable parts) as well as other information important for repair work.



HOW TO READ THIS MANUAL

Component Parts Location (Cont'd)

COMPONENT SYMBOLS

Symbols	Description	Symbols	Description
	Tightening torque		Not reusable
	Should be lubricated with oil.		Select proper thickness.
	Searing point		

EGM0048

ECM Trouble Diagnosis

⚠ CAUTION:

- The following trouble diagnosis procedures are designed to identify the trouble causes efficiently. When performing diagnoses, carefully observe the following instructions.
- Before starting a trouble diagnosis, carefully read and understand the contents in "Basic Inspection", "Diagnosis Chart by Symptom" and "Trouble Diagnosis Flowchart".
- After the repair work, always verify that the trouble is eliminated.
- For the locations of the parts and harness connectors, refer to "Component Parts Location" in the relevant section.
- To perform a simple inspection, utilize the circuit diagrams. To inspect the circuit for continuity in details including the sub-harnesses, identify the relevant connectors and harness layouts referring to the "Wiring Diagrams".
- Before inspecting a circuit for continuity, always turn the ignition switch to OFF.
- Before measuring voltage at a connector, always measure the battery voltage.
- After finishing diagnoses or inspections, always ensure that all removed harness connectors are reconnected correctly.

TROUBLE DIAGNOSIS

ECM Trouble Diagnosis (Cont'd)

SYMBOLS

Symbols	Description	Symbols	Description
DISCONNECT 	Check after disconnecting the connector to be measured.		Procedure with SST
CONNECT 	Check after connecting the connector to be measured.		Procedure without SST
	Insert key into ignition switch.		A/C switch is "ON".
	Remove key from ignition switch.		A/C switch is "OFF".
	Turn ignition switch to "OFF" position.		Connect to battery power supply directly.
	Turn ignition switch to "ON" position.		Drive condition
	Turn ignition switch to "START" position.		Disconnect battery negative terminal.
	Turn ignition switch from "OFF" to "ACC" position.		Brake pedal depressed
	Turn ignition switch from "ACC" to "OFF" position.		Release brake pedal.
	Turn ignition switch from "OFF" to "ON" position.		Depress accelerator pedal.
	Turn ignition switch from "ON" to "OFF" position.		Release accelerator pedal.
	Do not start engine, or check with engine stopped.	<p>Shows connector terminals of ECM or other control units that have several terminals.</p>	
	Start engine, or check with engine running.		
	Apply parking brake.		
	Release parking brake.		
	Check after engine is warmed up sufficiently.		
	Voltage should be measured with a voltmeter.		
	Circuit resistance should be measured with an ohmmeter.		
	Current should be measured with an ammeter.	<p>CONNECT </p> <p></p>	

EGM0049

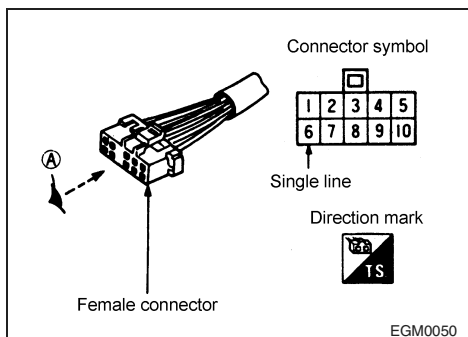
TROUBLE DIAGNOSIS

ECM Trouble Diagnosis (Cont'd)

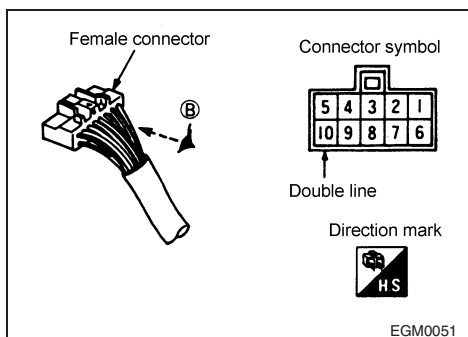
SYMBOLS FOR HARNESS CONNECTOR

FEMALE CONNECTOR

- When a harness connector is viewed from A (terminal side), the outer frame of the connector symbol is indicated with a single line. In addition, the direction indicator shows "TS" (Terminal Side) in description type font.

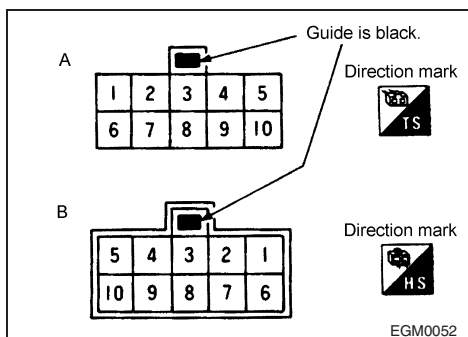


- When a harness connector is viewed from B (harness side), the outer frame of the connector symbol is indicated with double lines. In addition, the direction indicator shows "HS" (Harness Side) in description type font.
- Terminal assignments of a connector viewed from A and B are mirror images, indicating just as they are seen.



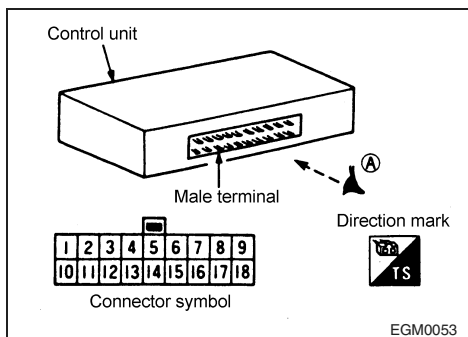
MALE CONNECTOR

The illustration method is the same as that for a female connector, the black guide box, however, indicates a male connector (the white guide box a female connector).



SINGLE UNIT (CONTROL UNIT)

A single control unit is viewed only from A, and the illustration is as shown in the figure.



TROUBLE DIAGNOSIS

ECM Abbreviations List

Abbreviations	Description	Abbreviations	Description
A/C	Air conditioner	INT	Intake
A/T	Automatic transmission	LH	Left
ALT	Alternator	LED	Light emitting diode
ASSY	Assembly	LLC	Long-life coolant
BAT	Battery	M/T	Manual transmission
C/P	Crankshaft pulley	OHV	Overhead valve
C/U	Control unit	OS	Oversize
Cyl	Cylinder	P/S	Power steering
ENG	Engine	PTO	Power take-off
EXH	Exhaust	RH	Right
F/L	Fusible link	RR	Rear
FR	Front	TAS	Throttle adjust screw
I/P	Idler pulley	Tr	Transistor
IGN	Ignition	US	Undersize

Connector Terminal Inspection

CONNECTOR INSPECTION PROCEDURE

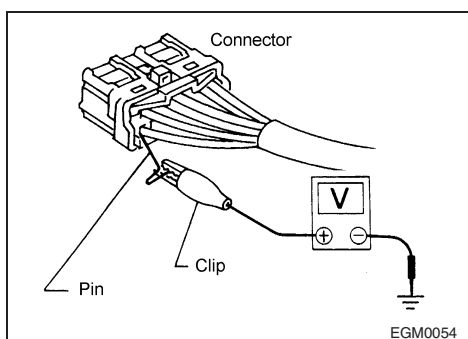
In circuit inspection, inappropriate connector probing will cause connector damages and/or poor connection. The probes provided with the circuit tester may be too large to probe connector terminals without damaging them. Always use alligator clips and "T" pins according to following the procedure.

INSPECTION FROM HARNESS SIDE

For a standard connector without any waterproofing, use "T" pins from the harness side.

⚠ CAUTION:

- For a connector with a rear cover, such as ECM connectors, remove the rear cover before the inspection.
- For a waterproof connector, do not probe the terminals from the harness side. Doing so may damage the seal.

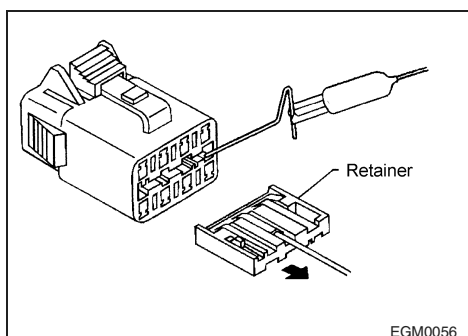
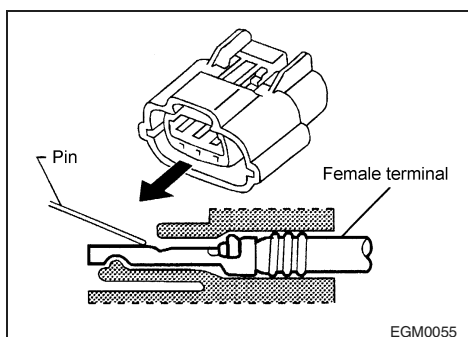


INSPECTION FROM TERMINAL SIDE

1. Female terminal
- Female connector terminals have a small notch difference inside. Insert a "T" pin along the step to inspect.

⚠ CAUTION:

Do not insert any objects to a female connector terminal other than the corresponding male connector terminal.



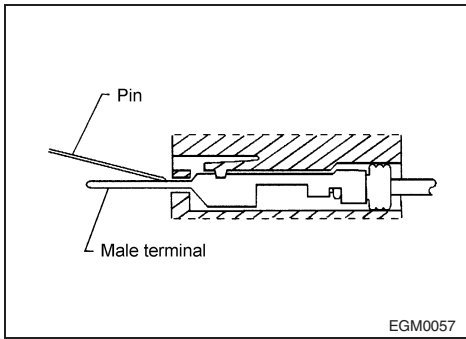
- In case of a female connector terminal without any notches, remove the retainer before probing.

Connector Terminal Inspection (Cont'd)

2. Male terminal

For a male connector terminal, apply a "T" pin to the surface of the terminal.

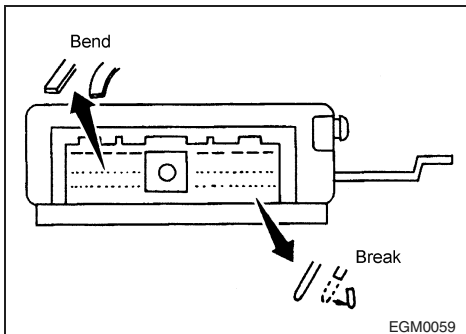
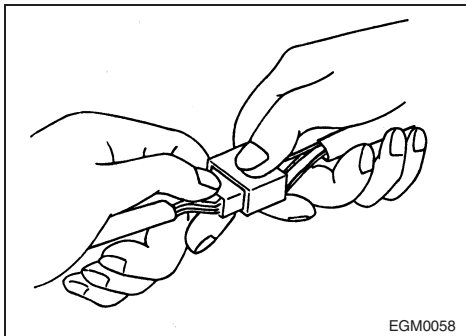
⚠ CAUTION:
Do not bend terminals.



Inspection for Electrical System

DESCRIPTION

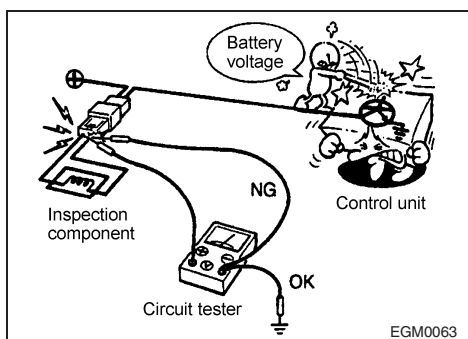
- If the malfunction can be traced directly to the electrical system, first check for items such as burned-out fuses and fusible links, broken wires or loose connectors, pulled-out terminals, and improper connections.
 - If a fuse or a fusible link is blown out, determine the possible cause and restore it. Always replace it with a new fuse or fusible link of the specified capacity.
 - When removing a connector, do not apply excessive force to the main body by grasping and twisting.
 - Do not pull a connector off by tugging on the harness.
 - For a lock-type connector, disengage its lock first, then disconnect the connector by holding the main body of the connector.
-
- Before connecting a connector, check terminals for bends or breakage. Connect it securely.
 - For a lock-type connector, press it until its lock is securely engaged.
 - When installing parts, prevent harnesses from being snagged or overextended.



Control Unit and Electronic Component

PRECAUTIONS

- Never reverse polarity of battery terminals.
 - Install only parts specified for each model.
 - Before replacing a control unit, check input and output signals to/from the control unit, and component functions.
 - When disconnecting a connector, do not twist or apply excessive force.
 - For a bolt-type connector, loosen the bolt first, then hold the main body of the connector to disconnect.
 - Before connecting a connector, check terminals for bends or breakage. Connect it securely. For a bolt-type connector, screw in the bolt until the colored lug is flush with the surface to be sure it is securely connected.
 - Do not drop, hit, or subject control units to impact.
 - Be sure to protect control units from condensation caused by a sudden shift in temperature, or from raindrops or splashes. If any water drops adhere to the unit, dry it well prior to installation.
 - Be sure to protect control unit connectors from oil.
 - Avoid cleaning control units with benzine.
 - Do not open a top or bottom cover on a control unit.
-
- When using a circuit tester, ensure the appropriate distance between test probes. A longer distance is recommended, because if the distance is too short, it may cause contact of the test probes, resulting in a short circuit. A short circuit allows battery voltage to be applied directly to the control unit, resulting in damage to its internal power transistors.
 - Use the specified check adapter to check input and output signals to/from control units.



ECM GENERAL SERVICE INFORMATION

SST

DESCRIPTION

SST is a small, lightweight handheld tester. When connected to the vehicle-side data link connector, it communicates with control units installed on the vehicle and performs a variety of diagnostic tests.

FUNCTION AND APPLIED SYSTEM

Items	Function
WORK SUPPORT	Sends command to control unit to set status suitable for inspection and service.
FUNCTION SYSTEM	Checks each system as ECM basic inspection.
SELF-DIAG RESULTS	Receives self-diagnostic results from control unit and indicates DTCs and number of occurrences.
SELF-DIAG RESULTS [MEMORY]	DTCs (Diagnostic Trouble Codes) recorded in control unit's memory are displayed.
DATA MONITOR	Receives input/output signals from control unit and indicates and stores them to facilitate locating cause of malfunctions.
DATA MONITOR [SPEC]	
Active test	Sends command to control unit to change output signals and check operation of output system.
DTC RECORD DISPLAY	Indicates self-diagnostic results stored in ECM prior to the most recent "ERASE MEMORY".
Control unit part No.	Displays control unit part number.
Control unit identification No.	Displays control unit identification number.

Diagnostic systems	Engine
WORK SUPPORT	○
SELF-DIAG RESULTS	○
SELF-DIAG RESULTS [MEMORY]	
DATA MONITOR	○
DATA MONITOR [SPEC]	○
Active test	○
DTC RECORD DISPLAY	
Control unit part No.	○
Control unit identification No.	

PRECAUTIONS FOR WORK

Precautions for Draining Coolant

Drain the coolant after its temperature lowers sufficiently.

Precautions for Separating Fuel Piping

- Work in a place where there is nothing to start a fire.
- Release the fuel pressure in advance.
- After separating the fuel piping, plug it to prevent the fuel from flowing out.

Precautions for Removal and Disassembly

- If specified, use correct special tools and pay attention. Do not apply an excessive force.
- Take extreme care not to lower the accuracy of the mating faces, sliding faces, etc.
- If necessary, cover the openings with tapes, etc. to prevent foreign matter from entering the engine.
- Make marks on the removed parts and arrange them for secure troubleshooting and assembly.
- As a rule, loosen the bolts and nuts from outside in the diagonal direction. If the loosening order is specified, observe it.

Precautions for Checking, Repairing, and Replacing Parts

Before repairing or replacing parts, check them sufficiently according to the check procedure. Check the new parts similarly and replace them if necessary.

Precautions for Assembling and Installing Parts

- When tightening the bolts and nuts, be sure to use torque wrenches.
- As a rule, tighten the bolts and nuts from inside to outside in the diagonal direction in 2 – 3 times. If the tightening order is specified, observe it.
- Replace the gaskets, packings, oil seal, and O-rings with new ones.
- Clean each part and dry it by blowing compressed air against it. In particular, take care that the oil passages and coolant passages will not be clogged.
- Take care not to damage the sliding surfaces and mating faces, and remove all dirt, lint, etc. from them. Apply sufficient oil to the sliding surface before assembling.
- If the coolant is drained, bleed air from the coolant system.
- After repairing, run the engine at high speed and check for leakage of the coolant, fuel, oil, grease, and exhaust gas.

PRECAUTIONS FOR WORK

Precautions for Using Power Tools

Use power tools such as an air runner for disassembly only. Do not use them for assembly.

Precautions for Applying Gasket Sealant

SEPARATION OF PARTS COATED WITH GASKET SEALANT

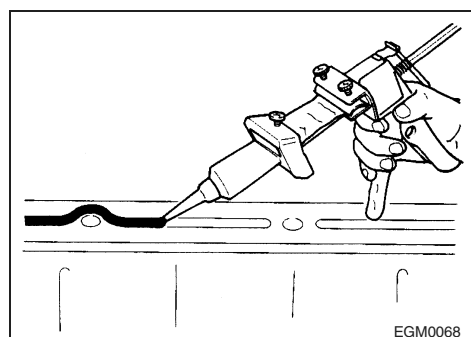
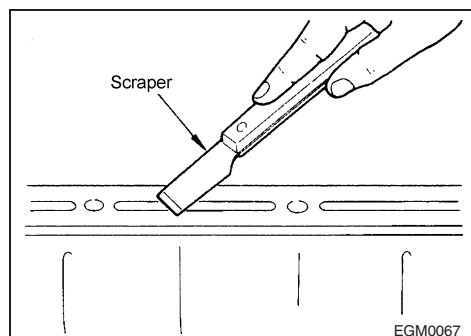
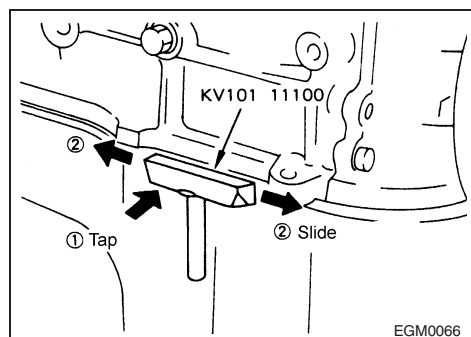
- After removing the mounting bolts and mounting nuts, cut and remove the gasket sealant with seal cutter (special tool KV101-11100) according to the following procedure.
 - [1] Drive in the seal cutter in the direction of the arrow.
 - [2] Slide the seal cutter in the direction of the arrow.
 - [3] Slide the seal cutter in the direction of the arrow.

⚠ CAUTION:

- Take care not to damage the mating faces.
- If it is difficult to use the seal cutter, remove the gasket sealant by hitting it lightly with a plastic hammer.

⚠ CAUTION:

If it is obliged to use a flat-head screwdriver, take extreme care not to damage the mating faces.



PROCEDURE FOR APPLYING GASKET SEALANT

- Remove the old gasket sealant sticking to the mating faces with scraper.
 - Remove all the gasket sealant from the grooves, mounting bolts, and bolt holes, too.
- Wipe the mating faces with isoparaffin, etc. to remove water, oil, grease, and foreign matter.
- Install the genuine gasket sealant to tube presser (common tool).
- Apply the gasket sealant to the specified parts and dimensions without breaking it.
 - Apply the gasket sealant to the grooves, too, if specified so.
 - As a rule, apply the gasket sealant to the inside of the bolt holes. The outside of the bolt holes may need to be coated with the gasket sealant, however. Accordingly, refer to the manual without fail.
 - Install the parts within 5 minutes after applying the gasket sealant.
 - Wipe off the projected gasket sealant immediately.
 - Do not retighten the bolts after installing the parts.
 - After installing the parts, wait at least 30 minutes before supplying engine oil or coolant.

⚠ CAUTION:

If a direction is given in the manual, observe it.

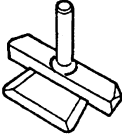
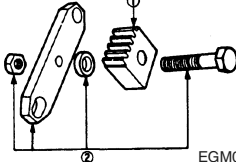
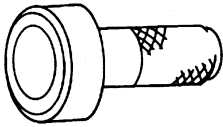
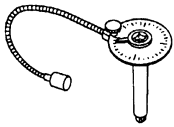
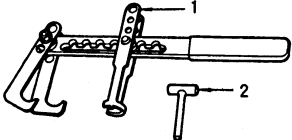
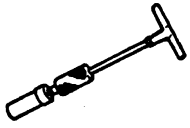

PRECAUTIONS FOR WORK

Parts Which Need to be Tightened by Angle Tightening Method

- Use angle wrenches (special tools) to tighten the following parts.
- Cylinder head bolt
Check that the cylinder head, cylinder block mounting face, and cylinder head gasket are free from oil and dirt, and then coat the threads and stem of the cylinder head bolt and tighten it.

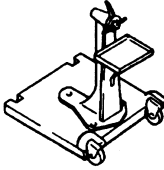
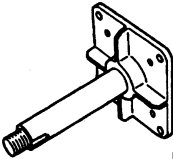
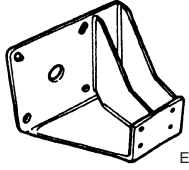
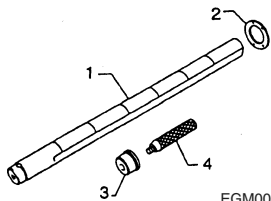
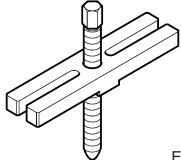
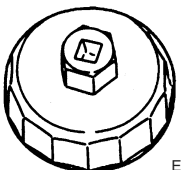
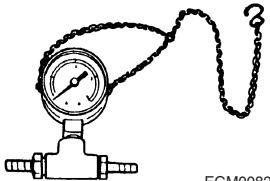
PREPARATION

Special Service Tools

Description	Application	Remarks
Seal cutter KV101 11100  EGM0069	Removing parts attached with liquid gasket	
Ring gear stopper KVI101 056S0 1 Adapter KV101 05630 2 Stopper plate KV101 05610  EGM0070	Removing and installing crankshaft pulley	
Oil seal drift KV101 04900  EGM0071	Installing front oil seal	
Angle wrench KV101 12100  EGM0072	Checking tightening angle	Already established
1. Valve spring compressor KV101 09210 2. Adapter KV101 11200  EGM0073	Removing and installing valve collet	
Valve oil seal puller KV101 07901  EGM0074	Removing valve oil seal	
Valve oil seal drift KV101 13000  EGM0075	Installing valve oil seal	

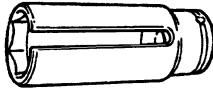
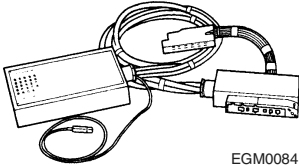
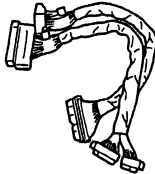
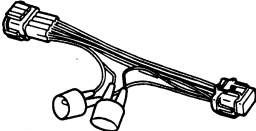
PREPARATION

Special Service Tools (Cont'd)

Description	Application	Remarks
Engine stand assembly ST0501 S000  EGM0076	Overhauling engine	Already established
Engine attachment KV101 06500  EGM0077		
Engine sub-attachment KV111 04800  EGM0078		
Camshaft bushing tool set KV111 045S0 1. Bar KV111 04510 2. Guide plate KV111 04520 3. Adapter KV111 04530 4. Drift ST1524 3000  EGM0079	Removing and installing camshaft bushing	
Pulley puller KV111 03000  EGM0080	Removing crankshaft pulley.	Already established
Oil filter wrench KV101 15801  EGM0081	Removing oil filter	Already established
EGI fuel pressure indicator ST1959 0000  EGM0082	For measuring fuel pressure gauge	

PREPARATION

Special Service Tools (Cont'd)

Description	Application	Remarks
Heated oxygen sensor wrench KV101 13700  EGM0083	Removing and installing heated oxygen sensor	
Maintenance tool 1. DIAGNOSIS KIT SKVEE GY010 2. SOFT WARE SKVEE GY100	For system inspection and diagnosis	
Check adapter V EG1755 0000 (for SMJ 150-pin connector)  EGM0084	For control unit input/output signal inspection	
Harness adapter EG1755 0200 (150-pin to 121-pin conversion adapter)  EGM0085		
For molding coil Adapter harness EG101 17500  EGM0086	Checking engine speed	

Service Parts

Piston oversize

0.5 mm (0.020 in) OS [0.5 mm (0.020 in) oversize]

1.0 mm (0.039 in) OS [1.0 mm (0.039 in) oversize]

Main bearing undersize

Unit: mm (in)

Size	Thickness
STD	2.000 (0.0787)
US 0.25 (0.0098)	2.125 (0.0837)
US 0.50 (0.0197)	2.250 (0.0886)
US 0.75 (0.0295)	2.375 (0.0935)
US 1.00 (0.0394)	2.500 (0.0984)

SERVICE DATA

Periodical Inspection

To maintain the initial performance of the KOMATSU FORKLIFT, make sure to perform appropriate maintenance and service work.

PERFORM INSPECTION

Make sure to perform the periodical inspections at the appropriate times, according to the month basis or the operating hour basis, whichever comes first.

Refer to the following notes for values in ().

Engine system inspection (except LPG fuel systems)																	
No.	Inspection items	Applicable control system	Months of use	1	2	3	4	5	6	7	8	9	10	11	12	...	18
			Operation hours (x 100 hours)	2	4	6	8	10	12	14	16	18	20	22	24	...	36
1	Intake/exhaust valve clearance Electronic controls	Electronic controls		A		A			A			A			A	...	A
2	Engine drive belt tension	Electronic controls		I	I	I	I	I	I	I	I	I	I	I	I	...	I
3	Engine oil	Electronic controls (1)		R	R	R	R	R	R	R	R	R	R	R	R	...	R
4	Oil filter	Electronic controls (1)		R		R			R			R			R	...	R
5	Engine coolant	Electronic controls													R	...	
6	Air cleaner element	Electronic controls		C	C	C	C	C	R	C	C	C	C	C	R	...	R
7	Ignition timing	Electronic controls		A	A	A	A	A	A	A	A	A	A	A	A	...	A
8	Spark plug	Electronic controls		I	I	I	I	I	I	I	I	I	I	I	I	...	R
9	Distributor	Electronic controls													C	...	
10	PCV valve	Electronic controls (1)				I			I			I			I	...	I
11	PCV hose	Electronic controls				I			I			I			I	...	I

SERVICE DATA

Periodical Inspection (Cont'd)

No.	Engine system inspection (LPG models)																
1	Gas leakage from piping and piping joints	Electronic controls	(2)	I	I	I	I	I	I	I	I	I	I	I	I	...	I
2	Damage to piping and piping joints	Electronic controls		I	I	I	I	I	I	I	I	I	I	I	I	...	I
3	Tar in vaporizer	Electronic controls		D	D	D	D	D	D	D	D	D	D	D	D	...	D
4	Injection nozzle	Electronic controls		I		I			I			I			I	...	I
5	LPG filter	Electronic controls				C			C			C			R	...	C

⚠ CAUTION:

- If the vehicle is being used in dusty and dirty environments, the maintenance work should be performed more frequently.
 - After replacing the LPG tank, apply soapsuds to the piping joints to check for any gas leakage.
- Meanings of symbols: I = Inspection. Repair or replace if necessary.

R = Replacement

A = Adjustment

C = Cleaning

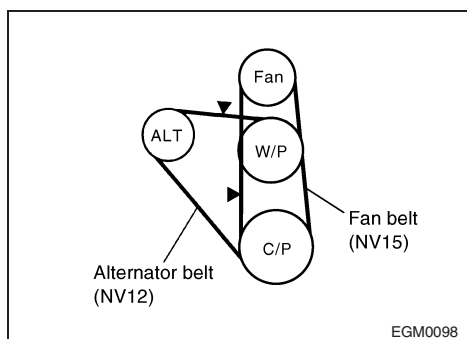
D = Draining

T = Tightening (Retightening)

SERVICE DATA

Standard, Repair Limit

Fuel in use		Gasoline specification		Lead-free regular gasoline with an octane value of 91 or more		
		LPG specification		20-100P		
Engine weight (without water, with oil) kg (lb)				Approx. GAS, LPG:301', DUAL:302'		
Firing order				1 - 5 - 3 - 6 - 2 - 4		
Compression pressure kPa (bar, kgf/cm ² , psi)/rpm		Standard		1,187 (11.87, 12.1, 172)/200		
		Repair limit		892 (8.92, 9.1, 129)/200		
		Difference limit among cylinders		98 (0.98, 1.0, 14)/200		
Distortion limit mm (in)		Intake manifold		0.2 (0.008)		
		Exhaust manifold		0.3 (0.012)		
		Cylinder head		0.2 (0.008)		
		Cylinder block		0.1 (0.004)		
Engine oil amount l (Imp qt) (SL class)		When replacing oil only		Approx. 8.3 (7-1/4)		
		When replacing oil and filter		Approx. 8.6 (6-5/8)		
Spark plug		Manufacturer/type/gap mm (in)		NGK/BPR4ES-D/0.8 - 0.9 (0.031 - 0.035)		
Resistance on high-tension cable (kΩ)				#1: Approx. 2.7 #2: Approx. 2.8 #3: Approx. 4 #4: Approx. 5 #5: Approx. 5.2 #6: Approx. 6.1		
Ignition advance device				Electronically controlled ignition advance		
Onboard idle speed (rpm)				750 ± 50		
Onboard idling pace speed (When feedback control is stopped) (rpm)				750		
Density of CO at idle speed/Density of HC at idle speed (%/ppm)				0.1 or less/50 or less		
Ignition timing (When feedback control is stopped) (BTDC°/rpm)				10 ± 2/750		
Valve clearance mm (in)		INT/EXH	Hot	0.35 (0.0138)/0.35 (0.0138)		
Thermostat opening valve temperature (Start - Full open) °C (°F)				82 - 95 (180 - 203)		
Engine drive belt deflection				New belt	After adjustment	Limit
[Measured by pressing with 98 N (10 kg, 22 lb)] mm (in)		Alternator belt/Fan belt		10 - 12 (0.39 - 0.47)	13 - 15 (0.51 - 0.59)	16 (0.63)



SERVICE DATA

Tightening Torque STANDARD BOLT TIGHTENING TORQUE

<Hexagon head> <No lubrication> Unit: N•m (kg-m, ft-lb)
N•m (kg-m, in-lb)*

Normal size d	Pitch P	4T		7T		9T	
		Non-flanged bolt	Flanged bolt	Non-flanged bolt	Flanged bolt	Non-flanged bolt	Flanged bolt
M3	0.5	0.6 (0.06, 5)*	0.7 (0.07, 6)*	1.1 (0.11, 10)*	1.3 (0.13, 11)*	1.6 (0.16, 14)*	1.9 (0.19, 16)*
M3.5	0.6	1.0 (0.10, 9)*	1.2 (0.12, 10)*	1.7 (0.17, 15)*	2.1 (0.21, 18)*	2.5 (0.25, 22)*	2.8 (0.29, 25)*
M4	0.7	1.5 (0.15, 13)*	1.7 (0.17, 15)*	2.5 (0.25, 22)*	2.9 (0.30, 26)*	3.5 (0.36, 31)*	4.2 (0.43, 37)*
M5	0.8	2.9 (0.30, 26)*	3.5 (0.36, 31)*	5.0 (0.51, 44)*	5.9 (0.6, 52)*	7.2 (0.73, 63)*	8.5 (0.87, 76)*
M6	1.0	5.0 (0.51, 44)*	6.0 (0.61, 53)*	8.4 (0.86, 75)*	10 (1.0, 87)*	11.8 (1.2, 8.7)	14.7 (1.5, 10.8)
M8	1.25	12.7 (1.3, 9.4)	14.7 (1.5, 10.8)	20.6 (2.1, 15)	24.5 (2.5, 18)	29.4 (3.0, 22)	35.3 (3.6, 26)
	1.0	13.7 (1.4, 10)	15.7 (1.6, 12)	21.6 (2.2, 16)	26.5 (2.7, 20)	31.4 (3.2, 23)	37.3 (3.8, 27)
M10	1.5	24.5 (2.5, 18)	29.4 (3.0, 22)	41.2 (4.2, 30)	49 (5, 36)	58.8 (6.0, 43)	69.6 (7.1, 51)
	1.25	25.5 (2.6, 19)	30.4 (3.1, 22)	43.1 (4.4, 32)	51 (5.2, 38)	61.8 (6.3, 46)	73.6 (7.5, 54)
M12	1.75	42.2 (4.3, 31)	51 (5.2, 38)	70.6 (7.2, 52)	84.3 (8.6, 62)	98.1 (10, 72)	118 (12, 87)
	1.25	46.1 (4.7, 34)	55.9 (5.7, 41)	77.5 (7.9, 57)	92.2 (9.4, 68)	108 (11, 80)	137 (14, 101)
M14	1.5	73.6 (7.5, 54)	87.3 (8.9, 64)	127 (13, 94)	147 (15, 108)	177 (18, 130)	206 (21, 152)
M16	1.5	108 (11, 80)	137 (14, 101)	186 (19, 137)	226 (23, 166)	265 (27, 195)	324 (33, 239)
M18	1.5	167 (17, 123)	196 (20, 145)	275 (28, 203)	324 (33, 239)	392 (40, 289)	471 (48, 34)
M20	1.5	226 (23, 166)	275 (28, 203)	382 (39, 282)	451 (46, 333)	549 (56, 405)	657 (67, 485)
M22	1.5	304 (31, 224)	363 (37, 268)	510 (52, 376)	608 (62, 448)	736 (75, 542)	883 (90, 651)

⚠ CAUTION:

- Except special parts.
- The bolt applicable to the list has the following number embossed on the head.

Model Number

4T ... 4 or none

7T ... 7

9T ... 9

CAUTION FOR USE OF POWER TOOLS

Do not use any power tools (e.g. air ratchet, impact wrench) to tighten the bolts and nuts. Use these tools only for loosening the bolts and nuts. However, do not use power tools in any event and for any purposes on the parts subject to heat (catalyst, muffler, and other exhaust parts) and the tapping screws. These parts may also be damaged when loosened with a power tool.

SERVICE DATA

Tightening Torque (Cont'd)

MAIN TIGHTENING TORQUE

* : Parts with tightening sequence
 1) - : Tighten separately in several turns.
 Unit : N•m (kg-m, ft-lb)
 N•m (kg-m, in-lb)*

Parts name or location	Tightening torque
Adjusting screw Lock nut	16 - 22 (1.6 - 2.2, 12 - 16)
Alternator Adjusting bar side Bracket side	17.5 - 23.7 (1.8 - 2.4, 13 - 17) 50.0 - 67.6 (5.1 - 6.9, 37 - 50)
Oil pan drain plug	54 - 59 (5.5 - 6.0, 40 - 43)
Spark plug	20 - 29 (2.04 - 2.96, 14 - 22)
* Intake manifold	15.7 - 18.6 (1.6 - 1.9, 12 - 14)
* Air horn	20.6 - 26.5 (2.1 - 2.7, 16 - 27)
Exhaust manifold cover	6.37 - 7.45 (0.65 - 0.76, 56 - 66)*
* Exhaust manifold	27 - 31 (2.8 - 3.2, 20 - 23)
Exhaust manifold connector	59 - 78 (6.0 - 8.0, 43 - 58)
* Oil pan [M6] [M8]	6.3 - 8.3 (0.64 - 0.85, 56 - 74)* 15.7 - 20.6 (1.6 - 2.1, 12 - 15)
Oil strainer	16 - 19 (1.6 - 1.9, 12 - 14)
* Rocker cover	1.0 - 2.9 (0.1 - 0.3, 9 - 26)*
Rocker shaft bracket	15.6 - 21.6 (1.6 - 2.2, 12 - 16)
* Cylinder head bolt	1) 29.4 (3, 22) 2) 61.7 (6.3, 46) 3) 0 (0, 0) 4) 29.4 (3, 22) 5) 69° - 74° (Angle tightening)
Cylinder head additional bolt	6.4 - 7.5 (0.65 - 0.76, 56 - 66)*
Crankshaft pulley	181 - 191 (18.5 - 19.5, 134 - 141)
* Front cover	15.7 - 20.6 (1.6 - 2.1, 12 - 15)
Camshaft sprocket	132.3 - 142.1 (13.5 - 14.5, 98 - 105)
Chain tensioner	5.6 - 8.4 (0.57 - 0.86, 49.5 - 74.7)
Distributor	9.35 - 11 (0.95 - 1.1, 82 - 95)*
Camshaft locating plate	5.6 - 8.4 (0.57 - 0.86, 49.5 - 74.7)
* Flywheel	146 - 167 (15 - 17, 108 - 123)
* Main bearing cap	162 - 172 (16.5 - 17.5, 119 - 127)
Connecting rod nut	1) 38 - 40 (3.9 - 4.1, 28 - 30) 2) 40° - 45° (Angle tightening)
Engine coolant drain plug	34 - 44 (3.5 - 4.5, 25 - 33)
Water pump	15.7 - 18.6 (1.6 - 1.9, 12 - 14)
Engine coolant temperature sensor	20 - 29 (2.0 - 3.0, 14 - 22)
PCV valve	20 - 29 (2.0 - 3.0, 14 - 22)
* Fuel tube	1) 9.3 - 20.6 (0.9 - 2.1, 78 - 182)* 2) 20.6 - 26.5 (2.1 - 2.7, 15 - 20)
Starter motor	41.2 - 52 (4.2 - 5.3, 30 - 38)
Heated oxygen sensor 1	40 - 60 (4.1 - 6.1, 30 - 44)