TOPTUL®
THE MARK OF PROFESSIONAL TOOLS
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JI-1203A

TOPTUL®

THE MARK OF PROFESSIONAL TOOLS

Automotive Specialty Tool Kit

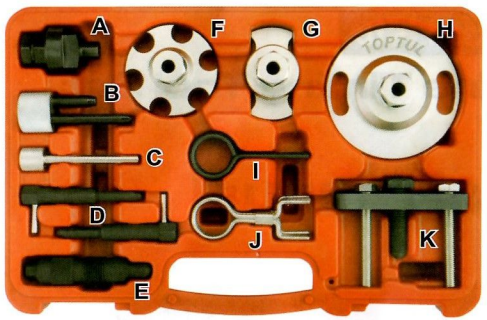
VW / Audi Diesel Engine Timing Tool Set

Part No. JGAI1203

Operational Manual

PLEASE READ THE SAFETY INSTRUCTION CAREFULLY BEFORE OPERATES THE TOOLS. ONLY 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. PLEASE KEEP INSTRUCTIONS SAFETY FOR FUTURE USE.

Kit Content



Part No.	Description	Q'ty
A	Crankshaft Adjuster	1
B	H.P. Pump Locking Pin	1
C	Balance Shaft Locking Pin	1
D	Camshaft Locking Pin	2
E	Crankshaft Locking Pin	1
F	Camshaft Adjuster	1
G	Camshaft Sprocket Adjuster	1
H	Crankshaft Adjuster	1
I	Tensioner Retaining Pin	4
J	Tensioner Retaining Pin	3
K	H.P. Pump Sprocket Remover	1

Application

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

Diesel Engine In:

Audi - A4 / A5 / A6 / A6 Allroad / A8 / Q5 / Q7

VW - Phaeton / Touareg

Engine Code:

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

Safety Precaution

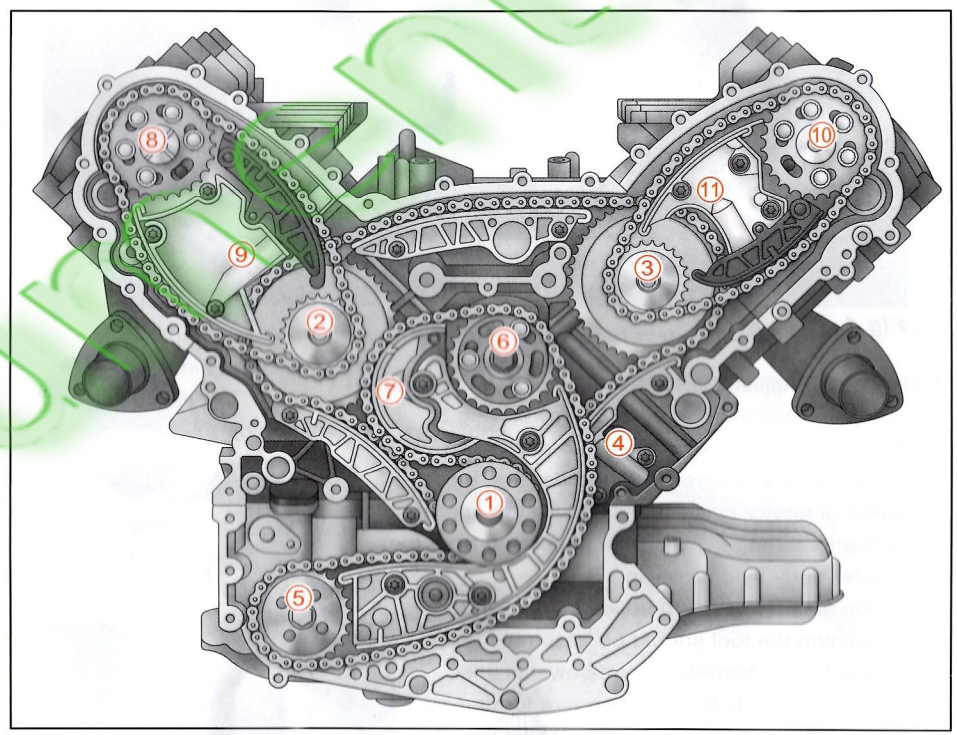
- Check each tool kits are in good condition before use. If damaged - Do not use!
- Read this manual completely before performing any operation procedures.
- Always observe safety precautions whenever working on a vehicle.
- Always wear protective goggles and gloves when work with this tool.
- Never use this tool for any other application which it was designed.

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.

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

Engine Timing Checking and Adjustment

(A) Checking Camshaft Timing

1. Remove the RH Bank camshaft sprocket access cover. (Fig.1)

2. Remove the vacuum pump from the LH Bank. (Fig.2)

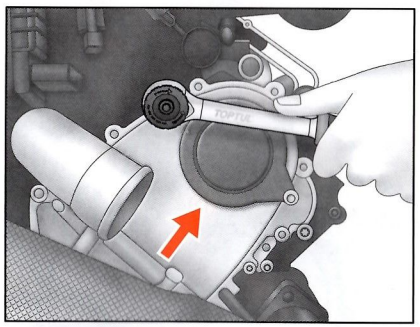


Fig.1

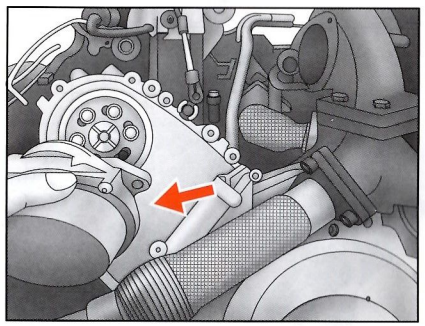


Fig.2

3. Crankshaft Adjuster (Part No.A) consists of two parts, an adjuster body and a location dowel. (Fig.3) 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. 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.4)

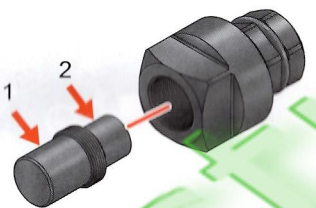


Fig.3

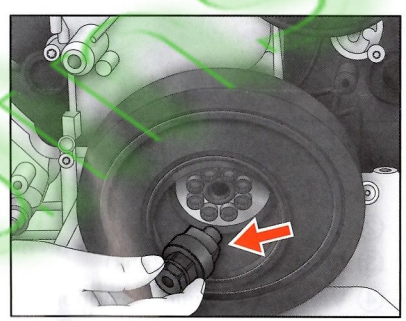


Fig.4

NOTE: The location hole in the centre of the crankshaft may contain dirt / corrosion. This may have to be cleaned out prior to fitting Crankshaft Adjuster (Part No.A) to allow the dowel to enter the hole.

4. Using Crankshaft Adjuster (Part No.A), rotate the crankshaft in the direction of rotation to TDC on No.1 cylinder. (Fig.5)

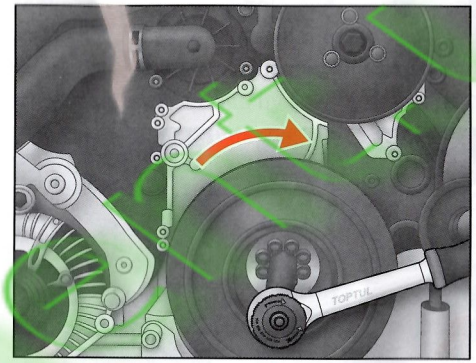


Fig.5

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

5. Remove the crankshaft timing plug located on the side of the sump. (Fig.6)
NOTE: A small amount of oil may leak out when removing the crankshaft timing plug.
The Crankshaft Locking Pin (Part No.E) 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.7)
Slowly turn crankshaft pulley clockwise, until Crankshaft Locking Pin (Part No.E) can fully into crankshaft timing plug hole. Tighten to 20 Nm. (Fig.8)

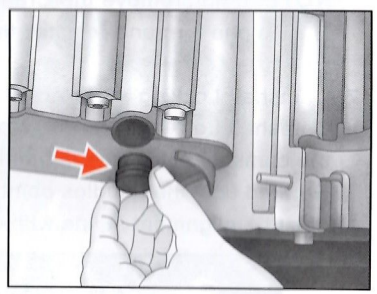


Fig.6

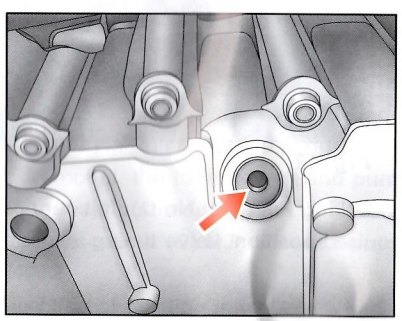


Fig.7

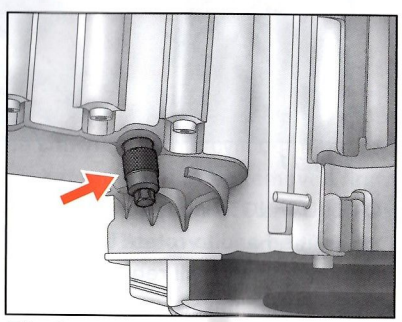


Fig.8

6. At TDC on No.1 cylinder the Camshaft Locking Pins (Part No.D) will easily locate through the slots in the camshaft sprockets, the camshafts and into the datum holes in the cylinder heads.
   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. (Fig.9 & 10)

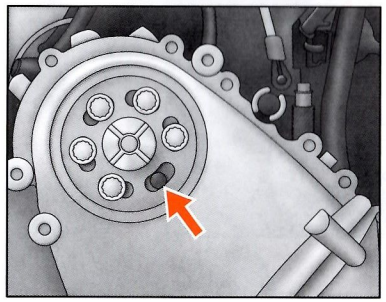


Fig.9

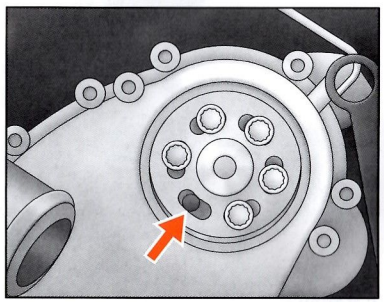


Fig.10

NOTE: If not, remove the Crankshaft Locking Pin (Part No.E), rotate the crankshaft one turn and reinstall the Crankshaft Locking Pin (Part No.E).

7. Camshaft Locking Pin (Part No.D) have a "flat" machined on both sides.
   Camshaft Locking Pin (Part No.D) should be inserted through both the sprockets and the camshafts, into the datum holes in the cylinder heads.
   Rotated until the handles point downwards at an angle towards the crankshaft and must be alignment in line with centre of camshaft sprocket. (Fig.11 & 12)

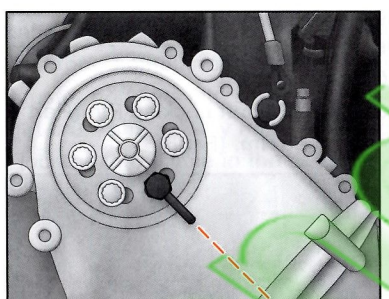


Fig.11

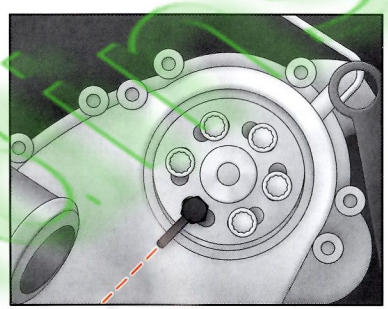


Fig.12

NOTE: DO NOT undue force to Camshaft Locking Pin (Part No.D). If it cannot be fitted and to rotate them to their required position, valve timing is incorrect, the timing will require adjustment.

(B) Adjusting Camshaft Timing

1. Ensure Crankshaft Locking Pin (Part No.E) is fully screwed into the crankshaft timing plug hole and tightened to 20 Nm. (Fig.13)

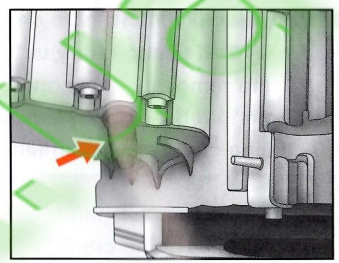


Fig.13

2. Slacken the five camshaft sprocket bolts by one turn, enabling the camshaft to move independently from the sprocket.
   Using Camshaft Adjuster (Part No.F), rotate camshaft until Camshaft Locking Pin (Part No.D) can be fitted. (Fig.14)
   Using Camshaft Adjuster (Part No.F) to counter hold the camshaft, tighten the 5 camshaft sprocket bolts, tighten to 5 Nm. (Fig.15)
   Remove Camshaft Locking Pin (Part No.D) and Camshaft Adjuster (Part No.F), tighten bolts for camshaft chain sprocket to final torque, 23 Nm.
   NOTE: Repeat procedure for another camshaft adjustment, if necessary.

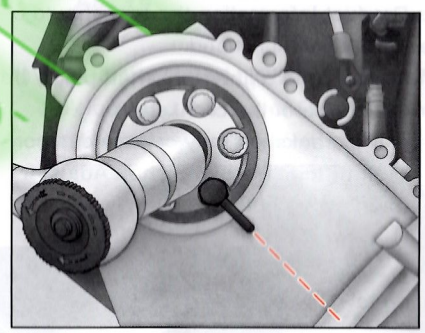


Fig.14

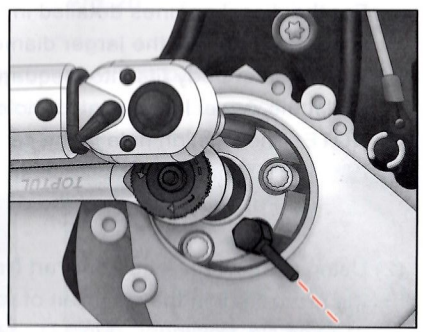


Fig.15

3. Remove Crankshaft Locking Pin (Part No.E).
   Using Crankshaft Adjuster (Part No.A), rotate the crankshaft in the direction of engine rotation two revolutions returning to TDC on No.1 cylinder, and check camshaft timing - Check procedure **"(A) Checking Camshaft Timing"**.

(C) Cylinder Head Removal & Installation

It is usually possible to remove the cylinder head 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 H.P. Pump Sprocket Remover (Part No.K).
- Check procedure **"(E) H.P. Diesel Pump Toothed Belt Removal & Installation"**.
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.

1. **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.

(1) Install Crankshaft Adjuster (Part No.A) to the centre of the crankshaft pulley. (Fig.16)
Crankshaft Adjuster (Part No.A) consists of two parts, an adjuster body and a location dowel. 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.
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.
NOTE: The location hole in the centre of the crankshaft may contain dirt / corrosion. This may have to be cleaned out prior to fitting Crankshaft Adjuster (Part No.A) to allow the dowel to enter the hole.

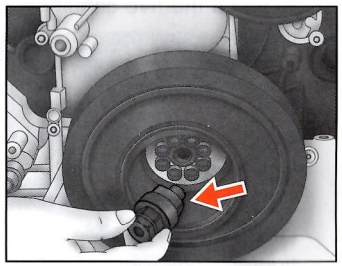


Fig.16

(2) Using Crankshaft Adjuster (Part No.A), rotate the crankshaft in the direction of rotation to TDC on No.1 cylinder. (Fig.17)
WARNING:
The crankshaft must only be rotated in the direction of engine rotation to avoid the risk of the timing chains slipping.

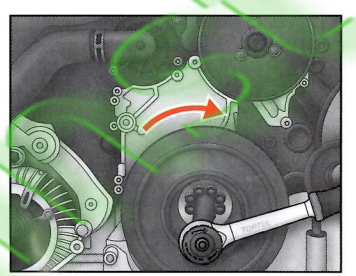


Fig.17

(3) Remove the crankshaft timing plug located on the side of the sump. (Fig.18)
NOTE: A small amount of oil may leak out when removing the crankshaft timing plug.

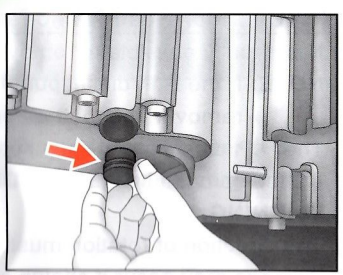


Fig.18

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.19)
Slowly turn crankshaft pulley clockwise, until Crankshaft Locking Pin (Part No.E) fully into crankshaft timing plug hole. Tighten to 20 Nm. (Fig.20)

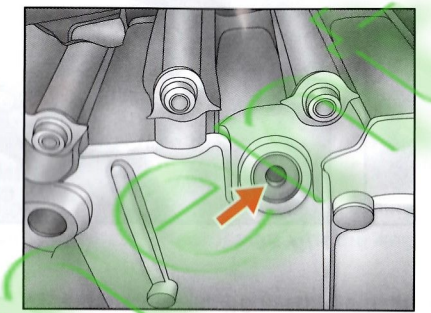


Fig.19

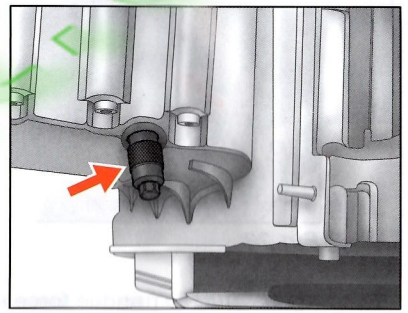


Fig.20

(4) 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. (Fig.21 & 22)

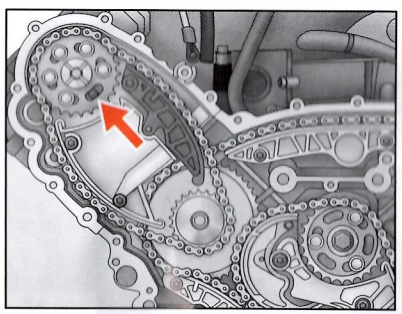


Fig.21

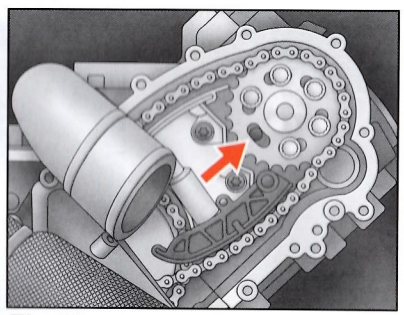


Fig.22

Camshaft Locking Pin (Part No.D) have a "flat" machined on both sides.
Camshaft Locking Pin (Part No.D) should be inserted through both the sprockets and the camshafts, into the datum holes in the cylinder heads.

Rotated until the handles point downwards at an angle towards the crankshaft and must be alignment in line with centre of camshaft sprocket. (Fig.23 & 24)

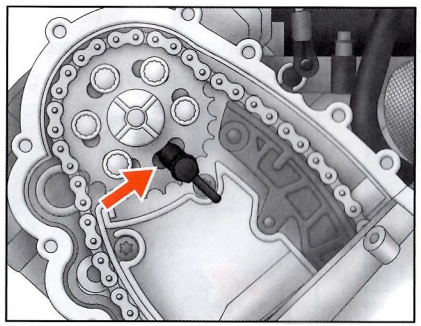


Fig.23

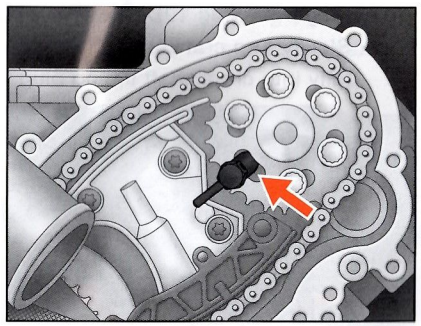


Fig.24

NOTE: DO NOT undue force to Camshaft Locking Pin (Part No.D). If it cannot be fitted and to rotate them to their required position, slacken the five camshaft sprocket bolts one turn and fit Camshaft Adjuster (Part No.F) and use it to rotate the camshaft to allow Camshaft Locking Pin (Part No.D) to be fitted and rotated into their correct positions. (Fig.25)

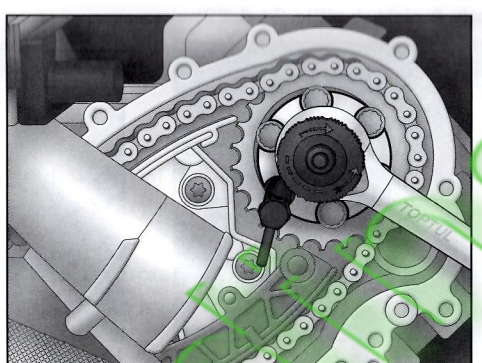


Fig.25

(5) Select the appropriate Tensioner Retaining Pin (Part No.I or J). Press the chain tensioner rail, compressing the tensioner plunger and retain in place using Tensioner Retaining Pin (Part No.I or J). (Fig.26)

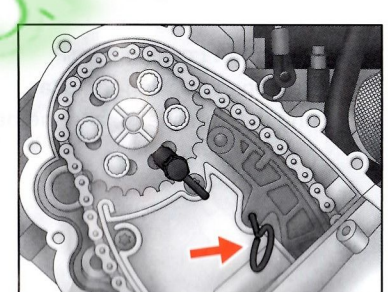


Fig.26

(6) Remove the five camshaft sprocket bolts. On the cylinder head being removed, remove Camshaft Locking Pin (Part No.D) and the camshaft sprocket from the camshaft. (Fig.27)

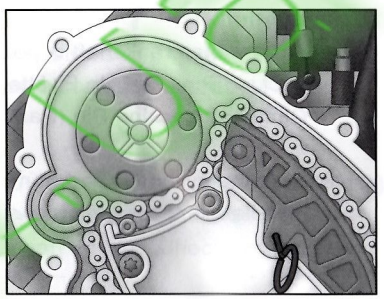


Fig.27

(7) Remove the chain tensioner. (Fig.28)

IMPORTANT:

Block off the opening in the valve timing housing with a clean cloth to prevent small iteAms from dropping into the engine.

(8) Refit Camshaft Locking Pin (Part No.D) to prevent the camshaft rotating while the remaining work is carried out in order to remove the cylinder head. (Fig.29)

WARNING:

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

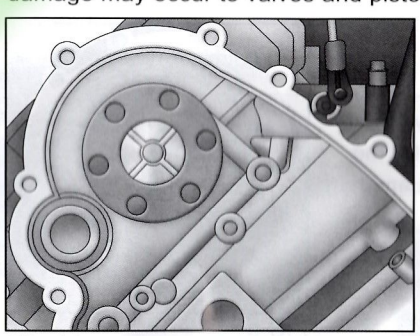


Fig.28

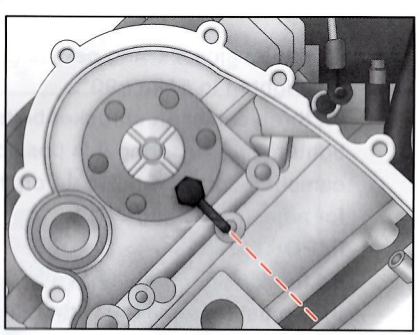


Fig.29

(9) Repeat the above action from another camshaft.

WARNING:

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

2. **Installation**

(1) Ensure the crankshaft is positioned at TDC on No.1 cylinder with Crankshaft Locking Pin (Part No.E) fitted and that the camshafts are in "timed" positions with Camshaft Locking Pin (Part No.D) correctly installed.

(2) Refit the cylinder head, remove Camshaft Locking Pin (Part No.D) to allow installation of the timing chain, camshaft sprocket and chain tensioner.

(3) Install the camshaft sprocket and the chain, the elongated holes in the camshaft chain sprocket must be aligned centrally over the tapped holes in the camshaft. (Fig.30)

(4) Reinstall Camshaft Locking Pin (Part No.D).

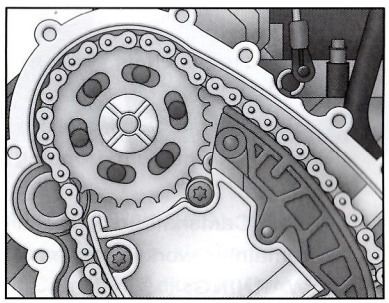


Fig.30

(5) Fit the tensioner using new tensioner bolts and tighten to 5 Nm + 90°.
Fit three camshaft sprocket bolts by finger tighten only, ensuring it is possible for the camshaft sprocket to rotate on the camshaft for adjustment. (Fig.31)
IMPORTANT:
As the tensioner bolts have been released they must be replaced with new bolts.

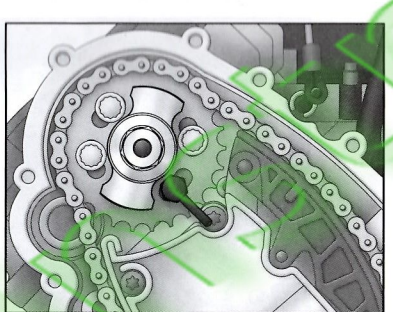


Fig.31

(6) Release the timing chain tensioner by removing the Tensioner Retaining Pin (Part No.I or J).

(7) 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 Camshaft Sprocket Adjuster (Part No.G), apply the specified preload torque in a clockwise direction, RH Bank - 20 Nm, LH Bank - 15 Nm.
While maintaining the preload torque, tighten the three camshaft sprocket bolts to 23 Nm.

(8) Remove Camshaft Sprocket Adjuster (Part No.G).
Install the two remaining camshaft sprocket bolts, then using Camshaft Adjuster (Part No.F) to counter hold the camshaft, tighten all camshaft sprocket bolts to 23 Nm.

(9) Remove Crankshaft Locking Pin (Part No.E), and Camshaft Locking Pin (Part No.D). Using Crankshaft Adjuster (Part No.A), rotate the crankshaft in the direction of engine rotation two revolutions and check camshaft timing - Check procedure "**(A) Checking Camshaft Timing**".

(D) 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.

1. **Engine timing**

(1) Remove the three timing chain covers giving access to the timing chains. (Fig.32)

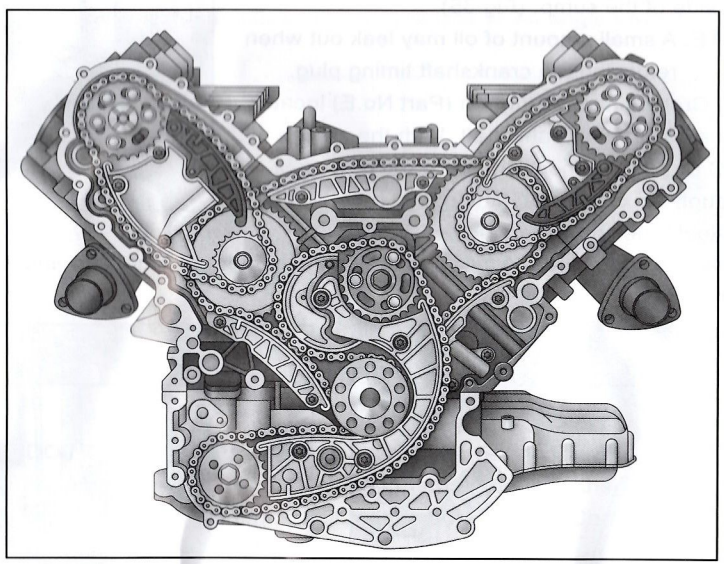


Fig.32

(2) Install Crankshaft Adjuster (Part No.H) to the crankshaft and secure in place using bolts. (Fig.33)

NOTE: Bolts from the automatic gearbox drive plate can be used to secure Crankshaft Adjuster (Part No.H). Bolts from manual gearbox dual mass flywheels MUST NOT be used as they are too long and may damage the timing chain assemblies.

(3) Using Crankshaft Adjuster (Part No.H) rotate the crankshaft in the direction of rotation to TDC on No.1 cylinder. (Fig.34)

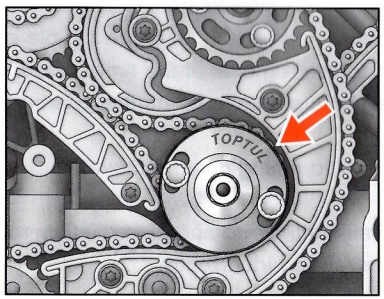


Fig.33

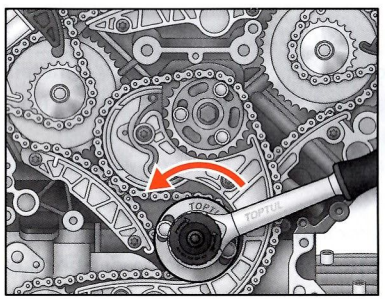


Fig.34

(4) Remove the crankshaft timing plug located on the side of the sump. (Fig.35)

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

The Crankshaft Locking Pin (Part No.E) 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.36)

To "lock" the crankshaft, screw Crankshaft Locking Pin (Part No.E) fully into the crankshaft timing plug hole and tighten to 20 Nm. (Fig.37)

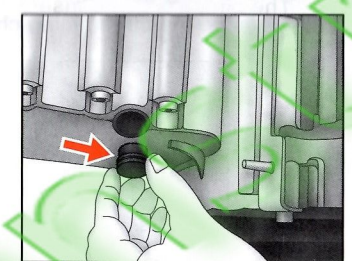


Fig.35

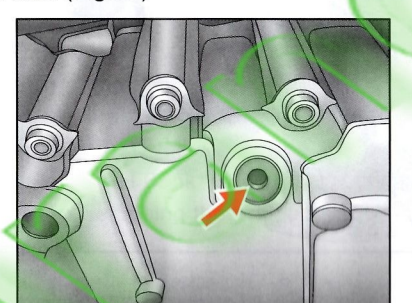


Fig.36

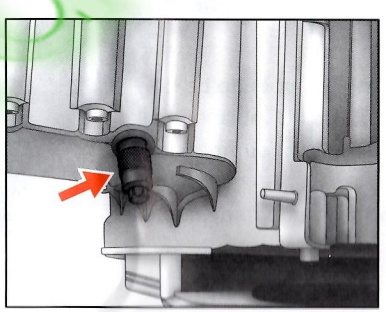


Fig.37

(5) At TDC on No.1 cylinder the Camshaft Locking Pins (Part No.D) will easily locate through the slots in the camshaft sprockets, the camshafts and into the datum holes in the cylinder heads. (Fig.38)

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. (Fig.39)

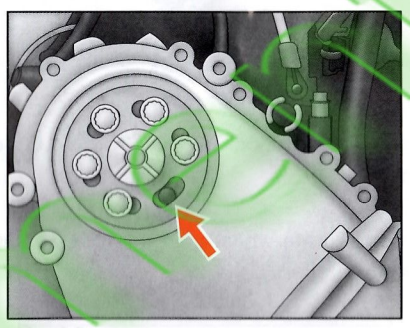


Fig.38

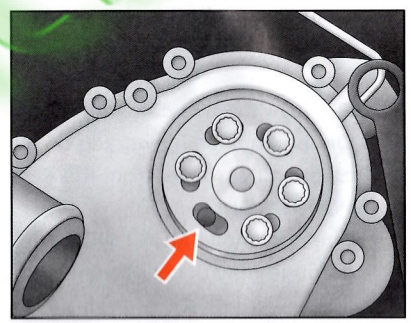


Fig.39

Camshaft Locking Pin (Part No.D) 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 Camshaft Locking Pins (Part No.D) should then be rotated until the handles point downwards at an angle towards the crankshaft. (Fig.40 & 41)

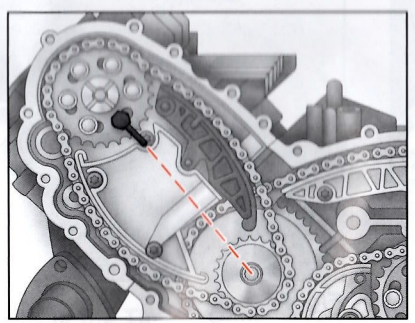


Fig.40

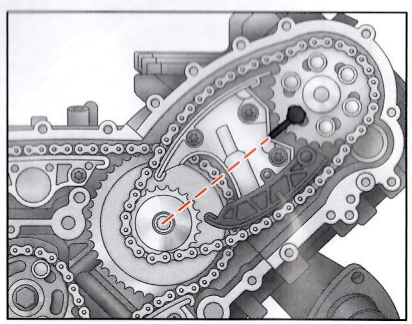


Fig.41

NOTE: DO NOT apply undue force to Camshaft Locking Pin (Part No.D). If it is not possible to install the pins and to rotate them to their required position, without forcing, the timing will require adjustment - Check procedure "**(B) Adjusting Camshaft Timing**".

2. **Removal**

■ **Removing the Camshaft Timing Chains**

(1) Select the appropriate Tensioner Retaining Pin (Part No.I or J). Press the chain tensioner rail, compressing the tensioner plunger and retain in place using Tensioner Retaining Pin (Part No.I or J). (Fig.42)

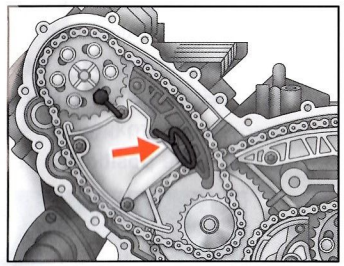


Fig.42

(2) Remove the five camshaft sprocket bolts.
On the bank being worked on, remove Camshaft Locking Pin (Part No.D) (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) Remove the chain tensioner and the camshaft timing chain.
IMPORTANT:
Plug tensioner/cylinder head oil ways to prevent the ingress of dirt. (Fig.43)

(4) Refit Camshaft Locking Pin (Part No.D) to prevent the camshaft rotating while the remaining work is carried out. (Fig.44)
Repeat this procedure for the remaining bank.

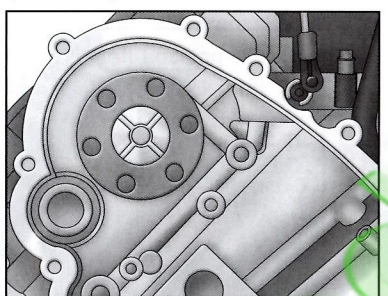


Fig.43

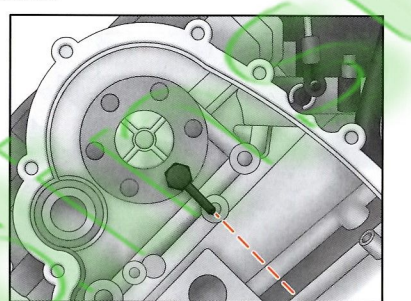


Fig.44

■ **Removing the Timing Chain for the Auxiliary Drives**

(1) Insert Balance Shaft Locking Pin (Part No.C) through the balance shaft and into the datum hole in the bearing plate. (Fig.45)

(2) Select the appropriate Tensioner Retaining Pin.
Press the chain tensioner rail, compressing the tensioner plunger and retain in place using Tensioner Retaining Pin (Part No.I or J). (Fig.46)

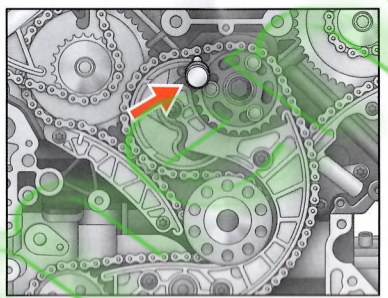


Fig.45

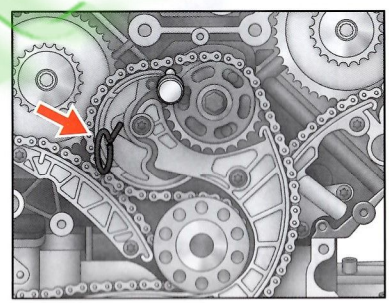


Fig.46

(3) Remove the bolts and sprocket from the balance shaft. (Fig.47)

(4) Remove the bolts from the auxiliary drive chain tensioner, and remove the tensioner with the chain. (Fig.48)

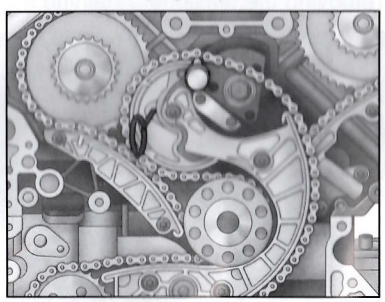


Fig.47

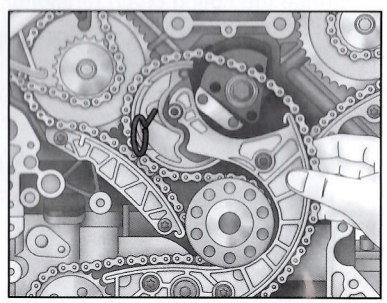


Fig.48

■ **Removing the Timing Chain for the Valve Gear**

(1) Select the appropriate Tensioner Retaining Pin. Press the chain tensioner rail, compressing the tensioner plunger and retain in place using Tensioner Retaining Pin (Part No.I or J). (Fig.49)

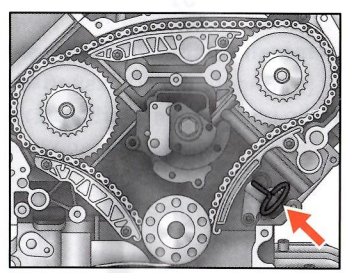


Fig.49

(2) Mark the orientation of the guide rail to ensure correct installation. Remove the guide rail bolts and the guide rail. (Fig.50)

(3) Remove the idler pulley bolts, then remove the idler pulleys with the timing chain. (Fig.51)

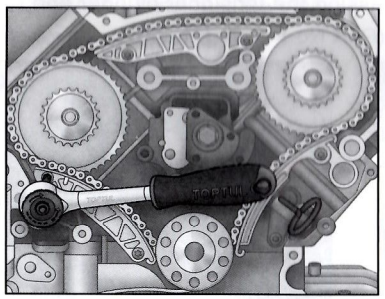


Fig.50

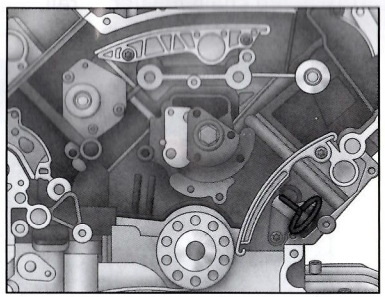


Fig.51

3. **Installation**

■ **Installing the Timing Chain for the Valve Gear**

(1) Install the timing chain and the idler pulleys using new bolts. Install the guide rail using new guide rail bolts. (Fig.52)

(2) Release the timing chain tensioner by removing the tensioner retaining pin. (Fig.53)

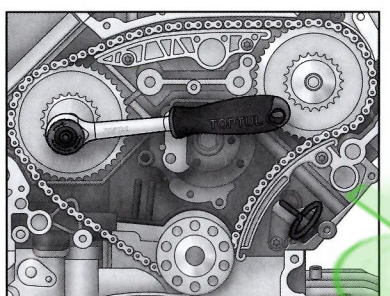


Fig.52

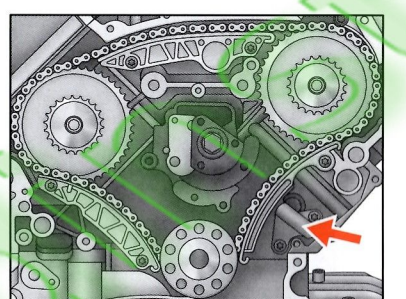


Fig.53

■ **Installing the Timing Chain for the Auxiliary Drives**

(1) Ensure the crankshaft is positioned at TDC on No.1 cylinder with Crankshaft Locking Pin (Part No.E) fitted.

(2) Ensure Balance Shaft Locking Pin (Part No.C) is located correctly through the balance shaft and into the datum hole in the bearing plate. (Fig.54)

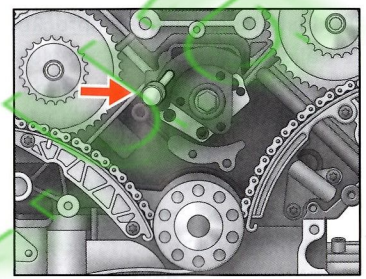


Fig.54

(3) Install the timing chain tensioner with the timing chain and tighten the tensioner bolts.

(4) 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.55)
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 (Part No.I or J).

(5) 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. Remove Balance Shaft Locking Pin (Part No.C). (Fig.56)

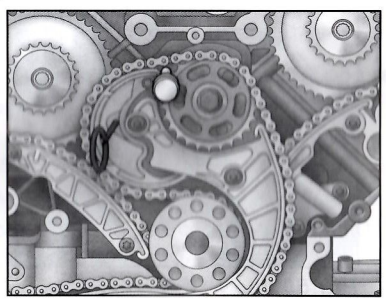


Fig.55

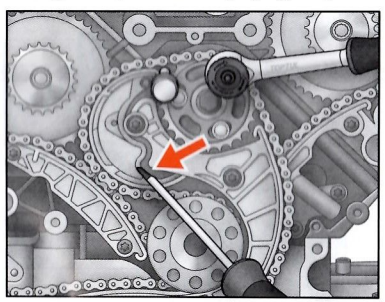


Fig.56

■ **Installing the Camshaft Timing Chains**

(1) Ensure the crankshaft is positioned at TDC on No.1 cylinder with Crankshaft Locking Pin (Part No.E) fitted, and that the camshafts are in their "timed" positions with Camshaft Locking Pin (Part No.D) correctly installed.
On the bank being worked on, remove Camshaft Locking Pin (Part No.D) 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.

(2) Install the camshaft sprocket and the chain, aligning the elongated holes of the camshaft sprocket centrally over the five camshaft sprocket bolt holes. (Fig.57)
Reinstall Camshaft Locking Pin (Part No.D).
Fit the tensioner using new tensioner bolts and tighten to 5 Nm + 90°.
IMPORTANT:
As the tensioner bolts have been released they must be replaced with new bolts.

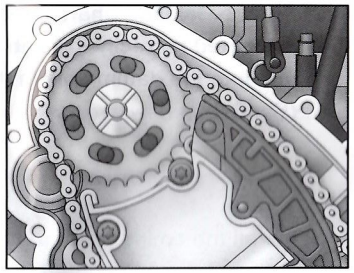


Fig.57

(3) Fit three camshaft sprocket bolts in the positions shown finger tight only, ensuring it is possible for the camshaft sprocket to rotate on the camshaft for adjustment. (Fig.58)
Release the timing chain tensioner by removing the Tensioner Retaining Pin (Part No.I or J).

(4) Using Camshaft Sprocket Adjuster (Part No.G), apply the specified preload torque in a clockwise direction, RH Bank - 20 Nm, LH Bank - 15 Nm. (Fig.59)
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 23 Nm.

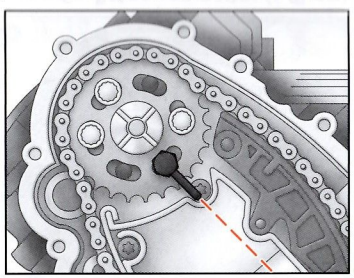


Fig.58

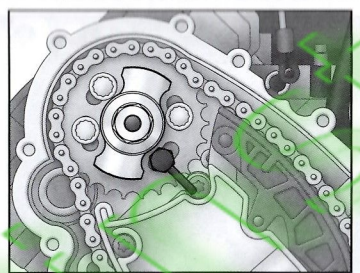


Fig.59

(5) Remove Camshaft Sprocket Adjuster (Part No.G).

(6) Install the two remaining camshaft sprocket bolts, then using Camshaft Adjuster (Part No.F) to counter hold the camshaft, tighten all five camshaft sprocket bolts to 23 Nm.
Repeat this procedure for the remaining bank.

(7) Remove Crankshaft Locking Pin (Part No.E), and Camshaft Locking Pin (Part No.D).

(8) Using Crankshaft Adjuster (Part No.H), rotate the crankshaft in the direction of engine rotation two revolutions and check camshaft timing - Check procedure "**(A) Checking Camshaft Timing**".

(E) 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 H.P. Pump Sprocket Remover (Part No.K) to position the H.P. diesel pump sprocket, and Crankshaft Locking Pin (Part No.E) 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 (Part No.K) 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"

1. **Removal**

(1) Remove the engine cover to give access to the pump belt.

(2) Slacken the belt tensioner bolt and remove the pump belt.

(3) If the pump sprocket requires removal, remove the weight from the H.P. diesel pump using a suitable counter hold. (Such as JGAI1101 Universal Pulley Holder & Fan Clutch Set)

(4) Attach H.P. Pump Sprocket Remover (Part No.K) to the sprocket using the two bolts provided. (Fig.60)
Remove the sprocket by tightening the central force screw.

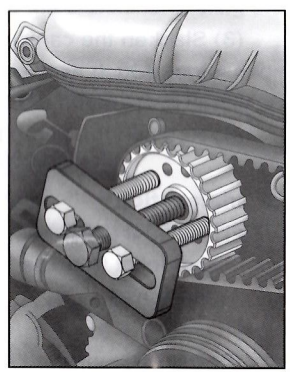


Fig.60

2. **Installation**

(1) Fit the H.P. diesel pump toothed belt.

(2) Using an allen key, rotate the tensioner in the direction indicated on the tensioner until the indicator lug is approximately 5 mm below the notch. (Fig.61)

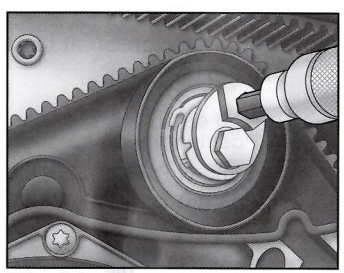


Fig.61

(3) Release the tensioner until the indicator lug and the notch are aligned, then tighten the tensioner bolt. (Fig.62)

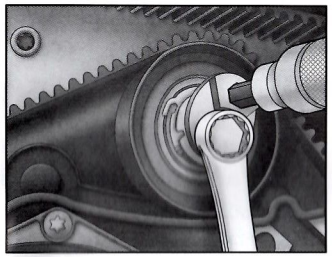


Fig.62

(4) Using Crankshaft Adjuster (Part No.A), rotate the crankshaft in the direction of engine rotation two revolutions and check the indicator lug and the notch are aligned.

NOTE: 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"

1. **Removal**

(1) Remove the engine cover to give access to the pump belt.

(2) Slacken the belt tensioner bolt.

(3) Slacken the camshaft sprocket bolt two turns while using a suitable counter hold tool. (Such as JGAI1101 Universal Pulley Holder & Fan Clutch Set)

(4) Remove the pump belt.

2. **Installation**

(1) Using a suitable remover Camshaft Sprocket Remover Tool, release the camshaft sprocket from the camshaft. Ensure the camshaft sprocket is free to rotate on the camshaft.

(2) Using Crankshaft Adjuster (Part No.A), rotate the crankshaft in the direction of engine rotation to TDC position on No.1 cylinder.

(3) Screw Crankshaft Locking Pin (Part No.E) fully into the crankshaft timing plug hole and tighten to 20 Nm.

(4) Position the pump sprocket and lock in position using H.P. Pump Locking Pin (Part No.B). (Fig.63)

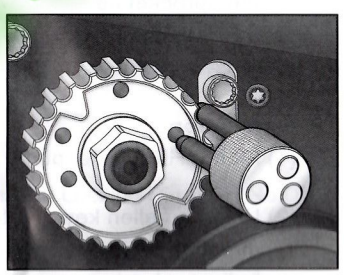


Fig.63

(5) Fit the H.P. diesel pump toothed belt.

(6) Using an allen key, rotate the tensioner in the direction indicated on the tensioner until the indicator lug is approximately 5 mm below the notch. (Fig.64)

(7) Release the tensioner until the indicator lug and the notch are aligned, then tighten the tensioner bolt. (Fig.65)

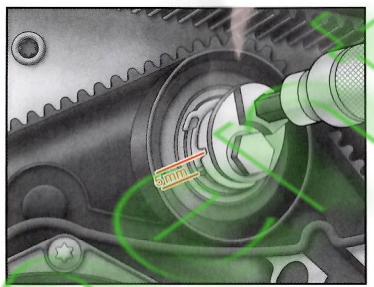


Fig.64

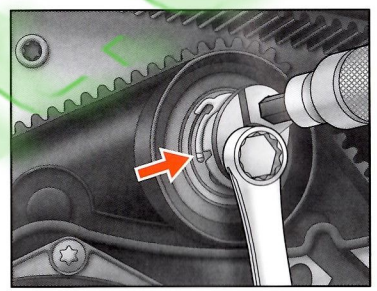


Fig.65

(8) Tighten the camshaft sprocket bolt while using a suitable counter hold tool. (Such as JGAI1101 Universal Pulley Holder & Fan Clutch Set)

(9) Remove Crankshaft Locking Pin (Part No.E), and replace the crankshaft timing plug.

(10) Using Crankshaft Adjuster (Part No.A), 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.

1. **Removal**

(1) Remove the engine cover to give access to the pump belt.

(2) Remove the tensioner bolt and the tensioner.

(3) Remove the toothed belt.

2. **Installation**

(1) Preload the tensioner by rotating the arm by hand and retain in place using an Tensioner Retaining Pin (Part No.I).

(2) Install the toothed belt, tensioner and tensioner bolt.

(3) Tension the belt by removing the pin.