

SECTION 2, CHAPTER 4

VIEWING

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Introduction

1. Viewing is the term used to cover both examination by sight (visual) and also checks using precision instruments and special equipment to determine whether component parts are fit for further service. Visual examination is normally done first, for if a fault necessitating the rejection of a component is apparent to the eye, time will not be wasted doing any precision checking. The results of viewing will be recorded on the appropriate forms.

Modifications

2. It is essential that anyone employed on viewing is supplied with the latest information regarding modifications affecting the parts being viewed, so that any parts made redundant by modification action may be rejected.

Visual Inspection

3. When dealing with surface damage it is difficult to set a standard of acceptance, and this knowledge will be gained mainly by experience. Surface defects consist broadly of pitting, picking-up, superficial cracks, scoring, corrosion and overheating.

4. Pitting of bearing surfaces may be caused by foreign matter being forced into the material, or by corrosion which was caused by moisture or acid in the lubricant. Pitting of

valve heads and piston crowns may be caused by tetra-ethyl-lead in the fuel that was used. All bearing surfaces, such as gear teeth, camshaft journals and cams, etc., must be examined for pitting. If the damage is slight, it will probably be rectified by stoning or grinding.

5. Picking-up is sometimes referred to as plucking and may be caused by incorrect fitting, overloading, partial breakdown of the oil film, inferior oil, or overheating. Slight damage may be rectified by stoning, or in some cases, by careful scraping.

6. Scoring may be caused by dirty oil or the presence of foreign matter. The removal of any foreign matter is one of the reasons for periodical oil draining. Drained oil should always be inspected for foreign matter such as small flakes of metal, which, if found, should be reported and investigated further. This procedure may prevent the complete breakdown of a major assembly.

7. Corrosion may take the form of fretting corrosion caused by badly fitting parts or actual rusting of a component caused by moisture. Rusting is frequently the result of inadequate attention during storage.

8. Overheating usually makes itself evident as discoloration of the parts. Evidence of overheating should always be further investigated in order to find the cause.

9. Superficial cracks may be caused by incorrect heat treatment, overloading, or by vibration. Scratches are the result of dirty oil, or rough handling during assembly or reconditioning. These cracks and scratches may be removed by light stoning, provided they are not deep. If stoning fails to remove them, they should be carefully examined with a magnifying glass. If any doubt exists regarding a crack, the component should be tested using one of the following methods.

Chalk Tests

10. These tests are a simple way of finding cracks and may be applied to both ferrous and non-ferrous metals, although they are used mainly for non-ferrous metals and non-magnetic steels. The hot method is the most satisfactory, but its application limits the size and shape of the components that can be tested.

11. **Hot Test.** A component is immersed in a bath of hot fluid, the fluid being a mixture of 3 parts kerosine and 1 part lubricating oil. The metal will expand and allow the fluid to enter any cracks that may be present. The component should be left in the bath until it reaches the same temperature as the fluid. The component should then be removed from the fluid, and quickly dried using a clean rag or sawdust. When dry, evenly coat the component with french chalk, lightly tapping the component on a wooden block to remove all surplus french chalk. On cooling, the metal contracts and forces the fluid out of any cracks, thus staining the french chalk. The component should now be examined for cracks which will be indicated by yellowish coloured lines or patches on the chalk.

12. **Cold Test.** This test can be used on larger components, and in many instances, can be applied to them without dismantling. The area to be tested should be cleaned thoroughly using a mixture of kerosine and lubricating oil. Wipe the component dry, and paint the suspected area with a mixture of french chalk and methylated spirits. The methylated spirit will evaporate, leaving a thin deposit of french chalk. Some cleaning fluid will be retained in any cracks that may be present, and this fluid will give the french chalk a yellowish tinge which will be seen when the component is inspected.

Magnetic Crack Detection

13. The standard crack detecting apparatus used in the Service is the Johnson-Fel universal. To carry out this test the component should be degreased and then passed through the demagnetizer. The component should then be set up on the detector and an electric current passed through it which will magnetize the component. Special ink is then sprayed over the component and examination made for cracks, which will show up as dark lines. Fig. 1 illustrates typical cracks revealed by the magnetic crack detector. The component must then be passed through the demagnetizer and taken away before the demagnetizer is switched off.

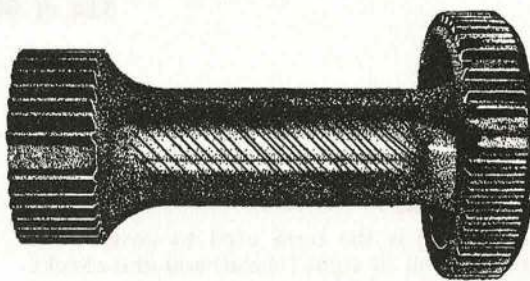


Fig. 1. TYPICAL CRACKS

Precision Checking

14. Most of the hand instruments which may be required when precision checking components, have already been described in Section 2, Chapter 2 of this publication. It will frequently be found that these instruments have to be augmented by special rigs, jigs and fixtures, some of which will probably have to be made up locally. Various examples of precision checking will be detailed in Section 5, Chap. 8. Components are checked for size, clearance, etc., the results being checked by reference to the Schedule of Fits and Clearances, and it can then be decided whether the parts are fit for further service. The Schedule of Fits and Clearances is described in Section 2, Chapter 3.

Ball and Roller Bearings

15. Ball and roller bearings, taper roller bearings, and needle bearings of various types are widely used in major assemblies. Consequently the following information will prevent constant repetition throughout Section 5, Chap. 8.

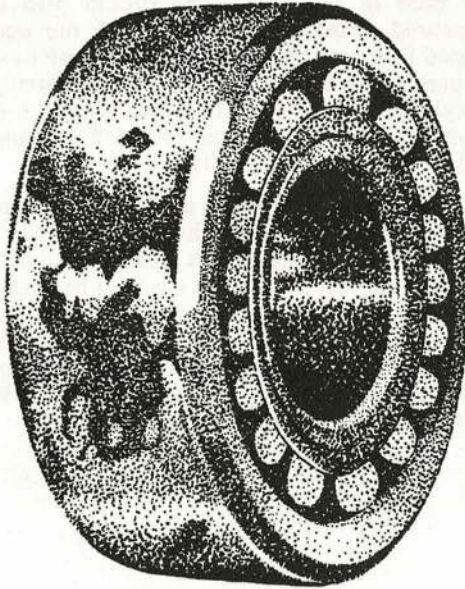


Fig. 2. FRETTING CORROSION

16. Visual Examination. The surfaces of a satisfactory bearing are dulled by the rolling and sliding action of the balls or rollers. These surfaces should be free from any signs of wear or pitting. After cleaning, the wearing surfaces should be examined for any of the following defects :—

- (a) General flaking of the highly polished bearing surfaces.
- (b) Pitting of the surfaces.
- (c) Corrosion, which may be either actual rusting of the raceway surfaces, or fretting corrosion as shown in Fig. 2.
- (d) Defects caused by faulty alignment or incorrect mounting, excessive preloading or thrust bearings being fitted in the wrong direction.
- (e) The inner or outer races may be cracked, because of excessive interference fit during mounting, or the careless fitting of a race.
- (f) Signs of spinning or excessive creep on the inner and outer races.

17. Rotation Test. Enclosed bearings which cannot be dismantled for examination, should be given a hand rotation test to determine the condition of the raceway surfaces. The bearing should be lubricated with low viscosity

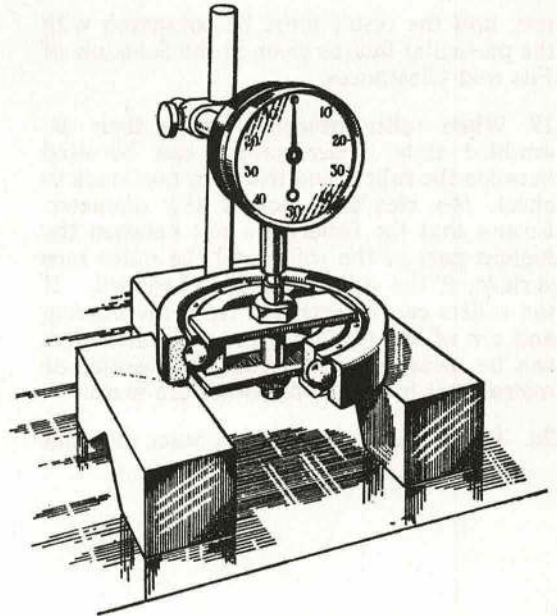


Fig. 3. TESTING END FLOAT

mineral oil, and the outer race turned slowly whilst holding the inner race stationary. The following observations should be made during the test :—

- (a) Slackness across the diameter should be compared with that of a new bearing of the same type and size.
- (b) Regular catching of the bearing at each revolution indicates damage to the raceway surfaces.
- (c) Irregular catching during rotation is caused by the defective surface of a ball or roller.
- (d) General roughness of the bearing during rotation is caused by flaking of the balls or rollers and raceway surfaces. Excessive slackness across the diameter would most probably also be evident in these circumstances.

The test should be carried out with the bearing at various angles, and it should be held in such a manner that its position can be easily changed during rotation.

18. Measurement. All complete bearings should be given a measurement test to find the amount of end float. Fig. 3 illustrates the method of using a dial indicator for this

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test, and the result must be compared with the particular figures given in the Schedule of Fits and Clearances.

19. When roller bearings are in their assembled state, feeler gauges can be used between the rollers and the outer race track to check the clearance across the diameter. Ensure that the feelers are put between the highest part of the roller and the outer race surface, if the rollers are barrel-shaped. If the rollers can be removed from the bearing and are of the straight type, their diameters can be measured individually by vernier or micrometer to find if the rollers are worn.

20. The diameter of a bearing outer race and

the bore of the inner race should also be measured, using a vernier to check the wear caused by creep. A micrometer or vernier can be used to measure the width of the bearing. A cylinder bore gauge or approved type of comparator should be used to check the inner and outer races for ovality.

21. The housings or liners into which bearing outer races will be fitted should be measured for bore, ovality, and width, and the radius at the housing face should be checked to ensure that the bearing outer race fits against the face of the housing. The shaft where the bearing fits should also be measured and checked for ovality, to ensure that the correct fit is obtained.



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