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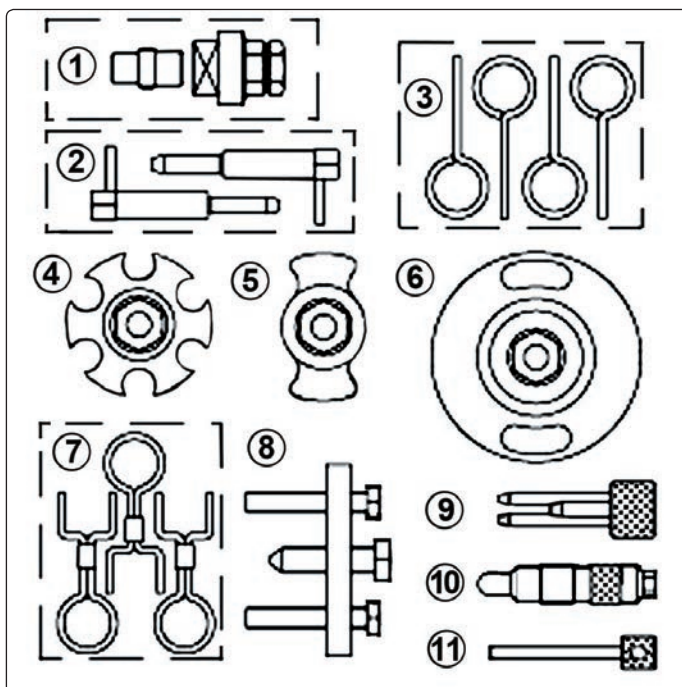
**IMPORTANT: PLEASE READ THESE INSTRUCTIONS CAREFULLY. NOTE THE SAFE OPERATIONAL REQUIREMENTS, WARNINGS AND CAUTIONS. USE THE PRODUCT CORRECTLY AND WITH CARE FOR THE PURPOSE FOR WHICH IT IS INTENDED. FAILURE TO DO SO MAY CAUSE DAMAGE AND/OR PERSONAL INJURY AND WILL INVALIDATE THE WARRANTY. PLEASE KEEP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

Comprehensive kit required for service work on timing chain, cylinder head and HP pump, and engine timing applications on VAG 2.7 - 3.0 TDiV6 and 4.0 - 4.2 TDiV8 Common rail diesel engines. Kit includes HP pump remover and required locking pin.



Item	Part No.	Description	OEM No.
1	VS5071	Crankshaft Adjuster - Pulley End	T40058
2	VS5072	Camshaft Locking Pin Set (*2 per kit)	T40060
3	VS5073	Tensioner Retaining Pin Set (*4 per kit)	n/a
4	VS5074	Camshaft Adjuster	T40062
5	VS5075	Camshaft Sprocket Adjuster	T40061
6	VS5076	Crankshaft Adjuster - Gearbox End	T40049
7	VS5077	Tensioner Retaining Pin Set (*3 per kit)	T40071
8	VS5078	H.P. Pump Sprocket Remover	T40064
9	VS5079	H.P. Pump Locking Pin	T40135
10	VS1242/01	Crankshaft Locking Pin	3242
11	VS124/V2	Balance Shaft Locking Pin	3359

This information table provides the Vehicle Manufacturers' Specialised Tool references and the Sealey tool numbers covering the relevant service application.

\*These spares are sold as individual tools - not as pairs or multiples.

#### Applications:

Make:	Model:	Year:
<b>Audi:</b>	A4	(05-12)
	A5	(07-12)
	A6	(04-11)
	A6 Allroad	(06-11)
	A8	(03-10)
	Q5	(08-13)
	Q7	(06-12)
<b>Volkswagen:</b>	Phaeton	(04-13)
	Touareg	(05-10)

#### Engine codes:

<b>2.7D TDiV6:</b>	BPP, CANA, CGKA,	BSG, CANB, CGKB.	CAMA, CANC,	CAMB, CAND,
<b>3.0D TDiV6:</b>	ASB, BMZ, CAPA, CASC, CCMA, CDYB,	BKN, BNG, CARA, CASD, CCWA, CDYC,	BKS, BUG, CASA, CATA, CCWB, CEXA.	BMK, BUN, CASB, CCLA, CDYA,
<b>4.0D TDiV8:</b>	ASE.			
<b>4.2D TDiV8:</b>	BTB,	BVN,	CKDA.	

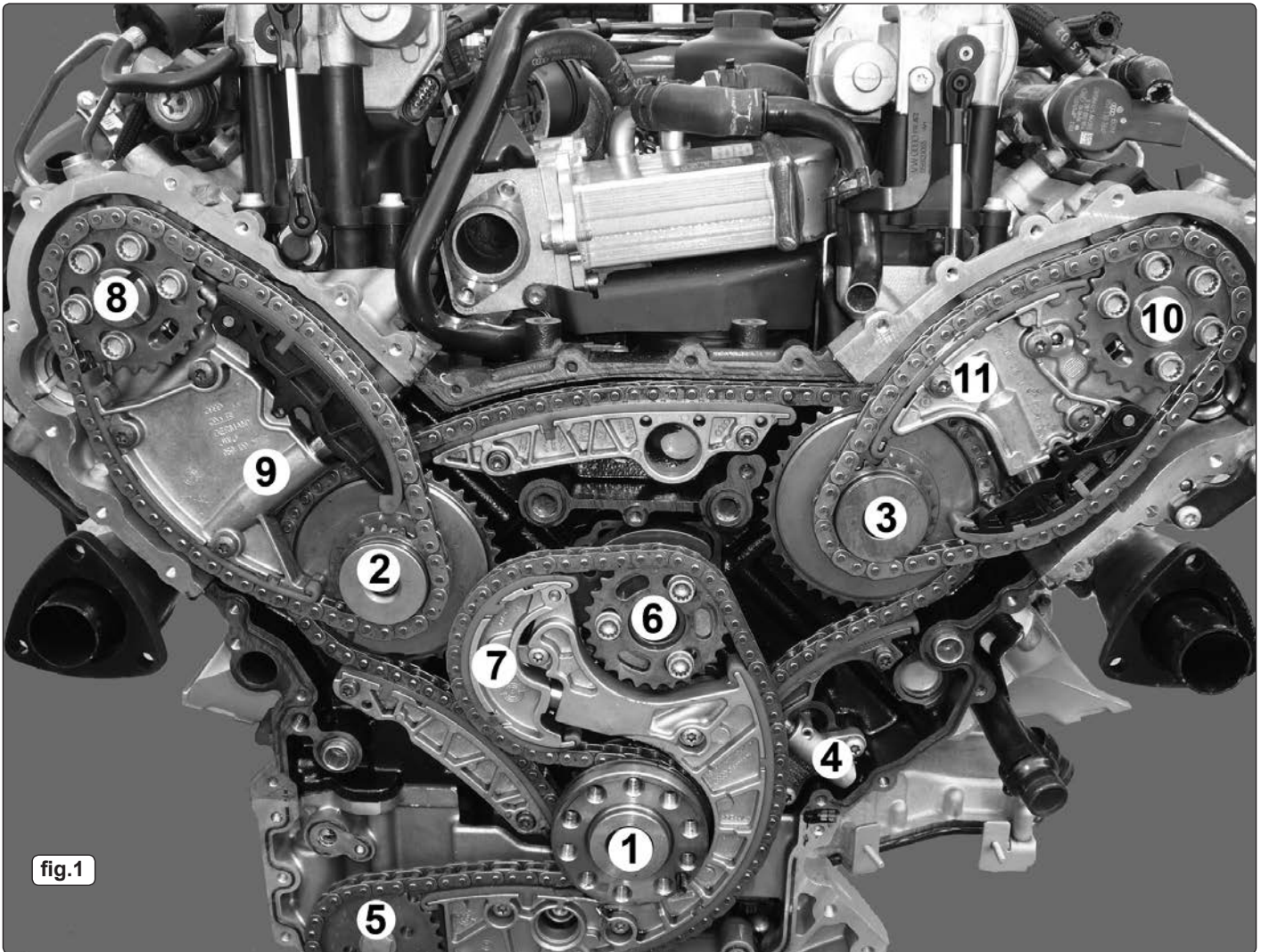
#### NOTE:

##### Additional tools required:

- VSE5852: Service Position Front End Support Guide Set.
- VS783: Camshaft Sprocket Holding Tool.
- PS960: Camshaft Pulley Removal Tool.

## Engine Introduction

This range of quad cam engines have 4 chains, and 4 tensioners, linking the oil pump, crankshaft, camshaft and balance shaft together. The chain system is located at the rear of the engine (gearbox end). The high pressure diesel pump is driven using a toothed belt from one of the camshafts.



### The Timing Chain Layout:

- |                                   |  |
|-----------------------------------|--|
| 1. Crankshaft                     | 7. Auxiliary Drive Chain Tensioner             |
| 2. Idler Pulley (Left Hand bank)  | 8. Camshaft (Left Hand bank)                   |
| 3. Idler Pulley (Right Hand bank) | 9. Camshaft Chain Tensioner (Left Hand bank)   |
| 4. Valve Gear Chain Tensioner     | 10. Camshaft (Right Hand bank)                 |
| 5. Oil Pump                       | 11. Camshaft Chain Tensioner (Right Hand bank) |
| 6. Balance Shaft                  |  |

**WARNING:** The crankshaft must only be rotated in the direction of engine rotation to avoid the risk of the timing chains slipping.

**NOTE:** All references to left and right hand banks are made as viewed when seated in the vehicle.

## 3. INSTRUCTIONS

### INDEX

- 3.1. Checking Camshaft Timing.
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  - 3.5.1. - V6 Engines with H.P. Diesel Pumps - that do not require timing.
  - 3.5.2. - V6 Engines with H.P. Diesel Pumps - that require timing.
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- 3.7. Camshaft Timing Chains Removal.
- 3.8. Camshaft Timing Chains Installation.



### 3.1. Checking Camshaft Timing

3.1.1. Remove the right hand bank camshaft sprocket access cover (fig.2).

3.1.2. Remove the vacuum pump from the left hand bank (fig.3).

3.1.3. Remove the crankshaft timing plug located on the side of the sump (fig.4).

**NOTE:** A small amount of oil may leak out when removing the crankshaft timing plug.

VS5071 Crankshaft Adjuster - Pulley End. VS5071 consists of two parts, an adjuster body and a location dowel. The adjuster body fits into a square formed by the eight crankshaft pulley bolts, whilst the dowel locates into a hole in the centre of the crankshaft (fig.5).

The location dowel is manufactured with two diameters and is reversible in order that the correct diameter can be selected for the appropriate application. The dowel can be separated from the adjuster body by unscrewing it.

For the diesel engines detailed in the Application List, the tool should be assembled so that the larger diameter of the dowel is used.

3.1.4. Fit VS5071 Crankshaft Adjuster to the centre of the crankshaft pulley.

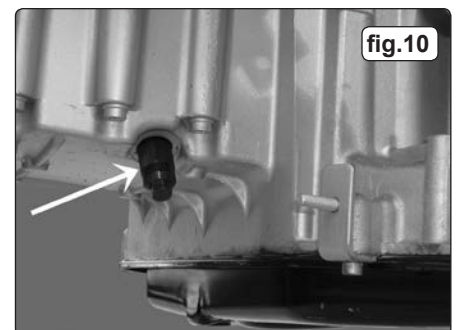
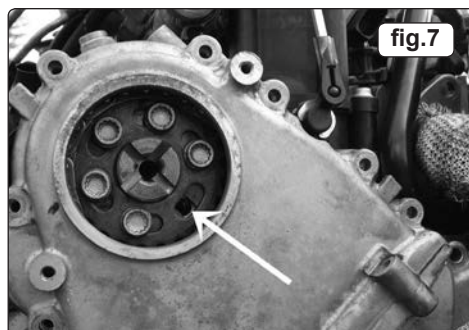
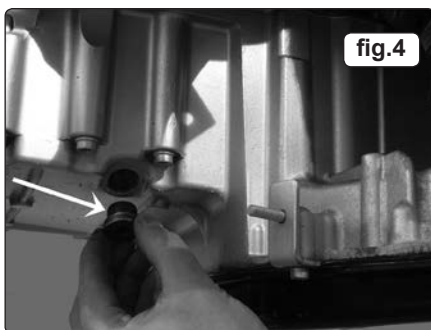
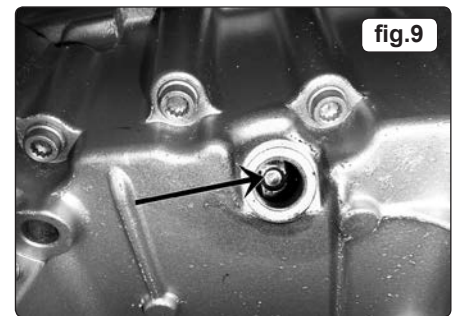
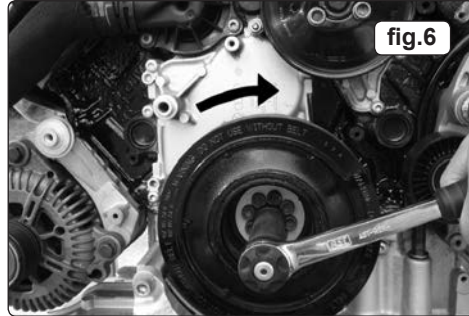
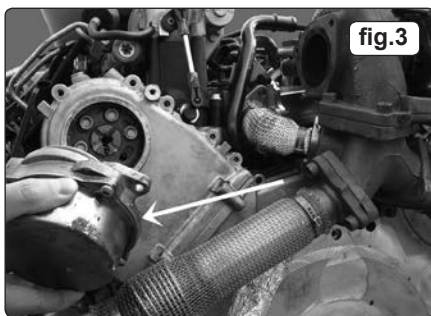
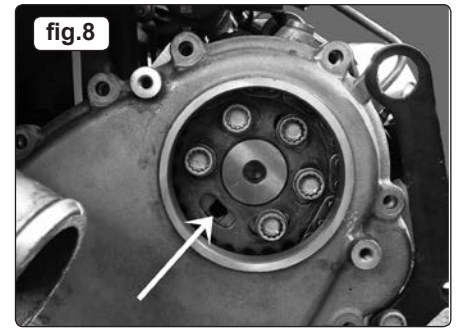
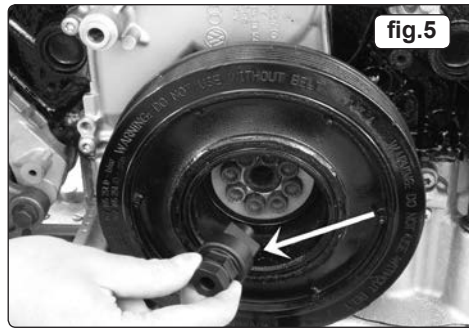
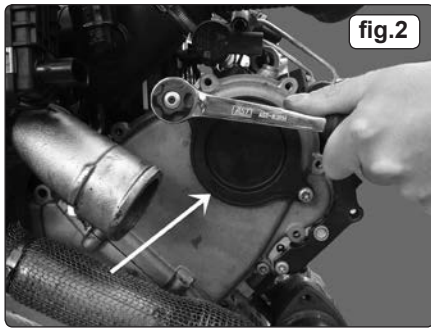
**NOTE:** The location hole in the centre of the crankshaft may contain dirt/corrosion. This may need to be cleaned out prior to fitting VS5071 Crankshaft Adjuster, to allow the dowel to enter the hole.

3.1.5. Using VS5071, rotate the crankshaft in the direction of rotation to TDC on No.1 cylinder (fig.6). At TDC on No.1 cylinder, the Camshaft Locking Pins will easily locate through the slots in the camshaft sprockets, the camshafts and into the datum holes in the cylinder heads (fig.7).

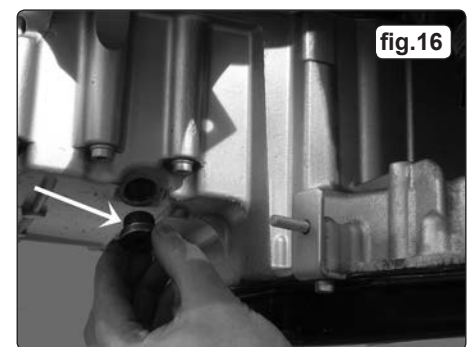
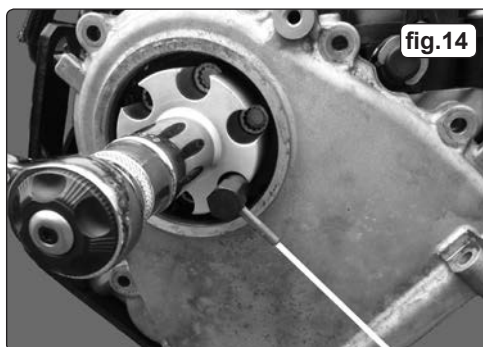
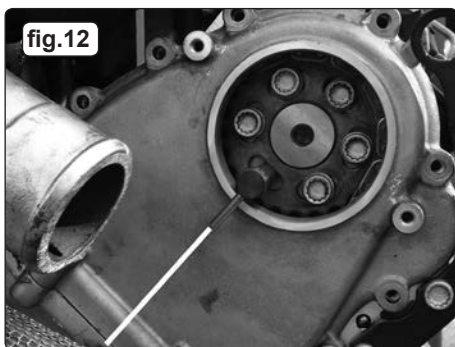
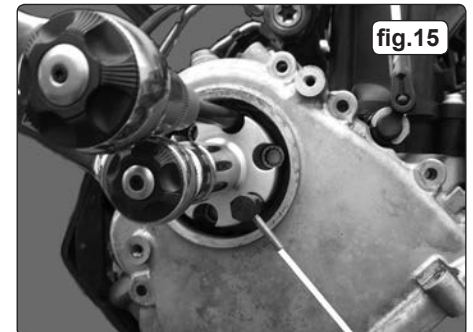
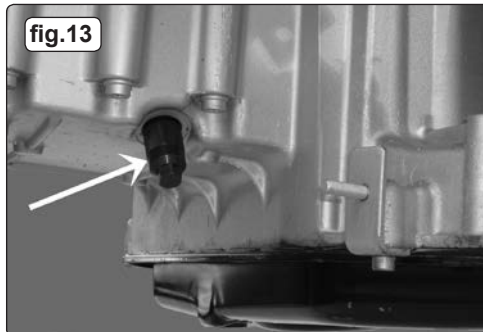
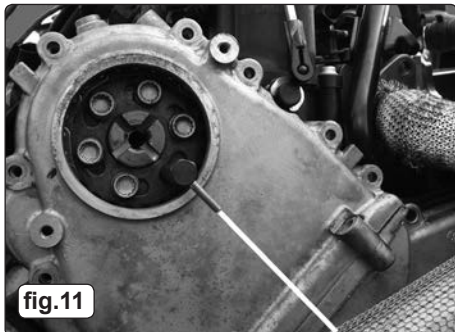
**NOTE:** At TDC, the slot of Left Hand Bank camshaft sprocket will be positioned at approximately 4 o'clock and the slot of Right Hand Bank camshaft sprocket will be positioned at approximately 8 o'clock (figs 7 and 8).

3.1.6. The Crankshaft Locking Pin locates into a hole in the crankshaft. With the engine at TDC on No.1 cylinder, this hole will be visible through the crankshaft timing plug hole (fig.9).

3.1.7. VS1242/01 Crankshaft Locking Pin - To "lock" the crankshaft, screw VS1242/01 Crankshaft Locking Pin **fully** into the crankshaft timing plug hole and tighten to 20Nm (fig.10).



- 3.1.8. VS5072 Camshaft Locking Pin Set (Pair) - VS5072 Camshaft Locking Pins have a “flat” machined on both sides. The “flats” are there to aid the installation of the Pins. The Pins should be inserted through both the sprockets and the camshafts, into the datum holes in the cylinder heads. The Locking Pins should then be rotated until the handles point downwards at an angle towards the crankshaft (figs.11&12).
- NOTE: DO NOT** apply undue force to VS5072 Camshaft Locking Pins. If it is not possible to install the Pins and to rotate them to their required position, without force, the timing will require adjustment.
- 3.2. Adjusting Camshaft Timing**
- 3.2.1. Ensure VS1242/01 Crankshaft Locking Pin is **fully** screwed into the crankshaft timing plug hole and tightened to 20Nm (fig.13).
- 3.2.2. VS5074 Camshaft Adjuster - Working on the camshaft requiring adjustment, slacken the five camshaft sprocket bolts by one turn, enabling the camshaft to move independently from the sprocket.
- 3.2.3. Using VS5074 Camshaft Adjuster, rotate the camshaft to allow VS5072 Camshaft Locking Pin to be inserted. Once fully inserted the Locking Pin can then be rotated until its handle points downwards at an angle towards the crankshaft (fig.14).
- 3.2.4. Using VS5074 Camshaft Adjuster to counter hold the camshaft, tighten the 5 camshaft sprocket bolts to 24Nm (fig.15).
- 3.2.5. Repeat the camshaft adjustment procedure on the second bank, if necessary.
- 3.2.6. Remove VS5072 Camshaft Locking Pins from the camshafts.
- 3.2.7. Remove VS1242/01 Crankshaft Locking Pin.
- 3.2.8. Using VS5071 Crankshaft Adjuster, rotate the crankshaft in the direction of engine rotation two revolutions returning to TDC on No.1 cylinder, and check camshaft timing - as per the procedure in Section 3.1.
- 3.3. Cylinder Head Removal**
- It is usually possible to remove the cylinder head(s) with the engine still fitted in the vehicle.
- NOTE:** If the H.P. diesel pump is driven from the camshaft of the cylinder head requiring removal, the toothed belt and pump sprocket will need to be removed first.
- 3.3.1. The H.P. diesel pump sprocket is removed using VS5078 - see H.P. diesel pump toothed belt removal & installation - Section 3.5.  
**WARNING: The direction of rotation must be marked on all chains and sprockets before removal. Damage may occur if chains or sprockets are refitted incorrectly.**
- 3.3.2. **NOTE:** It is necessary to “time” the engine prior to cylinder head removal.  
If the removal of only one cylinder head is required, remove the timing chain cover from that bank only. Removing the timing chain cover allows access to the camshaft, timing chain and chain tensioner. The camshaft sprocket on the opposite bank can be accessed for locking pin insertion by removing either the camshaft sprocket access cover, or vacuum pump or H.P. pump sprocket according to the engine being worked on.
- 3.3.3. Remove the crankshaft timing plug located on the side of the sump (fig.16).  
**NOTE:** A small amount of oil may drain from the engine when removing the crankshaft timing plug.





3.3.4. VS5071 Crankshaft Adjuster - Pulley End - VS5071 consists of two parts, an adjuster body and a location dowel. The adjuster body fits into a square formed by the eight crankshaft pulley bolts, whilst the dowel locates into a hole in the centre of the crankshaft (fig.17). The location dowel is manufactured with two diameters and is reversible in order that the correct diameter can be selected for the appropriate application. The dowel can be separated from the adjuster body by unscrewing it.

3.3.5. Fit VS5071 Crankshaft Adjuster to the centre of the crankshaft pulley.

**NOTE:** The location hole in the centre of the crankshaft may contain dirt/corrosion. This may have to be cleaned out prior to fitting VS5071 Crankshaft Adjuster to allow the dowel to enter the hole.

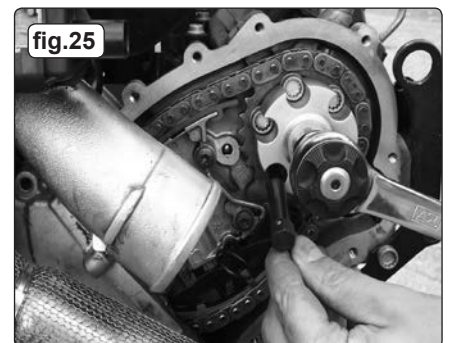
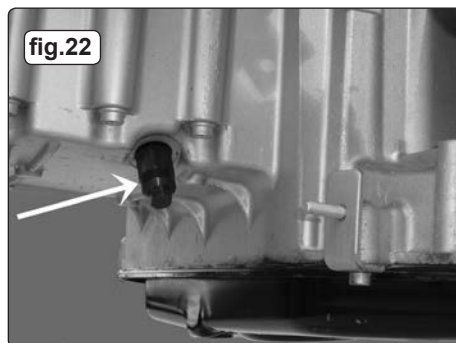
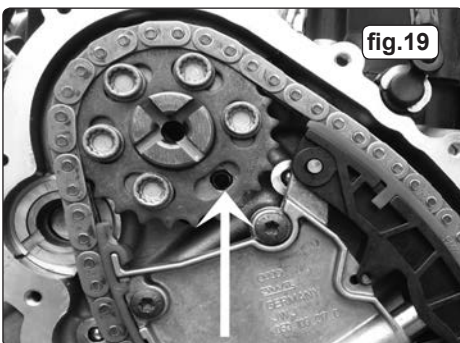
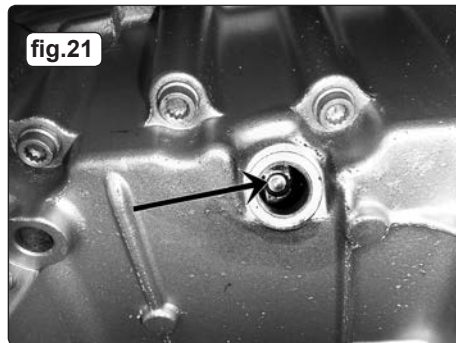
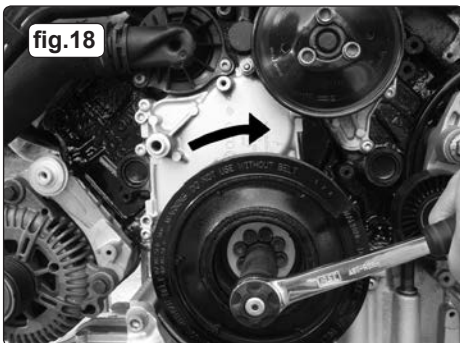
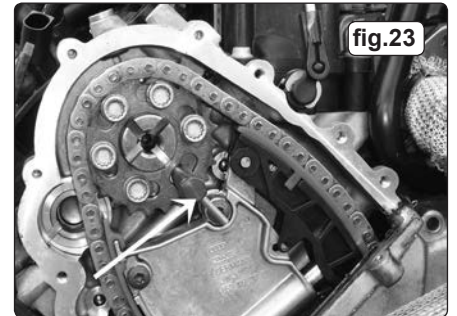
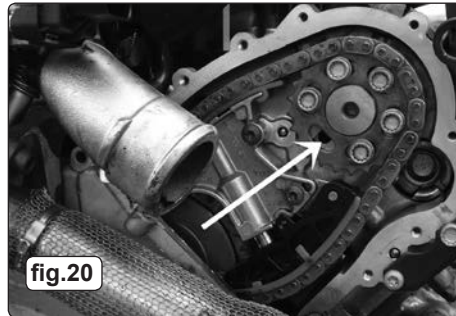
The camshaft sprockets are attached to the camshafts using five bolts. There is a slot in the camshaft sprocket where the Locking Pin locates through the camshaft and into the datum holes in the cylinder head.

3.3.6. Using VS5071, rotate the crankshaft in the direction of rotation to TDC on No.1 cylinder (fig.18). At TDC on No.1 cylinder, the slot of Left Hand Bank camshaft sprocket will be positioned at 4 o'clock approx (fig.19). The slot of Right Hand Bank camshaft sprocket will be positioned at 8 o'clock approx (fig.20) and the timing hole in the crankshaft will be visible through the crankshaft timing plug hole (fig.21).

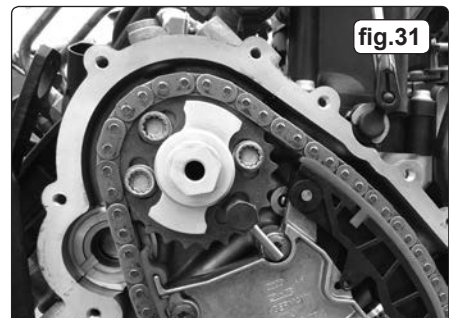
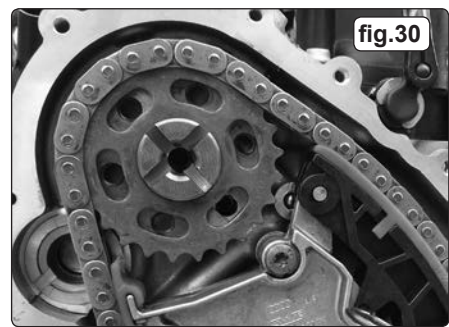
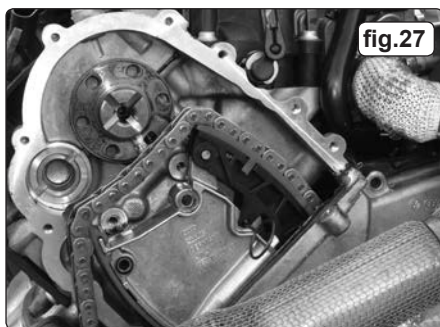
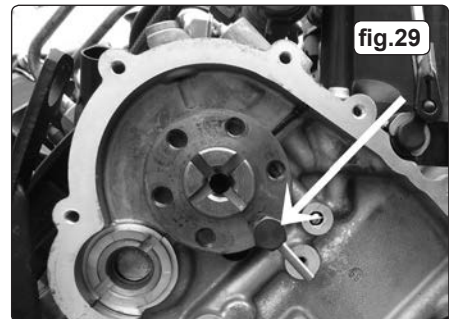
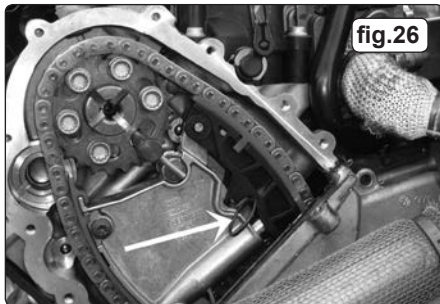
3.3.7. VS1242/01 Crankshaft Locking Pin - Screw VS1242/01 Crankshaft Locking Pin **fully** into the timing plug hole as shown and tighten to 20Nm (fig.22).

3.3.8. VS5072 Camshaft Locking Pin Set - VS5072 Camshaft Locking Pins have a "flat" machined on both sides. The "flats" are there to aid the installation of the Pins. The Pins should be inserted through both the sprockets and the camshafts, into the datum holes in the cylinder heads. The Locking Pins should then be rotated until the handles point downwards at an angle towards the crankshaft (figs 23 & 24).

**NOTE: DO NOT** apply undue force to the VSS5072 Camshaft Locking Pins to rotate. If it is not possible to install the Pins and to rotate them to their required position, slacken the five camshaft sprocket bolts one turn and fit VS5074 Camshaft Adjuster and use it to rotate the camshaft to allow VS5072 Camshaft Locking Pins to be fitted and rotated into their correct positions (fig.25).



- 3.3.9. VS5073/VS5077 Tensioner Retaining Pins - There are several chain tensioner variants fitted to these engines. VS5073 or VS5077 Tensioner Retaining Pins are required to ensure coverage of all variants. Select the appropriate Tensioner Retaining Pin. Press the chain tensioner rail, compressing the tensioner plunger and retain in place using VS5073 or VS5077 Tensioner Retaining Pin (fig.26).
- 3.3.10. Remove the five camshaft sprocket bolts. On the cylinder head being removed, remove VS5072 Camshaft Locking Pin and the camshaft sprocket from the camshaft (fig.27).
- 3.3.11. Remove the chain tensioner (fig.28). **IMPORTANT:** Plug tensioner/cylinder head oil ways to prevent the ingress of dirt. **WARNING: The camshafts MUST NOT be allowed to rotate whilst the engine is at TDC or damage may occur to valves and pistons.**
- 3.3.12. Refit VS5072 Camshaft Locking Pin to prevent the camshaft rotating while the remaining work is carried out in order to remove the cylinder head (fig.29).  
**WARNING: Damage may occur to the glow plugs and open valves when placing the cylinder head on a flat surface.**
- 3.4. Cylinder Head Installation**
- 3.4.1. Ensure the crankshaft is positioned at TDC on No.1 cylinder with VS1242/01 Crankshaft Locking Pin fitted, and that the camshafts are in their "timed" positions with VS5072 Camshaft Locking Pins correctly installed.
- 3.4.2. Refit the cylinder head. On the cylinder head being installed, remove VS5072 Camshaft Locking Pin to allow installation of the timing chain, camshaft sprocket and chain tensioner.
- 3.4.3. Install the camshaft sprocket and the chain, aligning the elongated holes of the camshaft sprocket centrally over the five camshaft sprocket bolt holes (fig.30).
- 3.4.4. Re-install VS5072 Camshaft Locking Pin.  
**IMPORTANT:** As the tensioner bolts have been released they must be replaced with **new** bolts.
- 3.4.5. Fit the tensioner using **new** tensioner bolts and tighten to 5Nm + 90°.
- 3.4.6. Fit three camshaft sprocket bolts in the positions shown in fig.31, finger tight only, ensuring it is possible for the camshaft sprocket to rotate on the camshaft for adjustment.
- 3.4.7. Release the timing chain tensioner by removing the Tensioner Retaining Pin.
- 3.4.8. VS5075 Camshaft Sprocket Adjuster - The camshaft timing chain of the cylinder head being worked on requires preloading. This ensures any slack in the chain is moved to the tensioner side. Using VS5075 Camshaft Sprocket Adjuster, apply the specified preload torque in a **clockwise** direction, Right Hand Bank - 20Nm, Left Hand Bank - 15Nm.
- 3.4.9. Whilst maintaining the preload torque, tighten the three camshaft sprocket bolts to 23Nm.
- 3.4.10. Remove VS5075 Camshaft Sprocket Adjuster.
- 3.4.11. Install the two remaining camshaft sprocket bolts, then using VS5074 Camshaft Adjuster to counter hold the camshaft, tighten all five camshaft sprocket bolts to 23Nm.
- 3.4.12. Remove VS1242/01 Crankshaft Locking Pin, and VS5072 Camshaft Locking Pins.
- 3.4.13. Using VS5071 Crankshaft Adjuster, rotate the crankshaft in the direction of engine rotation two revolutions and check camshaft timing - as per the procedure in Section 3.1.





### 3.5. H.P. Diesel Pump Toothed Belt Removal and Installation

The H.P. diesel pump is driven from a camshaft using a toothed belt.

**NOTE:** The location of the diesel pump differs on V6 and V8 engines. On both engines types the H.P. diesel pump is located within the “V”, but on V6 engines it is located at the front of the engine and on V8 engines it is at the rear.

There are different procedures for removing and installing the H.P. diesel pump toothed belt. Some diesel pumps do not have a “timed” position, while on other variants the H.P. diesel pump must be “timed” using the VS5078 Pin to position the H.P. diesel pump sprocket, and VS1242/01 Pin to lock the crankshaft.

H.P. diesel pumps which require setting in a “timed” position have a timing hole in the pump sprocket, and two holes in the pump body in order to locate VS5078 Pin and position the H.P. pump sprocket correctly.

**NOTE:** Mark the belt to show its direction of rotation before removal. If the used toothed belt is to be refitted, it must be reinstalled so it operates in the same direction of rotation.

#### 3.5.1. V6 Engines with H.P diesel pumps that do not require timing

##### Removal

3.5.1.1. Remove the engine cover to give access to the pump belt. Slacken the belt tensioner bolt and remove the pump belt.

3.5.1.2. VS5078 H.P. Pump Sprocket Remover - If the pump sprocket requires removal, remove the weight from the H.P. diesel pump using a suitable counter-hold such as a Camshaft Sprocket Holding Tool.

3.5.1.3. Attach VS5078 H.P. Pump Sprocket Remover to the sprocket using the two bolts provided (fig.32).

3.5.1.4. Remove the sprocket by tightening the central force screw.

##### Installation

3.5.1.5. Fit the H.P. diesel pump toothed belt.

3.5.1.6. Using a hex key, rotate the tensioner in the direction indicated on the tensioner until the indicator lug is approximately 5mm below the notch (fig.33).

3.5.1.7. Release the tensioner until the indicator lug and the notch are aligned (fig.34), then tighten the tensioner bolt.

3.5.1.8. Using VS5071 Crankshaft Adjuster, rotate the crankshaft in the direction of engine rotation two revolutions and check the indicator lug and the notch are aligned.

3.5.1.9. If the indicator lug and the notch are not aligned then slacken the tensioner bolt and using a hex key on the tensioner, adjust the belt tensioner so that the lug and notch are aligned.

#### 3.5.2. V6 Engines with H.P diesel pumps that do require timing

##### Removal

3.5.2.1. Remove the engine cover to give access to the pump belt.

3.5.2.2. Slacken the belt tensioner bolt.

3.5.2.3. Slacken the camshaft sprocket bolt two turns while using a suitable counter hold tool, such as a Camshaft Sprocket Holding Tool.

3.5.2.4. Remove the pump belt.

##### Installation

3.5.2.5. Using a suitable remover such as a Camshaft Sprocket Remover, release the camshaft sprocket from the camshaft (fig.35). Ensure the camshaft sprocket is free to rotate on the camshaft.

3.5.2.6. Using VS5071 Crankshaft Adjuster, rotate the crankshaft in the direction of engine rotation to TDC position on No.1 cylinder.

3.5.2.7. Screw VS1242/01 Crankshaft Locking Pin **fully** into the crankshaft timing plug hole and tighten to 20Nm.

3.5.2.8. VS5079 H.P. Pump Locking Pin - Position the pump sprocket and lock in position using VS5079 H.P. Pump Locking Pin (fig.36).

3.5.2.9. Fit the H.P. diesel pump toothed belt.



fig.32



fig.34



fig.35

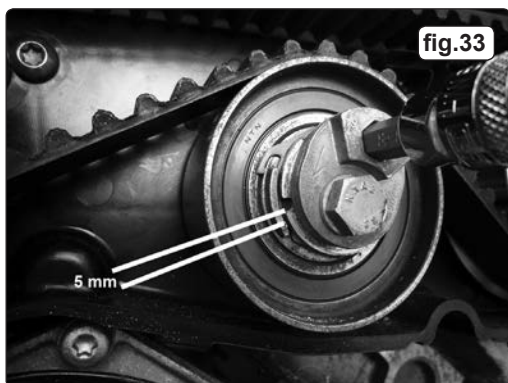


fig.33

5 mm



fig.36

- 3.5.2.10. Using a hex key, rotate the tensioner in the direction indicated on the tensioner until the indicator lug is approximately 5mm below the notch (fig.37).
- 3.5.2.11. Release the tensioner until the indicator lug and the notch are aligned, then tighten the tensioner bolt (fig.38).
- 3.5.2.12. Tighten the camshaft sprocket bolt while using a suitable counter hold tool, such as a Camshaft Sprocket Holding Tool.
- 3.5.2.13. Remove VS1242/01 Crankshaft Locking Pin, and replace the crankshaft timing plug.
- 3.5.2.14. Using VS5071 Crankshaft Adjuster, rotate the crankshaft in the direction of engine rotation two revolutions and check the indicator lug and the notch are aligned.

**3.5.3. V8 Engines with H.P diesel pumps that do not require timing.**

**NOTE:** Mark the belt to show its direction of rotation before removal. If the used toothed belt is to be refitted, it must be reinstalled so it operates in the same direction of rotation.

**Removal**

- 3.5.3.1. Remove the engine cover to give access to the pump belt.
- 3.5.3.2. Remove the tensioner bolt and the tensioner.
- 3.5.3.3. Remove the toothed belt.

**Installation**

- 3.5.3.4. Preload the tensioner by rotating the arm by hand and retain in place using a VS5073 Tensioner Retaining Pin. Install the toothed belt, tensioner and tensioner bolt. Tension the belt by removing the pin.

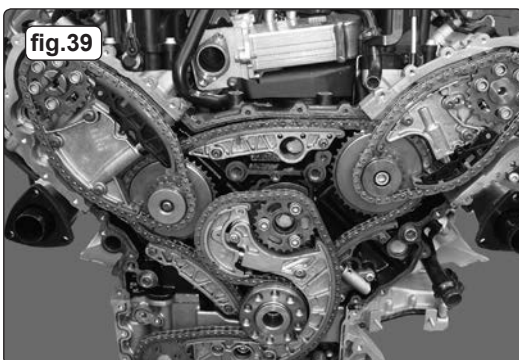
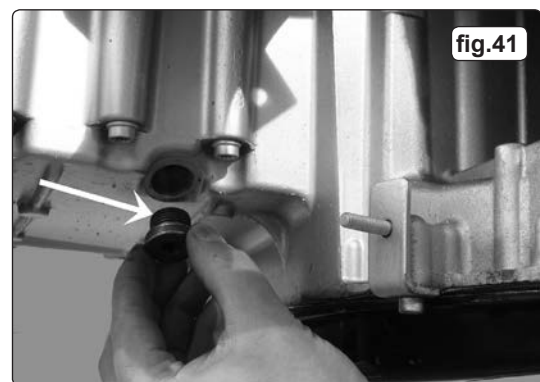
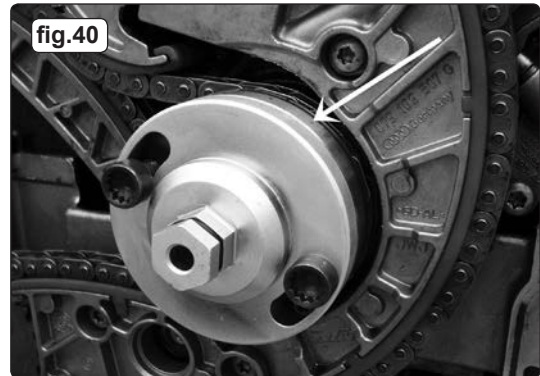
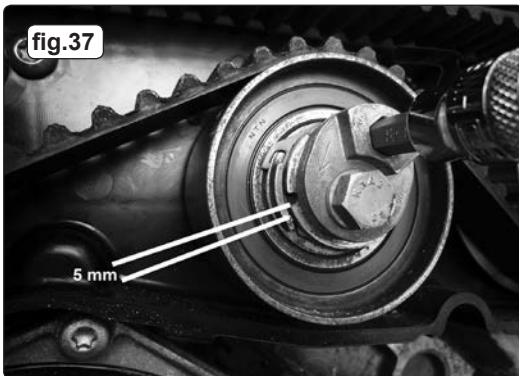
**3.6. Timing Chains Removal and Installation**

In order to carry out repair work which involves the removal of the timing chains, it will be necessary to remove the engine from the vehicle and separate the gearbox from the engine.

**NOTE:** It is necessary to "time" the engine prior to timing chain removal.

**WARNING:** The direction of rotation must be marked on all chains and sprockets before removal. Damage may occur if chains or sprockets are refitted incorrectly.

- 3.6.1. Remove the three timing chain covers giving access to the timing chains (fig.39).
- 3.6.2. VS5076 Crankshaft Adjuster, Gearbox End - Install VS5076 Crankshaft Adjuster to the crankshaft and secure in place using bolts (fig.40).  
**NOTE:** Bolts from the automatic gearbox drive plate can be used to secure VS5076. Bolts from manual gearbox dual mass flywheels **MUST NOT** be used, as they are too long and may damage the timing chain assemblies.
- 3.6.3. Remove the crankshaft timing plug located on the side of the sump (fig.41).  
**NOTE:** A small amount of oil may leak out when removing the crankshaft timing plug.



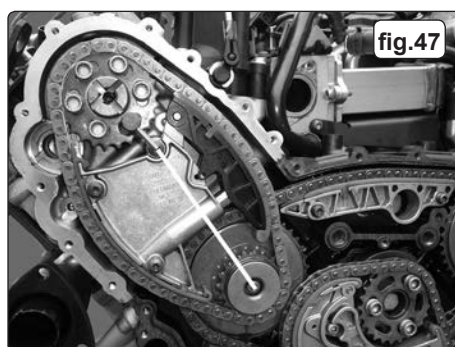
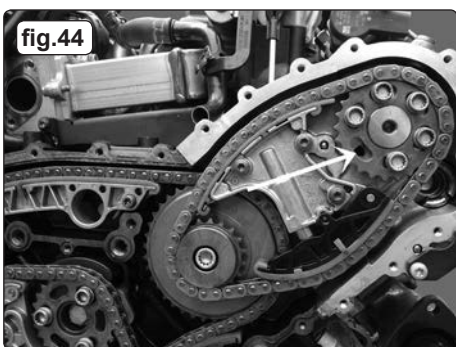
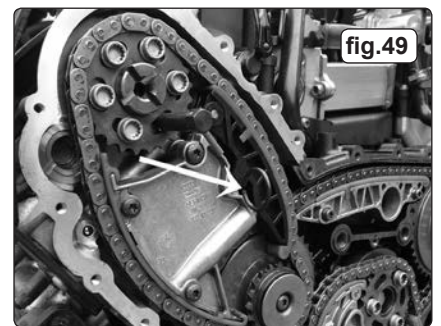
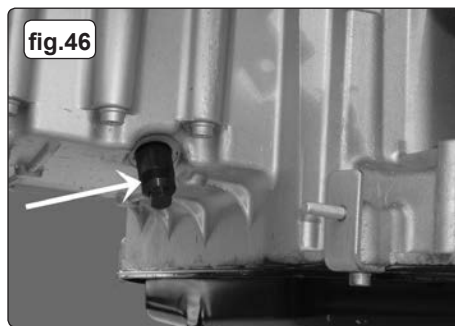
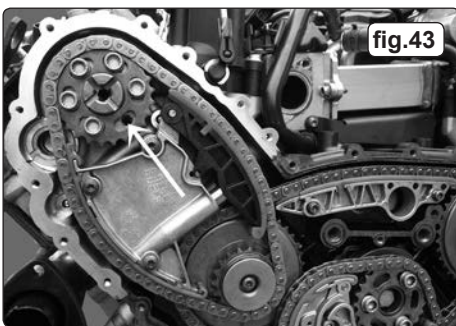
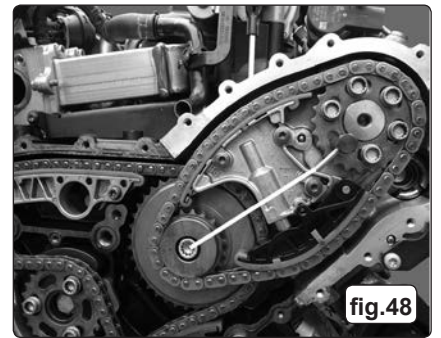
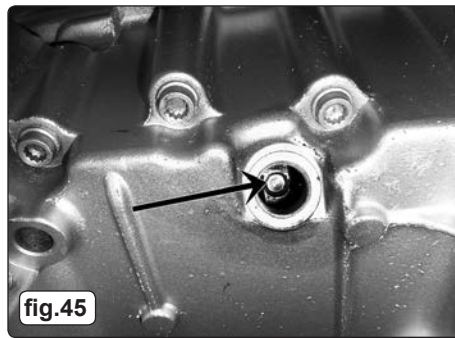
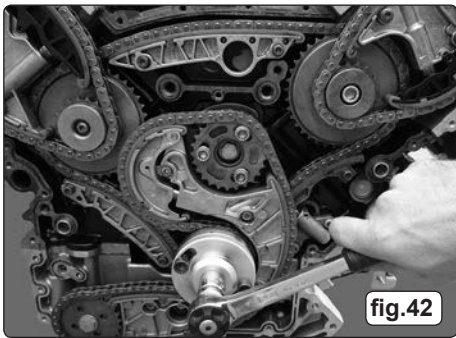


- 3.6.4. Using VS5076, rotate the crankshaft in the direction of rotation to TDC on No. 1 cylinder (fig.42).
- 3.6.5. At TDC on No. 1 cylinder the Camshaft Locking Pins will easily locate through the slots in the camshaft sprockets, the camshafts and into the datum holes in the cylinder heads (fig.43).  
**NOTE:** At TDC the slot of Left Hand Bank camshaft sprocket will be positioned at approximately 4 o'clock and the slot of Right Hand Bank camshaft sprocket will be positioned at approximately 8 o'clock (figs 43 and 44).
- 3.6.6. The Crankshaft Locking Pin locates into a hole in the crankshaft. With the engine at TDC on No. 1 cylinder, this hole will be visible through the crankshaft timing plug hole (fig.45).
- 3.6.7. VS1242/01 Crankshaft Locking Pin - To "lock" the crankshaft, screw VS1242/01 Crankshaft Locking Pin **fully** into the crankshaft timing plug hole and tighten to 20Nm (fig.46).
- 3.6.8. VS5072 Camshaft Locking Pin Set (Pair) - VS5072 Camshaft Locking Pins have a "flat" machined on both sides. The "flats" are there to aid the installation of the Pins. The Pins should be inserted through both the sprockets and the camshafts, into the datum holes in the cylinder heads. The Locking Pins should then be rotated until the handles point downwards at an angle towards the crankshaft (figs 47 & 48).  
**NOTE: DO NOT** apply undue force to VS5072 Camshaft Locking Pins. If it is not possible to install the Pins and to rotate them to their required position, without forcing, the timing will require adjustment - as per the procedure in Section 3.2.

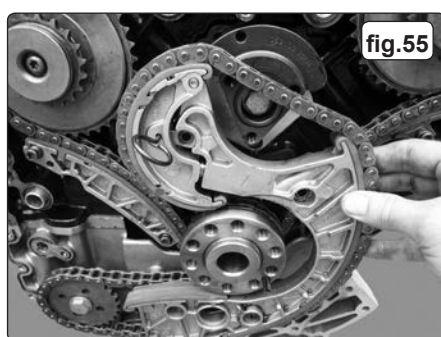
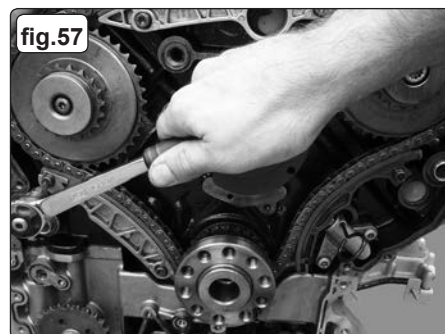
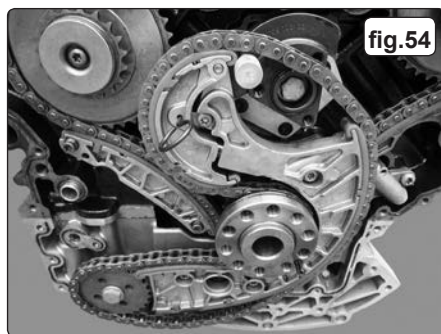
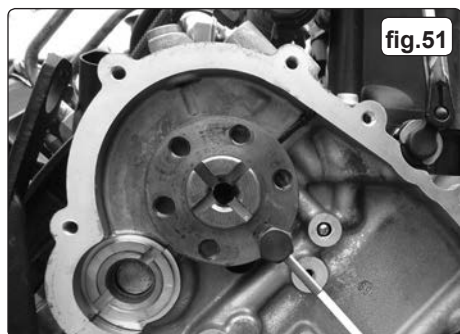
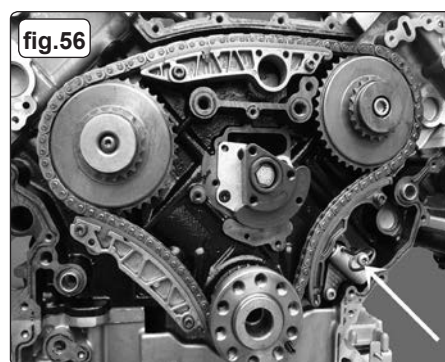
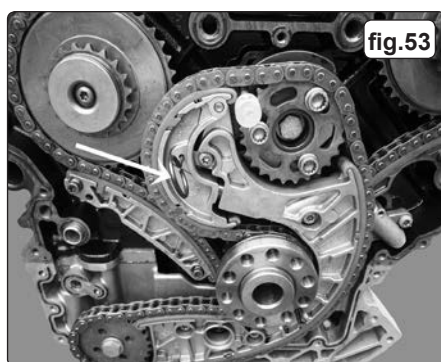
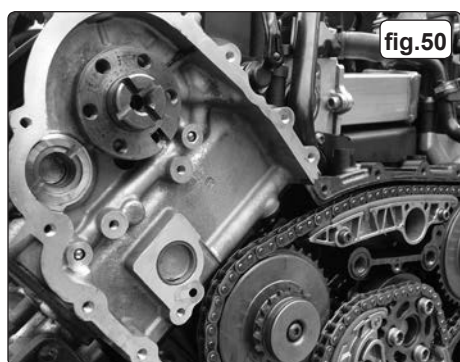
### 3.7. Removing the Camshaft Timing Chains

VS5073/VS5077 Tensioner Retaining Pins - There are several chain tensioner variants fitted to these engines. VS5073 or VS5077 Tensioner Retaining Pin Sets are included to ensure coverage of all variants.

- 3.7.1 Select the appropriate Tensioner Retaining Pin. Press the chain tensioner rail, compressing the tensioner plunger and retain in place using VS5073 or VS5077 Tensioner Retaining Pin (fig.49). Remove the five camshaft sprocket bolts. On the bank being worked on, remove VS5072 Camshaft Locking Pin and the camshaft sprocket from the camshaft.  
**WARNING: The camshafts MUST NOT be allowed to rotate whilst the engine is at TDC or damage may occur to valves and pistons.**



- 3.7.2. Remove the chain tensioner and the camshaft timing chain (fig.50).  
**IMPORTANT:** Plug tensioner/cylinder head oil ways to prevent the ingress of dirt.
- 3.7.3. Refit VS5072 Camshaft Locking Pin to prevent the camshaft rotating while the remaining work is carried out (fig.51). Repeat this procedure for the remaining bank.
- 3.7.4. **Removing the Timing Chain for the Auxiliary Drives** - VS124/V2 Balance Shaft Locking Pin - Insert VS124/V2 Pin through the balance shaft and into the datum hole in the bearing plate (fig.52).
- 3.7.5. VS5073 / VS5077 Tensioner Retaining Pins - Select the appropriate Tensioner Retaining Pin. Press the chain tensioner rail, compressing the tensioner plunger and retain in place using VS5073 or VS5077 Tensioner Retaining Pin (fig.53).
- 3.7.6. Remove the bolts and sprocket from the balance shaft (fig.54).
- 3.7.7. Remove the bolts from the auxiliary drive chain tensioner, and remove the tensioner with the chain (fig.55).
- 3.7.8. **Removing the Timing Chain for the Valve Gear** - VS5073/VS5077 Tensioner Retaining Pins - Select the appropriate Tensioner Retaining Pin. Press the chain tensioner rail, compressing the tensioner plunger and retain in place using VS5073 or VS5077 Tensioner Retaining Pin (fig.56).
- 3.7.9. Mark the orientation of the guide rail to ensure correct installation. Remove the guide rail bolts and the guide rail (fig.57).
- 3.7.10. Remove the idler pulley bolts, then remove the idler pulleys with the timing chain (fig.58).





### 3.8. Installing the Camshaft Timing Chains

3.8.1. **Installing the Timing Chain for the Valve Gear** - Install the timing chain and the idler pulleys using **new** bolts. Install the guide rail using **new** guide rail bolts (fig.59).

3.8.2. Release the timing chain tensioner by removing the tensioner retaining pin (fig.60).

3.8.3. **Installing the Timing Chain for the Auxiliary Drives** - Ensure the crankshaft is positioned at TDC on No.1 cylinder with VS124/01 Crankshaft Locking Pin fitted. Ensure VS124/V2 Balance Shaft Locking Pin is located correctly through the balance shaft and into the datum hole in the bearing plate (fig.61).

3.8.4. Install the timing chain tensioner with the timing chain and tighten the tensioner bolts. Install the sprocket on to the balance shaft and chain, aligning the elongated holes of the sprocket centrally over the three balance shaft bolt holes (fig.62).

3.8.5. Fit the three balance shaft bolts finger tight only, ensuring it is possible for the balance shaft sprocket to rotate for adjustment.

Release the timing chain tensioner by removing the Tensioner Retaining Pin. Using a lever, apply pressure to the tensioner guide rail, preloading the chain. While maintaining the pressure on the tensioner, tighten the three balance shaft sprocket bolts (fig.63). Remove VS124/V2 Balance Shaft Locking Pin.

3.8.6. **Installing the Camshaft Timing Chains** - Ensure the crankshaft is positioned at TDC on No.1 cylinder with VS124/01 Crankshaft Locking Pin fitted, and that the camshafts are in their "timed" positions with VS5072 Camshaft Locking Pins correctly installed.

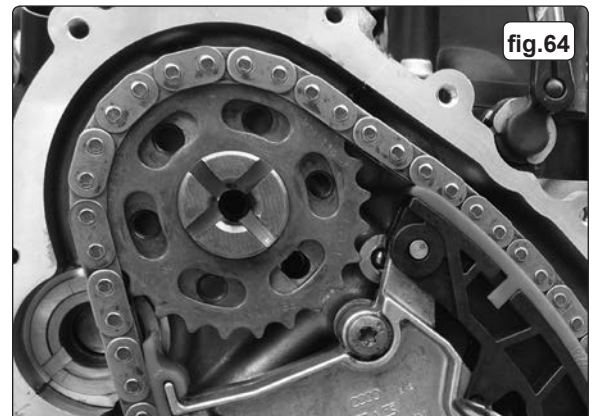
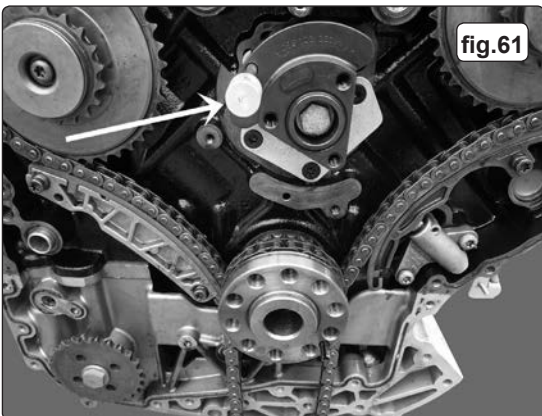
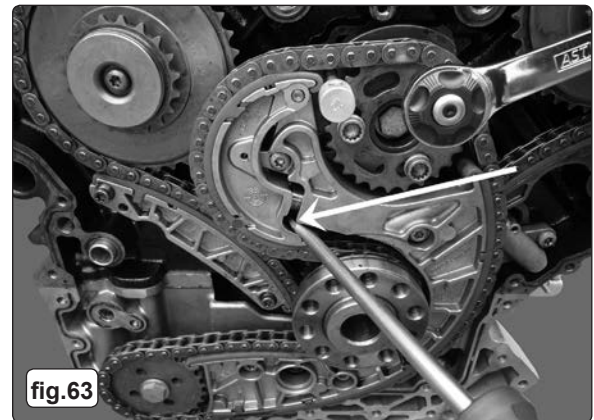
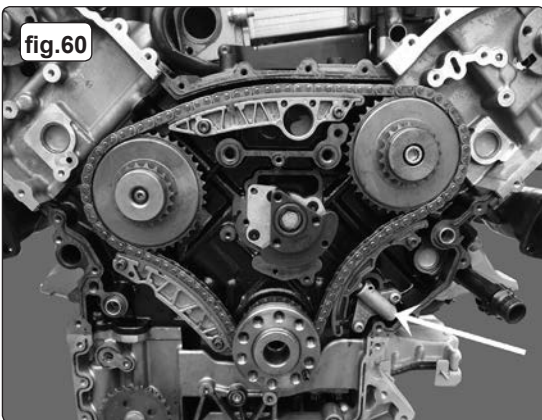
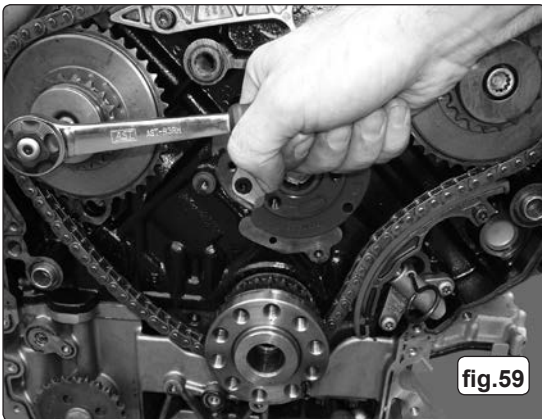
On the bank being worked on, remove VS5072 Camshaft Locking Pin to allow installation of the timing chain, camshaft sprocket and chain tensioner.

**WARNING: The camshafts MUST NOT be allowed to rotate whilst the engine is at TDC or damage may occur to valves and pistons.**

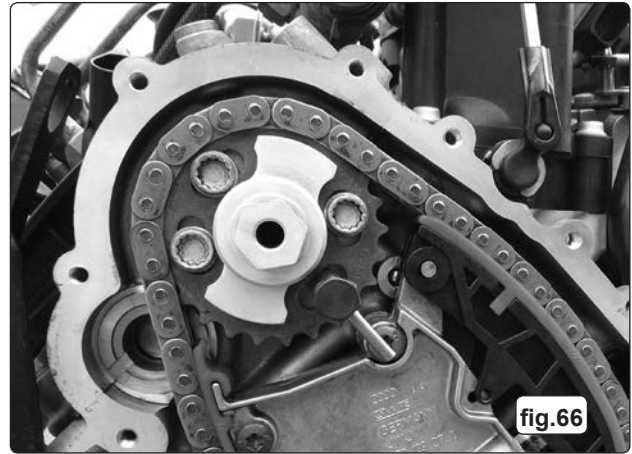
3.8.7. Install the camshaft sprocket and the chain, aligning the elongated holes of the camshaft sprocket centrally over the five camshaft sprocket bolt holes. Reinstall VS5072 Camshaft Locking Pin (fig.64).

**IMPORTANT:** As the tensioner bolts have been released they must be replaced with **new** bolts.

Fit the tensioner using **new** tensioner bolts and tighten to 5Nm + 90°.



- 3.8.8. Fit three camshaft sprocket bolts in the positions shown (fig.65) finger tight only, ensuring it is possible for the camshaft sprocket to rotate on the camshaft for adjustment. Release the timing chain tensioner by removing the Tensioner Retaining Pin.
- 3.8.9. VS5075 Camshaft Sprocket Adjuster - Using VS5075 Camshaft Sprocket Adjuster, apply the specified preload torque in a **clockwise** direction (fig.66): Right Hand Bank - 20Nm, Left Hand Bank - 15Nm. This ensures any slack in the chain is moved to the tensioner side. Whilst maintaining the preload torque, tighten the three camshaft sprocket bolts to 23Nm. Remove VS5075 Camshaft Sprocket Adjuster.
- 3.8.10. Install the two remaining camshaft sprocket bolts, then using VS5074 Camshaft Adjuster to counter hold the camshaft, tighten all five camshaft sprocket bolts to 23Nm. Repeat this procedure for the remaining bank.
- 3.8.11. Remove VS1242/01 Crankshaft Locking Pin, and VS5072 Camshaft Locking Pins. Using VS5076 Crankshaft Adjuster, rotate the crankshaft in the direction of engine rotation two revolutions and check camshaft timing - as per the procedure in Section 3.1.



**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.

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