
SECTION 1A

GENERAL ENGINE INFORMATION

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DESCRIPTION AND SYSTEM OPERATION

CLEANLINESS AND CARE

An automobile engine is a combination of many machined, honed, polished and lapped surfaces with tolerances that are measured in the ten-thousandths of an inch. When any internal engine parts are serviced, care and cleanliness are important. A liberal coating of engine oil should be applied to friction areas during assembly, to protect and lubricate the surfaces on initial operation. Proper cleaning and protection of machined surfaces and friction areas is part of the repair procedure. This is considered standard shop practice even if not specifically stated.

Whenever valve train components are removed for service, they should be kept in order. They should be installed in the same locations, and with the same mating surfaces, as when they were removed. Battery cables should be disconnected before any major work is performed on the engine. Failure to disconnect cables

may result in damage to wire harness or other electrical parts.

ON-ENGINE SERVICE

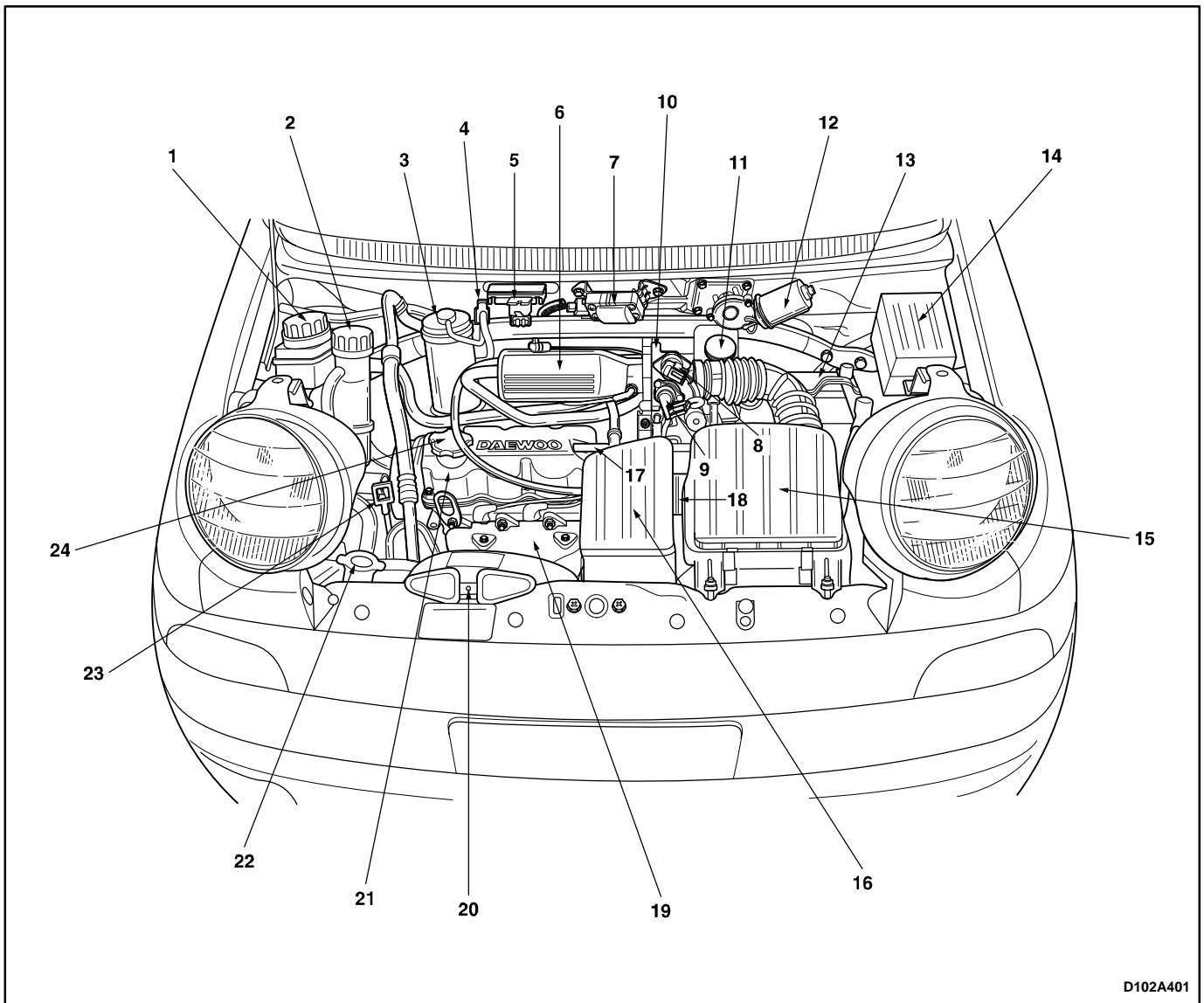
Caution: *Disconnect the negative battery cable before removing or installing any electrical unit, or when a tool or equipment could easily come in contact with exposed electrical terminals. Disconnecting this cable will help prevent personal injury and damage to the vehicle. The ignition must also be in B unless otherwise noted.*

Notice: Any time the air cleaner is removed, the intake opening should be covered. This will protect against accidental entrance of foreign material, which could follow the intake passage into the cylinder and cause extensive damage when the engine is started.

COMPONENT LOCATOR

ENGINE COMPARTMENT (TYPICAL)

(Left-Hand Drive Shown, Right-Hand Drive Similar)

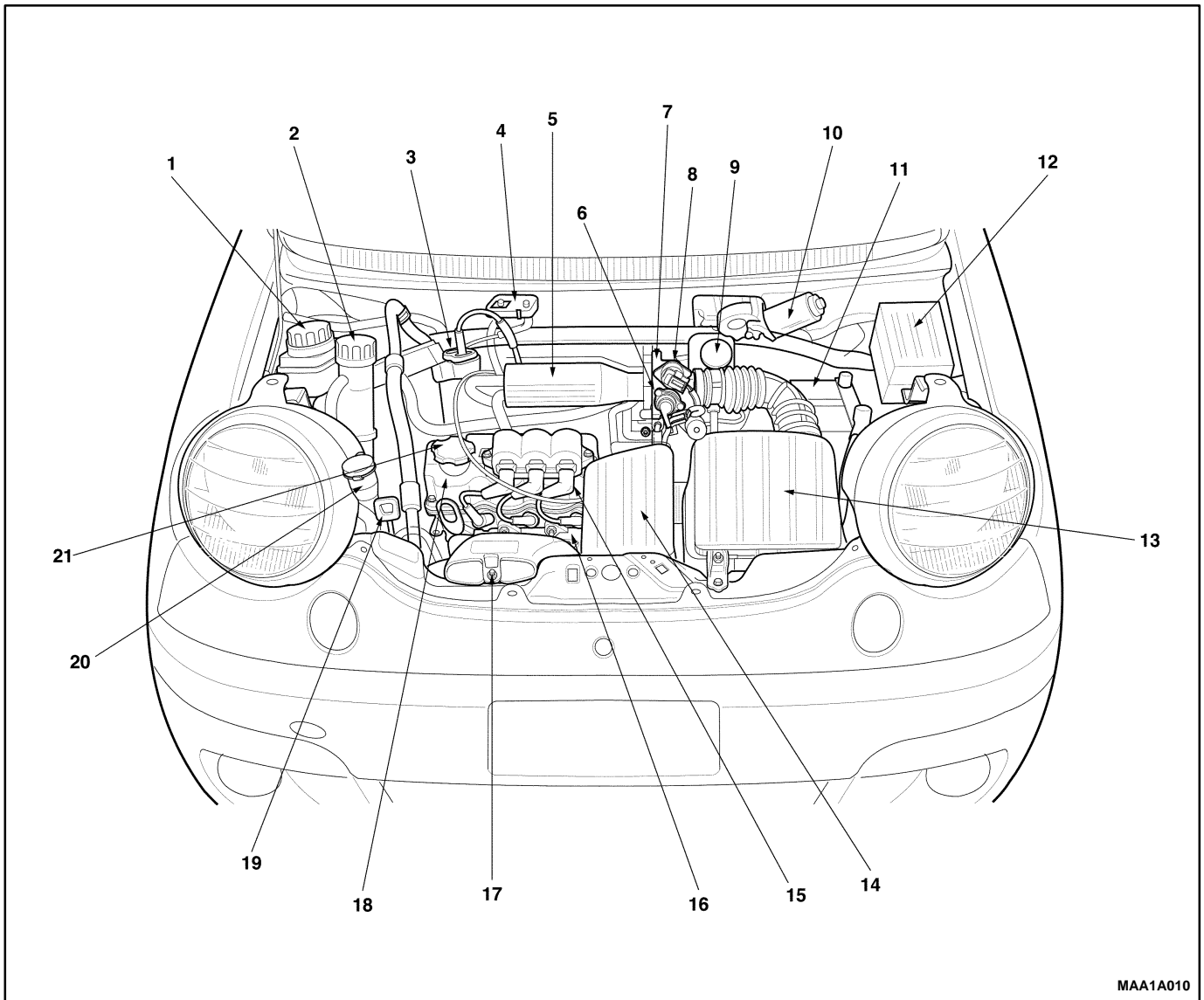


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- | | |
|---|---------------------------|
| 1 Power Steering Oil Reservoir | 13 Battery |
| 2 Coolant Reservoir | 14 Fuse Box |
| 3 Canister | 15 Air Cleaner Housing |
| 4 Canister Solenoid | 16 Resonator |
| 5 Manifold Absolute Pressure (MAP) Sensor | 17 PCV Hose |
| 6 Intake Manifold | 18 Distributor |
| 7 Ignition Coil | 19 Exhaust Manifold |
| 8 Idle Air Control (IAC) Valve | 20 Snorkel |
| 9 Throttle Position (TP) Sensor | 21 Engine |
| 10 Throttle Body | 22 Washer Fluid Reservoir |
| 11 Brake Fluid Reservoir | 23 Oil Level Gauge |
| 12 Wiper Motor | 24 Oil Filler Cap |

ENGINE COMPARTMENT (EURO III)

(Left-Hand Drive Shown, Right-Hand Drive Similar)



MAA1A010

- | | |
|---|---|
| 1 Power Steering Oil Reservoir | 11 Battery |
| 2 Coolant Reservoir | 12 Fuse Box |
| 3 Canister Purge Solenoid | 13 Air Cleaner Housing |
| 4 Manifold Absolute Pressure (MAP) Sensor | 14 Resonator |
| 5 Intake Manifold | 15 Electronic Ignition System Ignition Coil |
| 6 Throttle Position (TP) Sensor | 16 Exhaust Manifold |
| 7 Throttle Body | 17 Snorkel |
| 8 Idle Air Control (IAC) Valve | 18 Engine |
| 9 Brake Fluid Reservoir | 20 Washer Fluid Reservoir |
| 10 Wiper Motor | 19 Oil Level Gauge |
| | 21 Oil Filler Cap |

DIAGNOSTIC INFORMATION PROCEDURE

GENERAL DIAGNOSIS

Condition		Probable cause	Correction
Hard Starting (With normal cranking)	Malfunction of Ignition System	● Faulty fuse.	● Replace the fuse.
		● Faulty spark plug.	● Clean, adjust the plug gap or replace.
		● Electric leakage at the high tension cable.	● Replace the cable.
		● Poor connection of the high tension cable or lead wires.	● Replace the cable or wires.
		● Worn distributor cap or accumulated carbon in the distributor cap.	● Replace or clean the distributor cap.
		● Damaged distributor rotor or cap.	● Replace the rotor or the cap.
		● Improper ignition timing.	● Adjust the ignition timing.
		● Faulty ignition coil.	● Replace the ignition coil.
	Malfunction of Fuel System	● Lock of fuel in the fuel tank.	● Feed the fuel.
		● Dirty or clogged fuel filter.	● Replace the filter.
		● Clogged fuel pipe.	● Clean the fuel pipe.
		● Malfunction of the fuel pump.	● Replace the fuel pump.
		● Malfunction of the fuel injector.	● Replace the injector.
		● The foreign material in the fuel tank.	● Clean the fuel tank.
	Decline of Compression Pressure	● Poor tightening spark plug.	● Tighten to the specified torque.
		● Cracked cylinder head gasket.	● Replace the gasket.
		● Inadequate the valve clearance.	● Adjust the clearance.
		● Leakage of the valve clearance.	● Repair the valve.
		● Interference of the valve stem.	● Replace the valve or the valve guide.
		● Low elasticity or damage of the valve spring.	● Replace the valve spring.
		● Abnormal interference of pistons and cylinders.	● Replace the piston ring.
● Excessive wear of pistons, rings, or cylinders.		● Replace the ring or the piston and boring or replace the cylinder.	

GENERAL DIAGNOSIS (Cont'd)

Condition		Probable cause	Correction	
Hard Starting (With normal cranking)	Others	● Broken timing belt.	● Replace the belt.	
		● Malfunction of Positive Crankcase Ventilation (PCV) valve.	● Check and replace Positive Crankcase Ventilation (PCV) valve if needed.	
		● Loosening, damage or leakage of the vacuum hose.	● Connect the hose correctly or replace it.	
		● Leakage of intake system.	● Replace intake system.	
Lack of Engine Power	Decline of Compression Pressure	● Refer to "Page 1A-5".	● Refer to "Page 1A-5".	
	Malfunction of Ignition System	● Improper ignition timing.	● Adjust the ignition timing.	
		● Faulty spark plug.	● Adjust or replace the spark plug.	
		● Malfunction of the distributor.	● Repair or replace the distributor. Check the rotor.	
		● Electric leakage or poor connection of the high tension cable.	● Connect the cable correctly or replace it.	
	Malfunction of Fuel System	● Clogged fuel pipe.	● Clean the pipe.	
		● Clogged or contaminated fuel filter.	● Replace the filter.	
	Others	● Clogged exhaust system.	● Check and repair the system.	
		● Clogged or contaminated air cleaner element.	● Clean or replace the air cleaner element.	
		● Leak of the intake manifold gasket.	● Replace the gasket.	
		● Dragging brakes.	● Repair or replace the brakes.	
		● Slipping clutch.	● Adjust or replace the clutch.	
	Rough Engine Idling	Decline of Compression Pressure	● Refer to "Page 1A-5".	● Refer to "Page 1A-5".
		Malfunction of Fuel System	● Clogged fuel pipe.	● Clean the pipe.
● Clogged or contaminated fuel filter.			● Replace the filter.	
● Malfunction of the fuel pressure regulator.			● Replace the regulator.	
Malfunction of Ignition System		● Malfunction of the spark plug.	● Adjust or replace the spark plug.	
		● Electric leakage or poor connection of the high tension cable.	● Connect the cable correctly or replace it.	
		● Worn distributor cap terminal or accumulated carbon in the distributor cap.	● Replace or clean the distributor cap.	

GENERAL DIAGNOSIS (Cont'd)

Condition		Probable cause	Correction
Rough Engine Idling	Malfunction of Ignition System	● Loosening or damage of the distributor rotor or cap.	● Replace the rotor or cap.
		● Poor ignition timing.	● Adjust the ignition timing.
		● Malfunction of the ignition coil.	● Replace the ignition coil.
	Others	● Clogged or contaminated air cleaner element.	● Clean or replace the air cleaner element.
		● Leak of the intake manifold gasket.	● Replace the gasket.
		● Malfunction of Positive Crankcase Ventilation (PCV) valve.	● Check the valve or replace it if needed.
		● Poor connection or damage or leakage of the vacuum hose.	● Connect the hose correctly or replace it.
Engine Hesitate (Upon pressing accelerating pedal, the engine makes delayed response. This situation is remarkable when cruising or starting.)	Decline of Compression Pressure	● Refer to "Page 1A-5".	● Refer to "Page 1A-5".
	Malfunction of Ignition System	● Poor ignition timing.	● Adjust the ignition timing.
		● Poor spark plug or poor adjustment of the plug gap.	● Replace the plug or adjust the gap.
		● Electric leakage or poor connection of the high tension cable.	● Connect the cable correctly or replace it.
	Others	● Malfunction of the air cleaner system.	● Clean or replace the air cleaner system.
		● Leak of the intake manifold gasket.	● Replace the gasket.
	Engine Surging (Engine power makes fluctuation in a fixed speed and speed changes without operating the accelerating pedal.)	Decline of Compression Pressure	● Refer to "Page 1A-5".
Malfunction of Fuel System		● Clogged fuel pipe.	● Clean the pipe.
		● Clogged or contaminated fuel filter.	● Replace the filter.
		● Malfunction of the fuel pressure regulator.	● Replace the fuel pressure regulator.
Malfunction of Ignition System		● Malfunction of the spark plug.	● Adjust or replace the spark plug.
		● Electric leakage or poor connection of the high tension cable.	● Connect the cable correctly or replace it.
		● Worn distributor cap terminal or accumulated carbon in the distributor cap.	● Clean or replace the distributor cap.
		● Loosening or damage of the distributor rotor or the cap.	● Replace the distributor rotor or the cap.
		● Poor ignition timing.	● Adjust the ignition timing.

GENERAL DIAGNOSIS (Cont'd)

Condition		Probable cause	Correction
Engine Surging (Engine power makes fluctuation in a fixed speed and speed changes without operating the accelerating pedal.)	Others	● Leak of the intake manifold gasket.	● Clean or replace the gasket.
		● Leakage of the vacuum hose.	● Connect the hose correctly or replace it.
Excessive Detonation (According to the opening range of throttle valve, knocking sound of metallic is made with abnormal explosion.)	Overheated Engine	● Refer to "Overheat" in this page.	● Refer to "Overheat" in this page.
	Malfunction of Ignition System	● Abnormal spark plug.	● Replace the spark plug.
		● Poor ignition timing.	● Adjust the ignition timing.
		● Electric leakage or poor connection of the high tension cable.	● Connect the cable correctly or replace it.
	Malfunction of Fuel System	● Clogged or contaminated fuel filter and fuel pipe.	● Clean or replace the fuel filter and the fuel pipe.
	Others	● Leak of the intake manifold gasket.	● Replace the gasket.
● Excessive carbon deposit due to abnormal combustion.		● Remove the carbon.	
Overheat	Malfunction of Cooling System	● Lack of coolant.	● Refill coolant.
		● Malfunction of the thermostat.	● Replace the thermostat.
		● Malfunction of the cooling fan.	● Check or replace the cooling fan.
		● Poor water pump performance.	● Replace the pump.
		● Clogged or leaky radiator.	● Clean, repair or replace the radiator.
	Malfunction of Lubrication System	● Poor engine oil.	● Replace engine oil with the specified one.
		● Blocking oil filter or strainer.	● Clean or replace the oil filter or the strainer.
		● Lack of engine oil.	● Refill oil.
		● Poor oil pump performance.	● Replace or repair the pump.
		● Leakage of oil.	● Repair.
	Other	● Damaged cylinder head gasket.	● Replace the gasket.
	Poor Fuel Consumption	Decline of Compression Pressure	● Refer to "Page 1A-5".
Malfunction of Fuel System		● Leakage of the fuel tank or the fuel pipe.	● Repair or replace the fuel tank or the fuel pipe.

GENERAL DIAGNOSIS (Cont'd)

Condition		Probable cause	Correction
Poor Fuel Consumption	Malfunction of Ignition System	<ul style="list-style-type: none"> ● Improper ignition timing. 	<ul style="list-style-type: none"> ● Adjust the ignition timing.
		<ul style="list-style-type: none"> ● Abnormal spark plug (Excessive carbon deposit, inadequate gap, burnt electrode). 	<ul style="list-style-type: none"> ● Replace the plug.
		<ul style="list-style-type: none"> ● Electric leakage or poor connection of the high tension cable. 	<ul style="list-style-type: none"> ● Connect the cable normally or replace it.
	Malfunction of Cooling System	<ul style="list-style-type: none"> ● Malfunction of the thermostat. 	<ul style="list-style-type: none"> ● Replace the thermostat.
	Others	<ul style="list-style-type: none"> ● Improperly installed valve. 	<ul style="list-style-type: none"> ● Repair or replace the valve.
		<ul style="list-style-type: none"> ● Slipping clutch. 	<ul style="list-style-type: none"> ● Repair or replace the clutch.
<ul style="list-style-type: none"> ● Low pressure of tires. 		<ul style="list-style-type: none"> ● Adjust the pressure of tires. 	
Excessive Consumption of Engine Oil	Leakage of Engine Oil	<ul style="list-style-type: none"> ● Loosened oil drain plug. 	<ul style="list-style-type: none"> ● Tighten the plug.
		<ul style="list-style-type: none"> ● Loosened oil pan bolt. 	<ul style="list-style-type: none"> ● Tighten the bolt.
		<ul style="list-style-type: none"> ● Loosened oil filter. 	<ul style="list-style-type: none"> ● Tighten the filter.
		<ul style="list-style-type: none"> ● Loosened oil pressure switch. 	<ul style="list-style-type: none"> ● Tighten the switch.
		<ul style="list-style-type: none"> ● Leakage of camshaft front oil seal. 	<ul style="list-style-type: none"> ● Replace the seal.
		<ul style="list-style-type: none"> ● Leakage of crankshaft front oil seal. 	<ul style="list-style-type: none"> ● Replace the seal.
		<ul style="list-style-type: none"> ● Leakage at the cylinder head cover gasket. 	<ul style="list-style-type: none"> ● Replace the gasket.
		<ul style="list-style-type: none"> ● Damage of the cylinder head gasket. 	<ul style="list-style-type: none"> ● Replace the gasket.
	Oil Mixing in Combustion Chamber	<ul style="list-style-type: none"> ● Stuck piston ring. 	<ul style="list-style-type: none"> ● Remove carbon and replace the ring.
		<ul style="list-style-type: none"> ● Worn piston or cylinder. 	<ul style="list-style-type: none"> ● Replace the piston or the cylinder.
		<ul style="list-style-type: none"> ● Worn piston ring or ring groove. 	<ul style="list-style-type: none"> ● Replace the piston or ring.
		<ul style="list-style-type: none"> ● Inadequate position of the piston ring cutting part. 	<ul style="list-style-type: none"> ● Adjust the position.
		<ul style="list-style-type: none"> ● Abrasion or damage of the valve system. 	<ul style="list-style-type: none"> ● Replace the valve system.
Low Oil Pressure	Malfunction of Lubrication System	<ul style="list-style-type: none"> ● Inadequate oil viscosity. 	<ul style="list-style-type: none"> ● Replace with the specified one.
		<ul style="list-style-type: none"> ● Loosening of the oil pressure switch. 	<ul style="list-style-type: none"> ● Tighten the switch.
		<ul style="list-style-type: none"> ● Lack of engine oil. 	<ul style="list-style-type: none"> ● Refill oil.
		<ul style="list-style-type: none"> ● Blocking oil strainer. 	<ul style="list-style-type: none"> ● Clean the strainer.

GENERAL DIAGNOSIS (Cont'd)

Condition		Probable cause	Correction
Low Oil Pressure	Malfunction of Lubrication System	<ul style="list-style-type: none"> ● Lowered function of the oil pump. 	<ul style="list-style-type: none"> ● Replace the pump.
		<ul style="list-style-type: none"> ● Abrasion or damage of the oil pump relief valve. 	<ul style="list-style-type: none"> ● Replace the valve.
Engine Noise	Valve Noise	<ul style="list-style-type: none"> ● Inadequate valve clearance. 	<ul style="list-style-type: none"> ● Adjust the valve clearance.
		<ul style="list-style-type: none"> ● Abrasion of valve stem or guide. 	<ul style="list-style-type: none"> ● Replace the valve stem or the guide.
		<ul style="list-style-type: none"> ● Weak valve spring. 	<ul style="list-style-type: none"> ● Replace the spring.
	Piston, Ring, Cylinder Noise	<ul style="list-style-type: none"> ● Abrasion of the piston, the ring or the cylinder. 	<ul style="list-style-type: none"> ● Boring the cylinder or replace the piston, the ring or the cylinder.
	Connecting Rod Noise	<ul style="list-style-type: none"> ● Abrasion of the connecting rod bearing. 	<ul style="list-style-type: none"> ● Replace the bearing.
		<ul style="list-style-type: none"> ● Loosened the connecting rod nut. 	<ul style="list-style-type: none"> ● Tighten to the specified torque.
	Crankshaft Noise	<ul style="list-style-type: none"> ● Abrasion of the crankshaft bearing. 	<ul style="list-style-type: none"> ● Replace the bearing.
		<ul style="list-style-type: none"> ● Abrasion of the crankshaft journal. 	<ul style="list-style-type: none"> ● Grind or replace the crankshaft journal.
		<ul style="list-style-type: none"> ● Loosened bearing cap bolt. 	<ul style="list-style-type: none"> ● Tighten to the specified torque.
		<ul style="list-style-type: none"> ● Excessive clearance of the crankshaft thrust bearing. 	<ul style="list-style-type: none"> ● Adjust or replace.
<ul style="list-style-type: none"> ● Low oil pressure. 		<ul style="list-style-type: none"> ● Refer to "Low Oil Pressure" in this section. 	

CHECKING ENGINE FLUID LEVEL

Check the engine fluid level or condition. If needed, refill or replace the oil.

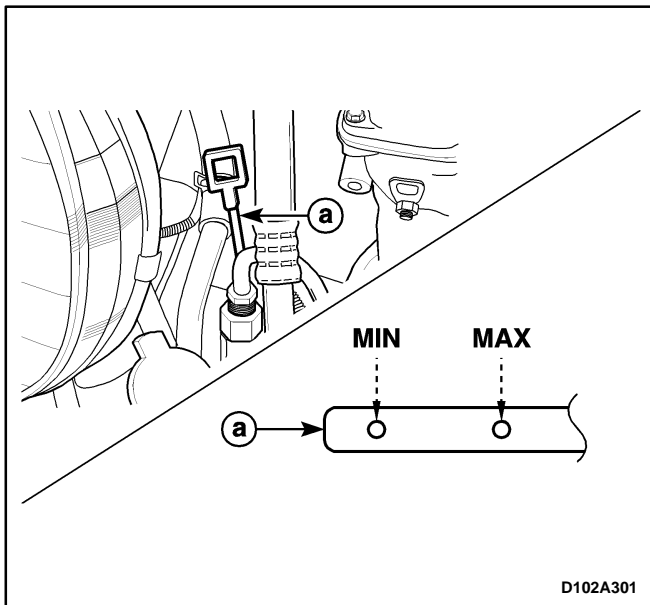
Check the engine oil level within engine normal operating temperature as follows ;

1. After stopping the engine, wait for a few minutes to accumulate oil into the oil pan.
2. After pulling out the oil level gauge (a), check the oil level.
3. Clean the oil level gauge and insert the gauge into guide.
4. After pulling out the oil level gauge again, recheck the oil level and insert the gauge into guide again.

Important: Oil level should be between “MIN” mark and “MAX” mark.

5. If oil level is below the “MIN” mark, refill engine oil as much as the demanded quantify.

Important: If checking oil level under the engine cold condition, oil is not accumulated into oil pan quickly and correct level checking can not be performed. Therefore, wait until temperature reaches the normal operating condition and check the engine oil level.



CHANGING ENGINE OIL OR OIL FILTER

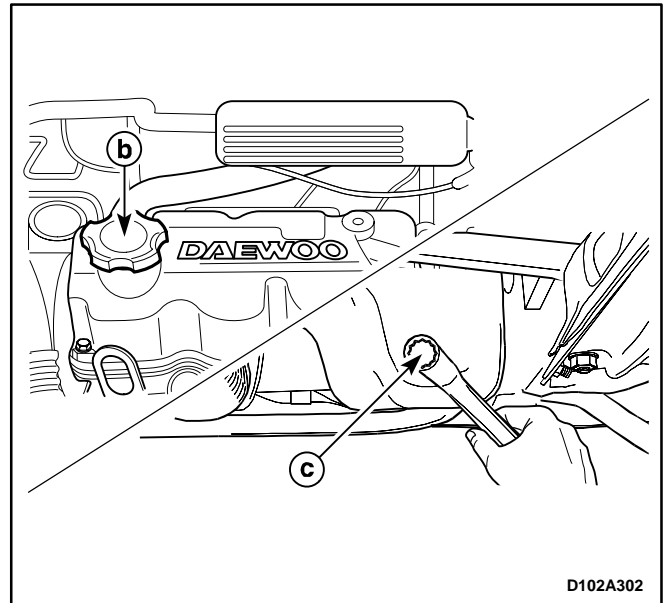
Tools Required

09915-47341 Oil Filter Wrench.

When checking engine oil level or condition, if needed, change engine oil (including the filter) as follows ;

1. After stopping the engine, wait for a few minutes to accumulate oil into the oil pan.
2. Remove the oil filter cap (b).

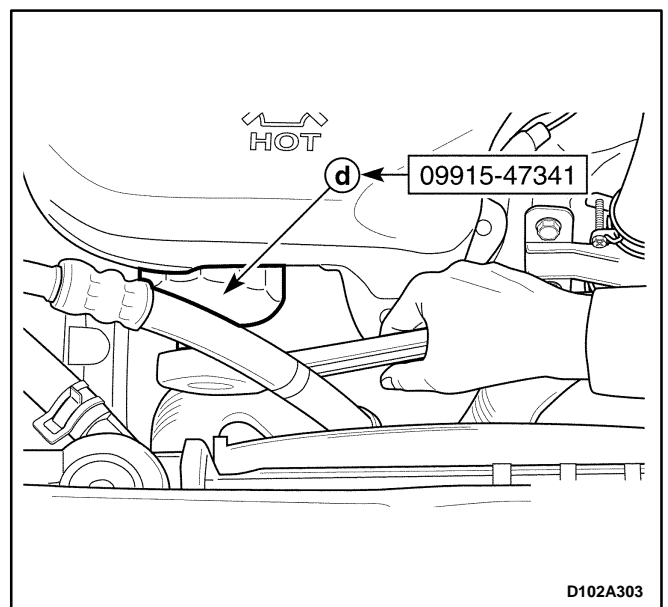
3. Remove the oil drain plug (c) and draw oil off.



4. After drawing oil completely, tighten the oil drain plug to 30–40 N•m (22–30 lb-ft).
5. Replace the oil filter using the oil filter wrench 09915-47341 (d).

- Remove the air cleaner/resonator/snorkel assembly.
- After removing the bolts, remove the heat shield.
- Loosen the power steering pump cap screw and pull the power steering hose into the front.
- Remove the oil filter.

Important: Whenever changing engine oil, replace the oil filter. When replacing new oil filter, apply engine oil on oil filter sealing.

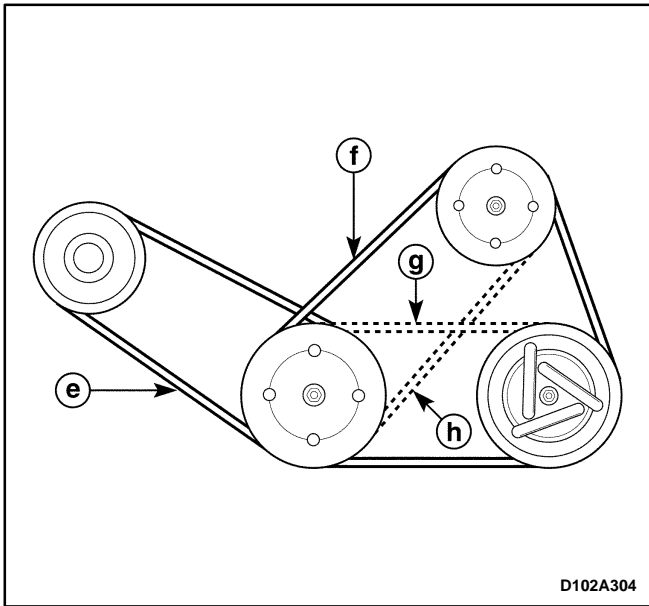


CHECKING ENGINE TIMING BELT

After checking the timing belt for looseness, crack, wear or tension, replace the belt if necessary.

CHECKING ACCESSORY BELT

After checking the alternator belt (e), air conditioning/power steering belt (f), air conditioning belt (g), power steering belt (h), for looseness, crack, wear or tension, replace the belt if necessary.

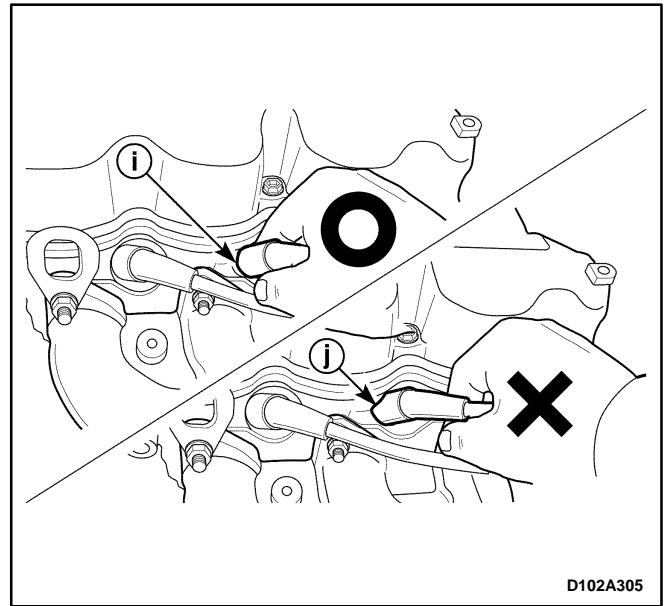


CHECKING SPARK PLUG

After checking the spark plug for bad clearance, excessive carbon deposit, worn electrode or damaged insulator, replace the new one if necessary.

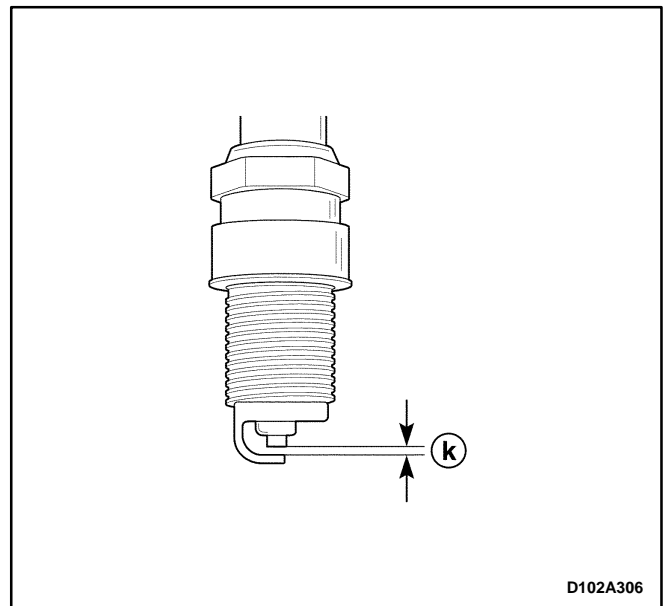
Remove and check the spark plug as follows ;

1. Pull the high tension cable cap portion (i), and disconnect the high tension cable from the spark plug.
If pulling the high tension cable (j), circuit could be disconnected. Therefore, the cap portion should be used.



2. Remove the spark plugs from cylinder head using a wrench.
3. Measure the spark plug clearance (k) with the filler gauge. If measured value is not within the specified value, adjust the grounding electrode.

When installing new spark plug, check the clearance for equality and install it.



CHECKING AIR CLEANER ELEMENT

If the air cleaner element becomes dirty, engine efficiency could be deteriorated.

Be sure to check the element often.

Especially, if a vehicle frequently runs on a dusty road, check and replace the element often.

CHECKING FUEL FILTER

If fuel filter is used over the specified period, engine efficiency is deteriorated by dust or foreign material.

Therefore, replace a new one within the specified period.

CHECKING FUEL SYSTEM

Check the fuel system as follows ;

- Check the fuel line or line connection portion for damage or leakage.
- Check the fuel hose surface for damage.
- Check the fuel cap for looseness.

CHECKING HOSE SYSTEM

Check the engine vacuum hose, PCV hose or canister hose as follows ;

- Check the hose surface for damage by heat or machine.
- Check the hose for hardening, crack, tear, or coming off.

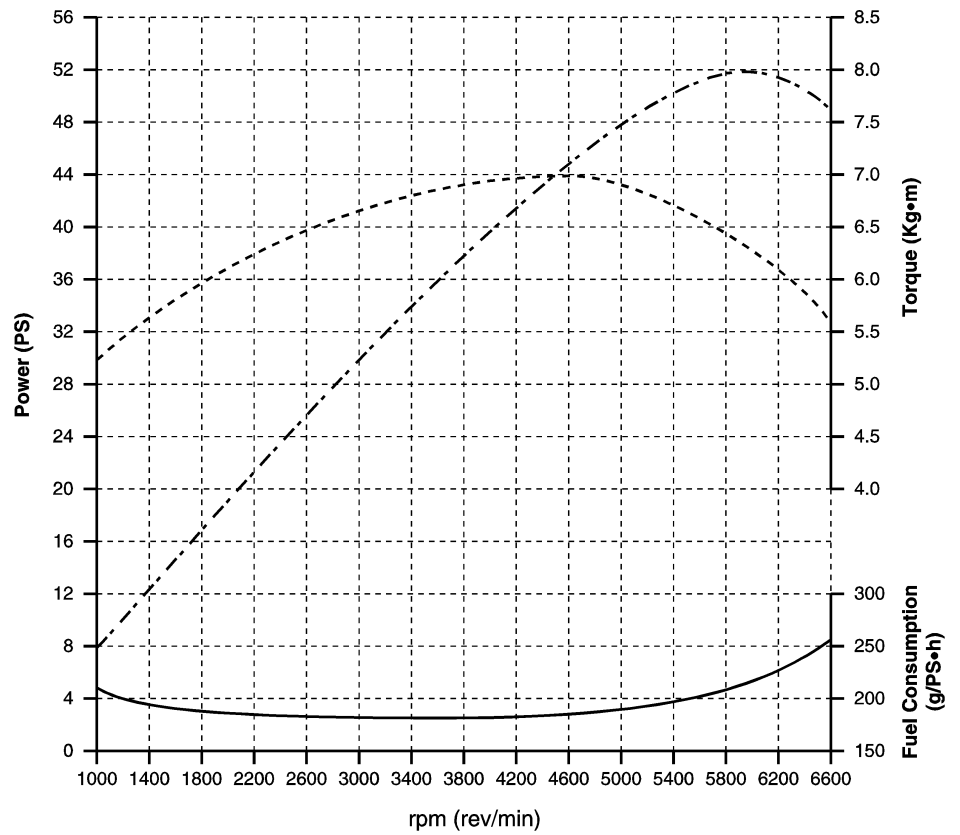
SPECIFICATIONS

GENERAL SPECIFICATIONS

Application		Description	
Vehicle Capacity	Maximum Speed	144 km/h (90 mph)	
	Gradeability	0.420 tan θ	
	Minimum Turning Radius	4.5 m (14.8 ft)	
Engine Information	Bore \times Stroke	68.5 \times 72.0 mm (2.70 \times 2.83 inch)	
	Displacement	796 cm ³ (48.6 in ³)	
	Compression Ratio	9.3 : 1	
	Maximum Power	37.5 KW (6,000 rpm)	
	Maximum Torque	68.6 N·m (50.59 lb-ft) (at 4,600 rpm)	
	Ignition Timing (Ignition Sequence)	5° BTDC (1-3-2) / 10° BTDC (1-3-2)	
	Idle Speed	Air Conditioning System (ON)	1,000 \pm 50 rpm
Air Conditioning System (OFF)		950 rpm	
Engine Part Type	Engine	Overhead Cam L-3	
	Ignition Type	Direct Ignition System (DIS) / High Energy Ignition (HEI)	
	Distributor	Optical Sensor Type	
	Starter	SD 80	
	Spark-Plug	Unleaded	BPR5EY-11, RN9YC4, WR8DCX
		Leaded	BPR5EY, RN9YC, WR8DC
	Fuel Injection Type	MPI	
	Fuel Pump	Electric Motor Pump	
	Fuel Filter	Cartridge	
	Lubricating Type	Forced Feed Type	
	Oil Pump	Rotary Pump Type	
	Cooling Type	Forced Water Circulation	
	Radiator	Cross - Flow	
	Water Pump	Centrifugal	
	Thermostat	Pellet Type	
	Air Cleaner Element	Non Woven Fabric	
	Muffler	Catalytic Converter, Closed Circuit	
Battery	MF		
Engine Part Capacity	Engine Oil	SJ Grade SAE 5W30, SAE 10W30, SAE 15W40	
	Refrigerant	Four Seasons	
Engine Information	Engine Oil	Engine Disassembly	3.0 L (3.17 qt)
		Oil Change (Including filter)	2.7 L (2.85 qt)
		Oil Change (Not including filter)	2.5 L (2.64 qt)
		Oil Level Gauge	1 L (1.06 qt) (MIN to MAX)
	Coolant	3.8 L (4.02 qt)	
	Battery	12V-35 AH, 246 CCA	
	Generator	65 A	
	Starter	0.8 kW	
	Fuel Pump	Output Capacity	90 - 133 Lph
		Output Pressure	380 kPa (55.1 Psi)
Fuel Tank Capacity	35 L (9.2 gal), 38 L (10 gal)		

ENGINE PERFORMANCE CURVE

- Maximum Power : 51 PS (37.5 KW) (at 6,000 rpm)
- Maximum Torque : 7 Kg·m (68.6 N·m) (at 4,600 rpm)



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