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**Tier 4a
Engine**

SERVICE MANUAL

Part number 84474521

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INTRODUCTION

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Foreword - Ecology and the environment

Soil, air, and water are vital factors of agriculture and life in general. When legislation does not yet rule the treatment of some of the substances which are required by advanced technology, sound judgement should govern the use and disposal of products of a chemical and petrochemical nature.

NOTICE: *The following are recommendations which may be of assistance:*

- Become acquainted with and ensure that you understand the relative legislation applicable to your country.
- Where no legislation exists, obtain information from suppliers of oils, filters, batteries, fuels, antifreeze, cleaning agents, etc., with regard to their effect on man and nature and how to safely store, use and dispose of these substances.
- Agricultural consultants will, in many cases, be able to help you as well.

HELPFUL HINTS

- Avoid filling tanks using cans or inappropriate pressurized fuel delivery systems which may cause considerable spillage.
- In general, avoid skin contact with all fuels, oils, acids, solvents, etc. Most of them contain substances which may be harmful to your health.
- Modern oils contain additives. Do not burn contaminated fuels and or waste oils in ordinary heating systems.
- Avoid spillage when draining off used engine coolant mixtures, engine, gearbox and hydraulic oils, brake fluids, etc. Do not mix drained brake fluids or fuels with lubricants. Store them safely until they can be disposed of in a proper way to comply with local legislation and available resources.
- Modern coolant mixtures, i.e. antifreeze and other additives, should be replaced every two years. They should not be allowed to get into the soil but should be collected and disposed of properly.
- Do not open the air-conditioning system yourself. It contains gases which should not be released into the atmosphere. Your CNH dealer or air conditioning specialist has a special extractor for this purpose and will have to recharge the system properly.
- Repair any leaks or defects in the engine cooling or hydraulic system immediately.
- Do not increase the pressure in a pressurized circuit as this may lead to a component failure.
- Protect hoses during welding as penetrating weld splatter may burn a hole or weaken them, allowing the loss of oils, coolant, etc.

Safety rules

Personal safety



This is the safety alert symbol. It is used to alert you to potential personal injury hazards. Obey all safety messages that follow this symbol to avoid possible death or injury.

Throughout this manual and on machine decals, you will find the signal words DANGER, WARNING, and CAUTION followed by special instructions. These precautions are intended for the personal safety of you and those working with you.

Read and understand all the safety messages in this manual before you operate or service the machine.

! DANGER indicates a hazardous situation which, if not avoided, will result in death or serious injury. The color associated with DANGER is RED.

! WARNING indicates a hazardous situation which, if not avoided, could result in death or serious injury. The color associated with WARNING is ORANGE.

! CAUTION, used with the safety alert symbol, indicates a hazardous situation which, if not avoided, could result in minor or moderate injury. The color associated with CAUTION is YELLOW.

FAILURE TO FOLLOW DANGER, WARNING, AND CAUTION MESSAGES COULD RESULT IN DEATH OR SERIOUS INJURY.

Machine safety

NOTICE: Notice indicates a situation which, if not avoided, could result in machine or property damage. The color associated with Notice is BLUE.

Throughout this manual you will find the signal word Notice followed by special instructions to prevent machine or property damage. The word Notice is used to address practices not related to personal safety.

Information

NOTE: Note indicates additional information which clarifies steps, procedures, or other information in this manual.

Throughout this manual you will find the word Note followed by additional information about a step, procedure, or other information in the manual. The word Note is not intended to address personal safety or property damage.

Basic instructions - Important notice regarding equipment servicing

All repair and maintenance work listed in this manual must be carried out only by qualified dealership personnel, strictly complying with the instructions given, and using, whenever possible, the special tools.

Anyone who performs repair and maintenance operations without complying with the procedures provided herein shall be responsible for any subsequent damages.

The manufacturer and all the organizations of its distribution chain, including - without limitation - national, regional, or local dealers, reject any responsibility for damages caused by parts and/or components not approved by the manufacturer, including those used for the servicing or repair of the product manufactured or marketed by the manufacturer. In any case, no warranty is given or attributed on the product manufactured or marketed by the manufacturer in case of damages caused by parts and/or components not approved by the manufacturer.

The information in this manual is up-to-date at the date of the publication. It is the policy of the manufacturer for continuous improvement. Some information could not be updated due to modifications of a technical or commercial type, or changes to the laws and regulations of different countries.

In case of questions, refer to your CNH Sales and Service Networks.

Basic instructions - How To Use and Navigate Through This Manual

Technical Information

This manual has been produced by a new technical information system. This new system is designed to deliver technical information electronically through Web delivery, DVD and in paper manuals. A coding system called SAP has been developed to link the technical information to other Product Support functions, e.g., Warranty.

Technical information is written to support the maintenance and service of the functions or systems on a customer's machine. When a customer has a concern on his machine it is usually because a function or system on his machine is not working at all, is not working efficiently, or is not responding correctly to his commands. When you refer to the technical information in this manual to resolve that customer's concern, you will find all the information classified using the SAP coding, according to the functions or systems on that machine. Once you have located the technical information for that function or system then you will find all the mechanical, electrical or hydraulic devices, components, assemblies and sub assemblies for that function or system. You will also find all the types of information that have been written for that function or system, the technical data (specifications), the functional data (how it works), the diagnostic data (fault codes and troubleshooting) and the service data (remove, install adjust, etc.).

By integrating SAP coding into technical information, you will be able to search and retrieve just the right piece of technical information you need to resolve that customer's concern on his machine. This is made possible by attaching 3 categories to each piece of technical information during the authoring process.

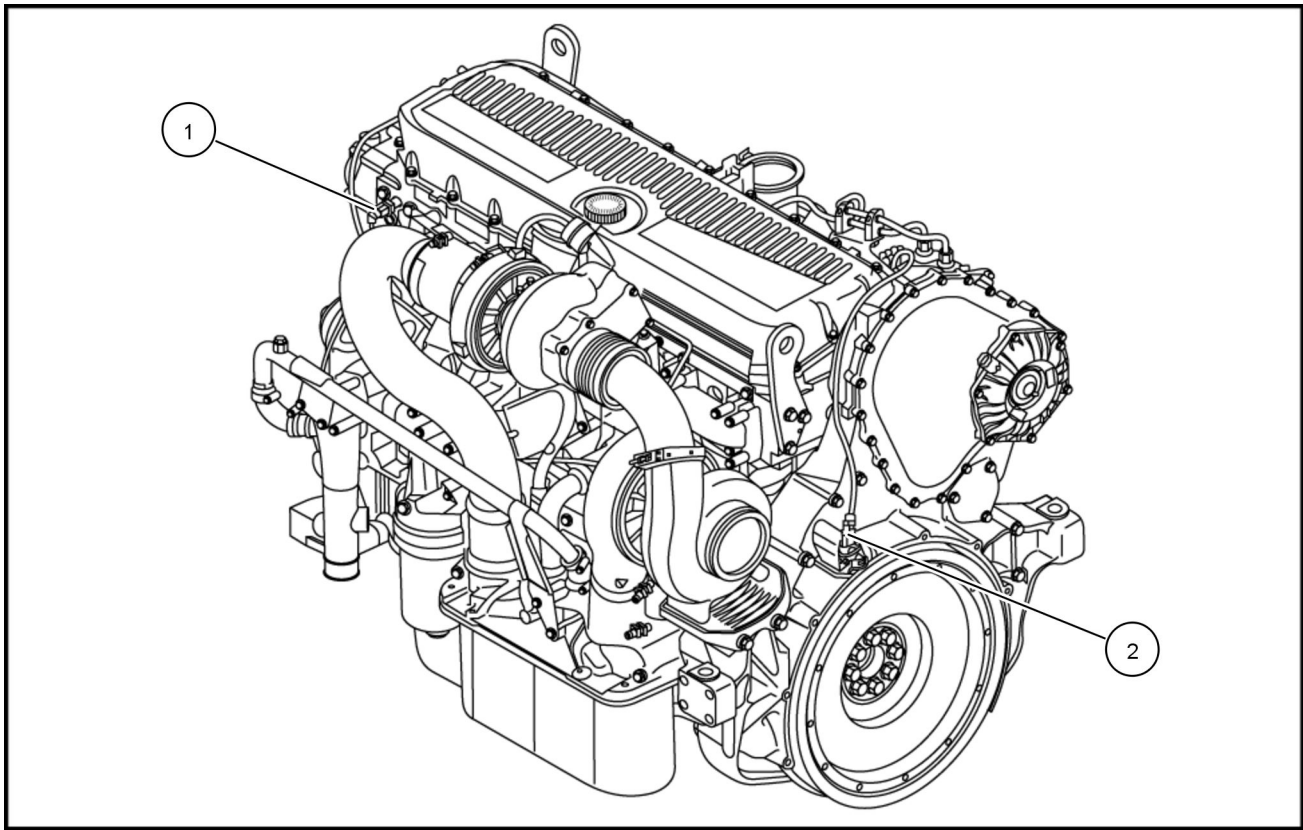
The first category is the Location, the second category is the Information Type and the third category is the Product:

- LOCATION - is the component or function on the machine, that the piece of technical information is going to describe e.g. Fuel tank.
- INFORMATION TYPE - is the piece of technical information that has been written for a particular component or function on the machine e.g. Capacity would be a type of Technical Data that would describe the amount of fuel held by the Fuel tank.
- PRODUCT - is the model for which the piece of technical information is written.

Every piece of technical information will have those 3 categories attached to it. You will be able to use any combination of those categories to find the right piece of technical information you need to resolve that customer's concern on his machine.

That information could be:

- the description of how to remove the cylinder head
- a table of specifications for a hydraulic pump
- a fault code
- a troubleshooting table
- a special tool



83113600 2

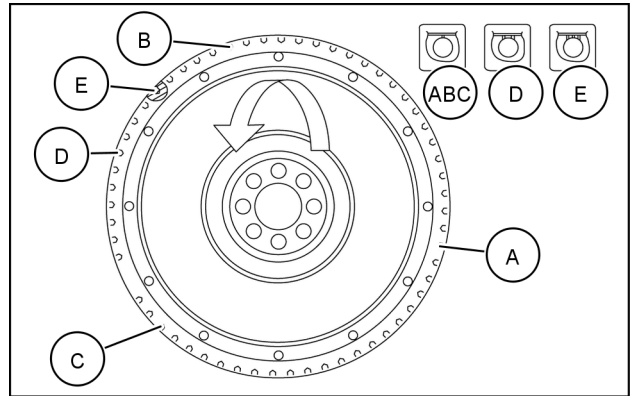
Left hand side view of engine

(1) Engine speed flywheel sensor

(2) Coolant temperature sensor

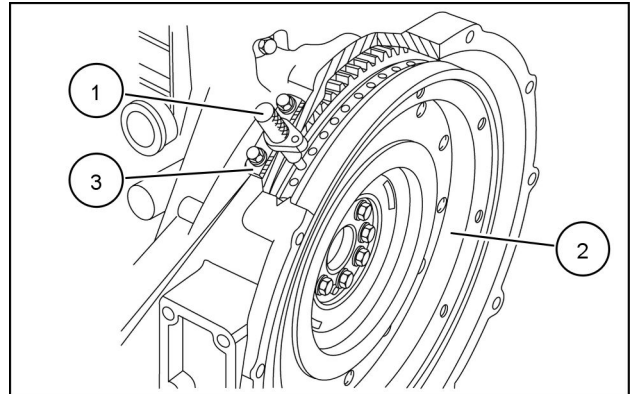
ENGINE - Service instruction - Finding Top Dead Center (TDC)

- Using the tool **380000137**, turn the engine flywheel in the direction of normal rotation until you see the hole with two reference marks (**D**).
- Continue to turn the flywheel until the hole with one reference mark (**B**) can be seen. This marks TDC of the number one cylinder.



83116759A-40589496 1

- The exact position of piston number one at TDC is obtained when the tool **380000150 (1)** fits into a hole in the flywheel (**2**) through the mounting surface of the engine speed sensor (**3**).
- Remove the tool **380000150 (1)**.



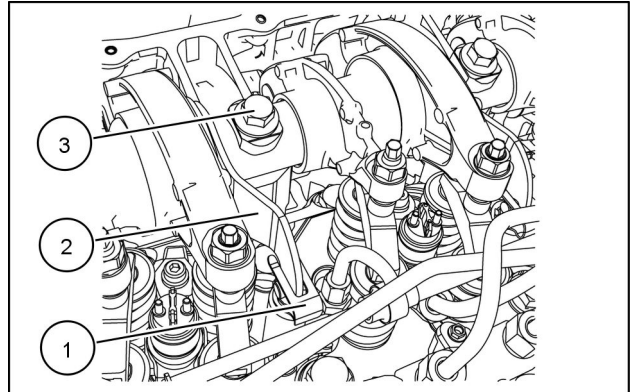
83116760 2

Valve drive Rocker assembly - Remove

Prior operation:

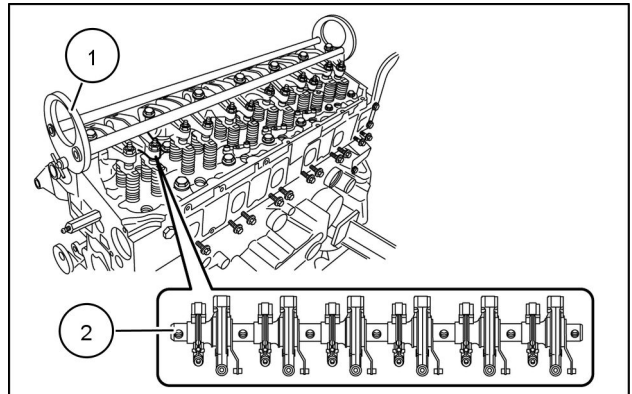
Valve cover - Remove (B.10.A)

1. Remove the retaining springs (1) from the engine brake control levers (2).
2. Remove the bolts (3) securing the rocker shaft to the cylinder head.



83116795 1

3. Apply tool **380000148** (1) to the rocker shaft (2) and remove the shaft from the cylinder head.



83115059 2

Next operation:

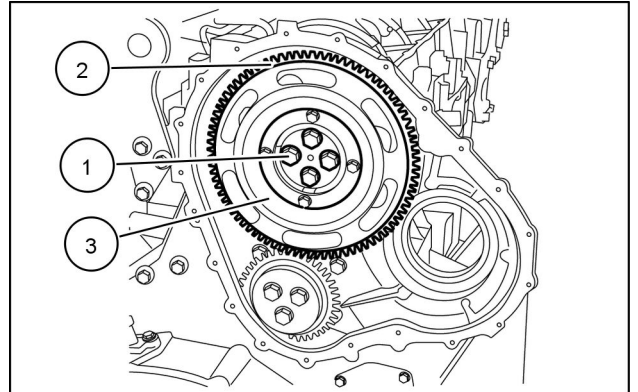
Valve drive Rocker assembly - Install (B.10.A)

Camshaft Gear - Remove

Prior operation:

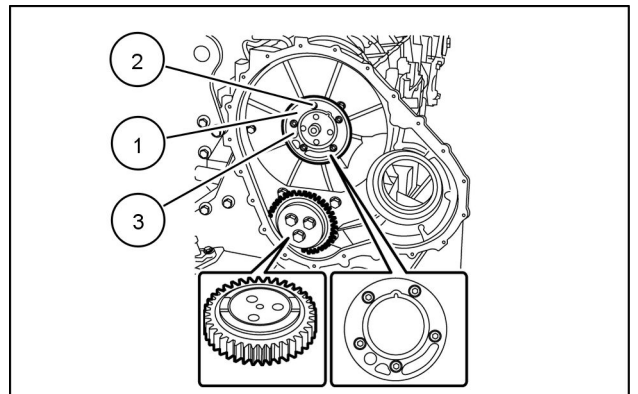
Blowby re-circulation system - Remove (B.60.A)

1. Loosen and remove the bolts (1) and remove the gear (2) fitted with the timing plate (3).



83116735 1

2. Remove the screws (1) securing the shoulder plate (2).
3. Using a mounting screw (1), insert it into the threaded hole (3) on the shoulder plate.
4. Turn the screw clockwise to remove the shoulder plate (2).
5. Remove the gasket.



83116736 2

Next operation:

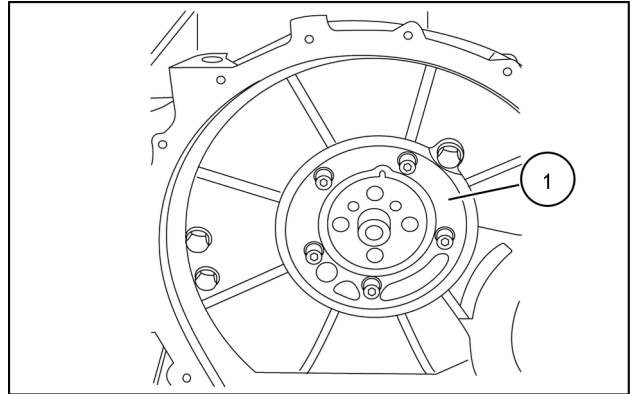
Valve drive Camshaft - Timing adjust (B.10.A)

Valve drive Camshaft - Remove

Prior operation:

Valve drive Rocker assembly - Remove (B.10.A)

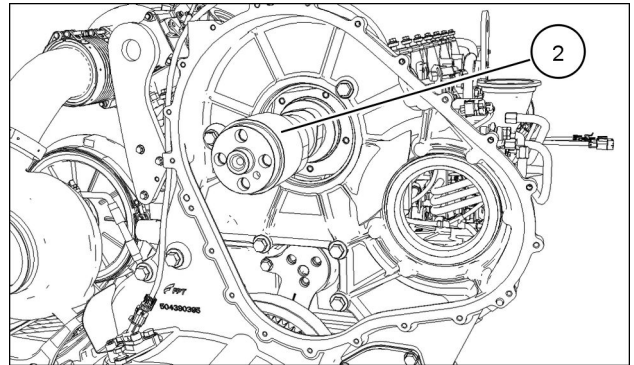
1. Remove the shoulder plate (1).



83116768 1

2. Remove the camshaft (2) from the cylinder head.

NOTE: Be sure not to damage the camshaft bushings.



23116816-40895319 2

Next operation:

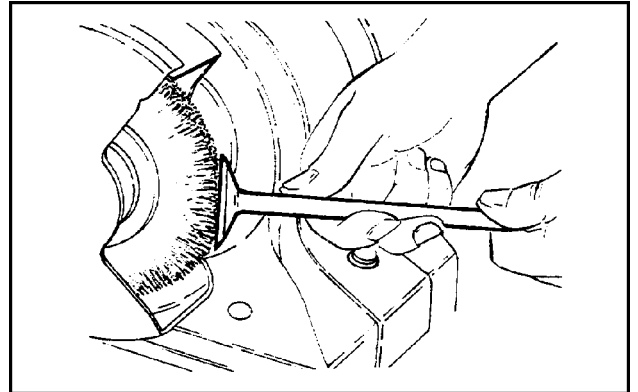
Valve drive Camshaft - Install (B.10.A)

Valve assembly Valve - Cleaning

Prior operation:

Cylinder head - Disassemble (B.10.A)

1. Remove carbon deposits from the valves using a wire wheel.
2. Check that the valves show no signs of seizure or cracking. Replace if any defects are found.



BAPH04APH151ASA 1

Next operation:

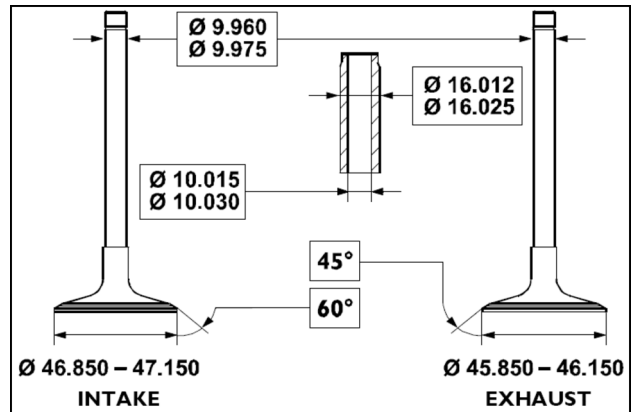
Valve assembly Valve - Measure (B.10.A)

Valve assembly Valve - Measure

Prior operation:

Valve assembly Valve - Cleaning (B.10.A)

1. Using a micrometer, check that the valve stem measurements are as specified.
2. If necessary, grind the valve seats, removing the least amount of material as possible.



VALVE 1

Next operation:

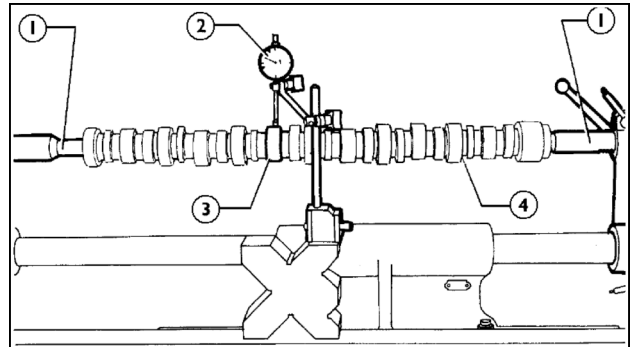
Cylinder head - Assemble (B.10.A)

Valve drive Camshaft - Measure

Prior operation:

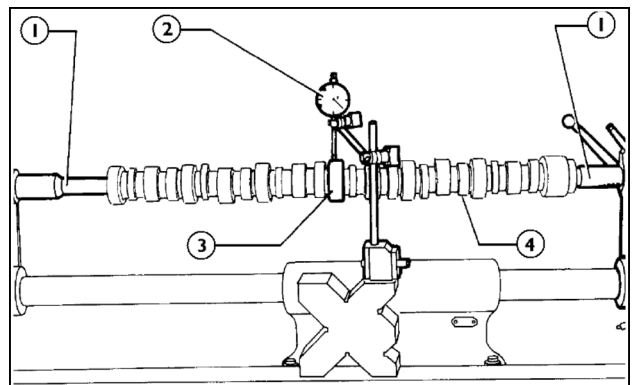
Valve drive Camshaft - Remove (B.10.A)

1. Place the camshaft (4) on the tailstock (1) and check the cam lift (3) using a dial gauge (2).



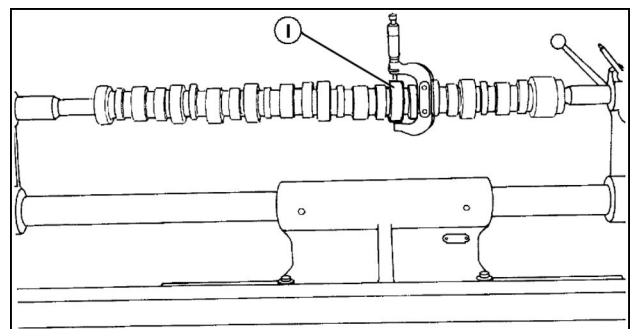
CAMSHAFT 1

2. When the camshaft (4) is on the tailstock (1), check the alignment of the supporting pin (3) using a dial gauge (2).
3. If the misalignment exceeds **0.030 mm (0.0012 in)**, replace the shaft.



CAMSHAFT2 2

4. To check the clearance of the camshaft and bushing, measure the inside diameter of the bushing and the outside diameter of the camshaft pin (1).
5. Subtract the pin diameter from the bush diameter to obtain the clearance. If the clearance exceeds **0.135 mm (0.0053 in)**, replace the bushes and, if necessary, the camshaft.



CAMSHAFT3 3

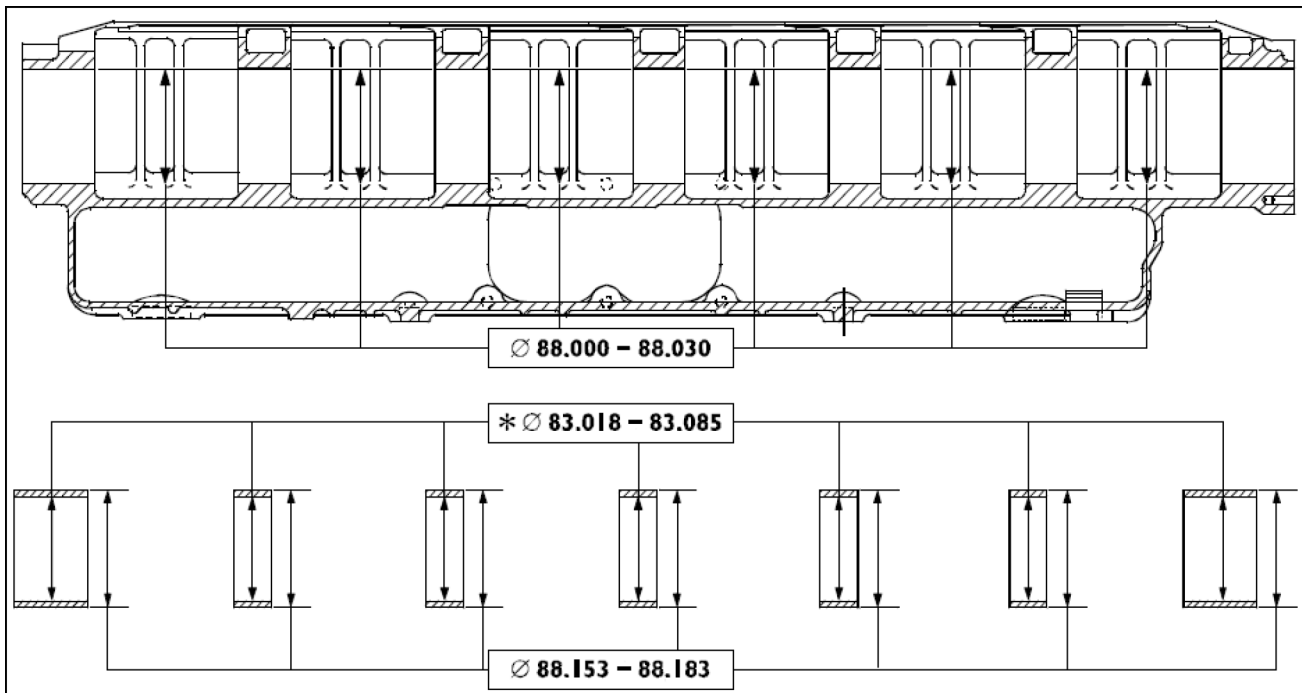
Next operation:

Valve drive Camshaft - Install (B.10.A)

Camshaft Bushing - Replace

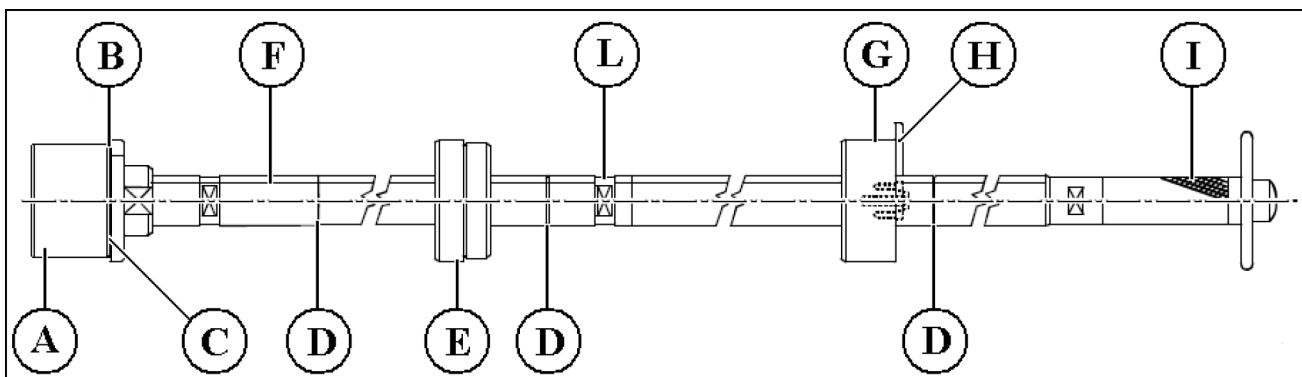
Prior operation:

Valve drive Camshaft - Remove (B.10.A)



* Measurement to be taken after installation.

1. The surface of the bushing must show no sign of seizing or scoring. Replace them if they do.
2. Measure the inside diameter of the bushings with a bore gauge. If you find a higher tolerance than specified, replace them.
3. To remove and install the bushings, use the appropriate drift **380000146**.

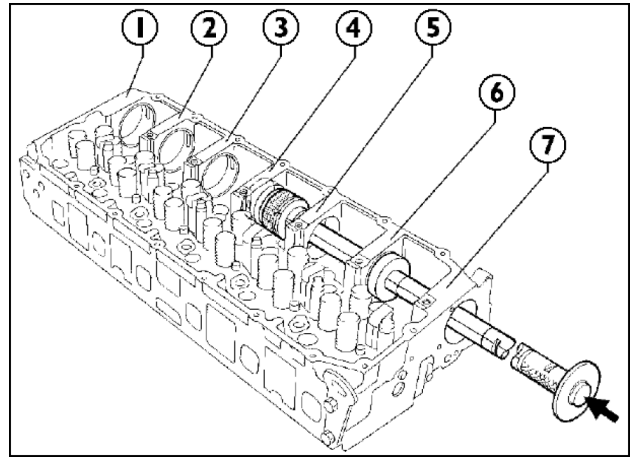


CAMBUSHING4 2

- | | |
|--------------------------------------------------------------|------------------------------------------------------------|
| (A) Drift with seat for removal and installation of bushings | (F) Guide line |
| (B) Grub screw for positioning bushings | (G) Guide bushing to secure the seventh bushing mount |
| (C) Reference mark to insert bushing 7 correctly | (H) Plate securing the yellow bushing to the cylinder head |
| (D) Reference marks (red) to insert bushings 1 - 6 | (I) Grip |
| (E) Guide bushing | (L) Extension coupling |

Removal

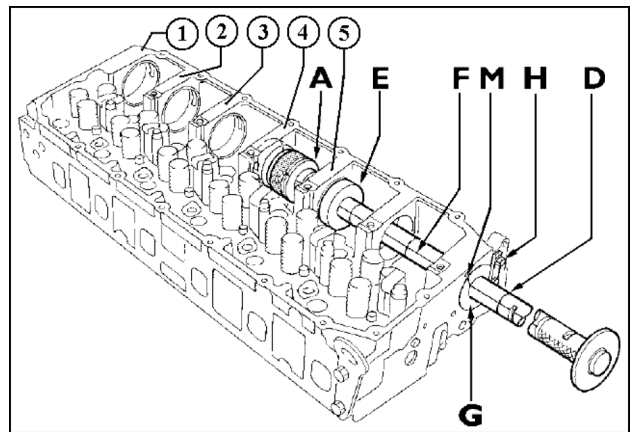
4. Remove the bushings in the following sequence: **(7)**, **(6)**, **(5)**, **(4)**, **(3)**, **(2)**, **(1)**.
5. The bushings are driven out towards the front side of the cylinder head.
6. Bushings **(5)**, **(6)** and **(7)** do not require the drift extension or the guide bushing.
7. For bushings **(1)**, **(2)**, **(3)** and **(4)** it is necessary to use the extension and the guide bushings.
8. Make sure the drift positioned accurately during remove so as not to damage the cylinder head.



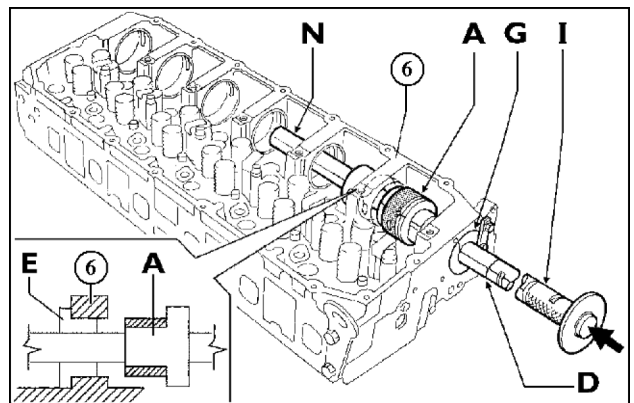
CAMBUSHING3 3

Installation

9. Using the drift with the extension, insert bushings **(1)**, **(2)**, **(3)**, **(4)** and **(5)** and proceed as follows.
10. Position the bushing to be installed on the drift **(A)** making the grub screw **(B)** coincide with the seat on the bushing.
11. Position the guide bushing **(E)** and secure the guide bushing **(G)** on the seat of the seventh bushing with the plate **(H)**.
12. While driving in the bushing, make the reference mark **(F)** match the mark **(M)** so the lubrication hole in the bushing will align with the oil passage in its seat.
13. The bushing is fully seated when the first red reference mark **(D)** is flush with the guide bushing **(G)**.
14. To insert bushing **(6)**, unscrew the grip **(I)** and the extension **(N)**.
15. Position the extension **(N)** and the guide bushing **(E)** as shown in the figure, and repeat the steps outlined for bushings **(1)**, **(2)**, **(3)**, **(4)** and **(5)**.

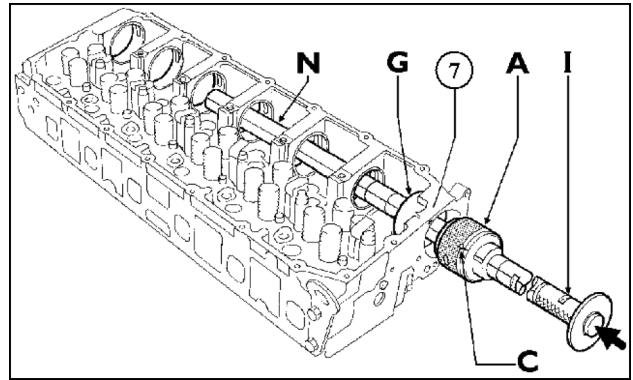


CAMBUSHING5 4



CAMBUSHING6 5

16. To insert bushing (7), unscrew the grip (I) and the extension (N).
17. Install the guide (G) from the inside as shown in the figure.
18. Position the bushing on the drift (A).
19. Line up the lubrication hole in the bushing with the oil passage in its seat.
20. Drive the bushing into position. It is fully inserted when the reference mark (C) is flush with the bushing seat.



CAMBUSHING7 6

Next operation:**Valve drive Camshaft - Install (B.10.A)**

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