1.8L Turbo-Engine

Four cylinder special tools for camshafts

- Holding tool 3036 or equivalent
- Retainer for chain tensioner 3366 or equivalent
- Tensioning screw T10092 or equivalent
- Guide pin T40011 or equivalent

To Remove:

1. Before servicing the vehicle refer to the precautions at the beginning of this section.
2. Disconnect the negative battery cable.
3. Lock carrier in service position.
4. Remove or disconnect the following:
   - Toothed belt from camshaft sprocket
   - Engine cover
   - Secondary air combination valve
   - Connector at camshaft adjuster
   - Cylinder head cover
   - Camshaft sprocket bolt (counter-hold with 3036 or equivalent).
   - Camshaft sprocket
   - Hall sensor

   **CAUTION**

   Excessive tightening of chain tensioner holder can damage camshaft adjuster.

Camshaft chain tensioner holder installed

5. Secure camshaft adjuster with chain tensioner holder 3366 or equivalent.

Camshafts at TDC
6. Re-check TDC position of camshafts:
   - Mark on the two camshafts must be in line with arrows on bearing caps
   - Clean chain and camshaft sprockets opposite two arrows on bearing caps and mark installation position using colored markings
   - The distance between the two arrows or between colored markings is 16 rollers on the drive chain

   Distance between the colored markings

   ![Distance between the colored markings](image)

   - The notch on exhaust camshaft is offset slightly toward inside in relation to chain roller A

   **Note:** Do not mark chain with a center punch or by making a notch, etc.

7. Remove or disconnect the following:
   - Bearing caps three and five on intake and exhaust camshafts
   - Double bearing cap
   - Both bearing caps on intake and exhaust camshaft chain sprockets
   - Bolts securing camshaft adjuster

8. Loosen bearing caps two and four of intake and exhaust camshafts alternately in diagonal sequence and remove.
9. Remove intake and exhaust camshafts together with camshaft adjuster.

To Install:

   ![Sealant location](image)
1. Replace rubber/metal gasket for camshaft adjuster and apply a thin coat of sealant to shaded areas as shown in illustration.

2. Install drive chain on camshaft sprockets as follows:
   - If old chain is used install chain so that colored markings are in line with notches.
   - If new chain is used distance between notches one and two on camshafts must be 16 rollers on chain. Illustration shows exact positions of 1st and 16th rollers on sprockets.
   - The notch one is offset slightly toward inside in relation to chain roller A.
   - Insert camshaft adjuster between drive chain (two technicians are needed).
   - Locate camshafts together with drive chain and camshaft adjuster in cylinder head.
   - Oil camshaft journal surface.
   - Dowel sleeves for bearing caps and camshaft adjuster must be installed in cylinder head.

3. When installing bearing caps ensure that identification mark is readable from intake side of cylinder head.

4. Torque camshaft adjuster bolts to 89 inch. lbs. (10 Nm). Watch position of dowel sleeves.

5. Torque bearing caps two and four of intake and exhaust camshafts alternately in diagonal sequence to 89 inch. lbs. (10 Nm). Watch position of dowel sleeves.

6. Install both bearing caps on intake and exhaust camshaft chain sprockets.

7. Check correct setting of camshafts:
   - The two markings on camshafts must be in line with the two arrows on bearing caps.
   - The distance between the two arrows on bearing caps or between colored markings is 16 rollers on the drive chain.
   - The notch on exhaust camshaft is offset slightly toward inside in relation to chain roller A.

8. Torque bearing caps to 89 inch. lbs. (10 Nm). Watch position of dowel sleeves.

9. When installing bearing caps with identification mark on intake side.

10. Install drive chain on camshaft sprockets as follows:
    - If old chain is used install chain so that colored markings are in line with notches.
    - If new chain is used distance between notches one and two on camshafts must be 16 rollers on chain. Illustration shows exact positions of 1st and 16th rollers on sprockets.
    - The notch one is offset slightly toward inside in relation to chain roller A.
    - Insert camshaft adjuster between drive chain (two technicians are needed).
    - Locate camshafts together with drive chain and camshaft adjuster in cylinder head.
    - Oil camshaft journal surface.
    - Dowel sleeves for bearing caps and camshaft adjuster must be installed in cylinder head.

11. Torque camshaft adjuster bolts to 89 inch. lbs. (10 Nm). Watch position of dowel sleeves.

12. Install or connect the following:
    - Remaining bearing caps; torque bolts to 89 inch. lbs. (10 Nm). Watch position of dowel sleeves.
    - Oil seals for intake and exhaust camshafts.
    - Camshaft sprocket.
    - Bolt for camshaft sprocket; torque to 48 lb-ft. (65 Nm). Use Counterhold 3036 or equivalent.
    - Hall sensor; torque rotor ring to 18 lb-ft. (25 Nm) and housing to 89 inch. lbs. (10 Nm).
    - Cylinder head cover.

Note: Narrow web of camshaft sprocket must face outward and marking for TDC No. 1 cylinder must be visible from front.

Set crankshaft and camshaft to TDC No. 1 cylinder.
12. Align marking on camshaft sprocket with marking on cylinder head cover.
13. Align marking on vibration damper with marking on bottom section of toothed belt guard.

**CAUTION**
The crankshaft must not be at TDC when camshaft is rotated. Otherwise there is a risk of damage to valves and piston crowns.


**Note:** After installing camshafts, engine must not be started for approximately 30 minutes. Hydraulic valve compensation elements have to settle (otherwise valves will strike pistons). After working on valve gear, rotate crankshaft carefully at least two rotations, to ensure that none of the valves make contact when starter is operated.

### 2.8L Engine

**To Remove:**

1. Before servicing the vehicle refer to the precautions at the beginning of this section.
2. Remove or disconnect the following:
   - Timing Belt
   - Camshaft gears
   - Combination valve for Secondary Air Injection
   - Right-side cylinder head:
   - Electrical harness connectors at Camshaft Position (CMP) Sensor
   - Bracket with idler roller
   - Toothed belt guard at rear right
   - Left-side cylinder head:
   - Toothed belt guard at rear left
   - Both cylinder heads:
   - T40030 or equivalent camshaft adjuster gauge from camshafts
   - Housing for camshaft adjustment valves
   - Housing for Camshaft Position (CMP) sensor

**Camshaft guide frame bolt loosening sequence**

3. Loosen bolts of guide frame in the sequence of the numbers and follow arrows.

**Press off guide frame**