

# DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

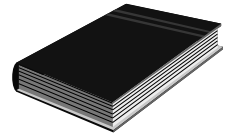
## CODE: BIF

# EXAMINE BEARINGS

# INDEX

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## SOURCE REFERENCES

Bearing display board in the training centre.

Audio-visual aids.

## OBJECTIVE

You will be learning towards the outcome “Examine bearings”. Whilst learning towards the outcome you will be required to achieve the following:

- Familiarise yourself with the different types of bearings and uses.
- Examine bearings for serviceability.

On completion of this module, the learner must be able to:


- Identify the eight different types of bearings dealt with in this module and state uses for each.
- Examine a variety of bearings, in and out of service, and record the findings regarding their serviceability on a standard bearing checklist.

During this process you must adhere to certain specified requirements as listed in the Module.

## ASSESSMENT AND EVALUATION CRITERIA

You will be assessed, when you are confident that you are able to achieve the outcomes as listed, to determine your competence as measured against the required criteria. This assessment will be in line with accepted best practices regarding assessment.

- A theoretical test and practical test will be set at the end of the module and must be completed without using references.
- Bearings must be correctly identified on a list of diagrams and their applications correctly stated.
- The learner will be given a variety of bearings to examine for serviceability. Faults must be correctly identified and recorded on a standard bearing checklist.
- The learner will be expected to examine two plumber blocks of a running shaft and must correctly identify the faulty bearing.

<b><u>HAZARD IDENTIFICATION AND CONTROL (HIAC) FORM</u></b> <div style="display: flex; justify-content: space-around; align-items: center;">  <div style="text-align: center;"> <b>BIF</b>  <b>EXAMINE BEARINGS</b> </div> </div>		
STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
1. Use hand tools.	<ul style="list-style-type: none"> <li>Using damaged tools or wrong tools for the job can cause injury and damage to equipment.</li> </ul>	<ul style="list-style-type: none"> <li>Always use the correct tool for the job.</li> <li>Ensure tools are in good condition.</li> <li>Use tools correctly.</li> <li>Wear appropriate PPE where necessary.</li> <li>Always take good care of tools. Maintain, clean and store it properly.</li> </ul>

**NOTE:** Before doing the practical work contained in this module, the learner must study the content of the above HIAC form again and then sign the statement below.

The above risks, which will be encountered in this module, are fully understood and will be controlled during the practical work.

Signature of learner:

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Signature of Training Officer:

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Date:

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## DICTIONARY

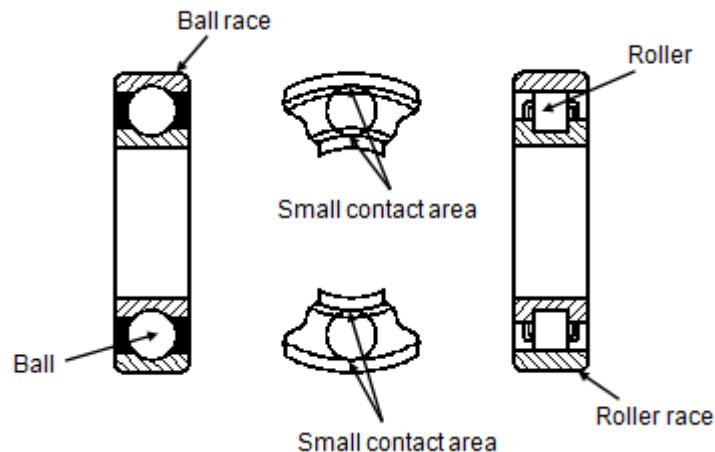
<b>Bearing</b>	:	A supporting part of a machine that bears the friction, especially between rotating shaft and its housing.
<b>Antifriction</b>	:	To lessen friction (rubbing of two bodies).
<b>Radial load</b>	:	Load in the direction of the radius of a shaft.
<b>Thrust load</b>	:	“Pushing” load, parallel to a shaft.
<b>Align</b>	:	To bring into line.
<b>Cylindrical</b>	:	Tube-shaped, either hollow or solid, with perfectly circular ends.
<b>Taper</b>	:	To gradually narrow or thin at one end.
<b>Spherical</b>	:	Something completely round in shape.
<b>Periphery</b>	:	The outside edge of an area or thing.
<b>Score</b>	:	To make scratches, cuts, or lines in or on a surface.
<b>Lubricate</b>	:	To oil or grease the moving parts of a machine, so that they will move more easily.
<b>Brinelling</b>	:	Small indentations.
<b>Dowel</b>	:	Headless pin of wood, metal, etc.

# 1. GENERAL INFORMATION

**ITEM / TASK:** Introduction.

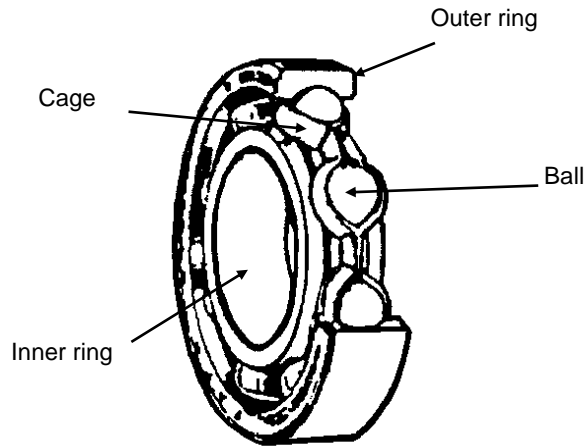
## **DESCRIPTION:**

A. Bearings dealt with in this module all have **rolling elements** consisting of balls or rollers.  
(Fig 1)



**FIG 1.**

- B. Because the load is taken on the small contact areas between the balls or rollers and the inner and outer rings of the bearing (Fig 1), this type of bearing is commonly referred to as an **antifriction bearing**.
- C. The rolling elements, inner and outer rings or races are made of **hardened alloy steels** to provide the **maximum resistance to wear** and pressure.
- D. The majority of these bearings are used in mechanical power transmission applications as supports and as guides for sliding or rolling components.
- Many bearings are found in units, which are not direct parts of a power transmission system.
  - A good example is the type of bearing used to support the rollers in a conveyor system.
- E. Antifriction bearings consist of an inner ring, an outer ring, several rolling elements, and a cage. (Fig 2 on the next page)
- The rolling elements are placed at regular distance between the two rings and are prevented by the cage from coming into contact with one another.
  - Antifriction bearings are constructed so as to have a smooth rolling movement between the rings.



**FIG 2.**

**ITEM / TASK:** Bearing classification.

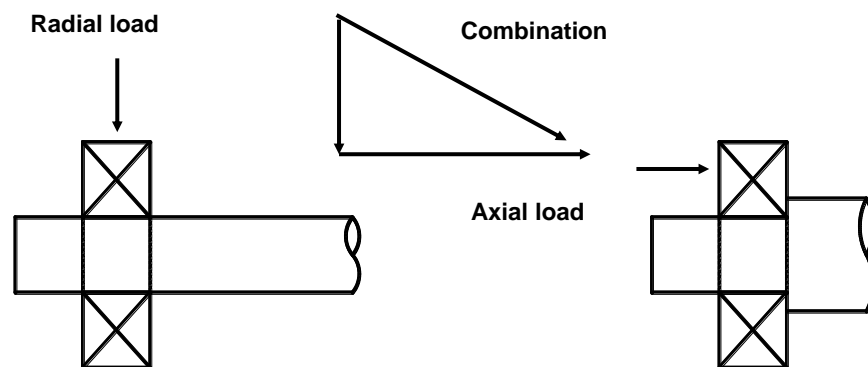
**DESCRIPTION:**

**A. Rolling element:**

Bearings are classified into ball bearings and roller bearings according to the shape of the rolling elements. (Fig 1)

**B. Loading:**

Bearings are also classified according to the types of load they must bear, e.g. radial or axial thrust loads or a combination of the two. (Fig 3)



**FIG 3.**



## 2. BALL BEARING CLASSIFICATION AND APPLICATION

**ITEM / TASK:** Ball bearings.

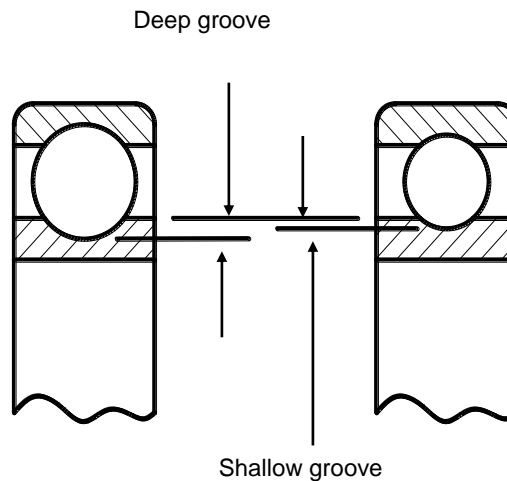
**DESCRIPTION:**

- A. Ball bearings are classified according to the relationship between the rolling elements and the ring. See the display board in the training centre.

**ITEM / TASK:** Deep groove ball.

**DESCRIPTION:**

- A. These bearings (Fig 4) are designed primarily for light radial loads and are used in electric motors, water pumps, spur gearboxes, etc.

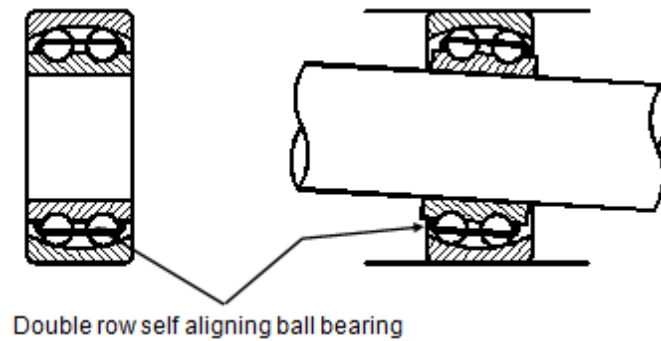


**FIG 4.**

**ITEM / TASK:** Self aligning ball.

**DESCRIPTION:**

- A. These bearings (Fig 5 on the next page) allow satisfactory operation with considerable misalignment between the inner and outer rings.
- B. Self-aligning ball bearings are particularly suitable in applications where housing alignment or shaft deflections are difficult problems, e.g. a line shaft with a “V”- belt drive or a flat belt drive.

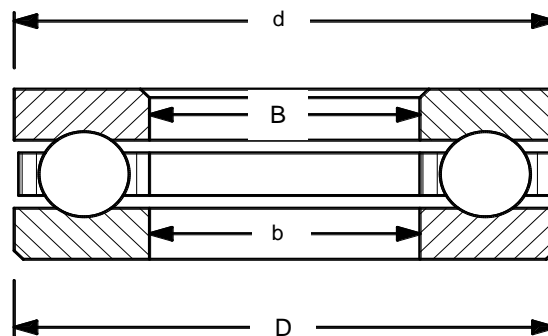


**FIG 5.**

**ITEM / TASK:** Thrust ball bearings.

**DESCRIPTION:**

- A. Thrust ball bearings (Fig 6) are designed to support high pure thrust loads, e.g. in a tailstock live centre on a lathe.
- B. One ring is normally a tight fit on the outside diameter (D) with clearance in the bore (b), while the other ring is a tight fit in the bore (B) with clearance on the outside diameter (d).

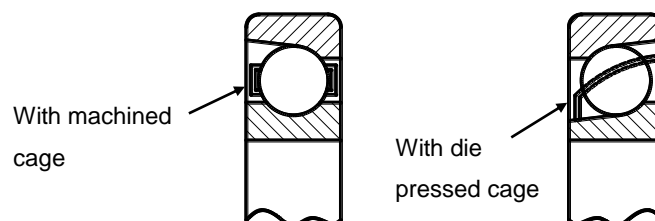


**FIG 6.**

**ITEM / TASK:** Angular contact bearings.

**DESCRIPTION:**

- A. Angular contact bearings (Fig 7) are specially designed to carry a combination of a radial and an axial thrust load, e.g. bearings on the worm shaft of a worm gearbox.



**FIG 7.**

### 3. ROLLER BEARING CLASSIFICATION AND APPLICATION

**ITEM / TASK:** Roller bearings.

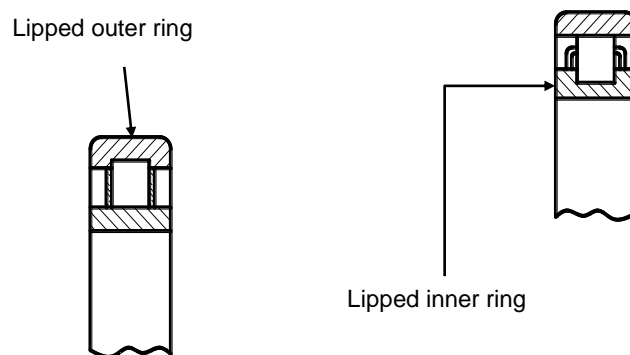
**DESCRIPTION:**

A. Roller bearings can withstand much heavier loads than a ball bearing. See the display board in the training centre.

**ITEM / TASK:** Cylindrical roller bearings.

**DESCRIPTION:**

- A. These bearings (Fig 8) are designed to support heavy radial loads, e.g. axle bearings on a railway truck.
- B. Either the inner ring is lipped to contain the rollers and allow them to slide over the outer ring, or the outer ring is lipped to contain the rollers and allow them to slide over the inner ring.

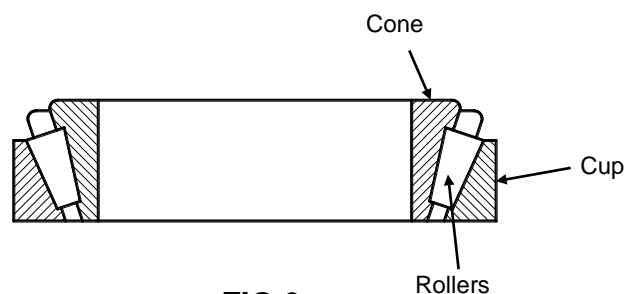


**FIG 8.**

**ITEM / TASK:** Taper roller bearing.

**DESCRIPTION:**

A. Taper roller bearings (Fig 9) are designed to carry a combination of a heavy radial and a thrust load, e.g. front wheel assembly of a motor car.

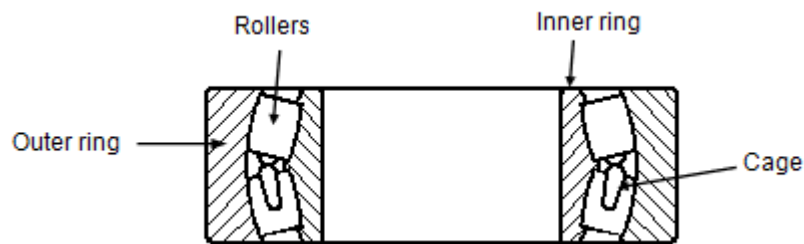


**FIG 9.**

**ITEM / TASK:** Spherical roller bearing (self aligning).

**DESCRIPTION:**

- A. Spherical roller bearings (Fig 10) are designed for heavy radial loads and operate satisfactorily even with considerable misalignment between the inner and outer ring e.g. jaw crushers.

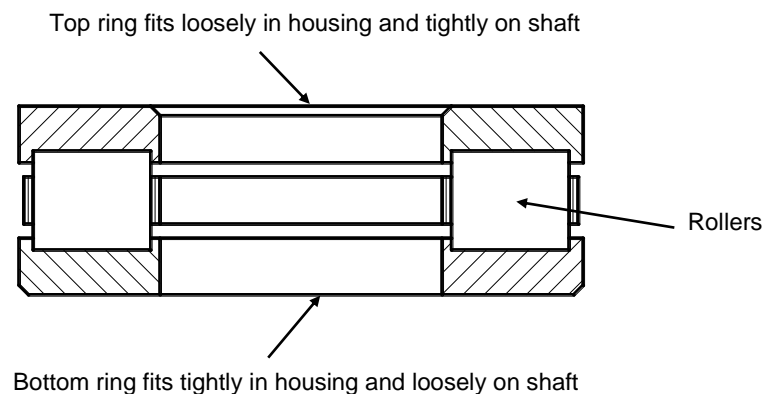


**FIG 10.**

**ITEM / TASK:** Cylindrical roller thrust bearing.

**DESCRIPTION:**

- A. These bearings are designed for heavy thrust loads (Fig 11). The fits are the same as for thrust ball bearings. (Fig 6)



**FIG 11.**

**DO SELF TEST 1 ON THE NEXT PAGE BEFORE  
CONTINUING WITH THE REST OF THE MODULE.**



## SELF TEST 1

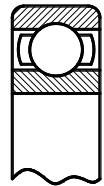
State the names of the following bearings and describe their applications.

Name :

\_\_\_\_\_

Application :

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

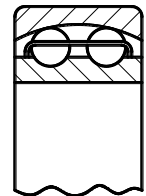


Name :

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Application :

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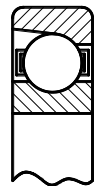


Name :

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Application :

\_\_\_\_\_  
\_\_\_\_\_  
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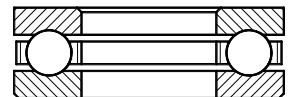


Name :

\_\_\_\_\_

Application :

\_\_\_\_\_  
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Name :

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Application :

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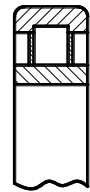
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Application : \_\_\_\_\_

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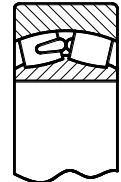
Name : \_\_\_\_\_

Application : \_\_\_\_\_

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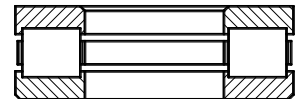
Name : \_\_\_\_\_

Application : \_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_

\_\_\_\_\_



Refer to your notes to check your answers.

If they are not all correct, study the notes again. Ask your Training Officer to check your work and sign below when you have answered all the questions correctly and achieved the required standards, then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

## 4. BEARING FAILURE AND CAUSES

**ITEM / TASK:** Scratches and pit marks.

**DESCRIPTION:**

A. There will be scratches and pit marks around the periphery of the race with corresponding scoring of the ball or roller. (Fig 12)



**FIG 12.**

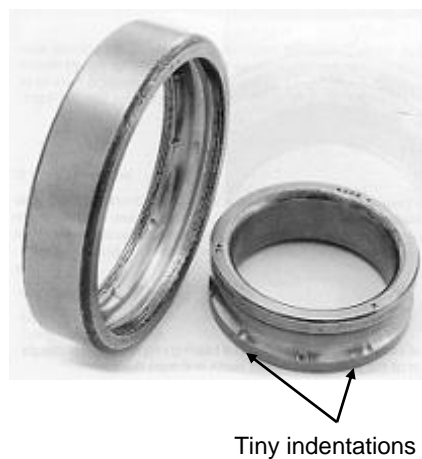
B. These are normally caused by:

- sand, metal fillings or any abrasive material in the lubricant, or
- insufficient lubrication.

**ITEM / TASK:** Brinelling.

**DESCRIPTION:**

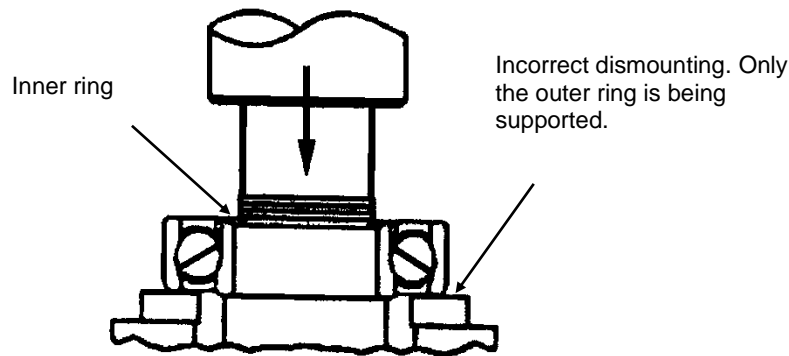
A. This failure will appear as tiny indentations high on the shoulder of the race. (Fig 13)



**FIG 13.**

B. This is normally caused by:

- force incorrectly applied when mounting or dismounting a bearing. Fig 14 shows a bearing being dismounted from a shaft with only the outer ring supported. Either the inner ring or both the inner and outer rings should be supported.



**FIG 14.**

- shock loads imposed radially on a non-rotating bearing.

**ITEM / TASK:** Cracks.

**DESCRIPTION:**

- A. Clear cracks appear through the races accompanied by excessive noise when the bearing is running.
- B. These are normally caused by the bearing fit being too tight on the shaft or in the housing.

**ITEM / TASK:** Flaking.

**DESCRIPTION:**

- A. Material comes away from the surface in the form of flakes or scale-like particles and the bearings become excessively hot when running.
- B. This is normally caused by:
- contamination in the bearing, or
  - insufficient lubricant.

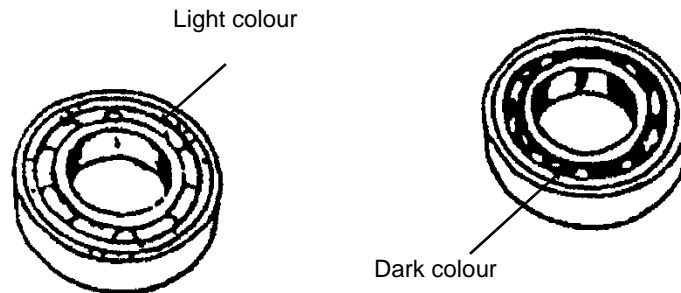


**ITEM / TASK:** Lubrication failure.

**DESCRIPTION:**

A. The following are symptoms of lubrication failure -

- The original colour of the grease turns to a dark shade or a jet-black colour. (Fig 15)



**FIG 15.**

- The temperature rises abnormally.
- There is a whistling noise.
- A brownish or bluish discoloration appears on the races and balls.

B. These faults are normally caused by:

- contaminated lubricant,
- too much lubricant,
- too little lubricant, or
- wrong lubricant.

**NB:**

**Bearings must always be one-third to one-half full of grease.**

**DO SELF TEST 2 ON THE NEXT PAGE BEFORE  
CONTINUING WITH THE REST OF THE MODULE.**



## SELF TEST 2

Name the five types of bearing failures and their causes.

a.

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b.

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c.

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d.

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e.

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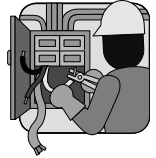
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Refer to your notes to check your answers.

If they are not all correct, study the notes again. Ask your Training Officer to check your work and sign below when you have answered all the questions correctly and achieved the required standards, then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



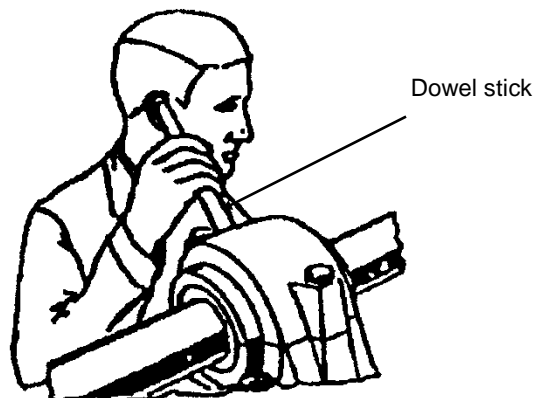
## 5. INSPECTION OF BEARINGS IN SERVICE

**ITEM / TASK:** Scratches and pit marks.

### **DESCRIPTION:**

When inspecting bearings in service, the following should be done:

- A. Listen for bearing **noise**. This is done by placing a dowel stick or a screwdriver between the plumber block and your ear. (Fig 16)



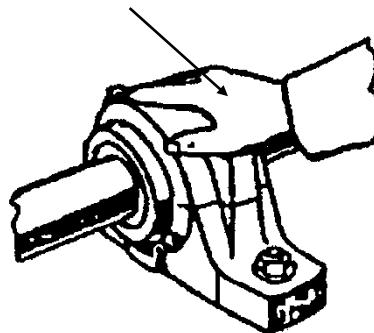
**FIG 16.**

To help you distinguish between a new and an old bearing, a driving shaft with two plumber blocks has been set up as a training aid. One end is fitted with an old bearing and the other with a new one. With the aid of a screwdriver or dowel-stick, listen to the **difference in sound** when they are running.

Check for **excessive bearing temperature**. Place your hand over the plumber block or onto the housing. If it is too hot to hold your hand there, the bearing temperature is too high.

(Fig 17)

Feeling the temperature



**FIG 17.**

**NB:**

**Under certain conditions (e.g. near to a furnace) the running temperature of the bearings can be much higher and the above method will be impractical. In that case, consult the supplier for the correct temperatures and use a thermometer to measure the temperature.**

**B. Check the lubricant.**

- When the bearing is running at a speed slower than 200 revolutions per minute the plumber block must be packed full of grease.
- When the bearing is running faster than 200 revolutions per minute the plumber block must be packed two-thirds full of grease.

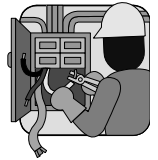
**C. Check all the fasteners** (e.g. plumber block bolts and nuts or the bearing cover bolts) for tightness.

**D. Check for undue vibration** due to an unbalanced shaft, by placing your hand on the plumber block or bearing housing.

**E. Check for oil leaks** or damaged seals. Remember that the function of a seal is to keep the lubricant in, and dust or dirt out.

**Note:**

*A Standard Bearing Checklist is included at the end of the module and must be used when bearings are examined.*



## PRACTICE

Go to the driving shaft with plumber blocks, which have been set up as a testing aid.

Switch on the motor, examine the bearings and record your findings on the standard bearing checklist provided.

Ask your Training Officer to sign you off when you have answered all the questions correctly and achieved the required standards.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



## **REMEMBER ALWAYS WORK SAFE**

Once you have passed the entire self tests and practice, you are now at liberty to request a Formative Assessment from your Assessor.

## STANDARD BEARING CHECKLIST.

Bearing type  
(Identification) : \_\_\_\_\_

CHECK FOR :	YES	NO
Bearing rusty.		
Bearing discoloured.		
Bearing fractured.		
Bearing cracked.		
Bearing pitted.		
Bearing flaking.		
Bearing brinelling.		
Bearing scratched.		
Lack of lubrication.		
Seals damaged.		
Cage damaged.		
Bearing loose in housing.		
Housing worn.		
Bearing loose on shaft.		
Shaft worn.		
* Bearing overheating.		
* Bearing vibration.		
<b>BEARING ACCEPTABLE</b>		

\* For in service inspection only.

REASONS FOR BEARING NOT ACCEPTABLE.

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## STANDARD BEARING CHECKLIST.

Bearing type  
(Identification) : \_\_\_\_\_

CHECK FOR :	YES	NO
Bearing rusty.		
Bearing discoloured.		
Bearing fractured.		
Bearing cracked.		
Bearing pitted.		
Bearing flaking.		
Bearing brinelling.		
Bearing scratched.		
Lack of lubrication.		
Seals damaged.		
Cage damaged.		
Bearing loose in housing.		
Housing worn.		
Bearing loose on shaft.		
Shaft worn.		
* Bearing overheating.		
* Bearing vibration.		
<b>BEARING ACCEPTABLE</b>		

\* For in service inspection only.

REASONS FOR BEARING NOT ACCEPTABLE.

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## STANDARD BEARING CHECKLIST.

Bearing type  
(Identification) : \_\_\_\_\_

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Seals damaged.		
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Bearing loose in housing.		
Housing worn.		
Bearing loose on shaft.		
Shaft worn.		
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* Bearing vibration.		
<b>BEARING ACCEPTABLE</b>		

\* For in service inspection only.

REASONS FOR BEARING NOT ACCEPTABLE.

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## STANDARD BEARING CHECKLIST.

Bearing type  
(Identification) : \_\_\_\_\_

CHECK FOR :	YES	NO
Bearing rusty.		
Bearing discoloured.		
Bearing fractured.		
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Bearing loose on shaft.		
Shaft worn.		
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* Bearing vibration.		
<b>BEARING ACCEPTABLE</b>		

\* For in service inspection only.

### REASONS FOR BEARING NOT ACCEPTABLE.

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