

# SECONDARY TIMING CHAIN

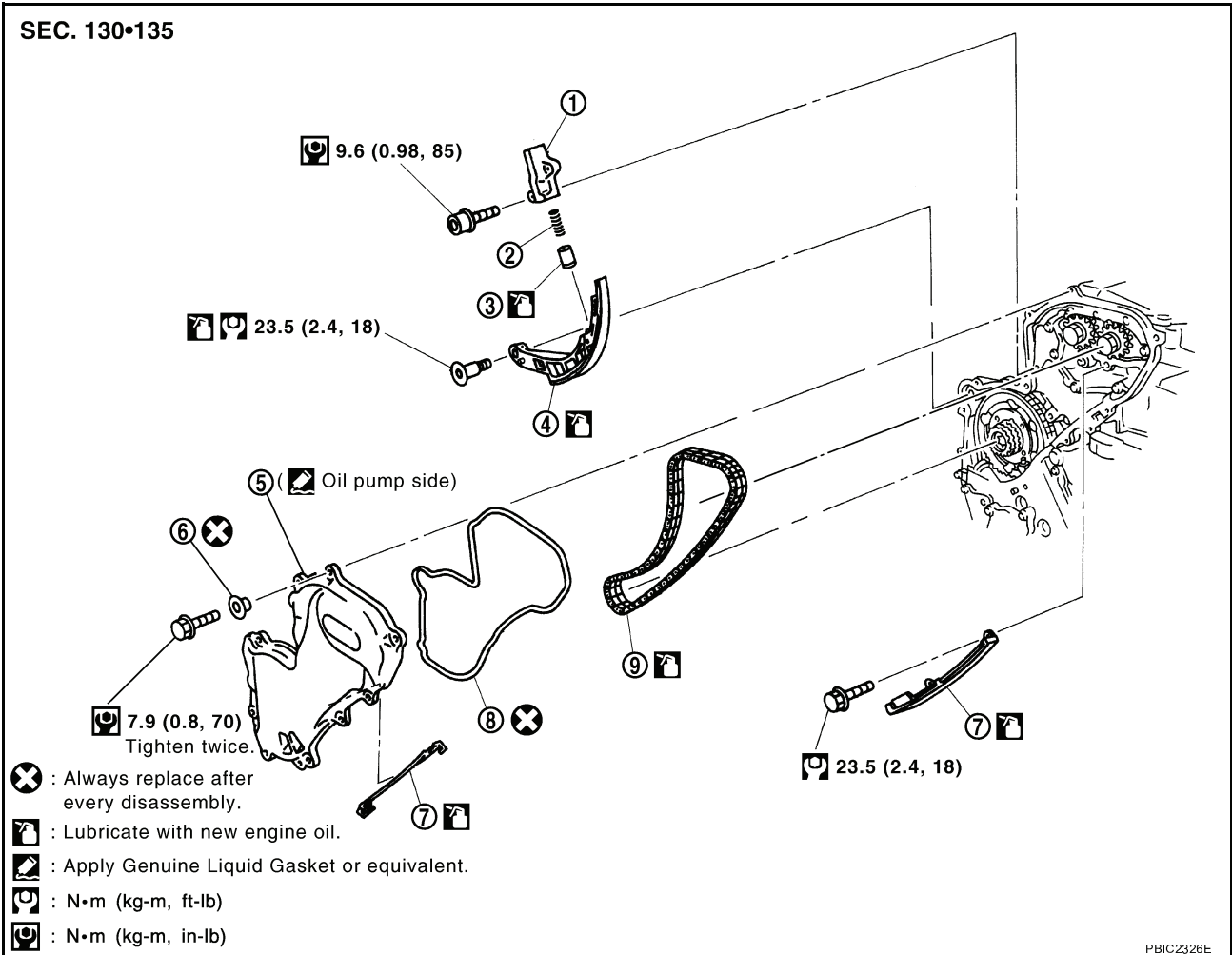
[YD]

## SECONDARY TIMING CHAIN

PF1:13028

### Components

GBS00019



- |                    |                     |                           |
|--------------------|---------------------|---------------------------|
| 1. Chain tensioner | 2. Spring           | 3. Plunger                |
| 4. Slack guide     | 5. Front chain case | 6. Rubber washer          |
| 7. Tension guide   | 8. Gasket           | 9. Secondary timing chain |

## Removal and Installation

GBS0001A

### 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-193, "FUEL PUMP"](#).
  - To prepare for removing/installing secondary timing chain to remove/install camshaft, refer to [EM-203, "Removal and Installation"](#).
1. Remove radiator shroud (upper and lower) and cooling fan (crankshaft driven type). Refer to [CO-40, "RADIATOR"](#) and [CO-48, "COOLING FAN"](#).
  2. Remove EGR cooler (A/T models) and related water hoses, or EGR tube (M/T models).

### CAUTION:

- Perform this step when engine is cold.
  - Do not spill engine coolant on drive belts.
3. Remove front chain case.

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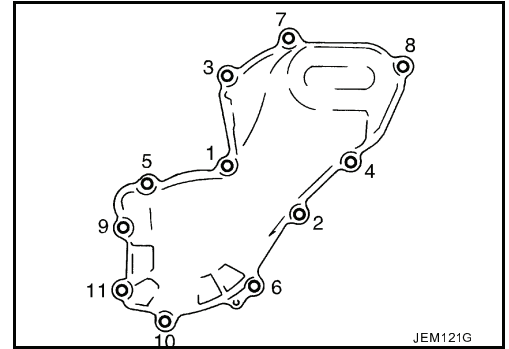
## SECONDARY TIMING CHAIN

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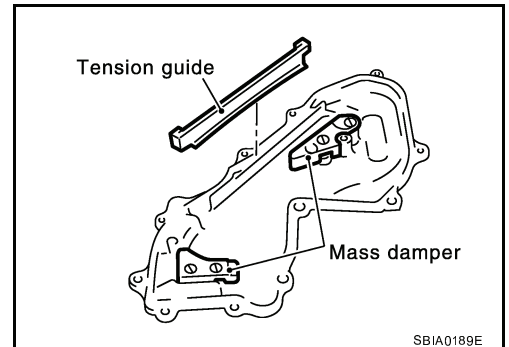
- Loosen fixing bolts in reverse order of that shown in the figure and remove them.

**CAUTION:**

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

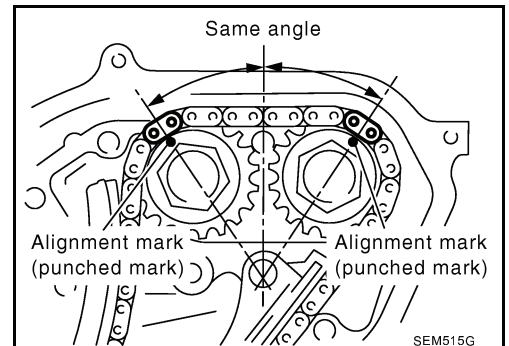


- Do not remove two mass dampers on the back of cover.



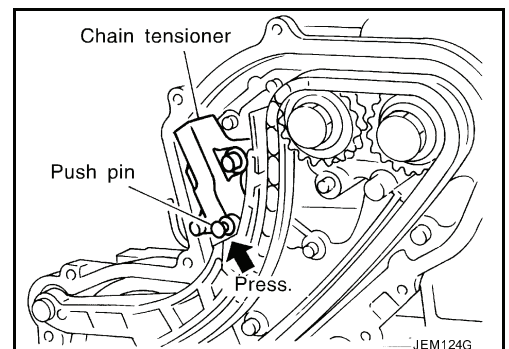
- Set the No. 1 piston to TDC on its compression stroke.

- 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.



- Remove chain tensioner.

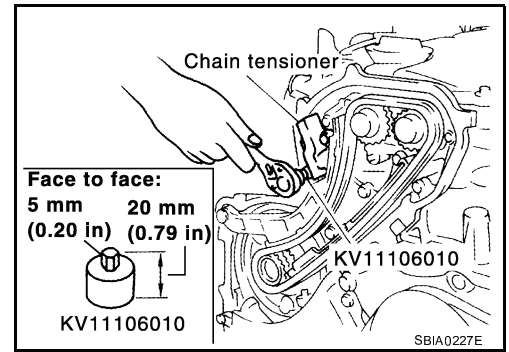
- Push the plunger of chain tensioner and keep it pressed with a push pin.



## SECONDARY TIMING CHAIN

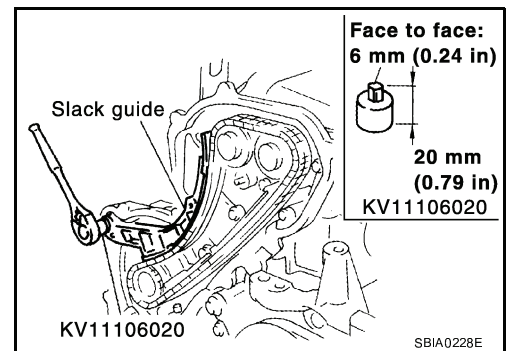
[YD]

- b. Using the hexagon wrench [SST], remove bolts to remove chain tensioner.



6. Remove slack guide.

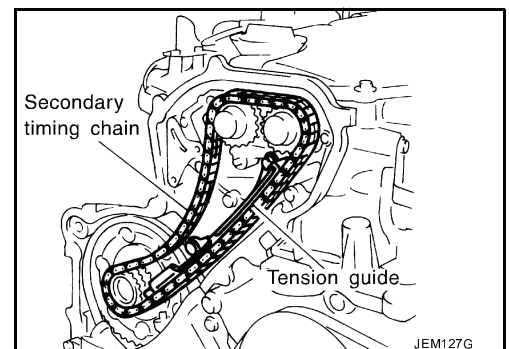
- Using the hexagon wrench [SST], remove bolt to remove slack guide.



7. Remove tension guide.

8. Remove secondary timing chain.

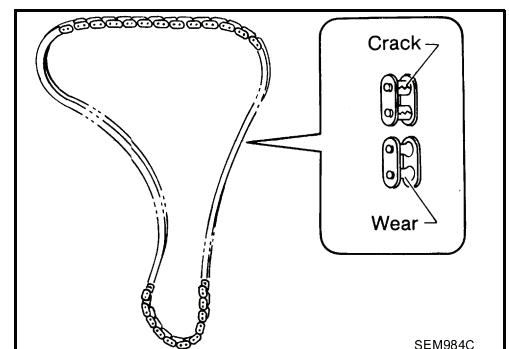
- Timing chain alone can be removed without removing sprockets.



### INSPECTION AFTER REMOVAL

#### Timing Chain

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



### INSTALLATION

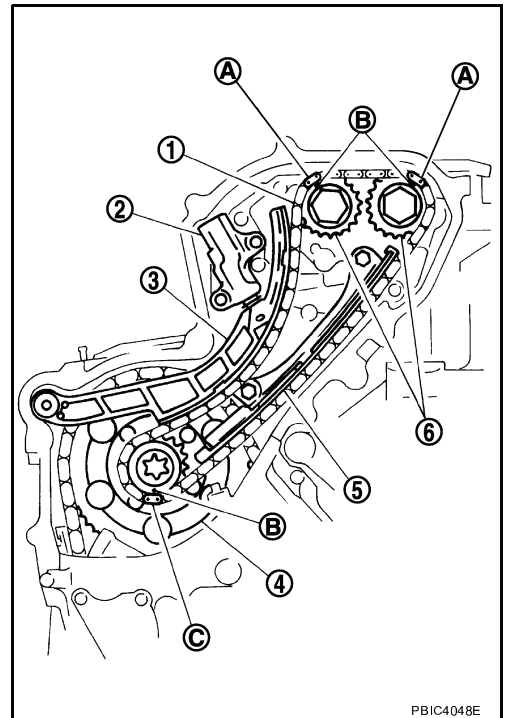
1. Install secondary timing chain.

## SECONDARY TIMING CHAIN

[YD]

- When installing, match the alignment marks on sprockets with color coded alignment marks (colored links) on the timing chain.

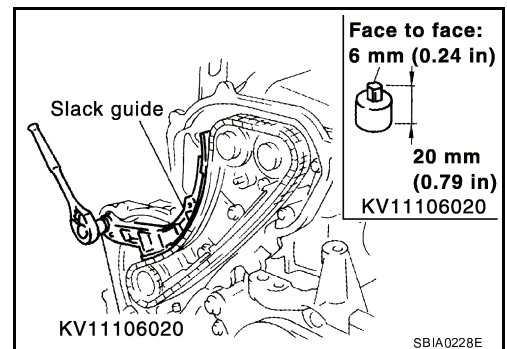
- 1 : Secondary timing chain
- 2 : Chain tensioner
- 3 : Slack guide
- 4 : Fuel pump sprocket
- 5 : Tension guide
- 6 : Camshaft sprocket
- A : Alignment mark (silver link)
- B : Alignment mark (punched mark)
- C : Alignment mark (yellow link)



### 2. Install tension guide.

- The upper bolt has a longer shank than the lower bolt.

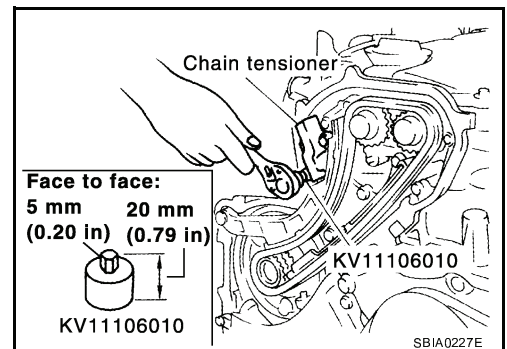
### 3. Using the hexagon wrench [SST], install slack guide.



### 4. Install chain tensioner.

- Push the plunger of chain tensioner. While holding it with a push pin, install chain tensioner.
- Using the hexagon wrench [SST], tighten bolts.
- 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.**

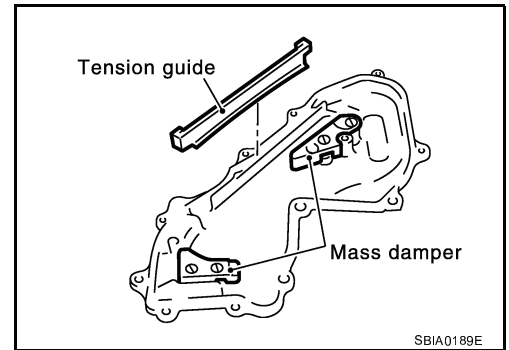


### 5. Install front chain case.

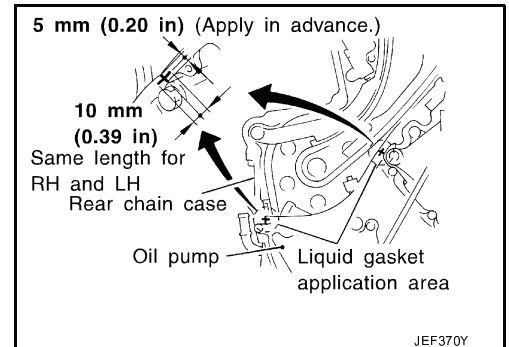
## SECONDARY TIMING CHAIN

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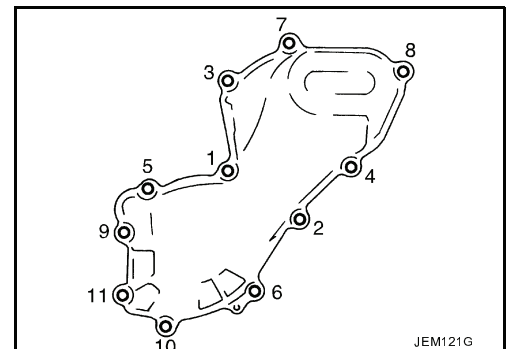
- a. Install tension guide on the back surface of front chain case.
- Hold front chain case vertically when installing. Tension guide may come off if front chain case is tilted.



- 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.

### INSPECTION AFTER INSTALLATION

#### Inspection for Leaks

The following are procedures for checking fluids leak, lubricates leak and exhaust gases leak.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to [MA-13, "RECOMMENDED FLUIDS AND LUBRICANTS"](#).
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
  - Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.
- Warm up engine thoroughly to make sure there is no leakage of fuel, exhaust gases, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill to the specified level, if necessary.

## SECONDARY TIMING CHAIN

[YD]

### Summary of the inspection items:

Item	Before starting engine	Engine running	After engine stopped
Engine coolant	Level	Leakage	Level
Engine oil	Level	Leakage	Level (*2)
Other oils and fluid (*1)	Level	Leakage	Level
Fuel	Leakage	Leakage	Leakage
Exhaust gases	—	Leakage	—

\*1: Transmission/transaxle/CVT fluid, power steering fluid, brake fluid, etc.

\*2: Check engine oil level 10 minutes after engine stopped.

# PRIMARY TIMING CHAIN

[YD]

## PRIMARY TIMING CHAIN

PPF:13028

### Components

GBS0001B

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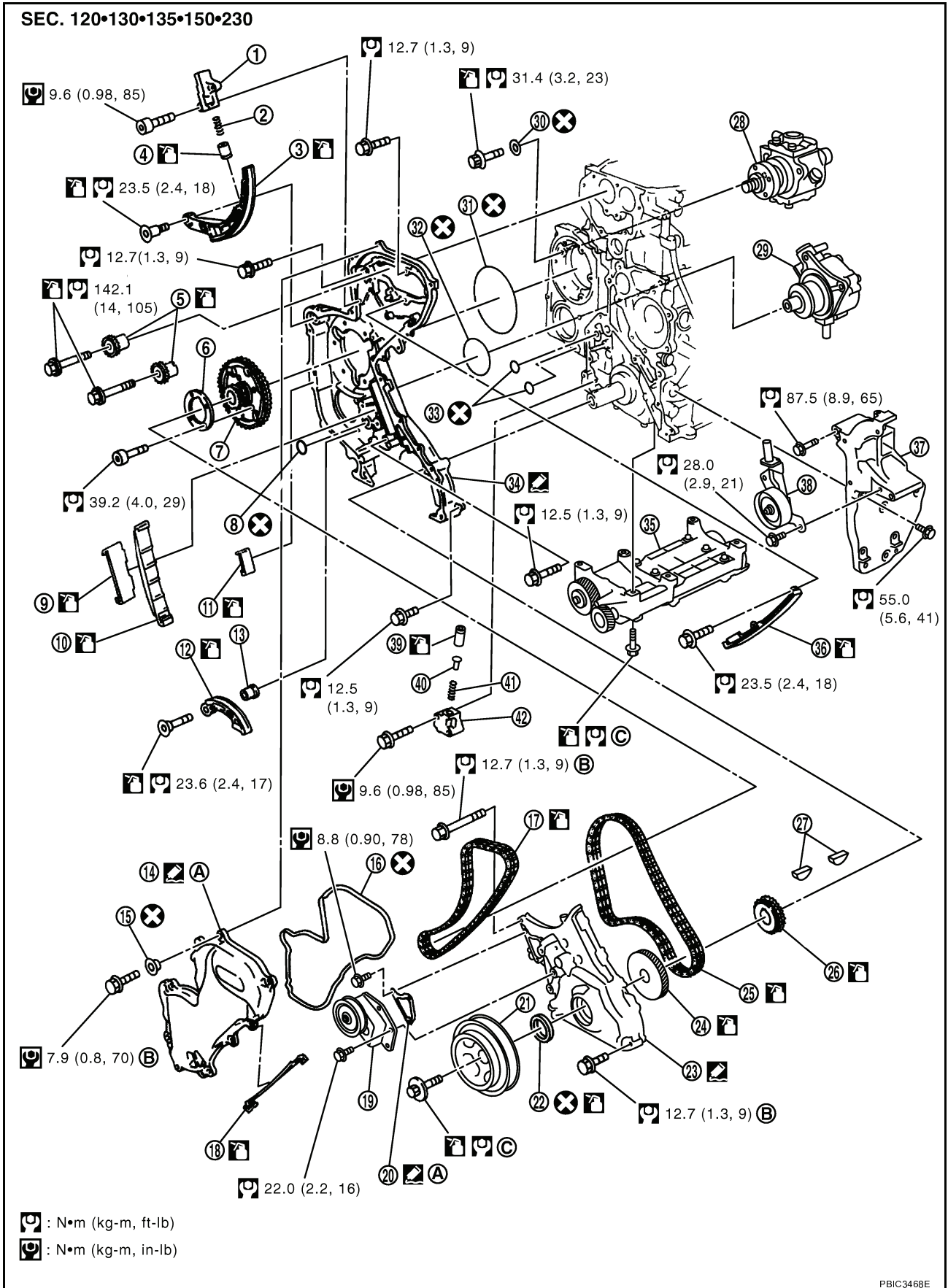
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PBIC3468E

# PRIMARY TIMING CHAIN

[YD]

- |                            |                                |                                      |
|----------------------------|--------------------------------|--------------------------------------|
| 1. Chain tensioner         | 2. Spring                      | 3. Slack guide                       |
| 4. Plunger                 | 5. Camshaft sprocket           | 6. Washer                            |
| 7. Fuel pump sprocket      | 8. O-ring                      | 9. Tension guide                     |
| 10. Tension guide          | 11. Chain guide                | 12. Slack guide                      |
| 13. Spacer                 | 14. Front chain case           | 15. Rubber washer                    |
| 16. Gasket                 | 17. Secondary timing chain     | 18. Chain guide                      |
| 19. Idler pulley           | 20. Vacuum pump cover          | 21. Crankshaft pulley                |
| 22. Front oil seal         | 23. Oil pump housing           | 24. Crankshaft gear                  |
| 25. Primary timing chain   | 26. Crankshaft sprocket        | 27. Key                              |
| 28. Fuel pump              | 29. Vacuum pump                | 30. Seal washer                      |
| 31. O-ring                 | 32. O-ring                     | 33. O-ring                           |
| 34. Rear chain case        | 35. Balancer unit (4WD models) | 36. Tension guide                    |
| 37. A/C compressor bracket | 38. Idler pulley               | 39. Plunger                          |
| 40. Plug                   | 41. Spring                     | 42. Chain tensioner                  |
| A. Oil pump side.          | B. Tighten twice.              | C. Refer to <a href="#">EM-229</a> . |

- Refer to [GI-10, "Components"](#) for symbol marks in the figure.

## Removal and Installation

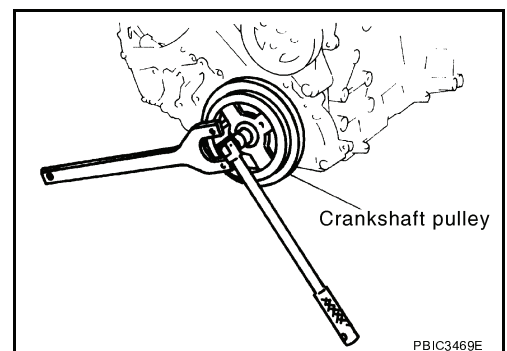
GBS0001C

### 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

1. Remove power steering oil pump and power steering oil pump bracket. Refer to [PS-24, "POWER STEERING OIL PUMP"](#) .
2. Remove idler pulleys.
3. Remove rocker cover. Refer to [EM-200, "ROCKER COVER"](#) .
4. Remove oil pan (upper and lower). Refer to [EM-180, "OIL PAN AND OIL STRAINER"](#) .
5. Remove fuel injector. Refer to [EM-188, "INJECTION TUBE AND FUEL INJECTOR"](#) .
6. Remove secondary timing chain and associated parts. Refer to [EM-217, "SECONDARY TIMING CHAIN"](#) .
7. When removing rear chain case, remove camshaft sprockets. Refer to [EM-203, "CAMSHAFT"](#) .
8. Remove crankshaft pulley.
  - a. Hold crankshaft pulley with the pulley holder (commercial service tool).
  - b. Loosen crankshaft pulley fixing bolt and pull out the bolt approximately 10 mm (0.39 in).

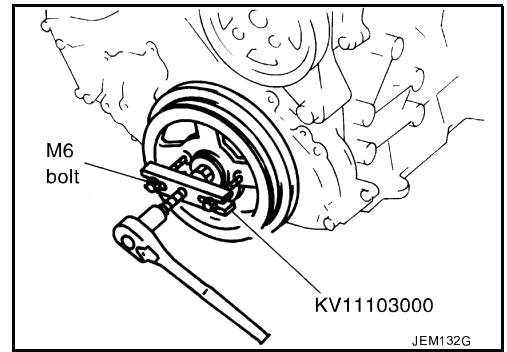




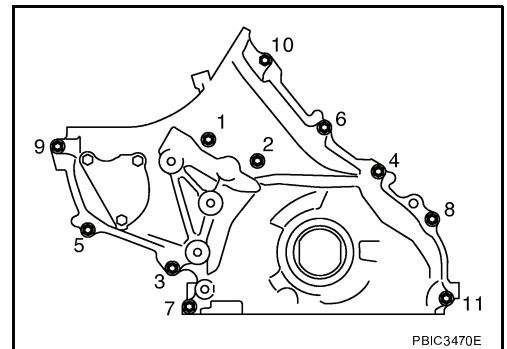
## PRIMARY TIMING CHAIN

[YD]

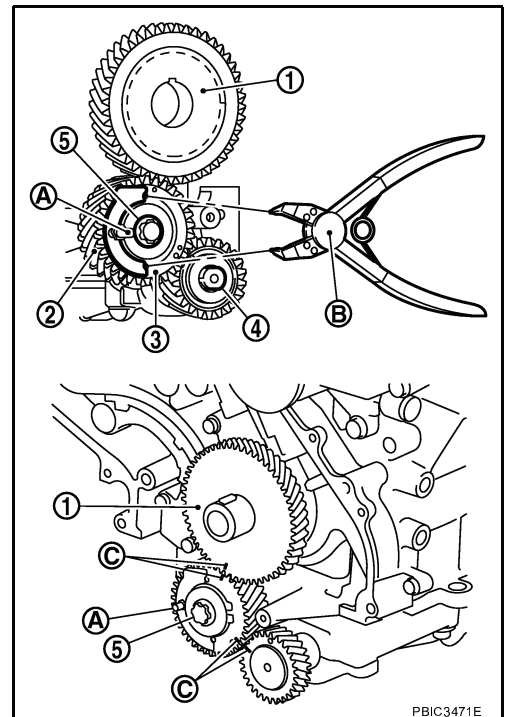
- c. Using the pulley puller [SST], remove crankshaft pulley.
- Use two M6 bolts with approx. 60 mm (2.36 in) shank length for securing crankshaft pulley.



9. Remove oil pump housing.
- Loosen bolts in reverse order of that shown in the figure and remove them.
  - Use the seal cutter [SST: KV10111100] etc. for removal.



10. Remove crankshaft gear.
- Remove crankshaft gear (1) with the following procedure (4WD models).
- a. Make sure that No.1 piston is TDC on its compression stroke.
- b. Turn the idler sub gear (3) counterclockwise with snap ring plier (B) or suitable tool for aligning idler sub gear (3) and idler main gear (2).
- If idler gear rotates, hold the flat faces on balancer drive shaft front end (4).
- c. Install internal mechanism securing bolt and plate (Service part: 13012 EB30A and 13013 EB30A) (A) and tighten to the specified torque.



 : 4.0 N·m (0.41 kg-m, 35 in-lb)

### CAUTION:

- Do not loosen idler gear mounting bolt (5).
  - Only use the genuine internal mechanism securing bolt and plate (A), or the idler gear (2) and (3) will be damaged.
  - Do not remove internal mechanism securing bolt and plate (A) from idler gear (2) and (3) until crankshaft gear (1) and all of the parts in connection have been installed.
  - If internal mechanism securing bolt and plate (A) is not installed, internal mechanism of idler gear (2) and (3) will disengage after crankshaft gear (1) is removed. This will prohibit the balancer unit from being reusable.
- d. Apply mating marks (C) to crankshaft gear (1) and idler sub gear (3).
- e. Remove crankshaft gear (1).
11. 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.

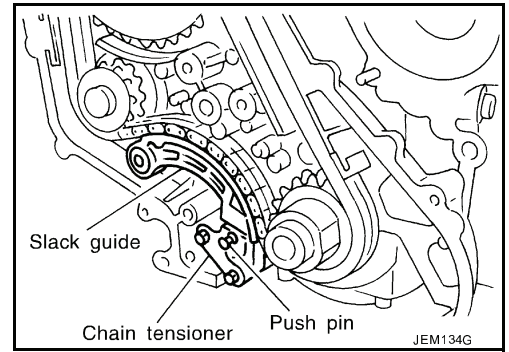
## PRIMARY TIMING CHAIN

[YD]

12. Remove chain tensioner.

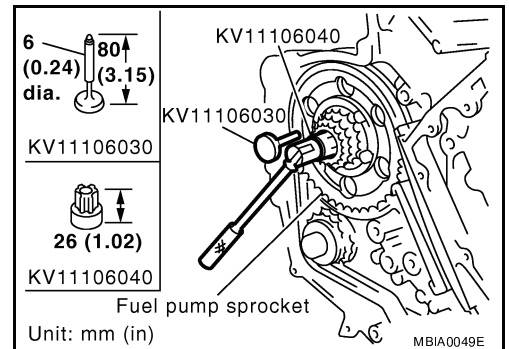
- When removing chain tensioner, push the plunger of chain tensioner and keep it pressed with a push pin, etc.

13. Remove slack guide.

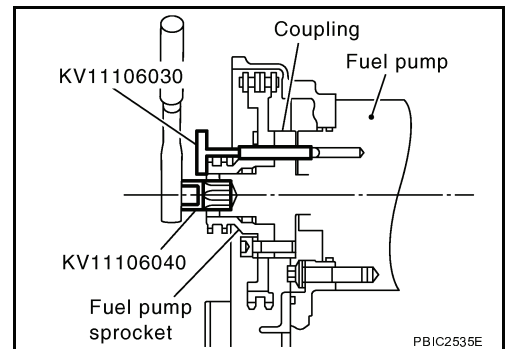


14. Hold fuel pump sprocket and remove bolt.

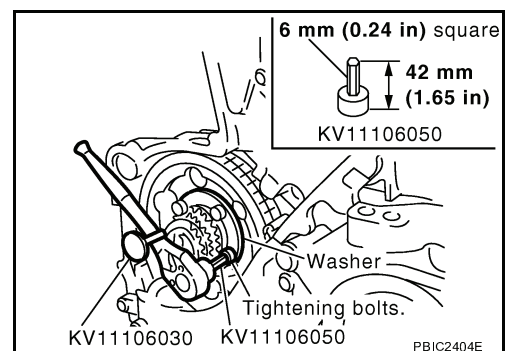
- Insert positioning stopper pin [SST] into the hole 6 mm (0.24 in) in the diameter on fuel pump sprocket.
- Using the TORX wrench, turn pump shaft little by little to adjust the position of fuel pump sprocket so that the holes align.
- Push positioning stopper pin through fuel pump sprocket to fuel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



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

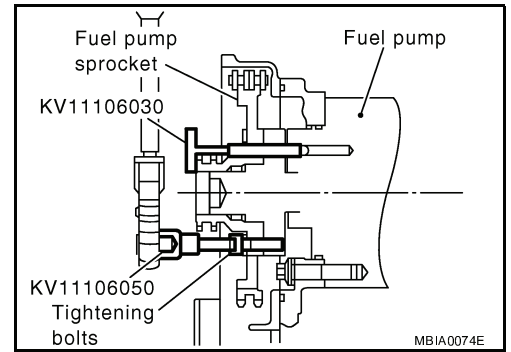


15. Using the hexagon wrench [SST] remove tightening bolts to fuel pump sprocket.



# PRIMARY TIMING CHAIN

[YD]



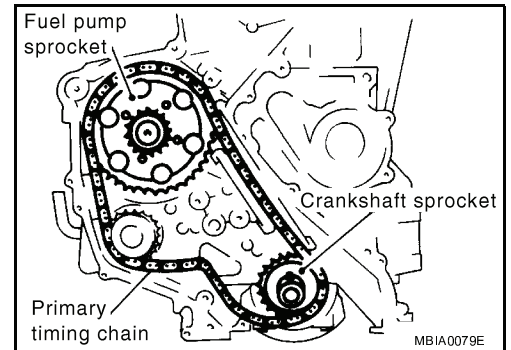
A

EM

C

D

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

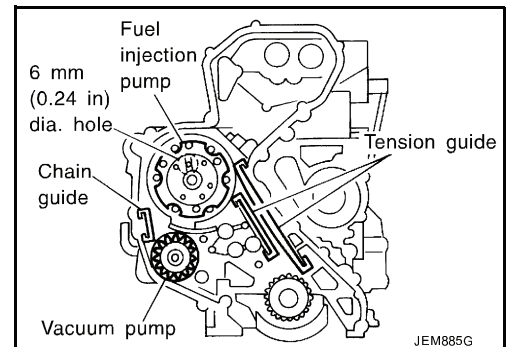


E

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17. Remove chain guide and tension guides.



H

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18. Remove fuel pump. Refer to [EM-193, "FUEL PUMP"](#) .  
19. Remove vacuum pump. Refer to [EM-186, "VACUUM PUMP"](#) .

L

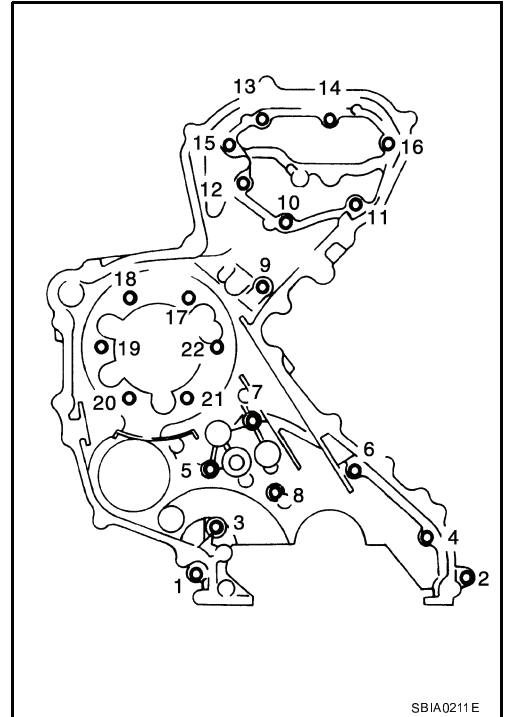
M

# PRIMARY TIMING CHAIN

[YD]

20. Remove rear chain case.

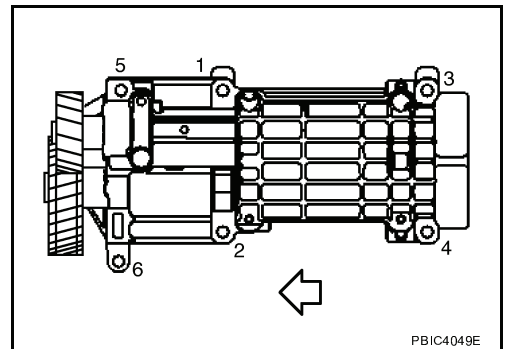
- Loosen fixing bolts in the reverse order of that shown in the figure and remove them.
- Use the seal cutter [SST: KV10111100] for removal.



21. Remove balancer unit (4WD models).

- Loosen mounting bolts in the reverse order as shown in the figure.

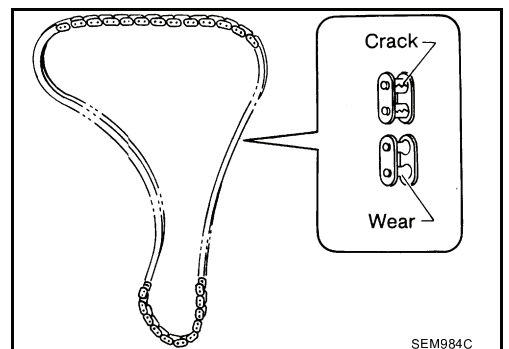
⇐ : Engine front



## INSPECTION AFTER REMOVAL

### Timing Chain

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



# PRIMARY TIMING CHAIN

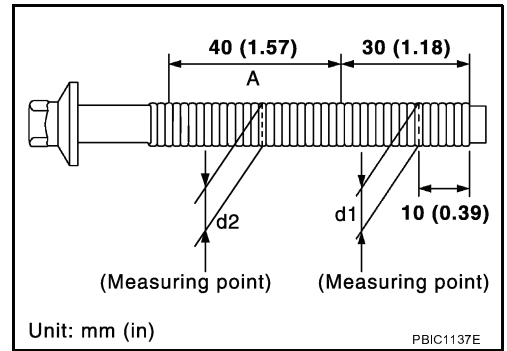
[YD]

## Balancer Unit Mounting Bolt Outer Diameter (4WD Models)

- Measure the outer diameters ("d1" , "d2" ) at two positions as shown in the figure.
- If reduction appears in "A" range, regard it as "d2" .

Limit ("d1" - "d2" : 0.15 mm (0.0059 in))

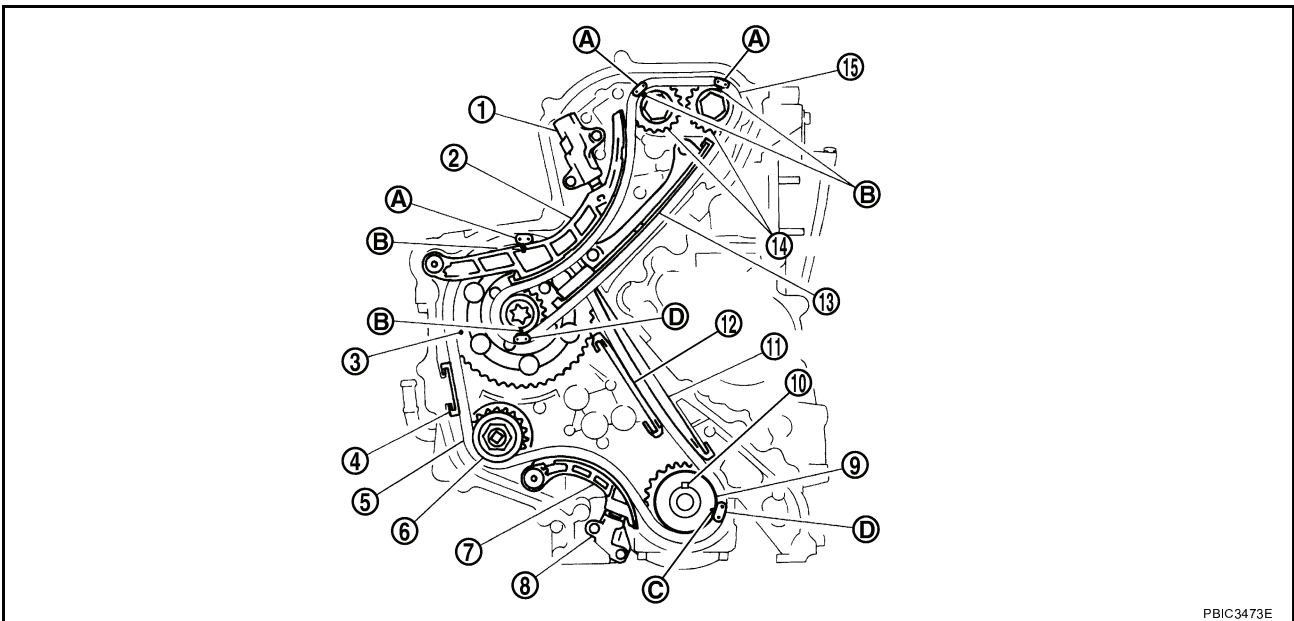
- If it exceeds the limit (large difference in dimensions), replace it with a new one.



## INSTALLATION

### NOTE:

The figure shows the relationship between the mating mark on each timing chain and that on the corresponding sprocket, with the components installed.



- |                                 |                                  |                                  |
|---------------------------------|----------------------------------|----------------------------------|
| 1. Chain tensioner              | 2. Slack guide                   | 3. Fuel pump sprocket            |
| 4. Chain guide                  | 5. Primary timing chain          | 6. Vacuum pump sprocket          |
| 7. Slack guide                  | 8. Chain tensioner               | 9. Crankshaft sprocket           |
| 10. Key                         | 11. Tension guide                | 12. Tension guide                |
| 13. Tension guide               | 14. Camshaft sprocket            | 15. Secondary timing chain       |
| A. Alignment mark (silver link) | B. Alignment mark (punched mark) | C. Alignment mark (cut-out area) |
| D. Alignment mark (yellow link) |                                  |                                  |

### CAUTION:

Before starting work, make sure that No. 1 piston is on its compression stroke.

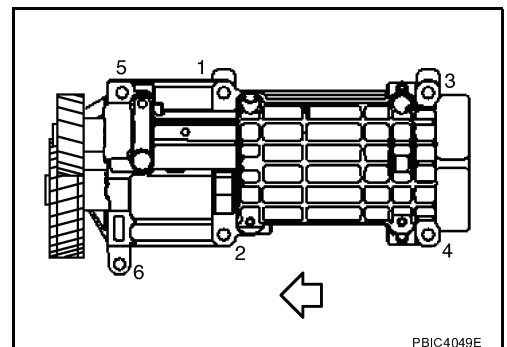
1. Install balancer unit, and tighten mounting bolts in numerical order as shown in the figure (4WD models).

← : Engine front

### CAUTION:

If mounting bolts are re-used, check their outer diameter before installation. Refer to [EM-229, "Balancer Unit Mounting Bolt Outer Diameter \(4WD Models\)"](#) .

- a. Apply new engine oil to threads and seat surfaces of mounting bolts.
- b. Tighten all bolts.



# PRIMARY TIMING CHAIN

[YD]

: 29.4 N·m (3.0 kg-m, 22 ft-lb)

- c. Turn all bolts 65 degrees clockwise (angle tightening).

1 : Balancer unit

A : KV10112100

- d. Completely loosen.

: 0 N·m (0 kg-m, 0 ft-lb)

**CAUTION:**

In this step, loosen bolts in the reverse order as shown in the figure.

- e. Tighten all bolts.

: 29.4 N·m (3.0 kg-m, 22 ft-lb)

- f. Turn them another 65 degrees clockwise (angle tightening).

**CAUTION:**

Check tightening angle with an angle wrench [SST] (A) or a protractor. Do not make judgment by visual check alone.

2. Install rear chain case.

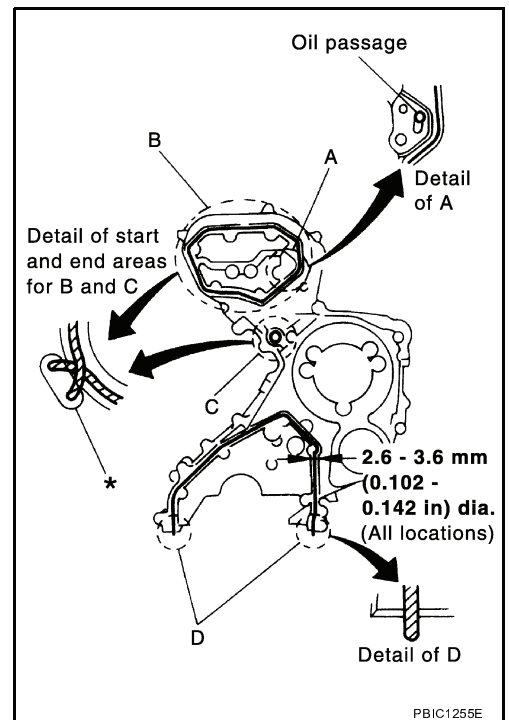
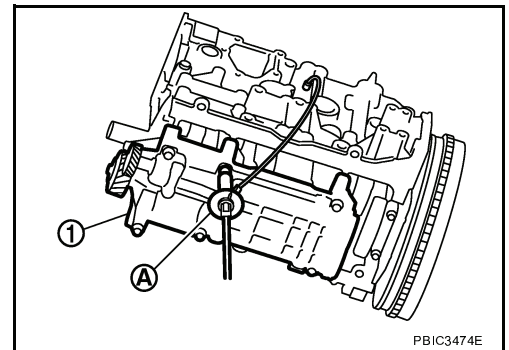
- a. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000] on locations shown in the figure.

**Use Genuine Liquid Gasket or equivalent.**

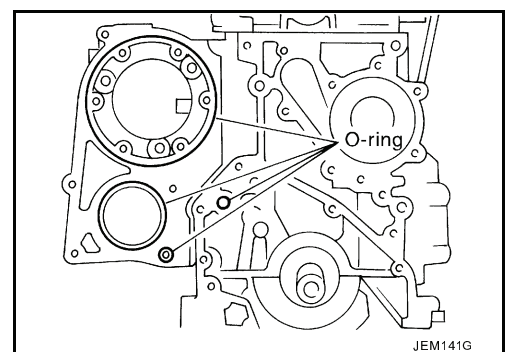
A: Apply bead so that it does not protrude into the oil passage.

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.



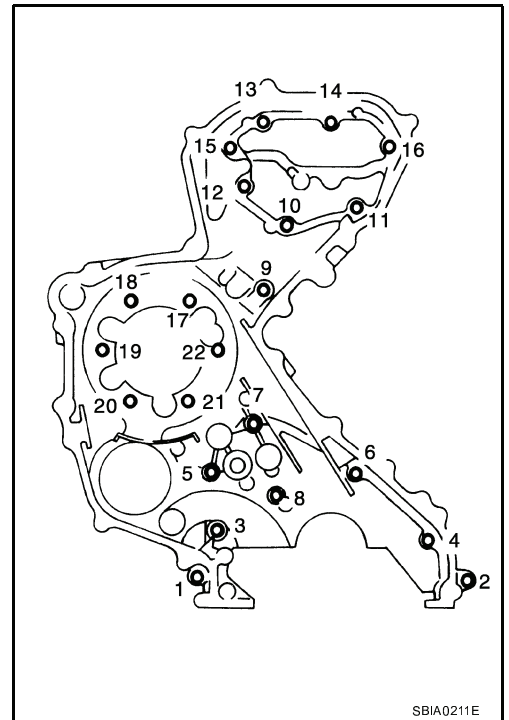
- c. Install rear chain case.

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

# PRIMARY TIMING CHAIN

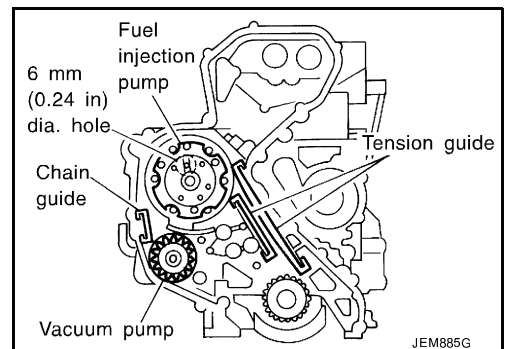
[YD]

- 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.



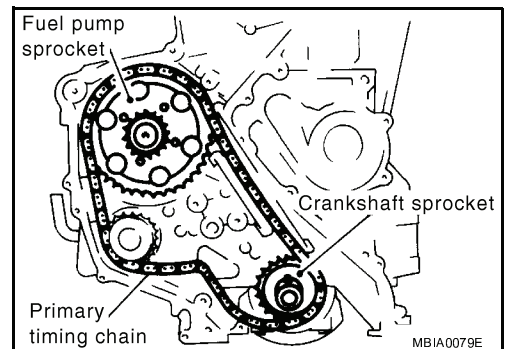
A  
EM  
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G

3. Install vacuum pump. Refer to [EM-186, "VACUUM PUMP"](#) .
4. Install fuel pump. Refer to [EM-193, "FUEL PUMP"](#) .
- Before installing, make sure that spacer and the hole 6 mm (0.24 in) in diameter on coupling are aligned.
5. Install chain guide and tension guides.
6. Install crankshaft sprocket, aligning it with crankshaft key on the far side.



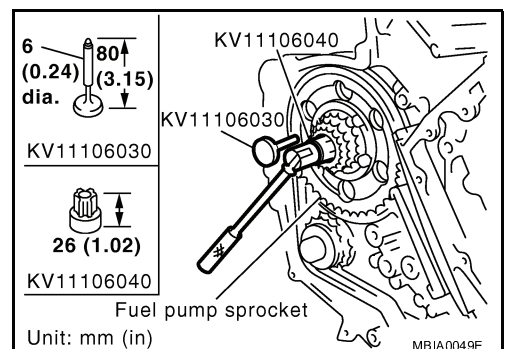
H  
I  
J  
K

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



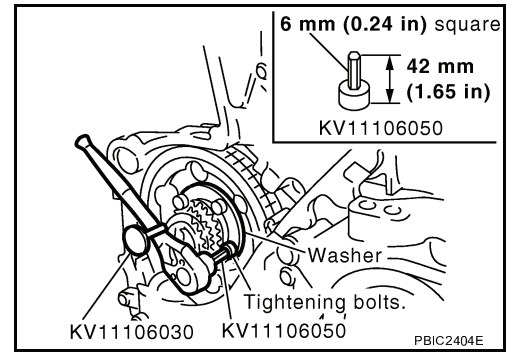
L  
M

9. Use the positioning stopper pin [SST] to hold the fuel pump sprocket and install the bolt.
- Using the TORX wrench [SST], 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.



# PRIMARY TIMING CHAIN

[YD]



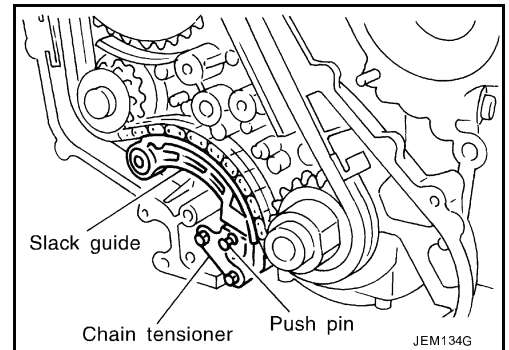
10. Install timing chain slack guide.

11. 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:**

**Make sure again that the alignment marks on sprockets and the colored alignment marks on timing chain are aligned.**

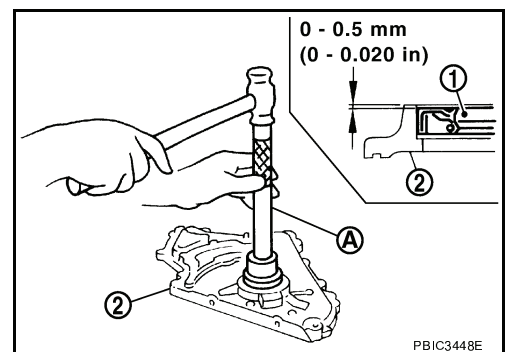


12. Install front oil seal (1) to oil pump housing (2).

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

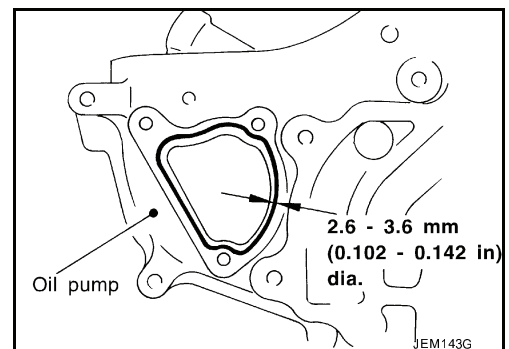
**CAUTION:**

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



13. Install vacuum pump cover to oil pump housing.

- Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000] as shown in the figure. **Use Genuine Liquid Gasket or equivalent.**
- Apply liquid gasket on oil pump-side surface.



14. Install crankshaft gear.

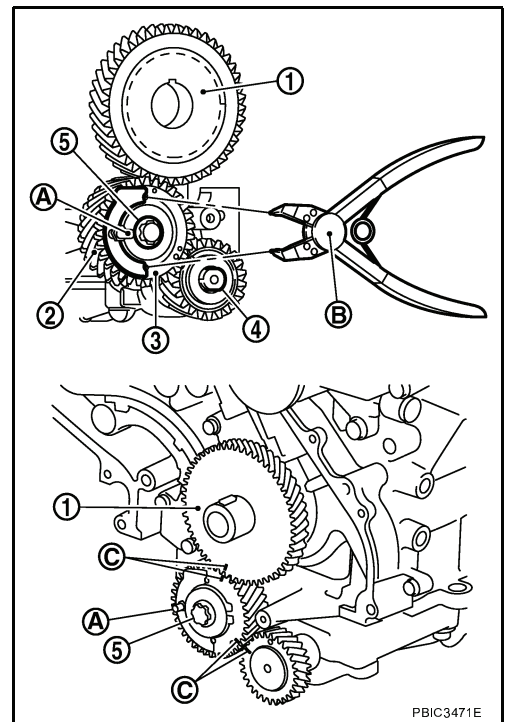
- Install crankshaft gear with the following procedure (4WD models).



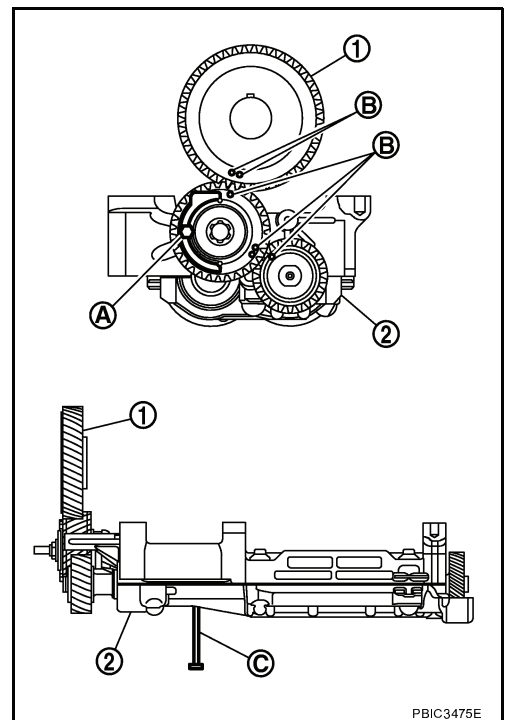
# PRIMARY TIMING CHAIN

[YD]

- Align crankshaft gear (1) mating mark and idler sub gear (3) mating mark (C).
- 2 : Idler main gear
- 4 : Balancer drive shaft front end
- 5 : Idler gear mounting bolt (do not loosen)
- B : Snap ring plier
- Remove internal mechanism securing bolt and plate (Service part: 13012 EB30A and 13013 EB30A) (A).

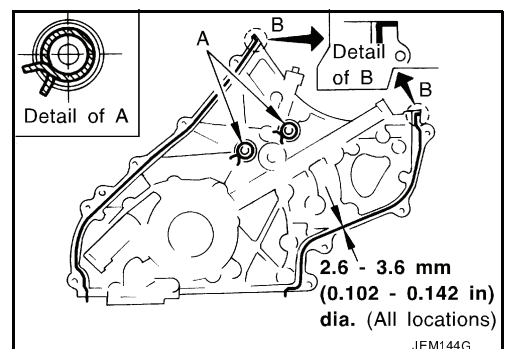


- If new balancer unit (2) is used, align matching marks (B) of each gear as shown in the figure.
- Remove securing-bolt-and-plate (A) and securing pin (C) after installing crankshaft gear (1).



## 15. Install oil pump housing.

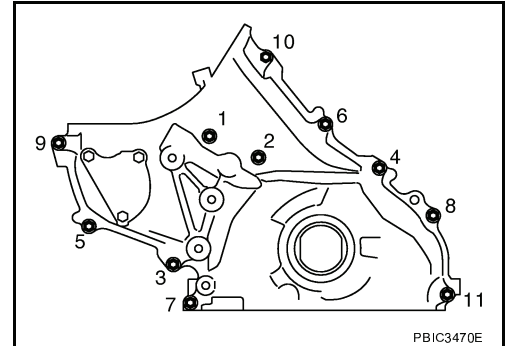
- a. Apply a continuous bead of liquid gasket with the tube presser [SST: WS39930000] as shown in the figure.
  - A: Leave the start and end areas of the bead slightly protruding from the surface.
  - B: Apply liquid gasket along upper end surface of oil pump housing.



# PRIMARY TIMING CHAIN

[YD]

- b. Install O-ring into the groove of rear chain case.
- c. 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.
- d. Tighten fixing bolts in numerical order shown in the figure.
- e. After tightening all the bolts, re-tighten in the same order.



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

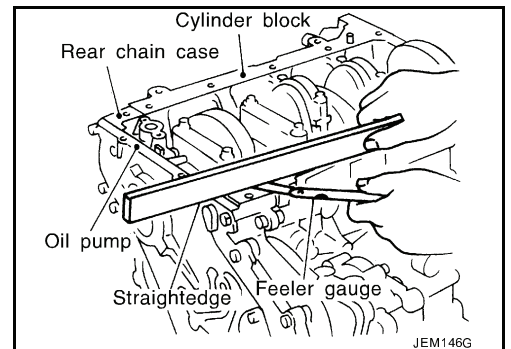
**Oil pump housing and rear chain case:**

**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.



17. Install crankshaft pulley.

**CAUTION:**

**Be careful not to damage front oil seal.**

- a. Install crankshaft pulley to crankshaft.
- b. Apply new engine oil to thread and seat surfaces of crankshaft pulley bolt.
- c. Hold crankshaft pulley with the pulley holder [SST].
- d. Tighten crankshaft pulley fixing bolt.

 : 75.0 N·m (7.7 kg-m, 55 ft-lb)

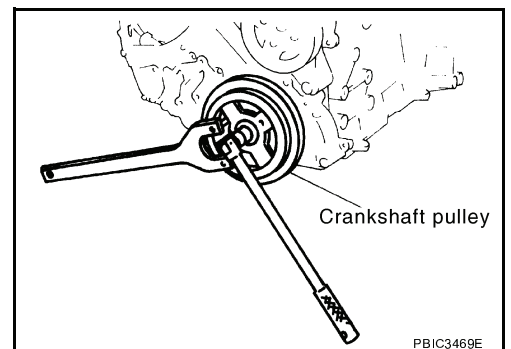
- e. Completely loosen.

 : 0 N·m (0 kg-m, 0 ft-lb)

- f. Tighten crankshaft pulley bolt.

 : 75.0 N·m (7.7 kg-m, 55 ft-lb)

- g. Put an alignment mark on crankshaft pulley that aligns with one of the punched marks on the bolt.



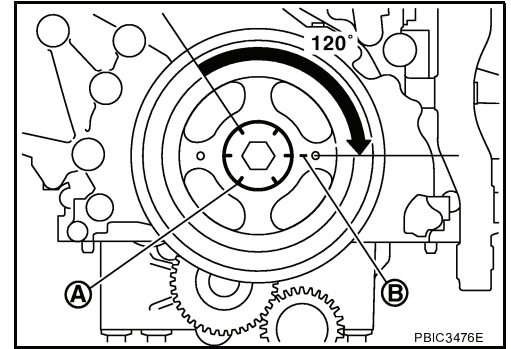
# PRIMARY TIMING CHAIN

[YD]

h. Tighten fixing bolt another 120 degrees (angle tightening) (turn by 2 notch).

**A** : Indicate embossments

**B** : Alignment mark



18. Install secondary timing chain and the associated parts.

Refer to [EM-219, "INSTALLATION"](#) .

19. Install in the reverse order of removal.

## INSPECTION AFTER INSTALLATION

### Inspection for Leaks

The following are procedures for checking fluids leak, lubricates leak and exhaust gases leak.

- Before starting engine, check oil/fluid levels including engine coolant and engine oil. If less than required quantity, fill to the specified level. Refer to [MA-13, "RECOMMENDED FLUIDS AND LUBRICANTS"](#) .
- Use procedure below to check for fuel leakage.
  - Turn ignition switch "ON" (with engine stopped). With fuel pressure applied to fuel piping, check for fuel leakage at connection points.
  - Start engine. With engine speed increased, check again for fuel leakage at connection points.
- Run engine to check for unusual noise and vibration.
- Warm up engine thoroughly to make sure there is no leakage of fuel, exhaust gases, or any oil/fluids including engine oil and engine coolant.
- Bleed air from lines and hoses of applicable lines, such as in cooling system.
- After cooling down engine, again check oil/fluid levels including engine oil and engine coolant. Refill to the specified level, if necessary.

### Summary of the inspection items:

Item	Before starting engine	Engine running	After engine stopped
Engine coolant	Level	Leakage	Level
Engine oil	Level	Leakage	Level (*2)
Other oils and fluid (*1)	Level	Leakage	Level
Fuel	Leakage	Leakage	Leakage
Exhaust gases	—	Leakage	—

\*1: Transmission/transaxle/CVT fluid, power steering fluid, brake fluid, etc.

\*2: Check engine oil level 10 minutes after engine stopped.