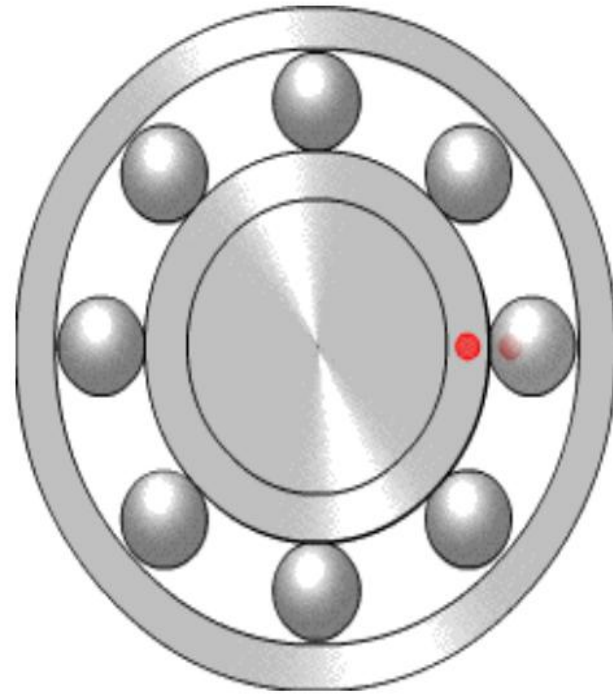


# Roller Bearing



**Presented by-**

**Rajendra Kushwaha**

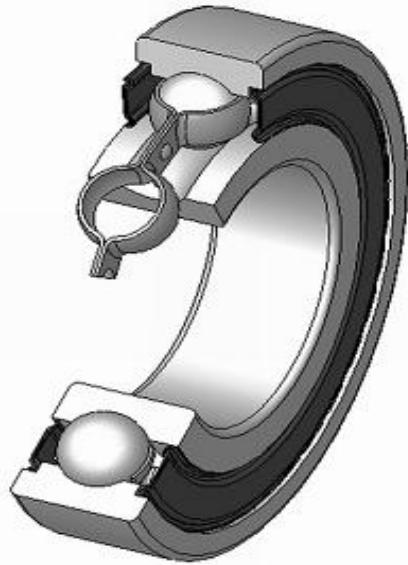
**Instructor/C&W**

**MSTC/GKP**

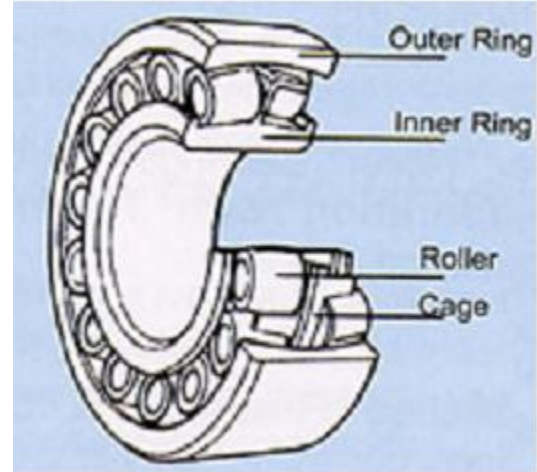
# Introduction

- A bearing is a device to permit constrained relative motion between two parts, typically rotation or linear movement.
- Bearings may be classified broadly according to the motions they allow and according to their principle of operation

# CLASSIFICATION OF BEARINGS

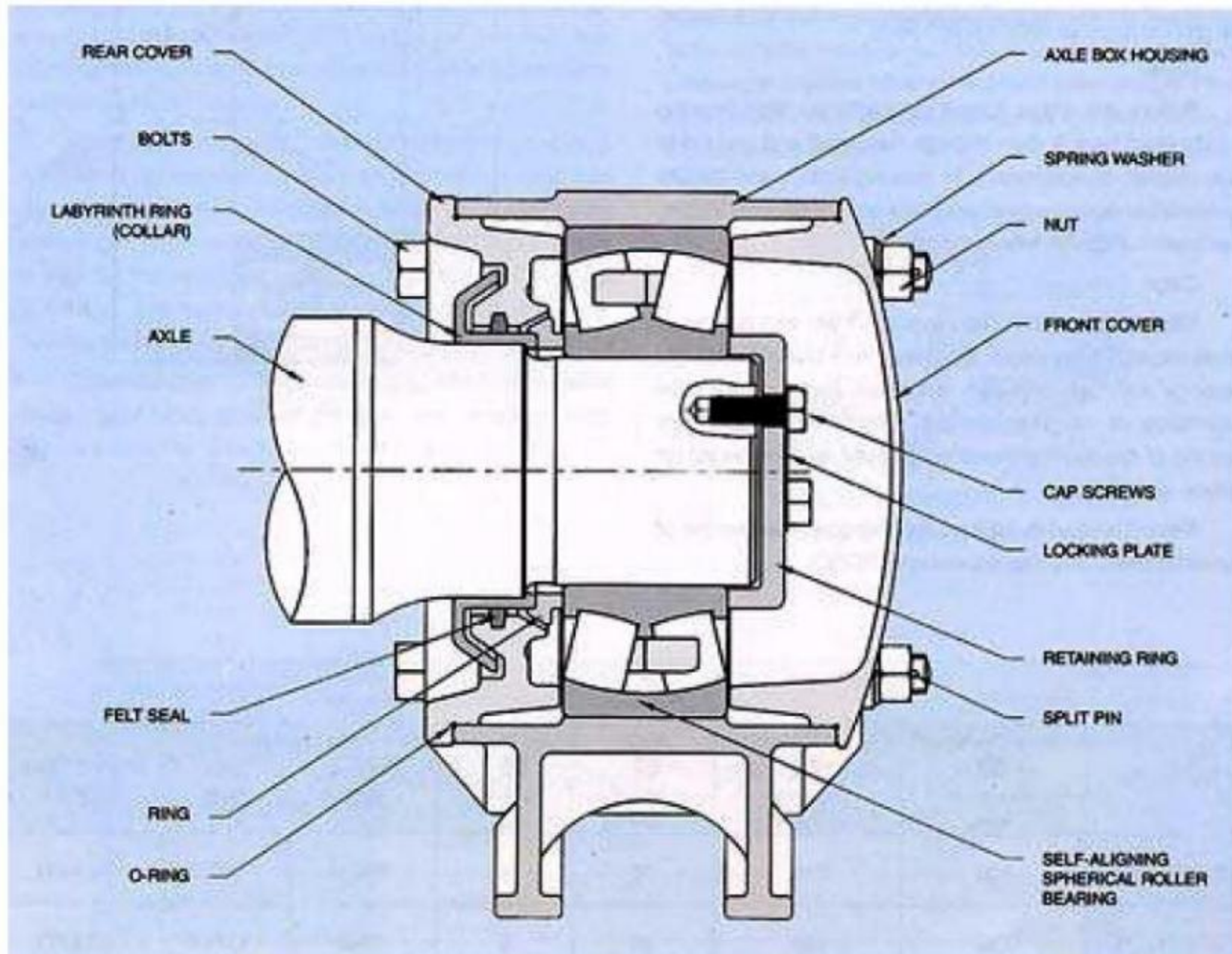


# spherical roller bearing

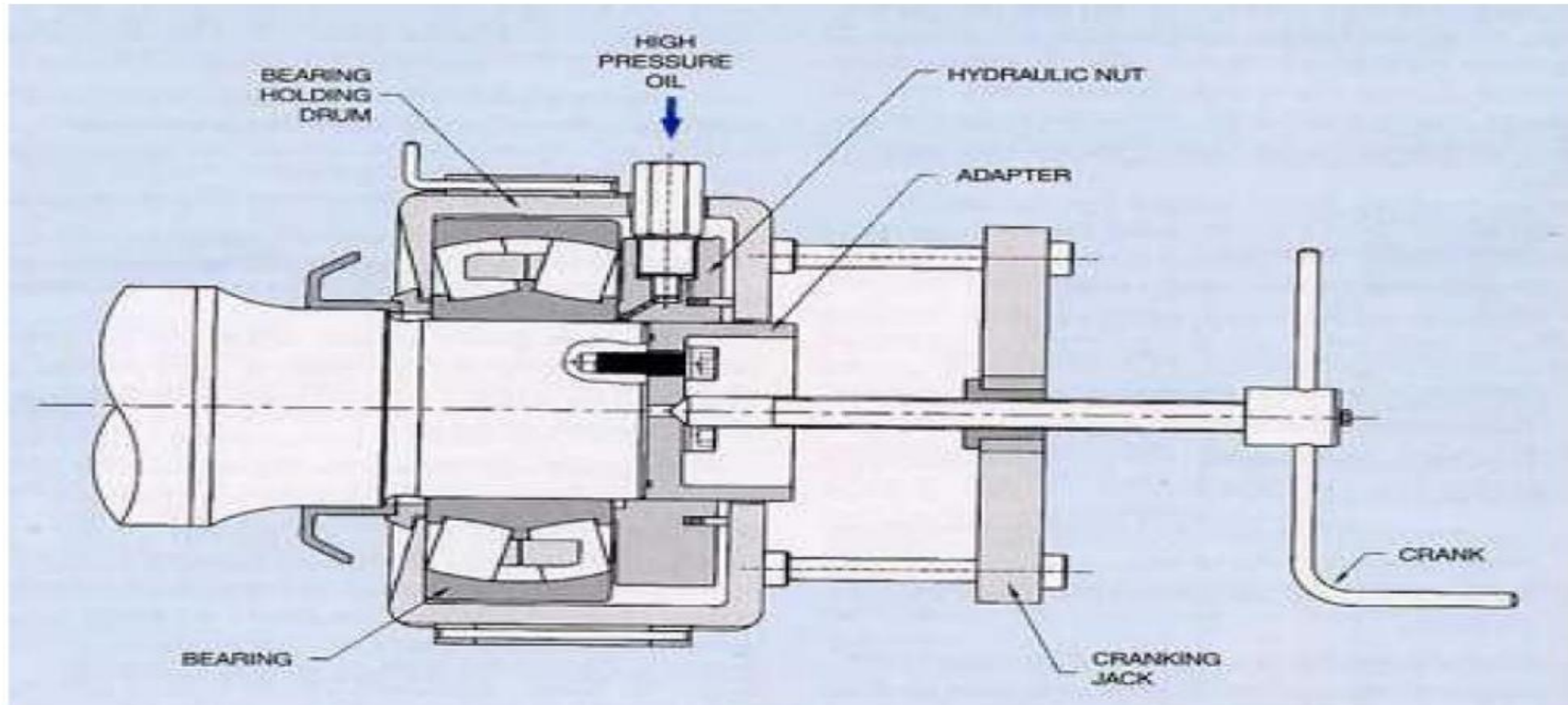


# SPHERICAL ROLLER BEARING

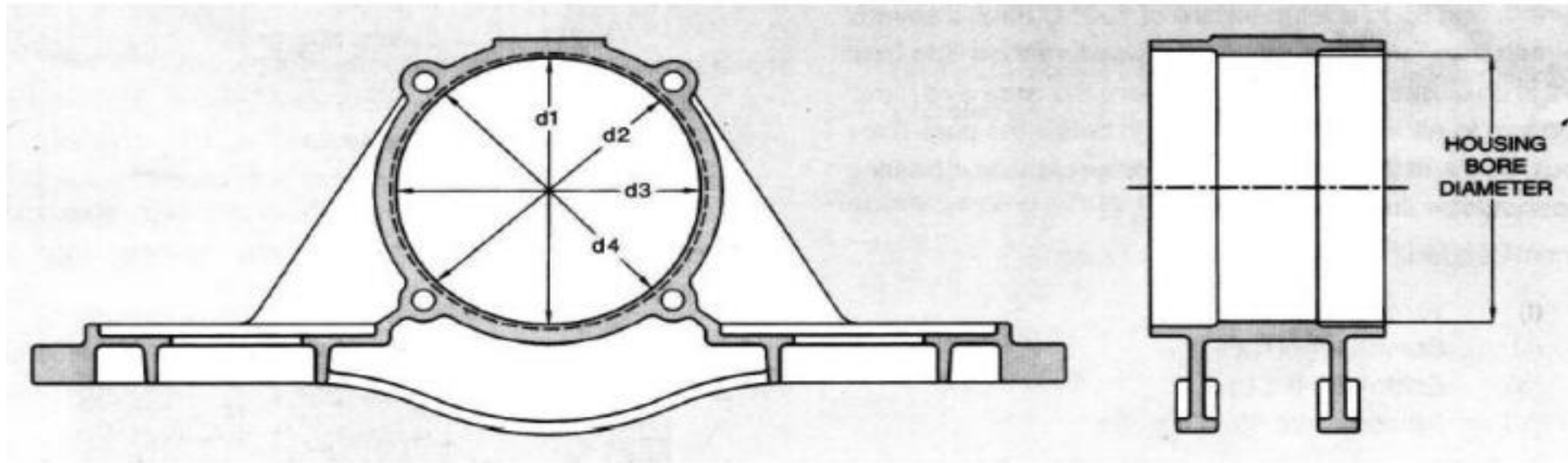
- Spherical roller bearings have a large capacity for radial loads, axle loads in either direction, and complex loads.
- They are suited for the applications such as railway rolling stocks where vibrations and shock loads are encountered.
- Roller Bearings are named according to the shape of rollers. Roller Bearings with spherical rollers are called as Spherical Roller Bearings
- Spherical Roller bearing no. **22326/C3 with 130 mm** parallel bore on the inner ring is being used on ICF type coaches.
- They are directly **shrunk fit on the axle journals**.



# ICF self aligning Spherical Roller Bearings : Dismounting -

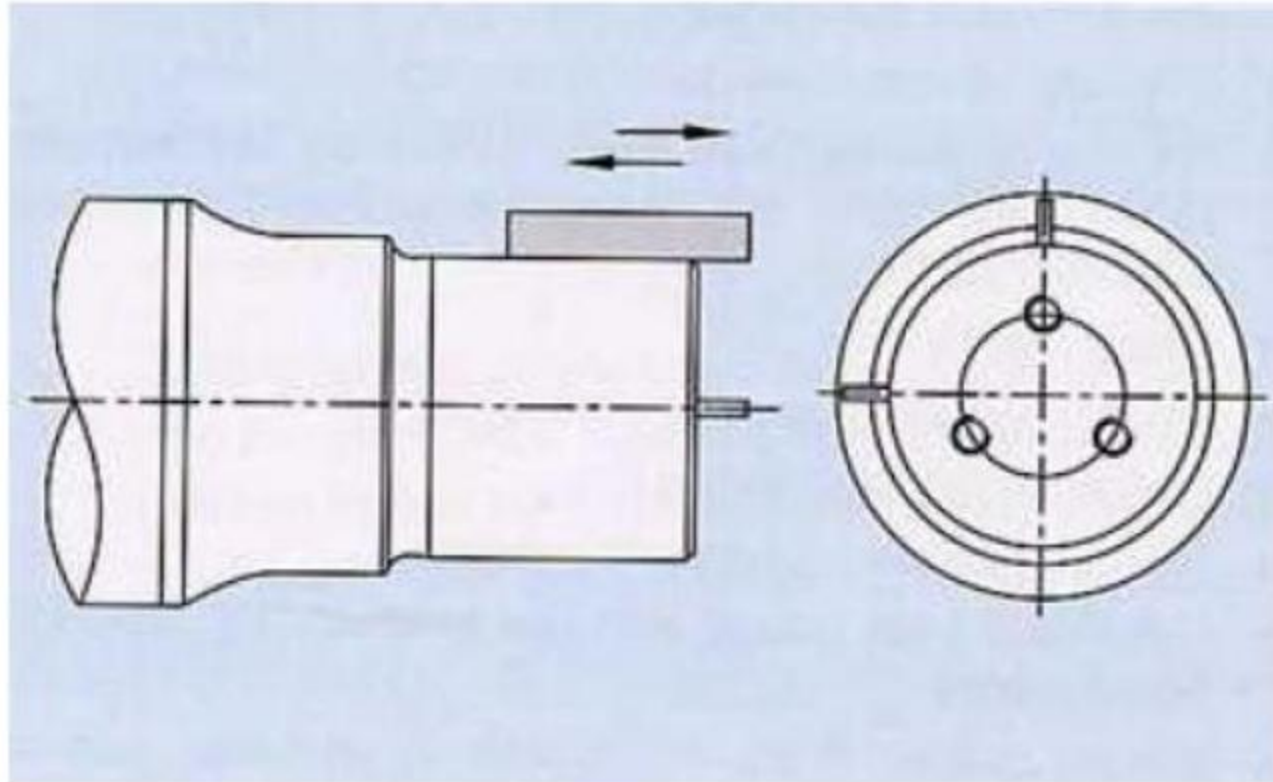


# ICF self aligning Spherical Roller Bearings : Mounting housing image -





# ICF self aligning Spherical Roller Bearings: Straight edge Journal checks-



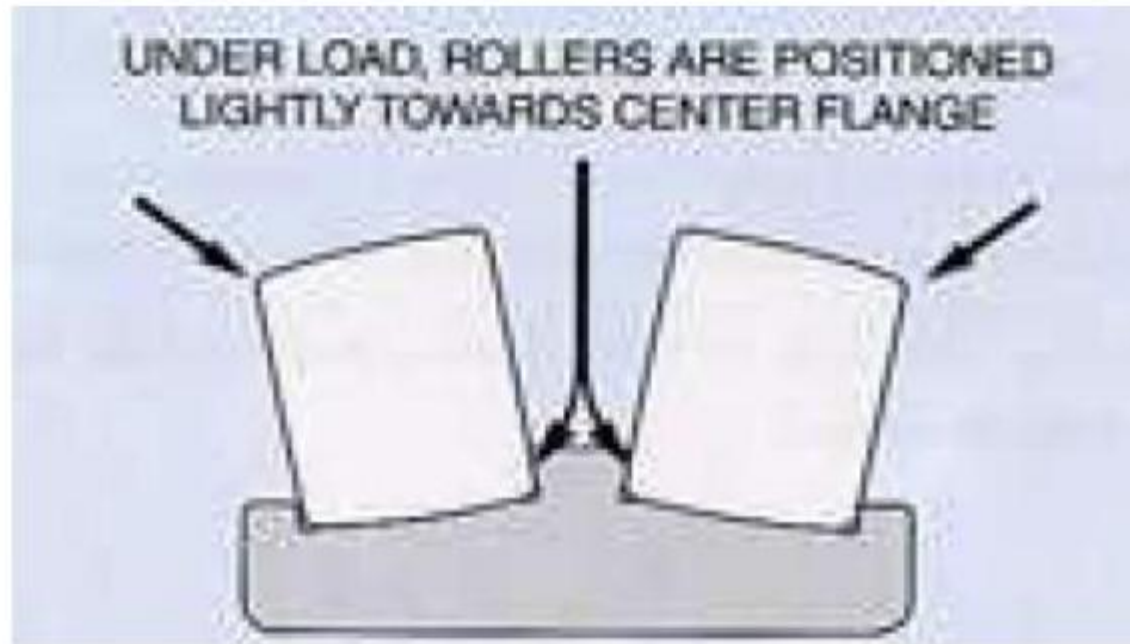
# ICF self aligning Spherical Roller Bearings: Dial Snap Gauge Journal Diameter checks-



**Journsl = Journal.**

<b>Journsl ØA(Max/Min)</b>	<b>Diameter</b>	<b>Maximum permissible out of roundness (mm)</b>	<b>Maximum permissible taper (mm)</b>
130.068 /130.043		0.015	0.015

## ICF Spherical Roller Bearings : Functions -



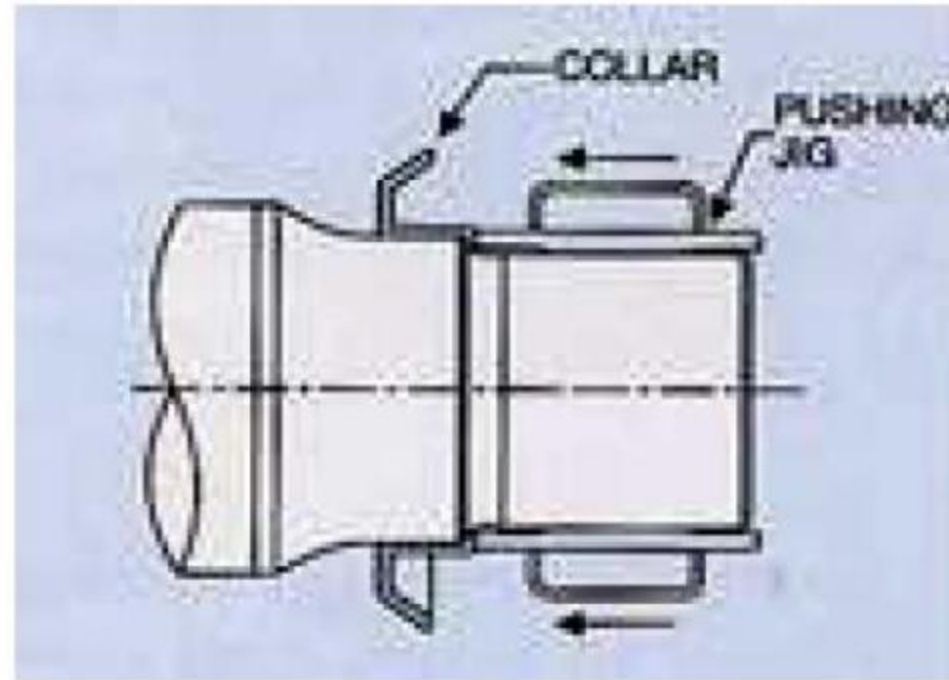
## ICF Spherical Roller Bearings : Inspections -



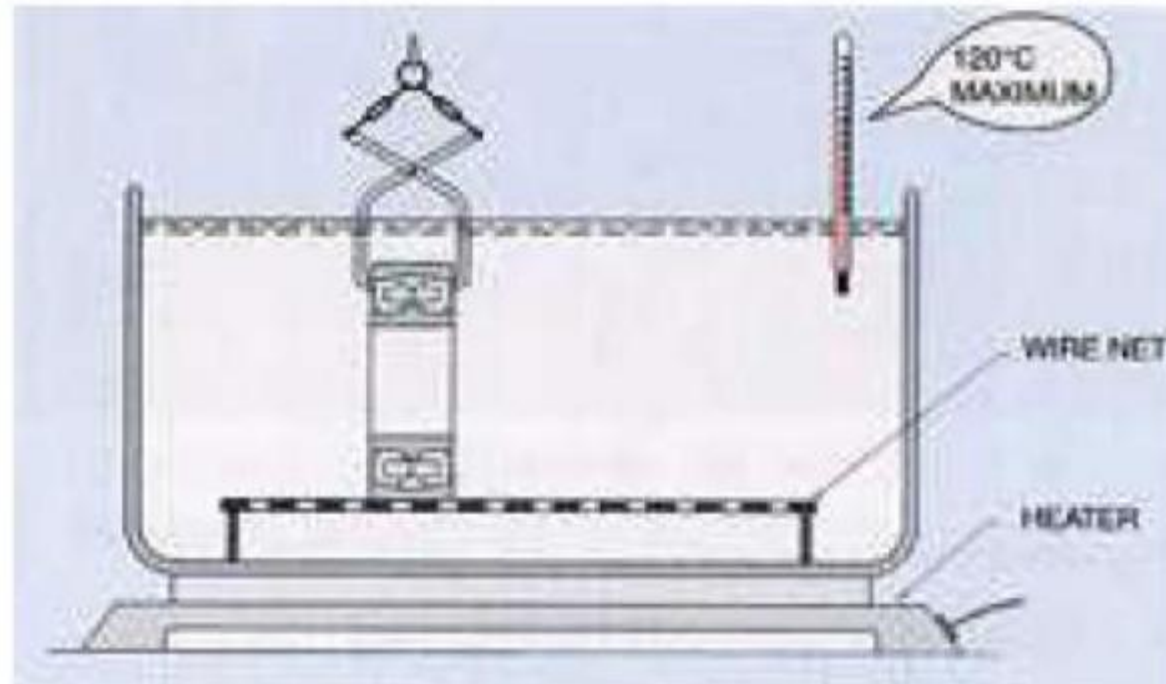
## ICF Spherical Roller Bearings : Clearances -



## ICF Spherical Roller Bearings : Mounting -



## ICF Spherical Roller Bearing : Oil bath Heating during mounting -





# ICF Spherical Roller Bearing : Induction heating during bearing mounting -



# ICF Spherical Roller Bearing : Radial clearance checks on mounting -



## ICF Spherical Roller Bearings : Radial Clearances in mounted bearings -

Bearing make	Radial clearance in mounted condition ( in mm)	
	New Bearings	In service bearings
FAG/NORMA	0.080-0.160	0.220 max.
NEI/NBC	0.080-0.160	0.245 max.

## ICF Spherical Roller Bearing : Incorrect mounting failures – Effects & Reasons.

Damage during mounting	Possible Cause
Score marks on rings	Bearing inner ring not properly aligned with axle during mounting. Forcible entry on axle box during mounting.
Surface cracks	Rapid or excessive heating of bearing (temperature more than 120 °C)
Discolored surface	Excessive heating temperature (more than 120 °C)
Axial cramping of bearing	Faces of bearing and associated part not flush with one other.
Radial cramping of bearing	Oversize or undersize journal diameter.
Excessive fretting of outer race	Oversize housing bore
Grease oozing from rear cover	Used or poor quality of felt seal

**ICF Spherical Roller Bearings : Peak Operating  
temperature – 80 deg. Cel. {Li based grease  
filled/Axlebox = 1.75 Kg}**

**HOT AXLES**

**IN CORRECT FIT**

**IMPROPER MOUNTING**

**IMPROPER HANDLING**

**POOR LUBRICATION**

**CONTAMINATION**

**EXCESSIVE HEATING**

**EXCESSIVE LOAD**

## Hot Axles : Reasons & Effects -

<b>Defect</b>	<b>Effect on Bearing</b>
<b>Felt ring perished</b>	<ol style="list-style-type: none"><li data-bbox="1233 482 1814 588">1. Grease may ooze out from rear cover</li><li data-bbox="1233 616 1814 722">2. Dust and water may enter the axle box</li></ol>
<b>Rubber 'O' rings of cover perished</b>	Dust and water may enter the axle box

## ICF Spherical Roller Bearings : Hot Axles Continued -

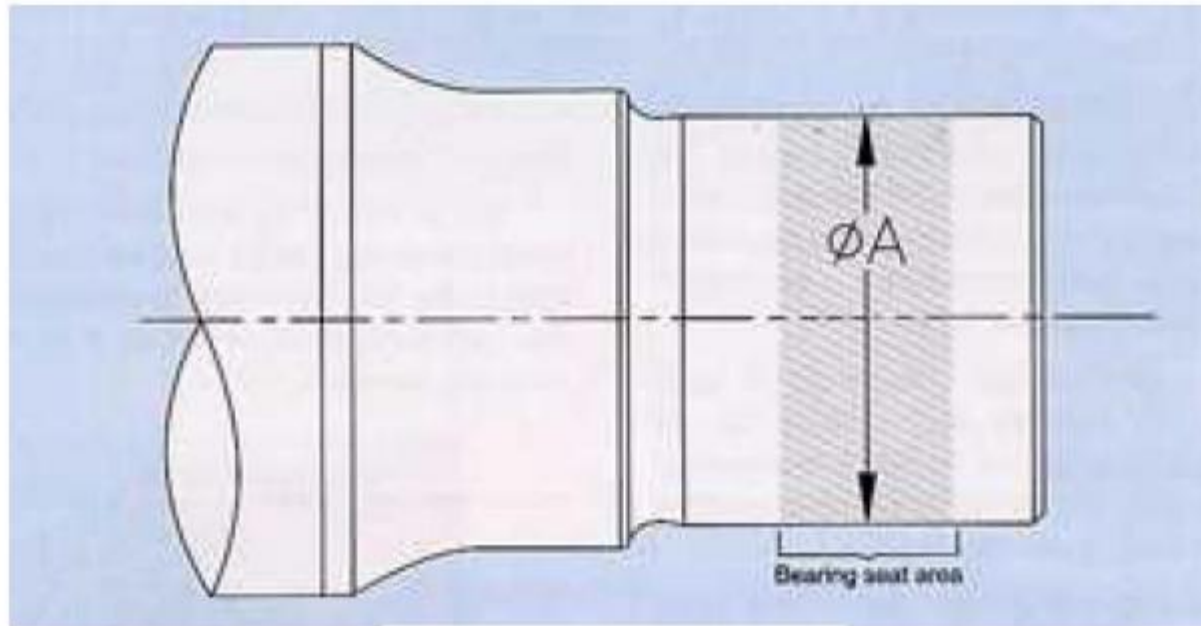
<b>'V' grooves on rear cover, front cover and axle box faces not filled with grease.</b>	Dust and water may enter the axle box.
<b>Improper and/or excessive / inadequate grease.</b>	Excessive temperature, seizing or complete failure of Roller Bearing.
<b>Bearing clearance not within prescribed limits.</b>	Excessive wear of rollers and races leading to bearing failure.

## ICF Spherical Roller Bearings : Hot Axles Continued -

<b>End locking screws not tightened properly.</b>	End locking arrangement may fail.
<b>Journal finish and Diameter not as prescribed in the drawing.</b>	Bearing may become loose/inner ring cracks causing serious damage to the bearing leading to bearing failure.
<b>Excessive or inadequate lateral clearance between axle box covers and bearings.</b>	1.Excessive clearance may damage roller bearings or covers. 2.Inadequate clearance may result in gap between axle box housing and bearings.



# ICF self aligning Spherical Roller Bearings: Journal Diameter-



## ICF Spherical Roller Bearings : Hot Axles Concluded -

<b>Fitment of substandard/improper size end locking bolts/ screws.</b>	Bolt may fail in service cause damage to front cover and bearings
<b>Improper locking of end locking screws.</b>	Screw may get loose in service and cause damage to front cover and bearings
<b>End locking screws not tightened properly.</b>	End locking arrangement may fail.

## **Outer ring**

Outer ring for spherical roller bearings are manufactured from forged and rolled rings from bearing quality steel. It is through hardened and precision ground all over. The track or roller surface of bearing outer ring is spherical in shape for self-aligning.

## **Inner Ring**

Inner ring for spherical roller bearing are also made from bearing quality steel which is forged and rolled. Inner rings are also precision machined heat treated and precision ground. Inner rings have two rolling surface which are ground together with high accuracy.

## **Roller**

Roller are either forged or machined from bearing quality steel bars & then through hardened and ground to high degree of accuracies.

## **Cage**

Spherical roller bearings are fitted with machined brass cages. These cages are made from brass centrifugal castings and then precision machined. Brass cages have advantage of assuring positive lubrication and cooler running of the bearing therefore are best recommended for railway applications.

# GENERAL INSTRUCTIONS AND PRECAUTIONS

- 1. Do not drop the bearing.**
- 2. Bearing should not be unpacked until it is ready for mounting.**
- 3. All plastic wedges inserted between rollers to protect from any damage during transportation, must be removed prior to fitment on axle journal.**
- 4. Spherical Roller bearings are designed, manufactured and assembled to provide a specific amount of radial clearance. Therefore, components of any spherical roller bearings should never be interchanged with other bearing. This can lead to poor performance or failure of the bearing.**
- 5. Mounting, dismounting, inspection and maintenance work of bearings must be done by trained/ qualified persons as per laid down procedures/ specifications.**
- 6. Use only recommended tools for mounting / dismounting and maintenance work.**

**Contd.**

**7. Use only those parts, which are new or otherwise satisfactory to reach the next**

**reconditioning interval after service.**

**8. Bearing parts of different roller bearing units or different manufacturers must**

**never be mixed or interchanged. This can disturb the radial and axial clearances,**

**which can lead to poor performance of the bearing during service.**

**9. Never mix two different brands of grease or used grease with fresh grease.**

**10. Lubricate both new and used cap screws prior to installation.**

# Periodicity of Inspection of Roller Bearing

All roller bearings should be cleaned, inspected and re-lubricated with fresh grease during each attention to the wheel set /bearings in the workshop.

The roller bearings should be dismantled from the wheel set during every alternate attention in the workshops for thorough inspection of the components, rear cover and renewal of the felt sealing ring. The wheel bearing should however necessarily be dismantled and overhauled in case of any warranted out of course of attention in the workshop.

# Radial Clearance In Bearings

Bearing make	Radial clearance in un-mounted condition. (mm)		Radial clearance in mounted condition. (mm)	
	New Bearings	In service bearings	New Bearings	In service bearings
<b>FAG/NORMA</b>	0.145–0.190	0.270 max.	0.080-0.160	0.220 max.
<b>NEI/NBC</b>	0.145–0.190	0.295 max.	0.080-0.160	0.245 max.



**Fig: 3.0 Checking Bearing radial clearance in mounted condition**

## Life of Spherical Roller Bearing

The codal life of spherical roller bearings type 22326 (16.25 t) used on BG main line coaches is fixed as **20 years**.



# Lubrication

- **The quantity of grease filled per axle box**

FAG/NBC/other make bearings      **1.75 kg**

- Only lithium base grease of approved brands should be used

<b>Brand Name Of Grease</b>	<b>Supplier</b>
Servogem RR3	Indian Oil Corporations
LL3 (Balmerol multigrease)	M/s Bamer Lawre & Co. Ltd. Corporation Limited
Bharat RR Grease-3	M/s Bharat Petroleum Corp. Ltd.

# Bearing should be rejected for the following defects

- Pitted or flaked roller tracks and rollers.
- Cracked or deformed or badly worn out cage.
- Cracked inner or outer ring.
- Scored or damaged outer surface of the outer ring.
- Indentation on rings or rollers.
- Scoring of roller tracks or rollers.
- Rust/corrosion, damage or excessive fretting corrosion.
- Brinelling or false brinelling.
- Rings exhibiting deep straw or blue or purple colour indicating heat effect.
- Excessive or less radial clearance.

### **Rust and corrosion**



Surface becomes partially or fully rusted. Sometimes rusted at spacing equal to distances between rolling element

### **Fretting**



Fretting Surfaces wear producing red coloured particles that form hollows.

### **Flaking/ Spalling**



Flakes form on the surfaces of the raceway and roller elements. When the flakes fall off, the surface becomes rough and uneven.

### **Seizure**



Bearing heats up, becomes discolored and eventually seizes up.

### **Cracking**



Splits and cracks in bearing rings and rollers

### **Cage damage**



Breaking or wear of cage.

### **Smearing and scuffing**



Surface becomes rough with small deposits. "Scuffing" generally refers to roughness of the bearing ring ribs and roller end faces.

### **Rolling Path Skewing**



Roller contact path in raceway surface strays or skews.

### **Indentations**



Hollows in raceway surface produced by solid foreign objects trapped or impacts (False brinelling)

### **Electric Current Damages**



Pits form on raceway and develop into ripples. Further development leads to corrugated surface. Some times spot or localized burns are also noticed.

### **Discoloration**



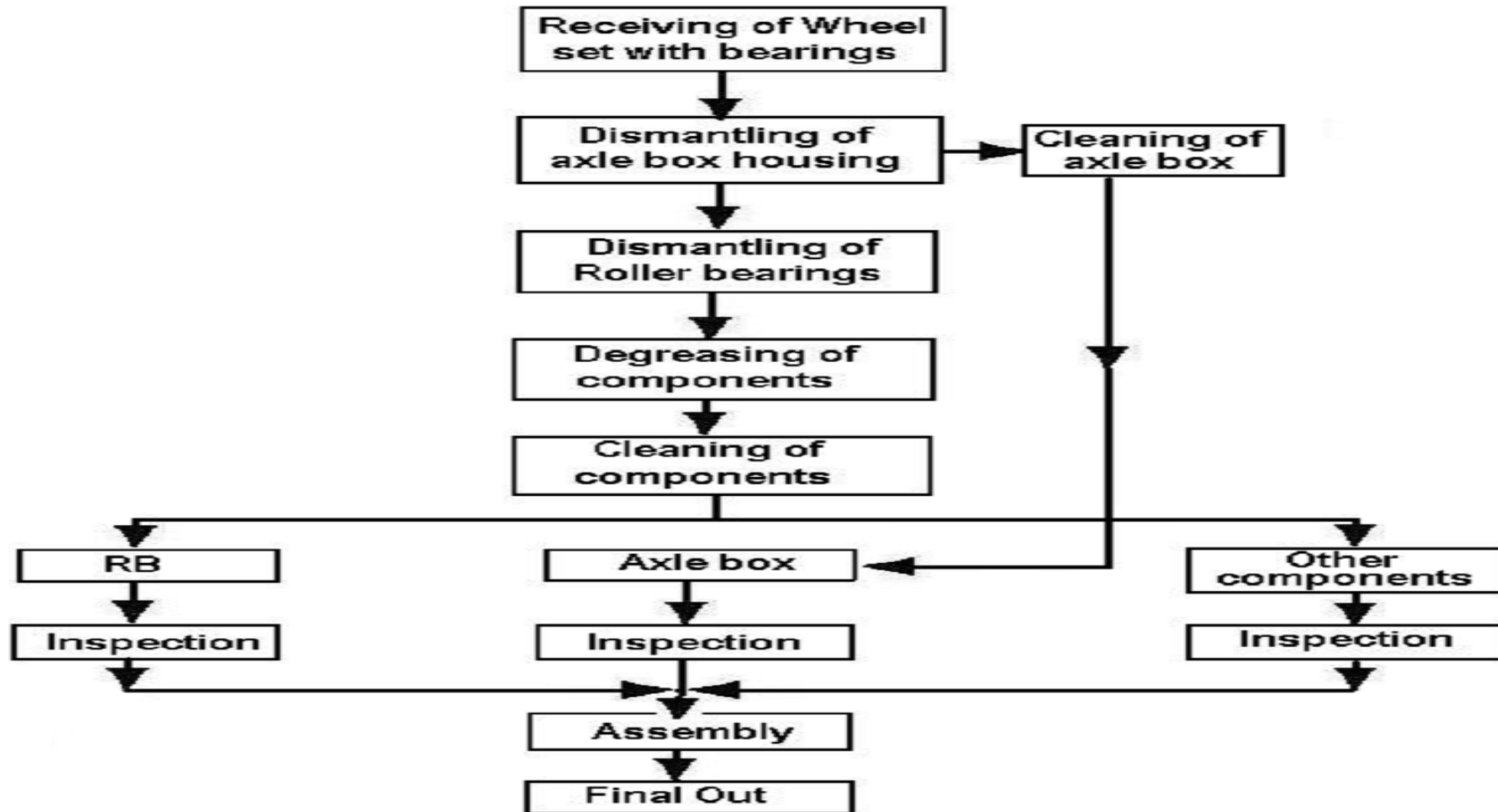
Change of raceways / roller colour

### **Peeling**



Peeling is a cluster of very small spalls. Peeling can also include very small cracks which develop in to spalls.

# FLOW CHART FOR ROLLER BEARING MAINTENANCE IN WORKSHOPS



## **MAINTENANCE IN OPEN LINE & PRECAUTIONS TO AVOID HOT AXLE CASES**

### **Visual Examination**

During Rolling-in & Rolling out examination, inspect axle box for any indication of hot box. Any wheel set with axle box running hot in the coach, must immediately be removed from service and sent for replacement. Visually inspect the axle box housing, front cover, rear cover and other parts for any damage. Check for any missing or loose fasteners. Watch for any other reason that could be detrimental to the performance of roller bearing and could lead to unsafe condition in service.

Roller bearings and axle boxes damaged due to fire, over heating, water submersion or welding, must be removed from service and sent for detailed internal examination.

### **Running Temperature**

Check operating temperature of axle box by non-contact type thermometers at top of the cast steel axle box (crown) housing. The limit of temperature of the axle box top crown will be 80<sup>0</sup> C. If the temperature of axle box is found above 80<sup>0</sup> C, the affected coach should be detached en-route from the train service.

(RDSO Letter No. MC/AB Dated 21/24.08.2009).

### **Abnormal sound**

In Rolling-in and Rolling-out examination, try to listen for any unusual / abnormal noise or grinding. Detach the coach & remove the wheel set / roller bearing axle box in case it produces abnormal sound and should be sent for internal part examination.

### **Grease oozing**

During service, a small amount of grease leakage could be normal and comes from initial purging of grease and relieving of internal pressures. However, if fresh grease continues to leak, wheel set must be removed from service.

### **Axle boxes involved in Derailment / Accidents / Flood**

All wheel sets of the coaches, involved in accident, fire, flood or submerged in water, must be removed from service.

Bearing and parts must be identified separately by marking "ACCIDENT INVOLVED" and should not be reused. It is recommended that inspection of roller bearing is made together with parts including wheel sets, bogie etc.

***Any Question?***



THANK YOU