ENGINE MECHANICAL

SECTION EM

CONTENTS

PRECAUTIONS	2
Parts Requiring Angular Tightening	2
Liquid Gasket Application Procedure	2
PREPARATION	3
Special Service Tools	
Commercial Service Tools	5
NOISE, VIBRATION AND HARSHNESS (NVH)	
TROUBLESHOOTING	7
NVH Troubleshooting Chart — Engine Noise	
OUTER COMPONENT PARTS	
Removal and Installation	
WARM-UP THREE WAY CATALYST LH (FOR	
4WD MODEL)	11
MEASUREMENT OF COMPRESSION PRESSUR	RE 12
OIL PAN	13
Removal	13
Installation	14
TIMING BELT	
Components	
Removal	17
Inspection	
BELT TENSIONER AND TENSIONER SPRING	
Installation	
BELT TENSION CHECK	
OIL SEAL	
Replacement	
VALVE OIL SEAL	
OIL SEAL INSTALLING DIRECTION	22
CAMSHAFT OIL SEAL	
FRONT OIL SEAL	
REAR OIL SEAL	
CYLINDER HEAD	
Components	
Removal	
Disassembly	
Inspection	
CYLINDER HEAD DISTORTION	
CAMSHAFT VISUAL CHECK	
CAMSHAFT RUNOUT	
CAMSHAFT CAM HEIGHT	

CAMSHAFT JOURNAL CLEARANCE	29
CAMSHAFT END PLAY	29
CAMSHAFT SPROCKET RUNOUT	
VALVE GUIDE CLEARANCE	
VALVE GUIDE REPLACEMENT	
VALVE SEATS	31
REPLACING VALVE SEAT FOR SERVICE PARTS.	
VALVE DIMENSIONS	
VALVE SPRING	32
ROCKER SHAFT AND ROCKER ARM	
HYDRAULIC VALVE LIFTER	
Assembly	34
Installation	34
ENGINE ASSEMBLY	39
Removal and Installation	39
REMOVAL	
CYLINDER BLOCK	
Components	
CYLINDER BLOCK HEATER	
Removal and Installation	
Disassembly	
PISTON AND CRANKSHAFT	44
Inspection	
PISTON AND PISTON PIN CLEARANCE	
PISTON RING SIDE CLEARANCE	
PISTON RING END GAP	
CONNECTING ROD BEND AND TORSION	
CYLINDER BLOCK DISTORTION AND WEAR	
PISTON-TO-BORE CLEARANCE	
CRANKSHAFT	
BEARING CLEARANCE	
CONNECTING ROD BUSHING CLEARANCE	
(SMALL END)	.50
REPLACEMENT OF CONNECTING ROD	
BUSHING (SMALL END)	.51
FLYWHEEL/DRIVE PLATE RUNOUT	.51
Assembly	.51
PISTON	.51
CRANKSHAFT	.52
REPLACING PILOT BUSHING (M/T) OR PILOT	
CONVERTER (A/T)	.53

CONTENTS (Cont'd)

SERVICE DATA AND SPECIFICATIONS (SDS).	54
General Specifications	54
Cylinder Head	55
Valve	55
VALVE	55
VALVE SPRING	
HYDRAULIC VALVE LIFTER	
VALVE GUIDE	56
ROCKER SHAFT AND ROCKER ARM	56
Valve Seat	
INTAKE VALVE SEAT	57
EXHAUST VALVE SEAT	58
Camshaft and Camshaft Bearing	59
Cylinder Block	
Piston, Piston Ring and Piston Pin	

AVAILABLE PISTON61 PISTON RING61 PISTON PIN62	M/	Ĵ
Connecting Rod62		
Crankshaft62	EM	
Available Main Bearing	LĈ	
NO. 4 MAIN BEARING	EC	
Available Connecting Rod Bearing		
BEARING CLEARANCE	FE	
	CL	:
	MT	
	A17	;
	TF	
	PD	i
	AX	
	su	
	BR	
	ST	
	RS	
	BT	
	HA	
	SC	
	ĒL	:
[1DX	
		1

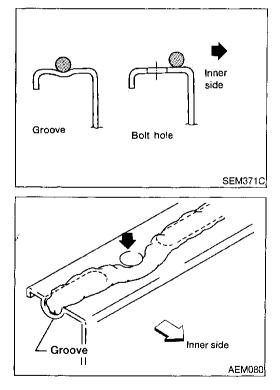
GI

ł.

PRECAUTIONS

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
- d) Crankshaft pulley bolt
- 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.



Liquid Gasket Application Procedure

- Use a scraper to remove all traces of old liquid gasket from mating surfaces and grooves. Also completely clean any oil stains from these portions.
- Apply a continuous bead of liquid gasket to mating surfaces. (Use Genuine RTV silicone sealant Part No. 999MP-A7007, Three Bond TB1207D or equivalent.)
- Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) dia. (for oil pan).
- Be sure liquid gasket is 2.0 to 3.0 mm (0.079 to 0.118 in) dia. (in areas except oil pan).
- 3) Apply liquid gasket to inner surface around hole perimeter area (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.

Special Service Tools

Special Service Tools GI NAEM0003 The actual shapes of Kent-Moore tools may differ from those of special service tools illustrated here. Tool number MA (Kent-Moore No.) Description Tool name ĒΜ ST0501S000 Disassembling and assembling $(\mathbf{1})$) Engine stand assembly 2 LC 1 ST05011000) Engine stand 2 ST05012000 EC () Base FE NT042 KV10106500) CL Engine stand shaft MT NT028 KV10110001 AT) Engine sub-attachment TF NT032 PD ST10120000 Loosening and tightening cylinder head bolt (J24239-01) a: 13 mm (0.51 in) dia. Cylinder head bolt wrench b: 12 mm (0.47 in) AX c: 10 mm (0.39 in) Ē SU NT583 KV10112100 Tightening bearing cap, cylinder head bolts, BR (BT8653-A) etc. Angle wrench ST RS NT014 KV10110600 Disassembling and assembling valve compoq (J33986) BT nents Valve spring compressor Ⅎ HA NT033 SC KV10107501 N Installing valve oil seal Valve oil seal drift M EL NT025 IDX

Special Service Tools (Cont'd)

Tool number (Kent-Moore No.) Tool name	Description	
KV10110300 (— Piston pin press stand assembly 1 KV10110310 (— 2 KV10110330 (— 2 KV10110330 (— 2 KV10110330 (— 3 ST13030020 (— Press stand 4 ST13030030 (— Spring 5 KV10110340 (— Drift 6 KV10110320 (— Center shaft	6 0 0 0 0 0 0 0 0 0 0 0 0 0	Disassembling and assembling piston with connecting rod
EM03470000 (J8037) Piston ring compressor	NT044	Installing piston assembly into cylinder bore
ST16610001 (J23907) Pilot bushing puller	NT045	Removing crankshaft pilot bushing
KV10111100 (J37228) Seal cutter	NT046	Removing oil pan
WS39930000 (—) Tube presser	NT052	Pressing the tube of liquid gasket
KV10117100 (J3647-A) Heated oxygen sensor wrench		Loosening or tightening heated oxygen sensor For 22 mm (0.87 in) hexagon nut
	NT379	

Special Service Tools (Cont'd)

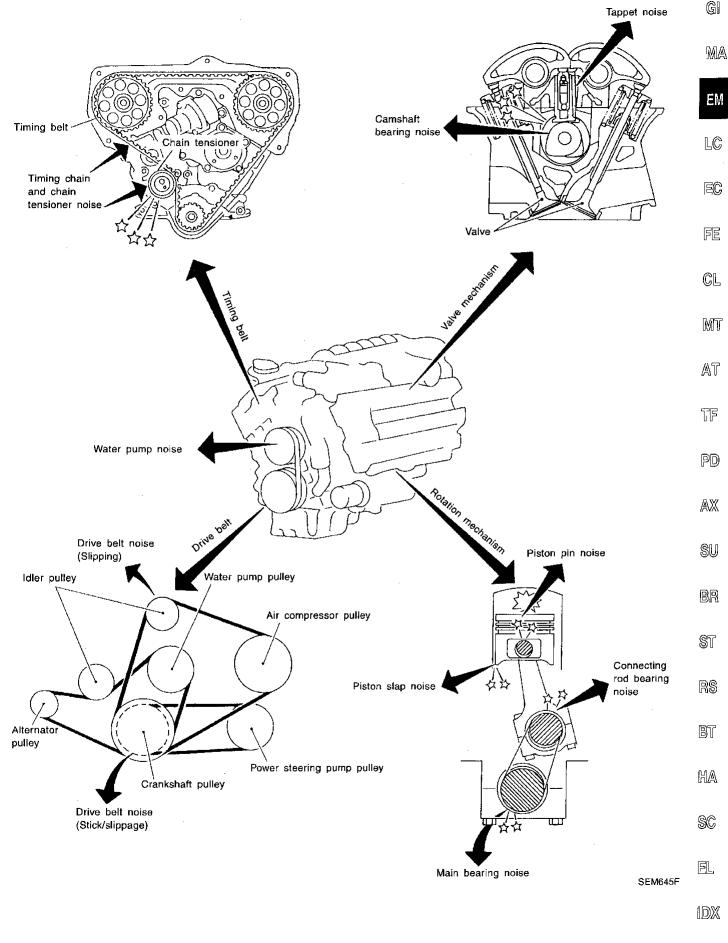
(Kent-Moore No.) Tool name	Description	
KV10114400 (J38365) Heated oxygen sensor wrench		Loosening or tightening rear heated oxygen sensor (For right bank) a: 22 mm (0.87 in)
	NT636	- <u> </u>
	Commercial Se	
Tool name	Description	
Spark plug wrench	16 mm (0.63 in)	Removing and installing spark plug
Pulley holder	NT047	Holding camshaft pulley while tightening or loosening camshaft bolt
	NT035	
Valve seat cutter set		Finishing valve seat dimensions
Piston ring expander	NT048	Removing and installing piston ring
PISION mig expanses	NT030	Removing and instanting pistor may
Valve guide drift	a b	Removing and installing valve guide Intake & Exhaust: a = 10.5 mm (0.413 in) dia.
	NT015	b = 6.6 mm (0.260 in) dia.
Valve guide reamer	NT015	Reaming valve guide 1 or hole for oversize
Valvo guido rou		valve guide 2 Intake: $d_1 = 7.0 \text{ mm} (0.276 \text{ in}) \text{ dia.}$ $d_2 = 11.2 \text{ mm} (0.441 \text{ in}) \text{ dia.}$
	de 7	Exhaust:

IDX

Commercial Service Tools (Cont'd)

Tool name	Description	
Camshaft oil seal drift		Installing camshaft oil seal a: 60 mm (2.36 in) dia. b: 44.5 mm (1.752 in) dia. c: 75 mm (2.95 in)
	NT613	
Front oil seal drift	c b a f e d	Installing front oil seal a: 24.5 mm (0.965 in) dia. b: 36 mm (1.42 in) dia. c: 44 mm (1.73 in) dia. d: 17 mm (0.67 in) e: 3 mm (0.12 in) f: 5 mm (0.20 in)
Rear oil seal drift		Installing rear oil seal a: 46 mm (1.81 in) b: 110 mm (4.33 in)
		c: 84 mm (3.31 in) d: 96 mm (3.78 in)
	NT719	

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING



EM-7

95

NAEM0039

NOISE, VIBRATION AND HARSHNESS (NVH) TROUBLESHOOTING

NVH Troubleshooting Chart — Engine Noise

NVH Troubleshooting Chart — Engine Noise

Use the chart below to help you find the cause of the problem.

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

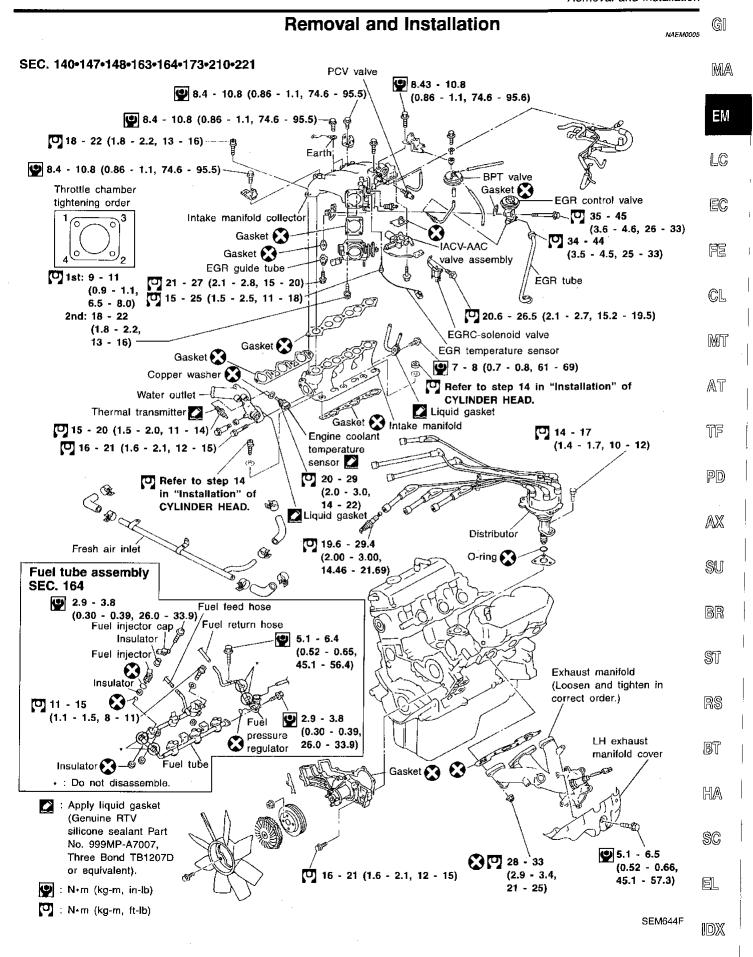
If necessary, repair or replace these parts.

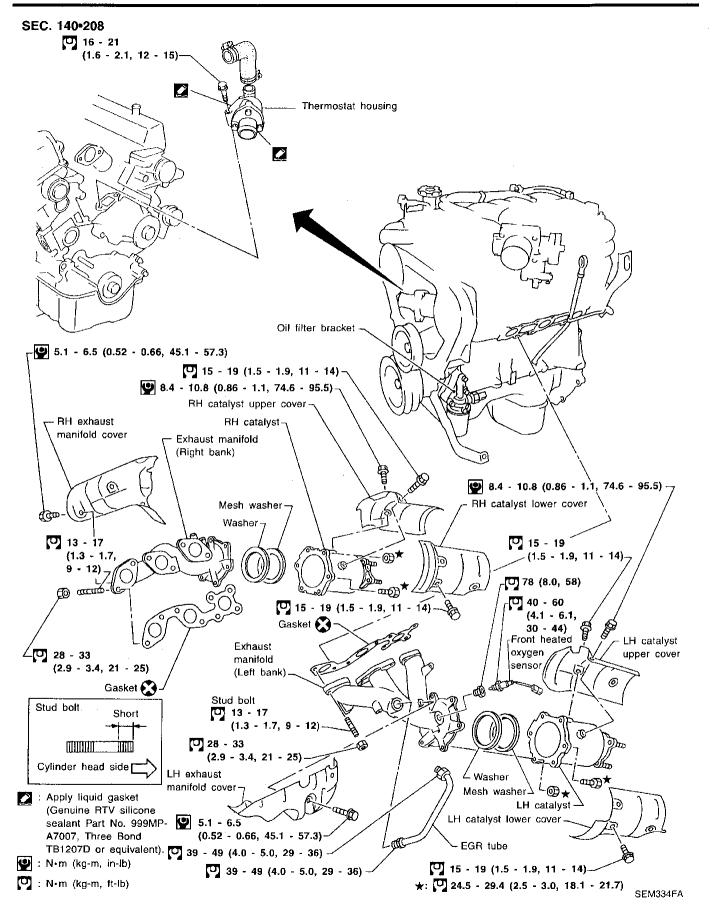
			Operat	ing con	dition of	f engine) 				
Location of noise	Type of noise	Before warm-up	After warm-up	When starting	When idling	When racing	While driving	Source of noise	Check item	Reference page	
Top of engine Rocker	Ticking or clicking	с	А		А	в		Tappet noise	Valve clearance	EM-30	
cover Cylinder head	Rattle	с	A	_	А	В	с	Camshaft bearing noise	Camshaft journal clearance Camshaft runout	EM-29, EM-28	
	Slap or knock	-	A	_	в	в	_	Piston pin noise	Piston and piston pin clearance Connecting rod bushing clearance	EM-44, EM-50	
Crankshaft pulley Cylinder	Slap or rap	A	_		в	в	A	Piston slap noise	Piston-to-bore clearance Piston ring side clearance Piston ring end gap Connecting rod bend and torsion	EM-46, EM-45, EM-45, EM-45	
block (Side of engine) Oil pan	Knock	A	В	с	в	В	в	Connecting rod bearing noise	Connecting rod bushing clearance (Small end) Connecting rod bearing clearance (Big end)	EM-50, EM-50	
	Knock	A	В		Α	в	с	Main bear- ing noise	Main bearing cil clearance Crankshaft runout	EM-48, EM-48	
Timing belt cover	Whine or hissing	с	A	—	А	А		Timing belt noise (too tight)	Loose timing belt	EM 16	
	Clatter	А	в	_	с	А		Timing belt noise (too loose)	Belt contacting case	EM-16	
Front of engine	Squeaking or fizzing	А	в	_	в		С	Other drive belts (Sticking or slipping)	Drive belts deflection	*1	
	Creaking	А	В	A	в	А	в	Other drive belts (Slip- ping)	Idler pulley bearing operation		
	Squall Creak	А	В		в	A	в	Water pump noise	Water pump operation	*2	

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

*1: MA section ("Checking Drive Belts", "ENGINE MAINTENANCE")

*2: LC section ("Water Pump Inspection", "ENGINE COOLING SYSTEM")





OUTER COMPONENT PARTS

Removal and Installation (Cont'd)

		Removal and Installation (Cont'd)	
File Charles		ARM-UP THREE WAY CATALYST LH (FOR 4WD DDEL)	GI
Exhaust mount	1. 2.	Remove front tube nut RH and LH. Loosen exhaust mount insulator bolt.	MA
Rear heated oxygen sensor	3. 4.	Remove rear heated oxygen sensor. Use SST KV10114400 (J38365). Remove front tube LH side.	EM
SEM641F			LC
	5. 6.	Remove heat insulator upper side. Remove heat insulator lower side.	EC
	0.		FE
Heat insulator lower			CL
Front tube LH			MT
SEM642F	7.	Remove warm-up three way catalyst.	AT
Under vehicle view Warm-up three way catalyst LH Front propeller shaft		· · · · · · · · · · · · · · · · · · ·	TE
			PD
			AX
SEM643F	•		SU
	8.	Installation is in reverse order of removal.	BR
			ST
			RS
		· · · · · ·	BT
			HA
			SC

El

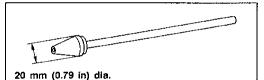
1

ļ

[[D]X

MEASUREMENT OF COMPRESSION PRESSURE

- 1. Warm up engine.
- 2. Turn ignition switch off.
- 3. Release fuel pressure.
 - Refer to "Releasing Fuel Pressure" in EC section.
- 4. Remove all spark plugs.
- 5. Disconnect distributor center cable.
- SEM814C



Use compressor tester whose end (rubber portion) is less than 20 mm (0.79 in) dia. Otherwise, it may be caught by cylinder head during removal.

SEM387C

- 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 as shown above.
- Always use a fully-charged battery to obtain specified engine speed.

Compression pressure: kPa (kg/cm², psi)/300 rpm Standard

1,196 (12.2, 173)

Minimum

883 (9.0, 128)

Difference limit between cylinders

98 (1.0, 14)

- 10. If cylinder compression in one or more cylinders is low, pour a small amount of engine oil into cylinders through spark plug holes and retest compression.
- If adding oil improves cylinder 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.) If valve or valve seat is damaged excessively, replace them.
- If compression in any two adjacent cylinders is low and if adding oil does not improve compression, there is leakage past the gasket surface. If so, replace cylinder head gasket.

OIL PAN

Removal

eme	oval		NAEMDO
		Appli	ed model
	Removal order and points	2WD	4WD
1	Remove undercover.	0	0
2	Drain engine oil.	0	0
3	Remove stabilizer bracket bolts (RH & LH).	0	0
4	Remove front propeller shaft from front differential carrier.	_	0
5.	Remove front drive shaft fixing bolts (RH & LH).		0
6	Remove front differential carrier bleeder hose.	-	0
7	Remove front suspension cross- member.	0	0
8	Remove differential front mounting bolts (RH & LH) and rear mounting bolts.		0
9	Remove front differential carrier.		0
10	Remove front differential carrier mounting bracket.		0
11	Remove starter motor.	0	0
12	Remove transmission to rear engine mounting bracket nuts (RH & LH).	0	0
13	Remove engine mounting bolts or nuts (RH & LH).	0	0
14	Remove power steering mounting brackets (RH & LH).	0	0
15	Lift up engine. If necessary, disconnect exhaust tube.	0	0
16	Remove oil pan.	0	0

WARNING:

- Place vehicle on a flat and solid surface.
- Place chocks at front and rear of rear wheels.
- You should not remove oil pan until exhaust system and cooling system have completely cooled off.
 Otherwise, you may burn yourself and/or fire may break out in the fuel line.
- When remove front and/or rear engine mounting bolts or nuts, lift up slightly engine for safety work.
 CAUTION:
- In lifting engine, be careful not to hit against adjacent SC parts, especially against accelerator wire casing end, brake tube and brake master cylinder.
- For tightening torque, refer to AT, MT and PD sections.

DX

RS

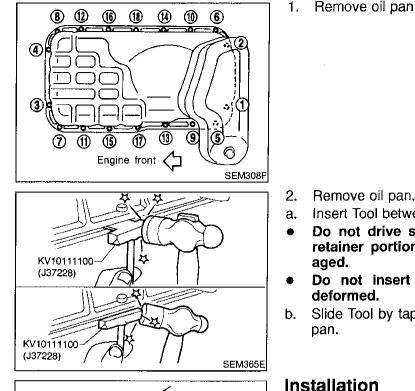
EM-13

101

OIL PAN

Removal (Cont'd)

Scraper



SEM309F

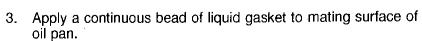
Apply sealant.

Remove oil pan bolts.

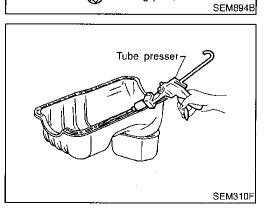
- Remove oil pan.
- Insert Tool between cylinder block and oil pan.
- Do not drive seal cutter into oil pump or rear oil seal retainer portion, or aluminum mating face will be dam-
- Do not insert screwdriver, or oil pan flange will be
- Slide Tool by tapping its side with a hammer, and remove oil

Installation

- EMOOOB Before installing oil pan, remove all traces of liquid gasket from 1. mating surface using a scraper.
- Also remove traces of liquid gasket from mating surface of • cylinder block.
- 2. Apply sealant to oil pump gasket and rear oil seal retainer gasket.



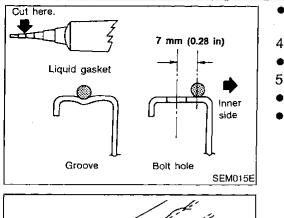
Use Genuine RTV silicone sealant Part No. 999MP-A7007, • Three Bond TB1207D or equivalent.



: Sealing point

EM-14

OIL PAN



Inner side

AEM080

6

- Groove

	Installation (Cont'd)		
•	Be sure liquid gasket is 3.5 to 4.5 mm (0.138 to 0.177 in) wide.	GI	•
4. • 5.	Apply liquid gasket to inner sealing surface as shown in figure. Attaching should be done within 5 minutes after coating. Install oil pan.	MA	
•	Install bolts/nuts in their reverse order of removal. Wait at least 30 minutes before refilling engine oil.	EM	
		LC	
		EC	
		FE	
		CL	
		MT	
		AT	
		<u>j</u> tþ	

IDX I

PD

AX

SU . |

BR

ST

RS

BT

HA ł

SC

EL

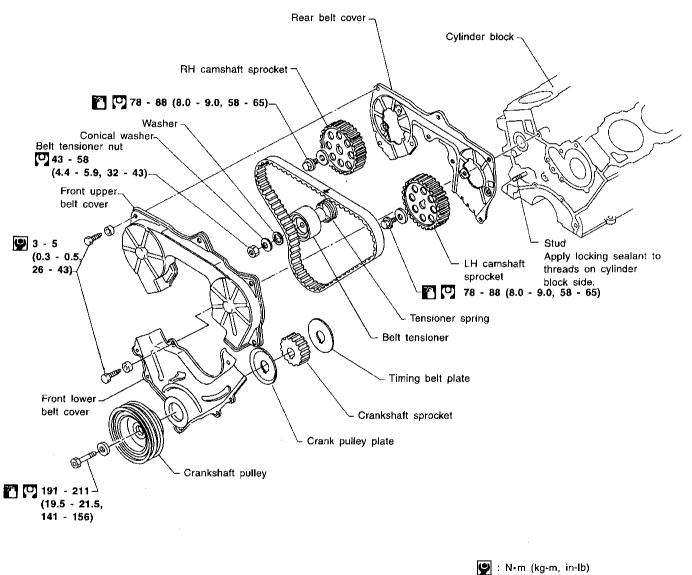
ī.

Components

CAUTION:

- Do not bend or twist timing belt.
- After removing timing belt, do not turn crankshaft and camshaft separately because valves will strike piston heads.
- Make sure that timing belt, camshaft sprocket, crankshaft sprocket and belt tensioner are clean and free from oil and water.
- Installation should be carried out when engine is cold.

SEC. 120-130-135



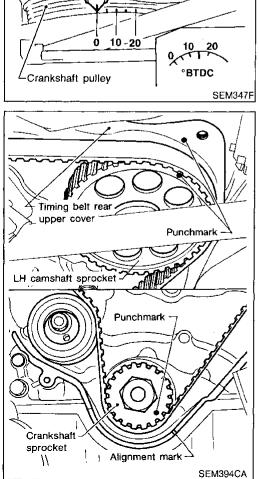
💟 : N•m (kg-m, ft-lb)

🚹 : Lubricate with new engine oil

SEM311FA

NAEM0009

		Removal		
<u></u>	Removal	NAEM0010	GI	
	 Remove engine under cover. Drain engine coolant from radiator. 		DOG	
	Be careful not to spill coolant on drive belts.		MA	
	3. Remove radiator. (Refer to LC section.)		EM	
	 Remove engine cooling fan and water pump pulley. Remove the following belts. 			
	Power steering pump drive belt		LC	
	 Compressor drive belt Alternator drive belt 			
	 Remove all spark plugs. 		EC	
	7. Remove distributor protector.			
	 Remove compressor drive belt idler bracket. Remove fresh-air intake tube for rocker cover. 		FE	
	10. Remove water hose for thermostat housing.			
			CL	
			1 Mihr	ļ
			100 1	
	11. Oct No. 1 eight at TDO on its compression stroke by	rotatina	AT	1
	 Set No. 1 piston at TDC on its compression stroke by crankshaft. 	otating		
	12. Remove crankshaft pulley bolt.		TF	
	 Remove crankshaft pulley with a suitable puller. Remove front upper and lower belt covers. 		തര	ł
			PD	İ
10 20			AX	
BTDC				
SEM347F			SU	ļ
	 Align punchmark on LH camshaft sprocket with mark on timing belt upper rear cover. 			
	Align punchmark on crankshaft sprocket with notch	ı on oil	BR	ł
	 pump housing. Temporarily install crank pulley bolt on crankshaft s 	so that	ST	
	crankshaft can be rotated.		01	
chmark _			RS	i
3.3				I
1/			BT	:
5			ППА	I
			HA	ļ
		1	SC	
		ł	EL	
SEM394CA			IDX	
			1	



-Timing indicator

6

Ę

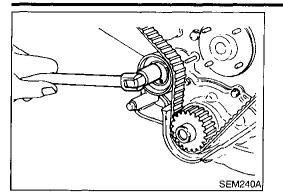
O

105

j.

ł

Removal (Cont'd)



15. Loosen timing belt tensioner nut, turn tensioner, then remove timing belt.

Inspection

NAEM0011

Visually check the condition of timing belt. Replace if any abnormality is found.

Item to check	Problem	Cause
Tooth is broken/tooth root is cracked.	SEM394A	 Camshaft jamming Distributor jamming Damaged camshaft/crankshaft oil seal
Back surface is cracked/worn.	SEM395A	 Tensioner jamming Overheated engine Interference with belt cover
Side surface is worn.	 Belt corners are worn and round. Wicks are frayed and coming out. 	 Improper installation of belt Malfunctioning crankshaft pulley plate/timing belt plate
Teeth are worn.	Rotating direction SEM397A • Canvas on tooth face is worn down. • Canvas on tooth is fluffy, rubber layer is worn down and faded white, or weft is worn down and invisible.	 Poor belt cover sealing Coolant leakage at water pump Camshaft not functioning properly Distributor not functioning properly Excessive belt tension
Oil/Coolant or water is stuck to belt.	_	 Poor oil sealing of each oil seal Coolant leakage at water pump Poor belt cover sealing

		SIONER AND TENSIONER SPRING belt tensioner for smooth turning.	NAEM0011S01	GI
Etc		condition of tensioner spring.		MA
REE (O)				EM
				LC
Aligning - Rear	Installatio	n		EC
Aligning Rear Aligning marks		that No. 1 piston is set at TDC on its com	NAEMOD12	<u>P</u>
Camshaft sprocket				ĈL
(RH) No. 1 cylinder at TDC in compression sprocket Oil pump marks SEM51DEA				MT
Oil pump-/ 2- marks SEM510EA	2. Install te	nsioner and tensioner spring.		AT
Hook tensioner spring	If stud is or	nce removed, apply locking sealant to thr nder block side before installing.	reads of	TF
				PD
Tensioner spring Arrow A				AX
SEM243A	3. Turn tens	sioner fully outward with hexagon wrench, and	tempo-	SU
		ten lock nut.		BR
				ST
i Constant				RS
SEM829A				BT
Aligning Aligning marks	1) Align whi	g belt when engine is cold. te lines on timing belt with punchmarks on ca and crankshaft sprocket.	amshaft	HA
		ow on timing belt toward front belt cover.		SC
Camshaft () () () () () () () () () () () () ()		eeth (reference):	100	-
(RH) r r r r r r r r r r r r r r r r r r r	Number of timir	g belt teeth Between LH and RH camshaft sprockets	133 40	EL
Crankshaft timing sprocket Aligning marks	Number of teeth between timing marks	Between LH camshaft sprocket and crankshaft tim- ing sprocket		IDX
SEM511EA			L	

EM-19

Inspection (Cont'd)

Installation (Cont'd)

70° - 80 SEM886B Camshaft Camshaft sprocket sprocket (LH) (RH) 98 N (10 kg, 22 Ib) Tensioner pulley Timing belt ∠ Crankshaft sprocket SEM887BA Crankshaft sprocket Timing Tensioner belt pulley Feeler gauge SEM240E NG NG oк Feeler gauge Tensioner pulley \odot

Timing belt

Crankshaft

SEM889BA

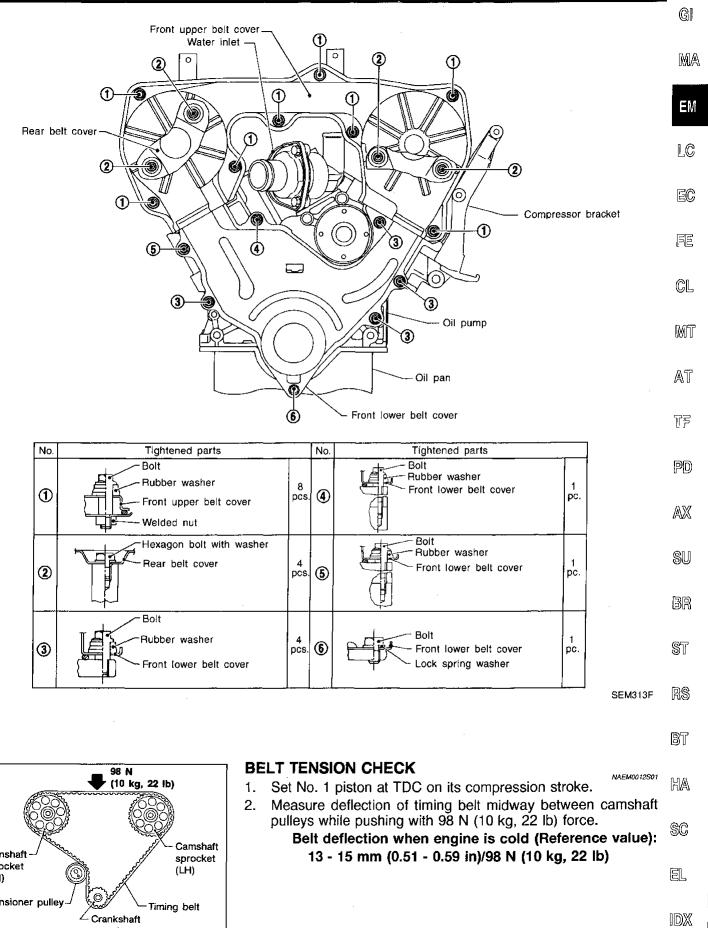
sprocket

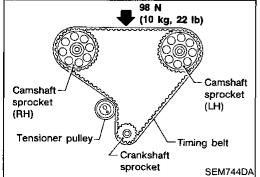
TIMING BELT

- 5. Loosen tensioner lock nut, keeping tensioner steady with hexagon wrench.
- 6. Turn tensioner 70 to 80 degrees clockwise with hexagon wrench, and temporarily tighten lock nut.
- 7. Turn crankshaft clockwise at least 2 times, then slowly set No. 1 piston at TDC on its compression stroke.
- 8. Push middle of timing belt between RH camshaft sprocket and tensioner pulley with force of 98 N (10 kg, 22 lb).
- 9. Loosen tensioner lock nut, keeping tensioner steady with hexagon wrench.

10. Set feeler gauge as shown in figure which is 0.35 mm (0.0138 in) thick and 12.7 mm (0.500 in) wide.

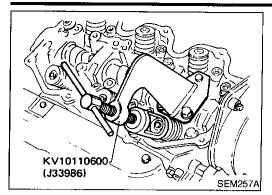
- 11. Turn crankshaft clockwise until feeler gauge is positioned as shown in figure.
- Timing belt will move about 2.5 teeth.
- 12. Tighten tensioner lock nut, keeping tensioner steady with hexagon wrench.
- 13. Turn crankshaft clockwise or counterclockwise, and remove feeler gauge.
- 14. Turn crankshaft clockwise at least 2 times, then slowly set No. 1 piston at TDC on its compression stroke.
- 15. Install lower and upper belt covers.





OIL SEAL

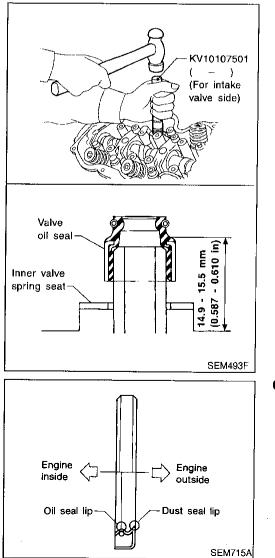
Replacement



Replacement VALVE OIL SEAL

NAEM0013 NAEM0013S01

- 1. Remove rocker cover.
- 2. Remove rocker shaft assembly and valve lifters with valve lifter guide.
- 3. Remove valve springs and valve oil seal.
- Piston concerned should be set at TDC to prevent valve from falling.
- When removing intake side valve oil seal, use Tool or suitable tool.
- When removing exhaust side valve oil seal, pull it out with suitable tool.



- 4. Apply engine oil to new valve oil seal and install it.
- Before installing valve oil seal, install inner valve spring seat.
- When installing intake side valve oil seal, use Tool.
- When installing exhaust side valve oil seal, set it by hand.

OIL SEAL INSTALLING DIRECTION

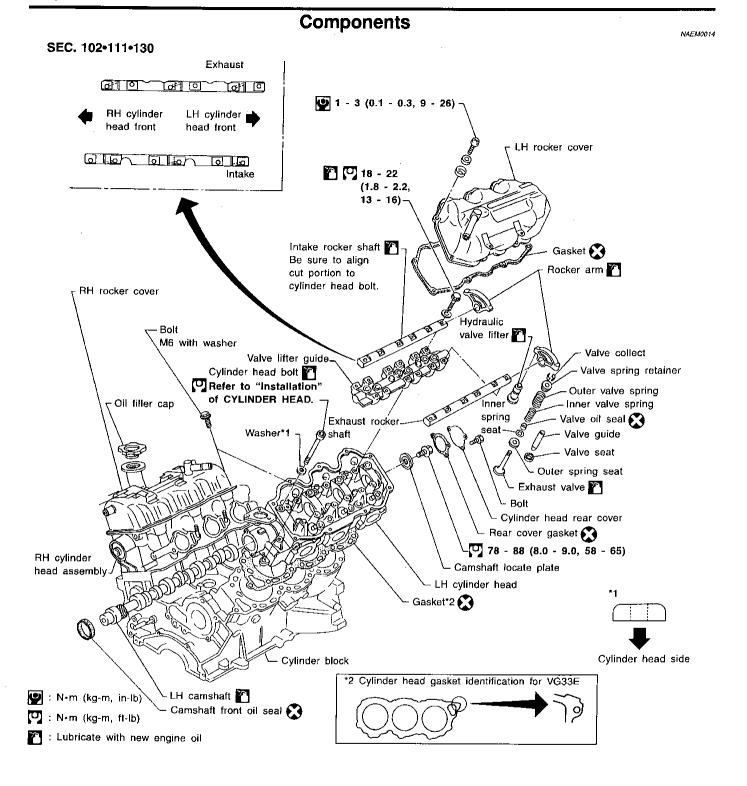
NAEM0013S02

OIL SEAL

	Першеенноги	· · ·		
	CAMSHAFT OIL SEAL 1. Remove timing belt. 2. Remove camshaft sprocket.	VAEM0013S03	GI MA	
A Start Area	 Remove camshaft. Remove camshaft oil seal. Be careful not to scratch camshaft. 		IMIA EM	
	5. Apply engine oil to new camshaft oil seal.		LC	
	 Remove timing belt and crankshaft sprocket. 	AEM0013S04	EC	
E E L	 Remove oil pump assembly. Remove front oil seal from oil pump body. Apply engine oil to new oil seal and install it using suitab 	le tool.	FE CL	
Suitable tool SEM241E			MT	
	REAR OIL SEAL I. Remove flywheel or drive plate. 2. Remove rear oil seal retainer.	4 <i>EM0013\$05</i>	AT TF	:
	 Remove rear oil seal from retainer. Apply engine oil to new oil seal and install it using suitabl Install rear oil seal retainer with a new gasket to cylinder 		PD	
SEM242E			AX SU	:
			BR	
			ST	
			rs 	ļ
			BT HA '	
			SC	
			EL '	
		[idx	

1

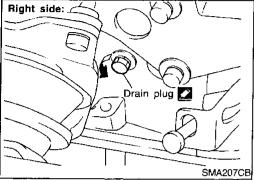
i

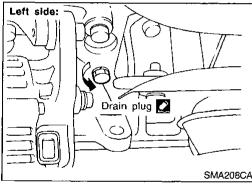


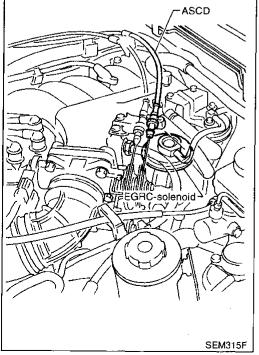
EM-24

Removal

		Remova	1
	R ε	Release fuel pressure.	, GI
	۰. 2.	Refer to "Releasing Fuel Pressure" in EC section. Remove timing belt.	MA
	_,	Refer to "TIMING BELT Removal" (EM-17).	EM
			LC
	3.	Drain coolant by removing drain plugs from both sides of cyl- inder block.	EC
]리
n plug 💟			CL
			MT
SMA207CB			AT
			TF
			PD
			AX
SMA208CA			SU
		Separate ASCD and accelerator control wire from intake mani- fold collector.	
ASCD	5.	Remove intake manifold collector from engine. The following parts should be disconnected to remove intake manifold collector.	BR
	a.	Harness connectors for: IACV-AAC valve, Throttle position sensor, Throttle position switch, Ignition coil, Power transistor,	ST
		EGRC-solenoid valve, and EGR temperature sensor. Water hoses from collector	RS
		Heater hoses PCV hose from RH rocker cover	BT
	e. '	Vacuum hoses for: EVAP canister, Master brake cylinder and Pressure regulator.	HA
STA DE		Purge hose from EVAP canister EGR tube	זרישם ם
	h. I	Earth harnesses Air duct hose	SC
			EL
SEM315F			IDX -







113

Removal (Cont'd)

Injector harness connector Fuel return hose Fuel feed hose SEM817C (2) c. Ð $\widehat{\mathbf{T}}$ 3 (5) Loosen bolts in numerical order. SEM818C Camshaft sprocket SEM819C Cylinder block Compressor Power steering pump SEM316F 5 **Right bank** (3) 1 (2) Engine 8 9.96 front 2 Left bank ി 3

5

SEM317F

D

- 6. Remove fuel feed and fuel return hoses from injector fuel tube assembly.
- 7. Disconnect all injector harness connectors.
- 8. Remove injector fuel tube assembly.

- Remove intake manifold from engine. The following parts 9. should be disconnected to remove intake manifold.
- Engine coolant temperature switch harness connector a.
- Thermal transmitter harness connector b.
- Water hose from thermostat housing
- 10. Remove both camshaft sprockets.
- 11. Remove rear timing belt cover.
- 12. Remove distributor and ignition wires.

After pulling out distributor from cylinder head, do not rotate distributor rotor.

- 13. Remove harness clamp from RH rocker cover.
- 14. Remove front exhaust tube from exhaust manifold.
- 15. Remove compressor and power steering pump.
- 16. Remove alternator.
- 17. Remove compressor and alternator bracket.

18. Remove both rocker covers.

For LH cylinder head	For RH cylinder head
No. 1 No.	5, 3 No. 5 '
	OF WORKS
Engine (6)	
Loosen in num	erical order.
	SEM926AA

- 19. Remove cylinder head with exhaust manifold.
- A warped or cracked cylinder head could result from removing in incorrect order.
- MA Cylinder head bolts should be loosened in two or three steps.

EM

G

LC

EC

NAEM0016

Disassembly

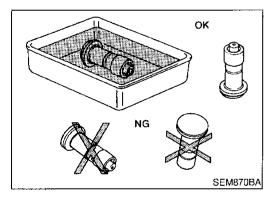
CAUTION:

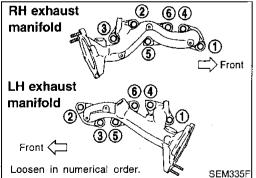
1.

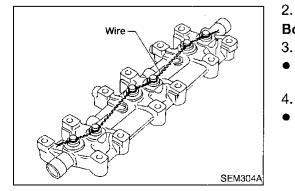
- When installing sliding parts such as rocker arms, cam-FE shaft and oil seal, be sure to apply new engine oil on their sliding surfaces.
- CL When tightening cylinder head bolts and rocker shaft bolts, apply new engine oil to thread portions and seat surfaces of bolts. MT

AT









If hydraulic valve lifter is kept on its side, there is a risk of air entering it. After removal, always set hydraulic valve lifter straight up, or when laying it on its side, have it soak in new engine oil.	J <u>ę</u>
•	

- Do not disassemble hydraulic valve lifter.
- PD Attach tags to valve lifters so as not to mix them up.
 - SU
 - Remove exhaust manifolds from cylinder head.

BR

AX

ST

RS

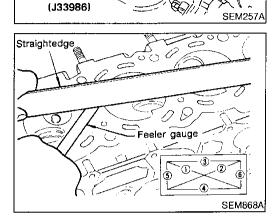
- BT
- Remove rocker shafts with rocker arms. HA Bolts should be loosened in two or three steps. Remove hydraulic valve lifters and lifter guide. Hold hydraulic valve lifters with wire so that they will not SC drop from lifter guide.
- Remove oil seal and camshaft. 4.
- Before removing camshaft, measure camshaft end play. EL

Disassembly (Cont'd)

KV10110600

CYLINDER HEAD

- 5. Remove valve components with Tool.
 - 6. Remove valve oil seals with Tool or suitable tool.



Inspection CYLINDER HEAD DISTORTION Head surface flatness:

NAEM0017

NAEM0017S01

Less than 0.1 mm (0.004 in)

If beyond the specified limit, resurface it or replace it. **Resurfacing limit:**

The resurfacing limit of cylinder head is determined by the cylinder block resurfacing in an engine. 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:

106.8 - 107.2 mm (4.205 - 4.220 in)

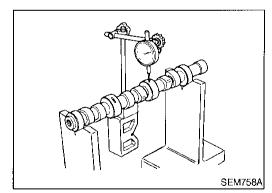
CAMSHAFT VISUAL CHECK

Check camshaft for scratches, seizure and wear.

NAEM0017S02

NAEM0017S03

NAEM0017S04



CAMSHAFT RUNOUT

- Measure camshaft runout at the center journal. Runout (Total indicator reading): 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: 39.242 - 39.432 mm (1.5450 - 1.5524 in) Exhaust: 38.943 - 39.133 mm (1.5332 - 1.5407 in) Cam wear limit:

0.15 mm (0.0059 in)

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

EM-28

SEM549A

ļ

I

	CAMSHAFT JOURNAL CLEARANCE	, GI
RH camshaft DDDDDDDDDDD A Front B C C C C C C C C C C C C C		MA Em Ilc
SEM893BA	 Measure inner diameter of camshaft bearing. Standard inner diameter: A 47.000 - 47.025 mm (1.8504 - 1.8514 in) 	EC Fe
	B 42.500 - 42.525 mm (1.6732 - 1.6742 in) C 48.000 - 48.025 mm (1.8898 - 1.8907 in)	CL
Bore gauge SEM879A		MT AT
i i i i i i i i i i i i i i i i i i i	 Measure outer diameter of camshaft journal. Standard outer diameter: A 46.920 - 46.940 mm (1.8472 - 1.8480 in) B 42.420 - 42.440 mm (1.6701 - 1.6709 in) 	TF
	C 47.920 - 47.940 mm (1.8866 - 1.8874 in) 3. If clearance exceeds the limit, replace camshaft and/or cyli der head. Camshaft journal clearance limit: 0.15 mm (0.0059 in)	pd Ax
۲ SEM012A		SU
End play	 CAMSHAFT END PLAY 1. Install camshaft and locate plate in cylinder head. 2. Measure camshaft end play. 	BR
	Camshaft end play: Standard 0.03 - 0.06 mm (0.0012 - 0.0024 in)	ST RS
Dial gauge SEM392E		nə BT
Unit: mm (in) 0.03 0.06 0.02 (0.0012) (0.0024)	3. If it is out of the specified range, select thickness of camshaft locate plate to obtain standard specified end play. Example:	HA
(0.0008) 1 - 2 - 4 3 - 4 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5 - 5	When camshaft end play is 0.08 mm (0.0031 in) with camshaft locate plate 2, replace camshaft locate plate 2 with camshaft locate plate 3 to set the end play at 0.05 mm (0.0020 in).	SC
Identifi- No A B		EL
cation identification Punched identification- mark C mark mark SEM393E	FM-29	IDX

Inspection (Cont'd)

CAMSHAFT SPROCKET RUNOUT

1. Install sprocket on camshaft.

VALVE GUIDE CLEARANCE

0.20 mm (0.0079 in)

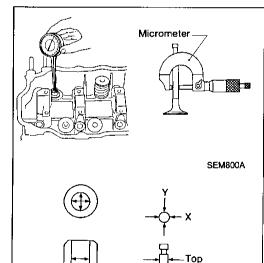
- 2. Measure camshaft sprocket runout. Runout (Total indicator reading): Limit 0.1 mm (0.004 in)
- 3. If it exceeds the limit, replace camshaft sprocket.

NAEM0017S07

30 mm (1.18 in)
SEM872B

1.

b.



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

Measure valve deflection in a right-angled direction with cam-

shaft. (Valve and valve guide mostly wear in this direction.)

Valve deflection limit (Dial gauge reading):

- a. Measure valve stem diameter and valve guide inner diameter.
 - Check that clearance is within specification.
 - Valve to valve guide clearance:

Intake

0.020 - 0.053 mm (0.0008 - 0.0021 in) Exhaust

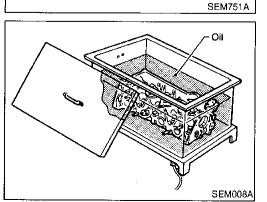
0.040 - 0.049 mm (0.0016 - 0.0019 in) Limit

0.10 mm (0.0039 in)

c. If it exceeds the limit, replace valve or valve guide.

VALVE GUIDE REPLACEMENT

1. To remove valve guide, heat cylinder head to 150 to 160°C (302 to 320°F) by soaking in heated oil.



Valve

Valve guide

118

بر کر

to the second second	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.	G!
4		MA
		EM
Tool &		LC
SEM264A	3. Ream cylinder head valve guide hole.	EC
Suitable reamer	Valve guide hole diameter (for service parts): Intake 11.175 - 11.196 mm (0.4400 - 0.4408 in)	11 13
	Exhaust 12.175 - 12.196 mm (0.4793 - 0.4802 in)	CL
		MT
SEM088C	 Heat cylinder head to 150 to 160°C (302 to 320°F) and press service valve guide onto cylinder head. 	AT
Jam Mark	Projection "L": 13.2 - 13.4 mm (0.520 - 0.528 in)	TF
	5. Ream valve guide. Finished size:	PD
Intake side Exhaust side	Intake 7.000 - 7.018 mm (0.2756 - 0.2763 in) Exhaust	AX
SEM089C	8.000 - 8.011 mm (0.3150 - 0.3154 in)	SU
	VALVE SEATS Check valve seats for any evidence of pitting at valve contact surface, and reseat or replace if it has worn out excessively.	BR
A Contraction	 Before repairing valve seats, check valve and valve guide for wear. If they have worn, replace them. Then correct valve seat. 	ST
	Use both hands to cut uniformly.	RS
SEM090C		BT
Recess diameter	··· ··································	HA
	z. nearr cymuer reau recess.	SC
	Reaming bore for service valve seat Oversize [0.5 mm (0.020 in)]: Intake	<u>E</u> L
SEM795A	44.500 - 44.516 mm (1.7520 - 1.7526 in)	IDX

Inspection (Cont'd)

T (Margin thickness)

CYLINDER HEAD

37.500 - 37.516 mm (1.4764 - 1.4770 in)

Reaming should be done in circles concentric to the valve guide center so that valve seat will have the correct fit.

- 3. Heat cylinder head to 150 to 160°C (302 to 320°F) by soaking in heated oil.
- 4. Press fit valve seat until it seats on the bottom.
- 5. Cut or grind valve seat using suitable tool at the specified dimensions as shown in SDS (EM-55),
- 6. After cutting, lap valve seat with abrasive compound.
- 7. Check valve seating condition.

	Intake	Exhaust
Seat face angle "a" degree	45	45
Contacting width "W" mm (in)	1.75 (0.0689)	1.7 (0.067)

8. 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 specified, repeat step 5 above to adjust it. If it is longer, replace the valve seat with a new one.

Intake:

SEM892B

ntake

SEM621F

SEM188A

44.7 - 44.9 mm (1.760 - 1.768 in)

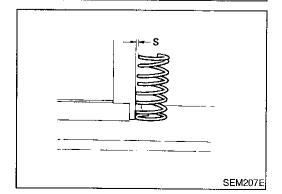
Exhaust:

45.4 - 45.6 mm (1.787 - 1.795 in)

VALVE DIMENSIONS

Check dimensions in each valve. For dimensions, refer to SDS. 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 Squareness 1. Measure "S" dimension. Out-of-square: Outer Less than 2.2 mm (0.087 in) Inner Less than 1.9 mm (0.075 in) 2. If it exceeds the limit, replace spring.

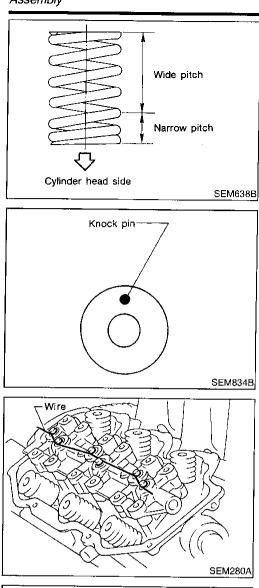
NAEM0017513 NAEM0017S1301

EM-32

Inspection (Cont'd)

	Inspection (Contra)	
	Pressure NAEMD017S1302 Check valve spring pressure.	Gi
	Standard pressure: N (kg, lb) at height mm (in) Outer: 523.7 (53.4, 117.7) at 30.0 (1.181)	MA
	Inner: 255.0 (26.0, 57.3) at 25.0 (0.984) Limit pressure: N (kg, lb) at height mm (in)	EM
EM113	Outer: More than 228.5 (23.3, 51.4) at 25.0 (0.984) Inner: More than 225.6 (23.0, 50.7) at 25.0 (0.984) If it exceeds the limit, replace spring.	LĈ
	ROCKER SHAFT AND ROCKER ARM	EC
	 Check rocker shafts for scratches, seizure and wear. Check outer diameter of rocker shaft. Diameter: 	FE
and the second sec	17.979 - 18.000 mm (0.7078 - 0.7087 in)	CL
		MT
SEM761A	3. Check inner diameter of rocker arm.	AT ,
	Diameter: 18.007 - 18.028 mm (0.7089 - 0.7098 in)	TF
	Rocker arm to shaft clearance: 0.007 - 0.049 mm (0.0003 - 0.0019 in)	PD
	• Keep rocker arm with hydraulic valve lifter standing to prevent air from entering hydraulic valve lifter when	
	checking.	AX
SEM762A		SU
	 HYDRAULIC VALVE LIFTER 1. Check contact and sliding surfaces for wear or scratches. 2. Check diameter of valve lifter. 	BR
	Outer diameter: 15.947 - 15.957 mm (0.6278 - 0.6282 in)	ST
		RS
SEM243E		BT
		HA
	16.000 - 16.013 mm (0.6299 - 0.6304 in) Standard clearance between valve lifter and lifter guide:	SC
	0.043 - 0.066 mm (0.0017 - 0.0026 in)	EL !
A CORPACIENT		1DX
SEM760A		I

Assembly





Assembly

- 1. Install valve component parts.
- Always use new valve oil seal. Refer to OIL SEAL REPLACEMENT (EM-22).

NAEM0018

- Before installing valve oil seal, install inner valve spring seat.
- Install outer valve spring (uneven pitch type) with its narrow pitch side toward cylinder head side.
- After installing valve component parts, use plastic hammer to lightly tap valve stem tip to assure a proper fit.
- 2. Install camshafts, locate plates and cylinder head rear covers.
- Set knock pin of camshaft at the top.

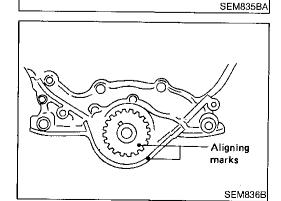
- 3. Install valve lifters into valve lifter guide.
- Assemble valve lifters to their original position and hold all valve lifters with wire to prevent lifters from falling off.
- After installing, remove the wire.

- 4. Install rocker shafts with rocker arms.
- Tighten bolts gradually in two or three stages.
- Before tightening, be sure to set camshaft the lobe at the position where lobe is not lifted.
- a. Set No. 1 piston at TDC on its compression stroke and tighten rocker shaft bolts for No. 2, No. 4 and No. 6 cylinders.
- b. Set No. 4 piston at TDC on its compression stroke and tighten rocker shaft bolts for No. 1, No. 3 and No. 5 cylinders.
- 5. Install exhaust manifold to cylinder head in reverse order of removal.

Installation

- 1. Set No. 1 piston at TDC on its compression stroke as follows:
- a. Align crankshaft sprocket aligning mark with mark on oil pump body.
- b. Confirm that knock pin on camshaft is set at the top.

EM-34



নি তি

Exhaust

ত দিত

LH cylinder

Intake

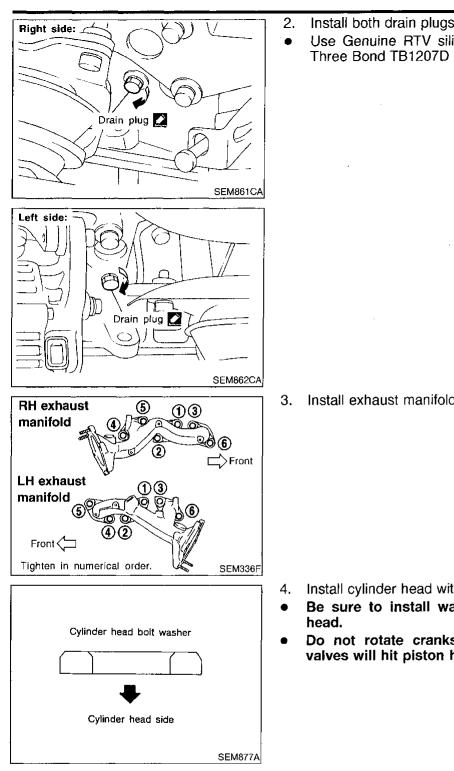
head front

Rocker shaft direction

ଡୀତ

RH cylinder

head front



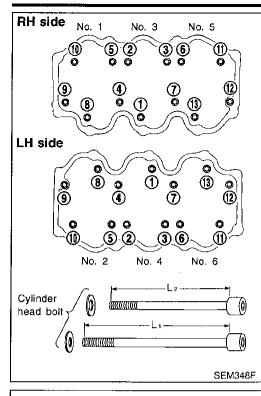
l both drain plugs. Genuine RTV silicone sealant Part No. 999MP-A7007, 9 Bond TB1207D or equivalent.	gi Ma
	IMIA
	EM
	LC
	EĊ
• •	þ
	CL
	MT
exhaust manifolds to cylinder head.	AT
·	ΊF
	PD
	AX
outinder head with new generat	SU
cylinder head with new gasket. are to install washers between bolts and cylinder	BR
ot rotate crankshaft and camshaft separately, or s will hit piston heads.	ST
	RS
	BT

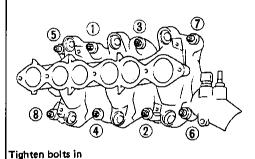
HA

SC

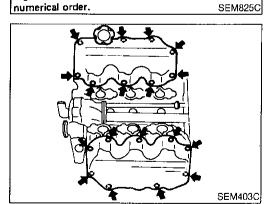
IDX

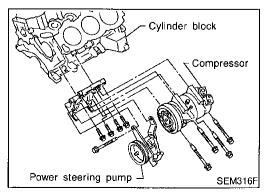
Installation (Cont'd)





numerical order.





CYLINDER HEAD

Tighten cylinder head bolts in numerical order using angle 5. wrench [ST10120000 (J24239-01)].

Apply engine oil to threads and seating surfaces of cylinder head bolts before installing them.

Cylinder head bolts for 4, 7, 9 and 12 are longer than the others.

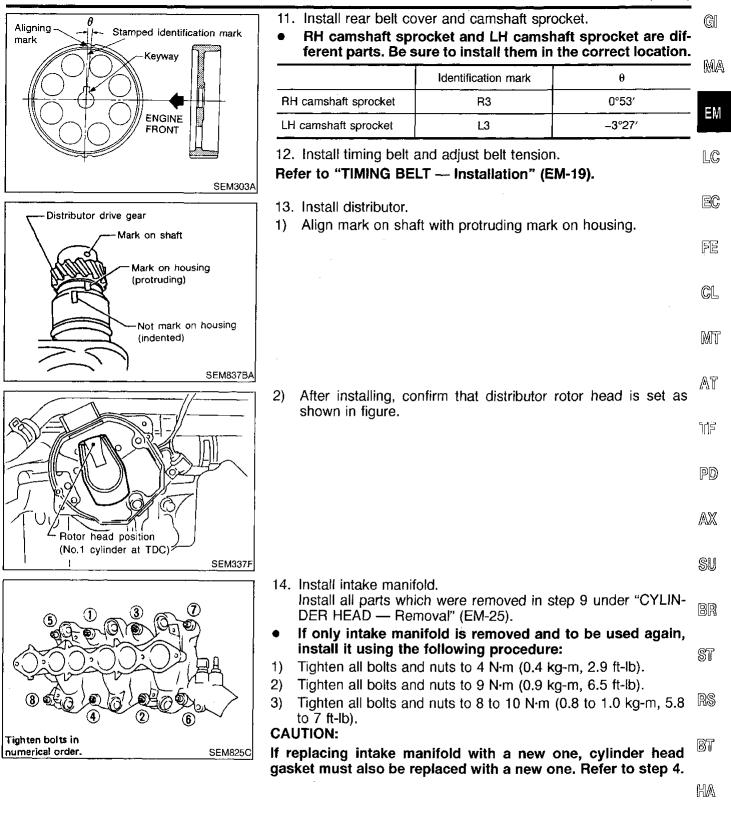
> L₁: 127 mm (5.00 in) for 4, 7, 9 and 12 L₂: 106 mm (4.17 in) for others

- Install intake manifold and cylinder head at the same time . using the following procedure:
- Tighten cylinder head bolts to 29 N·m (3.0 kg-m, 22 ft-lb). 1)
- Tighten cylinder head bolts to 59 N·m (6.0 kg-m, 43 ft-lb). 2)
- Loosen cylinder head bolts completely. 3)
- Tighten cylinder head bolts to 10 N·m (1.0 kg-m, 7 ft-lb). 4)
- Tighten intake manifold bolts and nuts to 4 N·m (0.4 kg-m, 2.9 5) ft-lb).
- Tighten intake manifold bolts and nuts to 18 N·m (1.8 kg-m, 13 6) ft-lb).
- Tighten intake manifold bolts and nuts to 16 to 20 N·m (1.6 to 7) 2.0 kg-m, 12 to 14 ft-lb).
- Loosen intake manifold bolts and nuts completely. 8)
- Tighten cylinder head bolts to 29 N·m (3.0 kg-m, 2.2 ft-lb). 9)
- 10) Turn cylinder head bolts to 60 to 65 degrees clockwise. If an angle wrench is not available, tighten cylinder head bolts to 54 to 64 N·m (5.5 to 6.5 kg-m, 40 to 47 ft-lb).
- 11) Tighten cylinder head sub-bolts to 9.0 to 11.8 N·m (0.92 to 1.20) kg-m, 6.7 to 8.7 ft-lb).
- 12) Tighten intake manifold bolts and nuts to 4 N·m (0.4 kg-m, 2.9 ft-lb).
- 13) Tighten intake manifold bolts and nuts to 9 N·m (0.9 kg-m, 6.5 ft-lb).
- 14) Tighten intake manifold bolts and nuts to 8 to 10 N·m (0.8 to 1.0 kg-m, 5.8 to 7 ft-lb).
- 6. Install both rocker covers.

- Install compressor and alternator bracket. 7.
- 8. Install alternator.
- 9. Install compressor and power steering pump.
- 10. Install exhaust front tube to exhaust manifold.

CYLINDER HEAD

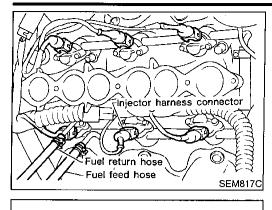
Installation (Cont'd)

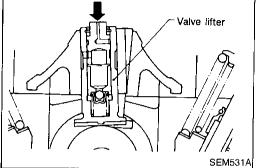


SC

EL

Installation (Cont'd)





CYLINDER HEAD

- 15. Install injector fuel tube assembly.
- 16. Connect all injector harness connectors.
- 17. Install fuel feed and fuel return hoses to injector fuel tube assembly.
- 18. Install intake manifold collector. Install all parts which were removed in step 5 under "CYLINDER HEAD Removal" (EM-25).
- 19. Install ASCD and accelerator control wire.
- 20. Check hydraulic valve lifter.
- a. Push plunger forcefully with your finger.
- Be sure to check it with rocker arm in its free position (not on the lobe).
- b. If valve lifter moves more than 1 mm (0.04 in), air may be inside it.
- c. Bleed air off by running engine at 1,000 rpm under no load for about 10 minutes.
- d. If hydraulic valve lifters are still noisy, replace them and bleed air off again in the same manner as in step 20 (c).

ENGINE ASSEMBLY

	Removal and Installation	
	Removal and Installation	j[
	WARNING:	
	Situate vehicle on a flat and solid surface.	A
	 Place chocks at front and back of rear wheels. 	טרענ
	 Do not remove engine until exhaust system has com- pletely cooled off. Otherwise, you may burn yourself and/or fire may break out in fuel line. 	М
	 For safety during subsequent steps, the tension of wires should be slackened against the engine. 	Ĉ
	 Before disconnecting fuel hose, release fuel pressure from fuel line. 	9
	Refer to "Releasing Fuel Pressure" in EC section.	9
	 Before removing front axle from transmission, place safety stands under designated front supporting points. Refer to GI section for lifting points and towing. 	l u l
	 Be sure to hoist engine and transmission in a safe manner. 	L
	 For engines not equipped with engine slingers, attach proper slingers and bolts described in PARTS CATALOG. CAUTION: 	Ţ
	 When lifting engine, be careful not to strike adjacent parts, especially accelerator wire casing, brake lines, and brake master cylinder. 	7
	 In hoisting the engine, always use engine slingers in a safe manner. 	ت د
	 Before separating engine and transmission, remove crankshaft position sensor (OBD) from the assembly. 	
	 Always take extra care not to damage edge of crankshaft proposition sensor (OBD), or ring gear teeth. 	Ì
	AX	7
	SU	Ì
g nut –y	 Do not loosen front engine mounting insulator cover securing nuts. 	

securing nuts. BR When cover is removed, damper oil flows out and mount-ing insulator will not function. For tightening torque, refer to AT, MT and PD sections. For 4WD model, sealant should be applied between engine ST and transmission.

Refer to "Installation" in MT section.

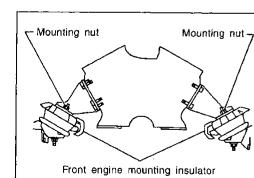
- RS
- BT

HA

SC

EL

IDX



SEM322F

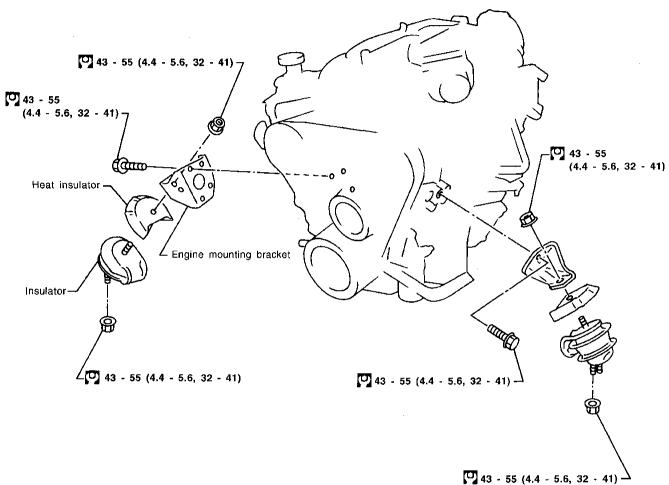
ENGINE ASSEMBLY

REMOVAL Front Engine Mounting

NAEM0020S01

NAEM0020S0101

SEC. 112



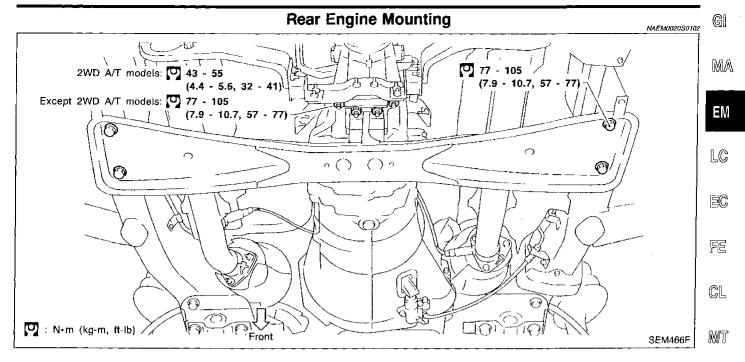
► **4** 43 = 55 (4.4 = 5.6, 52 = 41)

🕐 : N-m (kg-m, ft-lb)

SEM320F

ENGINE ASSEMBLY

Removal and Installation (Cont'd)



Rear Front Engine slinger SEM323F

SEM324F

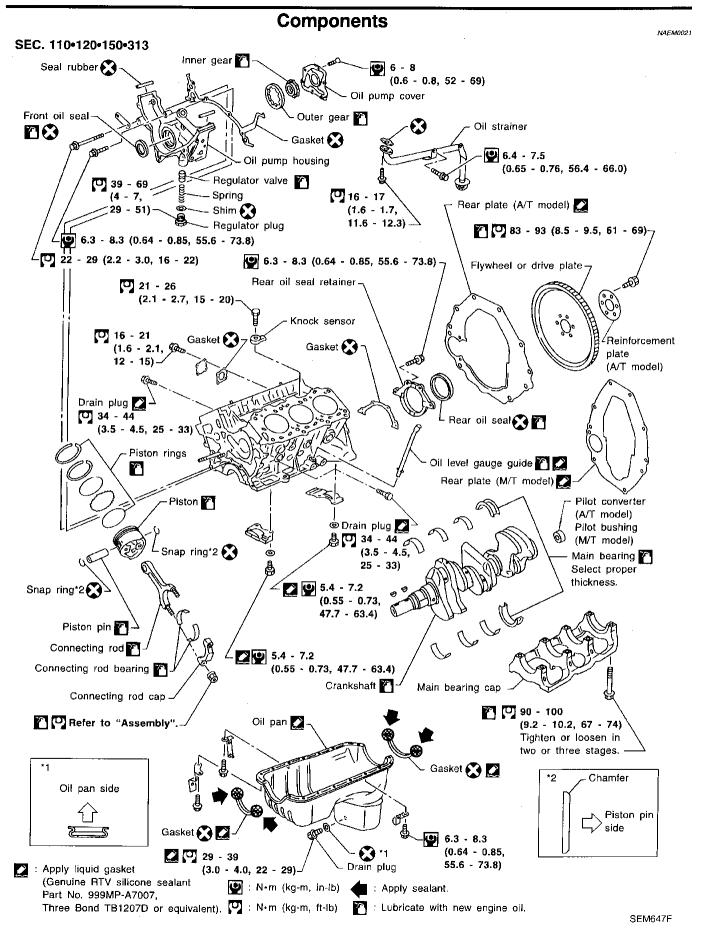
		AT
1.	Remove engine undercover and hood.	<i>t</i> -3 (i
2.	Drain engine coolant.	
3.	Remove vacuum hoses, fuel tubes, wires, harnesses and connectors and so on.	귀단
4.	Remove radiator with shroud and cooling fan.	PD
5.	Remove drive belts.	ГIJ
6.	Remove power steering oil pump and air conditioner compres-	
	sor.	AX
7.	Remove front exhaust tube.	
8.	Remove transmission from vehicle.	SU
Ref	er to "Removal" in MT and AT sections.	90
9.	Install engine slingers.	
	Slinger bolts:	BR
	🖸 : 20 - 26 N·m (2.1 - 2.7 kg-m, 15 - 20 ft-lb)	
	Hoist engine with engine slingers and remove engine mount- ing nuts from both sides.	ST
11.	Remove engine from vehicle.	
		RS
		BT

HA

SC

IDX

129



Components (Cont'd)

GI

MA

ЕΜ

LC

EC

[2]]

GL

MT

AT

ΪF

PD

CYLINDER BLOCK HEATER NAEM0021\$01 For Canada SEC. 110 0 Front propeller shaft A Cylinder block heater O-ring 💽 Connector protector cap O-ring 🔀 Cylinder block heater Engine front 🕑 1.6 - 2.2 N•m (0.16 - 0.22 kg-m, 13.9 - 19.1 in-lb) Remove liquid gasket completely after removing cylinder block heater. · Install cylinder block heater with heater part downward as shown in the figure. Apply LLC to O-ring when installing cylinder block heater. SEM625F

Refer to "OUTER COMPONENT PARTS" in EM-11 as to "Removal and Installation" for the procedures prior to removing the block heater.

AX

SU

BR

ST

NAEM0022

Removal and Installation

CAUTION:

- When installing sliding parts such as bearings and pistons, be sure to apply engine oil on the sliding surfaces.
- Place removed parts such as bearings and bearing caps in their proper order and direction.
- When installing connecting rod boits 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 on flywheel or drive plate and rear plate.

HA

SC

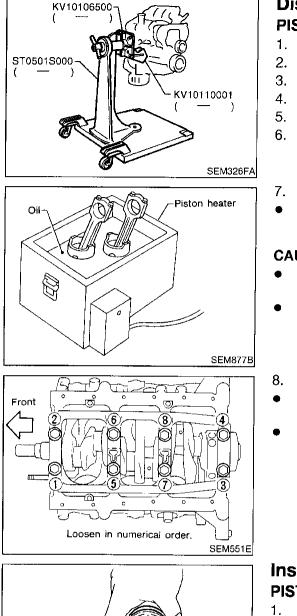
ĒL

IDX

131

Disassembly



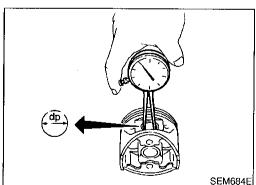


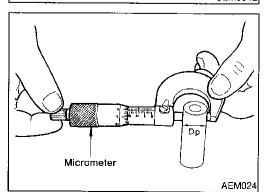
Disassembly PISTON AND CRANKSHAFT

- 1. Place engine on a work stand.
- 2. Drain coolant and oil.
- 3. Remove oil pan and oil pump.
- 4. Remove timing belt.
- 5. Remove water pump.
- 6. Remove cylinder head.
- 7. Remove pistons with connecting rods.
- When disassembling piston and connecting rod, remove snap ring first, then heat piston to 60 to 70°C (140 to 158°F) or use piston pin press stand at room temperature.

CAUTION:

- 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.
- 3. Remove bearing cap and crankshaft.
- Before removing bearing cap, measure crankshaft end play.
- Bolts should be loosened in two or three steps.





Inspection PISTON AND PISTON PIN CLEARANCE 1. Measure inner diameter of piston pin hole "dp". Standard diameter "dp": 20.969 - 20.981 mm (0.8255 - 0.8260 in)

NAEM0024 NAEM0024S01

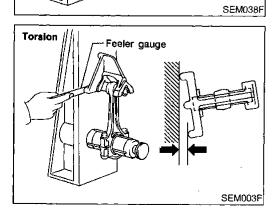
NAEM0023

NAEM0023\$01

- Measure outer diameter of piston pin "Dp". Standard diameter "Dp": 20.971 - 20.983 mm (0.8256 - 0.8261 in)
 Calculate piston pin clearance. dp - Dp = 0 - 0.004 mm (0 - 0.0002 in)
- If it exceeds the above value, replace piston assembly with pin.

EM-44

Inspection (Cont'a)
NG PISTON RING SIDE CLEARANCE NAEM002450	2 GI
Top ring: 0.024 - 0.076 mm (0.0009 - 0.0030 in) Preeler 2nd ring: 0.030 - 0.070 mm (0.0012 - 0.0028 in)	MA
gauge ок Сок Сок Сок Сок Сок Сок Сок Сок Сок	EM
Feeler gauge	LC
Piston7 Piston7 PiSTON RING END GAP	EC
Press-fit / Fnd gap:	
Top ring: 0.21 - 0.40 mm (0.0083 - 0.0157 in) gauge 2nd ring: 0.50 - 0.69 mm (0.0197 - 0.0272 in)	FE
Oil ring: 0.20 - 0.69 mm (0.0079 - 0.0272 in) Max. limit of ring gap:	CL
Ming Top ring: 0.54 mm (0.0213 in) Measuring point 2nd ring: 0.80 mm (0.0315 in) Oil ring: 0.95 mm (0.0374 in)	MT
SEM822B If out of specification, replace piston ring. If gap still exceeds the limit even with a new ring, rebore cylinder and use oversized piston and piston rings. Refer to SDS (EM-61).	AT
 When replacing the piston, check the cylinder block surface for scratches or seizure. If scratches or seizure are found, hone 	TĒ
or replace the cylinder block.	PD
	AX
Bend CONNECTING ROD BEND AND TORSION	SU
Feeler gauge Bend: Limit 0.15 mm (0.0059 in)	BR
per 100 mm (3.94 in) length Torsion:	ST
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.	RS
SEM038F	BT



133

HA

SC

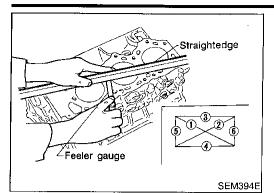
EL

IDX I

i

-

Inspection (Cont'd)



CYLINDER BLOCK DISTORTION AND WEAR

 Clean upper face of cylinder block and measure the distortion. Limit:

0.10 mm (0.0039 in)

 If out of specification, resurface it. The resurfacing limit is determined by cylinder head resurfacing in engine.

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)

Nominal cylinder block height from crankshaft center: 227.60 - 227.70 mm (8.9606 - 8.9645 in)

3. If necessary, replace cylinder block.

PISTON-TO-BORE CLEARANCE

- Using a bore gauge, measure cylinder bore for wear, out-ofround and taper.
 - Standard inner diameter:

91.500 - 91.530 mm (3.6024 - 3.6035 in)

Refer to "CYLINDER BLOCK" in SDS.

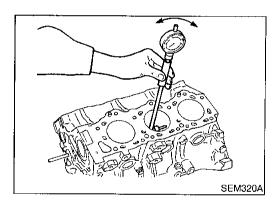
Wear limit:

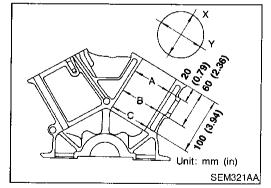
0.20 mm (0.0079 in)

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

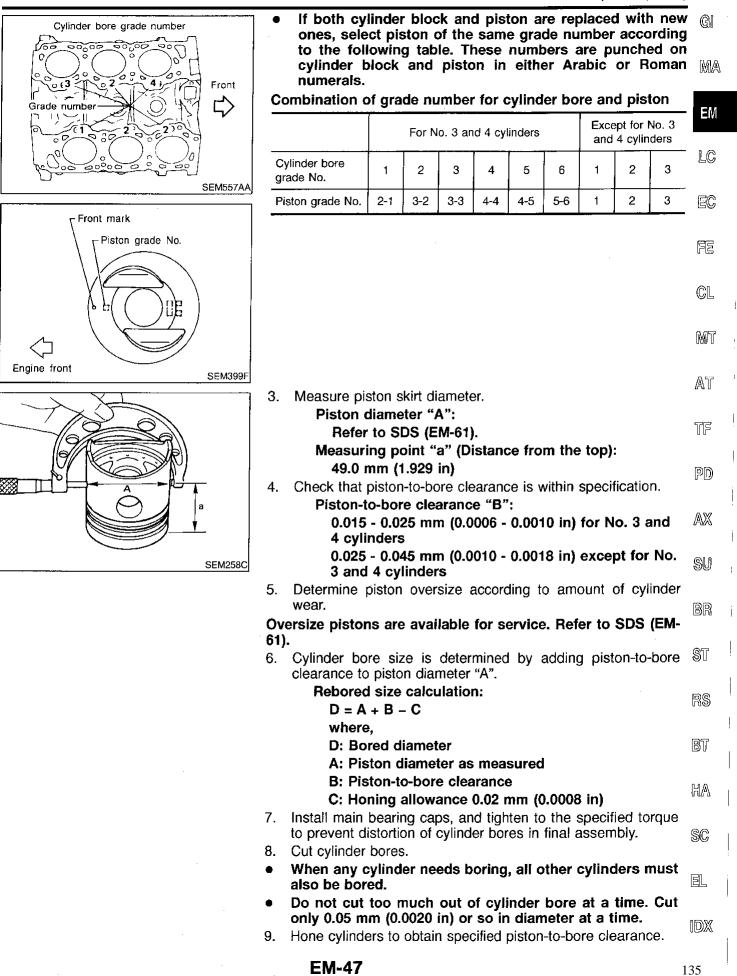
Out-of-round (X – Y) standard:

- 0.015 mm (0.0006 in)
- Taper (A B or A C) standard:
 - 0.015 mm (0.0006 in)
- 2. Check for scratches and seizure. If seizure is found, hone it.

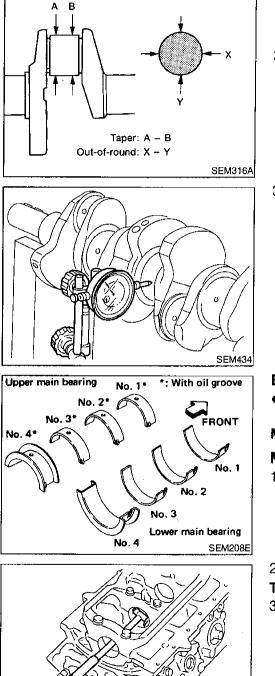




Inspection (Cont'd)



- 10. Measure finished cylinder bore for out-of-round and taper.
- Measurement should be done after cylinder bore cools down.



Bore gauge

SEM505A

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): Less than 0.005 mm (0.0002 in) Taper (A – B): Less than 0.005 mm (0.0002 in)

3. Measure crankshaft runout. Runout (Total indicator reading): Less than 0.10 mm (0.0039 in)

BEARING CLEARANCE

• Either of the following two methods may be used, however, method A gives more reliable results and is preferable.

Method A (Using bore gauge & micrometer)

Main Bearing

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

Tighten all bolts in correct order in two or three stages.

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

AEM033

SEM184A

No. 4

b.

8.

a.

b.

c.

	Inspection (Cont'd)		
4.	Measure outer diameter "Dm" of each crankshaft main journal.	G	
5.	Calculate main bearing clearance.		
	Main bearing clearance (A – Dm):	ាគគ	
	Standard	MA	
	0.028 - 0.055 mm (0.0011 - 0.0022 in)		
	Limit	EM	
	0.090 mm (0.0035 in)		
6.	If it exceeds the limit, replace bearing.	LC	
7.	If clearance cannot be adjusted within the standard of any	GQ	
	bearing, grind crankshaft journal and use undersized bearing.		
a.	When grinding crankshaft journal, confirm that "L" dimension in	EC	
	fillet roll is more than the specified limit.		
	"L": 0.1 mm (0.004 in)	FE	
b.	Refer to SDS for grinding crankshaft and available service	•	
	parts.	ଜା	
		CL	
		MT	
_		AT	
8.	If crankshaft is reused, measure main bearing clearances and		
	select thickness of main bearings. If crankshaft is replaced with a new one, it is necessary to	TF	
	select thickness of main bearings as follows:	יים זו	
a.	Grade number of each cylinder block main journal is punched		
	on the respective cylinder block. These numbers are punched	PD	
	in either Arabic or Roman numerals.		
		AX	
		SU	
h	Grade number of each crankshaft main journal is punched on	00	
b.	the respective crankshaft. These numbers are punched in		
	either Arabic or Roman numerals.	BR	
с.	Select main bearing with suitable thickness according to the		
	following example or table.	ST	
	For example: Main journal grade number: 1		
	Crankshaft journal grade number: 2	RS	
	Main bearing grade number = $1 + 2 = 3$ (Yellow)	വര	
		BT	

SEM508A No. 4 journal No. 3 grade number No. 2 No. 1-SEM167B

No. 2

No. 3

No. 1 journal grade number

Front

 $\langle \cdot \rangle$

Main bearing grade number (Identification color):

	/ 5	•			- 000
		Main journal grade number			HA
		"0"	"1" or " I "	"2" or "II"	-
Crankshaft	"0"	0 (Black)	1 (Brown)	2 (Green)	- sc
journal grade	"1" or "l"	1 (Brown)	2 (Green)	3 (Yellow)	- EL
number	"2" or "II"	2 (Green)	3 (Yellow)	4 (Blue)	- <u>E</u>

IDX I

EM-49

Inspection (Cont'd)

Inside micrometer

Dp

AEM034

Connecting Rod Bearing (Big end)

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

Tighten bolts to the specified torque.

- 3. Measure inner diameter "C" of each bearing.
- 4. Measure outer diameter "Dp" of each crankshaft pin journal.
- 5. Calculate connecting rod bearing clearance.

Connecting rod bearing clearance (C – Dp): Standard

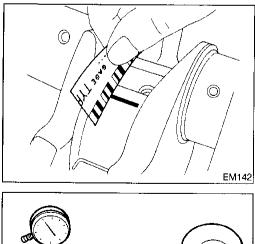
0.014 - 0.054 mm (0.0006 - 0.0021 in) Limit

0.090 mm (0.0035 in)

- 6. 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 step 7 of "BEARING CLEARANCE — Main bearing" (EM-48).

Do not turn crankshaft or connecting rod while plastigage

When bearing clearance exceeds the specified limit, ensure that the proper bearing has been installed. Then if excessive bearing clearance exists, use a thicker main bearing or undersized bearing so that the specified bear-



CONNECTING ROD BUSHING CLEARANCE (SMALL END)

NAEM0024S09

1. Measure inner diameter "C" of bushing.

ing clearance is obtained.

Method B (Using plastigage)

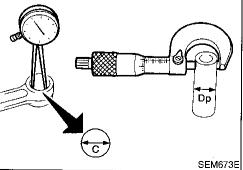
is being inserted.

CAUTION:

- 2. Measure outer diameter "Dp" of piston pin.
- 3. Calculate connecting rod bushing clearance.

Connecting rod bushing clearance = C - DpStandard: 0.005 - 0.017 mm (0.0002 - 0.0007 in) Limit: 0.023 mm (0.0009 in)

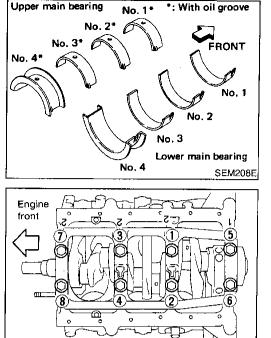
If it exceeds the limit, replace connecting rod assembly or connecting rod bushing and/or piston set with pin.

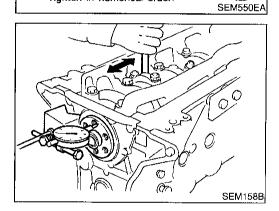


	Inspection (Cont'd)	
	REPLACEMENT OF CONNECTING ROD BUSHING (SMALL END)	GI
	 Drive in small end bushing until it is flush with end surface of rod. 	i MA
	Be sure to align the oil holes.2. After driving in small end bushing, ream the bushing so that clearance between connecting rod bushing and piston pin is	
Align.	the specified value. Clearance between connecting rod bushing and pis- ton pin:	LC
SEM062A	0.005 - 0.017 mm (0.0002 - 0.0007 in) FLYWHEEL/DRIVE PLATE RUNOUT	EC
-Dial gauge	Runout (Total indicator reading): Flywheel (M/T model)	FE
00	Less than 0.15 mm (0.0059 in) Drive plate (A/T model)	GL
	Less than 0.15 mm (0.0059 in) CAUTION: Be careful not to damage the ring gear teeth.	_
	 De caleful not to damage the ring gear teem. Check the drive plate for deformation or cracks. Do not allow any magnetic materials to contact the ring 	MT
AEM100	 gear teeth. Do not surface flywheel. Replace as necessary. 	AT
		PD
		AX
		SU
Front mark	Assembly PISTON 1. Install new snap ring on one side of piston pin hole.	BR
Engine front	2. Heat piston to 60 to 70°C (140 to 158°F) and assemble piston, piston pin, connecting rod and new snap ring.	ST
Oil hole	 Align the direction of piston and connecting rod. Numbers stamped on connecting rod and cap correspond to each cylinder. 	RS
Cylinder number SEM400F	 After assembly, make sure connecting rod swings smoothly. 	BŢ
Oil ring expander	3. Set piston rings as shown.	HA
Engine front		SC
		EL
2nd ring		(DX

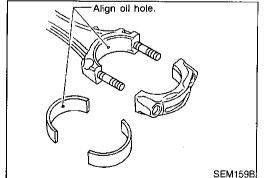
SEM160B

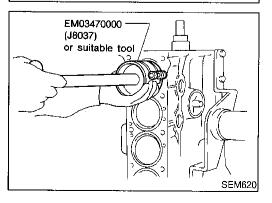
139





Tighten in numerical order.





CYLINDER BLOCK

CRANKSHAFT

- 1. Set main bearings in their proper positions on cylinder block and main bearing cap.
- Confirm that correct main bearings are used.

Refer to "Inspection" (EM-48).

- 2. Install crankshaft and main bearing caps and tighten bolts to the specified torque.
- Prior to tightening bearing cap bolts, place bearing cap in its proper position by shifting crankshaft in the axial direction.
- Tighten bearing cap bolts gradually in two or three stages. Start with center bearing and move outward sequentially.
- After securing bearing cap bolts, make sure crankshaft turns smoothly by hand.
- Lubricate threads and seat surfaces of the bolts with new engine oil.
- 3. Measure crankshaft end play.

Crankshaft end play:

Standard

0.050 - 0.170 mm (0.0020 - 0.0067 in)

Limit

0.30 mm (0.0118 in)

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

- 4. Install connecting rod bearings in connecting rods and connecting rod caps.
- Confirm that correct bearings are used.

Refer to "Inspection".

 Install bearings so that oil hole in connecting rod aligns with oil hole of bearing.

5. Install pistons with connecting rods.

- a. Install them into corresponding cylinders with Tool.
- Be careful not to scratch cylinder wall by connecting rod.
- Arrange so that front mark on piston head faces toward front of engine.

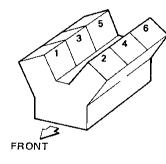
	 b. Install connecting rod bearing caps. Lubricate threads and seat surfaces with new engine oil. Tighten connecting rod bearing cap nuts to the specified torque. C1: Connecting rod bearing nut (1) Tighten to 14 to 16 N·m (1.4 to 1.6 kg-m, 10 to 12 ft-lb). (2) Turn nuts 60 to 65 degrees clockwise. If 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). 6. Measure connecting rod side clearance. Connecting rod side clearance: Standard 0.20 - 0.35 mm (0.0079 - 0.0138 in) Limit 0.40 mm (0.0157 in) If beyond the limit, replace connecting rod and/or crankshaft. 	GI MA EM LC EC FE CL MT AT TF PD AX	
ST16610001 (J23907) or suitable tool	 REPLACING PILOT BUSHING (M/T) OR PILOT CONVERTER (A/T) 1. Remove pilot bushing (M/T) or pilot converter (A/T). 2. Install pilot bushing (M/T) or pilot converter (A/T). 	SU BR ST RS BT HA SC EL	
A/T A/T SEM163B	EM-53	IDX 141	

General Specifications

General Specifications

		NA	EM0026
Cylinder arrangement		V-6	
Displacement		3,275 cm ³ (199.84 cu in)	
Bore and stroke		91.5 x 83 mm (3.602 x 3.27 in)	
Valve arrangement		OHC	
Firing order		1-2-3-4-5-6	
Number of sister rises	Compression	2	
Number of piston rings	Oit	1	
Number of main bearings		. 4	
Compression ratio		8.9	

Cylinder number



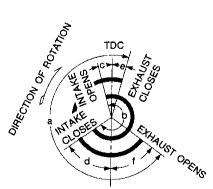
SEM713A

Unit: kPa (kg/cm², psi)/300 rpm

	Standard	1,196 (12.2, 173)
Compression pressure	Minimum	883 (9.0, 128)
	Differential limit between cylinders	98 (1.0, 14)

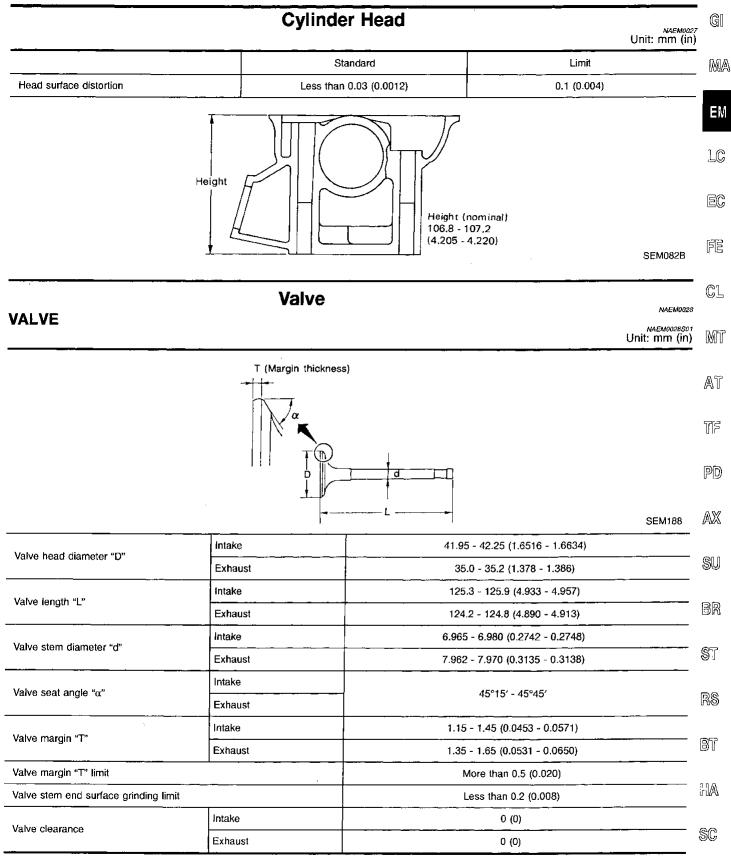
Unit: degree

Valve timing



	BDC EM120				
а	b	с	d	Ð	1
240	244	4	60	9	51

Cylinder Head



EL

IDX

Valve (Cont'd)

VALVE SPRING			
	Outer	NAEM0028502 51.2 mm (2.016 in)	
Free height	Inner	44.1 mm (1.736 in)	
Pressure	Outer	523.7 N (53.4 kg, 117.7 lb) at 30.0 mm (1.181 in)	
	Inner	255.0 N (26.0 kg, 57.3 lb) at 25.0 mm (0.984 in)	
	Outer	2.2 mm (0.087 in)	
Out-of-square	Inner	· 1.9 mm (0.075 in)	

HYDRAULIC VALVE LIFTER

NAEMOO2BSO3 Unit: mm (in)

Lifter outside diameter	15.947 - 15.957 (0.6278 - 0.6282)
Lifter guide inside diameter	16.000 - 16.013 (0.6299 - 0.6304)
Clearance between lifter and lifter guide	0.043 - 0.066 (0.0017 - 0.0026)

VALVE GUIDE

NAEM0028504 Unit: mm (in)

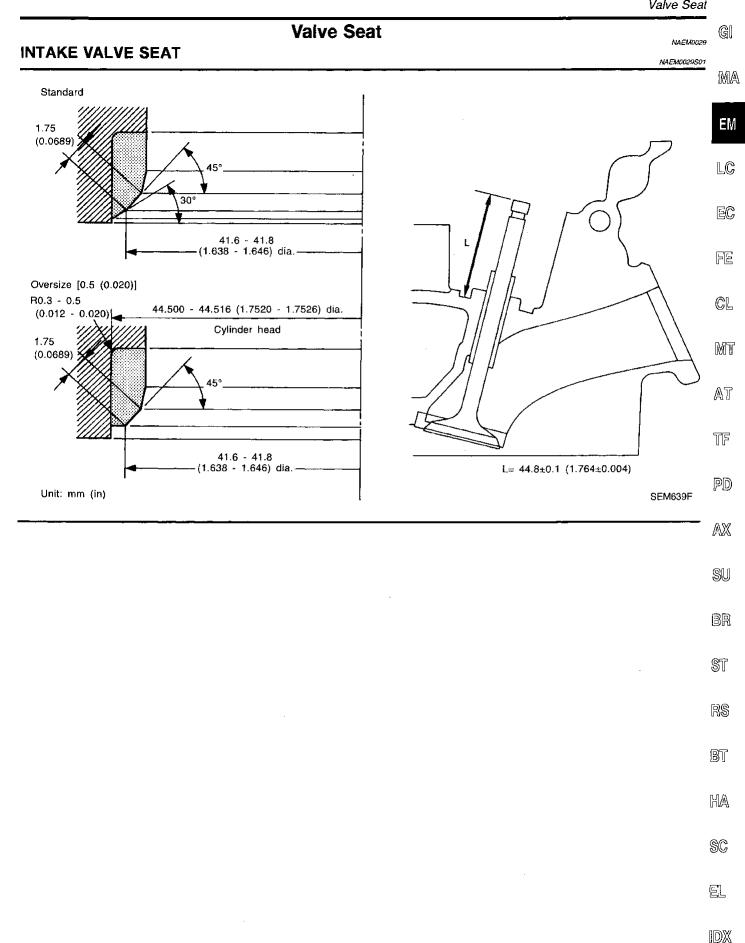
			Standard	Service	
		Intake	11.023 - 11.034 (0.4340 - 0.4344)	11.223 - 11.234 (0.4418 - 0.4423)	
Value quide	Outer diameter	Exhaust	12.023 - 12.034 (0.4733 - 0.4738)	12.223 - 12.234 (0.4812 - 0.4817)	
Valve guide	Inner diameter (Finished	Intake	7.000 - 7.018 (0.2756 - 0.2763)		
	size)	Exhaust	8.000 - 8.011 (0.3150 - 0.3154)		
Cylinder head valve guide hole diameter		Intake	10.975 - 10.996 (0.4321 - 0.4329)	11.175 - 11.196 (0.4400 - 0.4408)	
		Exhaust	11.975 - 11.996 (0.4715 - 0.4723)	12.175 - 12.196 (0.4793 - 0.4802)	
Interference (it	of volvo quido	Intake	0.027 - 0.059 (0.0011 - 0.0023)		
menerence m	of valve guide	Exhaust			
			Standard	Max. tolerance	
Stem to guide clearance		Intake	0.020 - 0.053 (0.0008 - 0.0021)	0 10 (0 0020)	
		Exhaust	0.040 - 0.049 (0.0016 - 0.0019)	0.10 (0.0039)	
Valve deflection limit		_	0.20 (0.0079)		

ROCKER SHAFT AND ROCKER ARM

NAEM002BS05 Unit: mm (in)

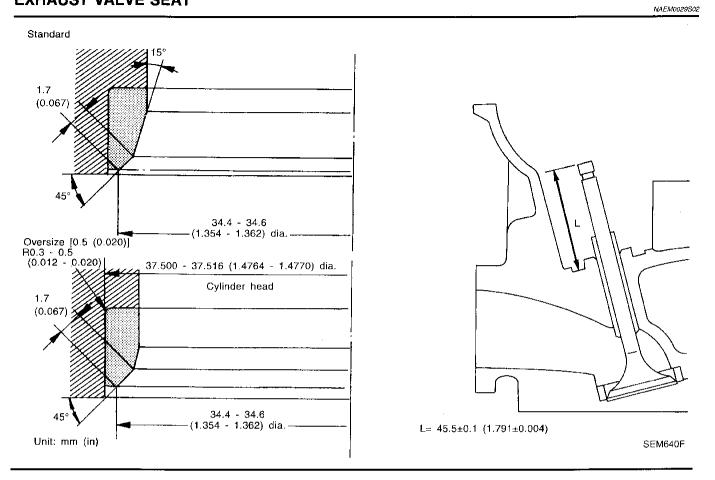
Rocker shaft	Outer diameter	17.979 - 18.000 (0.7078 - 0.7087)
Rocker arm	Inner diameter	18.007 - 18.028 (0.7089 - 0.7098)
Clearance between rocker arm and rocker shaft		0.007 - 0.049 (0.0003 - 0.0019)

Valve Seat



1

EXHAUST VALVE SEAT



Camshaft and Camshaft Bearing

Camshaft and Camshaft Bearing

NAEM0030 Unit: mm (in)

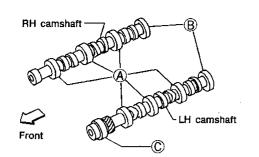


ΕM

LC

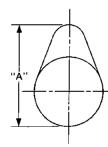
EC

GI



SEM893BA

		O LINOS	
	Standard	Max. tolerance	- (7)2
Camshaft journal to bearing clearance	0.060 - 0.105 (0.0024 - 0.0041)	0.15 (0.0059)	 @1
	A: 47.000 - 47.025 (1.8504 - 1.8514)		CL
Inner diameter of camshaft bearing	B: 42.500 - 42.525 (1.6732 - 1.6742)		 MT
	C: 48.000 - 48.025 (1.8898 - 1.8907)		
	A: 46.920 - 46.940 (1.8472 - 1.8480)		— AT
Outer diameter of camshaft journal	B: 42.420 - 42.440 (1.6701 - 1.6709)	_	Pat
	C: 47.920 - 47.940 (1.8866 - 1.8874)		TF
Camshaft runout [TIR*]	Less than 0.04 (0.0016)	0.1 (0.004)	UU.
Camshaft end play	0.03 - 0.06 (0.0012 - 0.0024)		PD
	I		- PU



i	
	SU

EM671

BR

Cam height "A"	Intake	38.943 - 39.133 (1.5332 - 1.5407)	
	Exhaust	38.943 - 39.133 (1.5332 - 1.5407)	ST
Wear limit of cam height		0.15 (0.0059)	
*Total indicator reading			RS

*Total indicator reading



HA

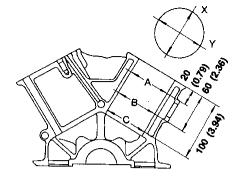
SC

EL

1DX

Cylinder Block

NAEM0031 Unit: mm (in)



SEM321A

Surface flatness Standard			Less than 0.03 (0.0012)	
		Limit		0.10 (0.0039)
		Standard (for No. 3 and 4 cylinders)	Grade No. 1	91.500 - 91.505 (3.6024 - 3.6026)
			Grade No. 2	91.506 - 91.510 (3.6026 - 3.6027)
			Grade No. 3	91.511 - 91.515 (3.6028 - 3.6029)
			Grade No. 4	91.516 - 91.520 (3.6030 - 3.6031)
Cylinder bore	I nn er diameter		Grade No. 5	91.521 - 91.525 (3.6032 - 3.6033)
Oyinider bore			Grade No. 6	91.526 - 91.530 (3.6034 - 3.6035)
		Standard (except for No. 3 and 4 cylinders)	Grade No. 1	91.500 - 91.510 (3.6024 - 3.6027)
			Grade No. 2	91.511 - 91.520 (3.6028 - 3.6031)
			Grade No. 3	91.521 - 91.530 (3.6032 - 3.6035)
		Wear limit		0.20 (0.0079)
Out-of-round (X -	- Y)			Less than 0.015 (0.0006)
Taper (A – B or A	N – C)			Less than 0.015 (0.0006)
			Grade No. 0	66.645 - 66.654 (2.6238 - 2.6242)
Main journal inner diameter			Grade No. 1	66.654 - 66.663 (2.6242 - 2.6245)
			Grade No. 2	66.663 - 66.672 (2.6245 - 2.6249)
Difference in inner diameter between standard			Less than 0.05 (0.0020)	

SERVICE DATA AND SPECIFICATIONS (SDS) Piston, Piston Ring and Piston Pin

Piston, Piston Ring and Piston Pin

AVAILABLE PISTON

маемоозабот Unit: mm (in)

NAEM0032

GI

		·····	NAEMO03256 Unit: mm (in	<u> </u>
				[[
			A SEM882E	
		Grade No. 2-1	91.480 - 91.485 (3.6016 - 3.6018)	-
	Standard (for No. 3 and 4 cylinders)	Grade No. 3-2	91.486 - 91.490 (3.6018 - 3.6020)	- (
		Grade No. 3-3	91.491 - 91.495 (3.6020 - 3.6022)	
		Grade No. 4-4	91.496 - 91.500 (3.6022 - 3.6024)	- [
		Grade No. 4-5	91.501 - 91.505 (3.6024 - 3.6026)	
viston skirt diameter		Grade No. 5-6	91.506 - 91.510 (3.6026 - 3.6027)	
Ą "		Grade No. 1	91.465 - 91.475 (3.6010 - 3.6014)	
	Standard (except for	Grade No. 2	91.476 - 91.485 (3.6014 - 3.6018)	
		Grade No. 3	91.486 - 91.495 (3.6018 - 3.6022)	
	No. 3 and 4 cylinders)	0.25 (0.0098) oversize (Service)	91.715 - 91.745 (3.6108 - 3.6120)	ľ
		0.50 (0.0197) oversize (Service)	91.965 - 91.995 (3.6207 - 3.6218)	ŀ
"a" dimension			49.0 (1.929)	9
Piston pin hole diameter			20.969 - 20.981 (0.8255 - 0.8260)	9
Piston clearance to	Standard	For No. 3 and 4 cylin- ders	0.015 - 0.025 (0.0006 - 0.0010)	00
ylinder block	Standard	Except for No. 3 and 4 cylinders	0.025 - 0.045 (0.0010 - 0.0018)	ල්

PISTON RING

 തര
RS

		Standard	Limit	
	Тор	0.024 - 0.076 (0.0009 - 0.0030)	0.11 (0.0043)	BT
Side clearance	2nd	0.030 - 0.070 (0.0012 - 0.0028)	0.10 (0.004)	
	Oil	0.015 - 0.185 (0.0006 - 0.0073)		HA
	Тор	0.21 - 0.40 (0.0083 - 0.0157)	0.54 (0.0213)	·
Ring gap	2nd	0.50 - 0.69 (0.0197 - 0.0272)	0.80 (0.0315)	SC
	Oil (rail ring)	0.20 - 0.69 (0.0079 - 0.0272)	0.95 (0.0374)	

٢L

į.

DX

Piston, Piston Ring and Piston Pin (Cont'd)

PISTON PIN

NAEM0032503 Unit: mm (in)

Piston pin outer diameter	20.971 - 20.983 (0.8256 - 0.8261)
Interference fit of piston pin to piston	0 - 0.004 (0 - 0.0002)
Piston pin to connecting rod bushing clearance	0.005 - 0.017 (0.0002 - 0.0007)

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

Connecting Rod

NAEM0033 Unit: mm (in)

Center distance		154.1 - 154.2 (6.067 - 6.071)
Bend, torsion [per 100 (3.94)]		Bend: 0.15 (0.0059) Torsion: 0.30 (0.0118)
Piston pin bushing inner diameter*		20.982 - 20.994 (0.8261 - 0.8265)
Connecting rod big end inner diameter		53.000 - 53.013 (2.0866 - 2.0871)
	Standard	0.20 - 0.35 (0.0079 - 0.0138)
Side clearance	Limit	0.40 (0.0157)

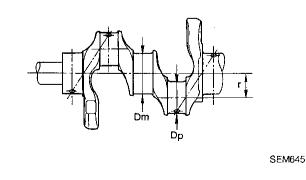
*After installing in connecting rod

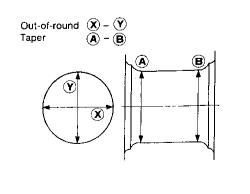
Crankshaft

NAEM0034 Unit: mm (in)

EM715

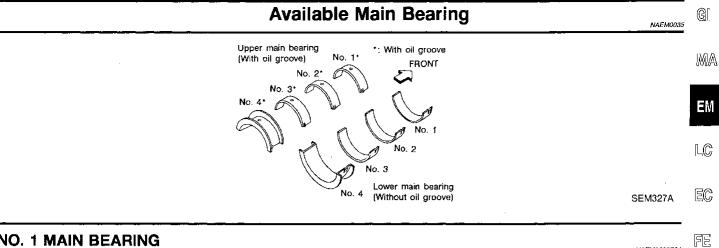
	Grade No. 0	62.967 - 62.975 (2.4790 - 2.4793)
Main journal dia. "Dm"	Grade No. 1	62.959 - 62.967 (2.4787 - 2.4790)
	Grade No. 2	62.951 - 62.959 (2.4784 - 2.4787)
Pin journal dia. "Dp"		49.955 - 49.974 (1.9667 - 1.9675)
Center distance "r"		41.5 (1.634)
Out-of-round (X – Y)	Standard	Less than 0.005 (0.0002)
Taper (A – B)	Standard	Less than 0.005 (0.0002)
Runout [TIR]	Standard	Less than 0.025 (0.0010)
	Lìmít	Less than 0.10 (0.0039)
Free end play	Standard	0.050 - 0.170 (0.0020 - 0.0067)
	Limit	0.30 (0.0118)





Available Main Bearing

NAEM0035501



NO. 1 MAIN BEARING

Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color	
0	1.817 - 1.821 (0.0715 - 0.0717)		Black	CL
1	1.821 - 1.825 (0.0717 - 0.0719)		Brown	
2	1.825 - 1.829 (0.0719 - 0.0720)	22.4 - 22.6 (0.882 - 0.890)	Green	MIT
3	1.829 - 1.833 (0.0720 - 0.0722)		Yellow	
4	1.833 - 1.837 (0.0722 - 0.0723)		Blue	- At

NO. 2 AND 3 MAIN BEARING

NO. 2 AND 3 MAIN	NO. 2 AND 3 MAIN BEARING			ĩF
Grade number	Thickness "T" mm (in)	Width "W" mm (in)	Identification color	
0	1.817 - 1.821 (0.0715 - 0.0717)		Black	PD
1	1.821 - 1.825 (0.0717 - 0.0719)		Brown	
2	1.825 - 1.829 (0.0719 - 0.0720)	18.9 - 19.1 (0.744 - 0.752)	Green	AX
3	1.829 - 1.833 (0.0720 - 0.0722)	1 Γ	Yellow	
4	1.833 - 1.837 (0.0722 - 0.0723)		Blue	SU

NO. 4 MAIN BEARING

Grade number	Thickness "T" mm (in)	Identification color	
0	1.817 - 1.821 (0.0715 - 0.0717)	Black	
1	1.821 - 1.825 (0.0717 - 0.0719)	Brown	
2	1.825 - 1.829 (0.0719 - 0.0720)	Green	
3	1.829 - 1.833 (0.0720 - 0.0722)	Yellow	
4	1.833 - 1.837 (0.0722 - 0.0723)	Blue	

UNDER SIZE

UNDER SIZE Unit: mm (in			
	Thickness "T"	Main journal diameter "Dm"	IL(A
0.25 (0.0098)	1.948 - 1.956 (0.0767 - 0.0770)	Grind so that bearing clearance is the specified valve.	SC

빌

IDX

Available Connecting Rod Bearing

Available Connecting Rod Bearing

CONNECTING ROD BEARING UNDERSIZE

NAEM0036

NAEM0036S01 Unit: mm (in)

		Thickness	Crank pin journal diameter "Dp"	
Standard	<u> </u>	1.502 - 1.506 (0.0591 - 0.0593)	49.955 - 49.974 (1.9667 - 1.9675)	
Undersize	0.08 (0.0031)	1.542 - 1.546 (0.0607 - 0.0609)	Grind so that bearing clearance is the specifie value.	
	0.12 (0.0047)	1.562 - 1.566 (0.0615 - 0.0617)		
	0.25 (0.0098)	1.627 - 1.631 (0.0641 - 0.0642)		

Miscellaneous Components

NAEM0037 Unit: mm (in)

Flywheel runout [TIR]	
	Less than 0.15 (0.0059)
Drive plate runout [TIR]	

BEARING CLEARANCE

NAEMOO37501 Unit: mm (in)

Main bearing clearance	Standard	0.028 - 0.055 (0.0011 - 0.0022)
	Limit	0.090 (0.0035)
Connecting rod bearing clearance	Standard	0.014 - 0.054 (0.0006 - 0.0021)
	Limit	0.090 (0.0035)