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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

Essential tools for timing BMW N47/N47S 2.0 twin camshaft diesel chain drive engines, fitted to the BMW 1 Series, 3 Series, 5 Series and X3.

Kit features crankshaft turning tool to rotate engine to TDC position. Supplied with warning tag.

Associated tool: VS5014 - H.P. Pump Remover / Sprocket Retainer. Used to remove high pressure pump and retains the pump sprocket in-situ. Reduces the level of engine dis-assembly required.

Associated Tool: VS5014



Kit contents/spares

Item	Part Number	Description
1	VS5011	Flywheel Locking Pin
2	VS5012	Camshaft Setting Plate
3	VS5013	Crankshaft Turning Tool
-	VS5010-84	Case & Insert



Applications:

BMW N47/N47S (chain) 2.0d Diesel engines in:

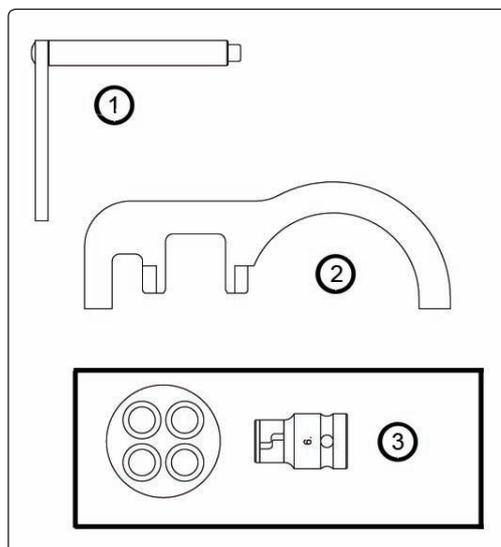
BMW:

1 Series: 118d (E81/E87)
 120d (E81/E82/E87)
 123d (E81/E82/E87)

3 Series: 318d (E90/E91)
 320d (E90/E91/E92)

5 Series: 520d (E60/E61)

X3: 2.0d (E83)



3. INSTRUCTIONS

VS5010 Diesel Engine Setting/Locking Tool Kit Comprises:

VS5011	Flywheel Locking Pin
VS5012	Camshaft Setting Plate
VS5013	Crankshaft Turning Tool

The BMW N47 2.0d twin camshaft diesel engine was introduced in 2005 and replaced the M47 engine. It is currently fitted to the BMW 1 Series, 3 Series, 5 Series and X3.

The inlet camshaft is driven, via the timing chain, directly from the crankshaft. The inlet and exhaust camshafts are connected via gears situated at the front of the camshafts.

Timing applications on this engine will require the removal of the camshaft cover, exposing the camshafts and camshaft sprockets.

Removal of the high pressure pump requires the use of associated tool VS5014 (not in kit), to retain the position of the pump sprocket, in-situ, whilst the pump is removed.

Details on the use of VS5014 are included in sections 3.3. and 3.4. of this manual.

3.1. Checking the camshaft timing.



fig.1

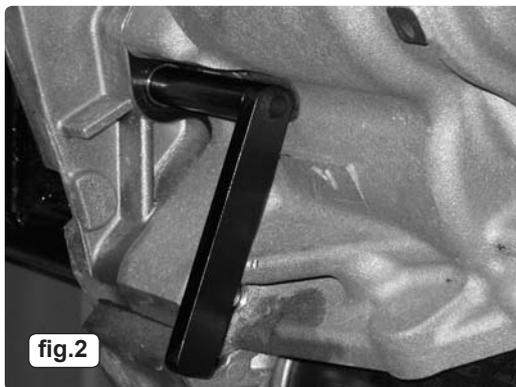


fig.2

VS5011 Flywheel Locking Pin

- 3.1.1. Remove the dust plug from the flywheel locking pin access hole (fig.1) and insert VS5011 Flywheel Locking Pin into the access hole (fig.2).

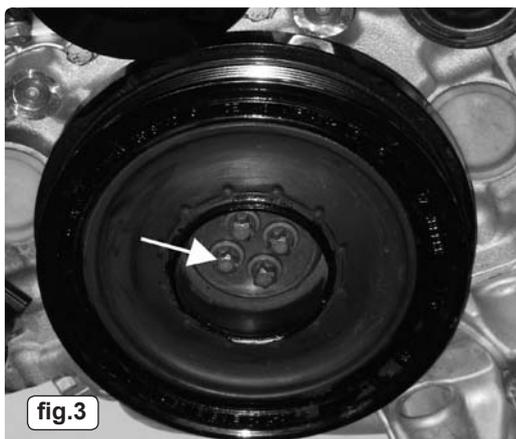


fig.3

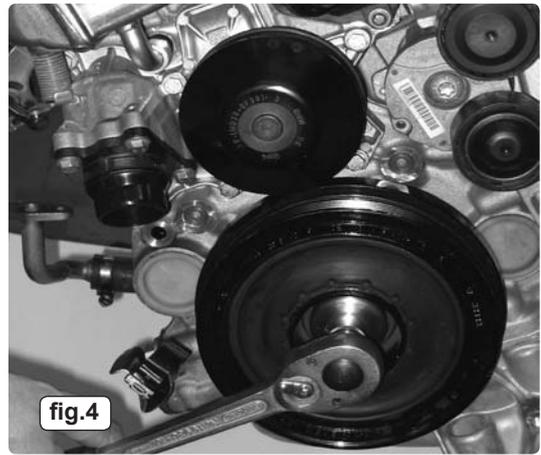


fig.4

VS5013 Crankshaft Turning Tool

- 3.1.2. Insert the VS5013 Crankshaft Turning Tool onto the front of the crankshaft pulley, locating it on to the heads of the 4 pulley retaining bolts (figs 3 and 4). Use VS5013 to turn the engine by hand in the **normal direction** to TDC No.1 cylinder position, and then push VS5011 the Flywheel Locking Pin further in to locate it into the datum hole in the flywheel. The crankshaft is now timed in the correct position.

WARNING: The engine must only be turned in the normal direction of rotation. It **MUST NOT** be turned in the opposite direction.

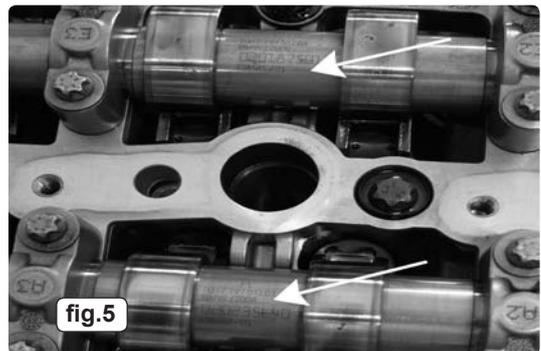


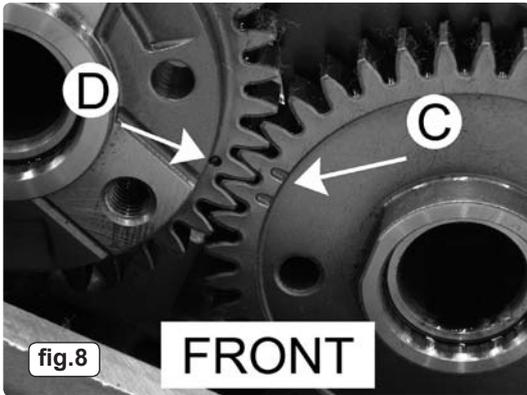
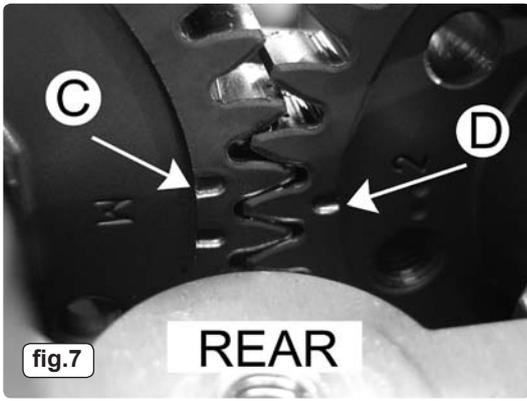
fig.5

NOTE: With the engine in this position it should be possible to read the part numbers on the inlet and exhaust camshafts from above (fig.5).



fig.6

- 3.1.3. TDC position is confirmed by the position of the camshaft lobes on the 1st cylinder pointing at a slight angle upwards and to the left – when viewed from the direction looking along the top of the engine, towards the rear of the camshaft gears (fig.6).



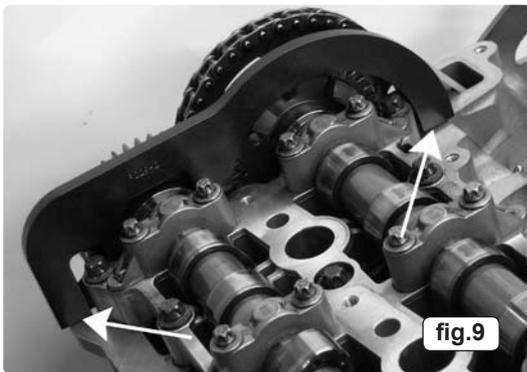
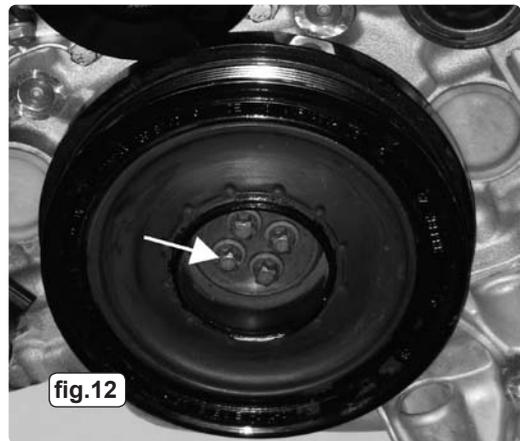
3.2. Adjusting the camshaft timing.

The following procedure covers valve timing adjustment and also applies to setting up the valve timing when installing the camshafts' gears after cylinder head overhaul etc.

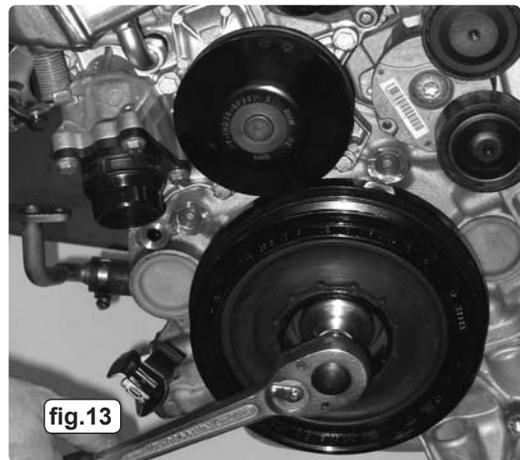
- 3.2.1. Remove the dust plug from the flywheel locking pin access hole (fig.10) and insert VS5011 Flywheel Locking Pin into the access hole (fig.11).

- 3.1.4. The camshaft timing marks are on the front and rear of the camshaft gears (see figs.7 and 8).

Check that the timing mark on the **exhaust** camshaft gear (C) is aligned with the timing mark on the **inlet** camshaft gear (D).

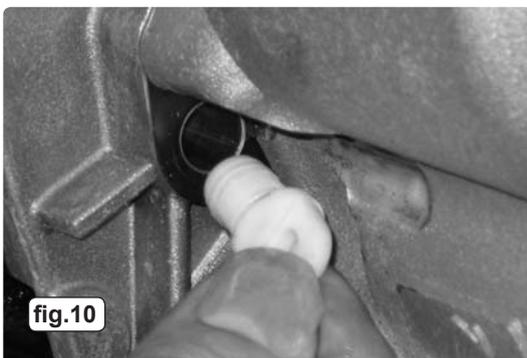


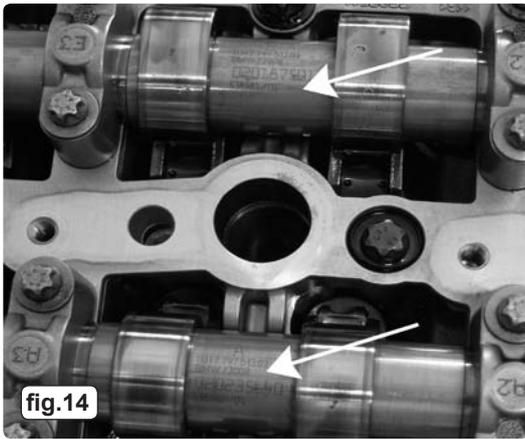
VS5012 Camshaft Setting Plate



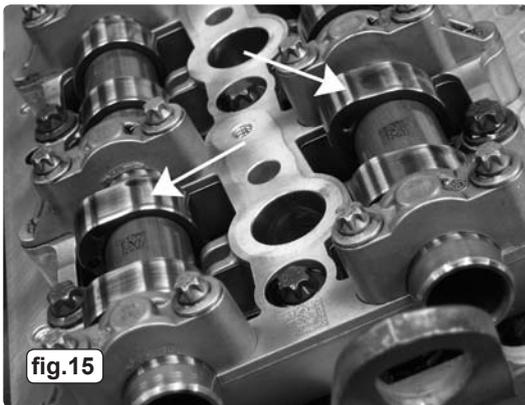
- 3.1.5. Position the VS5012 Camshaft Setting Plate onto the exhaust camshaft, making certain that each side of the tool sits flush on top of the cylinder head (fig.9). For the camshaft timing to be correct, the VS5012 Camshaft Setting Plate must be **fully in contact with both sides of the cylinder head** - i.e. sitting flush on the surface of the cylinder head, without a gap. **NOTE:** If the sprocket timing marks do not align and / or the VS5012 Camshaft Setting Plate does not fit flush onto the cylinder head, then timing adjustment will be necessary.

- 3.2.2. Insert the VS5013 Crankshaft Turning Tool onto the front of the crankshaft pulley, locating it on to the heads of the 4 pulley retaining bolts (figs.12 and 13). Use VS5013 to turn the engine by hand in the **normal direction** to TDC No.1 cylinder position, and then push the Flywheel Locking Pin further in to locate it into the datum hole in the flywheel. The crankshaft is now timed in the correct position. **WARNING:** The engine must only be turned in the normal direction of rotation. It **MUST NOT** be turned in the opposite direction.

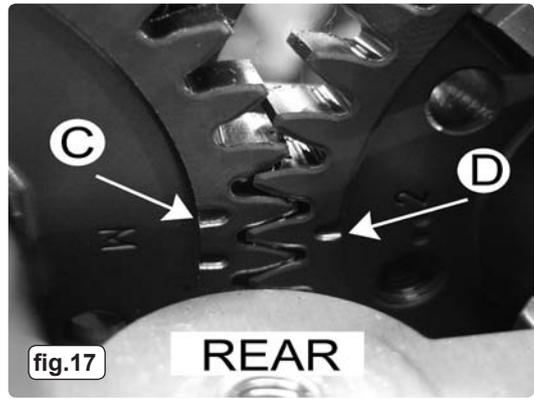
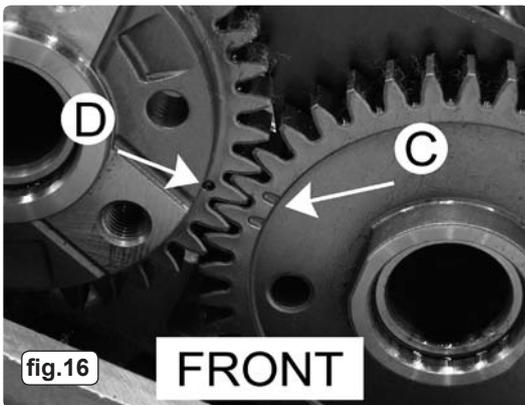




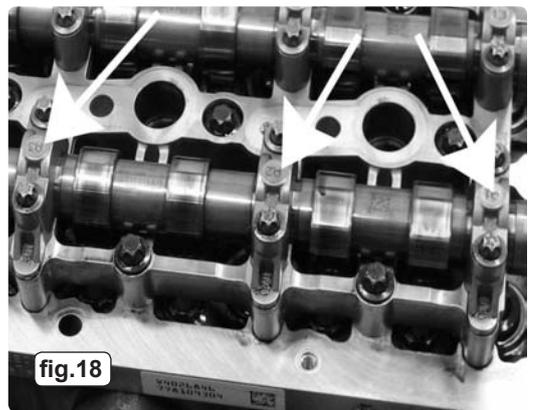
NOTE: With the engine in this position it should be possible to read the part numbers on the inlet and exhaust camshafts from above (fig.14).



3.2.3. TDC position is confirmed by the position of the camshaft lobes on the 1st cylinder pointing at a slight angle upwards and to the left – when viewed from the direction looking along the top of the engine, towards the rear of the camshaft gears (fig.15)



3.2.4. The timing mark on the exhaust camshaft gear (C) must be aligned with the timing mark on the inlet camshaft gear (D) (figs.16 and 17). If these marks are out of alignment the exhaust camshaft (C) must be removed in order to adjust the timing.



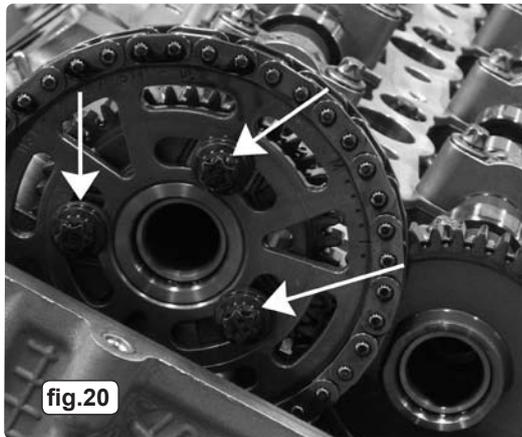
3.2.5. **Removing the exhaust camshaft**
Working from the outer bearing journals inwards, slowly release all of the bearing cap bolts from the bearing journals 1 to 5 (fig.18).

3.2.6. Place the bearing journal caps on a clean tray, keeping them in the correct sequence and orientation.

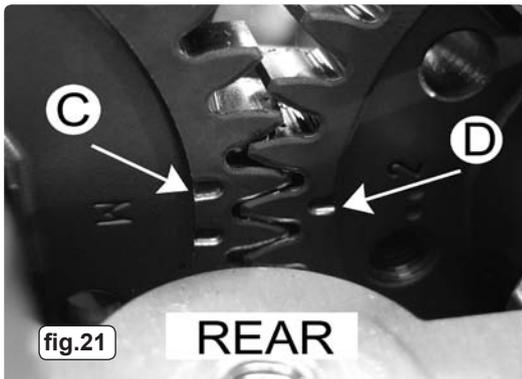
3.2.7. Remove the camshaft by gently pulling it upwards.



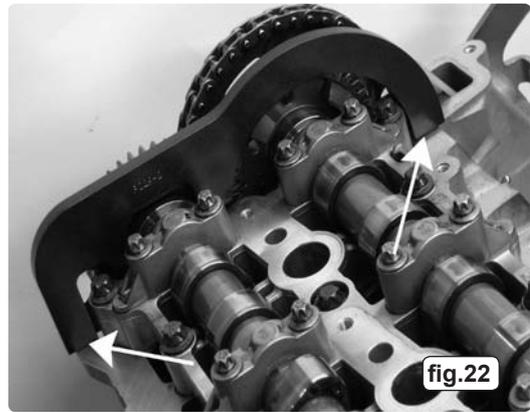
3.2.8. Remove the timing chain tensioner (fig.19).



- 3.2.9. Release and remove the three inlet camshaft chain sprocket bolts, and detach the camshaft sprocket (**fig.20**).



- 3.2.10. Reposition the inlet camshaft, noting the position of the roller cam follower.
- 3.2.11. Refit the exhaust camshaft, ensuring that the timing marks **(C)** and **(D)** are correctly aligned (**fig.21**).
- 3.2.12. Refit all of the bearing journal caps and lubricate the bearing faces with engine oil before installation, again check correct position and orientation of the bearing caps.
- 3.2.13. Progressively tighten all of the bearing fixing bolts working from the inner bearing journals outwards.
- 3.2.14. Torque the bolts to **10Nm**.
- 3.2.15. Position the inlet camshaft sprocket, with the timing chain in place, onto the inlet camshaft and ensure that the bolts are located in the centre of the adjustment slots (**fig.20**).
- 3.2.16. Tighten the bolts to **10Nm** and **slacken by ¼ turn**, to allow the sprocket position to adjust within the slots during chain tensioning.
- 3.2.17. Install the timing chain tensioner and tighten to **70Nm**.



- 3.2.18. Place the VS5012 Camshaft Setting Plate onto the exhaust camshaft, making certain that each side of the tool sits flush onto the cylinder head (**fig.22**).
- 3.2.19. Tighten the inlet camshaft sprocket bolts to **15Nm**.
- 3.2.20. Remove the VS5011 Flywheel Locking Pin and VS5012 Camshaft Setting Plate. Using VS5013 Crankshaft Turning Tool fitted onto the crankshaft pulley, turn the engine over by hand in the **normal direction** for two revolutions, returning to TDC No.1 cylinder position.
- 3.2.21. Refit the VS5011 Flywheel Locking Pin and the VS5012 Camshaft Setting Plate and check the timing marks on the camshaft gears for correct alignment.

VS5014 HP Pump Remover/Sprocket Retainer Associated Tool – (not in kit).

VS5014 H.P. Pump Remover and Sprocket Retainer covers removal of the High Pressure Diesel Pump on BMW models fitted with N47 / N47S engines.

The main purpose of the tool is to maintain the position of the pump sprocket during removal and refitting of the high pressure pump. This allows engine timing and the chain configuration to remain undisturbed, reducing the level of engine dis-assembly required.

WARNING: The alternator must be protected against oil, fuel and coolant ingress. All entry points to the fuel system must be sealed with protective caps to prevent contamination when disconnecting any of the fuel system components.

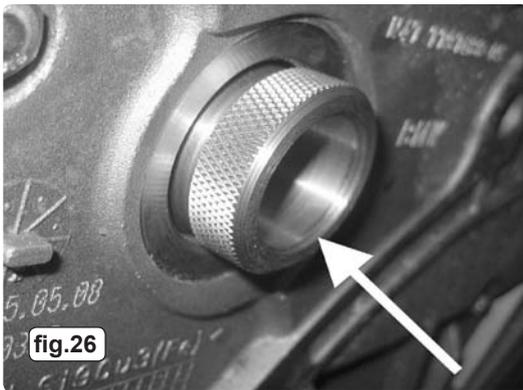
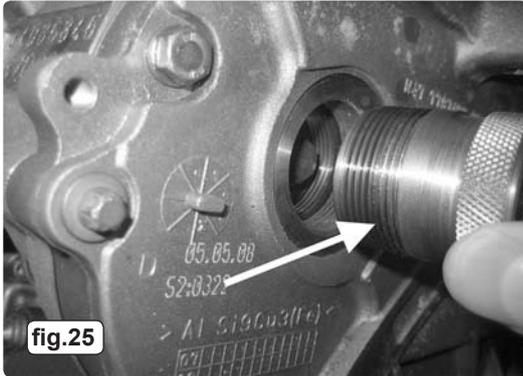
3.3. Removal of the High Pressure Pump.



- 3.3.1. Rotate the engine to TDC No.1 cylinder position and insert VS5011 Flywheel Locking Pin (**fig.23**) as detailed in section **3.1. Checking the camshaft timing**.

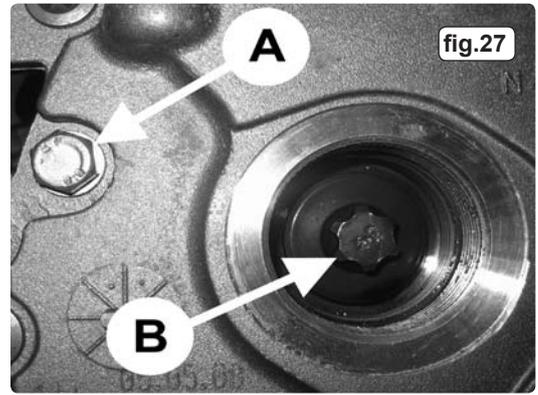


3.3.2. Remove the blanking plug from the engine (fig.24) to provide access to the pump sprocket centre bolt. **DO NOT** release the sprocket centre bolt at this stage.



3.3.3. Screw VS5014 onto the high pressure pump sprocket. The tool will pass through the front cover of the engine and screw fully into the thread of the sprocket (figs.25 and 26).

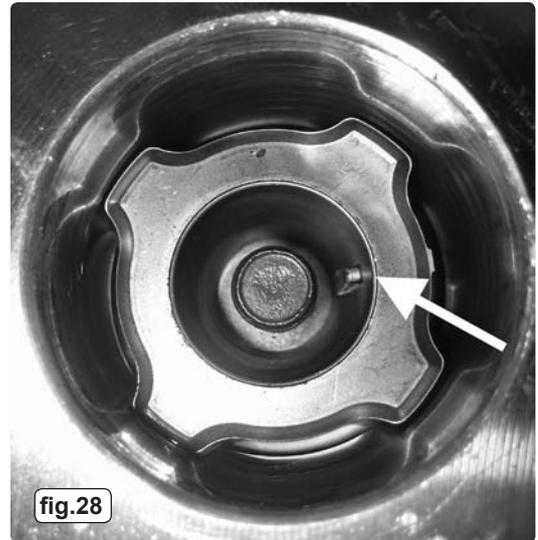
WARNING: VS5014 MUST NOT be removed from the sprocket until the high pressure pump has been refitted.



3.3.4. On E60 / E61 models, remove the high pressure pump cover plate. Remove the support bracket and the pump retaining bolts.
NOTE: Pump retaining bolt (fig.27.A) can remain in the engine casing throughout the procedure.
 Release the sprocket centre bolt and remove the pump.
NOTE: Pump sprocket centre bolt (fig.27.B) will remain in position throughout the procedure.

3.4. Installation of the High Pressure Pump.

3.4.1. The orientation of the high pressure pump in relation to the valvetrain has no effect on its function, but the drive shaft keyway and the sprocket location key must be correctly aligned during assembly (fig.28).



Pump sprocket key.

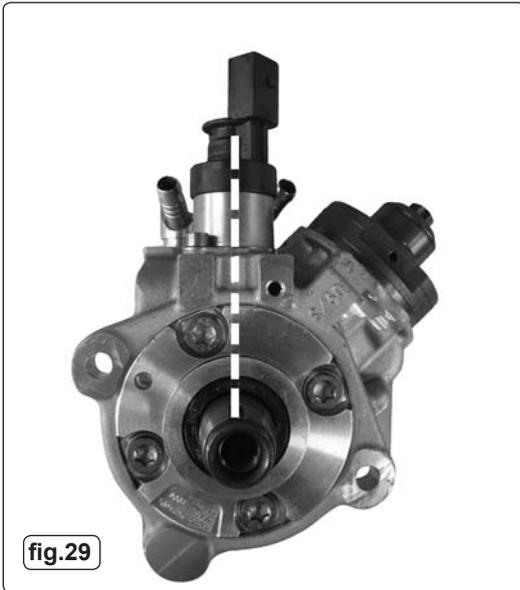


fig.29

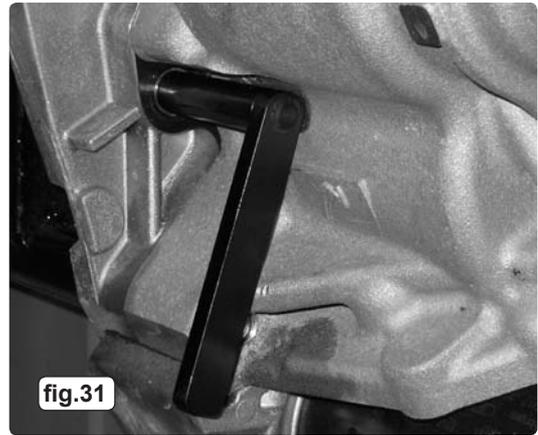


fig.31

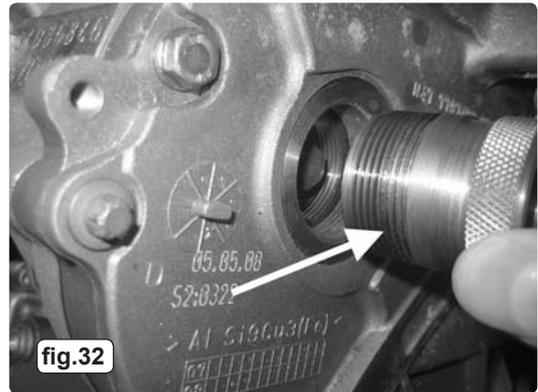


fig.32

3.4.2. Pump showing approximate position of keyway for installation (fig.29).
The drive shaft of the high pressure pump can be positioned by holding and rotating the shaft at its largest diameter. **DO NOT** use the tapered area or the keyway of the shaft to rotate the pump as this may damage the drive shaft and the sprocket.
Fit the sprocket retaining screw and the pump retaining bolts.

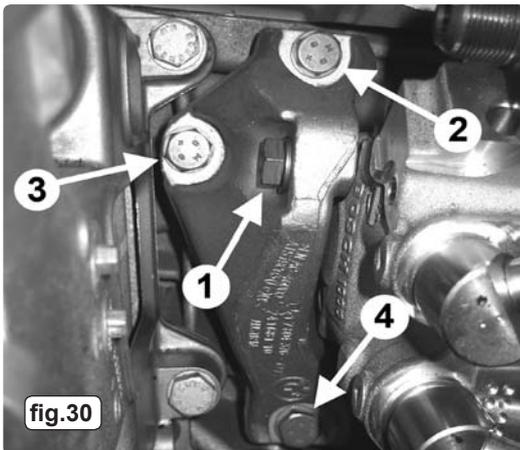


fig.30

3.4.3. **NOTE:** When reinstalling the support bracket for the high pressure pump, the securing screws should be fitted in a specific sequence (see fig.30).
Fit the support bracket and screws, tightening in sequence (1-2-3-4) until the support bracket is correctly positioned against the engine and the pump.
Then tighten the screws fully in sequence (2-3-4-1) to 19Nm.

3.4.4. **NOTE:** VS5014 can only be removed from high pressure pump sprocket when the sprocket retaining screw and pump support bracket are fully fitted.
Remove VS5011 Flywheel Locking Pin (fig.31) and VS5014 Pump Sprocket Retainer (fig.32). Re-fit the pump sprocket blanking plug.
Vent the fuel system and reset the high pressure fuel pump signal, (BMW diagnostic system may be required)
Check fuel system for leaks.

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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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