

DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

CODE: UN

UNIVERSAL JOINTS

INDEX

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MODULE OBJECTIVE

To enable the learner to remove and replace a universal joint in a drive shaft assembly.

LEARNING OBJECTIVES

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

- Remove a split-joint drive shaft mounted between two flanges.
- Remove service and replace the two universal joints.
- Replace the drive shaft between the two flanges.

ASSESSMENT AND EVALUATION CRITERIA

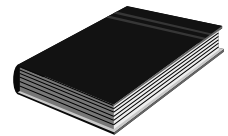
- A practical test will be set at the end of the module and must be completed without using references.
- The learner will be given a split-joint drive shaft assembly and will be required to remove the drive shaft from the flanges, remove, service and replace the universal joints, and fit the drive shaft to the flanges again.


The following standards must be achieved:

- The drive shaft assembly must not be damaged.
- The circlips must not be damaged and must be fitted in the correct positions.
- The shaft must be kept in balance.
- All the seals and packings must be replaced on the spider shafts.
- All the bolts on the flanges must be replaced and fitted with spring washers and tightened.
- The bearings must not be contaminated by rags, cotton waste or sand.
- The bearings must be lubricated according to the methods described in these notes.
- All safety procedures must be adhered to

ADDITIONAL RESOURCES

- A demonstration by a competent person e.g. a Training Officer.
- Audio-visual aids if available.



<u>HAZARD IDENTIFICATION AND CONTROL (HIAC) FORM</u>  UN REMOVE AND REPLACE A UNIVESAL JOINT		
STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
<ul style="list-style-type: none"> • Use hand tools 	<ul style="list-style-type: none"> • Using damaged tools or wrong tools for the job can cause injury and damage to equipment. 	<ul style="list-style-type: none"> • Always use the correct tool for the job. • Ensure tools are in good condition. • Use tools correctly. • Wear appropriate PPE where necessary. • Always take good care of tools. Maintain, clean and store it properly.
<ul style="list-style-type: none"> • Work on vehicle 	<ul style="list-style-type: none"> • Working on moving equipment can cause serious injury. 	<ul style="list-style-type: none"> • Make sure that vehicle is stationary, switched off and locked out (if applicable).
<ul style="list-style-type: none"> • Jacking up vehicle 	<ul style="list-style-type: none"> • Improperly jacked up vehicle can fall and cause injury and damage to vehicle. 	<ul style="list-style-type: none"> • Ensure vehicle stands level. • Install stop blocks behind and in front of wheels. • Ensure correct capacity jack is used. • In stall correct type and capacity stands under axles.

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: _____

Signature of Training Officer: _____

Date: _____

1. INTRODUCTION

ITEM / TASK: The Universal Joint

DESCRIPTION:

- A universal joint links two shafts and enables the rotary motion of one shaft to be transferred to the other.
- Universal joints can be used to link the two shafts even when they are not in line with each other. Fig. 1 shows the various parts.

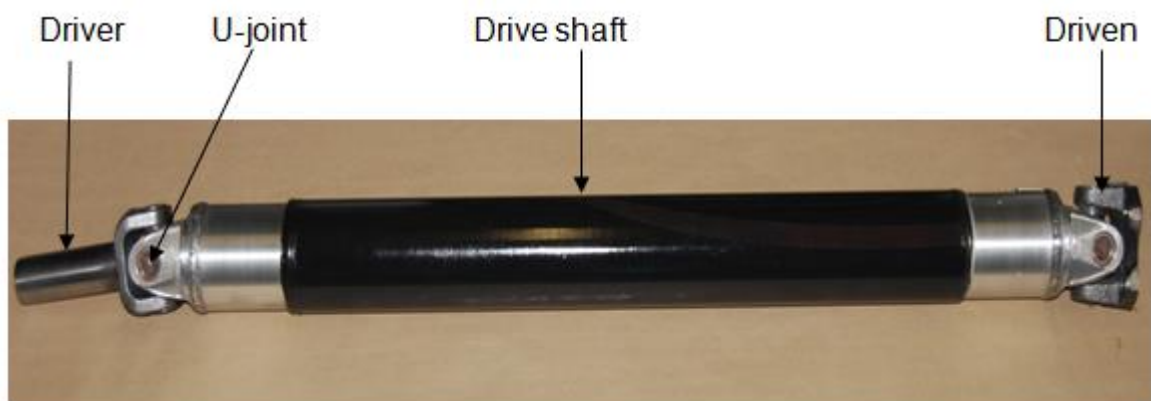


Fig. 1

- In Fig. 1 it will be seen that universal joints are required on both sides of the drive shaft. One joint connects the drive shaft to the engine (driver) and the other joins the drive shaft to the gearbox (driven).

2. PURPOSE OF A UNIVERSAL JOINT

ITEM / TASK: Purpose of a universal joint

DESCRIPTION:

- In a motor vehicle, the transmission shaft and differential are connected to a drive shaft by universal joints.
- The joints are essential in motor vehicles because the engine and the transmission are mounted as one unit and move up and down together because of the suspension system.
- The differential and rear axles move in a similar manner but unfortunately, the movements of the engine and differential is not synchronised. Consequently, the angle between the drive shaft and the differential varies considerably and universal joints are needed to transfer the rotary motion.

3. PARTS OF A UNIVERSAL JOINT

ITEM / TASK: Parts of a Universal Joint

DESCRIPTION:



Fig. 2

1. U-Joint Body (Cross)
2. Trunnion (Pin)
3. C-Clip
4. Bearing Cap
5. Needle Bearings

4. A SLIP JOINT

ITEM / TASK: A Slip Joint

DESCRIPTION:

- An allowance must be made for changes in the distance between the coupled shafts when they are in motion. A slip joint is used to allow the drive shaft to move as this distance varies.
- Fig. 3 shows a complete universal joint assembly and the parts that make up the slip joint. The internal splines are on the yoke and the external splines are on the drive shaft.
- The splined shaft fits into a sleeve and forms a strong sliding coupling.



Slip joint

Fig. 3

5. EXAMINE A DRIVE SHAFT

ITEM / TASK: Examine a drive shaft fitted with a universal joint

DESCRIPTION:

- The drive shaft will vibrate if any fault occurs in it or in the joints.
- The manufacturer balances the drive shaft by adding balancing weights. If the fault is traced to the drive shaft, check that the balancing weights have not fallen off (see Fig. 4 Next Page), and make sure that mud or other substances are not clinging to the shaft and upsetting the balance.



Fig. 4

- Check the universal joints for wear by rotating them backwards and forwards by hand and by trying to lift the shaft by hand. Excessive play between the spider and the needle bearings will indicate wear.
- Measure the propeller shaft run-out using a dial indicator (Fig. 5).
- Run-out 0.4 mm max.

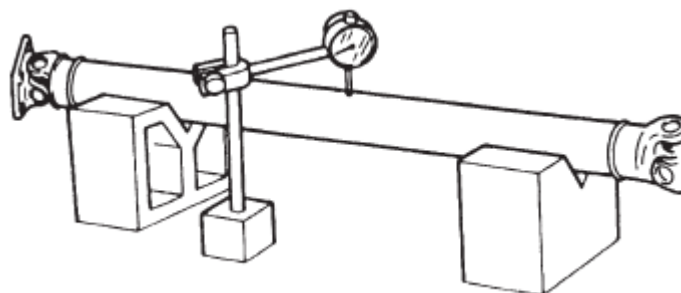


Fig. 5

- If the run out is excessive, replace the propeller shaft.
- Move the universal joint in the direction shown.

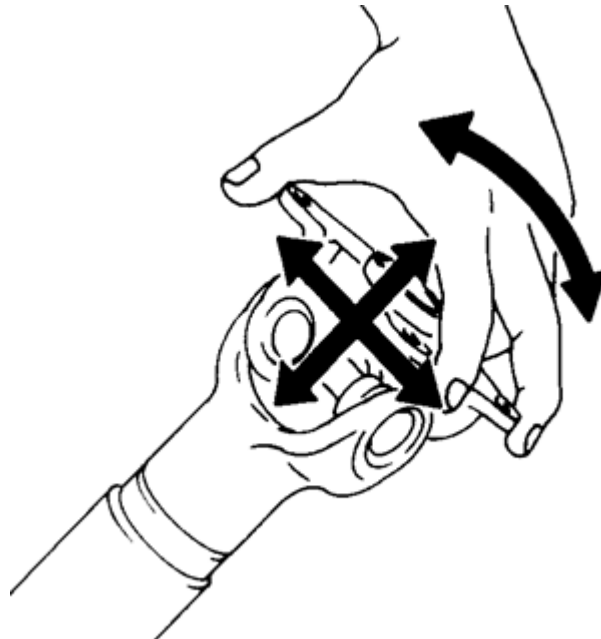
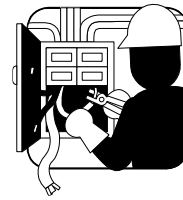


Fig. 6

- If there is excessive play or the starting torque is not within the specification, replace the propeller shaft

**DO THE PRACTICE ON THE NEXT PAGE BEFORE CONTINUING WITH THE
MODULE.**

PRACTICE



Check the universal joints on the display board for wear.

Ask your Training Officer to check your work and if it is correct, to sign below and then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

6. REMOVE A DRIVE SHAFT

ITEM / TASK: Introduction

DESCRIPTION:

- Parts of the universal joint should not be replaced individually. A complete kit of replacement parts is available (see display board) and should be used according to the steps described below.

Remove the drive shaft

- Before dismantling the shaft, make alignment marks on the slip yoke, the shaft and on the flanges. These marks enable the unit to be reassembled correctly and the balance of the shaft to be maintained (Fig. 7).

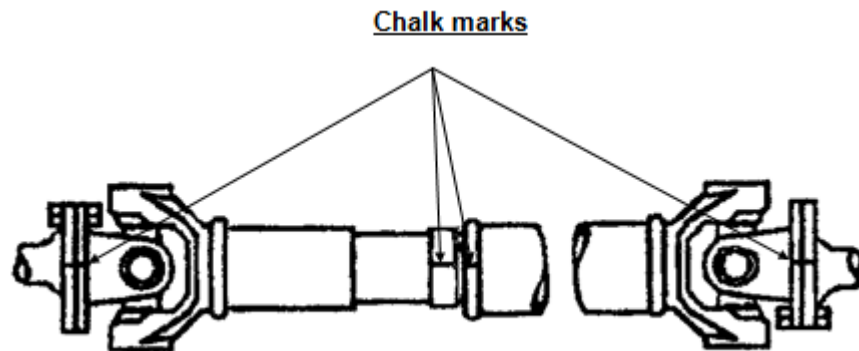
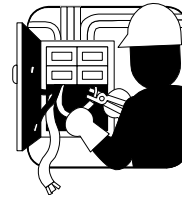


Fig. 7

- Remove all the bolts in the drive flanges.
- Remove the drive shaft.
- Separate the shaft at the slip joint. Clean and examine the internal and external splines for wear. Signs of wear are visible on the splines.

PRACTICE



Obtain the drive shaft assembly and remove it from the flanges.

Ask your Training Officer to check your work and if it is correct, to sign below and then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

7. REMOVE THE UNIVERSAL JOINT FROM DRIVE SHAFT

ITEM / TASK: Remove the Universal Joint from Drive Shaft

DESCRIPTION:

- Remove the circlips, which secure the bearings, with circlip pliers (Fig.8). If the circlips stick, clean away all the rust and apply oil to loosen them.



Fig. 8

Fit the drive shaft in a vice and use a universal bearing extractor to press out one bearing (Fig. 9).

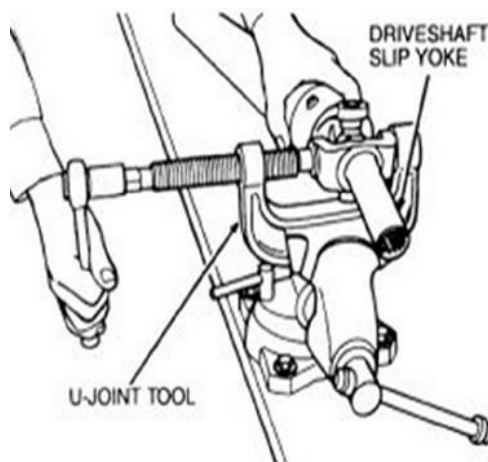


Fig. 9

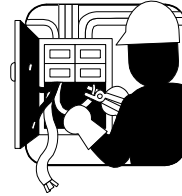
NB: Grip it in the vice on a solid portion of the drive shaft.

- Remove the bearing by hand. If this cannot be done, grip it lightly in the vice and remove it with a copper punch and hammer (Fig. 10).
- Remove the opposite bearing in a similar manner.
- When all four bearings have been removed manoeuvre the spider out of the yoke and drive shaft.
- Remove the opposite universal joint by repeating the process described above.



Fig. 10

DO THE PRACTICE ON NEXT PAGE BEFORE CONTINUING WITH THE MODULE.



PRACTICE

Remove the universal bearings on both sides of the drive shaft which was removed in the previous practice.

Ask your Training Officer to check your work and if it is correct, to sign below and then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

8. REPLACE THE UNIVERSAL JOINT

ITEM / TASK: Replace the Universal Joint

DESCRIPTION:

- Clean all the parts.

NB: Do not use cotton waste when working with bearings.

- Check the bores in the yoke arms for burrs or scores. Remove them with a smooth round file if necessary.

NB: The bearings must be a light drive fit through the bores. If the bores have worn oval, a new shaft or yoke assembly must be fitted.

- Check the circlip grooves for damage.
- Position the spider in the yoke (Fig. 11).

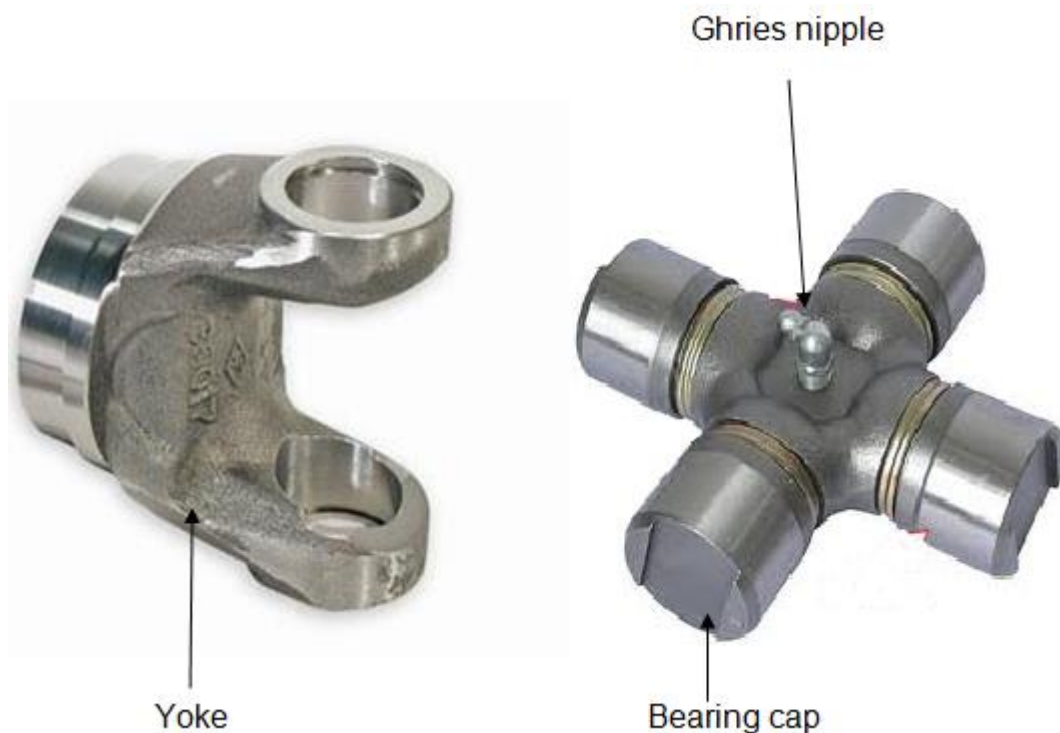


Fig. 11

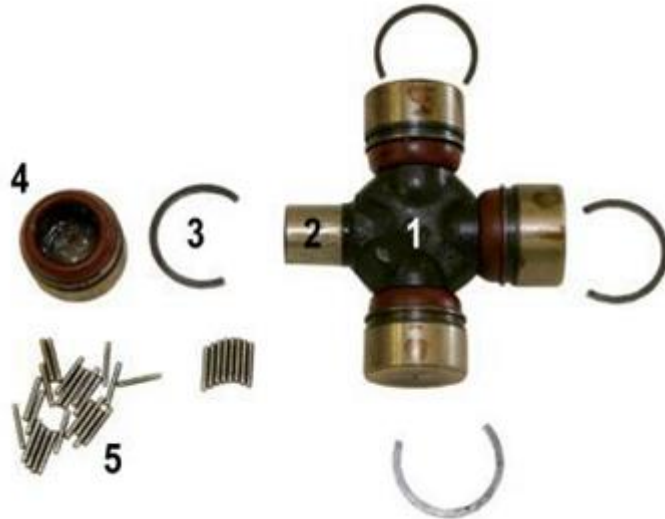
- Fit the seals and packings on the spider (Fig. 12 next page)

9. PARTS OF A UNIVERSAL BEARING

ITEM / TASK: Parts of a Universal bearing.

DESCRIPTION:

1. U-Joint Body (Cross)
2. Trunnion (Pin)
3. C-Clip
4. Bearing Cap
5. Needle Bearings



- Check that the needle rollers in the bearings are in place and pack the bearings with grease.

NB: The grease must hold the needle rollers in position.

- Place one bearing into the yoke bore by tapping it lightly with a soft hammer. Ensure that the bearing is square with the bore (Fig. 13).

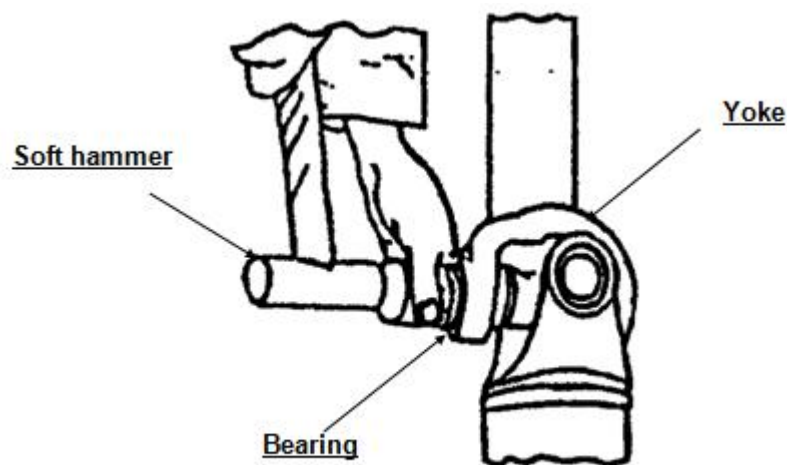


Fig. 13

- Push one journal of the spider into the bearing to hold the needle rollers in position.
- Select a dolly smaller than the outside diameter of the bearings and place the joint and dolly in a vice (Fig. 14).

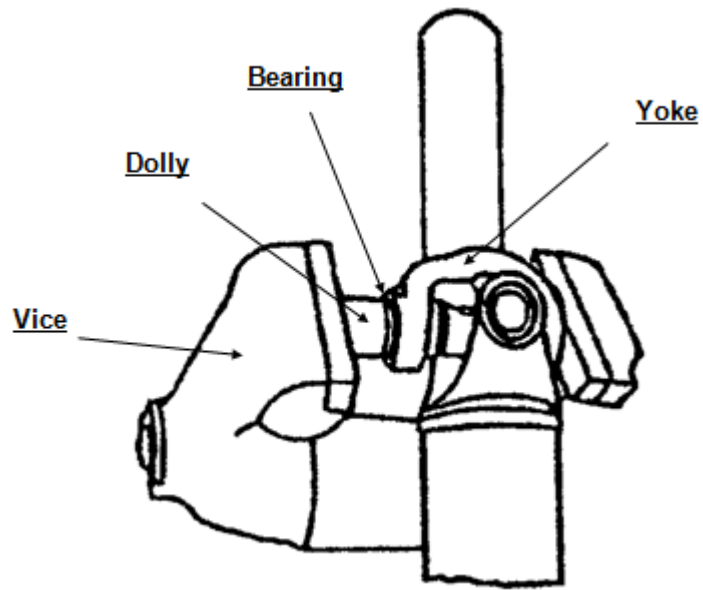
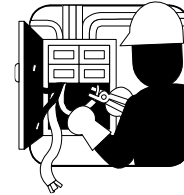


Fig. 14

- Press the bearing in by closing the vice. The bearing must just clear the circlip groove.
- Replace the circlip.
- Replace all the other bearings in a similar manner.

DO THE PRACTICE ON THE NEXT PAGE BEFORE CONTINUING WITH THE REST OF THE MODULE.

PRACTICE



Replace the universal joints on both sides of the drive shaft.

Ask your Training Officer to check your work and if it is correct, to sign below and then go on to the next section.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

10. REPLACE THE DRIVE SHAFT

ITEM / TASK: Replace the drive shaft.

DESCRIPTION:

- Smear grease over the splines of the slip joint.
- Fit the splines together and ensure that the marks on the shafts are in line with each other.

NB: The universal bearings must also be in line with each other (Fig. 15).

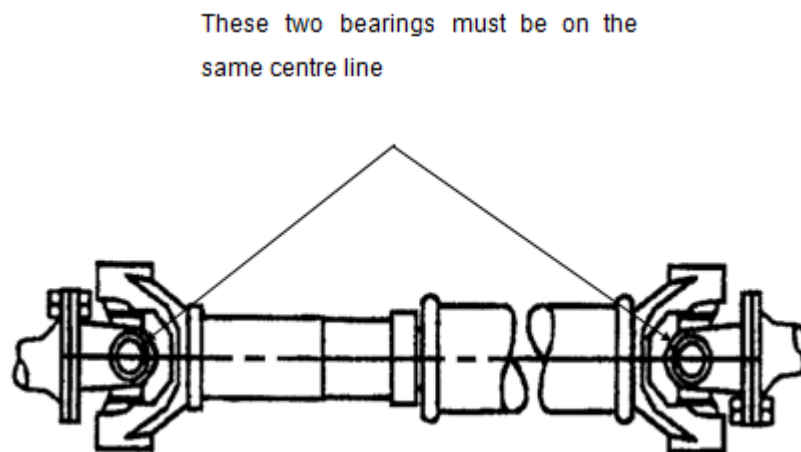
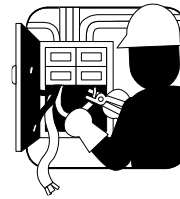


Fig. 15

- Fit the shaft onto the flanges.
- Replace all the bolts, making sure that each bolt is fitted with a spring washer.
- Tighten the bolts to the correct torque value.

**DO THE PRACTICE ON THE NEXT PAGE BEFORE ATTEMPTING THE ASSESSMENT
FOR THE MODULE.**

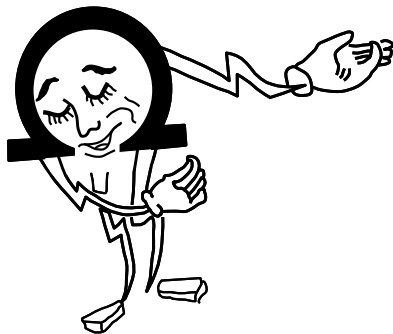
PRACTICE



Replace the drive shaft into the drive shaft assembly.

Ask your Training Officer to check your work and if it is correct, to sign below.

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



REMEMBER ALWAYS WORK SAFE

Once you have passed the entire practices, you are now at liberty to request a Formative Assessment from your Assessor