ENGINE GENERAL

0000-00

GENERAL INFORMATION

1. SPECIFICATIONS

Category	Specifications	Remarks
Engine model	G16DF MPI	-
Engine type / Number of cylinders	In-line 4 cylinders	
Displacement (cc)	1,597	
Compression ratio	10.5	
Max. power (PS)	128	
Max. torque (Nm)	160	
Cylinder block	Integrated with bed plate (Aluminum casting)	
Valve system	DOHC 16-valve / Dual CVVT	
Timing chain	Silent chain with 6.35 mm pitch	
Intake manifold	VIS intake manifold	
Exhaust manifold	Integrated with MCC	
Crankshaft	8 mm offset (Crankshaft offset from piston)	
Cooling system	Inlet control (Thermostat)	
Lubrication system	With VOP	
Engine oil capacity	4.0 ℓ	
Coolant capacity	6.5 ℓ	
Fuel tank capacity	47 ℓ	

2. APPEARANCE

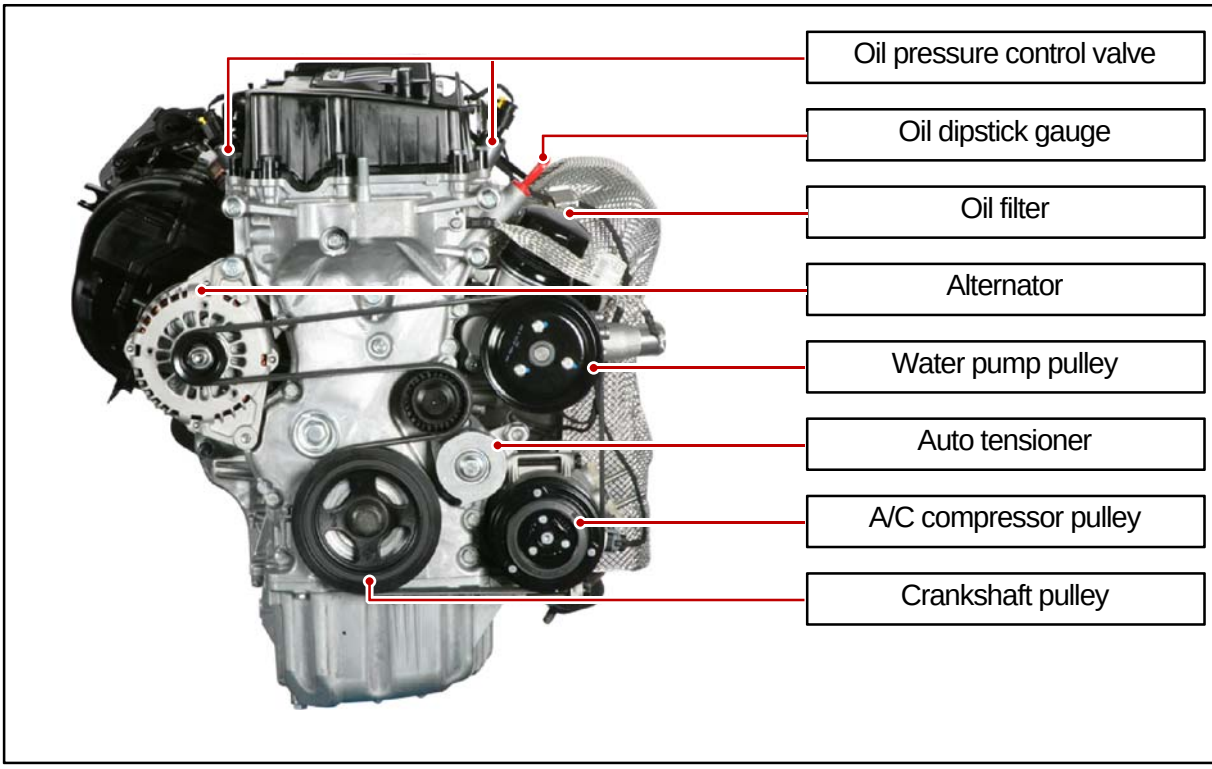
Front view	Rear view
	

Right view	Left view
	

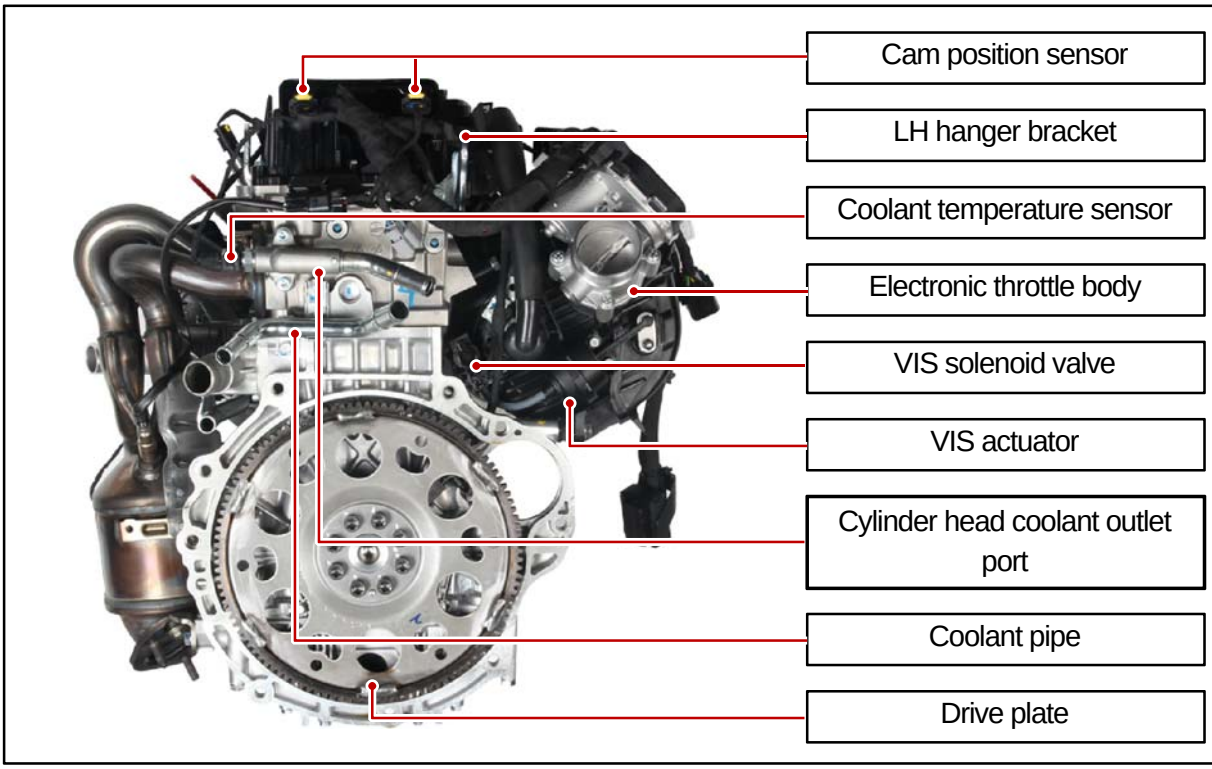
Modification basis	
Application basis	
Affected VIN	

3. MAJOR COMPONENTS

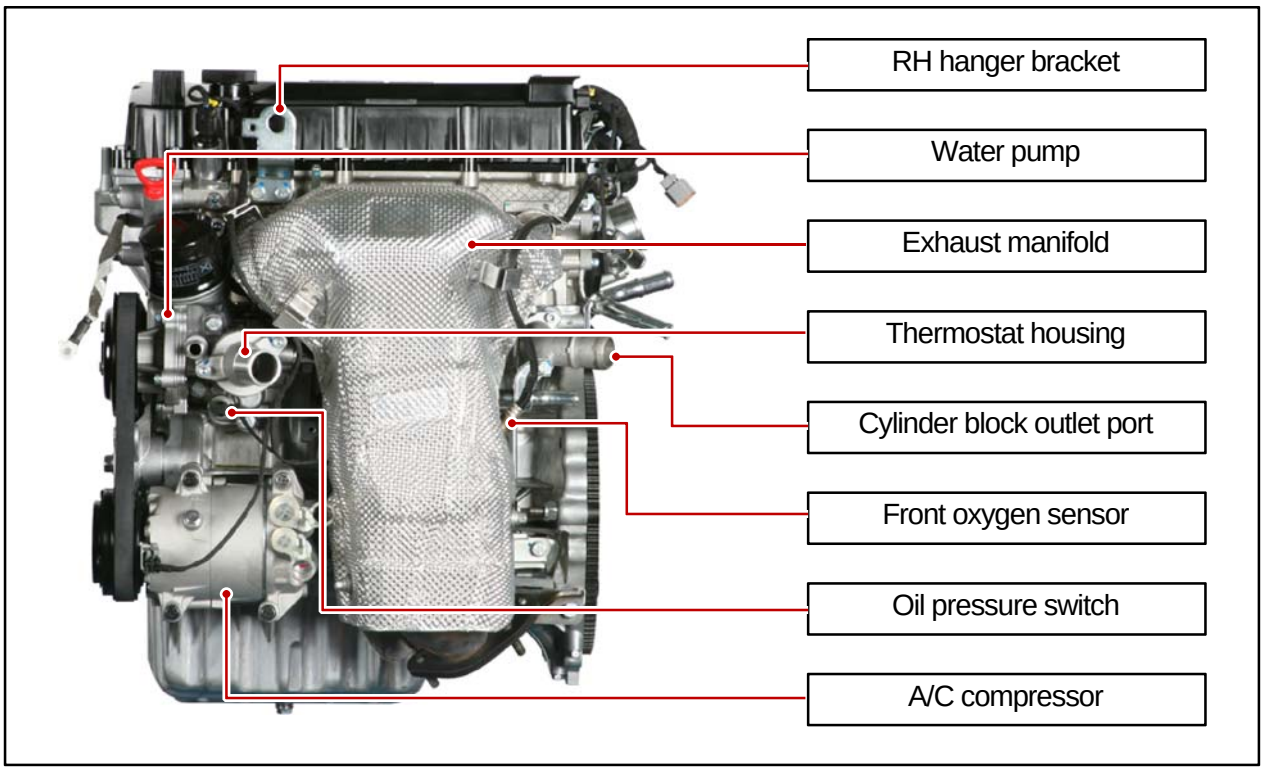
▶ Front view



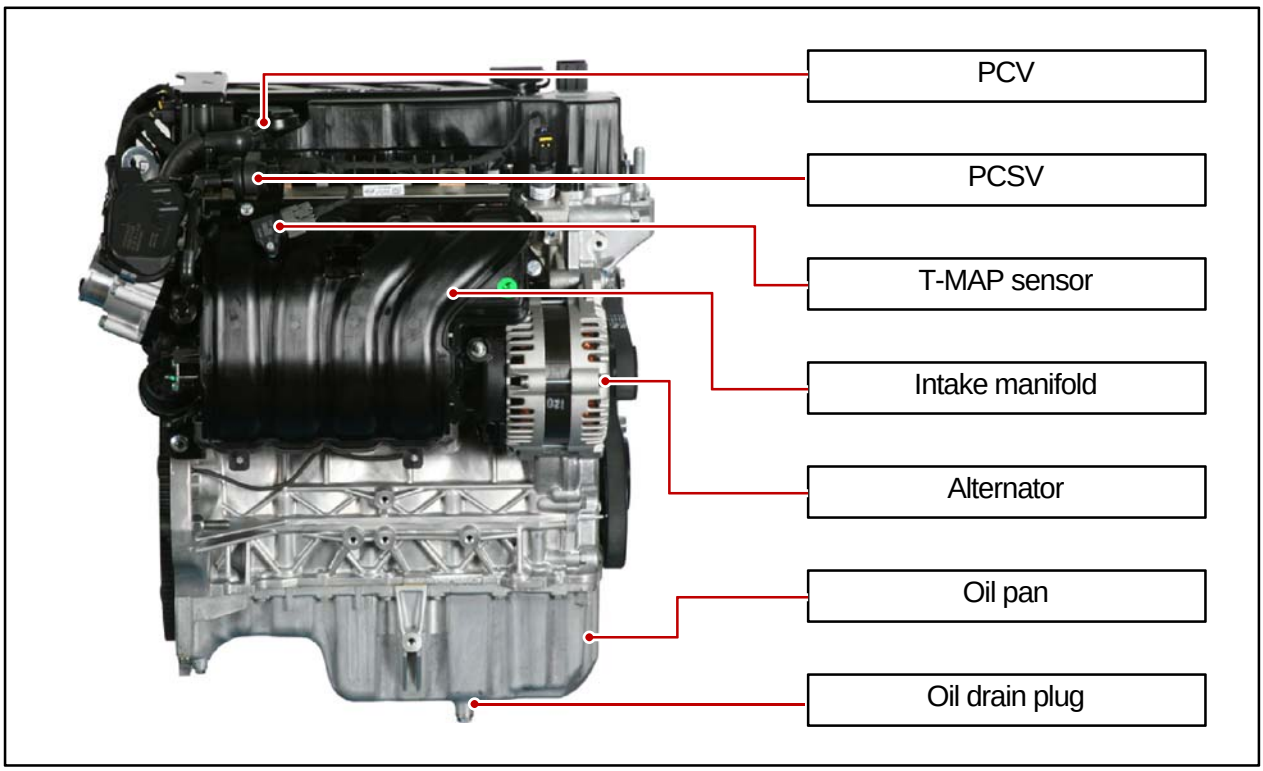
▶ Rear view



▶ Left view

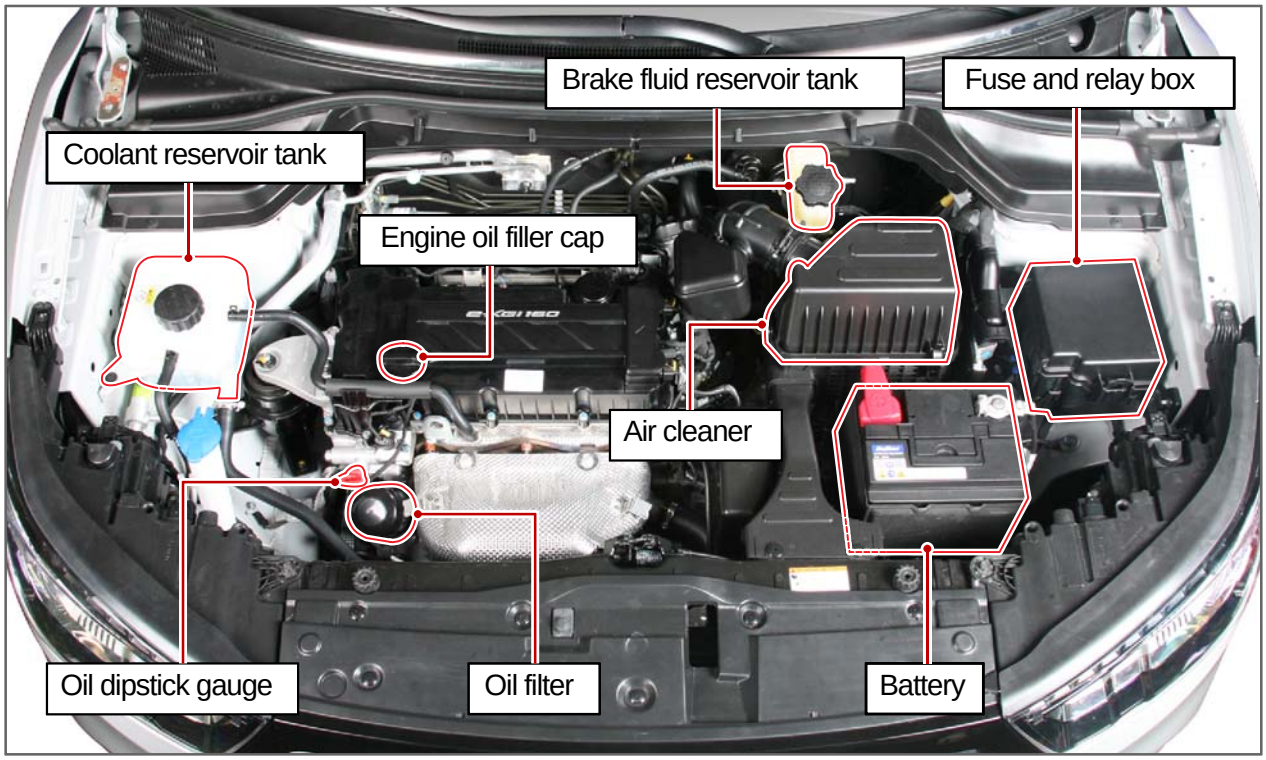


▶ Right view



Modification basis	
Application basis	
Affected VIN	

4. ENGINE COMPARTMENT LAYOUT



CAUTION

- When checking the engine compartment, be careful not to touch the hot components such as engine, radiator, exhaust manifold, catalytic converter, and muffler immediately after the engine has been stopped. Check the engine compartment after the engine has been cooled down sufficiently. Regularly check the engine oil level and add Ssangyong genuine engine oil, if necessary.
- Clean the oil dipstick gauge with a clean cloth to prevent any foreign material from entering.
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WARNING

- Operating the vehicle with insufficient amount of engine oil will result in severe damage the engine. Make sure that the engine oil level is correct and add oil, if necessary.

1) Major Check Items and Service Interval

Check item	Daily check	Weekly check	Change interval
Engine oil and oil filter	Check	-	Change at initial 10,000 km of driving, then change at every 15,000 km of driving or 12 months whichever comes first. Check the oil level randomly and add if necessary, Service more frequently under severe conditions Replace the oil filter when changing the engine oil.
Coolant	Check	-	Change at every 5 years or 200,000 km of driving. (Long life antifreeze)
Air cleaner element	-	Check	Clean at every 15,000 km of driving and replace at every 30,000 km of driving. Clean or service more frequently under severe conditions such as driving on a dusty road or off-road.
Fuel filter	-	-	Service at every 30,000 km of driving. Region where bad fuel is used: Change at every 50,000 km

2) Fluid Specifications And Capacity

Engine oil	**Specifications**	- MB 229.51 SAE 5W-30 - SN/GF-5 5W-20
	Type	1. SK ZIC SYMC 5W-30 2. SK ZIC SYMC FE 5W-20
	Capacity	Approx. 4.0 L (4.5 L at initial fill)
Coolant	**Specifications**	Ssangyong genuine coolant (Long life antifreeze) (water:antifreeze = 50:50)
	Capacity	Approx. 6.5 L

NOTE

Severe conditions

- Driving at high engine rpm or high speed, Excessive idling
- Driving for more than 2 hours at constant high speed (higher than 80% of maximum speed)
- Driving on dusty roads (off-roads) or muddy roads
- Driving on salted roads (coastal road, snow-melt road)
- Driving with high load such as trailer towing, cargo loaded

Modification basis	
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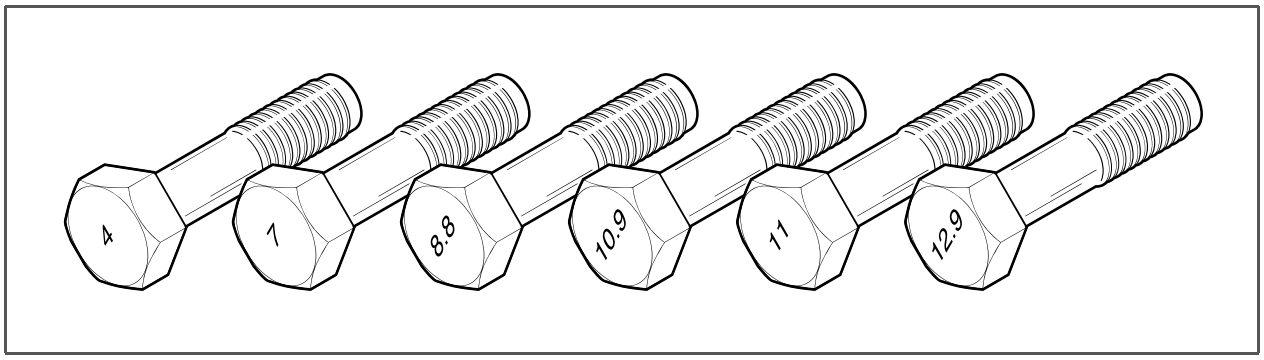
5. TIGHTENING TORQUE BY BOLT STRENGTH

Bolt	Pitch	Tightening torque(kgf.cm)					
		Standard			Limit		
		4T	7T	9T	4T	7T	9T
M3	0.5	5	9	13	7	12	17
M4	0.7	12	20	30	16	27	40
M5	0.8	24	40	57	32	53	77
M6	1.0	41	68	99	55	91	130
M8	1.25	88	160	230	130	210	310
M10	1.25	190	330	470	260	430	620
	1.5	190	310	450	250	420	600
M12	1.25	350	580	840	460	770	1,100
	1.75	330	550	790	440	730	1,000
M14	1.5	550	910	1,300	730	1,200	1,900
M16	1.5	830	1,100	2,000	1,100	1,900	2,700
M18	1.5	1,200	2,000	2,900	1,600	2,700	3,800
M20	1.5	1,700	2,800	4,000	2,200	3,700	5,300
M22	1.5	2,300	3,800	5,400	3,000	5,000	7,200
M24	1.5	2,900	4,900	7,000	3,900	6,500	9,400
	2.0	2,800	4,700	6,800	3,800	6,300	9,100



1) Metric bolt strength is stamped on the head of each bolt. The strength of bolt can be classified as 4T, 7T, 8.8T, 10.9T, 11T and 12.9T in general.
2) Observe the standard tightening torque during bolt tightening. You can determine the proper tightening torque within 15 % of standard value, if necessary. Try not to over permitted maximum tightening torque, if not required to do so.
3) Determine the proper tightening torque separately, if tightening with washer or packing is required. When the bolts are needed to be tightened to the below materials, follow the tightening torque
4) specified below.

- Aluminum alloy: Tighten to 80 % of above torque table.
- Plastics: Tighten to 20 % of above torque table.

6. ENGINE TIGHTENING TORQUE

Components	Tool dimensions	Bolt Quantity	Specified torque (Nm)	Remarks
Belt tensioner	17 mm	1	61 ± 2.0 Nm	-
Crankshaft pulley	27 mm	1	220 Nm 90°	
Engine ground cable	10 mm	2	10 ± 1.0 Nm	
Alternator	15 mm	1	61 ± 6.1 Nm	
	17 mm	1		
A/C compressor	13 mm	4	25 ± 2.5 Nm	
Water pump pulley	10 mm	3	10 ± 1.0 Nm	
Water pump	5 mm hexagon wrench	5	10 ± 1.0 Nm	
Exhaust manifold heat protector	10 mm	4	10 ± 1.0 Nm	
Exhaust manifold	12 mm	7	40 ± 5.0 Nm	Non-reusable
	13 mm	3	25 ± 2.5 Nm	-
TOC coolant return pipe (vehicle with A/T)	10 mm	2	10 ± 1.0 Nm	
Coolant return pipe (vehicle with M/T)	10 mm	3	10 ± 1.0 Nm	
TOC coolant supply pipe (vehicle with A/T)	10 mm	2	10 ± 1.0 Nm	
Cylinder head outlet port	5 mm hexagon wrench	2	10 ± 1.0 Nm	
Cylinder block outlet port	5 mm hexagon wrench	2	10 ± 1.0 Nm	
Oil filter module	13 mm	1	25 ± 2.5 Nm	Bolt length: 60 mm
		1		Bolt length: 105 mm
		3		Bolt length: 40 mm
Thermostat	5 mm hexagon wrench	2	10 ± 1.0 Nm	-
Electronic throttle body	10 mm	4	10 ± 1.0 Nm	
Fuel rail	13 mm	2	25 ± 2.5 Nm	
Intake manifold	13 mm	3 bolts 1 nut	25 ± 2.5 Nm	

Modification basis	
Application basis	
Affected VIN	

Components	Tool dimensions	Bolt Quantity	Specified torque (Nm)	Remarks
Knock sensor	13 mm	1	20 ± 5.0 Nm	-
OCV	8 mm	2	8 ± 1.0 Nm	
Cam position sensor	10 mm	2	10 ± 1.0 Nm	
Ignition coil	10 mm	4	10 ± 1.0 Nm	
Spark plug	16 mm	4	20 ± 2.5 Nm	
Cylinder head cover	10 mm	16	10 ± 1.0 Nm	
Cylinder head	E16	10	30 ± 3.0 Nm 90° X 2 times	Non-reusable
Camshaft sprocket	M14 (12-point bit socket)	2	110 ± 10 Nm	
Camshaft front bearing cap	10 mm	4	10 ± 1.0 Nm	
Camshaft bearing cap	10 mm	16	10 ± 1.0 Nm	
Oil pan	10 mm	2	10 ± 1.0 Nm	Bolt length: 115 mm
		2	10 ± 1.0 Nm	Bolt length: 105 mm
		16	10 ± 1.0 Nm	Bolt length: 25 mm
	13 mm	2	25 ± 2.5 Nm	Bolt length: 80 mm
Timing gear case cover	15 mm	4	58 ± 5.8 Nm	Bolt length: 80 mm
		1	58 ± 5.8 Nm	Bolt length: 50 mm
	13 mm	1	25 ± 2.5 Nm	Bolt length: 45 mm
		9	25 ± 2.5 Nm	Bolt length: 30 mm
Timing chain tensioner	5 mm hexagon wrench	2	10 ± 1.0 Nm	-
Tensioner rail	T40	1	25 ± 2.5 Nm	
Guide rail	T40	3	25 ± 2.5 Nm	
Sliding upper rail	5 mm hexagon wrench	2	10 ± 1.0 Nm	
Baffle plate	10 mm	6	10 ± 1.0 Nm	
Oil pump chain tensioner	T40	1	25 ± 2.5 Nm	
VOP extension wiring	5 mm hexagon wrench	1	10 ± 1.0 Nm	

Components	Tool dimensions	Bolt Quantity	Specified torque (Nm)	Remarks
Oil pump	6 mm hexagon	4	25 ± 2.5 Nm	-
Connecting rod cap	12-point socket 8 mm	8	20 ± 5.0 Nm 80° + 10°	
Crankshaft position sensor	5 mm hexagon wrench	1	5 ± 1.0 Nm	
Drive plate	T55	8	45 ± 5.0 Nm 45° ± 5°	Non-reusable
Crankshaft rear seal	10 mm	6	10 ± 1.0 Nm	-
Bed plate	E10	10	25 ± 5.0 Nm	Non-reusable
Main journal	12-point socket 13 mm	10	55 ± 5.0 Nm 100° + 5°	
starter motor	14 mm	2	45 ± 5.0 Nm	-
Oil filter	Oil filter installation/ removal cup	-	12 to 16 Nm	
Cylinder block coolant screw plug	19 mm	1	30 Nm	
Flywheel	T55	8	45 ± 5.0 Nm 90° ± 5°	Non-reusable

Modification basis	
Application basis	
Affected VIN	

7. VARIANT CODING

When any ECU including engine ECU has been replaced, the variant coding is necessary.
If there is improper operation and error in a system, check the variant code first.

Variant Code	Select	Remark
Unleaded/leaded	Unleaded	Select “Unleaded".
	Leaded	
NC inhibit	No inhibit	Select “Inhibit".
	Inhibit	
MIL	MIL not illuminate	Select “MIL illuminate".
	MIL illuminate	
Tire Size	195/70R15	16 inch: Select “205/60R16". 18 inch: Select “215/45R18".
	205/60R16	
	215/45R18	
	Undefined	
Coding is completed	YES	Select "YES".
	NO	
Immobilizer & key	Non-IMMO(Non-IMMO+BCM+Conv.key)	Select the appropriate system.
	BCM(Non-IMMO+BCM+Conv.key)	
	SKM(Non-IMMO+BCM+Smat key)	
	Reserved	
Engine type	G16DF	Select "YES".
Transmission type	MT	MT: Select “MT ". AT: Select “AT ".
	AT	
TPMS	not equipped	Select “not equipped” or “equipped”.
	equipped	
ABS/ESP	not equipped	Select “ABS” or “ESP”.
	ABS	
	ESP	

Variant Code	Select	Remark
RON correction	RON87~100	Select "RON95".
Drive Control System	No system	Select “No system” or “Cruise control”.
	Cruise control	
	ACC	
	Undefined	
Vehicle speed max	180Km/h	Select "180Km/h".
	190Km/h	
	200Km/h	
	210Km/h	
Cooling fan	Relay	Select "Relay".
	PWM	
Air-conditioning	Not equipped	Select “equipped”.
	Equipped	
Able signal of vehicle variant message	Not defined	Select "YES".
	NO	
	YES	
	Signal not valid	
Platform	Tivoli	Select "Tivoli".
Transfer case	2WD	Select “2WD” or “4WD”.
	4WD	
Electric power steering	Not equipped	Select “equipped”.
	Equipped	
Korea/Export	Korea	Select the region.
	General export	
	EU export	

Modification basis	
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DURING SERVICE WORK

1. GUIDELINES FOR SERVICE WORK SAFETY

1) For Safety

To maintain and operate the vehicle under optimum state and carry out the service safely, following the correct methods and procedures is required.
Accordingly, the purpose of this manual is to prevent differences in personal working methods, skills, tips and service procedures; and to provide prompt/correct service procedures.

The "Note" and "Caution" stated in this manual has the follow meaning:

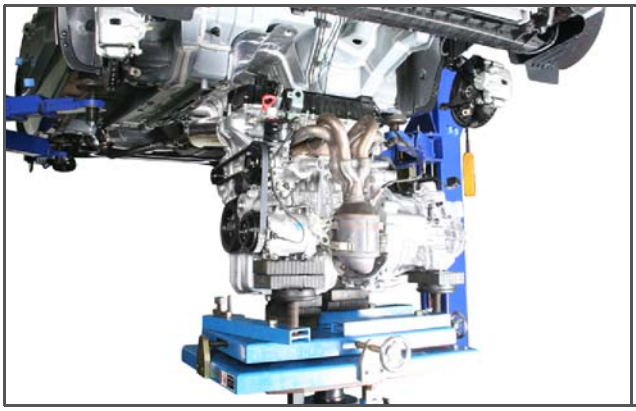
NOTE
This indicates detailed description of supplementary information on work procedure or skill.

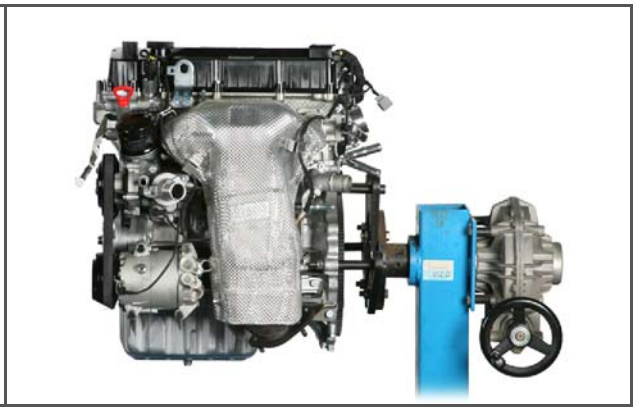
CAUTION
This indicates precautions on tool/device or part damages or personal injuries that can occur during service activities.

However, the notes and cautions cannot be comprehensive measures, so always observe and pay close attention to the situations based on common senses.

2) Equipment

- This vehicle is a Front Engine Front Drive (FF) type vehicle, and engine compartment is crowded with the engine and powertrain system. Thus a 2-column vehicle lift and dedicated equipments are needed when working on the engine and transmission.
- Major dedicated equipments: Engine and transmission jack (use the one for Chairman W), Engine stand, Engine crane, transmission jack, Engine hanger





3) During Service Activities

(1) Before lifting up the vehicle with a vehicle lift, support and lift the vehicle on the correct lifting points.

(2) When using a jack, park the vehicle on the level ground and place wheel chocks underneath the tires. Position the jack under the frame and lift up the vehicle and then support with chassis stand before servicing.

(3) Before performing the service, be sure to disconnect the battery negative (-) terminal to prevent damages by bad wire and short circuit.

(4) If performing the service inside of the vehicle is required, use protection cover to prevent damage and contamination to the seats and floor.

(5) Brake fluid and anti-freeze can damage the painted surfaces of body. So carefully handle them while performing the service.

(6) Use recommended and specified tools to increase efficiency of service activities.

(7) Use only genuine parts recommended by Ssangyong.

(8) Never reuse cotter pins, gaskets, O-rings, oil seals, lock washers, and self-locking nuts. Replace them with new ones.

(9) If they are reused, normal functions will not be expected.

(10) Always arrange disassembled parts in order of the disassembly and put them to one side.

(11) The hardness and design of the bolts and nuts vary depending on the installation location. So be careful not to mix up the removed bolts and nuts and arrange them in good order.

(12) Clean the parts which will be inspected and assembled. Thoroughly clean the oil-related parts to prevent the dirt or foreign materials on these parts from affecting the oil viscosity.

(13) Apply oil or grease on the driving and sliding surfaces before installing parts. Use sealers or specified gaskets to prevent leaks, if necessary.

(14) Tighten every bolt and nut to the specified torque.

(15) When the service activities have been completed, thoroughly check if the service activities were carried out properly or the problems were solved.

Modification basis	
Application basis	
Affected VIN	

4) Basic Inspection

(1) Exhaust system

- Abnormal sounds and a burnt odor from the exhaust pipe mean leaks in or overheating of the exhaust system. Have the system inspected and repaired immediately at the nearest repair facility.
- Inspect the complete exhaust system including the underbody installed to the exhaust system and the catalytic converter, if equipped. Inspect the body near the exhaust system. Look for broken, damaged, missing, or out-of position parts as well as open seams, holes, loose connections, or other conditions which could cause heat buildup in the floor panel or could let exhaust gases enter the vehicle.

(2) Engine oil

- Check the oil level and add or change the oil, if necessary. The best time to check the engine oil level is when the engine is running at normal operating temperature.

(3) Coolant

- Check the coolant level and coolant conditions (contamination, foreign materials) in the coolant reservoir tank. Inspect the coolant hose for damage or leaks. Add Ssangyong genuine coolant or replace with Ssangyong genuine parts, if needed.

(4) Engine drive belt

- Check all drive belts of the engine for wear, cracks, looseness, tension. Re-tighten or replace the belt, if needed.

5) Guidelines on Engine Service

Basic cautions and service guidelines which can be easily forgotten by technicians are described here. Follow these instructions: (a) to prevent personal injuries and vehicle damages that can be caused by mistakes during inspection/repair of the engine and components; and (b) to ensure optimized engine performance and safety after completing service.

(1) Precautions

- Before work on engine and electrical equipments, be sure to disconnect the negative (-) battery terminal.
- Before performing the service, be sure to clean the work areas.
- Always put the ignition switch to the OFF position, except when required. Otherwise, there may be electrical equipment damages or personal injuries due to short-circuit or short-circuit to ground.
- There should be no leaks in the fuel injection system (HP pump, fuel hose, high pressure pipe) of the engine. To achieve this always protect the components of the fuel injection system from foreign materials.
- While removing the engine, use the dedicated equipments, such as, jack for engine and transmission, engine stand, engine crane, etc.

(2) Engine and accessories

Working with an engine requires high precision. Therefore, tighten the parts to the specified torque and keep the removed parts clean when disassembling, removing, installing, and assembling.
Keeping the working areas clean and servicing with great care are essential for checking the engine and parts of the vehicle.

- When removing the engine, the engine-related parts (bolts, gaskets, etc.) should be arranged in good order.
- When disassembling/assembling the internal components of the engine, follow the disassembly/assembly instructions in this manual and clean each component thoroughly and apply engine oil before installation.
- While removing the engine, drain the engine oil, coolant, and fuel in the fuel system to prevent leaks. When removing and installing parts, be sure to check that each connection to the engine does not
- interfere with other parts.

(3) Electrical equipment

Take extra care when handling the electrical equipments. The engine is equipped with so many electrical equipments. This complexity may cause short circuit and bad contacts which can lead to engine performance reduction, incomplete combustion and other problems. Therefore, the technicians should be familiar with the characteristics of the vehicle's electrical equipments.

- When working with the electrical equipments, be sure to disconnect the negative (-) battery terminal and turn the ignition switch to off, except when required.
- When replacing the electrical equipments, use the same genuine parts and be sure to check if the ground or connections are securely connected. Loose grounding or connections can lead to vehicle fire or severe personal injuries.

(4) Fuel and lubrication systems

The engine oil and fuel can cause corrosion damage to the painted surface of the body and rubber products (e.g. hoses). If these fluids contact with the engine, foreign materials or dust in the air may be attracted and cause further damage to the fuel system.

- Working with the system related to fluids, such as fuel and oil, should be done in a well-vented and no smoking area.
- The gaskets and seals of the fuel and lubrication systems should be replaced with new ones. The bolts and nuts should be tightened to the specified torque.
- After removing or installing, be sure to check the connections for leaks.

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