SECTION EM
ENGINE MECHANICAL

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PRECAUTIONS

PFP:00001

Precautions for Drain Coolant

EBS007JS

- Drain coolant when engine is cooled.

Precautions for Disconnecting Fuel Piping

EBS007JT

- Before starting work, make sure no fire or spark producing items are in the work area.
- Release fuel pressure before disassembly.
- After disconnecting pipes, plug openings to stop fuel leakage.

Precautions for Removal and Disassembly

EBS007JU

- When instructed to use special service tools, use the specified tools. Always be careful to work safely, avoid forceful or uninstructed operations.
- Exercise maximum care to avoid damage to mating or sliding surfaces.
- Cover openings of engine system with tape or the equivalent, if necessary, to seal out foreign materials.
- Mark and arrange disassembly parts in an organized way for easy troubleshooting and re-assembly.
- When loosening nuts and bolts, as a basic rule, start with the one furthest outside, then the one diagonally opposite, and so on. If the order of loosening is specified, do exactly as specified.

Precautions for Inspection, Repair and Replacement

EBS007JV

- Before repairing or replacing, thoroughly inspect parts. Inspect new replacement parts in the same way, and replace if necessary.

Precautions for Assembly and Installation

EBS007JW

- Use torque wrench to tighten bolts or nuts.
- When tightening nuts and bolts, as a basic rule, equally tighten in several different steps starting with the ones in center, then ones on inside and outside diagonally in this order. If the order of tightening is specified, do exactly as specified.
- Replace with new gasket, packing, oil seal or O-ring.
- Thoroughly wash, clean, and air-blow each part. Carefully check oil or coolant passages for any restriction and blockage.
- Avoid damaging sliding or mating surfaces. Completely remove foreign materials such as cloth lint or dust. Before assembly, oil sliding surfaces well.
- Release air within route after draining coolant.
- After repairing, start engine and increase engine speed to check coolant, fuel, oil, and exhaust systems for leakage.

Parts Requiring Angular Tightening

EBS007JX

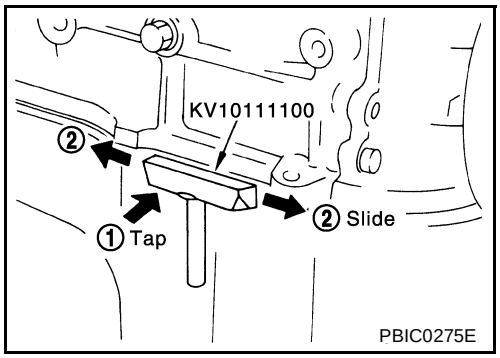
- Use an angle wrench for the final tightening of the following engine parts:
  - Cylinder head bolts
  - Connecting rod cap nuts
- Do not use a torque value for final tightening.
- The torque value for these parts are for a preliminary step.
- Ensure thread and seat surfaces are clean and coated with engine oil.

Precautions for Liquid Gasket

EBS007JY

REMOVAL OF LIQUID GASKET SEALING

- After removing the mounting bolts and nuts, disconnect and remove the liquid gasket sealing using a seal cutter.



CAUTION:

Be careful not to damage the mating surfaces.

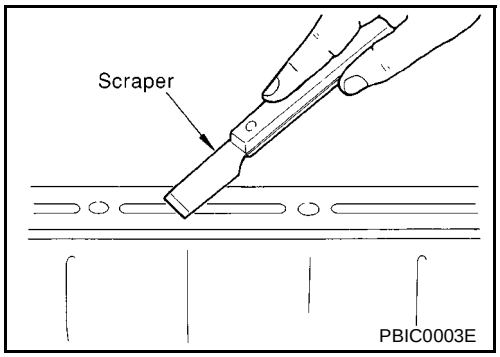
- In areas where the cutter is difficult to use, use a plastic hammer to lightly tap the areas where the liquid gasket is applied.

CAUTION:

If for some unavoidable reason a tool such as a flat-bladed screwdriver is used, be careful not to damage the mating surfaces.

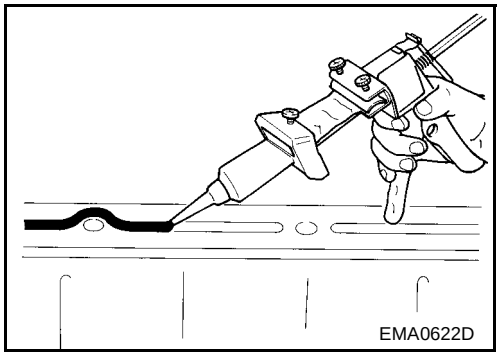
LIQUID GASKET APPLICATION PROCEDURE

1. Using a scraper, remove the old liquid gasket adhering to the gasket application surface and the mating surface.



- Remove the liquid gasket completely from the groove of the gasket application surface, mounting bolts, and bolt holes.

2. Wipe the gasket application surface and the mating surface with white gasoline (lighting and heating use) to remove adhering moisture, grease and foreign materials.
3. Attach the liquid gasket to the tube presser.
   Use Genuine Liquid Gasket or equivalent.
4. Apply the gasket without breaks to the specified location with the specified dimensions.



- If there is a groove for the liquid gasket application, apply the gasket to the groove.
- As for the bolt holes, normally apply the gasket inside the holes. Occasionally, it should be applied outside the holes. Make sure to read the text of service manual.
- Within five minutes of gasket application, install the mating component.
- If the liquid gasket protrudes, wipe it off immediately.
- Do not retighten after the installation.
- After 30 minutes or more have passed from the installation, fill the engine oil and coolant.

CAUTION:

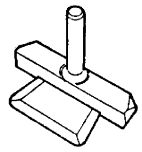
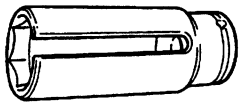
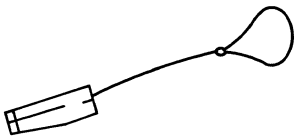
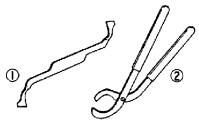
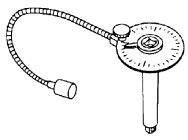
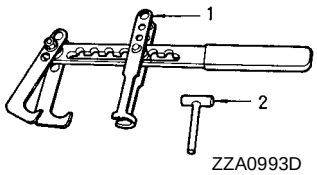
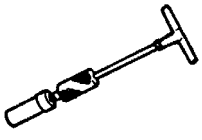
If there are specific instructions in the service manual, observe them.

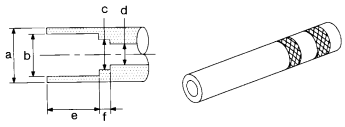
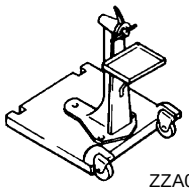
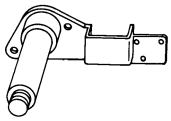
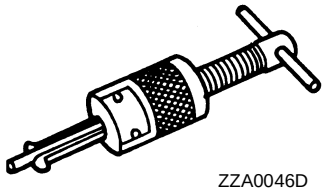
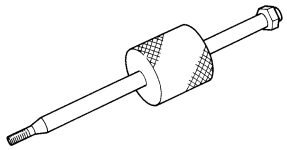
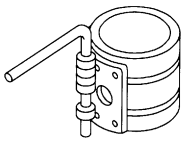
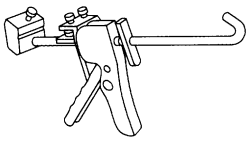
PREPARATION

PFP:00002

Special Service Tools

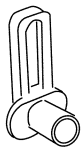
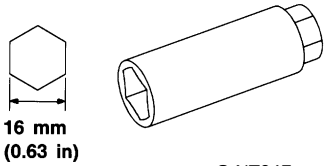
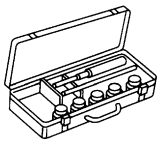
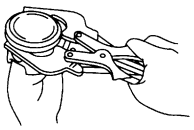
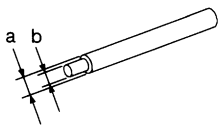
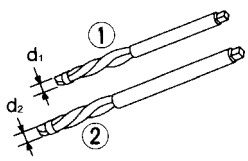
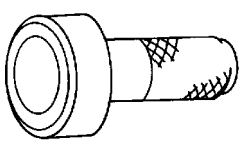
EBS007JZ

Tool number Tool name	Description
KV10111100 Seal cutter  ZZA0013D	Removing steel oil pan and rear timing chain case
KV10117100 Heated oxygen sensor wrench  ZZA1007D	Loosening or tightening heated oxygen sensors with 22 mm (0.87 in) hexagon nut
KV10105800 Timing chain stopper  ZZA1006D	Removing and installing idler sproket
KV101151S0 Lifter stopper set 1 KV10115120 Lifter stopper 2 KV10115110 Camshaft pliers  ZZA0103D	Changing valve lifter shims
KV10112100 Angle wrench  ZZA0120D	Tightening bolts for bearing cap, cylinder head, etc.
KV10116200 Valve spring compressor KV10111200 Adapter  ZZA0993D	Disassembling and assembling valve components
KV10116100 Valve oil seal puller  ZZA0015D	Removing valve oil seal

Tool number Tool name	Description
KV10116300 Valve oil seal drift  NT602	Installing valve oil seal a: 25 mm (0.98 in) dia. b: 14.4 mm (0.567 in) dia. c: 11.8 mm (0.465 in) dia. d: 10 mm (0.39 in) dia. e: 11 mm (0.43 in) f: 9 mm (0.35 in)
ST0501S000 Engine stand assembly  ZZA0022D	Engine overhaul
KV10105001 Engine attachment  ZZA1061D	
ST16610001 Pilot bushing puller  ZZA0046D	Removing crankshaft pilot bushing (M/T model only)
KV10114700 Main bearing cap remover  ZZA0023D	
EM03470000 Piston ring compressor  S-NT044	Installing piston assembly into cylinder bore
WS39930000 Tube presser  S-NT052	Pressing the tube of liquid gasket

Commercial Service Tools

EBS007K0

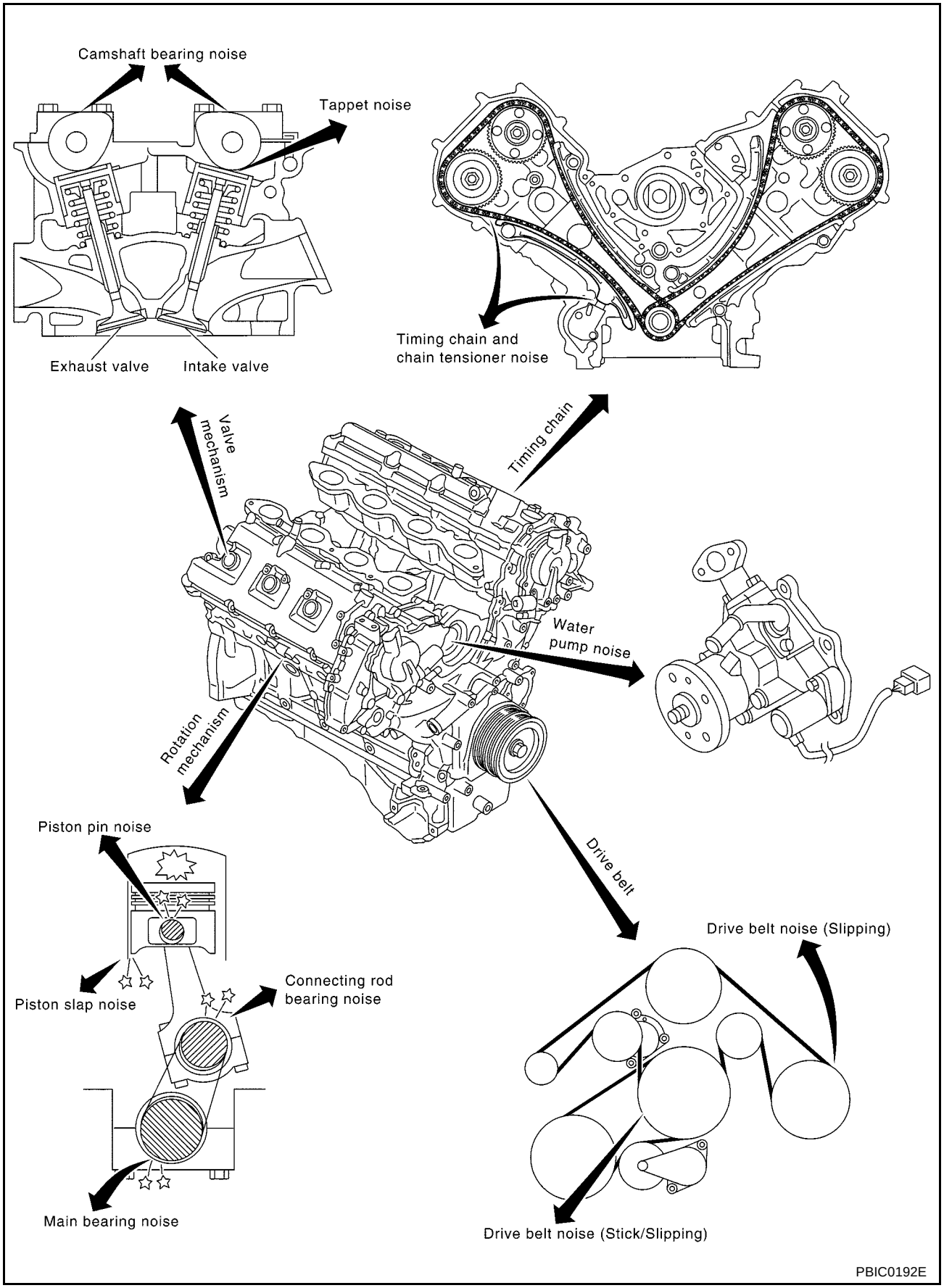
Tool number Tool name	Description	
Quick connector release	 PBIC0198E	Removing fuel tube quick connectors in engine room (Available in SEC. 164 of PARTS CATALOG: Part No. 16441 6N210)
Spark plug wrench	 16 mm (0.63 in) S-NT047	Removing and installing spark plug
Valve seat cutter set	 S-NT048	Finishing valve seat dimensions
Piston ring expander	 S-NT030	Removing and installing piston ring
Valve guide drift	 a b S-NT015	Removing and installing valve guide **Intake & Exhaust:** **a: 109.5 mm (0.413 in) dia.** **b: 6.6 mm (0.260 in) dia.**
Valve guide reamer	 ① ② d_1 d_2 S-NT016	1: Reaming valve guide inner hole 2: Reaming hole for oversize valve guide **Intake & Exhaust:** **d_1 : 7.0 mm (0.276 in) dia.** **d_2 : 11.175 mm (0.440 in) dia.**
Rear oil seal drift	 ZZA0025D	Installing rear oil seal

NOISE, VIBRATION, AND HARSHNESS (NVH) TROUBLESHOOTING

PFP:00003

NVH Troubleshooting —Engine Noise

EBS007K1



Use the Chart Below to Help You Find the Cause of the Symptom.

EBS007K2

1. Locate the area where noise occurs.
2. Confirm the type of noise.
3. Specify the operating condition of engine.
4. Check specified noise source.

If necessary, repair or replace these parts.

Location of noise	Type of noise	Operating condition of engine						Source of noise	Check item	Reference page
		Before warm-up	After warm-up	When starting	When idling	When racing	While driving			
Top of engine Rocker cover Cylinder head	Ticking or clicking	C	A	—	A	B	—	Tappet noise	Valve clearance	EM-38
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal clearance Camshaft runout	EM-36 EM-35
Crankshaft pulley Cylinder block (Side of engine) Oil pan	Slap or knock	—	A	—	B	B	—	Piston pin noise	Piston and piston pin clearance Connecting rod bushing clearance	EM-80 EM-80
	Slap or rap	A	—	—	B	B	A	Piston slap noise	Piston-to-bore clearance Piston ring side clearance Piston ring end gap Connecting rod bend and torsion	EM-80 EM-79 EM-79 EM-80
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing clearance (Small end) Connecting rod bearing clearance (Big end)	EM-80 EM-80
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	EM-84 EM-83
Front of engine Timing chain cover	Tapping or ticking	A	A	—	B	B	B	Timing chain and chain tensioner noise	Timing chain cracks and wear Timing chain tensioner operation	EM-44 EM-51
Front of engine	Squeaking or fizzing	A	B	—	B	—	C	Other drive belts (Sticking or slipping)	Drive belts deflection	EM-14
	Creaking	A	B	A	B	A	B	Other drive belts (Slipping)	Idler pulley bearing operation	
	Squall Creak	A	B	—	B	A	B	Water pump noise	Water pump operation	CO-21

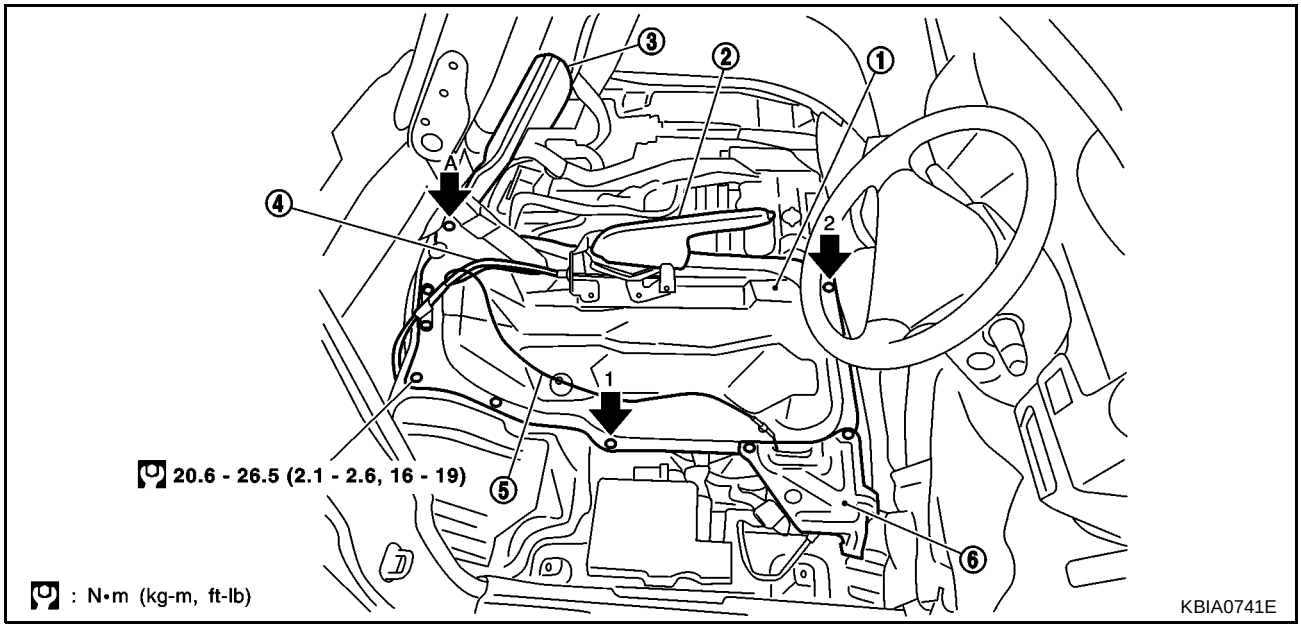
A: Closely related B: Related C: Sometimes related —: Not related

ENGINE ROOM COVER

PFP:14049

Removal and Installation of Engine Room Right Side

EBS00ALX



1. Engine room right side cover
2. Parking brake lever
3. Engine room left side cover
4. Parking brake cable
5. Harness
6. Harness protector

REMOVAL

1. Open engine compartment LH cover and secure it.
2. Remove RH seat. Refer to SE-4, "FRONT SEAT" .
3. Partially remove floor carpet.
4. Disconnect harness protector secured together at front right. Disconnect harness connector to move harness routed on top of engine compartment RH cover aside.
5. Move parking brake lever and cable from engine compartment RH cover. Refer to PB-3, "PARKING BRAKE SYSTEM" .
6. Remove mounting bolts, and remove engine compartment RH cover.

CAUTION:
When taking it out of vehicle, do not allow it to interfere with vehicle.

INSTALLTION

- Install in reverse order of removal following instructions below.

1. Temporarily tighten bolt No. 1 shown in the figure.
2. Tighten bolt No. 2 shown in figure to specified torque.
3. Tighten other bolts except bolt “A” shown in the figure (bolt No. 1 is included) to specified torque in any given order.
4. Close engine compartment LH cover.
5. Tighten bolt “A” shown in the figure to specified torque.

Removal and Installation of Engine Room Rear Cover

EBS00ALY

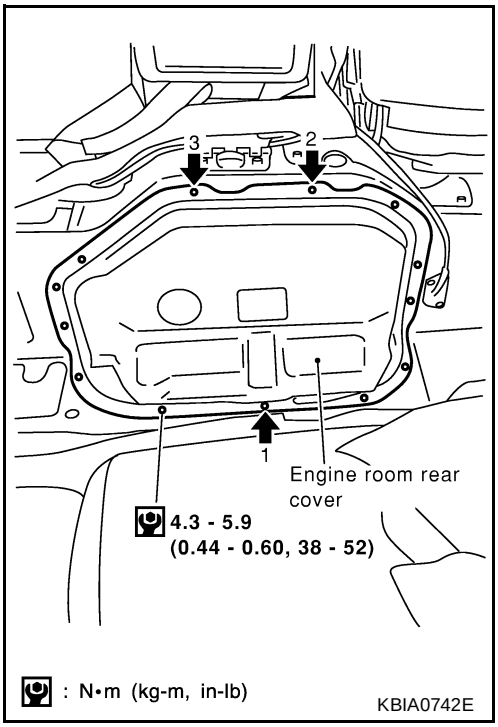
REMOVAL

1. Move folded seat on engine compartment rear cover side rearward, if applicable.
2. Partially remove floor carpet.
3. Remove mounting bolts, and remove engine compartment rear cover.

INSTALLATION

Following instructions below, install in reverse order of removal.

1. Tighten bolts No. 1 to No. 3 shown in the figure to specified torque in this order.
2. Tighten other bolts to specified torque in any given order.



DRIVE BELTS

PFP:02117

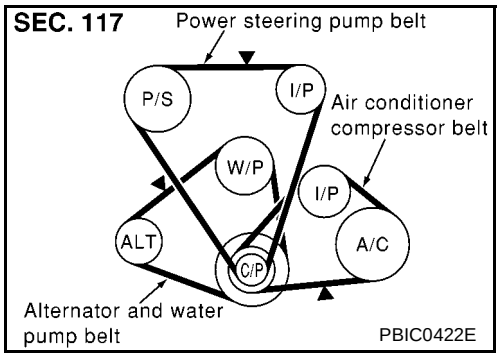
Checking Drive Belts

EBS007K4

WARNING:

Be sure to perform when the engine is stopped.

- Inspection should be done only when engine is cold, or over 30 minutes after engine is stopped.
- Measure belt tension with tension meter (special service tool) at points marked ▼ shown in the figure.
- Measure belt deflection by applying load of 98.1 N {10 kg} to ▼.



Unit: mm (in)

	Deflection adjustment		
	Used belt		New belt
	Limit	After adjustment	
Alternator	11 (0.43)	7 - 8 (0.28 - 0.31)	6 - 7 (0.24 - 0.28)
Air conditioner compressor	13 (0.51)	8 - 10 (0.31 - 0.39)	7 - 8 (0.28 - 0.31)
Power steering oil pump	13 (0.51)	8 - 10 (0.31 - 0.39)	7 - 8 (0.28 - 0.31)
Applied pushing force	98 N (10 kg, 72 lb)		

Tension Adjustment

EBS00AM2

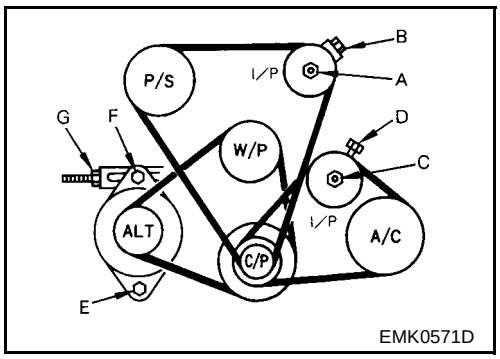
CAUTION:

- **When belt is replaced with a new one, tighten it a little stronger than current one to accommodate for insufficient adaptability with pulley grooves.**
- **When tension of belt being used exceeds "Retightening limit", adjust it to value for "Used belt".**
- **When installing belt, make sure that it is correctly engaged with pulley groove.**
- **Keep oil and water away from belt.**
- **Do not twist or bend belt excessively.**

POWER STEERING PUMP BELT

1. Open and fix engine compartment LH cover.
2. Loosen idler pulley lock nut (A) and adjust tension by turning adjusting bolt (B).
   - For specified belt tension, refer to EM-14, "Checking Drive Belts" .
3. Tighten nut (A).

: 25.5 - 32.4 N·m (2.6 - 3.3 kg-m, 19 - 23 ft-lb)



AIR CONDITIONER COMPRESSOR BELT

1. Open and fix engine compartment LH cover (passenger side for RHD models or driver-side for LHD models).
2. Loosen idler pulley lock nut (C) and adjust tension by turning adjusting bolt (D).
   - For specified belt tension, refer to EM-14, "Checking Drive Belts" .
3. Tighten nut (C).

: 25.5 - 32.4 N·m (2.6 - 3.3 kg-m, 19 - 23 ft-lb)

ALTERNATOR AND WATER PUMP BELT

1. Remove front-side under cover.
2. Remove RH seat. Refer to SE-4, "FRONT SEAT" .
3. Remove engine compartment RH cover. Refer to EM-12, "ENGINE ROOM COVER" .
4. Loosen alternator mounting bolt (E) and adjuster lock bolt (F), and adjust tension by turning adjusting nut (G).
   - For specified belt tension, refer to EM-14, "Checking Drive Belts" .
5. Tighten bolts (E), (F) and (G).

: 45.1 - 59.8 N·m (4.6 - 6.1 kg-m, 34 - 44 ft-lb) for E bolt

: 15.7 - 20.6 N·m (1.6 - 2.1 kg-m, 12 - 15 ft-lb) for F bolt

: 6.5 - 7.6 N·m (0.67 - 0.77 kg-m, 58 - 67 in-lb) for G bolt

Removal and Installation

EBS007K6

REMOVAL

- Loosen each belt while referring to "Adjustment", and remove them one by one starting from the one in front.

INSTALLATION

1. Install belts to pulley in reverse order of removal.
2. Adjust belt tension.

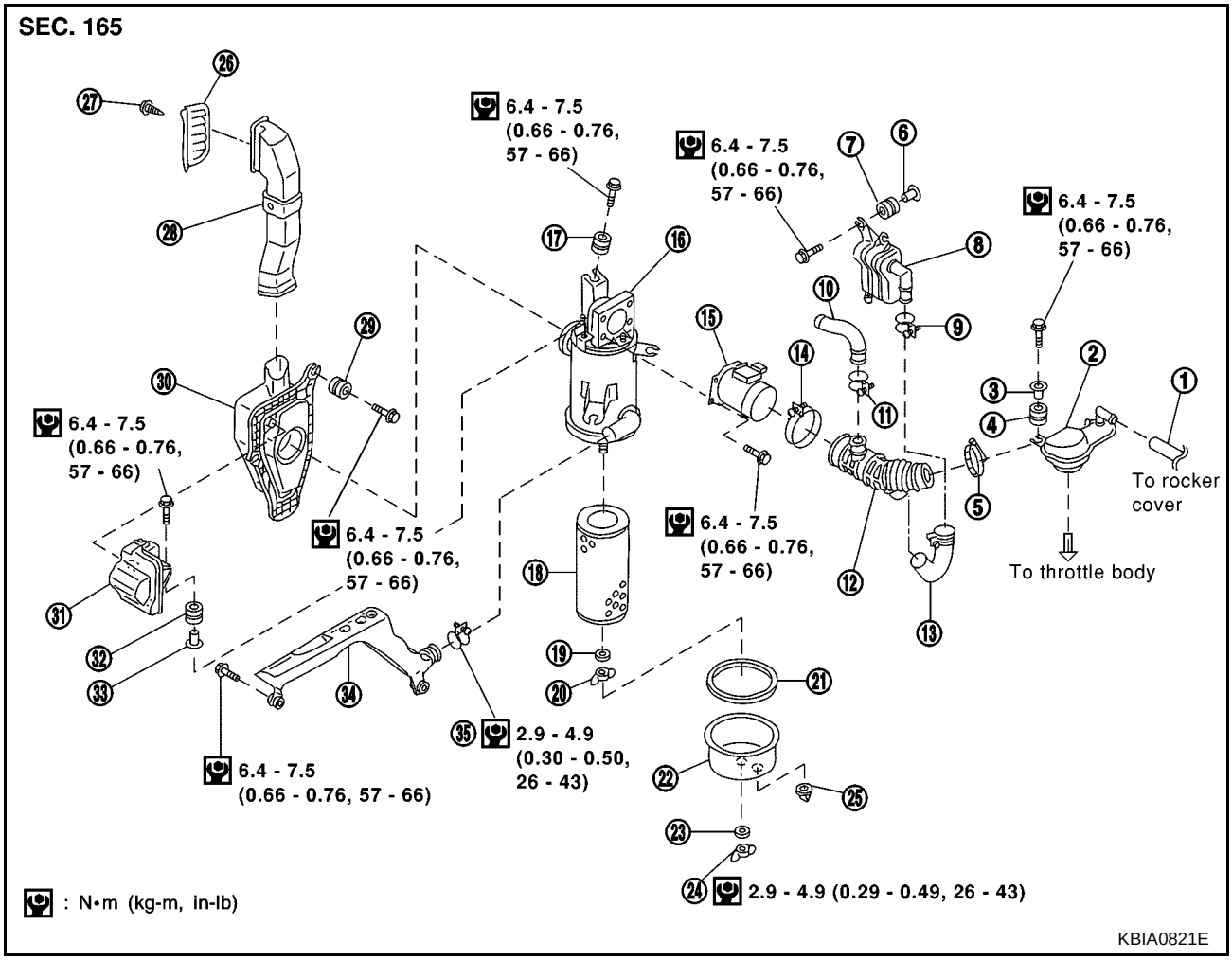
   CAUTION:
   - **When checking belt tension immediately after installation, first, adjust to specified value. Then, after turning crankshaft more than two turns, re-adjust to specified value to avoid variation in deflection between pulleys.**
   - **Tighten idler pulley lock nut by hand and measure tension without looseness.**
3. Tighten each adjusting bolt and nut to the specified torque.
4. Make sure that tension of each belt is within the standard.

AIR CLEANER AND AIR DUCT

PFP:16500

Removal and Installation

EBS007K8



1	PCV hose	2	Air duct	3	Collar
4	Grommet	5	Clamp	6	Collar
7	Grommet	8	Resonator	9	Clamp
10	Resonator	11	Clamp	12	Air hose
13	Resonator	14	Clamp	15	Mass air flow meter
16	Air cleaner case	17	Grommet	18	Air cleaner element
19	Washer	20	Wing nut	21	Seal ring
22	Dust pan	23	Washer	24	Wing nut
25	Dust exhaust valve	26	Grille	27	Screw
28	Air duct	29	Grommet	30	Air duct
31	Resonator	32	Grommet	33	Collar
34	Resonator	35	Clamp		

REMOVAL

1. Remove rear-side under cover.
2. Open and fix engine room LH cover.
3. Remove RH seat. Refer to SE-4, "FRONT SEAT" .
4. Remove engine room RH cover. Refer to EM-12, "ENGINE ROOM COVER" .
5. Remove floor cover behind RH seat.
6. Disconnect harness connector from airflow sensor.

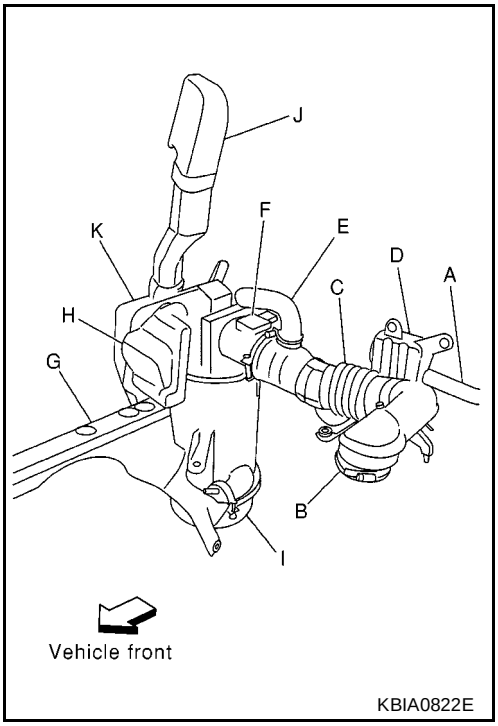
7. For correct installation, make matching marks on each connection.
8. Remove from engine side after separating the system with the following procedure.

a. Remove PCV hose (A).
b. Remove air duct (B).
c. Separate air hose (C) and resonator (D).
d. Remove resonator (E).
e. Remove air hose (C).
f. Remove resonator (D).
g. Remove mass air flow sensor (F).

CAUTION:

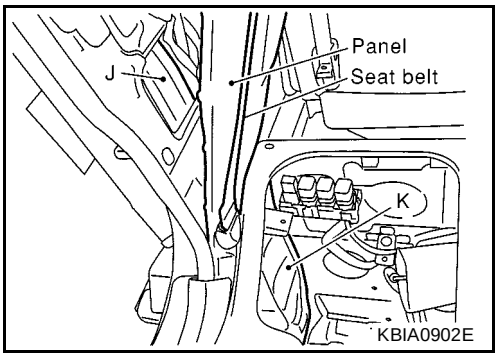
- **Handle with care, avoiding any shocks.**
- **Do not disassemble it.**
- **Do not touch sensor part.**

h. After removing mud flap of front RH wheel, remove resonator (G).
i. When removing following parts, remove EVAP canister, and set it aside.
j. Remove resonator (H).
k. Remove air cleaner case (I).



9. When removing components inside vehicle on right-hand, remove them with the following procedure.

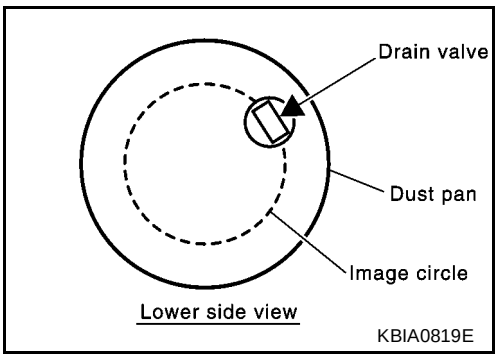
a. Remove components up to air cleaner case (I), referring to step 8.
b. Remove intake grille from outside of vehicle.
c. Remove kicking plate on RH side, and lift up panel under RH side seat belt anchor.
d. Lift up air duct (J) from vehicle opening, and separate it from air duct (K).
e. Pull and remove air duct (K).
f. Remove air duct (J) from mounting hole of air duct (K).



INSTALLATION

Install in reverse order of removal, paying attention to points below.

- After aligning matching marks marked when removing, install each connection, and firmly tighten clamps.
- Install dust drain valve so that its opening is along circumference.



Changing Air Cleaner Element

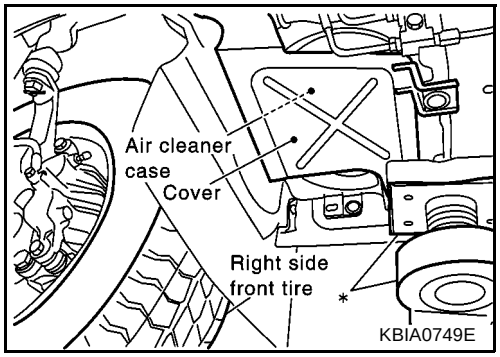
EBS0096T

REMOVAL

NOTE:

- Mark ″*″ in the figure shows part of lift arm.
- For replacement of air cleaner element, it is not necessary to lift up vehicle.

1. Remove brake pipe protector under vehicle, behind front RH wheel.
2. Remove 3 clips, and the cover at the bottom of air cleaner case.
3. Remove wing nut, dust pan under air cleaner case, and then air cleaner element.



INSTALLATION

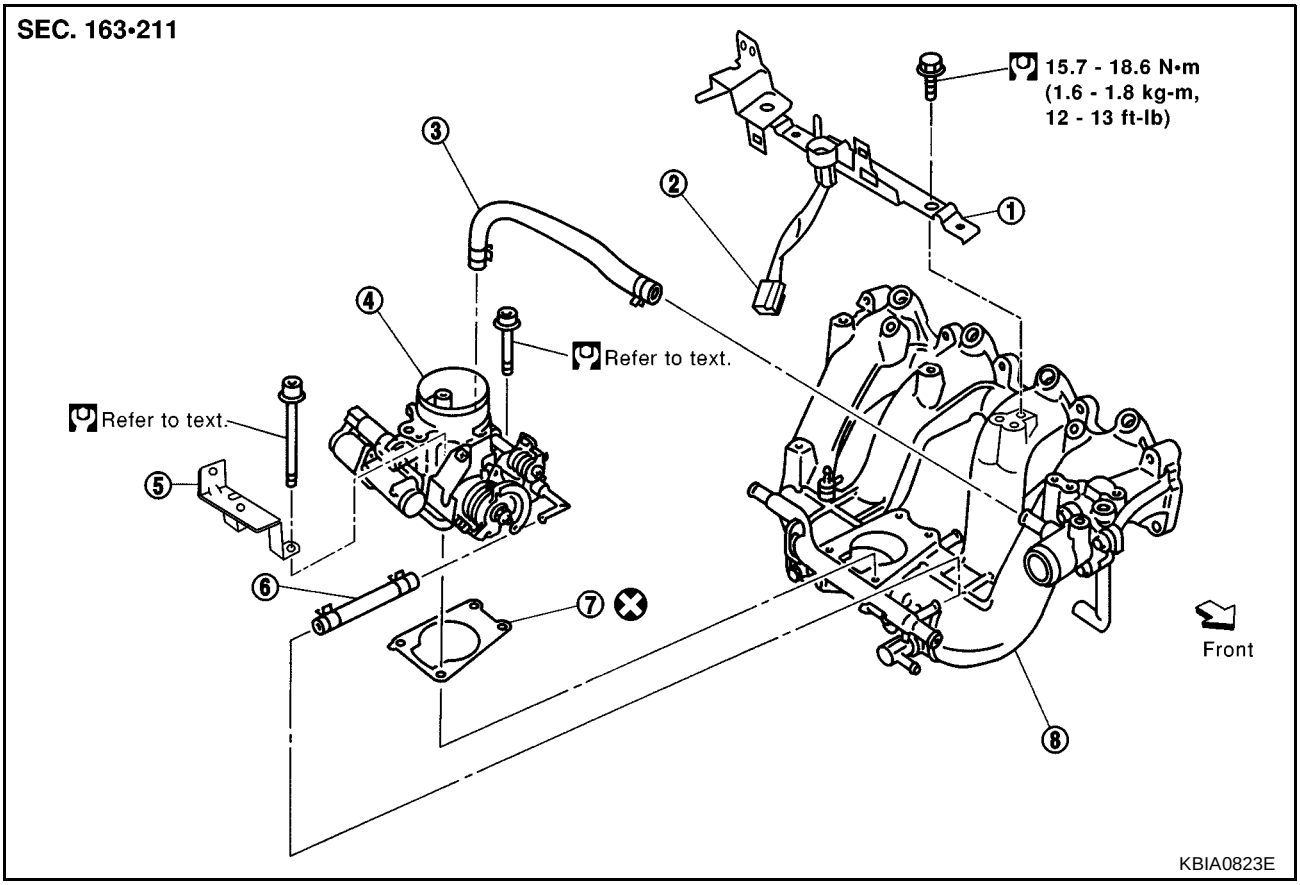
Install in the reverse order of removal.

THROTTLE BODY

PFP:16298

Removal and Installation

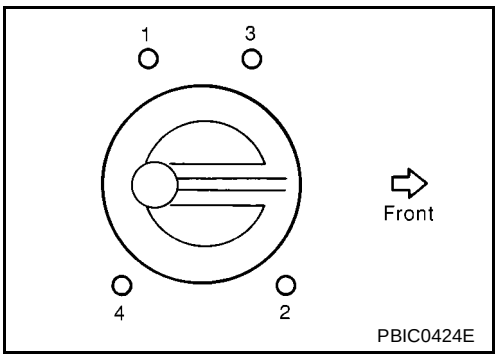
EBS008X7



1	Bracket	2	Throttle position sensor harness	3	Water hose
4	Throttle body	5	Bracket	6	Water hose
7	Gasket	8	Intake manifold		

REMOVAL

1. Remove RH seat. Refer to SE-4, "FRONT SEAT" .
2. Remove engine compartment RH cover. Refer to EM-12, "ENGINE ROOM COVER" .
3. Remove air duct on throttle body. Refer to EM-16, "AIR CLEANER AND AIR DUCT" .
4. Disconnect accelerator cable, and set it aside.
5. Disconnect harness connector.
6. Disconnect water hose.
   - After disconnection, plug the hose to prevent coolant leaks.
7. Loosen mounting bolts in reverse order shown in the figure, and remove throttle body.



INSPECTION AFTER REMOVAL

- If idle is rough when engine is cold or warmed up, check and adjust the fast idle cam (FIC). Refer to EC-28, "Fast Idle Cam (FIC) Inspection and Adjustment" .

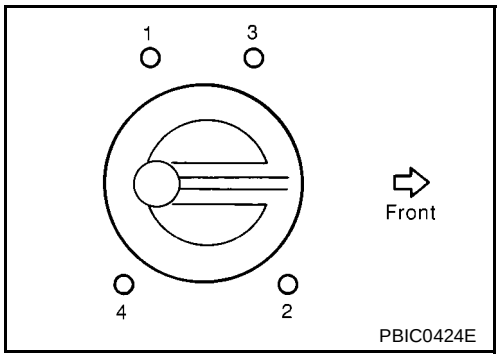
INSTALLATION

Install in reverse order of removal, paying attention to points below.

- For throttle body, tighten mounting bolts in two steps in the numerical order shown in the figure.
- For adjustment of accelerator cable, refer to ACC-3, "ACCELERATOR CONTROL SYSTEM (KA24DE)" .

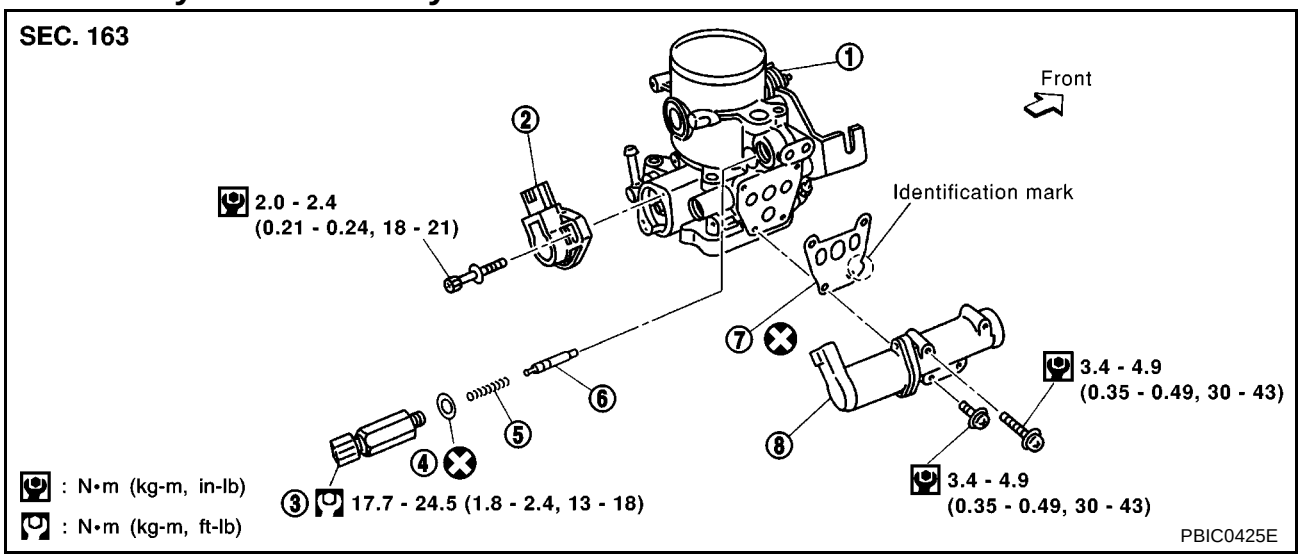
1st step : 8.8 - 10.8 N·m (0.9 - 1.1 kg-m, 78 - 95 in-lb)

2nd step : 17.7 - 21.6 N·m (1.8 - 2.2 kg-m, 13 - 15 ft-lb)



Disassembly and Assembly

EBS008X8



1	Throttle body	2	Throttle position sensor	3	IACV-FICD solenoid valve
4	Washer	5	Spring	6	plunger
7	Gasket	8	IACV-AAC valve		

DISASSEMBLY

Disassemble referring to the component illustration.

ASSEMBLY

Assemble in reverse order of disassembly, paying attention to points below.

- Insert throttle position sensor into throttle body, with connectors positioned as shown in the figure. Then rotate it in the direction shown by arrow and temporarily tighten mounting screws.
- While they are turned in direction shown by arrow, circumference of sensor hits projection. Avoid hitting projection by giving slight space, and insert projection into inside of mounting screw long hole. (It is temporarily held in place by counter-action of spring.)
- After adjustment on vehicle, tighten mounting screws.
  For adjusting procedure, refer to EC-45, "Basic Inspection" .