

ENGINE MECHANICAL

SECTION EM

CONTENTS

PRECAUTIONS	3	Installation	37
Parts Requiring Angular Tightening	3	CYLINDER HEAD	38
Liquid Gasket Application Procedure	3	Components	38
Special Cautions to Ensure the Safe Disposal of		Removal	39
Sodium-filled Exhaust Valves	3	Disassembly	41
DEALER DISPOSAL INSTRUCTIONS	4	Inspection	43
PREPARATION	6	CYLINDER HEAD DISTORTION	43
Special Service Tools	6	CAMSHAFT VISUAL CHECK	43
Commercial Service Tools	8	CAMSHAFT RUNOUT	43
NOISE, VIBRATION AND HARSHNESS (NVH)		CAMSHAFT CAM HEIGHT	43
TROUBLESHOOTING	10	CAMSHAFT JOURNAL CLEARANCE	44
NVH Troubleshooting - Engine Noise	11	CAMSHAFT END PLAY	44
OUTER COMPONENT PARTS	12	CAMSHAFT SPROCKET RUNOUT	45
Removal and Installation	12	VALVE GUIDE CLEARANCE	45
MEASUREMENT OF COMPRESSION PRESSURE	15	VALVE GUIDE REPLACEMENT	45
DRIVE BELTS	16	VALVE SEATS	46
Checking	16	REPLACING VALVE SEAT FOR SERVICE PARTS	47
AIR CLEANER	17	VALVE DIMENSIONS	48
Changing	17	VALVE SPRING	48
VISCOUS PAPER TYPE	17	HYDRAULIC LASH ADJUSTER	48
SPARK PLUG	18	ROCKER ARM, SHIM AND ROCKER ARM GUIDE	49
Changing	18	Assembly	49
PLATINUM-TIPPED TYPE	18	Installation	52
OIL PAN	20	TURBOCHARGER	58
Components	20	Removal	58
Removal	20	Disassembly	59
Installation	23	Inspection	60
TIMING CHAIN	25	OIL AND WATER TUBES	60
Components	25	ROTOR SHAFT	60
Removal	26	TURBINE WHEEL	61
Inspection	28	COMPRESSOR WHEEL	61
Installation	29	WASTEGATE VALVE	61
OIL SEAL	34	WASTEGATE VALVE ACTUATOR	62
Replacement	34	Assembly	62
VALVE OIL SEAL	34	Installation	62
FRONT OIL SEAL	34	OIL TUBES	63
REAR OIL SEAL	35	WATER TUBES	63
INTAKE MANIFOLD	36	CHARGE AIR COOLER	64
Removal	36	Removal and Installation	64
		Inspection	64
		ENGINE ASSEMBLY	65

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CONTENTS (Cont'd)

Removal and Installation	65	Compression Pressure	82
REMOVAL.....	66	Drive Belt Deflection and Tension	83
INSTALLATION.....	67	Spark Plug	83
CYLINDER BLOCK.....	68	Cylinder Head	83
Components.....	68	Valve	84
Removal and Installation	69	VALVE	84
Disassembly.....	69	VALVE SPRING.....	84
PISTON AND CRANKSHAFT.....	69	HYDRAULIC LASH ADJUSTER (HLA)	84
Inspection.....	70	VALVE GUIDE	85
PISTON AND PISTON PIN CLEARANCE	70	VALVE SHIM CLEARANCE ADJUSTMENT.....	85
PISTON RING SIDE CLEARANCE	70	AVAILABLE SHIM	86
PISTON RING END GAP.....	71	VALVE SEAT	87
CONNECTING ROD BEND AND TORSION	71	VALVE SEAT RESURFACE LIMIT.....	88
CYLINDER BLOCK DISTORTION AND WEAR.....	71	Camshaft and Camshaft Bearing	88
PISTON-TO-BORE CLEARANCE	72	Cylinder Block.....	89
CRANKSHAFT.....	73	Piston, Piston Ring and Piston pin.....	90
BEARING CLEARANCE	73	PISTON	90
CONNECTING ROD BUSHING CLEARANCE (SMALL END)	76	PISTON RING	90
REPLACEMENT OF CONNECTING ROD BUSHING (SMALL END)	76	PISTON PIN	90
REPLACEMENT OF PILOT BUSHING (M/T) OR PILOT CONVERTER (A/T).....	76	Connecting Rod.....	91
FLYWHEEL/DRIVE PLATE RUNOUT	77	Crankshaft.....	92
OIL JET (FOR PISTON)	77	Main Bearing.....	93
Assembly	78	STANDARD.....	93
PISTON	78	UNDERSIZE.....	93
CRANKSHAFT.....	79	Connecting Rod Bearing	93
SERVICE DATA AND SPECIFICATIONS (SDS)	82	STANDARD SIZE	93
General Specifications.....	82	UNDERSIZE	93
		Bearing Clearance	94
		Miscellaneous Components.....	94

PRECAUTIONS

Parts Requiring Angular Tightening

Parts Requiring Angular Tightening

- Use an angle wrench for the final tightening of the following engine parts:
 - a) Cylinder head bolts
 - b) Main bearing cap bolts
 - c) 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.

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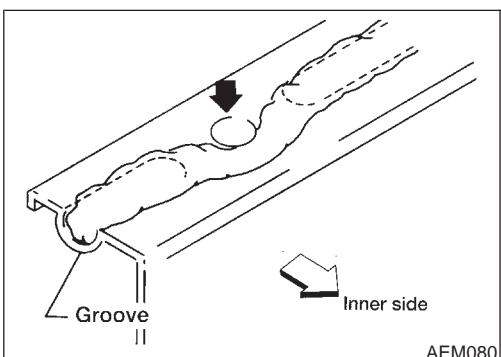
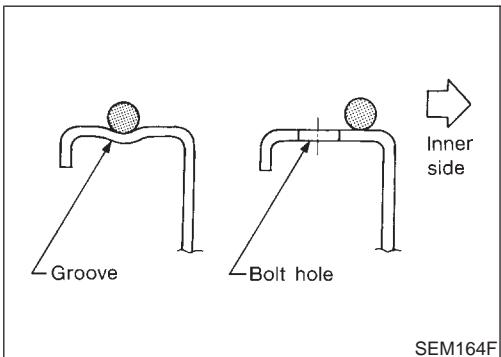
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Liquid Gasket Application Procedure

1. Use a scraper to remove old liquid gasket from mating surfaces and grooves. Also, completely clean any oil from these areas.
2. Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine Liquid Gasket or equivalent.)
- For oil pan, be sure liquid gasket diameter is 4.0 to 5.0 mm (0.157 to 0.197 in).
- For areas except oil pan, be sure liquid gasket diameter is 2.0 to 3.0 mm (0.079 to 0.118 in).
3. Apply liquid gasket around the inner side of bolt holes (unless otherwise specified).
4. Assembly should be done within 5 minutes after coating.
5. Wait at least 30 minutes before refilling engine oil and engine coolant.

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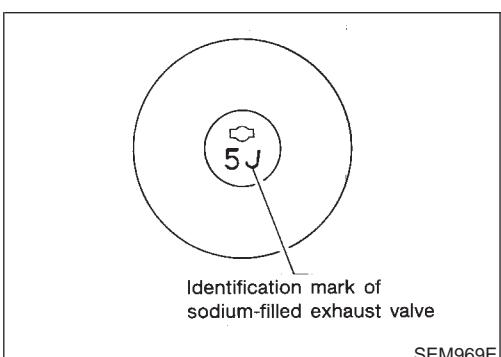
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A sodium-filled exhaust valve is identified on the top of its stem as shown in illustration.

PRECAUTIONS

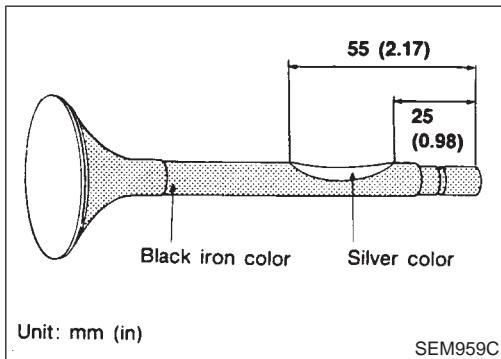
Special Cautions to Ensure the Safe Disposal of Sodium-filled Exhaust Valves (Cont'd)

DEALER DISPOSAL INSTRUCTIONS

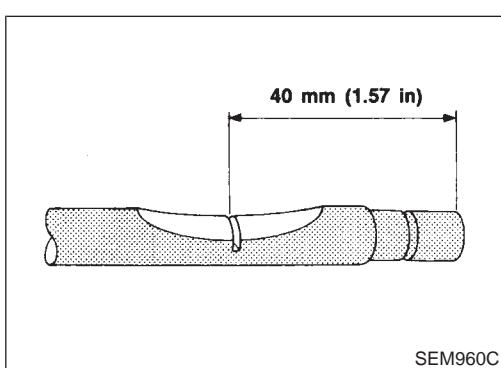
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CAUTION:

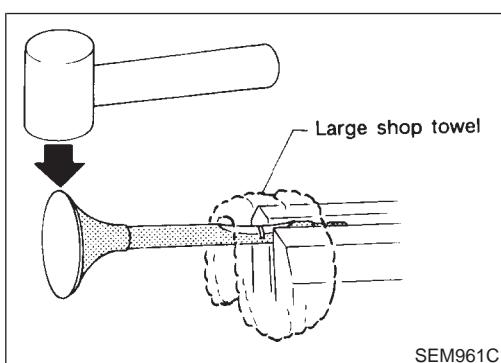
- Use approved shatter-resistant eye protection when performing this procedure.
 - Perform this and all subsequent disposal work procedures in an open room, away from flammable liquids. Keep a fire extinguisher, rated at least 10 ABC, in close proximity to the work area.
 - Be sure to wear rubber gloves when performing the following operations.
1. Clamp valve stem in a vice.
 2. The valve has a specially-hardened surface. To cut through it, first remove a half-round section, approximately 30 mm (1.18 in) long. Use an air-powered grinder until the black iron color is removed and the silver-colored metal appears.



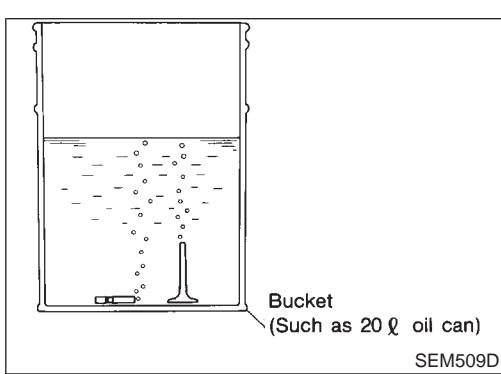
3. Use a hacksaw to cut through approximately half the diameter of the valve stem. Make the serration at a point 40 mm (1.57 in) from the end of the stem.



4. Cover the serrated end of the valve with a large shop towel. Strike the valve face end with a hammer, separating it into two pieces.



5. Fill a bucket (such as a 20 ℥ oil can) with at least 10 ℥ (2-5/8 US gal, 2-1/4 Imp gal) of water. Using a pair of large tweezers, carefully place the already-cut (serrated) valves into the water one at a time. Quickly move away at least 2.7 m (9 ft). Place the valves in a standing position as shown in the figure. This allows complete reaction of the sodium with the water. The major portion of the resultant chemical reaction lasts 1 to 2 minutes. After the bubbling action has subsided, additional valves can be placed into the water. Wait until each subsequent chemical reaction subsides before placing additional valves into the water. However, no more than 8 valves should be placed in the same 10 ℥ (2-5/8 US gal, 2-1/4 Imp gal).



PRECAUTIONS

Special Cautions to Ensure the Safe Disposal of Sodium-filled Exhaust Valves (Cont'd)

amount of water. The complete chemical reaction may take as long as 4 to 5 hours. Remove the valves using a set of large tweezers after the chemical reaction has stopped. Afterwards, the valves can be mixed with ordinary scrap metal.

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CAUTION:

- Make sure the resultant (high alkalinity) waste water does not contact your skin. If the waste water does contact you, wash the contacted area immediately with large quantities of water.
- Check country and local regulations concerning any chemical treatment or waste water discharge permits. These may be required to dispose of the resultant (high alkalinity) waste water.

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PREPARATION

Special Service Tools

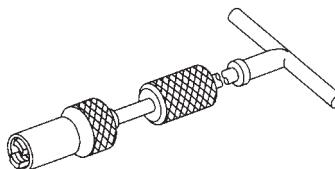
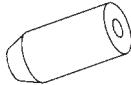
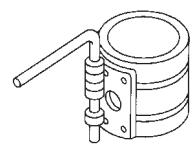
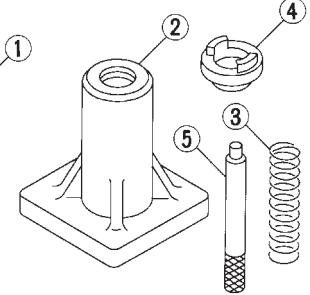
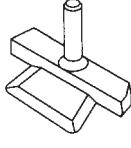
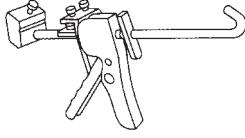
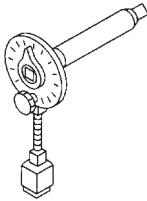
Special Service Tools

NMEM0003

Tool number Tool name	Description
ST0501S000 Engine stand assembly 1 ST05011000 Engine stand 2 ST05012000 Base	<p>Disassembling and assembling</p>
KV10106500 Engine stand shaft	
KV10115300 Engine sub-attachment	
ST10120000 Cylinder head bolt wrench	<p>Loosening and tightening cylinder head bolt a: 13 (0.51) dia. b: 12 (0.47) c: 10 (0.39) Unit: mm (in)</p>
KV10116200 Valve spring compressor 1 KV10115900 Attachment	<p>Disassembling valve mechanism</p>
KV10115600 Valve oil seal drift	<p>Installing valve oil seal Intake (Side A) a: 20 (0.79) dia. b: 13 (0.51) dia. c: 10.3 (0.406) dia. d: 8 (0.31) dia. e: 10.7 (0.421) dia. f: 5 (0.20) dia. Exhaust (Side B) a: 20 (0.79) dia. b: 14.2 (0.559) dia. c: 11 (0.43) dia. d: 8 (0.31) dia. e: 10.7 (0.421) dia. f: 5 (0.20) dia. Unit: mm (in)</p>

PREPARATION

Special Service Tools (Cont'd)

Tool number Tool name	Description	
KV10107902 Valve oil seal puller		Displacement valve lip seal
NT011		
KV10115700 Dial gauge stand		Adjusting shims
NT012		
EM03470000 Piston ring compressor		Installing piston assembly into cylinder bore
NT044		
KV10107400 Piston pin press stand 1 KV10107310 Center shaft 2 ST13040020 Stand 3 ST13040030 Spring 4 KV10107320 Cap 5 ST13040050 Drift		Disassembling and assembling piston pin
NT013		
KV10111100 Seal cutter		Removing oil pan
NT046		
WS39930000 Tube presser		Pressing the tube of liquid gasket
NT052		
KV10112100 Angle wrench		Tightening bolts for bearing cap, cylinder head, etc.
NT014		

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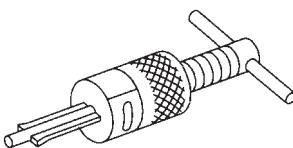
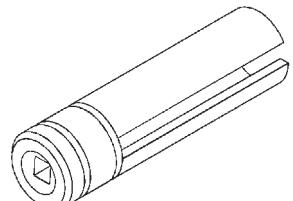
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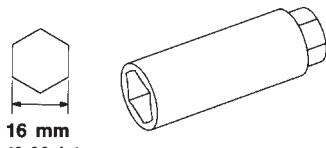
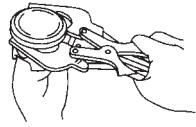
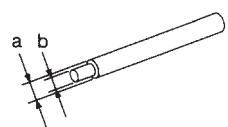
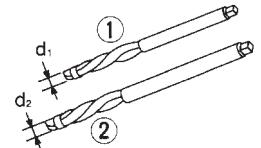
PREPARATION

Special Service Tools (Cont'd)

Tool number Tool name	Description
ST16610001 Pilot bushing puller	 NT045
KV10117100 Front (heated) oxygen sensor wrench	 NT379

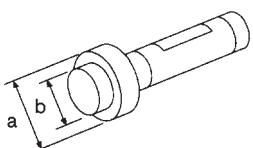
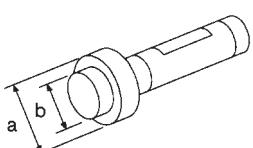
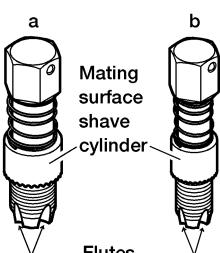
Commercial Service Tools

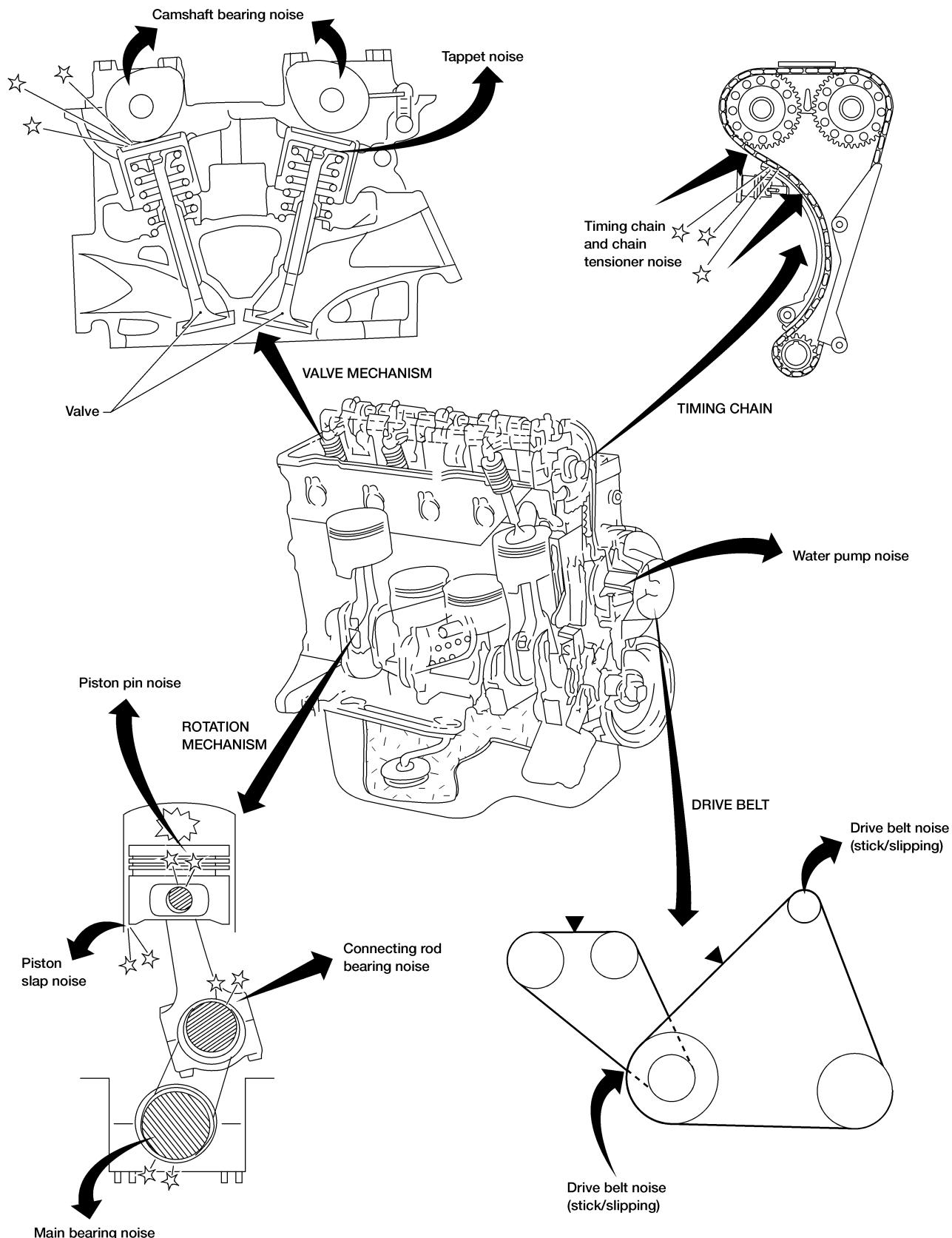
NMEM0004

Tool name	Description
Spark plug wrench	 NT047
Valve seat cutter set	 NT048
Piston ring expander	 NT030
Valve guide drift	 NT015
Valve guide reamer	 NT016

PREPARATION

Commercial Service Tools (Cont'd)

Tool name	Description	
Front oil seal drift	 NT049	Installing front oil seal a: 75 mm (2.95 in) dia. b: 45 mm (1.77 in) dia.
Rear oil seal drift	 NT049	Installing rear oil seal a: 110 mm (4.33 in) dia. b: 80 mm (3.15 in) dia.
Oxygen sensor thread cleaner	 AEM488	Reconditioning the exhaust system threads before installing a new oxygen sensor (Use with anti-seize lubricant shown below.) a: 18 mm dia. with a pitch of 1.5 mm for zirconia oxygen sensor b: 12 mm dia. with a pitch of 1.25 mm for titania oxygen sensor
Anti-seize lubricant (Permatex 133AR or equivalent meeting MIL specification MIL-A-907)	 AEM489	Lubricating oxygen sensor thread cleaning tool when reconditioning exhaust system threads



NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

Commercial Service Tools

Use the table below to help you find the cause of the symptom.

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

If necessary, repair or replace these parts.

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NVH Troubleshooting — Engine Noise

NMEM0005S01

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	Hydraulic lash adjuster	EM-48
	Rattle	C	A	—	A	B	C	Camshaft bearing noise	Camshaft journal clearance Camshaft runout	EM-43, 44
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-70, 76
	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-72, 70
	Knock	A	B	C	B	B	B	Connecting rod bearing noise	Connecting rod bushing clearance (Small end) Connecting rod bearing clearance (Big end)	EM-75, 76
	Knock	A	B	—	A	B	C	Main bearing noise	Main bearing oil clearance Crankshaft runout	EM-73, 73
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	EM-28
Front of engine	Squeaking or fizzing	A	B	—	B	—	C	Other drive belts (Sticking or slipping)	Drive belt deflection	EM-16, "Checking Drive Belts"
	Creaking	A	B	A	B	A	B	Other drive belts (Slipping)	Idler pulley bearing operation	HA
	Squall Creak	A	B	—	B	A	B	Water pump noise	Water pump operation	LC-12, "Water Pump Inspection"

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

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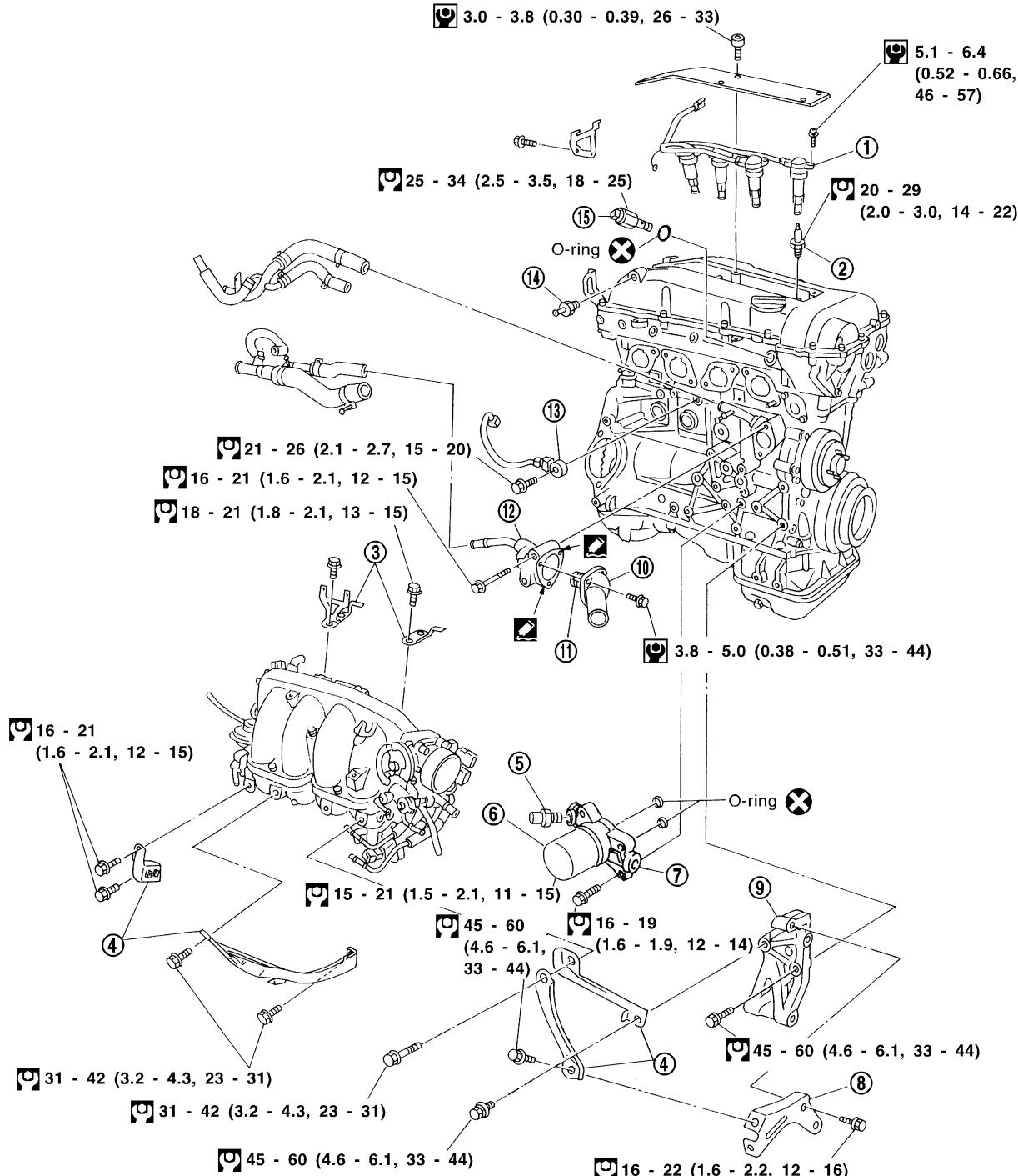
OUTER COMPONENT PARTS

Removal and Installation

Removal and Installation

NMEM0006

SEC. 111•118•140•150



: N·m (kg-m, ft-lb)

: N·m (kg-m, in-lb)

: Apply liquid gasket.

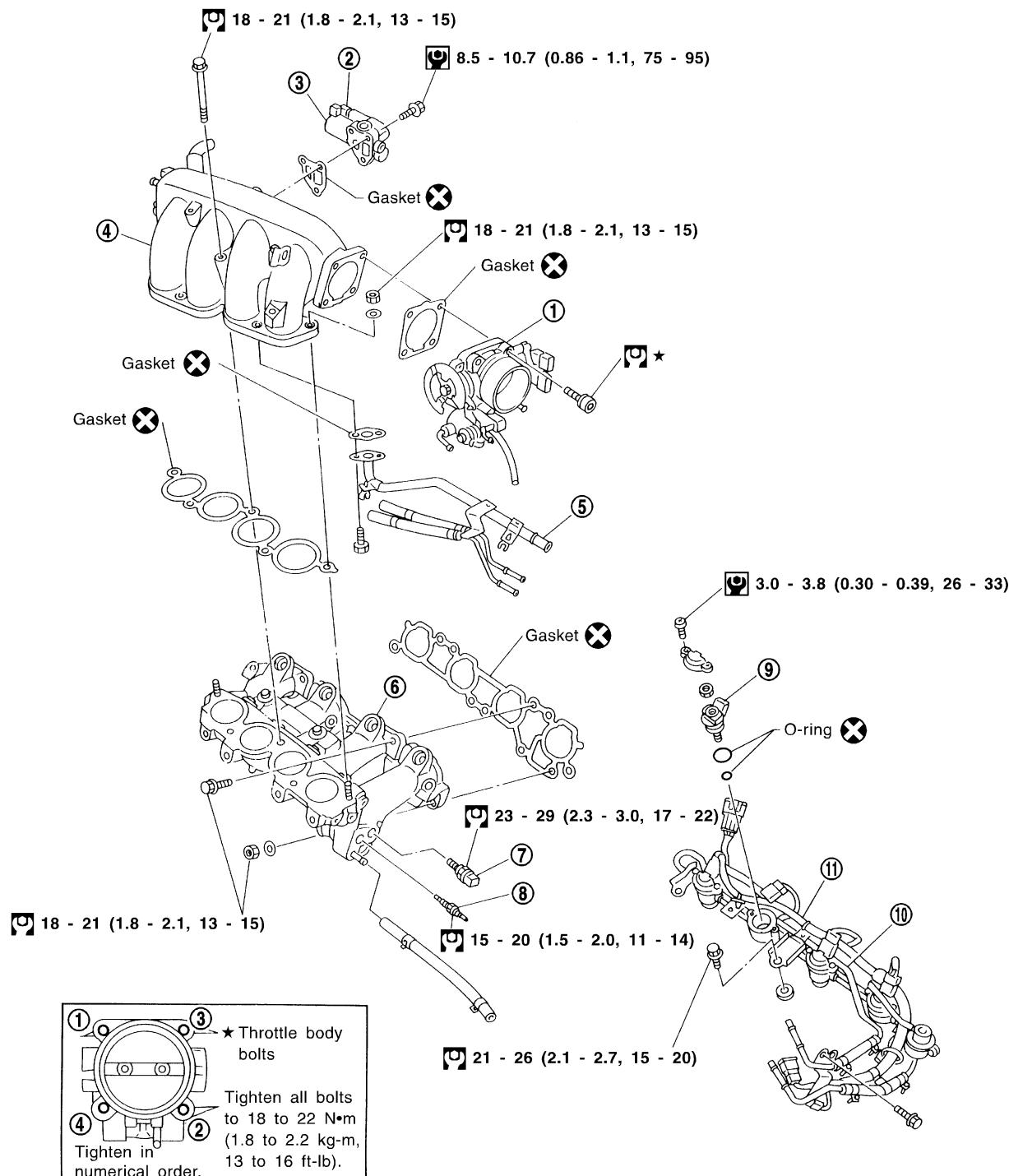
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1. Ignition coil
2. Spark plug
3. Intake manifold collector support
4. Intake manifold support
5. Oil pressure switch
6. Oil filter
7. Oil filter bracket
8. Alternator adjusting bar
9. Alternator bracket
10. Water outlet
11. Thermostat
12. Thermostat housing
13. Knock sensor
14. Blow-by control valve
15. VTC solenoid valve

OUTER COMPONENT PARTS

Removal and Installation (Cont'd)

SEC. 140•148•163•164•223



● : N·m (kg-m, ft-lb)

● : N·m (kg-m, in-lb)

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|------------------------------|--------------------------------------|------------------------|
| 1. Throttle body | 5. Air pipe | 8. Thermal transmitter |
| 2. IACV-FICD valve | 6. Intake manifold | 9. Injector |
| 3. IACV-AAC valve | 7. Engine coolant temperature sensor | 10. Fuel tube assembly |
| 4. Intake manifold collector | | 11. Injector harness |

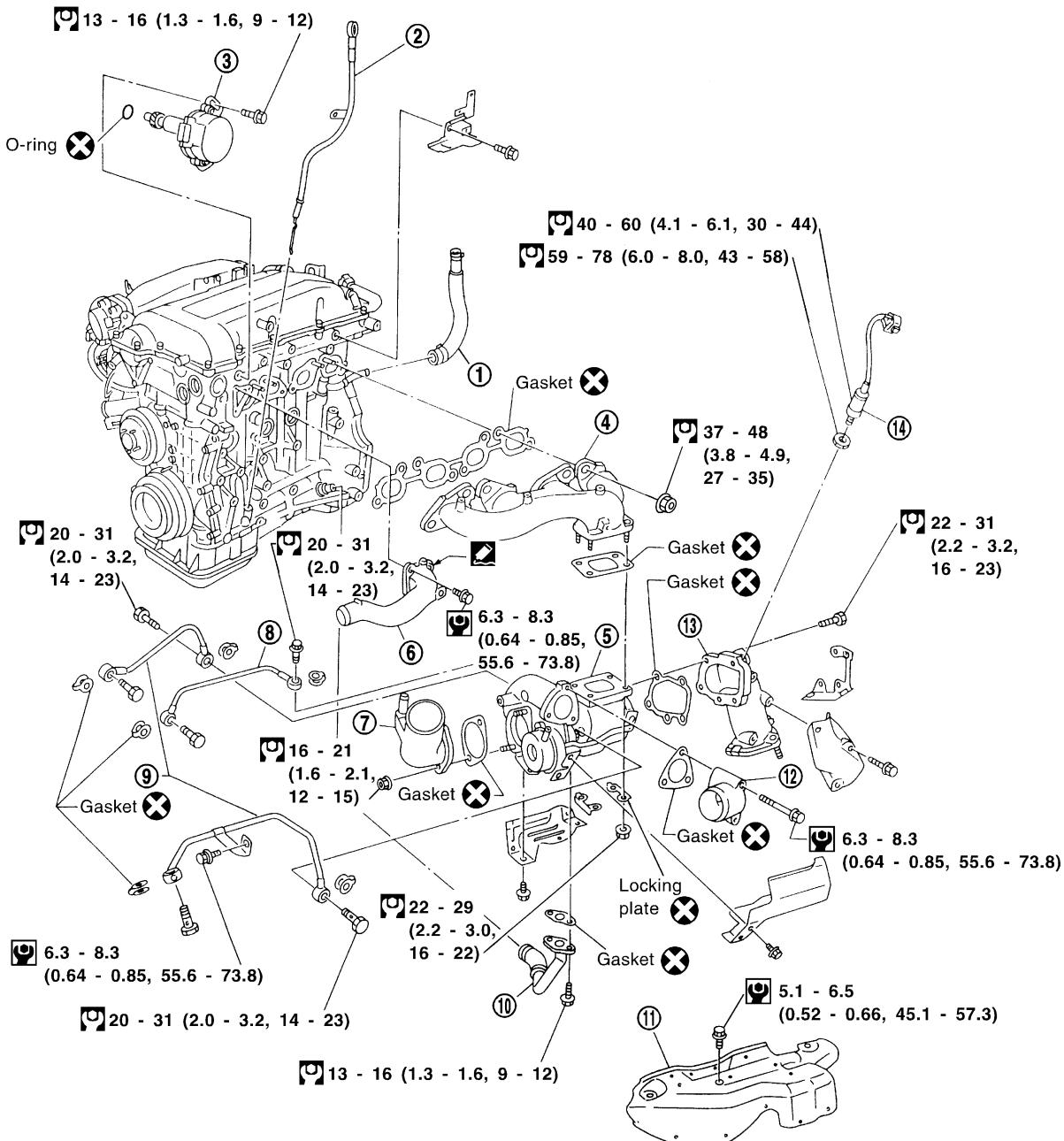
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OUTER COMPONENT PARTS

Removal and Installation (Cont'd)

SEC. 140•144



Ⓐ : N·m (kg-m, ft-lb)

Ⓑ : N·m (kg-m, in-lb)

Ⓒ : Apply liquid gasket.

SEM616G

1. Blow-by hose
2. Oil level gauge
3. Camshaft position sensor
4. Exhaust manifold
5. Turbocharger
6. Water outlet
7. Air inlet
8. Oil tube
9. Water tube
10. Oil return pipe
11. Exhaust manifold cover
12. Air outlet
13. Exhaust manifold outlet
14. Heated oxygen sensor

MEASUREMENT OF COMPRESSION PRESSURE

1. Warm up engine.
2. Turn ignition switch OFF.
3. Release fuel pressure.
Refer to EC-27, "Fuel Pressure Release".
4. Remove all spark plugs.
5. Disconnect distributor coil connector.

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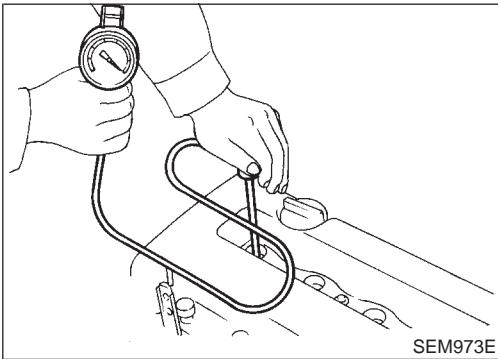
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6. Attach a compression tester to No. 1 cylinder.
7. Depress accelerator pedal fully to keep throttle valve wide open.
8. Crank engine and record highest gauge indication.
9. Repeat the measurement on each cylinder.
- Always use a fully-charged battery to obtain specified engine speed.

Compression pressure: kPa (kg/cm², psi)/rpm

Standard

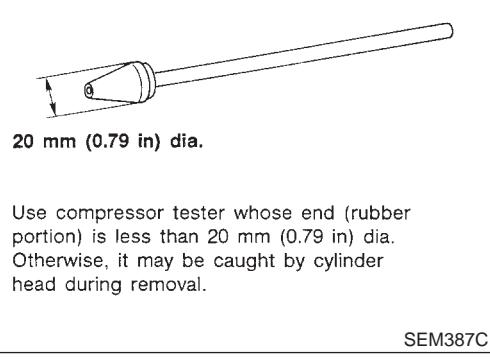
1,079 (11.0, 156)/300

Minimum

883 (9.0, 128)/300

Difference limit between cylinders

98 (1.0, 14)/300



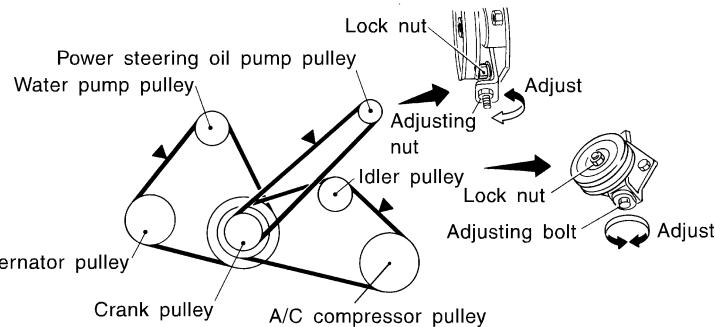
10. If compression in one or more cylinders is low:
 - a. Pour a small amount of engine oil into cylinders through spark plug holes.
 - b. Retest compression.
- If adding oil helps compression, piston rings may be worn or damaged. If so, replace piston rings after checking piston.
- If pressure stays low, a valve may be sticking or seating improperly. Inspect and repair valve and valve seat. Refer to SDS, EM-87. If valve or valve seat is damaged excessively, replace them.
- If compression stays low in two cylinders that are next to each other:
 - a) The cylinder head gasket may be leaking, or
 - b) Both cylinders may have valve component damage. Inspect and repair as necessary.

DRIVE BELTS

Checking

Checking

NMEM0043



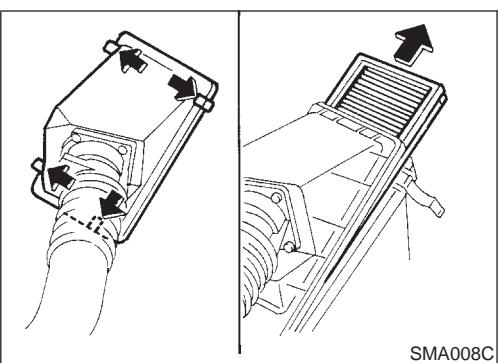
SEM617G

1. Inspect belt for cracks, fraying, wear and oil. If necessary, replace.
2. Inspect drive belt deflection or tension at a point on the belt midway between pulleys.
- **Inspect drive belt deflection or tension when engine is cold. Adjust if belt deflection exceeds the limit or if belt tension is not within specifications.**
- **Belt tension can also be checked at other points on the belt.**

DRIVE BELT DEFLECTION AND TENSION

		Deflection adjustment Unit: mm (in)		Tension adjustment *1 Unit: N (kg, lb)		
		Used belt		New belt	Used belt	
		Limit	After adjust- ment		Limit	After adjust- ment
Compressor	With air conditioner compressor	7 - 8 (0.28 - 0.31)	5 - 6 (0.20 - 0.24)	4 - 5 (0.16 - 0.20)	289.3 (29.5, 65)	556.1 - 645.3 (56.7 - 65.8, 125 - 145)
Alternator		11 - 13 (0.43 - 0.51)	7 - 8 (0.28 - 0.31)	6 - 7 (0.24 - 0.28)	333.4 (34.0, 75)	645.3 - 733.6 (65.8 - 74.8, 145 - 165)
Power steering oil pump		15 - 17 (0.59 - 0.67)	11 - 12 (0.43 - 0.47)	9 - 10 (0.35 - 0.39)	222.6 (22.7, 50)	377.6 - 466.8 (38.5 - 47.6, 85 - 105)
Applied pushing force		98 N (10 kg, 22 lb)			—	

*1: If the belt tension gauge cannot be installed at check points shown, check belt tension at a different location on the belt.



Changing

VISCOUS PAPER TYPE

NMEM0044

NMEM0044S01

GI

- The viscous paper type filter does not need cleaning.
- Remove air intake to replace air cleaner filter.

MA

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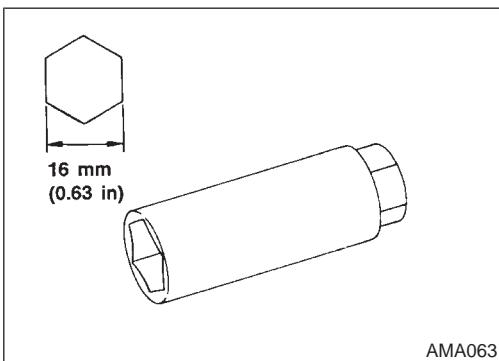
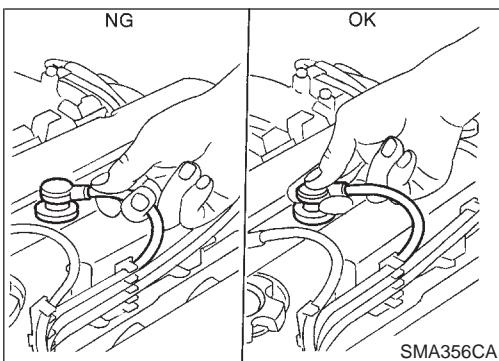
SC

EL

IDX

SPARK PLUG

Changing



Changing

PLATINUM-TIPPED TYPE

NMEM0045

1. Disconnect ignition wires from spark plugs at boot. Do not pull on the wire.

2. Remove spark plugs with spark plug socket.

Spark plug:

Standard type	PFR6B-9
Hot type	PFR5B-9
Cold type	PFR7B-9

Gap (Nominal): 0.9 mm (0.035 in)

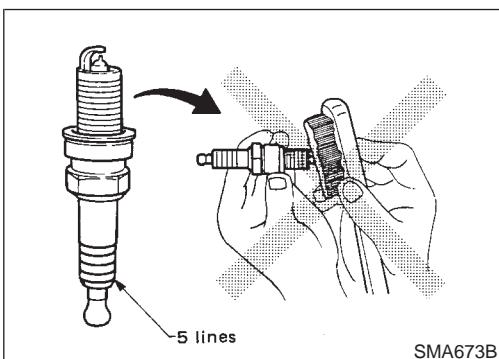
Use standard type spark plug for normal condition.

The hot type spark plug is suitable when fouling occurs with the standard type spark plug under conditions such as:

- frequent engine starts
- low ambient temperatures

The cold type spark plug is suitable when spark knock occurs with the standard type spark plug under conditions such as:

- extended highway driving
- frequent high engine revolution



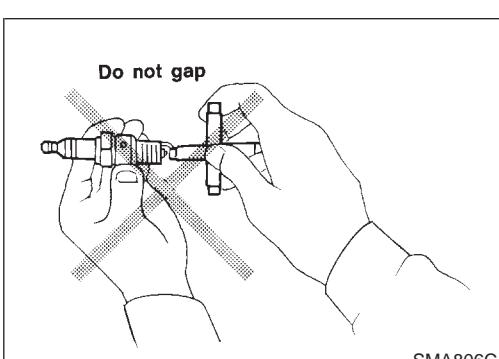
- Do not use a wire brush for cleaning.
- If plug tip is covered with carbon, spark plug cleaner may be used.

Cleaner air pressure:

Less than 588 kPa (6 kg/cm², 85 psi)

Cleaning time:

Less than 20 seconds



- Checking and adjusting plug gap is not required between change intervals.

SPARK PLUG

Changing (Cont'd)

-
3. Install spark plugs. Reconnect ignition wires according to numbers indicated on them.

Spark plug:

 : 20 - 29 N·m (2.0 - 3.0 kg-m, 14 - 22 ft-lb)

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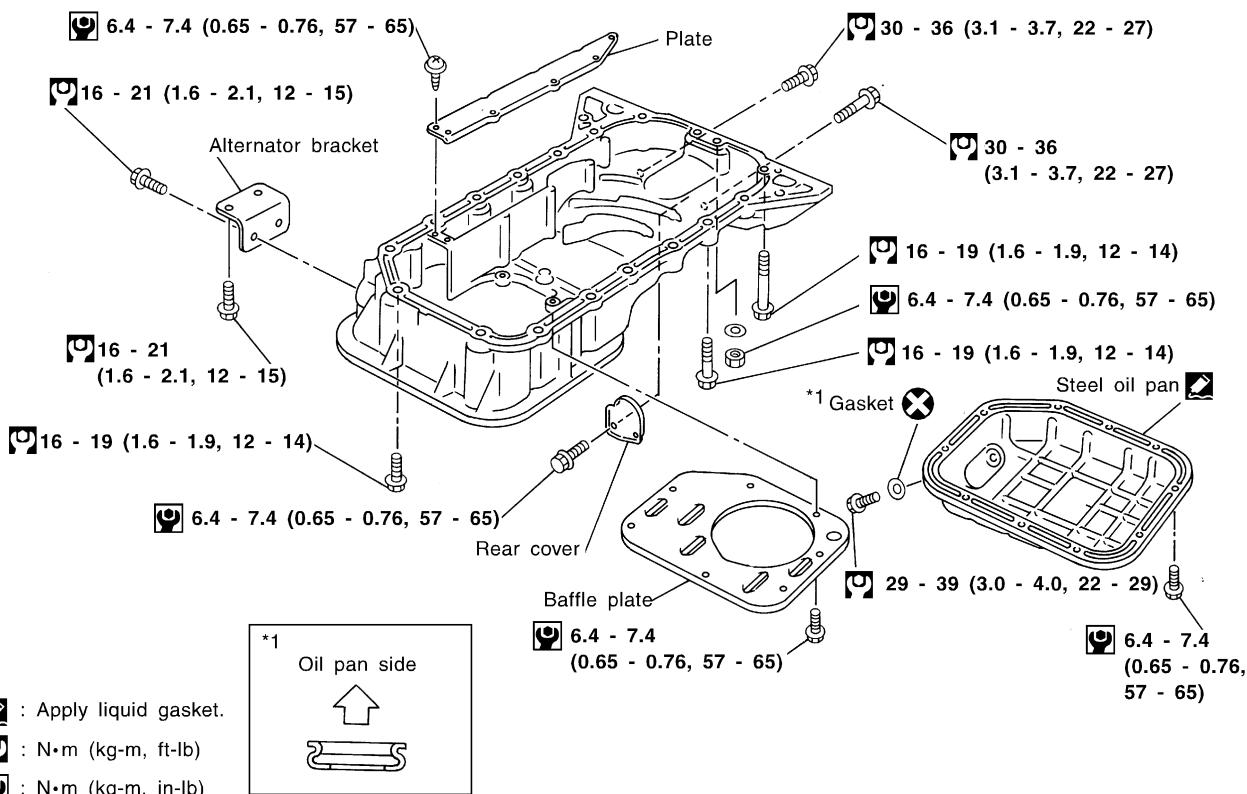
IDX

OIL PAN

Components

NMEM0008

SEC. 110



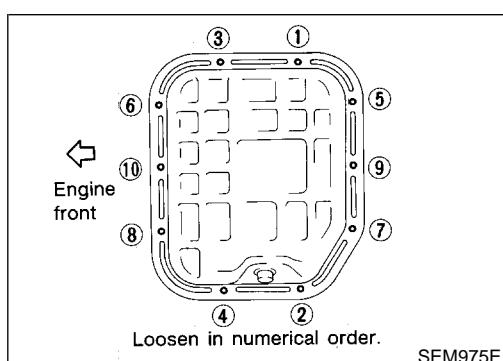
SEM618G

Removal

NMEM0009

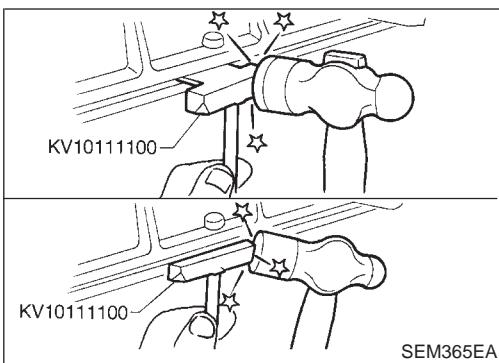
1. Remove engine under cover.
2. Drain engine oil.

3. Remove steel oil pan bolts in numerical order.

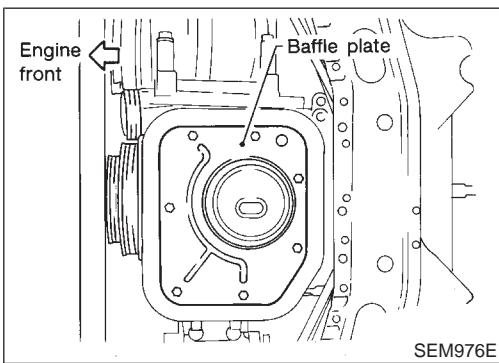


OIL PAN

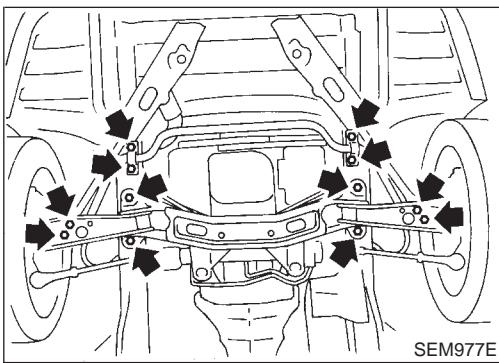
Removal (Cont'd)



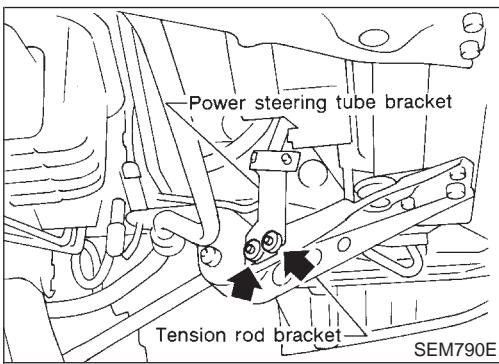
4. Remove steel oil pan.
- a. Insert Tool between aluminum oil pan and steel oil pan.
- **Be careful not to damage aluminum mating surface.**
- **Do not insert screwdriver, or oil pan flange will be damaged.**
- b. Slide Tool by tapping on the side of the Tool with a hammer.
- c. Remove steel oil pan.



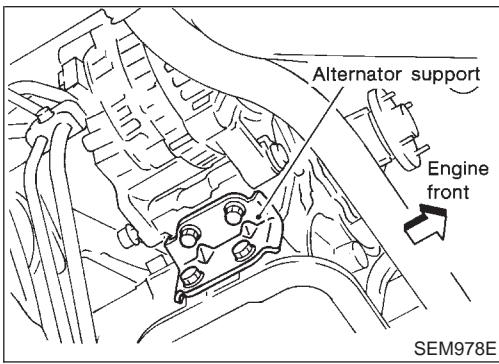
- d. Remove baffle plate.



5. Install engine slingers to cylinder head. Refer to "ENGINE ASSEMBLY" (EM-65).
6. Set a suitable hoist on engine slinger and hold the engine.
7. Remove the following parts.
- Tension rod bolts at transverse links
- Front stabilizer bar securing bolts and nuts from side member.
- Both left and right side engine mounting bolts. Refer to "ENGINE ASSEMBLY" (EM-65) and "Front Suspension" (SU-9).
8. Disconnect steering shaft lower joint.



9. Remove power steering tube bracket securing bolts at left tension rod bracket.
10. Remove front suspension member securing bolts while supporting with a jack.
11. Lower front suspension member by around 60 mm (2.36 in).



12. Remove alternator support.

GI

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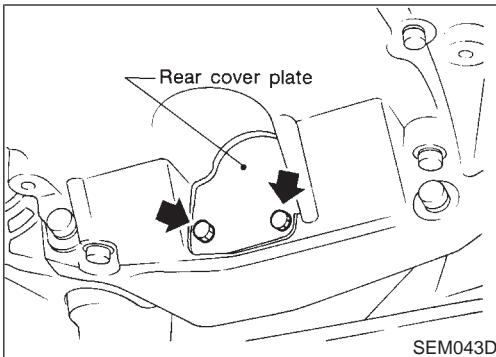
SC

EL

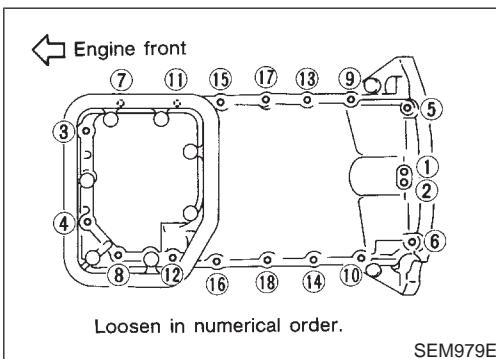
IDX

OIL PAN

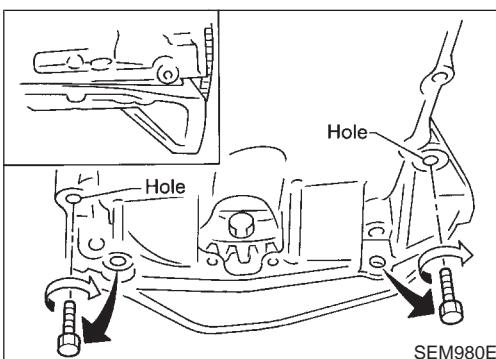
Removal (Cont'd)



13. Remove rear cover plate.

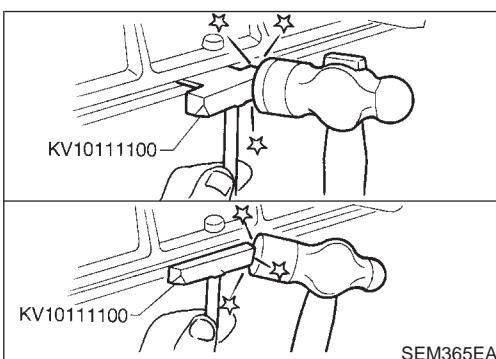


14. Remove aluminum oil pan bolts in numerical order.



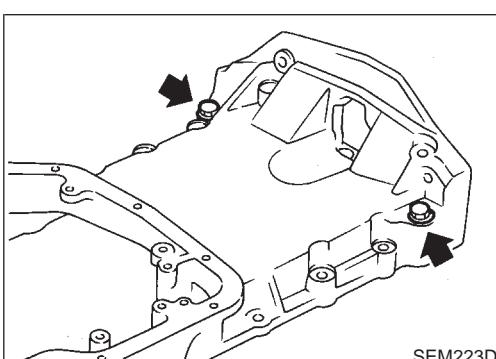
15. Remove four oil pan-to-transmission bolts.

16. Remove two engine-to-transmission bolts and install them into open bolt holes shown. Tighten the two bolts to release aluminum oil pan from cylinder block.



17. Remove aluminum oil pan.

- a. Insert Tool between cylinder block and aluminum oil pan.
 - Be careful not to damage aluminum mating surface.
 - Do not insert screwdriver, or oil pan flange will be deformed.
- b. Slide Tool by tapping on the side of the Tool with a hammer.
- c. Remove aluminum oil pan.



18. Remove two oil pan-to-transmission bolts previously installed in aluminum oil pan.

NMEM0010

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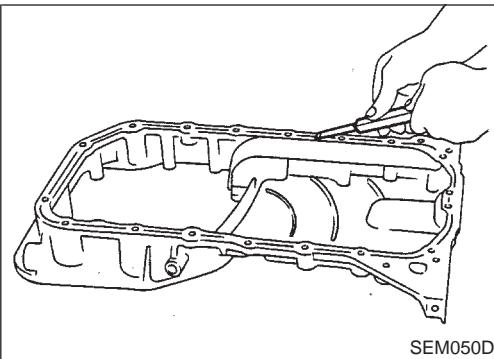
HA

SC

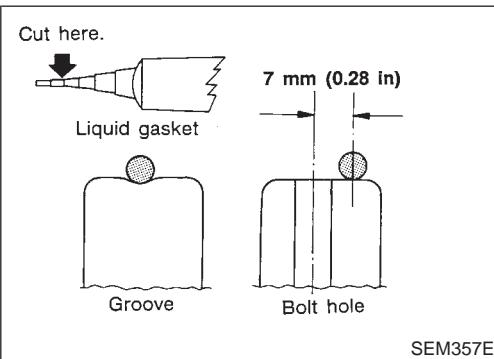
EL

IDX

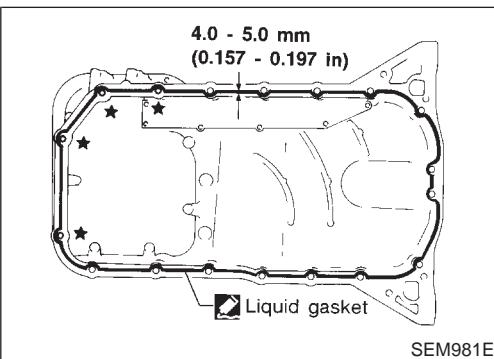
Installation



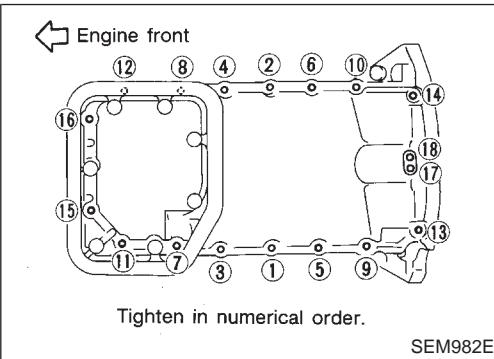
1. Install aluminum oil pan.
- a. Use a scraper to remove old liquid gasket from mating surfaces.
- **Also remove old liquid gasket from mating surfaces of cylinder block and front cover.**



- b. Apply a continuous bead of liquid gasket to mating surface of aluminum oil pan.
- **Use Genuine Liquid Gasket or equivalent.**
- **Apply to groove on mating surface.**
- **Allow 7 mm (0.28 in) clearance around bolt holes.**



- For areas marked with “★”, apply liquid gasket around the outer side of the bolt hole as shown.
- Be sure liquid gasket diameter is 4.0 to 5.0 mm (0.157 to 0.197 in).
- Attaching should be done within 5 minutes after coating.



- c. Tighten nuts and bolts in numerical order.

Bolts 1 - 16:

: 16 - 19 N·m (1.6 - 1.9 kg-m, 12 - 14 ft-lb)

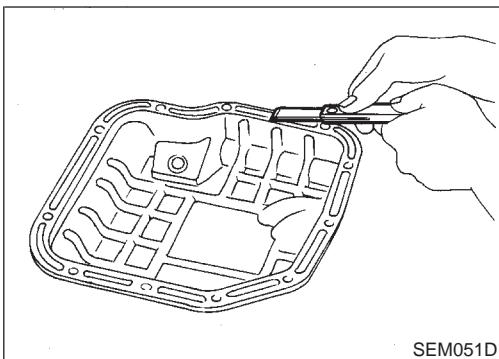
Bolts 17, 18:

: 6.4 - 7.5 N·m (0.65 - 0.76 kg-m, 56.4 - 66.0 in-lb)

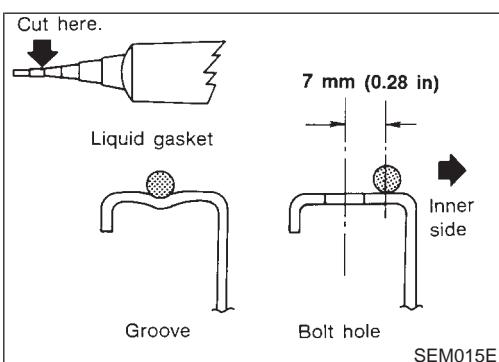
2. Install the four oil pan-to-transmission bolts.
3. Install rear cover plate.
4. Install alternator support.
5. Tighten front suspension member securing bolts.
6. Install all removed parts after removing steel oil pan.

OIL PAN

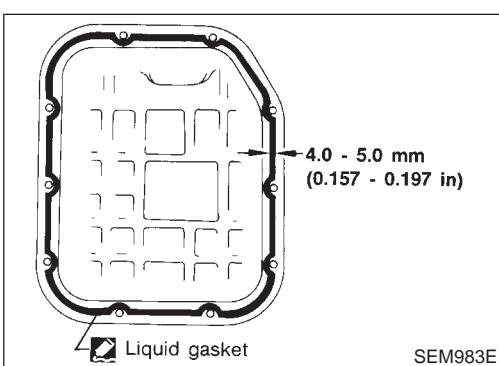
Installation (Cont'd)



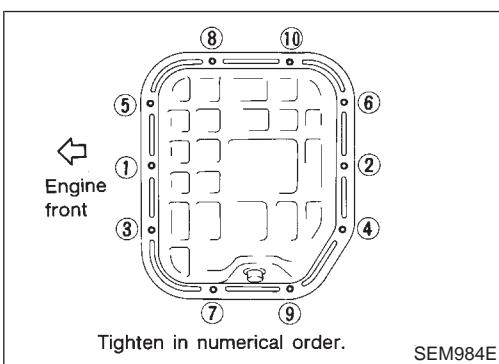
7. Install steel oil pan.
- a. Use a scraper to remove old liquid gasket from mating surface of steel oil pan.
- **Also remove old liquid gasket from mating surface of aluminum oil pan.**



- b. Apply a continuous bead of liquid gasket to mating surface of steel oil pan.
- **Use Genuine Liquid Gasket or equivalent.**
- **Apply to groove on mating surface.**
- **Allow 7 mm (0.28 in) clearance around bolt hole.**



- **Be sure liquid gasket diameter is 4.0 to 5.0 mm (0.157 to 0.197 in).**
- **Attaching should be done within 5 minutes after coating.**



- c. Tighten bolts in numerical order as shown.
- **Wait at least 30 minutes before refilling engine oil.**

TIMING CHAIN

Components

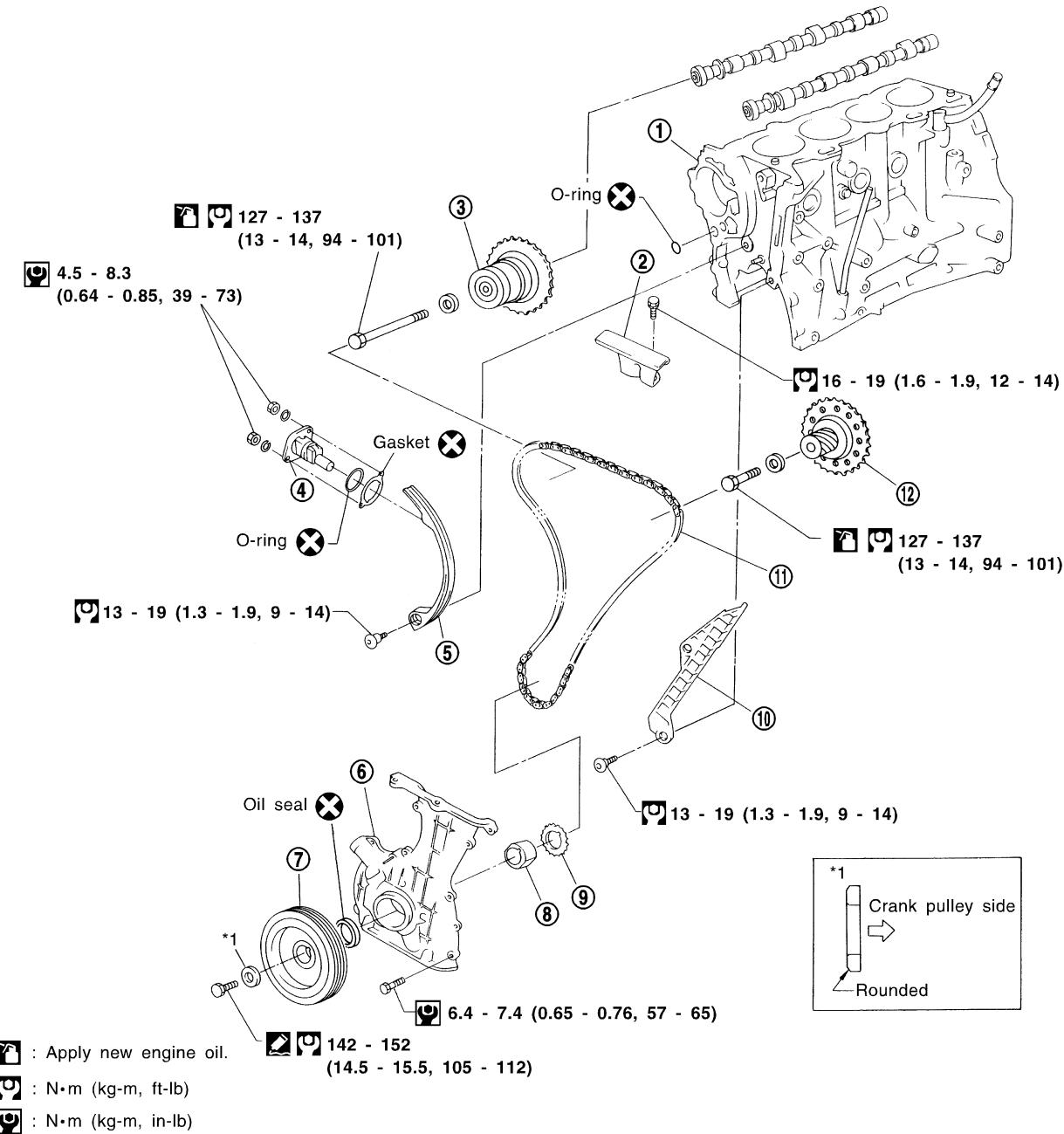
Components

NMME0011

CAUTION:

- After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.
- When installing rocker arms, camshafts, chain tensioner, oil seals, or other sliding parts, lubricate contacting surfaces with new engine oil.
- Apply new engine oil to bolt threads and seat surfaces when installing, camshaft sprockets, crankshaft pulley, and camshaft brackets.

SEC. 120•130•135



: Apply new engine oil.

: N•m (kg-m, ft-lb)

: N•m (kg-m, in-lb)

SEM619G

- Cylinder block
- Chain guide
- RH camshaft sprocket
- Chain tensioner
- Chain guide
- Front cover
- Crankshaft pulley
- Oil pump drive spacer

- Chain guide
- Front cover
- Crankshaft pulley
- Oil pump drive spacer

- Crankshaft sprocket
- Chain guide
- Timing chain
- LH camshaft sprocket

GI

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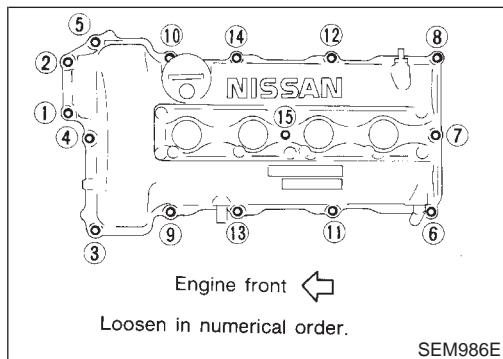
TIMING CHAIN

Removal

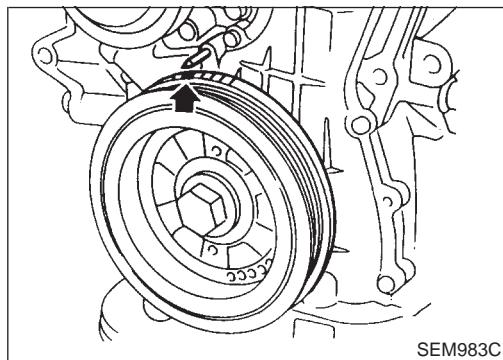
Removal

NMME0012

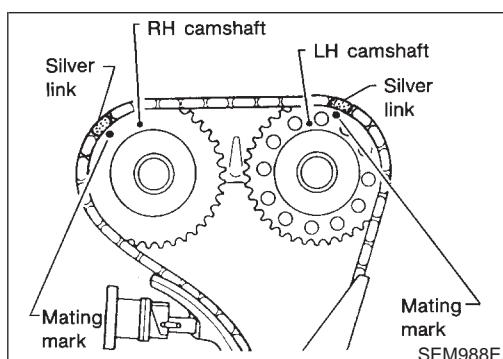
1. Remove engine under covers.
2. Drain coolant.
3. Remove radiator shroud and cooling fan.
4. Remove air duct to intake manifold and air recirculation duct.
5. Remove drive belts and water pump pulley.
6. Remove alternator.
7. Remove power steering oil pump.
8. Remove the following parts: vacuum hoses, wires, harness, connectors and so on.
9. Remove ignition coils.



10. Remove rocker cover bolts in numerical order.
11. Remove rocker cover.



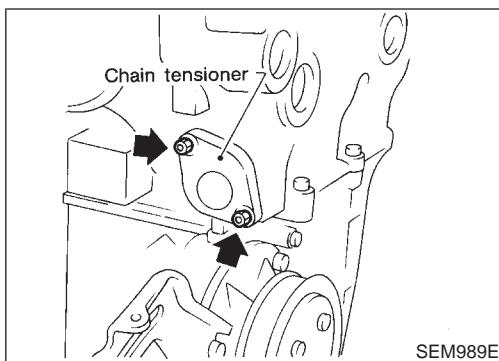
12. Set No. 1 piston at TDC of its compression stroke.



- Rotate crankshaft until mating mark on camshaft sprocket is set at position indicated in figure.

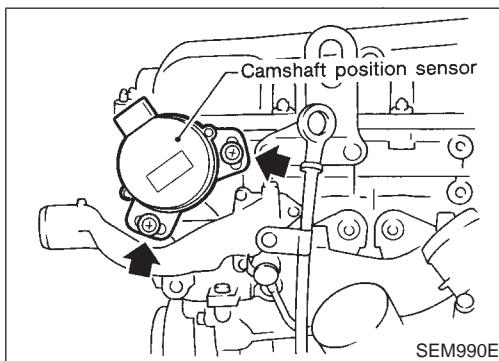
TIMING CHAIN

Removal (Cont'd)



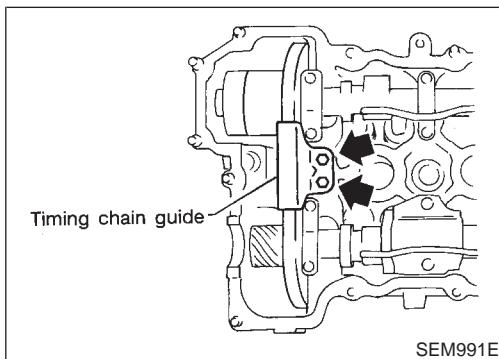
13. Remove chain tensioner.

GI



14. Remove camshaft position sensor.

EC

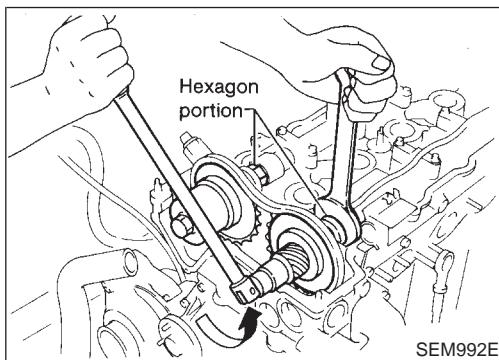


15. Remove timing chain guide.

AT

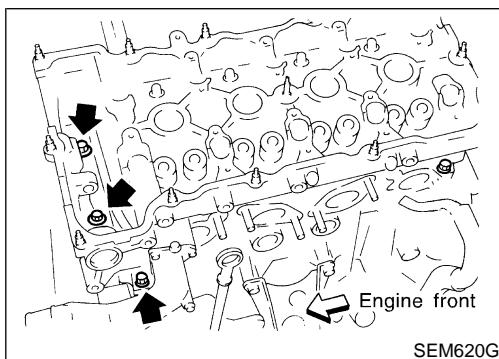
16. Remove cylinder head front cover.

PD



17. Remove camshaft sprockets.

BR



18. Remove cylinder head outside bolts and inside sub bolts.

HA

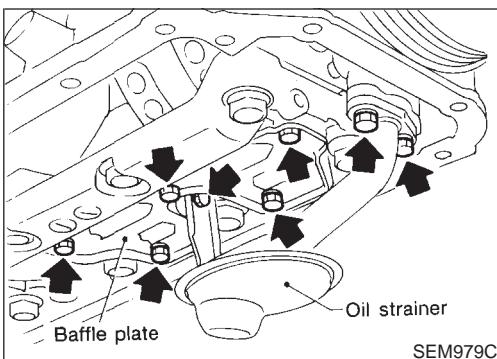
SC

EL

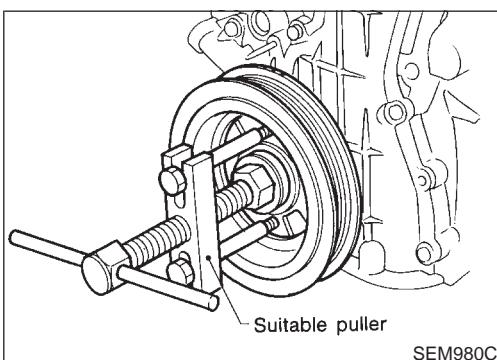
IDX

TIMING CHAIN

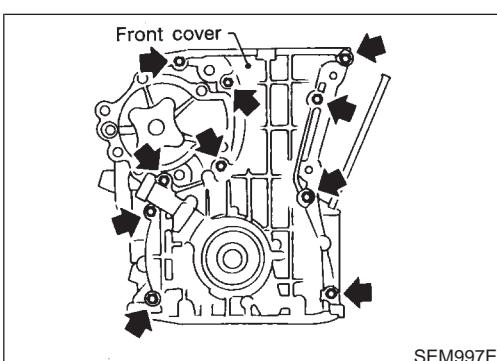
Removal (Cont'd)



19. Remove oil pans.
Refer to "Removal" in "OIL PAN" (EM-20).
20. Remove oil strainer and baffle plate.



21. Remove crankshaft pulley.

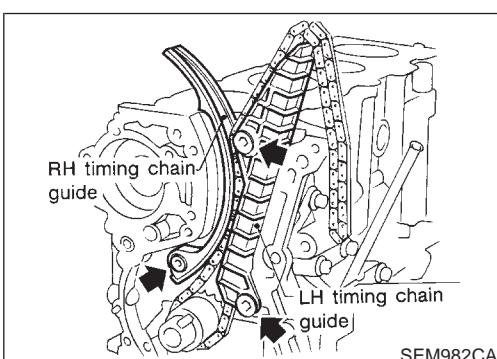


22. Remove front cover.

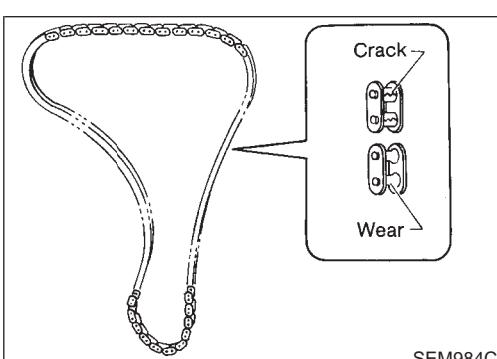
CAUTION:
Be careful not to tear or damage the cylinder head gasket.

23. Remove oil pump drive spacer.

CAUTION:
Be careful not to damage oil pump drive spacer and oil seal.



24. Remove timing chain guides and timing chain.



Inspection

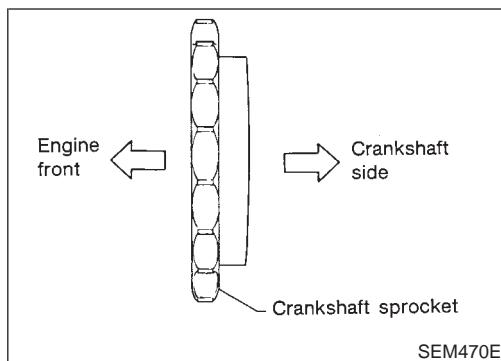
Check for cracks and excessive wear at roller links. Replace chain if necessary.

NMEM0013

TIMING CHAIN

Installation

NMEM0014



Installation

1. Install crankshaft sprocket on crankshaft.
- **Make sure that mating marks on crankshaft sprocket face front of engine.**

GI

MA

EM

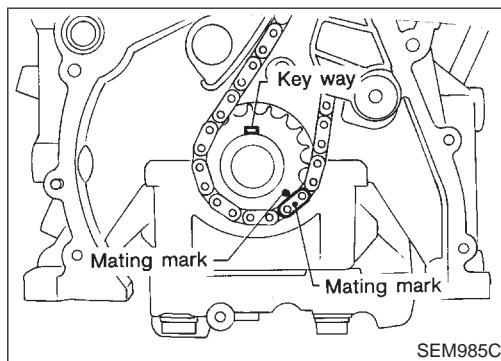
LC

EC

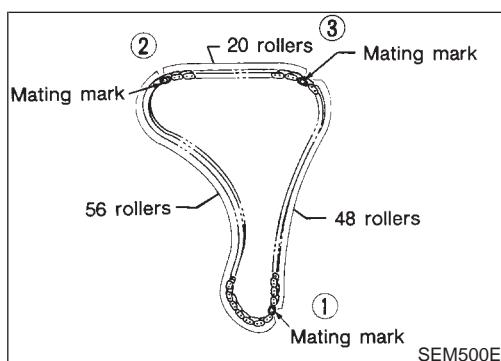
FE

CL

MT



2. Position crankshaft so that No. 1 piston is set at TDC and key way is at 12 o'clock. Fit timing chain on crankshaft sprocket, aligning the mating marks.



- Mating mark color on timing chain.

1: Gold

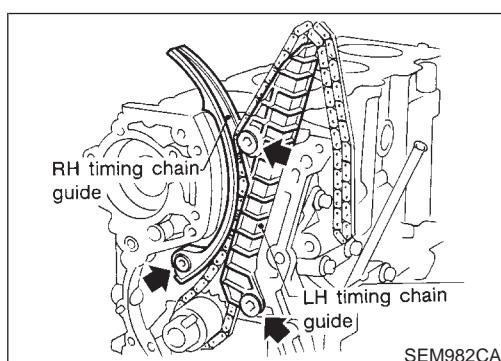
2, 3: Silver

AT

PD

AX

SU



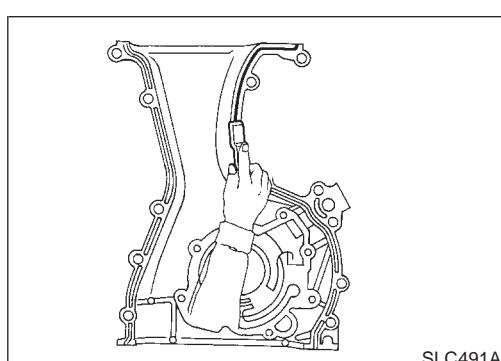
3. Install timing chain and timing chain guides.

BR

ST

RS

BT



4. Remove all traces of liquid gasket from mating surface using a scraper.
- **Also remove old liquid gasket from mating surface of cylinder block.**
- **Replace front oil seal with new one. Install front oil seal in the right direction. Refer to "OIL SEAL", EM-34.**

HA

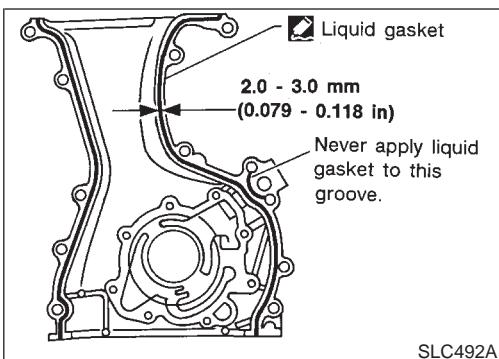
SC

EL

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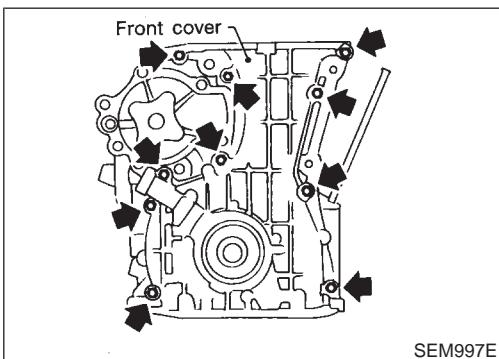
TIMING CHAIN

Installation (Cont'd)



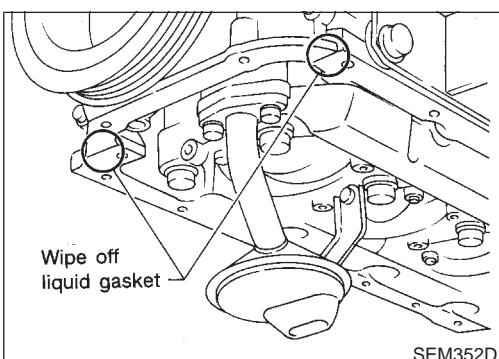
SLC492A

5. Apply a continuous bead of liquid gasket to front cover.
 - **Also apply liquid gasket to matching surface of cylinder head gasket.**
 - **Use Genuine Liquid Gasket or equivalent.**



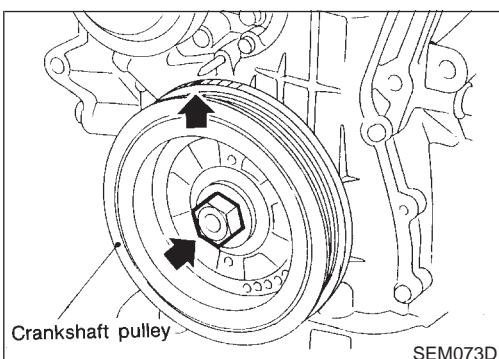
SEM997E

6. Install oil pump drive spacer and front cover.
 - **Make sure that O-ring is installed on oil pump outlet passage of cylinder block.**



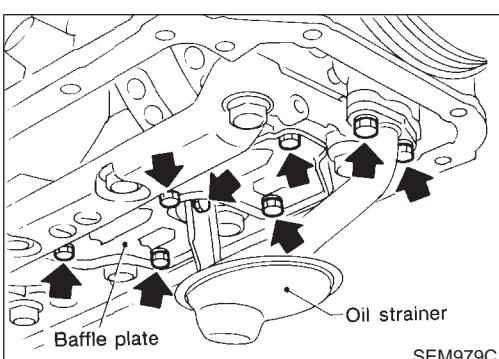
SEM352D

- Wipe off excessive liquid gasket.



SEM073D

7. Install crankshaft pulley.
8. Set No. 1 piston at TDC on its compression stroke.



SEM979C

9. Install oil strainer and baffle plate.

TIMING CHAIN

Installation (Cont'd)

10. Install oil pan.
Refer to "Installation" in "OIL PAN", EM-23.

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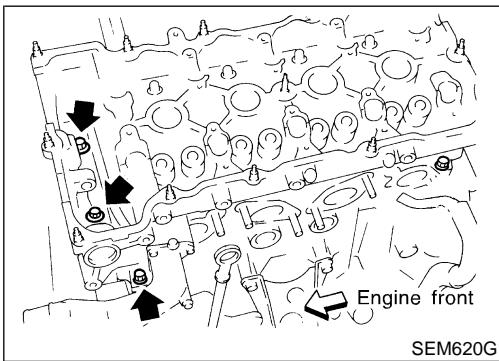
HA

SC

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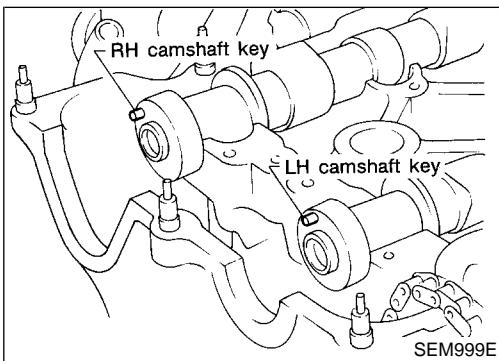
11. Install cylinder head outside bolts and inner sub-bolts.



SEM620G

12. Position camshaft.

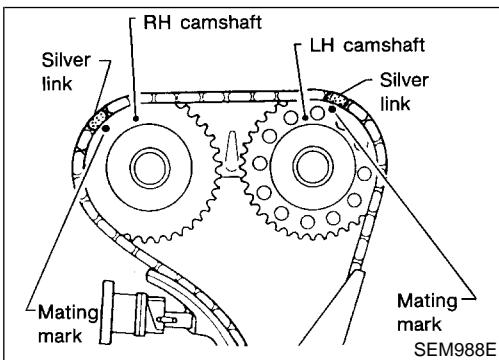
- LH camshaft key at about 12 o'clock
- RH camshaft key at about 10 o'clock



SEM999E

13. Install camshaft sprockets and timing chain.

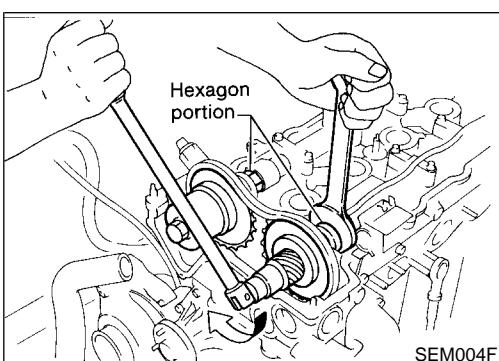
Line up mating marks on timing chain with mating marks on camshaft sprockets.



SEM988E

- Lock camshafts as shown in figure and tighten camshaft sprocket bolts to specified torque.

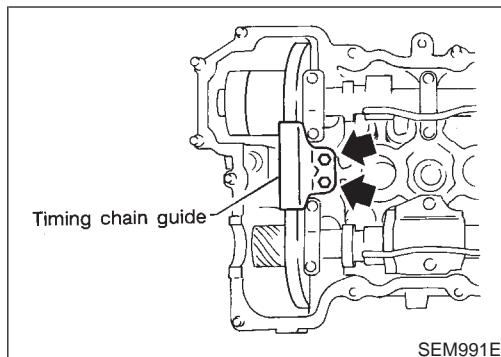
: 127 - 137 N·m (13 - 14 kg-m, 94 - 101 ft-lb)



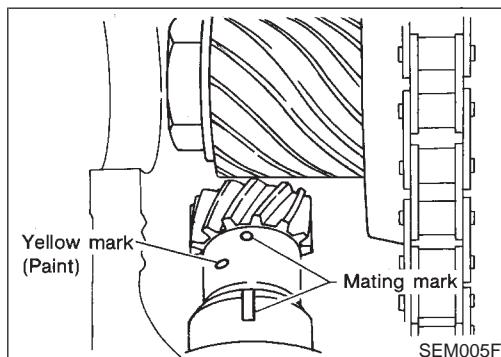
SEM004F

TIMING CHAIN

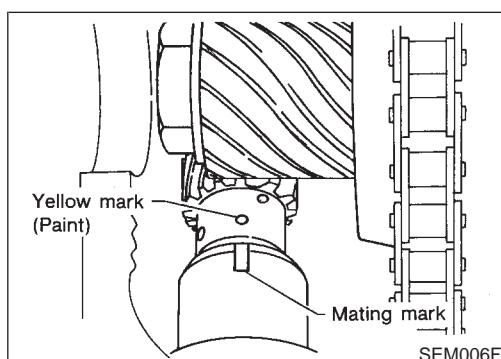
Installation (Cont'd)



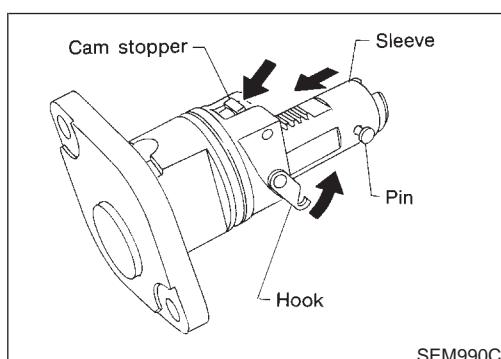
14. Install timing chain guide.



15. Install camshaft position sensor.
 - Make sure that No. 1 piston is at TDC on its compression stroke.
 - Set mating marks on rotor shaft of camshaft position sensor as shown.

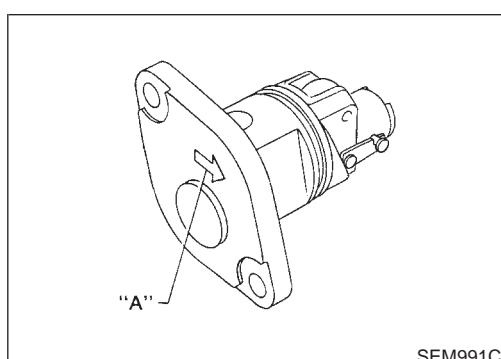


- Install camshaft position sensor aligning the center of fixing bolt hole.
- After installing, confirm that mating marks on rotor shaft of camshaft position sensor are as shown.**
- Tighten fixing bolts.



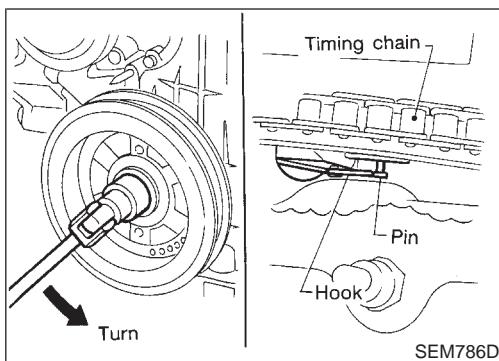
16. Install chain tensioner.

- Press cam stopper down and "press-in" sleeve until hook can be engaged on pin. When tensioner is bolted in position the hook will release automatically. Ensure arrow "A" faces the front of the engine.**



TIMING CHAIN

Installation (Cont'd)



- If hook does not release automatically, turn crankshaft counterclockwise until it does release.

GI

MA

EM

LC

EC

FE

CL

MT

AT

PD

AX

SU

BR

ST

RS

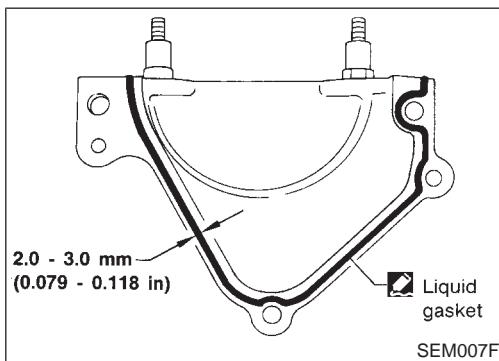
BT

HA

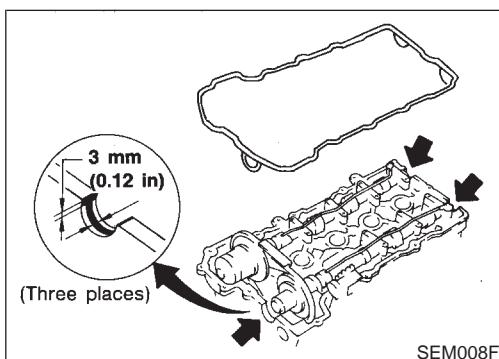
SC

EL

IDX

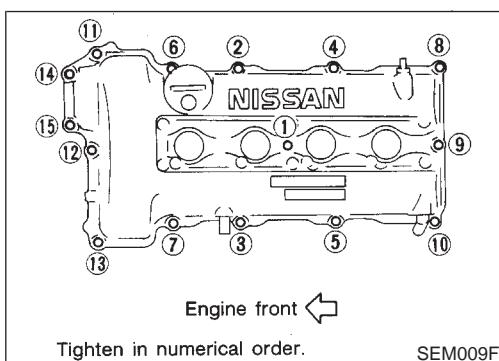


17. Install cylinder head front cover.
 - Remove all traces of liquid gasket from mating surface of cylinder head and the cover using a scraper.
 - Apply a continuous bead of liquid gasket to mating surface of cylinder head front cover.
 - Use Genuine Liquid Gasket or equivalent.



18. Remove all old liquid gasket from mating surfaces of rocker cover and cylinder head.
19. Apply a continuous bead of liquid gasket to mating surface of rocker cover gasket and cylinder head.

 - Use Genuine Liquid Gasket or equivalent.



20. Install rocker cover.

Tighten rocker cover installation nuts in two steps:

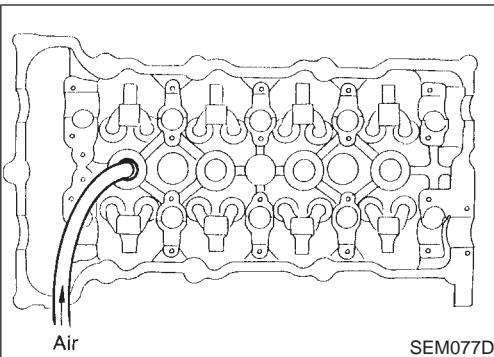
1st step (1 - 10 - 11 - 13 - 8 in that order):
4 N·m (0.4 kg·m, 2.9 ft-lb)

2nd step (1 - 15 in that order):
8 - 10 N·m (0.8 - 1.0 kg·m, 5.8 - 7.2 ft-lb)

21. Reinstall any parts removed in reverse order of removal.
 - When refilling engine coolant, refer to "Changing Engine Coolant", LC-15.

OIL SEAL

Replacement



Replacement

VALVE OIL SEAL

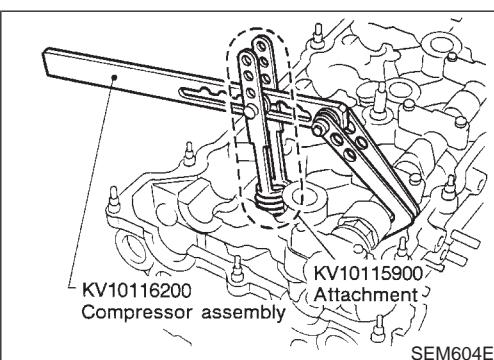
NMEM0015

NMEM0015S01

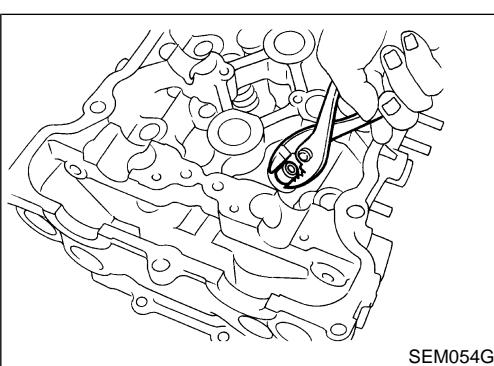
1. Remove rocker cover.
2. Remove camshafts and sprockets. Refer to EM-26.
3. Remove ignition coils from spark plugs.
4. Install air hose adapter into spark plug hole and apply air pressure to hold valves in place. Apply a pressure of 490 kPa (5 kg/cm², 71 psi).
5. Remove rocker arm, rocker arm guide and shim.

6. Remove valve spring with Tool. Temporarily install camshaft as shown.

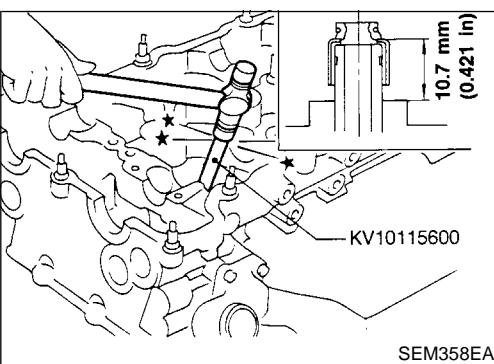
Piston concerned should be set at TDC to prevent valve from falling.



7. Remove valve oil seal with a suitable tool.



8. Apply new engine oil to new valve oil seal and install it with Tool.

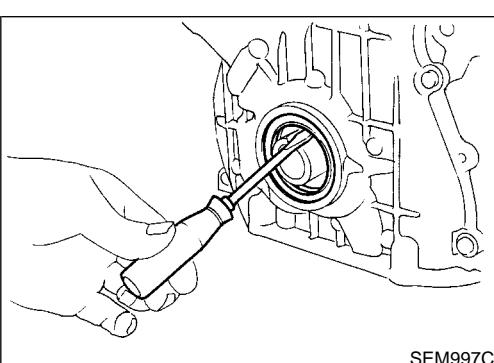


FRONT OIL SEAL

NMEM0015S02

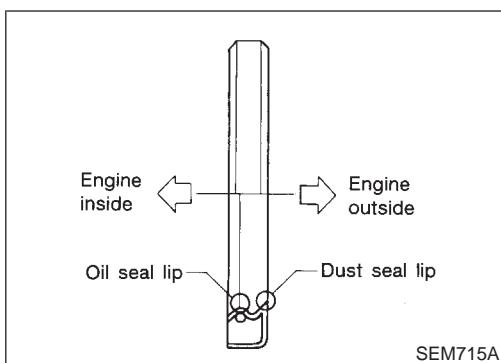
1. Remove the following parts:
 - Engine under cover
 - Drive belts
 - Crankshaft pulley
2. Remove front oil seal.

Be careful not to scratch front cover.



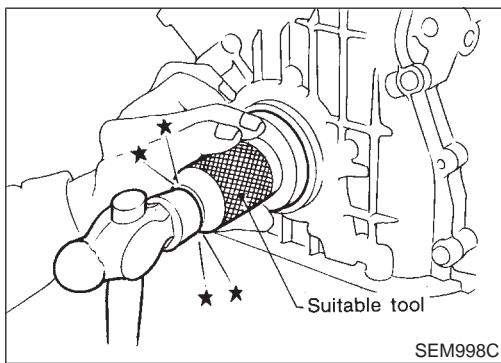
OIL SEAL

Replacement (Cont'd)



3. Apply new engine oil to new oil seal and install it using a suitable tool.
- **Install new oil seal in the direction shown.**

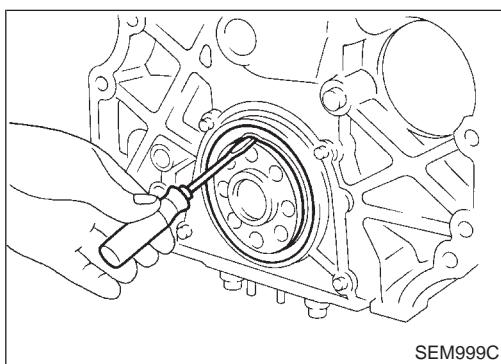
GI



REAR OIL SEAL

NMEM0015S03

AT

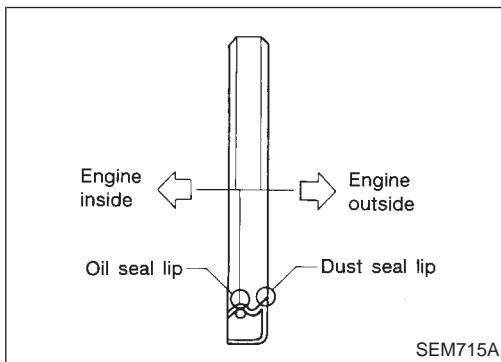


1. Remove transmission. (Refer to MT or AT section.)
 2. Remove flywheel or drive plate.
 3. Remove rear oil seal.
- **Be careful not to scratch rear oil seal retainer.**

PD

AX

SU



4. Apply new engine oil to new oil seal and install it using a suitable tool.

 - **Install new oil seal in the direction shown.**

BR

ST

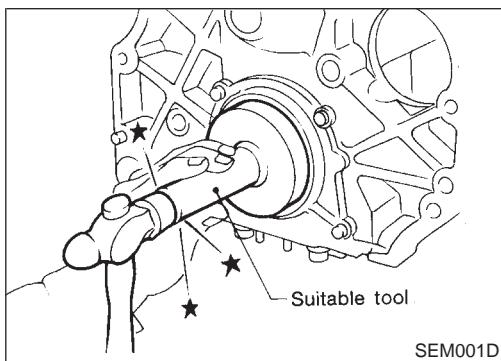
RS

BT

HA

SC

EL



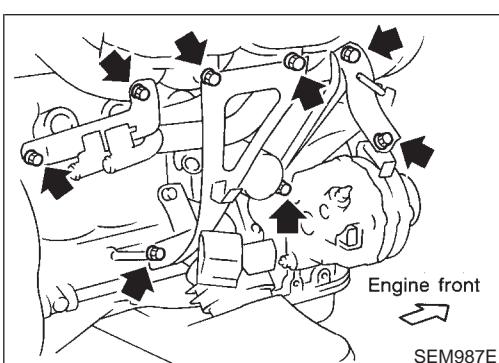
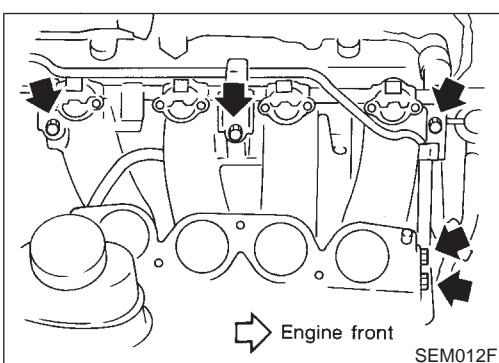
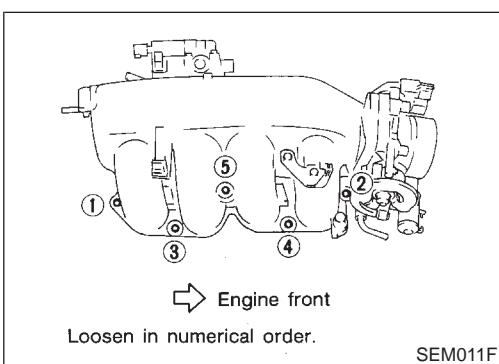
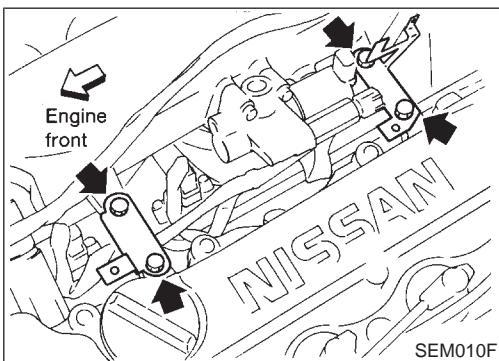
INTAKE MANIFOLD

Removal

Removal

NMME0046

1. Release fuel pressure.
Refer to "Fuel Pressure Release", EC-27.
 2. Drain coolant.
 3. Remove air duct from intake manifold.
 4. Remove PCV hoses from rocker cover.
 5. Remove vacuum hoses, fuel hoses, water hoses, wires, harnesses, connectors, etc. from intake manifold.
6. Remove intake manifold collector supports.



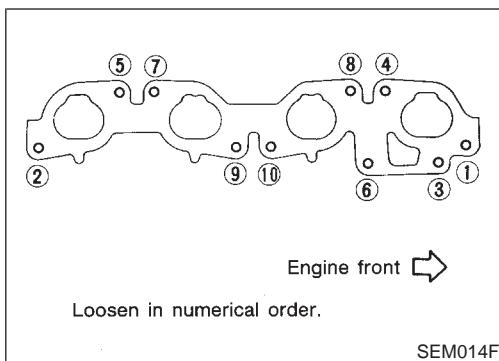
7. Remove intake manifold collector.

8. Remove harness connectors of engine coolant temperature sensor and thermal transmitter.
9. Remove fuel tube assembly.

10. Remove intake manifold supports.

INTAKE MANIFOLD

Removal (Cont'd)



GI

MA

EM

LC

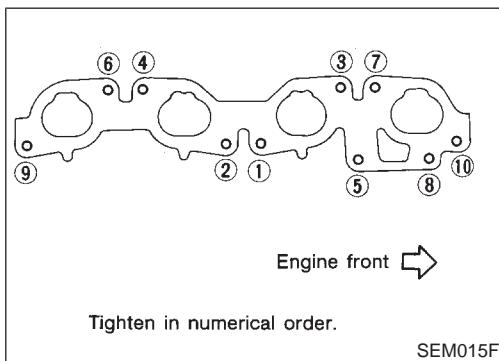
NMEM0047

EC

FE

CL

MT

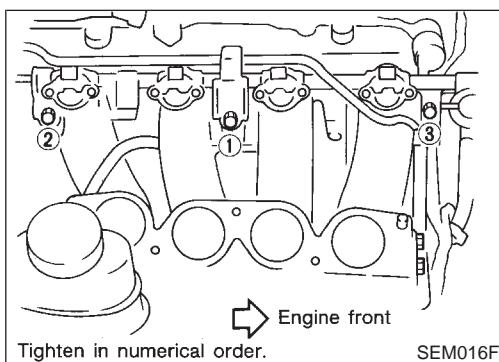


AT

PD

AX

SU

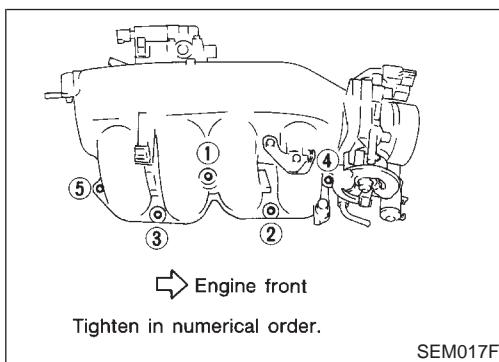


BR

ST

RS

BT



HA

SC

EL

IDX

11. Remove intake manifold.

Installation

1. Install intake manifold.
2. Install intake manifold supports.

3. Install fuel tube assembly.

Tighten bolts in two steps:

1st: 9.3 - 10.8 N·m (0.95 - 1.1 kg-m, 6.9 - 8.0 ft-lb)

2nd: 21 - 26 N·m (2.1 - 2.7 kg-m, 15 - 20 ft-lb)

4. Connect harness connectors of engine coolant temperature sensor and thermal transmitter.

5. Install intake manifold collector.

6. Reinstall any parts removed in reverse order of removal.

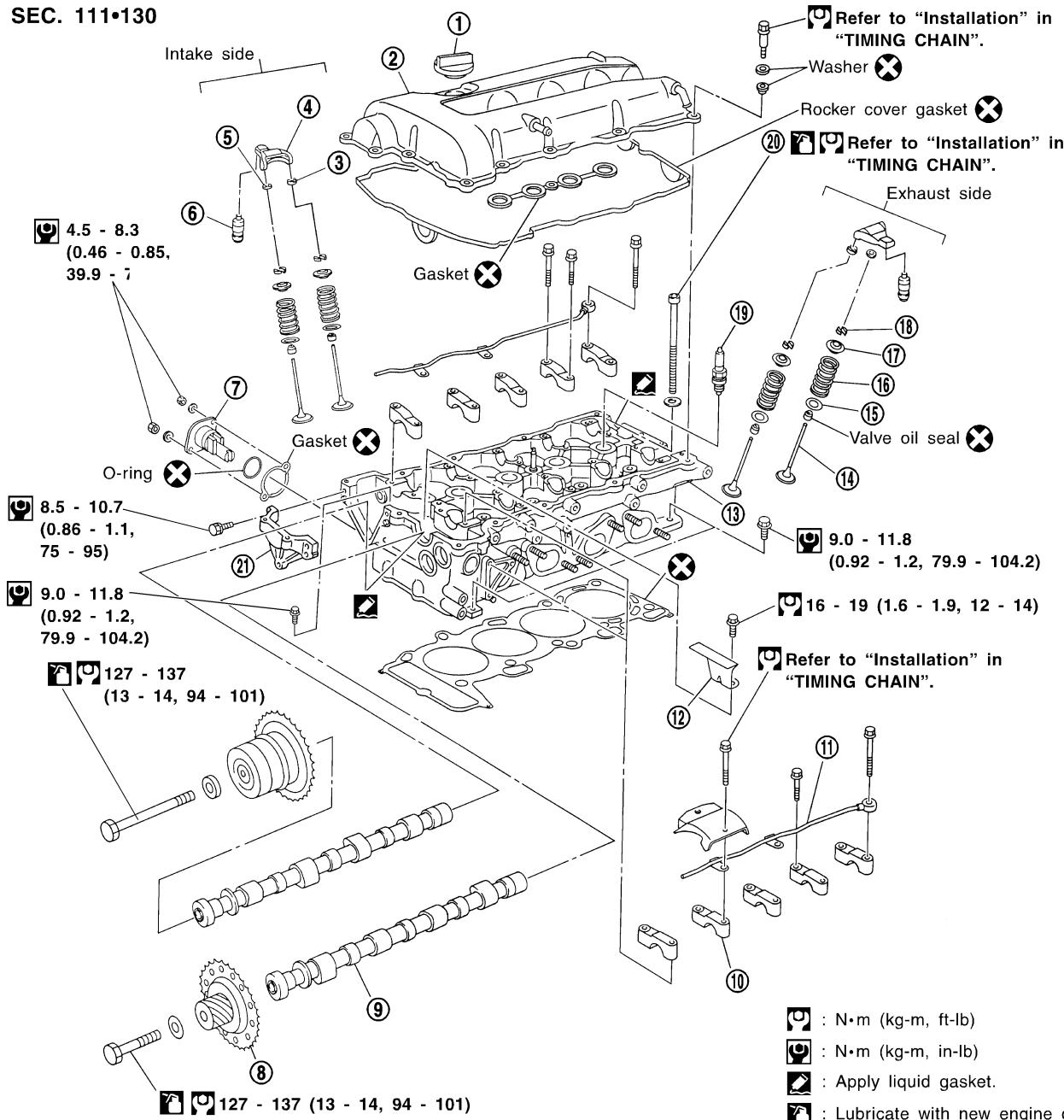
CYLINDER HEAD

Components

SEC. 111-130

NMEM0016

Components



- Ⓐ : N·m (kg-m, ft-lb)
- Ⓑ : N·m (kg-m, in-lb)
- Ⓒ : Apply liquid gasket.
- Ⓓ : Lubricate with new engine oil.

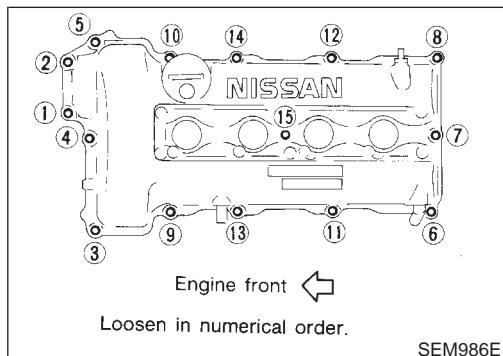
SEM621G

1. Oil filler cap
2. Rocker cover
3. Rocker arm guide
4. Rocker arm
5. Shim
6. Hydraulic lash adjuster
7. Chain tensioner
8. Camshaft sprocket
9. Camshaft
10. Camshaft bracket
11. Oil tube
12. Chain guide
13. Cylinder head
14. Valve
15. Valve spring seat
16. Valve spring
17. Valve spring retainer
18. Valve collet
19. Spark plug
20. Cylinder head bolt
21. Cylinder head front cover

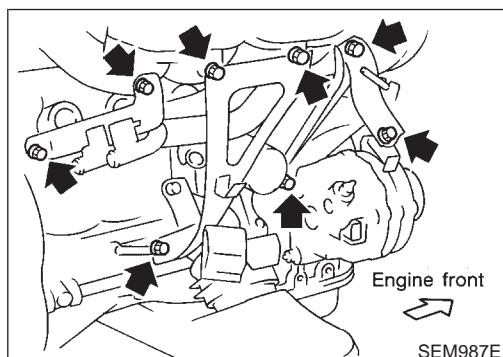
Removal

NMEM0017

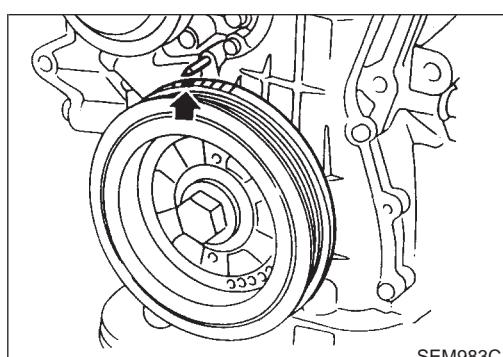
1. Release fuel pressure.
Refer to "Fuel Pressure Release" in EC-27. GI
2. Remove engine under covers. MA
3. Drain coolant. MA
4. Remove radiator. EM
5. Remove air duct to intake manifold and air recirculation duct. LC
6. Remove PCV hoses from rocker cover. LC
7. Remove drive belts and water pump pulley. LC
8. Remove alternator and power steering oil pump. LC
9. Remove the following parts from cylinder head and intake manifold: vacuum hoses, fuel hoses, water hoses, wires, and harness connectors and so on. EC
10. Remove ignition coils and all spark plugs. FE



11. Remove rocker cover, loosen bolts in numerical order. AT
12. Remove front exhaust tube. Refer to FE-11 ("Removal and Installation"). AT
13. Remove the lower intake manifold supports. PD



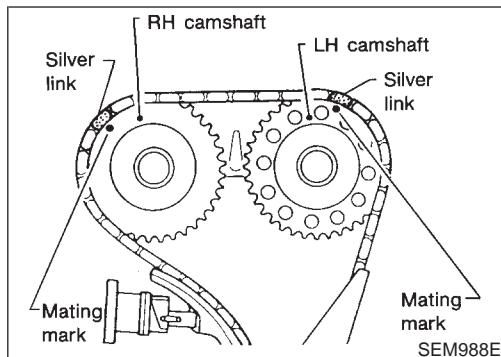
14. Remove intake manifold supports. BR



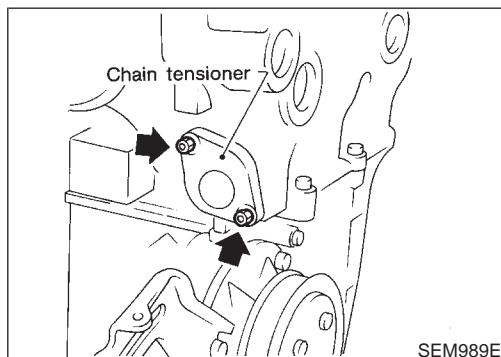
15. Set No. 1 piston at TDC on the compression stroke by rotating crankshaft. HA

CYLINDER HEAD

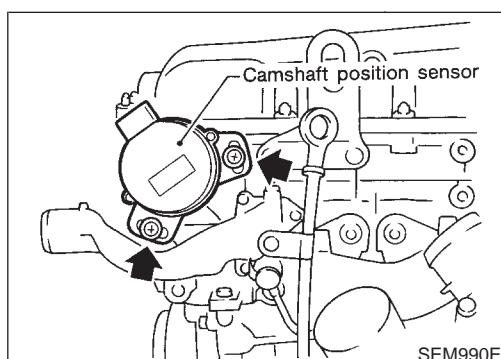
Removal (Cont'd)



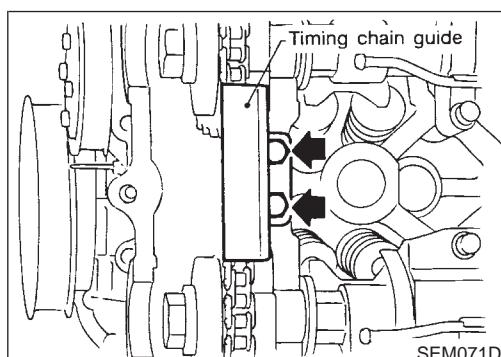
- Rotate crankshaft until mating mark on camshaft sprocket is set at position indicated in figure at left.
- Apply paint to timing chain and camshaft sprockets for alignment during installation.



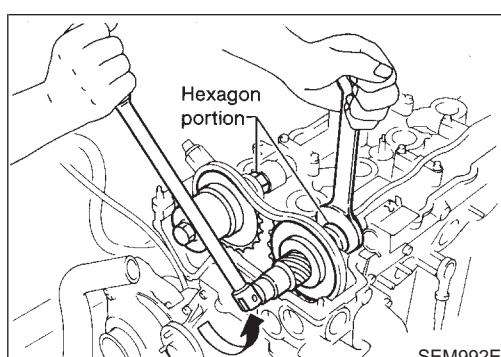
16. Remove chain tensioner.



17. Remove camshaft position sensor.
Do not turn rotor with distributor removed.



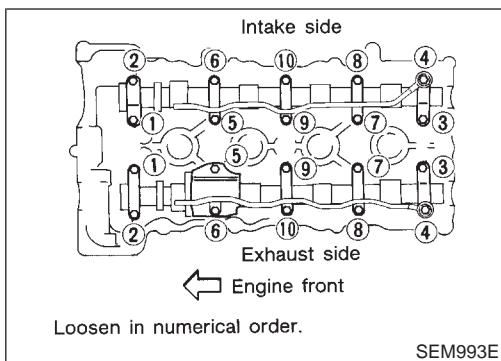
18. Remove timing chain guide.



19. Remove camshaft sprockets.

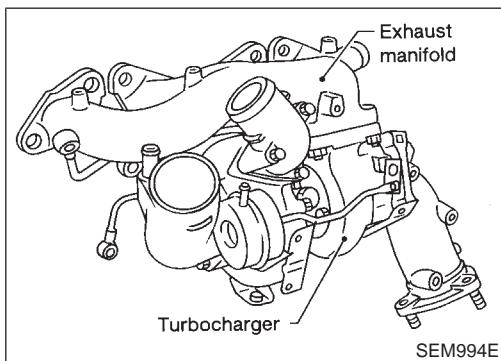
CYLINDER HEAD

Removal (Cont'd)



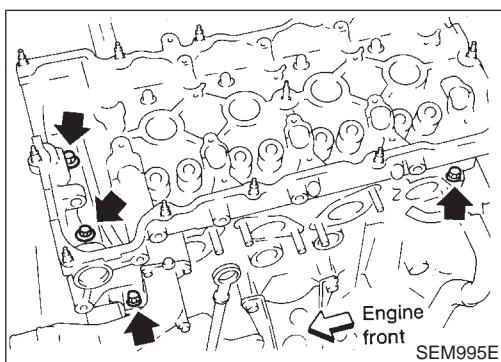
20. Remove camshafts and camshaft brackets, oil tubes and baffle plate.

GI



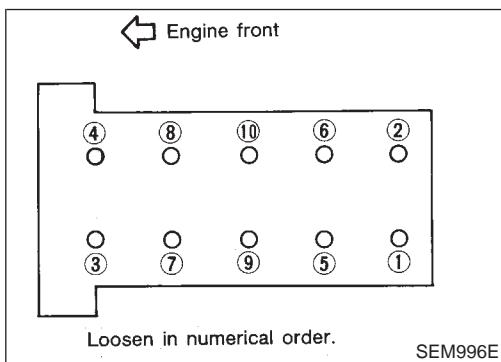
21. Remove exhaust manifold with turbocharger. Refer to EM-58, "Removal".

EC



22. Remove cylinder head outside bolts and inside sub-bolts.

AT



23. Remove cylinder head bolts.

BR

- **Bolts should be loosened in two or three steps.**

24. Remove cylinder head completely with intake manifold.

ST

RS

BT

HA

NMEM0018

SC

EL

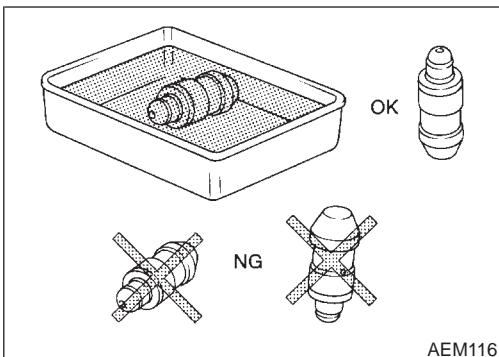
IDX

Disassembly

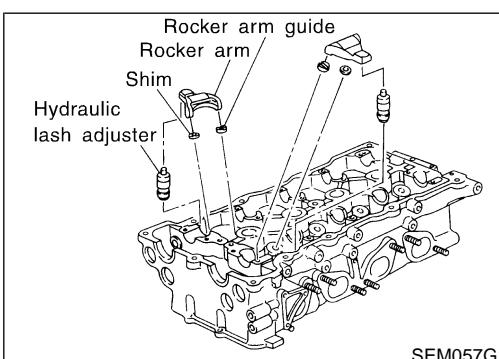
CAUTION:

CYLINDER HEAD

Disassembly (Cont'd)



- If a hydraulic lash adjuster is kept on its side, there is a risk of air entering it. When hydraulic lash adjusters are removed, stand them straight up or soak them in new engine oil.
- Do not disassemble hydraulic lash adjusters.
- Attach tags to lash adjusters so as not to mix them up.

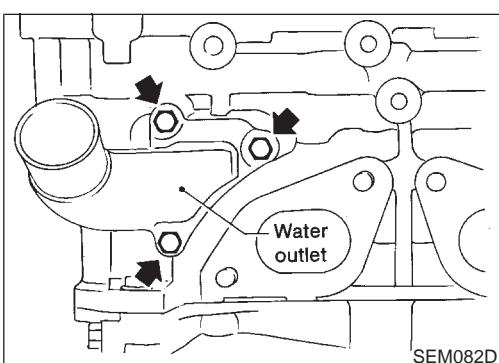


1. Remove rocker arms, shims, rocker arm guides and hydraulic lash adjusters from cylinder head.

CAUTION:

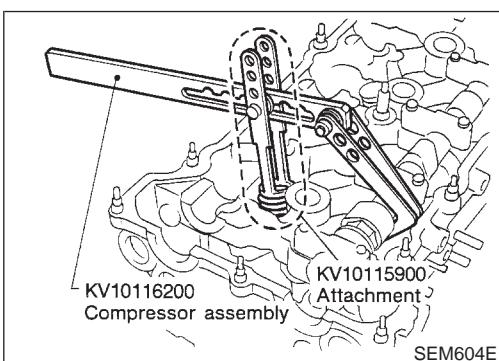
Keep parts in order so they can be installed in their original positions during assembly.

2. Remove intake manifold.
Refer to EM-39, "Removal".

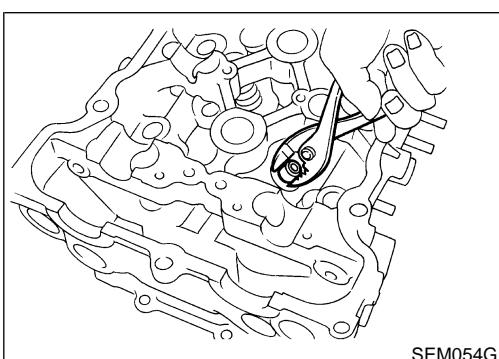


3. Remove water outlet.

4. Remove intake manifold with intake manifold collector.
Refer to EM-39, "Removal".



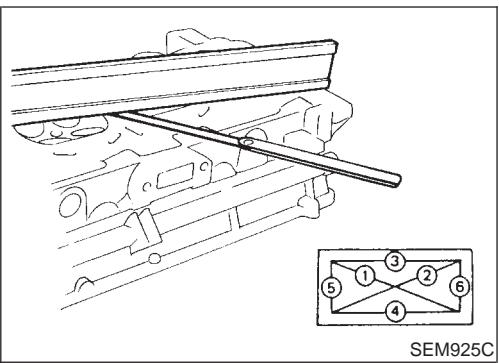
5. Remove valve components with Tool. Install camshaft temporarily.



6. Remove valve oil seal with a suitable tool.

CYLINDER HEAD

Inspection



Inspection

CYLINDER HEAD DISTORTION

- Clean mating surface of cylinder head.
- Use a reliable straightedge and feeler gauge to check the flatness of cylinder head mating surface.
- Check along six positions shown in figure.

Head surface flatness:

Standard: Less than 0.03 mm (0.0012 in)

Limit: 0.1 mm (0.004 in)

If beyond the specified limit, replace or resurface it.

Resurfacing limit:

The limit for cylinder head resurfacing is determined by the amount of cylinder block resurfacing.

Amount of cylinder head resurfacing is "A".

Amount of cylinder block resurfacing is "B".

The maximum limit is as follows:

A + B = 0.2 mm (0.008 in)

After resurfacing cylinder head, check that camshaft rotates freely by hand. If resistance is felt, cylinder head must be replaced.

Nominal cylinder head height:

136.9 - 137.1 mm (5.390 - 5.398 in)

NMEM0019S02

AT

NMEM0019S03

PD

NMEM0019S04

BR

ST

RS

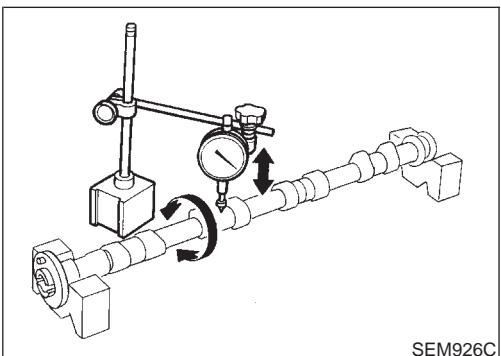
BT

HA

SC

EL

IDX



CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.

CAMSHAFT RUNOUT

1. Measure camshaft runout at the center journal.

Runout (Total indicator reading):

Standard

Less than 0.02 mm (0.0008 in)

Limit

0.1 mm (0.004 in)

2. If it exceeds the limit, replace camshaft.

CAMSHAFT CAM HEIGHT

1. Measure camshaft cam height.

Standard cam height:

Intake

37.920 - 38.110 mm (1.4929 - 1.5004 in)

Exhaust

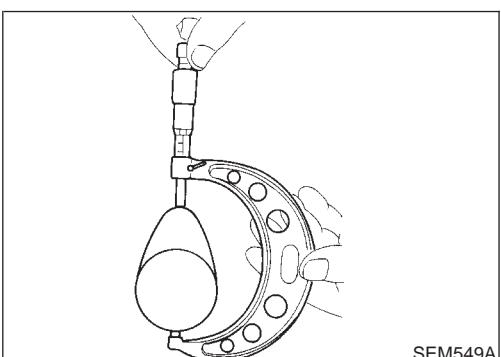
37.920 - 38.110 mm (1.4929 - 1.5004 in)

Cam height wear limit:

Intake & Exhaust

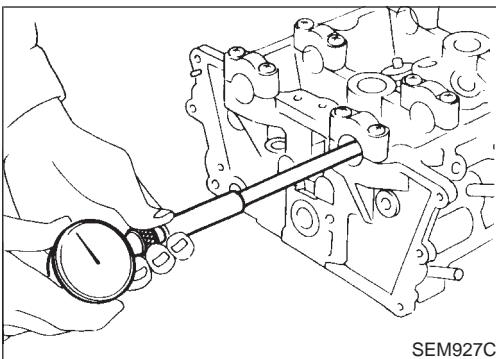
0.2 mm (0.008 in)

2. If wear is beyond the limit, replace camshaft.



CYLINDER HEAD

Inspection (Cont'd)



CAMSHAFT JOURNAL CLEARANCE

- NMEM0019S05
1. Install camshaft bracket and tighten bolts. Refer to EM-52.
 2. Measure inner diameter of camshaft bearing.

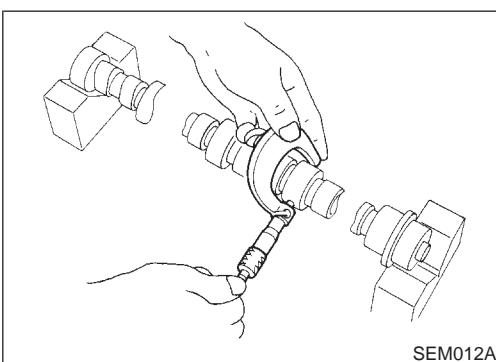
Standard inner diameter:

Except for No. 1 intake journal

28.000 - 28.021 mm (1.1024 - 1.1032 in)

For No. 1 intake journal

28.010 - 28.031 mm (1.1028 - 1.1036 in)



3. Measure outer diameter of camshaft journal.

Standard outer diameter:

27.935 - 27.955 mm (1.0998 - 1.1006 in)

4. Calculate camshaft journal clearance.

**Camshaft journal clearance = standard inner diameter
- standard outer diameter:**

Standard

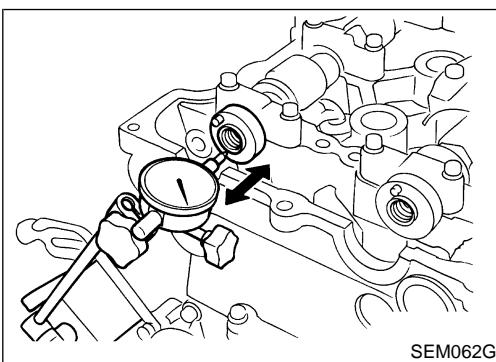
**0.030 - 0.071 mm (0.0012 - 0.0028 in) except for No.
1 intake journal**

**0.040 - 0.081 mm (0.0016 - 0.0032 in) for No. 1
intake journal**

Limit

0.15 mm (0.0059 in)

5. If clearance exceeds the limit, replace camshaft and remeasure camshaft journal clearance.
 - If clearance still exceeds the limit after replacing camshaft, replace cylinder head.



CAMSHAFT END PLAY

NMEM0019S06

1. Install camshaft in cylinder head. Refer to EM-52.
2. Measure camshaft end play.

Camshaft end play:

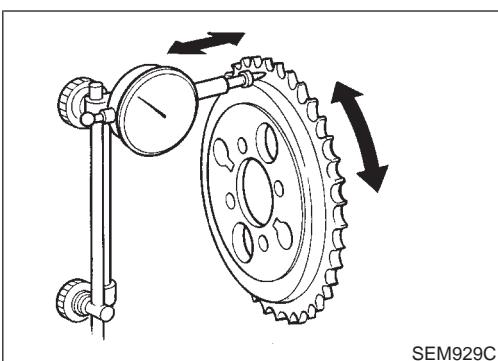
Standard

0.092 - 0.173 mm (0.0036 - 0.0068 in)

Limit

0.20 mm (0.0079 in)

3. If end play exceeds the limit, replace camshaft and remeasure camshaft end play.
 - If end play still exceeds the limit after replacing camshaft, replace cylinder head.

**CAMSHAFT SPROCKET RUNOUT**

NMEM0019S07

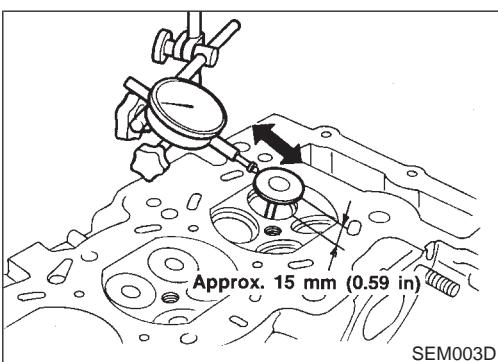
1. Install sprocket on camshaft.
2. Measure camshaft sprocket runout.
Runout (Total indicator reading):
Limit 0.25 mm (0.0098 in)
3. If it exceeds the limit, replace camshaft sprocket.

GI

MA

EM

LC

**VALVE GUIDE CLEARANCE**

NMEM0019S08

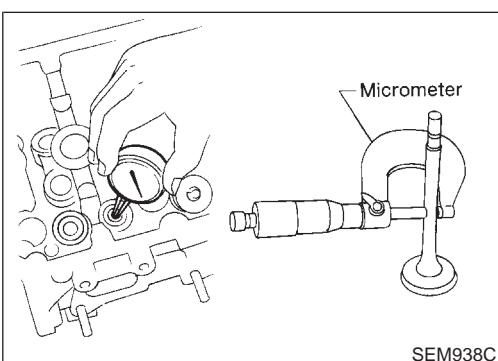
1. Measure valve deflection as shown in illustration. (Valve and valve guide mostly wear in this direction.)
Valve deflection limit (Dial gauge reading):
Intake & Exhaust
0.2 mm (0.008 in)

EC

FE

CL

MT



2. If it exceeds the limit, check valve to valve guide clearance.

AT

- a. Measure valve stem diameter and valve guide inner diameter.

PD

- b. Calculate valve to valve guide clearance.

Valve to valve guide clearance = valve guide inner diameter – valve stem diameter:

Standard

Intake 0.020 - 0.053 mm (0.0008 - 0.0021 in)

Exhaust 0.040 - 0.073 mm (0.0016 - 0.0029 in)

AX

Limit

Intake 0.08 mm (0.0031 in)

SU

Exhaust 0.1 mm (0.004 in)

- c. If it exceeds the limit, replace valve and remeasure clearance.

BR

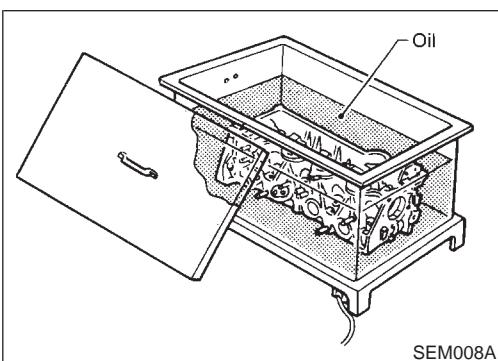
- If clearance still exceeds the limit after replacing valve, replace valve guide.

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**VALVE GUIDE REPLACEMENT**

NMEM0019S09

1. To remove valve guide, heat cylinder head to 110 to 130°C (230 to 266°F).

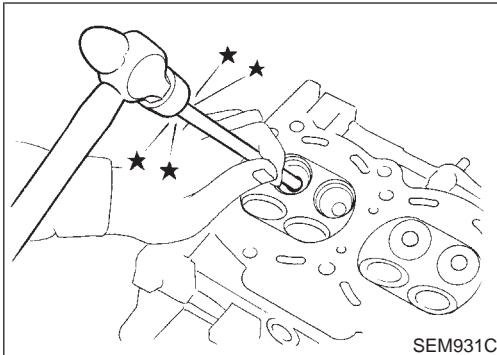
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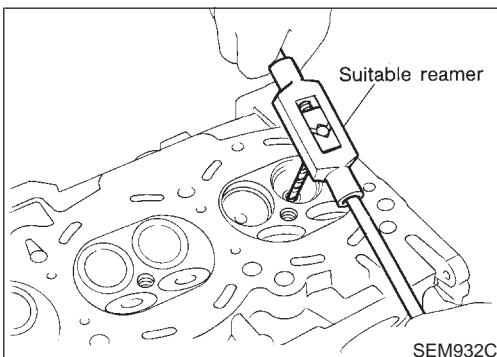
IDX

CYLINDER HEAD

Inspection (Cont'd)



2. Drive out valve guide with a press (under a 20 kN [2 ton, 2.2 US ton, 2.0 Imp ton] pressure) or hammer and suitable tool.



3. Ream cylinder head valve guide hole.

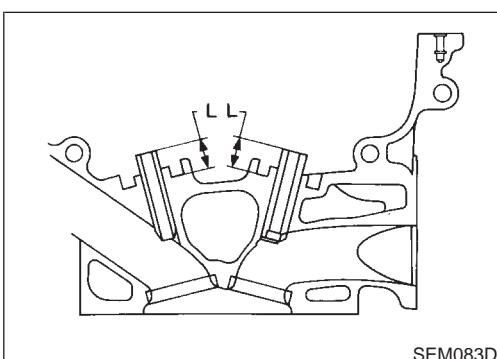
**Valve guide hole diameter
(for service parts):**

Intake

10.175 - 10.196 mm (0.4006 - 0.4014 in)

Exhaust

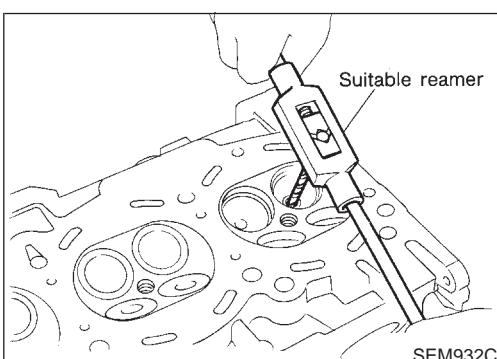
11.175 - 11.196 mm (0.4400 - 0.4408 in)



4. Heat cylinder head to 110 to 130°C (230 to 266°F) and press service valve guide into cylinder head.

Projection "L":

14.0 - 14.2 mm (0.551 - 0.559 in)



5. Ream valve guide.

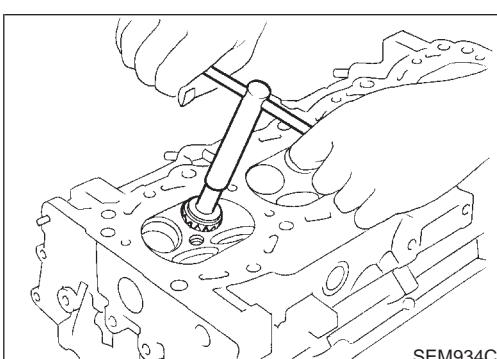
Finished size:

Intake

6.000 - 6.018 mm (0.2362 - 0.2369 in)

Exhaust

7.000 - 7.018 mm (0.2756 - 0.2763 in)



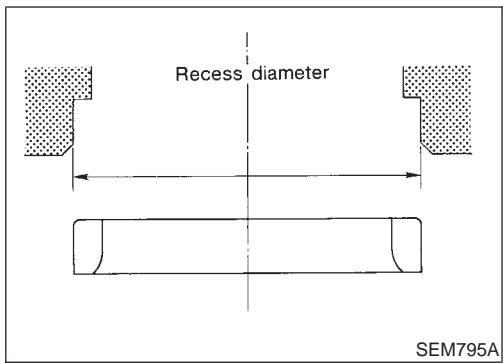
VALVE SEATS

Check valve seats for pitting at contact surface. Resurface or replace if excessively worn. NMEM0019S10

- Before repairing valve seats, check valve and valve guide for wear. If they are worn, replace them. Then correct valve seat.
- Use both hands to cut uniformly.

CYLINDER HEAD

Inspection (Cont'd)



REPLACING VALVE SEAT FOR SERVICE PARTS

NMEM0019S11

1. Bore out old seat until it collapses. Set machine depth stop so that boring cannot contact bottom face of seat recess in cylinder head.
2. Ream cylinder head recess.

Reaming bore for service valve seat

Oversize [0.5 mm (0.020 in)]:

Intake 35.500 - 35.516 mm (1.3976 - 1.3983 in)

Exhaust 31.500 - 31.516 mm (1.2402 - 1.2408 in)

Use the valve guide center for reaming to ensure valve seat will have the correct fit.

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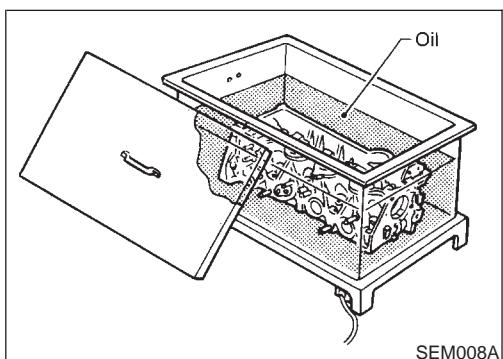
HA

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3. Heat cylinder head to 110 to 130°C (230 to 266°F).
4. Press fit valve seat until it seats on the bottom.



5. Cut or grind valve seat to the specified dimensions using a suitable tool. Refer to SDS, EM-87.
6. After cutting, lap valve seat with abrasive compound.
7. Check valve seating condition.

Seat face angle “ α ”:

44°53' - 45°07'

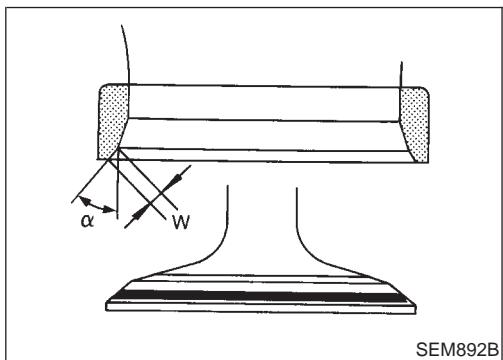
Contacting width “W”:

Intake

1.4 - 1.7 mm (0.055 - 0.067 in)

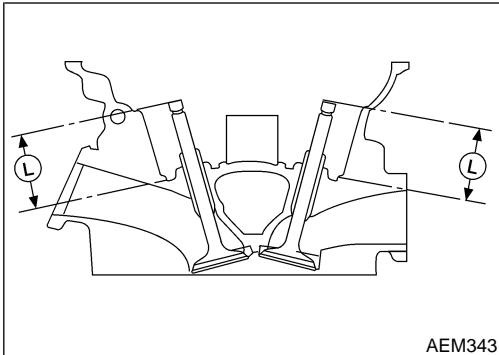
Exhaust

1.7 - 2.0 mm (0.067 - 0.079 in)



CYLINDER HEAD

Inspection (Cont'd)

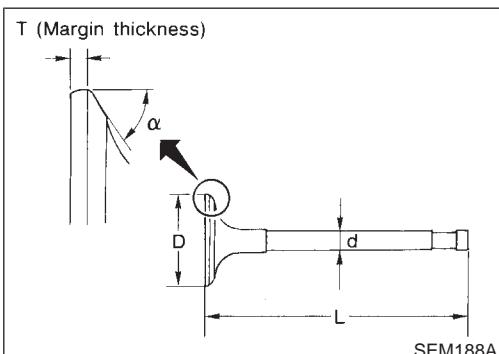


Use a depth gauge to measure the distance between the mounting surface of the cylinder head spring seat and the valve stem end. If the distance is shorter than the specified valve, repeat step 5 above to adjust it.

If it is longer, replace the valve seat with a new one.

Valve seat resurface limit:

42.74 - 43.26 mm (1.6827 - 1.7031 in)



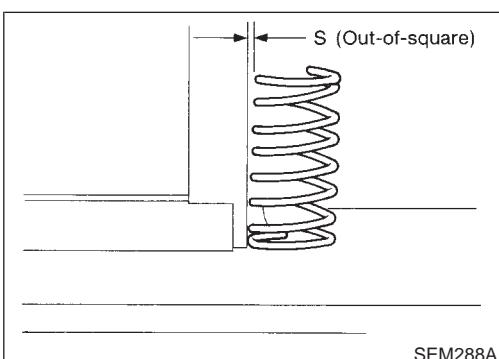
VALVE DIMENSIONS

NMEM0019S12

Check dimensions of each valve. Refer to SDS, EM-84.

When valve head has been worn down to 0.5 mm (0.020 in) in margin thickness, replace valve.

Grinding allowance for valve stem tip is 0.2 mm (0.008 in) or less.



VALVE SPRING

NMEM0019S13

Squareness

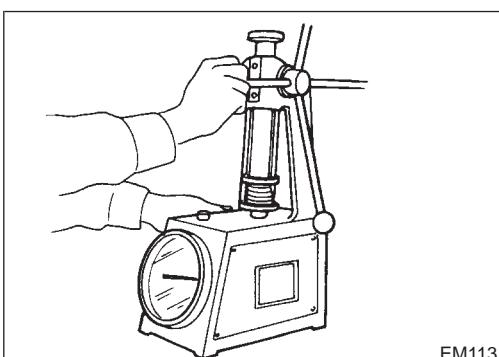
1. Measure dimension "S".

Out-of-square "S":

Less than 2.2 mm (0.087 in)

2. If it exceeds the limit, replace spring.

NMEM0019S1301



Pressure

NMEM0019S1302

Check valve spring pressure at specified spring height.

Pressure:

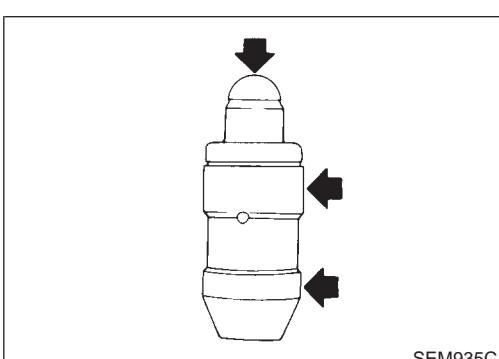
Standard

578.0 - 641.6 N (59.0 - 65.4 kg, 129.9 - 144.2 lb) at 30.0 mm (1.181 in)

Limit

549.2 N (56.0 kg, 123.5 lb) at 30.0 mm (1.181 in)

If it exceeds the limit, replace spring.



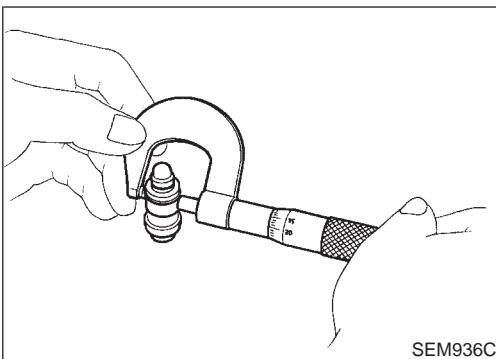
HYDRAULIC LASH ADJUSTER

NMEM0019S14

1. Check contact and sliding surfaces for wear or score.

CYLINDER HEAD

Inspection (Cont'd)

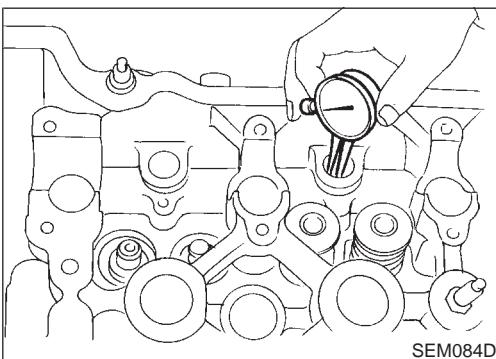


2. Check diameter of lash adjuster.

Outer diameter:

16.980 - 16.993 mm (0.6685 - 0.6690 in)

GI



3. Check lash adjuster guide hole diameter.

Inner diameter:

17.000 - 17.020 mm (0.6693 - 0.6701 in)

Standard clearance between lash adjuster and adjuster guide hole:

0.007 - 0.040 mm (0.0003 - 0.0016 in)

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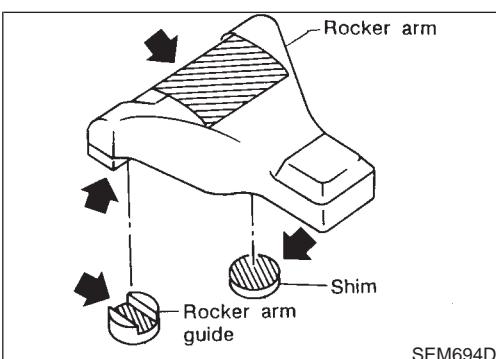
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ROCKER ARM, SHIM AND ROCKER ARM GUIDE

NMEM0019S15

Check contact and sliding surfaces of rocker arms, shims and rocker arm guides for wear or score.

AT

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AX

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Assembly

NMEM0020

CAUTION:

- When installing rocker arms, camshaft and oil seal, lubricate contacting surfaces with new engine oil.
- When tightening cylinder head bolts, camshaft sprocket bolts and camshaft bracket bolts, lubricate bolt threads and seat surfaces with new engine oil.

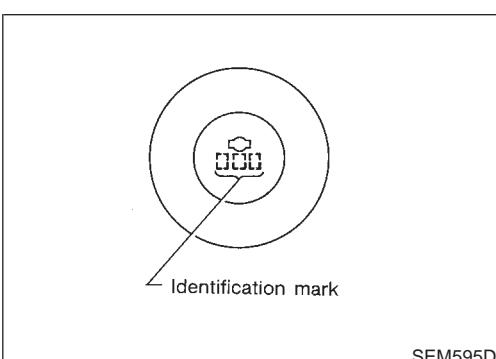
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1. Install valve component parts.

- Install valves, noting their identification marks as indicated in the table below.

	Identification mark
Intake valve	53J
Exhaust valve	5J

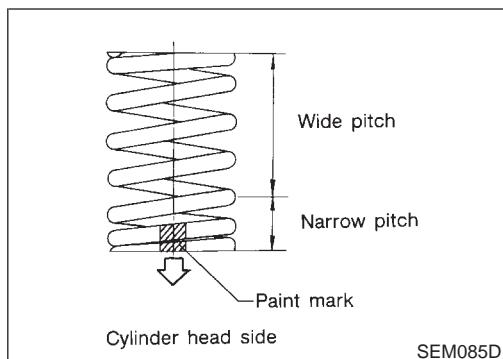
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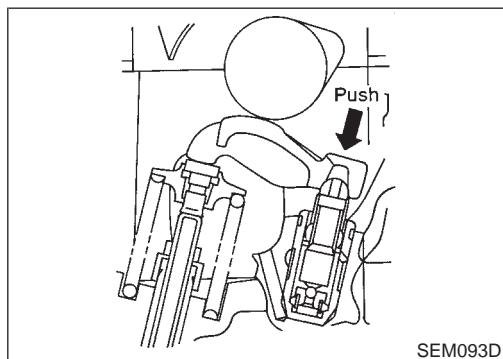
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CYLINDER HEAD

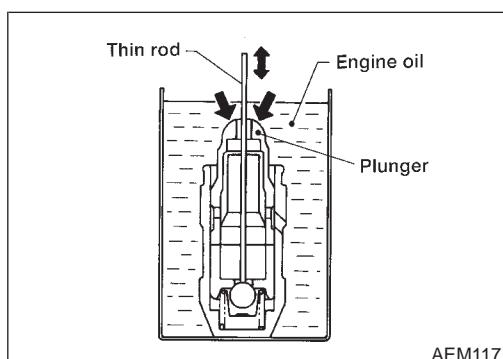
Assembly (Cont'd)



- Always use new valve oil seal. Refer to EM-34.
- Before installing valve oil seal, install valve spring seat.
- Install valve spring (uneven pitch type) with its narrow pitched side (paint mark) toward cylinder head side.
- After installing valve components, use plastic hammer to lightly tap valve stem tip to assure a proper fit.

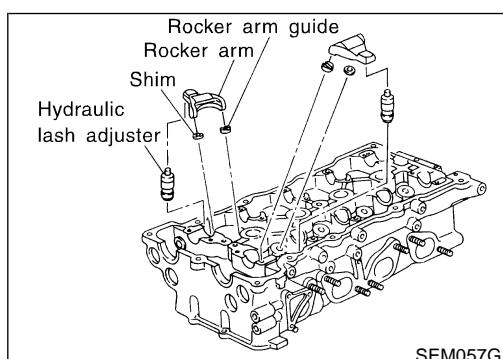


2. Check hydraulic lash adjusters.
 - a. Push on the rocker arm above the hydraulic lash adjuster. If it moves 1 mm (0.04 in) or more, there is air in the high pressure chamber of hydraulic lash adjuster. Noise will be emitted from hydraulic lash adjuster if engine is started without bleeding air.



- b. Remove hydraulic lash adjuster and dip in a container filled with new engine oil. While pushing plunger as shown in figure, lightly push check ball using a thin rod. Air is completely bled when plunger no longer moves.

Air cannot be bled from this type of lash adjuster by running engine.



3. Install, rocker arms, shims, rocker arm guides and hydraulic lash adjusters.

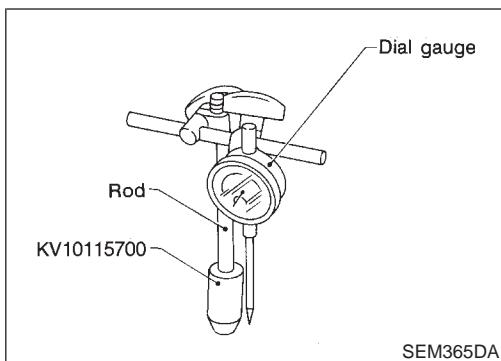
CAUTION:

Install parts in their original positions.

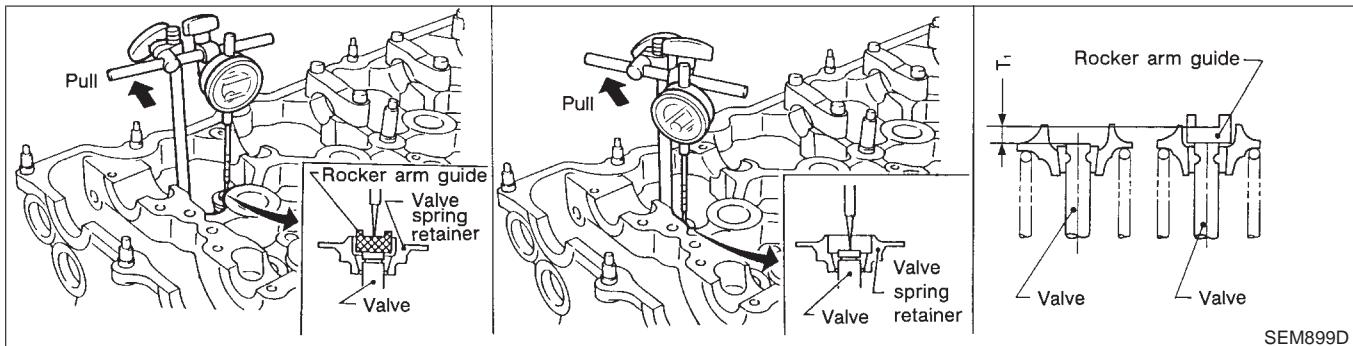
4. Select a suitable shim when replacing following parts with a new one: valve, cylinder head, shim, rocker arm guide and valve seat. Proceed as follows to select the shim of correct thickness.
 - a. Install valve component parts to cylinder head (Except shim).
 - b. Remove hydraulic lash adjuster.

CYLINDER HEAD

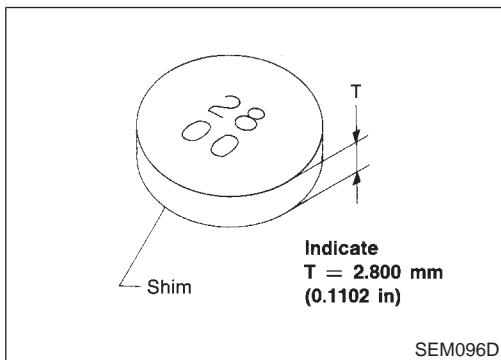
Assembly (Cont'd)



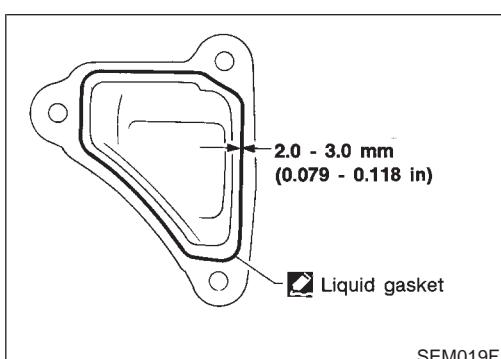
- c. Install Tool* into hydraulic lash adjuster fixing hole.
 * Tool (KV10115700) is screwed into magnetic stand rod used with dial gauge.



- d. Make sure that the following parts are installed to the cylinder head: valve, valve spring, collet, retainer, and rocker arm guide (except shim). Measure difference (T_1) between contact surfaces of rocker arm guide and valve stem end on shim side. **When measuring, lightly pull dial indicator rod toward you to eliminate play in Tool (KV10115700).**



- e. Select proper shim.
Shim thickness (T): $T_1 \pm 0.025 \text{ mm (0.0010 in)}$
- Shims are available in different thicknesses from 2.800 mm (0.1102 in) to 3.200 mm (0.1260 in) in increments of 0.025 mm (0.0010 in).

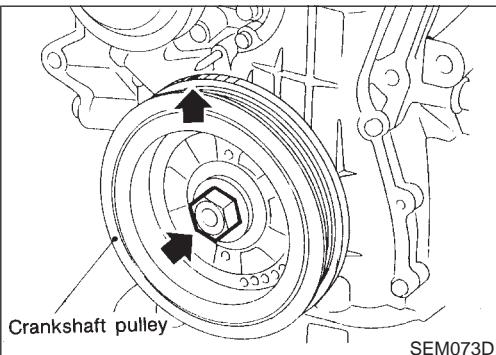


5. Install water outlet.
- Remove all traces of liquid gasket from mating surface using a scraper.
 - Also remove traces of liquid gasket from mating surface of cylinder head.
 - Apply a continuous bead of liquid gasket to mating surface of water outlet.
 - Use Genuine Liquid Gasket or equivalent.**

CYLINDER HEAD

Assembly (Cont'd)

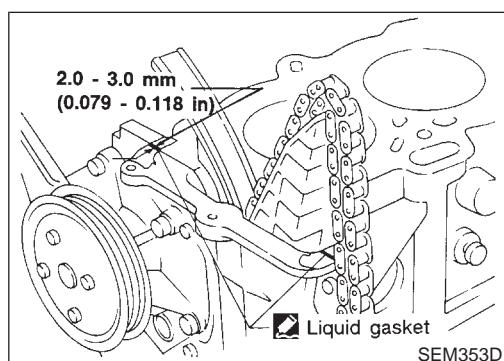
6. Install intake manifold.
Refer to EM-52, "Installation".



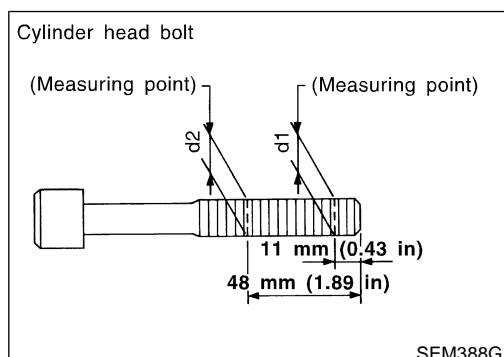
NMME0041

Installation

1. Set No. 1 piston at TDC on its compression stroke.



2. Before installing cylinder head gasket, apply a continuous bead of liquid gasket to mating surface of cylinder block.



3. Install cylinder head completely with intake manifold.

- **Apply engine oil to threads and seating surfaces of cylinder head bolts before installing them.**
- **Be sure to install washers between bolts and cylinder head.**

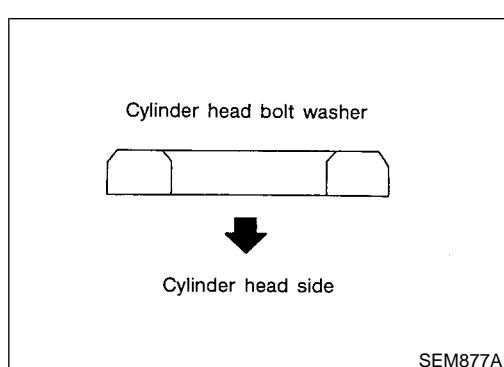
CAUTION:

Cylinder head bolts are tightened by plastic zone tightening method. Whenever the size difference between d1 and d2 exceeds the limit, replace them with new ones.

Limit ($d_1 - d_2$):

0.15 mm (0.0059 in)

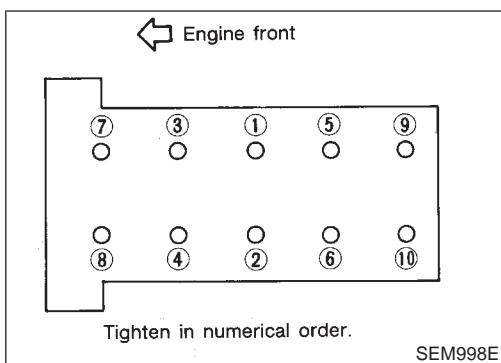
- If reduction of outer diameter appears in a position other than d2, use it as d2 point.
- Lubricate threads and seat surfaces of the bolts with new engine oil.



SEM877A

CYLINDER HEAD

Installation (Cont'd)



- **Tightening procedure:**

- Tighten all bolts to 39.2 N·m (4.0 kg-m, 29 ft-lb).**
- Tighten all bolts to 78.5 N·m (8.0 kg-m, 58 ft-lb).**
- Loosen all bolts completely.**
- Tighten all bolts to 34.3 - 44.1 N·m (3.5 - 4.5 kg-m, 26 - 32 ft-lb).**

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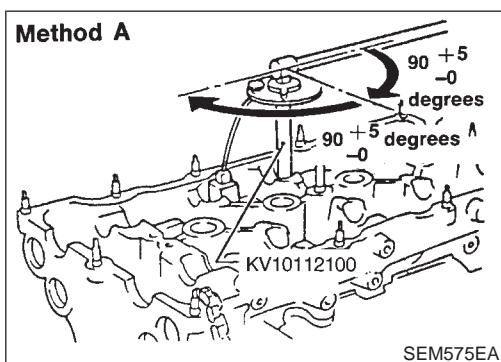
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e) **Method A:**

Turn all bolts 90 to 95 degrees clockwise with Tool or suitable angle wrench.

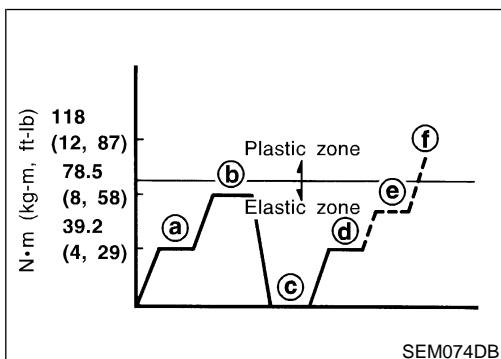
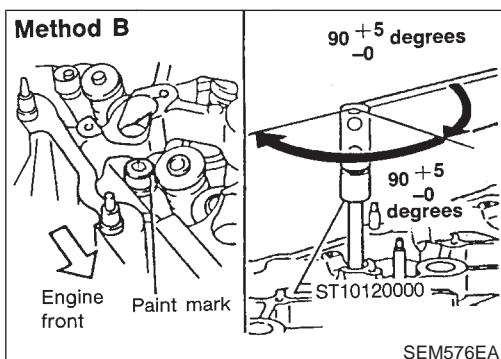
Method B:

If angle wrench is not available, do the following. Mark the side of all bolts with paint marks facing the front of the engine. Then turn them 90 to 95 degrees clockwise.

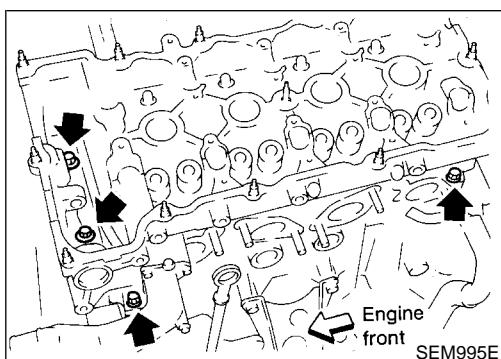
f) Turn all bolts 90 to 95 degrees clockwise.

g) Ensure that paint mark on each bolt faces the rear of the engine. (Method B only)

Do not turn any bolt 180 to 190 degrees clockwise all at once.



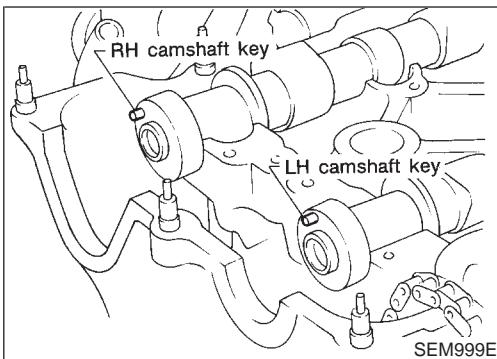
	Tightening torque N·m (kg-m, ft-lb)
a	39.2 (4.0, 29)
b	78.5 (8.0, 58)
c	0 (0, 0)
d	34.3 - 44.1 (3.5 - 4.5, 26 - 32)
e	90 - 95 degrees (90 degree preferred)
f	90 - 95 degrees (90 degree preferred)



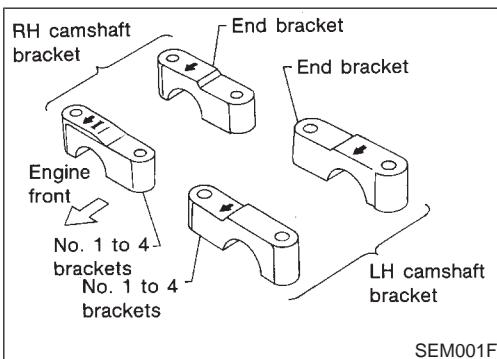
4. Install cylinder head outside bolts and inner sub-bolts.
5. Install exhaust manifold with turbocharger. Refer to "Installation" in "TURBOCHARGER", EM-62.

CYLINDER HEAD

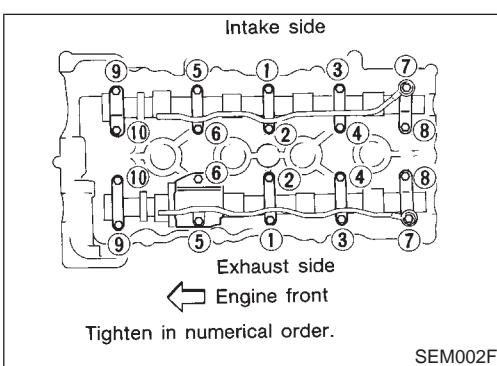
Installation (Cont'd)



6. Install camshafts, camshaft brackets, oil tubes and baffle plate.
- Position camshaft.
 - a. LH camshaft key at about 12 o'clock
 - b. RH camshaft key at about 10 o'clock



- Position camshaft bracket.



- Be sure that bolt length under seating surface is as shown below for each camshaft.

Bolts 2, 4, 6, 8 and 10:

38 mm (1.50 in)

Bolts 1, 3, 5 and 9:

55 mm (2.17 in)

Bolt 7:

65 mm (2.56 in)

- Camshaft bracket bolts tightening procedure

STEP 1:

Tighten bolts 9 - 10 in that order then tighten bolts 1 - 8 in that order.

: 2 N·m (0.2 kg-m, 1.4 ft-lb)

STEP 2:

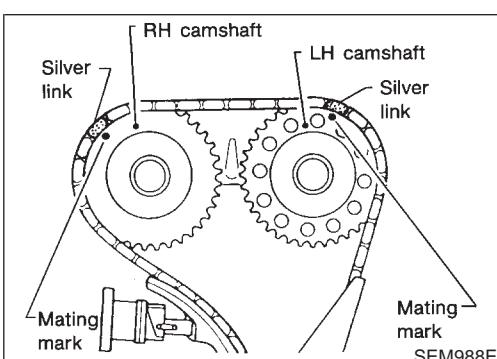
Tighten bolts in the specified order.

: 6 N·m (0.6 kg-m, 4.3 ft-lb)

STEP 3:

Tighten bolts in the specified order.

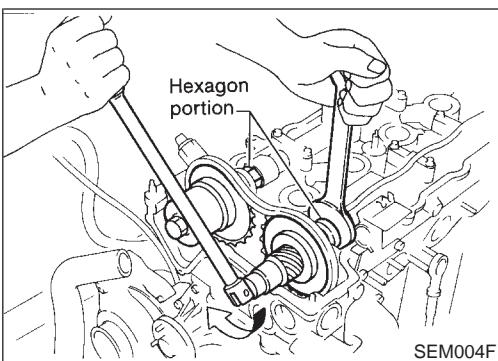
: 9.0 - 11.8 N·m (0.92 - 1.2 kg-m, 6.7 - 8.7 ft-lb)



7. Install camshaft sprockets.
Line up mating marks on timing chain with mating marks on camshaft sprockets.

CYLINDER HEAD

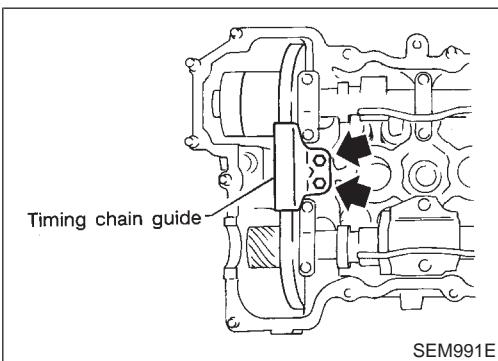
Installation (Cont'd)



- Lock camshafts as shown in figure and tighten to specified torque.

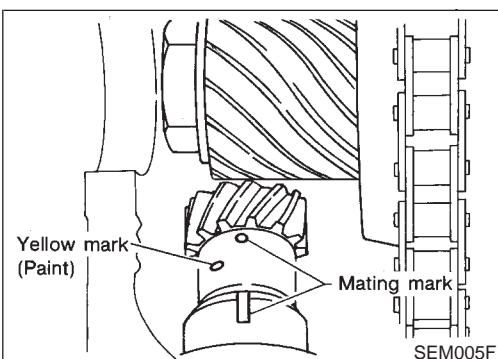
: 127 - 137 N·m (13 - 14 kg·m, 94 - 101 ft·lb)

GI



8. Install timing chain guide.

MA

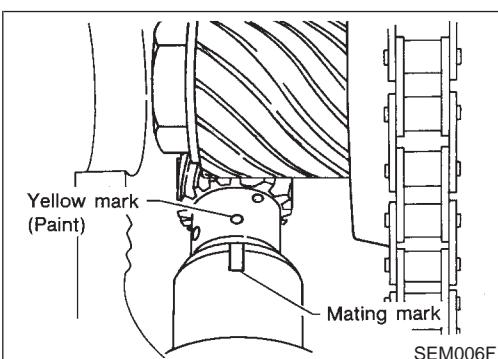


9. Install camshaft position sensor.

- Make sure that No. 1 piston is at TDC on its compression stroke.
- Set mating marks on rotor shaft of camshaft position sensor as shown.

AT

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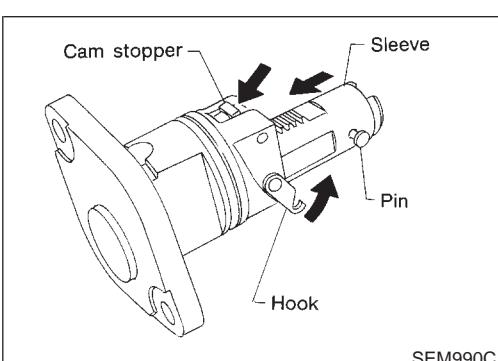
- Install camshaft position sensor aligning the center of fixing bolt hole.

- After installing, confirm that mating marks on rotor shaft of camshaft position sensor are as shown.

ST

- Tighten fixing bolts.

RS



10. Install chain tensioner.

- Make sure the camshaft sprockets are tightened completely.

Press cam stopper down and “press-in” sleeve until hook can be engaged on pin. When tensioner is bolted in position the hook will release automatically.

- If hook does not release automatically, turn crankshaft counterclockwise until it does release.

- Apply new engine oil to O-ring.

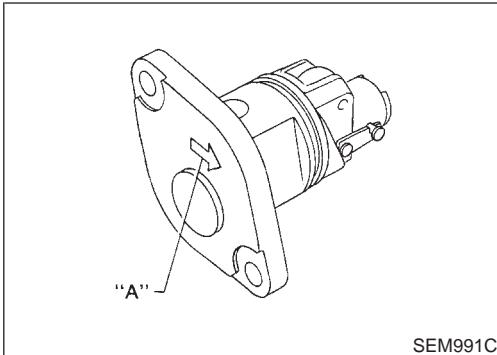
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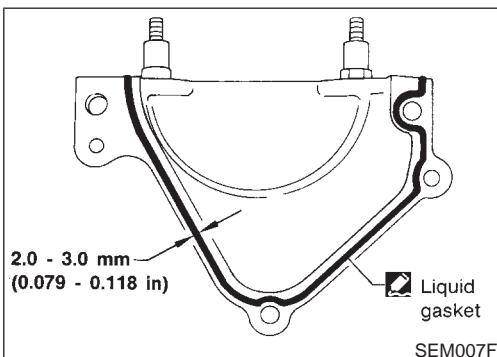
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CYLINDER HEAD

Installation (Cont'd)

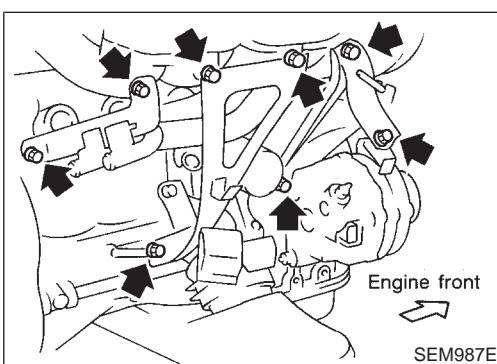


- Make sure arrow "A" points toward engine front.

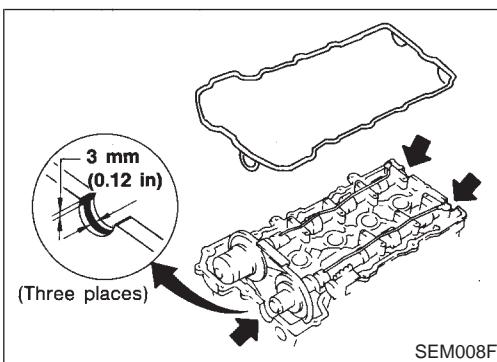


11. Install cylinder head front cover.

- Before installing, remove all traces of liquid gasket from mating surface of cylinder head and the cover using a scraper.
- Apply a continuous bead of liquid gasket to mating surface of cylinder head front cover.
- **Use Genuine Liquid Gasket or equivalent.**



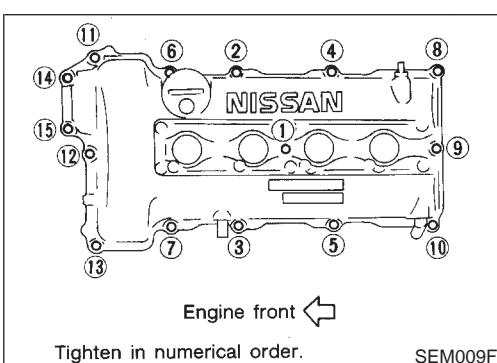
12. Install intake manifold supports.



13. Remove all old liquid gasket from mating surfaces of rocker cover and cylinder head.

14. Apply a continuous bead of liquid gasket to mating surface of rocker cover gasket and cylinder head.

- **Use Genuine Liquid Gasket or equivalent.**



15. Install rocker cover.

- 1) Tighten bolts 1 - 10 - 11 - 13 - 8 in that order to 8 to 10 N·m (0.8 to 1.0 kg-m, 69 to 89 in-lb).

- 2) Tighten bolts 1 through 13 in numerical order to 8 to 10 N·m (0.8 to 1.0 kg-m, 70 to 89 in-lb).

16. Refit spark plugs and leads.

17. Install vacuum hoses, fuel hoses, wires, harness, connectors and so on.

18. Install power steering oil pump.

19. Install water pump pulley and drive belts.

20. Install intake manifold collector and brackets.

CYLINDER HEAD

Installation (Cont'd)

21. Refit air duct to intake manifold.

GI

22. Install radiator.

23. Refit hoses and refill with coolant. (Refer to LC-15.)

24. Install engine under covers.

MA

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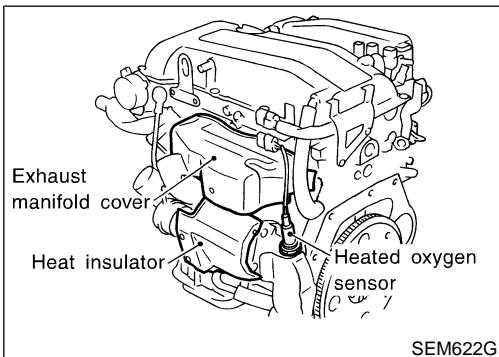
TURBOCHARGER

Removal

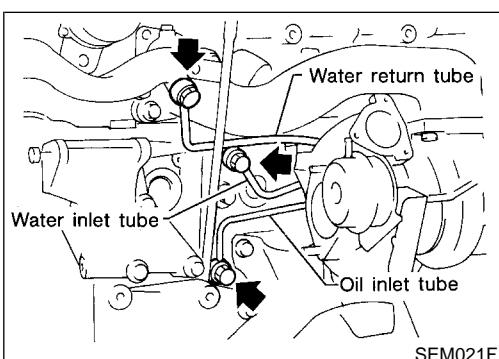
Removal

NMEM0048

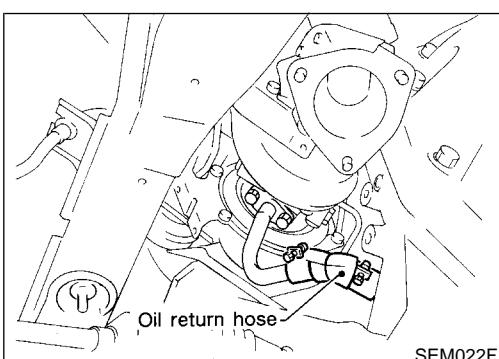
1. Drain coolant from radiator and cylinder block.
2. Remove engine under cover.
3. Remove front exhaust tube.
4. Remove air ducts for turbocharger unit.
5. Remove air cleaner case.
6. Remove wastegate valve control solenoid and its hoses.



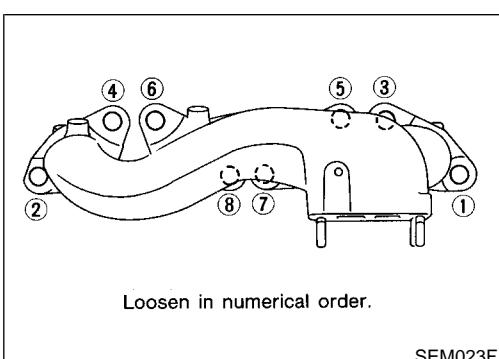
7. Remove exhaust manifold cover.
8. Remove heat insulator.
9. Remove heated oxygen sensor.



10. Remove connector bolts for water inlet and return tubes and oil inlet tube.



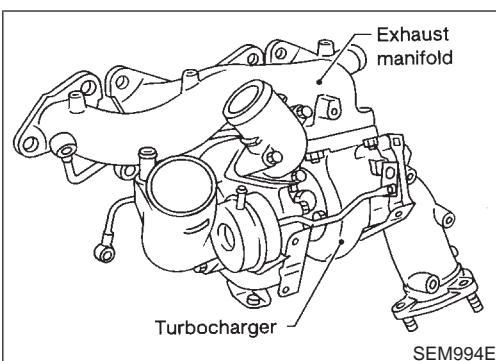
11. Remove oil return hose from cylinder block.



12. Remove exhaust manifold fixing nuts.

TURBOCHARGER

Removal (Cont'd)



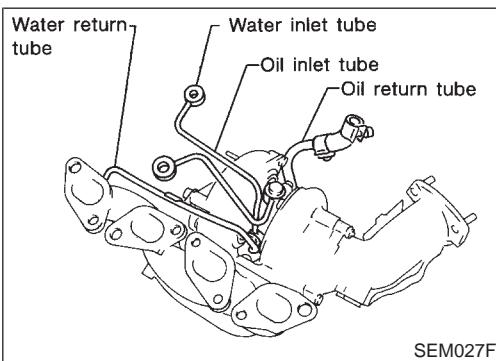
13. Remove exhaust manifold with turbocharger unit.

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Disassembly

1. Remove oil tubes and water tubes. Before removing tubes, put mating marks on tube connectors and turbocharger.

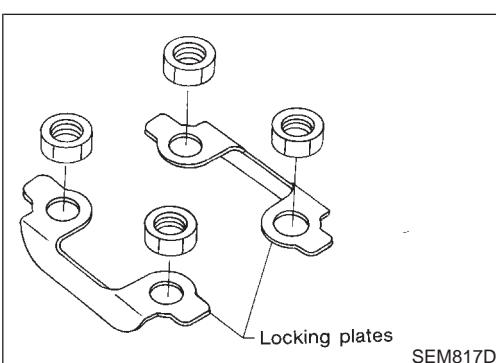
NMEM0049

EC

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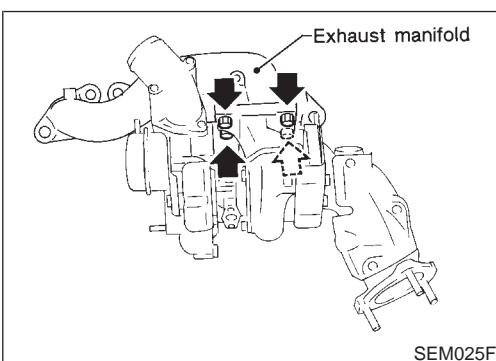
2. Unbend locking plates for turbocharger unit fastening nuts.

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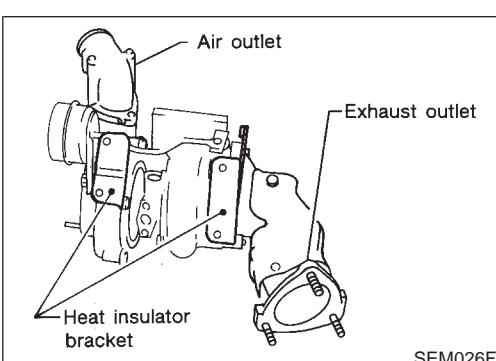
3. Remove exhaust manifold.

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4. Remove exhaust outlet, air outlet and heat insulator brackets.

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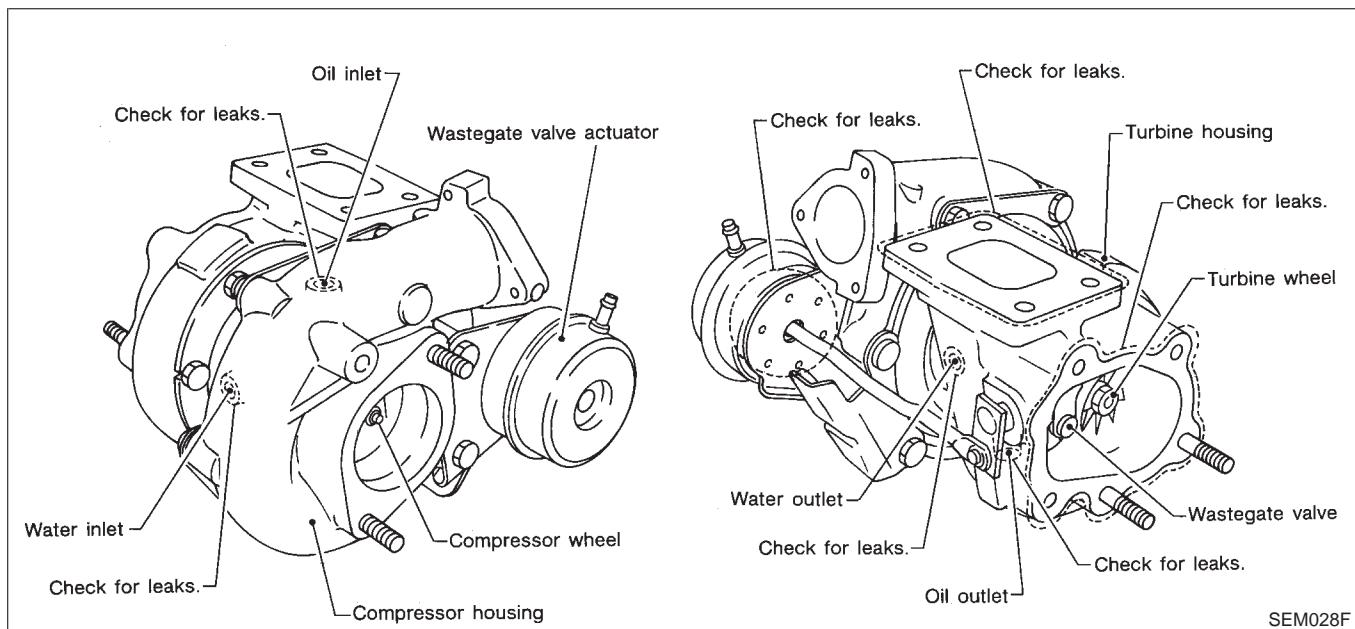
TURBOCHARGER

Inspection

Inspection

NMEM0050

Perform the following checks. If NG, replace turbocharger unit.

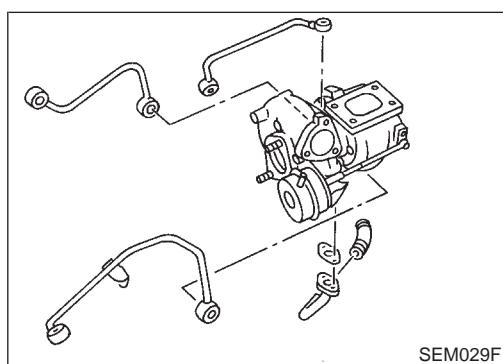


SEM028F

OIL AND WATER TUBES

Check tubes for clogging.

NMEM0050S01

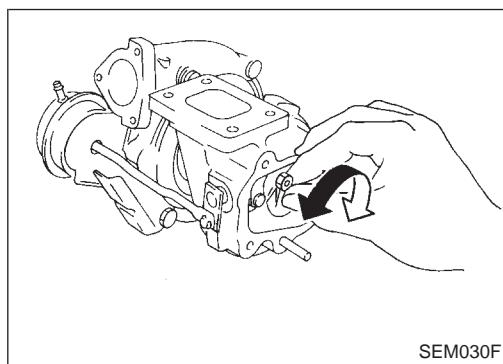


SEM029F

ROTOR SHAFT

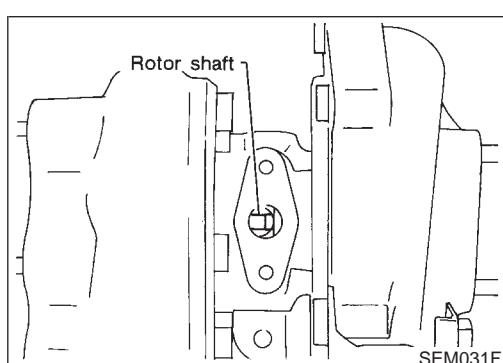
1. Check rotor shaft for smooth rotation.

NMEM0050S02



SEM030F

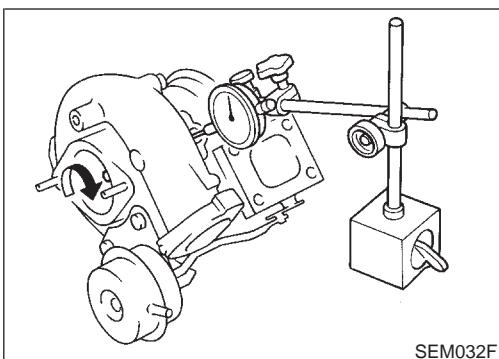
2. Check rotor shaft for carbon deposits.



SEM031F

TURBOCHARGER

Inspection (Cont'd)



3. Measure rotor shaft runout.

Runout (Total indicator reading):

Standard

0.056 - 0.127 mm (0.0022 - 0.0050 in)

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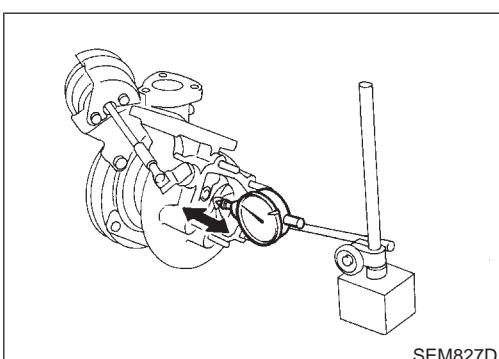
LC

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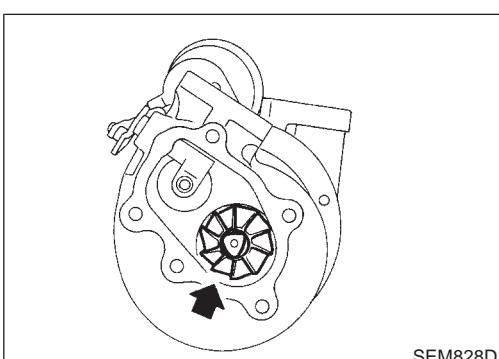
4. Measure rotor shaft end play.

End play:

Standard

0.013 - 0.097 mm (0.0005 - 0.0038 in)

- Do not allow wheels to turn when axial play is being measured.



TURBINE WHEEL

Check turbine wheel for the following.

NMEM0050S03

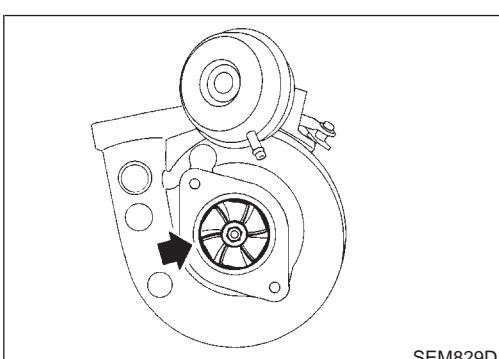
AT

- Oil
- Carbon deposits
- Deformed fins
- Contact with turbine housing

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COMPRESSOR WHEEL

Check compressor wheel for the following.

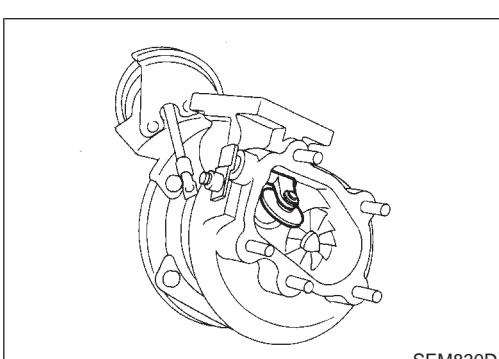
NMEM0050S04

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WASTEGATE VALVE

Remove rod pin and check wastegate valve for cracks, deformation and smooth movement. Check valve seat surface for smoothness.

NMEM0050S05

HA

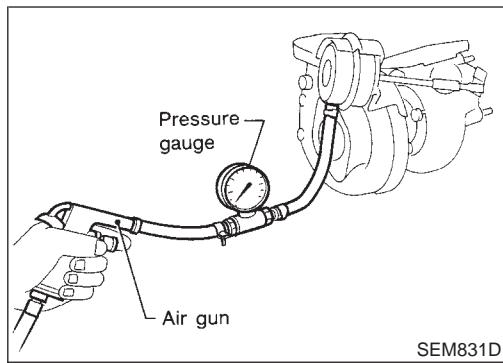
SC

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TURBOCHARGER

Inspection (Cont'd)



WASTEGATE VALVE ACTUATOR

NMEM0050S06

Apply compressed air to wastegate valve actuator and check it for smooth movement.

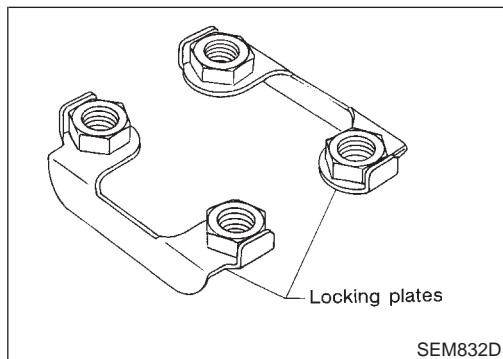
- Do not applying compressed air to the actuator continuously.
- The air pressure should be in the range of 38.7 to 44.0 kPa (290 to 330 mmHg, 11.42 to 12.99 inHg).

Assembly

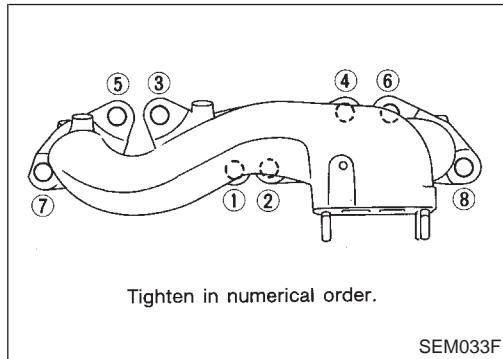
NMEM0051

Assembly is the reverse order of disassembly.

- Install gasket between exhaust manifold and turbocharger with lappet side facing exhaust manifold.



- Bend locking plates along the side of turbocharger fastening nuts.



Installation

1. Install exhaust manifold fixing nuts.

NMEM0052

2. Installation is the reverse order of removal.
 - Install oil tubes and water tubes in the following order, aligning the mating marks.
 - a. Oil feed tube
 - b. Water return tube
 - c. Water feed tube
 - d. Oil return tube
 - When installing oil and water tubes, first hand-tighten bolts connecting tubes, then slightly tighten bracket securing bolts. Finally, tighten bolts securely.
 - Be careful not to deform tubes.

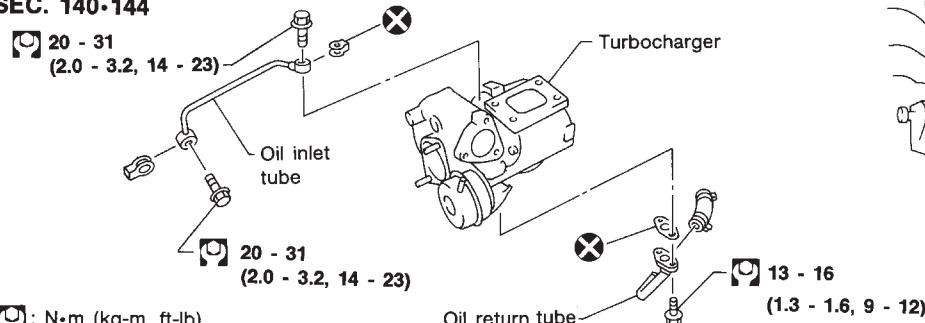
TURBOCHARGER

Installation (Cont'd)

- After installation, run engine for a few minutes, and check for oil or water leakage.

OIL TUBES

SEC. 140-144



NMEM0052S01

SLC983A

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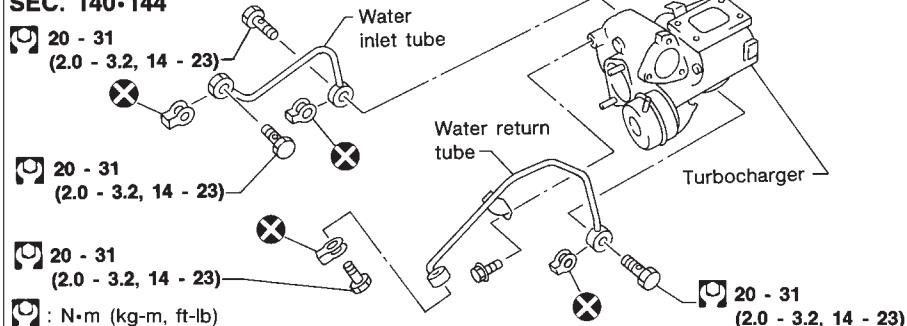
SC

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IDX

WATER TUBES

SEC. 140-144



NMEM0052S02

SLC984A

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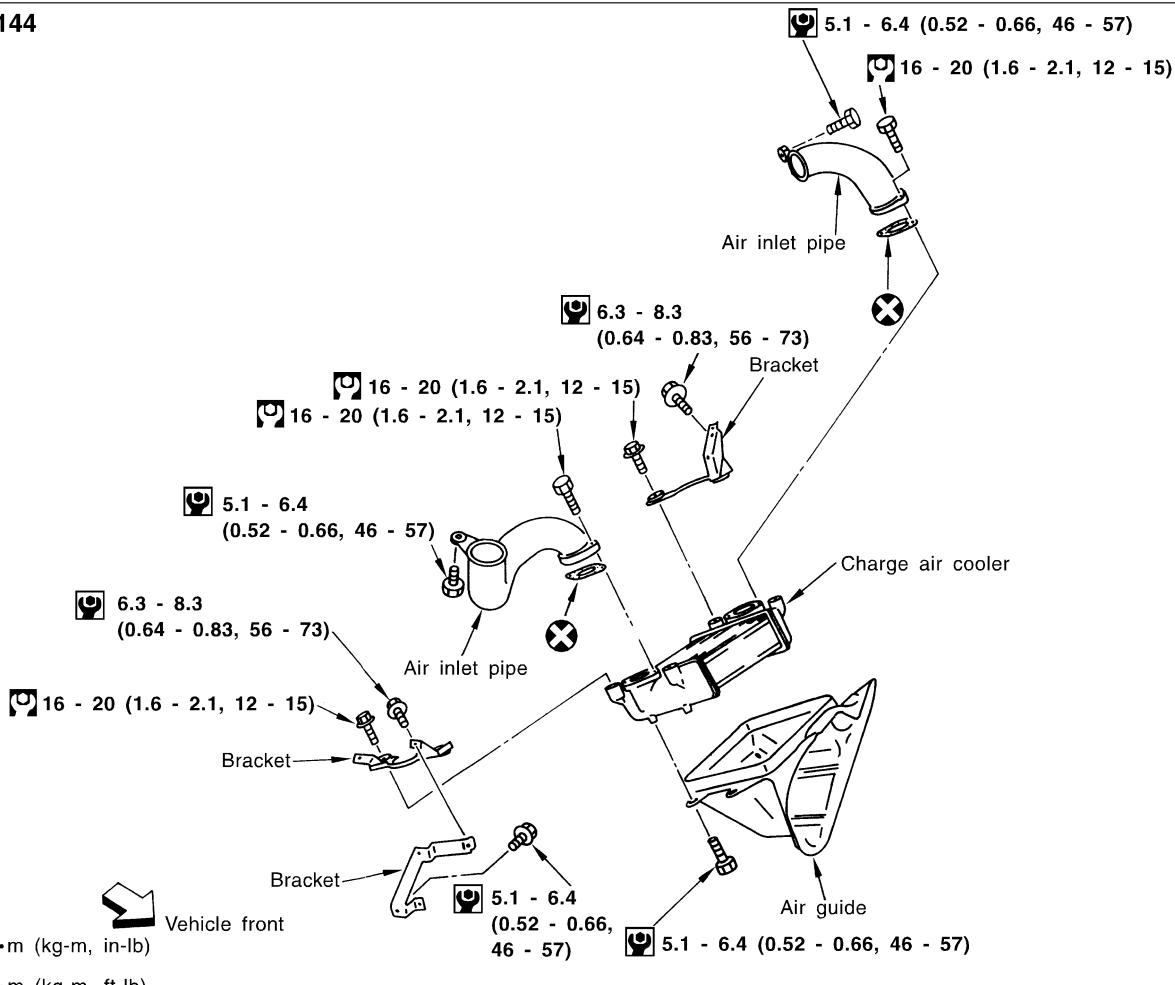
CHARGE AIR COOLER

Removal and Installation

Removal and Installation

NMEM0053

SEC. 144



SEM623G

Inspection

NMEM0054

Check air passages of charge air cooler core and fins for clogging, leaks or deformation. Clean or replace charge air cooler if necessary.

- Be careful not to deform core fins.
- For cleaning procedure of charge air cooler core, refer to LC-11, "CHECKING RADIATOR".

ENGINE ASSEMBLY

Removal and Installation

Removal and Installation

NMEM0022

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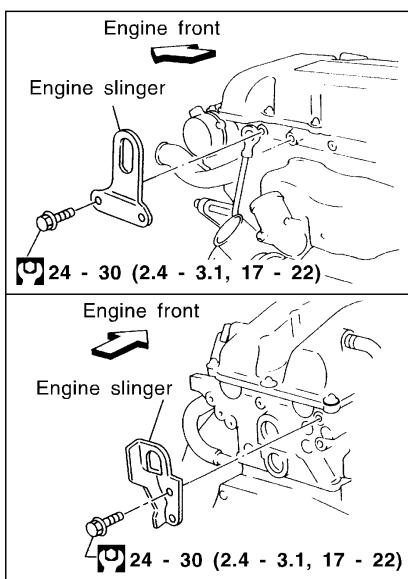
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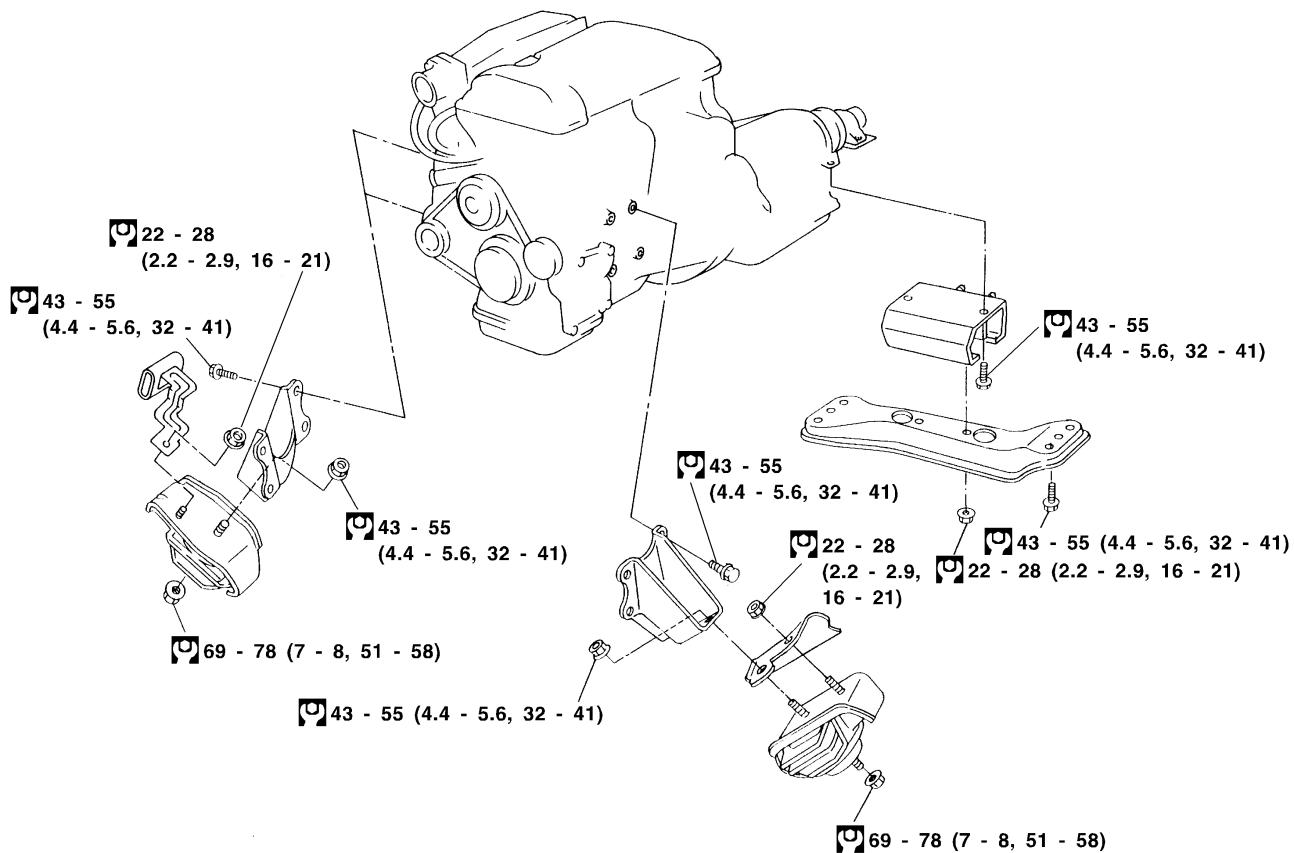
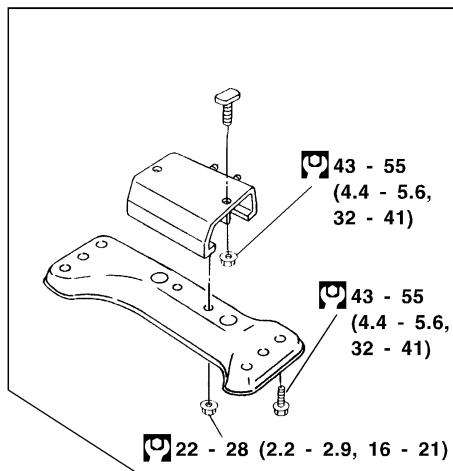
EL

IDX

SEC. 112•111



M/T model



● : N·m (kg·m, ft-lb)

SEM626G

ENGINE ASSEMBLY

Removal and Installation (Cont'd)

WARNING:

- Position vehicle on a flat and solid surface.
- Place chocks at front and back of rear wheels.
- Do not remove engine until exhaust system has completely cooled off, otherwise you may burn yourself and/or fire may break out in fuel line.
- Before disconnecting fuel hose, release pressure. Refer to EC-27, "Fuel Pressure Release".
- Be sure to lift engine and transmission in a safe manner.
- For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG.

CAUTION:

- When lifting engine, be sure to clear surrounding parts. Use special care near accelerator wire casing, brake lines and brake master cylinder.
- In lifting the engine, always use engine slingers in a safe manner.

REMOVAL

NMEM0022S01

1. Remove transmission. Refer AT-208 or MT-12, "Removal".
2. Remove engine under covers and hood.
3. Drain coolant from both cylinder block and radiator. Refer to LC-15, "Changing Engine Coolant".
4. Drain engine oil.
5. Remove air cleaner assembly and duct.
6. Remove the battery and battery tray.
7. Disconnect the following:
 - Vacuum hoses
 - Heater hoses
 - A/T cooler hoses
 - Power steering hoses
 - Fuel lines
 - Wires
 - Harnesses and connectors
 - Throttle cable
8. Remove the cooling fans, radiator and reservoir tank.
9. Remove front exhaust pipe.
10. Remove the drive belts.
11. Remove power steering oil pump and A/C compressor.
12. Attach a suitable engine slinger to cylinder head.
13. Set a suitable hoist on engine slinger.

ENGINE ASSEMBLY

Removal and Installation (Cont'd)

14. Remove engine mounting bolts from both sides, then slowly raise engine.

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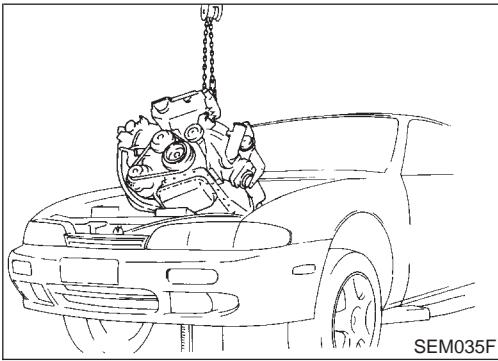
LC

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15. Remove engine as shown.

NMEM0022S02

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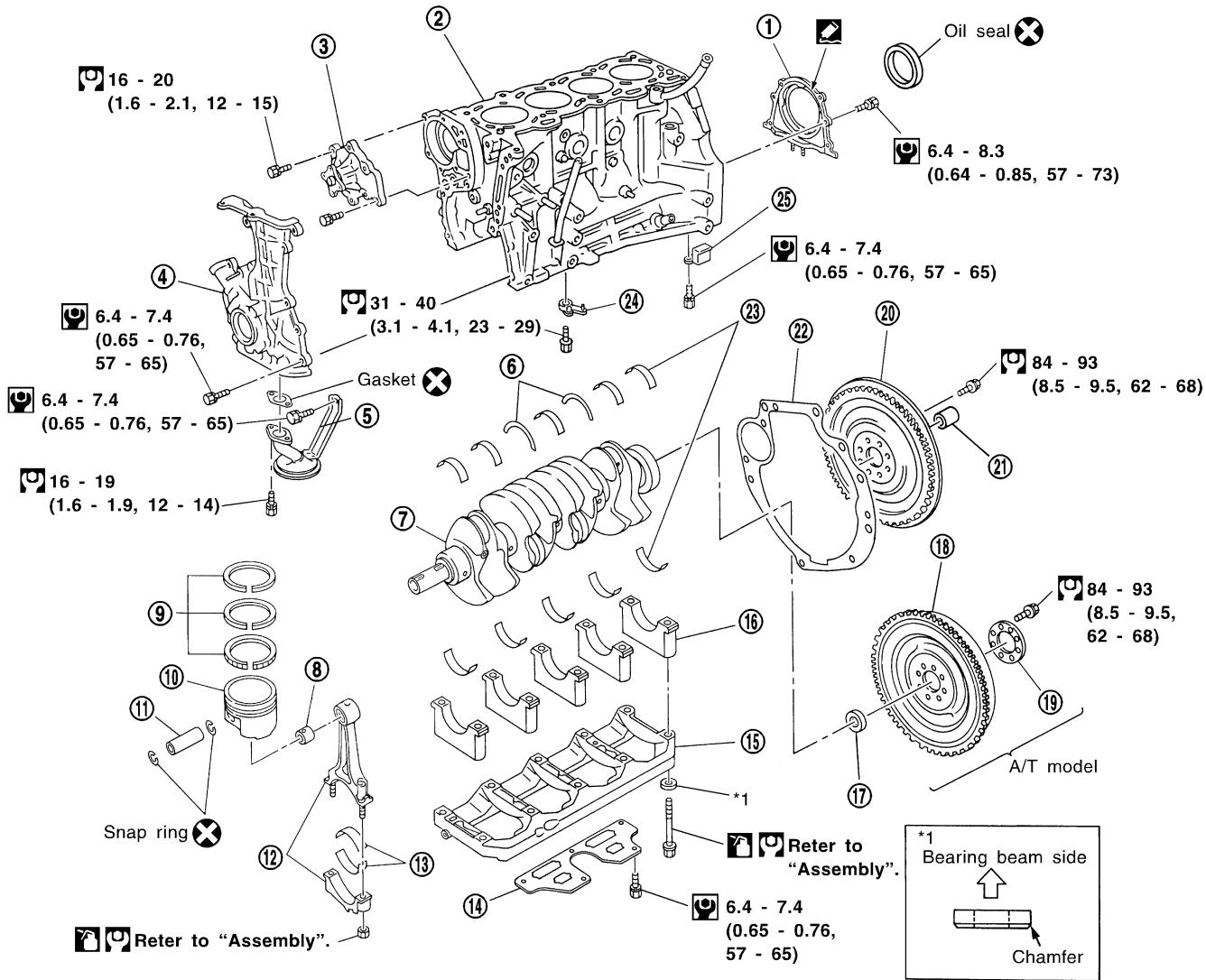
IDX

CYLINDER BLOCK

Components

NMME0023

SEC. 110•120



① : Apply new engine oil.

② : Apply liquid gasket.

③ : N•m (kg-m, ft-lb)

④ : N•m (kg-m, in-lb)

SEM625G

1. Rear oil seal retainer
2. Cylinder block
3. Water pump
4. Front cover with oil pump
5. Oil strainer
6. Thrust bearing
7. Crankshaft
8. Connecting rod bushing
9. Piston rings
10. Piston
11. Piston pin
12. Connecting rod
13. Connecting rod bearing
14. Baffle plate
15. Main bearing beam
16. Main bearing cap
17. Pilot converter
18. Drive plate
19. Reinforcement plate
20. Flywheel
21. Pilot bushing
22. Rear plate
23. Main bearing
24. Oil jet
25. Baffle plate

Removal and Installation

NMEM0024

GI

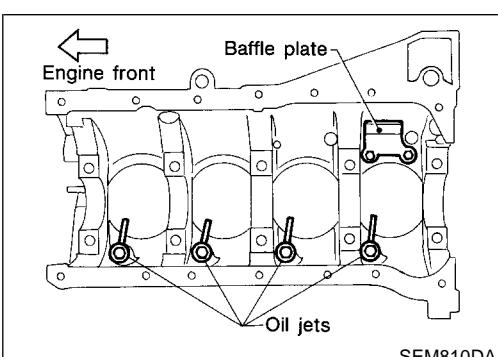
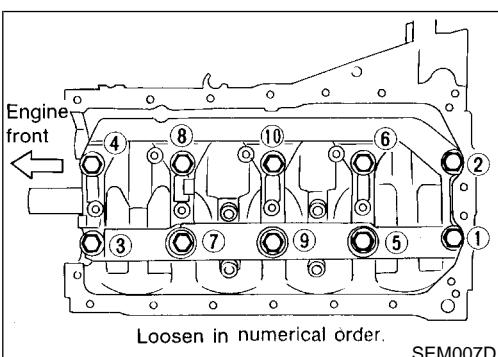
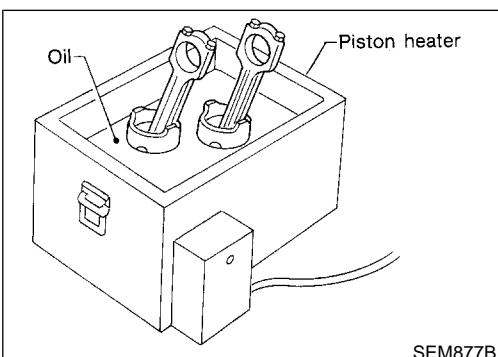
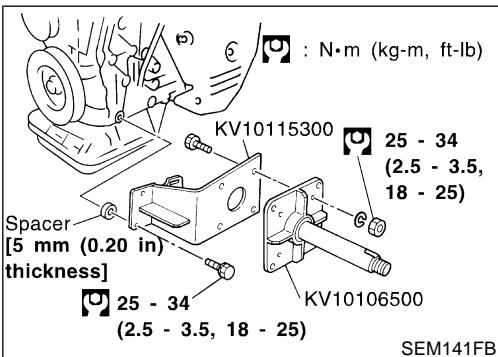
CAUTION:

- When installing sliding parts (bearings, pistons, etc.), lubricate contacting surfaces with new engine oil.
- Place removed parts such as bearings and bearing caps in their proper order and direction.
- When installing connecting rod nuts and main bearing cap bolts, apply new engine oil to threads and seating surfaces.
- Do not allow any magnetic materials to contact the ring gear teeth of flywheel or drive plate.

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Disassembly

PISTON AND CRANKSHAFT

NMEM0025

EC

NMEM0025S01

- Place engine on engine stand (ST0501S000).
- Remove cylinder head.
Refer to EM-39, "Removal".
- Remove oil pan.
Refer to EM-20, "Removal".
- Remove timing chain. Refer to EM-26, "Removal".
- Remove pistons with connecting rods.
 - To disassemble piston and connecting rod, first remove snap rings. Heat piston to 60 to 70°C (140 to 158°F) then use piston pin press to remove pin.
 - When piston rings are not replaced, make sure that piston rings are mounted in their original positions.**
 - When replacing piston rings, if there is no punchmark, install with either side up.**
- Remove rear oil seal retainer.
- Remove main bearing cap and crankshaft as shown.
 - Bolts should be loosened in two or three steps.**
 - Before removing thrust bearing cap, measure crankshaft end play. Refer to EM-92.**
 - Before removing connecting rods, measure connecting rod side clearance. Refer to EM-91.**
- Remove baffle plate.
- Remove oil jets.

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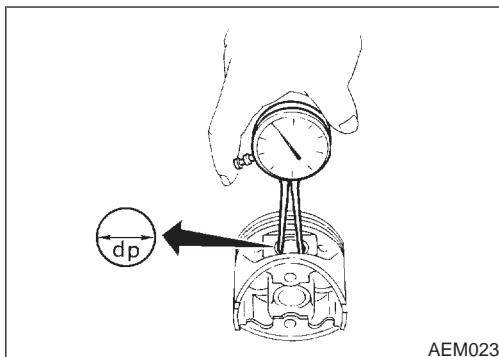
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CYLINDER BLOCK

Inspection



Inspection

PISTON AND PISTON PIN CLEARANCE

NMEM0026

NMEM0026S01

1. Measure inner diameter of piston pin hole "dp".

Standard diameter "dp":

21.987 - 21.999 mm (0.8656 - 0.8661 in)

2. Measure outer diameter of piston pin "Dp".

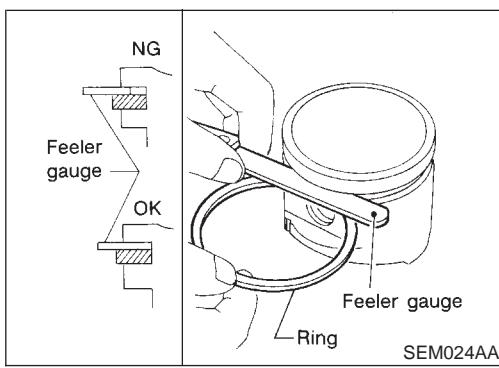
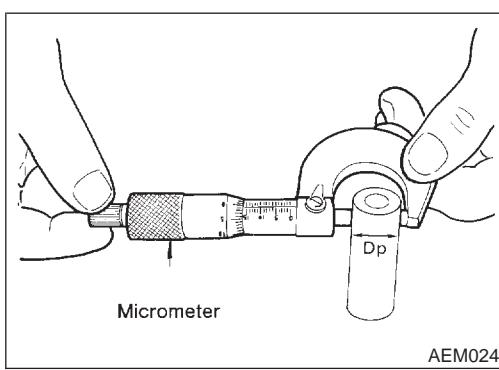
Standard diameter "Dp":

21.989 - 22.001 mm (0.8657 - 0.8622 in)

3. Calculate interference fit of piston pin to piston.

D_p - d_p: -0.004 - 0 mm (-0.0002 - 0 in)

If it exceeds the above value, replace piston assembly with pin.



PISTON RING SIDE CLEARANCE

NMEM0026S02

Side clearance:

Top ring

0.045 - 0.080 mm (0.0018 - 0.0031 in)

2nd ring

0.030 - 0.065 mm (0.0012 - 0.0026 in)

Max. limit of side clearance:

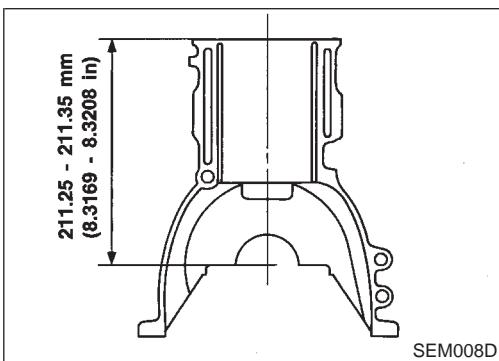
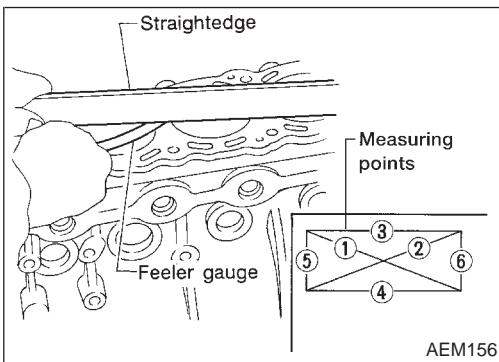
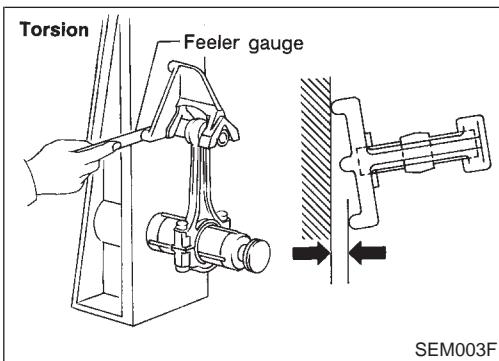
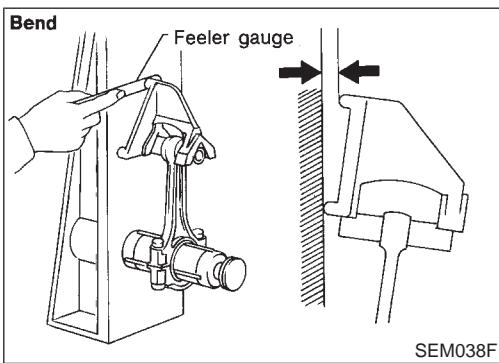
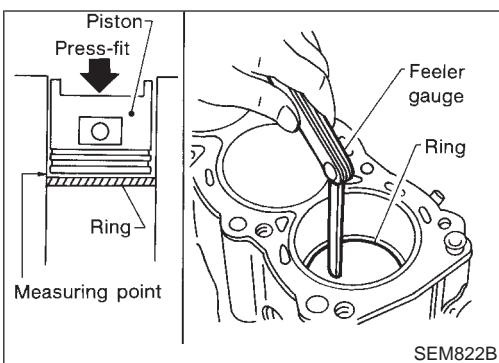
Top and 2nd ring

0.1 mm (0.004 in)

If out of specification, replace piston and/or piston ring. If clearance exceeds maximum limit with new ring, replace piston.

CYLINDER BLOCK

Inspection (Cont'd)



PISTON RING END GAP

NMEM0026S03

End gap:

Top ring 0.20 - 0.30 mm (0.0079 - 0.0118 in)

2nd ring 0.35 - 0.50 mm (0.0138 - 0.0197 in)

Oil ring 0.20 - 0.60 mm (0.0079 - 0.0236 in)

Max. limit of ring gap:

Top ring 0.39 mm (0.0154 in)

2nd ring 0.59 mm (0.0232 in)

Oil ring 0.60 mm (0.0236 in)

If out of specification, replace piston ring. If gap exceeds maximum limit with a new ring, rebore cylinder and use oversized piston and piston rings. Refer to SDS, EM-90.

- When replacing the piston, check cylinder block surface for scratches or seizure. If scratches or seizure are found, hone or replace the cylinder block.

CONNECTING ROD BEND AND TORSION

NMEM0026S04

Bend:

**Limit 0.15 mm (0.0059 in)
per 100 mm (3.94 in) length**

Torsion:

**Limit 0.30 mm (0.0118 in)
per 100 mm (3.94 in) length**

If it exceeds the limit, replace connecting rod assembly.

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CYLINDER BLOCK DISTORTION AND WEAR

NMEM0026S05

Clean upper surface of cylinder block.

Use a reliable straightedge and feeler gauge to check the flatness of cylinder block surface. Check along six positions shown in figure.

Block surface flatness:

Standard Less than 0.03 mm (0.0012 in)

Limit 0.10 mm (0.0039 in)

If out of specification, resurface it.

The limit for cylinder block resurfacing is determined by the amount of cylinder head resurfacing.

Amount of cylinder head resurfacing is "A".

Amount of cylinder block resurfacing is "B".

The maximum limit is as follows:

$A + B = 0.2 \text{ mm (0.008 in)}$

**Nominal cylinder block height
from crankshaft center:**

211.25 - 211.35 mm (8.3169 - 8.3208 in)

If necessary, replace cylinder block.

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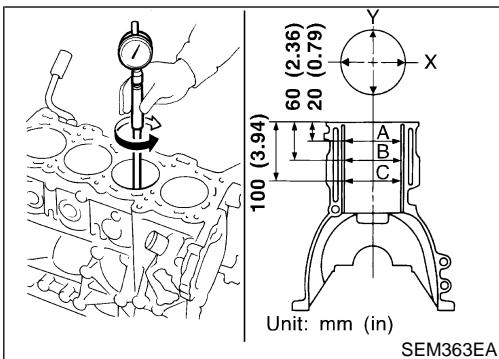
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CYLINDER BLOCK

Inspection (Cont'd)



PISTON-TO-BORE CLEARANCE

NMME0026S06

- Using a bore gauge, measure cylinder bore for wear, out-of-round and taper.

Standard inner diameter:

86.000 - 86.030 mm (3.3858 - 3.3870 in)

Wear limit:

0.20 mm (0.0079 in)

Out-of-round (X - Y) standard:

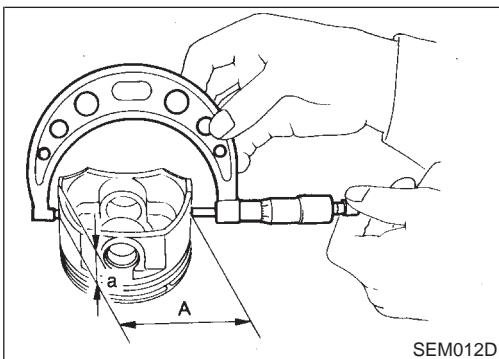
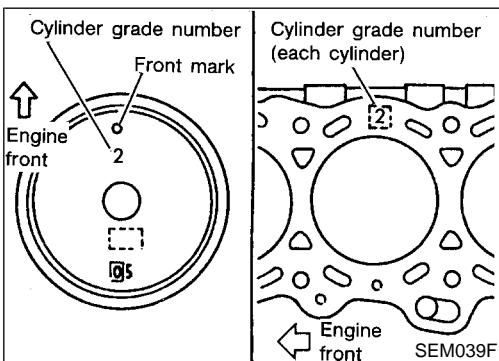
0.015 mm (0.0006 in)

Taper (A - B and A - C) standard:

0.010 mm (0.0004 in)

If it exceeds the limit, reboore all cylinders. Replace cylinder block if necessary.

- Check for score and seizure. If seizure is found, hone it.
- If cylinder block and piston are replaced, match piston grade number with grade number on cylinder block upper surface.



- Measure piston skirt diameter.

Piston diameter "A": Refer to SDS, EM-90.

Measuring point "a" (Distance from the top):

10.5 mm (0.413 in)

- Check that piston-to-bore clearance is within specification.

Piston-to-bore clearance = bore measurement "C" - Piston diameter "A":

0.010 - 0.030 mm (0.0004 - 0.0012 in)

- Determine piston oversize according to amount of cylinder wear.

Oversize pistons are available for service. Refer to SDS, EM-90.

- Cylinder bore size is determined by adding piston-to-bore clearance to piston diameter "A".

Rebored size calculation:

$$D = A + B - C$$

where,

D: Bored diameter

A: Piston diameter as measured

B: Piston-to-bore clearance

C: Honing allowance 0.02 mm (0.0008 in)

- Install main bearing caps and bearing beam, and tighten to the specified torque. This will prevent distortion of cylinder bores, otherwise cylinder bores may be distorted in final assembly. Refer to EM-79, "Crankshaft".

- Cut cylinder bores.

• When any cylinder needs boring, all other cylinders must also be bored.

• Do not cut too much out of cylinder bore at a time. Cut only 0.05 mm (0.0020 in) or so at a time.

- Hone cylinders to obtain specified piston-to-bore clearance.

- Measure finished cylinder bore for out-of-round and taper.

CYLINDER BLOCK

Inspection (Cont'd)

- Measurement should be done after cylinder bore cools down.

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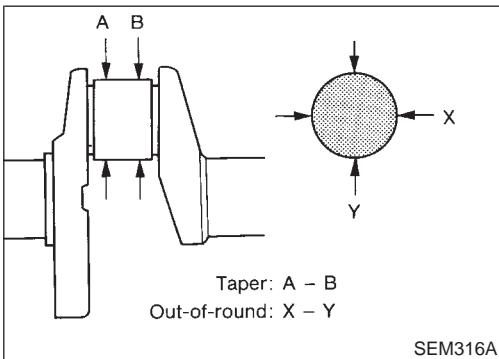
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CRANKSHAFT

1. Check crankshaft main and pin journals for score, wear or cracks.
2. With a micrometer, measure journals for taper and out-of-round.

Out-of-round (X - Y):

Taper (A - B):

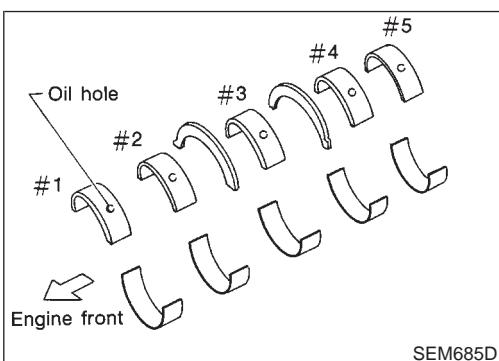
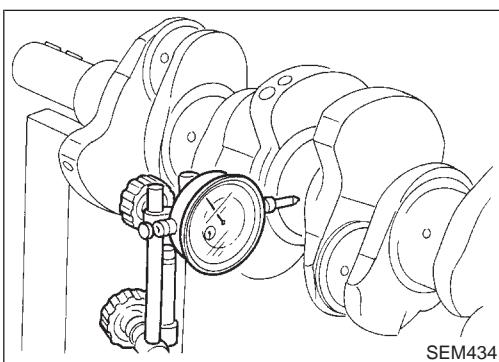
Main journal: Less than 0.005 mm (0.0002 in)

Pin journal: Less than 0.003 mm (0.0001 in)

3. Measure crankshaft runout.

Runout (Total indicator reading):

Less than 0.05 mm (0.0020 in)



BEARING CLEARANCE

- Use Method A or Method B. Method A is preferred because it is more accurate.

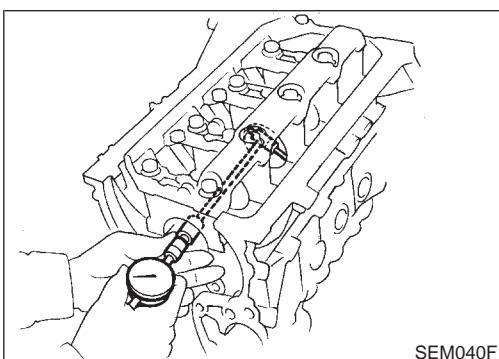
Method A (Using bore gauge and micrometer)

Main bearing

1. Set main bearings in their proper positions on cylinder block and main bearing cap.
2. Install main bearing cap and main bearing beam to cylinder block.

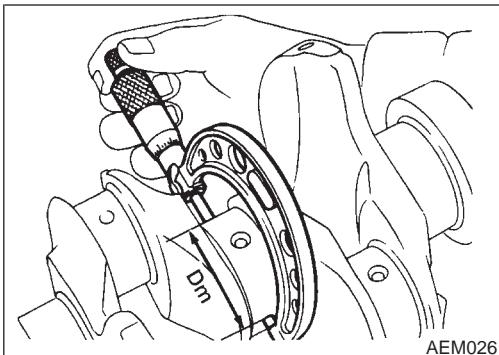
Tighten all bolts in correct order in two or three stages. Refer to EM-79.

3. Measure inner diameter "A" of each main bearing.



CYLINDER BLOCK

Inspection (Cont'd)



4. Measure outer diameter "Dm" of each crankshaft main journal.
5. Calculate main bearing clearance.

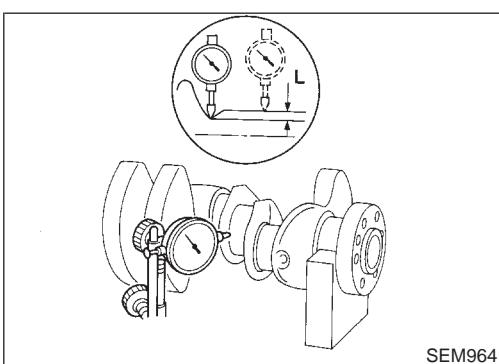
Main bearing clearance = A - Dm

Standard: 0.004 - 0.022 mm (0.0002 - 0.0009 in)

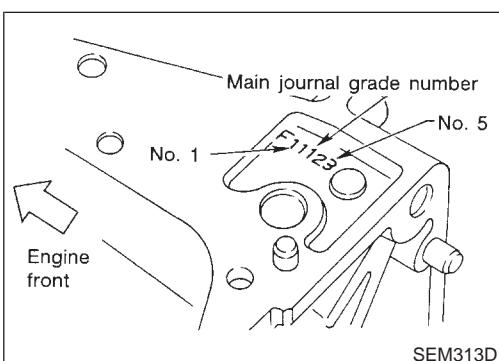
Limit: 0.050 mm (0.0020 in)

If it exceeds the limit, replace bearing.

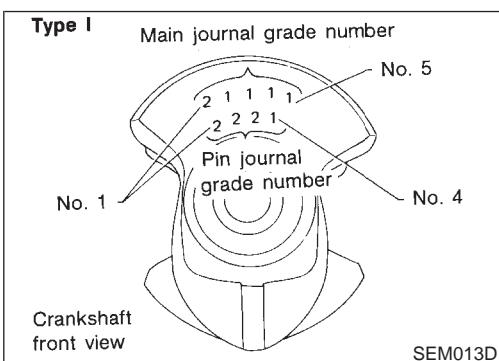
- If clearance cannot be adjusted within the standard of any bearing, grind crankshaft main journal and use undersized bearing.



- When grinding crankshaft journal, confirm that "L" dimension in fillet roll is more than the specified limit.
"L": 0.05 mm (0.0020 in)
- Refer to SDS, EM-92 for grinding crankshaft and available service parts.



- If crankshaft is replaced, select thickness of main bearings as follows:
- a. Grade number of each cylinder block main journal is punched on the respective cylinder block. These numbers are punched in either Arabic or Roman numerals.



- b. Grade number of each crankshaft main journal is punched on the respective crankshaft. These numbers are punched in either Arabic or Roman numerals.
- c. Select main bearing with suitable thickness according to the following table.

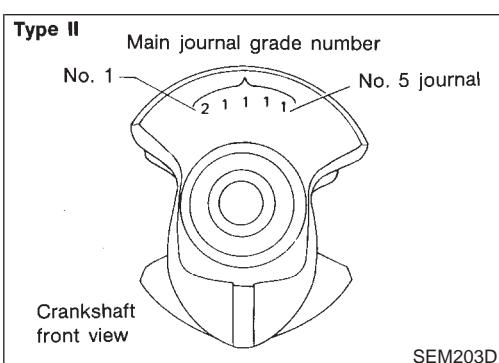
How to Select Main Bearings (Identification mark and color)

NMEM0026S0803

Crankshaft main journal grade number	Cylinder block main journal grade number			
	0	1	2	3
0	0 (A, Black)	1 (B, Brown)	2 (C, Green)	3 (D, Yellow)
1	1 (B, Brown)	2 (C, Green)	3 (D, Yellow)	4 (E, Blue)
2	2 (C, Green)	3 (D, Yellow)	4 (E, Blue)	5 (F, Pink)
3	3 (D, Yellow)	4 (E, Blue)	5 (F, Pink)	6 (G, No color)

For example:

Cylinder block main journal grade number: 1



Crankshaft main journal grade number: 2
Main bearing grade number = 1 + 2
= 3 (D, Yellow)

GI

MA

EM

LC

EC

FE

CL

MT

AT

PD

AX

SU

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RS

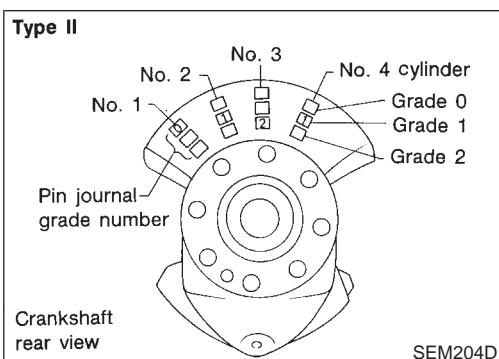
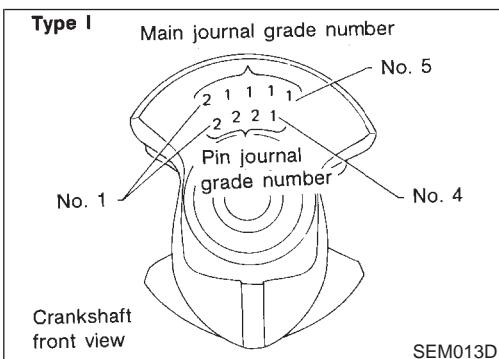
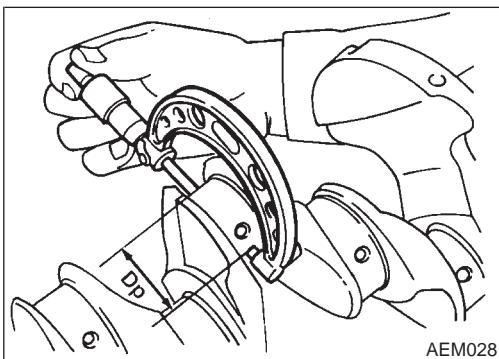
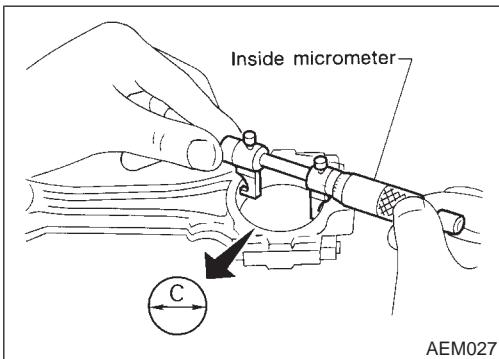
BT

HA

SC

EL

IDX



Connecting Rod Bearing (Big end)

- NMME0026S0802
1. Install connecting rod bearing to connecting rod and cap.
 2. Install connecting rod cap to connecting rod.

Tighten bolts to the specified torque. Refer to EM-79.

3. Measure inner diameter "C" of each bearing.

4. Measure outer diameter "Dp" of corresponding crankshaft pin journal.
5. Calculate connecting rod bearing clearance.

Connecting rod bearing clearance = C - Dp

Standard: 0.020 - 0.045 mm (0.0008 - 0.0018 in)

Limit: 0.065 mm (0.0026 in)

If it exceeds the limit, replace bearing.

- If clearance cannot be adjusted within the standard of any bearing, grind crankshaft journal and use undersized bearing. Refer to EM-73 for fillet roll remarks, grinding crankshaft and available service parts.
- If crankshaft is replaced with a new one, select connecting rod bearing according to the following table.

Connecting rod bearing grade number:

These numbers are punched in either Arabic or Roman numerals.

Crank pin grade number	Connecting rod bearing grade number
0	0
1	1
2	2

Identification color:

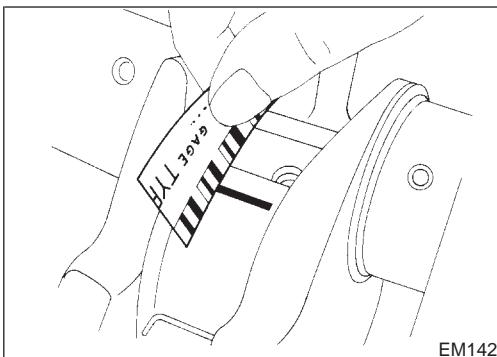
Grade 0; No color

Grade 1; Black

Grade 2; Brown

CYLINDER BLOCK

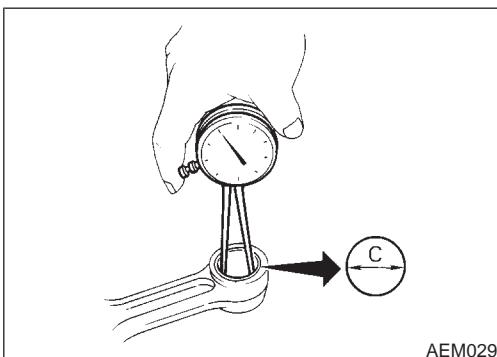
Inspection (Cont'd)



Method B (Using Plastigage)

CAUTION:

- Do not turn crankshaft or connecting rod while Plastigage is being inserted.
- If incorrect bearing clearance exists, use a thicker or undersized main bearing to ensure specified clearance.



CONNECTING ROD BUSHING CLEARANCE (SMALL END)

1. Measure inner diameter "C" of bushing.

NMEM0026S09

2. Measure outer diameter "Dp" of piston pin.

3. Calculate connecting rod bushing clearance.

$$\text{Connecting rod bushing clearance} = C - D_p$$

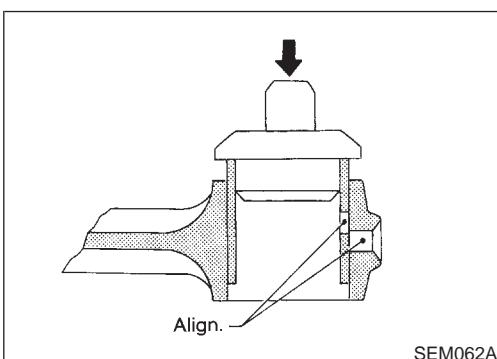
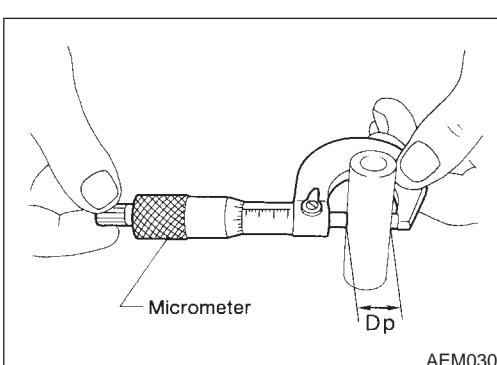
Standard:

0.005 - 0.017 mm (0.0002 - 0.0007 in)

Limit:

0.023 mm (0.0009 in)

If it exceeds the limit, replace connecting rod assembly or connecting rod bushing and/or piston set with pin.



REPLACEMENT OF CONNECTING ROD BUSHING (SMALL END)

1. Drive in small end bushing until it is flush with end surface of rod.

NMEM0026S10

Be sure to align the oil holes.

2. Ream the bushing so that clearance with piston pin is within specification.

Clearance between connecting rod bushing and piston pin:

0.005 - 0.017 mm (0.0002 - 0.0007 in)

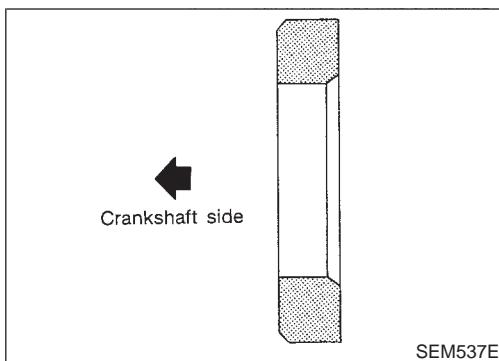
REPLACEMENT OF PILOT BUSHING (M/T) OR PILOT CONVERTER (A/T)

1. Remove pilot bushing from flywheel or pilot converter from crankshaft using Tool or other suitable tool.

NMEM0026S11

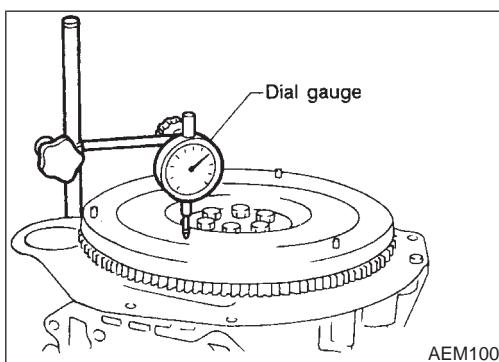
CYLINDER BLOCK

Inspection (Cont'd)



- Install pilot bushing into flywheel or pilot converter onto crank-shaft as shown.

GI



FLYWHEEL/DRIVE PLATE RUNOUT

CAUTION:

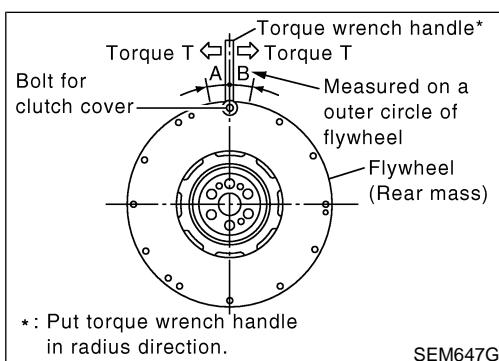
- Be careful not to damage the ring gear teeth.
- Check the drive plate for deformation or cracks.
- Do not allow any magnetic materials to contact the ring gear teeth.
- Do not resurface or disassemble flywheel. Replace as necessary.

EC

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NMEM0026S12



Runout (Total indicator reading):

Flywheel (M/T model)

Less than 0.45 mm (0.0177 in) on a circle of 210 mm (8.27 in) diameter

MT

Drive plate (A/T model)

Less than 0.20 mm (0.0079 in)

AT

Flywheel free play (MT model) installed on crankshaft:

Axial direction

Less than 0.8 mm (0.031 in)/Applied force 100 N (10.2 kg, 22.5 lb) on a circle of 250 mm (9.84 in) diameter

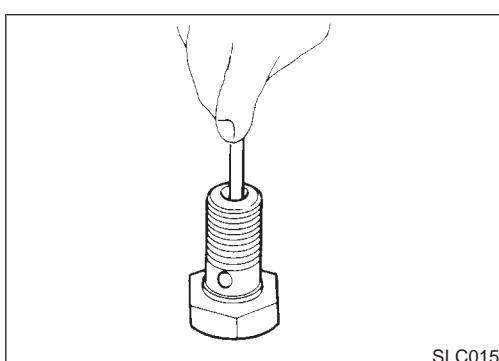
AX

Rotational direction

A+B (shown in figure) should be less than 29 mm (1.14 in)/Applied torque T of 9.8 N·m (1.0 kg-m, 87 in-lb)

SU

BR



OIL JET (FOR PISTON)

- Blow through outlet of oil jet and make sure that air comes out of inlet.
- Push cut-off valve of oil jet bolt with a clean resin or brass rod and make sure that cut-off valve moves smoothly with proper repulsion.

NMEM0026S13

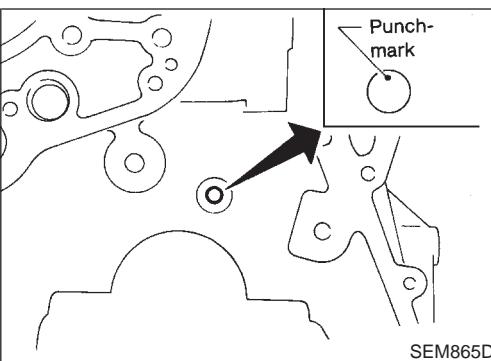
SC

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IDX

CYLINDER BLOCK

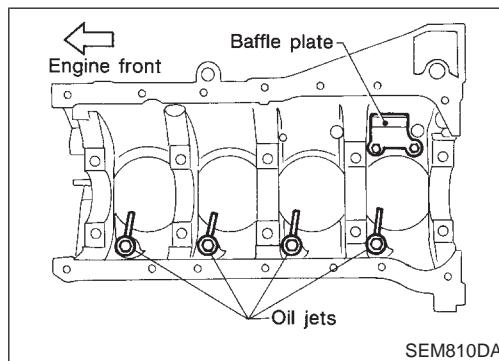
Assembly



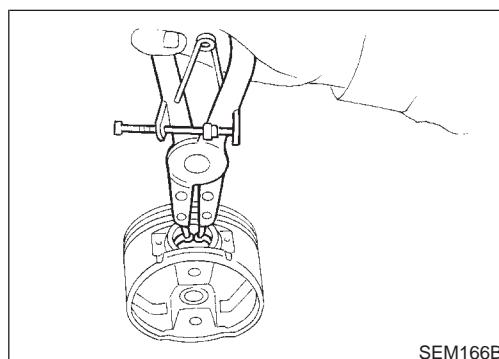
Assembly

NMEM0027

1. Install timing chain oil jet.
Drive oil jet into cylinder block with punchmark facing up.



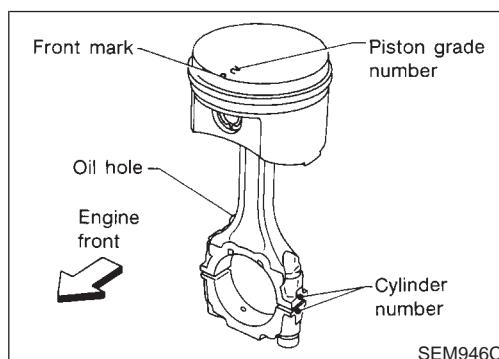
2. Install piston oil jets.
Align oil jet bosses with holes on the cylinder block.
3. Install baffle plate.



PISTON

NMEM0027S01

1. Install new snap ring on one side of piston pin hole.

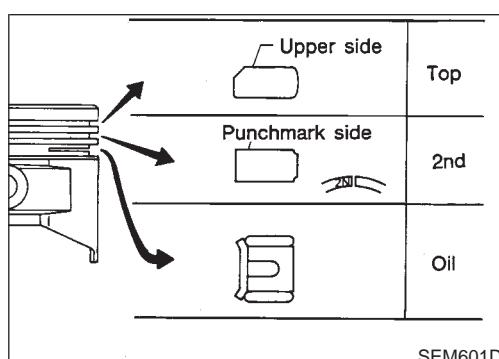


2. Heat piston to 60 to 70°C (140 to 158°F) and assemble piston, piston pin, connecting rod and new snap ring.
 - Align the direction of piston and connecting rod.
 - Numbers stamped on connecting rod and cap correspond to each cylinder.
 - After assembly, make sure connecting rod swings smoothly.

3. Set piston rings as shown.

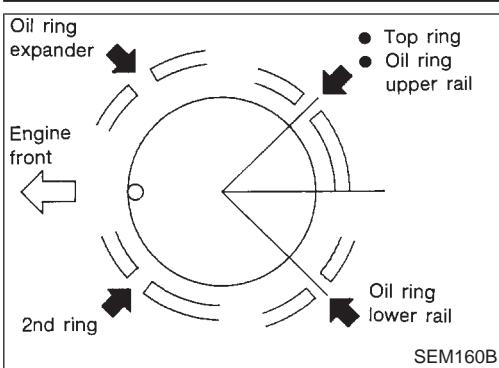
CAUTION:

- When piston rings are not replaced, make sure that piston rings are mounted in their original positions.
- Install new piston rings either side up if there is no punch mark.



CYLINDER BLOCK

Assembly (Cont'd)



- Align piston rings so that end gaps are positioned as shown.

GI

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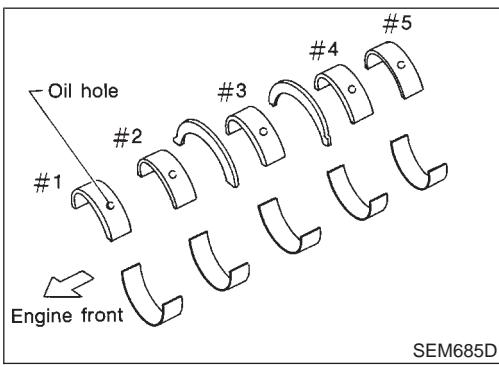
BT

HA

SC

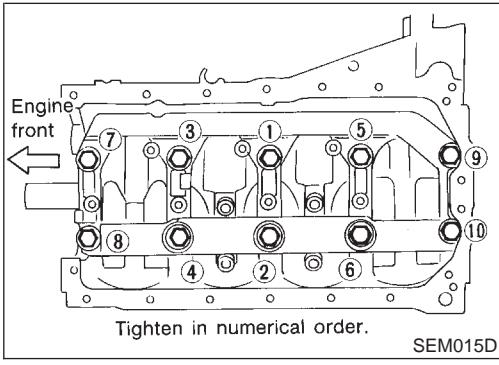
EL

IDX

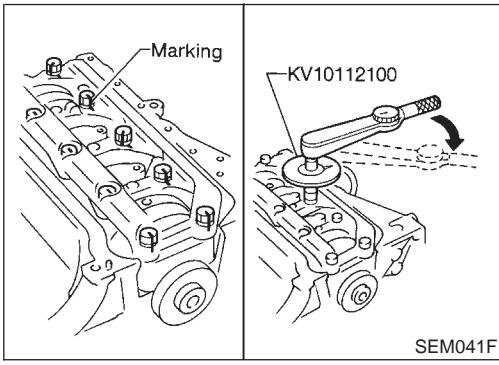


CRANKSHAFT

- Set main bearings in their proper positions on cylinder block and main bearing cap.
- Confirm that correct main bearings are selected by using Method A or Method B. Refer to EM-73.**
- Apply new engine oil to bearing surfaces.
- Direct the oil grooved side of the thrust bearings to crankshaft arm side.



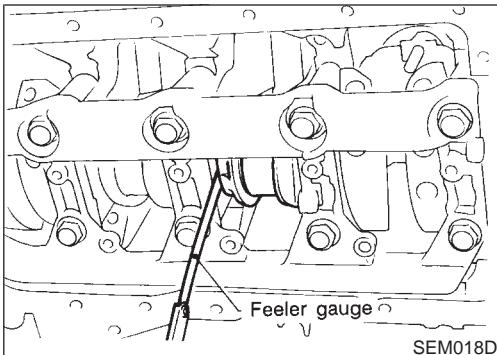
- Install crankshaft, main bearing caps and beam, then tighten bolts to the specified torque.
- Prior to tightening bearing cap bolts, shift crankshaft back and forth to properly seat the bearing cap.**
- Apply new engine oil to threads and seating surfaces of bearing cap bolts before installing them.
- Tightening procedure:**
- Tighten all bolts to 27 to 32 N·m (2.7 to 3.3 kg-m, 20 to 23 ft-lb).**



- Turn all bolts 75 to 80 degrees clockwise with Tool or suitable angle wrench.**
- Loosen all bolts completely.**
- Tighten all bolts to 33 to 38 N·m (3.3 to 3.9 kg-m, 24 to 28 ft-lb).**
- Turn all bolts 45 to 50 degrees clockwise with Tool or suitable angle wrench.**
- If an angle wrench is not available, mark all bearing cap bolts on the side facing engine rear. Then, turn each bolt specified degrees clockwise. Confirm angle of degrees with a graduator, not by eye measurement.
- After securing bearing cap bolts, make sure crankshaft turns smoothly by hand.**

CYLINDER BLOCK

Assembly (Cont'd)



- Measure crankshaft end play at thrust bearing.

Crankshaft end play:

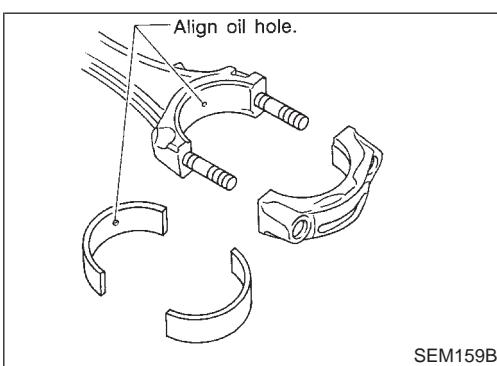
Standard

0.10 - 0.26 mm (0.0039 - 0.0102 in)

Limit

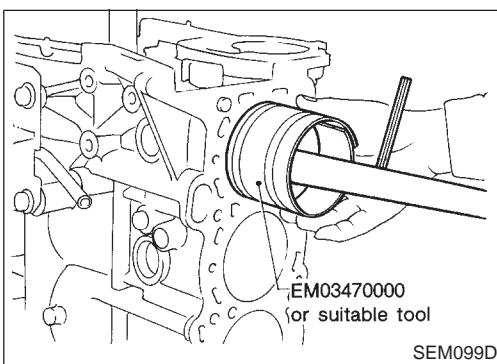
0.30 mm (0.0118 in)

If beyond the limit, replace thrust bearing with new one.



- Install connecting rod bearings in connecting rods and connecting rod caps.

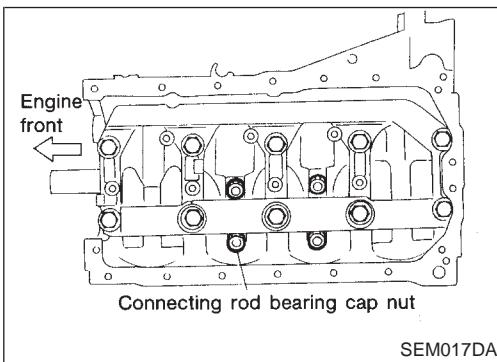
- Confirm that correct bearings are used. Refer to EM-74.
- Install bearings so that oil hole in connecting rod aligns with oil hole of bearing.
- Apply new engine oil to bolt threads and bearing surfaces.



- Install pistons with connecting rods.

- Install them into corresponding cylinders with Tool.

- Make sure connecting rod does not scratch cylinder wall.
- Make sure connecting rod bolts do not scratch crankshaft pin journals.
- Arrange so that front mark on piston head faces engine front.
- Apply new engine oil to piston rings and sliding surface of piston.
- Be careful not to hit oil jet with connecting rod.

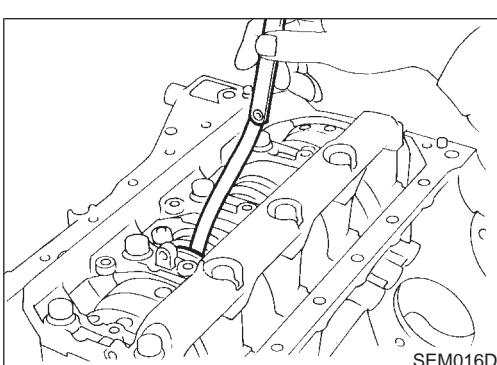


- Install connecting rod caps.

- Apply new engine oil to threads and seat surfaces.

Tighten connecting rod cap nuts using the following procedure:

- Tighten nuts to 13.7 to 15.7 N·m (1.4 to 1.6 kg·m, 10 to 12 ft-lb).
- Turn all nuts 60 to 65 degrees clockwise. If an angle wrench is not available, tighten nuts to 38 to 44 N·m (3.9 to 4.5 kg·m, 28 to 33 ft-lb).



- Measure connecting rod side clearance.

Connecting rod side clearance:

Standard

0.20 - 0.35 mm (0.0079 - 0.0138 in)

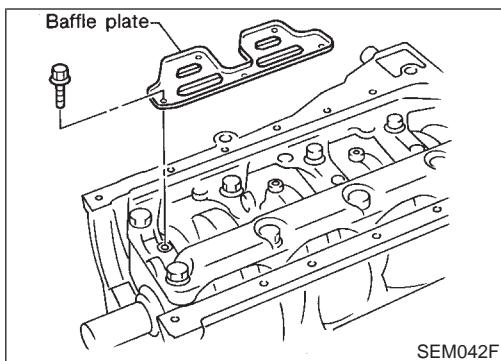
Limit

0.45 mm (0.0190 in)

If beyond the limit, replace connecting rod and/or crankshaft.

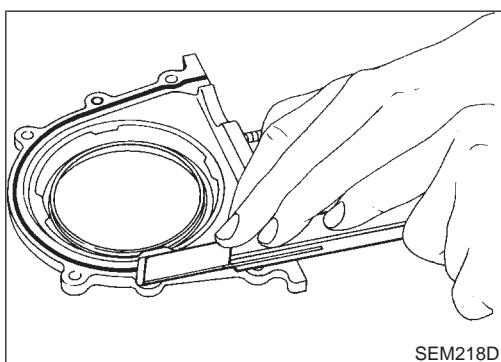
CYLINDER BLOCK

Assembly (Cont'd)



7. Install baffle plate.

GI



8. Install rear oil seal retainer.

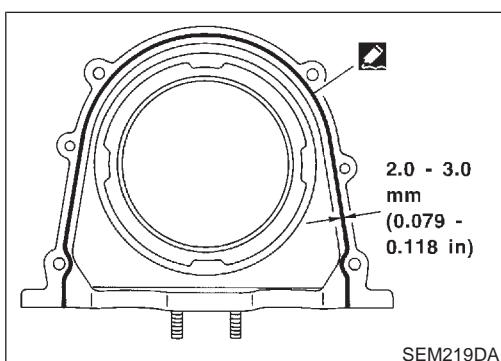
- Before installing rear oil seal retainer, remove old liquid gasket from mating surface.
- Also remove old liquid gasket from mating surface of cylinder block.
- Install rear oil seal. Refer to EM-35, "REAR OIL SEAL".

EC

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MT



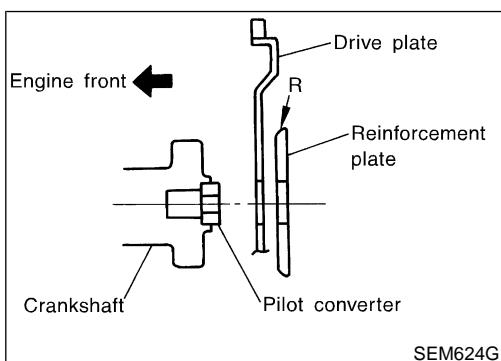
- Apply a continuous bead of liquid gasket to mating surface of rear oil seal retainer.
- Use Genuine Liquid Gasket or equivalent.**
- Apply around inner side of bolt holes.**

AT

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AX

SU



9. Install rear plate.

10. Install flywheel or drive plate (A/T models).

- Install reinforcement plate (A/T models) directing the rounded edge side to drive plate.**

BR

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IDX

SERVICE DATA AND SPECIFICATIONS (SDS)

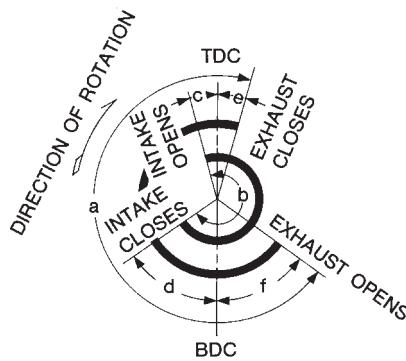
General Specifications

General Specifications

NMME0028

Cylinder arrangement	In-line 4	
Displacement cm ³ (cu in)	1,998 (121.92)	
Bore and stroke mm (in)	86 x 86 (3.39 x 3.39)	
Valve arrangement	DOHC	
Firing order	1-3-4-2	
Number of piston rings	Compression	2
	Oil	1
Number of main bearings	5	
Compression ratio	8.5	

Valve timing
Unit: degree
(VTC solenoid valve OFF)


EM120
a
b
c
d
e
f
240°
240°
-6°
66°
7°
53°

Compression Pressure

NMME0029
Unit: kPa (kg/cm², psi)/300 rpm

Compression pressure	Standard	1,079 (11.0, 156)
	Minimum	883 (9.0, 128)
	Differential limit between cylinders	98 (1.0, 14)

SERVICE DATA AND SPECIFICATIONS (SDS)

Drive Belt Deflection and Tension

Drive Belt Deflection and Tension

NMEM0055

		Deflection adjustment Unit: mm (in)		Tension adjustment *1 Unit: N (kg, lb)			
		Used belt		New belt	Used belt		New belt
		Limit	After adjustment		Limit	After adjustment	
Compressor	With air conditioner compressor	7 - 8 (0.28 - 0.31)	5 - 6 (0.20 - 0.24)	4 - 5 (0.16 - 0.20)	289.3 (29.5, 65)	556.1 - 645.3 (56.7 - 65.8, 125 - 145)	666.9 - 755.1 (68.0 - 77.0, 150 - 170)
Alternator		11 - 13 (0.43 - 0.51)	7 - 8 (0.28 - 0.31)	6 - 7 (0.24 - 0.28)	333.4 (34.0, 75)	645.3 - 733.6 (65.8 - 74.8, 145 - 165)	755.1 - 843.4 (77.0 - 86.0, 170 - 190)
Power steering oil pump		15 - 17 (0.59 - 0.67)	11 - 12 (0.43 - 0.47)	9 - 10 (0.35 - 0.39)	222.6 (22.7, 50)	377.6 - 466.8 (38.5 - 47.6, 85 - 105)	490.4 - 578.6 (50.0 - 59.0, 110 - 130)
Applied pushing force		98 N (10 kg, 22 lb)			—		

*1: If the belt tension gauge cannot be installed at check points shown, check belt tension at a different location on the belt.

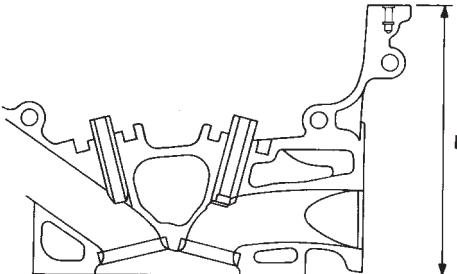
Spark Plug

NMEM0056

Standard type	PFR6B-9
Hot type	PFR5B-9
Cold type	PFR7B-9
Gap (Nominal) mm (in)	0.9 (0.035)

Cylinder Head

NMEM0030
Unit: mm (in)

 SEM043F	Standard	Limit	
	Head surface distortion	Less than 0.03 (0.0012)	0.1 (0.004)
	Nominal cylinder head height "H"	136.9 - 137.1 (5.390 - 5.398)	
	Resurfacing limit	0.2 (0.008)*	

*Total amount of cylinder head resurfacing plus cylinder block resurfacing

SERVICE DATA AND SPECIFICATIONS (SDS)

Valve

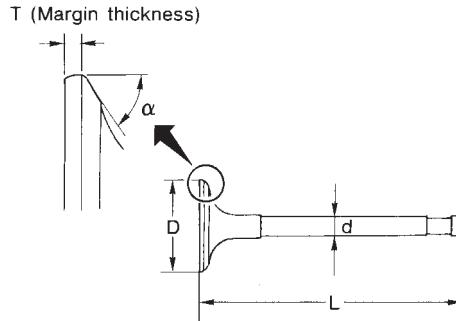
Valve

NMEM0031

VALVE

NMEM0031S01

Unit: mm (in)



SEM188A

Valve head diameter "D"	Intake	34.0 - 34.3 (1.339 - 1.350)
	Exhaust	30.0 - 30.3 (1.181 - 1.193)
Valve length "L"	Intake	101.19 - 101.61 (3.9839 - 4.0004)
	Exhaust	102.11 - 102.53 (4.0201 - 4.0366)
Valve stem diameter "d"	Intake	5.965 - 5.980 (0.2348 - 0.2354)
	Exhaust	6.945 - 6.960 (0.2734 - 0.2740)
Valve seat angle "α"	Intake	45°15' - 45°45'
	Exhaust	
Valve margin "T"	Intake	1.1 (0.043)
	Exhaust	1.3 (0.051)
Valve margin "T" limit		More than 0.5 (0.020)
Valve stem end surface grinding limit		Less than 0.2 (0.008)

VALVE SPRING

NMEM0031S02

Free height mm (in)	49.36 (1.9433)
Pressure N (kg, lb) at height mm (in)	Standard 578.0 - 641.6 (59.0 - 65.4, 129.9 - 144.2) at 30.0 (1.181)
	Limit 549.2 (56.0, 123.5) at 30.0 (1.181)
Out-of-square mm (in)	Less than 2.2 (0.087)

HYDRAULIC LASH ADJUSTER (HLA)

NMEM0031S03

Unit: mm (in)

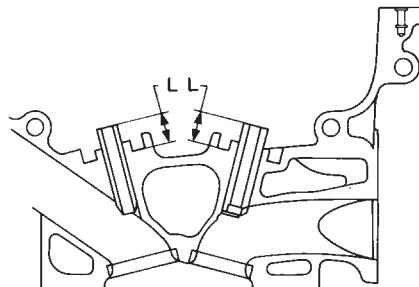
HLA outer diameter	16.980 - 16.993 (0.6685 - 0.6690)
HLA guide hole diameter	17.000 - 17.020 (0.6693 - 0.6701)
Clearance between HLA and HLA guide hole	0.007 - 0.040 (0.0003 - 0.0016)

SERVICE DATA AND SPECIFICATIONS (SDS)

Valve (Cont'd)

VALVE GUIDE

NMEM0031S04
Unit: mm (in)

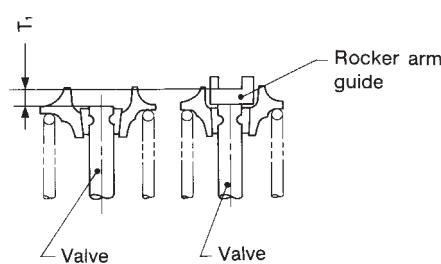


SEM083D

		Standard	Service
Valve guide Outer diameter	Intake	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
	Exhaust	10.023 - 10.034 (0.3946 - 0.3950)	10.223 - 10.234 (0.4025 - 0.4029)
Valve guide Inner diameter (Finished size)	Intake	6.000 - 6.018 (0.2362 - 0.2369)	
	Exhaust	7.000 - 7.018 (0.2756 - 0.2763)	
Cylinder head valve guide hole diameter	Intake	9.975 - 9.996 (0.3927 - 0.3935)	10.175 - 10.196 (0.4006 - 0.4014)
	Exhaust	10.975 - 10.996 (0.4321 - 0.4329)	11.175 - 11.196 (0.4400 - 0.4408)
Interference fit of valve guide		0.027 - 0.059 (0.0011 - 0.0023)	
		Standard	Limit
Stem to guide clearance	Intake	0.020 - 0.053 (0.0008 - 0.0021)	0.08 (0.0031)
	Exhaust	0.040 - 0.073 (0.0016 - 0.0029)	0.1 (0.004)
Valve deflection limit		0.2 (0.008)	
Projection length "L"		14.0 - 14.2 (0.551 - 0.559)	

VALVE SHIM CLEARANCE ADJUSTMENT

NMEM0031S06
Unit: mm (in)



SEM095D

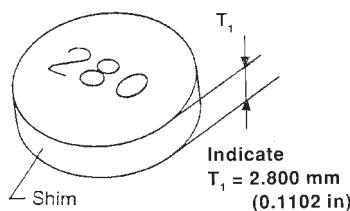
Valve shim clearance (cold) Intake & Exhaust	Less than 0.025 (0.001)
Shim thickness "T ₁ "	$T_1 \pm 0.025$ (0.001)

SERVICE DATA AND SPECIFICATIONS (SDS)

Valve (Cont'd)

AVAILABLE SHIM

NMEM0031S07



AEM236

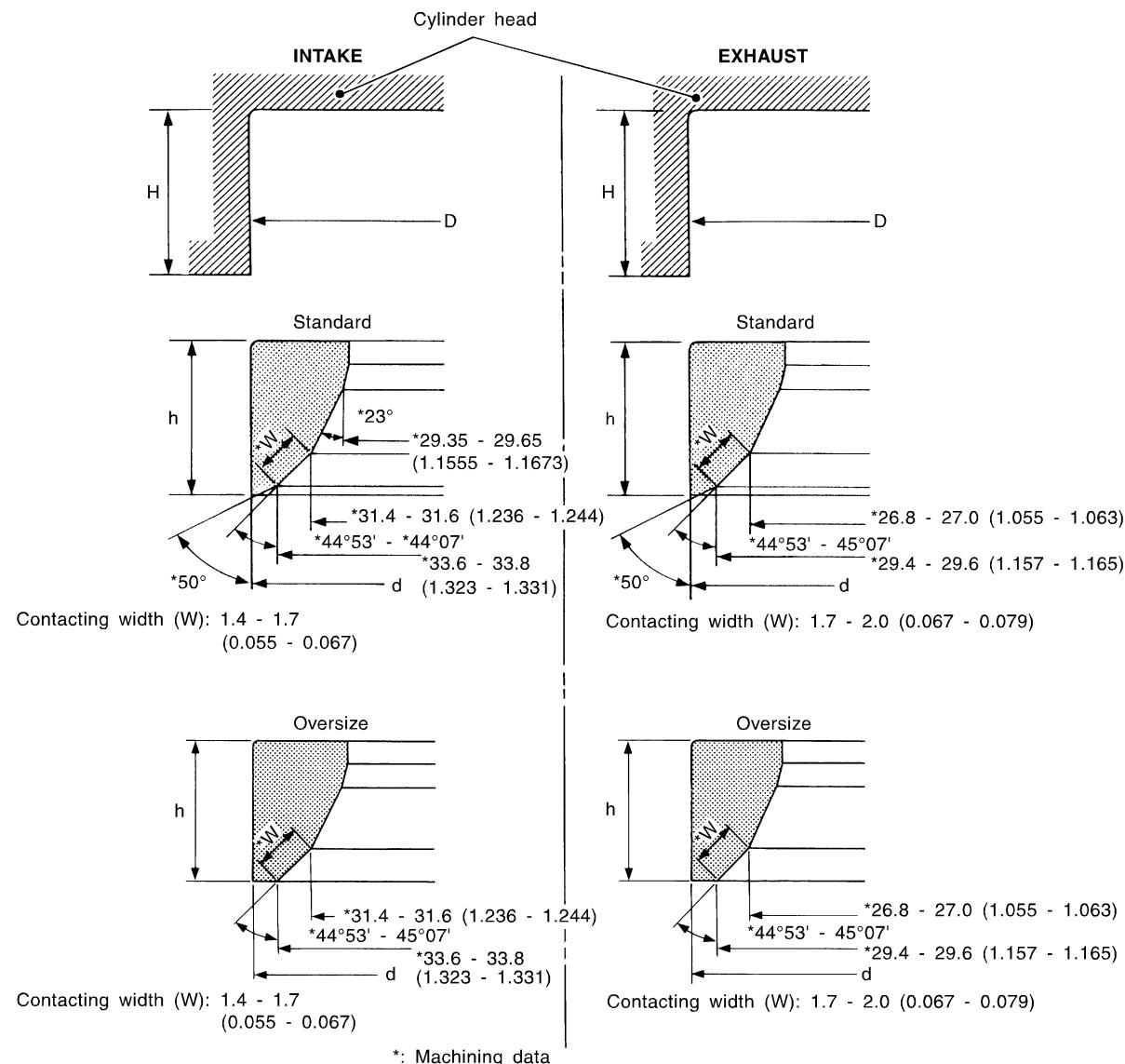
Thickness mm (in)	Identification mark
2.800 (0.1102)	28 00
2.825 (0.1112)	28 25
2.850 (0.1122)	28 50
2.875 (0.1132)	28 75
2.900 (0.1142)	29 00
2.925 (0.1152)	29 25
2.950 (0.1161)	29 50
2.975 (0.1171)	29 75
3.000 (0.1181)	30 00
3.025 (0.1191)	30 25
3.050 (0.1201)	30 50
3.075 (0.1211)	30 75
3.100 (0.1220)	31 00
3.125 (0.1230)	31 25
3.150 (0.1240)	31 50
3.175 (0.1250)	31 75
3.200 (0.1260)	32 00

SERVICE DATA AND SPECIFICATIONS (SDS)

Valve (Cont'd)

VALVE SEAT

NMEM0031S05
Unit: mm (in)



SEM651D

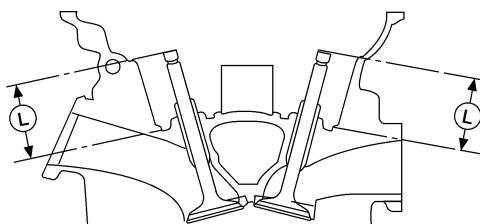
		Standard	Service
Cylinder head seat recess diameter (D)	In.	35.000 - 35.016 (1.3780 - 1.3786)	35.500 - 35.516 (1.3976 - 1.3983)
	Ex.	31.000 - 31.016 (1.2205 - 1.2211)	31.500 - 31.516 (1.2402 - 1.2408)
Valve seat interference fit	In.	0.064 - 0.096 (0.0025 - 0.0038)	
	Ex.	0.064 - 0.096 (0.0025 - 0.0038)	
Valve seat outer diameter (d)	In.	35.080 - 35.096 (1.3811 - 1.3817)	35.580 - 35.596 (1.4008 - 1.4014)
	Ex.	31.080 - 31.096 (1.2236 - 1.2242)	31.580 - 31.596 (1.2433 - 1.2439)
Depth (H)	In.		6.25 (0.2461)
	Ex.		6.25 (0.2461)
Height (h)		6.2 - 6.3 (0.244 - 0.248)	5.4 - 5.5 (0.213 - 0.217)

SERVICE DATA AND SPECIFICATIONS (SDS)

Valve (Cont'd)

VALVE SEAT RESURFACE LIMIT

NMEM0031S08
Unit: mm (in)



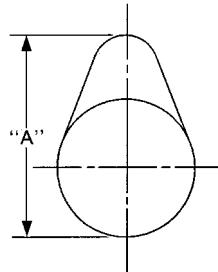
AEM343

Depth (L)	42.74 - 43.26 (1.6827 - 1.7031)
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Camshaft and Camshaft Bearing

NMEM0032
Unit: mm (in)

	Standard	Limit
Camshaft journal to bearing clearance (Except No. 1 intake journal)	0.030 - 0.071 (0.0012 - 0.0071)	0.15 (0.0059)
Camshaft journal to bearing clearance (No. 1 intake journal)	0.040 - 0.081 (0.0016 - 0.0032)	0.15 (0.0059)
Inner diameter of camshaft bearing (Except No. 1 intake journal)	28.000 - 28.021 (1.1024 - 1.1032)	—
Inner diameter of camshaft bearing (No. 1 intake journal)	28.010 - 28.031 (1.1028 - 1.1036)	—
Outer diameter of camshaft journal	27.950 - 27.970 (1.1004 - 1.1012)	—
Camshaft runout [TIR*]	Less than 0.02 (0.0008)	0.1 (0.004)
Camshaft sprocket runout [TIR*]	Less than 0.25 (0.0098)	—
Camshaft end play	0.092 - 0.173 (0.0036 - 0.0068)	0.20 (0.0079)



EM671

Cam height "A"	Intake	37.920 - 38.110 (1.4929 - 1.5004)
	Exhaust	37.920 - 38.110 (1.4929 - 1.5004)
Wear limit of cam height		0.2 (0.008)
Valve lift	Intake	9.2 (0.362)
	Exhaust	9.2 (0.362)

*Total indicator reading

SERVICE DATA AND SPECIFICATIONS (SDS)

Cylinder Block

Cylinder Block

NMME0033
Unit: mm (in)

GI

MA

EM

LC

EC

FE

CL

MT

AT

PD

AX

SU

BR

ST

RS

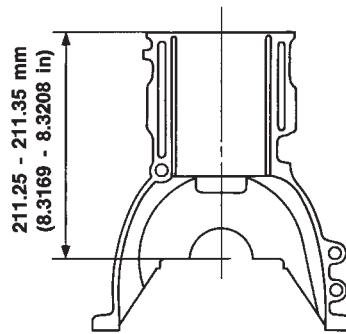
BT

HA

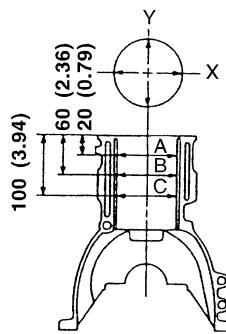
SC

EL

IDX



SEM008D



SEM686DB

Surface flatness	Standard		Less than 0.03 (0.0012)
	Limit		0.10 (0.0039)
Cylinder bore Inner diameter	Standard	Grade No. 1	86.000 - 86.010 (3.3858 - 3.3862)
		Grade No. 2	86.010 - 86.020 (3.3862 - 3.3866)
		Grade No. 3	86.020 - 86.030 (3.3866 - 3.3870)
	Wear limit		0.20 (0.0079)
Out-of-round (X - Y)		Less than 0.015 (0.0006)	
Taper (A - B and A - C)		Less than 0.010 (0.0004)	
Difference in inner diameter between cylinders	Limit		Less than 0.05 (0.0020)
Main journal inner diameter	Grade No. 0		58.944 - 58.950 (2.3206 - 2.3209)
	Grade No. 1		58.950 - 58.956 (2.3209 - 2.3211)
	Grade No. 2		58.956 - 58.962 (2.3211 - 2.3213)
	Grade No. 3		58.962 - 58.968 (2.3213 - 2.3216)

SERVICE DATA AND SPECIFICATIONS (SDS)

Piston, Piston Ring and Piston pin

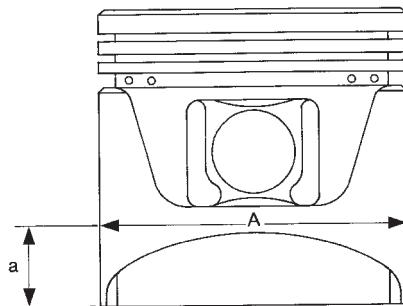
Piston, Piston Ring and Piston pin

NMEM0034

PISTON

NMEM0034S01

Unit: mm (in)



SEM750C

Piston skirt diameter "A" Standard	Grade No. 1	85.980 - 85.990 (3.3850 - 3.3854)
	Grade No. 2	85.990 - 86.000 (3.3854 - 3.3858)
	Grade No. 3	86.000 - 86.010 (3.3858 - 3.3862)
	0.20 (0.0079) oversize (Service)	86.180 - 86.210 (3.3929 - 3.3941)
"a" dimension		10.5 (0.413)
Piston clearance to cylinder block		0.010 - 0.030 (0.0004 - 0.0012)
Piston pin hole diameter		21.987 - 21.999 (0.8656 - 0.8661)

PISTON RING

NMEM0034S02

Unit: mm (in)

Side clearance	Top	Standard	0.045 - 0.080 (0.0018 - 0.0031)
		Limit	0.1 (0.004)
	2nd	Standard	0.030 - 0.065 (0.0012 - 0.0026)
		Limit	0.1 (0.004)
	Oil	Standard	0.065 - 0.135 (0.0026 - 0.0053)
		Limit	—
Ring end gap	Top	Standard	0.20 - 0.30 (0.0079 - 0.0118)
		Limit	0.39 (0.0154)
	2nd	Standard	0.35 - 0.50 (0.0138 - 0.0197)
		Limit	0.59 (0.0232)
	Oil	Standard	0.20 - 0.60 (0.0079 - 0.0236)
		Limit	0.69 (0.0272)

PISTON PIN

NMEM0034S03

Unit: mm (in)

Piston pin outer diameter	21.989 - 22.001 (0.8657 - 0.8622)	
Interference fit of piston pin to piston	0 - 0.004 (0 - 0.0002)	
Piston pin to connecting rod bushing clearance	Standard	0.005 - 0.017 (0.0002 - 0.0007)
	Limit	0.023 (0.0009)

* Values measured at ambient temperature of 20°C (68°F)

SERVICE DATA AND SPECIFICATIONS (SDS)

Connecting Rod

Connecting Rod

NMEM0035
Unit: mm (in)

Center distance	136.25 - 136.35 (5.3642 - 5.3681)	
Bend [per 100 (3.94)]	Limit	0.15 (0.0059)
Torsion [per 100 (3.94)]	Limit	0.30 (0.0118)
Connecting rod small end inner diameter		24.980 - 25.000 (0.9835 - 0.9843)
Piston pin bushing inner diameter*		22.000 - 22.012 (0.8661 - 0.8666)
Connecting rod big end inner diameter		51.000 - 51.013 (2.0079 - 2.0084)
Side clearance	Standard	0.20 - 0.35 (0.0079 - 0.0138)
	Limit	0.5 (0.020)

*After installing in connecting rod

GI

MA

EM

LC

EC

FE

CL

MT

AT

PD

AX

SU

BR

ST

RS

BT

HA

SC

EL

IDX

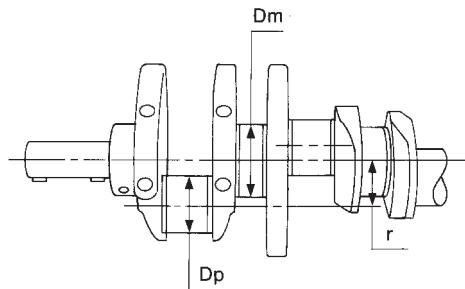
SERVICE DATA AND SPECIFICATIONS (SDS)

Crankshaft

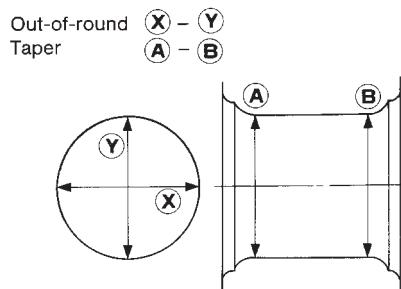
Crankshaft

NMEM0036
Unit: mm (in)

Main journal dia. "Dm"	Grade No. 0	54.974 - 54.980 (2.1643 - 2.1646)
	Grade No. 1	54.968 - 54.974 (2.1641 - 2.1643)
	Grade No. 2	54.962 - 54.968 (2.1639 - 2.1641)
	Grade No. 3	54.956 - 54.962 (2.1636 - 2.1639)
Pin journal dia. "Dp"	Grade No. 0	47.968 - 47.974 (1.8885 - 1.8887)
	Grade No. 1	47.962 - 47.968 (1.8883 - 1.8885)
	Grade No. 2	47.956 - 47.962 (1.8880 - 1.8883)
Center distance "r"		42.96 - 43.04 (1.6913 - 1.6945)
Out-of-round (X - Y) Standard	Main journal	Less than 0.005 (0.0002)
	Pin journal	Less than 0.0025 (0.0001)
Taper (A - B) Standard	Main journal	Less than 0.005 (0.0002)
	Pin journal	Less than 0.0025 (0.0001)
Runout [TIR]	Standard	Less than 0.025 (0.0010)
	Limit	Less than 0.05 (0.0020)
Free end play	Standard	0.10 - 0.26 (0.0039 - 0.0102)
	Limit	0.30 (0.0118)



SEM954C



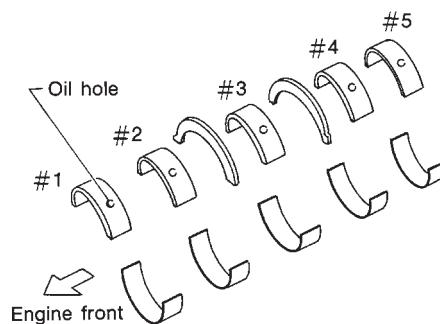
EM715

SERVICE DATA AND SPECIFICATIONS (SDS)

Main Bearing

Main Bearing

NMEM0037



SEM685D

GI

MA

EM

LC

EC

NMEM0037S01
Unit: mm (in)

STANDARD

Grade number	Thickness "T"	Width "W"	Identification color (mark)
0	1.977 - 1.980 (0.0778 - 0.0780)	18.9 - 19.1 (0.744 - 0.752)	Black (A)
1	1.980 - 1.983 (0.0780 - 0.0781)		Brown (B)
2	1.983 - 1.986 (0.0781 - 0.0782)		Green (C)
3	1.986 - 1.989 (0.0782 - 0.0783)		Yellow (D)
4	1.989 - 1.992 (0.0783 - 0.0784)		Blue (E)
5	1.992 - 1.995 (0.0784 - 0.0785)		Pink (F)
6	1.995 - 1.998 (0.0785 - 0.0787)		No color (G)

FE

CL

MT

AT

PD

UNDERSIZE

Undersize	Thickness "T"	Main journal diameter "Dm"
0.25 (0.0098)	2.109 - 2.117 (0.0830 - 0.0833)	Grind so that bearing clearance is the specified value.

NMEM0037S02
Unit: mm (in)

AX

SU

BR

STANDARD SIZE

NMEM0038S01
Unit: mm (in)

ST

Grade number	Thickness "T"	Width "W"	Identification color (mark)
0	1.500 - 1.503 (0.0591 - 0.0592)	16.9 - 17.1 (0.665 - 0.673)	No color (A)
1	1.503 - 1.506 (0.0592 - 0.0593)		Black (B)
2	1.506 - 1.509 (0.0593 - 0.0594)		Brown (C)

RS

BT

UNDERSIZE

NMEM0038S02
Unit: mm (in)

HA

Undersize	Thickness "T"	Crank pin journal diameter "Dp"
0.08 (0.0031)	1.541 - 1.549 (0.0607 - 0.0610)	Grind so that bearing clearance is the specified value.
0.12 (0.0047)	1.561 - 1.569 (0.0615 - 0.0618)	
0.25 (0.0098)	1.626 - 1.634 (0.0640 - 0.0643)	

SC

EL

IDX

SERVICE DATA AND SPECIFICATIONS (SDS)

Bearing Clearance

Bearing Clearance

NMEM0039
Unit: mm (in)

Main bearing clearance	Standard	0.004 - 0.022 (0.0002 - 0.0009)
	Limit	0.05 (0.0020)
Connecting rod bearing clearance	Standard	0.020 - 0.045 (0.0008 - 0.0018)
	Limit	0.065 (0.0026)

Miscellaneous Components

NMEM0040
Unit: mm (in)

Camshaft sprocket runout limit [TIR]	0.25 (0.0098)
Flywheel runout limit [TIR]	0.45 (0.0177)
Drive plate runout limit [TIR]	0.2 (0.008)