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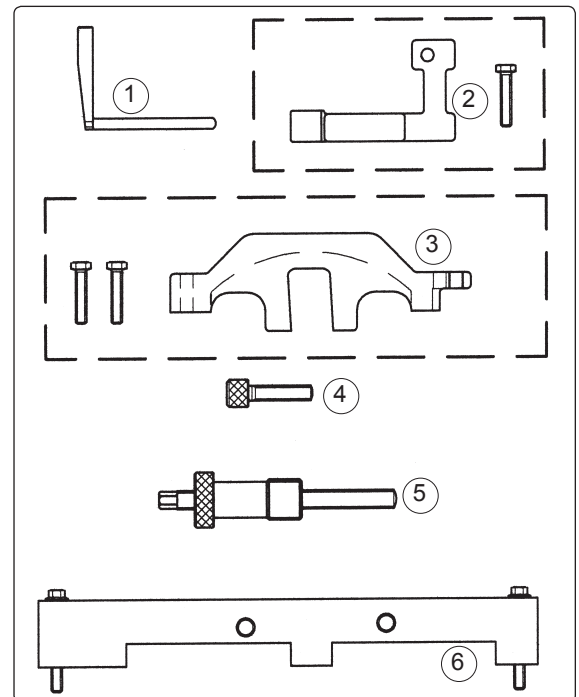


**IMPORTANT: PLEASE READ THESE INSTRUCTIONS CAREFULLY. NOTE THE SAFE OPERATIONAL REQUIREMENTS, WARNINGS AND CAUTIONS. USE THE PRODUCT CORRECTLY AND WITH CARE FOR THE PURPOSE FOR WHICH IT IS INTENDED. FAILURE TO DO SO MAY CAUSE DAMAGE AND/OR PERSONAL INJURY AND WILL INVALIDATE THE WARRANTY. PLEASE KEEP INSTRUCTIONS SAFE FOR FUTURE USE.**

### 1. SAFETY INSTRUCTIONS

- WARNING!** Ensure Health and Safety, local authority and general workshop practice regulations are adhered to when using tools.
- DO NOT** use tools if damaged.
- Maintain tools in good and clean condition for best and safest performance.
- Ensure that a vehicle which has been jacked up is adequately supported with axle stands.
- Wear approved eye protection. A full range of personal safety equipment is available from your Sealey dealer.
- Wear suitable clothing to avoid snagging. **DO NOT** wear jewellery and tie back long hair.
- DO NOT** attempt to start engine or move vehicle whilst in gear with locking devices fitted.
- Always display warning notification on steering wheel when locking engine components.
- Account for all tools, locking bolts, pins and parts being used and do not leave them in or near the engine.
- WARNING!** Incorrect or out of phase camshaft timing can result in contact between valve head and piston crown causing damage to the engine.
- IMPORTANT:** These instructions are provided as a guide only Always refer to the vehicle manufacturer's service instructions, or a proprietary manual, to establish the current procedure and data.

### 2. CONTENTS & APPLICATIONS



**Applications:**  
 BMW N40 and N45(T) Twin Camshaft Petrol engines in

**BMW  
 1 Series**  
 116i. E81/E87

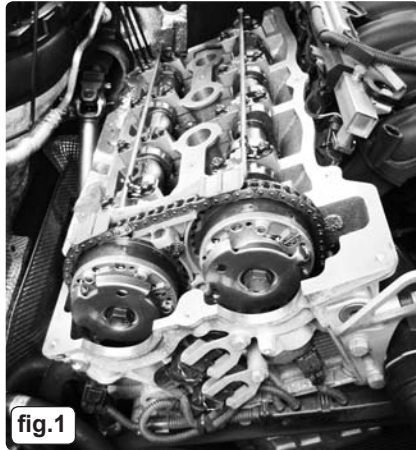
**3 Series**  
 316i. E46/E90  
 316Ci. E46  
 316ti. E46

**B16 (N40/N45/N45T) engines**

Kit contents/spares

Item	Part Number	Description
1	VS4801	Flywheel Locking Pin
<b>VS4868 Camshaft Setting Plate Assembly (items 2 to 4)</b>		
2	VS4868-1	Camshaft Setting Plate (Inlet)
3	VS4868-2	Camshaft Setting Plate (Exhaust)
4	VS4805-3	Camshaft Setting Plate Securing Screw
5	VS4803	Timing Chain Tensioner Pre-Load Tool
6	VS4869	VANOS Alignment Plate
--	VS4870-84	Case + Insert

### 3. INSTRUCTIONS



This range of 1.6 BMW 4 cylinder twin camshaft 16v. petrol engines have VANOS (VCT) units on inlet and exhaust camshafts but are not Valvetronic engines.

The N40 was introduced in the BMW 3 Series (E46) in 2001, followed by the N45 in the 1 Series (2003). The N45T appears in both the 1 Series and 3 Series from 2006.

#### VS4870 Setting/Locking Tool Kit

Comprises: VS4801 Flywheel Locking Pin

VS4803 Chain Tensioner Pre-Load Tool

VS4868 Camshaft Setting Plate Assembly

Comprises: VS4868-1 (Inlet Plate)

VS4868-2 (Exhaust Plate)

VS4805-3 (Securing Screw)

VS4869 VANOS Alignment Plate

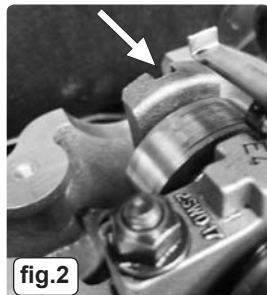
For checking and adjusting valve timing, the timing positions for the camshafts are achieved using the VS4868 Camshaft Setting Plate Assembly and the VS4803 Timing Chain Tensioner Pre-Load Tool.

The crankshaft is locked at TDC (via the flywheel) using VS4801 Locking Pin.

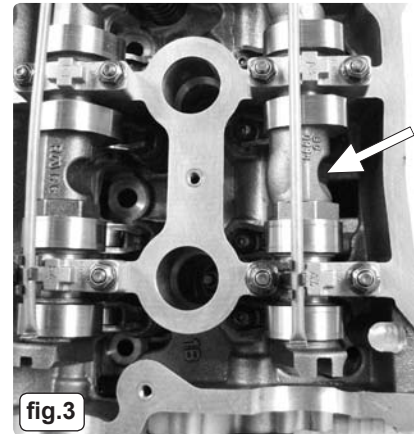
The VANOS Units positions are adjusted with VS4869 Alignment Plate.

#### 3.1 Checking valve timing

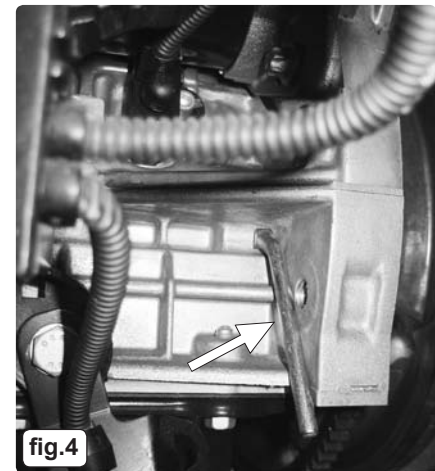
- 3.1.1 Remove the cylinder head cover and all spark plugs. Unscrew the bolt retaining the oil supply line and unclip the line. Turn the crankshaft, in normal direction of engine rotation, to TDC No.1 cylinder (ignition), using a wrench on the crankshaft pulley centre bolt.



- 3.1.2 Check the timing positions of the camshafts – each camshaft has a rectangular section at the rear which has a curved edge on top and a straight edge on the bottom. With the engine in the correct TDC engine timing position, the **curved edge** of the rectangles, on both camshafts, will be **uppermost** (fig.2).



An additional guide to correct camshaft position, using the exhaust camshaft, is that in the correct TDC engine timing position, the recesses in the sections of the exhaust camshaft between the lobes, will be pointing towards the exhaust manifold (fig.3).



#### 3.2 VS4801 Flywheel TDC Locking Pin

- 3.2.1 Insert VS4801 Flywheel TDC Locking Pin through the datum hole, which is located underneath the starter motor, and into the timing hole in the flywheel (fig.4).

**NOTE:** The datum hole can be difficult to locate and may be constricted by dirt/corrosion.

**IMPORTANT:** On Automatic Transmissions – there is a much larger hole in the flywheel very near to the timing hole and checks are required to ensure that this hole has not been selected in error. With VS4801 Locking Pin inserted, check that the engine will not rotate back and forth. Use a wrench on the crankshaft pulley bolt to rotate the engine.

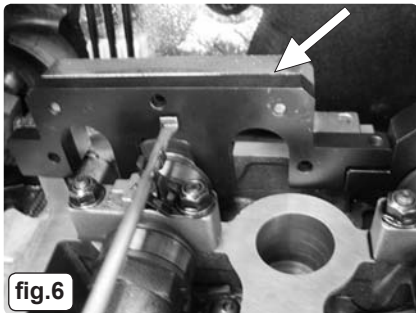
#### VANOS Units:

**IMPORTANT:** If the VANOS Unit has 'locked' correctly, the camshaft will not turn. If the VANOS Units cannot be locked to the camshafts, it is likely they are faulty, and must be replaced – refer to Removing and Installing VANOS Units.

#### 3.3 VS4868 Camshaft Setting Plate Assembly (comprises VS4868-1, VS4868-2 & VS4805-3)

- 3.3.1 Place VS4868-1 Camshaft Setting Plate on to the rectangular section at the rear of the INLET camshaft, and ensure the Plate **rests fully** on the surface of the cylinder head. (Do not insert fixing bolts) If timing is correct, VS4868-1 Plate should rest on the cylinder head without any gap, or at most, raised 0.5mm. to the exhaust side only (fig.5).





- 3.3.2 Place VS4868-2 Camshaft Setting Plate on to the rectangular section at the rear of the EXHAUST camshaft, and ensure the Plate **rests fully** on the surface of the cylinder head (Do not insert fixing bolts) (fig.6).

If timing is correct, VS4868-2 should rest on the cylinder head without any gap, or at most, raised 1.0mm to the exhaust side only.

If the above position cannot be achieved with the Setting Plates, then it will be necessary to adjust the timing.

Remove the Camshaft Setting Plates.

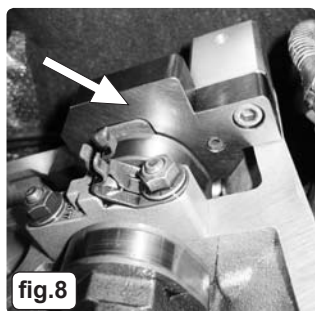
### 3.4 Adjusting timing



- 3.4.1 Slacken the bolts of the VANOS Units on the inlet and exhaust camshafts (fig.7).

**WARNING: These bolts are likely to be tight. It will be necessary to counter-hold against engine rotation at the crankshaft pulley centre bolt. Do NOT rely on the Flywheel Pin to counter-hold when loosening these bolts.**

- 3.4.2 Screw in the VANOS Unit bolts to finger-tight only, sufficient so there is no play or tilt on the units.
- 3.4.3 Ensure that the VS4801 Flywheel TDC Locking Pin is fitted into the timing hole in the flywheel.

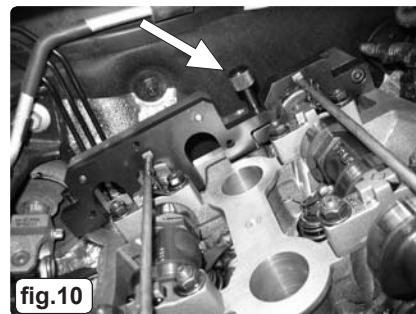


- 3.4.5 Place VS4868-1 Camshaft Setting Plate on to the rectangular section at the rear of the INLET camshaft, ensuring that the curved edge of the rectangular plate is uppermost. Align the camshaft so the Setting Plate **rests fully** on the surface of the cylinder head (Do not insert fixing bolt at this stage) (fig.8).



- 3.4.6 Fit VS4868-2 Camshaft Setting Plate on to the rectangular section at the rear of the EXHAUST camshaft, ensuring that the curved edge of the rectangular plate is uppermost. Align the camshaft so the Plate **rests fully** on the surface of the cylinder head (fig.9).

- 3.4.7 **Screw in the two fixing bolts and tighten to secure the Setting Plate VS4868-2 to the cylinder head.**



- 3.4.8 Screw in VS4805-3 Securing Screw into Setting Plate VS4868-2 until it presses on Setting Plate VS4868-1 (fig.10).

- 3.4.9 **Screw in the fixing bolt for VS4868-1 and tighten to secure this Setting Plate to the cylinder head.**

### 3.5 VS4803 Timing Chain Tensioner Pre-Load Tool

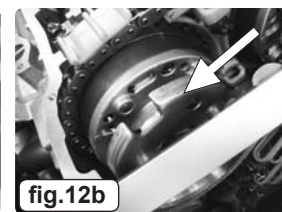
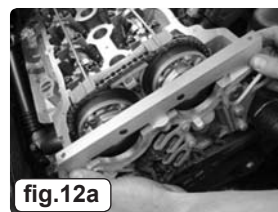


- 3.5.1 Remove the timing chain tensioner, and in its place insert VS4803 Tensioner Pre-Load Tool (fig.11).

- 3.5.2 Screw in the adjusting screw of VS4803, by hand, until it makes contact with the tensioner rail **but does not apply pressure.**

- 3.5.3 Remove the old bolts of the VANOS Units on the inlet and exhaust camshafts and fit new bolts. Screw in the bolts to finger-tight only, sufficient so there is no play or tilt on the units.

### 3.6 VS4869 Vanos Alignment Plate



- 3.6.1 Fit VS4869 VANOS Alignment Tool to the front of the Units ensuring that its two location pins enter into the holes in the VANOS Units (fig.12b) and that the Alignment Tool **fits fully** on to the surface of the cylinder head (fig.12a).



- 3.6.2 Screw in the two bolts and tighten to secure VS4869 to the cylinder head. Slacken the VANOS Unit bolts half turn and re-tighten to finger-tight (fig.13).



- 3.6.3 Attach a suitable torque wrench to the adjusting screw of VS4803 (fig.14). Turn to apply a pre-load to the tensioner rail of 0.6Nm.



- 3.6.4 Tighten the bolt of the exhaust camshaft VANOS unit to the specified torque, followed by the bolt of the inlet VANOS Unit, again, to the specified torque – Torque 20Nm. + 90°+ 90° (fig.15).
- 3.6.5 Remove the VS4869 VANOS Alignment Tool.
- 3.6.6 Unscrew the adjusting screw of VS4803 and remove the Pre-Load Tool.
- IMPORTANT:** Install the chain tensioner.
- 3.6.7 Remove **all** timing tools and turn the crankshaft twice (at the crankshaft pulley centre bolt), in normal direction of engine rotation, returning to TDC engine timing position, No.1 cylinder.
- 3.6.8 Insert the Flywheel TDC Locking Pin and Camshaft Setting Plates to check timing position, follow the procedure as described in “**Checking valve timing**”.

**Removing, Installing and Replacing VANOS Units.**

If either of the VANOS Units, on inlet or exhaust camshafts, cannot be ‘locked’ and are faulty, they must be replaced.

**3.7 Removal**



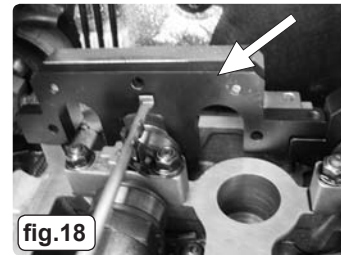
- 3.7.1 Slacken the bolts of the VANOS Units on the inlet and exhaust camshafts (fig.16).

**WARNING:** These bolts are likely to be tight. It will be necessary to counter-hold against engine rotation at the crankshaft pulley centre bolt. Do NOT rely on the Flywheel Pin to counter-hold when loosening these bolts.

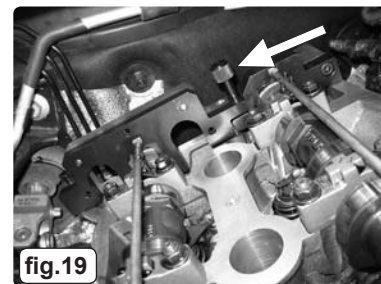
- 3.7.2 Screw in the bolts to finger-tight only, sufficient so there is no play or tilt on the units.
- 3.7.3 Ensure that the VS4801 Flywheel TDC Locking Pin is fitted into the timing hole in the flywheel.



- 3.7.4 Place VS4868-1 Camshaft Setting Plate on to the rectangular section at the rear of the INLET camshaft, ensuring that the curved edge of the rectangular plate is uppermost. Align the camshaft so the Setting Plate **rests fully** on the surface of the cylinder head. (Do not insert fixing bolt) (fig.17).



- 3.7.5 Place VS4868-2 Camshaft Setting Plate on to the rectangular section at the rear of the EXHAUST camshaft, ensuring that the curved edge of the rectangular plate is uppermost. Align the camshaft so the Plate **rests fully** on the surface of the cylinder head (fig.18).
- 3.7.6 **Screw in the two fixing bolts and tighten to secure the Setting Plate VS4868-2 to the cylinder head.**



- 3.7.7 Screw in VS4805-3 Securing Screw into Setting Plate VS4868-2 until it presses on Setting Plate VS4868-1 (fig.19).
- 3.7.8 **Screw in the fixing bolt for VS4868-1 and tighten to secure this Setting Plate to the cylinder head.**
- 3.7.9 Remove the timing chain tensioner.
- 3.7.10 Fully remove the bolt of the VANOS Unit on the **exhaust** camshaft. Lift chain off the sprocket and feed out and remove the **complete** VANOS Unit.
- 3.7.11 Repeat this procedure on the VANOS Unit on the **inlet** camshaft.

**3.8 Replacement**



**WARNING:** It is important to note that the Inlet and exhaust VANOS Units are different. It is essential to keep the parts of Inlet Unit separate from the Exhaust Unit. Under no circumstances should the parts be mixed or parts from any other engine variant be used.

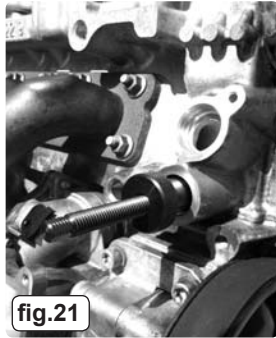
Inlet Unit part is marked “EIN / IN” (fig.20a) and the Exhaust Unit part marked “AUS / EX” (fig.20b).

**Installation**

- 3.8.1 Assemble the Unit of the Inlet camshaft, including the sensor gear (front plate), and feed on to the inlet camshaft fitting the chain onto the sprocket. Screw in a new bolt and tighten only so there is no play or tilting (finger-tight).

- 3.8.2 Assemble and install the Exhaust camshaft Unit and screw in a new bolt and tighten only so there is no play or tilting.

**IMPORTANT:** Press the chain rail, by hand, and ensure the timing chain is guided within the rail.



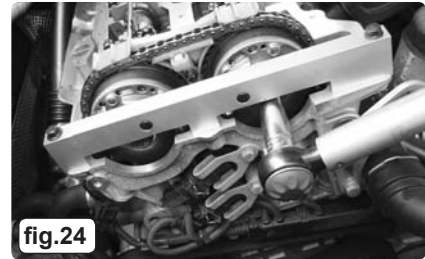
- 3.8.3 Insert VS4803 Tensioner Pre-Load Tool and screw in the adjusting screw by hand, until it makes contact with the tensioner rail (fig.21).



- 3.8.4 Fit VS4869 VANOS Alignment Tool to the front of the Units ensuring that its two location pins enter into the holes in the sensor gears and the Tool fits **fully** on to the surface of the cylinder head. Screw in the two bolts to secure VS4869 Tool to the cylinder head and tighten (fig.22).
- 3.8.5 Unscrew the bolts of the VANOS Units half turn and then tighten to finger-tight, ensuring that there is no play or tilting of the VANOS units.



- 3.8.6 Attach a suitable torque wrench to the adjusting screw of VS4803 (fig.23) and turn to pre-load the tensioner rail to 0.6Nm.



- 3.8.7 Tighten the bolt of the **exhaust** camshaft VANOS unit to the specified torque, followed by the bolt of the **inlet** VANOS Unit, again, to the specified torque – Torque 20Nm. + 90° + 90° (fig.24).
- 3.8.8 Remove VS4869 Alignment Tool.
- 3.8.9 Unscrew the adjusting screw of VS4803 and remove the Pre-Load Tool
- 3.8.10 **IMPORTANT:** Install the chain tensioner.
- 3.8.11 Remove all timing tools and turn the crankshaft twice (at crankshaft pulley centre bolt), in normal direction of engine rotation, returning to TDC engine timing position, No.1 cylinder.
- 3.8.12 Insert the Flywheel TDC Locking Pin and Camshaft Setting Plates to check timing position as described in “Checking valve timing”.

**NOTE:** It is our policy to continually improve products and as such we reserve the right to alter data, specifications and component parts without prior notice.

**IMPORTANT:** No liability is accepted for incorrect use of this equipment.

**WARRANTY:** Guarantee is 12 months from purchase date, proof of which will be required for any claim.

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