



Government of India

भारत सरकार

Ministry of Railways

रेल मंत्रालय



**INSTRUCTIONS FOR INSPECTION AND MAINTENANCE
OF CARTRIDGE TAPERED ROLLER BEARING FITTED
ON CAST STEEL BOGIES**

TECHNICAL PAMPHLET No. G-81

(Revision-3) (Supersedes G-81 Rev.-2)

IRCAMTECH/MECH/GWL/G-81/MP-5/JULY 2019

आजापा संरक्षण RDS
रेल अग्रदृष्टि Transforming Railways



**Indian Railways
Centre for Advanced Maintenance Technology**

MAHARAJPUR, GWALIOR-474005(INDIA)

Ph. No. 0751-2470803

Foreword

Cast Steel CASNUB Bogies of freight Stock of Indian Railways have been provided with Cartridge Taper Roller Bearings (Class E). Revised Instructions for Inspection and Maintenance of cartridge tapered roller bearings (version-3 of Technical Pamphlet No. G-81) covers constructional details, maintenance procedure and precautions during inspection and maintenance of CTRB. Wherever required, sketches and colored photographs have been provided to make the understanding clear.

I am sure that revision-3 of Technical Pamphlet No. G-81 will be useful to the concerned staff of Workshop and ROH Depot to ensure trouble free and reliable service of the freight operation.

Technological up-gradation and learning is a continuous process. Hence feel free to write us for any addition, which will be highly appreciated.

We welcome any suggestion for addition or improvements from our readers at edcamtech@gmail.com.

Place: CAMTECH/GWL

Date: 30.07.2019

(Jitendra Singh)
Principal Executive Director
CAMTECH/GWL

PREFACE

The Maintenance instructions of CTRB (G81) has been revised and given a face lift to make it more useful, easy to understand and simple to extract information. This is based on the feedback received from Workshops, ROH depots. Many diagrams, topics, figures and annexure have been added. Some topics have been elaborated for better understanding.

Suggestions, enquiries/comments are welcome and should be directed to Jt. Director/Mechanical, Maharajpur, and Gwalior-474005. Feel free to ask your queries on **0751 2470890** or send your suggestions on **Email Id- dirmech@gmail.com**, Fax - **0751 2 470841**.

Place: CAMTECH/GWL
Date: 30/07/2019

(Manoj Kumar)
Jt. Director/Mechanical
CAMTECH/GWL

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1. TERMINOLOGY

SN	Terminology	Description of Cartridge Bearing Parts
1.	Backing ring	Collar between bearing and journal fillet; Axle collar; Dust guard ring; Enclosure collar
2.	Cage	Retainer; Separator.
3.	Cap screws	End cap fasteners.
4.	End cap	Cap at end of journal; Axle end cap; Locking cup; End cover.
5.	Fitted backing ring	Backing ring with extension to provide press fit with suitable diameter axle dust guard seat.
6.	Inner ring	Cone or inner race.
7.	Locking plate	Cap screw locking device.
8.	No Field Lubricating (NFL) bearing	Bearings which are not designed to be lubricated in the field and do not have a lubricant fitting, or pipe plug.
9.	Outer ring	Cup or outer ring.
10.	Raceways	Surfaces of outer and inner ring on which rollers operate.
11.	Roller assembly	Rollers with inner ring and cage, inseparable
12.	Rollers	Tapered rollers
13.	Seal	Seal proper, including inner case, if used.
14.	Seal wear ring	Ring on which seal rides or makes contact
15.	Spacer	Spacer, spacer ring; Cone spacer
16.	Adapter (Roller Bearing Adapter)	A casting that fits between a freight car roller bearing and the bogie side frame to transfer the load from the side frame to the bearing.

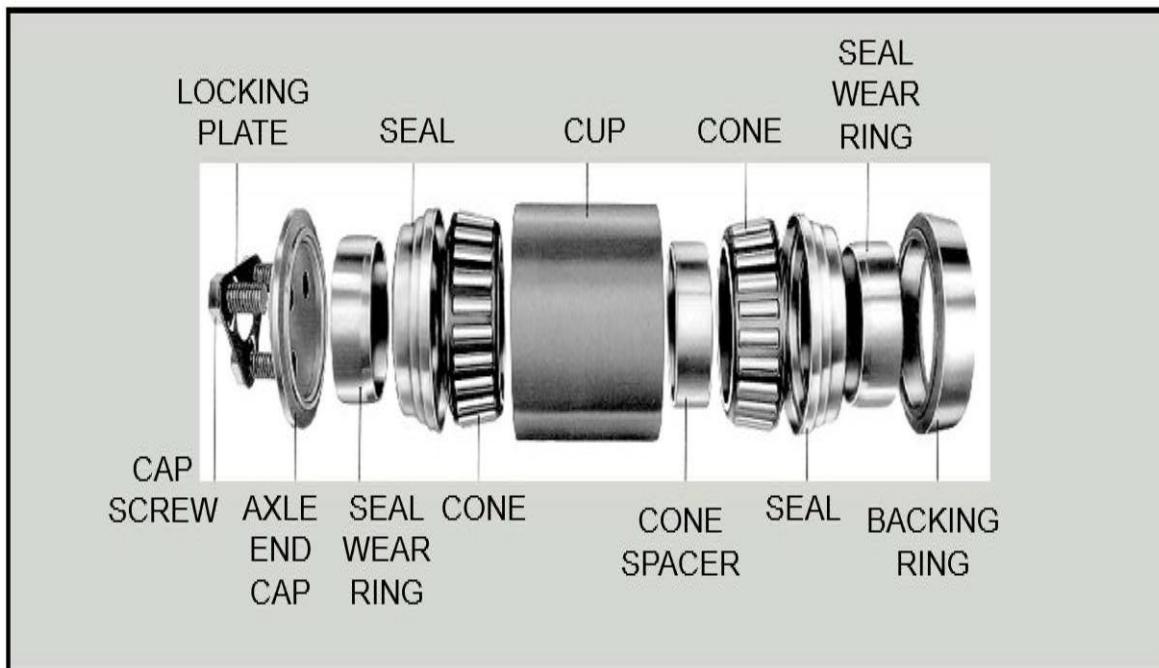


Fig.1: Expanded View of Cartridge Tapered Roller Bearing

2. GENERAL CONSTRUCTION

The Cartridge Tapered Roller Bearing is a self-contained, pre-assembled, pre-adjusted, pre-lubricated, completely sealed unit and applied to or removed from the axle without exposing the bearing elements, seals or lubricants to contamination or damage.

The **Cartridge Tapered Roller Bearing(CTR-B)** has two inner races (Cones) along with rollers and Cage, separated by a Spacer, a single case-hardened outer race (Cup), a grease seal and a seal-wear ring at each end, a backing ring at the rear, axle end cap, 3 cap-screws and locking plate as shown in **Fig.2**. The cup also acts as the bearing housing and is fitted in the bogie side frame with a suitable adapter (See General Arrangement of CTRB Drg. No.WD-92089-S-01 for Narrow Jaw adapter & WD-13042-S-01 for Wide Jaw adapter at **Annexure-IA & IB** respectively).

The weight of **Class 'E'(6"X11")** CTRB is around 34.3 kg, weight of Narrow Jaw Adapter is around 12.0 kg and weight of wide jaw Adapter is around 23 kg.

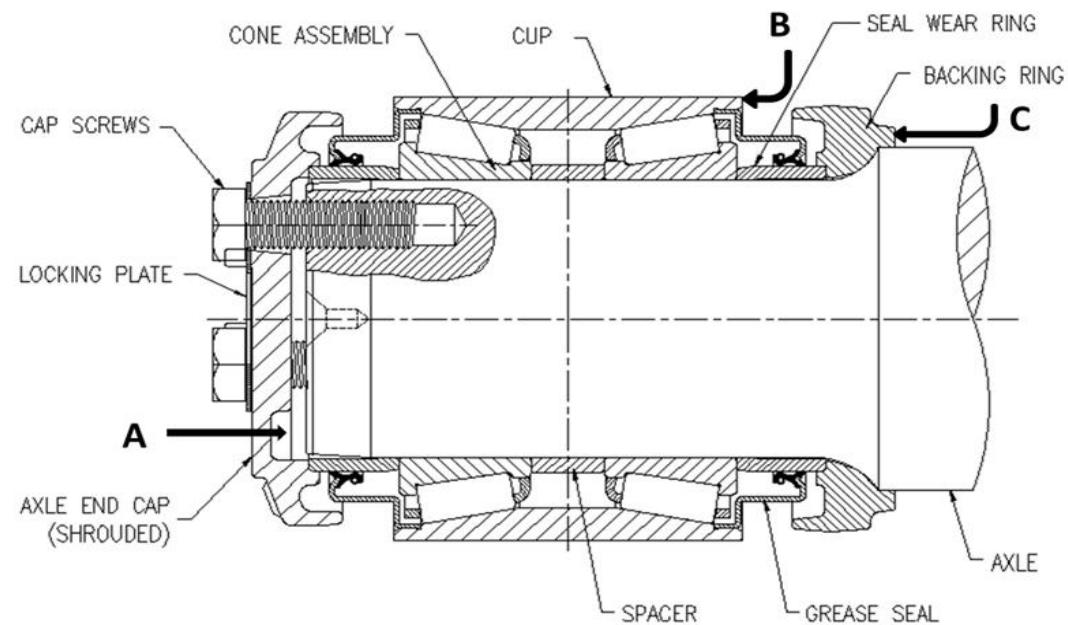


Fig.2: Cartridge Tapered Roller Bearing Section view

3. GREASE SEAL

The grease seal is made of special synthetic rubber of superior oil resistance quality. Double lip seal element is bonded to the steel plate seal cover which is retained in the outer ring by a press-fit. The seal lips are moulded to provide bi-directional grease retention employing the elasto hydro-dynamic principle (Fig.3).

Seals perform two important functions:-

- (a) Retain a quantity of grease inside the bearing to provide adequate lubrication through the bearing service period.
- (b) Prevent the ingress of water and other contaminants in to the bearing.

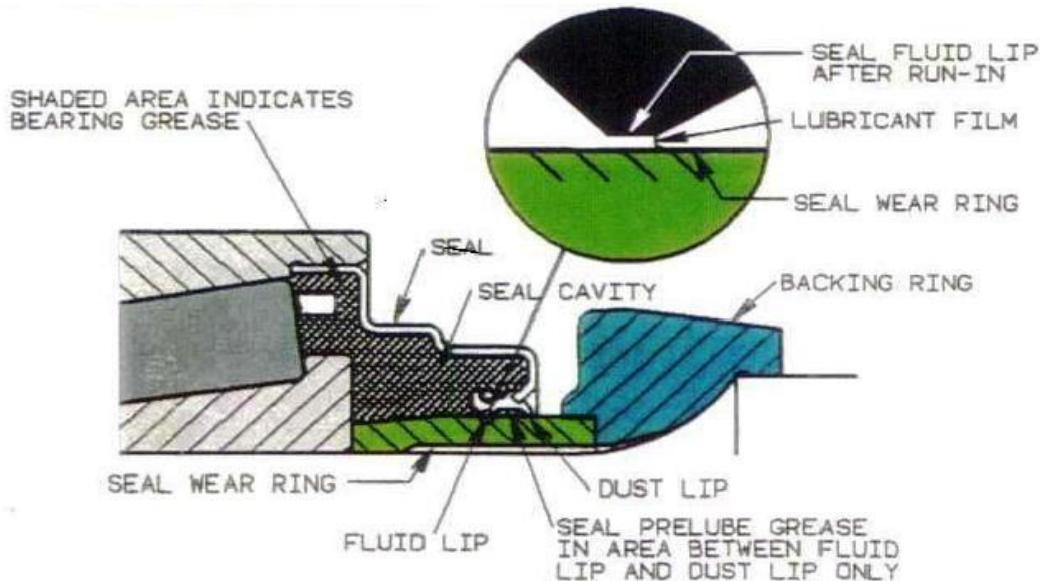


Fig.3

The limiting dimensions of Class 'E' (6"X11") Grease Seal (Indigenous) have been mentioned at Annexure – II

4. LIFE EXPECTANCY

The '**L₁₀ Life**' is defined as that life at which no more than 10% of the bearings may have been replaced **solely due to fatigue of metal**. The L₁₀ life of bearing is the theoretical fatigue life.

5. APPLICATION

The Cartridge Bearings used on Indian Railways freight stock are of type Class 'E' (6"x11"). This bearing is suitable for RDSO's Axle to drawing no. **WD-89025-S-02**. These bearings are being used on all BG wagons/Container fitted with bogies like CASNUB 22NL/22NLB/22NLC/22HS/LCCF-20(C) like BOXN, BOXNHL, BOXNEL, BCN, BCNAHS, BOY, BOYEL, BTPN, BOBSN, BOBRNHS, BLCA/BLCB etc.

5.1 Different Makes of Cartridge Tapered Roller Bearings& Related Details

Indian Railways have procured these bearings from four manufacturers viz: M/s NEI/Brenco, M/s Timken, M/s FAG and M/s SKF.

a. M/s National Engineering Industries Ltd./ BRENCO Bearings

M/s NEI, Jaipur have indigenized all the components of CTRB Class 'E' except Grease Seal. The general arrangement of Cartridge Bearing application Class 'E' of M/s NEI is shown in its Drg.No.PESD-6085 for Narrow jaw adapter and Drg.No PESD-6086 for Wide jaw adapter (**Annexure-III'A' &III'B'**).

b. M/s Timken India Ltd. Bearings

M/s Timken India Ltd .has indigenized all the components of CTRB Class 'E'. The general arrangement of M/s Timken bearings is shown its drawing No. P.A-G.A11100 (**Annexure IV**).

c. M/s FAG Bearings India Ltd.

Initially complete unit of CTRB Class 'E' was imported from FAG, Germany. Now the company is in the process of indigenization. The general arrangement drawing of Class 'E' CTRB is drawing No EDD TL/003/01/B/05 000.

d. M/s SKF Bearings.

Initially complete Unit was imported from SKF/Italy. Now the company is in the process of indigenisation. M/s SKF Class 'E' CTRB assembly drawing No is 1637504 B.

6. PERIODICITY OF MAINTENANCE

The Cartridge Taper Roller Bearings used on Indian Railways are of '**No Field Lubrication**' (NFL) Type. These bearings require no maintenance between POH to POH. The periodicity of first POH of BOXN Wagons has been laid down as six years by Railway Board vide letter No. 85/M (W)/814/53 dated 19-3-86. The periodicity of subsequent POH has been fixed as **4 1/2** years by Board vide their letter No.85/M (W)/814/53 dated 3-7-90.

POH interval of various Wagons of air brake has been mentioned below: -

POH INTERVAL OF AIR BRAKE STOCK.

S .No	Stock/Wagons	*POH (Years)	
		First	Subsequent
1.	BOXN, BLC	6	4.5
2.	BCN/BCNA, BOXN CR	6	6
3.	BRN	6	4.5
4.	BOY	3	3
5.	BTPH	6	4.5
6.	BTPN	6	6
7.	BOBR & BOBRN	6	6
8.	BTPGLN	4	4
9.	BTALN	4.5	4.5

[* Note: Please see/refer **IRCA Part-III** (latest) & Railway Board latest instructions/letters for latest update/change related to POH interval of Wagons]

7. SCHEDULE OF INSPECTION & MAINTENANCE

The following are the recommended practices for long life and trouble-free operation of Cartridge tapered Roller bearings

7.1 Recommended Practice during incoming examination in yards

7.1.1 The bearings should be examined for

i. **Abnormal Noise**

Check for any abnormal sound and/or grinding noise.

ii. **Running Temperature**

Detection of warm bearings on arrival of the train .Check operating temperature of the bearing by touching the adapter or underside of the bearing cup with bare hands immediately after wagon/vehicle is halted. If it is found impossible to hold the hand for a few seconds on the adapter or the Cup it means that the bearing is running hot. Cross check the bearing temperature with temperature sensing hand held pyrometers/sensors giving direct reading of the bearing.

If bearing temperature is **more than 90 degree** centigrade the wagon/vehicle should be removed from service. Running temperature up to 38^0C above ambient may be expected under normal operating conditions.

iii. Visible Damage

Inspect adapter, axle cap screws, locking plate, outside of the cup and seal. If any of these are found cracked, broken or distorted the wheel set must be removed from service. If one cap screw is found loose or missing examine the bearing by rotating it. If it is OK remove all the cap screws. Apply a new locking plate and, torque tighten all the cap screws. If two or more cap screws are found loose or missing, the bearing should be removed from service for complete inspection and servicing before reuse.

If locking plate tab are broken, remove locking plate and fit a new one. Tighten the axle cap screw with torque wrench to a specified torque of **40 kg-m**. Lock the cap screws by bending the tabs of locking plate.

iv. Displaced Adapter.

Check for displaced adapter from its correct location on **the bearing outer cup which can result from lack of care at the time of bogie assembly or from vehicle abuse during tippling**. A displaced adapter can cause mechanical damage, off centre loading, accelerated fatigue damage and pre-mature bearing failure. **Any wear of damage to the end cap or backing ring is an indicator that the adapter has been out of position.** Sometimes a displaced adapter can get automatically reseated in its correct position due to bogie action. If an adapter is found displaced, the bogie should be lifted. Outer cup, backing ring and end cap should be thoroughly examined and then the adapter should be properly seated.



Fig.4: Adapter properly positioned in side-frame



Fig.5: Adapter properly located on bearing cup

v. Grease Leakage

In case of grease purging or leaking out of the bearing, check for visible damage to seals. Grease leaking between the cup counter bore and the seal cage major diameter (**Location B in Fig. 6**) may be an indication of a loose seal. Seal is loose if it can be moved by hand or is cocked out of position. Grease leaking between backing ring on the axle dust guard (**Location C in Fig. 7**) is an indicator of a loose backing ring and a loose bearing. If a backing ring can be moved by hand on application of pressure it is considered to be loose. Bearing with loose backing ring should be removed from service. The break out diameter **d1** of backing ring should not exceed 178.562 mm (7.03") **see clause 8.5.9.**

Please keep in mind, in new mounted/installed bearing (either POHed CTRB or New CTRB) Leakage of grease upto30 grams from seal and wear ring contact area is normal and comes from the purging of seal prelube and the reliving of internal bearing pressure. This should not be wiped away. **It will “set-up” and stop further leakage”.**



Fig.6: Old grease accumulations (dried and covered with dirt)



Fig.7: Grease leakage (shiny/wet appearance)-on side of dried grease

- vi. Availability of adapter retaining nut and bolt in **wide jaw bogie**.

7.2 Examination in Sick-lines

- 7.2.1 When wagons pass through sick-lines for some repair or re-profiling of wheel tread, the bearing should be subjected to external examination as listed in **Para 7.1.1** above. **In case if the bogie is lifted for any reason the bearing should be rotated by hand and checked for any unusual sound due to raceway damage.** Bearings giving unusual sound should be removed from service.
- 7.2.2 Before re-profiling of wheel tread/ tyre turning, open out the axle end cap and replace it with a dummy cover. The dummy cover can be made as per RDSO Drg. No. **WDIIA-8514/S-1(Annexure-V)**. Clean the axle ends thoroughly after tyre turning. Take special care to see that no grit or swarf is left. Also check axle end cap screw holes for any grit/swarf.
- 7.2.3 Mount the axle end cap and locking plate. Tighten the axle cap screws with torque wrench. The torque specified is **40 kg-m**. Bend the tabs of locking plate and finally rotate the bearing, and check the condition of bearing seals and adapter.

7.3 Recommended Practices for ROH Depots:

1. Area where bearings are opened for UST of axle must have controlled environment.
2. Proper visual examination of bearings to be done. Some important aspects to be checked are as under:

2.1 Overheating, such as discoloration or parts fused together.



Fig. 8: Phenomenon of discoloration due to overheating

2.2 Check for loose and/or missing cap screws.



Fig. 9: Missing Cap Screw

2.3 Check that all tabs of the locking plate are properly bent up against the flats of the cap screw in the loosening direction



Fig.10: Position of End Cap Screw

2.4 Inspect for damage or wear to the End cap from a displaced adapter



Fig.11: Damaged End Cap

2.5 Examine the bearing for welding damage or exposure to extreme heat, such as from a cutting torch. Remove the bearing from service if you find any damage.

2.6 Check for cracked or broken **outer rings** (also called bearing Cups).



Fig. 12: Damaged Bearing Cup

2.7 Inspect for a loose backing ring. If you can move or rotate the backing ring by hand, remove the bearing from service.



Fig.13: Loose Backing Ring

2.8 Check the backing ring for damage or wear from a displaced adapter



Fig.14: Damaged Backing Ring

2.9 Check whether the grease seal is displaced or cocked or has external damage



Fig.15: Cocked Grease Seal

3. While carrying out wheel turning, the prescribed dummy/protective covers (as mentioned in clause 7.2 (2) & shown in Drawing No. WDIIA-8514/S-1) on bearing shall be used.
4. Proper tightening of End cap Screws with periodically (monthly) calibrated torque wrench at specified torque may be ensured on wheel sets. The specified torque should be maintained to 40 Kg-m (290 foot-pounds). The torque wrench must be maintained with an accuracy of $\pm 4\%$ (Maximum). Minimum 2 passes and maximum 5 passes to be applied to ensure proper clamping. If any screw movement persists after 5 passes check for any irregularity.
5. Handling of wheel sets to be done by using the prescribed lifting tackle and not by wire ropes which can damage the grease seals.
6. In case bogie(s) are dismantled for any purpose, the Adapter must be thoroughly inspected for soundness and wear. Gauging must be done as specified in clause 19.
7. Ensure the Adapter is properly placed on CTRB. Most bearings will “creep” in service, creating two wear bands as pictured below. This is a normal condition that also causes wear to the adapter’s seat pads

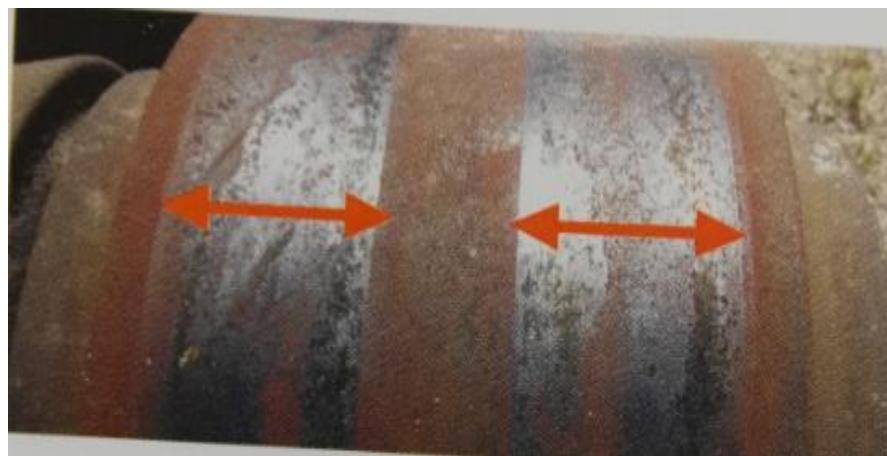


Fig.16: Normal wear bands

Wear bands that extend to the end of the outer ring (cup), as shown on the left side of the image below, indicate an excessively worn adapter seat. A shiny edge at the extreme end of the outer ring, as shown on the right side of the image below, is an indication that the thrust shoulder is worn. Replace the adapter if either of these conditions exists.

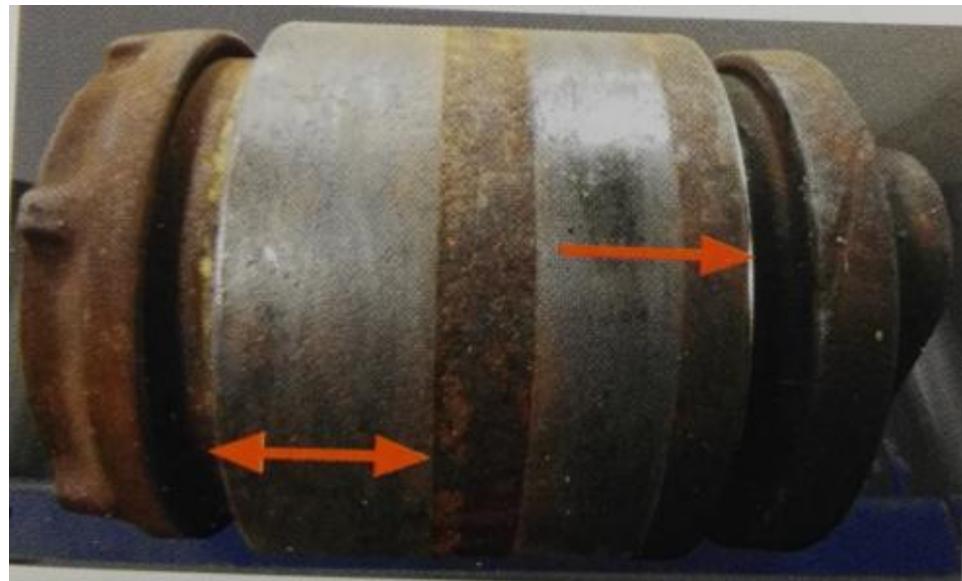


Fig.17: Excessive wear bands

8. Whenever wagons or bogies fitted with CTRBs require welding in ROH Depots/Sick lines, special attention should be paid so that electric current does not pass through the bearings. The earthing should be done very close to welding area and the earthing wire should be tightly secured at both ends. Alternatively the earthing can be done with an earthing wire/strip running parallel to the track instead of earthing with the rails. If wagon is not properly earthed the current passing through the bearings will cause arcing in between the rollers and the raceways leading to failure.

7.4 Overhauling of Taper Bearing

7.4.1 The overhaul includes the removal, cleaning, inspection, repair or replacement, assembly of all parts and installation. **Overhauling should be carried out at the time of POH of wagon and also at the following occasions:-**

- a) **Re-discing**
- b) When wagon has been **submerged in flood, etc.**
- c) When Hot Box or Bearing failure has been reported on account of **broken cup, unusual sound etc.**
- d) **Derailment:** All the bearings of wagons involved in accident should be removed and sent for servicing/overhauling in the workshop. The word '**Accident Involved**' should be painted on the outside of the cup of such bearings before sending to workshop for detailed examination (Refer **Para 8.6**).

➤ The workshops does the following works during POH of Cartridge Bearings:-

- i. **Disassembly**
- ii. **Cleaning**
- iii. **Inspection**
- iv. **Reassembly**

Major repairs like remachining/remanufacturing of the track raceway of cone/cup, cage changing etc. is to be done only by the bearing manufacturer.

For rectification of defective bearings in Railway workshop refer to **clause 13.0**.

8. PROCEDURE FOR OVERHAUL

8.1 Removal of wheel set from the side frame.

8.1.1 Remove side frame key bolt and the key. Lift side frame and take out wheelset. Remove adapter retaining bolt and nut (only for wide jaw bogies) and take out adapter from the side frame.

8.2 Removal of Bearing from Axle

8.2.1 Clean the outside surface of bearing. Unscrew the axle cap screws from the end cap and remove locking plate and end cap.

8.2.2 Attach pilot sleeve to the axle end or where press is used to the press ram. The details of pilot sleeve are shown in **Fig. 18**.

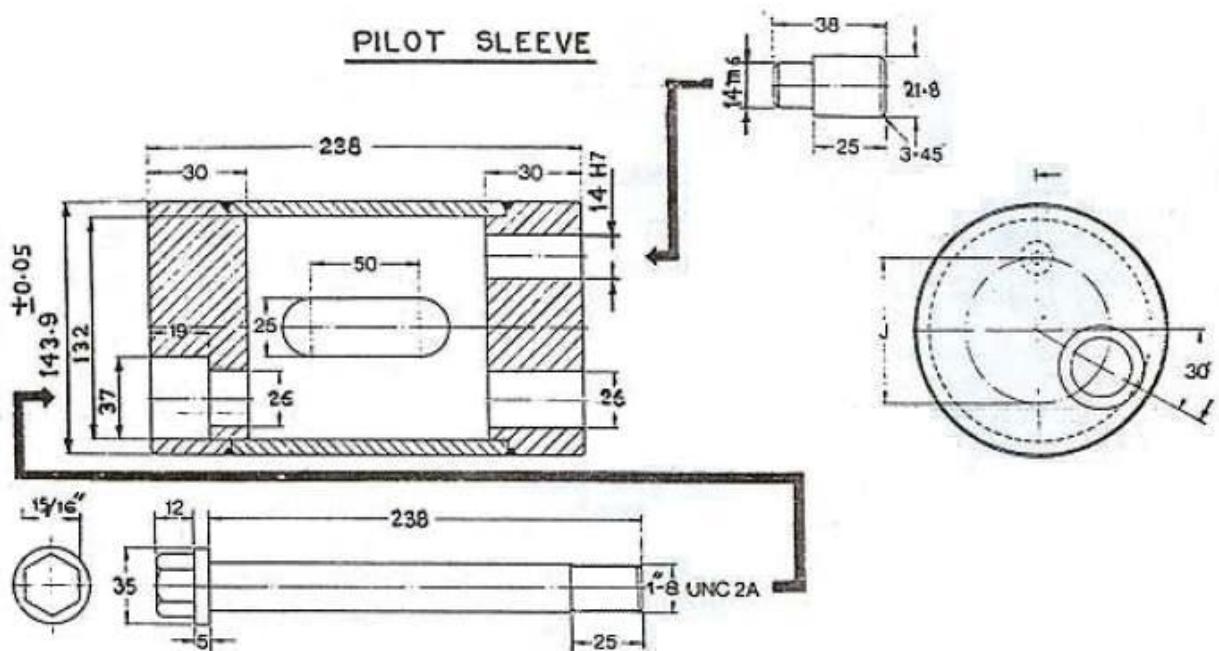


Fig. 18

- 8.2.3 Apply pulling shoe behind the backing ring. Hold it in position until the pressure has been applied. Go on increasing the pressure to pull the bearing off the axle end. **The pressure may exceed 5 tons**. A general arrangement for removal of bearing is shown in **Fig. 19**.

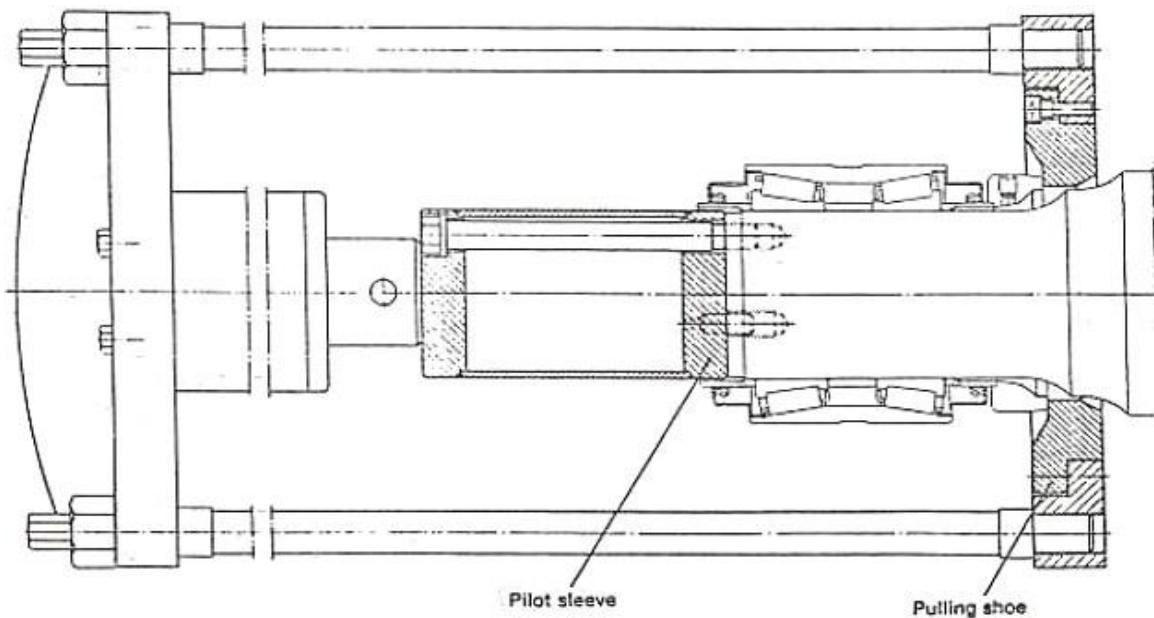


Fig. 19



Fig.20: Position the bearing removal fixture on the bearing assembly to be removed by tilting the pulling frame.

- 8.2.4 Removed bearings should immediately be kept in a clean and dry place in a covered room. **Under no circumstances a bearing should be left in open** to avoid ingress of moisture/water causing severe rusting of the bearing.
- 8.2.5 The bearings should be very carefully handled. While loading/unloading the bearings for transportation from one place to another or otherwise, **care should be taken to ensure that the bearings are not thrown one over the other**. The bearings should be carefully stacked one over the other as even a small impact is enough to damage the bearing. Every bearing is precious – **SO HANDLE IT CAREFULLY**.

8.3 Dismantling of Bearing

After the assembly is taken out from the puller, remove backing ring, seal wear rings and excess grease. The bearing is now ready for dismantling on the workbench. Remove seals from both sides with the help of seal dismounting jig. The application of seal dismounting jig is shown in **Fig. 21**.

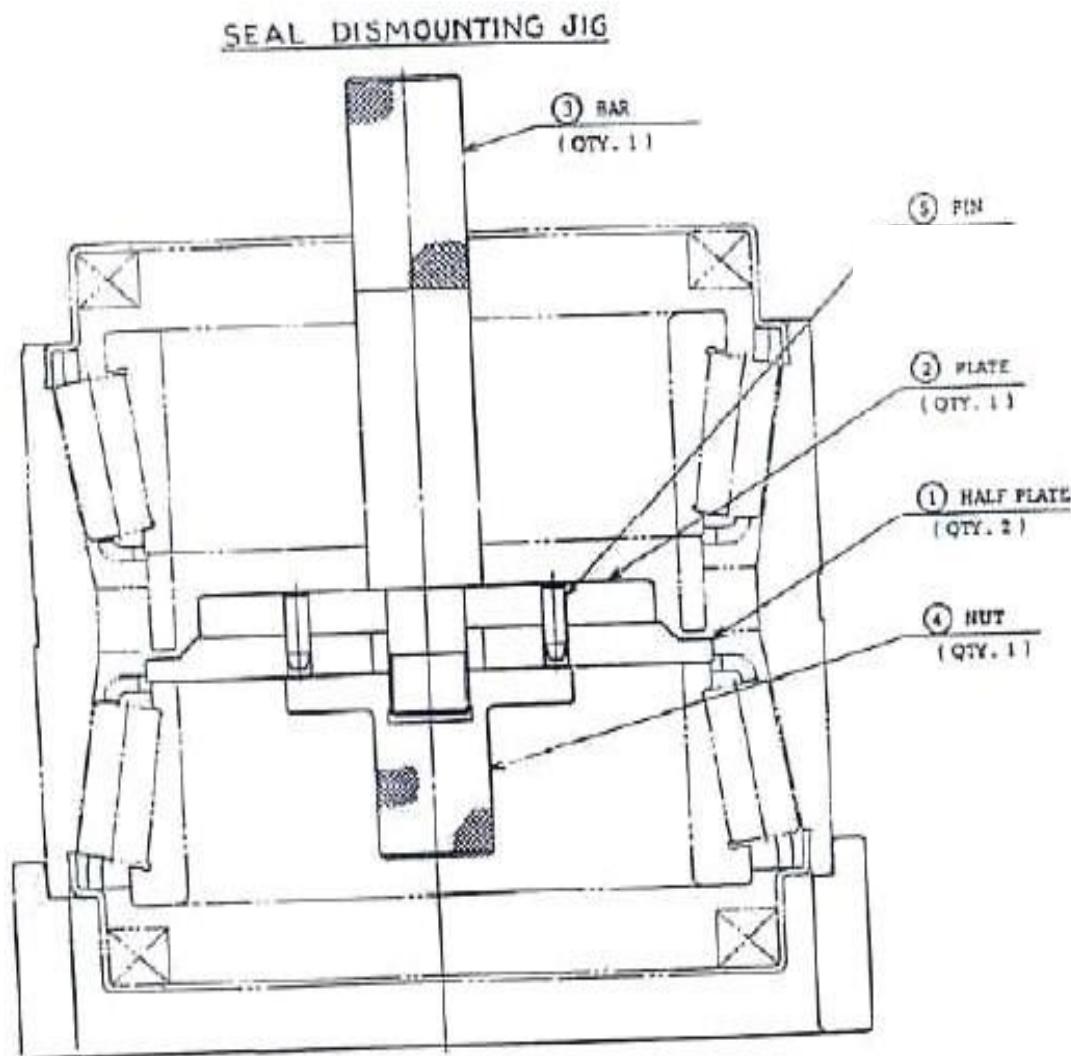


Fig. 21: Seal Dismounting Jig

The parts of seal dismounting jig and its details are shown in the **Annexure- V 'A'** & **V 'B'**. Remove the inner ring assembly and Spacer from the outer cup. Alternatively seal may be removed with pry bar as shown in **Fig. 22**. The details of pry bar given in **Fig. 23**.

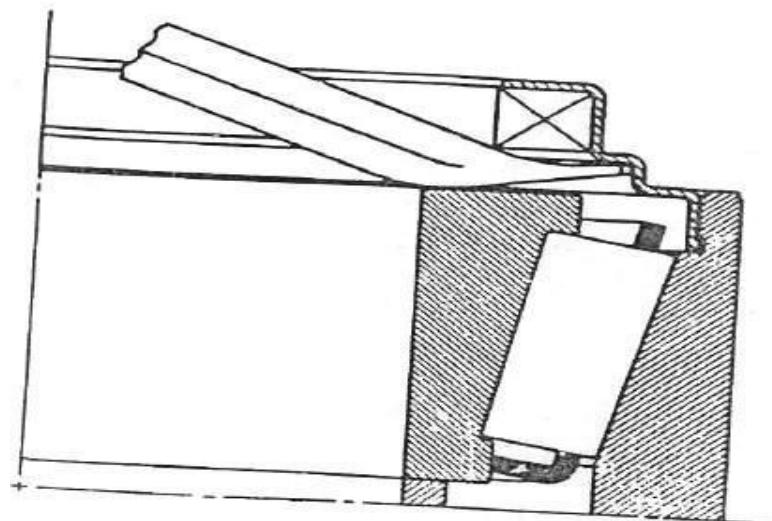


Fig. 22: Seal Removal Using a Pry Bar

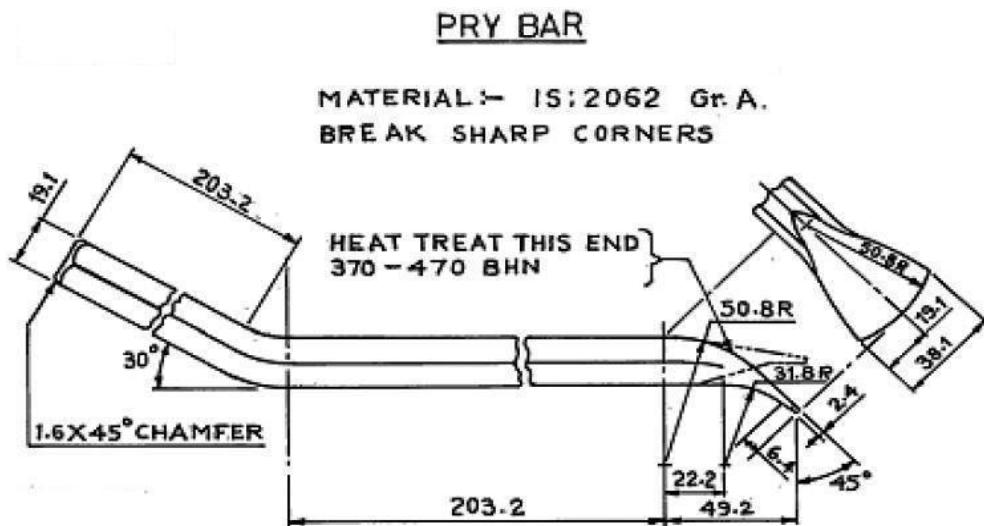


Fig. 23: Pry bar

8.4 Cleaning of Components

After the dismantling of components remove the residual grease as much as possible from the components before washing can be done by automatic cleaner, agitator or spray system or by hand. White spirit or other suitable solvent should be used. **Washing medium should be filtered before reuse, at least once in a day.** Overnight filtering is one of the solutions.

Note: Alternatively automatic bearing cleaning plant has been discussed in Annexure xx.

8.5 Inspection of Bearing Component

Check each component carefully. Measure the dimension of components which have been laid down by the manufacturer. **Ref: Annexure VI** for these dimensions.

8.5.1 End Cap

Inspect for cracks, breakage, wear and distortion of machined surfaces. Surface marked C in **Fig. 24** is critical as this comes in contact with the seal wear ring. Axle end caps that are distorted, cracked or damaged should be scrapped.

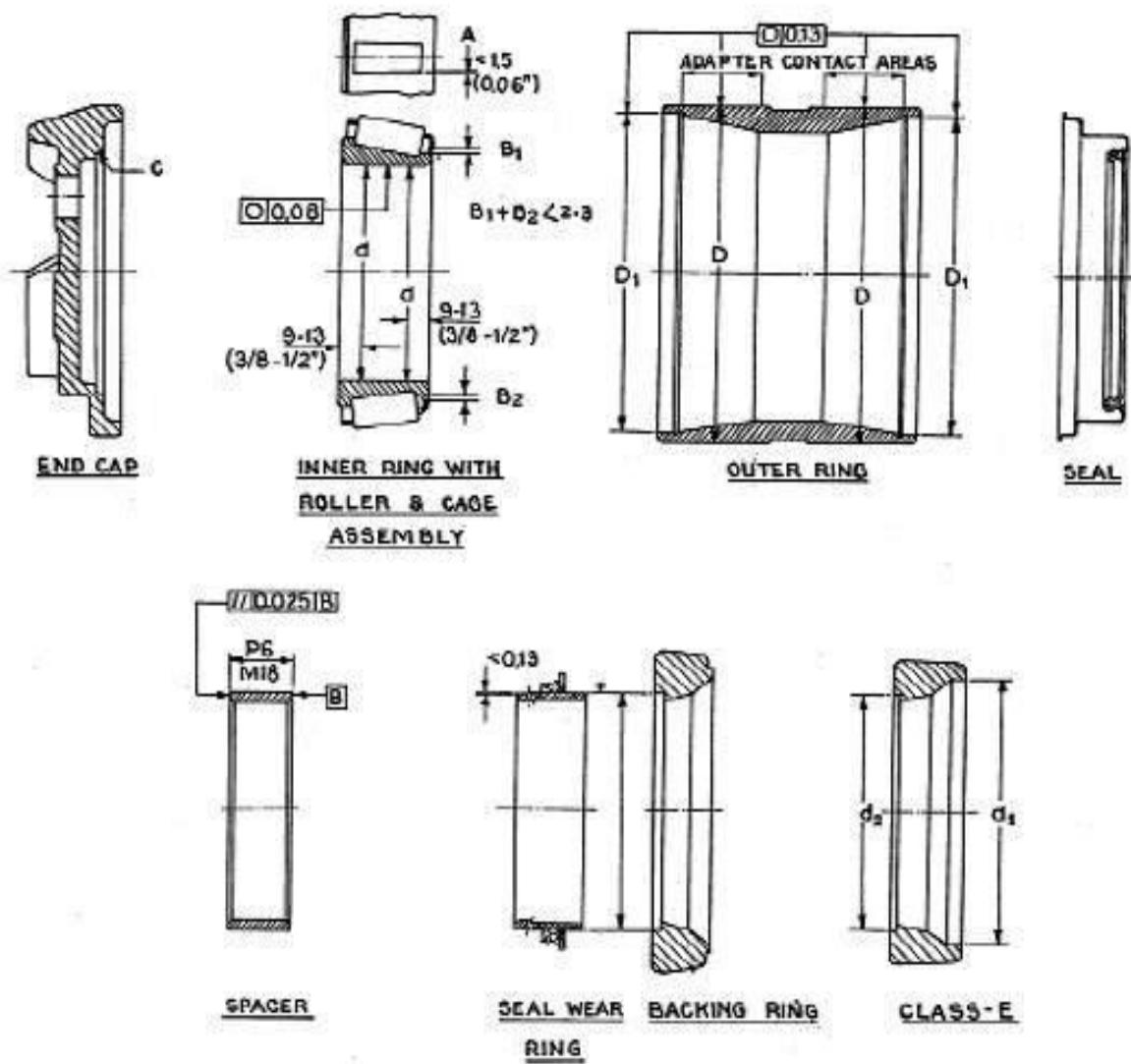


Fig. 24

8.5.2 Cone Inspection (Inner Rings with Roller Cage Assemblies)

Inspect the raceways for staining, corrosion, pitting, heat discolouration, false brinelling, spalling, indentation, electrical burns, cracks and embedded contamination (See **Clause 18**). The inner ring with roller and cage assembly should be placed on an inspection stand. Sufficient light should be made available at the inspection stand. Sufficient light

should be made available at the inspection stand. A feeler gauge probe or surface roughness tester is inserted between the roller and cage at the large and small ends of roller in turn. The inner ring is rotated on the inspection stand. Surface defects can be noted visually or by any roughness felt through the feeler gauge probe as shown in **Fig.25 and 26**.

Place the inner ring with the roller and cage assembly with back face (large diameter face) down on a horizontal support. Measure the bore diameter at both ends **9 to 13 mm from each face**. The average bore dia shall not be **more than 144.488 mm(5.6885")** at three locations (see 'd' in Fig. 24, 27) out of roundness should not exceed 0.076 mm (0.003") as per **Annexure VI**.

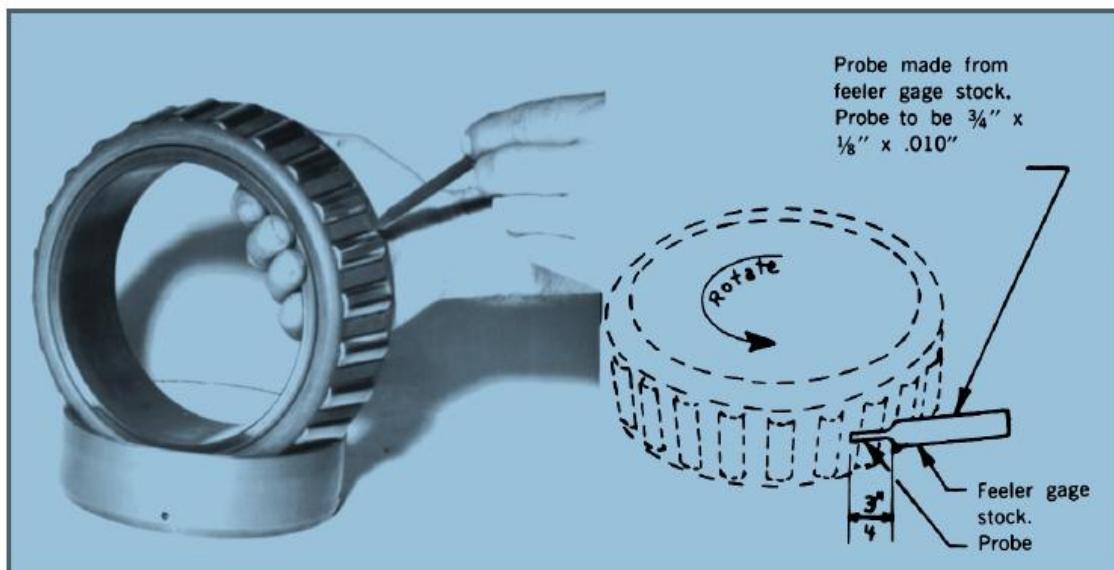
$$\text{Average out of roundness} = (D_{\text{Max}} - D_{\text{Min}})/2 \leq 0.076 \text{ mm (0.003")}$$

Cone face wear depth shall not exceed 0.127 mm (0.005") as shown in Fig. 28.

Measure the gap between the small flange of the inner ring and bore of cage flange in two diametrically opposite location. If the total of the two sets of **feeler gauges is 2.3 mm (0.090") or more**, the roller assembly should not be returned to service. (See dim. **B₁ & B₂ in Fig. 24** i.e. **B₁ + B₂ < 2.3 mm (0.090")**). This is to be measured only for Timken, Benco/NEI& SKF make bearings.

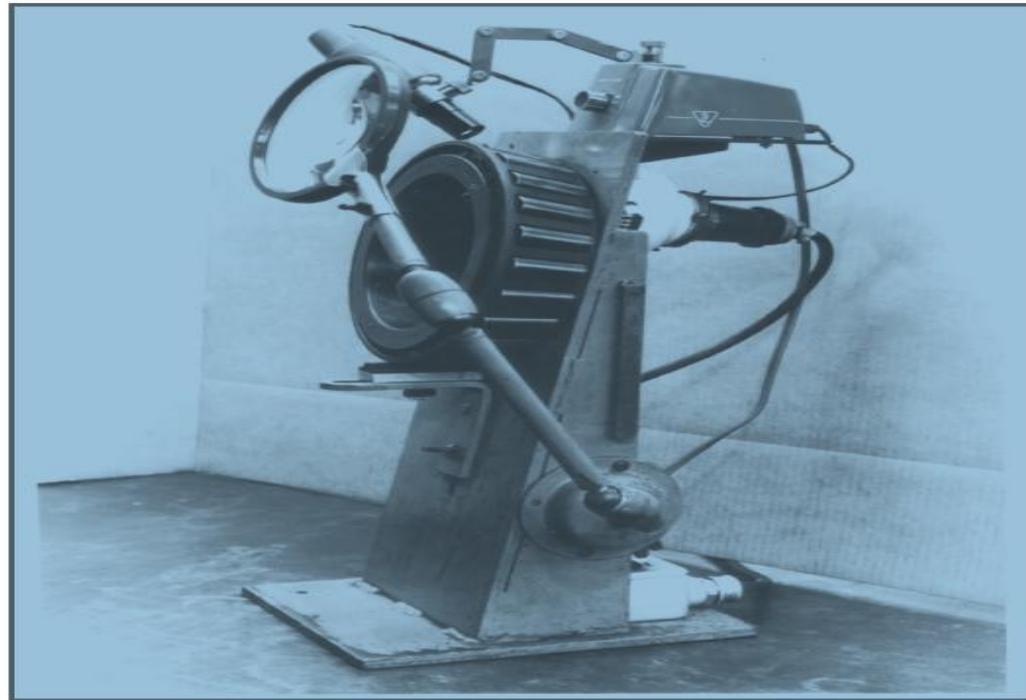
Measure the gap '**A**' in Fig. 24 between the roller and the cage. The assembly should be rejected in case feeler gauge to the condemning dimensions given below can be inserted:-

Make	Condemning Dimension 'A'
TIMKEN, NEI/BRENCO, FAG, SKF	1.5 mm (0.06")



Place feeler of surface roughness tester between the roller and cage adjacent to both the large and small ribs, rotate inner ring. Any surface defects can be noted by roughness felt through the feeler gauge.

Fig.25: Inspection inner ring for defects



By rotating the inner ring and observing the light area between rollers, the inner race can be visually inspected. Additionally while rotating the inner ring, the feeler gauge (as shown in Fig.25) can be used to inspect the raceway adjacent to both the large and small thrust shoulders.

Fig. 26: Inspection stand (typical)



**Fig.27: Checking inner ring bore with dial bore gauge
(Recommended method)**

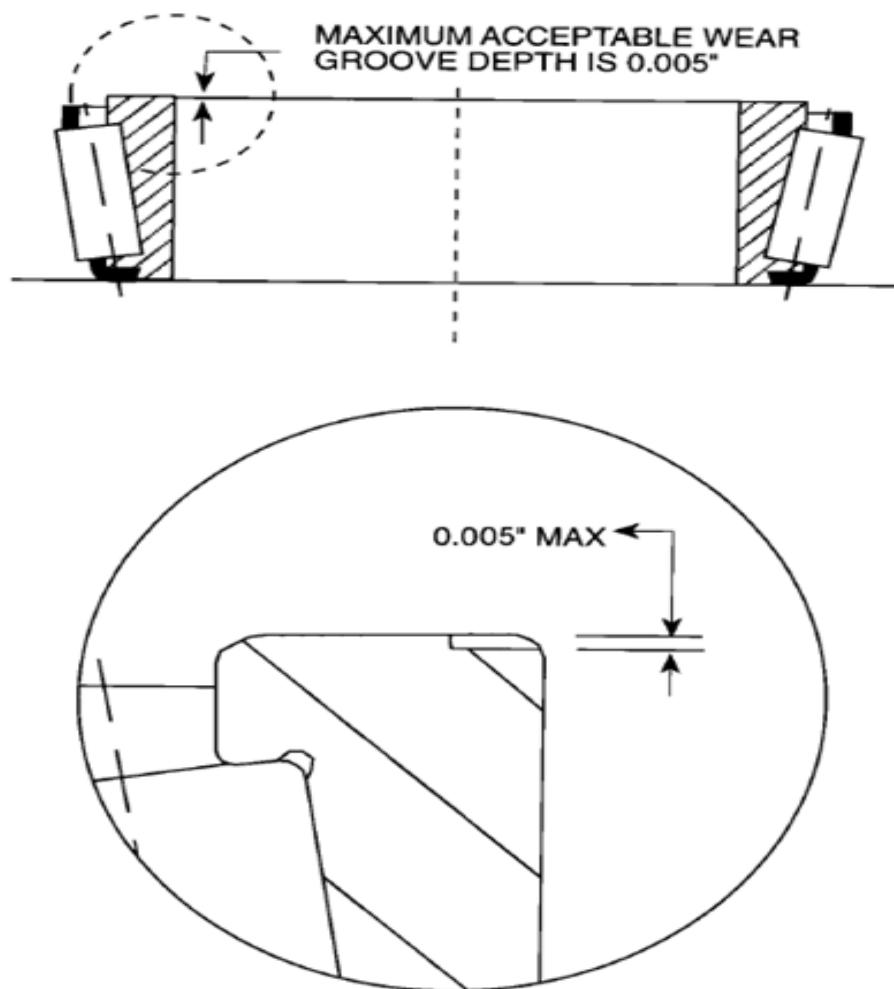


Fig.28: Cone back face wear groove

8.5.3 Rollers

The contact area of each roller must be inspected for any damage or type of defects like brinelling, spalling, smearing, indentation and corrosion etc. (See clause 18).

8.5.4 Outer Ring (Cup) Inspection

8.5.4.1 Counter bore

Check inside diameter of counter bores D_1 in **Fig. 24** for the seal fit which should be **within 209.677 mm (8.255") to 209.423 mm (8.245")** [See Annexure-VI]. Measure the counter bores at both ends (see Fig 29, 30). The out of roundness should not exceed 0.127 mm (0.005").



Fig. 29: Checking seal fit counter bore with dial bore gauge (recommended method)

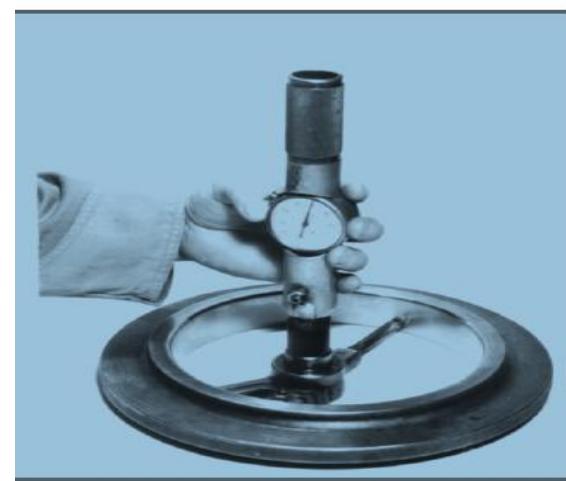


Fig.30: Master setting ring to set dial bore gauge

8.5.4.2 Cup Outer Diameter

Measure the outside diameter using a micrometer at the points where the **adapter has been in contact** (See location 'A; in Fig. 31, 32) with the cup. The diameter should not be less than that specified in the manufacturer's specification (**Annexure VI**). The make wise limits of outside cup diameter are reproduced below:

Make	Condemning Cup Outside diameter mm (in.)
TIMKEN,BRENCO/NEI,SKF, FAG	220.345 (8.675)

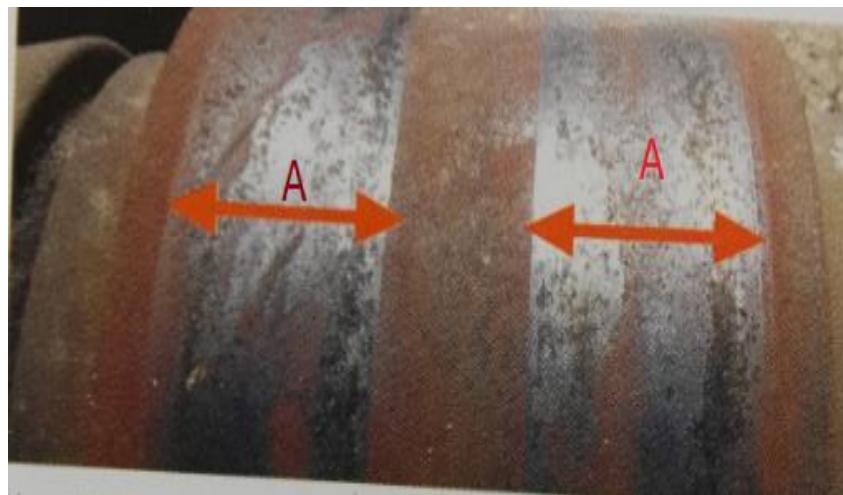


Fig. 31: Normal wear bands



Fig. 32: Normal wear bands

8.5.4.3 Wear Pattern

The maximum out of roundness should not exceed 0.127 mm (0.005") (See **Annexure-VI**).

The wear pattern on the outer side of the cup should be studied because it reveals excessive wear of adapter. Inspect cup for wear band due to an excessively worn adapter at the ends. If wear bands extend upto the ends of the cup it reveals excessive wear on the adapter (See **location B in fig. 33**). The adapter in such case should be rejected.

Inspect rolling surface for any damage or type of defects like brinelling, spalling, smearing or peeling, fragment indentation or electric burns (See Fig. 35& Clause 18). Inspect for intensity of corrosion also.

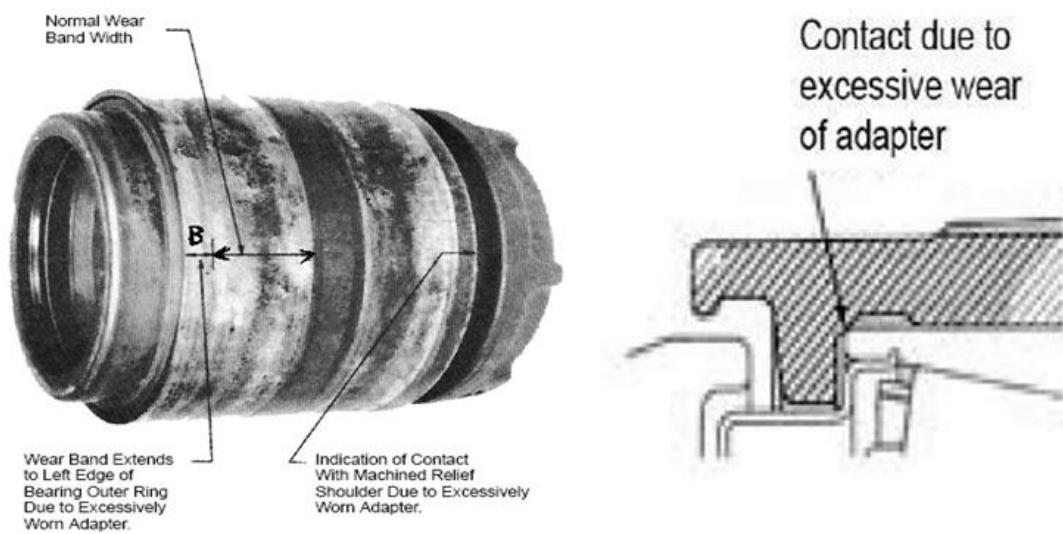


Fig. 33: Abnormal wear of outer ring/Cup due to excessively worn adapter

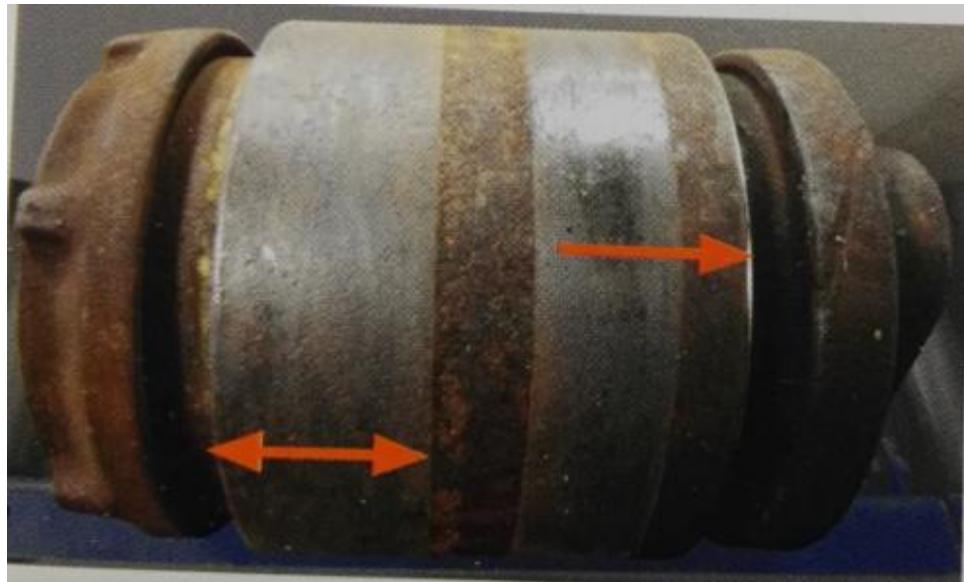


Fig. 34: Abnormal wear of outer ring/Cup due to excessively worn adapter



Fig.35: Rolling track of Cup

8.5.5 Cage

Check cage pocket clearance as given in the last two paragraphs of clause 8.5.2. Cracks of any size on the cage especially at the corners of the roller pockets are cause for scrapping roller assembly.

Cage once taken out cannot be re-used. Cage changing can be done by the bearing manufacturer only and not by the workshops.

8.5.6 Seals

Seals must never be reused. All used seals must be replaced with new seals.

8.5.7 Spacers

Spacers must be visually inspected for cracks, nicks and burrs. Cracked spacer must be scrapped. Nicks and burrs on the end faces should be ground smooth. The end faces of the spacer should be parallel within **0.025 mm (0.001")** (See spacer in Fig. 24 & 36). Width selection must provide for proper lateral clearance.



Fig. 36: Spacer width gauging

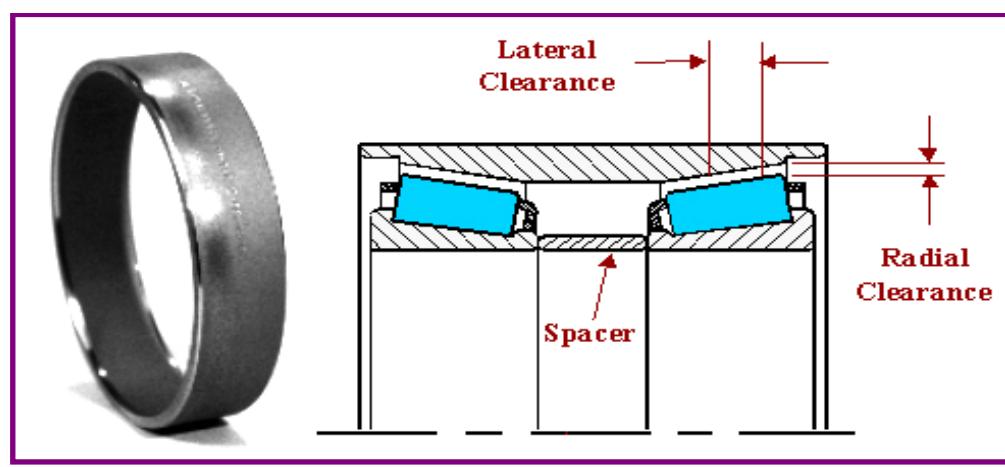


Fig. 37: Radial and Lateral Clearance indication

Note: Widths of Spacer decides bearing Lateral Play

8.5.8 Seal Wear Rings

Seal wear rings must be visually inspected for nicks, cracks, or scratches on the outside surface. The seal lip contact path must be smooth and free from any defects that might damage the seal lip. Check seal wear ring for wear. If seal lip contact path worn to a depth of more than **0.13 mm (0.005")** they should be replaced (See seal wear ring in **Fig. 24 & 38**). **The wear ring and backing ring must fit tightly together.** If worn to the extent that there is no longer a tight fit, they must be scrapped (see 'F' in **Annexure-VI** also). Seal wear rings with vent holes should be discarded if found during maintenance /reconditioning.



Fig.38: Checking Seal wear ring groove depth

8.5.9 Backing Ring

Check backing ring break out diameter **d1** in **Fig. 39**, which shall not exceed **178.511 mm (7.028")** for Timken, Brenco/NEI, FAG & **178.562 mm (7.03")** for SKF. Check backing ring for excessive corrosion. Scrap backing ring with break-out dia. which exceeds the specified limits. Scrap distorted, cracked or heavily pitted rings also. Check seal wear ring counter bore diameter **d2** in **Fig. 39**. The counter bore must provide a tight fit for seal wear ring. See **G, H, I** in **Annexure-VI** also. Backing rings with vent holes should be discarded if found during maintenance/overhauling.

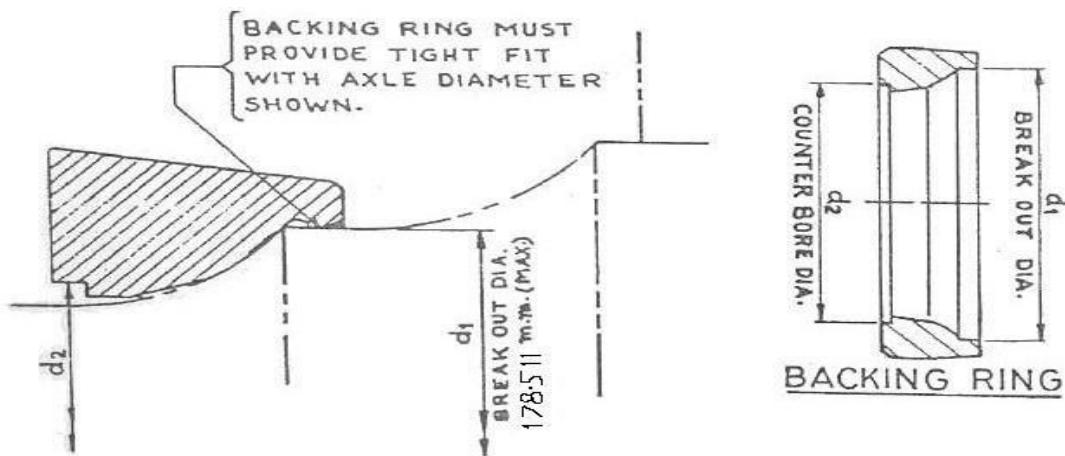


Fig. 39: Backing ring break-out (counter-bore) diameter limits

8.5.10 Cap Screw

Check cap screws wear on threads, and for stretching or elongation. Reject and replace if any defect is found. Cap screws which cannot be tightened to the recommended torque must be scrapped. The new cap screws shall conform the size 1" Dia-8 UNC-2A X 2-1/4" Long having Hexagonal head and material shall be IS: 1367 (Part-3): 2002 Class **P 8.8** (See Fig. 40). **The cap screw threads should be properly cleaned and lubricated before fitment.** Cap screws having rusted threads should be used only after proper cleaning and lubricating. **Mating threads on axle end holes should also be checked, cleaned and lubricated.**

With clean and lubricated threads the major portion of the applied torque is used for tension of the cap screw. Higher the amount of tension developed in the cap screw, higher is the end cap deflection and better is the clamping of the bearing on the axle i.e. **better retention.** A deflected end cap acts like a lock washer. In dry threads or rusted threads a major portion of the torque is used up to overcome the friction. **SO DO NOT FORGET TO CLEAN & LUBRICATE CAP SCREW THREADS AND AXLE END HOLES'**

If bearing attended on ROH/POH Depot for investigation and the End Cap is removed then tighten the cap screws for the recommended torque of 40 Kg-m. Repeat the torque wrench pass until no further screw movement is detected. Ensure to use the properly calibrated torque wrench. **Apply minimum 2 passes & maximum 5 passes** and bend the tab of locking plate against the sides of bolt using adjustable rib joint pliers. **It is advisable to use new locking plate, whenever re-torquing is done.**

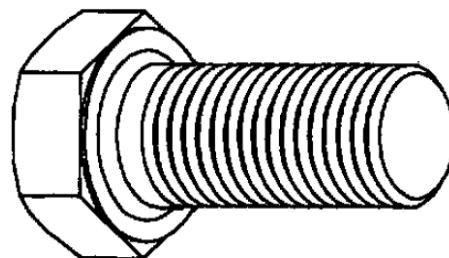


Fig. 40: Hexagonal head Cap screw 1" dia-8UNC-2A x2 1/4" long

8.5.11 Locking Plate

Locking plate should never be reused. Whenever locking plates are removed they should be replaced with new locking plates. Locking plate shall be as per RDSO Drg. No. WD-87019/S-1 (**Annexure-VII**).

8.6 Accident Involved Bearings

Extra precaution should be taken during inspection of accident involved bearings in the shop for brinelling, denting, cracks etc. on rollers and raceways (Refer **Clause 7.4.1 d**).

8.7 Assembly of Bearing

After proper inspection of all the components they can be assembled. Care should be taken that these parts do not get contaminated during assembly. So assembly should be done in a proper place. Make sure that all components, tools and work benches are thoroughly cleaned. Cover the parts with waxed paper, polythene sheet or similar material whenever reassembly work is discontinued or delayed due to some reasons. **Never use cotton waste.**

8.7.1 Bench Lateral

Improved rolling contact fatigue is the 'BENEFIT' of proper 'Bench Lateral'. Check the unmounted play of the bearing assembly to make sure that the **spacer has the correct width**. Use radial indicator mounted to a cam actuated hand operated device (**Fig.41**) for checking the bench lateral. The bench lateral must be within as specified below:

Bench Lateral	
With Hand Operated Device	With Power Operated Device
0.51 - 0.66 mm (0.020 to 0.026 in.)	0.58 - 0.74 mm (0.023 to 0.029 in.)

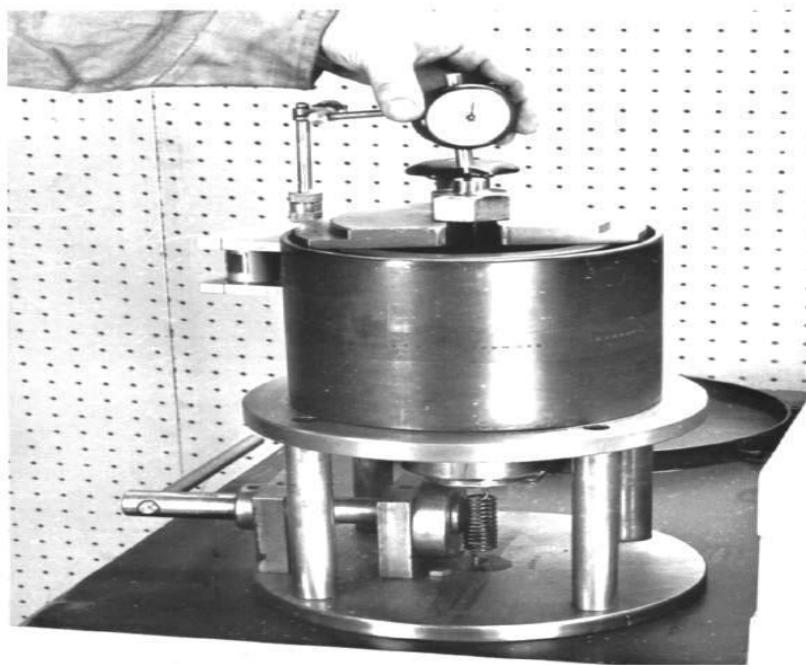


Fig. 41(a): Fixture for checking Bench lateral (recommended method)



Fig. 41 (b)

8.7.2 Lubrication

Grease to be used should be clean and free from all kind of contamination. **The grease container should always remain closed.** The grease recommended for use on CTRB of freight stock shall be AAR approved in accordance with M-942-2004 or latest of AAR MSRP Section H or Grease Approved by RDSO, in accordance with their **specification No. WD-24-MISC-2003** or latest.

Before applying the grease, clean all the equipment to be used for lubrication. Apply grease to each single assembly and between the roller and cage assemblies in the quantity as given below:-

Amount of grease& distribution of grease to be applied for Class 'E' bearing

Each Roller Assembly (Each Cone assembly)	Between Roller Assembly (Around spacer)	Total ± 30 (Quantity per Bearing)
115 gram	170 gram	400 ± 30 gram

Accurate lubrication system/device must be used to apply correct amount by weight of lubricant and **must be verified by measuring two samples per day.** Quantity of grease excess than the specified should not be applied, as excess quantity of grease causes higher operating temperatures and also results in purging at the seal, **thus giving false indication of seal wear or seal damage.** The lips of the seal should also be lubricated with same grease, if not pre-lubricated by supplier. The recommended cone greasing fixture and its details are shown in the **Annexure-VIII, IX & X.**

8.7.3 Mounting of Roller & Cage Assembly & Fitment of Seals.

Use seal mounting jig for assembly of cone and seals. The three parts of Jig are:-

- (i) **Support Ring** - in which the outer ring stands to keep it in an upright position.
- (ii) **Adapter Ring** - transfers pressures directly to the seal base shoulder.
- (iii) **Installing Plate** - may be required depending upon the type of press used.

Recommended dimensions of these parts are given in(**Fig. 42**).

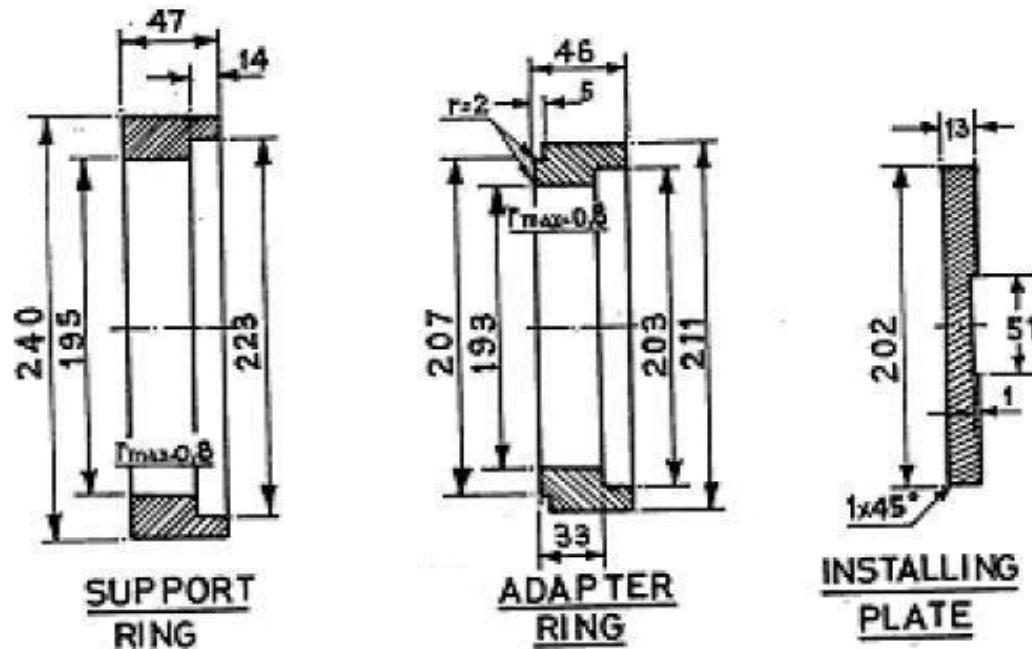


Fig.:42

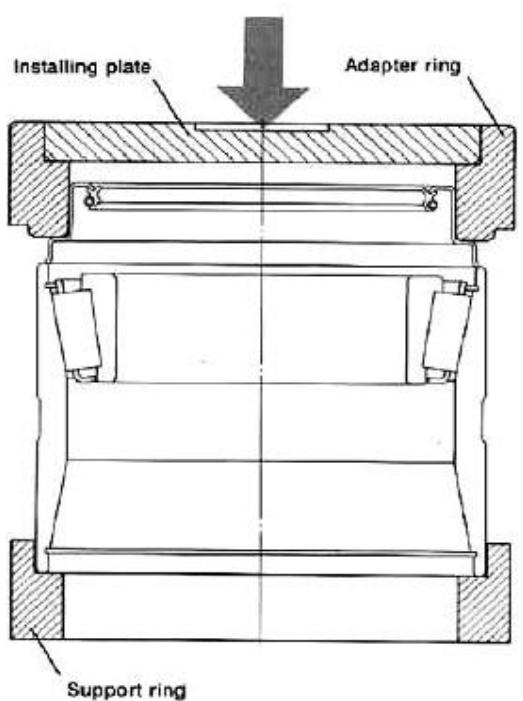


Fig. 43

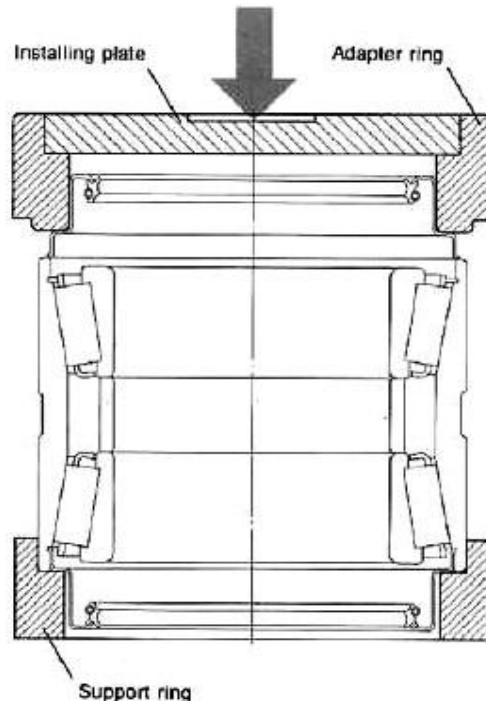


Fig. 44

Keep the support ring on the work bench and place the outer ring (cup) in its recess. Keep the first cone assembly in the outer ring. Then keep seal in position and press into the outer ring with the use of seal adapter ring as shown in **Fig. 43 & 44**). The shoulder of the seal must be flush with or below the bearing outer ring face. Turn the unit upside down and keep it on the support ring again. Insert spacer in position. Fill the space between spacer and outer ring with grease as prescribed in **Para 8.7.2**. The procedure for fitment of other outer ring is repeated as described above.

8.7.4 Fitment of Seal Wear Rings & Backing Ring

Slowly force the seal wear ring in position so that lips of seal expand and do not get turned under. While mounting the seal wear ring, make sure that they are assembled with the tapered end towards the bearings. Put the backing ring and other seal wear ring in their respective places (See para 8.5.8 & 'F' in Annexure- VI).

9. STORAGE & PACKING OF BEARINGS.

Special attention must be given to proper packing and storage of CTRB. All outer surfaces should be coated with rust preventive. After servicing/ overhauling a **triangular card board as shown in Annexure-XI should be inserted in the bore to avoid displacement of the spacer & to prevent lubrication loss**. The complete bearing should then be wrapped in polythene bags of minimum 400 mm width and 600 mm length. The thickness of polythene should be 0.127 mm minimum. The packed bearings should be kept in a container as shown in **Annexure- XII**.

Complete bearing unit and components should be stored in a clean area with good protection from moisture. Periodic inspection of the storage area should be made. As the self-life of grease is limited, the bearing unit should be used in the order in which they were stored, **i.e., first in, first out (FIFO)**. The packages of new bearing should be opened only before mounting. If they are opened for inspection etc. ensure that they are carefully sealed again.

The bearings should leave the servicing room only in properly packed condition even if they are to be used within the same premises/workshop.

10. INSPECTION OF AXLES BEFORE MOUNTING OF TAPERED BEARING ON AXLE& MOUNTING OF TAPERED BEARING ON AXLE

Before mounting, the journal should be inspected in a clean and well-lit area. Check the axles to make sure that they are fit for service. Axle bearing seat diameters, shoulders and radii should be within tolerance and free from defects like sharp corners, burrs, nicks, tool marks, scratches, corrosion, upset end/bulging etc. Axle bearing seat diameters should be concentric with the wheel seat diameters. The cap screw holes in the ends of the axle should be checked with a bolt circle checking gauge (See figure 46).



Fig. 45: Checking backing Ring Seat on Axle



Fig. 46: Axle end thread checking Gauge

Method of measuring journal diameter for new and old axles is as under:-

10.1 For New Axles

Measure the journal diameter at three points A, B & C (See **Fig. 47**). Take three readings, equidistant (i.e. 120^0 apart) around diameter at each point A, B & C. The three circumferential readings taken at 'A' must be averaged and the average must be within the tolerance shown below, or axle must be rejected. The same applies for points B & C. Total nine readings have to be taken.

DO NOT AVERAGE ALL NINE READINGS:-

AXLE ALLOWABLE DIA - 144.564 mm to 144.539 mm

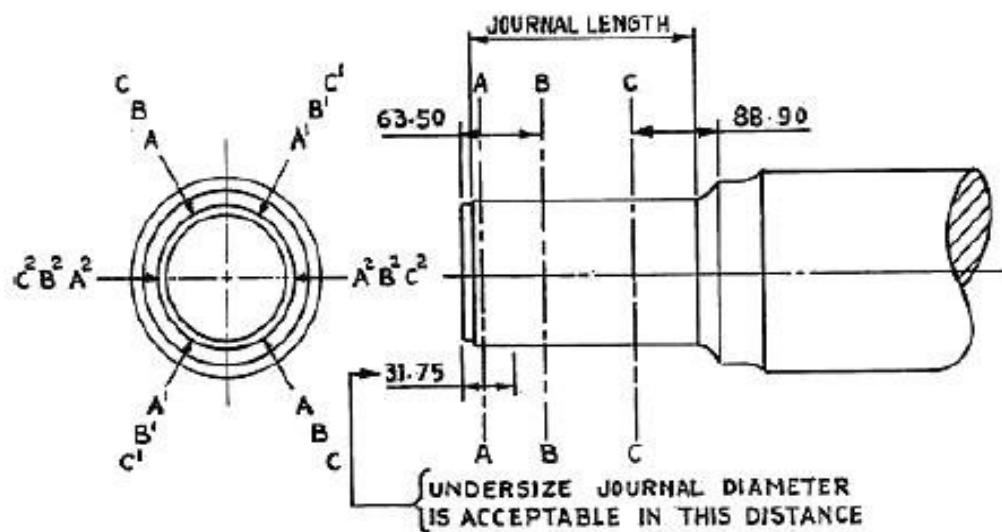


Fig. 47

10.2 For Old Axles

Measure the journal diameter at the two bearing seat locations at three equidistant points (i.e. 120° apart) around the journal shown in cross hatched area (**Fig. 48**). The three measurements at each individual bearing seat may be averaged to obtain the average size, which must be within the tolerance given in Clause 10.1 above. **DO NOT AVERAGE ALL THE SIX READINGS.**

NOTE: - There should be no abrupt changes or steps over the length of the journal for either **NEW** or **OLD** axles.

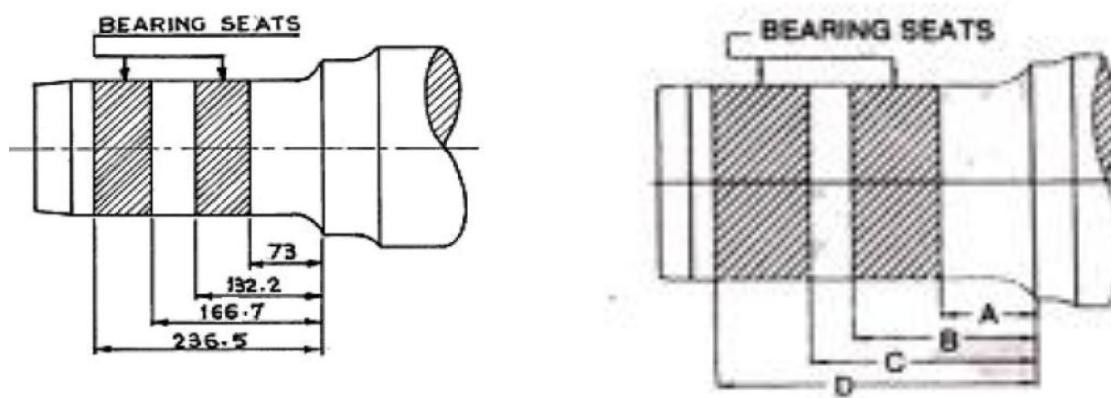


Fig. 48

Journal of axle to RDSO Drg. No.WD-89025-S-02	Dimensions (mm)			
	A	B	C	D
	73	132.2	166.7	236.5



Fig. 49: Measuring journal diameter by snap gauge

10.2.1 Journal Grooving From Inboard Seal Wear Ring

Groove in axle not over 0.05 mm (0.002") deep can be repaired by polishing with abrasive cloth (80 grit or finer). No abrupt changes or sharp edges are permissible (Fig. 50).

GROOVE CAUSED BY
SEAL WEAR RING.

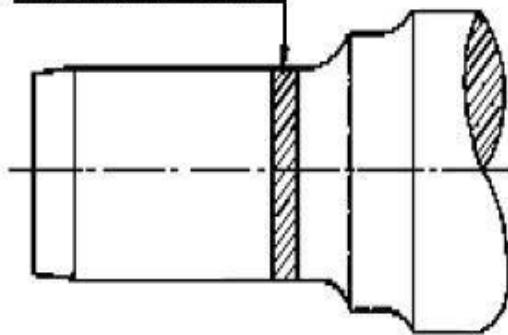


Fig. 50

AREA WHERE UPSET OCCURES

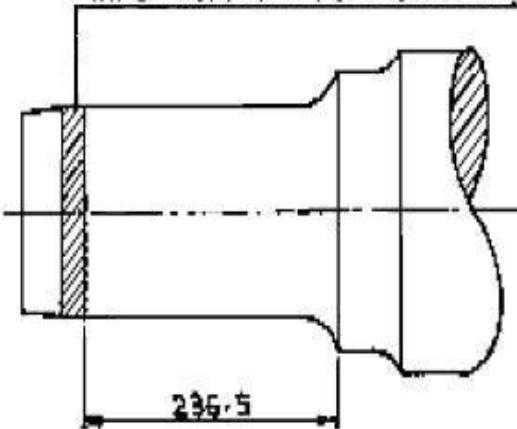


Fig. 51

10.2.2 Measuring for Upset Journal Ends

Measure the journal diameter in the cross hatched area (Fig. 51). Take three readings at 120° apart around the journal. Journal must never exceed **0.075 mm** (0.003") above maximum diameter in this area, but may be below the minimum diameter in this area. Upset ends over **0.075 mm** (0.003") may be corrected by only files, provided surface roughness meets the specification.

- 10.3 Check fillet radius for proper seating of backing ring with template (See Fig. 52, 53). If feeler gauge can be inserted more than **10 mm** (3/8") around the journal periphery, the fillet must be corrected.

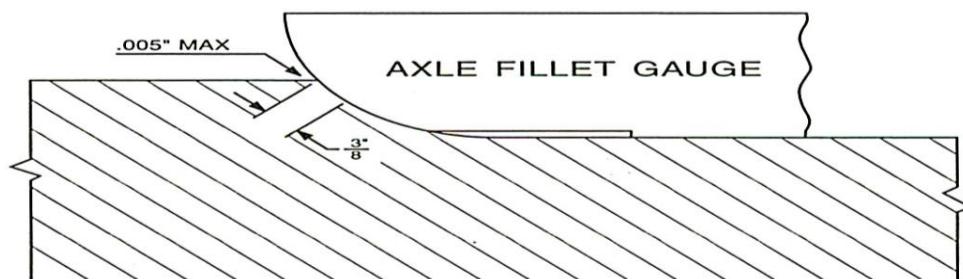
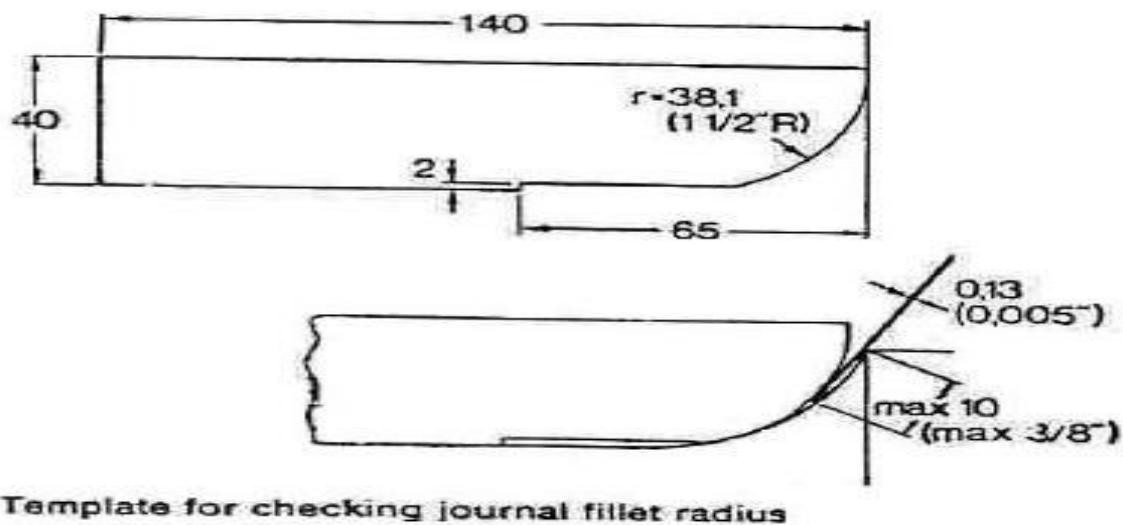


Fig. 52



Fig.53: Checking of fillet with fillet gauge

10.4 Mounting of Tapered bearing on Axle

10.4.1 The bearing unit should be **cold remounted**, i.e. pressed on to the journal without heating. A hydraulic type of mounting equipment is shown in **Fig. 54**.



Fig. 54: Hydraulic Press (Bearing Puller/Installer)

To facilitate mounting, a pilot sleeve shown in **Fig. 18** should be used for pressing bearing unit on to the journal. The mounting sleeve can either be separate or attached to the press ram. However, it must be designed to ensure that the ram pressure is applied to the centre of the mounting sleeve and squarely to the face of the seal wear ring. The recommended dimensions of pilot sleeve and the mounting sleeve are given in **Fig. 18** and **Fig. 57** respectively. **Coat the journal fillet and portion of axle between wheel hub and the fillet with lead free rust preventive (Spec. No. IS: 9862).** Then coat the bearing seating on the journal with **heavy mineral oil (SAE 30/SAE 40) or Castor oil** (See Fig. 55, 56).

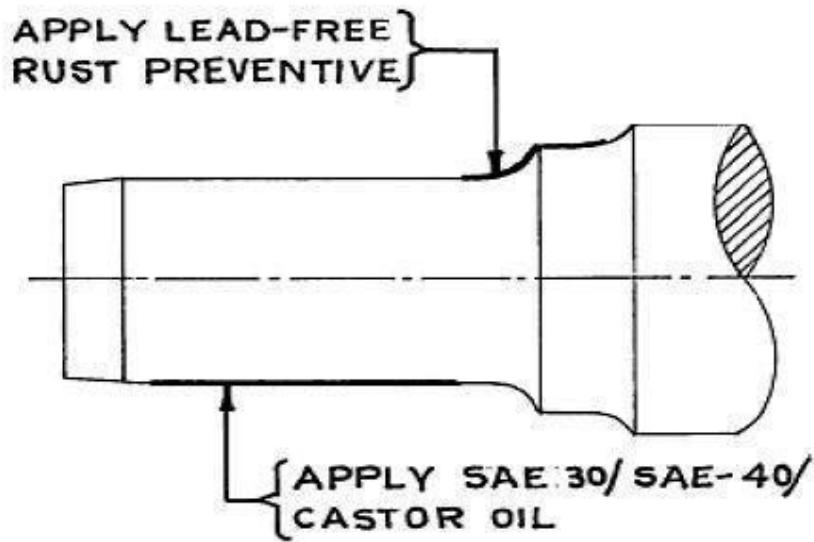


Fig. 55



Fig. 56: Journal fillet and Dust guard Coated with lead free rust preventive & Bearing seat heavy mineral oil or Castor oil

Bolt the pilot sleeve to the axle end. Place the bearing unit on the pilot sleeve and slide it up against the journal as far as it will go without using force. Now put mounting sleeve (**See Fig. 57**) on the free end of pilot sleeve and roll the wheels and axle assembly into position in the press. Check that journal and pilot end are square in all planes with the face of the ram (**See Fig. 58**). Apply pressure from the wheel press ram. The pressure will reach **between 10 to 16 tons just before** the backing ring alongwith the bearing butts against the dust guard fillet. To ensure that the backing ring alongwith the bearing is **firmly seated** against the fillet allow **the pressure to built up to the final gauge readings of 50 ± 5 tons held for 5 seconds** to fully seat the bearing.

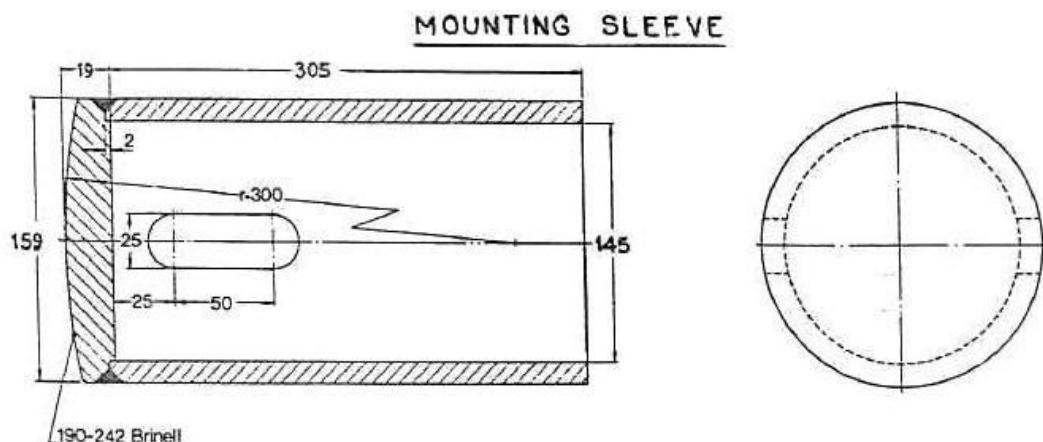


Fig. 57

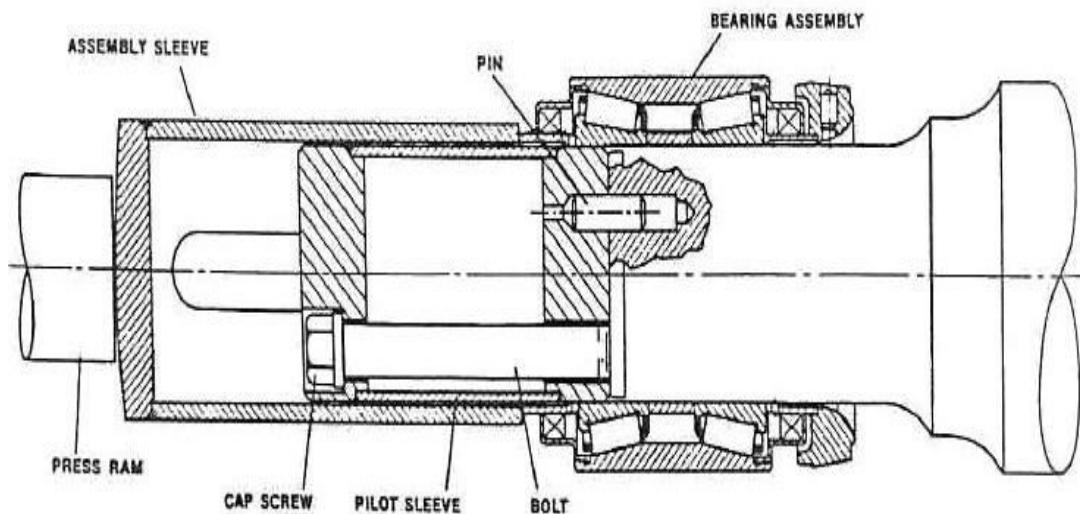


Fig.58

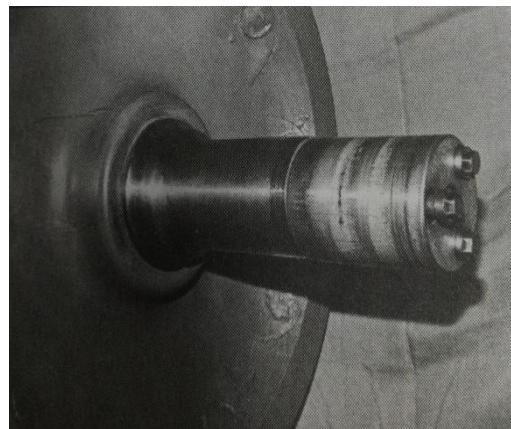


Fig. 59

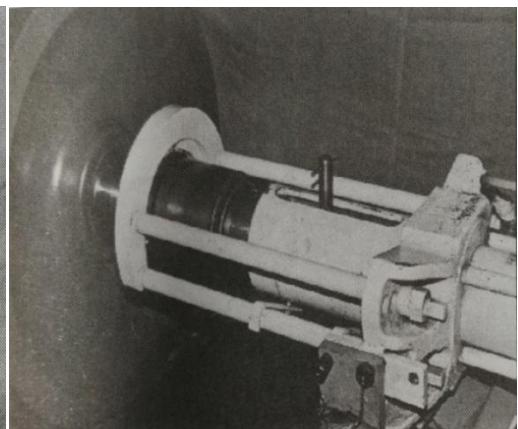


Fig. 60



Fig. 61



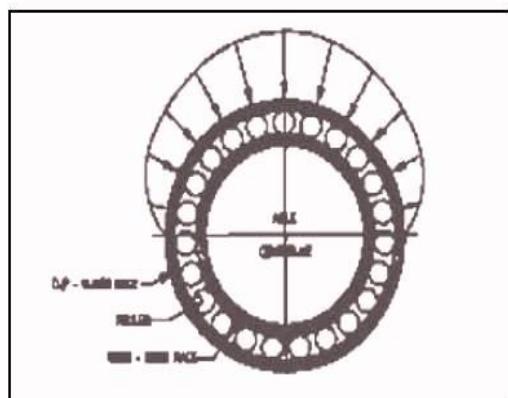
Fig. 62

When the final pressure has been reached, remove mounting tools and wipe the end of the axle using a clean lint free cloth (**No cotton waste is to be used**). Assemble the end cap, cap screws, and locking plate to the end of the axle (Fig. 61, 62). The cap screws should be of High Tensile Steel to IS Specification 1367(Part-3): 2002 Class **P 8.8**. The threads shall be to 1"dia 8 UNC- 2A x 2-1/4"Long'.

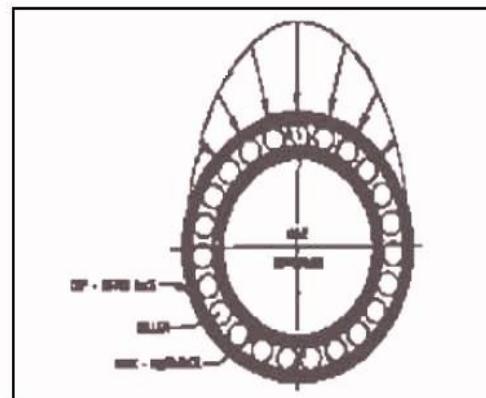
Torque wrench should be used to tighten the axle cap screws. **The torque wrenches should be calibrated at least once in a month**. The recommended torque value is 40 kg-m (290 foot- pound). The locking plates to be used shall be as per RDSO Drg. No. **WD-87019/S-1** (Annexure -VII). The torque wrenches to be set to one fix value i.e. 40 Kg-m. Torque wrenches must be accurate within $\pm 4\%$. **Locking plate once opened must be replaced with new one**.

10.5 Mounted Lateral

Mounted lateral is **CRITICAL** to bearing performance. With correct mounted lateral more rollers share the load as result peak loads on individual rollers are less (**Fig. 63**). Excessive mounted lateral causes high peak roller loads (**Fig. 64**) as a result of fewer rollers sharing the load. This reduces **FATIGUE LIFE**.



Roller Load Distribution For Zero Mounted Lateral



Roller Load Distribution For 0.030" Mounted Lateral

Fig. 63

Fig. 64

10.6 Check the mounted lateral play with a magnetic base dial indicator (See **Fig. 65**). Start by pushing the bearing laterally towards the wheel hub and zero the indicator. Then pull the bearing laterally away from the wheel hub to obtain the lateral reading. The lateral play should be between **0.03 mm to 0.38 mm** (0.001" to 0.015"). If lateral play is somewhat less than 0.03mm but greater than 0.00 and the bearing can be rotated freely by hand, the application is still satisfactory for service (See Fig. 66). If the clearances are not in the limits, dismount the bearing for further inspection.



Fig. 65: Checking mounted lateral



Fig. 66: Oscillating movement to the Cup during the pushing as well as during the pulling phase

Lock the cap screws by bending all the tabs of the locking plate flat against the side of the cap screw head. Do not bend the tabs against the corner and do not break them (See Fig. 67).

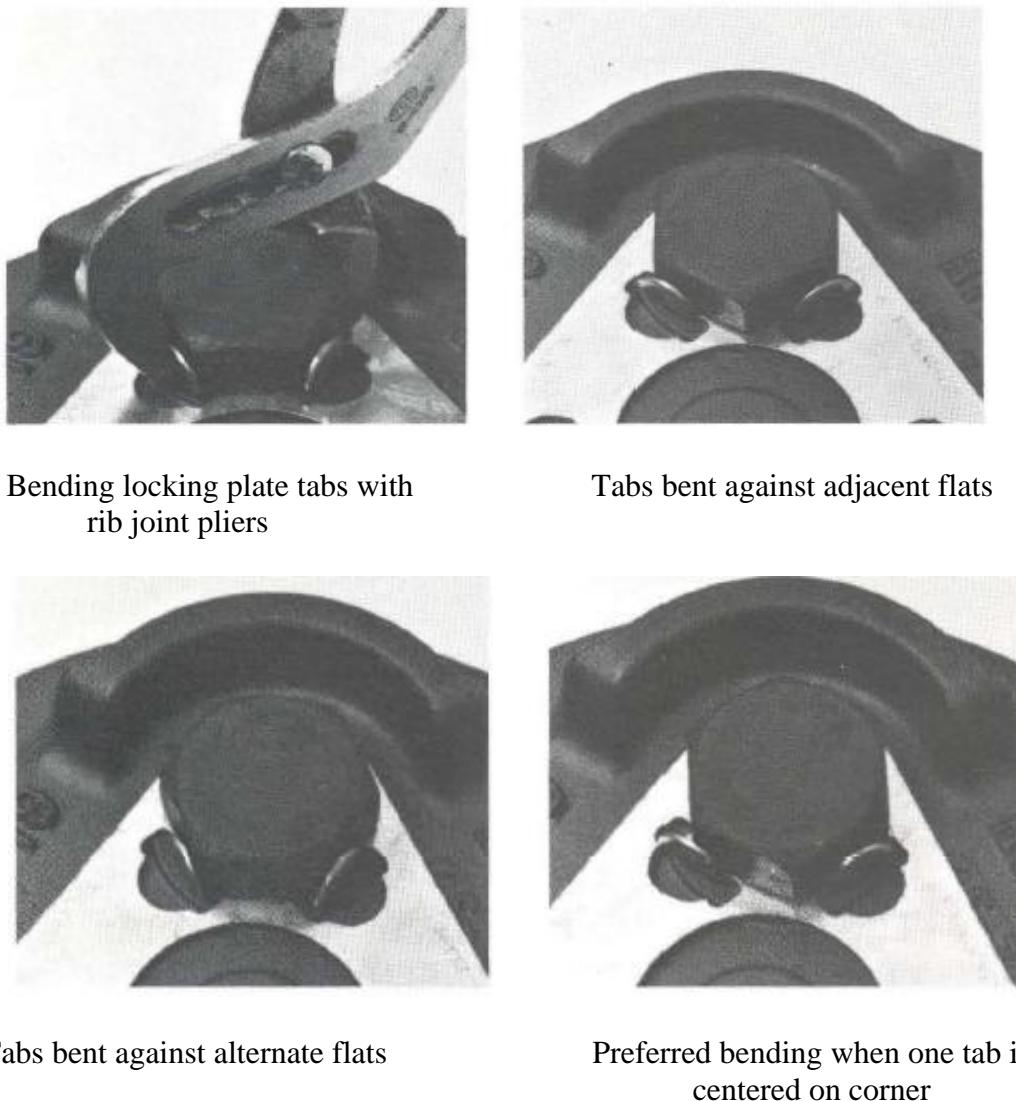


Fig.67

11. FITMENT OF AXLE UNDER THE BOGIE

The axle after the mounting of bearings is ready for fitment under the bogie. Place the adapter in between the side frame of wide jaw bogies hold it firmly and tighten the adapter retaining nut and bolt. In narrow jaw bogies adapter retaining nut and bolt is not used. Lower the side frame over wheel set. While lowering attention should be given to avoid adapter retaining bolt head hitting the cup of bearings due to less clearance (See **Dim. A in Fig. 68**). Hitting of retaining bolt head may cause breakage/denting of cup.

Whenever adapter seating marks are found to be confined on a limited circumferential length on the outer cup, the bearing should be rotated so as to bring that portion of the cup under the adapter which does not have adapter seating marks. **This is to shift the loading zone and in turn increase the life of the bearing.**

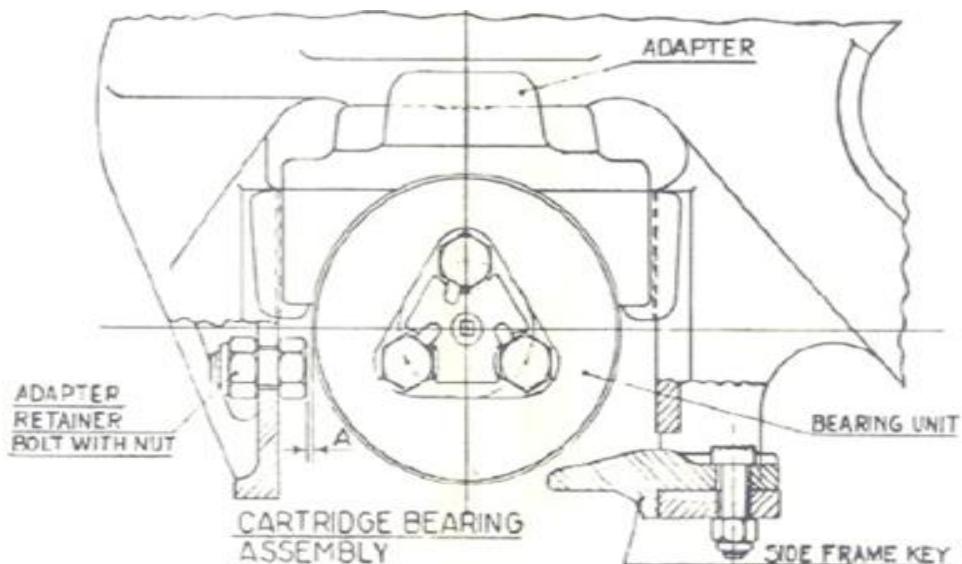


Fig. 68



Fig. 69

12. MAINTENANCE SPECIFICATIONS

The suppliers of Cartridge Bearings have recommended condemning dimensions of components. These are reproduced in **Annexure-VI**.

13. INTER-CHANGEABILITY OF BEARING COMPONENTS

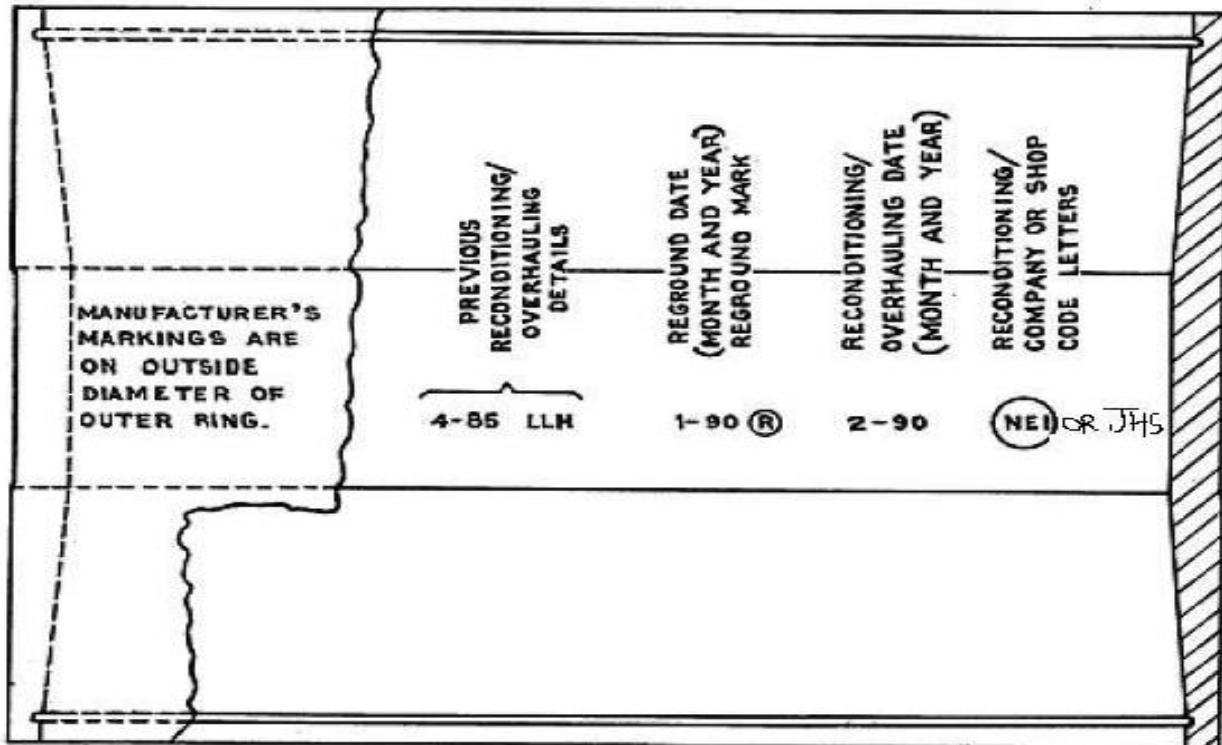
The components like axle **cap screws, locking plates and Grease seals are common for all make of bearings**. All other components viz. cup, cone, spacer, seal wear ring, end cap and backing ring etc. of any two make, are not interchangeable. Precaution should be taken that **components of one unit do not get mixed up with components of other unit of same make or of other make** during servicing. However cannibalization of parts of two defective bearings of the **SAME MAKE** is permitted. However, to the extent possible, it may be ensured that cup and cones used in same CTRB are of similar age profile (See Annexure- XIII).

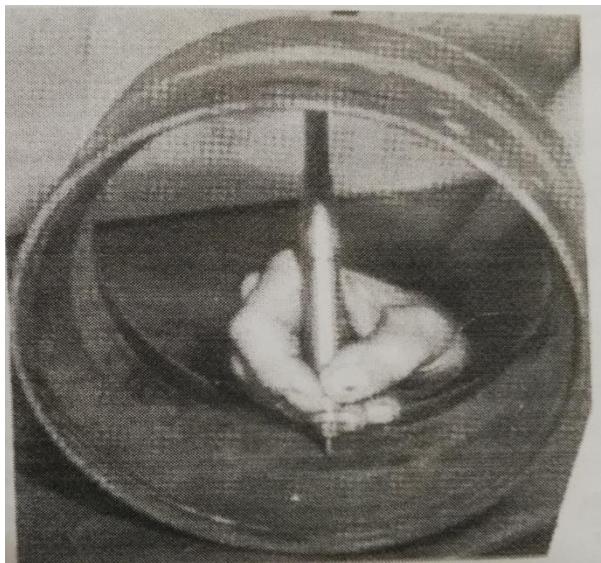
14. BEARING MARKING

a) Marking of Overhauled Bearings.

Bearings that have been serviced during POH or otherwise because of rediscing, hot box, accident etc. have to be **permanently and legibly marked on the Cup/outer ring inner diameter on the straight portion** in the centre between the raceways as **shown in Fig. 70 and also on backing ring as per details shown in Annexure- XIV**. The marking will include the date i.e. month and year and servicing workshop code/company's initial.

Example: - If the bearing has been serviced in Liluah workshop in April, 1985 the marking will be **4-85- LLH**.

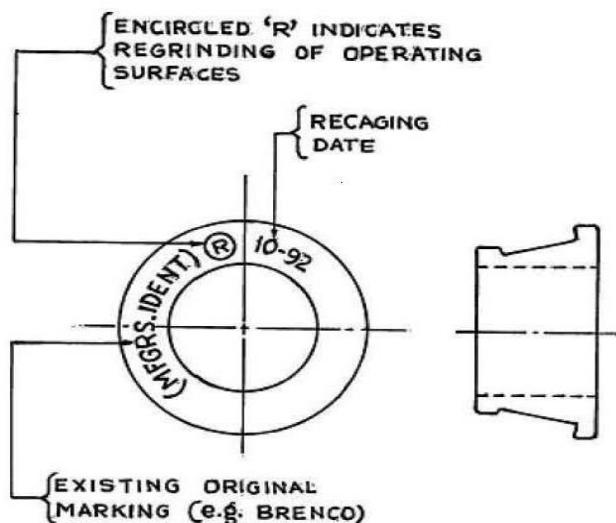




OUTER RING MARKING

NOTE: Reconditioning and remanufacturing markings (encircled 'R' for regrinding) must be on the inner diameter of the outer ring on the straight portion in the center between the raceways. Caution must be used to avoid nicking or damaging the raceway surfaces. Mark with a suitable scribing tool. Electric etching or steel stamping is not permitted

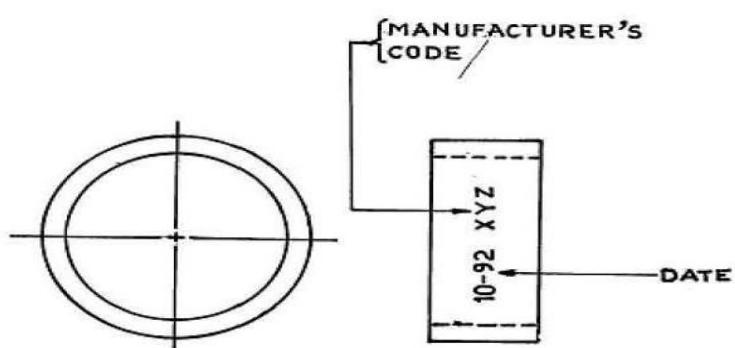
Fig. 70



INNER RING

(MARKING REQUIRED WHEN REMANUFACTURED)

FIG. 71



SPACER

(MARKING REQUIRED WHEN REMACHINED BY MANUFACTURER)

FIG. 72

b) Laser Engraving

- i. In addition to above said marking, the laser etching marking of overhauling particulars on Grease seal at location shown in Fig.73 (a) & 73 (b) at shall be done by bearing overhauling workshops on each overhauled bearing to ensure traceability.



Fig.73 (a) : Laser engraving machine and fixture for Grease Seal



Fig.73 (b) : Laser engraved marked on seal Case

(Note: The marking on Seal case will include the date i.e. month and year and servicing workshop code.)

- ii. Marking of overhauling particulars on backing ring of CTRB shall be done by bearing overhauling workshops as per Annexure – XIV

- iii. Color marking (coding)/marking as directed by Railway Board vide its letter no. 2015/M(N)/915/32 dated 04-10-2017 (See Annexure-XIV 'A') shall be strictly followed.
- iv. In case, bearing mounting conducted by ROH depot in compliance of Railway Board letter No. 2015/M (N)/951/32 dated 30/05/2016 in such case marking of such mounted bearings shall be conducted by pneumatic cutter/ engraving machine on the **Cup** as per procedure/location mentioned in RDSO,s drawing No. WD-16048 (See Annexure-XIV 'B').

c) Marking of Remanufactured or Repaired Components.

i. Outer Ring/Cup

Outer ring with reground race must be marked as indicated in Para (a) with **the additional remanufacturing symbol** encircled **R** i.e. **®**. **For example:-** if the outer ring races of a bearing have been remanufactured by M/s NEI/JP in **Jan., 1990** and servicing has been done by M/s NEI/JP in **Feb., 90** then the marking shall be **1-90 ® 2-90 (NBC)**. If the bearing has been serviced by any manufacturing company like M/s NEI/JP the manufacturers code has to be encircled, so as to clearly differentiate that the servicing has been done by some company (See Fig. 70).

ii. Inner Ring

Inner ring which have been remanufactured (cage removed for inspection and/or operating surfaces reground) must be marked on the end face following manufacturers identification in the manner illustrated in **Fig. 71**.

Note: Encircled ® should be marked only when operating surfaces have been reground

Example: - If cage has been removed for inspection and re-caging done by Timken India in Oct., 1992 without any regrinding of the races, the marking will be **10-92**. If regrinding is also done, then marking will be **(R) 10-92**.

iii. Spacer

Space which have end faces re-machined must have the date (month and year) and the re-machining Workshop/Company's initials marked on the outside diameter as shown in **Fig. 72**.

- (d)** New bearings, with no service mileage, which are removed from axles for inspection for suspected damage must be marked as per Para (a) with additional marking of symbol 'N' following the repairing Workshop/Company's code marking. All new bearing inspected and marked as per this rule will be considered new bearing.

Example: - If a new bearing with no service mileage has been opened for suspected damage and found **O.K. by RAINAPADU** workshop in Jan. 1988 the marking will be **1-88- RYPS-N.**

Note: - Outer ring raceways and Inner ring operating surfaces can be reground only once.

15. BEARING MAINTENANCE WORKSHOPS

For efficient maintenance, the work place should be well lit and sufficiently spacious. The whole room, tools, benches and work places should be kept clean as even minute particle entering the bearing during mounting would render the most efficient sealing arrangement ineffective and cause premature failure. Maintenance should, therefore, be carried out in a dust-free and dry environment. A general layout of the maintenance shop is appended as **Annexure XV& XVI.**

16. HANDLING OF MOUNTED WHEEL SETS.

Handling of wheel sets after mounting cartridge bearings is to be done carefully. Special attention is required during handling, transportation from workshop to Division or Division to workshop. The **cup and seals can be damaged** due to:-

- (a) **Hitting of flange (See Fig. 74)**
- (b) **Slinging more than one wheel set while lifting**
- (c) **Loading in wagon without proper wedging.**
- (d) **Slinging the wheel set over the bearings.**

To ensure that no damage occur to the bearing, the following steps should be taken:-

- (i) Wheel sets should be handled with a lifting tackle as per Sk. No. WD-II-A-8513/S-1 (**Annexure XVII**).
- (ii) The instructions given in SK. No. WD-II-A-8513/S2 should be followed (**Annexure XVIII**).

Wheel sets with mounted bearings may be kept on single storage track overlapped as shown in Fig. 75 to save space. With this arrangement the flanges of the wheels will not contact either the roller bearing assemblies or axle bodies of adjacent wheel sets.

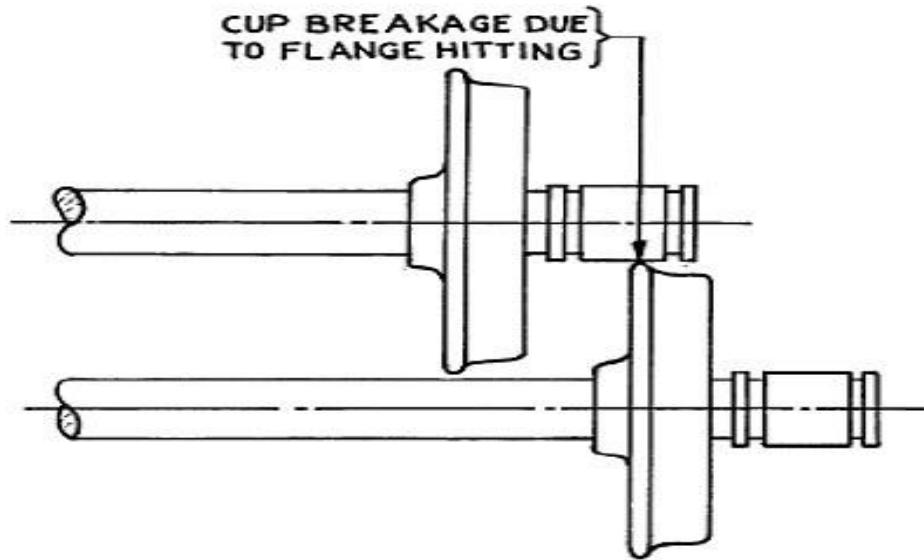


Fig. 74

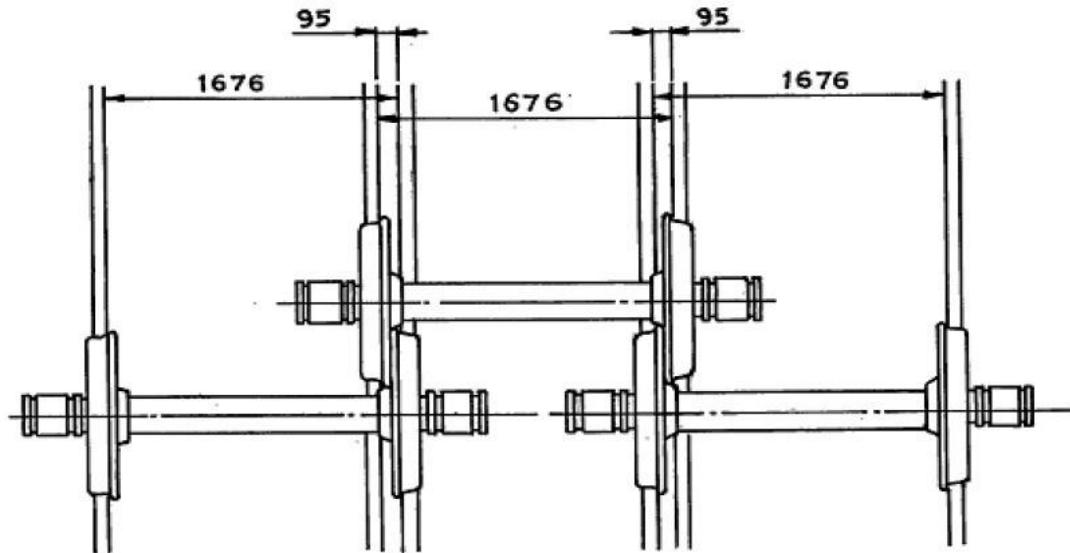


Fig. 75

Note: -Handle the bearing carefully so that Cup/Cone/ bearings components should not be damage/ break.

17. WELDING OF WAGONS/BOGIES FITTED WITH CTRB

Whenever wagons or bogies fitted with roller bearings require welding in Workshops/ROH Depots/Sicklines **special attentions should be paid so that electric current may not pass through the bearings**. The earthing should be done very close to welding area and the earthing wire should be tightly secured at both ends. One of the proposed scheme of earthing is given in **Fig. 76**. However, do not forget to earth the two bogie bolster ends of two bogies of the wagon prior to welding. **If wagon is not properly earthed the current passing through the bearings will cause arcing in**

between the rollers and the raceways leading to failure (also see **para 18.7**). Alternatively the earthing can be done with an earthing wire/strip running parallel to the track instead of earthing with the rails.

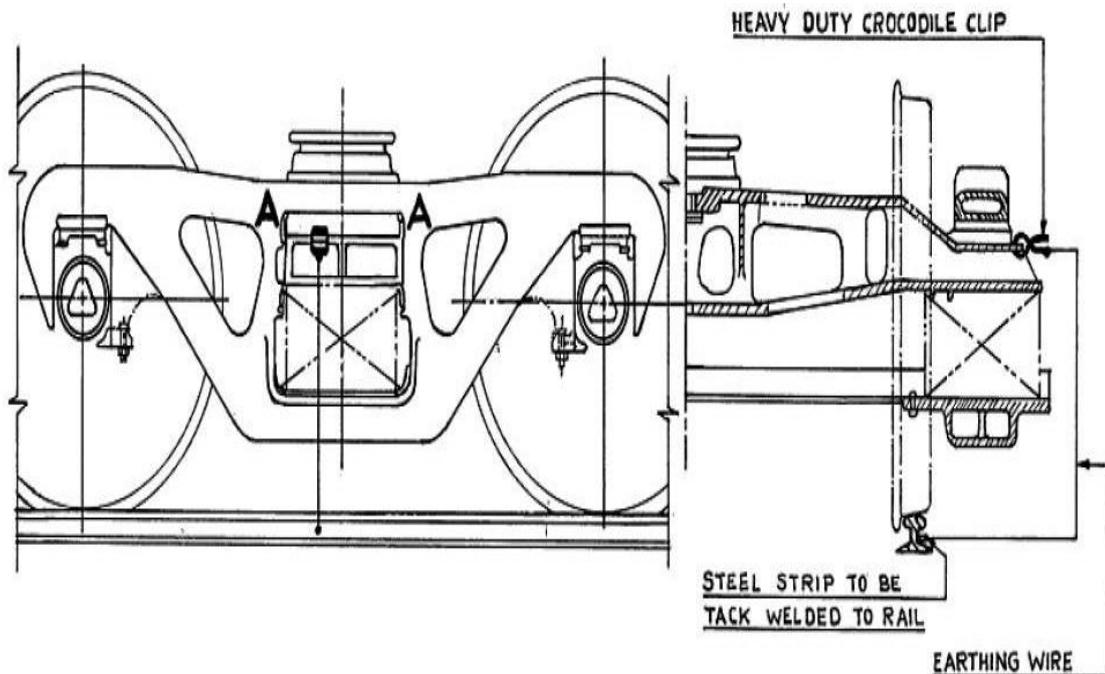


Fig.76

NOTE: -EARTH THE TWO ENDS OF THE TWO BOGIE BOLSTERS UNDER A WAGON WITH THE RAIL PRIOR TO WELDING.

18. BEARING DAMAGES - DESCRIPTION

Following are some of the most common damages found in Cartridge tapered roller bearing at the time of overhauling/reconditioning and inspection in bearing shop. If a bearing has failed it is recommended that the reason for bearing failure should be investigated so that corrective actions may be taken.

18.1 Flaking / Spalling:

Minute surface cracks are the first visible indication that flaking on the rolling surface has started. Fatigue spalling or flaking originates as minute fatigue cracks and eventually pieces of metal drop out. This occurs in the roller path of inner rings (cones) and outer rings (cups) and in the roller surfaces.

It spreads up due to increase in stresses at edges of the spall. Metal fragments those separated from the spalled area are carried in lubricant and causing increase in size of the flaked area. There are so many reasons for flaking e.g. metal fatigue, abnormal loading conditions, displaced adapters, grease contamination, lack of lubricant, impact load on the bearing etc.



Fig.77: Fatigue spall



Fig. 78: Spalling from misalignment, deflection or heavy loading

Flaked / Spalled Cone Assembly:

If the raceway of cone or a roller surface is spalled, the complete cone assembly should be scrapped. However small pinhead size spalls on the cone raceway 2.4 mm x 2.4 mm (3/32" x 3/32") are acceptable as exception for further service.

Flaked / Spalled Cup:

As specified in AAR Roller Bearing Manual, incipient spalls on cup or cone can be repaired using pencil grinder and fine abrasive wheel to grind away loose material and to remove sharp edges of the spall. It is recommended to use spall limit gauge to determine maximum repairable spall size.

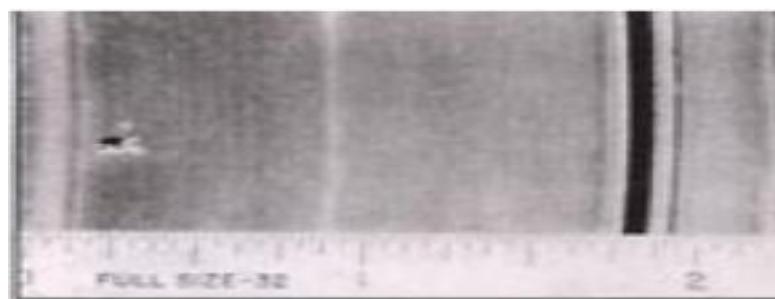


Fig.79: Incipient spall acceptable after repair

Not more than two spalls of maximum size 10 mm x 10 mm (3/8" x 3/8") should be repaired in a 50 mm (2") circumferential section of the raceway and not more than four spalls 1.5 mm x 1.5 mm (1/16" x 1/16") or less in an equally large section. A bridge of 5 mm (3/16") must be left between two spalls after grinding, except where the spalls can be run together within the maximum dimension if one spall 10 mm x 10 mm (3/8" x 3/8"). The maximum acceptable depth for spall is 3 mm (1/8"). If the spall size is more than 10 mm x 10 mm (3/8" x 3/8") the cup must be rejected.



Fig.80: Incipient spall acceptable after repair

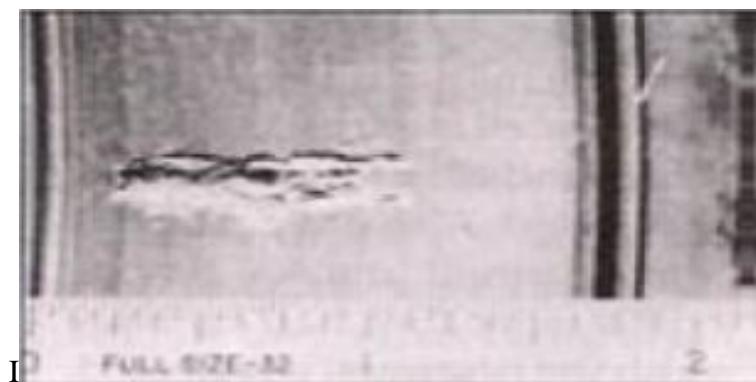


Fig.81: Large Spall (rejectable)

18.2 Brinelling

Brinelling are the surface indentation marks in raceways made by roller under impact load. In other words, when rollers are forced into surface of either raceway while the bearing was subjected to heavy impact loading beyond its capacity. If the length of a faint brinell mark is less than half the width of raceway and if its width at the widest point does not exceed 4mm (5/32") the part is acceptable for service. If the length of the faint brinell mark is more than half the width of raceway and it's width at widest point does not exceed 2.4 mm (3/32") the part is satisfactory for further service. Any number of brinell marks is permissible. If the brinell marks exceed either of these limitations, the cup must be rejected. Also if the part has heavy brinell marks having length more than half raceway Width the ring must be rejected. It is recommended to use "Brinell width and Spall Limit Gauge" to check width of the brinell mark.

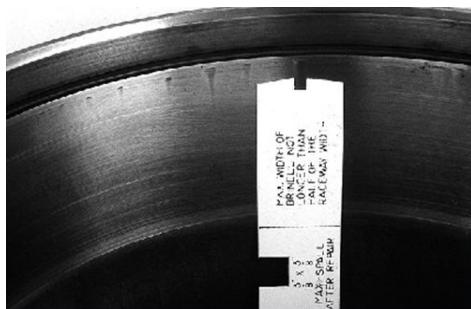


Fig.82: Showing Brinelling mark

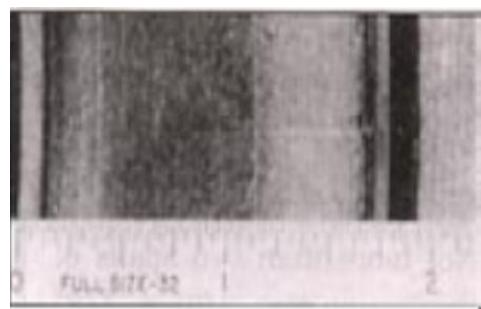


Fig. 83: Acceptable Brinelling

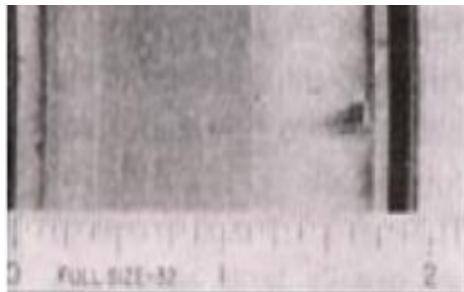


Fig.84:Acceptable Brinelling

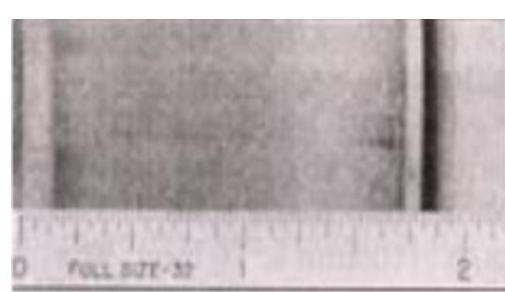


Fig. 85: Acceptable Brinelling

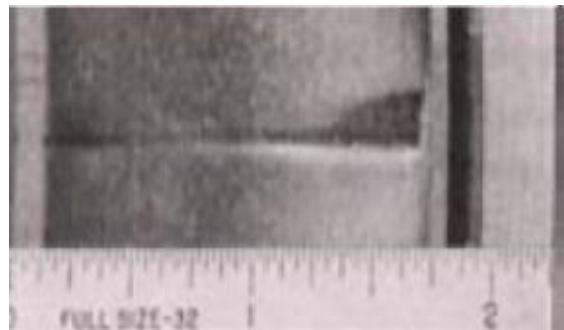


Fig.86: Brinelling not acceptable

18.3 Smearing & Peeling:

Smearing is transfer of metal from one surface to another as a result of galling. This may be due to sliding of rollers on raceways due to adverse lubricating condition. If the cup, cone or rollers has very shallow smearing less than 0.025 mm (0.001") depth it may be returned to service after polishing.

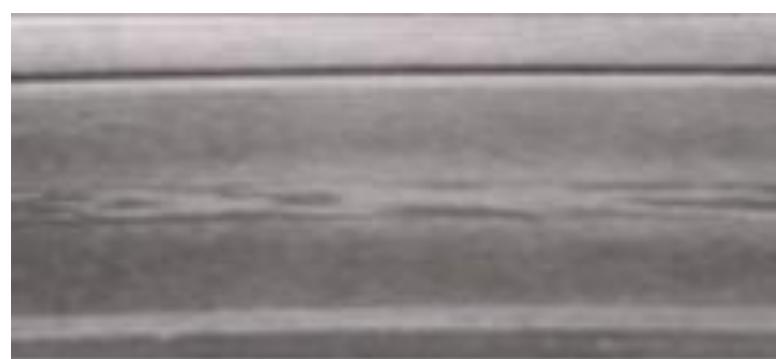


Fig.87: Smearing-Acceptable after Polishing

Peeling is the condition caused by minute particles of metal peeling away from original metal surface. Cup, cone & rollers having very shallow peeling depth 0.025 mm (0.001") or less on rolling surface may be returned to service.

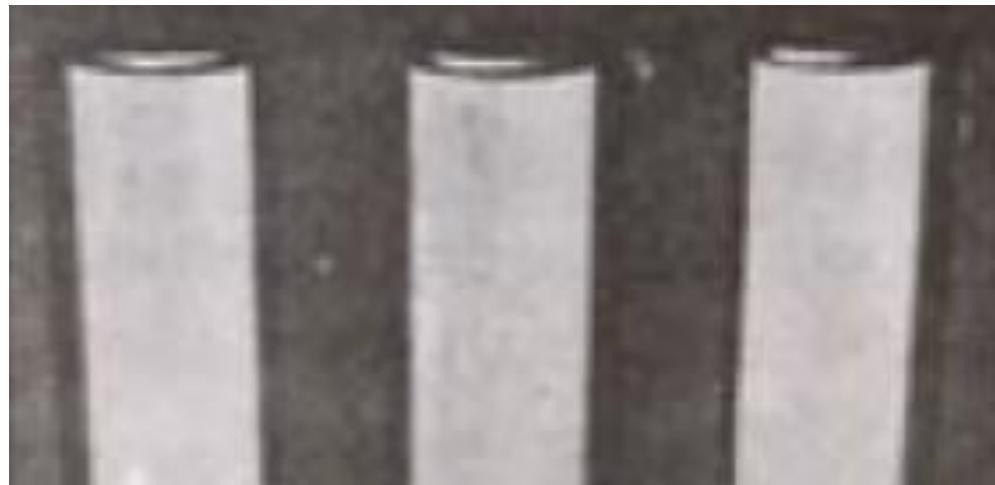


Fig.88: Peeling-Acceptable

18.4 Stain Discoloration, Corrosion Pitting & Rust

The adjacent figure shows surface corrosion damage on raceways and rollers, of three different intensities. Stain discoloration are caused by etching due to moisture or acidity in the lubricant. Superficial stains & discoloration having no depth and which can be removed by 180 grit abrasive or finer or wire brush are acceptable after polishing. Care should be taken that metal is not removed from rolling surfaces. Corrosion pitting or rusting (black corrosion lines or pit marks) which has advanced to severe pitting must be repaired by polishing raceways and rollers. Slight pitting after polishing is acceptable. The cup or cone assembly which cannot be repaired satisfactorily by polishing must be rejected.



Fig.89:Strain & discoloration having no depth

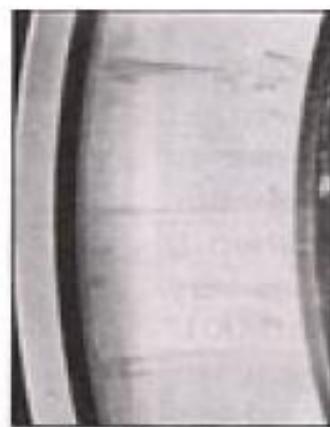


Fig.90: Superficial water or acid etching

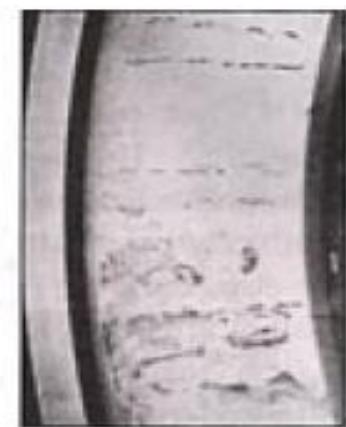


Fig.91:Severe corrosion pitting

18.5 Heat Discoloration

Color from **faint straw to dark blue** may be indication of overheating of bearing (Heat discoloration should not be confused with lubricant stains or the dark coating used on certain parts by some manufacturers). Parts should be rejected only if there is other evidence of overheating. Overheating from an internal source generally originates in the roller inner ring rib contact area and will usually be indicated by visible inner ring rib and/or roller end face wear. Overheating from an external source would usually show indications on both the outside and inside. If there is evidence of overheating, parts must be rejected.

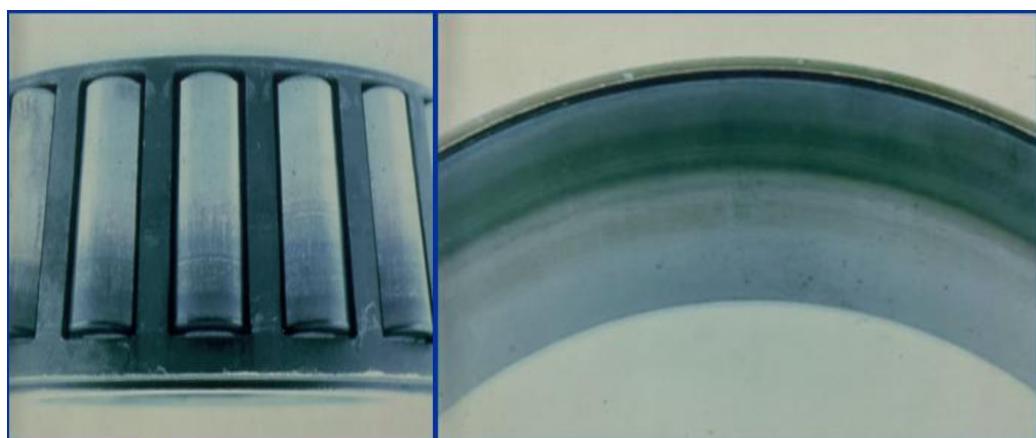


Fig. 92: Heat Discoloration

18.6 Fragment Indentations

Fragment indentations in the bearing may be caused due to lubricant contamination e.g. dirt, dust and spalling debris passing over rolling surfaces. Bearing parts should not be rejected for indentation marks present on raceways unless the damage is such that roughness can be detected when the bearing can be rotated by hand (**See Fig.93**).

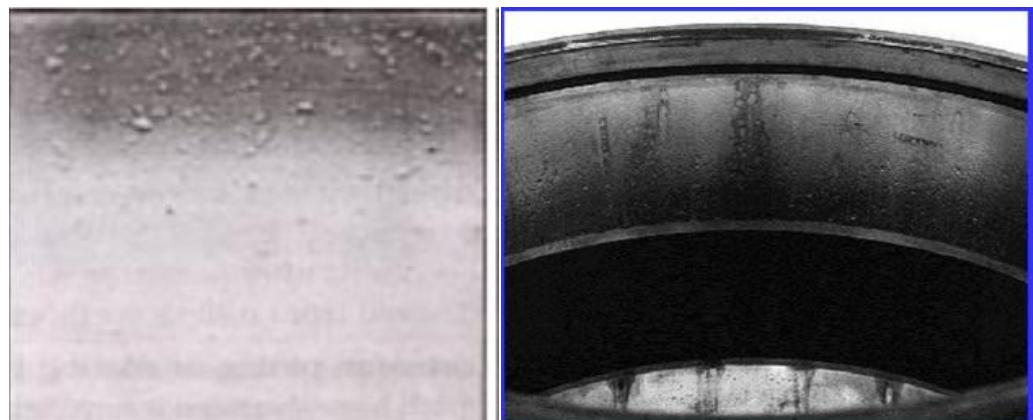


Fig.93: Fragment Indentations

18.7 Electric Burns

Surface damage from passage of electric current (causing localized craters, pits, fluting or corrugations). Pitting, shown in Figs. 94 and 95, is the result of electric current passing through the bearing, such as when the ground cable is clamped to the rail or wheel for arc-welding repairs on wagons/cars. Parts so affected must be rejected. Although only one pit is shown in the below photographs, pitting may occur at several points simultaneously on any or all bearings on the wagon/car when arc-welding is used for repair work, if the ground cable is not clamped to or near the part being welded as recommended (See Para17).

Welders must attach the ground cable so that the circuit formed will not allow current to flow through the roller bearings. Fluting or corrugations, as shown in Fig. 96, result from electric current passing through the rotating bearing. The parts of bearings so affected must be rejected.

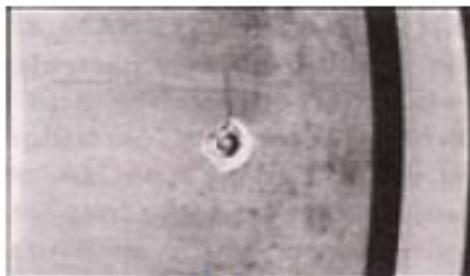


Fig. 94



Fig. 95

Fig.94 & 95: Pitting, resulting from electric current passing through bearing (Bearing parts affected must be rejected)

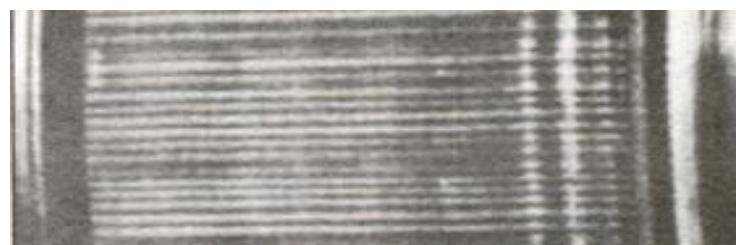


Fig.96: Fluting or corrugation, resulting from electric current passing through rotating bearing (Bearing parts affected must be rejected)

18.8 Nicks

Nicks are surface damages caused due to rough handling of bearing parts. Nicks present on component can be corrected by use of oil stone, provided part is repairable and functioning of part is not affected after repairing.

18.9 Cracks & Fracture

A crack of any length/size is found on any roller, any location in inner ring/cone or outer ring/cup or cage the component should be scrapped.

19. ADAPTER

Earlier wide jaw adapter were used on Casnub 22W and Casnub22W (M) bogies. In order to reduce undamped mass of the bogie, **22 NL** bogies were designed with narrow jaw adapters these are under manufacture since 1990-91.

Instruction for inspection of Adapter has been exhaustively mentioned in RDSO manual '**Instructions for Inspection and maintenance of Casnub Bogies** Technical Pamphlet No.**G-95**'. However for ready reference the main points have been reproduced below (also see Annexure-XIX).

Adapter Drawings

1.	Narrow Jaw Adapter for Casnub-22NL , Casnub-22NLB, Casnub-22NLC, and Casnub-22 HS Bogie.	WD-89067/S-9(Latest Alt.)
2.	Wide jaw Adapter for LCCF 20(C) bogie for BLC wagons	SK - 78527 (Latest Alt.)
	Wide jaw Adapter for Casnub-22W Bogie without Elastomeric pad and Casnub-22W (M) Bogie with elastomeric pad.	
3.	Modified Adapter for Casnub-22W Bogie with Elastomeric pad retrofitted.	WD - 85053/S-1 (Latest Alt.)

Note: Adapter shall not be welded at any location.

19.1 Inspection Of Adapters

When bogie are dismantled for any purpose adapter must be thoroughly inspected for its soundness and wear. The inspection for wear shall include the application of gauges at locations detailed in para 19.2 to 19.7.

19.1.1 Broken or cracked adapters must be scrapped. Repairing of **adapters by welding/brazing is not permitted.**

19.1.2 Warped, distorted or twisted adapters must be scrapped. To check distortions, place the adapters on the bearing **cup** and it must seat firmly on the cup without rocking or pinching when hand pressure is applied.

- 19.1.3 When adapters are worn to such an extent that ridges or grooves prevent proper seating in side frame on the adapter or proper seating on cup, adapters must be scrapped.
- 19.1.4 **If** the crown portion of the adapters has fully worn (up to the crown relief groove) adapters must be replaced by new adapters (**See Fig. 97&98**).
- 19.1.5 **Thrust** shoulders of the adapters may show wear due to contact with ends of the cup. When such groove exceeds 0.7 mm in depth at any point, the adapters must be scrapped (**See Figs. 98, 100**).
- 19.1.6 Adapter machined relief must have 0.8 mm (1/32") or greater depth (**See Fig.100**).
- 19.1.7 Check full bearing seats of the adapter for wear by gauge (**See Figs. 100, 104**). Excessively worn out adapters must be scrapped.
- 19.1.8 Adapters which are worn on one side between thrust lugs due to braking reaction, but otherwise satisfactory must be reversed in direction when reapplied into the pedestal frame. When both sides' shows wear more than 3 mm (1/8") do not reuse the adapters.
- 19.1.9 Adapters must be checked for proper fit on the cup and in the pedestal before placing in the bogie/truck frame.

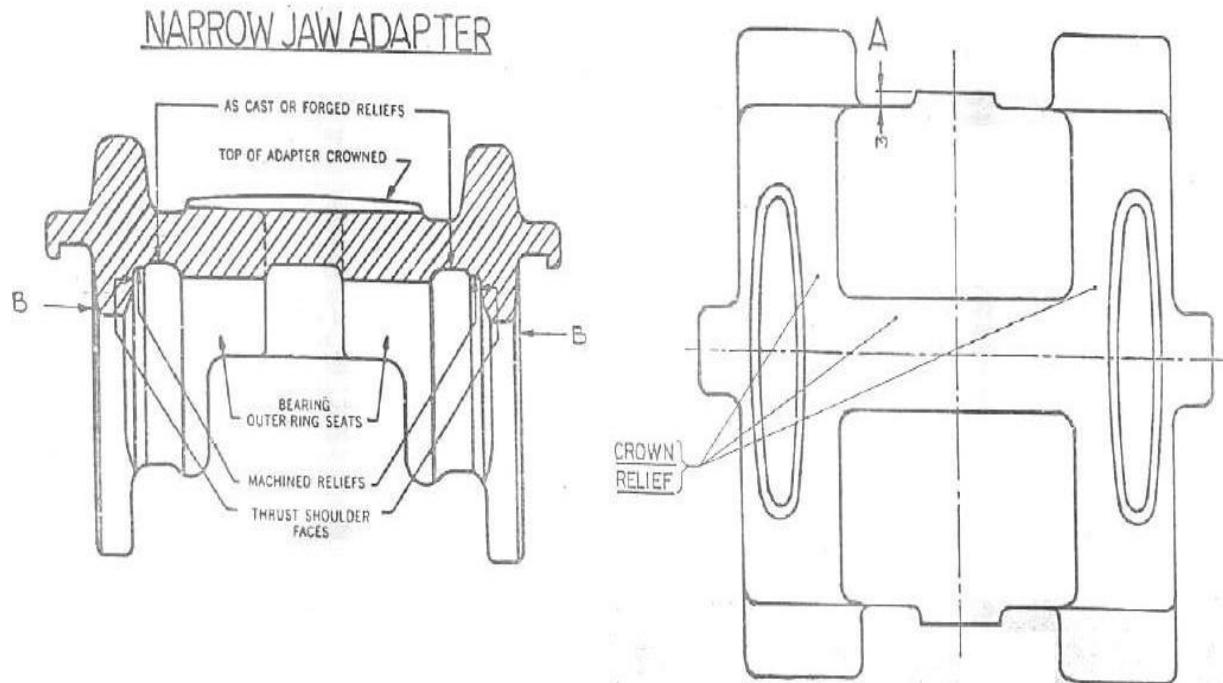


Fig. 97

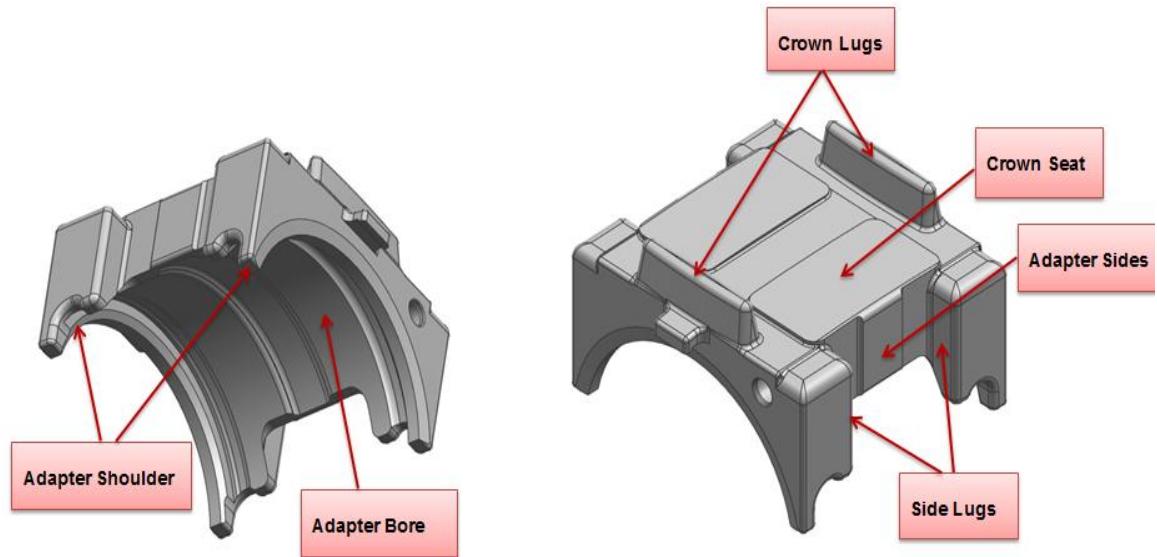


Fig. 98

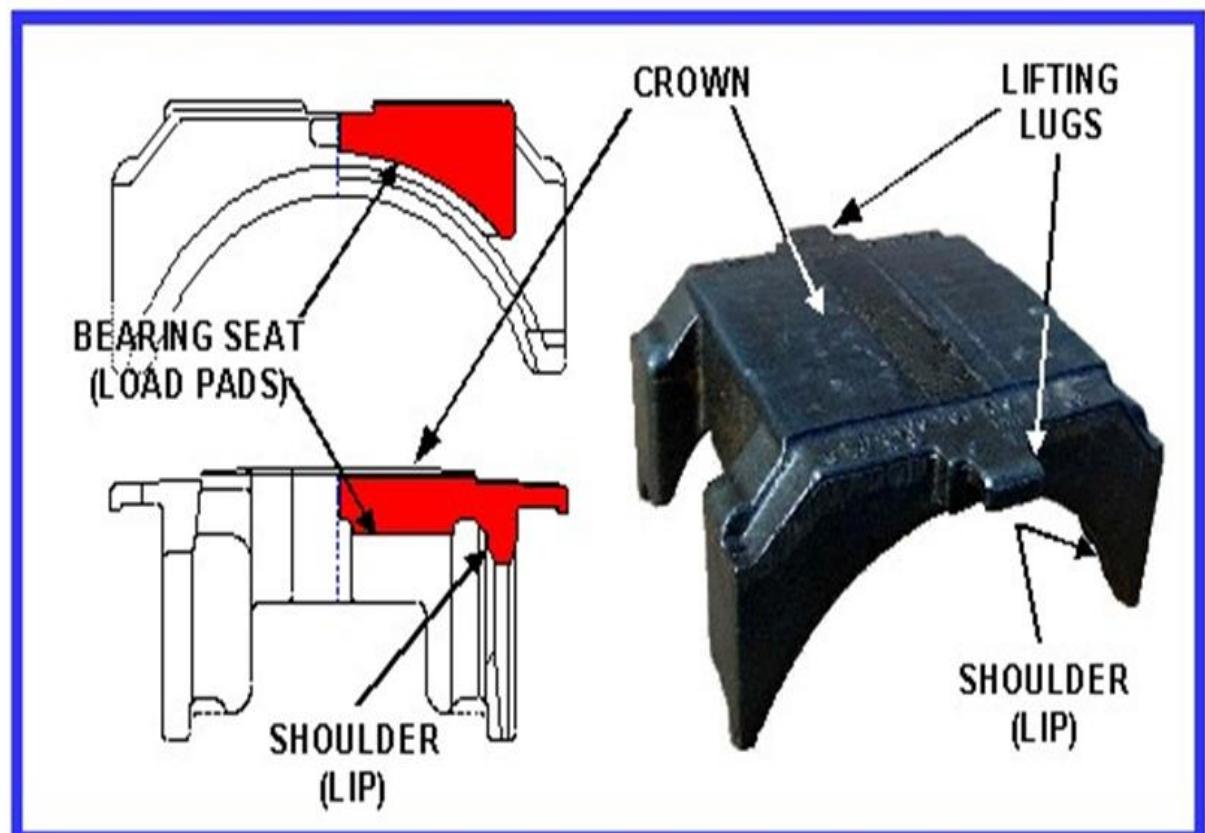
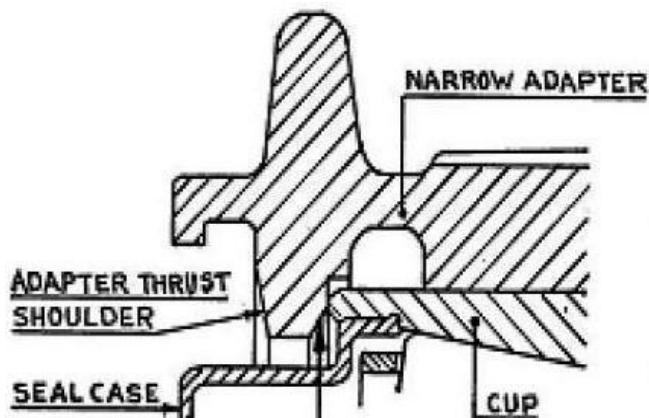
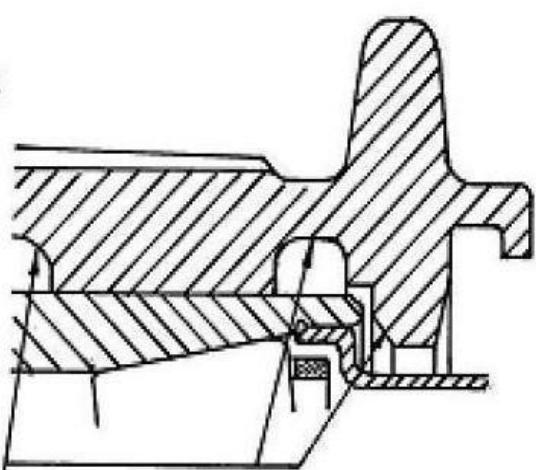


Fig. 99



NOTE CHAMFER ON THRUST SHOULDER WHICH PROVIDES ADDITIONAL CLEARANCE BETWEEN THRUST SHOULDER FACE AND SEAL CASE.



ADAPTER HAVE DEEP CAST OR FORGED RELIEFS AND MACHINED THRUST SHOULDER CHAMFERS TO ASSURE SEAL CASE CLEARANCE AND TO CAUSE THE ADAPTER TO SEAT PROPERLY ON THE BEARING.

Fig. 100 A

Fig. 100 B

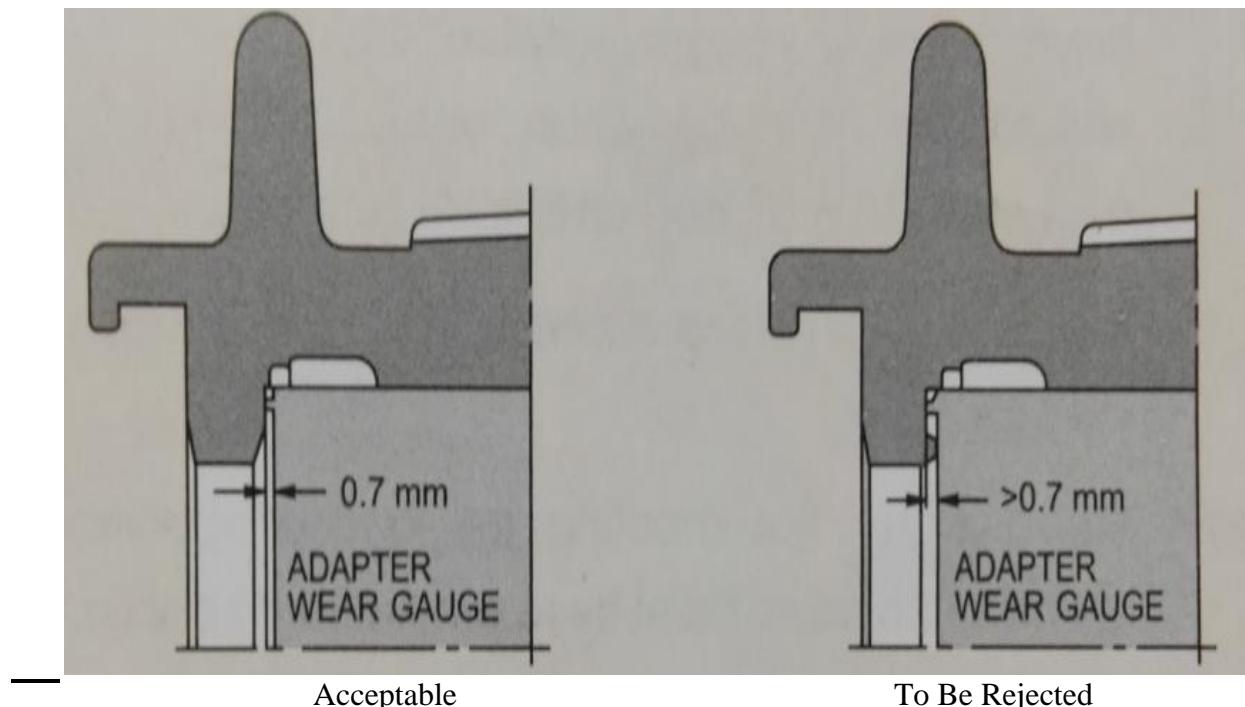


Fig. 100 C

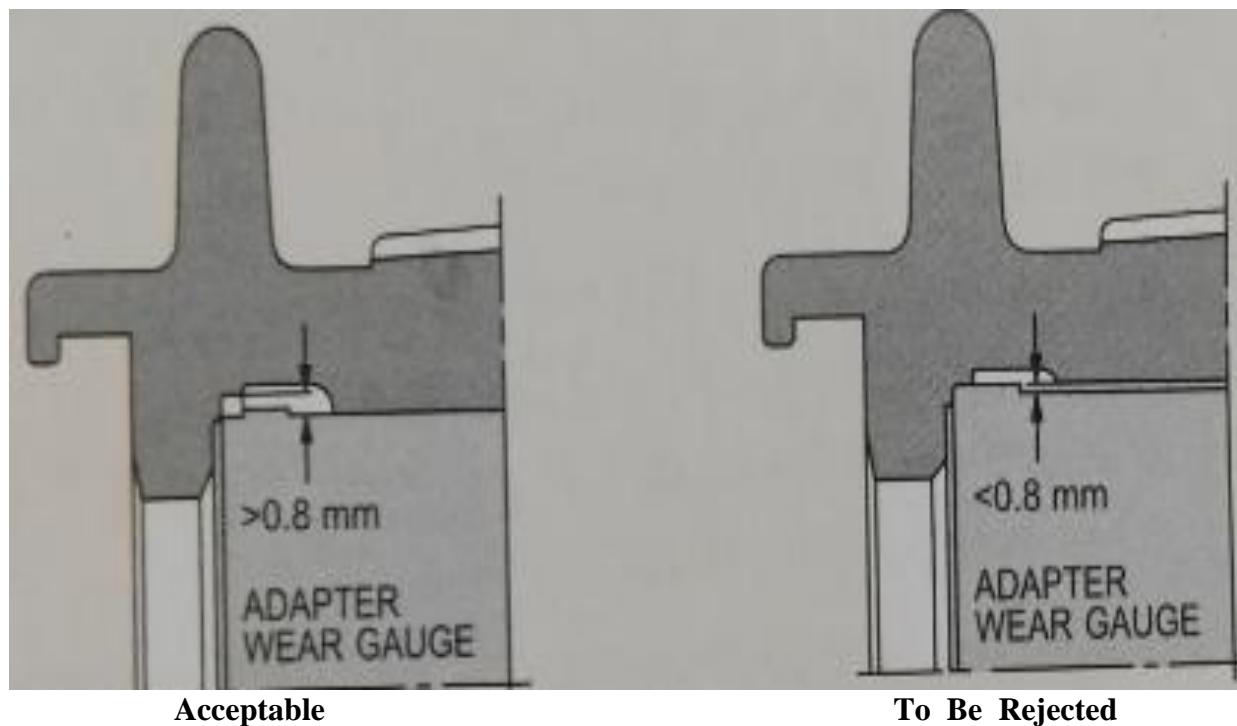


Fig. 100 D



Fig. 101

19.2 Thrust shoulder

Wear limit	0.7 mm
Gauge : Wide Jaw Narrow jaw	Fig.102

The thrust shoulders of used adapter may show grooves due to contact with the ends of outer ring. The depth of such grooves shall be gauged by using gauge at Fig. 102. If at any point on the periphery of adapter, the gauge touches i.e the **groove is 0.7 mm, the adapter shall be scrapped (See Fig. 100 C&103)**.

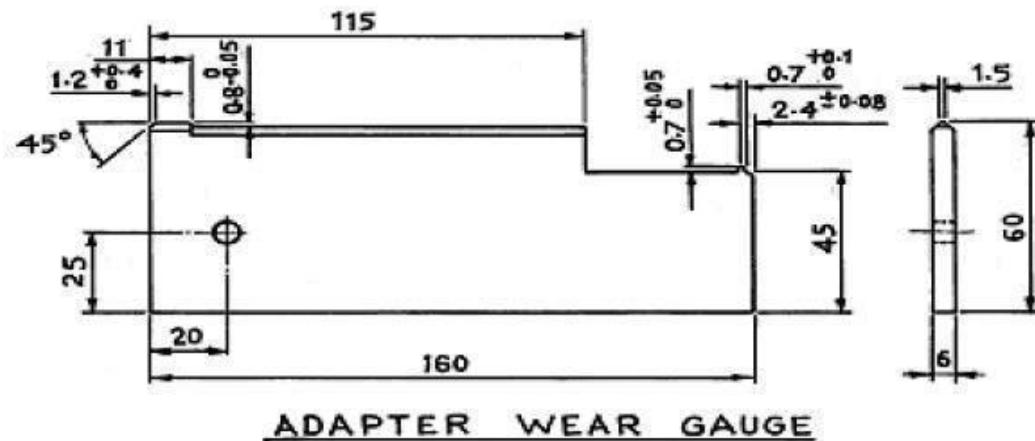


Fig. 102

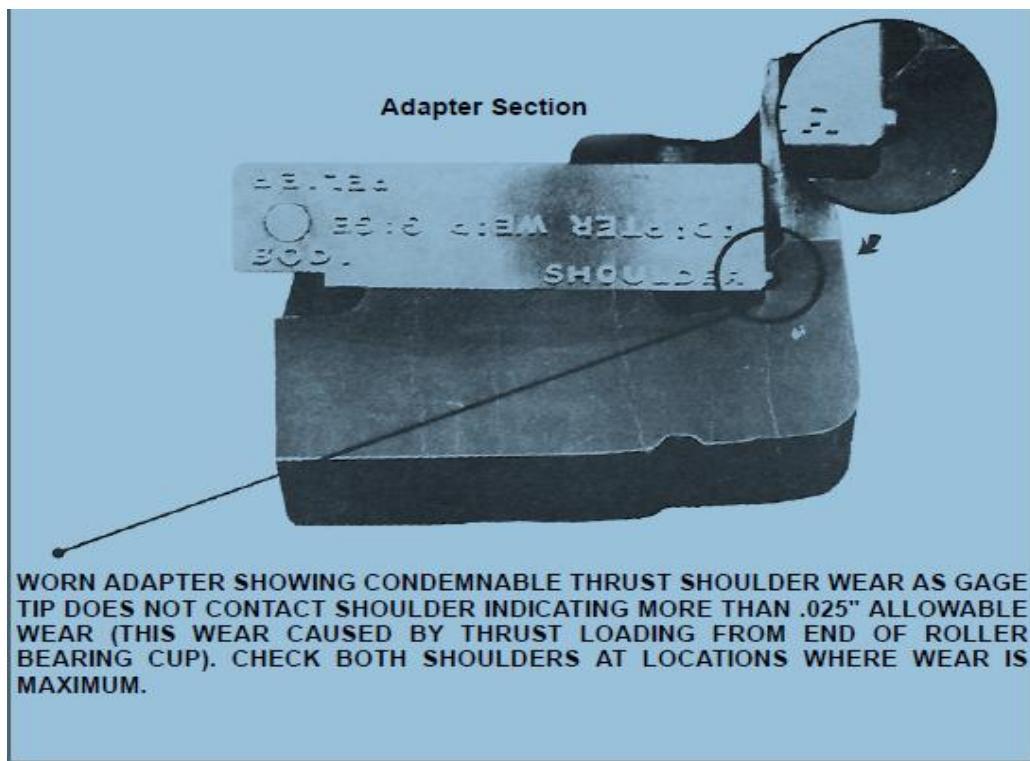


Fig. 103

19.3 Adapter bore (bearing seat)

Adapter machine relief depth	≥ 0.8 mm
Gauge : Wide Jaw Narrow jaw	Fig. 102

Machined relief has been provided by the side of the bearing seats at different level. When measured, machined relief depth shall be **0.8 mm or more**. The gauge shown at Fig.102 shall seat on the bearing seat without touching the machined relief. If the gauge touches the machined relief, the adapter shall be scrapped. The adapter bearing seat must be checked over full arc by this gauge (See Fig. 100 D&104).

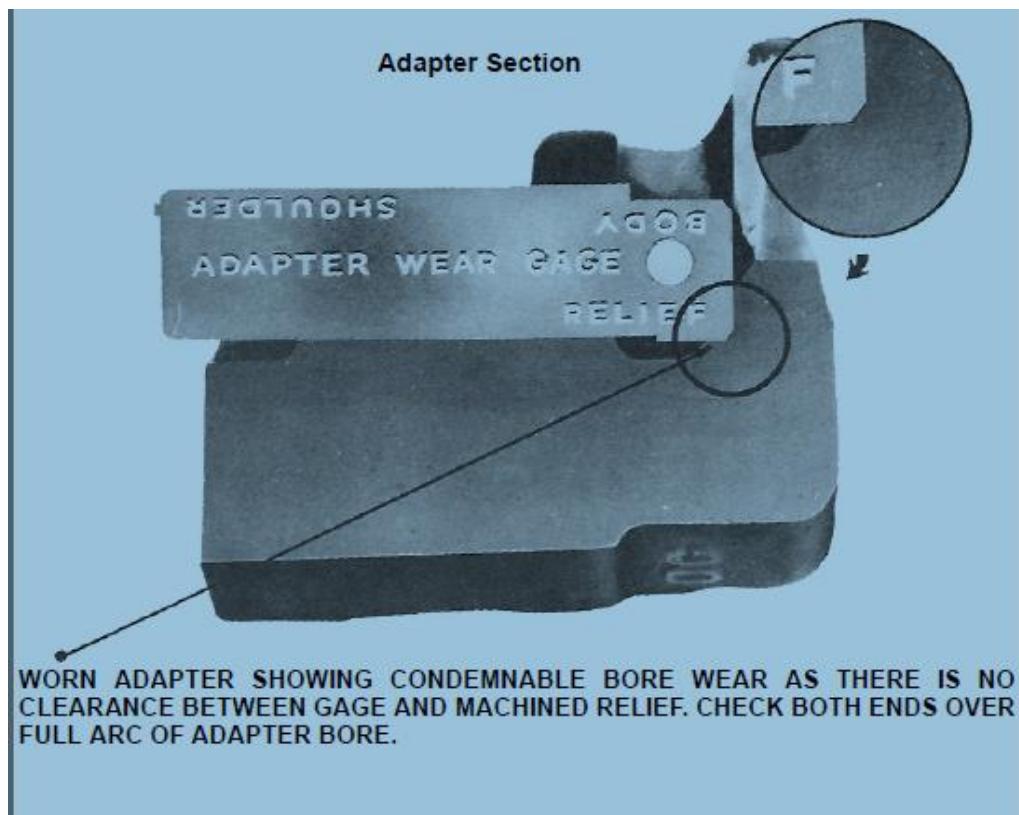


Fig. 104

19.4 Adapter Crown Lugs:

Wear limit = 4 mm (either sides)

	New (mm)	Worn (mm)	Wear Limit (mm)
Adapter Crown lugs (Narrow Jaw)	155.5	163.5	4
Adapter Crown lugs (Wide Jaw)	156	164	4

To determine the amount of wear in the adapter outer and inner lugs use the gauge shown in the Fig.105 for narrow jaw adapter and Fig. 106 for wide jaw adapter.

With gauge in position as shown in figure 107, if a **5 mm** thick shim can be inserted between the worn lug and the gauge on either side at any point, the adapter should be scrapped.

Before using the gauge, the Centre line of crown seat is to be marked taking the unworn surface of the crown lugs as datum. While using the gauge, the Centre line of the gauge and the marked Centre line of the crown seat should be kept in the same line. The gauge should be moved for full length of crown surface to measure wear.

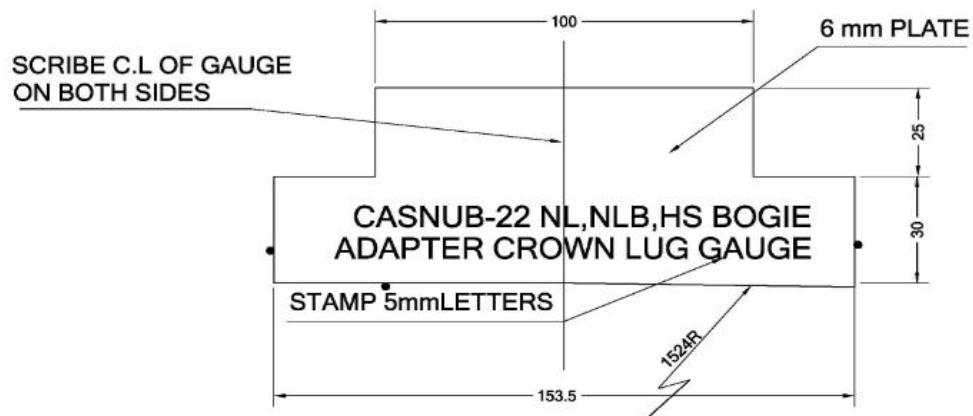


Fig 105: Gauge applicable for Narrow jaw adapter

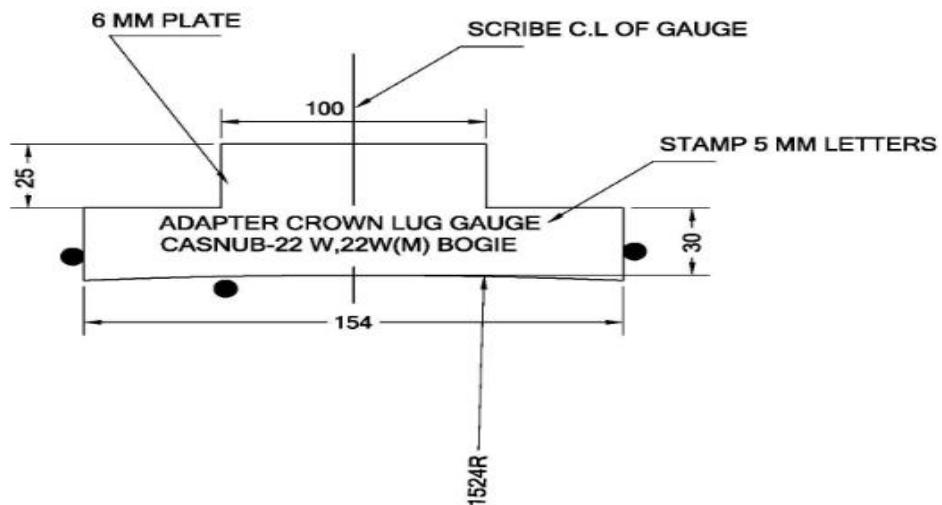


Fig 106: Gauge applicable for Wide jaw adapter

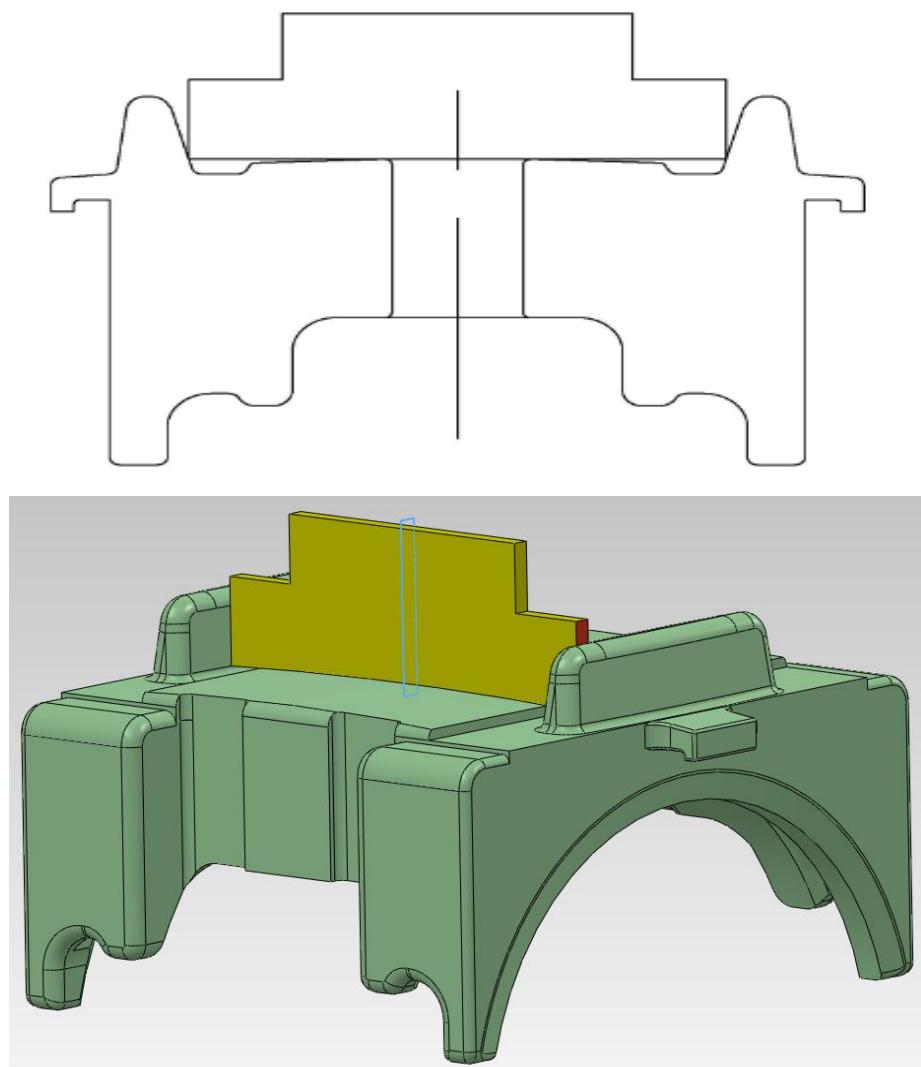


Fig 107: Adapter Crown lug Gauge application

19.5 Adapter Crown Seat:

Wear limit = 3.5 mm

	New (mm)	Worn (mm)	Wear Limit (mm)
Adapter bore seat to Crown seat of Narrow jaw adapter	26.2	22.7	3.5
Adapter bore seat to crown seat of Wide jaw adapter	48.5	45	3.5
Adapter bore seat to crown seat of Modified wide jaw adapter	25.5	22	3.5

To determine the amount of wear on the adapter crown seat by using the gauge shown in the Fig. 108 for Narrow Jaw adapter & Fig. 109 for Wide jaw adapter or Modified Wide jaw adapter.

The gauge should be applied as shown in Fig. 110. If a **4.5 mm** shim can be inserted between gauge 1 and gauge 2, it indicates the limit of wear and the adapter should be scrapped.

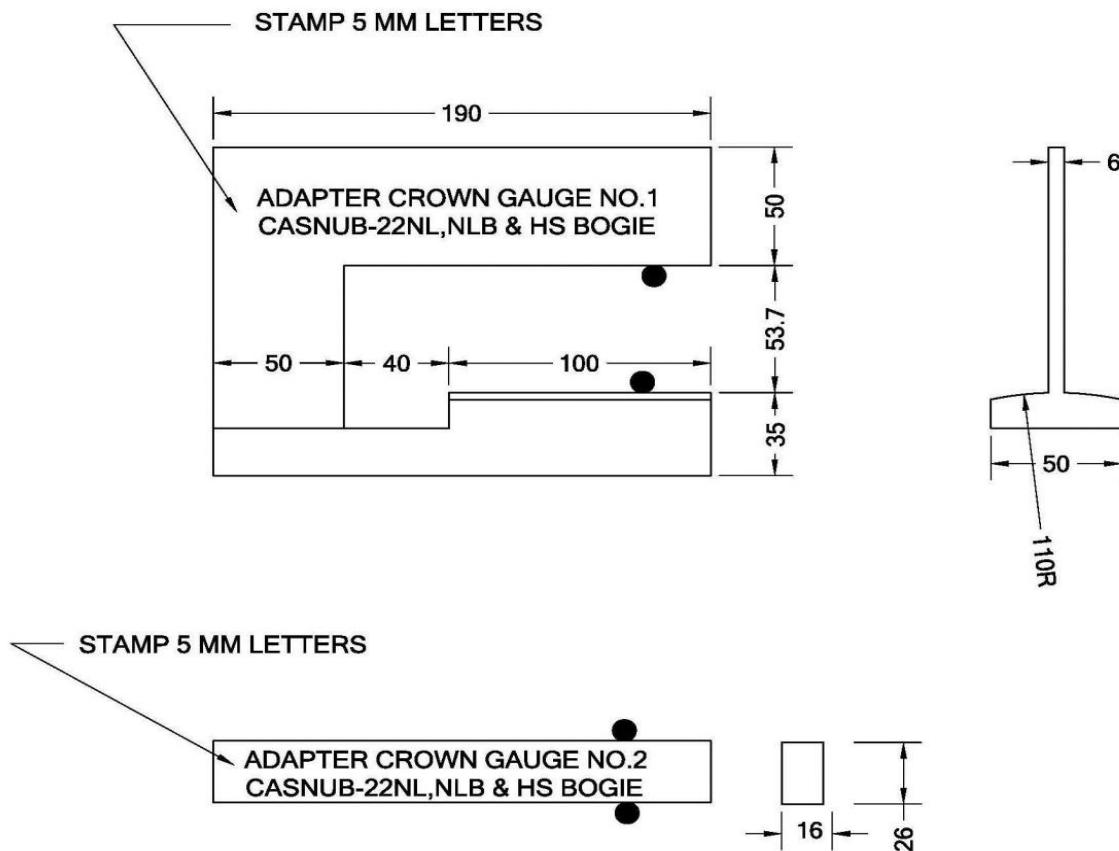
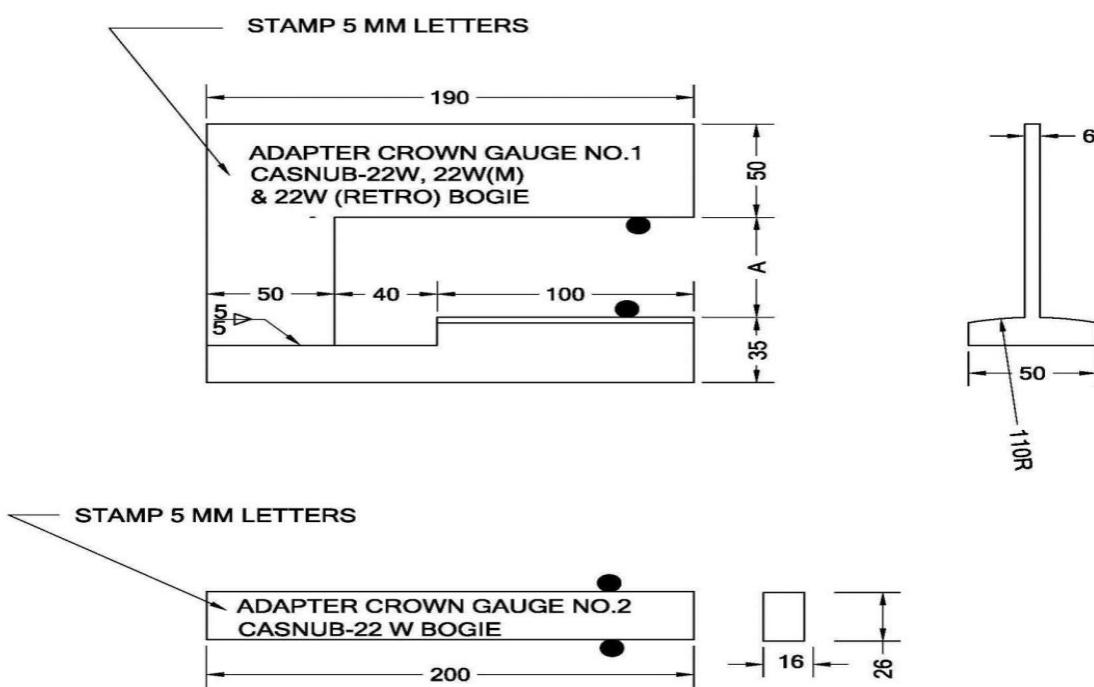


Fig.108: Adapter Crown seat Gauge applicable for Narrow jaw adapter



DIM	Wide Jaw adapter (CASNUB-22W 22W(M))	Modified Wide Jaw adapter (RETROFITTED CASNUB-22W)
A	76	53

Fig 109: Adapter Crown seat Gauge applicable for Wide jaw/Modified wide jaw adapter

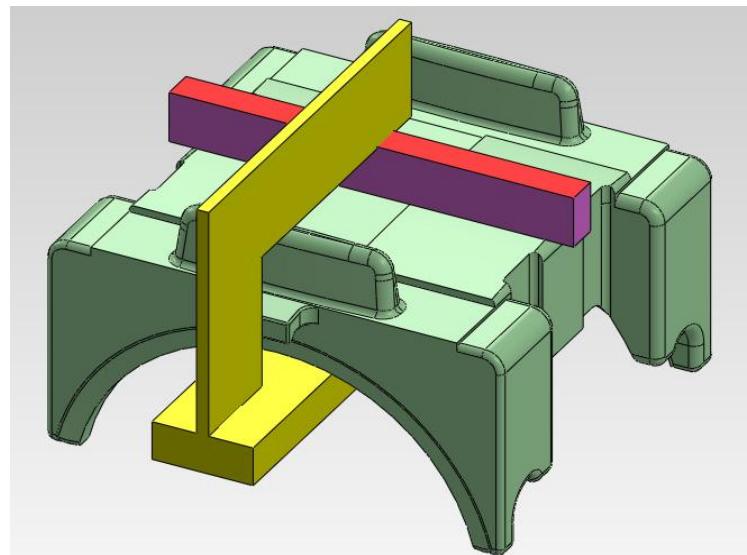
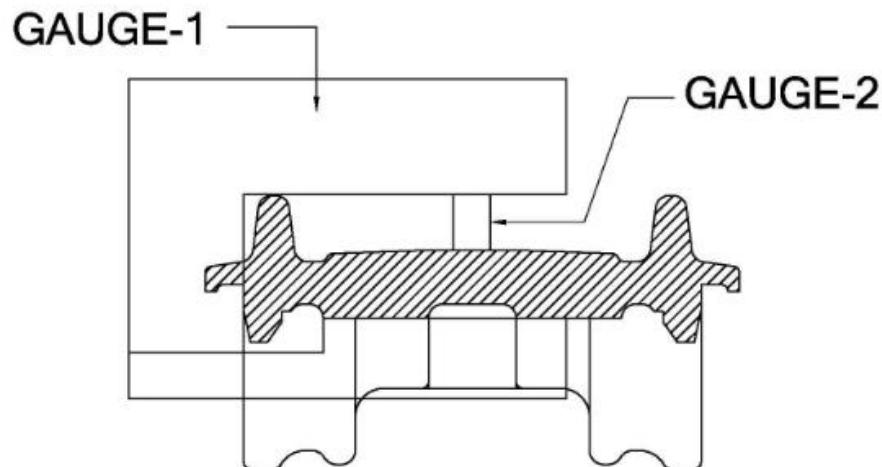


Fig 110: Adapter Crown seat Gauge application

19.6 Adapter Side Lugs:

Wear limits = 3 mm (either sides)

	New (mm)	Worn (mm)	Wear Limit (mm)
Adapter Side Lugs (Narrow jaw)	97	103	3
Adapter Side Lugs (Wide jaw)	130	136	3

To determine the amount of wear on the adapter side lugs by using the gauge shown in the fig.111 for Narrow jaw adapter & fig.112 for Wide jaw adapter. To determine the amount of wear on the side lugs with the gauge in position as shown in Fig. 113 .If a **4 mm** thick shim can be inserted between worn surface of the lug and gauge at **either side** at any point, the adapter should be scrapped.

Note: Before using the gauge, vertical Centre line of each side is to be marked taking the unworn surface of the side lugs as datum. While using the gauge, the Centre line of gauge and the marked Centre line of the side of adapter should be kept in the same line. The Gauge should be moved for the full length of worn surface to measure wear.

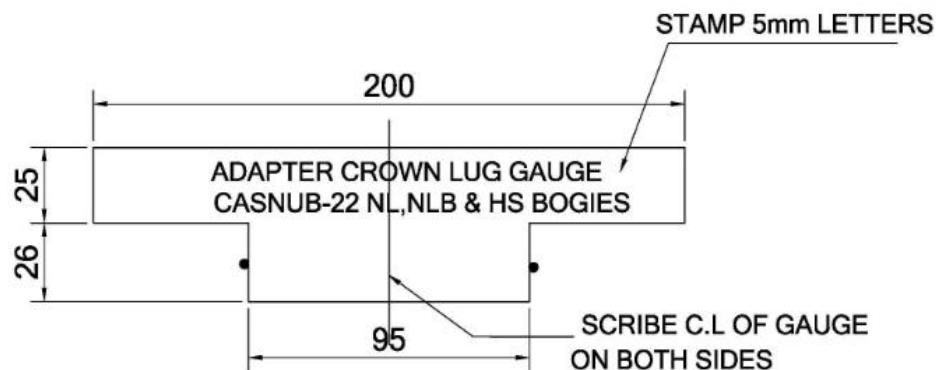


Fig 111: Adapter side lug Gauge applicable for Narrow jaw adapter

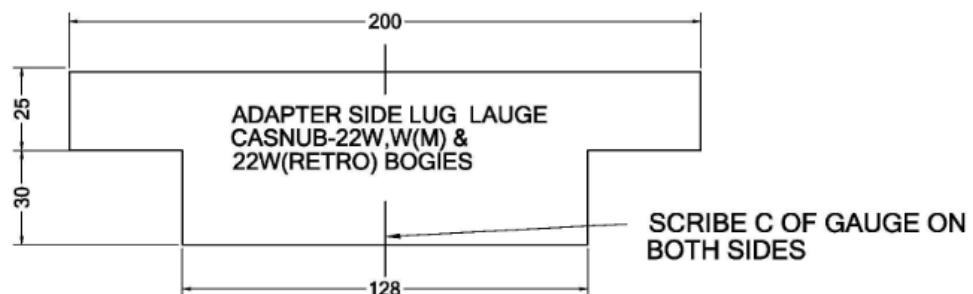
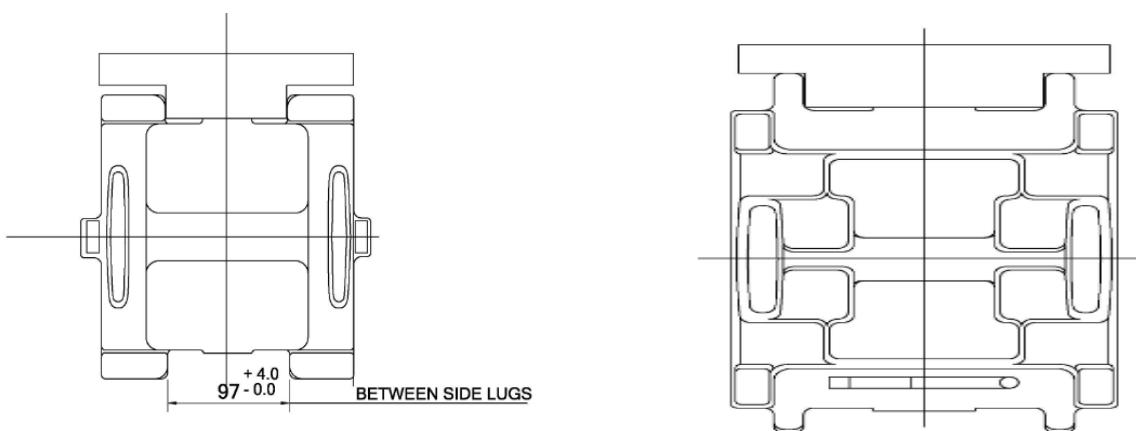


Fig 112: Adapter side lug Gauge applicable for Wide jaw adapter



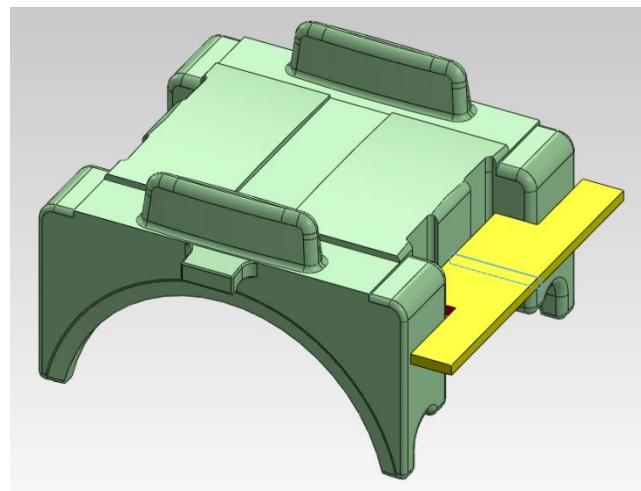


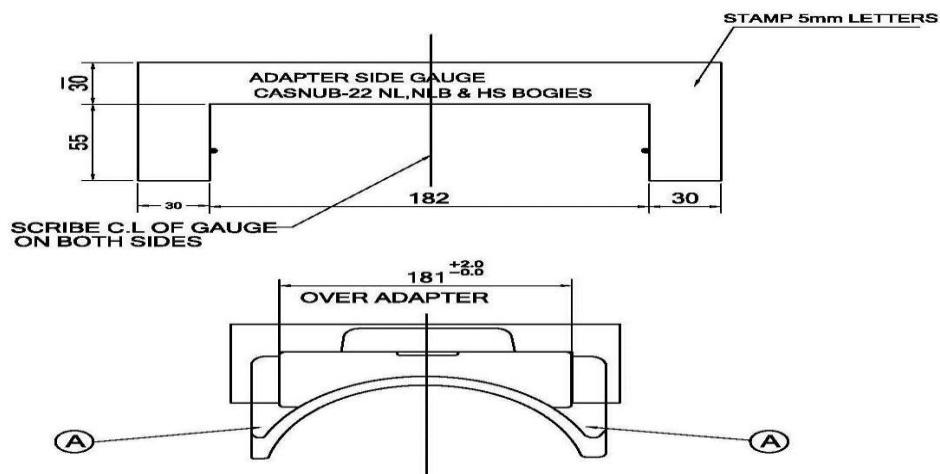
Fig 113: Adapter side Lug Gauge application

19.7 Adapter Sides:

Wear limit = 3 mm (either side)

Description	New (mm)	Worn (mm)	Wear Limit (mm)
Adapter Sides (Narrow jaw adapter)	181	175	3
Adapter Sides (Wide jaw adapter)	268	262	3

To determine the amount of wear on the adapter side by using the gauge is shown in Fig. 114/115. With the gauge in position as shown in **Fig.114/115**. If a **3.5 mm** thick shim can be inserted between the casting and the gauge at **each end** at any point, the adapter should be scrapped. Before using the gauge, the centre line of the adapter side is to be marked on the adapter sides taking the unworn surface of their adapter as datum. The gauge centre line should be kept to fall on the marked centre line of adapter sides. Two 3.5 mm thick shims are required to be used simultaneously.



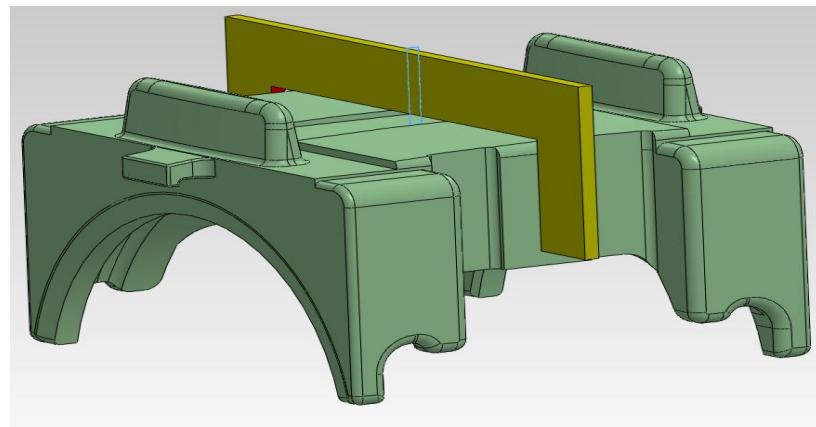


Fig 114: Adapter sides Gauge application on Narrow jaw adapter

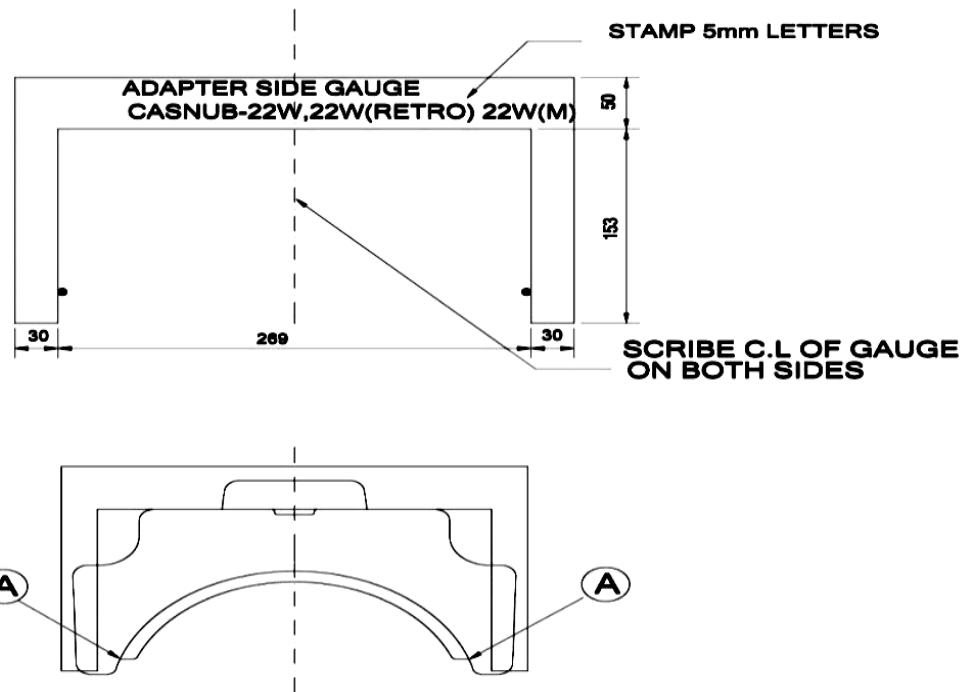


Fig 115: Adapter sides Gauge application on Wide jaw adapter

20. AT A GLANCE

CHECK LIST OF MEASUREMENTS/CHECKS TO BE CARRIED OUT

S. No	Description	Specified Dimensions/ parameter in mm unless otherwise stated	Relevant Clause.
CTR B			
1.	Cone Bore/ID (max)	144.488	8.5.2
2.	Cone Bore out of roundness (max)	0.076	8.5.2
3.	Inspection of Cone Raceways by feeler gauge probe.	-	8.5.2
4.	Gap between Inner ring & Cage Flange i.e. B1 + B2 (max) (Only for TIMKEN, BRENCO/NEI& SKF Bearing)	2.3	8.5.2
5.	Gap (A) between Cage Pocket & Roller TIMKEN, BRENCO/NEI, FAG, SKF	1.5	8.5.2.
6.	Cup Counter Bore D₁ (a) Maximum	209.677	8.5.4.1
	(b) Minimum	209.423	
7.	Cup Counter Bore out of roundness (max)	0.127	8.5.4.1
8.	Cup Outside Diameter (min) TIMKEN, BRENCO/NEI, FAG & SKF	220.345	8.5.4.2
9.	Cup Outer Dia out of roundness (max)	0.127	8.5.4.3
10.	Inspect Cup for extended wear band.	B in Fig.33	8.5.4.3
11.	Parallelity of end faces of Spacer	0.025 (max)	8.5.7
12.	Wear limit for Seal Wear Ring outer dia. (max)	Seal Lip contact path has worn to a depth less than 0.13 mm (0.005")	8.5.8
13.	Bench Lateral: With Hand Operated Device With Power Operated Device	0.51-0.66 0.58-0.74	8.7.1
14.	Amount of Grease to be Applied	400 ± 30 gram	8.7.2

15.	Verification of Quantity of Grease	Minimum two samples per day.	8.7.2
16.	Greasing of Seal Lips	10 gram (approx.) to be applied, if not prelubricated by supplier	8.7.2
17.	Seal wear ring fitting into Backing Ring Counter Bore.	Tight fit	8.5.8
18.	Backing Ring Breakout Diameter	Average I.D not to exceed 178.511 (7.028") for Timken, Brenco/NEI, FAG& 178.562 (7.03") for SKF	8.5.9
19.	Backing Ring with vent holes	Backing rings with vent holes should be discarded	8.5.9
20.	Machined Surface 'C' of End Cap in Fig. 24.	-	8.5.1
21.	Wear on threads of Cap Screws	No wear	8.5.10
22.	Wear on threads of Axle End Holes	No wear	8.5.10
23.	Cleaning & Lubricating of Cap Screws & Axle End Holes	To be done	8.5.10
24.	Packing	Polythene bags etc.	9

Axle

25.	Journal size	Journal of axle to DrgNo. WD-89025/S-02	5
26.	Journal Diameter of Axle	144.564 to 144.539	10.1 &10.2
27.	Groove depth on Axle Journal	0.05 (max)	10.2.1
28.	Upset End of Axles	0.075 (max)	10.2.2
29.	Axle Fillet Radius with Feeler Gauge (Max. depth of insertion).	10 (max)	10.3
30.	Axle Fillet Radius	38.1	10.3
31.	Axle end Tapped hole Thread Size	1" – 8 UNC – 2B	5

Mounting

32.	Journal Coating	Anti-rust lead free compound to IS: 9862	10.4
	(a.) Fillet & Collar Dia.		
	(b.) Bearing Seats	Heavy mineral oil (SAE 30/SAE 40) or Castor oil	

33.	Mounting Pressure before abutment.	10 to 16 tons	10.4
34.	Final Mounting Pressure (Hold for 5 seconds for proper seating)	$50^{\pm 5}$ tons	10.4
35.	Mounted Bearing Lateral play (apply hand pressure only)	0.03 – 0.38	10.5 &10.6
36.	Cap Screw Tightening Torque	40 kg-m (apply minimum 2 passes)	10.4
37.	Cap Screw	1" DIA-8UNC - 2A X 2-1/4" long	8.5.10 &10.4
38.	Torque Wrench Accuracy	Must be within $\pm 4\%$	10.4
39.	Locking Plate	Bent all tabs properly	10.6
40.	Frequency of Calibration of Torque Wrenches	Once in a month	10.4

Adapter

(wear limit, mm)

41.	Adapter Crown Wear	-	19.1
42.	Adapter Thrust Shoulder Wear (max)	0.7	19.2
43.	Adapter Machined Relief Depth (min)	0.8	19.3
44.	Adapter Crown Lugs	4.0	19.4
45.	Adapter Crown Seats	3.5	19.5
46.	Adapter Side Lugs	3.0	19.6
47.	Adapter sides	3.0	19.7

Note: - All gauges should be calibrated /checked with Master Gauge at least once in a month.

Must change items at a glance

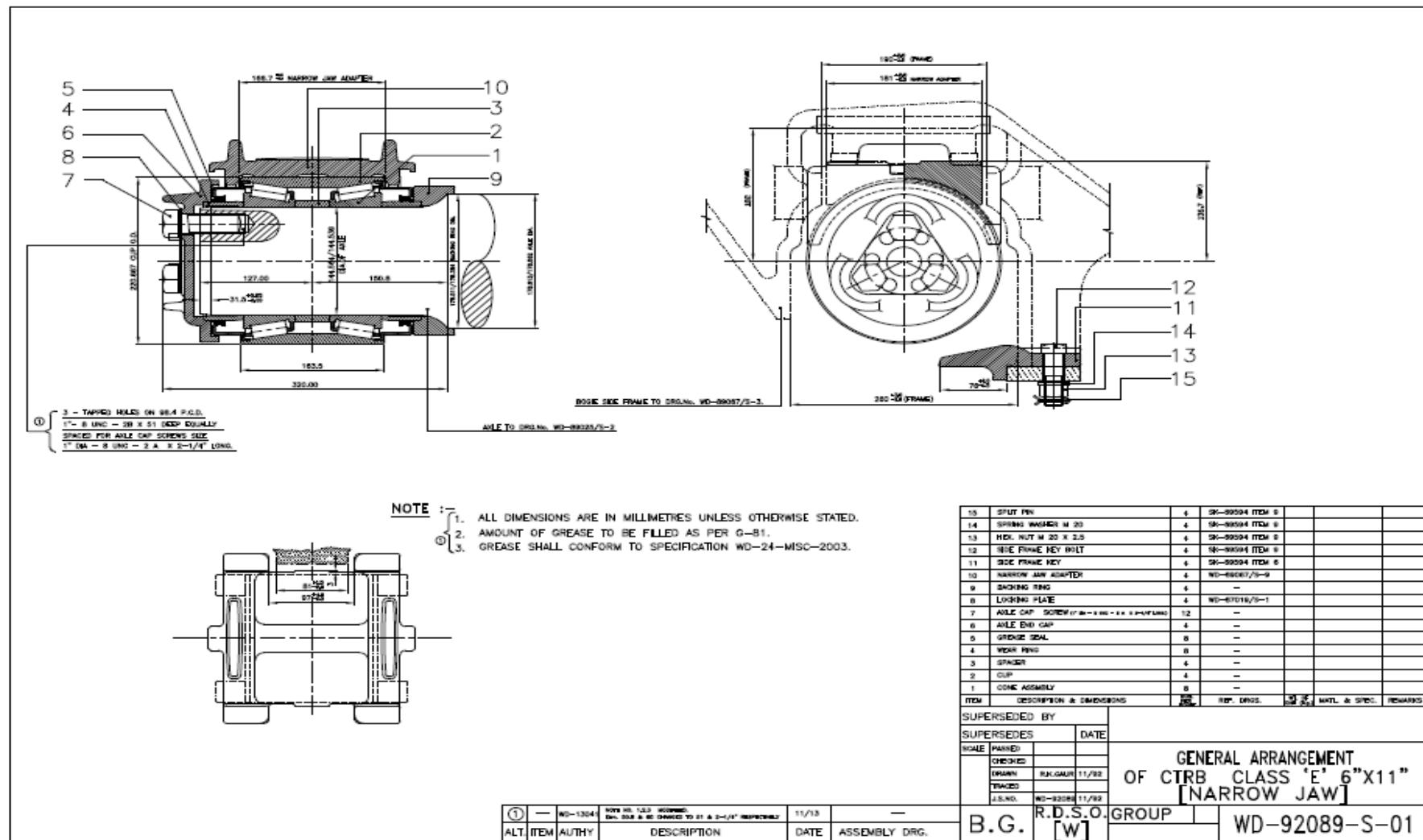
A. Must Change Items of CTRB/components during ROH

S. No.	CTRБ Components	What to change in ROH	Relevant Clause
1.	Locking Plate	Used locking plate must replace with new locking plate whenever Locking plates are removed/opened for UST of Axle/Tyre turning of wheels etc during ROH.	8.5.11, 10.4

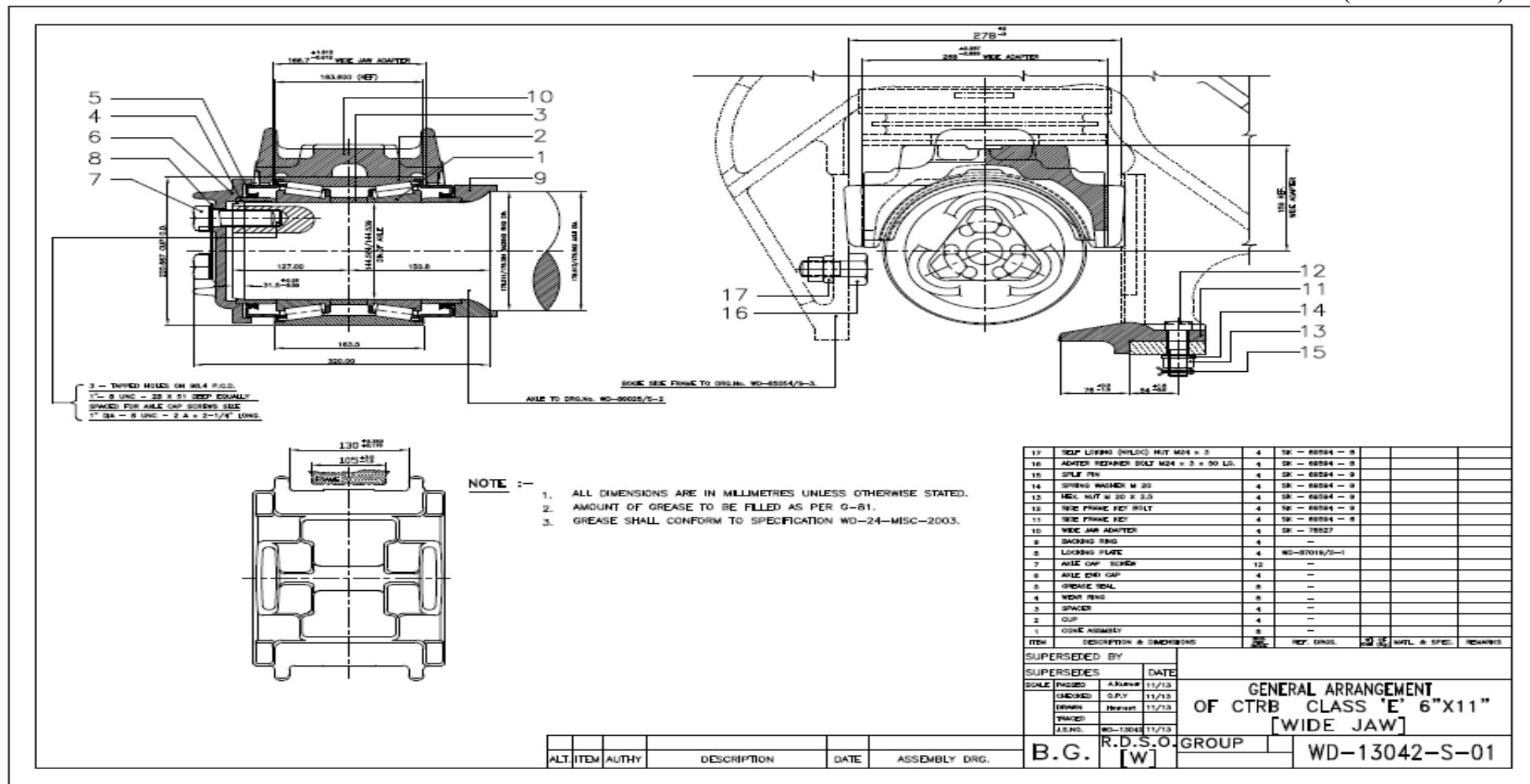
B. Must Change Items during Overhauling/Reconditioning of CTRB by Overhauling Workshop

S. No.	CTRБ Components	What to must change during Overhauling of CTRB in Workshop	Relevant Clause
1.	Locking Plate	Locking plate should never be reused. Whenever locking plates are removed they should be replaced with new locking plates.	8.5.11, 10.4
2.	Grease Seal	Used Grease seal must replace with new Grease seal whenever CTRB is dismounting/Overhauling in Workshop.	8.5.6
3.	End Cap Screw	Used end cap screw must replace with new	Annexure XIV A (Rly. Bd's letter no. 2015/M (N)/951/32 dated 04/10/2017)
4.	Grease	Charge/lubricate CTRB with fresh grease	8.7.2

ANNEXURE-IA
(Refer clause-2)



ANNEXURE-I B
(Refer clause-2)



ANNEXURE-II
(Ref. clause - 3)

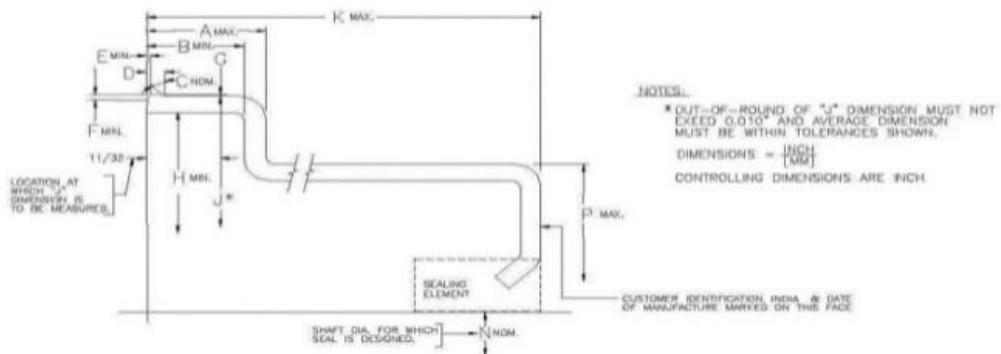
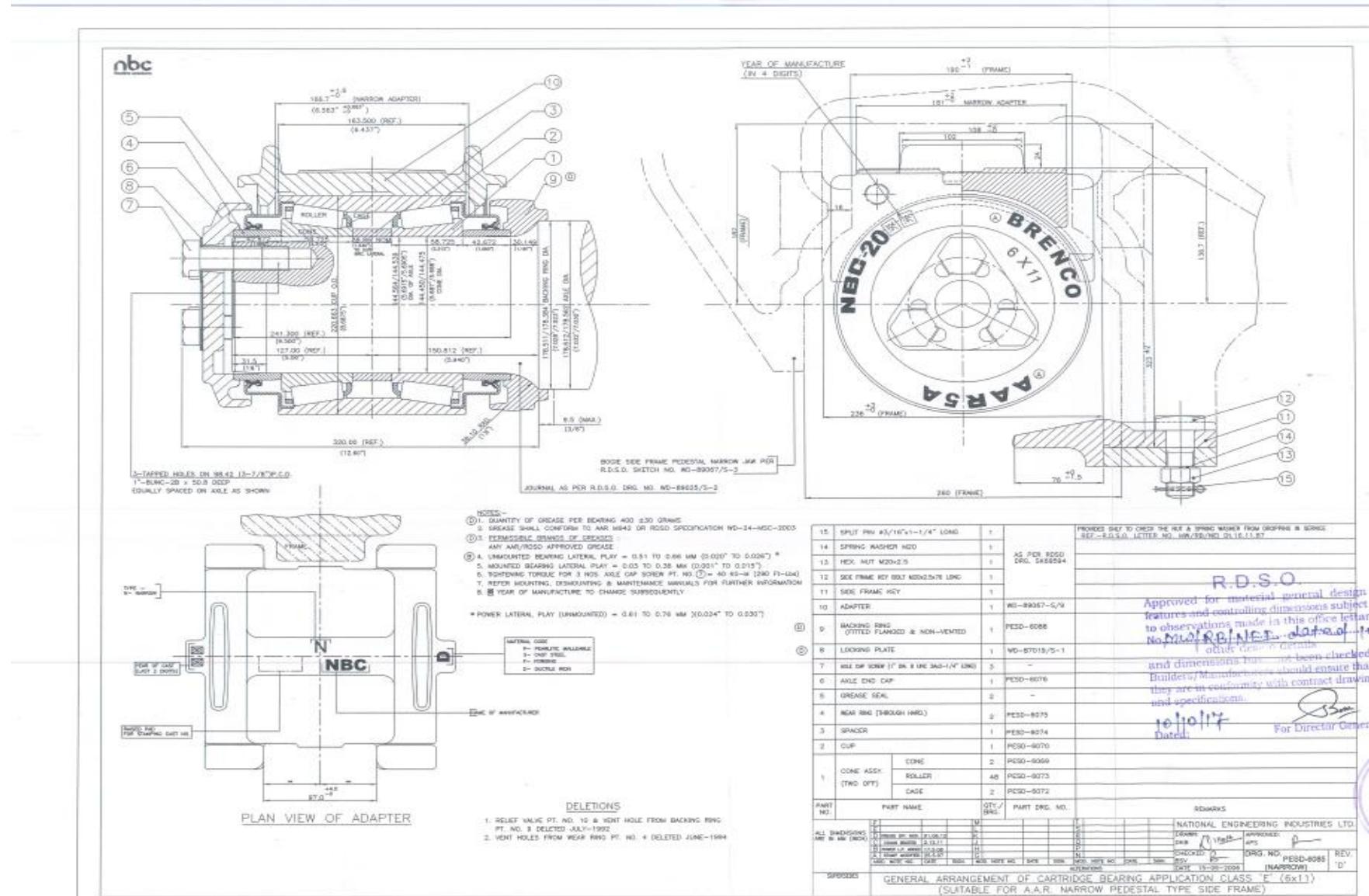


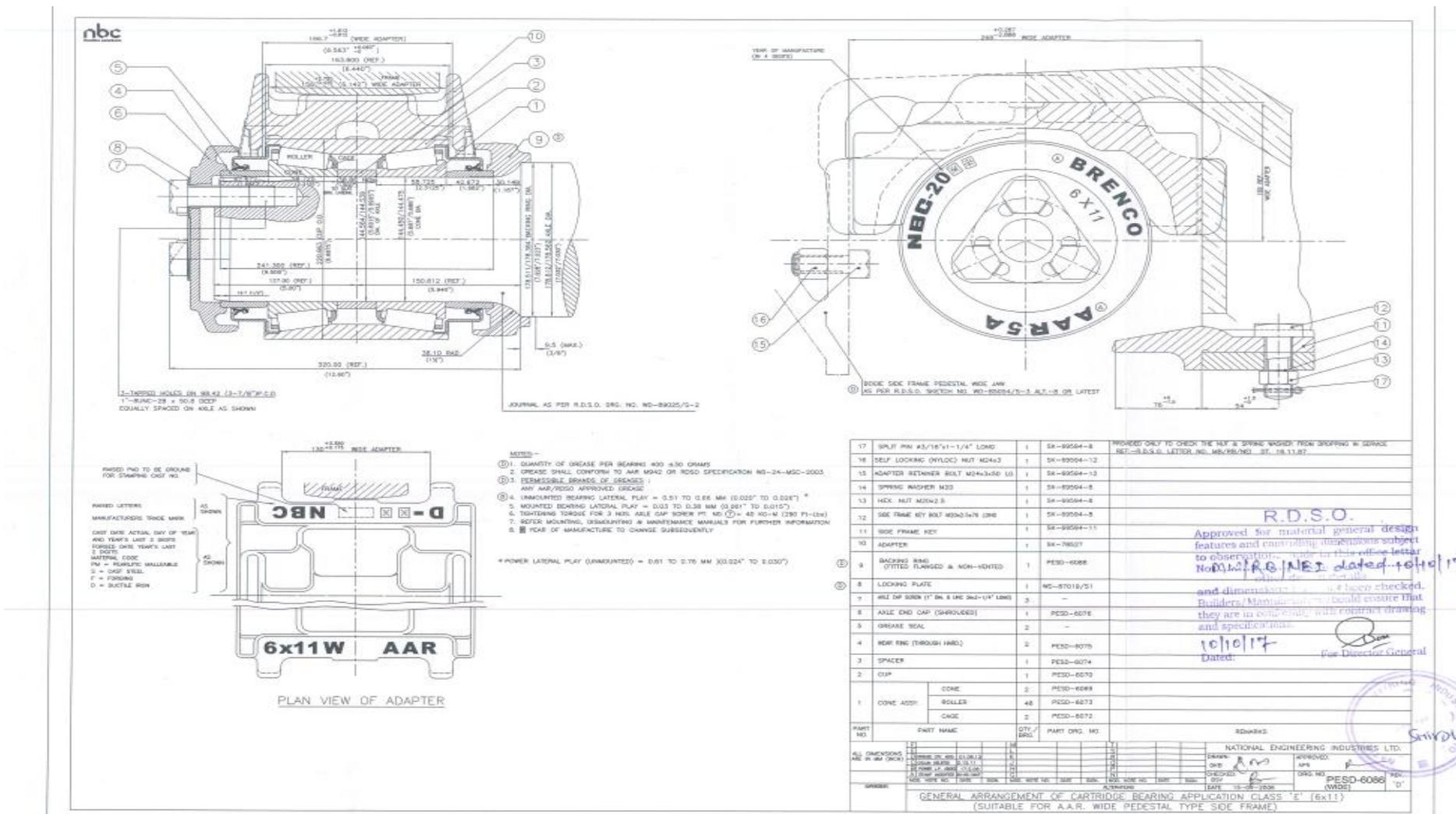
Fig. Seal case clearance outline and limiting dimensions

CTR Class 'E' Seal (6" X11")	A (mm)	B (mm)	C	D (mm)		E (mm)	F (mm)	G (mm)		H (mm)	J (mm)		K (mm)	N (mm)	P (mm)	Dust lip dia. (mm)	Fluid Lip dia. (mm)
				Max.	Min.			Max.	Min.		Max.	Min.					
Specified value (as per Specification M-959 AAR MSRP-H)	13.4 (max)	10.7 (min.)	45 ⁰	1.9	1.4	0.4 (min)	0.8	0.3	0.2	205.1 (min)	209.9	209.8	42 (max)	157.2 (nom)	190.7 (max)	not mentioned	not mentioned
M/s. Timken Seal part No. K-86861	13.157 to 12.751	10.7 (min)	45 ⁰	1.9	1.4	0.4 - 0.8	0.8 to 1.58	0.3	0.2	205.638 to 206.3	209.956 (with sealant)	209.83 (with sealant)	41.63 (max)	-	182.04	156.31 to 157.15	155.24 to 156.41
M/s. SKF Seal Drg. No. MP 70113- 1100	13 - 13.4	10.7 (min.)	45 ^{0 ±} ₁	1.9	1.4	0.4 - 0.8	0.8 to 1.2	0.3	0.2	205.1 (min)	209.9 (with sealant)	209.82 (with sealant)	41.03 - 41.63	157.14 to 157.18	189.92 to 190.68	156.4 to 156.7	155.4 ^{±0.5}

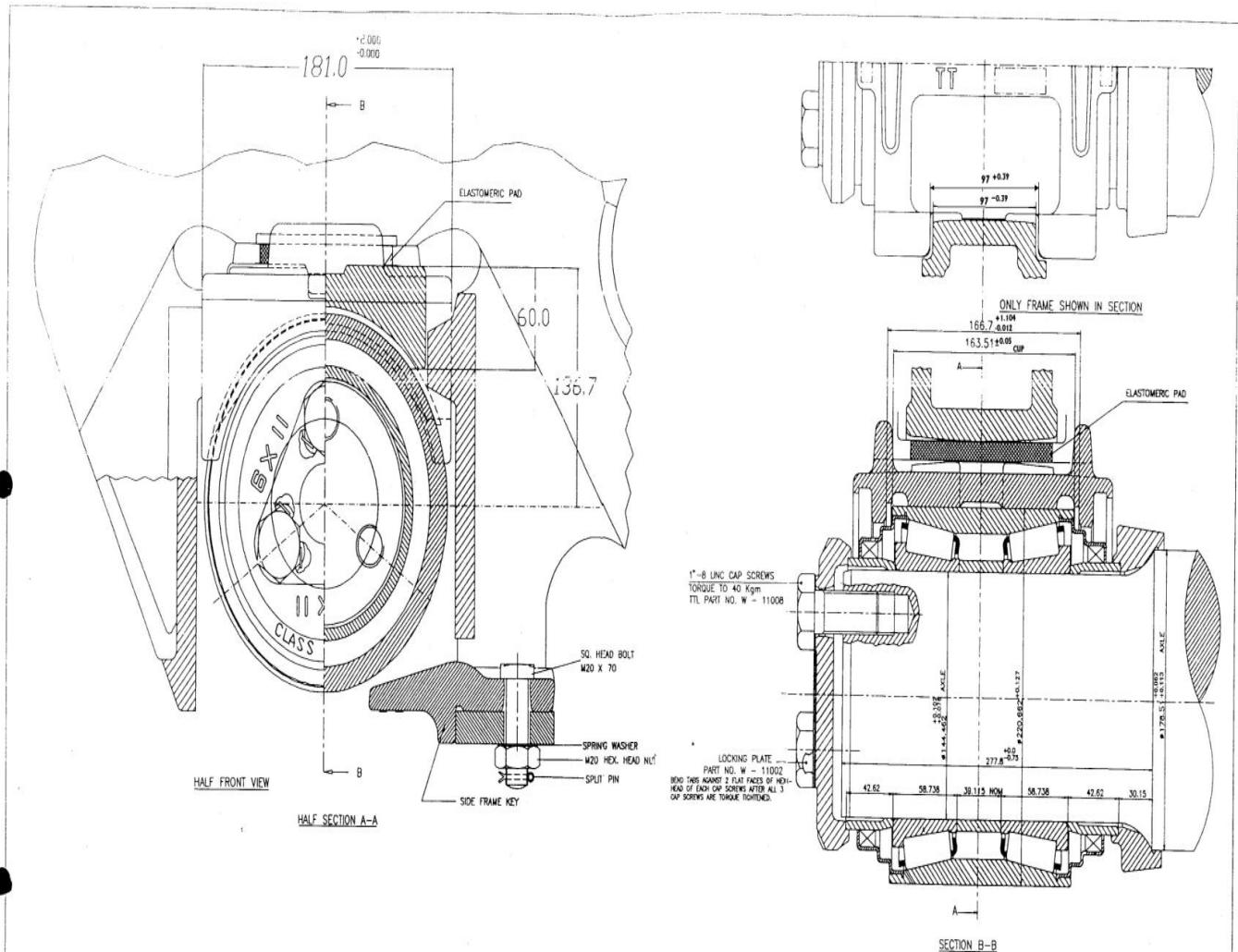
ANNEXURE- III A



ANNEXURE- III B
(Refer clause - 5.1 a)



ANNEXURE- IV
(Refer clause - 5.1 b)

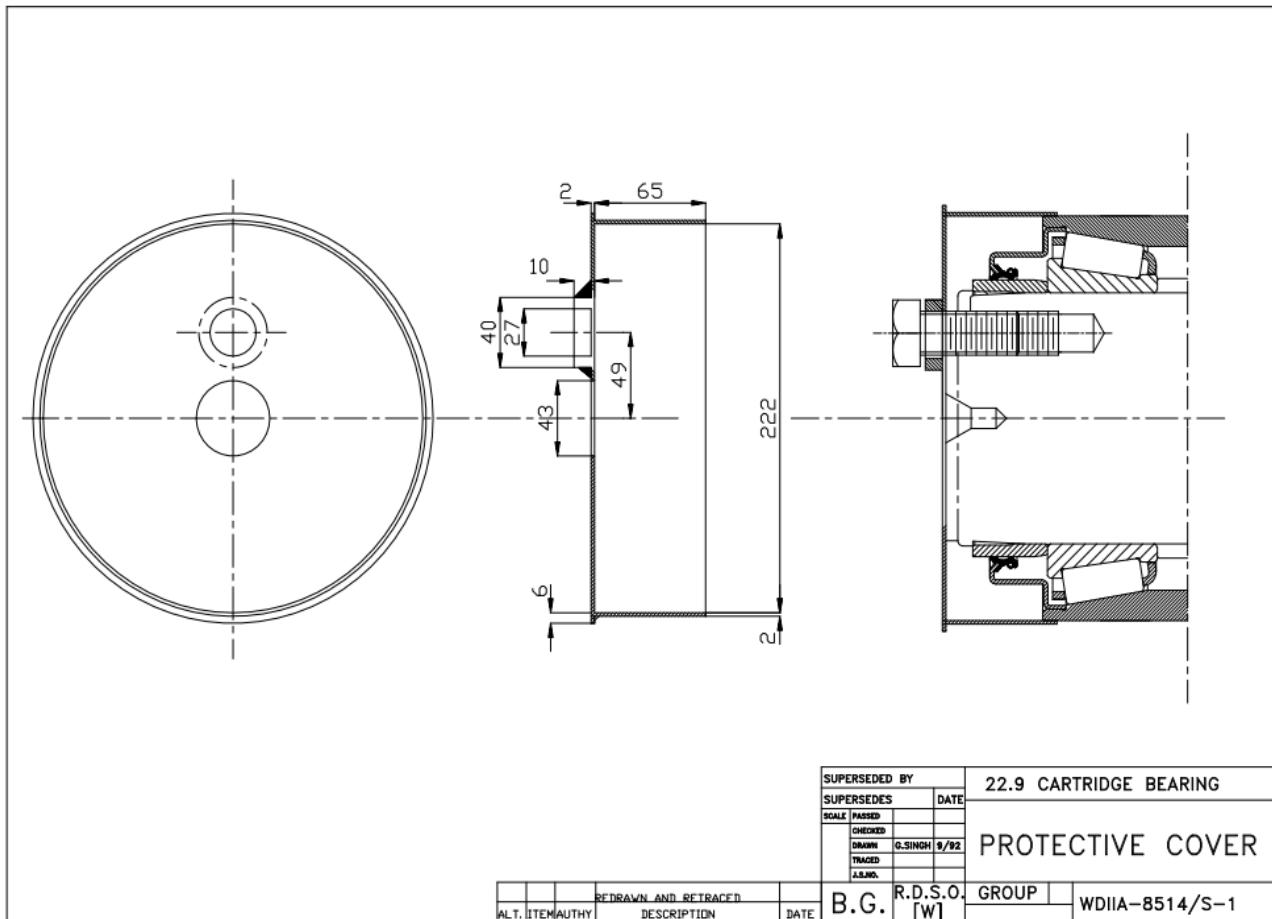


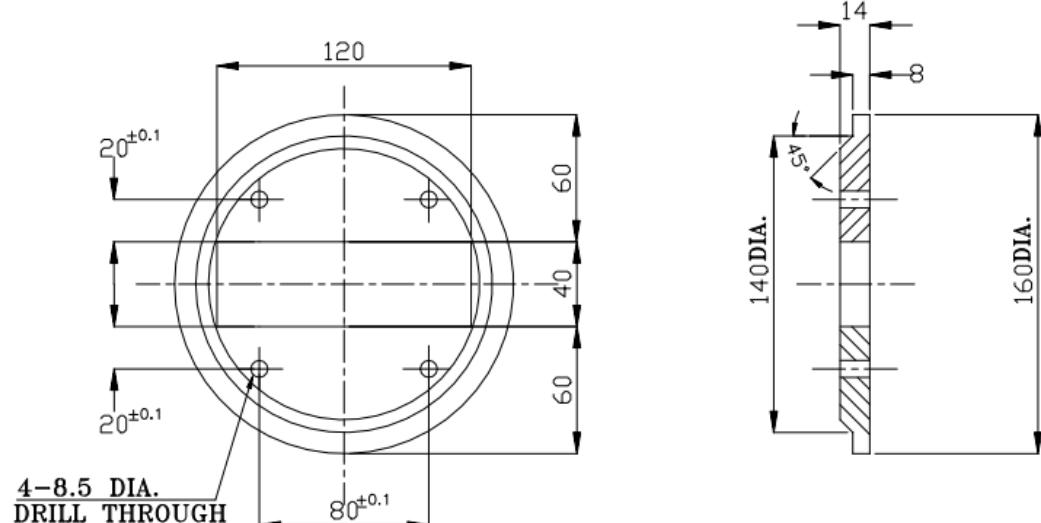
THIS DRG. SUPERSEDES ALL EARLIER DRGS.

METRIC

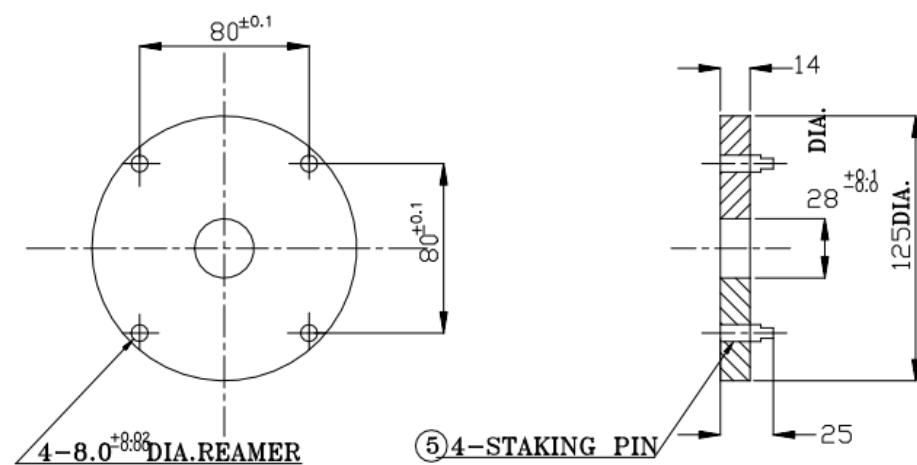
REV - D	DATE	REVISION	REMARKS	APPROVED BY	SPECIFICATION - C		GENERAL ARRANGEMENT
					PROJECTION	DESIGN SCALE	
	29.07.2000	REV.D	NOMINAL DIMENSION OF CUP OD CORRECTED AND TORQUE OF CAP SCREWS CHANGED TO 40 Kgm TOLERANCE OF WIDTH OF NARROW JAW ADAPTER CORRECTED	N.B.			
	27.07.2000	REV.C	NOMINAL DIMENSIONS OF CONE SPACER RING AND SEAL WARRING CORRECTED	N.B.			
	05.02.2000	REV.B	TEXT HEIGHTS ALTERED AND NOMINAL DIMENSIONS MATCHED WITH COMPONENT DRAWINGS TATA NAME REMOVED FROM SIDE VIEW	P.S.			
	28.09.99	REV.A	TITLE BLOCK CHANGED DUE TO CO. NAME CHANGE TO TIMKEN INDIA LTD.	A.D.			
					THIS DRAWING MUST NOT BE COPIED OR REPRODUCED WITHOUT THE CONSENT OF THE TIMKEN COMPANY		PA-GA 11100 REF. TIMKEN DRG. NO. E-34462 (ONLY FOR ENGINEERING)

ANNEXURE-V
(Refer clause – 7.2)

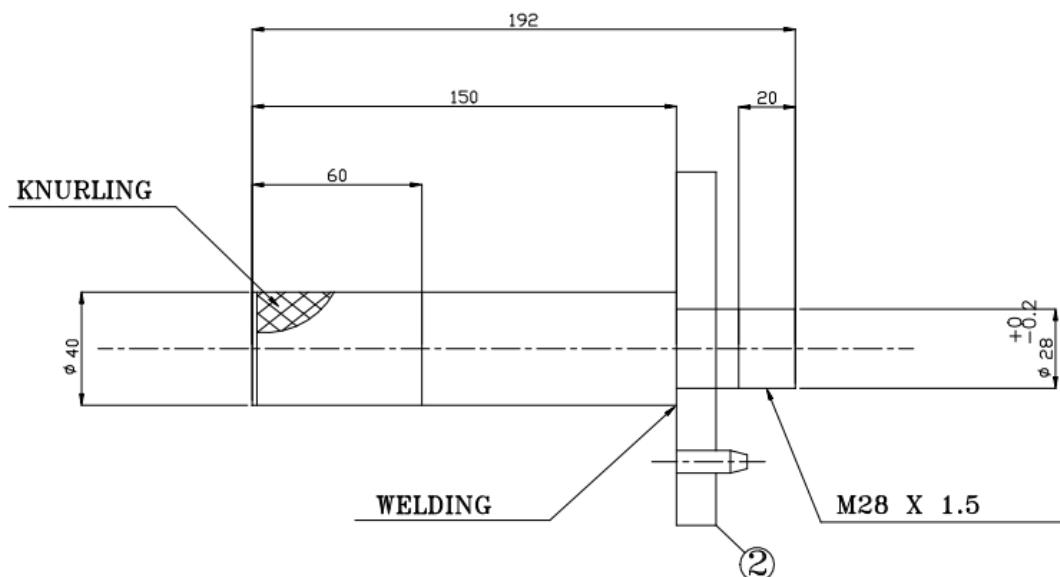
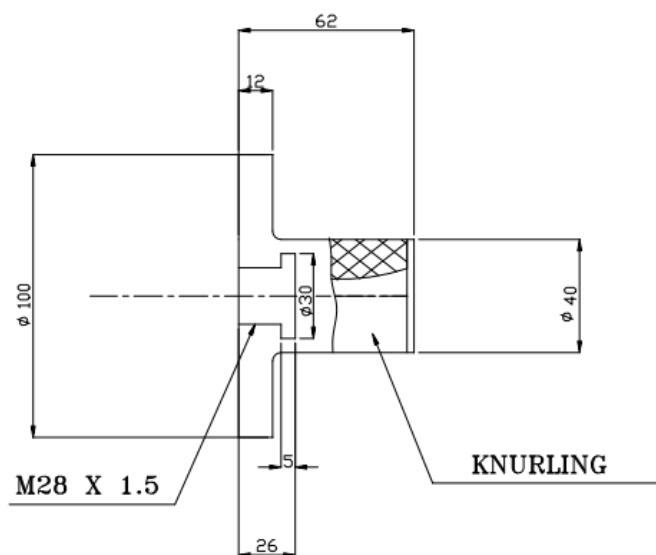
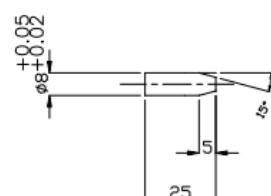


PART OF SEAL DISMOUNTING JIG

① HALF PLATE

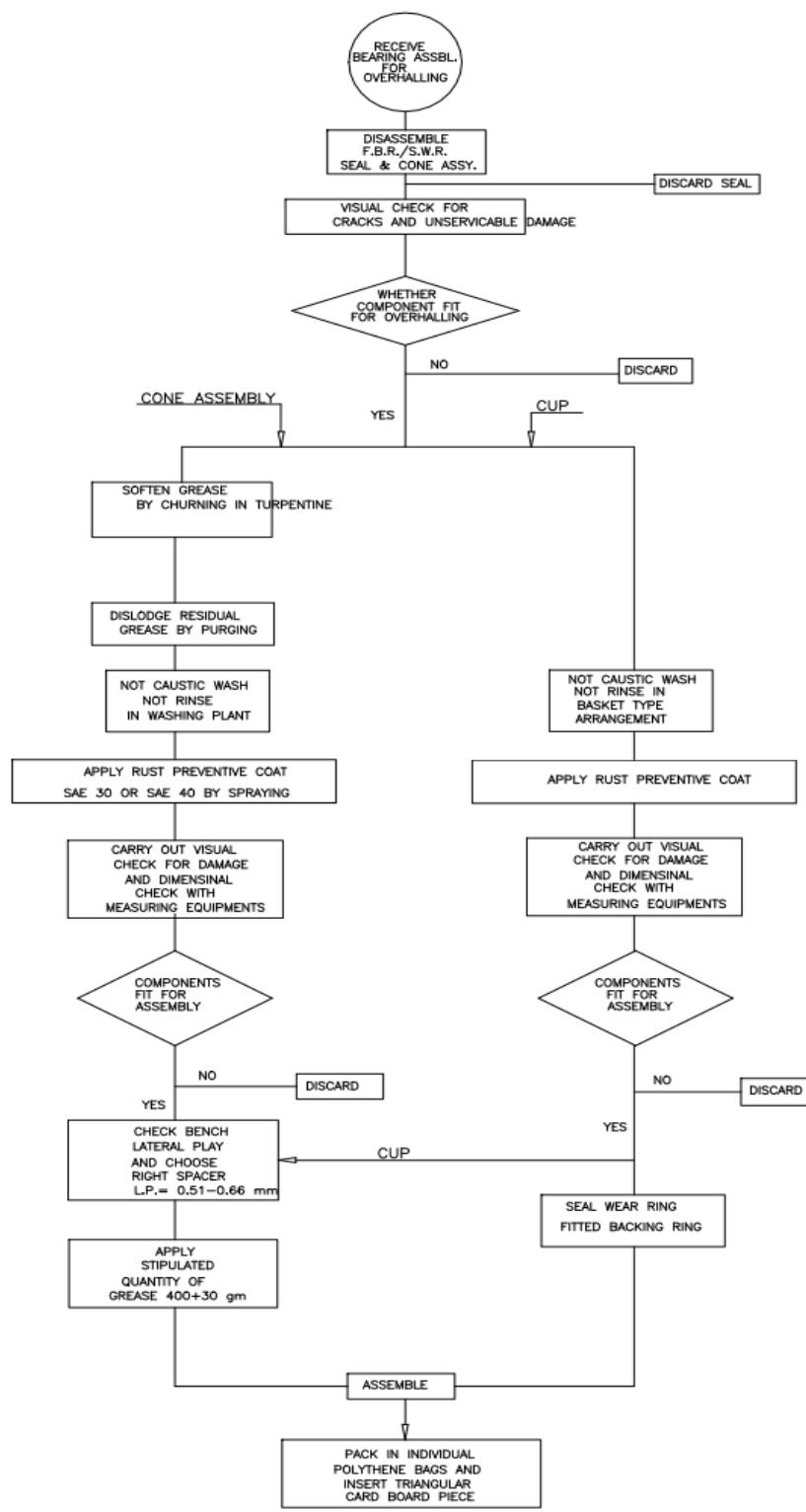


② PLATE

PARTS OF SEAL DISMOUNTING JIG③ BAR④ NUT⑤ PIN

PROCEDURE FLOW DIAGRAM FOR MAINTAINCE
OF 'AP' CLASS 'E' (6X11) AT
RAILWAY WORKSHOP

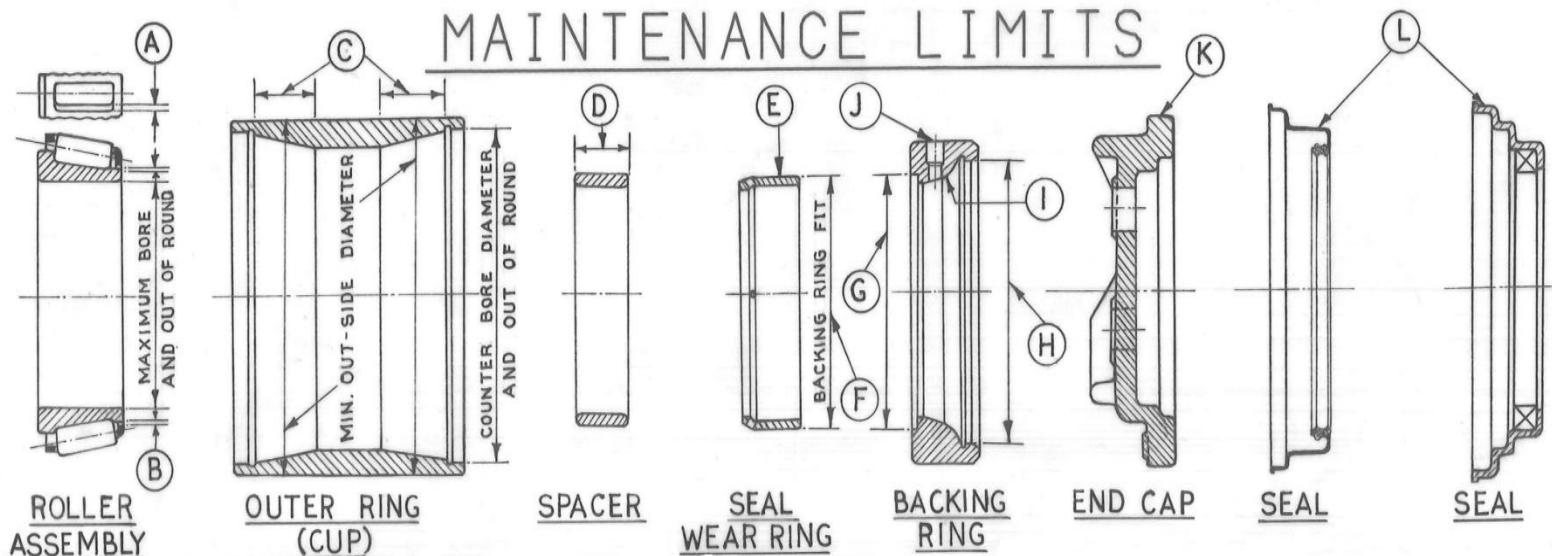
ANNEXURE- V 'C'
(Refer clause – 8.4)



SWR—SEAL WEAR RING
FBR—FITTED BACKING RING
L.P.—LATERAL PLAY IN mm

* HOT CAUSTIC SOLUTION SHOULD BE
PREPARED FROM GRANULAR CAUSTIC SODA
MIXED WITH WATER IN THE RATIO 0.6 OUNCE
PER GALLON & HEATED TO

ANNEXURE-VI
(Refer Clause – 8.5, 12)



NAME OF THE FIRM	AAR Approval No. (as on April - 2011)	Diameters are averages						AMOUNT OF GREASE gram(oz.)			
		ROLLERASSEMBLY		OUTER RING/CUP			BACKING RING				
		MAX. BORE mm (inch)	OUT OF ROUND mm (inch)	MINIMUM O.D. mm (inch)	MAXIMUM C. BORE mm (inch)	MINIMUM C. BORE mm (inch)	OUT OF ROUND mm (inch)	MAXIMUM C. BORE mm (inch)	EACH ROLLER ASSEMBLY	AROUND SPECER	TOTAL QUANTITY ± 30gm
TIMKEN	1A	144.488 (5.6885)	0.076 (0.003)	220.345 (8.675)	209.677 (8.255)	209.423 (8.245)	0.127 (0.005)	178.511 (7.028)	115 (4)	170 (6)	400 (14)
BRENCO/ NBC	5A	144.488 (5.6885)	0.076 (0.003)	220.345 (8.675)	209.677 (8.255)	209.423 (8.245)	0.127 (0.005)	178.511 (7.028)	115 (4)	170 (6)	400 (14)
FAG	32	144.488 (5.6885)	0.076 (0.003)	220.345 (8.675)	209.677 (8.255)	209.423 (8.245)	0.127 (0.005)	178.511 (7.028)	115 (4)	170 (6)	400 (14)
SKF	23	144.488 (5.6885)	0.076 (0.003)	220.345 (8.675)	209.677 (8.255)	209.423 (8.245)	0.127 (0.005)	178.562 (7.030)	115 (4)	170 (6)	400 (14)
ALL DIAMETERS ARE THE AVERAGE OF 3 MEASURMENTS, 60° APART											

CAGE INSPECTION/CAGE WEAR :-

PLACE ROLLER ASSEMBLY ON BACK FACE (LARGE DIA. FACE) WHEN CHECKING CLEARANCES.

(A) IF THE ROLLER POCKET OF THE CAGE IS WORN TO THE EXTENT THAT A **1.5 mm (0.06")FEELER** GAUGE CAN BE INSERTED BETWEEN THE ROLLER AND THE CAGE BRIDGE, THE ROLLER ASSEMBLY SHOULD NOT BE RETURNED TO SERVICE.

FOR KOYO BEARING THE ACCEPTABLE DIMENSION **IS 2.0mm (0.08")**.

(B) MEASURE THIS CLEARANCE USING TWO SETS OF FELLER GAUGES. INSERT THE FEELER GAUGES BETWEEN THE SMALL RIB AND CAGE FLANGE AT TWO LOCATIONS DIAMETRICALLY OPPOSITE. IF TOTAL OF THE TWO SETS OF FEELER GAUGES IS **2.3mm (0.09")** OR MORE, THE ROLLER ASSEMBLY SHOULD NOT BE RETURNED TO SERVICE.

(C) **OUTER RING (CUP):**-MINIMUM O.D. TO BE MESURED IN ADAPTER PAD WEARS AREAS. IF THE OUTER RING IS DISTORTED IN THE AREA OF THE COUNTER BORE A CLOSE VISUAL INSPECTION OF THE INSIDE AND OUTSIDE SURFACES IS REQUIRED. OUTER RING THAT HAS HAIR LINE CRACKS MUST BE SCRAPPED.

(D) **SPACER WIDTH-BENCH LATERAL:** - A SPACER MUST BE SELECTED TO PROVIDE BENCH LATERAL AS SPECIFIED BELOW.

(E) **SEAL WEAR RING LIMIT:-** IF THE OUT SIDE SURFACE OF THE SEAL WEAR RING IS CRACKED OR SCRATCHED OR IF THE LIP CONTACT HAS WORN TO A DEPTH OF 0.13mm (0.005") i.e. 0.26mm (0.010") ON DIA., THE SEAL WEAR RING SHOULD BE SCRAPPED.

(F) **SEAL WEAR RING – FIT IN BACKING RING:** - THE SEAL WEAR RING MUST HAVE A TIGHT FIT IN THE BACKING RING COUNTERBORE.

(G) **BACKING RING – FIT ON THE SEAL WEAR RING:** - THE COUNTER BORE OF THE BACKING RING MUST HAVE A TIGHT FIT ON THE SEAL WEAR RING. SCRAP BACKING RING WHICH ARE BENT OR DISTORTED.

BACKING RING – SIZE AND RADIUS (FITTED) :-

(H) CHECK BRAKE OUT DIAMETER.

(I) CHECK BORE RADIUS FOR EXCESSIVE CORROSION. LIGHT PITTING AND RUSTING IS ACCEPTABLE.

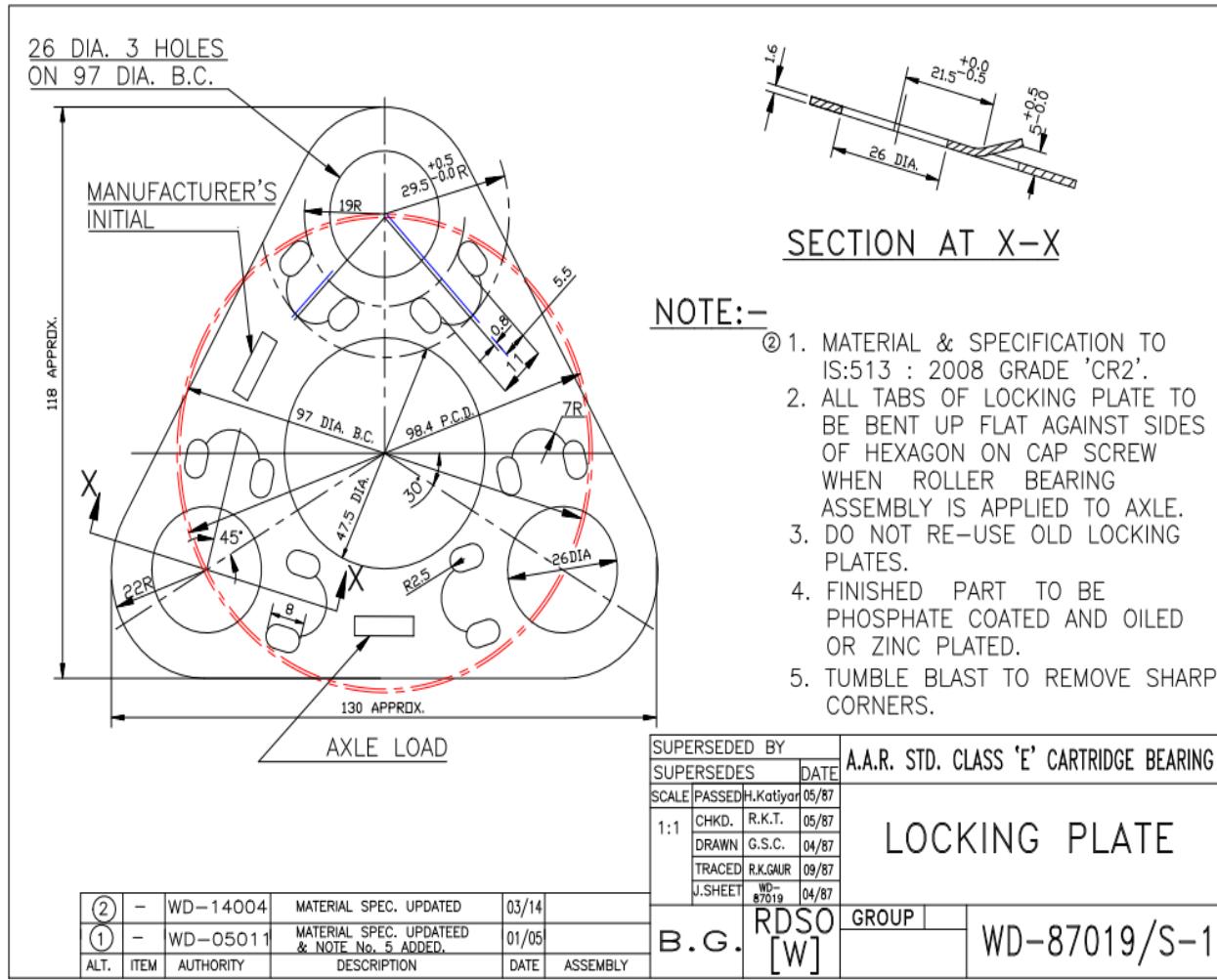
(J) **END CAP:** -INSPECT FOR CRACKS, BREAKAGE, WEAR OR DISTORTION.

(K) **SEAL:**-SCRAP ALL USED SEALS AND REPLACE WITH NEW SEALS.

Power Equipment mm (in.)	Driven mm (in.)	Hand Operated Equipment mm (in.)
0.58 -0.74 (0.023" - 0.029")		0.51- 0.66 (0.020" - 0.026")

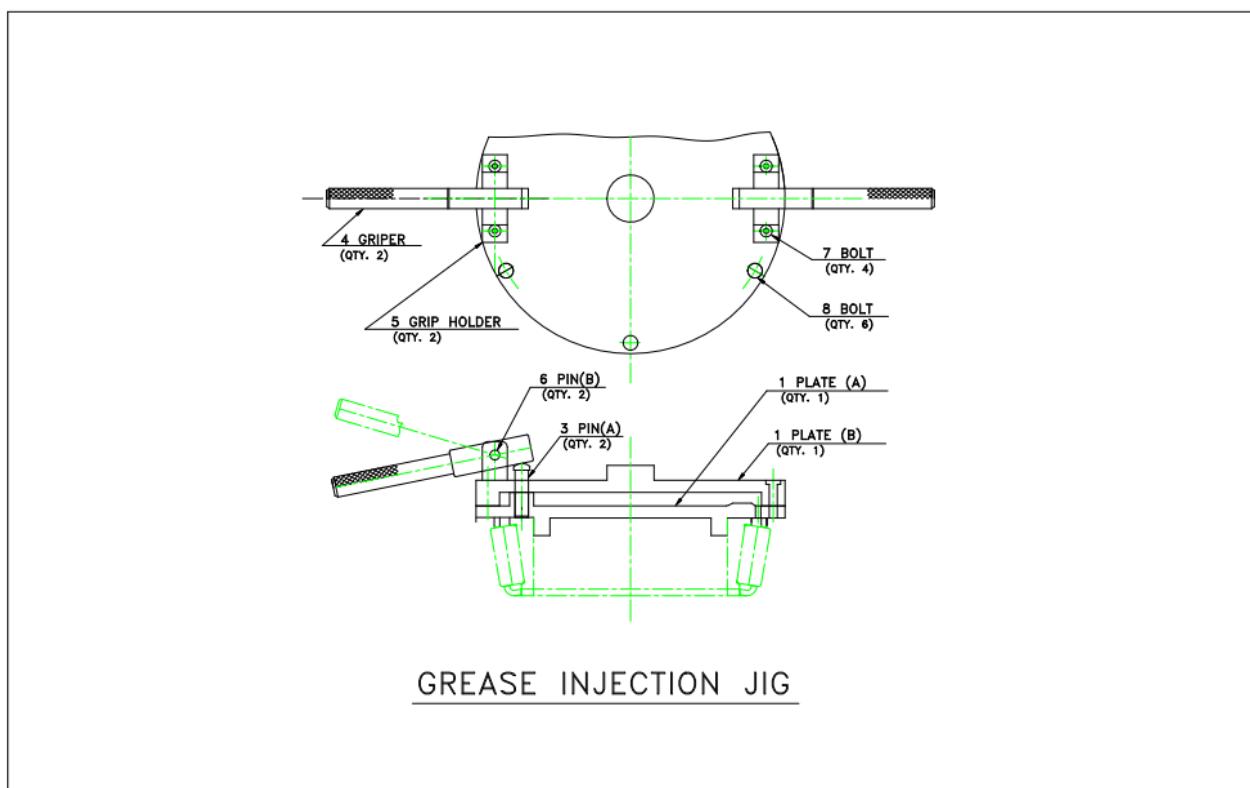
IF THE BEARING BENCH LATERAL IS NOT WITHIN THE ABOVE LIMITS THE CONE SPACER SHOULD BE GROUND OR A NEW CONE SPACER SELECTED TO PROVIDE THE SPECIFIED BEARING BENCH LATERAL.

ANNEXURE-VII
(Refer clause 8.5.11, 10.4)



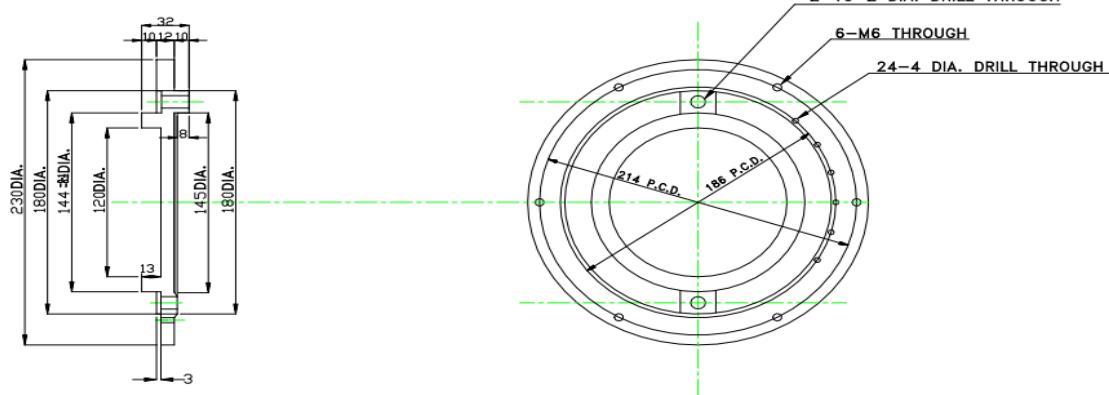
WD2dra/WD87019s1

ANNEXURE- VIII
(Refer clause 8.7.2)

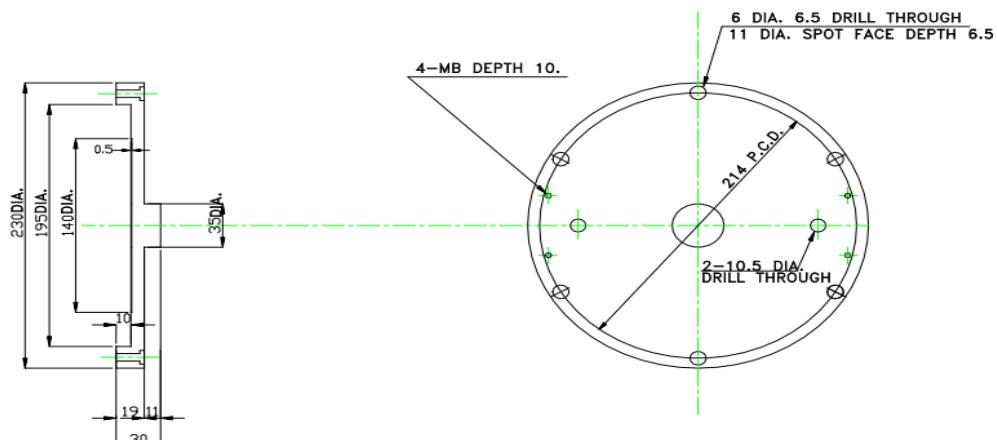


ANNEXURE- IX
(Refer clause 8.7.2)

PARTS OF GREASE INJECTION JIG.(1)

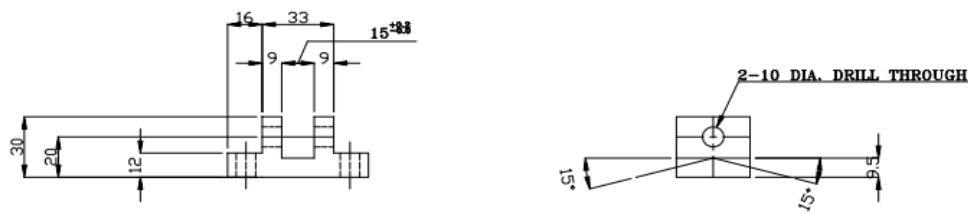
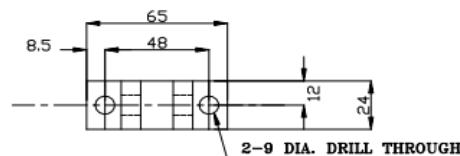
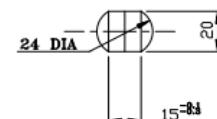
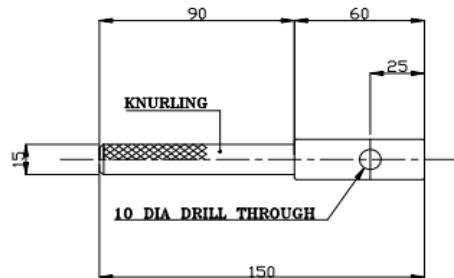
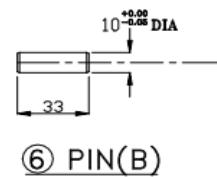
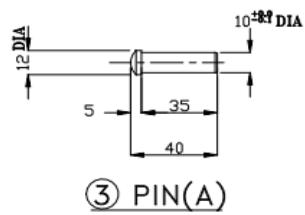


① PLATE (A)

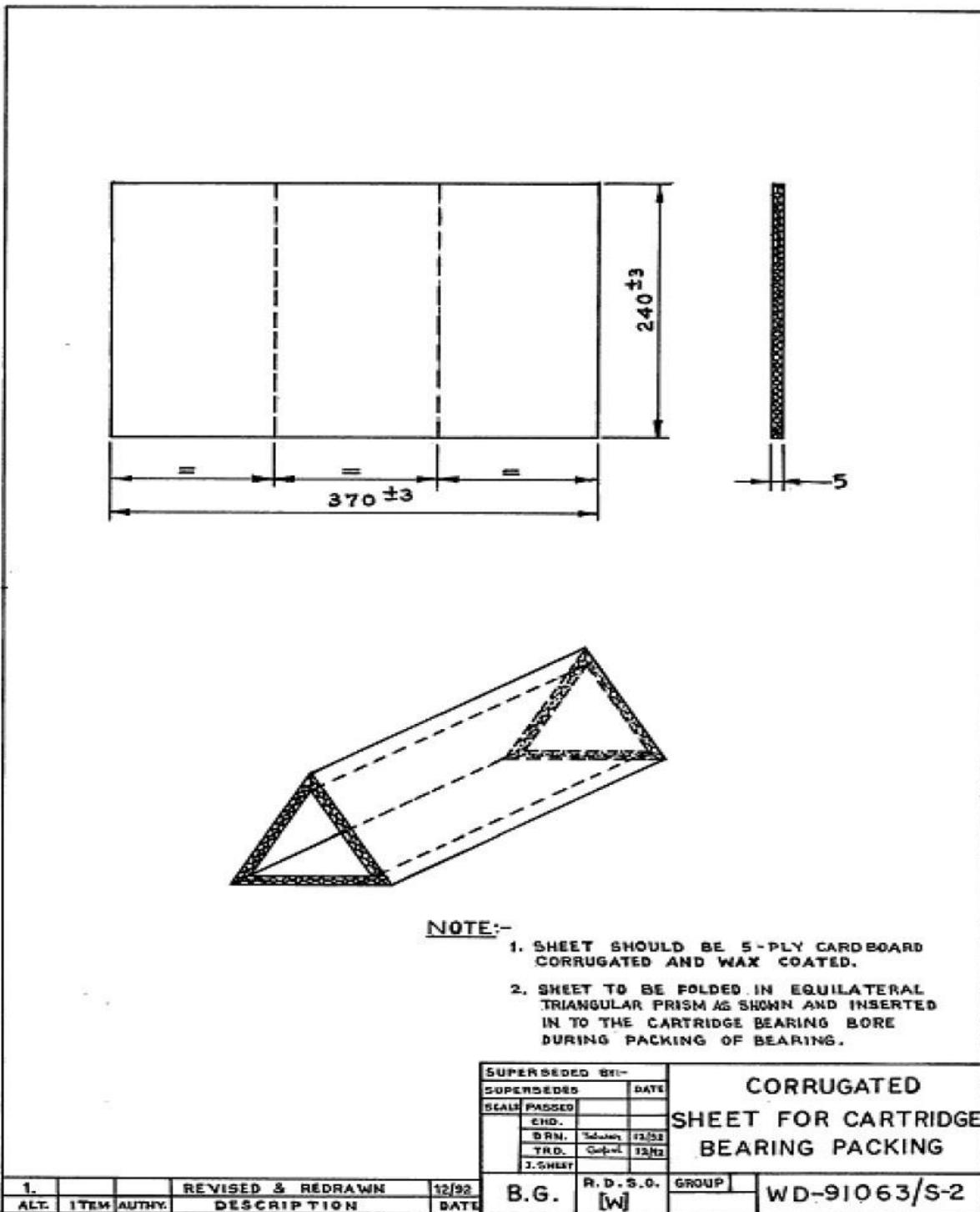


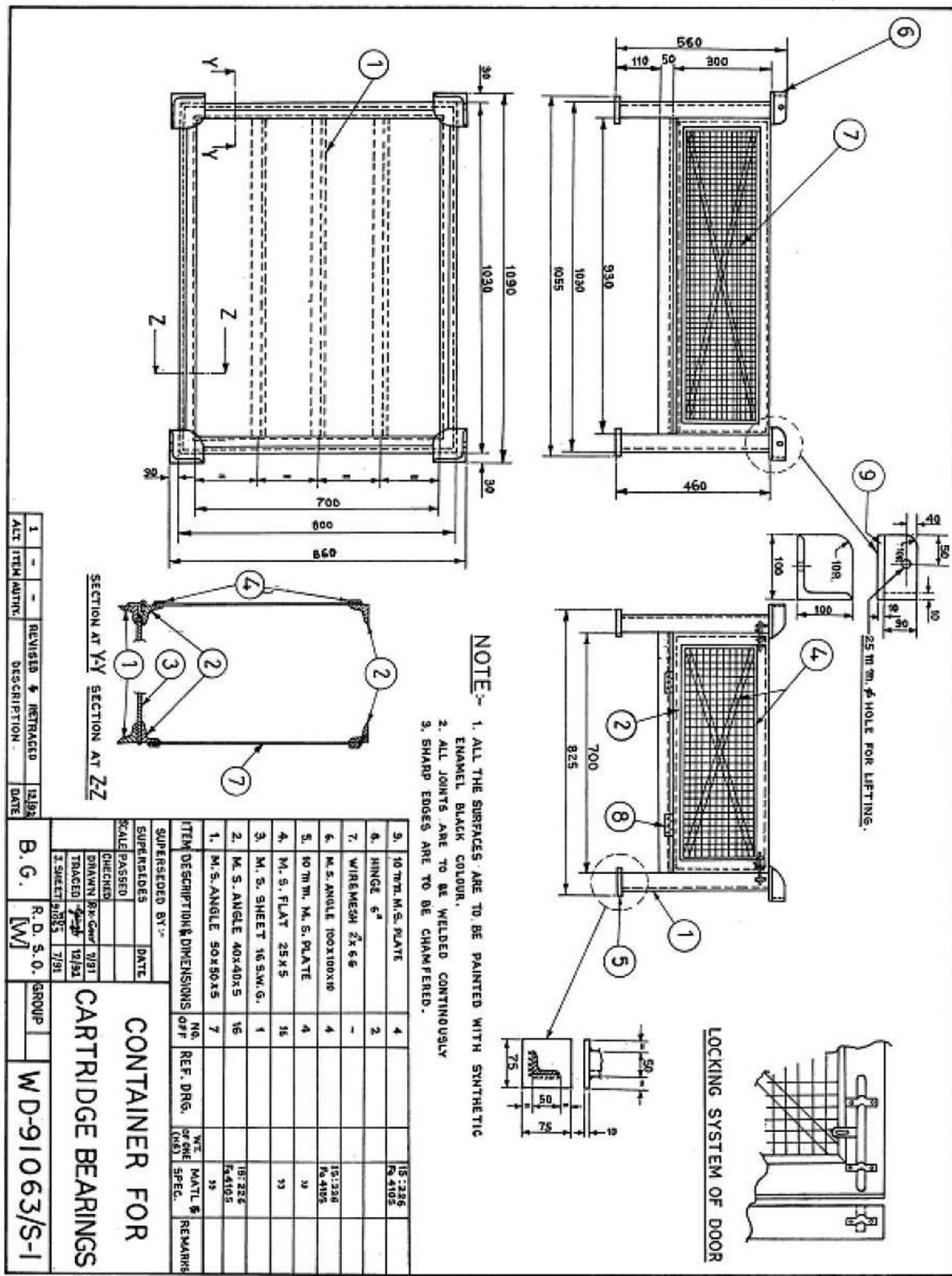
② PLATE (B)

PARTS OF GREASE INJECTION JIG (2)



ANNEXURE- XI
(Refer clause 9)



ANNEXURE- XII
(Refer clause 9)

ANNEXURE- XIII
(Refer Clause – 13)

Government of India
Ministry of Railways
Research Design & Standards Organisation
Manak Nagar, Lucknow – 226 011



भारत सरकार – रेल मंत्रालय
अनुसंधान अभिकल्प और मानक संगठन
मानक नगर, लखनऊ – 226011

टेलीफोन : (0522) – 2465744
फैक्स : (0522) – 2452494

dswbdrdso@gmail.com

No. : MW.RB.Genl

Dated : 09/07/2012

10

As per enclosed list

Sub : Interchangeability of Cup and Cone of same make while overhauling of CTRBs in Railway Workshops.
Ref : Para 2.1 of Railway Board's letter no.2009/MW/814/Safety/Pt. dated 07/05/2012.

Railway Board vide their letter quoted above have instructed RDSO to clarify whether Cup and Cone of same make can be used interchangeably while overhauling of CTRBs in Railway Workshops.

The issue has been studied in consultation with wagon workshops and OEMs. It is found that the volumes of cups and cones of CTRBs being overhauled in workshops make it extremely difficult to maintain them as a single unit throughout the overhauling process. Further, rejection of any of these components also leads to the single unit concept being disrupted.

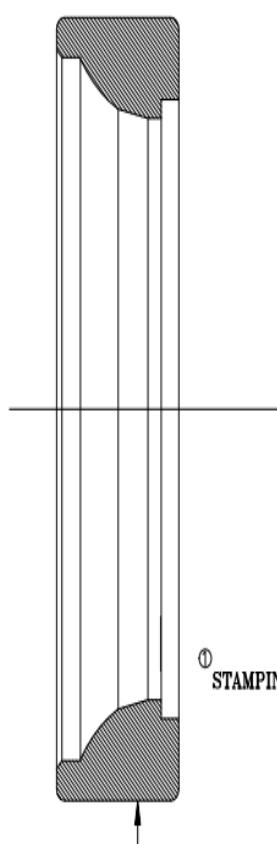
Based on the above deliberations, it is advised that Cup and Cones **of the same make** may be provided in overhauled CTRBs. To the extent possible, it may be ensured that cup and cones used in the same CTRB are of similar age profile.

09/07/12
(Anirudh Kumar)
Director (Wagon)
For Director General (Wagon)

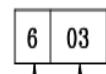
Circulation:

1. **EDME (Freight)** : For kind information please.
**Railway Board, Rail Bhawan,
New Delhi – 110 001**
2. **EDME (W)** : For kind information please.
**Railway Board, Rail Bhawan,
New Delhi – 110 001**
3. **Executive Director, CAMTECH** : For kind information please.
Maharajpur, Gwalior (M.P.) – 474 005
4. **The Chief Mechanical Engineer:**
 1. Central Railway, C.S.T., Mumbai – 400 001
 2. Eastern Railway, Fairlie Place, Kolkata – 700 001
 3. East Central Railway, Hajipur – 844 101
 4. East Coast Railway, Rail Vihar, B – 2, Chandrashekherpur, Bhubaneswar – 751 023
 5. Northern Railway, Baroda House, New Delhi – 110 001
 6. North Central Railway, Subedargunj, Allahabad – 211 011
 7. North Eastern Railway, Gorakhpur – 281 001
 8. Northeast Frontier Railway, Maligaon, Guwahati – 781 001
 9. North Western Railway, Near Jawahar Circle, Jaipur – 302 017
 10. Southern Railway, NGO Annexe, Park Town, Chennai – 600 003
 11. South Central Railway, Rail Nilayam, Secunderabad – 500 371
 12. South Eastern Railway, Garden Reach, Kolkata – 700 043
 13. South East Central Railway, RE Office Complex, Bilaspur – 495 004
 14. South Western Railway, Club Road, Keshwapur, Hubli – 560 023
 15. West Central Railway, Opposite Indira Market, Jabalpur – 482 001
 16. Western Railway, Churchgate, Maharishi Karve Marg, Mumbai – 400 020
5. **The Chief Works Manager:**
 1. Eastern Railway Workshop, Liliuah, District: Howrah (West Bengal) – 711 204
 2. Eastern Railway Workshop, Jamalpur, District: Munger (Bihar) – 811 214
 3. Mechanical Workshop, East Central Railway, Samastipur (Bihar) – 848 101
 4. Mechanical Workshop, Northern Railway, Civil Albert Road, Amritsar (Punjab) – 143 001
 5. Mechanical Workshop, Northern Railway, Jagadhari, District: Yamunanagar (Haryana) – 135 002
 6. Wagon Repair Workshop, North Central Railway, Jhansi (U.P.) – 248 003
 7. Loco Workshop, North Western Railway, Lal Phatak, Ajmer (Rajasthan) – 305 001
 8. Carriage & Wagon Workshop, Southern Railway, Perumbur (Tamil Nadu) – 600 023
 9. Central Workshops, Golden Rock (Ponmalai), Tiruchirapalli (Tamil Nadu) – 620 004
 10. Wagon Workshop, South Eastern Railway, Kharagpur (West Bengal) – 721 301
 11. Wagon Repair Workshop, South East Central Railway, Raipur (Chhattisgarh) – 490 015
 12. Wagon Repair Workshop, West Central Railway, Kota (Rajasthan) – 324 002
 13. Wagon Repair Workshop, South Central Railway, Guntupalli (A.P.) – 521 241
 14. Western Railway Workshop, Freelanganj, Dahod, District: Panchmahal (Gujarat) – 389 160
 15. Western Railway Workshop, Pratap Nagar, Vadodara (Gujarat) – 390 004
 16. Carriage & Wagon Workshop, North East Frontier Railway, New Bongaigaon (Assam) - 798 381

ANNEXURE- XIV
 (Refer Clause – 14)



MARKING DETAILS



MONTH



YEAR

WORKSHOP CODE

① STAMPING SHALL BE LEGIBLE AND DONE IN 20 mm LETTERS AND NUMBERS

MARKING LOCATION.

BACKING RING

SURFACE ROUGHNESS VALUE TO IS:3073	Gr.NUMBER	N1 N2 N3 N4 N5 N6 N7 N8 N9 N10 N11 N12													
		Ra _{um}	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50		
		①	WD-14003										①	1) TITLE BLOCK DESCRIPTION MODIFIED 2) MARKING NOTE MODIFIED	03/14
	SYMBOL	WWW	WWW	VV	V	✓	ALT. ITEM	ITEM AUTHORITY	DESCRIPTION	DATE	ASSEMBLY DRG.		B.G. [W]	R.D.S.O. GROUP	WD-03034/S-1

SUPERSEDED BY		DATE
SUPERSEDES		
SCALE	PASSED	Turn.Js 06/93
	CHECKED	Manu. 06/93
	DAWN	Gepl. 06/93
	TRACED	
	A.S.N.	WD-03034 06/93

MARKING OF OVERHAULING PARTICULARS ON BACKING RING OF CTRB

ANNEXURE- XIV 'A'
(Refer Clause – 14)

No. : 2015/M (N)/951/32

रेल भवन, नई दिल्ली- 110001, तिथि
Rail Bhavan, New Delhi-110001, dated: 04/10/2017

The Chief Mechanical Engineers
All Indian Railways

Sub: Marking of overhauling particulars of CTRB
Ref: This office letter of even number dated 12/01/2017

For the purpose of ensuring proper inspection and timely withdrawal of due overdue CTRBs from service, instructions have been issued from time to time the latest being through letter under reference. Based on the feedback from ROH depots and POH workshops, it has been noticed that a significant no. of CTRBs are reaching shops with residual service period before next overhauling of 18 months or more. On the other hand, ROH depots are receiving CTRBs, which have no residual service period left. Workshops therefore, are required to undertake additional overhauling of CTRBs and the ROH depots need to make associated logistics arrangements, for replacing the due/overdue CTRBs during ROH.

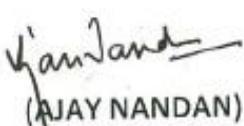
It is seen that the opportunity for finding out the last overhauling data is available only when end cap has been opened for removal of UST and wheel turning in the ROH depots and once the end cap has been fitted after wheel turning, there is no reliable way to find out the correct last overhauling data.

In order to ensure easy identification of approximate residual service period of the CTRB before the next overhauling, the following methodology needs to be followed:

- a) During POH end caps screws are a must change item. The end cap screws fitted by POH workshops should be fitted **without any painting on their heads**. This should ensure that any end cap with unpainted cap screws in service indicates that the CTRB is within the first ROH cycle after its overhauling.
- b) During the first ROH, **one of the CTRB end cap screws head** shall be required to be painted with golden yellow colour on its head. This would indicate during the service that the CTRB has crossed one ROH cycle from its last overhauling.
- c) Similarly, during the second ROH, **one additional cap screw** will be painted yellow on the head so that it has two cap screws painted yellow. This should indicate that the CTRB has crossed two ROH cycles from its last overhauling.
- d) In certain wagon types, where there are 3 ROH schedules prescribed during the first POH cycle. In such wagons, during the third ROH, the 3rd cap screw shall also be painted yellow to indicate that the CTRBs have crossed the 3rd ROH. This shall be applicable to new CTRBs fitted in new wheels which are received in new wagons.

- e) Since during wheel turning & UST, the wheels are moving on shed floor of ROH depot without end cap, ROH depots would need to make suitable temporary markings on wheels, so as to identify the ROH status of the CTRBs fitted on them.
- f) While fitting CTRBs back into a wagon in ROH depots, it must be ensured that **ONLY** CTRB with cap screws having one particular type of painting scheme (One cap screw painted/two cap screw painted/ three cap screw painted) are strictly placed under a wagon undergoing ROH.
- g) Wagons undergoing last ROH before their next POH should be fitted with CTRBs with two/three (as the case may be) end cap screws painted yellow.
- h) The existing instructions regarding CTRB of BCN and other wagon classes having 2 year ROH and 6 year POH cycle being fitted into the same group during ROH shall continue to be followed.
- i) The NTXR concerned shall be making sample checks to ascertain whether the marking on caps screw is strictly being done in terms of above directives and fitment on wagons with different type of CTRB is as per the above scheme.

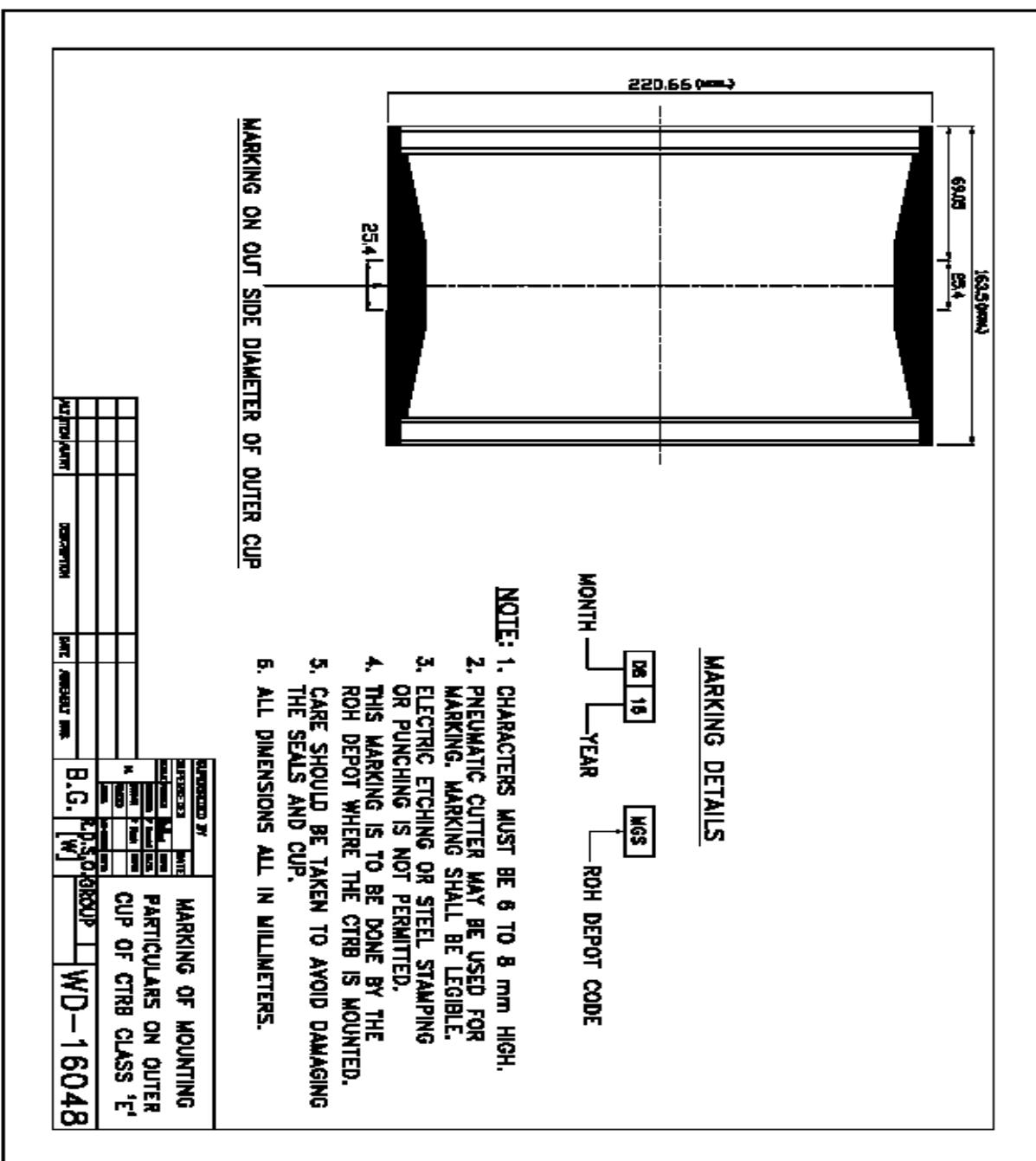
It is advised that the above instructions be implemented w.e.f. 01.11.2017.


(AJAY NANDAN)
Exec. Director Mech. Engg. (Frt)
Railway Board

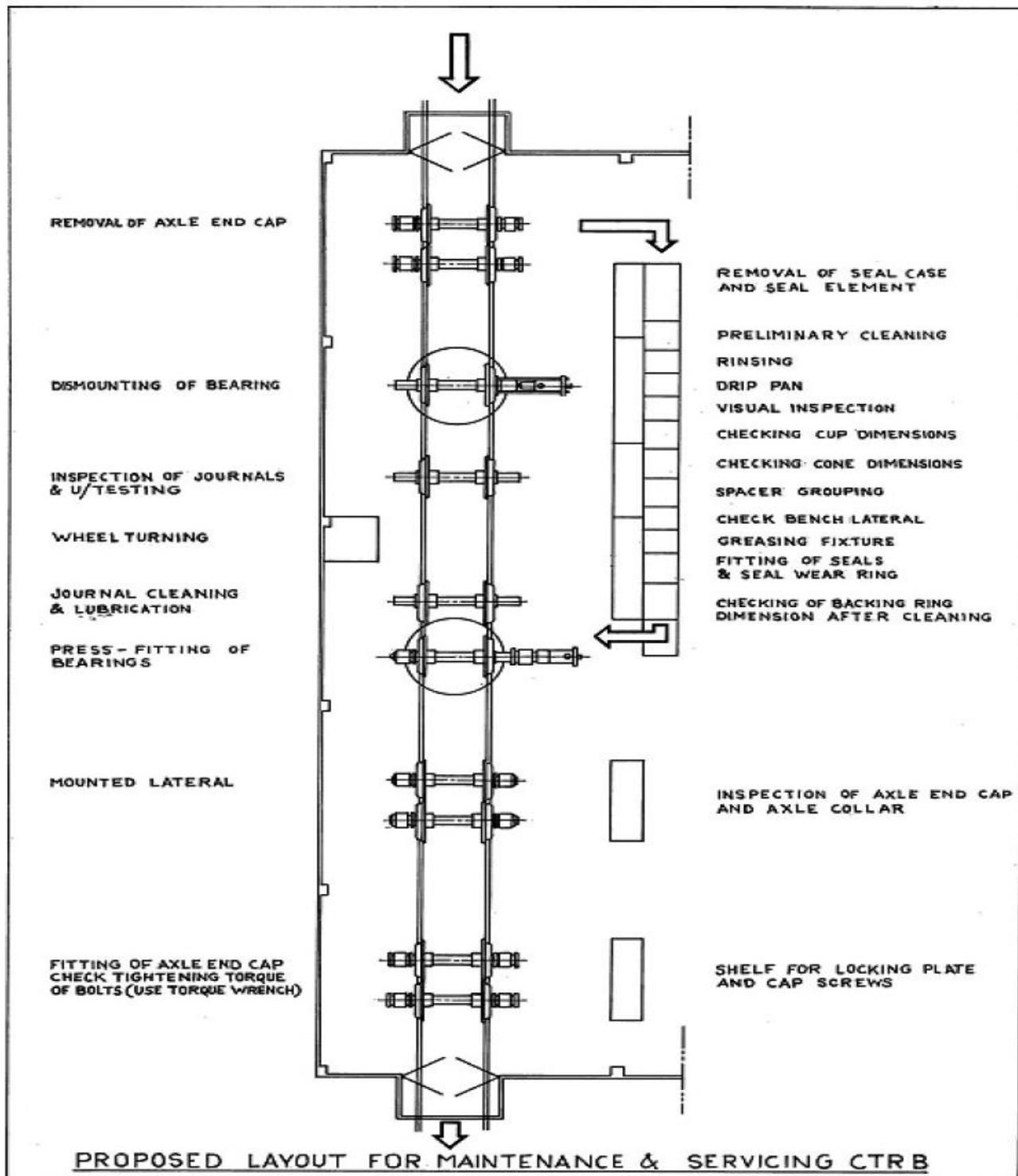
Copy:

1. ED (Wagon), RDSO : For inclusion of the above in G 81
2. ED/CAMTECH : For updating Wagon Maintenance Manual
3. NCO/IRCA : For ensuring compliance

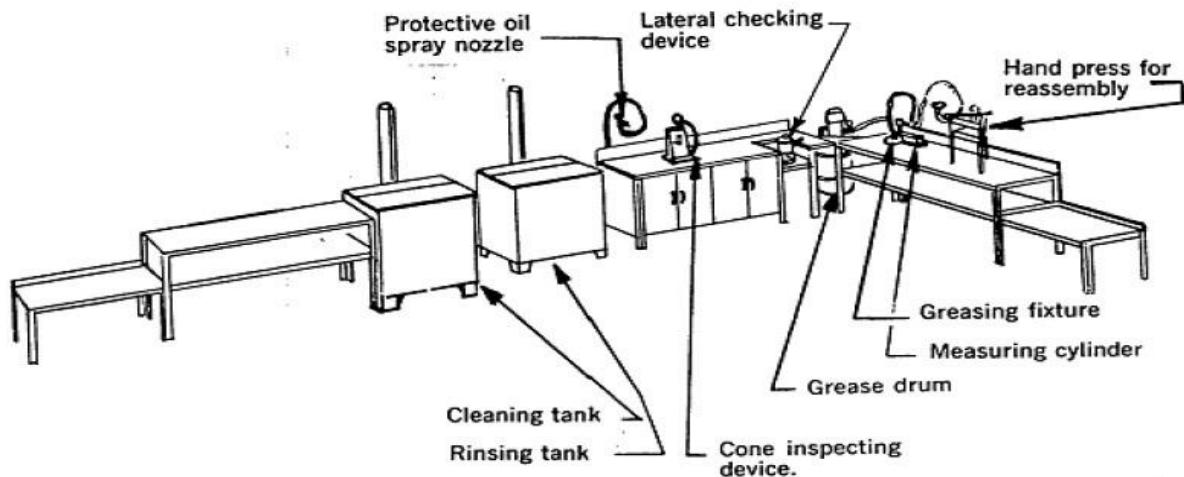
ANNEXURE- XIV ‘B’ (Refer Clause – 14)



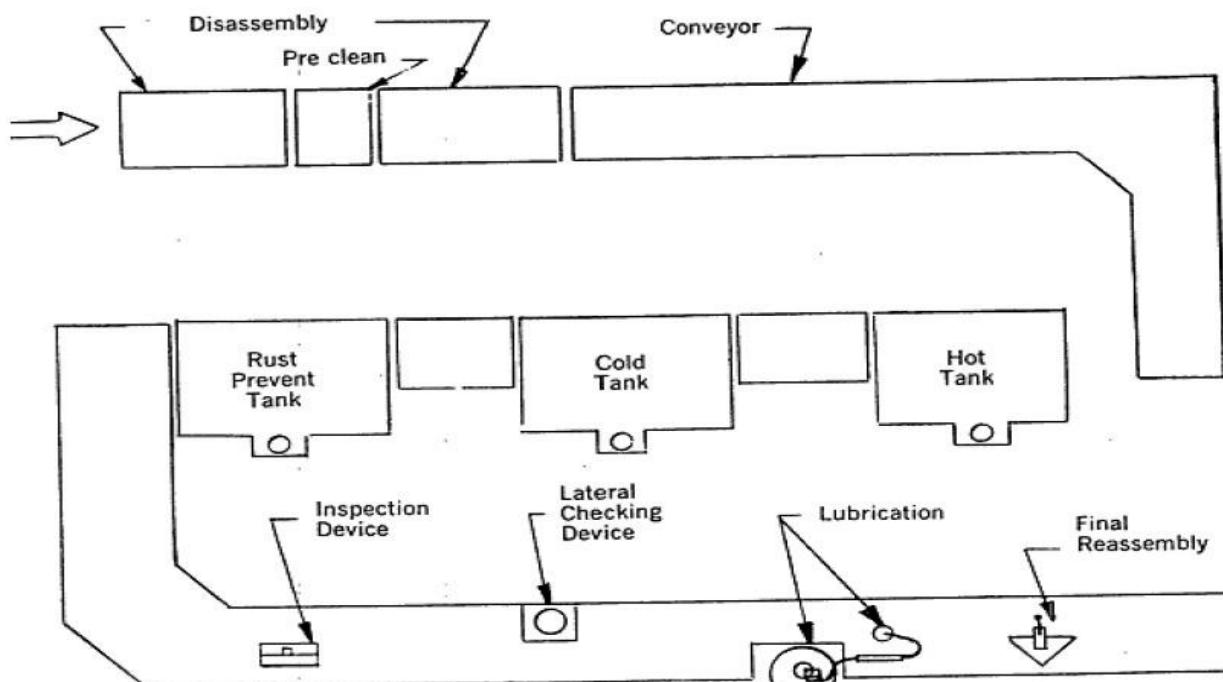
ANNEXURE- XV
(Refer clause 15)



ANNEXURE- XVI
(Refer clause 15)



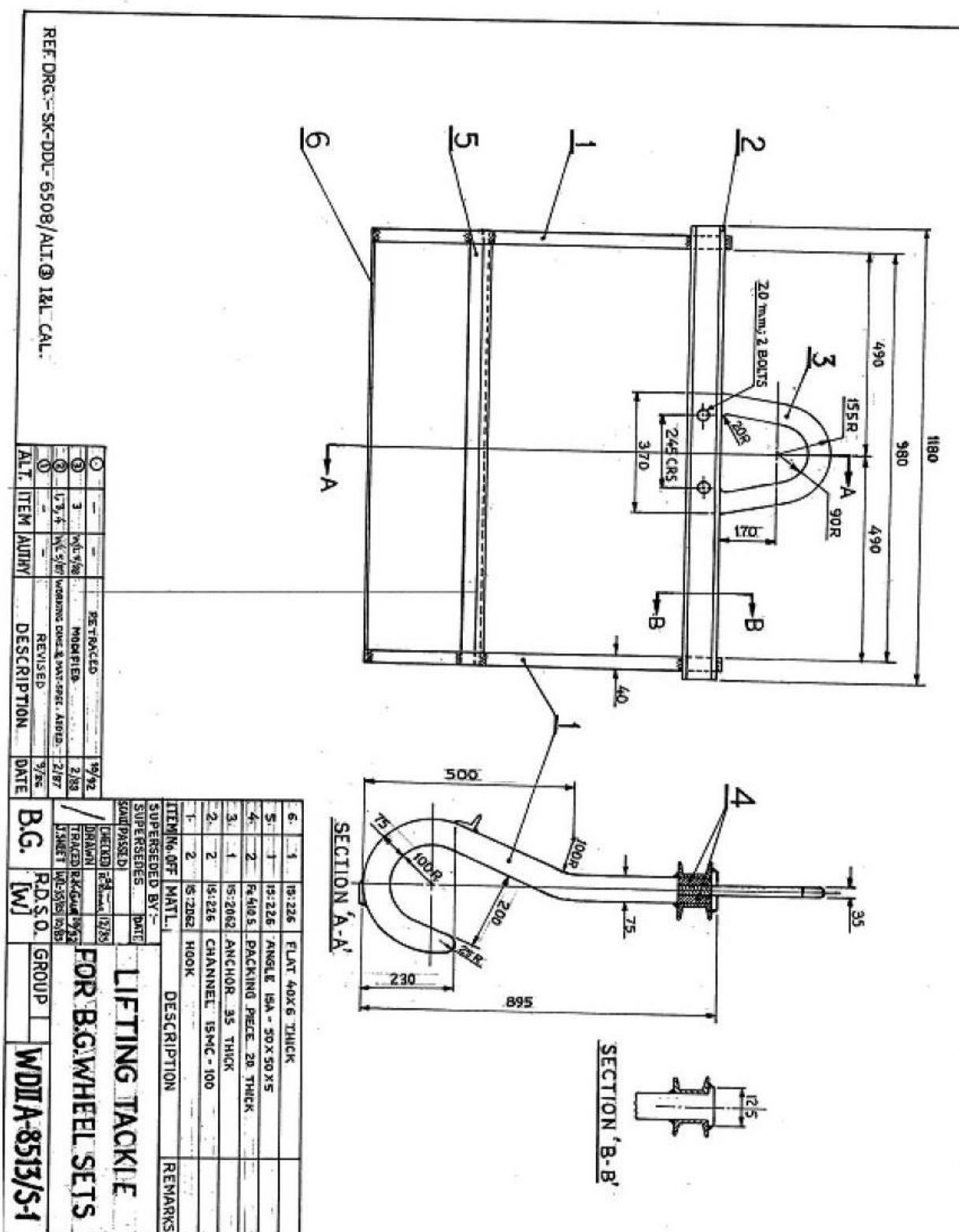
TYPICAL SMALL SHOP LAY OUT (RECOMMENDED)



TYPICAL LARGE SHOP LAY OUT (RECOMMENDED)

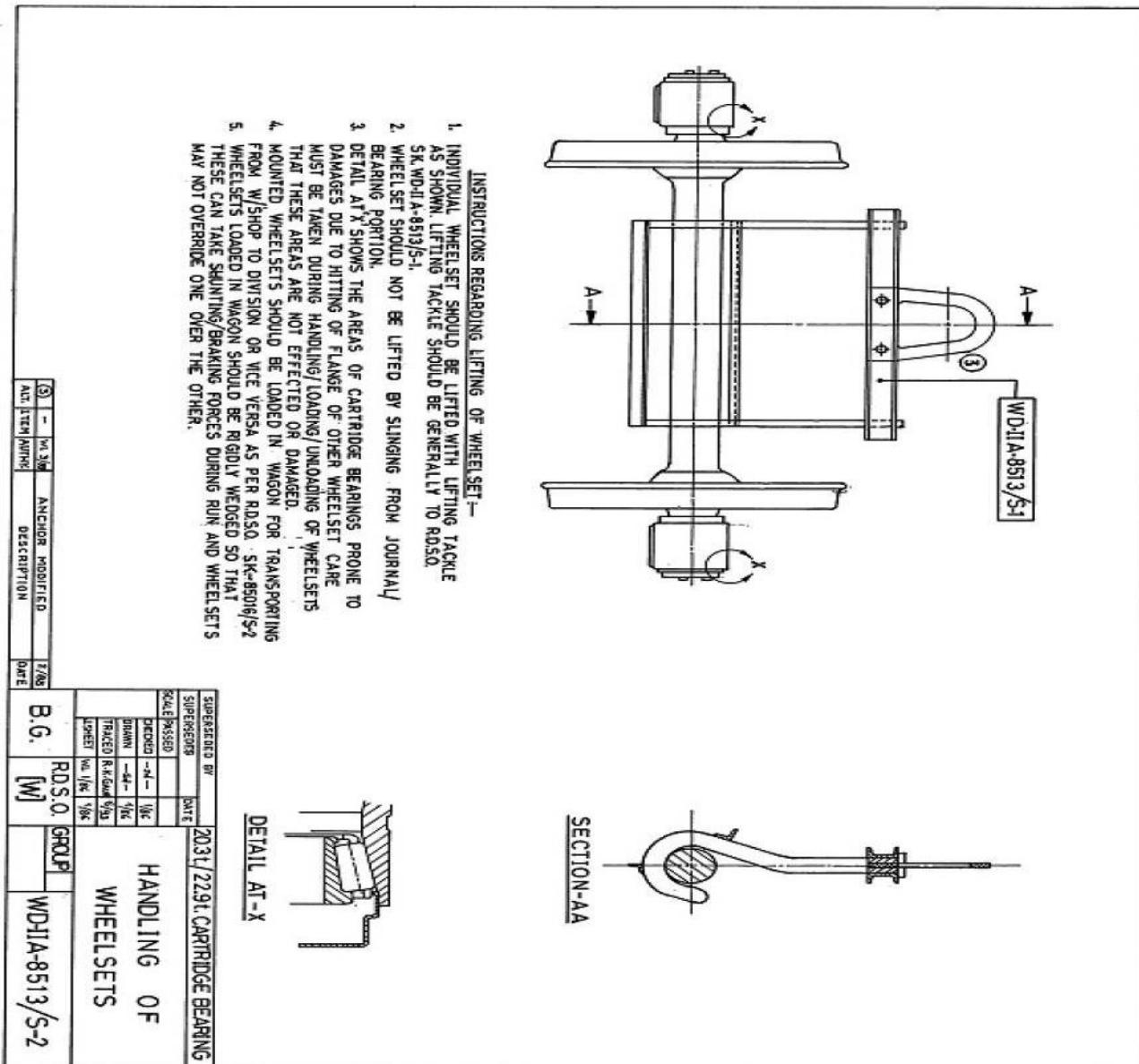
ANNEXURE- XVII

(Refer clause 16)



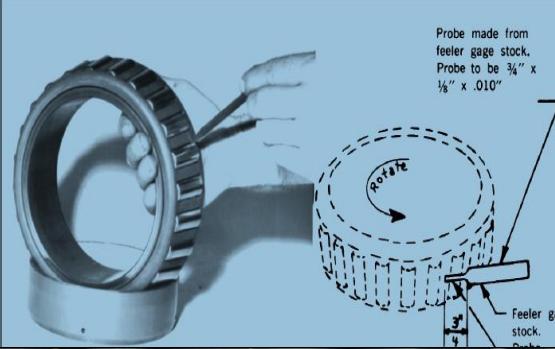
ANNEXURE – XVIII

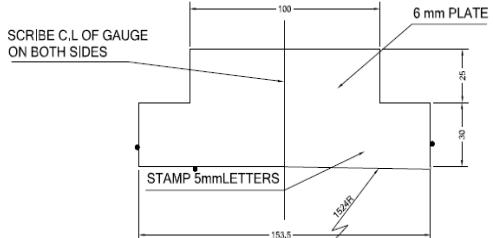
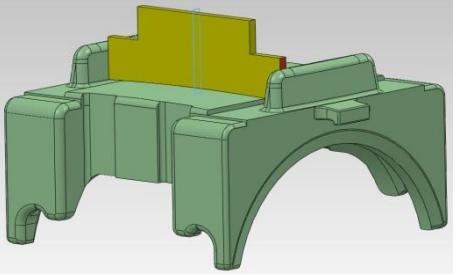
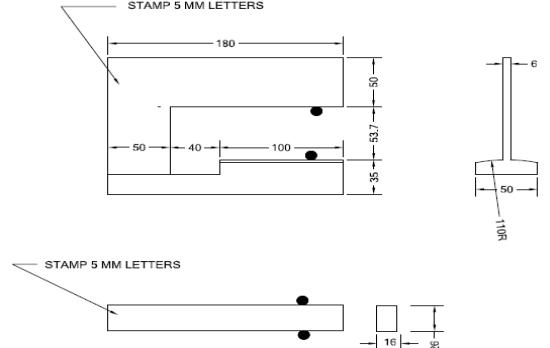
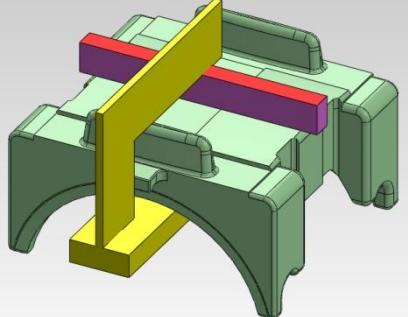
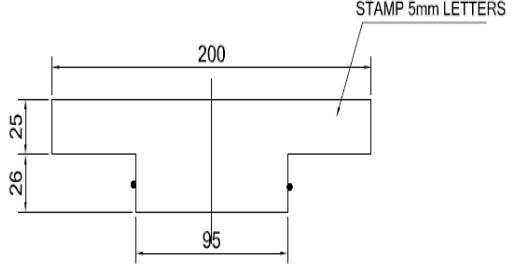
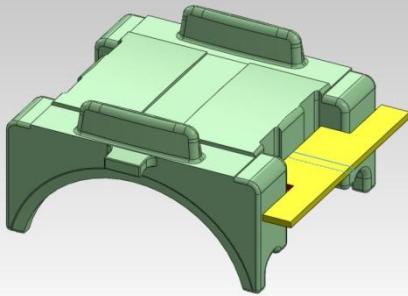
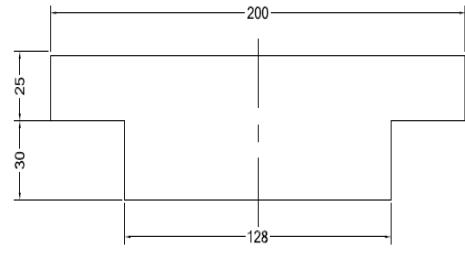
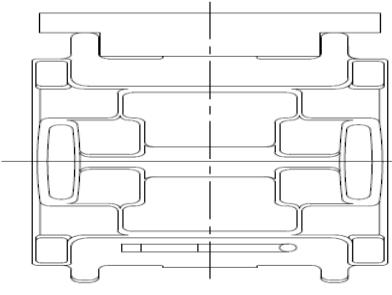
(Refer clause 16)

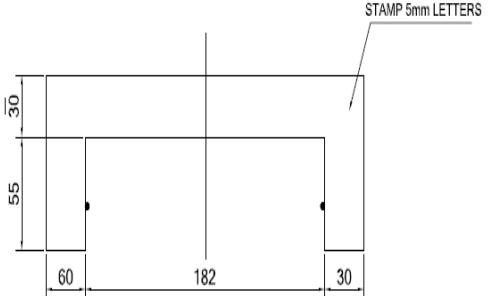
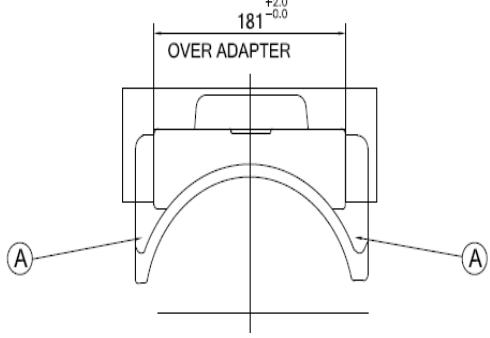
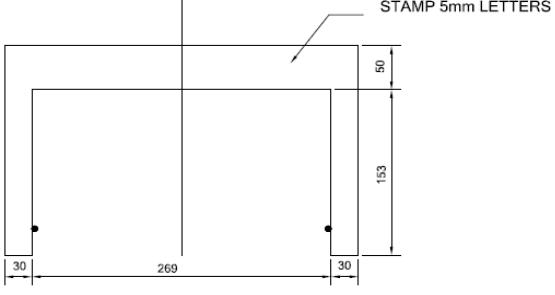
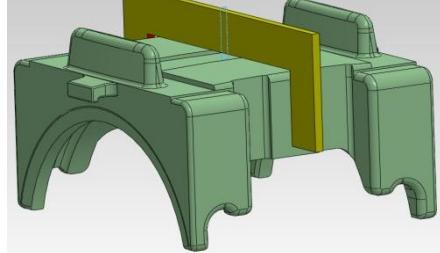
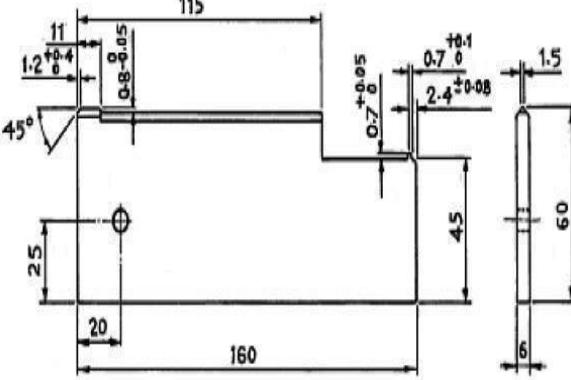
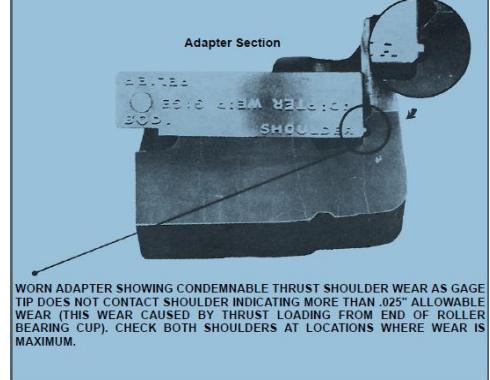
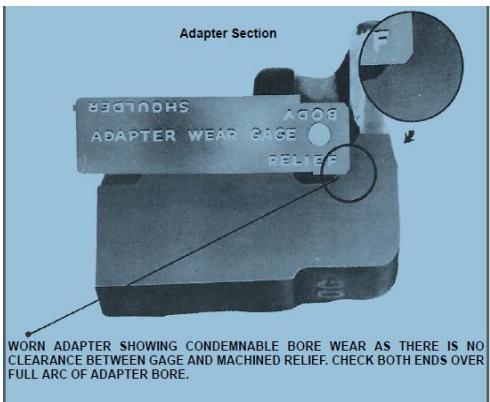


ANNEXURE- XIX

LIST OF MAIN GAUGES FOR CTRB AND ADAPTER

S. No.	Photo or Sketch of Gauges	Name of Gauge	Uses of Gauges
1.		Dial bore gauge	  (See clause 8.5.2/ 8.5.4.1)
2.		Feeler gauge	See clause 8.5.2
3.		Seal wear ring groove depth gauge	See clause 8.5.2

4.		Adapter Crown Lugs Gauge	 (See clause 19.4)
5.		Adapter Crown seat Gauge	 (See clause 19.5)
6.		Adapter side lug Gauge for Narrow jaw adapter	 (See clause 19.6)
7.		Adapter side lug Gauge for Wide jaw adapter	 (See clause 19.6)

8.	 <p>STAMP 5mm LETTERS</p>	<p>Adapter sides Gauge for Narrow jaw adapter</p>	 <p>181^{+0.20}_{-0.0} OVER ADAPTER</p> <p>(See clause 19.7)</p>
9.	 <p>STAMP 5mm LETTERS</p>	<p>Adapter sides Gauge for Wide jaw adapter</p>	 <p>(See clause 19.7)</p>
10.		<p>Adapter Wear Gauge</p>	 <p>Adapter Section</p> <p>WORN ADAPTER SHOWING CONDEMNABLE THRUST SHOULDER WEAR AS GAGE TIP DOES NOT CONTACT SHOULDER INDICATING MORE THAN .025" ALLOWABLE WEAR. (THIS WEAR CAUSED BY THRUST LOADING FROM END OF ROLLER BEARING CUP). CHECK BOTH SHOULDERS AT LOCATIONS WHERE WEAR IS MAXIMUM.</p>  <p>Adapter Section</p> <p>WORN ADAPTER SHOWING CONDEMNABLE BORE WEAR AS THERE IS NO CLEARANCE BETWEEN GAGE AND MACHINED RELIEF. CHECK BOTH ENDS OVER FULL ARC OF ADAPTER BORE.</p> <p>(See clause 19.2 &19.3)</p>

ANNEXURE- XX

In the area of cleaning of CTRB and its components eco-friendly M&P and efficient synthetic chemicals are being used in JUDW and RYPS Workshops, the details about M&P and chemicals are written bellow.

- ***Bearing Washing Plant JUDW***

- ***Capacity:*** 200 no. bearing cleaning per eight hour shift
- ***Three types of chemicals are being used in bearing washing plant***

- a. ***Cleaner:*** Alkaline cleaner

- Properties of cleaner:
 - I. Soluble in water
 - II. PH Value ≥ 12
 - III. It is not health hazardous
 - IV. It does not affect ferrous base material during use

Make: Unikleen 15R, Orion -355 or equivalent

- b. ***Rust Inhibitor:*** Alkaline Chrome Salt

- Properties of Rust Inhibitor:
 - i. It has corrosion prevention characteristic
 - ii. Soluble in water
 - iii. PH Value ≥ 12
 - iv. It is not health hazardous
 - v. It does not affect ferrous base material during use

Make: Unikleen 500, Orion IP-500 or equivalent

- c. ***Millipore Patch Test Solvent:*** Alkaline Chrome Salt

- Properties of Millipore Patch Test Solvent:
 - I. Assay(GS), Isomers & Methylcyclopantane Max: 98.5%
 - II. Residue after evaporation max:10ppm,
 - III. Sulpher compound: max 0.005%, Thiophene: passes test.
 - IV. Water: max 0.1%

Make: Haxane, Orion or equivalent



Bearing Cleaning Plant – Operation Sequence

- Switch ON Servo Stabilizer & Control panel.
- Switch on the control logic.

The oil skimmer starts automatically at the early morning with help of PLC programming and by real clock timer and it will skim oil from the washing solution tank because the oil will be easy skim effectively when the washing solution is idle. It will run for the desired pre set time and it will switch OFF automatically.

(The real clock timer works if when the control panel and control Logic are always switched ON).

- The Electric Immersion heaters starts automatically at the early morning with help of PLC programming and by real clock timer and it will heat the washings solution, rinsing water to the required set temperature and further the temperature controller will maintain the set temperature automatically. Maintain the temperature in the range of 60 to 80 deg Centigrade plus or minus 10 deg centigrade.
(The real clock timer works if the control panel and control Logic are always switched ON).
- Check the PH value by the operator manually with the Help of PH meter and maintain the PH value as recommended at starting of the every shift.
- Ensure the Pneumatic Air Line pressure and it is in open condition to operate pneumatic system properly.
- Load the input bearing from the centrifugal machine in the pallet with the help of JIB crane and further the pallet with bearing loaded on the bearing cleaning plant rotary table with the help of jib crane.
- Switch ON the cleaning cycle by push button station in front of the machine easy access to operator.
- Pallet moves with help of motorized gear drive conveyor mechanism automatically in to cleaning cabin and properly located inside the cleaning cabin.
- The door closes automatically with help of pneumatic cylinder or by gear box type. After door closes properly it is ensured by limit Switch and door reads switch for safety interlock.
- The Bearing with pallet rotates with help of geared drive rotary table and also washes solution pump starts and de-greasing will be carried out for the desired cycle time.
- Fume Exhauster will start automatically and to exhaust and evacuate the steam fumes which are generated due to hot washing solution spraying the inside closed cleaning to the atmosphere and it will stop after some time delay of completion of the cleaning cycle.
- The Oscillating lance with spray nozzle will oscillates with the help of geared motor in 3Dimensional arrangement hence all around the pallet and bearing will covered in top vertical , bottom (X,Y,Z Axis) and washing solution.
- After washing solution time is over it stops automatically and next process, hot water rinse spraying will be carried and parallelly the rust solution with inject in the rinse hot water by means of metering diaphragm pump which has separate lance arrangement. Separate lance arrangement for Hot water rinse with rust preventive solution will spray for the desired set time.

- While the hot water rinse is undergoing the rinsed hot water will be drained in to the wash solution tank for making up water to replenish the losses in the wash solution evaporation and etc.
- After completion of hot water rinse with rust preventive solution spraying process.
- Door Opens automatically after door open ensured by the read switch and limit switch.
- The Pallet with cleaned bearing moves towards the unloading station with the help of motorized gear drive conveyor automatically.
- Unload the cleaned bearing with the pallet with the help of Jib crane for further process and load the next charge load which is ready for loading with the help of Jib Crane.
- After that go the next cycle as similar.
- While the cleaning process is undergoing for the next charge load the bearings to be loaded in the pallet and kept ready to load on the rotary table of the bearing cleaning plant .
- The Automatic Sludge Removal drag scrapper conveyor starts by separate Switch in the control panel at the end of the shift and it will stop automatically by pre set time as programmable in PLC.

ANNEXURE- XXI

About Next Generation Cartridge Tapered Roller Bearings**Class 'K' (6 1/2" X 9")**

- RDSO's STR No. AB/RB-41-2016 for Class 'K' (6 1/2" X 9") Cartridge Tapered Roller Bearings for freight stocks fitted with Light Weight Low Height (LWLH) bogies (Narrow Jaw) for 25t axle load application
- Minimum 'L₁₀' life of CTRB Class 'K' is 16 lackm whereas Class 'E' is 10 lackm.
- Fretting index for CTRB 'K'(6 1/2" X 9")is 0.5 where as for Class 'E' (6" X11") the same is 1, hence lesser tendency for fretting wears of 'K' axle journal.
- CTRB 'K' (6 1/2" X 9") shall be fitted in Axle to RDSO drawing No.WD-15020/S-02 for 25t axle load application.
- CTRB 'K' (6 1/2" X 9") wheel sets shall be fitted in 'LWLH BOGIE' TO RDSO Specification No. WD-40-LWLH25 BOGIE ('K' CLASS)-2015

.0

CTRБ Class 'K' (6 1/2" X 9") Service Limits

Make/ Bearing Class 'K' (6 1/2" X 9")	Diameters are averages							AMOUNT OF GREASE gram (oz.)		
	ROLLERASSEMBLY		OUTER RING/CUP			BACKING RING				
	MAX. BORE mm (inch)	OUT OF ROUND mm (inch)	MINIMUM O.D.mm (inch)	MAXIMU M C. BOREmm (inch)	MINIMUM M C. BOREmm (inch)	OUT OF ROUND mm (inch)	MAXIMU M C. BOREmm (inch)	EACH ROLLER ASSEMBL Y	AROUND SPACER	TOTAL QUANTITY
BRENCO (AAR-28& 31)	157.175 (6.1880)	0.076 (0.003)	249.555 (9.825)	238.252 (9.380)	237.998 (9.370)	0.127 (0.005)	191.211 (7.528)	170 (6)	15 (1/2)	355 (12 1/2)
TIMKEN (AAR-27)	157.175 (6.1880)	0.076 (0.003)	249.555 (9.825)	238.252 (9.380)	237.998 (9.370)	0.127 (0.005)	191.211 (7.528)	57 (2)	170 (6)	284 (12)