

ENGLISH FOR ACADEMIC PURPOSES SERIES

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GENERAL ENGINEERING

C M and D Johnson



CASELL

CONTENTS

UNIT

1. Metals	1
2. Measurement	8
3. Design and Function	18
4. Energy, Heat and Work	29
5. Control Devices	40
Check Your Progress (1)	49
6. Pumps	54
7. Air-Conditioning Systems	63
8. Diesel Engines	71
9. Data Communications	79
10. Electric Power Systems	90
Check Your Progress (2)	100
11. Refrigeration Systems	105
12. Water Treatment	115
13. Telecommunications	124
14. Engineering Design	134
15. Engineering and the Earth's Resources	146

DIESEL ENGINES

UNIT 8

A. Understanding a printed text (1)

This text will describe the **cylinder head** in a diesel engine, and will give instructions on how to remove it.

Read the passage through and find the answers to these questions. Remember, you do not have to understand every word to answer the questions.

1. What is a cylinder head made of?
2. What is its function?
3. What are the parts of a cylinder head called?
4. What part of the engine can you see when the cylinder head is removed?

The Cylinder Head

The cylinder head is cast as one piece. It is the upper sealing surface of the combustion chamber. It may serve one, two, three, four or six cylinders. The valve guides, which guide the valve stem during the opening and closing of the valve, are pressed into the cylinder head. All cylinder heads are made of a special iron alloy casting containing carbon, silicon, and copper. This alloy mixture provides elasticity and good thermal conductivity, and has a low thermal expansion rate. The size of the cylinder head is not determined by the number of cylinders but rather by such factors as the overall cost of the engine, the cylinder block design, the number of main bearings, the expected thermal stress, and the anticipated cooling and sealing difficulties (of the cylinder head).

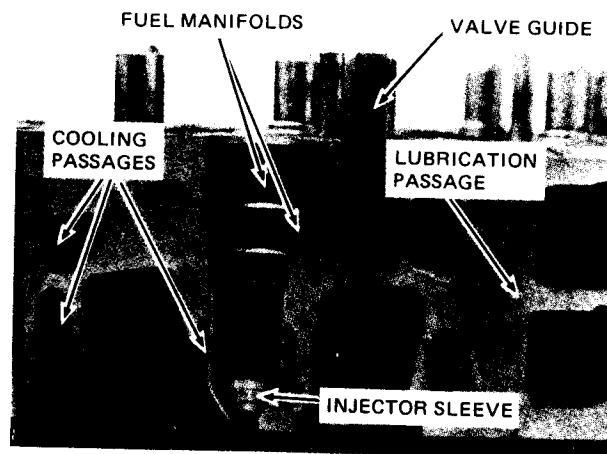


Fig. 5-7 Sectional view of a cylinder head.

Whether an individual cylinder head is used for each cylinder (Fig. 5-7) or whether the cylinder head covers two, three, four or six cylinders, it must nevertheless have adequate strength and stiffness. It must act as a sealing surface between the cylinder sleeve, cylinder-block top deck, and oil and cooling passages, without distorting the sleeve or valves. The cylinder head must be sufficiently strong so that it does not crack between the cylinder-head bolts (studs), between the intake and exhaust valve, or between the valves and injector (sleeve or bore).

The internal cooling passages must be located to ensure that the coolant flow has a high velocity at and around the valves and injector tubes. It must remove heat (steam bubbles) and prevent the accumulation of deposit or scale. The passages should have no dead ends. The external openings must prevent turbulence and permit unrestricted circulation from the cylinder block to the cylinder head and from the cylinder head to the radiator.

The valves must be located so that the fuel spray can reach the total combustion area, but they must be far enough apart so that the coolant can circulate freely between them, thereby preventing the cylinder head from cracking between the valve seats.

Removal of Cylinder Head

Care should be taken when removing the cylinder-head bolts or nuts.

Caution Never remove the cylinder head when it is hot because it will become distorted (warped).

If the cylinder head is very heavy, use a hoist to lift it from the cylinder block. If it is small, screw the lift handles into the cylinder head to lift it from the block. If a cylinder head is excessively tight, do not drive a chisel or screwdriver between the cylinder block and head to remove it, as this will damage both surfaces. Lightly tap the cylinder head with a bronze or lead hammer or use a block of wood to break it loose.

Carefully inspect the combustion chamber once it is exposed. Close scrutiny can often reveal the cause of high oil consumption, overfueling, water leakage, or overheating. Damage to pistons, cylinder sleeves, and cylinder block can also be seen.

Caution When removing the cylinder head, take care not to damage it or the cylinder block surface or threads. If studs are used, take care not to bend them. After removal, place the cylinder head in a holding fixture, or if it happens to be square, you may place it on a workbench.

E.J. Schulz, *Diesel Mechanics* (second edition), pp 23–4. McGraw-Hill, 1983.

B. Check your understanding

Now study the text carefully. As you do, look for the answers to these questions:

1. The alloy used to make the cylinder head should have the following properties (tick all those which will complete the above sentence):

- | | | |
|--------------------------------------|---|--------------------------|
| <input type="checkbox"/> strength | <input type="checkbox"/> good electrical conductivity | <input type="checkbox"/> |
| <input type="checkbox"/> flexibility | <input type="checkbox"/> good thermal conductivity | <input type="checkbox"/> |
| <input type="checkbox"/> ductility | <input type="checkbox"/> stiffness | <input type="checkbox"/> |
| <input type="checkbox"/> brittleness | <input type="checkbox"/> low thermal expansion rate | <input type="checkbox"/> |
| <input type="checkbox"/> elasticity | <input type="checkbox"/> high thermal expansion rate | <input type="checkbox"/> |

2. The size of the cylinder head depends on (tick all the statements which are correct):

- (a) the number of main bearings
- (b) the number of cylinders
- (c) the design of the cylinder block
- (d) the amount of thermal stress it must withstand
- (e) the cost of the engine
- (f) the cost of raw materials

3. Tick all the statements below which refer to things that *must be done* or *must happen*:

- (a) The coolant must flow quickly around the valves and injector tubes.
- (b) The fuel spray must reach the total combustion area.
- (c) The cooling passages must have dead ends.
- (d) Turbulence must be prevented.
- (e) The valves must be located as close together as possible.
- (f) The accumulation of scale must be prevented.
- (g) The cylinder head must be removed when it is hot.
- (h) A screwdriver must be used to loosen the cylinder head when removing it.

4. What problems of a general kind might be discovered by removing the cylinder head and inspecting the combustion chamber?

Make a list (seven are mentioned in the text).

C. Increase your vocabulary

1. Notice the use of these words in the text:

- adequate/inadequate
- sufficient
- excessive

Read the following sentences and notice how they can be expressed in another way:

- We had sufficient supplies to last three days.
= We had *enough* supplies to last three days.
- The instructions they gave were inadequate.
= The instructions they gave were *not good enough*.
- The costs were excessive (or: excessively high).
= The costs were *too high*.

Now re-write these sentences in the same way:

- The accumulation of deposit was excessive.
- The strength of the material was inadequate to withstand stress.
- The cylinder block cracked because it was not sufficiently strong.
- The mechanic used excessive force to remove the block.
- The inspection was not carried out with sufficient care.
- There is an inadequate amount of detail in the text.

2. Now look in the text to see how these words were used.

- provide
- prevent
- permit
- ensure

When you have studied the use, decide which one can be used in each of these sentences:

- Lubricants are used to _____ friction.
- The coolant system must _____ the coolant to expand.
- An outlet is _____ so that excess coolant can escape.
- Piston rings must fit correctly to _____ proper sealing and oil control.

F. Understanding a printed text (2)

Read the following passage:

Bearing Wear

Normal Bearing Wear Before you can diagnose abnormal wear, you must first understand what is considered to be normal wear. Most bearing wear that occurs during the first few hours of operation is minimal and accepted as 'normal'. The bearing shown in Fig. 17-7 was taken from a truck engine which was operated for 4500 hours. It shows normal wear. Under normal usage some of the thin lead-tin overlay surface wears off, exposing the lining (copper, nickel, or aluminum). The pattern of wear is concentrated toward the center of the bearing because of its larger diameter. When motortruck engine bearings show this wear within less than 2000 hours or 100,000 miles (mi) [160,930 km] of operation, the wear is considered to be abnormal, suggesting that abrasives have entered the oil. Check for the following: poor air filtration, intake manifold leakage, poor lubrication filtration, overfueling, or restricted engine breathing. Fine abrasives may also enter the oil during the engine rebuilding period or through carelessness while making oil and filter changes.

Most bearing failures are due to foreign matter (plain old dirt) passing between the journals and bearings. This also applies, of course, to other operating components. Depending on the type of foreign matter in the lubricant, the journals, bearings, and components may become scratched, pitted, or discolored, etc.

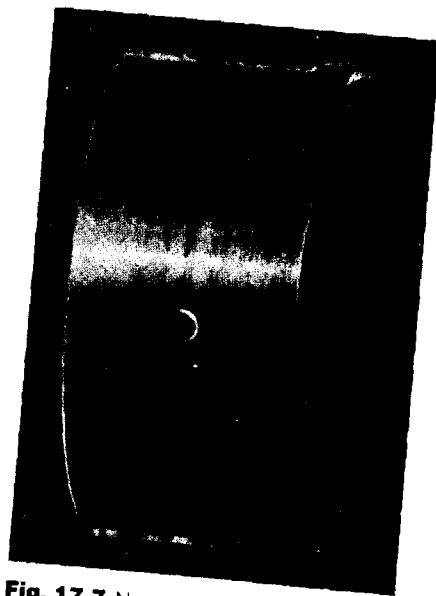


Fig. 17-7 Normal friction-bearing wear after long use. [J.I. Case Agricultural Equipment Division (TENNECO).]

How to Prevent Dirt From Contaminating Lubricant

1. To begin with, your work area and tools must be clean.
2. Before assembling the engine, make sure that all components and bores are clean. When the engine is not being worked on, cover it with plastic sheets to keep out any fine dust.
3. Keep all oil storage containers and measuring equipment clean.
4. Follow the manufacturer's recommended procedure when making oil and filter changes.
5. Avoid excessive delay between oil filter changes because this may cause the filter to become plugged.
6. When adding oil, wipe the area around the dipstick clean before reinserting.
7. Remember that the entry of even a small amount of dirt into the lubricant will create extensive damage at a later date.

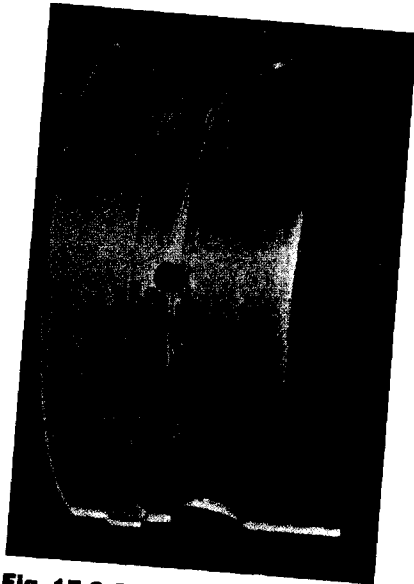


Fig. 17-8 Damage caused by coarse particles. (Cummins Engine Company, Inc.)

Bearing Failure due to Coarse Particles in Oil

Coarse particles may originate as residue from moving engine components, from improper handling of lubricant or oil filters, or from incomplete removal of honing or boring abrasives.

The bearing shell shown in Fig. 17-8 will fail completely because of the long deep scratches which decrease the efficiency of the lubricant and heat dissipation. The visible particles have displaced metal (aluminum) and have added to the abrasion, causing heat to build up and melt the lead surface. However, if the bearings show fine scratches and the consequence of embedded particles, but nevertheless the bearing surface is smooth and reformed, it can be reused.

Note: Use your dictionary, and make sure you know the meaning of these words describing *damage* to bearings:

<i>Noun</i>	<i>Verb</i>	<i>Adjective/participle</i>
wear	wear/wear off	worn
scratch	scratch	scratched
pit	pit	pitted
discolouration	discolour	discoloured
abrasion	—	—
leak/leakage	leak	leaking

G. Check your understanding

1. Tick all the instructions which are correct according to the text:
 - (a) Understand what normal wear is.
 - (b) If wear shows within 2000 hours, do nothing.
 - (c) When working on the engine, cover it with plastic sheets.
 - (d) Remember to keep all equipment and tools clean.
 - (e) Change oil and filters according to manufacturers' instructions.
 - (f) Do not change oil filter unless it becomes plugged.
 - (g) Wipe the dipstick clean before removing it.
 - (h) Do not reuse bearings which show fine scratches and still have a smooth surface.
2. Complete these statements according to information given in the text:
 - If an engine bearing shows wear within less than about 160,000 km . . .
 - Abrasives entering the oil cause . . .
 - Carelessness while working on the engine can cause . . .
 - Most bearing failures are caused by . . .
 - The bearings may become scratched, pitted or discoloured as a result of . . .
 - If the bearing shell becomes deeply scratched . . .
 - If particles displace the metal and add to the abrasion . . .
 - If the bearings have fine scratches and the surface is still smooth . . .
3. The *negative forms* and *opposites* of these words appear in the text. Can you find them?
 - increase ● coarse
 - complete ● careful
 - proper ● coloured
 - clean ● smooth
 - normal

H. Understanding discourse



Listen to the conversation between two friends, Tom and Bill. Listen for the answers to the following questions:

1. What is the problem with Tom's car?
2. What question does Bill ask first, to try to find the cause of the trouble with Tom's car?
3. What are the possible reasons for the trouble?
4. Which of these possible reasons can be eliminated, according to what Tom says?
5. What other possible causes remain to be checked?
6. How can Tom check the electrical system?