

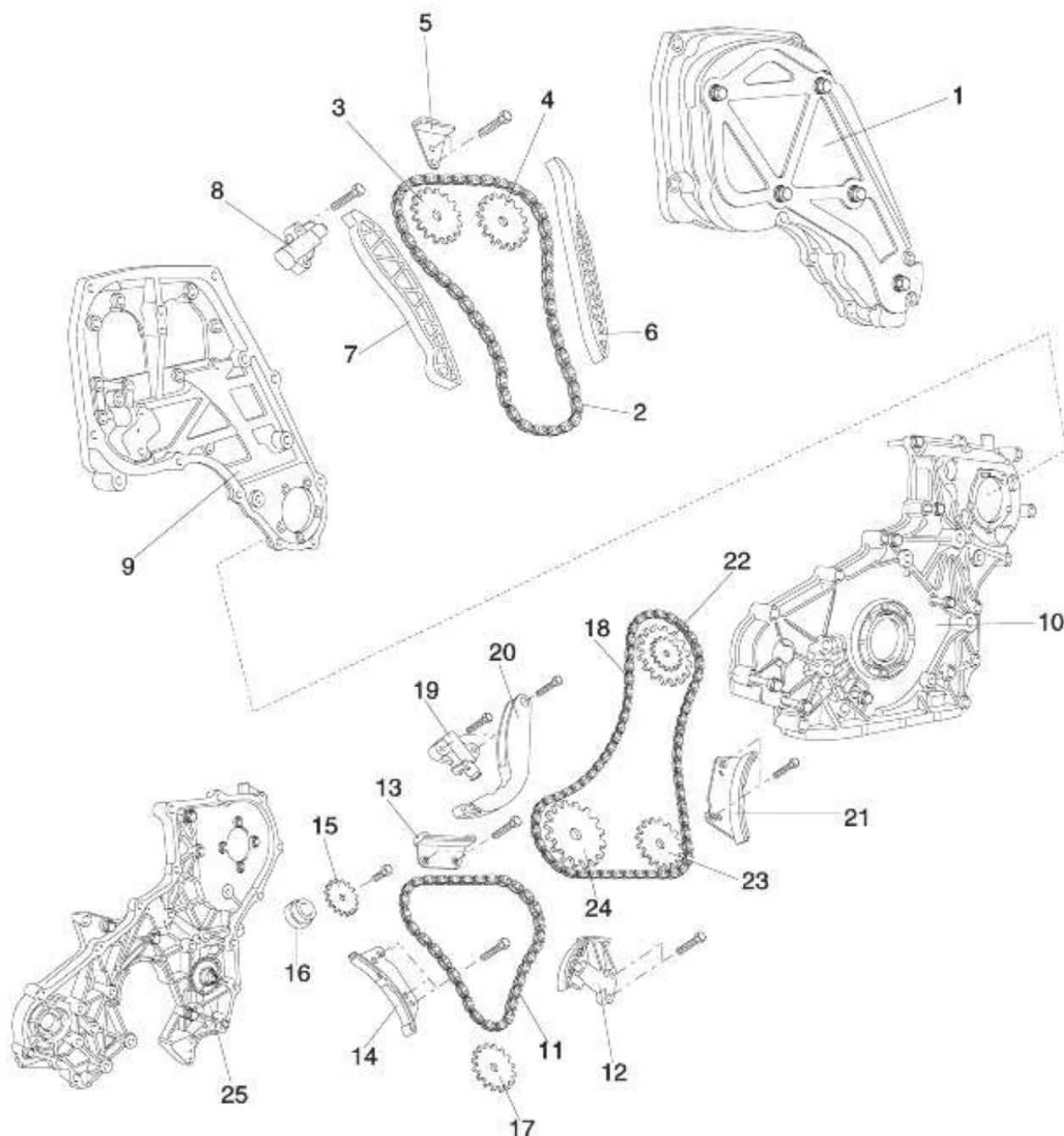


# **Engine Mechanical System**

Timing System - Timing Chain



## Components

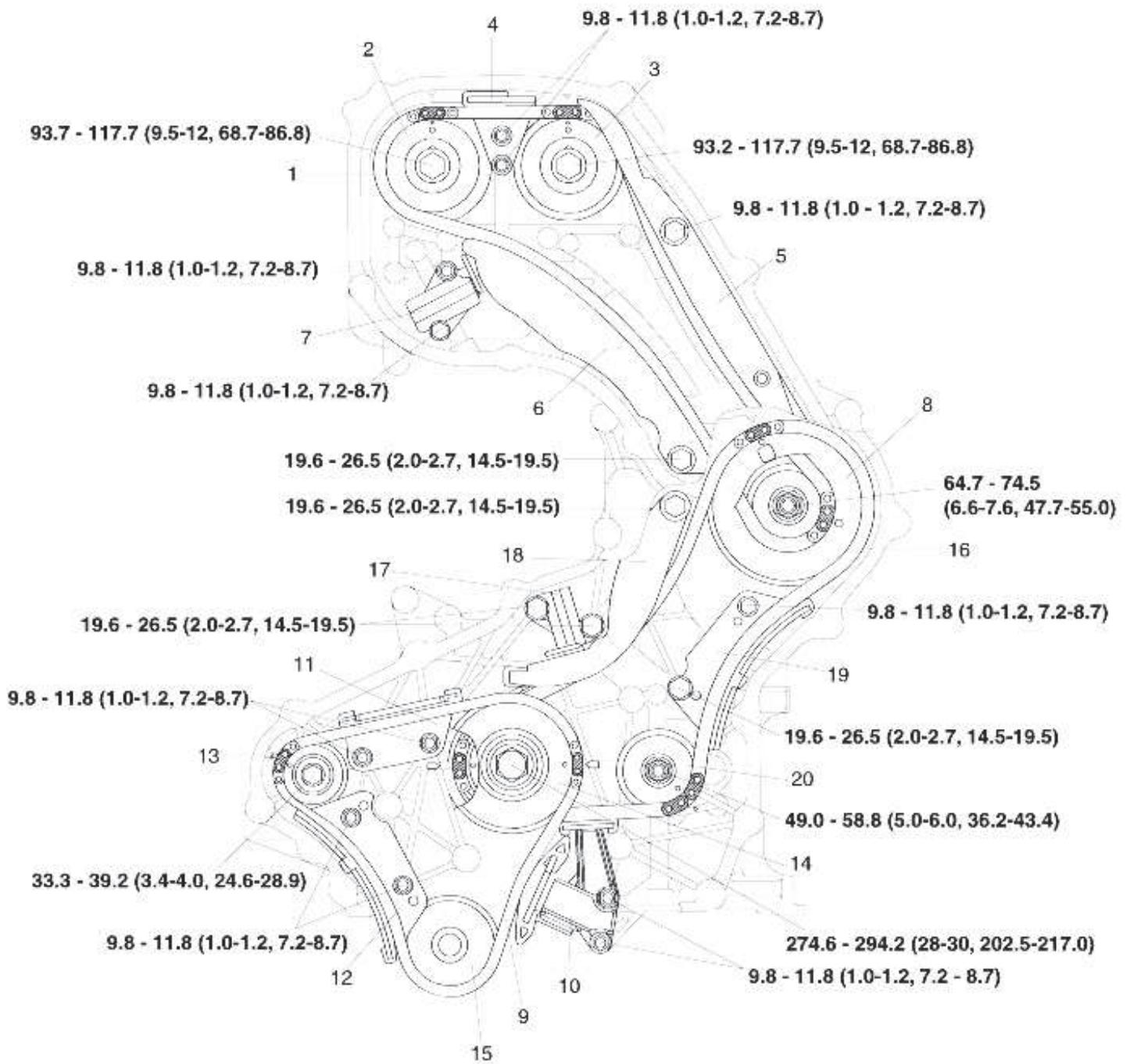


- 1. Timing chain upper front cover
- 2. Timing chain "C"
- 3. RH Camshaft sprocket
- 4. LH Camshaft sprocket
- 5. Guide "C(2)"
- 6. Guide "C(1)"
- 7. Lever "C"
- 8. Auto-tensioner "C"
- 9. Timing chain upper under cover

- 10. Timing chain lower front cover
- 11. Timing chain "B"
- 12. Auto-tensioner "B"
- 13. Guide "B(1)"
- 14. Guide "B(2)"
- 15. RH Balance shaft sprocket
- 16. Spacer
- 17. Oil pump sprocket
- 18. Timing chain "A"

- 19. Auto-tensioner "A"
- 20. Lever "A"
- 21. Guide "A "
- 22. High pressure pump sprocket
- 23. LH Balance shaft sprocket
- 24. Crank shaft sprocket
- 25. Timing chain lower under cover

## Component



**TORQUE : N·m (kg·m, lb·ft)**

- |                         |                                |                               |
|-------------------------|--------------------------------|-------------------------------|
| 1. Timing chain "C"     | 8. High pressure pump sprocket | 15. Oil pump sprocket         |
| 2. RH Camshaft sprocket | 9. Timing chain "B"            | 16. Timing chain "A"          |
| 3. LH Camshaft sprocket | 10. Auto-tensioner "B"         | 17. Auto-tensioner "A"        |
| 4. Guide "C(2)"         | 11. Guide "B(1)"               | 18. Lever "A"                 |
| 5. Guide "C(1)"         | 12. Guide "B(2)"               | 19. Guide "A"                 |
| 6. Lever "C"            | 13. RH Balance shaft sprocket  | 20. LH Balance shaft sprocket |
| 7. Auto-tensioner "C"   | 14. Crank shaft sprocket       |                               |



## DISASSEMBLY

### TIMING CHAIN "C"

1. Rotate the crankshaft pulley to align the timing mark with TDC, in which No.1 piston locates at the top dead center of compression stroke.
2. Remove the timing chain upper front cover.
3. Remove the cylinder head cover.
4. Holding the slot of the camshaft with the spanner, loosen the bolts for the high-pressure pump sprocket and camshaft sprocket.
5. Remove the timing chain auto-tensioner "C".

#### NOTICE

Before removing auto-tensioner "C", install a set pin (Ø2.5mm steel wire) after compressing the tensioner so that inner parts are not missing during disassembly.

6. Remove the timing chain lever "C".
7. Remove the timing chain guide "C(1)", C(2)".
8. Remove the LH and RH camshaft sprocket bolts.
9. Remove the timing chain "C" with the camshaft sprocket.
10. Remove the timing chain upper under cover.

### TIMING CHAIN "B"

1. Remove the timing chain "C".
2. Remove the crankshaft pulley.
3. Remove the oil pan.
4. Remove the timing chain lower front cover.
5. To prevent the rotation of RH balance shaft, remove the plug at the side of cylinder block and insert the screwdriver (or bolt) with an 8 mm(0.32in) diameter into the plughole more than 60 mm (2.4in).
6. Loosen the RH balance shaft sprocket bolt.
7. Remove the timing chain auto-tensioner "B".

#### NOTICE

Before removing auto-tensioner "B", install a set pin (Ø2.5mm wire) after compressing the tensioner.

8. Remove the timing chain guide "B(1), B(2)".
9. Remove the RH balance shaft sprocket bolt.
10. Remove the timing chain "B" with the RH balance shaft sprocket.

### TIMING CHAIN "A"

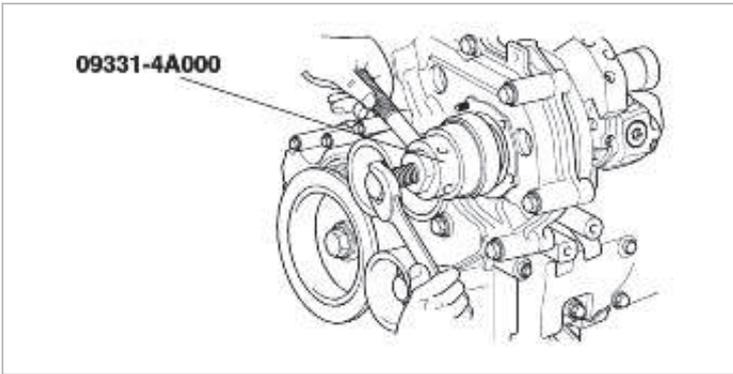
1. Remove the timing chain "C" and "B".
2. Loosen the high-pressure pump sprocket.
3. Remove the timing chain auto-tensioner "A".

#### NOTICE

Before removing auto-tensioner "A", install a set pin (Ø2.5mm wire) after compressing the tensioner.

4. Remove the timing chain lever "A".

5. Remove the timing chain guide "A".
6. Set the special tool (09331-4A000) around the high pressure pump sprocket and install a knob.



7. Grab the knob with the left hand and remove the high pressure pump sprocket with a spanner.
8. Remove the timing chain "A" with the high-pressure pump sprocket.

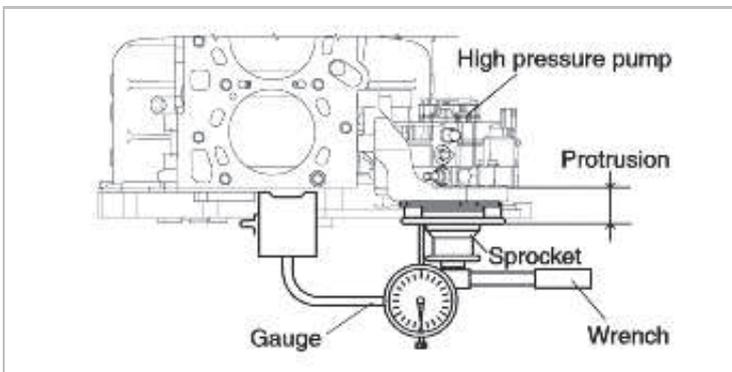
**CAUTION**

Remove thoroughly sealant and oil etc left at the sealing surface after remove the chain cover and oil pan. (If any impurities are left at the sealing face, oil may leak after reassembly even with the sealant application.)

**REASSEMBLY**

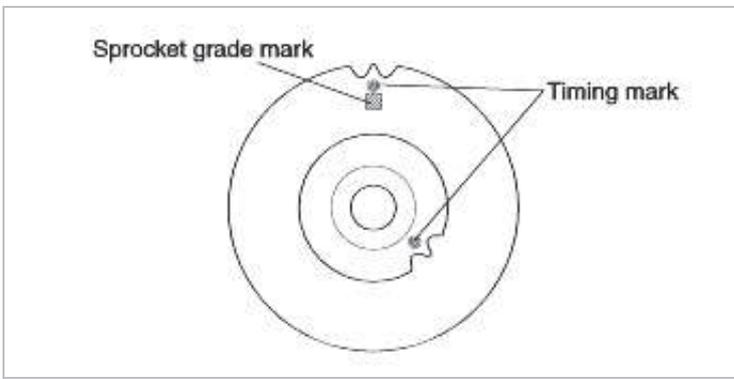
**TIMING CHAIN "A"**

1. Check the worn of timing chain, lever, guide and sprocket and replace them if necessary.
2. Choose proper high pressure pump sprocket after measuring protrusion of sprocket
  - A. Assemble a high-pressure pump sprocket (Grade A) tentatively to high-pressure pump.
  - B. Install a gauge to the cylinder block as shown illustration. And then turn the high pressure pump sprocket once by using a wrench.



- C. Choose proper sprocket grade according to average of maximum and minimum value of gauge.

Grade	Color	Protrusion (mm(in))
A	Blue	34.2-35.0 (1.3465-1.3780)
B	White	33.4-34.2 (1.3150-1.3465)
C	Red	35.0-35.8 (1.3780-1.4094)



3. Install the crankshaft sprocket as the timing mark of crankshaft sprocket aligns with the timing mark of lower under cover, at which No.1 piston locates at the top dead center of compression stroke.

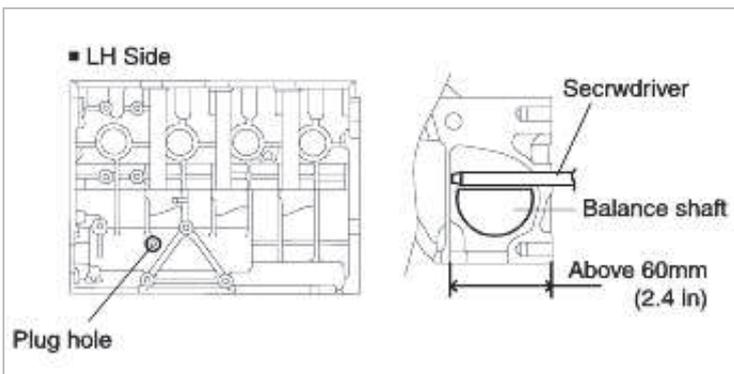
**NOTICE**

In installing crankshaft sprocket, apply oil to the O ring inside the sprocket.

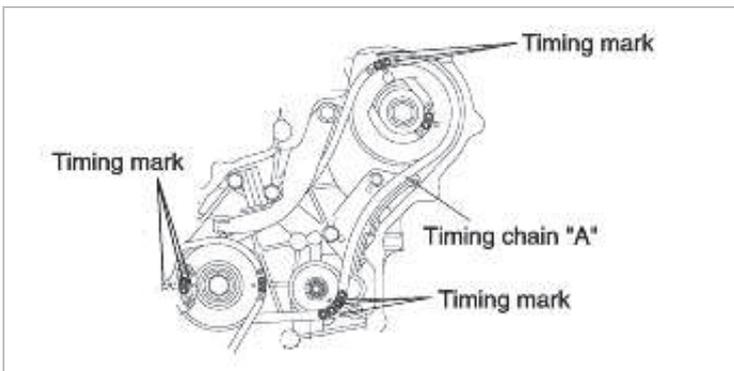
4. Align the timing mark of LH balance sprocket with the timing mark of timing chain lower under cover.
5. Check the LH balance shaft whether it is located at the right position. To prevent the rotation of balance shaft, remove plug at the side of cylinderblock. Insert screwdriver (or bolt) with an 8 mm (0.32in) diameter into the plughole and check whether it slides more than 60 mm(2.4in).

**NOTICE**

When the screwdriver (or bolt) depth is about 25-30mm(1-1.2in), rotate LH balance shaft sprocket 1 revolution. And insert the screwdriver (or bolt) again to check whether it slides more than 60mm(2.4in).



6. Assemble the upper bolt of timing chain guide "A" tentatively.



7. Align the timing marks of sprocket and chain when high-pressure pump sprocket is not installed to pump.
8. Using the chain connected to the high-pressure pump sprocket, install as the timing marks of LH balance shaft sprocket and crankshaft sprocket align with each other.
9. Assemble the high-pressure pump sprocket to the high-pressure pump tentatively.
10. Install the other bolt of the timing chain guide "A" at the lower side and tighten it.

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Tightening torque :

Upper bolt :

9.8-11.8 N·m(1.0-1.2 kg·m, 7.2-8.7 lb·ft)

Lower bolt :

19.6-26.5N·m(2.0-2.7 kg·m, 14.5-19.5 lb·ft)

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11. Install the timing chain lever "A".
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Tightening torque :

19.6-26.5 N·m(2.0-2.7 kg·m, 14.5-19.5 lb·ft)

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12. Install the timing chain auto-tensioner "A", and remove a set pin from the auto-tensioner.
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Tightening torque :

19.6-26.5 N·m(2.0-2.7 kg·m, 14.5-19.5 lb·ft)

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### NOTICE

After assembling timing chain, check whether chain is assembled within the rail at both sides.

13. Remove the screwdriver (or bolt) from the plughole and install the plug.
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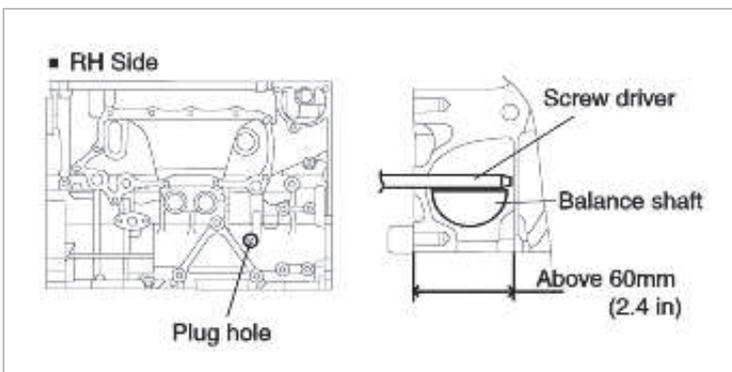
Tightening torque :

14.7-21.6 N·m(1.5-2.2 kg·m, 10.8-15.9 lb·ft)

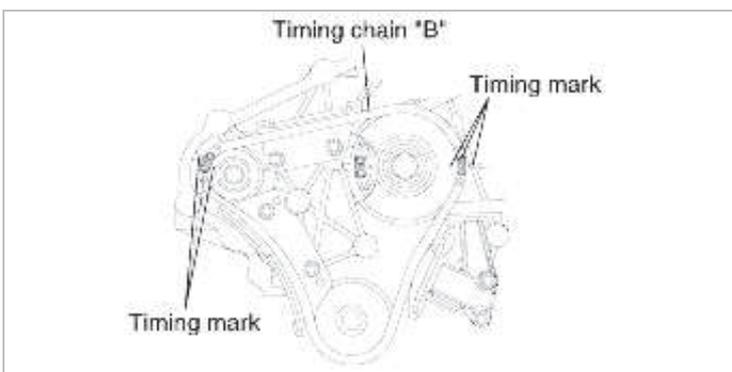
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## TIMING CHAIN "B"

1. Check the worn of timing chain, lever, guide and sprocket and replace them if necessary.
2. Install the timing chain "A".
3. Check the RH balance shaft whether it is located at the right position. To prevent the rotation of balance shaft, insert the screwdriver (or bolt) into the plughole at the side of cylinder block and check whether it slides more than 60 mm(2.4in).



4. Align the timing marks of sprocket and chain when balance shaft sprocket is not installed to the balance shaft.



5. Using the chain connected to RH balance shaft sprocket, install as the timing marks of crankshaft sprocket and oil pump sprocket align with each other.

6. Assemble the RH balance shaft sprocket to the balance shaft tentatively.

7. Install the timing chain guide “B(1), B(2)”.

Tightening torque:

9.8-11.8 N·m(1.0-1.2 kg·m, 7.2-8.7 lb·ft)

8. Install the timing chain auto-tensioner “B”, and remove the set pin from the auto-tensioner.

Tightening torque:

9.8-11.8 N·m(1.0-1.2 kg·m, 7.2-8.7 lb·ft)

9. Assemble the RH balance shaft sprocket bolt.

Tightening torque:

33.3-39.2 N·m(3.4-4.0 kg·m, 24.6-28.9 lb·ft)

10. Remove the screwdriver (or bolt) from the plughole and install the plug.

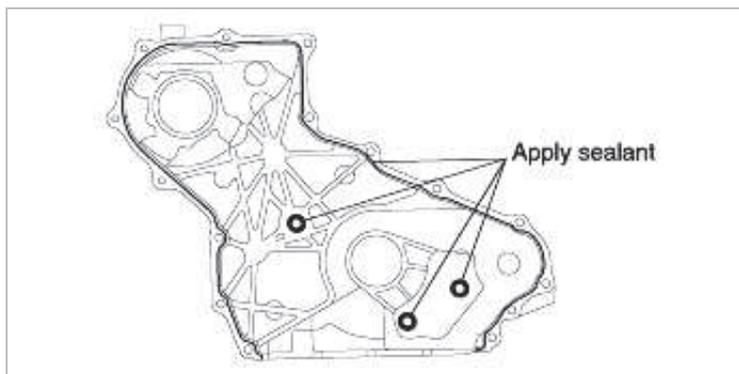
Tightening torque:

14.7-21.6 N·m(1.5-2.2 kg·m, 10.8-15.9 lb·ft)

11. Apply the sealant at the timing chain lower front cover.

Sealant type : Lotite #5902

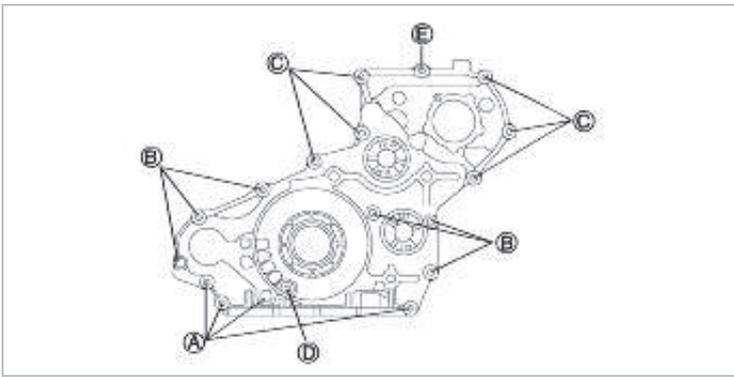
Bead width : 2-4 mm(0.08-0.16 in)



12. Install the timing chain lower front cover.

Bolt	Size	Quantity	Tightening torque N·m (kg·m, lb·ft)
A	8 x 80	4 EA	9.8-11.8 (1.0-1.2, 14.5-19.5)
B	8 x 70	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
C	8 x 50	3 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
D	8 x 40	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
E	8 x 22	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)

\* Bolt Size = Diameter x Length



13. Install the oil pan.

**CAUTION**

Then apply the sealant additionally to prevent the oil leak to the overlapping part (T-joint: 4 points right and left of the engine), where bed plate, timing chain lower under cover, timing chain lower front cover and oil pan overlap.

**TIMING CHAIN “C”**

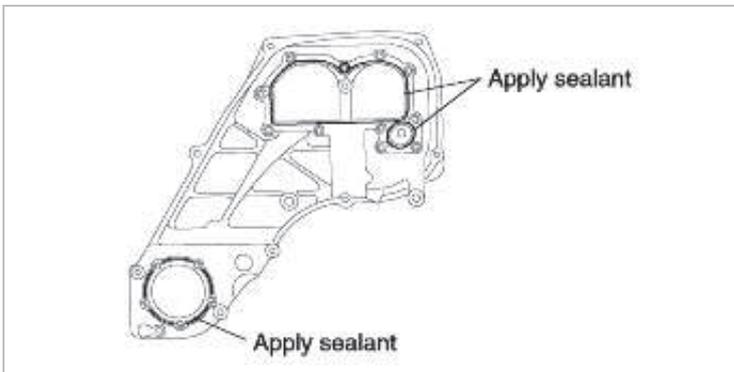
1. Check the worn of the timing chain, lever, guide and sprocket and replace them if necessary.
2. Install the timing chain “A” and “B”.
3. Apply the sealant at the timing chain upper under cover.

Sealant type : Lotite #5902

Bead width : 2-4 mm (0.08-0.16 in)

**CAUTION**

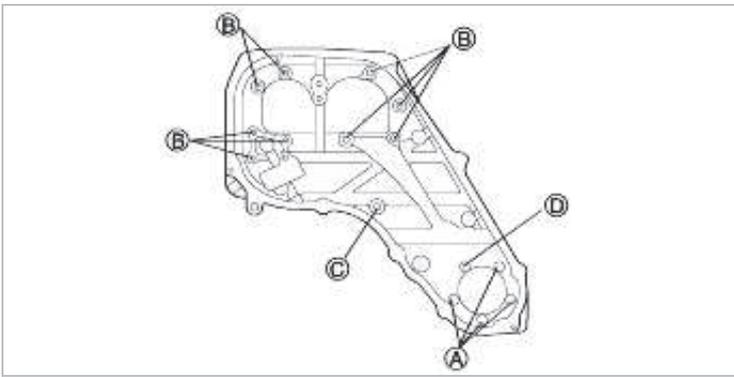
Then apply the sealant additionally to prevent the oil leak to the overlapping part (T-joint : 2 points right and left of the engine), where cylinder head, timing chain cover plate and timing chain upper under cover overlap.



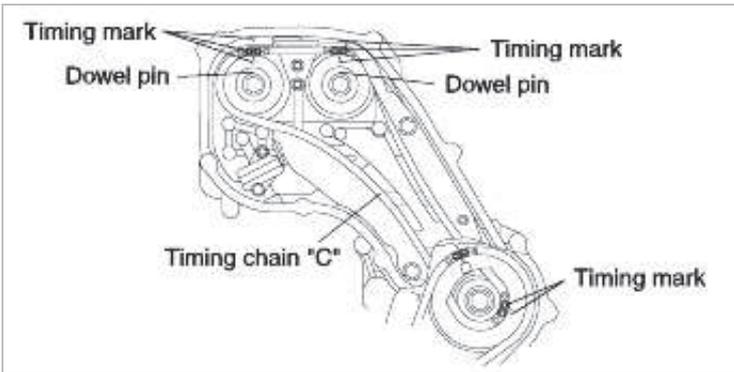
4. Install the timing chain upper under cover.

Bolt	Size	Quantity	Tightening torque N-m (kg-m, lb-ft)
A	6 x 14	4 EA	9.8-11.8 (1.0-1.2, 14.5-19.5)
B	6 x 22	9 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
C	8 x 22	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
D	8 x 40	1 EA	19.6-26.5 (2.0-2.7, 14.5-19.5)
E	Nut	1 EA	9.8-11.8 (1.0-1.2, 7.2-8.7)

\* Bolt Size = Diameter x Length



- Assemble the LH camshaft sprocket tentatively, and align the timing mark with that of timing chain upper under cover.



- Align the RH camshaft dowel pin with the timing mark of the timing chain upper under cover.
- Align the timing marks of sprocket and chain when RH camshaft sprocket is not installed to the camshaft.
- Using the chain connected to the RH camshaft sprocket, install as the timing marks of high-pressure pump sprocket and LH camshaft sprocket align with each other.
- Assemble the RH camshaft sprocket to the RH camshaft tentatively.
- Install the timing chain guide "C(1), C(2)".

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Tightening torque:  
 9.8-11.8 N·m(1.0-1.2 kg·m, 7.2-8.7 lb·ft)

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- Install the timing chain lever "C".

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Tightening torque:  
 19.6-26.5 N·m(2.0-2.7 kg·m, 14.5-19.5 lb·ft)

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- Install the timing chain auto-tensioner "C", and remove the set pin from the auto-tensioner.

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Tightening torque:  
 9.8-11.8 N·m(1.0-1.2 kg·m, 7.2-8.7 lb·ft)

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- Assemble the high-pressure pump sprocket bolt.

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Tightening torque:  
 64.7-74.5 N·m (6.6-7.6 kg·m, 47.7-55.0 lb·ft)

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- Assemble camshaft sprocket bolt.

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Tightening torque:  
 93.2-117.7 N·m (9.5-12 kg·m, 68.7-86.8 lb·ft)

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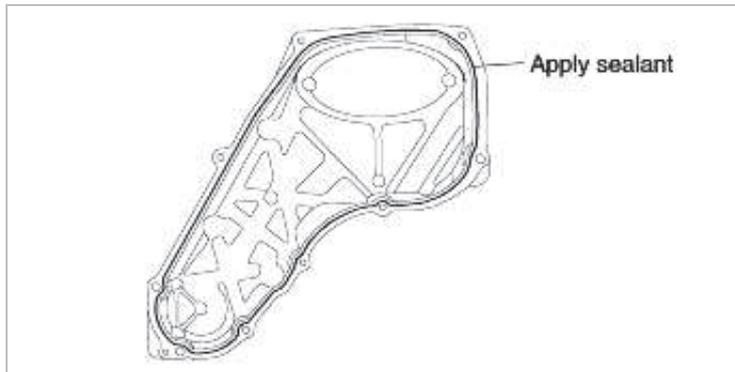
**NOTICE**

Then assemble the damper pulley to the crankshaft tentatively and align the timing mark of the damper pulley to that of chain cover. And check whether timing mark of the camshaft positions at the right place finally.

15. Apply the sealant at the timing chain upper front cover.

Sealant type : Lotite #5902

Bead width : 2-4 mm (0.08-0.16 in)



16. Install the timing chain upper front cover.

Tightening torque:

19.6-26.5 N·m(2.0-2.7 kg·m, 14.5-19.5 lb·ft)

## REPLACEMENT

### TIMING CHAIN LOWER FRONT COVER OIL SEAL

1. With the timing chain lower front cover oil seal installed, install the oil seal using the special tool (09214-4A000).

#### NOTICE

Apply engine fluid to the circumference of oil seal lip.

