2AR-FE ENGINE MECHANICAL: CAMSHAFT: INSTALLATION

INSTALLATION

1. SET CAMSHAFT TIMING GEAR ASSEMBLY

HINT:
- When reusing the camshaft timing gear, release the lock pin and set the camshaft timing gear to the advanced position before installation.
- If the camshaft timing gear is new or has already been set to the advanced position, install the camshaft timing gear after the camshafts have been installed to the engine.

(a) Check the camshaft timing gear position.

NOTE: If the camshaft timing gear is set to the advanced position, do not let the camshaft timing gear rotate clockwise during
installation.

If the camshaft timing gear rotates to the retarded position, release the lock pin and set the camshaft timing gear to the advanced position.

(b) Align and attach the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear.

(c) Check that there is no clearance between the camshaft timing gear and camshaft flange.

(d) Fix the camshaft in place by hand, and then install the installation bolt of the camshaft timing gear by hand.

**NOTE:** Do not use any tools to install the bolt. If the bolt is installed using a tool, the lock pin will be damaged.

(e) Release the lock pin.
(1) Clean the camshaft journal with non-residue solvent.
(2) Cover the 4 oil paths of the cam journal with vinyl tape as shown in the illustration.

HINT: There are 4 oil paths in the grooves of the camshaft. Plug three of the paths with pieces of rubber.
(3) Open a hole at port A shown in the illustration.
(4) While applying approximately 200 kPa (2.0 kgf/cm², 29 psi) of air pressure to the oil path, forcibly turn the camshaft timing gear assembly in the advance direction (counterclockwise).

**CAUTION:** Cover the paths with a piece of cloth when applying pressure to keep oil from splashing.

**NOTE:** Do not allow the camshaft timing gear assembly to lock. If it locks, release the lock pin again.

**HINT:**
- The camshaft timing gear assembly may be turned in the advance direction without applying any force.
- If enough air pressure cannot be applied because of air leakage from the port, releasing the lock pin may be difficult.

(5) Remove the vinyl tape and rubber pieces from the camshaft.

(f) Remove the bolt and camshaft timing gear.

**NOTE:** Do not allow the camshaft timing gear assembly to lock. If it locks, release the lock pin again.

2. INSTALL VALVE LASH ADJUSTER ASSEMBLY

(a) Inspect the valve lash adjuster before installing it. See: Engine > Component Tests and General Diagnostics > Inspection.

(b) Install the 16 lash adjusters to the cylinder head.

**NOTE:** Install the lash adjuster to the same place it was removed from.

3. INSTALL NO. 1 VALVE ROCK ARM SUB-ASSEMBLY

(a) Apply engine oil to the lash adjuster tips and valve stem caps.

(b) Install the 16 valve rocker arms as shown in the illustration.

4. INSTALL NO. 2 CAMSHAFT BEARING See: Engine > Overhaul > Reassembly

5. INSTALL NO. 1 CAMSHAFT BEARING See: Engine > Overhaul > Reassembly

6. INSTALL OIL CONTROL VALVE FILTER See: Engine > Overhaul > Reassembly

7. INSTALL CAMSHAFT
(a) Clean the camshaft journals, camshaft housing and bearing caps.
(b) Apply a light coat of engine oil to the camshaft journal, camshaft housing and bearing caps.
(c) Install the No. 1 and No. 2 camshafts to the camshaft housing.

8. INSTALL CAMSHAFT BEARING CAP

(a) Confirm the marks and numbers on the camshaft bearing caps and place them in their proper positions and directions.

(b) Install the 11 bolts in the order shown in the illustration.
   **Torque: 16 Nm (163 kgf-cm, 12 ft-lbf)**

   **NOTE:** Make sure that the camshaft rotates smoothly after installing the bearing caps.

9. INSTALL CAMSHAFT HOUSING SUB-ASSEMBLY
(a) Check that the valve rocker arms are installed as shown in the illustration.

(b) Apply seal packing in a continuous line as shown in the illustration.

Seal packing:
- Toyota Genuine Seal Packing Black, Three Bond 1207B or equivalent
- Standard seal diameter: 3.0 to 4.0 mm (0.118 to 0.157 in.)

NOTICE:
- Remove any oil from the contact surface.
- Install the camshaft housing within 3 minutes and tighten the bolts within 10 minutes after applying seal packing.
(c) Position the knock pin of the No. 1 and No. 2 camshafts as shown in the illustration.

(d) Install the camshaft housing, and then install the 20 bolts in the order shown in the illustration.
   Torque: 27 Nm (275 kgf-cm, 20 ft-lbf)

NOTICE:
- Do not apply oil for at least 4 hours after the installation.
- Do not start the engine for at least 4 hours after the installation.
- Thoroughly wipe clean any seal packing.

10. INSTALL CAMSHAFT TIMING GEAR ASSEMBLY
(a) Check the camshaft timing gear position. If the camshaft timing gear is not set to the advanced position, release the lock pin and reset the camshaft timing gear (Refer to the "SET CAMSHAFT TIMING GEAR ASSEMBLY" procedures).

(b) Align and attach the knock pin of the No. 1 camshaft with the pin hole of the camshaft timing gear.
(c) Check that there is no clearance between the camshaft timing gear and camshaft flange.

(d) Using a wrench to hold the hexagonal portion of the No. 1 camshaft, install the bolt.

   Torque: 85 Nm (867 kgf-cm, 63 ft-lbf)

   NOTICE:
   - Be careful not to damage the cylinder head or spark plug tube with the wrench.
   - Do not disassemble the camshaft timing gear.

11. INSTALL CAMSHAFT TIMING EXHAUST GEAR ASSEMBLY
(a) Align and attach the knock pin of the No. 2 camshaft with the pin hole of the camshaft timing exhaust gear.

(b) Check that there is no clearance between the camshaft timing exhaust gear and camshaft flange.
(c) Using a wrench to hold the hexagonal portion of the No. 2 camshaft, install the bolt.

Torque: 85 Nm (867 kgf-cm, 63 ft-lbf)

NOTICE:
- Be careful not to damage the cylinder head or spark plug tube with the wrench.
- Do not disassemble the camshaft timing exhaust gear.

12.ADD ENGINE OIL

(a) Add 50 cc (3.1 cu. in) of engine oil into the oil hole shown in the illustration.

NOTICE:
- Oil must be added if the lash adjusters were removed.
- Make sure that the low pressure chamber and oil paths of the lash adjusters are full of engine oil.
13. SET NO. 1 CYLINDER TO TDC / COMPRESSION

(a) Temporarily install the crankshaft pulley bolt.
(b) Rotate the crankshaft 40° counterclockwise to position the crankshaft pulley key as shown in the illustration.
(c) Check that the timing marks of the camshaft timing gears are as shown in the illustration.

**HINT:** “A” is not a timing mark.

(d) Remove the crankshaft pulley bolt.

14. INSTALL NO. 1 CHAIN VIBRATION DAMPER
(a) Install the chain vibration damper with the 2 bolts.  
**Torque: 21 Nm (214 kgf-cm, 15 ft-lbf)**

### 15. INSTALL CHAIN SUB-ASSEMBLY

(a) Place the chain onto the camshaft timing gears and crankshaft timing sprocket. 

**HINT:**
- Make sure the mark plate of the chain faces away from the engine.
- It is not necessary to install the chain to the teeth of the gears and sprocket.

(b) Align the mark plate (yellow) of the chain with the timing mark of the camshaft timing exhaust gear and install the chain to the camshaft timing exhaust gear.
(c) Align the mark plate (pink) of the chain with the timing mark of the crankshaft timing sprocket and install the chain to the crankshaft timing sprocket.

(d) Tie a string above the crankshaft timing sprocket so that the chain is secure.
(e) Using the hexagonal portion of the intake camshaft, rotate the intake camshaft counterclockwise with a wrench, align the timing mark of the camshaft timing gear with the mark plate (yellow) of the chain and install the chain to the camshaft timing gear.

**HINT:** Hold the intake camshaft in place with a wrench until the chain tensioner is installed.
(f) Remove the string above the crankshaft timing sprocket, rotate the crankshaft clockwise, and loosen the chain so that the chain tensioner slipper can be installed.

**NOTE:** Make sure the chain is secure.

16. INSTALL CHAIN TENSIONER SLIPPER

(a) Install the chain tensioner slipper with the bolt.

**Torque:** 21 Nm (214 kgf-cm, 15 ft-lbf)

17. INSTALL NO. 1 CHAIN TENSIONER ASSEMBLY
(a) Install a new gasket and the chain tensioner with the 2 bolts.
Torque: 10 Nm (102 kgf-cm, 7 ft-lbf)

(b) Remove the pin from the stopper plate.

18. INSTALL TIMING CHAIN GUIDE

(a) Install the timing chain guide with the bolt
Torque: 21 Nm (214 kgf-cm, 15 ft-lbf)

19. CHECK NO. 1 CYLINDER TO TDC / COMPRESSION
(a) Temporarily install the crankshaft pulley bolt.
(b) Rotate the crankshaft clockwise, and check that the timing marks on the crankshaft timing sprocket and camshaft timing gears are as shown in the illustration.

**HINT:** "A" is not a timing mark.

c) Remove the crankshaft pulley bolt.

20. INSTALL TIMING CHAIN COVER SUB-ASSEMBLY
   (a) Install the timing chain cover See: Oil Pump, Engine > Removal and Replacement > Installation.

21. CONNECT CABLE TO NEGATIVE BATTERY TERMINAL

22. RESET MEMORY
   (a) When replacing the engine assembly, perform the Reset Memory procedure (A/T initialization) for U241E (2WD) See: Automatic Transmission/Transaxle > Programming and Relearning > Initialization or for U140F (4WD).

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