To improve engine breathing at a variety of rpms, thus improving fuel efficiency, emissions and power, BMW engines are designed with VANOS, an acronym based on the German words *VAriable NOckenwellenSteuerung* or variable camshaft timing. Though a number of VANOS systems have been designed and implemented, the basic principle behind all of them is the need to change the relative timing between the intake valve and exhaust valve opening. The VANOS actuator on each camshaft is supplied with engine oil under pressure; a solenoid controlled by the engine control module (ECM) retards or advances camshaft timing by modifying the supply of pressurized oil to the VANOS actuator.

Intake valves:

* Retarded during idle, improves smoothness of idle
* Advanced during part-throttle acceleration, improves torque and emissions
* Retarded at full-throttle, improves high power production

Exhaust valves:

* Retarded during deceleration so that more exhaust can stay and mix with the cylinder charge, thus diluting the mixture, lowering combustion temperature and reducing NOx in the exhaust; this is similar to the effect of exhaust gas recirculation (EGR)
* Advanced during warm-up phase in order to allow rapid warm-up and more efficient operation of catalytic converters

BMW 6-cylinder engines installed in E60 vehicles are equipped with two different versions of VANOS, described below.

The BMW E46 engine utilizes two VANOS (variable camshaft timing) solenoids, one for the intake camshaft and one for the exhaust camshaft. These solenoids mount to the VANOS actuator at the front of your cylinder head. They are responsible for the direct oil flow to the VANOS actuator and can become restricted over time on high mileage engines. You can clean or replace the solenoids quite easily if needed. The exhaust side solenoid is a little harder to replace, due to space restrictions. The oil supply line to the VANOS actuator is also a problem area. It leaks over time at the hose clamp locations. The clamps are the crimp-type and cannot be replaced separately; you will have to replace the entire hose if it is leaking.

Keep in mind that when your car was serviced before, parts may have been replaced with different size fasteners used in the replacement. The sizes of the nuts and bolts we give may be different from what you have, so be prepared with different size sockets and wrenches.

Protect your eyes, hands and body from fluids, dust and debris while working on your vehicle. If  you are working with the electrical system, disconnect the battery before beginning. Always catch fluids in appropriate containers and properly dispose of any fluid waste. Recycle parts, packaging and fluids when possible. Do not work on your vehicle if you feel the task is beyond your ability.

Vehicle models change and evolve, as they grow older, so the vehicle shown in our illustrations may vary slightly from yours. If something seems different, let us know and share your info to help other users. Do you have questions or want to add to the article? Leave a comment below. When leaving a comment, please include your vehicle information.

In this article, I will go over how to replace each E46 VANOS solenoid and the VANOS oil supply line.

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| **Intake VANOS Solenoid** | |
| [While working at the left front corner of the cylinder head cover, disconnect the crankcase vent hose by squeezing the release tabs and pulling it away from the cylinder head cover.](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_small/pic01.jpg)  **Figure 1** | While working at the left front corner of the cylinder head cover, disconnect the crankcase vent hose by squeezing the release tabs and pulling it away from the cylinder head cover.  [Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_med/pic01.jpg) | [Extra-Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_large/pic01.jpg) |
| [Disconnect the VANOS solenoid electrical connector (green arrow).](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_small/pic02.jpg)  **Figure 2** | Disconnect the VANOS solenoid electrical connector (green arrow). Squeeze the metal release clip and pull it off the solenoid.  [Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_med/pic02.jpg) | [Extra-Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_large/pic02.jpg) |
| [Then, using a 32mm wrench, loosen the VANOS solenoid.](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_small/pic03.jpg)  **Figure 3** | Then, using a 32mm wrench, loosen the VANOS solenoid. If the VANOS oil line prevents access to the VANOS solenoid hex, remove the oil line 19mm banjo bolt. This will improve access to the VANOS solenoid. Be prepared to catch dripping oil with a rag.  [Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_med/pic03.jpg) | [Extra-Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_large/pic03.jpg) |
| [Unscrew the BMW E46 VANOS solenoid from the VANOS actuator.](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_small/pic04.jpg)  **Figure 4** | Unscrew the BMW E46 VANOS solenoid from the VANOS actuator. Have a rag handy to catch any dripping oil. Install the new VANOS solenoid in the reverse order. When complete, check the engine for oil leaks.  [Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_med/pic04.jpg) | [Extra-Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_large/pic04.jpg) |
| **Exhaust VANOS Solenoid** | |
| [Remove the engine cooling fan and the fan shroud.](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_small/pic05.jpg)  **Figure 5** | Remove the engine cooling fan and the fan shroud. Read our Pelican Parts technical article how to remove them. Once thatÃƒÂƒÃ‚Â‚ÃƒÂ‚Ã‚Â's done, locate the VANOS solenoid at the lower right side of the VANOS actuator (green arrow).  [Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_med/pic05.jpg) | [Extra-Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_large/pic05.jpg) |
| [Then disconnect the electrical connector by pressing the release tab and pulling it off (green arrow).](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_small/pic06.jpg)  **Figure 6** | Then disconnect the electrical connector by pressing the release tab and pulling it off (green arrow). Next, using a 32mm wrench, loosen the VANOS solenoid. You may have to use a short wrench or a 32mm crowfoot adapter, depending on the VANOS solenoid orientation in the VANOS actuator. Be prepared to catch dripping oil with a rag. Unscrew the VANOS solenoid from the VANOS actuator. Install the new VANOS solenoid in reverse order. When complete, check the engine for oil leaks.  [Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_med/pic06.jpg) | [Extra-Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_large/pic06.jpg) |
| **VANOS Oil Line** | |
| [Remove the alternator.](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_small/pic07.jpg)  **Figure 7** | Remove the alternator. Using a 19mm wrench, remove the VANOS oil line (below oil filter housing). Cover the line and opening to prevent any dirt from entering the VANOS system (purple arrow).  [Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_med/pic07.jpg) | [Extra-Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_large/pic07.jpg) |
| [Working at the rear of oil filter housing (purple arrow), using a 19mm wrench, remove the BMW E46 VANOS oil line.](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_small/pic08.jpg)  **Figure 8** | Working at the rear of oil filter housing (purple arrow), using a 19mm wrench, remove the *BMW E46 VANOS oil line*. Cover the line and opening to prevent dirt from entering the VANOS system (green arrow). Remove the VANOS oil line from the engine.Ã‚ Install new the VANOS oil line with new sealing washers and tighten the banjo bolt. Reinstall the alternator and check the engine for oil leaks once complete.  [Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_med/pic08.jpg) | [Extra-Large Image](https://cdn4.pelicanparts.com/BMW/techarticles/BMW-3-Series-E46/15-ENGINE-VANOS_Solenoid_Oil_Line_Replacement/images_large/pic08.jpg) |
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