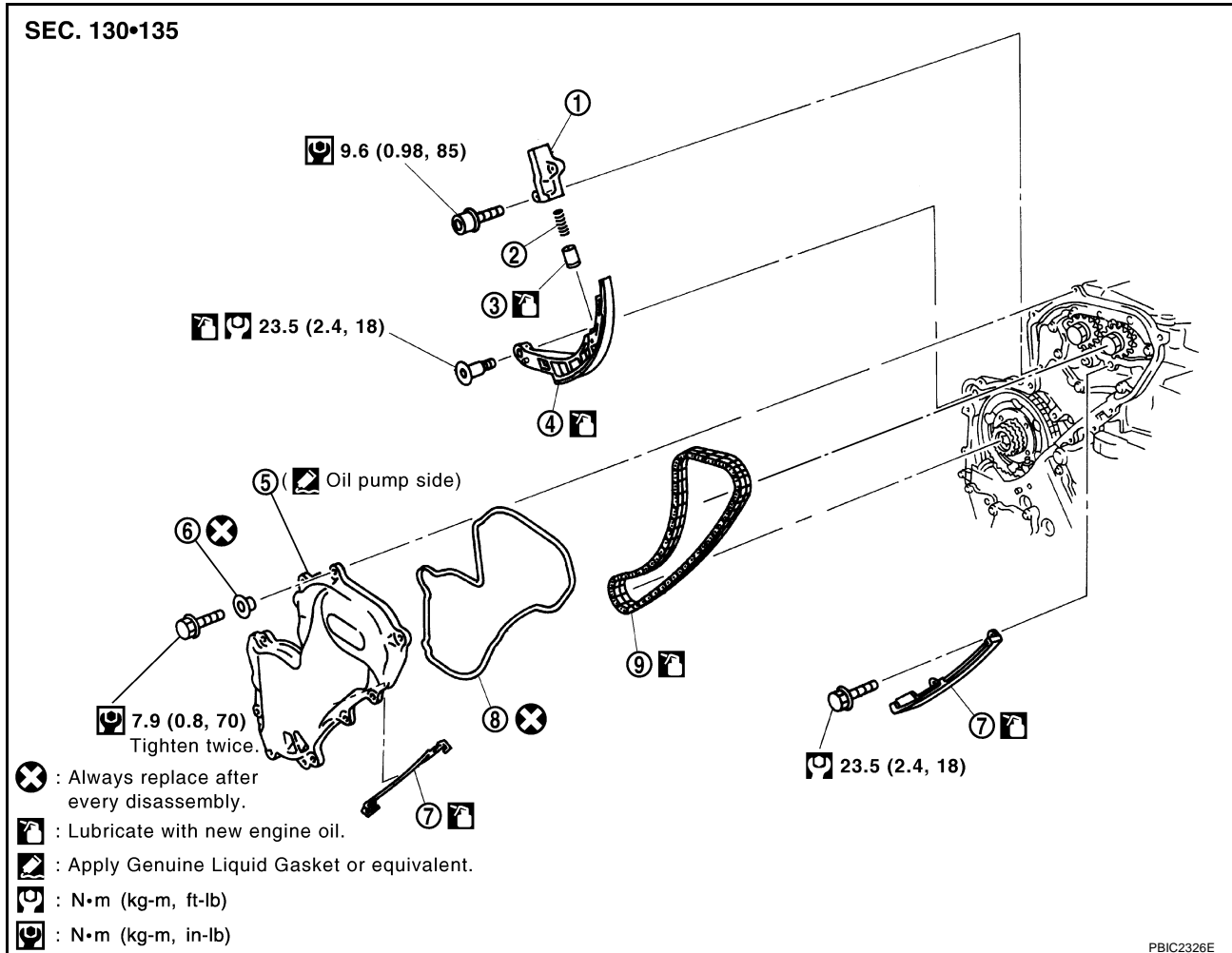


SECONDARY TIMING CHAIN

Removal and Installation

CAUTION:

- After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.
- When installing camshafts, chain tensioners, oil seals, or other sliding parts, lubricate contacting surfaces with new engine oil.



REMOVAL

- For preparative work for removing/installing secondary timing chain to remove/install fuel pump, refer to [EM-161, "FUEL PUMP"](#).
 - To prepare for removing/installing secondary timing chain to remove/install camshaft, refer to [EM-170, "Removal and Installation"](#).
- Remove engine coolant reservoir tank. Refer to [CO-34, "RADIATOR"](#).
 - Remove RH engine mounting insulator and bracket. Refer to [EM-208, "Removal and Installation"](#).
 - Pull power steering reservoir tank out of brackets to move power steering piping. Refer to [PS-34, "HYDRAULIC LINE"](#).

CAUTION:

To avoid removing power steering reservoir tank out of brackets, move it with power steering piping aside.

- Remove front chain case.

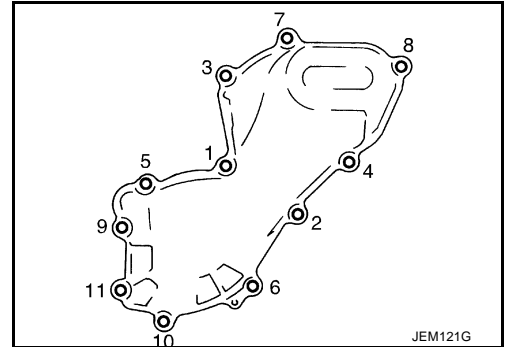
SECONDARY TIMING CHAIN

[YD22DDTi]

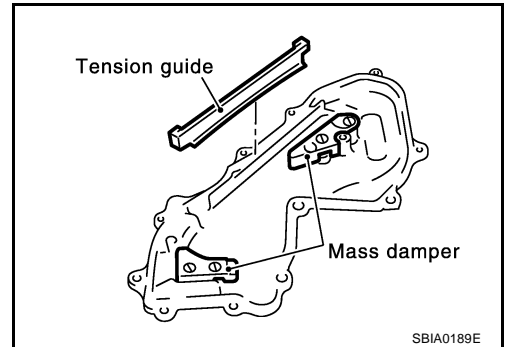
- Loosen fixing bolts in reverse order of that shown in the figure and remove them.
- Remove No. 6, 10 and 11 bolts with the rubber washer as space is limited for pulling them out.

CAUTION:

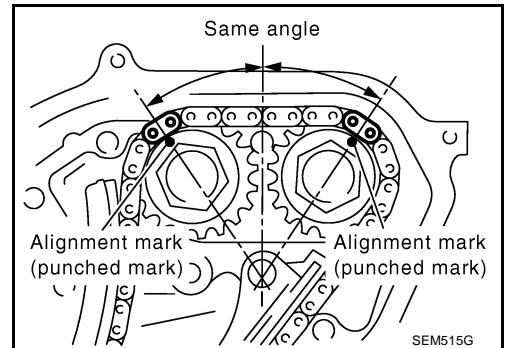
- While front chain case is removed, cover openings to prevent entry of foreign material into engine.



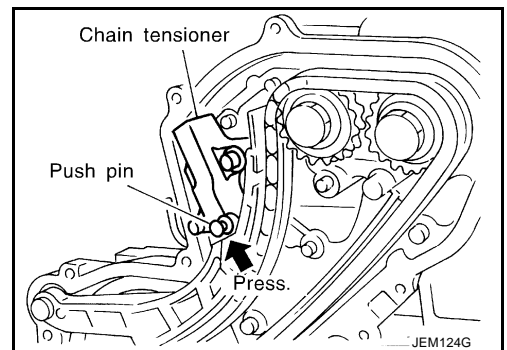
- Do not remove two mass dampers on the back of cover.



5. Set the No. 1 piston to TDC on its compression stroke.
 - Turn crankshaft pulley clockwise so that the alignment mark (punched mark) on each camshaft sprocket is positioned as shown in the figure.
 - No position indicator is provided on crankshaft pulley.
 - When installing, color coded links on secondary timing chain can be used as alignment marks. Marking may not be necessary for removal; however, make alignment marks as required because the alignment mark on fuel pump sprocket may not be easy to see.



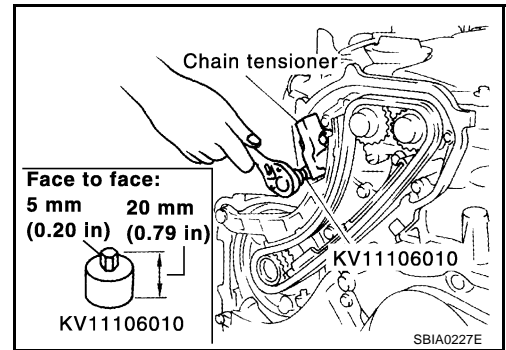
6. Remove chain tensioner.
 - a. Push the plunger of chain tensioner and keep it pressed with a push pin.



SECONDARY TIMING CHAIN

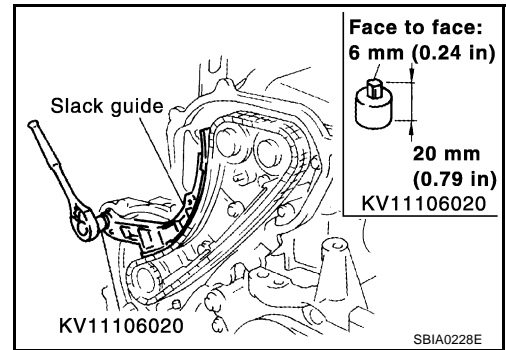
[YD22DDTi]

- b. Using the hexagon wrench (special service tool), remove bolts to remove chain tensioner.



7. Remove slack guide.

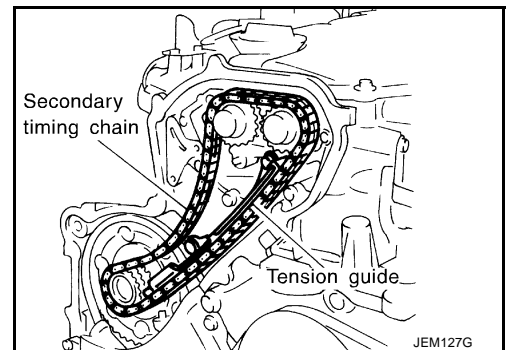
- Using the hexagon wrench (special service tool), remove bolt to remove slack guide.



8. Remove tension guide.

9. Remove secondary timing chain.

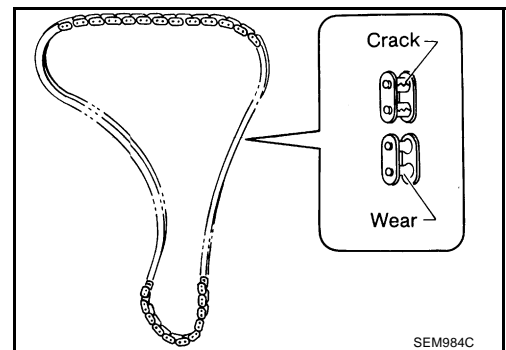
- Timing chain alone can be removed without removing sprockets.



INSPECTION AFTER REMOVAL

Timing Chain

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



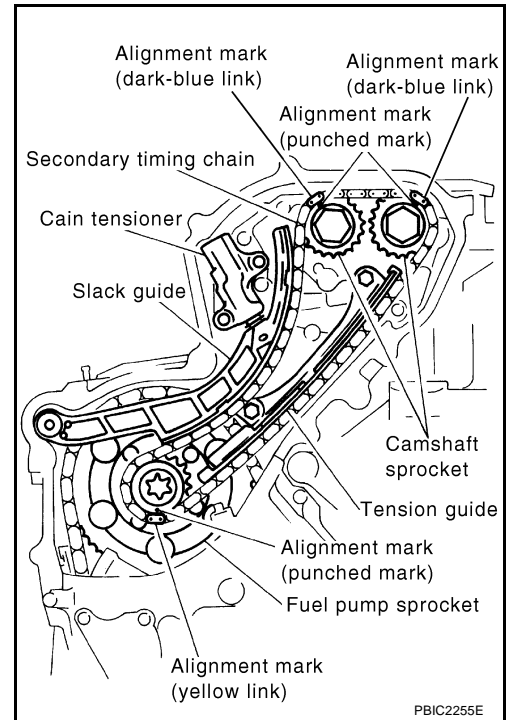
INSTALLATION

1. Install secondary timing chain.

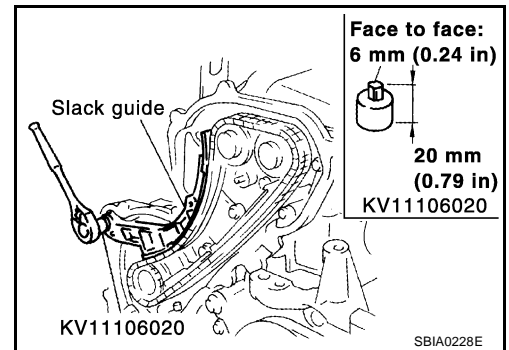
SECONDARY TIMING CHAIN

[YD22DDTi]

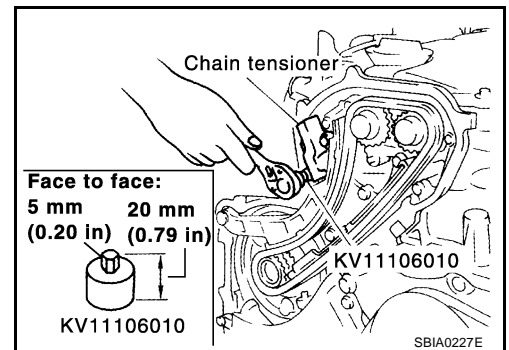
- When installing, match the alignment marks on sprockets with color coded alignment marks (colored links) on the timing chain.
2. Install tension guide.
 - The upper bolt has a longer shank than the lower bolt.



3. Using the hexagon wrench (special service tool), install slack guide.



4. Install chain tensioner.
 - a. Push the plunger of chain tensioner. While holding it with a push pin, install chain tensioner.
 - b. Using the hexagon wrench (special service tool), tighten bolts.
 - c. Pull out the push pin, etc. holding the plunger.
 - **Make sure again that the alignment marks on the sprockets and the colored alignment marks on the timing chain are aligned.**

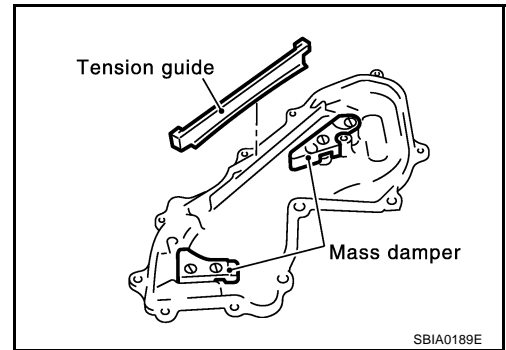


5. Install front chain case.

SECONDARY TIMING CHAIN

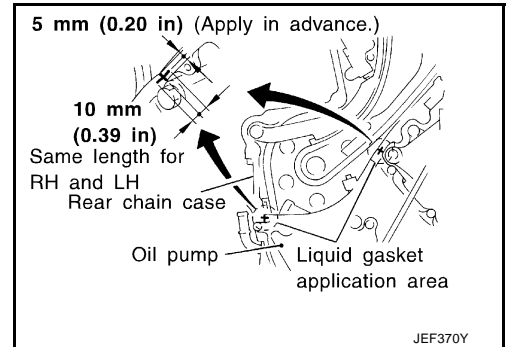
[YD22DDTi]

- a. Install tension guide on the back surface of front chain case.
- Hold front chain case vertically when installing. Tension guide may come off if front chain case is tilted.

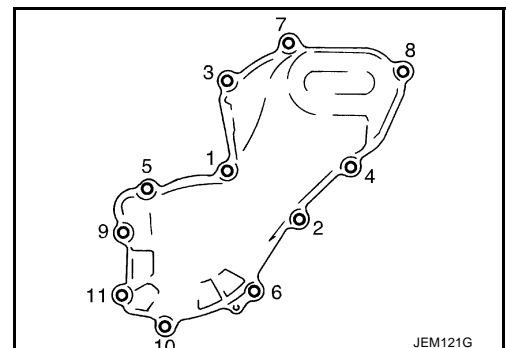


- b. Apply a continuous bead of liquid gasket on both ends of arched area (locations where rear chain case is adjoined) as shown in the figure.

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



- c. Install front chain case.
- When installing, align dowel pin on oil pump housing with the pin hole.
 - Install No. 6, 10 and 11 bolts with the rubber washer to front chain case.
- d. Tighten fixing bolts in numerical order shown in the figure.
- e. After tightening all the bolts, re-tighten in the same order.



6. Hereafter, install in the reverse order of removal.

PRIMARY TIMING CHAIN

PFP:13028

Removal and Installation

EBS00LRU

CAUTION:

- After removing timing chain, do not turn crankshaft and camshaft separately, or valves will strike piston heads.
- When installing camshafts, chain tensioners, oil seals or other sliding parts, lubricate contacting surfaces with new engine oil.

A

EM

C

D

E

F

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[YD22DDTi]

[illegible]

- EM-186**

- | | | |
|-----------------------------------|-----------------------------|----------------------------|
| 10. O-ring | 11. Chain guide | 12. Tension guide |
| 13. Spacer | 14. Gasket | 15. Front chain case |
| 16. Rubber washer | 17. Crankshaft pulley | 18. Front oil seal |
| 19. Power steering oil pump cover | 20. Oil pump housing | 21. Primary timing chain |
| 22. Oil pump drive spacer | 23. Crankshaft sprocket | 24. Secondary timing chain |
| 25. Rear chain case | 26. Power steering oil pump | 27. Key |

A

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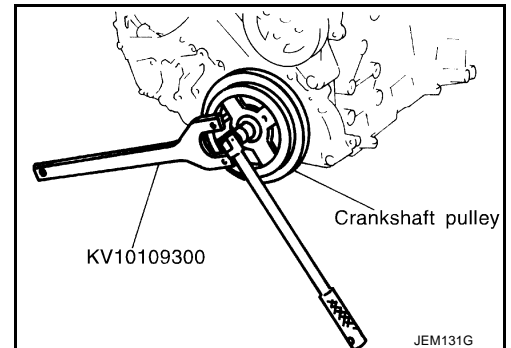
REMOVAL

1. Remove engine coolant reservoir tank. Refer to [CO-34, "RADIATOR"](#) .
2. Remove charge air cooler. Refer to [EM-135, "Removal and Installation"](#) .
3. Remove air cleaner and air duct. Refer to [EM-133, "Removal and Installation"](#) .
4. Remove rocker cover. Refer to [EM-168, "Removal and Installation"](#) .
5. Remove RH engine mounting insulator and bracket. Refer to [EM-208, "Removal and Installation"](#) .
6. Pull power steering reservoir tank out of brackets to move power steering piping. Refer to [PS-34, "HYDRAULIC LINE"](#) .

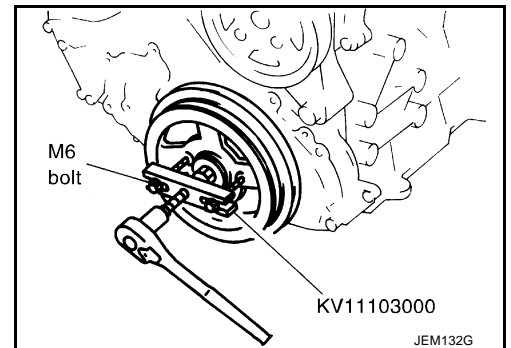
CAUTION:

To avoid removing power steering reservoir tank out of brackets move it with power steering piping aside.

7. Remove oil pan (upper and lower). Refer to [EM-147, "Removal and Installation"](#) .
8. Remove oil filter bracket. Refer to [LU-26, "OIL FILTER BRACKET"](#) .
9. Remove fuel injector. Refer to [EM-157, "Removal and Installation"](#) .
10. Remove secondary timing chain and associated parts. Refer to [EM-180, "Removal and Installation"](#) .
11. When removing rear chain case, remove camshaft sprockets. Refer to [EM-170, "Removal and Installation"](#) .
12. Remove crankshaft pulley.
 - a. Hold crankshaft pulley with the pulley holder (special service tool).
 - b. Loosen crankshaft pulley fixing bolt and pull out the bolt approximately 10 mm (0.39 in).



- c. Using the pulley puller (special service tool), remove crankshaft pulley.
 - Use two M6 bolts with approx. 60 mm (2.36 in) shank length for securing crankshaft pulley.

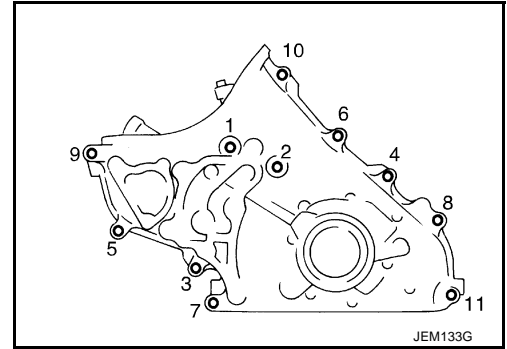


13. Remove oil pump housing.

PRIMARY TIMING CHAIN

[YD22DDTi]

- Loosen bolts in reverse order of that shown in the figure and remove them.
- Use the seal cutter (special service tool: KV10111100) etc. for removal.



14. Remove front oil seal from oil pump housing.

- Punch out the seal off from the back surface of the oil pump housing using a flat-bladed screwdriver.

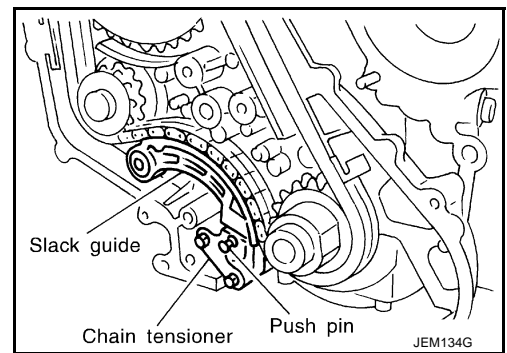
CAUTION:

Be careful not to damage oil pump housing.

15. Remove chain tensioner.

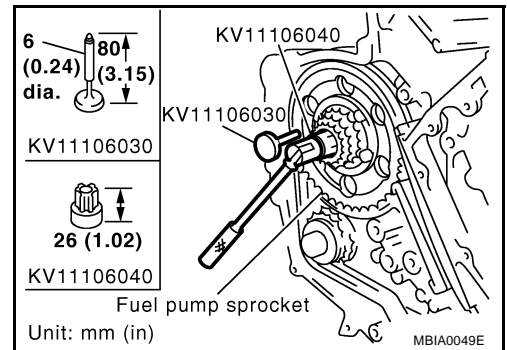
- When removing chain tensioner, push the plunger of chain tensioner and keep it pressed with a push pin, etc.

16. Remove slack guide.

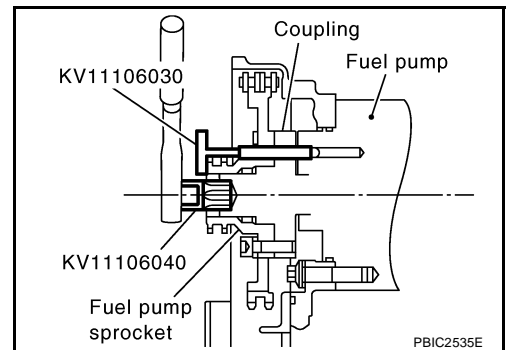


17. Hold fuel pump sprocket and remove bolt.

- Insert positioning stopper pin (special service tool) into the hole 6 mm (0.24 in) in the diameter on fuel pump sprocket.
- Using the TORX wrench, turn pump shaft little by little to adjust the position of fuel pump sprocket so that the holes align.
- Push positioning stopper pin through fuel pump sprocket to fuel pump body to hold fuel pump sprocket.



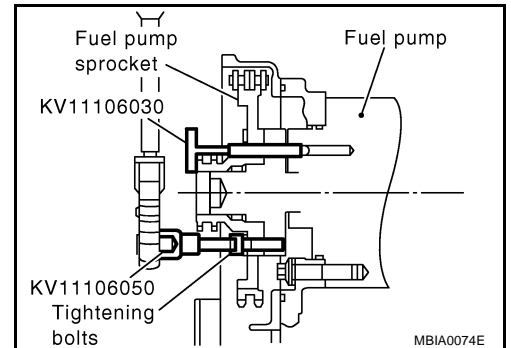
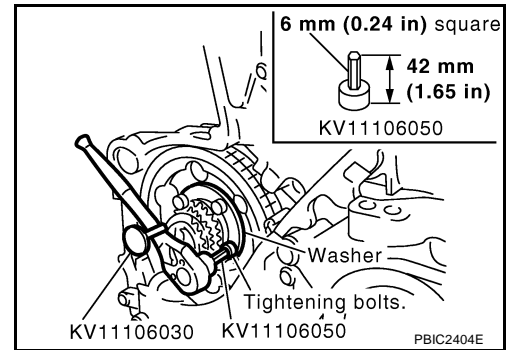
- Insert the positioning stopper pin until its flange contacts fuel pump sprocket.



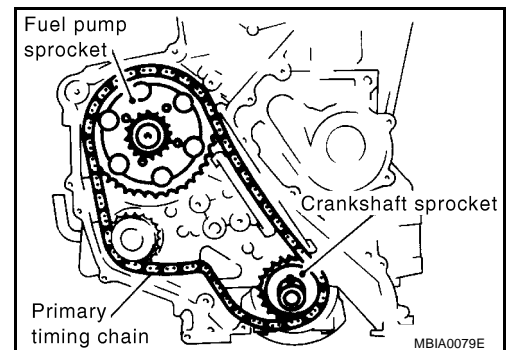
PRIMARY TIMING CHAIN

[YD22DDTi]

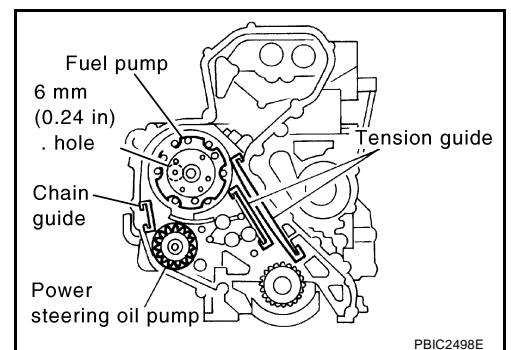
18. Using the hexagon wrench (special service tool) remove tightening bolts to fuel pump sprocket.



19. Remove primary timing chain with fuel pump sprocket and crankshaft sprocket.



20. Remove chain guide and tension guides.



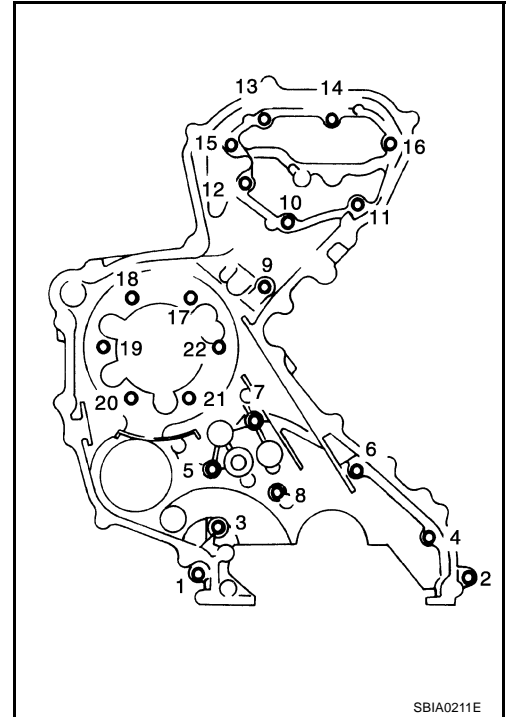
21. Remove fuel pump. Refer to [EM-161, "FUEL PUMP"](#) .
22. Remove power steering oil pump.

PRIMARY TIMING CHAIN

[YD22DDTi]

23. Remove rear chain case.

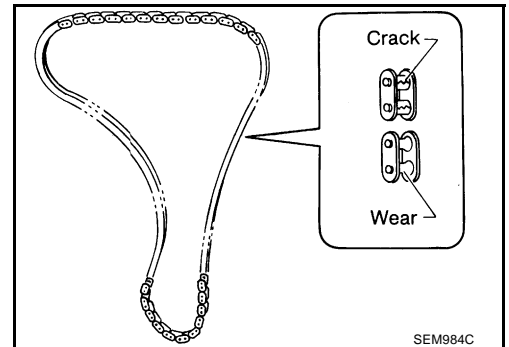
- Loosen fixing bolts in reverse order of that shown in the figure and remove them.
- Use the seal cutter (special service tool: KV10111100) for removal.



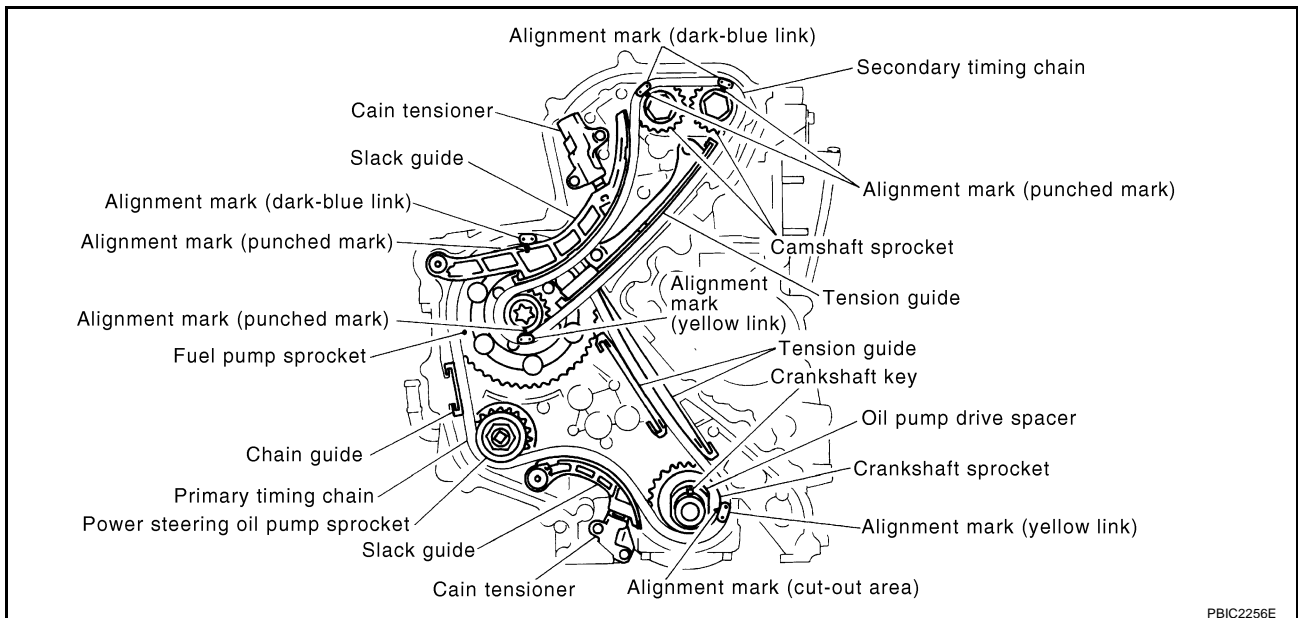
INSPECTION AFTER REMOVAL

Timing Chain

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



INSTALLATION



1. Install rear chain case.

PRIMARY TIMING CHAIN

[YD22DDTi]

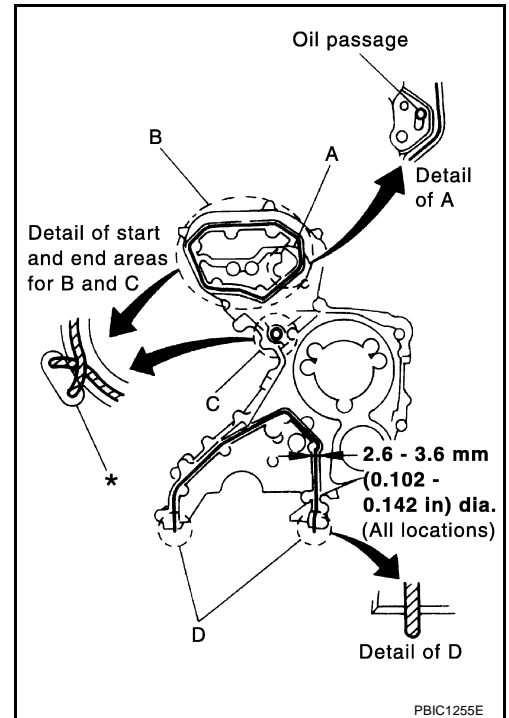
- a. Apply a continuous bead of liquid gasket with the tube presser (special service tool: WS39930000) on locations shown in the figure.

Use Genuine Liquid Gasket or equivalent.

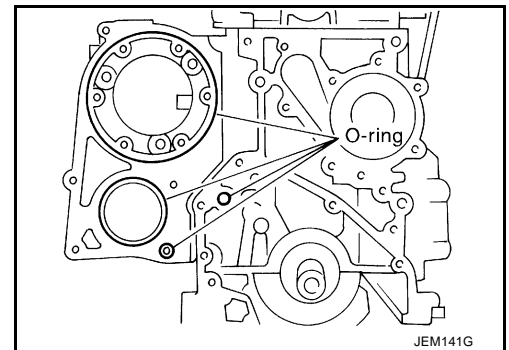
A: Apply bead so that it does not protrude into the oil passage.

B, C: Minimize overlapping area of bead, by starting and ending at areas of bead as shown in the figure. Apply so that the portion marked * comes at an external location but cannot be viewed externally after engine assembly.

D: Leave the start and end areas of the bead slightly protruding from the case surface.



- b. Install four O-rings to the grooves of the cylinder block and fuel pump bracket.



- c. Install rear chain case.

- When installing, align the dowel pin with the pin hole.

PRIMARY TIMING CHAIN

[YD22DDTi]

d. Tighten bolts in numerical order shown in the figure.

- Install the following four types of bolts, referring to the figure.

16 mm (0.63 in) : Bolt No. 1, 2, 16, 17, 18, 19, 20, 21, 22

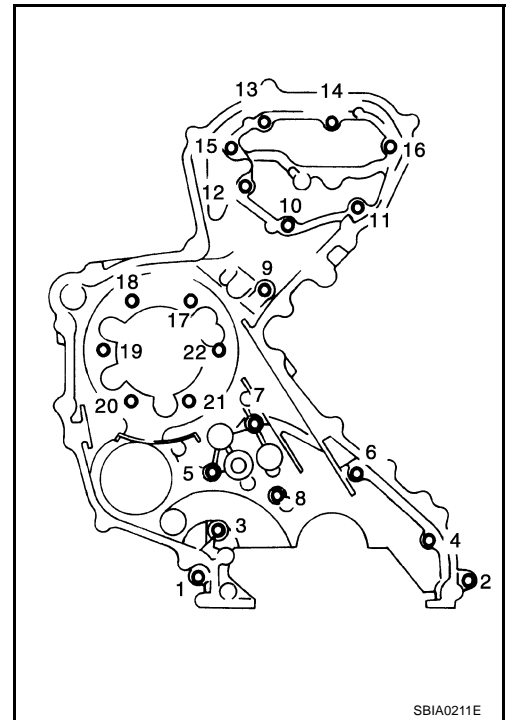
20 mm (0.79 in) : Bolt No. 3, 4, 6, 9, 10, 11, 13, 14

25 mm (0.98 in) : Bolt No. 12, 15

35 mm (1.38 in) : Bolt No. 5, 7, 8

- The shank length under the bolt neck above is the length of threaded part (pilot portion not included).

e. After tightening all the bolts, re-tighten in the same order.



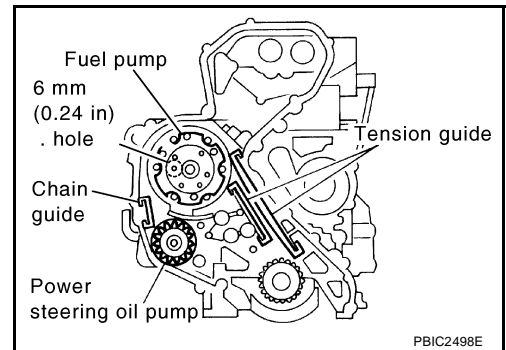
2. Install power steering oil pump.

3. Install fuel pump. Refer to [EM-161, "FUEL PUMP"](#).

- Before installing, make sure that spacer and the hole 6 mm (0.24 in) in diameter on coupling are aligned.

4. Install chain guide and tension guides.

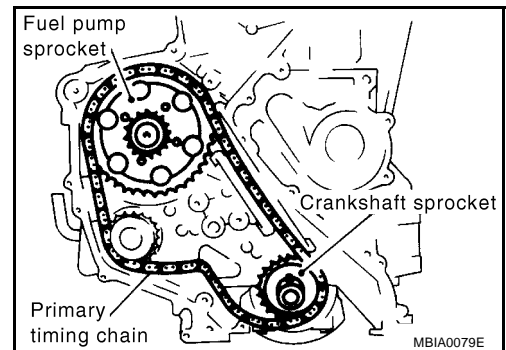
5. Install crankshaft sprocket, aligning it with crankshaft key on the far side.



6. Install primary timing chain with fuel pump sprocket.

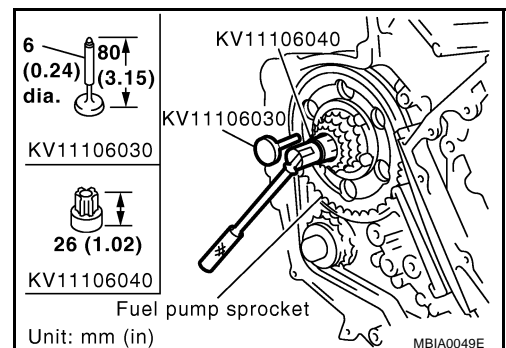
- When installing, match the alignment marks on sprockets with color coded alignment marks (colored links) on primary timing chain.
- Install fuel pump sprocket washer with the surface marked "F" (front mark) facing the front of the engine.

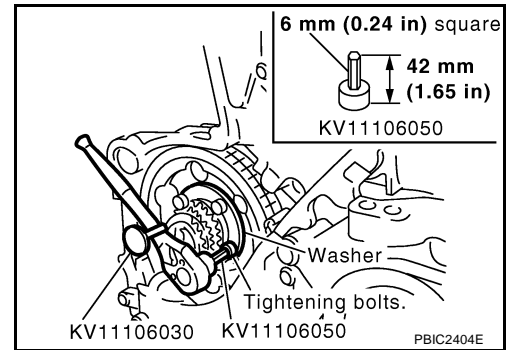
7. Install timing chain onto power steering oil pump sprocket and through chain guide.



8. Use the positioning stopper pin (special service tool) to hold the fuel pump sprocket and install the bolt.

- Using the TORX wrench (special service tool), turn the fuel pump shaft little by little to adjust the position of the fuel pump sprocket. Insert positioning stopper pin into the hole 6 mm (0.24 in) in diameter on fuel pump sprocket so that the stopper pin goes through the fuel pump body. While the stopper pin is in place, install the bolt.





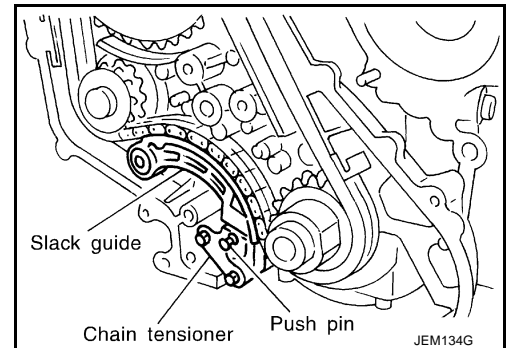
9. Install timing chain slack guide.

10. Install chain tensioner.

- Push the plunger of the chain tensioner. While keeping plunger pressed down with a push pin, etc., install chain tensioner.
- After installation, pull out the push pin holding the plunger.

CAUTION:

Check again that the alignment marks on sprockets and the colored alignment marks on timing chain are aligned.

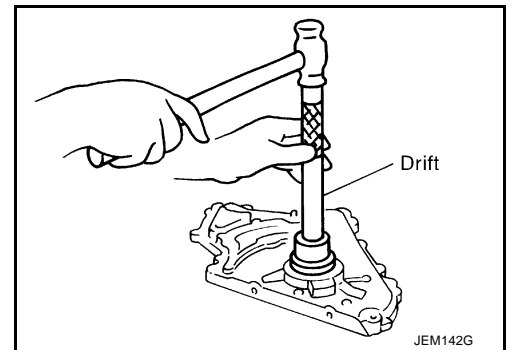


11. Install front oil seal to oil pump housing.

- Using the suitable drift [62 mm (2.44 in) dia.], force fit the seal until it hits the bottom.

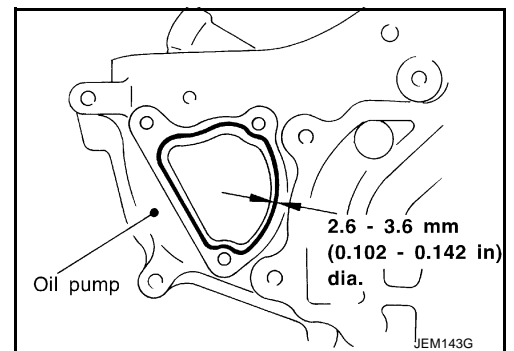
CAUTION:

Do not touch lips of oil seal. Make sure seal surfaces are free of foreign materials.



12. Install power steering oil pump cover to oil pump housing.

- Apply a continuous bead of liquid gasket with the tube presser (special service tool: WS39930000) as shown in the figure. **Use Genuine Liquid Gasket or equivalent.**
- Apply liquid gasket on oil pump-side surface.

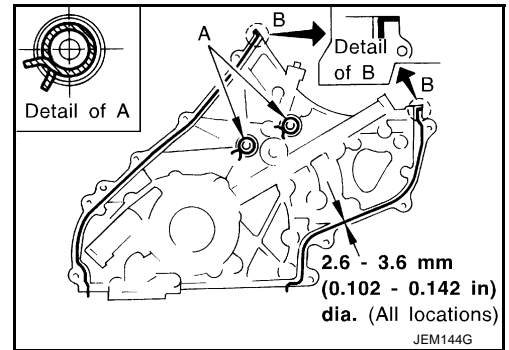


13. Install oil pump housing.

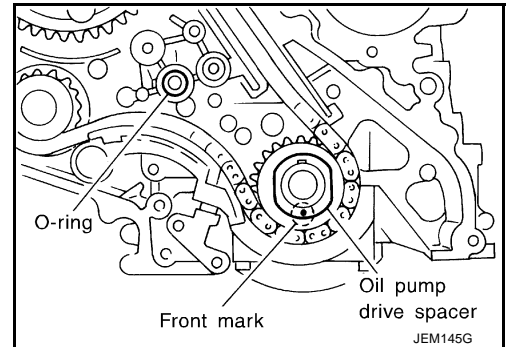
PRIMARY TIMING CHAIN

[YD22DDTi]

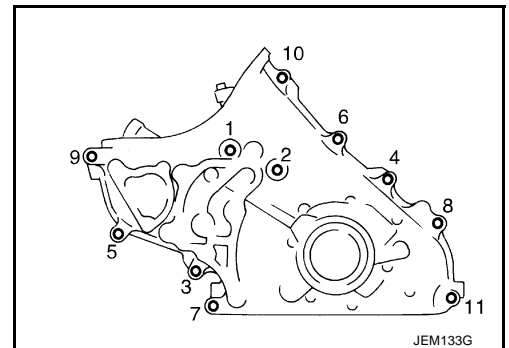
- a. Apply a continuous bead of liquid gasket with the tube presser (special service tool: WS39930000) as shown in the figure.
A: Leave the start and end areas of the bead slightly protruding from the surface.
B: Apply liquid gasket along upper end surface of oil pump housing.



- b. Install oil pump drive spacer to crankshaft.
 - Install with the front mark (punched mark) facing the front of the engine.
- c. Install O-ring into the groove of rear chain case.



- d. Install oil pump housing.
 - When installing, align the inner rotor in the direction of the two facing flats of oil pump drive spacer.
 - When installing, align the dowel pin with the pin hole.
- e. Tighten fixing bolts in numerical order shown in the figure.
- f. After tightening all the bolts, re-tighten in the same order.



14. Check gaps on upper oil pan mounting surface.
 - Using straightedge and feeler gauge, measure gaps between the locations of the following parts:

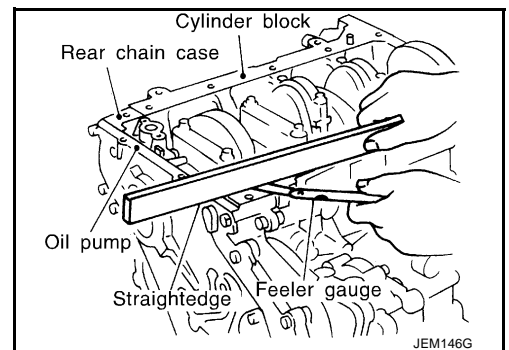
Oil pump housing and rear chain case:

Standard : – 0.09 to 0.09 mm (– 0.0035 to 0.0035 in)

Rear chain case and cylinder block:

Standard : – 0.19 to 0.07 mm (– 0.0075 to 0.0028 in)

- If the measured value is out of the standard, install again.



15. Install crankshaft pulley.
 - a. Install crankshaft pulley to crankshaft.

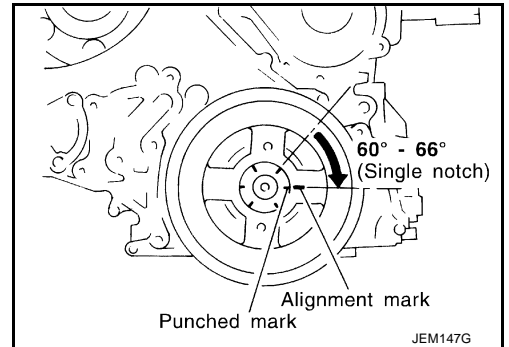
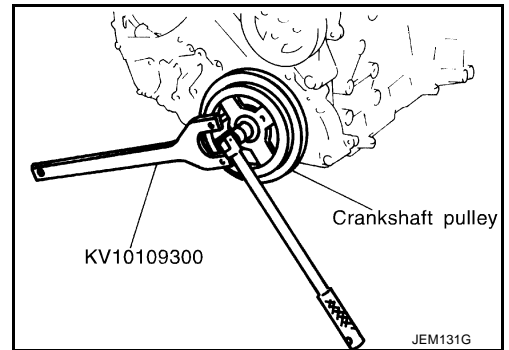
PRIMARY TIMING CHAIN

[YD22DDTi]

- b. Hold crankshaft pulley with the pulley holder (special service tool).
- c. Tighten crankshaft pulley fixing bolt.

 : 20 - 29 N·m (2.0 - 3.0 kg-m, 15 - 21 ft-lb)

- d. Put an alignment mark on crankshaft pulley that aligns with one of the punched marks on the bolt.
- e. Tighten fixing bolt another 60 to 66 degrees [target: 60 degrees (turn by one notch)].



- 16. Install secondary timing chain and the associated parts.
Refer to [EM-182, "INSTALLATION"](#).
- 17. Install in the reverse order of removal.