

- 8) Install cylinder head cover referring to "Cylinder Head Cover Removal and Installation".
- 9) Install oil pan. Refer to "Oil Pan and Oil Pump Strainer Removal and Installation in Section 1E" for installation.
- 10) Install crankshaft pulley. To lock crankshaft pulley (1), use special tool (camshaft pulley holder) as shown in figure.

Special tool
(A): 09917-68221

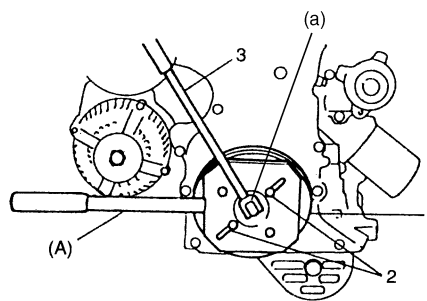
NOTE

Be sure to use the following bolts instead of pins in order to fix crank pulley by special tool.

Bolt size: M8, P1.25 L = 25 mm (0.98 in.)
Strength: 7T

Tightening torque

Crankshaft pulley bolt (a): 150 N·m (15.0 kgf·m, 108.5 lb-ft)



I2RH01140060-01

2. Bolt	3. Wrench
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- 11) Install engine assembly to vehicle referring to "Engine Assembly Removal and Installation".

Timing Chain Cover Cleaning and Inspection

S6RW0C1406017

Clean

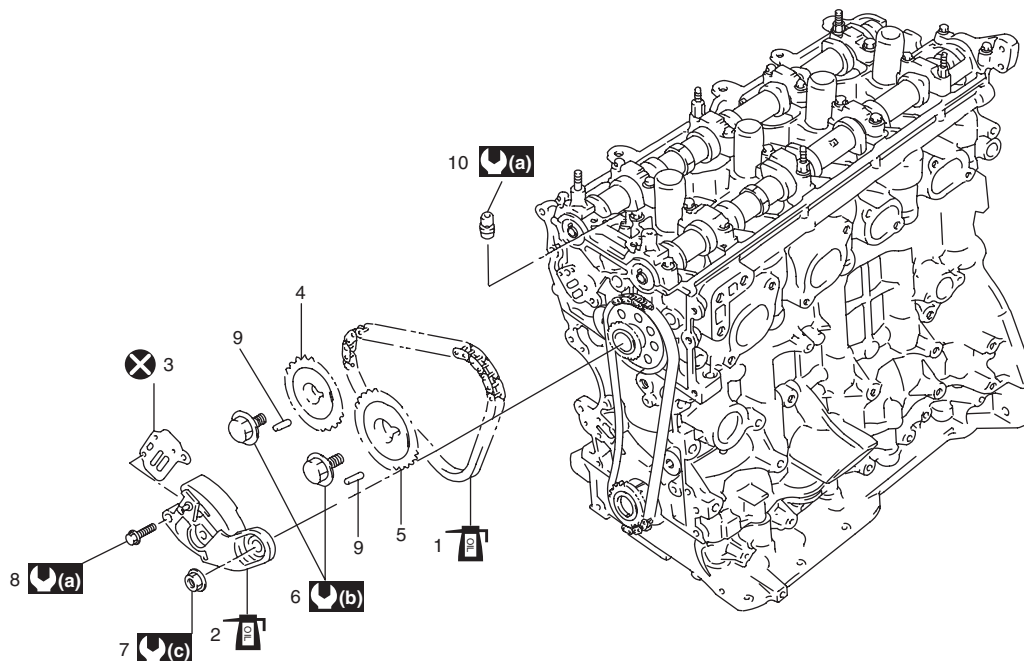
Clean sealing surface on timing chain cover, crank case, cylinder block and cylinder head.
 Remove oil, old sealant, and dust from sealing surface.

Inspection

Check oil seal lip for fault or other damage. Replace as necessary.

2nd Timing Chain and Chain Tensioner Components

S6RW0C1406018



I7RW01140049-01

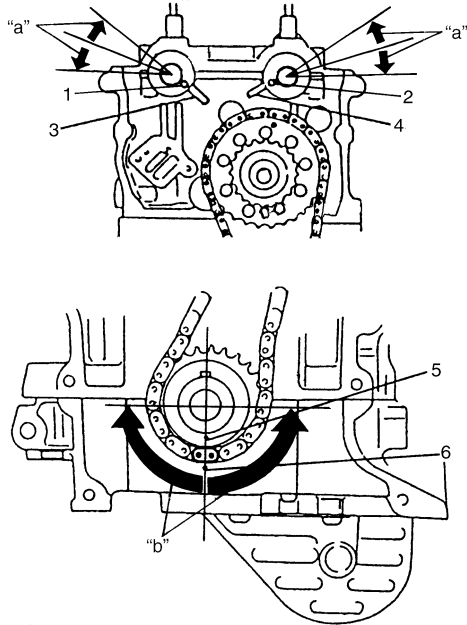
1. 2nd timing chain : Apply engine oil	6. Camshaft timing sprocket bolt	: 11 N·m (1.1 kgf·m, 8.0 lb-ft)
2. Timing chain tensioner adjuster No.2 : Apply engine oil to sliding surface.	7. Timing chain tensioner adjuster No.2 nut	: 80 N·m (8.0 kgf·m, 58.0 lb-ft)
3. Tensioner adjuster No.2 gasket	8. Timing chain tensioner adjuster No.2 bolt	: 45 N·m (4.5 kgf·m, 32.5 lb-ft)
4. Intake camshaft timing sprocket	9. Knock pin	: Do not reuse.
5. Exhaust camshaft timing sprocket	10. Oil relief valve	

**2nd Timing Chain and Chain Tensioner
 Removal and Installation**

S6RW0C1406019

⚠ CAUTION

After 2nd timing chain is removed, never turn intake camshaft, exhaust camshaft and crankshaft independently more than such an extent as shown. If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.

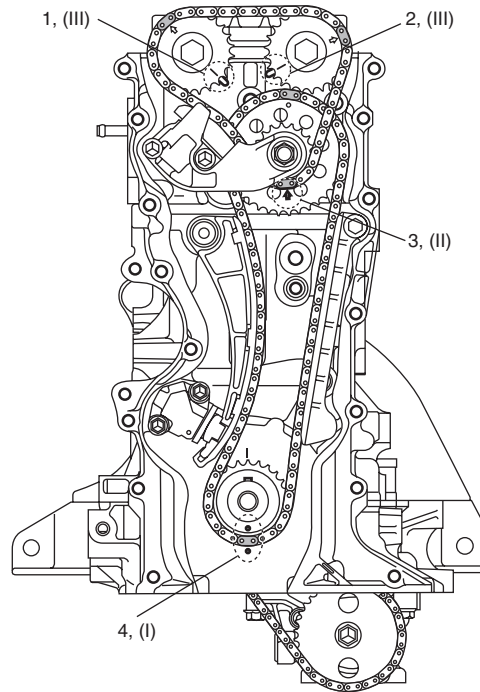


I5JB0A142060-01

1. Knock pin of intake camshaft
2. Knock pin of exhaust camshaft
3. Timing mark of intake side
4. Timing mark of exhaust side
5. Match mark on crank timing sprocket
6. Timing mark on lower crankcase
"a": Camshafts (IN & EX) allowable turning range..... Within 20° on both right and left
"b": Crankshaft allowable turning range..... Within 90° on both right and left

Removal

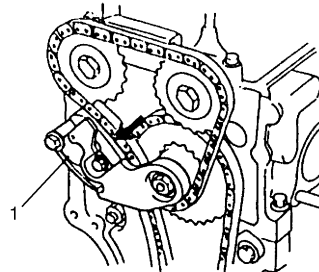
- 1) Remove timing chain cover. Refer to "Timing Chain Cover Removal and Installation" for removal.
- 2) Turn crankshaft clockwise to meet the following conditions.
 - Mark on crank sprocket match with mark on lower crankcase (I).
 - Arrow mark on idler sprocket points upward (II).
 - Marks on cam sprockets match with marks on cylinder head (III).



I7RW01140050-01

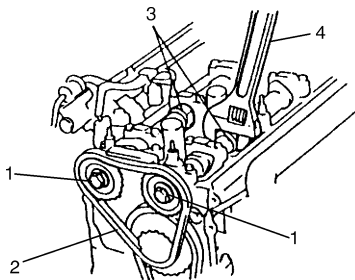
1. Timing marks of intake camshaft timing sprocket
2. Timing marks of exhaust camshaft timing sprocket
3. Arrow mark on idler sprocket
4. Timing mark of crankshaft timing sprocket

- 3) Remove timing chain tensioner adjuster No.2 (1) and gasket. To remove them, slacken 2nd timing chain by turning intake camshaft counterclockwise a little while pushing back pad.



I2RH01140064-01

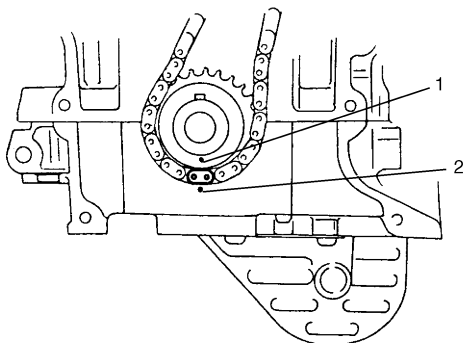
- 4) Remove intake and exhaust camshaft timing sprocket bolts (1). To remove them, fit a spanner (4) to hexagonal part (3) at the center of camshaft to hold it stationary.
- 5) Remove camshaft timing sprockets and 2nd timing chain (2).



I7RW01140052-01

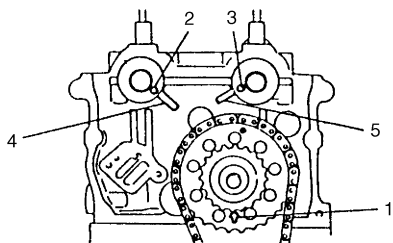
Installation

- 1) Check that match mark (1) on crank timing sprocket is in match with timing mark (2) on lower crankcase as shown in figure.



I2RH01140067-01

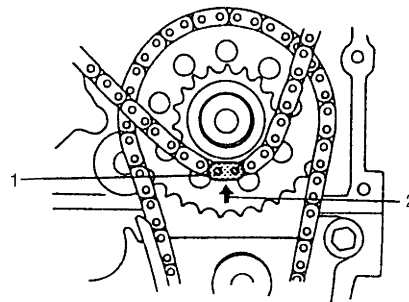
- 2) Check that arrow mark (1) on idler sprocket faces upward as shown in figure.
- 3) Check that knock pins of intake (2) and exhaust (3) camshafts are aligned with timing marks on cylinder head as shown in figure.



I2RH01140068-01

4. Timing mark of intake side
5. Timing mark of exhaust side

- 4) Install 2nd timing chain by aligning yellow plate (1) of 2nd timing chain and match marks on idler sprocket.



I2RH01140069-01

2. Match mark of 2nd timing chain (Arrow mark)
--

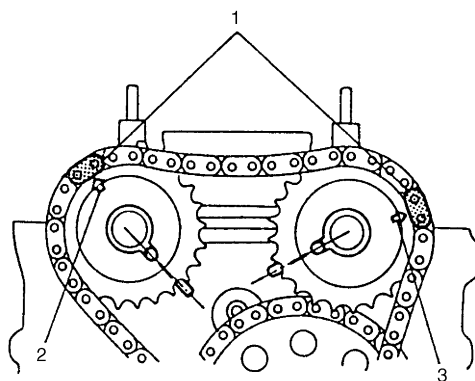
- 5) Install sprockets to intake and exhaust camshafts by aligning dark blue plate of 2nd timing chain, match marks on intake sprocket and exhaust sprocket respectively.

CAUTION

**Do not turn more than allowable turning range.
 If turned excessively, valve and piston may be damaged.**

NOTE

As an arrow mark is provided on both sides, camshaft timing sprocket has no specific installation direction.



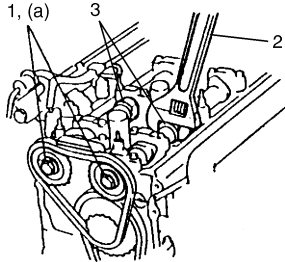
I2RH01140070-01

1. Dark blue plate
2. Arrow mark on intake camshaft timing sprocket
3. Arrow mark on exhaust camshaft timing sprocket

- 6) Tighten intake and exhaust camshaft timing sprocket bolts (1) to specified torque. To tighten it, fit a spanner (2) to hexagonal part (3) at the center of camshaft to hold it stationary.

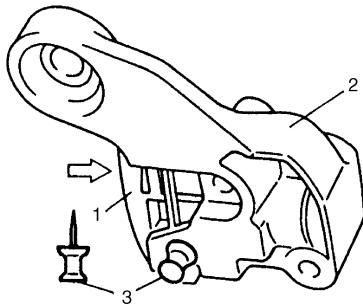
Tightening torque

Camshaft timing sprocket bolt (a): 80 N·m (8.0 kgf-m, 57.5 lb-ft)



I7RW01140053-01

- 7) Push back plunger (1) into tensioner body (2), and hold it at the position by inserting stopper (3) into body.



I2RH01140072-01

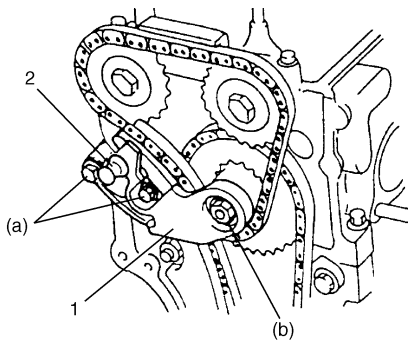
- 8) Install timing chain tensioner adjuster No.2 (1) with new gasket.

Tightening torque

Timing chain tensioner adjuster No.2 bolt (a): 11 N·m (1.1 kgf-m, 8.0 lb-ft)

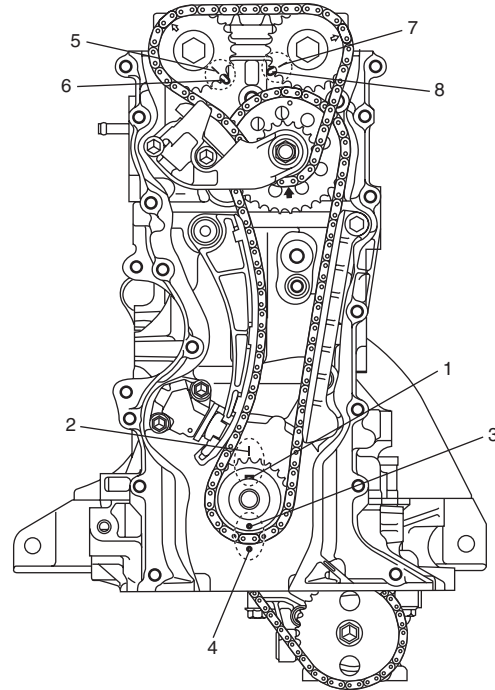
Timing chain tensioner adjuster No.2 nut (b): 45 N·m (4.5 kgf-m, 33.0 lb-ft)

- 9) Pull out stopper (2) from timing chain tensioner adjuster No.2.



I2RH01140073-01

- 10) Turn crankshaft two rotations clockwise, and then align timing mark (1) on crankshaft and timing mark (2) on cylinder block as shown in figure. At this time, check timing marks (3, 5 and 7) of sprockets are in match with timing marks (4, 6 and 8) of cylinder head, cylinder block and lower crank case.



I7RW01140056-01

3.	Timing mark on crank timing sprocket
4.	Timing mark on lower crankcase
5.	Timing mark on intake camshaft timing sprocket
6.	Timing mark of intake camshaft timing sprocket
7.	Timing mark on exhaust camshaft timing sprocket
8.	Timing mark of exhaust camshaft timing sprocket

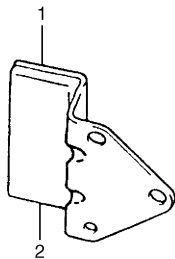
- 11) Apply oil to timing chains, tensioner, tensioner adjusters, sprockets and guides.
- 12) Install timing chain cover. Refer to "Timing Chain Cover Removal and Installation" for installation.
- 13) Install cylinder head cover. Refer to "Cylinder Head Cover Removal and Installation" for installation.
- 14) Install oil pan. Refer to "Oil Pan and Oil Pump Strainer Removal and Installation in Section 1E" for installation.
- 15) Install engine assembly to vehicle referring to "Engine Assembly Removal and Installation".

2nd Timing Chain and Chain Tensioner Inspection

S6RW0C1406020

Timing Chain Guide No.2

Check shoe (2) for wear or damage.

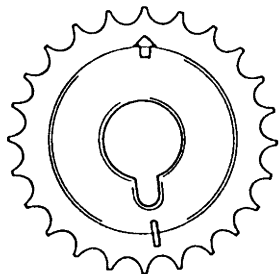


I2RH01140075-01

1. Timing chain guide No.2

Camshaft Sprocket

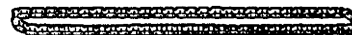
Check teeth of sprocket for wear or damage.



I2RH01140076-01

Timing Chain

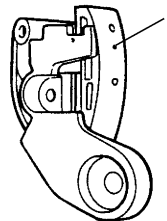
Check timing chain for wear or damage.



I2RH01140077-01

Tensioner Adjuster No.2

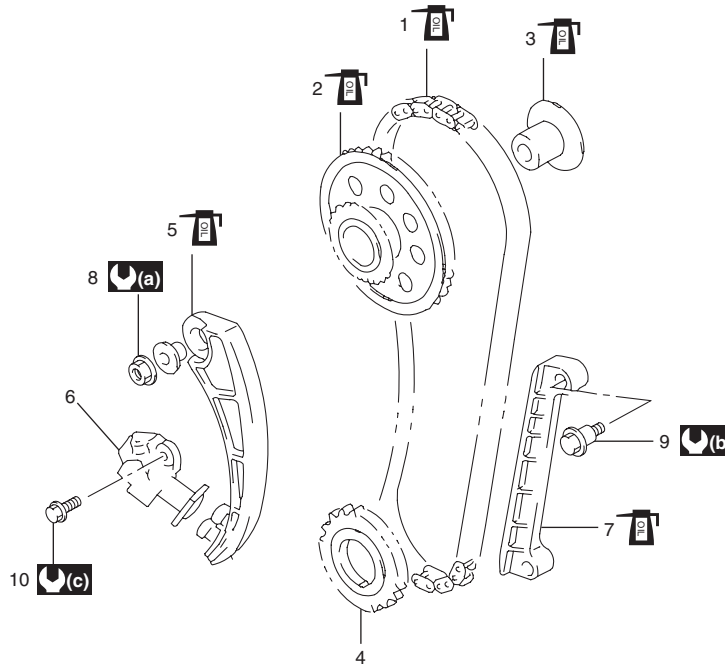
Check shoe (1) for wear or damage and latch functions properly.



I2RH01140078-01

1st Timing Chain and Chain Tensioner Components

S6RW0C1406021



I5JB0A142027-01

1. 1st timing chain	6. Timing chain tensioner adjuster No.1	(a) : 25 N·m (2.5 kgf-m, 18.0 lb-ft)
2. Idler sprocket	7. Timing chain guide No.1	(b) : 9 N·m (0.9 kgf-m, 6.5 lb-ft)
3. Idler sprocket shaft	8. Timing chain tensioner nut	(c) : 11 N·m (1.1 kgf-m, 8.0 lb-ft)
4. Crankshaft timing sprocket	9. Timing chain guide No.1 bolt	: Apply engine oil to sliding surface.
5. Timing chain tensioner	10. Timing chain tensioner adjuster No.1 bolt	

1st Timing Chain and Chain Tensioner Removal and Installation

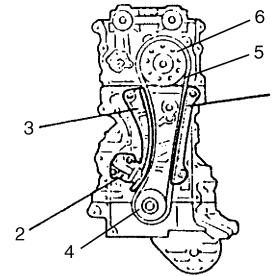
S6RW0C1406022

CAUTION

After timing chain is removed, never turn crankshaft and camshafts independently more than its allowable turning range described referring to “2nd Timing Chain and Chain Tensioner Removal and Installation”. If turned, interference may occur between piston and valves and valves themselves, and parts related to piston and valves may be damaged.

Removal

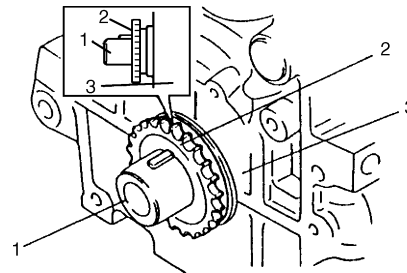
- 1) Remove 2nd timing chain. Refer to “2nd Timing Chain and Chain Tensioner Removal and Installation” for removal.
- 2) Remove timing chain guide No.1 (1).
- 3) Remove timing chain tensioner adjuster No.1 (2).
- 4) Remove timing chain tensioner (3).
- 5) Remove idler sprocket (6) and 1st timing chain (5).
- 6) Remove crankshaft timing sprocket (4).



I4RH01140029-01

Installation

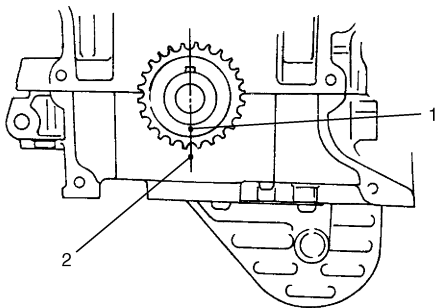
- 1) Install crankshaft timing sprocket (2) as shown in figure.



I7RW01140057-01

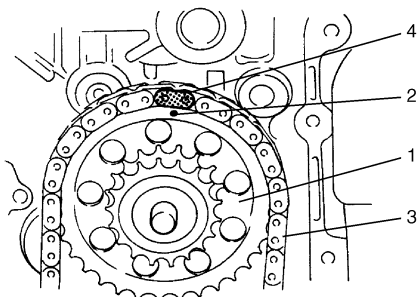
1. Crankshaft	3. Cylinder block
---------------	-------------------

- 2) Check that match mark (1) on crankshaft timing sprocket is in match with timing mark (2) on lower crankcase.



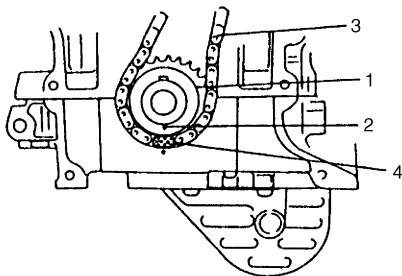
I2RH01140082-01

- 3) Apply engine oil to idler sprocket shaft and bush of idler sprocket (1).
 4) Install idler sprocket and idler sprocket shaft.
 5) Install 1st timing chain by aligning dark blue plate (4) of 1st timing chain (3) and match mark (2) on idler sprocket (1).



I2RH01140084-01

- 6) Bring gold plate (4) of 1st timing chain (3) into match with match mark (2) on crankshaft timing sprocket (1).

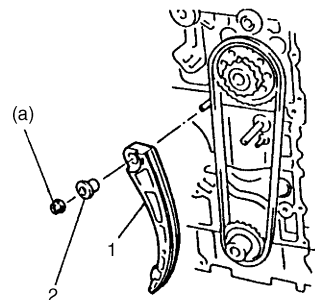


I2RH01140085-01

- 7) Apply engine oil to sliding surface of timing chain tensioner (1) and then install it as shown in figure. Tighten tensioner nut to specified torque.

Tightening torque

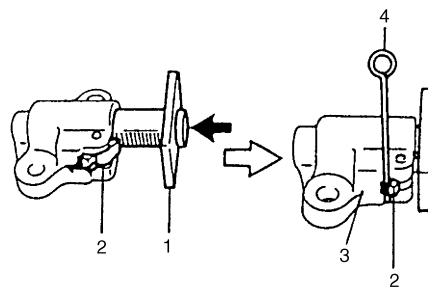
Timing chain tensioner nut (a): 25 N·m (2.5 kgf·m, 18.0 lb-ft)



I2RH01140086-01

2. Spacer

- 8) With latch of tensioner adjuster No.1 returned and plunger (1) pushed back into body, insert stopper (4) into latch (2) and body (3). After inserting it, check to make sure that plunger will not come out.



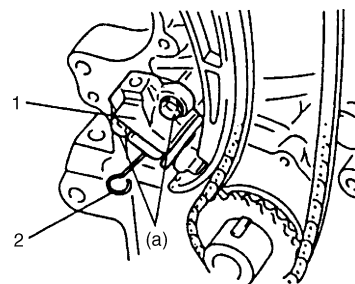
I2RH01140087-01

- 9) Install timing chain tensioner adjuster No.1 (1).

Tightening torque

Timing chain tensioner adjuster No.1 bolt (a): 11 N·m (1.1 kgf·m, 8.0 lb-ft)

- 10) Pull out stopper (2) from timing chain tensioner adjuster No.1.



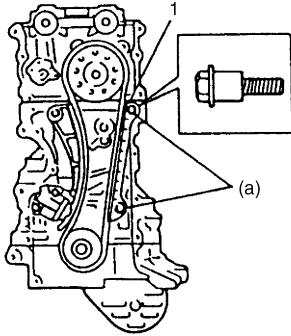
I7RW01140058-01

1D-29 Engine Mechanical:

- 11) Apply engine oil to sliding surface of timing chain guide No.1 (1) and then install it.
Tighten guide bolts to specified torque.

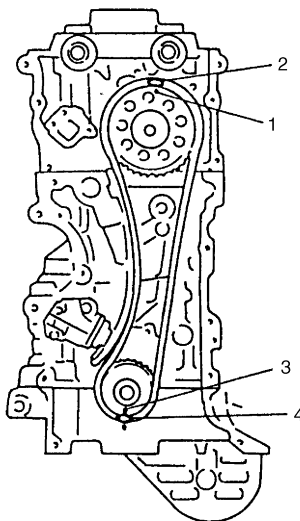
Tightening torque

Timing chain guide No.1 bolt (a): 9 N·m (0.9 kgf·m, 6.5 lb-ft)



I2RH01140089-01

- 12) Check that dark blue and gold plates of 1st timing chain are in match with match marks on sprockets respectively.



I2RH01140090-01

1. Match mark on idler sprocket
2. Dark blue plate
3. Match mark on crankshaft timing sprocket
4. Gold plate

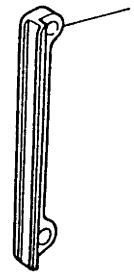
- 13) Install 2nd timing chain. Refer to "2nd Timing Chain and Chain Tensioner Removal and Installation" for installation.
- 14) Install timing chain cover. Refer to "Timing Chain Cover Removal and Installation" for installation.
- 15) Install cylinder head cover. Refer to "Cylinder Head Cover Removal and Installation" for installation.
- 16) Install oil pan. Refer to "Oil Pan and Oil Pump Strainer Removal and Installation in Section 1E" for installation.
- 17) Install engine assembly to vehicle referring to "Engine Assembly Removal and Installation".

1st Timing Chain and Chain Tensioner Inspection

S6RW0C1406023

Timing Chain Guide No.1

Check shoe for wear or damage.

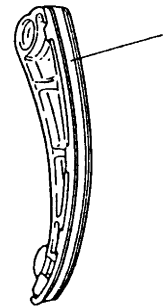


I2RH01140091-01

- | |
|----------------------------|
| 1. Timing chain guide No.1 |
|----------------------------|

Timing Chain Tensioner

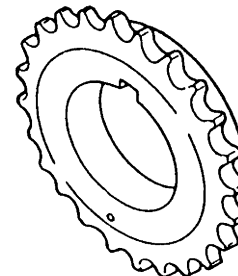
Check shoe (1) for wear or damage.



I2RH01140092-01

Crankshaft Timing Sprocket

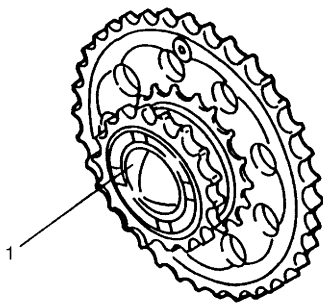
Check teeth of sprocket for wear or damage.



I2RH01140093-01

Idler Sprocket

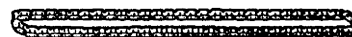
Check teeth and bush (1) of sprocket for wear or damage.



I2RH01140094-01

1st Timing Chain

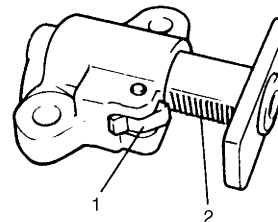
Check timing chain for wear or damage.



I2RH01140077-01

Timing Chain Tensioner Adjuster No.1

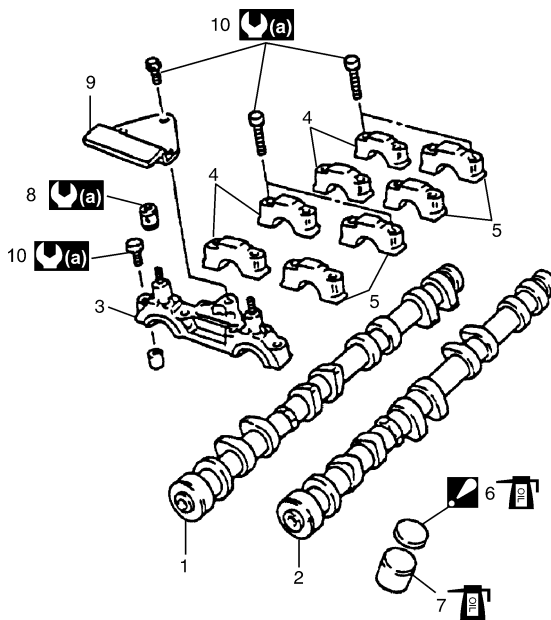
Check that latch (1) and tooth surface (2) are free from damage and latch functions properly.



I2RH01140095-01

Camshafts, Tappet and Shim Components

S6RWOC1406024



I7RW01140059-01

1. Intake camshaft	5. Exhaust camshaft housing	9. Timing chain guide No.2
2. Exhaust camshaft	6. Shim : Direct shim No. side toward tappet.	10. Camshaft housing bolt
3. Camshaft housing	7. Tappet	(a) : Tighten 11 N·m (1.1 kgf-m, 8.0 lb-ft) by the specified procedure.
4. Intake camshaft housing	8. Oil relief valve	Ⓜ : Apply engine oil to sliding surface of each part.

Camshafts, Tappet and Shim Removal and Installation

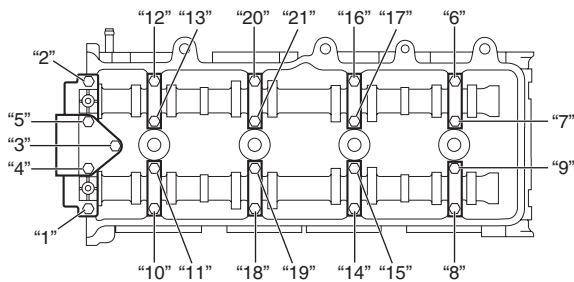
S6RW0C1406025

⚠ CAUTION

- Keep working table, tools and hands clean while overhauling.
- Use special care to handle aluminum parts so as not to damage them.
- Do not expose removed parts to dust. Keep them always clean.

Removal

- 1) Remove 2nd timing chain. Refer to "2nd Timing Chain and Chain Tensioner Removal and Installation" for removal.
- 2) Loosen camshaft housing bolts in such order as indicated in figure and remove them.



I5JB0A142029-01

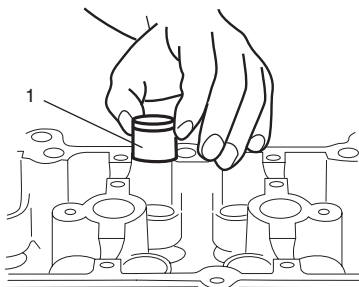
- 3) Remove camshaft housings.
- 4) Remove camshafts.
- 5) Remove tappets with shims.

Installation

- 1) Apply engine oil around tappet (1) and shim, and then install tappets with shims to cylinder head.

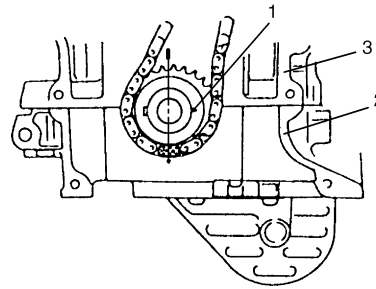
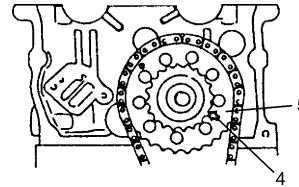
NOTE

When installing shim, make sure to direct shim No. side toward tappet.



I5JB0A142030-01

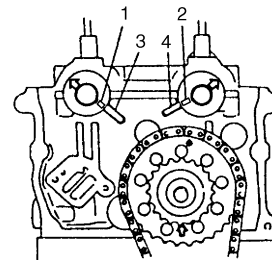
- 2) Match match mark (1) on crank timing sprocket and mating surface of cylinder block (3) and lower crankcase (2) as shown in figure. At this time, make sure that arrow mark (4) on idler sprocket (5) at the position as shown in figure.



I7RW01140060-01

- 3) Install camshafts.

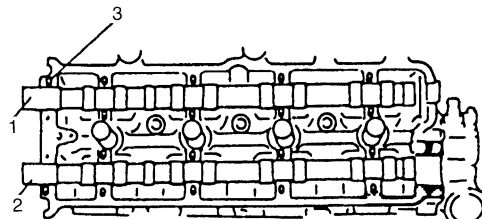
Apply oil to sliding surface of each camshaft and camshaft journal then install them by aligning match marks on cylinder head and camshafts as shown in figure.



I5JB0A142031-01

- | |
|-----------------------------------|
| 1. Knock pin of intake camshaft |
| 2. Knock pin of exhaust camshaft |
| 3. Match mark of intake camshaft |
| 4. Match mark of exhaust camshaft |

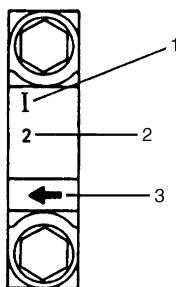
- 4) Install camshaft housing pins (3) as shown in figure.



I4RH01140032-01

- | | |
|--------------------|---------------------|
| 1. Intake camshaft | 2. Exhaust camshaft |
|--------------------|---------------------|

- 5) Check position of camshaft housings.
 Embossed marks are provided on each camshaft housing, indicating position and direction for installation. Install housings as indicated by these marks.



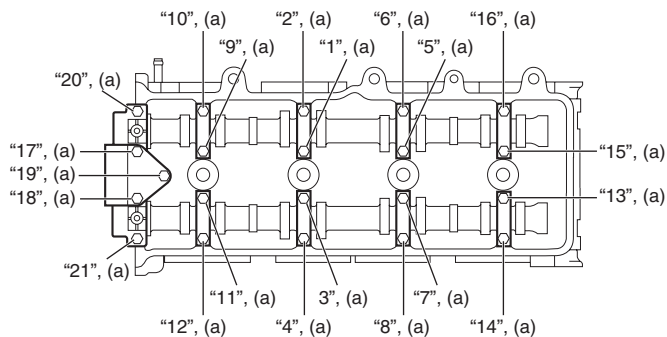
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1. I: Intake side or E: Exhaust side
2. Position from timing chain side
3. Pointing to timing chain side

- 6) After applying oil to housing bolts, tighten them temporarily first. Then tighten them by following numerical order in figure.
 Tighten a little at a time and evenly among bolts and repeat tightening sequence two or three times before they are tightened to specified torque.

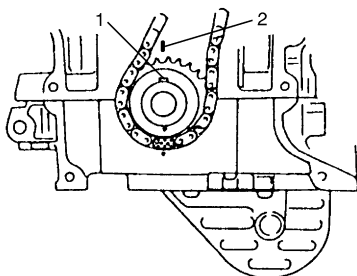
Tightening torque

Camshaft housing bolt (a): Tighten 11 N·m (1.1 kgf·m, 8.0 lb·ft) by the specified procedure



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- 7) Turn crankshaft clockwise then align crankshaft timing sprocket key (1) with timing mark (2).



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- 8) Install 2nd timing chain. Refer to "2nd Timing Chain and Chain Tensioner Removal and Installation" for installation.
 9) Install timing chain cover. Refer to "Timing Chain Cover Removal and Installation" for installation.
 10) Install cylinder head cover. Refer to "Cylinder Head Cover Removal and Installation" for installation.
 11) Install oil pan. Refer to "Oil Pan and Oil Pump Strainer Removal and Installation in Section 1E" for installation.
 12) Install engine assembly to vehicle referring to "Engine Assembly Removal and Installation".
 13) Check valve lashes referring to "Valve Lash (Clearance) Inspection".

Camshaft, Tappet and Shim Inspection

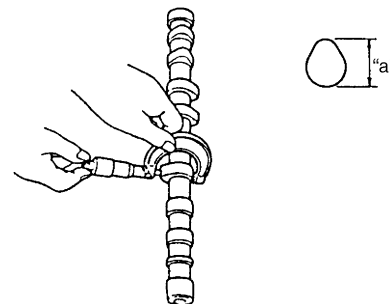
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Cam Wear

Using a micrometer, measure cam height. If measured height is below its limit, replace camshaft.

Cam height "a"

Cam height	Standard	Limit
Intake cam	45.669 – 45.829 mm (1.798 – 1.8043 in.)	45.550 mm (1.793 in.)
Exhaust cam	45.550 – 45.710 mm (1.7933 – 1.7996 in.)	45.430 mm (1.789 in.)



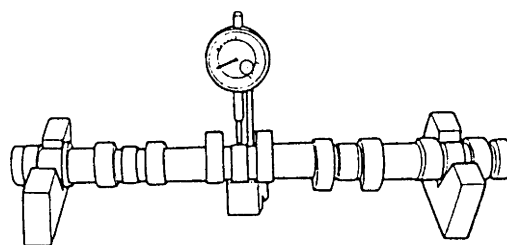
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Camshaft Runout

Set camshaft between two "V" blocks, and measure its runout by using a dial gauge.
 If measured runout exceeds the specified limit, replace camshaft.

Runout limit

0.03 mm (0.0012 in.)



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