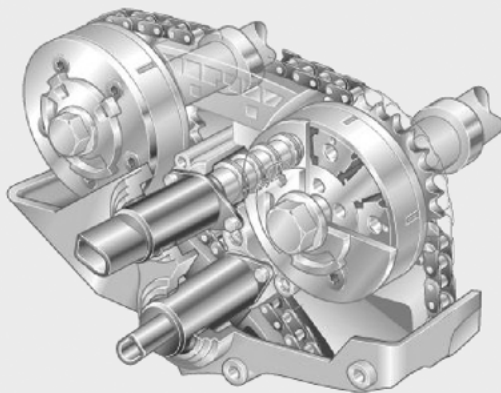
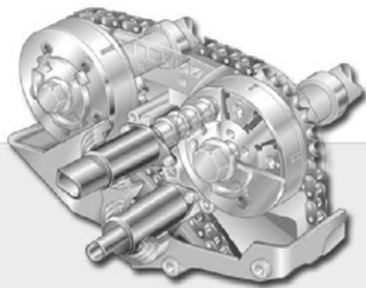


24-Valve VR6 **Variable Camshaft Timing Operation**

SYSTEM OVERVIEWS







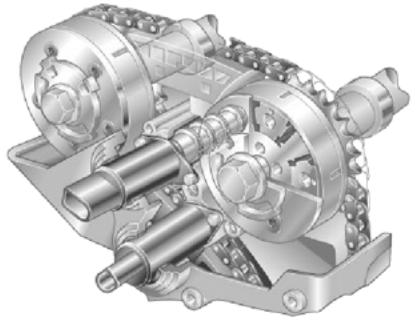
Operation

SYSTEM OVERVIEWS

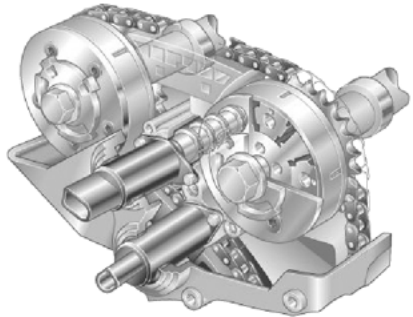




Variable Valve Timing for the 24-valve VR6 was developed to open and close valves at precise points during the combustion process.



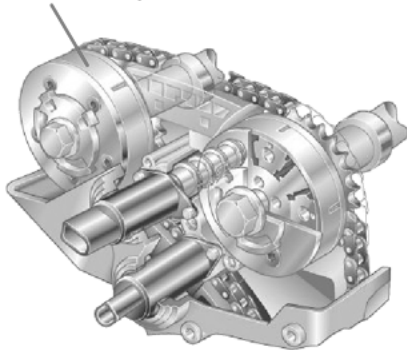
Camshafts with fixed timing are designed to provide a compromise power due to fixed valve opening and closing. Adjustable camshaft timing systems can provide more power and economical operation, while still meeting stringent emissions requirements.



The adjustable camshaft system in the 24-valve VR6 engine is comprised of:

- An **Intake** Camshaft Adjuster

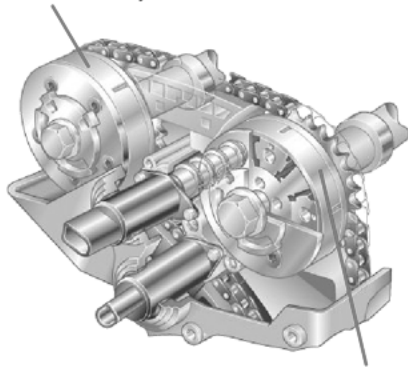
Intake Camshaft Adjuster



The adjustable camshaft system in the 24-valve VR6 engine is comprised of:

- An **Intake** Camshaft Adjuster
- An **Exhaust** Camshaft Adjuster

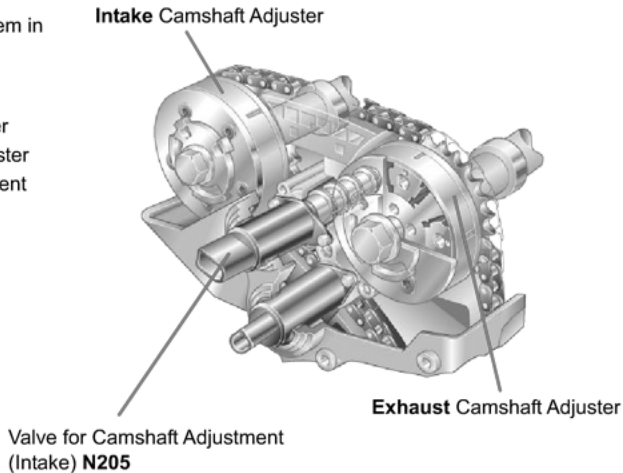
Intake Camshaft Adjuster



Exhaust Camshaft Adjuster

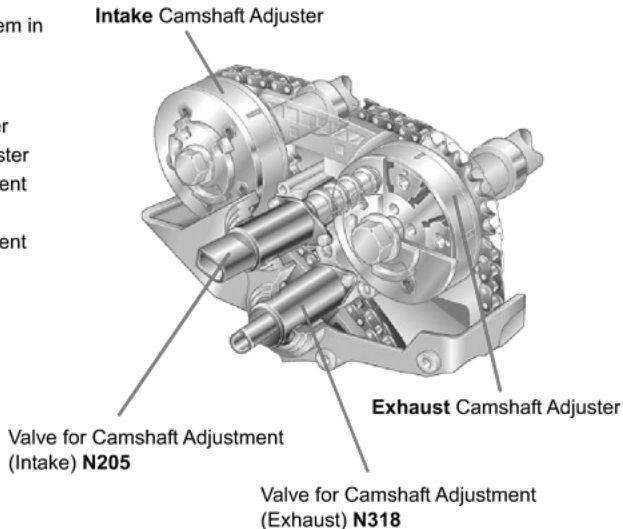
The adjustable camshaft system in the 24-valve VR6 engine is comprised of:

- An **Intake** Camshaft Adjuster
- An **Exhaust** Camshaft Adjuster
- Valve for Camshaft Adjustment (Intake) **N205**



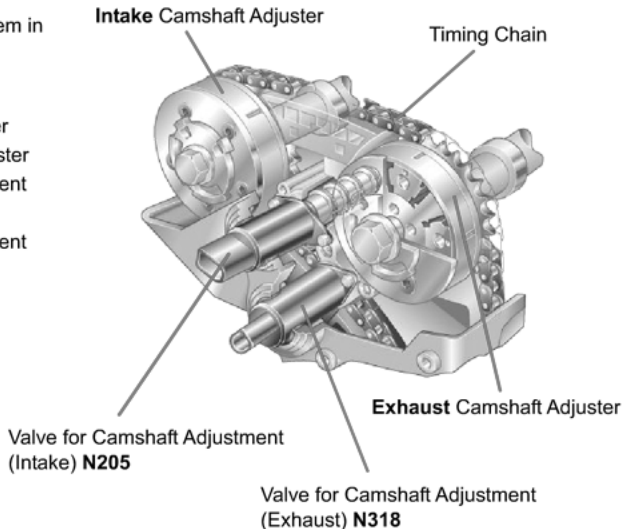
The adjustable camshaft system in the 24-valve VR6 engine is comprised of:

- An **Intake** Camshaft Adjuster
- An **Exhaust** Camshaft Adjuster
- Valve for Camshaft Adjustment (Intake) **N205**
- Valve for Camshaft Adjustment (Exhaust) **N318**



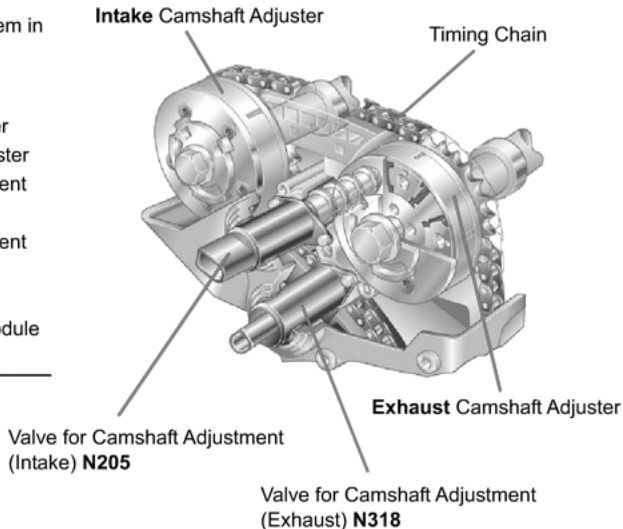
The adjustable camshaft system in the 24-valve VR6 engine is comprised of:

- An **Intake** Camshaft Adjuster
- An **Exhaust** Camshaft Adjuster
- Valve for Camshaft Adjustment (Intake) **N205**
- Valve for Camshaft Adjustment (Exhaust) **N318**
- Timing Chain



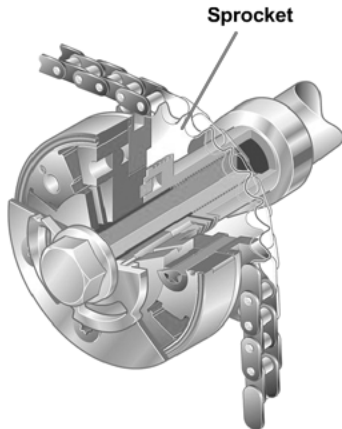
The adjustable camshaft system in the 24-valve VR6 engine is comprised of:

- An **Intake** Camshaft Adjuster
 - An **Exhaust** Camshaft Adjuster
 - Valve for Camshaft Adjustment (Intake) **N205**
 - Valve for Camshaft Adjustment (Exhaust) **N318**
 - Timing Chain
 - Motronic Engine Control Module (**ECM**) - not shown
-



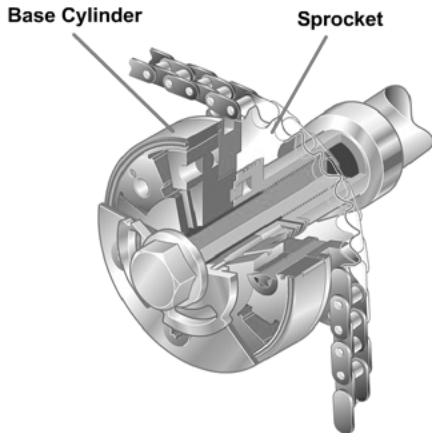
Each Camshaft Adjuster is composed of:

- **Sprocket**



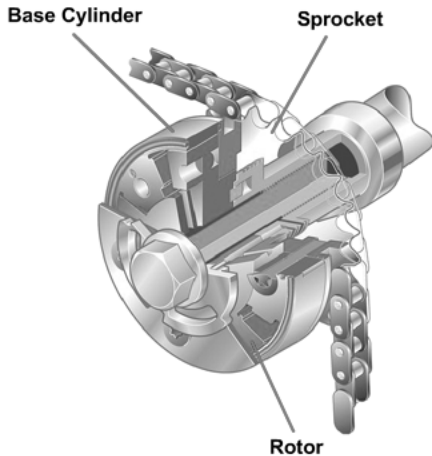
Each Camshaft Adjuster is composed of:

- **Sprocket** (connected to the cover)
- **Base Cylinder** (connected to the cover)



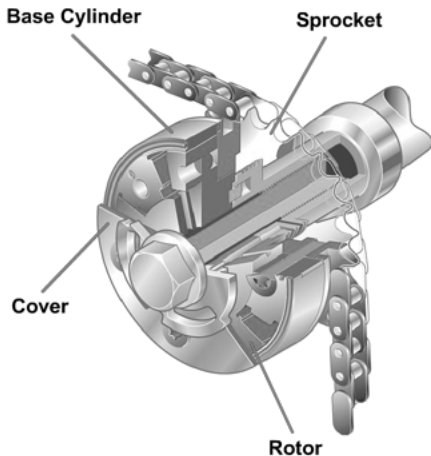
Each Camshaft Adjuster is composed of:

- **Sprocket** (connected to the cover)
- **Base Cylinder** (connected to the cover)
- **Rotor** (connected to the camshaft)



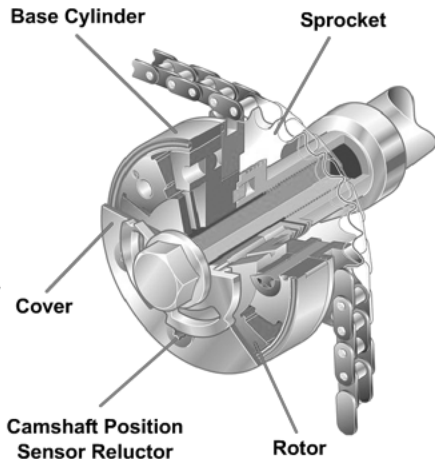
Each Camshaft Adjuster is composed of:

- **Sprocket** (connected to the cover)
- **Base Cylinder** (connected to the cover)
- **Rotor** (connected to the camshaft)
- **Cover**



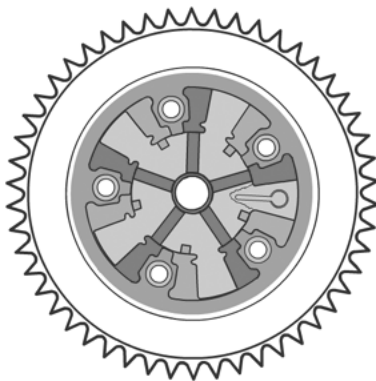
Each Camshaft Adjuster is composed of:

- **Sprocket** (connected to the cover)
- **Base Cylinder** (connected to the cover)
- **Rotor** (connected to the camshaft)
- **Cover**
- **Camshaft Position Sensor Reluctor**

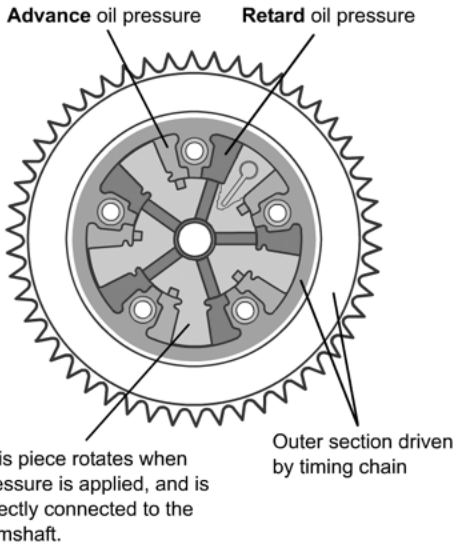




As the chain drives the cover, the base cylinder is turned. This, in turn, pushes on the rotor, turning the camshaft.



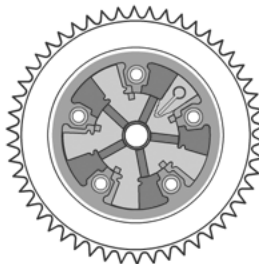
The space between the rotor and base cylinder is filled with oil. The Valves for Camshaft Adjustment can direct oil pressure to either side of the rotor, controlling the separation of the rotor from the base cylinder. This causes the camshaft to rotate to a different position, changing the timing of the valves.



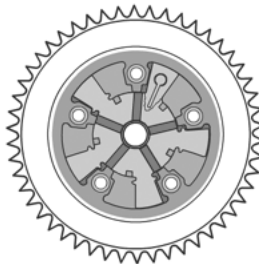


The camshaft adjusters have different internal chamber widths. As a result, the intake camshaft can rotate up to 25 degrees in either direction from its original position. The intake camshaft is infinitely adjustable within this range.

The exhaust can rotate 11 degrees in either direction and is always either fully advanced or fully retarded.



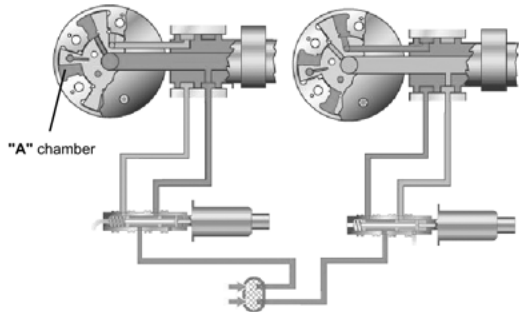
Intake



Exhaust

Valves for Camshaft Adjustment:

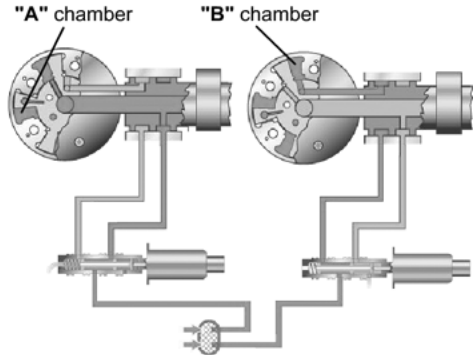
The oil pressure responsible for rotating the camshafts is delivered by the **Valves for Camshaft Adjustment**. This oil runs through passages and into either the "A" or "B" chamber of the Camshaft Adjuster assembly. If oil is run to the "A" chamber, the rotor will remain in its resting state. If oil is run to the "B" chamber, the rotor will move to advance the opening and closing of the valves.



Variable Camshaft Operation- Idling:

Intake Camshaft - Oil pressure to "A" chamber, rotor at its resting state, valves open at 25 degrees after Top Dead Center.

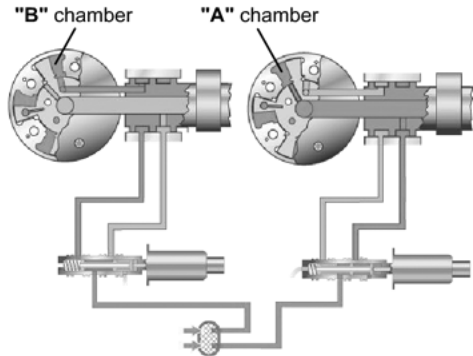
Exhaust Camshaft - Oil pressure to "B" chamber, rotor advanced 22 degrees, closing 25 degrees before Top Dead Center.

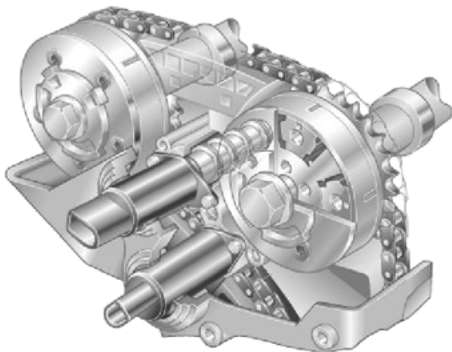


Variable Camshaft Operation-
Working positions - above 1200 rpm
and under load:

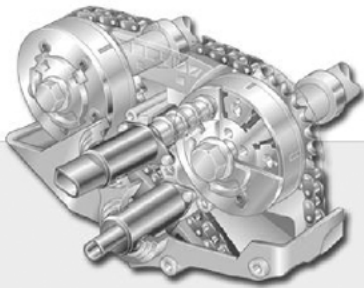
Intake Camshaft - Oil pressure to **"B"** chamber, rotor advanced 25 degrees after and 25 degrees before Top Dead Center.

Exhaust Camshaft - Oil pressure to **"A"** chamber, rotor returns to its resting state, exhaust valves will close 3 degrees before Top Dead Center





- ✓ **Module complete**
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Timing Setup

SYSTEM OVERVIEWS



Timing Setup

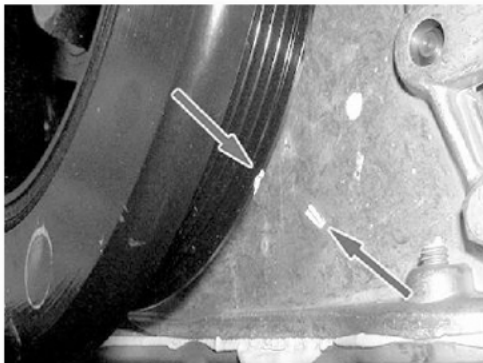
When servicing the 24-valve VR6, there is a specific procedure used to reset the timing.





Timing Setup

First, turn the crankshaft until the mark on the damper aligns with the mark on the engine block. This assures that the engine is at **Top Dead Center**.





Timing Setup

To make sure that the engine is at the correct **Top Dead Center** position, look for a slot on the top of the intermediate shaft sprocket.

This slot can only be seen every second **Top Dead Center** position.



Timing Setup

Align the notches in the camshaft so that the valves for the #1 piston are closed.

A 32mm wrench can be used to turn the camshafts.

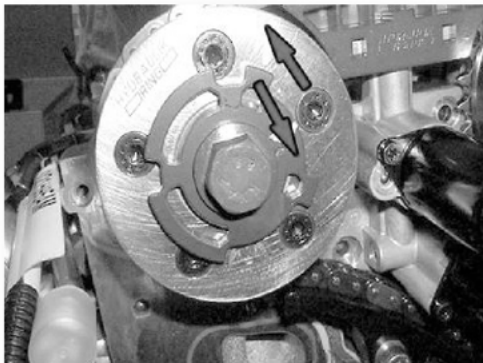
Special Tool T10068 is used to position the camshafts correctly.



Timing Setup

Load the camshaft adjusters in the direction of the arrows before installing.

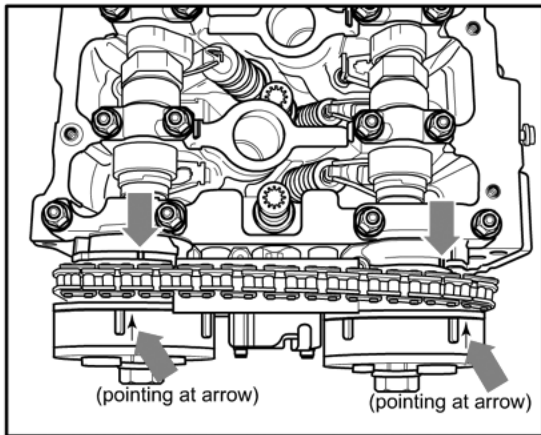
Note: After setting camshaft timing, and before reassembling the covers, it is a good idea to hold the chain by hand to prevent slack while turning the engine over a few times. This will assure that the timing is correct.



Timing Setup

Align the marks on the intake and exhaust camshaft timing adjusters with the notches in the chain tensioner housing.

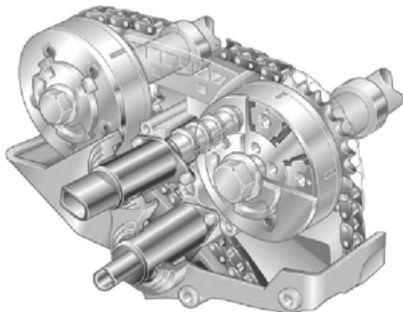
Count 16 chain links from the arrow on the intake timing adjuster, place a load on the exhaust timing adjuster, and line up the aligning mark with the notch in the chain tensioner housing.





Timing Setup

The complete timing procedure is outlined in **VESIS**.



✓ **Module complete**

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