

Product Information

9430950

Diesel Engine V6/V8

Setting/Locking & HP Pump Removal/Installation Tool Kit

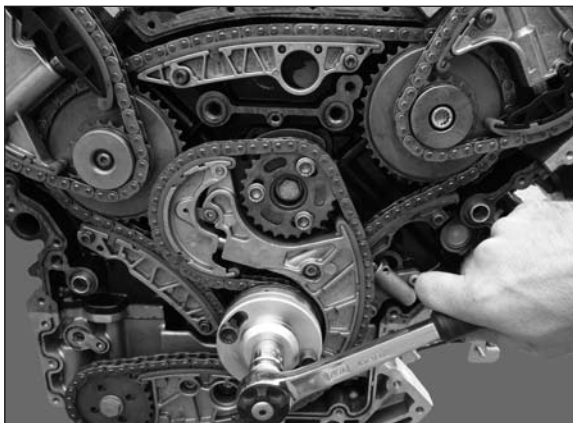
Associated Tool: 43012860
Camshaft Sprocket Holding Tool



Associated Tool
43012860



IMPORTANT: Always refer to the vehicle manufacturer's service instructions, or proprietary manual, to establish the current procedures and data. Product Information Sets detail applications and use of the tools with any general instructions provided as a guide only.



Applications:

VW Group 2.7/3.0 TDi V6 & 4.0/4.2 TDi V8

Diesel engines in:

AUDI

A4	A5	A6
A6 Allroad	A8	
Q5	Q7	

VOLKSWAGEN

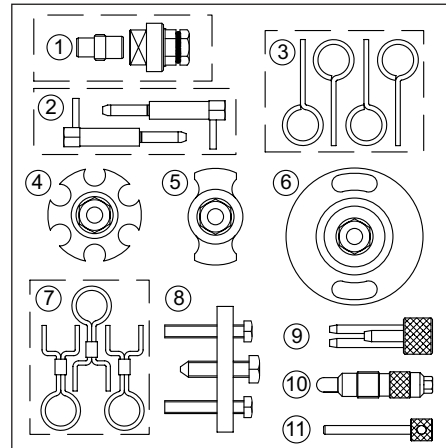
Phaeton Touareg

V6 Engines: ASB, BKN, BKS, BMK, BMZ, BNG, BPP, BSG, BUG, BUN, CAMA, CAMB, CANA, CANB, CANC, CAND, CAPA, CARA, CARB, CASA, CASB, CASC, CATA, CCMA, CCWA, CCWB, CDYA, CDYB, CDYC, CEXA, CGKA, CGKB

V8 Engines: ASE, BTR, BVN, CCFA

Additional Tools required:

4741 Front End Support Guides
43012860 Camshaft Sprocket Holding Tool
4989 Camshaft Sprocket Remover

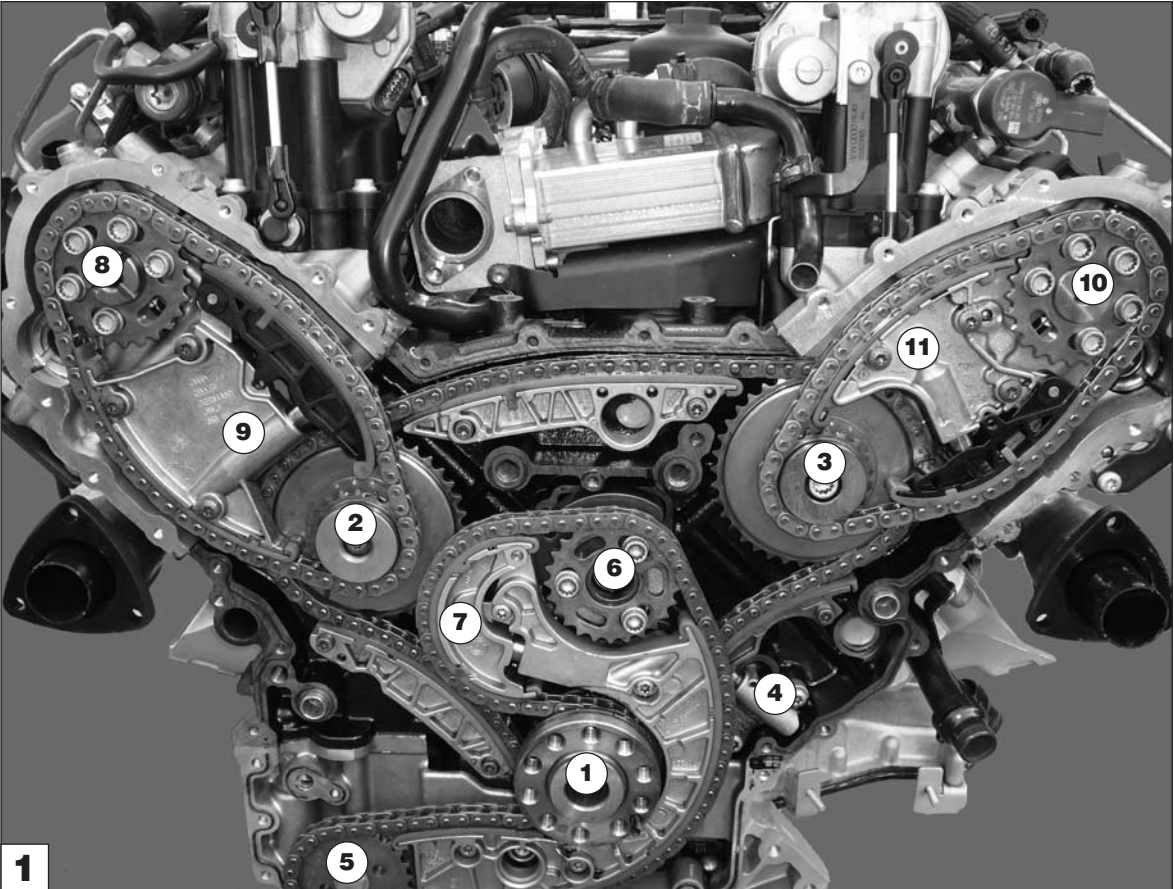


Kit contents/spares

Item	Part Number	Description
1	5071	Crankshaft Adjuster - Pulley End
2	5072	Camshaft Locking Pin Set (Pair)
3	5073	Tensioner Retaining Pin Set (x4)
4	5074	Camshaft Adjuster
5	5075	Camshaft Sprocket Adjuster
6	5076	Crankshaft Adjuster - Gearbox End
7	5077	Tensioner Retaining Pin Set (x3)
8	5078	H.P. Pump Sprocket Remover
9	5079	H.P. Pump Locking Pin
10	4401	Crankshaft Locking Pin
11	4440V2	Balance Shaft Locking Pin Case+ Insert

Engine Introduction

These 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 a camshaft.



The timing chain layout:

- | | | | |
|---|----------------------------|----|------------------------------------|
| 1 | Crankshaft | 7 | Auxiliary drive chain tensioner |
| 2 | Idler pulley (LH Bank) | 8 | Camshaft (LH Bank) |
| 3 | Idler pulley (RH Bank) | 9 | Camshaft chain tensioner (LH Bank) |
| 4 | Valve gear chain tensioner | 10 | Camshaft (RH Bank) |
| 5 | Oil pump | 11 | Camshaft chain tensioner (RH Bank) |
| 6 | Balance shaft | | |

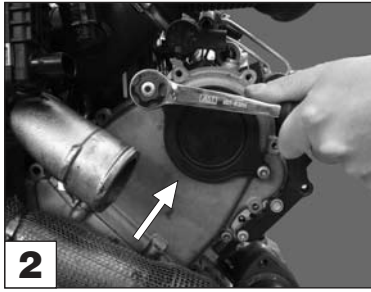
WARNING: The crankshaft must only be rotated in the direction of engine rotation to avoid the risk of the timing chains slipping.

NOTE: All references to left and right banks in this Product Information are made as viewed when seated in the vehicle.

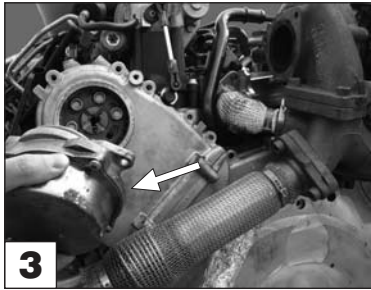
This guide is made up of the following sections:

Section 1 - Checking camshaft timing	page 3
Section 2 - Adjusting camshaft timing	page 4
Section 3 - Cylinder head removal & installation	page 4
Section 4 - H.P. diesel pump toothed belt removal & installation	page 7
Section 5 - Timing chains removal & installation	page 8

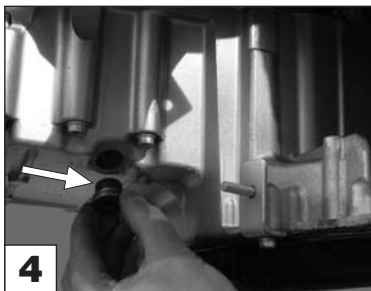
Section 1 - Checking camshaft timing



Remove the RH Bank camshaft sprocket access cover.

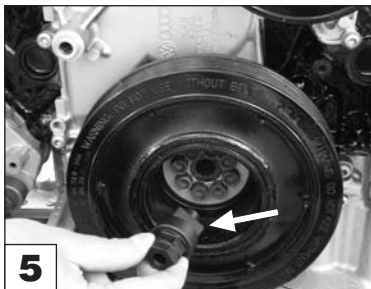


Remove the vacuum pump from the LH Bank.



Remove the crankshaft timing plug located on the side of the sump.

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



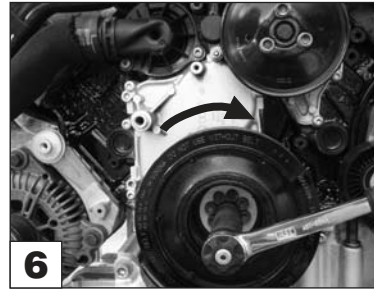
5071 Crankshaft Adjuster - Pulley End 5071 consists of two parts, an adjuster body and a location dowel. The adjuster body fits into a square formed by the eight crankshaft

pulley bolts, whilst the dowel locates into a hole in the centre of the crankshaft.

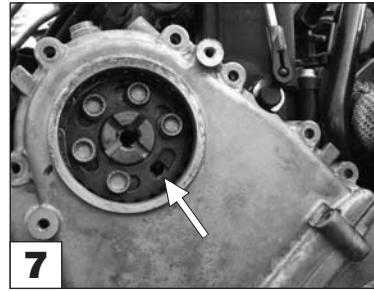
The location dowel is manufactured with two diameters and is reversible in order that the correct diameter can be selected for the appropriate application. The dowel can be separated from the adjuster body by unscrewing.

For the diesel engines detailed in this Product Information the tool should be assembled so that the larger diameter of the dowel is used. Fit 5071 Crankshaft Adjuster to the centre of the crankshaft pulley.

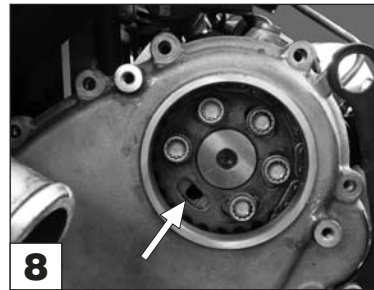
NOTE: The location hole in the centre of the crankshaft may contain dirt/corrosion. This may have to be cleaned out prior to fitting 5071 Crankshaft Adjuster to allow the dowel to enter the hole.



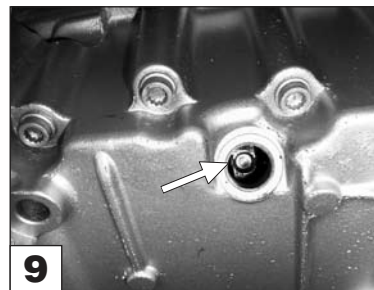
Using 5071, rotate the crankshaft in the direction of rotation to TDC on No. 1 cylinder.



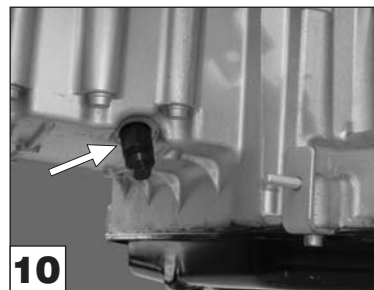
At TDC on No. 1 cylinder the Camshaft Locking Pins will easily locate through the slots in the camshaft sprockets, the camshafts and into the datum holes in the cylinder heads.



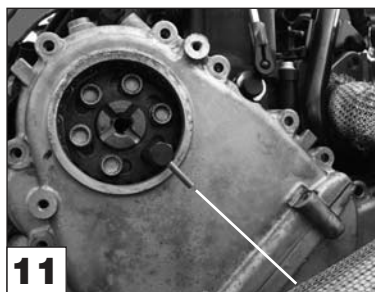
NOTE: At TDC the slot of LH Bank camshaft sprocket will be positioned at approximately 4 o'clock and the slot of RH Bank camshaft sprocket will be positioned at approximately 8 o'clock.



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.

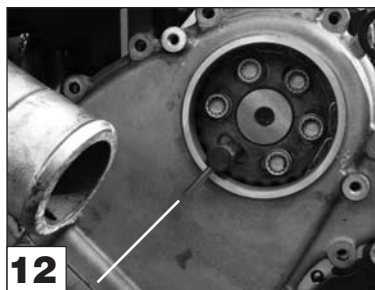


4401 Crankshaft Locking Pin
To "lock" the crankshaft, screw 4401 Crankshaft Locking Pin **fully** into the crankshaft timing plug hole and tighten to 20Nm.



5072 Camshaft Locking Pin Set (Pair)

5072 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 (see pictures 11&12).

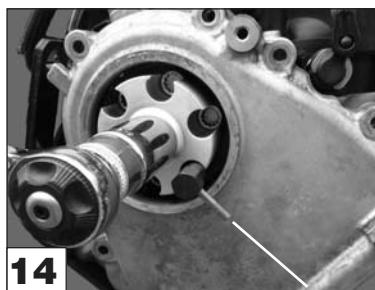


NOTE: DO NOT apply undue force to 5072 Camshaft Locking Pins. If it is not possible to install the Pins and to rotate them to their required position, without forcing, the timing will require adjustment.

Section 2 - Adjusting camshaft timing



Ensure 4401 Crankshaft Locking Pin is **fully** screwed into the crankshaft timing plug hole and tightened to 20Nm.



5074 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.

Using 5074 Camshaft Adjuster, rotate the camshaft to allow 5072 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 (See picture 14).



Using 5074 Camshaft Adjuster to counter hold the camshaft, tighten the 5 camshaft sprocket bolts to 24Nm.

Repeat the camshaft adjustment procedure on the second bank, if necessary.

Remove 5072 Camshaft Locking Pins from the camshafts.

Remove 4401 Crankshaft Locking Pin.

Using 5071 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 1 page 3.

Section 3 - Cylinder head removal & installation

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.

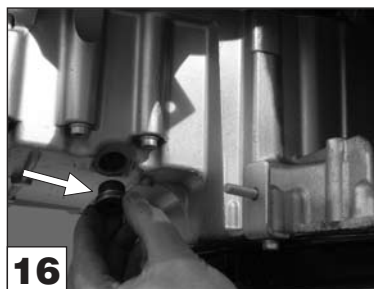
The H.P. diesel pump sprocket is removed using 5078. See H.P. diesel pump toothed belt removal & installation - Section 4 page 7

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.

Removal

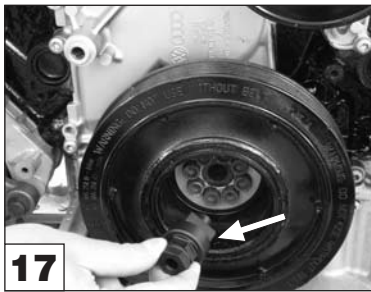
NOTE: It is necessary to "time" the engine prior to cylinder head removal.

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.



Remove the crankshaft timing plug located on the side of the sump.

NOTE: A small amount of oil may drain from the engine when removing the crankshaft timing plug.



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5071 Crankshaft Adjuster - Pulley End

5071 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.

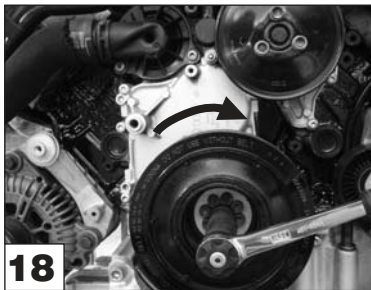
The location dowel is manufactured with two diameters and is reversible in order that the correct diameter can be selected for the appropriate application. The dowel can be separated from the adjuster body by unscrewing.

Fit 5071 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 5071 Crankshaft Adjuster to allow the dowel to enter the hole.

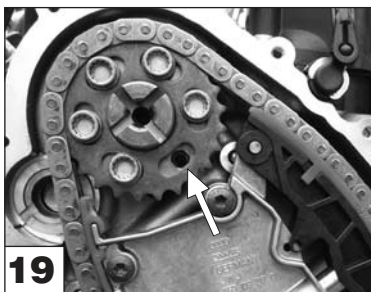
The camshaft sprockets are attached to the camshafts using five bolts.

There is a slot in the camshaft sprocket where the Locking Pin locates through the camshaft and in to the datum holes in the cylinder head.



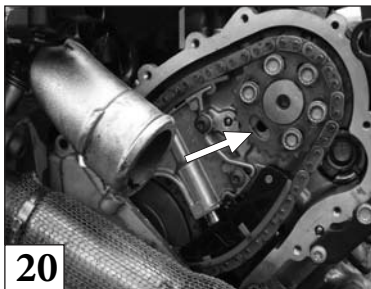
18

Using 5071, rotate the crankshaft in the direction of rotation to TDC on No. 1 cylinder.



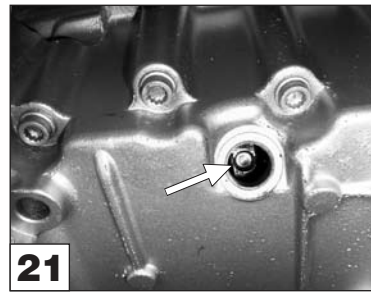
19

At TDC on No. 1 cylinder the slot of LH Bank camshaft sprocket will be positioned at 4 o'clock approx.



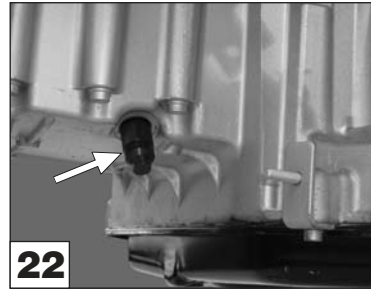
20

The slot of RH Bank camshaft sprocket will be positioned at 8 o'clock approx.



21

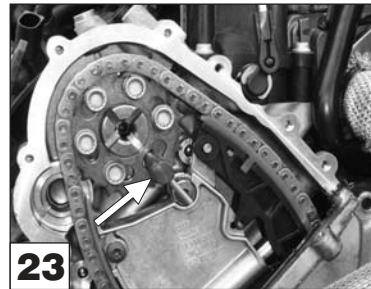
The timing hole in the crankshaft will be visible through the crankshaft timing plug hole.



22

4401 Crankshaft Locking Pin Screw

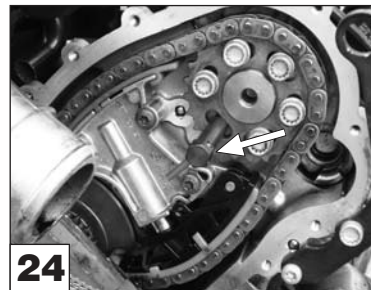
4401 Crankshaft Locking Pin **fully** into the timing plug hole as shown and tighten to 20Nm.



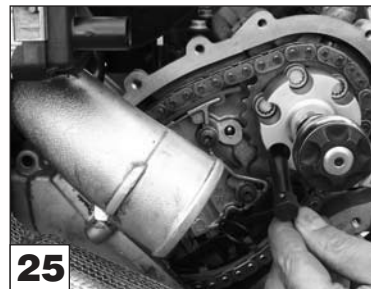
23

5072 Camshaft Locking Pin Set

5072 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 (see pictures 23 & 24).



24



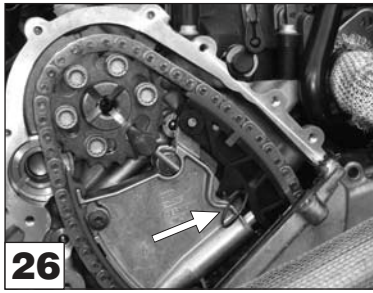
25

NOTE: DO NOT apply undue force the 5072 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

5074 Camshaft Adjuster and use it to rotate the camshaft to allow 5072 Camshaft Locking Pins to be fitted and rotated into their correct positions. (see picture 25).

5073 / 5077 Tensioner Retaining Pins

There are several chain tensioner variants fitted to these engines. 5073 or 5077 Tensioner Retaining Pins are required to ensure coverage of all variants.



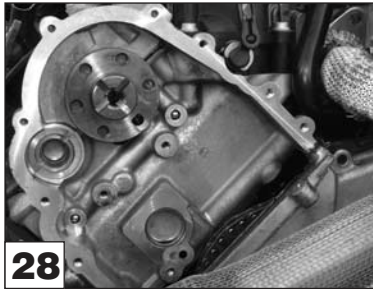
Select the appropriate Tensioner Retaining Pin.

Press the chain tensioner rail, compressing the tensioner plunger and retain in place using 5073 or 5077 Tensioner Retaining Pin.



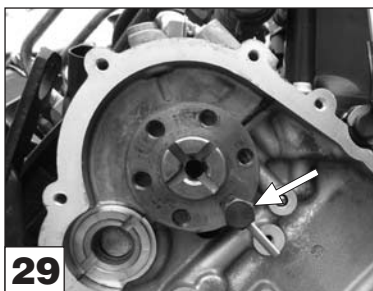
Remove the five camshaft sprocket bolts.

On the cylinder head being removed, remove 5072 Camshaft Locking Pin and the camshaft sprocket from the camshaft.



Remove the chain tensioner.

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.

Refit 5072 Camshaft Locking Pin to prevent the camshaft rotating while the remaining work is carried out in order to remove the cylinder head.

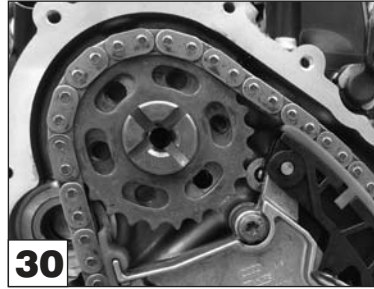
WARNING: Damage may occur to the glow plugs and open valves when placing the cylinder head on a flat surface.

Installation

Ensure the crankshaft is positioned at TDC on No.1 cylinder with 4401 Crankshaft Locking Pin fitted, and that the camshafts are in their "timed" positions with 5072 Camshaft Locking Pins correctly installed.

Refit the cylinder head.

On the cylinder head being installed, remove 5072 Camshaft Locking Pin to allow installation of the timing chain, camshaft sprocket and chain tensioner.



Install the camshaft sprocket and the chain, aligning the elongated holes of the camshaft sprocket centrally over the five camshaft sprocket bolt holes. Reinstall 5072 Camshaft Locking Pin.

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°.

Fit three camshaft sprocket bolts in the positions shown (see picture 31) 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

5075 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 5075 Camshaft Sprocket Adjuster, apply the specified preload torque in a **clockwise** direction, Right Bank - 20Nm, Left Bank - 15 Nm.

While maintaining the preload torque, tighten the three camshaft sprocket bolts to 23Nm.

Remove 5075 Camshaft Sprocket Adjuster.

Install the two remaining camshaft sprocket bolts, then using 5074 Camshaft Adjuster to counter hold the camshaft, tighten all five camshaft sprocket bolts to 23Nm.

Remove 4401 Crankshaft Locking Pin, and 5072 Camshaft Locking Pins.

Using 5071 Crankshaft Adjuster, rotate the crankshaft in the direction of engine rotation two revolutions and check camshaft timing - as per the procedure in Section 1 page 3.

Section 4 - H.P. diesel pump toothed belt removal & 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 5078 Pin to position the H.P. diesel pump sprocket, and 4401 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 5078 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.

V6 Engines with H.P. diesel pumps that do not require “timing”

Removal

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

Slacken the belt tensioner bolt and remove the pump belt.

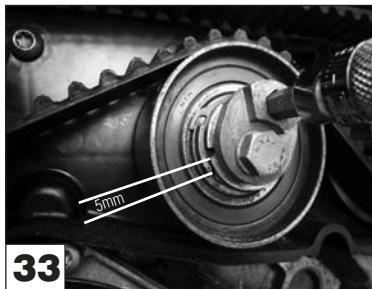


5078 H.P. Pump Sprocket Remover

If the pump sprocket requires removal, remove the weight from the H.P. diesel pump using a suitable counter hold such as 4844 Camshaft Sprocket Holding Tool.

Attach 5078 H.P. Pump Sprocket Remover to the sprocket using the two bolts provided.

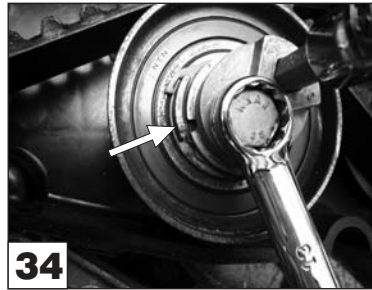
Remove the sprocket by tightening the central force screw.



Installation

Fit the H.P. diesel pump toothed belt.

Using an Allen key, rotate the tensioner in the direction indicated on the tensioner until the indicator lug is approximately 5mm below the notch.



Revolutions and check the indicator lug and the notch are aligned. If the indicator lug and the notch are not aligned then slacken the tensioner bolt and using an allen key on the tensioner, adjust the belt tensioner so that the lug and notch are aligned.

V6 Engines with H.P. diesel pumps requiring “timing”

Removal

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

Slacken the belt tensioner bolt.

Slacken the camshaft sprocket bolt two turns while using a suitable counter hold tool, such as 4844 Camshaft Sprocket Holding Tool.

Remove the pump belt.



Using 5071 Crankshaft Adjuster, rotate the crankshaft in the direction of engine rotation to TDC position on No.1 cylinder.

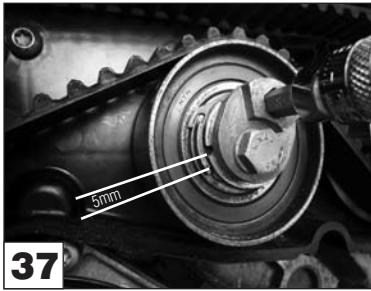
Screw 4401 Crankshaft Locking Pin **fully** into the crankshaft timing plug hole and tighten to 20Nm.



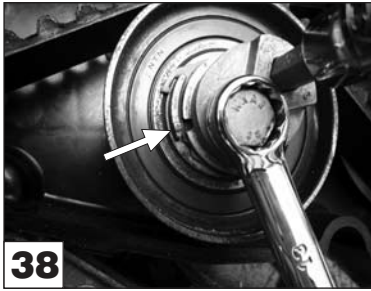
5079 H.P. Pump Locking Pin

Position the pump sprocket and lock in position using 5079 H.P. Pump Locking Pin.

Fit the H.P. diesel pump toothed belt.



Using an Allen key, rotate the tensioner in the direction indicated on the tensioner until the indicator lug is approximately 5mm below the notch.



Release the tensioner until the indicator lug and the notch are aligned, then tighten the tensioner bolt.

Tighten the camshaft sprocket bolt while using a suitable counter hold tool, such as 4844 Camshaft Sprocket Holding Tool.

Remove 4401 Crankshaft Locking Pin, and replace the crankshaft timing plug.

Using 5071 Crankshaft Adjuster, rotate the crankshaft in the direction of engine rotation two revolutions and check the indicator lug and the notch are aligned.

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

Remove the engine cover to give access to the pump belt.
Remove the tensioner bolt and the tensioner.
Remove the toothed belt.

Installation

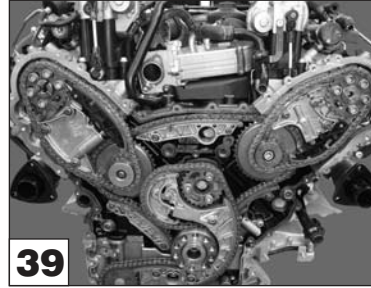
Preload the tensioner by rotating the arm by hand and retain in place using an 5073 Tensioner Retaining Pin.
Install the toothed belt, tensioner and tensioner bolt.
Tension the belt by removing the pin.

Section 5 - Timing chains removal & installation

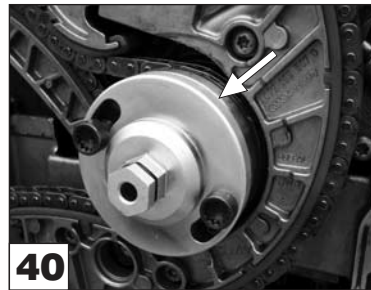
In order to carry out repair work which involves the removal of the timing chains it will be necessary to remove the engine from the vehicle and separate the gearbox from the engine.

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.

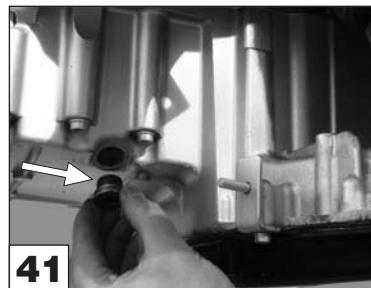


Remove the three timing chain covers giving access to the timing chains.



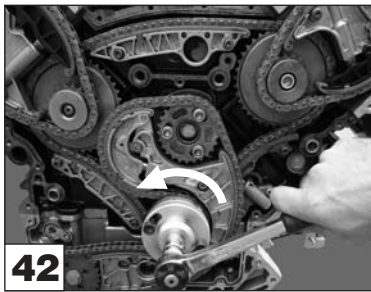
5076 Crankshaft Adjuster - Gearbox End Install 5076 Crankshaft Adjuster to the crankshaft and secure in place using bolts.

NOTE: Bolts from the automatic gearbox drive plate can be used to secure 5076. Bolts from manual gearbox dual mass flywheels **MUST NOT** be used as they are too long and may damage the timing chain assemblies.

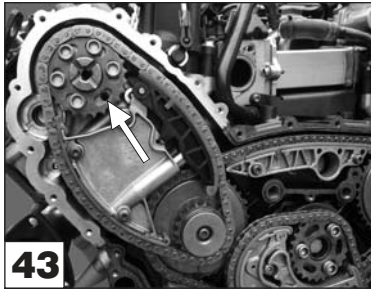


Remove the crankshaft timing plug located on the side of the sump.

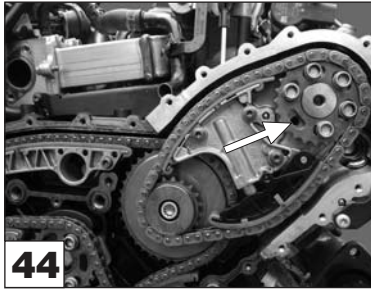
NOTE: A small amount of oil may leak out when removing the crankshaft timing plug.



Using 5076, rotate the crankshaft in the direction of rotation to TDC on No. 1 cylinder.



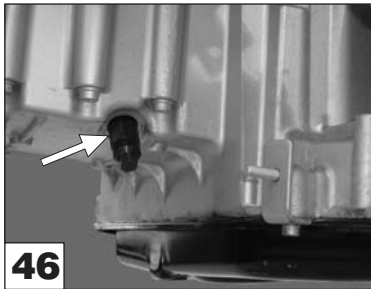
At TDC on No. 1 cylinder the Camshaft Locking Pins will easily locate through the slots in the camshaft sprockets, the camshafts and into the datum holes in the cylinder heads.



NOTE: At TDC the slot of LH Bank camshaft sprocket will be positioned at approximately 4 o'clock and the slot of RH Bank camshaft sprocket will be positioned at approximately 8 o'clock.



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.



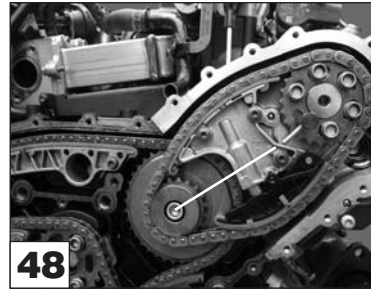
4401 Crankshaft Locking Pin

To "lock" the crankshaft, screw 4401 Crankshaft Locking Pin **fully** into the crankshaft timing plug hole and tighten to 20Nm.



5072 Camshaft Locking Pin Set (Pair)

5072 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 (see pictures 47 & 48).



NOTE: DO NOT apply undue force to 5072 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 2 page 4.

Removing the camshaft timing chains

5073 / 5077 Tensioner Retaining Pins

There are several chain tensioner variants fitted to these engines.

5073 or 5077 Tensioner Retaining Pins are required to ensure coverage of all variants.



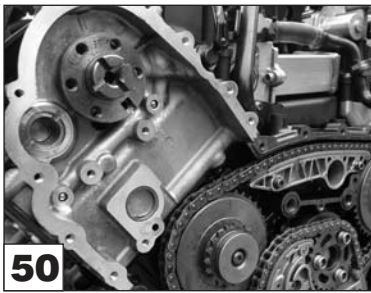
Select the appropriate Tensioner Retaining Pin.

Press the chain tensioner rail, compressing the tensioner plunger and retain in place using 5073 or 5077 Tensioner Retaining Pin.

Remove the five camshaft sprocket bolts.

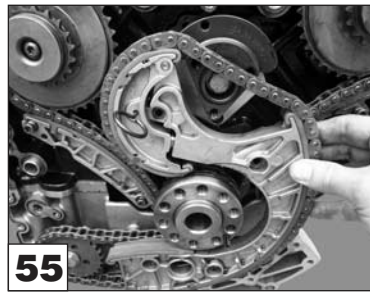
On the bank being worked on, remove 5072 Camshaft Locking Pin and the camshaft sprocket from the camshaft.

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

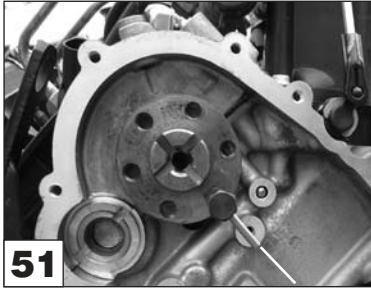


Remove the chain tensioner and the camshaft timing chain.

IMPORTANT: Plug tensioner/cylinder head oil ways to prevent the ingress of dirt.

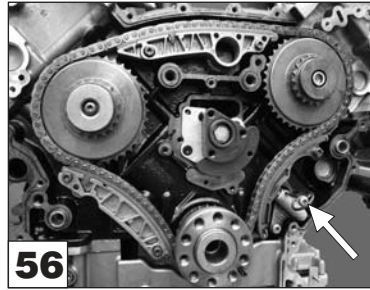


Remove the bolts from the auxiliary drive chain tensioner, and remove the tensioner with the chain.



Refit 5072 Camshaft Locking Pin to prevent the camshaft rotating while the remaining work is carried out. Repeat this procedure for the remaining bank.

Removing the timing chain for the valve gear

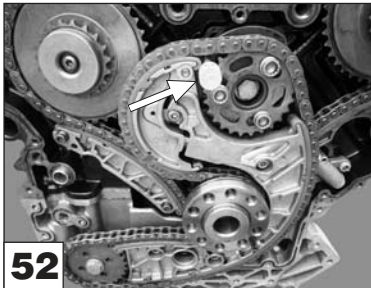


5073 / 5077 Tensioner Retaining Pins

Select the appropriate Tensioner Retaining Pin.

Press the chain tensioner rail, compressing the tensioner plunger and retain in place using 5073 or 5077 Tensioner Retaining Pin.

Removing the timing chain for the auxiliary drives

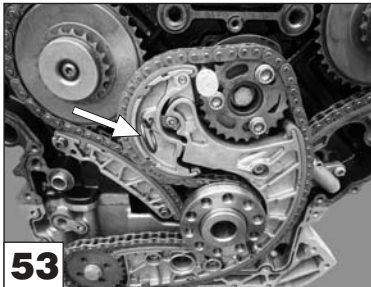


4440V2 Balance Shaft Locking Pin

Insert 4440V2 Pin through the balance shaft and into the datum hole in the bearing plate.



Mark the orientation of the guide rail to ensure correct installation. Remove the guide rail bolts and the guide rail.



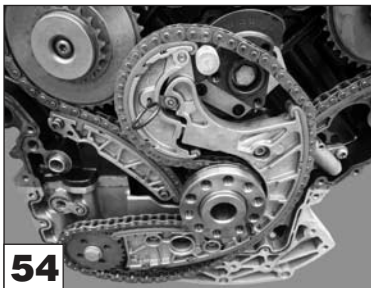
5073 / 5077 Tensioner Retaining Pins

Select the appropriate Tensioner Retaining Pin.

Press the chain tensioner rail, compressing the tensioner plunger and retain in place using 5073 or 5077 Tensioner Retaining Pin.



Remove the idler pulley bolts, then remove the idler pulleys with the timing chain.

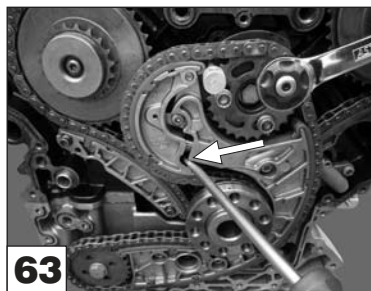


Remove the bolts and sprocket from the balance shaft.



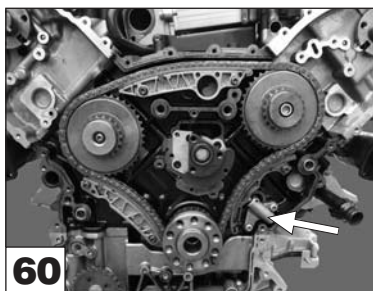
Installing the timing chain for the valve gear

Install the timing chain and the idler pulleys using **new** bolts. Install the guide rail using **new** guide rail bolts.



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.



Release the timing chain tensioner by removing the tensioner retaining pin.

Remove 4440V2 Balance Shaft Locking Pin.

Installing the camshaft timing chains

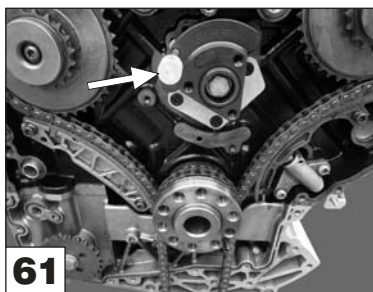
Ensure the crankshaft is positioned at TDC on No.1 cylinder with 4401 Crankshaft Locking Pin fitted, and that the camshafts are in their "timed" positions with 5072 Camshaft Locking Pins correctly installed.

On the bank being worked on, remove 5072 Camshaft Locking Pin to allow installation of the timing chain, camshaft sprocket and chain tensioner.

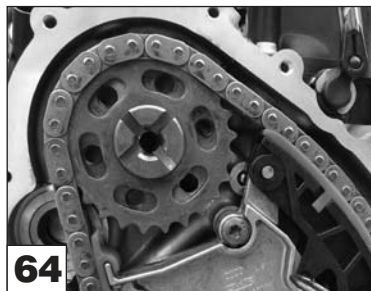
WARNING: The camshafts **MUST NOT** be allowed to rotate whilst the engine is at TDC or damage may occur to valves and pistons.

Installing the timing chain for the auxiliary drives

Ensure the crankshaft is positioned at TDC on No.1 cylinder with 4401 Crankshaft Locking Pin fitted.



Ensure 4440V2 Balance Shaft Locking Pin is located correctly through the balance shaft and into the datum hole in the bearing plate.



Install the camshaft sprocket and the chain, aligning the elongated holes of the camshaft sprocket centrally over the five camshaft sprocket bolt holes. Reinstall 5072 Camshaft Locking Pin.

Install the timing chain tensioner with the timing chain and tighten the tensioner bolts.

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°.



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.

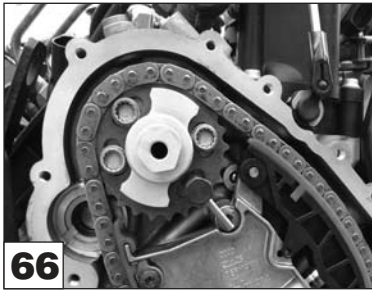


Fit three camshaft sprocket bolts in the positions shown (see picture 65) finger tight only, ensuring it is possible for the camshaft sprocket to rotate on the camshaft for adjustment.

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.

Release the timing chain tensioner by removing the Tensioner Retaining Pin.



5075 Camshaft Sprocket Adjuster

Using 5075 Camshaft Sprocket Adjuster, apply the specified preload torque in a **clockwise** direction, Right Bank - 20Nm, Left Bank - 15 Nm.

This ensures any slack in the chain is moved to the tensioner side. While maintaining the preload torque, tighten the three camshaft sprocket bolts to 23Nm.

Remove 5075 Camshaft Sprocket Adjuster.

Install the two remaining camshaft sprocket bolts, then using 5074 Camshaft Adjuster to counter hold the camshaft, tighten all five camshaft sprocket bolts to 23Nm.

Repeat this procedure for the remaining bank.

Remove 4401 Crankshaft Locking Pin, and 5072 Camshaft Locking Pins.

Using 5076 Crankshaft Adjuster, rotate the crankshaft in the direction of engine rotation two revolutions and check camshaft timing - as per the procedure in Section 1 page 3.