

DIESEL MECHANIC



MINING QUALIFICATIONS AUTHORITY

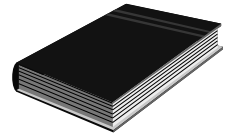
CODE: BRR-3

REMOVE AND MOUNT A BEARING FITTED WITH AN ADAPTOR SLEEVE

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 “Remove and mount a bearing fitted with an adapter sleeve”. Whilst learning towards the outcome you will be required to achieve the following:

- Enable you to remove and mount bearings that are fitted with adapter sleeves.

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

- Remove adapter bearings from a shaft assembly in the correct way.
- Clean and inspect the bearings for serviceability.
- Remount the bearings on to the shaft and the shaft into the shaft assembly.

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 practical test will be set at the end of the module and must be completed without using references other than bearing clearance charts.

The following standards must be achieved:

- The shaft and bearing must be removed from the plumber blocks correctly and in accordance with the standards contained in Module BRR – 2.
- There must not be any damage to the bearings, adapter sleeves, shaft and the lock nuts.
- The bearings must be correctly cleaned and inspected for serviceability in accordance with the standards contained in Module BIF.
- The bearings must be replaced in the same position on the shaft that they were.
- The bearing clearances must comply with the bearing charts (tables).
- The lock nuts must be locked as described in the notes.
- The shaft and bearings must be correctly replaced in the plumber blocks as described in these notes.

All safety procedures must be adhered to.

<u>HAZARD IDENTIFICATION AND CONTROL (HIAC) FORM</u> <div style="display: flex; justify-content: space-around; align-items: center;">  <div> BRR-3 REMOVE AND RMOUNT A BEARING FITTED WITH AN ADAPTER SLEEVE </div> </div>		
STEPS IN OPERATION / PROCESS	POTENTIAL ACCIDENT / INCIDENT	CONTROLS (BY RESPONSIBLE PERSON)
1. 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.
2. Replace bearings on shaft.	<ul style="list-style-type: none"> Burrs on the shaft can cause damage to the bearing and/or housing when mounting or removing the bearing. 	<ul style="list-style-type: none"> Inspect shaft and remove any burrs with a smooth file.
	<ul style="list-style-type: none"> Fragments in the form of chips and splinters from using wrong tools can enter bearings and housings and lead to bearing failure. 	<ul style="list-style-type: none"> Use only tools not likely to splinter or chip when fitting bearings.

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:



DICTIONARY

- Adapter sleeve** : A tapered metal ring used to adapt (fit) a tapered bearing on to a shaft.
- Bore** : The hollow of a cylinder or pipe or sleeve or bearing.
- Adapter bearing** : A bearing with a tapered bore.

1. REMOVE AND REPLACE ADAPTER BEARINGS

ITEM / TASK: Introduction.

DESCRIPTION:

- A. Adapter bearings are fitted to a shaft by using adapter sleeves.
- B. Adapter sleeves have tapered outside diameters to match the taper bores of adapter bearings. (Fig 1)

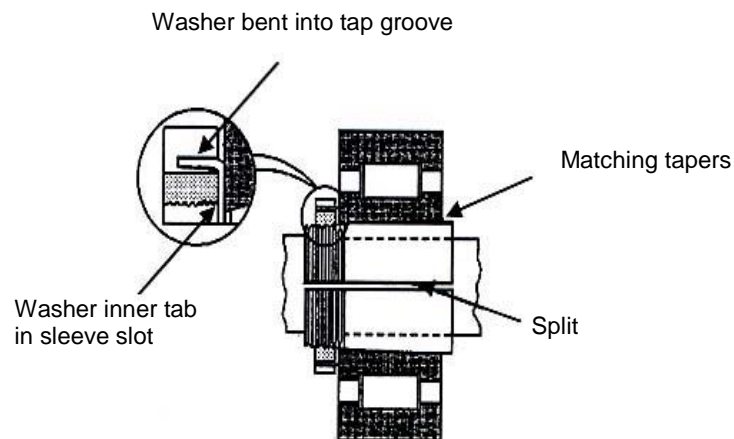
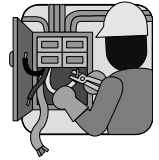


FIG 1.

- C. The bores of adapter sleeves are parallel and they are split along one side. This allows them to be drawn into the taper in the bearing by tightening the lock nut and thereby, locking it onto the shaft.
- D. The lock nut is locked in position by bending one of the tabs on the outside circumference of the lock washer into a groove in the nut that lines up.
- E. The washer in turn is held stationary by a tab on its inside circumference that fits into a slot on the threaded section of the sleeve as shown in Fig 1.



ITEM / TASK: Remove the bearing.

DESCRIPTION:

- A. Mark the position of the bearing on the shaft.
- B. Pry the lock washer tab out of the locknut groove. (Fig 2)

The outer tab of the lock washer
being pried out of the locknut
groove

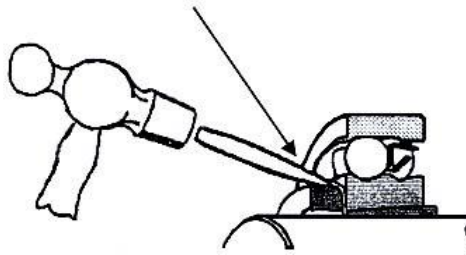


FIG 2.

- C. Slacken the lock nut two or three turns with a hook spanner. (Fig 3)

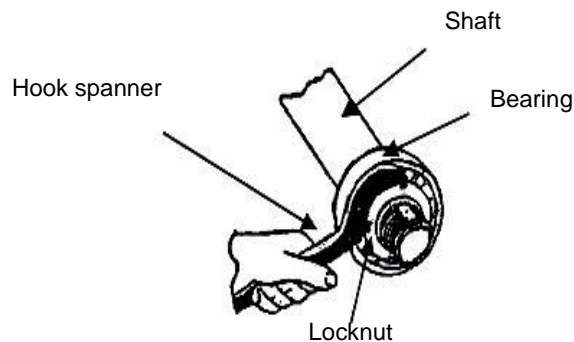


FIG 3.

- D. Place the driving dolly / mild steel punch against the **inner ring** of the bearing and tap the dolly / mild steel punch with a hammer until the bearing dislodges from the tapered sleeve. (Fig 4)

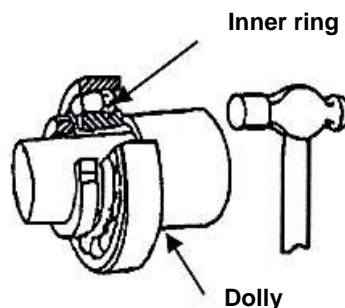


FIG 4.

- E. Remove the lock nut and the lock washer.
- F. Remove the bearing.
- G. Remove the burrs from the shaft with a smooth file and clean the shaft with emery tape to prevent damage to the sleeve when it is removed.
- H. Remove the adapter sleeve by driving the tapered point of a screwdriver or wedge in the split of the sleeve and forcing it open. (Fig 5)

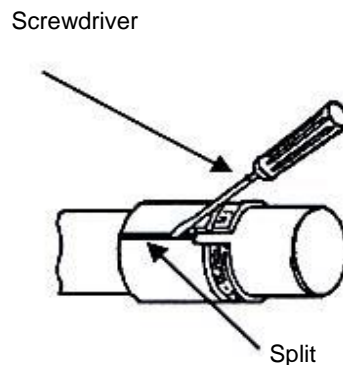
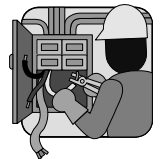


FIG 5.

ITEM / TASK: Remove and replace a self-aligning ball bearing.



DESCRIPTION:

- A. Clean and inspect the bearing for serviceability as learned in Module BIF. **Complete the bearing checklist.** (Checklist available at end of module)
- B. Screw the lock nut onto the sleeve to check if it turns freely.
- C. Fit the adapter sleeve to the shaft.
- D. Push the bearing over the shaft and onto the adapter sleeve. Make sure that the tapers match.
- E. Check to see that the tab on the inside of the lock washer and tabs on the outside circumference are not damaged.
- F. Fit the lock washer onto the sleeve.
- G. Smear grease on the threads of the sleeve and screw the lock nut finger-tight onto the sleeve with the chamfered side facing the bearing.
- H. Hold the bearing and sleeve with one hand and use the other hand to tighten the nut with a hook spanner until the sleeve locks onto the shaft at the marked position.
- I. Measure the distance (x) between the end of the sleeve and the nut with a vernier calliper and make a note of it. (Fig 6 on the next page)

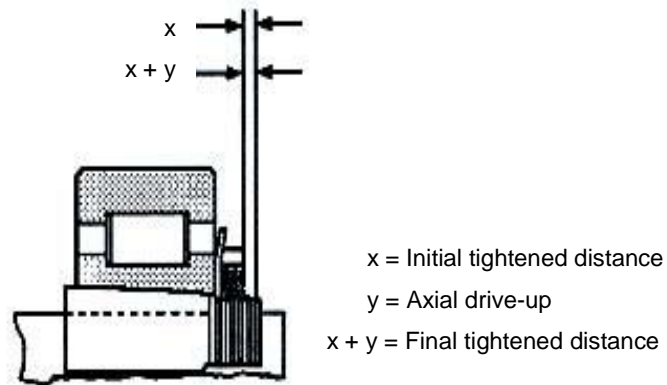


FIG 6.

- J. Determine the axial drive-up (y) from the bearing chart (Table 1 on next page), e.g. with a bearing size of 40mm the axial drive-up will be between 0.4mm and 0.45mm.
- K. Add the axial drive-up to the dimension obtained in the previous step.
- L. Tighten the nut until this size (x + y) is measured from the small end of the sleeve and the nut. Refer back to Fig 6.
- M. Bend over the tab of the lock washer, which is in line with a slot on the lock nut.
- N. Check that the bearing is running free.



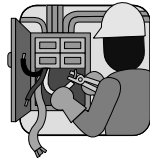
N.B.

Remember to work cleanly and prevent contamination of the bearing.

**TABLE 1 -
BEARING CHART**

SHAFT DIAMETER (MM)		AXIAL DRIVE – UP (Y) (MM)	
FROM	TO	MIN	MAX
30	40	0.35	0.40
40	50	0.40	0.45
50	65	0.45	0.60
65	80	0.60	0.75
80	100	0.60	0.90
100	120	0.70	1.10
120	140	0.75	1.40
140	160	1.10	1.60
160	180	1.20	1.70
180	200	1.30	2.00
200	225	1.40	2.20
225	250	1.60	2.40
250	280	1.90	2.70
280	315	2.00	3.00
315	355	2.40	3.30
355	400	2.60	3.60
400	450	3.10	4.00
450	500	3.30	4.40
500	560	3.70	5.00
560	630	4.00	5.00
630	710	4.60	6.20

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



PRACTICE

Using the method explained above, remove and replace the self-aligning ball bearings with adapter sleeves on the 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.

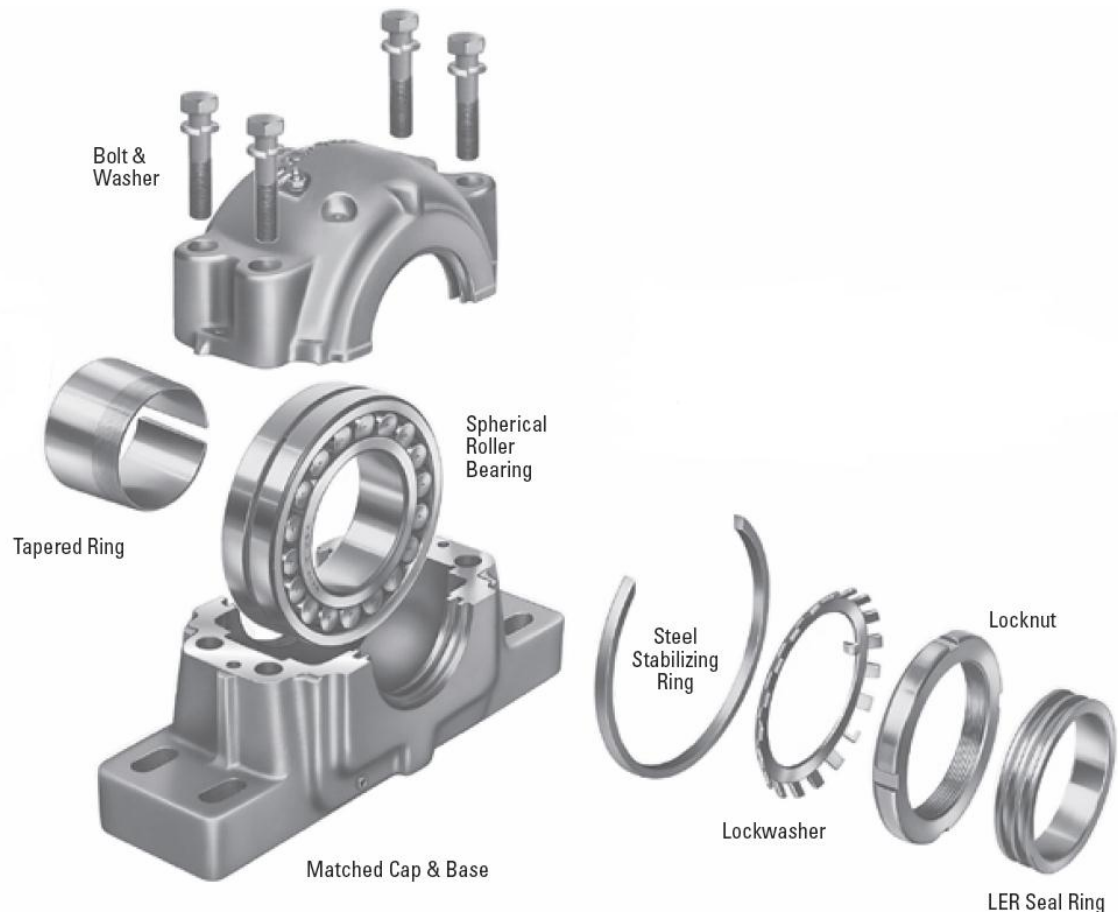
LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :

2. SET CLEARANCE ON A SPHERICAL ROLLER BEARING

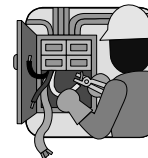
ITEM / TASK: Introduction.

DESCRIPTION:

- A. When a spherical bearing with an adapter sleeve is mounted, the internal radial clearance between the races and the rollers will be reduced when the bearing is drawn onto the taper with the nut.
- B. This reduction in internal clearance is normally used as a measure to determine when the nut is drawn tight enough.
- C. Before the bearing is mounted the internal radial clearance should be measured with a feeler gauge between the outer race and rollers.



Exploded view of complete spherical roller bearing assembly.



ITEM / TASK: Adjust a spherical roller bearing.

DESCRIPTION:

- A. Rest the bearing on a clean surface and rotate the inner ring through one or two revolutions so that the rollers position themselves correctly.
- B. Measure the clearance between uppermost roller and the outer ring with a feeler gauge.



Note:

If bearing is hanging on a shaft, the clearance must be measured at the bottom of the bearing and visa-versa.

NB:

The measured radial internal clearance should be the same for both rows of rollers.

- C. Use Table 2 to determine the recommended reduction in clearance for a bearing when it is drawn onto an adapter sleeve.

Example:

The bearing bore is 100mm.

The internal radial clearance measured before mounting is 0.08mm.

The reduction in radial internal clearance, from Table 2, is between 0,05mm to 0,07mm.

- D. Subtract first 0.05mm and then 0.07mm from the clearance measured, to obtain the **limits of the final clearance** after the bearing has been drawn up onto the sleeve.
- E. Fit the bearing, with the sleeve, onto the shaft.
- F. Draw the bearing onto the sleeve with the nut. Check the reduction in internal clearance at regular intervals during the drive-up. The clearance should now be measured between the lowest roller and the outer ring (Fig 7), i.e. opposite to the position of measuring the initial clearance, which was at the top.

N.B.

The clearance must be within the limits as determined from Table 2 for a particular bearing. Refer to Paragraph D above.

Clearance is measured at the bottom

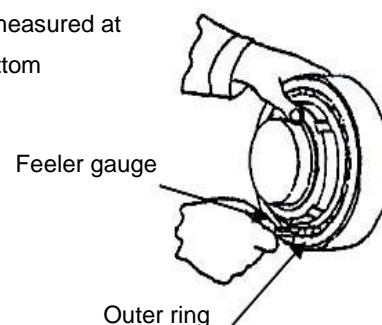
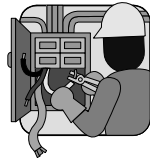


FIG 7.

**TABLE 2 -
PERMISSIBLE CLEARANCE FOR BALL BEARINGS**

SHAFT DIAMETER (MM)		REDUCTION IN RADIAL INTERNAL CLEARANCE (MM)	
FROM	TO	MIN	MAX
30	40	0.020	0.025
40	50	0.025	0.030
50	65	0.030	0.040
65	80	0.040	0.050
80	100	0.045	0.060
100	120	0.050	0.070
120	140	0.065	0.090
140	160	0.075	0.100
160	180	0.080	0.110
180	200	0.090	0.130
200	225	0.100	0.140
225	250	0.110	0.150
250	280	0.120	0.170
280	315	0.130	0.190
315	355	0.150	0.210
355	400	0.170	0.230
400	450	0.200	0.260
450	500	0.210	0.280
500	560	0.240	0.320
560	630	0.260	0.350
630	710	0.300	0.400

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



PRACTICE

A shaft with spherical roller bearings fitted in plumber blocks will be provided.

1. Remove the shaft from the plumber blocks and remove the bearings from the shaft.
2. Clean, inspect and replace the bearings and adjust them by using the method explained in these notes.
3. Replace the shaft assembly in the plumber blocks.

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

LEARNER	TRAINING OFFICER
DATE :	DATE :
SIGNATURE :	SIGNATURE :



REMEMBER ALWAYS WORK SAFE

Once you have passed the entire 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.		
BEARING ACCEPTABLE		

* For in service inspection only.

REASONS FOR BEARING NOT ACCEPTABLE.

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.		
BEARING ACCEPTABLE		

* For in service inspection only.

REASONS FOR BEARING NOT ACCEPTABLE.
