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GOVERNMENT OF INDIA

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MINISTRY OF RAILWAYS

(RAILWAY BOARD)

MAINTENANCE MANUAL FOR WAGONS

MARCH 2001

FOREWORD

1. The Maintenance manual for Wagons was last compiled and issued by Ministry of Railways in 1979.

2. During the last two decades, considerable work has been done in upgrading the wagons to meet the traffic demand for higher productivity. Thus, it has become necessary to update the Wagon Maintenance Manual incorporating the technological upgradations / innovations brought out in the wagon design, maintenance strategy and operation over Indian Railways.

3. The manual deals with maintenance of all systems of the wagons like superstructure, running gear, braking system, etc. Thus, it can act as the single bare reference document for maintenance of wagons in workshops and open line depots. In this manual, the attempt is not to cover the entire range of individual working conditions, which may exist on the various zonal railways. The zonal railways may, if considered necessary, supplement these instructions with subsidiary procedures based on local practices with the approval of CME.

4. Technological upgradation is a continuing process. Those that have been implemented have been covered in this manual. With IR's thrust in increased productivity and market orientation, emphasis on factors such as increased throughput in terms of higher axle load and speeds, product specific designs, enhanced reliability and availability etc. will gather momentum ushering in newer designs and technological upgradation of wagons more than ever before. Therefore, separate maintenance instructions will also be issued as and when the newer designs are inducted in to the system.

5. This manual has been written with the purpose of knowledge dissemination and guidance of staff dealing with repairs and maintenance of wagons. Hence full use of the same must be made to derive the intended benefits fully.

6. Apart from detailed maintenance instructions for the different types of wagons now on IR, this manual also lists out various rules and provisions given in IRCA Part III as a supplement for reference purposes. It is, therefore, not the intention to replace IRCA rules Pt. III. Statutory provisions and instructions contained in the general rules and various codes are to be followed and remain unaffected by the issue of this manual.

K. B. Sankaran
Member Mechanical, *Railway Board*

New Delhi, dated March 9, 2001

INDIAN RAILWAYS
(MECHANICAL DEPARTMENT)

The previous "Maintenance Manual for Wagons" was published in 1979. Since only vacuum brake system was existing on Indian Railways at that time, this manual did not contain any details of Air Brake System. The induction of Air Brake stock on Indian Railways transformed the complete scenario of operating and maintenance disciplines in Railways.

Railway Board nominated a committee of officers comprising of Executive Director/CAMTECH/GWL, ED(Wagon)/RDSO/LKO, CRSE/W.Rly/Mumbai and DME(Freight)/Railway Board vide letter No. 70/M(N)/7/16(H.T.)-Pt.I dated 4.9.98 for updation and revision of "Indian Railways Unified Maintenance Manual for Wagons". The revision and updation of manual has been completed taking into account latest fleet of freight stock currently running on Indian Railways.

The present manual bridges this gap and covers detailed treatise of Air Brake System including its maintenance. The other salient features of the manual are as follows:

- The manual has been divided into logical chapters covering various sub-assemblies and systems. The constructional details and functioning has been explained before describing the detailed maintenance procedures.
- The important dimensions, clearances, material specifications, drawing references etc. have been given immediately after the paragraphs where they have been referred to while describing maintenance procedures.
- Clear sketches and isometric views of the important sub-assemblies/components have been given in the manual.
- A separate chapter titled "YARD MAINTENANCE" has been added covering the maintenance work to be done in yards.
- A separate chapter titled "SPECIAL TYPE OF WAGONS" is included in the manual.

For convenience of indexing of reference, the paragraphs have been numbered according to a 3 /4 figure "Code", in which the last two figures give the number of the paragraphs and the remaining figures the number of the chapter. Thus paragraph 101 of any code is paragraph 1 of chapter 1 of that code and paragraph 1103, paragraph 3 of chapter 11.

The page number in each chapter in this manual starts from 1. The reader can easily identify the chapter number to which a page belongs by reading the footer of the page at the bottom where chapter number as well as chapter title is given. This scheme of page numbering is adopted to provide flexibility of easily revising the chapters in future, on account of design or procedure changes or induction of new stock without disturbing the page numbers of succeeding chapters.

The tables in each chapter consist of two numbers separated by a decimal point. The number before decimal point indicates the chapter number whereas the number after the decimal point indicates the running serial number of the table which start from 1 in every chapter. The convention adopted for numbering the figures is also identical to the numbering scheme adopted for the tables.

The items of maintenance required to be carried out in sickline, ROH & POH have been listed out separately towards the end of various chapters under appropriate headings for each system/subassembly covered in the manual for easy reference and guidance of maintenance units.

Future addition/ deletion/ modification to this manual will be processed by RDSO and will be require approval of the Railway Board.

The Committee is thankful to shri V.K. Manglik, EDME(Fr.), Railway Board, shri B.B.Modgil, DRM/BRC, shri D.K. Saraf, ADRM/Jabalpur, shri O.P.Chaube, Exec.Director, RDSO, shri Sanjay Kumar, Director, RDSO and shri S.S.Gavane, Dy.CME, N.Rly for their valuable contribution in finalisation of this manual. Members of the committee also express their appreciation for the valuable assistance provided by shri A.K.Arora, AEME(Fr.), Railway Board and shri K.K.Giri, Sr.CTA/CAMTECH.

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CAMTECH	*RDSO*	*W.Rly.*	*Rly. Bd.*

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C.S. No. & Date	Reference Item No. & Chapter No.	Remarks

MAINTENANCE MANUAL
FOR
WAGONS

Chapter – 1 ***Introduction***

CHAPTER 1

INTRODUCTION

101. GENERAL

a) For ensuring optimum performance of wagon fleet, it is necessary that:

- Preventive maintenance is given timely to avoid occurrence of defects
- Defects are attended effectively and well in time so that the wagons remain fit for traffic use till the next schedule falls due
- Detention during examination and repairs is kept to minimum
- Frequent failures of similar nature are studied and necessary modifications/ design changes are effected to eliminate the cause of such failure.

In course of time and based on experience, various procedures/schedules for maintenance of wagons have been prepared. The schedules and procedures have been largely standardized and issued by Railway Board, RDSO, IRCA etc. However, in many cases, instructions have been issued piecemeal. This manual consolidates various standing instructions issued on wagon maintenance and lays down guidelines for ensuring uniformity in the practices to be followed on various railways. The important aspects of wagon maintenance have been covered and wherever necessary, the references are indicated so that the reader can refer these, if necessary, for detailed instructions and procedures not contained in this manual. In addition, the Workshop Orders, Carriage and Wagon circulars, important letters and Technical Standing Orders issued by Zonal Railways; taking into account the particular requirements and conditions existing on the railways; must be read in conjunction with this manual.

b) This manual does not deal with the special stock or ODCs for which separate instructions are issued by RDSO/manufacturers. It also doesn't cover non-pooled stock, used only on one or two zonal Railways.

c) At the end of this chapter, the list of important instructions and references have been given. Throughout this manual, wherever IRCA Part III has been mentioned, it refers to IRCA Part-III, 2000 edition.

d) While proper maintenance plays a vital role in ensuring effectiveness of the rolling stock, an equally crucial role is played by proper handling and careful operation of the wagon fleet so as to minimise the incidences of damage and subsequent need for repairs. Care must be taken to avoid bumping of wagons having CBC Knuckles in closed position. Proper release of brakes must be ensured. Cleaning of wagon interiors after unloading of corrosive, hygroscopic or other harmful consignments is necessary by unloading party and to be ensured by the commercial staff. Place free end of hose pipes on dummy carriers and couplings on suspension hooks.

102. IMPORTANT DIMENSIONS OF WAGONS

The important dimensions and sketches of main type of wagons have been given below.

TABLE 1.1 UIC BOGIE WAGONS – VACUUM BRAKE

Type of wagons	BOXT	BOXC	BCXT
Length over Head stock (mm)	12800	12800	14500
Length over Buffers (mm)	14070	N.A.	15770
Length over Couplers (mm)	14082	13729	15782
Length inside/ Length of wall (mm)	12792	12790	14494
Width inside (mm)	2852	2852	2944
Inside height/ Height of wall (mm)	1880	1880	2446
Wheel Base (mm)	2000	2000	2000
Bogie Centre (mm)	8800	8800	10,000
Journal Size (mm)	RB 130	RB 130	RB 130
Journal Centre (mm)	2240	2240	2240
Wheel dia on tread (mm)	1000	1000	1000
Max. Axle load (t)	20.32	20.32	20.32
Tare (t)	26.23	25.0	28.5
Pay load (t)	55.05	56.28	52.8
Gross load (Pay + Tare) (t)	81.28	81.28	81.3
Ratio Gross Load/Tare	3.1	3.24	2.85
Loading density (t/m)	5.77	5.92	5.16
Floor Area (Sq. m)	36.5	36.5	42.7
Cubic Capacity (Cu. m)	68.58	68.58	104
Total Brake power- Empty (Kg)	19339	19339	18618
Total Brake power – Loaded (Kg)	34913	34913	34192

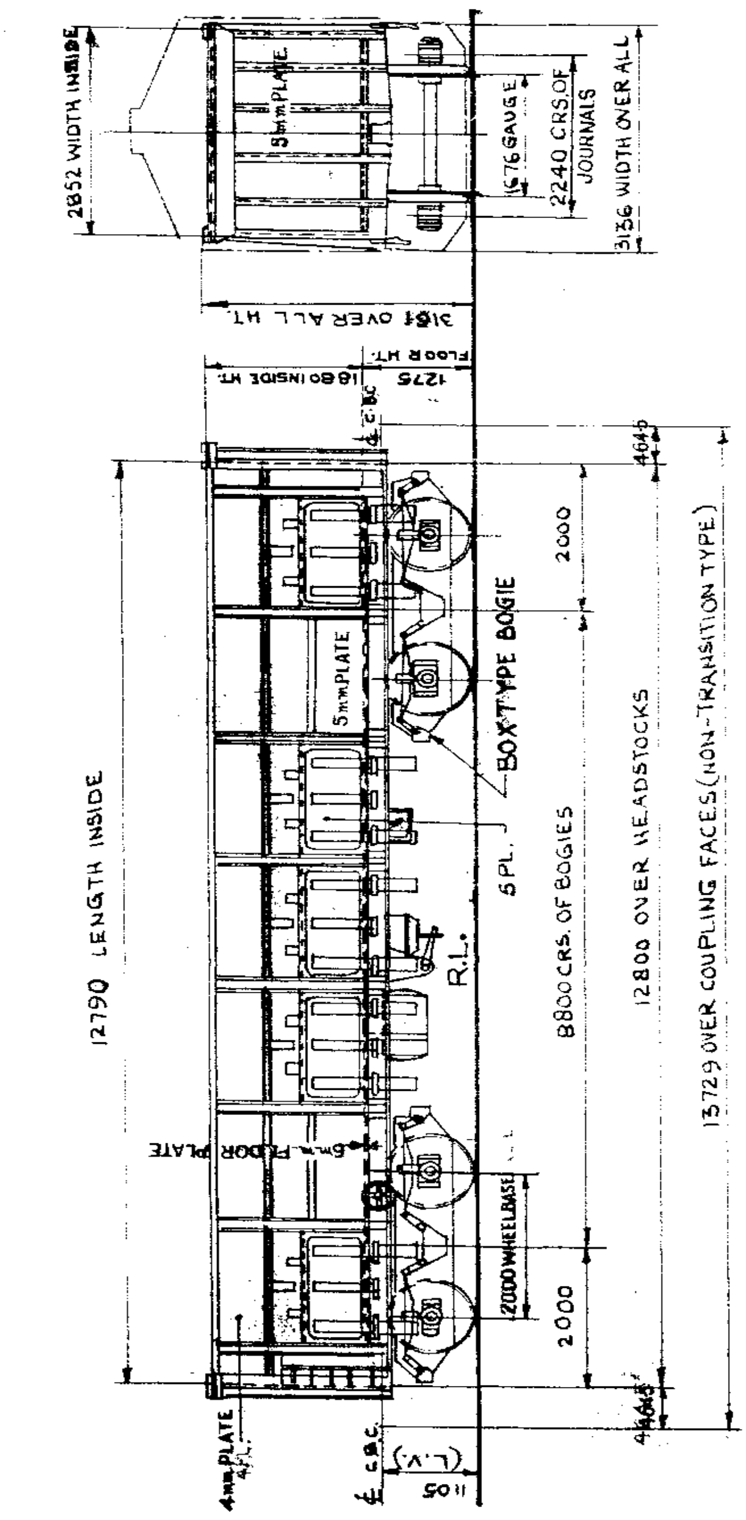

Fig. 1.1 BOXC WAGON (Ref: RDSO SK.101-626010)

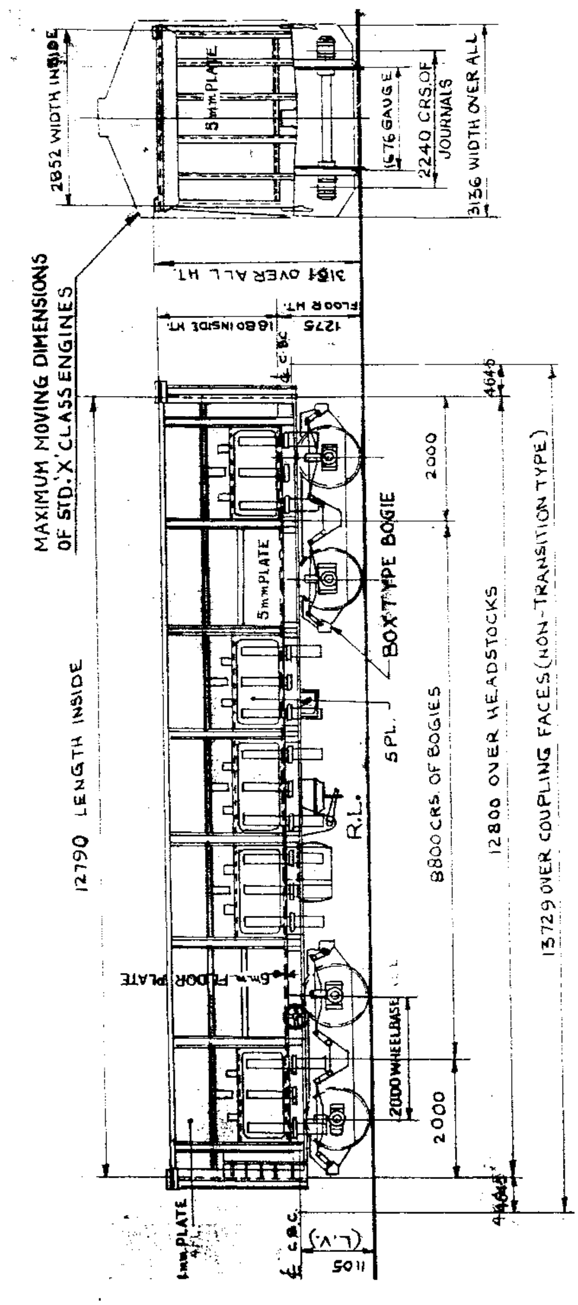

Fig. 1.2 BCXT WAGON (Ref: RDSO SK 701-83901)

TABLE 1.2 CASNUB BOGIE WAGONS – AIR BRAKE

Type of wagons	BOXN	BCN	BRN
Length over Head stock (mm)	9784	14500	13716
Length over Buffers (mm)			14986
Length over Couplers (mm)	10713	15429	14645
Length inside/ Length of wall (mm)	9784	14494	13716
Width/Dia inside (mm)	2950	2944	2845
Inside height/ Height of wall (mm)	1950	2446	
Wheel Base (mm)	2000	2000	2000
Bogie Centre (mm)	6524	10,000	9144
Journal Size (mm) CTRB	144.5	144.5	144.5
Journal Centre (mm)	2260	2260	2240
Wheel dia on tread (mm)	1000	1000	1000
Max. Axle load (t)	20.32	20.32	20.32
Tare (t)	22.47	27.20	24.4
Pay load (t)	58.81	54.08	56.9
Gross load (Pay + Tare) (t)	81.28	81.28	81.3
Ratio Gross Load/Tare	3.62	2.99	3.33
Loading density (t/m)	7.59	5.27	5.55
Floor Area (Sq. m)	28.86	42.67	39
Cubic Capacity (Cu. m)	56.28	104.37	
Total Brake power- Empty (Kg)	18900	18900	18900
Total Brake power – Loaded (Kg)	33642	33642	33642

TABLE 1.3 OPEN FOUR WHEELER WAGONS

Particulars	Broad gauge		Metre gauge		
Mechanical code	O	OM	MO	MOX	MOM
Description	Open general purpose	Open military	Open	Open heavy	Open military
Tare (t)	10.31	10.62	5.69	5.84	5.5
Pay load (t)	22.29	21.98	18.71	18.56	18.9
Axle load(t)	16.30	16.30	12.2	12.2	12.2
Length over buffers/couplers (mm)	7214	9652	7786	7786	7786
Floor area (Sq.m)	16.91	23.85	14.98	14.97	14.98
Cubic capacity (Cu.m)	27.00	15.07	17.5	21.28	9.5
Journal centre (mm)	2235	2235	1475	1475	1475
Journal size (mm)	255x127	255x127	230x115	230x115	230x115
Wheel dia on tread (mm)	1090	1090	725	725	725
Wheel base (mm)	3504	4877	3657	3657	3657
Type of coupler	Screw coupling	Screw coupling	ABC	ABC	ABC
Type of bearing	Plain	Plain	Plain	Plain	Plain
Type of brakes	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum

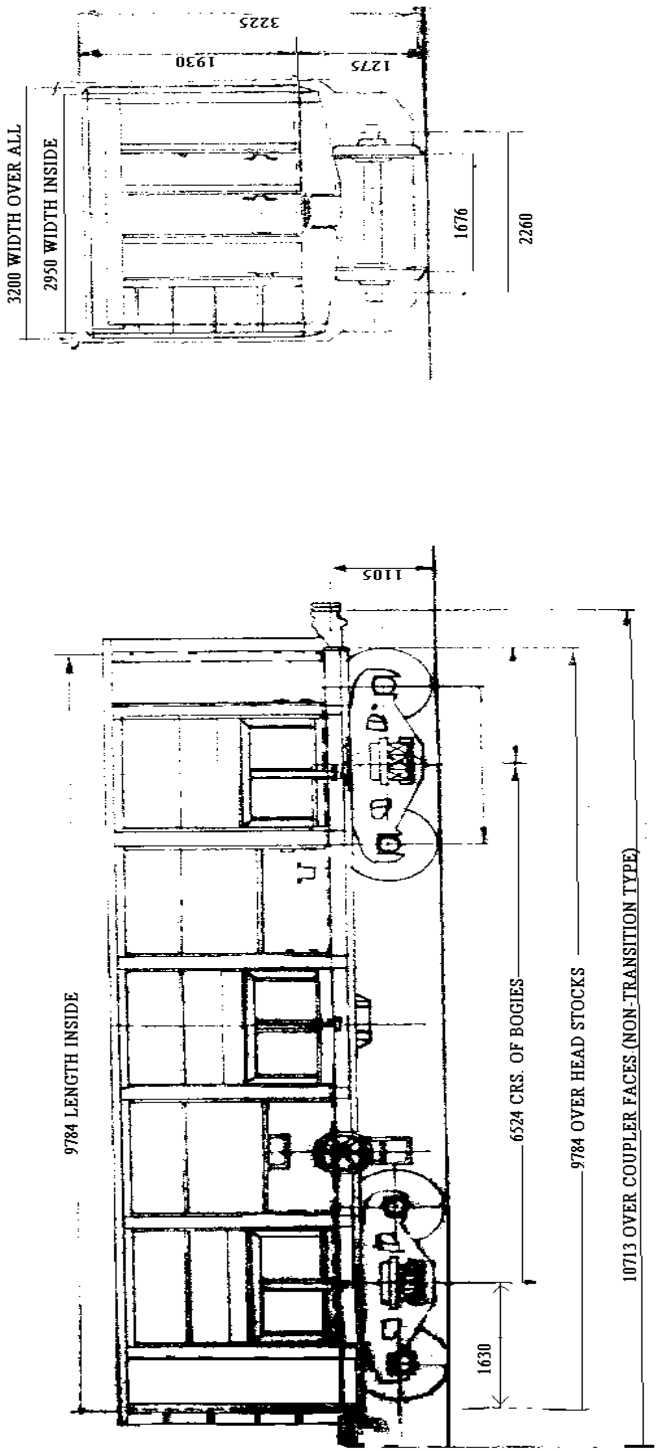

Fig. 1.3 BOXN WAGON (Ref: RDSO WD 80007-S-02)

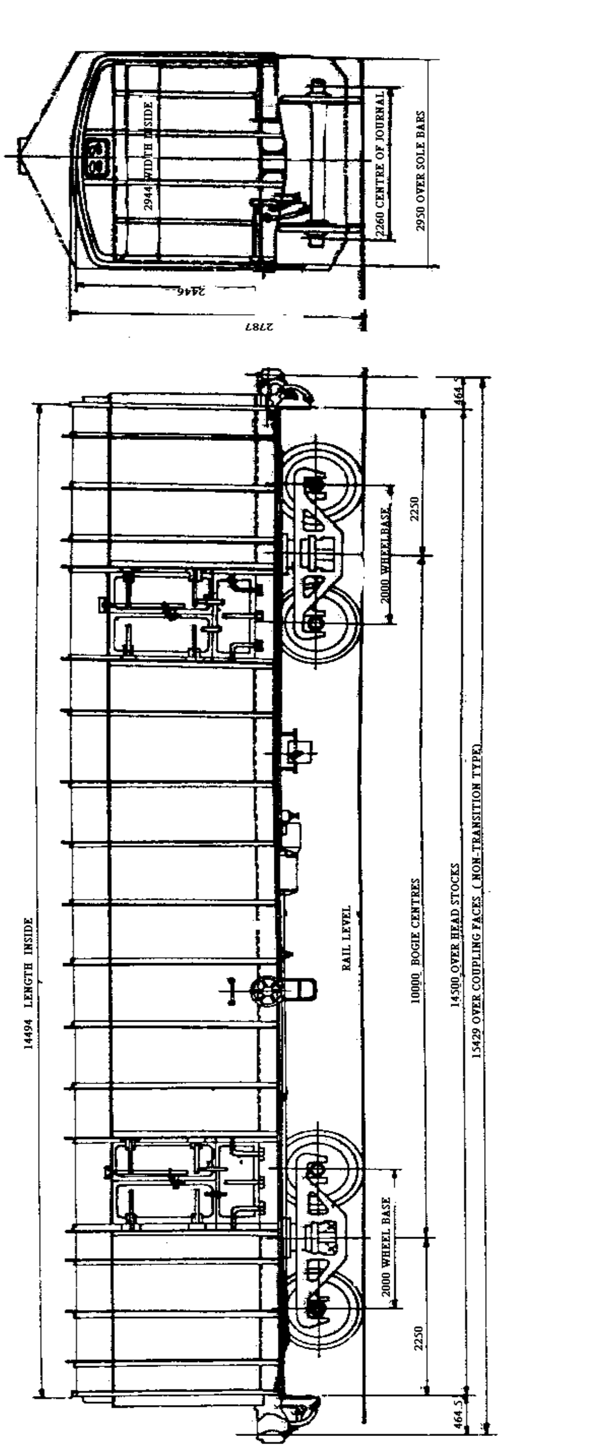

Fig. 1.4 BCN WAGON (Ref: RDSO WD-84014-S/1)

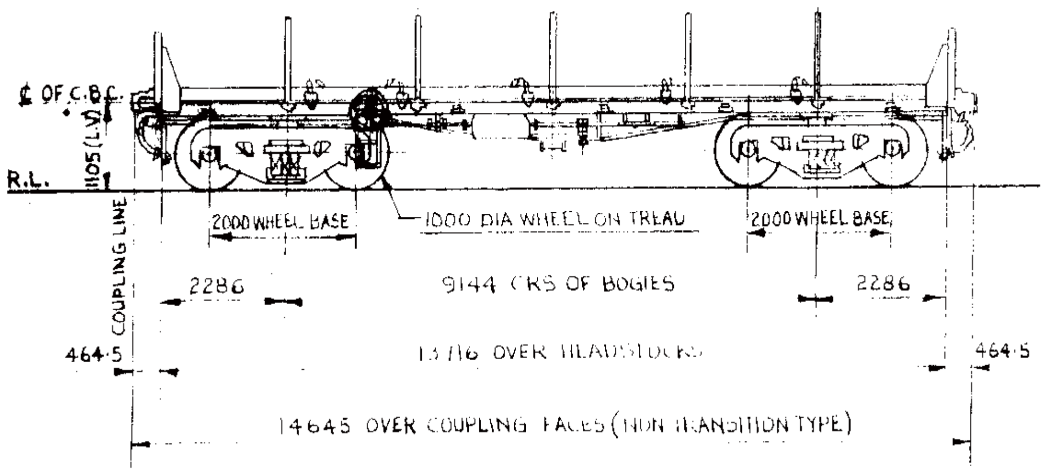

Fig. 1.5 BRN WAGON (Ref: RDSO WD-84013-S-1)

TABLE 1.4 OTHER STANDARD WAGONS

Particulars	Broad gauge				Metre gauge		Narrow gauge
Mechanical code	TP	CRT	BOI	BOY	MBO	MBOC	NOL
Description	Tank Petrol	Cover-ed wagon	Open gondo-la	Open gondo-la	Bogie open	Open coal	Bogie open
Tare (t)	12.2	13.1	22.80	19.9	10.82	13.98	8.48
Pay load (t)	20.4	27.54	58.48	71.7	37.98	35.82	24.03
Axle load(t)	16.3	20.32	20.32	22.9	12.2	12.2	8.1
Length over buffers/ couplers (mm)	8280	8822	11629	11929	12511	14340	11430
Floor area (Sq.m)		23.2	30.47	32.13	25.78	29.96	22.76
Cubic capacity (Cu.m)	25.5	61.9	32.0	37.75	16.32	35.0	29.02
Journal centre (mm)	2235	2240	2240	2260	1475	1475	1220
Journal size (mm)	255 x 127	RB 130	130	144.5	230x115	230x115	180x95
Wheel dia on tread (mm)	1090	1000	1000	1000	725	725	585
Wheel base (mm)	4572	4900	6700	7330	7620	9449	7925
Type of coupler	Draw bar	Tran. CBC	CBC	CBC	ABC	ABC	ABC
Type of bearing	Plain/ RB	RB	RB	RB	Plain	Plain	Plain
Type of brakes	Vac	Vac	Vac/ Air	Air brake	Vac	Vac	Vac

TABLE 1.5 TANK WAGON

Particulars	Broad gauge				
Mechanical code	TBT	TR	TM	TPGL	TPGLR
Description	Bitumen tank	Coal Tar tank	Molasses tank	Liquid petrolium gas tank	Liquid petrolium gas tank
Tare (t)	13.00	10.8	10.75	20.66	17.1
Pay load (t)	19.5	21.7	21.76	11.84	15.4
Axle load(t)	16.3	16.3	16.3	16.3	16.3
Length over buffers/ couplers (mm)	7215	7215	7215	9652	9652
Dia inside barrel (mm)	2362	2143	2143	2000	2300
Cubic capacity (Cu.m)	23.5	19.4	19.4	24.1	33.1
Journal centre (mm)	2235	2235	2235	2235	2235
Journal size (mm)	RB120 dia	RB120 dia	RB120 dia	RB120 dia	RB120 dia
Wheel dia on tread (mm)	1090	1090	1090	1090	1090
Wheel base (mm)	3505	3505	3505	4877	4878
Type of coupler	Screw coupling	Screw coupling	Screw coupling	Screw coupling	Screw coupling
Type of bearing	RB	RB	RB	RB	RB
Type of brakes	Vacuum	Vacuum	Vacuum	Vacuum	Vacuum

TABLE 1.6 BRAKE VAN

Particulars	Broad Gauge	
Mechanical code	BVG	BVM
Description	Brake van goods	Brake van match truck
Tare (t)	10.77	12.7
Pay load (t)		
Axle load(t)	16.3	16.3
Length over buffers/ couplers (mm)	7213	7213
Journal centre (mm)	2235	2235
Journal size (mm)	225 x 127	225 x 127
Wheel dia on tread (mm)	1090	1090
Wheel base (mm)	3505	3505
Type of coupler	Screw coupling	CBC
Type of bearing	Plain	Plain
Type of brakes	Vacuum	Vacuum

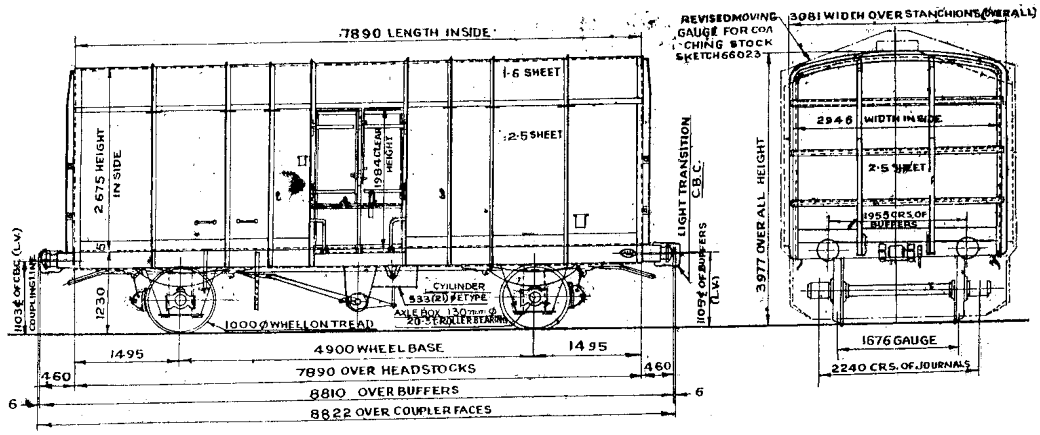

Fig. 1.6 CRT WAGON (Ref: RDSO SK. 71605)

103. IMPORTANT RULE BOOKS AND REFERENCES

List of technical monograms/instructions relevant to maintenance of freight stock are included in the compendium of instructions/ technical monograms issued vide Railway Board's letter No. 99/EAR/3400/21 dt. 4.5.99. The following rule books, pamphlets and monograms contain information required to supplement this manual. These may be referred to for details not available in this manual.

i. IRCA Conference Rules Part III (2000) - Rules for Maintenance, Examination and Interchange of Goods Stock (BG & MG System) of Indian Government Railways
ii. Prevention of Hot Boxes - A Guide (Published by Railway Board)
iii. RDSO's Technical Pamphlet G-16 - Instructions for Maintenance and Operation of Box Wagons
iv. RDSO's Technical Pamphlet G-37 - Recommended practice for welded fabrication in wagons
v. RDSO's Technical Pamphlet G-38 - Instructions for Maintenance and Operation of 'TCL' Tank wagon
vi. RDSO's Technical Pamphlet G-40 - Manual of Instructions for Anhydrous Ammonia Tank.
vii. RDSO's tech. Pamphlet No. G-44H/Jan 78 Instructions for operating staff hump shunting and marshalling of BOX wagon
viii. RDSO's tech. Pamphlet No. G-45H Instructions for fitting trapauling equipment on BOX wagon.
ix. RDSO's tech. Pamphlet No. G-55H/Aug.76 Instructions for maintenance and operation of hydrochloric acid tank wagon type THA.
x. RDSO's tech. Pamphlet No. G-62/June.77 Maintenance manual of alliance II coupler
xi. Indian Railways Code for the Mechanical Department (Workshops)

xii. RDSO's Technical Pamphlet G-65 Instructions for inspection and maintenance of TPGLR

xiii. RDSO's tech. Pamphlet No. G-66/1983 Maintenance manual for TSA.

xiv. RDSO's Technical Pamphlet G-70 Instructions for inspection and maintenance of BOXN wagons fitted with CASNUB Bogies and twin pipe air brake system.

xv. RDSO's tech. Pamphlet No. G-71 Maintenance manual for phosphoric acid tank wagon.

xvi. RDSO's tech. Pamphlet No. G-72 General standard specification for fabrication of wagon U frame and bogies.

xvii. RDSO's Technical Pamphlet G-73 Instructions for inspection and maintenance of BOBR

xviii. RDSO's Technical Pamphlet No.G-76 (Supersedes old pamphlet No.G-46)

xix. RDSO's tech. Pamphlet No. G-79 Instructions for operation and maintenance for BTAL/BTALN

xx. RDSO's Technical Pamphlet No. G-80(Supersedes old pamphlet No. G-47)

xxi. RDSO's Technical Pamphlet G-81 Instructions for inspection and maintenance of CTRB

xxii. RDSO's tech. Pamphlet No. G-82 Instructions for operation and maintenance BG bogie tank wagon for alumina type BTAL.

xxiii. RDSO's tech. Pamphlet No. G-83 Instructions for operation for maintenance of BTCS wagon

xxiv. RDSO's Technical Pamphlet G-86 Instructions for inspection and maintenance of BTPGL/BTPGLN

xxv. RDSO's tech. Pamphlet No. G-87 Safe handling of hazardous chemicals transported in rail tankers.

xxvi. RDSO's Technical Pamphlet G-90 Instructions for inspection and maintenance of BTPN

xxvii. RDSO's Technical Pamphlet G-92 Instructions for inspection and maintenance of Slack Adjuster type IRSA 450 & 600

xxviii. RDSO's Technical Pamphlet G-95 Instructions for inspection and maintenance of CASNUB Bogies

xxix. RDSO's Technical Pamphlet G-97 Instructions for inspection and maintenance of Air Brakes

xxx. RDSO's Technical Pamphlet No. WT-77-1 & WT-79-1 for inspection and maintenance of 20.3 Tonnes Roller Bearing and 16.3 Tonnes Roller Bearing axle boxes fitted wagons.

104. EXISTING WAGON FLEET

The strength of present wagon fleet on Indian Railways is given at the end of this manual in Appendix-I.

105. STANDARD INFRASTRUCTURE FOR WAGON DEPOT

The standard infrastructure required in wagon depot is given in Appendix-II.

106. IMPORTANT WAGON MODIFICATIONS

The list of important modifications to be carried out on freight stock is given in Appendix-III.

107. NUMBERING CONVENTION IN THE MANUAL

For convenience of indexing of reference, the paragraphs have been numbered according to a 3 /4 figure "Code", in which the last two figures give the number of the paragraphs and the remaining figures the number of the chapter. Thus paragraph 101 of any code is paragraph 1 of chapter 1 of that code and paragraph 1103, paragraph 3 of chapter 11.

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108. NUMBERING OF TABLES AND FIGURES IN THE MANUAL

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MAINTENANCE MANUAL
FOR
WAGONS

Chapter – 2 Warranty, Maintenance & Condemnation

CHAPTER 2

WARRANTY, MAINTENANCE & CONDEMNATION

This chapter gives general information about periodicity of various types of inspections and maintenance schedules for goods stock on open line. Prescribed period at which POH is to be carried out on various types of stock has also been given. However, special practices to be followed for repairs during POH are indicated in the concerned chapters later in the manual.

At the end of this chapter, at a glance picture of the prescribed intervals for POH and ROH of wagons are given in the tables 2.1, 2.2 & 2.3.

201. WARRANTY INSPECTION OF NEWLY BUILT WAGONS

(Ref.- Rly. Bd.'s letter no. 64/M(WTY)/954/Policy dated 3.4.74)

a) All newly built wagons have a warranty period of one year or as prescribed in the purchase contract. In accordance with the conditions mentioned in the wagon manufacturing contracts, the charges for rectification of the following category of defects can be realised from the wagon builder :-

- Use of inferior material
- Poor workmanship on the part of contractor
- Imperfect protection
- Other faults on the part of contractor which are noticed during the warranty period.

b) To enable the Railway Board to realise the warranty charges, a systematic inspection of new wagons must be undertaken by JE(C&W) to locate defects during the warranty period. The following procedure is laid down for this purpose:-

(i) All newly built wagons turned out must bear the warranty legend stencilled on both sides of the wagons. The warranty legend will consist of the following particulars:-

- Contract Number
- Date of Commissioning
- Commissioned by
- Inspection due on
- Inspection done by ______ Depot_______ Date_______

The due date of inspection falls due on completion of 11 months from the date of commissioning.

(ii) Whenever wagons due for warranty inspection pass nominated yards, preferably detach them from the train and send to sick line for a systematic check. This warranty inspection can also be done on the train at the time of incoming or outgoing examination if the sufficient time is available.

(iii) Examination of Defects

During the course of warranty inspection, it must be borne in mind that only those defects, which are attributable to the manufacturer due to use of inferior material, poor workmanship, improper protection or any other faults, are to be reported. The following are some of the defects, which fall under this category :-

A) Welding defects

- All types of welding failures
- Welding defects such as insufficient or unequal leg length of fillet weld, porosity, lack of fusion, etc.

B) Riveting defects

- Loose rivets
- Badly formed rivet heads
- Rivets with staggered heads
- Improperly filled rivet holes

C) Fitting Defects

- Improper fitting of axle guards
- Tie rods not bent tight over the axle guards etc.

D) Material failures such as breakage of:

- Bearing Springs
- Shackle pins
- Shackles
- Screw coupling and drawbar
- Underframe and body members

E) Improper Protection

- Improper pairing of underframe body, roof and components resulting in corrosion
- Wagons not being water tight

F) Train Pipe leakage and unsatisfactory working of brake cylinders

G) Roller Bearing Defects

Wagons fitted with roller bearings are normally examined only in major sick lines. If any defect is noticed on opening the covers, the entire wheel assembly must be sent to the workshop. After inspection in the workshop, if it is felt that the defect is attributable to the contractor, the workshop incharge should report the defect to the concerned roller bearing manufacturer and others concerned. Since the Railways normally supply wheels and axles to the builder, defects noticed on the wheel and axles need not be reported to the wagon builders. However, the extant instructions for reporting any defect on the tyres, wheels and axles must be followed. With regard to centre buffer couplers also, if the defect is attributable to the manufacturer, the same procedure should be followed as in case of wheels, as this is also a free supply item to the wagon builders by Railways.

The procedure of warranty inspection of BTPN wagons are same as above with special attention to internal and external examination of barrel for any failure of longitudinal/ circumferencial joint, cracks in barrel, leakage by barrel fittings and examination of cradles and anchoring rivets as per Technical pamphlet No. G-90.

c) METHOD OF REPORTING

A. The particulars, which are to be furnished, are as follows:-

i. Contract No.

This indicates the contract number under which the order has been placed by the Railway Board on the Wagon Builders for the manufacturer of wagons. This will be stencilled on the wagon in the Warranty legend. The Junior Engineer (C&W) should ensure that correct particulars as obtained on the wagon are fill against this item.

ii.	**Wagon number**	} Needs no clarification. Both
iii.	**Code (Mech./Transport**.)	} Mechanical and Transportation
iv.	**Owning Railway**	} codes of the wagon must be
v.	**Name of the Manufacturer**	} recorded.

vi. **Date of Commissioning** - Junior Engineer (C&W) must fill the date as obtained the Warranty legend stencilled on the wagon .

vii. **Date of Warranty Inspection** - Junior Engineer (C&W) must fill the date on which the wagon was actually inspected by him.

viii. **Defects attributable to the Manufacturer** - all the defects attributable to the manufacturer should be clearly indicated.

The actual location of the defect should be clearly recorded. For this purpose, the Board has issued a Drawing SK. No.1 WTY which indicates the numbering of axle boxes on meter gauge four-wheelers, broad gauge four-wheelers, meter gauge bogie wagons and BG bogie wagons BCX and BOX. The Board has also issued another drawing No. WG/1/65114/S-1, which indicates the numbering of axle, boxes for BRH wagons. For instance, if one bearing spring is found broken the number of axle box on which the particular bearing spring is fitted should be indicated in the report.

In the case of material failure like top plate of laminated spring breakage, etc. it is essential that such items should be sent to the Chemist and Metallurgist of the respective Railways so as to enable him to submit the test reports. While sending the materials to the CMT, the particulars of the wagon i.e. the wagon No., owning Railway, Mechanical/Transportation codes the Builders' name, the Contract Number and the serial number of the Warranty Inspection Report must be mentioned in the forwarding memo. These particulars can be included in the Test Report submitted by the CMT. This will facilitate in connecting the test reports with the respective Warranty reports at the Railway Board's Office.

The CMT will send his analysis report direct to the Railway Board's office. In order to prefer the claims expeditiously as possible, it is desired by the Board that the reports of Chemist and Metallurgist should be sent to the Secretary(WP), Warranty, Railway Board, New Delhi, within 20 days from the date of warranty inspection. The report of the CMT should not be sent to the wagon Builders.

A 'NIL' defect report should be sent if there are no defects attributable to the manufacturers.

B. Estimated cost of rectification

It has been found that the estimates prepared by Junior Engineer(C&W) differ from the estimates prepared by Board. To avoid advice of different estimates to wagon builders, it is decided by Railway Board that no estimates are to be furnished by Junior Engineer(C&W) in the warranty inspection reports. Against this column, simply mention "Cost will be advised by the Railway Board".

Along with other remarks, if any, a written certificate must be given to the effect that the defects mentioned have arisen due to inferior material (i.e. material of wrong specification or cheap quality) or bad workmanship (poor workmanship like bad riveting, welding, fitting etc.) or imperfect protection of the components (vacuum cylinder rusted etc.) or any other defaults on the contractor's part.

C. Numbering of the report

In order to enable the Board's office to keep a check on the performance of each nominated C&W Depot and also to detect the missing reports, all Warranty Inspection Reports must be serially numbered.

For uniformity it is desired that the C&W Depots should indicate the number of Warranty reports in three barrels by indicating the station code in the first barrel, Warranty in the 2nd barrel and serial number of the report in the last barrel. For example ASN/WTY/81 indicates that this warranty report was sent from Asansol Carriage Shed, 'WTY' refers to Warranty report and '81' refers to the serial number of the warranty report i.e. serial number the wagon which has been warranty inspected from the commencement of the inspection.

Date on which the Warranty report is submitted must be indicated. The Junior Engineer(C&W) who signs the report should ensure that his designation is properly recorded by affixing his rubber stamp, which should indicate the designation as well as the reporting station.

D. Disposal of the Proforma

- In the case of wagons built by railway workshops, the report should be sent to the following addresses :-

  1. The workshop which manufactured the wagon
  2. CME of the manufacturing workshop
  3. Secretary (WP)/Railway Board/New Delhi.
  4. CME of the inspecting zonal railway
  5. D.M.E. of the inspecting division

- In the case of wagons built by private manufacturers, the report should be sent to the following addresses :-

  1. Wagon builder concerned
  2. Secretary (WP)/Railway Board, New Delhi.
  3. G..M.(Mech.) of the inspecting zonal railway
  4. D.M.E. of the inspecting division.

E. It is necessary that Junior Engineer(C&W) must send the warranty inspection report to the parties indicated above after inspection without any delay.

F. After submission of the warranty reports, the Railway Board will decide the finalisation of claims. Zonal railways should not enter into any correspondence with the wagon builders on this subject after sending the warranty report. If any wagon builder returns the warranty report or refuses to accept the claim, such cases must be immediately advised to Railway Board. Only Railway Board will do all further correspondence and processing in this regard.

d) MAINTENANCE OF RECORDS

The Train Examining Depot should maintain following files and registers:

- One file for filing all the policy instructions on warranty inspection received from their divisional office/CME. The Junior Engineer(C&W) should be conversant with the instructions issued from time to time. It is desired that an index sheet be maintained giving the particulars of the letters so as to keep a continuity of all the instructions.
- A second file for filling all the warranty inspection reports, intermediate or finally submitted by the Depot.
- A third file should be maintained for filing all correspondence regarding warranty inspection, periodical statements of inspections carried out etc.
- A register should be maintained giving the following details of the wagons inspected during the warranty period :-

a) Date of Inspection
b) Wagon No.
c) Owning Railway
d) Mech. Code
e) Name of Builder
f) Date of Commissioning
g) Defects noticed
h) Warranty inspection report no. and Date
i) Remarks

The above inspection procedure after 11 months of commissioning does not in any way preclude any Railway from reporting any defect direct to the wagon builder and to the parties mentioned above. In the same manner, if defects are noticed at any time during the warranty period. During the intermediate warranty inspection, stencilling of the Station Code and date of Inspection should not be done on the wagon. This should only be done at the time of final warranty inspection i.e. after completion of 11 months and before completion of 12 months from the date of commissioning the wagon.

202. EXAMINATION AND MAINTENANCE PERIODICITY

a) ROLLING IN EXAMINATION

All terminating trains are to be given “Rolling-in-examination” while entering a station having a train examining depot. After Rolling in examination when the train stops in yard, immediately feeling of axle boxes is necessary to arrest hot/over warm axle box.

b) EXAMINATION OF TERMINATING LOAD

Examination of terminating loads and through goods trains, passing through station with a train examination depot, is to be carried out as soon as the train comes to a halt (unless the competent local authority of the Mechanical Department has waived off such examination). For the examination of terminating loads the pattern of train examination issued by individual Zonal Railway keeping in the view of the Railway Board's guidelines vide their letter no. 94/M(N)/951/57 dated 28.2.2000.

c) EXAMINATION OF TRAIN AT ORIGINATING STATION

i. The train examining staff must ensure that the wagons are in fit condition and do not have any rejectable defects. A certificate has to be given to the Station Master by JE(C&W) to this effect before despatch of the train. Before issuing fit Certificate, train examining staff also ensure minimum permissible percentage of brake power. For details refer Chapter 3.

ii. The level of vacuum/air pressure on the engine & brake van alongwith the percentage of effective brake cylinders must be recorded on the brake certificate duly countersigned by the driver and guard.

iii. Wagons, which have been humped, must be specially checked for damages occurring due to impacts during humping.

d) MAKING WAGONS FIT TO RUN BY PASSENGER TRAIN

Goods wagon may be attached to a passenger train provided the maximum speed to the train does not exceed 75Kmph for BG and 50Kmph for MG. The wagons must satisfy the following condition:-

i. They are fully fitted with operative brake cylinders
ii. Fitted with shackle type bearing springs and not shoe ended springs
iii. Shackle pins with bearing springs fitted with split cotters and washers
iv. Brake gear should have closed type of safety brackets
v. Should not be overdue re-packing/oiling
vi. Axle Guards should have angle type bridle with two rivet holes at each end
vii. The wagon should not be overloaded or unevenly loaded
viii. Wagon fitted with wheels having no star marks on journal cap to be ensured by duly opening the Axle Box cover
ix. Wagons should not be overdue POH
x. Minimum wheel base should be 4724 mm (15'-6") for BG and 3658 mm (12'-0")for MG.

e) NURSING OF AXLE BOXES

It is generally observed that plain bearing axle boxes, which have been attended to, have greater tendency to develop higher temperature in the first 40 to 50 km of the run after attention. If the axle boxes are felt at this stage and "nursed", if required, the possibility of detachment of wagons on account of hot axle is greatly minimised during subsequent run. Keeping this fact in mind, "nursing stations" are often established at suitable stations, 40-50 km away from major marshalling yards. Whenever such nursing stations are set up, in addition to feeling the axle boxes and giving necessary attention to them, C&W staff there must also look out for any loose, broken or deficient wagon components.

f) INTENSIVE EXAMINATION

The purpose of intensive examination of goods stock is to permit extended run of through trains by raising the general standard of fitness of rolling stock by concentrated attention at the time of despatch from originating yards. Runs can be extended upto 4500 Km on BG in case of air brake stock and 800 km in case of vacuum brake. For empty rake consisting of only BOX wagons, this can be extended up to 1000 km.

Note: The details of above examinations are given in chapter 3.

203. INTERCHANGE EXAMINATION

The procedure for train examination at interchange points has been dispensed with after introduction of end to end examination**.**

204. ROH OF WAGONS WITH UIC BOGIE

a) BOX Wagon and other wagons fitted with plate fabricated UIC bogies are to be given a routine overhaul (ROH) at C&W Depots nominated for this purpose at an interval of 18 months (i.e. two ROH schedules between successive POH).

b) Detailed instructions issued by RDSO in publication No. G-16 (Rev.II) and R7 to be strictly followed. The important points are summarised below for ready reference:-

   i. Lift the body and place it on trestles
   ii. Run out the bogies
   iii. Strip the brake gear fittings and examine for wear and damages. The fittings should be checked with condemning gauge prescribed in G-16 (Rev.II) to ensure the serviceability.
   iv. Lower vacuum brake cylinders. Overhaul and test. Station code initials and date to be stencilled after overhaul.
   v. Gauge the wheels. If necessary, carry out tyre turning
   vi. Strip springs and springs suspension gear. Check springs for free camber and defects. Replace if required. Check the suspension gear and replace worn components
   vii. Examine bogie frame for welding defects/failures; repair; modify; and check alignment to ensure confirmation to RDSO pamphlet R-7

viii. Rectification of welding defects to be done as prescribed in RDSO technical pamphlet G-37.
ix. Examine centre pivot and side bearer for wear and cracks. Gauge the centre pivots. Repair if necessary
x. Check horn cheeks and axle box lugs for wear. Fit liners if necessary
xi. Examine brake shaft bearings
xii. Examine brake gear levers, rods, etc. for proper functioning and wear. Check adjustment of the tare tie rod, empty load device and rectify if required. Manual adjustment of brake gear is done in accordance with wheel diameter.
xiii. Examine slack adjuster. Check dia 'A' and adjust if necessary
xiv. Examine all draft and buffing gears, CBC, locking levers and transition gears. Attend the defective/worn out parts. Knuckles to be checked by contour gauge, anti creep/ articulated rotary operation of CBC lock assembly to be checked.
xv. Replace worn out brake blocks
xvi. Thoroughly inspect axle boxes externally for any sign of defects such as grease leaking out, visible sign of damage or seized bearing. Rotate axle box by hand to see if it revolves freely and smoothly. If the movement is abnormal or heavy, open axle box for inspection. Take further action as prescribed in RDSO pamphlet No. WT-77-1.
xvii. All the wheels are to be ultrasonically tested, Axle boxes to be topped up by fresh grease. Axle bolts are to be tightened up by torque wrench with proper torque. Old locking plates are not to be reused. UT and RB examination to be carried out duly replacing the old grease.
xviii. Check doors, hinges and other fittings. Lubricate.
xix. Touch up paint and lettering, if necessary.
xx. Ensure that at the time of re-assembly, all specified anti-pilferage measures have been taken and all safety straps, loops and other safety fittings are correctly fitted.
xxi. After completion of ROH work, each wagon has to be tested for leakage for ensuring reliability of vacuum cylinder and other brake gear components.

205. ROH OF AIR BRAKE WAGON WITH CASNUB BOGIE

BOXN wagons are to be given Routine Over-Haul (ROH) after every 18 month at the nominated sick line/wagon depot, where proper facilities are provided. The ROH schedule is as follows:

a) Lift the body, keep it on trestles and run out bogies
b) Strip bogie component for examination and repair as below:

- Strip spring & spring suspension arrangement including snubbing device. Check springs for free height and other defects. Replace where required.
- Examine Bogie frame. Check frame alignment as per instructions contained in RDSO Technical Pamphlet No. G-64.

- Examine pivot for welding defects/cracks/abnormal depth due to wear. Replace where necessary and lubricate with graphite flakes to IS:495 in dry condition.

c) Strip brake gear levers and rods for examination of worn out/damaged parts.

d) The equipment shall be given attention in accordance with the maintenance manual issued by respective air brake equipment manufacturer:-

i. Cleaning of strainer discs (Reference 6 & 218 of the pamphlet SBA 795/258 of P4aG type Distributor Valve)
ii. Lubrication of brake cylinder/cleaning of its strainer
iii. Check for easy operation of isolating cock & anti-pilferage device of distributor valve cut-off angle cock , manual quick release valve & isolating cock of feed pipe
iv. Draining of Auxiliary Reservoir
v. Checking of hose coupling for serviceability
vi. Cleaning of strainer
vii. Dirt collector to be cleaned
viii. Leakage in pipes and joints to be checked
ix. After carrying out above items of work the wagon shall be tested for proper function of air brake system with single car test device in accordance with the procedure indicated below :

- Connect the BP coupling of single car test rig to the corresponding coupling of the wagon to be tested .The couplings of the other end of the wagon to be closed with dummy coupling heads .Fix pressure gauge on the brake cylinder.
- The single car test device should now be coupled to the main line of a compressor through a pipe.
- Carry out the preparation and testing in accordance with the procedure given in the manufacturers Maintenance Manual and record the reading in the test proforma.
- For passing the wagon, all the parameters shall be within specified limits.

e) Clean horizontal lever, hand brake & gears and lubricate
f) Examine head stock for damage, bent/cracks
g) Refit brake gear levers and rods, lubricate pins and other equipment and apply graphite to horizontal levers of empty load box
h) Replace worn out brake blocks
i) Check wheel profile, turn the wheels as needed. UST of Axle to be carried out & turning of wheel to worn wheel profile during ROH
j) All the wheels are to be checked ultrasonically and Axle box cap bolts are to be tightened up by torque wrench with proper torque and in no case old locking plates are to be reused.
k) CBC Knuckles are to be checked by contour gauge, anti creep/ articulated rotary operation of locking arrangement to be checked.
l) Manual adjustment of brake gear to be done in accordance with wheel diameter.
m) Modification work are to be attended as issued by RDSO from time to time.

206. ROH OF CRT WAGON

a) ROH periodicity 21 months.
b) Brake gear examination of worn out/damaged parts.
c) Vacuum cylinders overhaul, testing, stencilling of station code, initials, dates etc.
d) Checking of spring and spring suspension gear, free camber, checking of shackle, stone, scroll iron , shackle pin, washer for worn out/damaged etc.
e) Examination of horn cheek, axle guard etc.
f) Examination of underframe.
g) Replacement of worn out brake blocks.
h) Attention to draw and buffing gear and attention to defective/ worn out parts.
i) Examination of alliance and CBC, uncoupling gear etc.
j) Checking of Doors and door opening gears and lubrication.
k) Attention, special modification as ordered time to time where practicable in ROH depots.
l) Attention to Roller bearing axle boxes as per instructions given in Technical pamphlet No. WT 77-1. Roller bearing axle boxes should be thoroughly examined externally for detecting sign of defects viz;

- Wear on lugs of axle box body
- Abnormal warmer axle box
- Grease leaking out of Axle box
- Tell tale marks of grease on axle box body and wheels to be looked for Visible sign of damage on axle box body or front cover
- Seized roller bearing
- Axle box is also to be turned by hand to ascertain that its rotation is smooth.

207. NPOH OF GOODS STOCK

Classification of wagon repairs has been rationalised under the following nomenclature :-

a) **Petty Repairs** :- Repairs involving not more than 8 man - hours. Such repairs are to be normally carried out on nominated lines in traffic yards in less than 8 man hours.

b) **Medium Repairs** :- Repairs involving more than 8 man - hours and upto 100 man - hours. These would normally cover repairs to underframe members viz. head stock, middle bars, sole bars, changing of axle guards, wheel changing heavy panel patching, heavy floor repairs, etc. Such repairs are to be carried out in sick lines.

c) **Special Repairs** :- Repairs to heavily damaged wagons involving more than 100 man hours. Such repairs may be carried out either in the workshops or in major sick line. Recommended work areas where serious repairs should be carried out are given in the Table 2.4 at the end of this chapter. Repair to under frame members and other heavy work should be dealt in properly equipped major and medium sickline. Repair to under frame members viz. patching of headstock, sole bar and middle bars, strengthening of bulged ends, replacement of end angle, fitment of more than 5 new full width panel patches, replacement of axle guards to be done in sickline.

Unloadable BOX wagons will be classified as under :-

Category 'A': Such unloadable BOX wagons, which can be repaired and made loadable in wagon depots.

Category 'B': Unloadable BOX wagons, which require attention/repairs in workshops and cannot be classified as Category 'A' or Category 'C'

Category 'C': Unloadable BOX wagons in the age group of 18 to 25 years with sound underframe requiring heavy repairs on body/floor. These wagons to be sent for rebuilding to Dahod, Jamalpur or Charbagh workshops.

Railways to note the aforesaid and ensure that marking of unloadable BOX wagons to nominated workshops are carried out accordingly. JE/SE(C&W) shall do the classification/marking of the wagons under the above three categories in open line.

(i) For wagons classified under Category 'B', the workshops undertaking repairs/conversion of unloadable BOX wagons should observe the following broad guidelines:-

- Unloadable BOX wagons which are over aged or have less than 10 years residual life but having under frame in good condition should be converted to container flats for carrying ISO containers to the maximum possible extent.

- Other serviceable unloadable BOX wagons should be given requisite POH/NPOH attention and made as loadable.

(ii) BOXN wagons of (8-10) years of age and beyond, which are heavily corroded and due/overdue POH, should normally be selected for rehabilitation. However at the time of attention in workshops, wagons due for POH within next 12 months should be given POH. Similarly, the wagons falling due for ROH within next 6 months but not due for POH within next 12 months should be given ROH attention at the time of repairs in the workshops.

Wagons so attended for POH/ROH should be stencilled with a fresh return date for POH/ROH based on laid down periodically for POH/ROH for BOXN wagons. All above rehabilitated wagons should be painted with golden yellow for easy identification.

The repair of BOXN wagons should be carried out as per instructions contained in RDSO's G-70 /1986.

208. CONDEMNATION OF WAGONS

For condemnation of rolling stock, the powers delegated to various officers on zonal railways through their Schedule of Powers may be used. Certain issues have been clarified in Railway Board's letter No. 74/M(N)/951/19 dated 16.10.1974. The same are summarised below:-

a) Condemnation of overage wagons

Over aged wagon stock can be inspected personally by CWM/Dy. CME/WM-Incharge/Sr.DME and condition report prepared and personally signed. Condemnation can be approved by any of these officers.

b) Condemnation of underage wagons

Under aged wagon stock should be inspected personally by CWM/Dy.CME/WM-Incharge/Sr.DME and condition report prepared and personally signed. Condemnation proposals should be sent to CME/CRSE for approval duly concurred by associated finance i.e., WAO of the workshop concerned, further this proposal to expedite the whole process, following procedure to be adopted:-

BG and MG wagons should be condemned on 'as is where is' basis and moved from division to the yards/stations nominated by DRMs. Each DRM should nominate sufficient number of yards/stations on their division for disposal of condemned wagons. Workshops can continue the present practice of sending the wagons to scrap yards.

209. POH & ROH INTERVAL

(Ref: i. IRCA letter M.219/Policy/W Dated 10.5.99)

TABLE No. 2.1

POH INTERVAL OF AIR BRAKE STOCK

Sr. No.	Stock	POH (Years) First	Subsequent
1.	BOXN	6	4.5
2.	BCN/BCNA	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:

1. Wagons become due POH from the last date of the month indicated in the return date
2. Empty wagon will be marked sick for POH up to 30 days in advance of the due date
3. Loaded wagons will be allowed up to 30 days after the due date of POH

TABLE 2.2

POH INTERVAL OF VACUUM BRAKE STOCK

Sr.No.	Type of Wagon	First POH in Years	Subsequent POH in Years
1.	All other wagons including Tank Wagons and CRT wagons except those listed below	4	3 ½
2.	Bogie well wagons	4	4
3.	General service Hopper wagon	4	4
4.	BOBX, BOBS	3	3
5.	BOX, BCX , BRH, BOI, BOM & BTAL wagons fitted with UIC bogie	4 ½	4 ½
6.	Cattle wagons	2 ½	2 ½
7.	Brake Van	2	2
8.	TX/TCL, THA, TSA	2	2
9.	TAL, TPGLR, BTPGL	4	4
10.	Departmental Hopper wagon type BOB, BOBY etc.	6	6
11.	Departmental Stock	4	4
12.	Domestic Containers	1.5	1.5

TABLE 2.3
ROH INTERVAL OF WAGONS

Sr. No.	Stock	ROH Newly Built (Months)	ROH After First POH (Months)
1.	Roller Bearing Tank Wagons	24	21
2.	4-Wheeler wagons converted from 16.3 Tonnes Plain bearing to Roller bearing	24	21
3.	CRT	24	21
4.	TPGLR	24	24
5.	BOX,BCX,BRH fitted with UIC bogie	18	18
6.	BOXN,BCN,BCNA, BRN	18	18
7.	BOBR, BOBRN	24	24
8.	BTPN	18	18
9.	BTPGL, BTPGLN	24	24

10.	BTPH	24	18
11.	BTAL, BTALN	18	18
12.	BTCS	24	24
13.	BOY	18	18

210. WORK AREAS WHERE ATTENTION TO BE GIVEN

Table 2.4 summarises the nature of work to be done during various examinations and repairs in sick line.

TABLE 2.4

WORK AREAS WHERE ATTENTION TO BE GIVEN

Sr. No.	Nature of Repairs		Repairs to be under taken at			
			Intensive repairs	Sick lines	ROH	POH
1.	BODY (BOXN Wagons)					
	UNDERFRAME- Sole Bar					
	Scrap the portion of sole bar at door ways, clean and apply primer paint followed by Top coat		-	-	X	X
	SIDE WALL- Skirting					
	1. Check and patch if corroded then apply primer and top coat on the patch		-	X	X	X
	2. Side Doors- Check damage and repair clean & lubricate hinges		X	X	X	X
	3. Side Pillars- Check cracks at the base & repair		-	X	X	X
2.	**UNDER GEAR**					
	1. Brake Linkage- Check free movement on SWTR test		X	X	X	X
	2. Hand Brake - Check proper working		X	X	X	X
3.	**BODY WORK EMPTY STOCK**					
	1. Patching of body, roof, door or floor plates straightening buldged ends repairs to angle irons, stanchions and crib angles etc.		-	X	X	X
	2. Making wagons water-tight		-	X	X	X
	3. Fitting/replacement of door fastening road, door cotter pin eye, bolt hook and eye locking pin on empty wagons and closing of doors.		X	X	X	X
	4. Fitting/replacement of door fastening rod guide, door hasp which requires riveting on empty wagons. Repairs by welding to door fittings.		-	X	X	X
	5. Hand rail/foot board deficient/or damaged, insecurely fastened at door way of guard's brake van		X	X	X	X
	CASNUB BOGIE					
4.	BOLSTER					
	1. Pocket slope liner	Change liner if thickness less than 5 mm	-	-	X	X
	2. Rotation stop lugs	Provide liners (thickness to suit) if dimensions less than 514 mm	-	-	X	X
	3. Inner Column Gib	Provide liners (thickness to suit) if dimension more than 142 mm	-	-	X	X
	4. Land surface	Provide liners (thickness to suit) if dimension less than 442 mm	-	-	X	X
	5. Outer Column Gib	Renew by welding if dimension more than 241 mm	-	-	X	X
	6. Pocket slope liner	Change liner if thickness less than 5 mm	-	-	X	X

Sr. No.	Nature of Repairs		Repairs to be under taken at			
			intensive repairs	Sick lines	ROH	POH
	7. Rotation stop lugs	Provide liners (thickness to suit) if dimensions less than 514 mm	-	-	X	X
	8. Inner Column Gib	Provide liners (thickness to suit) if dimension more than 142 mm	-	-	X	X
	9. Land surface	Provide liners (thickness to suit) if dimension less than 442 mm	-	-	X	X
	10. Outer Column Gib	Renew by welding if dimension more than 241 mm	-	-	X	X
5.	**SIDE FRAME**					
	1. Column Friction Liner	Change liner if dimension more than 455 mm	X	X	X	X
	2. Column sides	Provide liners (thickness to suit) if dimension less than 209 mm	-	X	X	X
	3. Anti rotation lugs	Provide liners (thickness to suit) if dimension more than 526 mm	-	-	X	X
	4. Key seat to pad 22 W	Provide liners (thickness to suit) if dimension more than 276 mm	-	-	X	X
	5. Crown Roof 22WM	Provide liners (thickness to suit) if dimension more than 321 mm	-	-	X	X
	6. Crown Roof 22NL	Provide liners (thickness to suit) if dimension more than 326 mm	-	-	X	X
	7. Pedestal Crown Sides	Renew by welding if dimension less than 147 mm	-	-	X	X
	8. Pedestal Jaw 22 W	Provide liners (thickness to suit) if dimension more than 275 mm	-	-	X	X
	9. Pedestal Jaw 22 WM	Provide liners (thickness to suit) if dimension more than 283 mm	-	-	X	X
	10. Pedestal Jaw 22 NLS	Provide liners (thickness to suit) if dimension more than 195 mm	-	-	X	X
	11. Pedestal Jaw 22 NLL	Provide liners (thickness to suit) if dimension more than 241 mm	-	-	X	X
	12. Pedestal Sides 22 W	Provide liners (thickness to suit) if dimension less than 102 mm	-	-	X	X
	13. Pedestal Sides 22 WM	Provide liners (thickness to suit) if dimension less than 102 mm	-	-	X	X
	14. Pedestal Side 22 NL	Provide liners (thickness to suit) if dimension less than 78 mm	-	-	X	X
6.	**WEDGE**					
	1. Slope Surface	Renew by welding if dimension less than 7 mm	-	-	X	X
	2. Vertical Surface	If vertical surface from centre line of spigot less than 56 mm provide liner of 6 mm thickness	-	X	X	X
7.	**CENTRE PIVOT (BOTTOM)**					
	Vertical Side 22 W	Renew by welding if wear more than 4 mm	-	-	X	X
	Vertical Side 22 WM	Renew by welding if wear more than 3 mm	-	-	X	X
	Vertical Side 22 NL	Renew by welding if wear more than 3 mm	-	-	X	X
	Seat Side 22 W	Renew by welding if wear more than 3 mm	-	-	X	X
	Seat Side 22WM	Renew by welding if wear more than 3 mm	-	-	X	X
	Seat Side 22 NL	Renew by welding if wear more than 3 mm	-	-	X	X

Sr. No.	Nature of Repairs		Repairs to be under taken at			
			Intensive repairs	Sick lines	ROH	POH
8.	**COIL SPRING**					
	Outer	Group and use in sets. Replace if free height less than 245 mm	X	X	X	X
	Inner	Group and use in sets. Replace if free height less than 247 mm	-	X	X	X
	Snubber	Group and use in sets. Replace if free height less than 279 mm	-	X	X	X
9.	**BOGIE BRAKE GEAR**					
	Pins & Bushes	Change if clearance more than 1.5 mm	X	X	X	X
10.	**AIR BRAKE SYSTEM**					
	Distributor Valve	**Overhauling**				X
	Distributor Valve	Test on SWTR	-	-	X	X
	DV Isolating Cock	Examine operation	X	X	X	X
	DV Release valve	Examine operation	X	X	X	X
	DV Filter	Clean	-	-	X	X
11.	**BRAKE CYLINDER**					
	Filter of Escorts & RPIL make	Clean	-	-	X	X
	Brake Cylinder of Greysham & WSF make	Lubricate	-	-	X	X
12.	**CUT OFF ANGLE COCK**					
	Angle cock	Examine and lubricate	X	X	X	X
	Rubber Seals	Change	-	-	X	X
13.	**DIRT COLLECTOR**		-	X	X	X
	Dirt Collector	Clean	-	-	X	X
	Sealing Ring	Change				
14.	**RESERVOIR**					
	AR & CR	Drain	-	X	X	X
	Sealing Ring	Change	-	-	X	X
15.	**HOSE COUPLING**					
	HOSE & Coupling	Examine	X	X	X	X
	Gasket (MU washer)	Change	X	X	X	X
16.	**METAL PIPES & JOINTS**					
	Pipe Joints	Examine leakage & repair	X	X	X	X
	Seals (20 mm & 32 mm)pipe	Change	X	X	X	X

Sr. No.	Nature of Repairs		Repairs to be under taken at: Intensive repairs	Sick lines	ROH	POH
17.	**SLACK ADJUSTER**					
	Slack Adjuster	Test Functioning, repair if required	X	X	X	X
	“A” dimension	Adjust	X	X	X	X
	M20 Anchor Pin nut	Ensure securing by welding to pin	-	X	X	X
	Air Brake System	Test on SWTR as per procedure	-	X	X	X
	Brake Block	Ensure Std. Key, Spilt pin & all new brake blocks	X	X	X	X
		NB: For detailed main procedure refer RDSO manual G78.				
	CENTRE BUFFER COUPLER					
18.	**CBC BODY**					
	Coupler Body	Replace on condition	-	X	X	X
	CBC Contour	Examine, replace if required	-	-	X	X
	Shank Wear Plate	Replace on condition	X	X	X	X
19.	**KNUCKLE**					
	Nose	Replace if wear more than 4.3 mm with THE knuckle	-	-	X	X
	Knuckle pin	Replace on condition	X	X	X	X
	Knuckle Stretch	Examine, Replace if required	-	-	X	X
20.	**STRIKER CASTING**					
	Wear Plate	Replace	-	-	X	X
	Striker casting	Replace on condition	-	-	X	X
21.	**COUPLER MECHANISM**					
	Anti Creep Protection	Examine and repair	X	X	X	X
	Lock lift assembly	Examine	X	X	X	X
	Operation Mechanism	Examine	X	X	X	X
	Lock	Examine	-	X	X	X
22.	**DRAFT GEAR**					
	Slack	Measure & take correction	-	-	X	X
23.	GENERAL					
	Yoke pin support	Replace on condition	-	X	X	X
	Buffer Height	Examine & Correct if required	X	X	X	X
	NB: 1. For detailed maintenance Practices refer RDSO’s Manual G-76 2. Knuckle with nose more than 4.3 mm and less than 9.0 mm can be used in yard.					

Sr. No.	Nature of Repairs		Repairs to be under taken at			
			Intensive repairs	Sick lines	ROH	POH
24.	**WHEEL AXLE & BEARING**					
	AXLE					
	1. Ultrasonic Testing	To be carried out every ROH & reject if fails	-	-	X	X
	2. Deep Notches due to gearing of pull rod	Reject if depth is more than 5 mm	X	X	X	X
	3. Axle end holes	Clean and lubricate in case end cover is opened	-	-	X	X
25.	**WHEEL**					
	1. Tread profile	Check with tyre defect gauge	X	X	X	X
	2. Height of flange	If height more than 31 mm do not use under ROH wagon	-	-	X	X
	3. Smooth flange	If flange not completely smooth do not use under ROH wagon	-	-	X	X
	4. Wheel profile	Turn to WWP if above clause are not met for use under ROH wagon.	-	X	X	X
26.	**BEARING**					
	1. Cup	Rotate the bearing for unusual sound check up for Crack/chipping	-	-	X	X
	2. Seal	Check seal for external damage/sent	-	-	X	X
	3. Backing Ring	Check backing ring for looseness & vent fitting on backing ring with vent hole (the vent fitting should be intact or the vent hole should be plugged)	-	-	X	X
	4. Locking Plate	Use new locking plate when ever and cover is opened	-	-	X	X
	5. Axle end Cap screw	Clean and lubricate in case end cover is opened	-	-	X	X
	6. Load Zone Change	Change load zone area of the cup while lowering bogie side frame	-	-	X	X
27.	**ADAPTER**		-	-	X	X
	1. Crown Surface	Replace if worn to relief depth	-	-	X	X
	2. Side lug	Replace/reverse and use	-	-	X	X
	3. Thrust shoulder	Replace if depth exceeds 0.7 mm	-	-	X	X
	4. Machined relief	Replace if depth more than 0.8 mm	-	-	X	X

Sr. No.	Nature of Repairs	Repairs to be under taken at			
		Intensive repairs	Sick lines	ROH	POH
28.	**AXLE BOX**				
	1. Welding of worn out axle box grooves, wearing of axle box liners	-	X	X	X
	2. Fitting of bent/grooved liners in the axle box grooves	-	X	X	X
	3. Repairs by welding to cracked or broken axle boxes	-	X	X	X
	4. Fitting of axle box back plates and/or dust shield	-	X	X	X
	5. Fitting of axle box back cover top plates	-	X	X	X
	6. All repairs by welding to back plates, back collars	-	X	X	X
	7. Attention to hot boxes	-	X	-	-
	8. Changing of axle boxes and wheels	-	X	X	X
	9. Changing of axle boxes and wheels				
	10. Re-packing of axle boxes	X	X	X	X
	11. Attention/Examination of roller Bearings	X	X	X	X
	12. Attention to warm boxes, ranging faceplates, etc.	-	X	X	X
	13. Changing of axle boxes and wheels	-	X	X	X
29.	**AXLE GUARDS**				
	1. Repairs to expanded axle guard legs.	-	X	X	X
	2. Repairs to worn axle guards and/or horn cheeks by welding, changing of horn cheeks, and/or rivets	-	X	X	X
	3. Repairs to bent axle guards	-	X	X	X
	4. Repairs to pressed steel axle guards cracked upto 25 mm	-	X	X	X
	5. Repairs to pressed steel axle guards cracked more than 25 mm. Fitting of a new axle guard	-	X	X	X
	6. Fitting/replacing axle guard rivets, cross bracing rivets or horn cheeks rivets.	-	X	X	X
	7. Replacement/fitting of axle guard bridles	X	X	X	X
	8. Attention to hanging axle guard bridles	X	X	X	X
	9. Changing of axle guards.	-	X	X	X

Sr. No.	Nature of Repairs	Repairs to be under taken at			
		Intensive repairs	Sick lines	ROH	POH
30.	**BRAKE GEAR**				
	1. Attention to cracked or perforated train pipe/replacement of knee or piece	-	X	X	X
	2. Periodical overhauling and testing of vacuum cylinders	-	X	X	X
	3. Replacement fitting release valves, levers diaphragms and seating washers, replacement of packing ring and stuffing box.	X	X	X	X
	4. Replacing deficient and defective vacuum cylinders	-	X	X	X
	5. Attention to vacuum cylinder after lowering	-	X	X	X
	6. Fitting of brake blocks/adjustment of brake/fittings or replacement or replacement of pins and cotters	X	X	X	X
	7. Fitting of brake beam hanger bolt/nut/pin cotters	X	X	X	X
	8. Adjustment of hand brakes	X	X	X	X
	9. Fitting of hand brake lever collars/rivets	X	X	X	X
	10. Fitting/replacement of safety hangers to pull rod and brake beam and push rod, which are required to be secured by, rivets.	-	X	X	X
	11. Repairs to broken safety brackets/hangers by welding	X	X	X	X
	12. Riveting of brake beam hanger brackets to the underframe	-	X	X	X
	13. Changing of brake beams	-	X	X	X
31.	**BUFFING GEAR**				
	1. Repairs by welding to buffer socket, plunger, replacement of buffer spindle/springs and washer, replacement of buffer socket or plunger	-	X	X	X
	2. Attention to dead buffer requiring releasing of springs	-	X	X	X
	3. Attention to dead buffers involving changing the broken/perished spring/pads	-	X	X	X
	4. Replacement of deficient or wrong buffer spindle nut	-	X	X	X
	5. Attention to drooping buffers, replacement to deficient bolts.	X	X	X	X

Sr. No.	Nature of Repairs	Repairs to be under taken at			
		Intensive repairs	Sick lines	ROH	POH
32.	**DRAW GEAR (B.G. & M.G.)**				
	1. Replacement/fitting draw links shanks and other components	X	X	X	X
	2. Replacement of draw bar springs, washers or rubber pads.	X	X	X	X
	3. Repairs to draw bar cradle yoke support plate, race plate or wearing plates.	-	X	X	X
	4. Replacement/fitting screw coupling shackles, links, pin, suspension hook or shackle pin rivets.	X	X	X	X
	5. Replacing draw bar nuts/check nuts cotter, etc.	X	X	X	X
	6. Building up of draw bar shank or link, worn more than ½" (13 mm) As this requires normalising after building up	-	-	X	X
	7. Provision of anti-turning device on MG draw bar	-	X	X	X
33.	**BUFFING GEAR (M.G.)**				
	1. Replacement of any of the components of buffing or coupling assembly not involving removal of draw bar	X	X	X	X
	2. Replacement of buffer springs, washers involving removal of draw bar	X	X	X	X
	3. Fitting of bolsters, stanchions, lashing chain and coupling on bogie rail trucks	-	X	X	X
	4. Securing of lashing chain against trailing	X	X	X	X
	5. Any fitting or part of a wagon or load infringing standard dimensions secured or preventing free movement of the wagon	X	X	-	-
	6. Inspection of wagons overdue warranty inspection or stencilling of details on newly built wagons or warranty inspection.	-	X	-	-
34.	**SPRING GEAR**				
	1. Replacement of laminated bearing spring	X	X	X	X
	2. Replacement of bolster spring	-	X	X	X
	3. Setting of displaced plates of laminated bearing spring	X	X	-	-
	4. Replacement/fitting of scroll iron or rivet of correcting alignment of scrolling	-	X	X	X
	5. Repairs to scroll iron by welding (As this repair involves normalising after welding, only Workshops should undertake the repair where proper facilities are available)	-	-	-	X
	6. Replacement/fitting of bearing spring shackle, shackle pin, hanger bolt, nut and cotter etc.	X	X	X	X

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NOMINAL & MAXIMUM CLEARANCES IN CASNUB BOGIE

S. No.	Particular	Type	Measurement of location			Total Clearance in			Nominal Clearance
			New	At ROH	Cond.	New	ROH	Max	
1.	**Lateral clearance between**								
	S.F. Column sides	All	216	209	206	18	32	38	18+3/-0
	‘Bolster column jib	All	234	241	244				
2.	**Lateral clearance between**								
	a. S.F. Pedestal sides	I/II	105	102	101	25	34	35	25+3/-0
	b. S.F. Pedestal sides Adapter	I/II	130	136	136	136			
3.	**Lateral clearance between**								
	a. S.F. Crown sides	I/II	152	147	144	4	17	20	4+/-0
	Adapter crown	I/II	156	164	164				
	b. S.F. Crown sides	NL	152	147	144	3.5	16.5	19.5	3.5+/-0
	Adapter Crown	NL	155.5	163.5	163.5				
4.	**Long clearance between**								
	a. S.F. Pedestal jaw	I	270	275	278	2	13	16	2+/-0
	Adapter	I	268	262	262				
	b. S.F. Pedestal jaw	II	278	283	286	10	21	24	10+7/-0
	Adapter	II	268	262	262				
	c. S.F. Pedestal jaw	NL	190	195	198	9	20	23	9+2/-3
	Adapter	NL	181	175	175				
5.	**Long clearance between**								
	Side frame column	All	450	455	458	6	13	20	6+/-0
	Bolster land surface	All	444	442	438				
6.	**Clearance between**								
	Anti rotation lug	All	522	526	528	4	12	16	4+3/-0
	Bolster rotation stop lug	All	518	514	512				
Ref:	***RDSO manual G-95 and Review of ROH issued by RDSO L.No. MW/BOXN/Maint. Dt. 16.1.95 of DG(W)***								

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MAINTENANCE MANUAL
FOR
WAGONS

Chapter –3 ***Yard Maintenance***

CHAPTER 3

YARD MAINTENANCE

The efficient working of freight stock is closely linked to the standard of yard maintenance. Several factors are responsible for good and quality examination/repairs in the yard. The method of examination is described in the succeeding paragraphs.

301. PATTERN OF FREIGHT TRAIN EXAMINATION:

Comprehensive instructions regarding the pattern of freight train examination and issue of Brake Power Certificate have been issued by Railway Board in the form of Joint Procedure Order vide letter No.94/M(N)/951/57 dated 28.2.2000 (Para 314).

302. NOTIFICATION OF EXAMINATION POINTS:

A) All goods trains must invariably be given Intensive Examination for repairs.

B) Railways should notify nodal points authorise to issue intensive brake power certificates for running of air brake trains on End-to-End basis and in Close Circuits. These nodal points should have adequate facilities like cemented pathways, welding points, proper lighting etc. for proper examination of air brake trains.

C) Intensive BPC for vacuum brake stock to be issued from nodal examination points only.

D) As a special case, a Safe-to-Run certificate may be issued from examination points other than the nodal points for empty journey of air brake stock after unloading up to the first/nominated nodal point in the direction of movement as mentioned in para 314.

303. FREQUENCY OF INTENSIVE EXAMINATION FOR DIFFERENT STOCK:

A) All freight trains should be subjected to intensive examination in empty condition at originating stations.

B) In exceptional cases the back loaded freight trains can be examined as per instructions mentioned in para 314 item 1 (v).

C) All freight trains shall be re-examined if stabled for more than 24 hours by JE (C&W) in yard and by guard and driver in non C&W station up to next C&W point in the direction of movement for examination, as per Railway Board’s Joint Procedure Order placed at para 314.

D) All conventional (plain bearing) stock should be offered for examination after having travelled 800 km on BG and 600 km on MG from its last intensive examination.

E) Vacuum brake stock other than conventional stock shall run on end-to-end pattern as per instructions mentioned in para 314. The intensive BPC shall remain valid provided:

i. the empty examined rake reaches the loading point within **4 days** of the issue of BPC.
ii. the **destination is mentioned** on the BPC of the loaded train.
iii. the composition of the rake is not changed by **10 or more Four-Wheeler Units**.
iv. the rake is **not stabled** for more than **24 hours.**

F) Air brake stock shall run on end-to-end pattern as mentioned in para 314. The intensive BPC shall remain valid provided:

i. the **destination is mentioned** on the BPC of the loaded train.
ii. the composition of the rake is not changed by **4 or more wagons**
iii. the rake is **not stabled** for more than **24 hours.**

G) Air brake stock shall run on nominated Close Circuit for 4500 KMs as mentioned in para 314. The intensive BPC issued at the nodal point shall remain valid provided:

i. the kilometrage have been logged in correctly and continuously, if not, BPC will be deemed to be valid for 15 days only from the date of issue of BPC.
ii. the rake integrity is not changed and only the listed wagons are included.
iii. the rake is **not stabled** for more than **24 hours.**
iv. the rake is running in the predefined circuit as mentioned on the BPC. (Breaking the rake into parts and reforming the same parts, will not be deemed to have broken the rake integrity)

H) No intermediate examination of the Close Circuit rake is required. It would be the responsibility of the Driver and Guard to check the unloaded CC rake at the unloading point and ensure brake continuity before starting.

I) All close circuit freight trains will be given intensive examination during day light hours.

J) BPC issued after intensive examination in empty condition must be revalidated after loading. Revalidation includes conducting brake continuity test, ensuring completeness/securing of brake gears only and endorsing on intensive BPC . No detachments unless safety is affected.

304.STEPS OF INTENSIVE EXAMINATION:

A) Rolling-in-examination including axle box feeling.
B) Intensive examination of originating trains including repairs, detachment of damaged/sick wagons, brake testing etc.
C) Issue of Intensive Brake Power Certificate after ensuring brake continuity of the formed load.

For loads requiring sorting and/or having different terminating and originating yards/locations, the steps for issuing intensive BPC will be as follows:

- Rolling-in-examination including axle box feeling (same as para 305 A).
- Terminating examination including detachment of damaged/sick wagons (given in para 305 D).
- Intensive examination of originating trains including repairs, brake testing etc. (Same as para 305 B).
- Issue of Intensive Brake Power Certificate after ensuring brake continuity of the formed load (same as Para 305 C).

305.DETAILS OF INTENSIVE EXAMINATION:

305A. ROLLING-IN-EXAMINATION INCLUDING AXLE BOX FEELING -

All terminating trains should be given rolling in examination while entering a station/yard with a train examination depot. To carry out this examination the Train Examiner and his staff should take up positions on both sides of the lines short of the normal halting place on which the train is to be received. The following inspection should be carried out during the rolling in examination:

i. In motion inspection and observation of under gear of wagons for any loose or dangling components and flat places on tyres/wheels.

ii. Immediately after the train has come to a halt, all axle boxes should be felt within 20 minutes of the train arrival and those, which are found running at high temperature, should be marked for opening/checking at the time of examination and attention if necessary.

iii. Examination of any abnormal behaviour of any of the vehicles or any other observation which may relate to unsafe working condition.

iv. The rolling in examination must be conducted to detect any skidded wheel. Defect in the brake system or faulty manipulation by the driver may cause skidding of wheels.

v. Incoming BPC should be collected by yard C&W staff.

305 B. INTENSIVE EXAMINATION AND REPAIRS -

Once, the train has been offered for examination by Traffic Department, the rake should be protected at both the ends before undertaking the following examination and repair activities:

i) Inspection and repairs of running gear fittings.

ii) Inspection and repairs of brake gear and spring gears.

iii) Inspection and repairs of draw and buffing gear.

iv) Checking and making good the deficiency of safety fittings, safety brackets, safety loops, etc.

v) Replacement of brake blocks:

- Brake blocks should be replaced on reaching condemning thickness as given in para 307 A.
- Cast iron brake blocks as per RDSO drawing No. WA/BG-6158 with latest alteration or composite brake blocks should be used.
- Worn out composite brake blocks should be replaced with composite brake blocks.
- To ensure correct fitment of brake blocks, only spring steel key as per RDSO Drg. No. W/BG-6150 should only be used.
- After fitment of brake block and key on brake head fitment of split pin should be ensured.

vi. Correct fitment of washers, bulb cotters and all brake gear pins to be ensured.

vii. Correct functioning and positioning of empty load device.

viii. Identified Plain bearing warm axle box should be opened for examination and attention, if any. Roller bearing stock found running at high temperature may be taken in sick lines for further attention

ix. Checking and proper securing of doors of covered wagons.

x. Look for abnormal and /or unequal buffer heights/CBC height, wear plate knuckle, etc. to the extent it is possible to detect by visual examination. In case of doubt, the buffer height/CBC height should be measured.

xi. Meticulous check of brake cylinders, distributor valves, auxiliary reservoir control chambers and other pipe points should be carried out to ensure that these are in proper working order. Isolating cocks and angle cocks to be checked for proper position. Brake cylinder should be released and checked for piston stroke as per para 307 B for empty and loaded position.

xii. After brakes are released, the wheel profile should be examined visually. If any defect is noticed, it should be checked with tyre defect gauge and wagon to be marked sick for wheel changing, if required. if bent axle is suspected wheel gauging must be done.

xiii. The bogies, complete side frames and bolsters to be visually examined for cracks and missing parts. bolster springs, snubbers, spigots, centre pivots fastening, roller side bearer in case of CASNUB 22 bogie to be checked for defects, if any.

xiv. Examine brake rigging components with special attention to brake beam deformation and wear on integral brake shoe bracket. Check intactness of the pull and push rods with pins, washers, split pins and cotters, etc. Hand brakes must be checked for smooth and effective operation.

xv. Visual examination of under frame members, body, door mechanism, CBC wear or deficiency of parts to be marked and their operation to be checked.

xvi. Brake power should be tested as per rule E-5 of Appendix E of the IRCA Rules Part III for vacuum brake stock and as per rake testing procedure stated herewith at Para 306.

xvii. At certain nominated yards, vacuum braked trains moving over falling gradients in ghat sections shall be subjected to Balanced Vacuum Test. The detailed procedure for carrying out this test is given in IRCA Part III, 2000-Appendix E.

xviii. Examination of loaded stock should be done as per IRCA part-III.

xix. Examination of tank wagons should be done as per IRCA Part-III.

xx. Where a rejectable defect can not be attended to on the train in the yard, the wagon shall be damaged labelled for attention in the sick line.

305C. ISSUE OF INTENSIVE BRAKE POWER CERTIFICATE –

i) All freight trains after being subjected to intensive examination will be given a Brake Power Certificate.

ii) The standard format for Brake Power Certificate for vacuum brake stock, air brake stock and close circuit rakes is enclosed at Annexure-II, Annexure-III and Annexure-IV respectively.

iii) To distinguish the brake power certificates, the colour of **vacuum brake and air brake stock** will be **Pink and Green** respectively.

iv) On originating **BG** and MG vacuum goods trains, there shall be **85%** and 80 % effective brake power respectively, subject to observance of **any higher limit** prescribed by the Railways for particular Ghat/other sections.

v) The **minimum originating brake power** for air braked goods trains, running on end-to-end pattern of examination, shall be **85%** except wherever local instructions have specified higher level of brake power to meet specific requirement. Exception shall only be made after prior approval of Chief Rolling Stock Engineer has been obtained for each individual case.(Reference RB's letter No.94/M(N)/951/57 dated 29.9.95)

vi) The **originating brake power** for air braked goods trains, running **in close circuits shall be 100 %** with adequate brake block thickness for the extended run of 4500 KMs.

vii) As far as possible, the close circuit air brake rakes should be formed by off-ROH and off-POH wagons for better monitoring.

viii) No fresh Brake Power Certificate shall be issued during revalidation.

ix) No Safe-to-Run BPC shall be issued from nodal points.

x) No Safe-to-Run BPC shall be issued for vacuum brake stock either in empty or in loaded condition.

xi) Brake pipe pressure required in the air braked train with locomotive should be as follows:

No. of wagons	On Locomotive	On last wagon
Up to 56	5.0 Kg/Cm^2	4.8 Kg/Cm^2
Beyond 56	5.0 Kg/Cm^2	4.7 Kg/Cm^2

xii) The minimum level of vacuum should be 46 cm in engine and 38 cm in the brake van. The level of the vacuum on the engine and the brake van along with the percentage of effective brake cylinders must be recorded on the vacuum certificate and countersigned by the Driver and the Guard. (RB's letter No.83/M(N)/951/34 dated 26.5.99)

xii) The following procedure should be followed to issue the BPC after attachment of the locomotive:

- All BP hoses/ hose pipes on the train should be coupled up. The angle cocks in case of air brake stock at both ends of the wagon in brake pipe should be open. The angle cock at the end of air brake van must be in closed position. In case of vacuum stock, hose pipe of the rear most vehicle should be kept on dummy carrier.
- Attach front wagon BP hose/ hose pipe to BP hose/ hose pipe of the locomotive.

- Ensure firmness and tightness of hoses with palm ends/universal coupling and clips.
- Ensure that all the cut of angle cocks on brake pipes are in open position in case of air brake stock.
- Attend to all leaks by replacing MU washer/IR washer, leaky hoses and angle cock assembly, if requisite BP pressure is not coming in the last vehicle.
- Inoperative or defective brake cylinders should be isolated by putting the isolating cock handle in close position.

305 D. TERMINATING EXAMINATION OF STOCK REQUIRING SORTING AND/OR HAVING DIFFERENT TERMINATING AND ORIGINATING YARDS/LOCATIONS :

Examination of terminating load should be carried out as soon as the train has come to a halt. The examination would consist of the following: -

i) All under gear fittings including brake gear, draw and buffing gear and spring gear, air brake, underframe, body, door mechanism, bogies, wheels, axle, etc. should be examined for being in sound condition and with all fittings intact.

ii) The tyre profiles should be checked to ensure that rejectable defects have not arisen. In doubtful cases, use of the tyre defect gauge should be made for this purpose.

iii) Vacuum brake cylinders should be tested in accordance with Rule E-5 of Appendix E of the IRCA Rules Part III. All vacuum brake cylinders should be released.

iv) Ensure functioning and position of load/empty device.

v) Identified plain bearing warm axle box Plain should be opened for examination and attention, if any. Roller bearing stock found running at high temperature may be taken in sick lines for further attention.

vi) Other items to be checked in case of air brake stock are as follows:

- Meticulous check of brake cylinders, distributor valves, auxiliary reservoir control chambers and other pipe points should be carried out to ensure that these are in proper working order. Isolating cocks and angle cocks to be checked for proper position. Brake cylinder should be released and checked for piston stroke as per para 307 B for empty and loaded position.
- During terminating examination, special care should be exercised for any deficiencies, damages, leaky components, malfunctioning of distributor valves, brake cylinders, control and auxiliary reservoirs, angle cocks, BP hoses so that necessary replacement and repairs can be executed to minimise attention during outgoing examination.

vii) In case of terminating loading trains to be subjected to tippler for unloading, the Brake power available on train should be recorded deficiencies noticed should be chalk marked so that after unloading/Tippler operation, deficiencies can be identified and replaced during outgoing examination.

viii) **Where a rejectable defect is not expected to be attended to on the train during the subsequent outgoing examination in the yard, the wagon shall be sick marked/ damaged-labelled for attention in the sick line.**

306. AIR BRAKE TESTING :

A rake consisting of air brake wagons should be tested with rake test rig. This rig may be used for testing the train in yard before attaching the engine. The rake test rig has compressed air supply and a mobile test rig. The mobile test rig has a cubical structure and is mounted on wheels.

i) Attach the locomotive/compressor through the test rig to the train & couple brake pipes. Ensure correct coupling with pipes so that there is no leakage of air from coupled joints

ii) The coupling should be done with angle cocks in closed position.

iii) Open the angle cocks of loco after coupling brake pipe.

iv) Open the angle cock of the brake pipe on all the wagons., Check for continuity of brake pipe by reducing and rebuilding brake pipe pressure. The verification should invariably be carried out through the pressure gauge provided in Guard's Brake Van.

v) After the brake pipe pressure has stabilised in the locomotive and rearmost vehicle to the level indicated below. Move the driver's automatic brake valve handle towards application position to reduce the brake pipe pressure from 5 kg/cm^2 to 4 kg/ cm^2

TABLE 3.1 Brake pipe pressure required in the train

S. No.	No. of wagons	On Locomotive	On last wagon
1.	Up to 56 wagons	5.0 Kg/Cm^2	4.8 Kg/Cm^2
2.	More than 56 wagons	5.0 Kg/Cm^2	4.7 Kg/Cm^2

vi) After the brake pipe pressure has been stabilised, close the brake pipe isolating cocks provided between additional C2 relay valve and brake pipe of the locomotive.

vii) Wait for 60 seconds for temperature and gauge settlement. Then note the drop in pressure in the brake pipe gauge in the locomotive for five minutes.

viii) The drop in brake pipe pressure gauge shall not be more than 0.25 kg/cm^2 per minute.

ix) Examine for leaky components, malfunctioning of distributor valves, brake cylinders, control and auxiliary reservoirs, angle cocks, BP hoses.

x) If the leakage rate is more then the value indicated in para viii, check for excessive leakage on individual wagon as indicated below:

- A hissing sound would be audible at points where leakage is heavy.
- Once the hissing sound is heard from a particular area, pin point the location of leakage by applying soap water solution
- Use of permitted material viz. Teflon tape for arresting the leakage at threaded joints.

xi) In case leakage is heavy and cannot be arrested, the wagon may have to be isolated/detached

xii) In case where leakage can be arrested temporarily by tape and the nature of leakage is such that it requires attention at primary depot, clear marking on the wagon must be made to draw attention of primary depot for adequate attention.

xiii) In case the leakage is from the distributor valve and cannot be arrested, close the distributor valve isolating cock. In such a condition, clear marking should be provided on the wagon to indicate this defect to primary depot. Do not close brake pipe angle cocks under any circumstances either for isolation of wagons or for any other purpose whatsoever except for carrying out shunting operation after which the angle cocks should again be opened to ensure continuity of brake pipe.

307. IMPORTANT PARAMETERS TO BE ENSURED DURING INTENSIVE EXAMINATION:

307 A. BRAKE GEAR LIMIT AND CLEARANCES:

Description	Limit
Brake block condemning limits	10 mm
Yard leaving thickness of brake block except BOY wagons	20 mm
‘A’ dimension of slack adjuster BOX/UIC bogie wagons	50 mm +2 / - 0
‘A’ dimension of air brake stock fitted with CASNUB bogie except BOBRN wagon	70 mm +2 / - 0
‘A’ dimension of BOBRN wagons	27 mm +2 / - 0

307B. PISTON STROKE:

Type of wagon	Piston Stroke	
	Empty	Loaded
BOXN, BCN/BCNA, BRN, BTPGLN	85 mm +/- 10	130 mm +/- 10
BTPN	87 mm +/- 10	117 mm +/- 10
BOY	90 mm +/- 10	135 mm +/- 10
BVZC	70 mm +/- 10	
BOX, BOI & BCX	130 mm	180 mm
BOBRN/BOBR	100+/- 10	110+/- 10

307 C. BUFFER HEIGHT :

Description	Limit
Buffer height from Rail level	Max. 1105 mm (Empty)
	Min. 1030 mm (Loaded)

308. IMPORTANT PARAMETERS TO BE ENSURED DURING SICK LINE/ DEPOT ATTENTION:

308A. CLEARANCES OF SCREW COUPLING

S. No	Description	Clearances
1	Draw bar & Screw coupling (BG) Roof of hook near point of a)Contact with screw coupling shackle b) Shackle pin hole c) Underside of sq. position of shank d) Cotton hole e) Trunion pin (nut) f) Shackle pin	Max. permissible wear 12.7 mm 6.35 mm 12.7 mm 12.7 mm 3.17 mm 3.17 mm
2	Variation in camber between any two Springs on a bogie under load should not exceed	12 mm
3	Min. clearance between eye end & top surface	2 mm
4	Maximum variation in effective inside length	2 mm
5	Maximum permissible wear of the shackle at the places of contact with stone	2 mm
6	Clearance between U/F side bearer and bogie side bearer of UIC	4 mm

308 B. SPRING GEAR CLEARANCES FOR VACUUM BRAKE STOCK :

S. No	Description	Clearances
1	Max. Clearance between shackle pin dia and shackle plate	3 mm
2	Clearance along the length of shackle pin assembly with shackle plate, scroll iron, spring eye and cotter.	Max.1.5 mm
3	Shackle pin diameter and shackle plate hole	Max. 1.00 mm
4	Eye end is clear of top surface	Min. 2 mm

308 C. NOMINAL CLEARANCES OF CASNUB BOGIES

Description	22W 22W(RETRO)	22W(M)	22NL NLB	22HS
Lateral clearance between side frame and bolster	18 mm	18mm	18 mm	25 mm
Lateral clearance between side frame and axle box/adopter	25 mm	25 mm	16 mm	16 mm
Longitudinal clearance between side frames and axle box/adopter	2 mm	10 mm	9mm	9 mm
Longitudinal clearance between side frame and bolster	6 mm	6 mm	6 mm	6 mm
Clearance between anti rotation lug and bolster	4 mm	4 mm	4 mm	4 mm

308 D. WEAR LIMITS :

Adapter Thrust shoulder	0.7 mm
Adapter Crown lugs	4.0 mm
Adapter crown seat	3.5 mm
Adapter side lugs	3.0 mm
Adapter sides	3.0 mm
Side frame column friction plate	4.0 mm
Side frame column sides	5.0 mm
Side frame anti rotation lug	3.0 mm
Pedestal crown roof	5.0 mm
Pedestal crown sides	4.0 mm
Pedestal sides	2.0 mm
Pedestal jaw	4.0 mm
Bolster liner wear limit	5.0 mm
Bolster land surface	3.0 mm
Bolster column sides – Inner/Outer	5.0 mm

308 E. LOAD/SNUBBER SPRINGS OF CASNUB

Type of Bogie	Location	Free Height (Nominal mm)	Recommended free condemning height (mm)
All version except CASNUB 22 HS	Outer Inner Snubber	260 262 294	245 247 279
CASNUB 22 HS	Outer Inner Snubber	260 243 293	245 228 278

308 F. WEAR LIMIT FOR FRICTION WEDGE BLOCK

Vertical Surface	7 mm
Slope Surface	3 mm

308 G. CENTRE PIVOT DIMENSIONS

	CASNUB 22(W)	OTHERS
Seat	5.5 mm	4.0 mm
Vertical sides	4.0 mm	4.0 mm

308 H. RUBBER BONDED METAL PAD

Description	Nominal dimension	Dimension after permanent set (condemning size)
Elastomeric Pad	46 mm	42 mm
Side bearer rubber Pad	114 mm	109 mm

Note : The parameters given above are as per IRCA Pt.III, 2000- Rejections.

308 I. WHEEL & AXLE

Description	Limit	
	New	Condemn.
Wheel dia used on BOX/UIC bogie)	1000 mm	860 mm
Wheel dia used on BOXN/CASNUB bogie)	1000 mm	906 mm
Lateral clearance between axle box lug and horn cheek (for BOX/UIC wagons)	20 mm	25 mm
Lateral clearance available between spring buckle and horn gap stiffener for UIC	25 mm	
Lateral clearance for CRT wagons	12 mm	
Buffer height from Rail level	Max. 1105 mm (Empty)	Min. 1030 mm (Loaded)

309. COMMON PROBLEMS IN BRAKE SYSTEM AND REMEDIES

309 A. Jammed Brakes

Taking the following precautions can prevent jamming of brakes:

a) Both the vacuum and hand brakes on a loaded wagon should be fully released before commencement of unloading.
b) Adjustment of brake regulator and empty tie rod should not be tampered with.
c) Empty load box lever handle should be brought to empty position before unloading by the commercial staff or by station staff while placing the wagon in goods shed line.

Despite the above precaution, if the brakes jam, the following steps should be taken:-

i. Try to rotate brake regulator barrel by hand or with spanner on the hexagon flat or with a Tommy bar in the slot provided at the end. **DO NOT HAMMER OR USE EXCESSIVE FORCE.**

ii. If this fails, then apply and release the brakes fully two or three times either with vacuum or hand brake. When using the hand brake, make sure of full application and full release. If jamming ids not severe, this will make brake regulator operate automatically to create enough slack, by paying out, to release the brakes.

iii. If this also fails, then it means the brakes are severely jammed, also jamming the brake regulator. In this case knock out the shaft crank pin but not the pin securing the brake regulator in any case. Then rotate brake regulator barrel until pull rod pinholes align and the pin can be replaced easily. Always replace the pin, which had been withdrawn to release brakes, with its washer and split pin, and tack weld the washer with pin.

309 B. Piston stroke too short

If the piston strokes are not within the limits the brake equipment should be thoroughly examined. Probable causes for too short piston strokes are given below:-

i. Vacuum too low i.e. less than 460 mm.
ii. Free lift too small i.e. much less than 13 mm.
iii. One brake cylinder out of action, or one or both cylinders defective.
iv. Brake shaft or piston jammed/seized.
v. Brake rigging jammed e.g. pull rod pin or hanger partly out of its hole and fouling vertical levers in the bogie brake rigging or end of bogie pull

rod striking transverse trimmer. In both cases there may be no application of brakes at the outer wheels

vi. Adjustment of pin holes in bogie brake rigging not corresponding to wheel diameter.
vii. Some parts of the brake rigging distorted or non-standard.
viii. New brake blocks just fitted and brakes not applied and released at least twice before checking piston strokes.
ix. Hand brakes partly "ON".
x. Brake regulator or empty load box maladjusted or damaged causing either insufficient "slack" or empty braking at all times (This is a serious defect and should be attended to immediately)
xi. Fully loaded wagon just emptied but brakes not applied and released at least twice before checking piston strokes.

Note: If slightly short piston strokes are not caused by any of the defects mentioned above, they are not harmful.

309 C. Piston stroke too long

If the piston strokes exceed the maximum limits prescribed, examine the equipment thoroughly. Probable causes for too long piston strokes are given below.

i. Vacuum high, i.e. over 510 mm
ii. Free lift too large, i.e. more than 13 mm
iii. Parts of brake gear defective, broken, worn out, missing or non-standard e.g. pull rod pins missing or under sized pin fitted.
iv. Wearing parts beyond condemning size i.e. wheels, brake blocks and pin/hole joints.
v. New brake blocks just fitted and brakes not applied and released at least twice before checking piston strokes.
vi. Empty wagon just loaded and brakes not applied and released at least twice before checking piston strokes.
vii. Adjustment of pin/holes in the brake rigging not corresponding to wheel diameter
viii. Brake regulator or empty load box maladjusted or damaged causing either excessive slack or load braking at all times.
ix. Brake regulator control rod assembly damaged, detached or missing. (This is a serious defect and should be attended to immediately)

310. INFRASTRUCTURE & FACILITIES REQUIRED IN THE YARD:

i. Adequate centre to centre distance between tracks for nominated lines for conducting intensive examination. There should be enough space of at least 2.5 metre for jacking, to change springs etc.

ii. Concrete pathways with monorails/material handling equipment to facilitate movement of man and material smoothly from one end to another.

iii. Proper illumination specially covering bogies and brake gear locations so that the wagons needing attention can be easily detected.

iv. Welding grid on the entire length of train of nominated line with return lead arrangement so that welding can be carried out without marking the wagon sick.

v. Enough outlets for tapping vacuum/air pressure for testing of the stock.

vi. Duty room for Junior Engineer (C&W),staff room, air compressor/vacuum exhauster room, store room for stocking material, tool room, oil grease room, welding machine room, battery charging room etc.

vii. VHF sets for closes monitoring and communication between supervisors, staff and yard foreman.

311. MACHINERY & PLANT ITEMS

The following machinery and plant are essential for train examination during yard maintenance:

- Diesel Screw Compressor
- Vacuum exhauster
- Welding plant
- Rake Test rig
- Hydraulic jacks of various capacities.
- Lister truck for carrying material such as brake blocks etc.

312. TOOLS

All fitters should carry the following tools in their bags at all times for examination:

- Tool Bag
- Hammer
- Chisel
- Punch (Flat & Round End)
- Inspection lamp
- Spanner
- Wheel tyre defect gauge
- Vaidhyanathan gauge
- Oil Syringe
- Oil can
- Measuring foot rule
- Ultrasonic leak detector
- Electronic device for detecting warm box (Non contact hot axle detector)
- Cord for measuring spring camber
- Gauge for measuring "A" dimension
- Test plate
- Wheel gauge
- CBC "GO NO GO" gauge

To be made available in Section Engineer/Junior Engineer (C&W) office

- All types of jacks
- Banner flag/Tail lamp
- Tools for attending warm box
- Buffer height gauge
- Vacuum/Air pressure gauge
- Wire chisel
- Wire punch
- Sledge hammer
- Brass tools (hammer, chisel, spanner)

313. MAN HOURS FOR VARIOUS TYPE OF EXAMINATIONS

The man-hours for examination of various types of stock are given below **as a guideline**. Zonal railways may however permit variation based on local conditions, typical characteristics prevailing at site and availability of infrastructural facilities.

TABLE 3.2 Man-hours for examination of various types of stock

Stock	**Type of Examination**		
	Terminating (wherever applicable as per para 305 D)	**Intensive** (As per para 304 B)	**Originating** (As per para 304 C)
Vacuum Brake (End-to-End running)	6	40 (for 70 FWUs)	10
Air Brake (End-to-End running)	6	56	10
Air Brake(Close Circuit)	6	100	10

The standard gang for conducting intensive examination should consist of two Junior Engineers, 10 Fitters & 10 Khalasis. They will complete one intensive examination in 2 hours. However, wherever the density of train examination is less, local conditions will prevail for formation of the gangs.

The distribution of intensive staff gang wise with tools and material is given in Table 3.3.

314. JOINT PROCEDURE ORDER FOR GOODS TRAINS EXAMINATION

(Railway Board's letter No.94/M(N)/951/57 dated 28.2.2000)

At present, practices for the issue of BPC to freight trains vary considerably between various Zonal railways. The matter has been considered in the Railway Board and the following comprehensive instructions are issued.

ITEM 1: END TO END RUNNING OF UIC/CRT RAKES

UIC/CRT stock will be permitted to run on end-to-end pattern with following conditions:

i) The rake should normally be intensively examined in empty condition except when back loading of rake has to be done at stations/sidings. After such intensive examination, the empty rake should be moved to the loading station as per the requirement of traffic.

ii) The BPC of empty rake may have no destination mentioned. But, after loading the empty rake, the operating staff (commercial staff, if not operating staff is posted at that station) will ensure that the destination of the loaded train is clearly mentioned on the BPC and the same BPC will then become valid upto such destination.

iii) No driver should move the loaded train from the loading point unless the destination is clearly mentioned on the BPC. BPC of the loaded train without destination will be considered as invalid.

iv) The empty rake must reach the loading point within 4 days of the issue of BPC including the day of issue, for the loaded rake to move on the same BPC, otherwise the rake (empty or loaded) will have to be offered for examination for issue of fresh BPC at a suitable examination point in the direction of movement.

v) At the destination after unloading, the rake must be examined once again in the empty condition and the above cycle repeats. In the absence of freight train examination facilities at the unloading point, the empty rake/back loaded rake must be examined at the first freight train examination point in the direction of movement. The movement of empty rake/back loaded rake from the unloading point to the first freight train examination point will be permitted on Driver and Guard's certificate for which the following instructions should be followed:

   a) Driver and Guard will ensure vacuum/air pressure continuity before starting.
   b) Guard and the Driver will ensure that there are no loose or missing fittings in the under gear (such as brake blocks, safety brackets, draw gear

pins, brake gear pins etc.) which may endanger the safe running of the train.

c) Driver and Guard can then prepare the memo jointly on a plain sheet in triplicate and both Driver and Guard will sign it. One copy each will be retained by the Driver and Guard and third copy will be handed over to Station Master.

ITEM 2: END TO END RUNNING OF AIR BRAKE STOCK

Condition (I) to (V) mentioned under item 1 shall apply for end-to-end running of Air Brake stock also except item (iv) i.e. the 4 day limit will not apply to air brake stock. However, since these rakes are likely to run for extended periods on each loading cycle, the examination should be through and intensive to take care of such long runs.

In case empty rakes are moving on Safe to run examination BPC, the rake will be dropped for intensive examination at nominated point before being taken for loading.

ITEM 3: BACK LOADING OF TRAINS

When back loading is done at a station where freight train examination facilities exists, the loaded rake should be examined at that station only and BPC issued. In cases where back loading is done at a non-TXR station, such trains can be:

a) Either checked by flying squad, if operationally feasible.

b) or, if that is not possible, permitted to run on a driver & Guard's memo for which the instructions given under item 1 (v) should be followed.

Running of trains on Driver and Guard's memo will be permitted only up to the first freight train examination point in the direction of train movement.

ITEM 4: VALIDITY OF BRAKE POWER CERTFICATE FOR CLOSE CIRCUIT AIR BRAKE RAKES

A per instructions issued vide Board's letter No. 87/M(N)/951/31 dt. 22.8.1994, BPC of air brake stock running in close circuit shall remain valid for 4500 kms. In case it is seen that the record of the distance covered by the rake is discontinuous or not mentioned properly, the BPC will be deemed to be valid for only 15 days from the date of issue. It is the responsibility of the crew to check that entries regarding distance are clearly and continuously recorded.

ITEM 5: STANDARDISATION OF BRAKE POWER CERTIFICATE FOR AIR BRAKE CLOASE CIRCUIT RAKES

Since the existing BPC format was having certain discrepancies, the same has been modified. A copy of the modified format is enclosed. Zonal railways must ensures that, in future, BPCs for CC rakes are issued as per the modified format only.

Zonal Railways may issue detailed joint instructions for C&W examination of freight trains on the above guidelines. In terms of Board's letter No. 78/M(W) 84/8 Vol. II dtd. 1.10.80 and 91/M(N)951/31 dtd. 24.3.95, this exercise should be done jointly by Operating and Mechanical departments every year in line with the changes in traffic pattern.

(R.N. Verma)	(V.K. Manglik)
EDTT(S)	EDME(Fr.)
25.2.2000	25.2.2000

(Format – I)

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BRAKE POWER CERTIFICATE FOR AIR BRAKE (GOODS) CLOSE CIRCUIT RAKES

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ISSUED BY : (Exam. Point/Divn

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Nominated Close Circuits

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Ôãâ.

Date **BPC No.**

ãä¶ãªñÃÍã INSTRUCTIONS

†. □ãã¡Ã †Ìãâ ¡Èã*ƒ*»ãÀ

GUARDS AND DRIVERS:

1. □ãã¡üãè ‡ãŠãñ “ãÊãã¶ãñ Ôãñ ¹ãÖÊãñ □ãã¡Ã †Ìãâ ¡Èã*ƒ*»ãÀ Ôãìãä¶ããäÍ“ã¦ã ‡ãŠÀññ:

Before starting the train, guard and driver should ensure:

i) ¹ãÆ©ã½ã Ìãõ□ã¶ã Ôãñ ‚ãä¶¦ã½ã Ìãõ□ã¶ã ¦ã‡ãŠ Ìãã¾ãì ª»ããÌã ‡ãŠãè ãä¶ãÀâ¦ãÀ¦ãã .

Continuity of air pressure from first to last vehicle of the train.

ii) »ãÆñ‡ãŠ ¹ããÌãÀ ¹ãÆ½ãã¥ã ¹ã¨ã ‡ãŠãè Ìãõ²ã¦ãã ý ¾ãããª ¹ãÆ½ãã¥ã ¹ã¨ã ‚ãÌãõ²ã Öõ ¦ããñ Ôãñ‡ã‹Íã¶ã ‡ãŠâ›ÈãñÊãÀ ‡ãŠãñ Ôãîãä“ã¦ã ‡ãŠÀñâ Ìã Ôããè.¡ãè.†½ã.*ƒ*Ã.

‡ãŠõÀñ•ã ‡ãŠâ›ÈãñÊãÀ Ôãñ „ãä“ã¦ã ãä¶ãªñÃÍã ¹ãÆã¹¦ã ‡ãŠÀñ.

Validity of BPC. If found invalid. inform the control office immediately and take necessary instructions from carriage control/Sr. DME.

2. ¡Èã*ƒ*»ãÀ Ìã □ãã¡Ã ‚ããä•ãÃ¦ã ãä‡ãŠÊããñ½ããè›À ‡ãŠãñ □ãè‡ãŠ Ìã Ôãã¹ãŠ ¤â□ã Ôãñ ãäÊãŒãñâý

Driver and guard should correctly log the kilometers earned

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STATION STAFF

1. □ãã¡üãè ‡ãŠñ Ôãã©ã ‚ã¶ããããäµã‡ãŠðã¦ã ”ñ¤ü”ã¤ü Ìã “ããñÀãè ‡ãŠñ ¹ãÆãä¦ã Ôã¦ã‡ãŠÃ ÀÖñ ý *ƒ*Ôã ¹ãÆ‡ãŠãÀ ‡ãŠãè ãä‡ãŠÔããè ¼ããè ‘ã›¶ãã ‡ãŠãè Ôãî“ã¶ãã ¦ã¦‡ãŠãÊã Ôãñ‡ã‹Íã¶ã ‡ãŠõÀñ•ã ‡ãŠâ›ÈãñÊãÀ ‡ãŠãñ ªñâ Ìã *ƒ*Ôãñ ãäª¾ãñ □ã¾ãñ Ô©ãã¶ã ¹ãÀ ¼ãÀñâý

They should be vigilant for averting any theft or tempering with this rake. Any incident of theft tempering to be reported to TXR Control and entry made in the space provided.

¾ãÖ ¹ãÆ½ãã¥ã ¹ã¨ã 4500 ãä‡ãŠÊããñ½ããè›À Ìãõ²ã Öõ :

1. ¾ãããª ,ããä•ãÃ¦ã ãä‡ãŠÊããñ½ããè›À ‡ãŠãè Êã□ãã¦ããÀ Ìã □ãè‡ãŠ ¤â□ã Ôãñ ããÊã¾ãã □ã¾ãã Öãñ ý ,ã□ãÀ ¶ãÖãè ¦ããñ »ãÆñ‡ãŠ ¹ããÌãÀ ¹ãÆ½ãã¥ã ¹ã¨ã ‡ãŠãè Ìãõ²ã¦ãã •ããÀãè ‡ãŠãè □ãƒÃ ããª¶ããâ‡ãŠ Ôãñ ‡ãŠñÌãÊã 15 ããª¶ã Öãñ□ããè ý
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3. ¾ãããª □ãã¡üãè ‡ãŠãñ 24 'ãâ›ñ Ôãñ ,ãããµã‡ãŠ Ô›ñ»ãÊã ¶ãÖãè ãä‡ãŠ¾ãã □ã¾ãã Öãñ ý
4. ¾ãããª □ãã¡üãè ¹ãîÌãÃ ãä¶ãããÍã"ã¦ã Ôããä‡ãŠÃ› ¹ãÀ Öãè "ãÊã ÀÖãè Öãñ ý

THIS CERTIFICATE IS VALID FOR 4500 Kms.

i. Provided the kilometrage have been logged in correctly and continuously, if not, BPC will be deemed to be valid for 16 days only from the date of issue of BPC.

iiPrivided the rake integrityis not changed and only listed wagons are included.

iii. Provided the rake is not stabled for more than 24 hours.

iv.Provided the rake is running in pre-defined close circuit as mentioned above.

Ôããè. ¹ãÀãè□ã¥ã Ô©ãÊã ¹ãÀ □ãã¡üãè ¹ãÀãè□ã‡ãŠ ‡ãŠð¹ã¾ãã ¼ãÀñ :
TO BE FILLED AT THE ORGINATING EXAMINATION POINT BY TRAIN EXAMINING STAFF.

3. ›Èñ¶ã ¶ Train No. Loco No.

5. ¼ããÀ †Ìã Load & stock 6. ‡ã ÔãÊãñ¥¡À Total No. Bk. Cyls.

7. ‡ãŠã¾ãÃÀ¦ã »ã ãÊãñ¥¡À ‡ãŠ ¹ããÌãÀ ¹ãÆãä¦ãÍã¦ã
No. of Operating Cyls. Brake Power %

9. Ìãã¾ãì ª»ããÌã ¹ãÆÔ©ã : ƒâ•ã¶ã ½ãñ ãÆã Ôãñ ½ããè[2] »ãÆñ‡ãŠ »ãã¶ã ¹ãÀ ãÆã Ôãñ ½ããè[2]
Air pressure on dep. : On loco KG/CM[2] On Bk. Van KG/CM[2]

10. □ãã¡üãè ¹ãÀ ƒâ•ã¶ã ¶ãñ ‡ãŠã Ôã½ã¾ã ¾ãì ª»ããÌã ¦ãõ¾ããÀ Öãñ¶ãñ ‡ãŠã ¾ã
Engine on train Air pressure ready at

Ìãõ□ã¶ããñ ‡ãŠãè ÌãÇŠ½ã»ã®¦ãã
LIST OF WAGONS IN ORDER

ÌãÇŠ ½ãã â‡ãŠ S.No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.	ÌãÇŠ ½ãããâ ‡ãŠ S.No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.	ÌãÇŠ ½ãããâ ‡ãŠ S.No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.
1		21		41	
2		22		42	
3		23		43	
4		24		44	
5		25		45	
6		26		46	
7		27		47	
8		28		48	
9		29		49	
19		30		50	
11		31		51	
12		32		52	
13		33		53	
14		34		54	
15		35		55	
16		36		56	
17		37		57	
18		38		58	

19		39		59	
20		40		60	

¡Èãƒ»ãÀ ‡ãŠã ¶ãã½ã Ìã ÖÔ¦ãã□ãÀ DRIVER S NAME & SIGN	□ãã¡Ã ‡ãŠã ¶ãã½ã Ìã ÖÔ¦ãã□ãÀ GUARD S NAME & SIGN	JE/SE ‡ãŠã ¶ãã½ã Ìã ÖÔ¦ãã□ãÀ JE/SE (C&W) NAME & SIGN

¡ãè. ½ããÊã□ãã¡üãè ´ãÀã ¦ã¾ã ‡ãŠãè □ãƒÃ ªîÀãè (¡Èãƒ»ãÀ ‡ãŠð¹ã¾ãã ¼ãÀñâ)
DISTANCE TRAVELLED (TO BE FILLED BY DRIVERS)

ÌãÇŠ ½ãããâ ‡ãŠ S.No.	ããäª¶ã ãâ‡ã Š DATE	Êããñ ‡ãŠã ñ ¶ãâ. LOCO No.	›Èñ ¶ã ¶ãâ . TRAIN No.	¡Èãƒ»ãÀ ‡ãŠã ¶ãã½ã Öñ¡ ‡ã‹Ìãã›Ã À DRIVER NAME/HQ	‡ãŠ Öãù Ôãñ FROM	‡ãŠ Öãù ¦ã‡ã Š TO	ãä‡ ãŠ ½ã ãè KMS	‡ãŠìÊ ã ãä‡ã Š½ãã è CUM KMS	¡Èãƒ» ãÀ ‡ãŠñ ÖÔ¦ã ã□ãÀ DRIVERS SIGN

½ãã□ãÃ ½ãñ ‡ãŠã›ñ □ã† Ìãõ□ã¶ããñâ ‡ãŠñ ããÌãÌãÀ¥ã :
PARTICULARS OF WAGONS DETACHED ENROUTE

1.
2.
3.
4.
5.

ƒÃ. »ãÆñ‡ãŠ ãä¶ãÀâ¦ãÀ¦ãã / Ìãõ²ã¦ãã ‡ãŠãè ¹ãì¶ã: •ããù“ã, Êããñãä¡â□ã Ô©ãÊã ¹ãÀ ¾ãã ãä¶ã‡ãŠ›¦ã½ã ¹ãÀãè□ã¥ã ¹Ìããƒâ› ¹ãÀ □ãã¡üãè ¹ãÀãè□ã‡ãŠ ´ãÀã
BRAKE CONTINUITY / REVALIDATION AT LOADING POINTS
(OR THEIR NEAREST EXAMINATION POINTS BY TRAIN EXAMINING STAFF)

ÌãÇŠ ½ãã â‡ãŠ S.No.	Ô›ñÍã¶ã STATION	ÀñÊãÌãñ RAILWAY	ããª¶ããâ ‡ãŠ DATE	Êããñ‡ãŠãñ ¶ãâ. LOCO No.	Ìãã¾ãì ª»ããÌã ¦ãõ¾ããÀ Ôã½ã¾ã PR. READY AT	¹ããƒÃ □ãƒÃ ããäÌãÓã½ã¦ãã ABNORMALITY OBSERVED	ÖÔ¦ãã□ãÀ SIGN

†¹ãŠ. ½ãã□ãÃ ½ãñ ¹ããƒÃ □ãƒÃ ‡ãŠãä□¶ããƒÃ¾ããù †Ìãâ ãä¶ãÌããÀ¥ã
ENROUTE PROBLEMS NOTICED & ATTENTION GIVEN

ããª¶ããâ ‡ãŠ DATE	Êããñ‡ãŠãñ ¶ãâ. LOCO No.	¡Èãƒ»ãÀ ‡ãŠã ¶ãã½ã DRS NAME	¡Èã. ‡ãŠã Öñ. ‡ã‹Ìãã.	‡ãŠãä□¶ããƒÃ¾ããù ãä¶ãÌããÀ¥ã PROBLEMS & ACTION TAKEN		¡Èãƒ»ãÀ Ìãã Ô›ñÍã¶ã Ô›ã¹ãŠ ‡ãŠñ ÖÔ¦ãã□ãÀ SIGN OF DR / STN. STAFF
				Ô›ñÍã¶ã STN	¹ãÆ‡ãã ŠãÀ NATURE	

(Format – II)

Ôã‘ã¶ã »ãÆñ‡ãŠ ¹ãäÌãÀ ¹ãÆ½ãã¥ã ¹ã¨ã Ìãã¾ãì »ãÆñ‡ãŠ (½ããÊã□ãã¡üãè) ”ãñÀ Ôãñ ”ãñÀ ¾ãã¨ãã ‡ãŠñ ãäÊã¾ãñ

INTENSIVE BRAKE POWER CERTIFICATE FOR AIR BRAKE (GOODS)

(END TO END RUN)

•ããÀãè ãä‡ãŠ¾ãã : (¶ãã½ããâãä‡ãŠ¦ã Ô ã /½ãâ¡Êã/ÀñÊãÌãñ)

ISSUED BY : (Nominated Intensive Exam. Point/Div./Rly)

□ã¶¦ãÌ¾ã Ô

Destination

ãäª¶ãã

Date BPC No.

›Èñ¶ã ¶ ƒâ•ã

Train No. Loco No.

¼ããÀ †Ìãâ Ô ‡ãŠìÊã »ãÆñ‡ãŠ ãäÔãÊãñ¥¡À

Load & Stock Total No. OF Bk. CyLS.

‡ãŠã¾ãÃÀ¦ã »ãÆñ‡ã Êãñ¥¡À ñ‡ãŠ ¹ããÌãÀ ¹ãÆãä¦ãÍã¦ã

No. Of Operating Cylinders Brake Power %

Ìãã¾ãì ª»ããÌã ¹ãÆÔ©ãã ãÀ : ƒâ•ã¶ã ½ãñ ãä‡ãŠ□ãÆã/Ôãñ½ããè^2 »ãÆñ‡ãŠ Ìãã¶ã ¹ãÀ ãä‡ãŠ□ãÆã/Ôãñ½ããè^2

Air pressure on dep.: On Loco KG/CM^2 On Bk. van KG/CM^2

ãä¶ãªñÃÍã INSTRUCTIONS

†. □ãã¡Ã †Ìãâ ¡Èãƒ»ãÀ

GUARDS AND DRIVERS:

□ãã¡üãè ‡ãŠãñ “ãÊãã¶ãñ Ôãñ ¹ãÖÊãñ □ãã¡Ã †Ìãâ ¡ÈãƒÀ Ôãìãä¶ãäÍ“ã¦ã ‡ãŠÀññ:

Before starting the train, guard and driver should ensure:

i) •ã»ã ¦ã‡ãŠ ¼ãÀãè ÖìƒÃ ½ããÊã□ãã¡üãè ‡ãŠñ »ãÆñ‡ãŠ ¹ãäÌãÀ ¹ãÆ½ãã¥ã ¹ã¨ã ¹ãÀ □ã¶¦ãÌ¾ã Ô©ãã¶ã ¶ã ãäÊãŒãã Öãñ, □ãã¡üãè ¶ã “ãÊãã¾ãñâý

No driver should move the loaded train from the loading point unless the destination is clearly mentioned on the brake power Certificate.

ii) ¹ãÆ©ã½ã Ìãõ□ã¶ã Ôãñ ‚ãâãä¦ã½ã Ìãõ□ã¶ã ¦ã‡ãŠ »ãã¾ãì ª»ããÌã ‡ãŠãè ãä¶ãÀâ¦ãÀ¦ãã.

Continuity of air pressure from firstto last vehicle of the train.

iii) ¾ãããäª »ãÆñ‡ãŠ ¹ããäÌãÀ ¹ãÆ½ãã¥ã ¹ã¨ã ‚ãÌãõ²ã Öõ ¦ããñ Ôãñ‡ã‹Í¶ã ‡ãŠâ›ÈãñÊãÀ ‡ãŠãñ Ôãîãä“ã¦ã ‡ãŠÀñ Ìã ‡ãŠõÀñ•ã ‡ãŠâ›ÈãñÊãÀ Ôãñ „ãä“ã¦ã ãä¶ãªñÃÍã ¹ãÆã¹¦ã ‡ãŠÀñâý

If IBP is invalid, inform the Control Office and take necessary instructions from C&W controller.

¾ãÖ ¹ãÆ½ãã¥ã ¹ã¨ã »ãõ²ã Öõ :
1. ¾ãããª ¼ãÀãè Öìƒã ½ããÊã□ãã¡üãè ‡ãŠñ »ãÆñ‡ãŠ ¹ããÌãÀ ¹ãÆ½ãã¥ã ¹ãÀ □ã¶¦ãÌ¾ã Ô©ãã¶ã ããÊãŒãã Öãñý
2. ¾ãããª ½ãã□ãÃ ½ãñ 4 ¾ãã ‚ãããµã‡ãŠ »ãõ□ã¶ã □ãã¡üãè ½ãñ •ããñ¡ñ ¾ãã ‡ãŠã›ñ ¶ãÖãèâ □ã¾ãñ Öãñâý
3. ¾ãããª □ãã¡üãè ‡ãŠãñ 24 ‘ãâ›ñ Ôãñ ‚ãããµã‡ãŠ Ô›ñ»ãÊã ¶ãÖãèâ ãä‡ãŠ¾ãã □ã¾ãã Öãñ ý
THIS CERTIFICATE IS VALID:
1. Provided the destination is mentioned on the BPC of the loaded train.
2. Provided the composition of the rake is not changed by 4 or more wagons.
3. Provided the rake is not stabled for more than 24 hours.

»ã. Ìãõ□ã¶ããñâ ‡ãŠãè ÌãÇŠ½ã »ã®¦ãã / LIST OF WAGON IN ORDER:

ÌãÇŠ ½ãã â‡ãŠ Sr. No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.	ÌãÇŠ ½ããâ ‡ãŠ Sr. No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.	ÌãÇŠ ½ããâ ‡ãŠ Sr. No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.	ÌãÇŠ½ã ãâ‡ãŠ Sr. No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.
1		16		31		46	
2		17		32		47	
3		18		33		48	
4		19		34		49	
5		20		35		50	
6		21		36		51	
7		22		37		52	
8		23		38		53	
9		24		39		54	
19		25		40		55	
11		26		41		56	
12		27		42		57	
13		28		43		58	
14		29		44		59	
15		30		45			

Ôããè. Êããñãä¡â□ã ‡ãŠñ »ããª »ãÆñ‡ãŠ ãä¶ãÀâ¦ãÀ¦ãã / »ãõ²ã¦ãã ‡ãŠãè •ããù“ã, Êããñãä¡â□ã Ô©ãÊã ¾ãã ãä¶ã‡ãŠ›¦ã½ã ¹ãÀãè□ã¥ã ¹Ìããƒâ› ¹ãÀ □ãã¡üãè ¹ãÀãè□ã‡ãŠ ´ãÀã

BRAKE CONTINUITY / REVALIDATION AFTER LOADING AT LOADING POINT OR THE NEAREST EXAMINATION POINT BY TRAIN EXAMINATION STAFF:

ÌãÇŠ ½ãã â‡ãŠ S.No.	Ô›ñÍã¶ã STATION	ÀñÊãÌã ñ RAILWAY	ãäª¶ ããâ ‡ãŠ DATE	Êããñ ‡ãŠã ñ ¶ãâ. LOCO No.	Ìãã¾ãì ª»ããÌã ¦ãõ¾ããÀ Ôã½ã¾ã PR. READY AT	¹ããƒÃ □ãƒÃ ããÌãÓã½ã¦ã ãã ABNORMALITY OBSERVED	ÖÔ¦ãã□ ãÀ SIGN

¡ãè. ½ãã□ãÃ ½ãñ ¹ããƒÃ □ãƒÃ ‡ãŠãä□¶ããƒÃ ¾ããù †Ìãâ ãä¶ãÌããÀ¥ã

ENROUTE PROBLEMS NOTICED & ATTENTION GIVEN

ãäª¶ããâ ‡ãŠ DATE	Êããñ‡ãŠ ãñ ¶ãâ. LOCO No.	¡Èãƒ»ãÀ ‡ãŠã ¶ãã½ã/ Öñ. ‡ã‹Ìãã. DRS NAME & HQ	‡ãŠãä□¶ããƒÃ¾ããù ãä¶ãÌããÀ¥ã PROBLEMS & ACTION TAKEN		¡Èãƒ»ãÀ Ìã Ô›ñÍã¶ã Ô›ã¹ãŠ ‡ãŠñ ÖÔ¦ãã□ãÀ SIGN OF DR / STN. STAFF
			Ô›ñÍã¶ã STN	¹ãÆ‡ãŠ ãÀ NATURE	

ƒÃ. Ôãî“ã¶ãã¾ãñ / NOTES:

1. ,ãã¶ãñ ÌããÊãã ¡Èãƒ»ãÀ ¹ãÆ½ãã¥ã ¹ã¨ã ‡ãŠã¾ãÃ ½ãì‡ã‹¦ã ‡ãŠÀ¶ãñ ÌããÊãñ ¡Èãƒ»ãÀ ‡ãŠãñ Ôããñ¹ã ªñ□ããý ¾ãããª ÌãÖ ãä»ã¶ãã †Ìã•ããè (ããÀÊããè¹ãŠ) ‡ãŠñ □ãã¡üãè ”ãñ¡ü¦ãã Öõ ¦ããñ ¾ãÖ ƒÔãñ ¶ãããä½ã¦ã ,ãããµã‡ãŠãÀãè ‡ãŠñ ¶ãã½ã •ã½ãã ‡ãŠÀ ªñ□ãã •ããñ ãä‡ãŠ ƒÔãñ •ãã¶ãñ ÌããÊãñ ¡Èãƒ»ãÀ ‡ãŠãñ ªñ□ãã ý
   The incomming driver shall handover the brake power certificate to releving driver . If he is leaving the train without relief, it shall be deposited with the nominated auththority, who will give it to the outgoing driver.
2. •ãã¶ãñ ÌããÊãã ¡Èãƒ»ãÀ ,ããõÀ □ãã¡Ã ããä³¾ãñ □ã¾ãñ »ãõ□ã¶ããñâ ‡ãŠñ ¶ãâ»ãÀ ‡ãŠñ »ããÀñ ½ãñâ ,ã¹ã¶ãñ ,ãã¹ã ‡ãŠãñ Ôãâ¦ãìÓ› ‡ãŠÀ Êãñ□ãñ ãä‡ãŠ ¹ãÆ½ãã¥ã ¹ã¨ã □ãã¡üãè Ôãñ Ôãâ»ãâãäµã¦ã Öõý
   The outgoing driver and guard will satisfy themselves from the listed wagon numbers that the Brake Power Certificate pertains to their train

¡Èãƒ»ãÀ ‡ãŠã ¶ãã½ã Ìã ÖÔ¦ãã□ãÀ DRIVER S NAME & SIGN	□ãã¡Ã ‡ãŠã ¶ãã½ã Ìã ÖÔ¦ãã□ãÀ GUARD S NAME & SIGN	TXR ‡ãŠã ¶ãã½ã Ìã ÖÔ¦ãã□ãÀ JE/SE (C&W) NAME & SIGN

(Format – III)

Ôã‘ã¶ã »ãÆñ‡ãŠ ¹ããÌãÀ ¹ãÆ½ãã¥ã ¹ã¨ã Ìãõ‡ã‹¾ãî½ã »ãÆñ‡ãŠ (½ããÊã□ãã¡üãè) ”ãñÀ Ôãñ ”ãñÀ ¾ãã¨ãã ‡ãŠñ ããäÊã¾ãñ

INTENSIVE BRAKE POWER CERTIFICATE FOR VAC BRAKE (GOODS) (END TO END RUN)

•ããÀãè ãä‡ãŠ¾ãã : (Ôã‘ã¶ã ¹ãÀãè□
ISSUED BY : (Intensive Exam. Point/
□ã¶¦ãì¾ã Ô
Destination
ãäª¶ãã
Date BPC No.
›Èñ¶ã ¶
ƒâ•ã¶ã
Train No Loco No.
¼ããÀ †Ìãâ
‡ãŠìÊ
ããäÔãÊãñ¥
Load & Stock Total No. OF Bk. CyLS.
‡ãŠã¾ãÃÀ¦ã »ãÆñ‡ã À
»ãÆñ‡ãŠ ¹ããÌ ã
No. Of Operating Cylinders Brake Power %

Ìãõ‡ã‹¾ãî½ã ¹ãÆÔ© ¹ãÀ : ƒâ•ã¶ã ½ãñ Ôãñ½ããè
»ãÆñ‡ãŠ Ìãã¶ Ôãñ½ããè
Vacuum on dep.: On Loco CM On Bk. van CM

ãä¶ãªñÃÍã INSTRUCTIONS

†. □ãã¡Ã †Ìãâ ¡Èãƒ»ãÀ
GUARDS AND DRIVERS:

□ãã¡üãè ‡ãŠãñ "ãÊãã¶ãñ Ôãñ ¹ãÖÊãñ □ãã¡Ã †Ìãâ ¡Èãƒ»ãÀ Ôãìãä¶ãäãÍ"ã¦ã ‡ãŠÀññ:

Before starting the train, guard and driver should ensure:

i) •ã»ã ¦ã‡ãŠ ¼ãÀãè Öìƒã ½ãããÊã□ãã¡üãè ‡ãŠñ »ãÆñ‡ãŠ ¹ããÌãÀ ¹ãÆ½ãã¥ã ¹ã¨ã ¹ãÀ □ã¶¦ãì¾ã Ô©ãã¶ã ¶ã ããÊãŒãã Öãñ, □ãã¡üãè ¶ã "ãÊãã¾ãñâý

No driver should move the loaded train from the loading point unless the destination is clearly mentioned on the brake power Certificate.

ii) ¹ãÆ©ã½ã Ìãõ□ã¶ã Ôãñ ,ãâããä¦ã½ã Ìãõ□ã¶ã ¦ã‡ãŠ »ãõ‡ã‹¾ãî½ã ‡ãŠãè ãä¶ãÀâ¦ãÀ¦ãã.

Continuity of Vacuum from first to last vehicle of the train.

iii) ¾ãããª »ãÆñ‡ãŠ ¹ããÌãÀ ¹ãÆ½ãã¥ã ¹ã¨ã ,ãÌãõ²ã Öõ ¦ããñ Ôãñ‡ã‹Íã¶ã ‡ãŠâ›ÈãñÊãÀ ‡ãŠãñ Ôãîãä"ã¦ã ‡ãŠÀñ Ìã ‡ãŠõÀñ•ã ‡ãŠâ›ÈãñÊãÀ Ôãñ „ãä"ã¦ã ãä¶ãªñÃÍã ¹ãÆã¹¦ã ‡ãŠÀñâý

If IBP is invalid, inform the Control Office and take necessary instructions from C&W controller.

¾ãÖ ¹ãÆ½ãã¥ã ¹ã¨ã »ãõ²ã Öõ :
1. ¾ãããª Œããêããè ½ããÊã□ãã¡üãè »ãÆñ‡ãŠ ¹ããÌãÀ ¹ãÆ½ãã¥ã ¹ã¨ã •ããÀãè ãã‡ãŠ¾ãñ •ãã¶ãñ ‡ãŠñ 4 ãäª¶ã ‡ãŠñ ,ã¶ªÀ Öãè Êããñãä¡â□ã ¹Ìããƒâ› ¹ãÀ ¹ãÖìù"ã¦ããè Öõ ý
2. ¾ãããª ¼ãÀãè Öìƒã ½ããÊã□ãã¡üãè ‡ãŠñ »ãÆñ‡ãŠ ¹ããÌãÀ ¹ãÆ½ãã¥ã ¹ãÀ □ã¶¦ãì¾ã Ô©ãã¶ã ããÊãŒãã Öãñý
3. ¾ãããª ½ãã□ãÃ ½ãñ 10 (FW) ¾ãîãä¶ã› ¾ãã ,ãããµã‡ãŠ Ìãõ□ã¶ã □ãã¡üãè ½ãñ •ããñ¡üñ ¾ãã ‡ãŠã›ñ ¶ãÖãèâ □ã¾ãñ Öãñ
4. ¾ãããª □ãã¡üãè ‡ãŠãñ 24 'ãâ›ñ Ôãñ ,ãããµã‡ãŠ Ô›ñ»ãÊã ¶ãÖãèâ ãä‡ãŠ¾ãã □ã¾ãã Öãñ ý
THIS CERTIFICATE IS VALID:
1. Provided the empty examined rake reaches the loading point within 5 days of the issue of BPC.
2. Provided the destination is mentioned on the BPC of the loaded train.
3. Provided the composition of the rake is not changed by 2- or more Four ^ Wheeler Units.
4. Provided the rake is not stabled for more than 24 hours.

»ã. Ìãõ□ã¶ããñâ ‡ãŠãè ÌãÇŠ½ã »ã®¦ãã / LIST OF WAGONS IN ORDER:

ÌãÇŠ ½ãã â‡ãŠ Sr. No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.	ÌãÇŠ ½ãããâ ‡ãŠ Sr. No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.	ÌãÇŠ ½ãããâ ‡ãŠ Sr. No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.	ÌãÇŠ ½ãããâ ‡ãŠ Sr. No.	Ìãõ□ã¶ã ¶ãâ. WAGON No.
1		19		37		55	

2		20		38		56	
3		21		39		57	
4		22		40		58	
5		23		41		59	
6		24		42		60	
7		25		43		61	
8		26		44		62	
9		27		45		63	
19		28		46		64	
11		29		47		65	
12		30		48		66	
13		31		49		67	
14		32		50		68	
15		33		51		69	
16		34		52		70	
17		35		53		71	
18		36		54		72	

Ôãåè. ½ãã□ãÃ ½ãñ ¹ããƒÃ □ãƒÃ ‡ãŠãä□¶ããƒÃ ¾ããù †Ìãâ ãä¶ãÌããÀ¥ã / ENROUTE PROBLEMS NOTICED & ATTENTION GIVEN

ãäª¶ããâ ‡ãŠ DATE	Êããñ‡ãŠ ãñ ¶ãâ. LOCO No.	¡Èãƒ»ãÀ ‡ãŠã ¶ãã½ã/ Öñ. ‡ã‹Ìãã. DRS NAME & HQ	‡ãŠãä□¶ããƒÃ¾ããù ãä¶ãÌããÀ¥ã PROBLEMS & ACTION TAKEN	¡Èãƒ»ãÀ ‡ãŠñ ÖÔ¦ãã□ãÀ SIGN OF DR

ƒÃ. Ôãî“ã¶ãã¾ãñ / NOTES:

1. ,ãã¶ãñ Ìããʆãã ¡Èãƒ»ãÀ ¹ãÆ½ãã¥ã ¹ã¨ã ‡ãŠã¾ãÃ ½ãì‡ã‹¦ã ‡ãŠÀ¶ãñ ÌããÊãñ ¡Èãƒ»ãÀ ‡ãŠãñ Ôããñ¹ã ªñ□ããý ¾ãããª ÌãÖ ãä»ã¶ãã †Ìã•ããè (ããÀÊããè¹ãŠ) ‡ãŠñ □ãã¡üãè ”ãñ¡ü¦ãã Öõ ¦ããñ ¾ãÖ ƒÔãñ ¶ããããä½ã¦ã ,ãããµã‡ãŠãÀãè ‡ãŠñ ¶ãã½ã •ã½ãã ‡ãŠÀ ªñ□ãã •ããñ ãä‡ãŠ ƒÔãñ •ãã¶ãñ ÌããÊãñ ¡Èãƒ»ãÀ ‡ãŠãñ ªñ□ãã ý

   The incomming driver shall handover the brake power certificate to releving driver . If he is leaving the train without relief, it shall be deposited with the nominated auththority, who will give it to the outgoing driver.

2. •ãã¶ãñ Ìããʆãã ¡Èãƒ»ãÀ ,ããõÀ □ããÃ ãäª¾ããñ □ã¾ãñ »ãõ□ã¶ããñâ ‡ãŠñ ¶ãâ»ãÀ ‡ãŠñ »ããÀñ ½ãñâ ,ã¹ã¶ãñ ,ãã¹ã ‡ãŠãñ Ôãâ¦ãìÓ› ‡ãŠÀ Êãñ□ãñ ãä‡ãŠ ¹ãÆ½ãã¥ã ¹ã¨ã □ãã¡üãè Ôãñ Ôãâ»ãâããµã¦ã Öõý

   The outgoing driver and guard will satisfy themselves from the listed wagon numbers that the Brake Power Certificate pertains to their train

¡Èãƒ»ãÀ ‡ãŠã ¶ãã½ã Ìã ÖÔ¦ãã□ãÀ DRIVER S NAME & SIGN	□ããÃ ‡ãŠã ¶ãã½ã Ìã ÖÔ¦ãã□ãÀ GUARD S NAME & SIGN	TXR ‡ãŠã ¶ãã½ã Ìã ÖÔ¦ãã□ãÀ JE/SE (C&W) NAME & SIGN

MAINTENANCE MANUAL
FOR
WAGONS

Chapter –4 ***Wagon body***

CHAPTER 4

WAGON BODY

401. INTRODUCTION

The superstructure attached to the underframe of a wagon is called wagon body. It consists of body side and ends with their supporting structures such as stanchions, copings, roof structures, carlines; roof sheets in the case of covered wagons; hoppers and their supporting members in case of hopper wagons; tank barrels, cladding, if any, and supporting saddles in the case of tank wagons. Doors, door fittings, louvers for ventilation and various fittings such as cleats, handles, hooks, footsteps, hand brake wheel and ladders also form part of the body.

This chapter is concerned with the body or superstructure of general purpose open and covered wagons, hopper wagons, bogie flat wagons including container wagons and military wagons. The Superstructure and fittings of tank wagons are dealt with separately in the Chapter 10 on Tank wagon.

402. GENERAL CONSTRUCTION OF OPEN WAGON

A. SIDES

Sides are made up of side panels and side stanchions, which are attached to the underframe by crib angles, riveting strips and side stanchions. They include top copings, intermediate copings if any, doors, door fittings, hand holds, tarpaulin cleats and label holders.

B. ENDS

Ends are similar in construction to sides in that they consist of end panels, end stanchions, top copings and in some cases end shut stiffener, ventilator and intermediate copings. Attachment to the underframe is by means of end floor angles and through the stanchions. Corner stanchions connect the ends with the sides. Open wagons have reinforcing angles at each end together with reinforcing gussets and corner pressings at the corner.

C. DOORS

Each side of the wagon is provided with door for manual unloading. The doors are hinged at the bottom with locking arrangement by chainless cotter at the top. In BOXN wagons two extra locking bolts per door have also been provided to avoid slipping of chainless cotter during tippling of wagon.

403. GENERAL CONSTRUCTION OF COVERED WAGON

A. SIDES

Sides are made up of side panels and side stanchions, which are attached to the underframe by crib angles / riveting strips /welding strips. They include top copings, doors, door fittings, label holders, rain protection angles above swing doors, door striking plates and anti bleeding device below the flap doors. Cattle wagons are also fitted with side louvers, breast bar fittings and wainscot boards.

B. ENDS

Ends are similar in construction to sides in that they consist of end panels, end stanchions, top copings and in some cases, intermediate copings. Attachment to the underframe is by means of end floor angles and through the stanchions. Covered wagons are provided with ventilators at the upper end of body ends. Corner stanchions connect the ends with the sides. Ends of cattle wagons include wainscot boards.

C. ROOF

Roofs of covered wagons consist of roof sheets and carlines. Roof sheets are much thinner than the sheets used for the body sides and end panels.

D. DOOR

Each side of the wagon is provided with door for manual unloading. The doors consist of swing doors at the top with lebel holder hinged to the angles on the sides and flap doors at the bottom, hinged at the bottom with Anti bleeding device.

404. GENERAL CONSTRUCTION OF FLAT WAGON AND WELL WAGON

A. ENDS

Flat/well wagons do not have side wall and roof. The superstructure consists of either fixed or flexible ends. These are fixed to the underframe through stanchions, side attachment plates and crib angle.

B. SIDE STANCHION

Flexible side stanchions are attached to the sole bar through brackets. In addition, lashing chains and support brackets are also provided in rail wagons and well wagon. In container flat wagons, retractable anchoring locks are provided.

405. GENERAL CONSTRUCTION OF HOPPER WAGON

A. SIDES

Sides are made up of side panels and side stanchions, which are attached to the underframe. They include top copings, side stiffeners, doors in side discharge wagons, and label holders.

B. ENDS

Ends consist of end panels, end stanchions, end top copings and in some cases, stiffeners. Attachment to the underframe is through the stanchions. Corner stanchions connect the ends with the sides.

C. DOOR AND DOOR OPERATING MECHANISM

Hopper wagons are provided with either side discharge/centre discharge doors or both. Door operating mechanism is generally manually operated by means of bevel wheel and worm wheel connected to door operating hand wheel. In some special type of hopper wagons like BOBR/BOBRN, electro pneumatically operated door operating mechanism has been provided.

406. NATURE OF REPAIRS REQUIRED IN WAGON BODY

Apart from wagons involved in accidents or other serious mishaps, attention is normally necessitated because of the following defects:-

i. Corrosion of panels, floor plates and roof sheets.
ii. Puncturing of panels due to improper loading, inadequately secured consignments or deliberate tampering.
iii. Bulging of ends due to shifting of loads.
iv. Tearing of panels, fracture of stanchions and shearing of rivets due to severe impacts, and shifting of loads.
v. Corrosion of end floor angles and crib angles.
vi. Bulging of side usually occur after a prolonged period in service.
vii. Slackening of rivets due to the combined effect of ageing, corrosion, wear and tear.
viii. Weakening of welded joints due to loss of weld metal by corrosion, wear and tear.

ix. Wearing out of door hinges.
x. Damage to door fittings because of wear and tear or mishandling.
xi. Distortion of doors mainly because of mishandling.
xii. Failure of welded joints.
xiii. Distortion or cracking of stanchions and other structural members because of abnormal loads, e.g., those due to defective clamping on tipplers.
xiv. Wear and tear or breakage of miscellaneous fittings, such as ladders, cleats, label holders etc.

407. CORROSION IN WAGON BODY

The corrosion of wagon floor and roof plates results from:

i. Water logging in crevices and overlaps. This is greatly accentuated if cleaning is neglected, since the accumulated dust and refuse retain moisture for a prolonged period.

ii. Contact of panels with residues from corrosive consignments e.g., salt, fertilisers etc.

iii. Spillage of corrosive fluids due to defective packing or rough handling.

iv. Escape of corrosive vapours from the consignment.

v. Inadequate protection from weathering because of poor painting or inadequate surface preparation.

vi. The current practice is to paint only the exterior of the wagon body and not the interior, except for inside panels up to a height of 230 mm from floor, rivet seams and in the case of covered wagons, the swing and flap doors and the roof. The interior is left largely unpainted because paints have hitherto not been available which could withstand the constant scrubbing action of the consignment against the wagon walls. It is nevertheless a fact that most of the time corrosion originates from the interior of a wagon rather than the exterior.

408. ANTICORROSIVE MEASURES

i. The most important anti corrosive measure to be taken in day to day working is to ensure that the wagon is kept thoroughly clean and receives special attention in this respect after it has transported a corrosive or hygroscope commodity.

ii. The second important step to prevent corrosion is to ensure that cleaning, surface preparation and painting are carried out with due thoroughness.

The correct procedure to be followed in major maintenance schedules is given at the end of this chapter. The procedure to be adopted at the time of minor repairs should come as close to this as practicable.

iii. While attending to miscellaneous repairs, panel patching or welding; it is important to ensure that surfaces in contact are well fitted to avoid water pockets. Due care is to be taken to clean and paint the affected surfaces to prevent corrosion by electrochemical action.

409. REJECTABLE DEFECTS

The inspection of wagon body is to be carried out in sicklines and workshops as per procedure laid down in IRCA Part-III (2000) Rule 4.2 & 4.7.

410. REPAIRS IN SICKLINE & ROH DEPOT

410 A. PANEL PATCHING

The bottoms of body side and end sheets are particularly vulnerable to destruction by corrosion and also puncturing by miscreants. Instructions have been issued to use 5 mm thick skirting plates on CR wagons (8mm thick skirting plates on CRT wagon) at these locations. These must be strictly followed. Table 4.1 gives the sizes of panel patches to be used for skirting plates on these wagons. If the area to be patched extends beyond 260mm from the floor height, either two standard patches of 5 mm thickness should be used one above the other or a single special patch of 5 mm thickness and a width of 520 mm should be used. In case two or more adjacent panels require patching at a time, the complete length of corrosion can be covered by a special patch, which must, however, extend from stanchion to stanchion, as shown in figure 4.1. The standard panel patches for BOX and BOXN wagons are given in Table- 4.2 & 4.3. For detailed instructions of panel patching for BOX wagon RDSO Drg. No. WD-80056-S-1 and for BOXN wagon RDSO Drg. No. WD-94047-S-1 may be referred to.

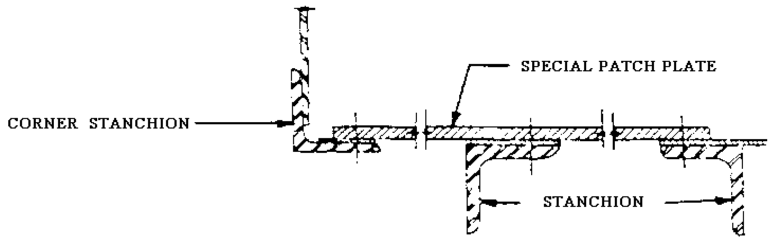

FIG 4.1

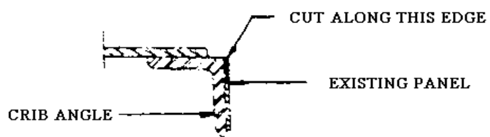

FIG 4.2

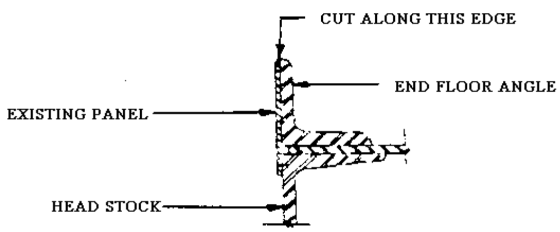

FIG 4.3

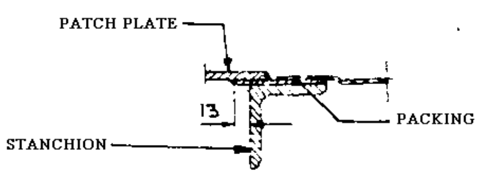

FIG 4.4

TABLE- 4.1
PANEL PATCHES FOR CRT/CRC WAGON
[Ref: IRCA Part III rule 2.11.9.1]

S.No	Width (mm) STEP SIZE A	B	Length (mm)	Thickness	Material and Specification
1.	210	260	1024	5	IS:2062Fe410CuWA
2.	210	260	1060	5	-do-
3.	210	260	804	5	-do-
4.	210	260	904	5	-do-
5.	210	260	1096	5	-do-

TABLE- 4.2
PANEL PATCHES FOR BOX WAGON

Sr. No	Width (mm)						Plate length (mm)		Patch thick n-ess (mm)	Material specifica -tion
	Step size A		Step size B		Step size C		R	W		
	Riveted	Welded	Riveted	Welded	Riveted	Welded				
1.	300	300	580	430	1190	1030	350	260	5	IS:2062 Fe410 CuWA
2.	705	610					350	260	5	"
3.	300	300	580	430	1190	1030	1540	1470	5	"
4.	350	300	705	610			1540	1470	5	"
5.	430	210					1540	1470	5	"
6.	300	300	600	600	960	800	470	400	5	"
7.	936	820					470	400	5	"
8.	300	300	600	600	960	800	620	560	5	"
9.	936	820					620	560	5	"
10.	300	300	600	600	960	800	770	710	5	"
11.	936	820					770	710	5	"

TABLE- 4.3
PANEL PATCHES FOR BOXN WAGON

S. No	Width (mm)			Plate length (mm)	Plate thickness (mm)	Material specification
	Step size A	Step size B	Step size C			
1.	300	610	1275	552	5	IRS M-41
2.	300	610	-	552	5	"
3.	300	680	-	1470	5	"
4.	300	680	-	1445	5	"
5.	300	525	1170	1445	5	"
6.	315	-	-	1470	5	"
7.	300	600	850	445	5	"
8.	820	-	-	445	5	"
9.	300	600	850	555	5	"
10.	820	-	-	555	5	"
11.	300	600	850	700	5	"
12.	820	-	-	700	5	"

TABLE- 4.4
THICKNESS OF PATCH PLATES

S.No	Type of Wagon	Thickness of patch plate (in mm)			Remarks
		At the roof	At the sides	At the end	
1.	BCX MK.II	1.6	3.15	3.15	(End ventilators)
2.	CRT	1.6	2.5	2.5	(At centres)
3.	BOX	-	4.0	4.0*	*5mm plate to be used in the modified wagons.
4.	BOI	-	5.0	5.0	
5.	BOY	-	5.0	5.0	
6.	CR	1.6	2.5	2.6	End ventilators at centres.
7.	CMR	1.6	2.5	2.5	
8.	CE	1.6	2.5	2.5	
9.	O	-	5.0	5.0	
10.	OM	-	5.0	5.0	Falling ends.
11.	BRH	-	-	6.0	
12.	BR	-	-	6.0	
13.	BRN	-	-	6.0	
14.	BOXN	-	5.0	5.0	
15.	BCN/BCNA	1.6	3.15	3.15	

410A i. For locations other than the skirting plates, damaged panels should be replaced by using standard patches. These patches should invariably be of the same thickness as the damaged panel. The thickness of panels at different locations on various wagons is given in Table 4.4.

ii. Sick lines may weld or rivet smaller patches to take care of minor damages, but in no case, should a patch of less than 100mm on any one side be used. If the patch is attached by riveting there should not be less than 8 rivets securing the patch. The pitch of the rivets must also not exceed 90 mm.

iii. Standard patch plates should, preferably be kept ready in stock in shops and sicklines after proper surface cleaning and painting with two coats of zinc chromate primer.

410 B. PROCEDURE FOR WELDED PATCHES

i. Examine and mark the area of patch to be cut. Cut the corroded panel along crib/end floor angle and up to a height suitable for standard patches, as shown in Fig. 4.2 and 4.3. The 2.5 mm thick old panel sheet at the stanchion should be retained as a packing piece if not badly corroded. Otherwise use fresh 5 mm thick packing(RDSO Drawing No. WD-94047-S-1). The packing should extend 13mm wherever lap welding of the new patch with packing piece is involved (See Fig. 4.4).

ii. Cut rivets on stanchion as required and end floor angle horizontal leg by 10 mm when fitting patches at the corners as shown in Fig.4.5. Take a standard patch plate from stock or prepare the same from plate of requisite thickness.

iii. Cut floor plates by 8mm (10mm for CRT wagons) for fitting new patch, as shown in Fig. 4.5. As an alternative, the patch plate may be made to rest over the floor plate, as shown in Fig. 4.6 & 4.7. In case, floor plates also require renewal, the width of the floor plates should be reduced to follow the arrangement shown in Fig. 4.8 & and 4.9. Secure the standard patch on the wagon by means of tack welding. Weld all round.

iv. Rivet 2.5mm packing piece in position as shown in Fig. 4.10.

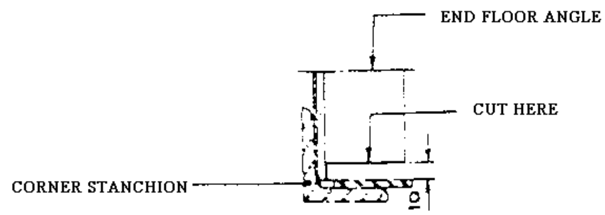

FIG 4.5

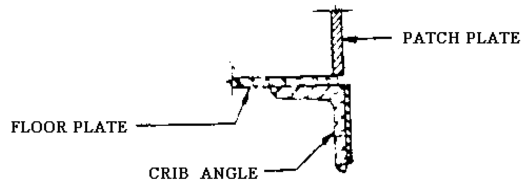

FIG 4.6

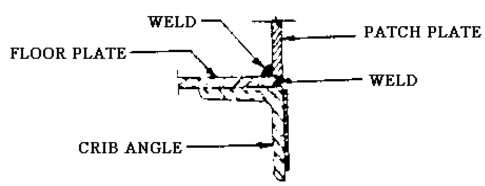

FIG 4.7

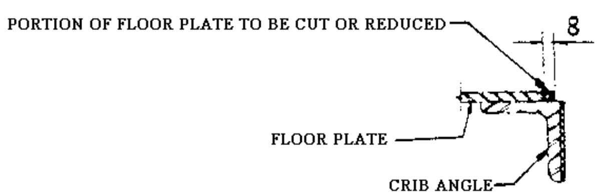

FIG 4.8

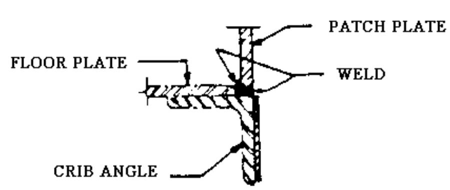

FIG 4.9

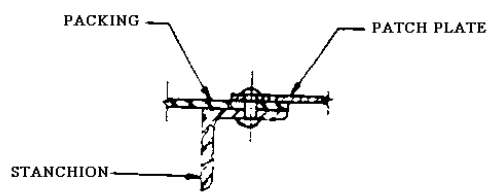

FIG 4.10

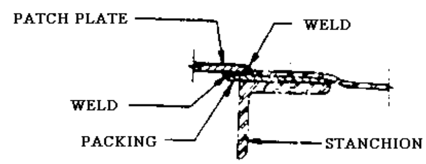

FIG 4.11

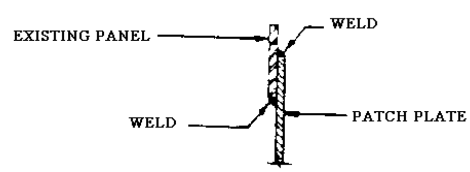

FIG 4.12

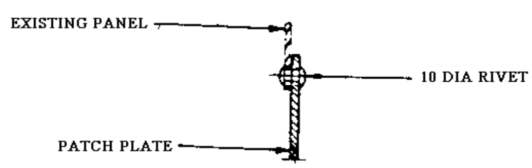

FIG 4.13

v. Overlapping portions should be welded on both sides as shown in Fig. 4.11 and 4.12.

vi. Ensure continuous welding without any craters.

vii. In case of bulged panels, the patch should be riveted to the panels, as shown in Fig. 4.13.

viii. Clean and repaint the welded portion at locations where paint has been burnt off.

410 C. RIVETED PATCH

i. Examine and mark the area of the patch to be cut.

ii. Take a standard patch plate from stock or prepare the same from plate of requisite thickness.

iii. Position the patch on the wagon and mark the location of the rivet holes.

iv. Drill/punch the holes on both the patch and the wagon panel and secure the latter in position by temporary bolts and nuts.

v. Rivet the patch in position.

vi. Ensure that riveting is sound and with concentric snap heads, and also that mating edges are set properly leaving no gap in between.

410 D. REPAIRS TO BULGED ENDS

If there are no serious damages to wagon ends other than bulging, the bulges can be effectively removed without dismantling. If two wagons with bulged ends are coupled together and a hydraulic jack is applied between them at the bulges, suitable packing being interposed between the jack and the wagon body. This method is particularly effective in dealing with dread-naught ends.

410 E. REPAIRS TO BODY STRUCTURAL MEMBERS (STANCHIONS, CARLINES AND COPINGS)

a. Damages to these members are usually due to rough handling, heavy shunting impacts or shifting of loads due to improper packing/stacking of the consignments. At first these components bulge out, but later even the rivets holding them to the underframe/superstructure members break out. It should be ensured that the bulging of these components does not cause infringements with the maximum moving dimensions of 1929 mm. Bulging of these components by more than 25mm should be rectified. These components should be straightened without dismantling by pulling into correct position with the help of a chain and screw coupling or stripped and straightened either cold or by heating, as required and then riveted in position. Spot heating and cooling to straighten the stanchions can rectify bulging of all welded ends.

b. In certain cases, these components may have developed cracks, or may have broken in pieces. Such of these components should be repaired by welding both the pieces and applying a stiffener angle prepared by bending a 6mm plate in the shape of an angle with its outer faces sitting flush in the inner profile of the member to be patched and welding it all round to the member. Elongated holes in these components should be filled up by welding and refilled.

410 F. WATER TIGHTENING OF WAGON

Covered wagons must be kept watertight at all times. Covered wagons must be tested for water tightness at the time of leaving the workshop after POH or other repairs. All empty covered wagons attended to in sicklines, should also be tested for leaks, and made watertight by applying sealing compound. Before the onset of the monsoon season, a special drive should be instituted and sealing compound must be applied at all points of covered wagon bodies, which are likely to leak particularly peripheries of riveted patches other overlaps and small holes.

Before the application of sealing compound, mechanical defects such as bulged panels severely distorted body structural members, gaping joints, loose rivets and other corroded areas must be attended to. It should be ensured that the surfaces are clean and dry before sealing compound is applied. An attempt must not be made to fill up large gashes or other openings with sealing compound. Holes more than 6 mm in diameter should be filled by rivets. Irregular openings and cuts with more than 25 mm length and 3 mm width should be repaired by patching or welding.

After a wagon has been made watertight, it should be marked “**WT**” with station code and date on the left-hand bottom corner of both sides.

410 G. REPAIRS TO DOORS AND DOOR FITTINGS

The main defects arising in doors are:-

- distortion due to wedging or other mishandling
- jamming of hinges

- excessive clearances in hinges
- inadequate overlap between flaps and door leaves
- gaping of doors at the stanchions
- distortion or breakage of tower bolts
- breakage of hinges and
- damage to gravity cotters, hooks and hasps.

Damaged doors of covered wagons are responsible for a very large proportion of claims due to wetting or pilferage of consignments. Warpage of flap doors is often responsible for jamming of flap door hinges. Special care must therefore, be taken in attending to doors.

Distorted or bulged doors must be taken down and straightened to ensure proper fit. Worn out hinges are responsible for sagging or gaping doors and inadequate overlap. Such hinges must be replaced with new or reconditioned ones.

Bent door stanchions and depressed crib angles must be straightened to ensure free functioning of doors and prevent gaping. Corroded crib angles must be cut out and replaced. Graphite grease should be introduced in all hinges, sliding cotters and other working parts.

After repairs, doors must sit flush against striking plates with adequate overlap between leaves and without gaping at the stanchions or crib angles. Anti-bleeding devices and rain protection angles should also be checked and rectified where necessary.

In the case of hopper wagons, it should be ensured that when the doors are closed, no gap is left between the chute plate and frame, and that the operating gear works freely and is in good condition.

410 H. LOUVERS

Louvers of cattle wagons are particularly prone to corrosion because of corrosive fumes emanating from the excreta of these animals. Corroded louvers have to be replaced by new ones. Special care must be taken to ensure that the louvers are given good surface preparation and painting, and those overlapping joints are properly cleaned and painted to obtain the maximum possible life.

410 I. CLEANING, SURFACE PREPARATION AND PAINTING

The correct sequence and procedure for cleaning, preparation of metal surfaces to be painted and the painting thereof is described on next page.

a. Preparation of surface before painting

The purpose of cleaning is to remove dirt, oil, grease, rust and other contaminants, which would prevent the paint film from adhering to the metal or would provide a nucleus for commencement of corrosion.

Cleaning by hammering, chiselling or scraping is unsatisfactory and should not be resorted to. The surface cleaning may be done by vigorously scrubbing with a stiff brush. All welded parts and adjacent surfaces should be thoroughly cleaned to remove residual alkaline flux and washed with hot water.

b. A coat of priming paint should be applied immediately after the surface has been cleaned and dried. A delay of more than 4 hours may result in development of fresh rust on the surface. A second coat of primer must be given when the first coat is dry. Painting must be done under cover in a shed or shop. The painted surfaces must remain under cover until the paint is dry.

c. Panel patches and riveting strips must be cleaned, as prescribed above, and given two coats of primer before storage or fitment.

d. After completion of all repairs a final coat of finishing paint should be given to all painted surfaces.

e. When the paint film is only partially damaged, it should be touched up with one coat of primer and then given the finishing coat.

f. Surfaces, which will become inaccessible after assembly must be given complete painting before assembly.

411. REPAIRS AND MAINTENANCE IN WORKSHOPS DURING POH AND NPOH

a. For body repairs, same procedure as described in para 410 A to 410 I above is to be followed.

Note :- The detailed procedure for painting and specifications for different coats of paint are given in general standard specification G-72 (Rev.1) read with latest amendments which may be referred to for more details.

In addition to the above, following items to be carried out during POH in workshops.

b. Lettering

Lettering to be carried out as per IRCA Part III (2000) Rule 2.4 by stencilling the relevant figures.

c. Punching of wagon particulars.
d. PRIO plate
e. Tare weight to be measured after POH and it should be marked up to one decimal.

412. IMPORTANT PRECAUTIONS TO BE TAKEN WHILE CARRYING OUT WELDING

Welding entails the risk of fire if combustible materials are present near the area being welded. To prevent such accidents, the following precautions must be taken:

A. Loaded wagons

It should be ensured that the content is not inflammable. Should the contents be inflammable they must be transhipped before welding is attempted.

Tank wagons should never be welded when loaded.

B. Empty wagons

It should first be ensured that no portion of an inflammable consignment packing material or dunnage is present in the area to be welded.

Empty tank wagons should be given welding repairs only in depots specially equipped for this purpose and only after thorough steam cleaning and testing to ensure that there are no inflammable/explosive vapours left.

C. Wagons fitted with roller bearing

No welding should be attempted without effectively earthing the member or component to be welded. Neglect in taking this precaution will result in passage of the return current through the roller bearing, which may suffer severe damage leading to premature failure.

413. IMPORTANT DO'S AND DON'TS

Do's

i. Ensure that you have the proper tools required for the job. Use of improper tools can make matters worse.

ii. Ensure that tools and equipment are in good condition.

iii. See that rivet heads are properly formed with correctly profiled snaps.

iv. While fitting patches to structural members, ensure that the pitch of rivets conforms to the original pitch in the structural members.

v. See that doors are provided with all required fittings so as to ensure proper securing and prevent unauthorised opening.

vi. Ensure that door hooks are intact and so placed that they will engage with the door eye in open position.

vii. Ensure that all chains links and other attachments are in position and in working order.

Don'ts

i. Do not use patches of less thickness than the original panel.

ii. Do not patch existing patches.

iii. Do not build up perforations in panel due to corrosion. Cut out and fit a new patch.

iv. Do not permit empty wagons to run with open doors.

v. Do not permit loaded wagons to run without properly secured doors.

vi. Do not allow wagons with inadequately secured/lashed consignments.

414. IMPORTANT MODIFICATIONS

a) Fitment of glass wool in place of wood dust bags on BVG brake van vide RDSO letter No. MW/CWSC/59 Dt. 10.2.95.

b) Strengthening of fixed end of BRN wagon vide RDSO letter No. MW/BRN Dt. 7.1.99.

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MAINTENANCE MANUAL FOR WAGONS

Chapter – 5 ***Underframe***

CHAPTER 5

UNDERFRAME

501. GENERAL

The type and size of a particular underframe is intimately related to the type and design of a wagon, as it constitutes the main load bearing sub-assembly for the vehicle. The overall dimensions and design of this structure take into account the quantum and pattern of loading on the vehicle as well as the track considerations. This in turn determines the permissible wheel base and whether a four wheeler or a bogie wagon would be required for the purpose of carrying the required load. Accordingly, while designing an underframe, the loading per meter is also taken into account as this is to be permitted by the type of track available. The buffing and impact loads also govern the strength of the underframe and the shunting speeds permitted for the marshalling of the goods stock. In the case of bogie wagons, the load transfer to the bogie frame is by means of pivot arrangement and thus the bogie frame also assumes an equally important function.

502. GENERAL CONSTRUCTION OF BG WAGON UNDERFRAME

A. The main members of a typical conventional BG wagon underframe are as under:

i. Sole bars
ii. Head stock
iii. Longitudinal
iv. Cross bars
v. Diagonals
vi. Floor
vii. Crib angle
viii. End angle
ix. Gusset plates and knees

B. The main underfame of a vehicle generally consists of two outer longitudinal members viz. Sole bars and the two head stocks which are strengthened by two middle longitudinal and various cross members. The diagonals and gusset plates protect the under frame against diagonal deflection and help in absorbing and distributing the buffing loads over different members. As already mentioned, the gusset plates and knees are provided at critical locations to impart additional strength to the joints. The whole structure is so designed that various loads are uniformly distributed and no single member has to bear excessive load than designed for.

Various rolled sections are used for the underframe members. Channel sections are generally used for headstock and sole bars for facilitating fitment of axle guards and buffers and Z-Sections are used for centre sills. Welding is generally used for joining the underframe members. But in earlier wagons, riveting had been used for joining these members. In the case of bogie wagons, the underframe has comparatively stronger cross members, known as bolsters, for fitting the upper centre pivot casting, which rests on the bogie pivot.

C. The underframe and all its members are necessarily to be true and square and these should conform to the manufacturing tolerances as given in Fig 5.1.

D. All underframe are given an initial camber at the time of manufacture so that under actual loading conditions, these do not sag.

E. The following tolerances are permitted in the new wagon construction:

i)	Inside length	+5 mm (riveted) - 5 mm +7 mm (welded) - 3 mm
ii)	Inside width	+3 mm - 3 mm
iii)	Inside height	+3 mm - 3 mm
iv)	Difference between diagonals	
	a. Under frame	5 mm
	b. Body side	5 mm
	c. Body end	5 mm
	d. Door opening	4 mm
	e. Door	3 mm
v)	Distance between bogie pivot centres	+3 mm (riveted) -3 mm + 5 mm (welded) - 2 mm
vi)	Distance between bogie pivot centre and adjacent headstock	+2 mm - 2 mm

vii)	Distance between stanchions:	
	(a) Body side	+3mm -3mm
	(b) Body end	+1.5 mm - 1.5 mm
viii)	Door opening (vertical or horizontal)	+0 mm -3 mm
ix)	Door length	+5 mm - 0 mm
x)	Door width	+3 mm - 0 mm
xi)	Distance between door centre line to centre line of door hinge	+1.5 mm -1.5 mm
xii)	Coupler height from rail level in case the bogies are fabricated by the wagon builder himself.	+0 mm -5 mm
xiii)	Coupler height from bogie top pivot in case bogies are provided as free supply items.	+0 mm -3 mm

xiv) Tolerances on dimensions of non-pressure tank wagon barrels shall be as under:

a) Length of barrel measured over the centre of the two dished ends	+10mm/-3mm
b) Diameter including ovality	+3mm/-3 mm
c) Inside dia of manhole	+3mm/-3 mm
d) Height of dome	+3mm/-3 mm

NOTE: Butting faces of two courses or a barrel course and dished end should be aligned to + 1 mm accuracy before welding.

F. The other major sub-assemblies fitted to the underframe are as under:

i. Buffer sub assembly

ii. Draw gear/CBC sub assembly
iii. Axle guards and tie rod arrangement
iv. Scroll irons for suspension arrangement
v. Container locking/anchoring arrangement (on container flats only).
vi. Side stanchions & lashing chains.
vii. Door operating mechanism on hopper wagons.
viii. Top centre pivot

G. The underframe is main load bearing member in the vehicle which is not only subjected to static loads but also dynamic impacts owing to the unevenness in the track. In addition to this, it has to successfully withstand heavy buffing impacts during the course of marshalling as well as heavy jerks have to be sustained by the draw gear at the time of starting of goods trains. Hence in order to ensure safe and smooth running of vehicles, the maintenance of underframe has to be done very carefully.

H. It is therefore the duty of all supervisors both in workshops and divisions, to ensure that a thorough inspection of underframe is carried out at the time of POH. Other major repairs and all defects and deficiencies that come to notice must be given meticulous and thorough attention. The defects and deficiencies generally noticed together with recommended repair practices have been discussed in detail in this chapter.

503. BG FOUR WHEELER UNDERFRAME

A) A sketch of BG four-wheeler underframe is given at Fig. 5.2. The underframe consists of two sole bars, two cross bars and two longitudinal, each of channel section. Two crib angles are provided at the sides and two end- angles at the ends. These members are assembled by riveting and strengthened by knees and gusset plates. To complete the rectangle, two head stocks are provided at the ends. Between the head stock and the longitudinal, four diagonal bars are fitted to help in distributing the buffing load to all the members of the underframe equally, thus providing a sturdy structure. These BG underframes are provided with two buffers on each end for absorbing the shocks and these must be maintained in good fettle so that the chances of any underframe member getting damaged are minimized.

B) The life of four wheeler and bogie wagon is 35 years except for tank wagons which is 45 years. The main structure has to serve the full length of a wagon life without much repairs. Since these are attended to generally only when these are damaged/bent whereas other subassemblies like the running gear, brake gear, suspension etc. receive periodical attention. Under service conditions, the wagon has to absorb dynamic shunting impacts and heavy jerks of starting and braking. These shocks are to be primarily absorbed by the buffers and draw gear provided at each end. It is, therefore, essential that buffer sub assemblies and draw gear are within certain minimum and maximum dimensions so that these are maintained in good working order and efficiently perform their primary function of protection of the underframe against the impacts.

C) Despite all precautions, the underframe members, especially the head stock, sole bars and diagonal members do get damaged and are required to be attended either in sick line or in the shops at the time POH.

D) In certain types of stock, there are chronic failures of the main members and action to strengthen these members had to be taken. For instance, the IRS four wheeler wagons were found to have weak headstock and diagonal joints. In order to increase the rigidity of these joints cast steel/ fabricated knees and brackets were developed and are to be provided when these wagons pass through shops at the time of periodical overhaul. The sketch of cast steel knees and brackets of fabricated design to suit ISMC diagonals are given at Fig. 5.3 to 5.6.

504. REPAIR PROCEDURE

A. Inspection of underframe

At the time of POH, the underframe is to be inspected in respect of following points specifically, as the underframe is the most important sub assembly of the wagon which imparts necessary rigidity to the wagon body as a whole.

a) Rivets

All the rivets specifically those of axle guard, scroll irons, head stock and knees joining the main members are checked for looseness. Ensure that these are not broken. All slack/broken rivets are to be replaced by sound ones at the time of POH.

b) **Cracks**

The underframe is also inspected for any cracks. In case of a horizontal crack, it is drilled at both ends and the cracked portion gauged out and welded. In case of vertical cracks, patching strengthens the cracked portion.

B. Alignment

The underframe is inspected for its proper alignment and any deflection of its members either in the form of sagging or buckling should be attended to or rectified. Since the alignment of the underframe has a very important role to play in guiding the wheels to run properly, the alignment is checked at various planes as follows:

a. In the case of Four wheeler wagons, the correct location of the scroll iron is very important for ensuring correct running of the wagon. Certain important datum planes are, therefore, required to be fixed and correct positioning of important fittings like scroll irons, horn cheeks, buffer etc. should be checked. (refer Fig. 5.7 and 5.8)

b. Longitudinal central plane, called the `L' plane is determined with the help of a thin steel wire from the spring scroll iron locations. The lower flanges under sole bars determine horizontal plane, called `H' plane. Perpendicular to the `L' plane, through the middle of the length of the wagon is the `O' plane. Perpendicular parallel planes through the axle centre line may be called `Q1' and `Q2' planes. While inspecting the underframe, the following measurements should be undertaken:-

i. Longitudinal check measurement of the wheel base.

ii. Transverse check measurement for the wheel guidance. B/2 (Distance between the outer surfaces of the horn cheeks from the `L' plane)

iii. Width for the axle box guidance C (distance between inner surfaces of the horn cheeks from the Q1 and Q2 planes).

iv. Longitudinal distance of the scroll irons from the centre line E/2 (distance between the scroll iron eyes from the `Q' plane.

v. Transverse distance of the scroll irons - F/2 (distance of the scroll irons centres from the `L' plane).

vi. Longitudinal distance of the brake block hanger brackets from the centre line-H/2 (distance of the brake block hanger bracket centre from the Q1 and Q2 planes).

vii. Transverse distance of the brake block hanger brackets from the `L' plane.

viii. Transverse distance of buffers-K/2 (distance of the buffer centre is from the `L' plane).

ix. Transverse distance of the spring buckle centres-D.

x. Location of the scroll iron eyes with respect to wagon longitudinal axis and vertical inclination of the scroll eyes with respect to `H' planes.

Figures explaining the various items to be checked as above are given at Fig. 5.12 and 5.13.

c. The above rigorous check is essential for the smooth running of the wagon. The diagonal distance between the axle guard centres is also checked for finding out if the underframe has retained its overall alignment or has become skew. Suitable gauges for the purpose of this check can also be provided to facilitate this work.

505. CLEANING AND DE-RUSTING OF THE UNDERFRAME

The cleaning of the underframe and its fittings can be carried out after the wagon is placed on the trestles. Both the de-rusting and cleaning of underframe and its fittings can be carried out simultaneously. The members of the underframe are de-rusted by scraping and hammering so that it can be checked if any members are by heavily corroded or deformed requiring rectification. Badly bent members, which can not be kept in service, are marked specially for replacement/application of suitable strengthening pieces. In case head stock pressings are badly damaged, these should be preferably replaced. It is also a good practice to keep stock of some spare head stock pressings to expedite the replacement and the damaged ones can then be brought into re-use after repairs in the blacksmith shops.

506. REPAIRS TO HEAD STOCK

i. Slightly bent members or portions of them as the case may be, are heated in position by hack's burner and straightened by means of straightening devices or by applying blows with sledgehammer. For carrying out this repair, the buffer assembly is stripped off and if necessary, the floor plate which is riveted to the head stock is gas cut and rivets punched out to facilitate the proper straightening of the bent portion.

ii. Stripping the heavily bent/damaged members and getting them straightened and aligned in the smith shop repairs headstock, which are excessively damaged/bent, by heating.

iii. All the underframe members are to be inspected as per IRCA Part III.

507. REPAIRS TO DIAGONALS AND CROSS BARS

The repair procedure for these items is also done as per procedure given in para 506.

508. REPAIRS TO SOLE BARS

Sole bars are made from ISMC-250x9.0 web channel of copper bearing mild steel for all bogie wagons except on BOXNCR wagons where the channel is of IRSM-41 corten steel.

Generally, damage to sole bar occurs at locations adjacent to head stock. It is repaired in the following three methods:-

i. Cutting of entire sole bar portion and grafting a new portion prepared out of channel of the same section. Such type of replacement is always supported with double flanged U shaped sole bar patch, not less than 10 mm thick and a back plate is to be also provided.

ii. Cracks at flanges and web are given proper repairs by electric welding as per instructions contained in IRCA Part III rulebook and issued by authorities from time to time. Cracks extending up to webs are duly support with plain or flanged patch as the case may be.

iii. Slightly bent sole bars are, however, repaired by local heating and straightening. If the flanges are only bent, the same are straightened by a jawed crow bar.

iv. The patching has to confirm to IRCA part III rule No. 2.11.3.

v. No patch shall be less than 10mm thick. Every patch shall be riveted to sole bar web and flange.

vi. The outer patch shall cover the full depth of the web and the full width of the crack flange, top or bottom.

vii. The inner patch shall cover the full depth of the channel and shall be of the same length as per the outer patch to the extent possible.

viii. Where inner and outer patches cannot be fitted due to the presence of other fittings on the sole bar, only the outer or inner patch may be fitted. The thickness of the patch plate in such cases shall not be less than 10 mm for metre gauge and 14 mm for broad gauge wagons.

ix. The cracks in mild steel sole bar flange may be repaired by welding.

x. Existing rivet holes shall be utilised for patch rivets.

xi. Additional rivets shall be of diameter not less than 16 mm at a pitch of not more than 90 mm.

xii. The length of the sole bar patch plate should not be less than 508 mm.

xiii. Experience shows that on BG, the underframe of open wagon gets damaged more often than covered wagon because heavier loads are generally carried in open wagons. This also leads to higher incidence of damage during shunting in case of uneven loading or when the consignment is not secured properly inside the wagon.

xiv. A sketch of a typical straightening device used for repairs of headstock is given at Fig. 5.10.

xv. Generally pitting/ corrosion on sole bar occur at door ways on open wagons. The provision of protection plates to sole bars at these locations as may be seen at Fig. 5.20. In this sketch, 3.15mm thick copper bearing mild steel protection sheet is to be welded around the web below the door opening area if the thickness of the web has not been reduced by more than 2mm where as by 5mm copper bearing mild steel plate if the reduction in the web thickness is more than 2mm but less than 5mm. As the web thickness of the sole bar of ISMC 250x82 is 9mm, it concludes that any sole bar web found to be less than 4mm should be replaced.

509. REPAIRS TO FLOOR PLATE

The underframe also derives strength from the floor plates, which are generally of 5-mm/6mm thickness. These floor plates are generally riveted/welded to the underframe members, thus providing additional strength to the underframe. As this method is very time consuming, most of the workshops are now resorting to the welding of floor plates as an alternative. This is now an approved practice and RDSO has issued standard sketches for various types of wagons showing how this is to be done.

i. In cattle wagons, wooden flooring is provided. Refer to IRCA Part III rule 2.11.14 for details.

ii. GMR wagons have also been provided with chequered steel flooring with a view to conserve wood and also to overcome the high incidence of pilferage of floor boards. Plain steel plates with strips welded across the width alongwith a coating of paint leitumastic have also been used by certain railways in the place of steel chequered plates whenever these are not available.

510. UNDERFRAME OF BRAKE VAN

It has been observed that underframe of brake vans have a tendency to buckle in service.

One method of straightening of the drooping ends is to hold the main members in a fixed position by means of screw couplings anchored against a fixed structure and then raising the ends by means of screw jacks. No heating is required in this case and as such damages to the underframe steel structure which may occur as a result of heating are also avoided.

511. BOGIE WAGON UNDERFRAME

Figures of the BG bogie underframe are given at Fig. 5.11 to 5.13. The main members of the bogie wagon underframe are as under:

- Sole bar
- Head stock
- Centre sill
- Cross bars
- Bolster
- End longitude
- Buffing strut

a. The underframe is built up of suitable rolled and pressed steel sections welded together. In earlier design underframe members were riveted construction by providing gussets, knees etc. It is a general practice to provide a positive camber in the underframe to obviate any chances of sagging after loading in service. This is necessary since the underframe of a bogie wagon is considerably longer than that of four wheeler.

b. In bogie wagons also, the general damage to the headstock is of the same type as in the case of 4 wheeler wagons. However, some of these underframes are susceptible to development of cracks at side bearer location on the underframe bolster bottom flange. The repair procedure for this defect is given in RDSO technical pamphlets WM-74002 and 74003.

c. The other defects noticed on the bogie underframe are of a similar nature as those which occur in the four wheeler underframe and the general repairs are on the same lines as described in detail in the case of four wheeler underframe.

d. On the BG bogie wagons, pressings of the head stock get damaged and at the time of POH they are invariably required to be stripped, straightened and refitted, for proper head stock alignment. In case head stock pressings are badly damaged, these should be replaced. It is also a good practice to keep stock of some spare head stock pressings to reduce the cycle time and the damaged ones can then be brought into reuse after repairs in the blacksmith shop.

e. In case of bogie goods stock i.e. BOX and BCX wagons, the underframe were showing signs of weakness at the head stock and diagonal joints. The codal life of BOX wagons reduced from 35 years to 30 years. These joints originally supported by a simple bent plate knee welded to both head stock and diagonal. As these joints were failing in service, strengthening arrangements as shown in RDSO Drg.No.SK-71539 were provided. The bent plate knee had been replaced by a cast steel one of riveted construction. Wagons, with both head stock and diagonal damaged, are provided with cast steel knee to Drg.No.SK-1570.

f. In the latest design of bogie goods stock like BOXN, BCNA etc. not much signs of weakness at head stock, bolsters and sole bar have been noticed due to robust design. However, in case of any damage repair should be done as detailed in para 506 to 507.

g. Centre sills, of bogie wagons, are generally fabricated with rolled Z-Section. In service, centre sills are not damaged. However, some times due to accident or over loading, centre sills may get damaged. Such center sills should be repaired as per RDSO Drg.No.WD-99031-S-1.

h. The BFRs were primarily designed for loading of rails. However in actual practice, other commodities are also loaded in these wagons. Particularly where heavy machinery items like steel coils are loaded on these wagons and due care is not exercised in lowering these on the BFR, heavy impact of the load can cause damage to the underframe of the BFR with the result that these sag in the middle. Sometimes, these sag only one side, the repair of these underframe posses serious difficulties. If the underframe sags uniformly on both sides, the ends are anchored and the middle portion is raised by the application of screw jacks to make straight. In case of BRN wagons, the problem of breakage/detachment of fixed ends/ headstock and sagging of sole bar/centre girder was noticed within first POH period. RDSO vide letter no.MW/BRN Dt. 7.1.99 asked Railways to modify the wagon to arrest such failures. These modifications are shown in RDSO Drg.No.WD-95010-S-1,S-2 and S-3.

512. MG FOUR WHEELER WAGON UNDERFRAME

a. A diagram of four-wheeler, IRS underframe is given at Fig. No. 5.14. Unlike BG underframe, a MG underframe has two end longitudes and only one longitudinal member in the centre and no diagonal bars. The headstock is designed to take a centre buffer coupler which combines both the function of buffing and draw gear. Since the buffing load is to be taken by the central portion of the head stock, this portion generally gets bent and is required to be attended in the workshops at the time of POH or in the sick lines when found damaged. The straightening of the bent portion is carried out by the help of device shown in figure No. 5.10.. In the case of excessive bend, the bent portion is heated either by a Huck burner or by some other media before being pulled out with the help of this device. The damage to the head stock also generally results in the cracking of the box pressing which has to be welded before refitting the buffer assembly i.e. before the outer and inner buffer castings are refitted.

b. In the case of presence of cracks in the Headstock, these should be patched in accordance with IRCA Part III . However, in the case of cracks on the wings, welding is permissible and no patching is necessary. If the box channel is completely cracked, it required to be renewed.

c. The damage to the head stock also results in the cracks in the outer buffer casing at the root of the housing for the outer buffer spring. If the crack is not extensive enough to practically separate this portion from the main body of the buffer casing, it can be repaired by electric welding. These buffer casings also get bent when the head stock is bent and have therefore to be straightened by heating before re-assembly.

d. The other member of the underframe, which gets damaged/cracked, is the sole bar but unlike a BG four wheeler wagon, the damaged generally occurs in the vicinity of the scroll iron in the shape of cracks. This portion should be patched in terms of IRCA Part III as shown in Fig. No. 5.9.

e. In case of BG as well as MG four wheeler underframe, the dimensions shown in Fig. 5.1 are very important in order to ensure the squareness of the underframe. Whenever the underframe is damaged or there is any doubt about the squareness of the same, it should be checked in accordance with the Fig. 5.1. Any deviation in the dimensions beyond specified tolerances should be rectified.

513. MG BOGIE WAGON UNDERFRAME

A. Diagrams of MG bogie wagon underframe are given at Fig. 5.15 and 5.16. The main load bearing members in this are the longitudinal, which are of built up girder construction. The longitudinal are fabricated by using angles and plates of the required shape to permit fitting of the bogie. The conventional underframe is of riveted construction whereas in the latest stock, welding is used increasingly for fabricating underframe members. On the longitudinal, cantilever boxes are fitted to provide a base for the body and the floor. The ends of these cantilevers on the side are linked by sole angles and are riveted or welded. At the point of predetermined wheel-base, the top plate is riveted to the gusset plate supported by two transverse pressings.

In the case of a bogie wagon, the underframe directly provides for the fitting of buffing and draw gear and AVB cylinders and other items like brake rigging are provided on the bogie frame. The bogie wagon underframe on the MG have peculiar problems of their own in certain type of stock. These are discussed below in detail.

B. MBTPX (IRS underframe)

The underframe of MBTPX type of wagons suffers distortion at the ends, as these were not able to withstand heavy shunting impacts in service. In the case of these underframe, the two longitudinal constitute the main load bearing members and only angle sole bars have been provided at the two outer ends to complete the underframe alongwith the head stock. The barrels mounted on cradles are fitted near the pivot locations. The ends of these underframes have a tendency to droop. To avoid this strengthening arrangements as shown in RDSO' Fig.No.64626 and 64627 have been made.

As mentioned above, details of the modifications for strengthening these underframe are depicted in the Fig. 5.17 and 5.18. The procedure of straightening of the underframe is briefly given below:-

C. The modification envisages strengthening of the ends by following major alterations:-

a) The longitudinal is provided with a 10mm stiffening plate at the back covering the full width as a stiffener.

b) The sole angles are made into channel section by riveting another angle in an inverted portion.

As per existing practice, the longitudinal are oxy-cut from a point beyond the cradle. The cantilevers centre boxes and headstock are straightened and de-stressed. They are reassembled with 10mm plate as stiffener to the longitudinal and an angle is riveted in inverted position to the sole angle to form a channel section. The point where the longitudinal is oxy cut, is patched as per IRCA Part III (2000) . In this process, the centre box and the cantilevers also need modification so that they can fit the reduced dimensions between the two longitudinal.

In case the longitudinal are very badly damaged or cracked, the same are replaced with a new section.

Since the entire portion of underframe beyond location of pivots is required to be strengthened and has to be detached for this purpose, it is advisable to keep a few subassemblies for the underframe ends ready with a view to reduce the cycle time for execution of this modification. The detached portions of the underframe can also be subsequently put into reuse after strengthening and carrying out alterations, thus reducing the number of additional subassemblies required for the purpose.

D. MBTPZ wagons

These underframe have longitudinal of built up channel sections which are enlarged at the ends to accommodate centre buffer coupler and buffer casing. The sole bars unlike MBTPX underframe consist of channel section. These underframe have also developed typical defects which are discussed below:-

a. The built up section of the longitudinal has shown failure of welds and if these are not attended to in time, the weld failures leads to development of cracks in the body of the longitudinal.

b. The enhanced buffer casing has been provided to take additional buffing load by means of a robust coil spring which is housed between two steel blocks. A higher section of draw bar has also been provided. It has been noticed that higher section draw bars are sometimes replaced by standards IRS draw bars, thereby resulting in damages to the casing since the clearance between the buffer head lip and the enhanced casing is reduced.

c. The repair procedure for underframe defects is given below:

   i. Lift wagon and run out bogie
   ii. Drill arrester hole as shown in Fig. 5.19.1
   iii. Gouge crack to U or V groove (included angle for V groove should be 60 Deg.-70Deg.) up to arrested hole.
   iv. If gusset plate butt weld is cracked/defective, gouge weld to expose sound metal and re weld. Weld reinforcement should not exceed 1/16".
   v. Fill arrester hole and weld crack. Weld reinforcement should not exceed 1/16".
   vi. Grind all welds flush with parent metal.
   vii. Apply reinforcement plate (Fig. 5.19.2) ensuring close fitting and tack weld in position, do complete welding all round as shown in Fig. 5.19.1.

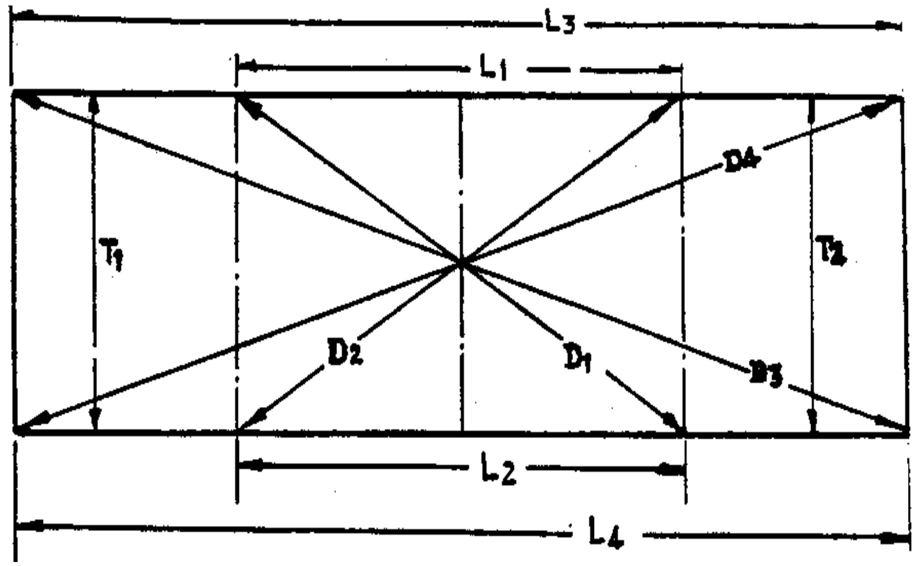
Note - The above repair procedure should be followed if length of crack in the channel web is within 3". If length of cracks exceeds 3", crack should be first repaired by welding as per procedure given in para 13.4.3 above and then an outer patch applied as shown in Fig. 5.19.3.

514. LIST OF MODIFICATIONS

i. Provision of side bracket with link on BRH/BRN wagons to facilitate securing of steel plant consignments to wagon body vide letter No. MW/ACT/BG dated 27.5.94.

ii. Provision of stiffener angle on axle guard of BVZC brake van vide letter No. MW/CWSC/SECRETARIAT dated 23.11.93 & 28.2.94.

iii. Strengthening of BRN wagon underframe vide letter No. MW/BRN dated 7.1.99.



The permitted manufacturing tolerances in the above measurement on new underframe of four-wheeler stock are given below:-

1. The difference between dimension L1 and L2, longitudinal axle guard centre should not exceed 3 mm. The tolerance permitted in the length L3 and L4 is 3.0 mm and –1.5 mm.
2. The difference between dimension T1 and T2, transverse axle guard centre, should not exceed 1.6 mm.
3. The difference between dimension D1 and D2 diagonals of axle guard centres should not exceed 1.5 mm. The difference in the diagonals of the underframe, D3 and D4 should be within 2.5 mm.

FIG. 5.1 DIMENSIONAL CHECKS ON UNDERFRAME

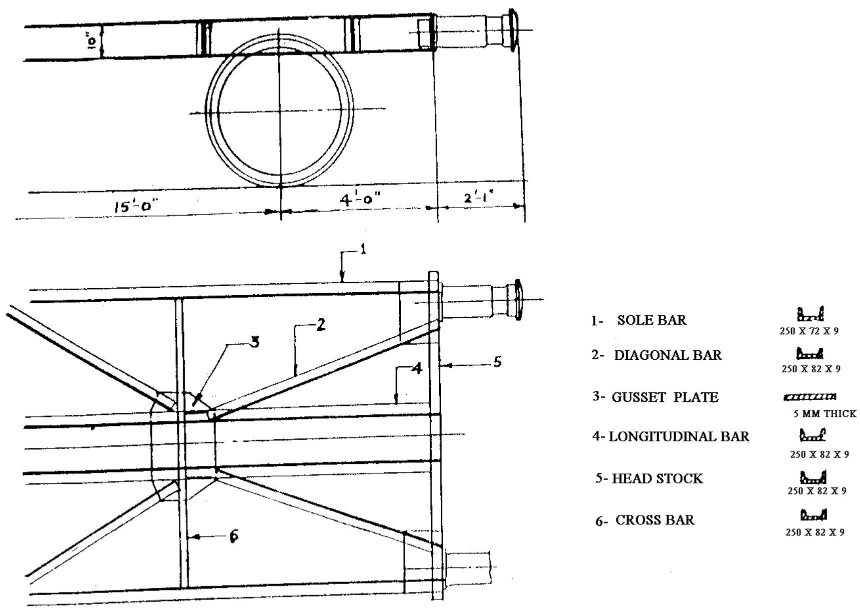
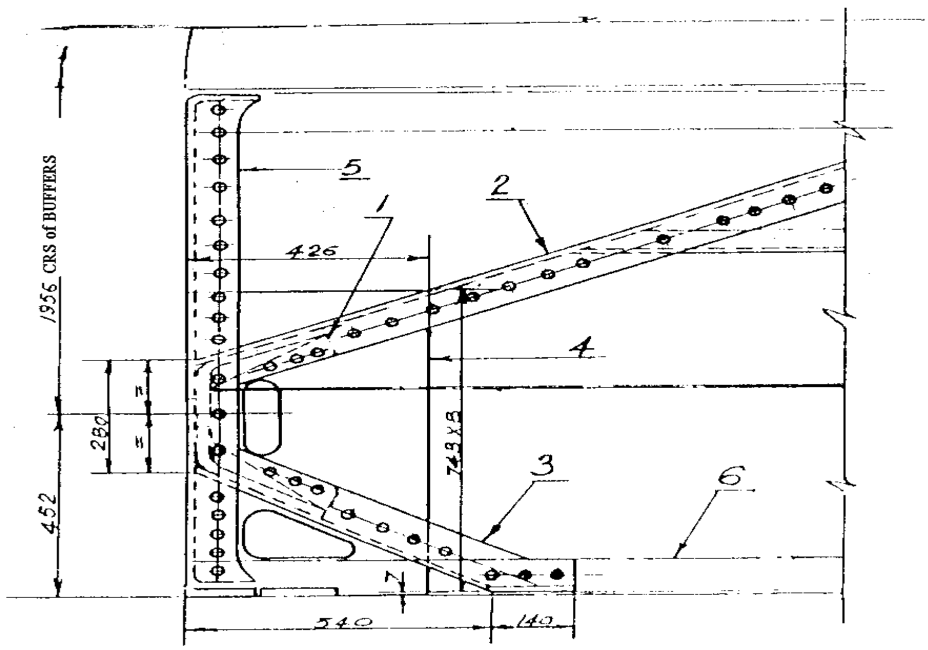


FIG 5.2 TYPICAL FOURWHEELER UNDERFRAME



1 CAST STEEL KNEE
2 DIAGONAL PRESSING (LONG)
3 DIAGONAL PRESSING (SHORT)
4 BOTTOM GUSSET
5 HEAD STOCK PRESSING
6 SOLE BAR

FIG 5.3 MODIFICATION TO HEAD STOCK DIAGONAL & KNEE JOINT
(FOR BOGIE OPEN WAGON TYPE BOX MK)

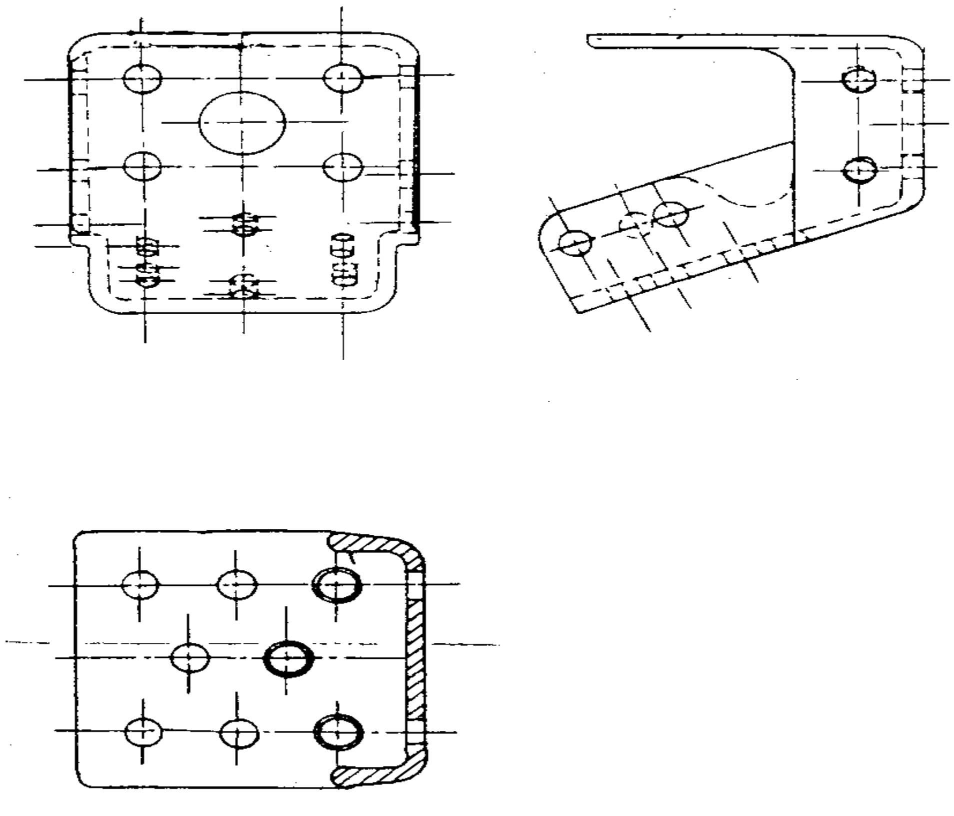


FIG 5.4 CAST STEEL BRACKET
(FOR GOODS BRAKE VAN TYPE BVGT)

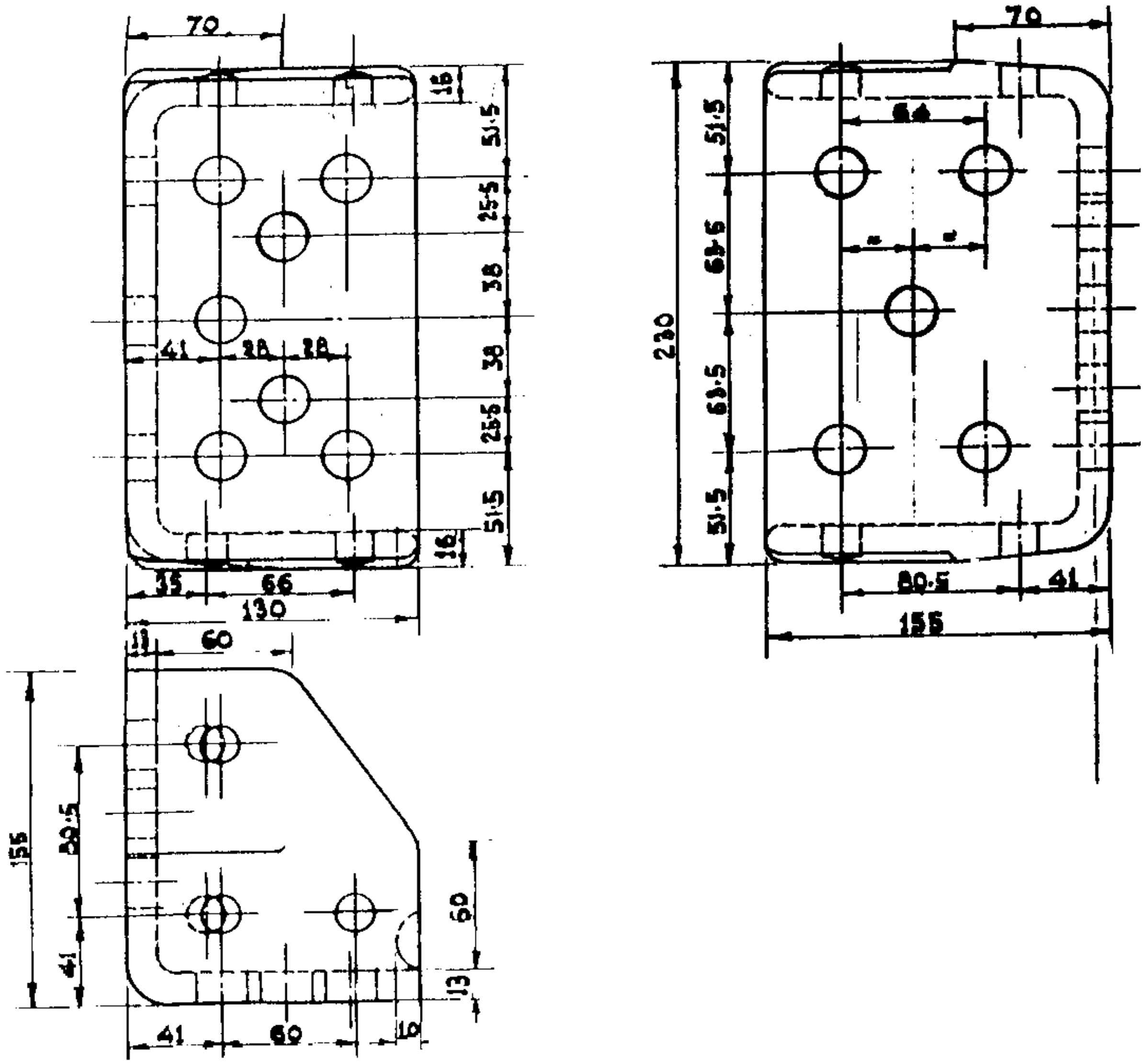


FIG 5.5
CAST STEEL KNEE FOR FOUR WHEELER BG WAGON TYPE "BVGT"

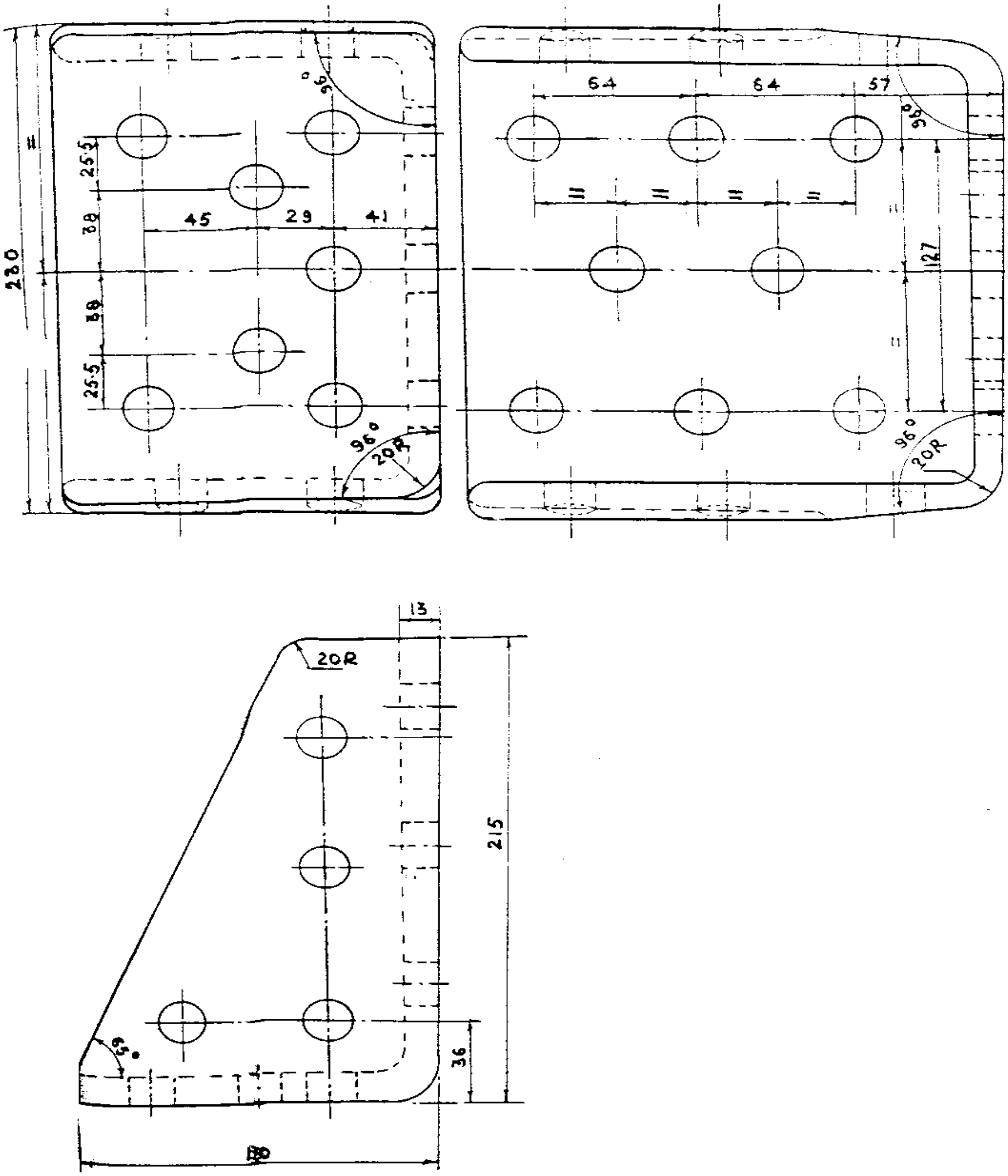


FIG 5.6
CAST STEEL KNEE FOR FOUR WHEELER WAGON

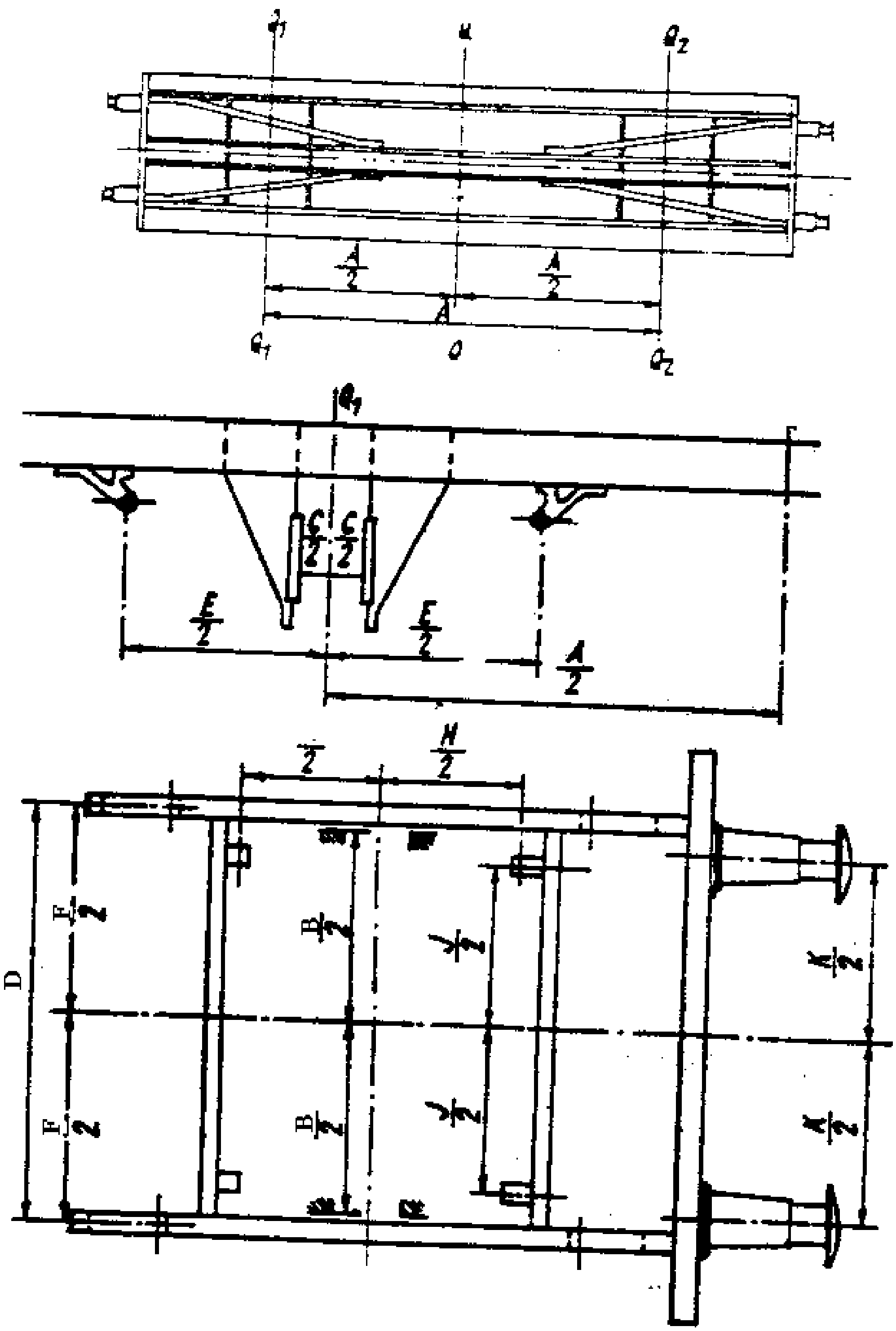


FIG 5.7
POSITIONING OF SCROLL IRON, HORN CHEEK AND BUFFERS

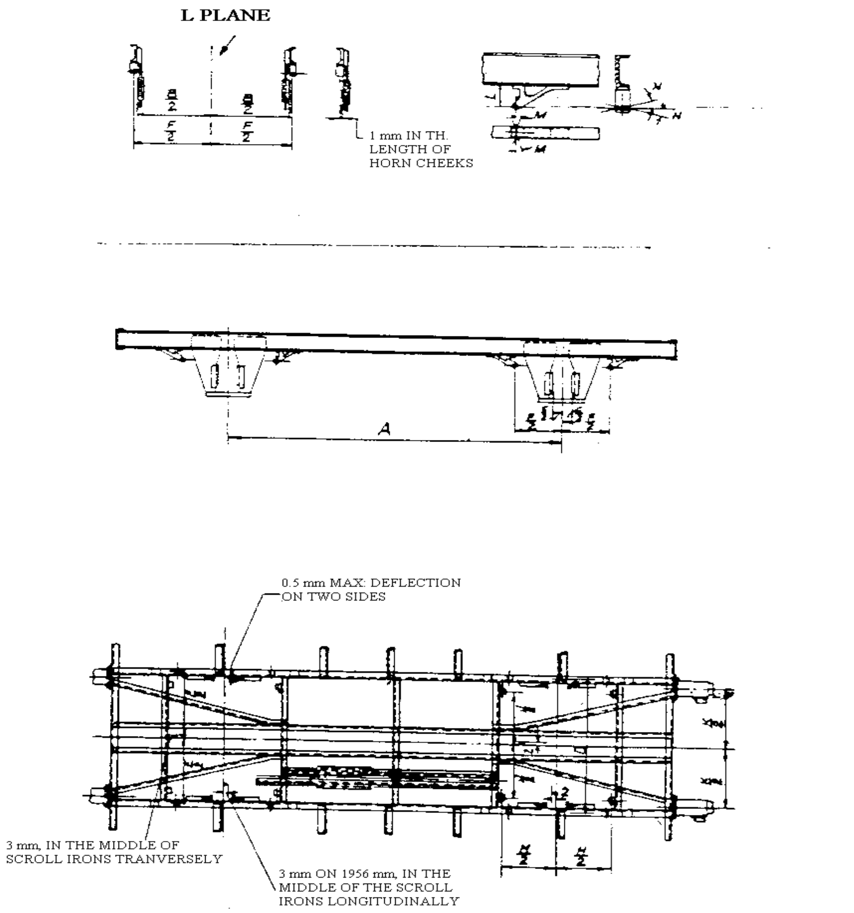


FIG 5.8

POSITIONING OF SCROLL IRONS, HORN CHEEKS, BUFFERS etc. ON A FOUR WHEELER WAGON

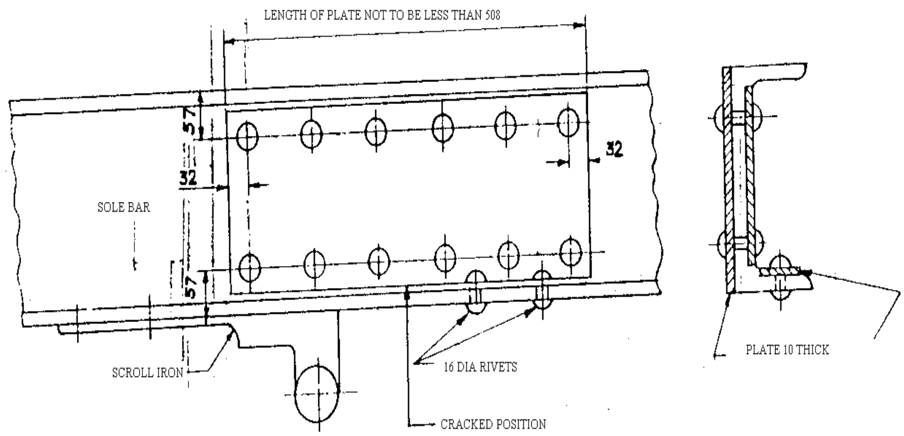


FIG 5.9
PATCHING OF SOLE BAR

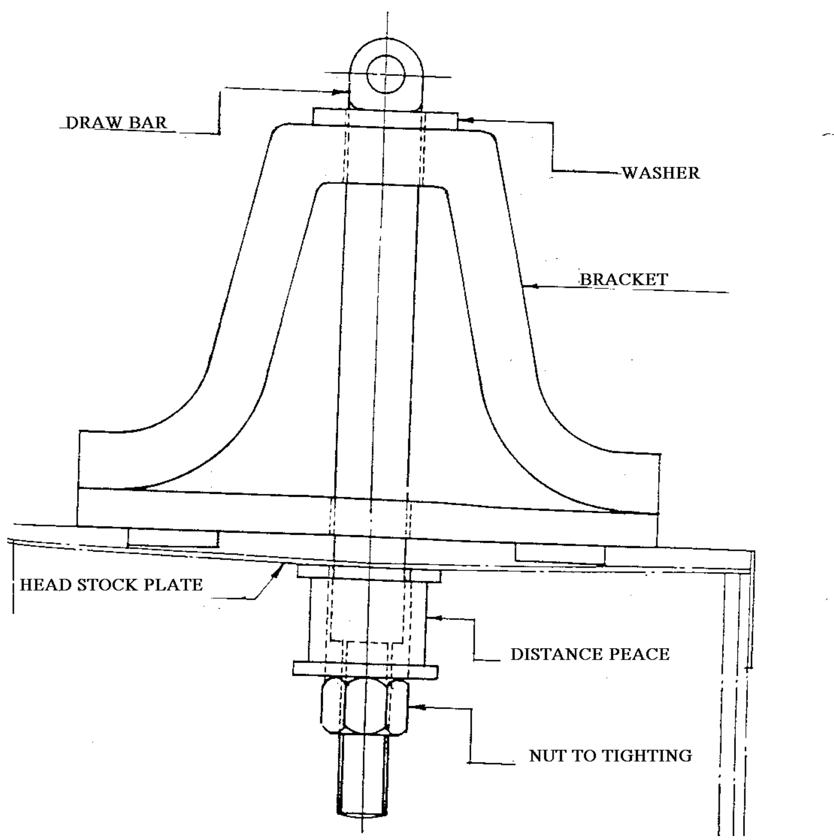


FIG 5.10
HEAD STOCK STRAIGHTENING DEVICE

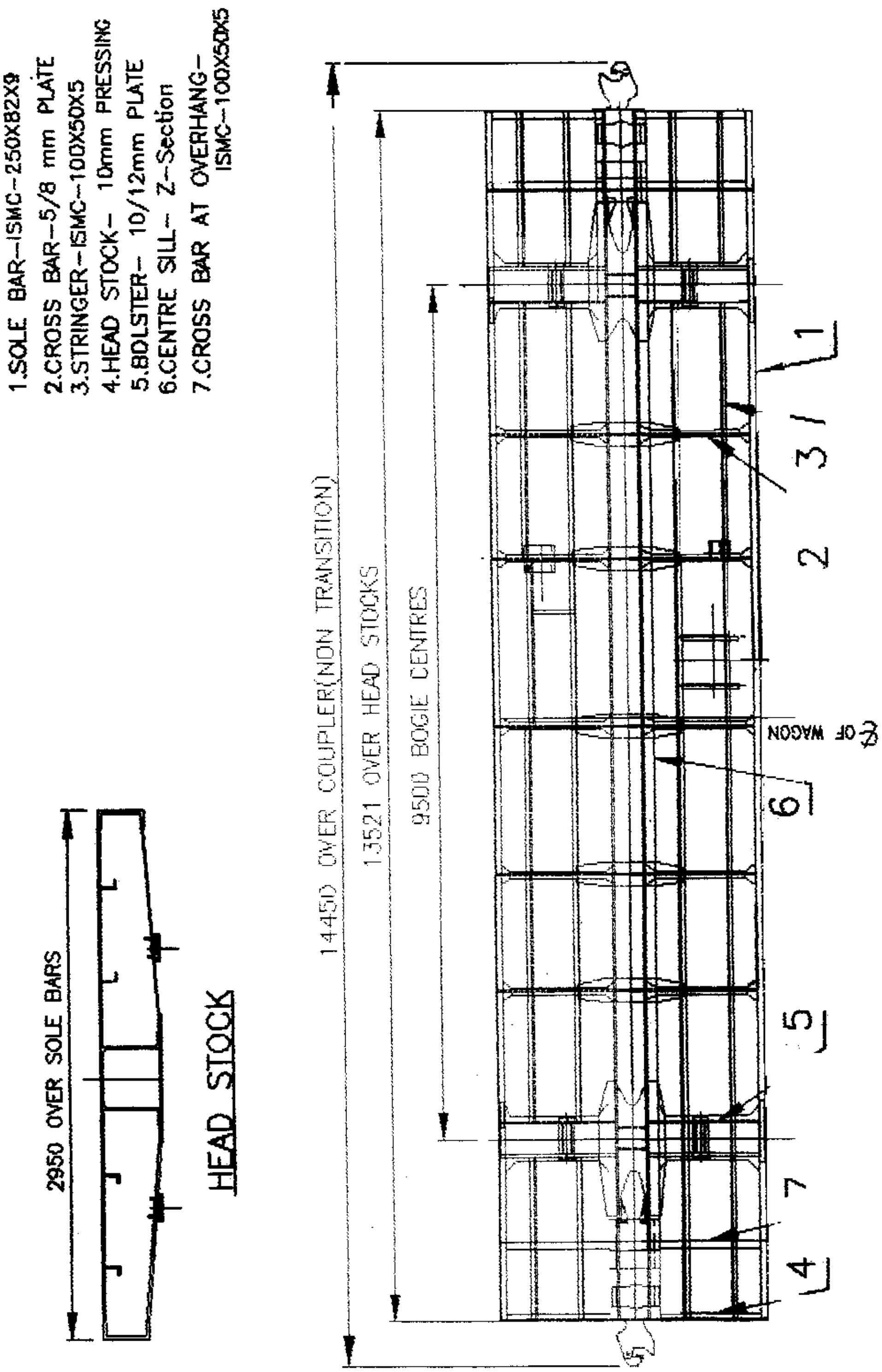


FIG 5.11
BG WAGON TYPE "BCNA"

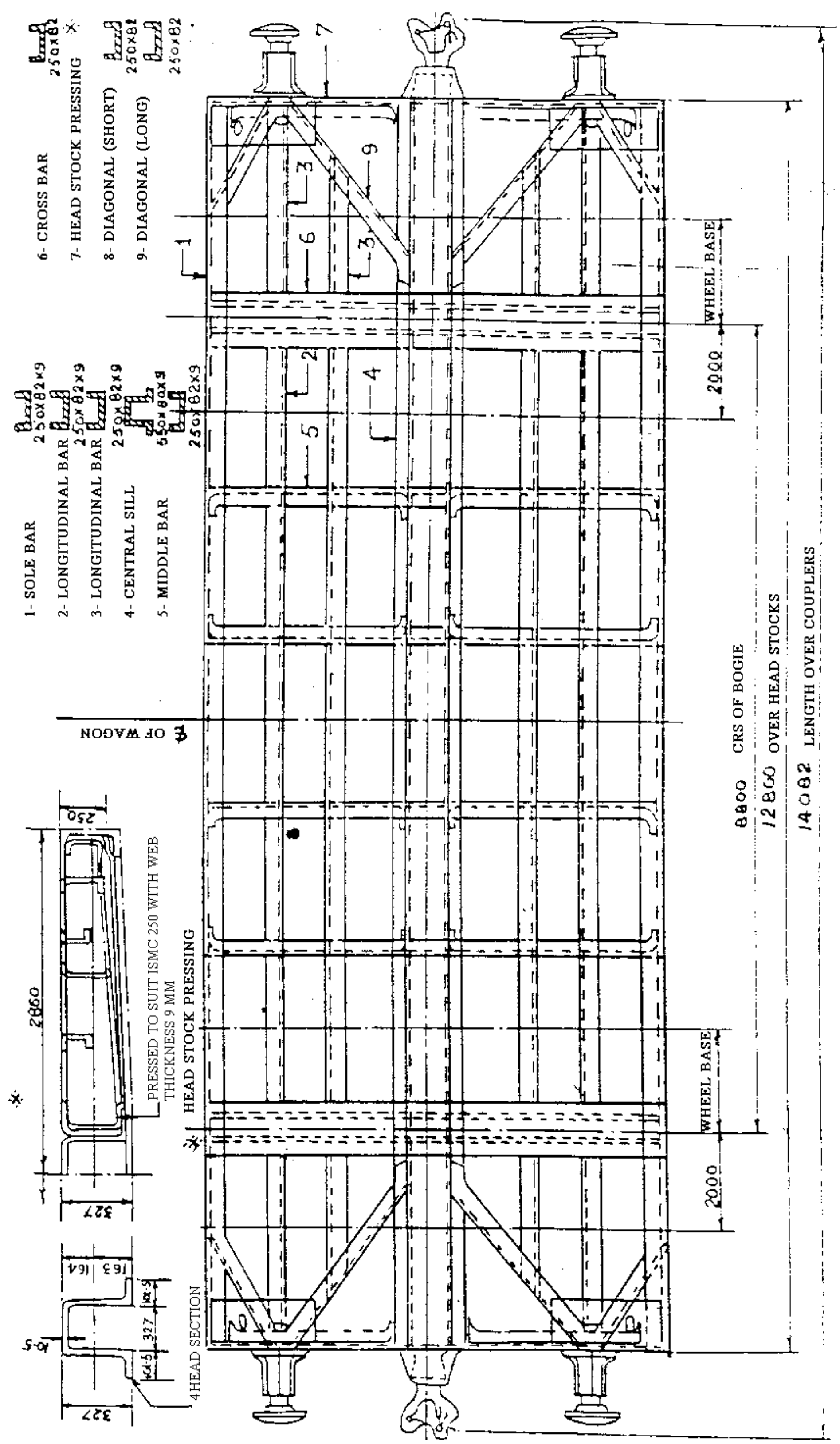


FIG 5.12

UNDERFRAME FOR BOGIE OPEN WAGON (TYPE BOX)

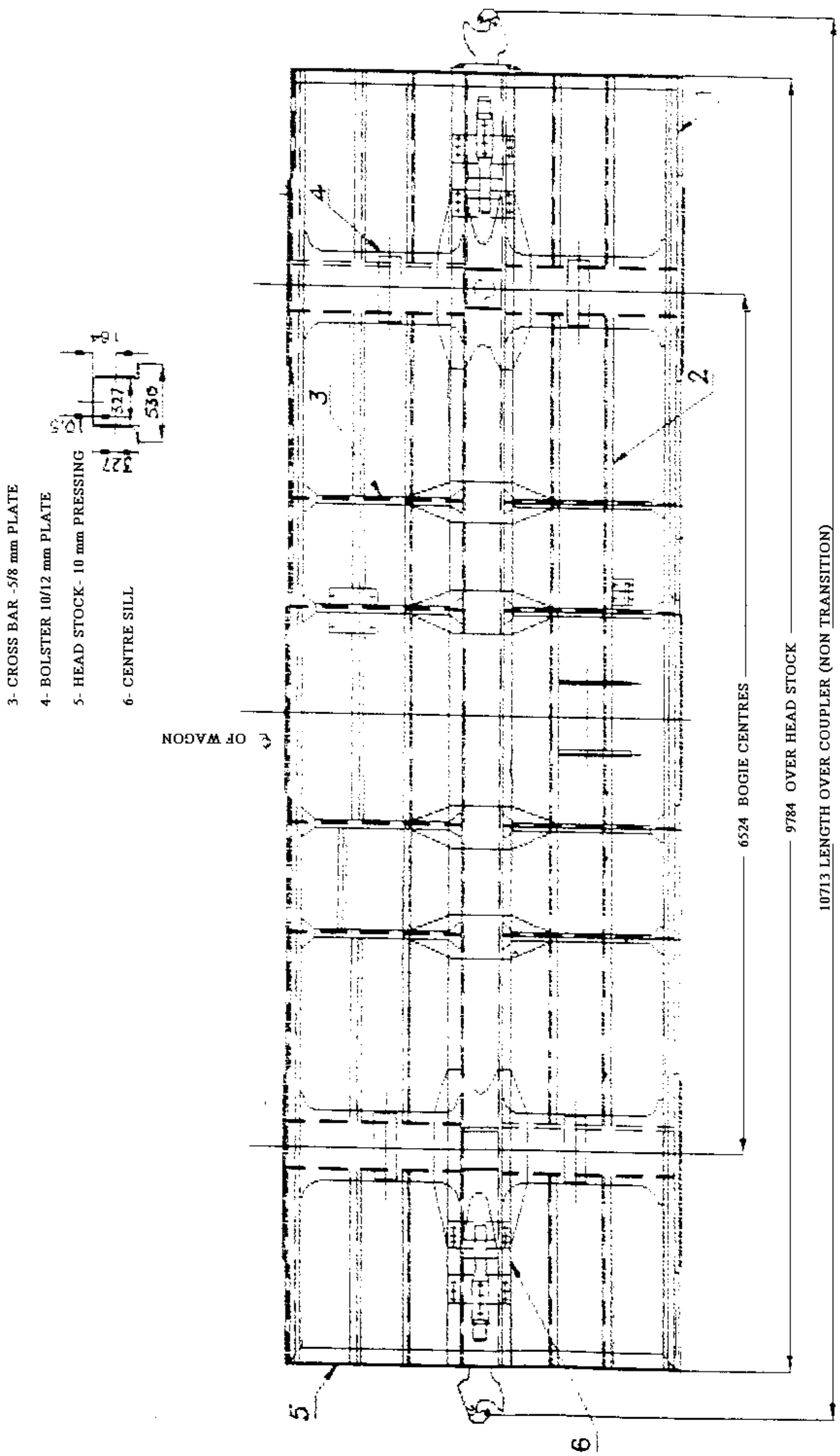


FIG 5.13
UNDERFRAME OF BOGIE OPEN WAGON
(TYPE BOXN)

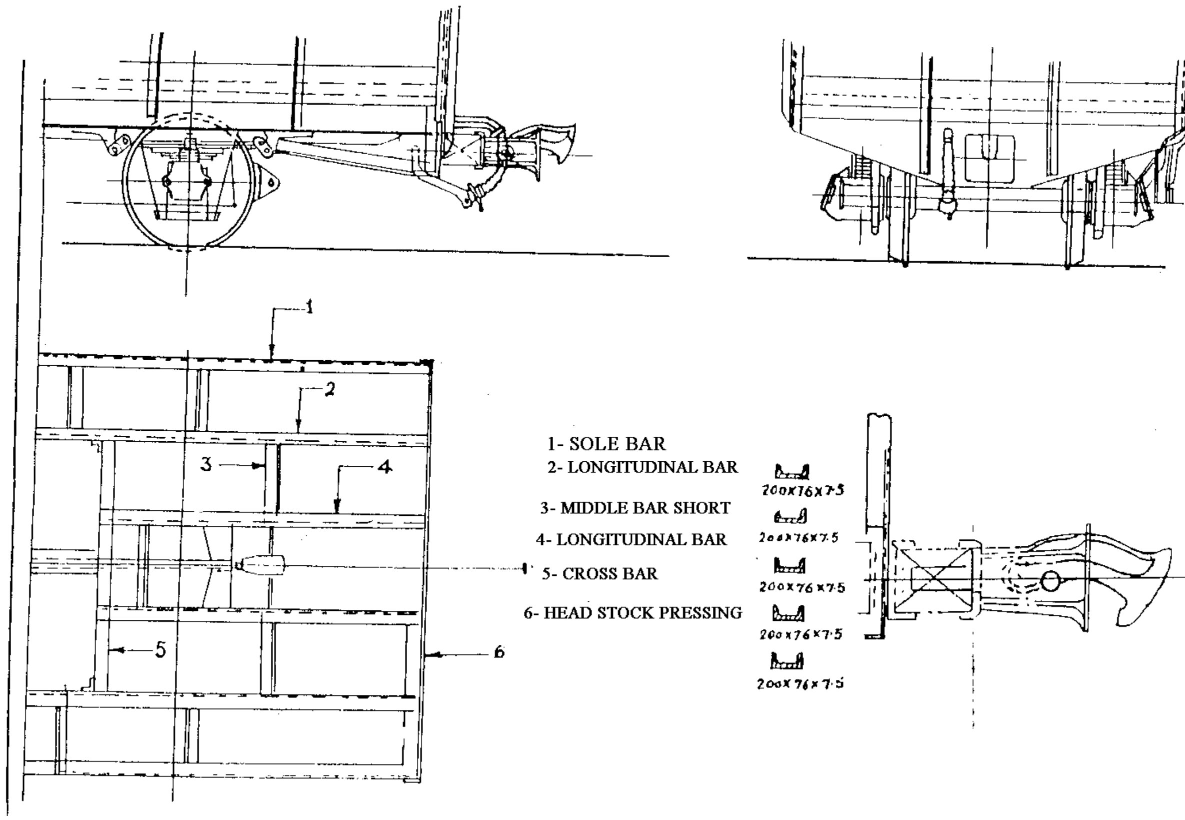


FIG 5.14
IRS COVERED WAGON UNDERFRAME
(MG FOUR WHEELER)

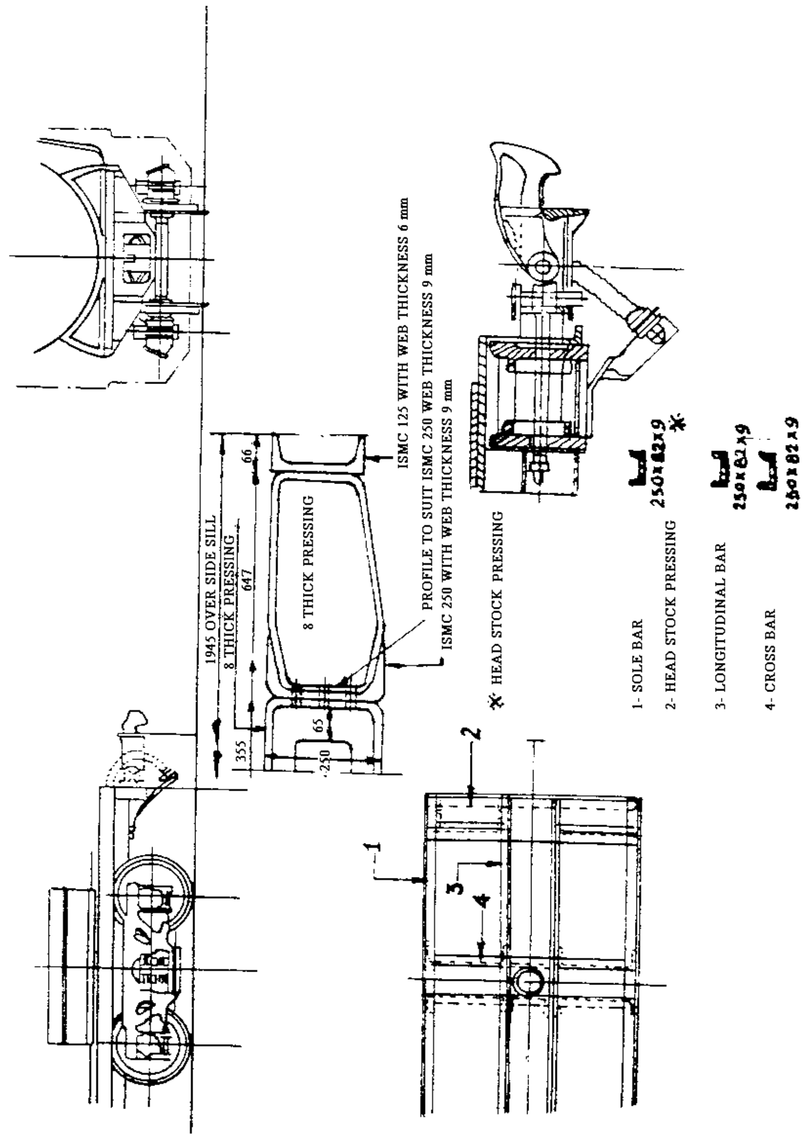


FIG 5.15
UNDERFRAME BOGIE WAGON
(TYPE MBTPX)

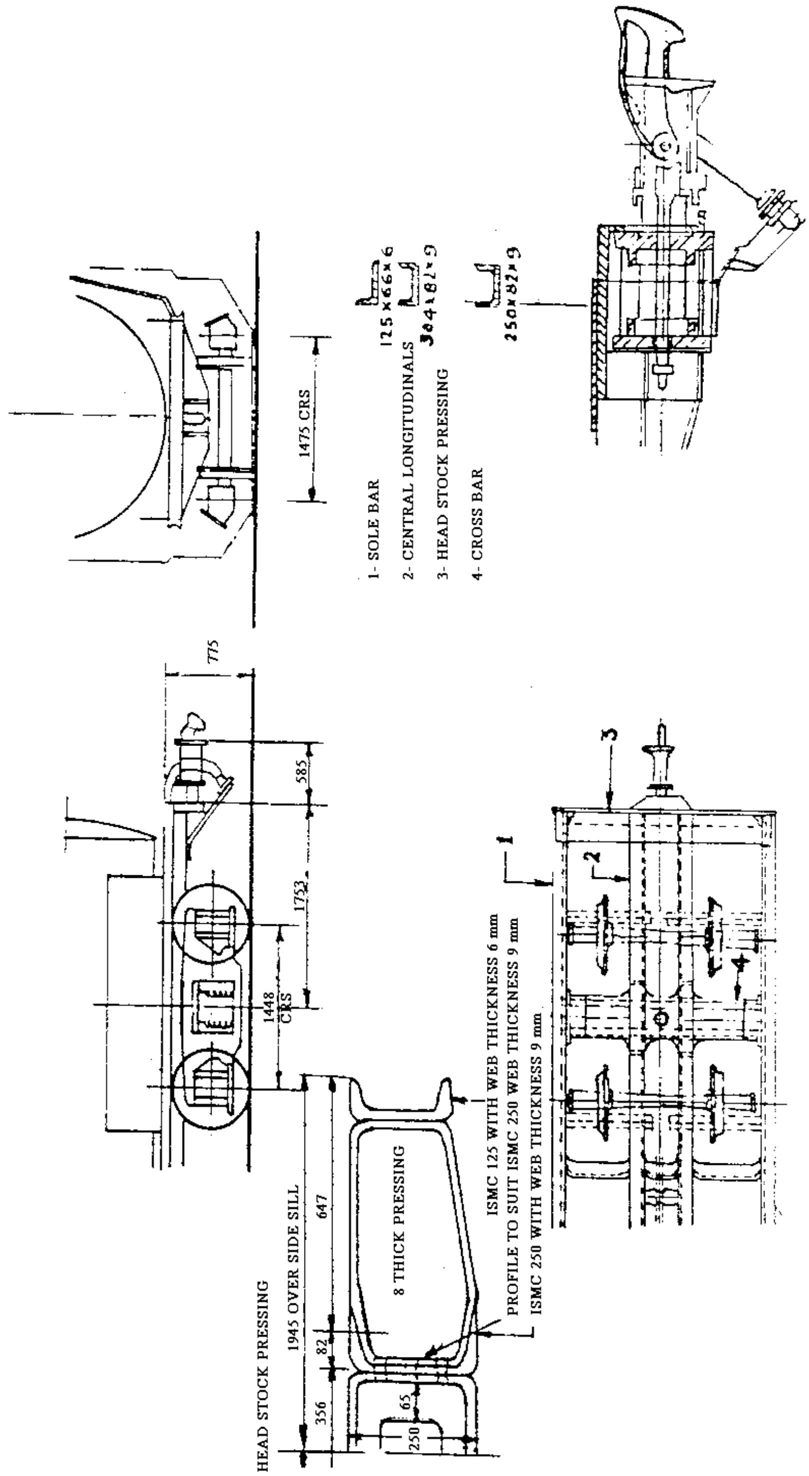


FIG 5.16

IRS EIGHT WHEELER UNDERFRAME
MBTPZ TANK WAGON

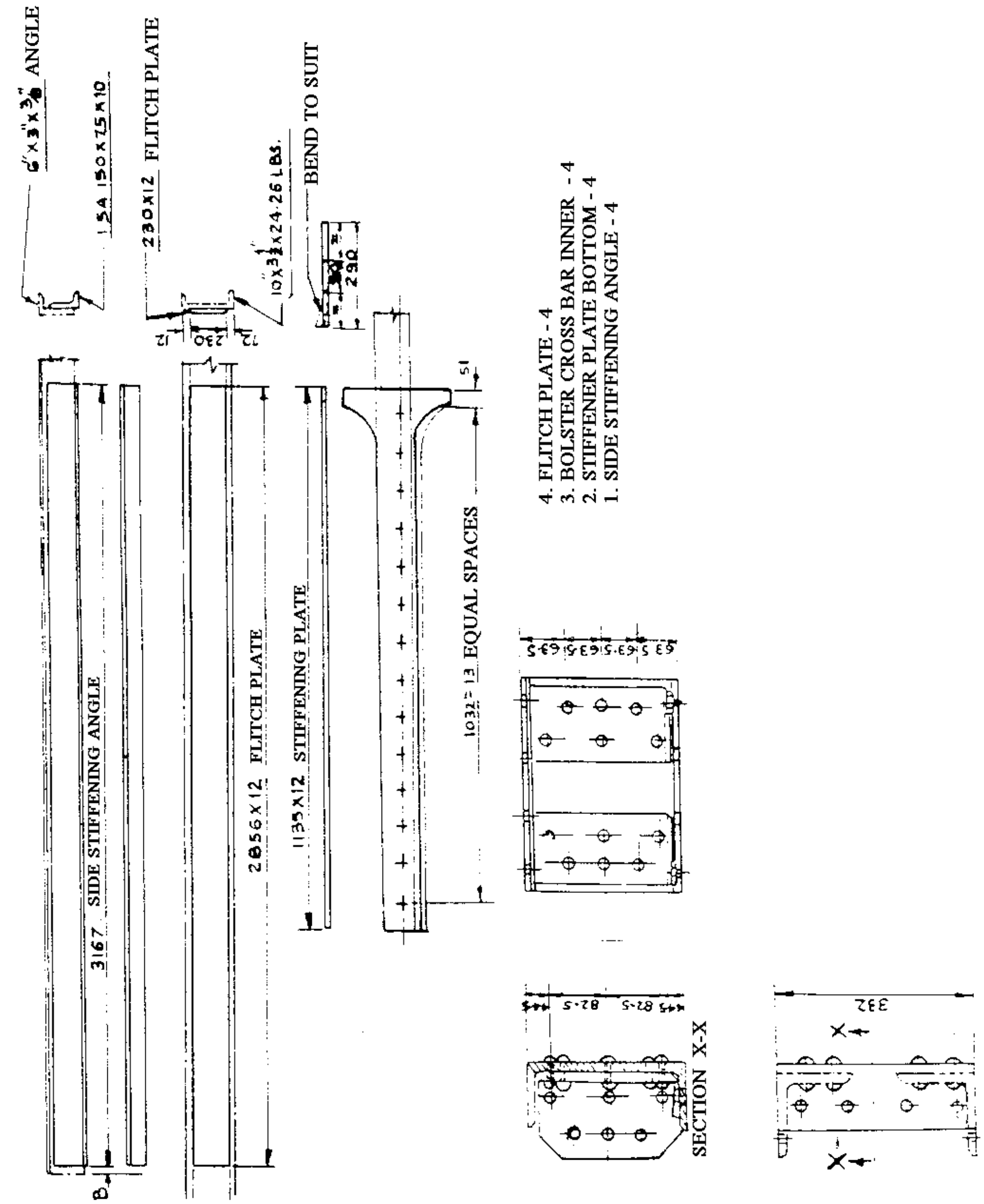


FIG 5.17

DETAILS OF STIFFENING OF UNDERFRAME IN EXISTING "MBTPX" WAGON

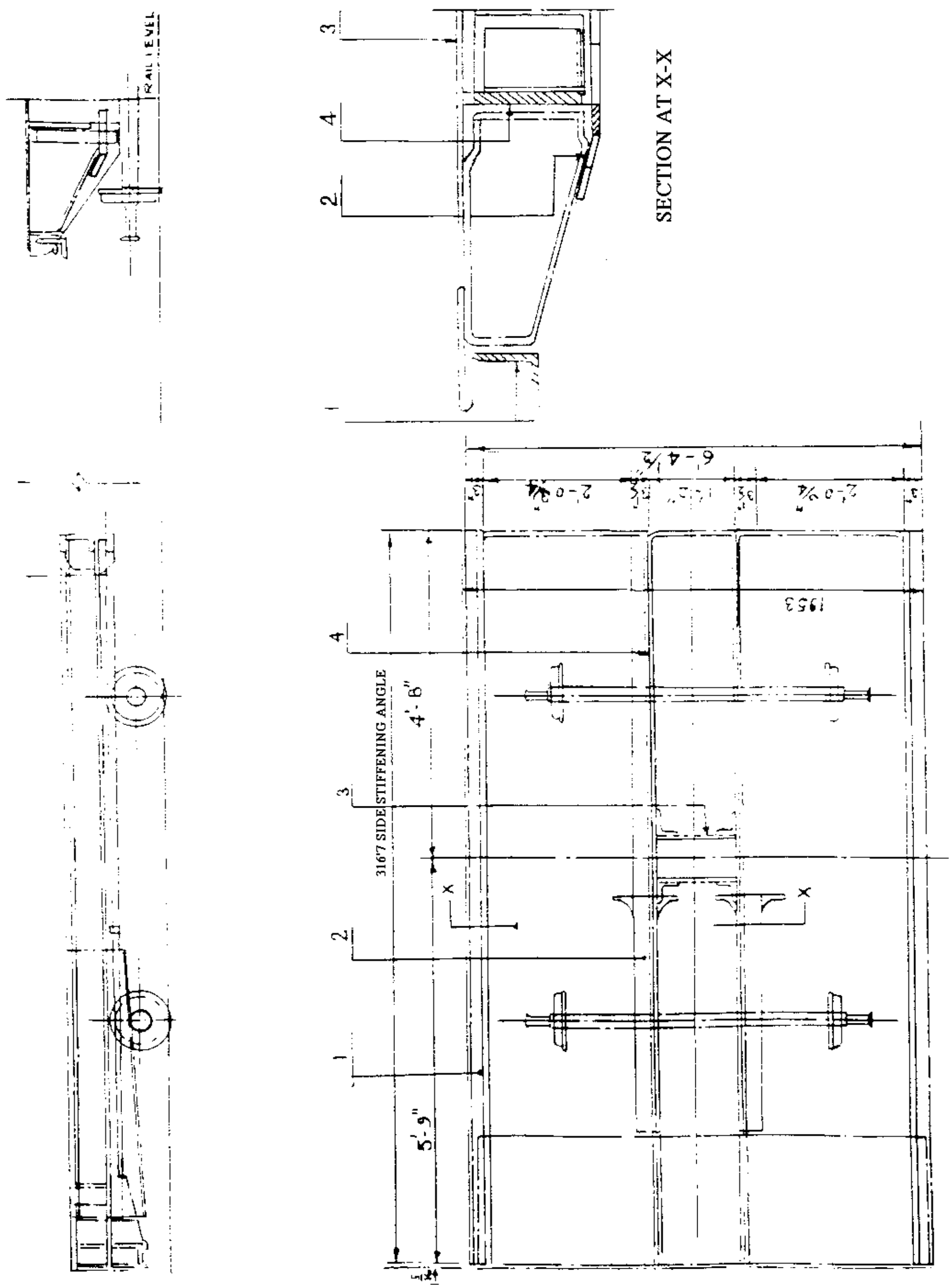


FIG 5.18
ARRANGEMENT OF STIFFENING OF UNDERFRAME IN EXISTING "MBTPX" WAGON

REPAIR PROCEDURE FOR CRACK IN LONGITUDINAL CHANNEL WEB

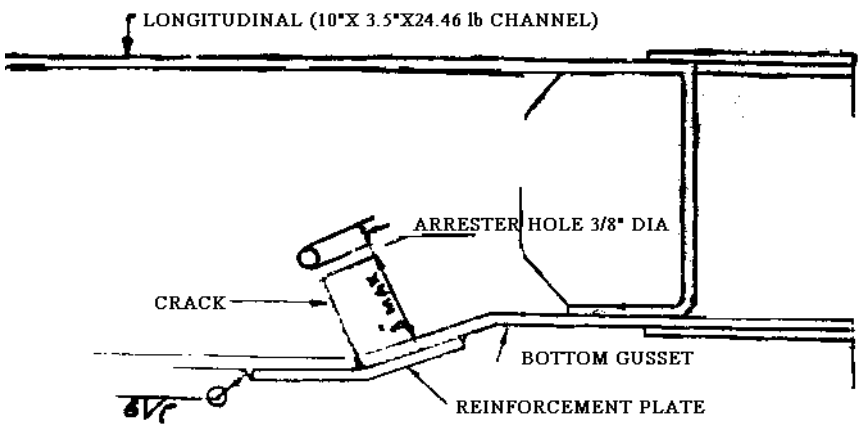


FIG. 5.19.1

CRACK IN LONGITUDINAL CHANNEL WEB AT WELDED JOINT OF BOTTOM GUSSET PLATE

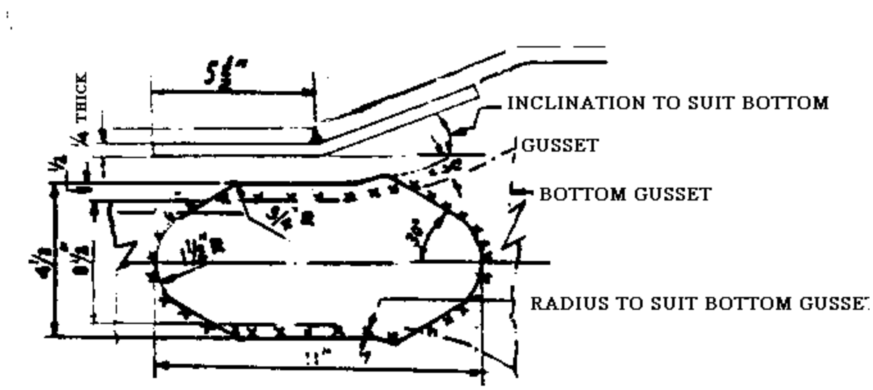
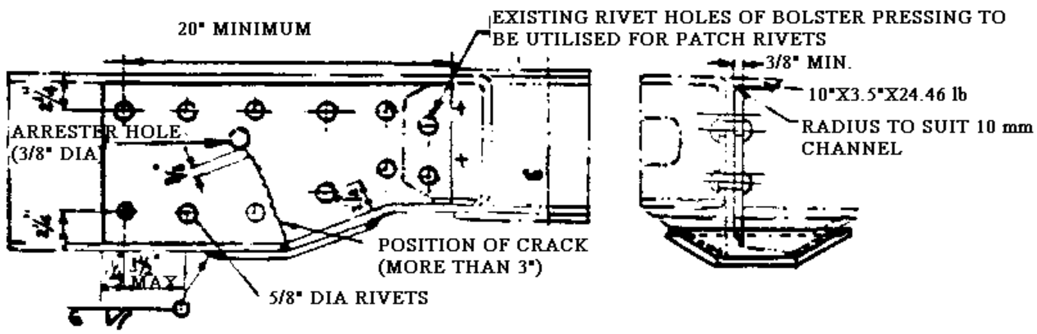


FIG. 5.19.2

REIN FORCEMENT PLATE

REPAIR PROCEDURE FOR CRACK IN LONGITUDINAL CHANNEL WEB



REPAIR PROCEDURE

1. Lift wagon and run out bogie
2. Drill arrester hole as shown in fig 19.1
3. Gouge crack to “U” or “V” groove(included angle for “V” groove should be 60^0 –70^0) up to arrester hole
4. If gusset plate butt weld is cracked or defective, gouge weld to expose sound metal and reweld. Weld reinforcement not to exceed 1/16”.

FIG 5.19.3 PATCHING OF LONGITUDINAL

515. REPAIR AND MAINTENANCE IN SICKLINE & ROH DEPOT

Thorough inspection of underframe is to be carried out. Major repairs as well as all defects and deficiencies that come to the notice must be given meticulous and thorough attention. The following work is to be carried out:

- Buffer sub assemblies and draw gear should be within prescribed minimum and maximum dimensions
- Ensure that the buffers are not dead i.e. the springs have not become ineffective otherwise all the buffing load will have to be directly taken by the underframe members leading to extensive damage.
- Head stock, sole bars and diagonal members to be repaired.
- For stocks having chronic failure of the main members, action to be taken to strengthen these members. In order to increase the rigidity of the joints, cast steel/fabricated knees and brackets to be provided.
- All the rivets, specifically of axle guard, scroll irons, head stock and knees joining the main members, are checked for looseness

- In case of a horizontal crack, it is drilled at both ends. The cracked portion is gouged out and welded. In case of vertical cracks, patching is done to strengthen the cracked portion.
- Repairs to head stock to be done as given in para 506.
- Repairs to diagonals and cross bars to be done as given in para 507.
- Repairs to sole bars to be done as given in para 508.

516. REPAIR & MAINTENANCE IN WORKSHOP DURING POH/NPOH

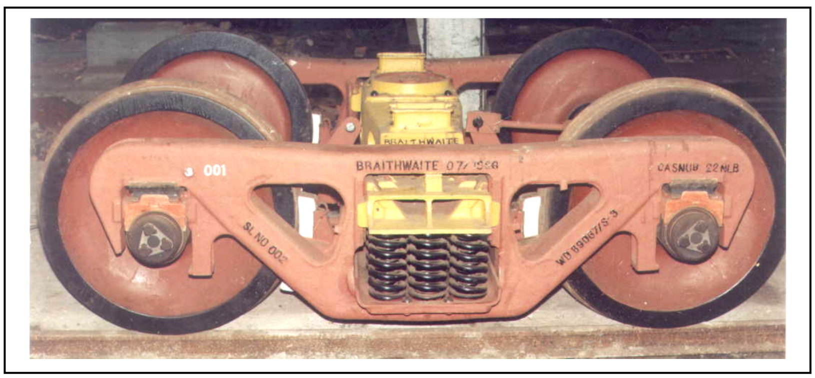
Thorough inspection of underframe is to be carried out. Major repairs as well as all defects and deficiencies that come to the notice must be given meticulous and thorough attention.

In addition to the work indicated in Para 515, the following work is to be carried out in workshops during POH/NPOH :-

- Inspection of underframe, as given in para 504, to be done for
    i. Rivets
    ii. Cracks
    iii. Alignment

- The diagonal distance between the axle guard centres is checked for finding out if the underframe has retained its overall alignment or has become skew.
- The cleaning and de-rusting of the underframe and its fittings.
- Repairs to floor plate as given in para 509.
- Underframe of brake van as given in para 510.
- Underframe of Bogie wagon as given in para 511.
- MG four wheeler and Bogie wagons underframe as given in para 512 & 513.
- Paint underframe as per Spec. G-72 (Rev.1) read with latest amendment.

MAINTENANCE MANUAL
FOR
WAGONS



Chapter – 6 ***Bogies & Suspensions***

CHAPTER 6

BOGIES AND SUSPENSION

At present, following four types of bogies are in service:-

- **CASNUB Bogie**
- **BOX Bogie (UIC Bogie)**
- **Cast Steel Bogie**
- **Diamond Frame Bogie**

601. CASNUB BOGIE

A. GENERAL DESCRIPTION

This bogie was first fitted in BOXN wagons and was designated as CASNUB 22W. This was later modified as CASNUB 22W(M) to take care of high wheel wear reported on earlier version. Subsequently CASNUB 22NL (Narrow jaw) and CASNUB 22 NLB (Narrow jaw with fish belly bolster) versions were introduced. The CASNUB 22 HS bogie has been developed for high-speed operation with maximum permitted speed up to 100 km/h. All CASNUB 22W bogies are to be converted to CASNUB 22W (Retrofitted) by the maintenance depots and workshops. The various bogie versions developed are as under :

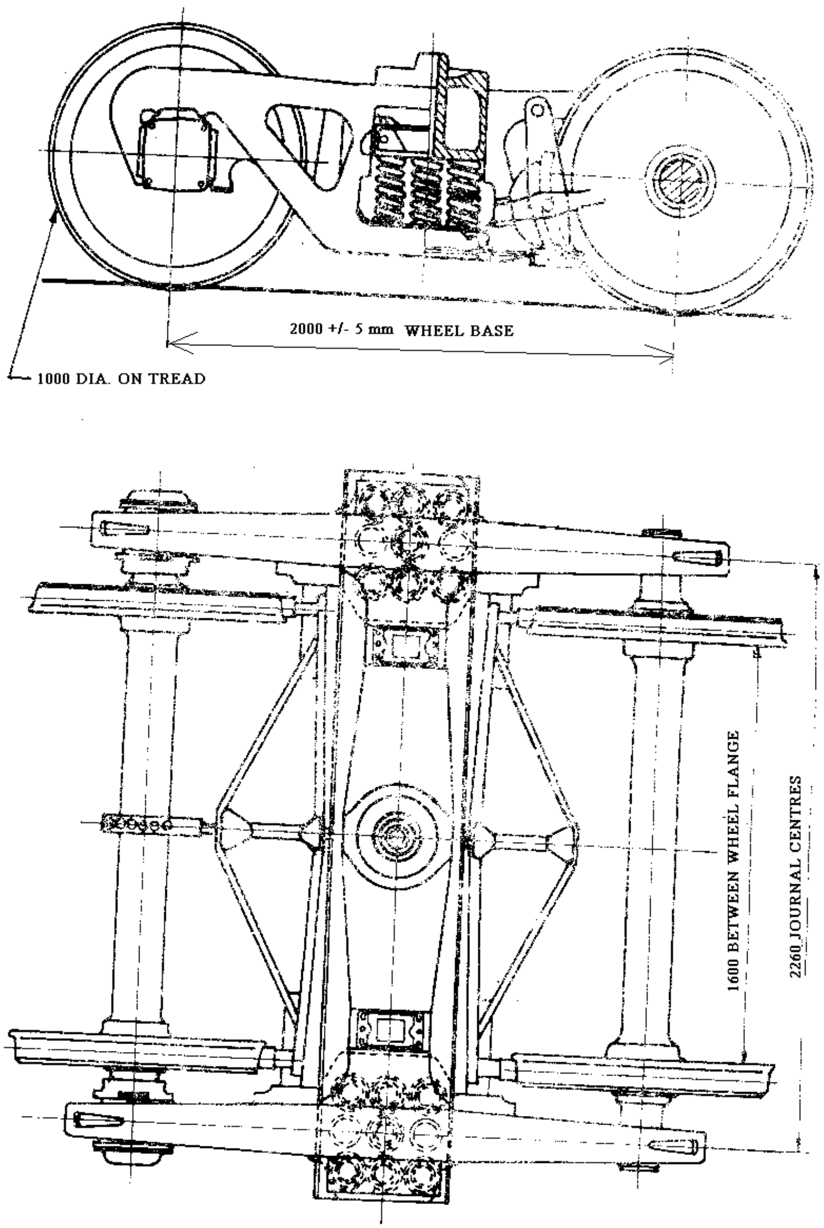
- CASNUB -22W
- CASNUB -22W (Retrofitted)
- CASNUB -22W(M)
- CASNUB -22NL
- CASNUB -22NLB
- CASNUB -22HS

These bogies are now used in the following wagons:-

BOXN	BOBR
BCN	BOBRN
BCNA	BOBY
BRN	BOBYN
BTPN	BFK
BTPGLN	

601 B. CONSTRUCTIONAL DETAILS

- The bogie comprises of two cast steel frames and a floating bolster. The bolster is supported on the side frame through two nests of springs. This also provides a friction damping proportional to load. A fabricated mild steel spring plank connects the side frames.



BOGIE GENERAL ARRANGEMENT

CASNUB 22 W BOGIE

Fig. 6.1

The salient features of CASNUB bogie are given below.

Sr. No	Features	Description
1.	Gauge	1676 mm
2.	Axle load	20.3 t, However all bogies except CASNUB 22 HS can be upgraded up to 22.9 t.
3.	Wheel diameter	1000 mm (New) 956 mm (New) for Retrofitted CASNUB 22 W
4.	Wheel base	2000 mm
5.	Type of Axle bearing	**CASNUB 22W & 22W(M)** (i) Cylindrical Roller Bearing Axle Box in a limited number of CASNUB 22W Bogies only. (ii) Standard AAR Tapered Cartridge Bearing Class E suitable for 144.5 x 277.8 mm wide jaws. **CASNUB 22NL, 22NLB & 22HS** (i) Standard AAR Tapered Cartridge Bearing Class E suitable for 144.5 x 277.8 mm narrow jaw
6.	Distance between journal centres	2260 mm
7.	Distance between side bearers	1474 mm
8.	Type of side bearers	**CASNUB 22W** Roller Type (Clearance Type) **Retrofitted CASNUB 22W, CASNUB 22W(M), 22NL, 22NLB** Constant contact type (Metal bonded rubber pad, housed inside side bearer housing) **CASNUB 22HS** Spring loaded constant contact type side bearer.
9.	Type of pivot	**CASNUB 22W** IRS Type TOP Pivot- RDSO Drg. No. W/BE-601 Bottom Pivot – RDSO Drg. No. W/BE-602 or similar mating profile integrally cast with bolster. **CASNUB 22W(M), 22NL, 22NLB, 22 HS** Spherical Type RDSO Drg. No. WD-85079-S/2
10.	Anti rotation features	Anti rotation lugs have been provided between bogie bolster and side frame
11.	Type of brake beam	**CASNUB 22W, 22NL, 22NLB, 22 HS :** Unit type fabricated brake beam supported and guided in the brake beam pockets. **CASNUB 22W(M) :** Unit Type Cast Steel brake Beam suspended by hangers from side frame brackets.
12.	Suspension details	Long travel helical spring
13.	Elastomeric pads	On all types of bogies except CASNUB 22 W.

The CASNUB bogie assembly consists of the following components:

i. Wheel set with Cartridge Bearing
ii. Axle Box/ adapter, retainer bolt & side frame key assembly
iii. Side frames with friction plates and brake wear plates
iv. Bolster with wear liners
v. Spring plank, fit bolts & rivets
vi. Load bearing springs and snubber springs
vii. Friction shoe wedges
viii. Centre pivot arrangement comprising of Centre pivot top, Centre pivot Bottom, Centre pivot pin, Centre pivot retainer & locking arrangement
ix. Side Bearers
x. Elastomeric Pad
xi. Bogie Brake Gear
xii. Brake Beam

a) WHEEL SET WITH CARTRIDGE BEARING

The initial batch of CASNUB bogie was fitted with cylindrical roller bearing axle box and matching wheel set. However standard AAR taper cartridge bearings have been subsequently standardised for these bogies. Maintenance requirement of cartridge taper roller bearing have been issued under "Instruction for inspection and maintenance of Cartridge Taper Roller Bearing fitted on Cast Steel Bogies", Technical Pamphlet No. G-81 by RDSO.

M/S NEI Jaipur to their Drawing No. 92-4289A supplies cylindrical roller bearing axle boxes fitted on CASNUB bogies. The maintenance Instructions to be followed as indicated in Drg. No. M 33128.

Wheel profile used had been standard 1 in 20 taper after the root radius, earlier. However, currently a worn wheel profile has been prescribed to reduce wheel wear and increase wheel life. The worn wheel profile for new wheel is as per Drg No. WD-88021. During re-profiling, wheels should be turned as per intermediate profile having varying wheel flange thickness selecting the appropriate flange thickness out of the four flange thicknesses so that minimum material is removed at the time of turning. These are as per Drg. No. WD-89060- S/2.

Wheel diameter for new wheel is 1000 mm. However, for CASNUB 22W (retrofitted), maximum permissible wheel diameter is 956 mm. Condemning wheel dia is 906 mm for all versions but with suitable packing.

b) AXLE

Axles have to be subjected to ultrasonic testing during ROH/POH or whenever the wagons are sent to the shops. Wheel sets whose axles have under gone ultrasonic testing shall be stamped on the hub fillet as per RDSO's drawing no. WD-81089-S/1.

Axle end holes should be properly cleaned and lubricated before reuse. Threads should be checked with standard thread gauge. Reclamation of axles with defective cap screw holes shall be carried out as per instructions given in RDSO letter MW/WA/Genl dated 8.5.92.

Some axles on CASNUB bogies have been reported to have grazing on account of Main pull rod. This can be reclaimed in case notches/scratch/nicks are less than 5 mm as per instructions issued vide RDSO's letter No. MW/WA/GENL dated 20.12.91. The reclamation of the axle, for reasons not indicated in the above quoted letter, is not permitted.

Whenever axles are renewed, the workshop shall punch the following particulars in 5 mm letters on the axle end :-

i. Serial No.
ii. Workshop code where pressing has been done
iii. Date of pressing
iv. Journal centre
v. Pressing on pressure in tonnes (Both ends)

After rediscing, the stamping shall be as per RDSO Drg No. WD-87080/S-1.

c) AXLE BOX ADAPTER, RETAINER BOLT & SIDE FRAME KEY ASSEMBLY

CASNUB 22W

Initial lot of CASNUB 22W type bogies were provided with cylindrical roller bearing axle box on the wheel sets. However, cartridge taper roller bearing was soon standardised having adapter & adapter retainer bolt. The CASNUB 22W bogies are provided with wide jaw adapter as per RDSO sketch No. Sk-78527 but without elastomeric pads with wheel sets to Drg. No. WA/WL-4902, Sk-68512 and WD-89025-S/1 with retainer bolts to Drg No. SK-69594.

CASNUB 22W(M)

Wheel sets are with wide jaw adapter, cartridge roller bearing and adapter retainer bolt (WA/WL-4902/WD-89025-S/1 for wheel sets).

CASNUB 22NL,22NLB & 22 HS bogies

Wheel sets are provided with narrow jaw adapter, cartridge roller bearing (WD-89025-S/1 for wheel sets).

CASNUB 22W (Retrofitted)

Bogies are provided with modified wide jaw adapters but these are not interchangeable with CASNUB 22W and CASNUB 22WM.

The wear limits are given in Table 6.1.

d) SIDE FRAMES WITH FRICTION PLATES

Side frame column has been provided with 10 mm thickness Silico Manganese Steel wear liners to IS: 3885 Pt.-I Gr. IV welded on the columns. It must be ensured that the liners permitted in service up to a thickness of 6 mm only.

The new friction plate is to be held tight against the column face during welding which should be done in down hand position. Start welding at diagonal ends of the plate and work towards the centre. No paint or grease should be applied on the friction plate.

The side frame should be checked for its wheelbase (distance between centre lines of the jaw openings) and ensure whether the correct button marking is left on the side frame. While pairing the side frame for a bogie, it should be ensure that there should not be any difference between the numbers of buttons on the two-side frames.

The wear limits are given in Table 6.1.

e) BOLSTER WITH WEAR LINERS

Bolster pocket has been provided with 8 mm thick silico manganese Steel liners welded with pocket slope. The liners may be permitted in service upto a thickness of 3 mm. The welded liners should be chipped off to prepare the surface for welding new liners. No paint or grease should be applied on the plate.

Some bogie bolsters such as those of CASNUB 22NLB &22HS bogies have been provided with 5mm thick wear liners on land surfaces & same are to be required to be replaced after 3mm wear.

The wear limits are given in Table 6.1.

f) SPRING PLANK, FIT BOLTS & RIVETS

Spring plank is a member made of solid steel (flanging quality). It joins two side frames of CASNUB bogie by eight 24 dia rivets and four M24 "fit" bolts to keep bogie frame square.

Spring plank should be examined for defects like loosening of rivets/cracks/bending, welding failure of spring spigot etc. Whenever, spring plank is renewed, the leading dimension of the bogie as per Drg no. SK-69599(W), WD-85054-S/6(22WM), WD-90042-S/1(NLB), WD-92058-S/7(HS) must be measured. Special care is to be taken regarding the use of fit bolts as well as quality of riveting. Fitment of spring plank with side frames should be done on suitable fixture.

g) LOAD BEARING SPRINGS AND SNUBBER SPRINGS

The bogies are fitted with two groups of long travel helical spring nests. The spring details are shown in WD-83069-S/1 (Common for all versions except CASNUB- 22HS Bogie). The spring details of CASNUB 22HS are shown in WD-92058-S/5.

DAMPING

The suspension is provided with load proportional friction damping arrangement with the help of manganese steel cast wedge supported on the snubber springs. The springs are manufactured out of silico Manganese steel, chrome vanadium, chrome molybdenum.

The matching of load and snubber springs is important. It is recommended that the springs should be so grouped that the free height variation in the group is not more than 3 mm. Mixing of new and old springs should be avoided. The nominal free height and condemning height are given in Table 6.1.

h) FRICTION SHOE WEDGES

Friction shoe wedges are fitted on snubber springs. Its vertical surface is with side frame and slope surface is in contact with bolster pocket liners.

A table containing wear limits on vertical surface and slope surface nominal and recommended is placed at Table 6.1.

i) CENTRE PIVOT ARRANGEMENT

Centre pivot arrangement for CASNUB 22W bogie is as per RDSO Drg No. W/BE-601 for top centre pivot and W/BE-602 for bottom centre pivot for separate cast bottom pivot. For CASNUB bogies other than CASNUB 22W, centre pivot bottom and centre pivot top are as per RDSO Drg No. WD-85079-S/2.

Centre pivot pin for CASNUB 22W bogie is a headless pin while for other versions, a special type of pin is provided with castle nut/shackle lock for locking.

To determine the seat wear, the gauge should be placed in position. If the pivot surface starts touching the surface on the gauge at any point, repair to be made by welding. The gauge should be moved on the complete worn surface to be measured. The surface after reclamation shall be the original dimension as per the respective drawings for proper matching of surfaces with top centre pivot.

The repairs should be carried out if a 9 mm thick shim in CASNUB 22W bogie (7 mm thick for other bogies) can be inserted for the full depth between the worn surface and the gauge at any point on the vertical wall of the bowl with gauge in position.

During POH/ROH the wear on the vertical side of the bowl, seat of the bowl should be built up by welding. Preheat the surface to be reclaimed up to a maximum temperature of 250^0 Celsius. After welding, it should be allowed to cool slowly by covering the welded portion with asbestos/sand.

j) SIDE BEARER

CASUNB 22W Bogies are fitted with roller type side bearers, which are free to move in cast steel housing, riveted on the bogie bolster. CASNUB 22W(Retrofitted), CASNUB 22W(M), 22NL, 22NLB Bogies are fitted with constant contact type of side bearer rubber pads located in cast steel housing which is riveted to the bogie bolster. CASNUB 22HS Bogies are fitted with helical spring loaded constant contact type side bearer, riveted/bolted on the bogie bolster.

k) ELASTOMERIC PAD

Elastomeric pads are provided in all versions of CASNUB bogie except CASNUB 22W. The main purpose of providing elastomeric pad is to reduce wheel flange wear.

Elastomeric pads to 95005-S/4, Wd-92058-S/8 (for HS) & WD-95005-S-1 and side bearer rubber pads to WD-85076-S/1 shall be condemned and replaced by new ones on the following grounds :-

i. If the top of the bottom plates or intermediate plate in case of side bearer pads show any crack in service.
ii. If any crack of more than 50 mm is developed at any surface of rubber.
iii. If a bond failure giving way more than 40 mm in any direction is developed in service.
iv. If any sign of crushing of rubber is noticed.
v. When in free condition, the pad has taken a permanent set of the order given in Table 6.1.

l) BOGIE BRAKE GEAR

The brake gear mainly consists of Brake Beam (with brake head and brake block assembly), equalising levers, Push rod, End pull rod, Brake Beam hangers (in CASNUB 22WM bogies). The bushes provided are case hardened or through hardened and pins are made from steel. The maximum permissible wear on the pin diameter and bush inside diameter is limited to 1.5 mm.

In service as the tread diameter of wheel decreases due to wear, pins located in End Pull Rod with underframe to be relocated. The brake beam of CASNUB 22W is of a purely fabricated (structural steel member) design with integrally fabricated brake head. In case of CASNUB 22WM bogies it is of cast steel and Brake head and Block assembly is a separate assembly. This assembly attached with the circular end of a cast steel Brake beam by means of a pin.

In case of CASNUB 22 NL/22NLB/22HS bogies, the brake beam is fabricated, brake beam strut and end piece casting are of cast steel. Brake head is integral part of “End Piece Casting”.

The standard brake shoe to Drg No. WA/BG 6158 which, is used on BOX wagon can be locked in position on the brake head by means of a key. The brake shoes should be replaced when worn to 48 mm thickness i.e. when 10 mm metal is left from the base of the shoe.

m) BRAKE BEAM (CASNUB 22W, 22NL, 22NLB & 22HS) AND BRAKE WEAR PLATES

Bogies are fitted with unit type fabricated brake blocks that slide in the guide cavity provided in the side frame.

Cavities are provided with silico manganese steel liners. The brake heads are integral part of the brake beam. brake beam is shown in WD-89033-S/1, however the brake block to WA/BG-6158 is common for all versions.

CASNUB 22W(M) Bogies

The bogie is fitted with unit type suspended cast steel brake beam. The brake head is a separate sub assembly which is fixed with brake beam circular end by means of pin passing through brake beam end and brake shoe adjuster along with spring loaded brake head. Assembly provides rotational flexibility to brake head. Details are shown in Drg No. WD-85084-S/1, WD-88012-S/1 & WD-86034-S/1.

n) RECLAMATION OF BRAKE BEAM ON ACCOUNT OF WORN OUT BRAKE HEADS

Reclamation procedure for different versions of CASNUB bogie brake beams shall be as follows.

I) CASNUB 22W Bogie

Brake heads are welded with brake beam channel, side rest and outer stiffener plate as shown in Drawing No. SK 69596. The repair procedure for worn out brake heads is as follows.

REPLACEMENT

i. Remove worn out brake heads by gas cutting the welds indicated in drawing SK 69596 with as little damage to other members as possible. Other part, if damaged should be built up by welding by using electrode and taking precaution followed by proper cleaning and finishing operation.
ii. Weld new brake head at correct position with brake beam channel, outer stiffener plate and side rest by fillet welds of sizes indicated in Drawing SK 69596.

REPAIR BY WELDING

Depending upon extent of wear on brake head it is optional for repairing shop/depots to either go for total replacement of worn out brake heads or to build up worn out portion by welding followed by proper finishing operations.

II) CASNUB 22 W(M) Bogie

Brake heads are fitted on brake beam with the help of brake shoe adjuster as shown in drawing no. WD-88012-S/1. Brake heads are further secured on brake beam-ends by washer and split pin. Procedure for replacing worn out brake heads is as under;

i. Remove split pin and washer from brake beam end. Remove pin securing brake shoe adjuster with brake beam by removing split pin.
ii. Take brake heads out of brake beam along with brake shoe adjuster.
iii. Disengage brake shoe adjuster from brake head by providing bolt after disengaging split pin, nut cover, spring and adjusting piece.
iv. Assemble new brake head with brake shoe adjuster by using items mentioned in para (C) as shown in RDSO Drawing No. WD-88012-S/1.
v. Slide new brake head assembled with brake shoe adjuster on brake beam end. Engage brake shoe adjuster with brake beam by using pin and split pin as shown in RDSO Drawing No. WD-88012-S/1.
vi. Further secure brake heads on brake beam end by putting washer and split pin as shown in RDSO Drawing No WD-85054-S/4.

III) CASNUB 22 NL, 22NLB & 22HS Bogie

Brake head is integrally cast with end piece casting, which is welded with structural steel brake beam channel and Truss flat at ends as shown in RDSO Drawing No WD-89033-S/1. Depending upon the extent of wear, worn out brake heads can either be built up by welding or worn out brake heads can be replaced by new brake head.

601 C. REPAIR AND MAINTENANCE IN SICK LINE

In order to obtain optimum life from the bogie, it is desirable to maintain the various clearances within recommended limits. Prescribed clearances are given in para 601 E.

a. Due to wear of the mating components, increase in clearances should be monitored. Whenever the component reaches the condemning limits, repairs should be undertaken for either building up the wear on such surfaces or changing their liner, as the case may be.

b. Due to the wear in bolster/side frame liners and wedge surface, the wedges shall move upwards. If the holes of bolster pocket wall and wedges starts crossing, repair shall be under taken. The gauge shall be used for determining the wear.

c. The class of electrode, gauge of electrode, welding current and welding precautions to be taken while repairing the surfaces by welding.

601 D. REPAIR AND MAINTENANCE DURING ROH & POH

In addition to all the work prescribed at para 601 C above, the following work is also to be done in ROH/POH :-

a. The bogie should be dismantled. Dismantling and assembly procedure is given in para e. The bogie clearances and tolerances should be checked and rectified, if found necessary.

b. Position the job for down hand welding and carry out the repairs. Ensure that suitable manipulators are used.

c. After the repairs the repaired surface should be checked with relevant gauge for correctness. Excess material, if any, should be removed by grinding or machining.

d. All the wearing surfaces of bogie shall be brought to “As New” condition.

e. Assembly and disassembly of the bogie

I. DISASSEMBLY

- Disconnect bogie brake rigging attachment to underframe and brake gear and raise car body. Run out the bogie.

- Inset assembly pin (12mm dia x 250 mm long) to retain friction shoes.
- Raise bolster to connect top member of side frame.
- Remove outer, inner and snubber springs.
- Remove assembly pins and lower wedge blocks to take them out.
- Lower bolster to rest on the spring plank.
- Slide the bolster to one side to take it out.
- Take out the key from side frame to release the wheel sets.
- Take out the side frames and spring plank assembly.
- Remove the adapter retainer bolt to release the adapter.

II. ASSEMBLY

- Re-assemble the bogie by re-raising the procedure as above.

  Important: Inspect all the load and snubber springs for proper seating after wagon body is on bogies.

- Matching of both load and snubber spring is important. It is recommended that springs having upto 3 mm free height variation should be assembled in same group. Mixing of new and old springs should be avoided.
- The centre pivot of the bogie shall be lubricated with graphite flakes to IS:495 at the time of assembly. No other mating surface in the bogie shall be lubricated.

For detailed description of each item and its maintenance procedure, refer to RDSO publication No. G-95 (Rev.1); March 1997.

601 E. NOMINAL CLEARANCES

The nominal clearances and the tolerances of the bogie assembly are given below.

Sr. No.	Description	**Type of CASNUB Bogie**			
		22W & 22W (Retro)	22W(M)	22NL NLB	22HS
1.	Lateral clearance between side frame & bolster	18 mm	18 mm	18 mm	25 mm
2.	Lateral clearance between side frame & adapter	25 mm	25 mm	16 mm	16 mm
3.	Longitudinal clearance between side frame & adapter	2mm	10 mm	9 mm	9 mm
4.	Longitudinal clearance between side frame & bolster	6mm	6mm	6mm	6mm
5.	Clearance between anti- rotation lug & Bolster	4mm	4mm	4mm	4mm

TABLE 6.1
WEAR LIMITS FOR BOGIE COMPONENTS

Sr. No.	Description	New or Renewed	Worn	Wear Limit
1.	**AXLE BOX**			
	Axle Box Crown lugs (Cylindrical Roller Bearings)	159 mm	167 mm	4 mm
	Axle Box Crown seat (Cylindrical Roller Bearings)	36.5 mm	33 mm	3.5 mm
	Axle Box side lugs (Cylindrical Roller Bearings)	130 mm	136 mm	3 mm
	Axle Box sides (Cylindrical Roller Bearings)	268 mm	262 mm	3 mm
2.	**ADAPTER**			
	Adapter Crown lugs (Wide Jaw)	156 mm	164 mm	4 mm
	Adapter Crown lugs (Narrow Jaw)	155.5 mm	163.5 mm	4 mm
	Adapter Crown seat	3.5 mm		
	Adapter bore seat to crown seat			
	Wide jaw adapter	48.5 mm	45 mm	3.5 mm
	Modified wide jaw adapter	25.5 mm	22 mm	3.5 mm
	Narrow jaw adapter	26.2 mm	22.7 mm	3.5 mm
	Adapter Side Lugs			
	Wide Jaw	130	136	3
	Narrow Jaw	97	103	3
	Adapter Sides			
	Wide Jaw	268	262	3
	Narrow Jaw	181	175	3
3.	**Side Frames**			
	Side frame wear friction plate	10	6	4
	Side frame column sides	216	206	10
	Side frame anti rotation lug	522	528	6
4.	**Pedestal Crown Roof**			
	Key Seat to Pedestal Crown Roof 22W	273	278	5
	Key Seat to Pedestal Crown Roof 22W(M)	318	323	5
	Key Seat to Pedestal Crown Roof 22NL/ NLB/HS	323	328	5

5.	**Pedestal Crown Sides and Sides of the Pedestal** All Bogies – Crown Sides Pedestal Sides 22W,22W(M) Pedestal Sides 22NL,NLB, HS	 152 105 81	 144 101 77	 4 2 2
6.	**Distance between Outer & Inner Pedestal Jaw of CASNUB Bogies** 22W & 22W(Retrofitted) 22W(M) Pedestal Jaw (Short) for 22NL/NLB/HS Pedestal Jaw (Long) for 22NL/NLB/HS	 270 278 190 236	 278 286 198 244	 4 4 4 4

Description	**New**	**Worn**	**Wear Limit**
BOLSTER			
Pocket	35 degree on slope		
Liner	8 mm	3 mm	5 mm
Bolster land surface	444 mm	438 mm	3 mm
Rotation stop lug	518 mm	512 mm	3 mm
BOLSTER COLUMN GIBS			
Outer gib	234/241 mm	244/251 mm	5 mm
Inner gib	136 mm	146 mm	
CENTRE PIVOT			
Wear limit vertical side			
CASNUB 22W	-	-	5.5 mm
Others	-	-	4 mm
SEAT			
CASNUB 22W	-	-	4 mm
Others	-	-	4 mm
FRICTION SHOE WEDGE BLOCK			
Vertical Surface from			
Centre line of spigot	61 mm	54 mm	7 mm
Slope surface by gauge	-	-	3 mm

ELASTOMERIC PADS

Type of pad	Nominal Dimension	Dimension after permanent set
Elastomeric pad	46 mm	42 mm
Side bearer rubber pad	114 mm	109 mm

SPRINGS

Bogie Type		Spring free height nominal (mm)	Recommended free condemning height (mm)
All version except CASNUB 22 HS	Outer	260	245
	Inner	262	247
	Snubber	294	279
CASNUB 22 HS	Outer	260	245
	Inner	243	228
	Snubber	293	278

It is recommended that springs having less than 3 mm free height variation should be assemble in the same group. Mixing of new and old spring must be avoided. The bogie is fitted with two groups of long helical spring nests. The spring groups per bogie for various axle load applications are as under:

Axle Load	**Number of Springs**		
	Outer	**Inner**	**Snubber**
22.9 t	**14**	**10**	**4**
20.3 t	**12**	**8**	**4**
20.3 t (22HS)	**14**	**12**	**4**
16.3 t	**8**	**8**	**4**

601 F. REFERENCE DRAWING NUMBERS FOR COMPONENTS

Sr.No.	Components	Drawing No./Pamphlet No.
1.	AAR taper cartridge bearing	BP-200923-1-NBC G 81,1st revision issued by RDSO
2.	Worn Wheel Profile	WD-88021, or as per drg.
3.	Wide jaw adapter for CASNUB 22w & CASNUB 22 W(M)	RDSO Sketch No. Sk- 78527
4.	Wheel set and retainer bolt foe CASNUB 22W (without Elastomeric pad)	WA/WL-4902, Sk-68512, WD-89025-S/1, Sk-69594 (retainer bolt)
5.	CASNUB 22 W(M) wheel set	WA/WL-4902/WD-89025-S/1
6.	CASNUB 22 NL,22NLB & 22HS with wheel set	WD-89025-S/1
7.	Leading dimension and tolerances	Sk-69599(W), WD-85054-S/6(22WM), WD-90042-S/1(NLB), WD-92058-S/7(HS)
8.	Load bearing Springs & Snubber Springs	WD-83069-S/1(All versions except 22HS Bogies)

		WD-92058-S/5 (22HS Bogies)
9.	Springs	Silico Mangnese steel to IS : 3195 Gr 60 Si7, Gr 60 Cr4V2 Gr. 51 CrMoV4, IRS specification R2 and RDSO specification WD-01-HLS-94 (rev.1)
10.	Centre pivot CASNUB 22W	W/BE-601 for top pivot W/BE-602 for Bottom pivot
11.	Centre pivot other than CASNUB 22W	WD-85079-S/2
12.	Elastomeric Pads	WD-89067-S/10, WD-92058-S/8 (for HS), WD-95005-S/1
13.	Side Bearer Rubber Pads	WD-85076-S/1
14.	Brake Block	WA/BG-6158
15.	CASNUB 22W(M) bogie, brake beam, brake head & block assembly	WD-85084-S/1, WD-88012-S/1, WD-86034-S/1
16.	Brake beam [22W, 22NLB & 22HS]	Sk-69596, WD-89033-S/1

602. FABRICATED BOX BOGIE (UIC BOGIE)

A. GENERAL DESCRIPTION

These bogies are used on BOX, BCX, BCXT, BRH, BRS wagons. It is also known as UIC bogie.

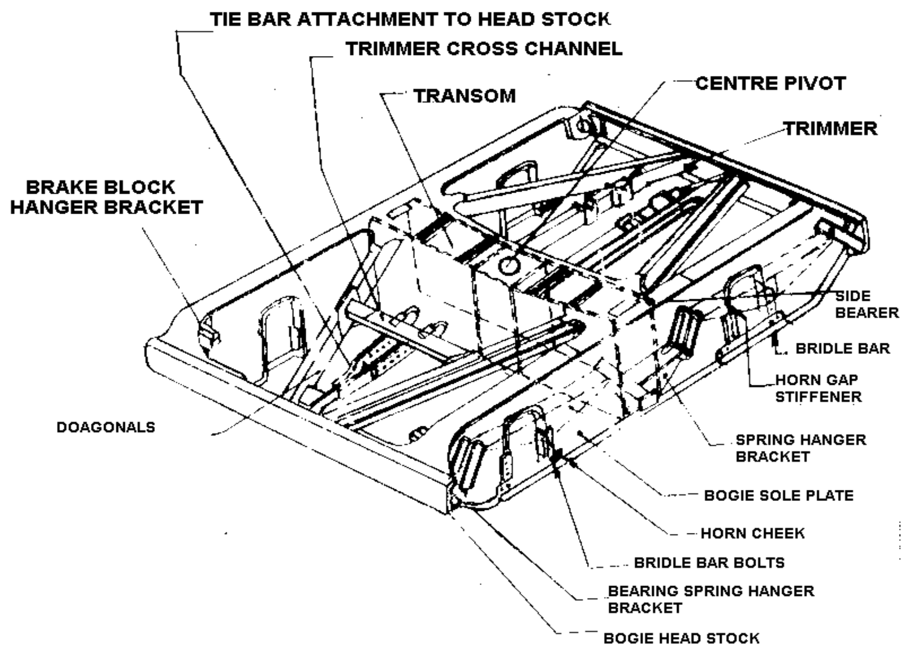
The BOX bogie is designed for an axle load of 20.3t. It is an all welded, plate fabricated bogie having a fixed bolster with hemispherical centre pivot and primary suspension incorporating four laminated bearing springs with long links supported by mild steel stones. The suspension arrangement and axle box design with liberal lateral and longitudinal clearance are intended to permit the wheel set to "float" relative to the bogie frame, with the object of improving the riding characteristics of the bogie. The roller bearing axle boxes are provided with "L" type lugs, so that in its lateral movement, wheel set is constrained by only one axle box at a time and there is no reversal in bending of bogie sole plate.

602 B. CONSTRUCTIONAL DETAILS

A limited number of mark 'O' type bogies were applied on BOX, BRH and BRS type wagons during their initial production. The bogie frame of the Mark 'O' type is of a riveted cum welded construction whereas Mark-I has an all welded plate fabricated bogie frame. Apart from this basic change in the construction of the bogie frame, there is no change in any of the general design features between Mark-I and Mark 'O' bogies. Both of them are interchangeable. Mark 'O' bogies has withdrawn from service.

The bogie consists of the following important parts :-

a) Bogie frame including integral bolster, head-stock and trimmers
b) Centre pivot arrangement
c) Side Bearer arrangement
d) Spring suspension arrangement
e) Horn cheeks
f) Roller bearing axle boxes
g) Wheel sets
h) Bogie Brake gear



ISOMETRIC VIEW OF BOX TYPE WAGON BOGIE FRAME (B.G.)

Fig. 6.2

a) SIDE FRAME

This acts as a sole plate of the bogie frame. It runs parallel to the track, two side frames are joined together at the centres by bolster and by two head stocks at the ends. They maintain correct distance between the side frames as well is squareness and alignment of the bogie. On each side frame, two horn gaps are provided near the ends for fixing axle boxes. In the central position, control spring hanger bracket is fitted. Two inner and two outer cap pressings have been provided to strengthen the opening of the sole plate provided for the insertion of shackle pins. Spring stops have been welded on sole plate/top flange.

The sole plate is made of 8 mm thick plate. Other plates are also made of this material. The trolley frames were found to be having many welding defects. RDSO has issued detailed instruction vide No. R-7 for rectification of these welding defects on bogie frame.

b) BOLSTER

Bolster is welded at right angles to the two side frames. It alongwith head stock, keeps them at correct distance and maintain squareness and alignment of the bogie. It is a fabricated construction consisting of one top plate and one bottom plate and two vertical side plates.

These are joined together to form a box section. In the centre where centre pivot is fitted, two stiffener plates have been provided at a distance of 360 mm. Perpendicular to the vertical side plates. In the ends, near the side bearers it is strengthened suitably. The top and bottom plates are 12 mm thick and side plates are 8 mm thick made out of plate. Other plates used in the assembly are mostly 8 mm and 10 mm thick. The top plate is bent in the centre and the side plate is at suitably forming a well in the centre. In the centre portion the bogie pivot is welded and on both ends the side bearers are welded.

c) HEAD STOCK

The head stocks are welded at right angles to the sole plates at both ends. Head stock and bolster together maintain the required distance between the two sole plates and also ensure squareness and alignment of the bogie frame. The head stock is a channel section of 200x75 x 7.5 mm. It is suitably joined with the sole plate at both the ends. Two diagonals (one each on RH and LH) are also attached with it. The safety loop brackets are also welded to it in the central portion.

d) DIAGONALS

To absorb draw and buffing force, the bogie has been strengthened by providing two diagonals between the head stock and the bolster on its either ends. Thus there are total of 4 diagonals, 2 left handed and 2 right handed. The diagonal is made of the channel section of 125x65x6 mm web. They are suitably notched at both ends to fit the head stock and transoms. The diagonal is inclined. Its height from the rail level is higher near the bolster and lower near the head stock.

e) SAFETY LOOP BRACKETS

It is made of steel plate 8 mm thickness out to a suitable shape. At one of the ends it has got 13.5 mm dia hole. It is welded to the head stock channel near its central portion. Two brackets are fitted on each head stock. Thus a total of four brackets have been provided.

f) BOGIE TRIMMER (OUTER & INNER)

In the initial builds of MK-I and MK 'O' bogies the trimmer arrangement consists of a pipe between the diagonals, two cantilever arms and one tie attached to the pipe trimmer on one side and on the other side to head stock, in the case of outer trimmer. In case of inner trimmer, two pairs of cantilever arms are attached to the pipe trimmer. Due to welding failures in the regions, the design was altered and all the bogies, manufactured since 1963-64, have been provided with channel type of trimmers. In this design, the outer trimmer consists of one cross channel connected in between two diagonals and two channels running between cross channel and bolster. There is also an additional pressing running transverse over the two longitudinal channels and one pair of brake suspension flats. In the case of inner trimmer, it consists of one cross channel between two diagonals and two longitudinal channels running between bolster and cross channel. This carries two pairs of brake suspension brackets.

g) SAFETY LOOP BRACKETS

Two safety loop brackets have been provided on outer trimmer and two on inner trimmer arrangement. It is a trapezium shaped plate of 8 mm thickness with a hole of 13.5 mm dia. in the centre. It is attached at suitable locations in the bottom of the longitudinal trimmer channel.

h) CENTRE PIVOT ARRANGEMENT

Centre pivot is of hemispherical design. The whole load on the centre point is borne by a fixed bolster that distributes the load directly to the laminated bearing springs and to the journals. There is no secondary suspension in these bogies. The centre pivot arrangement consists of the following :-

I. Retaining ring

II. Bogie centre pivot top
III. Bogie centre pivot bottom
IV. Centre pivot retainer
V. Washer
VI. Bogie centre pivot top (Bolts & nuts) - 4 Nos.
VII. Dust shield for bogie centre pivot

Bogie centre pivot is fitted centrally on the fixed bolster. The bolster is suitably strengthened from below at the centre to take the weight of the body. Similarly, the underframe of the body has been suitably strengthened from top at the centre.

I. RETAINING RING

The retaining ring is given a special shape to afford sufficient strength against impact loads and also to provide requisite length of welding. The outer periphery of the ring is finished machined. The retaining ring is welded to the gusset plate of the under frame from inside. The retaining ring outer periphery fits closely in the internal circular recess of the centre pivot top. The head of the centre bolt comes between the bottom lugs of the retaining ring.

II. BOGIE CENTRE PIVOT TOP

It is made of cast steel, hemispherical shape at the bottom and at the top flange portion it is a square when the corners are rounded off to liberal radius. There are four holes of 26 mm dia. to enable fitment of centre pivot bolts. There is a recess of 270 mm dia. Close tolerance (+0.5/-0) for fitment of retaining ring. Lubricating groove has been provided over the hemispherical surface. The centre pivot is rough machined over the top flange surface and the pivot bearing surface is finish machined. The sides of the top flange are rough ground.

It is secured with the body of the wagon by means of 4 Nos. of M-25 bolts, 90 mm long with nuts. After fitting, the nut should be tack welded with the bolts. The other hemispherical surface rests on the centre pivot bottom.

III. CENTRE PIVOT BOTTOM

It is made of cast steel, hemispherical in shape with a circular flange near the top. It has a boss at the centre. Its top hemispherical surface is of 200 mm radius. The outer diameter of the circular flange is 430 mm and its total height is 125 mm. The boss has a hole of 60 mm dia. The external dia. of the boss on top is 100 mm and at bottom 130 mm. On the bottom surface of the circular flange, there is a recess of 380 mm outer dia, 310 mm inner dia & 9 mm depth. The vertical surface of the internal dia. fits in the opening in the bolster. The bottom surface of the circular flange rests on the bolster. A semicircular grease groove of 5 mm radius and depth is provided on the hemispherical surface near the boss. The top surface of the boss is 30 mm below the top surface of the pivot. The top surface of the boss, the hemispherical surface, the centre hole on the vertical surface of the internal recess are finished machined. The outside surface of the boss having 100 mm dia. is rough machined. The top circular flange surface is rough ground.

The centre pivot bottom fits in internal opening provided in the bolster opposite to its internal vertical surface of the bottom recess. The bottom surface of the flange rests on the bolster and is tack welded all round at its outer most periphery. The centre pivot top rests on the hemispherical surface of the centre pivot bottom.

IV. CENTRE PIVOT RETAINER

Its top surface is circular and lateral surface is hemispherical with flat surface in the bottom. Both top and bottom surfaces have circular recesses in the centre. The depth of the top recess is 15 mm and dia. 175 mm. The depth of the bottom recess is 12 mm and dia. 110 mm. The top surface is 240 mm in dia. It has been chamfered at 45^0 for a depth of 2 mm. The dia. of the bottom surface is 130 mm. The total height of the retainer is 42 mm. There is a centre hole of 60 mm dia, 15 mm long. The hemispherical surface has a radius of 168.5 mm. The top surface, the top recess surface, bottom flat surface are rough machined. The hemispherical surface, the central hole surface and the inner surface of the bottom recess are finish machined. The chamfered surface is rough machined.

The centre pivot retainer rests on the top surface of the boss of the bogie centre pivot bottom. Thus a small clearance is left between the inner hemispherical surface of the bogie centre pivot top and the retainer. The washer is made to rest on the top recess of the centre pivot retainer.

V. CENTRE PIVOT WASHER

The washer assembly has 2 different parts glued together. The thickness of each pivot is 10 mm with 170-mm external dia. and 60 mm internal dia. The top is made of steel and the bottom part is made of either Buna synthetic rubber or India rubber. The latter is glued to the former and both together are stocked as washer.

The bottom rubber portion of the washer rests on the top recess of the retainer. The head of the centre bolt rests on its top steel surface.

VI. CENTRE PIVOT BOLT

It is made of steel size 227 mm long x 56 mm dia. The length of the threaded portion from bottom is 79 mm. The circular head is of 80 mm dia., 25 mm thick. The circular head has been machined to two flat edges opposite to each other kept at a distance of 70 +0/ -1.2 mm. An undercut of 8 mm width x 3 mm depth has been provided at a distance of 79 mm from bottom. The thread is of M-56 size. A hexagonal castle nut to suit M-56 thread of 74 mm height is used on this bolt. The material of the castle nut is same as that of the bolt130 mm external dia. 58 mm internal dia. and 10 mm thick washer is used before the nut.

The head of the bolt fits between the bottom lugs of the bogie centre pivot retaining ring. The head rests on the metallic surface of the composite washer. It then passes through the hole of the washer, retaining and the bogie centre pivot bottom. The washer and the castle nut is fitted below the bottom surface of the boss of the bogie centre pivot bottom. A clearance of 2 mm is maintained between the bottom surface of the boss and the washer.

The flat surface of the bolt head fitting between the bottom lug of the centre pivot retainer ring prevents it from retaining. As the nut is fitted at a place, difficult to access, the bogie should be run out by opening the four bolts of the bogie centre pivot and lifting the body by about 150 mm.

VII. DUST SHIELD FOR BOGIE CENTRE PIVOT

It is made of mild steel sheet. The plate is of 2 mm thickness. It is bent like a circular ring having inclined surface. The height of the ring is 50 mm. The outer dia. at top and bottom are 385 mm and 405 mm respectively. The ring is large enough to cover the important surface of the centre pivot assembly and surface is welded around to the bottom surface of the square its top flange of the bogie centre pivot top, just inside the bolt heads. It protects the centre pivot assembly from dust and dirt.

i) SIDE BEARERS

The two bogie side bearers are fitted at a distance of 1940 mm, i.e. 970 mm from the centre of the bogie. The bogie side bearer is welded along its length of top plate on the bolster 12 mm thick. At this location, the bolster plate has been strengthened from below. The top side-bearer is secured with the under frame plate by two nos. of M-20 CSK bolts. Below the nut a spring washer is provided and the nut is secured by 6.3 dia, 32 mm long split pin. At this location, the under frame plate has also been suitably strengthened from above.

j) BOGIE SIDE BEARER

It is a rectangular plate of size 300 x90x20 mm. At the bottom, it is flat and on top it has a radius of 1 metre long its length. In the centre, the bottom surface has a recess of 40 dia. x 9 mm. The thickness at the sides is 9 mm and at the centre is 20 mm. On the covered surface, 2 rectangular recesses of size 40 x 100 mm have been provided at both ends. Towards the centre end the recess has been curved to a semicircle of 40 mm dia. The thickness of the plate at the recessed portion is 9 mm. The bottom surface of the side bearer is rough machined and the curved surface rough ground.

k) SIDE BEARER (TOP)

It is a plate of 300 x 100 x 25 mm size with two countersunk bolt holes size M-20 at a distance of 240 mm. The chamfered height of the bolt hole is 12 mm. This plate is fastened to the underframe by means of two countersunk bolts of M-20 size.

l) SPRING SUSPENSION ARRANGEMENT

The spring suspension arrangement on BOX wagon is an improvement over the suspension of 4 wheeler wagons. The shackle plate has been replaced by long shackles and stones. The split cotter replaced by shackle pin retainer and split pin. The scroll iron replaced by brackets attached with the bogie frame. The spring buckle has a spigot at the bottom, which engages in a bush seat located at the crown of the Axle Box. For each spring, 4 vertical spring stops have been provided to restrict its movement in the vertical direction in the event of breakage.

The load of the wagon Body including its contents and under frame is transmitted to the bogie frame through the central pivot arrangement. On the bogie frame, one central and two head stock brackets have been provided. The load is transmitted to the spring from these brackets through shackle pin, stone, shackles followed by stones on the spring and pin and the spring eye. From the top plate of the spring eye, the load is transmitted to the Axle box crown through spring plates buckle and its spigot.

m) SHACKLE PIN

It is secured in position by Retainer and split pin. The dia. of the shackle pin is 35 +0/ -0.5 mm. Starting from the head end of the shackle pin the stone is inserted followed by spring Eye/Bush Eye, stone again and shackle pin Retainer. Each shackle pin Retainer, which has a rectangular fork shape is further secured by a split pin. The Retainer fits on the two flat and parallel recesses of the shackle pin.

n) SHACKLE STONE

It is a solid block having a hole of 36 (+0.5/-0.0) mm dia. in the centre. On both sides, it has a semicircular forked end perpendicular to the axis of the hole. The radius of the circular portion of the forked end is 13.5 (-0.0/+0.5) mm. The shackle pin passes through the hole of the stone. The shackle stone has been made reversible so that both ends thereof can be used for longer life. One stone is provided on either side of the spring Eye/Bush of the spring suspension Bracket. The spring shackle sits on the circular portion of the stone.

o) SPRING SHACKLE

It has a circular cross section of 25 +1.0/ -0.5 mm. It should not be finished. A shackle can also be made out of a bar by bending it to two 'U' pieces and joining the ends by resistance welding. The effective length of the shackle is connected from the inner edges along its width. The top and bottom inner edges & side inner edge upto a length of 25 mm from top and bottom edges should be rough ground to a circular form to ensure proper contact with the stone.

p) SHACKLE PIN RETAINER

It is made in a forked shape that has varying cross section at different locations. The inside edges of the fork end is made to a rectangular shape having a semicircular closed end and on open end. The rectangular portion of the edges fit on the two flats of the shackle pin and the circular edges match the curved portion of the shackle pin. The open end has a split pin hole of 8 mm dia. After fastening the stone in the assembly, the retainer is fitted on the shackle pin and is secured by the split pin.

q) LAMINATED SPRING

The weight of the wagon body including its contents, under-frame, bogie frame, is transmitted to the spring eye through the shackle suspension arrangement. From the spring eye, the weight is transmitted to the Axle Box crown, through the spring plates, Buckle and its spigot. The various aspects of the laminated spring viz. its material, cleanliness, maintenance and manufacturing practices, the rejection defects, defects noticed in service, precautions are to be taken. These are applicable to the laminated spring fitted on UIC Bogies. The special features of laminated Bearing spring for BOX/BCX and other similar type of wagons are given as under:-

Ten plate bearing spring to IRS Drg.No.WA/SN-6302/WD-86007-S/1 has been provided on BOX wagons. The spring buckle has a spigot at its bottom, which engages in the bush seat provided in the crown of Axle Box. The spring, as such, directly bears on the Axle Box Crown. In the original design, the top plate had rib and groove. Now, the Bearing spring has been modified to incorporate flat top plate with a clip at either end.

r) SOLE PLATE TROLLEY FRAME

It is a plate of 8 mm thickness.

s) RIVETING STRIP

It is made of a plate of 6 mm thickness, 240 mm long and 45 mm wide with 4 mm chamfer at 45^0 on one of the vertical edges. It has 4 rivet holes of 17.5 mm dia. at a distance of 16 mm, from the chamfered edge having pitch of 60 mm. It is fitted on the inner surface of the sole plate. The snap head of the rivet bears on its other surface. The edge has been chamfered to enable the Horn gap stiffener to be fillet welded to the sole plate. The other edge should be tack welded with the sole plate.

t) HORN CHEEK PACKING

It is 240 mm long and 38 mm wide. It has a 8 mm chamfer at 45^0 on its vertical edge to enable fillet welding of horn gap stiffener with the sole plate. It has four rivet holes similar to the riveting strip except that they are at a distance of 18 mm from the chamfered edge. It is fitted on the outer surface of the sole plate. On the surface opposite to this surface, the horn cheek is secured. The vertical edge opposite the chamfered edge is fillet welded to the sole plate.

u) HORN CHEEK

It is an 'L' shaped part made of steel. Its short leg is kept perpendicular to the track and the long one parallel to the track. The long leg is secured with the sole plate by four countershunk rivet of 16 mm dia.

with horn Cheek packing between the two and the riveting strip placed behind the sole plate. The four parts are riveted together. The thickness of the long leg is 17.5 (+0/-0.5) mm and short leg 15 $\pm$ 0.5 mm.

v) HORN GAP STIFFENER

It is a inverted 'U' shaped block of 25 mm thickness and 65 mm width at most of the places. At the top, the width increases to 80 mm and the bottom decreases to 45 mm. Its outer surface is kept perpendicular to the sole plate and welded to it on both sides through out its periphery. The inner straight edge is kept at a distance of 37 mm from the inner surface of the sole plate. The outer edge opposite the horn cheeks is at a distance of 20 mm from outer surface of the sole plate.

w) PACKING BEHIND SOLE PLATE
(FOR HORN GAP TIE BARS)

Its vertical edges near the horn gap stiffener is inclined and chamfered. It is fitted just after the horn gap stiffener keeping its bottom longer side 20 mm above the bottom edge of the sole plate. It is tack welded to the inner surface of the sole plate along its longer sides. It has two rivet/bolt holes, which are drilled in position after tack welding with sole plate.

x) HORN GAP BRIDLE BAR

The horn gap bridle bars were secured to the bogie sole plate by means of four bolts and stock put in service initially. Now the bridle bars to be secured by riveting. Special attention should be paid to the security arrangements of the bridle bar at the time of maintenance or when wagons are received in sick-line for repairs. Slack tie bar can induce cracks in the bogie sole plate.

y) CENTRE SPRING HANGER BRACKET

It is centrally welded to the sole plate of the bogie. Two brackets are required for each trolley. On the brackets ferrules and two bushes are provided. The shackle pin passes through the bush hole. On both sides of the bush, shackle stones and shackles are fitted. The load transmitted from the trolley frame to the bracket thus gets transmitted to the spring.

The bracket consists of four parts, viz. hanger brackets, pressing, ferrule and bush. The hanger bracket is made of 8mm thick steel plate. Its front view is like a trapezium. Its all four side are bent at 90°. At both the top corners suitable openings have been provided to fit pressing. The pressing is also made of 8mm thick steel plate bent at right angle. One side is welded to the sole plate and the other side to the hanger bracket.

The ferrule is made of steel of size 75 mm outer dia (46 + 0.039/ - 0.0 mm inner dia.) X (120 + 0 / -0.5 mm length). The outside surface of the ferrule is welded to the bracket and pressing. Its inside surface is fine finish machined whereas outside and both side surfaces are finish machined.

The bush is made of steel having internal dia. as 36 +0.2/-0.5mm and length 120 +0.0/ -0.5 mm. Its outer surface is fine finish machined. The inside and two side surfaces are finish machined. Its out side dia. is in four sizes as under:

Normal size	46	+ 0.10 mm + 0.07 mm
Over size	46.5	– 0.05mm – 0.09 mm
Step size	47.5	+ 0.10 mm + 0.07 mm
Over size	48	– 0.05mm – 0.09 mm

z) HEAD STOCK SPRING HANGER BRACKETS

It is fitted to the headstock of the trolley frame. Four brackets are required for each trolley. It consists of following parts:

Sr.	Name of the Part	No. Per Trolley	Material
1.	Side plate outer	4	Steel 42WC to IS : 2062
2.	Side plate inner	4	--do--
3.	Cover plate	4	--do--
4.	Top ribs	4	--do--
5.	Bottom ribs	4	--do--
6.	Ferrule	4	--do--
7.	Bush	4	--do--

Side Plate Outer: It is 8 mm thick plate cut to a polygon having five sides and welded to the channel of the head stock perpendicular to it. One of the sides out of the five is circular in shape.

Inner Side Plate: It is similar to outer plate except that near the vertical end, it has been joggled to triangular shape towards the sole plate of the trolley frame.

Cover plate: It is made of 6 mm thick plate bent to angular shape matching the profile of 3 sides of the inner and outer plates. It has been welded to the inner and outer plates joining them together.

Top Ribs: It is made of 12 mm thick plate and cut to polygon shape having six sides. It is welded in the center to the cover plate at right angle. One of its other side is welded to the end plate of the bogie side frame.

Bottom Rib: It is made of 12 mm thick plate cut to a polygon shape having the five sides. It is welded to the cover plate similar to the top rib and of its other side is welded to the bottom end plate of the bogie side frame.

One end of the spring is attached to the Centre spring hanger bracket and the other end to the head stock spring hanger through the shackle assembly. Shackle pin of shackle assembly passes through bush of ferrule & transfers load.

602 C. MAINTENANCE OF SUB-ASSEMBLIES

a) MAINTENANCE OF CENTRE PIVOT ASSEMBLY

The inner surface of the centre pivot bottom and the outer surface of the centre pivot top are liable to wear in service. After certain period the surfaces may no longer be hemispherical. These two hemispherical surfaces have a common radius of 200 mm. It can be reduced in thickness by 3 mm. In order to restore uniform hemispherical shape, it should be machined to the same radius of 200 mm by bringing the centre nearer for the bottom pivot and furthering it away for the top pivot to a maximum extent of 3 mm. This will lower the height of top side bearer to a maximum extent of 6 mm. Replace centre pivot if the wear exceeds 3 mm on each. If the wear is within permissible limit, in order to keep the prescribed side bearer clearance between 4 mm to 7 mm, a liner ring of not more than 3 mm thick has to be used between the under frame bolster bottom gusset and centre pivot top.

Wear will also take place between top surface of the retainer and bottom surface of the washer. As rubber washers are used, the wear on the top surfaces of the retainer will be negligible. When the thickness of the rubber portion of the washer reduces to 7mm the washer on the rubber should be replaced. Wear may also take place between the bolt head and the metallic portion of the washer. The ridges at this location should be removed.

b) MAINTENANCE OF SIDE BEARER CLEARANCE

The prescribed clearances are:

	Clearance on one side	Total Clearance
Minimum	**4 mm**	**8 mm**
Maximum	**7 mm**	**14 mm**

The initial clearance provided is 4 mm. In service, both the side bearers wear. The bottom side bearer should be built by welding when it is worn out by 3 mm.

c) MAINTENANCE OF SHACKLE PIN AND SHACKLE STONE

The diametrical clearance between the shackle pin and the spring Eye should not exceed 1.25 mm when new. The clearance between the shackle pin and bush hole of the spring suspension bracket should not exceed 1.5 mm when new. The maximum permissible diametrical clearance for these two locations is 3 mm. For one BOX bogie 16 and for one BOX wagon 32 shackle pins are required.

The radius at the corner of the shackle and stone have been increased from 6 mm to 10 mm reduce the stress concentration at the corners of the shackles. A stone having 10 mm to radius may be used in conjunction with shackle having 10 mm radius. In such cases, the corners of the stone should be machined to 10 mm radius. Since, these modifications were issued long ago, very few shackle and stone of 6 mm radius will be in use now. It should be ensured that the spring shackle freely articulate on shackle stone without binding at corners.

When new, the effective length of spring shackle should be 332 (+1.0/-0.0) mm. The maximum permissible wear at this place is 2 mm. The shackle should be replaced when the diameter is reduced below 23 mm at this location. While pairing the shackle on either end of the spring, it must be ensured that variation in effective inside length does not exceed 2 mm. Excessive variation in effective length can lead to uneven loading of the two shackles and the heavily loaded shackle may fail. Inside width of the shackle is 62 (+1.0/-0.0) mm. It is necessary to ensure this dimension is less than the shackle else it will not clear the sides of the stone.

The radius at the corners of the shackle has been increased from 6 mm to 10 mm to reduce undue concentration of stress at this place. The shackles manufactured with 10 mm radius should be printed yellow with two coats of paint to distinguish if from shackles having 6 mm radius. Either ends of the shackles can be used in the spring end or Bush-end of the bracket. It is important that the inside edges of the retainer is made to correct dimensions and the shackle pin hole is drilled at correct locations.

d) MAINTENANCE OF HORN CHEEK & GAP STIFFENER

Both the legs of the horn cheek wear in service. All the six vertical edges along the length of the horn cheek have been given a radius of 1.5 mm.

The lateral play between axle box lug and horn cheek, when the both are new is 20 mm and when worn out is 25mm. The lateral clearance available between spring buckle and horn gap stiffener is 25 mm. In view of this clearance, the Horn cheek must be replaced if reduced to 13 mm in thickness, i.e. worn out by 4.5 mm or when total wear on axle box lug and horn cheek reaches 5 mm to avoid spring buckle coming in contact with horn gap stiffener.

Longitudinally, a total of 12 mm clearance is provided in between the axle box and horn cheeks when new. This clearance, when axle box and horn cheeks are worn out, should not exceed 18 mm or the short leg of horn cheek should not be permitted below 12 mm in thickness.

Special attention should be paid to lateral and longitudinal clearance between axle box and bogie frame, since these clearances govern the above mentioned floating characteristics of the wheel set.

e) MAINTENANCE OF AXLE BOX LUGS

Normally, the faces of the lugs of axle box are not expected to wear fast. However, mainly due to improper alignment of the bogie frame some times wear takes place on axle box lugs. Whenever such wear is noticed, alignment of the bogie should be done as detailed in RDSO's Technical Pamphlet No. G-16 (Rev.2).

Worn out axle box may be reclaimed by using manual metal arc welding of Manganese steel liner (cast or rolled) of 3 mm or 5 mm thickness to the lugs of 3mm or 5mm thickness. In case wear exceeds more than 5 mm. no reclamation should be done.

Condemning size for horn cheek is based on the assumption that wear taken place on horn cheek. When Axle boxes are found to be worn, it has to be kept in mind that horn cheeks will have to be above the condemning dimensions so maximum limit of total longitudinal clearance of 18mm and lateral clearance of 24.5 mm do not exceed.

Whenever wear on axle box lug is more than 1.5 mm on any side, Manganese steel liner of size 6 mm or 5 mm thickness can be welded to the lugs of these boxes. After axle box is restored to its original dimensions. The surface of the axle box lugs should be machined or ground. The mill scale on the liner should be removed either by grinding or by the wire brushing. The liners should be flat and straight. While replacing the old Manganese steel liners by new one, care should be exercised to remove all old welding by chipping or grinding to ensure a smooth surface. The surface of the axle box should be thoroughly cleaned by wire brush. The surface of the axle box lugs and liners should be totally free of oil, grits and grease etc. before the welding is undertaken.

The longitudinal distance between lugs of the axle box is 265 +0 / -0.3 mm. When this distance reduces, the liners should be provided as given below.

Sr. No.	Longitudinal distance between lugs of the axle box	Distance from the centre of axle box to any side	Liner to be used
1.	Between 259 mm to 262 mm	between 129.5 to 131 mm	3 mm thick
2.	Between 259 and 254.7 mm	Between 127.35 mm to 129.5 mm	5 mm thick

The lateral distance of lug from the axle box is 65± 0.0/0.4mm. When this distance reduces, the following liners are to be provided.

Sr. No.	Lateral distance between lugs of the axle box	Liner to be used
1.	Between 62 and 63.5 mm	3 mm thick
2.	Between 60 mm to 62 mm	5 mm thick

The condemning dimensions are as under:

- Longitudinal distance between lugs — Below 254.7 mm
- Longitudinal distance between lugs from the centre of the axle box on side — Below 126.35 mm
- Lateral distance of the lugs from the centre of the axle box — Below 60 mm

Detailed instruction on the procedure of manual metal arc welding of Manganese steel liners to the lugs of axle box is given in RDSO Technical Pamphlet No. WT-77-1 Appendix (VI).

f) SPRING

The spring is designed to give reverse chamber at full gross load and is made to the following dimensions:-

i) Length between Eye centre when straight	=	1200 $\pm$ 3 mm
ii) Width of plate	=	120 $\pm$ 0.6 mm
iii) Thickness of plate	=	16 + 0.32 mm - 0.24 m
iv) Size of Eye	=	36 + 1 mm -0
v) Free camber	=	47 + 6 mm -0
vi) Estimated camber at tare	=	35 mm
vii) Estimated camber under gross	=	- 4 mm
viii) Deflection per ton	=	5.58

The Buckle should be heat shrunk with 875 + 25^{0}C and at 50.8 Tonnes pressure. The maximum variation permitted in the camber of two springs on a bogie truck is 12 mm.

g) HORN CHEEK ASSEMBLY

The axle box horn cheek assembly of Box type wagon have 'L' type lugs on the axle box. The horn cheek assembly consists of the following parts :-

S. No.	Name of Parts	Nos. per Bogie
1.	Sole plate of the Bogie Frame	2
2.	Riveting strip	8
3.	Horn Cheek packing	8
4.	Horn Cheek	8
5.	Horn gap stiffener	4
6.	Countershunk rivets 16 mm dia.	32

602 D. REPAIR AND MAINTENANCE IN SICK LINE

i. Examine and attend the repair of the centre pivot and centre pivot pin. as given in para 603 C(a).

ii. Keep the side bearer clearance between 4 mm to 7 mm by inserting a liner ring (3 mm thick) between the under frame bolster bottom gusset and centre pivot top.

iii. Maintain the side bearer clearance. In service, both the side bearers wear. The bottom side bearer should be built by welding when it is worn out by 3 mm.

iv. Shackle pin and shackle stone to be checked and replaced as given in para 602 C(c).

v. Horn cheek and Gap stiffener to be checked and attended as given in para 602 C(d).

vi. Free camber of spring to be checked. Spring must be changed if it is not as per the specification given in para 602 C(f).

602 E. REPAIR AND MAINTENANCE DURING ROH & POH

In addition to the above repair work attended at sick line, the following additional work is also to be carried out during maintenance at the time of ROH and POH:-

i. Bogie is to be fully dismantled
ii. Wear between the inner surface of the centre pivot bottom and the outer surface of the centre pivot top to be checked and repaired as given in para 602 C(a).
iii. Clearance of side bearer is to be maintained as given in para 602 C(b).
iv. Maintenance of shackle pin and shackle stone to be done as given in para 602 C(c).
v. Maintenance of horn cheek & gap stiffener to be done as given in para 602 C(d).
vi. Maintenance of axle box lugs to be done as given in para 602 C(e).
vii. Spring to be checked as given in para 602 C(f).

For details of maintenance and repair procedures of various components, refer to RDSO publication No. G-16 (Rev.2), July 1978.

602 F. MATERIAL SPECIFICATION OF BOX (UIC) BOGIE

Sr. No.	Description of item	Material
1.	Bogie Sole Plate	8 mm thick plate to specification No. IS2062: ST-42-W
2.	Transom	Top & Bottom plate 12 mm thick; Side Plate 8 mm thick , specification no. IS:2062 : ST-42-WC
3.	Headstock	Channel Section of 200 x 75 x 7.5 mm, specification no. IS:2062 : ST-42-WC
4.	Diagonals	Channel Section of 125 x 65 x 6 mm, specification no. IS:2062 : ST-42-WC
5.	Safety loop bracket	Steel plate 8 mm thickness, specification no. IS:2062 : ST-42-WC
6.	Retaining Ring	Specification no. IS:2062 : ST-42-WC
7.	Bogie Centre pivot Top	Cast steel to specification no. IRS: M-2 CLA Gr I
8.	Bogie Centre pivot Bottom	Cast Steel Class A Gr I to specification No. IRS M2.
9.	Centre pivot Retainer	Steel Class IV to specification no. IS :2004.
10.	Washer Top	Steel ST-42-S to specification No. IS : 226
11.	Washer Bottom	Buna Synthetic rubber or India Rubber to specification No. IRS-B-20
12.	Centre Pivot Bolt	Steel St-42-S to specification No. IS-226
13.	Dust Shield for bogie centre pivot	Mild steel sheet grade “O” to specification No. IS-1079.
14.	Side Bearer (Bottom)	Cast steel class A grade I to specification no. M-2 IS-2004 or Class II ST-42-S to specification No. IS:226.
15.	Side Bearer (Top)	Steel ST-42-S to specification No. IS:226.
16.	Shackle pin	Steel Class IV , M4 (Normalised)
17.	Shackle Stone	Steel class II or class S gr.I to specification No. IS:2004 or IRS-M2.
18.	Spring Shackle	Steel class III to specification No. IS:2004 and normalised
19.	Shackle pin Retainer	Steel class II to specification No. IS:2004 and normalized
20.	Riveting Strip	Plate of 6 mm thickness to specification No. 2062 St-42-WC.
21.	Horn Cheek Packing	20 mm thick plate to specification No. No. 2062 St-42-WC.
22.	Horn Cheek	Steel ST-42-Sc or steel class II to specification

		No. IS:226 or 2004.
23.	Horn Gap stiffener	Steel 42 W to IS: 2062
24.	Packing behind Sole plate	Steel 42 WC to specification No. IS: 2062
25.	Centre Spring Hanger Bracket	8 mm thick steel plate of specification No. IS 3747
26.	Ferrule	Steel 42 WC to specification No. IS: 2062
27.	Bush	Steel class iv to specification No. IRS:M4.

603. CAST STEEL BOGIE

The cast steel bogies are used in BOB wagons.

A. GENERAL DESCRIPTION

The two side frames of cast steel are joined together by a spring plank, which is riveted to the side frames. The floating bolster rests on the nest of springs at either end of the spring plank. The load of the wagon is transferred through centre pivot to the floating bolster and then to the two side frames through the bearing springs. These bogies have thus only secondary suspension.

B. CONSTRUCTIONAL DETAILS

The bogie consists of the following main sub assemblies:

a. Cast steel side frame
b. Spring plank
c. Cast steel floating bogie bolster
d. Bogie centre pivot bottom
e. Bogie side bearer (Top& bottom)
f. Spring nest assembly
g. Spring plate
h. Axle box with side frame

a) CAST STEEL SIDE FRAME

Two side frames are required for each trolley. These act as sole bars in the trolley frame. Both are connected together by a spring plank. The spring plank keeps the two side frames at fixed distance as required in design and three together form the letter “H”. The spring plank also keeps the two side frames parallel to each other and ensures squareness of the trolley.

The side frame casting is hollow. In larger portion it forms a box section and in some portion a "C" section. In the central portion of the casting, there is an opening to accommodate the spring nest and floating bolster. On either end of the casting on top, there is an extended portion called pedestal, which rests over axle box top surface. It has two holes for axle box bolts. On both bottom ends, there is an integrally cast bracket to secure the side frame tie bar. The latter is secured to the frame by three rivets. The bottom portion of the axle box rest on the tie bar. On the inner side of the casting, two brackets are integrally cast in the central top portion to suspend the brake beam hanger.

The bottom surface of the top extended portion and the top surface of the bottom integrally cast bracket meant to secure axle box and tie bar respectively are finish machined. The centre opening, which receives the spring plank and bolster assembly, is filed rough ground at all places except on the top. The four axle box bolt holes in the extended portion are drilled. There are six holes in the central opening at the bottom to secure the spring plank by rivets. There are two holes in each of the integrally cast bracket to rivet the tie bar with it. Each of the four brackets meant to suspend the brake beam hanger has a hole. Bushes have been provided in the holes for wear and tear caused due to the pin.

b) SPRING PLANK

The spring plank is manufactured by pressing the steel plate of required thickness and size. The spring plank connects the two side frames and keeps the latter at a fixed distance. It ensures the squareness and correct alignment of the trolley.

The same type of spring plank is used on the cast steel bogie. The vertical sides of spring plank are attached to the bogie column. In the case of MG bogie, the two brake beam support plates are riveted to the spring plank while in case of BG, a brake support channel is riveted to the spring plank through angle cleats. The brake push rod safety loops are riveted to spring plank in MG bogie while these are riveted to brake support channel in BG bogie.

c) FLOATING BOGIE BOLSTER

The fabricated design of bogie bolster in lieu of cast steel bolster is in use. The fabricated design fulfils all the requirements of cast steel bolster and both are freely interchangeable. The same type of floating bolster is used on diamond frame and casts steel bogie. It is fitted in transverse direction, perpendicular to the track.

It is a hollow casting forming a box section for about 2/3 of its middle length and 'C' section for 1/3 of its length at the ends. Its ends sit on the spring nest through the spring plate. In the centre and on its top surface, bottom centre pivot is fixed with four counter-sunk rivets. Bottom side-bearers are fitted on its top surface at both the ends, each secured with the bolster by two bolts. Similarly bogie top centre pivot and top side-bearers are fitted in corresponding positions on the underframe of the wagons. The portion of the bolster, where centre pivot is fitted, is rough machined and the portions coming in contact with side- bearers are finish-machined. There are four holes in the bolster to rivet the bottom centre pivot and two holes on both ends to bolt the bottom side-bearers with it. Also, at each end, there are two blind holes to receive the nibbed portion of the spring plate. In the centre, an opening is left in the casting to receive the centre pivot pin. The pin goes to about half the depth of the casting.

In the central portion on both the sides, at about half the depth of the casting, four holes have been provided to fit the bogie brake fulcrum bracket with the bolster. One fulcrum bracket is fitted on the bolster towards the buffer end.

d) BOGIE CENTRE PIVOT (BOTTOM)

It is fitted on the top of the floating bolster, exactly in the centre, secured with the latter by means of four counter-sunk rivets. It is finish machined all round at all places except on the four vertical edges of the rectangular flange. There is a central hole to allow the fitment of bogie centre pin through it. The initial diametrical clearance between the hole and the pin is 2 mm. The top surface of the bottom pivot is in concave spherical shape (Radius: MG-710 mm, BG-495 mm). The corresponding convex spherical surface of the top pivot of equal radius rests on it. The vertical central pin like portion of the bottom pivot goes inside the corresponding hollow portion of the top pivot. The side surface of the pin portion is in convex spherical shape (Radius: MG - 115 mm, BG - 225 mm). There are circular grease grooves on the concave & convex surfaces of the bottom and top pivot respectively. The vertical inner edge of the bottom pivot has slight radius at the top. There are four rivet holes near the corners of the rectangular flange.

e) BOGIE SIDE BEARERS (TOP & BOTTOM)

Side bearers are provided on the wagons to limit the rolling movement. Two bottom side bearers are fitted on the bogie bolster, one at each end. Similarly two top side-bearers are fitted in corresponding position on the underframe. The bottom side-bearers are made of cast iron. Its cross section is like a box section with one side having a flange. Its longer edge is curved. It has a long rectangular hole in which oil soaked cotton waste is provided for lubricating the rubbing surfaces. The flanged side has two bolt holes to bolt it with the bogie bolster. Its top and bottom surfaces are finish machined.

It has the same construction as that of bottom side-bearers except that its flanges are inclined instead of being parallel to its bottom surface. The inclination has been given to match the profile of the underframe to which it is fitted.

The prescribed clearances for the side-bearers are as under:

	Clearance in one side	Total Clearance
New	**3 mm Nominal**	**6 mm**
Worn	**6 mm Maximum**	**12 mm**

As wagon body does not always rest horizontally, side-bearer clearances should be measured on both the sides by feeler gauge. Action should be taken on the basis of total clearance.

f) SPRING NEST ASSEMBLY

Spring nest assembly consists of two spring plates, four outer and four inner coil springs. The bottom spring plate rests on the spring plank. The nibbed portion of spring plate sits in the two holes provided in the spring plank. This arrangement keeps the spring plate in position. There are four washers riveted to each spring plate at suitable locations. At each of these locations, one inner and one outer coil spring is placed. The raised portion of the spring plank (made by riveting the washer) prevents displacement of the coil springs. The inner coil has opposite hand to the outer coil. On the top of these coil springs, the top spring plate rests. On the top surface of the top spring plate, the floating bolster is placed. In the floating bolster, there are two holes at each end to receive the nibbed portion of the top spring plate.

g) SPRING PLATE

h)

It is made out of steel plate. On the outer side, it is bent at right angles. There are four holes at a suitable distance to rivet washers with it. Washer is made of steel. In the central position, the plate is nibbed at two locations. The nibbed portion sits against the holes in the spring plate/floating bolster and prevents the displacement of coil spring in service.

Generally four nests of springs are required on each side of the bogie/trolley. The number may vary with heavier axle load bogies. The same type of springs are used in the diamond frame and cast steel bogies. Each nest consists of an outer coil spring and an inner coil spring of circular section. The outer spring has left-handed coils while the inner one has right-handed coils. These springs are made of spring steel hardened and tempered. After manufacturing, the "IRS" part no., Maker's name and year of manufacture should be stamped as specified in the standard drawing while the spring is hot.

h. COIL SPRING

The spring shall be manufactured as per the schedule of Technical Requirement for hot coiled helical springs WD-01-HLS-94 (Rev. I May, 95 with latest amendment) by the spring manufacturers approved by RDSO. Procurement of spring steel shall be done only from reputed manufacturers approved by RDSO. Only spring steel bars duly inspected and passed by RDSO shall be used for manufacture of springs.

TABLE 6.2

IMPORTANT DIMENSIONS OF COIL SPRING

Type	Coil Dia. (mm)	Free ht. (mm)	Height in mm Load (Tonnes)							Home ht. (mm)	Defle-ction per tonne in mm
			½	1	1.25	2	3	4	5		
MG											
Outer Drg.No. W/BE-816	26	252	-	239	-	226	213	-	-	195	13
Inner Drg.No. W/BE-761	14	252	229	207	-	-	-	-	-	191	45
BG											
Outer Drg.No. W/BE-606	30	225	-	217.5	-	210	202	194.5	187	180	7.6
Inner Drg.No. W/BE-607	16	225	211	197	190	-	-	-	-	180	28

i) AXLE BOX WITH SIDE FRAME

There are two bolt hole on each axle box to fit it rigidly with the frame. On both longitudinal ends, there are two projections in axle box casting, one on the top and another at the bottom. One common bolt hole is centrally drilled through both these projections. The outer surface of the projection is finish machined. The top surface of the projection rests below the corresponding machined surface of the extended portion of the side frame in case of cast steel bogies and below the bottom arch bar in case of diamond frame bogies. The bottom surface of the bottom projection presses the machined surface of the tie bars in both type of trolleys. The bolt passes through these holes connecting the three parts together and holds them rigidly. Two locking plates are inserted in each bolt, one after the bolt head on the top and the other before the nut in the bottom. After tightening the nut fully, the locking plates are bent at right angles against the edges of the nut/bolt head to prevent turning of nut or bolt.

On diamond frame bogies, in order to facilitate proper fitment of the axle box, the transverse edges on the top projections are chamfered to 3 mm x 45 degree on both sides as per latest modification.

603 C. MAINTENANCE OF SUBASSEMBLIES

a) MAINTENANCE OF CAST STEEL SIDE FRAME

It is very important that the axle box holes are drilled at correct distance from the centre of the casting. Also centre distance of the holes meant for the same axle box should be correct. Holes meant for riveting the spring plank should be correctly located and marked in the side frame as well as in the spring plank otherwise this will not give correct bogie alignment. After and before riveting, the holes alignment should be checked and corrected, if necessary. Similarly, after assembly of the tie bar, its alignment should be checked before final riveting it with the casting. For alignment, it is necessary to check whether the axle box bolt holes in the side frame & tie bar are in the same line and top and bottom holes are in alignment with each other. It should also ensured that tie bar is horizontal & parallel to the top surface and at correct distance from the top surface. The longitudinal edges of the tie bar should also be parallel to the top edge of the side frame otherwise, box will not fit properly.

At the time of POH as well as in sick line, side frame should be examined for cracks, distortion, excessive pitting etc. During POH, longitudinal, transverse and diagonal distances of the journal centres should be checked to ascertain the squareness and correct alignment of the trolley. The permissible variation is 3 mm in longitudinal and diagonal distances, and 2 mm in transverse distances. If the variation extends beyond these limits, the defects should be rectified.

During POH the central distance of axle box holes and the diameter should be checked. Normally wear takes place in the hole. However the holes should be built up by welding & drilled to correct distance, when the dia exceeds by 2 mm above the nominal size. The steel bushes in the bracket of the brake beam hanger should be checked for wear and replaced when dia exceeds 0.75 mm above the nominal size. The rivets of the spring plank and tie bar should be checked for soundness. It should be replaced if found unsound. The alignment of the tie bar with corresponding top surface and side frame should be checked If found defective, it should be rectified.

There is one drain hole in each of the top extended portion and two in bottom central portion of the side frame. During POH and in service, these holes should be cleaned and kept clear.

b) MAINTENANCE OF SPRING PLANK

It is important that the holes meant to secure the Cast Steel frame and Diamond frame bogies respectively are drilled correctly to ensure squareness and proper alignment of the trolley. Before finally riveting the squareness and alignment should be checked. In service, the spring plank is prone to corrosion and excessive pitting. The extent of pitting should be assessed at the time of POH. If necessary, the spring plank should be replaced.

c) MAINTENANCE OF FLOATING BOGIE BOLSTER

It is important that machining of the casting in the portion where the bottom pivot & side bearers fit is done correctly. Similarly corresponding surfaces of the top pivot and side bearers fitted on the under frame should be correctly machined. Four holes both in the bottom pivot and bolster should be drilled at correct distances otherwise there will be difficulty in matching the two parts. The two holes on either side for fitting the bottom side bearer should be drilled at correct distance from the centre of the bolster failing which necessary clearance to facilitate turning of bogie on curved track and matching with the corresponding top side bearers will not be possible.

It has been experienced in few cases that correct distances are not ensured. It should also be ensured that the two blind holes meant to receive the nibbed portion of the top spring plate are at correct distances. Also the centre line of the four vertical legs provided on each end of the casting (integrally cast) which fit in the side frame at about half the depth should be at correct distances from the centre line of the bolster. If these two conditions are not fulfilled there will be difficulty in assembling the bolster, in the side frame and the spring nest assembly. All the above important distances and points given should also be checked at the time on POH and if they are not up to the requirement, suitable corrective action should be taken.

After manufacture the casting should be thoroughly examined for distortion, cracks blowholes and thin-sections etc. Those found suitable should only be processed for machining At the time of POH as well as on open line they should be examined against cracks, distortion and excessive pitting etc. and suitable action should be taken as the case may be. The four blind holes meant to receive the nibs of the spring plate if found over should be brought to original dimensions be building up & re-drilling. All 4 rivets of the bottom centre pivot should be checked for soundness and replaced if found unsound. Similarly the side bearer bolts should also be checked against slackness, breakage etc. and should be renewed if found with these defects.

d) MAINTENANCE OF BOGIE CENTRE PIVOT

It is important that four rivet holes are drilled at correct distances to ensure its riveting with the bolster without any difficulty. It is important that the bottom & top centre pivots are finish machined to accurate sizes otherwise there will be difficulty in mating the corresponding parts.

The clearance between the central pin portion of the top pivots which plays main part in transmission of forces should not exceed the prescribed limit, otherwise the outer edges of the bottom and top pivots will be called upon to transmit the force. In service therefore, the maximum diametrical wear on the central vertical surface of the bottom pivot should not exceed 3 mm. in dia . In corresponding hollow in the top pivot 1 mm. The pivots should be replaced if clearance exceeds above limit.

During service wear takes place on the concave and convex spherical surface of the bottom and top pivots respectively thus reducing the side bearer clearances. In service minimum clearance should be ensured otherwise the transmission of the weight of the body will be through these surfaces which is not desirable. Also there will be obstruction in turning of trolley relative to the body. The workshops should turn out wagon at least with a minimum clearance as prescribed. This will permit sufficient wear up to next POH corresponding to permissible variation in side bearer clearance. The total wear on the pivots is not likely to exceed 3 mm in between the two POH of the wagon. The difference between actual clearance and initial clearance gives the total wear on the concave and convex surface of the bottom and top pivots.

The wear on concave and convex surface of the pivots is generally uneven. At the time of POH, these surfaces should be rough ground and their spherical shapes should be restored as for is possible. For checking the spherical profile standard gauge should be used. The rivets of top and bottom pivots should be checked for soundness and renew if required, pivots should also be checked for breakage and cracks.

e) MAINTENANCE OF BOGIE SIDE BEARER

In service, side bearer clearance increases due to wear of bottom and top pivots and increases on account of wear on rubbing surfaces of top and bottom side bearers. To adjust side bearer clearance step size liners of 1 mm and 3 mm thickness should be used in workshop and sick lines after loosening the bolts, the liners should be inserted below the bottom side bearers and then the bolts should be tightened up. Workshops should run out wagon stock with side bearer clearance of 4 to 5 mm on one side.

There is no necessity to insert liner on topside bearers. If the adjustment is not possible with insertion of liners, top and or bottom side bearer should be replaced as the case may be.

While machining both top and bottom side bearer height should be adjusted to give correct relative height of bogie centre and side bearers within tolerance provided.

At the time of POH and in the sick lines, care should be exercised to fill side bearers pockets with soaked cotton waste and sufficient oil to ensure adequate lubrication during service. Also bolts should be checked for slackness and breakage.

To prevent turning out of nut and consequent loosening of bolts, the fitting has been modified. A split pin is to be fitted after the nut by making corresponding holes in the bolt.

f. MAINTENANCE OF SPRING PLATE

It has to be noted carefully that four rivets are countersunk on the outer side so that it properly rests upon the spring plank and floating bolster. It is important that four holes meant for riveting the washer and the nibbed portion are kept at correct distances else there would be difficulty in assembling the coil springs.

During POH, it has to be ensured that the plate is not excessively corroded, the rivets are not loose and the nibbed portion is maintaining its correct shape. In case of excessive corrosion, the spring plank may be replaced. If the rivets are loose, these should be renewed. If the nibbed portion is not maintaining correct shape, it should be restored to correct shape.

g. MAINTENANCE OF COIL SPRING

It is recommended that springs having less than 3 mm free height variation should be assembled in the same group. Mixing of new and old spring must be avoided. If any spring is found broken or cracked, it should be replaced. The condemning dimensions of inner and outer springs are given below;

Gauge	Free Height	Condemning Height
MG	**252**	**246**
BG	**225**	**219**

603 D. REPAIR AND MAINTENANCE IN SICK LINE

i. Side frame should be examined for cracks, distortion and excessive pitting etc.

ii. The side bearer bolts should also be checked against slackness breakage etc. and should be renewed if found with these defects.

iii. To adjust side bearer clearance step size liners of 3 mm thickness should be used in sick lines after loosening the bolts. The liners should be inserted below the bottom side bearers and then the bolts should be tightened up.

iv. Care should be exercised to fill side bearers pockets with soaked cotton waste and sufficient oil to ensure adequate lubrication during service. Also bolts should be checked for slackness and breakage

603 E. REPAIR AND MAINTENANCE DURING ROH & POH

The following additional work also to be carried out during maintenance at the time of ROH and POH including the above repair work at sick line:-

i. Bogie is to be fully dismantled.

ii. Side frame should be examined for cracks, distortion, excessive pitting etc.

iii. Longitudinal, transverse and diagonal distances of the journal centres should be checked to ascertain the squareness and correct alignment of the trolley.

iv. Central distance of axle box holes and the diameter should be checked. Holes should be built up by welding & drilled to correct distance, when the dia exceeds by 2 mm above the nominal size.

v. The steel bushes in the bracket of the brake beam hanger should be checked for wear and replaced when dia exceeds 0.75 mm above the nominal size.

vi. The rivets of the spring plank and tie bar should be checked for soundness. It should be replaced if found unsound.

vii. The alignment of the tie bar with corresponding top surface and side frame should be checked If found defective, it should be rectified.

viii. There is one drain hole in each of the top extended portion, and two in bottom central portion of the side frame, these holes should be cleaned and kept clear.

ix. Maintenance of spring plank is to be done as given in para 603C(b)

x. Maintenance of floating bogie bolster is to be done as given in para 603C(c)

xi. Maintenance of bogie centre pivot is to be done as given in para 603C(d)

xii. Maintenance of bogie side bearer is to be done as given in para 603C(e)

xiii. Maintenance of spring plate is to be done as given in para 603C(f)

603 F.MATERIAL SPECIFICATIONS FOR BOGIE ITEMS (CAST STEEL BOGIE)

Sr.No.	Description of item	Material
1.	Cast steel side frame	Cast Steel class “C” grade 2 Specification No. IRSM2 and R- 13.
2.	Spring Plate	Steel plate to specification no. IS:226
3.	Floating Bogie Bolster	Cast Steel class “C” grade 2 Specification No. IRSM2 and R-13
4.	Bogie Centre pivot Bottom	Cast Steel class “A” grade 1 Specification No. IRSM-2 duly normalize
5.	Side bearer	Cast Iron grade 20 to Specification No. IS : 210
6.	Spring Plate	Steel plate to Specification IS:226
7.	Spring	Spring steel to specification No. IRS: R-2

604. DIAMOND FRAME BOGIE

These trolleys are used on BFR wagons.

A. CONSTRUCTIONAL DETAILS

These trolleys are made of three steel frames riveted to each other. The bogie consists of the following main sub-assemblies:-

a. Fabricated side frame including vertical column
b. Spring plank
c. Cast steel/fabricated floating bogie bolster including centre pivot and side bearer assembly.
d. Spring nest assembly.
e. Axle box assembly
f. Wheel set assembly
g. Bogie brake gear

Item b, c & d mentioned above have already been covered in cast steel bogie construction in Para 603 B.

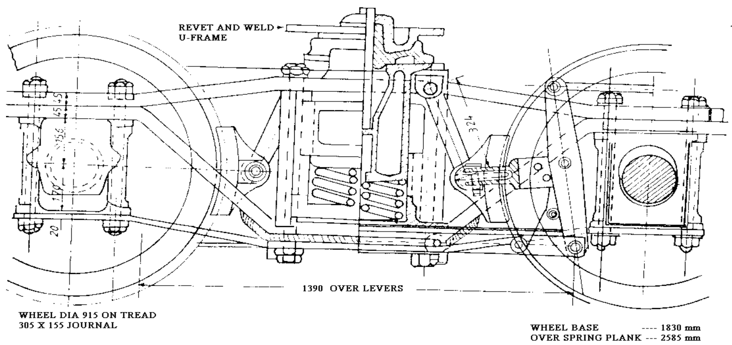


Fig 6.3 DIAMOND FRAME BOGIE

a)

I. FABRICATED SIDE FRAME

It is an alternative version of cast steel side frame. It consists of top and bottom arch bars connected together by a tie in between. These are kept in position by axle box bolts and column bolts. In the central position on each side frame, two vertical columns are provided to maintain the distance between the top and bottom bars and to receive the spring nest assembly. The distance and squareness between the two side frames is maintained by spring plank. The vertical sides of the spring plank are secured with each column by two rivets. The column in turn is secured with top and bottom arch bars and tie bars by column bolts.

II. COLUMN

There are two columns on either side of the bogie frame, one is left handed and another right handed. Each of them contains two holes through which the column bolt passes. It has an integrally cast bracket at the top to suspend the brake beam hanger. The column and the spring plank are riveted together. The inner rivet is counter sunk as per latest modification to avoid the possible infringement with the brake beam and brake block assembly. Its top and bottom surface, where top and bottom arch are connect are finish machined. Its surface around the rivet holes is also finish machined. The two columns are kept at sufficient distance to accommodate spring nest assembly and connect it at proper locations with the spring plank.

The radius of column at bottom outer side on MG stock is 12 mm. It has now been increased to 16 mm, to avoid its infringement with central radius portion of the unmodified tie bars. As per latest modifications, the centre of the radius of the tie bar which is 38 mm have been shifted towards the end by 3 mm. Where modified tie bars are used, the radius of the column need not be increased.

III. TIE BAR

Tie bar is made of 250 x 32 mm flat in MG Bogies and 150 x 45 mm flat in BG bogie. Recently in order to remove the bogie column over the radius portion of tie bar, the centres of the radius has been altered.

IV. STRENGTHENING BAR

Due to large scale breakage of MG tie bars mostly at the bottom and top bends, a strengthening plate 10 mm thick and 125 mm wide has been provided at the bottom surface of tie bar. It covers the entire bottom and the radius portion of the bottom bends of the tie bar. The strengthening plate is secured with the tie bar by fillet welding at all the four edges. In the middle portion of the strengthening plate, two holes have been provided to plug weld it with the tie bar. Strengthening bar of section 125 x 22 mm is provided in the case of BG 22.9t bogie.

Very recently, the length of the MG tie bar has been increased from 1740 mm to 1830 mm. In the increased length portion, one square piece 32 mm thick and 126 mm long is required to be fillet welded at outer edge and two side edges. Similar modification has also been carried out on BG 22.9t bogie.

V. TOP ARCH BAR

It is made of steel flat. Its width and thickness are 150 x 32 mm for MG. For BG 22.9t bogie, it is 150 x 45 mm & for 16.2t bogie, it is 150 x 40 mm. In the central position, the plate is bent upward. At four bends, suitable radius is provided. Two holes have been provided for column bolt and four holes for axle bolts. While manufacturing, care should be exercised that the holes are drilled at correct locations.

The ends of the top arch bar rest on the end of the tie bar and the central portion upon the top of the column. These are secured together by axle box bolt & column bolts.

At the time of POH, if the dia holes are found exceeding 2 mm above the nominal dia, it should be built up by welding and re drilled to correct size. Normally no wear takes place on these holes. It should be checked for breakage and cracks and loss of off set. Arch bar found with these defects, should renewed/repaired. There are hardly any case of breakage or cracking of top arch bars.

VI. BOTTOM ARCH BAR

It is made of flat steel. Its width and thickness are 150 x 16 mm for MG. For BG 22.9t & 16.2t bogie the bottom arch size is 150 x 20 mm. It has two holes for column bolts and four holes for axle box bolts. At four bends suitable radius have been provided. It is important that the holes are drilled at correct locations.

The central portion of bottom arch bar is placed below the bottom surface of the tie bar (below the strengthening bar, where fitted). The end of the arch bar mate with the bottom surface of the axle box. Assembly is kept together by means of 2 column bolts and four axle box bolts.

On MG arch bar, the offset was 22 mm. When strengthening bar below tie bar was introduced as a modification, the off set was increased from 22 mm to 32 mm. As an interim measure where it was not possible to alter the off set of the top arch bar, packing plate of 10 mm thickness was permitted between the bottom arch bar and axle box. This interim arrangement is not permitted now. As it is economical and easier to alter the off set of the arch bar, practice of putting packing plate between axle box should not be resorted to.

At the time of POH, if the holes are found to exceed 2 mm in dia above the nominal dia, it should be built up by welding and holes should be drilled to correct size. Normally no wear takes place on these holes. At the time of POH and in service, the bottom arch bar should be checked for cracks breakage and loss in off - set. If these defects are found, it should be renewed/ repaired. There are hardly any case of cracking or breakage of bottom arch bar.

VII. BOGIE SPRING PLANK PACKING

Four numbers are required for each trolley. It is placed between the vertical side of the spring plank and column and these are secured together by rivets. Each packing plate has two rivet holes. The rivet holes should be drilled at correct locations. Packing plates are provided only if necessary on diamond frame bogies. It gives enough space for inserting and withdrawing the floating bolsters to and from the side frame.

e. AXLE BOX WITH SIDE FRAME

This is identical to Cast Steel Bogie axle box and side frame covered earlier in this chapter.

604 B. REPAIR AND MAINTENANCE IN SICK LINE

i. The tie bar should be checked for crack/breakage. Cracked tie bars should be changed.

ii. The column should be checked for cracks distortion etc. and necessary replacement/repairs should be done.

iii. The rivets should also be checked for cracks/breakage and slackness and renewed.

iv. The brake beam hanger bracket bushes should be checked for wear and be replaced if necessary.

v. Repair of Top & bottom arch bar to be done as given in para 604 A (a) V, VI..

604 C. REPAIR AND MAINTENANCE DURING ROH & POH

In addition to all the work mentioned above in para 604 B, the following work is also to be carried out in ROH & POH :-

a. The column should be checked for cracks, distortion etc. and replacement/repairs should be done. The four rivets should be checked for cracks/breakage and slackness and renewed.

b. It is important that the rivets and bolt holes are drilled at correct locations otherwise there will be difficulty in assembling the parts and ensuring correct alignment.

c. The brake beam hanger bracket bushes should be checked for wear and replaced if dia exceeds 0.75 mm above the nominal size. The dia of hole for the column bolt should be checked if exceed with nominal size by 2 mm, the holes should be built up by welding and drilled to correct size.

d. It is important that the off set of the tie bar is correct and the two projected portions are parallel to the bottom side. The profile of the tie bar should be checked with a master template.

e. Four axle box bolt and two column bolt holes to be drilled at correct distance from the central portion failing which correct assembly will not be possible.

604 D. MATERIAL SPECIFICATION (DIAMOND FRAME BOGIE)

Sr. No.	Description of item	Material
1.	Column	Casting made of steel to IRS M-2 Grade 1
2.	Tie Bar	150 x 45 mm flat and to specification no. 2062 St.42W (for 22.9 t bogie) 150 x 40 mm flat and to specification no. 226 St.42S (for 22.9 t bogie)
3.	Strengthening Bar	Flat steel 42-S to specification No. IS :226
4.	Top Arch Bar	Flat steel 42-S to specification No. IS :226
5.	Bottom Arch Bar	Flat steel 42-S to specification No. IS :226
6.	Bogie Spring Plank packing	Flat steel 42-S to specification No. IS :226

605. SUSPENSION

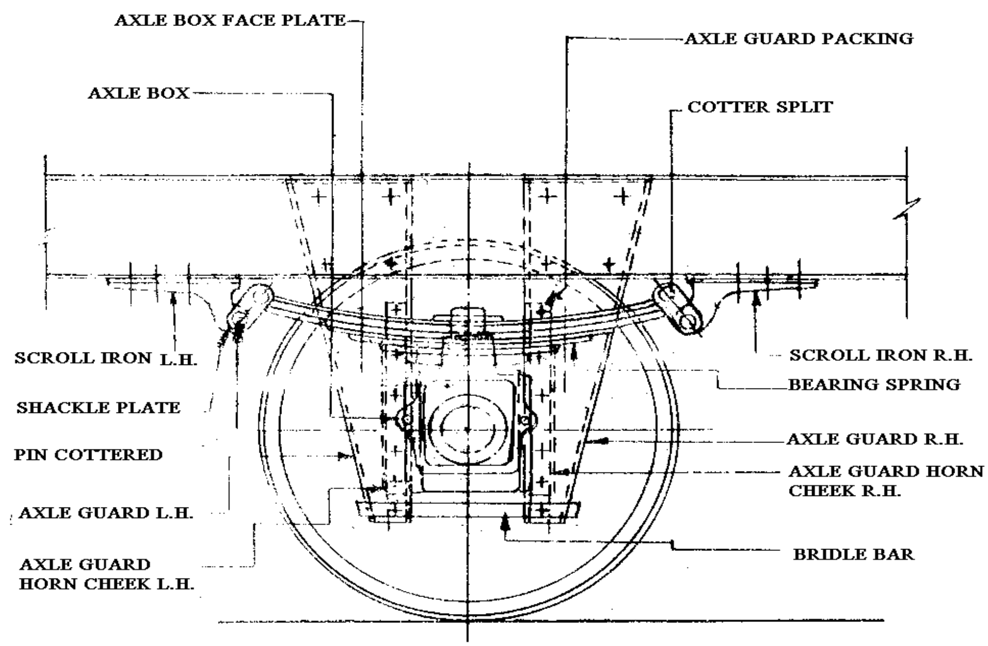
A. GENERAL

The suspension of a wagon includes the wheels, bearings, axle boxes springs, spring links and spring brackets/scroll irons. In the case of 4 wheeled wagons, the suspension is mounted directly under the wagon underframe whereas in the case of bogie stock, the under frame is carried on the bogies which in turn is supported by the springs, bearings and wheels.

The suspension system is required to cushion the vibrations of a vehicle due to irregularities in the track and other dynamic conditions owing to various parasitic movements of the vehicle.

B. FOUR WHEELER SUSPENSION

In four wheeler wagons the load is transmitted in the conventional arrangement via the sole bar, scroll iron, shackles or shackle plates to the springs and axle box, axle box key plates and bearing journal.



SUSPENSION ARRANGEMENT OF 4-WHEELER WAGON

Fig. 6.4

The individual elements of four wheeler suspension are listed below:

Sr. No.	Name of the part	No. per assembly
a)	Scroll Iron	One RH & One LH
b)	Shackle pins	4
c)	Shackle plates	4
d)	Bearing Spring	1
e)	Shackle pin Washers	4
f)	Split Cotters/bulb cotters	4

a) SCROLL IRON

The Scroll iron is forged out of class II steel to IS-1875. It is secured to the bottom flange of the sole bar by means of 3 rivets.

The following defect may arise in scroll irons in service:-

(i) Rivets loose, deficient or broken
(ii) Scroll iron cracked or broken
(iii) Scroll iron shifted out of alignment
(iv) Eye hole worn over size or oval

Defects mentioned against item (i) to (iv) are rejectable defects. On noticing any of these defects the wagon should be marked sick and sent to sick line for repairs. The wagon should not leave workshops, wagon depots and NPOH depots with these defects. To determine quality, it has to be kept in view that the maximum permissible diametrical clearance between the scroll iron and shackle pin during service is 4 mm and 1.05 mm when new. If clearance more then 4 mm is noticed, the shackle pin should be replaced. Scroll iron should also be replaced.when the eye hole diameter exceeds 1 mm above the upper nominal size(viz 29.65 mm for BG 23.65 mm for MG).

The scroll iron may be repaired by electric welding & normalising in the workshop. The workshop code and date of welding must be stamped on the upper surface of the scroll iron close to the weld.

b) SHACKLE PIN

100% Shackle pin is made of steel class III. In view of the large scale breakage of shackle pins on M.G. stock, RDSO vide their letter No. MW/SNG/W dated 1.1.1976/10-3-76 have recommended the use of class IV M-4 steel instead of class III M-4 steel for MG only. Shackle pin is manufactured out of bars by forging process followed by normalising. Since Jan.'73, stamping on the top of the pin head of IRS part No., manufacture's initial, manufacturing month and year in 3 mm type has been introduced. Since December 1975, stamping as class IV on shackle pins manufactured out of class IV steel for M.G only has also been introduced Scroll iron and spring eyes are connected through shackle plates provided on either end of the eyes. One shackle pin connects the shackle plates with scroll iron and another shackle pin connects it with spring eye.

Shackle pin is a highly stressed part and its breakage and failure are very common. It should receive top most attention in workshops and in open lines. The following defects may arise or get noticed in service:-

- worn out in dia beyond permissible limits
- broken/cracked
- bent
- deficient or of wrong size
- having excessive lateral clearance in its assembly
- manufactured out of sub standard material

When new, diametrical clearance between the scroll iron and shackle pin, shackle plate and shackle pin should not exceed 1.05mm and between the spring eye and shackle pin should not exceed 1.15 mm. The maximum diametrical clearance permissible for the above is 4 mm. The lateral clearance when new should not exceed 1.5 mm and the maximum possible is 6 mm.

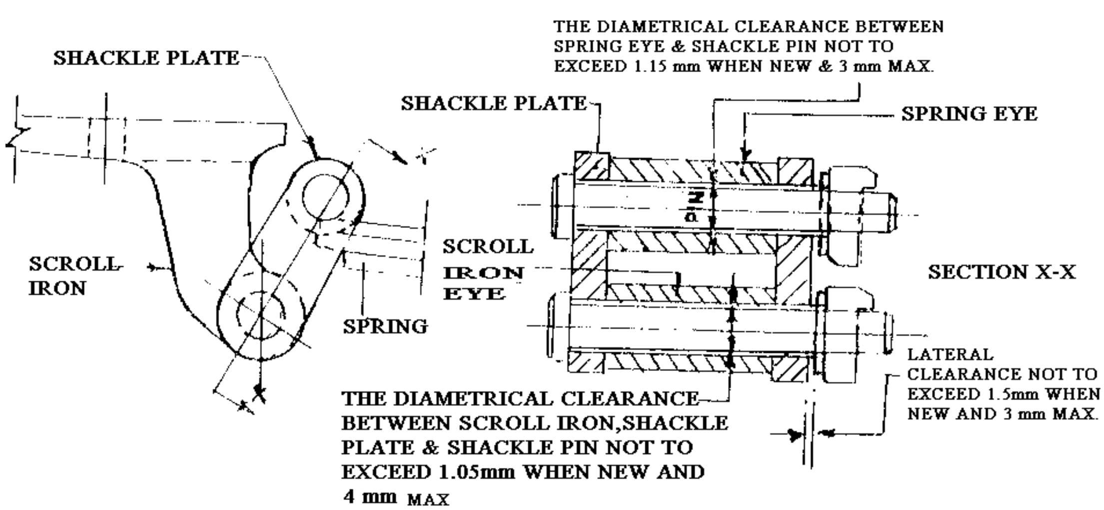


Fig. 6.5 SCROLL IRON AND SHACKLE PLATE

If the clearances are found beyond permissible limits; the shackle pin, shackle plate and scroll iron should be replaced as the case may be.

The shackle pin normally be replaced when it is worn out 1 mm in dia. below the lower nominal size viz, at 26.6 mm for BG and 20.6 mm for MG. Broken/ cracked, deficient and wrong size shackle pins should be replaced/made good. Bent shackle pins should also be replaced. It is difficult to detect shackle pin manufactured out of wrong and sub standard material. In case of doubt, it should be sent to metallurgical laboratory for test and if necessary, the whole lot should be rejected. While manufacturing, 2 mm radius at the root of the head and 4 mm at the inner corners of the cotter hole should be ensured. The same should also be checked during service. In absence of there radii shackle pin will be prone to breakage. At the time of POH in the workshop, shackle pins must be replaced. Old shackle pins should be inspected and those up to & above 27 mm dia. for BG and 21 mm dia for MG and also suitable otherwise should be normalised and handed over to store department for open line use.

c) **ACTION TO BE TAKEN BY CMT**

i) He will make a regular programme to examine the shackle pins being procured from trade to ensure that the pins have been manufacture from correct material and specification and that there is no manufacturing defect.

(ii) For the purpose of examination, every purchased lot along with the purchase order, particulars and firm address detected that they are correct to the sizes. Matter to be brought into the notice to Depot Officer, Works Manager, Controller of Stores and CWE.

(iii) In case the pins are manufactured in Railway workshops. CMT should test a sample in raw material in advance to ensure that the correct raw material is being used for manufacturing the pins. The manufacture of shackle pins tested and certified fit by CMT.

d) SPRING SHACKLE

Spring shackle is a rectangular shaped plate made of steel 42-S to specification No.:IS 226 Its thickness for B.G is 25 mm and for M.G. is 20 mm. It is rounded at both the ends having two holes near the ends to receive the shackle pin. It is generally manufactured by profile gas cutting or by punching out. Two such plates are fitted one on each side of the scroll iron and spring eye. Shackle plate, eyes of the scroll iron/spring followed by shackle plate. The shackle pin is kept in position by washer and split cotter. This arrangement ensures transmission of load from scroll iron to spring providing adequate flexibility to the spring to move in relation to the wagon body.

Except elongation of holes no other defects are noticed on shackle plates in service. However, shackle plate should be examined visually for cracks/failures on open line and in workshops and replaced if these defects are noticed. Limits of clearances given should be observed. Shackle plate should normally be replaced when the eye hole dia exceeds 1mm above the upper nominal size viz., 29.65mm for BG and 23.65mm for MG. The distance between two holes of shackle plate, the diameter of the holes of shackle plate, the diameter of holes and the radius of 2mm on either end of the holes are very important. These dimensions should be ensured /checked while manufacturing and in service. If 2mm radius is not provided it will be difficult to ensure correct lateral clearance in shackle pin assembly.

e) WASHER

It is made of steel St 42-S to specification No:IS:226. On BG M-27 and on MG M-22 (and now M/SN-750) washer are in use. Its thickness is 4mm (and now 6mm in case of MG). It is fitted just after the shackle plate (outer) covering the radius portion of the cotter slot, ensuring correct fitment of split cotter in the slot. The washer ensures proper grip and minimises wear on the shackle plate. Use of two washers to make up the gap is not permitted. Worn out washers should be replaced as and when required.

f) SPLIT BULB

It is fitted in the cotter slot of the shackle pin just after the washer. It keeps the shackle pin secured in position and prevents its working out of the assembly. It is made of steel to specifications no:IS 2636 and IRS part drawing no: WD 94068-S/1 item 1 suitable for use on 20 to 28 mm dia pins. In service cotters are found to be broken deficient or wrong size, not split properly and some times fitted not in correct position. In the first three cases the cotter should be replaced and in the last two cases, it should be fitted properly or replaced where necessary.

g) SPRING

It is a laminated bearing made out of a number of spring steel plates of different lengths fastened together in the centre by means of buckle and other fastenings. Plates are nibbed at suitable locations or have “rib and groove” section. On some BG springs a few plates are clamped together near both the ends by means of clips and its fastenings. Similar clamping has been recently been introduced on MG spring also. The top plate is rolled at the both ends to form an eye which receives the shackle pin.

Bearing spring is a medium of transmitting wagon weight including consignment to the axle box. Any defect in the bearing spring would lead to undesirable loading of axle box and the bearing brass resulting in derailment or hot box. Bearing springs on both the ends are connected with the wagon underframe through the shackle pins, shackle plates and scroll iron. The central portion sits on the axle box crown.

Springs are manufactured/ repaired in the workshops. It involves proper heat treatment, inspection and testing. The springs should not be repaired on open line where adequate repair facilities does not exists. On open line, inspection and checking of camber of springs should be done, and defective springs should be replaced.

There are various types and sizes of springs in used on wagons, as different types of wagons were put on line from time to time. It is not possible to describe all types of spring here. Only standard types of springs are being described here. The factors causing difference in springs can be broadly classified as under:

(i) **Difference in material of plate**

They can be broadly classified as oil hardening and water hardening quality as indicated below.

Sr. No.	IS Spec. No.	Equivalent IR specification	Part	Grade	Type of steel	Quality
1	3885*	M-11	I	4	Silico manganese steel	Oil hardening quality
2	3885**	M-11	II	4	Silico manganese steel	Oil hardening quality
3	3885	M-11	I	3	Silico manganese steel	Water hardening quality
4	3885	M-10	I	1	Carbon spring steel	Water hardening quality

*-Used on all standard wagons except those given against Sr. No. 2.
**-Used on Std. BOX, BCX, BOI, BRH & BRS types of wagons using UIC type of bogies and BG 4 wheeled 16.3 tonnes axle load wagon (except for top plate).\

(i) Difference in thickness and the length of the plates, number of plates used and number provided. In many designs of springs top plate is thicker than the other plates.

(ii) Method of securing the plates. Material specification of standard spring.

The material specification of the parts used in manufacturing springs for standard wagons are as under:

Sr.No	Name of the part	Specification
1	Spring steel flat	Already given above
2	Buckle (a) BG (b) MG	 Steel class II to IS :1875 & R-66 should be normalised after welding. (i) St. Class I for smithy weld (ii) St Class I or II for electric weld (iii) St Class II for without weld.
3	Spring buckle key	Steel ST 42 S to IS:226
4	Clip	Steel ST 42 S to IS:226
5	Ferrule	Steel ST 42 S to IS:226
6	Rivets of different sizes	IS:1148

h. REJECTABLE DEFECTS

The following are the rejectable defects in springs:

i. Any plate of laminated bearing spring cracked or broken.
ii. Bearing spring buckle loose, broken, cracked and/or packing plated loose or deficient.
iii. Any plates of buckle are displaced form its central position by 13mm or more.
iv. Bearing spring buckle not sitting square in the axle box housing or crown packing when fitted.
v. Incorrect type of bearing spring for particular design of wagon.
vi. Bearing spring eye or shackle plate touching the sole bar.
vii. On meter gauge wagon bearing shoe fractured or with a rivet bolt or stud broken or deficient or bolt stud or wrong size.

The following additional defects are also noticed in service:

i. Loss of spring camber
ii. Biting marks on rolled eye portion. There should be gap of 2mm between rolled and upper surface of the top plate other wise this may raise the stress and lead to fracture of the spring along the dent marks.
iii. Uneven bearing of pins on spring eye: this is due to use of worn out pin and may lead to fatigue crack or sudden fracture.
iv. The gap between any two plates exceeding beyond 0.5mm.

v. Lateral and diametrical clearance exceeding permissible limits. Spring should normally be replaced when the eye hole dia exceeds 1 mm above the upper normal size viz. 29.75 for BG and 23.75mm for MG.

vi. Wagons over and unevenly loaded or with shifted loads causing over stressing of spring and difference of cambers. This may cause failure of spring and or derailment.

NOTE:

(i) The goods stock is allowed to be over loaded beyond maximum carrying capacity inclusive of loading tolerance to the extent shown below subject to conditions laid down in IRCA Rules Pt.III 2000 edition.:

	Four wheeler wagon	Bogie wagon
BG	2	4
MG	1	2

(ii) It has to be carefully noted that the overloading of tank wagons is not permitted. Also BOX, BOI, BRS, BRH, BCX, BOBX type BG bogie wagons and nonstandard BG BFRS are not allowed to be over loaded.

i. GRADING OF SPRINGS

Camber of spring plays a important part in the stability of wagons. Under ideal conditions, the camber of all the four springs used on the wagon should be equal and they should have the same load deflection characteristics. However it is not possible to manufacture springs of equal cambers. A variation of spring camber up to 5 mm and 6 mm for MG and BG respectively from the nominal size is permissible for new spring. In order to ensure that all the four springs of the wagons have almost equal camber, the springs are devided in four groups according to the camber. While fitting springs on wagons in the workshops and open line, it should be ensured that as far as possible, all should be of same group or one group higher or lower. The workshops shall ensure that after manufacture / repair testing and measuring of camber, the spring should be marked by paint on the buckle as A, B, C and D, as the case may be. Following type of springs are commonly used:

BROAD GAUGE

Sr. No.	Type of springs	Free camber	Plus 2mm	Plus 4mm	Plus 6mm
		A	B	C	D
1	10 plated IRS type of BOX BCX type wagons etc.	47	49	51	53
2	13 plated IRS type for 4 wheeled wagon, 16.3t axle load (now being replaced by SK73560)	76.2	78.2	80.2	82.2
3	13 plated IRS type to Drg no. SK73560 for 4 wheeled wagon, (16.3t axle load)	75.5	77.5	79.5	81.5
4	9 plated laminated spring to Drg. No. WD-87024-S/1 used on CRT wagons.	58	60	62	64

METER GAUGE

SN	Type of springs	Free camber	Plus 1.5 mm	Plus 3mm	Plus 5mm
		A	B	C	D
1	7 plate IRS type for 4 wheelers wagons	50.8	52.3	53.8	55.8
2	7 plate IRS type for non standard wagons	76	77.5	79	81
3	9 plate IRS type for non standard 4 wheelers and 6 wheelers wagons	86	87.5	89	91
4	9 plate for IRCA type wagons	51	52.5	54	56

605 C. PROCEDURE FOR MANUFACTURE, REPAIR, TESTING & INSPECTION OF SPRINGS IN THE WORKSHOP

a. The correct procedure for manufacture of laminated bearing springs has been prescribed in Board's letter No: 76//M(W)/814/43 dated 12.3.64 and 3.6.68 RDSO letter no: M&C/STC/2/1 dated 26.3.75 and MW/II/Springs dated 18.7.77 (approved V, and IRS specification RS-68). The pamphlet "Laminated bearing spring failures- description classification and reporting" issued by RDSO in 1969, with a corrigendum in 1972, contains useful information on the subject and should be consulted.

b. All spring will first be given a scrag test and also their camber will be checked. Facilities for these two checks should be provided in the lifting shop so that the springs, which pass both these tests, need not be transported to the smithy/spring shop. The springs fail to these test should be taken to smithy/spring shop where it should be dismantled and scrag plate visually examined for presence of any surface defects such as cracks, corrossion, pits, dent marks etc. Those which are free from these defects should be re-heat treated (hardnened and tampered) under controlled conditions. The defective plates, if found, should be replaced by new once, properly heat treated. The assembled spring should be given scrag camber tests.

c. Re-tempering of spring

I. For restoring lost tamper, it is necessary to first re-harden the plate.

II. Water Hardening: The plates should be at a temperature of 810°C to 840°C at the time of quenching. If in resetting the plates to the required camber, the temperature drops below this limit, the plates should be re-heated. For quenching the plate should be dipped edgewise taking care that the plate is kept horizontal. The plate or the quenching medium should be kept vigorously agitated. The plate should be withdrawn when it has cooled down.

III. Oil hardening: The plate should be at a temperature of 840°C to 870°C. the dipping of the plate should be done in the same manner as for water. The quenching medium would be quenching oil of an approved brand. The oil temperature should be prevented from rising abnormally be a water jacket in which water should be freely circulated. Aeration for the quenching oil would help in keeping down the temperature and also in keeping the oil in a state of agitation.

IV. Tempering.: For tampering the correct temperature is even more important than hardening. A salt/lead bath maintained between 380°C to 420°C for water hardening quality, and between 450°C to 500°C for oil hardening quality spring steel should ensure plates being tempered uniformly.

V. Temperature control: Hardening and tempering furnace should be provided with automatic pyrometric control to ensure correct hardening and tempering temperature.

VI. Rolled eye: It should be ensure that there is a minimum gap of 2mm between the rolled end and the upper surface of the top plate. This is necessary to prevent the end bearing hard against the top plate when the spring is deflected.

VII. Indentation: The malpractice of cold hammering of spring plate, as a result of which indentations are left should be seriously avoided as the indentations are potential stress raisers.

d) SCRAG TEST

a) Measure camber.
b) Press the spring home, six times.
c) Re-measure camber. The loss of camber must not exceed half the thickness of the top plate.

e) Load deflection Test

At least 5% of C&W springs must be subjected to load deflection test.

605 D. CAUSES FOR FAILURE OF SPRINGS

The spring may fail in service for reasons described below. Action/ precautions to be taken in each case are being indicated item wise:

i. Incorrect composition of material: Different grades of steel plates some times get mixed up. It should be avoided.

ii. **Abnormal surface de-carburisation**: This results in initiation of progressive cracks and hence reduction of spring life. This should be avoided during manufacture/repair.

iii. Incorrect hardness of the plates: Brinell hardness of the plate should be within the specified limit. For heat treated laminated spring plates to IS 3885, range is 380-420. In case the hardness is beyond specified limit of material used, the spring plate should be re-heat treated.

iv. **Sharp edges of nib/groove**: These act as stress raisers during service, causing cracks to originate from them. Sharp edges, if any, should be removed by grinding or other means. Nibbing tool should be properly chamfered to avoid sharp edges.

v. Biting marks at the rolled eye portion: Biting marks act as stress raisers leading to fracture along the dent marks. A minimum gap of 2 mm should be ensured.

vi. **Punch marks on plates**: These marks, particularly on tension side of plates, act as stress raisers during service and lead to early failure of springs. No punching should be done on spring plates.

vii. **Accidental injury to plate:** Sharp dents or notches caused during manufacture or in service act as stress raisers and reduce the life of spring. It should be avoided during manufacture/ repair. If necessary, plate should be replaced. If such defects come to notice in service spring should be replaced.

viii. **Quenching cracks:-**These are usually caused by (a) inadvertent use of wrong grade of steel for a given heat treatment procedure, (b) too drastic a quenching medium, (c) high hardening temperature, (d) insufficient soaking period, (e) surface defects such as seems laps, cluster of non-metallic inclusions occuring at or near the surface, (f) sharp grooves or dents on surface. In service, they act as stress raisers resulting in premature failure. Due care should be exercised during manufacture.

ix. Corrosion:- Corrosion occurs either locally or throughout the section in the form of small shallow pits (pitting corrosion). These act as stress raisers under alternating stress conditions during service. Such plates should be rejected during repair/manufacture. If springs with corroded plates are noticed in service, they should be replaced.

x. Other causes: The following causes may lead to either fatigue crack formation or sudden fracture (a) uneven loading of wagons, (b) uneven bearing of pins on spring eyes due to use of worn out pins, (c) lateral shifting of spring plates due to slackness of buckle.

Wagons unevenly loaded should not be allowed to run in service. Worn out pins should be replaced. Spring with shifted plates beyond limit should be replaced.

605 E. CAUSES FOR FAILURE OF BUCKLE

The buckle may fail for following reasons. Action to be taken has been indicated against each item:

i. Wrong materials: Correct material of buckle should be used.

ii. Poor welding: When buckles are made by bending flat to shape and are welded at the ends, welding should be sound and without defects.

iii. Overheating: At the time of heating for buckling ensure that they do not get overheated or over soaked both of which will cause brittleness in the steel.

iv. Larger buckle: (a) Too large a buckle compared to the cross sectional dimensions of the spring assembly results in folds being formed on the buckle especially at the corners which may open up immediately after or in service (b) Rigid inspection should be done while manufacturing. Buckles with such defects should be rejected.

v. Cold buckling: (a) Ensure correct temperature during buckling since cold working gives rise to crack/residual stresses resulting in cracking up of the buckle immediately after or during service. Insufficient buckling pressure or temperature can also cause the buckle to shift. (b) Ensure rigid inspection during manufacture/repair.

vi. Sharp corners: The edges of the packing or keyplates and the bottom plates should be grounded to a smooth radius. It prevents the formation of sharp corners in the buckle that may result in tearing of buckle or act as stress raiser in service.

vii. Excessive nip on plate: Ensure that excessive nip between plates is not provided to prevent building up of additional tensile stresses tending to crack the buckle either during manufacture or in service.

605 F. IMPORTANT Do's & Don'ts DURING REPAIR OF SPRINGS

Do

i. Ensure a minimum gap of 2 mm between the rolled end and upper surface of the two plates. .
ii. Ensure that the eye holes are laterally parallel within the specified dimension, smooth and free from burrs and are not bell-mouth.
iii. Ensure that stamping and punching is done on spring buckle only and not on plates.
iv. Ensure correct diametrical and lateral clearances in shackle assembly as explained above.
v. Ensure proper seating of bearing spring buckle in axle box housing or crown packing where fitted.
vi. All plates shall be so fitted that a 0.5 mm feeler should not enter the gap between the plates.

Don't

i. cold hammer plates and buckle: this results in indentations which are potential stress raisers.
ii. rough handle, springs.
iii. allow a spring in service with biting mark at the rolled eye.
iv. permit a wagon to be in service with sole bars resting on bearing spring buckles.
v. allow a spring in service with plate or buckle displaced from its central position by 13 mm or more.
vi. allow wagon to run, which are unevenly loaded/over-loaded or have shifted loads as explained above.
vii. allow a difference in excess of 13 mm in working camber between any two springs on a loaded wagon.
viii. allow springs in service with cracked or broken plate/plates.

605 G. AXLE BOX CROWN PACKING PLATE (SPRING SEAT)

It is made of steel 42-S to IS:226. It is used for raising the buffer height of wagons lost due to reduced wheel dia. It also makes good the height lost due to reduced brass thickness loss in camber of springs and reduced journal dia. It is placed on the top of the axle box crown. The spring buckle rests over it. The shape of packing plate is made to suit the shape of axle box crown and the spring buckle. Depending upon the height of the buffer to be raised, different step sizes of plates are used. On BG stock, the step sizes of plates raise the height by 11, 26, 37 mm as per IR part Drg. No. W/SN 1460, 1616 & combination of 1460 & 1616 respectively. On MG stock, step-size spring seats raise the height by 9, 19, 6 & 35 mm as per Drg. Nos. W/SM-1462, 1461, 1421 and combination of W/SN-1462 and 1421 respectively.

It should be ensured that packing plate sits properly on the axle box crown and the spring buckle rests properly over it and there should be no chance for them to come out of the crown.

605 H. AXLE GUARD HORN CHEEK ASSEMBLY

On 4 Wheeled stock, the axle guards are provided to keep the axle boxes in their correct aligned position. They are riveted to the sole bars except in MG weighted brake vans. On latter, use of bolts is permitted. The distance between the centres of the axle guard on the same side of the wagons is kept equivalent to the required rigid wheel base.

The axle guards are subjected to wear on the inner portions due to the relative movement between axle guard and axle box grooves in service. On portion where wear takes place, horn cheeks have been provided on the axle guard. After reaching condemning limit the horn cheeks can be replaced at lesser cost as compared to replacement of complete axle guards.

The axle guards are of various types and sizes, standard being the IRS and IRCA types. Axle guards get seriously damaged on account of hump or rough shunting. IRS type axle guards are built up of pressed steel and are robust in construction. Incidence of breakage in service of IRS type of axle guards is much less as compared to IRCA and other types.

To avoid widening of the axle guards jaw in service, a bridle bar is riveted to the axle guard at the lowest position. One end of the bridle bar is riveted to the left hand and the other end to the right hand leg of the axle guard. The two jaws of the axle guards on either side of the axle box are connected by bridle bar at the bottom and thus the widening is prevented.

The axle guard, horn cheeks and bridle bar are described below.

a) AXLE-GUARDS (PRESSED STEEL TYPE)

For one axle box, one right handed and one left handed axle guard is required. It is made of steel plate (8 mm thick for MG & 10 mm thick for BG) to specification IS: 3747 and pressed to shape. Its inner edge is vertical and the outer edge is inclined. Its top and bottom edges are horizontal. Its shape is like a trapezium having two right angles. The plate is bent at right angles along the vertical and inclined edges forming a channel. The bent side on outer edge has a tapering width, maximum at the top and minimum at the bottom. Similarly, the bent side at the inner edge has tapering width from top up to about half the height and thereafter, uniform width up to the bottom. Both the bent sides have been chamfered at the top at an angle of about 45 degrees.

There are ten rivet holes on MG & 11 on BG on each axle guard leg. The bottom hole/holes is/are meant for riveting briddle bar with axle guard leg. Its dia is 17.5 mm (for 16 mm rivet) starting from top two holes in the vertical row and 2/3 holes on the indicated row are meant to rivet the axle guard with the sole bar. The 3rd rivet hole in case of BG and 3rd & 4th rivet hole in case of MG, from top of the first row are chamfered on outer face of the axle guard to enable use of countersunk rivets, thus preventing infringement of bearing spring with axle guard rivets. The horn cheek is riveted to axle guard with a packing plate in between them through 3rd to 6th rivet hole in case of BG and 4th to 7th rivet hole in case of MG. In case of MG, the packing plate is riveted through the third rivet hole in addition.

The bridle bar is riveted to the axle guard through the 8th rivet hole in case of MG and 7th & 8th rivet hole in case of BG. In addition to the above, BG axle guards are further secured with the bottom flange of the sole bar channel by an angle cleat. Angle cleat is riveted to the sole bar and axle guard by three rivets on its each side.

It is very important that the $10/11^{th}$ rivet holes are correctly drilled otherwise it will cause difficulty in securing the axle guard with the sole bar, horn cheek packing plate and bridle bar with axle guards.

b) AXLE GUARD (LEG TYPE IRCA)

It is made of steel plate Grade ST 42-S ‘A’ to specification No. IS:226. It has a vertical leg with a sloping arm branching upwards from about 1/3rd distance from the bottom. The sloping arm after certain distance is again bent to become vertical and parallel to the main vertical leg. All the three arms are made out of one plate with vertical arm and sloping arm close to each other. After cutting the sloping arm is hot bent to required shape. The important sizes of MG axle guard are :-

Thickness of the plate -	20 mm (MG)	25 mm (BG)
Width of the vertical leg -	70 mm (MG)	115 mm (BG)
Width of the small vertical & sloping arm -	57 mm (MG	102 mm (BG)
Dia of rivet holes	8 of 21.5 mm for 20 mm rivets(MG)	10 of 24 mm for 22 mm rivets (BG)
Dia of bottom rivet hole for bridle bar -	11.5 mm for 16 mm rivets.	

There are 7/8 rivet holes in the main vertical arm and 2/3 in short vertical arm. The bottom most rivet hole in the main vertical arm is meant for bridle bar, 2/3 rivet holes of the small vertical arm. Corresponding 2/3 rivet holes of the small vertical arm and corresponding 2/3 rivet holes in the main vertical arm are meant to rivet axle guard with the sole bar. The remaining four rivet holes in the main vertical arm are meant to rivet the horn cheek. Unlike pressed steel type, right handed and left handed axle guards legs are not required in this case.

c) HORN CHEEK

It is a "L" shaped piece made of steel to IS: 226 or IS: 1875 for wagon stock. One left-handed and one right-handed horn cheek is required for one axle guard. (On coaching stock, in addition to steel, cast iron Grade 17 horn cheeks are also used. Care should be exercised so that cast iron horn cheeks meant for coaching stock are not used on wagon stock). It is finish machined all over except on vertical edge of long leg and top and bottom surfaces. The shorter leg is fixed perpendicular to the track and the longer leg is riveted with a packing plate in between them. The top-most rivet is countersunk having chamfered edge on the outer surface of the axle guard (not on horn cheek). The horn cheeks have two suitable recesses on the top and one at the bottom. It is important that the rivet holes are drilled at correct locations. The important sizes of horn cheeks are :-

	MG	**BG**
Thickness	12 m	19 mm
Leg Size	82 x 36(+0.5/-0.0) mm	95x45 mm
Height	317(+0.0/-3) mm	419(+/-3) for CI and 406 for steel
Rivet hole dia	21.5 mm for 20 mm rivets (for both)	
Distance of centre line of rivet holes from bent corner	47 mm	57 mm

d) TIE BAR (BRIDLE BAR)

It is made of steel to specification No. IS: 226. BG Axle Guard tie is of angle section having rivet holes 2 at each end. MG tie bar made out of a plate and its ends are bent at 90^o and are inclined to match the inclined edge of the axle guard leg. It has 2 rivet holes one on either end. The bridle bar is riveted on either end to the jaws of left handed and right handed axle guards respectively. The turned ends of the bridle bar does not allow the bridle bar to fall in case one of the rivets break, because the same remains sticking with axle guard leg. The important sizes for Tie bars are :-

	MG	BG
Thickness	12 mm	ISS50 50X6
Dia of rivet hole	17.5 mm for 16 mm rivets	

e) AXLE GUARD PACKING

It is made of steel plate to specification No. IS:226. The size for BG is 586 x 75 x 10 mm & for MG is 387 x 55 x 12 mm thick. One edge out of 4 has a radius (6 mm on MG) (10 mm on BG). It is rectangular plate having 5 rivet holes. Distance from the rounded edge is 28 mm for BG and 27 mm MG. The dia of rivet holes is 21.5 mm to suit 20 mm rivets. This piece is fitted between the Axle Guard and horn cheek of pressed steel type axle guards.

605 I. CLEARANCES AND REPAIRS OF AXLE GUARD ASSEMBLY

The axle guards must be fitted true & square with the sole bar. The lateral and longitudinal clearances when new and at the time of POH and the maximum limit, have been given below ;

Clearances	When New	At the time of POH in Workshops (Max.)	Maximum Limit
Lateral	6 mm	8 mm	10 mm
Longitudinal	3 mm	6 mm	Has not been laid down excepting that the axle guard leg should not work to out of the axle box groove.

Though the maximum longitudinal clearance has not been laid down, yet action should be taken to replace the worn out parts, viz., horn cheeks, axle box liners when this clearance reaches 8 mm. Non-detection of excessive clearance will throw the axle guard out of axle box grooves or make the axle box and bearing brass to cant, which is a dangerous condition. To ensure that the longitudinal and lateral clearances on horn cheeks are within limits ‘not go gauge’ and ‘wear limit gauge’ for condemning the horn cheeks should be used.

Bent and expanded axle guards are an undesirable feature and result in displacement of brass from its correct aligned position. The lateral clearance between the axle guard and axle box groove should be uniform throughout the entire length and an axle guard binding the groove at the top and free at the bottom or vice-versa must be rectified. There should be a free relative movement between the axle guard and axle box. Bent, twisted or expanded axle guards will not permit the foregoing movement.

To fulfil the above conditions, it is essential that the axle guards should be perpendicular to the sole bar, both on its side and main face. At the time of POH at least 5% underframe of wagons above 10 years age should be checked for alignment and squareness. The method of checking alignment of the under frame and the squareness of the axle guards have been shown in Fig. 6.6. The tolerances permitted at the time of manufacture have also been shown. These tolerances should be within limits.

The following defects should be specially checked at the time of POH :-

1. Slack rivets
2. Misalignment
3. Cracks/Breakages

a) REJECTABLE DEFECTS

The specified rejectable defects are as under:-

i. Axle guard worn or expanded sufficiently to permit either leg to work clear of its groove in the axle box.
ii. Any portion of the axle guard horn cheek broken or deficient beyond the limit.
iii. Axle guard so bent as to prevent free movement of axle box.
iv. Any crack on leg type axle guard extending through the section more than 25 mm unless repaired in accordance with methods prescribed below.
v. On Broad Gauge wagons leg types axle guard cross-racing without a full component of six rivets or with one or more rivets broken or deficient or wrong size.
vi. Pressed steel axle guard cracked unless repaired according to methods prescribed below.
vii. One or more rivets deficient or broken or of wrong size.
viii. Axle Guard fitted with one or more bolts.

(Note: On Metre Gauge weighted brake van axle guards will be allowed with bolts).

ix. Any axle guard leg shaking due to slack rivets.
x. One or more rivets broken or deficient in horn cheek.
xi. Bridle broken or deficient.
xii. Bridle without jaws or turned ends.
xiii. Bridle of a section less than 4 sq. inch. Thickness less than 13 mm.
xiv. Bridle of wagon not secured by rivets or with a rivet deficient or broken.

MANUFACTURING TOLERANCE FOR UNDERFRAME

1. Difference between longitudinal axle guard centre (A1-A2) is not to exceed 3 mm.
2. Difference between Transverse axle guard centre (B1-B2) is not to exceed 3 mm.
3. Difference between diagonals of axle guard (C1-C2) is not to exceed 3 mm.
4. The difference between specified and actual distance of the centres of the scroll iron (D) should not to exceed plus 1 mm.
5. The distance between the centre of the scroll iron and axle guard should not be more than 1 mm.

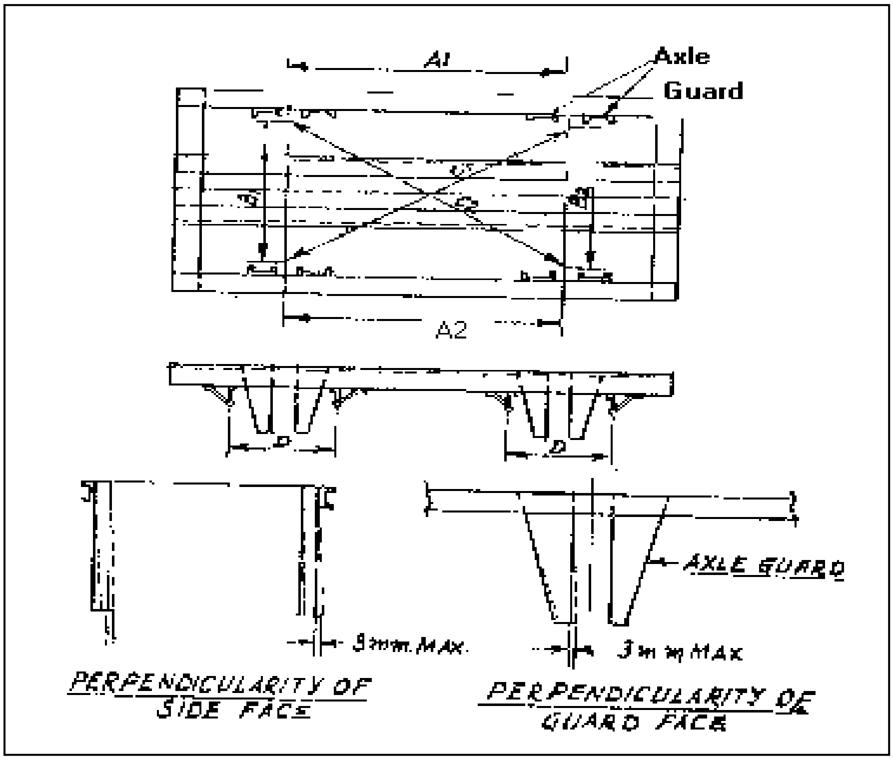


Fig. 6.6 SQUARENESS OF AXLE GUARD

b) AXLE GUARD REPAIR

Axle guard should be checked for cracks, mis-alignment and slack rivets. In service, the rivet holes of the sole bars and axle guards get elongated, resulting in slack rivets and mis-alignment. Where necessary, the hole must be built up and should drilled to correct size ensuring proper alignment.

For repairing the cracked axle guards, following methods have been laid down:-

- **Oxyacetylene welding** - on leg type of axle guards only.
- **By patching only** - on leg type axle guards only.
- Electric Welding by grafting a new piece preferably **flash butt welding** - only on leg type axle guards.

- **Electric welding** only - on leg type axle guards and upto 25 mm length of crack on pressed steel axle guards.
- **Electric welding with patch** - only on pressed steel axle guards having cracks more than 25 mm and up to half width of the section. If crack length is more than half, the width of the section on pressed steel axle guards, it should be scrapped.

In addition to the methods, prescribed above, the following conditions should be ensured while repairing the axle guards :-

I. PRESSED STEEL AXLE GUARDS

For repair method given above at item No. (v), cracked area should be supported by mild steel patch plate of 10 mm thickness. It should be electrically seam welded on the reverse side of the axle guard covering the entire cracked portion, except the portion covered by the packing plate or horn cheek.

II. LEG TYPE AXLE GUARDS

(i) One axle guard leg should not be welded at more than two places.

(ii) When cracks more than half the width of the section or repaired by welding the station code and date should be stamped close to the welded spot.

(iii)If repairs are done as per method prescribed in item (v), it should be confirmed to workshops or approved maintenance depots with following conditions :-

- The original axle guard and make up piece should be of weldable quality with low carbon content.
- The edges to be welded should be prepared to double VEE, except in the case of flash butt welding.
- The weld should be ground flush. The cross section of the welded portion should be rectangular. Crater and under cuts should be avoided.
- Make up piece should be obtained preferably from a plate by oxy-cutting. If hot bending, make up piece is necessary. It should be ensured that no cracks or gathering of material takes place.
- The shop code and date of welding should be stamped on new piece close to the weld.

(iv)Repair by patching should be adopted only when the length of the crack is up to half width of the section. The minimum thickness of the patch plate should be 10 mm and equal to the width of the section being patched and should be secured with a minimum of 4 rivets of 16 mm dia. Where it is not possible to flush the patch with the inner edge of the axle guard, the patch may be extended to include 2 rivets in the leg and 2 rivets in the sloping arm. The patch should be only on one side of the axle guard. On one leg, the number of patches should not be more than one.

(v) The Broad Gauge leg type of axle guards, if repaired by welding or patching, should be provided with cross-bracing.

III. WELDING OF MANGANESE STEEL LINERS ON ROLLER BEARING AXLE BOXES.

The procedure to be followed at the time of welding manganese steel liners on axle boxes will be as under :-

(i) **Process** - Only manual metal arc process with RDSO approved brand of electrodes suitable for welding Manganese Steel should be used.

(ii) **Weld Position** - The welding shall be done in down hand position.

(iii) **Electric current characteristics** - The current used shall be direct current (D.C.) keeping the electrode positive and the work piece negative. The current value should be according to the electrode manufactures recommendations.

(iv) **Fit up and Welding Technique**

- Prior to welding, the liners shall be clamped squarely in place to hold them flat against the housing. Clearance between liners and the prepared lug surface before and after welding shall not exceed .006” (0.152 mm).
- Care must be taken to prevent cracking of liners.
- Clamp the liners, check the dimensions/alignment, adjust if required and tack weld if correctly aligned.

IV. The axle box body (casing) should be either preheated or immersed in water as detailed below:-

Procedure No. 1 : Pre-heating method –

- The axle box casing should be preheated uniformly to about 250^{o}C-300^{o}C before welding is undertaken and then placed in position to facilitate down hand welding.
- On completion of welding the axle box casing should be allowed to cool in still air.

Procedure No. 2: Submersion under water –

The axle box casing should be immersed under water in a suitable container duly earth. The level of the water should be such that only guide portion (lug) requiring welding remains above water-level.

V. Care should be taken to avoid heat build up. Factors within the control of the welder to reduce the heat build up of the base metal are :-

- Holding a short arc
- Short welding periods
- Lowest possible current
- Use of smallest diameter electrode (consist at) with thickness of the section to be welded
- The temperature of the material should not exceed 200^{o} C at a distance of ½" from the weld.

VI. A slight convex fillet weld profile is desirable.

VII. To eliminate cracking at starts and stops of weld, proper welding techniques shall be adhered to. The arc shall be struck slightly forward in the weld path and then the arc moved to the welding area. By this method, the arc strike will be re-welded when reached. Weld crater cracking will be eliminated by pausing at the end of the weld bead before with drawing the arc. All craters shall have the same throat thickness as the weld bead.

VIII At no time shall the arc be struck of the face of Manganese Steel liners or axle box casing except on those parts of the parent metal where weld metal is to be deposited.

IX. Welding current and manner of depositing of weld shall be such that there is no under cutting, cold laps or porosity, cavities, slag inclusions and other deposition faults.

X. Any weld cracking porosity or cold laps shall be ground to sound metal and re-welded.

XI. Electrode Care

- Electrode shall be stored in the original packets/cartons in a dry place and adequately protected from weather effects. If special protection during storage is recommended by the manufacturer of the electrodes,these shall be stored in accordance with the conditions detailed by the manufacturers.
- Drying oven shall be provided to ensure that the electrodes used are perfectly dry and free from moisture.
- Electrode effected by dampness but not otherwise damaged may be used after being dried out in a manner approved by electrodes, the

same shall be dried out at temperature of 150^{o} C and maintained at that temperature for minimum period of half an hour as specified by the manufacturer.

Attention :- Electrodes must be kept dry after the original packet/carton has been opened and those which have been subjected to drying treatment .

- Electrodes, which are as of the flux covering broken away or damaged shall be discarded.
- Precautions must be taken by the welder to maintain the low moisture content. He must protect the electrode from exposure to rain humidity and other possible moisture pick-up.
- where the high humidity exists, the welder shall obtain from the drying oven, the amount of electrodes in accordance with his rate of usage for a period of two hours.
- The detrimental effect primarily in causing porosity and or causing in the weld metal and heat effected zone (under bead cracking).

Inspection

i). All welds shall be visually inspected.
ii) Any cracks porosity blowhole shall be repaired.

Repairs

Weld repairs shall be made to either Manganese liners welds by first removing defective area by grinding to reach sound metal and re welding in accordance with procedure detailed above.

605 J. ROLLER BEARING AXLE BOXES

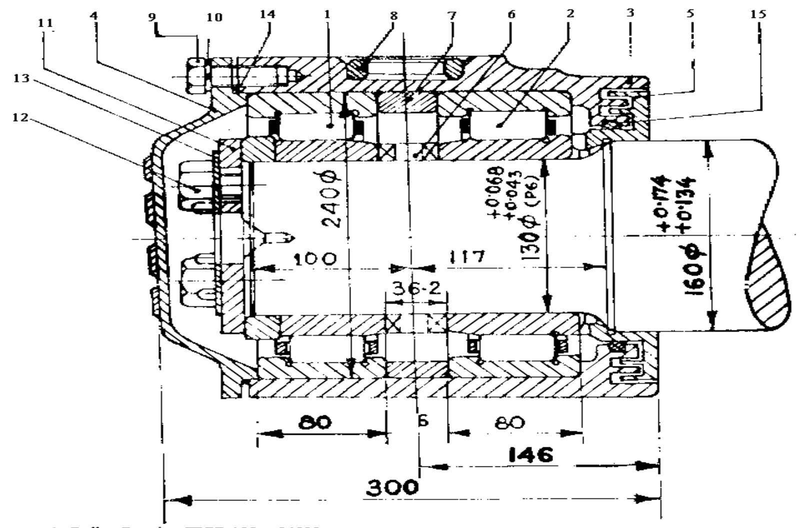
The type of Roller Bearing Axle boxes fitted on BG wagons are as under:

Sr.No.	Type of Bearings	Axle Load	Type of wagon on which fitted
1.	Cartridge Taper Roller Bearing	20.3/22.9 t	Wagon stock fitted with Cast Steel Bogies
2.	Cylindrical Roller Bearing	22.9 t	BOX,BWT/A, BOBX-MK-II, BWT (Jessop & Cimmco)
3.	Cylindrical Roller Bearing	20.3 t	Wagons fitted with UIC Bogies & CRT wagons
4.	Spherical Bearings	22.9 t	BOBS (German), BOBS(ISW) BWT(German)
5.	Spherical Bearings	20.3t	BWL Imported
6.	Spherical Bearings	18.1 t	BWS (Swiss)
7.	Tapered Roller Bearing	18.7	BWS (Japan)

8.	Tapered Roller Bearing	16 t	TCL Imported

The diagrams indicating main components of cylindrical roller bearing and cartridge tapered roller bearing are shown in Fig 6.6 A & 6.6 B respectively.

Normally roller bearing axle boxes will not need any attention from POH to POH.



1. Roller Bearing WGP 130 x 240M
2. Roller Bearing WJ 130 x 240 M.
3. Axle Box Body
4. Front Cover
5. Labyrinth Ring
6. Journal Distance Ring
7. Housing Distance Ring
8. Bush
9. Hexagon Screw M 16 x 40 L
10. Spring Washer M 16 STD.
11. Axle Cap
12. Hex. Hd. Screw M 22x 60
13. Locking Plate
14. Sealing Ring
15. Gelt Ring

Fig. 6.7 A - ROLLER BEARING AXLE BOX

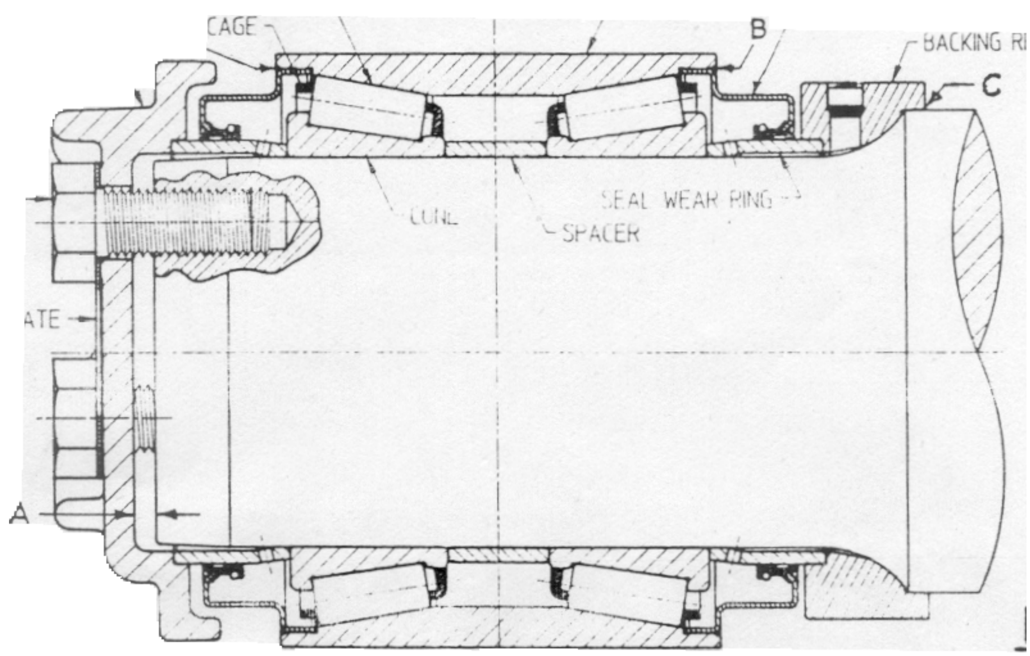


Fig. 6.7 B - CARTRIDGE TAPERED ROLLER BEARING

605 K. IMPORTANT Do's & Don'ts DURING POH

a) Do's

i) At every POH , all the Roller bearing axle boxes fitted on BG freight stock shall be attended as per maintenance manual listed below:-

- G-81- Instructions for Inspection and Maintenance of CTRB fitted on Cast steel bogies
- WT-77-1- (1st rev.1985)- Instructions for Inspection and Maintenance of 20.3 Tonne Cylindrical roller bearing fitted on wagons
- WT-79-1 (1st rev.1987)- Instructions for Inspection and Maintenance of 16.3 Tonne Cylindrical roller bearing fitted on wagons

ii) Inspect the roller bearings and axle boxes after all parts are thoroughly cleaned and dried.

iii) Pay particular attention to inner and outer races, surfaces of rollers, rings and cages.

iv) Discard all parts with cracks without exception.

v) Replace the bearings, having reached the condemning limits.

vi) Protect all parts of bearings, after cleaning, against corrosion with a coat of preserving oil.

vii) Replace all seals and gaskets.

viii) Proper tools should be used. Improvised tools should not be used. Use of cotton waste is prohibited.

ix) The Roller bearing section should be adequately protected, glazed and provided with pucca paved floors.

x) Protect the roller bearings and axle boxes mounted on axles before the wheel-sets are sent for tyre turning by dummy faceplate.

xi) Charge fresh grease of approved Brand and recommended quantity in the axle boxes, before mounting.

xii) Change the wheel set fitted with roller bearing whenever a warm/hot box is detected.

xiii) Short circuit the roller bearing while carrying out welding repairs on the bogies or wagon-body fitted with roller bearings.

xiv) The date of POH & Shop code shall be stamped on the axle box.

xv) Axle-Cover bolts of cylindrical RB axle boxes should be fitted with the locking washers on the line unless otherwise stipulated.

b) Don'ts

(i) Cleaning with compressed air is totally prohibited.

(ii) All locking washers/plates used for locking the bolt/nuts in the 'Axle-Cap' and 'Front Cover' should never be used twice and should invariably be replaced at the time of POH/ROH.
(iii) Do not over-charge the grease in the axle boxes.
(iv) Do not recharge the grease in between the two POH.
(v) Do not open the roller bearing axle boxes in sick line /Yard, except for the specified examination/attention at the nominated sick line.
(vi) Do not carry out any welding on the wagons, without earth the bogie frame/wagon body.
(vii) Do not carry out any welding on the axle box during POH, except for provision of manganese liners under special precautions, as stipulated.

605 L. REPAIR AND MAINTENANCE IN SICK LINE

a) The Scroll iron is to be checked for

i. Rivets loose, deficient or broken
ii. Scroll iron cracked or broken
iii. Scroll iron shifted out of alignment
iv. Eye hole worn over size or oval

The repairs should be done as given in para 605 B (a)

b) Shackle pin is checked and to be repaired as given in para 605 B (b)

c) Cotters found to be broken, deficient or wrong size, not split properly and some times jib not in correct position. In the first three cases the cotter should be replaced and in the last two cases, it should be fitted properly or replaced where necessary.

d) Spring to be examined and repaired as given in para 605 B (h)

e) The buckle to be examined and repaired as given in para 605 B (e)

f) Wagons unevenly loaded should not be allowed to run in service. Worn out pins should be replaced. Spring with shifted plates beyond limit should be replaced.

605 M. REPAIR AND MAINTENANCE DURING ROH & POH

The following additional work also to be carried out during maintenance at the time of ROH and POH including the above work mentioned at para 605 L.

i. All spring to be given a scrag test and their camber should be checked..
ii. At least 5% of springs must be subjected to load deflection test.

iii. Important Do's & Don'ts for spring as given in para 605 F to be followed.

iv. It should be ensured that packing plate sits properly on the axle box crown and the spring buckle rests properly over it and there should be no chance for them to come out of the crown. Buffer height to be adjusted as given in para 605 G.

v. The inner portions where axle guards wear, horn cheeks have been provided on the axle guard. Horn cheek should be replaced after reaching condemning limit.

vi. To ensure that the longitudinal and lateral clearances on horn cheeks are within limits 'not go gauge' and 'wear limit gauge' for condemning the horn cheeks should be used

vii. Important Do's & Don'ts for Roller bearing as given in para 605 K to be followed.

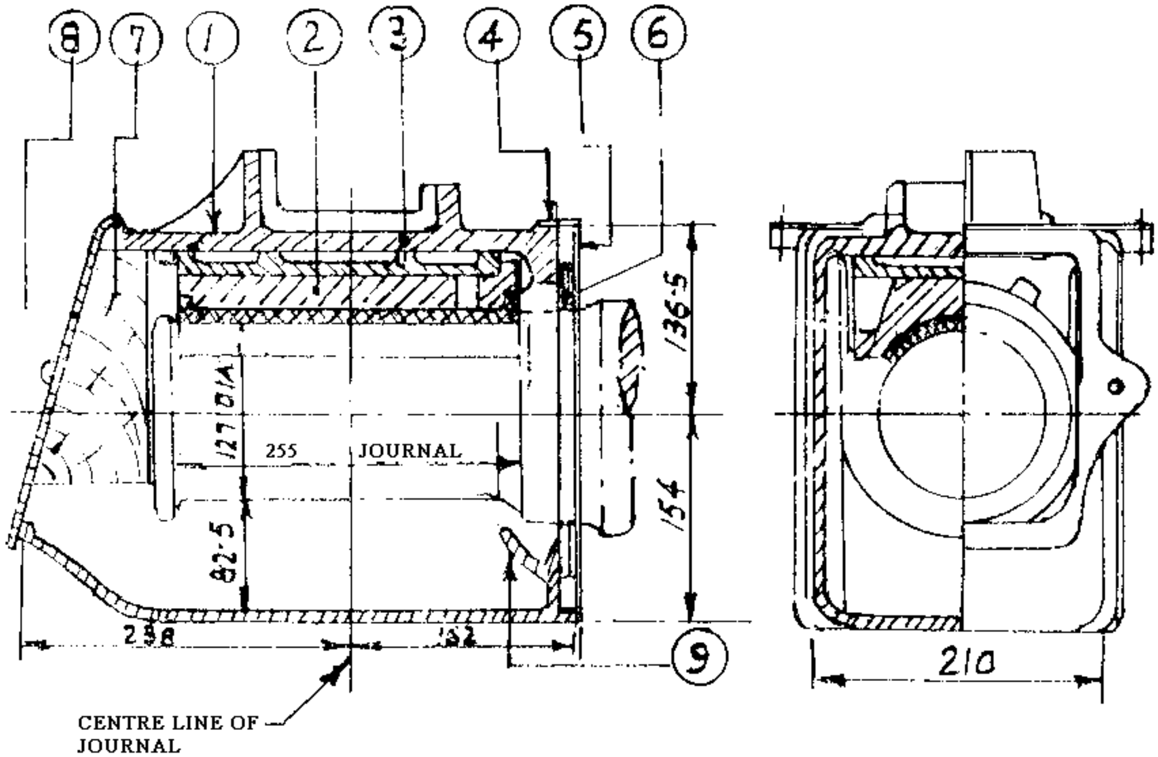
605 N. AXLE BOX ASSEMBLY WITH PLAIN BEARING

Axle box keeps the axle in position and provides lubrication to the journal. It encloses bearing and conditions lubrication. The bearing may be a plain brass or SGCI bearing or a roller bearing using oil soaked waste for the former and grease for the latter. There are many types of axle boxes in use on Railways. Plain brass bearing axle boxes in use on Railways of IRS & IRCA type only are being described in this chapter.

1. IRS Axle box (BG) for 8 wheeler wagons journal size 255 x 127 mm to Drg. No. W/AB-555.
2. IRS Axle box (BG) for 8 wheeler wagons journal size 305 x 155 mm to Drg. No. W/AB-1650
3. IRS axle box (BG) for 4 wheeler wagons journal size 255 x 127 mm to Drg. No. W/AB-570
4. IRS Axle box (BG) for 8 wheeler wagons journal size 305 x 152 mm.
5. IRS axle box (MG) for 4 wheeler wagons journal size 230 x 115 mm to Drg. No. W/AB-1401
6. IRS axle box (MG) for 8 wheeler wagons journal size 230 x 115 mm to Drg. W/AB-1404
7. IRCA axle box (for 4 wheeler wagons journal size 254 x 127 mm.
8. IRCA axle box (MG) for 4 wheeler wagons journal size 229 x 114.
9. IRCA axle box (MG) for 4 wheeler wagons journal size 187 x 120 mm.

IRS axle boxes have been provided with key plate. IRCA Non-standard type are without key plate. Four wheeler axle boxes have two channel in which the axle guards slide.

Axle box is made of cast steel class 'A' grade. It is normalized. An IRS BG axle box assembly for journal size 255 x 127 mm meant for four wheeler wagons has been shown in the figure on next page :-



1. AXLE BOX BODY
2. AXLE BOX BEARING
3. KEY PLATE
4. TOP COVER PLATE
5. BACK COVER PLATE
6. DUST SHIELD LEATHER
7. WOODEN KEEP
8. FACE PLATE
9. BACK SHROUD PLATE

Fig. 6.8 AXLE BOX ASSEMBLY 255X127 BG

The axle box is a rectangular hollow box with openings in front and back a crown on the top. Back opening is meant for entry of the journal. Front opening has been provided for insertion/withdrawal of bearing brass, oil soaked cotton waste/FRLP, key plate, etc. Crown has been provided to keep bearing spring in position and preventing its displacement. Crown also enables insertion of packing plate between axle box and spring.

After replacement of the soaked waste/FRLP, wooden key, bearing brass, key plate in position axle box is sealed in the front by riveting a faceplate to its lugs. On the backside the axle box is sealed by providing a dust shield, back cover and top plate. Axle box body is 8 mm thick at bottom and sides and 13 mm thick at the top. On the backside near the bottom, a shroud is provided for keeping soaked packing into position and not to allow the oil to find way out through and back opening.

Axle boxes having key plate have been provided with lugs in the front and back as well as on both the sides. The key plate is kept in position by these lugs. The bearing brass gets suitably locked with the key plate and thus the former is prevented from having undue movement longitudinally and transversally in relation to axle box. It is, therefore, very important that machining of the lugs should be correctly done, otherwise, there will be undue movement of the brass in relation to the axle box. The front, back and side lugs are fine-finish machined. The inner top surface of the axle box, which comes in contact with the top surface of the key plate should be fine machined. The surface on which the faceplate sits should be rough machined. The machining tolerance between the front and back lugs and side lugs is +1.0/ - o.5 mm. In addition to machine tolerance, 1 mm wear is allowed on the lugs. These dimensions should be very strictly followed at the time of manufacture as well as at the time of POH and at the times of re-packing in sick lines.

It has been the experience that the initial machining at the time of manufacture is not always satisfactory and, therefore, 1 to 2% of the new axle boxes should be checked in the workshops to ensure that –

- The crown inner surface has not been machined out of square.
- The lugs are of equal depth and also at an equal distance from the centre line of the axle box and
- The machining of the guides is not on a taper or in other words, guide surfaces must be parallel to each other along the full length.

In service, the inside crown of the axle box wears. It should be checked for wear at the time of POH and re-packing. Concave wear on the inside crown should not be permitted under any circumstances. If worn, the inside crown should be fine machined to ensure proper flatness. The thickness of the crown may be reduced to the extent of 2 mm by machining.

IRCA axle boxes have not been provided with key plates. On such axle boxes instead of front & back lugs, the top inner surface have a downward projection. These axle boxes have side lugs. The bearing brass has upward projections at the 2 ends at a distance corresponding to the downward projected portion of the axle box. The projected portion rests on the top recess of the bearing brass. The raised portions of the brass do not permit its movement along the centre line of axle. The side movement is prevented by the side lugs. It is, therefore, important that the projected portions should be machined accurately. The distance between the edges should be correct. If it is more, it will infringe with the brass and if less, it will give excessive movement of the brass in relation to the axle box.

a) AXLE BOX COVER PLATE (TOP AND BOTTOM)

The back opening of the axle box is covered with cover plates/plate. In IRS boxes the cover plate is used in two half. It is known as ‘Cover plate top’ and ‘cover plate bottom’. In IRCA axle boxes, one complete plate is used. It is secured with axle box by welding.

Top and bottom cover plates are made of 3.15 mm thick plate of steel. It has a rectangular shape with a semicircular portion removed from one of the edges. The radius of the semicircular portion should invariably be more than the dia. of the axle at the shoulder. It has a hole in the centre. The top bent edge is kept substantially long to cover axle box top opening. For IRCA axle boxes, a separate top cover is not required. The cover plate keeps the dust-shield in position. In addition, it also prevents ingress of dust inside the axle box.

b) AXLE BOX TOP COVER

An opening is provided on top of the axle box for inserting the dust shield. After inserting the dust shield, this opening is covered by axle box top cover. Top cover should be fitted without fail otherwise dust will find its way in the axle box through this opening. Top cover is a rectangular piece made of steel plate SI-42-S to Specification No. IS: 226. It has two rivet holes, one at each end (6.5 mm dia. to suit 6 mm rivets).

c) DUST SHIELD

It is made of leather of either 3 ply or 2 ply. It has rectangular shape with a circular hole in the centre. Its four outer-corners have been cut at 45^o for a length of 25 mm. It is stitched close to the outer edges and central hole. The outer leather should be pliable and inner ply/plies should be as stiff as possible. The thickness of the dust-shield is 9.5 ± 1 mm. The manufacturing tolerance for the edge is 1.5 mm and for the hole is + 0 mm/ -1.5 mm the outer ply is bent inwards at right angles leaving sufficient gap from the inner ply. The thickness of the outer leather is 3 mm for 3 ply and 5 mm for 2 ply.

Before using the dust shield it should be soaked in axle oil medium for 48 hours. It should not be allowed to come in contact with water. It should be stocked in dry place. The dust shield should be examined, every time the axle box is repacked in sick lines as well as at the time of POH. If found worn, torn, or if it has lost its stiffness, it should be replaced.

d) AXLE BOX GUARD GROOVE LINER

It is a channel shape piece made of steel to Specification No. IS: 1079. The thickness of the plate is 3.15 mm to BG and 4 mm for MG four wheeler wagon. Its sizes are as under:-

B.G. Stock - 273 long x 60.3 $\pm$ 3.4 wide x 30 mm depth
M.G. Four Wheeler Stock - 232 long x 50.8 $\pm$ 8.4 wide x 22 mm depth

At bend corners, the inner radius is 6 mm for BG., 4 mm for MG four wheeler & 3 mm for MG bogie. The Liner is tack welded vertically to the Axle Box Groove. When the Liners are worn to such an extent that the prescribed permissible lateral and longitudinal clearances exceed, it should be replaced. Provision of Liners prevents wear of Axle Box Groove. The Liners can be replaced at a much lower cost compared to repair/replacement of Axle Box.

e) AXLE BOX FACE PLATE

It is fitted to the front opening of the Box by riveting it to the axle box lugs. It prevents entrance of dust/moisture inside the Box as well as leakage of oil from the Box, pilferage of soaked cotton waste and bearing Brass. While riveting care should be exercised that the face plate fits square on the face of the box and does not gap. Now, it has been prescribed to provide a rubber gasket between the face plate and Axle Box face to ensure proper sealing.

The face plate is made of 6 mm thick steel plate to specification No. IS: 226 by hot-blanking, pressing in die and bending the end at the top. It is almost of a rectangular shape with two projected lugs at mid-height. In these projections, two rivet holes of 13.5 mm dia have been Jig-drilled to suit 12 mm rivets. In the vertical plane, 3 mm, camber provided to ensure proper fitment on sides of the Axle Box. Near the top, a 14 mm dia oil hole has been provided. It is covered by a cover fitted at a distance of 19 mm upwards. The Oil hole cover is secured with the face plate by an 8 mm dia standard rivet head. A 7 mm dia counter sunk hole has been drilled in the face plate for the rivet. The 8 mm dia portion of the rivet goes inside the 10 mm dia hole of the oil hole cover. This clearance of 2 mm. enables the oil hole cover to rotate freely. After putting oil in the axle box, the oil hole cover should be put back to the normal position, thus covering the 14 mm dia oil hole.

The face plate is likely to get dented and damaged near the rivet holes when the rivets are cut by hammering, oxy-cutting or by pneumatic busters at the time of repacking/POH. To avoid it, lead hammers should be used, pneumatic cutting should not be resorted to and oxy-cutting should be done very carefully. The elongated/oval cut holes is a very undesirable feature as it does not allow proper riveting of the face plate leaving gap between the face plate and axle box.

Also proper shape heads are not formed. At the time of riveting the face plate, it is also important to check its camber. Only good face plate should be used at the time of re-packing in sick lines or at the time of POH in workshops. For this purpose, sufficient stock of good face plate should be reclaimed to the extent possible by re cambering it and repairing worn holes. Axle box should be repaired by oxy or electric welding.

I. REJECTABLE DEFECTS IN AXLE BOX

The rejectable axle box defects are as under:-

(i) Axle box visibly worn in such a way as to interfere with the lubrication of the bearing.

(ii) More than one loose liner used for taking up wear in a groove of an axle box.

(iii) Axle box loose liner, when fitted to take up wear, not bent over the top and bottom of axle box.

(iv) Axle box cracked below the journal centre or with a crack through both lugs of an axle guard jaw or groove.

(v) Axle box broken.

(vi) Deficient back plate or dust shield.

(vii) Axle box back top cover plate deficient on Broad Gauge wagons.

(viii) Integrally cast back plate broken so as to allow the dust shield to be displaced.

(ix) Axle box fitted with mild steel back plate in one piece or in two halves not with horizontal, joint seam weld and if the thickness of plate is not 3.15 mm

(x) Hot box.

(xi) Axle box overdue oiling.

(xii) Axle box face plate less than 6 mm thick not provided with oil hole with cover lip on top for BG. On Metre Gauge face plate of an axle box less than 1.6 mm if dished or less than 3 mm thick if plain.

(xiii) Overdue re-packing.

(xiv) Oiling or re-packing marks not legibly stenciled with the standard stenciling on at least one PRO plate/sole bar

(xv) Axle box face plate broken, insecurely fastened or gaping more than 1.5 mm

(xvi) Axle box face plate deficient or with rivet broken or deficient.

Note : When an axle box face plate rivet is found broken or deficient, the box must be examined from inside to ensure correct assembly of fittings and contents.

(xvii) Axle box face plate not permanently secured unless exempted under IRCA Part III Rule 2.9.2.2.

(xviii) Faceplate of a Wagon axle box secured with rivets bent over.

Axle boxes should be examined and inspected in Workshops and on open lines for above defects. If these defects are found, it should be rectified.

f) KEY PLATE (SLIPPER PLATE)

Key plates have been provided on IRS Wagons in between axle box top inner surface and the bearing brass. It is an important load distribution medium as well as a device to assist in removal of bearing brass. It is rectangular Plate of 16 mm thickness for BG and 13 mm thickness for MG. Its top and bottom surfaces are flat. Top surface has been provided with recesses. Its top and bottom surfaces are ground and 4 side surfaces finish machined. It has a 10 mm dia hole near front in central portion to facilitate its easy removal. The size of Broad Gauge is 234.5 mm +0/-1.0mm x 155.5 mm maximum and for MG is 209.5 +0.0/-1.0 mm x 138 mm maximum. On BG key plates, the top edges along the length have been rounded off. The back and top has been chamfered by 3 x 11. It is made of one of the following materials :-

- Malleable cast iron grade 'A' to specification No. IS: 2107/IS: 2108
- Steel casting grade 2 to specification no. IS:1030.
- Steel ST 42-S to specification No. IS: 226. For this type, recesses at top need not be provided.

As key plate is an important load distribution medium, it is very important that the key plate must rest squarely on the top surface of the brass and the inside crown surface of the axle box to ensure proper transmission of load.

In service, it has been found that both top and bottom surfaces of key plate wear unevenly. The front and which bears against the axle box front lug and the back and which bears against the bearing brass get battered badly. At the time of POH and repacking, the top and bottom surfaces and the two ends should be checked. The front end should fit securely with axle box front lug and back and with bearing brass. The key plate with badly battered ends should be discarded. The key plate having uneven surfaces should not be used. It should be reused only after proper grinding. Thickness of top and bottom surfaces should not be reduced beyond 1.5 mm each. While fitting key plate, the condition of the top surface of the brass as well as inner crown, surface of the axle box should also be checked for uneven wear. If such defects are found on them, it should be rectified. It should always be ensured that the key plate bears evenly with bearing brass and does not rock. Badly battered and with a worn out axle box front lug may cause the displacement of the key plate disturbing the stability of the wagon. Both top and bottom surfaces should be smeared with oil while fitting it in the axle box.

g) **BEARING BRASS**

The load from axle box crown as transmitted directly on the bearing brass on non- IRS wagons and through key plate on IRS wagons. The bearing brass rests directly on the axle journal and it, in turn, transmitted the load to the axle. As the journal rotates and the bearing brass remains stationary, frictional forces come into pay and enough heat is generated. It is required to kept to the minimum and suitably dissipated. It is, therefore, necessary that the surface of bearing brass and journal, coming in contact with each other, should be of very high finish and should have adequate and proper lubrication. Absence of any of these two basic requirements will lead to a hot box.

Bearing brass consists of a bronze or S.G.C.I. shell with white metal lining. The latter comes in contact with journal. The shell provides necessary strength and shape to the while metal. The design of bearing brass has received considerable attention in the recent past and many improvements have been incorporated. For IRS stock, the bearing brasses have been standardised in 3 step sizes, to suit decreasing dia. and increasing length of the journals. In service due to wear, the journal dia. decreases, whereas the length increases due to wear on its shoulders and fillets. At the time of POH, the worn out journal surface is turned and ground/burnished in order to get back the required surface finish. Such journals are condemned when they reach condemning dia. or, the wear on fillets and/or on shoulders has gone beyond the permissible limit.

The step sizes of brass cater for all the journals which have dimensions between the new and condemning limit. The 3 step sizes are known as A, B & C. On 'A' size brass, the diameter of the while metal shell is kept 3 mm. more than the new journal as well as on the journals having diameters less upto 3 mm. from the new axle. Similarly, the length of the bearing is kept 3 mm less for MG & 5 mm less for BG than the length of the new journal. These shells can be used for journal length, which are even 2 mm. more than the new. When the length and dia. of the journal crosses these limits 'B' size bearing brass is used. After certain stage, 'C' size bearing is used. Thereafter the journal is condemned. Use of step size brasses is tabulated below:-

S. No.	Particulars		Nominal Size	A	B	C
1.	Journal Dia		mm D	Mm D to (D-3)	Mm Below (D-3) to (D-8) for MG & (L-6) for BG	mm Below (D-8) for MG & (D-6) for BG to condemn-ing size.
2.	Bearing diameter	BG MG	D+2 D+2	D+2 D+2	D-1 D-2	D-4 D-6
3.	Length of Journal	BG MG	L L	L Minimum L Minimum	L+2Minimum L+3Minimum	L+5 Minimum L+6 minimum
4.	Length of Bearing	BG	L-5 L-3	L-5 L-3	L-3 L	L L+3

5.	Shell Height at Crown		H	H	H+2	H+4
6.	Length of Collar (Outer) Depth of Anchor groove (outer)		1 L	1 D	1+3 D+3	1+6 D+6

The composition of bronze shell and while metal is as under:-

Bronze Shell

Lead	4 to 6%
Tin	4 to 6 %
Zinc	4 to 6%
Antimony	0.3% (Max.)
Phosphorous	0.05% (Max)
Copper	Balance

White Metal

Antimony	14 to 16%
Tin	4.5 to 5.5%
Copper	0.3 to 0.7%
Lead	Balance

STEP SIZES

The various improvements incorporated are as under:-

i. The thickness of the white metal lining has been kept as 6 mm. at centre, gradually reducing to 5 mm. at the ends. This facilitates in ensuring 30^o arc of contact of the bearing with the journal. The white metal lining having more clearance on sides does not have a tendency to bind with the journal. The gradually reduced thickness of white metal is obtained by shifting away the centre of radius of bottom surface of white metal lining, from the centre of the radius of the shell.
ii. The white metal lining is not provided up to the edge of the shell, but is finished 3 mm short of it. Thus the unprotected soft white metal at the longitudinal sides of the bearing has been eliminated against damages in rough/hump shifting.
iii. The thickness of the white metal has been reduced from 10 to 6 mm to eliminate its spreading in service.
iv. Step size brasses have been introduced as explained.
v. hole for the bronze shell provided for anchoring & pouring of white metal have been eliminated.

The bronze shell has a flat top surface with 4 recesses. Towards the end, it has a rectangular lug across its width for locking the key plate. A small 5 mm.

dia. semicircular groove has been provided just before the lug to ensure proper fitment of key plate. The front and rear ends of the brass have square vertical edges for certain length. The remaining length of the brass has inclined vertical edges. Its bottom surface is circular with flat longitudinal edges. The white metal lining has been provided with suitable recesses at the 2 ends.

The bearing brass is machined all over except on inclined vertical surfaces and top recesses. Accurate machining of shell and white metal lining, as per drawing, is very important and should be ensured without fail. Use of un-machined metal brass is not permissible. The back of the brass forms the datum surface for machining. It should be checked for perfect flatness by using a master key plate. There should be no rocking motion and if found, it should be removed by filing. Even old brasses should also be checked for flatness immediately after de-metalling. Upsetting the centre for machining the white metal lining is also very important and should be ensured.

The bond strength between bronze/SGCI shell and white metal is very important. Bond strength should be more than the strength of the white metal. In case of excessive tensile stress or shear, the failure should take place in the white metal and not in the region of the bond. Correct white metalling procedure has been prescribed. It should be rigidly followed to avoid failure on hot box of the bearing.

The particular step size of bearing should always be fitted on the corresponding step size journal. 'B' size bearing should not be fitted on 'A' size journal. The dia of 'B' size bearings less than it will rest against the journal on its side instead of at centre and will result in hot box. In extreme cases, step size 'A' bearing can be used on 'B' size journal and the 'B' size bearing on 'C' size journals. Care should, however, be exercised that length suits the journal for which lateral play should be checked. In no case, 'C' size bearing should be used on 'B' and 'A' size journals and 'B' size bearing on 'A' size journals.

It is important to identify the step sizes of the bearing and journals. Identification color strips should be painted at one of the recesses on the top of the bearing brass to know its step size with following color scheme :-

Step size 'A'	**-**	***Green***
Step size 'B'	**-**	***Yellow***
Step size 'C'	**-**	***Red.***

Suitable span gauges should be used for measuring the diameter of the journals by which step size of journal can be decided. The length of the journal mostly falls within step size of the journal based on dia. The lateral play of the brass may be checked on a dummy journal or on a journal on which the brass will be used. The gauge to be used for checking the lateral play. Step size brasses, however ensure adequate initial lateral clearances. The prescribed minimum and maximum lateral play of the brasses is tabulated below:-

Lateral play of brass on journal	Trolley		Four Wheeler	
	BG	MG	BG	MG
Minimum	5	3	5	3
Maximum	10	6	10	10

One of the main reasons for the introduction of step size bearing brass is to ensure an initial arc of contact of 30^o on the crown. In the course of service, the arc of contact will increase. At the time of re-packing, if the brass is not found to be sound, it should be side relieved with hand scraper so as to provide once again a 30^o arc of contact at the crown. The advantages of providing 30^o arc of contact are as under :-

i. It will ensure an adequate feed of oil to the fluid oil film.
ii. It will permit the bearing to easily adjust itself to the geometry of the particular axle box
iii. In the event of excessive plastic flow of the white metal, there will be lesser possibility of the oil feed being blocked by the spread white metal.

Adequate number of bearing brasses of different size should be stocked to workshop and in sick lines.

The requirement of bearing brasses of different step size is expected to be in the following proportion:-

Step size - ‘A’ 80%
Step size - ‘B’ 15%
Step size - ‘C’ 5%

However, the proportion to be determined by users after conducting their own survey.

However, the proportion should be determined important aspect. If brasses are not properly handled, it may suffer considerable damage in a number of cases. Throwing of metalled bearings while loading and unloading and careless handling leads to damage to the bond between the white metal and the shell and damage to the white metal surface. The bearing should be loaded one by one on a lister truck or any other type of transport. Similarly, it should be unloaded one by one. In stores, it should be neatly stacked. While sending the bearing from stores to out station depot in Store van, wooden boxes having a carrying capacity of 50 to 100 bearing should invariably in used. These boxes should be fixed in the van and not to be allowed to be handled in loaded condition. Similarly, bearings loaded in wagons should be handled carefully. The bearing should also be handled carefully in sick line. Transportation of bearing from sick line stores to sick line should be done in wooden boxes having a carrying capacity of 4 to 10 bearings.

h) JOURNAL

The portion of the axle on which the bearing brass comes in contact with the axle is known as journal. This journal is an integrated portion of the axle. It differs greatly with the other portion of the axle in respect of surface finish. The journals of wagons are provided outside the wheel. Just after the wheel seat on outer side a small length of the axle is known as shoulder. The journal portion begins just after the shoulder. The diameter of the journal portion is less by about 25 mm to 30 mm as compared to the shoulder. The two surfaces are joined giving a radius of 16 mm for MG and 19 mm for BG. Except at the radius portion, the journal surface is parallel. The journal surface is joined with the collar by a radius of 6 mm. The outer edge of the collar is rounded with a radius of 10 mm.

During service, the journal wears all over. It results in decrease of the dia of the journal and increase in its length. The wear on the journal is not uniform at every place. In workshops at the time of POH, the journal should be turned to a fine-finish, where necessary and should invariably the ground/burnished to a high degree of accuracy. Worn out collar and shoulder should also be restored to correct radius. Even a small mark on the surface of the journal due to mating of two different surfaces being turned or ground/burnished in two different attempts may result in a hot box. Similar care should also be taken on the sides on curved surface. There should be no mark present on it. While checking the surface finish the journal should be hand felt by an experienced man or by a surface finish gauge. Defects if any should be removed by regrinding/burnishing or by hand polishing with emery cloth.

The ovalty and taper on the journal should be within the permissible limit of 0.1 mm. The ovalty and taper of the journal should be checked by measuring the diameter with micrometer at 3 locations both on the vertical and horizontal axis. If required, measurements at more locations should also be taken. If cases of ovalty and taper going beyond the permissible limits, are detected, the grinding and burnishing machine should be checked and its defects should be rectified. Cent percent check for ovality and taper should be carried out. Diameter of all journals coming one of the wheel shop should be measured & a record be maintained. The dia of the journal should be written with chalk on inner surface of the wheel for guidance of the staff in the lifting section. The top surface of the outer collar, where necessary, must be finished by a suitable form tool either on grinding or burnishing machines or on another suitable lathe.

As indicated above, normally the minimum length of the journal for a particular step size diameter is automatically re-ensured. However, there may be exception and the minimum length of the journal should, therefore, be checked by means of a gauge.

Wheels which are required to be send to out stations after repair or which are required to be kept in spare pool, for some days, should be carefully painted with 3 coats of bituminous solution to IS : Specification No. 158. To protect the journal surface of the wheels being sent to out stations against mechanical damage, it should be fitted with tightly bound wood lagging extending outside the collar and up to wheel seat, completely surrounding the journal.

Concentricity of the journal and wheel tread is an important matter for satisfactory performance of the bearings and this should be occasionally checked when wheels are attended to in shop or in sick lines.

The total permissible wear in the length of the different size of BG and MG journals of goods stock for shop purposes, will be as under :-

Size of Journals (mm)	Maximum permissible wear on Length of Journal (mm)	Inner Collar (mm)	Outer Collar (mm)	Maximum thickness of outer collar
BG (i) 255x127 } (ii) 254x127 } (iii) 229x144 } **MG** (iv) 230x115 } (v) 229x114 }	11	6	5	11
(vi) 180x100	10.5	6	4.5	8
(vii) 170x102	11	6	5	8
(vii) 178x89	8	5	3	8

The axle has its lowest diameter at the journal. The dia of the journal, therefore, is the limiting factor for deciding the gross load at rail.

The permissible gross load for standard and non-standard BG & MG axles has been given in IRCA Part III Rule 2.8.10. Upto a certain reduced diameter of the journal compared to the new, the axle cap carry full designed load, thereafter less than the designed load. If full axle load has to borne at the reduced diameter of journal should be condemned and re-axling of the wheels should be done. The axle can, however, be used further by corresponding reduction in gross load and carrying capacity of the wagon. However, this practice is not desirable from commercial point of view. Axle should be changed as soon as its journal dia reaches the condemning limit corresponding to the designed axle load of the wagon.

The distance between the centres of the 2 journals is also very important. The spring shackle assembly axle box and axle guard for a particular type of wagon, have a fixed journal centre. The correct distance between the journals as well as the distance of individual journals from the outer surface of the wheel centre is, therefore, very important and should be ensured. Its absence will cause difficulty in ensuring correct alignment and the bearing brass will have a tendency to ride over collar on one side and shoulder on the other side of the journal.

Many times the axle gets out on the shoulder portion by the back plate of the axle box. Such an axle can be used again after turning the cut provided the cut is only in the part where the dust shield may does not reduce the dia by more than 12 mm, compared to a new shoulder dia and the width of cut is not more than 15 mm. The portion which is turned, shall extend only upto that part of the axle upon which the dust shield may bear. The radius should be provided as shown in IRCA Conference Rule part III and the radius should be merged.

The axle also gets notched in service due to rubbing loose with loose brake rigging parts or any other part. Thus effective diameter reduces and the axle may break in service. Axle should looked for such defects at every stage and any axle found with these defects should be withdrawn and replace.

The journal surface is a highly polished, which has to be handled with care in workshop and other places. Sling chain or hooks, etc., therefore, should never be applied to the journals for handling and lifting the wheels in workshops, sick lines and other places,

Holes provided in the wheel centres may be used for this purpose. While using the wheel it should be checked again for any mechanical damage likely to have taken place during transportation and handling.

During service, many bearings run hot causing considerable damage and scoring of journals. Such scored journal should be used only after proper grinding, burnishing and testing. Wheels with scored journals should be sent to shops or to depots, where facilities to do proper repairs exist. Such journals should not be used on passenger service. Every time the axle runs hot a 5 mm size star mark should be stamped on the face of the affected journal to distinguish it from other journal and to know how many times the journal, in question, has run hot.

The part of axles is not to be built except the outside fillet by electric welding. If the wear on the outer side of the journal is beyond limit, the collar should be built up by electric welding, and be turned to its original size and shape.

The axle should be checked in workshops for flaws. The axle should be tested by ultrasonic equipment for flaws and cracks. All axles being used in workshop for POH stock as well as axles being sent to out-station should be given above tests.

To economize on the consumption of raw material, the BG condemned axles are being used on MG stock and MG condemned axles on NG stock by forging down, cutting to required length, heat-treatment and turning. Such axles should also be subjected to examination and flaw detection. After forging and heat treatment, a test piece of the material out of the same lot, should be sent to CMT for metallurgical test to ensure that the material and properties of converted axle are at part with that of the specified new axles. While converting axle in this manner the journal portions should be discarded.

i) COTTON WASTE PACKING

Lubrication between the journal and the bearing brass is provided by soaked cotton waste roll packing. The packing is now being provided in the form of rolls on standard stock.

A good lubricator should possess following essential qualities:-

- It should have adequate oil holding capacity.
- It should have good wicking action so as to keep packing up the oil from the bottom of the axle box.
- It should have sufficient resilience so as to maintain a continuous contact with the journal even on uneven track.
- The contact pressure between the journal and the lubricator should be such that it only maintains a continuous contact with the journal but is not so tight, as to cause a 'wiping action' leading to the suspension of the oil feed to the fluid oil film.
- It should remain, in a specified central position, in the course of normal service, which is seldom free from repeated impacts of varying intensity.
- The structure of the lubricator should be such as will not permit the detachment of any part of it, which might lodge itself between the journal and the bearing and thereby obstruct the oil feed.

The cotton waste should normally consist of 40% unteased cop bottoms mixed with 60% good quality reeling hard waste. The specification had to be relaxed due to non-availability of the required supplies and the permissible mixture should now consist of 90% unteased reeling waste. It must, however, be of good white color, absorbent and elastic. The waste should also be free from moisture, dust, oily substances, un-spun yarn, colored threads, rags, etc. The dry cotton waste must always be stored in a suitable clean and dry room free from damp and dust contamination.

Preparation of soaked waste required for the reel packing must be carried out with great care. The soaking of waste is, by and large, at present being carried out in the conventional method though a few railways have switched over to the steam vacuum process which gives a superior product in a such shorter period of time. The required quantity of dry waste should be weighed.

Foreign matter should then be carefully hand picked and the waste placed on an expanded metal table and then beaten with a cane. The weighed quantity of cotton waste should then be placed on an adjustable perforated tray in a suitable size rectangular tank. The tray should be lowered to the bottom position.

A measured or weighed quantity of medium axle oil, about six times the weight of the cotton should then be poured over the waste. It should be ensured that the waste is fully submerged in oil during the period of 36 hours for which it is to be soaked. The waste should be turned over, every four to six hours during the period of soaking.

The perforated tray should be lifted after 36 hours of soaking. Draining should then be permitted for a period of 12 hours in winter and 6 hours in summer. There should be a small black plate or board on each soaking tank for writing with chalk, the timings of commencement and termination of the soaking and the draining operations. The quantity of oil at the bottom of the tank after the draining period, should occasionally be measured with a dip stick to ensure that the drained soaked waste has oil and waste in the proportion of 4.1. The above waste should then, be transferred to a large rectangular but very shallow (250 to 400 mm deep) container. The packing so placed should also be turned over, three to four times in a day, to ensure uniformity of oil and waste proportions.

Dirty, wet and glazed portions of old packing should not be reclaimed, and the back rolls must invariably be discarded. The serviceable portion should then be thoroughly shaken on expanded metal table and also teased by hand. The old waste cleaned in the above manner should then be soaked and drained in a separate tank, which also has a perforated tray. The soaking period for the old waste should be 6 hours only and thereafter, the draining should be for 12 hours in winter and 6 hours during the summer months.

The reclaimed waste so prepared should be transferred a separate shallow container where it should be turned over 3 to 4 times in a day to ensure uniformity of oil and waste proportion. For roll making, the reclaimed and new waste may not be mixed, as far as possible, should be made of re-claimed waste is not available, the mixture of the reclaimed and the new waste in the proportion of 2:1 may be used. It must be remembered that while the maximum amount of old packing must be re-claimed, there should be no compromise in the matter of re-claimation of such old waste as is definitely unfit for further use.

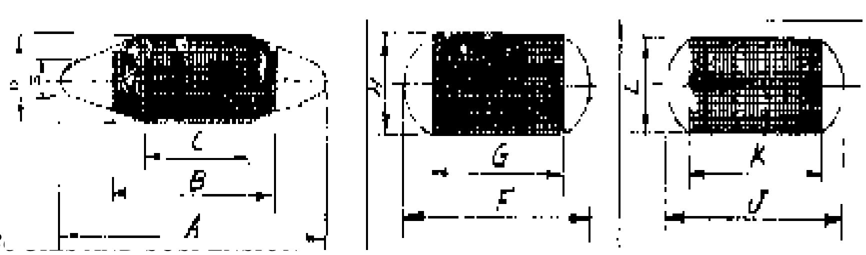
To be able to introduce the procedure mentioned above, 2 soaking tanks with perforated trays would be required, one for soaking new waste and the second for reclaimed waste and the requirement of shallow containers would be three, one for new soaked waste, another for reclaimed waste and the third for the mixed, new and reclaimed waste. This would be the minimum requirement and may be increased depending upon consumption of soaked waste. The steam heated vacuum waste soaking plant is an alternative to the conventional method for preparation of soaked waste, which is also in use on Railways.

The requisite quantity of cleared waste is placed in the soaking chamber and the temperature maintained at about 200^{o} with 25 cms. of vacuum. After an interval of 10 minutes which period has been found sufficient to remove the moisture from waste, the requisite quantity of oil (the ratio of oil to waste being 4:1) is discharged into the soaking chamber through the oil control valves. The oil flowing over the perforated plate fixed to the inside of the lid, assists proper distribution. The soaking time should be 40 minutes. No draining is necessary. Thoroughly impregnated packing is thereafter ready and this should be transferred to a shallow container.

Steam soaking of the reclaimed waste to be carried out by adding 1 Kg. of oil to 5 Kgs. of old waste. Soaking for a period of 10 minutes would be adequate. In the case of old waste which may thereafter be transferred to a separate shallow container for being used along with new steam soaked waste in the proportion already laid down earlier.

A set of roll packing for each axle box consists of one back roll, two centre rolls and one front roll. Their shapes, sizes and weights are indicated in figure 6.9.

The core of each roll may consist of reclaimed ready waste or of mixed ready waste. This should then be covered with new ready waste (on bottoms or reeling waste being pulled open to form long strings). Each roll must have standard density and firmness and should be neither be soft nor too hard. Every roll must be passed through a corresponding gauge to ensure the correct size. Frequent weighment of rolls must be conducted to ensure reasonably correct weight.



FOR AXLE BOX	BACK ROLL						CENTRE ROLL				FRONT ROLL			
	A	B	C	D	E	WEIGHT IN GRAMS	F	G	H	WEIGHT IN GRAMS	J	K	L	WEIGHT IN GRAMS
BG 255 X 127	305	205	100	95	40	1125	255	150	110	1950	205	125	75	900
MG 230 X 115	280	175	90	85	40	900	200	125	90	1130	180	100	85	850
MG 180 X 100	230	160	85	65	30	500	195	120	75	750	150	100	70	500

Fig. 6.9 DIMENSIONS OF ROLL PACKING

I. IMPORTANT Do's & Don'ts IN PREPARATION OF ROLL PACKING

Do's

i. Ensure that cotton waste, used for preparing axle box packing, is according to the specification laid down.
ii. Ensure before soaking that the cotton waste is free of all foreign matter and that the required quantity of oil is issued. Soaking and draining should be according to periods laid down.
iii. Arrangement adoption of steam soaking as it gives a superior soaked waste in a much shorter period.
iv. Ensure that the soaked waste is transferred to shallow containers and is turned over, three to four times a day, to ensure uniformity of oil and waste proportions.
v. Ensure that only serviceable waste is reclaimed from the old waste and soaked for the specified period.
vi. Ensure that as far as possible, the reclaimed and new waste are used in the proportion of 2:1 for preparation of roll packing
vii. Ensure that the rolls are made according to the sizes laid down and are of suitable density, neither hard nor soft.
viii. Ensure that a sufficiently large size room, maintained at a high level of cleanliness and free from dust is used for soaking and reclaiming of cotton waste and for preparation of roll packing.
ix. Ensure that medium axle oil to IS: Specification No. 1628-71 is used for waste soaking.

Don'ts

i. Do not curtail the soaking period nor increase the draining period as any such deviation would give an unsatisfactory soaked waste.
ii. Do not reclaim back rolls, which are invariably dirty and should be discarded.
iii. Do not store soaked waste in deep containers.

iv. Do not use rolls, which are either smaller in size or less in weight.

j) AXLE BOX PACKING (WOODEN KEEP)

A Wooden keep is placed in axle box between the journal and axle box faceplate. It is provided to keep the roll packing in position. Its top surface bears against, the inner surface of the axle box crown. After placing the front roll into position, the same is pressed downward and wooden keep is inserted making it to bear with the axle box crown and the wooden keep is set in position. The pressed centre roll is then released and thus it remains pressed by the bottom surface of the wooden keep. With front roll being kept into position there is no chance of other rolls getting displaced from their desired position.

Wooden keep is made of hard wood to IRS K-2. It is rectangular in shape. Its one surface is square to the bottom and the other surface inclined. The square surface is kept towards journal end and the inclined surface towards faceplate. In the central portion a cut has been made to facilitate oiling of the cotton waste. The oil is required to inject as near the journal as possible.

For this purpose, 13 mm semi-circular slot has been provided on the inclined surface upto 2/3rd height from the bottom. From the top a V cut or a rectangular cut is made on the inclined surface extending along its thickness upto the back surface. The circular slot joins with this slot. The V slot is also made inclined downwards the inner side. The oil can spout if inserted through the oil hole provided on the faceplate and it extends itself upto the Vee slot and oil is poured. The oil thus finds its way to the cotton waste packing by gravity through Vee and circular cut.

Wooden keep packing should be free from any cracks and other defects and should be of correct dimensions. Its surface finish should be smooth. Before use new wooden keep should be soaked in oil for 48 hours. It should be prevented from coming into contact with water.

605 O. PERIODICITY OF REPACKING AND OILING

The axle boxes of Broad Gauge and Metre Gauge stock have either permanently secured face plates or have face plate secured with studs/bolts. Face plates are secured permanently with axle boxes by means of 2 snap headed rivets, of dia. 12 mm or more which ensures reasonable tight joint between them. On MG stock face plates are also permanently secured by means of a bolt and nut with a lock washer which should bite into the threads and can only be removed by hammer and chisel. On many MG non-standard wagons, such as WE, face plates are permanently secured by bent over rivets or bolts riveted flush over the nut because due to design, it is not possible to use snap headed rivets on them.

For BG container flats of C. Rly., the B.G. vegetable oil tank wagons of N. Rly., B.G. wagons, special permission has been given to move them with face plates secured with bolts. The studs/bolts used for securing faceplates should have prescribed security fastenings.

The periodicity and occasion of re-packing will as under :-

(i) Permanently secured face plates -
8 months (+) 7 days for loaded (Maximum)
(-) 7 days for empty (Optional)

(ii) Face plates secured by studs and bolts -
BG - 2 months.
MG -3 months

(iii) In addition to above, all axle boxes should be repacked whenever a wagon is lifted or its wheels are drawn out.

(iv) During Hot Box attention

(v) Re-packing should also be done in Workshops at the time of POH.

(vi) Derailed wagon.

Periodicity of Oiling :-

(i)	Permanently secured BG wagons face plates having oil hole	30 days
(ii)	BG wagons having, face plates not permanently secured	15 days
(iii)	MG wagons with permanently secured face plates having oil holes	3 months.

The quantity of oil to be injected in each BG and MG axle box is 227 ml.

For oiling the axle box, the wagon need not be damage labeled and brought to the sick lines. The oiling of wagons should be done in terminating and originating yards or if they arrive in sick lines for repairs other than re-packing work.

On the left side of the sole bar on both sides of the wagon PRO/PR particulars are to be stenciled. The former is for plain bearings and the latter is for roller bearings. Against P, the date of POH and the name of the Workshop is recorded, against R, the re-packing date and station code of the wagon depot is recorded and against, the oiling date and station code of the wagon depot is recorded. When the wagons are repacked in Workshops at the time of POH, date of re-packing should not be recorded as P includes re-packing also. Similarly, at the time of re-packing date of oiling should not be recorded as re-packing includes oiling also.

605 P. PROCEDURE FOR REPACKING OF AXLE BOXES

While re packing axle boxes in sick lines, the following procedure should be followed:-

i. Accumulated dirt both at the end and at the rear end of the axle box should be removed with a scrubbing brush, scraper or with the help of other material such as condemned dry waste. Both rivets of the face plate should, thereafter, be cut by oxy cutting pneumatic cools or by sledge hammer and chisel.

ii. Remove the faceplate and then extract the wooden keep. It should be examined, and if found to be standard and undamaged, it may be reused after cleaning. The wooden keep should be kept in a bucket or a small drum painted red on the outside.

iii. Remove the front roll and the centre rolls and put these in the same red container. Lastly, remove the back roll which should preferably be put in a separate small red painted container. Clean the axle box from the inside and remove white metal pieces, if any. Place back the face plate so that it can stay in position with the help of its lip. Thereafter lift one or both boxes on the same axle at a time, for removal of the key plate and the bearing brass.

iv. Wipe the journal clean and feel with hand, right-round to ensure that there are no rough marks, on any portion of the journal. Measure the diameter and length of the journal by gauges. Chalk mark the length and diameter of each journal on the body panel just above the axle box.

v. Examine the brass for damage, such as cracks. Tap the brass to check the white metal bond by holding it in a suspension link. If the bond is satisfactory but the white metal has only slightly spread to the sides or ends, it should be dressed up for reuse. It must also be suitably relieved at the sides so as to restore an arc of contract of about 30^o on the crown. When put back in position, there should also be a minimum lateral play of 5 mm for B.G. and 3 mm for M.G.

vi. However, the old brass is unfit for reuse, it should be replaced by new brass already side relieved. For this purpose, the lifting staff should carry at the commencement of their duty, a few suitably side relieved step size brasses in a wooden box.

vii. The key plate must then be inspected to check that it is not battered at the front end and that it sits square on the back of the old serviceable brass or the new brass, as the case may be. This to be checked by putting hand-pressure at the diagonal ends to see that there is no rocking motion. When necessary, the key-plate or the back of the brass should be suitably filed. A bad fitting key plate or one with badly battered end must be replaced by a new one.

viii. It is also necessary to inspect the dust shield is missing or very badly worn, in which case it has to be replaced. In such cases the top cover plate, if found deficient must also be made good.

ix. Before re-fitting a bearing, the journal as also the bearing surface of the brass must be smeared with clean medium axle oil. Similarly, the key plate should also be oiled on both sides. After fitting the key plate it should be checked that it is in correct position and its front end is behind the key plate retaining lug.

x. The lifting back should then be lowered taking care that the position of the key plate and the brass is correctly set under load and that the brass does not bind against the journal cap.

xi. New packing should be carried in buckets or small drums fitted with lids, painted green on the outside. Clean and soaked wooden packing should also be carried in the same container.

xii. The back roll should first be inserted in the axle box by placing it across the journal. It should be pressed with a re-packing shovel to the extreme back end. The roll must be placed in the centre and its ends lifted equally. The two centre rolls should then be placed one behind the other and pressed against the back roll. The second centre roll, when in position, should not extend outward, beyond the inside edge of the outer - collar of the journal. It should also be seen that the ends of the centre rolls are at the same height.

xiii. 170 ml oil for BG and 115 ml for MG should now be syringed uniformly over the different rolls before inserting the front roll. If syringe is not done uniformly, most of the oil falls in front portion and there will be a tendency for this oil to spill out. Further, even when it is syringe uniformly, at least 5 minutes time should be allowed for the oil to soak & settle down as otherwise, when the front roll is fixed and pressed, the oil will ooze out. Thereafter place the wooden keep & press it down on the front roll, and push it into position so that when released, it is firmly held in position without any clearance at the top.

xiv. The faceplate should, thereafter, be properly riveted. One end should be held with the bolt and nut and the other end closed with snapped head rivet. The bolt should then be removed and the other end riveted. Where pneumatic riveting is not available hand snaps must be used. Thereafter the PRO/PR plates should be stenciled, as described earlier.

605 Q. AXLE BOX SEALING

i. Any satisfactory axle box design should provide effective sealing at the front and rear ends to prevent leakage of oil and ingress of dirt and moisture into the axle box. It is, therefore necessary to ensure satisfactory sealing at the two ends of axle box. As such, gaping faceplates and loose dust shields should not be permitted on any axle box.

ii. The gaping of faceplate of axle boxes in service is mainly due to unsatisfactory riveting of faceplate and also, in many cases due to warping of faceplates.

iii. Proper attention must, therefore, be paid to the examination and riveting of the face plates both at the time of POH in workshops and also at the time of re-packing in sick-line. The old faceplates must invariably be checked for warping and buckling and even those, which are having slightly defect should be rectified. A pool of good faceplate must, therefore, be maintained at all re-packing centres so that no defective faceplate is to be re-used. Before riveting the faceplate, it is necessary that rubber gasket of a proper size is used to ensure sealing. The rubber gasket should be stuck on the axle box opening by means of an adhesive.

iv. Greater attention is required in the case of rear end. The dust shield must invariably be renewed at the time of POH and a new dust shield must be soaked in oil for 48 hours before use.

v. When wheels have to be changed in sick line, the dust shield of the axle boxes should be thoroughly examined and those found slack or torn should be replaced by properly soaked dust shields. Fitment of top cover plate is also of great importance and must be ensured whenever axle boxes are taken out in workshops or in sick lines.

605 R. IMPORTANT Do’s & Don’ts DURING REPACKING

Do’s

(i) Ensure that a complete and thorough examination of every axle box and its components is carried out at the time of re-packing.

(ii) Ensure that adequate equipment, staff and spare parts are available at each sick line and nominated lines to carry out the re packing work properly.

(iii) Ensure that the correct re-packing procedure, as laid down, is followed.

(iv) Ensure that axle box and other components, viz. journal, brass, key-plate, baffle block and dust shield to be thoroughly examined and serviceable components are reused only.

(v) Ensure use of journal gauges to measure the length and diameter of the journal and the suspension link for sounding the brass.

(vi) Ensure that an arc of contact of 30^o is provided on the bearing brass.

(vii) Ensure that a minimum of 3 mm for MG and 5 mm for BG lateral play is provided between the brass and the journal.

(viii) Ensure that oil is measured on the journal, bearing brass and the two sides of the key plate before assembling the axle.

(ix) Ensure that the key plate is sitting properly in relation to the bearing brass lug and the axle box retaining lug.

(x) Ensure that packing is carried in drums fitted with lids.

Don’ts

(i) Do not re-use a bearing brass with spread white metal on sides without it being redressed and restored to an arc of contact of 30^o on the crown.
(ii) Do not use baffle block (wooden keep) of non-standard size.
(iii) Do not pack the axle box in a manner, which may permit the roll packing to come beyond the inner edge of the journal collar.

605 S. WHITE METALLING PROCEDURE

The carriage and wagon bronze bearing shell should be tinned and white metalled with antifriction metal strictly according to the practice laid down in the subsequent paragraphs. As regards SGCI shells, the procedure prescribed in the pamphlet "Prevention of Hot Boxes - A Guide" revision 1, issued by RDSO should be followed.

De-metal the old bearing in a de-metalling bath. The temperature of the de-metalling bath should be kept 400^oC and 450^oC. The bath should be an oil fired, pot type furnace with temperature controlling and recording devices.

In this operation, the white metal lining is melted and collected in the bath and all the oil is normally burnt. The white metal collected in the demetalling bath should be ingoted and reconditioned.

Remove the shell from the demetalling bath soon after the white metal has been melted and clean it by scrubbing with a stiff wire brush to remove traces of dross and other impurities. The shell should then be allowed to cool in air.

Check the demetalled shell with suitable gauges for important dimensions such as overall length, width at the ends, crown depth, and the height and length of the lug. The maximum wear of 2 mm may be permitted on the length and width of the brass as also on the length and height of the lug. Maximum permissible wear on the crown depth is 6 mm in B.G and 3 mm in M.G. Shells. Any demetalled shell, worn beyond these limits should be rejected and sent to the foundry for being recast.

Demetalled shells, which pass the dimensional check, should then be given the ringing test individually. Shells, which do not give satisfactory sound, should be rejected.

The demetalled shell should also be visually inspected for cracks. Shells having cracks, will not normally give satisfactory sound in the 'ringing test'. But in any case, cracked shells should be rejected.

Shells which are warped and do not permit even a true slipper plate to sit square on the back of the shell, should, if possible, be rectified by machining or otherwise rejected. It is important that the surface to be lined with white metal is prepared very satisfactorily. This must be carried out either by machining or by grinding with a coarse portable grinder until the surface is bright all over. It must be ensured that any serrations found on the surface of the shell are properly ground and where necessary machined.

The under-cuts of anchorage grooves, recesses, awkward corners and pockets should be scrapped so as to remove all dirty spots and sharp edges, thereby eliminating cracking of the white metal lining when the bearings are put into service. The most effective method is by immersion in a hot alkaline cleaning solution (solution of caustic soda 10-15%) followed immediately by washing in cool running water.

A freshly machined new shell or a demetalled shell where surface preparation has been satisfactorily carried out may not require the degreasing operation if it is immediately taken in hand for tinning. There is often some lapse of time between the machining and tinning operations of a shell and it is, therefore, desirable that the degreasing bath is also introduced in the bolt to ensure complete elimination of any oily substance on the shell.

The pre-heating should be carried out in thermostatically controlled electric furnace fitted with pyrometer and preferably with a conveyer. The pre-heating temperature range should be between $200^{o}C$ and $250^{o}C$.

The degreased shell should be given an application of liquid flux on the surface to be tinned and then placed in the pre-heating furnace. Remove the shell from the pre-heating furnace and apply liquid flux by brush uniformly on the surface to be tinned. The flux should be prepared by adding zinc chipping to cold concentrated commercial hydrochloric acid (gravity not less than 1.15) till no more dissolves (about 245 grams of zinc per litre of acid). The solution should be allowed to stand over-night with excess of zinc then decanted. To this solution should be added 60 grams of Ammonium chloride (salt) per litre of the decanted zinc chloride solution.

Tinning bath should be oil fired, pot type furnace, thermostatically controlled and fitted with pyrometer. The tinning bath should be covered with a layer of zinc chloride flux or tallow to prevent drossing. Immerse the fluxed shell with the concave surface down in a molten bath kept at a temperature between $260^{o}C$ and $280^{o}C$ and containing alloy of 50% tin and 50% lead. The bearing shell should be kept in the bath till it has reached the temperature of the bath (about two minutes). Remove the bearing shell, wire brush the surface immediately after removal, re-flux it and repeat the above operation.

It is desirable to carry out the above tinning operation, on each shell, three times but in any case the above operation must be repeated at least twice to ensure satisfactory tinning of the shell. Wire brush is not to be used after the last dip in the tinning bath. On the contrary, after the last dip, a soft hair-brush should be used which would help in spreading the tin evenly over the entire surface and also to remove the excess molten tin. A lime wash may be applied on the surface not to be tinned as this will prevent the tinning of such surfaces.

When tinning has been successfully carried out, a continuous layer of alloy covers the base metal (bronze metal) and this is covered with a smooth, bright, uniform layer of tin. Inadequate preparation of the surface before tinning leads to a lack of continuity or uniformity in one or both layers. The white metal when it is poured, amalgamates or alloys with the top layer of the tin. Thus in the final bearing there is a thin, continuous layer of alloy between the shell and the white metal.

Metalling should be carried out with the shell in the vertical position only.

A bearing should never be poured horizontally with the shell upper-most, as in this position both air and oxide are inevitably trapped between the white metal and the shell and a good and continuous bond cannot be guaranteed. When using a vertical chill, pudding should be carried out with a steel wire to ensure escape of air and gases.

A molten layer of tin to be available for amalgamating with the white metal to form a strong bond. It is essential that white metalling be commenced as early as possible and only about one minute time should be allowed to intervene between the withdrawal of the bearing from tinning bath and pouring of white metal on it. It may also be ensured that pouring of white metal is completed within 10 seconds.

The white metal bath should be a pot type, thermostatically controlled, oil fired furnace fitted with pyrometer. The molten baths should be kept covered with dry powdered charcoal to avoid oxidation. The white metal chill or mandrel should be sufficiently hot (150-175^{o}C) to check premature freezing an yet not too hot so as not to give a slight chill to the bearing surface. As far as possible, the running - gate should be 6.5 sq. cm. in section and 33 cubic cm. in volume to avoid shrinkage. Use bottom pour ladle of adequate capacity so that one shell could be completed without interruption. Pour the white metal into the bearing with steady and continuous flow at temperature between 350^{o}C and 380^{o}C so that no turbulence is created and the air and gases escape from the mould. While pouring the metal, care should also be taken to ensure that no dross runs with the metal into the bearing. Temperature of the metal in the bath must not exceed 45^{o}C under any circumstances because above this temperature, some of the valuable hardening elements like antimony and copper are partly lost by oxidation as dross and hard oxide inclusions cause excessive wear of the journal. Over heating also cause brittleness and excessive contraction. Remove the bearing after the metal is set and allow it to cool in air. However, a minimum time of 5 minutes must be given after pouring of white metal to enable the white metal to solidify properly.

Each metalled bearing should be tested for soundness by giving the 'ringing test' to a bearing suitably suspended. A perfectly metalled bearing with satisfactory bonding would give a ring more or less similar to the ring of the shell prior to its metalling. A dull sound would indicate discontinuity such as porosity, improper adhesion, loose spots and general unsoundness. At least 1 percent of the daily output of metalled brasses should be given a destructive test, preferably the chip test. This involves the removing of a portion of the white metal from the shell with a chisel and hammer. When properly bonded, difficulty will be experienced in doing this and the lining will torn away from the shell leaving a rough surface where some of the white metal will be still adhering to the shell. If on the other hand, bonding is not satisfactorily done, the white metal will come away from the shell quite easily, leaving a dull grey surface.

The temperature ranges, although indicated earlier in these instructions are summarized below and must be adhered to :-

Demetalling bath	**400^{o}C to 450^{o}C**
Caustic Bath	**60^{o}C to 70^{o}C**
Pre-heating prior to tinning	**200^{o}C to 250^{o}C**
Tinning bath	**280^{o}C to 300^{o}C**
Pre-heating of chill	**150^{o}C to 175^{o}C**
White metal bath	**350^{o}C to 400^{o}C**
White metal pouring	**350^{o}C to 380^{o}C**

Frequent checking of the temperatures of various baths is necessary. Pyrometers are likely to go out of commission or give faulty readings a bit too frequently. Portable thermometers must therefore be provide at each white metalling point to check on the accuracy of the pyrometers and also for regular use in the event of pyrometers going out of commission temporarily.

605 T. MAINTENANCE INSTRUCTIONS FOR FRLP

FRLPs may be procured/supplied in :

a) Dry condition

b) Pre-oiled condition

a) Preparation of FRLP Dry Pads

I. Insert FRLPs into a tank filled with axle oil to specification IS:1628 medium grade and ensure that they are fully submerged.

II. Periodically squeeze the pads to ensure proper absorption of oil.

III. Saturate the pads for 12 hours.

IV. On removal from the tank the saturated pads may be immediately applied to axle boxes, or placed on suitable rake/wire netting for draining of excess oil for a period not exceeding one hour prior to application to axle boxes or packaging in leak proof bag.

V. Pads that drain for more than one hour must be return for resaturation.

VI. Minimum amount of oil that must be retained by lubricator after 12 hours saturation and one hour draining should be

(i) MG Pads	1200 grams
(ii) BG Pads	1800 grams

The pads should occasionally be weighted for cross checking.

VII. Oil saturated FRLPs that are to be stored or sent to other fitment points must be packed in individual leak proof polythene bags and contains a minimum of 5% more oil by weight than that specified under para "VI" above.

VIII. Both dry and saturated pads should be kept in dry and clean place to avoid ingress of dust and other foreign material.

b) Preparation of FRLP Pre Lubricated Pads

I. These FRLPs are mechanically saturated with oil at the manufacturers end.

II. Pre oiled pads shall be supplied by the manufacturers packed in individual polythene leak proof bags and securely sealed.

III. These pads shall be packed by the manufacturer in corrugated or other suitable container lined with polythene or plastic material of sufficient thickness to prevent leakages.The container used shall be sufficient strength to avoid damage or permanent distoration of the package pads. Each container shall contain a set of 4 FRLPs. The container shall be suitable sealed to prevent contamination.

IV. These container should be properly stacked/stored in sickline/workshop to avoid any damage.

c) Preparation of Journal Boxes and Associated Parts

I. Before applying the pads to axle box remove journal bearing and wedge

II. Thoroughly clean the axlebox. Lintfree wiping rags must be used for cleaning purposes.

III. Waste or paper should never be used for cleaning purpose.

IV. Axle boxes must be inspected for crack or other defect, which could cause oil leakage. Those axle boxes found to be leaking should be repaired or removed from service.

V. Examine journal, journal bearing & wedge; renew all defective parts

VI. In shop new dust shield and front gasket have to be fitted. In nominated depots condition of dust shield and front gasket should be checked before fitment of FRLP. If found defective they should be replaced.

VII. Check and ensure that the surface of the journal is smooth and thoroughly clean before applying the bearing.

VIII. Ensure that the journal bearing is smooth and clean before application.

IX. Before applying journal bearings and wedges, the top surface of the journal must be thoroughly flushed with axle oil. Axle oil must be applied to the top surface of the bearings and wedges prior to installation.

d) Method of fitment to FRLP in the axle box

I. Jack the box

II. Remove the plain bearing and key plate

III. Jack the box down

IV. Insert the pad. The pad must be pushed to the rear of the box away from the journal collar and cantered from left to right to prevent cutting of the front of FRLP.

V. Jack the box up.

VI. Insert bearing and key plate.

VII. Jack the box down .

VIII. Check to make sure that the pad is centered.

IX. After re-packing the axle box of the wagon, the axle boxes must be added to the box to a depth of 60mm/45mm for BG/MG axle boxes to ensure full re-saturation of the pads.

X. Before releasing the wagon the axle boxes must be inspected to determine if atleast 25mm of free oil if visible in the bottom of the box after the pad has finished absorbing free oil.

XI. The front cover should then be riveted after applying new front gasket and ensuring proper sealing.

XII. While fitting FRLPs care must be taken to avoid damage to the pad through use of improper tools.

XIII. No other type of axle box packing/lubricating device is to be used with FRLPs.

XIV. Alternative method of fitment of FRLP in shops or on loose wheel sets should not be adopted.

XV. Remove axle box from journal and clean it from inside.

XVI. Fit new dust shield.

XVII. Clean the journal.

XVIII. Insert soaked FRLP with strap facing the front. The pad must be pushed to the rear of the box to prevent cutting of the front of the FRLP by the journal.

XIX. Insert the axle box over the journal.

XX. Fit bearing and key plate on the journal.

XXI. Add free oil in the box to the depth of 60mm/45mm for BG/MG axle boxes.

XXII. Fit axle box faceplate with front sealing gasket.

XXIII. While fitting FRLP care must be taken to avoid damage to the pad through use of improper tools.

ATTENTION AT INTERMEDIATE POINTS.

I. All axle boxes fitted with FRLP must be monthly oiled with 227ml of oil for BG wagons and once in 3 months for MG wagons and marking be done as per instructions in “Trial Scheme”.

II. In case of hot box the axle box cover should be opened and inspected. Proforma as per the trial scheme should be filled up and sent to Director General (Wagon) RDSO/Lucknow for information.

III. If during BOX feeling any axle box is found to have temperature above normal the same should be opened and inspected. If any irregularity as mentioned below is found it should be rectified as per instructions given below:

IV. If lubricator is out of place, away from the journal rear fillet, rolled up on one side or worked out under journal collar, it should be set up in proper place, using packing iron with blunt ends as shown in Fig-2 or whenever the axle box is opened for inspection.

V. If during service or whenever the axle box is opened, it is found that the pad does not properly contact the journal due to excessive compression set, as shown in Fig-3 may be used as an aid to determine proper contact to pad.

VI. Sufficient axle oil should be added to provide a oil level of not less than 25mm. When no free oil is visible in the box, oil must be poured on the top of the pad along each side and in front of the journal to bring oil level to a depth of 60/45mm for BG/MG axle boxes.

VII. If a box contains any foreign matter which has a detrimental affect on the lubrication of the bearings the box must be repacked with a new pad.

VIII. If axle box cover is broken or does not provide proper sealing, it must be replaced.

IX. Axle boxes should be topped with axle oil whenever the axle box cover is opened for any inspection.

X. Proper sealing should be ensured before rivetting the journal cover.

XI. Pad life

XII. The lubricating pads are expected to have a normal life around of 2 years and have to be changed after a service of about two years. During any inspection in between the pads will be considered as defective and will require renewal for the following reasons:

i) Any non-contact with journal.

ii) Any scorched or burnt areas.

iii) Any glazing of the surface.

iv) Top, front, back or side torn for more than on half it length.

v) Fabric deteriorated or decayed.

vi) Exposed core or metal part contacting journal.

vii) When wagons are dismantled for any reason necessitating removal of the pad.

viii) Axle boxes given attention during POH.

ix) When involved with a hot box requiring renewal of journal bearing.

x) Contaminated by flood, excessive water or debris.

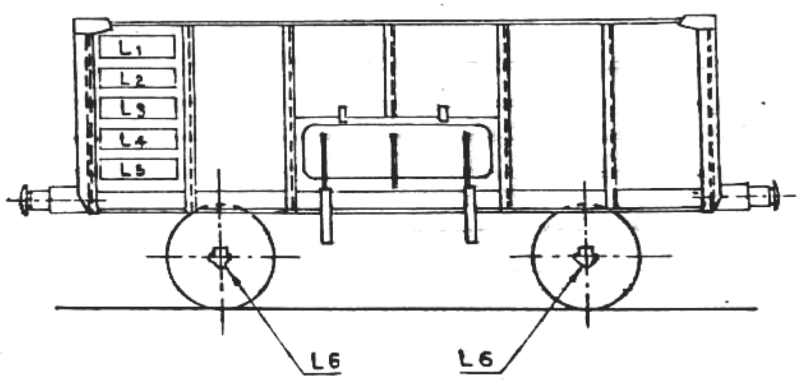
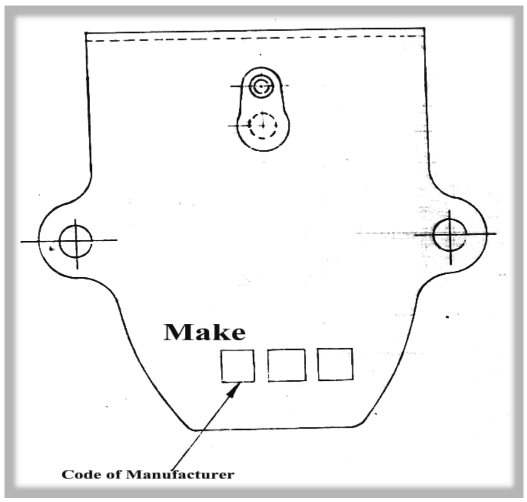


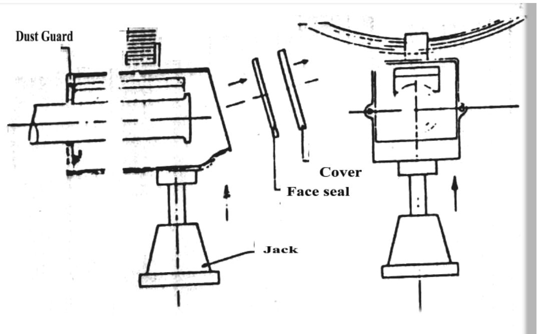
Fig 6.10 IDETIFICATION MARKS FOR WAGONS



Note: Code of manufacturers.
Trivendrum Rubber Works – TRW
Ransal Rubber industries – RAN
Technicla works industries link ltd. – TWL

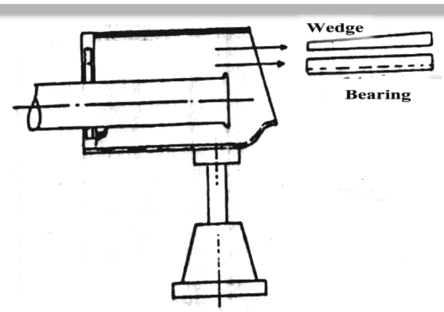
Fig 6.11 Marking of Face Plates

Fig 6.12 Fitment of FRLP



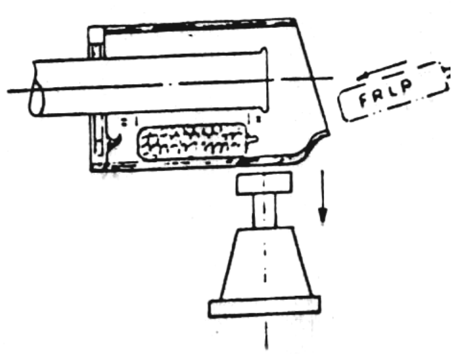
Remove cover with face seal and raise journal box with help of jack or other device

2.



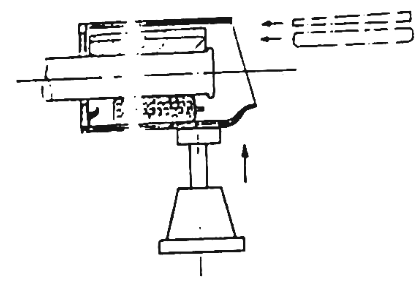
Remove plain bearing and wedge fron journal box

3.

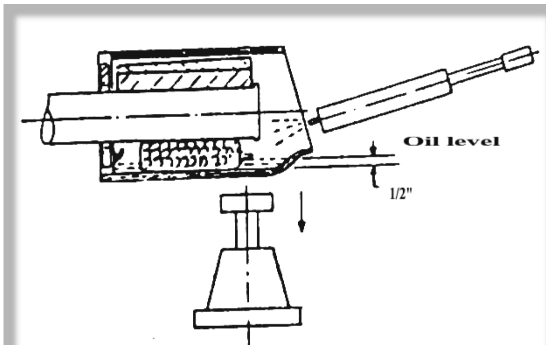


Lower Journal Box to the maximum possible. Insert pre oiled FRLP into journal box. Ensure it is centred from back to front and left to right keeping strap facing the front.

Note: do not use any implements to push in FRLP which may tear FRLP cover

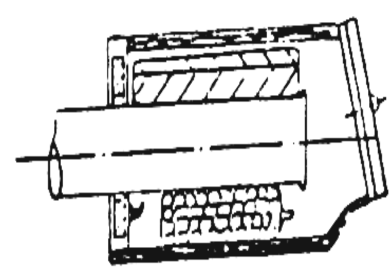


5.



Lower journal box to normal position fill lubricating oil to 1/2" level in journal box

6.

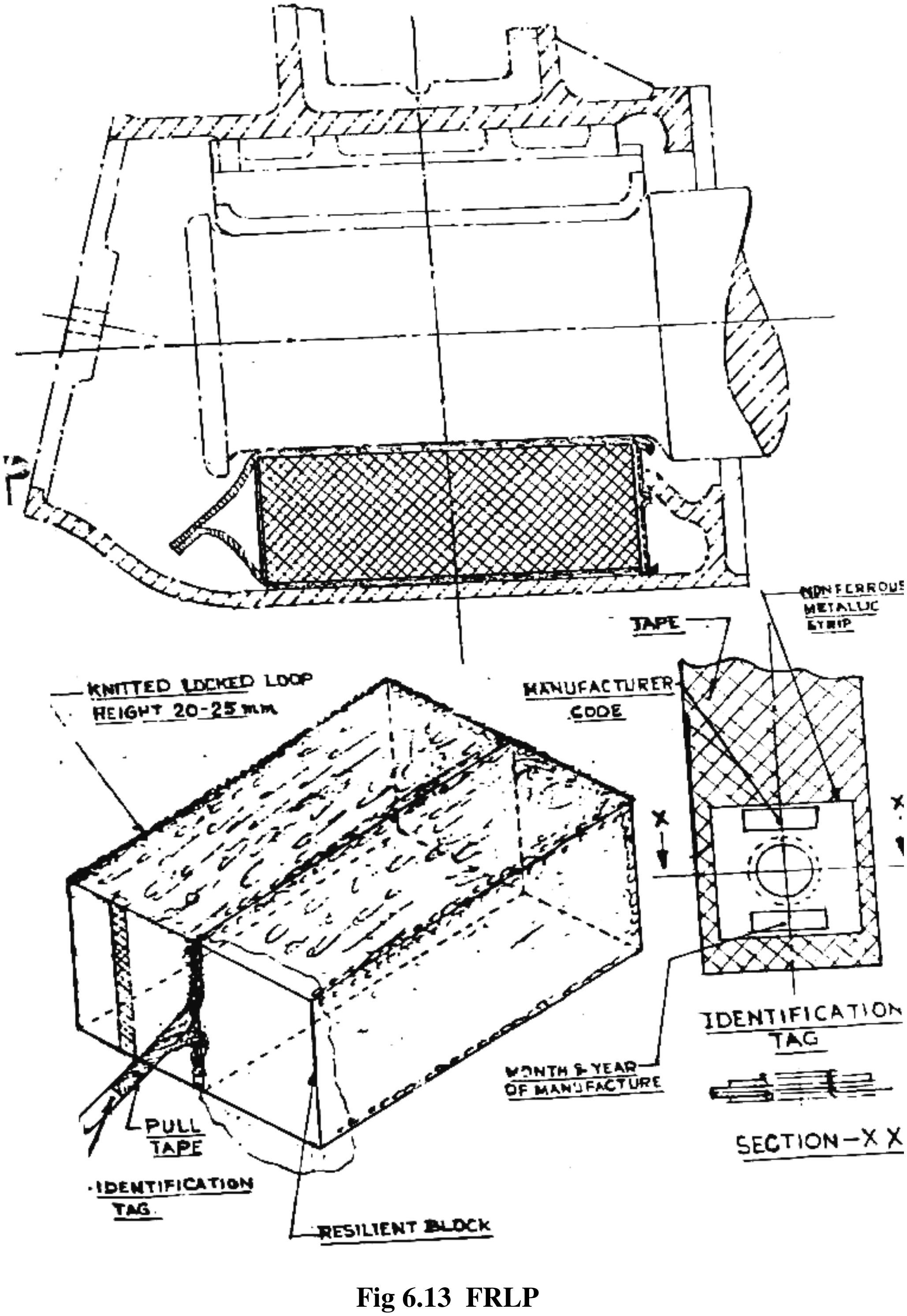


Fit back face seal cover

Note

i) Ensure dust guard and face seal is fitted with every FRLP.

ii) Far detail instructions see over leaf.



NON FERROUS METALLIC STRIP
TAPE
KNITTED LOCKED LOOP HEIGHT 20-25 mm
MANUFACTURER CODE
X
X
IDENTIFICATION TAG
MONTH & YEAR OF MANUFACTURE
PULL TAPE
SECTION – X X
IDENTIFICATION TAG.
RESILIENT BLOCK

Fig 6.13 FRLP

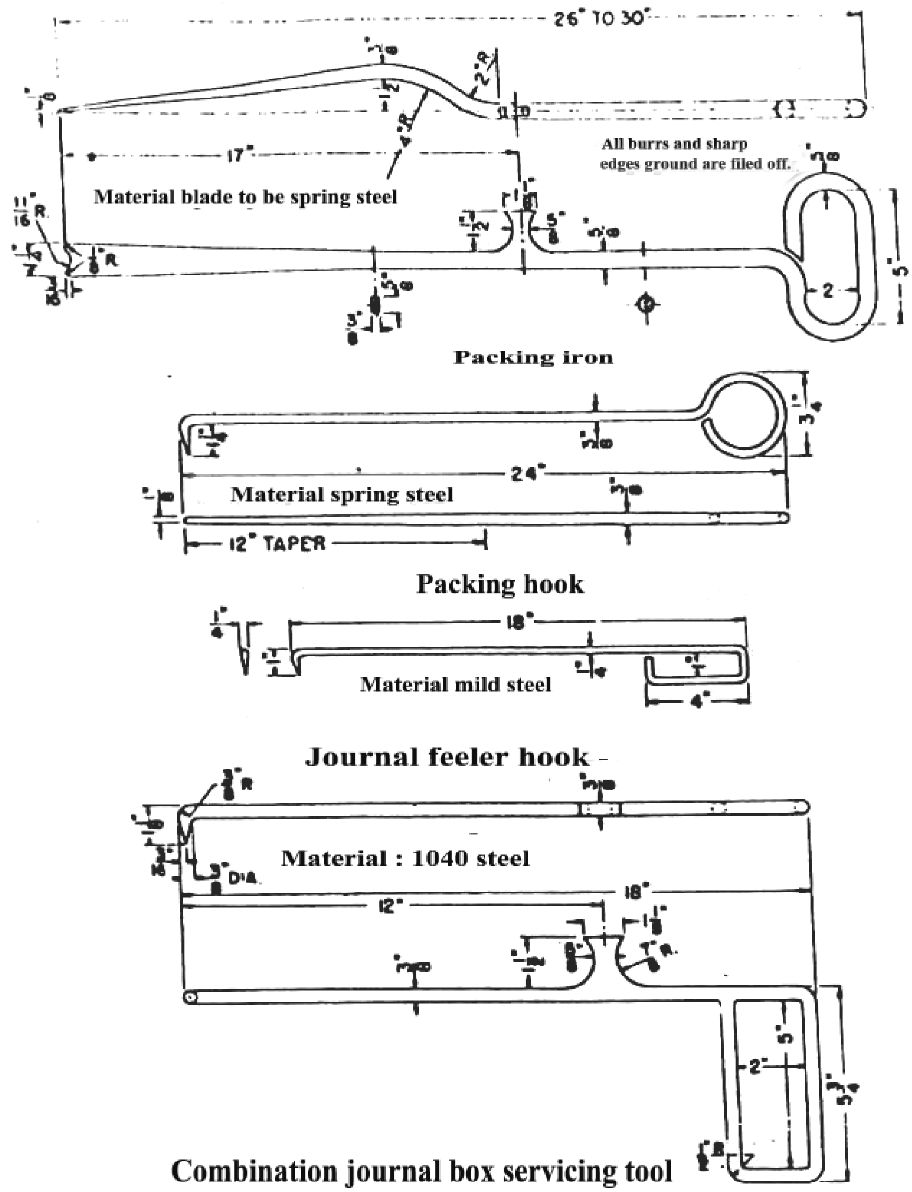
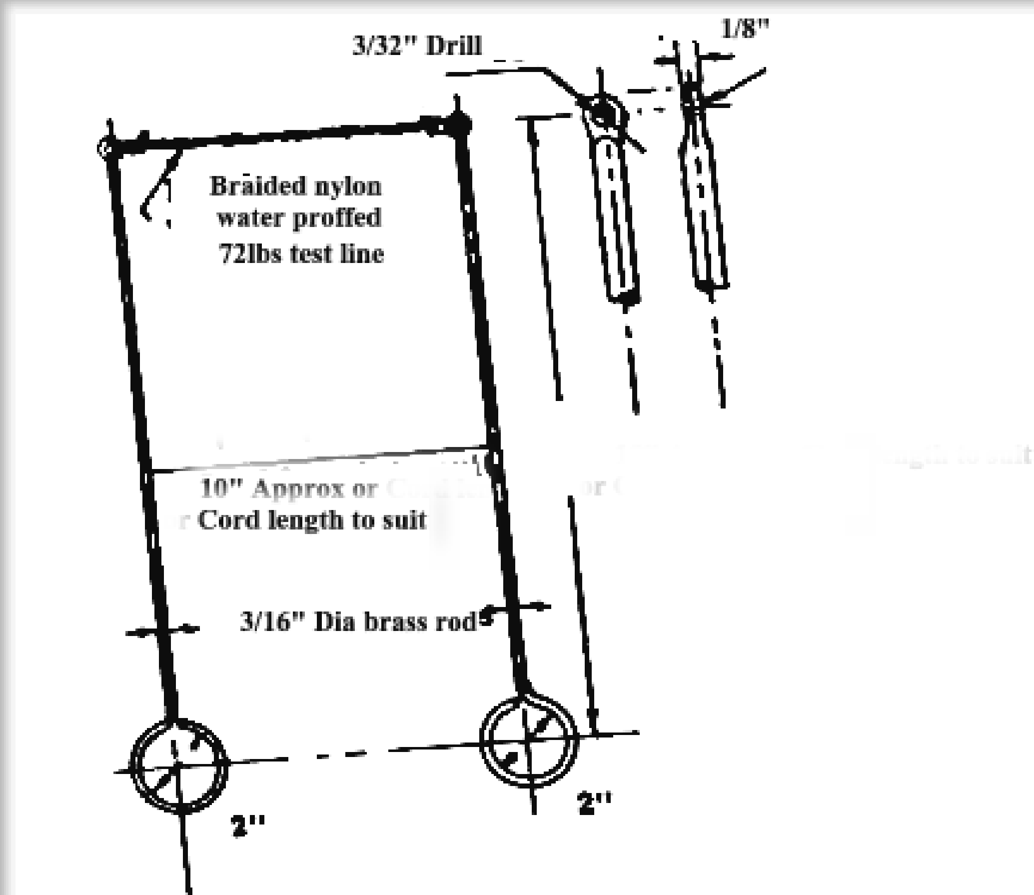


Fig 6.14 Tools



Journal lubricator contact test tool

Fig 6.15 Tools

606. WHEEL ASSEMBLY

A. Axle

An axle is a long steel bar to hold a pair of wheels in position. Carriage & Wagon axle is made of steel to specification No. IRS-R-16. Its journal portion is suitably designed to mount a plain or roller bearing. It can be divided into following portions:-

i. Portion between the wheel seats.
ii. Wheel seat on either side.
iii. Shoulders just after the wheel seat on either side.
iv. Journal just after the shoulder on either side.

The portion of axle between the two wheel seats used to be made taper the lowest diameter being the centre of the axle. Now the practice of tapering axles have been discontinued and is made parallel. The portion of the axle on which the wheel centre is pressed is known as wheel seat. The seat is fine finish machined. The shoulder portion is also fine finish machined.

Two small axle centres are drilled on end surfaces on the axle. These holes facilitate turning of the axle on centre lathes, grinding/furnishing of the journals and turning of the tyre on the wheel lathe.

No collar is provided on roller bearing axles. Axle on which roller bearings are mounted should have surface finish and ovality as per drawing. To facilitate the locking of roller bearing in position, three holes are built and tapped on each face of the axle.

B. WHEEL

Wheels are of two types: solid and tyred. The tyred wheel consists of wheel centre, tyre and glut ring to fasten the tyre with the wheel centre. In solid wheels, the wheel centre and the tyre portion is rolled in one piece. Glut ring is therefore not required is case of solid wheels. Only solid wheel shall be procured for fitment.

After solid wheels get worn to condemning size in case of four wheel BG wagon and MG wagons, it is machined to the size of the wheel centre and separate tyre is shrunk fit on it and suitably fastened by glut ring. When the tyre also reaches condemning limit it is removed by machining its lip opposite the glut ring a new tyre is fitted. List of drgs. for wheels of different wagons is as under;

LIST OF DRGS. FOR WHEELS OF DIFFERENT WAGONS

S. No.	DRAWING NO.	AXLE LOAD(t)	TYPE OF WAGONS
1.	W/WL-4764 SK-68512 WD-97037-S-01 OR WAP/SK/M 153	22.9	BOXN, BCN, BRN, BOBR, BTPN (FITTED WITH CASNUM BOGIES)
2.	SK-69001	22.9	BOY, BOBX MK-II, BOZ
3.	W/WL-4771	22.9	BWT/A, BWL
4.	W/WL-4750 WD-89025/S-5	20.3	BOX, BOX MK-I, BOX MK-II, BOXC, BRH, BRHT, BRS, BOI, BRHC, CRT, CZ, BVZI, BVZC, OZ, BTAL, BTO, BTALN, BTPGL, BOXC, BOXT,
5.	W/WL-527	16.3	TPR, TORX, TORXT, TORXC, TCH, TSA, TCS, THT, TALR, TCL, TCIR, TPGL, TPG&R, TPRC, TPRT, O, BWX, BWX/A, TP, BVG, BVN, BVGT
6.	W/WL-770 WD-83074/S-2	12.2	MG 4 WHEELED & BOGIE WAGON
7.	W/WL-3140	8.1	ALL NG WAGONS

C. DIAMETERS OF WHEELS USED ON BG AND MG STOCK WITH CONDEMNING LIMITS

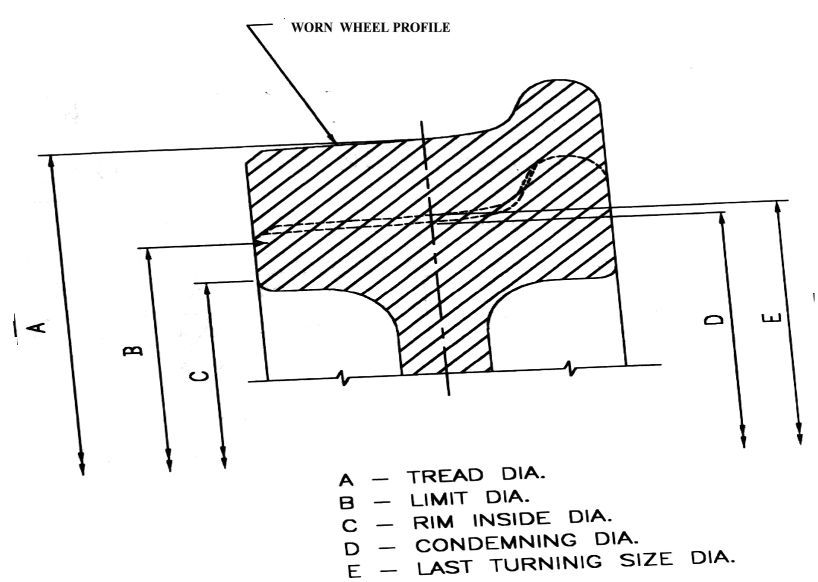


Fig 6.16 Wheel profile

The last shop issue size and the condemning dia of different wheels shall be as per RDSO Drg.No.WD-88089/S-1 given below;

S. No.	Axle (t)	Drg.No.	Nom. Dimensions				
			A	B	C	D	E
1.	22.9	W/WL-4764/Sk-68512	1000	897	850	906	919
2.	22.9	WAP/SK/M/153 or WD-97037-S-01	1000	897	-	906	919
3.	22.9	SK69601	1000	897	850	906	919
4.	22.9	W/WL-4771	915	804	761	813	826
5.	20.3	W/WL-4750	1000	851	814	860	873
6.	20.3	WD-89025/S-5	1000	851	814	860	873
7.	16.3	W/WL-527	1090	980	940	990	1003
8.	16.3	WD-89025/S-9	1090	980	940	990	1003
9.	14.0	WD-89061/S-2	725	626	585	635	647
10.	12.2	W/WL-770	725	626	585	635	647
11.	12.2	WD-83074/S-2	725	626	585	635	647
12.	8.1	W/WL-3135	585	496	456	505	518
13.	8.1	W/WL-3140	585	496	456	505	518

D. WHEEL CENTRE

There are two types of wheel centres namely solid, in which the wheel tread is integral with the wheel centre, and tyred, in which a separate tyre is shrunk on to the centre. Tyred wheels are again sub-divided into two types. Disc type, which is currently in use, and spoke type, which is rapidly becoming obsolete.

E. TYRE PROFILE

Presently Indian Railways using the wheels having optimised wheel profile known as Worn Wheel profile as per RDSO Drg. No. WD-88021 (for BG wagons) and Drg No SK-91122 (for MG wagons) . All wheels are being turned as per these drawings. For Intermediate worn wheel profiles RDSO Drg. No. WD-89060/S-2 shall be followed. Worn Wheel profile and Intermediate worn wheel profile are given below;

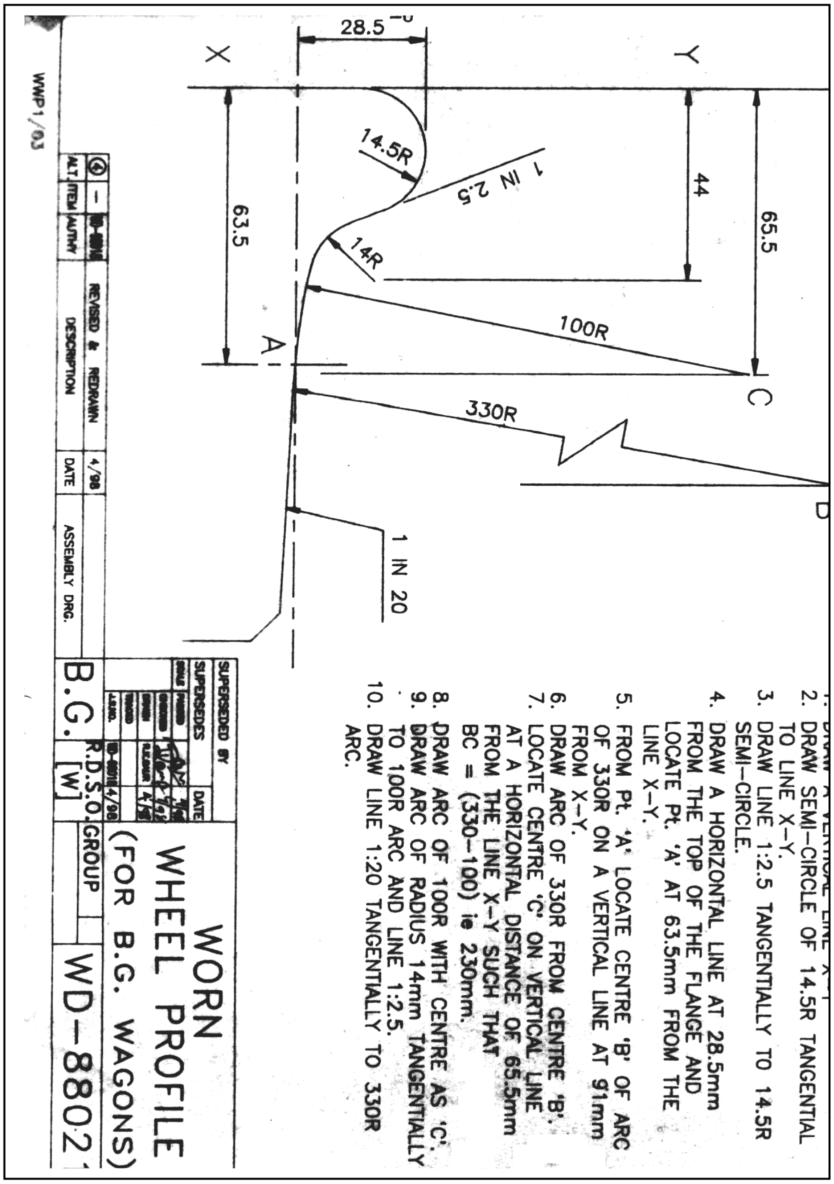


Fig. 6.17 WORN WHEEL PROFILE

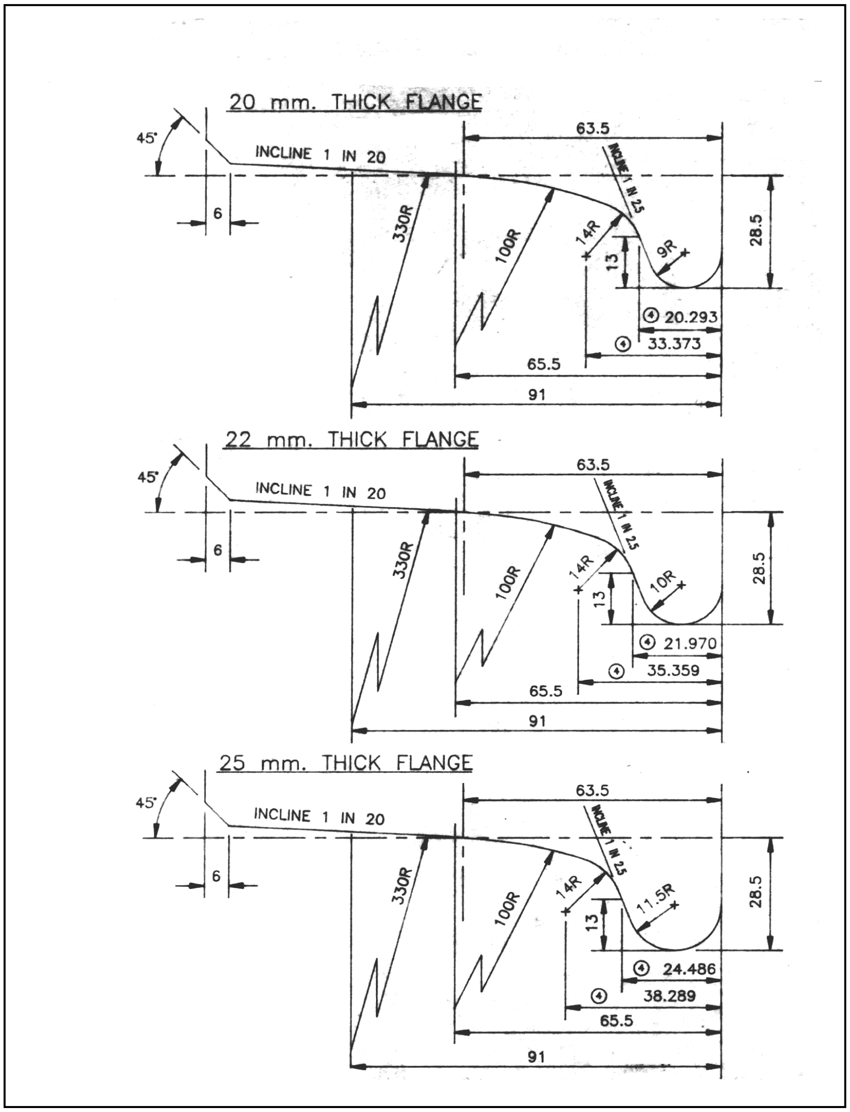


Fig. 6.18 INTERMEDIATE PROFILE (WD-89060/S-2)

F. RE-AXLING

Defective axles, which cannot be repaired, otherwise, required to be replaced. The axles requiring replacement are pressed out of the wheel centre on a Wheel Press machine, specially designed for this purpose. After machining new axles to the required size, wheel centres are pressed on it on the press machine.

After the wheel centre is pressed out with or without tyre, the bore shall be machined to specified finish on a vertical boring machine. The depth of cut should be minimum possible, just enough to remove the irregularity of the surface and to ensure fine finish machined surface. The finish size of the bore should be taken and wheel seat of the axle should be fine finish machined accordingly to a higher diameter giving allowance for the required interference fit. The interference should be kept as 0.001 mm per mm, of the dia of the wheel seat/bore of the wheel centre. For example, for a 180 x 100 mm journal dia of the MG axle, the nominal dia of the wheel seat is 127mm. The required interference fit will be equal to 0.127 mm. The dia of the axle at the wheel seat should, therefore, be kept 0.127 mm more than the dia of the bore of the wheel centre. This interference will normally ensure required pressure of pressing the axle. The prescribed pressure for mounting the wheels and axles shall be as per IRS specification R-19/93 Pt-I.

While pressing the wheel, care should be exercised to see that the pressing is stopped at a pre-marked correct location on the inner side of the wheel seat. Wheels can be mounted on axle with or without tyres. For spoked wheel, if wheel centre and tyres are separate, wheel centre should be pressed in first and thereafter tyre should be shrunk. After re-axling, the tyre should be turned on a wheel lathe to remove minor eccentricity, which is always present. For major eccentricity, which cannot be removed by tyre turning on a wheel lathe, it should be re-axled.

At the time of re-axling, following points to be ensured :-

i. Before mounting the wheels on axles, carefully clean the wheel seat and bore of the wheel to remove rust grit, chips and grease.
ii. Coat wheel seat and bore with mixture of basic carbonate white load and boiled (not raw) linseed oil to avoid scoring of mounting surface.
iii. Keep special care so that wheel-seat and bore and not damaged during mounting operation.
iv. Mounting press must have dial pressure gauge and a pressure recording gauge.
v. Mount the wheels centrally on axle at a proper gauge distance.
vi. Recorder must be maintained and kept properly adjusted all the time.
vii. Check wheel mounting and check gauge frequently so that excessive wear does not allow improper mounting of wheels.
viii. Stamp at the end of the axle box code pressing on pressure and date of mounting to facilitate tracing of history of the paid of wheels.
ix. After mounting of wheels on axle apply rail gauge at three or more equi-distant points around the circumference to see that wheels are within gauge limits.

G. Retyring

Retyring may have to be done on a solid wheel which has reached condemning limit in case of four wheeled MG wagon or over a composite wheel. Solid wheels are turned to the size and the shape of wheel centre on a wheel lathe. Retyring of solid or composite wheels becomes necessary when it reaches the condemning dia. at tread or the tyre and/or wheel centre have become slack or loose or has cracked. Other defects on the tyre profile can be removed by tyre turning.

For composite wheels requiring re-tyring, the old tyre is to be removed first. For composite wheels secured by Glut rings the inner side surface of the tyre opposite the Glut ring has to be removed by machining on a wheel lathe. Thereafter the old tyre is removed either by oxy-cutting it at one location on the circumference or by heating it on furnace. The former method is more economical. Where the tyre is oxy cut, the tyre has to be removed by knocking it down. The wheel centre is now available for fitting a new tyre. The wheel centre should be checked for its squareness on top rim surface of the wheel centre is parallel to the axle and is not tapered. Tapered rim will not grip the tyre properly. The distance between the two wheel centres and its diameter should also be checked to ensure that they are within the prescribed limits. The rough machine tyres should then be finish machined to suite the individual dia of the wheel centre. The diameter of the tyre is kept less than the dia of the wheel centre to ensure proper grip after shrunk fit. The prescribed allowance is 0.001 mm per mm of the dia of the wheel centre. If the dia of the wheel centre is 611 mm the internal dia of the tyre will be 610.389 mm (611 mm)..

After fine finish machining the tyre should be heated on an electric induction furnace or on a cool/oil fired furnace, designed for the purpose. The shrinkage on the tyre should be done at low heat. The temperature of the tyre should be enough so that by expansion if exceeds the dia of the wheel centre and is able to easily go over the wheel centre. After the tyre is heated to the required temperature, it should be kept at a suitable flat location and the wheel centre along with the axle should be inserted in it vertically. Thereafter the Glut ring should be inserted. If any small gap is left on the circumference, a small make up piece of the Glut ring section should be inserted. It is important that while shrinking the tyre on the wheel centre, water should not be used to cool the tyre. After the tyre has cooled, it should be removed to a wheel rolling press. On the press the lip of tyre on the inner surface opposite the Glut ring is pressed in till no gap is left between the Glut ring and the tyre. Now the wheel is ready for tyre turning.

H. TYRE TURNING OR REPROFILING

To remove irregular surface on the profile caused due to wear in service re-profiling is to be done. In service some of the wheel develop defects beyond the permissible limit for the safe turning. Such wheels are to be withdrawn and should be sent to workshop for removing the defects. The wheel requiring re-profiling shall be turned to worn wheel profile or to intermediate profile to RDSO Drg. No. WD-88021 or WD –89060/S-2 respectively.

On receipt of wheels in wheel shop, the diameter of both the tyres at wheel tread should be measured. Some times wheel with unequal dia. on the same axle are received. The tyre should be tapped and if sounding dull, re-profiling should be done. Many times skidded wheels are received due to which tyre surface at some spots got hard. Such spots can not be machined on wheel lathes available in many workshops. Such wheels should be sent to re-profiling section for softening the hard spots on suitable designed furnaces. After softening, the wheels should be sent to tyre turning section. Wheels requiring re-axling and re-tyring should be sent to these sections first and only after completing the re-axling and tyre turning should be resorted to.

Tyre turning is done on a specially designed wheel lathe. The root radius, vertical inclined surface, radius on the top of the flange are difficult portions to be machined.

To machine these portions, specially designed gadgets are provided on the Tool ports. On some old type of lathes form tools are used. Use of form tool is not desirable. Apart from not getting the desired profile it involves frequent grinding of the form tool. Also excessive wear is caused on the tool post and the productivity is very low. When the specially designed gadgets go out of order, form tools should be used in lieu for very short duration. Very attempt should be made to put the gadgets in working order as early as possible.

While tyre-turning, the following should be kept in mind :-

i. The wheel gauge, i.e. the distance between the flanges of the 2 wheels of the same axle should be within the laid down limit. The aspect has to be particularly ensured when new tyres have been fitted. On old tyres normally the distance is correct. But in some cases where the machining has not been done accurately in the past, the distance may be beyond the permissible limit. If the distance is less it can be corrected by machining the side surface of the wheel. In case the distance is more, the wheel shall required re-axling. It is very important that the turner of the wheel lathe checks this distance at the time of turning in addition to the check done by incoming Inspection staff. The laid down distance is 1600 +2/-1 mm for BG and 930 +2/-1 mm for MG.

ii. The variation in tread diameter of wheel tyres on the same axle should not exceed 0.5 mm. The turner normally machines the wheels to equal diameters. However, small variation may occur if the cut has not been taken carefully. After finishing the operators should assure dia of both wheels. If the difference is more than 0.5 mm he should take another cut on the tyre having the large diameter.

I. PAIRING OF WHEELS

Different wheels fitted on a wagon are to be paired. Normally it is done in the Lifting section of the wagon shop. Where large number of wheels of the same tyre are turned on each day, no difficulty is experienced for such pairing. However, when the supply of wheels to Lifting section is from hand to mouth such pairing for the day's requirement has to be done in the tyre, turning section of the Wheel shop itself. Pairing in Wheel shop also becomes necessary for special tyre of wheels received in small numbers. When pairing is done in the Wheel shop, it becomes necessary to turn such wheels even to lesser diameters than is required from the point of view of wear. For such cases specific instructions should be given to turner of the Wheel lathe.

The variation in tread diameter should be as per Clause2.8.14.2 of IRCA Part III(2000).

J. WHEEL DEFECTS

The wheels are required to be withdrawn from service for the following major defects:-

i) Reached condemning limits
ii) Flat places/skidded
iii) Flanges sharp/deep/thin
iv) Too insufficient radius at the root of flange
v) Gauge slack/tight
vi) Slack Tyre
vii) Cracked or broken

Defects i) to iv) mentioned above are detected with the help of tyre Defect Gauge. Defect as in item (v) is checked by Wheel Gauge. Defect as in item (vi) is checked by ringing test and defect as in item (vii) is determined by visual examination.

Permissible maximum flat surfaces on tread are as under:

Wagon Type	**Permissible Flat Surface**
BG Wagons	60 mm
MG Wagons	51 mm

a) THIN AND SHARP FLANGE

(i) For proper method of using Tyre Defect Gauge, please refer IRCA Part III .

(ii) Wheel may be passed provided the minimum thickness of flange is 16 mm.

(iii) Wheel must not be allowed to run if flanges are worn to knife edge but may be passed if the radius is not less than 5 mm.

(iv) Wheels with too small radius at the root of flange should not be allowed to remain in service.

K. REPAIR AND MAINTENANCE IN SICK LINE

i. Inside Crown of the Axle Box should be checked for wear at the time of re-packing. Concave wear on the inside Crown should not be permitted under any circumstances.

ii. The dust shield should be examined during re-packing of axle boxes in sick lines. If found worn, torn, or if it has lost its stiffness, it should be replaced.

iii. Axle boxes with rejectable defects to be attended as given in para 605 I(b).

iv. Bearing brass to be examined and repaired as given in para 605 N(g).

v. Periodicity of re-packing and oiling to be followed as given in para 605 -O.

vi. Procedure of re-packing of axle boxes to be done as given in para 605 P.

vii. Important do’s & don’ts in re-packing of axle boxes to be followed as given in para 605 R.

viii. Examination and maintenance of Axle, wheels and tyres should be done as per IRCA Part III (2000) Rule 2.8.

L. REPAIR AND MAINTENANCE DURING ROH & POH

The following additional work is also to be carried out during maintenance at the time of ROH and POH including the work mentioned in para J.

i. The dust shield should be examined, every time the axle box is repacked during POH. If found worn, torn, or if it has lost its stiffness, it should be replaced.

ii. Axle boxes should be examined and inspected on open lines for defects. Rejectable defects of axle box to be attended as given in para 605 I(b).

iii. The elongated/oval cut holes on face plate should not allowed. Proper riveting of the face plate to be done with axle box.

iv. Bearing brass to be examined and repaired as given in para 605 N(g).

v. Repair of the journal to be done as per IRCA Part III (2000).

vi. Periodicity of repacking and oiling to be followed as given in para 605-O.
vii. Procedure of re-packing of axle boxes to be done as given in para 605 P.
viii. Proper attention must be paid to the examination and riveting of the face plate at the time of POH in workshop. Important do's & don'ts in re-packing of axle boxes to be followed as given in para 605 R.
ix. Procedure for white metalling to be done as given in para 605 S.
x. Examination and maintenance of Axle, wheels and tyres should be done as per IRCA Part III (2000).

607. IMPORTANT DIMENSIONS RELATED TO SUSPENSION

(Unless otherwise indicated, the dimensions are in mm)

Sr. No.	Description	MG	BG
1.	■ Scroll iron eye hole dia max. ■ Shackle pin-dia ■ Max. Clearance between Shackle pin and scroll iron when new ■ Max. clearance between shackle pin and spring eye when new ■ Shackle plate thickness ■ Shackle plate eye hole dia ■ Washer	23.65 mm 21.6 mm 1.05 mm 1.15 mm 20 mm 23.65 mm 6 mm	29.65 mm 27.6 mm 1.05 mm 1.15 mm. 25 mm 28.65 mm 4 mm
2.	■ plated IRS type spring for 4 wheeler wagons (MG) ■ plated non standard sp- 76 mm ring for 4 wheeler wagons ■ plated non standard for 4 & 6 wheeler wagons ■ plated IRCA type ■ plated BG spring for 4 wheelers ■ plated BOX spring for UIC bogies	Free camber 50.8(+5/-0)mm 76 mm 86 mm 51 mm	 75.5(+6/-0) mm 47(+6/-0) mm
3.	■ Spring buckle packing pieces step sizes ■ Pressed steel axle guard plate thickness	Buffer Height adjustment. 9, 19, 26 & 35 mm 8 mm	11,26, 37 mm 10 mm
4.	■ Horn cheek thickness ■ Leg size ■ Height	12 mm 82x36 317 mm	19 mm 96x48(for 16 t) 95 x 64 (for 22t) 419 (for 16t), 432 (for 22t)

	■ Rivet hole dia ■ Distance of centre line of holes from bent corner	21.5 mm 47 mm	21.5 mm 57 mm
5.	■ Tie bar thickness ■ Rivet hole dia ■ Axle Guard packing plate ■ Edge radius ■ No. of rivet holes ■ Dia of rivet hole	12 mm 17.5 mm 387x55x12 (thick) 6 mm 5 Nos. (27 mm from edge 21.5 mm New	20 (for 22t ISA 50 x 50 x 6 (16.3t) 17.5 mm 536x75x10 (thick) 10 mm 5 Nos. (28 mm from edge) 21.5 mm Max.
6.	■ Axle guard lateral clearance ■ Box Bogie ■ Longitudinal clearance ■ BOX Bogie	MG - 6.8; BG - 6 20 mm MG – 3; BG - 3 12 mm	25 mm Max. 18 mm Max.
7.	■ No. of holes to secure spring plank by rivets ■ No. of holes in bracket in tie bar ■ Axle box bolt hole dia max. wear ■ Diamond frame bogie spring plank rivet holes (number) ■ Cast steel bogie spring plant rivet holes ■ Brake beam support plate rivet holes ■ Push rod safety loop rivets holes ■ Spring plank Inspection hole ■ Bogie brake fulcrum bracket bolster	6 3 2 mm 12 8 mm(vertical) 6 mm 4 mm 127 mm dia 4 holes	6 3 2 mm 4 8 mm (vertical) nil nil 152x76x2 holes nil
8.	■ Rivet dia clearance ■ Top surface radius of bottom pivot ■ Side surface of bottom pivot ■ Diametrical clearance between pivot bin portions ■ Diametrical clearance between outer edges ■ Diametrical clearance between top pivot and pin	2 710 115 Min.4 Max.8 8 10	2 495 255 3 16 10
9.	■ Side bearer clearance ■ Axle box bolt size ■ Radius of column at bottom outer side	Max. 6 Min. 3 M-30x390 12	BOX Bogie:- Max.-7, Min.- 4 M-30x386 12

	■ Centre of radius of tie bar ■ Column bolt size ■ Tie Bar ■ Tie bar camber ■ Distance between centre of two radius ■ Strengthening bar ■ Length of tie bar ■ Square piece welded ■ Top arch bar ■ Top arch bar camber ■ Radius at bends ■ Bottom arch bar ■ Bottom arch camber ■ Bottom arch bar radius at bends	70 M-30 x 50 150x82 thick 286 578 125x10 thick 830 32x126 32x150 30 70 150x16 32 70	40 M-45x590 150x50 thick 390 508 Nil 217 Nil 40x150 45.5 152 150x20 85 152
10.	■ Axle box top cover rivet holes ■ Axle box guard groove liner plate thickness ■ Axle box guard groove liner sizes 4 wheeler ■ Axle box guard groove liner inner radius at bends ■ Key plate thickness	2(6.5 dia) 4 (for 4 wheelers) 232x50.8 M x22 4 mm (for 4-wheeler) 13 x 209.5x 138	2(6.5 dia) 3.15 (for 4 wheelers) 273 x 60.3x30 deep 6 mm (for 4-wheeler) 16x 234.5x155.5
11.	Radius provided on top of flange: ■ Profile A ■ Profile B (1st intermediate) ■ Profile C (2nd intermediate)	 12 10.75 9.5	 14.5 R 12 (NR practice) 10 (NR practice)

■■■■■

MAINTENANCE MANUAL
FOR
WAGONS

Chapter – 7 *Vacuum Brake System*

CHAPTER 7

VACUUM BRAKE SYSTEM

701. GENERAL

Brakes are essentially meant for controlling the speed and stopping the train. Different brake systems exist world over depending upon the requirements laid down by individual railway systems. The brake system should meet the following basic requirements:-

- Should be automatic and continuous i.e. in the event of train parting, brakes should automatically apply
- Shortest possible emergency braking distance
- Maximum possible braking force
- Shorter brake application time
- Shorter brake release time
- Low exhaustibility of brake power under continuous or repeated brake application
- Ease in maintenance
- Minimum "run in" and "snatch" action during braking

The vacuum brake system derives its braking force from the atmospheric pressure acting on the lower side of the piston in the vacuum cylinder while vacuum is maintained above the piston. The nominal vacuum is 510 mm which gives an effective pressure of 0.7 kg/cm^2 on the piston. The vacuum is created in system by the ejector or the exhauster mounted on the locomotive.

702. CONSTRUCTIONAL DETAILS

A. The main parts of vacuum brake system are:

I. The vacuum cylinder suspended by trunions from the underframe
II. Brake shaft
III. Brake rigging i.e. pull rod, levers etc.
IV. Train pipe and pipe connections
V. Hand brake (Lever or screw type)
VI. Empty-Loaded Tie Rod
VII. Slack Adjuster

B. VACUUM BRAKE CYLINDER

There are two basic types of vacuum brake cylinders in use on goods stock namely “E” type and “F” type. In “E” type brake cylinders, the volume of upper chamber is enhanced by provision of a dome or casing which forms an integral part of the vacuum cylinder. In “F” type vacuum cylinder, the top is kept flat but a separate vacuum reservoir is provided, which is connected to the upper chamber by a syphon pipe to achieve the same purpose. The higher volume of the upper portion ensures higher efficiency of the vacuum cylinder.

Both E and F type brake cylinders are further sub-divided according to the cylinder diameter. Types and size fitted on various standard wagons are as under:

S. No.	Type	Size (in mm)	Drg. No.	Stock where fitted
1.	E	457	VBA-7/M	All 16 ton Axle load wagons except BVG & BVM
2.	E	533	VBA-8/M	On BWL,BWT,BOB,BOBX, BOBS
3.	F	533	VBA-15/M	On BWS,BRS,BRH,BVG and BVM
4.	F	560	VBA-20/M	On BOX,BCX and BOI.

703. “F” TYPE CYLINDER

In “F” type cylinders the volume of upper portion of the vacuum cylinder is kept much larger as compare to “E” type cylinder. Larger volume of the upper portion ensures higher efficiency of the vacuum cylinder

In E type cylinders the upper portion volume is provided by giving sufficient annular space between barrel, casing and a dome on top. In F type cylinder the top is kept flat and there is no casing to give annular space. A separate cylindrical shaped vacuum chamber of larger volume is suspended on the underframe. The upper portion of the vacuum cylinder is connected to this chamber thought double branch release and siphon pipe. “E” type cylinders have a barrel and a casing whereas in F type cylinders a back and a bottom pan. Their shapes are also different. The barrel and the bottom pan are joined sides by means of studs on lugs provided in circumferences. The barrel is of cylindrical shaped with closed top. The pan is also of cylindrical shape with closed bottom. On F type cylinders double branch release valve is provided near the joint instead of single barrel cylinders. A separate passage from the top of the barrel to the release valve is provided side the barrel. This passage is connected through the release valve to the vacuum reservoir and lying separately from the underframe. The most advantages of F type cylinders over E type cylinders are as under:

(i) Larger volume of upper portion of vacuum cylinder increasing the efficiency of vacuum cylinder.

(ii) The renewal and examination of rolling ring is extremely easy as the bottom can be removed easily from joint. In E type cylinders the complete cylinders is required to be taken off for examination of rolling ring.

(iii) The life of rolling ring increases due to more even milling or serration and the rolling ring is not required to be forced and skidded in to position while fitting the piston head.

Except barrel bottom pan and release valve other parts of the F type cylinders are identical with E type cylinders of same size. The three parts and vacuum chamber are described severally.

Barrel:

It is made of cast iron. It is cylindrical in shaped. At the bottom there are 4 lugs for securing the bottom pan with 4 studs. Near bottom there is a circular vertical flange with 4 studs of M-10 size at 82.5mm P.C.D. for securing the double branch release valve it. On the body at a suitable height there two integrally cast trunions. From the top portion of the barrel a 16 mm dia passage is provided outside the barrel leading to vertical flange. This passage connects the top of the barrel with vacuum chamber through the release valve. The top portion of the barrel has strengthened by 4 integrally cast ribs starting from the circumference and extending up to the central boss having 10 mm thickness and increasing height from zero to 32 mm upto the central boss. The inside and outside dia of central boss is 102 and 122 mm respectively. On the top portion of the barrel above the passage leasing to the release valve a hole is required to be provided to facilitate manufacturer. This hole should close by FP 3/8 “A” plug. the hole should therefore, be tapped accordingly. Manufacturers can, however omit it at their option. On the centre of the circular flange a 19 mm dia horizontal hole is drilled on the barrel leading to the lower portion of the cylinder. At the bottom of the barrel there are two recess; the first one is of 2 mm height and the second on 10 mm in height. The vertical surface of the second recess is fine finished machined and the horizontal surface rough machined. The horizontal surface of the first recess and the bottom flange is finish machined. Inside of the barrel is finished machined except on the radius portion where it is rough machined. The vertical circular flange is finish machined. The bottom pan is secured with barrel by means of 4 studs and nuts. The thickness of the barrel is 8 mm.

The trunnions of the barrel of ‘F’ type cylinders are integrally cast with the cylinder. In ‘E’ type a separate trunnion is fillet welded to the barrel. Due to casting there is a slight change in the shape of the portion around trunnion. ‘F’ type of cylinders of 457 mm dia have solid pin of size 51 + 0.5 mm dia x 41 mm long. ‘F’ type cylinders of 533 mm dia have a hollow pin of dia 51 + 0.5 mm and length 51 mm. The hollowness of the pin starts from the end having 25 mm dia at the face and 16 mm at the end of the hole. The hole extends up to a length of 35 mm. The decreasing hole is suitably curved inside along the length of the pin.

Pan

It is made of cast Iron. It is cylindrical in shape with closed bottom paving flange and four lugs near the top for securing it with the barrel. The shape of the bottom is identical to ‘E’ type cylinder. The vertical wall of the flange where the barrel comes in contact is kept 1 mm more on the top compared to the bottom. Starting from top the wall is projecting out 1 mm for a height of 1 mm, followed by inward taper of 1 in 8 for a height of 8mm, and again a vertical surface 1 mm in height. The total height of the wall is 10 mm. The vertical surface is rough machined and the horizontal surface finish machined. Starting from top, the other out surface of the pan is parallel up to a height of 3 mm followed by a tapered surface of 3 in 10 for a 10 mm height. Following this surface there are 4 equal holes on the circumference at a resembling to an oval shape. The size of the hole is 102 mm long x 22 mm height. The sides of the holes are at a radius of 6 mm. The bottom is flat and the top portion is lightly oval, keeping the maximum height as 22 mm. Those four holes are made for connecting the train pipe with the lower portion of the vacuum cylinders viz. the space between the bottom of the pan and piston up to the rolling ring. Though at a time only one hole is required but 4 identical holes on the circumference enable the bottom pan to be fixed in any one of the position out of 4 in relation to the barrel. Outside circumferencial surface above the hole is rough machined. Immediately following the hole portion, the lug portion commences. Other inside and outside surfaces of the pan are not machined. Surfaces around the boss is machined in the same manner as for ‘E’ type cylinders. The total height of the pan for 457 mm ‘F’ type cylinder is 140 mm. It is important that the surfaces are machined to the standard laid down in the drg.; otherwise there will be difficulty in assembling the parts and an air-tight joint would not be possible.

The recess made in the barrel fits on the corresponding portion of the flange of the pan. A rubber joint ring is inserted in between to make the joint air-tight. Thereafter the two parts are tightened together by means of studs and nuts. Piston rod used for Box wagon brake cylinders are different from the cotter key type.

Vacuum Reservoir

It is a hollow cylinder having its both ends closed. Both the ends are dished by pressing 5 mm thick plates. The cylindrical portion is made by rolling 3.15 mm thick plate in circular shape and then welding the joint. The dished ends extend inside by 25 mm and are welded to the main body by fillet welding around. The dished radius is of 1525 mm. On the circumference of the cylinder at mid length there is a 19 mm hole in which a boss of 32 dia x 6 mm height outside the barrel and 19 dia x 3 mm height inside the cylinder is fillet welded alround. This boss has a tapped hole to suit FP 3/8 A Plug, which keeps the hole closed. As and when required the plug is removed to drain out water from the reservoir. Similarly one of the dished ends has a hole of 38 mm dia in the centre. A boss 13 thick x 50 mm dia is kept outside the end is fillet welded alround with the end. The size of the boss inside is 5/6 mm length x 38 mm dia. This boss has a tapped hole to suit FP ¾. In the tapped hole a syphon nipple is fitted. Nipple is connected by a flexible hose pipe to release valve. On the cylindrical surface rear the dished ends having syphon nipple, 4 pads are tack welded, two at one location and the other two diametrically opposite. The size of pads are 40 wide along the length x 75 mm long along the circumference x 20 mm thick. These pads are kept at a distance of 45 mm to enable fitting of suspension strap between them. The pads prevent shifting of cylinder in relation to straps. The centre of these straps is at a distance of 127 mm from the outer most point of the dished end. The reservoir whose size is 700 long x 560 mm outside dia has a capacity of 0.1596 Cu Metres.

These vacuum reservoirs are provided on those wagons, which are fitted with 457 and 560 mm size cylinders on BG and MG stock.

The vacuum reservoir is suspended from the under frame by two straps. One strap is held between pads. The other strap is used near the other end of the reservoir. Each strap is secured with the under frame at suitable locations by means of 2 bolts and 2 rivets one each on either side. Bolt which is kept below the rivet hole joins two pieces of straps together besides securing the strap with the under frame.

Double branch round flange release valve.

All its parts are same as in ‘E’ type cylinder except the body and the flange joint washer. In ‘E’ type the washer is oval shaped whereas in ‘F’ type it is round shaped. In relation to the cover of the release valve the flange joining the cylinder in ‘F’ type cylinders is at the bottom against on top in ‘E’ type and it is round against oval. In ‘F’ type cylinders, flange is kept vertical against horizontal on ‘E’ type. There is no change in the first and the second space. The passage for the central space i.e. the first space instead of going upwards goes downwards for connecting it with the lower portion of the vacuum cylinder. The third space leads to the vacuum reservoir. In the body of the cover an annular space has been provided connecting the passage of vacuum reservoir with the flange of the body. Thus the third space always keeps the upper portion of the vacuum cylinder and the reservoir connected together through the rectangular hole on the release valve flange. Similar to 'E' type cylinder when the release spindle is pulled out the seating washer gets pulled and the first and third space get connected.

Release valve round joint washer :-

It is of size 2 mm thick x 105 outside dia. It has 4 holes of 11 mm dia at 83 pitch C. Dia for studs. It has a hole in the centre of 19 mm for the passage of lower portion of vacuum cylinder. It has 4 rectangular shaped holes at 90^0 , 19 mm long, 12 mm high. The top edge of this hole is curved to a radius of 27 mm from the centre of the washer. These 4 holes are meant for connecting the vacuum reservoir with the upper portion of the vacuum cylinder. Though only one hole is required yet 4 holes enable fitment of washer in any one position. The material of the washer is rubber with a single ply of cotton fabric insertion. The washer should pass gauge.

Release valve 20 mm single branch round flange:

These type of release valves are used on BOX, BCX and BOI, B.G. bogie wagons. It is similar in construction to that of 'F' type double branch round flange 20 mm release valve except that it does not have a passage leading to the vacuum reservoir. The third space remains connected with the hole in the circular flange leading to the upper portion of the vacuum cylinder. Other parts are same as for double branch release valve 'F'type.

Reservoir Suspension Strap – Top & Bottom

It is made by bending steel flat 40 x 6 mm to shape. The bottom strap is bent to a semicircle. In the central portion, the two ends are kept parallel to each other and are 305 mm long. The top strap is bent to a part of circle in the centre and its ends are bent to reverse circular shape. The radius at the bent is 25 mm. The top of the reversed end is kept at a distance of 140 mm from the transverse centre line of the reservoir. Its height from the lowest point is 100 mm. At a distance of 70 mm from the lowest point of the reversed end and 95 mm from the end of the top strap a 12 mm dia bolt hole is drilled on both the straps. A rivet hole of 12 mm dia is also drilled in the bottom strap at a distance of 30 mm from its top end. The bolt joins bottom and top strap together as well as it secures them with the under frame. Through the top hole the bottom strap is riveted to the under frame.

704. PRINCIPLE OF OPERATION

The cross section of a "F" type brake cylinder is shown in fig 7.1. The piston and rolling ring together divide the brake cylinder in two airtight chambers, which are known as "Upper Chamber" and "Lower Chamber". The volume of the two chambers varies with the position of the piston. When the piston moves up during brake application, the volume of the upper chamber reduces. Since the reduction in vacuum level of upper chamber is more if its volume is low, the volume of this chamber is kept as large as possible by providing a dome or reservoir. A higher level of vacuum in upper chamber helps the piston to move up faster resulting in quicker brake application. A release valve, connected to both upper and lower chamber, is mounted on the cylinder and is connected to the train pipe by a flexible syphon pipe.

The lower end of the piston rod is connected to the brake shaft arm. When vacuum is created in the train, air is exhausted from both upper and lower chamber of the vacuum cylinders, the piston by its own weight comes to rest at the bottom of the cylinder and the brakes are fully released. When vacuum in the train pipe destroyed due to brake application by the driver, air enters the lower chamber of the cylinder raising the piston and piston rod. This lifts the brake shaft arm causing the brake shaft to rotate and transmit the brake force through pull rods and levers to the brake blocks.

Since all the air enters the train pipe from locomotive end, the brakes on the leading wagons of the train get applied earlier than those on the rear portion. To accelerate the process, "Direct application" or "Quick Application" valves are used on some stock. These valves sense pressure difference in the train pipe and permit direct entry of atmospheric air into the brake system of each wagon.

The release valve is provided to ensure complete release of brakes on a standing load by connecting the upper and the lower chamber and thus equalising the pressure in them.

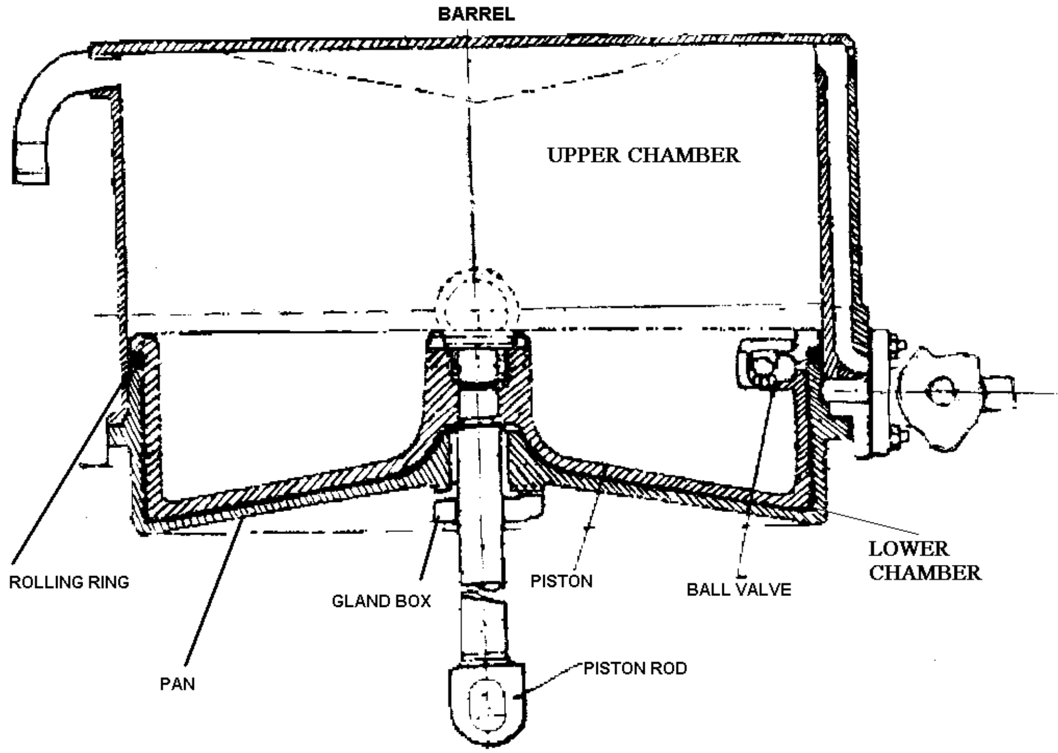


FIG. 7.1 - VACUUM BRAKE CYLINDER ("F" TYPE)

A schematic arrangement of vacuum brake equipment fitted on a typical wagon in shown in fig. 7.2. The piston being connected by a suitable linkage to the brake blocks, causes the later to bear against the wheel tread. In order to release the brakes, vacuum is regenerated in the lower chamber of the brake cylinder permitting the piston to drop and brake blocks to disengage from the wheel tread. The standard vacuum is 510 mm Hg, which gives a theoretical piston effort of 0.703 Kg/Cm2. The ejectors/ exhausters provided in the locomotive produce the vacuum.

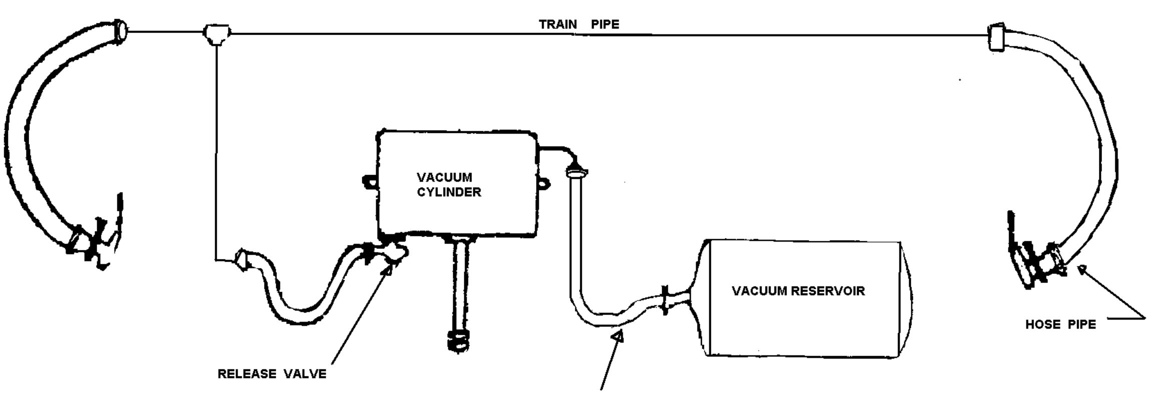


FIG. 7.2 - Schematic arrangement of Vacuum Brake Equipment

705. LIMITATION OF VACUUM BRAKE

Some adverse features impose limitations on extending its application on heavier and faster trains. These limitations are as under:-

A. BRAKE POWER

The brake power on vacuum brake is determined by the size of brake cylinder and the leverage. The 560-mm brake cylinders on BOX wagon are found to be the maximum size, which can be accommodated in the underframe. An increase in size would require redesign of underframe. The studies conducted in this area revealed that this proposal is not worthwhile. BOX has a leverage of 13.11 in loaded and 7.38 in empty condition. An increase in the leverage further leads to reduction in cylinder efficiency.

B. PROPAGATION RATE

The rate of propagation of impulse of brake wave through the pipe on conventional wagon was found to be 104 m/sec, where as for wagon fitted with QAQR valve, it was found to be 229m/sec. This value, however, is less than the limit of 250m/sec set by UIC. There is no further scope to increase this rate.

C. BRAKE FADE AND EXHAUSTIBILITY

Brake fade occurs due to leakage of air into the vacuum space above the piston when the brake is kept applied for a long period resulting in loss of brake power. Tests have indicated that for an emergency brake application, the brake fade rate is 3 to 3.5 mm/ minutes.

Brake exhaustibility is the extent of deterioration of brake power due to repeated controlling of train by train brake while descending steep gradients. For safe running of trains, the brake must have sufficient reserve brake power after controlling so as to stop the train under emergency. Vacuum brake has very high exhaustibility. This necessitates stopping of the trains in order to replenish the brake power after a certain period of control during cyclic application.

D. RELEASE TIME

Laboratory test on 4500t train of 600m length indicated that the release time for the last wagon would be about 310 sec in case of train fitted with conventional vacuum brakes. With the fitment of QAQR valve, this was found to be about 114 sec. However, this adversely affects the available brake power for a subsequent application on the wagon by 60%, since the upper chamber vacuum is equalised with the lower chamber/train pipe. This feature has been found unsafe for train running on ghat section where controllability is to be done by means of train brakes only.

E. BRAKING DISTANCE

The braking distance obtained on a train is not dependent on brake power alone. This also depends upon propagation rate, brake application time etc. It has been worked out for a trainload of 4500t with improved vacuum brake (with QAQR valve), that the braking distance would be 1780 meter from a speed of 75 km/h on level track. This is higher than the intersignal distance of 1400 metres. It would be even higher for higher speeds.

F. BRAKE POWER DETERIORATION DURING RUN

Owing to inherent limitations of vacuum brake system, the brake power of a train during extended run reduces considerably. The trials conducted by railways and RDSO show that up to a distance of 400 kms, the reduction of brake power was between 6.5% and 16%.

706. MODIFICATIONS

The vacuum brake system has been the standard on Indian Railways till recently. This system has been improved gradually over the years. Major improvements incorporated in the system are given below:-

A. Following improvement and modification have been done to improve the effectiveness of the vacuum brake system in the vacuum cylinder;

- Hole in ball valve seat increased to 10 mm
- Number of 6-mm diameter holes in ball cage increased to four.
- Diameter of three holes in piston head increased to 6 mm
- Slack adjuster DRV-2-600

While adjusting control dimension 'A', it is important that vacuum cylinder piston and fork arm of the brake shaft are in the lower most position.

B. LARGER BRAKE CYLINDERS WITH SEPARATE VACUUM RESERVOIR

The upper chamber volume has been considerably enhanced by the adoption of “F” type 560 mm diameter cylinder with separate vacuum reservoir. This has resulted in improvement of cylinder efficiency from 76% to 84% at a stroke of 160 mm, due to reduced drop in upper chamber vacuum.

C. IMPROVED BALL VALVE PASSAGE

The original size of the ball valve passage was 7.2 mm dia. The passage has been increased to 8 mm dia. resulting in a further improvement in the minimum stabilised vacuum in the upper chamber of last wagon brake cylinder.

D. ROLLING RING

The diameter of the rolling ring has been increased from 12.7/13.0 mm to 12.9/13.15 mm. This has reduced the leakage of air into vacuum space above the piston when brakes are applied continuously.

E. IMPROVED DESIGN OF CAGE

Hose pipe cage design has been modified to increase the flow area from 72% to 86% and wire construction instead of pressed plate design has been used to reduce the turbulence in the air stream. For a BOX wagon train of 350 metre length, provision of these modified cages results in 10 to 13% reduction in braking distances, which can be seen in fig below;

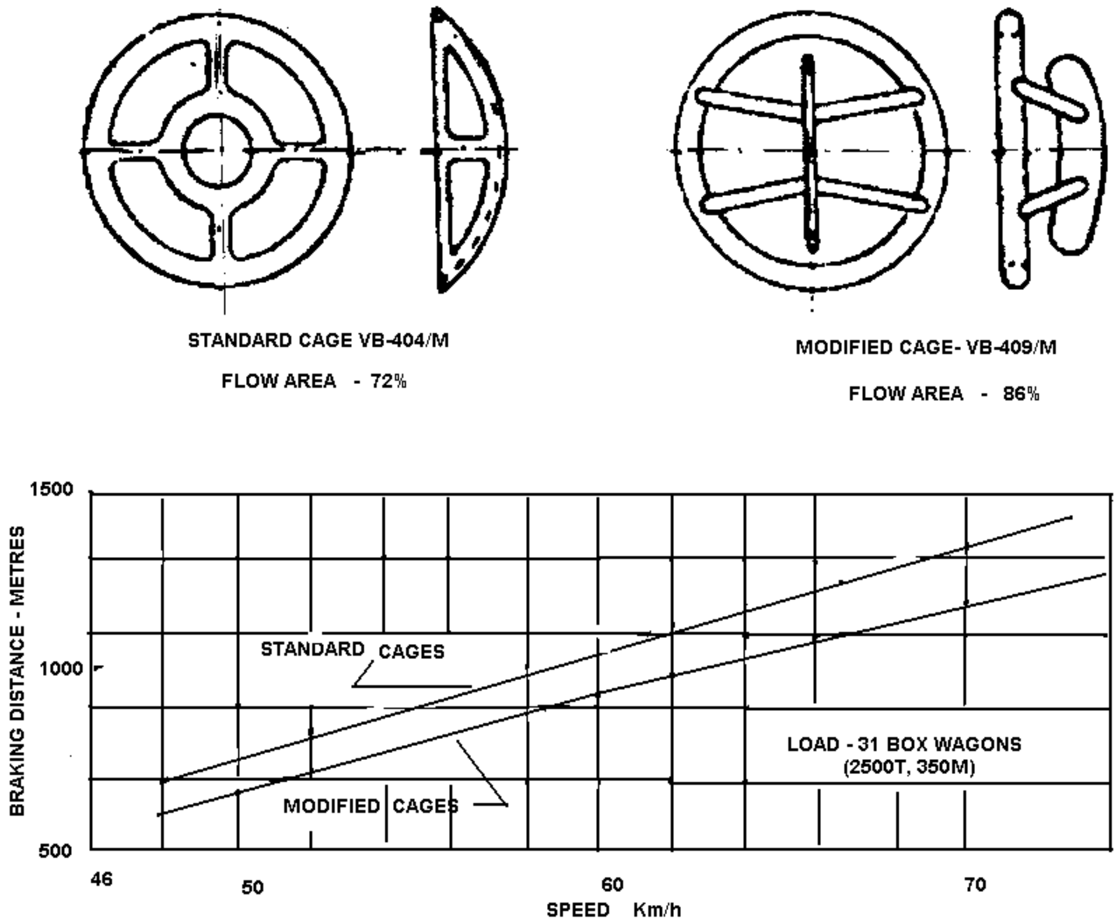


Fig. 7.3 DESIGN OF CAGE

There is also a corresponding improvement in braking application and release time.

F. OTHER DESIGN IMPROVEMENTS

The following improvements have also been incorporated in the brake system:

- Double acting slack adjuster to maintain pre set clearance between brake block and wheel. This eliminates manual adjustment of pull rod length to ensure constant piston stroke.
- Empty-Load change over device to obtain high brake ratio in loaded condition.
- Clasp brakes having higher co-efficient of friction so as to reduce unit brake block pressure.

707. MAINTENANCE & REPAIR

A. INSPECTION OF RUBBER HOSE PIPE AND SYPHON PIPE

- Renew the Hose pipe and syphon pipes if they are cracked or the bonding between various components is loose.
- Useful Hose pipes should be tested using vacuum retaining test.
- The hose pipe should be connected by means of a cylindrical nozzle, to suit the corresponding vacuum with syphon hose bore.
- Connect the chamber of 1640 cu. cm. volume with the free end, close with a cylindrical plug identical in external dimensions with the nozzle and with 510 mm of vacuum throughout the assembly.
- On isolation from the source of vacuum, record drop of more than 75 mm in one hour on the chamber gauge.
- The pipe shall not be clipped or otherwise bound to the chamber nozzle or plug.
- The hose shall be bent around the 228 mm diameter mandrel until ends are parallel without any displacement or permanent distortion of wire.

Crack, porosity and tears etc. of the hose can also be detected by stretching and holding the hose 20 % more than its original length. Serviceable hose pipe should be secured on swan neck (after applying the rubber solution on swan neck) with clip.

The corroded or damaged hose pipe clips to be renewed. The broken, damaged or distorted cages should be replaced with modified cage to Drg No.VB 409 / M. Universal coupling should be examined for broken/cracked/distorted lugs and renewed on condition base. Rubber solution should be applied on the mating surfaces and cages fitted before the couplings are inserted in the hose holes. They should be clipped firmly.

B. EXAMINATION AND MAINTENANCE OF VACUUM RESERVOIR STRAPS

Replace the damaged or corroded straps by modified or new straps. If the securing holes in the underframe are worn by 3 mm, build up by welding and re-drill the holes. The reservoir straps should be double secured with spring washer and check nuts. After all repairs, the reservoir straps should be given a coat of anti-corrosive paint.

C. EXAMINATION AND MAINTENANCE OF VACUUM RESERVOIR

The vacuum reservoir should be examined for corrosion, damages, distortion, cracks, etc. If the extent of corrosion is about 5 % of total area, it should be cut and replaced with another plate by welding. Otherwise the whole barrel should replaced. Open the drain plug and blow compressed air in the reservoir to remove dust, dirt, water particles etc. accumulated inside the reservoir. After thorough cleaning, replace the drain plug smeared with small quantity of graphite grease on the threads and tighten it firmly. Clean the pipe threads in both disc ends and fit the syphon nipples. Replace the missing or damaged syphon nipples in the disc ends of the reservoir.

After attending the defects and before painting the reservoir, a pneumatic pressure of 2.0 kg/cm² should be applied to it for the purpose of ensuring sound fabrication and finish. The welded seams all over the body should be thoroughly checked for leakage.

Vacuum retaining capacity test

Vacuum reservoir with 510 mm of vacuum source with isolating cock between the source and reservoir after creating 510 mm of vacuum by closing isolating cock, record drop of vacuum in 30 minutes on test gauge. After all repairs, the reservoir should be given a coat of anti-corrosive paint.

D. EXAMINATION AND MAINTENANCE OF GUARD VAN VALVE

During overhaul of Guard van valve, its rubber diaphragm and rubber washer should invariably be changed. The Passage, connecting train pipe to its chamber, should be cleaned. If the passage hole diameter exceeds more than 6 mm, the valve should be replaced.

The chamber space of the Guard van valve should be checked for leakage, cracks, damages etc. and repaired / replaced if necessary. The valve itself should be checked for easy and correct lift. The blocked holes to be opened and to be cleaned. The bent / deficient lever to be replaced. The vacuum gauge nipple provided on the Guard van valve chamber to be checked for damaged or worn out threads. The loose nipple should be secured firmly on the chamber.

All studs and nuts with worn or damaged threads should be replaced. The threads in the body of the chamber should be good enough to prevent any leakage. The Guard van valve body threads on which train pipe is secured, should also be checked for damages & wear and the body replaced if the threads are bad. After overhaul, the entire Guard van valve assembly should be tested for satisfactory functioning.

a. Vacuum Retaining Capacity Test

Guard van valve connected to a chamber of 1640 cu. cm volume with 510 mm of vacuum throughout the assembly, on isolation from the source of vacuum, should not record a drop of more than 25 mm in 1 minute on the chamber gauge.

b. OPERATION TEST

On release of operating handle, the valve should, with atmospheric pressure throughout the assembly, re-set itself by its own weight.

With 460 to 510 mm of vacuum throughout the assembly, and the source of vacuum isolated, gradual admission of air to the train pipe should show a corresponding drop in vacuum on the van valve gauge.

The Guard van valve should automatically lift on a rapid destruction of the vacuum in the train pipe of approximately 225 mm of vacuum. When the operating handle of the test apparatus is put in the " running " position, the Guard van valve should re-set itself within 3 to 5 seconds.

E. EXAMINATION AND MAINTENANCE OF VACUUM CYLINDER TRUNION BRACKET

The brackets, where bushes are provided, should be renewed and a light coat of graphite grease applied before fitting a cylinder. Trunions of the cylinder must not either be too loose or too tight in their brackets. Lateral clearances on the trunions (on each side) should not exceed 3 mm after P.O.H. It should be adjusted by renewing the bushes. If bushes are not already provided, the trunion bracket should be bored and bushes of correct size are fitted to get the required clearance.

F. CLEANING, INSPECTION AND MAINTENANCE OF VACUUM BRAKE CYLINDER

- I. Dismantle the vacuum cylinder and clean thoroughly.
- II. A wire brush should be used for cleaning the serrations in the bore of cylinder as well as on the periphery of piston head.
- III. Piston heads and cylinders with excessive clearance due to worn serrations (cuts) should be rejected and replaced.
- IV. Check for defects like cracks, damages, worn, etc.
- V. Replace the cracked Barrel.
- VI. Cracked or broken lugs may be replaced with new lug by welding and grinding. Replace the Barrel if cracks are found on the trunions.
- VII. Clean the release valve seat .

VIII. The holes should be cleaned for proper seating and free passage of air.

IX. Barrel should be painted with one coat of anti-corrosive paint excluding the serrated surface.

G. BALL VALVE

The ball valve should be opened, thoroughly cleaned to make it free from dust, dirt and sediments and lightly lapped. The ball valve cage cover should be checked for threads. The ball should be replaced if worn even. The ball valve should be changed if found cracked, pitted, or having any other surface defects.

H. EXAMINATION AND MAINTENANCE OF RELEASE VALVE

The release valve helps in releasing the brakes on rolling stock. The vacuum does not get destroyed during release of brake. It releases brakes whenever necessary, without the use of ejector or exhuaster. Without release valve, it is not possible to release the brakes of rolling stock on a terminating train. It helps in keeping the brakes on for about 48 hours after destruction of vacuum.

During overhaul, open the release valve and renew all the rubber items like diaphragm, seating washer and joint washer. Dry the release valves, if found wet after wiping out. Check the release valve operating lever and renew if found cracked. The release valve studs should be cleaned and replaced if found damaged or worn. While assembling, the valve nut should be smeared with graphite grease. It should also be ensured that all the sharp edges on the seat of the spindle washer are rounded off.

a. Vacuum Retaining Capacity Test

Connect the release valve through the cylinder port to chamber of 1640 cu. cm volume with 510 mm of vacuum. Isolate from the source of vacuum. Record the drop of vacuum. It should not be more than 20 mm in one minute on the chamber gauge.

b. OPERATION TEST

Connect release valve through the chamber port to a reservoir with vacuum throughout the assembly. When the vacuum is destroyed in the train pipe and the valve remains in the open position too long, there is pull on the lever wire. Re-set immediately.

On re-creation of not more than 205 mm of vacuum, the valve shall re-set itself. Replace the cracked/broken cylinder cover. The lugs having more than 50%

crack are to be replaced with new lugs by welding and grinding. After attending the defects, paint with one coat of anti-corrosive paint.

Renew all the rubber items of Gland Box (Stuffing box) like Gland packing ring, Gland box joint washer etc. Renew the worn/loose guide bush. Replace the worn, threaded, damaged, broken studs.

I. PISTON HEAD & PISTON ROD

Renew the bent, damaged, dented, worn, corroded, pitted and thread damaged piston rods. The cracked piston should be replaced. The piston skirt serration should be cleaned for dust, dirt and sediments etc. dried with hot air. If the serration is worn, replace the piston. After attending the defects, barrel should be painted with one coat of anti-corrosive paint excluding the serrated surface. Stencil the station code, date, staff number of the technician inside the piston rod.

J. ASSEMBLY OF VACUUM CYLINDER

Select the serviceable/new piston assembly components. Assemble the piston assembly. After attending the defects of vacuum cylinder parts and assemble the parts. Care should be taken to replace all the rubber items like rolling ring, joint ring, release valve joint washer, piston cap washer, etc. during P.O.H. After complete assembly, the vacuum cylinder should be tested on the test bench, Stencil the date of overhaul, date of testing and shop code on the vacuum cylinder body.

K. MAINTENANCE OF BRAKE SHAFT

Brake shaft should be examined for straightness, bending and wear on its bearing surfaces. The shaft bearings worn beyond 3 mm should be built up by welding and machined to its original size. Before the shaft is fitted into its brackets, its bearing surfaces should be smeared lightly with grease. The fork arm should also be examined for bending, distortion and wear on its forked ends and restored to its original shape and size as required. The brake shaft mounted with brackets under a coach should be parallel to the trunnions on which the cylinder swings to avoid side or cross stresses and hence damages to the arm. The brake shaft should not have side play of more than 2 mm in its bracket bushes after POH.

L. BRAKE SHAFT BRACKET

Brake shaft bracket bolts and nuts should be examined for rusting, wear, looseness, damaged threads etc. and replaced, if necessary. Good bolts and nuts should be reused after greasing their threads. The brackets should be checked for cracks, corrosion and damage and repaired/replaced as required. The brake shaft bracket bushes should invariably be changed.

M. PINS & BUSHES

In wagons built earlier, steel class IV pins were provided in unbushed holes of the brake rigging but the latest practice is to provide class IV/class I case hardened steel bushed and pins made from steel class II (IS-226 St 42S). The maximum permissible wears on the pin diameter and bush inside diameter is limited to 1.5 mm.

708. REPAIR AND MAINTENANCE IN SICKLINE

The brake gear system shall be examined and repaired as under:-

I. The pins/bushes shall be examined for wear and repaired/replaced to maintain prescribed minimum clearances as per para 707 M.

II. Safety brackets provided for brake gear should be in proper condition and secured firmly.

III. Special care shall be taken to ensure proper condition of trunions and their bracket as per para 707 E. A light coat of graphite grease should be applied on trunion bracket.

IV. Inspection of rubber hose pipe and syphon pipe to be done as given in para 707 A.

V. Replace the damaged or corroded straps by new straps as per para 707B.

VI. The vacuum reservoir should be examined for corrosion, damages, distortion, cracks, etc. as per para 707 C.

VII. The Passage connecting train pipe to its chamber should be cleaned. If the passage hole diameter exceeds 6 mm, the valve should be replaced.

VIII. Vacuum gauge in Guard van should be removed and calibrated with master gauge before refitting. The vacuum gauge guard must be invariably provided to protect the gauge from damage or theft.

IX. Testing of brakes shall be done according to the methods laid down in IRCA Part III (2000) rule 2.12.2.4.

709. REPAIR AND MAINTENANCE DURING ROH

In addition to all the items attended in sickline, the following items should also be checked and repaired :-

I. Vacuum reservoir : After all repairs, the reservoir should be given a coat of anti-corrosive paint.

II. During overhaul of Guard van valve, its rubber diaphragm and rubber washer should invariably be changed.

III. The chamber space of the Guard van valve should be checked for leakage, cracks, damages etc. and repaired/replaced.

IV. The valve should be checked for easy and correct lift. The blocked holes to be opened and cleaned.

V. The bent/deficient lever to be replaced.

VI. The vacuum gauge nipple should be checked for damage/wear on threads. The loose nipple should be secured firmly on the chamber.

VII. The brackets, where bushes are provided, should be renewed and a light coat of graphite grease applied before fitting a cylinder. Trunion of the cylinder must not either be too loose or too tight in their brackets.

VIII. Cleaning, inspection and maintenance of vacuum brake cylinder should be done as per IRCA Part III.

IX. The ball valve should be opened and thoroughly cleaned to make it free from dust, dirt and sediments and lightly lapped. The ball valve cage cover should be checked for threads. The ball valve should be changed if found cracked, pitted, or having any other surface defects.

X. Open the release valve and renew all the rubber items like diaphragm, seating washer and joint washer. Check the release valve operating lever and renew if found cracked. The release valve studs should be cleaned and replaced if found damaged or worn.

XI. Piston rod if bent, damaged, dented, worn, corroded, pitted or thread damaged should be renewed. The piston skirt serration should be cleaned for dust, dirt and sediments etc. dried with hot air. If the serration is worn, replace the piston. After attending the defects, barrel should be painted with one coat of anti-corrosive paint excluding the serrated surface.

XII. Brake shaft should be examined for straightness, bending and wear on its bearing surfaces. The shaft bearings worn beyond 3 mm should be built up by welding and machined to its original size.

XIII. Brake shaft bracket bolts and nuts should be examined for rusting, wear, looseness, damaged threads etc. and replaced, if necessary. Good bolts and nuts should be reused after greasing their threads. The brackets should be checked for cracks, corrosion and damage and repaired/replaced as required. The brake shaft bracket bushes should invariably be changed.

XIV. Testing of brakes shall be done according to the methods laid down in IRCA Part III (2000) rule 2.12.2.4.

710. REPAIR AND MAINTENANCE DURING POH

During POH, all components of the brake gear system shall be examined, repaired and replaced as necessary. The following item should be checked and repaired in addition to all the items attended in ROH as above:-

I. Vacuum cylinder to be removed, overhauled and tested. Special care shall be taken to ensure proper condition of the trunion and their brackets. Date of overhaul, name and ticket number of overhauling staff shall be written at the inside bottom of the cylinder.

II. Vacuum reservoirs and train pipes shall be dismantled, examined and tested to ensure elimination of leaks. Rubber hoses and siphon pipes shall be examined and replaced, if necessary.

III. Crack, porosity and tears of the hose to be detected by stretching and holding the hose 20 % more than its original length.

IV. The corroded or damaged hose pipe clips to be renewed. The broken, damaged or distorted cages should be replaced with modified cage.

V. Universal coupling should be examined for broken/cracked/distorted lugs and renewed on condition base.

VI. The vacuum reservoir should be examined for corrosion, damages, distortion, cracks, etc. If the extent of corrosion is about 5% of total area, it should be cut and replaced with another plate by welding. Otherwise the whole barrel should be replaced.

VII. Open the drain plug and blow compressed air in the reservoir to remove dust, dirt, water particles etc. accumulated inside the reservoir. After thorough cleaning, replace the drain plug smeared with small quantity of graphite grease on the threads and tighten it firmly.

VIII. Clean the pipe threads in both disc ends and fit the syphon nipples. Replace the missing or damaged syphon nipples in the disc ends of the reservoir.

IX. All studs and nuts with worn or damaged threads should be replaced.

X. The brackets, where bushes are provided, should be renewed and a light coat of graphite grease applied before fitting a cylinder. Trunions of the cylinder must not either be too loose or too tight in their brackets. Lateral clearances on the trunions (on each side) should not exceed 3 mm after POH. It should be adjusted by renewing the bushes. If bushes are not already provided, the trunions should be bored and bushes of correct size are fitted to get the required clearance.

XI. The cracked piston should be replaced. The piston skirt serration should be cleaned for dust, dirt and sediments etc. dried with hot air. If the serration is worn, replace the piston. After attending the defects, barrel should be painted with one coat of anti-corrosive paint excluding the serrated surface.

XII. Brake shaft should be examined for straightness, bending and wear on its bearing surfaces. The shaft bearings worn beyond 3 mm should be built up by welding and machined to its original size.

XIII. Before the shaft is fitted into its brackets, its bearing surfaces should be smeared lightly with grease. The fork arm should also be examined for bending, distortion and wear on its forked ends and restored to its original shape and size as required. The brake shaft mounted with brackets should be parallel to the trunions on which the cylinder swings to avoid side or cross stresses and hence damages to the arm. The brake shaft should not have side play of more than 2 mm in its bracket bushes after POH.

XIV. Brake shaft bracket bolts and nuts should be examined for rusting, wear, looseness, damaged threads etc. and replaced, if necessary. Good bolts and nuts should be reused after greasing their threads. The brackets should be checked for cracks, corrosion and damage and repaired/replaced as required. The brake shaft bracket bushes should invariably be changed.

XV. Testing of brakes shall be done according to the methods laid down in IRCA Part III (2000) rule 2.12.2.4.

711. STORAGE OF RUBBER FITTINGS

The adoption of rubber fittings in the vacuum brake cylinder serves the purpose of making the joints airtight. The correct storage of such rubber fittings is equally important. The rubber fittings, if badly stored, leads to deterioration and their use in the vacuum cylinders will not fulfil the desired objective. RDSO vide letter no. M&C/RIH/1/1 of 29.9.75 has circulated some useful instructions as under:-

i. Rubber fittings should be kept away from direct sun light.
ii. They should be stored in a cool place preferably below 30 degree centigrade.
iii. They should be kept away from the contact of copper and manganese.
iv. Rubber fittings, under no circumstances should be kept stressed else it will lead to deformation and permanent set.
v. Contact of oil and grease to be avoided.
vi. Prolonged storage should be avoided.
vii. To avoid deterioration of rubber fittings, every C&W depot should have adequate and effective arrangement for storing the rubber fittings.

712. SPECIAL TOOLS, JIG & FIXTURES

The tools, equipment and other facilities required for overhauling vacuum cylinders are given below.

i. Vacuum pump of capacity 200 CF/Minute or more.
ii. Forklift or plat form truck for transporting cylinders to and from repair shed.
iii. Pipe line connecting the exhauster and test bench and test stands
iv. Balance vacuum testing apparatus
v. Portable electrical drill for drilling out broken studs
vi. Wire brush attachment to electric drill
vii. Hand tools like hammers, chisels, punches, and spanners of assorted sizes.
viii. Overhead electric pulley block for movement of cylinders from workbenches to test benches.
ix. Building/structures for overhauling and testing 8 to 10 cylinders
x. Room/shed of size 10 m X 10 m with hardonite flooring. Part of the shed may be used to store overhauled cylinders.
xi. Room of size 5 m X 5 m for housing vacuum exhauster
xii. Test stand for holding 4 cylinders simultaneously.
xiii. Workbench for overhauling cylinder, release valve, guard van valves, vacuum gauges, etc.

713. BRAKE POWER CALCULATIONS FOR BOX WAGON

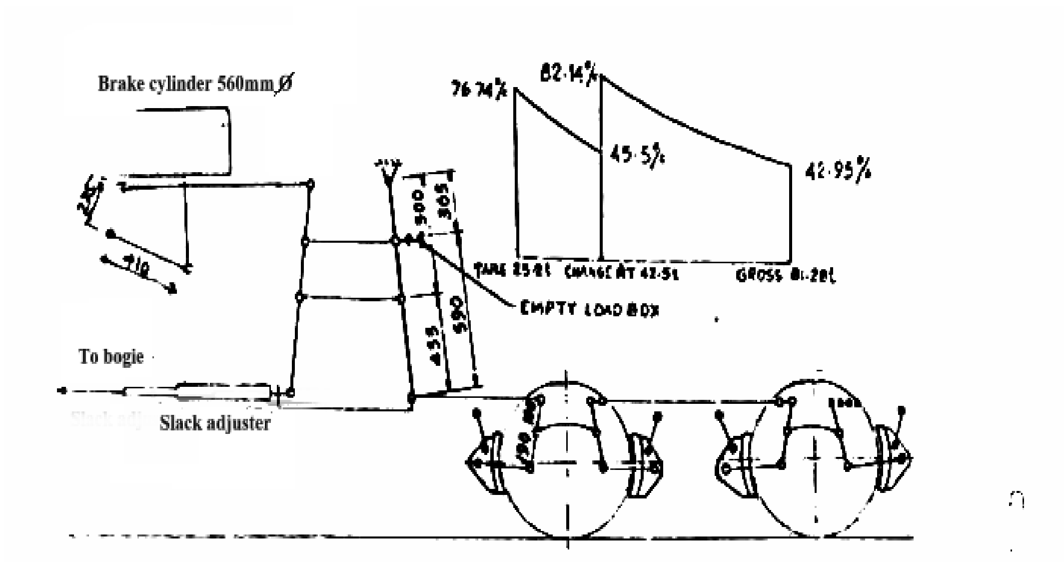


Fig. 7.4

TYPE OF BRAKE SYSTEM	= VACUUM
BRAKE CYLINDER DIA	= 560 mm
NO OF CYLINDERS	= TWO
TOTAL EFFECTIVE PISTON FORCE (K)AFTER SUBTRACTION OF RESTORING SPRING FORCE AT A STORKE OF 135mm	= 3020 KG

LEVERAGE i,

EMPTY $= \frac{410}{275} \times \frac{365}{590} \times 8 = 7.38$

LOADED $= \frac{410}{275} \times \frac{500}{455} \times 8 = 13.11$

TOTAL BRAKE BLOCK PRESSURE $P=(K\,i - 8Q)\,\eta$

RIGGING EFFICIENCY $\eta = 0.9$

FORCE OF SLACK ADJUSTER SPRING Q= 100 Kg

P Empty 19339 Kg

P Loaded 34913 Kg

BRAKE PERCENTAGE $\frac{P \times 100}{\text{Tare or gross}}$

BRAKE PERCENTAGE EMPTY $= \frac{19339}{25200} \times 100 = 76.74\%$

BRAKE PERCENTAGE LOADED $= \frac{34913}{81280} \times 100 = 42.95\%$

BRAKE POWER AT CHANGE WEIGHT $\frac{P(TARE) \times 100}{CHANGE\ WT} = \frac{19339}{42500} \times 100 = 45.5\%$

$\frac{P(GROSS) \times 100}{CHANGE\ WT} = \frac{34913}{42500} \times 100 = 82.14\%$

■■■■

MAINTENANCE MANUAL
FOR
WAGONS

Chapter – 8 ***Air Brake System***

CHAPTER 8

AIR BRAKE SYSTEM

801. CLASSIFICATION OF AIR BRAKE SYSTEM

On the basis of type of release, air brake system is classified as:

- Direct release air brake system
- Graduated release air brake system

Both Direct and Graduated release are further available in two forms viz.

- Single pipe and
- Twin pipe

The diagram shown in fig. 8.1 illustrates the schematic layout of air brake equipment on the under frame of freight stock. As shown in figure, the single pipe graduated release air brake system consist of following components:-

i) Distributor valve
ii) Common pipe bracket with control reservoir.
iii) Auxiliary reservoir.(100 Litres)
iv) Three way centrifugal dirt collector.
v) Isolating cock.
vi) Brake cylinder (355mm diameter).
vii) Cut off angle cock (32mm size on either ends of brake pipe).
viii) Air brake hose coupling (32mm for brake pipe)..
ix) Brake pipe (32mm dia).
x) Branch pipes from BP to brake equipment (20mm bore).
xi) Guard emergency brake valve.
xii) Pressure gauges for BP

802. PRINCIPLE OF OPERATION OF SINGLE PIPE GRADUATED RELEASE AIR BRAKE SYSTEM

The Air Brake goods stock on IR is at present fitted with single pipe graduated release air brake system. In single pipe, brake pipes of all wagons are connected. Also all the cut off angle cocks are kept open except the front cut off angle cocks of BP of leading loco and rear end cut off angle cock of BP of last vehicle. Isolating cock on all wagons are also kept in open condition. Auxiliary reservoir is charged through distributor valve at 5kg/cm^2.

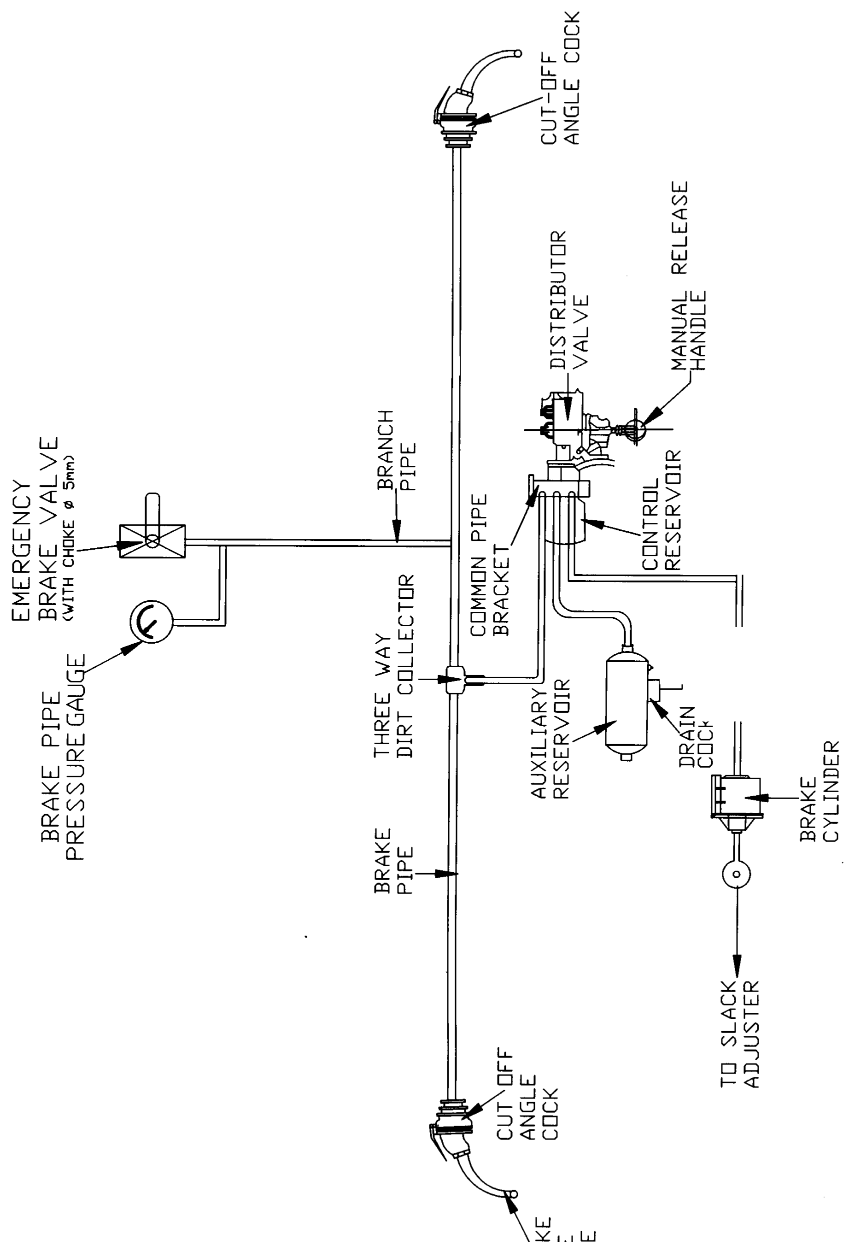


Fig. 8.1

GRADUATED RELEASE SINGLE PIPE AIR BRAKE SYSTEM

A. Charging stage

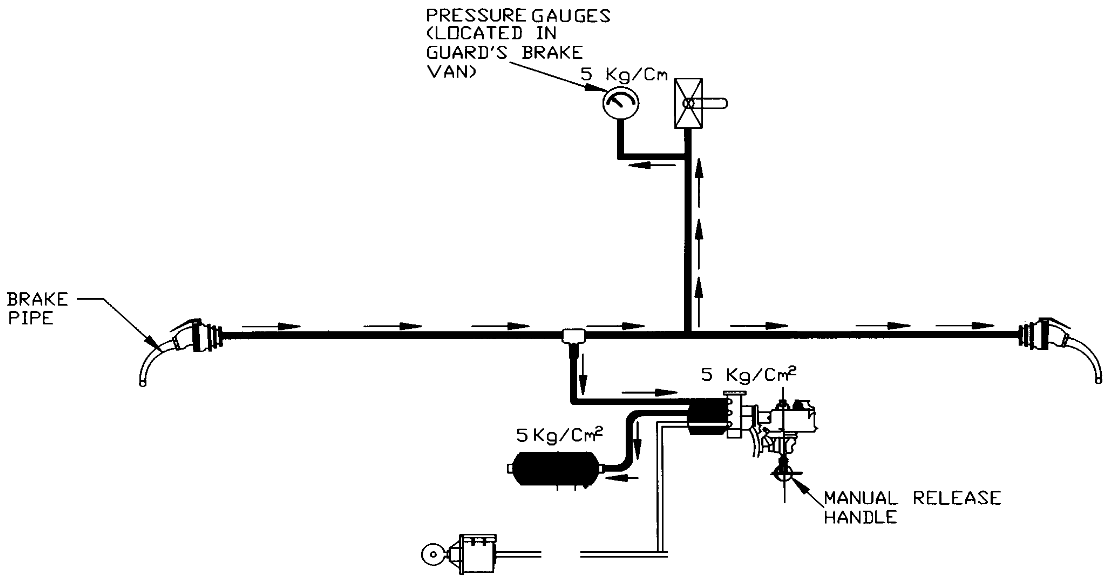


Fig. 8.2 CHARGING

During this stage, brake pipe is charged to 5kg/cm^2 pressure which in turn charges control reservoir and auxiliary reservoir to 5 kg/cm^2 pressure via distributor valve. At this stage, brake cylinder gets vented to atmosphere through passage in Distributor valve.

B. Application Stage

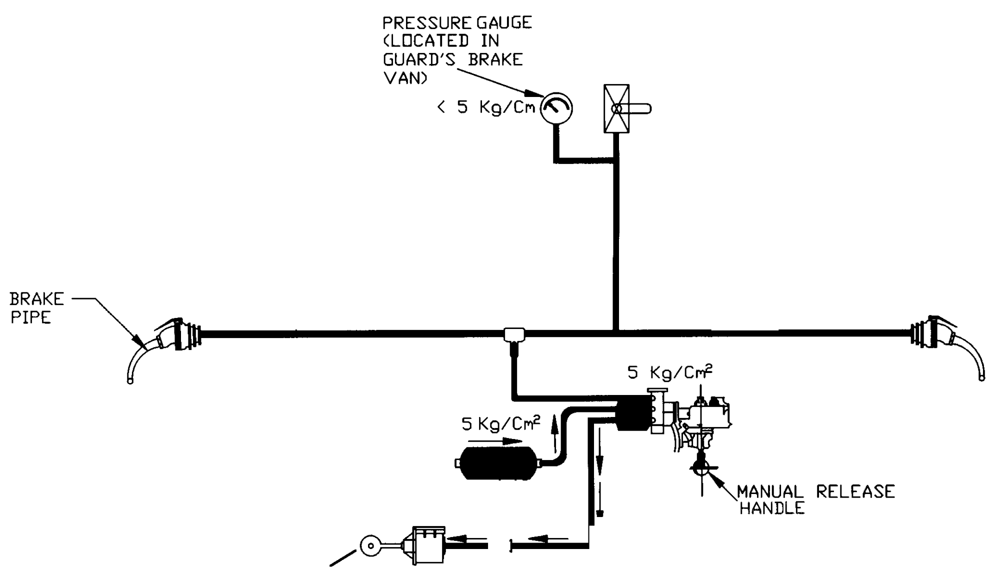


Fig. 8.3 APPLICATION

For application of brakes, the pressure in brake pipe has to be dropped. This is done by venting air from driver's brake valve. Reduction in brake pipe pressure positions the distributor valve in such a way that the control reservoir gets disconnected from brake pipe and auxiliary reservoir gets connected to brake cylinder. This results in increase in air pressure in brake cylinder resulting in application of brakes. The magnitude of braking force is proportional to reduction in brake pipe pressure

Note: 1. Brake Application takes places when Brake pipe pressure is dropped.
2. The drop of pressure may be a) Intentional and b) Accidental.

C) Release stage

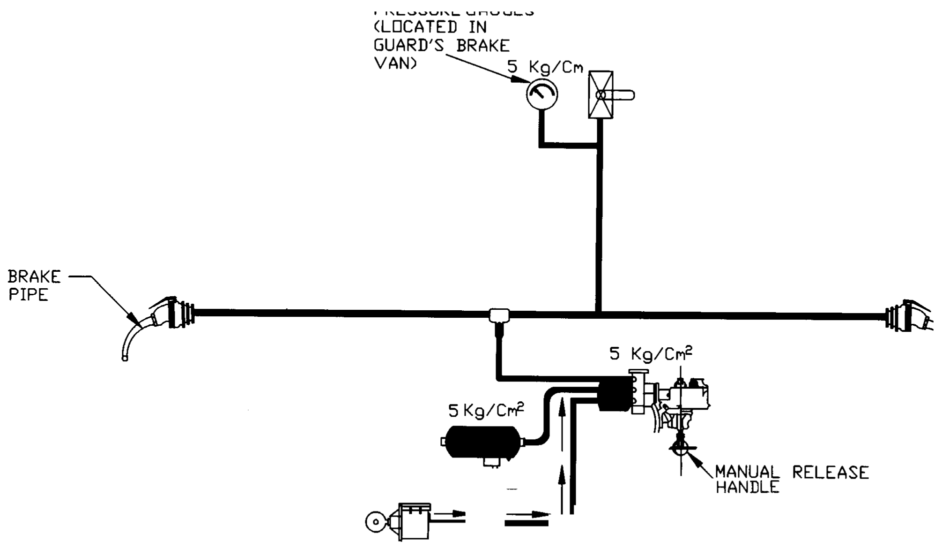


Fig. 8.4 RELEASE

For releasing brakes, the brake pipe is again charged to 5 kg/cm^2 pressure by compressor through driver's brake valve. This action positions distributor valve in such a away that auxiliary reservoir gets isolated from brake cylinder and brake cylinder is vented to atmosphere through distributor valve and thus brakes are released

AIR BRAKE SUB ASSEMBLIES

803. COMMON PIPE BRACKET

Common pipe bracket is permanently mounted on the under frame of a vehicle. The distributor valve along with the intermediate piece (sandwich) which houses the isolating cock is mounted on one face of the common pipe bracket. The control reservoir is mounted on the other face of the Common pipe bracket.

The Common pipe bracket has been evolved with the purpose of making it suitable for use with any make of distributor valve adopted on Indian Railways.

Common pipe bracket is a sturdy casting with internal air passages, matching the intermediate piece mounting face with accurately profiled air cavities and flanged ports leading to the appropriate ports of the distributor valve.

Branch pipes to the brake pipe and brake cylinders are fitted on the appropriate ports on the common pipe bracket. The advantage of fitting a common pipe bracket is to remove the distributor valve for repair or replacement without disturbing the pipe connections.

804. INTERMEDIATE PIECE (SANDWICH PIECE)

Intermediate piece serves the purpose of blanking all the other ports on the common pipe bracket front face other than required for a particular make of distributor valve. Each type of distributor valve is mounted on the common pipe bracket with its own intermediate piece (sandwich).

Intermediate piece is mounted on the common pipe bracket face with a common gasket and the distributor valve is fastened to the intermediate piece. Isolating cock for distributor valve, which is housed in the intermediate piece is for isolating the distributor valve in case of malfunctioning or for disconnecting the brake pipe pressure. Isolating cock on intermediate piece has a built in venting arrangement.

805. BRAKE PIPE HOSES

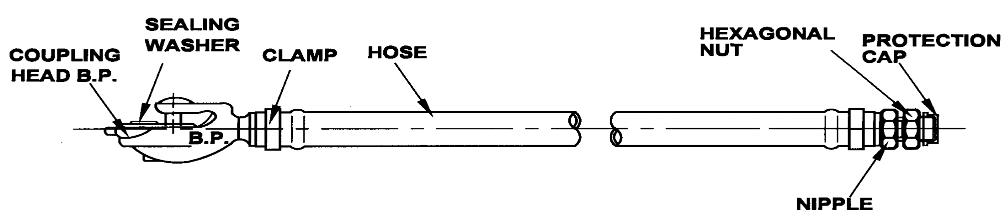


Fig. 8.5

In order to connect two successive wagons, the brake pipes (BP) installed on the underframe are fitted with flexible hoses. The hoses are named as BP hose.

806. BRAKE PIPE COUPLING

To connect subsequent wagons, the hoses of BP are screwed to coupling and hose nipple by means of stainless steel `Bend it' type clips. The coupling is specially designed in the form of palm end and hence also known as palm end coupling. For easy identification the couplings are engraved with letter BP and coupling heads are painted green

Note: Design, controlling dimensions, material and specification of components shall conform to the latest revision of RDSO drg. number SK-73547 for BP and appendix F of 02 ABR 94 of RDSO specification.

The air brake hose couplings are provided in the brake pipe line throughout the train for connecting the brake pipe of adjacent wagons to form the complete rake. Each Air Brake Hose coupling consists of a specially manufactured rubber hose clamped over a nipple on one end and a coupling head on the other end. Rubber sealing washers are provided on the outlet port of the coupling head.

Since a joint is formed at the coupling head, leakage may take place, through it. Therefore it is necessary to subject the hose coupling of brake pipe to leakage test.

A. TOOLS AND EQUIPMENT

a) Test stand (Fig. 8.6)

Test stand for testing of the hose coupling consists of the following main equipment

1) Supply of compressed air at – 10 Kg/cm^2
2) Isolating cock – 1a and 1b
3) Exhaust cock – 1c
4) Main reservoir
5) Pressure gauge
   - 6a for main reservoir
   - 6b for flexible hose
6) Flexible hose - for connecting hose coupling for immersing in to water.
7) Water tub with safety cage – for checking leakage from hose coupling.
8) Dummy coupling head.

b) TEST PROCEDURE

For testing the hose coupling the steps given below should be followed:

i. Use a dummy coupling head to block the outlet port of the hose coupling.
ii. Connect to hose coupling under test to the end of flexible hose.
iii. Open isolating cock 1(a)
iv. Adjust pressure regulator (2) so that pressure gauge (6a) shows 10$Kg./cm^2$ air pressure.
v. Immerse the hose coupling assembly completely in the tub of water.
vi. Open isolating cock (1b) and see that (6b) shows 10 Kg/cm^2 pressure.
vii. Observe leakage, if any from all parts of the hose coupling.
viii. Close the isolating cock 1(b).
ix. Disconnect the hose coupling from test bed.
x. If the leakage is observed through the coupling head, replace the gasket and test again.
xi. If leakage persist even after change of gasket the coupling head is unserviceable and complete assembly shall be rejected. However if leakage occurs at the hose nipple or coupling end hose joint the clamp should be attended/replaced to make the assembly leak proof.

c) SAFETY PRECAUTIONS

- Specified tools and fixtures should be used for connecting and disconnecting the hose coupling with the air supply.
- While testing the hose coupling before charging it to 10kg/cm^2 pressure, the tube should be covered and locked with a protective cage.
- Exhaust the pressure from the hose coupling under test, before lifting the safety cage and uncoupling it.
- After testing, the hose assembly shall be stored in a dry and clean space. The inlet and outlet port must be plugged with protective cap to prevent entry of dust and foreign particles inside the hose coupling.

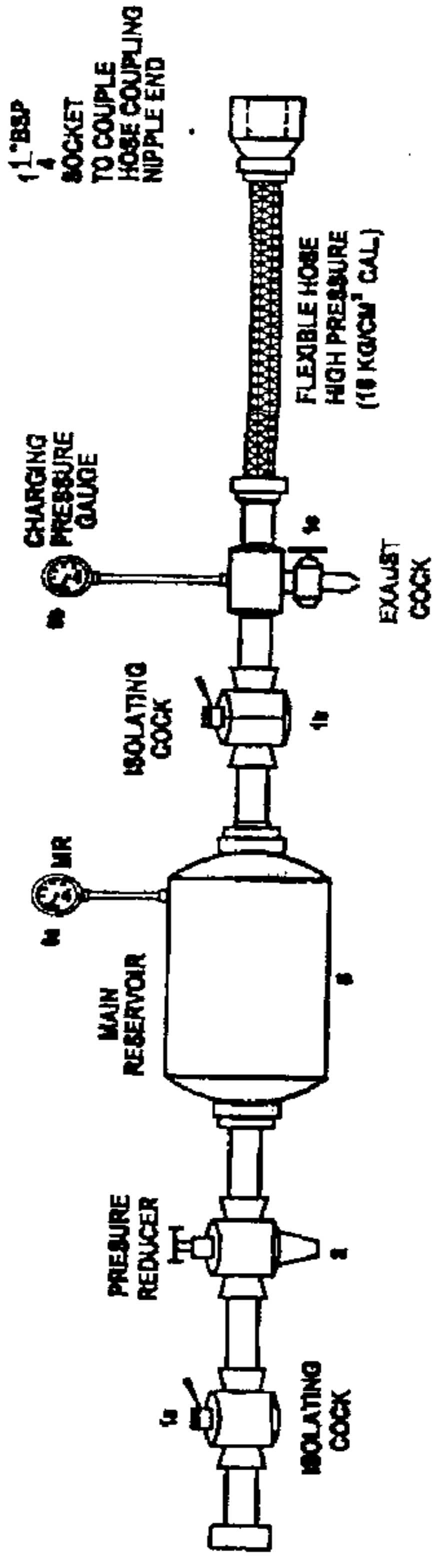


Fig. 8.6 TESTING OF HOSE COUPLING

807. CUT OFF ANGLE COCK

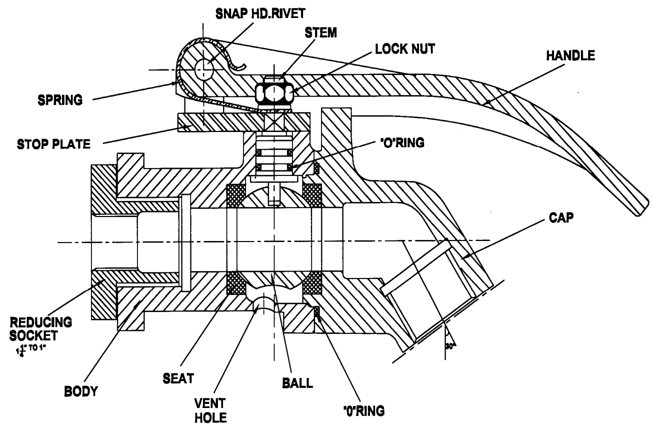


Fig. 8.7

Cut off angle cocks are provided on the air brake system to facilitate coupling and uncoupling of air hoses (i.e. brake pipe). When the handle of the cut off angle cock is placed in closed position it cuts off the passage of compressed air, there by facilitating coupling and uncoupling action.

If coupling action has to be performed on a given rake, ensure that the cut off angle cock provided at the end of the brake pipes are closed. By doing this the compressed air gets cut off and does not enter into the brake pipe air hose . The air hoses without compressed air can thus easily be coupled without any jerk. Similarly during uncoupling the cut off angle cocks of subsequent wagons should be closed. By doing so the air present in the brake pipe air hose gets leaked through the vent provided in the body of the cut off angle cock. Finally the air hoses get emptied and thus can be easily uncoupled without any jerk.

The cut off angle cock consists of two parts viz. cap and body which are secured together by bolts. The cap and the body together hold firmly the steel ball inside it, which is seated on rubber seat. The ball has a special profile with the provision of a groove at the bottom portion for venting the air to the atmosphere.

On the top surface of the body a bore is provided for placing the stem, to which a self locking type handle is fixed. When the handle is placed parallel to the cut off angle cock the inlet port of the cut off angle cock body is connected to the outlet port, through the hole provided in steel ball. Thus air can easily pass through the cock. This position of the handle is known as open position. When the handle is placed perpendicular to the cock body the steel ball gets rotated and the spherical and groove portion of the ball presses against the sealing ring at inlet and outlet port, there by closing the passage of inlet air and venting the outlet air through the vent hole. This position of the handle is known as closed position.

With the stem one leaf spring is provided which presses the operating handle downwards. By virtue of this, handle gets seated in deep grooves at ON/OFF position resulting in a mechanical lock.

Under normal working conditions, the handle of all cut off angle cock of BP are kept open except the rear end angle cock (BP). This facilitates in charging the complete air brake system with compressed air supplied by the compressor housed in the locomotive. Cut off angle cock fitted on the brake pipe is painted green.

Note: The dimension and tolerances of cut off angle cock shall be as indicated in latest revision of RDSO drawing nos. WD-88123-S-01 and WD-88123-S-02.

Since a number of manufacturers exist for air brake equipment and component, refer to concerned original manufacturer's maintenance manual for part no. and description of spares.

A. OVERHAULING OF CUT OFF ANGLE COCK

These angle cocks are of ball-type ensuring better sealing against leakage and facilitate ease of operation. During overhauling, it is dismantled for cleaning, replacement of parts and checking for effective functioning.

The cut-off angle cock is to be completely dismantled and overhauled during POH or when there is some specific trouble.

a) TOOLS & EQUIPMENT

The following tools and fixtures are required for overhauling

(I) Single end spanner.
  1) A/F 17 for M10 nut pivot screw.
  2) A/F 10 for M6 nut.

(II) Screw driver 12"/300 mm long.

(III) Vice.

(IV) Light hammer.

b) PROCEDURE

Dismantling

- Hold the cut – off angle cock in vice.
- Unscrew the lock nut from the stem.
- Take out the handle assembly (The handle assembly need not be dismantled further unless it is necessary to change the plate spring i.e. if it is found, heavily rusted, pitting crack or the spring is permanent set).
- Unscrew the four hexagonal bolts and spring washers.
- Detach cap from the body.
- Remove 'O' ring and ball seat from the cap.
- Turn the stem in such a way that the ball can be pulled from the stem.
- Slightly hammer the stem at its top and take out the stem through the bore of the body.
- Remove the ball seat from the body.

c) Cleaning of Parts

- Clean out side portion of the body and cap with wire brush.

- Direct a jet of air to remove the dust.
- Clean all metallic parts with kerosene oil and wipe dry.

d) Replacement of Parts

- Replace all rubber parts.
- Replace spring-washer, nut & bolts in case they are excessively corroded or defective.
- Replace handle spring if it is found heavily rusted, is having pitting crack or is permanently set (Dismantle the handle assembly, and fit a new spring along with a snap head rivet).
- Replace stainless steel ball if found with scratch marks on the outer surface or dented.

e) Assembly

- Insert the two ‘O’ rings in their respective grooves on the stem.
- Keeping the threaded end of the stem first, insert the stem into the body through the bore of the body.
- Place one ball seat in its groove inside the body.
- Position the ball after correctly aligning its venting slot in the bore of the body.
- Place the second ball seat and ‘O’ ring in their respective positions on the cap.
- Secure the body and cap by Hex. Hd. Bolt (M6) and spring washer (for M6).
- Place the handle assembly on the stem and secure it with Hex. Hd. Nut (M10).
- During assembly apply a light coat of shell MP2 or equivalent grease on the external surface of the threads and the ball.

B. TESTING OF CUT–OFF ANGLE COCK

a) TOOLS AND EQUIPMENT

i. Test Bench
ii. Compressor to build pressure more than 10 kg/cm^2.
iii. Single ended spanner as per IS 2027
   a) Across face 17 (for M10 lock nut) - 1 No.
   b) Across Face 13 (for M8 studs) 2 No.
iv. Screw Driver –300mm, 1 No.
v. 1 ¼ “ BSP dummy Plug with seal.
vi. Dummy plug for angle cock.

b) TEST PROCEDURE

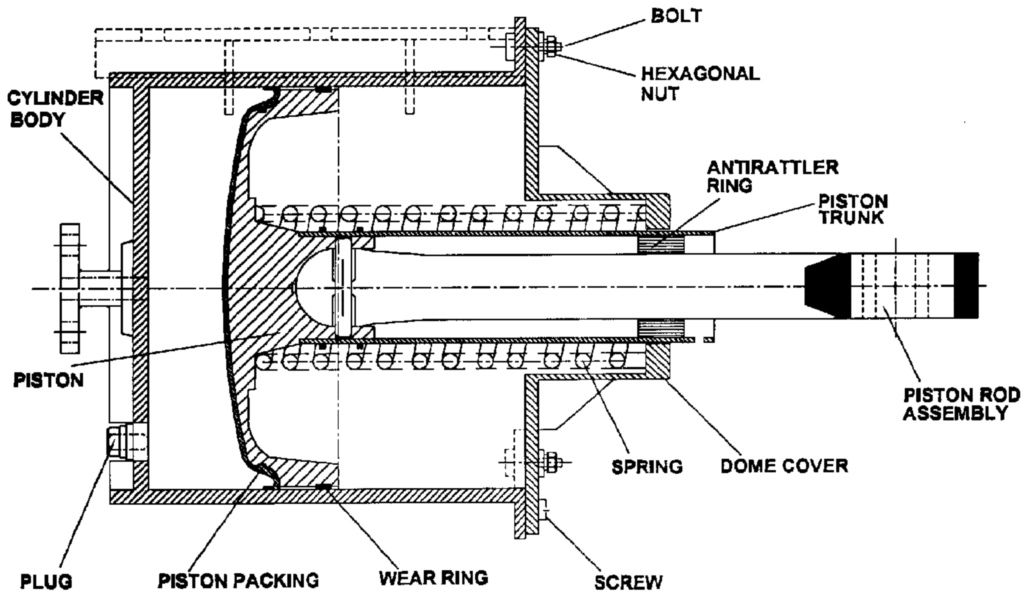
Following test procedure should be adopted step by step for performing the leakage test.

i. Mount the angle cock on the base of the test bench (Part No. 7 of the figure of the test bench).
ii. Move the handle to the closed position.
iii. See that cock (1e) and (1c) are in closed position.
iv. Now open cock 1(a) and 1(b) till MR indicates a pressure of 10 Kg/Cm^2.
v. If necessary, adjust pressure regulator (2) to maintain the pressure at 10 kg/Cm^2.
vi. Open cock (1c) and check the leakage with soap solution. There should not be any leakage.
vii. Check pressure drop in gauge (6b) there should not be any leakage from flange joints, vent and outlet port of the angle cock.
viii. Close cock (1c) and tighten the dummy plug and seal the outlet of the angle cock.
ix. Move the handle to the open position. Open cock 1c.
x. Check for leakage from body and cap joint, vent and all over the stem periphery using soap water. No leakage is permissible.
xi. Move the handle to closed position and notice a short blast of air through the vent.
xii. Close cock 1c then Open cock (1d) and exhaust the pressure to zero.
xiii. Remove the angle cock.
xiv. Report results of the test.

e) SAFETY PRECAUTIONS

- Specified tools and fixtures should be used for assembly and disassembly operations.
- The small metal parts like leaf spring, nut, bolts, washers, screws etc should be kept in a safe place and replaced in case found defective.
- Inlet and outlet port of the tested angle cock should be plugged with protection cap to prevent entry of dust and moisture inside the cut off angle cock.
- Ball should be handled carefully to avoid any damage on its surface.
- Threaded portion of body and cap should not be damaged at the time of dismantling.

808. BRAKE CYLINDER



(Note: Anti-rattler ring shall be provided on brake cylinder for passenger stock)

Fig. 8.8 BRAKE CYLINDER

On every wagon fitted with air brake system one brake cylinder is provided for actuating the brake rigging for the application and release of brakes.

During application stage the brake cylinder receives pneumatic pressure from the auxiliary reservoir after being regulated by the distributor valve. There after the brake cylinder develops mechanical brake power by outward movement of its piston assembly. To transmit this power to the brake shoe, the push rod of piston assembly is connected to the brake shoe through a system of levers to amplify and transmit the brake power. During release action of brakes the compression spring provided in the brake cylinder brings back the rigging to its original position.

The cylinder body is made out of sheet metal or cast iron and carries the mounting bracket, air inlet connection, ribs and flange. To the cylinder body, a dome cover is fitted with the help of bolts and nuts. The dome cover encloses the spring and the passage for the piston trunk, which is connected to the piston by screws. The piston is of cast iron having a groove in which piston packing is seated. Piston packing of rubber material which is of oil and abrasion resistant and unaffected by climatic changes. It is snap fit to the piston head and has self lubricating characteristic which ensures adequate lubrication over a long service period and extends seal life considerably

The piston packing also seals the air- flow from the pressure side to the other side and is guided by the wear ring. The wear ring prevents the friction between cylinder body and the piston head. The piston sub assembly incorporates a push rod, which can articulate and take minor variations in alignment during fitment/operation.

Note: The dimension and tolerances of brake cylinder shall conform to the latest revision of

RDSO drawing number WD-92051–S 06, WD-92051-S-07, WD-92051-S-08, WD-92057-S-09, WD 92051 –S-09 and WD 94048-s-01.

A. OVERHAULING OF BRAKE CYLINDER

Brake cylinder has to be thoroughly overhauled for efficient and reliable trouble free performance during its prolonged service life. The complete overhauling of the brake cylinder is to be carried out during POH or when there is some specific trouble.

a) TOOLS & EQUIPMENT

Sr. No.	Description
1.	Torque Wrench 0-3 Kg range
2.	Double End Spanner 24x27 mm across face (For M16)
3.	Double End Spanner across face 13x14 (For M12)
4.	Socket Wrench 19 mm (For M12)
5.	Screw Driver 12" (300 mm)
6.	Special fixture (Screw press/ Pneumatic)
7.	Gauge for examining bore of the cylinder

b) Dismantling of Brake Cylinder

Before dismantling the dome cover insert a rounded head pin of 12x25 long and secure one of the hole in the piston trunk for the purpose of safety to prevent dome cover working out of the piston rod due to the cylinder return spring force while opening the dome cover with the help of a special fixture clamp the dome cover.

- Unscrew the Hex. Hd. nut and take out the spring washer on the dome cover.
- Turn the handle of the fixture to release the clamp and withdraw the holding clamp of the fixture till the return spring inside the cylinder is fully expanded and free.
- Remove the dome cover and take out the return spring.
- Remove the bush on the rod and brake cylinder.
- Remove the piston rod sub-assembly, piston ring packing, wear ring and slide out the anti rattler ring from the piston rod.
- Unscrew the CSK, head screw and separate the piston, pin, piston trunk & piston rod assembly.

- Unscrew the brake cylinder plug at the rear end.

c) Cleaning of Parts

- Blow a jet of air to clean the dust on the external surface.
- Clean the metallic parts using wire brush and kerosene oil.
- Clean the internal parts with nylon bristle brush.
- Clean piston packing, wear ring and rubber parts with soap water solution.

d) Replacement of Parts

- Replace return spring in case of crack, kinks or permanent set.
- Replace the brake cylinder body if found with deep marks, heavily corroded, or the bore is worn uneven or having ovality.
- Replace all rubber parts.
- If piston trunk is worn excessively it should be replaced.
- Replace piston and piston rod for damages, bent etc.
- Replace dome cover for damage, damaged hole etc.

e) Inspection and Repairs of the Parts

- Examine visually that the internal surface is free from scratches, rust.
- Brake cylinder bore to be checked for ovalness with proper gauge.
- Check the characteristics of the return spring.
- Piston trunk to be checked for wear and tear.
- Pin, piston rod should be checked for wear.
- Dome cover shall be checked for excessive wear and if worn build up with welding and thereafter re-bore to the required size.
- Gauge, bush bore of the piston rod, replace it if worn.

f) Testing Of Brake Cylinder Body for Leakage

Before assembly, put dummy plate on the dome side and subject the brake cylinder for hydraulic pressure of 10 kg/cm^2 for 5 minutes. No leakage is permitted.

g) Assembly of Brake Cylinder

- Assemble piston rod, pin, piston trunk on piston, tighten CSK screws to piston trunk and piston.
- Slide anti-rattler ring from the piston front side.
- Assemble piston return spring on the piston head and insert the dome cover over the piston trunk.
- Insert ϕ 12 x 25 mm long head pin into the hole provided in the extended portion of the trunk.
- Smear the piston head & inside the cylinder body with MP 2 grease or equivalent.
- Ease the packing into the cylinder with a wooden spatula with a round nose and round edge to avoid damage to the piston packing.
- Push the piston assembly approximately to the central position of the cylinder.
- With the help of special fixture, bring down the dome cover on to the cylinder body and fasten the 8 Hex. HD bolt, nut and spring washer with required torque.
- Take out the ϕ 12x25 long pin from the piston trunk hole.
- Fit back the plug at the rear of the cylinder.
- Fit the new piston packing and wear ring.

B. TESTING OF BRAKE CYLINDER

a) BRAKE CYLINDER TEST BENCH (Fig. 8.9)

Test bench consists of the following main parts

i. 3 nos. of isolating cocks
ii. Isolating cock with 1mm choke
iii. Pressure reducing valve

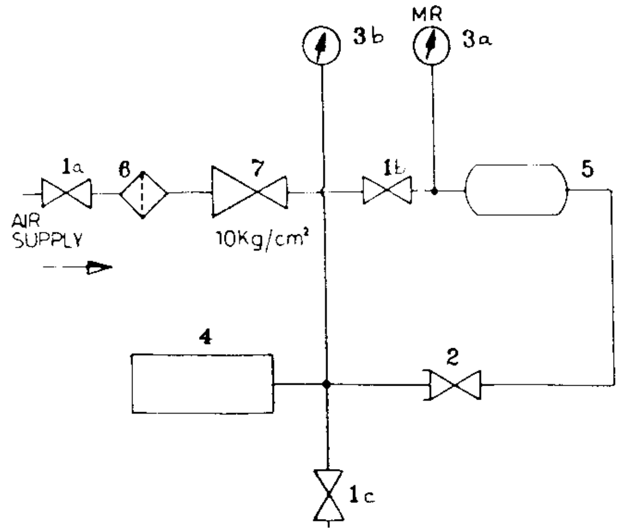


Fig. 8.9 TEST BENCH FOR BRAKE CYLINDER

iv. 2 Nos. Pressure gauges
v. Pipe line filter
vi. Brake cylinder pressure mounting base with safety guard
vii. Air reservoir

b) TOOLS REQUIRED DURING TESTING

i. Torque wrench range (2-3 kgM capacity) – One number.
ii. Double ended spanner (M16) across face 24x27 – One number.
iii. Socket wrench (M12) across face 19 – One Number.
iv. Double ended spanner (M8) across face 13x14 – One number.
v. Screw Driver – 300mm – One number.

After the overhauling of the brake cylinder, it is mounted on the test bench and tested. It should be operated a few times on the test bench to ease the piston. Each brake cylinder after its maintenance and overhaul shall be subjected to the following tests on the test bench.

Arrangement as shown in Fig. 8.9 is used for testing.

c) STRENGTH TEST

Follow the procedure as given below.

i. Place the brake cylinder on base (4) and connect the line to brake cylinder. Brake cylinder stroke should be free.

ii. Close the safety guard, close the cock (Ic).
iii. Open cock (1b) and let reservoir pressure reach 10 Kg/cm2. Check the pressure in MR gauge (3a).
iv. Open cock (2) till the pressure reaches 6 Kg/cm2 in pressure gauge (3b).
v. Close the cock (2) and wait for 2 minutes.
vi. Open cock (1c).

The above test should be done with the safety guard.

d) PRESSURE TIGHTNESS TEST

Follow the following procedure.

i. Mount the cylinder on the test stand and tighten the mounting bolts & nuts.
ii. Set the brake cylinder stroke at 85 $\pm$ 10 mm.
iii. Open cock (2) and let the pressure gauge (3b) reaches 0.8 Kg/cm^2.
iv. Close the cock (2) and wait for 1 minute till the pressure stablise in gauge (3b).
v. Check for the pressure drop which should not be more than 0.1 Kg/cm^2 in 10 minutes.
vi. Open cock (1 c)
vii. Repeat the test at 130 + 10 mm piston stroke and 3.8 Kg/cm^{2}pressure. Close cock (2) open cock (1c). Remove the brake cylinder.

If pressure is not correct or leakage rate is higher, dismantle the brake cylinder and examine piston packing wear ring for proper fitment. Examine plug for leakage. Reassemble the components and retest.

e) PAINTING

The exterior of the brake cylinder shall be painted with black enamel paint.

f) STORING

■ Assembled or dismantled brake cylinder should be stored in such a way to prevent the following.
■ Flange surface should be prevented from damages.
■ Inlet and outlet port should be plugged with protective cap to prevent the entry of dust and moisture inside the brake cylinder.

g) PRECAUTIONS DURING TESTING

■ Safety Guard should be used during the strength test.
■ Assembled or dismantled brake cylinder should be stored in such a way to prevent the following:
  i. Flange surface should be prevented from damage.
  ii. Inlet port should be plugged with a protective cap to prevent the entry of dust and moisture inside the brake cylinder.

- Avoid damage to piston packing by dull or sharp edged thin bladed tool.
- Fit 12 dia, 25 mm long round headed pin on the hole provided in the extended portion of trunk surface before loosening the cover bolts.
- Excessive lubrication of the cylinder must be avoided.
- Specified tools and fixtures should be used for handling, mounting and removing the brake cylinder from the test bench.
- The small metal parts like springs, washer, screws, nuts, bolts, washers should be kept in a safe place and replaced in case found defective.

809. DIRT COLLECTOR

A. FUNCTION OF DIRT COLLECTOR

Dirt Collector is placed in the brake pipe line at a point from where a branch is taken off to the distributor valve. As the name indicates the purpose of the dirt collector is to protect the distributor valve and the auxiliary reservoir by trapping dust and other foreign matters from the compressed air before it enters into the distributor valve and the auxiliary reservoir. This action is achieved by centrifugal action. Hence it is also known as centrifugal dirt collector. The dirt collector ensures inter vehicular full flow of dirt free compressed air to the auxiliary reservoir and the distributor valve through the branch pipes. When the air enters into the body of the dirt collector tangentially through port `A' it passes down through inverted case in a spiral path. Due to the velocity of air flow, dirt particles get flung outwards. There after they slide down & collect at the bottom.

B. SALIENT FEATURES OF DIRT COLLECTOR

The air entering into the dirt collector from the brakepipe is guided through suitably shaped passage in dirt collector body to produce centrifugal flow. The air is then filtered through additional filter assembly before it is passed to outlet on branch pipe side to provide dust proof air to the distributor valve /auxiliary reservoir after arresting fine dust particles. The dirt contained in the air descends down and gets deposited in the dirt chamber. However, fine particles are also arrested in the filter assembly. The dust particles accumulated in the dirt chamber are removed by opening the drain plug. Rubber gasket is provided between the cover and housing to prevent leakage. Similarly leather washer is provided between the housing and the drain plug to prevent leakage.

Note: The dimensions and tolerance of dirt collector shall be as indicated in latest revision of RDSO drawing number WD-92051-S-03, WD-92051-S-04 and WD-92051-S-05.

The dirt collector is to be completely dismantled and overhauled once in 5 years or after 8 lakhs kilometers whichever is earlier or when there is some specific trouble.

C. TOOLS AND FIXTURES

The following tools and fixtures are required for overhauling:

a) Spanner 19 x 22mm
b) Vice.
c) Screw Driver

D. PROCEDURE FOR MAINTENANCE

I. Disassembly

- Hold the dirt collector in vice.
- Loosen drain plug and remove it completely from housing.
- Remove top cover and seal by loosening four hexagonal nuts and removing hexagonal bolts.
- Remove filter from body.

II. Cleaning of Parts

- Clean all metallic parts using brush and kerosene oil.
- Clean filter with soap water.
- Check all parts for any damage.

III. Replacement of Parts

- Replace sealing ring and gasket.
- Replace filter if found punctured or damaged.
- Check spring washer and replace in case defective or excessively corroded.

IV. Assembly

- Assemble body after smearing grease.
- Locate filter in position and assemble top cover with new gasket.
- Fix hexagonal bolts/nuts along with the spring washer.
- Fix new sealing ring to the bottom and assemble drain plug.

E. TESTING OF DIRT COLLECTOR

Centrifugal Dirt Collector is provided at the junction of the main pipe and branch pipe in brake pipes. There are three purposes for providing the dirt collector.

i. To ensure inter-vehicular full flow of brake pipe lines.
ii. For branching and feeding to the distributor valve.
iii. To remove dust and scale particles from the air prior to entering the distributor valve and the air reservoir.

As Dirt collector is subjected to high air pressure it has to be tested for the leakage and strength. Testing of dirt collector is needed after its overhauling. There may be various causes due to which overhauling and subsequent testing of the dirt collector is required.

F. TOOLS AND EQUIPMENT

- Test Bench (Fig. 8.10)
- Compressor, capable of building air pressure up to 10 kg/sq. cm.
- Double ended spanner (Across Face 19x22) – One No.
- Dummy flange for dirt collector – 2 nos.

G. TEST PROCEDURE

Each dirt collector after overhauling and maintenance should be subjected to pressure test as below:

i. Mount the dirt collector on base of the test bench.
ii. Keep cocks (1f), (1c) and 1(e) closed.
iii. Open cock (1a) and (1b).
iv. Charge the reservoir (5) to 10 kg/cm^2.
v. Close two openings on the dirt collector using dummy flanges.
vi. Open cock (1e), check the pressure at (6c). it should be equal to 10 kg/sq. cm.
vii. If not develop pressure up to 10 kg/cm^2 by
viii. adjusting pressure regulator (2).
ix. Close cock (1e)
x. Check for leak over the body and joints with the help of soap solution, no leak is permitted.
xi. Also check for pressure drop in gauge 6(c)- for 3 minutes
xii. Pressure in the gauge 6c should be maintained.
xiii. Reduce the pressure in the main reservoir (5) to 5 kg/cm^2 by opening cock (1f) and adjusting the pressure regulator (2).
xiv. Close cock (1f) as soon as pressure reaches upto 5 kg/cm^2.
xv. Remove the dummy flange from the outlet port (which feeds to the distributor valve).
xvi. Check for free flow of air from the outlet port. (If air is not flowing freely it means that the filter is choked).
xvii. The pressure will soon exhaust through the outlet port.
xviii. Remove the dirt collector from the test stand.
xix. Report Results.

H. SAFETY PRECAUTIONS

- The assembled dirt collector should be stored in such a way to prevent the following:
- Flange surface should be prevented from damage.
- Inlet and outlet port should be plugged with protective caps to prevent the entry of moisture and dirt inside the dirt collector.
- Specified tools and fixtures should be used for handling, mounting and removing the dirt collector from the test bench.
- The small metal parts like screws, nuts, bolts, washers etc. should be kept in a safe place and replaced in case found defective,

TEST BENCH FOR ANGLE COCK & DIRT COLLECTOR

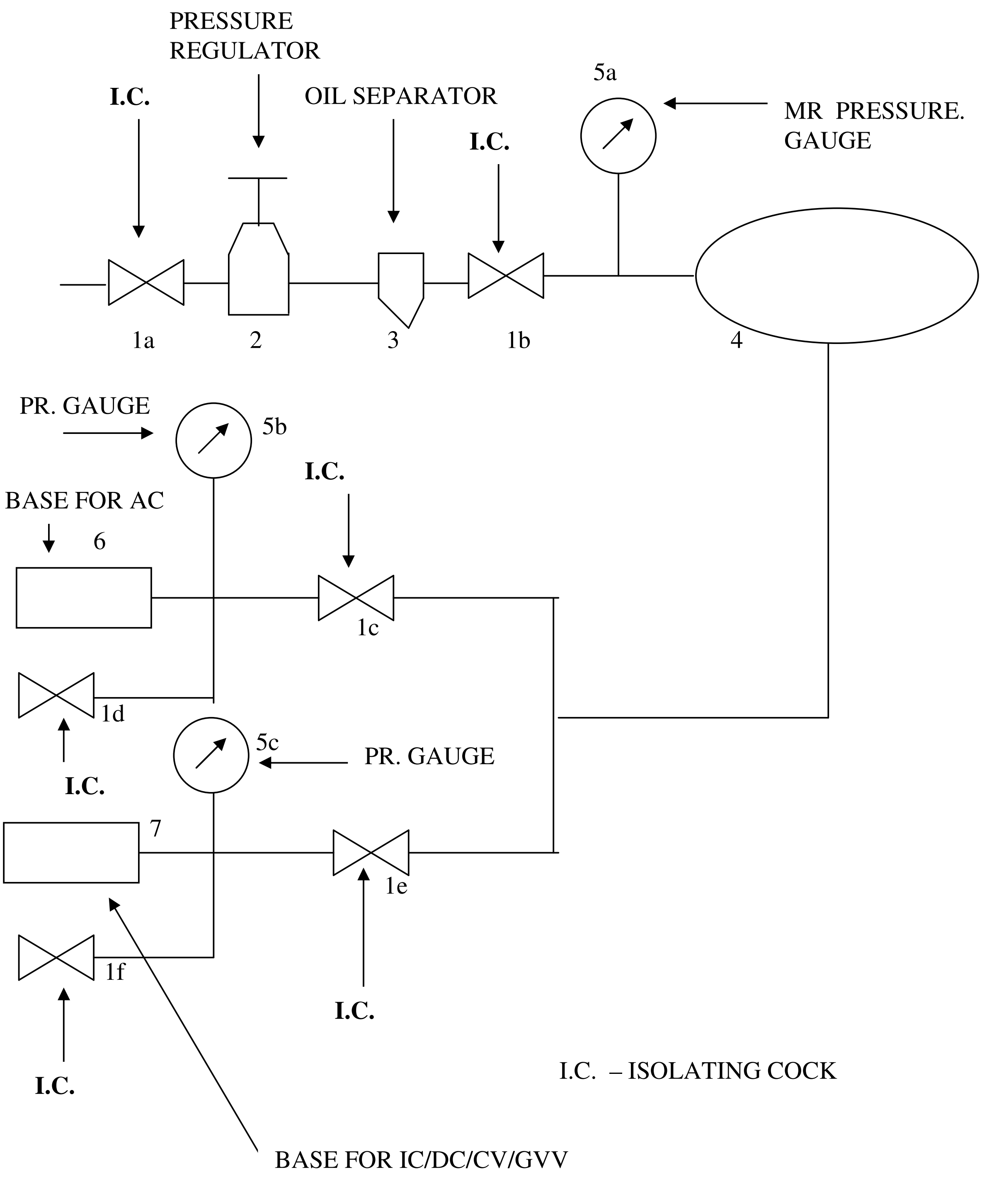


Fig. 8.10

810. AUXILIARY RESERVOIR

A. FUNCTION

Auxiliary reservoir is actually a pressure vessel and its function is to feed dry compressed air to the brake cylinder for application of brakes.

B. SALIENT FEATURES

The auxiliary reservoir is a cylindrical vessel made of sheet metal. On both the ends of the reservoir, flanges are provided for pipe connection. One end of the auxiliary reservoir is connected to the brake pipe through the distributor valve. Auxiliary reservoir is charged through the brake pipe. The auxiliary reservoir is charged to 5kg/cm^2 pressure, charging from the brake pipe through Distributor valve.

At the bottom of the auxiliary reservoir, drain plug (or drain cock) is provided for draining out the condensate/moisture.

Note: The dimension & tolerances of the auxiliary reservoir shall be as indicated in latest revision of RDSO drawing WD-92051-S-01 for 100 lit. Capacity and RDSO drawing number WD-92051-S-02 for 75 lit. capacity.

The auxiliary reservoir is to be completely dismantled and overhauled during POH or if there is some specific trouble.

C. TOOLS AND EQUIPMENT

Spanner A/F 19x22.
Light hammer

D. PROCEDURE FOR MAINTENANCE

DISMANTLING

Unscrew the drain plug or drain cock.
Drain the water accumulated in the tank.

CLEANING OF PARTS

Examine the outer surface for any pitting scales or rusting.
Clean the exterior of the auxiliary reservoir with a wire brush.
Pour kerosene oil in to the auxiliary reservoir and roll few times and drain the oil.
Dry the interior of the reservoir with a jet of air.
Rinse the reservoir with RUSTO-LINE and then with ESSO-RUST 392 or equivalent.
Clean the drain plug with a wire brush.

Auxiliary reservoir shall be painted on the exterior with two coats of zinc chromium primer and two coats of black enamel.

REPLACEMENT OF PARTS

Replace the plug washer.
Replace the plug if threads are rusted or damaged.
Replace the reservoir having deep cuts on surface.

ASSEMBLY

Assemble the drain plug with washer by screwing it back into its position.

E. TESTING OF AUXILIARY RESERVOIR

Air Pressure Test

Block one side passage of the auxiliary reservoir with dummy flange.
Admit air pressure from the other side passage at 10 Kg/cm^2.
Check the leakage at the weld seams, with soap water solution.
No leakage is permitted.

Hydraulic Test

With a hydraulic pump, apply a pressure of 16 $Kg./cm^2$ from one flange end after blocking the opposite end.
Hold the pressure for 5 minutes.
Check for the leakage on the external surface of the reservoir by gently tapping on the weld seams with a light hammer.
No leakage is permitted.
Drain out the water completely and allow the reservoir to dry, by directing a jet of air.

F. SAFETY PRECAUTIONS

- Specified tools and fixtures should be used for assembly and dismantling operations.

- Rubber / leather components should be stored in a safe place away from heat, alcohol & acids. All metal parts like washers should be kept in a safe place.

811. GUARD'S EMERGENCY BRAKE VALVE

Guard's emergency brake valve is provided in the guard 's compartment. This valve provides a facility to the guard to initiate brake application in case of any emergency. The working and salient features of guard's emergency brake valve is described on next page.

Guard’s emergency brake valve is connected to the brake pipe. This valve is actually placed in the guard’s compartment so that in case of an emergency, the guard of the train can communicate to the driver of the train by operating the valve provided in the brake van. When the handle of the guard’s emergency brake valve is placed parallel to the pipe, the air from the brake pipe is exhausted to the atmosphere. However, to restrict the excessive drop of air pressure in the brake pipe, a choke of 5mm is provided in this valve. This drop in pressure in the brake pipe can also be observed in the air flow meter provided in the locomotive cabin and finally the driver applies the brakes for stopping the train. The handle of the guard’s emergency brake valve has to be reset manually to normal position before the brake pipe pressure is to be recharged.

A. SALIENT FEATURES

The guard’s emergency brake valve consists of a housing in which a ball is housed. The ball has a through hole similar to the isolating cock. To the ball a handle is fixed at the top. By operating the handle the ball can be rotated along the vertical axis. When the hole in the ball gets aligned with the inlet and the exhaust port the compressed air can pass through the valve. However, for restricting the flow of air a choke of 5mm is fitted in the exhaust port for controlling the rate of BP exhaust. In order to have leak proof assembly two rubber seats are also provided in the guard’s emergency brake valve

Note: The general design and controlling dimension of guard’s emergency valve shall conform to the latest revision of RDSO drawing no SK-73549, 97030.

The guard's emergency brake valve should be completely dismantled and overhauled during POH or when there is some specific trouble.

B. TOOLS AND FIXTURES FOR MAINTENANCE

The following tools and fixtures are required for overhauling

Spanner A/F 19/22.
Special spanner for removing thread plug.
Spanner for removing gland.
Light hammer
Vice.

C. PROCEDURE FOR MAINTENANCE

a) **DISMANTLING**

Hold the valve in the vice.
Unscrew the nut on the stem and remove the nut and the spring washer.
Remove the handle.
Unscrew the gland and pull out the stem from the body.
Remove the two gland packing on the stems.
Unscrew the threaded plug from the body using a special spanner.
Remove the ‘O’ ring and the ball seat from the body.

Remove the ball and the second ball seat from the body.

b) CLEANING OF PARTS

Direct a jet of air on the valve body to remove the dust & dirt.
Clean the external parts of the valve with wire brush.
All metal parts shall be washed with kerosene oil and wiped dry.
Rubber parts shall be washed with soap water solution.
Steel ball shall be handled carefully to avoid scratch marks or dent.

c) REPLACEMENT OF PARTS

Replace all the rubber parts such as gland packing and 'O' ring.
If spindle thread is corroded or damaged, the spindle shall be replaced with a new one.
If threads on the threaded plug are damaged or corroded badly, the plug shall be replaced with a new one.
If ball of the valve has dent or scratch marks it should be replaced with a new one.

d) ASSEMBLY

Place seat ring in its position in the bore of the body on one side.
Apply grease lightly on the ball.
Fit 'O' rings on the spindle.
Insert the ball in the bore of the body in such a way that the ball sits on the seat ring and the groove seat for spindle is in top position.
Insert the spindle with 'O' rings such that the spindle enters in to the groove.
Screw the gland in to the body.
Insert the second seat ring through the bore of the housing.
Fit 'O' ring on the threaded plug. With a special tool screw the threaded plug.
Screw the threaded plug along with the 'O' ring into the housing till the ball seat touches the ball.
The handle shall be put on the spindle and tightened with spring washer and nut.

D. TESTING OF GUARD'S EMERGENCY BRAKE VALVE

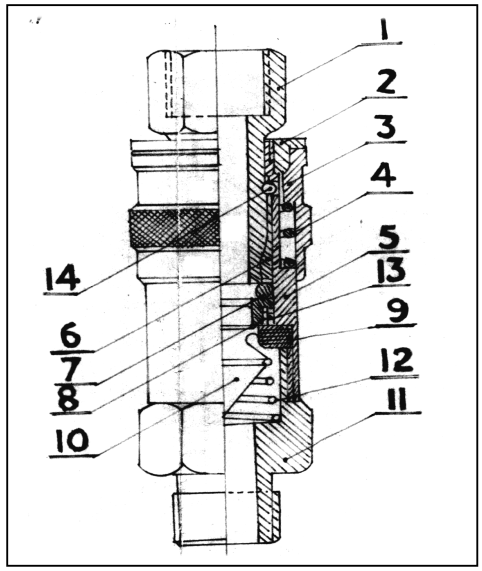
After overhauling, fix the valve to the test bench.
Put the handle of the valve in off position (close position).
Charge the inlet port with a pressure of 10Kg./cm^2.
Check for leakage on the spindle portion and on the exhaust port with soap water solution.
No leakage is permitted.
Operate guard's emergency brake valve, by putting the handle in open position. Air should escape through the vent of the valve.

E. QUICK COUPLING ARRANGEMENT

For fitment of gauge an arrangement for quick coupling is provided. The figure showing the arrnagement. The quick coupling when assembled with and without plug shall be leakproof when tested upto 10 kg/cm^2 air pressure.

Details of part nos are as under;

1. Plug
2. Locking nut
3. Locking Ring
4. Spring
5. Body Top
6. Locking Bush
7. Seal
8. Valve
9. Valve Seat
10. Valve
11. Lower Body
12. Spring
13. Spring
14. Ball 3.5 Φ



812. SLACK ADJUSTER

A. SALIENT FEATURES

Slack adjuster (also known as brake regulator) is a device provided in the brake rigging for automatic adjustment of clearance/slack between brake blocks and wheel. It is fitted into the brake rigging as a part of mechanical pull rod. The slack adjuster is double acting and rapid working i.e. it quickly adjusts too large or too small clearance to a predetermined value known as `A' dimension. The slack adjuster maintains this `A' dimension throughout its operation. The slack adjuster, type IRSA-800 used on wagons is composed of the following parts

- Adjuster spindle with screw thread of quick pitch (non self locking)
- Traction unit containing adjuster nut, adjuster tube and adjuster ear etc.
- Leader nut unit containing leader nut and barrel etc.
- Control rod with head.

The out standing features of slack adjuster DRV2 600 are:

(I) Fully Automatic

Once initially set, no manual adjustment is further necessary at any time during its operation.

(II) Double-Acting

The brake shoe clearance is adjusted to its correct value both ways, either when it has become too large (owing to wear of the brake shoes and wheels) or when it has become too small (e.g. owing to renewal of `worn out brake blocks').

(III) Rapid Working

Correct brake shoe clearance is automatically restored after one or two applications of the brake.

Verification

If resistance occurs early in the brake application, caused by heavy brake rigging, e.g. an ice coating on the brake shoes, etc., in such cases the DRV does not pay out slack immediately, but indexes the amount of slack to be paid out. If the slack really is too small, the DRV will pay out this indexed slack at the next brake application. Thus false pay-out will not occur.

True Slack Adjuster

The slack adjuster adjusts incorrect slack only, thus giving the brake its best possible pre-adjusted limit of piston strokes, ensuring a smooth and efficient braking force at all times.

Shock Resistant

Train shocks will not cause false take-up or pay-out of slack. When brakes are released, the moving parts of the slack adjuster are securely locked.

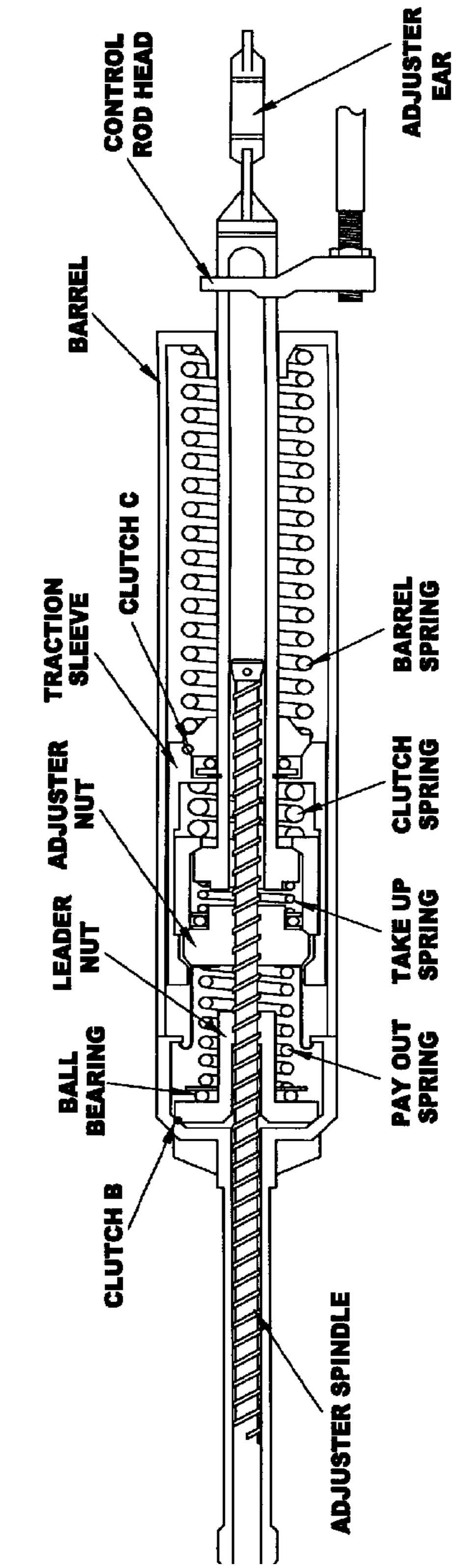


Fig. 8.11 SLACK ADJUSTER

B. WORKING PRINCIPLE OF SLACK ADJUSTER

In slack adjuster the 'A' dimension is the controlling feature. `A` dimension is the distance measured between the control rod head and the barrel when the brakes are fully released. In other words 'A' dimension corresponds to the correct slack when brakes are fully released. For wagons it defers wagon to wagon and 'e' dimension which is the limit of length that adjuster will adjust is 575$\pm$25mm ('A' and 'e' dimension should be maintained under all working conditions). For effective operation, slack adjuster has to operate under three different conditions, i.e. with:-

- Correct slack
- Too large slack
- Too small slack.

a) CORRECT SLACK

If slack is correct then under normal released position, control rod head is at a distance 'A ' from barrel end which corresponds to the correct slack (Refer fig. 1).

For light brake application: During the first part of brake application, adjuster ear traverses distance `A'. With correct slack, the brake shoes start applying against the wheel at the same time when control rod head touches the end of the barrel. (Refer fig. 2). Because of the braking action the left sleeve in traction sleeve is drawn against adjuster nut, against the force of barrel spring. This action compresses the clutch spring and clutch C is disengaged.

For full brake application the brake is more heavily applied. During this action all parts of the brake rigging will be submitted to proportionate stress and will develop elasticity. As a result the ear end will travel an additional distance `e' corresponding to elasticity/full brake force (Refer Fig. 3). However the barrel is held back against the control rod head. Thus traction unit is drawn longitudinally through the barrel thereby compressing the barrel spring. Also it tries to take leader nut unit along in the movement. This action releases clutch B. The movement of adjuster spindle through leader nut causes leader nut to rotate on the spindle.

For releasing the brakes (Refer Fig. 4)- When pressure in the brake cylinder decreases, the brake cylinder piston and the brake rigging moves back. The traction unit then moves to the left through barrel. As still the clutch spring is compressed the clutch C will remain in open position. The leader nut now gets locked by clutch B and will again begin to rotate on the thread. This time the rotation is in opposite direction, as spindle moves to left. However clutch B is not able to stop this rotation because entire barrel and barrel spring is free to rotate as long as clutch C is held open. Thus barrel and barrel spring rotate with leader nut and during this rotation, barrel spring extends and keeps the end of barrel in contact with control rod head.

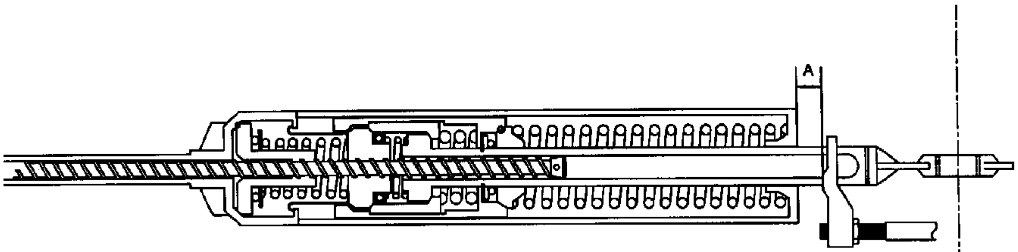


Fig.1

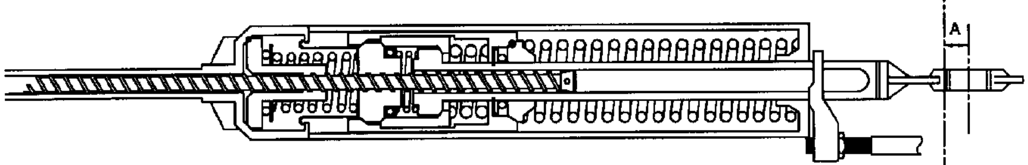


Fig. 2

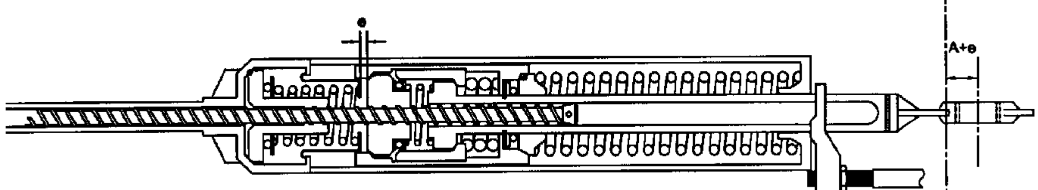


Fig. 3

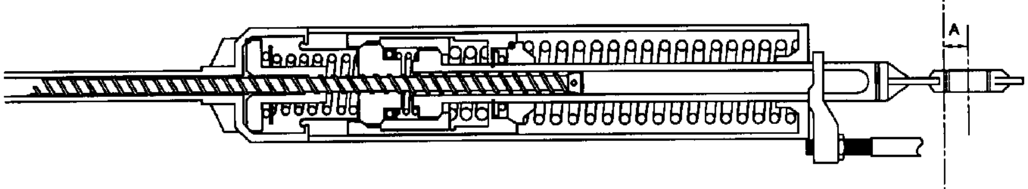


Fig. 4

As long as clutch C is open adjuster nut is kept firmly locked in place on adjuster spindle. Any cycles of brake will cause a correspondingly idle rotation of leader nut unit back and forth on spindle thread. The idling of leader nut prevents all movements from influencing the adjustment. Thus adjustment is governed only by the amount of slack present in the brake rigging.

For full brake release, the effective pressure in brake cylinder gets totally released. Also as braking stress disappears, clutch spring locks clutch C. As a result further rotation of barrel and leader nut gets stopped. If the slack is correct, the locking of clutch C takes place at the same moment as distance `e' is consumed. Adjuster nut is then momentarily arrested and adjuster ear, adjuster tube and traction sleeve continues to move to left so that sleeve pushes against adjuster nut and locks it. Thereupon whole assembly moves to left until brake is fully released and distance A is restored. (Refer Fig. 1)

Even in emergency application no adjustment takes place. The only difference is that the idle movement of leader nut back and forth will be somewhat longer. This is due to greater deflection of brake rigging under heavier stresses and longer piston travel.

b) TOO LARGE SLACK

In released position there is no difference from release position with correct slack (Refer Fig. 5).

Now during first stage of brake application as the brake cylinder piston is pushed out the force is transmitted through the horizontal lever to pull the adjuster ear to the right until a distance 'A' is traversed. At this point the end of the barrel touches control rod head. When this happens, barrel is arrested and also momentarily adjuster spindle with adjuster nut and leader nut is arrested. The left-hand seat in traction sleeve is then immediately drawn against adjuster nut thereby locking it in place on adjuster spindle (Refer fig. 6).

For full brake application as slack is too large, brake shoes not yet contacted the wheel. Thus adjuster ear is drawn further to right to a distance `l' (Refer Fig. 7) pulling adjuster tube, traction sleeve, adjuster nut and adjuster spindle under compression of barrel spring against control rod head. Leader nut is being retained by spring and ball bearing in leader nut unit now starts rotating as adjuster spindle is drawn through it. When brake shoes starts contacting the wheels braking stress starts developing as a result clutch spring is compressed and clutch C is disengaged.

For releasing the brake (Refer Fig. 8) take up action. When brake release starts there is an idle rotation of leader nut unit together with barrel and barrel spring in opposite direction as brake rigging moves back and braking stress decreases. As braking stress disappears and clutch C locks stopping further rotation of barrel and leader nut. The movement of adjuster spindle to the left stops. Adjuster ear, adjuster tube and traction sleeve continue to the left, adjuster nut is also being pushed along to the left by take up spring acting on ball bearing. This movement of adjuster nut to left over the spindle (under rotation on the spindle threads) continues until adjuster nut abuts the sleeve of spring in leader nut unit, which is held stationary by barrel. This permits the right hand seat of traction sleeve to engage adjuster nut and lock it in place on adjuster spindle. After this whole assembly moves as a unit to left. Barrel then moves away from control rod head until brake is fully released and distance A restored.

Thus adjustment `l' that has taken place by adjuster nut is displaced on adjuster spindle, corresponds exactly to excess of slack that was present in brake rigging.

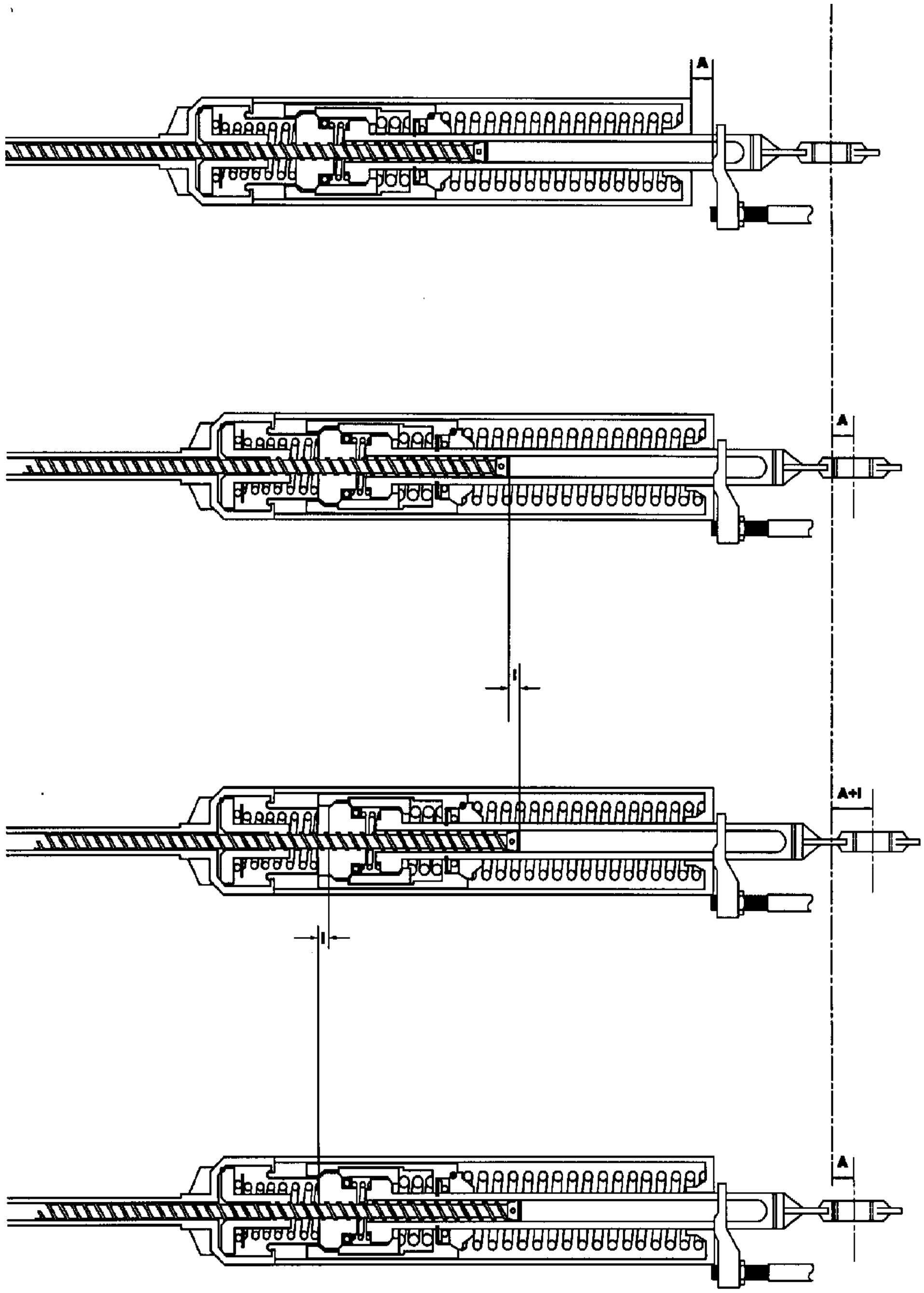


Fig. 5

Fig. 6

Fig. 7

Fig. 8

c) TOO SMALL SLACK

For released position_there is no difference from released position with correct slack.

During **first stage of brake application** (all parts move together to right until) shoes touches the wheels. When this happens, end of barrel has not yet touched the control rod head. There is a distance ‘m’ between end of barrel and control rod head corresponding to deficiency in slack. The left hand side of traction sleeve is drawn against adjuster nut locking it in place on adjuster spindle. (Refer fig. 9).

During full brake application, braking stress builds up and clutch spring is compressed there by clutch C is disengaged. The force of barrel spring now moves barrel, leader nut, barrel spring to the right to contact the control rod head. Due to this displacement the spring in leader nut unit is compressed and the distance `m' at the end of barrel is transferred to interior of leader nut unit (Refer Fig. 10).

For releasing the brake after usual idle movement of leader nut back and forth, braking stress disappear and clutch spring lock the clutch C. The rotation of barrel and leader nut stops and adjuster spindle is held back momentarily, and right hand seat in traction sleeve engages adjuster nut. There upon the whole assembly moves to the left to a distance corresponding to still deficient slack, thus the end of barrel moves away only the distance A-m. The distance `m' is still indexed in leader nut unit (Refer Fig. 11).

During next brake application (Refer Fig. 12) at first stage all parts move together to the right, until further movement of adjuster spindle is stopped by brake shoes contacting the wheel. The end of barrel then very nearly touches control rod head. Barrel is held back on adjuster spindle by the still locked clutch C.

Now **during second stage** of brake application i.e. payout (Refer fig. 13) adjuster ear, adjuster tube and traction sleeve continue their movement to the right. Now the compressed pay out spring expands and pushes adjuster nut on adjuster spindle under rotation on ball bearing so as to follow receding movement of traction sleeve. When distance 'm' is traversed, sleeve of spring in leader nut unit, stop in barrel, and pushing on adjuster nut is ceased. The left hand seat in traction sleeve engages and locks the nut and the brake action is continued. Thus the effective length of slack adjuster is increased exactly by distance `m' corresponding to the deficiency of slack.

C. OVERHAULING OF SLACK ADJUSTER

a) TOOLS & EQUIPMENT

The following tools and fixture are required for overhauling of slack adjuster;

(i) Jacking tool – for mass repair / overhauling of Slack Adjuster pneumatically operated fixture is used.
(ii) Special Spanner
(iii) Straight Nose plier (external) (spring type)18 mm to 25 mm-external
(iv) Bend nose plier (internal) 25-30mm –internal
(v) Screw driver
(vi) Pipe vice & simple 6" vice
(vii) Open end spanner 11-13 mm.
(viii) Hand punches
(ix) Kerosene oil bath
(x) Air jet gun
(xi) Slack Adjuster test bench

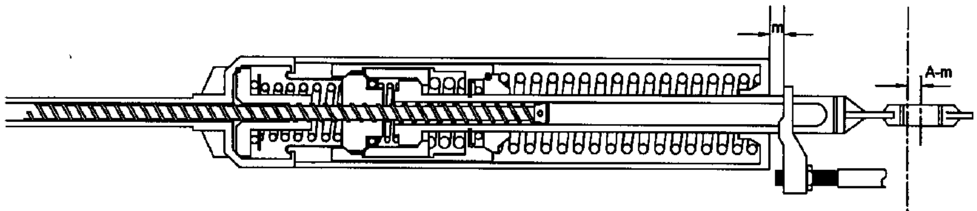


Fig. 9

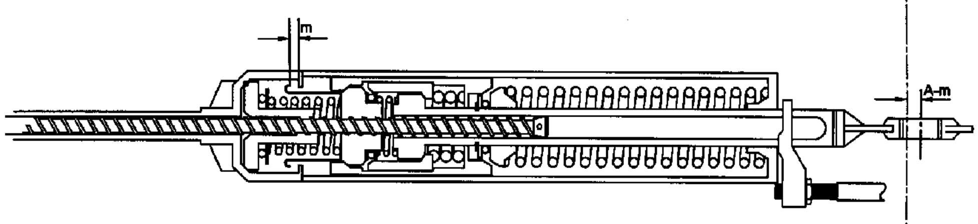


Fig. 10

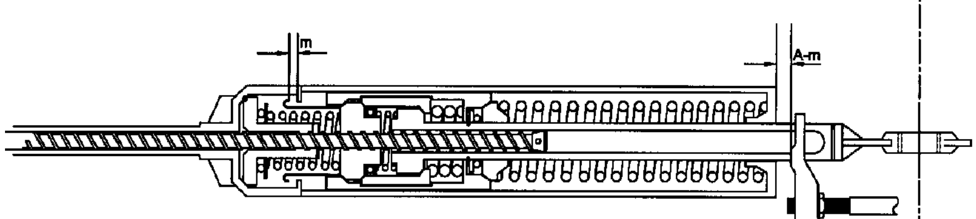


Fig. 11

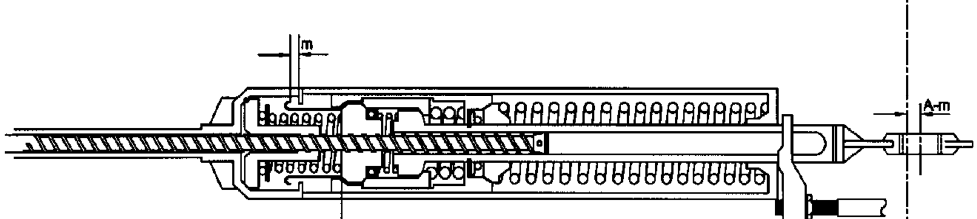


Fig.12

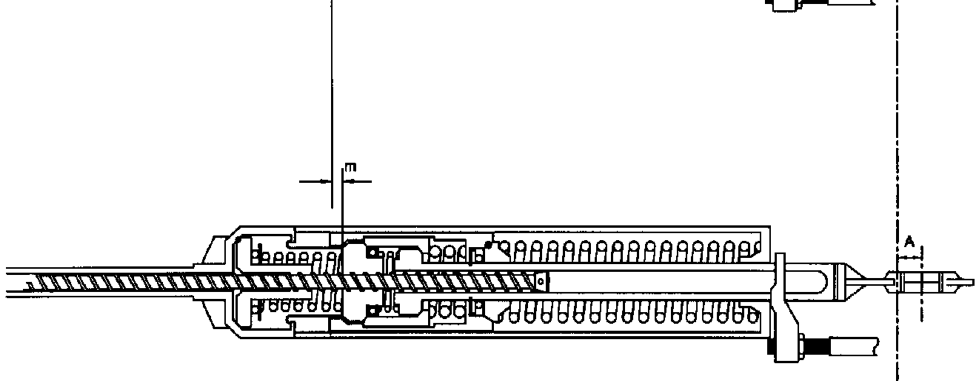


Fig. 13

b) PROCEDURE FOR MAINTENANCE

The slack adjuster shall be overhauled at the time of POH of rolling stock.While dimentaling or assembling it is essential to use special tools. Each component of slack adjuster shall be examined. Worn ourt part shall be checked according to the limits. ***For details, refer RDSO Technical pumphlet No. G-92(October-98).***

I. The minimum desired characteristic of each spring should be taken as under [Ref: RDSO Technical pumphlet No. G-92 (October-98)]:

Sr. No.	**Desc. Of spring**	**Part No.**	**Spring length compr.**	**Corrosp. Min. permissible force**
1.	Barrel spring	21	475 mm	143 Kg.
2.	Pay out spring	11	100 mm	58 Kg.
3.	Take out spring	37	21.5 mm	22 Kg.
4.	Clutch spring	39	38 mm	300 Kg.

Any spring, which does not conform to the above characteristic, should not be used. In addition any of the springs is badly rusted or having compressed coil turns should not be used.

II. The following parts must be replaced during POH of the slack adjuster [Ref: RDSO Technical pamphlet No. G-92 (October-91)];

- Spring dowel sleeve part No. (18)
- Lock washer part No. (27)
- Seal ring part No. (2)
- Seal ring part No. (43)
- Rubber gasket part No. (4)
- Spring dowel sleeve part No. (25)
- Dog pin part No. (6)
- Tab washer part No. (34)

D. LUBRICATION

After cleaning and inspection all parts of slack adjuster should be coated with semi-fluid grease SERVOGEM-2 or equivalent before undertaking re-assembly.

E. SAFETY PRECAUTIONS

The following safety precautions should be observed during overhauling of slack adjuster.

i. The place of overhauling must be clean and free from dust.
ii. Ensure that no foreign matter/particle remain inside the sub-assemblies during re-assembly.
iii. All rubber gasket, seal ring, washers must be replaced during overhaul.
iv. Specified tools and fixtures be used for disassembly and assembly operations.

F. TESTING OF SLACK ADJUSTER

After overhauling, the testing of slack adjuster is carried out in a test rack (Fig. 8.12) for :- i) Take up test & ii) Pay out test

a) Attach the adjuster ear to the free end of the cylinder lever of the test rack
b) Screw the test rack spindle into the Slack Adjuster until the entire length of thread is covered by spindle sleeve and attach the free end of the spindle to the test rack.

I. Take up or Pay-in test

- Let down the control rod, so that the fork of the rod clasps the adjuster tube of the Slack Adjuster
- Apply and release the brake a few times letting the slack adjuster take up until the correct piston stroke is obtained (until the indicator is within $\pm$ 5 mm tolerance field of the scale).

Note: The Slack Adjuster takes up 100 mm per braking.
Dimension A1 will be 98 {+1} mm.
{- 4}

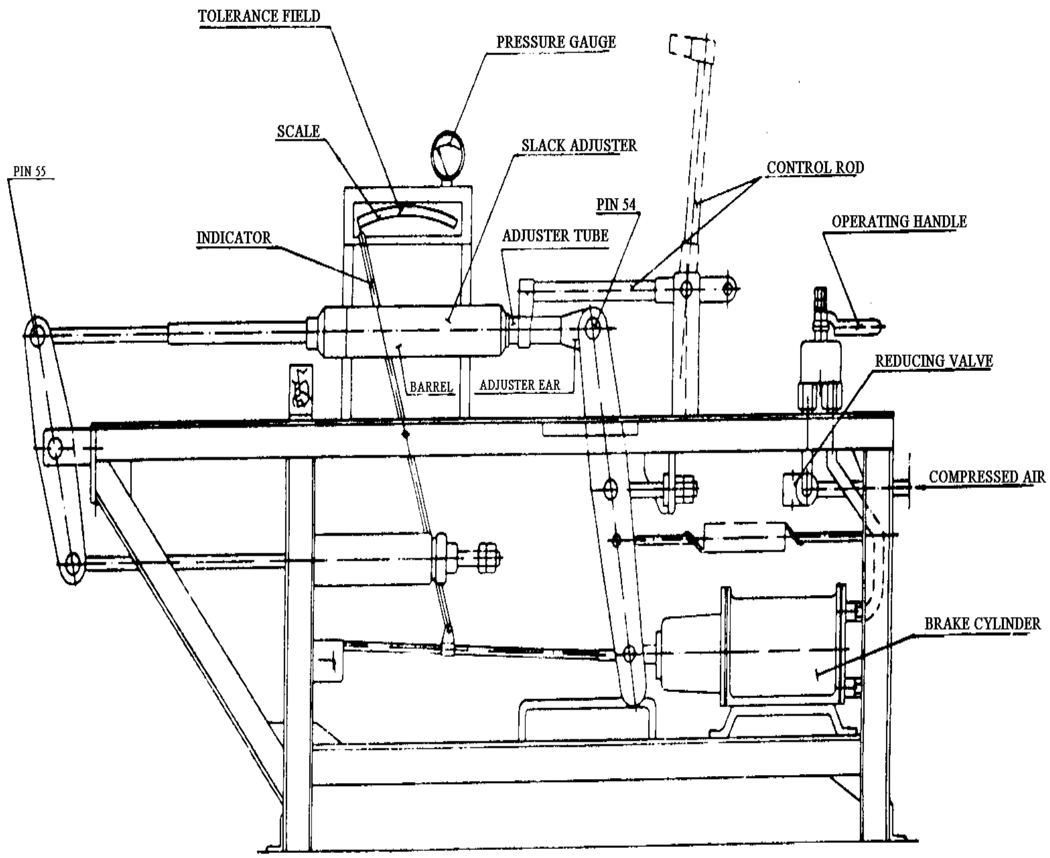


Fig. 8.12

II. Pay-out test

- Turn up control rod and make two brake applications letting the slack adjuster pay out.

Note : The slack adjuster pays out max. 30 mm per braking

- Repeat the above pay in and pay-out tests a couple of times.
- In case the slack adjuster does not accomplish the above mentioned tests satisfactorily, dismantle it and check that the parts are placed correctly.
- The slack adjuster must then be tested once more in the test rack in accordance with the above instruction.
- After the test is finished, remove the spindle from the slack adjuster.
- Remove the slack adjuster from the test rack and unscrew adjuster ear 28.

Give adjuster spindle 23 a final thorough inspection making sure that the threads are liberally greased, and screw it into the Slack Adjuster until its end protrudes from Adjuster tube 41. Put the safety collar 24 and secure it with the sping dowel sleeve. Make sure that the spring dowel sleeve pin fits tightly and that its ends do not protrude above the surface of the collar. Should there be any burrs on the collar, smooth off with a fine file an wipe clean. Then screw the adjuster spindle 23 back into the Slack Adjuster enough to make room for the adjuster ear 28.

Slide control rod head 26 with control rod 44 on to adjuster tube 41. Place lock washer 27 on threaded portion of adjuster ear 28 and screw ear into threaded end of adjuster tube 41.

Note : Hold adjuster tube firmly with a pipe wrench. Secure lock washer 27. Install the Slack Adjuster in the brake rigging.

III. Testing of slack adjuster in brake rigging with hand brake

In case a test rack is not available in the work shop, a test of function of the slack adjuster ought to be carried out after the slack adjuster is installed in the brake rigging and the correct piston stroke is obtained as follows:-

- Place an iron object e.g. a hammer between the brake block and the wheel tread. Make two brake applications after the second application the correct piston stroke should be obtained.

- Remove the iron object. Make two brake applications. After the first application the piston stroke is too long, but after the second application the correct piston stroke is recorded by the slack adjuster.

G. PAINTING

The slack adjuster is given a coat of anticorrosive paint, excluding the adjuster tube 41.

Note : The unthreaded portion of the adjuster spindle 23 should not have a thick coating.

H. PROCEDURE FOR BRAKE RIGGING SETTING AND MEASUREMENT OF "A" AND "e" DIMENSIONS

The procedure to be adopted for operating brake rigging setting and measuring 'A' and 'e' dimension is listed below:-

(I) For 'A' dimension

(i) Ensure the air brake is in fully released condition and all the brake rigging gears are in proper condition.

(ii) Apply brake three to four times to ease the rigging, by dropping and re-charging the air pressure in the brake pipe

(iii) Ensure once again that brake rigging is in fully released condition.

If ‘A’ dimension is not correct

(iv) Remove pin securing the control rod in U bracket.
(v) Detach control rod and rotate it to adjust the gap between barrel end face & control rod head as specified in note above. Secure the control rod in U bracket.
(vi) Apply brakes two to three times.
(vii) Check the ‘A’ dimension using the gauge.
(viii) Recheck dimension ‘A’ with brakes fully released after every brake release.
(ix) Lock the control rod head firmly with check nut and tooth lock washer.
(x) Secure pin with split pin.

(II) For ‘e’ dimension

(i) If slack is in excess beyond the capacity of slack adjuster (\`e' dimension 575$\pm$ 25mm) there won't be any slack take up provision in the slack adjuster and slack adjuster will only act as strut/pull rod. This is because of brake shoes and wheel wear reaching their condemning limit/near condemning limit. In such cases the \`e' dimension can be restored by adjusting link provided on the bogie frame head stock.

(ii) Measure ‘e’ dimension i.e. distance between protection tube end and mark on adjuster spindle using measuring stick after two or three brake application. It should be set to nearly to its maximum limit i.e. 575±25mm.

I. SAFETY PRECAUTIONS

i. Always use wedge between wheel and rail before application and release operations for setting and measuring A and e dimension to prevent rolling of wagon
ii. Ensure no part of the worker’s body is in touch with moving brake rigging gears during application and releasing of brakes.
iii. Do not touch or hold slack adjuster barrel while it is in motion.
iv. Before setting any dimension ensure wear of brake shoe does not exceed to its minimum permissible worn limit (i.e. thickness of the shoe should not be less then 20mm).
v. There won't be any slack take up provision in the slack adjuster and slack adjuster will only act as strut/pull rod. This is because of brake shoes and wheel wear reaching their condemning limit/near condemning limit. In such cases the \`e' dimension can be restored by adjusting link provided on the bogie frame head stock.
vi. Measure ‘e’ dimension i.e. distance between protection tube end and mark on adjuster spindle using measuring stick after two or three brake application. It should be set to nearly to its maximum limit i.e. 575±25mm.

813. DISTRIBUTOR VALVE

Distributor valve is the most important functional component of the air brake system and is also sometimes referred to as the heart of the air brake system. The function of the distributor valve is to distribute compressed air received from brake pipe to auxiliary reservoir and control reservoir. In addition to this it also senses drop and rise in brake pipe pressure for brake application and release respectively. It is connected to brake pipe through branch pipe. Various other components connected to the distributor valve are auxiliary reservoir, brake cylinders and control reservoir.

MANUFACTURERS OF DISTRIBUTOR VALVE

Three designs of distributor valves are in use on wagons. These are:

i) C3W Type distributor valve
ii) KE type distributor valve.
iii) P4aG type distributor valve.

Various companies presently manufacturing distributor valves are listed below:

Type	Manufacturers
C3W Type Distributor Valve.	Greysham and Co. Delhi
	Railway Product India Ltd. Hosur
	Stone India Ltd. Calcutta.
KE Type Distributor Valve	Escorts Ltd. Faridabad
	Knorr- Bremse Faridabad
P4aG Type Distributor Valve	M/s. S.D. Technical Services Pvt. Ltd. Delhi.
	Westing house, Saxby Farmer, Ltd. Calcutta

A decision has already been taken that new wagons manufactured henceforth will only be fitted either with C3W or KE type distributor valve. Hence the chapter covers description and maintenance of these two types of distributor valves only. For repair and maintenance of P4aG distributor valve, refer to concerned manufacturer's maintenance manual.

814. C3W DISTRIBUTOR VALVE

The C3W Distributor Valve (Fig. 8.13) consists of the following main subassemblies:

i. Main body
ii. Quick Service valve
iii. Main valve

iv. Limiting device
v. Double release valve
vi. Auxiliary reservoir check valve
vii. Cut off valve
viii. Application choke
ix. Release choke.

A. FUNCTION OF DISTRIBUTOR VALVE

For application and release of brakes the brake pipe pressure has to be reduced and increased respectively with the help of driver's brake valve. During these operations the distributor valve mainly performs the following function.

(i) Charges the air brake system to regime pressure during normal running condition.
(ii) Helps in graduated brake application, when pressure in brake pipe is reduced in steps.
(iii) Helps in graduated brake release, when pressure in brake pipe is increased in steps.
(iv) Quickly propagates reduction of pressure in brake pipe throughout the length of the train by arranging additional air pressure reduction locally inside the distributor valve.
(v) Limits maximum brake cylinder pressure for full service application/ emergency application.
(vi) Controls the time for brake application and brake release depending on service conditions
(vii) Facilitates complete discharge of air from the air brake system manually with the help of operating lever.
(viii) Protects overcharging of control reservoir when the brake pipe pressure is quickly increased for releasing the brakes.

B. WORKING OF C3W DISTRIBUTOR VALVE

The distributor valve distributes the compressed air received from brake pipe to charge control reservoir through cut off valve and auxiliary reservoir through auxiliary reservoir check valve. After charging control reservoir and auxiliary reservoir, when brake pipe pressure is reduced by driver's brake valve, pressure differential acts across the large diaphragm of hollow stem assembly. As a result, the hollow stem gets lifted, opening the check valve of main valve. This action allows auxiliary reservoir pressure to enter into brake cylinder via limiting device for brake application. Main valve together with the limiting device limits brake cylinder pressure to rise to a maximum pressure of 3.8 ± 0.1 Kg/cm^2. As the brake cylinder pressure increases it starts acting on top of upper diaphragm of main valve. This results in downward movement of the main valve along with check valve till it reaches lap position. At this stage the check valve of main valve gets closed, stopping further rise of brake cylinder pressure.

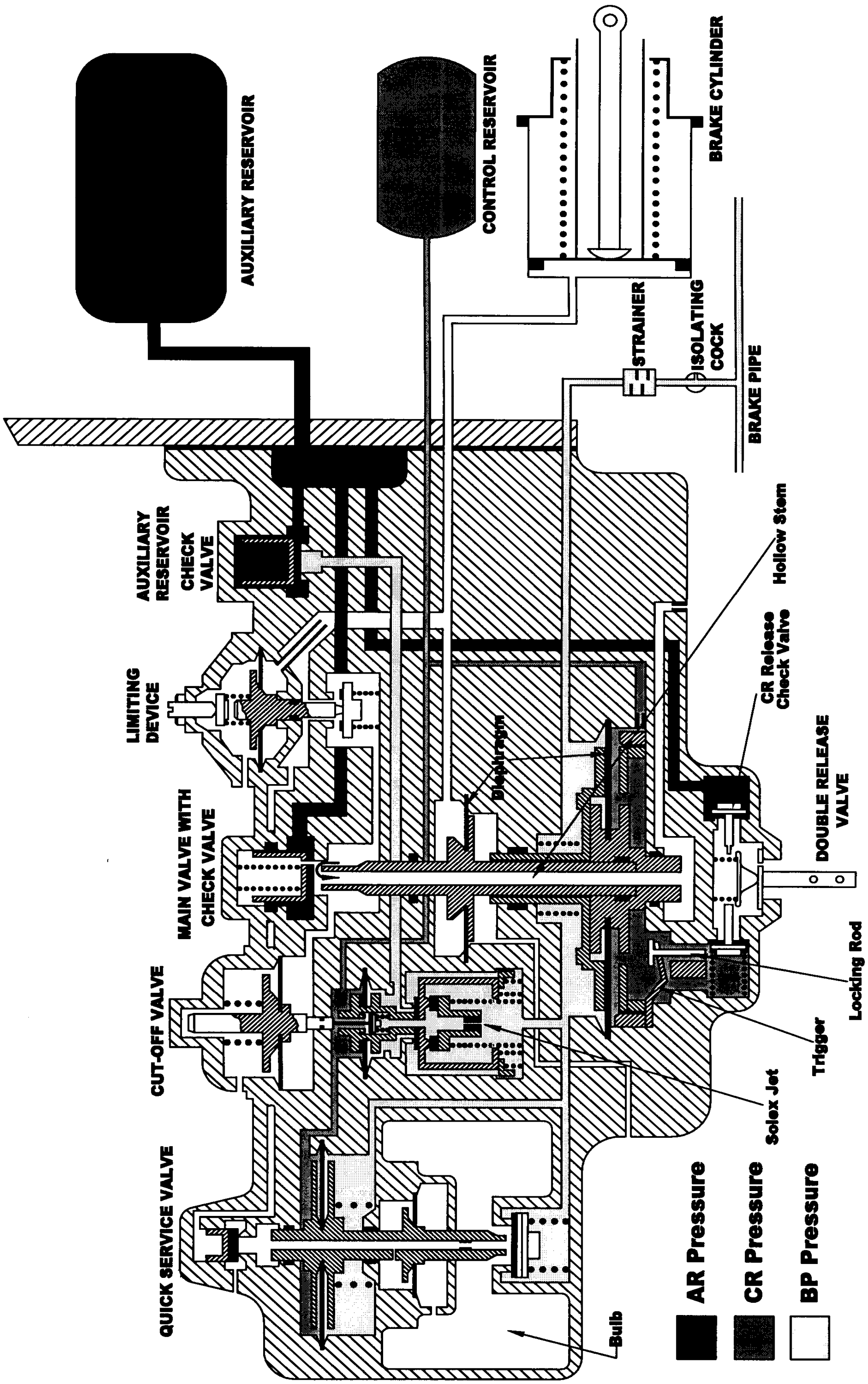


Fig. 8.13 C3W DISTRIBUTOR VALVE

In this position, no further pressure can enter or exit from the brake cylinder. Every time brake pipe pressure is reduced gradually in steps, this phenomenon gets repeated thereby increasing the brake cylinder pressure finally to 3.8 $\pm$ 0.1 Kg/cm^2.

For releasing the brakes, brake pipe pressure is increased by drivers brake valve and the hollow stem assembly of main valve is brought to normal position by neutralizing the pressure differential across main valve large diaphragm. At this stage hollow stem gives way at its top to exhaust the brake cylinder pressure to atmosphere.

How ever, if brake pipe pressure cannot be increased then for releasing the brakes the pressure of control reservoir acting on large diaphragm of main valve has to be reduced. This can be achieved by tilting the release lever of double release valve. Tilting action opens the control reservoir release check valve thereby allowing control reservoir pressure to vent out & simultaneously hollow stem is pulled down which gives passage to brake cylinder pressure to exhaust to atmosphere resulting in brake release.

C. DESCRIPTION OF VARIOUS COMPONENTS AND SUB-ASSEMBLIES

(a) MAIN VALVE

The main valve is housed in the main body. The various parts alongwith part numbers (as per manufacturer's catalogue) are shown in Fig. 8.14.

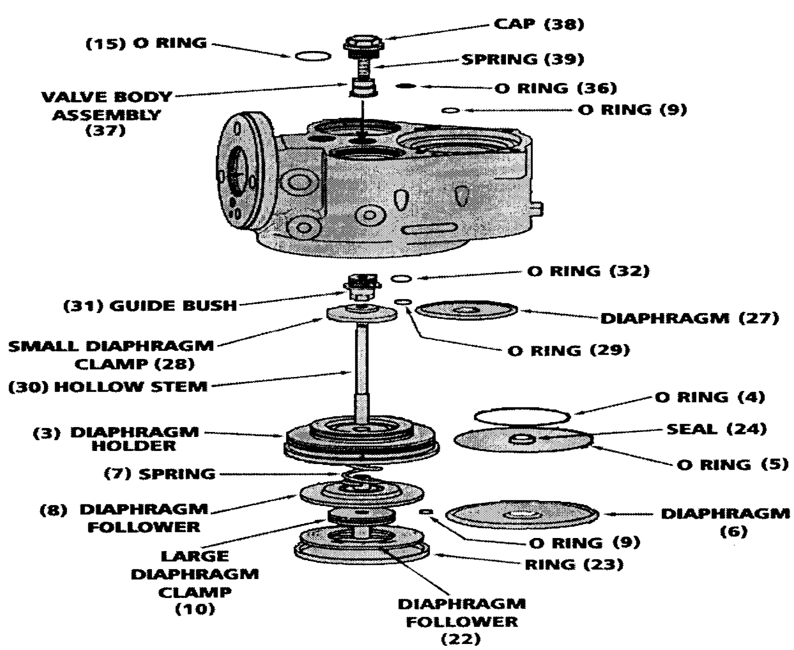


Fig. 8.14 MAIN VALVE

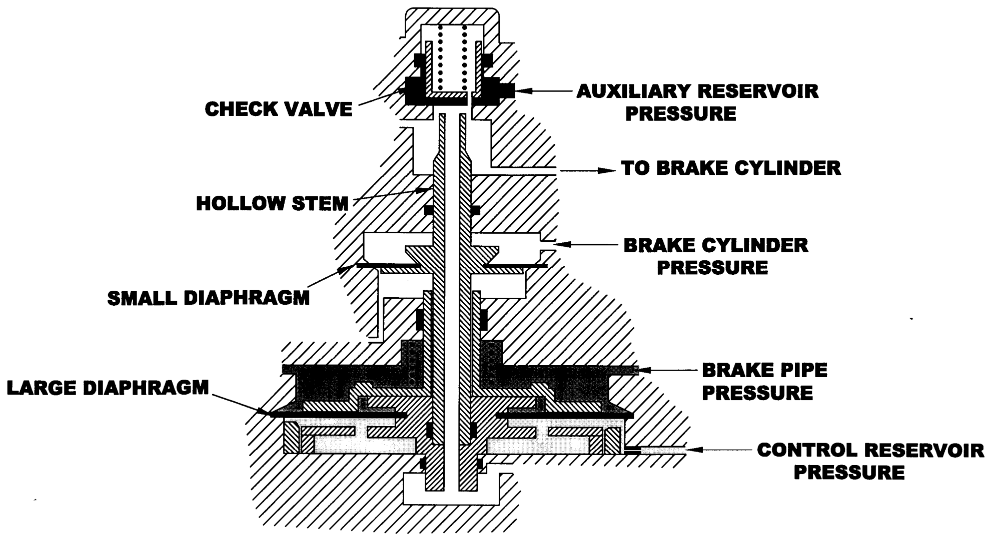


Fig. 8.15 SECTIONAL VIEW OF MAIN VALVE

The main valve consists of two diaphragms i.e. large and small. The top face of the large diaphragm, which is situated at the lower position of the stem assembly, is subjected to brake pipe pressure where as the bottom face is subjected to control reservoir pressure. The small diaphragm is situated at the upper position of the stem. The top face of small diaphragm is subjected to brake cylinder pressure and bottom face to atmosphere. At the top of hollow stem the check valve is situated which controls connection of auxiliary reservoir and brake cylinder. The main valve is also some times referred to as three pressure valve. Fig. 8.15 shows various parts of the main valve. The function of main valve is to supply requisite amount of pressure into the brake cylinder when BP pressure is reduced. Also it provides passage for brake cylinder pressure to exhaust to atmosphere, when brake pipe pressure is raised.

(b) CUT OFF VALVE

The cut off valve is housed in the main body and it consists of the following items:

- Solex jet
- Jet valve assembly.
- Valve retainer.
- Valve assembly.
- Diaphragm.
- Diaphragm clamp.
- Diaphragm follower.
- 'O' rings.
- Body.
- Internal circlips.
- Springs.
- Spring seats.
- Pusher pin.
- Guides etc.

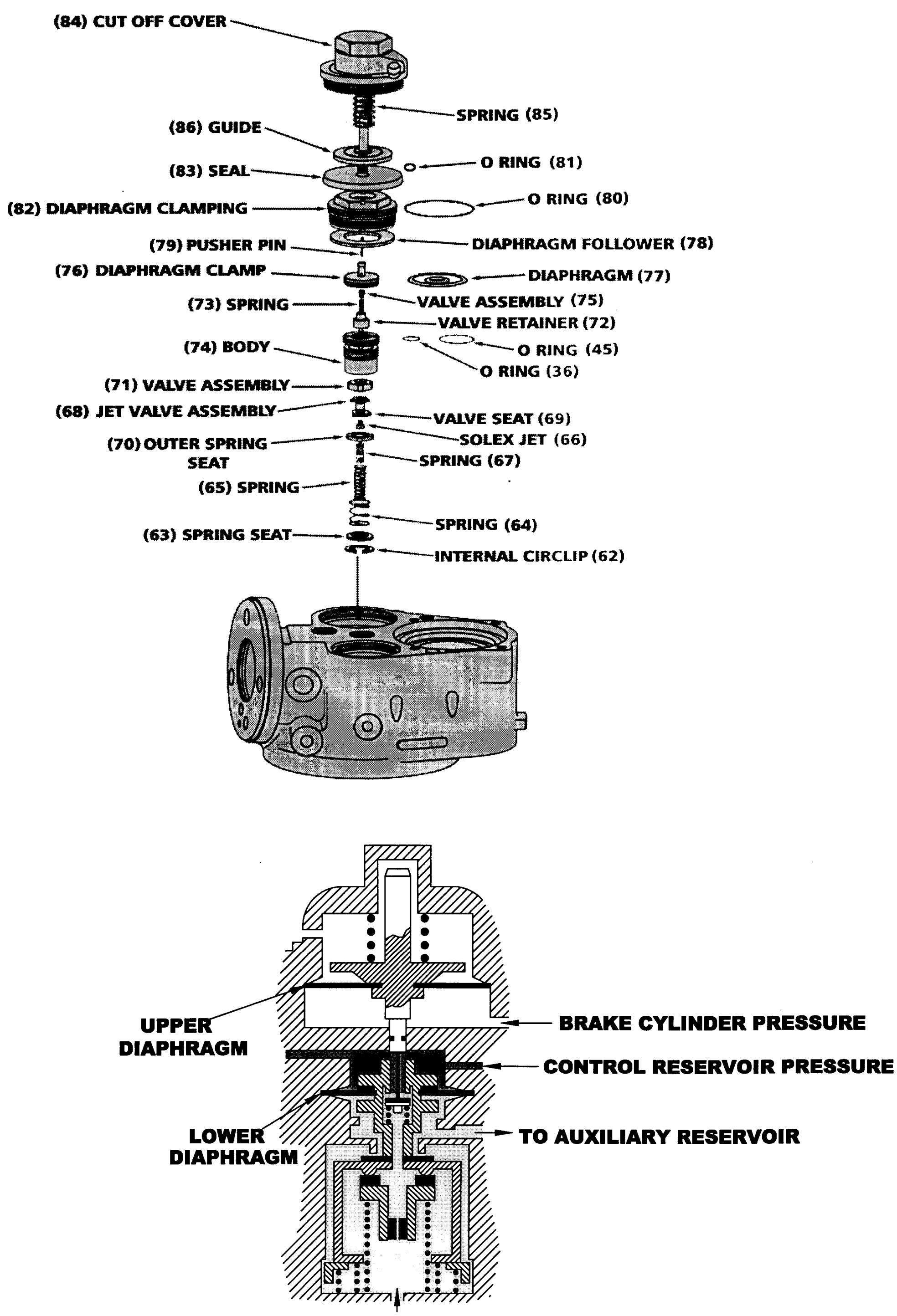


Fig. 8.16 CUT OFF VALVE

The cut off valve has two diaphragms, upper and lower. The top face of lower diaphragm is subjected to control reservoir pressure and the bottom face to the brake pipe pressure. The bottom face of upper diaphragm is subjected to brake cylinder pressure, and the top face is subjected to atmosphere and compressed spring pressure.

The cut off valve connects the brake pipe to control reservoir during charging and cuts off the connection with control reservoir when brake pipe pressure is dropped for application of brakes. This valve also provides a way to BP pressure from its chamber to auxiliary reservoir check valve.

(c) AUXILIARY RESERVOIR CHECK VALVE

The auxiliary reservoir check valve is housed in the main body. It consists of the following items.

- Cap
- Valve assembly
- Spring
- 'O' ring

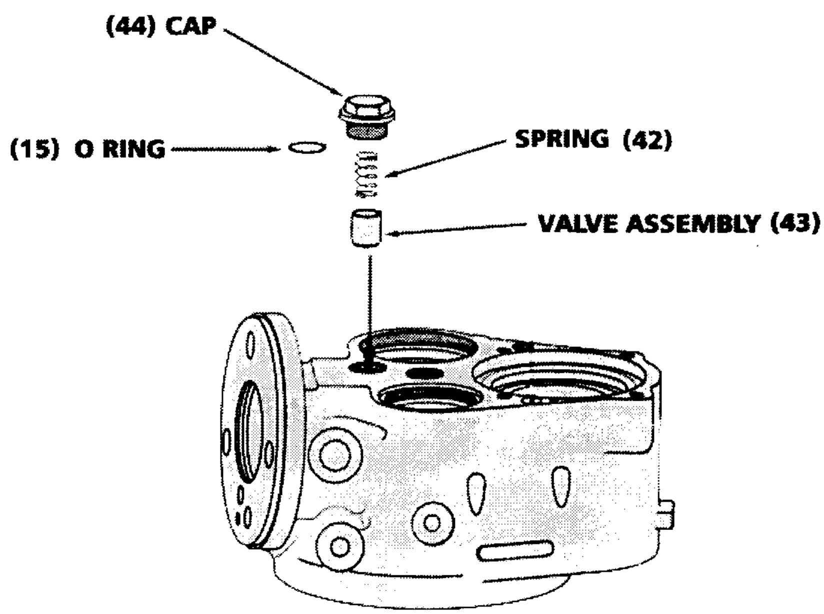


Fig. 8.17 CHECK VALVE

Auxiliary Reservoir Check Valve helps in charging the auxiliary reservoir. In addition to charging it also checks back flow of auxiliary reservoir pressure when brake pipe pressure is dropped for application of brakes.

(d) QUICK SERVICE VALVE

The quick service valve is housed in the main body and consists of the following items :

- Diaphragm
- Diaphragm clamp

- Retainer
- Seal Washer
- 'O' rings
- Springs
- Seal
- Cup
- Valve assembly
- Internal circlip
- Socket etc.

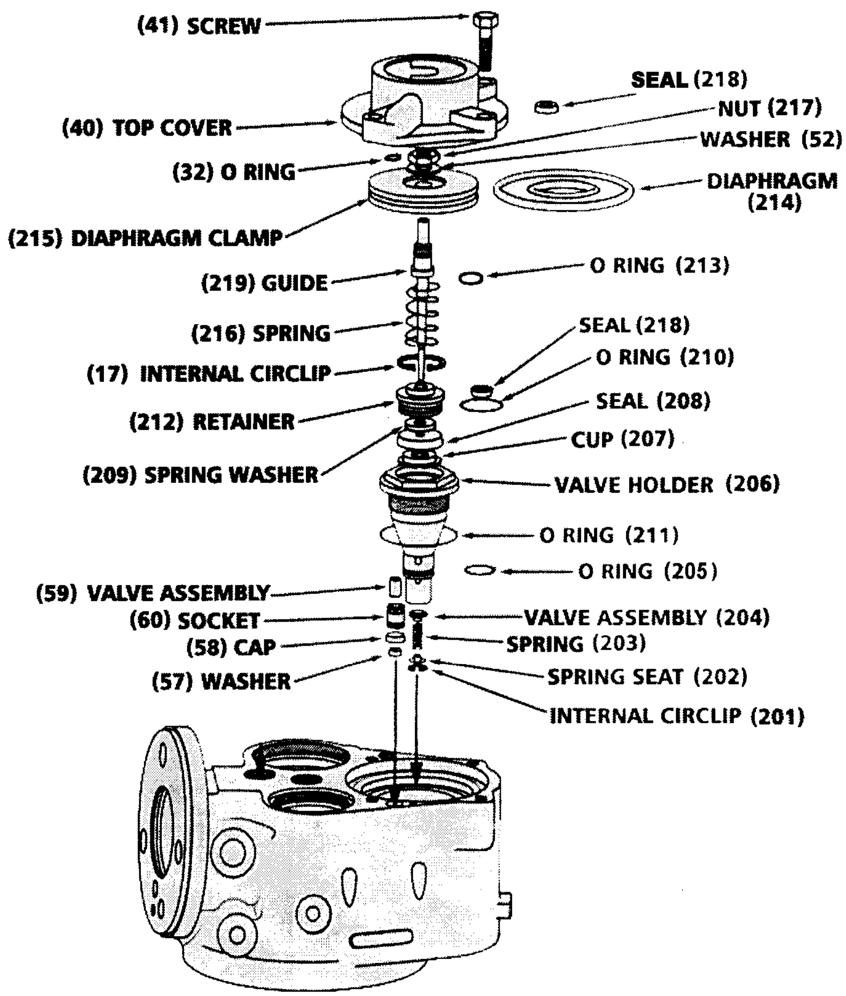


Fig. 8.18 QUICK SERVICE VALVE

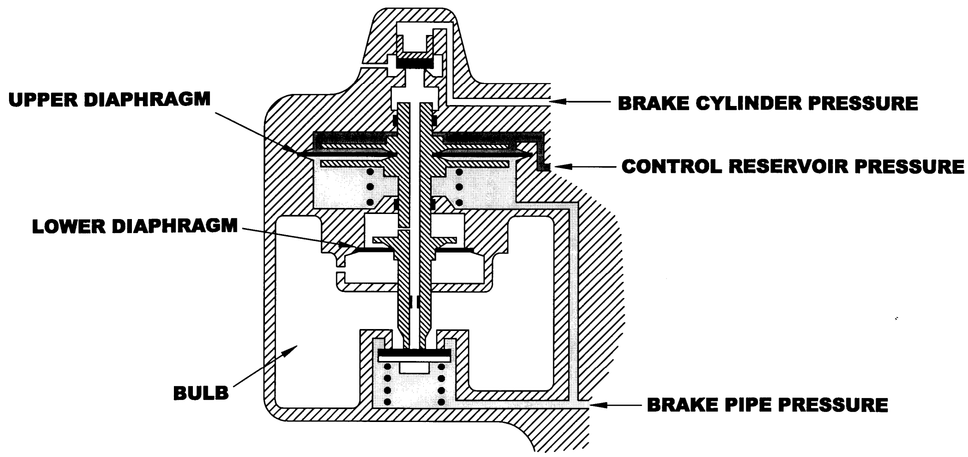


Fig. 8.19 SECTIONAL VIEW OF QUICK SERVICE VALVE

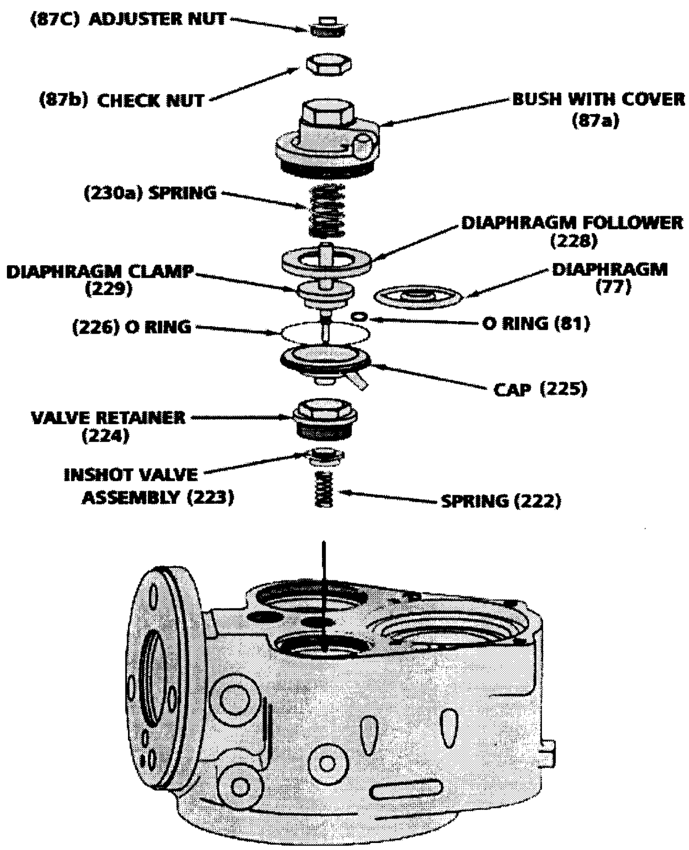
The quick service valve has two diaphragms i.e. upper and lower. The top face of upper diaphragm is subjected to control reservoir pressure and bottom face to brake pipe pressure. Where as at lower diaphragm, the bottom face is subjected to brake pipe pressure when brakes are applied.

The function of quick service valve is to create an initial pressure drop in brake pipe pressure by allowing a sudden entry of brake pipe pressure into the large volume bulb at the start of brake application. This ensures rapid propagation of pressure reduction in brake pipe through out the length of train.

(e) LIMITING DEVICE

The limiting device is housed in the main body and consists of the following items.

- Diaphragm.
- Diaphragm clamp.
- Diaphragm follower.
- Cap.
- Valve retainer.
- Inshot valve assembly.
- Adjusting nut.
- Check Nut.
- Bush with cover.
- ‘O’ rings.



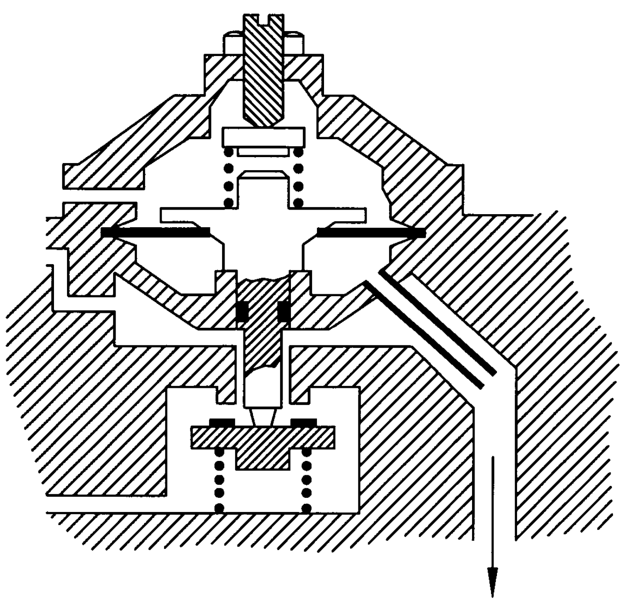


Fig. 8.20 LIMITING DEVICE

The limiting device has one diaphragm. The bottom face of the diaphragm is subjected to brake cylinder pressure during applied brake condition and top face is under pressure of compressed spring and atmosphere.

The function of limiting device is to restrict the maximum brake cylinder pressure to 3.8 $\pm$ 0.1 Kg/cm^2 irrespective of the drop in brake pipe pressure or auxiliary reservoir pressure.

(f) DOUBLE RELEASE VALVE

The double release valve is housed in the bottom cover and it consists of the following items.

- Tilt
- Pin
- Spring
- Swivel Rod
- Spring valve seat
- Washer
- Circlip
- Cap
- Split pin
- Choke
- Control reservoir release check valve
- Auxiliary reservoir release check valve

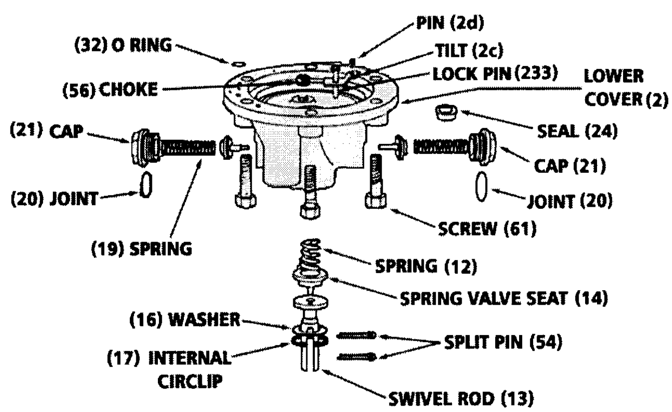


Fig. 8.21 DOUBLE RELEASE VALVE

The function of double release valve is to release the brakes manually when a single brief pull is given to the lever. However with a continuous pull to the release lever it also vents auxiliary reservoir pressure.

D. DIFFERENT STAGES IN OPERATION OF C3W DISTRIBUTOR VALVE

For effective functioning of the air brake system, the distributor valve has to operate effectively during :

a) Charging stage
b) Application stage and
c) Release stage

(a) CHARGING STAGE

During charging stage the compressed air flows from the brake pipe and enters into the brake pipe chamber of the main valve, cut off valve and quick service valve. Due to this pressure the various valves get activated and perform as under.

Main Valve: Due to brake pipe pressure acting on top face of the large diaphragm, differential pressure acts on the main valve. As a result the hollow stem moves downwards there by connecting brake cylinder to atmosphere. In addition, because of BP pressure at the top, large diaphragm presses the ring and trigger. This action unlocks the CR release valve by raising the locking rod upwards.

Cut Off Valve: As brake pipe pressure enters into the cut off valve, it flows through the solexjet and valve (which is held open due to action of BP pressure on bottom side of the lower diaphragm) to the control reservoir. As the CR & BP pressure equalises, diaphragm assembly comes down and valve reaches the lap position. The control reservoir pressure now also reaches the upper portion of top diaphragm of quick service valve and the bottom portion of large diaphragm of main valve.

Simultaneously, the auxiliary reservoir is charged with BP pressure reaching from cut off valve chamber via auxiliary reservoir check valve.

b) APPLICATION STAGE

During emergency application, the brake pipe pressure is reduced rapidly to 0 kg/cm^2 by the driver's brake valve. Because of this drop, the position of the various valves will be as described below.

(i) Main valve: With drop in BP pressure to zero, the differential pressure acts across the large diaphragm. As a result, the hollow stem is moved in upward direction and pushes the check valve thereby opening the passage for entry of auxiliary reservoir pressure at the top portion of main valve. This pressure then gets a way to brake cylinder through limiting device. The brake cylinder thus gets charged with the compressed air. This pressure is known as “BC pressure”.

(ii) Limiting Device: The auxiliary reservoir pressure which entered into the top position of main valve now enters the limiting device through the valve which is held open. From limiting device air pressure now enters the brake cylinder. When the BC pressure rises to 3.8 kg/cm^2, the upward force on the diaphragm lifts the guide and the valve at the bottom of the limiting device gets closed. Thus further entry of air into the brake cylinder stops.

When the brake cylinder pressure reaches 3.8 kg/cm^2, this pressure i.e. BC pressure acts on :

- Top face of small diaphragm of main valve
- Bottom face of upper diaphragm of cut off valve
- Top (small chamber) of quick service valve

Now because of BC pressure acting at main valve small diaphragm, the hollow stem is pulled down. As a result, the check valve at top comes down to “close” stage and assumes lap position with the hollow stem closing further entry of AR pressure.

(iii)Cut off valve: In cut off valve, the bottom face of the upper diaphragm is subjected to BC pressure. As a result, the guide is lifted. Also the upper portion of lower diaphragm is subjected to CR pressure, which pushes the total assembly downwards. This action closes the valve of cut off valve, thereby isolating it from control reservoir pressure.

(iv) Quick Service Valve: In quick service valve, BC pressure acts at the top of valve and control reservoir pressure acts at the top face of upper diaphragm. As a result, the stem is pushed down and the valve at the bottom gets opened. Now as the BP pressure inside DV is at zero, the residual BP pressure from the bulb of quick service valve will flow back and vent to the atmosphere.

(v) GRADUATED APPLICATION

During graduated brake application the brake pipe pressure is dropped in steps by driver's brake valve. The movement of various valve assemblies is almost in the same direction as during emergency application, but their movement is comparatively less. In the main valve however after each application the hollow stem assumes the lap position with the check valve.

In addition to this during graduated application the bottom valve of limiting device is held open to allow compressed air to enter into brake cylinder.

When BC pressure reaches 3.8 kg/cm^2 the bottom valve in limiting device gets closed. Similarly at the time of full service application as the BC pressure reaches 3.8 $\pm$ 0.1 kg/cm^2 within specified time, the position of various valve assemblies will be the same as described above.

(c) RELEASE STAGE

When the brake pipe pressure is increased in steps for graduated release of brakes, the position of the different valves is as described below.

(i) Main valve: At the top face of large diaphragm, as the BP pressure increases, the hollow stem moves downwards leaving its lap position with the check valve. The BC pressure thus finds a passage from top of hollow stem to exhaust to the atmosphere. This action reduces pressure on the top of upper diaphragm and the hollow stem again lifts up to lap position. It closes the hollow stem top portion. The same cycle is repeated when BP is increased during next stages. In this way graduated release effect is obtained.

(ii) Cut off valve: As the BP pressure increases the position of cut off valve remains similar as in graduated application i.e. the cut off valve will remain closed, isolating CR pressure from brake pipe pressure.

(iii) Quick service valve: When the BP pressure is increased, then as explained above for the main valve, the BC pressure gets exhausted to atmosphere. This action gradually reduces the BC pressure. When BC pressure reduces to 0.8 kg/cm^2 during brake release, the force at the top of the quick service valve becomes comparatively less than BP pressure present in Quick Service Valve. As a result, the valve at the top gets lifted thereby giving passage to blocked BP pressure to atmosphere. With the exhaust of BP pressure, the Quick Service Valve of the Distributor Valve again gets ready for next brake application.

(iv) Manual release: Double release valve provides for accelerated manual brake release, which is particularly useful during shunting operation. A short pull on the lever of double release valve is all that is needed. This action opens the control reservoir release check valve, which is then held open by the locking rod. Venting of control reservoir through the open control reservoir release check valve brings the main valve to release position and exhausts the brake cylinder pressure through the hollow stem.

E. SPECIFICATION OF C3W DISTRIBUTOR VALVE

The C3W distributor valve is a graduated release type of valve and has been approved by UIC to comply with requirement of its specification no. 540 and 547.

F. PERIODIOCITY OF OVERHAULING

The overhauling of the distributor valve is carried out during POH or when there is some specific problem.

G. MAINTENANCE

C3W Distributor Valve consists of various sub-assemblies possessing highly finished, accurate and sophisticated small parts and therefore need a well arranged work-shop equipped with standard tools as well as specially designed tools and fixtures. It is also important to state that the work place (DV-overhauling section of the workshop) should be a clean, well organized, dust & dirt free and a properly developed space where the following activities should be adjacently and separately organized:-

- dismantling and cleaning
- assembling and testing
- storage of assembled distributor valve &
- storage of spare parts including POH kits stocking store etc.

The tools and fixtures required for the disassembly and assembly of C3W distributor valve are given in table below.

H. TOOLS AND FIXTURE FOR C3W DISTRIBUTOR VALVE

Sr.No.	Description
1	Open end spanners of 24-27 mm, 20-22 mm, 17-19 mm and 11-13 mm
2	Socket wrenches of size 13mm, 17mm, 19mm, 22mm, 27mm & 32mm with driving handles – a. Simple L Shaped b. Reversible ratchet and c. Torque calibrated for (1.5 to 6 Kg.m) range
3	Ring spanner (32-36 mm)
4	Allen key (6 mm)
5	Circlip pliers internal & external both (Small & Medium)

6	Plier general design and long nose separately
7	Screw drivers (5 mm and 8 mm blade sizes)
8	Nylon hammer
9	Special tools 1. SCT-6014-pin end tool 2. SCT-6016-pin end tool 3. SCT-6015-'O' ring set tool 4. SCT-6017-hollow stem-lead-tool 5. SCT-6026-spetula (bent tool) 6. SCT-6092-socket spanner 7. RPBF-0003-) fixture for holding guide (76) 8. Air jet gun with flexible hose
10	Bench mounted DV - holding fixture

I. OVERHAULING PROCEDURE

Before opening the distributor valve, it needs to be dusted and cleaned externally. The disassembling and assembling of the distributor valve in the workshop is facilitated by using a bench mounted DV-holding fixture, with facility to rotate through 360^0 in the vertical plane and locking it after every 90^0 rotation.

The distributor valve is mounted on the fixture and can be locked in any desired position. The sub assemblies of different valve are dismantled in the sequence. It is imperative that components of each sub assembly have to be carefully handled and arranged in an identifiable group sequence. For part numbers and name of components of various sub-assemblies / valves, refer to the concerned manufacturer's maintenance manual.

For POH kit, refer RDSO Technical pamphlet No. G-97 Annexure XIII.

815. TESTING OF DISTRIBUTOR VALVE

For the proper functioning of the Air Brake System, it is necessary to test the Distributor Valve. The following tests are carried out to ensure the proper functioning of Distributor valve:

The following tests are conducted on the distributor valves:

(i) Pressure tightness test – (during charging, application and release test &

emergency application test).

(ii) Charging time.
(iii) Full service application and release.
(iv) Overcharge protection test.
(v) CR overcharge reduction test
(vi) Emergency application.
(vii) Sensitivity test.
(viii) Quick service test.
(ix) Insensitivity test.
(x) Re-feeding test.
(xi) Graduated application test.
(xii) Graduated release test.
(xiii) Quick release test
(xiv) Control reservoir check valve reset test.

A. PURPOSE OF CONDUCTING VARIOUS TESTS

a) Pressure Tightness Test

Before conducting any other performance test (to ensure the efficiency of the DV it is advisable to check for the leakage from any part of the DV). For this purpose BP is charged to regime pressure and then DBV is brought to full application, Emergency and release positions respectively, and in each of the above positions DV is tested by soap solution to confirm no leakage. This is done so that every valve of DV operates at least once and leakage from every part of the DV is checked. If DV is leakage free then it can be said with high probability that its maintenance or overhaul and assembly is carried out properly and generally it should perform as per specifications in other tests also. However, if other tests are conducted before conducting leakage test, and leakage is detected during any test then that leakage is to be attended and tests are to be repeated. Therefore to avoid reworking it is always advisable to test the DV first for leakage and once leakage free operation is assured only then other tests are to be conducted.

However in KE type of valves, it is possible to test subassemblies of the DV also before finally assembling it. In this type of valve, three main assemblies i.e. R–charger with isolating valve, Choke cover & Bottom cover with Quick release valve can be tested for leakage before fully assembling the DV and the chances of leakage from the DV are than highly reduced.

b) **Charging Time**

Charging time for initially charging the control reservoir and auxiliary reservoir up to desired pressure is specified. Operation of the DV should be such that time required to charge the CR and AR should neither be more nor less than the specified limits. It is necessary because if the DV of different wagons operate with different timings, then brakes will be applied and released in different wagons with different timings, and this may create problems.

c) Full Service Application and Release.

For efficient operation of brakes, it is necessary that after operating the DBV for applying the brakes, brake cylinder pressure should rise to the desired level, very quickly (i.e. from 0 to 3.6 kg/cm^2 in 18 to 30 seconds). Therefore all the distributor Valves are to be tested for the time required to raise the brake cylinder pressure. This time should neither be more nor less than the specified limits. In this test it is also checked that brake should release quickly and it means that brake cylinder pressure should be released within specified time period, and hence the DV is tested for release timings also. If the brakes of different wagons operate with different speeds then it can prove disastrous and hence this test ensures that speed of operation of various DV are more or less same.

d) Overcharge Protection

Sometimes driver overcharges the brake pipe for short duration so that brake pipe is completely charged till last wagon and brakes in every wagon are released quickly.

But this overcharging of brake pipe should not result in overcharging of control reservoir and auxiliary reservoir, because the pressure of control reservoir works as reference pressure for the DV and if the control reservoir is overcharged then it may result in malfunctioning of the DV. And hence the DV should be such that it should avoid overcharging of CR and AR even if brake pipe is slightly overcharged (In this test, brake pipe is charged up to 6 kg/cm^2 for 25 seconds and it is assured that CR and AR should not get overcharged by 0.1 kg/cm^2.)

e) CR Overcharge Reduction Test

Some times when locomotive connected with a rake is changed, in that case there may be problems due to different regime pressures of locomotive and rake. In these type of cases control reservoir is overcharged for short duration for adjustments, but control reservoir pressure should come back to brake pipe pressure when release valve handle of the distributor valve is pulled for 3 seconds.

f) Emergency Application Test

The purpose of this test is similar to that of full application and release test i.e. in this test time taken to raise the brake cylinder pressure during emergency application is measured. It is also seen that maximum rise in the brake cylinder pressure is within limits.

g) Sensitivity Test

The DV should be sensitive enough to sense the drop in brake pipe pressure quickly and to respond accordingly by raising the brake cylinder pressure so that brakes are applied. Therefore sensitivity test is conducted on DV for checking the fastness of response of DV. In this test it is expected that DV should respond to apply brakes when BP pressure is reduced by 0.6 kg/cm2 in 6 seconds.

h) Quick Service Test

This test is conducted to ensure proper functioning of quick service valve of C3W type DV. While in case of KE type DV it ensures proper functioning of U-controller

i) Insensitivity Test

As explained in the above test, DV should be sensitive enough but at the same time it should not be very sensitive. Since if it is very sensitive, then it may operate even when there is a small leakage from brake pipe i.e. even when there is a small drop in pressure of the brake pipe. Therefore it is expected that DV should be insensitive enough so that it does not operate due to small drop in pressure in brake pipe due to leakage. And hence insensitivity test is conducted On DV and it is assured that it should not operate if brake pipe pressure is reducing @ of 0.3 kg/cm^2 in 60 seconds.

j) Re-feeding Test

If brakes are in applied position and brake cylinder starts leaking due to some problem then brake cylinder pressure may drop and it may result in releasing of brakes, which may prove disastrous. Therefore the DV is designed in such a way that it continues to supply air to the brake cylinder so that the brake cylinder pressure is maintained at desired level, even when it is leaking. The re-feeding test assures the proper functioning of main valve in case of C3W type DV and three pressure valve in case of KE type DV.

k) Graduated Application Test

This test is conducted to prove that brakes can be applied gradually or slowly. This test ensures response of the distributor valve when brake pipe pressure is gradually reduced i.e. brake cylinder pressure should increase accordingly when brake pipe pressure is reduced gradually.

l) Graduated Release Test

Similarly air brake system should be such that brakes can be released gradually or slowly. To ensure this in this test, brake pipe pressure is increased in steps and it is seen that brake cylinder pressure should reduce accordingly.

m) Quick Release Test

This test is also known as automatic exhausting of brake cylinder. When a wagon is disconnected from the rake, its brake pipe pressure becomes zero. In this condition, brakes of the wagon will be automatically in applied position. To release the brakes a manual handle is provided on the DV. When this handle is pulled, it results in complete draining of AR and CR and brake cylinder, and in other words, the brakes are released.

But at the same time on pulling this lever when brakes are in released position (i.e. when brake pipe is in charged condition) it should not result in releasing of CR & AR. Similarly when brakes are in applied condition and if some one pulls the release lever even then ideally brake cylinder pressure should not exhaust. But DV design is such that in this condition brake cylinder pressure exhausts to some extent but it should not exhaust beyond 1 kg/cm^2 i.e. even after pulling release lever when brakes are in applied position, the brake cylinder pressure should not fall below 1 kg/cm^2.

This test ensures proper functioning of the DV when release lever is pulled.

n) CR Check Valve Reset Test

This test is also known as "automatic repositioning of quick release system". If brake pipe pressure is again increased in the above test (CR is in discharged condition) by pulling the release lever in emergency operation or detached wagon condition (i.e. when brake pipe pressure is zero), double release valve (which is responsible for discharging the control reservoir) should close automatically so that CR is again charged.

815 B. TOOLS AND EQUIPMENT FOR TESTING

i) Test bench
ii) Compressed air supply source for supplying air pressure at 7.5 Kg/cm^2
iii) Stopwatch – 2 No
iv) Soap water solution

816. TESTING OF C3W DISTRIBUTOR VALVE

A. DESCRIPTION OF THE TEST BENCH

The schematic diagram of the test bench for C3W valve is shown in the Fig. 8.22.

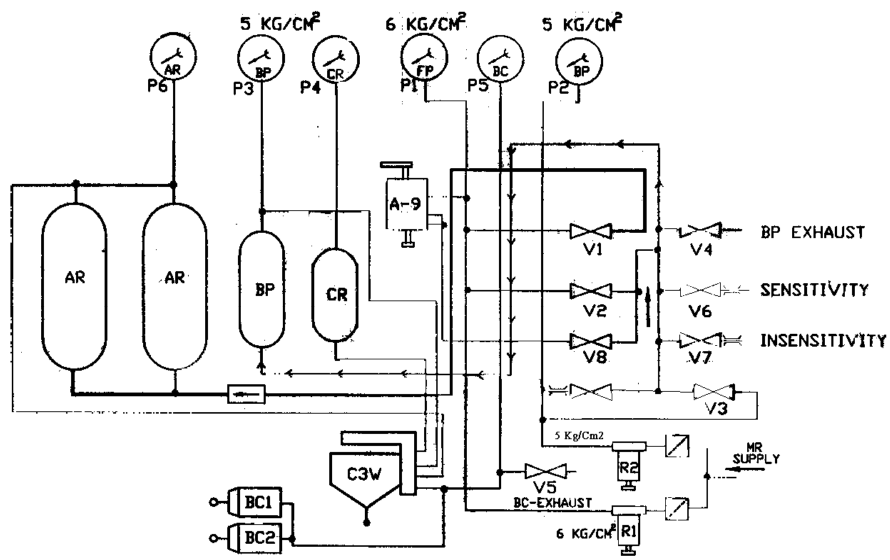


Fig. 8.22
TEST RACK FOR C3W DISTRIBUTOR VALVE

- P1 – Pressure in feed pipe (not applicable in single pipe)
- P2 – Input pr. regulated at 5 Kg/cm^2 in the brake pipeline.
- P3 – Brake pipe reservoir pressure.
- P4 – Pressure in the Control Reservoir (CR)
- P5 – Pressure in the brake cylinder.
- P6 – Pressure in the auxiliary reservoir.

Isolating cocks as given below –

- V1 – for isolating the supply of air to the auxiliary reservoir at 6 Kg/Cm^2 (i.e. to test the system in single pipe).
- V2 – To connect/isolate BP pressure.
- V3 – for controlling the supply of air to the brake pipe at 5 kg/cm^2.

- V4 – for exhausting the brake pipe pressure.
- V5 – for exhausting the brake cylinder pressure.
- V6 – It is an isolating cock with a choke for releasing the brake pipe pressure at a desired rate for sensitivity test and for graduated application test.
- V7 – It is a isolating cock with a choke for releasing the brake pipe pressure at a desired rate for insensitivity test
- V8 – For controlling air pressure in the brake pipe with the help of the drivers brake valve.
- V9 – Isolating cock with a choke for increasing the brake pipe pressure in the desired steps for graduated release test and for CR check valve reset test.

The test bench consists of the following components :

(i) Source of compressed air supply at 7.5 kg/cm^2
(ii) Pressure regulator R1 - to supply air at 6 kg/cm^2.
(iii) Pressure Regulator R2 - to supply air at 5 kg/cm^2
(iv) Brake cylinders – 2 No. i.e. BC (1) and BC (2)
(v) Auxiliary reservoir AR (1) and AR (2) each having a capacity to store 100 litre of air at 6 kg/cm^2.
(vi) Brake pipe pressure reservoir having a capacity to store 18 litres of air at 5 kg/cm^2.
(vii) Control reservoir cylinder having a capacity to store 6 litres of air at 5 kg/cm^2.
(viii) Automatic brake valve (A9), which is used as the drivers brake valve in the locomotive along with the C2 relay valve. This is supplied compressed air at 6 Kg/cm^2. With the help of the A9 valve, the pressure in the brake pipe can be increased or decreased.
(ix) Six Pressure Gauges to indicate pressures at different locations.

B. PREPARATION OF TEST BENCH

Preparation of the test bench requires the following steps –

- Setting of the pressure regulators and the brake valve
- Leakage testing of automatic pipe network
- Calibration of chokes

C. SETTING OF THE REGULATOR AND AUTOMATIC BRAKE VALVE

(i) Block C3W distributor connections by putting blanking gasket in between the distributor and its pipe bracket.

(ii) Close all isolating cocks (i.e. V1 to V9).

(iii) Supply compressed air at 7.5 kg/cm^2 at the test rack intake.

(iv) Adjust the regulators R1 and R2 so that the pressure gauges P1 and P2 indicate the pressure as 6 kg/cm^2 and 5 kg/cm^2 respectively

(v) Open isolating cock V3 and note that both the gauges P3 (i.e. Brake pipe reservoir pressure) and P2 (brake pipe pressure) show 5 kg/cm^2

(vi) Close isolating cock V3 and open cock V4 to vent out BP. reservoir pressure. Gauge P3 will indicate zero pressure in this condition

(vii) Adjust drivers brake valve A9 at 5 Kg/cm^2, check this adjustment by opening isolating cock V8. This will increase BP reservoir pressure to 5 Kg/cm^2 and this can be checked by gauge P3.

(ix) Close the cock V8

D. LEAKAGE TESTING OF PIPE NETWORK

- Open isolating cock V1 to charge the auxiliary reservoir to 6 kg/cm^2
- Check this pressure from the pressure gauge P6
- Open isolating cock V2 to overcharge the brake pipe pressure to 6 kg/cm^2. Check this pressure from the pressure gauge P3
- When pressure in the pressure gauges P6 and P3 are stabilised at 6 kg/cm^2 then close isolating cocks V1 and V2. Wait for one minute for stabilising of pressure in gauges P3 and P6.
- Leakage must not exceed 0.1 kg/cm^2 in one minute as shown by these gauges
- If there is any leakage. Identify its location with the help of soap solution and arrest the leakage before proceeding further.

E. TEST PROCEDURE

Tests are conducted in a particular sequence for reducing the time required in opening and closing of various valves. In the test bench described above, following test sequence is optimum as far as the time required in testing distributor valves are concerned. In any other type of test bench arrangement, some other test sequence may be optimum. The valve V1 is kept closed during testing.

Note : Although pressure tightness test is supposed to be conducted in the beginning for every position of the distributor valve. But in this arrangement of test bench, it is convenient to conduct charging time test before pressure tightness test.

(I). Charging time of auxiliary reservoir and control reservoir.

a) Close all the isolating cocks.
b) Set air pressure regulator R1 and R2 at 6 and 5 Kg/cm^2 respectively.
c) Check pressure in the pipe by P1 and P2. It should be 6 and 5 Kg/cm^2 respectively. If required, adjust the pressure regulator R1 and R2 to achieve these pressures.
d) Open isolating cock V3 and with the help of a stopwatch, note time taken by gauge P4 (CR) and P6 (AR) to rise from 0 to 4.8 Kg/cm^2. Two separate stopwatches will be required. It is better if two persons monitor these pressures separately.
e) For control reservoir, the charging time should be 260±20 seconds and for auxiliary reservoir it should be 270±30 seconds.

(II). Pressure tightness test

a) Apply soap water all over C3W valve. No leakage is permissible.
b) Close isolating cock V3 after pressure gauges. P3 (Brake pipe), P4 (Control reservoir) and P6 (Auxiliary reservoir) indicates 5 Kg/cm^2. Wait till reading in gauges settle.
c) Switch on a stopwatch and monitor pressure in these gauges. There should be no drop in pressure in one minute duration.

(III). Full service application and release test.

a) Automatic brake valve should be set at 5 Kg/cm^2 (as done during setting of the test bench). Bring handle in release position.
b) Open isolating cock (V8) and note gauges P4 (CR) and P6 (AR) shows exactly 5Kg/cm^2.
c) Move A9 handle to service application position, so that P3 (Brake pipe pressure) falls from 5 to 3.4 Kg/cm^2.
d) Switch on the stopwatch as soon as the handle of A9 is moved to service application position in the above step and note the time taken by brake cylinder pressure (P5) to rise from 0 to 3.6 Kg/cm^2. This time should be 18 to 30 seconds.
e) Wait for brake cylinder pressure (P5) to settle and note the maximum pressure to which it reaches. The maximum pressure should be 3.8±0.1 Kg/cm^2.
f) Move A9 handle to release position and switch on the stopwatch

immediately to note the time taken by brake cylinder pressure (P5) to fall from 3.8 to 0.4 Kg/cm^2. This time should be within 15 to 20 seconds.

(IV). Overcharge protection test

a) When A9 handle is in release position, brake pipe, auxiliary reservoir and control reservoir pressures i.e. pressures in gauges P3, P4 and P6 should be at 5 Kg/cm^2.
b) Move A9 handle to emergency position. In this case brake pipe pressure (as per gauge P3) will fall to zero and brake cylinder pressure (as per P5) will reach to its maximum value.
c) Close isolating cock V8 and move A9 handle to release position. In this position brake pipe pressure (P3) will again rise to 5 Kg/cm^2 and brake cylinder pressure (P5) will fall to zero, while auxiliary reservoir pressure (P6) and control reservoir pressure (P4) will be around 5 Kg/cm^2.
d) Open isolating cock V2 and overcharge brake pipe to 6 Kg/cm^2 for 25 seconds (see it in gauge P3) and then immediately close isolating cock V2 and open cock V8. But during this, control reservoir should not be overcharged by 0.1 Kg/cm^2 over regime pressure of 5 Kg/cm^2 (as seen by gauge P4).

(V). CR over charge reduction test

a) Allow over charging of CR and AR at 5.7 Kg/cm^2 and bring back BP pressure to 5 Kg/cm^2 by closing the isolating cock V2 and V1.
b) Pull the double release lever of DV for 3 seconds and note down the fall in pressure of control reservoir.
c) The control reservoir pressure should return back to brake pipe pressure i.e. 5 Kg/cm^2 as seen by P3.

(VI). Emergency application test

a) With brake pipe, control reservoir and auxiliary reservoir (i.e. P3, P4 and P6) charged to 5 Kg/cm^2. Move A9 handle to emergency application position.
b) As soon as handle is moved to emergency application position, switch on the stopwatch and note down the time taken by the brake cylinder pressure (P5) to rise from 0 to 3.6 Kg/cm^2. This time should be between 3 to 5 seconds.
c) Also note the maximum pressure to which brake cylinder is charged. This pressure should be 3.8 ± 0.1 Kg/cm^2.

(VII). Sensitivity test

a) Move A9 handle to release position to recharge the brake pipe pressure (P3) to 5 Kg/cm^2.
b) Close isolating cock V8.
c) Open isolating cock V6. Switch on the stopwatch as soon as isolating cock V6 is opened and note the time taken by brake pipe pressure to drop by 0.6 Kg/cm^2. This time should be 6 seconds.
d) Brake cylinder pressure (P5) should start rising within 1 second and within 6 seconds piston should start moving for application of brakes.

(VIII). Quick service test

Close isolating cock V6 and immediately observe the applied brakes, they should remain applied.

(IX). Insensitivity test

a) Open isolating cock V3 to recharge BP, CR and AR to 5 Kg/cm2 (as seen by P3, P4 and P6).
b) Close isolating cock V3 and open isolating cock V7.
c) As soon as isolating cock V7 is opened, start stopwatch and check that BP pressure (P3) drops by 0.3 Kg/cm^2 in 60 seconds.
d) There should not be any rise in brake cylinder pressure and brake cylinder piston should not start moving i.e. brakes should not apply.

(X) Re-feeding test

a) Close isolating cock V7 and open V3 to recharge brake pipe, control reservoir and auxiliary reservoir to 5 Kg/cm^2 (As seen by P3, P4 and P6 respectively).
b) Bring A-9 valve handle to full service application position. BC pressure will become 3.8 ± 0.1 Kg/cm^2 (as seen by P5).
c) Exhaust the brake cylinder by slightly opening the isolating cock no V5.
d) Observe brake cylinder pressure in the gauge no. P5. It should not become zero and should stabilize at some particular value (since re-feeding to brake cylinder is available via distributor valve).
e) Fall in brake cylinder pressure should not be more than 0.15 Kg/cm^2 from 3.8 ± 0.1 Kg/cm^2 (i.e. it should not fall below 3.65 ± 0.1 Kg/cm^2).
f) Close exhaust cock no. V5.

(XI). Graduated application test

a) See that brake pipe, control reservoir and auxiliary reservoir are at 5 Kg/cm^2 (as seen by P3, P4 and P6 respectively).
b) Close isolating cock V3.

c) Decrease P3 (BP) pressure in steps of 0.2 Kg/cm^2 (min 7 steps) by slowly opening and closing cock V6 i.e. starting from 4.6 Kg/cm^2 and then to 4.4, 4.2, 4.0, 3.8, 3.6 and 3.4 Kg/cm^2.
d) Note down the corresponding increase in brake cylinder pressure (P5).
e) Also note the brake pipe pressure (P3) at maximum brake cylinder pressure (P5). This BP pressure (P3) should be 3.4 to 3.7 Kg/cm^2.

(XII). Graduated release test

a) Close isolating cock V6.
b) Increase brake pipe pressure (P3) in steps of 0.2 Kg/cm^2 by opening and closing cock V9. The Brake pipe pressure will rise from 3.6 to 3.8 Kg/cm^2.
c) Note corresponding decrease in the brake cylinder pressure (P5).
d) Also note the maximum pressure of brake pipe (P3) at which brake cylinder pressure (P5) is exhausted completely. This pressure should be 4.85 Kg/cm^2.

(XIII). Quick release test

a) Close isolating cock V9.
b) Open isolating cock V3 to charge brake pipe, auxiliary reservoir and control reservoir pressure (P3, P4 and P6) to 5 Kg/cm^2. Close isolating cock V3 when pressure in P3, P4 and P6 stabilizes.
c) Open isolating cock V4 for emergency application and see that. Brake cylinder (P5) is charged to 3.8 Kg/cm^2.
d) Make a short pull on the release valve handle. As soon as this handle is pulled, control reservoir (P4) and brake cylinder (P5) should be completely vented.
e) Close cock V4.

(XIV). CR check valve reset test

a) Continue to pull the release valve handle of the distributor valve to completely vent out auxiliary reservoir (P6).
b) Recharge by opening cock V9.
c) Control reservoir (gauge P4) should be isolated from the atmosphere when brake pipe (gauge P3) pressure exceeds 0.2 Kg/cm^2.

817. KE DISTRIBUTOR VALVE

These valves are also referred as KEO and KEGiSL in some publications. The KE distributor valve consists of the following main subassemblies:

(a)	Three pressure valve	e)	Minimum pressure limiter
(b)	U controller	f)	Maximum pressure limiter
(c)	R charger	g)	A controller
(d)	Choke cover	h)	Quick release valve

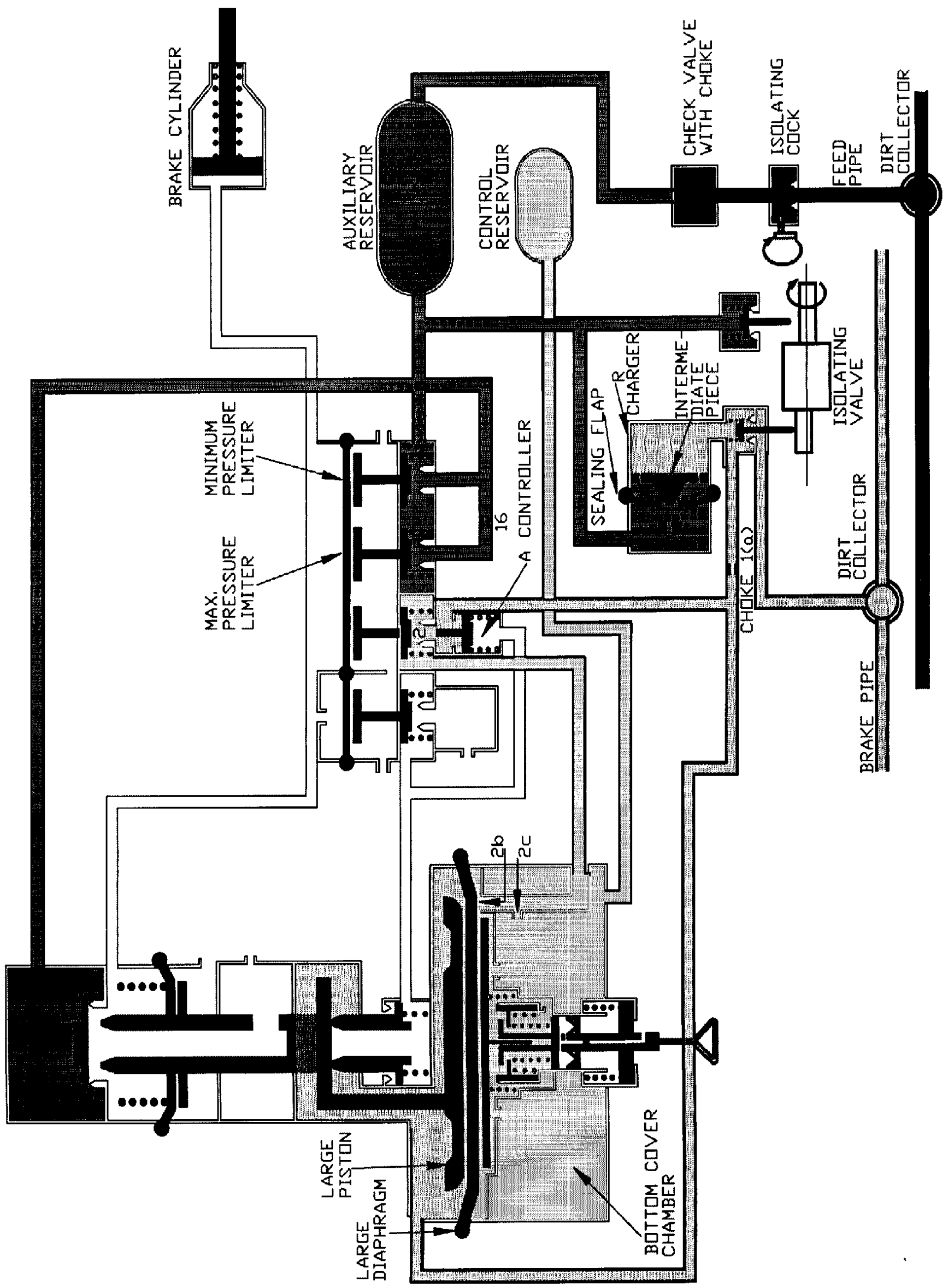


Fig. 8.23 KE DISTRIBUTOR VALVE

A. DESCRIPTION OF VARIOUS SUBASSEMBLIES OF KEGiSL DISTRIBUTOR VALVE

(a) THREE PRESSURE VALVE

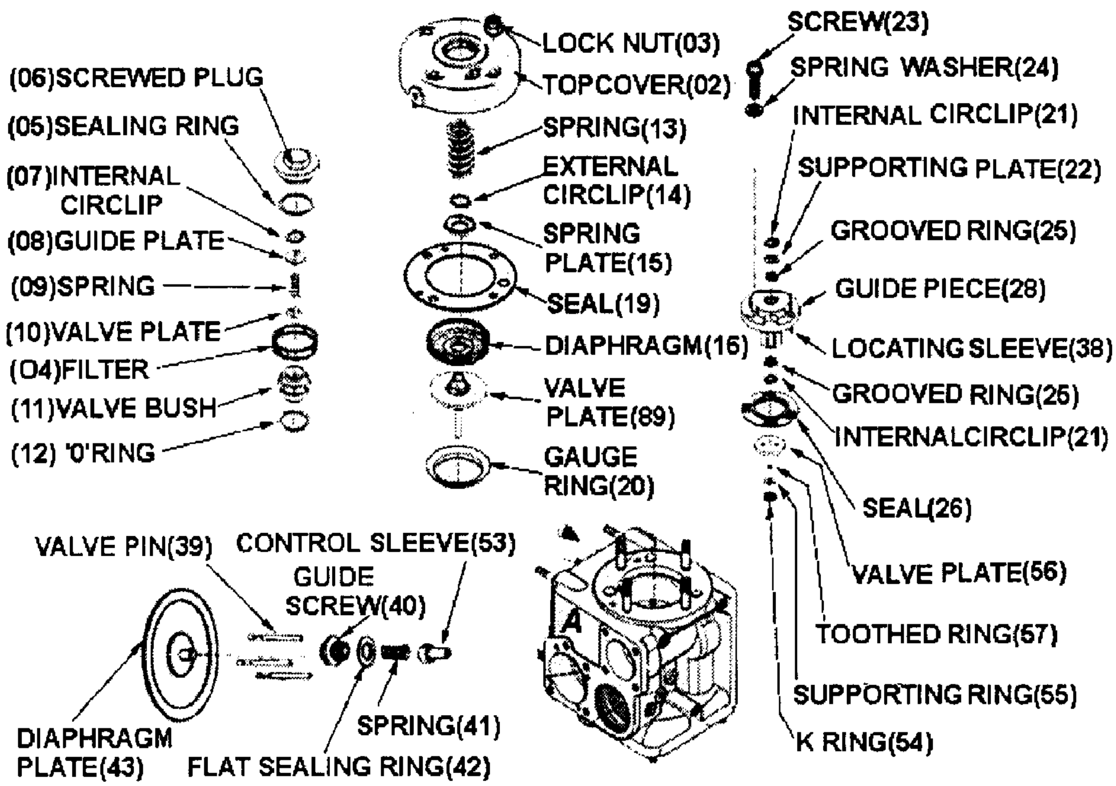


Fig. 8.24 THREE PRESSURE VALVE

The three pressure valve is housed in the vertical central bore between the top and bottom face. The function of the three pressure valve is to control charging and discharging of the brake cylinder in accordance with the change in the brake pipe pressure. The three pressure valve responds to the slightest variation of brake pipe pressure. The U controller, R charger and choke cover are housed on one face of the distributor valve.

(b) U-CONTROLLER

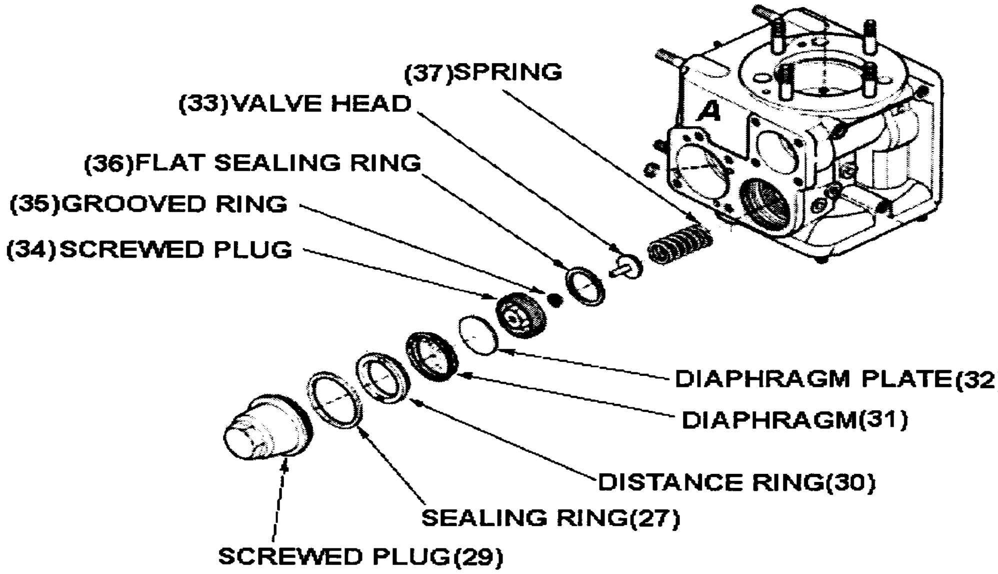


Fig. 8.25 U CONTROLLER

The function of the 'U' controller is similar to the function of quick service valve of C3W Distributor Valve. The U-controller gets activated during start of the brake application and taps off a small amount of brake pipe pressure from Distributor Valve during initial brake application. This action increases initial pressure reduction & causes simultaneous rapid propagation of braking impulse throughout the length of the train.

(c) 'R' CHARGER

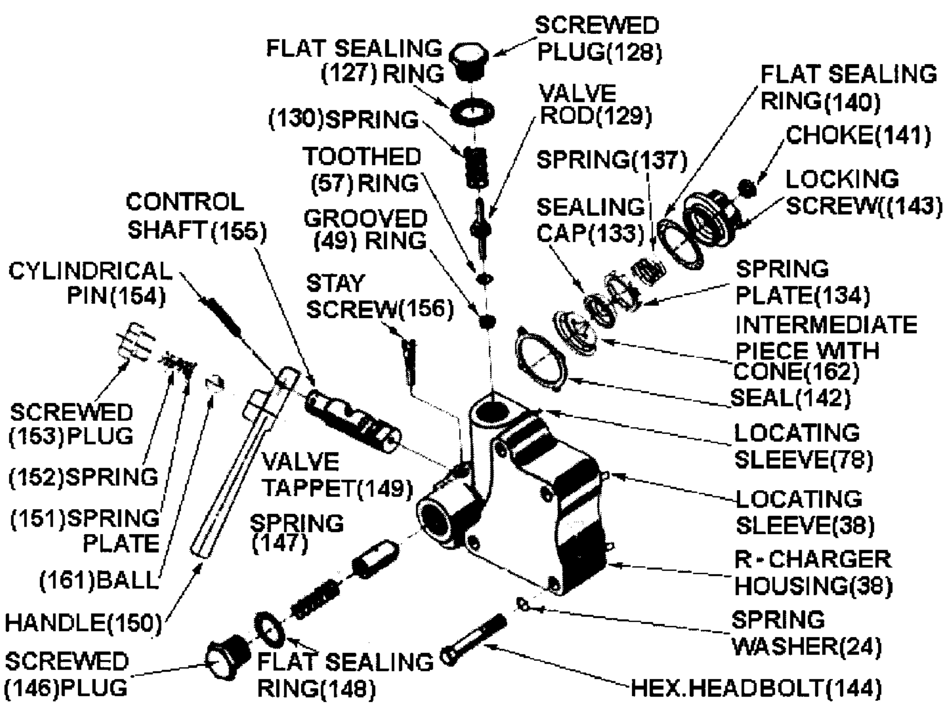


Fig. 8.26 R-CHARGER

The function of the 'R' charger is to supply compressed air from the brake pipe to the auxiliary reservoir 'R' charger also separate the auxiliary reservoir from the brake pipe through check valve (which is located inside 'R' charger) when BP pressure is less than AR pressure.

(d) CHOKE COVER

The choke cover has application & release chokes inside it. The application and release chokes help in regulating the application and release times of brake.

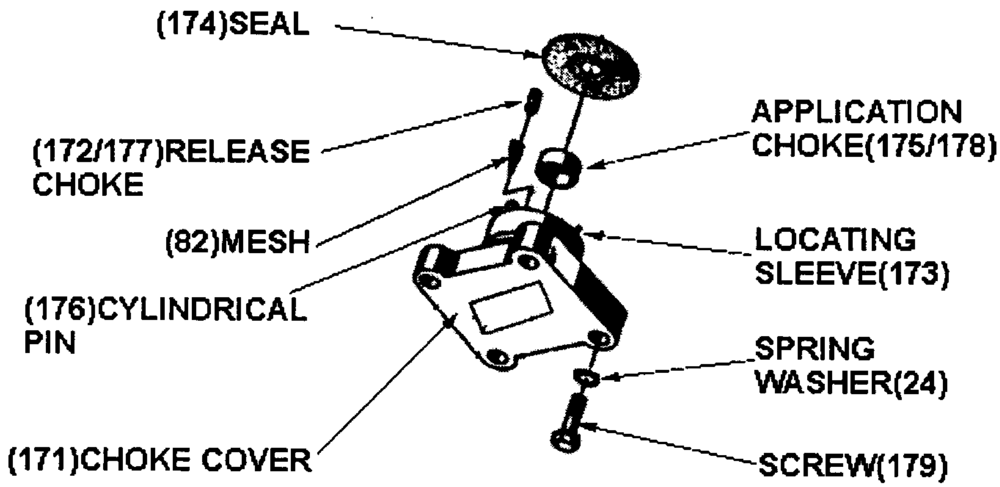


Fig. 8.27 CHOKE COVER

On the face opposite to face 'A' are housed, maximum pressure limiter, minimum pressure limiter and 'A' controller.

(e) MINIMUM PRESSURE LIMITER

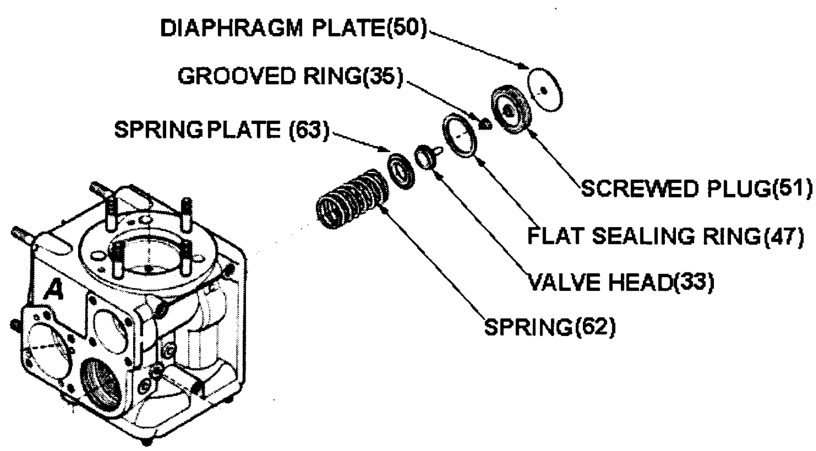


Fig. 8.28 MINIMUM PRESSURE LIMITER

The minimum pressure limiter gets activated during initiation of brake application. The minimum pressure limiter helps in rapid charging of brake cylinder upto a determined pressure to overcome rigging resistance.

(f) MAXIMUM PRESSURE LIMITER

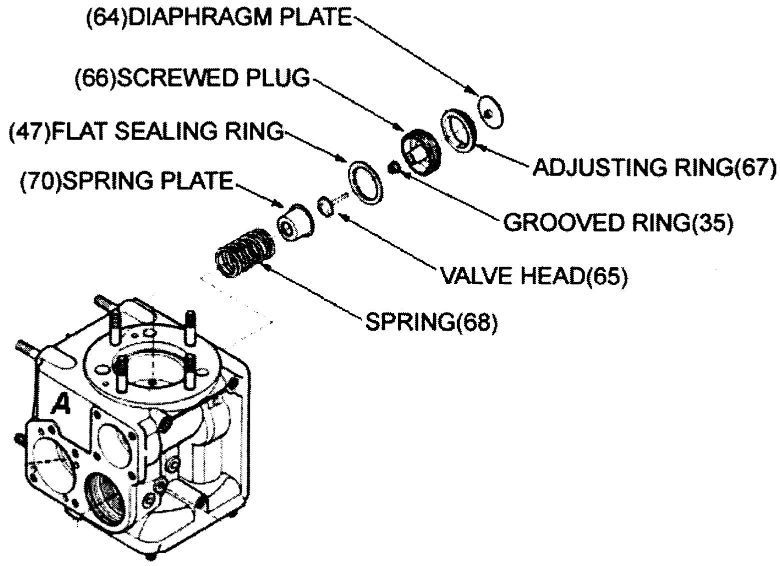


Fig. 8.29 MAXIMUM PRESSURE LIMITER

The function of maximum pressure limiter is similar to the limiting device in the C3W Distributor valve. The maximum pressure limiter limits the maximum brake cylinder pressure to 3.8 $\pm$ 0.1 kg/cm^2 irrespective of the auxiliary reservoir pressure.

(g) 'A' CONTROLLER

The function of 'A' controller is similar to that of cut off valve of the C3W Distributor Valve.

Besides charging control reservoir during charging operation 'A' controller isolates control reservoir pressure when brakes are applied. 'A' controller also protects control reservoir from overcharging.

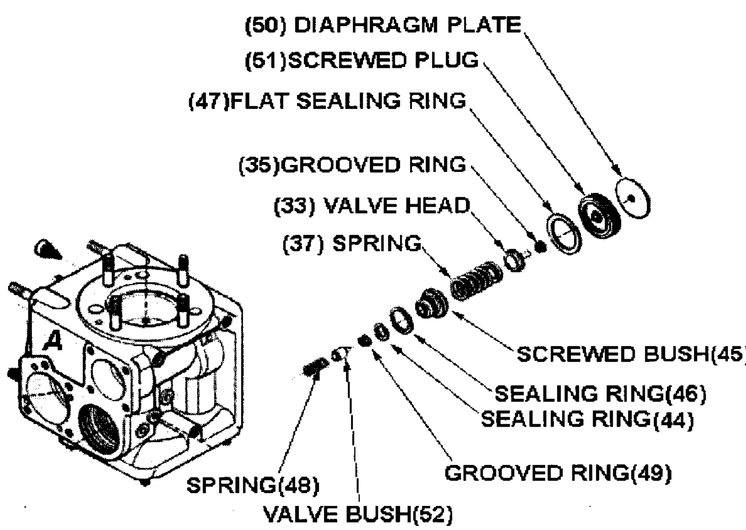


Fig. 8.30 A-CONTROLLER

(h) QUICK RELEASE VALVE

The quick release valve allows the brakes of the wagons to be fully released by means of manually pulling of handle.

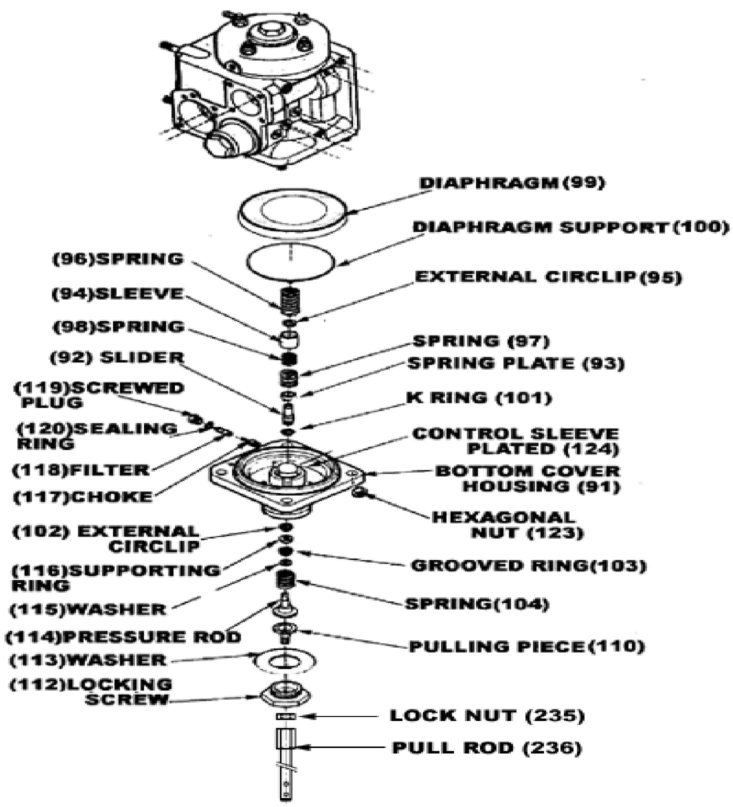


Fig. 8.31 QUICK RELEASE VALVE

817 B. FUNCTIONING OF KE DISTRIBUTOR VALVE

For effective functioning of the air brake system, the KEGisl distributor valve has to operate effectively during :

- Charging stage
- Application stage and
- Release stage.

(a) CHARGING STAGE

During this stage, the compressed air flows from the driver's brake valve into the brake pipe which charges the control reservoir, bottom cover chamber and auxiliary reservoir. During charging stage, the path followed by compressed air is as follows.

(i) Charging of control reservoir

During charging, the compressed air flows from brake pipe, dirt collector, isolating valve and through choke to brake pipe chamber above the large piston and to the 'A' controller. Due to brake pipe pressure acting on top of the large piston, the three pressure valve is pushed down and the port gets closed by the large diaphragm.

Air also flows to the 'A' controller through choke. It passes through sensitivity port, and from there to the bottom cover chamber through port. From the bottom cover chamber, the air enters the control reservoir. When the BP pressure above the large diaphragm gets equal to control reservoir pressure (at bottom cover chamber), the large piston diaphragm gets lifted up and opens the port.

(ii) Charging of Auxiliary Reservoir

For charging the auxiliary reservoir, air from BP passes from dirt collector to the 'R' charger via the isolating valve. Air entering the 'R' charger passes through the intermediate piece and opens the sealing flap. Therefrom, air enters the auxiliary reservoir and charges it to 5kg/cm^2.

(b) APPLICATION STAGE

The application of brakes can either be emergency, full service or graduated.

(i) Emergency application:

When the brake pipe pressure is reduced from 5kg/cm^2 to zero the passage from auxiliary reservoir to the brake pipe is closed by the sealing flap in the 'R' charger, because of differential pressure acting on either side of the sealing flap. At the same time pressure differential acts across the large diaphragm of the three pressure valve which pushes the piston unit (large & small) upwards. The upward movement of the piston unit closes the outlet port by uplifting of the control sleeve.

In addition to this, the outlet port at the top of the three pressure valve closes and the inlet port opens. The air from auxiliary reservoir through the minimum pressure limiter, the maximum pressure limiter and the choke, enters the top of the three pressure valve and through the open inlet port, the air enters into the brake cylinder.

When the pressure in the brake cylinder reaches 0.8 kg/cm^2, first minimum pressure limiter gets closed and there after maximum pressure limiter gets closed when the pressure in the brake cylinder reaches 3.8 kg/cm^2. With the rise in BC pressure the 'A' controller gets closed, maintaining the pressure in the control reservoir.

During full brake application, the brakes are applied at slower rate than in emergency application. BP pressure to be reduced by 1.5 kg/cm^2 instead of 5 kg/cm^2.

Note: At the beginning i.e. when BP pressure is reduced and control sleeve lifts outlet port of BP, air from top of the control sleeve reaches U-chamber that is already open to atmosphere and some BP air thus vents off. This causes a sudden extra drop in the remaining BP pressure inside the DV and accelerates the effect of brake application, propagating this action throughout the length of the train.

By this action brake cylinder pressure starts rising. The brake cylinder pressure also acts on diaphragm at U-controller, A controller, Minimum Pressure limiter and maximum pressure limiter. As BC start to rise the A controller valve is closed isolating BP and CR. Also the U controller is closed and local reduction of BP is stopped. As BC reaches 0.8 kg, it closes the minimum pressure limiter and now the rising BC pressure can pass through maximum limiter through choke which regulates the rate of BC rising. As BC reaches 3.8$\pm$0.1 kg per sq. cm., maximum pressure limiter also closes and no further rise of BC is possible. This rise of BC to 3.8$\pm$.1 kg per sq. cm. comes to effect at BP pressure dropping to 1.5 kg/sq. cm.

(ii) Graduated application

When the brake pipe pressure is reduced in steps for graduated application of brakes, the increase in brake cylinder pressure is at a controlled rate and in proportion to brake pipe pressure reduction.

As soon as the brake cylinder pressure rises in proportion to brake pipe pressure reduction, it causes the piston unit (large & small) to move down into lap position thereby closing the top inlet port without opening the top outlet port. Thus feeding of air from the auxiliary reservoir to the brake cylinder is cut off. This cycle is repeated every time BP is reduced in steps effecting graduated application of brakes.

(c) RELEASE STAGE

For releasing the brakes, the pressure in the brake pipe is increased and the pressure above the large piston increases. Thus the differential pressure across the large piston reduces. As a result, the piston unit (large & small) moves down thereby opening the top outlet port and closing the top inlet port. The brake cylinder pressure thus passes through the outlet port and gets exhausted to atmosphere through the release choke. As the BP pressure reaches 4.85 kg/cm^2, the brake cylinder is almost completely drained and the three pressure assembly attains its charging/running position again.

(i) Graduated release

If the pressure in the brake pipe is increased in steps, the releasing procedure starts as before. However the top outlet port get closed and come to lap position as soon as piston unit (large & small) moves up due to fall of brake cylinder pressure.

ii) Manual Release

Sometimes manual release of brakes is very helpful and thus provision is made in the distributor valve for manually releasing the brakes. When a short pull is given to pulling lever, it tilts the pressure piece. As a result, the pressure rod and pin are pushed upwards against force of spring. The air thus flows from control reservoir and passes through port and then from narrow passage to atmosphere. This will continue until the brake pipe pressure acting on large piston moves the supporting plate down. This results in downward movement of the pin thereby closing the passage of air to exhaust.

If however, there is no more pressure in brake pipe (i.e. after emergency application), when short pull is given to release handle then pressure piece is tilted & pin remains in top position. As a result control reservoir pressure is completely exhausted. The tilted pressure piece is then immediately restored to its initial position by spring. The brake cylinder pressure starts exhausting after control reservoir is exhausted upto 1.2 kg/cm$^{2.}$ and then simultaneously both get exhausted completely.

During refilling, the pressure in brake pipe rises more rapidly via choke and port so that the large piston immediately moves down causing the pin to move to lap position.

817 C. SPECIFICATION OF KE DISTRIBUTOR VALVE

KE distributor valve is a graduated release type of valve and has been approved by UIC to comply with requirement of its specification no. 540 and 547.

818. TESTING OF KE TYPE DISTRIBUTOR VALVE

Schematic diagram of the test bench for KE valve is shown in Fig. 8.32. Test bench consists of the following components:-

(i). Source of compressed air supply at 7.5 Kg/cm^2.
(ii). Pressure regulator (Item no. 4) : to supply air at 6.5 Kg/cm^2.
(iii). Pressure regulator (Item no. 24): to supply air at 6 Kg/cm^2.
(iv). Brake cylinders (Item no. 17) : two numbers
(v). Auxiliary reservoir [Item no 21(A) and 21(B)] each having capacity to store 100 liters of air at 6 Kg/cm^2.
(vi). Brake pipe reservoir (item no. 9) having capacity to store 60 liters of air at 6 Kg/cm^2.
(vii). Equalizer reservoir (Item no. 7) to store air at 6 Kg/cm^2 pressure. This reservoir supplies air to drivers brake valve whenever it is needed by DBV due to loss of air.
(viii). Drivers brake valve (item no. 6). It is same as provided in the locomotive. Its purpose is to control the brake pipe pressure.
(ix). Item no. 2 : Filter in supply to filter out any oil, grease etc.
(x). Item no. 22 : Auxiliary reservoir check valve. This prevents back flow of air i.e. flow of air from auxiliary reservoir to supply.
(xi). Item no. 5 : Main reservoir to store 60, liters of air at 6.5 Kg/cm^2.
(xii). Item no. 14 : Common pipe bracket, KE type distributor valve which is under test is to be mounted on this.
(xiii). Five pressure gauges to indicate the pressure in different locations as given below –

Item no. 25 : Main reservoir pressure.
Item no. 26 : Brake pipe pressure
Item no. 27 : Control reservoir pressure
Item no. 28 : Auxiliary reservoir pressure
Item no. 29 : Brake cylinder pressure.

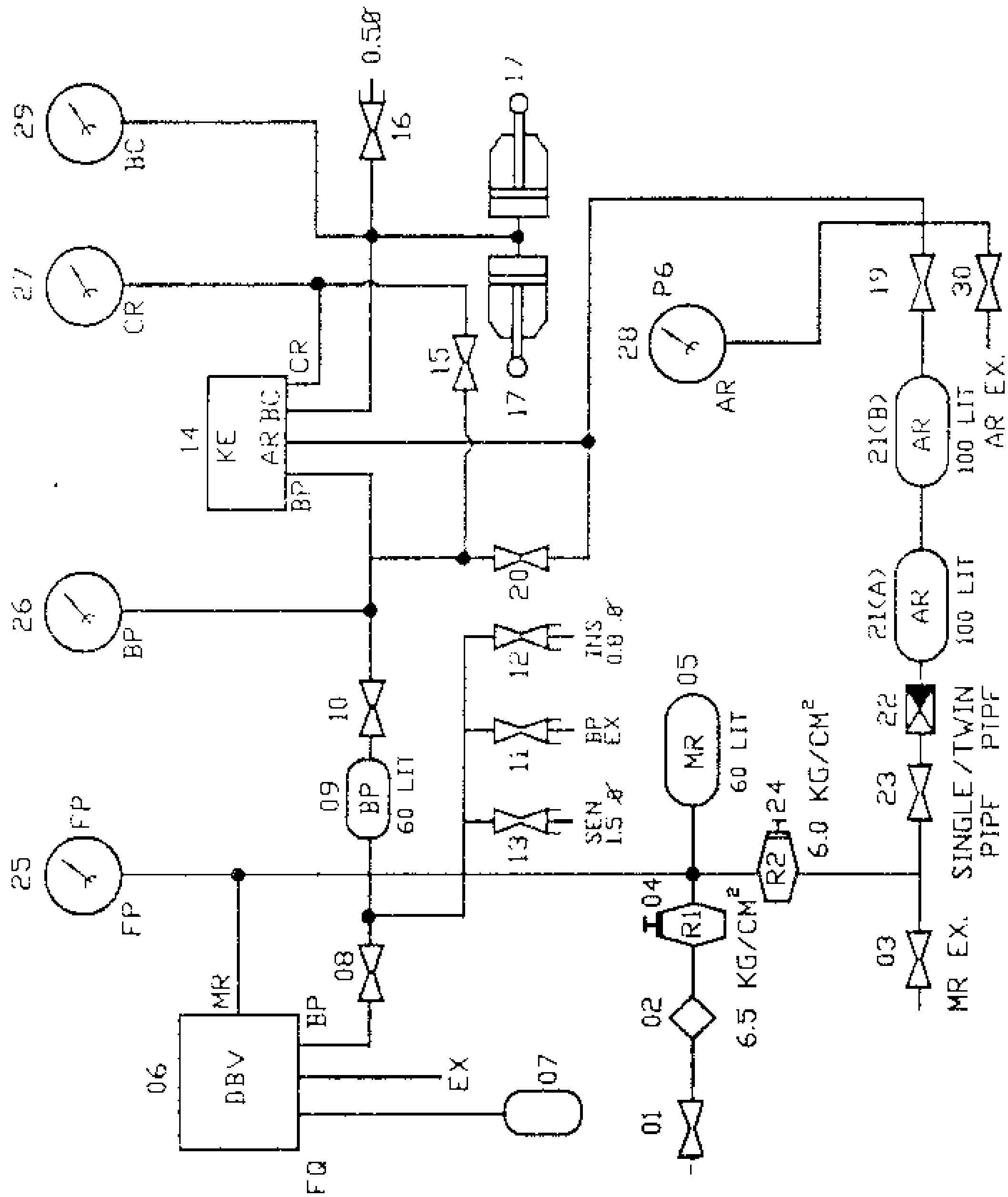


Fig. 8.32 TEST BENCH FOR KE DISTRIBUTOR VALVE

(xiv). Isolating cocks as given below-

- Item no. 1: Supply of compressed air to main reservoir.
- Item no. 3 : For exhausting main reservoir pressure.

- Item no. 8 : For controlling air pressure in brake pipe with the help of drivers brake valve.
- Item no. 10 : For isolating common pipe bracket from the brake pipe reservoir.
- Item no. 11 : For exhausting brake pipe pressure.
- Item no. 12 : It is with a choke for releasing brake pipe pressure at a desired rate for insensitivity test.
- Item no. 13 : It is with a choke for releasing brake pipe pressure for sensitivity test.
- Item no. 15 : Provided between brake pipe line and control reservoir. Normally it is kept closed and is used only for quick charging (or direct charging) of the control reservoir.
- Item no. 16 : Isolating cock with a choke for exhausting brake cylinder pressure at a desired rate.
- Item no. 19 : For isolating auxiliary reservoir from common pipe bracket.
- Item no. 20 : Provided between brake pipe and auxiliary reservoir for direct charging of brake pipe (I.e. by bypassing the driver's brake valve).
- Item no. 23 : It is the cock which connects the auxiliary reservoir with feed pipe in twin pipe system. This valve is kept closed in single pipe operation.
- Item no. 30 : For exhausting auxiliary reservoir.

A. TEST PROCEDURE

Tests are conducted in a particular sequence for reducing time required in opening and closing of various valves. In the test bench described above, following test sequence is optimum as far as time required in testing the distributor valves are concerned. In any other type of test bench arrangement, some other test sequence may be optimum. The isolating cock 23 is kept closed during testing.

(i) Pressure tightness test

a) In case of the KE type distributor valve, subassemblies are tested for leakage etc. during overhauling. This is done in order to detect defects early, if any, and to save the time. Normally three main subassemblies are tested for leakage i.e. R-charger with isolating valve, choke cover and bottom cover.

Since subassemblies are tested in advance for leakage, it is not necessary to test distributor valve for leakage in the beginning. Instead leakage test in different positions of the DV is carried out during conduction of test related to the concerned positions and hence the leakage test is conducted during following tests :

(i). Charging time
(ii). Full service application and release
(iii). Emergency application and release

(ii) Charging time of auxiliary reservoir and control reservoir

a) Mount the distributor valve under test on the bracket of the test bench
b) Close all the isolating cocks of the test bench
c) Set the air pressure regulators R1 and R2 at 6.0 and 6.5 Kg/cm^2 respectively
d) Open isolating cock (1)
e) Opening of isolating cock (1) will supply compressed air at 7.5 to 8 Kg/cm^2
f) Adjust pressure regulator (4). So that main reservoir is filled and its pressure as indicated by gauge no. 25 becomes 6.5 Kg/cm^2
g) Air at this pressure i.e. 6.5 Kg/cm^2 will be available at drivers brake valve
h) Bring drivers brake valve in release and running position. This will supply air to brake pipe at 5 Kg/cm^2
i) Open isolating cock (8), this will supply air at 5 Kg/cm^2 to brake pipe
j) Open isolating cock (10), this will supply air at 5 Kg/cm^2 to distributor valve
k) Open isolating cock (19). This will connect the auxiliary reservoir (i.e. 21A & 21B) to the DV
l) See that pressure in main reservoir (gauge no. 25) is 6.5 Kg/cm^2, in brake pipe, (gauge no. 26) and control reservoir (gauge no. 27) is 5 Kg/cm^2. If not, adjust with the help of pressure regulator (4)
m) Bring handle of R charger in off position
n) Exhaust auxiliary reservoir pressure by opening isolating cock (30). It will be indicated by gauge no. 28 and control reservoir by pulling quick release lever of the bottom cover. It will be indicated by gauge no. 27. Close cock (30)
o) But in the above step, MR and BP pressure should not drop below 6.5 Kg/cm^2 and 5 Kg/cm^2 respectively as shown by gauge no. (25) and (26)
p) Bring the handle of the R-charger in on position and simultaneously switch on the stop watches to measure the charging time of auxiliary reservoir and control reservoir. Two separate stopwatches will be required, it is better if two persons monitor these pressures respectively
q) Note time taken by gauges (28) and (27) to rise from 0 to 4.8 Kg/cm^2.
r) Apply soap solution all over the body of DV, no leakage should be observed

(iii) Full service application and release

a) Bring driver's brake valve in full service application position, so that brake pipe pressure (gauge no. 26) falls from 5 to 3.4 Kg/cm^2.
b) Switch on the stop watch as soon as the handle of drivers brake valve is brought to full service application position in the above step and note the time taken by brake cylinder pressure (gauge no. 29) to rise from 0 to 3.6 Kg/cm^2. This time should be 18 to 30 seconds.
c) Wait for brake cylinder pressure (gauge no. 29) to settle and note the maximum pressure to which it reaches. The maximum pressure should be within 3.8±0.1 Kg/cm^2.
d) Bring DBV in release position and switch on the stop watch simultaneously to note the time taken by brake cylinder pressure (gauge no. 29) to fall from 3.8 to 0.4 Kg/cm^2. This time should be within 45 to 60 seconds.
e) Apply soap solution all over the body of DV, no leakage should be observed.

(iv) Overcharge protection test

a) When DBV is in release position, ensure that brake pipe pressure (gauge no. 26) and control reservoir pressure (gauge no. 27) is at 5 Kg/cm2 and brake cylinder (gauge no. 29) is at 0 Kg/cm^2.
b) Open isolating cock (23). In this condition auxiliary reservoir will get supply at 6 Kg/cm^2. Adjust pressure regulator no. 24 to see that pressure indicated by gauge 28 is 6 Kg/cm^2.
c) Now operate driver's brake valve to emergency application position. In this case, brake pipe pressure (gauge no. 26) will become zero and brake cylinder pressure (gauge no. 29) will rise to its maximum value i.e. 3.8±0.1 Kg/cm^2.
d) Isolate DBV from the brake pipe by closing cock no. 8 and then bring DBV handle to release position.
e) Open isolating cock no. 20 to connect (via auxiliary reservoir) to brake pipe to bring brake pipe pressure at 6 Kg/cm^2 as seen by gauge no. 26. Maintain this position for 25 seconds.
f) Close isolating cock no. 20 and open isolating cock no. 8, this will bring brake pipe pressure to 5 Kg/cm^2 again.
g) Now observe rise in control reservoir pressure as seen by gauge no. 27. It should not go beyond 5.1 Kg/cm^2 i.e. CR should not be overcharged by 0.1 Kg/cm^2 over stipulated pressure of 5 Kg/cm^2.

(v) CR Overcharge reduction test

a) Open isolating cock no. 15 and 20, allow overcharging of control reservoir and auxiliary reservoir at 5.7 Kg/cm^2 by using isolating cock no. 23.

b) Bring back brake pipe pressure to 5 Kg/cm^2 by closing isolating cock no. 15 and 20.
c) Pull the double release lever of the distributor valve for three seconds and note down the fall in pressure of control reservoir.
d) The control reservoir pressure should return back to brake pipe pressure i.e. 5 Kg/cm^2 as seen by gauge no. 27.

(vi) Emergency application test

a) Close isolating cock no. 23, so that supply to auxiliary reservoir is disconnected and system again becomes single pipe system again.
b) In this condition ensure that brake pipe, control reservoir and auxiliary reservoir are at 5 Kg/cm^2 pressure as seen by gauge nos. 26, 27 and 28 respectively.
c) Now move DBV handle to emergency application position.
d) As soon as handle is moved to emergency application position, switch on the stop-watch and note down the time taken by the brake cylinder pressure to (gauge no. 29) to rise from 0 to 3.6 Kg/cm^2. This time should be between 18 to 30 seconds.
e) Also note the maximum pressure to which brake cylinder is charged. This pressure should be 3.8 ± 0.1 Kg/cm^2.
f) Apply soap solution all over the body of DV, no leakage should be observed.

(vii) Sensitivity test

a) Bring back DBV handle to release position. In this position the brake pipe, the control reservoir and the auxiliary reservoir pressure will become 5 Kg/cm^2 as seen by gauge no. 26, 27 and 28 respectively and brake cylinder pressure (gauge no. 29) will become 0 Kg/cm^2.
b) Disconnect DBV from the brake pipe by closing isolating cock no.8.
c) Open isolating cock no. 13 and switch on the stopwatch simultaneously and note the time taken by brake pipe pressure to drop by 0.6 Kg/cm^2. This time should be 6 seconds.
d) Brake cylinder pressure (gauge no. 29) should start rising and within 6 seconds, piston should start moving for application of brakes.

(viii) Quick service test

Close isolating cock no. 13 and immediately observe the applied brakes, they should remain applied.

(ix) Insensitivity test

a) Open isolating cock no. 8, so that DBV is connected to brake pipe.

b) Ensure that brake pipe and control reservoir are recharged at 5 Kg/cm^2 and brake cylinder pressure becomes 0 Kg/cm^2.
c) Open isolating cock with a choke (no. 12) and switch on the stopwatch simultaneously and check that brake pipe pressure (gauge no. 26) drops by 0.3 Kg/cm^2 in 60 seconds.
d) There should not be any rise in the brake cylinder (gauge no. 29) and the brake cylinder piston should not start moving i.e. the brakes should not apply.

(x) Re-feeding test

a) Bring DBV in full release position (i.e. brake pipe, control reservoir and auxiliary reservoir at 5Kg/cm^2 and brake cylinder at 0 Kg/cm^2).
b) Again bring DBV in full service application position. BC pressure will become 3.8±0.1 Kg/cm^2.
c) Exhaust the brake cylinder by using the exhaust cock no. 16.
d) Observe brake cylinder pressure in the gauge no. 29. It should not become zero and should stabilize at some particular value (since re-feeding to brake cylinder is available via distributor valve).
e) Brake cylinder pressure should not be more than 0.15 Kg/cm^2 from 3.8±0.1 Kg/cm^2 (i.e. it should not fall below 3.65±0.1 Kg/cm^2).
f) Close exhaust cock no. 16.

(xi) Graduated application test

a) Bring DBV in full release position (see that the brake pipe, the control reservoir and the auxiliary reservoir are at 5 Kg/Cm^2 and brake cylinder at zero pressure.
b) Close isolating cock no. 8 to isolate brake valve with brake cylinder.
c) Now reduce brake pipe pressure (as seen in gauge 26) in steps of 0.2 Kg/cm^2 (min. 7 steps) by slowly opening and closing sensitivity (isolating cock no.13) i.e. starting from 4.6 Kg/cm^2 and then to 4.4, 4.2, 4.0, 3.8, 3.6 and 3.4 Kg/cm^2.
d) Note down the corresponding increase in brake cylinder pressure (gauge no. 29).
e) Also note down the brake pipe pressure (gauge no. 26) at maximum brake cylinder pressure (gauge no. 29). This BP pressure (26) should be 3.4 to 3.7 Kg/cm^2.

(xii) Graduated release test

a) Close isolating cock no.13 and open isolating cock no.8.
b) Bring DBV at full application position in this condition brake pipe pressure (as seen in gauge no.26) will be 3.6 Kg/cm^2.
c) Increase brake pipe pressure / gauge no.26) in steps of 0.2 Kg/cm^2 by bringing back DBV gradually towards full release position i.e. starting from 3.4 Kg/cm^2 to 3.6, 3.8, 4.0, 4.2, 4.4 and 4.6 Kg/cm^2.

d) Note down the corresponding decrease in the brake cylinder pressure (gauge no.29) when brake cylinder pressure is fully released it should be 4.85 Kg/cm^2 approximately.

(xiii) Quick release test

This test is also known as "Automatic exhausting of brake cylinder". For conducting this test follow these steps –

a) Bring driver's brake valve handle in emergency position. In this condition, the brake pipe pressure will be zero (gauge no.26) and brake cylinder pressure will be 3.8 Kg/cm^2 (gauge no.29).
b) Give a brief pull to quick release lever at bottom cover. As soon as this handle is pulled, control reservoir (gauge 27) and brake cylinder (gauge 29) pressures should automatically exhaust to zero.

(xiv) Control reservoir check valve reset test

a) After brake cylinder and control reservoir pressure becomes zero, charge the system by opening drivers brake valve to release position. As soon as brake pipe pressure reaches 0.2 Kg/cm^2, the quick release system should be isolated from atmosphere and control reservoir should again begin to charge.

819. TEST REPORT PROFORMA FOR C3W/KE DISTRIBUTOR VALVE

Type of Valve ………… Sr. No. …………

Sr. No.	Description of Test		Observation
1.	AR Charging Time from 0 to 4.8 Kg/ cm^2 (Main Reservoir pressure > 7.5 Kg/ cm^2)		
2.	CR Charging Time from 0 to 4.8 Kg/cm^2 (Main Reservoir pressure >7.5 Kg/cm^2)		
3.	Leakage Test (Brake Release) Check DV Leakage by Soap water only at joints.		
	FULL SERVICE APPLICATION & RELEASE		
	Brake Cylinder filling time from 0 to 3.6 Kg/cm^2		
	Maximum Brake Cylinder Pressure		
	Leakage Test (Application) Check Leakage in DV by Soap water only at joints		

Sr. No.	Description of Test		Observation
	Brake Cylinder Release Time from Max.B.C. Pressure i.e. from 3.8 +/-0.1 Kg/cm^2 to 0.4 Kg/cm^2	45 to 60 Seconds	
	OVERCHARGE PROTECTION (BP pressure 6 $Kg/cm^{2)}$	CR pressure should not increase by more than 0.1 Kg/cm^2 in 25 sec.	
	CR overcharge reduction test Overcharge CR to 5.7 Kg/cm^2 and pull double release lever for 3 seconds.	Overcharged CR should come to regime pressure of 5 Kg/cm^2.	
	EMERGENCY APPLICATION		Single pipe
	Brake Cylinder filling Time from 0 to 3.6 Kg/cm^2	18 to 30 Seconds	
	Maximum Brake Cylinder Pressure	3.8 ± 0.1 Kg/cm^2	
	Leakage Test (Emergency) Check Leakage in DV by Soap water only at joints	No Leakage	
	Brake Cylinder Release Time from Max. B. C. Pressure i.e. from 3.8 ± 0.1 Kg/cm^2 to 0.4 Kg/cm^2	45 to 60 Seconds	
	SENSITIVITY & INSENSITIVITY		
	BP pressure drop at the rate of 0.6 Kg/cm^2 in 6 Seconds	Brake should start applying within 1 Sec.	
	With a pressure drop stopped immediately after the operation of Quick Service Valve	Brakes must remain applied.	
	BP pressures drop of 0.3 Kg/cm2 maximum in 60 seconds.	Brakes must not apply.	
	REFEEDING		
	Create leak in BC through a 2 mm choke	BC pressure should decrease initially but re-feeding should be available and BC pressure should get stabilized at some pressure.	

	GRADUATED APPLICATION Decrease BP pressure in steps as below - BP Pressure (Kg/cm2) 4.8 4.6 4.4 4.2 4.0 3.8 3.6		
	Continue Graduated Application until max. BC Pressure is obtained	BP pressure drop must be between 1.4 and 1.6 Kg/cm^2	
	BP Pressure at maximum brake application	BP pressure drop must be between 3.4 & 3.7 Kg/cm^2	
	GRADUATED RELEASE Increase BP pressure in steps as below – BP Pressure (Kg/cm2) 3.6 3.8 4.0 4.2 4.4 4.6 4.8		BC Pressure
	Check BP Pressure when BC pressure is 0.4 Kg/cm^2 (Recharging pressure to release BC Fully)	4.85 Kg/cm^2 approx.	
	QUICK RELEASE TEST Apply emergency brake & pull briefly the double release valve lever	Brake cylinder & CR are automatically exhausted to zero	
	CR check valve reset test. Start recharging of the system	Control reservoir should be isolated from atmosphere when brake pipe pressure exceeds 0.2 Kg/cm^2.	

820. SINGLE WAGON TEST

'Single wagon Test' is performed on a wagon to ensure proper functioning of the air brake system. It is generally performed on the sick wagon attended in the sick line or whenever a subassembly of the air brake system is replaced either in depot or workshop. Single wagon test is also carried out after POH and after every change of distributor valve in the workshop.

The different tests to be performed on the subassemblies of a wagon are as follows:

Test1: Leakage Test.
Test2: Sensitivity and Insensitivity Test.
Test3: Brake Application and Release Test.
Test4: Graduated Application and Release Test.
Test5: Check and adjust Slack Adjuster.

A. TOOLS AND EQUIPMENT

1. Test Rig
2. Spanners 10mm, 12mm

B. CONCEPT

Single Wagon Test is performed, by using a portable device called 'Test Rig'. This test rig provides all facilities similar to a driver's brake valve. The source of compressed air for conducting the test is through a compressor installed in depots and workshops for conducting various tests without the need of a locomotive. The part description and specification are given in table below.

C. PROCEDURE FOR SINGLE WAGON TESTING

A systematic lay-out of Single Wagon Test Rig (SWTR) is shown in fig. 8.33. This SWTR is utilised for testing the air brake system fitted on single wagon. The wagon should not be connected with the locomotive at the time of testing. The following procedure shall be followed for testing.

i) The wagon under testing is to be coupled at one end with the SWTR coupling head BP and the other end should be closed with dummy coupling head. Pressure gauge should be fitted on brake cylinder.
ii) Couple the SWTR to the main line of compressor.
iii) Place the isolating cock of distributor valve on the wagon in open position i.e. the handle should be vertically down wards.
iv) Set the pressure reducing valve (1) to 5 ± 0.1 Kg/cm^2 Open the cocks (2) and (8) and so the angle cocks on the both ends of the wagons. Move the driver's brake valve (3) in the charging and release position.
v) Wait for about 5 minutes to charge the complete system.

vi) Check the pressure in BP pressure gauge (7). Pressure should be 5+ 0.1 Kg./cm^2 in BP. If there is pressure drop in the gauge (7) detect the source of leakage and eliminate it.
vii) Close cocks (2) & (8). Check the leakage on BP for one minute.
viii) Open cock (2). Bring Driver's brake valve in full service application position.
ix) Record the brake cylinder filling time from 0 to 3.6 Kg./cm^2 in brake cylinder pressure gauge.
x) Record maximum pressure in brake cylinder.
xi) Record the pressure drop in BP from pressure gauge (4).
xii) Record the piston stroke of brake cylinder.
xiii) Bring Driver's brake valve in the charging and release position.
xiv) Record the brake cylinder draining time from 3.8 $\pm$ 0.1 to 0.4 Kg./cm^2 in brake cylinder pressure gauge & check complete release of brakes i.e. piston should reach its initial position.
xv) Open cock (8) for charging the reservoirs to 5 Kg./cm^2 and close cock (2).
xvi) Open cock (6) for checking sensitivity of brakes. Record time within which brakes get applied.
xvii) Close cock (6) and open cock (2). Wait till brakes are released.
xviii) Close cock (2) and open cock (7) for checking the insensitivity of brakes. The brakes should not apply.
xix) Close cock (7) and (8) and open cock(2), BP pressure should rise to 5 Kg./cm2
xx) Close cock (2) and open cock (5) for emergency application.
xxi) Record the brake cylinder charging time from 0 to 3.6 Kg./cm^2 in BC pressure gauge.
xxii) Record maximum BC pressure.
xxiii) Check the leakage in BC for 5 minutes.
xxiv) Pull the manual release lever of distributor valve for about 10 sec. Brake cylinder pressure should become zero automatically.
xxv) The above tests should be done in both empty and loaded condition.
xxvi) The results of test shall be recorded in the test proforma attached herewith.

D. PROFORMA FOR SINGLE WAGON TEST FOR WAGONS OTHER THAN BOBR & BOBRN

S.No.	Check	Specified
1.	Pressure in BP	5 $\pm$ 0.1 Kg./cm^2
2.	Pressure in AR	5 $\pm$ 0.1 Kg./cm^2
3.	Leakage from the system after charging	0.1 kg/cm^2 in one minute
4.	Full service application	
4.1	Brake cylinder filling time (Pressure rise from 0 to 3.6 kg/cm^2)	
	a) Empty	18 to 30 sec.
	b) Loaded	18 to 30 sec.
4.2	Maximum brake cylinder pressure	
	a) Empty	3.8 $\pm$ 0.1 kg/cm^2

	b) Loaded	3.8 ± 0.1 kg/cm^2
4.3	Reduction in BP pressure required for full service application	1.3 to 1.6 kg/cm^2
5.	Release after full service application	
5.1	Draining time (Brake cylinder pressure to fall from 3.8 + 0.1 kg/cm^2 to 0.4 kg/cm^2	45 to 60 sec.
6.	Sensitivity of brakes Isolate brake pipe from mainline. Check the response of brakes when the brake pipe pressure is reduced at the most equal to 0.6 kg/cm^2 in 6 sec.	Brake should apply within 6 sec.
7.	Insensitivity of brake. Isolate brake pipe from mainline. Check the response of brakes when brake pipe pressure is reduced at least equial to 0.3 kg./cm2 in 60 seconds.	Brake should not apply.
8.	Emergency application	
8.1	Brake Cylinder filling time (Pressure to rise from 0 to 3.6 kg/cm^2)	
	a) Empty	18 to 30 sec.
	b) Loaded	18 to 30 sec.
8.2	Maximum brake cylinder pressure	
	a) Empty	3.8 ± 0.1 kg/cm^2
	b) Loaded	3.8 ± 0.1 kg/cm^2
9.	Piston stroke	
	a) Empty	See note below
10.	Leakage from brake cylinder after emergency application	0.1 kg/cm^2 within 5 minutes
11.	Automatic exhausting of brake cylinder and control chamber	
12.	Apply emergency brakes (i.e. BP= 0 kg/cm^2). Check the brake cylinder pressure after giving a brief pull to release hook.	Brake cylinder and control reservoirs should exhaust automatically.

Date: Signature & Name of testing Authority.

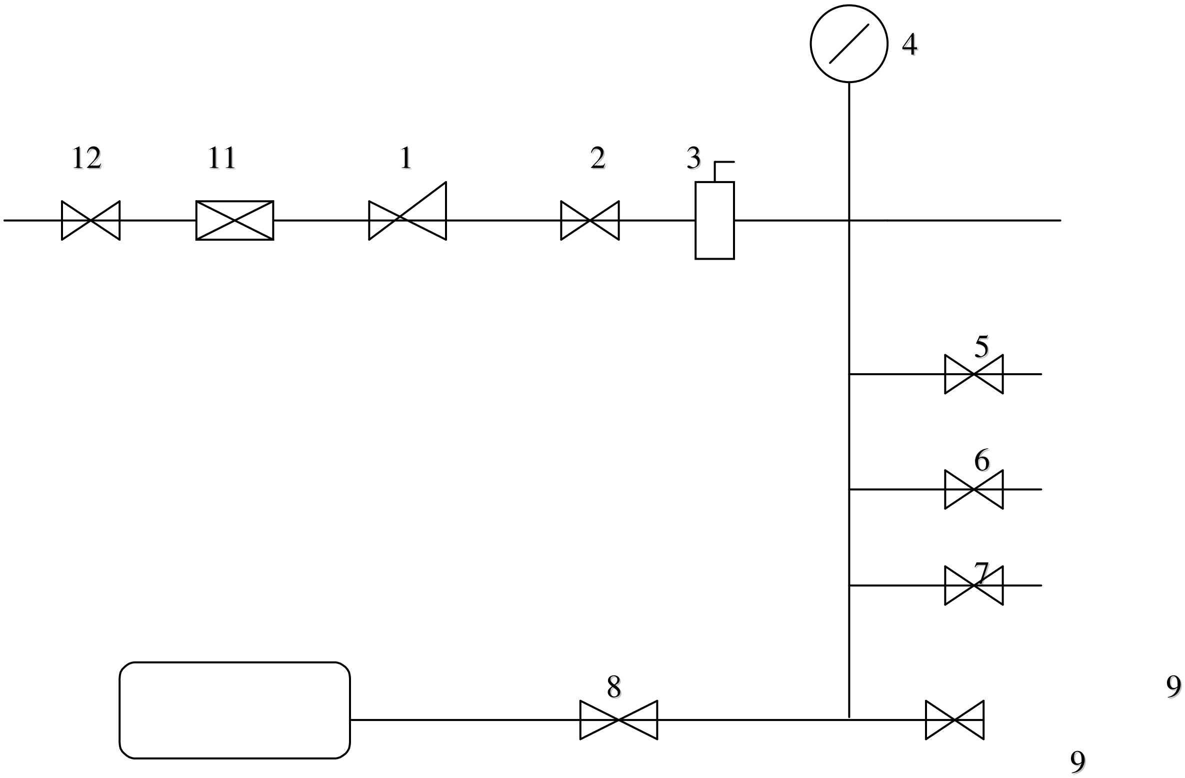


Fig. Ref. No.	Description	Qty.
1.	Pressure reducing valve	1
2.	Isolating cock 15 mm	1
3.	Drivers brake valve	1
4.	Pressure Gauge for BP	1
5.	Isolating Cock 15 mm	1
6.	Isolating Cock 15 mm with choke	1
7.	Isolating Cock 15 mm with choke	1
8.	Isolating cock 15 mm	1
9.	Air Reservoir 40 L	1
10.	Flexible hose BP 1 M long	1
11.	Check valve 15 mm	1
12.	Isolating cock 15mm	1
13.	Adapter for AR	1
14.	Adapter for CR	1
15.	Adapter for BC	1
16.	Flexible Hose 10mmx2 m long	3
17.	Pressure gauge	3
18.	Trolley (Not Shown)	1

Fig. 8.33 SINGLE WAGON TEST RIG (SWTR)

821. RAKE TEST

A schematic layout of rake test rig (RTR) is shown in Fig. 8.34. A rake consisting of 56 wagons can be tested with this rig. This rig may be used for testing the train in yard before attaching the engine.

The rake test rig has air supply and mobile test rig. The mobile test rig is having a cubical structure and is mounted on wheels. It can be taken to the yards and sick lines. The procedure is as follows:

A. Carry out Visual Examination.
B. Prepare set up (Rig) for Rake Test.
C. Conduct Leakage, Service Application and Release Test.

Visual inspection is a check of air brake subassembly, for any damage on the brake pipe, hose coupling etc and then rectifying it. The steps are :-

i) Inspect loose suspension brackets and anti-pilferage devices of all air brake subassemblies
ii) Visually inspect for any problem/damage in the brake pipe, hose pipe, coupling etc.
iii) Rectify or replace the problematic part/subassembly.

Rake Test can be performed, by using a portable device called 'Test Rig' (Fig. 8.32 B) or by locomotive. The test rig provides all facilities like a locomotive to conduct the test. The source of compressed air supply to the test rig is through a compressor installed in the wagon depot for Brake Pipe of the test rig.

A rake consisting of 56 air brake wagons can be tested with this rig. This rig may be used for testing the train in yard before attaching the engine. The rake test rig has air supply and a mobile test rig.

A. AIR SUPPLY SYSTEM

This consists of a compressor (1), after cooler (2), check valve (3) main reservoir (4), safety valve (5) and filter (6). All these items are to be installed in a room in a yard.

The compressor generates pneumatic pressure of 10 kg./cm^2 and compressed air is stored in main air reservoir MR(4). The safety valve (5) opens out if the pressure exceeds 10 Kg./cm^2. The oil and dirt will be separated out in the filter (6). The check valve(3) prevents back flow of air while compressor is off.

The compressed air line is connected to the pipe line in the sickline/yard. Angle cock and hose coupling (BP) are provided at various points depending upon the train formation and check points in sickline.

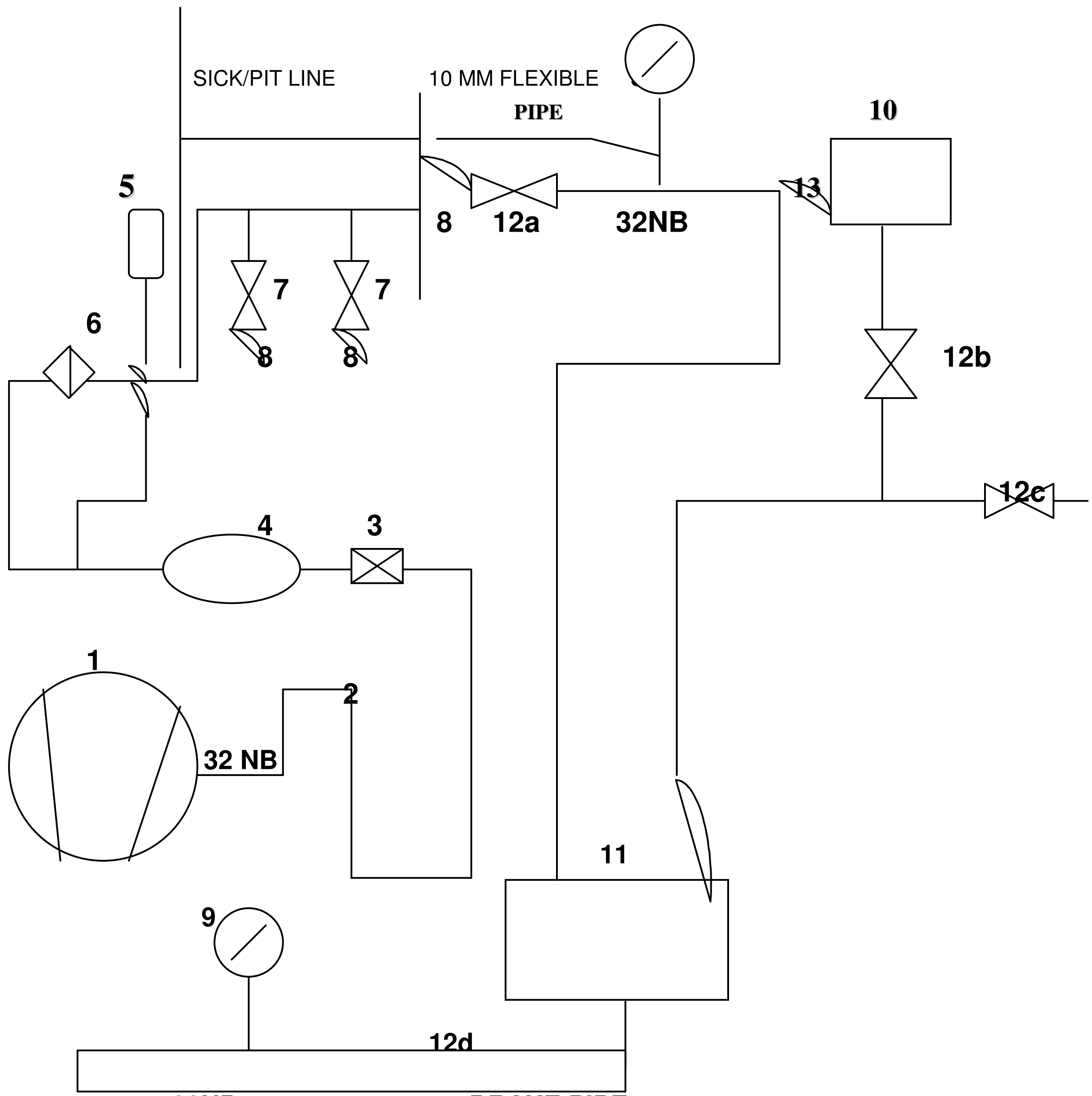


Fig. Ref. No.	Description	Qty.
1.	Compressor 2000L/Min pressure 8-10 Kg/Cm^2	1
2.	After Cooler	1
3.	Check valve	1
4.	Main reservoir 300 lts.1	1
5.	safety vlave	1
6.	Filter	1
7.	Cut off angle cock	2
8.	Brake hose coupling BP	4
9.	Pressure gauge	2
10.	Driver's Brake valve	1
11.	Relay valve	1
12.	Isolating cock a,b,c,d	4
13.	10 mm FLEXIBLE HOSE	1

Fig. 8.34 RAKE TEST RIG

B. MOBILE TEST RIG

The rig consists of brake hose coupling BP (8) and isolating cock (12) at the inlet of the mobile test rig. The air connection can be tapped from one of the points of sickline. The mobile test rig is provided with driver's brake valve (10).

Brake pipe in the rake is charged while driver's brake valve (10) is kept in released and running position. The driver's brake valve inlet is connected to MR. It regulates the pressure to 5 kg./cm2 through the relay valve (11). Isolating cock (12d) is provided to isolate BP from driver's brake valve (10).

The relay valve (11) has been provided in the system for augmenting the feeding capacity of driver's brake valve. The hose coupling of BP is connected to the brake pipe coupling of the rake.

Note : In case rake test rig is not available, testing may be done by engine.

C. TOOLS AND EQUIPMENT

1. Rake Test Rig/Locomotive.
2. Open End spanner 18x19"
3. Spanner 10mm, 12mm

D. PROCEDURE FOR RAKE TESTING

Attach the rake test rig to the rake through the couplings. Carry out tests as per the procedure given in G-97 Annexure-XI.

822. REPAIR AND MAINTENANCE IN SICKLINE

i) Check for any missing component and replace them, wherever necessary.
ii) Charge the BP pressure and check for leakage
iii) Check whether the application and release of brakes is taking place properly. Also check for the free movement of brake rigging.
iv) Drain the brake pipe, control reservoir and auxiliary reservoir fully and ensure that there is no pressure in the system.
v) Remove the drain plug of auxiliary reservoir, control reservoir and centrifugal dirt collector and allow the draining of the condensate. Then charge the brake pipe and allow air to come out to the plug holes for some time so that all the dirt and other impurities may be driven out.
vi) Remove filter housing of the common pipe bracket, clean the filter and refit making replacements, if necessary.
vii) Remove the brake cylinder breather hole strainer, clean it and refit making replacements, wherever necessary.

viii) Check the handles of the cut off angle cock and isolating cock are moving freely. If there is any resistance, open the assembly, overhaul it, reassemble and ensure that there is free movement.

ix) Refer to the defects observed during checking of the arrival of the rake and make necessary rectifications.

x) The following items on individual sub assembly to be checked :-

- **Distributor Valve**

  Clean filter of the common pipe bracket

  Ensure ease of movement and function of quick release valve. Ensure valve is switched on i.e. isolating valve handle is vertically down. Ensure free movement of handle.

- **Brake Cylinder**

  Clean the brake cylinder breather filter at regular intervals. Ensure that the piston rod is fully in.

- **Air Reservoir.**

  Remove the condensate by opening the drain plug. Replace drain plug seal if needed.

- **Cut off Angle Cock**

  Replace sealing ring and dowel pin, put any lubricating oil on top of handle at regular intervals. Ensure cock is open i.e. handle is parallel to the pipe.

- **Dirt Collector**

  Remove condensate by opening drain plug. Replace drain plug sealing ring, if necessary. Open the cover and clean the filter.

- **Pipe Joints and Air brake Hose Coupling**

  Replace rubber seals, if needed. Replace hose coupling assembly, if required. If there is any leakage, arrest the leakage by using appropriate sealing compound or by tightening the joints or by changing the seals as required.

i. Check the working of Slack adjuster and adjust "A" dimension, if required as gien in para 820.

ii. After complete maintenance of the wagons testing should be done as given in para 820.

823. REPAIR AND MAINTENANCE DURING ROH

A. In routine overhaul first test the brake system using single wagon test rig as per procedure given in RDSO publication G-97 (May1996) Annexure (XII). Following action should be taken for the defects/discrepancies identified during testing.

a) Replace DV by a DV tested in test bench if any of the following defects identified: (Ref: test proforma at Annexure-XII)

i) AR pressure not as specified
ii) CR pressure not as specified
iii) Maximum brake cylinder pressure in full service application/Emergency application not as specified.
iv) Brake cylinder filling time/draining time after full service and/or emergency application not as specified.
v) Insensitivity/sensitivity parameters are not as specified.
vi) Leakage through distributor valve.
vii) Brake cylinder pressures in empty & loaded condition are not within the specified limit.

b) Replace brake cylinder by tested brake cylinder, if following defects are identified.

i) Leakage from brake cylinder after emergency application is not as specified.
ii) If any visual damage is noticed.

c) Examine and repair or replace Seals/Gaskets of pipe and joint fittings if leakage rate of system is not within specified limits.

i) Replace the angle cock if it is leaking or damaged

ii) Replace leaking Guard's Emergency Brake Valve, isolating cock, and quick coupling of brake van.

iii) Examine rigging/Slack Adjuster if Piston Stroke is not as specified. (See Annexure - XV & XVI of G-97)

B. Carry out following checks and examinations.

a) Cut off Angle Cock

Check for easy operation of cut-off angle cock. If found jammed put a few drops of light lubricating oil on top of the cock and give light hammer shocks on the top of the cock simultaneously trying to operate the handle. Operate handle 10-12 times to ensure smooth movement. If working of angle cock even after lubrication is not smooth replace by tested angle cock.

b) Dirt Collector

Open the drain plug and drain out the Condensate and replace the drain plug. If the leather washer is found defective it should be changed.

c) Brake Cylinder

Check the brake cylinder for smooth movement of piston. Lubricate the piston by injecting 2 cc of lubricating grease through the gauge point. Brake cylinder movement even after lubrication is not smooth, replace by tested brake cylinder.

d) Auxiliary Reservoir/Control Reservoir

Open the drain plug and drain out the condensate and replace the drain plug. If the Leather Washer is found defective it should be changed.

e) Hose Coupling

i) Check serviceability of hose coupling .

ii) Check the Gasket for any visual damage and replace if found necessary.

f) Guard's Emergency Brake Valve

Check easy operation of Valve. Operate 5 to 6 times. Defective valve should be replaced.

g) Isolating Cock for BVZC Brake Vans

Check easy operation of cock. Operate 5 to 6 times. Replace defective isolating cock.

h) Quick Coupling for BVZC Brake Vans

Check for proper working and replace if defective.

i) Load Sensing Device (Fig. 4, 5, 7, 23 & 24 of G-97) for BOBR/BOBRN Wagons

i) Check that wagons fitted with C3W DV are provided with LSD type VN5 and Swivelling Adapter and KEO DV with Operating Valve B1 and Spring Buffer F1.

ii) Check that nuts have been provided between lever of VN5 Valve and Swivelling Adapter and between Swivelling Adapter and fixing Bracket on Spring Plank.

iii) Check proper working of load sensing device fitted on bogie. For checking the proper working of LSD in loaded condition press the piston of operating valve by inserting a bar in case of equipment of M/s. Escorts & M/s Greysham with EST 3f DV. In the case of equipment supplied by M/s. RPIL & M/s. Greysham with C3W valves, the swivelling adapter may be disconnected from the spring plank and operate the valve manually to simulate loaded condition of wagons and observe higher brake cylinder pressure.

C. Ensure the following :-

i) Hose coupling support at both ends are fitted properly.

ii) All mounting nuts and bolts of various equipment, pipe fitting and pipe joints are secured and tight in position.

iii) APD of the following are as per RDSO drawings and specifications.

(a) DV including additional APD
(b) Angle cock

i) Examine and ensure that the Air Brake equipment are not physically, damaged from outside.

D. After carrying out all the work, test the brake system in single wagon test rig for all parameters as per procedure given in Annexure XII of G-97. Rectify the defects if identified during testing. In no case wagon with brake system not meeting requirement be allowed to come out from ROH repair.

E. Attend to special modifications, as ordered from time to time in the nominated Depots.
F. Touch up paint and lettering where necessary.

G. Details of replacement of DV shall be marked on the sole bar as indicated in RDSO Drg. No. WD - 93003 - S - 01.

H. Defective equipment replaced should be taken to test bench for repair and after repair use them as spare unit for further ROH of wagons.

a) For the repair of Air Brake Equipment necessary spares shall be readily available with the Depot. A maintenance kit for different equipment is given at Annexure XII of G-97. The Depot shall make assessment of the total quantity required and procure the same in Kit form. Small quantity of spares, which are not covered in maintenance kit may also be require. Such spares can be purchased as non stock item or by cash imprest.

b) Only spare parts procured from approved Air Brake Supplier shall be used for repairs. Under no circumstances Shop made/duplicate spares shall be used. The marking on items shall be seen to verify the Supplier.

c) ROH Maintenance Depot should have sufficient Nos. of various spare assemblies for unit exchange.

d) ROH Maintenance Depot should have following Repair and Maintenance facilities for various assemblies :-

i) Facilities for opening, repair, assembly and testing of all type of DVS.

ii) Facilities for Opening, Repair, Assembly and Testing of Angle cock, Dirt collector, Brake Cylinder, Isolating Cock, Guard's emergency brake valve isolating cock and quick coupling.

e) The maintenance facilities for repair of various assemblies should be similar for what has been recommended for POH.

f) Do not allow wagon to come out from ROH repair without APD & additional APD of DV and APD of angle cock.

g) After complete maintenance of the wagons testing should be done as given in para 820.

824. PERIODICAL OVERHAUL OF AIR BRAKES SYSTEM

The following procedure shall be followed for the POH of Air Brake Equipment

i) Remove APD of DV & Angle Cocks from wagon.

ii) Remove all assembly i.e. DV, Brake cylinder, Angle cock, Auxiliary Reservoir and Dirt Collector from Wagon.

iii) Remove Guard's emergency brake valve, Isolating cock and quick coupling also form brake van.
iv) Remove automatic load changeover device also from wagon in case of BOBR/BOBRN Wagons
v) Remove pipe bracket, pipe clamps, pipe joints and strip all pipes.
vi) The pipes should be slightly hammered to loosen the rust and scale.
vii) After de-scaling, pipe must be blown with dry compressed air to ensure complete cleaning of rust and scale.
viii) Clean the outside of all pipes thoroughly.
ix) Examine all pipes for damage, cut, corrosion, etc. Damaged and heavily corroded pipe must be replaced.
x) Examine joints for the following damage:

a) Sockets for cracks
b) Fixed Flanges for straightness
c) Sockets and flanges for Corrosion/damages & replace defective parts.

xi) Replace all rubber items of pipe joints irrespective of conditions of old items.
xii) Assemble pipe joints. Tight bolts properly and secure them by spring washer and nut.
xiii) Fit, properly overhauled and tested, following assembly.

a) DV. In case new DV is fitted it should be ensured that casting tag is available on DV.
b) Pipe bracket
c) Dirt Collector
d) Both Angle Cocks
e) Brake Cylinder
f) Auxiliary Reservoir
g) Guard's emergency brake valve in case of BrakeVan.
h) Isolating cock in case of Brake Van.
i) Quick Coupling in case of Brake Van.
j) Automatic empty load change over device in case of BOBR/BOBRN Wagons.

Use new rubber items for joints between pipe and equipment irrespective of condition of old items.

xiv) Properly secure nut and bolts of joints between pipe and equipment.
xv) Examine all pipe and pipe fittings and brackets and properly secure them. Pipes should not be loose inside the pipe clamps.

xvi) Fit following APD :

a) Additional APD of DV.
b) APD of DV.
c) APD of Angle Cock

xvii) Fit overhauled Hose Couplings at both ends of Brake Pipe.

xviii) **PAINTING**

All items shall be painted black as per standard practice.

xix) **MARKING**

Besides standard marking, details shown in Drg. No. WD-93003-S-01 shall also be stencilled on the sole bar.

xx) For overhauling of various assemblies removed from wagon, follow the procedure given in various Annexures of RDSO publication No. G-97 (1996) as mentioned below :-

S.No.	**ASSEMBLY**	**ANNEXURE**
1.	Distributor Valve	I
2.	Brake Cylinder	II
3.	Dirt Collector	III
4.	Angle Cock	IV
5.	Auxiliary Reservoir	V
6.	Hose Coupling	VI
7.	Guard's Emergency Brake Valve	VII
8.	Isolating Cock	VIII
9.	Load Sensing Device	IX
10.	Pipes & Joints	X

xxi. TESTING OF WAGON BRAKE EQUIPMENT

Single Wagon Test

This test shall be conducted on the wagon with Single Wagon Test Rig. The procedure and the specified values are given at para 820.

If the values obtained are not within the specified limits, identify the defects and rectify the defects. Single Wagon Test shall be carried out once again after rectification.

Wagons with air brake system not meeting the complete requirement of single wagon test should not be allowed to come out from POH. In case of new DV, the casting tag shall be removed after the wagon has passed the test.

xxii PRECAUTION

a) It must be ensured that rubber items of pipe to pipe joints and pipe to equipment joint do not get damaged during fitment.
b) It must be ensured that pipes are properly secured so that these do not vibrate on run and consequently result in leakage from joints.
c) During assembly, it must be ensured that foreign particles or dust etc. are prevented from entering inside the pipes and equipment.
d) It must be ensured that POH wagons coming out of workshop are fitted with hose coupling support at both ends.

825. DETAILS OF TOOLS, FIXTURES AND EQUIPMENT

List of tools, fixtures and equipment's with specification required to mount/dismantle the subassemblies of air brake system are as under

Sr. No	Description	Size
	General Tools :	
1.	Open End spanner	11-13 mm 17-19 mm 20-22 mm 24-27 mm
2.	Ring Spanners (Hexagonal or bi-Hexagonal)	17 mm,19 mm, 32 mm,36 mm, 37 mm, 47 mm, 57 mm, 58 mm
3.	Box Spanners	A/F 9 mm,13 mm, 14 mm,16 mm, 26 mm, 27 mm, 28 mm.
4.	Allen keys	A/F 5 mm, 6 mm, 8 mm, 17 mm
5.	Screw driver	6 mm blade, 3 mm blade and 10 mm blade
6.	Circlip pliers set (Internal & External)	Small, medium & large
7.	A. General Plier B. Long Nose Plier	200 mm 150 mm
8.	Socket wrenches with Driving handle 1. 'L' shaped 2. Ratchet (R&L) 3. Torque calibrated	13 mm, 17 mm,19 mm, 22 mm, 27 mm, 32 mm & 50 mm.

9.	A. Hammer (Nylon) B. Hammer (Steel)	200 mm 150 mm
10.	Torque wrench	1.7 to 6.5 m-kg. (Range)
Special Tools: KE- Type		
11.	Diaphragm Tool 4A54802	
12.	Adjustment Tools 4A59318	
13.	Tools for Locking screw of bottom cover 3KB3349	
14.	Clamping fixture or DV holding fix	
15.	Wrench for Max. Limiter 4A47740	
16.	Installation Tools (Assembly punch) 4A93186	
17.	Thrust piece	
18.	Installation hook	
19.	Adjusting key	
20.	Guide Tool for pin (92) Pressure rod (1A) sub assembly	
Special Tools: C3W –Type		
21.	SCT6014 Two-pin tool for part no. 74	
22.	SCT6016 Two-pin tool for part no. 72	
23.	RPBF 0003 Holding fixture for guide 76	
24.	Socket Spanner (SCT6092) 50 mm	
25.	Stem leading Tool (SCT6017)	
26.	Bent Tool (SCT6026) for removing air from diaphragm	
27.	"O" Ring positioning (SCT 6015) Tool	

(b). DIRT COLLECTOR

Sr.No	Description	Size
1.	*General tools :* Single end spanner	A/F 27 mm
2.	Socket spanner	19, 22, 24 mm
3.	Double Ended spanner	(17-19); (22-24)
4.	DC- holding fixture or vice with semi-circular jaws	125 mm
5.	Screw driver	8 mm (Blade)

(c). BRAKE CYLINDER

Sr.No.	Description	Size
1.	Brake cylinder Assembly Fixture	
2.	*General Tools :* Torque wrench	Torque of 200 cm-kg.
3.	Socket wrench	19 mm
4.	Ring spanner	Bi-hex (19-24)
5.	Screw driver	8 mm blade
6.	Double Ended spanner	A/F 13x14 mm, 32x36 mm

(d). AIR RESERVOIR

Sr.No.	Description	Size
1.	Open end spanner	A/F 28 mm A/F 22X24 (17-19) (22-24)
2.	Socket spanner	19,22 mm, 24
3.	Screw driver	8 mm Blade

(e). CUT OFF ANGLE COCK

Sr.No.	Description	Size
1.	Open end spanner	A/F 63
2.	Double open end spanner	(11-13), (17-19)
3.	Screw driver	8 mm Blade

(f). SLACK ADJUSTER

Sr.No.	Description	Size
1.	Double Ended Spanner	(11-13)
2.	Special spanner (E)	
3.	Circlip plier spring type (C) (External)	203.2 mm to 250 mm
4.	Circlip plier bend nose type (Internal)(D)	250 mm to 304.8 mm
5.	*Special Tools :* Jacking Tool (B)	

(g). HOSE COUPLING

Sr.No.	Description	Size
1.	Pipe wrench	450 mm
2.	Open end tool	55, 65

826. BRAKE POWER CALCULATIONS FOR BOXN WAGON

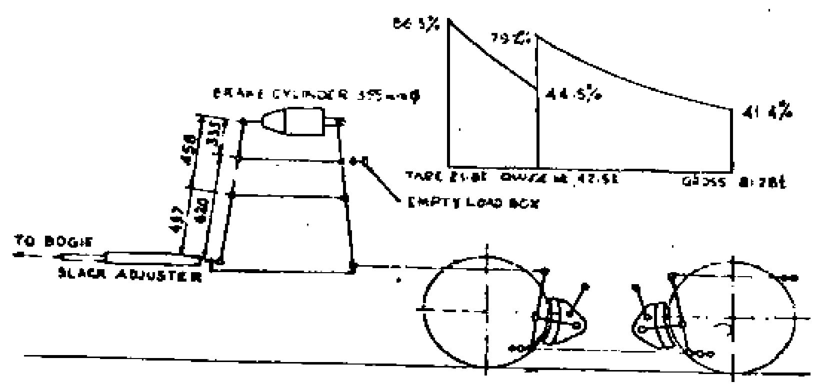


Fig 8.35

TYPE OF BRAKE SYSTEM = AIR BRAKE
BRAKE CYLINDER DIA = 355 mm
NO OF CYLINDERS = ONE
TOTAL EFFECTIVE PISTON FORCE (K)AFTER SUBTRACTION OF RESTORING SPRING FORCE AT A STORKE OF 135mm = 3600 Kg
LEVERAGE

EMPTY $= \frac{335}{620} \times 12 = 6.5$

LOADED $= \frac{458}{497} \times 12 = 11.05$

TOTAL BRAKE BLOCK PRESSURE $P=(K\,i - 12Q)\,\eta$
RIGGING EFFICIENCY $\eta = 0.9$
FORCE OF SLACK ADJUSTER SPRING Q= 200 Kg

P Empty 18900 Kg
P Loaded 33642 Kg

BRAKE PERCENTAGE $\frac{P \times 100}{\text{Tare or gross}}$

BRAKE PERCENTAGE EMPTY $= \frac{18900}{21800} \times 100 = 86.5\ \%$

BRAKE PERCENTAGE LOADED $= \frac{33642}{21800} \times 100 = 41.4\%$

BRAKE POWER AT CHANGE WEIGHT $\frac{P(TARE)100}{CHANGE\ WT}$ $= \frac{18900}{42500} \times 100 = 45.5\%$

$\frac{P(GROSS) \times 100}{CHANGE\ WT}$ $= \frac{33642}{42500} \times 100 = 79.2\%$

827. BRAKE RIGGING

Brake Rigging

- **Bogie Brake Rigging**
  - **With Sliding Brake beams [22w, 22NL]**
  - **With Hanging Brake Beams [22 W (M)]**
- **Body Underframe Brake Rigging**
  - **- Hand Brake Arrangement**
  - **- Empty Load Device**
  - **- Under Gearing Arrangement with slack adjuster**

A. **INTRODUCTION**

The Brake Rigging is provided to control the speed of a wagon by transferring the braking force from Brake Cylinder to wheel treads.

The Brake Rigging can be divided into two groups, as can be seen in the figure above.

I. Hand Brake

General

The Hand Brake provides a means of attaining retarding force with the brake shoe. The BOXN & BCN wagon are equipped with side operated Hand Brake.

Constructional detail

The Hand Brake arrangement consists of the following components:-

1. Hand Brake Wheel
2. Hand Brake Spindle rod
3. Bevel Gear set
4. Hand Brake screw rod with nut
5. Hand Brake connecting links
6. Hand Brake equalising levers
7. Support Bracket
8. Hand Brake pull rod
9. Bevel gear box
10. Sleeve for spindle.

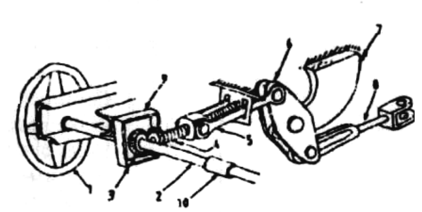


Fig No. 8.36 Hand Brake Arrangement

II. **Empty-load device**

General

The Empty Load device is provided in the Brake Rigging. It is a device by means of which lower leverage ratio for tare/empty condition and higher leverage ratio for loaded condition of the wagon can be obtained by a simple manual operation of a handle.

Constructional details

This device comprises of the following :-

1. Horizontal lever "live'.
2. Horizontal lever "dead"
3. Empty Tie rod in two pieces with sleeve nut
4. Loaded Tie rod
5. Empty load box assembly
6. Empty Load shaft.
7. Change over handle
8. Toothed segment
9. Sign plate
10. Connecting rods – one is plane & another is single twist.
11. Bell crank and pins.

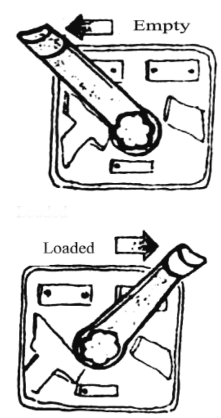


Fig No. 8.37 Empty Load Device

The Sign Plate is painted with two colours. Half yellow (empty) and half-black (loaded) portions indicate positions respectively, to which the change over handle is set.

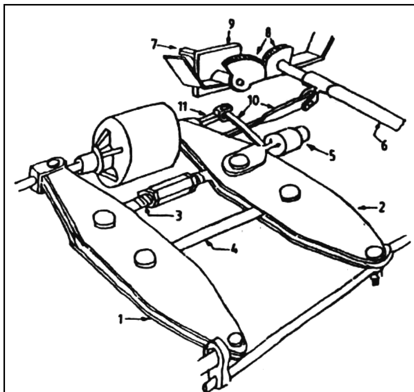


Fig No. 8.38 Empty Load Device

III. Components

Depending on the brake beam arrangements, brake rigging can be of following two types.

Sliding Brake Beam

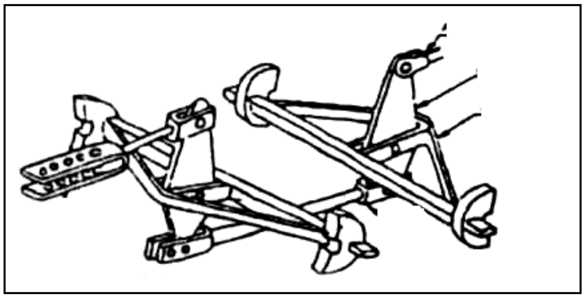


Fig No. 8.39 Sliding Brake Beam

For CASNUB 22W Bogie, the brake beam is of sliding type having fabricated structural steel construction with integral brake head.

For CASNUB 22-NL, NLB, NLM & HS bogies, the brake beam is of sliding type, having fabricated box-steel structure with integral cast steel pieces for strut & brake-heads.

Hanging brake beam without additional brake beam support.

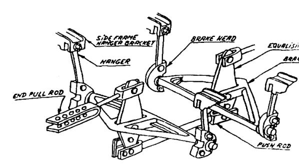


Fig. No. 8.40

Hanging brake beam with additional brake beam support.

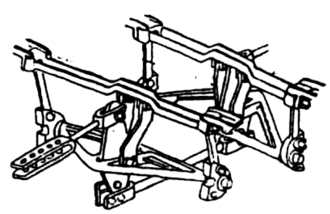


Fig. No. 8.41

Body Underframe Components

Details of components and assemblies used in various types of brake rigging arrangements are given below and shown in figure;

1. End pull rod
2. Equalising lever
3. Push rod
4. Brake beam
5. Brake head assembly
6. Brake beam hanger
7. Brake block
8. Brake show key
9. Brake wear plate
10. Brake gear pins, washers, cotters
11. Short pull rod
12. Long pull rod
13. Control rod with head
14. Horizontal lever
15. Empty tie rod with sleeve nut
16. Loaded tie rod
17. Empty load device
18. Hand brake pull rod
19. Hand Brake arrangement
20. Slack Adjuster

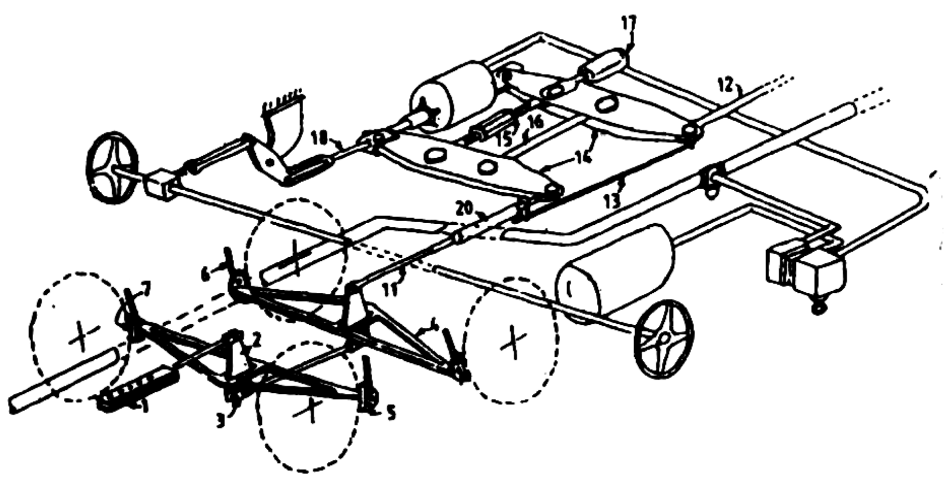


Fig. No. 8.42 Body Underframe

BRAKE-HEAD REPLACEMENT

CASNUB-22NL, 22NLB, 22W, 22NLM & 22HS Brake Beams

a) Remove worn-out brake head. Other members, if damaged, should be built up by welding, followed by proper cleaning and finishing operation, as shown in figure to the right.

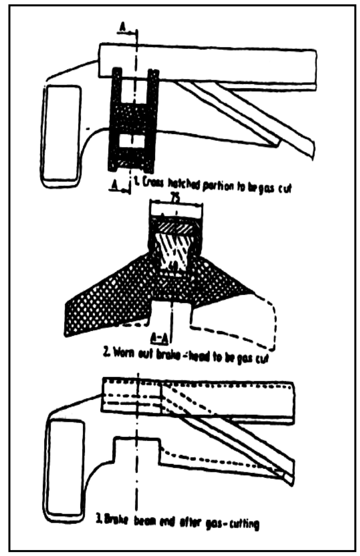


Fig. No. 8.43

b) Weld new brake head at correct position.

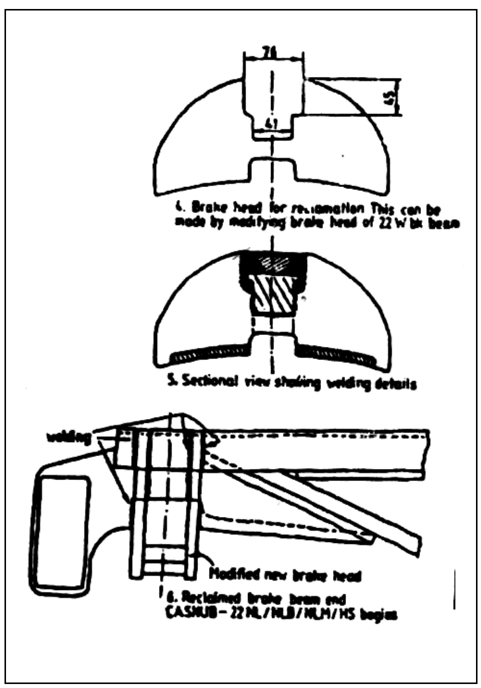


Fig. No. 8.44

CASNUM 22W (M) Brake beam

a) Remove split pin and washer from brake beam ends. Remove pin securing brake shoe adjuster with brake beam by removing
b) Take the Brake Heads out of the Brake Beam along with Brake shoe adjuster
c) Disengage brake shoe adjuster form brake head by removing bolt after disengaging split pin, nut, cover, spring and adjusting piece.
d) Assemble the new brake head with brake shoe adjuster.
e) Secure brake heads on brake beam end by putting washer and split pin.

Holes of end pull rod pins to be used for brake adjustment as per diameter of wheels.

Hole	**Wheel diameter on tread**
A	Between 1000 & 982
B	Between 981 & 963
C	Between 962 & 944
D	Between 943 & 925
E	Between 924 & 906

The figure on next page shows where the holes are.

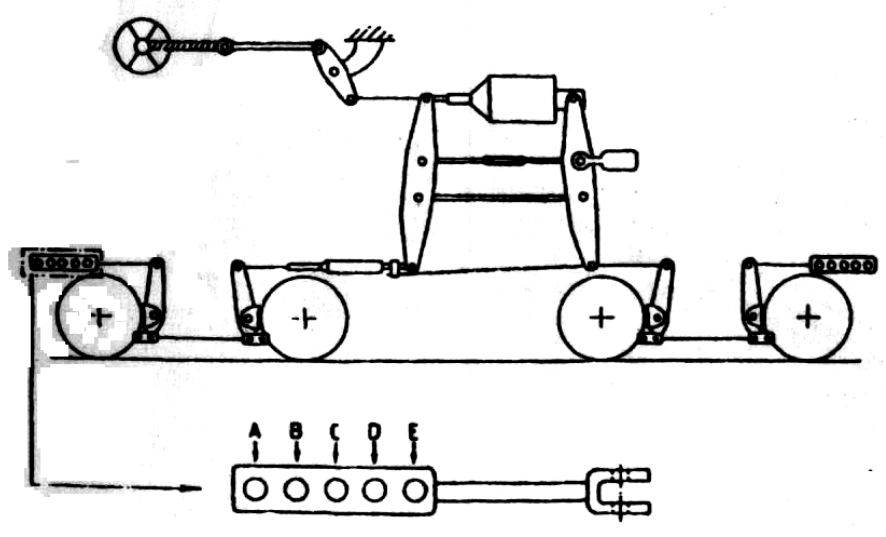


Fig. No. 8.45

828. COMPOSITION BRAKE BLOCK

Indian Railways using cast iron brake blocks for braking on freight stock. The frictional properties of cast iron brake blocks decline with the increase in speeds resulting in increased braking distance. The composition brake block has the following benefits as compared to cast iron brake blocks:-

i) Reduced braking distance due to uniform coefficient of friction .
ii) Reduced weight.
iii) Longer life due to reduced wear of composition brake blocks.
iv) Reduced noise during braking.

Initially L—type composition brake blocks were developed and tried out. After successful trials the decision was taken to progressively switch over to L-type composition brake blocks. Presently following firms are approved for regular supply of L- type composition brake blocks:-

1. M/s Rane Brake Lining, Chennai.
2. M/s Stone India Ltd., Calcutta.
3. M/s Escorts Ltd,. Faridabad.
4. M/s Allied Nippon

Cast iron brake blocks can be replaced by L- type composition brake blocks and condemning limit is the same as that of CI.

K-type composition brake blocks having higher average coefficient of friction are being developed. Moreover adoption of K-type brake block requires change in brake rigging. Development of K-type brake blocks at testing stage at present.

Do's and Don'ts for fitment of Composition Brake Blocks

The following procedure shall be followed to ensure proper fitment of composition brake blocks;

To be done

i) Brake block shoe key shall be of spring steel as per RDSO drawing
ii) Brake head shall be of spring steel as per RDSO drawing
iii) Brake block taper should match with the wheel taper i.e. lower thickness of brake block towards flange of wheel disc and higher thickness towards other side of wheel flange
iv) Sufficient clearance should be created by rotating the barrel of slack adjuster for fitment of brake block

v) The brake block should be fitted from the top of wheel and pressed down so that it sits properly on brake head.

vi) Key shall be inserted from the top and slightly hammered so that it sits properly with the brake head. Slight hammering requirements indicates that the brake shoe key is made of proper material and as per drawings.

vii) Split pins shall be inserted through the brake head whole passing the edge of brake shoe key and ends of split pins should be bent.

Not to be done:

i) No hammering should be done for fitment of brake blocks.

ii) Brake blocks should not be dropped.

iii) Brake blocks should be handled properly and carefully to avoid damages such as chipping / cracking.

iv) Do not store on radius side. (the best way is to store them on the side ways).

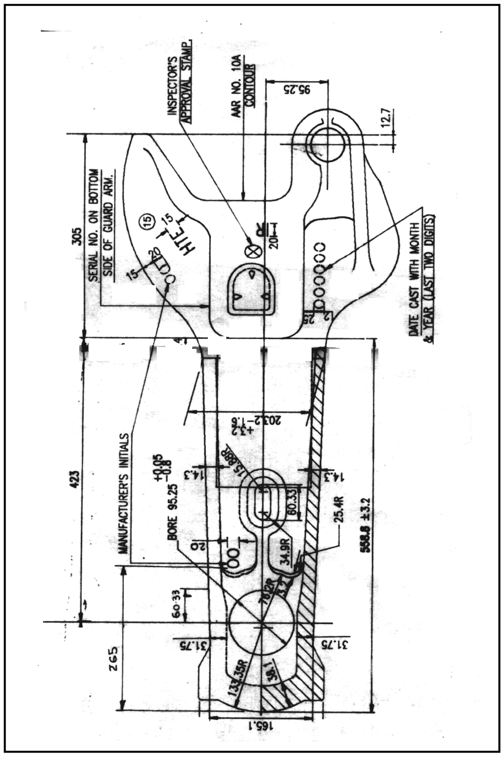
v) Do not strike key if stopped by brake block nib.

vi) Composition and cost iron brake blocks shall not be fitted on same brake beam.

vii) Avoid fitment of composition and cast iron brake block on the same rake to get optimum wear life out of the composition brake blocks.

■■■■■

MAINTENANCE MANUAL
FOR
WAGONS



Chapter – 9 *Draw & Buffing Gear*

CHAPTER 9

DRAW AND BUFFING GEAR

901. GENERAL

There are two main arrangements of draft and buffing gear in use on Broad Gauge. The older arrangement, which is found on few wagons, consists of a screw coupling with side buffers. In this design the draft load is transmitted through the screw coupling, draw hook and draw hook springs while the buffing force is borne by the side buffers. The conventional screw coupling (WA/BD-125) has a working load of 22.5t. The restrictions of size and weight limit the extent to which the draft capacity of this coupling can be improved. Recognizing this fact, the other arrangement on BG wagons is that of a Centre Buffer Coupler (CBC) which transmits both draft and buffing loads. The knuckle type centre buffer coupler was adopted for BOX, BOXN and other new design of wagons. Later on, a smaller knuckle type coupler, known as the Alliance-II coupler, was introduced for four wheeler wagons. The working strength of CBC and Alliance-II coupler is 120 tonnes and 54 tonnes respectively. CBC also has a transition version called "Transition Coupler" which incorporates a screw coupling and a pair of side buffers to permit attachment with wagons fitted with screw coupling.

902. CONVENTIONAL BUFFING GEAR

The buffing gear plays a vital role in protecting the entire wagon against damages due to impacts. The buffing springs have to perform the basic function of absorbing buffing impacts received in service and to transmit these gradually to the underframe. Hence the working capacity of these buffing springs should be adequate to meet these requirements.

The buffing gears are of two types viz. "Long Case" & "Short Case". Long case buffers are higher capacity buffers. These are provided on bogie stock to protect the head stock and underframe from damages. It has a capacity of 1030 kg-m as the momentum of bogie stock in marshalling/shunting is greater than that of four wheeler stock.

The short case buffers were used on four wheeler stock and has a capacity of 515Kg-m. It was decided to replace the 515 Kg-m (20 inch-ton) side buffers of four wheeler stock by 1030 Kg-m (40 inch-Ton) capacity side buffers with a view to minimise incidence of damages to Four wheeler underframe as was found inadequate.

The main components of the buffing gear sub-assembly are as under:-

- Plunger
- Buffer casing.
- Spindle
- Outer coil spring.
- Inner coil spring
- Centre washer.
- Washer
- Nut
- Cotter
- Plug.

903. BUFFING GEAR REPAIRS

For POH of buffing gear, IRCA Pt. III Rule No. 2.13 should be followed.

The shop repair practices for various components of the sub-assembly are described below:-

A) **Plunger**- The plunger generally wears on the buffing face or at the portion of the body where it rubs against the casing. It is sometimes patched by means of a M.S. plate secured by six countersunk rivets to provide proper thickness. The wear on the plunger body that occurs due to rubbing against the casing should be rectified by welding.

B) **Buffer Casing** - This item is also subjected to bending owing to heavier shocks in hump shunting or severe jerks during train running. The casings are also subjected to cracking under these conditions. The minor cracks are repaired by heating, straightening and welding using electric arc welding.

C) **Spindl**e – Any damage to the threads is rectified by re-threading and a suitable step size nut. Wear on the portion that moves in the cover washer, buffer casing and head stock is rectified by plaster welding followed by machining and normalizing. The spindle is also subjected to bending. In this case, it becomes necessary to detach the spindle from the plunger by oxy-cutting the plug and straightening. Sometimes, the spindle is also found cracked at the cotter way. Such spindles are to be scrapped.

D) **Outer and Inner Coil Springs-** The springs are subjected to load deflection test and repaired before reuse, if necessary. The other items are generally reused unless found defective or broken.

904. BUFFER PROJECTION

Buffer projection from the headstock on broad gauge wagons should be within limits shown below:

	For Long Case	For Short Case
Maximum	635 mm	456 mm
Minimum	584 mm	406 mm

After POH, the projection shall not be less than 625 mm and 445 mm for long case and short case buffers respectively.

905. BUFFER HEIGHT

Buffer height in B.G. stock shall be within limits given below on level track:

Empty	Loaded
1105 mm (max.)	**1030 mm (min.)**

906. B.G. DRAW GEAR

The draw gear helps in transmitting the tractive effort of the loco to the individual wagons. It has to perform this function smoothly without causing any damage to the wagon structure.

The draw gear arrangement has to be of robust construction and adequately sprung to minimize the impact loads owing to the starting jerks reaching the wagon underframe. The draw gear provides a continuous link between different vehicles comprising the train and failure of any of these can lead to train parting which can cause damages to wagons.

The main components of BG conventional draw gear are as under:-

- Draw Hook
- Draft Key
- Draft link
- Cotter
- Helical Springs
- Washer
- Nut
- Bent Pin
- Screw coupling

The parts of the screw coupling are as under:-

- Shackle
- Links
- Trunion nut
- Ferrule
- Screw
- Washer

The following procedure may be followed for repair of the BG Draw gear and screw coupling components in the workshops.

907. PROCEDURE FOR RECLAMATION OF B.G. DRAW BARS IN WORKSHOP

A. SCREENING DRAW BARS FOR RECLAMATION

For reconditioning by welding/stamping or forging, the maximum permissible wear at the different locations are as follows:-

Location.	Max. permissible wear in mm.
(a) Root of hook near point of contact with screw coupling shackle.	12.7
(b) Shackle pin hole	6.35
(c) Underside of sq. portion of shank	12.7
(d) Cotter hole	12.7

The hooks on which wear is more than above should not be considered for reconditioning.

B. METHOD OF RECONDITIONING

For wear at: -

Location (a)	Reconditioning should be done only by stamping or forging.
Location (b)	For reconditioning of shackle pin hole, bush to be fitted in position.
Location (c) and (d)	Reconditioning should be done by building up with weld deposition.

C. RECONDITIONING BY WELDING

a. The worn out portions to be reclaimed should be ground or filed in order to remove scales, rust, work hardened layers and cracks, if any.

b. The draw bar should be uniformly preheated in a suitable furnace to a temperature between 200 to 250 deg. C before welding and soaked for at least one hour at the preheating temperature.

c. Welding should be carried out in down-hand position following the sequence in accordance with RDSO Sketch No. SK 69075.

d. Low hydrogen type of electrodes approved under class D or class E of the approved list of electrodes issued by RDSO should be used. Class

E electrodes are preferred. The electrodes should be preheated between temperature 120 and 150 deg. C for atleast one hour immediately before use.

The usual precautions for using low hydrogen type electrodes should be carefully followed i.e. use of shortest possible arc, avoiding weaving as far as possible etc. The polarity and current range recommended for the particular brand of electrode by the electrode manufacturer should be strictly adhered to.

I. Stray arcing on the portions which are not covered by weld deposits should be avoided.

II. The number of layers to be deposited varies according to wear. Either 4 mm or 5mm dia. electrodes should be used.

III. Inter pass cleaning in case of multi-run deposits should be carried out properly to avoid slag entrapment.

e. After welding, the draw bar should be heated to hardening temperature of 840-860 deg. C, soaked at the rate of 1/2 hr. per 25 mm of thickness and quench in oil Temper at the temperature between 550-600 deg. C (soaking period atleast 1/2 hr. per 25 mm of thickness) and then allow to cool in air.

f. The reclaimed portion should be dressed smooth and flush with contour of the portion built up.

g. The weld metal and heat-affected zone after the cleaning should be tested with magnetic crack detector/surface penetrant.

D. RECONDITIONING BY STAMPING/FORGING

a. Make sure that sufficient material is available in the hook portion of the worn out draw bar for carrying out stamping or forging for reconditioning. Where sufficient material is not available, drawbars should be condemned.

b. For stamping/forging, the draw bar should be soaked at a temperature of 1050-1100 deg. C for three hours. No stamping/ forging should be continued when the temperature falls below 900 deg. C.

c. After forging, the draw bar should be cooled and fins removed.

d. Heat to hardening temperature of 840 - 860 deg. C, soak at the rate of ½ hr. per 25 mm of thickness and quench in oil. Temper at a temperature between 560 - 600 deg. C (soaking period at least 1/2 hr. per 25 mm of thickness) and allow to cool in air.

e. **Proof load Test**- Each reconditioned draw hook shall be subjected to a proof load of 36 tonnes and must not show any signs of permanent set under that load as indicated in IRS specification No. R-11-67 Clause 7.1.

f. All drawbars reclaimed should be stamped with the shop code initials, date, month and year for easy identification and reference in case of failures.

908. PROCEDURE FOR RECLAMATION OF B.G. SCREW COUPLING IN WORKSHOPS

A. TRUNION, TRUNION NUT AND SHACKLE PINS

The wear on the trunion nut and worn shackle should not be repaired by welding and these should be discarded when worn to permissible limits. The maximum permissible wear at trunion pin (nut) as well as for shackle pin is 3.17 mm.

B. PROCEDURE OF RECONDITIONING SHACKLES OF SCREW COUPLINGS BY WELDING

The shackle of screw coupling develop wear at both the EYES and on the bend where it rubs against the hook of draw bar. The worn out shackle can be repaired by welding. The reconditioning procedure is detailed below:

a. The worn out portions to be reclaimed should be ground or filed in order to remove scales, rust, work-hardened layers and cracks, if any.

b. The job should be uniformly preheated to 200 deg. C to 250 deg. C prior to welding.

c. An approved brand of low hydrogen type of electrode classified under class 'E' by R.D.S.O. should be used.

I. The low/hydrogen type electrodes to be used should be heated 130 deg. C to 150 deg. C for at least one hour immediately before use.

II. The usual precautions for using low hydrogen type electrodes should be followed i.e. use of shortest possible arc, avoiding weaving as far as possible etc.

d. After welding, the shackle should be hardened heating to 840 - 860 deg. C (soaking at the rate of 1/2 hr. per 25 mm of thickness) and quench in oil. Temper at 550-600 deg. C soaking at the rate of 1/2 hr./25 mm of thickness and allow to cool in air.

e. The welded portion should be dressed smooth by filing / grinding.

f. While repairing transition coupling, it should be ensured that trunion washers used in the assembly are according to R.D.S.O. Drg. No. SK-69503. The washers should preferably be riveted properly on the trunion lugs.

g. **Heat Treatment -** All screw coupling assemblies, spare shackles, trunion nuts ,screws, links and pins shall be suitably oil quenched and tempered as per the following procedure-

"Heat to hardening temperature of 840 - 860 deg. C soak at the rate of 1/2 hr. per 25 mm of thickness and quench in oil. Temper at a temperature between 550 - 600 deg. C soaking period at least 1/2 hr. per 25 mm thickness and then allow to cool in air.

909. MAINTENANCE OF DRAW GEARS DURING RE-PACKING AND NORMAL REPAIRS IN SICK LINE

A) Check all draw gear components for correctness and ensure that they are properly assembled.

B) Pay special attention to draw bar assembly to prevent excess play.

C) Correct type and size of draw bar springs, sufficient plain washers of 13 mm thickness beyond the spring and inside the nut must be provided which must be tightened sufficiently to clear the cotter slot and a correct size of cotter used and properly split to avoid slackening.

D) Use of non-standard material such as shackles and pins manufactured locally in sick line should be avoided.

E) Repair to drawbar, screw couplings and their components are prohibited in sicklines as they are not provided with stress relieving facilities. It must be ensured that only metric size nuts are used on metric size drawbars.

F) Screw couplings of wagons passing through sick lines should be oiled and greased.

G) When re-packing is done on M.G, the draw gears components should be checked. The main draw bar nut is to be removed and refitted to ascertain if the fit of the thread is tight.

910. REPAIR & REJECTION RULES

The **s**taff in workshops and maintenance depots should strictly follow repair practices embodied in IRCA Part III Rule No. 2.14.1 to 2.14.16.3 for BG and MG. Rejection rule No. 4.9.1 to 4.9.17 for BG and Rule No. 4.10.1 to 4.10.13 for MG.

911. CENTRE BUFFER COUPLER & DRAFT GEAR

A) Indian Railway uses AAR type centre buffer couplers having E-type head and F-type shank for freight stock on Broad Gauge system. These couplers are generally as per requirements of AAR specifications M-201, M-205 and M-211.

B) The draft capacity of the AAR coupler depends on the strength of knuckle, which is weakest link in the assembly. The yield strength of knuckle of material AAR M-201 Grade `C' & Grade `E' is 132t and 180t respectively.

C) ADVANTAGES OF AAR CENTRE BUFFER COUPLER

- Coupler and buffing gear are both located together at the centre of the wagon.
- Centre buffer coupler is identical at either end of the wagon and hence wagon direction is immaterial.
- Coupling action between wagons is automatic.
- With transition arrangement, coupling with screw coupling is possible.

912. PARTS OF CENTRE BUFFER COUPLER ASSEMBLY

The main parts of Centre Buffer Coupler are as under:-

i) Coupler body
ii) Knuckle
iii) Knuckle pivot pin with washer
iv) Lock
v) Knuckle thrower
vi) Toggle
vii) Universal lock lift lever connector
viii) Lock lift lever hook
ix) Lock lift rivet
x) Lock lift lever rivet
xi) Top lifter hole cap
xii) Yoke pin
xiii) Yoke
xiv) Yoke pin support.
xv) Striker casting
xvi) Striker casting wear plate
xvii) Shank wear plate
xviii) Yoke support plate
xix) Draft Gear arrangement with front follower
xx) Safety bracket with anchor plate
xxi) Uncoupling gear arrangement
xxii) Back stop
xxiii) Clevis for Transition type coupler only
xxiv) Screw coupling for Transition type coupler only
xxv) Clevis pin for transition type coupler only

All parts of non-transition coupler are identical and therefore inter-changeable with those of the transition type coupler except striker casting with wear plate and coupler body with shank. In transition CBC coupler body with shank is longer and provided an arrangement to fit clevis with the help of clevis pin.

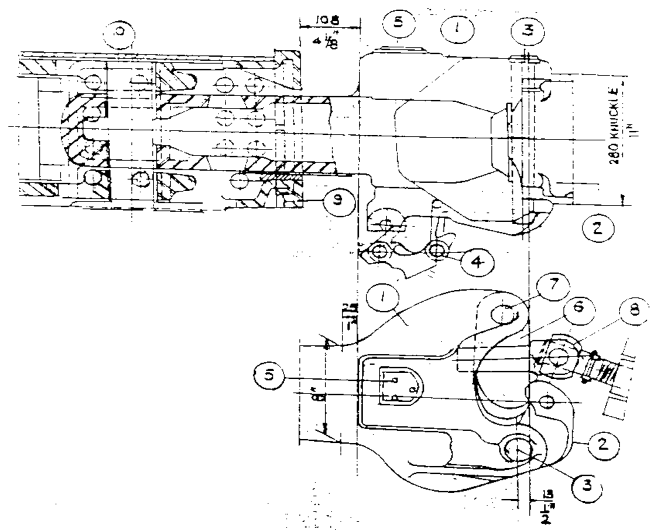


Fig. 9.1 TRANSITION COUPLER

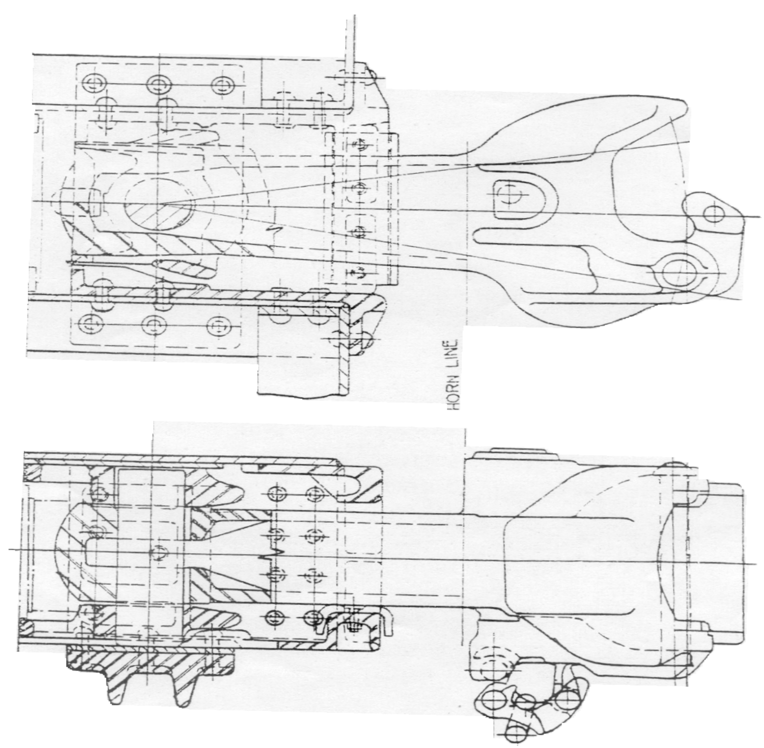


Fig. 9.2 NON-TRANSITION CBC

913. INSPECTION OF CBC

A) **Coupler and operating mechanism:** When inspection of coupler and coupler operating mechanism is made, it is important to check and make sure that when the coupler operating mechanism is operated to fully open the knuckle, the handle released and the knuckle slowly closed, the lock drops freely and the mechanism returns to fully locked position. The lock position is indicated by the toggle, which is clearly visible below the coupler head.

B) Only dry lubricant shall be applied to the coupler head or the coupler head fittings. This lubricant may be applied using water, alcohol, or other non-petroleum based carrier.

C) Only exposed surfaces of Coupler and Yoke shall be painted with Black quick drying paint in accordance with IRS R6. Paint must be applied to the inside of the Coupler or internal fittings. Painting shall be done after the completion of inspection of Coupler & Yoke of acceptable casting lot.

D) When in the transition Centre Buffer Coupler, the knuckle does not move freely, grind the top face of "top pulling lug" and "lock face" of knuckle in position. If still not free, remove knuckle and clean "pin protector guides" on coupler head. If, after attending to knuckle, the lock still does not fall, remove the lock and grind “locking face knuckle side” on lock so that the lock falls freely.

E) Inspection of couplers, whilst fitted to wagons, should be made to ensure that proper clearance is available to prevent interference in any position which it can assume during train operation. The procedure is as follows:-

a. Check correct operation in order to ascertain that full knuckle throw, lock set, lock-to-lock (anti-creep) and locking is obtained ,if any of these functions be unsatisfactory, they should be corrected by replacing the defective components.

b. Check that the shank is not bent out of alignment with the head. If defective, the coupler shall be removed for straightening of shank.

c. Examine shank wear plates (when fitted) and if worn through, the couplers shall be removed for fitting of new plates. Examine wear on shank (when wear plates not fitted) and if wear is approaching 6.5 mm (1/4"), the coupler shall be removed for building up of shank by welding.

d. Examine head for cracks in the knuckle side wall. If cracked, the coupler shall be removed for reclamation.

e. Check the distance between the nose of the knuckle and the guard arm with gauge No. 1. If it passes (which is 5.5/16" long), it indicates that the coupler has its condemning limit. In such a case the knuckle pivot pin, lock etc. should be replaced so that gauge No.2 does not pass. If this gauge passes, then the coupler should be removed for reclamation.

f. Examine the operating mechanism. If defective or deficient, the defective or deficient components should be replaced to ensure free movement.

g. Check knuckle pin & clevis pin to ensure that pin of correct size has been used. Check fastening arrangement of knuckle pin and clevis pin. The former has a welded washer while the later has a riveted head over a washer in position.

h. Coupler height should be checked in accordance with IRCA Part III Rule No. 2.13.7.

i. All defective/deficient components shall be replaced in CBC, clevis and screw coupling (in case of transition couplers).

914. INSPECTION OF DRAFT GEARS (HR-40-I & MF-400-I-IR)

A. Excessive slack in draft gears is not permitted and this should be either reduced or eliminated. The maximum permissible free slack in the draft gear is 25 mm(1") after which, it shall be removed and reclaimed or condemned. The free slack can be determined by first sledging the coupler back solid and then measuring the clearance between the coupler horn and the striker face. Next by inserting a long bar between the horn and striker face, pry coupler out as far as possible and again measure the space between the horn and the striker. The difference between these two measurements is the amount of free slack.

B. Visual examination of the rubber pads when the draft gear is in place in the wagon can be misleading and the draft gears shall therefore, be inspected at every POH of the wagon, irrespective of the amount of free slack existing.

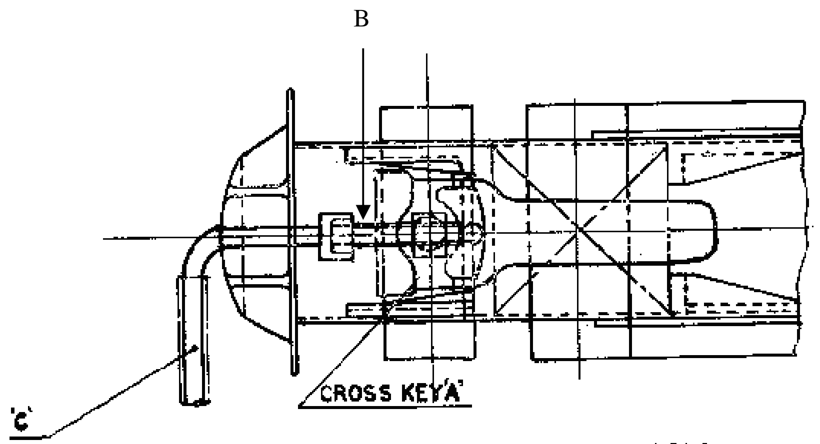
915. REMOVAL OF COUPLER AND DRAFT GEAR FROM WAGON

A) Remove yoke pin support plate by conventional methods. Then remove the yoke pin if necessary by inserting two chisels where the front follower bears hard against striker casting at the draft lugs.

B) The coupler will now be loose and can be pulled out. Care must be taken to avoid personal injury as the coupler weighs over 200 Kg. and its head is heavier than the shank.

C) Remove the yoke support plate by conventional means When the gear is loose in the wagon pocket, the gear and yoke assembly must be supported by jacks or other means to avoid personal injury.

D) To remove the gear and yoke assembly when the gear is tight in the wagon pocket, first apply cross key through front of yoke and position in yoke pinhole. Then apply screw B in cross key A and turn until contact is made with front follower of draft gear. With wrench C, turn screw with the aid of a piece of 38 mm (1 1/2") pipe until gear is loose in the wagon pocket. Remove wrench and lower the gear and yoke assembly on supports from the wagon pocket.



REMOVAL OF DRAFT GEAR FROM WAGONS

Fig. 9.3

E) To remove the draft gear from the yoke, compress the gear by means of screw and insert two pre-shortners as done during assembly. Then release the screw and remove draft gear.

916. COUPLER RECLAMATION PRACTICES

A. COUPLER BODY

a. Coupler body with broken or missing parts shall be scrapped. Building up of worn surfaces inside the coupler head such as pulling lugs, buffing shoulders, lock wall etc. is prohibited.

b. Cracks: Cracks on the coupler body may be repaired by welding, but the body shall be normalized after welding. Cracks in the guard arm of front face may be welded provided, they do not extend through the full thickness of the front face.

Note: After reclamation of coupler body and knuckle, check with gauge No 4 to ensure that contour has been properly restored.

B. SHANK

a. **Shank Length**: Shank length should be measured from the horn to the crest of the butt. It should conform to the dimensions shown in Fig. below.

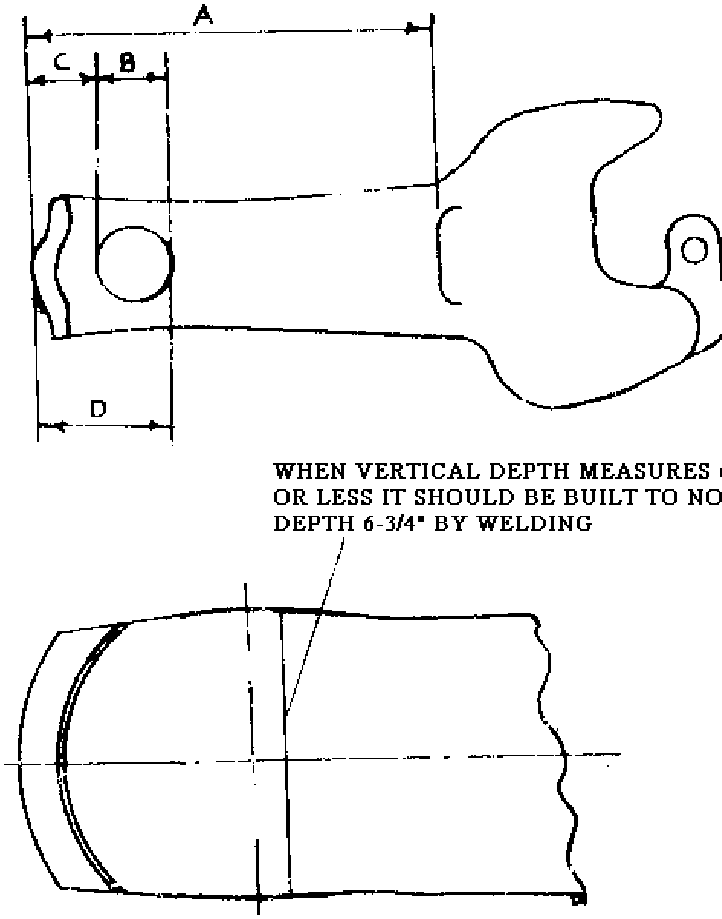


Fig. 9.4 SHANK LENGTH

If the butt is worn it may be built up by welding using suitable electrodes. After welding, surface ground reasonably smooth to fit gauges. While building up it must be ensured that the shank length is increased only by the amount necessary to restore the dimension "yoke pin hole to butt" but must not exceed the maximum. After welding, the coupler body shall be normalized in accordance with the instructions.

	Before Reclamation Min.	After Reclamation Min.	Max.
		TRANSITION	
A.	723.9mm(28 1/2")	733.4 mm(28-7/8")	739.8mm(29-1/8")
B*	98.4mm(3-7/8")	95.3+.051mm -.8	(3-3/4" + 0.002") - 1/32")

C.	74.6mm(2-15/16")	84.9mm(3-11/32")	88.9mm(3-1/2")
D.	173mm(6-13/16")	182.6mm(7-3/16")	185.7mm(7-5/16")

STRAIGHT

A.	546.1mm(21-1/2")	555.6mm(21-7/8")	562mm(22-1/8")
B.	98.4mm(3-7/8")	95.3+ 051mm - .8	(3-3/4" + .002") - 1/32")
C.	74.6mm(2-15/16")	94.9mm(3-11/32")	88.9mm(3-1/2")
D.	173mm(6-13/16")	182.6mm(7-3/16")	185.7mm(7-5/16")

* No reclamation for building up of wear on dia. is permitted. However, nominal dimensions is 95.3 (+0.051mm; -0.8 mm) or 3-3/4" (+ 0.002"; -1/32")

b. **Shank depth**: When vertical depth of shank is 165 mm(6 1/2") or less, it shall be built up to the normal depth of 171 mm (6-3/4") by welding and then normalized.

c. **Yoke pin hole in shank** :Building up of yoke pin hole is prohibited. However, the coupler may be used until the yoke pin hole diameter reaches 98 mm.

d. **Shank wear plate**: When thickness of shank wear plates is 5 mm, it should be replaced by new shank wear plate.

e. **Bent Shank:** A bent shank may be straightened under a press after heating to 845 deg.C. Care should be taken to bring the head into proper alignment within limits and then allowed to cool in still air. Before use, the coupler body shall be carefully examined for cracks that may have developed as a result of the straightening.

C) **Guard arm** : Coupler body with distorted guard arm may be restored either in a press or with light hammer blows after heating. Care should be taken to heat only a small area to prevent distortion of the opening in the front face of the coupler. After rectification the coupler body shall be normalize and then checked by Guard Arm Distortion on Gauge No.67.

D) **Knuckle**: (Nose wear stretch and cracks) Building up of nose wear on knuckles is hitherto prohibited. All knuckles exceeding the limits of gauge No. 3 for nose wear stretch shall be condemned.

a. Knuckle Pivot Pin:- Pins having steps or cracks or which have a diameter less than 40 mm at any point shall be condemned.

Bent pins may be reclaimed by heating, then straightened and allowed to cool in still air. Finally the pins shall be heat-treated to a hardness of 250-305 Brinell.

b. **Knuckle Thrower**:- Knuckle thrower excessively worn, broken, bent or otherwise distorted, shall be condemned.

E. **Hub Wear**: When hub height is less than 202.4 mm (7- 31/32"), it may be built up by welding the bottom hub face to the maximum height allowed by gauge No.8. After welding, knuckle shall be normalized and tempered in accordance with the heat treatment instructions.

F. **Pulling lug and pin protector wear**. Worn pulling lugs and pin protector bosses may be built up by welding within the limits of gauges 10 (top) and 11 bottom).Top and bottom pin protector gauge No.12 (Refer RDSO's Technical Pamphlet No. G-80 for Figures of gauge) shall be used to check the pin protector bosses separately after welding. After building up, the knuckle shall be normalized and tempered in accordance with heat treatment instructions.

G. Lock

a. Lock engagement surface wear: Wear on lock engagement surface may be built up by welding to the limits of gauge No. 9. After building up, normalizing or tempering is not required.

b. Depressions found on lock as a result of contact with the knuckle or coupler body lock engagement surfaces may be built up by welding. The building up shall only be to the level of the surrounding surface of the lock face. Normalize and quench/temper in accordance with the heat treatment instructions.

c. **Lock lift assembly**:- Lock lift assembly excessively worn, broken bent or otherwise distorted shall be condemned.

H. **Clevis and Clevis Pin**:- Clevis shall not be built up by welding. If worn more than 3 mm it shall be condemned. Pins having steps or cracks or which have a diameter less than 37 mm at any point shall be condemned. Bent pins may be reclaimed by heating, then straightened and allowed to cool in still air. Finally the pins shall be heat-treated to give a hardness of 250-305 Brinell.

I. The reclamation practice for screw couplings is similar to IRS WA2 screw coupling.

917. DRAFT GEAR RECLAMATION PRACTICES FOR CARDWELL WESTINGHOUSE (HR-40-I) DRAFT GEAR

A. YOKE

Building up wear on straps or in the yoke pin hole is prohibited. However, if yoke strap is worn 3 mm or less at contact with support plate, it may be inverted and reused. If yoke strap is worn more than 3 mm, the yoke shall be condemned. Maximum wear of 1.6 mm (1/16") on diameter is permitted in yoke pin hole. If wear exceeds this limit, the yoke shall be condemned.

B. YOKE PIN

Pins bent or having steps or cracks or if diameter is reduced by 3 mm at any point, they shall be condemned.

C. HOUSING

Building up of wear on housing is prohibited but a wear upto a maximum of 3 mm in depth on either side is permitted. Housings having excessive wear or cracks shall be condemned.

D. INTEGRAL FOLLOWER

Building up of wear to a depth of 3mm is permitted.

E. RUBBER PADS

Rubber pads may be reused provided no pads are bent, worn, broken or have rubber separation in excess of 38 mm deep x 127 mm wide. Damaged pads may be replaced by used serviceable pads removed from other gears. New pads should not be used as far as possible with old pads as fitting will not be satisfactory.

F. RUBBER PACK

a. The pack with 11 Nos. of rubber pads and 10 Nos. of spacer plates, when assembled in the housing with follower, shall not be less than 632 mm (24-7/8"). Slack more than 13 mm (1/2") below 619 mm (24-3/8"), shall be built up by use of either spacer plates or one rubber pad. For stability reasons the use of not more than one additional pad is recommended. Any worn pad shall not be replaced by steel shims. During reconditioning, precautions be taken to prevent oil or grease coming in contact with rubber pads as these substances shorten the life of the pads.

b. When draft gear is removed for causes other than lateral misalignment of pads and there is less than 6.35 mm(1/4") slack in the front unit, this unit may be reused. Prior to reusing, measure height of unit. If less than 187 mm (7-3/8") but not less than 168 mm (6-5/8"),a steel shim, 216 x 267 of sufficient thickness to restore the height to 187 mm (7-3/8") may be stitch-welded all around intermediate follower. Units measuring less than 168 mm (6-5/8") shall be scrapped.

c. When the front unit of pads is broken or damaged or found tight in the intermediate follower, it can be pressed out by using a 12.7 mm (1/2") steel pusher plate 203 x 179 m.(The width is required to bear on all 7 rubber pad steel inserts and still clear the followers). The intermediate follower must be blocked upto a height 229 mm or more (9" or more) that will allow the unit of pads to clear. Retaining tabs on both end pads must be straightened prior to pressing out the unit.

G. REAR CUSHIONING UNIT

a. The rear unit of rubber pads can be reused provided no pads are bent, worn, broken or have rubber separation in excess of 38 mm deep x 127 mm width. Replacement of the pads can be made with used serviceable pads removed from other gears. The use of new pads with used pads is not recommended as fitting between such pads will not be satisfactory.

b. Prior to re-application of a used rear unit of pads, measure its height. When the unit measure 188.9mm (7-7/16") or less but not less than 171.5 mm(6-3/4") a steel shim 216 x 305 mm of sufficient thickness to restore the height to 188.9 mm(7-7/16") can be used.

H. WAGON POCKET

Prior to re-application of the reconditioned gear to the car pocket measure the pocket. If greater than 628.6mm (24-3/4") build upto 625.5 mm (24-5/8") (+ 0-1/16" tolerance) by applying steel shims to back steps. To avoid unequal loading the pocket shall be kept square within 1.6 mm (1/16").

918. RECLAMATION PRACTICES FOR NATIONAL RUBBER (TYPE MF 400-I-IR) DRAFT GEAR

A. YOKE AND YOKE PIN

The yoke and yoke pin shall be reclaimed as detailed in 917 A and 917B above.

B. FOLLOWERS

Building up of wear on follower casting is prohibited. Normally, there is very slight wear and wear up to a depth of 3.2 mm (1/8") is permitted.

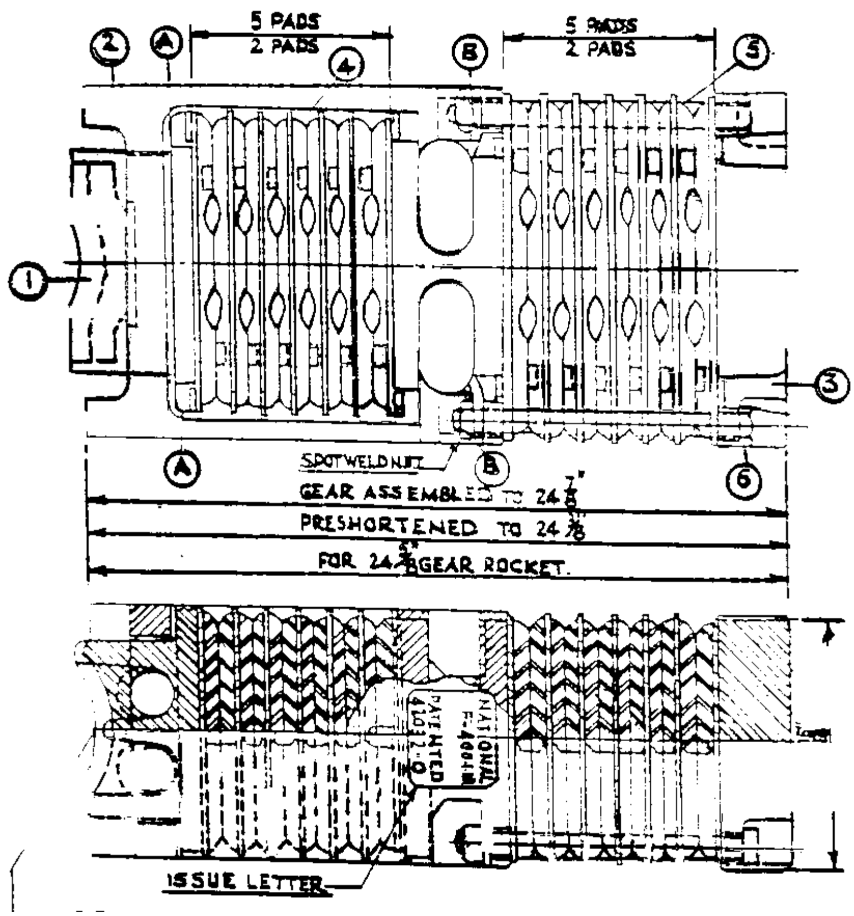


Fig. 9.5 RELEASED DRAFT GEAR

C. FRONT COMPENSATING UNIT

a) The front unit of rubber pad is to be replaced with a new unit when either of the following conditions is found:

I. More than 6.35 mm (1/4") slack in the unit length less than 168 mm (6-5/8").

II. Lateral displacement of pads to the extent where pads are being damaged.

b) Pads bent ,broken or having rubber separation from steel insert in excess of 38 mm deep by 127mm in width be stitch-welded all around to gear of the intermediate follower. Units measuring less than 171.5 mm (6-3/4") must be scrapped.

c) In either the front unit or the rear unit, rubber pads shall not be replaced by steel shims as it affects the characteristics. Similarly more than the original number of pads should not be provided. During reconditioning precautions shall be taken to prevent oil or grease from contacting the rubber pads, as these substances will shorten the life of pads.

d) Wagon Pocket

Prior to re-application of the reconditioned gear to the wagon pocket, measure pocket and if greater than 628.6 mm (24-3/4") built upto 625.5 mm (24-5/8") (+0-1/16 tolerance) by applying steel shims to back steps. To avoid unequal loading the pocket shall be kept square within 1.6mm (1/16").

919. DEVELOPMENT OF HIGH TENSILE COUPLER & HIGH CAPACITY DRAFT GEAR

On BG system, to minimize the maintenance problem and to run heavy hauled freight train, the existing grade `C' type coupler have been replaced to grade `E' type coupler known as high tensile coupler. A comparative chart of grade `C' and grade `E' coupler is given below:

	Material AAR M-201 & AAR M-211		Ultimate Tensile strength (in tonnes)		Yield strength (in tonnes)	
	STD.	HT.	STD.	HT.	STD.	HT.
Coupler body	Gr.B	Gr.E	290	330	169	205
Knuckle.	Gr.C	Gr.E	251	295	132	180

Standard CBC and high tensile CBC are identical in dimension hence no problem to couple each other. Draft capacity of the high tensile coupler also depends on the weakest link i.e. knuckle. The yield strength of the knuckle is 180t compared to 132t in standard coupler. The draft capacity of HT coupler is 36% higher.

The standard draft gears are to be replaced by high capacity draft gears vide Rly. Board`s letter No.84/M(N)/172/3 Vol. I dt. 11.1.90 and 84/M(N)/172/3 dt. 5.7.90. And new freight stocks would be fitted with high capacity draft gears.

- **Mark-50) These are the high capacity draft gears.**
- **RF-361)**

A. COUPLER

i. All bogie wagons manufactured prior to 1984-85 are fitted with HR-40-I or MF-400-I - IR draft gears.

ii. At present freight stock are fitted with high capacity draft gear i.e. **RF-361** & **MK-50**.

B. DESIGN FEATURES OF HIGH CAPACITY DRAFT GEARS

Type of Draft Gear	Wt. (kg)	Capacity (kg.m.)	Travel (mm)	Reaction force (tonnes)	Performance efficiency (%)	Energy absorption (%)
MK-50	170.3	5385	81.5	269.0	23.7	86
RF-361	138.0	5725	67.8	232.3	36.6	79.6

920. RF-361 DRAFT GEAR

This type of draft gear is a fully enclosed, self-contained unit assembled with pre-compression force of rubber pads, so that all parts are tight in relation to one another. Under normal service condition the draft gear is tightly fitted in yoke with front follower plate.

Note :- All the drawing no., part no. and gauge no. mentioned hereunder are as per literature of Burn Standard Co. Ltd., Howrah Works, titled "***INSPECTION AND MAINTENANCE MANUAL FOR HIGH CAPACITY DRAFT GEAR RF-361***"

A. COMPONENTS OF RF-361 DRAFT GEAR

- Housing (cylinder)
- Wedge
- Shoes 3 nos
- Bore inserts
- Top follower
- Rubber pads (Elastomer unit)
- Rear wall plate

A.

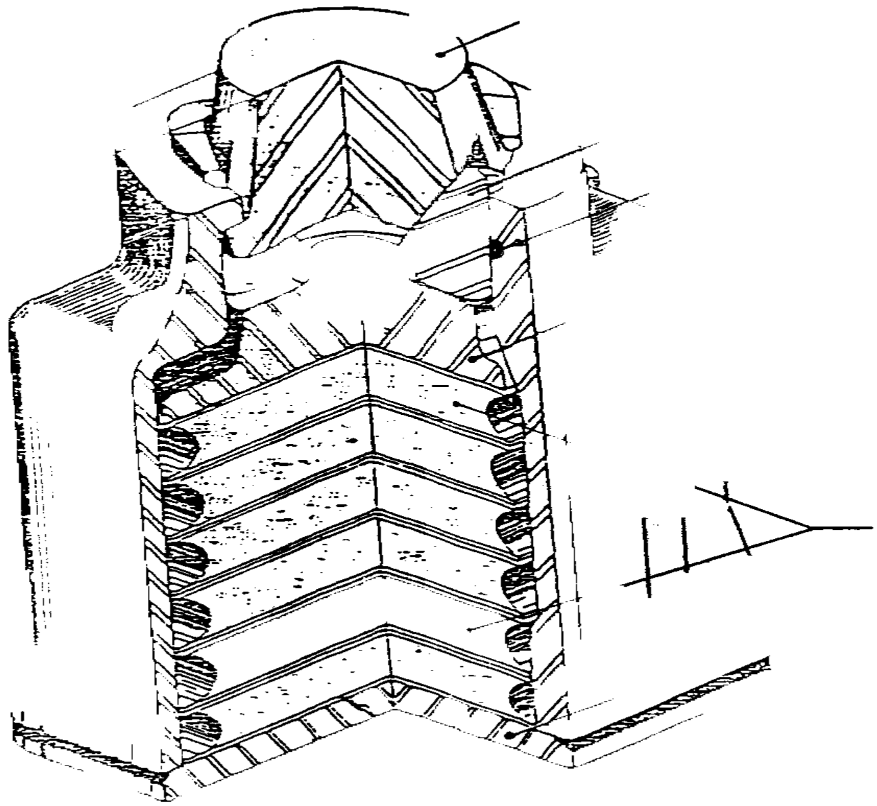


Fig. 9.6 RF-361 DRAFT GEAR

B. LIST OF GAUGES FOR RF-361 DRAFT GEAR

a. Gauges for housing:

- Gauge - 27200) Profile gauge.
- Gauge _ 27706)
- Gauge _ 27257 Flatness gauge.
- Gauge _ 27244 Height gauge (GO & NO-GO)

b. Gauges for Shoes

- Gauge - 27253
- Gauge _ 27254
- Gauge _ 27298
- Gauge _ 27716

c. Gauges for Wedge

- Gauge - 27215
- Gauge _ 27216
- Gauge _ 27266
- Gauge _ 27267

d. Final Inspection gauges

- Gauge - 27207 - Pre-shortened assembled gauge
- Gauge - 27739 - Box gauge

C. MAINTENANCE

a. The RF-361 draft gear will require complete reconditioning, i.e. removal and replacement of the rear wall plate only if the gear has loosed clutch components (shoes & wedges), a broken housing, or a cracked weld at the rear wall.

I. A loose clutch will normally mean that there is either a defective rubber springs package or excessive wear has taken place on the cylinder bore friction surfaces. With a loose clutch, the steel components will usually be moved by hand.

II. A cracked weld indicates poor welding practice during initial assembly causing a fatigue crack, or brittle weld which can fail under extremely high shocks loading etc.

III. If a loose clutch, broken housing, or a cracked weld are not present then only removal and replacement of clutch components is necessary. Normally, clutch disassembly and replacement is the only reconditioning needed in the RF-361 draft gear.

b. DISASSEMBLY PROCEDURE FOR RF-361 DRAFT GEAR

If either the shoes or wedge are broken and clutch is not loose, the following disassembly procedure can be used to replace the broken components.

(I) The following equipment & special tools will be required to remove the shoes and wedge from the draft gear;

i. 200 tonnes vertical open gap press
ii. Assembly block Drg. No.27051
iii. Assembly Ring

iv. A wooden taper wedge plug for the old style hollow wedge or a 76 mm or 3" diameter industrial strength magnet with special long handle for the new solid wedge.

(II) The press should be equipped with an appropriate ram press head to drg. no 27800 to facilitate removal operations.

III. Place the assembly ring over the top outside of the friction bore of the cylinder. Put the assembly block inside the assembly ring so that its three slegs evenly contact the three shoes. Place the magnet on top of the solid wedge, its handle protruding through the hole in the assembly block.

IV. Press down the assembly block compressing the shoes slowly into the gear. While continuing to press on the shoes grasps the magnet or wooden plug handle and rotate the wedge clockwise until the wedge lugs are completely clear of the housing lugs. The top of the shoes need to be almost even with the bottom of the housing lugs before the rotation can be accomplished. Once the lugs are clear to each other compression can be released and wedge and shoes can be removed.

c. INSPECTION OF COMPONENTS

I. SHOES

The shoe, which have to be reused must be free from the following defects.

- No concave wear on any friction surface
- No cracks or spalls
- No wear more than 0.8 mm or 1/32" on any friction surface

II. WEDGE

The wedges which have to be re-used must be free from the following defects.

- No crack or spall of the carburized case on the friction faces or the top of the wedge.
- No wear more than 0.8 mm or 1/32" on the friction surface.
- No indication of broken or any cracks on any of the locking lugs.

III. HOUSING OR CYLINDERS

- The inside friction bore walls must be worn symmetrical and the wall thickness must not be less than 20.6 mm or 13/16"
- There must not be any bottom ridging in the bore.
- Bore taper should be smooth and any concavity must not be exceed 0.8 mm or 1/32". There should not be broken lugs or cracks in the housing.
- The housing should not be bulged outside.
- The housing must pass through profile gauges No. 27706 and 27200.
- Housing base flatness must meet gauge No. 27257.

IV. To function properly, every part of the assembly must be free of oil, grease and moisture. The parts should be kept properly during storage, handling and re-assembly.

V. Wedge and shoes are to be shot-peened to remove rust and dirt before assembly. Shot-peening also allows better visual examination. No sharp edges are to be permitted on these parts, since they could cause cutting and gouging.

VI. For re-assembly, the assembly ring is first placed over the housing. The three shoes are put into position in the bore, and the wedge (with magnet placed over the shoes) with each wedge lug resting on the angled shoulder of a shoe. Next, the assembly block is put over the wedge carefully, pushing the shoes into the housing. When the top of the wedge lug has cleared the bottom of the housing lug, clockwise, the wedge will fall into place and the compression can be released, completing the assembly.

D. COMPLETE RECONDITIONING

a. If complete reconditioning of the gear is required either because of a loose clutch or a broken weld, the shoes and wedge must be removed from the gear in the manner that has been described above. This reduces the internal spring force of the gear stated above.

b. The rear wall plate must be removed from the gear housing for complete dis-assembly. The gear should be mounted in a holding fixture incorporating a hydraulic press acting axially on the housing ends. Lock the hydraulic ram about ¼” (6 mm) longer than the housing length so that the rear plate will be able to separate from the housing during cutting. The press ram must be capable of resisting a force of 10 tons exerted by the rubber pad spring stack.

c. Cutting of the rear wall plate can be done by an abrasive cut-off wheel, sawing or flame cutting. Make the cut just less than the 1 ¼" (32 mm) thickness of the rear wall plate.

NOTE

If the flame cutting is used, adequate ventilation and air movement during the cutting must be provided. If there is a shortage of air during rubber burning, the rubber pyrolysis could create an explosive mixture.

d. Release the hydraulic ram to free the gear. Remove the rubber pads and internal follower from the housing.

e. Inspect the housing and also the housing wall thickness at the bottom which must not be less than 11.9mm (or 15/32") and 19.8mm (or 25/32") respectively.

f. **Inspection of Rubber pads**

I. Reject pads which show tears, large material chunks, large bond failures, or extreme wear into the steel plate edges.

II. Pads are gauged and must not be less than 2 $^{1}/_{8}$" (54 mm) as measured by a gap gauge at the middle of each side.

III. Bent (but not broken or cracked) steel plates are acceptable as these will straighten during assembly.

IV. Creases and folds are normal and are acceptable for reconditioned gears.

V. **VISUAL INSPECTION OF RUBBER PADS**

i. Full bonding to each of the metal is required.
ii. Top and bottom surfaces of plates must be free of elastomer films or drops.
iii. Inspection sprues must be 3.18 mm or 1/8" min. below the steel plate surface.
iv. Pad must be free from cracks.
v. Parting line flash should not exceed 0.78mm or 1/16".
vi. Elastomeric material should be free from foreign material i.e., trapped air etc.
vii. Check for proper markings.

VI. STATIC TEST

i. Rubber pads must be inspected carefully. Hundred percent pads are inspected visually. Squeeze each pad to a height of 36.8 mm or 1.45" and check for bond failure, chunks cracks and bubbles. These defects are causes for rejection.
ii. Check pads for bulge. Elastomer should not extend beyond the steel plates when squeezed to solid height.
iii. Pad must be returned to minimum free height of 60.96 mm or2.4" within one minute after load is released.
iv. Pads must not be skewed after the load is released.

g. INSPECTION OF INTERNAL FOLLOWER

I. Outside profile dimension must be at least $11^{1}/_{4}$” x 7” (286mmx178 mm).
II. Base must be flat within 1/16” (1.6mm) across the diagonals.
III. Base and show support boss must be parallel within 1/16” (1.6mm).
IV. Shoe wear indentations on the boss must not exceed 1/16” (1.6 mm).

h. INSPECTION OF FORGED ITEMS

I. Parts will be visually inspected for seams laps, scale pits, improper grinding and other defects.
II. All items should be checked for proper and distinct markings which should be legible.
III. Parts are to be gauged for dimensional checking.
IV. Some dimensions are checked with calipers scales or other measuring instruments as required if gauges do not exist or not available.

i. INSPECTION OF HOUSINGS (CYLINDERS)

I. Housings or cylinders must not have excessive porosity, surface discontinues shrinkage and inclusions.
II. proper gauges should be used to ensure sufficient yoke clearance and for checking rear wall flatness.

j. PREPARATION OF HOUSING PRIOR TO RE-ASSEMBLY

I. The housing is placed bore end down on a flat metal work table next to a flame cutting fixture. An accurate flame cut may be achieved by using either a guided torch nozzle which moves along the stationary housing length at a fixed height, or by moving the housing past a fixed torch nozzle.

II. The housing is to be cut to a length of 463.6 mm + 21.6 mm (18 ¼" ± 1/16"). It is important to regularly clean the torch tip to help ensure a clean and accurate cut.

III. After each side is cut, the housing is hit with a hammer to remove slag. The work table and guides should be swept clean of slag after each cut to ensure a level cutting surface and proper height position for the following cuts. The housing can be rotated by hand before cutting on a new side.

IV. Check the finished housing (cylinder) height using gage no 27244.

V. Grind after cutting with a hand grinder to;
- Remove flame cutting marks back to clean steel
- Remove slag deposits on the housing
- Bring correct size to the finished length.

E. RE-ASSEMBLY OF RE-CONDITIONED RF-361 DRAFT GEAR

a. Tools required

- 50t vertical press
- Draft Gear assembly ring support fixture.

b. For re-assembly, the assembly ring is first placed over the housing. The three shoes are put in position in the bore and the wedge is placed over the shoes, with each wedge lugs resting on the angled shoulder of the shoes. Next, the assembly block to drg. No.27051 is put over the wedge, so the legs of the assembly block contact the top of the shoes. Press down very slowly and carefully, pushing the shoes into the housings. When the top of the wedge has cleared the bottom of the housing lugs by either tapping the handle or slightly rotating it clock- wise, the wedge will take its position in place and the compression can be released.

F. INSPECTION OF RECONDITIONED DRAFT GEARS RF-361

Draft gear shall be visually inspected for the following characteristics:-

- Inserts - one insert per leg properly located and intact in position.
- Shoes - must be properly positioned with respect to the wedge.
- Housing- must be free from cracks lumps and other defects. Components must be properly seated. Clutch components must be tight.

G. WELDING OF REAR PLATE AFTER ASSEMBLY

a. After the weld zones of the housing and rear wall plate have been suitably preheated, the heating gas is to be turned off, and the heating ring is to be removed from the housing.

b. Place the remaining two RF-8 rubber pads on the pad stack These pads will be projecting above the rear of the housing.

c. Place the preheated rear wall plate on top of the rubber stack and position it as closely as possible so the edges of the plate align with the edges of the housing.

d. Position on draft gear assembly so that it is centered directly under the ram of the press (50 tonne vertical press). This is done to ensure even loading and square closure.

e. Compress the rear wall plate down until it is firmly and squarely in contact with the housing base. Check the alignment of the rear wall plate sides in relation to the housing base sides. If necessary, release the press pressure, reposition the plate and compress again until the sides of the two pieces are aligned. It may be necessary to do this a number of times, depending on the skill and experience of the operator, till the proper alignment is obtained.

H. ROOT RUN WELDING

a. With the rear wall plate firmly held in place under the press, a root run, approximately 6.4 mm-7.9 mm (1/4"-5/16") in depth is made completely around all four sides. It is very important to obtain complete fusion and penetration into the full depth of the weld preparation.

b. MIG welding with AWS A5.18-69 class E70S-1B, 1.14 mm (0.45")diameter, 100,000 psi tensile wire is used. Preferable shielding is a 75% Argon and 25% CO_2 gas. Wire feed speed is 45.7-50.8 cm (18-20 inches) per minute and the welding machine to be set for 250 - 280 amps. 26-32 volts.

c. When the root run has been completed, the gear is removed from the press and moved aside. Inspect, to be sure that it is free of any visible defects. A total of three to four gears can be accumulated in this manner before filler pass welding is done.

I. FILLER PASS WELDING

a. The accumulated root run welded gears are placed side by side on a holding table, which is either flat or slightly tilted up to permit down hand welding of the filler pass.

b. Use MIG welding with the same wire as used in the root run. 100% CO_2 shielding gas is used in the fill pass. The wire feed is 2300mm-3540mm (90-100 inches) per minute, at 250-280 Amp and 26-32 Volts.

c. Weld one side of each of the accumulated gears.
d. Turn each of the gears 90 degree and weld the second side of each gear. Continue this process till all 4 sides have been welded. The fill pass should leave a weld bead that protrudes just above the housing surface.
e. All welds are to be ground flush. The finished gear assemblies are then box gauged with Gage 27200 for dimensional acceptability.

J. PRE-SHORTENING & PAINTING

The assembled RF-361 draft gear must be pre-shortened to facilitate installation into the yoke and draft pocket.

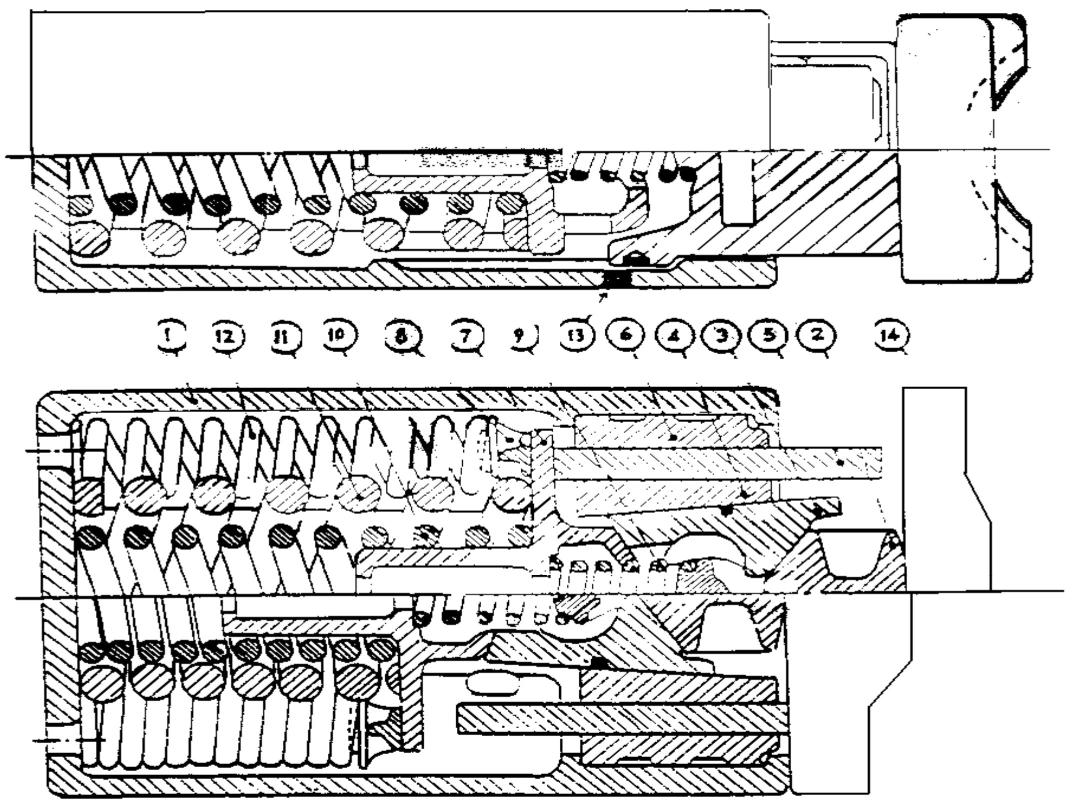
a. Place the gear under a 200 ton open gap press, position the pre-shortening block (Drg. no 25658) on the shoes and apply a load. Compress the gear until there is sufficient vertical clearance between the housing and wedge lugs to insert standard powdered metal. Attach tap to 3 inserts (cube) using taps lower inserts through openings.
b. Check the pre shortened length (using gauge 27207)
c. After pre-shortening the external surfaces of the draft gear is to be painted with black or blue paint.

921. MAINTENANCE OF MARK-50 DRAFT GEAR

Note :- All the drawing no., part no. and gauge no. mentioned hereunder are as per literature of Mrs. BESCO.

A. **INSPECTION**

a. The draft gear shall be inspected whenever wagons are coming in ROH depot. The following instructions shall be followed to determine whether draft gear is in normal released condition or in stuck condition.
b. A normally released draft gear would appear as shown in Fig 9.3, where the follower plate is against the front lugs, the housing is against the rear lugs and the components of the friction clutch are fully returned to their neutral position. The internal spring forces in a normal fully released Mark 50 draft gear will be from 7,000 kg to 10,000 kg.



1. HOUSING
2. CENTRE WEDGE COMPLETE
3. WEDGE SHOE COMPLETE
4. TAPERED STATIONARY PLATE
5. MOVABLE PLATE
6. OUTER STATIONARY PLATE SPRING SEAT
8. CORNER SPRING SEAT
9. RELEASE SPRING
10. INNER COIL SPRING
11. OUTER COIL SPRING
12. CORNER COIL SPRING
13. SHORTENING DEVICE
14. FOLLOWER

Fig. 9.7 RELEASED DRAFT GEAR

c. It is possible for a slight gap to be seen at either the front or rear draft lugs when the draft gear is in a normal fully released position, e.g. in an enlarged draft gear pocket.

B. REMOVAL OF DRAFT GEAR FROM WAGON POCKET

When a draft gear with follower plate is installed into the pocket of a wagon, it has ample initial spring load to provide a tight fit into the draft gear pocket. While removing the draft gear from the wagon pocket, it is necessary to compress the draft gear approximately 6.35 mm (1/4”). In order to clear the front and rear stops, a suitable device can be used to compress the draft gear so that the draft gear and Yoke assembly may be free to be lowered from the wagon.

a. NORMAL CONDITION

I. Remove yoke pin support. Drop yoke pin down and draw coupler out of wagon.

II. Place suitable lifting/lowering jack under yoke support plate. Holding yoke support in position with centre-sill, cut and take out rivets.

III. Insert nut (Ref: RDSO manual G 80) in the yoke pin hole. Apply screw from the mouth and compress by rotating screw by means of wrench so that the draft gear with follower is clear of the pocket length by about 6 to 8 mm.

IV. Lower support at yoke support plate and take out yoke with draft gear and screw.

V. Unscrew and remove nut. Now draft gear, follower is loose in yoke and they can be taken out separately.

b. FOLLOWER BROKEN

A broken follower will remain within pocket only if it is cracked at centre and split in two at centre vertically or horizontally.

If cracked but not split, follow procedure as in 23.3.1 above. When cracked and split jerk by hammer or by pulling yoke forward to loosen the follower in the pocket.

c. PARTIALLY STUCK GEAR

In a partially stuck draft gear, the draft gear is loose in the pocket and the draft gear travel will be less than 82.55 mm (3-1/4”) .

d. FULLY STUCK DRAFT GEAR

A fully stuck draft gear is one where the components of the friction clutch are jammed and flush with the open end of the housing. A large gap would appear at the front or rear stops or at both stops.

The internal spring forces between 11,000 kg and 23,000 kg would propel the friction parts outward if the gear was to suddenly release.

e. REMOVAL OF STUCK OR DAMAGED DRAFT GEAR

WARNING:

WEAR SAFETY EQUIPMENT INCLUDING HARD HAT, SAFETYGLASSES, SAFETY SHOES, GLOVES AND BODY PROTECTION

I. When follower is not missing

.

DO NOT STAND OR WORK DIRECTLY IN FRONT OF COUPLER

i. First move another wagon against the couple, forcing follower and draft gear against rear stops. Do not remove the yoke support plate. Securely weld draft gear housing and follower.
ii. Cut gear housing in spring area to expose coil springs and cut each coil of every spring to eliminate the compressive force or the springs.

II. Where yoke is broken and follower is missing

i. First move another wagon against coupler forcing draft towards the stops as for as possible.
ii. Remove a section of the yoke straps with the torch to permit installation of a follower and bracket

IMPORTANT: The follower with the bracket must be installed with a lift table or fork truck to eliminate any one putting their hands near the open end of this stuck draft gear. Once fitted into place,

iii. Securely weld the bracket to the draft gear housing.
iv. Remove coupler.
v. Position lift table or other lowering means under the support plate, yoke and draft gear.
vi. Remove rivets from yoke support plate. Slowly lower down the assembly unit on the ground.
vii. Scrap draft gear, yoke and follower.

C. REMOVAL OF STUCK DRAFT GEAR SO AS TO REUSE

In case it is desired not to gas cut and scrap stuck draft gear as above, the following procedure may be adopted:-

a. Place the stuck draft gear in front of a wall or 50 to 75 mm facing another working draft gear with follower. Force compressed air to clean any dust or mud from draft gear.

b. Give sledge hammer blows with 8-10 kg hammer on the top front, side fronts, edges and rear wall. The inside components will be forced out. Re-examine this draft gear for any broken or unserviceable part. Re-use or reclaim the draft gear for use.

D. INSPECTION OF MARK-50 DRAFT GEAR FOR RECONDITIONING

Mark-50 draft gears have a built in wear life gauge. This is known as "plate clearance" and can be observed by looking up at the gear while it is in the wagon When the draft gear is out of the wagon a straight edge can be placed on the centre wedge of draft gear. Both movable plates should be driven or forced down until solid before measurement is made. The plate clearance is an indicator of the total surface wear of the friction components. When the plate clearance reduces to zero, the draft gear loses its effectiveness to cushion. Once the draft gear reaches this stage, some of the parts will start wearing on the housing and cause considerable damage, rendering it impossible to recondition. Cardwell recommended that Mark-50 draft gear should be inspected whenever wagon is in shop or under repair or when the draft gears are removed from the wagon.

E. SUMMARIZED GUIDE TO DISMANTLE MARK-50 DRAFT GEAR

- A press of 40 tonnes is required.
- Press down with fixture D and insert the two pins.
- Remove movable plate one side.
- Remove wedge shoe same side.
- Remove movable plate other side.
- Remove wedge, shoe other side.
- Turn and remove centre wedge.
- Remove release spring.
- Remove both tapered stationary plates.
- Remove both outer stationary plates.
- Apply fixture C and press to remove pins.
- Remove spring seat.
- Remove all coil springs and corner spring seats.
- Reverse procedure for assembly.

F. List of Gauges For Mk-50 Draft Gear

a. Housing Gauges For Initial Inspection

I. Housing reconditioned gauge No. BE-91/62-2 (No-Go Gauge to check minimum length of housing)

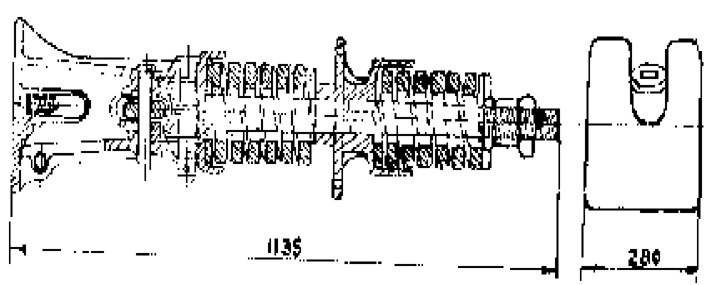
II. Housing reconditioned Gauge No. BE-91/62-1 (GO Gauge to check maximum housing for Yoke and Sill clearance).

III. Housing reconditioned Gauge No. BE-92/62-6 (No GO Gauge to check minimum housing wall thickness)
IV. Housing reconditioned bottom flatness check

b. Housing Weld Repair Gauges
   I. Reconditioned gauge No. BE-91/62-5 (No-Go Gauge to check to centre wedge stop area)
   II. Reconditioned gauge No. BE-91/62-3 (Go, No-Go Gauge to check movable plate area)
   III. Reconditioned gauge No. BE-91/62-4 & 5 (Go, No-Go Gauge to check on the wedge area)
   IV. Centre wedge gauging gauge No. BE-91/61-1
   V. Spring seat gauging gauge No. BE-91/61-5
   VI. Gauging centre wedge and spring seat for sorting gauge No. BE-91/72-1.
   VII. Tapered stationary plate gauge No. BE-91/61-4
   VIII. Outer stationary plate gauge No. BE-91/61-3
   IX. Wedge shoe gauge No.BE-91/61-2.
   X. Gauging springs inner coil, corner coil & release gauge No. BE-91/61-7 & 8
   XI. Outer coil gauge No. BE-91/61-6
   XII. Corner spring seat reclamation.
   XIII. Movable plate gauging gauge No. BE-91/61-10

922. M.G. BUFFING AND DRAW GEAR

A sketch of a MG Buffing and Draw gear is given at Fig 9.4. Unlike the conventional BG buffing and draw gear comprising of two separate sub-assemblies, a centre buffer coupler with combined functions of buffing as well as taking the draw load is provided on MG.



BUFFER MCA.P.H. YOKE END (MG)

Fig. 9.8 MG BUFFING & DRAW GEAR

MG buffer height

Empty	585 max
Loaded	535 min

To enable the coupling of two wagons on one end, a buffer with hook is provided while at the other end, a buffer, yoke and a screw coupling arrangement is provided. This is a very important sub-assembly linking all the goods wagons and transmitting the tractive effort through the draw bars, it also absorbs the jerks occurring during running and shunting. Hence proper repair as well as inspection and maintenance on line is very important. The parts which constitute these sub-assemblies are as under:-

A. HOOK

The bite of the hook is very important as any excessive wear at this point can result in train parting. When these hooks are taken out at the time of POH in the workshops, the wear on the bite is made good . The radius and the distance from the hook bolt hole to the bite are corrected. This is a drop stamp item manufactured from class IV steel to IS:1875 & IRS R-12. These hooks after repairs, are normalized and tensile tested before use. The test is carried out at 24.5 tonne.

B. **Hook head** -

This is a cast steel item and develops the following defects:-

a. The hook head face thickness is reduced due to the constant wear.
b. The head cracks at the corner of the face are sometimes even below the `U'. As per IRCA Rule Nos.4.10.3 any crack below the `U' is rejectable defect.

C. Hook bolt

This is forged on a bolt forging machine to provide hexagonal head and at the end threads are provided to take the hook bolt and nut and there is a provision for a rivet/split pin hole as a securing arrangement. This item is manufactured from class IV steel to IS:1875 or IRS M4 & R.12.

D. DRAW BAR

a. This is the most important component in the sub-assembly as any failure of this item leads to train parting. This item is manufactured out of class IV steel IS:1875 & IRS R-12. The Draw bar has a rated capacity of 16.3 tonnes and is tested to a proof load of 24.5 tonnes

b. The subject of high incidence of train parting on MG due to breakage of the draw bars to Drg. No. W/BD-651 was discussed in the 47th C.W.S.C. meeting. The committee recommended that existing drawbar when these need replacement be replaced by modified drawbar as shown in RDSO Sk-72543. This was approved by Railway Board and standard drawings for modified draw bar No. W/BD-418 and nut to Drg. No. W/BD-419 were issued in 1974. The main feature of the modification is that the dia of the threaded portion has been increased from M 52 to M 60.

c. The draw bars are provided with nut and split cotter as an additional fastening device. However, for old draw bars a split pin is also permissible as an alternative security fastening when a check nut is used. This is in terms of IRCA Part III Rule No. 4.10.12.

d. At the time of train examination, Junior Engineer (C&W) and his staff should check that these nuts are properly tightened and the cotter is in position as and properly split to ensure that no train parting takes place on this account.

e. As an anti-pilferage measure, a spot weld is provided between the split end of the cotter to make its removal difficult as well as to prevent dropping down during service.

f. The continuous pull and push loads result in rubbing against the head-stock due to which the outer and inner buffer casings, draw bars gets worn out in service.

g. To reclaim such draw bars, Railway Workshops should follow the process sheet issued by RDSO vide their letter No. MW/CBC, dated 23/28-6-1977.

h. Draw bar Pivot Pin: This is manufactured out of class IV steel IS:1875 or IRS M-4 & R-12. Since these pins have to bear all the buffing draw and shock loads in service in addition to wear, these are renewed at the time of POH. The pins are secured by a cotter and a spot weld between the split ends.

i. Springs: Helical spring are provided one each for draft and buffing, one outside the head stock and other inside the head stock. These springs are heated and brought to the original free height and hardened during POH to give the required load characteristic and the free height for which they are designed. The inner coil spring is provided with a collared bush before fitting the draw bar nut and the cotter.

j. At the time of train examination, Junior Engineer (C&W) or his staff should see that:-

- These springs are not broken
- They have not lost their free height or become dead
- They have not lost their spring action which will be apparent from the looseness of the buffer

E. YOKE END

In the yoke end, all other items i.e. draw bar, draw bar nut, draft and buffing springs, draw bar pin and the buffer head (only the design is modified to take screw coupling arrangement instead of a hook) are the same as in the hook head.

F. Block

This item enables the tight coupling of the two vehicles and is manufactured out of class IV steel of a tensile strength of 118 - 134 Kgs/mm2 (& Spec. R-12) and is a drop stamp item. Normally, this is a trouble free item.

G. Link

This item is either of cast steel or fabricated out of mild steel plates with a spacer bush operated together. The function of this item is to link the block and the yoke in the screw coupling sub-assembly.

H. Yoke

This item is a steel casting which acts as a fulcrum and is held in the yoke head by a pin. As an anti- pilferage measure, the following two alternative methods have been devised for adequate fastening.

- Providing 8 mm riveting to be bent over.
- Welding of the mild steel washer and the spilt pin.

I. Screw

This is drop stamp item made out of the class IV steel IS:1875 & R-12. The central portion has a hole to take other screw coupling handle with two knobs at the ends.

Since the proper functioning of this sub-assembly has to be ensured for the safe running of the trains, RDSO has laid down the shop issue sizes and condemning size for various components which have to be followed at the time of POH as given in Table 9.1.

Table 9.1
SHOP ISSUE & CONDEMNING SIZES FOR MG COUPLER COMPONENTS

Component	Nominal size in mm	Shop Issuing in mm	Condemning size in mm
1. WA/BD-27 Hook end			
Hook Head W/BD-659			
Buffer face	176.5	175	173.5
Hook bolt hole	41	41.8	42.5
Hook WA/BD-640			
Hook-Bite	334.5	336.0	337.5
Hook bolt hole	41	41.8	42.5
Hook bolt W/BD-649	40	39.2	38.6
2. WA/BD 28-YOKE END			
Hook head W/BD-658	258.5	257	255.5
Yoke Pin hole	29	29.8	30.5
3. Coupling Block W/BD-643			
Block face	73	71.5	70.5
Link pin hole	26	26.8	27.5
4. Yoke WA/BD-642			
Yoke pin hole	29	29.8	30.5
Link pin hole	26	26.8	27.5
Yoke nut hole	64	64.8	65.5
5. Coupling link W/BD-642			
Link pin hole	27	27.8	28.5
Link pin hole	27	27.8	28.5
6. Link pins W/BD-648			
Pin	25	24.2	23.5
Pin	25	24.2	23.5
7. Yoke pin W/BD-646	28	27.2	26.5
8. Yoke Nut W/BD-647	63	62.2	61.5

923. REPAIR AND MAINTENANCE IN SICKLINE & ROH DEPOT

A) Ensure that the draw bars and their components are free from defects. Special attention should be paid to draw bar assembly to prevent excessive play.

B) Repair to draw bars, screw coupling and their component are prohibited in sick lines as they are not equipped with normalizing facilities. Use of non-standard material such as shackles and pins manufactured locally in sick lines should be strictly avoided.

C) Screw couplings must be so tightened that the gap between buffers is not left. Buffer projection to be maintained as given in para 904.

D) Screw couplings must be oiled and greased.

E) Correct type and size of draw bar springs, sufficient plain washers of 13 mm thickness after the spring and inside the nut to be provided, sufficiently clearing the cotter slot. The correct size of cotter should be used, properly splitting the same to avoid slackening.

F) It must be ensured that the `U' shape securing pins of the draft key is fitted and bent correctly ensuring that this pin is in proper position.

G) IRCA Part III (2000) Rule No. 4.9 for BG stock and Rule No. 4.10 for MG stock should be followed.

H) In case of CBC on BOX/BCX/BOXN/BCN etc., staff must carefully check the clearance between the lock lift lever and the bottom of the CBC casting. If the clearance is less than 19 mm, it indicates improper locking of CBC which may cause a train parting.

I) In order to satisfy that the CBC knuckles are correctly engaged and locked, the same should be checked by operating the lever handle ensuring that the lock lever falls automatically by its own weight.

J) Maintenance of draw gear to be done as given in para 909.

K) The **s**taff in maintenance depots should strictly follow repair practices embodied in IRCA Part III (2000) Rule No. 2.14.

L) The condition of wear in the knuckle, guard arm and other concerned components affecting the coupler head opening in closed position should be checked with Gauge No. 1, 2 and 3 as given in G-80 and corrective action to be taken as indicated therein.

M) Check that there is free movement and articulation at the joints between the various components of rotary lock lifting gear. They are sometimes wrongly welded at the joints which makes them rigid. In such cases, welding to be cut out and proper riveting with proper clearance to be done to ensure free articulation.

924. REPAIR AND MAINTENANCE IN WORKSHOP DURING POH

A) Drawbar of all stock coming to workshops for repairs must be invariably examined for wear on the hole, neck shank and screwed portion for cracks. Unless drawbar can be rectified to the correct sizes, they should not be used.

B) All drawbars must be stress relieved and subjected to the specified proof load test. Meticulous care should be taken to ensure proper heat treatment in all cases.

C) Screw couplings should be stress relieved and tested to the specified proof load test.

D) Draw bar springs should be thoroughly inspected and changed, if found distorted or damaged. Steel springs to be given a deflection test.

E) All draw bars manufactured by shops should be stamped with the shop code initials, date, month and year for easy identification and reference in case of failures.

F) IRCA Pt. III (2000) Rule No. 2.13 should be followed for buffing gear repair.

G) The shop repair practices for various components of the sub-assembly to be followed as given in para 903.

H) Buffer projection from the head-stock on broad gauge wagons should be within limits as mentioned in para 904.

I) For reclamation of the sub assemblies, the procedure given in para 907, 908 & 909 to be followed.

J) Inspection of CBC to be done as given in para 913.

Note: There are two maintenance publications i.e. G-76 for lines staff and G 80 for workshop staff issued by RDSO on "Inspection and Maintenance of Centre Buffer Couplers BG stock". For Alliance No. 2 CBC, RDSO has issue G 62 for inspection and maintenance by Train Examining and Workshop staff.

VENDOR LIST

(as on 31.10.2000)

(CENTRE BUFFER COUPLER)

1. HIGH TENSILE CBC COUPLER & ITS COMPONENTS FOR FREIGHT STOCK (SPEC-48-BD-94)

1.	BESCO Ltd. 7B &C Poonam, 5/2 Russel Street, Calcutta-700001
2.	Bhilai Engg. Corp. Ltd. PostBox No. 31, Industrial Area, Hathkhoj Village, Bhilai-490001
3.	Braithwaite & Co.Ltd. Angus works, P.O. Angus Distt-Hoogly-712221
4.	Burn Standard Co. Ltd. Nityadhan Mukharjee Road, Howrah-711101
5.	Datre Corporation Ltd. Falta industrial growth centre, sector 3rd South, 24 Pargana-743504 (WB)
6.	Hindustan Development Corp. Ltd. 27, Sir R.N. Mukharjee Road, Calcutta-700002
7.	Mukand Ltd. Lal Bahadur Shashtri Marg, Kurla, Mummbai-400070
8.	Orient Steel Industries Ltd. 2, Brabourne Road, Calcutta-700001
9.	Renuka Industries Ltd. Plot No. 17, Sector III, Sagore, Pithanm pur, Distt. Dhar M.P.
10.	Texmaco Ltd. Belgharia , 24 Paragana, Calcutta-700 056
11.	Titagarh Industries Ltd. 113, Park Street, Calcutta-700 016.

2. HIGH TENSILE CBC COUPLER & ITS COMPONENTS FOR LOCOMOTIVE (SPEC-56-BD-96)

1.	BESCO Ltd. 7B &C Poonam, 5/2 Russel Street, Calcutta-700001
2.	Burn Standard Co. Ltd. Nityadhan Mukharjee Road, Howrah-711101
3.	Hindustan Development Corp. Ltd. 27, Sir R.N. Mukharjee Road, Calcutta-700002
4.	Mukand Ltd. Lal Bahadur Shashtri Marg, Kurla, Mummbai-400070
5.	Orient Steel Industries Ltd. 2, Brabourne Road, Calcutta-700001
6.	Renuka Industries Ltd. Plot No. 17, Sector III, Sagore, Pithanm pur, Distt. Dhar M.P.

7.	Texmaco Ltd. Belgharia , 24 Paragana, Calcutta-700 056
8.	Titagarh Industries Ltd. 113, Park Street, Calcutta-700 016.

3. ALLIANCE II COUPLER & ITS COMPONENTS (SPEC-24-BD-79)

1.	BESCO Ltd. 7B &C Poonam, 5/2 Russel Street, Calcutta-700001
2.	Burn Standard Co. Ltd. Nityadhan Mukharjee Road, Howrah-711101
3.	Mukand Ltd. Lal Bahadur Shashtri Marg, Kurla, Mummbai-400070
4.	Renuka Industries Ltd. Plot No. 17, Sector III, Sagore, Pithanm pur, Distt. Dhar M.P.
5.	Titagarh Industries Ltd. 113, Park Street, Calcutta-700 016.

4. HIGH CAPACITY DRAFT GEAR (SPEC-49-BD-94)

1.	BESCO Ltd. 7B &C Poonam, 5/2 Russel Street, Calcutta-700001	MK 50 Caedwell design
2.	Burn Standard Co. Ltd. Nityadhan Mukharjee Road, Howrah-711101	RF-361 Miner design
3.	Hindustan Development Corp. Ltd. 27, Sir R.N. Mukharjee Road, Calcutta-700002	RF-361 Miner design
4.	Mukand Ltd. Lal Bahadur Shashtri Marg, Kurla, Mummbai-400070	MK 50 Caedwell design
5.	Titagarh Industries Ltd. 113, Park Street, Calcutta-700 016.	RF-361 Miner design

5. MG ENHANCED AND ABC COUPLER

1.	BESCO Ltd. 7B &C Poonam, 5/2 Russel Street, Calcutta-700001
2.	Burn Standard Co. Ltd. Nityadhan Mukharjee Road, Howrah-711101
3.	Renuka Industries Ltd. Plot No. 17, Sector III, Sagore, Pithanm pur, Distt. Dhar M.P.

6. TOP LOCK LIFT HOLE CAP (SPEC 48-BD-94)

1.	Annpurna Engg. Works, 89/1, Deshprn, Sasmai Road, Howrah-711 101
2.	Comet Technocom (P) Ltd. 37, Bhagwan Ganguly Lane, 3rd floor, Howrah-1
3.	Decon India, 9 Duffer Street, Liluah, Howrah-4
4.	Krishna Engg. Works, 57/9, Q Road, Netajigarh, (Belgachia) Howrah
5.	Nirmal Engg. Works 26/1, Benaras Road, Salkia, Howrah-711 106
6.	Raj Iron & Steel Company, 1A&3, Raghav Koley Lane, Bamungachi, Hawrah-6
7.	Shiv Engg. Woprks, 64/4, G.T. Road, Liluah, Howrah

7. KNUCKLE PIN WITH WASHER (SPEC 48-BD-94)

1.	Anand Sales Corporation 6 Poonamchand Bagaria Belly, Howrah-711005
2.	Annpurna Engg. Works, 89/1, Deshprn, Sasmai Road, Howrah-711 101
3.	Comet Technocom (P) Ltd. 37, Bhagwan Ganguly Lane, 3rd floor, Howrah-1
4.	Cosmic Engineers, 2, Duffer Road, Liluah, Howrah-711202
5.	Eastern Engineering Industries, 40 E road Belgachia Post Dasnagar, Howrah 711105
6.	Industrial Corporation, Ghoshpara, Baltipuri, Howrah
7.	Kaypee Industries D 108 Phase V, Focal Point, Ludhiana-141010
8.	Krishna Engg. Works, 57/9, Q Road, Netajigarh, (Belgachia) Howrah
9.	Laha Engg. Works, 157, Mahendra Bhattachaarjee Road, Santragachi, Howrah- 711 104
10.	Lal Baba Industrial Corporation 78, Lalababu Shir Road, Belur, Howrah- 711 202
11.	Melbro Engineering Works Pvt.Ltd., 1/1, “X” Road, Belgachia, Howrah
12.	Shiv Engg. Woprks, 64/4, G.T. Road, Liluah, Howrah

8. YOKE PIN (SPEC 48-BD-94)

1.	Anand Sales Corporation 6 Poonamchand Bagaria Belly, Howrah-711005
2.	Annpurna Engg. Works, 89/1, Deshprn, Sasmai Road, Howrah-711 101
3.	Comet Technocom (P) Ltd. 37, Bhagwan Ganguly Lane, 3rd floor, Howrah-1
4.	Cosmic Engineers, 2, Duffer Road, Liluah, Howrah-711202
5.	Eastern Engineering Industries, 40 E road Belgachia Post Dasnagar, Howrah 711105
6.	Excel Entreprises, 220 A, Naskapara Road, Ghusuri, Howrah
7.	Industrial Corporation, Ghoshpara, Baltipuri, Howrah
8.	Krishna Engg. Works, 57/9, Q Road, Netajigarh, (Belgachia) Howrah
9.	Laha Engg. Works, 157, Mahendra Bhattachaarjee Road, Santragachi, Howrah- 711 104
10.	Lal Baba Industrial Corporation 78, Lalababu Shir Road, Belur, Howrah- 711 202
11.	Melbro Engineering Works Pvt.Ltd., 1/1, “X” Road, Belgachia, Howrah
12.	N.F. Forging Pvt. Ltd., 72, Lalbabu Shiv Road, Brlur, Howrah- 711 202
13.	Pranay Engg. Co. Ltd., 19, R.N. Mukharjee Raod , Calcutta-1
14.	SBS Forging Pvt. Ltd., GI-140 to 143, Industrial Area, Behror, Phase –I ALWAR (Rajsthan)
15.	Shiv Engg. Woprks, 64/4, G.T. Road, Liluah, Howrah

9. KNUCKLE THROWER (SPEC 48-BD-94)

1.	Amar Forging Pvt. Ltd., 56-C, Industrial Area, Bammore, Distt Morena- 476444
2.	Annpurna Engg. Works, 89/1, Deshprn, Sasmai Road, Howrah-711 101
3.	Krishna Engg. Works, 57/9, Q Road, Netajigarh, (Belgachia) Howrah
4.	Lal Baba Industrial Corporation 78, Lalababu Shir Road, Belur, Howrah- 711 202

MARKING ON CBC (MANUFACTURERS INITIAL)

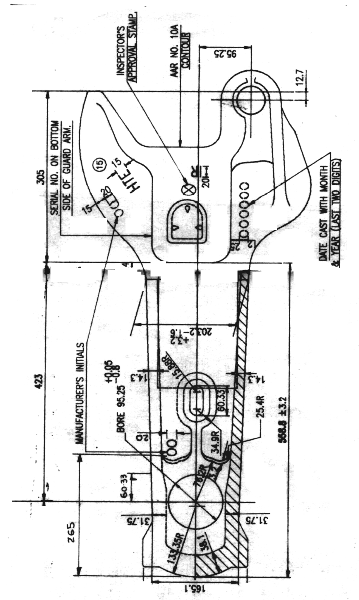


Fig No. 9.9 Coupler

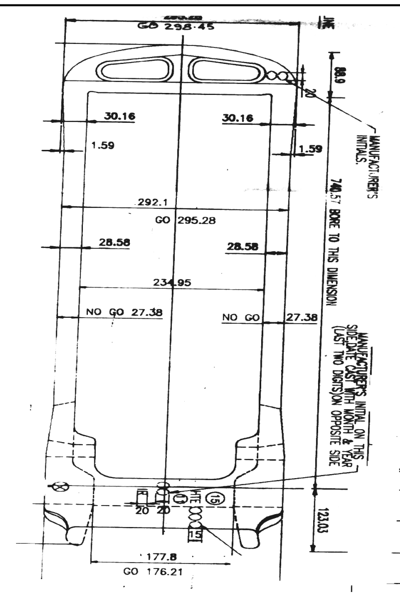


Fig No. 9.10 Yoke

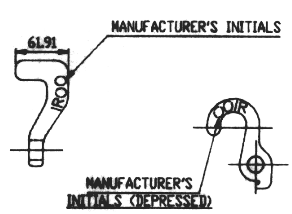


Fig No. 9.11 Lock Lifter

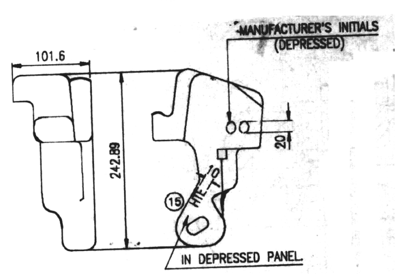


Fig No. 9.12 Lock Piece

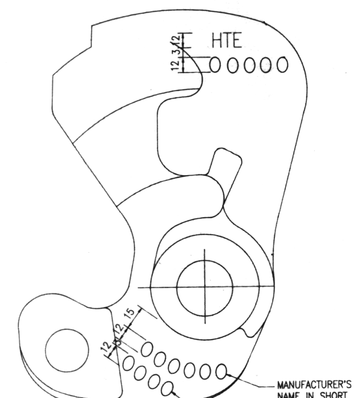
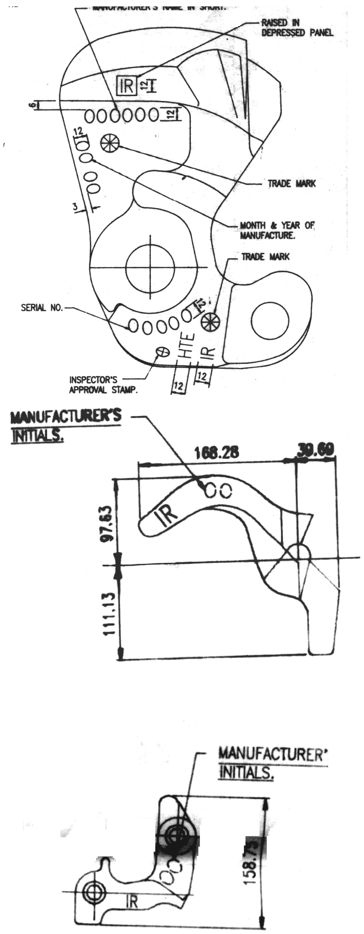


Fig. No. 9.13 Knuckle



S.NO.	MANUFACTURER'S NAME	IN SHORT
1	BURN STANDARD COMPANY LTD.	BURN
2	BHARTIA ELECTRIC STEEL COMPANY LTD.	BESCO
3	BHILAI ENGINEERING CORPORATION LTD.	BECO
4	HINDUSTAN DEVELOPMENT CORP. LTD.	HDC
5	MUKAND LTD.	MUKAND
6	ORIENT STEEL INDUSTRIES LTD.	ORIENT
7	SRI RANGA ALLOYS LTD.	RANGA
8	TITAGARH INDUSTRIES LTD.	TITA
9	TEXMACO LTD.	TEXMA
10	DATRE CORPORATION LTD.	DCL
11	RANEKA INDUSTRIES LTD.	RIL
12	BRAITHWAITE & CO. LTD.	BWT

Fig No. 9.14 Marking of Parts

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MAINTENANCE MANUAL
FOR
WAGONS

Chapter – 10 ***Tank Wagon***

CHAPTER 10

TANK WAGON

Tank wagons form a special class of non-pooled rolling stock. They are classified according to the product carried by the tank and its design. Tank wagons fall in the following categories:

- Tanks as pressure vessels.
- Tanks for corrosive liquids.
- Tanks for petrol and other highly inflammable products.
- Tanks for middle distillates of petroleum and others products.

For information about these wagons in respect of their mechanical code and the products carried, refer to Appendix "B" of IRCA Part III (2000).

1001. CONSTRUCTIONAL DETAILS

A. **Underframe**

The design of the underframe of four wheeled and eight wheeled wagon is generally similar to that of other IRS wagons except that a pair of saddles is provided on the underframe at each end for mounting the barrel. Refer to Chapter 5 for repair and maintenance of underframe.

B. **Barrel and saddles**

The barrel is cylindrical vessel generally fabricated out of low carbon structure steel to IS:2062 Fe 410CuW. Material specification for various types of tanks are given in Table-10.1. The barrel is placed longitudinally on the underframe and secured by means of rivets to the saddle. The saddle is welded on underframe at each end.

TABLE 10.1
MATERIAL SPECIFICATION

Sr. No.	Type of wagon	Cylindrical portion	Dished ends
1	Ammonia tank wagon type TAL BTAL BTALN	Steel.toBS:1501-224Gr.32AT 50ASTM-516Gr-70	Steel to BS:1501-224-Gr.32 A LT 50 ASTM-516 Gr.-70
2	Chlorine tank wagon type LCT	Steel To BS: 1501-157 Gr C Colvilles Coltuff 28	Steel To BS:1501-157 Gr C Colovilles Clotuff 28
3	Liquified petroleum gas tank wagon type TLGL,BTPGL,BTPGLN	Steel to BS: 1501-224-Gr32 A LT 30 ASTM-516 Gr. 70	Steel to BS: 1501-224-Gr32 A LT 30 ASTM-516 Gr. 70
4	Sulphuric acid tank TSA & MBTSA	Steel to IS 2062 St. 42 WC	Steel to IRS:M 30/IS:3747
5	Petrol tank wagons type TPR TPR/A,MBTPX &MBTPZ	---do--	---do---
6	Oil tank wagon type TORX	---do---	---do---
7	Heavy oil tank wagon TORX	---do---	---do---
8	Bitumen tank wagon type TBT	---do---	---do---
9	Coaltar tank wagon type TR	---do---	---do---
10	Petrol tank wagon type TR& MBTP	Steel to IS:2062 St. 42 WC	---do---
11	Oil tank Wagon type TO	---do---	---do---
12	Oil tank wagon type MBTOX	---do---	---do---
13	Caustic soda tank wagon type TCS,BTCS	Steel. to IS: 2062 St. 42 WC	Steel to IS 2062 St.42 WC
14	Hydrochloric acid tank wagon type THA	---do---	---do---
15	Molasses tank wagon type TM & MBTM	---do---	---do---
16	Tank wagon for phosphoric acid	ASTM A 240 55 316 L	ASTM A 240 55 316 L

C. Barrel mountings and safety Fittings

Various types of barrel mountings are necessary for filling, measuring and decanting depending upon the product handled. Safety fittings are generally provided inside the dome on a diaphragm plate so as to protect them from accidental injury. These fittings as used on various types of wagons are given in Table 10.2.

TABLE 10.2
DETAILS OF SAFETY FITTINGS

Sr No	Descri-ption of fittings	Particula-rs and Mech. Code	Anhydr-ous liquid **Ammonia** BGTALBTAL BTALN	Liquified petro-leum gas BG TPGI **BTPGLN**	Liquid chlorine BGTCL	Sulphurc acid tanks BGTSA MG MBSTA	Caustic soda TCS BTCS	Hydro-chloric acid THA	BG,TP,TPR,TPRA BTPN MG MBTP MBTPZ MPTPX	BG,To,TPRX, MG MB TOX	TOH	TBT	**Coaltar**	Molass-es
	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1	Safety valves	No.off	Two	one	One		One		One	No	No	One	No	No
		Drg. NO	IRS 2137\ 56	IRS 2138\ 55	Midland A-255B		IRS 2136\ 57/M		URS WA FT 87		IRS 2139 /77			
		Location	Inside dome	Inside dome	Inside dome		Outside on barrel		Outside on barrel			Outside on barrel		
		Vapour tight at pressure Kg/sq.cm	(80% of (33.47)	247	127				112					
		Start ot discharge pressure	Above 33.47	28	1585+5		21		1406			2.11		
2	Pr. release valve	No.off				One		One	NO		NO	NO	NO	NO
		Drg.NO				IRS WA/T F7083		IRS 8133/54						
		Location				Outside on barrel		Outside on barrel						
		Set to operate at pressure kg/sq.cm)				21		21						
3	Safety vent	NO off				One	One	One	NO	NO	NO	NO	NO	NO

	with frangi -ble disc													
		Drg.NO.				IRS2132/ 57	IRS2135 /57m	IRS2133/ 54						
		Location				Outside on dome	Outside barrel	Outside barrel						
		Disc not to rupture pressure kg/sq.cm				211	211	211						
		Rupture pressure for disc kg/sq.cm				32	32	32						

C. **Safety valve**

The safety valve is provided to prevent building up of excess pressure inside the barrel. Its fitting on the barrel is either on the diaphragm plate inside the dome or on a separate opening on the barrel. Table 10.2 shows the location, number of safety valves used and their working pressure, etc. for various types of wagons.

D. **Relief valve**

It is a spring loaded valve fitted on the barrel of tanks for corrosive liquids. Its main function is to release built up pressure, if it exceed the working pressure limit. Table 10.2 shows the type of wagons on which these are fitted and their working pressure limit.

E. **Safety vent**

This consists of a frangible disc (lead or any approved material not affected by lading) which ruptures at specified pressure. It is an additional safety fitting to safeguard against the failure of the relief valve. When the built up pressure exceeds the working pressure of the relief valve and the latter fails to function for any reason the frangible disc of this safety vent ruptures to release the pressure.

F. **Compressed air valve**

It is provided on tank wagons from which the contents are unloaded by compressed air. Its main function is to control the rate of discharge by controlling the rate of air admission.

G. **Vapour extractor cock**

Its function is to extract vapour from the tank while filling (Drg.No.2131/58/M & WD-86081-S/65).

H. **Master valve assembly**

It is a gravity discharge valve fitted with a hand wheel in the dome for manual operation.

I. BG 4-wheeler tank wagon bottom discharge valve (Drg. No. WA/TF-88 & WD-93066-S/01) are provided with a single bottom discharge valve situated underneath the master valve while on BG/MG eight wheeler stock two bottom discharge valves are fitted, one on either side and connected with the master valve through a tee pipe. The main function of the valve is to control the flow of the contents and also to serve as an additional safety stop in case the master valve fails or breaks. The bottom discharge valve openings are also provided with blank flanges to be used with 2mm compressed asbestos fibre jointing material to IS:2712-65 to serve as a further check on accidental leakage of contents.

1002. PERIODICITY OF OVERHAULING OF TANK WAGON

The periodical overhauling of IRS tank wagons should be carried out in fully equipped mechanical workshops. The periodicity of POH (refer IRCA Part III Rule 2.4.3) is given below in Table 10.3.

TABLE 10.3
PERIODICITY OF OVERHAULING

	Type of wagon	For 1st POH	For subsequent POH
1.	4 wheeler tank wagons except those listed below.	4 years	3-1/2 years.
2.	Tanks for liquid chlorine and hydrochloric acid, type TCL/THA	2 years	2 years
3.	Tanks for liquids ammonia type TAL,TPGLR	2 1/6 years	2 1/6 years
4.	Tanks for petroleum gas BTAL, BTALN,BTPGL,BTPGLN	4 years	4 years
5.	BTPN	6 years	6 years

A. INTERIOR EXAMINATION OF TANK BARREL

No person should be allowed to enter the tank barrel for internal examination/repair unless the barrel is free from noxious or inflammable fumes. Therefore, before internal inspection of barrel is allowed, it must be steam cleaned/washed with solution of sodium phosphate commercial or soda ash, washed with water or other suitable cleaning agent as prescribed in case of various types of tank barrels.

B. STEAM CLEANING OF TANK BARRELS

The tank(s) requiring steam cleaning should be placed as near the steam supply line as possible and protected against any movement. The berthing siding should be completely isolated from all other traffic.

Tanks as pressure vessels, tanks for petroleum, other highly inflammable products, vegetable oils, bitumen, coal tar and molasses are cleaned by steam. In case of pressure vessels, it should be ensured that all the gas has been discharged to the atmosphere. After ensuring that the tank barrel is no longer under pressure, the following sequence should be followed:

i. Remove the manhole cover together with manhole housing, valves etc. and leave the tank exposed to atmosphere for 24 hours.

ii. Entry of staff in the tank barrel should be strictly prohibited and signs with suitable legends displayed at a reasonable distances away from the tank(s) to be steam cleaned.

iii. Insert pipe through man hole and steam interior of barrel for 12 hours. In order that the tank barrel is thoroughly steamed from inside, the stem pipe should be provided with a "T" connection at its lower end and so directed as to blow steam towards both ends.

iv. Remove condensed steam collected in the tank barrel and keep the barrel exposed to atmosphere for another 24 hours.

v. Ascertain if the tank barrel is free from gas fumes. This may be done as follows:

(a) AMMONIA TANK BARREL

Fill the tank barrel with water and take a specimen of the same in a clean glass bottle since ammonia is readily soluble in water. The specimen of water should be tested for any traces of ammonia with red litmus paper. Any trace of ammonia in water would turn red litmus blue. Another very sensitive method known as Nessler's test may be applied to find out if the specimen of water contains any traces of ammonia. In this test, the reagent used is a solution of potassium mercuric iodide with potassium hydroxide. This reagent gives a brown colour when mixed with the specimen of water containing even a minute trace of ammonia.

If ammonia is detected, empty out the tank barrel and refill with fresh water. This process may be repeated till the tank barrel is free from ammonia traces completely.

(b) CHLORINE TANK WAGONS

Fill the tank barrel with water and take a specimen of the same in a clean glass bottle. Since chlorine is readily soluble in water, specimen of water taken out should be tested for any traces of chlorine. Any trace of chlorine in water would have a bleaching effect on coloured litmus paper. If chlorine is present, the tank should be repeatedly emptied and refilled wit h fresh water till free from chlorine traces completely.

(C) LPG TANK WAGONS

A clean bottle filled with fresh water is lowered through the manhole. A string is attached to the bottom of the bottle before lowering. Tilt the bottle at the bottom of the tank to allow its water to flow out and the gas in the tank to take its place. The bottle should be left in this position for about 5 minutes and then withdrawn away from the tank. A lighted match stick should then be brought near the mouth of the bottle or applied to the air or gas inside and bottle. If there is no flame the tank is free from injurious gas. But, in case it gives out a flame, the tank should again be steam cleaned.

After ascertaining that there is no trace of gas in the barrel the tank should be dried out by blowing in hot compressed air before proceeding with inspection and repairs.

1003. STEAM CLEANING OF BITUMEN AND MOLASSES TANK WAGON

The procedure for steam cleaning of these barrels is as under:

A) Close the manhole cover and open bottom discharge valve.

B) Pass steam through the air inlet valve for sufficient time till the bitumen melts and drains away through the water discharge valve. The bitumen should be collected in containers and not drained out on the floor.

C) Open the manhole cover to see whether the tank is completely clean from inside. In case any residue is left behind the above procedure should be repeated.

D) Remove heating arrangement i.e., heating pipe, internal pipe, etc. from the tank. Clean inside surface of the heating pipe by scrapping the carbon layer with wire brush or other suitable process. Blow in air under pressure from one end.

E) The outer surface of the heating pipe should be cleaned with kerosene oil.

1004. CLEANING OF TANKS FOR CORROSIVE LIQUIDS

A. Hydrochloric acid tanks: Open the manhole and the washout covers and start cleaning the barrel with water. Initially the water coming out of the washout opening will show excessive acidity which will turn blue litmus paper red. The washing should be continued till blue litmus paper shows no change. The washout cover should be refitted and the tank wagon filled with water. A sample of the water in the tank barrel should be taken out in a bottle and its reaction on litmus paper tested. The water should then be drained out. The tank wagon is now ready for internal inspection and repairs.

B. Sulphuric acid tank barrels : Sulphuric acid tank barrels should be washed with 1/2 to 1% solution of sodium phosphate commercial or half percent solution of soda ash so as to neutralize the sulphuric acid. This washing may be done as soon as possible after receiving the wagon in workshops. Since concentrated sulphuric acid absorb moisture when left open to moist air, the acid will in drop in concentration with time. It is to be remembered that dilute sulphuric acid is highly corrosive and thus, as the acid absorbs moisture, it will attack the tank barrel more vigorously. Freedom from presence of sulphuric acid can be ascertained with the help of litmus paper (if blue litmus paper turns red, the liquid contains acid). Now, rinse the tank with water, clean and dry.

Caution: As addition of water to sulphuric acid will produce intense heat, resulting in splashing due to generation of steam, the solution of commercial sodium phosphate should be added or spread gradually and with care.

C. Caustic soda tanks: These barrels should be washed free of alkalinity with hot water. Freedom from alkalinity can be easily ascertained by litmus test (if red litmus changes to blue, there are still traces of alkalinity). After it is free from alkalinity, water should be drained and barrel dried out before inspection and repairs.

1005. INSPECTION OF TANK BARRELS

A. Generally tank barrel defects will be indicated by hydraulic test but it is necessary to inspect the barrel before hydraulic test so as to avoid accidental rupture of corroded barrel plates at the time of hydraulic test. The barrel should be examined by a competent inspector nominated by the CME, who must examine the interior of the barrel and the internal fittings for their general condition and freedom from wasting, wear, tear and damage. Measure barrel thickness by D-meter to ensure extent of corrosion. If the examination indicates that the corrosion/erosion has taken place to such an extent that the barrel is likely to rupture during hydraulic test, first carry out the repairs and then give a hydraulic test.

B. Inspection of rubber lining

Hydrochloric acid tank wagons are fitted with rubber lining inside the barrel. The procedure for inspecting this rubber lining is as follows:

i. The barrel and its fittings are rubber lined, in accordance with code of practice for rubber lining of hydrochloric acid tank barrel.. This lining should be subjected to an examination every six months.

ii. While inspecting the barrel, lining defects such as dents on the surface, cracks, damages as well as embedding of foreign bodies should be particularly noted.

iii. It should be ensured that there are no pin holes in the rubber lining by examining the entire surface with suitable high frequency test electrodes.

iv. It should also be ensured that there are so crevices and peeling at the joints of the rubber sheets.

v. In cases where the condition of the lining causes doubts in respect of soundness, the firms specializing in rubber lining should be contacted for examination and necessary repairs/rectification.

vi. The rubber lining can perish if heat is applied externally to any part of the barrel. This should be borne in mind in the context of repairs by welding.

1006. TESTING OF BARREL

A. Ensure that all filling lines with low pressure and other appurtenances, which should not be subjected to the test pressure, are disconnected.

B. The tank barrel and manhole orifice should then be completely filled with water at a temperature which must not exceed 38 Deg.C (100 Deg.F) during test. The barrel should be vented to prevent formation of air pockets while it is being filled. Before applying pressure, the equipment should be inspected to see that it is tight. The tank barrel should be tested by using a power driven hydraulic pump which should enable a steady increase of pressure in the tank barrel. Test pressure should be maintained for a sufficient length of time to permit a thorough examination of the barrel for any leaks.

For the purpose of this test, connection is to be made through a dummy flange with pressure gauge attached, fitted on the safety valve seating. The filling, discharge and gas valve should be tested in position on the tank in following two ways:

a) With valves closed and outlet cap off, and
b) With valves open and outlet cap in position.

C. In case of any sign of leakage that may be evident from the drop in pressure under hydraulic test, the pressure should be reduced by 20%. The lagging and insulation is removed for locating leaks. The welded seams of the tank barrel should be given a thorough hammer test by striking the plates on both sides adjacent to the weld. The plate should be struck at intervals of about 6" for the whole length of all main welded seams.

D. The hammer used for the above test should be of a material softer than the barrel plate and its edges so rounded as to prevent denting of the barrel plates. The weight of the hammer should not exceed 5 Kg.

E. The pressure should then be raised to the full test pressure and maintained for a sufficient length of time, but not less than 30 minutes. Inspect all seams and connection.

F. The tank barrel should remain secured to the underframe during this test.

1007. BARREL TEST PRESSURE

The testing pressures for different types of wagons are given in the following table:

Description	Mech.Code	Hydraulic test pressure
Chlorine tanks	TCL	43.7 Kg/cm^2(623 lbs/sq.in)
Ammonia tank	TAL,BTAL, BTALN	56.23Kg/ cm^2 (800 lbs/sq.in)
LPG tank	TPGL/TPGLR, BTPGL,BTPGLN	23.7 Kg/ cm^2 (337 lbs/sq.in)

1008. TESTING OF TANKS USED FOR CORROSIVE LIQUIDS

A) The procedure for testing sulphuric acid tanks (TSA and MBTSA) and caustic soda lye tanks (TCS,BTCS) is the same as that given for tanks as pressure vessels above except that their testing pressure would be 4.22 Kg/cm^2 (60 lbs/in^2)

B) No hydraulic test should be done on a tank wagon, which is rubber lined. Such tanks should only be subjected to pneumatic test at a pressure of 2.1 Kg/ cm^2. The pressure should be watched for a minimum period of 10 minutes. Drop in pressure will indicate leakage through rubber lining and barrel.

1009. TESTING OF TANK WAGONS USED FOR PETROL AND MIDDLE DISTILLATES OF PETROLEUM AND VEGETABLE OIL

The following procedure should be followed for hydraulic test of petrol tanks:

A) Remove the safety valve from its seating and fill the tank completely with water. Provide connections with the hydraulic pump through the safety valve opening. Close the manhole cover and fully tighten it. It should be ensured that the bottom discharge valve is properly closed before filling the barrel with water. The pressure should be increased gradually by means of a hydraulic pump provided with a pressure gauge. Close the control cock as soon as the pressure reaches 2.1 Kg/cm2 (40 PSI). Watch the pressure for a minimum period of 5 minutes.

B) In case of leakage (which will be evident from the drop in pressure under hydraulic test), the joints should be checked first and made tight. Thereafter, the well seems of the tank barrel should be examined thoroughly by applying soap solution, which will show up the crack or other source of leakage.

C) A similar procedure should be adopted for hydraulic testing of bitumen tank wagons except that in this case the top outlet pipe should be suitably dummied before applying any pressure. If leakage is noticed even after the joints are found satisfactory, an examination of the barrel after removal of the lagging will be necessary. Insulation should be opened only after making sure that leakage is through the tank barrel.

1010. REPAIRS TO TANK BARRELS BY WELDING

A. Pressure vessels

Pressure vessels requiring repairs should be inspected by a competent authority approved by Chief Consultative Explosives. A workshop undertaking such repairs must be properly equipped for the same and facilities for radiographic examination of the repaired joints must be available. The detailed procedure for repairs of pressure vessels is given in Appendix – IV.

B. Tanks for transport of corrosive liquids

i. Tanks used for transport of corrosive liquids suffer most, commonly from pitting and also have a tendency to develop cracks. Pits when not deep enough to affect the strength of the parent plate may be chipped to sound metal welded and then ground flush to the original thickness of the plate. When pits are in a close group or in one straight line and are deep enough to affect the strength of the plate, the affected area should be cut out and replaced with a let in patch.

ii. Cracks should be fully explored to ascertain their extent. The crack may be on surface or in full depth of the thickness. If possible, a portable magnetic crack detector should be used. Such detector are manufactured in the country and are a very useful piece of equipment for every railway workshop. In absence of crack detector, dye penetration test shall be performed to ascertain extent of crack. A 12mm dia hole should be drilled at the ends of the crack and the full length of the crack should then be carefully chipped and C grooved for welding. Removal of all paint, grease, oil, dirt etc. by frame heating and brushing is essential both for the purpose of proper inspection and to prevent contamination of the welded joint. Perform DP test and then do welding..

iii. After completion of welding from one side, the other side of the crack should be grooved, cleaned and welded. It is preferable if the welding is done from the inside of the barrel and is in the down hand/horizontal position. Flush ground the welded position and perform DP test along the weld.

iv. If a crack occurs in an area where the plate is wasted and of inadequate strength, the defective portion should be cut out and replaced with a let in patch. It must be ensured that the let in patch is of the same material and thickness as the parent metal. Corners of patches should be rounded to a minimum radius of 25mm and edges must be carefully prepared to obtain a V butt weld. Weld deposits should be smoothened flush with the parent metal. Perform DP test and radiography of barrel plate.

v. Rubber lined barrels should be repaired in the same manner as described above and then relined with rubber.

C. Tanks for petrol, middle distillates of petroleum, vegetable oil etc.

The repair procedure will generally be same as described above.

D. Welding procedure and technique

i. Only approved brands and grades of electrodes should be used. Lists of such approved brands and grades are published by RDSO every year and these should be available in all workshops and repair depots for reference and guidance.

ii. Welding should be as possible done in the down hand position. Welding current (also polarity if direct current is used) should be set as recommended by the electrode manufacturer.

iii. Transverse speed of the electrodes should be controlled to obtain proper fusion of the parent metal.

iv. After every interruption of the arc, welding should be restarted ahead of the previous deposit and then moved back to fill the crater before proceeding forward again.

v. Care should be taken to remove slag before depositing successive beads.

E. Welding of stiffening plate.

Weld reinforcement should be made flush with the parent metal of the tank barrel for welding a stiffening plate.

First, tack weld the stiffening plate in the position as below. Stiffening plate to be fitted from out side only. They should be welded with the angle in the case of old design of "TPR" wagons having the bearing plate inside. In case of new designs having both angle and bearing plate outside, weld with the existing bearing plate. The welding should be completed as shown in Fig. 10.1.

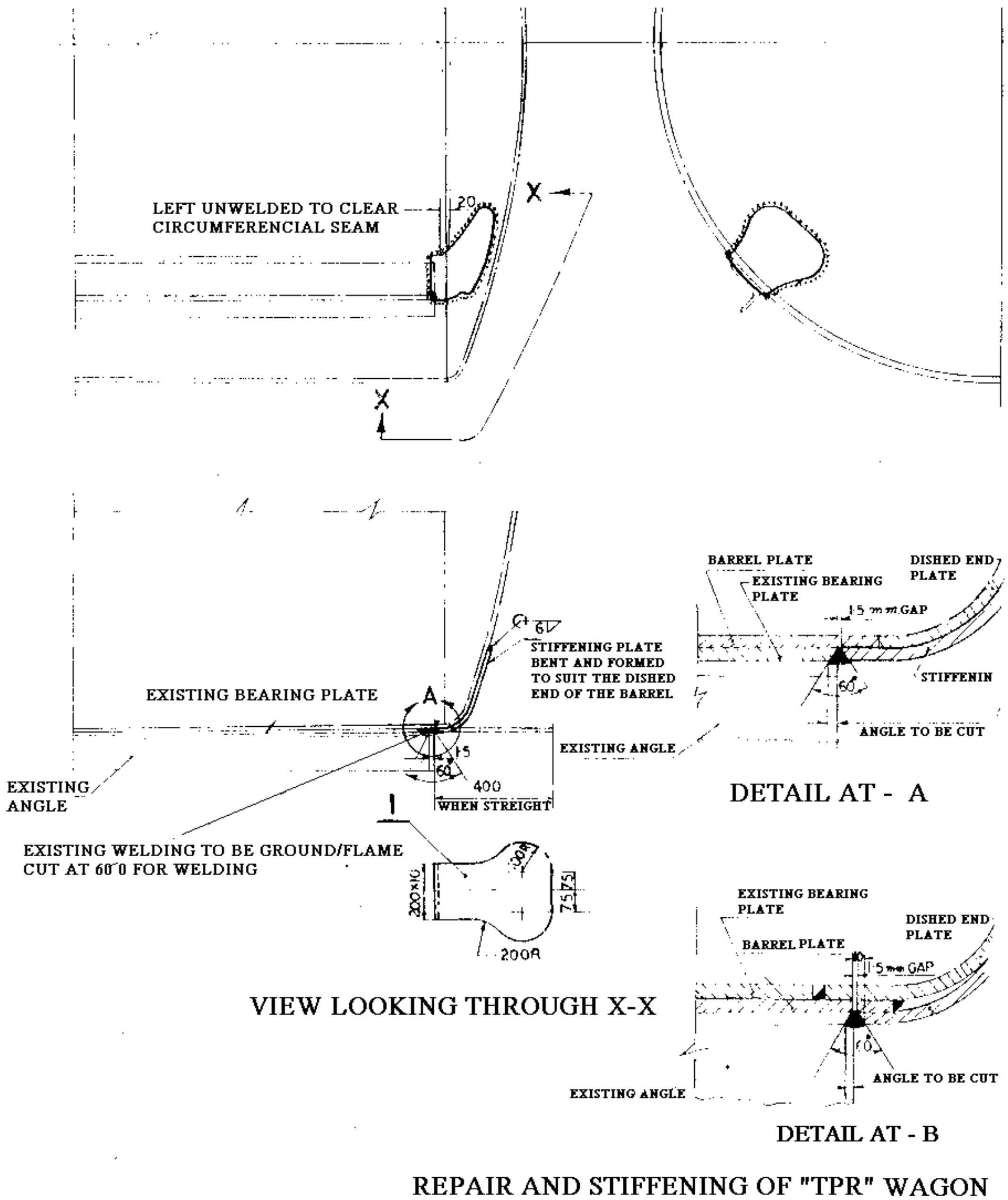

Fig. 10.1 TANK WAGON WITH BEARING PLATE OUTSIDE

1011. REPAIRS AND TESTING OF TANK BARREL MOUNTING FITTINGS

A. Fittings of pressure vessels

a) Safety valve

The safety valve should be given a pneumatic test. It must be vapour tight against leakage at pressures indicated in Table 10.2.

The safety valve adjustment should not be interfered with unless repairs to the valve become necessary or the valve operates incorrectly. In such cases, it must be repaired, correctly adjusted and re-tested at the pressure specified.

b) Packing and seals must be particularly checked for leaks, and those found defective or damaged, perished, should be changed. The packing should be of correct material and size/shape.

Since deteriorated seals and dirt on the seals are the most frequent cause of leakage, the seals should be given careful attention. Changing of resilient seals of liquified petroleum gas tank wagons type TPGL & BTPGLN, when the vessel is under pressure within 10 pounds of the operating pressure of the valves, should not be attempted.

c) Other fittings of pressure vessels:

i. Apart from the safety valve, each type of mounted pressure vessel has its own special fittings. The fittings are specific for each type of vessel and details regarding their examination and maintenance are contained in instructions pamphlets published by the RDSO for the respective wagons.

ii. Items to be perticularly checked for defective, damaged or perished packing. “O” ring, “V” ring and lead seals. Asbestos packing or rubber packing is commonly used depending upon the type of vessels and commodity carried. V rings are pressure seals, which expand on application of pressure to remain leak proof.

iii. The various valves and fittings of these vessels are usually designed to give long periods of trouble free service and should not ordinarily require any maintenance other than cleaning. However, if a fitting become defective, it would be desirable to consult the manufacturer. Most of these valves and fittings are specialized pieces of equipment, made of special materials. Substitution by components made of incorrect materials or to wrong tolerances could have undesirable repercussions.

iv. The main fittings are two liquid education valves, a vapour education valve, a safety valve, a slip tube for determining liquid level, a pressure gauge, a thermometer well and excess flow valves which control the rate of flow through the three education valves.

B. PRESSURE GAUGE

In view of the possibility of pilferage/damage, the pressure gauge should be fitted only when required at the time of filling or discharging, or when the pressure is to be checked enroute. It should be removed before releasing the tank wagon. The necessary valve and fittings for attachment of the pressure gauge are provided on the manhole cover plate.

1012. FITTINGS OF TANKS FOR CORROSIVE LIQUIDS

A) Pressure relief valve/safety valve: These valves should be given a pneumatic test at the pressures indicated in the table 10.2.

B) Safety vent with frangible disc: The safety vent should be provided with rubber lining of 5mm (3/16") and closed with a frangible disc which should rupture at a pressure not exceeding 3.2 Kg/cm^2 (45 lbs/sq.in) for a working pressure of 3.1 Kg/ cm^2 (30 lbs/sq.in). The ruptured frangible disc indicates that excessive pressures have been built up in the tank wagon and may be the first sign of malfunctioning of the safety valve. The cause needs to be investigated and removed. A ruptured frangible disc should be replaced by a new frangible disc, conforming to the required specification.

C) Globe valves/compressed air valves/washout valves: All these valves should be tested on a bench by applying hydraulic pressure by means of a pump and it should be ensured that they are leak proof at the pressures of individual wagons mentioned under “Testing of the Barrel” in para 8 above. Leaky valves should be attended for defects before fitting body on the tank.

1013. FITTINGS ON TANK WAGONS OF PETROL, OTHER INFLAMMABLE PRODUCTS, VEGETABLE OIL ETC.

A) **Safety valve** : These valves are provided on petrol tank wagons and bitumen tank wagons. The safety valves should be subjected to pneumatic test after repairs/POH at the pressure given.

B) **Master valve**: Wherever repairs to the master valve and its seating are undertaken, after filling the valve should be tested in position under air pressure of 0.35 to 0.56 Kg/ cm^2 (5 to 8 psi), the tank barrel being filled with water to a minimum height of 150 cms. The hydraulic test should be carried out keeping the bottom discharge valve and blank flange open.

C) **Bottom discharge valve** : The bottom charge valve should also be tested in position under air pressure of 0.35 to 0.56 Kg/ cm^2 (5 to 8 psi) after filling the tank barrel with water to a minimum height of 150 cm. Master valve should remain open during this test. This test to be done after satisfactory testing of the master valve.

D) **Blank flange** : The blank flange should be tested in the same manner as the master valve and bottom discharge valve after ensuring that a gasket of specified material has been fitted underneath.

1014. HEATING ARRANGEMENT OF TOH TANK WAGONS

The heating arrangement of tank wagons meant for carrying heavy oils, namely residual fuel oil, LSHS oil, pitch, etc., should be subjected to a hydraulic test at a pressure of 14 Kg/ cm^2 maintained for about 15 minutes. In case of any leakage (which will be evident from drop in pressure under this test), the joints of the pipe system should be checked. The defect should be located and rectified.

1015. TEST REPORTS AND RECORDS OF INSPECTION

Re-tests of all tanks, safety valves and rubber lining must be certified by the official making the tests and records maintained in the office of the CME. Certification must show railway initial, number of tank wagon, pressure to which tested, date and place of test, etc. A copy of the certificate may be submitted to the party owning the tank wagon in the case of private or dual owned tank wagons.

The testing authority must maintain detailed records of the tests carried out on each individual tank wagon.

A special report must be submitted to the CME concerned in every case where the maximum permissible working pressure is reduced or the examination shows that the tank can not continue to be used with safety unless certain repairs are carried out immediately or within a specified time. Such a tank wagon must not be commissioned in service till it is certified fit for use after repairs and re-testing under specified pressure by the testing authority.

The testing authority competent to test the barrel, safety valve and rubber lining under the above clause is to be nominated by the CME.

1016. IMPORTANT MODIFICATIONS

The important modifications to be carried out in workshops and depots are given in Table 10.4.

1017. PAINTING AND LETTERING

Full schedule of painting and lettering following as per standard practice as given in Corrigenda No. 5 & 6 to IRS specification No R.6-59 as supplemented by the diagrams issued by RDSO for each such type of wagon. The test particulars must be marked at the prescribed places on the tank wagon. In case of tanks used for acids the external surface of the tank barrels should be printed with an acid-resistant paint to prevent external corrosion.

TABLE 10.4

LIST OF IMPORTANT MODIFICATIONS TO BE CARRIED OUT

S.NO	ITEM DESCRIPTION	RDSO REF.	TO BE DONE IN			
			SICK LINE	ROH	POH	NEW BUILT
1.	Conversion of Centre Pivot top arrangement from bolted to riveted design on a) BCNA/BRN wagons b) BTPN wagons c) BOXN/BCN wagons	MW/PLNG/CSNB Dt. 3.5.94 & MW/BTPN Dt. 18.7.94 & MW/BOXN/MAINT Dt. 28.6.93.	No	Yes	Yes	Yes
2.	Modification to blank flange arrangement on BTPN	MW/WT Dt. 23.12.93.	No	No	Yes	Yes
3.	Modification to brake gear in BTPN wagon to prevent breakage/bending of pull rod.	MW/BTPN Dt. 3.1.94.	No	No	Yes	Yes
4.	Modification to BTPN empty/load spindle bracket.	MW/BTPN Dt. 1.11.94.	No	No	Yes	Yes
5.	Modification of main pull rod to prevent hitting with T pipe on BTPN wagons	MW/BTPN Dt. 9/10.5.96.	No	Yes	Yes	Yes
6.	Modification to securing of dome arrangement of BTPN wagon.	MW/BTPN Dt. 6.6.97.	No	No	Yes	Yes
7.	Modification to anchoring tee joint on BTPN wagons.	MW/BTPN Dt. 24/26.8.98.	No	Yes	Yes	Not applicable

Specification of the paint should be generally as follows Ready mixed paint brushing bituminous black lead free acid alkali water and heat resisting for general purpose to specification IS 158-1960 while using these paints care should be taken to prepare the surface properly so that all rust loosely adherent scale and dirt are removed by means of metal scraper suitable hammer and wire –brush . Grease oil etc if present should also be removed with white spirit or other suitable solvent. In case of tanks already used for carrying acid care should be taken to wash down the surface with water to remove all traces of acid and to ensure that the surface in dry before application of paint.

1018. EXAMINATION AND REPAIR OF TANK WAGONS BY JUNIOR ENGINEER (C &W) AT SICK LINE & BASE DEPOT

A) Any repairs to tank barrels should be done only at nominated sick lines where facilities for steam cleaning are available. After repairs, the barrels and valves must be tested to ensure that there is no leak. Safety valves must not be permitted with any nut or bolt deficient from sickline. The tank wagon discharge valves blank flange and manhole covers should be secured with full complement of bolts and nuts whenever the tank wagons are empty or taken out of sickline. Whenever tank wagons containing petrol or other inflammable fluids are examined, only specified safety torches (battery torches) should be used for this purpose.

B) Before any repairs are commenced on such stock, due precautions must be taken to remove all such petroleum and other inflammable fluids as required under IRCA red tariff and special instructions issued by the railway/railway board from time to time. These precautions must be observed on empty tank wagons also and no staff should be allowed to enter the tank or to bring naked light or matches near it till the tank has been steam cleaned and tested free of vapour.

The following simple checks should be carried out by train examining staff before a tank wagon is certified fit for loading:

a. **Master valve** : Leakage of master valve should be checked while keeping the bottom discharged valve open.

b. **Bottom discharge valve** : Proper functioning and fluid tightness of the bottom discharge valve should be ensured.

c. **Blank flange** : The blank flange of the correct thickness made out of steel plate and with a gasket of proper material between the blank flange and bottom discharge valve flange should be tightened by six bolts and nuts.

d. **Tank barrel** : Tanks with cracks on barrels should be marked sick.

e. **Leaky tank barrels** : The leakage of tank barrels may be caused due to one or more of the following reasons:

   i. Mechanical injury to the valve face and/or valve seat as a result of foreign material, particularly nuts and bolts finding their way inside the tank wagon.
   ii. Valve seats not properly secured to the stool by proper interference fits.
   iii. Mal functioning of master valve.

1019. PRECAUTION WITH LEAKY TANK WAGONS

A. TCL,TAL,BTAL, BTALN tank wagons

Chlorine and ammonia gases are poisonous gases and have a characteristic pungent odour, which gives warning of their presence in the atmosphere before dangerous concentrations are attained. In the case of chlorine gas, the greenish yellow colour of the gas makes it visible when high concentrations are present. In the case of ammonia, if sufficient concentration of the gas is present in the atmosphere, it will irritate the eyes and the respiratory system. As such, in the event of leakage, all present in the vicinity should be warned to keep on the wind ward side of the leak.

B. TPGL, TPGLOR, BTPGL & BTPGLN tank wagon

Action in any particular case will depend upon existing conditions, and good judgement will be necessary to avoid disastrous fires on one hand and useless sacrifice of valuable property on the other hand:

a. When a tank wagon is leaking, all flames or fires near it should be extinguished or removed. No smoking should be allowed. Spectators should be kept away. Only battery operated torches or incandescent electric lights with gas proof sockets should be used.

b. Oil lanterns or signal lamps necessarily used for signaling must be kept far away and at as high an elevation as can be obtained from the tank and on the side from which wind is blowing. The vapour will go with the wind, not against it. The ash pan and fire boxes of steam locomotive are sources of danger especially when wind is blowing across the leaking tank towards them. The locomotives be moved away from the site and ash pit fires be extinguished with water.

c. The leaky tank wagon should be removed as quickly as possible to an open area where the escaping gas will be less hazardous.

d. Earth should be spread over any surface on which the LPG has leaked out in liquid form.

e. A leaky tank, which has been emptied, should under no circumstances be sent to the loading point and should be suitably stenciled as such. A leaky tank wagon must only be dealt with in a fully equipped mechanical workshop.

f. Recommended procedures to stop leaks in dome fittings:

   i. The liquid outlet valves face each end of the tank wagon, while the vapour outlet valves face the sides of the wagon. If there is leakage around the valve hold down bolts, tighten the bolts until the leakage stops. If leakage persists, isolate the tank wagon and notify the oil company concerned.

ii. If there is any indication of leakage around safety valve, which is in the centre of the dome, it should first be checked whether the valve is merely performing its function, i.e., relieving excess pressure. However, if considerable flow of gas is evident, isolate the tank wagon and notify the oil company concerned.

iii. If there is leakage from the outlet of the valve, turn the valve handle by hand, if it does not stop leaking, the seat is defective. Do not try to use a wrench but insert and tighten the plug attached by a chain to the valve.

iv. If there is any leakage out of the thermometer well, the only thing that can be done is to tighten the plug. If the leak cannot be stopped, by tightening, isolate the wagon and notify the oil company. DO NOT TAKE THE PLUG OUT FOR LAPPING OF THE THREAD. The thermometer well is, in fact, a part of the shell of the tank, and if there is any evidence of leakage from the thermometer well, a bad situation is indicated. If the plug is removed when leakage is present, liquid will probably be discharged with a consequent extreme hazard.

v. A high percentage of any leaks that might occur will be in the gauging and sampling devices. The sampling valve is a part of a fixed line to the bottom of the tank. The valve on the gauging device (slip tube) must be used in gauging the volume of the liquid in the tank wagon. It is open while moving the gauge down to find the liquid level. Once the liquid level is found, the valve should be closed. In both cases, a turn of the shut off valve handle will probably stop any leakage that might be occurring through the valve. However, on the slip tube, which is moved up and down to determine the liquid level, there is a packing gland, which is subject to wear. If the leak is occurring through this packing gland, tighten the packing nut until the leak stops.

vi. The Junior Engineer (C&W) staff must be most careful that liquefied petroleum gas does not get on their skin. The effect is substantially the same as when dry ice comes in contact with the skin viz. freezing. The white fog of its discharge can distinguish liquefied petroleum gas while liquid can only be distinguished by careful viewing. In many cases, soapy water must be used to locate liquid leaks because the are not readily visible.

C. **All other types of tanks**

No leaky tank wagon should be allowed in service and such tank wagons should be attended in properly equipped sick line and/or shops.

1020. PRECAUTIONS TO BE TAKEN AT LOADING AND UNLOADING POINTS (TANKS AS PRESSURE VESSELS)

i. Ensure that the tank is loaded/unloaded under supervision of a responsible and competent person and all precautions taken by him to see that the persons engaged in the filling/discharging operations are properly protected against the poisonous gas contaminated atmosphere. A list of precautionary measures to be taken by the staff must be exhibited at a conspicuous place near the installation. The loading/unloading connections must be securely attached to the pipe line before valves are opened.

ii. Ensure that the tank to be loaded/unloaded is placed in position, preferably under shade, and secured properly against any movement. The handbrakes must be put on and hand brake lever secured in that position.

iii. Shunting of any kind of the tank under loading/unloading must be strictly prohibited.

iv. Ensure that points leading to loading/unloading line on which the tank is to be loaded/unloaded are set and pad locked so as to isolate the line on which loading/unloading is to be done. If loading/unloading is to be done at one end of a long siding, it must be protected properly by a scotch block or other authorized device so as to prevent any wagon dashing against the tank wagon. It must also be ensured that shunting is not permitted on the same line when loading/unloading is being done.

v. Ensure that signs are exhibited at a suitable distance away from the tanks on the approach end or both ends as applicable.

vi. Ensure that the tank is filled by connections to the liquid valves, which have dip pipes to the bottom of the tank. The other gas valve is connected to the absorption system of the chlorine plant or Ammonia plant. In the case of TPGL tanks, two liquid valves are provided for loading/unloading of the tank. The rate of flow of LPG liquid becomes too great in case only one liquid line is provided and this may result in the excess flow valve (provided inside the pipes below the diaphragm plate) closing off. Use of only one valve may result in closing down of excess flow valve repeatedly.

vii. The tank should not be loaded beyond its marked capacity under any circumstances.

viii. Tank wagon(s) must not be allowed to stand with loading/unloading connections attached after loading/unloading is completed.

ix. Throughout the entire period of transfer operations or while the tanks connected to loading/unloading devices, the tank(s) must be continuously attended to by the operator.

x. If it is necessary to discontinue transfer operations for any reasons, all loading/loading connections must be tightly closed and closure of all other concerned components strictly ensured.

xi. On completion of filling operation, the valves should be properly closed and dome cover sealed. The caution signs should then be removed and padlocks on the points opened to enable the tank(s) to be taken out for attaching to trains.

xii. The loading of pressure gas tank wagons must be carried out by using a gas compressor i.e. the compressor will be connected to the gas valve on the tank. The liquid valve on the tank will be connected to the storage tank. By ensuring that the pressure in the tank barrel is about 10 lbs/sq.in (gauge) above the pressure in the storage tank, the liquid gas will discharge itself. To avoid reverse siphoning of the liquid gas into the tank barrel, the above pressure must be maintained inside the barrel till such time the whole contents are discharged.

xiii. While discharging, the pressure inside the tank barrel should be maintained steady so as to avoid any chance of sudden evaporation and consequent chilling of the barrel plates.

xiv. When all the liquid gas has been transferred, which will be indicated by the level ceasing to rise in the storage tank, the liquid valve on the tank must be closed.

xv. All tools and implements used in connection with transfer operations must be kept free from oil, grease, dirt and grit.

xvi. Seals and other substances must not be thrown into the tank. Care must also be taken to avoid spilling of the contents over the tank.

1021. LOADING AND UNLOADING CORROSIVE LIQUIDS (TSA, BTCS & TCS TANK WAGONS)

i. Only concentrated sulphuric acid of concentrations 80% or 85% and above is to be loaded in a TSA wagon. Dilute sulphuric acid of lower concentrations if loaded will corrode the tank since the latter is unprotected/unlined from inside. No chemical other than concentrated sulphuric acid should be loaded in a TSA wagon. Caustic soda lye (liquor) having specific gravity of 1.51 at 15^0C or a concentration of not less than 48% and containing not more than 3% of any chloride and no free chlorine, is loaded in the caustic soda tanks type BTCS & TCS.

ii. Before loading it should be ensured that the tank barrel and washout valve is free from any leaks and the dome cover fits airtight. A leaky tank wagon should not be allowed to run on line and it should be suitably marked for repairs after unloading. Dome fittings should be inspected for leaks and other defects before unloading to avoid acid spillage or spraying.

iii. An air space of not less than 5% of the capacity of the tank should be left. When higher concentrations are filled, it should be ensured that tank wagon is not overloaded beyond its carrying capacity in tonnes.

iv. All empty tank wagons should be securely closed airtight as sulphuric acid is self-diluting and absorb moisture from atmosphere. Dilute sulphuric acid is highly corrosive to mild steel.

v. During the loading and unloading operations, caution signs must be exhibited at a suitable distance away from the tank on the approaches at both ends.

vi. Smoking or bringing a naked flame or lamp near TSA wagons is strictly prohibited. An incandescent electric light with gas proof socket should be used.

vii. At the time of loading/unloading, the tank wagons should be protected by means of scotch blocks or other suitable devices to prevent any risk of damage due to inadvertent shunting.

viii. Steel spanners/tools should not be used as they may cause sparks on striking, Brass tools may be used.

ix. All spillage of acid should first be neutralized by means of hydrated lime and washed down the drain with an adequate supply of water.

x. The tank wagon has a top discharge arrangement. For loading the tank it should be connected to an air compressor through the globe valve and it must be ensured that the pressure in the tank does not rise above 30 psi. The discharge pipe should be connected to the designated line after removal of the blank by means of a suitable flange after inserting a rubber gasket/lead lining. The gasket/lead lining prevents spillage of acid on the tank barrel.

xi. The filling in of the tank wagon is also effected through the discharge pipe by connecting it to the consignee's acid supply pipeline by means of a suitable flange after inserting a rubber gasket/lead lining. During the filling in operation, the globe valve/air compression valve should be in open position to permit exit of air from the tank.

1022. LOADING AND UNLOADING OF TANK WAGONS

i. Hydrochloric acid has a characteristic pungent odour, which gives warning of its presence. All unprotected contact with the hydrochloric acid fumes should be avoided.

ii. No chemicals other than hydrochloric acid should be loaded in THA type tank wagons.

iii. Adequate supervision of filling and emptying of wagons is necessary to ensure that this is done in an authorized manner only.

iv. The filling should be done from the filling and discharge pipe. This pipe is provided with a rubber lined flange. A corresponding flange should make the connection to the acid supply line after inserting a rubber gasket between the filling flange and the supply flange. The gasket prevents spillage of acid on the tank barrel and would also prevent damage to the rubber lining on the filling/delivery flange.

v. In order to give vent to the air inside the tank barrel, the air flange should be removed for the filling operation.

vi. The decanting should be done after connecting the delivery pipe to the discharge flange. Connecting with the help of a suitable flange using a rubber gasket should do this.

vii. The air pipe flange should be removed and a pneumatic line should be connected to the air pipe, by means of a suitable flange after inserting a rubber gasket.

viii. The pneumatic pipeline should be connected to a pneumatic system wherein the pressure in the line cannot exceed 1.75 Kg/cm^2 (25 psi). This is done to prevent damage to the tank barrel.

ix. After the tanks have been unloaded, they should be filled with clean water at a temperature not exceeding 38^0 C (100^0 F). This is done to prevent deterioration of the rubber lining as the rubber decomposes in presence of air.

x. All spillage of acid should be washed down the drain with an adequate supply of water. If the spillage is excessive, the acid should first be neutralized by means of hydrated lime.

1023. PRECAUTIONS FOR TANKS FOR PETROLEUM AND OTHER INFLAMMABLE PRODUCTS

A. At loading points

i. Ensure that all tank fittings are in good working condition.
ii. Ensure that tank fittings are provided with requisite anti-pilferage devices.
iii. Ensure that the safety valve is intact and properly sealed.
iv. Ensure that the master valve is fluid tight.
v. Ensure that the bottom discharge valve is fully closed and fitted with a blank flange and gasket before commencement.
vi. Ensure that the vapour extractor cock and vent plug are open before commencement of loading.
vii. Ensure that loading is done through the filling pipe only.
viii. Ensure that recommended air space as specified for the particular petroleum product is provided and that payload does not exceed the permissible limit.

ix. Remember to close the vapour extractor cock after loading.
x. Remember to fit the cap on the vapour extractor cock after loading.
xi. Remember to fit the cap on the filling pipe after loading.
xii. Ensure closure of the vent plug cock after loading.
xiii. Provide proper sealing when dome cover eye bolt nuts are tightened.
xiv. Make sure that the dome cover is closed after loading.

B. At unloading points

i. Close the master valve after unloading.
ii. Close the bottom discharge valve after unloading.
iii. Fit the dummy flange with gasket and all its bolts back in position after unloading.
iv. Close the dome cover after unloading.
v. Tighten eye bolt nuts of dome cover after unloading.
vi. Do not allow rough, hump or loose shunting.
vii. Do not allow unauthorized persons to operate valves.
viii. Do not allow any person to enter the tank barrel for internal examination/repairs unless the barrel has been steam cleaned.
ix. Do not undertake repair of the tank barrel by welding unless it is properly steam cleaned.
x. Do not start welding repairs on a tank wagon fitted with roller bearings unless the barrel is properly earth and roller bearings are short circuited.
xi. Do not allow tank wagon to move from loading/unloading points unless the tank fittings are properly refitted and dome cover closed.

1024. PRECAUTIONS FOR BITUMEN TANKS

A. Loading

i. The tank wagon offered for loading must be examined for any signs of leakage through the gaskets or flange stud holes. Tank wagons having any signs of leakage should be rectified before being offered for loading bitumen.
ii. Place the wagon at the proper loading point and ensure that the bottom discharge valve is properly closed. Load the bitumen through the manhole cover. Fill the tank to about $1/3^{rd}$ of its capacity and then stop loading for about half-an-hour. Check for leakage through the studs or gaskets provided at the end of the barrel, if any. Tighten the nuts all this stage if leakage is noticed through the gaskets/stud holes.
iii. Start loading again upto marked capacity. Close the manhole cover tightly.

B. Unloading

The wagon to be unloaded should be placed as near as possible to the storage tank in which it has to be unloaded. Open the mouth of the internal pipe and fix the burner centrally on the flanges. Ignite the burner and adjust the flame suitably for correct combustion to get a long blue flame. After heating for half-an-hour, check if any leakage is noticed through the studs and gasket provided at the end of the barrel. Tighten the nuts to stop the leakage. Check leakage from the bottom discharge valve.

If leakage is found, close the valve tightly. Heating should be continued till such time the temperature rises to 150-160^0 C. Stop the burners and connect the air inlet valve of the wagon to the compressor. The top discharge valve should be connected with the storage tank with proper sealing and tightening of the nuts to ensure against leakage through these connections. The man hole cover along with its sealing ring must be secured tightly to avoid leakage. Unloading of the Bitumen from the tank should be completed in one stretch. During unloading, compressed air pressure should be maintained between 12 to 15 lbs/sq.in. It should be ensured that the tank is completely drained of its contents before releasing it. After unloading, the cover plate on the mouth of the internal pipe should be refitted.

1025. MAINTENANCE AND REPAIR IN SICK LINE

A) No person should be allowed to enter the tank barrel for internal examination/repair unless the barrel is free from noxious or inflammable fumes. Therefore, before internal inspection of barrel is allowed, it must be steam cleaned/washed with solution of sodium phosphate commercial or soda ash and washed with water or other suitable cleaning agent as prescribed in case of various types of tank barrels.

B) Before any repairs are commenced on such stock, due precautions must be taken to remove all such petroleum and other inflammable fluids as required under IRCA red tariff and special instructions issued by the Railway/Railway Board from time to time. These precautions must be observed on empty tank wagons also and no staff should be allowed to enter the tank or to bring naked light or matches near it till the tank has been steam cleaned and tested free of vapour.

C) Any repairs to tank barrels should be done only at nominated sick lines where facilities for steam cleaning are available. After repairs, the barrels and valves must be tested for leak. Safety valves must not be permitted with any deficient nut or bolt from sickline.

D) The tank wagon discharge valves blank flange and manhole covers should be secured with full complement of bolts and nuts when the tank wagons are released from sickline.

E) Whenever tank wagons containing petrol or other inflammable fluids are examined, only specified safety torches (battery torches) must be used for this purpose.

F) In addition to routine attention to underframe, suspension, running gear, draw gear, buffing gear and braking gear, the following examinations and repairs to be done in sickline :-

- i) Examination of tank barrels.
- ii) Testing of discharge valves and barrels to ensure that there is no leak.
- iii) Adjustment and examination of security fittings of safety valves
- iv) Examination of tank barrel insulation where provided.
- v) Examination of dome equipment

vi) Examination of barrel, cradles and fastening arrangements

G) The checks as mentioned in para 1018 B must be carried out by train examining staff before a tank wagon is certified fit for loading.

H) Testing of barrel is to be done as given in para 1006.

I) Procedure for repairs of tank barrel to be followed as given in para 1010.

J) The important modifications to be carried out in depots are given in Table 10.4.

K) The painting and lettering to be done as given in para 1017.

1026. MAINTENANCE AND REPAIR IN WORKSHOP DURING POH

The periodical overhauling of IRS tank wagons should be carried out in fully equipped mechanical workshops. The periodicity of POH (refer IRCA Part III Rule 2.4.3) is given in Table 10.3. For various type of tank wagons, detailed maintenance procedure is given is RDSO publications listed in Table 10.5. The detailed procedure for repair of tank wagon pressure vessels is also described in Appendix-IV.

TABLE 10.5 TANK WAGON

Particulars	BG wagons	
Mechanical code	BTPN	BTPGLN
Description	Bogie Petrol Tank Wagon	Bogie Liquid Petroleum Gas Tank wagon
Length over head stock (mm)	11491	18000
Length over couplers (mm)	12420	18929
Barrel Dia (inside) (mm)	2850	2400
Barrel Length (mm)	11458	17994
Wheel Base(mm)	2000	2000
Bogie Centre(mm)	8391	12970
Journal Size(mm)	RB 144.5 Φ	RB 144.5 Φ
Journal Centre(mm)	2260	2260
Wheel Dia on Tread(mm)	1000	1000
Max.AxleLoad (t)	20.32	20.32
Tare(t)	27.0	41.60
Pay Load (t)	54.28	37.60
Gross Load (Pay+Tare) (t)	81.28	79.20
Ratio Gross Load/Tare	3.01	1.90
Loading Density (t/m)	6.54	4.19
Cubic Capacity (Cu/m)	70.40	79.48
Total Brake power Empty (Kg)	19742	34128
Total Brake power Loaded (Kg)	35035	34128

TABLE 10.6

MODIFICATION ON BTPN TYPE WAGON

S.No.	Item	RDSO Ref.
1.	Breakage/bending of pull rods	MW/BTPN dated 3.1.94 and 12-95
2.	Inadequate clearance between discharge pipe flange and pull rod on BTPN wagon	MW/BTPN dated 9/10.3.96
3.	Securing of dome arrangement of BTPN wagon	MW/TPN dated 6.6.97
4.	Anchoring tee and barrel cracks modifications	MW?BTPN dated 12/13.12.97
5.	Broken valve spindle nut Drg. No. WD-86081-S/1 item NO.14 (This is to be modified as per RDSO Drg. No. WD-7-8994-S/1)	MW/CS/BTPN dated 19.12.89
6.	In-sufficient length of spindle screw (item No. 10 of Drg. No. WD-86081-S/61) This is to be modified as per RDSO Drg. No. WD-8994-S/2	--do--
7.	Modification to blank flange arrangement on BTPN wagon	MW/WT dated 23.12.93
8.	Conversion of top centre pivot arrangement from bolted to rivetted design on BTPN wagon	MW/BTPN dated 18.7.94
9.	Modification to BTPN empty/load spindle	MW/BTPN dated 1.11.94
10.	Master Valve a) Provision of stoper (Ref. Drg. No. WD-7-91-38 Item 3) b) Increase in collar dia meter Item 2 of WD-7-91/38 c) Provision of valve operating screw collar item 1 of WD-7-91/38	 MW/CS/BTPN dated 31.7.91 -do- -do-

TABLE 10.7 LIST OF RDSO MAINTENANCE PUBLICATIONS FOR TANK WAGONS

Sr. No.	Description	Name of manual/Publication
1.	Four wheeler wagon type ”TPR”(petrol)	G-3/Nov.60
2.	Bogie wagon type ”MBTPZ”(petrol)	G-5/July 62
3.	Bogie wagon type ”MBTPX”(petrol)	G-6/Dec.60
4.	Instruction for operation & maintenance of liquid chlorine tank wagon, type ”TCL”	G-38 H
5.	Manual for instructions for anhydrous ammonia tank	G-40H/Oct.76
6.	Instruction for maintenance & operation of Hydrochloric acid tank wagon type “THA” liquid chlorine tank wagon, type ”TCL”	G-55 H/Aug.76
7.	Instruction for maintenance & operation of bitumen tank wagon type ”TB”(preliminary)	G-60 H/Oct.76
8.	Maintenance manual for 9 wheeled liquified petroleum gas tank type ”TPGLR”(preliminary)	G-65/1983
9.	Maintenance manual for TSA	G-66/1983
10.	Maintenance manual for Phosphoric Acid tank wagon	G-71/1996
11.	Instruction for operation and maintenance for BTAL/BTALN	G-79/1988
12.	Instruction for operation and maintenance BG bogie tank wagon for Alumina type ”BTAP” for BTAL/BTALN	G-82/1988
13.	Maintenance manual for bogie liquified petroleum gas tank wagon type BTPGL	G-86A/1994 Rev.-1
14.	Safe handling of Hazardous chemicals transported in Rail Tankers	G-87
15.	Maintenance & operating instruction for bogie petrol tank wagon type “BTPN”	G-90 /1993

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MAINTENANCE MANUAL
FOR
WAGONS

Chapter – 11 ***Special Type of Wagons***

CHAPTER 11

SPECIAL TYPE OF WAGONS

1101. BOXNHA WAGON

a) SALIENT FEATURES

A BG Bogie Open wagon type `BOXN-HA' has been designed for carrying increased payload for bulk movement of Coal and Iron Ore over Indian Railways. The length and width of the wagon are same as those of existing BOXN wagon except the height of wagon, which is 3450 mm from rail level. Thus BOXNHA wagon is higher by 225 mm compared to BOXN wagon. The wagon is fitted with cast steel IRF 108HS, secondary suspension bogie, non-transition centre buffer coupler and single pipe graduated release air brake system.

The Salient Features of BOXNHA wagon are given below-

i.	Length over coupler faces	10,713 mm
ii.	Overall width	3200 mm
iii.	Overall Height	3450 mm
iv.	Estimated Tare Weight	23.17 tonnes
v.	Axle Load	22.1 tonnes
vi.	Gross Load	88.40 tonnes

These wagons are to be put in regular service by end of 1999. These wagons are expected to run in close circuit initially on Hospet-Chennai section of Southern and South Central Railway.

b) WAGON SUPERSTRUCTURE

The wagon superstructure consists of the following sub- structures:-

- Underframe
- Body sides
- Body Ends
- Side Doors

i. Underframe : The underframe is provided with two sole bars of ISMC 250 rolled channel section with centre sill of standard `Z' section alongwith ISMC 100 for stringers. To combat corrosion, corrosion resistant steel has been used. The body bolster is of box type construction fabricated by welding of plates and the cross bars are also of fabricated design made out of plate sections. The underframe is of all welded construction with material IS2062 Fe 410 CuWA. The floor plate is made out of Corten Steel to IRS-M41 and welded to the underframe. The details of underframe members are given in Table 11.1.

TABLE 11.1
DETAILS OF SUPERSTRUCTURE

Description	Section	Material Specification
Sole bar	ISMC-250	IS:2062 Fe410CuWA
Centre Sill	Standard `Z' Section	-do-
Underframe Stringers	ISMC 100	-do-
Bolster	Fabricated Box Section using 12 mm thick plate.	-do-
Floor Plate	6 mm thick plate	IRSM 41
Side Stanchion	Fabricated with 8 mm Plate	IRS-M41
Top Coping	Fabricated with ISMC 100 +6 mm plate	IS:2062 Fe410 CuWA,
Inter Coping	ISMC 100	-do-
Body Side Sheet	5 mm Sheet	IRSM-41
End Stanchion	ISMC 150	IS:2062 Fe 410 CuWA
End Sheet	5 mm Sheet	IRSM-41
Door Frame	Fabricated IS:1079 Gr.0 Sheet	IS:2062 Fe 410 CuwA
Door Sheet	5 mm Sheet	IRSM-41

ii. **Body Side:** The body side consist of box section stanchions with sturdy top coping and intermediate copings. Body side sheets are made out of corten steel and are welded to the underframe crib angle on top of solebar. Floor plates are manufactured from Corten Steel. The side stanchions are however, connected to underframe by riveting.

iii. **Body-Ends:** Body- ends consist of end panels, end stanchions, top coping and intermediate coping. During assembly to the underframe, the end panels are welded to end floor-angles. End stanchions are, however, connected to the head stock by riveting.

iv. **Side Doors:** Each side of BOXNHA wagon is provided with three side doors alternately between the dummy quarters. The doors have been provided to unload the material manually in case of emergency when mechanical unloading system is out of order. The side doors are hinged at the bottom similar to conventional doors of wagon. The doorplates are made of corten Steel and door frames are of fabricated design.

v. **Use of IRSM 41 Steel:** Body panel of Coal Wagons like BOXNHA encounter corrosive environment due to presence of sulphur and other carbonoic acid components in coal. Use of corrosion resistance steel to IRSM-41 will face the situation better due to formation of an adherent protective oxide film on the surface if it is left undisturbed. IRSM-41 steel has following properties-

- Stronger than mild steel
- Easily weldable
- Develops its own protective film against corrosion.

vi. **Welding of IRSM-41:-** Barring a few riveted joints, wagon structure is an all welded assembly of plates and rolled section. Extensive repair by welding is, therefore done during maintenance/rectification of defects.

vii. **Precautions during welding of IRSM-41**

For welding fabrication of IRSM 41, following precautions should be taken-

- Electrodes to IRS D2 shall be used.
- Edge preparation shall be done as per IS:9595.
- Electrodes shall be preheated as per recommendation of manufacturer.
- Interpass runs shall be cleaned properly.
- Welders should be qualified.

c) NATURE OF REPAIRS IN BOXNHA

BOXNHA wagons are used extensively for transportation of Coal/Iron ore in bulk. Due to mechanised loading/unloading, these wagons are subjected to heavy shock loads due to which following defects may develop:-

- Bulging of Body Structure
- Puncturing of panels due to improper loading
- Corrosion of panels
- Slackening of rivets
- Failure of welded joints
- Distortion of doors
- Wear on door hinges

d) MAINTENANCE & REPAIR PROCEDURE

i. Body Building: Body normally bulges out on the sides due to improper handling at tipplers during unloading of commodity. Similarly, the end structure bulges out due to shunting forces. If there is no serious damage on side/end structure other than bulging, bulges can be effectively removed without dismantling. When bulging of the structure is more than 25 mm, it should be rectified by pulling with the help of chain & screw coupling. Bulging of all welded body sides can be rectified by spot heating and pulling by chain and screw coupling. In case of end bulging, two wagons with bulged end are coupled together and hydraulic jack is applied between them at the bulges. Suitable packing can be interposed between jack and wagon body. For all welded ends spot, heating can be applied for straitening.

ii. Puncturing of Panels: Body side/end panels are punctured due to improper loading and shunting. Punctured end side panels are repaired by welding of panel patches as per standard practice.

iii. Corrosion of panels : Corrosion of body and floor takes place due to the following:-

- Water logging
- Accumulated dust and refuse which retain moisture for long period
- Spillage of corrosive fluid due to defective packing
- Inadequate protection due to poor painting.

The current practice is not to paint the wagon from inside because the painting on inside wall can not withstand the constant scrubbing action of commodity during mechanized unloading. The following measures should be undertaken-

a) Most important measure to be taken in day to day working is to ensure that the wagon is kept thoroughly cleaned after unloading. It should receive attention in this respect after it has transported a corrosive or hygroscopic commodity.

b) While attending to repairs and panel patching, it is important to ensure that surfaces in contact are well fitted to avoid water pockets. Due care should be taken to clean and paint the affected surface to prevent corrosion.

c) The table below indicates the sizes of panel patches to be used for repairs of corroded panels. If area of the patch extends beyond 260 mm from floor height, either two standard patches of 5 mm thick seat should be used one above another or a single patch of 5 mm thick and 520 mm width should be used. In case two or more adjacent panels require patching at the same time, the complete length of corrosion can be covered by a straight pitch which must extend from stanchion to stanchion.

iv. **Slackening of Rivets for BOXNHA wagon:** Rivets are provided at the bottom of the side stanchions to join them with underframe structure. These rivets sometime get loosened due to combined effect of shock, corrosion and wear. Loose rivets can be identified by gentle hammering on rivets which will produce dull sound. The loose rivets shall be cut by chisel and then holes shall be set/repaired by welding. Re-drill to size and put new rivets.

v. **Door Defects:** The main defect in doors is distortion due to mishandling, wedging or jammed hinges. The distorted doors shall be taken down and straighten to ensure proper fitment. Worn out /damaged hinges should be replaced by reconditioned/new hinges. After repair, doors must sit flush against striking plates with adequate overlap between levers. Graphite grease should be applied on all the hinges.

vi. **Repairs to Door and Fittings:** The main defects which arise in side doors of these wagons are distortion due to mis-handling, jamming of engine and Bulging of door panels due to improper handling during un-loading on tipplers. Distorted or bulged doors must be taken down and straightened to ensure proper fitment. The worn out hinges, which are responsible for sagging/gaping of doors, shall be replaced with new or reconditioned ones. The corroded frame of door must be cut out and replaced by welding after repairs. The doors must sit flush against the wagon structure with proper support.

1102.BOXNCR WAGON

a) SALIENT FEATURES

Bogie open wagon type BOXNCR is similar to BOXN wagon except the following:-

i. Barring rolled sections, the wagon body is manufactured from steel to IRSM M-44 instead of steel to IS:2062 Fe410CuWA or IRSM-41.

ii. Crib angles side to ISA 50x50x6 is manufactured from IRSM- 44 steel instead of IS:2062 Fe 410 CuWA steel.

iii. Sole bar is manufactured from IRSM-41 instead of IS:2062 FeCuWA steel.

Other features like overall dimensions, bogie couplers and draft gear, brake gear, brake system, etc. are exactly same as BOXN wagon.

b) MAINTENANCE & REPAIR

i. Since BOXNCR wagon is similar to BOXN wagon, the maintenance schedule and repair procedure shall be similar to BOXN wagon. However, since the wagon body is made from IRSM-44 steel, the body panels, when corroded, shall be replaced with IRSM-44 steel panels only. The IRSM-44 steel panels/plates shall be cut either by shearing machine or by plasma cutting machine but not by oxy-cutting. The welding electrodes to be used for repairs are indicated in table 11.2.

TABLE 11.2 ELECTRODES FOR WELDING

S. No	**Material to be welded**	**Electrodes/filler wire to be used**
1.	IRS M-44 to IRS M-44	IRS class M1 with IS code E19. 9LR16 (as per IS;5206-83) or 3081 (MIG) as per AWS.
2.	IRS M-44 to IS:2062/5986/1079	IRS class C2 basic coated low hydrogen type having IS code EB5426H3JX or EB5424H3JX as per IS:814-91.
3.	IRS M-44 to IRS M-41	IRS class D2 with high deposition.
4.	IS:2062/5986/1079 to IS:2062/5986/1079	Same as indicated in (2) above or CO2 filler wire as per IRS class I and IA.
5.	IRS M-41 to IRS M-41	Same as indicated in (3) above or CO2 filler wire as per IRS Class-III.
6.	IRS M-41 to IS:2062/5986/1079	Same as indicated in (5) above.

ii. The edge preparation should be done as per IS:9595 for both "V" butt as well as fillet joints. Electrodes and filler wires should be procured from any RDSO approved sources and the parameters like current, voltage, etc. should be as per IS code and manufacturers recommendations. Preheating of electrodes of IRS class C2 & D2 at 250 deg. C for 2 hours, 350 deg. C for one hour or as recommended by the manufacturer be done prior to use. After heating, electrodes are to be kept in an electrode oven at 110^{o} C to avoid any moisture pick up.

c) PRECAUTIONS FOR WELDING STAINLESS STEEL

i. Since Stainless steel has high coefficient of thermal expansion and less heat conductivity, it is advised to use low welding currents with the recommended range and smaller gauge electrode to minimize heat input and reduce distortions.

ii. Surface to be welded must be clean, dry and free from dirt, oxide film, oil, grease etc.

iii. Electrodes should be re-dried before use.

iv. Always maintain short arc to minimize the loss of alloying elements.

v. Avoid weaving and make stringer beads.

vi. After finishing welding, lift electrode slowly and fill the crater before breaking the arc. This will avoid crater cracks.

vii. Use stainless steel wire brush for cleaning welds.

viii. Use electrode preferably with DC(+).

ix. Every bead should be properly cleaned before further welding on it.

x. Welding should be preferably carried out in flat position.

xi. Correct electrode size, recommended current, arc length, travel speed and electrode angle must be followed.

xii. Any defect like crack, blowhole etc. must be properly gouged out and re-welded.

xiii. Do not strike arc adjacent to the weld.

xiv. Tack the welded area correctly to ensure proper gap.

xv. Proper welding sequence must be followed to reduce internal stresses and hence reduce warpage of structure.

xvi. Always weld towards the free ends.

d) SURFACE PREPARATION & PAINTING

i. The surface preparation and painting schedule for underframe of the wagon shall be as per standard specification No.G-72 (Rev.1) read with latest amendments.

ii. Surface preparation of the wagon body

Degreasing with petroleum hydrocarbon solvent to IS:1745-1978 (low armatic grade 145/205) or any other degreaser (applicable for both SS,MS and corten steel).

iii. PAINTING OF WAGON BODY

For stainless steel

- Apply thin coat of etch primer to IS:5666-1970.
- Two coats of IS:2074-1992, ready mixed paint, air drying, red oxide zinc chrome priming to minimum DFT of 50 microns.
- Two coats of IS:123-1962, ready mixed paint, red oxide, brushing, finishing, semigloss to ISC:446 to IS:5-1994 to a DFT of 80 microns.

For mild steel and corten steel

- Remove dust, loose rust and mill scale etc. manually by scrapping, chipping and wire brushing to at least St.2 of IS:9954.
- Two coats of IS:102-1962, ready mixed paint, brushing, red lead, priming to minimum DFT of 80 microns.
- Two coats of IS:123-1962, ready mixed paint, red oxide, brushing, finishing, semi-gloss to ISC:446 to IS:5-1994 to a DFT of 80 microns.

iv. The painting of bogies, couplers and air brake equipment shall be done as given in para 11.2.5 of General Standard Specification No. G-72 (Rev.1) read with latest amendments.

1103. BOGIE LOW PLATFORM CONTAINER FLATS (BLC)

Bogie container flat wagons have been designed for transportation of 2896 mm high Series-I, ISO containers for a gross payload of 61t at an operating speed of 100 km/h. These containers, when loaded on the earlier flat wagon caused infringement to the X-class MMD, resulting in constraints in their free movement.

In order to ensure that the wagons loaded with 2896 mm containers lie within the X- class MMD, a low platform height of 1009 mm has been achieved with the use of hybrid design of bogie frame and bolster and with the use of smaller diameter wheels (840mm).

The wagons have all welded construction and are mounted on two cast steel bogies. The flats are formed into units of five wagons, each unit having two “A” car at ends and three intermediate “B” cars. One end of “A” car is fitted with centre buffer couplers to ensure proper coupling with the locomotive while the other end has slackless draw bar to couple with “B” cars. “B” cars are coupled together and to “A” cars by slackless drawbars.

The length of A car is 1362 mm while the length of B car is 12212 mm. The coupler of A car for attaching to loco or other stock is at 1105mm. The coupler in the B car at both ends is at 845 mm from rail level. The wagons are equipped with Air Brake. The diameter of new wheel is 840 mm and the condemning size is 780 mm.

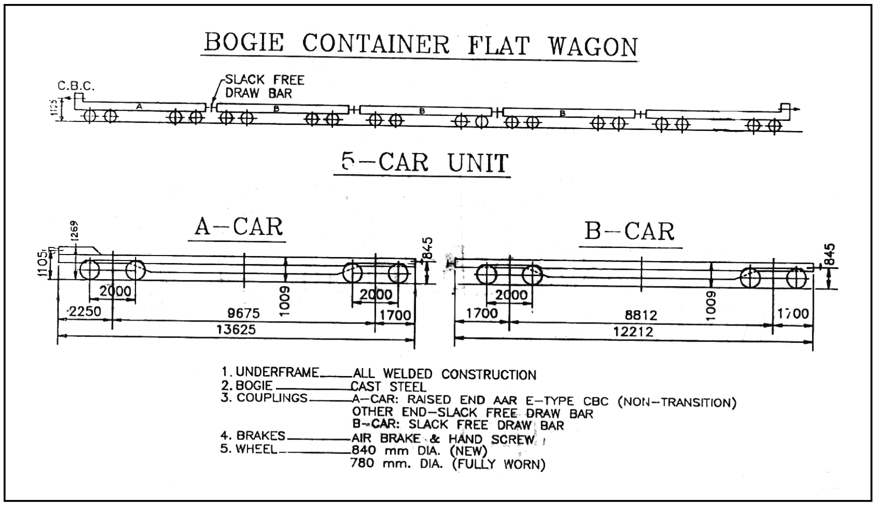

Fig 11.1

TABLE 11.3 NEW WAGONS

S.No.	Stock	Description
1.	BLCA/BLCB (Holding = 1080)	Low platform container flat wagons, light weight, all welded skeleton design underframe for an optimum tare to payload ratio, 840 mm wheel dia, A&B cars with A AR ‘E’ type CBC on raised ends of ‘A’ cars and use of slackness draw bar system on the inner ends of ‘A’ cars and on all ‘B’ cars, tare weight ‘A’ cares 19.lt ‘B’ cars 18.01, pay load 6lt.Fit to run 100 Kmph.
2.	BOXNHA (Holding = 125)	Higher axle load wagon suitable for 22.lt axle load and 8.25t/m TLD for coal loading. Payload per rake shall increase to 3783t as against341lt. In the existing BOXN wagon resulting in 11% increase in throughput per rake. Fit for 100 Kmph Tare weight=23.17, Payload = 23.17t Pay Load=65.13t
3.	BOXN (Holding = 580)	Use of corten steel in place of mild steel for the manufacture of BOXN wagons has resulted in arresting the problem of corrosion only to a limited extent. In order to reduce the problem of corrosion substantially, 3CR12 stainless steel has been used in the manufacture of BOXNCR

4.	BFKN (Holding = 580)	Air Brake CASNUB bogie container flat wagons owned by container corporation LTD. (being converted from BFKI)" Another 175 are yet to be converted.
5.	BCCN (Holding=30)	Double Decker Bogie covered wagon for transportation of automobile cars, Low platform 840 mm dia, air brake, fit for high speed (100 Kmph) axle load = 10.5t, pay load = 10t, Gross load = 42t, No. of wagons per rake = 18
6.	BFNS	Special wagons for transportation of HR coil, Tare weight 23.6t, payload 57.7t suitable for accomodating various sizes of coils Adjustable stoppers have been provided for suitable placement of coil in the groove and preventing longitudinal shifting of coils. The length and width have been kept equal to BRN wagons to facilitate loading flat products as being done on BRN wagons, Fit to run at 100 Kmph, The commercial production is yet to start.
7.	BCW (Holding = 125)	It is privately owned by M/s. Bulk Cement Corporation India Ltd. and are based at Wadi, Sholapur Division of CR, to run between Wadi and Kalamboli (Mumbai Division). Axle Load = 20.32t. The wagon is fitted with Air Brake.
8.	BTPGL	Bogie liquefied petroleum gas tank wagon, tare 45.7t, CC 35.5 t, Gross 81.28t. The wagon is fitted with automatic vacuum brake, length over head stock 18000 mm, length over Coupler faces 19282 mm.
9.	BTPGLN	Bogie liquefied petroleum gas tank wagon, tare 41.60t, CC 37.6 t, Gross 79.20t. The wagon is fitted with Air brake system, length over head stock 18000 mm, length over coupler faces 19282 mm

APPENDIX "I"

EXISTING POPULATION OF MAIN TYPE OF WAGONS

AS ON 31.3.2000

(As per PRM-8)
Table – I

STOCK	In vehicle Unit	In 4-wheeler unit
VAC. BRAKE STOCK		
C.CA.CJ.X.XC	3471	3471.0
CRC,CRT	16063	16063.0
Other for Wheelers	1108	1108.0
Total for Wheelers	**20642**	**20642.0**
Tank Wagons(Bogies)	7	14.0
Tank Wagon(FW)	28838	28838.0
Total Tank Wagon	**28845**	28852.0
BCX/C/R/T	17729	44322.5
BOX/C/R/T,BKCX	15986	39965.0
BRH/C/T/,BRS,BRST	5086	12715.0
BOB,BOBS,BOBC,BOBX	4075	11111.0
BFK,BFKI,BOKX,BFKX	3929	9350.0
MBKM	167	334.0
Other Bogies	3021	7159.0
Brake vans	2684	2684.0
Total Vac. Brake Stock	**102164**	**177135.0**
AIR BRAKE STOCK		
BCN	15814	39535.0
BCNA	23586	58965.0
BOXN	61686	154215.0
BRN	2733	6832.5
BOBR	2729	6822.5
BTPN	5715	14287
BTPGLN	849	1698.0
BOY	621	1863.0
BVZC	2881	2881.0
Total Air Brake Stock	116614	287099.5
GRAND TOTAL	**218778**	**464234.5**

OWNERSHIP OF BG WAGONS As on 31.3.2000
(Figures are in units)
Table - II

RLY	BCN	BCNA	BCX	CRT	BOX	BOXN	BRN BRNA	BRH BRHC BRHT
CR	4153	3257	2829	3802	1867	8128	392	231
ER	3160	-	2563	1015	4049	9698	174	1041
NR	2024	1643	3720	3198	1471	6650	42	379
NE	650					1244		
NF	974	1214				1353		
SR	1216	3630	1287	1032	541	3146		199
SC	815	4455	1854	2293	2717	6925	441	
SE	2517	5892	3359	1562	4766	19240	1621	2630
WR	305	3495	2117	2799	575	5303	63	494
TOTAL	**15814**	**23586**	**17729**	**15701**	**15986**	**61686**	**2733**	**4974**

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OWNERSHIP OF BG WAGONS As on 31.3.2000
(Figures are in units)

RLY	BRS BRST	BOB BOBS BOBY	BOBC	BOBX	BFK BFKI BOXK	BOI	BOY	BOBR
CR	67	380	-	-	543	-	-	147
ER		518			796			1924
NR	45	633			379			42
NE		57						
NF		49			69			49
SR		199			97			
SC		159			336			10
SE		1769	4	24	1304	03	621	557
WR		283			405			
TOTAL	**112**	**4047**	**04**	**24**	**3929**	**03**	**621**	**2729**

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OWNERSHIP OF BG WAGONS As on 31.3.2000
(Figures are in units)

RLY	BTPN	BVZC	TOTAL BK. VANS	TOTAL TANKS	OTHERS	TOTAL IN UNITS	TOTAL IN FOUR WHEEL ERS
CR	724	564	951	8989	2182	37918	**74,152.5**
ER	197	405	785	7310	1609	34642	**71093.5**
NR	522	455	831	1979	1401	24437	**51953**
NE	72			776		2727	**5765**
NF	1269	15	27	1926	1	5662	**13093**
SR	74	141	303	1581	595	13826	**29,846**
SC	7	427	660	835	549	22049	**48,795**
SE	435	810	1647	3521	823	51860	**120145.5**
WR	2415	64	361	8492	966	25657	**49815.5**
TOTAL	**5715**	**2881**	**5565**	**35409**	**8126**	**218778**	**464659**

APPENDIX "II"

STANDARDISATION OF INFRASTRUCTURAL FACILITIES IN AIR BRAKE ROH DEPOTS

Air brake depots have been classified based on the target capacity for ROH outturn/month as follows :

Category	Targeted capacity for ROH (Average/month)
Super Depots	Above 500
Mega Depots	250 to 500
Major Depots	125 to 250
Minor Depots	Upto 125

A. RECOMMENDED LAYOUT

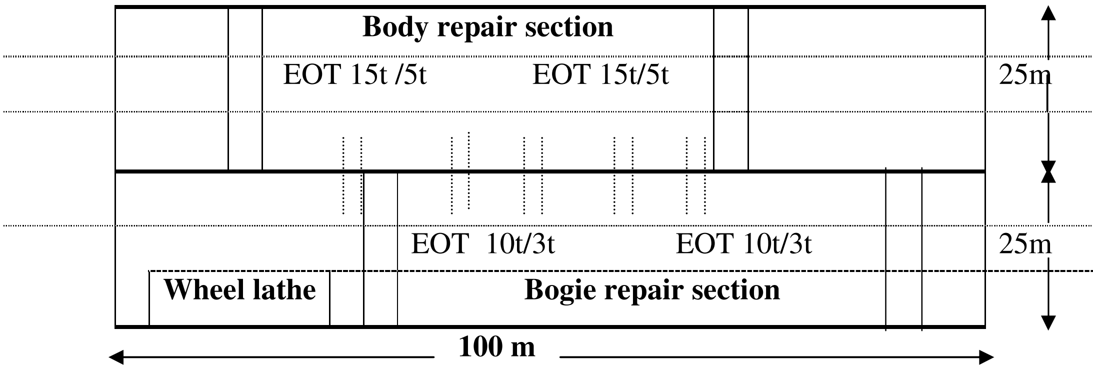
Analysis of sick marking of existing ROH depots on IR reveals that on an average each air brake wagon visits the depot thrice in 18 months, once for schedule ROH and twice for out of course repairs requiring lifting.

Therefore, an air brake depot meant for undertaking 250 ROHs/month needs to tackle another 500 wagons/m out-of-course repairs requiring lifting. Thus the layout should be spacious enough to release about 25-30 wagons/day.

The ROH schedule should be completed within 24 hours including placement and withdrawal time. Thus, if the depot has to undertake 250 ROHs/month the berthing capacity for ROH wagons **on trestles** should be 12 taking 20% margin for heavy repairs. Considering a mixed ROH outturn and the working length for BOXN as 15m & BCN/BTPN as 20 m, the length of the ROH depot works out as 100 m.

Casnub bogies require extensive repairs of bogie components. These bogies need to be tackled on bogie manipulators to ensure downhand welding. All wearing surfaces need to be built up to original (new) sizes. Further, all modifications issued by RDSO need to be implemented to ensure adequate safety. The bogie section is required to supply 20 bogies/day for undertaking 250 ROHs/month apart from repairing bogies required for out-of -course repairs. For this purpose, adequate work stations need to be set in a cranage area of about 2500 sq.m. (including wheel lathe area).

Recommended layout of bogie and body repair section for a Major depot undertaking 250 ROHs per month along with sick line work of out-of-course repairs is given below:



Further details of the model layout and its end view are given in the attached Fig. II-A. The above layout has to be supplemented with facilities for Stores, machine shop, smithy shop, air brake equipment overhauling sections, model room, compressor room, canteen, hostel, etc. which will largely depend on the existing layout.

Covered area under cranes i.e. cranage area for a fixed ROH outturn is a function of placement/withdrawal and number of working shifts. The recommended cranage area for depots undertaking 250 to 500 ROHs per month is given below:

1. For ROH depots WITH sickline attention		
250 ROHs/month + sick line repairs with double shift.		5000 sq. m including wheel lathe shed.
300	ROHs/month + sick line repairs with double shift.	5600 sq. m.
350		6200 sq. m.
400		6800 sq. m.
450		7400 sq. m.
500		8000 sq. m.

2. For ROH depots WITHOUT sickline attention
Depots undertaking only ROH workload and no out-of-course repairs can manage the outturn of 250 ROHs/month in about 3000 sq. m. cranage area working in double shifts.

MODEL LAYOUT FOR UNDERTAKING 250 ROHs/ MONTH

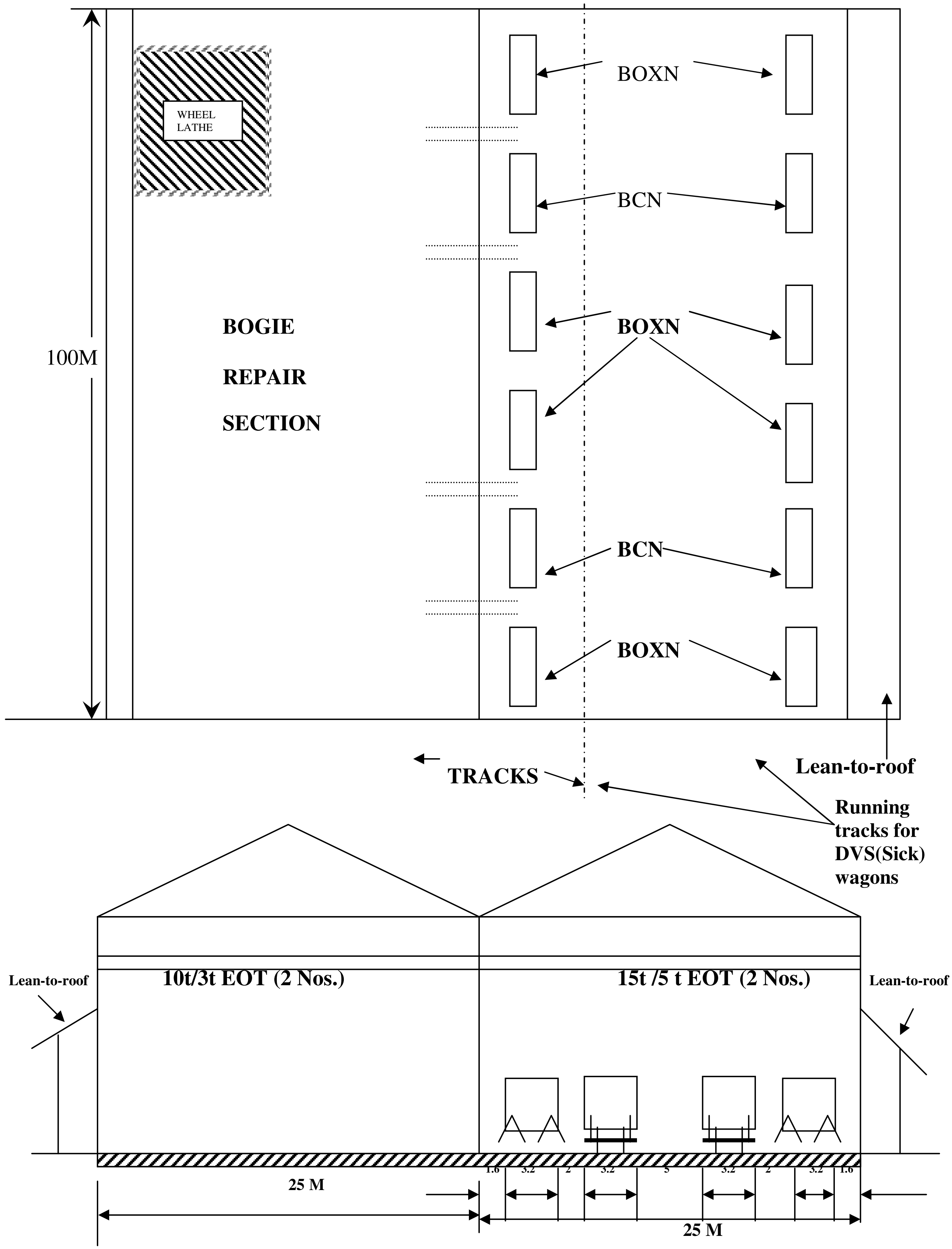


Fig. II-A

B. REQUIREMENT OF MACHINERY AND PLANTS

M&P requirement is closely linked with the Depot layout and the system of working. Certain M&Ps are directly related to outturn of depot (e.g. welding machines) but certain M&Ps are related to depot layout, especially material handling equipment. Various repair centres/sections in a depot are as follows :

1. Body shop
2. Bogie shop
3. Air brake equipment
4. Wheel reconditioning
5. Machine shop & material reclamation
6. Stores
7. Black smithy shop
8. Training equipment
9. Canteen & Staff amenities
10. Management information system
11. Office equipment
12. CMT laboratory
13. Miscellaneous.

Recommended list of M&P for a unit depot i.e. handling 250 ROH per month has been prepared. For a depot handling more than 250 ROH per month, the requirement has to be scaled up depending on depot layout and facilities created. Requirement of M&P for each section is given below:

1. Body section

Sr.No.	M&P	Quantity
1	EOT cranes 15t/5t	2 Nos.
2	Welding machines	4 Nos.
3	Portable hydraulic rivetter	1 Nos.
4	Trestles	12 sets
5	PC terminal (common with bogie section if layout permits)	No. will depend on layout.
6	Winches	As per layout
7	Portable Grit Blasting Machine	1 No.

2. Bogie section

1	EOT crane 10t / 3t	2 Nos.
2	Welding machines	6 Nos.
3	Portable hydraulic rivetter	1 Nos.
4	Stores bin	20 Nos.
5	Portable electric griders	3 Nos.
6	Jib crane 2.5t	10 Nos.
7	Fixture for rivetting spring plank	2 Nos.
8	Work station for bogie repair	10 Nos.

9	Turn table for wheel sets	As per layout.
10	Road crane 10t capacity	1 No.
11	Bogie manipulators	3 Nos.
12	Roller bearing diagnostic equipment	2 Nos.
13	Magnetic flaw detector	2 Nos.
14	CO2 welding machine	2 Nos.

3. Air brake equipment

1	Elec. Stationery screw air compressor complete with air receiver 15 m 3/min (This is for depot only. Additional compressors will be required for yard).	1 No.
2	Portable diesel compressor	1 No.
3	Single car test rig	2 Nos.
4	DV test stand	1 No.
5	Hydraulic pipe bending machine	1 No.
6	Air conditioners with voltage stabilizer	2 Nos.
7	Torque wrench with various sizes of sockets less than 1 inch.	4 set.
8	Ultrasonic cleaning table for DV components	1 Nos.

4. Wheel Reconditioning Equipment

1	Surface wheel lathe with Servo controlled voltage stabilizer	1 No.
2	Pneumatic torque wrench with sockets 1” to 2”	4 sets
3	Pressure grease drum with guns 15t capacity.	2 Nos.
4	Ultrasonic flaw detector	2 Nos.
5	Bearing marking gadget	1 set
6	Mono-rail for handling swarf (detail plan will depend on layout)	1 set
7	Bins for storing bearings	As per requirement
8	Fork lifter 2.5t	1 No.
9	P.C. Terminal	1 No.
10	Wheel diameter measuring gauge	2 Nos.

5. Machine shop & material reclamation

1	Heavy duty shaping machine	1 No.
2	Jib crane 2.5t	1 No.
3	Centre lathe 12 ½” cap.	1 No.
4	Redial drilling machine	1 No.
5	Centre lathe 6” cap	1 No.
6	Bench drilling machine	1 No.
7	Heavy duty pedestal grinder double ended	1 No.
8	Shearing machine 6 mm	1 No.

6. Stores

1	Truck 10t capacity	1 No.
2	Tractor with hydraulic lifting machine and 3 trolleys (trailers)	1 No.
3	Fork lift 2t	2 No.
4	Platform truck 2t	2 Nos.
5	Battery charger	2 No.
6	Weighing machine 500 kg	1 No.
7	Light store vehicle	1 No.
8	Hand trolleys with rubber wheels	10 Nos.
9	Storage racks	As per layout
10	Computer terminal with printer	1 No.
11	Furniture	As per layout

7. Black smithy

1	Black smithy hearth	1 No.
2	Anvil	1 No.
3	Hand tools	5 sets
4	Motorised blower	1 No.

8. Training equipment

1	Cut models of DV, SAB, Angle cock.	1 No. of each design
2	Television (large screen) projector type	1 No.
3	VCR	1 No.
4	Furniture	As per layout
5	Hostel along with kitchen equipment	
6	Overhead projector	1 No.
7	LCD projector	1 No.

9. Canteen & staff amenities

1	Water cooler	3 No.
2	Stainless steel tables & chairs	As per reqt.
3	Kitchen equipment, cooking gas, utensils	As per reqt.
4	Fitter's lockers	As per reqt.

10. Office Equipment

1	PC terminal	2 No.
2	Printer	1 No.
3	Furniture	As per layout
4	Air conditioner for DME's chamber & computer room.	3 No.
5	Intercom 10 lines	1 No.

6	Fax with P&T line	1 No.
7	First aid equipment	4 set
8	Photocopier	1 No.
9	V.H.F. sets.	10 sets

11. Miscellaneous

1	Gas cutting equipment	4 Nos.
2	Hydraulic jacks	As per requt.
3	SAB test bench	1 No.
4	CBC and draft gear replacement equipment	1 No.
5	DG set 350/500 KVA	1 No.
6	Lumpsum for electric and pneumatic tools	
7	Lumpsum for fitter's hand tools.	
8	Lumpsum for gauges & instruments.	
9	Wheel flat detector system	*
10	Wheel flange welding machine	*

(*) To be installed in depots/yards as per instructions of Railway Board.

12. Where power failures are rampant, a Diesel Generating Set to run the wheel lathe and cranes may also be planned.

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APPENDIX "III"

LIST OF IMPORTANT MODIFICATIONS TO BE CARRIED OUT ON FREIGHT STOCK

(IRCA letter No. M/129/Policy/W dated 12.4.99 & Rly Bd. L. No. 98/M(N)/951/11 dt.6.4.99)

I. BOGIE & ITS COMPONENTS

Sr. No.	ITEM DESCRIPTION	RDSO'S REFERENCE	TO BE DONE IN			
			Sick line	ROH	POH	New Built
1.	The existing push rod support arrangement are to be removed and replaced by shown in SK69597Alt 15 for 22W & WD 85054 S/4 Alt.4 22W(M) bogies	MW/BOXN/MAINT dt.10/11.9.90 and WM/PLANG/CSNB Dt.13.9.94	NO	YES	YES	YES
2.	Retrofitment of elastomeric pads and constant contact side bearer pads in CAS. 22W bogies	MW/PLNG/CSNB dt.15.1.90	NO	YES	YES	Not under manufacture
3.	Fitment of strengthened brake shoe adjuster to Drg No. WD 88012-S/1 Alt 7 (item 4)	MW/PLNG/CSNB dt.10.11.90	NO	YES	YES	Not under manufacture
4.	Replacement of nylon bush by steel bushes on CASNUB bogies	MW/Nylon BG/Comp. dt 18.5.94	NO	YES	YES	YES
5.	Modification of Centre pivot Bottom on CAS 22W(M) type bogies to avoid jamming	MW/PLNG/CSNB/M dt.31.1.94	NO	YES	YES	Not under manufacture
6.	Provision of wear liner on wearing surface of CASNUB 22(W),NLM,NLB bogie. Alternatively wearing surfaces may be reclaimed by welding.	MW/PLNG/CSNB/M dt.28.12.93 & MW/BOXN/MAINT dt.6.1.93	NO	YES	YES	YES
7.	Conversion of top centre pivot arrangement from bolted to riveted design on BCNA/BRN wagons, BTPN, BOXN, BCN wagons	MW/PLNG/CSNB/M dt.3.5.94 & MW/BTPN dt.18.7.94 & MW/BOXN/MAINT dt.28.6.93	NO	YES	YES	YES
8.	Use of bulb cotters in place of standard split cotters in CASNUB bogies	MW/PLNG/CSNB/M dt.14.9. 94	YES	YES	YES	YES
9.	The brake beam to WD-89033-S/1 Alt 14 to be strengthened by providing stiffener plate	MW/PLNG/CSNB dt.17.11.95	NO	YES	YES	YES
10.	In centre pivot details WD-85079-S/2 Alt-15, assembled height with tolerances given and material of top pivot changed to AAR 201 Gr. C	MW/PLNG/CSNB dt. 2.4.96	NO	YES	YES	YES
11.	Instruction for welding of bottom centre pivot with bolster has been given by welding size and type of	MW/PLNG/CSNB dt. 2.4.96	NO	YES	YES	YES

	electrodes					
12.	Use of modified Elastomeric pads to Drg No. WD-95005-S/1 for casnub type bogies		NO	YES	YES	YES

II. WHEELS, AXLES , BEARINGS

1.	Adoption of worn wheel profile for all BG wheels	MW/CWSC/58 dt.18.3.92	YES	YES	YES	YES

III. WAGON SUPER STRUCTURE AND BRAKE RIGGING

1.	Modification to blank flange arrangement on BTPN	MW/WT dt.23.12.93	NO	NO	YES	YES
2.	Modification to brake gear in BTPN wagon to prevent breakage/bending of pull rod.	MW/BTPN dt. 3.1.94	NO	NO	YES	YES
3.	Strengthening of horizontal lever support (large on BOXN/BCNA wagons)	MW/BOXN/MAINT/dt.24.1.94	NO	YES	YES	YES
4.	Provision of anti rotation lug on empty tie rod coupling nut of BOXN/BCN wagons	MW/BOXN/MAINT/dt.15.1.94	YES	YES	YES	YES
5.	Provision of stiffener angle on axle guard of BVZC wagon	MW/CWSC/Secretariat dt. 23.11.93 & 28.2.94	NO	NO	YES	YES
6.	Increase in the diameter of control rod from 28 to 32 mm of IRSA-600 Slack Adjuster	MW/SLA dt 23/29.12.93 & 10.5.94	NO	YES	YES	YES
7.	Provision of side bracket with link on BRH/BRN wagons to facilitate securing of steel plant consignment to wagon body	MW/ACT/BG dt. 27.5.94	NO	YES	YES	YES
8.	Modification to empty/load spindle bracket	MW/BTPN dt. 1.11.94	NO	NO	YES	YES
9.	Provision of extra roller type pull rod supports as per drg. WD-90016-S/1 Alt 12		NO	YES	YES	Not under manufacture
10.	Modification of main pull rod to prevent hitting with train pipe on BTPN wagons	MW/BYPN dt. 9/10.5.96	NO	YES	YES	YES
11.	Underframe strengthening of all welded BRN wagons	MW/BRN dt 12.12.98	NO	NO	YES	Not under manufacture
12.	Modification of existing door hold stiffener of BOBRN	MW/DOM/BOBR dt. 14.6.90	NO	YES	YES	YES
13.	Modification to securing of Dome arrangement of BTPN wagons	MW/BTPN dt.6.6.97	NO	NO	YES	YES
14.	Modification to anchoring tee joint on BTPN wagons	MW/BTPN dt.24/26.8.98	NO	NO	YES	NA

IV. NON AIR BRAKE FREIGHT STOCK

1.	Split COTTERS TO BE	MW/BOX/Drg. Dt 29.2.96	YES	YES	YES	Not under

	REPLACED BY BULB COTTERS IN UIC BOGIES (Ref. Drg No. 4000/9)					manufacture
2.	Bulb cotters are to be used in place of flat cotters in 4 wheeler tank wagons/CR/RTs	MW/WMG dt. 18/26.9.95	YES	YES	YES	Not under manufacture
3.	Increase in lateral clearance from 2.5 mm to 12 mm to provide better lateral flexibility in CRT suspension	MW/CRT dt.2/3.12.93	NO	NO	YES	Not under manufacture
4.	IRS specification R-66-81 introduced in place of IRD-R-8 in the following drawings a) WD/1 b) WD/SN-6303 c) W/SN-4727	MW/BOX/Spring/s.d. dt.1.6.93	NO	NO	YES	YES
5.	Fitment of glass wool in place of wood dust bags on BVG brake vans	MW/CWSC/59 dt. 10.2.95	NO	NO	YES	Not under manufacture

V. COUPLER & DRAFT GEARS

1.	Fitment of modified striker casting wear plate in CBC	MW/CPL/BG/HT dt.6.1.88	NO	NO	YES	YES

VI. AIR BRAKE SYSTEM

1.	Standardisation of isolating handle cock on DV	MW/APB/TP/M dt.27.9.88	NO	YES	YES	YES
2.	Modification to filtering arrangement of C3W DV of SCL	MW/APB/TP/M dt.24.11.88	NO	YES	YES	YES
3.	Provision of additional APD to DV	MW/APB/TP/M dt.1/6-5-92	NO	YES	YES	YES
4.	Modification to quick release valve of DV of Escorts make	MW/APB/TP/M dt.3/9-7-92	NO	YES	YES	YES
5.	Strengthening of APD for DV	MW/APB/TP/M dt.15.7.92	NO	NO	YES	YES
6.	Modification to the piping of BVZC wagon for fitment of quick coupling and detachable pressure gauge	MW/APB/TP/M dt.3/6-12-93	NO	YES	YES	YES
7.	Modification to hose coupling support	MW/APB 8/10-4-94	NO	YES	YES	YES
8.	Modification to the locking arrangement of barrel with leader nut casing of DRV2-600	MW/SLA dt. 20/21-7-88	NO	YES	YES	YES

APPENDIX- IV

REPAIR OF TANK WAGON PRESSURE VESSELS

1. Pressure vessels of tank wagons should only be repaired in nominated workshops having the following facilities:

- Manual welding machine
- Automatic welding machine
- Stress relieving furnace
- X-ray Gamma Ray equipment for taking radiographs of welded joints.
- Pneumatic testing arrangement at pressure given in Table- 10.2.
- Testing for valve.
- Dome fittings with 1t overhead joint.

2. In addition to the equipment mentioned in para 1, the workshops should have qualified staff to operate the above equipment. The welders for repair of the pressure vessels should have the performance qualifications as prescribed in IS 2825, Para 7.2.

3. Repair of fracture

Tank fractures should be repaired by one of the following methods:

- By preparation and welding of the fracture in compliance with interior and exterior reinforcement patch may be applied over repaired area if deemed necessary.
- By removal of defective area and application of welded insert.

4. Welding of fractures

When fractures are to be welded, each end of the cracks must be drilled or chipped out. Dia of drilled holes shall be at least half the plate thickness. If the fracture is not drilled, the chipped groove must be continued at least 25mm beyond each end of the crack and must be tapered towards the plate surface to provide sound weld metal and homogeneous base metal. The metal must be chipped or frame gouged along the fracture on one side of the tank to form a welding groove and then welded. After welding a groove must be back chipped or frame gouged from the opposite side to form a groove deep enough to permit complete weld metal penetration into the weld of the first side. Finished welds may be ground flush on both the sides. Prior to welding all oil, grease, scale, rust or foreign material must be removed from the tank shell around the area of the welding groove. A fracture not exceeding 75mm in length may be repaired by fusion welding without post heat treating or weld except when the fracture is in the knuckle radius of a head in which case it must be heat treated after welding. When several small fractures occur they may be repaired in this manner provided there is space of at least 6 times the plate thickness between any adjacent fractures and provided the total length does not exceed 600mm for tanks having test pressure of 100 lbs/sq.in above. If reinforcement is to be applied the repaired fracture must be first radiograph to ensure the soundness of the welding. Such reinforcement must be of a thickness at least equal to the original plate thickness and the area must be locally heat treated after welding.

5. Repair of pits and corrosion

Random pits may be chipped or ground to sound metal and welded and then ground flush to original shell thickness, post weld heat treating or radiograph are not required. Where pits are closely grouped or aligned and are deep enough to affect the strength of the metal, the affected area must preferably be removed and an insert applied and locally.

6. Repair of corroded location adjacent to welds

Corrosion in an area adjacent to a weld be repaired by welding. Radiography is not required if the corroded area does not exceed 10mm in width and 5mm in depth irrespective of length. If these dimensions are exceeded the repair weld must be radiograph in its entire length.

7. Repair of deformation and scoring

- Dents or buckles may be repaired provided the procedure by which the areas are restored to contour does not damage the material. If the sharpest radius formed by dents or buckles maybe removed by pressing or jacking to restore the plate to original contour. Excessive heating of the metal shall be avoided. For carbon steel the maximum temperature in 705 Deg.C. If the area formed by dents or buckles is less than 4 times the plate thickness or if the material thickness has been reduced, the affected area must be removed and replaced.

- Scores not exceeding 5mm deep and 10mm wide may be repaired by fusion welding and the surface ground flush. IN such scores post weld heat treatment is not required, provided the length of the score does not exceed 300mm and scores are separated by at least 6 times the shell thickness. Scores in excess of above limitations may be repaired by fusion welding but post weld heat treatment must be applied.

8. Repair by means of welded inserts and tank section

On fusion welded tanks, welded insert and tank sections may be applied to any part of the tank shell and head. The inserted material must conform to specification equivalent or superior to the original tank material. The insert or plate must have a double welded butt joint with 25mm minimum corner radius. The insert or plate must be formed to fit the contour of the particular location where it is to be installed. Welded but inserts and tank shell sections must be radio-graphed throughout their entire length.

9. Radiography

- If repaired by butt weld, the entire length of the welded portion must be radiographed.
- When deformation has been removed all weld seams in that area must be radiographed.

10. Post weld heat treatment

- After all welding is complete post weld heat treatment of the tank as a unit or by the double ending method is desirable for carbon steel tanks and mandatory for high alloy steel tanks.
- In lieu of unit post weld heat treatment for carbon steel tanks, local post weld heat treatment may be applied, provided stress relieving equipment such as controlled gas or electric uniform required temperature to an area at least 6 times the plate thickness on each side of weld is used. Local post weld heat treatment by manually held gas torch method must be limited to welds not more than 900mm in length or insert welds not exceeding 1500mm in perimeter. The temperature must be controlled so as to provide protection to adjacent metal to prevent harmful temperature gradient. Post weld heat treatment may be omitted for single or double butt welds not exceeding 25mm in length.

11. Retest

After repairs requiring welding, hot or cold forming to restore tank contour, tanks must be retested as specified in Table-10.2 before return to service.

12. All the repair to the barrel must meet the requirement of IS:2825 and should be done under the guidance of a reputed inspecting agency approved by Chief Controller of Explosives.

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APPENDIX –V

WAGON MANUFACTURERS AND WORKSHOPS

A. WAGON MANUFACTURERS (As on 31st OCTOBER 2000)

1. M/s. Modern Industries Ltd., P.O. Malik Nagar, G.T. Road, Sahibabad, Ghaziabad – 201 001
2. M/s. Cimmco Ltd., Bharatpur – 321 001
3. M/s. Braithwaite Co. Ltd. Hide, Kidderpore, Calcutta – 700 043
4. M/s. Texmaco Ltd., P.O. Balgharia, Calcutta – 700 058
5. M/s. Jessop & Co. Ltd. 63, Netaji Subhash Road, Calcutta – 1
6. Ms/. Burn Standard Co. Ltd. Santa Works, Burnpur – 713 325
7. M/s. Bharat Wagon & Engg. Co. Ltd., P.O. Mokameh, Distt. Patna – 803 302
8. M/s. Bharat Wagon & Engg. Co. Ltd., Muzaffarpur – 842 001
9. Ms/. Hindustan Development Corpn. Ltd., 27, R.N. Mukherjee Road, Calcutta Pin 700001
10. Ms/. Burn Standard Co. Ltd., Howrah Works, Howrah – 711 101
11. M/s. Southern Structurals Ltd., 8 Pughas Road, RajaAnnamalai Puram, Madras – 600 028
12. M/s. Binny Ltd., 65, Aramanian Street, P.O. Box. 66, Madras 600 001
13. M/s. BESCO Ltd., 8 Anil Maitra Road, Calcutta – 700 019
14. M/s. Bharat Gold Mines Ltd., Railway Wagon Works, Nundydroog Workshop, Oorgaum P.O. Kolar Gold Fields, Karnataka - 563 120
15. M/s. Sri Ranga Alloyds Ltd., Post Box 2096, 61, Athipalayam Road, Ganapathy, Coimbatore – 641 006
16. M/s. Titagarh Industries Ltd., 113, Park Street, Calcutta – 700 016
17. M/s. Bridge & Roof Co.(India) Ltd., 427/1, Grand Trunk Road, Howrah- 711 101
18. M/s. Triveni Structurals Ltd., Naini, Allahabad – 211 010
19. M/s. Richardson & Cruddas (1972) Ltd., Byculla Iron Works, Post Box No. 4503, Sir J.J. Road, Mumbai – 400 008

B. RAILWAY REPAIR WORKSHOPS

Every workshop has been allotted with five digit code. The first two digit will indicate the Railway in which the workshop is situated. The third digit will indicate the type of workshop and the fourth and fifth digit will indicate the individual number of the workshop.

The code alotted to the Railways are as follows;

Name of Railways	Code
1. Central Railway	01
2. Eastern Railway	02
3. Northern Railways	03
4. North Eastern Railway	04
5. N.F. Railway	05
6. Southern Railway	06
7. South Central Railway	07
8. South Eastern Railway	08
9. Western railway	09

For the type of workshops, the following codification will be made use of;

Type of workshop	Code
1. Loco workshops	1
2. Carriage and Wagon workshops	2
3. Loco Carriage & Wagon workshops	3

Accordingly, the following is the codification for various workshops;

Railway	S.No.	Name of Workshop	Code
Central Railway 1	1.	Parel	01101
	2.	Matunga	01201
	3.	Jhansi	01202
	4.	Bhopal	
Eastern Railway 2	5.	Jamalpur	02101
	6.	Kancharapara(Loco)	02102
	7.	Kancharapara(C&W)	02201
	8.	Lilluah	02202
	9.	Andal	02203
Northern 3	10.	Charbagh	03101
	11.	Amrtsar	03102
	12.	Alambagh	03201
	13.	Jagadhari	03202
	14.	Kalka	03203
	15.	Jodhpur	03301
	16.	Bikaner	03302
North Eastern 4	17.	Samastipur	04202
	18.	Gorakhpur	04301
	19.	Izatnagar	04201

Northeast Frontier 5	20.	New Bongaigaon	05201
	21.	Bongaigaon	05202
	22.	Baghdogra	05203
	23.	Dibrugarh	05301
	24.	Tindharia	05302
Southern 6	25.	Perambur (loco)	06101
	26.	Perambur (C&W)	06201
	27.	Golden Rock	06301
	28.	Mysore	06302
South Central 7	29.	Guntapalli	07201
	30.	Lalaguda	07301
	31.	Hubli	07302
	32.	Kurdwadi	07303
	33.	Tirupati	07202
South Eastern 8	34.	Raipur	08201
	35.	Bhubneshwar	08202
	36.	Nagpur	08302
	37.	Kharagpur	08301
Western 9	38.	Dahod	09101
	39.	Ajmer (Loco)	09102
	40.	Parel & Mahalaxmi	09201
	41.	Ajmer (C&W)	09202
	42.	Kota	09203
	43.	Jaipur	09206
	44.	Junagarh	09208
	45.	Pratapnagar	09303
	46.	Bhavnagar	09304

C. WAGON ROH DEPOTS

Name	Code
4. New Katni Junction.	NKJ
5. Mughalsarai	MGS
6. Andal jn.	UDL
7. Barwadih jn.	BRWD
8. Ramgundam	RDM
9. Bokaro Steel City	BKSC
10. Vishkhpattanam	VSKP
11. Bilaspur	BSP
12. Vijaiwada	BZA
13. Bhusawal	BSL
14. Vatava	VTA
15. Satna	STA
16. Ambala	UMB
17. Gooty	GY
18. Bhilai	BIA

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