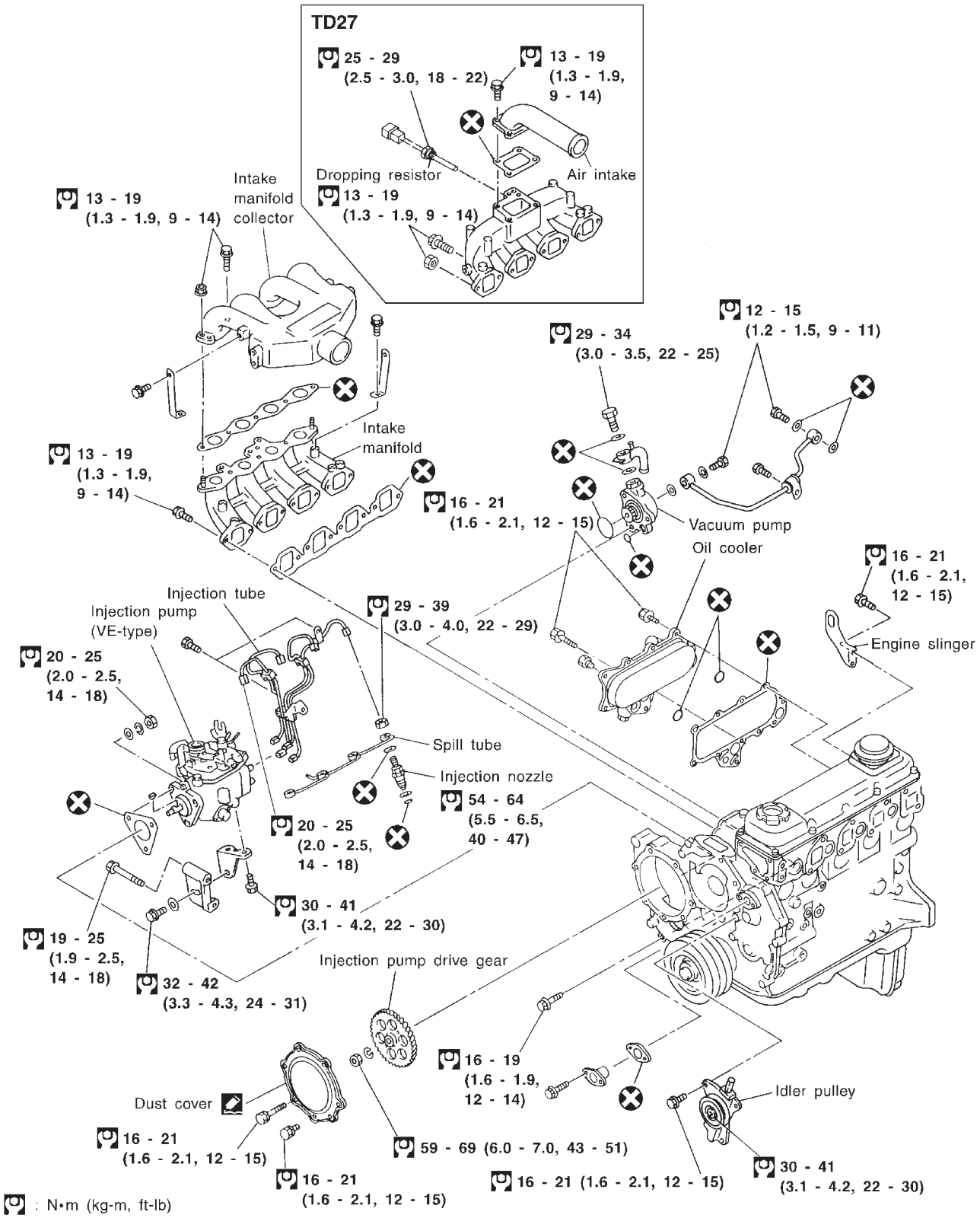
SEC. 135•140•185•186•213

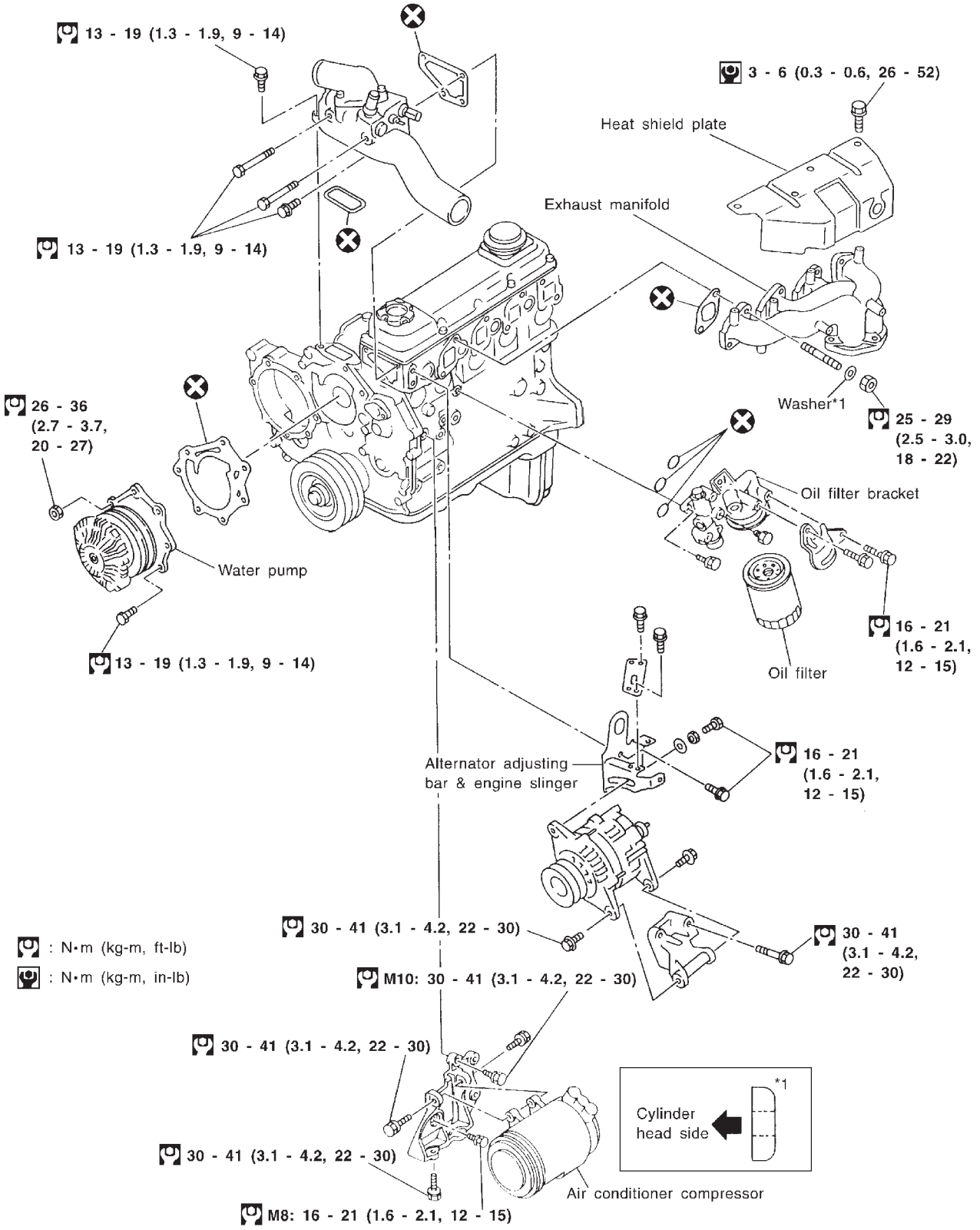


: N•m (kg-m, ft-lb)

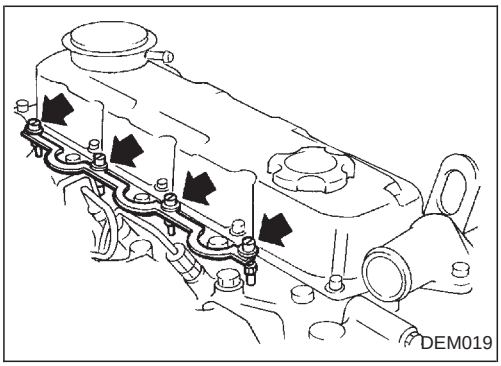
: Apply recommended sealant
(Nissan genuine part: KP610-00250) or equivalent.

DEM017

SEC. 140•150•268•230•275

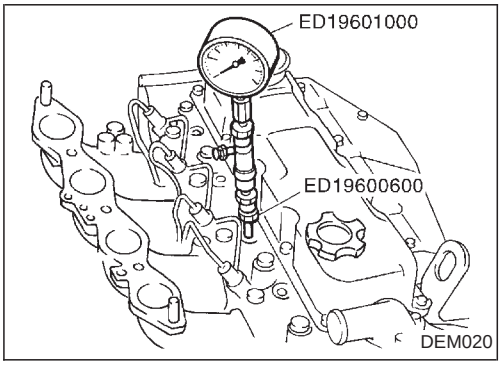


DEM018


DEM019

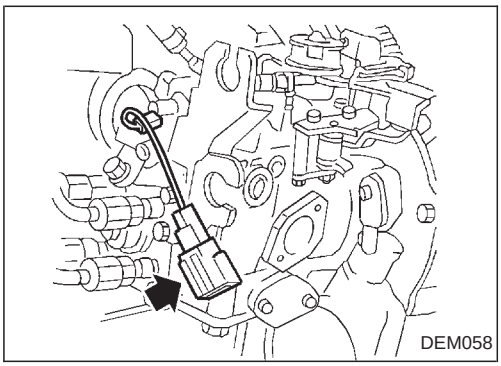
Measurement of Compression Pressure

1. Warm up engine.
2. Stop engine. Remove glow plate and glow plugs.



DEM020

3. Fit compression gauge adapter to cylinder head.
   Compression gauge adapter:
   : 15 - 20 N·m (1.5 - 2.0 kg-m, 11 - 14 ft-lb)


DEM058

4. Disconnect fuel cut solenoid wire connector.
5. Crank engine, then read gauge indication.

- **Engine compression measurement should be made as quickly as possible.**

Compression pressure:

Unit: kPa (bar, kg/cm^2, psi)/200 rpm

Standard	2,942 (29.4, 30, 427)
Minimum	2,452 (24.5, 25, 356)
Differential limit between cylinders	294 (2.9, 3, 43)

6. If cylinder compression in one or more cylinders is low, pour a small quantity of engine oil into cylinders through the glow holes and retest compression.

- **If adding oil helps the compression pressure, chances are that piston rings are worn or damaged.**
- **If pressure stays low, valve may be sticking or seating improperly.**
- **If cylinder compression in any two adjacent cylinders is low, and if adding oil does not help the compression, there is leakage past the gasketed surface.**
  Oil and water in combustion chambers can result from this problem.

Removal

Removal order and points		Applied model	
		2WD	4WD
1	Remove undercover.	○	○
2	Drain engine oil.	○	○
3	Remove front propeller shaft from front differential carrier.	—	○
4	Remove front drive shaft fixing bolts (RH & LH).	—	○
5	Remove front suspension crossmember.	○	○
6	Remove differential front mounting bolts (RH & LH) and rear mounting bolts.	—	○
7	Remove front differential carrier.	—	○

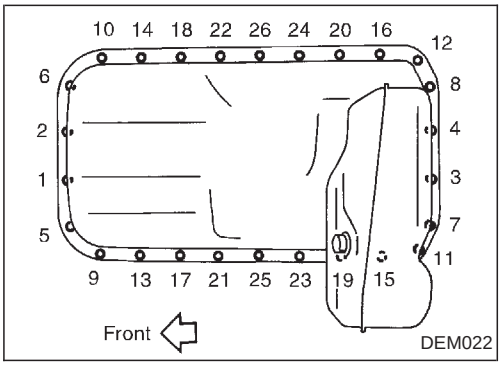
Removal order and points		Applied model	
		2WD	4WD
8	Remove front differential carrier mounting bracket.	—	○
9	Remove transmission to rear engine mounting bracket nuts (RH & LH).	○	○
10	Remove engine mounting bolts or nuts (RH & LH).	○	○
11	Lift up engine. If necessary, disconnect exhaust tube.	○	○
12	Remove oil pan.	○	○

WARNING:

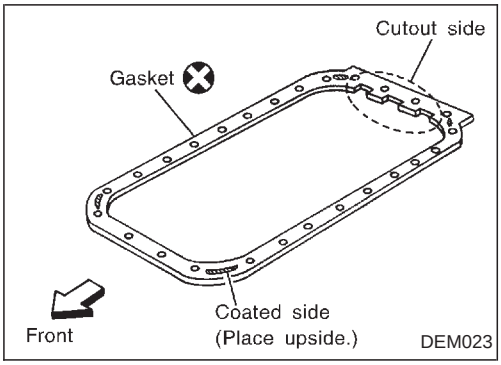
- **Place vehicle on a flat and solid surface.**
- **Place chocks at front and rear of rear wheels.**
- **You should not remove oil pan until exhaust system and cooling system have completely cooled off.**
  Otherwise, you may burn yourself and/or fire may break out in the fuel line.
- **When removing 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 parts, especially against accelerator wire casing end, brake tube and brake master cylinder.**
- **For tightening torque, refer to EM-157, MT and PD sections.**

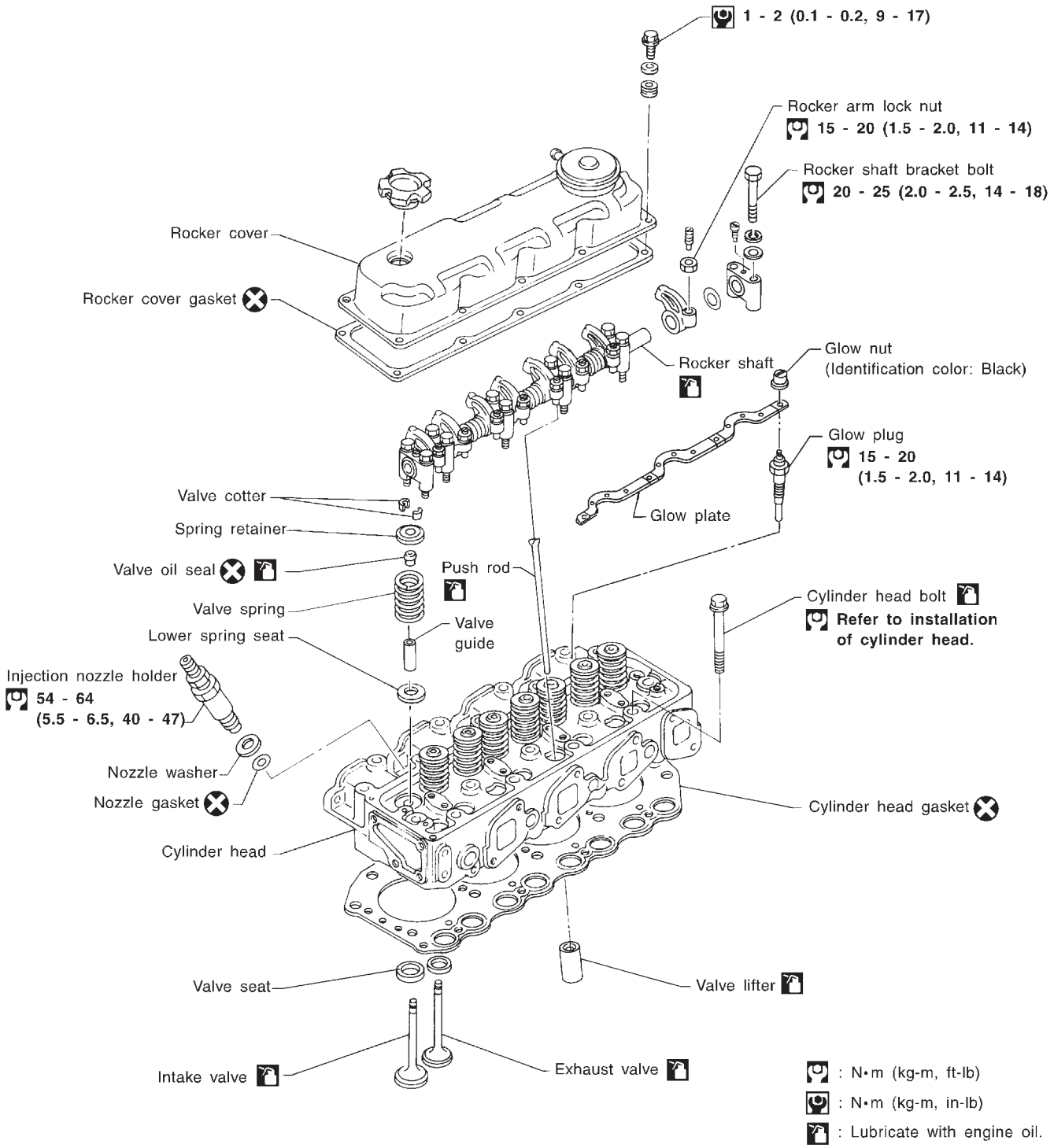


Remove oil pan bolts in order shown.



Installation

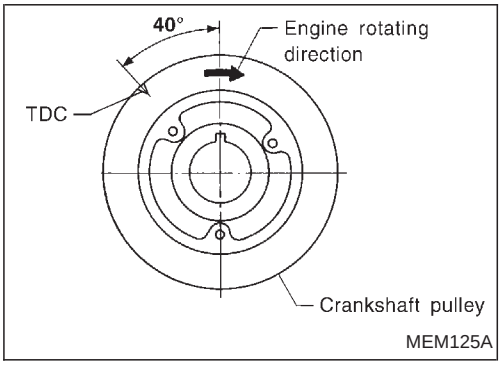
1. Install the oil pan gasket with the coated surface facing the cylinder block and the notch facing the rear of the engine.
2. Tighten all bolts in reverse order of removal.


1 - 2 (0.1 - 0.2, 9 - 17)
Rocker arm lock nut
15 - 20 (1.5 - 2.0, 11 - 14)
Rocker shaft bracket bolt
20 - 25 (2.0 - 2.5, 14 - 18)
Rocker cover
Rocker cover gasket
Rocker shaft
Glow nut
(Identification color: Black)
Glow plug
15 - 20
(1.5 - 2.0, 11 - 14)
Glow plate
Valve cotter
Spring retainer
Valve oil seal
Push rod
Valve spring
Valve guide
Lower spring seat
Cylinder head bolt
Refer to installation of cylinder head.
Injection nozzle holder
54 - 64
(5.5 - 6.5, 40 - 47)
Nozzle washer
Nozzle gasket
Cylinder head gasket
Cylinder head
Valve seat
Valve lifter
Intake valve
Exhaust valve
: N•m (kg-m, ft-lb)
: N•m (kg-m, in-lb)
: Lubricate with engine oil.

DEM006-A

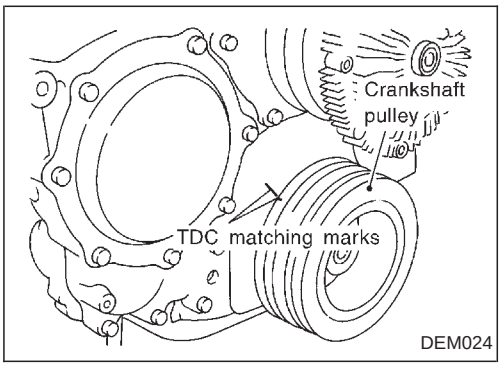
CAUTION:

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

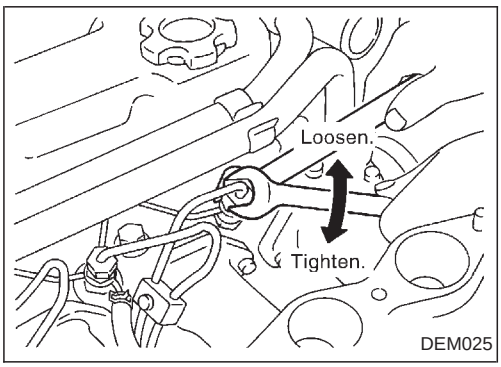


Removal

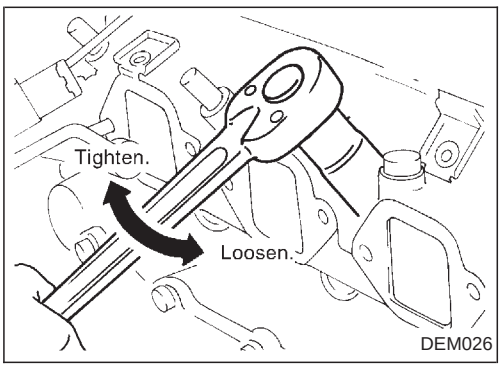
1. Set No. 1 cylinder at TDC (top dead center) on its compression stroke.
2. Drain engine coolant from drain plugs on cylinder block and radiator.
3. Remove air cleaner and/or air duct.
4. Remove alternator adjusting bolt.
5. Disconnect exhaust manifold from front exhaust tube.
6. Disconnect radiator outlet hose and thermostat housing water inlet hose.
7. Remove intake manifold collector (QD32) and air intake housing (TD27).



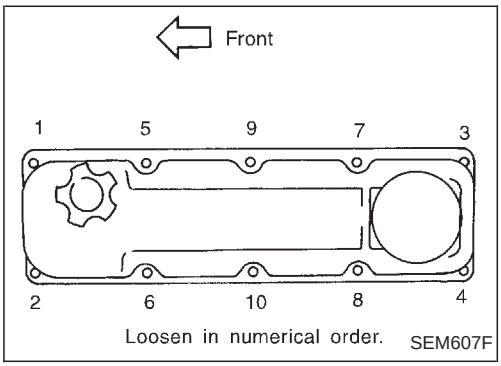
8. Remove fuel injection tube assembly and spill tube.



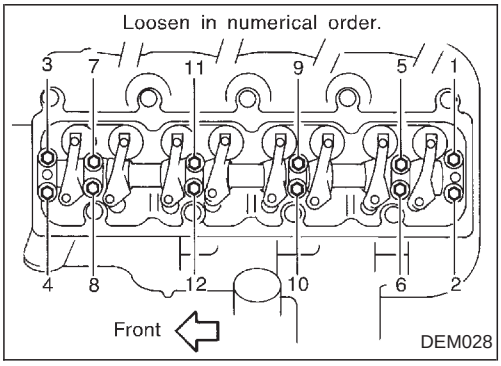
9. Remove injection nozzle holder and top nozzle gasket using deep socket wrench.



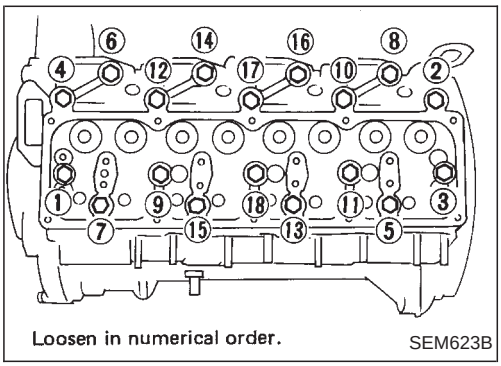
Removal (Cont'd)



10. Remove rocker cover.



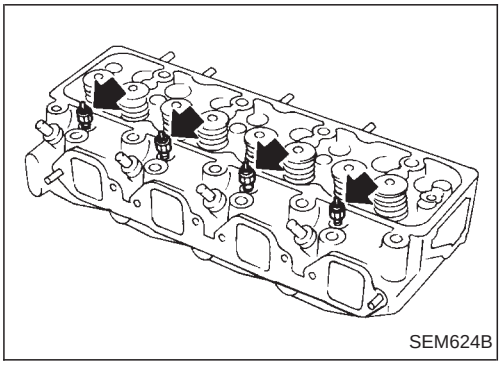
11. Remove rocker shaft with rocker arms.
12. Remove push rods.



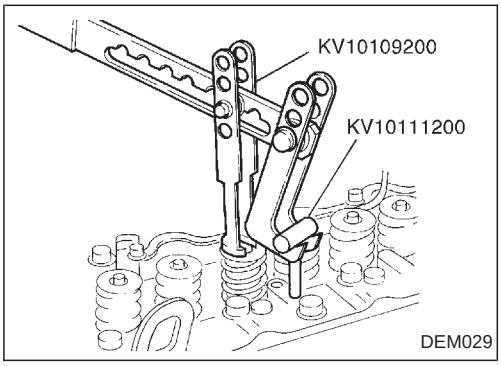
13. Remove cylinder head bolts in numerical order and remove cylinder head.

Head warpage or cracking could result from removing in incorrect order.

Disassembly

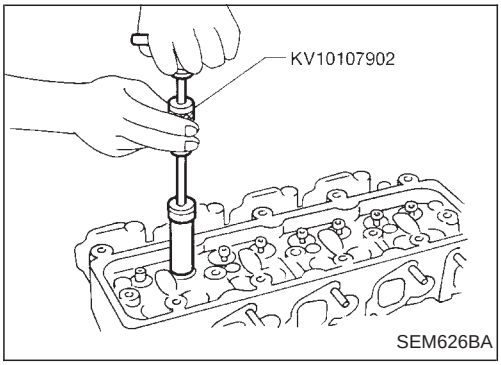


1. Remove following parts:
a. Intake manifold
b. Exhaust manifold
c. Thermostat housing
d. Alternator adjusting bar & engine slinger
e. Glow plate and glow plugs



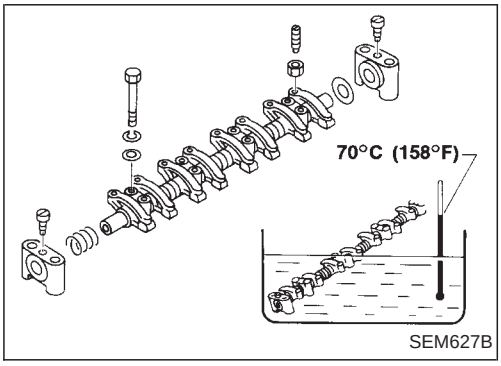
2. Remove valve component parts with Tool.

Disassembly (Cont'd)



SEM626BA

3. Remove valve oil seals with Tool.



SEM627B

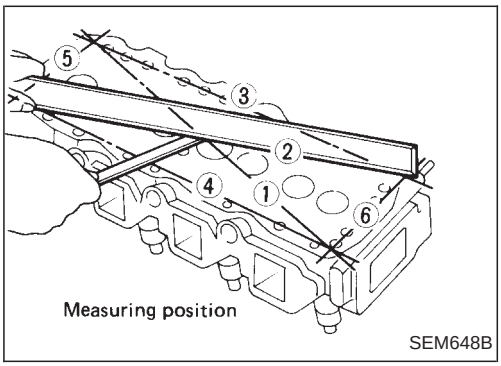
4. Disassemble rocker shaft assembly.
a. Remove rocker shaft lock bolt.
b. Remove valve rocker and rocker shaft bracket.

If it is difficult to remove rocker shaft bracket, immerse rocker shaft assembly in oil of 70°C (158°F) for a few minutes and then remove bracket.

Inspection

CYLINDER HEAD DISTORTION

Cylinder head distortion: mm (in)
Standard
Less than 0.07 (0.0028)
Limit
0.2 (0.008)



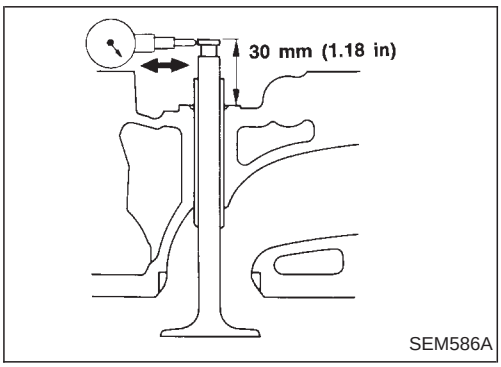
SEM648B

If beyond the specified limit, correct with a surface grinder. Cylinder head height should be greater than 89.7 mm (3.531 in) after surface has been ground.

VALVE GUIDE CLEARANCE

- **Valve guide clearance should be measured parallel with rocker arm. (Generally, a large amount of wear occurs in this direction.)**

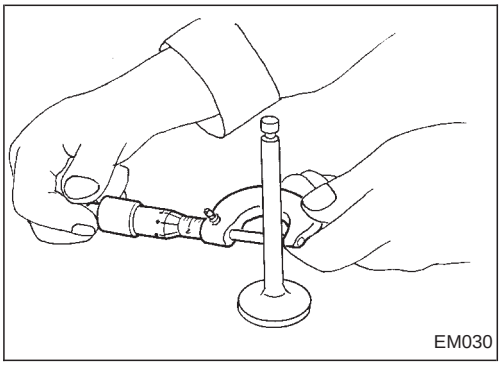
Stem to guide clearance: mm (in)
Limit
Intake 0.15 (0.0059)
Exhaust 0.20 (0.0079)
Maximum allowable deflection
(Dial indicator reading)
Intake 0.30 (0.0118)
Exhaust 0.40 (0.0157)



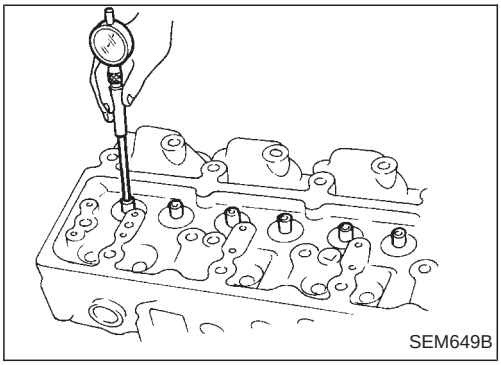
SEM586A

- **To determine the correct replacement part, measure valve stem diameter and valve guide inner diameter.**

Valve stem diameter: mm (in)
Standard
Intake
7.962 - 7.977 (0.3135 - 0.3141)
Exhaust
7.945 - 7.960 (0.3128 - 0.3134)


EM030

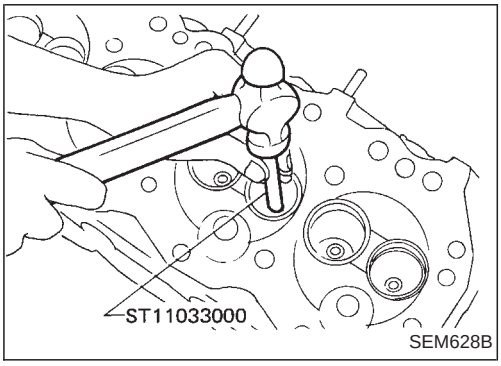
Inspection (Cont'd)


SEM649B

Valve guide inner diameter:
8.000 - 8.015 mm (0.3150 - 0.3156 in)

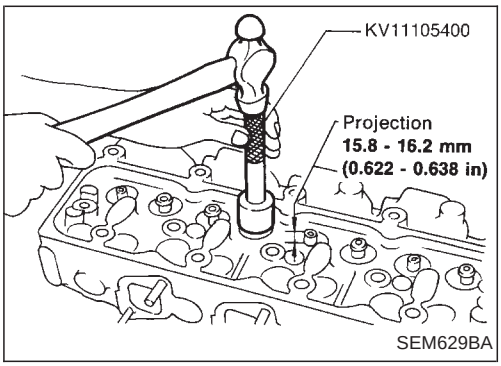
VALVE GUIDE REPLACEMENT

1. 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.



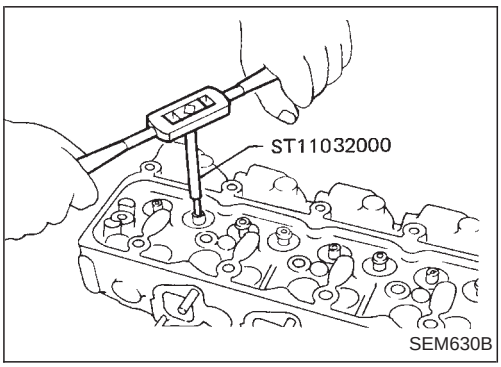
SEM628B

2. Press service valve guide onto cylinder head using suitable tool until the guide projects out 15.8 to 16.2 mm (0.622 to 0.638 in).



SEM629BA

3. Ream valve guide.
   Finished size:
   8.000 - 8.015 mm (0.3150 - 0.3156 in)

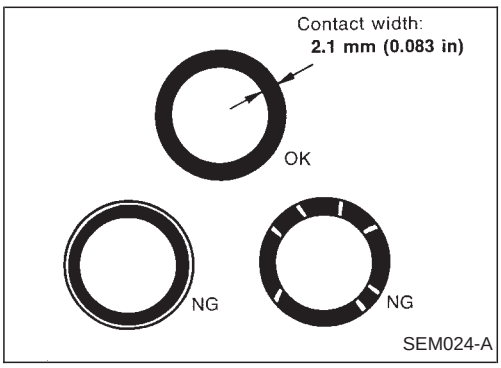


SEM630B

VALVE SEATS

Check valve for any evidence of pitting at valve contact surface, and reseat or replace if worn out excessively.

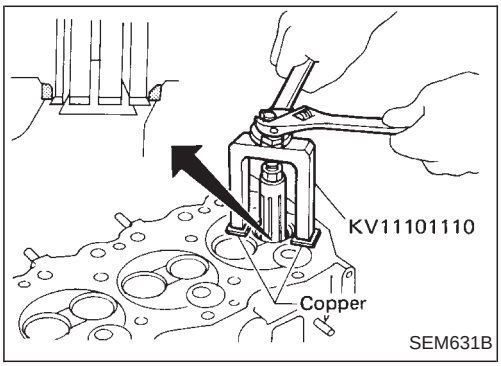
- **When repairing valve seats, check valve and valve guide for wear beforehand. If worn, replace them. Then correct valve seat.**
- **The cutting should be done with both hands for uniform cutting.**



SEM024-A

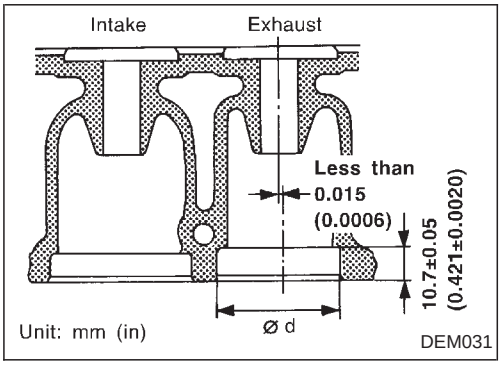
Inspection (Cont'd)

REPLACING VALVE SEAT FOR SERVICE PARTS



1. Bore out old seat until it collapses or remove valve seats with Tool.

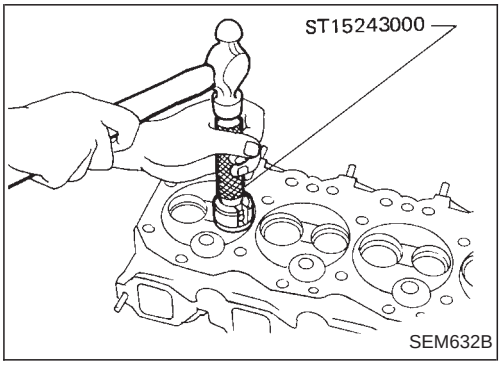
Place a copper seat between contact surface of Tool and cylinder head.



2. If the valve seat for the exhaust side is oversized, machine its mating area (on the cylinder head side) to the dimensions indicated in the table below. Refer to the figure at the left for machining procedures.

Unit: mm (in)

Oversized valve seat	Bore diameter "d"	
	QD32	TD27
0.2 (0.008)	40.695 - 40.710 (1.6022 - 1.6028)	39.695 - 39.710 (1.5628 - 1.5634)
0.4 (0.016)	40.895 - 40.910 (1.6100 - 1.6106)	39.895 - 39.910 (1.5707 - 1.5713)

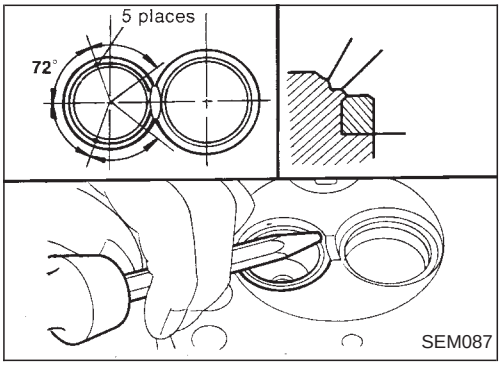


3. Place new valve seats on dry ice and allow them to cool for five minutes.

WARNING:

Do not touch cooled valve seats with bare hand.

4. Heat cylinder head to 80°C (176°F).
5. Install cooled valve seats on cylinder head with Tool.

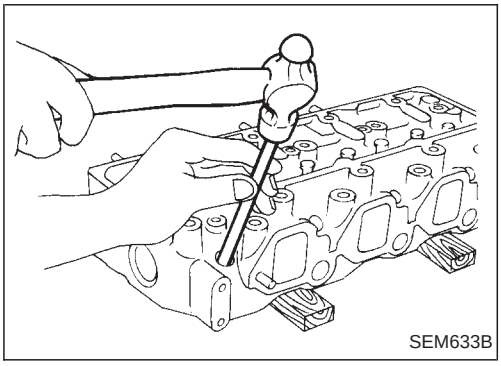


6. Stake exhaust valve seat at five places with punch.

When staking valve seat, select different places than those staked before.

Inspection (Cont'd)

7. Cut or grind valve seat using suitable tool at the specified dimensions as shown in SDS, EM-198.
8. After cutting, lap valve seat with a lapping compound.
9. Check contact condition of valve seat.


SEM633B

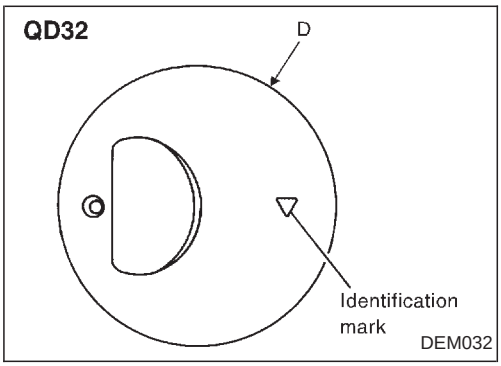
COMBUSTION CHAMBER

Check combustion chamber for cracks and other damage. If necessary, replace.

REPLACING COMBUSTION CHAMBER

Usually combustion chamber should not be removed.

1. Remove combustion chamber so that cylinder head cannot be damaged.

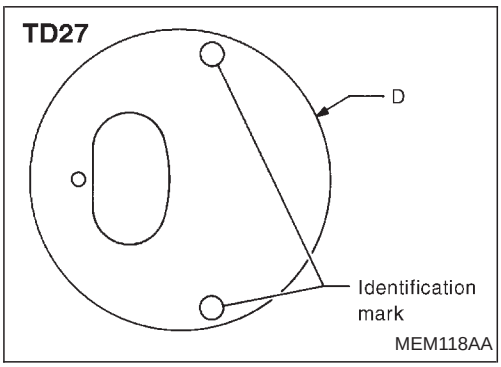


DEM032

2. Install combustion chamber.

Identification of combustion chambers

Identification mark (on combustion chamber)	Outer diameter "D" mm (in)	Engine
1 place	37 (1.46)	QD32
2 places		TD27

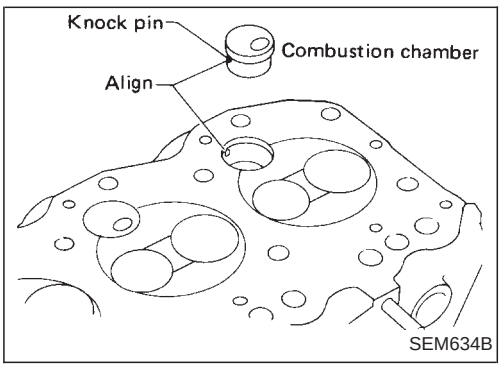


MEM118AA

(1) Cool combustion chamber with dry ice for approximately 5 to 10 minutes.

WARNING:

Do not touch cooled combustion chamber with bare hand.



SEM634B

(2) Align combustion chamber knock pin with cylinder head notch, and drive in combustion chamber with a soft hammer.

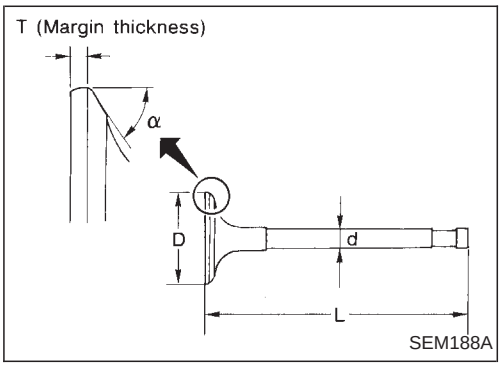
3. Check amount of protrusion of combustion chamber.

Protrusion:

Standard

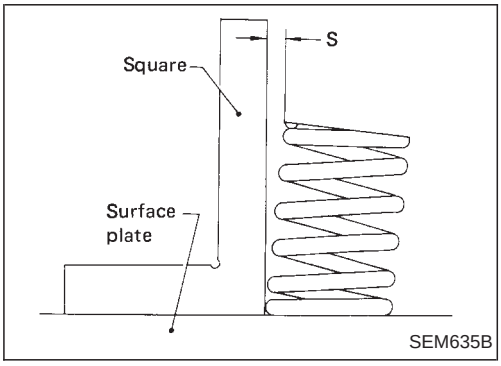
−0.05 to 0.10 mm (−0.0020 to 0.0039 in)

Inspection (Cont'd)



VALVE DIMENSIONS

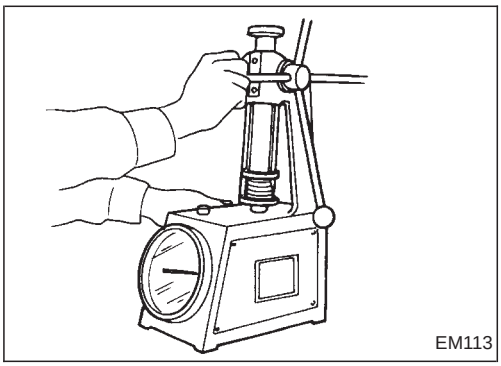
Check dimensions in each valve. For dimensions, refer to SDS.
When valve head has been worn down to 0.5 mm (0.020 in) in margin thickness, replace the valve.
Grinding allowance for valve stem tip is 0.2 mm (0.008 in) or less.



VALVE SPRING SQUARENESS

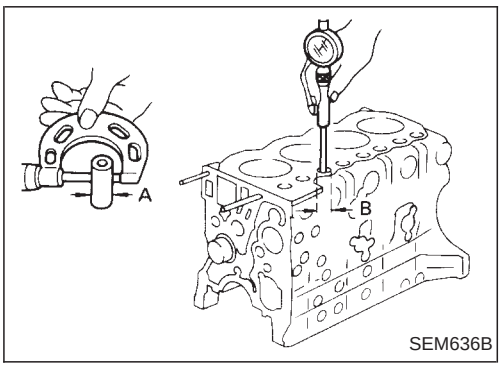
Align the valve spring with a square. Rotate the spring to measure any gap between the top of the spring and the square.

Out-of-square "S":
Less than 2.3 mm (0.091 in)



VALVE SPRING PRESSURE LOAD

Refer to SDS, EM-197.



VALVE LIFTER AND PUSH ROD

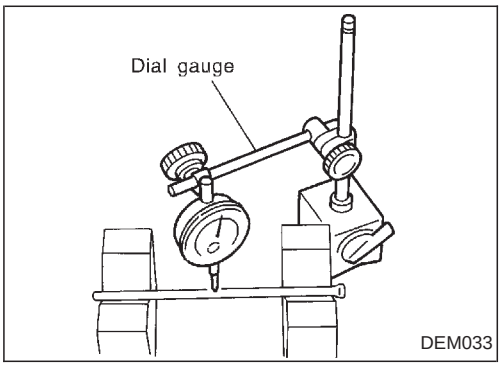
Valve lifter

1. Check valve lifters for excessive wear on the face.
2. Replace with new ones if worn beyond repair.

a. Valve lifter end should be smooth.
b. Valve lifter to lifter hole clearance: mm (in)
Standard
0.030 - 0.073 (0.0012 - 0.0029)
Limit
Less than 0.20 (0.0079)
Valve lifter outer diameter "A":
Standard
25.960 - 25.970 mm (1.0220 - 1.0224 in)
Cylinder block valve lifter hole diameter "B":
Standard
26.000 - 26.033 mm (1.0236 - 1.0249 in)

Inspection (Cont'd)

Push rod

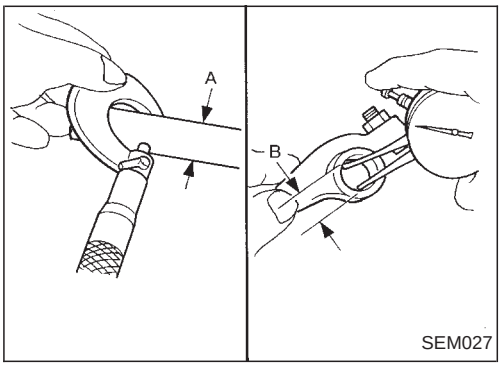


1. Inspect push rod for excessive wear on the face.
2. Replace if worn or damaged beyond repair.
3. Check push rod for bend using a dial gauge.

Maximum allowable bend
(Total indicator reading):
Less than 0.5 mm (0.020 in)

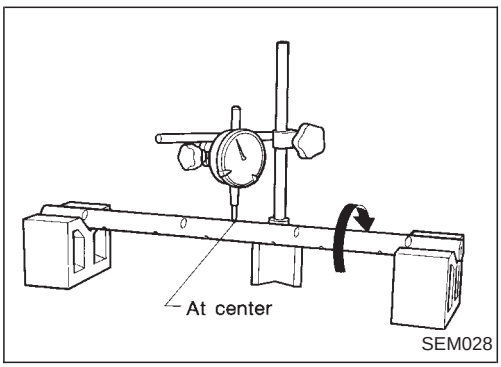
ROCKER SHAFT AND ROCKER ARM

1. Check valve rockers, brackets and rocker shafts for scoring, wear or distortion. Replace if necessary.



2. Check clearance between valve rockers and rocker shaft. If specified clearance is exceeded, replace affected valve rockers or shafts.

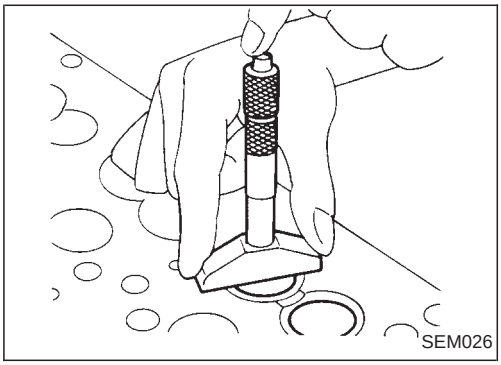
Specified clearance: mm (in)
Standard
0.014 - 0.056 (0.0006 - 0.0022)
Limit
Less than 0.15 (0.0059)
Rocker shaft outer diameter "A":
Standard
19.979 - 20.000 mm (0.7866 - 0.7874 in)
Rocker arm inner diameter "B":
Standard
20.014 - 20.035 mm (0.7880 - 0.7888 in)



3. Check rocker shaft bend at its center. If bend is within specified limit, straighten it; and if it is greater than specified limit, replace rocker shaft.

Rocker shaft bend
(Total indicator reading):
Limit
Less than 0.3 mm (0.012 in)

Inspection (Cont'd)


SEM026

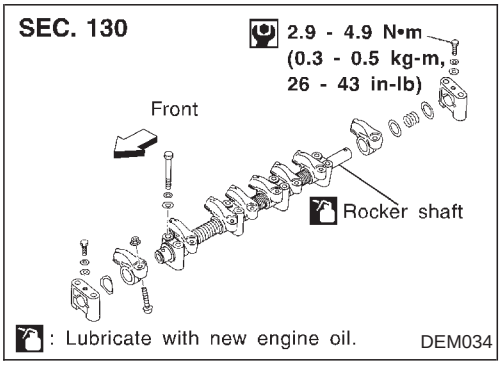
MEASURING CYLINDER HEAD TO VALVE DISTANCE

Measure distance from cylinder head surface to intake and exhaust valves. If specified distance is exceeded, replace valve(s) or valve seat(s).

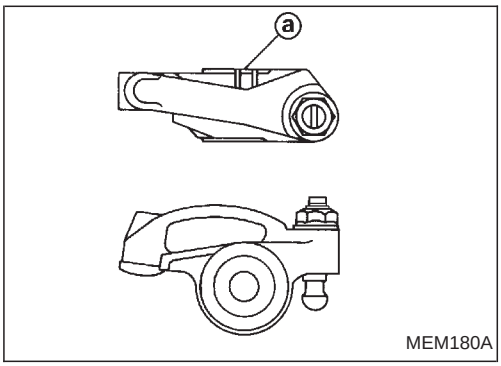
Specified distance: mm (in)
Standard
Intake and Exhaust
0.7 - 1.3 (0.028 - 0.051)
Limit
Less than 1.7 (0.067)
for intake and exhaust valves

Assembly

1. Assemble rocker shaft component parts.



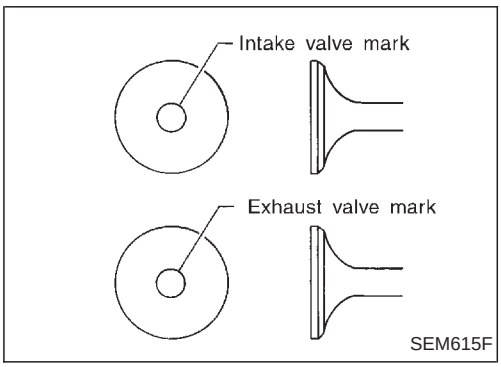
Identification of rocker arms



Identification mark (At area ⓐ on rocker arm)	For use with
Two ridges	Intake
No ridge	Exhaust

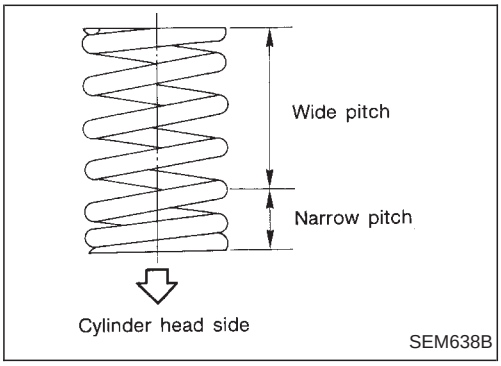
2. Install valve component parts.

Identification of valves

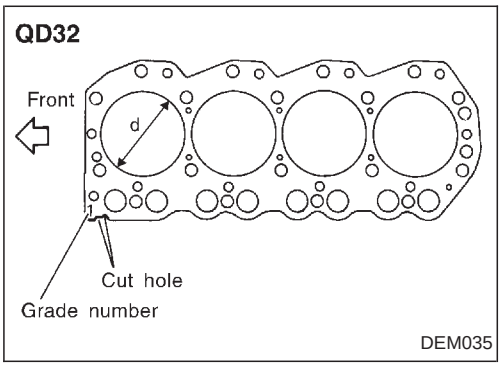


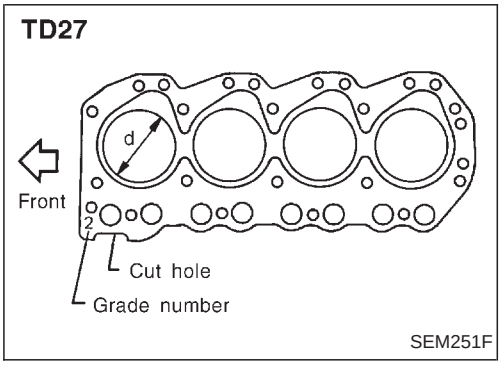
Identification mark (on intake and exhaust valve)		Engine
Intake valve	Exhaust valve	
4	J	QD32
3	C	TD27

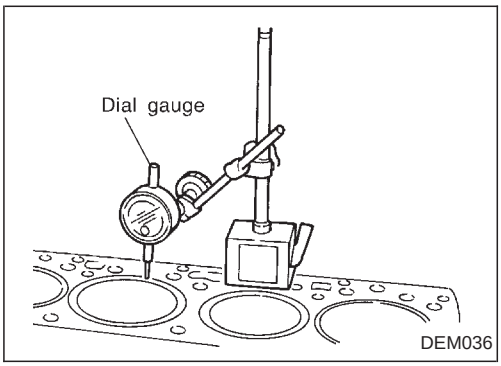
- **Always use new valve oil seal. (Refer to EM-153.)**

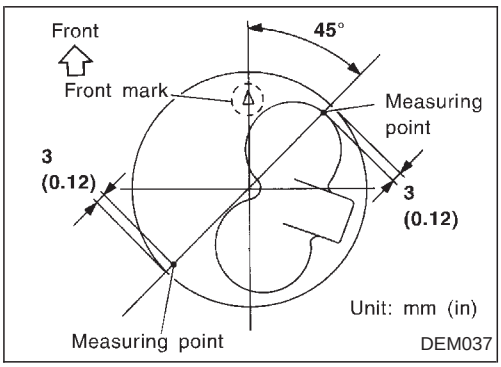


- **Install valve spring (uneven pitch type) with its narrow pitch side toward cylinder head side.**









Installation

1. Install cylinder head gasket.

Identification of cylinder head gaskets

Identification cut hole (on cylinder head gasket)	Inner diameter "d" mm (in)	Engine
2	100.4 (3.953)	QD32
1	97.5 (3.839)	TD27

a. When replacing only cylinder head gasket, install same grade gasket as the one formerly used.

b. When replacing or repairing cylinder block, cylinder head, piston, connecting rod and crankshaft, select gasket as follows:

- **Selecting gasket thickness (QD32 engine)**

(1) Measure piston projection from cylinder block surface.

a. Measure the projection (piston height above cylinder block) at two points, when the piston is at the top dead center position.

b. Average the two projections (piston height above cylinder block) for each cylinder H_L.

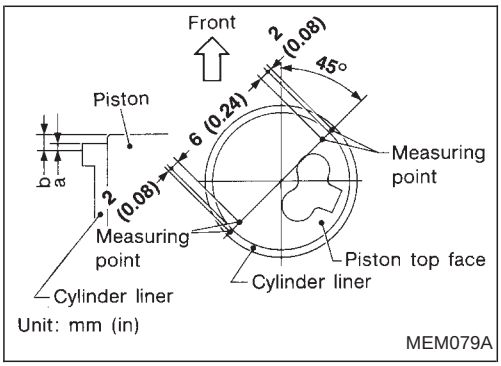
(2) Select suitable cylinder head gasket which conforms to the largest amount of projection of the four pistons.

Unit: mm (in)

Average values piston projections H_L	Gasket thickness		Gasket grade number
	New parts	In assembly	
Less than 0.168 (0.0066)	1.35 (0.0531)	1.20 (0.0472)	1
0.168 - 0.218 (0.0066 - 0.0086)	1.40 (0.0551)	1.25 (0.0492)	2
More than 0.218 (0.0086)	1.45 (0.0571)	1.30 (0.0512)	3

Make sure that No. 1 piston is at TDC on its compression stroke.

Installation (Cont'd)



- **Selecting gasket thickness (TD27 engine)**

(1) Measure piston projection from cylinder block surface.

a. Measure the projection a and a′ (cylinder liner height above cylinder block) at two points in each cylinder.

b. Measure the projection b and b′ (piston height above cylinder block) at two points, when the piston is at the top dead center position.

c. Calculate the piston height projection above cylinder liner b - a (b′ - a′).

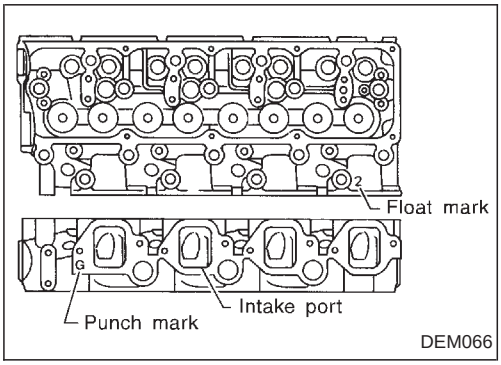
d. Average the two projections (piston height above cylinder liner) for each cylinder H_L.

(2) Select suitable cylinder head gasket which conforms to the largest amount of projection of the four pistons.

Unit: mm (in)

Average values piston projections H_L	Gasket thickness		Gasket grade number
	New parts	In assembly	
Less than 0.168 (0.0066)	1.35 (0.0531)	1.20 (0.0472)	2
0.168 - 0.218 (0.0066 - 0.0086)	1.40 (0.0551)	1.25 (0.0492)	3
More than 0.218 (0.0086)	1.45 (0.0571)	1.30 (0.0512)	4

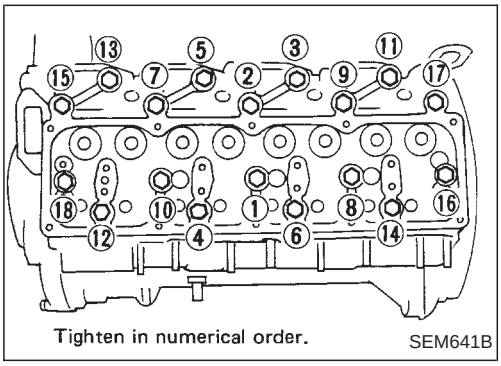
Make sure that No. 1 piston is at TDC on its compression stroke.



2. Install cylinder head.

Cylinder head identification mark

Identification number (on cylinder head)		Engine
Float mark	Punch mark	
5	—	QD32
2	G	TD27



3. Apply oil to the thread portion and seat surface of bolts and tighten cylinder head bolts using Tool.

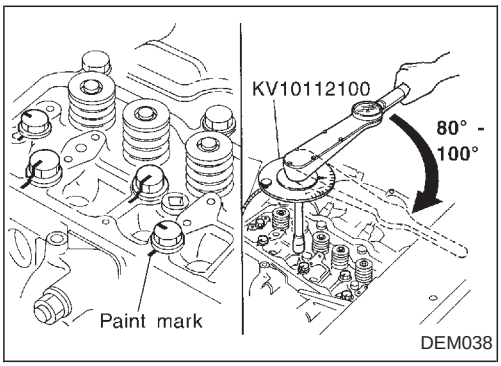
CAUTION:

- **Tightening procedure**

1st: Tighten bolts to 39 - 44 N·m (4.0 - 4.5 kg-m, 29 - 33 ft-lb).

2nd: Tighten bolts to 59 - 64 N·m (6.0 - 6.5 kg-m, 43 - 47 ft-lb).

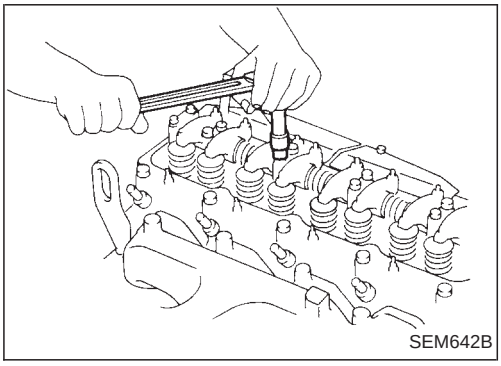
Installation (Cont'd)



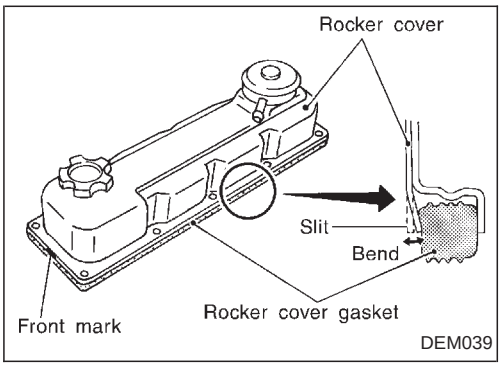
3rd:

(1) Mark exhaust side of cylinder head and cylinder head bolts with paint as shown.
(2) Turn all bolts 90±10 degrees clockwise.
(3) Check that the paint mark of each bolt is facing the front of the vehicle.

- **Always check the bolt tightening angle with an angle wrench or protractor. Do not check visually.**

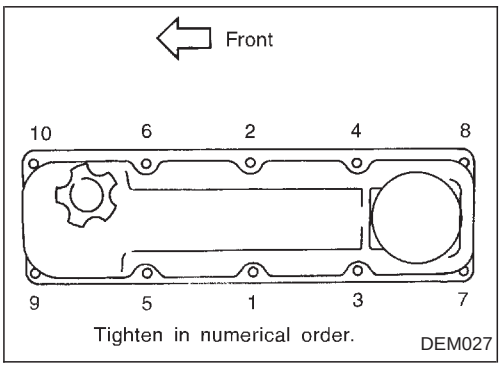


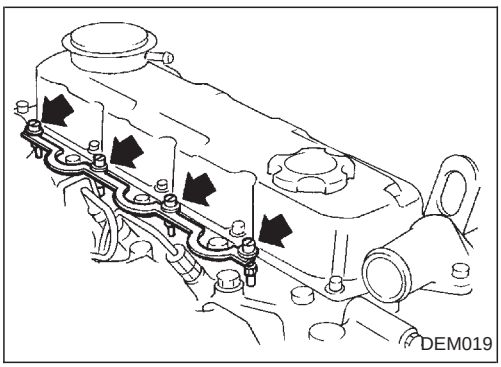
4. Apply engine oil and install push rods.
5. Install rocker shaft assembly.
   Adjust intake and exhaust valve clearance tentatively.
   Refer to "Adjusting Intake and Exhaust Valve Clearance", "ENGINE MAINTENANCE" in MA section.



6. Install rocker cover.

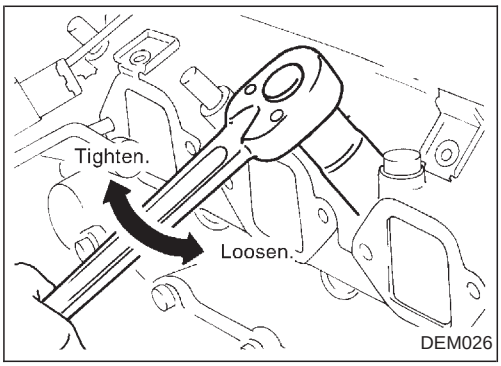
- Be sure the "F" mark on rocker cover plate faces upward and is at the front end.
- When replacing rocker cover gasket, bend slit of rocker cover baffle plate a little to hold the gasket. Do not twist gasket.
- **Tighten all bolts in numeral sequence (as shown in the figure at left) to the specified torque.**



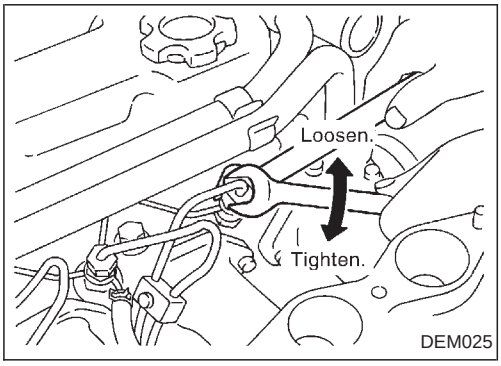


7. Install glow plugs and glow plate.

Installation (Cont'd)

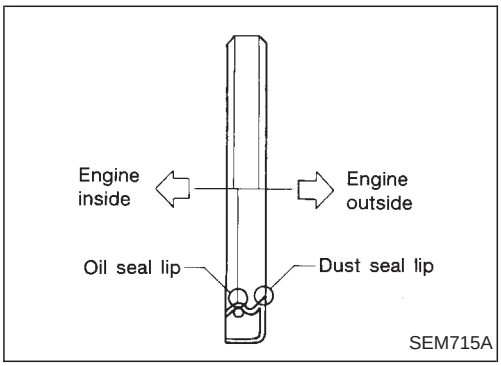


8. Install new top nozzle gasket and injection nozzle.



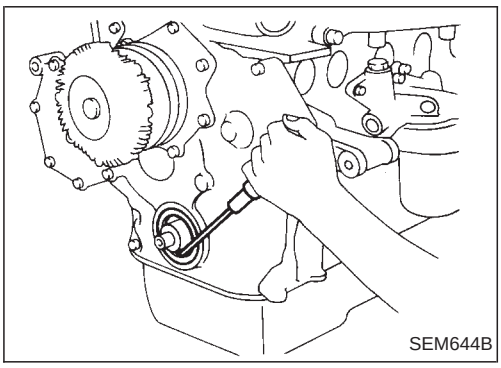
9. Install spill tube and injection tube.

10. Connect thermostat housing water inlet hose and radiator hose.
11. After assembling all disassembled parts, fill radiator and engine with new coolant up to filler opening.



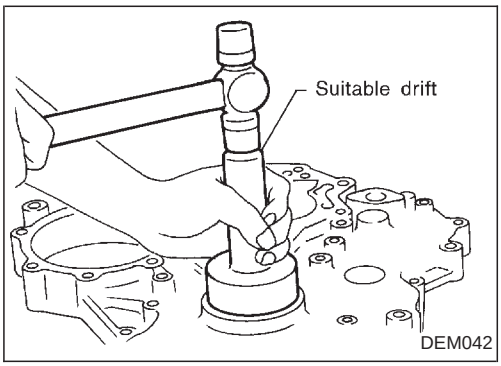
OIL SEAL INSTALLING DIRECTION

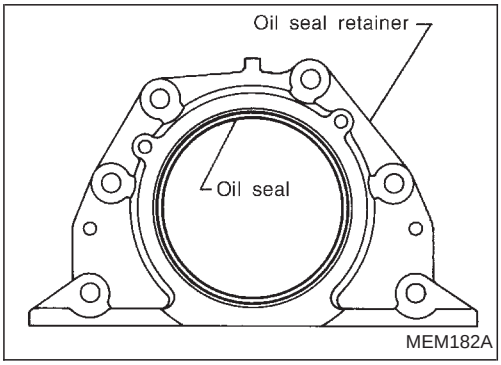
- When installing a new front or rear seal, make sure its mounting direction is correct.



CRANKSHAFT FRONT OIL SEAL

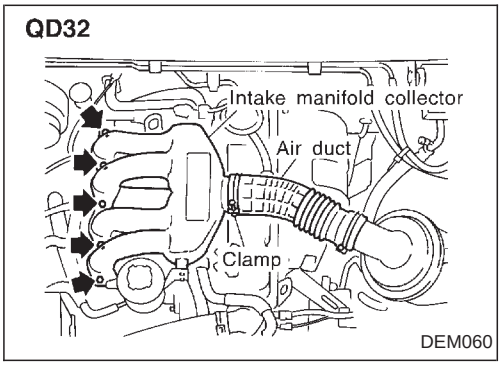
1. Remove radiator shroud.
2. Remove cooling fan.
3. Remove drive belts.
4. Remove crankshaft pulley.
5. Remove crankshaft oil seal.
- Be careful not to damage sealing surfaces of crankshaft.
6. Coat new oil seal with engine oil and install it in place.
- Press the oil seal until it contacts with the front cover.





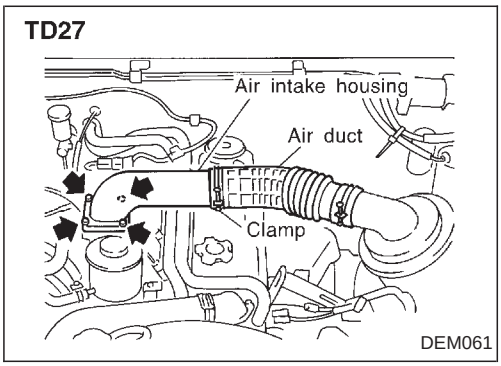
CRANKSHAFT REAR OIL SEAL

1. Dismount transmission.
2. Remove clutch cover assembly.
3. Remove flywheel and rear plate.
4. Remove oil pan and oil pan gasket.
5. Remove oil seal retainer assembly and retainer gasket.
- **Replace oil seal and retainer assembly as a single unit (mono-block type combined with oil seal).**
6. Coat oil seal with engine oil and install new oil seal retainer assembly in place.

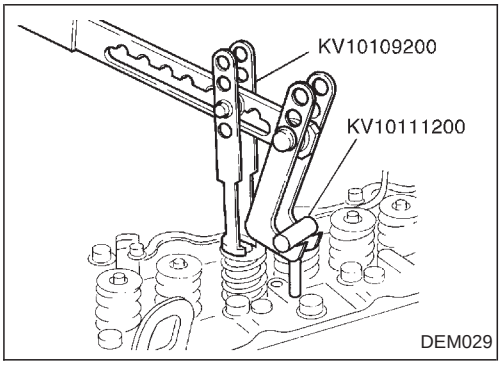


VALVE STEM OIL SEAL

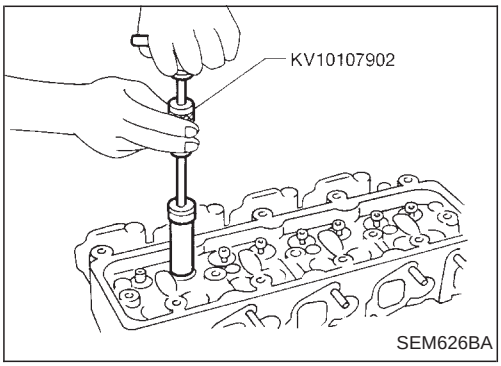
1. Remove following parts.
- Intake manifold collector and air duct (QD32)



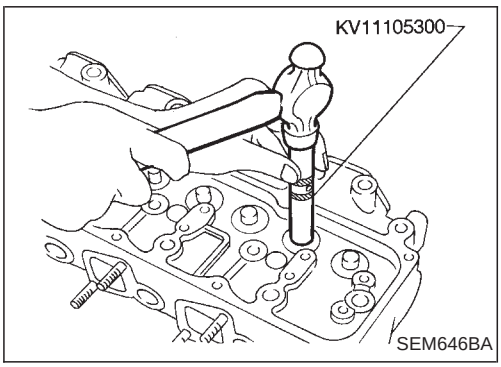
- Air intake housing and air duct (TD27)



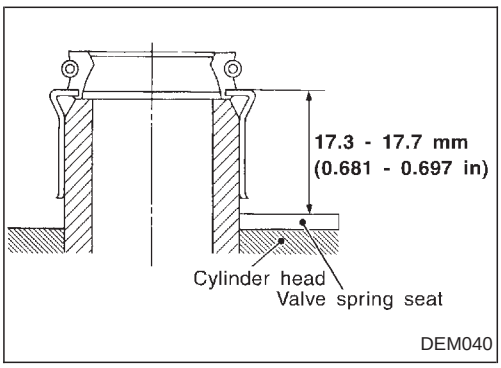
2. Remove rocker cover.
3. Remove rocker shaft assembly.
4. Remove valve spring.

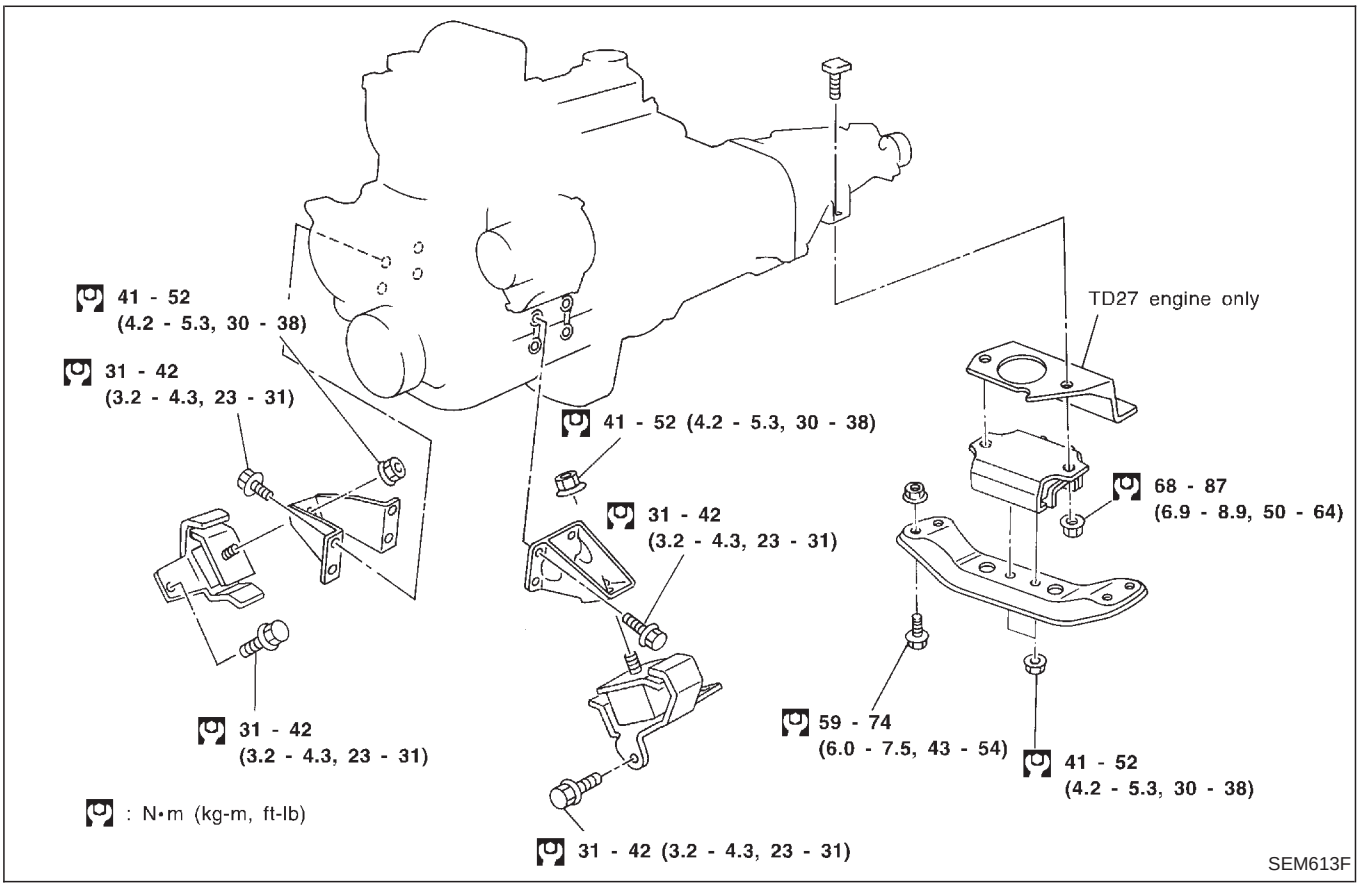


5. Remove valve oil seals.



6. Apply engine oil to valve oil seal and install it in place.



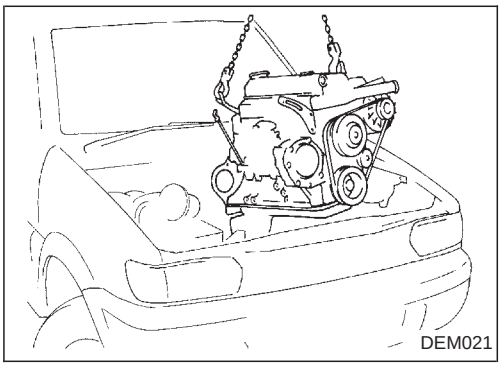


WARNING:

- **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.
- **Be sure to hoist 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. Take special care near accelerator wire casing, brake lines and brake master cylinder.**
- **In lifting the engine, always use engine slingers in a safe manner.**
- **For 4WD models, apply sealant between engine and transmission. Refer to MT section (“Removal and Installation”).**


DEM021

Removal

1. Remove engine undercover and hood.
2. Drain engine coolant.
3. Remove vacuum hoses, fuel tubes, wires, harnesses and connectors and so on.
4. Remove radiator, shroud and cooling fan.
5. Remove drive belts.
6. Remove power steering oil pump and air conditioner compressor.
7. Remove front exhaust tube.
8. Remove transmission from vehicle.

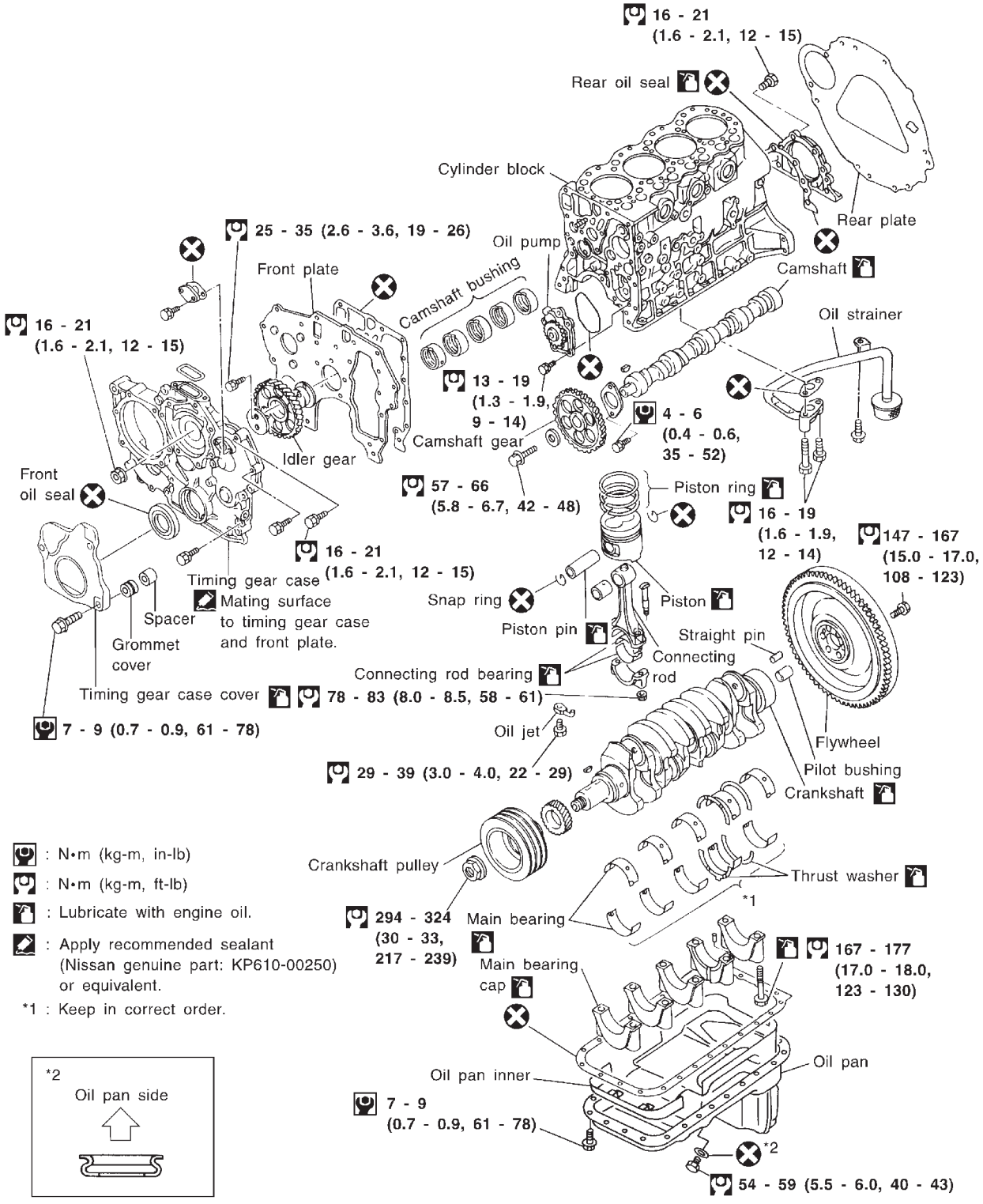
Refer to MT section.

9. Install engine slingers.
10. Hoist engine with engine slingers and remove engine mounting bolts from both sides.
11. Remove engine from vehicle.

Installation

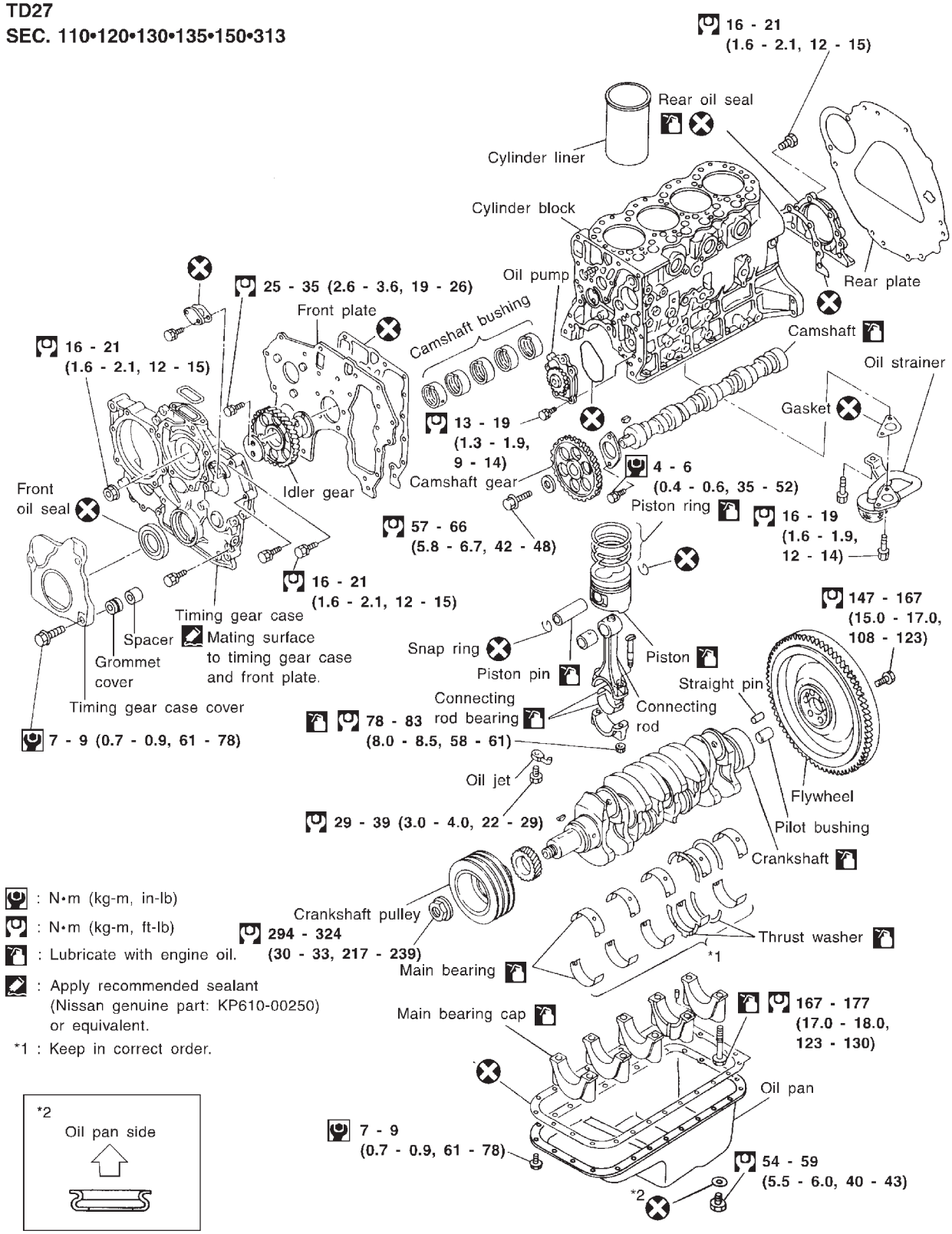
- Install in reverse order of removal.

QD32
SEC. 110•120•130•135•150•313

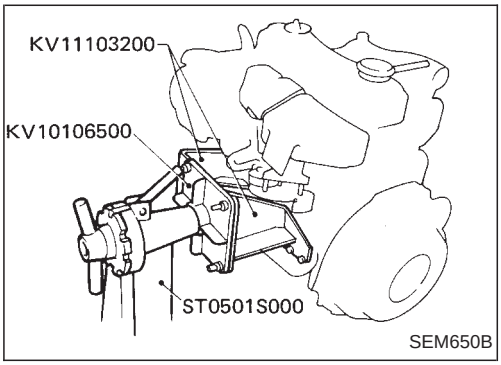


DEM041

TD27
SEC. 110•120•130•135•150•313



DEM065

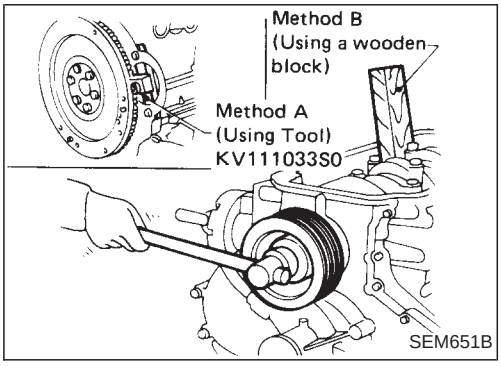


SEM650B

Disassembly

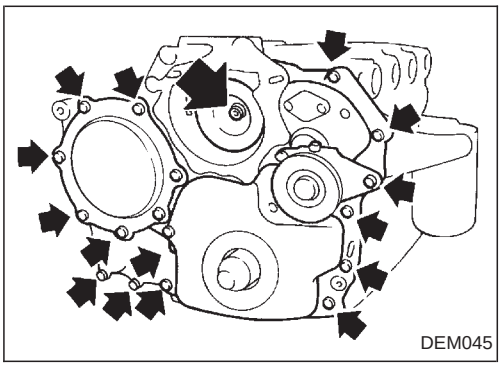
PISTON AND CRANKSHAFT

1. Remove oil filter.
2. Place engine on work stand.
3. Drain coolant and oil.
4. Remove drive belts.
5. Remove cylinder head.
6. Remove oil pan.

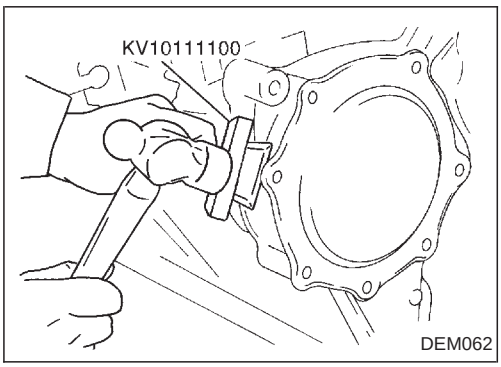


SEM651B

7. Remove crankshaft pulley.

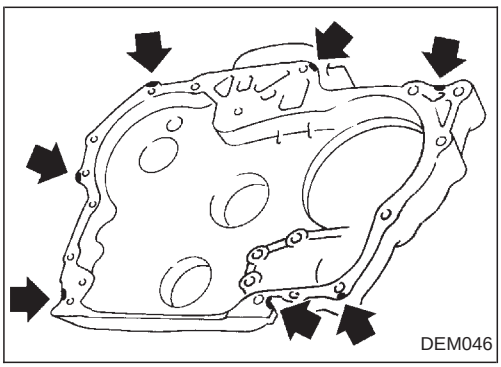

DEM045

8. Remove water pump.
9. Remove timing gear case.



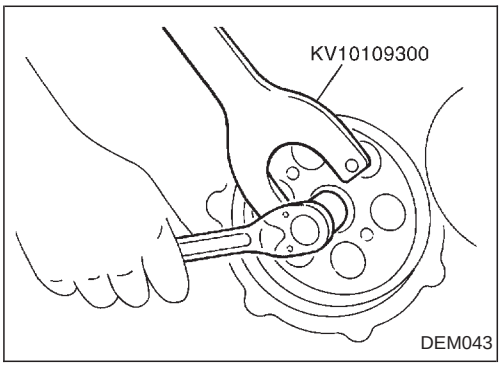
DEM062

- Remove dust cover with a seal cutter.

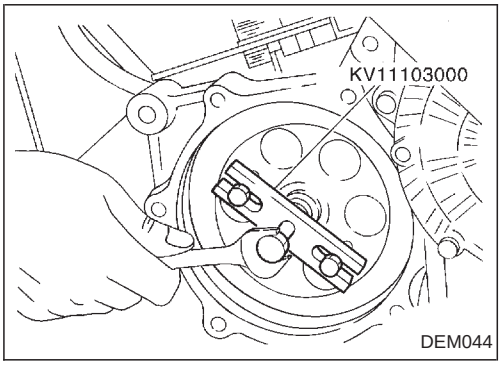

DEM046

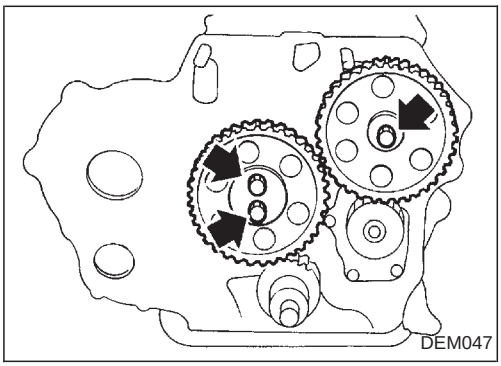
- **If the timing case is hard to remove due to liquid gasket, pry it off with a suitable tool at the cutout section.**

Disassembly (Cont'd)

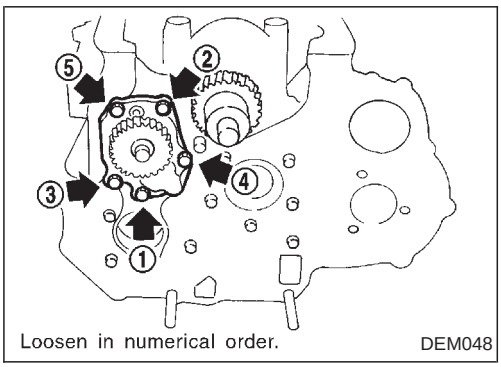


10. Remove injection pump gear.
- Be careful not to lose the woodruff key during injection pump removal.





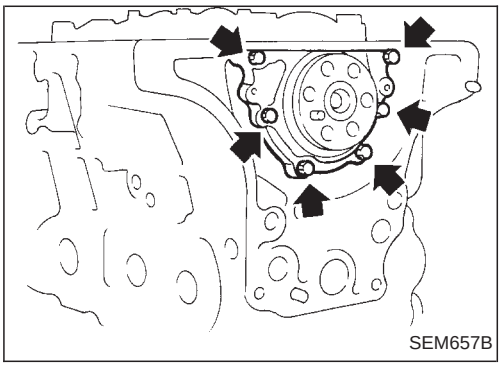
11. Remove idler gear and idler gear shaft.
12. Remove camshaft gear, camshaft and valve lifters.



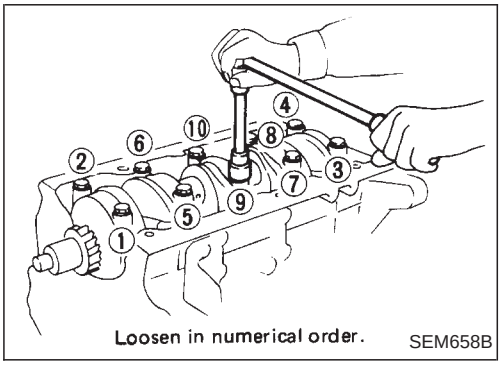
13. Remove oil pump assembly.

14. Remove crankshaft gear.
15. Remove flywheel and rear plate.
16. Remove connecting rod caps.
17. Remove pistons.
- Remove the connecting rod in such a way that it does not interfere with oil jet.

Disassembly (Cont'd)


SEM657B

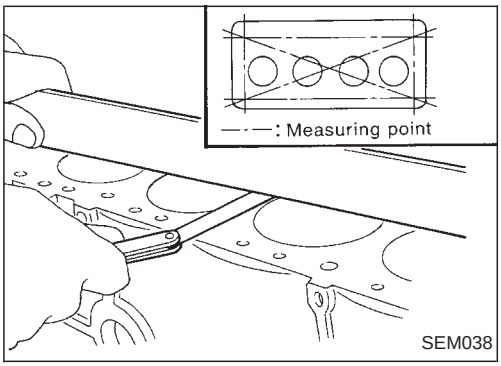
18. Remove rear oil seal retainer assembly.



19. Remove bearing cap and crankshaft.
Place the bearings and caps in their proper order.

Inspection and Replacement

CYLINDER BLOCK DISTORTION

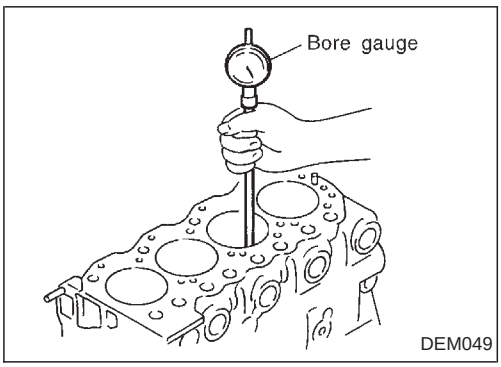


If beyond the specified limit, replace it.

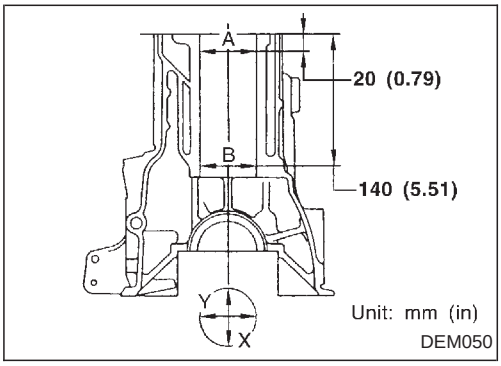
Cylinder block distortion: mm (in)
Standard
Less than 0.05 (0.0020)
Limit
0.2 (0.008)

- Remove all traces of gasket from the cylinder block. Do not allow pieces of the gasket to enter the oil and cooling water passages during gasket removal.

CYLINDER BORE WEAR (QD32 engine)



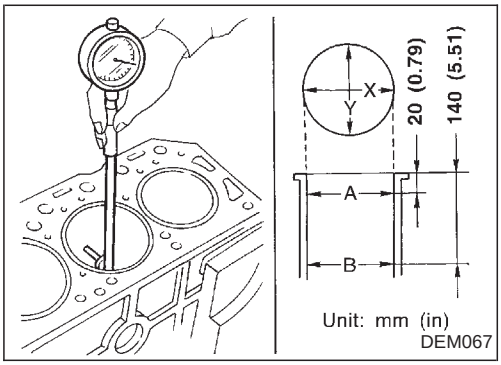
1. Using a bore gauge, measure cylinder bore for wear, out-of-round and taper.
   If it exceeds the limit, rebore all cylinders. Replace cylinder block if necessary.
   Standard inside diameter:
   99.200 - 99.230 mm (3.9055 - 3.9067 in)
   Refer to SDS, EM-200.
   Wear limit:
   0.20 mm (0.0079 in)
   Out-of-round (X − Y) standard:
   0.020 mm (0.0008 in)
   Taper (A − B) standard:
   0.020 mm (0.0008 in)



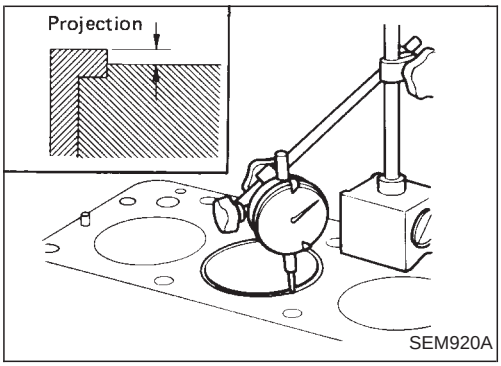
2. Check for scratches and seizure. If seizure is found, hone it.

Inspection and Replacement (Cont'd)

CYLINDER LINER WEAR (TD27 engine)



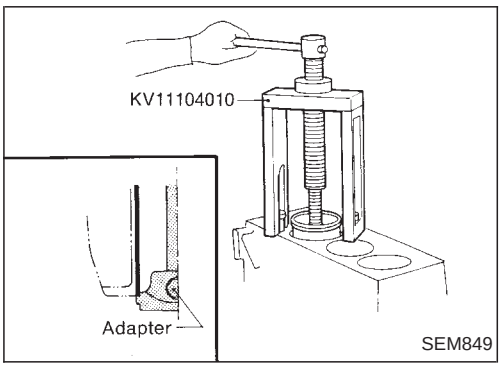
1. Measure cylinder liner bore for out-of-round and taper with a bore gauge. If beyond the limit, replace cylinder liner.
   Standard inside diameter:
   96.000 - 96.030 mm (3.7795 - 3.7807 in)
   Refer to SDS, EM-200.
   Wear limit:
   0.20 mm (0.0079 in)
   Out-of-round (X − Y) standard:
   0.020 mm (0.0008 in)
   Taper (A − B) standard:
   0.020 mm (0.0008 in)
2. Check for scratches or seizure. If seizure is found, replace cylinder liner.



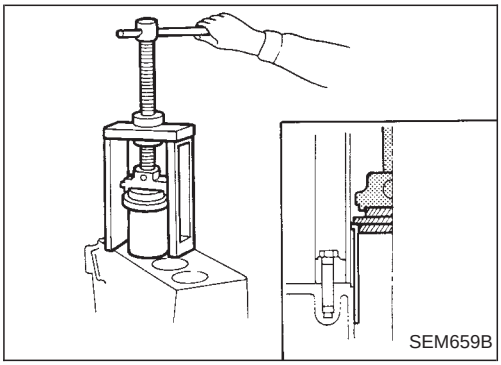
3. Check amount of projection of cylinder liner.
   Cylinder liner projection:
   Standard
   0.02 - 0.09 mm (0.0008 - 0.0035 in)
   Deviation of each cylinder:
   Less than 0.05 mm (0.0020 in)

CYLINDER LINER (TD27 engine)

Replacement

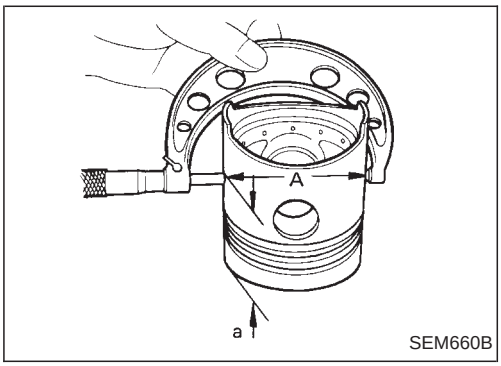


1. Remove cylinder liner with Tool.



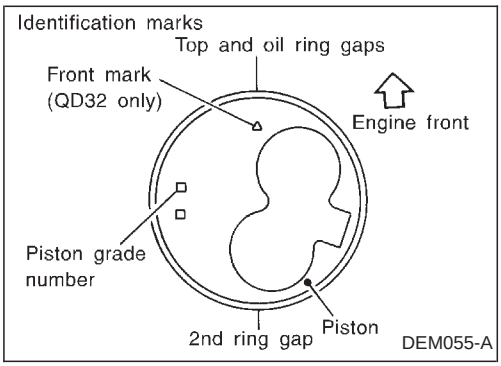
2. Install cylinder liner with Tool.
3. Check amount of projection of cylinder liner.

Inspection and Replacement (Cont'd)



PISTON TO CYLINDER WALL CLEARANCE

1. Measure piston and cylinder bore diameter.
   Piston diameter "A":
   Refer to SDS, EM-201.
   Measuring point "a"
   (Distance from the top): mm (in)
   QD32
   54.8 (2.157)
   TD27
   70 (2.76)
2. Check that piston clearance is within the specification.
   Piston clearance:
   0.05 - 0.07 mm (0.0020 - 0.0028 in)

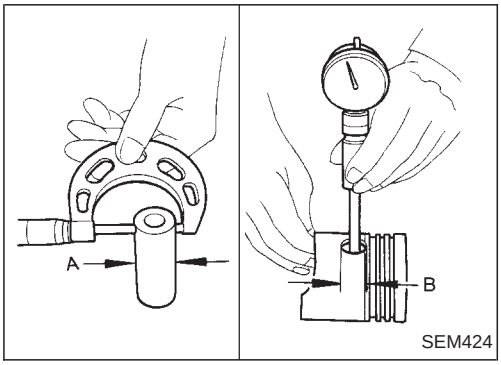


Combination of piston and cylinder bore

Use the same piston grade in one engine.

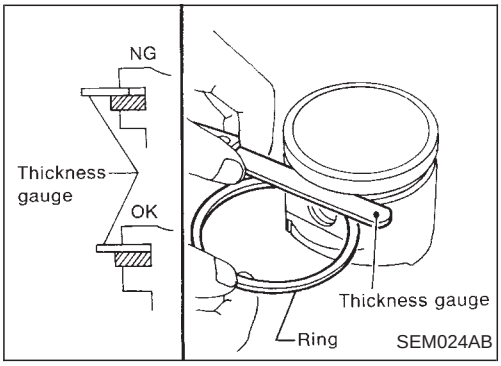
Cylinder bore grade number	Piston grade number		
	1	2	3
1	OK	NG	NG
2	Possible	OK	NG
3	Possible	Possible	OK

Refer to SDS, EM-200, for finding cylinder bore grade number.



PISTON AND PISTON PIN CLEARANCE

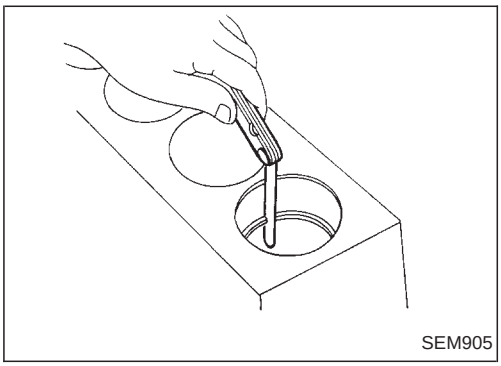
Check clearance between pistons and piston pins.
Clearance (A − B): mm (in)
Standard
−0.003 to 0.012 (−0.0001 to 0.0005)
Limit
Less than 0.10 (0.0039)



PISTON RING SIDE CLEARANCE

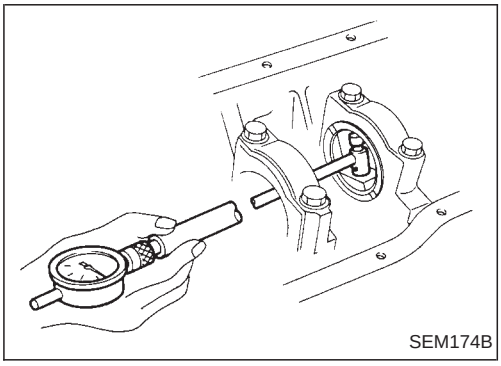
Side clearance: mm (in)
Top ring
0.06 - 0.10 (0.0024 - 0.0039)
2nd ring
0.04 - 0.08 (0.0016 - 0.0031)
Oil ring
0.02 - 0.06 (0.0008 - 0.0024)
Max. limit of side clearance: mm (in)
Top ring 0.50 (0.0197)
2nd ring 0.30 (0.0118)
Oil ring 0.15 (0.0059)

Inspection and Replacement (Cont'd)


SEM905

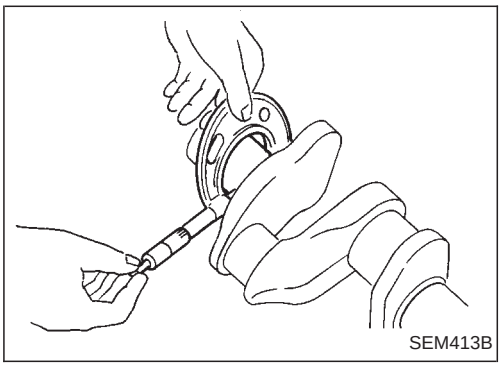
PISTON RING GAP

Standard ring gap: mm (in)
Top ring
0.30 - 0.45 (0.0118 - 0.0177)
2nd ring
0.50 - 0.65 (0.0197 - 0.0256)
Oil ring
0.30 - 0.50 (0.0118 - 0.0197)
Max. limit of ring gap:
1.5 mm (0.059 in)


SEM174B

MAIN BEARING CLEARANCE

1. Install main bearings to cylinder block and main bearing cap.
2. Install main bearing cap to cylinder block.
- **Apply engine oil to the thread portion and seating surface of bolts.**
- **Tighten all bolts with specified torque in correct order and in two or three stages. Refer to EM-174.**
3. Measure inside diameter "A" of main bearing.

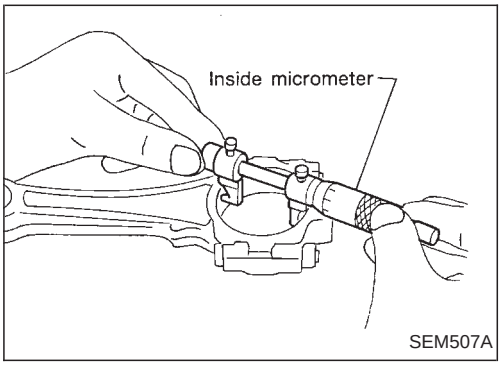

SEM413B

4. Measure outside diameter "Dm" of main journal in crankshaft.
5. Calculate main bearing clearance.
   Main bearing clearance = A − Dm
   Standard:
   0.035 - 0.087 mm (0.0014 - 0.0034 in)
   Limit:
   Less than 0.15 mm (0.0059 in)

CONNECTING ROD BEARING CLEARANCE

1. Install connecting rod bearing to connecting rod and cap.
2. Install connecting rod cap to connecting rod and tighten with specified torque.

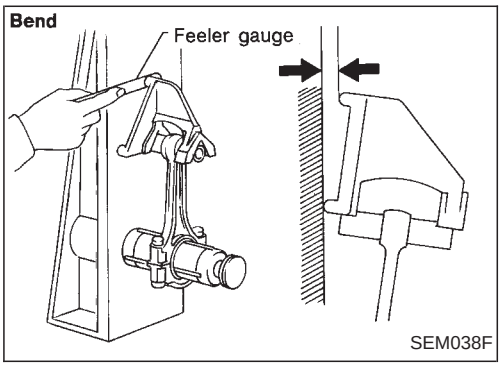
Apply engine oil to the thread portion of bolts and seating surface of nuts.



SEM507A

3. Measure inside diameter "A" of bearing.
4. Measure outside diameter "Dp" of pin journal in crankshaft.
5. Calculate connecting rod bearing clearance.
   Connecting rod bearing clearance = A − Dp
   Standard:
   0.035 - 0.081 mm (0.0014 - 0.0032 in)
   Limit:
   Less than 0.15 mm (0.0059 in)

Inspection and Replacement (Cont'd)

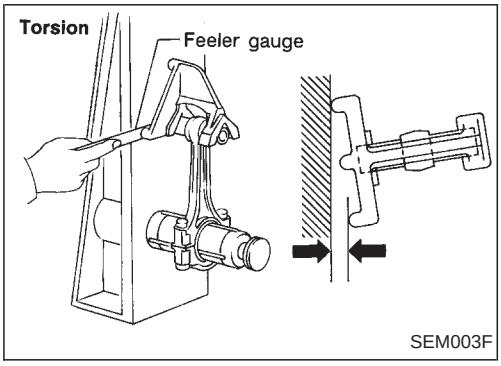


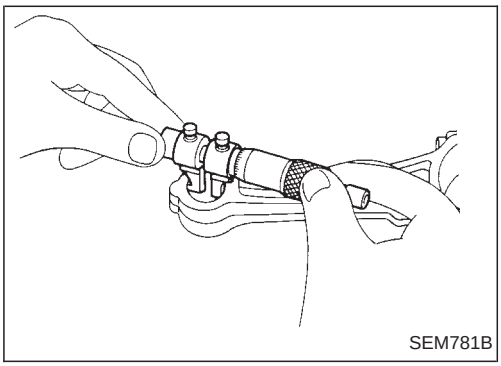
CONNECTING ROD BEND AND TORSION

Bend and torsion: mm (in)

Limit

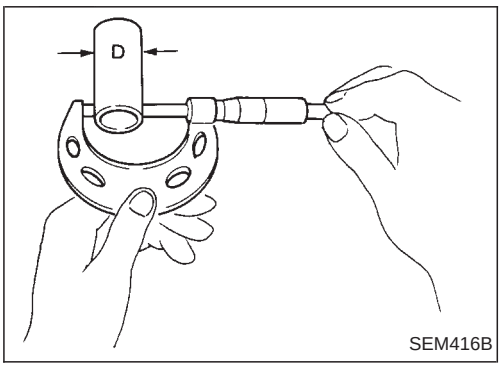
0.075 (0.0030) per 100 (3.94) length





CONNECTING ROD SMALL END BUSHING CLEARANCE

1. Measure inside diameter "A" of connecting rod small end bushings.



2. Measure outside diameter "D" of piston pin.
3. Calculate connecting rod small end bushing clearance.
   Connecting rod small end bushing clearance = A − D

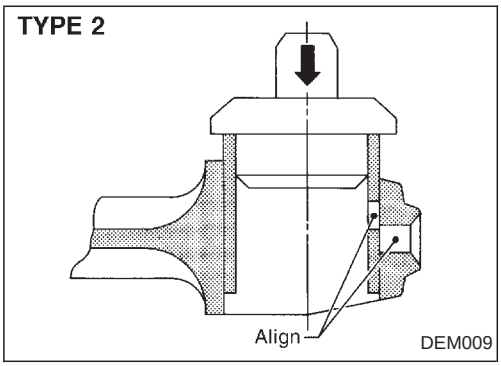
Standard:

0.025 - 0.045 mm (0.0010 - 0.0018 in)

Limit:

0.15 mm (0.0059 in)

Inspection and Replacement (Cont'd)



REPLACEMENT OF CONNECTING ROD SMALL END BUSHING

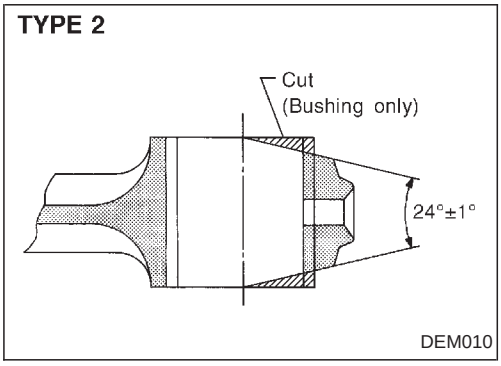
1. Drive in the small end bushing until it is flush with the end surface of the rod.

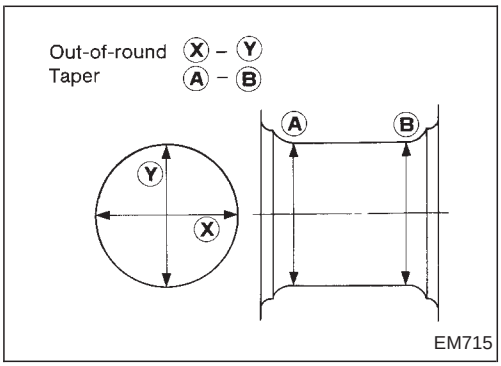
Be sure to align the oil holes.

2. After driving in the small end bushing, ream the bushing.

Small end bushing inside diameter: mm (in)
Finished size
QD32
33.025 - 33.038 (1.3002 - 1.3007)
TD27
30.025 - 30.038 (1.1821 - 1.1826)

3. Machine the bushing to match the tapered surface of the connecting rod small end.
4. Remove burrs from the machined bushing.

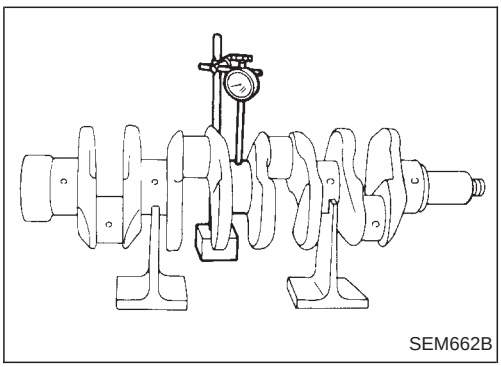




CRANKSHAFT

1. Check crankshaft journals and pins for score, bias, wear or cracks. If faults are minor, correct with fine crocus cloth.
2. Check journals and pins with a micrometer for taper and out-of-round.

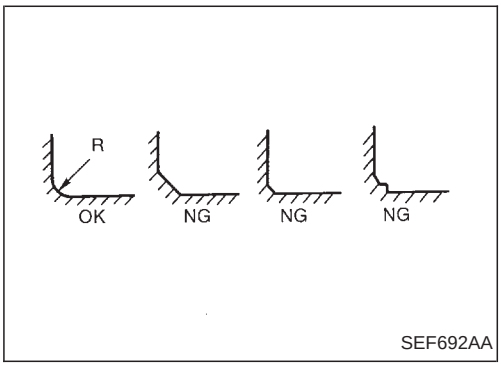
Out-of-round (X − Y): mm (in)
Standard
Less than 0.01 (0.0004)
Limit
0.02 (0.0008)
Taper (A − B): mm (in)
Standard
Less than 0.01 (0.0004)
Limit
0.02 (0.0008)



3. Check crankshaft runout.

Runout [TIR (Total Indicator Reading)]: mm (in)
Standard
0 - 0.03 (0 - 0.0012)
Limit
0.10 (0.0039)

Inspection and Replacement (Cont'd)



SEF692AA

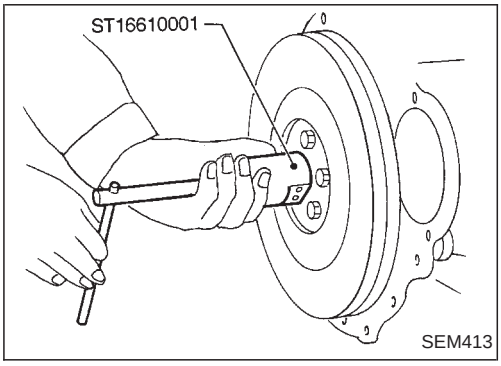
RESURFACING OF CRANKSHAFT JOURNAL AND CRANK PIN

When using undersize main bearings and connecting rod bearings, the crankshaft journals or crank pins must be finished to match the bearings.

R: Crank journal 3.0 mm (0.118 in)
Crank pin 3.5 mm (0.138 in)

CAUTION:

- **At the same time make sure that the surface width does not increase.**
- **Do not attempt to cut counterweight of crankshaft.**

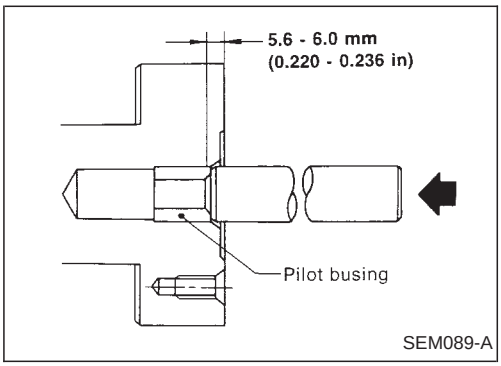


SEM413

CRANKSHAFT PILOT BUSHING

Replacement

1. Pull out bushing with Tool.

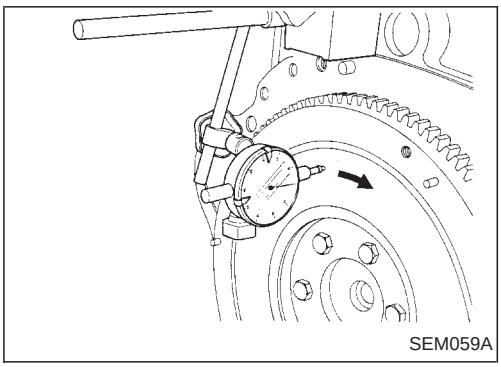


SEM089-A

2. Insert pilot bushing until distance between flange end and bushing is specified value.
   Distance:
   Approx. 5.6 - 6.0 mm (0.220 - 0.236 in)

FLYWHEEL RUNOUT

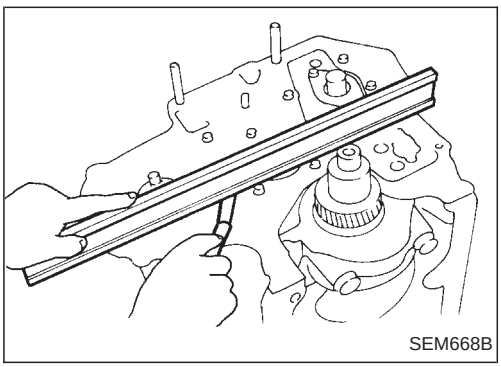
Runout (Total indicator reading):
Less than 0.15 mm (0.0059 in)


SEM059A

FRONT PLATE

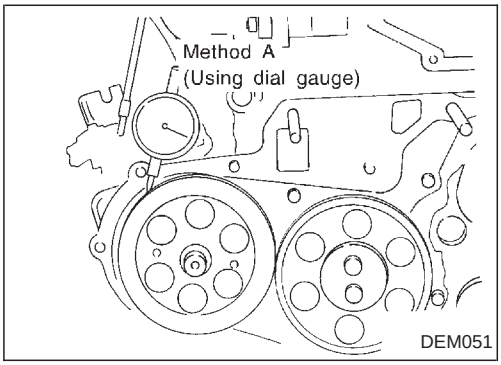
Check front plate for warpage. If not within the limit, make flat or replace front plate.

Warpage limit:
0.2 mm (0.008 in)


SEM668B

Inspection and Replacement (Cont'd)

GEAR TRAIN

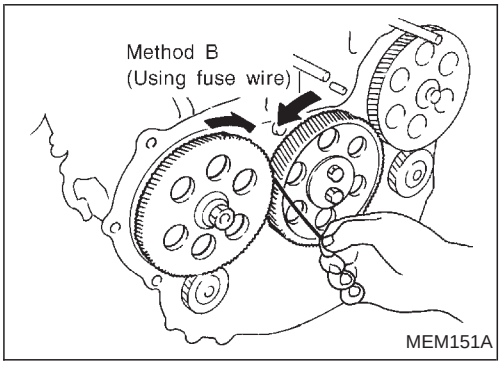


DEM051

Camshaft drive gear, injection pump drive gear, oil pump gear, idler gear and crankshaft gear

1. If gear tooth and key have scratches or are excessively worn, replace gear and key.
2. Check gear train backlash before disassembling and after assembling.
   Method A (Using dial gauge)
   Method B (Using fuse wire)
   If beyond the limit, replace gear.

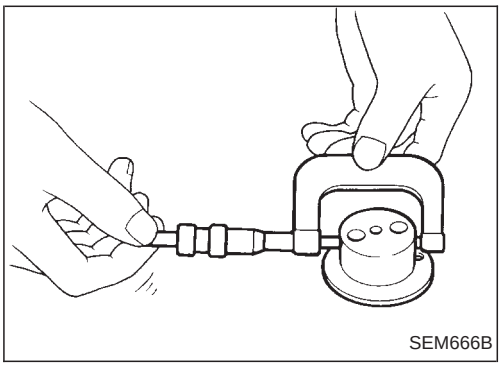
Backlash: mm (in)
Standard
0.07 - 0.11 (0.0028 - 0.0043)
Limit
0.20 (0.0079)



MEM151A

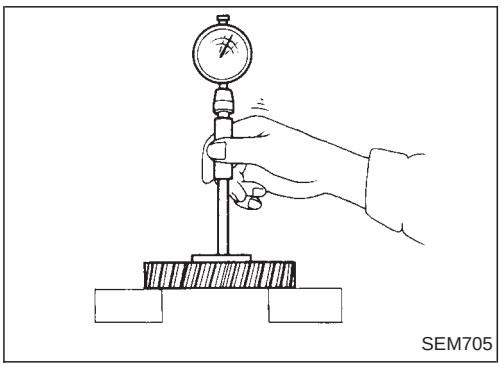
IDLER GEAR BUSHING CLEARANCE

1. Measure idler gear shaft outer diameter.


SEM666B

2. Measure idler gear bushing inner diameter.
3. Calculate idler gear bushing clearance.

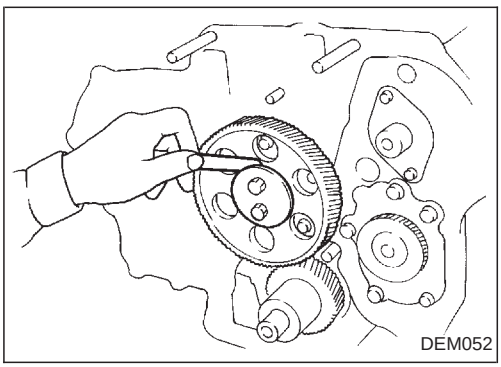
Bushing clearance: mm (in)
Standard
0.025 - 0.061 (0.0010 - 0.0024)
Limit
0.20 (0.0079)


SEM705

IDLER GEAR END PLAY

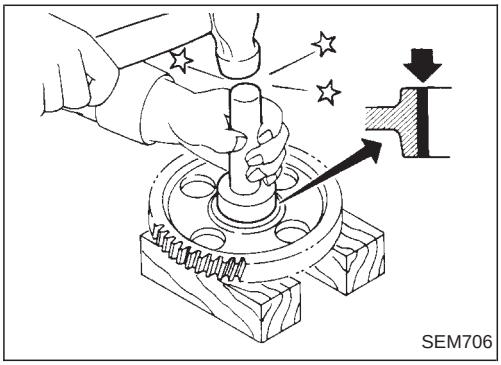
Measure idler gear end play between gear plate and gear.

Idler gear end play: mm (in)
Standard
0.03 - 0.14 (0.0012 - 0.0055)
Limit
Less than 0.3 (0.012)


DEM052

Inspection and Replacement (Cont'd)

REPLACEMENT OF IDLER GEAR BUSHING


SEM706

1. Use a suitable tool to replace bushing.
2. Ream idler gear bushing.
   Finished size:
   42.00 - 42.02 mm (1.6535 - 1.6543 in)

Idler gear shaft

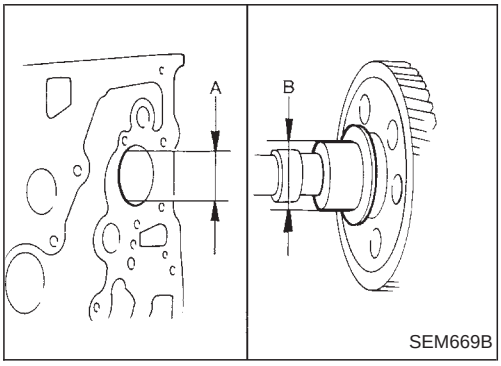
Install idler gear shaft so that oil hole of shaft faces upward.

CAMSHAFT AND CAMSHAFT BUSHING

Camshaft bushing clearance

Measure inside diameter of camshaft bushing and outside diameter of camshaft journal with a suitable gauge.

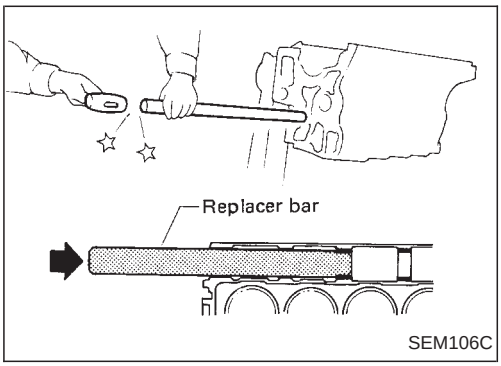
Clearance between camshaft and bushing
(A − B): mm (in)
Standard
0.020 - 0.109 (0.0008 - 0.0043)
Limit
Less than 0.15 (0.0059)



SEM669B

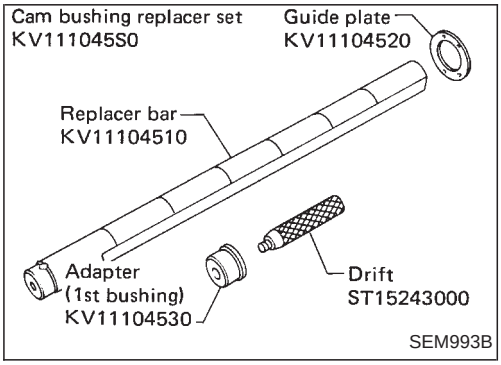
REPLACING CAMSHAFT BUSHING

1. Using Tool, remove camshaft bushings from the engine. Some bushings must be broken in order to remove.



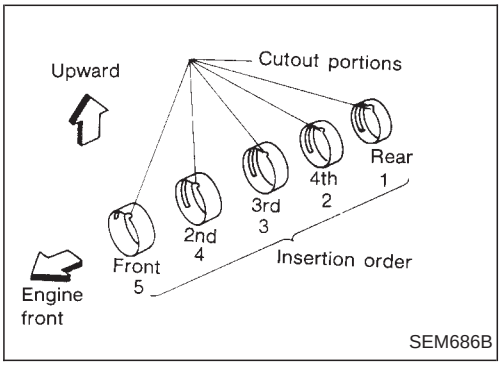
SEM106C

2. Using Tool, install camshaft bushings as follows:



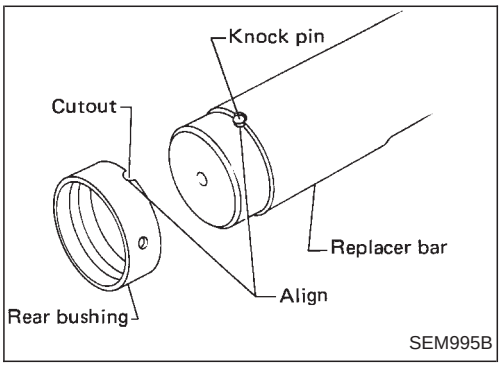
SEM993B

(1) Install camshaft bushings in the order of "rear", "4th", "3rd", "2nd" and "front". All bushings must be installed from the front.
(2) Face the cutout upward and toward the front of the engine during installation.



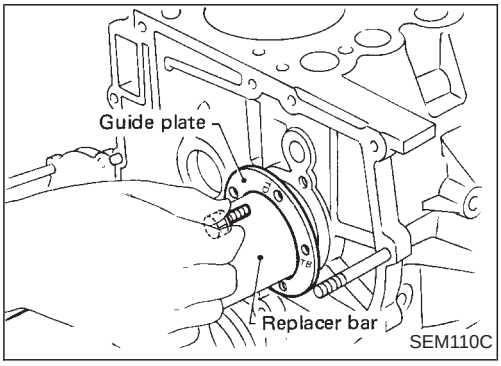
SEM686B

Inspection and Replacement (Cont'd)



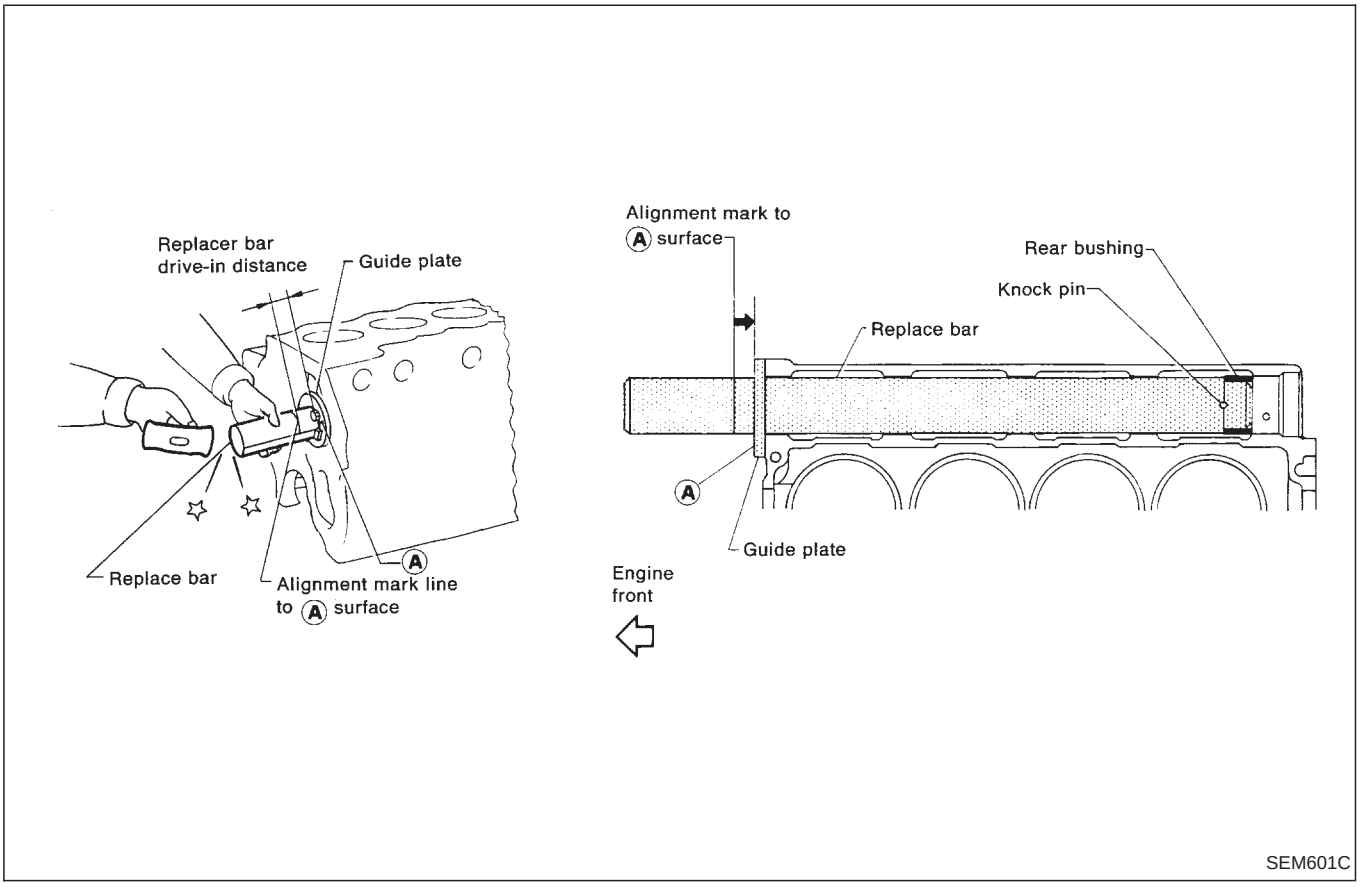
(3) Rear camshaft bushing

- Align the cutout of rear bushing with knock pin of replacer bar before installation.



- Insert rear bushing with replacer bar into the engine.
  Install guide plate with bolt holes (on the "TD" mark side) facing upper side of cylinder block. Tighten bolts.

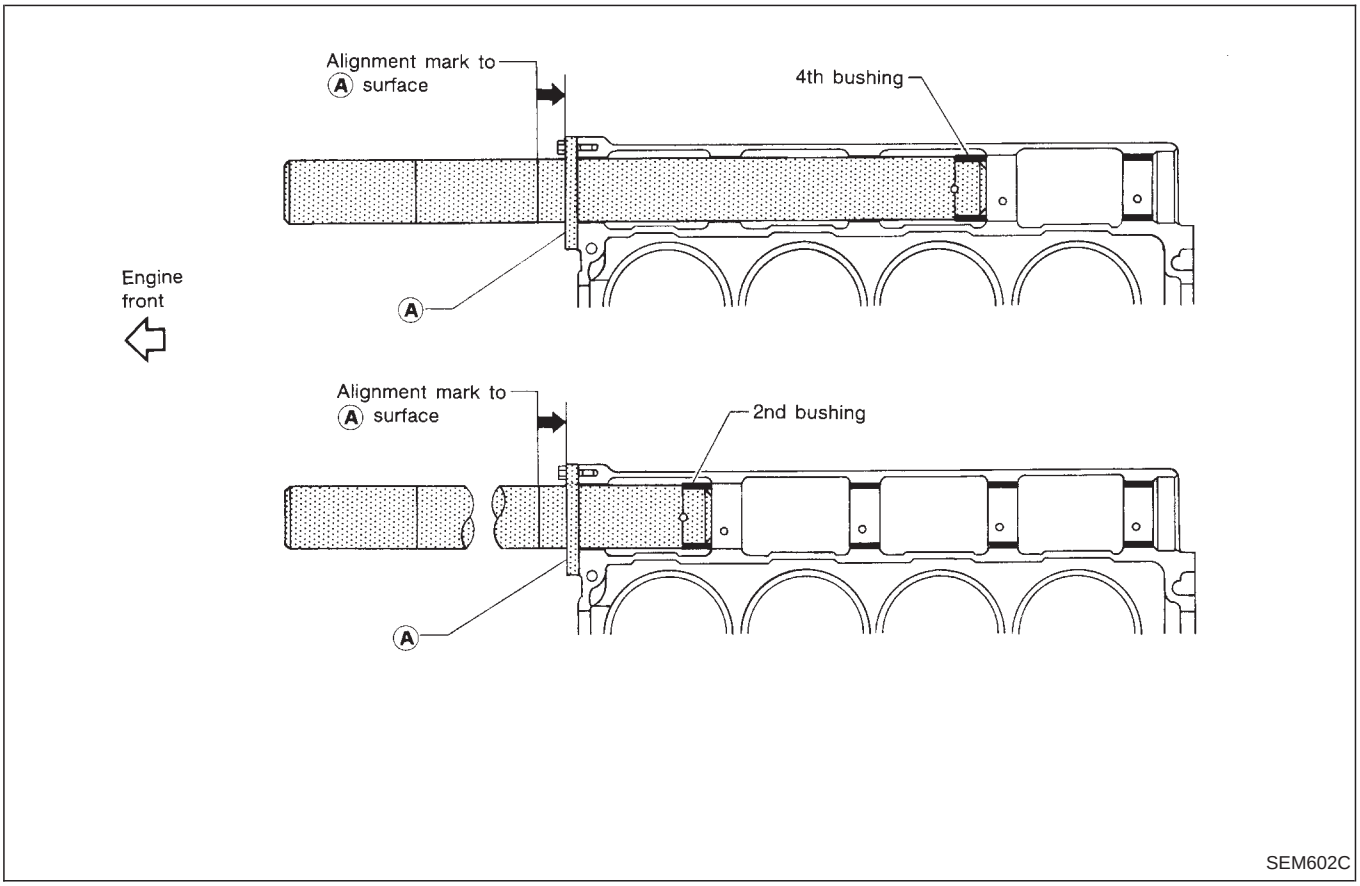
- Drive replacer bar until the alignment mark on replacer bar is aligned with the end of replacer guide.
  Remove replacer set.
  After installation, check that oil holes in camshaft bushings are aligned with oil holes in cylinder block.

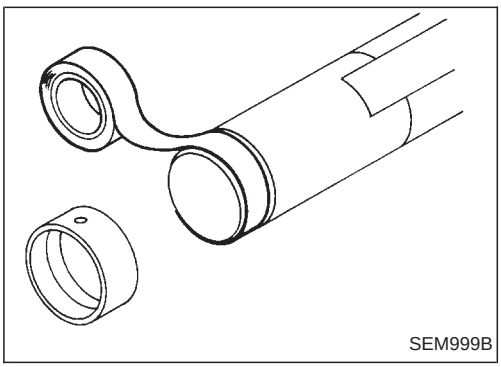


Inspection and Replacement (Cont'd)

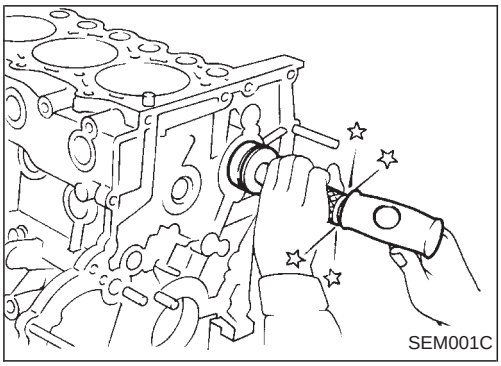
(4) 4th, 3rd and 2nd camshaft bushings

- Install in the same manner as rear camshaft bushing.





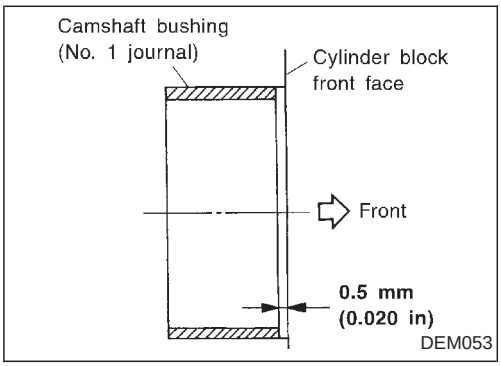
- When setting 4th through 2nd bushings on replacer bar, tape the bar to prevent movement.



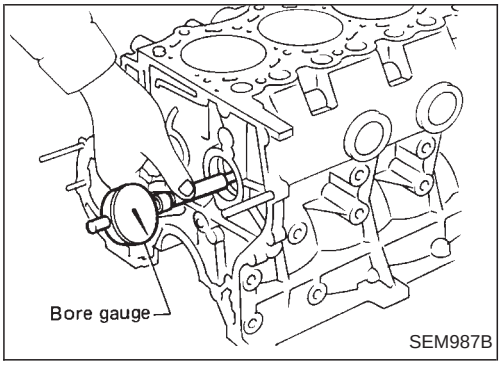
(5) Front camshaft bushing

- Using 1st bushing adapter, position front camshaft bushing so that oil hole in cylinder block is aligned with oil hole in bushing.

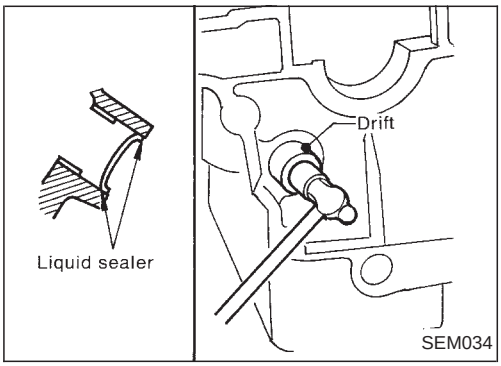
Inspection and Replacement (Cont'd)



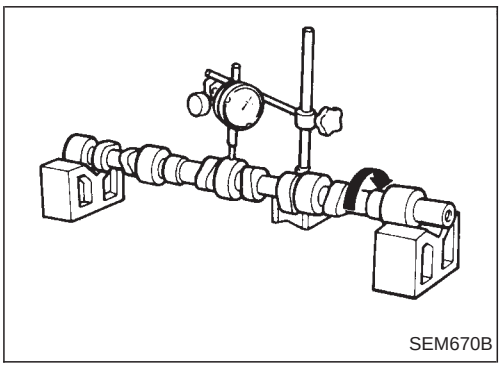
- Press the bushing until its front end is 0.5 mm (0.020 in) from the front surface of the cylinder block.



3. Check camshaft bushing clearance.
Refer to SDS, EM-199.



4. Install new welch plug into rear camshaft bushing hole with a drift.
Apply liquid sealer.

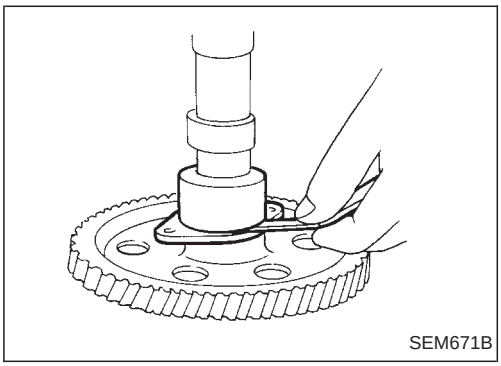


CAMSHAFT ALIGNMENT

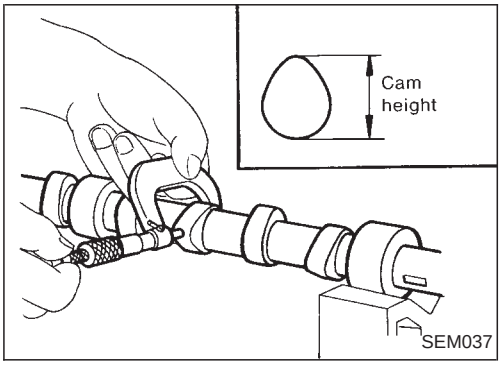
1. Check camshaft journal and cam surface for bend, wear or damage.
   If fault is beyond limit, replace.
2. Check camshaft bend at center journal.
   If bend is greater than specified limit, repair or replace camshaft.

Camshaft bend
(Total indicator reading): mm (in)
Standard
Less than 0.02 (0.0008)
Limit
Less than 0.06 (0.0024)

Inspection and Replacement (Cont'd)


SEM671B

3. Measure camshaft end play between locating plate and gear. If beyond the specified limit, replace camshaft locating plate.
   Camshaft end play: mm (in)
   Standard
   0.08 - 0.28 (0.0031 - 0.0110)
   Limit
   Less than 0.5 (0.020)



SEM037

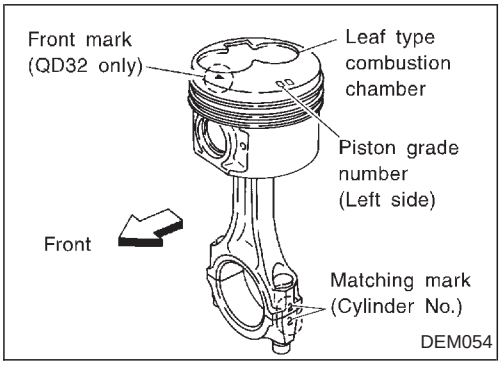
4. Measure camshaft cam height. If beyond the specified limit, replace camshaft.
   Cam height: mm (in)
   Standard
   Intake
   41.88 - 41.92 (1.6488 - 1.6504)
   Exhaust
   41.88 - 41.92 (1.6488 - 1.6504)
   Limit
   Intake
   Less than 41.40 (1.6299)
   Exhaust
   Less than 41.40 (1.6299)

Assembly

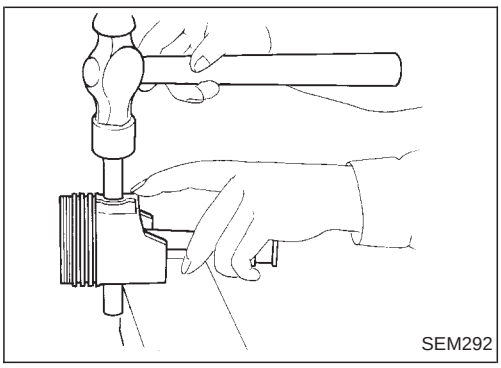
PISTON

Assemble pistons, piston pins, snap rings and connecting rods.

a. Numbers are stamped on the connecting rod and cap corresponding to each cylinder. Care should be taken to avoid a wrong combination including bearing.



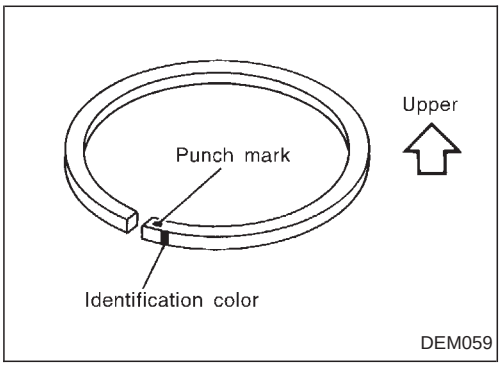
DEM054


SEM292

b. When inserting piston pin in connecting rod, heat piston with a heater or hot water [approximately 60 to 70°C (140 to 158°F)] and apply engine oil to pin and small end of connecting rod.

c. After assembling, ascertain that piston swings smoothly.

Assembly (Cont'd)

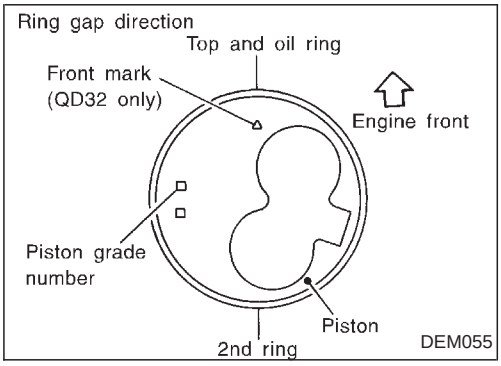


Install piston assembly.

CAUTION:

- **Stretch the piston rings only enough to fit them in the piston grooves.**
- **Always install new piston rings with the position marks facing up.**

	Identification color
Top ring	Yellow
2nd ring	Red



- **Install No. 1 piston ring in such a way that its gap faces the direction of the piston pin; and then install piston rings so that their gap positioned at 180° to one another.**

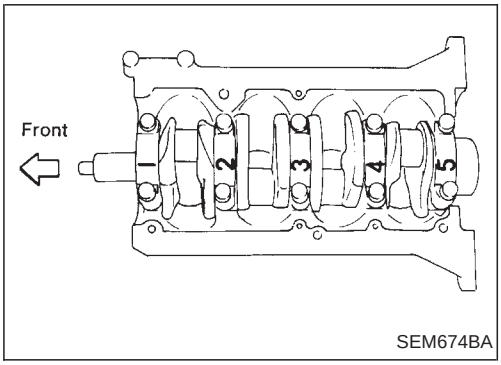
CRANKSHAFT

1. Install crankshaft.

(1) Set main bearings in the proper position on cylinder block.

a. If either crankshaft, cylinder block or main bearing is reused again, it is necessary to measure main bearing clearance.

b. Upper bearings have oil hole and oil groove, however lower bearings do not.



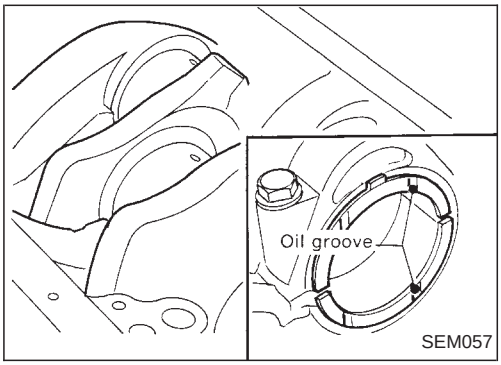
(2) Apply engine oil to crankshaft journal and pin and install crankshaft.

(3) Install main bearing caps.

a. Install main bearing cap with the number facing the front of vehicle.

b. Apply engine oil to main bearing cap and cylinder block contact surfaces.

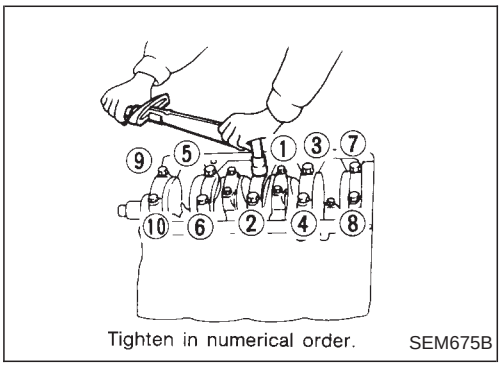
c. Install rear oil seal assembly. Apply engine oil to contact surface of rear end oil seal and crankshaft.



(4) Install crankshaft thrust washer at the 4th journal from front.

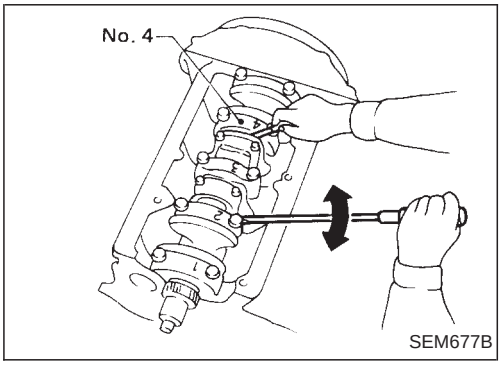
Install thrust washer so that oil groove can face crankshaft.

Assembly (Cont'd)



(5) Tighten main bearing cap bolts gradually in stages, starting from two to three separate stages, from center bearing and moving outward in sequence.

: 167 - 177 N·m (17.0 - 18.0 kg-m, 123 - 130 ft-lb)



(6) Measure crankshaft free end play at No. 4 bearing.

Crankshaft free end play: mm (in)

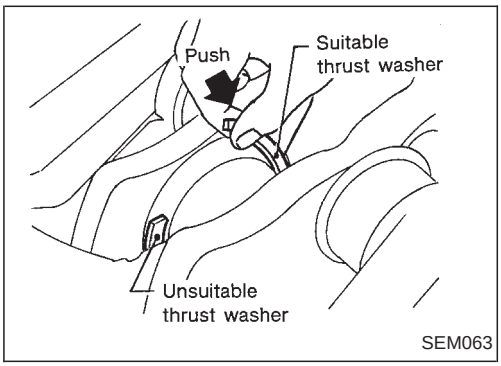
Standard

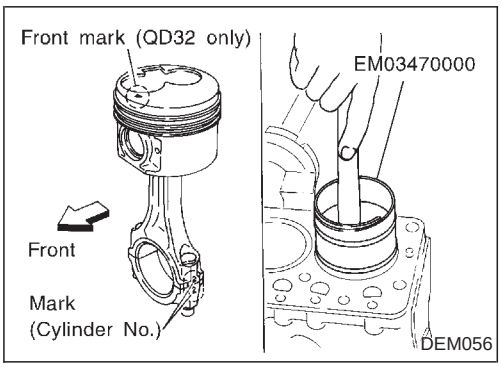
0.055 - 0.140 (0.0022 - 0.0055)

Limit

0.40 (0.0157)

If beyond the limit, replace No. 4 main bearing thrust washer. Refer to SDS, EM-204.

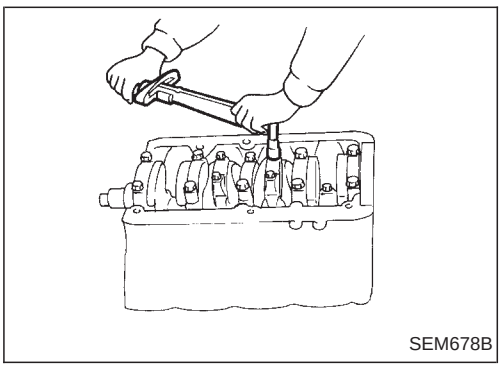




2. Install pistons with connecting rods.

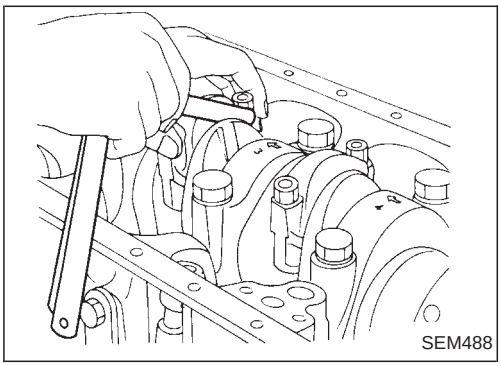
(1) Install them into corresponding cylinder using Tool.

- **Be careful not to scratch cylinder wall with connecting rod.**
- **Insert the connecting rod. Do not allow the larger end to touch the oil jet.**
- **Apply engine oil to cylinder wall, piston and bearing.**
- **The leaf type combustion chamber on piston head must be at right side of engine.**



(2) Install connecting rod bearing caps.

Assembly (Cont'd)

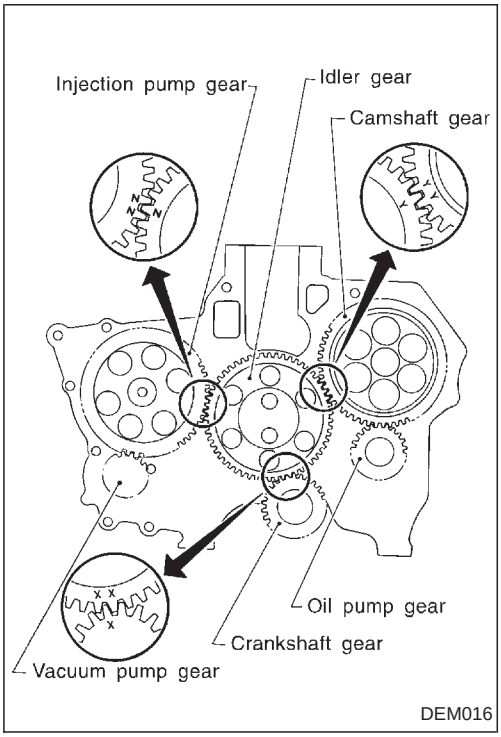

SEM488

3. Measure connecting rod side clearance.

Connecting rod side clearance: mm (in)
Standard
0.10 - 0.22 (0.0039 - 0.0087)
Limit
0.22 (0.0087)

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

GEAR TRAIN

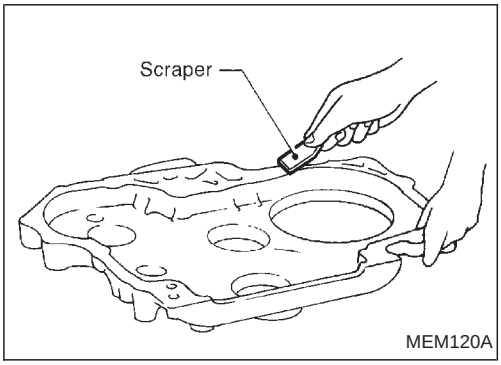


DEM016

1. Set No. 1 piston at TDC on its compression stroke.
2. Align each gear mark and install gears.

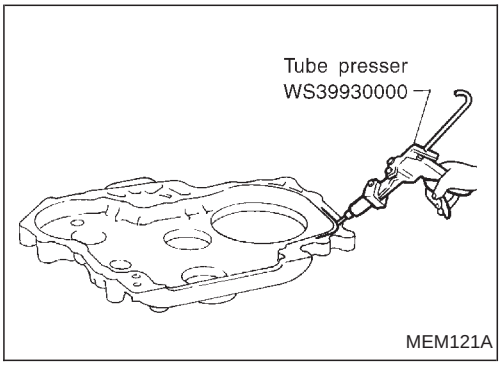
TIMING GEAR CASE

Installation



MEM120A

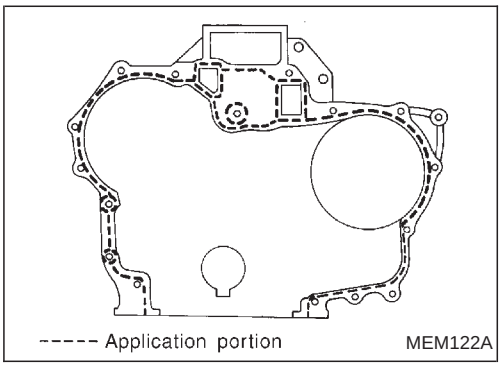
1. Before installing timing gear case, remove all traces of liquid gasket from mating surface using a scraper.
   Also remove traces of liquid gasket from mating surface of front plate.

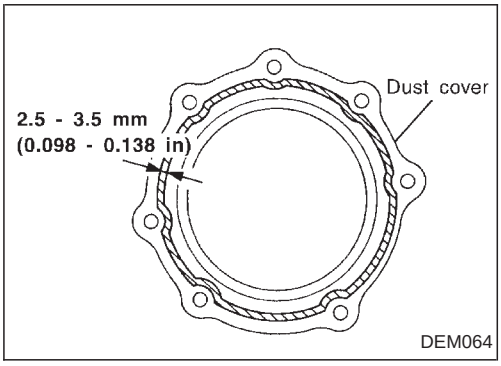


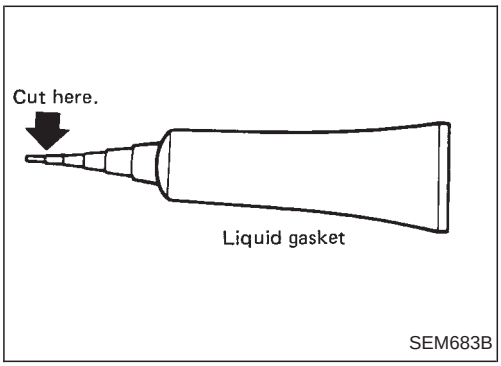
MEM121A

2. Apply a continuous bead of liquid gasket to mating surface of timing gear case and dust cover.

Assembly (Cont'd)







- **Be sure liquid gasket diameter is 2.5 to 3.5 mm (0.098 to 0.138 in).**
- **Attach timing gear case to front plate within 10 minutes after coating.**
- **Wait at least 30 minutes before refilling engine coolant or starting engine.**
- **Use Genuine Liquid Gasket or equivalent.**

General Specifications

Engine model		QD32	TD27
Cylinder arrangement		In-line	
Number of cylinders		4	
Valve arrangement		OHV	
Bore x stroke	mm (in)	99.2 x 102.0 (3.906 x 4.016)	96.0 x 92.0 (3.780 x 3.622)
Displacement	cm^3 (cu in)	3,153 (192.40)	2,663 (162.50)
Firing order		1-3-4-2	
Number of piston rings	Compression	2	
	Oil	1	
Number of main bearings		5	

Inspection and Adjustment

COMPRESSION PRESSURE

Unit: kPa (bar, kg/cm^2, psi)/rpm

Standard	2,942 (29.4, 30, 427)/200
Minimum	2,452 (24.5, 25, 356)/200
Differential limit between cylinders	294 (2.9, 3, 43)/200

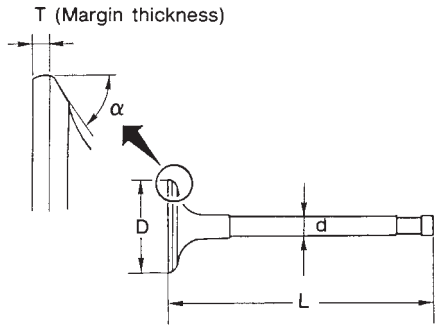
CYLINDER HEAD

Unit: mm (in)

	Standard	Limit
Head surface distortion	Less than 0.07 (0.0028)	0.2 (0.008)
Nominal cylinder head height	89.9 - 90.1 (3.539 - 3.547)	

VALVE

Unit: mm (in)



SEM188

Engine	QD32	TD27
Valve head diameter “D”		
Intake	45.4 - 45.6 (1.787 - 1.795)	43.4 - 43.6 (1.709 - 1.717)
Exhaust	38.9 - 39.1 (1.531 - 1.571)	37.9 - 38.1 (1.492 - 1.500)
Valve length “L”		
Intake	117 (4.61)	
Exhaust		
Valve stem diameter “d”		
Intake	7.962 - 7.977 (0.3135 - 0.3141)	
Exhaust	7.945 - 7.960 (0.3128 - 0.3134)	
Valve seat angle “α”		
Intake	45° - 45°30′	
Exhaust		
Valve margin “T” limit	0.5 (0.020)	
Valve stem end surface grinding limit	0.2 (0.008)	
Valve clearance (Hot)		
Intake	0.35 (0.0138)	
Exhaust		

Inspection and Adjustment (Cont'd)

Valve guide

Unit: mm (in)

	Standard	Service
Valve guide outside diameter	12.033 - 12.044 (0.4737 - 0.4742)	—
Valve guide inner diameter (Finished size)	8.000 - 8.015 (0.3150 - 0.3156)	
Cylinder head valve guide hole diameter	12.00 - 12.011 (0.4724 - 0.4729)	—
Interference fit of valve guide	0.022 - 0.044 (0.0009 - 0.0017)	
	Standard	Max. tolerance
Stem to guide clearance		
Intake	0.023 - 0.053 (0.0009 - 0.0021)	0.15 (0.0059)
Exhaust	0.04 - 0.07 (0.0016 - 0.0028)	0.20 (0.0079)
Valve deflection limit		
Intake	0.30 (0.0118)	
Exhaust	0.40 (0.0157)	

Valve spring

Free length mm (in)	
Painted red	53.4 (2.102)
Pressure height mm/N (mm/kg, in/lb)	
Painted red	31.8/713.9 - 788.5 (31.8/72.8 - 80.4, 1.252/160.5 - 177.3)
Assembled height mm/N (mm/kg, in/lb)	
Standard	42.3/314.8 - 361.9 (42.3/32.1 - 36.9, 1.665/70.8 - 81.4)
Limit	42.3/270.7 (42.3/27.6, 1.665/60.9)
Out-of-square mm (in)	2.3 (0.091)

VALVE LIFTER AND PUSH ROD

Unit: mm (in)

	Standard	Limit
Valve lifter outer diameter	25.960 - 25.970 (1.0220 - 1.0224)	—
Cylinder block valve lifter hole diameter	26.000 - 26.033 (1.0236 - 1.0249)	—
Valve lifter to lifter hole clearance	0.030 - 0.073 (0.0012 - 0.0029)	0.20 (0.0079)
Push rod bend (TIR)*	Less than 0.3 (0.012)	0.5 (0.020)

*: Total indicator reading

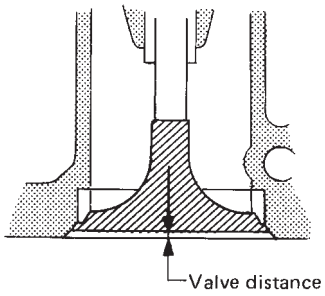
Rocker shaft and rocker arm

Unit: mm (in)

	Standard	Limit
Rocker shaft		
Outer diameter	19.979 - 20.00 (0.7866 - 0.7874)	—
Rocker shaft bend (TIR)	0 - 0.15 (0 - 0.0059)	Less than 0.30 (0.0118)
Rocker arm		
Inner diameter	20.014 - 20.035 (0.7880 - 0.7888)	—
Clearance between rocker arm and rocker shaft	0.014 - 0.056 (0.0006 - 0.0022)	0.15 (0.0059)

CYLINDER HEAD TO VALVE DISTANCE

Unit: mm (in)



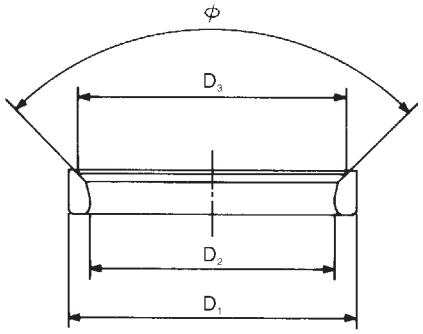
SEM724C

	Standard	Limit
Intake	0.7 - 1.3 (0.028 - 0.051)	1.70 (0.067)
Exhaust	0.7 - 1.3 (0.028 - 0.051)	1.70 (0.067)

Inspection and Adjustment (Cont'd)

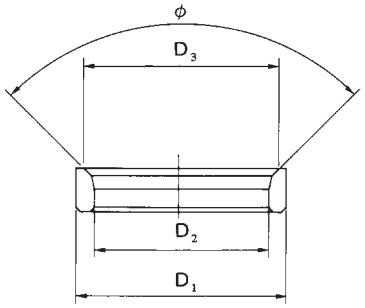
Valve seat

Unit: mm (in)



SEM258F

	QD32	TD27
Intake		
Outer diameter "D_1"	46.535 - 46.545 (1.8321 - 1.8325)	44.535 - 44.545 (1.7533 - 1.7537)
Inner diameter "D_2"	39.4 - 39.6 (1.551 - 1.559)	37.9 - 38.1 (1.492 - 1.500)
Diameter of seat "D_3"	45.3 - 45.7 (1.783 - 1.799)	42.5 (1.673)
Cylinder head valve seat diameter	46.500 - 46.515 (1.8307 - 1.8313)	44.500 - 44.515 (1.7520 - 1.7526)
Valve seat face angle "ϕ"	89° - 90°	89° - 90°



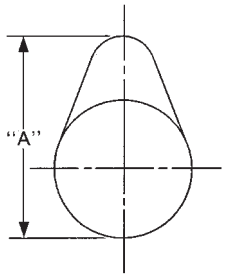
SEM953C

	QD32	TD27
Exhaust		
Outer diameter "D_1"		
Standard	40.535 - 40.545 (1.5959 - 1.5963)	39.535 - 39.545 (1.5565 - 1.5569)
0.2 (0.008) Oversize (Service)	40.735 - 40.745 (1.6037 - 1.6041)	39.735 - 39.745 (1.5644 - 1.5648)
0.4 (0.016) Oversize (Service)	40.935 - 40.945 (1.6116 - 1.6120)	39.935 - 39.945 (1.5722 - 1.5726)
Inner diameter "D_2"	33.65 - 34.35 (1.3248 - 1.3524)	32.4 - 33.1 (1.276 - 1.303)
Diameter of seat "D_3"	37.9 - 38.1 (1.492 - 1.500)	37.0 (1.457)
Cylinder head valve seat diameter		
Standard	40.495 - 40.510 (1.5943 - 1.5949)	39.495 - 39.510 (1.5549 - 1.5555)
0.2 (0.008) Oversize	40.695 - 40.710 (1.6022 - 1.6028)	39.695 - 39.710 (1.5628 - 1.5634)
0.4 (0.016) Oversize	40.895 - 40.910 (1.6100 - 1.6106)	39.895 - 39.910 (1.5707 - 1.5713)
Valve seat face angle "ϕ"	89° - 90°	89° - 90°

CAMSHAFT AND CAMSHAFT BEARING

Unit: mm (in)

	Standard	Limit
Camshaft journal to bushing clearance [Oil clearance]	0.020 - 0.109 (0.0008 - 0.0043)	0.15 (0.0059)
Camshaft journal diameter		
Front	50.721 - 50.740 (1.9969 - 1.9976)	—
2nd	50.521 - 50.540 (1.9890 - 1.9898)	—
3rd	50.321 - 50.340 (1.9811 - 1.9819)	—
4th	50.121 - 50.140 (1.9733 - 1.9740)	—
Rear	49.921 - 49.940 (1.9654 - 1.9661)	—
Camshaft bend (Total indicator reading)	Less than 0.02 (0.0008)	0.06 (0.0024)
Camshaft end play	0.08 - 0.28 (0.0031 - 0.0110)	0.50 (0.0197)



EM671

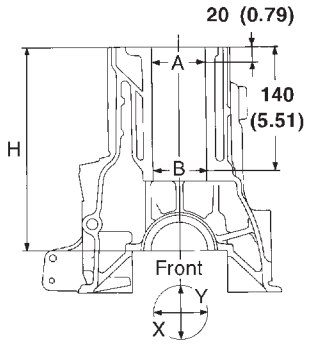
	Standard	Limit
Cam height "A"		
Intake & Exhaust	41.88 - 41.92 (1.6488 - 1.6504)	41.40 (1.6299)

Inspection and Adjustment (Cont'd)

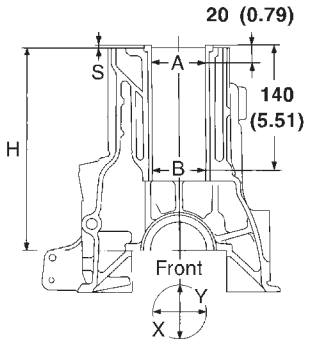
CYLINDER BLOCK AND CYLINDER LINER

Unit: mm (in)

QD32



TD27

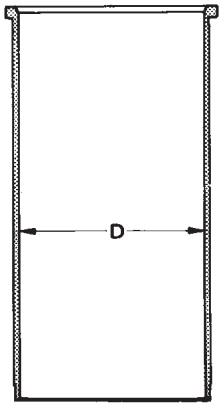


DEM057

	QD32	TD27
Nominal cylinder block height "H" (From crankshaft center)	252.95 - 253.05 (9.9586 - 9.9626)	
Surface flatness (Without cylinder liner)		
Standard	Less than 0.05 (0.0020)	
Limit	0.2 (0.008)	
Cylinder bore (Without cylinder liner)		
Inner diameter		
Standard	99.200 - 99.230 (3.9055 - 3.9067)	99.000 - 99.020 (3.8976 - 3.8984)
Cylinder bore	(Without cylinder liner)	(With cylinder liner for factory)
Inner diameter		
Standard		
Grade No. 1	99.200 - 99.210 (3.9055 - 3.9059)	96.000 - 96.010 (3.7795 - 3.7799)
Grade No. 2	99.210 - 99.220 (3.9059 - 3.9063)	96.010 - 96.020 (3.7799 - 3.7803)
Grade No. 3	99.220 - 99.230 (3.9063 - 3.9067)	96.020 - 96.030 (3.7803 - 3.7807)
Wear limit	0.20 (0.0079)	
Out-of-round (X − Y) standard	Less than 0.020 (0.0008)	
Taper (A − B) standard	Less than 0.020 (0.0008)	
Projection "S"	—	0.02 - 0.09 (0.0008 - 0.0035)
Deviation of each cylinder "S"	—	Less than 0.05 (0.0020)
Interference fit cylinder liner to block	—	−0.01 to 0.03 (−0.0004 to 0.0012)

Inspection and Adjustment (Cont'd)

Unit: mm (in)



SEM427

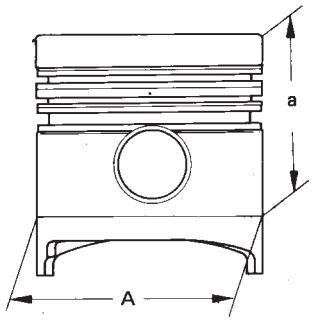
	TD27
Cylinder liner diameter "D" (service)*	96.050 - 96.070 (3.7815 - 3.7823)

*: Before installing in cylinder block

PISTON, PISTON RING AND PISTON PIN

Available piston

Unit: mm (in)



SEM778A

	QD32	TD27
Piston skirt diameter "A"		
Standard		
Grade No. 1	99.140 - 99.150 (3.9031 - 3.9035)	95.940 - 95.950 (3.7772 - 3.7776)
Grade No. 2	99.150 - 99.160 (3.9035 - 3.9039)	95.950 - 95.960 (3.7776 - 3.7779)
Grade No. 3*	99.160 - 99.170 (3.9039 - 3.9043)	95.960 - 95.970 (3.7779 - 3.7783)
"a" dimension	54.8 (2.157)	70 (2.76)
Piston pin hole diameter	32.997 - 33.005 (1.2991 - 1.2994)	29.997 - 30.005 (1.1810 - 1.1813)
Piston to cylinder liner clearance	0.05 - 0.07 (0.0020 - 0.0028)	

*: Grade No. 3 piston is not provided as a service part.

Inspection and Adjustment (Cont'd)

Piston ring

Unit: mm (in)

	Standard	Limit
Side clearance		
Top	0.06 - 0.10 (0.0024 - 0.0039)	0.50 (0.0197)
2nd	0.04 - 0.08 (0.0016 - 0.0031)	0.30 (0.0118)
Oil	0.02 - 0.06 (0.0008 - 0.0024)	0.15 (0.0059)
Ring gap		1.5 (0.059)
Top	0.30 - 0.45 (0.0118 - 0.0177)	
2nd	0.50 - 0.65 (0.0197 - 0.0256)	
Oil (rail ring)	0.30 - 0.50 (0.0118 - 0.0197)	

Piston pin

Unit: mm (in)

	QD32	TD27
Piston pin outer diameter	32.993 - 33.000 (1.2989 - 1.2992)	29.993 - 30.000 (1.1808 - 1.1811)
Piston pin to piston clearance		
Standard	−0.003 to 0.012 (−0.0001 to 0.0005)	
Limit	0.10 (0.0039)	
Piston pin to connecting rod clearance		
Standard	0.025 - 0.045 (0.0010 - 0.0018)	
Limit	0.15 (0.0059)	

CONNECTING ROD

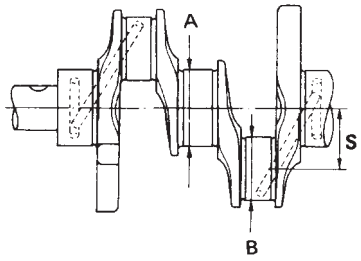
Unit: mm (in)

	QD32	TD27
Center distance	156.975 - 157.025 (6.1801 - 6.1821)	
Bend, torsion [per 100 (3.94)]		
Limit	0.075 (0.0030)	
Piston pin bore dia.	33.025 - 33.038 (1.3002 - 1.3007)	30.025 - 30.038 (1.1821 - 1.1826)
Side clearance		
Standard	0.10 - 0.22 (0.0039 - 0.0087)	
Limit	0.22 (0.0087)	

Inspection and Adjustment (Cont'd)

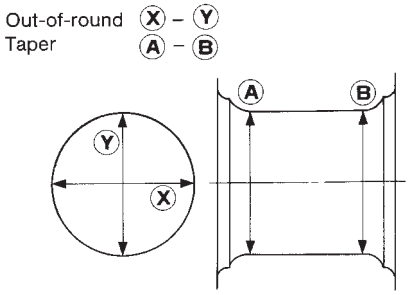
CRANKSHAFT

Unit: mm (in)



SEM100A

Journal diameter "A"	70.907 - 70.920 (2.7916 - 2.7921)
Pin diameter "B"	56.913 - 56.926 (2.2407 - 2.2412)
Center distance "S"	
QD32	51.00 (2.0079)
TD27	46.00 (1.8110)



EM715

Taper of journal and pin "A − B"	
Standard	0.01 (0.0004)
Limit	0.02 (0.0008)
Out-of-round of journal and pin "X – Y"	
Standard	0.01 (0.0004)
Limit	0.02 (0.0008)
Crankshaft bend	
Standard	0 - 0.03 (0 - 0.0012)
Limit	0.10 (0.0039)
Crankshaft end play	
Standard	0.055 - 0.14 (0.0022 - 0.0055)
Limit	0.40 (0.0157)

AVAILABLE MAIN BEARING

Bearing clearance

Unit: mm (in)

Main bearing clearance	
Standard	0.035 - 0.087 (0.0014 - 0.0034)
Limit	0.15 (0.0059)
Connecting rod bearing clearance	
Standard	0.035 - 0.081 (0.0014 - 0.0032)
Limit	0.15 (0.0059)

Main bearing undersize

Unit: mm (in)

	Crank journal diameter
Standard	70.907 - 70.920 (2.7916 - 2.7921)
Undersize	
0.25 (0.0098)	70.657 - 70.670 (2.7818 - 2.7823)
0.50 (0.0197)	70.407 - 70.420 (2.7719 - 2.7724)
0.75 (0.0295)	70.157 - 70.170 (2.7621 - 2.7626)
1.00 (0.0394)	69.907 - 69.920 (2.7522 - 2.7528)

AVAILABLE CONNECTING ROD BEARING

Connecting rod bearing undersize

Unit: mm (in)

	Crank pin journal diameter
Standard	56.913 - 56.926 (2.2407 - 2.2412)
Undersize	
0.25 (0.0098)	56.663 - 56.676 (2.2308 - 2.2313)
0.50 (0.0197)	56.413 - 56.676 (2.2210 - 2.2313)
0.75 (0.0295)	56.163 - 56.176 (2.2111 - 2.2116)
1.00 (0.0394)	55.913 - 55.926 (2.2013 - 2.2018)

Inspection and Adjustment (Cont'd)

AVAILABLE THRUST WASHER

Thrust washer undersize

Unit: mm (in)

	Thrust washer thickness
Standard	
Stamped mark A	2.275 - 2.325 (0.0896 - 0.0915)
B	2.300 - 2.350 (0.0906 - 0.0925)
C	2.325 - 2.375 (0.0915 - 0.0935)
Oversize	
0.20 (0.0079)	2.475 - 2.525 (0.0974 - 0.0994)
0.40 (0.0157)	2.675 - 2.725 (0.1053 - 0.1073)

MISCELLANEOUS COMPONENTS

Unit: mm (in)

Gear train	
Backlash of each gear	0.07 - 0.11 (0.0028 - 0.0043)
Limit	0.20 (0.0079)
Flywheel	
Runout (Total indicator reading)	Less than 0.15 (0.0059)
Front plate	
Warpage limit	0.2 (0.008)