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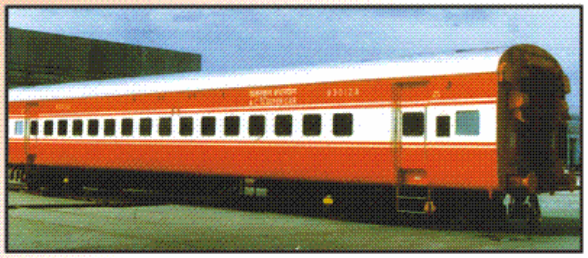
(भारत सरकार)

GOVERNMENT OF INDIA

रेल मंत्रालय

MINISTRY OF RAILWAYS

(RAILWAY BOARD)





आई.सी.एफ.डिजाइन के ब्रॉड गेज़ कोचों के लिये अनुरक्षण मैनुअल

MAINTENANCE MANUAL FOR BG COACHES OF ICF DESIGN

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NEW DELHI-110001

03rd July, 2002

FOREWORD

The maintenance manual for BG coaches currently in use was issued in December 1995. Since then, several improvements have taken place in the design and manufacture of coaching stock. This manual is an attempt to update information on the current fleet of coaching stock and to upgrade the maintenance practices. "CAMTECH" deserves all praise for bringing out such a well documented and comprehensive guide for the use of our engineers.

The need for proper maintenance of coaches for providing safety and comforts to the travelling public cannot be over-emphasised. It is necessary that correct practice are followed during POH and other maintenance schedules so that coaches give trouble-free and comfortable service on line.

Those of us involved in maintenance must appreciate the importance of right maintenance at right time so that the coach does not come for unscheduled repairs frequently. The effort should be to minimize overall maintenance time and reduce maintenance cost.

This manual covers rules governing Coaching Stock maintenance as given in IRCA Conference Rules Part IV apart from various maintenance instruction issued by RDSO/Lucknow from time to time. Frequent reference should, therefore, be made to the current IRCA Conference Rules also by the workshops/depots.

Practices and service wear limits laid down in this manual are for guidance during preventive maintenance to achieve better riding quality and comfort. These limits may appear more stringent than the safety limits for some items, but no change is intended in the prescribed safety limits.

Future addition/deletion/modification to this Manual shall be processed by RDSO/LKO with the approval of Railway Board.

(S. Dhasarathy)
Member Mechanical
Railway Board

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PREFACE

Maintenance Manual for BG Coaches was last published in December,1995. Several changes in maintenance and operational system like Bogie Mounted Brake System, enhanced capacity drawgear, fire retardant upholstery and running of 24 coach trains etc. have taken place which have been incorporated in this manual.

Railway Board had nominated a committee of officers comprising of Executive Director Standards (Carriage)/RDSO/LKO, CRSE/W.Rly, CME/O&C/C.Rly. and Director (Mech)/CAMTECH/GWL vide letter No. 95/M(C)/141/1 dated 10-05-2000 for scrutiny and updating the "Maintenance Manual for BG coaches of ICF design". This updated manual covers ICF(BG) Coaches manufactured by Integral Coach Factory/Perambur Rail Coach Factory/Kapurthala, BEML/Banglore and Jessop/Kolkata. Maintenance of LHB, IRS or MG coaches is not covered in this document.

The salient features of the manual are as follows.

i) Latest instructions from Board/ changes in maintenance instructions/ feedback on the previous manual and technological upgradation upto February,2001 have been incorporated.

ii) The manual has been divided into assembly-wise chapters. Maintenance practices to be followed in the workshop and depot are covered in the same chapter.

iii) Important dimensions, clearances, material specifications and references to RDSO technical instructions and drawings have been given.

iv) For convenience 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.

v) The tables/figures in each chapter consist of two numbers separated by a decimal point number before decimal point indicates the chapter number whereas the number after decimal point indicates the running serial number of the table/figure which start from 1 in every chapter.

Future Addition/Deletion/Modification to this manual will be issued through correction slips or reprints of chapters by RDSO and will require approval of the Railway Board.

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The revision and updating of the Manual has been the result of efforts put in not only by the members of the Committee but also from a number of Railway Officers and staff. The committee gratefully acknowledges the support received in its task from the following:

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ABBREVIATIONS

"	Inch
&	And
Φ	Diameter
+ve	Positive
^{0}	Degree
^{0}C	Degree Centigrade
A/F	Across face
AC	Air Conditioned
alt.	Alteration
AR	Auxiliary Reservoir
BC	Brake Cylinder
BP	Brake Power
BPC	Brake Power Certificate
BPC	Bharat Petroleum Corporation
C&W	Carriage & Wagon
CCR	Carriage Controller
CEE	Chief Electrical Engineer
cm	Centimetre
CME	Chief Mechanical Engineer
CMI	Carriage Maintenance Instructions
CO_2	Carbon dioxide gas
COM	Chief Operating Manager
CP	Centre Pivot
CR	Control Reservoir
CSC	Chief Security Commissioner
CSK	Counter Sunk
DA	Direct Admission Valve
DC	Direct Current
DEE	Divisional Electrical Engineer
dia. (Dia)	Diameter
DME	Divisional Mechanical Engineer
Drg	Drawing
DRS	Deficiency in Rolling Stock
DV	Distributor Valve
EFT	Emergency Feed Terminal
Elect.	Electrical
EOT Crane	Electric Overhead Travelling Crane
Eq.	Equalising
Fig	Figure
FP	Feed Pipe
FRP	Fibre Reinforced Plastic
GRP	Government Railway Police
Hd.	Head
hex.	Hexagonal
HPC	Hindustan Petroleum Corporation
HRC	Hardness on Rockwell 'C' scale

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I.C.	Isolating Cock
ICF	Integral Coach Factory
IOC	Indian Oil Corporation
IOH	Intermediate Overhaul
IRCA	Indian Railway conference Association
IS	Indian Standards
kg	Kilogram
kmph	Kilometre per hour
kW	Kilo Watt
m	Metre
M.R.	Main Reservoir
Max.	maximum
MCB	Miniature Circuit Breaker
Min.	minimum
Mm	Millimetre
no.	Number
nos.	Numbers
O.D.	Outer diameter
OCV	Other Coaching Vehicle
PCV	Passenger Coaching Vehicle
PM	Primary Maintenance
POH	Periodic Overhauling
Pr.	Pressure
PVC	Poly Vinyl Chloride
RCF	Rail Coach Factory
RDSO	Research Design and Standard Organisation
ref.	Reference
rev.	Revision
RMPU	Roof Mounted AC Package
RPF	Railway Protection Force
RTR	Rake Testing Rig
SC	Security Commissioner
SG	Self generating
SM	Secondary Maintenance
SMI	Standard Maintenance Instruction
Sp.	Specific
Spec	Specification
Sr. DME	Senior Divisional Mechanical Engineer
SS	Stainless steel
STR	Schedule of Technical Requirements
SWG	Standard Wire gauge
t	Tonne
TL	Train Lighting
V	Voltage
-ve	Negative

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CHAPTER 1

COACH

101 INTRODUCTION

The first attempt at standardisation of manufacture of passenger coaches on Indian Railways led to the development of IRS design of steel bodied coaches. An integral all metal coach design was taken from M/s Schlieren, Switzerland in 1954 for manufacture at Integral Coach Factory, Perambur. The original design had bogies with speed potential of 96 kmph only. The design was modified to all coil bogies with longer suspension hangers and weight transfer through side bearers, thereby enabling speed potential to 105 kmph on main line standard track and gradually to 140 kmph for Rajdhani/Shatabdi Express trains on tracks maintained to standards laid down in RDSO report No. C&M-I, volume I.

Over the years changes have been made to use helical springs instead of laminated springs in the secondary suspension while minor changes in the shell have been made to reduce corrosion and improve the strength of certain members. At present all new coaches are being manufactured with bogie mounted air brake system and enhanced capacity draw gear. To meet the demands of the passengers, coaches of various layout like second class sitting accommodation, sleepers, upper class, air conditioned chair car and sleeper, pantry cars, generator cars, luggage-cum-passenger cars and postal vans have been designed and manufactured. Luxury coaches mainly to boost tourism having air conditioned sleeping and sitting accommodation with catering facilities have also been designed and manufactured. On date, more than a hundred coach layouts catering to the needs of different class of passengers are on line. Transportation codes for coaches in general use are given in Appendix A.

102 CODAL LIFE OF COACHES

Steel bodied coaches (including dining/pantry cars)	25 years
IRS coaches	30 years
Light utilisation categories of coaches	40 years

103 PERIODICITY OF PERIODIC OVERHAULS (POH) IN DESIGNATED WORKSHOPS

Table 1.1

i) PCVs and OCVs on Mail and Express rakes	
(a) Coaches earning less than 2.5 lakhs kms. per annum	12 months
(b) Coaches earning more than 2.5 lakhs kms. per annum	12 months with IOH after 6 months
ii) PCVs on other than Mail and Express rakes	18 months. 12 months for AC coaches.
iii)OCVs on other than Mail and Express rakes	24 months
iv)Rajdhani and Shatabdi Express Coaches	POH in workshops after 4 lakhs kms or 18 months whichever is earlier. IOH in workshops after 2 lakhs kms or 9 months whichever is earlier

104. PERIODICAL OVERHAUL

104a The general sequence of work during POH of a coach is given in a typical PERT chart for normal POH as shown in **figure 1.1**.

104b List of "must change items" during POH is given in Appendix B

104c Modifications in BG coaching stock is given in Appendix C

104d List of relevant RDSO's technical pamphlets/instructions/specifications is given in Appendix D.

105 LIFTING THE COACH BODY

105a On receipt of a coach for POH, it must be taken on Lifting line/ Stripping line where electrical fittings should be stripped and batteries removed. Furnishings, especially seats and backrests should be inspected thoroughly and only those that require repairs or attention should be removed.

105b Before lifting a coach, the following components should be removed, disengaged or disconnected:-

(i) Dynamo belt on the axle pulley in case of underframe mounted dynamos and disconnection of electrical connection from junction box on alternator in case of bogie mounted alternator.

(ii) Lavatory chute, if situated over the bogie.

(iii) Brake pull rod from bogie brake rigging.

(iv) Centre pivot cotter.

(v) Axle box safety straps.

(vi) Bolster safety straps.

(vii) Steel/ wooden blocks of requisite thickness should be inserted in between the bolster and bogie frame on both sides and of both the bogies so as to keep the bolster springs compressed.

(viii) Dismantle vertical shock absorbers.

(ix) Air vent screws on bogie frame above dash pots should be unscrewed completely after cleaning the area around the air vent holes properly.

(x) Vacuum/air brake fittings

(xi) Buffer and draw gear

(xii) Lavatory chutes

(xiii) Under slung water tanks & WRAS, where provided.

(xiv) Battery box and electrical fittings.

(xv) AC equipment in AC coaches.

105c Coach body should be lifted off the bogies either by two overhead electric cranes of 25 tonnes capacity each with suitably designed lifting tackles or by four powered lifting jacks of 15 tonnes capacity each operated simultaneously by one control switch. The coach body should be lifted uniformly without jerks and should remain horizontal during the lifting/ lowering operation. Coach should not be lifted from any point other than at the lifting pads as shown in **figure 1.2** (sketch 68078).

105d The coach should never be lifted from one end only. If lifted from one end, the Centre pivots and the dash pot guides are likely to suffer damages, body panels are likely to get dented near the body bolster. The sealed windows of AC coaches are also likely to break.

105e After the coach body is lifted, it should be kept on trestles. The revolving steel trestles of the design shown in **Figure 1.3** (sketch 77310) would prove useful for this purpose Lines should be protected by scotch blocks with locking arrangement and key should be kept with Engineer till the time maintenance work is carried out.

105f The entire under frame should be cleaned of dust, rust etc. from underneath by pneumatic/water jet followed by wire brushing at critical locations and check for cracks/damage, corrosion etc. on the under frame members. Refer chapter 2 (Shell) for carrying out repairs on the coach shell.

105g After carrying out all repairs, the under frame should be painted as detailed in the chapter on Painting.

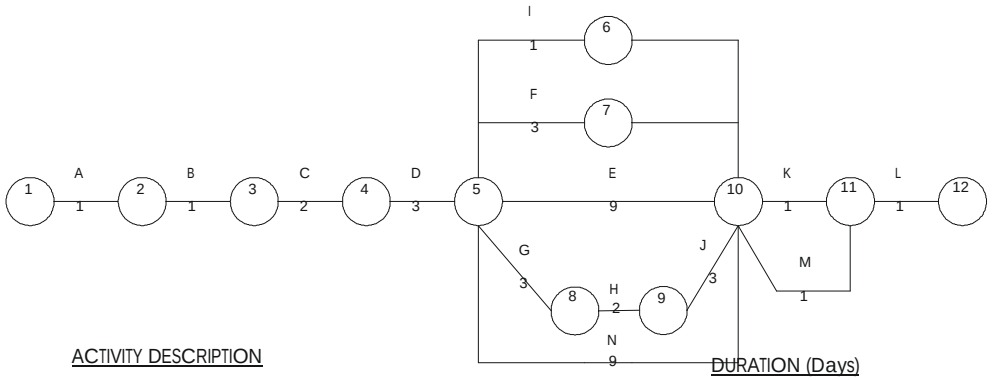
106 LOWERING THE COACH BODY

106a After all the repairs are carried out refit all repaired sub-assemblies which are removed for maintenance and lower the coach body on the overhauled and tested bogies.

106b The Centre pivot cotter should be fitted into position and secured by means of a split pin. A bottom cover should be fitted in position to cover the entire assembly to prevent dust getting in.

NETWORK FOR POH OF COACHES

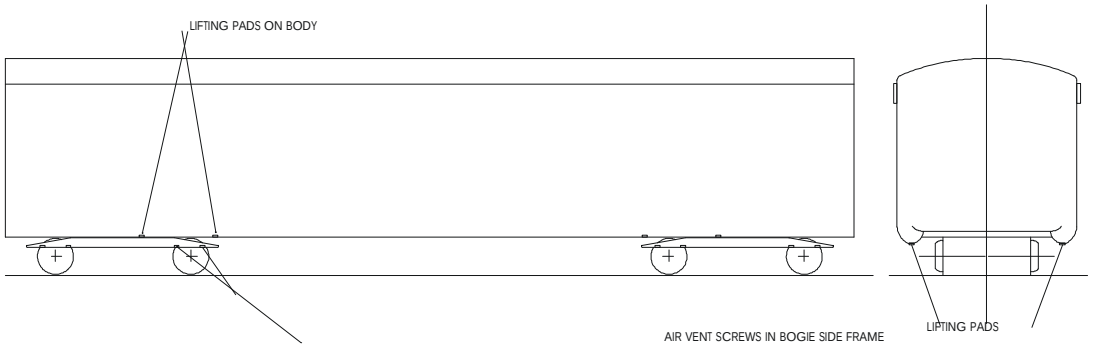
(NORMAL REPAIRS)



ACTIVITY DESCRIPTION	DURATION (Days)
A. VERIFICATION OF DEFICIENCIES.PB. PRE-INSPECTION & LIFTINGPC. STRIPPINGPD. BODY REPAIR, MODIFICATIONS AND ALTERATIONSPE. PAINTINGPF. FITTING OF WATER TANK, PLUMBING & LEAKAGE TESTINGPG. REPAIRS TO INTERIOR PANELSPH. FITMENT OF SHUTTERSPI. FITMENT OF DOORSPJ. FITMENT OF BERTHS & SEATSPK. VACUUM / AIR BRAKE TESTING & FINAL WORKSPL. FINAL INSPECTION & DESPATCHPM. FITMENT OF AXLE PULLEY, TENSION ROD & TESTING OF COACH WIRINGPN. TESTING OF BRANCH WIRING & FITMENT OF ELECTRICAL EQUIPMENT	1P 1P 2P 3P 9P 3P 3P 2P 1P 3P 1P 1P 1P 9

TOTAL DURATION = P18 DAYS

FIGURE 1.1



SKETCH-68078

POSITION OF LIFTING PADS I.C.F. B.G.

FIGURE 1.2

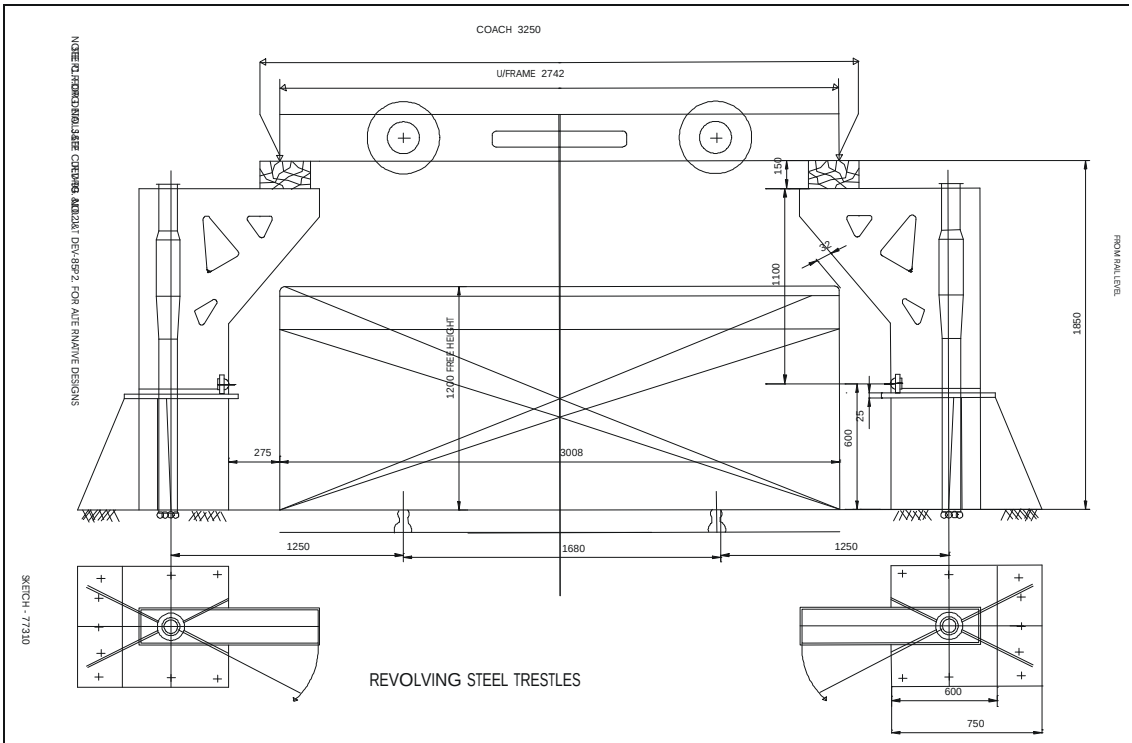

COACH 3250
U/FRAME 2742
150
32
1100
1650
FROM RAIL LEVEL
1200 FREE HEIGHT
25
600
275
3008
1250
1680
1250
600
750
SKETCH - 77310
REVOLVING STEEL TRESTLES

FIGURE 1.3

106c **Buffer height**

i) Buffer height of a coach under its tare condition should be as under:-

Table 1.2

	Maximum height from rail level	**Minimum height from rail level**
Production units	1105 mm	1095 mm
Workshops	1105 mm	1090 mm

ii) Buffer height of a coach should be measured under its tare condition from the top of the rail on a level and straight track. For this purpose, a specific portion of the track should be earmarked in each carriage repair workshop. Engineer (Permanent Way) should get track attended and leveled once every month and then give a certificate that nominated portion of the track has been fully attended to and is in perfect level and straight condition.

iii) Before the buffer height adjustment of the coach is taken up, it should be ensured that all its buffers are secured firmly in position.

iv) The diameters of all the wheels, measured before the assembly of the bogies must be available with the staff carrying out the buffer height adjustment.

106d **Buffer height adjustment**

i) To bring the buffer height to within the limits specified, depending on the wheel diameters, packing rings of thickness as given in **Table 3.18 of Bogie chapter** should be kept under the flanges of the lower spring seats as shown in **Figure 3.17** (sketch 77354) in bogie chapter.

NOTES:

i) The lowest permissible wheel diameter for a coach turned out after POH shall not be less than **836 mm**.

ii) According to tare weight of coaches compensating ring shall be provided over lower spring seats as shown in suspension diagrams issued by ICF and RCF for various types of coaches (see suspension diagrammatic arrangement of ICF self generating AC coaches in **figure 1.4a** and table nos. 1.3 & 1.4. See suspension diagrammatic arrangement of RCF AC coaches in **figure 1.4b** and table no. 1.5. See suspension diagrammatic arrangement of RCF Non AC coaches in **figure 1.4c** and table no. 1.6). Over this, additional compensating rings can be added to a limit not exceeding **12 mm**.

iii) While lowering the bogie frame and the bolster assembly on to the wheels, it should be ensured that the bogie frame is set evenly on the four axle boxes.

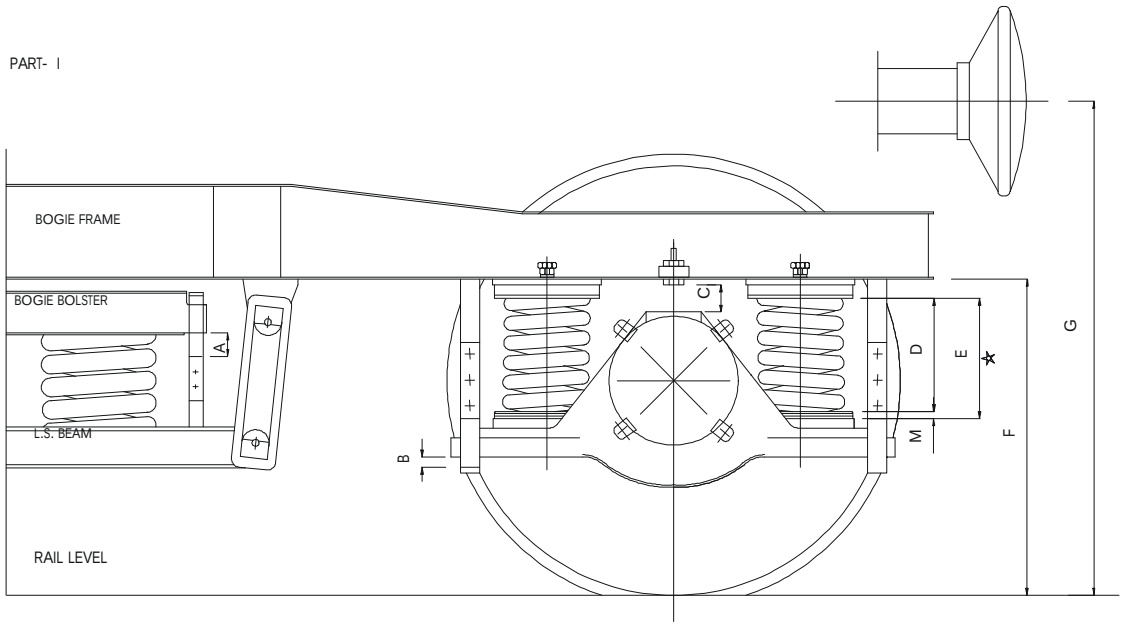
iv) The bogie assembled with packing and compensating rings as required, should now be loaded and the height of its bolster top surface from rail level measured. This should be compared with predetermined dimensions to decide on further adjustment of buffer height.

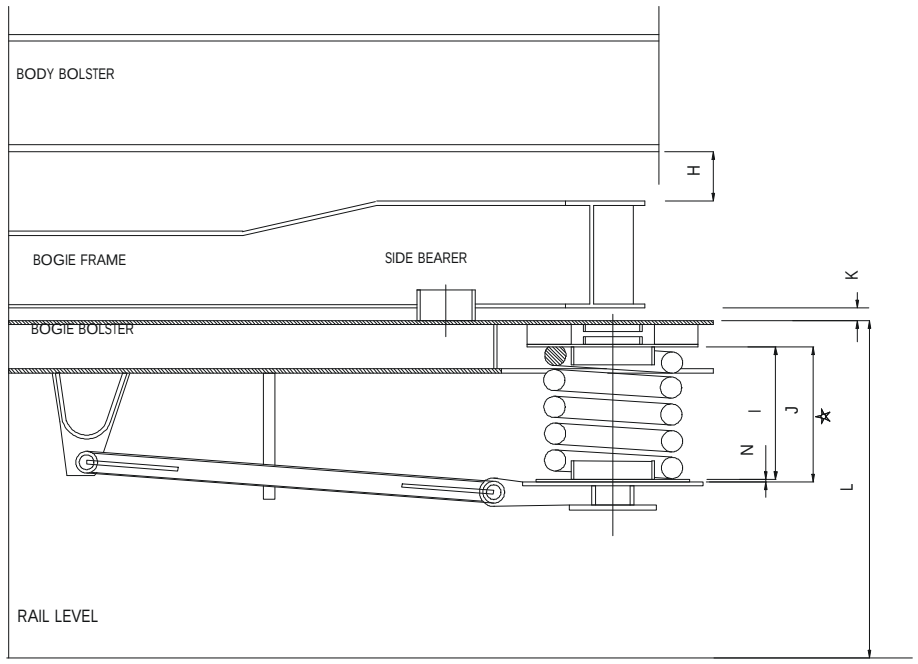
v) If the buffer height requires further adjustment, the load on the axle box springs should be released and the packing rings in halves should be inserted below the axle box springs. The total height of primary springs and compensating rings should not exceed **295 mm**. There should be a minimum clearance of **40 mm** between the axle box wing lugs and their safety straps.

vi) The clearance between the axle box crown and the bogie frame should thereafter be adjusted as per the table given below:

Table 1.7

Type of coach	**Crown clearance (mm)**
GS, SDC, SLR, SCN, VPH	43^{+0}_{-3}
WCB, WFC, WFAC, WSCZAC, WGSCZAC, WCBAC, WLRRM, WFCZAC, WGFAC, WACCW, WGACCW, WGFACCW, WACCN, WGACCN	27^{+0}_{-3}





NOTE - P1. Dimensions E & J shall be maintained with required number of compensating rings of standard thickness of 4 mm.P2. Axle box springs : WTAC -0-1-202P Bolster springs : WTAC -0-5-202

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2

2

SUSPENSION DIAGRAMMATIC ARRANGEMENT

FOR SELF GENERATING AC COACHES (ICF DRAWING NO. ICF/SK -9-0-126)P

2

FIGURE 1.4a

SUSPENSION DATA FOR SELF GENERATING AC COACHES
(DRAWING NO. ICF/SK$_2$-9-0-126)

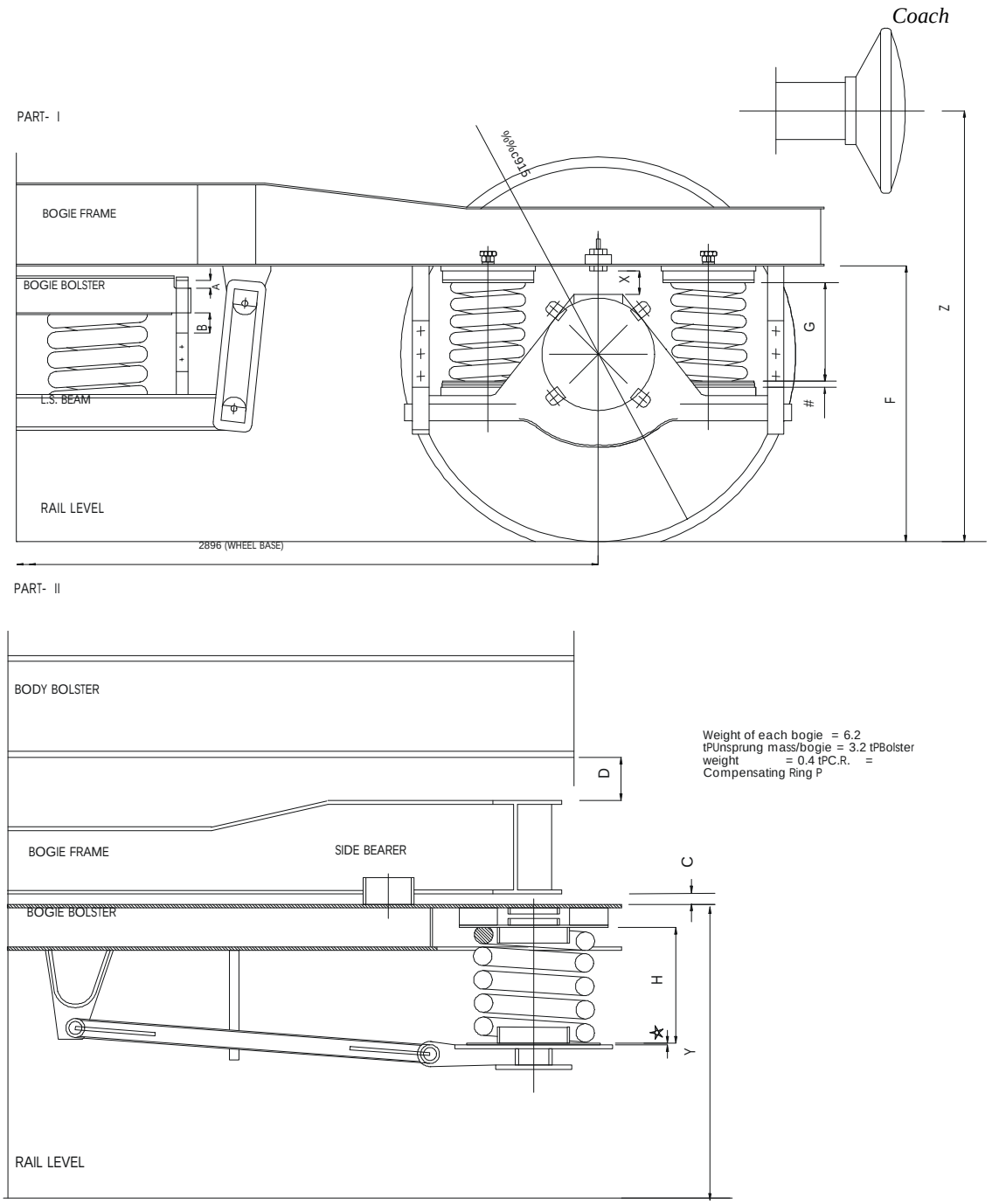
Table 1.3

COACH		LOAD	A	B	C	D	E	F	G	H	I	J	K	L	M✡ Nominal	N✡ Nominal
WGFAC$_4$		Tare	$38^{\pm5}$	$40^{\pm5}$	$36^{\pm3}$	$275^{+6/-4}$	$290^{\pm3}$	$686^{\pm5}$	$1104^{+0/-10}$	$70^{\pm3}$	$299^{+6/-4}$	$310^{\pm3}$	$40^{\pm5}$	$646^{\pm5}$	15	11
		Gross	$34^{+8/-5}$	$44^{\pm5}$	$32^{+5/-2}$	$275^{+6/-4}$	$286^{\pm3}$	$682^{\pm5}$	$1098^{+8/-5}$	$66^{\pm3}$	$295^{+6/-4}$	$308^{\pm3}$	$44^{\pm5}$	$638^{+8/-5}$	-	-
WGSCZAC		Tare	$38^{\pm5}$	$40^{\pm5}$	$36^{\pm3}$	$276^{+6/-4}$	$290^{\pm3}$	$686^{\pm5}$	$1104^{+0/-10}$	$70^{\pm3}$	$300^{+5/-4}$	$310^{\pm3}$	$40^{\pm5}$	$646^{\pm5}$	14	10
		Gross	$23^{+8/-5}$	$54^{\pm5}$	$22^{+5/-2}$	$262^{+6/-4}$	$276^{\pm3}$	$672^{\pm5}$	$1075^{+8/-5}$	$55^{\pm3}$	$285^{+7/-4}$	$295^{\pm3}$	$55^{\pm5}$	$617^{+8/-5}$	-	-
WGSCWAC		Tare	$38^{\pm5}$	$40^{\pm5}$	$36^{\pm3}$	$274^{+6/-4}$	$290^{\pm3}$	$686^{\pm5}$	$1104^{+0/-10}$	$70^{\pm3}$	$298^{+6/-4}$	$310^{\pm3}$	$40^{\pm5}$	$646^{\pm5}$	16	12
		Gross	$28^{+8/-5}$	$49^{\pm5}$	$27^{+5/-2}$	$265^{+6/-4}$	$281^{\pm3}$	$677^{\pm5}$	$1085^{+8/-5}$	$60^{\pm3}$	$288^{+7/-4}$	$300^{\pm3}$	$50^{\pm5}$	$627^{+8/-5}$	-	-
WGFSCZAC		Tare	$38^{\pm5}$	$40^{\pm5}$	$36^{\pm3}$	$272^{+6/-4}$	$290^{\pm3}$	$686^{\pm5}$	$1104^{+0/-10}$	$70^{\pm3}$	$296^{+6/-5}$	$310^{\pm3}$	$40^{\pm5}$	$646^{\pm5}$	18	14
		Gross	$28^{+8/-5}$	$48^{\pm5}$	$28^{+5/-2}$	$264^{+6/-4}$	$282^{\pm3}$	$678^{\pm5}$	$1086^{+8/-5}$	$60^{\pm3}$	$286^{+7/-4}$	$300^{\pm3}$	$50^{\pm5}$	$628^{+8/-5}$	-	-
WGFSCWAC		Tare	$38^{\pm5}$	$40^{\pm5}$	$36^{\pm3}$	$273^{+6/-4}$	$290^{\pm3}$	$686^{\pm5}$	$1104^{+0/-10}$	$70^{\pm3}$	$297^{+6/-4}$	$310^{\pm3}$	$40^{\pm5}$	$646^{\pm5}$	17	13
		Gross	$31^{+8/-5}$	$46^{\pm5}$	$30^{+5/-2}$	$267^{+6/-4}$	$284^{\pm3}$	$680^{\pm5}$	$1091^{+8/-5}$	$63^{\pm3}$	$290^{+7/-4}$	$303^{\pm3}$	$47^{\pm5}$	$633^{+8/-5}$	-	-
WGMWAC		Tare	$38^{\pm5}$	$40^{\pm5}$	$36^{\pm3}$	$282^{+6/-4}$	$290^{\pm3}$	$686^{\pm5}$	$1104^{+0/-10}$	$70^{\pm3}$	$307^{+6/-3}$	$310^{\pm3}$	$40^{\pm5}$	$648^{\pm5}$	8	3
		Gross	$32^{+8/-5}$	$45^{\pm5}$	$31^{+5/-2}$	$277^{+6/-4}$	$285^{\pm3}$	$681^{\pm5}$	$1093^{+8/-5}$	$64^{\pm3}$	$301^{+6/-4}$	$304^{\pm3}$	$46^{\pm5}$	$635^{+8/-5}$	-	-
ARMVAC	**DRIVING END**	Tare	$38^{\pm5}$	$40^{\pm5}$	$36^{\pm3}$	$279^{+6/-4}$	$290^{\pm3}$	$686^{\pm5}$	$1104^{+0/-10}$	$70^{\pm3}$	$304^{+6/-4}$	$310^{\pm3}$	$40^{\pm5}$	$646^{\pm5}$	11	6
		Gross	$35^{+8/-5}$	$43^{\pm5}$	$33^{+5/-2}$	$276^{+6/-4}$	$287^{\pm3}$	$683^{\pm5}$	$1098^{+8/-5}$	$67^{\pm3}$	$301^{+6/-4}$	$307^{\pm3}$	$43^{\pm5}$	$640^{+8/-5}$	-	-
	NON DRIVING END	Tare	$38^{\pm5}$	$40^{\pm5}$	$36^{\pm3}$	$272^{+6/-4}$	$290^{\pm3}$	$686^{\pm5}$	$1104^{+0/-10}$	$70^{\pm3}$	$296^{+6/-4}$	$310^{\pm3}$	$40^{\pm5}$	$646^{\pm5}$	18	14
		Gross	$33^{+8/-5}$	$44^{\pm5}$	$32^{+5/-2}$	$268^{+6/-4}$	$286^{\pm3}$	$682^{\pm5}$	$1095^{+8/-5}$	$65^{\pm3}$	$291^{+7/-4}$	$305^{\pm3}$	$45^{\pm5}$	$637^{+8/-5}$	-	-

WEIGHT AND TEST LOAD (IN TONNES)
FOR SELF GENERATING AC COACHES (DRAWING NO. ICF/SK$_2$-9-0-126)

Table 1.4

Description		$WGFAC_4$	WGSCZAC	WGSCWAC	WGMWAC	ARMVAC	
Tare weight of the coach		49.75	49.30	50.00	46.50	49.30	
Weight of the bogie		6.200	6.200	6.200	6.200	6.200	
Weight of the bolster		0.400	0.400	0.400	0.400	0.400	
Unsprung mass per bogie		3.200	3.200	3.200	3.200	3.200	
Normal pay load		1.440 (18x80 kg)	5.680 (71x80 kg)	3.680 (46x80 kg)	2.275 (34+1)x65 kg	1.495 (23x65 kg)	
Over load		Nil	Nil	Nil	Nil	Nil	
Total pay load		1.440	5.680	3.680	2.275	1.495	
Gross weight of the coach		51.19	54.98	53.65	48.78	50.79	
Test load/Bogie	Tare	18.68	18.45	18.80	17.05	DE	NDE
						17.87	19.23
	Gross	19.38	21.29	20.64	18.19	18.31	20.08



NOTE - P1. Dimensions A & B marked should be ensured less than dimensions C & D marked respectively.P2. # CR to drawing No.-CC01140 to be provided.P3. * CR to drawing No. - CC05252 to be provided.P4. 'F' the variation in all the four bogie corner heights must be less than or equal to 10 mm.P5. Drawing No. WTAC3-9-0.306 alt -e, AE90014, AE90015 are superseded by this drawing.P6. The height of axle box spring and Bolster spring in tare and gross conditions is for reference only.P7. The requirement of CR's as shown in the columns for primary & secondary suspension is for reference only.P8. The compensation by means of CR's must not exceed 20 mm in primary in all coaches except ACCN (SG) inP ACCN (SG) it is 30 mm & 30 mm in secondary suspension for all coaches.

SUSPENSION DIAGRAMMATIC ARRANGEMENT

FOR AC COACHES (RCF DRAWING NO. AW 90017)P

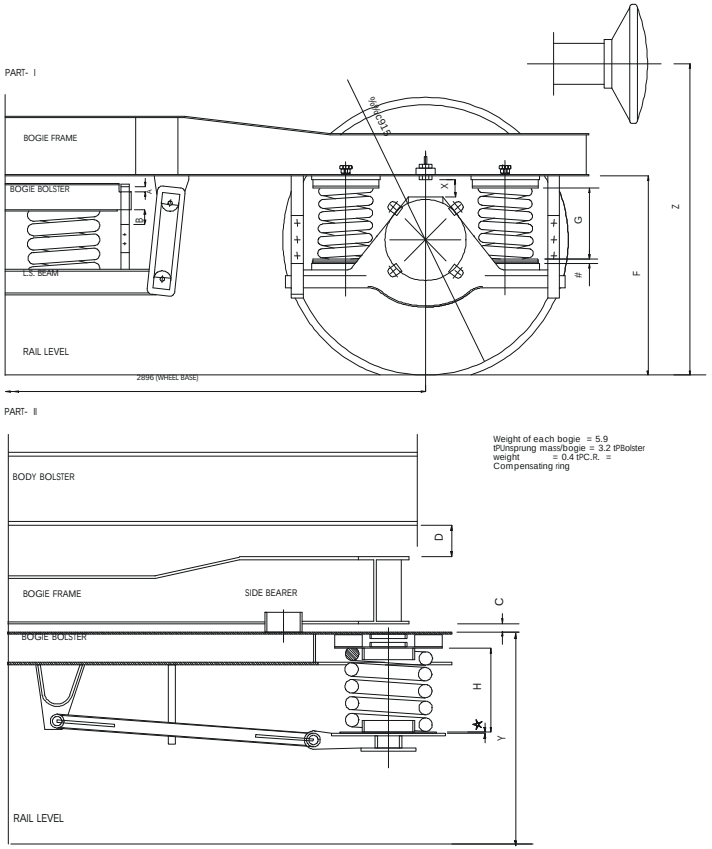
FIGURE 1.4b

TESTING PARAMETERS FOR AC COACHES (RCF DRAWING NO. AW90017)

Table 1.5

Type of coach	Tare weight of coach	Normal pay load	Total pay load	Test load per bogie		Bogie frame bolster clearance		Body bogie clearance		Axle box spring height			Bolster spring height			Crown clearance		Bogie bolster height		Buffer height	
AC	In tonnes	In tonnes	In tonnes	Under tare	Under Gross	C		D		G		CR	H		CR	X		Y		Z	
				In tonnes	In tonnes	Tare	Gross	Tare	Gross	Tare	Gross	#	Tare	Gross	*	Tare	Gross	Tare	Gross	Tare	Gross
ACCW (EOG)	44.8	3.68	3.68	16.2	18.04	40±5	50±5	70±3	60±3	$286^{+5/-4}$	$278^{+6/-4}$	4	$312^{+5/-4}$	$302^{+7/-5}$	Nil	28±3	20±3	646±5	$628^{+8/-5}$	$1104^{+0/-10}$	$1086^{+8/-5}$
ACCW (SG)	49.1	3.68	3.68	18.35	20.19	40±5	50±5	70±3	60±3	$276^{+5/-4}$	$268^{+6/-4}$	14	$301^{+6/-4}$	$291^{+7/-4}$	9	30±3	22±3	646±5	$628^{+8/-5}$	$1104^{+0/-10}$	$1086^{+8/-5}$
ACCN (EOG)	48.3	5.12	5.12	17.95	20.51	40±5	54±5	70±3	56±3	$278^{+6/-4}$	$266^{+7/-4}$	12	$303^{+6/-4}$	$289^{+7/-4}$	7	34±3	22±3	646±5	$620^{+8/-5}$	$1104^{+0/-10}$	$1078^{+8/-5}$
ACCN (SG)	52.53	5.12	5.12	20.07	22.63	40±5	53±5	70±3	57±3	$268^{+7/-4}$	$256^{+7/-5}$	22	$291^{+7/-4}$	$278^{+7/-5}$	19	35±3	23±3	646±5	$621^{+8/-5}$	$1104^{+0/-10}$	$1079^{+8/-5}$
ACCZ (EOG)	43.1	5.36	5.36	15.35	18.03	40±5	54±5	70±3	56±3	$290^{+6/-3}$	$278^{+6/-4}$	Nil	$316^{+6/-3}$	$302^{+6/-4}$	Nil	32±3	20±3	646±5	$620^{+8/-5}$	$1104^{+0/-10}$	$1078^{+8/-5}$

Type of coach	Tare weight of coach	Normal pay load	Total pay load	Test load per bogie		Bogie frame bolster clearance		Body bogie clearance		Axle box spring height			Bolster spring height			Crown clearance		Bogie bolster height		Coupler height	
AC	In tonnes	In tonnes	In tonnes	Under tare	Under Gross	C		D		G		CR	H		CR	X		Y		Z	
				In tonnes	In tonnes	Tare	Gross	Tare	Gross	Tare	Gross	#	Tare	Gross	*	Tare	Gross	Tare	Gross	Tare	Gross
ACCZ (SG)	46.83	5.84	5.84	17.22	20.14	40±5	56±5	70±3	54±3	$281^{+6/-4}$	$268^{+6/-4}$	9	$307^{+5/-4}$	$291^{+7/-4}$	3	35±3	22±3	646±5	$617^{+8/-5}$	$1104^{+0/-10}$	$1075^{+8/-5}$
FACZ (EOG)	42.6	3.68	3.68	15.10	16.94	40±5	50±5	70±3	60±3	$291^{+5/-3}$	$283^{+6/-4}$	Nil	$318^{+5/-3}$	$308^{+5/-4}$	Nil	27±3	19±3	646±5	$628^{+8/-5}$	$1104^{+0/-10}$	$1086^{+8/-5}$
RA (NON AC)	41.3	1.20	1.20	14.45	14.05	40±5	44±5	70±3	66±3	$279^{+5/-3}$	$276^{+6/-4}$	11	$298^{+5/-3}$	$294^{+5/-4}$	17	20±3	17±3	646±5	$640^{+8/-5}$	$1104^{+0/-10}$	$1098^{+8/-5}$
VP (HIGH CAPACITY)	32	23	23	9.8	21.3	40±5	81±5	70±3	29±3	$287^{+5/-3}$	$262^{+6/-4}$	03	$310^{+5/-3}$	$269^{+5/-4}$	Nil	36±3	11±3	646±5	$580^{+8/-5}$	$1104^{+0/-10}$	$1038^{8/-5}$
IRQ ACCN (SG)	41.3	5.12	5.12	19.45	22.01	40±5	54±5	70±3	56±3	$271^{+7/-4}$	$259^{+7/-5}$	19	$295^{+7/-4}$	$281^{+7/-5}$	15	35±3	23±3	646±5	$620^{+8/-5}$	$1104^{+0/-10}$	$1079^{+8/-5}$
RA AC	46.69	1.20	1.20	17.14	17.14	40±5	43±5	70±3	67±3	$282^{+5/-3}$	$279^{+6/-4}$	8	$307^{+5/-3}$	$304^{+5/-4}$	3	22±3	19±3	646±5	$640^{+8/-5}$	$1104^{+0/-10}$	$1098^{8/-5}$



NOTE - P1. Dimensions A & B marked should be ensured less than dimensions C & D marked respectively.P2. # CR to drawing No.-CC01140 to be provided.P3. * CR to drawing No. - CC05251 to be provided.P4. 'F' the variation in all the four bogie corner heights must be less than or equal to 10 mm.P5. Drawing No. SG90002, S290004, SE90011, LB90002 are superseded by this drawing.P6. The height of Axle box spring and bolster spring in tare & gross conditions is for reference only.P7. The requirement of CR's as shown in the columns for primary & 30 mm in secondary suspension.P8. Only blue bend springs both in primary and secondary stage are to be used in postal van coach.

SUSPENSION DIAGRAMMATIC ARRANGEMENT

FOR NON AC COACHES (RCF DRAWING NO. CC90019)P

FIGURE 1.4c

GO TO CONTENTS CHAPTER CONTENT

TESTING PARAMETERS FOR NON AC COACHES (RCF DRAWING NO. CC90019)

Table 1.6

Type of coach	Tare weight of coach	Normal pay load	Over load	Total pay load	Test load per bogie		Bogie frame bolster clearance		Body bogie clearance		Axle box spring height			Bolster spring height			Crown clearance		Bogie bolster height		Buffer height	
AC	In tonnes	In tonnes	In tonnes	In tonnes	Under tare	Under Gross	C		D		G		CR	H		CR	X		Y		Z	
					In tonnes	In tonnes	Tare	Gross	Tare	Gross	Tare	Gross	#	Tare	Gross	*	Tare	Gross	Tare	Gross	Tare	Gross
GS	36.99	5.85	100%	11.70	12.6	18.45	40±5	74±3	70±3	36±3	$289^{+4/-3}$	$262^{+5/-4}$	1	$308^{+5/-3}$	$274^{+7/-4}$	7	47±3	20±3	646±5	$585^{+8/-5}$	$1104^{+0/-10}$	$1043^{+8/-5}$
SOC	37.00	7.02	100%	14.04	12.6	19.62	40±5	81±5	70±3	29±3	$289^{+4/-3}$	$257^{+6/-4}$	1	$308^{+5/-3}$	$267^{+7/-5}$	7	50±3	18±3	646±5	$572^{+8/-5}$	$1104^{+0/-10}$	$1030^{+8/-5}$
SCN	38.03	5.76	-	5.76	13.12	16.00	40±5	57±5	70±3	53±3	$287^{+4/-3}$	$273^{+5/-3}$	3	$305^{+5/-3}$	$288^{+6/-4}$	10	31±3	17±3	646±5	$616^{+8/-5}$	$1104^{+0/-10}$	$1074^{+8/-5}$

Type of coach	Tare weight of coach	Normal pay load	Over load	Total pay load	Test load per bogie		Bogie frame bolster clearance		Body bogie clearance		Axle box spring height			Bolster spring height			Crown clearance		Bogie bolster height		Coupler height	
AC	In tonnes	In tonnes	In tonnes	In tonnes	Under tare	Under Gross	C		D		G	#		H		*	X		Y		Z	
					In tonnes	In tonnes	Tare	Gross	Tare	Gross	Tare	Gross	CR	Tare	Gross	CR	Tare	Gross	Tare	Gross	Tare	Gross
SLR	37.10	10.60	2.6	13.20	12.65	19.25	40±5	79±5	70±3	31±3	$289^{+4/-3}$	$258^{+6/-4}$	1	$308^{+5/-3}$	$269^{+7/-5}$	7	50±3	20±3	646±5	$577^{+8/-5}$	$1104^{+0/-10}$	$1035^{+8/-5}$
VP	32.00	18.00	-	18.00	10.30	19.30	40±5	77±5	70±3	33±3	$285^{+4/-3}$	$257^{+6/-4}$	5	$302^{+5/-3}$	$265^{+7/-5}$	13	39±3	11±3	646±5	$581^{+8/-5}$	$1104^{+0/-10}$	$1039^{+8/-5}$
IRQ SCN	37.2	5.76	-	5.76	12.7	15.58	40±5	57±5	70±3	53±3	$289^{+4/-3}$	$275^{+5/-3}$	1	$308^{+5/-3}$	$291^{+6/-4}$	7	30±3	17±3	646±5	$616^{+8/-5}$	$1104^{+0/-10}$	$1074^{+8/-5}$
Postal Van	36.5	3.0	-	3.0	12.35	13.85	40±5	49±5	70±3	61±3	$290^{+4/-3}$	$283^{+5/-3}$	Nil	$310^{+5/-3}$	$301^{+6/-4}$	5	22±3	15±3	646±5	$630^{+8/-5}$	$1104^{+0/-10}$	$1088^{+8/-5}$

107 EXAMINATION OF TRAINS

107a Examination of originating trains

i) All trains must be examined by the mechanical train examining staff before dispatch to ensure that all coaches on the train are in fit condition and without rejectable defects (for rejectable defects, please refer to IRCA Conference Rules, Part IV). On formation of a rake and after its placement for Examination, washing, cleaning and watering, the station master (SM) shall pass necessary memo to the Engineer (C&W). After carrying out all necessary work, the Engineer (C&W) shall communicate fitness of the train to Station Master. Normally, Railways have standard forms for the use of Station Masters and Engineers for this purpose. Railways, where such forms are not used, should also start using these forms as uniform practice for the guidance of both Engineer (C&W) and Station Master. The Station Master shall not dispatch the train unless the fitness certificate, in the prescribed form, is received from the Engineer (C&W).

ii) The level of the air pressure/vacuum on the train engine and the brake van gauges as well as the percentage of operative cylinders should be recorded on a prescribed certificate and signatures of the driver and the guard of the train should be obtained by the Engineer (C&W) as per the procedure laid down by each Railway. A suggested standard format for the certificate is placed at Annexure 1.1. No train should be allowed to leave with an inoperative/defective Brake cylinder on any coach after pit attention. Trains which have been attended on pitline should have **100% brake power**. Trains which are attended on platform or where secondary examination has been dispensed with or enroute should have minimum **90% brake power**.

107b Enroute/Terminating Examination of Passenger Trains

i) Sr.DME/DME incharge shall nominate the site for carrying out rolling in/rolling out examination after personal inspection of site. While nominating the site following should be kept in view:

a) Site shall provide unobstructed view of undergear from both sides.

Coach

b) Speed of the train shall not be more than **30 KMPH**,

c) It should cover the entire length of train,

d) Should have adequate space for fixing the lighting arrangement and for staff.

ii) For rolling in examination of train it has to be ensured that proper lighting arrangement is provided on both the sides of the track at nominated spots for examination of undergear parts during night. Focussing of lights shall be done by keeping a coach on the line and adjusting the angle of light to illuminate undergear and bogie. Use of fixed lights as indicated in **figure 1.5** is preferable.

iii) C&W staff should take position at nominated rolling in place on both the sides of the track before the arrival of train.

iv) As the train passes the nominated point, C&W staff should watch out vigilantly for loose/hanging/broken undergear parts of the coaches, any unusual sound coming from the coaches or any other abnormality in the coaches.

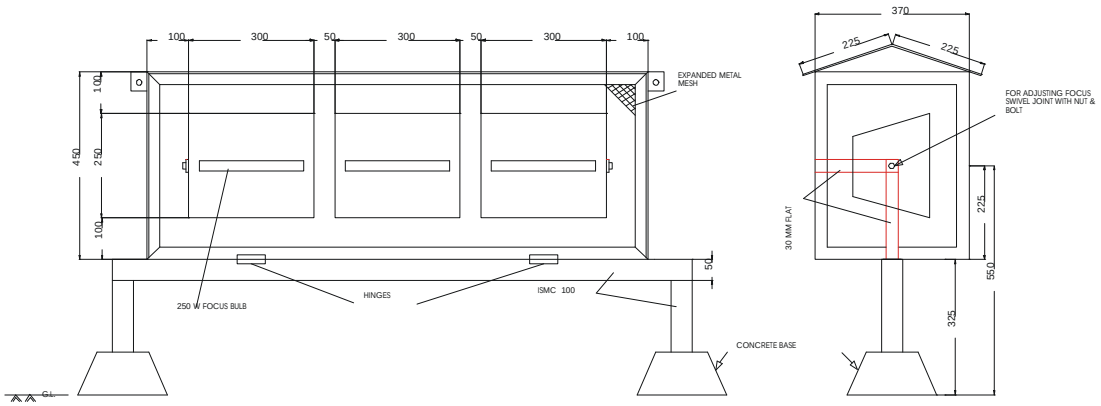
v) After train comes to halt, it should be ensured that the train is protected from both the sides (with the stop board/red flag during day time and red lamp during night time) before commencing the examination of the train. It should be ensured that a suitable indication board is placed at conspicuous location visible to the driver indicating that C&W staff is at work.

vi) Temperature of the axle boxes should be measured preferably with the help of the electronic temperature measuring device.

vii) Brake release shall be checked by physically moving the brake beam. However, in case where train locomotive has to be detached, brakes of all coaches shall first be manually released. For checking the release of brakes the hook may be used (drawing of hook is attached as **figure 1.6**).

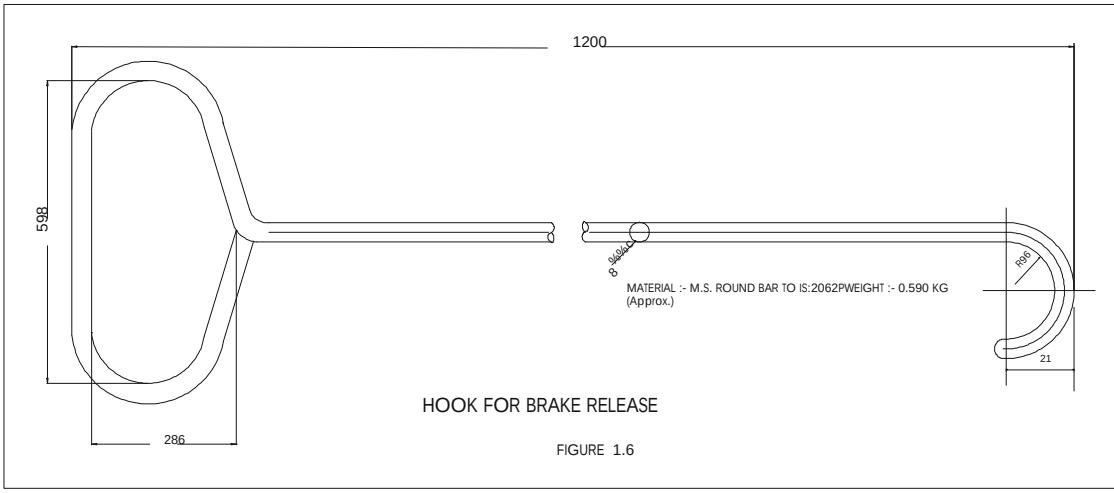
viii) Other undergear parts should be examined visually to ensure that the train is safe to run further. During night the lamps/search light shall be used for illumination .

ix) Repairs if required should be carried out promptly to avoid detention to train to the extent possible.



LIGHTING ARRANGEMENT FOR ROLLING IN/OUT EXAMINATION

FIGURE 1.5



HOOK FOR BRAKE RELEASE

FIGURE 1.6

x) Lavatories of the coaches should be properly cleaned using High pressure water jet machine provided at nominated stations during halt of the train. Any complaint from passengers should be attended promptly to the satisfaction of the passenger.

xi) After attending to any required repairs stop board/red flag should be removed.

xii) Carriage controller (CCR) should be informed about any out of course work done.

xiii) CCR shall repeat the out of course work done to the Primary Maintenance (PM) depot after corrective action.

xiv) At the train examination stations where locomotives are changed on through trains, the level of air pressure/vacuum created on the locomotive and brake van gauges should be recorded on the certificate to be issued to the guard and driver on prescribed form. The inoperative/blanked cylinders, if any, should also be written in the certificate for their information. This certification should be an endorsement on the original brake power certificate; no fresh brake power certificate needs to be issued.

108. MAINTENANCE PATTERN FOR COACHING TRAINS
(Railway Board letter no. 95/M(C)/141/1 dtd. 29.10.01)

Table 1.8

Sr. No.	Category of trains	Preventive maintenance schedules at pitline	Under gear examination and brake system maintenance at pit line	Internal cleaning, passenger amenity attention and watering	External cleaning on nominated line with proper facilities	Enroute/Terminating examination	Brake system check prior to start at platform at the other end
01	**Mail/Exp. One-way run>2500 kms**	At primary end	At both the ends	At both the ends	At both the ends	**Enroute**: After every 250 to 350 kms of run at locations to be decided by Railway for each train. **Terminating Exam** Terminating station	Complete air/ vacuum check with fresh BPC.
02	**Mail/Exp. One way run<2500 kms but round trip run> 2500 kms**	At primary end	At both the ends	At both the ends	At both the ends	- do -	Complete air/vacuum check with fresh BPC.
3 (a)	**Mail/Exp. Round Trip run upto 2500 kms**	At primary end	At both the ends	At both the ends	At primary ends	- do -	Only continuity check if stabled at platform, otherwise, brake power check with endorsement on original BPC.

Sr. No.	Category of trains	Preventive maintenance schedules at pitline	Under gear examination and brake system maintenance at pit line	Internal cleaning, passenger amenity attention and watering	External cleaning on nominated line with proper facilities	Enroute/Terminating examination	Brake system check prior to start at platform at the other end
3 (b)	**Shuttles/Interconnected Mail/Exp. round trip run upto 2500 kms.**	At primary end	To be done after 2500 kms or 4 days whichever is earlier only at Primary end.	At primary end and each terminal or as decided by the CME to ensure proper cleanliness.	At primary end ***Once a day for shuttles.***	**Enroute**: After every 250 to 350 kms of run at locations to be decided by Railway for each train. **Terminating Exam** Each Terminating station	Only continuity check if stabled at platform, otherwise, brake power check with endorsement on original BPC.
4.	**Passenger trains with toilets including interconnected passenger trains/Shuttles**	At primary end	To be done after 2500 kms or 7 days whichever is earlier at Primary end.	At every terminal or as decided by the CME to ensure proper cleanliness.	At primary end.	**Enroute**: After every 250 to 350 kms of run at locations to be decided by Railway for each train. **Terminating Exam** Once a day at nominated Terminating station	
5.	**Passenger trains without toilets.**	At primary end	To be done after 2500 kms or 7 days whichever is earlier at Primary end.	Once a day	At primary end.	Once a day at primary or a nominated terminal.	Only continuity check if stabled at platform, otherwise brake power check with endorsement on original BPC.

- Internal cleaning, Passenger amenity attention and watering may be done at platform line or nominated stabling line provided stipulated facilities are available at such line.
- Incase the rake stabled in yard for more than 6 hours positive safety arrangement should be made for the rake and in case the security is considered inadequate, the rakes should be taken to pit line for attention to under gear as given under column (4).

108a Approved Mandatory conditions to be fulfilled prior to introduction of Round Trip Primary Pattern of Maintenance on Coaching Trains

The following mandatory conditions should be fulfilled prior to introduction of **round trip/kilometers base PRIMARY** maintenance pattern on any passenger carrying train on Indian Railways:

PRIMARY END:

1. The attention during primary maintenance should be made more intensive with special emphasis on the following aspects:

   i) The brake gearing should be properly adjusted including the slack adjuster 'A' dimension & the brake cylinder stroke to ensure **100% brake power.**

   ii) Brake blocks should be changed in bogie sets only.

   iii) Dash-pot oil level must be checked and maintained.

   iv) All missing passenger amenity fittings must be replaced and the rake must be turned out as 'Zero-Missing-Fitting' rake.

   v) Intensive cleaning of coach toilets and lavatory.

   vi) No coach should run overdue schedule.

2. Clear maintenance time of 6 hours on the pit as per train schedule. Any exception to be jointly decided by COM/CME of the Railways.

3. Provision of proper washing cum maintenance pit line facility with adequate testing equipment and high pressure water cleaning arrangement.

4. Adequate gang strength with proper supervision.

THE OTHER END:

5. Whenever the lie-over is more than 2 hours at the platform or the rake is stabled in the yard, the rake should be locked and positive security should be provided.

6. Amenity and cleaning attention is ***carried out best on the washing lines*** where complete infrastructure by way of men, material and machines are available. Watering and drainage facilities are also available on these washing lines. Ideally, for cleaning and watering, the rakes should be taken to washing lines as far as possible. In the event of this being not feasible, such rakes can be returned from platform/yards. However, the minimum infrastructure to be provided at the platforms from where trains are returned without secondary maintenance should be as under.

   i) One storage room for essential safety and passenger amenity item.

   ii) Road transportation facility for ferrying material from the main depot to the platform.

   iii) Adequate number of mobile high pressure jet cleaning machines or high pressure water pipe line running around the platform /yard line.

   iv) Washable apron on the platform lines with the covered drains to facilitate movement of maintenance staff.

   v) Walkie-Talkie/mobile telephones for quick and easy communication.

   vi) Standard watering hydrants.

   vii) Flood light at the platform ends for rolling-in examination at night and 110 V inspection lights along the side of the track for night examination of the under gear.

7. The decision, whether such trains may be shunted for working on pit line or attended at platform itself, has to be taken carefully after weighing these factors by the mechanical and Traffic HODs on the zonal Railway on case to case basis.

8. The status of implementation of revised pattern of coaching trains should be reviewed every year in the month of June by Mechanical and Operating branches at Divisional level and any discrepancy should be removed.

109 WASHING AND CLEANING OF COACHES

Use recommended solutions for cleaning as per RDSO specification No. M&C/PCN/101/2001 or use cleaning agents approved by CME of the Railway.

109a Platform cleaning and washing

i) Wherever washable aprons are available on the platforms, the time available before the terminating trains are pulled out into the yard, should be utilised for inside sweeping and toilet cleaning.

109b External Cleaning / Washing

i) Place the rake/coaches on the washing pit provided with equipments required for washing and cleaning. It should be ensured that the rake/coach is protected with proper board/signal for safety of the staff working on washing/cleaning job to prevent movement/disturbance in the activity. Scotch blocks with locking arrangement should protect lines and keys should be kept with Engineer (C&W) till the time rake is under maintenance.

ii) Before starting washing and cleaning of side wall, ensure that the glass shutters and louver shutters of that side are lowered. Remove dirt/dust accumulated on shutters by compressed air or duster.

iii) Remove old reservation charts/labels on the body panels. Splash water on old charts so that they are wet for easy separation. Care should be taken to avoid any damage to the paint.

iv) The cleaning solution should be spread/rubbed with nylon brush or sponge brushes and then rubbed thoroughly to clean the panels. Extra attention should be given to oily and badly stained surfaces.

v) Destination boards may be removed and cleaned with brush/duster.

vi) Clean the external surface by high pressure jet where facilities are available.

vii) All exterior panels including end panels should be hosed with water and brushed with diluted soft soap (detergent solution) The strength of the solution may be increased or decreased according to RDSO specification M&C/PCN/101/ 2001.

109c Cleaning of Toilet

i) Before starting cleaning of toilets ensure that all repairs in the toilets have been carried out and after cleaning no employee should enter in the toilet.

ii) Doors and walls should be cleaned with water sprayed by high pressure jet up to waist level. Apply specified solution and rub thoroughly with sponge brush/duster/nylon bristle brush.

iii) Indian style lavatory pans have to be cleaned by thorough rubbing with concentrated solution of recommended cleaning agent.

iv) Western style commode shall be cleaned as (iii) however due care should be taken that recommended solution should not fall on commode lid which may damage/spoil it.

v) The flooring should be rubbed with nylon bristles/sponge brush and cleaned with recommended cleaning agent. The drain holes should be cleaned thoroughly for easy discharge of water.

vi) The mirrors in toilet should be cleaned with light wet cloth. Recommended solution should be used for cleaning the dirty portion of glasses.

vii) After all the washing and cleaning in the toilets mentioned above, the toilets should be thoroughly cleaned with water jets and water should be flushed out. All fittings and floor should be wiped dry with a cloth.

viii) After cleaning, spray deodorant in the toilet to remove the bad odour.

109d Internal cleaning of upper class AC and sleeper coaches

i) Collect the cigarette ends from all Ash trays, news paper from magazine bag and waste from dust bin. Sweep the whole coach with broom in sleeper coaches. Clean the floor of AC coaches with vacuum cleaner.

ii) Remove dust from floor, berths/seat, magazine nylon wire mesh bag fitted on panels and fan guards with duster. Use of vacuum cleaner is excellent in such areas.

iii) Also remove dust/dirt from under the berths, window sill, sliding door, railing corner and all corner & crevices of coach interior with vacuum cleaner if provided.

iv) Ceiling panels, wall panels, cushion berths, fittings, table top, etc. should be cleaned with duster and stain marks on these should be removed by use of recommended soft detergent.

v) Aluminum frames, strips, and other metal fittings, etc. should be cleaned with recommended cleaning agent.

vi) FRP window frames, louvers, etc. should be cleaned with recommended solution and rubbed out by nylon brush or sponge /duster to remove stain marks.

vii) Alarm chain handle and its holding bracket should be washed and cleaned.

viii) The coach flooring should be rubbed with hard coir brush and PVC flooring should be rubbed with nylon bristles/sponge brush and cleaned with recommended cleaning agent.

ix) In AC coaches, the amenity fittings and toilet fittings such as coat hanger, stools, arm rest, foot rest, towel hanger, etc. should be cleaned with duster. Stains on these items should be removed with recommended detergent solution.

x) The compartment carpet should be cleaned with vacuum cleaner. Every

month, the carpet should be cleaned thoroughly by taking it out from compartment and if necessary they should be dry cleaned in every three to four months. Before re-laying the carpet, the compartment floor should be thoroughly cleaned.

xi) Spray recommended air freshener in the coach. No employee should be allow to enter the coach for any purpose/work after complete cleaning

xii) Curtains in the AC Coaches and Tourist Cars should be removed for periodical washing and cleaning. Faded and damaged curtains should be replaced on condition basis.

xiii) Precaution should be taken to prevent nuisance of cockroaches in AC coaches and pantry cars by periodical spray of recommended insecticides

xiv) No repair works on Electrical train light/fan/AC) or Mechanical account should be left to be carried out after washing and cleaning of the coach..

109e Internal Cleaning of GS, SLR

i) Cleaning of GS, guard and passenger compartments of SLR should be done as mentioned under para 109d above wherever applicable.

ii) If necessary clean the wooden seat and their frames with recommended detergent solution and water.

iii) Interior surfaces of parcel and luggage vans should be cleaned with recommended detergent and water.

109f Cleaning of buffers and screw couplings

i) Buffer plungers should be scrubbed with a scraper to remove dirt and muck. Thereafter, they should be wiped clean with cleaning oil and rubbed with coir rope.

ii) Screw coupling threads should be cleaned with wire brush to remove all dirt and dust. Thereafter, it should be cleaned and given a light coat of oil. Oiling should be done on slack adjuster also.

110 CONDITIONS REQUIRED FOR MAINTENANCE OF 24 COACH TRAINS

(Railway Bd.'s letter no. 98/M(C)/137/19 Pt. I dt. 28.7.99 & dt. 05.05.2000)

110a Infra structural Requirements

(i) 24 coach length fully equipped pit line.

(ii) High pressure jet cleaning pipeline with plant for cleaning at primary pit line. Mechanised external cleaning is preferable.

(iii) Water hydrants for 24 coach length at en route watering stations with 20 minutes stoppage at nominated stations

(iv) Availability of the prescribed air brake maintenance and testing equipment.

110b Coach Design related Requirements

(i) Air brake with twin pipe graduated release system

(ii) Only enhanced capacity draw gear and screw coupling to RDSO sketch No. 79061 and 79067 are to be provided on the rake

110c Maintenance Practices and system related requirements

(i) The integrity of the rakes to be maintained.

(ii) Primary maintenance of the rake should be done in one hook without splitting

(iii) Minimum maintenance time of 6 hours on the pit during primary maintenance

(iv) It is mandatory to provide secondary maintenance to all trains augmented to 24 coaches .

(v) Trains leakage rate to be maintained within prescribed limits by using rake test rig.

(vi) Provision of proportionate brake system on the locomotive in good working order

(vii) Provision of audio visual alarm system on the locomotive

(viii) In case of double-headed diesel locos maximum traction motor current will be restricted to **650 amperes** and in case of double headed WAP1/WAP3 electric locos, the traction motor current limit will be **750 amperes** as prescribed in RDSO 's instructions for operation of main line air brake trains - C-9408.

110d Operational requirements

i) Communication between driver and guard should be provided through suitable means.

ii) Special care to ensure no gap between coach buffers after tightening the coupler.

iii) No additional coach attachment beyond **24 coaches** will be permissible.

111 MAINTENANCE PRACTICES IN OPEN LINE DEPOTS

111a Nomination of a Depot

i) All passenger coaching vehicles (PCVs), other coaching vehicles (OCVs), owned by individual railways should be allotted a base depot for primary maintenance and a base workshops for periodical overhaul and special repairs by the Chief Mechanical Engineer/Chief Operation Manager of the Railway.

ii) The base depot to which the coaches are allotted will be responsible for their maintenance. It will also be responsible for the secondary maintenance of the coaches as prescribed by the Railway.

iii) If a coaching stock allotted to a particular depot, finds its way to another depot, it should be despatched to the allotted depot for proper service.

iv) Due to exigencies of service a coach of another depot can be retained with the sanction of the Chief Mechanical Engineer (CME). It should, however, be subjected to necessary examination and repairs including maintenance schedules in the manner as it belonged to the depot.

v) No overdue periodical overhaul (POH) coaches of other railway should be allowed in service but should be booked to the owning railway for POH.

vi) If home railway stock is retained in service beyond return date for any reason, IRCA rule 2.2.4 should be followed.

vii) Standard integrated modular pit line should be provided as given in Appendix E.

111b Special Repairs

i) The special repairs (Non-POH repairs) by workshops are those repairs, which can not be done in the sickline with their existing facilities or are specifically prohibited to be carried out on the divisions.

ii) Special repair coaches should be sent to the base workshops only after obtaining the permission of the Chief Mechanical Engineer and according to the calling in program of the workshop.

iii) For requesting permission for non-POH repairs, the supervisor incharge of the depot should prepare a complete list of damages and deficiencies and forward it to Divisional Mechanical Engineer for getting permission of the Chief Mechanical Engineer to book the coach to the shop for non-POH repairs. A copy of the list of damages and deficiencies should simultaneously be sent to the workshop concerned for planning it in their calling-in programme.

111c Intermediate Overhaul

i) All bogies of such ICF coaches shall be given IOH after **six months ± 15 days** of the date of last POH as per table 1.1. All the newly built coaches shall be given IOH after one year of service.

ii) During this lifting schedule, bogies/underframe members and body including trough floors of integral type coaches should be thoroughly examined and all parts of running gears are repaired/ replaced as necessary. The bogie frames should be particularly checked to detect damage, cracks or deformation and necessary repairs carried out. Where it is not possible for the maintenance depot to do these repairs or are prohibited to be done in the maintenance depots, the bogies should be sent to the shops for carrying out these repairs.

iii) The detailed table of maintenance activities to be carried out during IOH schedule is enclosed as appendix-G.

iv) The date of intermediate lifting should then be stencilled at the appropriate place in schedule chart on the end panel.

111d Formation of Block Rakes

i) For the purpose of maintaining the coaches and the rakes in good condition and to avoid public complaints, the Chief Mechanical Engineer, in consultation with the Chief Operations Manager of the Railway, shall form Block Rakes for each of the long distance trains and the inter-railway trains; and also nominate spare block rake coaches of adequate number for these block rakes to replace sick block rake coaches.

ii) The station staff shall ensure that no non-block coach is attached in any Block Rake

except with the express permission of the Divisional Mechanical Engineer, who will grant such permission only in emergency and that too for a specified trip only.

111e Destination Boards

i) Coaches on originating trains should be provided with destination boards of approved types as prescribed by each Railway.

111f Fire Extinguishers

i) Fire Extinguishers should be provided on all originating trains according to the number prescribed by the Railways for air-conditioned coaches, brake vans, postal vans, dining cars, etc. These fire extinguishers should be checked every three months and completely refilled after one year. These extinguishers should not be overdue testing / refilling. In case they are used or damaged en route, the report of the same should be obtained from the guard, head sorter, etc., as the case may be, and replaced.

111g Brake Van Equipment

i) Similarly, other brake van equipment, which Mechanical Train Examining staff is responsible to supply, should be provided according to the instructions of each Railway. As per RDSO's letter no. MC/CB/28 dtd. 19.5.2000, racks have to be provided in the SLRS for provision of portable control telephones, portable train lighting equipments, portable fire extinguisher, wooden wedges/skids and stretcher. Railways can modified existing emergency equipments rooms in the guard's compartment to provide racks for keeping the above mentioned items except fire extinguisher as shown in the **figure 1.7** (RDSO's sketch K 0014)

111h Watering and cleaning of rakes.

i) Mechanical department of each railway will nominate the watering and the cleaning stations on the railway.

ii) All water tanks should be filled on a washing line so that no watering is necessary on a platform at the originating station. Arrangements should, however, be available at each of the platforms for filling the tanks in emergencies.

iii) Adequate staff and time should be provided at intermediate stations to enable complete replenishment of all the water tanks of the train at each of the nominated watering stations of the railway. If necessary, where halts are small, boosters of adequate capacity should be provided to increase the water pressure and accelerate water filling.

iv) After completing watering, the staff, in case of overhead watering arrangement, must ensure that water hosepipes are coiled and secured properly with the overhead hydrants and that the hydrants are fully closed. All leaky hydrants should be reported to the Engineer (C&W)/Engineer(Civil), as the case may be, who will arrange to get them attended. In case of ground level side filling watering arrangements, it should be ensured that water hose pipes are not dragged or left over on the platform aprons, but are hung properly on the poles to prevent contamination of water.

v) Adequate staff and time should be provided to clean the compartment and the bathrooms/ lavatories as prescribed at nominated cleaning stations of the railway. Portable pressure jet cleaning equipment should be used for efficient cleaning of toilets.

vi) Deployment of C&W staff on Rajdhani/Shatabdi Express/Rajdhani type nominated trains/Other superfast and Mail/Express trains should be as per Railway Board's letter no. 99/TG.V//12/2 dated 13.9.99. The `Safaiwalas' should wear identification armbands while on duty. A suitable cleaning kit consisting of requisite cleaning agents, brushes, mops, etc. should be standardised by the Railway and provided to them.

111i Deficiency Rolling Stock (DRS) for Coaching Stock

i) Railway should devise system for detecting deficiencies. Reports of deficiencies/ defects in Rolling Stock (DRS) reports in the proforma given in **Annexure 1.2**, should be prepared for each mail/express/passenger originating train in duplicate by the Engineer (C&W)/Electrical (TL) and should be signed jointly with the RPF representatives. Reports for mechanical deficiencies should be prepared on Performa I (the fittings mentioned in these Performa are selective and not exhaustive

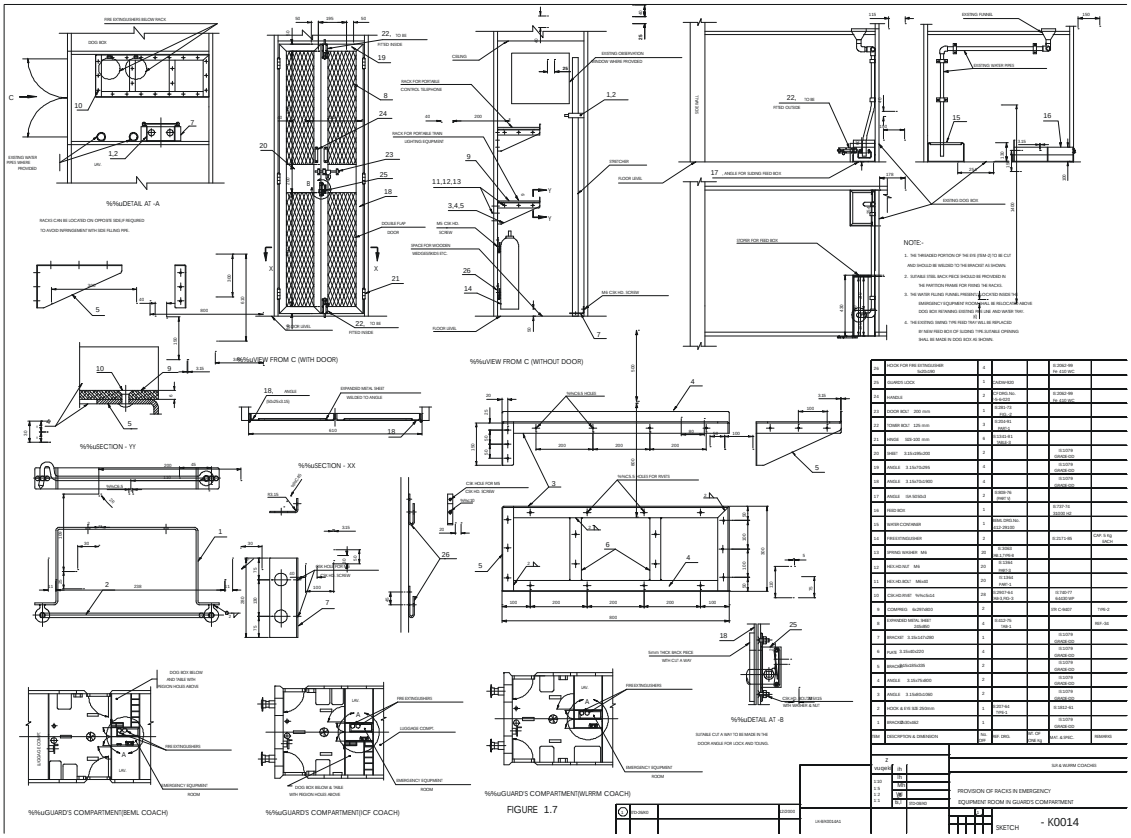

%%uDETAIL AT -A
%%uVIEW FROM C (WITH DOOR)
%%uVIEW FROM C (WITHOUT DOOR)
%%uSECTION - YY
%%uSECTION - XX
%%uDETAIL AT -B
%%uGUARD'S COMPARTMENT(SEMI. COACH)
%%uGUARD'S COMPARTMENT(ICF COACH)
%%uGUARD'S COMPARTMENT(WURM COACH)
NOTE:-
PROVISION OF RACKS IN EMERGENCY EQUIPMENT ROOM IN GUARD'S COMPARTMENT
SKETCH
- K0014

FIGURE 1.7

and may be altered by each Railway on the basis of the items most prone to theft on their system). This should be done soon after the maintenance of the rake is complete in the sick/ washing lines. In case the train starts from the platform itself, these reports should be prepared by the train duty Engineer (C&W)/Electrical (TL). The originating station must keep copy of the report. It should be preferable if one booklet is maintained for each service so that the carbon copy is sent with train guard, retaining the original for record.

ii) After the coaches have been jointly checked, and DRS reports have been made, the coaches should be padlocked/ key locked and the key and report should be sent to the platform Engineer (C&W).

iii) **Coaches with attendants**

For the coaches, which have nominated attendants, the DRS card will be given to him. Deficiencies will be noted down by the attendant and advised to Engineer (C&W) and Engineer (Electrical) at the coaching depot after end of the journey. So he will have to keep a register noting down the deficiencies and the date of advice and the date of recoupment.

iv) **Trains which are escorted by Engineer (C&W) & Engineer (Elect.)**

For trains where an escorting C&W staff is provided on the train, he shall carry DRS card for coaches other than para iii) above and get them filled up at the secondary maintenance depot by the Mechanical/Electrical staff and get the rake examined by RPF personnel in case of any deficiency.

v) **Trains/Coaches not covered in para iii) & iv)**

a) For other trains/coaches not covered in para iii) & iv), the DRS Reports should be handed over to the train guard and his signature obtained on the office copy. The guard will be responsible for safe carriage of the Report up to the destination. At the destination station, the outgoing guard must ensure that the reports are handed over to the Mechanical/Electrical staff immediately on arrival of the train.

b) On arrival of the train at the destination station, the Engineer (C&W) staff and electrical staff shall check the rakes jointly with a representative of RPF and comparison may be made with original report. If original report is not received, the general inspection should be recorded on DRS Cards as done at originating stations. New DRS Cards showing deficiencies/ defects of each vehicle will be prepared and sent to originating station along with the rake. In case vandalism is suspected, suitable remarks should also be given. The Engineer (C&W) staff, Electrical staff and RPF staff should sign the report. On receipt of the report by the originating station, a comparison will be made and statement prepared of deficiencies that occurred enroute.

vi) The Supervisors at the destination station, viz., Engineer (C&W)/Engineer (TL) shall report the thefts on the form already prescribed by RPF, to the RPF/GRP as quickly after arrival of the train as possible and not later than 24 hours after the arrival of each rake. If the GRP refuses to accept such reports at the arrival station of train from the Mech. /Elec. Supervisors, it shall be incumbent on the RPF in-charge at the arrival station of the train to get cases registered with GRP and take further action as deemed fit to get the thefts traced/ reduced. If such reports are to be made to any other RPF post, this shall also be done by the RPF in-charge of the train arriving station.

vii) The Supervisors of the originating station should compare these DRS Reports with the original DRS Reports and prepare a summary of the deficiencies/ thefts occurring in the up and down trips separately.

viii) A train wise summary of the deficiencies/ defects shall be prepared and forwarded to the DME/DEE with a copy to Security Commissioner, RPF, of the division. The cost of the fittings should also be shown in the summary, price being taken from IRCA Rules Part IV. For items not covered in these, stores cost should be given.

ix) In the first week of every month, Supervisors in charge of Mechanical, Electrical and Officer- in charge of RPF Posts/Outposts should hold a joint meeting to identify the areas where the deficiencies/ thefts are occurring and analyse the items more prone to breakage/losses/thefts. The officials should take remedial measures as possible at their level. A monthly statement of thefts, giving their cost and analysis should be prepared by RPF but jointly signed by Engineer(C&W), Engineer (TL)

with the copy each sent to DME, DEE and Security Commissioner, RPF.

x) The Divisional Officers, viz. Sr. DME, Sr. DEE & SC must meet every three months to carry out similar analysis and decide upon preventive steps to be taken in each area. They should submit similar joint report to their Headquarters Officers concerned, viz., CME, CEE and CSC.

xii) The CME, CEE and CSC should furnish every six months a report to the Director/ Mechanical Engineering, the Director/ Electrical Engineering and DG/RPF in the Railway Board, indicating the extent of theft of C&W and electrical fittings on their system and the remedial measures taken by them bringing out any help in any area required from the Ministry of Railways.

111j Reporting of thefts

i) All damages/deficiencies which may apparently be due to mischief or theft during service should be reported to the RPF/GRP and the Divisional Mechanical Engineer according to the procedure laid down in Railway Board's letter No.73M(c) /165/4 dt.4.7.77 circulated to General Managers, all Indian Railways.

111k Coach Maintenance History Card

i) Every coaching depot shall have computers for maintaining the coach maintenance history in a software programme which should be compatible with the programme of the coaching workshop.

ii) The "Coach Maintenance History Card" (MHC) for each of its coaches. The card will contain records of maintenance schedules including POH and special repairs in shops. It will also show the history of the coach from the time the coach is placed in service till its condemnation and will give details of all major repairs like wheel changing, bogie changing, etc.

iii) The complete history book of each coach, consisting of maintenance history cards, date card, trial card, etc. will, however, be maintained by the base workshops. When a coach is sent for POH or special repairs, a copy of its maintenance history card should be sent by its base depot to the workshops for record in its complete history book.

iv) The workshops should send a new maintenance history card (MHC) giving the condition of the coach, the list of important fittings and furniture in case of Air Conditioned coaches, dining cars, etc., defects and deficiencies of the fittings, if any, to the base depot when a coach is turned out of workshops after POH or special repairs. Any special instructions regarding the coach for its base depot should also be maintained in the card. If modifications are carried out, they should be indicated in the card under its appropriate column. Similarly, if trial fittings/ components are fitted or materials are on trial on the coach, the details of the fittings/ components or the materials, the authority for conducting such a trial, the purpose of the trial, the nature and the frequency of the observations to be made, the type of interim/final reports required to be submitted, the name and the address of the authority to whom it is to be submitted and any other instruction in detail should be maintained in a "Trial Card" which should be sent by the workshops to the base depot for compliance of the instructions. The base depot, on receipt of the coach from the shop, will check the fittings/ articles in the coach with the list sent by the workshops and note all the instructions for compliance. It will also make examinations and observations as prescribed in respect of trial fittings, components or materials and submit the trial reports to the appropriate authority as prescribed in the Trial Card received with the coach.

vii) The base workshops will also carry out a detailed examination when a new coach is received, register the coach, open its history book, make a list of all defects and deficiencies and then, in consultation with the CME's office, will allot a rake number and its base depot, stencil the same on the coach and, if it is fit in all respects, it will then send the coach to the base depot for service. Also, it will prepare a warranty card as per Performa given in **Annexure 1.3** and will forward it to the base depot with detailed instructions for preferring claims from the manufacturers through Divisional Mechanical Engineer.

111 Warranty claim for defective/failed items

There are some items for which it is mandatory for the manufacturers to give warranty claim if the item fails or becomes defective during the warranty period as specified in the specification/drawings /purchase order.

Warranty period for few items is given below as an illustration:

Table 1.9

S. No	Description of item	Warranty period
1.	Distributor valve	36 months from the date of delivery or 24 months for date of fitment whichever is earlier
2	Air brake cylinder	-do-
3	BP/FP hose	-do-
4	Slack adjuster	-do-
5	Shock absorber	15 months form the date of delivery or 12 months from date of fitment whichever is earlier.
6	Direct mounted spherical Roller bearing	36 months from the date of delivery or 4 lakhs km from the date of commissioning whichever is later
7	Upholstery for 1st AC coaches and executive class chair car of shatabdi express	One and half year from the date of delivery
8	Composition brake blocks	18 months from the month of supply or duty life cycle i.e. time taken in reaching the wear limit of the brake block, whichever is earlier
9	UIC type elastomer flange for UIC vestibule	36 months from the date of delivery or fitment whichever is later.
10	Rubber spring of 1000 kg.m side buffers	2 years from the date of mounted in coaching stock.

Format of warranty claim is given in **Annexure 1.5** (for workshop use) and **Annexure 1.6** (for Division/depot use).

112 MAINTENANCE SCHEDULES TO BE FOLLOWED IN COACHING DEPOTS

112a To maintain coaching stock in good condition, the following maintenance schedules are prescribed to be carried out in carriage depots on divisions where rake has been based for primary maintenance.

i) Schedule A - Monthly (**1 month ± 3 days**) in rake
ii) Schedule B - Quarterly (**3 month ± 7 days**) in rake
iii) Schedule C - After (**6 months ±15 days**) detach coaches

A detailed table of maintenance activities to be carried out during schedules is enclosed as **Appendix-F**

112b Primary maintenance schedules are required to be carried out by the base depots to which coaches are allotted. In emergency, when due to any reason coaches cannot reach their base depots and primary maintenance schedules become due, A & B schedules should be undertaken by the carriage depots where the coaches are available. 'C' schedule should be done at base depot.

112c **Open Line Maintenance of Parcel Vans (as per Rly. Bd's Lr. No. 95/M (C)/141/1Pt. dated 19.12.2001)**

For piecemeal operation of ordinary parcel vans or VHP, the responsibility to carry out openline schedules including 'C' schedule (irrespective of the owning railway) will be under :

1. **In case of parcel vans which from a regular part of the rake as per authorised composition:**
   The primary depot of the train.

2. **In case independent movement of parcel vans:**
   The coaching depot where it becomes due prior to next movement.

   In case facilities are not available at any destination, the van shall be moved a coaching depot for schedule within the stipulated period as per BG coaching Maintenance Manual.

No VPUs will be permitted to be attached to a train from a coaching depots without attending to prescribed preventive schedules as laid down above. As regards POH, the instructions contained in Board's above referred letter will be applicable.

112d **Maintenance Pattern for NMG rakes (as per Rly. Bd's Letter No. 91/M (C)/650/1 dated 29.5.2000)**

In order to optimize utilization of NMG rakes it has been decided to introduce the following maintenance pattern :

i) NMG rakes may be run on goods pattern with intensive examination at both the ends, following other conditions for enroute detention in case at stabling at road side stations. In case of close circuit runs upto 2500 km, the rake may be run on round trip basis.
ii) Close circuit rake must be clearly identified and should have a nominated base depot where adequate trained staff and spares should be available. Also each NMG coach should be marked with the nominated POH workshop and return date.
iii) The maintenance schedules of the NMG coaches will continue to be on the coaching pattern to be carried out by the base depot.
iv) NMG coaches are fit for only 75 kmph. Also the revised maximum payload of NMG coaches is fixed at 9.2 tonnes. Therefore, using these coaches as parcel vans for running on piecemeal basis on passenger carrying trains is strictly prohibited.

The instruction regarding POH and life of converted coaches continue to remain same which are as per Board's letter no. 91/M(C)/650/1 dtd. 10.9.96.

112e Each coach should be stencilled at a suitable place on its end panel, the code name of the base depot and a schedule chart. The date and station code of the depot where a particular schedule is carried out should be stencilled at the appropriate place in the schedule chart immediately when the schedule is completed.

113 PRIMARY/ SECONDARY MAINTENANCE

113a The rakes/ coaches of all trains should be given a Primary/Secondary Maintenance examination as prescribed by the Chief Mechanical Engineer of the Railway.

113b Coaches shall be washed and cleaned thoroughly from outside and inside as prescribed in clause 109.

113c **Brake system maintenance**

Air brake system (Bogie mounted and underframe mounted)

i) Visually check all the air brake equipments (DV, PEASD, PEAV, etc.) including their mounting brackets and anti pilferage devices for any damage on coach of the rake as per the check list given in clause 423**.**
ii) Check the operation of brake cylinder while conducting brake tests. If the red paint on the piston rod is visible, replace the brake blocks and make necessary resetting of Adjusting tube sub-assembly before the coaches are put into service runs.
iii) Perform leakage test for brake pipe and feed pipe and its connecting pipes as described in annexure 4.5 para 3 (Rake test).
iv) Performs service application and release tests as described in annexure 4.5 para 3 (Rake test).
v) Carry out alarm chain pull test & check the working of PEASD and Passenger emergency valve as per annexure 4.4 para 4.6 (Rake test)..
vi) Drain the dirt collectors for removal of water/moisture.
vii) Perform manual release test and check the movement of brake cylinder piston. Brakes should be in fully release condition.

Vacuum brake system

i) Entire vacuum brake system including slack adjusters and direct admission valves should be tested for leakage and proper functioning as described in vacuum brake system chapter at para no. 509b (Balance vacuum test and normal vacuum test). Balance vacuum test to be done as per schedule when vacuum cylinder is replaced.
ii) Test alarm chain apparatus under full vacuum. and check clappet for leakage.

113d In addition to above the following items of work should be attended during the maintenance schedule examination:

* underframes
* bogie frames
* axle boxes
* springs.

These items should be wiped with wet waste weaves or cotton waste as necessary so as to facilitate examination. All under gear components should then be examined and repaired as necessary to ensure that there is no `S' marked rejectable defect as mentioned in Chapter IV of IRCA Conference Rules.

113e The following items of undergear components should, however, be specially examined and attended to:-

i) Oil in hydraulic dash pots of Rajdhani and Shatabdi coaches should be checked once in 15 days to detect oil leakage from them through defective seals or through the vent screw. Add/ replenish with specified grade of oil if the oil level is below **40 mm** in the tare condition for ensuring better riding comfort.

ii) Wheel profiles should be visually examined and gauged in case they appear to be near condemning limits.

iii) The brake gear should be checked and so adjusted that the piston stroke is within the limits specified for different types of coaches. (see table 1.10). 'A' and 'e' dimensions for slack adjuster should be as per table 1.11.

Table – 1.10
Brake cylinder piston stroke

Type	Minimum	Maximum
Bogie mounted air brake cylinder	32	95
Under frame mounted air brake cylinder	75	95
Vacuum brake cylinder	125	135

Table – 1.11

'A' & 'e' dimension for slack adjuster		
Type of bogie	'A' dimension	'e' dimension
13 tonne bogie	**16 ±2 mm**	**375 ± 25 mm**
16.25 tonne bogie	**22 ± 2 mm**	**375 ± 25 mm**

113f The following coach body components and fittings should be specially checked and attended to :

(i) Doors should be properly secured with the hinges/pivots and should not be grazing with floor or door sill plates.

(ii) Door latches and safety catches should be firmly secured with screw of correct sizes and engaging properly and smoothly in their slots. The tongue of a gravity type latch should be in proper alignment with its slot plate.

(iii) Door lock handles should neither be stiff nor too loose and should be properly engaging on the striking plate.

(iv) Tower bolts should be complete and should operate easily and be in alignment with the clamp. Tower bolts should be fitted on a sound base with proper screws, at an **angle of 15°** to the horizontal to avoid locking by its self.

(v) Window shutters should neither be tight nor loose in railings to allow rattling and disengaging of catches on run.

(vi) Window shutter safety catches should properly engage in their slots.

(vii) Window frame should not be broken and its glass, gauze wire or venetian louvers should be in proper condition.

(viii) Vestibule assemblies of all vestibule coaches should be checked and repaired as necessary. No coach with vestibule ends should be allowed to work without provision of proper fall plates and end doors to make the vestibules functional.

(ix) Any defective vestibule should be checked with permanent locking.

(x) Water pipe connections, flushing valves, cocks and shower roses should not be leaking or choked.

(xi) Drain grills and drain holes in the bathroom floors and wash basin drainpipes should be cleaned and opened where found choked.

(xii) Any other deficiency as per **Annexure 1.2** should be made good.

113g After coaches are attended to in washing/pit lines, they should be disinfected and insecticide sprayed

especially at crevices and corners before they are released for use.

113h A proper record should be kept by Engineer (C&W) at washing/pit lines of schedules carried out by them, especially of items required to be attended at specific periodicity.

114 SCHEDULE `A' EXAMINATION

114a Schedule `A' is required to be given every month **± 3 days** at the nominated primary maintenance depot within the normal primary maintenance time on a washing/pit line in a rake. A coach need not be detached from the rake for Schedule `A' examination unless it requires such repairs which cannot be attended to on the washing line or within the prescribed maintenance time on the washing line.

114b **Brake system maintenance**

Air brake system (Bogie mounted)

'A' schedule maintenance as per air brake chapter.

(i) All items of primary/secondary maintenance schedule.
(ii) Test the working of brake cylinders for proper application and release.
(iii) Thorough inspection of brake pipe, feed pipe and their connecting pipes to brake cylinder, distributor valve, Auxiliary reservoir and hose coupling for leakage and attention.
(iv) Carry out manual brake release test on every coach to ensure proper functioning of release lever of distributor valve.
(v) Micro switch of ACP should be tested by electrical staff for proper functioning.
(vi) Clean Dirt collector filter with kerosene and refit.
(vii) Test the working of slack adjuster in under frame mounted air brake system as per **annexure 4.4 para 4.8** in Air brake chapter. Repair/Replace the defective slack adjuster.
(viii) Examine loops/ brackets and their securing devices and rectify.
(ix) Examine for wear and replace if required brake hanger pins, brake blocks and brake heads.

Vacuum brake

i) Thorough inspection of train pipe, hose pipes including their cages, vacuum cylinders, siphon pipes and vacuum system.
ii) Testing of cylinders and train pipe joints with exhauster under **51 cms of vacuum**.
(iii) Cleaning, greasing and testing of alarm chain apparatus under full vacuum with a spring balance and cleaning and checking of clappet valve for leakage.
(iv) Cleaning of DA valve filters as mentioned under in vacuum brake chapter para no. 506b for Escort / Greysham D.A valve.

114c The following items of work should be attended during Schedule `A' examination, i.e., monthly examination:-

(i) All items of primary/secondary maintenance schedule.
(ii) Intensive cleaning of coaches.
(iii) Intensive cleaning of lavatory pans and commode with specified cleaning agent.
(iv) Thorough flushing of tanks.
(v) Checking of water pipes, flush pipe, flushing cocks, push cocks, etc., for ease of operation and free flow of water.
(vi) Thorough dis-infection of all compartments.
(vii) Thorough inspection and repairs of draw gear as per item 6.0 of appendix F.
(viii) Thorough inspection and repairs of buffers as per item 7.0 of **appendix F**.
(ix) Oil in hydraulic dash pots should be checked to detect oil leakage from them through defective seals or through vent screws. Add/replenish with specified grade of oil if oil level is below 40 mm in tare condition to ensure better riding comfort. Similarly oil in side bearer baths should be checked when the oil is below the plug and replenished with specified grade of oil so that wear plate is fully covered by oil.
(x) Inspection and repairs of commode chute.
(x) Thorough check and repairs of sliding doors and vestibule doors for easy and smooth operation and

correct alignment and all wearing parts, loose screws, etc.

115 SCHEDULE `B' EXAMINATION

115a Schedule `B' is required to be given every three months **± 7 days** at the nominated primary maintenance depot within the normal time allowed for primary maintenance on a washing line in rake. Coach need not be detached from the rake for purpose of this examination unless it requires such repairs which cannot be attended to on the washing line or within the prescribed maintenance time on the washing line.

115b The following items of work should be attended.

Brake system maintenance
Air brake system (Bogie mounted)

(i) Same as 'A' schedule

Vacuum Brake system

(i) Examination, overhauling and testing of alarm chain apparatus as prescribed in vacuum brake chapter.
(ii) Overhauling of release valve, replacement of its diaphragm and sealing washers, if necessary.
(iii) Examination of neck rings and their replacement, if necessary.

Other assembly maintenance

(i) Besides brake system other items should be attended as given below:
(ii) All items of Schedule`A'
(iii) Painting of lavatories from inside.
(iv) Thorough inspection and repairs of brake gear components.
(v) Thorough checking of trough floor, turn unders, etc., from underneath for corrosion.
(vi) Touching up of painted portion, if faded or soiled.

116 DETACHMENT A COACH

A coach is detached from the rake due to several reasons such as:

116a **For IOH and schedule 'C' maintenance**.

i) Coaches required for detachment for maintenance under schedule 'C' and IOH maintenance.

ii) For maintenance of major break–down/ mal-functioning of any subassembly etc. the decision whether the coach is to be detached from the formation for attending to maintenance/replacement of major subassembly is dependent on maintenance requirements, operational convenience, time availability etc. The decision is taken by the Engineer (C&W). Coach failure report as per **Annexure 1.4** should be made. For failure components/assemblies during warranty, action to be taken as per para 111.

iii) At depot, the coach that is detached for schedule 'C' maintenance is taken over to the washing line for cleaning, lubrication and minor maintenance. The coach that are detached due to a major defect in the distributor valve, brake cylinder, Auxiliary reservoir etc, is taken to the pit line for the replacement of such sub-assemblies, on unit exchange basis. The detachment of coach is carried out so as to make the maintenance or testing activities convenient and faster so that the coach is made ready for use without delay.

116b PROCEDURE

The activities performed to detach a coach with Air Brake system are as follows:

i) Safety precautions shall be taken to prevent injury while detaching/attaching a coach.
ii) Remove the clamps on the cut-off angle cocks. Close the cut-off angle cock of both feed pipe and brake pipe on both sides of the coach that has to be detached.
iii) Close the cut-off angle cocks of the feed and brake pipe of adjacent coaches. This is to ensure that the air pressure locked up in the air hose coupling gets vented to atmosphere through the vent hole of the cut-off angle cock.
iv) Observe above mentioned safety measures to close all the four cut-off angle cocks on either side of the coach to be detached so that while opening air hose coupling, it may not cause injury due to air pressure inside.
v) Release the brake of the coach to be detached by pulling the manual release lever of the distributor valve.
vi) Open the Feed Pipe and Brake Pipe hose coupling from both sides of the coach.
vii) If the air pressure of brake cylinder does not vent by pulling the manual release valve of distributor valve, open the brake cylinder vent plug to drain the air pressure.

viii) Uncouple Screw coupling and detach the coach.

ix) Observe all other safety measures as prescribed.

117 SCHEDULE `C' EXAMINATION

Brake system Maintenance

Air brake maintenance:

(i) Schedule `C' is required to be given every six months **± 15 days** at the nominated primary depot.

(ii) Coaches are required to be detached from the rake and taken to the sick line for schedule `C' examination and repairs.

117a The following items of work should be attended during schedule `C' examination.

Air brake system maintenance

(i) 'C' schedule maintenance as per para 426 of air brake chapter.

(ii) Check brake cylinder for loose rocker arm plate and change on Bogie Mounted system.

(iii) Check proper functioning of slack adjuster mechanism.

(iv) Brake cylinder should be checked for smooth functioning and prescribed stroke. Defective brake cylinders shall be sent for repairs.

(v) Guard's van valve should be tested as per para 412d of air brake chapter.

(vi) Test BP & FP air pressure measuring gauges with master gauge and replace if found defective. A set of two master gauges should be kept for this purpose at every Primary Maintenance Depot and each master gauge should be sent one after the other to the base workshops for testing, repairs and calibration.

(vii) Thoroughly clean Dirt collector filter in kerosene or replace on condition basis.

(viii) Check working of PEASD & PEAV by hearing the hissing sound of exhaust air. After resetting with the help of key the exhaust of air should stop. Replace the defective PEASD/PEAV.

Vacuum brake system

(i) All items of 'B' schedule

(ii) Overhauling of vacuum cylinders, if due.

(iii) Testing of vacuum gauges with the master gauge, and replacement of defective or inaccurate gauge. A set of two master gauges should be kept for this purpose at every Primary Maintenance Depot and each master gauge should be sent one after the other to the base workshops for testing, repairs and calibration.

(iv) Thorough checking of train pipes under pressure of **2 kg/cm^2** to detect thin, corroded and punctured pipes. A high pressure pump must be provided at each Primary Maintenance Depot for this purpose.

Other assemblies maintenance

(i) All items of Schedule `B'

(ii) Thorough repairs of running gear including running out of bogies where considered necessary. All bogies which are working on rake links earning more than **2.5 lakhs kms**. per annum must however be run out and thoroughly attended to as laid down in clause **111c** under "**Intermediate Overhaul**".

(iii) Touching up damaged paint of coaches on outside as well as inside.

(iv) Polishing of the polished surfaces.

(v) Shock absorbers should be replaced and sent to the base workshops for repairs, testing and return. For this purpose, adequate spares must be maintained in the depot.

(vi) Thorough cleaning and removal of dust, rust, dirt, etc., accumulated at the pillars through the turn under holes, with coir brush and compressed air.

(vii) Thorough examination and repairs of upholstery, cushions, curtains, etc.

(viii) Thorough checking and full repairs of all window shutters, safety catches, safety latches, staples and hasps of compartment, lavatory, body side

and vestibule doors for ease of operation.

(ix) Thorough checking and repairs of UIC vestibules, their rubber flanges metal frames, doors, fall plate, locking gear, etc., for ease of operation and safety .

(x) Thorough checking and repairs of all cracks and worn out portions of flooring of the compartments.

117d Engineer (C&W) of Primary Coaching Maintenance Depots should be fully familiar with the vulnerable areas of ICF coaches for corrosion, viz., sole bar at doorways, lavatories and adjoining areas, corridor sides - more so in case of those SLRs which are used for Fish, Salt, etc. For facilitating inspection of sole bars even spaced elongated holes of (215x127 mm) are already provided in the turn unders.

117e Special attention should be taken for the following:-

i) Pocket between sole bars and turn unders should be thoroughly cleaned through the inspection opening of the sole bars and inspected with the help of torch light or inspection lamps.

ii) Drain holes provided in the trough floors should be kept clean and unclogged. If during the cleaning of these drain holes any accumulation of water is observed, the affected area should be very carefully inspected for possible corrosion.

iii) A register should be maintained of the primary maintenance coaches on the subject.

118 SPECIAL SCHEDULE

118a For high speed trains and some special coaches like Power Vans, etc., special maintenance schedules by the individual railways may be followed.

118b For maintenance of coaches of Rajdhani/ Shatabdi Express Rakes, the instructions given in RDSO Technical Pamphlet No. C-7807 should be followed.

118c The IOH of Rajdhani/Shatabdi high speed coaches should be carried out in workshops.

119. PROCEDURE FOR SENDING THE COACHES TO SHOPS FOR POH

The following procedure may be followed in regard to movement of coaching stock for repair to shops -

(a) Security Department shall arrange to escort all coaches booked to shops when booked by coaching specials or in lots of 3 coaches or more on receipt of memo from Engineer (C&W) of the booking station.

(b) All coaches booked to shops for POH will be booked by passenger/parcel/Coaching special.

c) Before any carriage is allowed to proceed to workshops a joint check should be carried out by the representatives of the Mechanical, Electrical and Security Branches on the basis of which a deficiency list will be prepared at the rake/coach maintaining station under joint signature of the three representatives in five legible copies with proper reference, number and date out of which one copy should be pasted in side the compartment on one of the end wall. Two copies of the deficiency list will remain in the personal custody of the RPF sainik accompanying the rolling stock to the workshop (In case of unescorted coach, deficiency list will be sent by post to CWM concerned and one copy will be sent to OC/RPF).the remaining two copies will be retained by the Engineer (C&W) /Electrical Supervisor of the base station. Upper class coaches must be pad locked/locked with carriage key and also sealed after the joint check at the starting station by the booking Engineer (C&W).

d) Once a Joint check has been carried out and the deficiency list drawn out no removal of fitting from the stock at the starting depot should be entertained.

e) Coaches escorted by the RPF staff will continue to be under watch of the Security Force (RPF) until coaches are taken over by the shops. On arrival of carriage at the Workshops, a careful check be made out jointly by the representatives of the Mechanical & Electrical Departments in presence of RPF staff in four copies. In case of any additional deficiency being noticed, a list of such additional deficiencies be made out in four copies jointly by all the three staff.

(f) One copy each of the deficiency list prepared by the representatives of workshop duly signed by RPF be sent to

the Engineer (C&W) /Elec. Supervisor of base station and one copy be given to RPF for submission of the same to the OC/RPF of the base station and one copy is to be kept on shop record. On receipt of the additional deficiency list, OC/RPF of the base station will arrange to fix responsibility for the additional deficiencies and take suitable action including sending a copy of his report to Engineer (C&W) /Elec. Supervisor concerned. On receipt of the report from OC/RPF, Engineer (C&W) /Elec. Supervisor will submit a report to the controlling Divisional Officer enclosing copies of the original as well as the additional deficiencies to enable the Divisional Officer to initiate action for the write-off of the cost of such materials. While granting write off or forwarding the case to Headquarters for arranging the write off due remarks should be given for the reasons of the deficiencies and the action taken. A certified true copy of the joint check mentioned above should accompany the losses due to theft and pilferage.

A copy of the write-off memo should be submitted to Budget section of the divisional Headquarters office for exhibition in Appropriation Accounts.

(g) Generally coaches should be sent in lots of three duly escorted. In exceptional cases coaching stock coming to Workshop by passenger/parcel trains unescorted by RPF sainik, the deficiency list prepared jointly at the originating station should again be checked at the workshop in presence of RPF representative and the difference of the two checking should be taken as theft. On receipt of unescorted coach in the Shop, the deficiency list in five copies in presence of representatives of RPF, Mechanical and Electrical Dept. will be prepared jointly. One copy of the deficiency list will be retained as office copy, 2 copies will be given to OC/RPF of the shop station and one copy each will be sent to Engineer (C&W) /Electrical Supervisor of base station. Out of two copies of deficiency list received by the RPF representative at the workshop, one copy be sent to OC/RPF base station for necessary action by the security Department.

(h) The workshop should have a proper organisation to check these coaches immediately on arrival.

Annexure 1.1
Indian Railways **Hkkjrh; jy**

cd ikoj iek.k lk=
BRAKE POWER CERTIFICATE

1. Date **fnukd**		**2. Station/Railways** **LV'ku@ jYo**	
3. Train No. **Vu u-**		**4. Load** **ykM**	
5. Engine No. **btu u-**		**6. Attached at** **xkMh ij yxu dk le;**	

7. Vac./Air Pr.ready **oD;e@ ,;j i'kj r;kj gku dk le;**

8. Vac/Air Pr. on Departure **oD;e@ ,;j i'kj pyr le;**

Air Pressure (kg/cm^{2})		Vac. cms of Hg
FP	**BP**	

In engine **btu e**

In Brake Van **cdoku e**

9. Pressure of Brake Power **lpfyr cd ikoj dk i'kj**

Air Brake Train **,;j cd Vu**	**100%**
Vacuum Brake Train **oD;e cd xkMh**	

9. A.i) Total No. of brake/Vac/Cylinders **cd@oD;e@flyMjk dh dy l-**
No. of operative Brake Vac. Cylinders **vkijfVo cd oD;e flyMj dh l-**

10. Individual numbers of two coaches next to the Engine and at rear in case of Vacuum trains and of 4 middle coaches also in case of Air Brake Trains
oD;e Vuk e btu@ cdoku e yx nk nk dkp d u- ,;j i'kj Vu e bud vfrfjDr chp d pkj dUn d dkpk d u- Hkh vfdr djA

Engine end **btu l**				**Rear end** **fiNyk fljk**
Middle **e/;**				

THIS CERTIFICATE IS VALID UPTO DESTINATION PROVIDED THE RAKE INTEGRITY IS NOT BROKEN OR CHANGED BY MORE THAN TWO VEHICLE UNITS OR THE TRAIN ENGINE IS NOT CHANGED IF RAKE INTEGRITY IS BROKEN BY MORE THAN TWO VEHICLE UNITS, A FRESH CERTIFICATE IS REQUIRED. IF THE TRAIN ENGINE IS CHANGED. THE CERTIFICATE SHOULD BE VALIDATED BY ENGINEER (C&W) THROUGH ENDORSEMENT IN THE COLUMN ON THE REVERSE.
;g iek.k lk= ij jd d xr0; LFkku rd ;fn [kfMr u gb gk tkjh fd;k tk;xk ;k nk dkp l vf/kd bdkb e ifjofrr gb gk ;k Vu btu dk u cnyk x;k gkA ;fn jd dh v[kMrk nk dkp l vf/kd bdkb e ifjofrr gb gk rk iek.k lk= dh vko';drk gkrh gA iek.k lk= dh o/krk vfhk;rk ¼d ,o o-½ }kjk fiNyh rjQ fy[k dkye }kjk fd;k tk;xkA

Driver's name & signature **Mkboj dk uke o gLrk{kj**
Guard's name & signature **xkM dk uke o gLrk{kj**
Engineer (C&W) **vfhk;rk ¼d ,o o-½**

(Space for enroute endorsement & Driver's remarks on the reverse)
Mkboj dh f'kdk;r ihN iUu ij

II. Driver remarks & enroute endorsements by Engineer (C&W)
Mkboj }kjk dh x;h fVli.kh d vuqkj vfHk;rk ¼d ,o o-½ }kjk jkLr e dh x;h iof"V

Station/Rly. where examined LV'ku @ jyo tgk ijh{k.k fd;k x;k gk	Engine No. btu u-	No. of vehicles without brake power			Percentage of brake power cd ikoj dk ifr'kr	Signature of Engineer xkMh ijh{kd d gLrk{kj
		DV Mh 0gh vkbZ lkyV	S.A.B ,l , ch [kjkc	Brake rigging [kjkc cd fjfxx		

IMPORTANT

1. The incoming Driver shall handover the certificate to relieving driver. If he is leaving the train without relief, it shall be deposited with the authority nominated to receive it, who will give it to the outgoing Driver.
bu dfex Mkboj dk pkfg, fd og viu iek.k Ik= vkmV xkbx Mkboj dk lkFk n vkj ;fn og fcuk fjyhoj d Vu NkM jgk g rk og viu iek.k Ik= ml vf/kdr 0;fDr d ikl tek dj tk fjyhfox Mkboj dk lkiA

2. The outgoing Driver & Guard will satisfy themselves from the coach nos. given in item 10 that the certificate pertains to their train.
tku oky Mkboj rFkk xkM] vkbVe dekd 10 e fn; x; dkp l[;kvk l viu vki dk lr"V djx tk mldh xkMh l lEcf/kr iek.k i= gkr gA

3. It is responsibility of the Driver of train to satisfy himself that the brake power certificate is proper and valid, before working the train shall handover the certificate to relieving driver. If he is leaving the train without relief, it shall be deposited with the authority nominated to receive it, who will give it to the outgoing Driver.
;g Vu Mkboj dh ftEenkjh g fd og viu vki dk lr"V dj fd cd ikoj dk iek.k i= mfpr ,o o/k gA xkMh d dk; dju l igy og ;g iek.k i= fjyhfox Mkboj dk gLrkUrfjr djxkA ;fn og xkMh dk fcuk fjyhoj vk; NkMrk g rk og ukeafdr ,o ftEenkj 0;fDr dk gLrkUrfjr djxk tk ckgj tku oky pkyd dk gLrkUrfjr djxkA

Annexure 1.2

CENTRAL RAILWAY
DRS CARD IN THE TRAIN SHOWING CONDITION OF MECHANICAL EQUIPMENTS

Rake No. …… **Train No. …….** **Date: ……** **Card No. ……**

Coach NO. Type & Owning Rly.	Coat hook	Ash tray	Mirrors	Push Cocks	Shower roses & valves	Towel Rail	Window Shutter	Folding Table	Tumbler holder	Mirror shelves	Ladder or foot steps	Remarks	Check enroute
1	2	3	4	5	6	7	8	9	10	11	12	13	14

Signature of inspecting staff	At Departure	On Arrival
	Engineer (C&W)	Engineer (C&W)
	RPF	RPF
	Guard	

Checking official will enter date, time and place after signature.

Annexure 1.3

WARRANTY CARD

PROFORMA FOR REPORTING DEFECTS ON THE NEWLY BUILT COACHES DURING THE WARRANTY PERIOD

1. Coach No.
2. Code transportation …….Mechanical code
3. Owning Railways
4. Name of manufacturer
5. Date of manufacture
6. Date of commission
7. Due date of warranty inspection
8. Date of inspection(by the depot)
9. Defects attributable to the manufacturers

Remark ……. (cost will be advised by the Railway board)

Report No. ……

Engineer (C&W)
(Rubber stamp of the depot)

Annexure 1.4

---------- Railway
Carriage Depot …….. (station)

COACH FAILURE REPORT

Train Details:
Date
Station
Originating Stn.
Prim. Maint. Depot

Train No.
Division
Last Exam. Stn
Sec. Maint. Depot.

Coach Details:
Coach Number
Coach type code
Last POH Date & Shop

Owning Railway & Base Depot
Coach Make: IRS/ICF/BEML/RCF
Return Date

Failure Particulars:
Cause of Failure (Detachment)

Defect found (on examination) Defect code

Remarks:

File No. DRM(M)'s Office,
---- Railway
---- (Station)
Date:---------

Copy forwarded to:
CME, (owning) Railway
CME, (reporting) Railway
Sr. DME, (C&W), Division Railway (of primary maint. depot)
Sr. DME, (C&W), Division Railway (of Secondary maint. depot)
CWM, Railway and Workshop (of last POH)

(Signature)
(Name and Designation)

Annexure - 1.5

File No.

CWM's Office
Carriage Workshop
_____Railway
Tele/Fax. no.
e.mail no.
Date:

To,

M/s

Sub: Warranty claim for failed /defective item (name) _____

1	Reporting workshop & Railway	
2	a) Coach no. & type	
	b) POH date	
	c) Return date	
3	a) Manufacturer's name	
	b) Date of Manufacture	
	c) No. given by Manufacturer	
4	Date of supply to workshop	
5	a) P.O. No.	
	b) Name of Inspecting agency	
6	a) Date of first fitment	
	b) Date of failure	
7	Type of service to which coach is generally attached	
8	Defects found/ cause of failures	
9	Other observations and remarks	i)
		ii)
		iii)
		iv)
		v)

Inspecting Officer
For CWM

Copy to:-

1. CME/ Rly. for kind information
2. COS/ Rly. for kind information
3. ED/Carriage/ RDSO Manak nagar Lucknow - 226011
4. CME/ ICF Perambur, Chennai/ RCF Kapurthala & BEML Bangalore
5. COS/ ICF Perambur, Chennai/ RCF Kapurthala & BEML Bangalore
6. Dy COS/Workshop for proper storage, delivery and receipt
7. Inspecting agency

Annexure - 1.6

File No.

CDO's/ DRM's Office
_____ Division
_____Railway
Tele/Fax. no.
e.mail
Date:

To,

M/s

Sub: Warranty claim for failed /defective item (*name of item)*

1	Reporting Division/Depot & Railway	
2	a) Coach no. & type	
	b) POH date	
	c) Return date	
3	a) Manufacturer's name	
	b) Date of Manufacture	
	c) No. given by Manufacturer	
4	Date of supply to workshop	
5	a) P.O. No. (if available)	
	b) Name of Inspecting agency (if available)	
6	a) Date of first fitment	
	b) Date of failure	
7	Type of service to which coach is generally attached	
8	Defects found/ cause of failures	
9	Other observations and remarks	i)
		ii)
		iii)
		iv)
		v)

Depot Officer/DME
For DRM(M)

Copy to:-

1. CME/ Rly. for kind information
2. COS/ Rly. for kind information
3. ED/Carriage/ RDSO Manak nagar Lucknow - 226011
4. CME/ ICF Perambur, Chennai/ RCF Kapurthala & BEML Bangalore
5. COS/ ICF Perambur, Chennai/ RCF Kapurthala & BEML Bangalore
6. CWM/Workshop
7. Dy COS/Workshop for proper storage, delivery and receipt
8. Inspecting agency

CHAPTER 2

SHELL

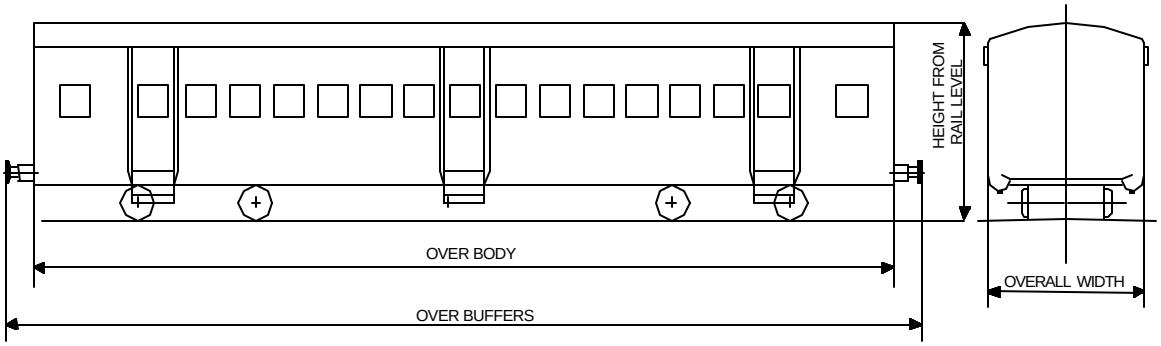
201 DESCRIPTION

The concept of the lightweight integral design originated in the recognition of the properties of hollow girders from the point of view of strength and utilization of material. The reduction in tare weight of these coaches could be achieved by utilising "stressed skin" concept and by use of low alloy fittings. Corrugated sheets are utilised for the trough floor to form part of the tubular construction as well as to absorb a large portion of the buffing forces. Anti-telescopic structure has been provided in the end-walls to avoid telescoping of the adjacent coaches and to absorb the major part of collision energy in case the ends collide during heavy collisions.

Leading dimensions of ICF, BEML and IRS are **(see figure 2.1)**:

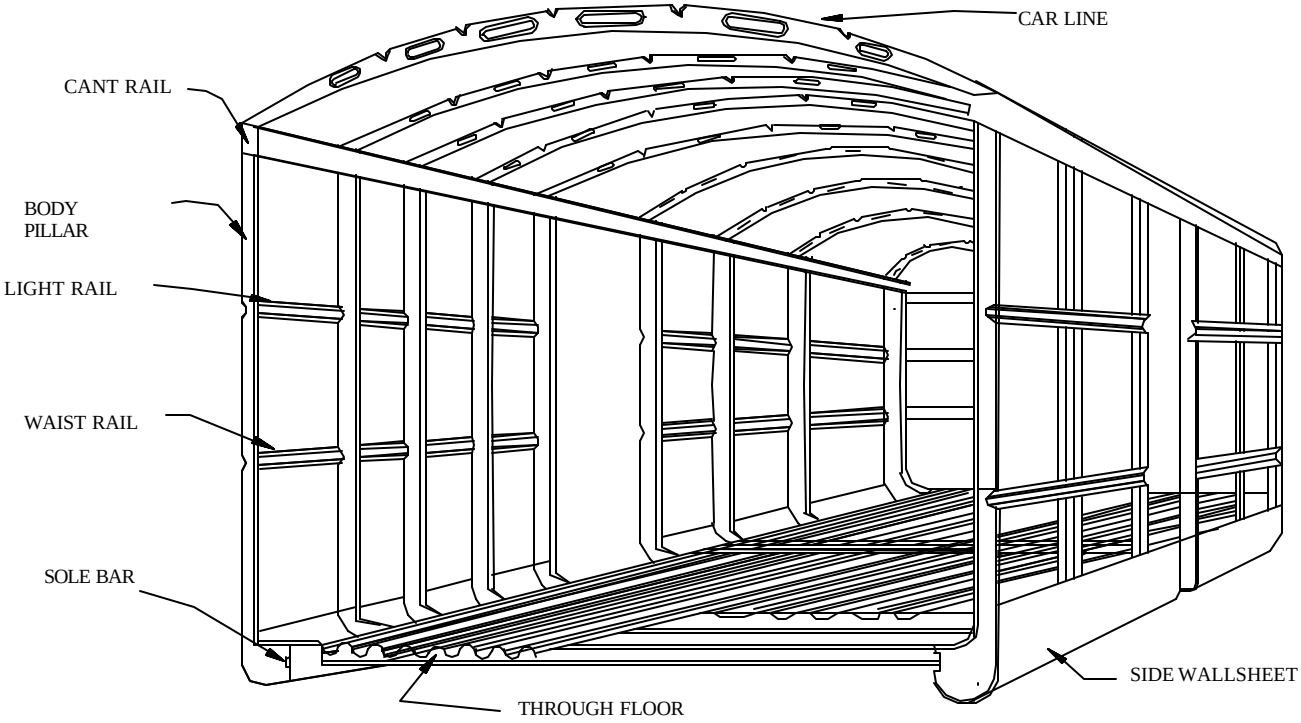
Table 2.1

Coaches	Over Buffers (mm)	Over Body (mm)	Over all width (mm)	Height from Rail level (mm)
ICF/RCF	22297	21337	3245	4025
BEML	22296	21336	3250	3991
IRS	21996	21030	3251	3886



COACH SHELL
Figure 2.1

201a The integral shell is made of a framework of series of hoops, consisting of floor crossbeams, body side pillars and roof carlines located transversely at regular intervals, to suit door and window openings **(see figure 2.2)**. These hoops are connected together by sole bars, waist rails, light rails, cant rails and carlines longitudinally. This frame work is sheathed all over by **2 mm thick** corten steel (IRS-M-41) on the side walls and **1.6 mm thick corten steel** on the roof. At the bottom **2-mm thick corten steel** corrugated trough floor is provided between the sole-bars and running over the length between the head stocks of underframe. The whole forms a tubular shell of integral construction in which the sides and roof panels also share the load. The corrugated trough floor with its corrugations running longitudinally from one head stock to the other takes up the buffing loads. Below lavatory the tubular constructions are provided in place of trough floor to avoid corrosion due to seepage of water **(See figure 2.2).** In coaches with stainless steel trough floor, no tubular structure is used.



SHELL FOR ICF COACHES (CROSS SECTIONAL VIEW)
Figure 2.2

201b End wall consists of four vertical pillars of box section connected transversely by `Z' sections and are welded to the head stock at the bottom and to the roof at the top. **(See figure 2.3)**

201c The head stock of BG integral coaches consists of outer and inner head stocks connected by two rigid center buffer stiffeners, which transmits all the buffing forces to the under frame structure.

201d Under-frame acts as support for mounting equipment like air or vacuum brake system (brake cylinders, DV, BP & FP pipes, auxiliary reservoirs, control reservoirs, etc.), air-conditioning system (Compressor unit, Battery, Control rectifier, etc.), train lighting battery boxes, under slung water tank, etc.

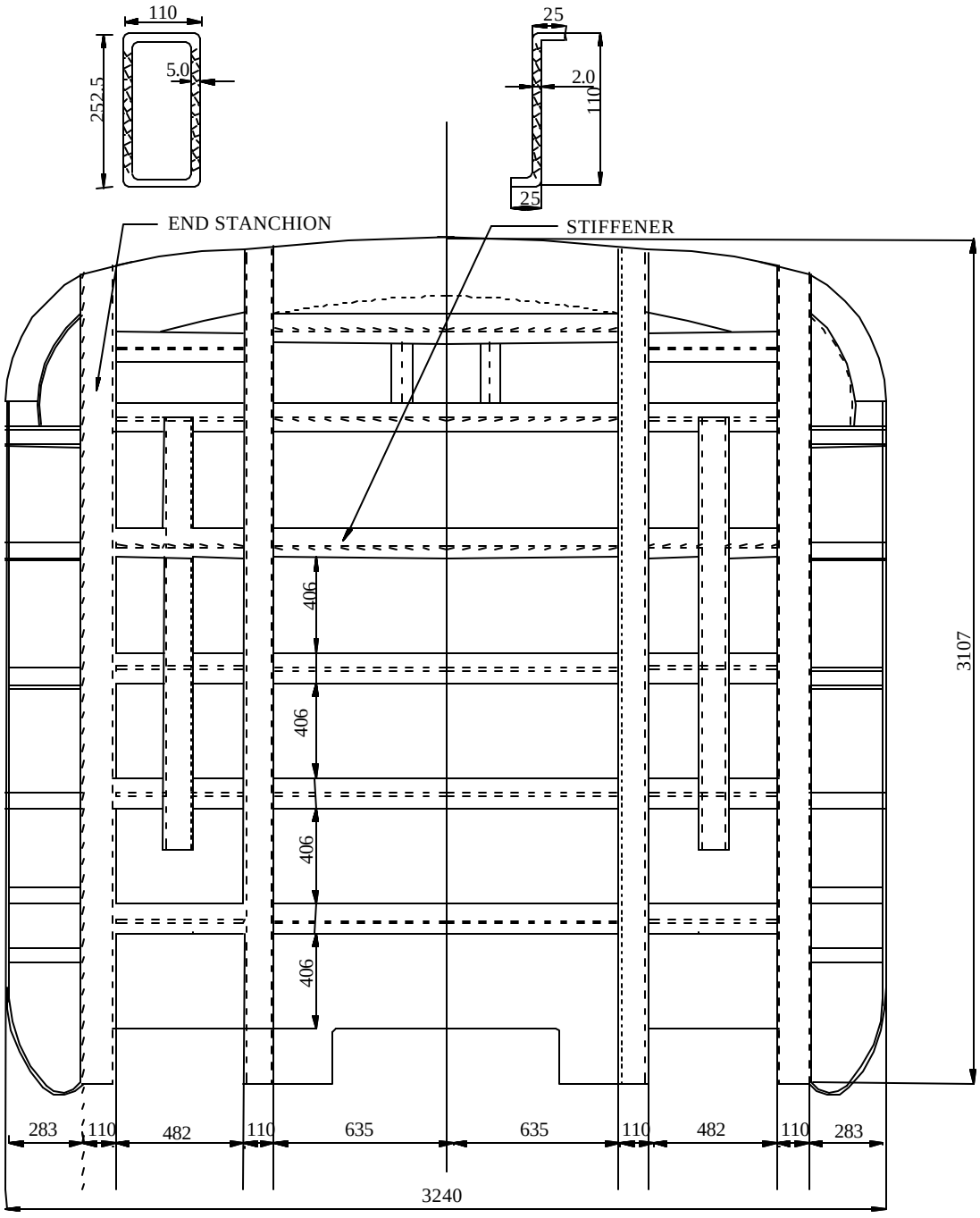
202 BODY REPAIRS

202a Inspection and repair of body members are done after the coach body is lifted off the bogies and placed on trestles.

202b All furnishing and other components from coach shell, which are stripped, are to be sent to the respective sections for maintenance. See **figure 1.1** (In chapter 'Coach') for normal repair chart for sequential POH repairs and fitment of overhauled equipment

202c **Inspection of Underframe**

i) The underframe members should be thoroughly inspected for locating cracked/bent/corroded members. Corrosion is indicated by flaking of paint, flaking of metal, pitting and scale formation. Components like sole bar and trough floor which are not visible from both sides should be examined by tapping with a spiked hammer. Proper illumination will be required to carryout the check. A component will require repair/ replacement, if it has lost more than **20% of it's thickness**.



END CONSTRUCTION OF BROAD GAUGE
ALL METAL LIGHT WEIGHT COACH ICF
Figure 2.3

ii) Particular attention should be paid to the more vulnerable members and locations listed below:-

- Sole bar, body pillars, turn under and tubular frame/ trough floor below lavatories in all types of coaches and the luggage compartments of all SLRs and parcel vans.
- Sole bars, body pillars, turn unders and pillars above lifting pads
- Sole bars and pillars behind the sliding door pockets of SLRs and parcel vans.
- Sole bars, pillars and turn unders at the door corners.
- Head stock.
- Sole bars, pillars and turn under near coach body bolster.

202d Procedure for inspection of underframe members for corrosion attention in case of vulnerable and not so-vulnerable locations should be followed as given in RDSO technical pamphlet No. 7602 (Rev.1)

i) Sole bar, body pillar and turn under at lavatory area

- Examine visually supplemented by tapping with a spiked hammer sole bars, body pillars and turn under in the bays under and adjoining lavatories from below the coach and through the elongated holes in the turn under after removing the accumulated dirt and cleaning the surface through the holes. If corrosion is suspected at places in the coaches without elongated holes in the turn under, a **100 mm diameter** hole should be cut in the bottom of the turn under without damaging the pillars for examining the inside.

- If incidence of corrosion is noticed in the bottom half of the sole bar, the trough floor should be cut to a width of **300 mm** and requisite length for examination of inside top half.
- If heavy corrosion is noticed, the side wall should be cut to a height of **500 mm** from the bottom of turn under covering sufficient length and all the exposed parts, after scraping and cleaning, should be examined to determine the extent of corrosion.

ii) Sole bar, turn under and pillars above the lifting pads

- Examine the above members in the same manner as described para 202d (i)

- If signs of corrosion are noticed, the side wall sheet above the lifting pads should be cut to a height of **500 mm** above the turn under and to a length of half metre, on either side of lifting pads. Scrape the structural members, clean and examine minutely to ascertain the extent of corrosion.

iii) Sole bar and pillars at door corners

- Examine the above locations visually. If corrosion is noticed, cut the turn under to a width of half metre from the door corner. Remove accumulated dust. Structural members should be thoroughly scraped, cleaned and examined to assess the extent of corrosion.

iv) Sole bar, turn under and body pillars at locations other than those described above

- Examine visible portion of sole bar through the elongated holes of turn under and from bottom of the underframe.

- Remove the accumulated dust in the turn under through elongated holes and scrape structural members to the extent possible. If corrosion is noticed, side wall sheet in the area of corrosion should be cut to a height of **450 mm**. from the bottom of turn under covering sufficient length for thorough examination.

v) Head stock

- Examine visually inner head stock, outer head stock, stiffening immediately behind the buffers and the junction of the sole bar at the head stock for incidence of corrosion.
- Examine carefully the base of buffer assembly as corrosion has been primarily noticed at this location.
- Examine carefully the buffer base of head stock by chalk test or sound test for cracks and dents. Buffer fixing holes should not be elongated and no minor cracks to be allowed. Replace head stock if the wear is more than **4 mm** i.e. when the thickness is below 4 mm.

vi) Trough floor

- Examine the trough floor in the bays adjoining the lavatories and under the luggage compartments of SLRs and parcel vans from below for signs of corrosion, supplemented by tapping with a spiked hammer.
- If signs of corrosion are noticed in the above examination, the part should be thoroughly cleaned by scraping and an intensive inspection should be carried out to detect the extent of corrosion in the trough floor.
- Magnesium oxychloride or plywood/compreg with PVC overlay flooring in the lavatories and bays adjacent to lavatories of all coaches over six years old should be broken and trough floor thoroughly examined for incidence of corrosion.

vii) Tubular frame below lavatories

- Examine visually the tubes and joints for incidence of corrosion.
- Corroded tubes shall be replaced. If corrosion is extreme, entire tubular frame should be replaced.

202e Corrosion repairs to Underframe Members

i) Corrosion repairs should be carried out as per instructions laid down in RDSO Technical Pamphlet nos. G-7602 (rev.1) for ICF coaches.

It is essential to use corrosion resistant steel sheets for corrosion repairs of coaches. Welding electrodes and paints should be of the prescribed quality conforming to the relevant IS/ IRS specifications.

- Corrosion resistant steel sheet for trough floor, pillars, side-wall and roof to IRS M.41 - 97.
- Electrode: IRS Class B2 of approved brands.
- Paints: Red oxide zinc chromate primer - IS 2074-62. Bituminous anti-corrosive solution to IRS P30-96, solution type, brushing quality.

ii) Where the corrosion noticed is of a very minor nature and has just started, there is no need to renew the parts. In those areas, the paint and the rust should be thoroughly cleaned to reach the bare metal and the surface treated with two coats of red oxide zinc chromate primer. In addition, underframe members should be given two coats of bituminous solution.

Where the corrosion repairs are carried out on the underframe or its paint coat is damaged, the underframe should be painted with two coats of red oxide zinc chromate primer followed by the four coat system of anti-corrosive bituminous paint.

For carrying out corrosion repairs to underframe members, the coach body should be lifted off the bogies and kept on trestles. For repairs to side wall and end wall, no lifting is required.

iii) The parts of a coach requiring corrosion repairs most commonly are:

1. Head stock (refer figure 2.4)

For replacement of head stock, the following parts need be stripped first:

- Side buffers.
- Plywood/compreg and PVC flooring.
- end partition and electrical wiring
- draw gear assembly.
- end portion of BP/FP in case of air brake coaches.

Before the corroded portion is cut off, the auxiliary head stock and the two sole bar ends should be firmly supported to rail lines. The corroded head-stock is then replaced as per annexure-v of RDSO Technical pamphlet no. C-7602 (Rev.1). Only 8 mm thick corrosion resistant steel sheets should be used for head stock repairs.

2. Sole bar

For carrying out repairs to sole bar, it is necessary to strip first the interior fittings, laminatepaneling and window frames. Before cutting off the corroded portion of sole bar, both the adjacent ends should be supported to the rail lines. The new sole bar piece should be welded from outside and inside. To facilitate welding from inside, the coach body should be lifted and kept on trestles.

2.1 Stiffening of sole bar at doorways

As incidence of corrosion in sole bar is predominant in the lavatory areas and adjoining doorways, the sole bar was strengthened in all coaches manufactured since 1974 by providing a box section as shown in RDSO sketch nos. 76011 & 76012. The doorways of luggage compartments in SLRs were strengthened as shown in RDSO sketch no. 76013. These modifications should be carried out in all coaches during POH, if not already done. On coaches which have not been manufactured or so far modified in accordance with above, this can be done as shown in RDSO's sketch nos. 78102, 78103 & 78096.

2.2 Corrosion repair of sole bar

Repairs to sole bar for replacement of corroded portions at the locations mentioned below should be carried out as per the respective RDSO sketches indicated:

- At locations other than lifting pads and body bolster - RDSO sketch no. 76018.
- At body bolster and lifting pad locations - RDSO sketch no.76019.

3. Side wall members

For repairs to side and end wall sheets, the interior fittings, laminate paneling and window frames should be stripped first. Corrosion repair of side/ end wall sheets, body pillars and turn unders should be done as per RDSO sketch no. 76020.

4. Trough floor

For replacement of trough floor, first decolite/ plywood flooring needs to be stripped. Corrosion repairs to trough floor at the locations mentioned below should be done as per the respective RDSO sketches indicated:

- At end lavatories of two-doors and three-doors aside coaches - RDSO sketch no. 76021.
- At end lavatories of four-doors aside coaches - RDSO sketch no. 76022.
- At middle lavatories of four-doors aside coaches - RDSO sketch no. 76023.

203 ROOF

203a Roof repairs

i) In ICF coaches, roof should be checked for corrosion. Special attention should be paid at location where gutter mouldings are welded and ventilators bolted. Corroded roof should be repaired according to the instructions given in annexure VII of RDSO Technical pamphlet no. C-7602 (Rev.1) for corrosion repairs of ICF coaches.

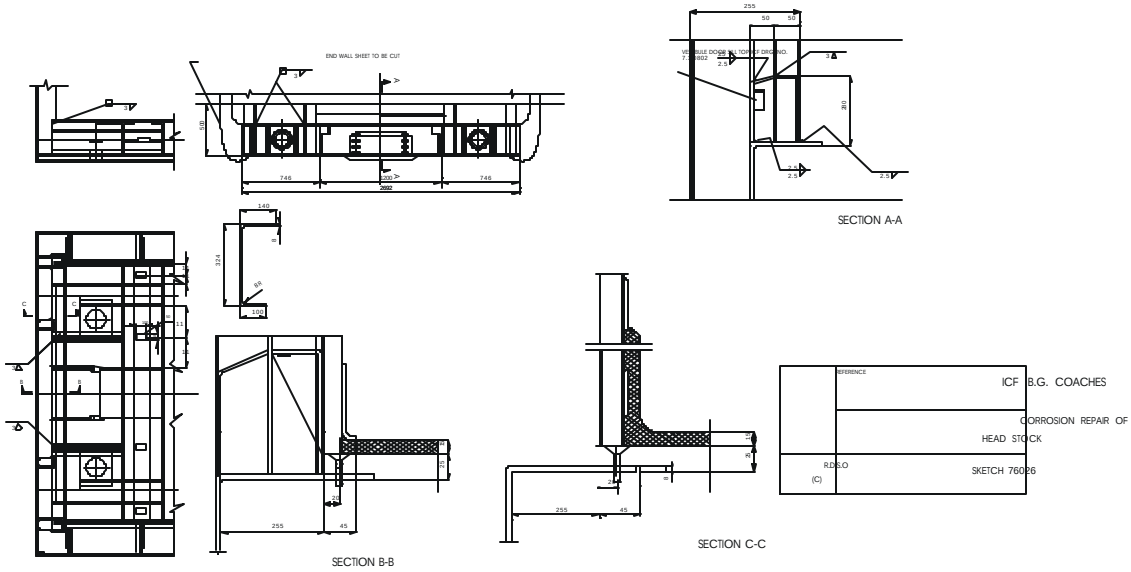

END WALL SHEET TO BE CUT
SECTION A-A
SECTION B-B
SECTION C-C
REFERENCE
ICF B.G. COACHES
CORROSION REPAIR OF
HEAD STOCK
R.DSO
(C)
SKETCH 76026

FIGURE 2.4

203b **TRA type Roof Ventilators repairs**

i) Examine the roof ventilator for damage or corrosion or leakage. If no corrosion is observed then seal the joints and crevices with water proof sealing agent. Ventilators found beyond repairs should be replaced as per RDSO technical pamphlet No.C-7602 (rev.1) annexure-VII. The securing bolts should be replaced whenever a ventilator is removed. Otherwise, they should be checked for tightness. Loose and corroded bolts should be replaced.

ii) After repairs and refitting, ventilators should be tested for water leakage at their base joints at the time of roof testing.

203c **Roof testing**

All coaches after POH repairs should be tested under water spray for roof leakage before they are finally turned out from the workshop. For this purpose, a fixture designed to simulate monsoon conditions should be provided in the workshop.

204 **REPAIRS TO DOOR HANDLES**

Examine the door handle for breakage, damages. If the fixing bolts are loose or missing, tighten the bolts. Replace the door handles which are found beyond repairs.

205 **REPAIRS TO DOOR PIVOTS**

Examine the door pivots for corrosion, breakage or wear by cutting the bottom portion of outer panel. Cut the corroded portion of the door pillar (Z molding) and weld new piece joining the door pivot pin. If the female socket is worn or damaged beyond repairs then replace it. Replace the bush provided in the socket.

206 **REPAIRS TO PARTITION WALL, SEAT PILLAR / MOUNTING PLATE**

Examine seat pillar/mounting plate for corrosion or breakage, etc. at bottom ends. If found corroded, repair the same as per RDSO technical pamphlet no. C-7602 (Rev.1).

207 **REPAIRS TO DRAW AND BUFFING GEAR SUPPORT STRUCTURE**

Examine the draw gear support structure for corrosion, breakage, etc. If the corrosion is light, scrap off the rust to bare metal, clean well and re-paint. If the corrosion is heavy, replace the corroded angle or gusset plate with new support angle.

Similarly examine the buffing gear support structure for corrosion, breakage, etc. If the corrosion is light, scrap off the rust to bare metal, clean well and re-paint. If the corrosion is heavy, replace the corroded angle or stiffeners.

208 **REPAIRS TO BODY BOLSTER**

Examine the body bolster for corrosion, breakage, wear, etc. If the corrosion is light, scrap off the rust to bare metal, clean well and re-paint. If the corrosion, breakage or wear are beyond repair, replace the body bolster. Check the area surrounding centre pivot pin mounting holes for cracks.

209 **REPAIRS TO CENTRE PIVOTS**

Clean and examine the centre pivot for bent, wear, cracks. Cracks shall be detected by doing chalk testing or magnaflux dye penetrant test. If the centre pivot is found cracked or worn beyond repair, it should be replace. Check the mounting bolts for loose or missing. Tighten and lock the bolts with locking plate.

210 **WATER TANK SUPPORT STRUCTURE**

Examine the water tank support structure for corrosion, breakage, wear, etc. If the corrosion is light, scrap off the rust to bare metal, clean well and re-paint. If the corrosion, breakage are beyond repair, replace the corroded angle with new angle of suitable size as per the requirement. Replace the rubber/wooden packing if perished or damaged.

211 **REPAIRS TO FLOOR CHANNEL**

Examine the floor channel for corrosion, breakage, wear, etc. by cutting opening the PVC and plywood flooring where the corrosion suspected. If the corrosion is light, scrap off the rust to bare metal, clean well and re-paint. If the corrosion,

breakage are beyond repair, replace the corroded channels with new channel of suitable size as per the requirement.

212 **GENERAL**

- All repairs of cracks should be carried out by gouging and welding by suitable electrodes.
- ***CAUTION :*** No electric welding on the coach should be carried out without proper earthing from near the portion being welded on such that the return current has a distinct path (earth) which should not be allowed through the bogies and rails. In the absence of such earthing, the return current passes through axle roller bearings causing pitting of rollers and bearing failure in service.
- Distorted and bent parts should be heated and straightened.
- The parts used for repairs should be given proper surface treatment and applied with protective paint. Relatively thick sections such as sole bars, cross bearers, etc. should preferably be grit blasted and immediately thereafter given a protective coat of red oxide zinc chromate primer paint.
- *Welders' Qualification:* Welders deputed to carry out welding work on coaches and coach components should be only those tested and certified as adequately skilled for welding work on coaches and coach components.

213 **LIST OF TOOLS AND PLANT**

Lifting shop	**Corrosion Repair Shop**
1. EOT cranes 2. Trestles for coach body 3. Inspection torches 4. Spiked hammers 5. Ball peen hammers 6. Goggles for inspection staff 7. Measuring tape 8. Measuring scale	1. EOT cranes 2. Trestles for coach body 3. Gas cutting plants 4. Multi-operator welding plants 5. CO_2 Welding plant 6. Electrical angle grinders 7. Pneumatic hand grinders 8. Component painting equipment 9. Phosphating plant

214 **EXAMINATION AND REPAIR PRACTICE IN CARRIAGE MAINTENANCE DEPOT**

214a **Primary/ Secondary/ Schedule 'A' schedule**

Check visually the following for any damages/defects/deficiencies:

- Destination board brackets.
- Body panels.
- End walls
- Windows walls
- Body side doors
- Condition of head stock, sole bar and other underframe members.

214b **Schedule 'B'**

- In addition to para 214a do the following.
- Examine trough floor, turn under and other under frames from underneath for corrosion.

214c **Schedule 'C' and IOH**

- In addition to para 214b do the following**.**
- Thoroughly clean and remove dust, rust accumulated at pillars through turn under holes with coil brush and compressed air.
- Examine for corrosion of sole bar and other under frame members with torch light and inspection lamp.

*****

CHAPTER 3

BOGIES

301 GENERAL

The main constructional and design features of the ICF/RCF all-coil bogies, used on mainline BG coaches are briefly described in the following paragraphs. Leading Parameters of ICF bogie are as under:

Table 3.1

S. No.	Description	Parameters
1.	Maximum Axle load bearing capacity	16.25t, 13t
2.	Wheel base	2896mm
3.	Wheel diameter (New)	915mm
4.	Axle guidance	Telescopic axle guide with oil damping
5.	Primary suspension	Coil spring
6.	Secondary suspension	Coil spring
7.	Shock absorbers	i) Vertical dashpot in primary suspension. ii) Hydraulic double acting vertical shock absorber in secondary suspension.
8.	Transfer of coach body weight	Through bogie side bearer pitched at 1600mm.

302 ALL-COIL ICF BOGIE

302a The bogies being currently manufactured by ICF/RCF which have been accepted as standards of the Indian Railways and are of an all welded light weight construction. Axles are located on the bogie by telescopic dash pot and axle guide assemblies. Helical coil springs are used in both the primary and the secondary stages. The axle guide device provides viscous damping across primary springs while hydraulic dampers are provided across the secondary stage. Dampers are protected against misalignment by resilient fittings. Isolation of vibration is effected by rubber pads in primary and secondary suspension.

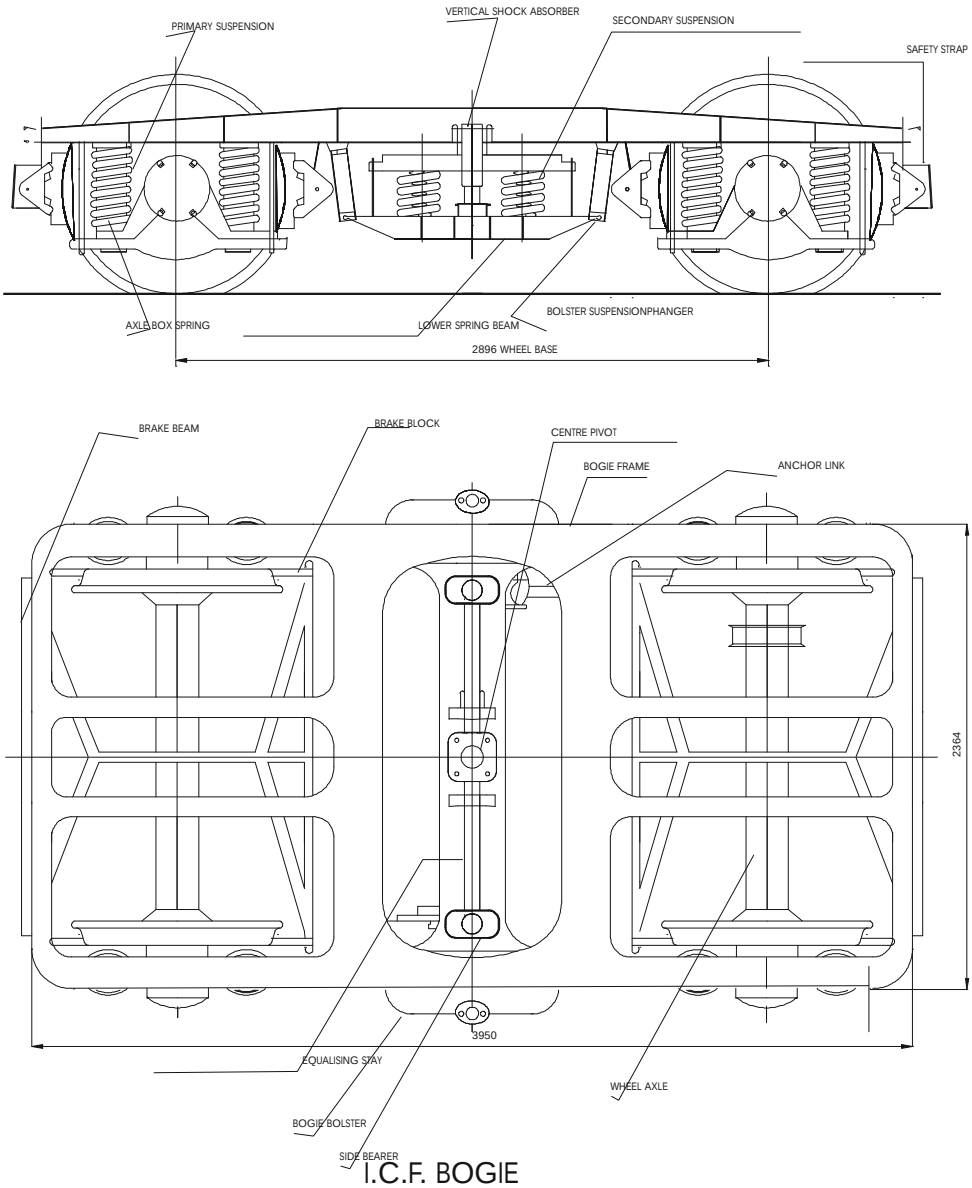
302b Deflection due to the tare weight is almost equally divided between axle and bolster springs. Weight of coach body is transferred to its bogie by side bearers pitched 1600 mm apart. Side-bearers consist of lubricated metal slides immersed in oil baths. No vertical weight transfer is effected through bogie pivot and the pivot acts merely as a centre of rotation and serves to transmit tractive/braking forces only.

303 BOGIE ASSEMBLY (see figure 3.1)

The bogie frame and components are of all-welded light construction with a wheel base of 2.896 metre. The wheel sets are provided with self-aligning spherical roller bearings mounted in cast steel axle box housings. Helical coil springs are used in both primary and secondary suspension. The weight of the coach is transferred through side bearers on the bogie bolsters. The ends of the bogie bolsters rest on the bolster helical springs placed over the lower spring beam suspended from the bogie frame by the inclined swing links at an angle 7^0. Hydraulic shock absorbers and dash pots are provided in the secondary and primary suspensions respectively to damp vertical oscillations.

304 AXLE BOX GUIDE WITH DASH POT ARRANGEMENT (see fig. 3.2a & 3.2b)

Axle box guides are of cylindrical type welded to the bottom flanges of the bogie side frame with close dimensional accuracy. These guides together with lower spring seats located over the axle box wings, house the axle box springs and also serve as shock absorbers. These guides are fitted with guide caps having nine holes of diameter 5 mm equidistant through which oil in the lower spring seat passes under



I.C.F. BOGIE

FIGURE 3.1

pressure during dynamic oscillation of coach and provide necessary damping to primary suspension to enhance better riding quality of coach. This type of rigid axle box guide arrangement eliminates any longitudinal or transverse relative movement between the axles and the bogie frame.

Figure 3.2a & 3.2b show modified and unmodified guide arrangement respectively. The quantity of oil required to achieve **40 mm** oil level above the guide cap in modified arrangement is approximately **1.6 liters** and in unmodified arrangement is approximately **1.4 liters**. As it is not possible in open line to distinguish between modified and unmodified arrangements, **40 mm** oil level is standardised for both.

305 AIR VENT SCREWS

On the bogie side frames, directly above the dash-pots, tapped holes are provided for replenishing oil in the dash pots. Special screws with copper asbestos washers are screwed on the tapped hole to make it air tight.

306 BOGIE BOLSTER SUSPENSION

The bolster rests on the bolster coil springs - two at each end, located on the lower spring beam which is suspended from the bogie side frame by means of bolster-spring-suspension (BSS) hangers on either side. The two anchor links diagonally positioned are provided with silent block bushes. The links prevent any relative movement between the bogie frame and coach body.

307 SPRINGS

In ICF bogie, helical springs are used in both primary and secondary suspension. The springs are manufactured from peeled and centreless ground bar of chrome vanadium/chrome molybdenum steel conforming to STR No. WD-01-HLS-94 (Rev.1)

308 CENTRE PIVOT ARRANGEMENT

The centre pivot pin joins the body with the bogie and transmits the tractive and braking forces on the bogies. It does not transmit any vertical load. It is equipped with rubber silent block bushes which tend to centralise the bogies with respect to the body and, to some extent, control and damp the angular oscillations of the bogies. **(see figure 3.3)**

309 SIDE BEARERS

The side bearer arrangement consists of a machined steel wearing plate immersed in an oil bath and a floating bronze-wearing piece with a spherical top surface kept in it, on both sides of the bogie bolster. The coach body rests on the top spherical surface of these bronze-wearing pieces through the corresponding attachments on the bottom of the body-bolster. The whole arrangement is provided with a cover to prevent entry of dust in the oil sump. **(see figure 3.4)**

Table 3.2

Wear limit for wearing plate

New size	Shop renewal size	Condemning size
10 mm	9 mm	8.5 mm

Wear limit for wearing piece

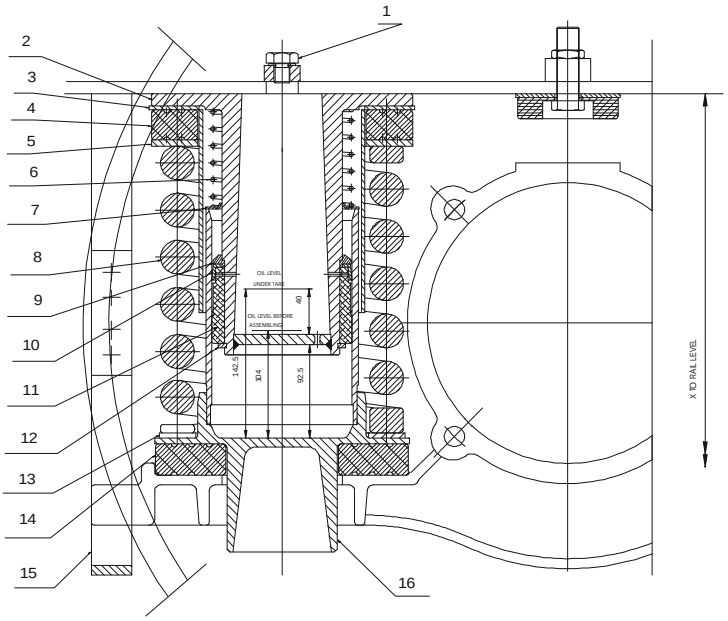
New size	Shop renewal size	Condemning size
45 mm	43.5 mm	42 mm

310 ANCHOR LINKS

The floating bogie bolster which supports the coach body is held in position longitudinally by the anchor links which are pinned to the bolster sides and the bogie Transoms. One anchor link is provided on each side of the bolster diagonally across. The links can swivel universally to permit the bolster to rise and fall and sway side wards. They are designed to take the tractive and braking forces. The anchor links are fitted with silent block bushes **(see figure 3.5)**

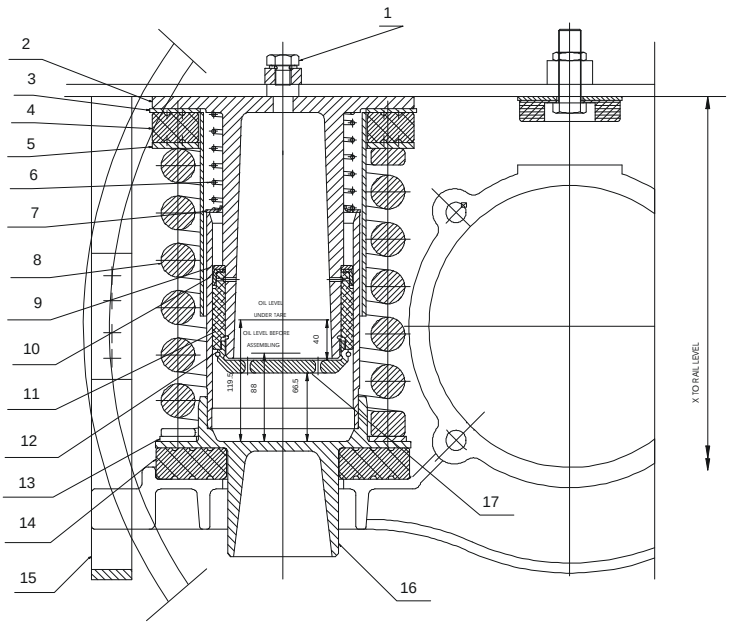
311 SILENT BLOCK

This is a synthetic rubber bush fitted in anchor link and center pivot of ICF bogies to transmit force without shock and reduce noise.



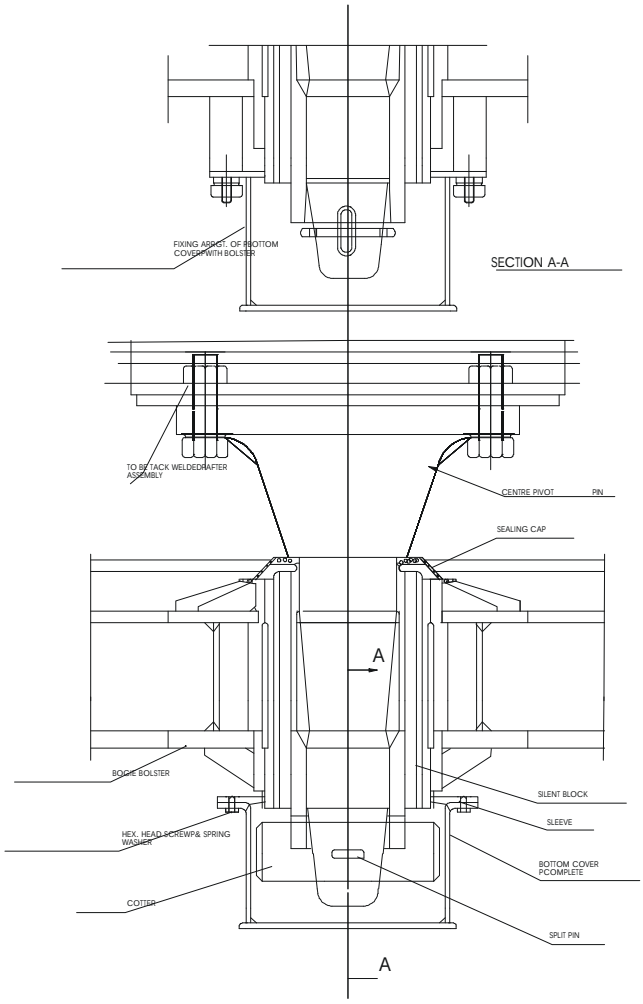
MODIFIED AXLE BOX GUIDE ARRANGEMENT

Figure 3.2a



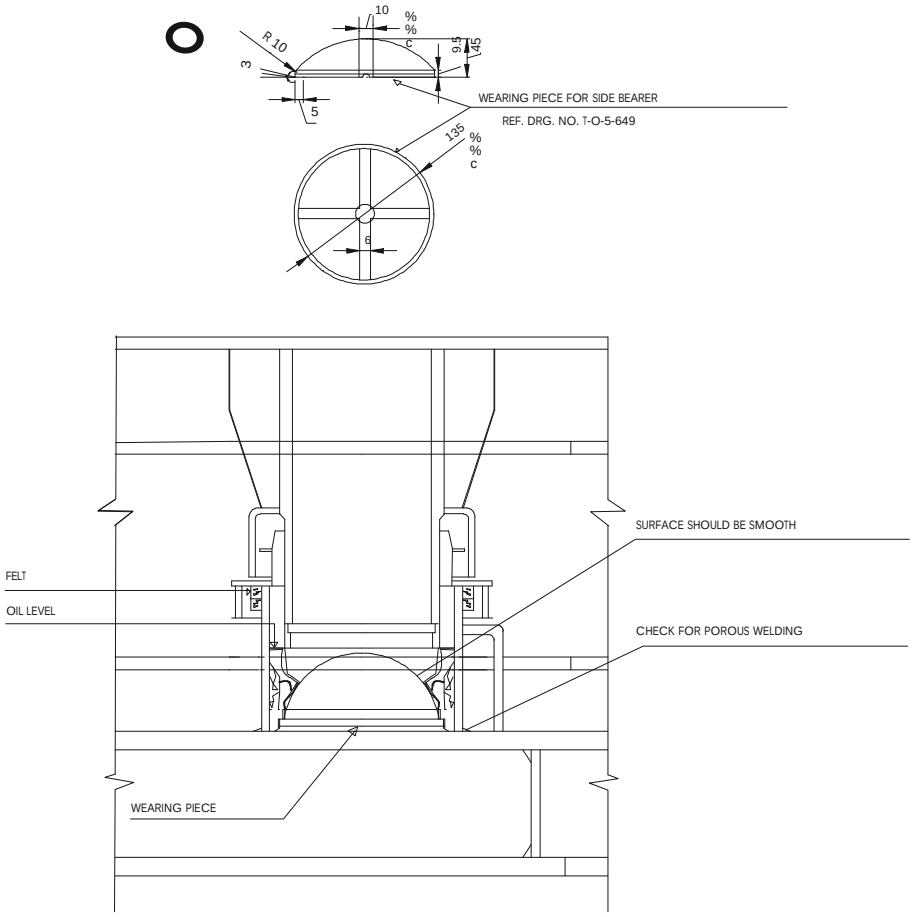
AXLE BOX GUIDE ARRANGEMENT

Figure 3.2b



CENTRE PIVOT ARRANGEMENT

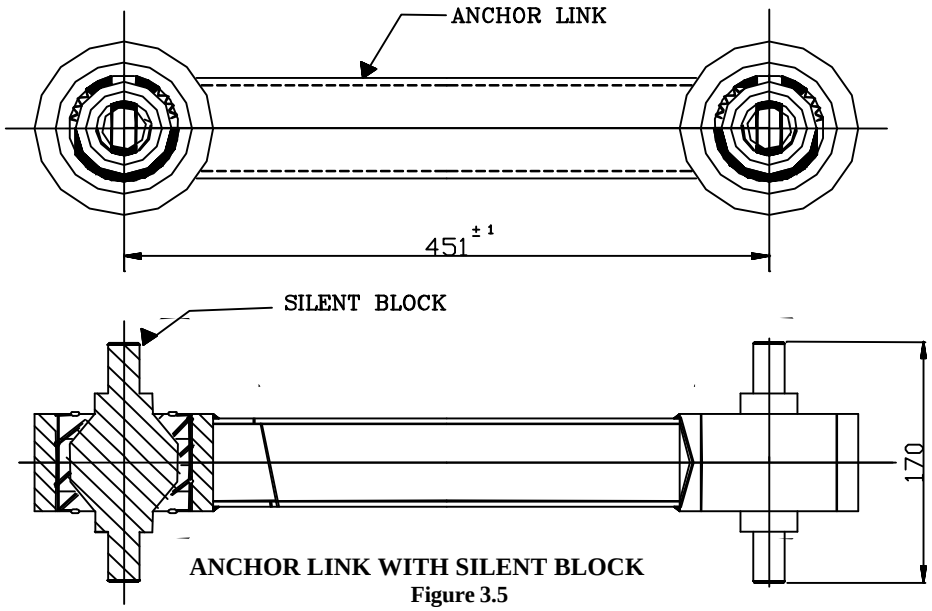
FIGURE 3.3



Note:-P1. Bronze Wearing Piece should be renewed when the wear on the mating surface reaches 3mm that is, height is less than 42 mm or damages occur to the oil grooves.P2. The hard ground plate should be renewed when the wear exceeds 1.5mm that is, thickness is less than 8.5 mm or ridges are observed on the plate.

SIDE BEARER ARRANGEMENT

FIGURE 3.4



ANCHOR LINK WITH SILENT BLOCK
Figure 3.5

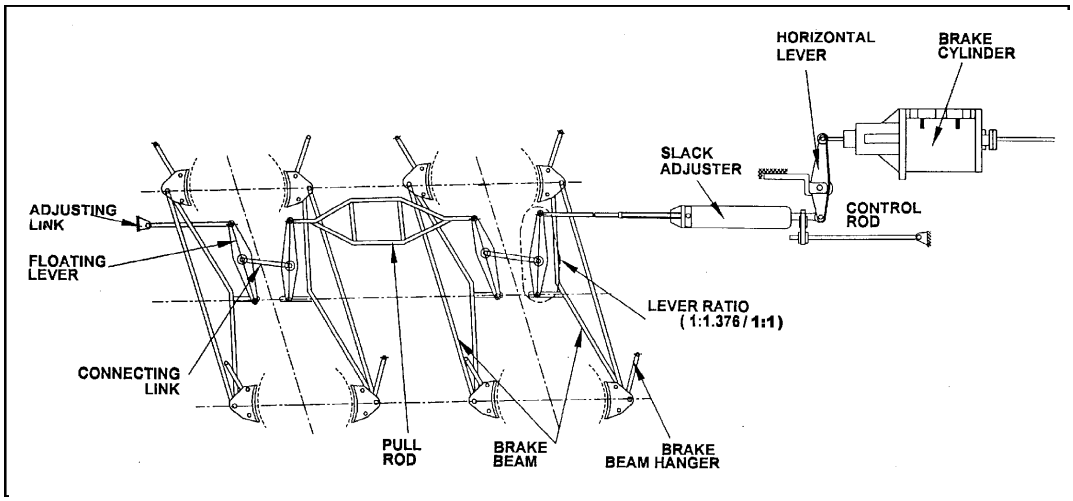
312 BRAKE RIGGING

Brake rigging is provided to control the speed of the coach by transferring the braking force from the brake cylinder to the wheel tread. Brake rigging can be divided into two groups i.e. Bogie mounted brake rigging and coach under frame mounted brake rigging.

312a Coach Under Frame Mounted Brake Rigging

The brake rigging is as per **figure 3.6**. In 16.25 t axle load bogie the four lever used in bogie brake rigging are each with lever ratio of **1:1.376** and hence the total Mechanical advantage in a bogie is **5.504** .

The components details of 16 t bogie are given in table 3.3 (Refer ICF drawing No. $WTAC_3$-3-2-305).



COACH UNDERFRAME BRAKE RIGGING
Figure 3.6

Table 3.3

Sr.No.	Description	Ref. Drg. NO (ICF)	Quantity
1	Brake Head & block complete (L.H. Assembly)	T-3-1-919	8
2	Brake Head & block complete (R.H. Assembly)	T-3-1-619	8
3	Short lever	WLRRM 3-2-002	12
4	Long lever	WLRRM-3-2-002	8
5	Brake Block Hanger	T-3-2-645	16
6	Adjusting link	WT AC3-3-2-302	2
7	Lever Hanger	HIG AC 3-3-2-302	16
8	Pull rod	WLRRM3-2-002	4
9	Pull rod	T-3-2-616	2
10	Pin	T3-2-048	50
11	Washer	ICF/STD 3-2-003	50
12	Split Cotter	T-3-2-632	50
13	Pin	T-3-2-648	8
14	Washer	ICF/STD 3-2-103	24
15	Split Cotter	T-3-2-632	8
16	Pin for lever Hanger	ICF/SK-3-2-179	16
17	Pin for safety wire rope	WT AC3/3-2-307	32
18	Plain washer M20	IS: 2016-67 T.2type A	32
19	Split cotter	EMU-3-2-048	32
20	Brake beam	T-3-2-804	8
21	Safety wire rope	T-3-2-651	16
22	Safety straps fixing Arrangement	WT AC-3-2-304	8

In 13 t axle load bogie the four lever used in bogie brake rigging are each with lever ratio of **1:1** and hence the total Mechanical advantage in a bogie is **4**.

The components details of 13 t bogie are given in table 3.4 (Refer ICF drawing No. T-3-2-601).

Table 3.4

Sr.No.	Description	Ref. Drg. NO (ICF)	Quantity
1	Brake Head & block complete	T-3-1-601	16
2	Brake Beam	T-3-1-602	8
3	Long lever	T-3-2-605	8
4	Short lever	T-3-2-604	8
5	Pull rod	T-3-2-607	4
6	Pull rod	T3-2-616	2
7	Adjusting Link	T-3-2-609	2
8	Lever Hanger	T-3-2-611	16
9	Safety Strap	T3-2-612	4
10	Safety Strap	T-3-2-621	4
11	Pin	T3-2-048	8
12	Pin	T3-2-048	50
13	Hex head screw ½" BSWx 38	BS :3083 –64	64
14	Spring Washer M-12	IS: 3063-72	64
15	Hex. Nut ½" BSW	BS:1083-65	64
16	Washer	DL-0-5-034	50
17	Washer	DL-0-5-034	24
18	Pin for lever Hanger	ICF/SK-3-2-179	16
19	Split cotter	T-3-2-632	50

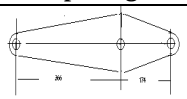
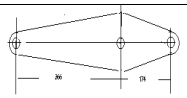
i) CONVENTIONAL AIR BRAKE COACH POWER CAR (refer figure 3.7)

TYPE OF COACH	BUILDER	TARE WEIGHT IN TONNES	% OF BRAKING
POWER CAR TO WLRRM6-9-0-601	ICF	53.7	118
HIGH CAPACITY POWER CAR	ICF	60	105.6

ii) CONVENTIONAL AIR BRAKE COACH SELF GENERATING AC COACHES (refer figure 3.8)

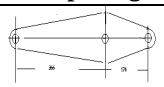
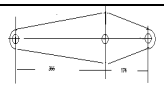
TYPE OF COACH	BUILDER	TARE WEIGHT IN TONNES	% OF BRAKING
WGACCW	ICF	50.0	114.8
	RCF	49.1	120.9
WGACCN	RCF	50.1	118.6
WGSCZAC	ICF	49.3	123.7
WGFAC	ICF	49.7	119.5
WGFSCZAC	ICF	50.0	118.8

Levers for Power car & self generating AC coaches

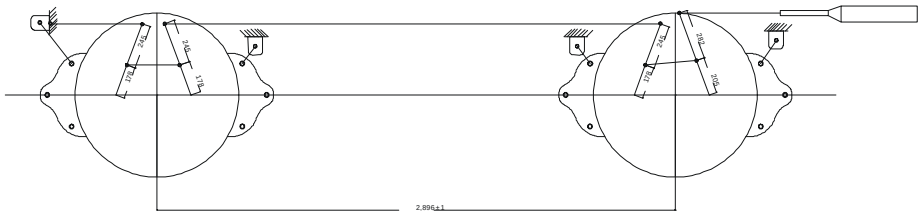
Sr. No.	Size	Shape/Drg.	Types of coaches fitted	Drawing no.
1.	282 x 205		POWER CAR TO WLRRM6-9-0-601, HIGH CAPACITY POWER CAR, WGACCW, WGACCN, WGSCZAC, WGFAC, WGFSCZAC	SK-93373 & SK-93371
2.	245 X 178		-DO-	-DO-

iii) CONVENTIONAL AIR BRAKE COACH NON AC COACHES (refer figure 3.9)

Levers

Sr. No.	Size	Shape/Drg.	Types of coaches fitted	Drawing no.
1.	230 X 230		GS,FC,SLEEPER, SLR, Second day coach, SCNLR, PANTRY CAR	SK-93372
2.	200 X 200		-DO-	-DO-

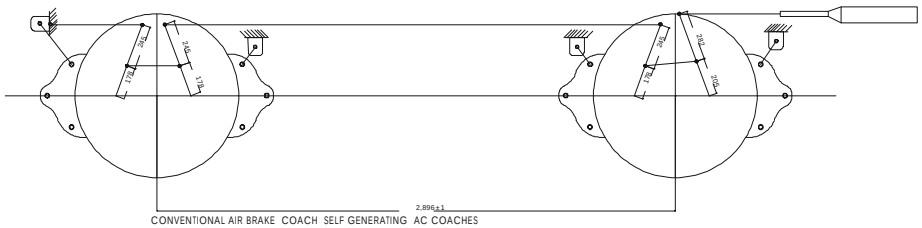
TYPE OF COACH	BUILDER	TARE WEIGHT IN TONNES	% OF BRAKING
GENERAL SECOND CLASS	ICF	36	120
	RCF	37.4	115.5
SECOND DAY COACH	ICF	37	116.7
	RCF	37.3	115.8
SLEEPER	ICF	39.5	109.3
	RCF	39.45	109.5
FIRST CLASS	ICF	41.8	103.3
SLR	ICF	40.6	106.4
	RCF	40.0	108.0
SCNLR	ICF	41.0	105.3
PANTRY CAR	ICF	41.3	104.6



CONVENTIONAL AIR BRAKE COACH (POWER CAR)

RDSO DRAWING NO. SK-93373

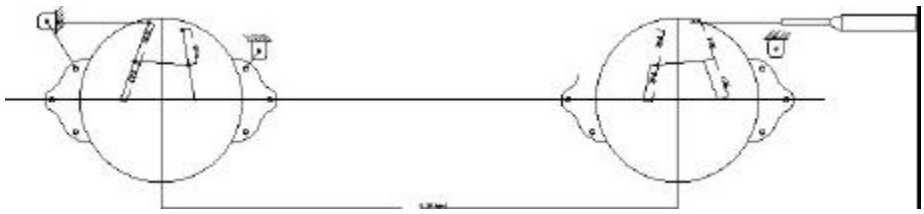
FIGURE 3.7



CONVENTIONAL AIR BRAKE COACH SELF GENERATING AC COACHES

RDSO DRAWING NO. SK-93371

FIGURE 3.8



312b Bogie Mounted Brake Rigging

Bogie brake rigging has been modified to incorporate a total mechanical advantage of **7.644** per bogie for non-ac coaches and **8.40** per bogie for ac coaches.

The components of bogie mounted air brake (16 t bogie) to ICF drawing no. $WTAC_4$-3-3-401 is given in table 3.5.

Table 3.5

Sr.No.	Description	Ref. Drg. No. (ICF)	Quantity
1	Brake Head & block complete (LH)	T-3-1-801	8
2	Brake Head & Block complete (RH)	T-3-1-801	8
3	Brake beam	T-3-2-650	8
4	Safety wire rope	T-3-2-651	16
5	Lever	WTAC4 -3-2-402	8
6	Lever	WTAC4 -3-2-402	8
7	Lever Hanger	WTAC4 -3-2-402	8
8	Pull rod	WTAC4 -3-2-402	8
9	Brake block Hanger	T3-2-645	16
10	Pin	T-3-2-648	44
11	Plain Washer	ICF/ISD 3-2-003	64
12	Split cotter	T-3-2-632	52
13	Pin	T3-2-648	4
14	Plain Washer	ICF/STD 3-2-003	4
15	Pin	T-3-2648	4
16	Pin for lever Hanger	T-3-2-801	16
17	Pin for Safety wire rope	WT AC3 –3-2-307	32
18	Pin Washer M 20	IS: W 16-67	32
19	Split cotter	EMU-3-2-048	32

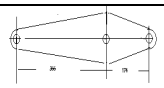
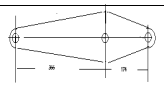
The components of bogie mounted air brake (13 t bogie) to ICF drawing no. T-3-2-801 is given in table 3.6

Table 3.6

Sr. No.	Description	Ref. Drg. NO ICF)	Quantity
1	Brake Head & block complete (L.H. Assembly)	T-3-1-801	4
2	Brake Head & block complete (R.H. Assembly)	T-3-1-801	4
3	Brake beam	T-3-1-804	4
4	lever	T-3-1-802	4
5	lever	T-3-1-802	4
6	lever Hanger	T-3-1-802	4
7	Pull rod	T-3-2-802	2
8	Brake block Hanger	T-3-1-645	8
9	Pin	T3-2-648	22
10	Plain Washer	ICF/STD-3-2-103	32
11	Split Cotter	T-3-2-632	26
12	Pin	T-3-2-648	2
13	Plain Washer	ICF/STD 3-2-103	2
14	Pin	T-3-2-648	2
15	Pin for lever Hanger	T-3-2-802	8
16	Pin for safety wire rope	WFT AC3/3-2-307	16
17	Plain washer M20	IS: 2016-67	16
18	Split cotter	EMU-3-2-048	16
19	Safety wire rope	T-3-2-651	8

i) AC COACHES WITH BOGIE MOUNTED AIR BRAKE CYLINDER (refer figure 3.10)

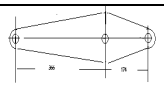
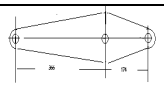
Levers

Sr. No.	Size	Shape/Drg.	Types of coaches fitted	Drawing no.
1.	366 x 174		WGSCZAC, WGSCWAC, WGFAC, WGFSCZ, WSCZAC, WSCWAC, WFAC, WCBAC	SK-98032
2.	311 X 148		-DO-	-DO-
3.	412		-DO-	-DO-

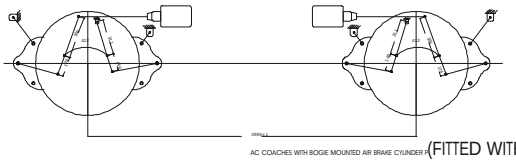
TYPE OF COACH	TARE WEIGHT IN TONNES	% OF BRAKING
WGSCZAC	50.95	40.56
WGSCWAC	52.10	39.66
WGFAC	49.90	41.41
WGFSCZ	50.00	41.33
WSCZAC	48.90	42.26
WSCWAC	49.40	41.83
WFAC	46.20	44.73
WCBAC	47.90	43.14

ii) NON - AC COACHES WITH BOGIE MOUNTED AIR BRAKE CYLINDER (refer figure 3.11)

Levers

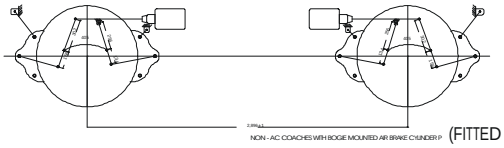
Sr. No.	Size	Shape/Drg.	Types of coaches fitted	Drawing no.
1.	302 X 158		GS,SCN,SDC,WCB, SLR, WFC	SK-98027
2.	256 X 134		-DO-	-DO-
3.	405		-DO-	-DO-

TYPE OF COACH	TARE WEIGHT IN TONNES	% OF BRAKING
GS	36.00	52.23
SCN	37.55	50.08
SDC	36.50	51.52
WCB	40.40	46.54
SLR	40.60	46.32
WFC	41.80	44.99



AC COACHES WITH BOGIE MOUNTED AIR BRAKE CYLINDER F(FITTED WITH K TYPE COMPOSITION BLOCK) RDSO DRAWING NO. SK-98032)

FIGURE 3.10



NON - AC COACHES WITH BOGIE MOUNTED AIR BRAKE CYLINDER P (FITTED WITH K TYPE COMPOSITION BLOCK) RDSO DRAWING NO. SK-98027

FIGURE 3.11

313 EQUALISING STAYS

This device has been provided on bogies between the lower spring plank and the bolster to prevent lateral thrust on the bolster springs which have not been designed to take the lateral forces. These links have pin connections at both ends and, therefore, can swivel freely. **(see figure 3.13)**

314 BOLSTER SPRING SUSPENSION HANGERS (BSS HANGERS)

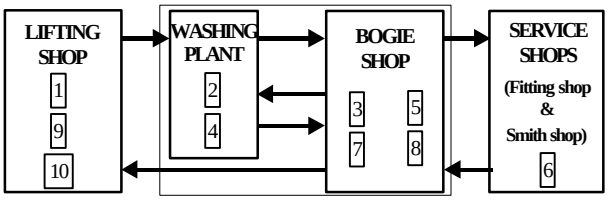
In the secondary suspension, the bolster is supported on helical coil springs which are placed on the lower spring plank. The lower spring plank is suspended from the bogie side frame through BSS hangers on hanger blocks. **(see figure 3.14)**

315 SHOCK ABSORBERS

Hydraulic shock absorbers with capacity of **± 600 kg** at a speed of 10 cm/sec. are fitted to work in parallel with the bolster springs to provide damping for vertical oscillations.

316 WORKSHOP MAINTENANCE-BOGIE SHOP

MAINTENANCE OF BOGIES
(Flow Diagram)



1. Coach lifting
2. Bogie cleaning
3. Bogie dismantling
4. Component cleaning
5. Attention to components
6. Repair of components
7. Bogie assembly
8. Load testing and adjustment
9. Lowering of coach
10. Final adjustment

Figure 3.12

After lifting the coach body (refer para 105 of chapter 'Coach'), roll out the bogies and send them to bogie washing plant in bogie shop.

316a **Washing Plant**

i) Remove all the oil from the side bearer oil bath.

ii) Wash the bogie with high pressure hot water jet to remove all dust, mud, scales, grease and other muck without damaging the base primer coating.

After washing and drying, roll the bogies to dismantling line.

316b **Dismantling**

i) Make sure that the vent screws are opened. Lift the bogie frame along with the bolster using overhead crane till all the eight axle guides disengage from the lower spring seats.

ii) Lower the bogie frame and bolster on to the shop floor.

iii) Remove and collect the axle box guide components and helical springs in respective bins/ pallets and send to washing plant for thorough cleaning.

iv) Wheel sets must be first cleaned thoroughly in the washing plant and then sent to wheel shop.

v) Remove vertical shock absorber and send to shock absorber maintenance section.

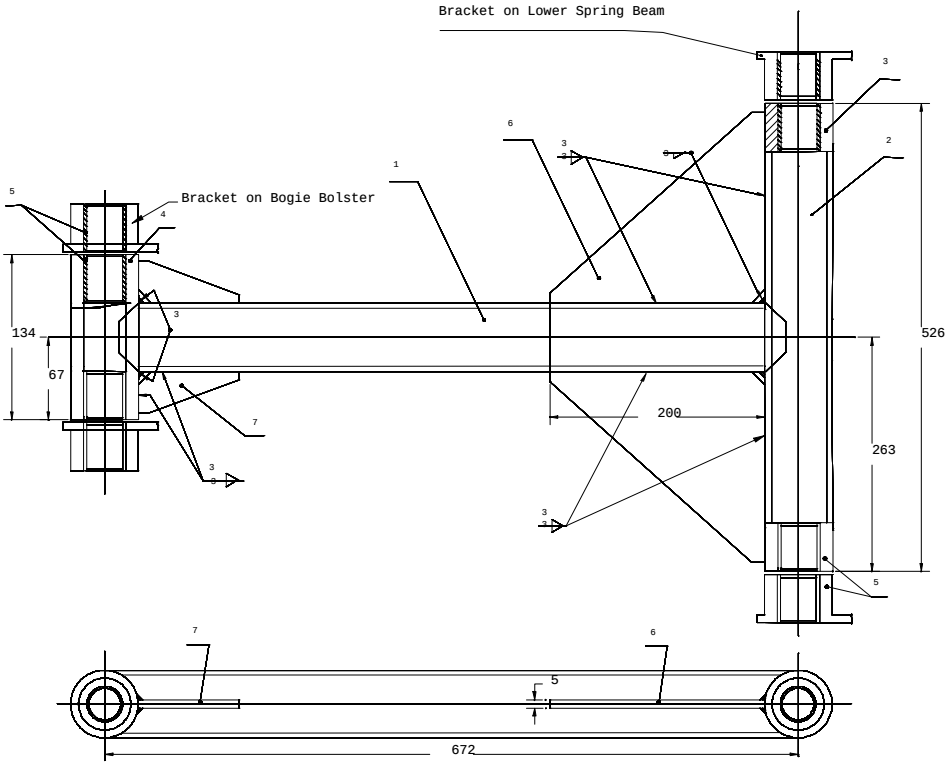
vi) Disconnect anchor links. Dismantle bolster suspension hangers by placing a dead weight on the bogie frame and by using a jack.

vii) Disconnect equalising stays. Lift the bolster off the bolster springs and remove the bolster springs.

viii) Collect anchor links, equalising stays, bolster spring suspension (BSS) hanger pins, BSS hanger blocks (stones), BSS hangers, pins of equalising stays, brake rigging components and bolster springs into respective bins/ pallets and send to washing plant for thorough cleaning.

ix) Send the bogie frame, bolsters, and lower spring planks to washing plant for thorough cleaning and drying.

Transport the cleaned and dried bogie frame, bolster and spring planks to inspection and repair stands. Place the bogie frame on repair stands in the inverted position.



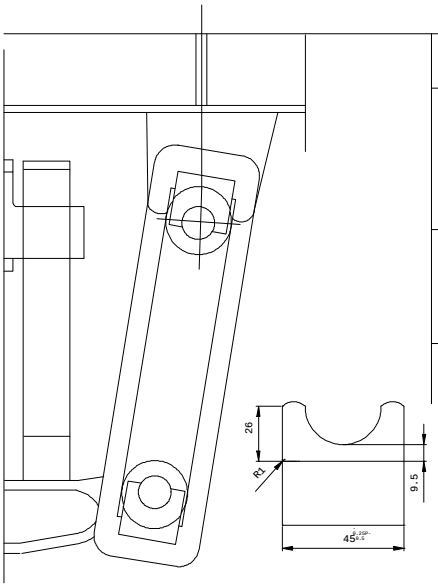
EQUALISING STAY FOR LOWER SPRING BEAM

(16.25 t Axle Load Bogie) (RDSO Sketch 88105)

ITEM	Description & dimensions	No. off per assembly
7	RIB 120X30X5	2
6	RIB 200x225x5	2
5	BUSH%%c 42/32 x32L	8
4	BODY %%c 60x134	1
3	BOSS %%c 60/40 x32L	2
2	TUBE %%c 50 BOREx462	1
1	TUBE %%c 50 BOREx640	1

FIGURE 3.13

)



COMPONENTS	SIZE-NEW	CONDEMNING	WEAR IN mm	SHOP ISSUE SIZE
HANGER BLOCKPTOP & BOTTOM	9.5	8	1.5	8.50
PIN	37	35.5	1.5	36.00
HANGER	38.4	36.5	1.5	37.00

HANGER AND HANGER BLOCKS

FIGURE 3.14

316c **Attention to Bogie Frame**

i) Check the bogie thoroughly for any possible cracks. Check the BSS brackets, axle guides, area surrounding the BSS bracket and axle guide and all the welding joints of bogie frame. If cracks are detected, hold the bogie frame in bogie manipulator. After proper gouging, weld the cracks and finish by grinding.

ii) If the BSS brackets or axle guides are worn (limits: **1 mm** for axle guide and **0.5 mm** for BSS bracket bush), damaged or cracked, they should be replaced.

iii) Bent or damaged suspension straps should be attended to as required.

iv) Safety wire rope arrangement and safety straps should be used for brake beams as per revised RDSO instructions.

Table 3.7

Suggested BSS bracket and axle guide alignment gauges	**13t bogies**	**16.25t bogies**
Longitudinal gauge for BSS brackets	**1400±1.0 mm (700±0.5 mm** from longitudinal center-line)	**1500±1.0 mm (750±0.5 mm** from longitudinal center-line)
Transverse gauge for BSS brackets	**2159 ±1.0 mm**	**2159 ± 1.0 mm**
Diagonal gauge for BSS brackets	**2573 ±1.0 mm**	**2629 ± 1.0 mm**
Longitudinal gauge for axle guide	**570±1.0 mm** (equidistant from center-line of axle)	**570 ± 1.0 mm** (equidistant from center-line of axle)
Transverse gauge for axle guide	**2159±1.0 mm**	**2159±1.0 mm**
Diagonal gauge for axle guide	**3612±1.0 mm**	**3612±1.0 mm**
Distance between BSS bracket and adjacent axle guide	**463±1.0 mm**	**413±1.0 mm**
Longitudinal gauge for suspension strap	**870±1.0 mm** (equidistant from center-line of axle)	**870±1.0mm** (equidistant from center-line of the axle)

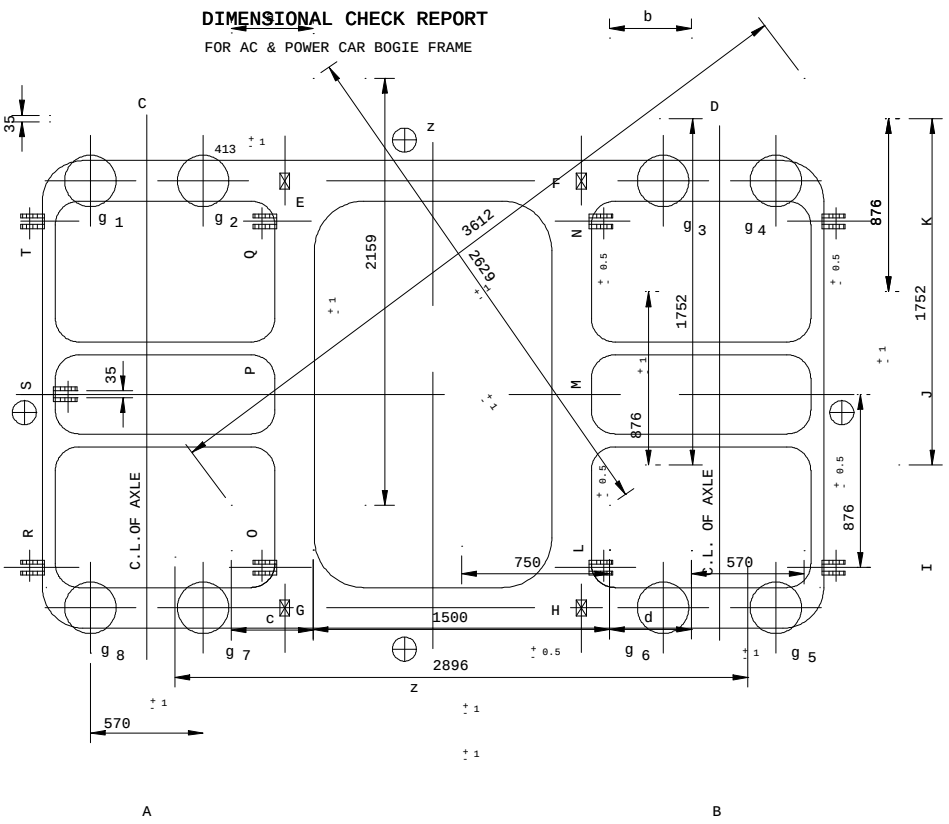
v) Check the squareness and alignment of BSS brackets and axle guides with the help of transverse, longitudinal, diagonal gauges and straight edge. Axle guide alignment should be checked with reference to the BSS brackets and recorded in RDSO dimensional check report . A coordinate measuring machine, preferably CNC type, can do these checks accurately.

vi) If the BSS brackets do not lie within the tolerances, relocate one or more BSS brackets with correct alignment. After ensuring correct alignment of the BSS brackets, measure the location of the axle guide from the BSS brackets and record in RDSO dimensional check report. If the measurements deviate from the standard measurements, relocate mis- aligned pair of axle guides.

vii) The relevant axle guides should be cut using special gouging nozzles (PO 18 or 19) to prevent undercutting of bogie frame. Axle guides found bent/cracked should also be cut out and replaced.

viii) Weld the new axle guides with the help of axle guide welding fixture, if the axle guides are damaged or worn. Check the alignment of new axle guides with respect to other axle guides using master gauges and straight edge. Any slight discrepancy in location can be rectified by suitable local heating of the frame. After complete rectification, record important dimensions in RDSO dimensional check report. **(See fig. 3.15 a&b, fig. 3.16 a&b)**

ix) Replace the BSS bracket bushes and pins if they were damaged or worn.



1. BOGIE SIDE FRAME & HEAD STOCK CENTRES ON EITHER SIDE OF THE BOGIE FRAME AS SHOWN THUS WILL BE PERMANENTLY PUNCH MARKED IN CONSPICUOUS MANNER.TO ENSURE THIS 2mmTHICK X 25mmWIDE STRIP SHOULD BE WELDED AT THE LONGITUDINAL AND TRANSVERSE CENTRES OF THE BOGIE FRAME.PUNCH MARK SHOULD BE PUNCHED ON THIS STRIP ACCORDINGLY.
2. g TO g REPRESENT LOCATIONS OF BOGIE GUIDES.
3. E,F,G & H REPRESENT LOCATIONS OF SUSPENSION BRACKETS FOR BOLSTER SUSPENSION ARRGT.
4. BOLSTER SUSPENSION BRACKET PIN HOLES E,F,G,H SHALL BE LOCATED AT 750 0.5mm FROM THE TRANSVERSE CENTRE LINE PUNCH MARKS ON BOGIE SIDE FRAME & CHECK IT AS PER FIG.-3.15b.
5. WELDING JOINT SHALL NOT COME UNDER THE BOGIE GUIDE.
6. NO INACCURACY IN LOCATION OF HANGER BRACKET AND THE ALIGNMENT OF HOLES IN THE BRACKETS WILL BE PERMITTED.

FIGURE-3.15a

ICF DRG. WTAC - 0-3-301

SHEET 1 OF 2

DIMENSIONAL CHECK REPORT FOR BOGIE FRAME (AC TYPE)

No. …….

ICF DRG. NO. WTAC3 0-3-301

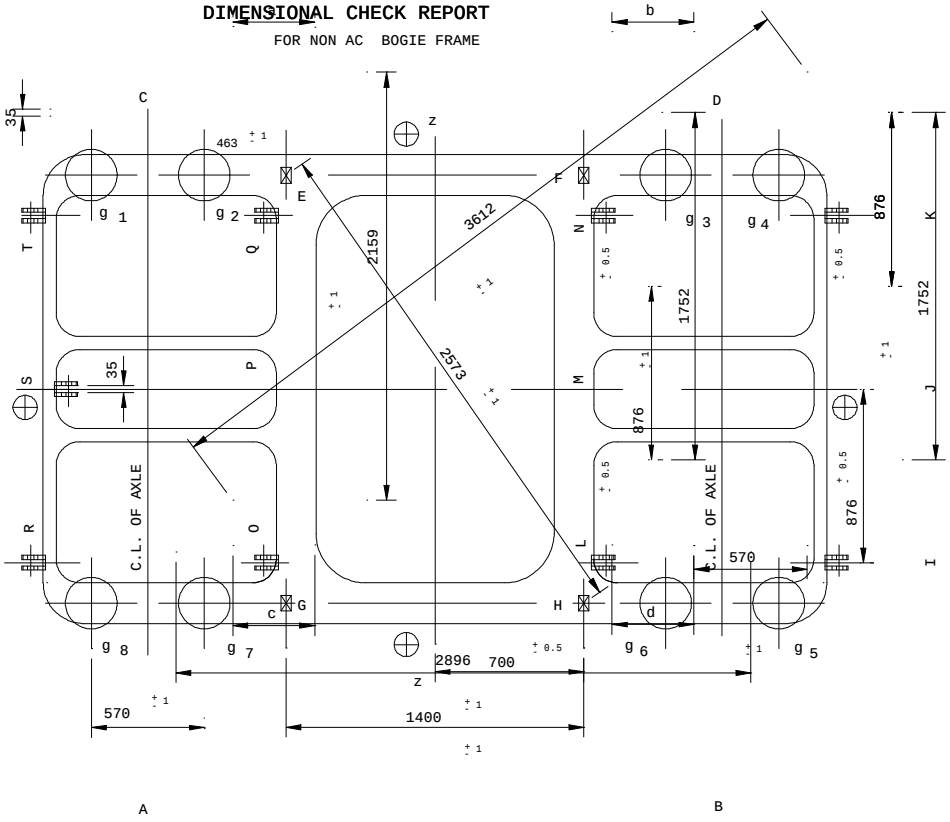
Measuring Point	Nominal Size (mm)	Actual Size (mm)	Variation (mm)	Measuring Point	Nominal Size (mm)	Actual Size (mm)	Variation (mm)
E - F	1500 ± 1.0			I - J	876 ± 0.5		
G - H	1500 ± 1.0			J - K	876 ± 0.5		
E - G	2159 ± 1.0			L - M	876 ± 0.5		
F - H	2159 ± 1.0			M - N	876 ± 0.5		
E - H	2629 ± 1.0			O - P	876 ± 0.5		
F - G	2629 ± 1.0			P- Q	876 ± 0.5		
a	413 ± 1.0			R - S	876 ± 0.5		
b	413 ± 1.0			S - T	876 ± 0.5		
c	413 ± 1.0			I - K	1752 ± 1.0		
d	413 ± 1.0			L - N	1752 ± 1.0		
g1 - g2	570 ± 1.0			O - Q	1752 ± 1.0		
g3 - g4	570 ± 1.0			R - T	1752 ± 1.0		
g5 - g6	570 ± 1.0			g1 - g6	3612 ± 1.0		
g7 - g8	570 ± 1.0			g2 - g5	3612 ± 1.0		
z - F	750 ± 0.5			g3 - g8	3612 ± 1.0		
z - H	750 ± 0.5			g4 - g7	3612 ± 1.0		

SHEET 2 OF 2

Figure - 3.15b

DIMENSIONAL CHECK REPORT

FOR NON AC BOGIE FRAME



1. BOGIE SIDE FRAME & HEAD STOCK CENTRES ON EITHER SIDE OF THE BOGIE FRAME AS SHOWN THUS WILL BE PERMANENTLY PUNCH MARKED IN CONSPICUOUS MANNER.TO ENSURE THIS 2mmTHICK X 25mmWIDE STRIP SHOULD BE WELDED AT THE LONGITUDINAL AND TRANSVERSE CENTRES OF THE BOGIE FRAME.PUNCH MARK SHOULD BE PUNCHED ON THIS STRIP ACCORDINGLY.
2. g 1 TO g 8 REPRESENT LOCATIONS OF BOGIE GUIDES.
3. E,F,G & H REPRESENT LOCATIONS OF SUSPENSION BRACKETS FOR BOLSTER SUSPENSION ARRGT.
4. BOLSTER SUSPENSION BRACKET PIN HOLES E,F,G,H SHALL BE LOCATED AT 700 0.5mm FROM THE TRANSVERSE CENTRE LINE PUNCH MARKS ON BOGIE SIDE FRAME & CHECK IT AS PER FIG.-3.16b.
5. WELDING JOINT SHALL NOT COME UNDER THE BOGIE GUIDE.
6. NO INACCURACY IN LOCATION OF HANGER BRACKET AND THE ALIGNMENT OF HOLES IN THE BRACKETS WILL BE PERMITTED.

FIGURE-3.16a

R.D.S.O./CARR./SK93280

SHEET 1 OF 2

DIMENSIONAL CHECK REPORT FOR BOGIE FRAME (AC TYPE)

No. …….

RDSO/SK/93280

Measuring Point	Nominal Size (mm)	Actual Size (mm)	Variation (mm)	Measuring Point	Nominal Size (mm)	Actual Size (mm)	Variation (mm)
E - F	1400 ± 1.0			I - J	876 ± 0.5		
G - H	1400 ± 1.0			J - K	876 ± 0.5		
E - G	2159 ± 1.0			L - M	876 ± 0.5		
F - H	2159 ± 1.0			M - N	876 ± 0.5		
E - H	2573 ± 1.0			O - P	876 ± 0.5		
F - G	2573 ± 1.0			P- Q	876 ± 0.5		
a	463 ± 1.0			R - S	876 ± 0.5		
b	463 ± 1.0			S - T	876 ± 0.5		
c	463 ± 1.0			I - K	1752 ± 1.0		
d	463 ± 1.0			L - N	1752 ± 1..0		
g1 - g2	570 ± 1.0			O - Q	1752 ± 1.0		
g3 - g4	570 ± 1.0			R - T	1752 ± 1.0		
g5 - g6	570 ± 1.0			g1 - g6	3612 ± 1.0		
g7 - g8	570 ± 1.0			g2 - g5	3612 ± 1.0		
z - F	700 ± 0.5			g3 - g8	3612 ± 1.0		
z - H	700 ± 0.5			g4 - g7	3612 ± 1.0		

SHEET 2 OF 2

Figure - 3.16b

x) Replace the anchor link brackets if they are worn or damaged. The M12 threaded hole should be cleaned and checked and attended to, as required.

xi) Bent, damaged, or worn brake hanger brackets should be replaced. If the holes are not aligned/located as per drawing, replace the brackets. Use single piece design of brake hanger bracket for renewal. Replace the bushes in the brake hanger brackets at every POH.

xii) Replace the brake lever hanger brackets if the holes are oblong/worn or damaged.

xiii) Replace all the axle box housing crown bolt and screwing piece by rubber stoppers.

Table 3.8

WEAR LOCATIONS (Dimensions in mm)		
Part name	**Wear location**	**Drg. Nos.**
Brake hanger bracket bush	32 H7 Hole $^{+0.025}/_{-0.00}$	T-0-3-669 & WTAC3-0-3-316
Brake hanger bracket	35 gap	T-0-3-675
Brake hanger bracket	C.D.1752 $\pm$1.0	T-0-3-675
Axle guide	115g6 $^{-0.034}/_{+0.00}$ diameter	T-0-3-670 alt. 2/f
Axle guide	120 diameter	T-0-3-670 alt. 2/f
BSS bracket bush	38 dia. Hole	T-0-3-626 alt. 9/h
Pin for BSS	37 diameter	T-0-5-637 alt. m/12
Bracket for anchor link	$25^{+0.021}/_{-0.0}$ slot	T-0-3-635 alt. j/16
Brake lever hanger bracket	32 dia hole	T-0-3-631 & T-0-3-632

xiv) The locations where the repairs have been carried out should be cleaned to bare metal and painted with two coats of primer to IS:2074 to a minimum Dry Film Thickness (DFT) of **50 microns** followed by one coat of anti-corrosive Black Japan Type-B to IS:341 to a DFT of 35 microns, after which entire bogie frame is to be given one coat of Black Japan Type-B to IS:341 to a minimum DFT of **35 microns**.

316d **Attention to Bogie Bolster Arrangement**

(Refer drg. no.WTAC3-0-5-301 & WLRRM-0-4-001 for 16.25t bogie and T-0-5-601 & T-0-4-601 for 13t bogie)

i) Check the bolster for twist, crack, corrosion, etc. Repair or replace the bolster as required, and attend to the lug as required.

ii) Repair or replace the equalising stay bracket if found bent, damaged, or corroded.

Table 3.9

Part name	**Wear location** (all dimensions in mm)	**Drg. Nos.**
Side bearer wearing plate	10 mm thick top wearing surface	T-0-5-648 alt 10/L
Side bearer wearing piece	45 mm thick bottom wearing surface	T-0-5-649 alt 17/h
Bolster Centre Pivot sleeve	Hole 155 H7 ($^{+0.040}/_{-0.0}$) c9($^{-0.2}/_{-0.3}$)	T-0-6-606
Centre-Pivot silent block sleeve	Hole 140 H7 ($^{+0.040}/_{-0.0}$)	T-0-6-606
Centre Pivot silent block	Hole dia. 90 $^{+0.15}/_{+0.30}$	T-0-6-611 alt. 16/p
Centre Pivot silent block	Hole dia. 75 $^{+0.1}/_{+0.2}$	-do-
Centre Pivot silent block	Out side dia 140 U6 ($^{+0.195}/_{+0.170}$)	-do-
Centre Pivot pin	Out side dia. 90 c9($^{-017}/_{-0.267}$) & 75 c9 ($^{-0.150}/_{-0.257}$)	T-0-6-602 alt.s (w)

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iii) Replace the anchor link bracket by holding in bolster repair fixture, if found worn or damaged.
iv) Replace the bushes in the stay rod brackets, if found worn or damaged.
v) Replace the centre pivot silent block if found worn, damaged or rubber has perished.
vi) Replace the centre pivot sleeve if worn or damaged or corroded.
vii) Replace the bolster centre pivot sleeve if worn or cracked.
viii) Replace the rubber sealing cap of centre pivot silent block, if torn or damaged or perished.
ix) Replace the centre pivot pin if worn or cracked. Chalk test the centre pivot pin 'in position' or 'off position' to detect cracks.
x) Force fit between silent block and sleeve and tolerance on pivot pin, i.e., c9 ($^{-0.18}/_{-0.27}$) should be maintained in every POH/IOH.
xi) Ensure that there is no leakage of oil from the side bearer oil-bath welding portion. Replace the hard ground plate in side bearer, if worn more than 1.0mm **(ref. table 3.2)** in thickness or ridges formed on the plate. Replace the bronze wearing piece for side bearer, if worn more than **1.5 mm** in thickness. Sharp edges on wearing piece should be rounded off before re-use. Ensure that the dust seal cover sits effectively all around without any gap on the oil-bath and the sleeves slide freely on the guide to ward off dust and moisture coming in contact with the oil. Clean refilling passages and deficient or damaged oil refilling cups with caps and pipes should be replaced. The oil filling plugs should be well secured by chain to prevent it from dropping.
xii) Repair or replace the bent or damaged or broken equalising stay rod safety loops.
xiii) The locations where the repairs have been carried out or found corroded should be cleaned to bare metal and painted with two coats of primer to IS:2074 to a minimum Dry Film Thickness (DFT) of **50 microns** followed by one coat of anti-corrosive Black Japan Type-B to IS:341 to a DFT of **35 microns**, after which entire bogie bolster is to be given one coat of Black Japan Type-B to IS:341 to a minimum DFT of **35 microns**.

316e **Anchor Link**

(Ref: Drawing No. T – 0 – 7 – 603 and T – 0 – 7 –607)

i) Replace the anchor link, if worn or corroded. Repair the anchor link, if found cracked (normally at weld joints) under magna flux testing, by re welding after gouging. Refit new silent block in every POH.

ii) Replace the silent block, if the rubber is perished (indicated by fretting) or loose in the anchor link housing, or the silent block pin is worn thin or loose in silent block rubber. The silent block should be force fit in the anchor link and the silent block pin should be slide fit in the anchor link bracket.

iii) The locations where the repairs have been carried out should be cleaned to bare metal and painted with two coats of primer to IS: 2074 to a minimum Dry Film Thickness (DFT) of **50 microns** followed by one coat of anti-corrosive Black Japan Type-B to IS:341 to a DFT of **35 microns**, after which entire anchor link is to be given one coat of Black Japan Type-B to IS:341 to a minimum DFT of **35 microns**.

Table 3.10
(all dimensions in mm)

Part name	Wear location	Drg. No.
Anchor link silent block pin	25 mm $^{-0.012}/_{-0.052}$, thick ends	RDSO-Sketch-94101 alt.1
Anchor link silent block	Outer dia. 90.5 $^{+0.05}/_{+0.025}$	RDSO-Sketch-94101 alt.1
Anchor link housing	Hole dia 90.5 $^{+0.015}/_{-0.03}$	T-0-7-605

316f **Equalising Stay Rod and Pins (Small & Big)**
(Ref: Drawing No. RDSO Sk-88105 Alt.2 for 16.25t bogie and Sk-88018 Alt.6 for 13t bogie)

i) Hot dip galvanised equalising stay of 16.25t bogie is used on all new coaches. The choice of retro-fitment of these stays on existing coaches is left to the Railways. For fitment of equalising stays to Sk-88105 Alt.2 on 13t bogies, follow RDSO Sk-93236.

ii) Replace the corroded equalising stays with new hot dip galvanised stays. If any repair like welding or straightening is carried out, which damages the galvanising, repaint the equalising stay with epoxy paint.

iii) Bushes should be replaced in every POH and fitted with washers and split pins. Replace the equalising stay pins if worn out more than **1 mm** in diameter.

Table 3.11

Wear Location (Dimensions in mm)	
Part name	**Wear location**
Pins for 16.25t axle load bearing capacity equalising stay	Dia.31 ($^{+0.5}/_{-0.2}$)
Pins For 13t axle load bearing capacity equalising stay	Dia. 24 ($^{+0.2}/_{-0.1}$)

316g **Lower Spring Beam**
(Ref: Drawing No.WLRRM - 0 -5 - 002 for 16.25t bogie and T-0 -5 - 643 for 13t bogie)

i) Check the lower spring beam (plank) for cracks, corrosion, etc. and repair or replace as required.

ii) The following parts of the lower spring plank should be inspected and repaired or replaced as required:
- bolster suspension straps if bent or damaged
- stay rod brackets if worn, bent or corroded
- shock absorber fixing bosses if damaged
- spring guide rings if required
- lug if damaged.

iii) Replace the following parts:
- bushes of BSS brackets if worn beyond permissible limits
- equalising stay bracket bushes
- BSS pins if worn beyond permissible limits.

iv) The locations where the repairs have been carried out or found corroded should be cleaned to bare metal and painted with two coats of primer to IS: 2074 to a minimum Dry Film Thickness (DFT) of **50 microns** followed by one coat of anti-corrosive Black Japan Type-B to IS:341 to a DFT of **35 microns**, after which entire lower spring beam is to be given one coat of Black Japan Type-B to IS:341 to a minimum DFT of **35 microns**.

Table 3.12
(all dimensions in mm)

Part name	**Wear location**	**Drg. No.**
BSS bracket bush	Hole 38 H11 ($^{+0.16}/_{-0.00}$)	WLRRM-0-5-002
Eq. Stay bracket	Hole 42 H7 ($^{+0.025}/_{-0.0}$)	WLRRM - 0-4-002

316h **BSS Hanger**
(Ref: Drawing No. T – 0 – 5 – 639)

i) Check the cleaned hangers for cracks and wear. Replace the hangers if cracked or wear exceeds **1 mm**. Magna flux crack detection equipment shall be used for checking.

ii) The horizontal wearing surface may be built up using 2B electrodes, filed and ground to size. Then hard powder coating may be applied. Hardness value should be **55-60 Rockwell-C**

iii) The vertical gap should be within the permissible limit i.e., **$384^{+0.0}/_{-1.0}$ mm**. All the hangers should be tested to tensile load of **8 tonnes** and replaced if any permanent set is observed in the hangers.

iv) After repair and testing all the BSS hangers should be painted with one coat of anti corrosive black paint. Write the actual length between the wearing arms on the BSS hanger with paint.

Table 3.13
(all dimensions in mm)

Part name	Wear location	Drg. Nos.
BSS hanger	distance between horizontal wearing arms 384	T-0-5-639
BSS hanger	thickness of vertical arm 25.5	-do-
BSS hanger	horizontal wearing surface 42	-do-
Hanger block	Thickness - 9.5	T-0-5-638
Hanger block	slot 29 ($^{+0.4}/_{-0.2}$)	-do-
BSS pin	29 ($^{+0}/_{-0.1}$)	T-0-5-637

316i **Hanger Block (Stone)**
(Ref: Drawing No.WLRRM - 0 - 5 – 203 and T-0-5-638*)*

i) Replace the hanger blocks if cracked. Worn hanger blocks may be built up by welding with 2B electrodes and machined to size. After repair and testing all the hanger blocks should be painted with one coat of anti-corrosive Black Japan Type-B to IS:341.

316j **Axle Box Guide Assembly**
(Ref: Drawing No.WTAC3 - 0 - 1 – 301 and T-0-1-636)

i. Use the modified guide cap *(RDSO sketch no. 85070 Alt.3)* and its securing arrangement on existing bogies. New bogies are fitted with dash- pot guide arrangement to T-0-1-641.

ii. Replace the upper rubber washer, lower rubber washer, packing ring, guide ring, dust shield , guide bush, dust shield spring, and spring clip as a kit.

Table 3.14

Critical Dimensions (dimensions in mm)		
Component	**Dimension**	**Drg. no.**
Lower spring seat	hole 140 H7 ($^{+0.04}/_{-0.0}$)	RDSO Sk-90005 Alt.2
Guide bush	O.D. 140 A9 ($^{-0.3}/_{-0.6}$)	RDSO SK-84102 Alt.5
Guide bush	hole dia 115 ($^{+0.15}/_{-0}$)	-do-
Guide Ring	hole 115 H7 ($^{+0.04}/_{-0}$)	-do-

iii. Replace the lower spring seat if worn, cracked, scored, etc.

iv) Whenever an axle guide is replaced due to damaged/ misalignment, preferably modified guide with circlip arrangement may be fitted.

v) Common defects found in axle guide assembly during POH and their reasons and remedies are given in **Annexure 3.1.**

317 COIL SPRINGS

i. Coil spring should be maintained as per C-8419 (Rev.1)

ii. Clean the spring thoroughly, remove any oil, grease, etc. by putting them in a Bosch cleaning tank. After that carry out visual inspection of the spring coil by coil. Carry out magna flux test to detect cracks. Springs having cracks, dents or hitting marks should be rejected and scrapped. Records should be maintained of rejected springs with details of defects noticed.

iii. Each spring should be subjected to incremental load up to the figure indicated in the table 3.16 and 3.17 and the load should be maintained for a period of **2 minutes**, after which the corresponding height of spring under load is determined.

iv. Replace the upper rubber washer, lower rubber washer, packing ring, guide ring, dust shield , guide bush, dust shield spring, and spring clip as a kit.

v. Replace the lower spring seat if worn, cracked, scored, etc.

vi. Each spring may be tested for other deflections/loads indicated in drawing and the spring characteristics plotted. The spring should be replaced if its characteristics are not within specified limits.

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Table 3.15

Drawing code of springs for ICF BG coaches

(Reference RDSO Amendment slip no. 5 of September 2001 to STR WD-01-HLs- 94 (Rev.1 May 95)

Type of spring	Type of bogies	ICF Drg. No	Drg. Code No.
Axle box	All Non AC ICF type	F-0-1-006	A01
	All AC ICF type	WTAC-0-1-202	A03
	Power car	WLRRM2-0-1-202	A04
	Double decker	DD-0-1-001	A06
	High capacity Power Car	WLRRM8-0-1-802	A09
	High capacity parcel van	RDSO /SK-98017	A10
Bolster	All Non AC ICF type	F-0-5-002	B01
	All AC ICF type	WTAC-0-5-202	B03
	Power car	WLRRM2-0-5-202	B04
	Double decker	DD-0-5-003	B06
Bolster	High capacity Power car	WLRRM8-0-5-802	B11
			B13
	High capacity Parcel van	RDSO /SK-98018	B15
			B16

Table 3.16

Load deflection testing and grouping of Axle box spring (B.G Main line coaches)

Code	Wire dia	Free height	Test Load	Acceptable height under test load	Groups as per loaded spring height		
					A	B	C
					Yellow	Oxford Blue*	Green
A01	33.5	360	2000	279-295	279-284	285-289	290-295
A03	33.5	375	2800	264-282	264-269	270-275	276-282
A04	35	372	3000	265-282	265-270	271-276	277-282
A06	36	337	2400	269-284	269-273	274-279	280-284
A09	37	360	3000	277-293	277-282	283-288	289-293
A10	39	315	1800	276-289	276-279	280-284	285-289

* As per RDSO's letter no. MC/SPG dated 25.7.01

Table 3.17

Load deflection testing and grouping of Bolster spring (B.G Main line coaches)

Code	Wire dia	Free height	Test Load	Acceptable height under test load	Groups as per loaded spring height		
					A	B	C
					Yellow	Oxford Blue #	Green
B01	42	385	3300	301-317	301-305	306-311	312-317
B03	42	400	4800	291-308	291-296	297-303	304-308
B04	47	400	6100	286-304	286-291	292-297	298-304
B06	36	416	4200	280-299	280-286	287-292	293-299
B11	47	*386	6700	306-322	306-311	312-317	318-322
B13	34						
B15	40	393**	6000	256-272	256-261	262-267	268-272
B16	32.5	286 **					

* Combined load deflection test is done

** As per RDSO's letter no. MC/MV dtd. 21.11.01

\# As per RDSO's letter no. MC/SPG dtd. 25.7.01

v. After load deflection test, the acceptable springs should be given one coat of Red Oxide Zinc Chromate primer to IS:2074 to a minimum DFT of **50 microns**. A coat of Black Japan Type-B to IS:341 to a minimum DFT to **35 microns** should follow the primer coat to have better abrasion resistance and corrosion resistance. Then the springs have to be painted with **50 mm** wide vertical stripes at three locations, equi-spaced on the circumference using different colours of paints to IS:8662 as given below:

Spring group	**Colour code**
A	Yellow
B	Oxford Blue
C	Green

vi. All the springs should be grouped in three groups as shown in table above, depending upon their deflection under test load. For pairing, springs should be selected from the same group. Height under test load should be painted on all springs to enable selection of springs.

318 BOGIE BRAKE GEAR

i. Repair or replace the worn, damaged, corroded bogie brake levers. Replace the bushes in the bogie brake levers. Nylon 66 brake gear bushes to RDSO STR No. C-8107 should be fitted in brake gear.

ii. Repair or replace the corroded, cracked, or worn brake beams.

iii. Repair or replace the corroded, dented, damaged brake head shoes. Replace the worn bushes, adjuster, weakened spring, etc., in all the serviceable brake head/ shoe.

iv. Replace the worn, damaged, etc. brake gear pins with new ground finished and chromium plated pins. 'Z' lever pin shall be to RDSO Sketch 98127.

v. Replace the brake blocks if worn out to thickness of **20 mm** or below.

vi. Replace the weak and damaged brake shoe key.

vii. All the brake gear components should be given one coat of red oxide primer and one coat of anti-corrosion Black Japan Type-B to IS: 341.

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319 BOGIE ASSEMBLY

319a General

Bogie assembly can be systematically carried out, if it is organised under three workstations described hereunder. A sub store in the bogie shop may be necessary to ensure supply of proper components and sub-assemblies for bogie assembly.

319b Brake Gear and Axle Guide Assembly Work Station

i. After the inspection, repair and alignment of BSS brackets, axle guides and the bogie frame, place the bogie frame in the normal position on assembly stands.

ii. Assemble the brake gear components including brake blocks on the bogie frame with pins, washers and split cotters. Ensure that the cotters are split minimum 90° and not slack in the pins. Modified lever hanger pins (RDSO sketch no. 98127) should be used to prevent the bush working out of the lever hanger. Ensure that the maximum dimensional clearance between the pins and bushes is **1.5 mm**.

iii. Apply some lubricating oil on axle guide outer surface and on inside surface of guide bush. Assemble the axle guide components on the axle guide and secure them with guide cap (whose 9 holes should be cleaned before securing) as per RDSO sketch no. 85070 Alt.3. While tightening the guide cap, it should be ensured that guide bush sits tight against the rubber packing ring and the holes in the guide are in alignment with corresponding holes in the guide bush. New coaches are fitted with modified axle guide arrangement to T-0-1-641.

319c Bolster Assembly Work Station

i. Grease the BSS pins, hanger blocks, anchor link silent block pins and anchor link brackets with graphite grease. Ensure that bolster springs with height (under test load) variation within **2 mm** are selected in the same group of springs for each bogie assembly.

ii. Assemble lower spring planks, compensating rings, bolster spring, rubber washer and other secondary suspension components. Compensating rings shall be specified in relevant suspension diagram issued by PUs. Additional compensating ring to maintain bolster clearance of **40±3** can be added. Lower the bogie frame assembled with brake gear and axle guide assembly on the bolster assembly. Connect the bogie frame and lower spring plank with BSS hanger with the help of a dead weight. Connect the lower spring planks and bolster with equalising stays and pins. Secure the equalising stay pins with washers and split pins. Ensure that the split pins are split to **minimum 90°** and not slack in the pins. Connect the bogie frame and bolster with anchor links. Secure the anchor links in the brackets with M12 hexagonal head screws and spring washers.

iii. Replace the rubber sealing cap on the centre pivot silent block.

319d Bogie Lowering Work Station

i. Select the wheel sets such that the maximum variation in tread diameter between the wheels on same axle as **0.5 mm**, between two wheel sets in same bogie as **5 mm** and among the four wheel sets in the same coach as **13 mm**. Select axle box springs in the same group of springs as given in table 3.16.

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ii. Assemble the lower rubber washer, lower spring seat, compensating ring, hard packing ring, selected axle box springs, upper spring seats, upper rubber washer, protective tube, etc., as per the drawing for axle box guide arrangement. Put dash pot oil of approved brand in lower spring seat to a level of **60 mm** from bottom. The approved brands of dash pot oil are the following:

a. Servoline - 100 of IOC b. Yantrol - 100 of HPC c. Bharat univol – 100 of BPC

iii. For obtaining correct buffer height when the coach body is lowered on the bogies, while assembling the bogie hard rubber, UHMWPE or NFTC packing of required thickness, depending on the wheel diameter, should be provided under the flanges of the lower spring seats. Packing rings of thickness as given in **table 3.18** and as shown in **figure 3.17** (RDSO sketch 77354) should be used. Compensating rings of suitable thickness as per suspension diagram for relevant coach should be placed over the flange of the lower spring seat.

Table 3.18

Average tread diameter of two wheel sets of bogie	Thickness of hard packing ring
889 to 864 mm	13 mm
863 to 840 mm	26 mm
839 to 820 mm	38 mm
819 mm	48 mm

iv. Lower the bogie frame with the bolster assembly on the wheel sets thus prepared, taking care to ensure that the rubber packing ring does not get damaged while lowering the guide bushes on to the lower spring seat. The maximum diametrical clearance between the lower spring seat and guide bush should not exceed **1.6 mm**. The bogie should sit evenly on the four axle boxes.

v. The assembled bogie should be load tested on a bogie test stand where it is loaded up to its normal working load and the height of bolster top surface form rail level should be measured for comparison with pre-determined dimension corresponding to correct coach buffer height. Adjustment for getting correct buffer height should be made, if needed. If the buffer height requires further adjustment, the load on the axle box spring should be released and compensating rings should be inserted below the axle box spring ensuring that the bogie frame height is **686 ± 5 mm**.

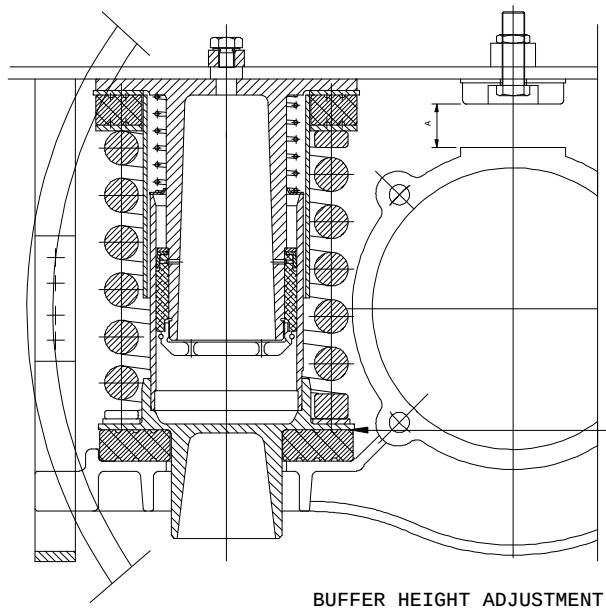
vi. Safety straps of the axle box wing lugs and bogie bolster should be adjusted so as to ensure a minimum clearance of **40 mm** between the lugs and bottom of safety straps.

vii. Fit the vertical shock absorber between the bolster and bottom spring plank.

viii. Check the oil in the dash pots with the flexible wire gauge and if necessary, top up the dash pots with the approved brand of dash pot oil to bring the level to **60 mm** from under surface of dash pot. If the flexible gauge indicates a higher level of oil, the guide cap may have fallen in dash pot. This should be checked and attended to.

ix. Axle box rubber bump stopper should be adjusted to obtain the required clearance between the axle box crown and the bogie frame.

x. After testing and making adjustments for correct buffer height, dispatch the bogie to Lifting shop for lowering the coach body.



DIMENSION `A' AS SHOWN BELOW

TYPE OF COACH	CROWN CLEARANCE A mm
GS,SDC,SLR,SCN	43 $^{+0}_{-3}$
WCB,WCBAC,WFC,WFAC WGFAC,WSCWAC,WGCWAC WGACCN,WACCN,WSCZAC WGSCZAC,WFCZAC,WLRRM	27 $^{+0}_{-3}$

1. INSERT 13 mm PACKING FOR 13 mm TREAD WEAR.
2. INSERT 26 mm PACKING FOR 26 mm TREAD WEAR.
3. INSERT 38 mm PACKING FOR 38 mm TREAD WEAR.
4. INSERT 48 mm PACKING FOR 819 DIA. TREAD.

BUFFER HEIGHT ADJUSTMENT
(ICF COACH)

SKETCH-77354

FIGURE 3.17

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CHAPTER CONTENT

LIFTING SHOP

319e Lowering the Coach Body in Lifting Shop

i. Place the wearing plate and wearing piece in side bearer oil-bath. Fill each side bearer oil-bath with **2 litres** of any of the following approved brands of oils.

- Servoline – 100 of IOC
- Yantrol – 100 of HPC
- Bharat univol – 100 of BPC

ii. Apply graphite grease on Centre pivot pin and lower the coach body on the side bearer wearing pieces. Care should be exercised to make sure that the side bearers are resting properly. Place the cotter in position in Centre pivot pin and secure it with a split pin. A bottom cover should be fitted for covering the entire assembly to prevent dust ingress. Tighten the air vent bolt with gasket to prevent spilling of dash pot oil.

319f Shock Absorbers

Reference may be made to RDSO specification C-8703 (Rev.1) for hydraulic shock absorbers for coaching stock.

1. Periodicity of overhaul

i) **Schedule overhaul:** Shock absorbers should be given a schedule overhaul:

a. When their capacities vary beyond **±20%** of their specified values, or

b. After 4 lakh kilometers or alternate POH, whichever is earlier.

ii) **Non schedule overhaul**: Shock absorbers should also be overhauled whenever suspected to be defective, which is indicated primarily by oil leakage or when they are physically damaged.

2. Testing

i) The shock absorber is tested on the special purpose machine *(RDSO sketch nos. 69.2.04.00 to 69.2.04.08)* which can measure its capacity in both tension and compression by developing the resisting force at a velocity of **10 cm/sec**. The length of the shock absorber and its stroke should be within the limits specified in the **table 3.19.**

ii) The shock absorber must be tested at every POH and reused if overhauling is not due and the capacity is within **± 20%**. A register should be maintained in the shock absorber section wherein the test results of each shock absorber should be recorded before the shock absorber is certified fit for use on coaches.

iii) After the testing and certification, the protection cover of the shock absorber should be pressed into position on the piston rod disc and spot welded at six points around the periphery.

iv) The shock absorber should then be extended on the mounting fixture and painted. When the paint dries, it should be compressed and then removed from the fixture.

v) The date of testing, the date of overhauling and the name of the shop where overhauled should invariably be stamped on the name plate of the shock absorber before it is sent for fitment.

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Table 3.19

Maker's Type	Length (mm)			Nominal Stroke (mm)	Variation from Nominal	
	Compressed	Nominal	Extended		Min. (mm)	Max. (mm)
Vertical shock absorbers: M/s ESCORTS M/s KNORR BREMSE M/s GABRIEL ICF/SK-0-5-015	**250 ± 3**	**320 ± 3**	**360 ± 3**	**110**	**-70**	**40**

320 LIST OF TOOLS AND PLANT

LIFTING SHOP	*FITTING SHOP*
Ball peen hammer Chisel Spanner ***WASHING PLANT*** Bosch tank Hot water jet system Bins and pallets Jib crane Fork lift Platform truck ***BOGIE SHOP*** Ball peen hammer Chisel Spanner set Welding transformer Gas cutting plant Bogie alignment gauges Spring testing machine Magnaflux crack detector Paint brushes Floor scraper Bogie frame repair fixture Bolster repair fixture Bogie test rig Working stands Overhead crane Bins and pallets Fork lift Platform truck	Ball peen hammer Chisel Welding transformer Gas cutting plant Hydraulic press Measuring gauges Center lathe Brake beam end turning m/c Electrode heater Hard surface plant BSS hanger testing m/c Bins and pallets Fork lift Platform truck ***SMITH SHOP*** Helical spring repair tools & plant Shot peening plant Heat treatment plant Smith's tongs, hammers & blocks

321 EXAMINATION AND REPAIR PRACTICE IN CARRIAGE MAINTENANCE DEPOT

Depot maintenance staff should ensure the following things in respect of proper functioning and safety of Bogie & Bogie components.

321a Bogie Frame

i) Primary/Secondary Examination, Schedule A & B Examination

- Examine visually condition of bogie side frame, transom, longitudinals and all welded locations.
- Examine rubber stopper/stop screw of axle box crown for damage/missing/loose.
- Inspect axle box safety straps/loops for damage/broken/missing.
- Bolster safety straps/loops for damage/broken/missing.
- Brake hanger brackets for damages.
- Inspect safety brackets for brake hanger pins.
- Check visually BSS hanger brackets.
- Examine visually anchor link brackets.
- Visually examine centre pivot mounting bolts and attend if needed.
- Visually inspect centre pivot cover.
- Side bearer oil to be replenished in A & B schedules, if needed.

ii) Schedule C Examination

- Examine as per (i) above.
- Examine condition of wearing piece and wearing plate
- Examine oil level in side bearer oil baths and replenish if oil level has gone down below the level of last thread of oil filling cup.

321b Primary Suspension

i) Primary/Secondary Examination

- Visually examine axle box springs for breakage.
- Visually examine dash pot oil filling special screw for deficiency.
- Check oil leakage in dash pot through defective seals/vent screws.
- Visually examine axle box clearance

ii) Schedule A & Schedule B

- Examine as per (i) above.
- Add specified grade of oil in dash pot.
- Visually examine axle box clearance.

iii) Schedule C

- Examine as per (ii) above.
- Check and attend axle guide assembly if necessary.
- Check axle box clearance with gauge

321c Secondary Suspension

i) Primary/Secondary Examination, Schedule A, B & C examination

- Visually examine bolster springs breakages/damages.
- Visually examine Bolster lower spring beam.
- Visually examine BSS hangers, hanger blocks, BSS pins.
- Check bolster clearance between top of bolster and bottom of bogie frame.
- Visually examine equalising stay rods and pins (small and big).
- Visually check anchor links.

- Examine Visually anchor link securing bolts and attend if needed.
- Visually examine Equalising stay rod brackets.
- Examine and attend safety loops of bolster.
- Check and attend safety loops of Equalising stay rod.
- Examine vertical shock absorbers for damages.

321d **Brake Rigging**

i) Primary / Secondary Examination

- Check brake gear and adjust so that the piston stroke is within the limit.
- Examine brake beams breakages/damages.
- Check and attend brake beam safety wire ropes/safety straps.
- Check and attend brake shoe head and key & replace if necessary.
- Check and replace worn brake blocks.
- Visually inspect and replace brake hangers, brake gear pins and cotters/split pins if necessary.
- Visually inspect and replace damaged/missing brake gear bushes if necessary.

ii) Schedule A, B & C Examination

- Examine as per (i) above.
- Check and attend brake block adjuster.
- Examine and attend brake levers.
- Examine and attend floating lever suspension brackets
- Examine lever hanger pins.

321e Bogie to be run out if found necessary/During IOH following should be done

- Examine and replace all the brake gear components found deficient / worn out.
- Examine and replace primary and secondary suspension components as required.
- Examine wheel profile and thickness and gauge in case they appear to be near condemning limit

322 **SAFETY PRECAUTIONS**

- Whenever a coach is examined at maintenance depot, it should be ensured that the prescribed number of safety straps, safety wire rope, axle box safety strap, bolster safety loop, centre pivot cap, hangers or brackets of specified dimension and sections required for various components are fitted at specified location.
- All fasteners e.g. bolts, nuts, cotters etc. used in under frame equipments, brake gear, buffing and draw gear should be checked.

Annexure - 3.1

COMMON DEFECTS FOUND IN AXLE GUIDE ASSEMBLY

S.No.	Defects	Reason	Remedies
1.	Perished rubber packing ring	Poor quality of rubber packing ring	1) Replace rubber packing ring at every examination. 2) Use only rubber packing rings conforming to IRS specification no. R-47-72 and the relevant drawing.
2.	Axle guide found worn on one side	1) Misaligned fitment of axle guides to bogie frame. 2) Dust ingress to lower spring seat.	1) The alignment of axle box guide should be checked with alignment gauges and corrected. 2) Vent hole should be sealed with gaskets. Screw to be tightened well after oil topping.
3.	Axle box spring rubbing upper spring seat	Do	Do
4.	Guide bush worn	Do	Do
5	Lower spring surface worn	Do	Do
6.	Guide ring broken	1) Axle guide is hitting lower spring seat 2) Weld joint of lower spring seat and tube is porous or cracked	1) Guide securing bolt should not project out of guide cap. 2) Use good quality upper and lower rubber washers and correct number of compensating rings in the axle guide assembly. 3) Adjust A, B and C clearances on leveled track. 4) Strip and reweld lower spring seat correctly.
7	Guide cap securing assembly broken	Do	Do
8.	Lower spring seat scored and dent mark on guide cap	Do	Do
9	Dust shield spring broken or distorted	Do	Do
10	Leakage from lower spring seat	Do	Do

******

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CHAPTER 4

AIR BRAKE SYSTEM

401 INTRODUCTION

In Air Brake system compressed air is used for operating the brake system. The locomotive compressor charges the feed pipe and the brake pipes throughout the length of the train. The feed pipe is connected to the auxiliary reservoir and the brake pipe is connected to the brake cylinder through the distributor valve. Brake application takes place by dropping the pressure in the brake pipe.

402 CLASSIFICATION OF AIR BRAKE SYSTEM

The schematic layout shown in figure 4.1 illustrates the underframe mounted twin pipe graduated release air brake system on main line coaches. The components and their relative location is indicated in the schematic layout.

403 PRINCIPLE OF OPERATION OF TWIN PIPE GRADUATED RELEASE AIR BRAKE SYSTEM (See figure 4.1)

403a Charging the brake system

- Brake pipe throughout the length of train is charged with compressed air at **5 Kg/cm^2**.
- Feed pipe throughout the length of train is charged with compressed air at **6 Kg/cm^2**.
- Control reservoir is charged to **5 Kg/cm^2**.
- Auxiliary reservoir is charged to **6 Kg/cm^2**.

403b Brake application stage

- For brake application the brake pipe pressure is dropped by venting air from the driver's brake valve. Subsequently the following actions take place
  - The control reservoir is disconnected from the brake pipe.

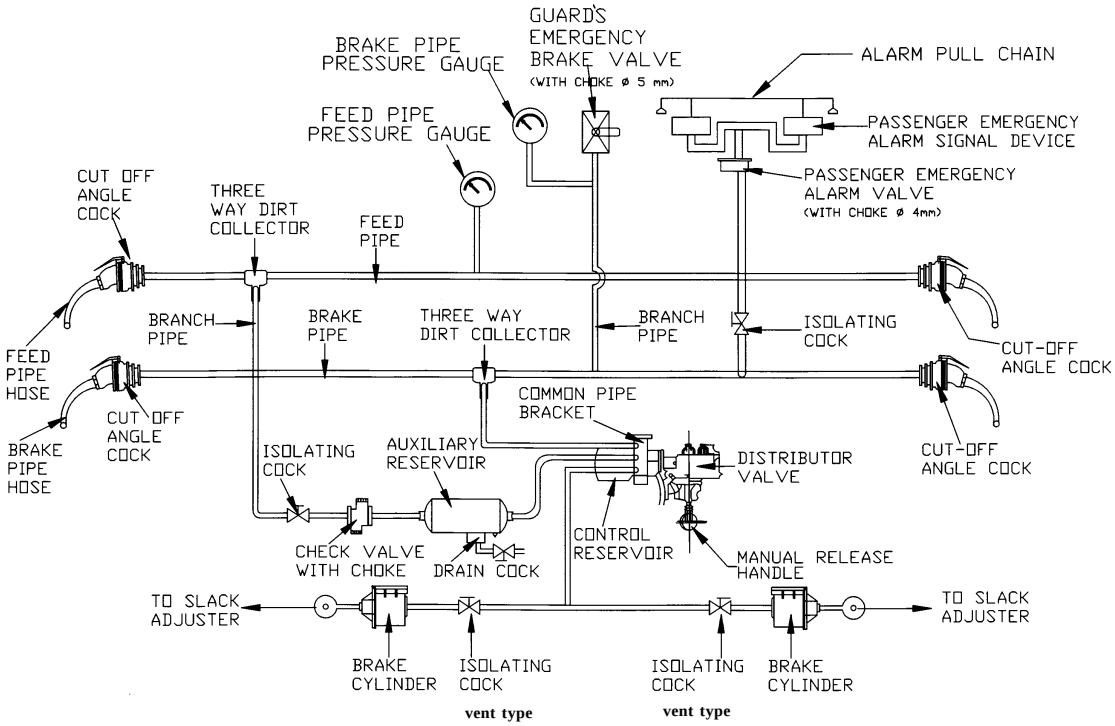


Figure 4.1 SCHEMATIC LAYOUT OF TWIN PIPE GRADUATED RELEASE AIR BRAKE SYSTEM

Note: Pressure gauges are installed only in guard's brake van.

- The distributor valve connects the auxiliary reservoir to the brake cylinder and the brake cylinder piston is pushed outwards for application of brakes.
- The auxiliary reservoir is however continuously charged from feed pipe at **6 Kg/cm^2**.

Table 4.1

Description	Reduction in B. P. Pressure
Minimum Brake Application	0.5 to 0.8Kg/cm^2
Service Brake Application	0.8 to 1.0Kg/cm^2
Full Service Brake Application	1.0 to 1.5Kg/cm^2
Emergency Brake Application	Brake pipe is fully exhausted and its pressure reduces to almost zero.

403c Brake release stage:

- Brakes are released by recharging brake pipe to **5 Kg/cm^2** pressure through the driver's brake valve.
- The distributor valve isolates the brake cylinder from the auxiliary reservoirs.
- The brake cylinder pressure is vented to atmosphere through DV and the Brake cylinder piston moves inwards.

404 AIR BRAKE SUB ASSEMBLIES

The various Air Brake sub-assemblies and components are:

i) Common pipe bracket
ii) Intermediate piece
iii) Brake pipe and feed pipe
iv) Brake pipe coupling
v) Cut-off angle cock
vi) Brake cylinder
vii) Dirt collector
viii) Auxiliary reservoir
ix) Slack adjuster
x) Distributor valve
xi) isolating cock
xii) PEASD
xiii) PEAV
xiv) Check valve

The brief details of the air brake components and it's maintenance and test procedure is described below:

405 COMMON PIPE BRACKET

Common pipe bracket is mounted on the coach under frame and is suitable for use with all type of distributor valves presently in use on main line coaches.

406 INTERMEDIATE PIECE (SANDWICH PIECE)

An intermediate piece is mounted on the common pipe bracket to fit the distributor valve on the common pipe bracket. The intermediate piece serves the purpose of blanking all the other ports on the common pipe bracket 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.

407 AIR BRAKE HOSES

407a Brake Pipe & Feed Pipe Hoses (see figure 4.2)

To maintain continuity through out the length of train, the brake pipe (BP) and feed pipe (FP) are fitted with flexible hoses. Each hose is provided with palm end coupling. For easy identification, coupling heads are painted with green colour for B.P and white colour for F.P. Also raised letters 'BP' and 'FP' are embossed on coupling heads representing Brake Pipe and Feed Pipe respectively. Hose couplings must be checked for leakage of air as per the test procedure given below:

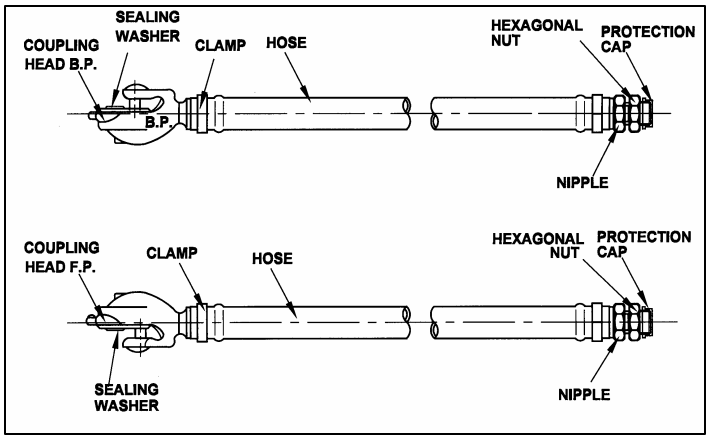


Figure 4.2 - AIR BRAKE HOSES

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407b Test Procedure (see figure 4.3)

For testing the hose coupling the steps given below should be followed:

- Use a dummy coupling head to block the outlet port of the hose coupling.
- Connect to hose coupling under test to the end of flexible hose.
- Open isolating cock 1(a)
- Adjust pressure regulator (2) so that pressure gauge (6a) shows **10Kg./cm^2** air pressure.
- Immerse the hose coupling assembly completely in the tub of water.
- Open isolating cock (1b) and see that (6b) shows **10 Kg/cm^2** pressure.
- Observe leakage, if any from all parts of the hose coupling.
- Close the isolating cock 1(b).
- Disconnect the hose coupling from test bed.
- If the leakage is observed through the coupling head, replace the gasket and test again.
- 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.

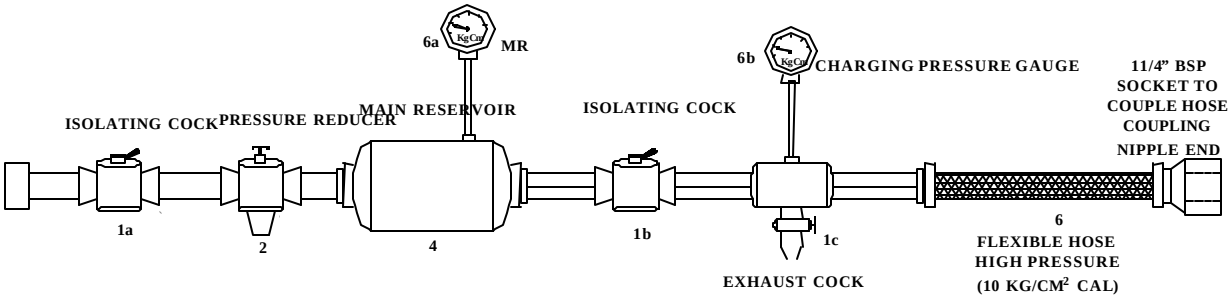


figure 4.3 – TEST BENCH FOR HOSE COUPLING

408 CUT OFF ANGLE COCK (see figure 4.4) (Ref: Drg. No. WD-88123-S-01 and WD-88123-S-01)

Cut off angle cocks are provided both on brake pipe & feed pipe on either end of each coach to facilitate coupling and uncoupling of air hoses. 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.

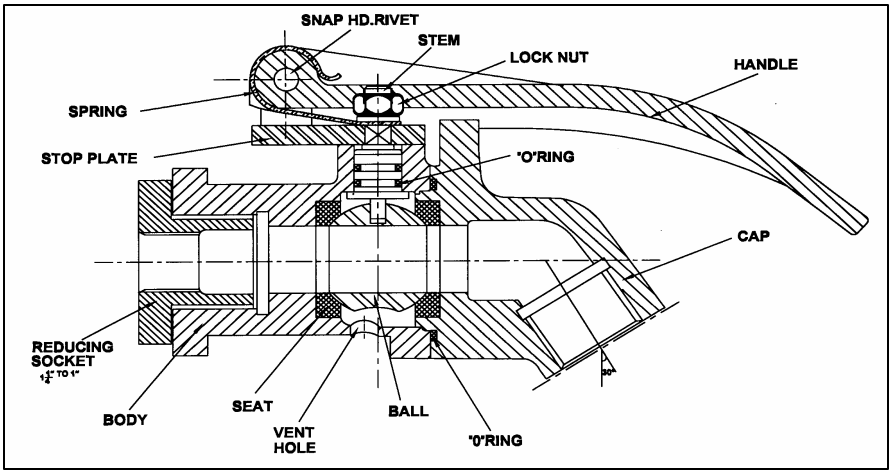


Figure 4.4 - CUT OFF ANGLE COCK

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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 seated is on nitrile 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 cocks of BP are kept open except the rear end angle cocks (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.

408a Overhauling of Cut Off Angle Cock

The cut-off angle cock is to be completely dismantled and overhauled in every POH or when there is some specific trouble. During overhauling, it is dismantled for cleaning, replacement of parts and checking for effective functioning. The POH kit should be as per annexure 4.3.

408b Tools & Equipment

The following tools and fixtures are required for overhauling

(a) Single end spanner.
  1) A/F 17 for M10 nut pivot screw.
  2) A/F 10 for M6 nut.
(b) Screw driver 12”/300 mm long.
(c) Vice.
(d) Light hammer.

408c Procedure

i) Dismantling

- Hold the cut – off angle cock in a 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.

ii) 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.

iii) 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.

iv) 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.

408d Testing of Cut Off Angle Cock

i) Tools and Equipment

- Test Bench
- Compressor to build pressure upto **10 kg/cm^2**.
- Single ended spanner as per IS 2027
  a) Across face 17 (for M10 lock nut) 1No.
  b) Across Face 13 (for M8 studs) 2 No.
- Screw Driver –300mm,1 No.
- 1 ¼ " BSP dummy Plug with seal.
- Dummy plug for angle cock.

ii) Test Procedure (*refer figure 4.9*)

Following test procedure should be adopted for performing the leakage test.

- Mount the angle cock on the base of the test bench (Part No. 7 of the figure 4.9 of the test bench).
- Move the handle to the closed position.
- See that cock (1e) and (1c) are in closed position.
- Now open cock 1(a) and 1(b) till MR indicates a pressure of **10 Kg/Cm^2**.
- If necessary, adjust pressure regulator (2) to maintain the pressure at **10 kg/Cm^2**.
- Open cock (1c) and check the leakage with soap solution. There should not be any leakage.
- Check pressure drop in gauge (6b) there should not be any leakage from flange joints, vent and outlet port of the angle cock.
- Close cock (1c) and tighten the dummy plug and seal the outlet of the angle cock.
- Move the handle to the open position. Open cock 1c.
- Check for leakage from body and cap joint, vent and all over the stem periphery using soap water. No leakage is permissible.
- Move the handle to closed position and notice a short blast of air through the vent.
- Close cock 1c then Open cock (1d) and exhaust the pressure to zero.
- Remove the angle cock.
- Report results of the test.

iii) 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.

409 BRAKE CYLINDER (see figure 4.5) (Refer Drg. RDSO SK-97015)

On every coach fitted with air brake system two brake cylinders are provided for actuating the brake rigging for the application and release of brakes. During application of brakes the brake cylinder develops mechanical brake power by outward movement of its piston assembly after receiving air pressure from Auxiliary reservoir through the distributor valve. This is transmitted to the brake shoes through a combination of levers. 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

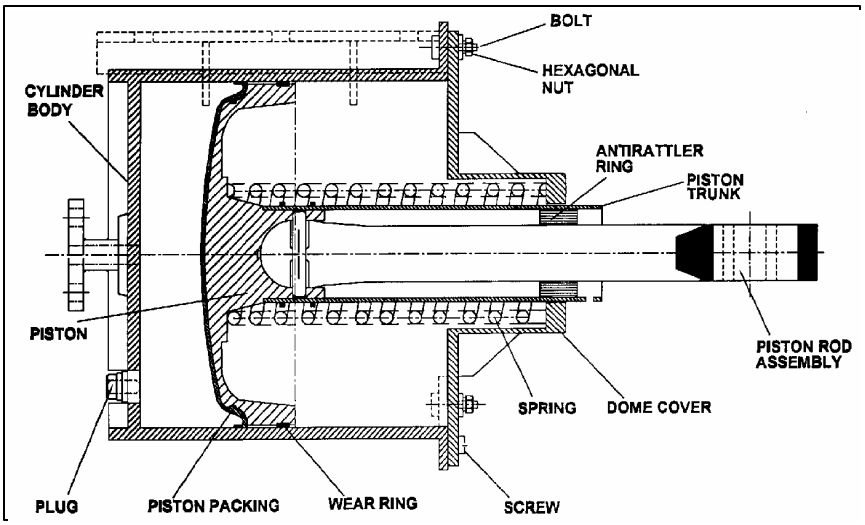


Figure 4.5 – BRAKE CYLINDER

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 is of oil and abrasion resistant rubber material and is snap fit to the piston head. The packing 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 var iations in alignment during fitment/operation. For preventing knocking during running, a rubber anti rattler ring is also provided.

409a 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 every POH of the coach.

409b Tools & Equipments

Sr. No.	Description
1.	Torque Wrench 0-3 Kg m 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

409c Dismantling of Brake Cylinder

Before dismantling the dome cover insert a bolt **f 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.

- 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 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, and piston trunk & piston rod assembly.
- Unscrew the brake cylinder plug at the rear end.

409d 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.

409e 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.

409f Inspection and Repairs of the Parts

- Examine visually that the internal surface is free from scratches, rust.
- Brake cylinder bore to be checked for ovality with 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.

409g 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.

409h Assembly of Brake Cylinder

- Assemble piston rod, pin, and 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 **f 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 **f 12x25 long** pin from the piston trunk hole.
- Fit back the plug at the rear of the cylinder.

409i Testing of Brake Cylinder (see figure 4.6)

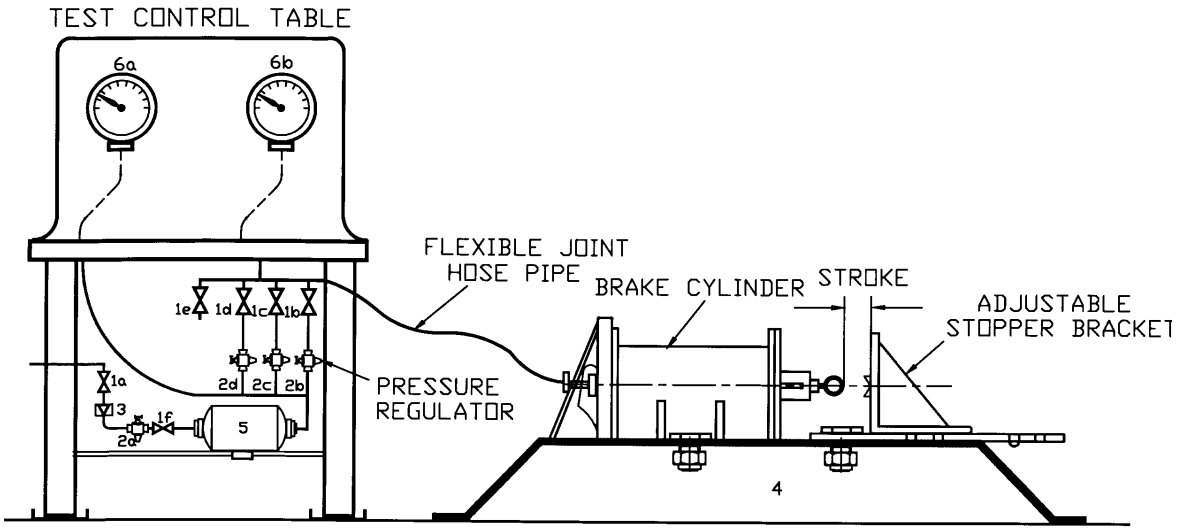
i) Brake Cylinder Test Bench

Test bench consists of the following main parts

a) 5 nos. of isolating cocks (1a, 1b, 1c, 1d, 1e and 1f).
b) Pressure reducing valves as below
c) 2a - to be set on **10 Kg/cm^2**.
d) 2b - to be set on **6 Kg/cm^2**.
e) 2c - to be set on **0.8 Kg/cm^2**.
f) 2d - to be set on **3.8 Kg/cm^2**.
g) Pressure gauges
h) 6a - to measure supply pressure.
i) 6b- to measure brake cylinder pressure.
j) Pipe line filter – Item no 3
k) Brake cylinder pressure mounting base with fixture –Item no 4
l) Air reservoir – Item no.5

ii) Tools required during Testing

a) Torque wrench range (2-3 kgm capacity) – One number.
b) Double ended spanner (M16) across face 24x27 – One number.
c) Socket wrench (M12) across face 19 – One Number.
d) Double ended spanner (M8) across face 13x14 – One number.
e) Screw Driver – 300mm – One number.



Ref. No. of	Description	No. of		Ref. No. of	Description	No. of
Isolating cock				Pressure Reducing valve		
1a	Supply angle cock	1		2a	Set on 10 kg/cm^2	1
1b	Angle cock	1		2b	Set on 6 kg/cm^2	1
1c	Angle cock	1		2c	Set on 0.8 kg/cm^2	1
1d	Angle cock	1		2d	Set on 3.8 kg/cm^2	1
1e	Exhaust cock	1		3	Pipe line filter	1
1f	Angle cock	1		4	Brake Cylinder pressure mounting base	1
				5	Air reservoir	1
				Pressure Gauge		
				6a	Supply Pressure	1
				6b	Brake Cylinder Pressure	1

Figure 4.6 – TEST BENCH FOR BRAKE CYLINDER

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.

a) Strength test
b) Pressure Tightness Test.

iii) Strength Test

For strength test, procedure described below should be follow:

- Place the repaired/overhauled brake cylinder body on mounting base of the test stand. This mounting base (4) is provided with a safety guard.
- Connect the air pressure line to the brake cylinder.
- Check the brake cylinder piston stroke at **0-5 kg/Cm^2** pressure for its jerk free smooth movement.
- Close the safety guard.
- Close the cock (1b), (1c) and (1d).
- Open cock (1a) and (1f) and let the reservoir pressure increase.
- Set pressure regulator (2a) at **10Kg/cm^2**.
- Monitor the pressure in the reservoir with the help of the MR Gauge (6a).
- Let the pressure reach upto **10 kg/cm^2.**
- Open cock (1b) so that air collected in the reservoir is transferred to the brake cylinder.
- Adjust the pressure in the brake cylinder with the help of the pressure regulator (2b).

- Monitor the pressure in the brake cylinder with the help of the pressure gauge (6b).
- Close the cock 1(b) as soon as pressure reaches **6 kg/cm^2**.
- Wait for 2 minutes.
- Brake cylinder should withstand this pressure.
- Open cock (1e), this will discharge the air pressure from the brake cylinder and the piston assembly will come back.

iv) Pressure Tightness Test

Brake cylinder when fully assembled must be tested for leakage. For pressure tightness test, procedure described below should be followed.

- Mount the brake cylinder on the test stand and tighten the mounting bolts and nuts.
- Set the brake cylinder, piston stroke at **85± 10 mm** and the pressure regulator (2c) at **0.8 Kg/cm^2**.
- Open cock (1c) and let the air be transferred to the brake cylinder till the air pressure reaches upto **0.8 kg/cm^2**. Monitor this pressure with the help of the pressure gauge (6b).
- Close cock (1c) as soon as the pressure reaches upto **0.8 kg/cm^2**.
- Wait for 1 minute till the pressure stabilizes in the gauge (6b). Measure the final pressure in the gauge (6b).
- Check for the pressure drop, which should not be more than **0.1 kg/cm^2** in 10 minutes.
- Open cock (1e).
- Close cock (1c) and open cock (1d).
- Repeat the test by setting the piston stroke at **130±10 mm**. This time the air pressure is to be maintained in the cylinder at **3.8 kg/cm^2** with the help of the pressure regulator (2d) at **3.8 Kg/cm^2**. As above, the leakage should not exceed **0.1 kg/cm^2** in 10 minutes.
- After the test is over, close the cock (1d) and the open cock (1e). This will discharge the brake cylinder.
- Remove the brake cylinder from the test stand.
- If operation is not correct or leakage rate is higher, dismantle the brake cylinder and examine the piston packing wear ring for proper fitment, examine the fitment of the plug for leakage, reassemble the components and retest.

v) 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.

410 DIRT COLLECTOR (See figure 4.7 & 4.8) (Ref. Drg. RDSO. SK-97005)

410a Salient features of Dirt Collector

Dirt Collector is placed in the brake pipe line and feed pipe line at a point from where a branch is taken off to the distributor valve and the auxiliary reservoir . The air entering into the dirt

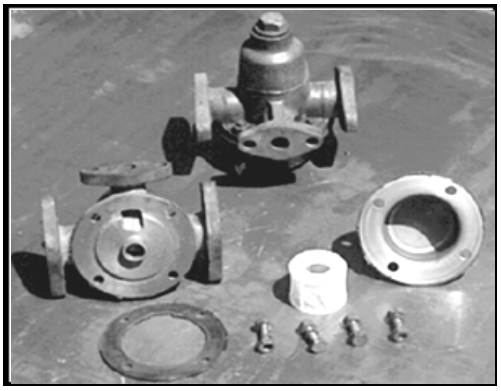


Figure 4.7 - COMPONENTS OF DIRT COLLECTOR

collector from the brake pipe and feed pipe is guided through suitably shaped passages in the 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.

The dirt collector is to be completely dismantled and overhauled in every POH.

410b Tools and Fixtures for overhauling

The following tools and fixtures are required for overhauling:

a) Spanner 19 x 22mm
b) Vice.
c) Screw Driver

410c Procedure for Overhauling

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.

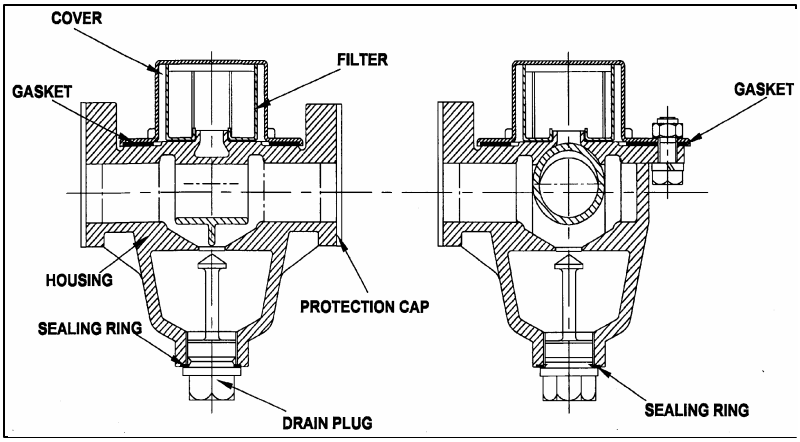


Fig. 4.8 - SECTIONAL VIEW OF DIRT COLLECTOR

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.

410d Testing of Dirt Collector

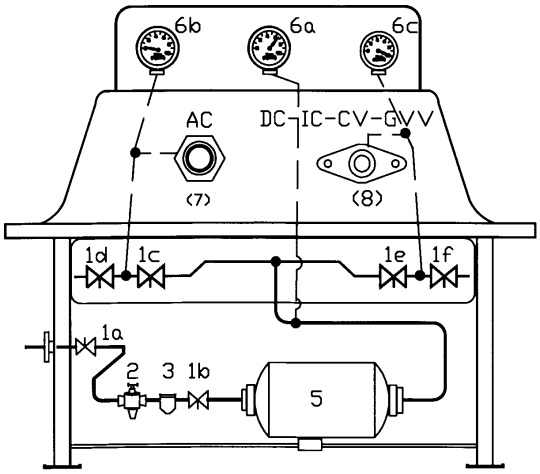
Testing of dirt collector is needed after its overhauling.

i) Tools and Equipment

- Test Bench
- 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.

ii) Test Procedure (refer figure 4.9)

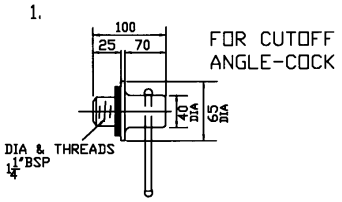
- Mount the dirt collector on base of the test bench.
- Keep cocks (1f), (1c) and 1(e) closed.
- Open cock (1a) and (1b).
- Charge the reservoir (5) to **10 kg/cm^2**.
- Close two openings on the dirt collector using dummy flanges.
- Open cock (1e), check the pressure at (6c). it should be equal to **10 kg/sq. cm**.
- If not develop pressure up to **10 kg/cm^2** by adjusting pressure regulator (2).
- Close cock (1e)
- Check for leak over the body and joints with the help of soap solution, no leak is permitted.
- Also check for pressure drop in gauge 6 (c) - for 3 minutes
- Pressure in the gauge 6c should be maintained.
- Reduce the pressure in the main reservoir (5) to **5 kg/cm^2** by opening cock (1f) and adjusting the pressure regulator (2).
- Close cock (1f) as soon as pressure reaches upto **5 kg/cm^2**.



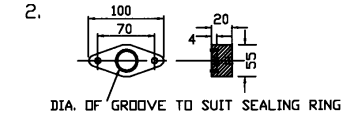
S.NO	DESCRIPTION	NO.OFF
1 (a,b,c,d,e,f)	ISOLATING-COCK	6
2	PRESSURE REGULATOR	1
3	OIL SEPRATOR	1
5	AIR RESERVOIR (40 Lit.)	1
6 (a,b,c)	PRESSURE GAUGE	3
7	BASE FOR AC	1
8	BASE FOR IC/DC/CV/GVV	1

DUMMY PLUG

1.



2.



FOR ISOLATING-COCK &
CHECK-VALVE

3. 2 Nos. LARGE SIZE (OF DESIGN No.2)
FOR DIRT-COLLECTOR

NOTE : ALL DIMENSIONS ARE IN MM.

Fig. 4.9 - TEST BENCH FOR ANGLE COCK, ISOLATING COCK, DIRT COLLECTOR, CHECK VALVE AND GUARD'S EMERGENCY VAN VALVE

- Remove the dummy flange from the outlet port (which feeds to the distributor valve).
- Check for free flow of air from the outlet port. (If air is not flowing freely it means that the filter is choked).
- The pressure will soon exhaust through the outlet port.
- Remove the dirt collector from the test stand.

411 AUXILIARY RESERVOIR (refer figure 4.10)

411a 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 connections. One end of the auxiliary reservoir is connected to the brake pipe through the distributor valve. Auxiliary reservoir is charged through the feed pipe to a pressure of 6kg/sq cm. At the bottom of the auxiliary reservoir, a drain cock is provided for draining out the condensate /moisture. The auxiliary reservoir should be overhauled in every POH.

Note: The dimension & tolerances of the auxiliary reservoir shall be as indicated in latest revision of RDSO drawing number SK-96081.

411b Tools and Equipment for overhauling

Spanner A/F 19x22.
Light hammer

411c Procedure for Overhauling

i) Dismantling

- Unscrew the drain plug and drain cock.
- Drain the water accumulated in the tank.

ii) 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.

iii) Replacement of Parts

- Replace the plug washer.
- Replace the plug if threads are rusted or damaged.

iv) Assembly

Assemble the drain plug with washer by screwing it back into its position

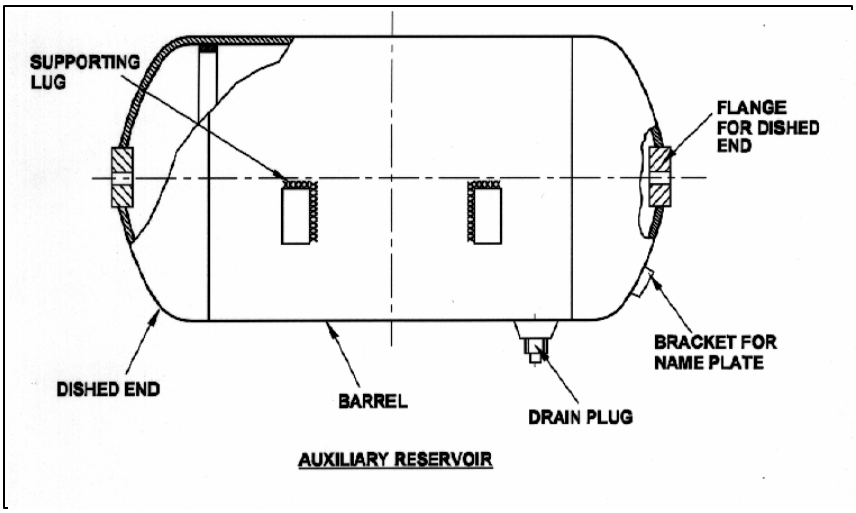


Figure 4.10 – AUXILIARY RESERVOIR

411d Testing of Auxiliary Reservoir

i) 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.

ii) 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 or bulging is permitted.
- Drain out the water completely and allow the reservoir to dry, by directing a jet of air.

411e 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.

412 GUARD'S EMERGENCY BRAKE VALVE (refer figure 4.11)

412a 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. The inlet port of the valve is connected to the brake pipe. In case of an emergency, the guard moves the handle of the guard's emergency brake valve so that it is placed parallel to the inlet pipe. This action causes the air from the brake pipe to be exhausted to the atmosphere through a choke of **5 mm**. The drop in pressure in the brake pipe can also be observed in the air flow meter provided in the locomotive cabin and 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 recharged.

Note: The general design and controlling dimension of guard's emergency valve shall conform to the latest revision of RDSO drawing no SK-73549.

The guard's emergency brake valve should be completely dismantled and overhauled in every POH.

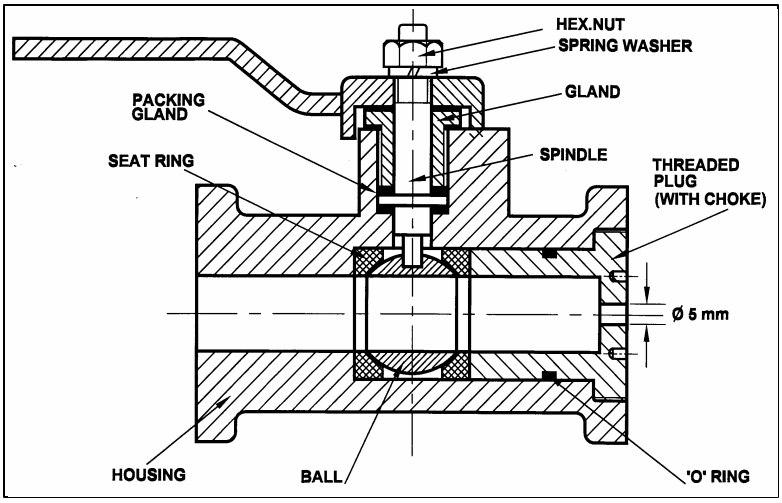


Figure 4.11 – GUARD'S EMERGENCY BRAKE VALVE

412b Tools and Fixtures for overhauling

The following tools and fixtures are required for overhauling

- Test rig/stand
- Spanner A/F 19/22.
- Special spanner for removing thread plug.
- Spanner for removing gland.
- Light hammer
- Vice.

412c Procedure for Overhauling

i) 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.

ii) 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.

iii) 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.

iv) 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.

412d Testing of Guard's Emergency Brake Valve

- After overhauling, fix the valve to the test bench. **(refer figure 4.9 & 4.11)**
- Put the handle of the valve in off position (close position).
- Charge the inlet port with a pressure of **10 Kg./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.

412e Safety Precautions

- Specified tools and fixtures should be used for assembly and dismantling operations.
- Rubber components should be stored in a safe place away from heat, alcohol & acids.
- All metal parts like nuts, washers should be kept in a safe place.

413 SLACK ADJUSTER (see figure 4.12)

413a 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-450 is used in passenger coaches, It is composed of the following parts

- Adjuster spindle with screw thread of quick pitches (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 IRSA-450 are:

Fully Automatic i.e. once initially set, no manual adjustment is further necessary at any time during its operation.

Double-Acting i.e. 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').

Rapid working i.e. correct brake shoe clearance is automatically restored after one or two applications of the brake.

Verification i.e. 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 slack adjuster does not pay out slack immediately, but indexes the amount of slack to be paid out. If the slack really is too small, the slack adjuster will pay out this indexed slack at the next brake application. Thus false payout will not occur.

True Slack Adjuster i.e. 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.

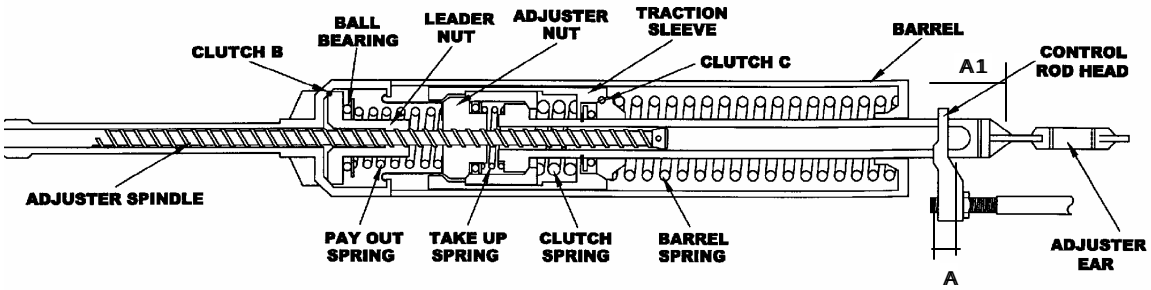
Shock Resistant i.e. Train shocks will not cause false take-up or payout of slack. When brakes are released, the moving parts of the slack adjuster are securely locked.

413b Overhauling of Slack Adjuster

i) 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 pliers (external) (spring type)18 mm to 25 mm-external
(iv) Bend nose pliers (internal) 25 -30 mm –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) SAB test bench



Note: The Slack Adjuster takes up100 mm per braking. Dimension A1 will be 98 + 1/-4 mm (refer G-92)
Figure 4.12 – SLACK ADJUSTER

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413c Procedure for Overhauling

The slack adjuster shall be overhauled at the time of POH of rolling stock. While dimantaling or assembling it is essential to use special tools. Each component of slack adjuster shall be examined. Worn out part shall be checked according to the limits. ***For details, refer RDSO Technical pamphlet No. G-92(October-91).***

The minimum desired characteristic of each spring should be taken as under [Ref: RDSO Technical pamphlet No. G-92 (October-91)]:

Table 4.3

Sr. No	Description of spring	Part No.	Spring length compression	Minimum permissible force
1.	Barrel spring	21	330 mm	140 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.

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)

413d Lubrication

After cleaning and inspection all parts of slack adjuster should be coated with semi-fluid grease SERVOGEM-RR3 or MALMEROL MULTIGREASE LL3 (refer G-92) before undertaking re-assembly.

413e Safety Precautions

The following safety precautions should be observed during overhauling of slack adjuster.

- The place of overhauling must be clean and free from dust.
- Ensure that no foreign matter/particle remain inside the sub-assemblies during re-assembly.
- All rubber gasket, seal ring, washers must be replaced during overhaul.
- Specified tools and fixtures are used for disassembly and assembly operations.

413f Testing of Slack Adjuster (refer figure 4.13)

After overhauling, testing of slack adjuster in carried out in a test rack 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) 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).

ii) Pay-out test

- Turn up control rod and make two brake applications letting the slack adjuster pay out.
- Repeat the above pay in and pay-out tests a couple of times.
- 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.

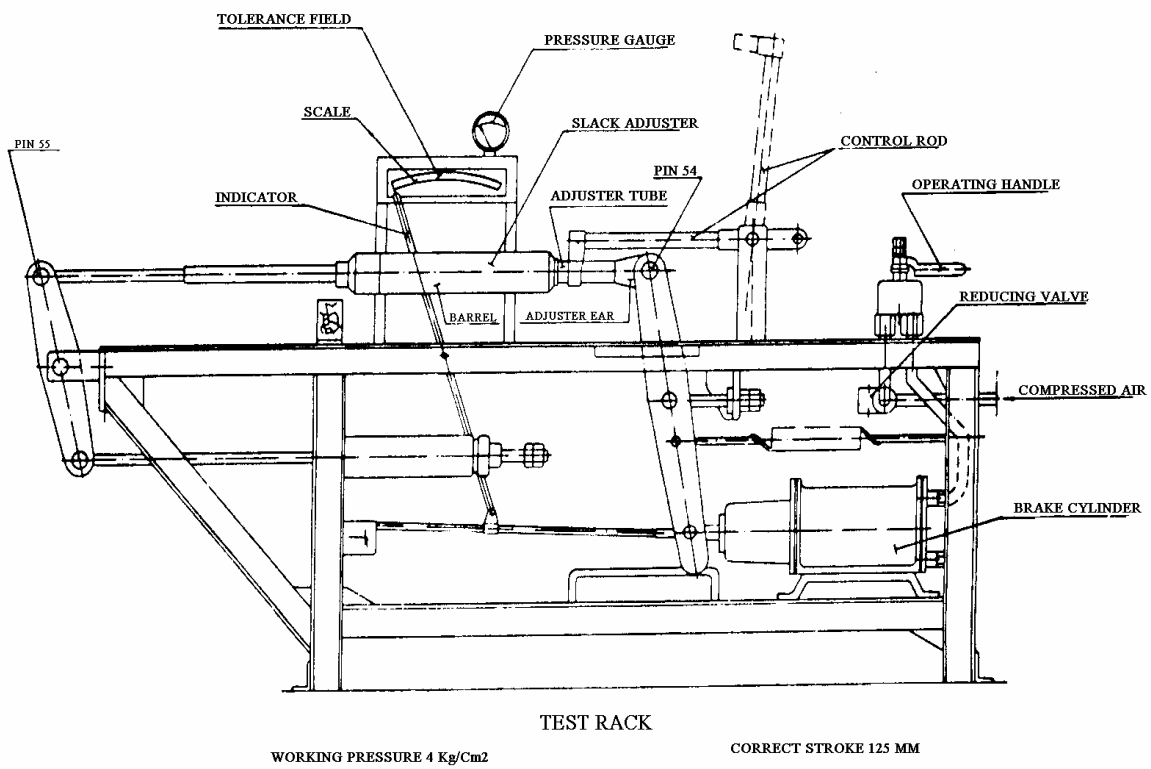


Figure 4.13 – TEST RACK FOR SLACK ADJUSTER

Give adjuster spindle 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. Put the safety collar and secure it with the spring 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 and wipe clean. Then screw the adjuster spindle back into the Slack Adjuster enough to make room for the adjuster ear.

Slide control rod head with control rod on to adjuster tube. Place lock washer on threaded portion of adjuster ear and screw ear into threaded end of adjuster tube.

Note : Hold adjuster tube firmly with a pipe wrench. Secure lock washer. 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.

413g Painting

The slack adjuster is given a coat of anticorrosive paint, excluding the adjuster tube.

Note : The unthreaded portion of the adjuster spindle should not have a thick coating.

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413h 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:-

For 'A' dimension (16 +2/-0 mm for 13 t bogie and 22 +2/-0 mm for 16.25 t bogie) (refer G-92)

(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

1. Remove pin securing the control rod in U bracket.
2. 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.
3. Apply brakes two to three times.
4. Check the 'A' dimension using the gauge.
5. Recheck dimension 'A' with brakes fully released after every brake release.
6. Lock the control rod head firmly with check nut and tooth lock washer.
7. Secure pin with split pin.

For 'e' dimension

(i) If slack is in excess beyond the capacity of slack adjuster (`e' dimension **375+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. **375±25mm**.

413i Safety Precautions

- Always use wedge between wheel and rail before application and release operations for setting and measuring A and e dimension to prevent rolling of coach.
- Ensure no part of the worker's body is in touch with moving brake rigging gears during application and releasing of brakes.
- Do not touch or hold slack adjuster barrel while it is in motion.
- 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 **20 mm**).
- 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.
- 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. **375±25 mm**.

414 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 distributor valve senses drop and rise in brake pipe pressure for brake application and release respectively. It is connected to the brake pipe through branch pipe. Various other components connected to the distributor valve are auxiliary reservoir, brake cylinders and control reservoir.

414a 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 functions.

(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.

Three designs of distributor valves are in use on coaches. These are:

i) C3W Type distributor valve
ii) KE type distributor valve.
iii) P4aG type distributor valve.

415 C3W DISTRIBUTOR VALVE (refer figure 4.14)

The C3W Distributor Valve consists of:

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.

415a Operation of C3w Distributor Valve (Refer Fig 4.14)

For effective functioning of the air brake system, the distributor valve has to operate effectively during

i) Charging stage
ii) Application stage and
iii) Release stage

i) 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. (shown by arrow in figure 4.14)

In addition to this because of BP pressure at top of large diaphragm it presses ring and trigger. This action unlocks the CR release valve by raising upward the locking rod.

Cut Off Valve: As brake pipe pressure enters into the cut off valve it flows through the solex jet 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 come down and valve reach to lap position. The control reservoir pressure now also reaches to 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.

ii) Application Stage

EMERGENCY APPLICATION

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.

Main valve: With drop in BP pressure to **0 kg/cm^2** differential pressure acts across the large diaphragm. As a result the hollow stem is moved in upward direction and pushes the check valve there by opening the passage for entry of auxiliary reservoir pressure at 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.

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 enter the brake cylinder. When the BC pressure rises to **3.8 kg/cm^2** the upwards 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 act 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 this 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 assume lap position with the hollow stem closing further entry of AR pressure.

Cut off valve: In cut off valve the bottom face of the upper diaphragm is

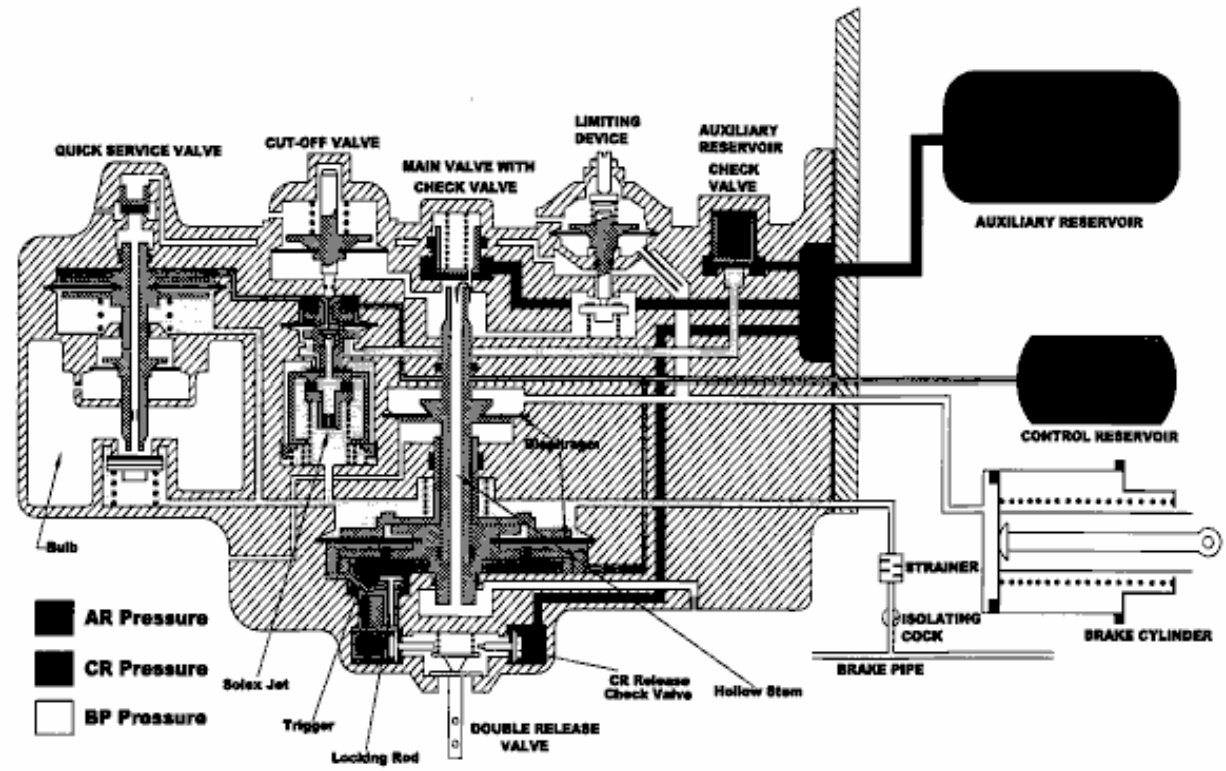


Fig. 4.14 C3W DISTRIBUTOR VALVE

subjected to BC pressure because of which 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, there by isolating it from control reservoir pressure.

Quick Service Valve : In quick service valve BC pressure acts at the top of valve and control reservoir pressure act at top face of upper diaphragm. As a result the stem is pushed down. The valve at the bottom gets opened. Now as the BP pressure inside the DV is at **"O" kg/cm^2** the residue BP pressure from the bulb of quick service valve will flow back and vent to atmosphere with the BP line.

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 the 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.

iii) 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;

Main valve : At the top face of large diaphragm as the BP pressure increases, the hollow stem is moved downward leaving its lap position with check valve. The BC pressure thus finds a passage from top of hollow stem to exhaust to the atmosphere. This action reduces pressure on top of the upper diaphragm and the hollow stem again lifts up to lap position. It close 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.

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.

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 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.

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.

415b Periodicity of Overhauling

The overhauling of the distributor valve is carried out once in five years or on completion of 8 lakh km whichever is earlier or if there is some specific trouble.

415c Overhauling

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:-

a) dismantling and cleaning
b) assembling and testing
c) storage of assembled distributor valve &
d) 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.

415d Tools and Fixture for Overhauling of C3W Distributor Valve

Table 4.5

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

415e 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 annexure no. 4.1.

415f Testing of Distributor Valve (Refer Fig 4.15)

For the proper functioning of the Air Brake System, it is necessary to test the Distributor Valve.

415g 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.

Testing of distributor valve is conducted in two steps i.e. first for single pipe operation and then for twin pipe operation. A distributor valve which is able to pass tests for single pipe operation requires only one or two more tests to show its capability to operate in twin pipe system.

i) Single Pipe operation.

V1 is kept closed during single pipe operation. (Since V1 is the valve which controls supply of air to the feed pipe at 6 Kg/cm^2).

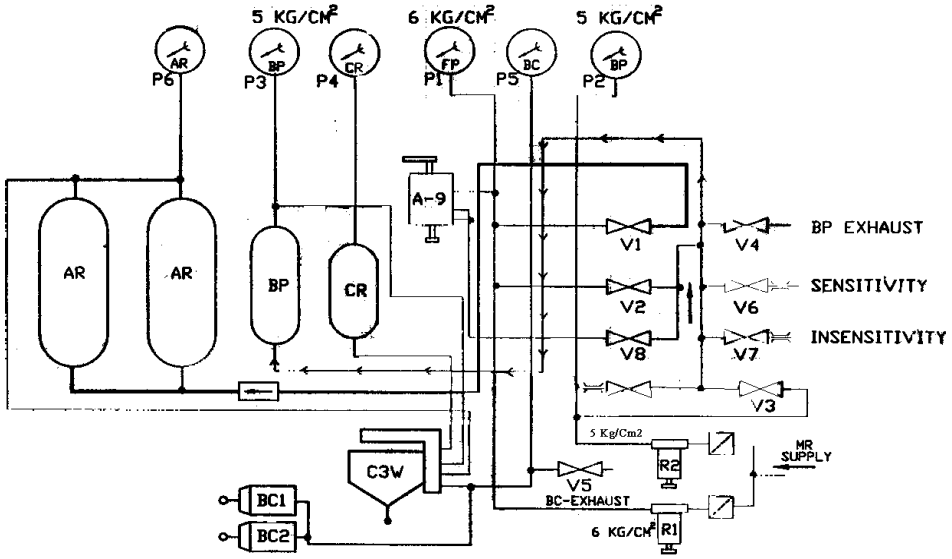


Figure 4.15 -TEST RACK FOR C3W DISTRIBUTOR VALVE

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/cm²** respectively.
c) Check pressure in the feed pipe and the brake pipe by P1 and P2. It should be **6 and 5 Kg/cm²** respectively. If required adjust the pressure regulator R1 and R2 to achieve these pressures before doing testing of DVs.
d) Open isolating cock V3 and with the help of a stop watch, note time taken by gauge P4 (CR) and P6 (AR) to rise from **0 to 4.8 Kg/cm²**
e) For control reservoir, the charging time should be **260±20 seconds** and for auxiliary reservoir it should be **270±30 seconds**.

Pressure tightness test

a) Apply soap water all over the C3W valve body. 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/cm²**. 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.

Full service application and release test.

a) Automatic brake valve should be set at **5 Kg/cm²** (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 **5 Kg/ cm²**.
c) Move A9 handle to service application position , so that P3 (Brake pipe pressure) falls from **5 to 3.4 Kg/cm²**.
d) Switch on the stop watch 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/cm²**. This time should be **3 to 5 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/cm²**.
f) Move A9 handle to release position and switch on the stop watch 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**.

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).

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.

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 stop watch 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**.

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 stop watch as soon as isolating cock V6 is opened and note the time taken by brake application. This time should be **6 seconds**.

Quick service test

Close isolating cock V6 and immediately observe the applied brakes, they should remain applied.

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 stop watch 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.

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.

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 by 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.**

Graduated release test

a) Close isolating cock V6.
b) Increase brake pipe pressure (P3) by 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 press ure (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**.

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.

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.**

ii) Twin pipe operation

- Start test with system completely empty and all the isolating cocks are closed.
- Open isolating cock V1 to charge AR (P6) to **6 Kg/cm^2**.
- Open isolating cock V3 to charge brake pipe (P3) and control reservoir (P4) to **5 Kg/cm^2**.
- Close isolating cock V3 as soon as pressure in gauge P3 and P4 is stabilized.
- Repeat service application & release test and emergency application test as described above.

416 KE DISTRIBUTOR VALVE

416a Operation 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.

(i) Charging Stage (see figure 4.16)

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. In twin pipe air brake system the auxiliary reservoir is also charged through the feed pipe from the rear end.

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 port gets closed by the large diaphragm. Air also flows to the 'A' controller through choke. It passes through sensitivity port 2 and from there to the bottom cover chamber through port 2c. 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 port 2b.

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 **5 kg/cm^2**. Simultaneously the auxiliary reservoir is charged by the feed pipe through dirt collector, isolating cock and check valve with choke to 6kg/cm^2 from the rear end.

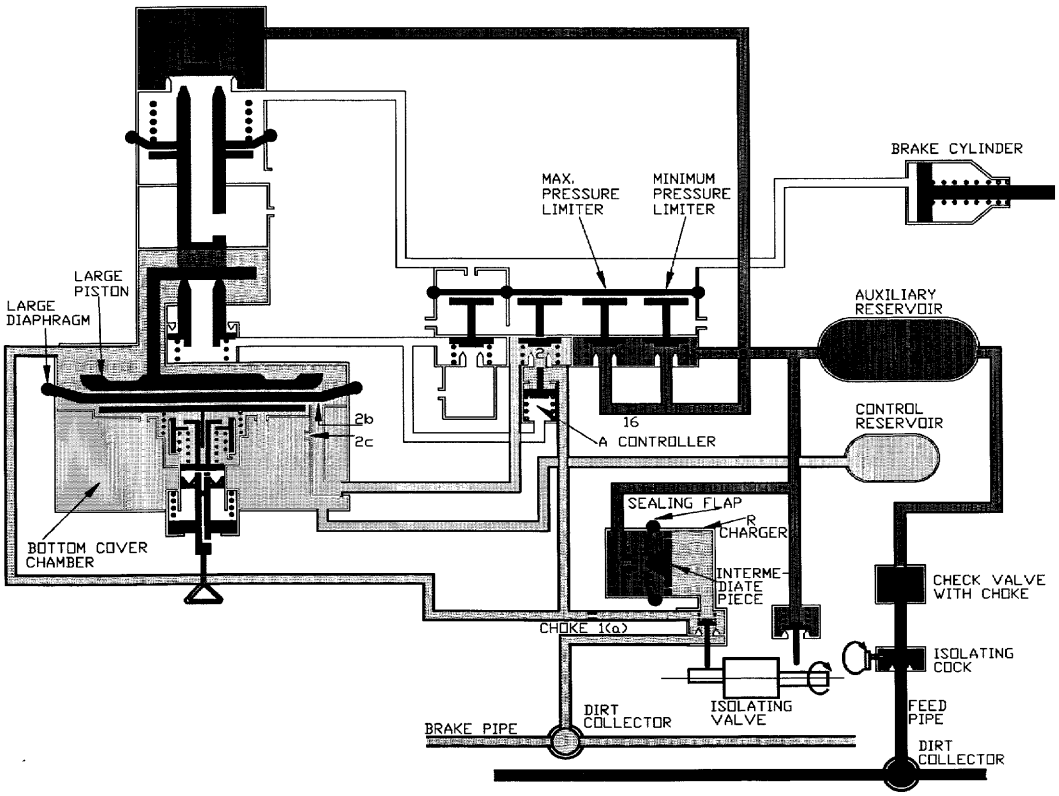


Figure 4.16 - KE DISTRIBUTOR VALVE (CHARGING STAGE)

GO TO CONTENTS CHAPTER CONTENT

ii) Application Stage

The application of brakes can either be emergency, full service or graduated.

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 open inlet port, the minimum pressure limiter, the maximum pressure limiter enters the brake cylinder.

When the pressure in the brake cylinder reaches **0.8 kg/cm^2** the minimum pressure limiter gets closed and there after maximum pressure limiter gets closed when the pressure in the brake cylinder reaches **3.8kg/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 **1.5kg/cm^2** instead of **5kg/cm^2**.

Note: At the beginning i.e. when BP is reduced and control sleeve uplifts outlet port - BP from top of the control sleeve reaches U-chamber already open to atmosphere and some BP thus vent 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 to rise. 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 0.8kg. it closes the minimum pressure limiter and now the rising BC pressure can pass through maximum limiter through choke 16 which regulates the rate of BC rising. As BC reaches **3.8±0.1** maximum pressure limiter also closes and no further rise of BC is possible. (This rise of BC **3.8+.1** come to effect at BP drop **1.5 kg**.)

Graduated application (see figure 4.17)

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.

iii) Release Stage

For releasing the brakes when the pressure in the brake pipe is increased 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 provided. 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.

Note: In twin pipe system during successive application and release of brakes air flows from feed pipe to the auxiliary reservoir directly. Thus the brake pipe pressure feeds directly the three pressure valve. This result in faster rise of brake pipe.

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.

Manual Release

Some times 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 pressure rod and pin are pushed upwards against force of spring. The reservoir and passes through port 48(a) and then from narrow passage 47(a) 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), if 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 1(a) and port (2) so that large piston immediately moves down causing the pin to move to lap position.

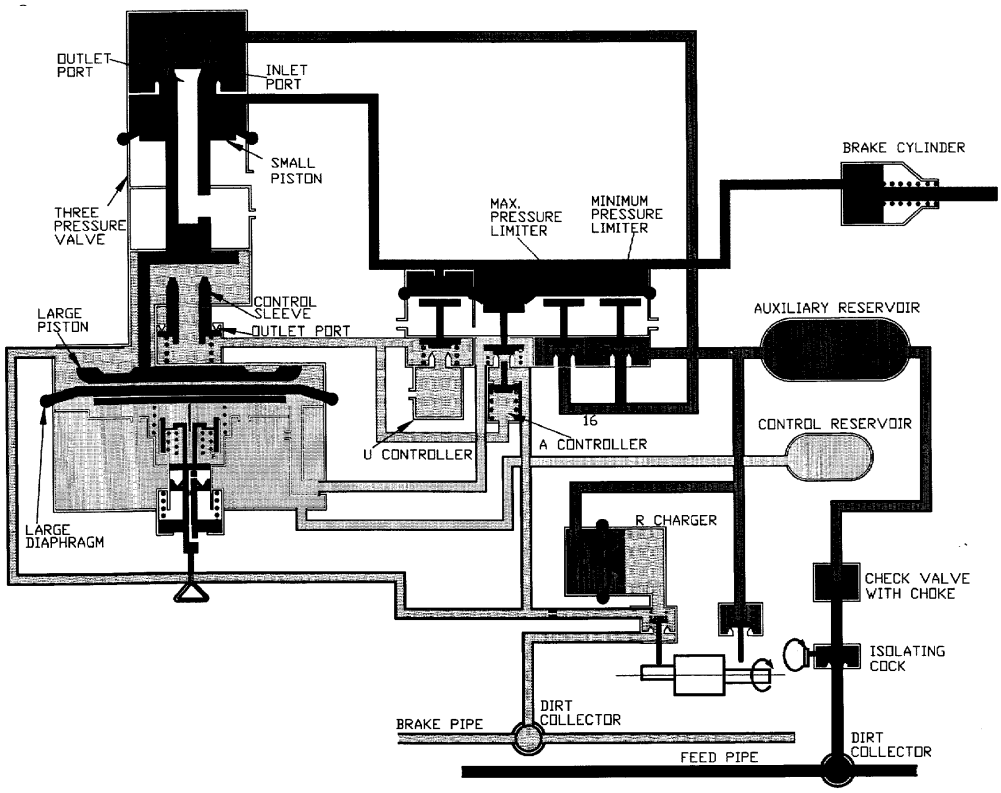


Figure 4.17 - KR DISTRIBUTOR VALVE (GRADUATED APPLICATION)

416b Overhauling procedure

Follows the procedure as given in 415i. For POH kit refer annexure 4.2.

416c Testing of KE type Distributor Valve

The testing of the KE distributor valve is to be done on the same test bench as is used for the C3W distributor valve and following the same procedure as given in 415g. The acceptable values of the various parameters are given in para 417

417 TEST REPORT

PROFORMA FOR C3W/KE DISTRIBUTOR VALVE

Type of Valve …… **Sr. No. ……**

Table 4.6

Sr. No.	Description of Test	Results Required	Observation	
1.	AR Charging Time from 0 to 4.8 Kg/ cm^2 (Main Reservoir pressure > 7.5 Kg/ cm^2)	270+/- 30 sec for C3W (170 +/- 10 sec for KE)		
2.	CR Charging Time from 0 to 4.8 Kg/cm^2 (Main Reservoir pressure >7.5 Kg/cm^2)	260+/- 20 sec for C3W (160 +/- 10 sec for KE)		
3.	Leakage Test (Brake Release) Check DV Leakage by Soap water only at joints.	No Leakage		
	FULL SERVICE APPLICATION & RELEASE			
	Brake Cylinder filling time from 0 to 3.6 Kg/cm^2	3 to 5 seconds		
	Maximum Brake Cylinder Pressure	3.8 +/- 0.1 Kg/cm^2		
	Leakage Test (Application) 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	15 to 20 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	Twin Pipe
	Brake Cylinder filling Time from 0 to 3.6 Kg/cm^2	3 to 5 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	15 to 20 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.		

Sr. No.	Description of Test **REFEEDING**	Results Required	Observation
	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		B.C Pressure
	Continue Graduated Application until max. BC Pressure is obtained BP Pressure at maximum brake application	BP pressure drop must be between 1.4 and 1.6 Kg/cm^2 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.	
	Twin pipe operation. Repeat the test : i). Full service application and release. ii). Emergency application.	Fill in column against test nos. 3 & 6	

418 PASSENGER EMERGENCY ALARM SYSTEM

Passenger emergency alarm system consists of two components:

(i) Passenger Emergency Alarm Signal Device (PEASD).
(ii) Passenger Emergency Alarm Valve (PEAV).

These two components in combination give an indication to the driver that some passenger is in need to stop the train. The indication is transmitted from the coach when the passenger pulls the chain

419 PASSENGER EMERGENCY ALARM SIGNAL DEVICE (refer figure 4.18)

Passenger Emergency Alarm Signal Device (PEASD) is a manually operated pilot vent valve. It is operated through mechanical force exerted by pulling the alarm chain provided inside the coaches for emergency use.

The passenger emergency alarm signal device does not need any maintenance during normal service except when it is found damaged or is due for periodic overhauling.

419a Overhauling

The passenger emergency alarm signal device should be completely dismantled and overhauled during every POH or if there is anysome specific trouble.

419b Tools and equipment

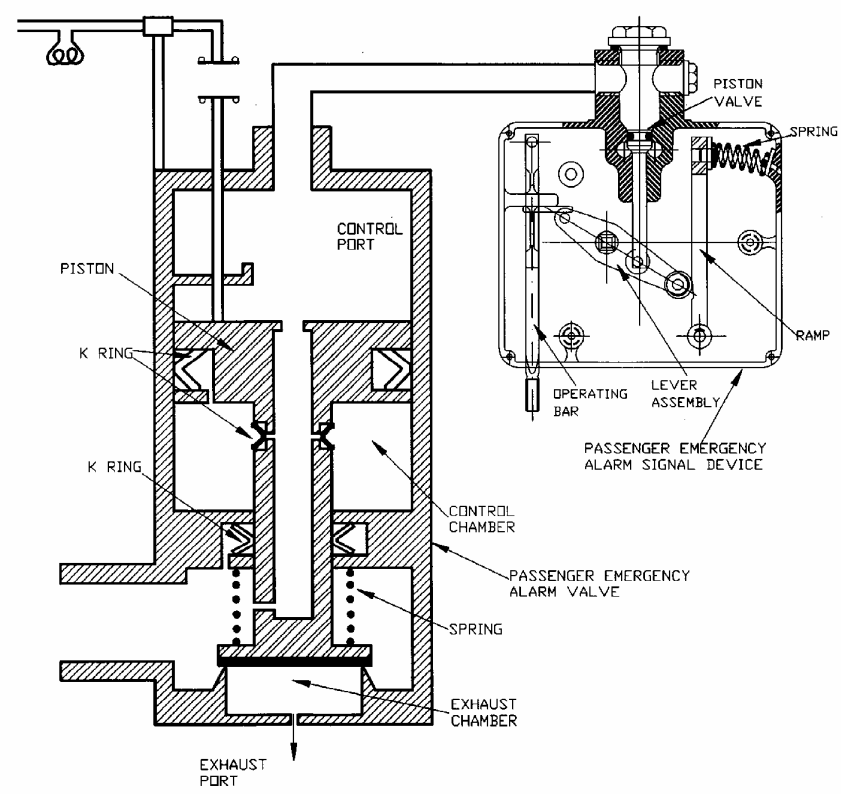
The tools and fixtures required for overhauling of passenger emergency alarm signal device are as follows.

a) Bench vice
b) Working table
c) Screw driver
d) Spanner 30 mm
e) Allen key for M6 and M8 Screw.
f) Open ended spanners -size 14 AF.

419c Disassembly

The passenger emergency alarm signal device after removing from the coach should be disassembled as follows:

- Unscrew 4 Nos. Counter sunk screws and remove the Cover.
- Pull out the sleeve and the lever assembly.



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- Pull out the ramp and the spring slowly.
- Take out the operating spindle assembly.
- Unscrew Stop using suitable spanner and take out the washer, piston and 'O' ring.
- Remove 'O' ring from the piston.

419d Cleaning of Parts

- Clean all the metallic parts using kerosene or equivalent solvent.
- Dry all the components using low-pressure compressed air.
- Ensure smooth scratch less finish of the bore for the displacement of the piston assembly.

419e Replacement of Parts

- Inspect all moving parts for abnormal wear, tear, crack and deformation. Replace the part if found defective.
- Replace the 'O' ring and other rubber parts.
- Replace the spring of ramp in case of cracks, kinks or permanent set.
- Replace damaged threaded screws.

419f Assembly

- To assemble the passenger emergency alarm signal device (PEASD) follow the instruction for disassembly in the reverse sequence.
- Lubricate the pivot, roller and moving parts and ensure smooth operation of the components.

419g Testing of Passenger emergency Alarm Signal Device (refer figure 4.19)

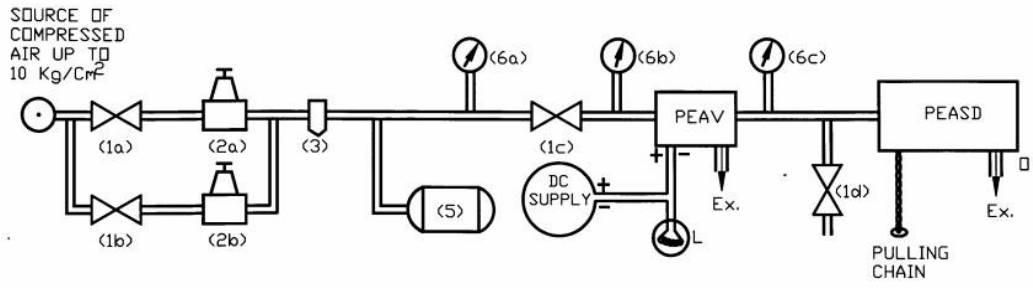
After overhauling of the passenger emergency alarm signal device it is checked for leakage at exhaust port and all over body with soap solution. Also check the mechanical chain pulling for smooth functioning.

A) Leakage Test

i. Close cock (1b) and open cock (1a), to apply air pressure of **10 kg/cm^2**. See that cock (1d) is closed.
ii. See that pressure indicated by the gauge (6a) stabilizes at **10 kg/cm^2**.
iii. Use pressure regulator (2a), if necessary, to adjust the pressure upto **10 kg/cm^2**.
iv. Open cock (1c) and wait till the pressure indicated by the gauges (6a) and (6b) and (6c) stabilizes at 10 kg/sq.cm. Wait for a few more minutes.
v. Check for leakage by applying soap solution all over the body of the pull off box or PEASD.
vi. No leakage is permitted, close cock 1(a) and 1(c), open cock (1d) and discharge the air pressure.

B) Functional Test

i. Close Cock (1d) and open cock (1c).
ii. Open cock (1b) and apply air pressure of **5 kg/cm^2**.
iii. See that the pressure indicated by the gauge (6a) stabilizes at **5 kg/cm^2**.
iv. Use pressure regulator (2b) if necessary to adjust the pressure upto **5 kg/cm^2**.



S.NO.	DESCRIPTION	NO. OFF
1(a,b,c,d)	ISOLATING COCK	4
2a & 2b	PRESSURE REGULATOR	2
3	OIL SEPARATOR	1
5	AIR RESERVOIR(40 litre)	1
6(a,b,c)	PRESSURE GAUGE	3

Fig. 4.19 TEST BENCH SCHEMATIC FOR TESTING PEAV AND PEASD

v. Pull the operating hook. Air pressure should start exhausting through the pull off box (PEASD) and PEAV.

vi. Air pressure inside the reservoir must be vented to atmosphere and gauge (6c) should read **0 kg/sq.cm**.

vii. As soon as pressure starts exhausting, lever of the pull off box should get locked in applied position.

viii. It should not be possible to stop the exhaust pressure without getting the lever locked in applied position.

ix. Reset the pull off box by turning square knob in clock- wise position. Repeat step (i) to (v), there should be no leakage.

420. PASSENGER EMERGENCY ALARM VALVE (PEAV) (refer figure 4.20)

Passenger coaches are fitted with an alarm chain pull arrangement to enable passengers to stop the train by pulling the alarm chain from within the coach in case of any emergency. Alarm chain in turn is connected to the two Passenger Emergency Alarm Signal Device which are situated at either side of one end wall of the coach. PEASD'S are connected to the Passenger Emergency Alarm Valve PEAV through a 10mm control pipe. BP pressure is fed to the PEAV through a 20mm branch pipe. In the event of alarm chain pull air is depleted from the control pipe connecting PEAV and PEASD causing BP pressure to exhaust through the 4mm choke in the PEAV. This causes partial application of brakes.

This drop in pressure in the brake pipe line is also observed in the flow meter fitted in the locomotive for the driver to stop the train.

420a Overhauling of PEAV

For effective and reliable functioning overhauling should be done every POH or if there is any specific trouble.

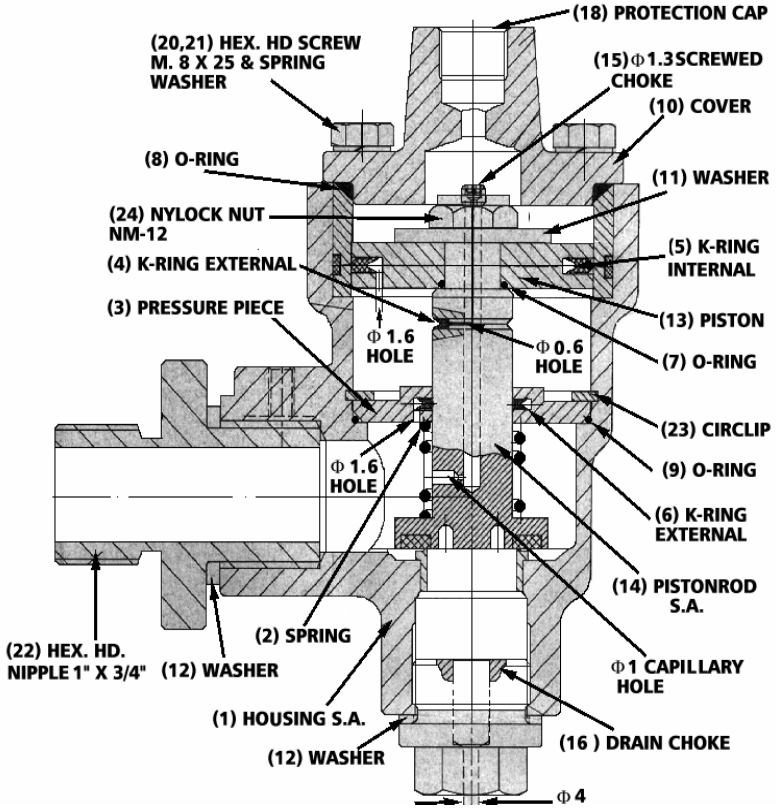


Figure 4.20 : PASSENGER EMERGENCY ALARM VALVE ASSEMBLY

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420b **List of tools and fixtures**

Table 4. 7

S.No	Description
1.	Rotatory PEAV holding fixture clamped on work bench
2.	General tools (A) D/E Spanner (11-13mm), (14-19mm) and (32 -36mm) (B) Socket Spanner with driving handle (11,13,,19mm) (C) Pipe wrench 250 mm (D) Screw Driver (8 mm blade) (E) Needle pokers (0.5, 0.8,1.0 dia) (F) Blunt tool (for K-ring) (G) Internal (long nose) circlip plier
3.	Kerosene tank
4.	Pin End Tool (suitable length and pin size)

420c Procedure for Overhauling

Before dismantling PEAV the outer body should be cleaned to remove dust and dirt by detergent solution followed by drying with air jet.

- Unscrew the Hexagonal Nipple (22) with washer (12) and then clamp the equipment to the holding fixture.
- Keeping the bottom side up unscrew the drain choke (16) with sealing washer (12).
- Turn and lock the PEAV top side up in the fixture and unscrew 4 Nos. Hex Head screw (M8 x 25) and remove cover (10) and 'O' Ring (8).
- Turn the PEAV to horizontal position keeping the top side of the PEAV to your right (or working hand side). Insert the pin-end-tool from the bottom side of PEAV and engage the pins of the tool to the two holes provided on the piston valve end and hold the pin-end-tool.
- With the help of 19 mm socket unscrew the 12 mm nylock nut (24) at the other end of the piston rod (14). Also remove washer (11).
- Push the piston rod to the upper side of the PEAV by the already engaged pin-end-tool against the compressed spring. By this action piston (13) along with K-ring (5) will come to the upper end of the PEAV body. Take out the pin-end-tool and remove the piston (13) with K-ring (5). Also take out 'O' Ring (7).
- Turn the PEAV top side up and with the help of a long nose internal circlip plier carefully take off circlip (23) from its groove (gently press the pressure piece by a screw driver against the spring force while trying to with draw the circlip).
- Take out the piston rod (14) along with K-ring (4), pressure piece (3) with K-ring(6) and spring (2). Also take out 'O' ring (9).
- Separate all the parts of the subassemblies.
- Unscrew the screwed choke (15) at the top end of the piston rod carefully with the screw driver.

Note: Pressed bush and seat bush need not be taken out from the body.

420d Cleaning of parts

- Clean all the metallic parts including housing (1) with a hair brush and kerosene oil and the rubber parts by detergent soap solution.
- Sponge all parts dry by a clean cloth and also remove any residues by dry air jet.
- Clean all the capillary passages on piston (13), pressure piece (3), Piston rod (4), drain choke (16) and the screwed choke (15) with the help of suitable Needle poker and blow air jet through.

420e Inspection and replacement of parts

- Check spring is free of kinks and rust, check free height and spring characteristics.
- Ensure the housing (1) is free of any crack or breakage, and internal bore surface is smooth. Ensure seat of bush is free of any dent or scratch.
- Threaded portion should be free from any damage and threads should not be damaged or wornout.
- Ensure all capillary holes are clear.
- Outer cylindrical surface of the piston rod should be free of scratches and smooth.
- During scheduled overhauling all rubber and rubber bonded parts should be replaced.
- Ensure the grooves for K-rings on piston, pressure piece and piston rod are clean and are not having any deep denting or scratches.

420f Assembly

- Smear light film of grease on all parts.
- Place properly the K-rings 4,5,6 on piston rod, piston and pressure piece respectively. Screw the screwed choke at the top end of piston rod.
- Hold the PEAV housing (1) on the fixture and proceed further assembly by reversing the sequence adopted for dismantling.
- Screw drain choke (16) and Nipple (22) with washers (12) to the valve.
- After assembling the PEAV should be tested for the prescribed performance on a suitable test bench. After testing place suitable protection cap on cover, nipple and drain choke openings to protect entry of dirt and dust into PEAV during storage. Nipple threads shall be suitably protected to avoid damage.

420g Test Procedures for PEAV

- Test bench as shown in the schematic in **fig. 4.19**.
- Source of compressed air at **10Kg/cm^2**.
- 110V DC Supply
- Indicating lamp

i) Electrical Test

This test is to be conducted during application test (functional test).

ii) Leakage Test

- Connect the PEAV to the test bench. When PEAV is being tested, make sure that the passenger emergency signal device fitted on the test bench is already a tested and approved one.
- Fix an operating hook to the signal device operating lever.
- Close cock (1c), (1d) and by opening cock (1a) admit compressed air at a regulated pressure of **10 kg/sq.cm** into the system.
- If required, adjust pressure regulator (2a) so that the gauge (6a) reading stabilizes at **10 kg/cm**.
- Open valve (1c) and charge the PEAV. Apply soap solution all over the alarm valve. No leak is permitted from any part of the body.
- Close (1c) and after waiting for a few minutes check pressure drop in gauge (6b).
- There should not be any drop in pressure in gauge. (6b).
- Close cock (1a) and discharge the PEAV by operating cock (1d).
- Close cock 1(c) and 1(d).

(iii) Functional Test

A) Charging

1. Open cock (1b) and charge the reservoir up to **5 kg/cm^2**, using pressure reducer (2b).
2. Open valve (1c) and charge the PEAV up to **5kg/cm^2**.
3. Wait till gauges (6a) and (6b) and (6c) are stabilized and show the same pressure .
4. These gauges should show a pressure of **5 kg/cm^2** and if the pressure is not equal to **5 kg/cm^2**, adjust the pressure regulator.
5. In this position emergency brake valve is charged.
6. Check leakage from exhaust port `O' of the PEASD, there should not be any leak.
7. Indicating lamp (L) should be off in this position.

B) Application

1. Apply a voltage of 110 V DC to the circuit of the indicating lamp of the PEAV as shown in the figure.
2. Pull the operating hook of the signal device and observe that the air pressure starts venting from both the PEASD and the PEAV from their exhaust ports continuously.
3. The lamp should glow.
4. The gauge (6b) should stabilize at an intermediate reading to balance between the inlet and the exhaust rate of flow of the compressed air.
5. Reset the signal device with the resetting key and note.
6. The venting of air pressure from the exhaust of the signal device should stop. It should also stop from the exhaust of the PEAV and the indication lamp should switch off.
7. The gauge (6b) and (6c) should start building up to **5 kg/sq. cm**.
8. Now again check for leakage all over the alarm valve, especially at the exhaust port. No leakage is permitted.

9. Close cock (1c) and pull the operating hook of the signal device.
10. Wait till gauge (6b) read zero.
11. Disconnect the alarm valve from the test stand and wipe out all soap suds from the device.
12. Close all open ports with suitable closure plugs till further fitment on the coach.

421 CHECK VALVE (see figure 4.21)

Check valve with choke (NON RETURN VALVE) is fitted in the branch line of feed pipe before auxiliary reservoir. Check valve allows flow of air in one direction as indicated by the arrow on the body and reverse flow of air is prevented thus avoiding fall in auxiliary reservoir pressure. A choke of 3 mm is fitted at the outlet port of the valve to have a uniform filling of air in the auxiliary reservoir of all the coaches in a rake. The check valve with choke is completely dismantled and overhauled once in every POH or when there is some specific trouble.

421a Tools and plant

Double ended spanner - A/F 24x27 mm.
Screw Driver – 12"(300 mm)
Vice.

421b Procedure for overhauling

i) Disassembly

- Hold the check valve in a vice.
- Unscrew the cap nut carefully and take out the spring.
- Take out the valve seat and valve assembly from the body. Remove valve seat washer.
- Unscrew the choke of 3mm from the body.

ii) Cleaning of Parts

- Clean the exterior with a jet of air.
- Clean all metal parts with wire brush and kerosene oil.

iii) Replacement of Parts

- Replace all rubber parts.
- Replace the spring if it has kinks or crack mark or if the spring has lost its stiffness or is heavily corroded.
- Replace the choke of 3mm if screwing slot is damaged or threads are heavily corroded.
- Inspect the valve seat of body for any minor scratch and lap the seat to remove such scratch marks.

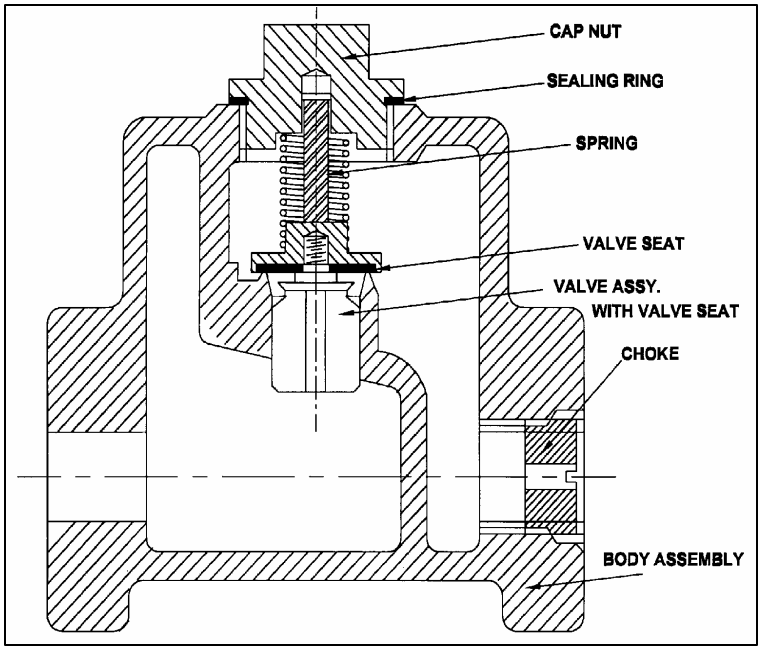


Figure 4.21 CHECK VALVE WITH CHOKE

iv) Assembly

- Fit a new valve seat in the housing, using Araldite.
- Insert the valve assembly in the housing from the top bore of the valve.
- Apply a sealing grease like Aseol Calla or equivalent on the cap threads and screw the cap to the body tightly after fitting spring.
- Apply sealing grease like Aseol Calla or equivalent on the choke threads before screwing it to the outlet port of the body.

v) Testing of check valve with choke

- After overhauling fix the check valve with choke on the test bench.
- Apply air pressure at inlet port in the direction of arrow. Air should freely flow through the outlet port.
- Blank the outlet port and apply air pressure at the inlet port. Check for leakage at cap with soap water solution. No leakage is permitted.
- Connect air supply to the outlet port firstly at 2Kg/cm^2 and afterwards at 5Kg/cm^2. There should be no air flow or leak through the inlet port.

422 ISOLATING COCK (refer figure 4.22)

Ball type isolating cocks are provided on the feed pipe branch line before the auxiliary reservoir as well as on the branch pipe leading to brake cylinders and passenger emergency alarm valve.

Isolating cocks can be operated to cut-off air supply to these equipments as per the service requirements.

In recent coaches ball type isolating cocks vent type is provided on the branch pipe leading to brake cylinder to drain brake cylinder pressure in the event of brake binding.

The isolating cocks are to be completely dismantled and overhauled once in every POH or when there is some specific trouble.

422a Tools & Plant

The following tools and fixtures are required for overhauling.

D/E Spanner A/F 13x14
D/E Spanner A/F 16x17
Special Tool
Vice.

422b **Procedure**

i) Disassembly

- Hold the isolating cock in a vice.
- Unscrew the nut from the stem and take out the handle assembly.
- Unscrew the gland and carefully pull out the stem from the body.
- Remove the two gland packings.
- Using special tool unscrew the plug and remove it from the bore of the body.
- Remove sealing washer from the plug.
- Remove the ball seats and the ball.

ii) 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 i.e. valve seats, ball etc. with nylon bristle brush.
- Clean rubber parts with soap water solution.

iii) Replacement of Parts

- Replace all rubber parts and gland packing etc.
- Replace the ball if heavy scratch marks or dents are found on the surface of the ball.
- Replace if threads of the stem / plug are heavily corroded.

iv) Assembly

- Insert ball seat into its seat in the bore of the body.
- Insert ball after applying a light coat of grease so that the ball fixes on valve seat in to the bore of the body. While inserting the ball, slotted portion to accommodate the stem should face the top of the body.
- Insert the ball seat to touch the ball.
- Assemble the stem from the top hole, after fixing the gland packing in such

Fig. 4.22 ISOLATING COCK

a way the stem tip enters into the ball slot.
- Fit sealing washer on plug.
- Screw the plug into the bore of the body with special tool after greasing the threads with Aseol Calla or equivalent.
- Fix the handle on the stem and fasten it.

422c Testing of ball type isolating cock

- After overhauling fit the isolating cock in the test bench .
- Operate the cock few times for the free movement.
- Close the outlet port with dummy flange.
- Put the handle in open position and apply air pressure at **10Kg/cm^2** from the inlet port. Check for leakage with soap water solution.
- No leakage is permitted.
- Put the handle in off position and check for leakage through the outlet port after removing the dummy flange.
- No leakage is permitted.

423. ROUND TRIP EXAMINATION

Salient Features

(i). Round trip examination is performed on a rake to ensure all equipment and subassemblies of air brake system are properly positioned on each coach of the rake.

(ii). Round trip examination is performed before train leaves the originating station.

(iii). The following maintenance attention is given in the round trip examination.

a). All worn out brake blocks are changed.

b). All the brake rigging pins should be intact and of correct size.

c). Dimension `A' of slack adjuster is adjusted to the specified valve.

d). Hose couplings for brake pipe on consecutive coaches are coupled to one another.

e). Hose coupling for feed pipe on consecutive coaches are coupled to one another.

f). All cut off angle cocks are kept open except those at the rear end of the train.

g). Brake pipe and feed pipe hose coupling at the rear end of the train are placed on their respective hose pipe coupling supports.

h). Isolating cock of distributor valves of all the coaches are in open position.

i). Isolating cocks placed before the auxiliary reservoir, brake cylinders and the passenger emergency alarm valve are in open position**.**

j). Pressure gauges for brake pipe and feed pipe are provided in brake van.

k). No leakage from the auxiliary reservoir, brake cylinder, control reservoir, and dirt collector.

l). Conduct rake test as per annexure 4.6

m). Release brake and see that all the brake cylinder pistons are fully inside.

n). Guard's emergency brake valve provided in brake van is working properly**.**

424. MAINTENANCE SCHEDULE 'A' *(Monthly Examination)*

The following major maintenance works are carried out during the schedule 'A' examination on Air Brake system.

A. All the maintenance activities performed during 'Round Trip Examination' are also carried out under Schedule 'A'. With references to the Air brake system the following activities are carried out.

i) Visual inspection of the rake/ coach is carried out to check any damage on the brake or feed pipe hose coupling or hanging hose pipe; the suspension brackets of air brake equipment and anti-pilferage device provided on the components are also checked for any defects. For example hanging hose pipe is shown in the **figure 4.46**. In case of any damage, the same is attended to / replaced.

ii) The Air Brake sub-assemblies of coaches are cleaned thoroughly from outside. The moving parts such as slack adjuster and brake rigging system are greased.
iii) The sub-assemblies of Air Brake System, such as slack adjuster are checked for 'A' and 'e' Dimensions.
iv) Leakage test is done for brake pipe, feed pipe and its connecting pipes.
v) Service Application and Release test of the rake is performed to ensure full brake power.

B. The Manual Brake Release test is carried out on every coach of the rake, to ensure proper functioning of the release lever, fitted below the distributor valve .

C. Micro Switch Test is performed to ensure that the Cam operated Micro Switch provided on end wall near Passenger Emergency Alarm Signal Device for the audio-visual indication, functions properly.

D. The guard van valve test is carried out on a coach to ensure functioning of the guard van valve during every alternate 'A' schedule.

E. The passenger emergency alarm valve and device test is carried out on a coach to ensure that the passenger emergency alarm valve (PEAV) and passenger emergency alarm signal device (PEASD) work properly in conjunction. This test is carried out in every alternate 'A' schedule.

425 MAINTENANCE SCHEDULE 'B'
(Tri-monthly Examination)

The following maintenance work should be attended during schedule 'B'

A. All the maintenance activities performed during schedule 'A'
B. Thorough inspection and repairs of brake gear components..
C. The alarm chain pull test to ensure proper working of passenger emergency alarm system for partial application of brakes.

426 MAINTENANCE SCHEDULE 'C'
(Half yearly examination)

The coaches of which the schedule 'C' maintenance is expected are required to be detached from the rake and taken to the sick line. The following maintenance work of Air Brake System needs to be attended during schedule 'C' examination.

A. All the maintenance activities performed during schedule 'B'
B. Thorough checks of slack adjusters for any damage and mal-functioning and subsequent replacement.
C. Testing of pressure gauges and replacement of the defective or inaccurate gauge (for SLR/ Guard compartment).
D. Apart from above maintenance activities, the coaches that are brought for Schedule 'C' maintenance are subjected to 'Single Car Test'.

Annexure 4.1

POH KIT FOR C3W DISTRIBUTOR VALVE

(M/s. Stone India Ltd., SAB Wabco (I) Ltd., Greysham & Co.)

S. No.	Description	WABCO Part No.	No. per set
01	Diaphragm	19185800	1
02	Diaphragm	19184900	1
03	Lip seal	70581800	2
04	“O” ring	70523903	5
05	Valve body assembly	19022000	1
06	“O” ring	70524914	1
07	“O” ring	70501278	2
08	“O” ring	70513278	1
09	“O” ring	70513478	1
10	“O” ring	70501178	1
11	“O” ring	70481903	1
12	Check valve	19187400	1
13	Check valve	19187300	1
14	Sealing ring	19187900	2
15	Seal	19196400	1
16	Diaphragm	18301900	1
17	Valve assembly	19194200	1
18	Jet valve assembly	18988800	1
19	Valve assembly	18988700	1
20	“O” ring	70521578	1
21	“O” ring	70521203	1
22	“O” ring	70525578	1
23	“O” ring	70525278	1
24	Valve	19011600	1
25	Valve assembly	19011500	1
26	Diaphragm	19189400	1
27	Seal	19191400	1
28	Valve assembly	19191700	1
29	Seal	70516478	2
30	'O' ring	70516478	1
31	'O' ring	70512878	1
32	'O' ring	70509178	1
33	Washer	19192001	1
34	Cap	19192100	1
35	'O' ring	70037803	1
36	Valve assembly	19192301	1
37	Main gasket	11746000	1
38	'O' ring	70503302	1
39	Filter	19184001	1
40	Filter	78768600	1

Annexure 4.2

POH KIT FOR KPISL DISTRIBUTOR VALVE
(M/s. Escorts Ltd., Knorr Bremse (I) Pvt. Ltd.)

S.No.	Descripotion	Part No.	Qty
1	Filter	4	1
2	Sealing ring	5	1
3	"O" ring	12	1
4	Diaphragm	16	1
5	Seal	19	1
6	Grooved ring	25	2
7	Seal	26	1
8	Sealing ring	27 or 90	1
9	Diaphragm	31	1
10	Valve head	33	3
11	Grooved ring	35	4
12	Flat sealing ring	36	1
13	Flat sealing ring	42	1
14	Sealing ring	44	1
15	Sealing ring	46	1
16	Flat sealing ring	47	3
17	Grooved ring	49	3
18	Valve head	65	1
19	"K" ring	54	1
20	Diaphragm	69	1
21	Fine filter	72	1
22	Flat sealing ring	75	1
23	Sealing ring	77	1
24	Fine filter	82	4
25	Sealing ring	85	2
26	Diaphragm	99	1
27	"K" ring	101	1
28	Grooved ring	103	1
29	Filter	118	1
30	Sealing ring	120	1
31	Flat sealing ring	127	1
32	Valve rod	129	1
33	Sealing cap	133	1
34	Flat sealing ring	140	1
35	Seal	142	1
36	Flat sealing ring	148	1
37	Valve tappet	149	1
38	Sealing ring	170	3
39	Seal	174	1
40	Toothed ring	57	2
41	Valve plate	10	1
42	Control sleeve	53	1
43	Valve plate	56	1
44	Supporting ring	55	1

Annexure 4.3

POH KIT FOR CUT OFF ANGLE COCK
(RDSO SK – Wd – 88123 . S.02 alt. 4)

S. No.	Description	Drg. No.	Qty / kit
1	**Seat**	RDSO SK – WD– 88123.S.02 alt. 4 item 7	02
2	**"O" ring**	RDSO SK – WD– 88123.S.02 alt. 4 item 5	01
3	**"O" ring**	RDSO SK – WD– 88123.S.02 alt. 4 item	02
4	**Spring**	RDSO SK – WD-88123.S.02 a lt. 4 item 8	01

POH KIT FOR 2 WAY DIRT COLLECTOR

S. No.	Description	Drg. No.	Qty / kit
1	Gasket	RDSO SK – WD– 92051.S.05 Sheet No. 2 item 4	1
2	Filter	RDSO SK- WD-97005 Sheet No. 2 item 3 & 4	1 each
3	Washer	RDSO SK – WD – 92051 –S-05 Sheet No. 2 item 5	1

POH KIT FOR ISOLATING COCK

S. No.	Description	Drg. No.	Qty / kit
1	Seat ring	RDSO SK – 97003 alt. 3 item 4	02
2	Sealing ring	RDSO SK – 97003 alt. 3 item 5	01
3	Gland packing	RDSO SK – 97003 alt.. 3 item 7	01

POH KIT FOR BRAKE CYLINDER 14"

S. No.	Description	Drg. No.	Qty / kit
1	Piston packing 14 " dia.	RDSO SK – WD – 92051 .S. 10	01
2	Wear ring	RDSO SK – WD – 92051 .S. 09 item 3 alt.1	01

POH KIT FOR ½" DRAIN COCK

S. No.	Description	Drg. No.	Qty / kit
1	Sealing ring	RDSO SK – 98003 item 2	01
2	Round cord ring	RDSO SK – 98003 item 4	01
3	Round cord ring	RDSO SK – 98003 item 11	01

ANNEXURE 4.4

SINGLE CAR TEST

Single Car Test' is performed on a coach to ensure proper functioning of Air Brake System. It is generally performed on the sick coach that are attended on the sick line or on the coaches that are subjected to primary maintenance schedule 'C'. Single car test is also carried out after Periodic Overhauling and after every change of distributor valve in the workshop. A photograph of a single car test rig coupled to a coach is shown in Figure 1.

Note : Whenever any subassembly of the air brake system on a coach is changed, it is recommended that single car testing must be done for the coach.

The different tests performed during single car test of a coach:-

Test1: Leakage Test.
Test2: Sensitivity and Insensitivity Test.
Test3: Brake Application and Release Test.
Test4: Graduated Application and Release Test.
Test5: Emergency Brake Application Test.
Test6: Passenger Emergency Valve Test.
Test7: Guard's Emergency valve Test
Test8: Check and adjust Slack Adjuster.

1. TOOLS & EQUIPMENTS

- Single Car Test Rig.
- Spanners 10mm, 12mm

2. CONCEPT

Single Car Test is performed, by using a portable device called 'Single Car Test Rig'. This test rig provides all facilities like that of a driver's brake valve. The source of compressed air for test rig is through a compressor installed insick lines for conducting various tests without the need of a locomotive. A schematic layout of 'Single Car Test Rig' is shown in **figure 2**



Figure 1

3. PREPARATION FOR TEST

i) Place the coach on the pit line for single car test.
ii) Arrange the single car test rig device near the coach.
iii) Ensure adequate air supply so that steady pressure of **7.5 kg/cm^2** is maintained at the inlet of single car test device.
iv) Close isolating cock of the distributor valve and the pipe connected between the compressor and Single Car Test Device (SCTD).
v) Open cut off angle cocks of both BP and FP on both ends of the coach.
vi) Connect the near end of coach under test, to the test rig by connecting both brake pipe (BP) and feed pipe (FP) through coupling heads.
vii) Open isolating cock (2) and (5) of the test rig that are connected to feed pipe and brake pipe of the coach. Open isolating cock (15) also.
viii) Blow air into both BP and FP to scavenge the pipes.
ix) Open dirt chamber of the Dirt Collector and clean the accumulated dirt and moisture, after cutting off air supply. Re-assemble the dirt collector.

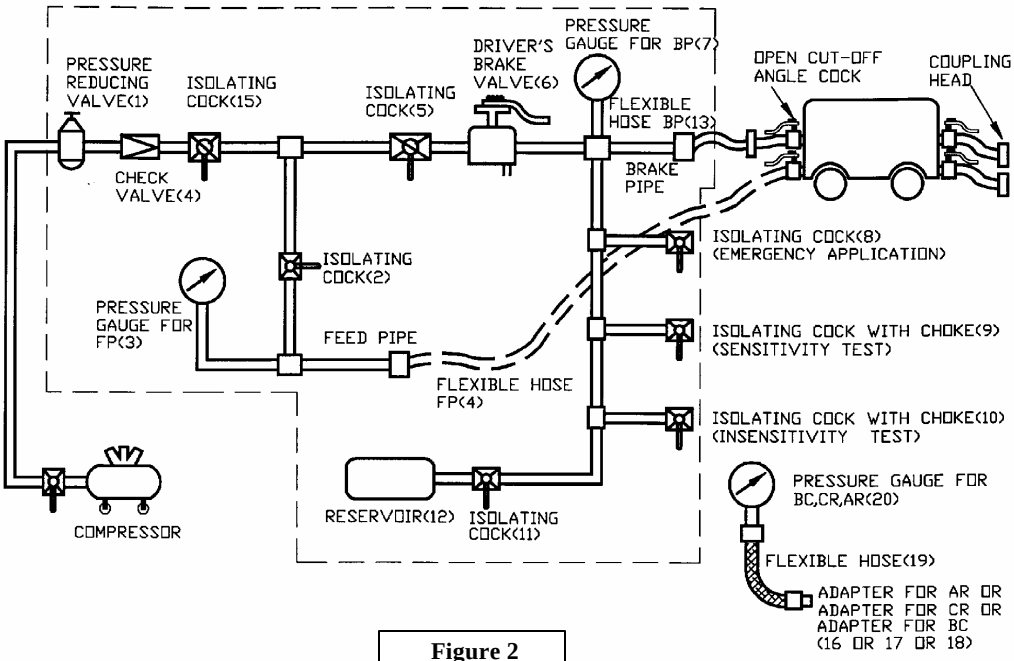


Figure 2

x) Connect dummy coupling to BP and FP hose coupling on the far end of the coach. Close isolating cock (2) and (5).

xi) Connect pressure gauges on Auxiliary reservoir and brake cylinders.

xii) Open isolating cocks (2) and (5) of the test rig that are connected to feed pipe and brake pipe of the coach. Close the isolating cocks (8),(9),(10) and (11) of the Test rig.

xiii) Open isolating cock of the distributor valve.

xiv) Open the BP and FP angle cocks of the near end of the coach

xv) Close both angle cocks at the other end of the coach.

xvi) Keep the driver's brake valve handle in release position and charge the system. Check BP and FP pressures of the test rig and these should be **5 +/-0.1 kg/cm^2** and **6 +/-0.1 kg/cm^2** respectively. Wait for 3 minutes to ensure stabilized pressure.

xvii) Before conducting the tests it is important to ensure that the entire Test Rig is pressure tight.

4.0 TESTS

4.1 Test1: Leakage Test

- Close cock (5) of the test rig and record the drop in BP pressure for 3 minutes. The drop should not exceed **0.2 kg/cm^2** in one minute.
- Close FP cock (2) and record the drop. It should not exceed 0.2 kg/cm^2 in one minute.
- Joints/connections to sub-assemblies. It should be tested with soap water for ascertaining leakage. Any leakage found should be rectified.

4.2 Test2: Sensitivity and Insensitivity Test

i) Open cocks (2), (5) and (11) of the test rig, to fully charge the system including the reservoir.

ii) Close cock (5) and open cock (9) to reduce the air pressure in the BP choke at the rate of **0.6 kg/cm^2 in 6 seconds**.

iii) Check sensitivity by recording the time within which brakes get applied.

iv) Close cock (9), after the test.

v) Open cock (5) and charge the air brake system till brakes are released.

vi) Close cock (5) and now open cock (10) to reduce the air pressure in the BP choke at the rate of **0.3 kg/cm^2**

vii) Check the insensitivity by recording the time within which the brakes do not apply.

viii) Close cock (10) and (11) of the test rig, after the test.

4.3 Test3:Brake Application and Release Test

i) Open cocks (2) and (5) of the test rig, and charge the system for 5 minutes.

ii) Keep brake application to full service position by driver's brake valve on the test rig.

iii) Record the Brake Cylinder (BC) filling time for BC pressure rising from **0 to 3.6 kg/cm^2**. The filling time should be between 3 to 5 seconds.

iv) Record the maximum BC pressure when it get stabilized, which should be **3.8 +/-0.1 kg/cm^2**.

v) Record the BC piston stroke and check that brake blocks are binding on wheels. Piston stroke should be between 85 to 130 mm.

vi) Release the brakes through driver's brake valve by charging the BP to 5kg/cm^2, after conducting the test.

vii) Record the draining time of both the cylinders for BC pressure dropping from **3.8 to 0.4 kg/cm^2**,. This should be between **15 to 20 seconds**. The piston should reach initial position and brake blocks should gets released fully.

4.4 Test4 : Graduated Application and Release Test

i) Charge the brake pipe and feed pipe at **5 kg/cm^2** and **6 kg/cm^2** respectively.

ii) Apply brake in steps by driver's brake valve handle and record the Brake Pipe Pressure (BP) and the Brake Cylinder (BC) pressure.

iii) BC pressure should rise in steps and BP pressure should decrease in steps.

iv) Release the brakes in steps by driver's brake valve handle and record the BP and BC pressure.

v) BC pressure should decrease in steps and BP pressure should rise in steps. When the BP pressure rises to **4.85 kg/cm^2** the BC will get fully released.

4.5 Test5 : Emergency Brake Application and Release Test

i) Charge fully the Air Brake system of the coach by opening cock (5) of the test rig.

ii) Open cock (8) for emergency application.

iii) Record the Brake Cylinder (BC) pressure and check for any leakage in BC for **5 minutes**.

iv) Pull the manual release handle for a short time (about 10 seconds).

v) Check BC pressure drops to zero.

vi) Close cock (8) and open cock (5) of the test rig, after the test is over.

4.6 Test6: Passenger Emergency Valve Test

- Open cock (5) and (2) of the test rig and charge the brake pipe and feed pipe at **5 kg/cm^2** and **6 kg/cm^2** respectively.
- Pull the alarm chain from inside the coach.
- Observe alarm disc rotates situated on the end wall.
- Observe air exhaust with hissing sound from (pilot valve) PEASD and PEAV that are connected to the Brake Pipe (BP).
- Observe partial brake gets applied.
- Observe that the Micro/limit switch operates and indication lamp on the coach glows.
- Observe the drop in brake pipe pressure on the test rig.
- Reset the alarm signal disc with the help of resetting key or with the fixed key.
- Hissing sound should stop and brakes should get released.

4.7 Test7: Guard's Emergency Van Valve Test

i) Open cock (5) and (2) of the test rig and charge the brake pipe and feed pipe at **5 kg/cm^2** and **6 kg/cm^2** respectively.

ii) Close cock (5) and then operate guard's Valve handle.

iii) Observe the air from Brake Pipe (BP), exhausts with hissing sound and the brakes in the guard van gets applied depending on exhaust of air.

iv) Reset the handle and observe the exhaust of air stops.

v) Observe and note the drop in BP pressures on test rig.

vi) Observe simultaneous drop of BP and FP pressure gauges provided in guard's Van.

vii) Close the Guard's van valve.

viii) Observe standard safety precautions.

4.8 Test8:Check and Adjust Slack Adjuster

a) Control Dimension 'A' for slack Adjuster

Slack adjuster is a device for automatic adjustment of the clearances between the wheel and the brake blocks. It quickly adjusts to; too large or too small clearances to the pre-determined value-dimension 'A' during application and release of brake.

Procedure

i) Ensure the air brake is in fully released condition and the brake rigging is in proper condition.

ii) Apply brake three to four times to ease the rigging, by dropping the air pressure in the brake pipe.

iii) Ensure once again the brake rigging in full release condition.

iv) Set the dimension 'A' between the control rod head and the barrel head to **16 + 2/-0 mm for 13t bogies** and **22 +2/-0 mm for 16.25 bogies**.

v) Remove pin securing the control rod in the 'U' bracket.

vi) Detach control rod and rotate to enable refitting control rod and pin when the dimension 'A' is correct.

vii) Apply brake few times at correct brake pipe pressure.

viii) Check the limits specified.

ix) Recheck dimension 'A' with brakes fully released and correct, if necessary.

x) Lock the control rod head firmly with nut and tooth lock washer. Secure pin with split pin.

xi) Observe the necessary safety precautions.

b) Dimension 'e' of Slack Adjuster.

The dimension 'e' which is **375 +/-25mm** represents the capacity available for adjustment and will decrease as wear takes place at the brake shoes , wheels and pin joints.

The maximum value of dimension 'e' should be within the permissible limits for each value when:

i) All brake shoes are new.

ii) All pin joints have new pins and bushes.

iii) All wheels are new.

iv) Adjust the length of one of the pull rods and piston stroke is checked again, if dimension 'e' is not within permissible limits.

5. PROFORMA FOR SINGLE CAR TEST

PROFORMA FOR SINGLE CAR TEST

Coach No.:
Type of DV:
BP pressure:
FP pressure:

	Check	Specified	Actual
1.	Leakage Rate a) Brake pipe b) Feed pipe	 0.2 kg/cm^2/min (max.) 0.2 kg/cm^2/min (max.)	
2.	a) Brake cylinder filling time (from 0 to 3.6 kg/cm^2 b) Max. BC pressure	3 to 5 seconds 3.8 +/-0.1 kg/cm^2	
3.	Brake cylinder release time (from 3.8 to 0.4 kg/cm^2)	15 to 20 seconds	
4.	Sensitivity and insensitivity a) Brake application when BP is reduced at the rate of 0.6 kg/cm^2 in 6 seconds b) Brake application when BP is reduced at the rate of 0.3 kg/cm^2 in 60 seconds	 Brake should apply Brake should not apply	
5.	Emergency brake application and release Maximum brake cylinder pressure Manual release of brake cylinder after emergency	3.8 +/-0.1kg/cm^2 Brake cylinder should get fully released	
6.	Graduated application and release a) Application b) Leakage in BC pressure in 5 minutes after emergency application c) Release	BP pressure decreases in steps and BC pressure builds up in steps 0.1 kg/cm^2 within 5 minutes BP pressure increases in steps and BC pressure reduces in steps	
7.	Piston stroke	85 to 130 mm	
8.	Passenger alarm system Pull the handle Reset PEASD	1) Air to exhaust from PEAV & PEASD 2) Brakes should apply 3) Coach indication light should glow Exhaust of air should stop and indication light should extinguish	
9.	Guard's emergency valve test a) Operate Guard's valve handle b) Normalise the handle c) Testing of BP and FP gauge in guard's compartment	1) BP air to exhaust 2) Brakes should apply Air exhaust to stop Gauges should register variation in BP and FP pressure	

ANNEXURE 4.5

RAKE TEST

The Air Brake system of the rake, that are brought at primary/ secondary maintenance depot, on every round trip should be tested by using a 'Test Rig' or with a locomotive. The test rig is as shown in **figure 1.**

The different activities/tests that are performed on the air brake assemblies of the rake are as follows:

A. Carry out Visual Examination.

B. Prepare set up (Rig) for rake Test.

C. Leakage, Service Application and Release Test.

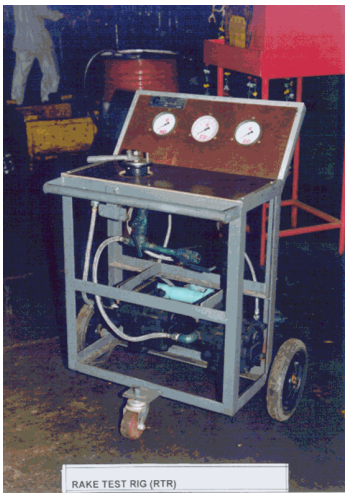


Figure 1 : Rake Test Rig

1. CARRY OUT VISUAL EXAMINATION

a) **Procedure**

- Check any loose suspension brackets and anti-pilferage devices of all air brake subassemblies
- Visually inspect for any problem/ damage in the brake or feed pipe hose pipe/coupling etc.
- Rectify or replace the problematic part/subassembly.

2. PREPARE SET UP FOR RAKE TEST

a) Concept

Rake Test can be performed, by using a portable device called 'Test Rig' or by a locomotive. The source of compressed air supply to the test rig is through a compressor installed in the sick lines . A schematic layout of 'Test Rig' is shown in figure 2.

b) Procedure (see figure 2)

The necessary pre-requisite activities to perform rake test are as given under:-

- Transport the rake in the primary maintenance depot for rake test.
- Take the test rig near the rake.
- Connect the near end of the first coach under test, to the test rig / locomotive by connecting both the brake pipe (BP) and feed pipe (FP) through coupling heads.
- Connect dummy coupling to BP and FP hose coupling on the far end of the last coach on the rake, if the brake van is not connected along with the rake.
- Open isolating cocks (2) and (5) of the test rig that are connected to feed pipe and brake pipe of the first coach. Close the isolating cocks (8),(9),(10) and (11). Or
- In the case of locomotive charge the brake pipe with 5kg/cm^2 pressure by placing DBV at releasing and running position. Then open the cock charging the feed pipe at **6.0 kg/cm^2.**
- Open the BP and FP angle cocks of the near end of the first coach and all subsequent coaches of the rake.
- Close both angle cocks at the rear end of the last coach.
- Keep the driver's brake valve handle in release position and charge the system for 5 minutes. Check BP and FP pressures and these should be **5 +/-0.1 kg/cm^2** and **6 +/-0.1 kg/cm^2** respectively.

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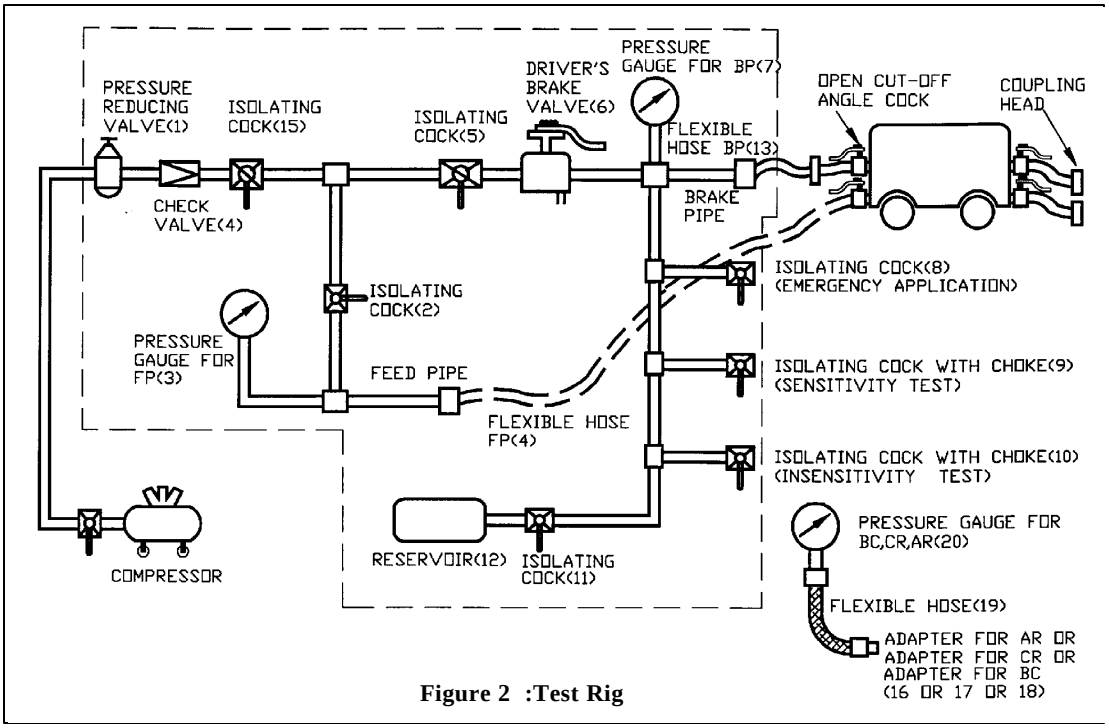


Figure 2 :Test Rig

3. LEAKAGE, SERVICE APPLICATION AND RELEASE TEST

- Cut off the supply of compressed air by closing cock (2) and (5) of the test rig. or cut off the supply of compressed air by operating DBV and the isolating cock charging brake pipe and feed pipe (if test is being conducted with the locomotive)
- If tested through the locomotive, excessive leakage will be indicated in the drivers air flow indicator installed in the locomotive.
- Watch the drop in pressure due to leakage in the pressure gauges of the guard van or the pressure gauge attached, for 3 minutes and record the drop in pressure.
- Drop in pressure of more than **0.2 kg/cm^2** per minute, indicates that there is leakage in the system.
- Examine the coaches using soap water and listening for hissing sound.
- Identify the leakage and take necessary remedial measures.
- Charge the Air Brake System to the required air pressure through the test rig again.
- Open the isolating cock for brake pipe and feed pipe of the test rig and make a full service application of brakes by reducing the brake pipe pressure by **1.5 kg/cm^2.**Or in the case of locomotive charge the brake pipe with **5 kg/cm^2** pressure by placing DBV at releasing and running position. Then open the cock charging the feed pipe at **6.0 kg/cm^2**. Make a full service application of brakes by DBV.
- Check the piston strokes of brake cylinders of all the coaches of the rake. The piston should be in applied position.
- Record the piston stroke.
- Release the brakes by charging the brake pipe to **5 kg/cm^2**.
- The pistons of all the brake cylinders should come to release position
- Identify and rectify the defects by repairing or replacing of defective assembly.
- Close the angle cock (2) and (5) of the test rig.
- Detach the brake pipe and feed pipe hose coupling connected to the test rig.
- Observe the required safety precautions.
- Record the results in the Proforma .

PROFORMA FOR RAKE TEST

Coach No.:
Type of DV:
BP pressure:
FP pressure:

	Check	**Specified**	**Actual**
1.	Leakage Rate a) Brake pipe b) Feed pipe	 0.2 kg/cm^2/min (max.) 0.2 kg/cm^2/min (max.)	
2.	Service Application and Release Test a) Brake application when B.P. pressure reduced to 1.5 Kg/cm^2 b) Observe Piston stroke of brake cylinder c) Record the piston stroke	 Brake should apply Piston in applied position	

CHAPTER 5

VACUUM BRAKE SYSTEM

501 GENERAL DESCRIPTION

501a Vacuum brake system has been improved gradually over the years by increasing the brake rigging ratio, effecting modifications to the vacuum brake cylinders, hose pipe cages and adopting direct admission valves and slack adjusters **(See figure 5.1)**.

502 MAINTENANCE AT WORKSHOP

502a During POH all components of the brake gear system shall be examined, repaired and replaced as necessary. The pins and bushes shall be examined for wear and replaced if the radial clearance exceeds **0.75 mm**.

502b Following items should receive particular attention during POH:

i) Safety brackets provided for brake gear components should be in accordance with the approved drawings and shall be examined for proper condition and secured according to the prescribed method.

ii) Vacuum cylinders and their trunnion brackets, vacuum reservoirs and train pipes, rubber hose & syphon pipes, alarm chain apparatus including the chain, disc and locking arrangement, brake beams, hangers, and brake blocks shall be secured as prescribed. All brake gear pins (should be chromium plated) shall be secured with washers and split cotters.

iii) Vacuum gauges shall be properly tested and adjusted using master gauges before being fitted.

503 LIFTING SHOP

503a After lifting the coach body and placing it on trestles, dismantle the following parts of the vacuum brake system and send to the respective repair/ maintenance sections for thorough cleaning in the washing plant and overhaul.

Slack adjuster
D.A.Valve
Vacuum cylinder with release valve
Vacuum reservoir
Alarm chain apparatus
Guard van valve

503b **Train pipe**

i) Check the train pipe with compressed air of 2 kg/cm^2 for leakage specially at threaded joints, bends and portions where clamps are fitted, tee joints, swan neck, etc. with one end dummy.

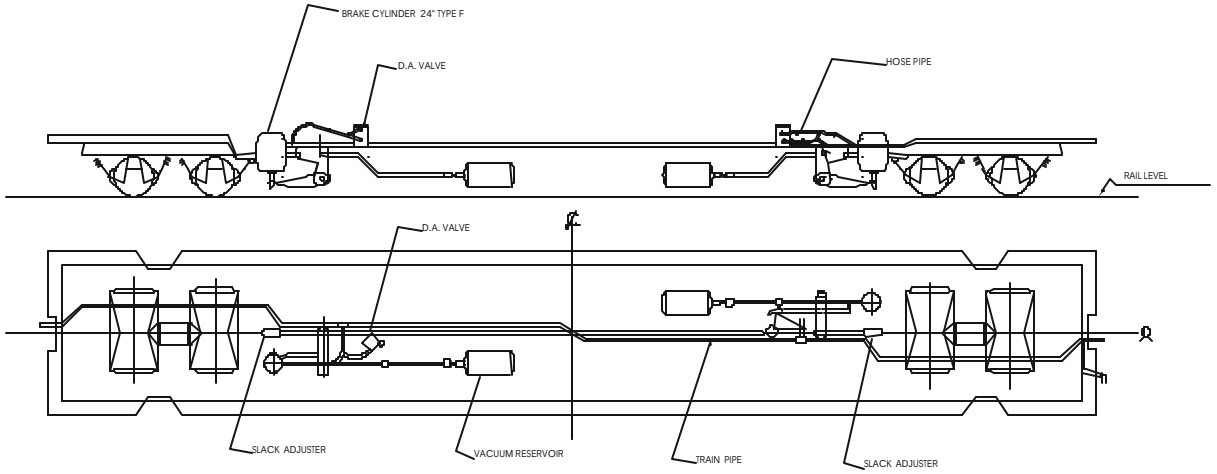
ii) Check and replace corroded, dented, bent more than **10 mm**, or thin walled portions of the train pipes. Spiked hammer should be used to check thin wall, corrosion, etc. While renewing the pipe, it should be ensured that bending do not decrease the cross sectional area of pipe passage at the bends. New brake pipe should be given a coat of anti-corrosive paint before fitting.

iii) Renew the damaged/ missing brackets or clamps used for clamping the train pipe.

iv) All the pipe threads must be cleaned and applied with white lead before couplings are fitted. Clean the grooves on swan neck.

v) After attending to all the repairs, test the train pipe for sound joints and bends with compressed air at **2 kg/cm^2** pressure. There should not be any leakage of air over the entire length of the train pipe.

vi) After repairs and testing, the train pipe should be given a coat of anti-corrosive paint.



LINE DIAGRAM OF VACUUM BRAKE

FIGURE 5.1

503c **Rubber hose pipe and syphon pipe**

i) Renew the hose pipe and syphon pipes if they had cracked or lost the bond between the various layers/ components.

ii) Reusable hose/ syphon pipes should be tested for vacuum retention. For this test, the hose should be connected by means of a cylindrical nozzle of size corresponding to the vacuum/ syphon hose bore to a chamber of **1640 cu. cm**. volume and the free end of hose closed with a cylindrical plug. **510 mm** Hg of vacuum should be created in the chamber and hose system. On isolation from the source of vacuum, the drop of vacuum should not be more than **75 mm Hg** in one hour on the chamber gauge. The pipe should not be clipped or otherwise bound to the chamber nozzle or plug for this test. The hose should also be bent around a mandrel of **228 mm** diameter till the ends of the hose are parallel. This should not result in any displacement or distortion of wire.

iii) Cracks, porosity, tears, etc., of the hose should be detected by giving it a stretch test. For this purpose, hose pipe should be secured to a special jig and should be stretched to **20% over** its original length and released 100 times. Thereafter, in the stretched position, its surface should be examined to detect the defects, if any. Cracked, torn, porous, or collapsed hose pipes or hose pipes with coiled wire loose or missing, or length reduced below **50 cms**. should be rejected.

iv) Serviceable hose pipe should be secured on swan neck (after applying rubber solution on swan neck) with clip and tighten with spanner.

v) Renew the corroded or damaged hose pipe clips.

vi) Broken, damaged, or distorted cages should be replaced with modified cages to drg.No.VB 409/M.

vii) Universal coupling should be examined for broken, cracked and distorted lugs and renewed on condition basis. Rubber solution should be applied on the mating surfaces and cages fitted before the couplings are inserted into the hoses. They should be clipped firmly.

503d Vacuum Reservoir Straps

Vacuum reservoir straps should be examined for slackness, corrosion and thinning, and damaged or worn out threads at their ends. and entire straps or threaded ends, as required, should be replaced. If the securing holes in the under frame are worn more than **3 mm**, build up by welding and redrill 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. FRP tissue should be placed in between reservoir and safety straps. APD should be done.

503e Vacuum cylinder trunnion bracket

Where bushes are provided in the brackets, they should be renewed and a light coat of graphite grease applied before fitting a cylinder. Trunnions of the cylinder must neither be too loose nor too tight in their brackets. Lateral clearances on the trunnions (on each side) should not exceed **3 mm**. It should be adjusted by renewing the bushes. If there are no bushes, the trunnions should be bored and bushes of correct size fitted to get the required clearance.

503f **Brake shaft**

Brake shaft should be examined for straightness, bending and wear on its bearing surfaces. The shaft bearing 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 in its brackets under a coach should be parallel to the trunnions on which the cylinder swings to avoid setting up of side or crosses stresses and hence damage to the arm. The brake shaft should not have a side play in its bracket bushes in excess of **2 mm** after POH.

503g **Brake shaft brackets**

Brake shaft bracket bolts and nuts should be examined for rusting, looseness, thinning and worn out or damaged threads and replaced, if required. Good bolts and nuts should otherwise be reused after greasing their threads. The brackets should be checked for cracks, corrosion and thinning or damage and repaired/ replaced as required. The brake shaft bracket bushes should invariably be changed.

503h **Slack adjuster support bracket on coach**

The support brackets should be stripped and examined for missing or worn out rollers and bent, defective or missing springs. The defective or missing roller and springs should be replaced. Defective spring should be repaired by restoring them to their original shape and size and hardened and tempered to give correct tension. The securing brackets and nuts as well as pins should also be checked and replaced or repaired as required.

503i **Alarm chain apparatus**

i) During POH, alarm chain apparatus should be opened, cleaned and overhauled.

ii) The chain must be of the prescribed specification and each link must be physically examined for crack/ wear/ elongation. Proper fitment/ anchoring of all the components should be checked and ensured to avoid their failure/ non-operation/ mal-functioning during service.

iii) The clappet valve should be removed from the coach for overhauling. Replace the rubber washer. The clappet valve cover should be checked and repaired or replaced as necessary. The clappet valve operating rods, levers, indicating discs and other moving parts should be cleaned and checked and straightened if bent, or replaced if broken or deficient. The pins if worn should be renewed, if not they should be cleaned before reuse.

iv) The vertical pipe connecting the clappet valve with train pipe should be examined to ensure that it is neither leaking nor blocked. The air passage in the vertical pipe should be blown clear with compressed air and the pipe threads should be checked before the assembly is connected to train pipe.

v) All moving parts including spring should be greased and checked for proper movement.

vi) The clappet operating chain and the pipe through which the chain passes should be dismantled, examined and renewed with standard chain or **6 mm** wire. If in normal position of the clappet valve, the chain hangs loose in any of the compartment openings, its length should be adjusted by cutting it out to the extent necessary. Wooden handles provided in the compartment openings for pulling the chain should also be checked and replaced where found broken or cracked.

vii) After the clappet valve assembly is overhauled and refitted, its chains, etc., are checked and replaced, the alarm chain apparatus should be tested at the outgoing pit for its operation in accordance with the following procedure.

503j **Alarm chain apparatus test**

i) Create **460 mm to 510 mm** of vacuum, pull the chain, using a spring balance, at both sides of the coach from the end where the chain is anchored, ie., from the end which is farthest away from the clappet valve.

ii) The alarm chain should not operate the clappet valve if the pull applied vertically down wards is less than **6.4 kgs**. It should also not require a pull of more than **10 kgs**. for its operation.

iii) When the chain is pulled, the brakes should apply on the coach and the drop of vacuum in the train pipe should be between **180 mm and 200** mm if one coach is being tested, or between **130 mm** and **180 mm** when a rake as a whole is being tested. If the drop in vacuum is less than **130 mm** and still the brakes are applied, it shows an obstruction in the vertical pipe, in which case it is necessary to locate and clear the obstruction in vacuum vertical pipe.

iv) On resetting the clappet valve, it should automatically come to lap position. After restoration of **460 mm to 510 mm** of vacuum, the exhauster should be isolated and the drop in vacuum noted. The drop in vacuum should not be more than **25 mm** in one minute. This check should be carried out twice.

504 OVERHAUL OF COMPONENTS

504a Vacuum reservoir

i) The vacuum reservoir should be examined for corrosion, damages, distortion, cracks, etc. If the extent of corrosion, etc., are only about **5%** of total area, it should be cut off and replaced with another plate by welding. Otherwise the whole barrel should be replaced. Open the drain plug and blow compressed air into the reservoir to remove dusts, dirt and water particles, accumulated inside the reservoir.

ii) After thorough cleaning, refit the drain plug smeared with small quantity of graphite grease on the threads and tighten it firmly. Clean the pipe threads with a brass wire brush in both the dish ends to fit the syphon nipples. Replace the missing or damaged syphon in the dish ends of the reservoir.

iii) After attending the defects and before painting the reservoir, a pneumatic pressure of **2.0 kg/cm^2** by gauge should be applied in it for the purpose of ensuring sound fabrication and finish. With the pressure applied, the welded seams all over the body should be thoroughly checked for leakage with soap and water solution.

iv) Vacuum reservoir should be tested for vacuum retaining capacity with **510 mm** of vacuum throughout the assembly. It should not, on isolation from the source of vacuum, record a drop of more than **13 mm in 30 minutes** on test gauge.

v) After all repairs and tests, the reservoir should be given a coat of anti-corrosive paint and FRP tissue pasted at the areas where suspension straps are located.

504b Guard Van Valve

i) During overhaul of guard van valve, its rubber diaphragm and rubber washer should be invariably changed. Passage through the valve connecting its train pipe side to its chamber should be cleaned. If the passage hole diameter exceeds **6 mm**, the valve should be replaced.

ii) The chamber space of the guard van valve should be checked for leakage, cracks and damage and repaired or replaced as necessary. The valve itself should be checked for easy and correct lift. The valve cover holes should be cleaned, blocked holes opened and bent/deficient lever replaced. The vacuum gauge nipple provided on the guard van valve chamber should be checked for damaged or worn out threads. The loose nipple should be secured firmly on the chamber.

iii) All studs and nuts with worn or damaged threads should be placed. The threads in the body of the chamber should also be good enough to ensure no leakage past them. The guard van valve body threads on which train pipe is secured should also be checked for damage and wear and the body replaced if the threads are bad.

iv) After overhaul, the entire guard van valve assembly should be tested for satisfactory functioning, as given below:

- **Vacuum retaining capacity test:** Guard van valve connected to a chamber of **1640 cu. cm**. volume throughout the assembly, should not, on isolation from the source of vacuum, record a drop of more than 25 mm in 1 minute on the chamber gauge.

- **Operation test**

  1) On release of operating handle, the valve should, with atmospheric pressure throughout the assembly, re-set itself by its own weight.

2) 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.

3) With vacuum throughout the assembly, the guard van valve should automatically lift on a rapid destruction in the train pipe of approximately **225 mm** of vacuum, and on the operating handle of the test apparatus being placed in the "running" position, the guard van valve should re-set itself within **3 to 5 seconds**.

Note:- Above tests 2 & 3 apply only to automatic type of guard van valves having a diaphragm and dome above the atmospheric valve.

504c **Vacuum gauge**

Vacuum gauge which is permanently fitted in guard's van should be removed and calibrated with master gauge before refitting. If defective, it should be repaired and again calibrated with master gauge and refitted. The vacuum gauge guard must be invariably provided to protect the gauge from damage or theft.

504d **Vacuum brake cylinder**

Strip the vacuum cylinder completely. Thoroughly clean and dry the components and check for defects like cracks, damages and wear.

504e **Pan (Cylinder cover)**

Replace the cracked/ broken cover or if the welded lugs are more than **50% of the total lugs**. Broken/ cracked lugs should be replaced with new lugs by welding and grinding. After attending to the defects, the pan should be painted with one coat of anti-corrosive paint.

504f **Gland box (Stuffing box)**

Table 5.1

Guide Bush	
Inside diameter	44.52 +0/-0.03 mm
Outside diameter	54 +0/-0.1 mm

Renew all the rubber items like the neck ring and gland box joint washer invariably. Renew the worn/ loose guide bush. Replace the worn, damaged, or broken studs. Secure the gland box on the cylinder cover with spring washers and nuts.

504g **Piston rod**

Dismantle the piston rod from the piston. Renew the bent, damaged, dented, worn, corroded, or pitted piston rods. If the threads of the piston rod are damaged, the rod should be replaced.

504h **Piston**

The cracked piston should be replaced. The piston skirt serrations should be cleaned free of dust, rust and sediments. Visually check the piston for worn or cracks. Replace the piston if found damaged beyond salvage. Measure the out side diameter with micrometer of range 575-600 mm & record the dimensions. While assembling the Piston and Vacuum cylinder the diametrical difference between the two should be **20.3 mm**. The blind holes for the piston rod cover bolts should be tapped and eased.

504i **Ball valve cage**

The ball valve should be opened, thoroughly cleaned free of dust, dirt and sediments and lightly lapped. Four holes in the cage which should be of 6 mm diameter should be cleaned thoroughly. The ball valve cage cover should be checked for good threads. The ball should be replaced even when slightly worn. Ball valve should be changed when its seating is worn out or pitted and the surface is not smooth to provide good seating for the ball. the ball and the ball seat should otherwise be cleaned with emery paper and lapped together before assembly. The cage cover should be replaced if its threads are damaged.

504j **Piston assembly**

Select the serviceable/ new piston assembly components and assemble the piston assembly as per drawing No.VBA - 16 / M. The piston should then be painted all over except over the working surface ie., serrated portion. The date of overhauling and the code of the shop of overhauling should then be stenciled on the cover end of the piston disc.

504k **Barrel (Cylinder body)**

Cracked barrel including the one with cracked trunnions should be replaced. Lugs cracked or broken should be replaced with new lugs by welding and grinding. The barrel should be replaced if the number of original lugs (ie., those which have not been repaired at all) goes down below **50%.** Thoroughly clean the serrations and check for wear. Measure the inside diameter with micrometer of range 600-625 mm. Replace the barrel if serrations are found worn or damaged. Dry the barrel with hot air after wiping out all the traces of water particles. Clean the release valve seat and the holes for proper seating and free passage of air respectively. After attending to the defects and cleaning, inside of the barrel should be painted with one coat of anti-corrosive paint except the serrated surface, which should be left unpainted.

504 **Joint rings**

Every time a vacuum cylinder is opened, the joint ring should invariably be replaced. After fitting the joint ring in the correct position between flange of cylinder and cover, it can be retained in the correct alignment while fitting the cylinder cover to the cylinder by suitably designed clips.

504m **Rolling ring**

i) Twisted, cut, worn out or perished rolling rings should be replaced. While fitting a rolling ring on a piston surface, it should be ensured that it is of the correct size, i.e. diameter is either **13.1mm** or **13.5 mm** depending upon the wear on the serrated surfaces of the piston and the cylinder and, that the ring does not get twisted. The seam line of the rolling ring should be even and horizontal, when the ring is in its piston groove.

ii) In order to test the ring for twist, it should be hung on a stretched finger and examined. A good ring should hang straight and should not make a figure of 8 and show a twist. The rolling ring should also be stretched by hand and examined. If any cracks appear, it should be considered as perished and replaced.

iii) New rolling rings should be tested for compression and stretching. A 50-mm long test piece cut from the ring should be compressed to half of its sectional diameter and kept in the compressed condition for 3 hours. On release, if its diameter does not come back within **2%** of its original diameter within an hour, it should be rejected as defective. Similarly, the ring should be stretched to **300%** of its original length and kept in the stretched condition for 3 hours. If on release, the ring does not come back to within **5%** of its original length within an hour, it should be rejected as defective.

504n **Release valve**

i) Open the release valve and renew all the rubber items like diaphragm, seating washer, etc., invariably during overhaul. Dry the release valve after wiping out all the traces of water. 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, nuts 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. After assembly, the release valve should be tested as given below:

A) **Vacuum retaining capacity test**

- Release valve, connected through the cylinder port to chamber of 1640 cu. cm. volume with **510 mm** of vacuum throughout the assembly, shall not, on isolation from the source of

vacuum, record a drop of more than **20 mm** in one minute on the chamber gauge.

- Release valve, connected through the chamber port to a chamber of 1640 cu. cm. volume with **510 mm** of vacuum throughout the assembly, shall not, on destruction of the vacuum, record a drop of more than **20 mm in 1 minute** on the chamber gauge.

B) **Operation test:**

- Release valve, connected through the chamber port to a reservoir with vacuum throughout the assembly shall, when the vacuum is destroyed in the train pipe by pulling on the operating lever wire thus operating the valve, remain in the open position till there is pull on the lever wire. It should re-set immediately on removal of the pull.
- On re-creation of not more than 205 mm of vacuum, the valve shall re-set itself.

505 ASSEMBLING AND TESTING OF VACUUM CYLINDER

505a After attending to the defects of vacuum cylinder parts, assemble the Parts as per IRS drawing No.VBA - 16 / M. alt 6. Care should be taken to invariably replace all the rubber items like rolling ring, joint ring, release valve joint washer, piston cap washer, etc. While assembling the Piston and Vacuum cylinder the diametrical difference between the two should be **20.3 mm**. After complete assembly, the vacuum cylinder should be tested on the test bed and stencil the date of overhaul, the date of testing and shop code on the vacuum cylinder body.

505b **Testing of Brake cylinder (Balanced Vacuum Test)**

i) Attach the overhauled brake cylinder to test stand train pipe and test reservoir. The balanced vacuum control valve is connected in between vacuum exhauster and train pipe. This valve will automatically control the vacuum to a maximum of **460 mm** with lever in horizontal position and a minimum of **356 mm** with the lever in vertical position with, exhauster working.

ii) Create **460 mm** of vacuum (lever of control valve horizontal).

iii) Destroy the vacuum.

iv) 20 minutes after destruction, create the balancing vacuum of **356 mm** (lever of control valve vertical). The piston of cylinder in good condition should partly descend but not completely. That which completely descends is faulty and should be dismantled and repaired again.

v) Increase vacuum to **460 mm** (lever of control valve in horizontal) when piston should completely descend. That which does not descend completely is faulty and should be dismantled and repaired again.

After successful BVT testing, supply the brake cylinder to lifting shop for fitting on coach.

506 D.A.VALVE (ESCORT- KNORR D.A. VALVE)

506a Open the two halves of DA valve by removing the four M8 hexagonal nuts. Clean all the components and sub assemblies like lower locking screw subassembly of the lower housing, housing upper subassembly, diaphragm sub assembly, valve seat subassembly, etc. All the rubber items should be replaced invariably and other parts should be changed on condition basis.

List of Rubber Items which should be changed

Table 5.2

Part Name	***Drawing Number***
Diaphragm	*4A 38266*
Seal	*48174*
Nylon guide bush	*KB 408*
Sealing ring A 35 x 41	*Dln 7603*
Sealing ring A 30 x 36	*Dln 7603*
K Ring	*N 891 / 20.2*
Joint ring	*KB 115*

506b The filter element of **(Escort-Knorr D.A.Valve)** should be thoroughly washed in kerosen and blow with compressed air to remove the entire collected dirt. Before fitting back, the filter element should be immersed in light machine oil and the oil allowed to be drained.

The filter element of **(Greysham D.A.Valve)** should be thoroughly washed in parafin to remove the entire collected dirt.

List of Items to be Changed in Escort type DA valve on Condition Basis

Table 5.3

Part Name	Drawing Number
Pin and screw assembly	*4KB 613*
Diaphragm seat	*4A 50314*
Valve seat	*4A 50807*
Locking screw	*4A 55757*
Valve seat	*4A 54952*
Locking screw	*4A 69805*
Hex. nut	M8, DIN 934
Spring washer	B8, DIN 127
Hexagonal bolt M8x35	DIN 931
Self tapping screw 4x5/16"	
Filter assembly	KB 137
Cup plate	KB 409
Hex. nut M10 x 1.5	DIN 439
Washer	DIN 433
Compression spring	4A 30485 / 8

506c The DA valves should be closely examined and seats ground lightly to avoid leaks. While assembling care should be taken for fitting the diaphragm on to the lower housing groove properly. The end corners must be pressed inside the groove. Free movement of the diaphragm subassembly should be checked by hand. During the final assembly of upper and lower housing, tightening of hexagonal nuts should start from the O-ring end and the 4 nuts must be tightened evenly.

506d Testing of DA valve: After the DA valve is overhauled and assembled, it should be tested on the test bench as indictated in **figure 5.2** for its functional performance and leakage.

i) **Retention test :** Mount the DA valve on the test stand and create vacuum till **530 mm Hg** is indicated on both gauges A and B of the test stand. Close stop cock "Y" and then stop cock "X". Record the drop of vacuum in both the gauges A & B, which should not be more than **12.5 mm in 10 minutes**.

ii) **Operation test :** The stop cock "X" is opened till the gauges A & B again record **530 mm of vacuum**. Then stop cock "X" is closed and "Y" is opened. Record the drop in gauge B (brake cylinder) from **530 mm to 25** mm which should be within 3 seconds.

iii) **Proportionality test :** Open stop cock "X". Vary vacuum in gauge A by opening and closing cock "Y". It will be observed the gauge B follows gauge A very closely both during creation of vacuum and brake application.

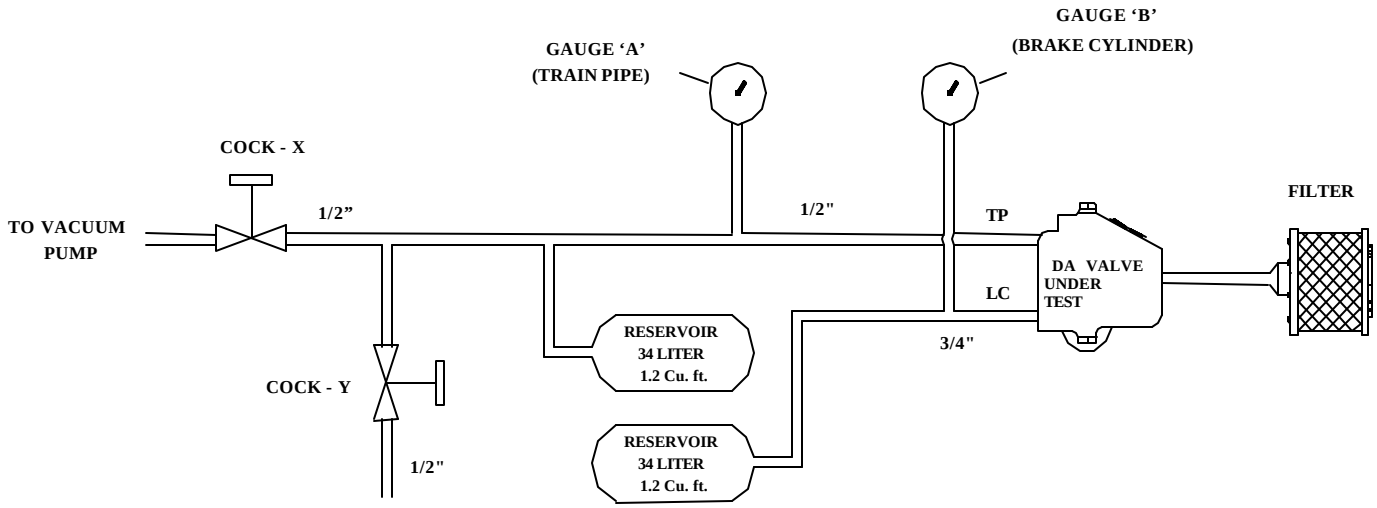
507 SLACK ADJUSTER (SAB DRV2-450)

Refer to write-up on Slack adjuster in para 413 of Air Brake Chapter.

507a End piece for slack adjuster pull rod

Prepare end piece for pull rod as per the RDSO SK - 96102 alt. 3 to be used in modified vacuum brake system to provide horizontal movement to slack adjuster:

Type of coaches	Length of end piece
WFSCN, SL, SCNLR	265 mm
All other vacuum braked coaches	155 mm



TESTING OF DA VALVE
Figure 5.2

508 ASSEMBLING BRAKE SYSTEM ON COACH

After receiving the overhauled brake system components, these should be fitted on the coach in proper order and in their respective locations. Then lower the coach on overhauled bogies and connect the pull rod end of slack adjuster to vertical levers of the bogie brake rigging.

509 **ADJUSTMENT OF BRAKES**

509a A vacuum cylinder as fitted shall have a minimum clearance of **13 mm** between the piston cotter and fork end arm of the brake shaft when both are in their lowest positions. The brake gear adjustment should be such that the piston stroke is within limits specified for different types of stock. With the piston in fully lifted up position, there must be a minimum clearance of **25 mm** between the top of the fork end arm and the cylinder stuffing box.

509b **Testing of vacuum brake system (Balance vacuum test)**

i) Adjust brake gear to ensure that the piston stroke is within prescribed limits i.e,. **203 –3 mm** (This is important as the balancing vacuum is based on the correct piston stroke). While this is being done, the train pipe should be tested with **255 mm** vacuum to detect and attend porous or leaky hose pipe and or joints.

ii) The balanced vacuum control valve is connected in between vacuum exhauster and train pipe. This valve will automatically control the vacuum to a maximum of **460 mm** with lever in horizontal position and a minimum of **356 mm** with the lever in vertical position with exhauster working. Although the vacuum reading at the valve applies to the front of the coach, it will control the necessary drop of **102 mm** for balancing throughout the train during test.

iii) After the vacuum is created up to the end of the coach completely destroy the vacuum.

iv) 20 minutes after destroying, create the balancing vacuum of **356 mm** (lever of control valve vertical). The pistons of cylinders in good condition should partly descend but not completely. That which completely descends is faulty and should be replaced and checked again.

v) Increase vacuum to **460 mm** (lever of control valve in horizontal) when piston should completely descend. That which does not descend completely is faulty and should be replaced and checked again.

510 ADJUSTMENTS OF SLACK ADJUSTER

510a Control dimension `A' Slack adjuster: After the Brake Regulator has been installed or when checking an existing installation, carry out the following:

i) Make sure that the hand brake and the vacuum brake are fully released and the whole rigging is in proper order.
ii) Make three or four brake applications at correct vacuum to ease the rigging.
iii) Once again ensure that the whole brake rigging is in the fully release position. The installation can not be correctly adjusted or checked if the brake rigging is only partly released.
iv) Now set the dimension `A' between the control rod head and the barrel head which is **16 +4/-0 mm** and **22 +4/-0 mm** for ICF coaches with 13t and 16.25t bogies respectively and rotate to suit refitting control rod and pin when the dimension `A' is correct.
v. Make a few more brake applications at the correct vacuum, this time checking piston strokes which should be within the limits specified. Also recheck dimension `A' again with brake fully released and correct if necessary.
vi) Lock the control rod head firmly with nut and tooth lock washer. Secure pin with split pin.

510b **Dimension `e'**

The dimension `e' which is **375 ± 25 mm** represents the capacity available for adjustment and will decrease as wear takes place at brake shoes, wheel and pin joints.

The maximum value of dimension `e' should be within the permissible limits for each value when:

i) All brake shoes are new.
ii) All pin joints have new pins and bushes.
iii) All wheels are new.

If it is not within permissible limits, after ensuring that all other relevant parts in the rigging are correct to the drawing, the length of one of the pull rods may be adjusted and the piston stroke checked again.

511 LIST OF TOOLS AND PLANT

Table 5.4

Lifting shop	**Vacuum brake shop**	**Slack adjuster shop**
Ball peen hammer	Ball peen hammer	Ball peen hammer
Chisel	Chisel	Chisel
Spanner set	Spanner set	Steel measuring type
Gas cutting plant	Single girder electric hoist	Pipe vice
Welding plant	Box spanner set	Spanner set
Jack for brake cylinder fitting	Vacuum exhauster	Jacking tool
BVT test equipment	BVT valve	Screw driver
Pallets	D.A. Valve test rig	soaking tank
Platform truck	Compressed air supply	Inspection guages
	Guard van valve test rig	Box spanner set
	Clapet valve test rig	Spring testing rig
	Vacuum gauge test bench	Gas cutting plant
	Train pipe test rig	Welding plant
	Vacuum test rig	
	D.A. Filter cleaning plant	
	Fork lift	
	Plat form truck	
	Cleaning plant	
	Hot water jet system	
	Waste water treatment plant	

512 **TROUBLE SHOOTING ON VACUUM BRAKE**

Table 5.5

Sr. No.	Defects	Probable cause	Method of Testing	Remedies
i)	Coaches not provided with Slack Adjuster			
	Brake Power Weak	a) Brake Blocks slack & not braking wheels	Check the piston travel. Brake shaft arm will be touching the cylinder when brakes are applied.	Adjust brake gear. If even then the brake power is weak, change the brake blocks.
		b) Brake blocks slack but braking wheels without requisite force.	Check whether the piston travel is more than 125 mm or not.	Adjust the brake gear or change the brake blocks.
		c) Brake gear bushes worn out.	Shake brake hangers with hand to see whether bushes come out along with the hangers or pins rattle in bushes.	Adjust the brake gear or Change all bushes and pins as necessary.
		d) Brake rigginng stiff and brake release spring too strong.	Brake shaft arm remains up even after release of brake, though the piston comes down.	Ease the brake shaft & replace the strong release spring with that having proper tension.
ii)	Coaches provided with Slack Adjuster			
	Brake Power weak	e) Excessive free lift	Measure free lift.	Adjust free lift to 14 mm.
		(f) Defective cylinder	See whether the piston goes up when vacuum is destroyed.	Repair or replace vacuum cylinder.
		(g) Excess 'A' dimension	Measure 'A' dimension	Adjust as specified for the type of coach.
		h) Defective brake rigging	Check that all brake rigging components are as per drawing and the clearance between brake gear pins & bushes are within the permissible limit.	Change brake gear compo-nents, pins and bushes as necessary.
		(i) Manual adjustment in respect of wear of wheel has not been made	Measure wheel diameter and check "e" dimension.	Adjust 'e' dimension in respect of wear of wheels

Sr. No.	Defects	Probable cause	Method of Testing	Remedies
		j) SAB Slack Adjuster pin defective.	On application & release of brake see whether the Slack adjuster barrel rotates.	Replace slack adjuster.
2)	Brake on a coach do not release.	(a) Brake rigging pin & brake shaft jammed.	Move or shake by hand and feet.	Ease the jammed compo-nents.
		(b) External leak in the train space of vac. cylinder commonly due to worn out neck ring or scored piston rod	Test by a flame which will be drawn in at places of leakage or close the valve connecting the source of vacuum, after creation of vacuum and check the train needle in the vacuum gauge which will come down.	Rectify the leak or change the neck ring or the piston rod as required.
		(c) Engine not creating the same amount of vacuum as was prior to an application of brakes	Visual examination	Release train vacuum cylinders.
3)	Fall in vacuum on run by 125 to 175 mm reported by Driver.	(a) Clappet valve spring defective. (b) Syphon pipe getting disconnected.	a) Drop of vacuum by 125 to 175 mm. b) Drop of vacuum by 125 to 175 mm.	Adjust the clappet valve or blank it. If can not be adjusted, adjust and secure the syphon pipe.
4)	Vacuum cannot be created on the train.	a) Leakage at joints of train pipe, train pipe nipple, hose pipe, Syphon pipe.	Check vacuum in the brake van and the engine. Listen for hissing sound to detect leaks.	Starting with the last coach, check all joints and rectify all leaks with a sealing compound, or/and replace defective hose pipe clips and rubber washer, as necessary. after checking all coaches upto the engine and rectifying defects as noticed, if vacuum still cannot be created, then devide the train into two equal parts and test each part separately. Again subdivide the part found defective and test each sub-part. This is continued till the defective vehicle is located.
		(b)Rubber washers in hose pipe joints missing or twisted.		
		(c)Rearmost hose pipe of the train not secured on its dummy.		
		(d)Leakage in vacuum chamber.		
		(e)Guard' s van valve leakage.		
		(f) D.A. Valve leaking.	Check for leakage.	Replace or by-pass D.A. Valve.

Sr. No.	Defects	Probable cause	Method of Testing	Remedies
5.	Abnormal variation in the amount of vacuum between engine gauge and brake van gauge.	a) Partial obstruction of hose pipes of the train pipe		Create the vacuum 460 to 510 mm and destroy it. Now observe closely the extent of piston travels of all coaches. The travel of the piston would be greater on coaches between the locked portion and the engine, than that of the coaches in the portion beyond the blockage i.e. between the blocked coach and the rear brake van. In case there is a complete blockage, the piston travel would indicate where the vacuum brake has not functioned, at all.
		b) Vacuum gauge of Guard Van valve defective.		Replace the defective vacuum gauge.
6)	Piston applies brakes when the vacuum is created	a) Leak at neck.	Destroy vacuum and see if the piston comes down.	Change the neck ring or blank off the vacuum cylinder and advise the next train examining station to change the neck-ring.
		b) Wrong connection of syphon pipe on the triple way release valve	Ditto	Correct the syphon pipe connection.

*****

CHAPTER 6

BOGIE MOUNTED AIR BRAKE SYSTEM

601 GENERAL

In order to overcome the problems of slack adjuster failure as well as problems associated with cast iron brake blocks, a design of brake system incorporating 8" size two cylinders on each bogie along with 'K' type high friction composite brake blocks has been introduced.

602 DESIGN FEATURES OF THE SYSTEM (refer figure 6.1)

This type of system is exactly similar to the standard air brake system except for the following:

a) External slack adjuster is removed/ eliminated

b) Four cylinder of 8" size is provided for each coach in place of two cylinders of **14"** in standard air brake system. These cylinders have built in single acting slack adjuster for taking the slack created between wheel and brake block on account of wheel / brake block wear. Mounting of cylinders is done on either side of the bogie frame in between central longitudinal members connecting the bogie transom to the headstocks. Each cylinder controls the braking on one wheel set. Each cylinder has a piston take up stroke of **32 mm** and adjustment capacity of **305 mm** (Ref. Drg. RDSO Sk- 81057)

c) High friction composite brake blocks of 'K' type have been used.

d) Bogie brake rigging has been modified to incorporate a total mechanical advantage of **7.644 per bogie** for non-AC coaches and **8.40 per bogi**e for AC coaches.

e) Curved profile pull rods have been used to interconnect levers controlling braking one wheel set. These pull rods provided with one additional hole for the adjustment of slack between wheel and block after specified amount of wear.

f) Since brake cylinders have been mounted on the bogie frame, 15mm. bore pneumatic pipeline has been laid over bogie frame to inter connect the brake cylinders of one bogie. Output pipe line of distributor valve has been connected to bogie pneumatic line through flexible hoses to provide flexibility to alround dynamic movement.

603 COMPOSITE BRAKE BLOCK

603a General

Low friction composite brake blocks have the following benefits:

- Reduced braking distance due to uniform co-efficient of friction.
- Reduced weight
- Reduction in the replacement of brake blocks vis a vis cast iron due to higher wear life in train operation.
- Reduced wear and tear of brake rigging.
- Reduced noise during braking.

603b Characteristics of composition brake blocks

i. Composition of material

The composition of material constituting the brake blocks must be chosen to give the best balance between :

- The braking characteristics
- The wear and service life of blocks
- Wear on the running surface of the wheels
- The effect on adhesion between the rail and wheel

ii. Requirement concerning friction

- The average coefficient of friction is **0.25**.
- As far as possible the coefficient of friction must be independent of the initial braking speed, the state of bedding-in of the brake block, the specific pressure also the temperature and atmospheric conditions.

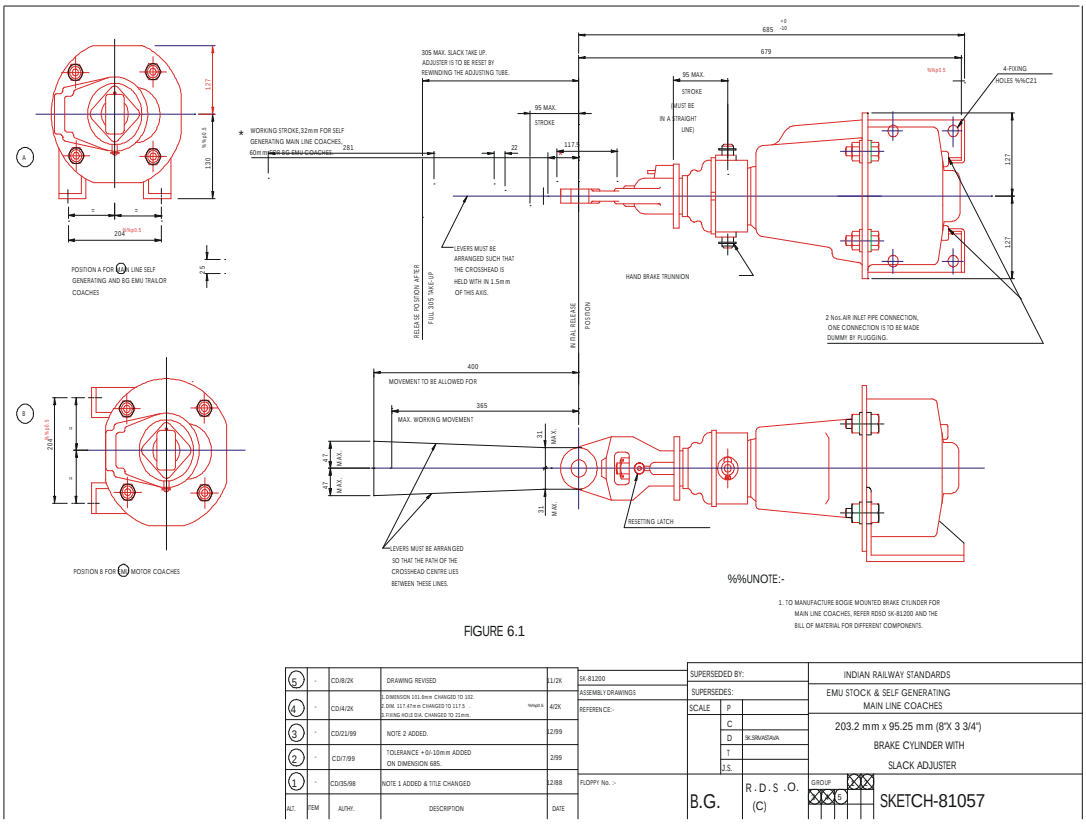


FIGURE 6.1

5	-	CD/B/2K	DRAWING REVISED	11/2K	SK-81200	SUPERSEDED BY:	INDIAN RAILWAY STANDARDS
4	-	CD/4/2K	1.DIMENSION 101.6mm CHANGED TO 102. 2.DIM. 117.47mm CHANGED TO 117.5 . 3.FIXING HOLE DIA. CHANGED TO 21mm.	4/2K	ASSEMBLY DRAWINGS	SUPERSEDES:	EMU STOCK & SELF GENERATING MAIN LINE COACHES
3	-	CD/21/99	NOTE 2 ADDED.	12/99	REFERENCE:-	SCALE P C D T J.S.	203.2 mm x 95.25 mm (8"X 3 3/4") BRAKE CYLINDER WITH SLACK ADJUSTER
2	-	CD/7/99	TOLERANCE +0/-10mm ADDED ON DIMENSION 685.	2/99		SK.SRINIVASAVA	
1	-	CD/35/98	NOTE 1 ADDED & TITLE CHANGED	12/88	FLOPPY No. :-	B.G. R.D.S.O. (C)	GROUP 6 SKETCH-81057
ALT.	ITEM	AUTHY.	DESCRIPTION	DATE			

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CHAPTER CONTENT

- Under the effect of dampness, the average coefficient of friction must not vary, with the other condition remaining the same, by more than **±15%** in relation to the value obtained during braking when dry.
- After prolonged braking followed by braking to a stop, particularly high temperature occur. Even in the case of these temperatures (**maximum 400 ^{0}C** on the opposing friction surface) the average coefficient of friction must not vary with the other conditions remaining the same – by more than **±15%** in relation to the value obtained during braking in cold and dry state.

iii. Geometrical characteristics of the brake blocks

- The constructional features of the brake blocks must enable them to wear down to a thickness of **12 mm** including the back plate, without the latter coming into contact with the running surface of the wheel.

iv. Mechanical and physical characteristics

- The various elements making up the brake blocks must be spread uniformly in the body of the block. There must be no pitting, flaws or other defects. The material must not attack the opposing friction surface or give rise to the formation of metal inclusions.

  Composition brake blocks must not bring about more serious heat damage to the wheels (hot spots, cracks, flaking) than would be caused by cast iron blocks used in the same way on the same wheels.
- The values of specific weight, thermal conductivity, hardness, bending strength and the modulus of elasticity must be given for acceptance purposes.
- No method is laid down for fixing the composite material part to the back plate. The back plate must be designed to support the stresses likely to occur.
- The composition blocks must not affect to an unacceptable degree the adhesion values between wheel and rail obtained on vehicles braked with cast iron inserts.

603c **Non-asbestos 'K' type composition brake block**

- Non-asbestos 'K' type blocks shall generally conform to RDSO drawing No. 98066.
- The use of asbestos is prohibited.
- The use of lead or zinc in the metal state or in the form of compounds is not advised. The same applies to all other compounds, if in the form of powder, particles or gas produced during the used of the brake blocks, they may constitute a danger to health.

603d **Asbestos based 'K' type composition brake**

- Asbestos based 'K' type blocks shall generally conform to RDSO drawing No. 98146.

603e **Marking**

Each block must bear the following marks:-

- Name of manufacturer
- Date of manufacturer (month and year)
- Material code including 'KA' for asbestos type and 'KNA' for non-asbestos type.
- Type of service ML.

These marks, preferably punched, cut or stamped, must be applied so that the block can be identified, even after being fully worn in service.

603f **Comparison of properties/Usage of composition brake block Vs Cast Iron Brake block**

Param-eters	Type of Brake blocks in use on main line coaches		
	'L' type CBB	'K' type CBB	CI
Appli-cability	All coaches with underframe mounted air brake system	All coaches with bogie mounted brake system	All coaches with vacuum brake and under frame mounted brake system
Speed	Upto 110 KMPH	upto 110 KMPH	Upto 140 KMPH
Coeffic ient of friction	0.12 to 0.14	0.25 max.	0.12 to 0.14
Weight	Approx. 3 kg.	Approx. 3 kg	Approx. 9 kg.

604 **WORKING PRINCIPLE**

There is no change in the overall brake system in bogie-mounted arrangement up to the action of distributor valve. Here the system will respond to action on A-9 valve in similar fashion as in the case of standard air brake system. Working of bogie mounted brake system beyond distributor valve is explained below.

604a **Application (see fig. 6.2)**

For application of brakes, driver moves the handle of A-9 valve in the application position. By this movement the brake pipe pressure is reduced which is sensed by distributor valve to operate brake cylinder (1). Pneumatic pressure in the brake cylinder causes piston assembly (2) to move outward thereby causing lever (3) to rotate about its fulcrum (a) thus bringing brake block (4) to come in contact with the wheel (5) through the brake beam (6). Since lever (3) is hung on the bogie frame through lever hangers, it will start moving forward about fulcrum (b) after brake block (4) has contacted wheel (5). This forward motion of the lever (3) about fulcrum (b) will cause pull rod (7) to move forward thereby causing lever (8) to swing about fulcrum (c) and hence resulting in contact of brake block (9) against wheel (5) through brake beam (10).

Extent of brake cylinder pressure developed in the brake cylinder will depend upon the extent of reduction in brake pipe pressure. Maximum brake cylinder pressure developed is **3.8 +/ - 0.1 kg/cm^2** as in the case of standard air brake.

604b **Release**

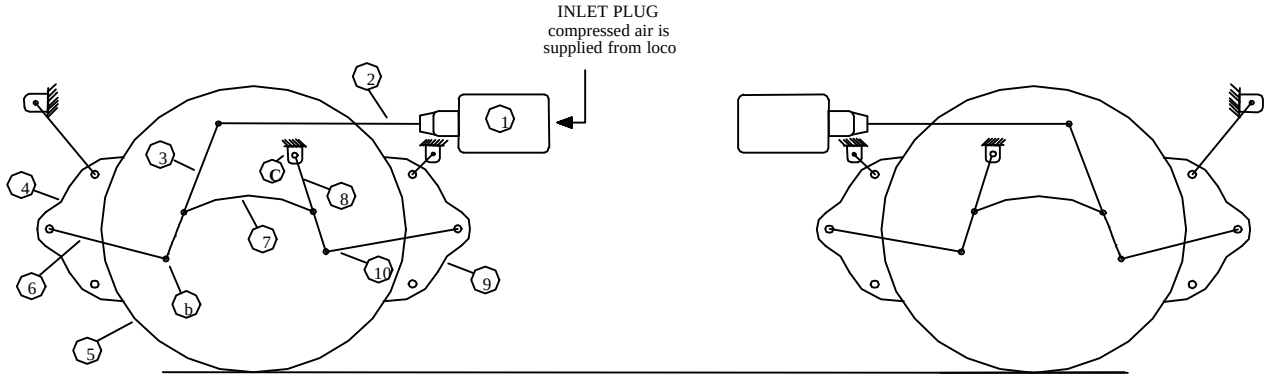
For release of the brakes, driver moves handle of A-9 valve to release position. By this movement, the brake pipe is charged to the required pressure **of 5 kg/cm^2.** This actuates the distributor valve and brake cylinder is cut off from the auxiliary reservoir. The air from brake cylinder is exhausted to atmosphere and brakes are released.

604c **Slack up Action**

Cylinders of bogie mounted brake system are provided with automatic slack take up features. As soon as the piston stroke exceeds a pre determined value (on account of either brake block or wheel or both) a ratchet with adjusting screw fitted inside the cylinder turns thereby increasing the length of the piston rod automatically. During return stroke, the adjusting movement takes place. A red paint mark on the adjusting tube assembly indicates that piston unit has extended over its full range and requires resetting of pull rod (7).

605 **COMPARISION OF IMPORTANT PARAMETERS**

In the underframe mounted brake gear arrangement, it is seen that there are 51 pin joints per bogie in the system. To reduce the number of pin joints, levers, pull rods and push rods, bogie mounted brake system for mainline coaches have become a viable alternative. Comparison



SCHEMATIC BOGIE BRAKE GEAR ARRANGEMENT FOR BOGIE MOUNTED BRAKE SYSTEM FIGURE 6.2

of bogie brake system with conventional air brake system for various parameters is as follows:-

Table 6.1

Item	Conventional Air Brake System	Bogie Mounted Brake System
Weight reduction (as compared to conventional air brake system)	-	492 kg.
Braking distance at 110 kmph (18 coaches)	905 m	800 m
No. of pins and bushes	102	84
Brake block wear rate	3 cc/kwh	1.325 cc/kwh

606 MAINTENANCE INSTRUCTIONS

As explained above, bogie mounted brake system from maintenance point of view is exactly same as the standard air brake system except for brake cylinder, which are different than the existing system. Therefore, to maintain the system, instructions contained in the Air Brake System (chapter 4) will have to be followed in addition to those which are indicated in the maintenance manual for brake cylinders supplied by manufacturers.

607 SPECIAL PRECAUTIONS TO BE TAKEN DURING MAINTENANCE

The maintenance of underframe equipments and fittings should be done as per underframe mounted air brake system. Following special precautions must be taken to ensure proper working of the bogie mounted brake system.

i) It shall be ensured that only high friction composition brake blocks 'K' type are used with this arrangement.

ii) It shall be ensured that levers of non-AC coaches (13T bogies) are not mixed with those on AC coaches (16T bogies) under any circumstances.

iii) It is very important to ensure that curved profile pull rods (item '6' of ICF Drg. No. T-3-2-802 which is meant to be used for 13T bogies is not intermixed or replaced with pull rod (item 4) of ICF Drg. No. WTAC4-3-2-402 which is designed for 16T bogies.

iv) While fitting curved profile/pull rods as per Para (iii) above, it shall be ensured that they are fitted as shown in the bogie brake arrangement drawings and not reversed under any circumstances.

v) Curved profile/pull rods as per Para (iii) have been provided with a single hole at one end and two holes at other end, for initial fitment, when wheel as well as brake blocks are new, connection of levers through pull rod will have to be made using extreme holes/strictly. When wheel diameter reduces to 839 mm. and 38 packing is provided at axle box to compensate for the wheel wear, connection of pull rod must be shifted to adjacent hole.

vi) Under new condition of wheel (**dia. 915 mm**) and brake block, gap between brake block and wheel (with brake block in released condition) be maintained at about 5 mm. This will ensure that piston stroke (without utilizing the slack take up capacity) of brake cylinder remained within the value of **32 mm**.

vii) Design of brake rigging has been done in such a way that up to wheel diameter of **839 mm**. and brake block in full worn condition, red paint mark on the adjusting tube sub assembly will not appear (indicating condition that piston unit has extended fully and requires resetting). However, if due to some reasons, this mark appears, worn brake blocks must be replaced by new ones. Failures to observe this condition will result in increased gap between wheel and brake blocks. Procedure for resetting is explained in the maintenance manual of brake cylinder supplied by the manufacturers.

viii) Once the brake block has worn to condemning limit (shown by the mark on the block) it must be replaced by a new one.

ix) The rocker from position of Brake Cylinder should be kept in horizontal axis of cylinder before fitment.

x) Adequate size of pins and bushes as indicated in the drawing of the system must be used in the rigging to get effective working of the system.

xi) All flexible hose pipes should be tested in every POH.

608 **DESCRIPTION AND MAINTENANCE OF BOGIE MOUNTED BRAKE CYLINDERS (REFER RDSO SKETCH- 81200 & 81204)**

608a Figure 6.3a & figure 6.3b (RDSO sketch. 81200) gives the details of brake cylinders and the part number list is indicated in the table 6.2.

608b Detail of 203 mm Air Brake Cylinder (with slack adjuster) is given in **figure 6.4** (RDSO sketch-81204)

608c **Hand Brake Attachment**

On the Piston trunk of brake cylinder hand brake trunions are fitted whenever it is required. During the service application the hand brake trunion does not move. The maximum hand brake stroke required at the trunion corresponds to maximum brake cylinder stroke.

608d **Re-Setting**

A red paint mark on the Adjusting tube sub-assembly indicates that the piston unit has extended over its full range and requires re-setting. The design of brake rigging unit is done in such a way that range of slack adjuster covers the life of brake blocks so that resetting and replacing the brake blocks will be done at the same time. While keeping the adjusting screw stationary, by turning the adjusting tube sub-assembly in clock wise direction the distance between piston to cross head is reduced to minimum level. The resetting of unit takes place at position.

608e **Procedure for Re-setting**

Hold the latch out of engagement with the resetting plate. The adjusting tube should be turned in clockwise direction by means of the lugs until it reaches the inner end. Then reengage the latch.

608f **Dismantling**

i) Unscrew cross head and adjusting tube sub-assembly.

ii) Loose jubilee clips and remove dust excluder and bush.

iii) Admit compressed air in brake cylinder, unscrew grub screw. Vent compressed air and unscrew collar by using C-spanner. remove hand brake trunion.

iv) Unscrew hex nuts M12 slowly. Please note that release spring compressed with force of **60 kg**. **Note:** The release spring exerts severe force while dismantling the unit, the front cover should be removed very carefully. The dismantling can not be done by a single person. Atleast two persons are necessary.

v) Remove front cover, release spring, piston trunk sub-assembly with trunion body and ratchet with adjusting screw.

vi) Remove split pin, pin and rocker arm.

vii) Remove allen bolts and piston and piston trunk sub-assembly. Please not that piston and piston trunk sub-assembly are matched pair and are not interchangeable. Always put some identification mark.

viii) Remove circlip, collar , ratchet with adjusting screw, pawl, pawl spring, Plunger, turnion body, thrust washer.

ix) Remove Piston packing from piston.

608g **Cleaning and Inspection**

Wash all the parts in suitable cleaning fluid and wipe them carefully. Inspect pawls, Pawl housing ring, ratchet, tooth rollers, roller plate, thrust washer for wear and damage. Inspect threads of ratchet with adjusting screw and adjusting tube for the possible damage. Replace packing. Check all the springs for possible corrosion and distortion. It is advisable to change the springs on every POH. Give all other parts a thorough visual inspection to detect apparent defects. Replace worn or damaged parts.

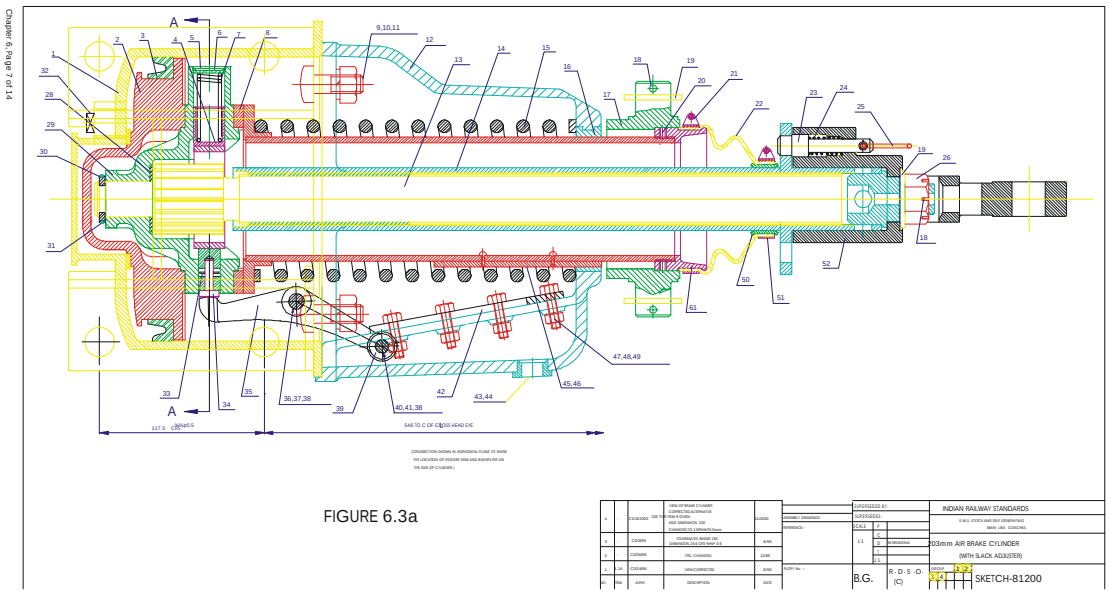
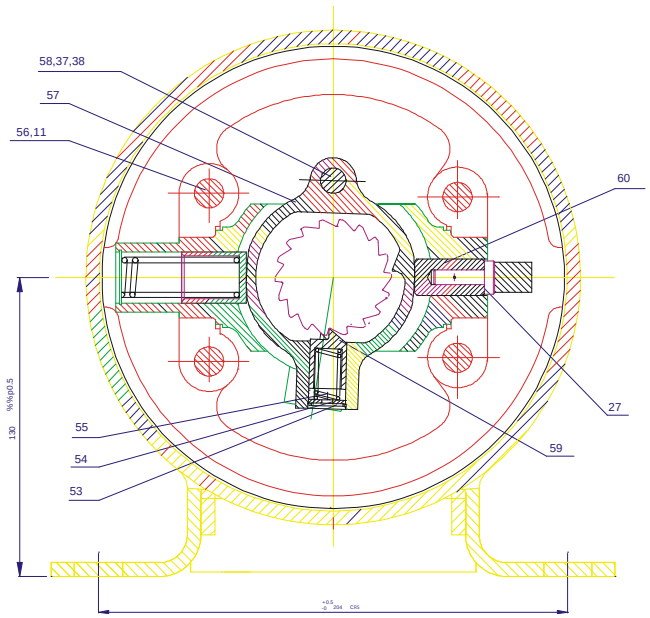


FIGURE 6.3a

					SUPERSEDED BY:	INDIAN RAILWAY STANDARDS
					SUPERSEDES:	
					SCALE	
				1:1		403mm AIR BRAKE CYLINDER (WITH SLACK ADJUSTER)
					GROUP	SKETCH-81200
					B.G.	R · D · S · O · (C)



%%USECTION A-A (FULL CROSSECTION OF CYLINDER SHOWN)

%%uNOTE:-

1. ITEM-17 WITH WASHER AND SPLIT PIN TO BE USED WHEN HAND BRAKE IS NEEDED.
2. BRAKE CYLINDER SHOULD BE LEAK PROOF WITH TESTING AIR PRESSURE 7 kg/sq.cm.
3. REFER RDSO SK-81057 FOR OTHER WORKING PARAMETERS.

ALT.	ITEM	AUTHY.	DESCRIPTION	DATE
4	-	CD/8/2000	VIEW OF BRAKE CYLINDER CORRECTED,ALTERNATIVE SIZE FOR ITEM 9 GIVEN AND DIMENSION 130 CHANGED TO 130%%P0.5mm	11/2000
3	-	CD/3/99	TOLERANCES ADDED ON DIMENSION 204 CRS %%P 0.5	8/99
2	-	CD/35/98	TITEL CHANGED.	12/98
1	1,16	CD/24/98	VIEW CORRECTED.	8/98

ASSEMBLY DRAWINGS
REFERENCE:-
FLOPY No. :-

SUPERSEDED BY:
SUPERSEDES:
SCALE 1:1 P C D T J.S. SK SRIVASTAVA

INDIAN RAILWAY STANDARDS
E.M.U. STOCK AND SELF GENERATING MAIN LINE COACHES.
203mm AIR BRAKE CYLINDER (WITH SLACK ADJUSTER)

B.G. R · D · S · O. (C)
GROUP 1 2 3 4
SKETCH-81200

FIGURE 6.3b

TABLE 6.2

Item	Description & dimensions	No. off	Ref. Drg.	Mtl. & spec.	Remarks
1	Cylinder Body	1	SK-81201		Item 1, 3,4 & 5
2	Piston	1	SK-81203		Item - 1
3	Piston packing	1	SK-81204		Item -10
4	Plunger	1	SK-81206		Item - 2
5	Circlip Light B22	1	-	IS:3075	Galv.
6	Special Washer	1	SK-81206		Item-14
7	Plunger Spring	1	SK-81206		Item-18
8	Piston Trunk	1	SK-81204		Item-1 & 2
9	Tee bolt M12x35 Alternatively M12x45	4	-		Galv.
10	Hex. head nut M12	4	-	IS:1363	Galv.
11	Spring washer M12 type A	8	-	IS:3063	Galv.
12	Dome cover	1	SK-81202		Item-1
13	Ratchet with adjusting screw	1	SK-81204		Item-9
14	Adjusting tube	1	SK-81204		Item-6, 7 & 8
15	Release Spring	1	SK-81206		Item-20
16	Guide bush	1	SK-81202		Item-2
17	Hand brake trunion	1	SK-81205		Item-12
18	Split pin ϕ5 x 40	3	-	IS:549	Galv.
19	Washer M22 type -C	3	-	IS:2016	Galv.
20	Slotted head grub screw 'C' M6x6	2	-	IS:2388	Galv.
21	Jubilee clip size-5	1	-		Galv.
22	Dust excluder	1	SK-81204		Item-11
23	Latch	1	SK-81206		Item-3
24	Latch spring	1	SK-81206		Item-21
25	Ring	1	SK-81206		Item-23
26	Slotted Nut 7/8" B.S.W. (20 mm high)	1	-		Galv.
27	Shims for plunger	As required	SK-81206		Item-16
28	Special washer	1	SK-81206		Item-12
29	Trunion Body	1	SK-81205		Item-1
30	Coller	1	SK-81206		Item-4
31	Circlip light A32	1	-	IS:3075	Galv.

Contd… on next page

Item	Description & dimensions	No. off	Ref. Drg.	Mtl. & spec.	Remarks
32	Plug ½" B.S.P.	1	-		Galv.
33	Solid Taper pin ϕ 2 x14	1	-	IS:2393	Galv.
34	Plunger pin	1	SK-81206		Item-11
35	Rocker arm	1	SK-81206		Item-1
36	Rocker arm pivot pin	1	SK-81206		Item-10
37	Special washer	2	SK-81206		Item-9
38	Split pin ϕ 3.2x18	3	-	IS:549	Galv.
39	Roller	2	SK-81206		Item-5
40	Rocker arm roller pin	1	SK-81206		Item-9
41	Washer	1	SK-81206		Item-5
42	Roller Plate	1	SK-81201		Item-2
43	Bush	1	SK-81202		Item-3
44	Filter	1	SK-81202		Item-4
45	Guide bar	1	SK-81204		Item-3
46	Snap Head rivet ϕ 2.5x8	2	-	IS:2155	Galv.
47	Hex. head bolt M6x25	8	-	IS:2155	Galv.
48	Hex. nut M6	8	-	IS:1363	Galv.
49	Spring washer M6 type A	8	-	IS:3063	Galv.
50	Bush	1	SK-81206		Item-17
51	Jubilee clip size 2	1	-		Galv.
52	Cross head	1	SK-81203		Item-2
53	Circlip light B16	2	-	IS:3075	Galv.
54	Special washer	2	SK-81206		Item-15
55	Pawl spring	2	SK-81206		Item-19
56	Alen screw ½" BSFx 2"x7/8" TD. length	4	-		Galv
57	Pawl housing ring	1	SK-81206		Item-6
58	Pivot pin	1	SK-81205		Item-3
59	Pawl	2	SK-81206		Item-8
60	Plunger	1	SK-81206		Item-7
61	Retaining nut	1	SK-81206		Item-24

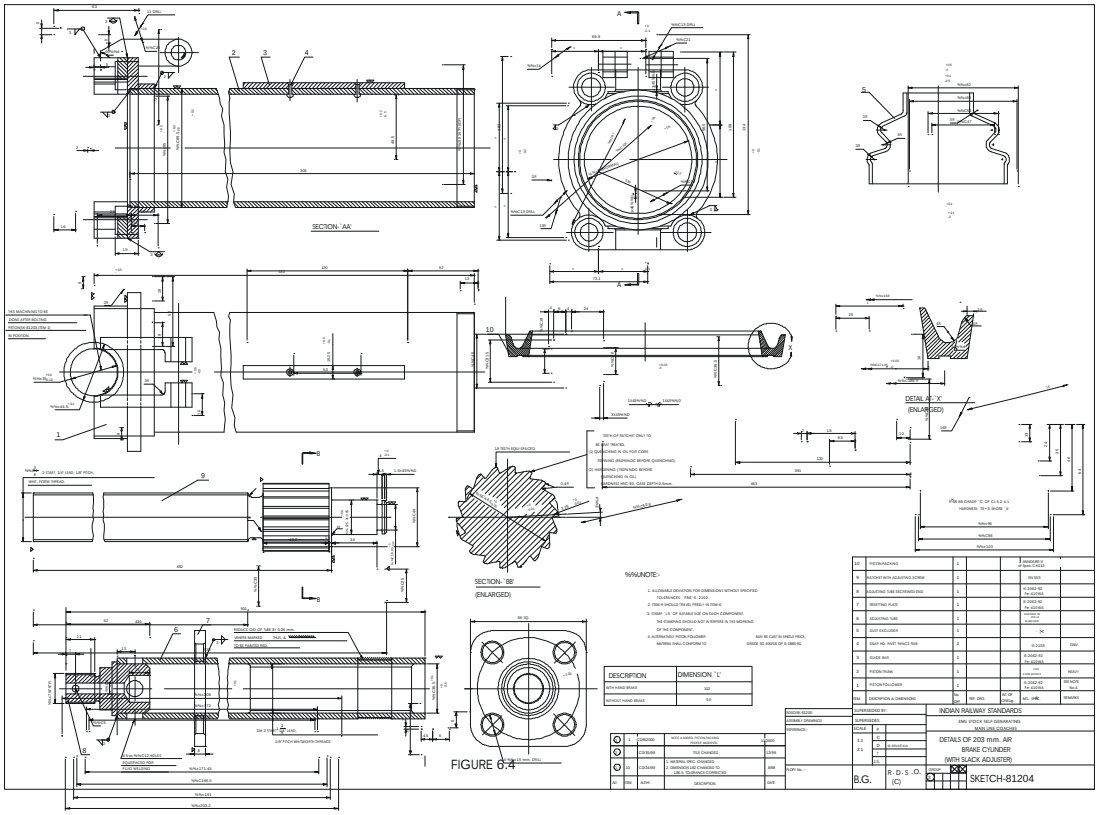

SECTION- AA
SECTION - BB
(ENLARGED)
DETAIL AT 'X'
(ENLARGED)
INDIAN RAILWAY STANDARDS
DETAILS OF 203 mm. AIR
BRAKE CYLINDER
(WITH SLACK ADJUSTER)
SKETCH-81204

FIGURE 6.4

608h **Assembly**

After cleaning and inspection of all the parts and before re-assembly apply uniform layer of grease Esso Becon 2 on all the moving parts. Grease cylinder body and piston packing liberally with Esso Becon 2.

i) Put washer and insert ratchet with adjusting screw in turnion body. Put two collars in the groove of ratchet with adjusting screw and lock it with circlip.

ii) Insert spring retaining cup plunger spring, washer and internal circlip with circlip plier in the longer side of trunion body.

iii) Insert pawl (ensure proper position) pawl spring in the square hole of the trunion body and lock it with strip. Bend the ends of the strip.

iv) Place pawl housing ring on trunion body so that it pivots on the pivot pin of turnion body. Check that tooth of pawl housing ring matches with teeth of ratchet with adjusting screw. If required, tooth of pawl housing ring may be filed.

v) Insert plunger pin with required No. of shims. Insert this sub-assembly in the shorter side of trunion body.

vi) Place the above sub-assembly (consisting of all the above parts) on piston (ensure proper position as indicated in the assembly drawing. Place piston trunk sub-assembly on it and lock it with piston by 4 Nos. allen screw and spring washer with a tightening torque of **200 kg.cm**. Insert packing on piston.

vii) Insert rocker arm roller pin in roller and then insert it in rocker arm. Insert roller and washer on the roller side of roller pin and lock it with split pin.

viii) Place rocker arm sub-assembly within two shackles of piston trunk ring sub-assembly and insert rocker arm pivot pin and washer and lock it with split pin.

ix) Tighten roller plate with front cover with 8 Nos. hex. bolts spring washers and hex. nuts .

x) After applying grease Esso Becon 2 on all the moving parts, piston packing, cylinder body, insert the above sub-assembly (consisting of piston trunk sub-assembly, piston in cylinder body.

xi) Place release spring on piston trunk sub-assembly.

xii) Place front cover in required position A,B,C on the release spring and compress the spring with a force of 60 kg approximately. Tighten front cover with body with 4 Nos. hex. head bolts, spring washer and hex. nut with a tightening torque of 200 kg cm.

xiii) Place hand brake trunion sub-assembly on piston trunk sub-assembly. Screw collar on piston trunk sub-assembly and screw in grub screw. Put latch spring and latch in cross head. Insert ring in the latch.

xiv) Put cross head sub-assembly on adjusting tube sub-assembly consisting of adjusting tube, adjusting tube screwed and resetting plate). Lock cross head with adjusting tube sub-assembly by washer, hex. slotted nut and split pin.

xv) Clamp dust excluder on bush with jubilee clip and insert adjusting tube sub-assembly in bush. Screw adjusting tube sub-assembly in bush. Screw adjusting tube sub-assembly on ratchet with adjusting screw till it reaches its dead end.

xvi) Clamp dust excluder on collar with jubilee clip.

xvii) Screw 1/2” plug with O-ring in body.

608i **Testing Procedure**

The testing procedure of brake cylinder is given below

PREPARATION FOR TEST

The test layout is shown in the attached **figure 6.5** (RDSO's Sk 98108). A special pin will be required to locate the cross head between the angle iron slots. During testing cock 2 must be opened slowly whenever the cock is used to admit air under pressure to the cylinder. Connect the air supply to the cylinder body. Commence with all cocks closed

TEST NO. 1 Leakage:

Open Cock 1 to charge the MR to **7 kg/cm2** pressure
Open Cock 2 to charge the cylinder **0.7 kg/cm2** pressure

The piston stroke must be limited to 32mm, wait for one minute for settlement and there must be no drop in pressure shown in the leakage volume gauge for a further minute. Also observe that leakage does not exceed **0.1 kg/cm2 in 10 minutes.**

Repeat this test with the cylinder charged to **3.8 kg/cm2** pressure and with cock 3 closed limiting the maximum piston stroke to **95 mm**. Observe that the leakage does not exceed **0.1 kg/cm2 in 10 minutes.**

Open Cock 3 to exhaust the cylinder pressure to zero.

TEST NO. 2 - OPERATION:

A. Full Stroke

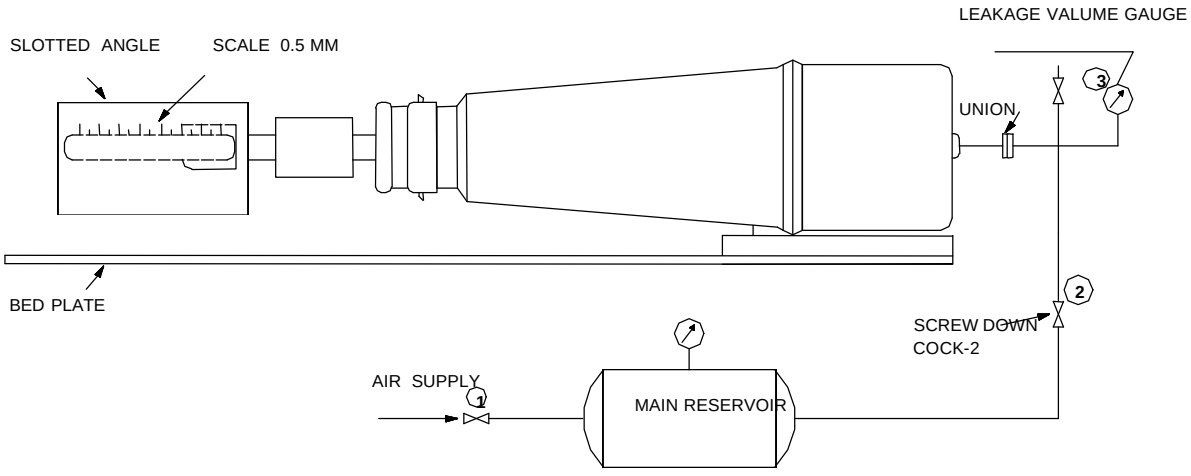
- Close cock 3 and open cock 2.
- Observe the full stroke of the piston.
- This must be within **± 1.0 mm** of the maximum stroke value.

B. Take-up Stroke

- Close cock 2 and open cock 3 to exhaust the cylinder pressure to zero.
- Close cock 3.
- Open cock 2 and allow the piston to move out slowly until the operating pawl is heard to "click over" then close cock 2.
- Measure the take up stroke .
- This must be 32 mm for main line self generating coaches of 95 mm stroke.
- Close cock 2 and open cock 3.
- As the cylinder returns to release the locking pawl must be heard to click into position

Note:

1. Operate the piston at full stroke at least 18 times to test all ratchet teeth.
2. Observe that the adjuster operates at each release and the adjusting tube and cross head being 'inched' out along the stroke.
3. The movement of the Piston must be smooth without any tendency to stick at any part of the stroke.



TEST LAYOUT FOR BRAKE CYLINDER WITH BUILT IN SLACK ADJUSTER

RDSO SKETCH - 98108

FIGURE 6.5

C. Take-up Length (without Quick Resetting Gear)

- Close cock 2 and open cock 3.
- Remove the pin from the cross head and unscrew the adjusting tube until the red resetting mark on the adjusting Tube is visible.
- Disengage resetting latch and screw in the Adjusting Tube.
- Re-engage resetting latch.
- Check that the Dust Excluder Collar is free and does not twist when the Adjusting Tube is being rotated.
- Close cock 1 and open cock 2.
- Close all cocks when the system is at atmospheric pressure.

D. Take-up Length (With Quick Resetting Gear)

- Close cock 2 and open cock 3.
- Remove the pin from the cross head and turn the resetting screw until the red resetting mark on Adjusting tube is visible.
- Screw in the Adjusting Tube with the resetting screw.
- Check that the Dust Excluder Collar is free and does not twist when the Adjusting tube is rotated . Close cock 1 and open cock 2.
- Close all cocks when the system is at atmospheric pressure

608j **Important Instructions for Reassembling the Brake Cylinder at the Workshops**

i) While fixing the Roller plate with front cover 4 pairs of hex. Bolts M 6x25 along with spring washer A6 and hex nut M6 are required. Before fixing the roller plate, the inner surface of front cover should be checked for perfect plane. At the time of fixing the roller plate with front cover 2 Nos. of spring washers are kept inside in between them (one each side) in first two bolts, so that the rollers can move smoothly in the cover plate in angular position.

ii) While matching the holes of plunger and plunger pin number of shims are added (say 2 or 3) as per the requirement, in the plunger pin so that spring Dowel pin Ø2X14 easily locks the plunger and plunger pin by inserting the dowel pin in the holes.

iii) At the time of re-assembly check that the tooth of pawl housing ring matches with the teeth of Ratchet with adjusting screw. The pawl housing ring must go smoothly inside the teeth of Ratchet. If it is not matching then the notch portion of the tooth of pawl housing ring should be filed till it matches with the teeth of Ratchet screw.

iv) Before final assembly of piston and piston trunk sub-assembly ensures that the threads of adjusting tube (turns in clock wise direction) smoothly matches with the threads of Ratchet screw.

v) Before fixing the front cover in the cylinder body check visually the red paint mark appears in the Adjusting tube. If it is not visible then repaint.

608k **Special Tools**

Table 6.3

Description	No. off
Ball peen hammer 1/2 kg	1
Screw driver big	1
Screw driver small	1
Double end spanner to tighten/loosen M6 nut	1
Press machine to apply 60 kg force for assembling front cover with body	1
Scriber to remove Split pin	1
5 mm Allen key	1
Torque wrench with 200 kg cm	1

*****

CHAPTER 7

TRAIN LIGHTING AND MAINTENANCE SCHEDULES OF NON AC COACHES

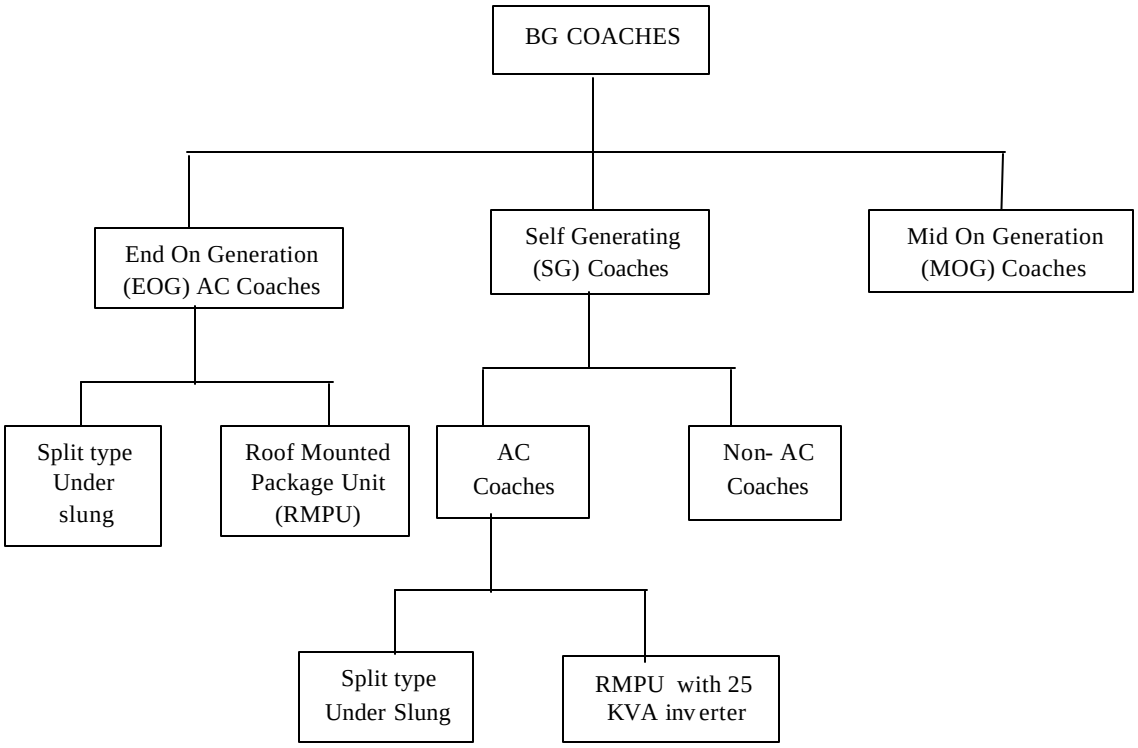
701 INTRODUCTION

The following systems of Train Lighting are in use on Indian Railways BG coaching stock:

1. End On Generation (EOG)
2. Self Generation (SG)
3. Mid On Generation (MOG)

Depending upon the train lighting systems, the coaches are of following types.

In this chapter the train lighting system of Non AC and AC SG coaches will be discussed.



GO TO CONTENTS CHAPTER CONTENT

702 GENERAL DESCRIPTION OF MAJOR EQUIPMENT

702a BRUSH LESS ALTERNATORS

Brushless alternators are axle driven, with 'V' belt drive, mounted on the bogies of the AC & TL coaches. These alternators are of various ratings and make as per requirement for different type of coaches. They are being procured as per following RDSO's specifications: -

Specification No.	Ratings
EL/TL/47 Rev 'C' with amdt no.1,2,3	4.5 kW, 37.5A, 120 V DC used on non AC coaches.
EL/TL/54 Rev 'A' with amdt no.1,2,3	18 kW, 138.5A, 130 V DC used on SG AC coaches. (Split type underslung)
ELPS/SPEC/TL/01, Dec. 1993 with amdt no. 1 & 2	Optimized 22.75 kW/25kW, 175A/ 193A, 130V DC, used on AC coaches of SG type

4.5 kW Brush less alternators are used on Non AC BG Coaches. It consists of a three-phase hetropolar inductor type Alternator and a static Rectifier-Cum-Regulator Unit (RRU).

Earlier AC coaches provided with under slung split type AC units were fitted with two nos. of 18 kW brush less alternators. After the development of roof mounted AC units (RMPU) and 25 KVA inverters, 22.75 kW (Optimized) brush less alternator was developed within the same frame size of 18 kW alternator. Subsequently 25 KW alternator with new design was developed for 2 tier and 3 tier AC sleeper coaches with RMPU and 25 kVA inverters and for AC 1st class one 25 kW alternator with 25 kVA inverter provided.

The brushless Alternator with the help of static rectifier cum regulator unit is capable of developing voltage at the set value to meet the coach load during journey from minimum speed for full output (MFO) to maximum speed. The alternator is used for:

i. Charging the coach batteries.

ii. To meet electrical load i.e. fans, lights, air conditioning, water-raising apparatus (WRA) etc. in the coach.

4.5 kW brush-less alternator are driven by 4 Nos. of C122 matched sets of 'V'belt coupled between the axle and the alternator pulley. The axle pulley is of 572.6 mm PCD (pitch circle dia.) and alternator pulley is of 200 mm PCD. Belts are kept under tension by a spring-loaded belt-tensioning device.

18kW/ 22.75kW/ 25kW alternators are fitted with 12 Nos. of deep V-grooved pulleys of 200 mm PCD with six grooves on each side of the shaft, which is driven by V-belt in conjunction with an axle pulley.

702b RECTIFIER-CUM-REGULATOR UNIT (RRU)

The rectifier cum regulator unit has mainly following functions:

i To rectify the 3 phase AC output of the alternator through DC full wave bridge rectifier.

ii Regulating the voltage generated by the alternator at the set value.

iii Regulating the output current.

Recently electronic rectifier cum regulator (ERRU) confirming to RDSO specification No.RDSO/PE/SPEC/D/AC/0013 (Rev.0), developed, which has been fitted on a very few coaches on trial.

702c BATTERIES

The following types of batteries are provided on under-frame of AC & non AC Self Generating type and End On Generation type coaches.

i. 6V/120 Ah flooded type (Mono block cells) on Non AC BG SG coaches.

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ii. 2V/120 Ah , VRLA cells on Non AC BG SG (Self Generating) coaches.

iii. 2V,1100 Ah 56 cells VRLA 110 V SG AC coaches fitted with RMPUs and 25 kVA Inverter

iv. 2 V, 800 Ah flooded type cells on under-slung mounted split type AC equipment.

v. 90/120 Ah, 24V on EOG (End-On-Generation) type AC coaches (Emergency batteries for lighting)

The 2V,120 Ah TL batteries are used in conjunction with brushless alternator with suitable Rectifier-cum Regulator of 4.5 kW capacity for train lighting system of TL BG SG type coaches. The 2V, 56 cells 800 Ah / 2V, 56 cells 1100 Ah VRLA batteries are used in conjunction with brushless alternator with Rectifier-cum Regulator unit of 18/22.75/25 kW capacity for AC coaches. 1100 Ah batteries are used on AC coaches equipped with the Roof Mounted Package type AC plants. 1100 Ah capacity battary are of the valve regulated lead acid (VRLA) type which has its inherent advantages like :

- Topping up with water is not required.
- Periodical checking of specific gravity is not required.
- Regular maintenance to avoid sulphation of terminals and connections not required.

The VRLA batteries are also known as Sealed Maintenance Free (SMF) batteries.

702d BATTERY BOX

ICF type design battery box for AC coaches is a fabricated framework made of mild steel confirming to drg. No. WGFAC-7-1-026. Whereas RCF design is of closed type confirming to drg. No. CC71448 (PP side) & CC71451 (NPP side), It is suspended on coach in the under frame and is provided with front opening doors for paying attention to batteries. FRP trays are provided to prevent corrosion. The interior of the battery box is painted with anti-corrosive paint.

While mounting the battery box in underframe of the coaches, special care is taken to provide locking nuts and split pins to avoid any accidental falling of batteries while running.

Recently both the Production Units have been instructed to provide battery boxes as per RDSO drg. No. RDSO/SK/K/0037, which is suitable for both makes of VRLA batteries i.e. M/S Exide and M/S Amar Raja. The battery box is having improved safety factor coupled with flexibility to accommodate both makes of VRLA batteries.

702e BCT (Battery Charging Terminals)

BCT is provided at the both sides of the coaches for external charging of the batteries at stations of maintenance lines.

702f RJB (Rotary Junction Box)

Rotary Junction Box is provided inside the coach. It is used to arrange and control the power supply to various circuit of the coach (e.g. light, fan) with the help of rotary switches and HRC fuses.

702g EFT (Emergency Feed Terminals)

It is provided at the both ends of the coach to feed the additional supply to the adjacent coach in case of emergency. Supply from the healthy coach may be extended to him/dark coach by connecting supply to the positive and negative terminals of the EFT.

702h TL Lamps

25 and 40 Watt lamps are provided in the non AC coaches. The power supply is at 110 Volt DC. 25 Watt lamps are used in corridor, light lamp, wash-basin, toilet. 40 W lamps are used for lights in the coach.

702i FTL (Fluorescent Tube Light)

It is a 2 feet long, 20 watt fluorescent tube light provided in the coach for the light. It works at 110 V DC supply. It gives better illumination and is being provided in the coaches in place of TL lamps.

702j Carriage Fans

On non AC BG coaches 400 mm sweep carriage fans are used where system voltage is 110 DC. These fans are fixed type and confirm to IS : 6680-92 with latest annexure 'H' for deviation to IS 6680-92.

703 TRIP SCHEDULE (PRIMARY & SECONDARY MAINTENANCE)

703a ATTENTION ON MAINTENANCE LINES

As soon as the rake is berthed in the maintenance lines and before commencing the work, a caution board shall be clamped to the rail on either side of the rake by TXR or his representative. Rail locks shall be used on either side of the rake for the safety of maintenance staff attending under gear equipment. TXR should ensure clearance from electrical Chargemen/staff incharge for the maintenance of rack before removing the caution board and rail locks.

To avoid any malfunctioning of the above system, printed forms for permit to work on pit lines issued by the traffic department and after completion of the work, completed / men withdrawn form can be used.

Check the plate-form attention report and concentrate first on attending the defects in these coaches by adapting systematic trouble shooting procedures. Proceed as follows in respect of other equipment.

703b ALTERNATOR

First attend alternators in coaches for generation, which have arrived "cold" and coach dark condition as per platform report. Proceed as follows:-

- Check field fuse, replace if found blown, with approved makes i.e., S&S or English Electric make.
- Check the continuity of field and phase winding with the help of test lamp/ multi-meter to ensure that windings are not open circuited.
- Check for loss of residual magnetism with the help of voltmeter across the field terminals. In case of loss of magnetism, give 12 V DC flashing to the field terminals for few seconds to regain lost residual magnetism.
- Check that the regulator feedback loop is O.K.
- Check connections for tightness in alternator and rectifier regulator. If this is all right, remove belt from alternator.
- Use testing machine for testing alternator in situation. Couple the portable motor drive with Alternator.
- Check the DC output voltage at the rectifier and regulator terminals. Identify the defects if any and rectify them. The battery should be isolated while doing this test.
- Provide new split pin for pulley castle nut after completion of work.
- Check up the condition of safety chain and availability of split pins in safety chain bolts.
- Check up alternator suspension bracket and tension gear for any damage and replace, if necessary.
- Check up and tighten loose bolts in terminals box covers.
- Check availability of split pin for alternator castle nut.
- Check the belt tension after every round trip of the coach.

- For new V-belt fitted, the belt should be re-tightened after completing the first trip.
- Check the tension indicator pin at suspension point after every round trip for flat belt drive alternator.
- Never energize field from battery in case of failure of field circuit diode in regulator. Apart from non regulation, this may cause permanent damage to field windings.
- If there is no generation, ensure that there is no breakage in the cable termination.

703c AXLE PULLEY

- Examine the indicating white mark on the pulley axle and ensure that the pulley has not slipped. If pulley has slipped, take necessary corrective action.
- Tap the pulley with hammer and judge the tightness or crack by sound. If it gives clean metallic sound the pulley is tight. Dull sound indicates that it is loose. Bolt should be tightened with torque wrench to 30 kgm.
- Check the lock nuts and split pins for availability and tightness.

703d BELTS

- Check condition of belt for fraying of edges, etc.,
- Check the belts for overturn and correct it, if necessary.
- Check the number of belts which should be 4 nos. for 4.5 kW alternator.
- Tension should be felt by hand by striking it slightly. Belt in correct tension will respond `alive' and `spring-back'. If required retensioning, the same shall be retensioned to the recommended values as applicable. This can also be checked using a suitable tension meter as per recommendations of V belt manufacturers.
- Check that all the sets of belts provided should be of same make & grade.

703e RECTIFIER CUM REGULATOR

- Clean regulator externally. Open regulator terminal cover and check for signs of overheating in all the terminals/bus bars/etc. Check up for loose connections and tighten the same. If the terminal board is found affected due to heat, replace terminal board with new one.
- Check for any damage to the phase and field wires /cables inter connecting regulator and alternator and its anchoring arrangement.
- Check and secure properly the terminal cover and regulator cover.
- If the generator is normal, check the cable termination of the regulator visually for any abnormality.
- If the alternator arrived without generation, open the regulator and check for any abnormality and ensure the fuses are intact.
- Check the cable for any abnormality from the alternator to the regulator by using test lamp, if found open/short attend the same.
- Ensure the residual magnetism is available in the alternator.
- If needed change the regulator and ensure the generator by running the alternator with a portable motor.

NOTE : Components : Components of RRU such as MA, ET, CT, OVR etc., and electronic components such as power diode, field diodes, zener diodes, auxiliary diaode etc., shall be procured only from OEM.

Maintenance of alternator/RRU has to be done in line with SMIs issued by RDSO as well as Manufacturer's recommendations.

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703f BATTERIES/BATTERY BOX

i. Conventional Lead Acid Batteries

- To know the condition of cells during `Trip Examination' some cells in a battery are treated as `pilot' cells. On arrival of train in the maintenance line, disconnect all inter vehicle connections. Record the specific gravity of `pilot' cells in each battery. Different cells should be identified as pilot cells every month. The idea of identifying different cells as pilot cells every month is to ensure that true condition of the battery is reflected.

  In case of conventional coaches working on 110 V D.C. system there are two crates with 9 mono block batteries in each battery box. Marking of these cells to indicate pilot cells shall be done as follows.

Table 7.1

1	2	3	4	5	6	7	8	9
10	11	12	13	14	15	16	17	18

Table 7.2

Month	Pilot Cells
1st Month	1, 12, 13
2nd Month	2, 11, 14
3rd Month	3, 10, 15
4th Month	4, 9, 16
5th Month	5, 8, 17
6th Month	6, 7, 18

Repeat cycle further.

Check the floats of each cell and check for correct electrolyte level as indicated in the float stem. Replace missing/defective floats. In case of low level, replenish with distill water. If any cell needs too much water for replenishing, watch for crack in the cells and also check the voltage on load which should not be less than 1.80 V. In case of any defect, remove the cell and replace by a spare one preferably of the same make and lug date or a lug date as close to the one already in the coach.

- Coaches with discharged batteries which shows less than 100 V on load should be put on charge at double the normal rate of charge and the charging reduced to half the rate of charge as soon as the gassing starts and continued till the specific gravity rises to the fully charged value which should be between 1210 and 1220. Use the battery charging terminals provided in coaches for charging purpose. Check up correct polarity and connect the charging cables. Use a clip on D.C. ammeter of 0-25 A range to check up the battery charging current. Note down the rate of charging and the number of hours of charge.

- Check specific gravity of pilot cells and the total voltage of battery on load at the end of charge and record.

- Keep micro porous vent plug tight. Ensure that washer is available in micro porous vent plugs.

- Check all the battery box members for any cracks in the fabricated battery box/cradle and take corrective action.

- Check for proper fit ment of mono block in the battery box ensuring wooden packing pieces.

- The person in charge of battery maintenance should record all the readings mentioned above in his diary and this information should be transferred to the register maintained for various trains.

- Check anti-theft rods and provision of nuts both inside and outside the battery box on either side. Provide if found missing. Secure battery box cover finally after all works are completed.

- Ensure that the fitment of the battery box is in order with all the bolts, nuts, lock nuts, split pins etc. are in order.

- Ensure the weldings are proper and the bottom plate of the box is well secured.

- Ensure the cells are properly cleaned.
- Ensure the water level in all the cells/mono block is upto the mark and top up the cells with distilled water wherever required.
- Ensure all micro porous vent plugs and sealed floats guide are properly closed.
- Check the sp. Gravity of the cells if it is less than 1200, the battery shall be connected on charge.
- Measure the load voltage of the cells/mono block if it less than 100 V, identify the low voltage cell and replace if needed.
- Check the terminations in the fuse and the condition of the fuse.
- Check the termination of cable in the under frame link box, for proper condition and attend if needed.

ii. VRLA Batteries :

SMI no.RDSO/PE/TL/SMI/0001-98 (Rev.0) dt. 01.06.98 to be followed.

703g EARTH CHECKING

Before checking the earth in the coach, it should ensure that coach is not connected to the adjacent coach through EFT (Emergency Feed Terminal). After isolating the coach the earth shall be tested by using a double test lamp as explained in the RDSO code of practice of 110 V coaches. If any earth is noticed the required corrective measures should be taken to remove the earth before inducting the coach in the service. No coach shall be allowed for service with +ve earth. However incase of –ve earth this can be allowed for maximum one trip that too with properly marking as –ve earthed.

Record all the attention given in the under frame and roof, the Specific Gravity, the condition of generation, lamps, fans and fuses, availability of belts etc. with coach and other details.

703h FANS

Following scheme is prescribed for all trains during primary or secondary maintenance at a depot:-

- Switch on each fan individually. Check starting of fan when switched on. In upper class coaches, check fan for starting in the lowest position of regulator and also for variation of speed in the other regulator positions. If the fan does not start, short the switch terminals with a small piece of wire temporarily. If the fan starts this will indicate that the controlling tumbler switch/regulator is defective. Replace defective switch/regulator.
- If the fan does not start when the toggle switch terminals are shorted, proceed as follows:
  - Test for supply at the 2way connector terminals near the fan with the tumbler switch on. If there is no supply, the wiring is defective and has to be attended.
  - Open dome cover in case of swiveling fans and remove fan body fixing screws in case of fixed fans.
  - Remove carbon brushes. Check brushes for condemning size, proper bedding, correct spring tension and correct grade of brush.
  - Check for free movement of brush in the brush holder. Replace defective brushes/ springs.
  - If the commutator is dirty, clean the surface with sand paper of 0/0 size.
  - If the commutator surface is grooved or the segments are found pitted in one or more locations, replace the fan by an overhauled fan. The defective fan can thereafter be rectified by replacing the defective

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armature by a good one. If spare armature is not available send defective fan to shop for attention.

- ♦ If the fan is noisy, check for loose blades/fan guards and tighten them. If the noise is due to bearings, replace the fan and send defective fan to shop for replacing.

- Check the fuse for fans and ensure that it is of correct size (35 SWG) tinned copper.

- Clean fan body and its guard.

- In swiveling and bracket fans ensure that the fan dust cover is promptly replaced after attention and also that the nylon cord provided to prevent loss of fan dust cover, is available in position.

- The MCB/fuse controlling the fan circuit shall be checked for correct rating (16A for non AC SG coaches and 6 A for SG AC coaches and proper functioning and replace if found defective.

- Note down the total number of fans in each coach and the number of fans found defective. Defective fans shall include fans, which required push start. The aim is to achieve cent percent working of fans. The records mentioned above will help in working out the extent of the problem in any particular service to take quick remedial action.

- The fans shall be available as per lay out for the coaches. In case it is necessary to remove any fan for attending to major defects and no spare fan is available a 'Deficiency Label' shall be affixed near the fan point. In case no deficiency Label is available. Theft Memo shall be issued to the security branch.

- Deficiency of fans shall be promptly made good when noted by any depot irrespective of whether the train is primarily maintained or not except in case of repeated large scale deficiencies of foreign Railway's coaches. The Depot/Railway entrusted with primary maintenance shall be advised by message whenever the deficiency is made good or when large scale deficiencies are noted on arrival.

703i LIGHTING

- Switch on each lamp/tube light. If the lamp/tube light does not glow, check lamp/tube light and replace, if fused. If the lamp is all right, check control fuse and replace, if found blown.

- If the fuse is all right, check control switch and replace, if necessary. If the switch is all right, check up lamp holder for stuck up plunger or loose connection and rectify defect. If there is no defect in the lamp holder, check up for supply at the holder terminals and if the wiring is found defective, mark the coach "Sick" and arrange for attention in maintenance lines.

- Note down the coach number, total number of lights in each coach and the number of defective/missing lights on arrival.

- Provide switch covers and fuse covers promptly, if they are missing.

- If any dome cover is open or not secured properly, rectify defect, if any and secure.

- Replace broken glass domes/acrylic covers of tubelights.

- In case of berth lights in first class and AC coaches, check up for free movement of shutters. Replace, if found defective.

- Clean side lamp glasses and red shield inside the lamp in SLRs. Check up for free movement of operating handle and drop same lubricating oil, if necessary. Clean tail lamp glass and the reflecting surface inside.

- In case of fluorescent light check holders, switches, electronic ballast and wiring and rectify defect/replace component.

- Check MCBs/fuses for light circuits in junction box for proper operation and replace defective MCBs. Watch for loose connections between MCB and bus bars and rectify. Ensure that MCBs/fuses are intact for protection of each circuits.

- Check tightness of terminal connections of HRC fuse for negative circuit in junction box and rectify defect, if any.

- Use fuses/fuse wires of recommended sizes in junction box as a stop gap measure in place of MCBs and HRC fuses. Ensure that fuse wire provided in junction box as a temporary measures enroute should be replaced with MCBs & HRC fuses of the correct sizes at the primary maintenance depot.

- Remember that fuses & MCBs are safety switch gears provided for isolating the supply in case of faults. Never by-pass or use incorrect fuses as this may result in serious failures.

703j WIRING AND ACCESSORIES

- Earthing of wiring in the coach shall be checked both on the positive and negative wire separately in each coach by the earth testing device. A coach with negative earth fault in case of 110 V DC system, which could not be attended in time, can be given in service in case of emergency. The coach shall be taken for attention by the primary maintenance station during the next trip.

- Cable insulation on coaches get damaged in various ways resulting in earthing. Damaged insulation whenever noticed shall be promptly taped with PVC tape.

- The chipping of insulation is a dangerous practice this leaves permanent scratch on the cable. The taped conductor will not be quite satisfactory and so chipping should never be done. Testing shall be done only at cable terminations.

- Poor chipping of cable, poor crimping of cable lugs and loose connections in terminals will result in excessive heating and discoloration of lugs, tapes and cables. Watch for this during inspection and take prompt action to locate and rectify the defects. Replace overheated tape and re-tape the overheated portion of cable insulation at terminals using PVC tape after ensuring proper cable connection and cause of overheating.

- Replace blown fuses, incorrect size fuses and discolored fuses by fuses of proper rating. Replace blown or incorrect size of HRC fuses by correct rating. Check all fuses and ensure that they are secured tightly to their terminals. Replace defective MCBs/fuses in junction box by MCBs/fuses of correct rating.

- Never replace a blown fuse by a higher gauge fuse. Remember that fuses are provided for protecting circuits in case of faults. Try to find out the cause of fault.

- Loose and exposed/hanging wires should be secured and properly covered. In case wiring is found mechanically damaged or tampered with or needs replacement , the coach should be marked electrically sick. If the work is of a minor nature, this may be done in maintenance lines.

- If the repairs are heavy the coach may be booked to Shops for attention. Coaches which are suspected to have wiring defect either in the underframe or roof shall be subjected to insulation test with 500 V megger.

704 FORTNIGHTLY SCHEDULE

704a BATTERY

In addition to the instructions contained under "Trip examination" the following works shall be carried out.

- Clean the interior of battery box.
- Clean the cell tops and deposit of sulphate, if any, in inter cell and end cell connections.
- Remove sulphated inter cell connections, clean the connecting surface with a piece of cloth. Use fresh fasteners. Sulphated internal connections and fasteners should be soaked in kerosene oil, cleaned with warm water and kept ready for use. Inter cell connections should be provided with both small and large strips and four fasteners each with one hexagonal nut, one spring washer to IS:3063 and two steel punched washers to IS:2016.
- Remove end cell connectors, clean the connecting surface both in cell and connector thoroughly and provide back. Check for proper crimping of terminal. In case strands of connecting cable are found cut at the crimping end, cut wire at the crimping end and re-crimp with a new inter cell connector. End cell connector confirming to IS:6848 should only be provided. Tinned copper crimping sockets with a single hole, if any, provided as a stop gap measure should be replaced by standard end cell connector. Provide end cell connectors with both the fasteners each with one spring washer to IS: 3063 and one punched steel washer to IS:2016.
- Tap sealed float guides and check for free movement. Look for elongated holes in sealed float guides and replace such guides. Replace deficient floats promptly.
- Check whether vent plugs are of the anti-splash type and replace if required.
- Check the "make of cells and the lug date. Different "makes" of cells mono block if found mixed together should be replaced by a single "make " of cells. If it is not possible to do this during one Fortnightly Examination this should be noted down and attempts made to replace the same during the next Fortnightly Examination.
- Check whether cell/ mono block packing is tight and provide additional packing, if necessary. Use only hard wood coated with acid resistant paint for cell packing. Never use untreated wood or plywood for packing of cells/ mono block. If any cell/ mono block is found cracked, replace it promptly.
- Check for provision of anti-theft rods and provision of nuts, both inside and outside the battery box on either side. Replace deficient rod and nuts.
- Apply petroleum jelly on inter cell connection and end cell connections. Do not use grease.
- Check battery fuses and replace overheated/incorrect size fuses by correct size.
- Check battery box fixing nuts for tightness.
- VRLA Batteries : SMI.No. RDSO/PE/TL/SMI/0001-98 IRev 0) dtd. 01.06.98 to be followed.

705 MONTHLY SCHEDULE

In addition to the works mentioned in Trip & Fortnightly Examination, carry out the following:

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705a ALTERNATORS, RECTIFIER AND REGULATORS

i) Check for tightness of terminal connections of alternators and rectifier regulators.

ii) Thoroughly clean externally the alternator and regulator.

iii) Open inspection cover of regulator. Blow dust with a portable blower. Secure covers tightly after inspection.

iv) Check locking of current setting of regulator, if disturbed it should be reset/locked as prescribed.

v) Check the alternator pulley for proper fixture and the availability of castle nut and split pin.

705b AXLE PULLEY

- Watch for shifting of axle pulley by observing the white band on either side of pulley. Reset the correct position of pulley, if found shifted and tighten the loose nuts with torque wrench with recommended torque..

- Check tightness of nuts and also availability of chuck nuts and split pins in all fixing bolts.

705c BATTERIES

i. Conventional Lead Acid Batteries

- Record specific gravity of individual cells/mono block. "Switch on" full load of the coach and record individual voltage of cells and total voltage. "Switch off" load. If the specific gravity is less than that painted on the battery box, charge the cells as specified under "Trip Examination" after topping up with DM water, if required.

- Use battery charging terminals provided on coaches for charging purposes. Charging should be continued till the specific gravity rises to the value of mentioned in battery box, on "Pilot" cells. In case pilot cells show no appreciable improvement, check specific gravity of adjacent cells. If the specific gravity does not improve in spite of charging, replace the battery by another set and send the defective battery to Depot/Shop for treatment at the earliest. Cells should be handled with due care while unloading and in transit to avoid breakage. Adequate facilities should be created in Depot for treatment of cells which do not pick up charge. Sulphation will be the main cause for this and Sulphated cells should be treated for their recovery as specified.

- On completion of charging, record the specific gravity of individual cells. If there is any wide variation in the specific gravity/ voltage of cells, disconnect and replace those cells showing low specific gravity/voltage by spare ones. In case there are more than 1/3 of total cells with low specific gravity, the entire set should be replaced. Cells showing reverse voltage, zero volts should be withdrawn and replaced by charged cells immediately.

- Record individual voltage of cells and the total voltage on full load of the coach.

- Change the marking of the pilot cell as given in table 7.2.

ii. VRLA Batteries

SMI no. IRCAMTECH/PE /TL/ SMI/ 0001-98- (Rev.0) dtd. 01.06.98 & RDSO/PE/TL/SMI/ 0002-98 (Rev.0) dt. 09.12.98

705d JUNCTION BOX

- Open front door. Check all connections in MCB-cum-fuse panel for tightness any for heating sign, fuses etc. Check availability of terminal lugs for all cables in junction box and replace if necessary by terminal lugs of correct size.

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- Check Rotary Switch / MCBs provided for lights, fans circuits for correct condition and Rotary Switch and EFTs for proper operation. Replace/ repair defective MCBs. If MCBs are not readily available provide rewirable fuses of appropriate ratings, purely as a stop gap measure. Check up negative fuse and replace if necessary by different ratings of HRC fuse for AC and non AC coaches. If rotary switches are provided instead of MCBs, Check for proper operation. Check up HRC fuses provided with rotary switches for correct rating and replace, if necessary.
- Close front door and secure properly by the locking key. If found defective, the same may be attended/replaced.

705e WIRING AND ACCESSORIES

In addition to the items listed under trip inspection, the following items shall be inspected:

Superstructure wiring and underframe wiring shall be tested separately for which the main negative fuse in shall be opened and controlling MCBs for all circuits kept off. All other fuses shall remain in circuit. Insulation resistance shall be measured with all fittings and equipment connected both on underframe and superstructure. The underframe wiring shall be tested with battery fuse open. The IR value should be minimum 2 Mega-Ohm in fair weather condition and min. 1 Mega-Ohm under adverse weather condition. Availability of inspection cover of DFBs should ensured.

705f FANS

In addition to the items listed under " trip examination ", the following works shall be carried out :

- The fan body, guards and blade shall be thoroughly cleaned with cloth.
- All fans shall be opened and condition of commutator, brushes and brush gear shall be thoroughly checked. Action should be taken where necessary as given under "Trip Attention".
- Studs used for fixing the fan to coach body, shall be checked and tightened, wherever necessary. Availability of all the three fixing studs should be ensured.
- All the switches controlling the fans shall be checked for its smooth operation and correct working and replaced, where necessary.
- Fan regulators in Upper class coaches shall be checked for smooth operation from one position to the other. In case the regulators are not regulating the fan speed, the resistance box shall be checked and replaced, where necessary.
- Fan blades shall be replaced if found bent, or if there is no proper air discharge.

705g CARRIAGE LIGHTING

In addition to the items listed out under "Trip Examination" proceed as follows.

- Open each fitting with the dome key and remove the dust of the fitting both from inside and outside. Ensure free operation of locking mechanism and **e**place defective fitting. Clean glass domes first with wet cloth and then with a clean dry cloth.
- Replace rusted fittings and fittings with damaged surface.
- Check up wattage of lamps and replace with that of correct wattage.
- Check up whether toggle switches are marked to indicate lighting control "L", night light control `NL', side lamps in guards compartment as `SL', tail lamps as `TL-Rear', `TL-Front', luggage room as `LRL'. If not, stencil legends with fluorescent paint.
- Check up all lighting circuit fuses in each coach for correct sizes and replace if necessary. Stencil the size of fuses near the locations, if not already done.

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- Mark inspection covers of Distribution fuse boards as `DFB' if not done already.

- Thoroughly clean metal guards for roof light fittings in luggage rooms and paint, if necessary.

705h TUMBLER / TOGGLE SWITCHES

Check each toggle switch of lights and fans for proper fixing and operation. Replace defective toggle switches. Toggle switches should be provided in the locations intended for them and provided with covers with their knobs exposed for operation by passengers.

705i DISTRIBUTION FUSE BOARDS AND FUSE CUT OUTS

Check distribution fuse boards and fuse cut outs of light and fan circuits, for tightness of connections and provisions of correct size of fuses in the fuse terminals. Replace missing distribution fuse board covers.

705j EMERGENCY FEED TERMINALS (EFTs)

- Check up supply and marking of polarity of EFTs.

- Replace missing EFTs and those without wiring nuts.

706 QUARTERLY SCHEDULES

706a BATTERIES

In addition to the instructions contained under "Monthly Examination" following activities should be done:

i. Conventional Lead Acid Batteries

- `Switch off' load. Charge the cells at 50% of normal rate of charge, i.e., at 1/10th of the rated capacity of cells. Record hourly cell voltage and specific gravity reading of every cell.

- Terminate charging when 3 successive readings are constant. Record specific gravity and no load voltage of each cell 10 minutes after terminating charge. Specific gravity should be between 1.210 and 1.220 for cells upto 120 Ah capacity. The voltage should not be less than 2.1 V.

- If there is a wide variation in the specific gravity and voltage readings, such cells should be replaced and sent to shops for treatment.

- Check the cell voltage on full load. Cells showing reverse and low voltage are to be replaced with hwalthy cells of the same make/type.

ii. VRLA Batteries :

SMI no.RDSO/PE/TL/SMI-0001-98 (Rev.0) dt.01.06.98 & RDSO/PE/TL/SMI/0002-98 (Rev.0) dt. 09.12.98 to be followed.

707 HALF YEARLY SCHEDULE

Measure insulation values as follows:

707a SUPER STRUCTURE

Short all the outgoing positive terminals from MCB cum fuse panel.

Measure and record the following insulation values:

- Between the bunched outgoing terminals and earth.

- Between the bunched outgoing positive terminal and main negative outgoing terminal.

- Between the main negative outgoing terminals and earth.

707b UNDERFRAME

Short the incoming terminals PM and L+ in MCB cum fuse panel. Measure and record the following insulation values:

- Between the bunched terminals PM & L+ and earth.
- Between the bunched terminals PM & L+ and main negative incoming terminal.
- Between the main incoming negative terminal and earth.

Note: Insulation resistance under fair weather conditions shall be minimum 2 mega ohm. However under adverse (highly humid/wet) weather conditions, the minimum insulation resistance upto 1 M.ohm will be acceptable.

In case the insulation resistance is found less than the values mentioned above, individual sub-circuits at junction box for super structure wiring and different feeders for underframe wiring shall be meggered separately. The sub-circuit having an insulation value lower than that prescribed above shall be taken up for rewiring. If the nature of repairs is heavy, the coach shall be booked to shops for attention. Do not resort to patchwork in wiring with temporary joints.

Proceed further as follows:

- Strands of alluminium wire cannot serve as tinned copper fuses to protect circuits. Never resort to this habit.
- Use crimped socket of appropriate size in all cable ends to avoid loose connections and consequent overheating.
- Use corrosion inhibiting conducting grease while crimping cables or while connecting wires to prevent oxidation.
- Stencil the correct size of fuses near the locations, if not already done.
- Check all fuses and MCBs for correct rating and MCBs for proper functioning. Replace if necessary.
- Provide spare fuse wires of correct rating for use in branch circuits on the bobbins located on distribution fuse boards.
- Check voltage drop between battery and the farthest light or fan point with full coach load "on". The voltage drop should not exceed 3.0 V.
- Provide deficient switch and fuse covers promptly.
- Coach wiring should be terminated in two way connectors which shall be of tough non-ignitable moulding materials of rigid PVC from which connection to the fitting shall be provided by flexible single core cables for the following :
  - Fans
  - Reading light fittings
  - Side light fittings
  - Tail light fittings
  - Step light fittings.
- Provide missing connectors.
- All cable ends shall be properly socketed. Provide crimping type sockets wherever this is not in existence. Use sockets of appropriate size. Corrosion inhibiting conducting grease shall be applied to the conductor as well as inside the socket before crimping. Soldered joints should ordinarily be avoided, where this is absolutely necessary, only approved grade of solder and flux shall be used.
- Electrical connections provided with bolts and nuts shall be checked and provided with a set of mild steel plain washer and spring washers, protected against corrosion by Zinc or Cadmium plating and passivation. Use correct tools for tightening cable connections.
- Surface of aluminum sockets and bus bars, whenever removed for attention shall be cleaned to remove the oxide film from the jointing surface before making a bolted joint and shall be coated with corrosion inhibiting conducting grease to prevent re-formation of oxide film.

- V-Belt : The existing V-Belts shall be replaced with the new V-belt. 4 nos. having same make/grade. The old V-belts removed from service to be destroyed.

708 POH SCHEDULE

708a BRUSHLESS ALTERNATOR

The procedure to be followed shall be as per guide lines given below.

i. VISUAL INSPECTION

Carry out visual inspection of the machine and record the following:-

- Serial number and name plate particulars of the machine.
- Check that rotor rotates freely.
- Check the suspension bushes.
- Check insulation resistance
- Check continuity of the field and stator
- Check alternator tension rod
- Check the bearing noise with shockpulse meter

ii. ELECTRICAL CHECKS

Carry out the following electrical checks and record the following: -

- Open the cover of the terminal box and check whether the internal termination and terminal board are intact.
- Tighten all the connections on the terminal board.
- Using a multimeter, check continuity between
  - Field terminal F+&F-
  - Stator terminals U&V, V to W and W to U
- Check the insulation resistance by 500 V megger between
  - Stator terminals and frame of machine
  - Field terminals and frame
  - Field terminals and stator terminals

(Note : Minimum insulation resistance should not be less than 1 Mega ohms for 4.5 kW under worst weather conditions and 20 mega ohm for 18/22.75 kW respectively)

iii. OVERHAULING

- The machine received for overhauling should be externally cleaned with wire brush and wiped before dismantling.
- Clean and re-grease the bearing after removing the bearing from the bearing housing. Only Servo Gem (RR-3) grease shall be used.
- Clean the mating surface of the end shield.
- While removing and placing the rotor, care should be taken that the rotor does not rub over the field coils.
- If any grease has crept into the stator surface, clean it before assembling.
- If stator and rotor parts are found rusty, clean. Apply the insulating varnish (air drying) of recommended grade. Impregnation of the varnish shall be done in an air circulated oven.
- Change the alternator suspension nylon bushes 100% and change the suspension pin on condition basis.
- Apply the insulating varnish (air drying) of recommended grade. Impregnation of the varnish shall be done in an air circulated oven.
- After complete fitment and greasing, the bearing noise shall be recorded using shock pulse meter.
- Only bearing of SKF/FAG shall be provided as per recommendation of RDSO.

iv. TESTING OF ALTERNATORS

INSULATION RESISTANCE TEST

Check the insulation resistance

- **Alternator**

Place of Check	**Required Value for Conventional Coaches**
Between stator. winding and earth	Above 1 MΩ
Between field winding and earth.	Above 1 MΩ
Between field winding and stator.	Above 1 MΩ

- **Regulator**

Place of Check	Required Value Conventional Coaches
Short all terminal (live parts) together and check the insulation resistance between the live parts and earth.	Above 1 M Ω

Note: The insulation resistance of all the above should be measured by 500 V megger.

v. NO LOAD TEST

Connect the alternator and regulator with a resistance/battery load. Run the Alternator at base load (1 A) at various speed from 357 rpm to 2500 rpm.

This voltage should not exceed ± 5% of set the voltage. The cut in speed should also be checked. It should not be more than 357 rpm at 108 volts at zero load.

vi. LOAD TEST

Connect the alternator and regulator with resistance/battery load. Run the alternator at half load i.e. 19 Amp. and full load 37.5 Amp. respectively at various speed from 600 rpm to 2400 rpm. Setting shall be done at 1500 rpm and half load 19A before starting the test.

The voltage should not exceed ± 5 % of the set voltage at a speed from 600 rpm to 2400 rpm. The set voltage can be 120 V, 122 V, 124 V at 19 Amp. 1500 rpm. Check the MFO (minimum speed for full output) i.e. 37.5 Amp. for 4.5 kW alternator, it should not be more than 600 rpm.

vii. TEMPERATURE RISE TEST

For 4.5 kW Alternator

Run the alternator at 600 rpm and apply the load. The alternator should be capable of giving 37.5 Amps at 120 Volts. Run the alternator at 2500 rpm with full load for five hours with a fan cooling the body. Check the temperature at different part of the alternator and should be as follows:-

a) Power diode - Should not exceed 100 ^{0}C at ambient of 50^0 C.

b) Alternator terminal - Should not exceed 100 ^{0}C at ambient of 50^0 C.

c) Bearing temperature - Should not exceed 85 ^{0}C at ambient of 50^0 C.

d) Stator and Field - Should not exceed 90^{0}C at winding load of 37.5 Amps.

708b RECTIFIER REGULATOR UNIT

The procedure to be followed shall be as per guidelines given below.

- Check the terminals and inside wires for heating signs and looseness. Blow out the dust.

- Replace the damaged wiring/terminals. The wiring of the regulator shall be done systematically,
- Check the PCB circuit with PCB testing kit or multimeter to identify defective components. Replace the defective components.
- Check field transformer for correct voltage. Replace, if found defective.

708c V- BELTS/ TENSIONING GEAR

- The existing V belts shall be replaced with the new V belts 4 Nos. having same grade/make. The old V belts removed from service to be destroyed.
- Tensioning gear shall be removed and its spring shall be checked for proper functioning. If required moving parts of tensioning device including spring shall be replaced.

708d 'V' GROOVED AXLE PULLEY

The procedure to be followed shall be as per guidelines given below:

- Check the axle pulley for slippage, tightness and physical damage to grooves. Ensure availability of locking nuts and split pins in position. Check the alignment of axle pulley with the alternator pulley and adjust. Change the rubber packing.
- Replace the pulley if any groove is damaged/broken/worn-out.
- The pulley shall be replaced after four years period or earlier on condition basis.

708e BATTERY AND BATTERY BOX

The procedure to be followed shall be as per guidelines given below.

- Remove the cells from the battery boxes on arrival of the coach in workshop and bring them in the battery shops for maintenance.
- Record voltage and specific gravity of each cell.
- Clean exterior of the cell/ mono block thoroughly. Wash top of the battery with a 10% solution of soda and a wire brush. During such cleaning, it is necessary to ensure that the micro porous vent plugs are mounted on the cells so that the water does not enter into the cells.
- Battery boxes shall be cleaned/repaired and repainted with anti corrosive epoxy based paint after removing the battery. Check the opening of welds and cracks thoroughly specially on load bearing members, vicinity of mounting bolts etc. Detection of minor hair line crack shall be done with ultrasonic testers.
- Top up cells wherever necessary with distilled water. The level should be corrected as indicated on the float.
- If there is corrosion/sulphation on the inter-cell- connectors etc., clean them thoroughly and protect from further corrosion by applying petroleum jelly or Vaseline. Cell connectors and fasteners should be changed on condition basis.
- Replace defective sealed float guide and micro porous vent plugs, if any.
- Clean micro porous vent plugs and sealed float guides and ensure that vent holes are in order.
- Record lug date to determine the life of the battery.
- Charge the battery fully till 3 constant half hourly readings of voltage and specific gravity are obtained. This will indicate that battery is fully charged.
- Discharge the battery at 10 hrs discharge rate. While discharging, record the voltage and specific gravity.
- Record the capacity of the battery during discharge. It should not be less than 80% of the rated capacity.

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- In case while discharging, any of the cells fall below 1.8 volts, disconnect the cell from the circuit for treatment with one or two cycles of slow charge and discharge.

- After two cycles of charge and discharge, recharge the cells fully.

- Battery box vertical/horizontal member shall be checked for any minor/hair line cracks, its mounting arrangement ensuring proper securing through nut bolts/washers etc.

- In case of VRLA Batteries, SMI no.RDSO/PE/TL/SMI/0001 -98 (Rev.0) dt. 01.06.98 and RDSO/PE/TL/SMI/0002-98 (Rev.0) dt. to be followed.

708f WIRING (After 2 years for new coaches and 1 year for old coaches)

The wiring shall be completely inspected for damage by opening side panels, end wall near EFT's and also near fittings after stripping. The re-wiring shall be done on condition basis or planned on the basis of life of 20 years for cables.

The cables used for re-wiring shall be as per IS:694-1990 (Third Revision) The cables taken up for re-wiring shall be done through PVC conduits in super structure conforming to IS:2509. Bushes/Grommets used shall be of Hard PVC as per BS:1767 - 1951 or to grade 6 of IS-5831 latest. Flexible conduits used, if any, under water tank shall be as per IS:6946.

i. Coach insulation

Insulation resistance of the coach shall be measured with 500 V megger. IR value should be minimum 2 Mega ohms but it should not be less than 1 Mega ohm under highly humid/wet weather.

ii. Cable termination joint

- All cable joints shall be checked for its loosness or heating signs. Loose joints and cables having damaged insulation shall be replaced/repaired. All cable ends shall be properly socketed with crimping type sockets.

- Surface of crimping sockets and bus-bars shall be cleaned to remove the oxide film from the jointing surface before making a bolted joint and shall be coated with corrosion resistant conducting grease of approved make to prevent reformation of oxide film.

- Fire retarding PVC grommets to IS:1767 or grade 6 of IS:5831 shall be provided at all cable entry points in metallic members.

- The under-frame wiring if running loose shall be provided in flexible steel conduit.

- All inspection covers shall be opened to check the distribution boards and condition of wiring.

iii. General Precautions

- Do not peel insulation for testing. If wires are found with peeled insulation replace them with fresh wires. If peeling is of short length apply proper PVC adhesive tape.

- Do not use twisted joints of aluminum cables to avoid oxidation and improper contacts and over heating/earth fault due to loose strands.

- Remove earth fault by isolation method instead of hit and trials and short circuiting of opposite polarity of earth.

- Use proper rating of fuses both in branch circuits, rotary panels and regulator boxes for field and main fuse.

- Use HRC fuse to the extent possible except for branch which may be done with re-wirable tinned copper fuse. In the absence of HRC fuse use correct size equivalent re-wirable fuse. Do not use under rated or over rated rewirable fuse to avoid faulty tripping of defective circuits.

- Use connectors for lights & fans.

- Ensure extra length of cables near termination's for future maintenance and replacement, if found inadequate at the earliest opportunity.

- Check for earth fault on every maintenance and rectify those detected.

- Do not tamper with regulator potentiometer setting unless tested in a proper alternator drive having variable speeds.

708g SWITCHES, LIGHT FITTINGS, ETC

i. Light fittings

The light fittings, reflectors, clear acrylic sheet cover, glass globe, holders, etc., shall be checked and cleaned. Any defective part shall be replaced. Anti- theft arrangement for fluorescent light fittings shall be checked as per ICF Drg. No. ICF/SK-7-6-079.

ii. Rotary Switch Cum Junction Box

Strip the housing from the coach and clean thoroughly and remove oxidation from terminal points and check the function of rotary switches. Fit back the same and do the connections using corrosion inhibiting compound for better conductivity and to avoid oxidation of all contacts.

708h FANS

- Dismantle the lower guard, upper guard, blade and fan motor.

- Check the guard assembly, repair/replace if necessary.

- Check the blade angle with a measuring gauge. Correct the same, if necessary.

- Check the insulation resistance of the fan motor. The IR value should not be less than 2 Mega ohms as specified in IS: 6680-1992.

- Check the fan leads and change it if necessary.

- Check the armature winding and field coil, repair/replace, if necessary.

- Check the commutator for grooving, pitting marks, ovality, blackness etc. Polish the commutator if required.

- Check the carbon brush and brush spring. Replace by correct grade of carbon brush as recommended by RDSO. The fan spring should meet the requirements given in IS:6680. Replace the same if necessary.

- Apply air drying insulating varnish if IR value of the armature and field coils is low, give impregnation treatment in an air circulated oven.

- Clean the ball bearing, check for noise, replace if necessary or grease it with recommended grade grease.

Testing

i) Check the load current at rated voltage. The wattage of the fan should not exceed the value specified in IS: 6680.

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ii) Check the air delivery of one or two fans from a batch to ascertain the correctness of the blade angle. The value of the air delivery shall not be less than that specified in IS:6680.

NOTE :

- SKF/FAG (imported) make bearings for alternator procured directly from manufacturers as specified in the RDSO specification shall be used. Use of other makes of bearing is not permitted.
- Shock pulse meter shall be procured by Railways and workshops to monitor condition of the bearing regularly during maintenance service and after replacement of defective bearings.
- Induction heater/oil bath shall be used for heating the bearing to the required recommended temperature.
- The pulley condition such as wear on V group, pulley key way, shaft way, groove angle etc. shall be monitored during POH. Proper gauges shall be used for checking "V" groove of the pulley.

709 DO'S AND DON'TS FOR MAJOR EQUIPMENT

709a ALTERNATOR

i. DO'S

- Do ensure the correct polarity of field winding i.e. positive connected to F + while measuring the continuity of the field winding, otherwise the alternator will not self excite.
- Do check the proper compression force on the tensioning spring with indicator plate by tightening the special nut.
- Do keep the terminal box tightly closed.
- Do open the terminal box once in a week and clean the accumulated dust, if any.
- Do check tightness of the connection regularly, at least once in a week.
- Do use the cable grommets or cable gland of correct size for reducing the vibration of terminal connections. It is preferable to anchor the cables externally to avoid shocks and vibrations on the terminals.

ii. DON'TS

- Don't use improper tools to handle the alternator, it may damage parts of the alternator.
- Don't re-grease the bearing frequently. Re-greasing should be done after thoroughly cleaning the bearing with white spirit. It is preferable to re-grease the bearing only during POH.
- Don't over-grease the bearing.
- Don't keep the belts in over tension as this may reduce life of the belt.

709b REGULATOR

i. DO'S

- Do check the regulator terminal box once in a month for loose connections and for cleaning the dust.
- Do short all seven terminals of the terminal box before measuring the insulation resistance.

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- Do ensure that DC '+' and DC '-' are connected to battery positive and battery negative respectively. Wrong connection will damage main diodes.

ii. DON'TS

- Don't disturb the settings of the regulator shunt and potentiometer.
- In any circumstances the burden resistance setting should not be disturbed.
- Don't open the regulator box unless there is a defect.
- Don't use a megger to test the components . Use multimeter.
- Don't reverse the field terminals on regulator and alternator.
- Never use a fuse wire for field fuse. Always use HRC fuse of specified value.

709c `V' BELTS

i. DO'S

- Use belt of the same length for a set.
- Belts should be stocked in lots as per date of receipt and use in the principle of first in first out basis. The belts shall be stored in a well ventilated room free from direct sunlight and moisture.
- Ensure correct belt tension i.e. 330 Kg for 18 kW, 22.75 kW and 25 kW alternators and 105 kg for 4,5 kW alternators. The tolerance of tension shall be ± 5 kg in both cases.
- Re-tension newly fitted belts after first trip.
- Maintain a gap of approx. 75 mm between supporting plate and fixing nut on the free end of tension rod or upto the split pin for the 18 kW, 22.75 kW, 25 kW Alternators and 55 mm for 4.5 kW alternators.
- Maintain proper alignment between axle pulley and alternator pulley.
- Replace pulley with burn out grooves i.e. 0.8 mm depression on sides and bottom of grooves with uniformly shining surface.
- Form grades of the belts received from the stores/suppliers after checking on belt measurement gadgets. The grading of belts should be between 48 and 52 only of matched sets.

ii. DON'TS

- Do not allow loose belts.
- Do not disturb the nut and check-nut on free end of tension rod if proper gap is available between supporting plate and fixing nut i.e. 75 mm for AC coach alternators and 55 mm for TL alternator.
- Do not use repaired pulleys.
- Do not use old and new mixed belts in sets.
- Belt should not have any oil or grease traces ,if persist clean it by soap and water.
- The matched set should have belts of one manufacturer only. Do not use belt of same grade of different manufacturer in a set.

709d VRLA Batteries : Do's and Don'ts from SMI no. RDSO/PE/TL/ SMI/ 0001 - 98 (Rev.0) dt. 01.06.98 to be followed.

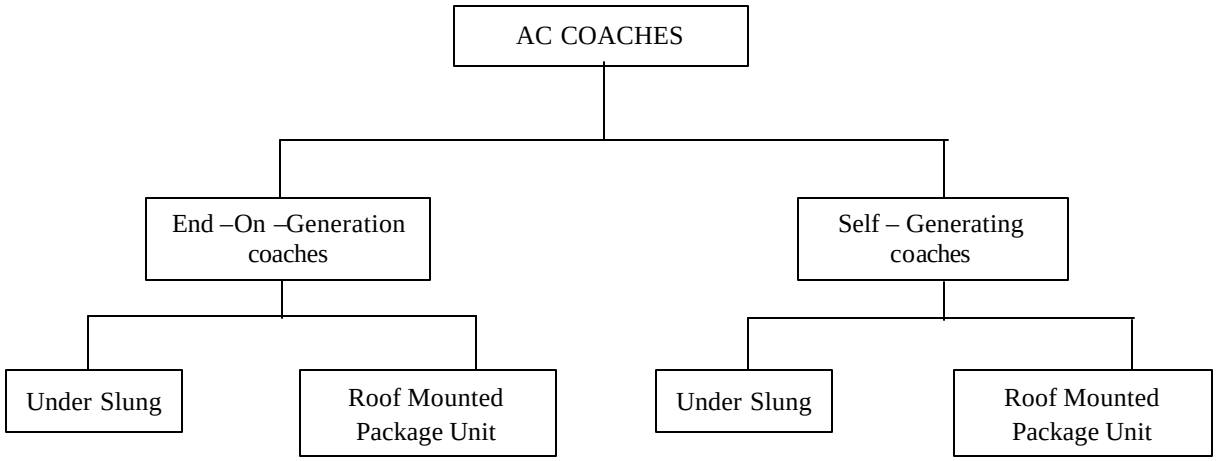
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CHAPTER 8

AIR CONDITIONED COACHES

801 INTRODUCTION

Types of AC coaches on Railways can be classified broadly as under :



801a Power Supply System: As far as power supply system is concerned, the coaches are of the following two types :

(i) End-On-Generation (EOG) : In this system two types of Power cars are used

a. Coaches mounted with 50 KVA, 750 V/415V, 3 ϕ transformer.

b. Coaches with out stepdown transformer suitable only for old low capacity power cars.

(ii) Self Generating (SG) : Based on AC equipment, there are two types of Self Generating coaches.

a. 110 V DC with under slung type AC equipment working from 110 V DC.

b. 110 V DC with Roof Mounted AC Package Units working from 415 V, 3 ϕ, obtained with the help of 25 KVA inverters mounted on underslung as well as onboard.

801b MAJOR EQUIPMENTS USED IN AC UNIT ARE :

1. Compressor (open type for under slung, sealed type for Roof Mounted Package Unit (RMPU)
2. Condenser including liquid receiver and dehydrator.
3. Expansion Valve
4. Evaporator with heater element.
5. Motors for compressor, condenser, evaporator .
6. Other protective devices and control panels.
7. Thermostat, Filters etc.

802 MAINTENANCE SCHEDULES FOR SELF GENERATING AIR CONDITIONED COACHES FITTED WITH UNDER SLUNG EQUIPMENT: (Ref: RDSO's maintenance schedule No EL/TL-AC/Maint.Sched./Rev.1)

802a TRIP SCHEDULE (PRIMARY AND SECONDARY MAINTENANCE)

i Axle Pulley

- Examine the indicating white mark on the pulley axle and ensure that the pulley has not shifted . If pulley has shifted , pulley to be removed and re-tightened after replacing rubber pads. Indicating white marks to be provided. Also check distance between wheel axle and axle pulley with gauge.
- Tap with hammer and judge the tightness by sound.
- Check the lock nuts and split pins for availability and tightness.
- Check profile of 'V' groove for worn out pulleys, replace pulley if worn out.

ii Belts

- Check condition of belt for fraying of edges and replace it on condition basis.
- Check the belts for overturn and correct it, if necessary.
- Check the number of belts. The belts should be 12 (6 on either side) for each alternator in primary depot and 10 (5 on either side) in secondary depot.
- Tension should be felt by hand by striking it slightly. Belt in correct tension will respond `alive' . Pull the belt and check the spring action.

iii. Alternators

- Check the condition of outgoing cables and its cleating arrangement. Replace the grommet, if necessary. Ensure that flexible pipe carrying the cables is connected properly to the grommet to prevent damage to insulation.
- Check the suspension pin, bush and securing nuts and bolts.
- Check the pulley fixing, concentrating on lock nut and locking collar pin. If lock nut is damaged, replace it.
- Carry out visual inspection of terminal box for signs of overheating and presence of fumes. Blow off dust if required.
- Check the terminal box for presence of water and drain out if necessary.
- Check the connections for looseness or cracks, if required re-crimping/ tightening should be done.
- Check main suspension lugs of alternators for signs of crack.
- Clean the regulator box externally and remove all the dust particularly from heat sinks.
- Check safety chains and chain fixing nuts, bolts and split pins.
- Check tension rod fixing pin of alternator with washer and split pin.
- Check the log book for abnormal /unequal load sharing . Corrective action should be taken to ensure that the difference is within the range of 30 %.

iv. Battery & Battery Box

- Check the level of electrolyte in all the cells and top up with distilled water, if necessary.
- Check the specific gravity and voltage of 4 pilot cells.
- Check inter-cell connection for looseness. Check for crack in containers leading to leakage. If needed replace the defective cell with healthy cell of similar capacity and lug date.
- Check for heating signs on the positive and negative terminals and discolouring of the cells container/top lid.
- If required, individual cells in the battery bank or complete battery bank may be subject to charging so that the Specific Gravity (SPG) may rises to min. 1240.
- Check the top of cells and keep it clean and dry. Plugs should be tight.
- In case of Valve Regulated Lead Acid (VRLA) batteries, check for abnormal bulging of cell lids, cracks on positive and negative terminals. Replace defective cells..
- In case of sulphation of terminals remove the connectors, clean, put back and apply petroleum jelly.
- Check suspension/cradle of battery box for availability of all suspension bolts, signs of any crack, corrosion, rusting and take corrective action, if necessary.
- Check for proper fitment of battery cells in battery box or module fitment in case of VRLA batteries, if required proper packing may be provided.
- Ensure that spare batteries, particularly VRLA cells are properly kept at places not exposed to direct sunlight, rain, dust etc. The batteries should be stored indoor preferably between 20 to 35°C in clean and dry location.
- VRLA Batteries : SMI no.RDSO/PE/TI/SMI/0001-98 (Rev.0) dt. 01.06.98 to be followed.

v. Compressor and Condenser Motor

- In case of compressor motor, examine the tyre coupling for any indication of looseness or slip and rectify defects.
- Open inspection cover and examine the condition of commutator. Clean with sand paper or pumice stone, if necessary. Do not remove the dark tan film unnecessarily. Clean all carbon dust with dry compressed air.
- Check condition of carbon brushes. If worn out, replace with carbon brushes of approved grade.
- Check condition of pigtails. If necessary, replace as per the manufacturer's recommendation.
- Check the starting resistance connectors for tightness.
- Check suspension of compressor motor unit for any signs of crack, corrosion and rusting. Take remedial action if required.
- Carry out visual inspection for signs of overheating and presence of fumes. Blow off dust if required.

- Check the direction of rotation for correctness if the same has been attended.
- Check the fan blades for tightness in case of condenser motor.

vi. Evaporator Motor

- Open the inspection cover and examine the condition of commutator. Clean with 0-0 sand paper or pumice stone, if necessary. Do not remove the dark tan film unnecessarily. Clean all carbon dust with dry compressed air.
- Check condition of carbon brushes and pigtails. Replace if necessary as per the manufacturer's recommendation.
- Check the bearing for noise.
- Check the blower fixing for tightness.
- Carry out visual inspection for signs of overheating and presence of fumes. Blow off dust if required.

vii. Compressor

- Check the proper lubrication of compressor level of oil when operating should be upto half of the bull eye glass.
- Lubricate the compressor as per RDSO SMI No. RDSO/AC/SMI/6
- Examine the reading of HP, LP and OP gauges recorded during the journey for abnormality and take necessary action.
- Examine flexible type coupling and replace, if found defective.
- Clean the compressor externally with compressed air.
- Check for signs of leakage at joints & shaft seal and take remedial measure wherever necessary.
- Examine the fixing arrangement, check the condition of the anti vibration mountings for tightness of the fixing bolt.

viii. Condenser

- Check and ensure that the protection plates and grills are provided on the three sides of the frame.
- Examine the fins for external damage due to flying ballast and take corrective action if necessary.
- Check suspension of the condenser for signs of cracks, corrosion or rusting and take remedial action. Tighten bolts, etc., if necessary.

ix. Dehydrator And Liquid Receiver

- Check the sight glass for leakage, rectify if necessary.
- After 10 minutes of starting the compressor, check the level of liquid refrigerant should be at the bottom of the lower glass of the liquid receiver.
- After 15 minutes of starting the plant, feel the outlet and inlet to dehydrator by hand for temperature difference. The outlet should not be colder than inlet.

x Filters

- Remove fresh air and return air filters and replace it by spare clean units.
- Check and ensure that fresh air dampers are in proper order.

xi Thermostats

- If the report of the attendant indicates that thermostate do not work, examine the thermostats for break in mercury, break in stem, etc. Replace the thermostats, if necessary. Follow RDSO SMI No RDSO/SMI/AC/15.
- Clean thermostat bulb with cotton.
- Ensure working of plants in auto mode for all temperature setting.

xii. Panel Board

- Clean the panel and remove dust.
- Check the working of indication lamps, replace it if necessary.
- Check the availability of spare fuses in the place provided for the same and provide if necessary.
- Check the availability of arc chute and provide if necessary.
- Check and clean the contacts of contactors 12, 13 and 13A.
- Check the operation of cooling pilot relay (by short circuiting terminals C.T.). Remove short after the completion of check.

xiii. Lights And Fan Wiring

- Check for earth leakage in the wiring with a double test lamp. Rectify if any defect noticed.
- Check for any loose connection & tighten if necessary.

xiv. Lights And Fans

- Check all the lights and fans for proper working. Rectify or replace if necessary.
- Clean the fan and light fitting externally.
- Check all switches, fan regulators, call bells and push buttons for proper working. Replace if necessary.

xv. Pre-Cooling Unit

- Clean rectifier unit externally with dry compressed air.
- Check the presence of water in terminal box, drain out if necessary.
- Load the pre-cooling unit to its maximum capacity and check for any overheating.
- Check suspension of battery charger for sign of any crack, corrosion or rusting and take action if required.
- Check the pre-cooling socket pins and its fixing arrangements.

xvi. General

- Check log- sheet of last trip and attend all the faults recorded in the log sheet.

- Run the plant for half an hour. Check system operation, specially the following:
  1. Suction pressure gauge reading should be 2-3 Kg/cm^2 .
  2. Delivery pressure gauge reading should be 10 – 14 Kg/cm^2.
  3. Oil pressure should be minimum $3kg/cm^2$ above suction pressure.
  4. Suction should be cold and sweaty. Delivery should be very hot and liquid line should be warm.
  5. Feel the expansion valve by hand. It should be cold.
- Note the battery voltage on LOAD and NO LOAD.

802b MONTHLY SCHEDULE

In addition to the trip schedule items, following are also to be attended.

i. Axle Pulley

- Ensure that the gap between the two halves of the pulley is 3 mm. Check tightness of the axle pulley bolts by 30 kg-m torque wrench.
- Check distance between wheel hub and axle pulley with gauge plate.

ii. Belts

- Check tension of belts. For the exact measurement of static tension, apply force `P' with a Spring balance at the Centre of span in direction perpendicular to the span until the belt is deflected from the normal to the extent of 16 mm per metre of span. The force `P' should be between 31.4 to 47.0 kg. If the belts are loose. replace them.

iii. Rectifier Cum Regulator Box

- Clean all dust with dry compressed air externally.
- Open the cover and check sealing rubber gasket for signs of fraying. Drain out water if any.
- Clean all dust with dry compressed air. preferably a hand blower from inside to remove all dust particularly from heat sink of electronic components and terminal board.
- Check that the voltage and current setting. Ensure that they have not been disturbed and are in locked position.
- Check the field fuses and phase fuse and ensure that only specific HRC fuses have been used.
- Check all the electrical connections for tightness.

iv. Alternators

- Lubricate the threads of the tension rod and adjusting nut.
- Check the profile of 'V' grooves and replace worn-out pulleys.

v. Battery Chargers

- Ensure that the coarse and fine control switch is in position No.1.
- Check and clean all connections and contacts.

vi. Battery

Conventional Lead Acid Batteries

- Check specific gravity and voltage of all cells.

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- Remove inter-cell connection, take out the cells, clean thoroughly the cells, intercell and end cell connectors and fit back in the coach. Use petroleum jelly.
- Examine condition of battery boxes. Paint if necessary.
- Check vent plugs. Tighten if necessary. Replace if missing.
- Check the condition of cells by cell tester. Replace defective cells.

VRLA Batteries

SMI no.RDSO /PE/ TL /SMI /0001-98 (Rev.0) dt. 01.06.98 and RDSO/PE/TL/SMI/0002-98 (Rev.0) dt. 09.12.98 to be followed.

vii. Compressor Motor

- Check tightness of the coupling and mounting bolts by 30 kg-m torque wrench and tighten, if necessary.
- Check the terminal connections in the terminal box and tighten, if necessary.
- Examine the incoming leads for proper connections and tightness. Check the flexible conduit for proper anchoring at both ends.
- Measure the spring tension of brush holder. If less than the value recommended by manufacturer, replace the spring.
- Check the carbon brushes; if necessary, replace with approved grade of carbon brushes.
- Check the alignment of the compressor and motor.

viii. Condenser & Condenser Motor

- Clean the condenser fins thoroughly with high pressure water jet so that air passes through the fins uniformly .
- Clean fins with liquid solution and high force water jet.
- Ensure minimum air flow of 4 meters per second through condenser.
- Check the incoming leads for proper connection and tightness. Ensure that the grommet is in position and the flexible hose- pipe is connected properly at both ends.
- Check the spring tension as recommended by the manufacturers.
- Check the carbon brushes; replace with approved grade of carbon brushes if necessary.

ix. Evaporator Motor

- Check the blower drum for looseness.
- Check the spring tension as recommended by the manufacturers.
- Flush the drip tray. Check drain pipe of drip tray for clogging by passing water through the drip tray and clean, if found clogged.

x. Compressor

- Check tightness of bolts of anti-vibration mounting with 30 kg- m torque and tighten if necessary.

- Check the tightness of nuts and bolts of compressor head and its cover.
- Check oil and liquid levels and note any signs of leakage which will be indicated by presence of the oil at the point of leakage.
- Clean the oil strainer with petrol or CTC (Carbon Tetrachloride).

xi. Evaporator & Drip Water Drain

- Clean evaporator coil.
- Replace return and fresh air filters.
- Pour water on evaporator coil and ensure the water drains out easily..

xii. Panel Board

- Clean contactor tips of all contactors; replace where necessary.
- Check all the electrical connections for tightness and tighten if necessary.
- Check the relays and contactors for their proper functioning.
- Check the PCB in the thermostat circuits.
- Check the diodes provided on the panel board.
- Check the rotary switch for fluorescent lights. The polarity change connections should be in order.

xiii. Light and Fan

- Open the inspection-cover of each coach fan and examine the condition of commutator. Clean with 0-0 sand paper. if necessary.
- Do not remove dark tan film unnecessarily. If necessary, replace the carbon brushes with carbon brushes of approved grade.
- Remove the cover of tube light, night light and clean the bulb, tube and cover from inside.

802c QUARTERLY SCHEDULE

In addition to Trip and Monthly Schedule items, following are also to be attended.

i. Axle Pulley

- Check grooves for wear and take necessary action.

ii. Alternator

- Disconnect the regulator and measure the insulation by 500 V megger; if less than 2 Meg ohm, remove winding of alternator and heat in the oven at 80 degrees C for 1 hour.

iii. Compressor, Condensor And Evaporator Motors

- Disconnect the motors, measure the insulation by 500 V megger; if less than 2 Meg ohms, remove and heat in air oven at 80° C for 1 hour.
- Check for the positive locking of rockers.
- Lubricate the bearings of all motors with recommended grease.

iv. Condenser

- Clean the compressor fins and copper tubes as per RDSO SMI No. RDSO/SMI/AC/16
- Check the condition of body frame and replace the condenser, if necessary.

v. Dehydrator and Liquid Receiver

- Clean the strainer in the dehydrator-cum-filter unit.

vi. Evaporator And Expansion Valve

- Clean the strainer used before expansion valve.
- Clean the assembly of evaporator coil and surroundings with vacuum cleaner.
- Clean the drip tray and drain-pipe thoroughly and check for water leakages.

vii. General

- Adjust the air distribution by measuring the temperature of each compartment.

803 MAINTENANCE SCHEDULE FOR ROOF MOUNTED AC PACKAGE UNITS AND ITS CONTROL PANEL

803a TRIP SCHEDULE (PRIMARY AND SECONDARY MAINTENANCE)

i. Clean all dust from panel by dry compressor air from the panel.

ii. Check that all the safety and protection devices are in working condition and not in the by passed condition.

iii. Replace defective/by passed components including indication LEDs and lamps, if any.

iv. Remove fresh air and return air filters by opening the access doors provided under the bottom of unit. Clean these filters with pressurised air and jet of water and place them in their place or replace them with pre-cleaned/new-filter and close access doors properly.

v. Check the log sheet maintained for each AC coach and attend the defects noticed during run as reported by escorting staff.

vi. Check for working of Roof Mounted Package Unit (RMPU) and Control panel as following:.

- Switch `ON' RSW-I and check that all the three pilot indication lamps (Red, yellow and blue) for R.Y.B. phases and power `ON' indication LED (Green) are glowing.
- Put RSW-2 in ``ON' position and keep RSW-3 in `VENT' position and check that:
  - Indication LED (green colour) for Blower `ON' is glowing and
  - Blower fan is working
- Check for satisfactory operation of vane relay by moving the flap by hand gently.
- Check for satisfactory operation of the package unit by moving RSW-3, in AUTO, MANUAL HEATING & MANUAL COOLING modes. This can also be verified from indication LEDs (green colour).
- Check that cooling system is working even if only one condenser fan out of the two is working. This can be done by simply switching off MCB 2 or MCB 3/taking out fuses of condenser motor 1 or condenser motor 2.

- Check that cooling and heating thermostats works properly, i.e. A/C system "cut-off" and "cut-in' in auto-mode.
- Check that compressor by pass switch RSW-5 works satisfactorily
- **HP1 & HP2 Cut-outs**

  Switch 'ON' the compressor with condenser fan 'OFF'. Take out fuses /switch-off MCB-1 and MCB-3 of the condenser fan motors and keep the package in manual cooling mode. Compressor should trip within 10 minutes. HP cut outs should be reset after each tripping.

- **LP-1 & LP-2 Cut outs**

  Switch `ON' the compressor with condenser. Take out fuses/switch-off MCB-1 provided in the power circuit of blower motor and short terminals of vane relay. Keep the package in manual cooling mode. Compressor should trip with 10 minutes.

- **OHP1 and OHP2**

  Switch 'ON' the heaters with blower off, take out blower motor fuses or put off MCB-I and short the terminals of contactors AC-I or vane Relay. In old control panels where AC-I is not provided, keep the package in manual heating mode. The heaters should trip with 10 minutes.

- **CONTROL PCB**

  Keep the AC package unit in Auto Mode. Run the blower short terminals of cooling thermostat on PCB. The compressor LED indication should come 'ON'. Open the terminals of heating thermostat on PCB Heater LED should come `ON'.

803b MONTHLY SCHEDULE

In addition to trip schedule following items should also to be attended to:-

i. Run the plant for half an hour and check the current drawn by various equipment with the help of clamp tester.

   Normal currents for various equipment and mode of operation shall be as under:-

   - Package in cooling mode : 20-23 Amp.
   - Package in heating mode : 11-13 Amp.
   - Compressor motors : 7-10 Amp.
   - Condenser motors : 1.5-2 Amp.
   - Blower Motor : 1.5-2.5 Amp.
   - Check working of both Roof Mounted Package Unit (RMPUs) with either of the inverter on the Self Generating (SG) AC coaches provided with two package units.

ii. Check and tighten all terminals in the control panel.

iii. Check and clean contacts of contactors and replace pitted contacts if required.

iv. Check visually condenser fan blades and ensure there is no crack on the blades or the hubs.

v. Check and tighten mountings of blower and condenser motors and ensure that these are in good conditions.

vi. Check that all legend plates inside the control are intact.

vii. Check all connections on switch gears, terminal blocks are tight.

viii. Check that glass cover over indication PCB is intact.

ix. Check for proper tightening of cover provided over evaporators compartments.

x. Create single phasing in compressor circuits by taking out one fuse/removing one phase wire from incoming terminals of MCB-4/MCB-5. Compressors should trip and CP1/CP2 over load trip indication should come ``ON'.

xi. Check for proper operation of time delay relays provided in compressor circuit. As soon as power supply is switched `ON' first compressor should come in circuit immediately and the second one after 2.5 minutes.

xii. Inverter

Caution: Inverter must be switched off preferably at power panel itself before attempting to do any maintenance operation.

- Cleaning of cubuicle : Dust deposit inside the converter should be carefully removed at regular basis. Unit should be cleaned with brush and vacuum cleaner or with dry compressor (Max. 1bar) – inaccessible parts.
- Cleaning of PCBs : Using a soft brush, remove the dust collected on PCBs gentle.

803c QUARTERLY SCHEDULE

In addition to trip and monthly schedules following items should also be attended.

i. Inverter

Caution: inverter must be switched off preferably at power panel itself before attempting to do any maintenance operation.

- **Cleaning of cubicle** : Dust deposit inside the converter should be carefully removed at regular basis. Unit should be cleaned with brush and vacuum cleaner or with dry compressor (Max. 1 bar) – inaccessible parts.
- **Cleaning of PCBs** : Using a soft brush, remove the dust collected on PCBs gently.
- Terminal Connections/Fixing :
- **Electrical** - Normally loose connections leading to wire burning/sparking are observed at connection terminals.
- Usage of spring washer mostly avoids this problem.
- Gently shake the wire (especially power cables) near the joints and on observation of loose joints, tighten the same and also observe cable insulation for any deformation/brittleness. If so replace them with same size of the cable only.
- **Mechanical** - Inverter should be fixed at the bottom as well as top, tighten the bolts and nuts used for fixing the inverter and ensure that it does not vibrate in run. Also tighten the sub-assemblies if found loosened. In case of under-slung inverter these shall also be regularly checked and tightened.
- Protection circuit/ Induction circuit :
  - Check the indication/ protection circuits ensure that all the protection and indication are working properly.
  - Uses of fuse of power rating in the inverter, don,t use wire fuses.
  - Remove both inverter and battery fuses in power panel before attempting some fitting or wiring in the inverter.
  - **Capacitor** - On observing leakage of any capacitor inside the inverter remove the respective capacitor and replace with new one of the same value and make.

- Cooling Fan – Check the cooling fan for operation. If damaged/burnt replace with new one of the same rating. Life of fan is about 3 years, replace, if due.

- Instrument cooling fans- Check if the instrument fan provided between inverter and chopper modules is working when the inverter is "ON". If not working replace the fan, by taking out chopper and inverter modules. (in on-board type inverter).

- PCB Terminal – Gently tap the wires at PCB terminals and check for any loose connection. Tighten the screw or solder the terminals if found blackened, informed the inverter supplier.

- Colour change in PCBs – Check for any colour change in PCBs. Replace the PCB, if found blackened and inform the inverter supplier.

- MCCB – When MCCB is switched "ON" MCCB is tripping and fuse is blowing instantaneously, it is due to IGBT problems. They have to be checked and replaced, if they are found defective.

ii. Drip Tray

- Check the normal flow of water in drip tray by running the AC plant continuously for 2 to 3 hours.

- Pour water into drip tray and ensure that the poured water is drained through the outlet pipe.

- Some sort of cleaning agent should be used for cleaning the sludge inside the pipe walls.

iii. Others

- Check all the motors for abnormal sound use shock pulse meter and replace the bearing of condenser and blower motor, if necessary.

- Check anti-vibration mountings of compressor, condenser and blower motors and replace if necessary.

- Charge refrigerant (R-22) if less cooling is noticed.(refer RDSO SMI No. RDSO/AC/SMI/7

- Check that locking arrangement of control panel works properly.

- Check insulation resistance of all the motor by 1000 V megger. Attend motors with poor insulated less than 2 Mega-ohm.

iv. **NOTE :**

- SKF/FAG (imported) make bearings for alternator procured directly from manufacturers as specified in the RDSO specification shall be used. Use of other makes of bearing is not permitted.

- Shock pulse meter shall be procured by Railways and workshops to monitor condition of the bearing regularly during maintenance service and after replacement of defective bearings.

- Induction heater/oil bath shall be used for heating the bearing to the required recommended temperature.

- The pulley condition such as wear on V group, pulley key way, shaft key way, groove angle etc. shall be monitored during POH. Proper gauges shall be used for checking "V" groove of the pulley.

804 SIX MONTHLY SCHEDULE

804a V-belts:

The existing "V" belts shall be replaced with the new "V" belt (6+6) nos., having same grade/make. The old "V" belts removed from service to be destroyed.

805 POH SCHEDULES OF UNDER SLUNG Self Generating (SG) TYPE AIR CONDITIONED COACHES
(Ref : RDSO doc. No. EL/AC/POH Schedule/002, Nov.,93)

805a. SEQUENCE OF WORK TO BE DONE DURING POH

On arrival into shop place the coach on pit line and inspect electrical and A/C equipment. Note down the defects and deficiencies. Disengage the `V' belt tensioning gear on both the bogies. Disconnect the alternator connection, and remove the belt-tensioning device.

i. Lifting

Remove the alternator cables and carry out visual inspection on conduit and refrigeration pipes. Remove the alternators from bogies. Replace alternator, regulator and tensioning gears with over hauled alternator, regulator and tensioning gear. During this activity carry out repairs, if required, to equipment suspension arrangement on under carriage. Send the alternators and regulators to shop for overhauling.

ii. Stripping

During this activity, the following air-conditioning and electrical equipment will be removed:

- Fresh air and return air filter
- Compressors and their motors
- Condenser including liquid receiver cum dehydrator and condenser motors
- Evaporator unit and its motor
- Water raising apparatus
- Battery and battery box for repairs.
- Battery charger-cum-pre-cooling transformer
- Thermostats
- Control p anel
- Expansion valve
- Gauges and cutouts
- Carriage fans
- Berth light fittings
- Ammeters and voltmeters of power panel

iii. Dusting

With the help of compressed air remove the dust of air ducts.

iv. Cleaning and overhauling

Before overhauling, measure the insulation resistance of all the electrical equipment such as alternator, motor and wiring to know the condition of equipment. Check and clean all the under frame suspension arrangements, lugs and terminals. After POH, test the wiring for insulation and fit the pre-cooling plugs.

v. Simulation testing

Check the alternator output on different load conditions. Check both the alternators for load sharing with the help of variable speed motors.

vi. Equipping

In this activity fit all the refrigeration and electrical equipment to their respective positions. Connect all the wiring and flanges in the refrigeration system wherever necessary. Charge the gas into the system.

vii. Static testing

Run the plant through pre-cooling terminal and check for proper functioning of electrical and AC equipment.

viii. Alternator Connection and Tensioning

Join the connections of alternators and fit the belt-tensioning device. Provide the new 6+6 `V' belts for alternators.

805b OVERHAULING ACTIVITIES OF MAJOR AC EQUIPMENTS DURING POH

i. Compressors

- The given activities are only for under slung type AC system installed with open type compressors. Remove driving flange and provide `V' groove pulley. Test the compressor to ascertain its condition. Record the oil pressure during run. For Carrier and ACCEL compressors, oil pressure developed should be 3.2 to 3.9 Kg/Sq. cm and 4.2 to 4.9 Kg/Sq.cm respectively.
- Dismantle the compressor completely.
- Inspect and check the dimensions of the wearing components. Replace the worn out components.
- Replace following components 100% irrespective of their condition.
  - Piston rings
  - Scrapper ring
  - Suction and discharge valve
  - Shaft seal assembly/O rings
  - Gasket packing
  - Half section bearing
  - Self locking nuts
  - Lubricating oil of correct grade.
- Replace other components on condition basis. The sealed control valve shall be replaced after ascertaining its performance.
- Assemble the compressor with replaced components and charge it with lubricating oil. Change the lube oil and refrigerant suction strainers.
- In case of carrier 5F 30 compressor match the colour to ensure proper matching between tapered shaft and corresponding flexible coupling.
- In case of ACCEL compressor check the end play of crank shaft and replace the thrust plate, if necessary.
- Check the anti vibration mounting and replace, if necessary on condition basis.
- Use suitable grade of oil for Lubricating the compressor as per RDSO SMI No.RDSO/AC/SMI/6.

ii. Tests on Overhauled Compressor

Following tests should be conducted on overhauled compressor

- Temperature rise test
- Volumetric efficiency test
- Leak back test
- Vacuum test
- Sub merge test

Temperature rise test

This test shall be conducted with compressor running in free air with both suction and discharge valve open. Run the compressor till the temperature gets stabilized. The temperature will be recorded on the casing cover. Maximum temperature rise at shaft seal shall not be more than 45° C.

Volumetric efficiency test

The compressor shall be run with air at nominal speed of 1500 rev/min and time taken to attain a pressure of 7 Kg./Sq.cm shall be recorded when the discharge line is connected to a reservoir of 100 litters capacity.

The time taken to attain a pressure of 7 Kg./sq cm in the reservoir should not be more than 53 seconds for ACCEL compressor and 73 seconds for Carrier, KPC, Elgi and Alfa Laval compressors. Time to attain above specified pressures in the reservoir shall vary according to working speed of the compressor and atmospheric pressure also.

Leak back test

This test is in continuation of volumetric efficiency test. In this test immediately after attaining pressure of 7 Kg/sq.cm. in the reservoir, the compressor shall be stopped and pressure drop due to leakage shall be noted. Pressure shall be recorded at the end of 5 minutes and the drop in pressure shall not exceed 1.25 Kg/sq.cm.

Vacuum test

The compressor shall be run with suction valve closed and delivery valve open to atmosphere till a vacuum of 100 mm of Hg. below atmospheric pressure is created. The drop in vacuum level shall be recorded, after switching off the compressor.

Sub-merge test

The compressor shall be charged with dry air at 21 Kg/sq.cm pressure and submerged in water. Then check shall be conducted for any leakage; the same shall be attended and test repeated. No leakage through casing shall be permitted.

iii. Condenser Unit (Including liquid receiver cum dehydrator)

- Dismantle the MS Frame, condenser coil, liquid receiver-cum-dehydrator. Cover the inlet and outlet flanges of cooling coil with a strip of cover plate and gasket so that water may not enter in to cooling coil. Clean thoroughly the condenser coil, MS frame by dry air to remove the loose suspended particles in and around cooling fins.
- Immerse the heat exchanger in water tank for 24 hours. Wash the coils and fins thoroughly with compressed water jet at 12 Kg/sq.cm pressure. Remove all the suspended material from the fins. Clean the water-spraying pipe and open the holes.
- The cleaning process shall be supplemented by scrubbing with brush and use of compressed water jet.
- After cleaning the cooling coil pressurize with air at 300 psi (21kg./sq.cm.) and immerse in water tank duly connecting a pressure gauge for 24 hours to detect any leakage by air bubble method. Also see if the pressure drops. Leaks in pipe shall be detected and brazed.
- After cleaning check the air flow of unit with anemometer.
- Deflange the liquid receiver by removing the outer cover and gasket packing. Clean thoroughly the inner walls of receiver to remove any oil/impurity. Clean the sight glass. Assemble the cleaned liquid receiver parts by providing suitable gasket and flanging the outer cover.
- Pressurize the liquid receiver at 300 psi (21 kg./sq.cm) and test it for leakage by immersing in water tank and notice for any air bubble in case of leakage.
- Replace the filter and drier after leak testing of the liquid receiver. Clean the condenser housing thoroughly and paint it before assembly of other equipment.
- Change the dehydrator-cum-filter element. Also clean the conical filter thoroughly.

iv. Evaporator Unit

- Dis-mantle the housing assembly and take out the cooling coil. Attend the heating element in position by conducting continuity test. Also check the insulation value between the positive terminal and negative terminals shorted and the earth. If the value is less than 2 meg ohms, replace the complete unit. IR value shall be measured with 500 V megger.
- Clean the cooling coil by blowing compressed air. Cover the inlet and outlet flanges of cooling coil with strip of cover plate and gasket so that water may not enter into cooling coil. Immerse in water tank for 24 hours and wash with compressed water jet at 12kg./cm. sq. pressure. Remove all suspended material on fins and clean the cooling coil. (as per RDSO SMI No. RDSO/AC/SMI/8
- The cleaning process shall be supplemented by scrubbing with brush and use of compressed water jet.
- After cleaning the cooling coil pressurize with compressed air at 300 psi (21kg./sq.cm) and immerse in water tank duly connecting a pressure gauge to detect any leakage by air bubble method. Also see if the pressure drops. Leaks in pipe shall be detected and brazed.
- Clean the Evaporator housing and paint it. Assemble the cleaned unit.
- Take out main and auxiliary drip trays from the bottom of the evaporator unit, disconnecting the drain pipe connection. Check for free flow of water through drip drainpipe by admitting water on the drip tray. Replace the hose pipes and hose clips by new ones.

v. Motors for Condenser, Compressor & Evaporator

- Dismantle the motor.
- Test the insulation resistance of armature with 500 V megger. It should be more than 1 mega ohm.
- Check armature winding by a voltage drop test method for open circuit & short circuit fault.
- If the armature is burnt, over heated or short circuited, rewind it as per manufacturer's instructions.
- If armature is in good condition apply a coat of air drying varnish on the winding.
- Check the commutator surface. If the surface is found improper, skim the commutator surface.
- Check the under cut between segments. If it is found shallow under cut the mica to the required depth. Chamfer the edges of the segments.
- Check the bearing with the help of shock pulse meter. In case of compressor and condenser motors, replace by new ones on condition basis, otherwise after cleaning and greasing re-use it. In case of evaporator motor 100%, bearings shall be changed.
- Check the field winding by resistance measurement method for open circuit and short circuit.
- Check the insulation of field coil with the help of 500 Volt megger. It shall be more than 1 mega ohm. Replace the field coil, if defective. If field winding is in good condition apply a coat of air drying varnish on the windings.

- Check the brush boxes and studs for rigidity, clean the rocker assembly.
- Replace the carbon brushes and clean the brushes using sand paper of size 400 grade or by using brush seating stone until the faces of brushes make perfect contact on commutator surface. Blow out the carbon dust using dry air jet.
- After assembly conduct the load test and insulation test. Current taken by motor should not be more than the rated current. Conduct insulation test with 500v megger. It should be more than 1 meg ohm.
- After the compressor/ condenser motor is completely assembled connect a milli-voltmeter across brushes of opposite polarity. Connect the shunt field to 110V mains through a switch. Switch on the mains and note the kick in the voltmeter. Rock the brush gear to the left or right and repeat the test as before. Clamp the rocker arm in a particular position at which the kick is zero or minimum. Before this test, care should be taken to make sure that the brushes are bedded properly. If brushes are at neutral axis, the speed in both the directions of rotation will be same.
- After the evaporator is completely assembled the neutral axis can be selected by running the motor in both the directions on no load at approximately 25% of the rated voltage and measure the speed in both the directions. If brushes are at neutral axis, the speed in both the directions of rotation will be same.

vi. Control Panel

- Completely isolate the panel from the power supply and its loads, Contacts of the contactors (12, 13, 13A, 29 and 17) shall be removed and cleaned by means of clean rag socked in petrol. Any contacts, which are burnt, should be replaced, after which they should be lightly covered with vaseline.
- Similarly, dismantle the contacts of the relays and clean them by means of clean rag socked in petrol. Any contacts which are burnt should be replaced.
- Check the flexible braided connections. If found damaged, replace the same.
- The pin holding the pull off spring on the armature frame-work of the contactor should be pulled out of its slot and the armature hinge pin removed. This should be examined for wear and if necessary, replaced by a new pin lightly covered with vaseline.
- Measure the insulation resistance of each relay and contactor. If the insulation value is less then 2 mega ohms, replace the coil of the respective unit.
- Check whether all connections are tight. If found loose, tighten the same.
- Replace all the fuse links.

vii. Gauge and Cut outs

- Clean the contacts with CTC/Petrol and test for correct operation of settings. Calibrate with the standard gauge.
- Check the performance of the gauges. Calibrate with the standard gauge. Replace defective gauges.

viii. Refrigerator Piping

- Whenever the AC equipment are removed from the refrigeration system for the purpose of overhauling the pipe outlets should be closed immediately to prevent entry of any foreign material into the piping system.
- After reconnecting all the AC equipment, pressure test and vacuum test shall be performed before charging the refrigerant.

ix. Pre-Cooling Transformer & Rectifier Unit

- Open the cover and clean externally with compressed air.
- Dismantle the unit as per manufacturer's instructions.
- Remove and clean the contacts by means of a clean rag soaked in petrol. Contacts, which are burnt shall be replaced and covered with petroleum jelly.
- Clean the transformer, rectifier and rotary switch (RSW). Check for operation and, if defective, change it. Checking shall be done as per following activities:
  - Check proper functioning of indication lamp.
  - Check all protective circuit and fuses etc.
  - Ensure that earthing of housing is intact at two points.
  - Check for any crack/aging in PVC cable. Replace if required.
  - Check the voltage generation at RSW position 1-1 and 4-4.
- Check IR value of the transformer with 500V megger. It shall be minimum one mega ohms.
- Check the gasket for sealing the front cover provided for proofing.
- Check the diodes and adhesion with heat sink. Clean the base and heat sink and tightened diode as per manufacturers guide line.

x. Fans

- Dismantle the lower guard, upper guard, blade and fan motor.
- Check the guard assembly, repair/replace if necessary.
- Check the blade angle with a measuring gauge. Correct the same, if necessary.
- Check the insulation resistance of the fan motor. The IR value should not be less than 2 mega ohms as specified in IS: 6680-1992.
- Check the fan leads and change it if necessary.
- Check the armature winding and field coil, repair/replace, if necessary.
- Check the commutator for grooving, pitting marks, ovulity, blackness etc. Skim or polish the commutator as required.
- Check the carbon brush and brush spring. Replace by correct grade of carbon brush as recommended by RDSO. The fan spring should meet the requirements given in IS:6680. Replace the same if necessary.
- Apply air drying insulating varnish if IR value of the armature and field coils is low, give impregnation treatment in an air circulating oven.

- Clean the ball bearing, check for noise, replace if necessary or grease it with recommended grade.

- **Testing**

  - Check the load current at rated voltage. The wattage of the fan should not exceed the value specified in IS-6680.

  - Check the air delivery of one or two fans from a batch to ascertain the correctness of the blade angle. The value of the air delivery shall not be less than that specified in IS- 6680.

xi. Wiring

- **Light fittings**

  The light fittings, reflectors, clear acrylic sheet cover, glass globe, holders, etc., shall be checked and cleaned. Any defective part shall be replaced. Anti- theft arrangement for fluorescent light fittings shall be checked as per ICF Drg. No. ICF/STD 7-6-001.

- **Coach insulation**

  Insulation resistance of the coach shall be measured with 500 V megger. IR value will be minimum 2 mega ohms but it should not be less than 1 mega ohm under highly humid/wet weather.

- **Cable termination joint**

  - All cable joints shall be checked. Loose joints and cables having damaged insulation shall be replaced/repaired. All cable ends shall be properly screwed with crimping type copper sockets.

  - Surface of copper sockets and bus bars shall be cleaned to remove the oxide film from the jointing surface before making a bolted joint and shall be coated with corrosion resistant conducting grease of approved make to prevent reformation of oxide film.

- Fire retardant PVC grommets to BS-1767 or grade 6 of IS-5831 shall be provided at all cable entry points in metallic members.

- The under frame wiring if running loose shall be provided in rigid steel conduit.

- All inspection covers shall be opened to check the distribution boards and condition of wiring.

xii. Air Filter

- For cleaning the ferrule type fresh air and return air filters remove them from frames and after brushing or shaking off all loose dirt immerse them in a solution of hot water and soda (sodium carbonate) approximately 6 grams to one litre of water. When thoroughly cleaned, the filter units should be rinsed in clean hot water and allowed to dry. When properly dry, they should be completely kept immersed in the oil (compressor lubricating oil) until air bubbles cease to rise. Then remove and allow to drain for at least 8 hrs. before being placed in service again.
- Replace the filter with new one in case of synthetic type filters.

xiii. Cooling Tests

- Cooling capacity test should be carried out by providing electrical compensating loads for worst ambient conditions and full occupancy of the coach. The duration for pre cooling of the coach should be between 3 to 4 hrs.

After the stabilization of the temperature of each berth (20 mm from window and back rest and 100 mm above the berth) should be recorded. The variation in temperature on different berths should not exceed 1 deg. C.

- The cycling duty of the plant shall be determined by recording ON and OFF time of the compressor. It should be between 10 to 15 cycles per hour.

xiv. Additional Items for End-On-Generation (EOG) Coaches

- Overhaul the DG set as per the manufacturer's instructions.
- **Inter-vehicle coupler, ratchet assembly, junction box and connections**: inspect, clean and check for over heating, solder run out, replace if defective. Tighten connections as needed.
- Measure insulation resistance value of the circuit with 500 V megger. It should not be less than 2 mega ohms.
- Check the proper functioning of WRA.

xv. Final Testing of AC Coach, after POH

- Visual inspection of each equipment for their proper fitment.
- Ensure that refrigerant pipes are properly clamped.
- Ensure all the modifications are complied with.
- Check safety chain and tension rod of alternator for proper fitness.
- Under frame cables leading to alternator should be properly cleaned.
- Check earth leakage by two lamp method.
- Check refrigration system for any leakage before charging the gas.
- Conduct vacuum test. (For 12 hrs.)
- Conduct pressure test (by charging Freon 12 or CO_2 gas)
- Vacuum test for 15 minutes for dehydration of refrigeration system.
- Check control panel and ensure that proper fuses are provided.
- Check contactors, relay and switches for correct sequential operation.
- Ensure that time delay in operation of contactor No. 12, 13, 13A is 2.5 sec.
- Check heaters for correct operation.
- Check hooter for proper operation.
- Start the plant and check condenser motor, compressor motor, blower motor for any abnormality.
- Check leakage air from doors.
- Check oil level in compressor, the level when operating should be 1/2 bull's eye.
- Check the proper working of capacity control solenoid valve.
- Run the plant for four hours. An equivalent heat load (convector heater) should be kept for performance test of plant.
- If new expansion valve is provided during POH, it should be set properly.
- Ensure that batteries are in fully charged condition.
- Run the plants with dynodrive motors for 8 hrs. at different speeds.
- Ensure that both the alternators are sharing load equally during run. If not set both the alternator panels.

xvi. General Checks

- Suction pressure gauge reading should be 37-40 PSI (2.6-2.8 Kg/sq.cm.)
- Delivery pressure gauge reading should be 150-170 PSI (10.6-12 Kg/sq.cm.)
- Oil pressure should be minimum 3 Kg/sq. cm. above suction pressure.
- Feel temperature. Suction should be cold and sweaty. Delivery should be very hot and liquid line should be warm.
- The coach shall be jointly inspected with division's staff and the performance of electrical and refrigeration equipment shall be recorded. Any attention to the given equipment shall be given before dispatch of the coach from workshop.

806 POH SCHEDULE FOR SELF GENERATING (SG) TYPE AC COACHES FITTED WITH ROOF MOUNTED AC PACKAGE UNIT (Ref. : RDSO maintenance schedule No. ELPS/SCH/AC/01)

806a SEQUENCE OF WORK TO BE TACKLED DURING POH

i. Pre-Inspection

On arrival to shop, place the coach on the pit line and inspect the electrical and air-conditioning equipment. Conduct the cooling test. If the cooling time is less than the specified values, any further attention to refrigeration circuit is not necessary, except cleaning. Check operation of all protections and note down the defects and deficiencies. In case of self-generating type of coaches, disconnect the cable connection from alternator terminals and remove belt tensioning device.

ii. Lifting

Remove the alternator cable and carry out visual inspection on conduit. Remove the alternator from bogies, replace alternator, regulator and tensioning gear with overhauled alternator, regulator and tensioning gear. Suspension arrangement on under carriage frame. Send the alternators regulators to shop for overhauling.

Lift the roof-mounted unit with the help of 1 ton lifting arrangement as per procedure given below and place it on the wheeled trolley to take it to the shop for overhauling.

iii. **Precaution / Procedure for Removal of AC Package Unit from the Roof**

- Remove lock to access the evaporator unit from bottom, in the doorway ceiling.
- Disconnect condensed drainpipe connection.
- Disconnect all electrical connections to package unit.
- Dismantle the first piece of main duct. Disconnect the supply duct and return air duct bellows.
- Remove Top cover provided above the package unit. Remove rubber package also provided to prevent water leakage.
- Unscrew the 8 Nos. of mounting bolts of AC package unit.
- Do not use forklift.
- Lift the package unit carefully using suitable crane of 1 ton capacity. Arrangement as per RCF drawing No.XZ003801 for lifting ring may be used.
- Do not drop the package unit on the ground while handling.

iv. Stripping

During this activity, the following air-conditioning and electrical equipment will be removed:

- Fresh and return air filters.
- Water raising apparatus
- Battery and battery box
- Battery charger
- A/C Control panel & power panel
- Inverter units
- Carriage fans

v. Dusting

With the help of compressed air, remove the dust of the conditioned air duct.

vi. Cleaning and Overhauling

Before overhauling, measure the insulation resistance of all the electrical equipment such as alternator, motor and wiring to know the condition of equipment. Check and clean all the under frame suspension arrangements, lugs and terminals. After POH, test the wiring for insulation and fit the pre cooling plugs.

vii. Equipping

In this activity fit all the refrigeration and electrical equipment to its respective positions. Connect all the wiring and flanges in the refrigeration system wherever necessary.

806b SPECIAL ITEMS TO BE INSPECTED DURING POH

i. Check for corrosion in trough

It is necessary to check steel trough, which is provided below AC package unit during every POH of AC coach. If any corrosion is observed, then it should be patched up with 2 mm. thick sheet of stainless steel.

ii. Check for corrosion of welded joints of AC package unit structure

The welded joints of AC package unit structure should be examined carefully for presence of corrosion and such corroded members shall be replaced/rectified.

iii. Check for accumulation of water in condensed drain pipe and trough outlet

Clean the condensed drain pipe and trough outlet pipe with help of compressed air. It is also desirable to blow compressed air into the pipe from below, every two months to avoid any choking of pipe due to accumulation of dust, etc.

iv. Deterioration of rubber lining

If there is any deterioration or cracks in rubber lining provided on AC package unit, it should be replaced.

806c PROCEDURE FOR LOWERING AC PACKAGE UNIT

- Before lowering package unit, check roof opening and stainless steel trough for corrosion. Jig to drawing No.XD000201 may be used for ensuring the squareness of the opening.
- Package unit is mounted on strengthening frame with the help of 8 Nos. of mounting pads (Resistoflex, STB-0069 Type-70). Mounting pad should preferably be replaced.
- While lowering the package unit, care should be taken that it does not touch/interfere with the coach at any place. The unit should sit properly on mounting pads.
- Lower the AC unit on the coach and secure it with 8 nos. of bolts as per drg. No.CC44162.

- Provide rubber sheet seal on the strengthening frame as shown in the drg. No.CC44162.
- Connect transition duct and return air duct bellows with the unit with D-panel.
- Make electrical connection as per circuit diagram issued for a particular type of coach and package unit.
- Connect condense drain pipe of package unit with the gradient of drain pipe to avoid filling of condense tray.
- Place roof top cover above the unit, after the unit is sealed by means of rubber sheet in evaporator area.
- Test the unit for water leakage. For stopping any leakage, suitable sized of rubber sheet may be used.

i. Static Testing

Run the plant through pre-cooling terminals and check for proper functioning of electrical and air conditioning equipment, including all the protections.

ii. Simulating Testing

For self-generating type of coaches, check the alternator and inverter output on different load conditions. Check both the alternators for load sharing.

iii. Alternator Connection and Tensioning

In this activity join the connection of alternator and fit the belt-tensioning device. Provide 6+6 'V' belts for alternator.

806d OVERHAULING ACTIVITIES OF MAJOR AC EQUIPMENTS

i. Compressor

There is no need to open the refrigeration system of the ac package units, since it is completely sealed at factory. Conduct the cooling test. If the time required to cool the coach is more than the recommended value and it does not decrease even after cleaning of condenser and evaporator, the compressor will have to be changed.

ii. Procedure for replacement of compressor

- Braze a 1/4" (6mm) OD copper tube fitted with shut off valve at one of the ends. Connect the shut off valve through a charging line to an empty refrigerant cylinder and keep in a cold iced water container until all gas is extracted. Weigh the cylinder before and after. Ensure that weight gain is minimum 2600 grams. A gas compressor can also be used to extract the gas and forcing it into the empty cylinder.
- De-solder the suction and discharge lines and disconnect the electrical wiring from the compressor.
- Remove the compressor and clean the system using carbon tetrachloride (CTC) with the help of circulating pump. It is advised that CTC flushing should not be done with compressor of AC coach in circuit but a separate compressor should be used.
- Install a new compressor, and re-solder the suction and discharge lines. Make the electrical connections. Use high quality silver based copper solder with minimum 40% silver.

- Test for leakage under 30 Kg/sq.cm. pressure using nitrogen/carbon dioxide gas cylinder fitted with a two stage pressure regulator.
- Create a vacuum of 50 micron for 15 minutes with the help of two stage rotary vacuum pump to extract the moisture from the refrigeration system.
- Charge the required quantity of refrigerant gas (R22) as per recommendation of the manufacturer. Charging stub-tube on the compressor should be 1/4" OD and of heavy gauge. Pinch off charging tube nearest to the compressor body so that it remains as short as possible. Longer stub tube can break due to vibrations. Place slight amount of solder at the pinch point for strengthening.

iii. Condenser and Evaporator

Clean the condenser coil and cooling coil with steam of 10 kg/sq.cm. to clean thoroughly and to remove all dirt and mud throughly. This can be done without removing the coils from their places.

iv. Motor for Condenser and Evaporator

- Check for abnormal noise, vibrations, burning smell.
- Check foundation bolts for looseness and tight, if necessary.
- Check the terminals after opening terminal box cover and see for tightness.
- Check the condition of terminal lugs.
- Check the earth connection of the motor body.
- Clean the motor by blowing compressed air.
- Lubricate the motor bearing by approved lubricant use lubricating gun for greasing.
- Check the alignment and re-align the driving and driven shafts.
- Check the coupling for looseness and tighten if necessary.
- Check the duct for crack and for loose/missing fixing bolts.
- Measure the insulation resistance of winding with a 500 V megger. If the insulation resistance is less than 10 M ohm, run the motor for half an hour for drying. If insulation level does not improve re-varnish the armature.
- To avoid brinelling, the armature must be rotated periodically by quarter to half of the revolution.
- It has been observed that bearing greases deteriorate when in the use and ceases to be effective as a lubricant with the lapse of time. The deterioration might show in the form of dry cakes/ flakes in sodium base grease while in the lithium base grease starts thinning and its oil content separates out of the rest of the grease. Deteriorated grease should be changed.

v. A/C Control Panel And Power Panel

- Completely isolate the panel from the power supply and its loads. Contacts of the contactors shall be removed and cleaned by means of clean rag socked in petrol. Contacts, which are burnt, should be replaced, after which they should be lightly covered with silican gel/petroleum jelly.
- Similarly, dismantle the contacts of the relays and clean them by means of clean rag soaked in petrol. Contacts which are burnt should be replaced.

- Check the flexible braided connections. If found damaged, replace the same.
- The pin holding the pull off spring on the armature frame-work of the contactor should be pulled out of its slot and the armature hinge pin removed. This should be examined for wear and if necessary, replaced it with a new pin lightly covered with silican gel/petroleum jelly.
- Measure the insulation resistance of each relay and contactor. If the insulation value is less than 2 mega ohms, replace the coil having Insulation Resistance less than 2 mega ohm, also check the following:
  - Leakage may be through tracking/dust accumulation.
  - Clearance and creapage distance may be checked.
  - Cracks in the housing of switch gear may be checked.
- Check whether all connections are tight. If found loose, tighten the same.
- Replace all the fuse links.
- Check rotary switch for proper working by ensuring following:
  - Ensure that all the poles are functioning.
  - Check that knob shaft is not having any play.
- Check, clean and tighten all connections.
- Check for defective ammeters and voltmeters, and replace the defective ones.
- Check for operation of heating/cooling relay and PCB for ensuring automatic functioning of AC units.
- Check for continuity and sequence list of AC equipment.
- Check for cracks/edging, deterioration of wiring. HV test shall be performed with 2.5 KV for 1 minute. IR shall be min. 10 M ohm.
- Check that all mounting screws are intact and tight.
- Check all terminals, terminal marking and ensure that legend plates are intact.
- Check all indicating LEDs are functioning.

vi. Cut Outs

- Clean the cover with CTC/Petrol and test for correct operation of settings.
- Calibrate with the standard gauges.

vii. Pre-Cooling Transformer Rectifier Unit

- Open the cover and clean externally with compressed air.
- Dismantle the unit as per manufacturer's instructions.
- Remove and clean the contacts by means of a clean rag soaked in petrol. Contacts, which are burnt, should be replaced and covered with Vaseline.
- Clean the transformer, rectifier and rotary switch. Check for operation; if defective, change it.

viii. Inverter Unit

- Open the front panel door and clean with compressed dry air. In case the compressed air pressure is too high, cover the nozzle with thin cloth to reduce the pressure.
- Clean the semi-conductor device's heat sink with compressed air. In case the dust is not removed completely from fins use hard hairbrush and again blow with compressed air for cleaning the heat sink.
- Check that all connections to PCB are tight and no insulation

on cables, boards and insulator is damaged.

- Check for normal routine performance test as per manufacturer's instructions.

ix. Fans and Lights

- Dismantle the lower guard, upper guard, blade and fan motor.
- Check the guard assembly, repair/ replace if necessary.
- Check the blade angle with a measuring gauge. Correct the same if necessary.
- Check the insulation resistance of the fan motor. The IR value should not be less than 2 mega ohms as specified in IS: 6680-1992.
- Check the fan leads and change it if necessary.
- Check the armature winding and field coils, repair/ replace, if necessary.
- Check the commutator for grooving, pitting marks, ovule, blackness etc. Skim or polish the commutator as required.
- Check the carbon brush and brush spring. Replace by correct grade of carbon brush as recommended by RDSO. The fan spring should meet the requirements given in IS:6680. Replace the same if necessary.
- Apply air drying insulating varnish if IR value of the armature and field coils is low, give impregnation treatment in an air circulating oven.
- Clean the ball bearing, check for noise, replace if necessary or grease it with recommended grade.
- Check the rubber packing at fan base. Replace if found cut/damaged.

x. Testing

- Check the load current at rated voltage. The wattage of the fan should not exceed the value specified in IS: 6680.
- Check the air delivery of one or two fans from a batch to ascertain the correctness of the blade angle. The value of the air delivery shall not be less than that specified in IS: 6680.

xi. Wiring

- **Light Fittings**

The light fittings, reflectors, clear acrylic sheet cover, glass globe, holders, etc., shall be checked and cleaned. All defective parts shall be replaced. Anti-theft arrangement for fluorescent light fittings shall be checked as per ICF Drg. No.ICF/SK-7-6-079.

- **Coach Insulation**

Insulation resistance of the coach shall be measured with 500 V megger. The same should be minimum 2 mega ohms in fair weather conditions but it should not be less than 1 mega ohm under highly humid/wet weather.

- **Cable Joints**

- It shall be checked. Loose joints and cables having damaged insulation shall be replaced/repaired. All cable ends shall be properly socketed with crimping type copper sockets.
- Surface of copper sockets and bus bars shall be cleaned to remove the oxide film from the jointing surface before making a bolted joint and shall be coated with corrosion resistant conducting grease of approved make to prevent reformation of oxide film.

- Fire retardant PVC grommets to BS:1767 or grade 6 of IS:5831 shall be provided at

all cable entry points in metallic members.

- The under frame wiring if running loose shall be provided in rigid steel conduct.
- All inspection covers shall be opened to check the distribution boards and condition of wiring.

xii. Air Filter

- Replace the filter with new one in case of synthetic type filters.
- In case of wire mess type filters, wash the filter in hot water first, then with non-subzing detergent and again with hot and cold water. Dry the filter and replace them in the unit.
- The manufacturer's instructions for any other specified type of filter, shall be followed.

xiii. Testing

- **Air delivery test**

After checking the air leakage, air delivery test is conducted. The total air delivery for any coach is calculated from the fundamental requirement of the `FRESH AIR REQUIRED PER PERSON' depending upon the type of the coach (i.e. smoking allowed in I class AC and no smoking allowed in II class AC coach). Minimum fresh air required per person for smoking coach is 0.7 m^3/min. for non-smoking coach is 0.35 m^3/min. respectively. Fresh, return and exhaust air velocities are measured with the help of anemometer using suitable hoods (for fresh air only) to avoid turbulence of air. The volume of air is computed by multiplying the velocity with face area. For ideal condition, the exhaust air should be equal to fresh air or it can be less by 10 % but for no reason it should be not more than fresh air.

Condition for airflow tests are-

- Voltage set at 130 volts ± 1 volts.
- Both side blower motors are working.
- Compartment fans are `OFF'.
- Readings are taken after half an hour stabilization.
- Coach inside the shop.
- Return air filter should be suitably regulated to achieve the fresh air flow nearer to the required quantity.
- Compartment door exhaust air grill blocked partially to make the exhaust air equal to fresh air or 10 % less.
- Fresh air dampers regulator permanently locked, with paint mark after setting the required fresh air on both sides.

- **Cooling test**

Cooling test should be carried out by providing electrical compensating heat loads for worst ambient conditions and full occupancy of the coach. After the stabilization, the temperature of each berth (20 mm from window and back rest panel and 100 mm above the berth) should be recorded. The variation in temperature on different berths should not exceed 1^0 C.

xiv. Additional Item for End-On-Generation (EOG) Coaches:

- Check Inter vehicle coupler, ratchet assembly, junction box and electrical connections.
- Inspect cleat for over heating, solder run out and replace if defective.

Tighten connections as needed.

- Measure insulation resistance value of the circuit with 500 V megger. It should not be less than 2 mega ohms.
- Overhaul the DG set as per manufacturer's instructions.
- Check the proper functioning of WRA.

xv. Final Testing of AC Coach after POH

- Visual inspection of coach for proper fitment of equipment.
- Ensure that refrigerant pipes are properly clamped.
- Suction pipe for proper lagging.
- Check safety chain and tension rod of alternators for proper fitness.
- Under frame cables leading to alternator are properly cleated.
- Check earth leakage by two lamp method.
- Check control panel and ensure that proper MCB/fuses are provided.
- Check contactors, relay and switches for correct sequential operation.
- Check heaters for correct operation.
- Check hooter for proper operation.
- Start the plant and check condenser motor, compressor, blower motor for any abnormality.
- Check leakage air from doors.
- Check that batteries are in fully charged condition.
- Run the plants with dynodrive motor for 8 hrs. at different speeds.
- Ensure that both the alternators are sharing load equally during run. If not set both the alternator panels.

xvi. Final Inspection

- The coach shall be jointly inspected with division staff and the performance of electrical and refrigeration equipment shall be recorded. A list of equipment changed with their serial nos. will also be handed over along with the coach. Any attention, if required to the equipment shall be given before dispatch of the coach from workshop to division

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CHAPTER 9

DRAW & BUFFING GEAR

901 ENHANCED DRAW GEAR & SCREW COUPLINGS

901a Description & Guidelines

i) Description

Enhanced draw gear and screw coupling components were earlier manufactured from Stc. 60.61 VSM10661 steel. The draw gear & screw couplings are designed for a proof load of **60t** (both) and a breaking load of **108t & 112t** respectively.

In 1998, the material for the draw gear and screw coupling components has been upgraded to IS:5517-93 Grade 35 Mn6M03 to enhance the proof load to 75t (both) and a breaking load of 130 t (both). Specifications C -9509 and C -9505 apply to these draw gear and screw coupling respectively. The dimensions of these draw gear & screw couplings are the same as earlier.

Relevant drawings are given below:

	VSM10661 Stc.60 -61	**IS:5517-93 Gr.35Mn6M03**
General Arrangement	SK-79061	SK-99003
Draw Hook	SK-79062	SK-99004
Draft Yoke	SK-79146	SK-99005
Draft Key	SK-79064	SK-99006
Draw bar and castle nut	SK-79063	SK-99007
Rubber buffer spring	SK-96002 Spec. C-9501(Rev.2)	
Screw coupling assly.	SK-79067	SK-99001
Details of screw coupling	SK-79068	SK-99002

ii) Guidelines

The components, except draft yoke, are specially heat treated to achieve the load bearing capacity. Hence these components should not be heated above **550°C**. The latest specified material for screw coupling and draw gear is 35 Mn6Mo3 to IS 5517-1993. The material is required to be in hardened and tempered condition to achieve high tensile and yield strength. Stress relieving during maintenance acts as tempering treatment and there will be adverse effect on tensile properties every time stress relieving is done. For screw couplings and draw gear manufactured from steel to IS 5517 the practice of stress relieving in workshops should be dispensed with.

Due to poor weldability of these steels as well as inadequate infrastructure in Railway workshops for pre- & post-weld heat treatment, reclamation of these components (except draft yoke) by hot working / welding is prohibited.

The proof load testing machines should have a capacity of applying loads upto a maximum of 100t - 150t. The load should be increased on the component gradually. When the prescribed load is achieved, hold it for 2 minutes before gradually releasing the load and checking for permanent set.

Measure permanent set by checking the distance across 2 marks on the component, as far as possible, before and after application of load. It is preferable to have direct indication of permanent set, for higher productivity.

901b Inspection & Maintenance in POH

Periodicity **:** Every POH.

Record-keeping**:** Inspection records should be kept for each inspection stage, relating them to the coach from which stripped & also the coach on which fitted after maintenance. Reasons for rejection & repairs should be clearly mentioned.

Load testing and crack detection should be carried out even on newly procured draw gear components before fitting them on the coaches.

i) Draw Gear Maintenance

(Ref. Drawing : RDSO Sk. 79061 alt 4 & SK. 99003)

Pre-inspection

- Inspect all components visually for dimensional distortion and surface defects such as crack, dent marks, pitting etc. Mark components failing in this check for rejection.
- Special attention should be paid to the condition of the yoke & draw gear pins for signs of creep motion, loose or bent /cracked pins. Elongated or worn out yoke holes should be marked for repairs. Any welding cracks or distortion in the yoke should also be checked visually.

Dismantling

- Take out the draft key from the draw bars and the draw hook after straightening & pulling out the draft key cotters.
- Remove the draw hook along with the screw coupling.
- Detach the screw coupling assembly from the draw hook by cutting off the snap head rivet and removing the pin from the collar.
- Remove the split pins and the castle nuts from the draw bar rear ends.
- Remove the spring end plates, draft pads and parting plates and pull out both the draw bars.
- Dismantle the draw hook beam by un-bolting it from the underframe.
- Remove the draft yoke, if required in pre-inspection, by pulling out the draw gear pins, using a puller.
- Clean the components by any suitable method (Bosch tanks, hot water jets etc) before inspecting them for cracks, distortions, corrosion or wear. The detailed instructions for inspection & repair of individual components are given below :-

Draw Hook

(Ref. drg. RDSO Sketch - 79062 alt.5 & 99004)

- Remove the scale, rust, work hardened layers and surface cracks, if any, by light grinding/filing. Take care so that no grinding cracks or sharp edges are generated which could act as stress raisers. Use dye-penetrant test for checking surface cracks in case of doubts.
- Inspect the draw hook for deformations & cracks. The neck, its pin hole, and the slot are vulnerable locations. Draw hooks worn beyond the maximum permissible wear laid down in the table below should be scrapped : -

Table 9.2

Location of wear	Wear limit	Suggested no go gauge
Root of hook near point of contract with bent link	13 mm	Profile gauge with 15 mm adjustable projection
62 mm dia pin hole	3 mm	65 mm flat
Bottom side of shank 56 mm height	15 mm	41 mm snap
Draft key slot(159 mm)	13 mm	173 mm flat
38 mm width	2 mm	40 mm flat
Hook opening 48 mm	5 mm	46 mm go 53 mm no go plug

- Stress relieve the draw hooks manufactured from steel to Stc. 60-61. Stress relieving should not be done for draw hooks manufactured from steel to IS:5517.
- Load Test draw hooks (Stc. 60-61) at 60 t and those of IS:5517 Gr. 35Mn6Mo3 at 75 t respectively. There should be no permanent set after release of load.

Draw Bar

Ref. Drawings :RDSO Sk. 79063 alt.4 & Sk. 99007

- Check the draw bar for dimensional distortions and damaged threads. Also check for wear on the following locations :-

Table 9.3

Location of wear	Wear limit	Suggested no go gauge
155mm draft key slot	9 mm	164 mm snap
39 mm shank body	3 mm	36 mm snap
Slot width 38 mm	2 mm	40 mm flat
Threads M39x3	1 mm	Thread profile

- Reject draw bars failing these standards. In acceptable draw bars, clean the threads and ease them. Round off the roots of threads at the slot.
- Check the castle nuts for damaged threads, worn nut faces and threads visually. Replace castle nuts if so.
- Stress relieve the draw hooks manufactured from steel to St. 60-61. Stress relieving should not be done for draw hooks manufactured from steel to IS:5517.
- Test all draw bars by magna-glow equipment for surface cracks.
- Load test draw bar (Stc. 60.61) at **39.5 t** and those of (IS 5517 Gr. 35Mn6Mo3) at 60t. There should not be any permanent deformation.

Draft Key

(Ref. Drawing : RDSO SK. 79064 alt.2 & Sk.99006)

- Check draft key for bending and for wear as given below :-

Table 9.4

Location of wear	Wear limit	Suggested no go gauge
Draw bar seating 139 mm	4 mm	Profile gauge with 5 mm adjustable projection
Draw hook seating 139 mm	4 mm	Profile gauge with 5 mm adjustable projection
Thickness 36 mm	4 mm	32 mm snap
Cotter hole 14 mm dia	2 mm	16 mm plug

- Renew worn, mis shaped draft keys. In acceptable draft keys, round off the contact area with the draw bars & draw hook to remove ridges, pitting, etc. if any.
- Stress relieve draft key manufactured from steel to Stc. 60-61. Stress relieving should not be done for draft key manufactured from steel to IS:5517.

Rubber draft pads

(Ref.drg. RDSO Sk.96002 alt.3 & spec.C- 9501 (Rev.2))

- The rubber pads should invariably be changed as a set every alternate POH. The sets should not be formed from supplies from different suppliers. Furthermore, the pads should be checked every POH for bulging, perishing or having got set to a length below **186 mm**. Replace the pads (as a set) if found defective.

Draft Yoke

(Ref. Drawing : RDSO Sk.79146 alt.2 & Sk.99005)

- Carry out detailed inspection, after removal and cleaning, for welding cracks, distortions and wear as given in the table below :

Table 9.5

Comp-onent	Wear location	Wear limit	Suggested no go gauges
Draft yoke	45 mm dia hole	3mm	48 mm flat
Bush	32mm dia hole	1mm	33 mm flat

- Rebuild the **45mm dia hole** by welding and drilling to the nominal size, if required. Ensure that the minimum distance between the inner edges of the 2 holes is $\mathbf{171^{+0.5}_{-0}}$ **mm**.
- Replace corroded, cracked or worn bushes.

Draw gear pin
(Ref. Drawing : ICF/Sk.-2-1-016)

- Replace pins, found damaged, bent or worn more than 1 mm anywhere on the nominal diameter **(31 mm).**

Draw hook beam
(Ref ICF drg. no. T-2-1-602 and Sk.99034)

- Check the following locations for wear :-

Table 9.6

Wear location	Wear limit	Suggested no go gauge
Wearing piece	6 mm	snap gauge 12 mm thick
Locating pins 25 mm dia	6 mm	19 mm snap

- The wearing piece on the draw hook beam should be replaced if worn or cracked.
- The locating pins provided to restrict side-ways movement of the draw hook, should be replaced if deficient , cracked or worn.

Screw Coupling Maintenance
(Ref. Drawings : 79067 alt. 7 & Sk. 99001 (Assembly),79068 alt.8 & SK 99002 (Details))

- Cut off rivets at both ends of screw and also rivets on trunnion for straight links and remove screw and straight links.
- Inspect the components for distortion, cracks or wear exceeding the limits below. In case of doubt, dye-penetrate tests may be used for confirming the presence/absence of cracks.

Table 9.7

Compo-nent	Wear location	Wear limit	Suggested no go gauge
Straight link	61 mm dia hole	2 mm	63 mm flat
Straight link	47 mm dia hole	2 mm	49 mm flat
Bent link	42 mm dia stem	3mm	39 mm snap
Bent link	47 mm dia hole	2 mm	49 mm flat
Bent link	78 mm 'U' gap	3 mm on each arm	77 mm to go 85 mm no go gauge
Pin on draw hook	60 mm dia	2mm	58 mm flat
Screw	55 x 6.35 mm k/thread	1 mm	K thread profile gauge
Trunnion LH/RH Knuckle	Thread 55.635x6 .35 K/thread	1 mm	K thread profile gauge
-do-	76 mm thickness	4 mm	72 mm snap
-do-	46 mm dia pin	2 mm	44 mm snap

- Replace the worn out components. Replace both the trunnions if required. Remove ridges, rust, notches etc. by grinding.
- Stress relieve the screw coupling manufactured from steel to Stc. 60-61. Stress relieving should not be done for draw hooks manufactured from steel to IS:5517.
- Assemble the screw coupling as shown in SK 79067 & 99001.
- Load test the screw coupling assembly under proof load of 60t (Stc. 60-61) and 75t (IS:5517) respectively. There should not be any permanent set.

Re-fitment of Draw Gear on coach

(Ref Drawing : RDSO Sk. 79061 alt. 4 & Sk.99003)

- Lubricate the wearing surfaces in the screw couplings, draw hooks and draw bars with graphite grease or used Roller Bearing grease.
- Place the draft yoke and secure it with draw gear pins. Place lock pins and splits pins in the bracket and secure lock pin with split pin. Do not re-use split pins.
- Position the draw hook beam on head stock and secure it with bolts and nuts as shown in ICF/SK T-2-1-602.

- Assemble the screw coupling with draw hook by inserting pin and rivet the pin.
- Position the draw bars in the draft yoke and insert draw hook. Insert the draft key in draw bars and draw hook. Fit cotters in the draft key and bend them. Do not re-use cotters.
- Place a rubber draft pad pack to STR No.C- 9501 (Rev.2), parting plates and spring end plate on each draw bar. The free height of rubber springs & parting plates should be 208 mm.
- Tighten the castle nuts **with 9.15 kg-m torque** so as to achieve a pre-compression of **196 mm** length of pack.
- Insert the split pins through the castle nuts and draw bars and open the split pins to **90 degrees**. Use new split pins always.
- Ensure that the projection of the shoulder on the draw hook from the head stock is within **92 mm – 120 mm.**
- Check for proper condition of the draw gear and screw couplings, after cleaning the accumulated dirt. Pay special attention to displaced draft key & it's cotters, draw bars and condition of draft pads.
- Lubricate the screw portion of the coupling and the area around the draw hook pin with graphite grease or used roller bearing grease.
- Always replace unused screw coupling on the suspension hook.

902 ICF TYPE BUFFER OF BG MAINLINE COACHES

902a Description and guidelines

i) Description

Presently enhanced capacity (**1030 kg.m**) buffer conforming to specification No. IRS-M 10 are fitted in all BG mainline coaches .

Relevant assembly and main component drawings are given in table 9.8.

Table 9.8

Components	Drawings
Buffer Assembly	SK 92090(existing) & Sk 98145(new)
Buffer casing (cast steel) (Forged)	W/BD –392 & Sk 94043 (with enlarged base) W/BD-393 & Sk 94044 (with enlarged base)
Buffer plunger-cast steel (Forged)	W/BD-359 & Sk 94255 (with flat face) W/BD-355 & S~ 94256(with flat face)
Rubber buffer pads Buffer spindle	SK 96002 and STR. no. C- 9501 (Rev . 2) W/BD- 353
Destruction tube	ICF drg. No. T-2-2-602
Recoil spring	W/BD-2252
Recoil spring parting plate	W/BD-2253
Recoil spring Washer	W/BD-350
Buffing spring parting plate	W/BD-2261
Face plate for buffer plunger M.24 Hex Head bolt	Sk 94254 ICF drawing No. T-2-2-503

Earlier buffer had a plunger with curved face. During reclamation a wear plate with centre hole as per SK-81142 is fitted and plug is welded at centre to prevent rotation of buffer spindle. To avoid welding of centre plug, an integral face plate is to be provided and the new buffer assembly should be to SK 98145

Rubber buffer pads are to be procured and used as a pack from RDSO approved sources.

Buffer casing of earlier design are to IRS drawing no W/BD 392 & 393. In order to reduce the stress level on fixing bolts and prevent cracks in underframe headstock, the size of base of casing and location of fixing holes were increased and design of casing to RDSO SK 94043 and SK 94044 has been advised to PU's and Railways in 1994. Railways mau use both existing and revised design of casings depending on the location of holes available in the underframe head stock.

902b **Inspection and Maintenance in workshops**

i) Periodicity – Every POH

ii) Record keeping

Record should be maintained related to the coach from which buffers are removed, the defects, repairs attended and the coach on which fitted after attention.

iii) Dismantling

- Take out split pin and unscrew nuts holding buffer casing with underframe head stock and remove buffer assembly from the coach .
- Remove split cotter and nut from buffer spindle and separate buffer plunger from casing and take out all components for inspection .

iv) Inspections and Repair

- Clean the components by any suitable method (Bosch tanks, hot water jet etc.) thoroughly before inspection and check for cracks, distortions, wear, corrosion & pitting.
- The instructions for inspection and repair of individual components are given below:

Buffer casing (R*ef. drawing W/BD-392/393 AND Sk 94043 & 94044)*

- Examine the buffer casing for cracks, damage, deformation & wear. The casing worn more than the wear limit and found cracked should be discarded. The elongated holes can he filled with weld metal and re drilled to **26 mm dia**. The location of 4 holes are **60.3 +/- 0.2 mm** from centre of casing along width & **174.5 ± 0.2 mm** along length in buffer casing to IRS W/BD – 3 9 2 / 3 9 3 . The respective dimensions in casing to SK 94043/94044 are **85 ± 0 .2 mm** & **174.5 ± 0.2 mm**. These dimensions should be checked and restored ,if found different.
- The wear limits are given in table 9.9.

Table 9.9

Wear location	Wear limit	Suggeste d gauge
Buffer casing body wall thickness 11.5 mm	5.5 mm in wall thickness	Inside micrometer
Fixing hole in the base 26 mm dia	2 mm on dia	28mm flat

Buffer plunger *(Ref. drg, W/BD- 355 & 359 and SK 94255 & SK 94256)*

- Examine the plunger for wear, cracks & deformation. The plunger worn more than the wear limit on body and cracked should be discarded. Worn out face plates shall be replaced.
- The wear limits are as follows :

Table 9.10

Wear location	Wear limit	Suggested gauge
Buffer plunger tub e wall thickness 9 mm	4mm	Micrometer
Plunger face/face plate 19 mm	11mm	1905 mm curvature gauge with depth measurement.

- Place buffer spindle in the plunger and rivet cast steel face plate to Sk 94254 with 6 Nos. of **16 mm dia** flat CSK rivets on buffer plunger from face plate side. No gap should exist. Circumferential welding of face plate with plunger is prohibited

Rubber buffer pads
(*Ref. Drg. RDSO SK 96002 alt.3 & STR No. C- 9501(Rev.2)*

- Rubber buffer pads should invariably be changed as a set at every alternate POH. The set should not be formed from different supplies. Further more, the pads should be checked every POH for perishing or permanent set to a length below **424 mm**.

Buffer spindle (Ref. drg. W/BD-353)

- Inspect the spindle for straightness, wear on body and threads. Straighten the spindle, if required.

  The Wear permissible on body is :

Table 9.11

Wear location	Wear permitted	Suggested no go gauge
Buffer spindle body 40 mm dia	5 mm	35 mm snap
Threads M 39	0.5 mm	thread profile gauge

Destruction Tube
(Ref. ICF drg. No. T-2-2-602.)

- Check the destruction tube for bulging, corrosion. Replace the damaged/corroded destruction tube.

v) Assembly of Buffer

- Measure the free height of a set of rubber buffer pad pack(consisting of 16 pads) to STR No.9501 (Rev.2) and add parting plates, as required, to achieve a free height of **484 +/- 2 mm**.

- Place washer (ICF Drg . No . T-2-2-602), measured rubber pad pack with parting plates, destruction tube in the buffer plunger and insert the plunger inside the buffer casing.

- Assemble recoil springs (W/BD-2252) parting plate (W/BD-2253) and washer (W/BD-2261) on buffer spindle . Place the M39 nut over spindle and tighten the nut as to achieve a length of buffer **of 635 + /- 2 mm**. The pre- compression of rubber pack with parting plate will be **439 +/- 2 mm**.

- Insert the split cotter in the spindle and split open to **90 degrees**. Use always new cotters. Use washer if needed, to eliminate gap between nut and split cotter.

vi) Mounting of Buffer on Coach

Before placing the buffer on the underframe head stock, check the condition of head stock for corrosion and damage and 4 nos. of **27 mm dia** holes for cracks and elongation. The corroded / damaged head stock behind buffer location should be replaced with new part head stock pressing for a length of **746 mm** as per RDSO Sk 76026 alt . 1 Annexure V of corrosion Manual G- 7602 (Rev .-1) Deposit weld metal in elongated holes and re drill if needed. The dstance of holes from centre of buffer is **60.3 +/- 0.2 mm** vertically & **174.5 +/- 0.2 mm** horizontally in earlier design of head stocks and this is suitable for fixing buffer casing to IRS drg No W/BD/392 &393. These dimensions should be checked and rectified if required for correct fitment of buffers.In the current design of headstock the distance is **85.5 ± 0.2 mm** vertically & **174 ± 0.2 mm** horizontally and is suitable for fixing buffer casing to RDSO SK94043 & 94044.

Place 4 nos. of Hex. Head bolts to ICF drg. No. T-2-2-503 through holes in head stock and buffer base and fully tight slotted nuts. Insert split pins through the slot in the slotted nut and hole in the bolts and split open to **90 degree**. Ensure the buffers remains horizontal.

vii) Maintenance in Depots

Check for tightness of buffer fixing bolts, drooping of buffers and slackness in buffer plunger to ensure destruction tubes are not damaged.

Buffer face should be scrubbed with a scrapper to remove dirt and muck and wiped clean using cleaning fluids After cleaning, the buffer face should be checked for the condition of CSK rivets holding face plate. Apply graphite grease on face plate after checking for cracks and wear.

viii) Pre-compression

The projection of buffer from head should be within **600 mm to 635 mm**.

903 EXAMINATION AND REPAIR PRACTICE IN CARRIAGE MAINTENANCE DEPOT

903a Draw Gear

i) **Primary & Secondary Maintenance**

- Check and replace damage/missing split pins/cotters/rivets.
- Examine draw hook, draw bars and rubber pads for damages.
- Check condition of the screw coupling and its components and replace if required.

ii) **Schedule A & Schedule B**

- Examine as per (i) above.
- Check condition of draw beam and locating pins on it.
- Examine visually draft key locking pins.

iii) **Schedule C**

- Follow the items given in (ii) above.
- Ensure that wear on screw coupling shackle pins, trunion pins shackle/link holes and draw hook holes should not exceed 3 mm.
- Ensure that wear at any section on draw hook should not exceed **10 mm**.

903b Buffing gear

i) **Primary & Secondary Maintenance, Schedule A and Schedule B**

- Buffing gear assembly should be externally examined for drooping, cracked and worn parts for proper securing.
- Buffer casing should be properly secured in t he prescribed manner.
- Buffer face rivets when provided should be counter sunk and intact i.e. not missing.
- Destruction tube should be examined and coaches with collapsed destruction tube should be withdrawn from service at the first opportunity for sick line attention.
- Buffer alignment with head-stock should be true.
- Buffers should not be dead i.e. they should have sufficient buffing capacity.
- The buffer spindle should be in proper condition with the bolts and cotter intact.

ii) Schedule C

- Follow the items given in (i) above.
- Buffer projection should be not less than **600 mm** and not more than **635 mm**.
- Destruction tube should be examined and coaches with collapsed destruction tube should be attended.
- Inspect buffer plunger false plate for wear and profile.

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CHAPTER 10

ROLLING GEAR

1001 WHEEL AND AXLE

1001a Introduction

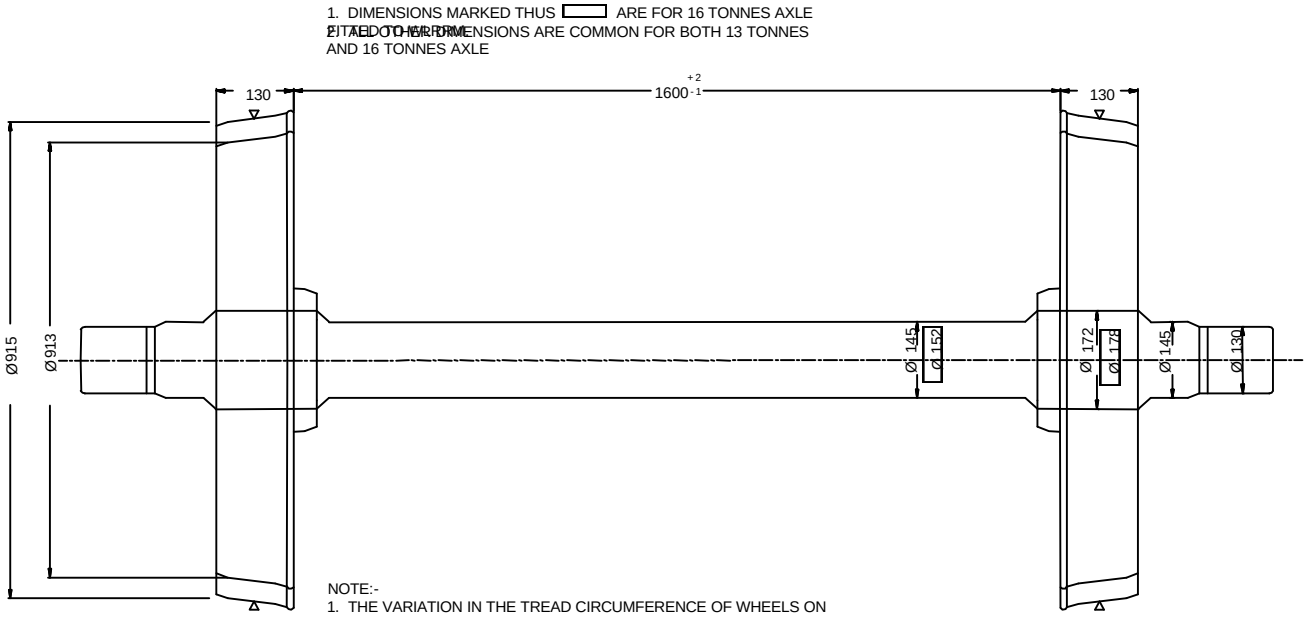
The movement of rolling stock on the track is possible only with the help of wheels. The complete wheel set is shown in the **figure 10.1** with the assembly components. These assembly components are described in detail in the following pages.

i) Wheel disc solid

The solid wheel disc is manufactured as per IRS Specification No. R - 19/ 93 Pt. II and drawing No. W/WL/1660 **(see figure 10.2)**.

ii) Axles

An axle is a component of a wheel set to hold the wheel discs in position. The axle box is also mounted on the journal of the axle (**See figure 10.3** for Axle)



WHEEL AND AXLE COMPLETE
Figure 10.1

1001b Components of a wheel set

A wheel set is an assembly mainly of two components:

- Wheel discs(solid) on both sides of the axle
- An axle to hold these wheel discs in position

Note:- Rly. Bd. vide their letter no. 98/RSF/874/1/SAIL (Pp) dt. 8/10/1998 has decided that only 16.25t axles would be used for wheel set under 13t bogie also for new wheel sets. The existing wheel set in service may however continue till they are required to be changed.

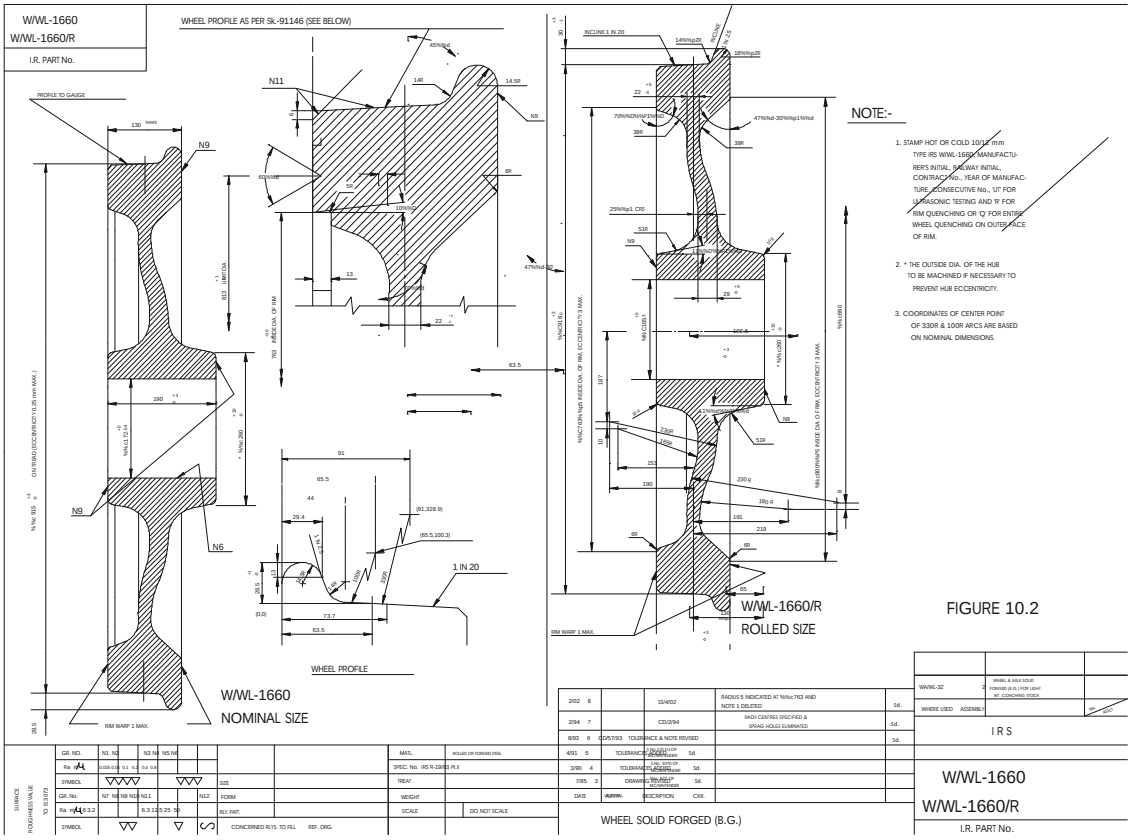
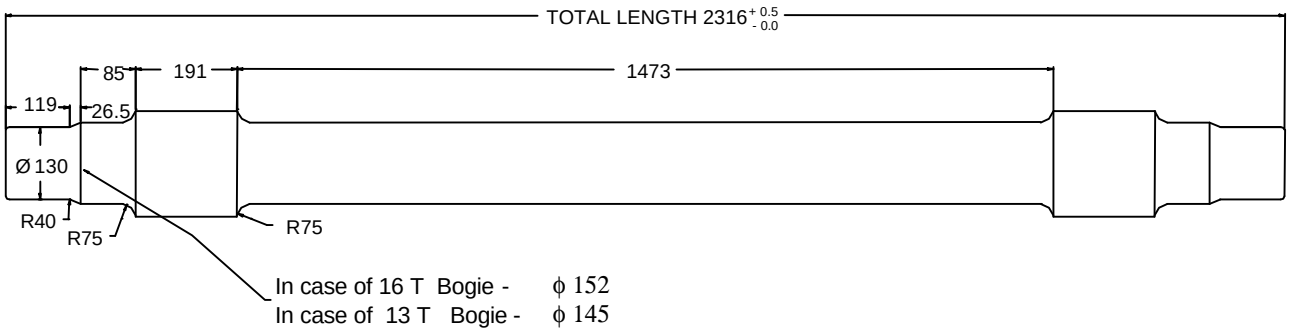

W/WL-1660
W/WL-1660/R
I.R. PART No.
WHEEL PROFILE AS PER Sk.-91146 (SEE BELOW)
NOTE:-
1. STAMP H.O.T. OR COLD 10/12 mm TYPE IRS W/WL-1660 MANUFACTURER'S INITIAL, RAILWAY INITIAL, CONTRACT No., YEAR OF MANUFACTURE, CONSECUTIVE No., 'UT' FOR ULTRASONIC TESTING AND 'R' FOR RIM QUENCHING OR 'Q' FOR ENTIRE WHEEL QUENCHING ON OUTER FACE OF RIM.
2. * THE OUTSIDE DIA. OF THE HUB TO BE MACHINED IF NECESSARY TO PREVENT HUB ECCENTRICITY.
3. COORDINATES OF CENTER POINT OF 330R & 100R ARCS ARE BASED ON NOMINAL DIMENSIONS.
W/WL-1660/R
ROLLED SIZE
W/WL-1660
NOMINAL SIZE
WHEEL PROFILE
RIM WARP 1 MAX.
1 IN 20
INCLINE 1 IN 20
W/WL-32
WHEEL & AXLE SOLID FORGED (B.G.) FOR LIGHT MT. CONCAVE STOCK
WHERE USED
ASSEMBLY
I R S
W/WL-1660
W/WL-1660/R
I.R. PART No.
WHEEL SOLID FORGED (B.G.)

FIGURE 10.2



AXLE
Figure 10.3

iii) Axle boxes with roller bearings

The axle boxes used on ICF coaches are with under mentioned spherical roller bearings

Spherical Roller Bearings No. 22326/C3

These roller bearings are with **130 mm** parallel bore on the inner ring and are directly shrunk on the axle journals.

1001c **Maintenance Procedure in the Workshop**

i) Pre-inspection of wheels in the workshop

During pre-inspection of incoming wheels, the wheel-set is inspected for assessing the condition of the components. Following measurements are carried out on all the wheels, received in shop for repairs.

a) Measurement of a wheel gauge (distance between two wheels flanges on the same axle)

The distance between two wheel flanges on the same axle should be **1600 mm + 2/-1 mm**. This measurement should be taken at three locations apart with the help of an adjustable pi gauge. If wheel gauge is not within permissible limits, then the wheel disc (s) have to be pressed off and then pressed on.

b) Measurement of Wheel Diameter (Tread Diameter)/Wheel Flanges

The wheel diameter is measured with the help of a trammel gauge with a least count of **0.5 mm**. on both sides. However, a gauge with a least count of **0.1 mm**. is recommended as the measurement of a diameter would be more accurate with this gauge.

The difference in tread diameter of the two wheels on the same axle should not exceed **0.5 mm** after tyre turning. There is no 'In service' limit for this variation and rejection shall be decided by tyre defect gauge

During last shop issue the wheel is to be turned to RDSO SK-91146. The profile is to be turned **1 mm** above the condemning limit groove. The maximum diameter and last shop issue size for ICF type wheels is given below:

Table 10.1

Type of wheel	New	Min. Shop issue
ICF solid	915	836

c) Inspection of wheel disc as per CMI-K003

The wheel should be inspected for rejectable defects in accordance with RDSO's instructions CMI-K003

d) Inspection of Wheel Flanges

The flanges on both sides of a wheel set are checked with the help of a profile gauge to measure the height and thickness of flanges. Accurate measurement of flange height and flange thickness is not possible with the profile gauge. It is, therefore, recommended to use a wheel profile gauge with which accurate measurement of flange height and flange thickness to the extent of **0.1 mm** can be made.

After recording the diameters of wheels and wheel flange measurements, the wheel set is nominated for necessary repairs.

e) Inspection of axle

Axle journals should be thoroughly cleaned for inspection to detect flaws, pitting, ovality, taper, ridges etc. Each axle should be ultrasonically tested for detecting internal flaws and defects as per the code of procedure issued by RDSO (**Annexure 10.1**). Axles found flawed, pitted or with under size journals should be replaced.

On ICF axle journal

- A taper should not exceed 0.015 / 0.010 mm.
- Out of roundness (ovality) must not exceed **0.015 / 0.020 mm**.

1002 **CATEGORY OF WHEELS**

The wheels are categorised after pre-inspection as below:

1002a **Normal repair wheels**

If all the components are within the acceptable range of limits, these are taken directly for wheel profiling and servicing of roller bearings.

1002b **Wheels requiring replacement of an axle (RA wheels)**

The wheel is taken for replacement of an axle for the following :

- A bent axle,
- Dimensional deviations on a journal / wheel seat
- Axle having groove marks in the middle due to rubbing of a pull rod,
- Dents, corrosion, pitting marks on the surface of the axle
- Axles found flawed in the ultrasonic flaw detection test

1002c **Wheels requiring replacement of solid discs (RD wheels)**

The wheel is taken for replacement of discs if found

- It is not possible to turn the wheel to the last shop issue size
- There is a rejectable defect as per CMI-K003.

1003 **REPAIR PROCEDURES FOR DIFFERENT CATEGORIES OF WHEELS**

Detailed procedure for carrying out repairs to different categories of wheel sets is described below:

1003a **Normal Repair of Wheel sets**

Normal repair wheels are of two categories.

a. With roller bearings mounted

b. With roller bearings removed

The activities involved in Normal Repair Wheels are as follows:

- Pre-inspection of incoming wheels.
- Drop axle boxes, clean and inspect axle boxes. If required, repair them.
- Carry out Ultrasonic Flaw detection test of axle.
- If required, dismount roller bearings from journals. (In any case dismount roller bearings in alternate POH)
- If the wheels are sent for re-profiling without dismounting roller bearings from the journals, special protective covers should be fitted on the bearings on either side of a wheel to avoid entry of chips / dust or damage to the bearing during machining.
- Machine wheel profiles to the prescribed dimensions. The wheel tread should be checked and machined to the worn wheel profile and machining standard N11 to IS: 3073. (**see figure 10.4** for worn wheel profile)
- Clean roller bearing and assemble components in position, if not dismounted.
- Inspect roller bearing and assembly in position.
- Check radial clearance and confirm it to be within permissible limits.
- Pack fresh grease
- Mount cleaned and inspected axle boxes.
- Fit front cover with new sealing ring.

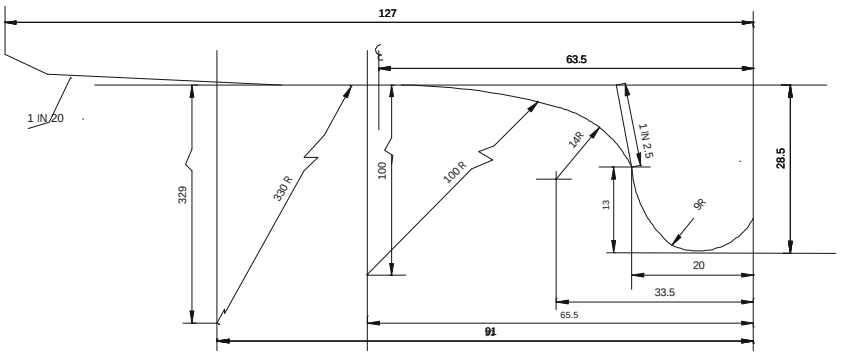


FIGURE - 1

(20 MM THICK FLANGE)

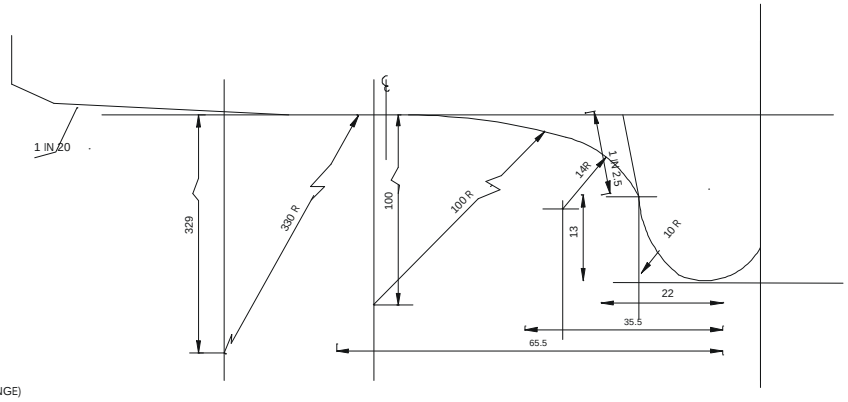


FIGURE - 2

(22 MM THICK FLANGE)

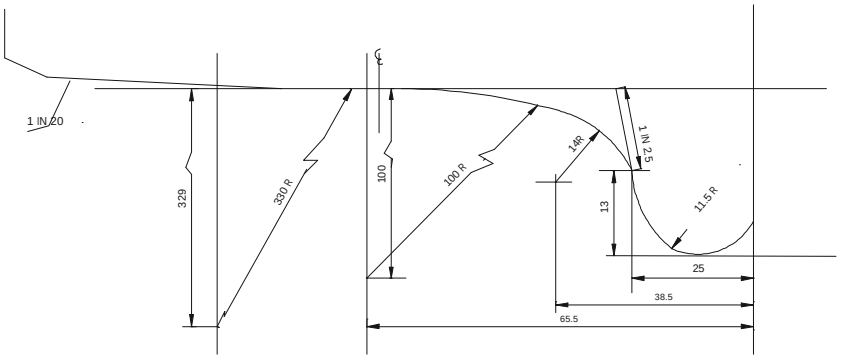


FIGURE - 3

(25 MM THICK FLANGE)

1. FIG.3 SHOULD BE THE LAST PINTERMEDIATE WHEEL PROFILEPFOR THE WHEELS MEANT FOR PTHE COACHES TO RUN AT MAX.PKMPH AND ABOVE.P2. ALL THE THREE INTERMEDIATE WORNPWHEEL PROFILE (FIG.1,2&3)PCAN BE USED FOR THE WHEELS FOR POTHER TYPES OF COACHES.

DEVELOPED BY:		INTERMEDIATE WORN WHEEL PROFILE FOR COACHING STOCK
SUPERSEDES:		
SCALE 1:1	P C D PAINT 9/92 T JS	
B.G. RDSO[C]		SKETCH-92082

FIGURE 10.4

1003b **RA (Replacement of Axles) Wheels**

The activities involved in replacement of an axle are as follows:

- **Pressing off a rejected axle from a wheel**

  The wheel is taken on the wheel press for separating the rejected axle from the wheels.

- **Machining of new axles**

  New axles should be machined to the correct drawing dimensions. Journal, journal fillets and shoulders should be finished smooth, concentric and without ridges, burrs or chatter marks.

- **Inspection of machined axles**

  Dimensional checks

  A machined axle should be inspected for dimensional accuracy with the help of a micrometer with least count of **0.01 mm**. Journal diameters should be measured at three points along the length of journals both on the vertical and horizontal axis. The ovality and taper must not exceed the limits prescribed in the drawing..

  Surface finish checks

  Surface finish of the axle on journals, wheel seat and middle portions should be checked with the help of a surface finish tester and the prescribed limits are as below: -

Table 10.2

Axle portions	**Prescribed (RA) value for Surface finish in microns**
Journal portion	0.8
Wheel seat portion	1.6
Middle portion	3.2

  Ultrasonic flaw detection checks

  Ultrasonic flaw detection test is carried out as per **annexure 10.1**.

- **Machining of serviceable wheel disc**

  The serviceable wheel discs are re-bored on the vertical boring machine. Care should be taken that the finished bore is straight, concentric to the tread of the wheel and has a smooth surface free from ridges, scores and chatter marks. A radius of **2.5 mm** is provided on the hub to facilitate mounting. It must be made after the finishing cut.

- **Inspection of re-bored wheel disc**

  The rebored wheel disc should be inspected with the help of an inside micrometer to ensure consistent results. Each wheel bore must be checked at not less than three points in its length and on the different diameters at each of these points to ensure roundness and absence of tapers. The variation for any of these measurements must not exceed **0.05 mm**.

  If any taper does exist, the small diameter must be outside ends of the hub (a reverse taper is not allowed). The surface finish of the bore should be within the permissible limits.

- **Machining of wheel seats for matching of wheel disc bores**

  The wheel seat of the axle to be used for re-axling is machined to suit the bore of the wheel disc keeping interference allowance as specified.

  The bore of wheel disc and wheel seat on the axle should be maintained to the specified surface finish and diameters to achieve correct interference fit and pressing in pressure

- **Pressing on Wheel Discs on Axle**

  - Before pressing on operation, wheel seats on the axle and bore of the wheel centres should be carefully cleaned to remove rust, grit, swarf, dirt etc.
  - The wheel seat should be lubricated with a mixture of basic carbonate white lead and boiled linseed oil, in the proportion of **1.2 kg.** of white lead paste to **1 litre** of boiled linseed oil. The wheel and axle should be properly aligned on the wheel press.

- The wheel press should be equipped with a dial pressure gauge and pressure recording gauge with graphs to record mounting pressure diagrams for each assembly.
- Wheels should be mounted within the prescribed pressure limits.
- Wheels should be mounted (pressed in) carefully on the axle such that the wheel gauge distance is maintained.
- The axle end should be stamped with the shop code, date of mounting, pressing in pressure, axle no., cast no., cons. no. to enable identification of wheels. Care should be taken to ensure that wheel disc number is preserved (**see figure 10.5**)
- The wheel gauge should be checked by gauging at three or more equi-angular points around the circumference.

1003c **RD (Replacement of solid discs) Wheels**

During pre-inspection, if it is found that tread diameters of the solid disc wheels cannot be issued at the last shop issue, the wheel is taken for replacement of discs.

The activities involved in replacement of discs:

- **Dismounting of Axle boxes & Roller Bearings**

  Axle boxes are dropped from the RD Wheel. The wheel is then taken for dismounting of roller bearings from journals.

- **Inspection of Axle journals/ Ultrasonic testing of the axle**

  Journal diameters should be measured with an outside diameter to confirm to be within the permissible limits. The axle should be ultrasonically tested for flaw detection and should be flawless.

- **Pressing off rejected discs from a wheel**

  The wheel is taken on the wheel press for separating the rejected discs from the wheels.

- **Boring (Machining) of new discs**

  New discs are bored on the vertical boring machine. Care should be taken to ensure the finished bore is concentric to the tread of the wheel and has a smooth surface free from ridges, scores and chatter marks. The radius of **2.5 mm**, which is provided on the wheel bore to facilitate mounting, should be made after the finishing cut. An inside micrometer should be used for measuring wheel bores to ensure consistent results. Each wheel bore must be checked at not less than three points in its length and on the different diameters at each of these points to ensure roundness and absence of tapers. The variation among any of these measurements must not exceed **0.05 mm**. If any taper does exist, the small diameter must be at an outside end of the hub bore (reverse taper is not allowed)

- **Machining of wheel seats on an old axle for matching of wheel disc bores**

  The wheel seats on the old axle (released from RD wheels) are machined to suit the bore of the wheel discs keeping interference allowance as prescribed.

  The bore and the wheel seat should be machined to the specified surface finish to achieve correct interference fit and pressing in pressure.

- **Pressing on Wheel on Axle**
  - Before pressing on operation, wheel seats on the axle and bore of the wheel should be carefully cleaned to remove rust, grit, swarf, dirt etc.
  - The wheel seat should be lubricated with a mixture of basic carbonate white lead and boiled linseed oil, in the proportion of **1.2 kg.** of white lead paste to **1 litre** of boiled linseed oil. The wheel and axle should be properly aligned on the wheel press.
  - The wheel press should be equipped with a dial pressure gauge and pressure recording gauge with graphs to record mounting pressure diagrams for each assembly.

- Wheels should be mounted within the prescribed pressure limits. Pressing pressure should be **400 to 600 kg/mm** of diameter of wheel seat. For ICF 16t axle with wheel seat diameter from **176mm** to **178mm**, the pressing pressure should be **71t to 108t**.
- Wheels should be mounted (pressed in) carefully on the axle such that the wheel gauge distance is maintained.
- The axle end should be stamped with the shop code, date of mounting, pressing in pressure, axle no., cast no., cons. no. to enable identification of wheels. **(see figure 10.5)**
- The wheel gauge should be checked by gauging at three or more equi-angular points around the circumference. **(see figure 10.6)**

List of Tools and Plant

1. EOT crane 5 tonnes
2. Wheel profiling lathe
3. Axle journal turning and burnishing lathe
4. Axle journal grinding machine for assembled wheel set.
5. Hydraulic wheel press with facility for mounting pressure diagram
6. Axle turning lathe
7. Vertical turning lathe
8. Axle centering machine
9. Axle end drilling machine
10. Axle grinder

1004 AXLE BOX ASSEMBLY

In passenger coaches of Indian Railway system, only single bearing type axle box arrangement is used. The inner ring of the bearing is provided with either a cylindrical bore (Direct Mounted type) or with a taper bore and withdrawal sleeve (Sleeve Mounted type). All new passenger coaches built by Indian Railways, use only direct mounted type spherical roller bearings. Therefore, practices related to the sleeve mounted bearings, have not been covered in this manual.

1005 ROLLER BEARINGS

1005a Construction feature of Roller Bearings

Spherical roller bearing consist of an outer ring having a continuous spherical raceway within which operate, two rows of barrel shaped rollers, which in turn are guided by an inner ring with two raceways separated by a centre rib. The spherical roller bearings have self-aligning properties and therefore can automatically adjust to any deviation in the centre line of the axle.

Spherical roller bearings have a large capacity for radial loads, axle loads in either direction, and complex loads. They are suited for the applications such as railway rolling stocks where vibrations and shock loads are encountered.

Roller Bearings are named according to the shape of rollers. Roller Bearings with spherical rollers are called as Spherical Roller Bearings. (**see figure 10.7** for roller bearing arrangement)

Spherical Roller bearing no. 22326/C3 with **130 mm** parallel bore on the inner ring are being used on ICF type coaches. They are directly shrunk fit on the axle journals.

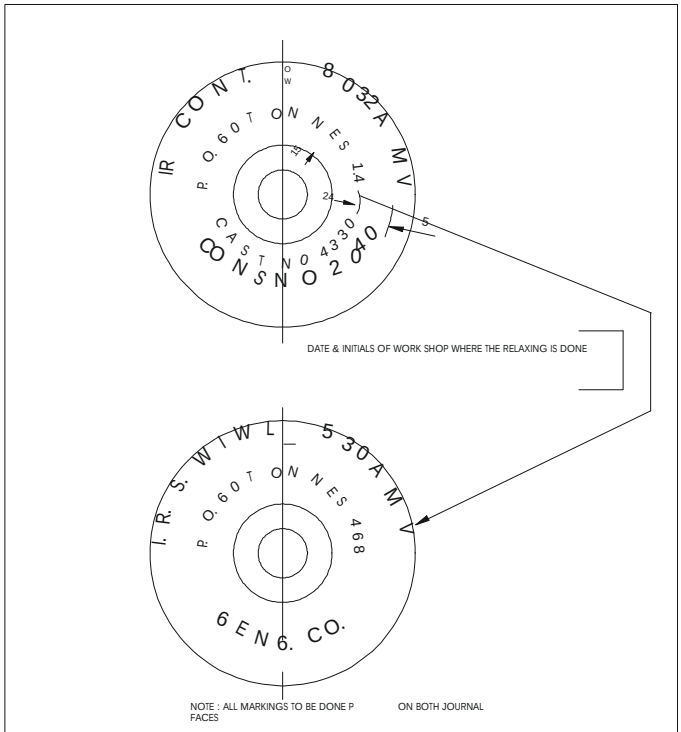
These roller bearings need to be inspected periodically at a pre-defined schedule in the workshop in a Roller Bearing Maintenance Shop well equipped with all the facilities and proper lay out. The period of maintenance specified is as follows:

Periodicity of Inspection of Roller Bearing

- All roller bearings should be cleaned, inspected and filled with fresh grease at every POH.
- All bearings should be dismounted every alternate **POH or 2 lakh km** whichever is earlier in the workshop for renewal of felt sealing ring and overhaul of the roller bearings.

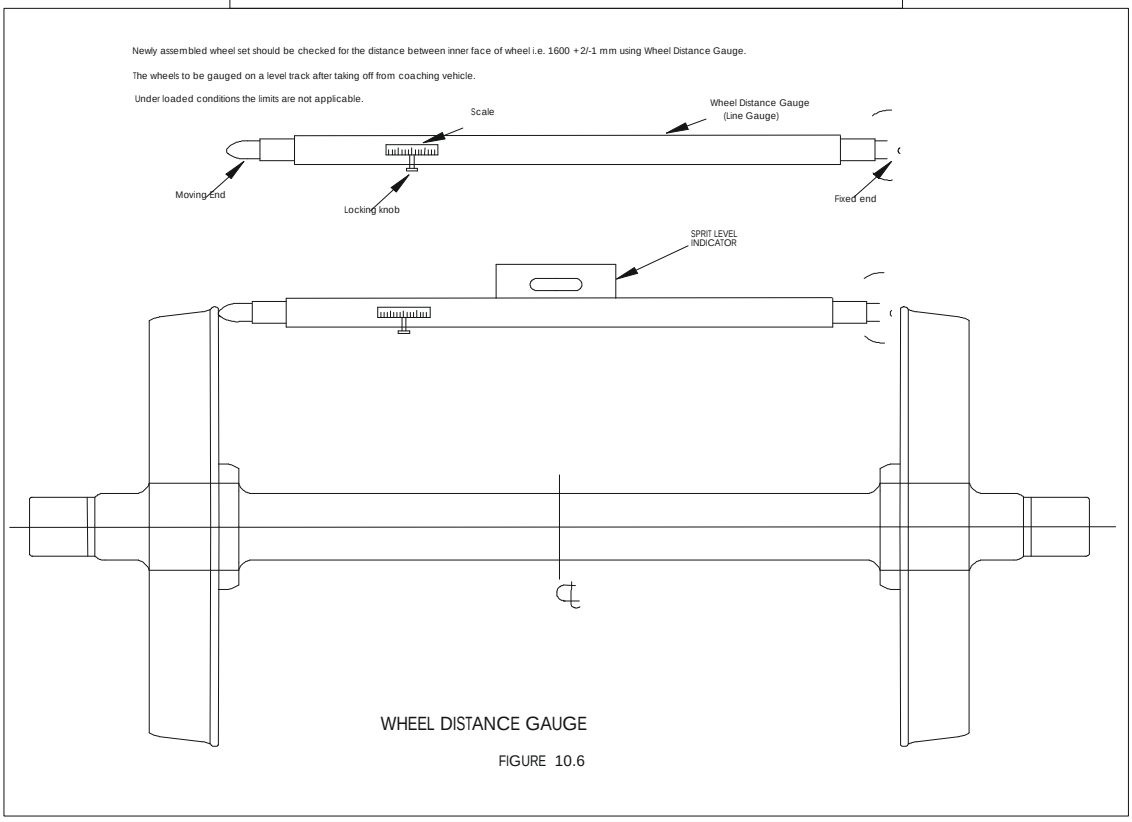
1005b Roller Bearing Maintenance in Shop

Roller Bearing Maintenance Shop should be well equipped with all the tools, equipment and facilities for careful bearing handling. It should have proper workflow for easy maintenance of roller bearings. Clean surroundings and dust free atmosphere should be maintained in the shop. It should have adequate equipment and facilities for cleaning, handling, dismounting, dismounting, inspection, repair and storage of roller bearings.



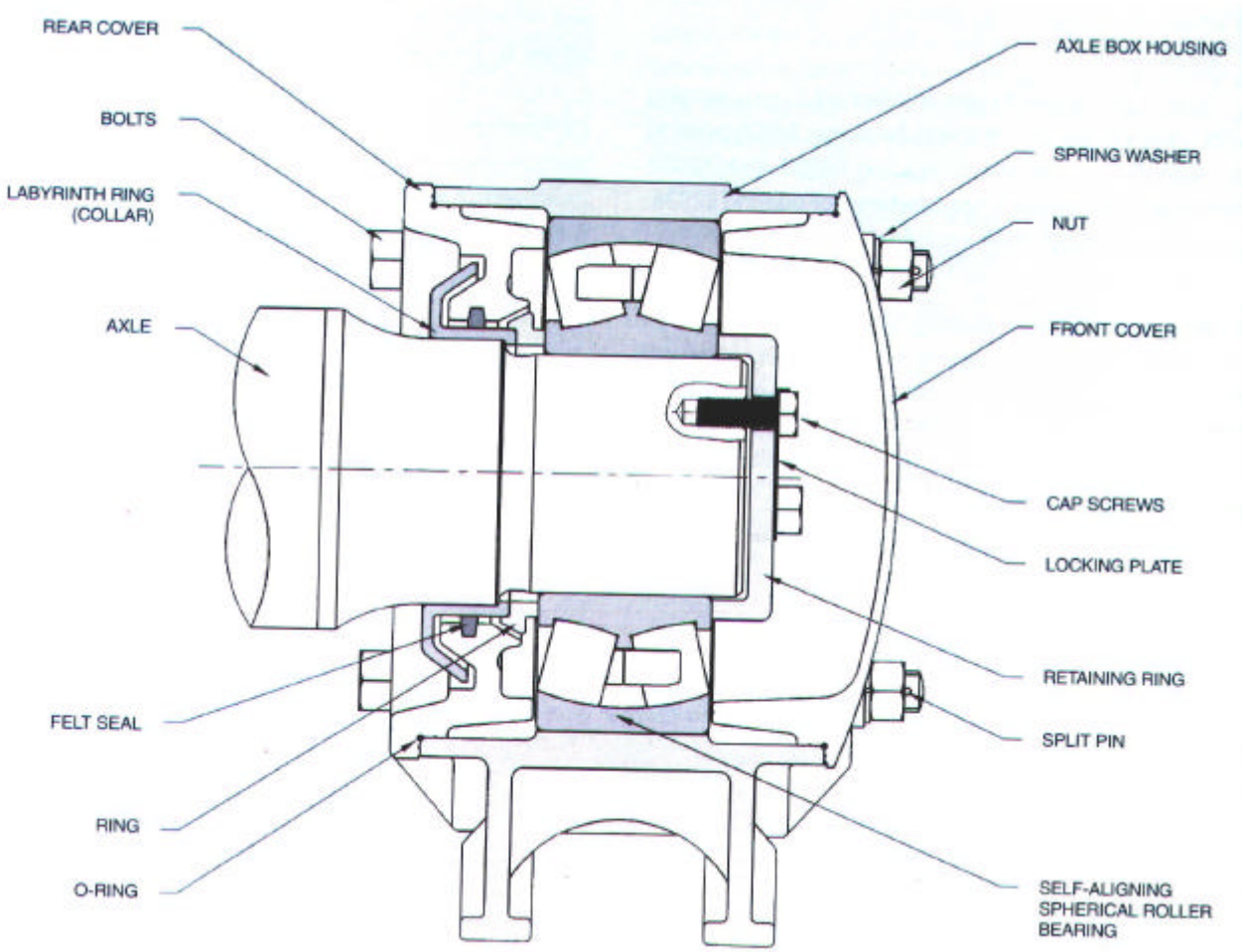
STAMPING SHOP INITIALS ON AXLE

FIGURE 10.5



WHEEL DISTANCE GAUGE

FIGURE 10.6



DIRECT MOUNED ROLLER BEARING ARRANGEMENT
Figure 10.7

1005c **List of Tool and Plants for Roller Bearing maintenance**

Following are the tools and plants required for a Roller Bearing Maintenance Shop.

Table 10.3

Sr.	Nature of Work	Equipment/Facility required
1	Cleaning of Roller Bearing	Automatic roller bearing cleaning equipment with 3 stage cleaning of pre-wash, wash and water rinsing.
2	Cleaning of Axle Boxes	Axle box cleaning plant with Bosch tank and spray jet cleaning in a close chamber
3	Axle Box extraction	Axle Box extractor
4	Dismounting of Spherical Roller Bearings - taper bore	Hydraulic dismounting Equipment – Withdrawal Nut
5	Dismounting of Spherical Roller Bearings - straight bore	Hydraulic Dismounting equipment
6	Mounting of Roller Bearings	Induction heater with de-magnetising device
7	Securing of end locking bolts	Torque wrench and torque wrench tester

Sr.	Nature of Work	Equipment/Facility required
8	Visual inspection of dismounted roller bearings	Magnifying glass with light
9	Measuring/checking of radial clearance	Long feeler gauge set with number of leaves with different thickness
10	Measurement of journal/ shoulder diameter	Outside micrometers
11	Inspection of axle end tapped holes	Thread plug gauges for different sizes of tapped holes
12	Inspection of locking bolts	Thread ring gauges for different sizes of Locking bolts
13	Exact quantity of grease to be filled	Volumetric containers with different Sizes for different quantity of grease
14	Identification of bearings, inspection details	Engraving / Etching machine

1005d **Inspection of Roller Bearings in Mounted Position**

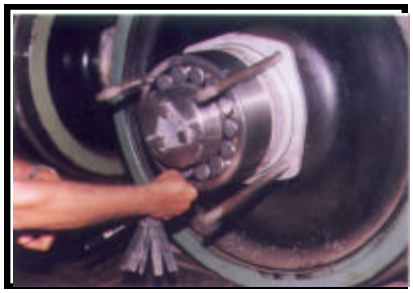
Following procedure should be adopted for carrying out inspection of roller bearings in mounted position.

- Clean the exterior of axle box, front cover, axle box housing.
- Remove axle box with the help of mechanical screw type puller, by taking care to protect axle centre with the use of pad not allowing the screw to rest on the axle centre. The end locking plate should be removed.
- Examine the grease for consistency, colour, contamination with water, foreign particles, etc.
- If the grease is in good condition, the bearing should not be dismounted, provided its felt sealing ring and rear cover do not require renewal.
- Remove old grease. Roller bearing and its components should be thoroughly washed and cleaned with kerosene and then petrol/white spirit.
- All components viz., rollers, cage, outer and inner rings (races), roller track of outer ring should be examined after swiveling the outer ring.

- Bearing should be rejected for the following defects: -

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

- Radial clearance should be measured in a mounted position with a long feeler gauge simultaneously over both the rows of roller **(see figure 10.8).** The blades of the feeler gauge should be inserted between the outer ring and the unloaded rollers. While measuring the radial clearance, the rollers should not be allowed to roll over the blade. The acceptable range of radial clearance for bearing in mounted position on journal for different makes of roller bearings is given in table 10.4.



Checking Bearing radial clearance in mounted condition
Figure 10.8

Table 10.4
(Reference Letter no. MC/ RB/ Genl dtd. 10.7.98)

Bearing make	Radial clearance in mm
SKF	0.105 to 0.296 mm
FAG/NORMA	0.080 to 0.185 mm
NEI/NBC	0.080 to 0.190 mm

- After inspection, if bearing is found satisfactory for further service, the bearing may be cleaned further for re-assembly and greasing. Care should be taken that outer ring is aligned or turned back to it's original position slowly. Jerky movement of outer ring can cause damage to rollers.
- Carry out detailed inspection of all other parts for wear, mechanical damage and any other defect, the locking plate should be fitted in position, the end locking bolts tightened with a torque wrench to a correct torque value as given below:

  11 to 12 m kg. For M16 bolts.
  15 to 16 m kg. For M20 bolts.

- Torque wrenches should be periodically checked for accuracy with torque wrench tester.
- Bend all tabs of locking plate against the sides of the bolt using adjustable rib joint plier.
- The date, the month, and the year of attention and workshop code should be punched on the locking plate in case of retaining ring and on the annular nut in case of annular nut type arrangement **(see figure 10.9)**

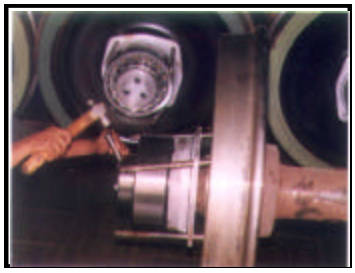


Figure 10.9

- Fresh grease should be packed between the rollers and the space between rear cover and the roller bearing. Correct quantity of grease is filled in each axle box for which volumetric containers having unique shape and size are used to eliminate mistake by staff.
- A truncated cone of grease should be formed to in from of the bearing. The 'V' grooves in the rear cover should also be filled with fresh grease after thorough cleaning.
- The axle box housing, front cover and 'V' grooves on their faces should be thoroughly cleaned and checked for damages, distortion and trueness of dimensions. After filling the fresh grease in the grooves, the axle box housing should be carefully pushed on the bearing and the front cover tightened in position. The nuts of the axle box should be secured with the split pin. Month, year and workshop code should be stenciled on the front cover and the axle box sealed. The free rotation of the axle box should be checked by hand.

1005f **Lubrication**

- The quantity of grease filled per axle box

  SKF make bearing **2.00 kg**
  Other make bearings **1.75 kg**

- Only lithium base grease of approved brands should be used

- **Guidelines for storage of Grease**

  1. Grease drums should be stored in vertical position in a covered room.
  2. Take all precautions to prevent contaimination of grease due to dirt, moisture, dust foreign particals etc.
  3. Always store grease in container with cover.
  4. Never mix different types of grease.
  5. Use only clean tools and container when handling the grease.

1005g **Inspection of other Roller Bearing Components**

- The following components other than roller bearing should be inspected during roller bearing maintenance in the workshop.

  - Axle end holes
  - End locking plates
  - End locking bolts
  - Retaining Ring
  - Collar
  - Felt ring
  - Rear and Front Cover
  - Axle box housing

i) Axle end hole

The axle end holes should be checked with GO–NO GO thread plug gauge for correct size and thread condition. If any of the tapped hole is worn out, a helical thread insert could be fitted in that hole for using the same size of bolt. The practice of blocking of worn out holes and drilling a new hole **60°** away from old ones reduces the probing are on axle face for ultrasonic testing.

ii) End locking plate

End locking plates should be replaced every time its folds are opened to unscrew bolt.

iii) End locking bolt

- The end locking bolts should be of high tensile steel of reputed brand/ RDSO approved manufacturers. The condition of their threads should be checked with GO-NO GO thread ring gauges and worn out bolts replaced.
- The bolt head should be free from any damages and should have proper spanner grip. The length of the bolt should be less than that of tapped axle end holes. Bolts in service should not be reused unless they meet the above standards.
- Bolt while fitting should have no radial or axial play.

iv) Retaining ring

The retaining ring should be cleaned and inspected for flatness and correct dimensions. The mating surfaces must be free from burr, sharp edge, rust or any other type of defect that will prevent proper seating with mating part.

v) Collar

The collar should not be dismounted unless it is damaged or the interference fit with the axle is lost. Once dismounted, it should be invariably replaced.

vi) Felt ring

Whenever the rear cover is removed from the roller bearing axle box, the felt ring should be replaced. New felt ring should be soaked in warm cylinder oil to IS-1589-60 type I Gr. 3 heated to **40 ° to 50° C for 30 minutes** and smeared with the same grease as used in the axle box before fitting in the rear cover.

vii) Rear and front cover

These covers should be cleaned and inspected for any crack, correct dimensions and concentricity of bolt holes. The height should be **61+/- 0.1 mm** in the as cast condition and may be checked with the help of a gauge. In case the cover is worn out, it should be replaced. However the height of the shoulder from the face of both front cover and rear cover should be **60 ± 0.1 mm** (refer RDSO's letter no. MC/RB/General dtd. 24/27-3-2000).

viii) Axle box housing

The axle boxes should be thoroughly cleaned in the axle box cleaning plant and inspected. Check for any mechanical damage or distortion. The housing should be free from score marks, excessive corrosion and any wear. The dimensions of the bore and width should be within specified tolerance limits. The axle box should be checked for distortion, particularly at the spring seat. Use cylindrical gauge fitted with dial indicator to check housing bore diameter at bearing seat **(see figure10.10 & 10.11)**. Check the bore at several places and it must be within specified tolerances. Housings not conforming to the limits or otherwise found unsatisfactory must be rejected.

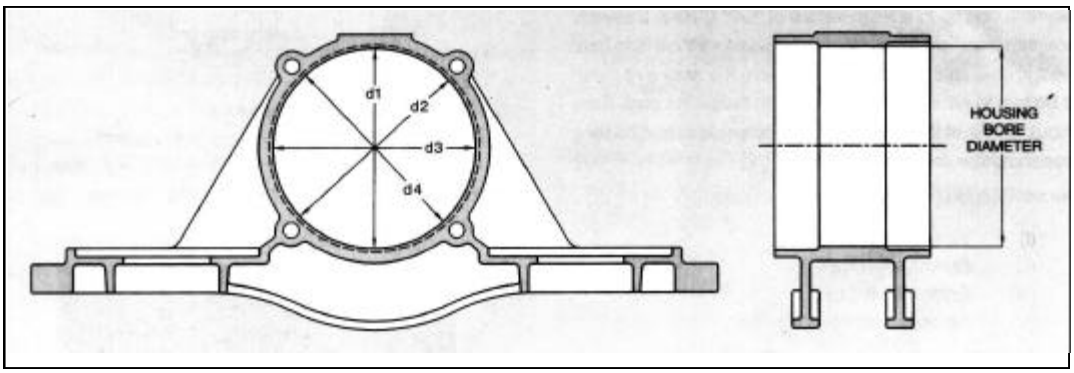


Figure 10.10

Axle box faces should be even. The width of the box should be **216+/- 0.1 mm** between faces.



Figure 10.11

1006 MAINTENANCE WHEN BEARING IS DISMOUNTED.

1006a Dismounting of bearing

- For dismounting roller bearings, a special hydraulic dismounting equipment is used **(see figure 10.12).** Following is the procedure for dismounting of roller bearing - Oil is injected between the journal and bore of the inner ring with high pressure, which expands inner ring resulting in breaking of interference. The bearing becomes loose on the journal and slides over it. The bearing is then removed from the journal and sent to the cleaning plant. Bearing after cleaning is thoroughly inspected for defects.
- All bearing components such as inner ring, outer ring, rollers, cage are examined for cracks, damage and breakage. Roller (track of outer ring) is examined by swiveling the outer ring. Roller track of inner ring is examined by mechanically pulling out a few rollers from the cage.
- Inspection of roller bearings should be carried out under sufficient light, using magnifying glass. If the bearing is found free from all the defects mentioned above, the radial clearance is measured with proper feeler gauge and compared with the permissible limits prescribed by RDSO in the maintenance manual for different makes of roller bearings. If any of the components is found to be defective or radial clearance is not within prescribed limits, the bearing is rejected and discarded from service.

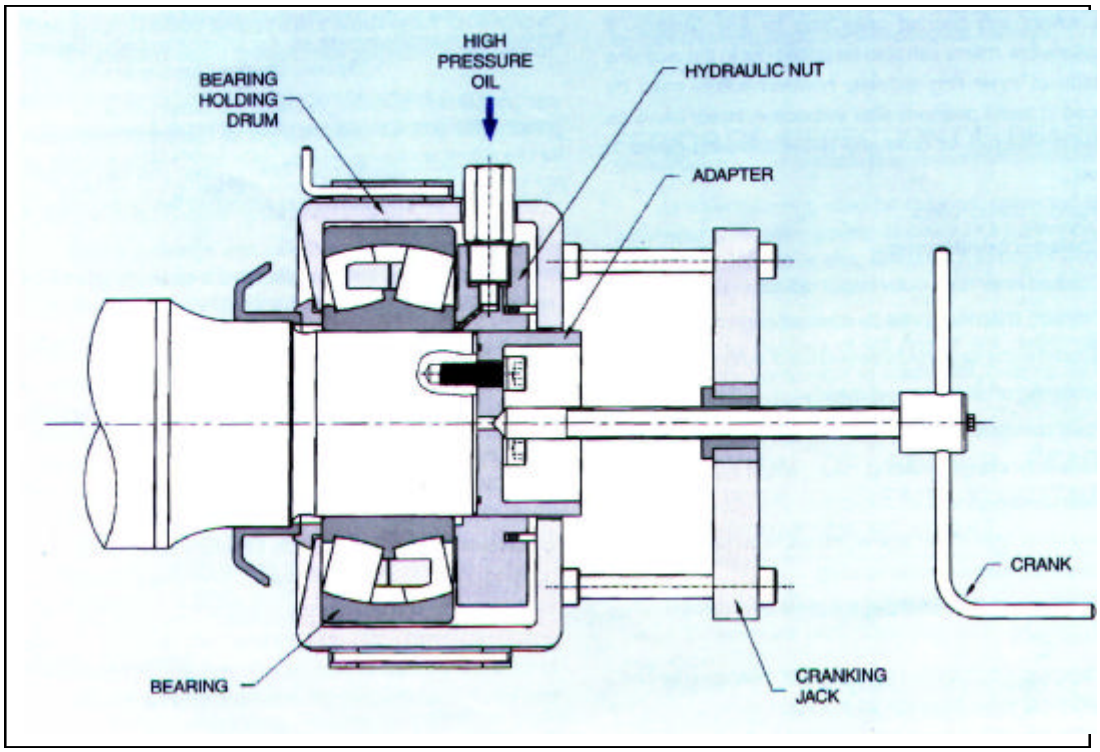


Figure 10.12

- Recommended limits of radial clearance for bearings in dismounted condition are as follows :

Table 10.5

New bearings	0.145 to 0.190 mm
Maximum permissible clearance for bearing in service	
SKF make	0.33 mm
FAG/NORMA makes	0.270 mm
NBC makes	0.295mm

1006b Mounting of spherical roller bearings and axle box components

- Before mounting the bearings, it is checked that journal and shoulder diameters are within permissible limits as per respective drawing.
- End holes are checked for elongation with the help of thread plug gauge. If found beyond permissible limits, these should be attended by using stainless steel helical thread inserts of the same size to use the same size of bolt.
- Mounting and maintenance work must be done by qualified personnel as per laid down procedures. When all necessary preparation have beentaken, proceed for bearing mounting in the manner described below -

Mounting of Labyrinth Ring (Collar) (see figure 10.13)

The labyrinth ring has an interference fit on the journal, and therefore requires heating for shrink fitting. Heat the labyrinth ring upto a temperature of **100^0 C max**. If several labyrinth rings are to be mounted a good method is to heat them in an oil bath. Oil bath should have a course wire mesh at bottom to allow sediments to settle below the part. Care should be taken that heating oil should be clean and heating time should be around 30 minutes.

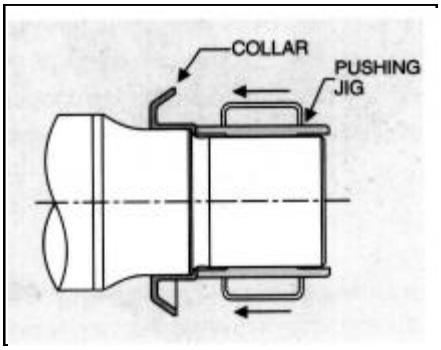


Figure 10.13

Recommended grades of oil for heating are :

i) Yantrol 150 (HPCL)
ii) Servoline 150 (IOC)
iii) Enklo 68 (HPCL)
iv) Servosystem 68 (IOC)

Alternatively, an induction heater can also be used. Heating time should be between **5-7 minutes**.

Clean the seating area of the axle, and push the heated labyrinth ring on the seating and hold it in position for few seconds when labyrinth ring has been cooled sufficiently to have a fairly firm fit on its seating, drive it home against the shoulder by tapping it with pushing jig, to avoid any possible gap. When tapping produces clear metallic sound, it shows that the part has seated correctly.

After cooling, coat the labyrinth ring with grease of recommended brand to prevent any damage due to moisture, dirt or other foreign matter.

Mounting of Rear cover, Felt Seal & O-Ring (Collar)

Wipe and clean the rear cover and insert 4 nos. bolts. Fill "V" grooves of rear cover with grease and fit rubber O-ring in it's position.

Now soak the felt seal in warm cylinder oil (IS:1589 type 1 grade 3), heated to **40° C to 50° C for about 30 minutes**. Smear the felt seal by hand with same grease as used in axle box and fit into the groove at rear cover. Always use new felt seal of specified quality.

Slide and push in the rear cover in position against the labyrinth ring along with bolts and rubber O-ring. Fill approximately **50%** of sealing collar cavity with grease. Fill the space between rear cover and the neck of collar with grease and align.

Mounting of Ring

Clean and wipe the ring. Ensure that faces are parallel, flat and free from burr, rust etc. Insert the ring it is position. Fill grease in the cavity in the rear cover up to the face of the ring.

Mounting of Spherical Roller Bearing

New bearings should be taken out from original packing only just before mounting. The spherical roller bearings are coated with rust preventive oil prior to dispatch. There is no need to wash new bearings before installation.

All direct mounted spherical roller bearing for passenger coach have interference fit with axle journal**,** therefore it requires heating and shrink fitting. Heating of bearings can be done either by using an oil bath or induction heater. Usually, temperature range of **100 to 120^0 C** give sufficient expansion for easy sliding of bearing over journal. However, while heating by either of these methods, do ensure that temperature of bearing does not exceed **120° C**.

Oil bath method (see figure 10.14)

The oil bath methods has advantage of gradual and unifirm heating of bearings. When several bearings are to be mounted, all can be put in oil bath simutaneously to save time.

The oil bath should be equipped with suitable arrangements for electrical heating, temperature controlling system (Auto cut-off) and thermometer. A wirenet should be provided at bottom, under which impurity can settle.

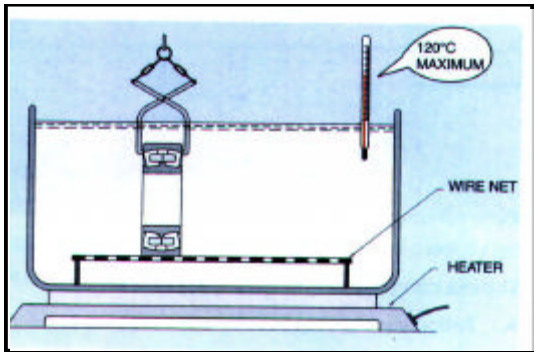


Figure 10.14

Oil used in oil bath should be fortified with anti-oxidation, anti-foaming additives.

Recommended oils for this purpose are:

Oil	Supplier
Enklo 68	HPCL
Servosystem 68	IOC

Bearing shuold be suspended in heated oil by suitable hanger so that it caneasily be lifted out. Heat the bearing for approximately **30 minutes** to attain the temperature of **100^0 C to 120 ^{o} C**.

Induction heating is a quick, safe, energy saving and environment friendly process. In this system, bearing is short circuited to perform as a secondary winding whereas the core winding is at primary side. Bearing is placed around a yoke. Due to principal of induction current, bearing is heated due to its electrical resistance and attains the desired temperature.

The Induction heater **(see figure 10.15)** should be equipped with:

- Temperature and cycle time controllers
- Auto demagnetizer
- Temperature and cycle time indicator
- Auto alarm to indicate completion of cycle



Figure 10.15

Heating time required in induction heating system largely depends upon the weight of the bearings. It is recommended to set the machine in such a way that it takes 5 to 7 minutes to attain the temperature of **120^0 C** maximum of bearing. Overheating (**beyond 120^0 C**) or rapid heating may result in dimensional instability or change in material properties due to change in microstructure, which may initiate cracks in bearings races in due course.

Heated bearing should be handled with the help of hook, tong or asbestos gloves and mounted on the journal. Push the heated bearing on the axle. During mounting, installer must be careful to

keep the bearing bore aligned with the axle to avoid the scoring marks. Bearing position must be corrected by giving light taps with plastic hammer. Keep the bearing pressed by hand towards rear cover side for new minutes, till it has acquired sufficient grip on its seat.

The stamp face of bearing should be kept towards outside so that stamping can be seen during inspection.

The rest of the procedure is same as for Roller bearing maintenance in mounted condition (para 1005e).

1007 **PRECAUTIONS FOR MAINTENANCE OF ROLLER BEARING**

During maintenance of Roller Bearing Axle Boxes, following precautions should be observed

- Only specified tools should be used for attention of roller bearings.
- Tools should be kept as clean as the bearing themselves
- Tools and bearings should be kept on dry surfaces
- Bearings should be handled carefully avoiding bruises to the bearings
- Bearings should not be dropped
- Only cotton cloth free from fluff should be used for cleaning of bearings.
- Cotton waste should never be used while cleaning and handling of bearings.

Spare bearings should be stored in a dry place. They should be opened only at the time of mounting so as to protect them from dust and moisture.

1008 **ROLLER BEARING DEFECTS AND REMEDIAL MEASURES**

Table 10.6

Defect	**Effect on Bearing**	**Remedial Measures**
1. Felt ring perished	1. Grease may ooze out from rear cover 2. Dust and water may enter the axle box	Renew the felt ring every time the bearing is dismounted in workshop. Felt ring should be as per schedule of requirement laid down by RDSO.
2. Rubber 'O' rings of cover perished	Dust and water may enter the axle box	Renew the rubber 'O' ring every time the bearing is attended in workshop. The material of the ring should conform to the specifications laid down by RDSO.
3. 'V' grooves on rear cover , front cover and axle box faces not filled with grease.	Dust and water may enter the axle box.	At the time of maintenance clean out the old grease and apply fresh grease.
4. Improper and/or excessive / inadequate grease.	Excessive temperature , seizing or complete failure of Roller Bearing.	1. Use only approved brands of grease. 2. Use specified quantity of grease.
5. Bearing clearance not within prescribed limits.	Excessive wear of rollers and races leading to bearing failure.	Check bearing clearance during attention to roller bearing axle boxes in workshops and scrap bearings with clearances outside prescribed limits.

Defect	Effect on Bearing	Remedial Measures
6. Fitment of substandard/ improper size end locking bolts/ screws.	Bolt may fail in service cause damage to front cover and bearings	Check the end locking bolts /screws and if worn/sub standard, replace
7. Improper locking of end locking screws.	Screw may get loose in service and cause damage to front cover and bearings	Follow correct procedure.
8. End locking screws not tightened properly.	End locking arrangement may fail.	Tighten screws with torque wrench at specified torque value.
9. Journal finish and Diameter not as prescribed in the drawing.	Bearing may become loose/inner ring cracks causing serious damage to the bearing leading to bearing failure.	Journal should be to the size , tolerance and finish shown on the relevant drawings.
10. Excessive or inadequate lateral clearance between axle box covers and bearings.	1. Excessive clearance may damage roller bearings or covers. 2. Inadequate clearance may result in gap between axle box housing and bearings.	Maintain correct lateral clearance as indicated in the drawings.

1009 **EXAMINATION AND REPAIR PRACTICE IN CARRIAGE MAINTENANCE DEPOT**

Depot maintenance staff should ensure the following things in respect of proper functioning and safety of Rolling gear:

1009a **Wheel and axle**

i) Wheel profile should be checked with Tyre defect gauge to ensure the profile dimensions are within the permissible limits. Coaches with wheels having thickness and profile worn below condemning limit should not be allowed to continue in service and the coach should be marked sick for change of wheels in the sick lines.

ii) Limits for flat tyres

The limits for permissible maximum flat surfaces on tread for BG ICF coaches is **50 mm** (reference Rly. Bd.'s Letter no. 83/M (N)/960/1/Vol I dated 15/18.3.99)

iii) Guidelines for wheel inspection in open line depots (Ref RDSO CMI-K003)

In addition to normal checks exercised on wheel condition during primary/secondary maintenance of coaches, a detailed inspection of wheels should be done when the coaches are received in sickline for attention for either schedules or out of course attention. The wheels sets shall be inspected for the following conditions and action taken as indicated for each condition:

1. **Shattered Rim –** a wheel with a fracture on the tread or flange must be withdrawn from service. This does not include wheels with localized pitting or flaking without presence of any rejectable condition.



2. **Spread Rim-** If the rim widens out for a short distance on the front face, an internal defect may be present. Spreading of the rim is usually accompanied by a flattening of the tread, which may or may not have cracks or shelling on the tread. Such wheels must be withdrawn from service.

This condition should not be confused with a uniform curling over of the outer edge of the rim around the entire wheel, which is called rim flow. Rim flow is not a defect.



3. **Shelled Tread -** Shelling can be identified by pieces of metal breaking out of the tread surface in several places more or less continuously around the rim. Shelling takes place when small pieces of metal break out between the fine thermal checks. These are generally associated with small skid marks or "chain sliding.". Such wheels should be withdrawn from service and sent to workshops for reprofiling.



4. **Thermal Cracks –** Thermal cracks appear on a wheel tread due to intense heating of the wheel arising out of severe brake binding. Such cracks occur on the tread and generally progress across the tread in a transverse & radial direction. Whenever such a crack becomes visible on the outer face of the rim or tread crack has reached the outer edge (non-gauge face) of the rim, the wheel should be withdrawn from service. If a crack becomes visible on the outer flange face, the wheel should be withdrawn from service. Such wheels should be sent to workshop for examination and subsequent rejection.



Wheels involved in service brake binding should be examined carefully during the maintenance to rule out the possibility of rejectable thermal cracks. Such wheels may be identified by presence of flats (even within acceptable limits) and severe discoloration or blue black heating marks on the tread.

5. **Heat checks** – Thermal cracks are deeper and need to be distinguished from fine superficial cracks visible on the tread on or adjacent to the braking surface. These are called heat checks, which are usually denser than the thermal cracks. Heat checks are caused on the tread due to heating and cooling cycles undergone by the wheel during normal braking. Such wheels do not need to be withdrawn but should be carefully distinguished from the rejectable thermal cracks.



Note: All wheel sets withdrawn from service for any of the conditions mentioned above must be sent to the associated workshops for detailed investigations and further disposal.

iv) The date and station code of the maintenance depot where the wheels are changed should be stenciled on the end panels. An entry should also be made in the maintenance card of the coach.

v) The defective wheel should be sent to workshop for repairs after entering in the maintenance card details of the work order and date of dispatch to workshop.
vi) No repairs, except wheel profiling of wheel sets is permitted to be done in the maintenance depot.

1009b **Roller Bearing Axle Boxes**

A coach should invariably be detached from service for the following defects

i) Hot axle box
ii) Damaged axle box
iii) Damaged front or rear cover
iv) Seized roller bearing
v) Coach involved in accident, derailment, fire, flood etc.

Care should be taken not to keep a coach fitted with roller bearing stationary for a long time. Coaches grounded for a long time should be shunted up and down at regular intervals.

Coaches fitted with roller bearing should be checked to ensure that :-

i) No wash basin drain hole / discharge pipe is directly above the axle box
ii) The front and rear covers of the axle boxes are not damaged, cracked or loose
iii) Clearance between axle box and wheel is such that the axle box does not bind against the wheel.
iv) Brake gear is properly adjusted to avoid possibility of brake binding

Annexure - 10.1

ULTRASONIC TESTING OF AXLES

All incoming wheel sets are tested for flaw detection test of axles in the shop before sending them to service. Following techniques are adopted to test the axles.

i. Far end scanning
ii. Trace delay
iii. Near end low angle scanning
iv. High angle scanning

i. Far end scanning technique:

This technique is used to detect fatigue crack, manufacturing defects, blow holes etc. In this technique, normal probe of 1 MHz to 2.5 MHz having 10 mm. and 20 mm. in size are generally used. By this technique, full length of the axle specimen is covered for test.

ii Trace delay technique:

In this technique, the specimen is tested part by part with normal probe.

iii Near and low angle scanning:

In this technique, the area which cannot be tested by far end scanning i.e. raised portion or shadow zone (wheel seat) is tested by low angle. In this technique, angular probe of 2.5 MHz having angle of 10", 12.5", 15", & 17.5" are generally used.

iv High angle scanning:

This technique is a confirmation test of low angle scanning. This test is carried out on the body of the specimen. In this technique, high angular probe of 37,60, & 70 are generally used.

All tested axles are stamped on the inner face of the hub with following details:

UT.O 1.201. MM/YY/XXXX

Legend:

UT: Ultrasonic test
01: Code for Railway (This code changes from RLY to RLY)
02: Code for type of work shop
(this code also changes for type of work shop)
01: Code for place of workshop
(this code also changes for place of workshop)
MM/YY: Month and year of testing
XXXX :Initial of person testing the axle.

A. GENERAL REQUIREMENT FOR ULTRASONIC TESTING OF AXLES

(as per RDSOs Compendium on Ultra Sonic Testing)

The general requirement prior to ultrasonic testing of axle are surface preparation, selection of couplant, care and checking of probe.

1. SURFACE PREPARATION

Surface preparation of the areas where the probe is to be applied is necessary for maximum transmission of ultrasonic energy in the test specimen. It is essential that the surface should be clear of loose paint, dirt and loose scale. Ultrasonic testing of an axle is carried out from axle ends journals and from body.

1.1 Axle end

Ultrasonic testing of an axle by far-end and near end low angle scanning is carried out from the axle ends.

The end faces are usually stamped with cast Nos. and other identification numbers and this process displaces the surface material into raised areas thereby resulting in an inadequate acoustic coupling. The raised areas must, therefore, be removing by filling, or by using energy cloth, while cleaning of the end faces, care must be taken not to allow filling debris, dirt and grit to enter the axle box or roller bearings. The end faces should be cleaned by cotton cloth soaked in kerosene oil. All the precautions as mentioned in maintenance schedule for disassembly of the axle box covers and end face fitment should be strictly observed.

1.2 Axle Journals

When using the high angle scanning techniques on axle journals the surface must be made free of dirt, girt using cotton cloth soaked in kerosene oil.

1.3 Axle Body

When using the high angle scanning techniques on axle body, loose paint, rust and scale must be removed and the surface must be free from dirt and grit. Some axle body surfaces may have machining marks and these may cause some loss of ultrasonic energy but there should not be any difficulty from this source unless the machining is rough. In such cases or in case where axle body is in forged condition it is advisable to use adequate quantity of grease as coupling media.

Where it has been necessary to remove protective paint, the surface should be repainted as per relevant specimen or as recommended in maintenance schedule before the axle is put into service.

2. CHOICE OF COUPLANT

The choice of couplant depends on the condition of probing surface. The following couplant may be used for ultrasonic testing of axles.

1.	Lubricant grease as recommended for particular type of bearings in order to avoid any chances of contamination.	For far-end scanning near end low angle scanning for all types of axles fitted with roller bearing.
2.	Lubricant grease grade 2 or 3 to IS 507-1967.	For high angle scanning of all types of axles.

3. CARE AND CHECKING OF PROBES

3.1 Inspection and checking of probes

The inspection and checking of the probes must be carried out periodically.

3.2 Low angle wedges

All the low angle perspex wedges should be regularly checked at 6 months interval for the correctness of angle of refraction in steel. Any charges in the angle of perspex wedges will seriously impair the test results.

3.3 High angle wedges

All high angle perspex wedges should be regularly checked at 6 months interval. The operator must ensure that the angle of refraction in steel not been affected by wear. Any change in the angle of wedges will seriously impair the test results.

4. CARE AND CLEANING OF PROBES

4.1 Probes should be handled very carefully. The probes should be carefully packed in cotton. U-foam etc, in order to avoid any damage during transportation from one place to another.

In any circumstances no attempt should be made to open the probes by the operator as the crystal used inside the probe is very brittle. If any probe shows loss of sensitivity, it should be sent for repair to maintenance cell or to the suppliers.

4.2 The probes and probe cable should be cleaned daily after completion of the work and characteristics of probe should be checked at regular interval. The probes should never dismantled in any way for cleaning but it should be thoroughly wiped over with clean cloth. At no time the probes should be immersed in the liquid paraffin.

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CHAPTER 11

INTERIOR FITTINGS

1101 **GENERAL DESCRIPTION**

Interior fittings are the fittings inside the coach consisting of panels, seats, berths, windows, lights, fans, sanitary fittings etc. All coaching stock shall be furnished according to the standards laid down by the Railways/RDSO for the various types and classes of vehicles in service.

1102 **AMENITIY FITTINGS FOR COACHING STOCK**

For passenger to have a comfortable train journey various passenger amenities fittings have been provided in the trains. Schedule of amenities for coaching stock (broad gauge) is indicated in Table 11.1.

Table 11.1

SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES

Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	Sleeper	Day coach	General	Double decker
1) Depth of faces of partition to the edge of:									
I. Seat (for seating purpose)	785	557 Long 665 Trans	635	680	785	560 Long 570 Trans	505	505	505
II. Berth (for sleeping purpose)	785	557 Long 665 Trans	600 Long 635 Trans	NA	785	560 Long 570 Trans	NA	NA	NA
2) Length									
I. Berth	2010	1877	1835	NA	2010	1870	NA	1676	NA
3) Hip width for passenger	610	550	550	450	610	480	415	480	450
4) Height clearance for seat / berth									
I. Clear space below seats	265	340	305	--	340	340	340	340	--
II. Height of top of seat from floor	405	405	420	405	405	405	405	405	405
III. Clear space between top of seat and bottom of upper berth bunk	900	900	610	NA	900	900	NA	900	NA
5) Corridor width	700	575	575	430	700	575	430	570	570
6) Bay width									
I. Four berths/ general component	2312	1876	1830	NA	2312	1700	1575	1575	1575

SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES

Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	Sleeper	Day coach	General	Double decker
II. Coupe single row	1600	1150	-	NA	1500	1050	880	880	880
III. Pitching of chairs	NA	NA	-	565	NA	NA	NA	NA	NA
7) Knee room									
I. Four berther	710	535	535	NA	710	535	535	535	535
II. Coupe	710	450	NA	NA	710	450	340	340	340
8) Lavatory									
I. In side area in Sq. metre	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
II. Max. No. of passengers per lavatory	6	13	17	20	12	20	27	25	36
9) Body side door									
I. Max. No. of passengers per door a side	12	40	34	40	40	60	60	60	72
10) Electrical requirement									
A- Lighting									
i) Minimum lux at horizontal plane 840 mm above floor level									
a) Compartment	40	30	30	30	30	30	30	30	30
b) Lavatory	16	16	16	16	16	-	11	11	11
c) Corridor	16	16	16	16	16	-	-	-	-
ii) Individual switches for ceiling light	Yes	Yes	Yes	No	Yes	Yes	No	No	No
iii) Berth reading light with switches	Yes	Yes	No	No	Yes	No	No	No	No
iv) Night light	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
v) Individual swit ch for night light	Yes	Yes	Yes	No	Yes	Yes	No	No	No
vi) Toilet engage light	Yes	Yes	Yes	Yes	No	No	No	No	No
vii) Toilet engage sign	No	No	No	No	No	No	No	No	No
viii) Socket out let 110V	No	No	No	No	No	No	No	No	No
ix) Call bell push button	yes	No	No	No	No	No	No	No	No

SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES

Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	sleeper	Day coach	General	Double decker
B. Fannage									
i) No of fans									
a) Compartment	One for two berths	One per bay	One per bay	One for two row	One per berth	3 per bay	3 per bay	3 per bay	3 per bay
b) Lavatory	One per lav.	One per lav.	One per lav.	One per lav.	No	No	No	No	No
ii) Size/type of fan									
a) Compartment (Swivelling = S) (Fixed = F)	400 mm (S)	300 mm (F)	300 mm (F)	400 mm (F)	400 mm (S)	400 mm (F)	400 mm (F)	400 mm (F)	400 mm (S)
b) lavatory	200 mm (F)	200 mm (F)	200 mm (F)	200 mm (F)	No	No	No	No	No
c) Regulator for fans	Yes	Yes	No	yes	Yes	No	No	No	No
d) On/Off switch for fans	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
11) Compartment and doorway fittings									
a) Cushioned seats and back rests	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
b) Cushioned berths	Yes	Yes	Yes	NA	Yes	Yes	NA	NA	NA
c) Longitudin al luggage racks i) Light (L) ii) Sturdy (S)	L	L	L	S	L	No	S	S	L
d) Folding or fixed table	Yes	Yes	Yes	Yes	Yes	No	No	No	No
e) Roof ventilators									
i) Compartment	No	No	No	No	Yes	Yes	Yes	Yes	Yes
ii) Doorway	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
f) T umbler holder	Yes	Yes	Yes	Yes	Yes	No	No	No	No
g) Ash tray									
i) Compartment	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes
ii) Door way	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
h) Waste paper basket dust bin									
i) Compartment	Yes	No	No	No	No	No	No	No	No
ii) Door way	Yes	Yes	Yes	Yes	No	No	No	No	No
i) Foot rest	No	No	No	Yes	No	No	No	No	No
j) Notices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
k) Mirror with shelf									
i) Compartment	Yes	Yes	Yes	No	Yes	No	No	No	No
ii) Doorway	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES

Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	sleeper	Day coach	General	Double decker
l) Coat hook	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
m) Foot steps	Yes	Yes	Yes	NA	Yes	Yes	Yes	NA	Yes
n) Magazine pouch	Yes	Yes	No.	Yes	Yes	No	No	No	No
o) Wash basin									
i) Compartment	Yes	No	No	No	No	No	No	No	No
ii) Door way	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
p) Ward robe with fixed hangers	Yes	No	No	No	No	No	No	No	No
q) Water cooler	Yes	Yes	No	Yes	No	No	No	No	No
r) Drinking water with container	Yes	Yes	Pouches	Yes	Yes	Yes	Yes	No	Yes
s) Thali rack	No.	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
t) Linen room	Yes	Yes	Yes	No	No	No	No	No	No
u) Rings below berths for securing luggage	No	Yes	Yes	No	Yes	Yes	No	No	No
12) Lavatory fittings									
a) Shower bath	Yes	No	No	No	Yes	No	No	No	No
b) Wash basin	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
c) Towel rail	Yes	Yes	Yes	Yes	No	No	No	No	No
d) Flushing commode e) Flushing pan	one except one	One except one	One Except one	One Except one	One Except one	Nil all	Nil all	Nil all	Nil all
f) Push cock for lotah filler	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
g) Lotah shelf	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
h) Commode rail	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
i)Mirror shelf	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
j) Bottle opener	Yes	No	No	No	No	No	No	No	No
k) Coat hook	3	3	3	3	5	4	4	4	4
l) Soap dish (SD), Liquid soap container (LC)	Both	SD	SD	SD	SD	SD	SD	SD	SD
m) Lavatory chutes should be slanting so that ground is not visible from inside and lavatory discharge does not fall on rails and track fasteners.									
n) Inter communication Inter communication doors shall be provided between the two classes of accommodation in a composite coach.									
13) External fittings									
a) Reservation display plates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No
b) Destination board	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
c) No. plates on mail & express trains only	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	yes

The schedule of safety items for passengers to be available in the interior of the coach is given in Table 11.2

Table 11.2

Safety requirements									
SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES									
Description	Air conditioned coaches			Non Air conditioned coaches					
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	sleeper	Day coach	General	Double decker
a) Alarm pull No. of per	-	-	-	-	-	-	-	-	-
i) Compartment	1	1	1	6 Total	1	One	One	One	One
ii)Lavatory						Alarm	Alternate	Alternate	Alternate
iii) Corridor	2				2	Bay	Bay	Bay	Bay
b) Internal latches at top and bottom on body side doors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
c) Provision of pad locking arrangement from outside on one body side door	Yes	Yes	NA	Yes	Yes	Yes	NA	NA	NA
d) Internal latch and shout bolts with notched stopper and outside pad locking arrangement for compartment sliding door	Yes	NA	NA	NA	Yes	NA	NA	NA	NA
e) Throw over latch and Pad Locking arrangement for sliding of vestibule	NA	Yes	Yes	NA	Yes	Yes	No	No	No
f) Shout bolts and sliding door bolts for swing doors and pad locking for rolling shutters of vestibules	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
g) Latches for windows shutters of body side doors and partition walls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
h) Fire extinguishers	2	2	2	2	No	No	No	No	No
i) Safety bars on all window opening	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
j) Windows shutters									

i) Glass shutters	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
ii) Louvre shutters	No	No	No	No	No	No	No	No	No
iii) Louvre cum gauge shutters	No	No	No	No	Yes	Yes	Yes	Yes	Yes
iv) Frosted single glass sealed window	Yes	Yes	Yes	Yes	No	No	No	No	No
v) Louvre cum Frosted glass liftable type shutters	No	No	No	No	Yes	Yes	Yes	Yes	Yes

1103 **FURNISHING MATERIALS ON PASSENGER COACHES**

Furnishing materials in a coach have changed considerably over the years. Plastics, FRP and various other synthetic materials have been introduced which are light in weight and require less maintenance and give better aesthetics.

1103a **Roof Panelling Sheet**

2 mm thick Limpet asbestos sheet to RDSO specification No. C 8105 (Rev. 1) is the material used for Roof panels. **1.5 mm** thick NFTC (Natural Fibre thermoset Composite) to RDSO's specification No.C-9511 can be used as a permissible alternative to **2 mm** limpet asbestos sheet.

1103b **Side Wall Panelling**

Thermosetting synthetic resin bonded decorative laminated plastic sheets (LP sheets) of **3 mm** thickness to RDSO's specification No. G9602 is used for side wall panelling.

The LP sheets panelling provide aesthetic look to the coach interior. Being the bad conductor of heat and electricity, the LP sheets prevent the radiation of heat from atmosphere to inside coach. The L.P sheet provides seating to various passenger amenity fittings such as ash tray, tumbler holder, coat hook, mirror and mirror shelf, luggage rack and news paper pocket.

1103c **Other Plastic Materials**

i) **Fibre Reinforced Plastic**

FRP has the potential of wide range of application in coach interior. So far SMC (Sheet Moulding Compound) moulded window shutters, wall protectors and axle box front covers have been developed in FRP.

ii) **Plastic Push Cocks**

Plastic push cocks made of HDPE (high density polyethylene) to RDSO Spec. G-9121 are being used in place of metallic push cocks. These push cocks are less prone to the theft.

Better form of plastics are now readily available. Push cocks in PTMT (Polytetramethyl triethylene) and acetal are also available.

1103d **Attention in Workshop**

- The interior fittings should be examined for corrosion and damage during pre inspection of the coach. All missing fittings should be made good and reported, defective ones removed from the coach, repaired and refitted.
- All distorted/ damaged panels should be replaced. No patch work should be resorted to and complete panel piece should be fitted. While replacing the panels, care should be taken to match the colour and design to the extent possible.
- While renewing ceiling panels opportunity should be taken to examine the insulation material. Full insulation should be checked when a coach is internally stripped fully after **5 to 7 years** to attend to corrosion on the roof sheets. Deficient/damaged insulation should be replaced.

1103e **Anti-Pilferage Measures**

In order to prevent theft of amenity fittings from coaches, workshop should carry out anti-pilferage measures on all coaches during POH, as prescribed by the Chief Mechanical Engineer or RDSO especially for the following items:

i) Mirror and mirror shelf.
ii) Soap dish.
iii) Ash tray.
iv) Push cock.
v) Wash basin.
vi) Tumbler holder.
vii) Hand hold.
viii) Upper berth hold.
ix) Coat hook.
x) Flushing valve.
xi) Window frame.
xii) Folding table.
xiii) Lotah cock.
xiv) Lotah shelf.
xv) Shower rose.
xvi) Wall protector.
xvii) Foothold bracket.
xviii) Fans
xix) Lights

1103f **Examination and repair practice in Carriage Maintenance Depot**

i) **Primary/Secondary examination and Schedule A, B & C**

- Examine laminated panels & mouldings for damages /cracks.
- Visually inspect passenger amenity fittings, replace if found damaged / deficient.
- Examine visually curtain cloth in AC coaches and attend if necessary.
- Examine ventilation grills for damages.
- Examine luggage racks / bunks for breakage.
- Examine push cock, flush valve for function.
- Check and attend leakage in pipes, fittings and shower roses in lavatory.
- Clean drain grills and drain holes in bath room and wash basin if found choke up.
- Check and replace damage/missing mirrors/shelves/soap dishes.

1104 **WINDOWS**

1104a **Windows of Non AC Coaches**

The non AC coaches are provided with glass and louver shutters made out of FRP. The Glass panel of the shutter is made of safety toughened glass. The shutters work in the grooved frame work of the window assembly. To prevent the glass shutters from dropping a balancing mechanism comprising of spring, lever etc. is provided. To close the window positive force is required to be applied against the spring force. In the case of louvre shutters instead of the balancing mechanism a spring loaded safety latch is provided to prevent the louvre shutter from dropping.

1104b **Windows of AC Coaches**

AC Coaches are fitted with double glass sealed windows. Two types of sealed windows are presently in use and they are as under:

i) **AC windows of ICF coaches** *(Ref: ICF drawing No. WGFAC-5-4-001.)*

a) Windows of earlier built ICF coaches consists of a outer glass shutter fixed on the out side of window opening of coach by studs and nuts and fully sealed with rubber packing all around and inner glass shutter which is top hinged on the inside and is capable of swinging open to clean inside surface of the glasses .

b) In the recent built ICF coaches outer glass is directly inserted in the fixing rubber glued over window opening. Inner glass shutter and other fittings remains same as above.

ii) **AC windows of RCF Coaches** *(Ref Drg:AE 54103)*

AC window of RCF built coaches are fitted with double glass hermetically sealed window units. Stainless steel supporting frame is welded in the inside of the window opening to support the window unit and also to fix specially designed sealing rubber profile. FRP window holding frame is screwed from inside of the coach to provide sealing of conditioned air.

In both types of sealed window toughened safety glass of **5.5/6 mm** thickness to IS 2553- Part II made from 'A' quality flat transparent glass to IS 2835 is used. A reflective sun control film of smoke grey colour is pasted on inside surface of outer glass.

1104c **Emergency Openable Windows** (for Non- AC Coaches - *ICF drg No. DMU/DPC –5-4-002 & ICF/STD-5-4-005)* (for AC coaches - *RDSO sketch SK-98161 alt. I)*

Emergency windows are provided as the third window from door on either side in passenger compartment.

1104d **Lavatory Windows (RDSO's Sk. 96104)**

FRP banjo type windows with frosted glass are fitted in lavatories.

1104e **Lavatory Windows of AC Coaches**
(ICF drg. No. WGFAC-5-5-001)

Sealed type windows with frosted glass are fitted in lavatories of AC coaches. Four protection bars are welded with outer frame.

1104f **Maintenance of AC windows in workshops**

- Broken, cracked, defaced or scratched glass should be replaced and the window frame repaired as necessary. Glass should be cleaned with lime and detergent before refitting. The rubber or felt lining between the glass and the frame should be changed every time the glass is removed. Chrome plated moulding, if provided, should be rechrome plated before fitting.
- In case of separate outer window, before fitting it, sealing compound should be applied on the joint surfaces of the coach as well as the window to form an air-tight joint. Sun control film should be pressed on the inside of outer glass.
- The hinges of inner window frame should be checked for easy operation and well oiled before refitting. The clamping catches should be attended to and tested for proper functioning.
- The rubber beading between window and coach body should be replaced if found set, deteriorated, or damaged, to ensure air tightness.
- The damaged FRP inner frames / holding frame should be replaced. The moulding on the window space between the outer and inner windows should be replaced if found deficient or damaged; otherwise, it should be well cleaned in position. In case of steel bodied coaches, the panel should be examined for corrosion and attended to as required.
- When components are replaced, it is good practice to assemble the sealed window on a mock-up window arrangement in the shop for correct fitment and sealing. This can then be taken as a set and fitted on the coach.

1104g **Maintenance of Windows of Non AC Coaches (ICF drg. no. T-5-4-701 & RDSO Sk. 96070) in workshops**

- All window shutters should be fully removed from the body shell at every second POH and also when they are found defective during pre inspection.
- When windows are not removed, the shutters should be checked for easy working by lifting and lowering them. The safety catches should also be checked to ensure that they are in working order and that, once they are engaged, the shutter should not be unlocked and opened. Their rubber channels, if deteriorated or torn, should be replaced.
- The entire window assembly should be dismantled and shutters removed. Presently windows are fitted with glass and louvre shutters having anodised aluminum or FRP shutter frames and louvers. The anodised aluminum / FRP shutters and other fittings on the newly built coaches should be cleaned with detergent only at the first POH. In subsequent POHs, these items should be painted with matching shades of paints, after painting oiling should be done on all the safety catches. Steel components should be cleaned of dust and dirt. The glass panes should be cleaned with lime and spirit. Broken or cracked glasses should be replaced with safety toughened glass. Under no circumstances should an ordinary glass sheet be used in shutters. Holes in the frames for safety catches, which have become oblong should either be bushed or plugged and re drilled. Torn, rusted or deteriorated wire gauze should be replaced by proper galvanized wire mesh.
- The shutters should be checked for easy working in grooves after rubber channels are replaced. Balancing mechanism for the shutters should be dismantled, cleaned and examined. All its worn out components like brass/nylon rollers should be repaired/replaced as required. Pin should be lightly greased. Backside and other portions of window frame

which get covered up when fitted on the coach should be painted before the balancing mechanism is reassembled.

- Spring tension should be correctly adjusted such that the shutter can be easily lifted and positioned wh erever required.
- The wire gauge should be cleaned with a wire brush and blown with compressed air.
- A coat of mastic compound should be applied on the contact surface of rubber channels for keeping them in position.
- On body side door windows of non-air-conditioned coaches safety bars should be provided as given in RDSO sketch no. 84162, if not already existing.

1104h **Examination and Repair Practice in Carriage Maintenance Depot**

i) Primary/Secondary examination and Schedule A, B & C

- Examine window shutters of non AC coaches for smooth movement in railing to prevent rattling and disengaging of catches on run.
- Window frame on non AC coaches should not be broken and its glass, gauze wire and venetian louver should be in proper condition.
- Check window balancing mechanism on non AC coaches for proper function.
- Examine window safety catches for proper engagement in their slots.
- Check lavatory banjo shutters for damage/missing.
- Examine window frame and rubber profile of sealed windows in AC coaches for dama ges and attend if needed.
- Window bars should be provided and fixed in prescribed manner and replaced if damaged.
- Examine sealed windows of AC coaches, replace broken/damage glasses.

1105 **FLOOR**

1105a **Introduction**

The use of PVC flooring is used in both upper and lower class coaches. RDSO vide their letter No.MC/CB/Flooring dt. 26.04.89 have circulated the guidelines for using PVC flooring on main line coaches. As per RDSO 's letter No.MC/CB/Flooring Dated: 08.04.96. **12mm** Compreg floorboards shall be used whenever floorboards of complete coach require replacement. Use of PVC flooring improves the aesthetics of compartments, besides providing for hygienic condition and easy maintenance.

This arrangement is also considerably lighter (approx.1.1t) as compared to Decolite flooring. It also prevents corrosion of under frames by eliminating water seapage. For this purpose, proper laying technique, sealing of joints with thermo-welding process and selection of right shades are very essential.

1105b **Flooring arrangement in a Coach**

The flooring in the coaches will consist of a compreg sub-floor covered with PVC sheet. The following ICF drawings give details of the PVC flooring arrangement over plywood sub-floor :

1. ICF/SK.4-1-135 - PVC flooring for GS coaches.
2. ICF/SK.4-1-139 - PVC flooring for GSCN coaches.
3. GS.4-1-002 - PVC sheet covering over Decolite in lavatories.
4. ICF/SK.4-1-136 - PVC flooring for AC-2Tier coaches.
5. ICF/SK-4-1-101- Flooring in lavatory for AC-2 Tier Coaches.

1105c **Material description**

- 12mm Compreg floor board to RDSO Specification C-9407 (Revised) type – II shall be used for all new coaches or used for coaches whenever floor boards of complete coach require replacement.
- When only part of the floor is to be replaced , repair to floor shall be carried out by using Plywood - 19 mm thick plywood to IS-303-1975 Grade A fully treated for protection

against fungi, termite, marine borers and other insecticides and requirements of preservative treatment to IS:5539.

- PVC Flooring - 2mm thick homogeneous Vinyl Flooring, preferably, in roll foam to RDSO specification No. G8515 (Rev.2). If laminated flooring is used, the top layer shall be of 1 mm hard wearing surface.
- Adhesive - Adhesive to fix PVC flooring to plywood Compreg will be Neoprene based rubber adhesive of Dunlop S-758 or Fevicol SR-998 make or equivalent quality.

1105d **Attachment and Fixing**

i) **Laying procedure for Sub-flooring**

- **12 mm** Compreg floor board to RDSO Specification C-9407 (Revised) type –II should be laid properly in level (ensure level by suitable packing, if required) to the cross members/trough floor. Before laying, the joining edges of compreg sheet shall be coated with water sealing compound to specification No.IS:7084 - 1973. This is essential to ensure effective sealing at the joining edges to prevent any seepage of water.
- Drill holes on the compreg floor board and cross members/trough floors and fix it by self tapping counter sunk screws as per relevant drawings.
- Joints between compreg floor board should be minimum and if any gaps exist, the same should be filled with epoxy putty. (see note)

  Note:- **5 Kgs**. of Epoxy putty is prepared to the following combination :

Table 11.3

French Chalk	2.1 Kg.
Resin HSK	2.1 Kg.
Acetone commercial	0.4 Kg.
Accelerator	0.2 Kg
Catalyst	0.2 Kg
Total	**5.0 Kg.**

- The self tapping screw head shall also be levelled by applying epoxy putty. This will ensure smooth level for effective laying of PVC flooring sheet and also avoid water seepage through screw holes.
- Scrap away excess putty, if any.
- Sweep and clean the coach floor thoroughly before laying the PVC floor sheets/rolls.

ii) **Laying of PVC Flooring**

- Spread open the PVC roll/sheet on half the width of coach (inside the coach)and leave it for some time (**30 to 40 minutes approx**.) to enable it to lie flat on the floor.
- Mark properly the position of the pillars, seat frames etc. on the PVC rolls/sheet and cut neatly around the pillars and frames.
- Fold the roll half way and spread a thin and even layer of adhesive with a notched trowel (serrator) on the compreg sub-floor. The recommended adhesive is Dunlop S-758 or Fevicol SR 998 or equivalent.
- Also apply adhesive on the rough reverse side of PVC flooring thinly and evenly as above.
- Allow some time for solvent evaporation (**30 minutes approx**.) to prevent solvent vapours being entrapped. As soon as the adhesive becomes touch dry, both on the floor and the PVC flooring, press down the sheet in position gently and gradually from one end taking care to prevent air from being entrapped. Follow same procedure for the other half of the same roll.
- No welding operation is allowed during laying of PVC, since the adhesive is flammable agent.
- After adhesive work of the 1st roll is over, apply pressure on the flooring with a steel roller of **25 kgs**. (approx.) so as to obtain perfect adhesion between PVC flooring and compreg sub floor and to eliminate air being entrapped.

- The second roll shall be laid in position, overlapping the Ist sheet by about **5 to 10 mm (see Fig.11.1)** while spreading the roll, ensure the cuts on the PVC flooring match with pillars of partition and seat frames.
- "Trim in" the length by placing a straight edge along the centre of the Over-lapping edges, and with a sharp knife, cut through both thickness of PVC flooring at the sametime. Pull out the overlapping edges of top and bottom of PVC flooring and press the same to the compreg floor to obtain perfect butt joint.

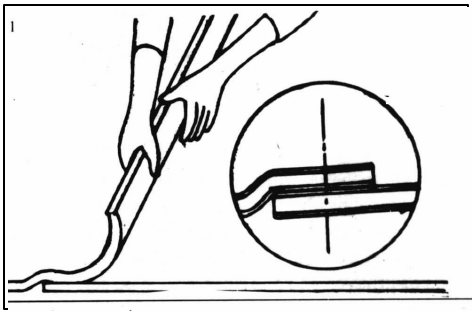


Figure 11.1

iii) **Thermo-Welding (Hot Air welding)**

Proper thermo-welding of PVC flooring is utmost necessary for obtaining satisfactory bonding/results. Thermo-welding of PVC flooring provides impervious continuous floor surface.

iv) **Grooving**

A grooving tool (hand or automatic) alongwith a straight edge/scale **(see Figure 11.2)** is used to groove the butting edges of the seam to approximately two third of the thickness of the wear layer of PVC flooring. This will leave a semi-



Figure 11.2

circular groove for thermo welding **(see Figure 11.3 & 11.4).**



Figure 11.3



Figure 11.4

Note :-A deep groove cut **(Figure 11.5)** into the PVC flooring will result in an unsupported weld which may split in use.



Figure 11.5

v) **Welding**

Seams are thermo-welded with a hot-air gun using flexible transparent Vinyl welding cord **(Figure 11.6)**. Details of welding equipment and PVC welding cord are given in the pare 1105f. To ensure a thermo-welded seam of maximum strength, the gun must be held at the correct angle to the flooring and used at the correct speed. The correct angle is achieved when the `foot' of the welding nozzle is parallel to the surface of the flooring. Start to weld the flexible cord into the PVC flooring at the most even and efficient rate to ensure the correct fusion of materials. Finish off as near to the end of the groove as possible. Welding of the ends of grooves on PVC flooring can be carried out with the use of hand roller.

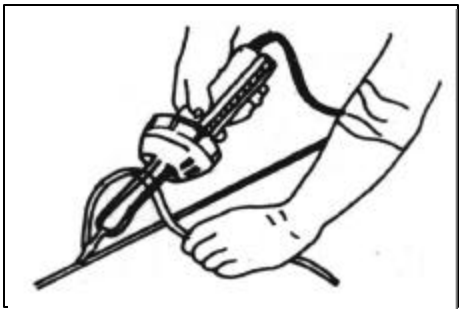


Figure 11.6

vi) **Trimming**

When the weld has cooled to room temperature, it should be trimmed off flush to the surface of the material with a trimming Spatula **(Figure 11.7**). If trimming is done before the welding cord has cooled, it will shrink below the surface of the flooring. If at this stage, the spatula disturbs the weld, this indicates that a positive joint has not been achieved. The existing weld should then be removed and the seam must be re-welded. To ensure that proper bond of PVC flooring to compreg base floor is obtained, allow it to dry for **24 hrs**. in normal atmospheric temperature. All the edges of PVC flooring in the compartments should be sealed with water sealing compound to avoid seepage of water.

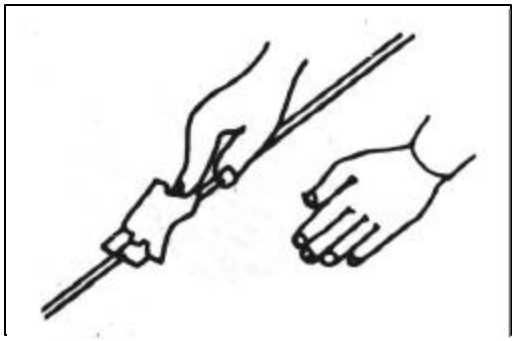


Figure 11.7

In the door way of GS coaches, an aluminum chequered sheet to IS:737 HS 20-W should be provided and properly anchored over PVC flooring to avoid any damage to PVC flooring.

Water sealing compound shall be used all around the aluminum chequered sheet as well as in the CSK screws to prevent seepage of water.

1105e **Lavatory Flooring**

All new coaches are provided with stainless steel inlay pasted with single piece PVC sheet to ICF drawing no. ICF/STD-4-1 001 in lavatories. Coaches having other types of lavatory floorings should be provided with stainless steel lavatory inlays during POH.

- The cracked, damaged or worn out PVC sheets should be removed and a new single piece PVC sheet should be pasted over stainless steel inlay.
- No patchwork should be done in the lavatory flooring.

1105f **Special Tools and Equipments**

i) PVC Flooring

PVC flooring shall be to RDSO Schedule of Requirement No.C-8515 (Rev.2).

a) HOT AIR WELDING EQUIPMENT

i) Hot air welding equipment - 750 watts capacity with air control device on the torch.
ii) Roller with handle for pressing the weld deposits.
iii) Welding Rod **2mm dia**. PVC Electrode
iv) Recommended procedure for welding of flexible PVC - to IS : 8002 – 1976
v) Adhesive
- Dunlop adhesive S-758
- Fevicol SR - 998

vi) Water proof sealing compound - Water proof sealing compound to IS: 1580-1960.

1105g **Maintenance Instructions**

i) All coaches, both AC and non-AC, except the luggage compartment portion of SLR coaches, are provided with compreg flooring having a PVC sheet pasted on it. The cracked, damaged or worn out PVC flooring sheets should be removed. Swollen or otherwise damaged floor boards should be renewed and a new PVC patch of same colour should be pasted. The joints of PVC patch should be properly thermo-welded to prevent seepage of water. For laying and repair of PVC flooring over compreg, the procedure detailed in RDSO pamphlet no. C9001 should be followed.

ii) The coaches undergoing corrosion repair should be provided with PVC flooring as per RDSO pamphlet no. C-9001.

iii) The coaches undergoing normal repairs may continue with the flooring arrangement as existing, ie., either Decolite or PVC flooring.

iv) In case of Decolite flooring, the cracked, uneven or worn out flooring should be broken and patched with the same colour Decolite. At the time of decoliting the floor it should be ensured that dovetailed wooden battens are properly fitted and the Decolite mixture is prepared in accordance with the instructions given in IS 657 and IS 658. The Decolite surface should be smooth finished and given proper slope. Special care should also be taken at the edges, joints and at the pedestals to ensure that freshly laid Decolite leaves not even an invisible gap to permit water to seep through and cause corrosion of the trough floor underneath.

1105h **Examination and repair practice in Carriage Maintenance Depot**

i) Primary/Secondary examination, Schedule A and B examination

- Visually examine floor for any damages.

ii) Schedule 'C' examination

- Inspect and attend torn/damage/ cracked PVC flooring.
- Examine and attend opened PVC joints.
- Examine Drain holes in trough floor for accumulation of water due to clogging if noticed, inspect affected area for corrosion

1106 **SEATS AND BERTHS**

1106a **Cushioned Seats and Berths**

i) The upholstery materials used for seats and berths of different classes of coaches is given in the following table.

Class of coach	**Furnishing material**	**Cushion material**
Ist class AC coaches and Executive class chair car of Shatabdi Express.	Flame retardant fabric upholstery to RDSO's STR No. C-9901.	Foam rubber cushion to IS:1741/60 Gr. 'B'
AC 2 tier and 3 tier, AC chair car, First class, First class chair car	Solid layer vinyl coated fabric to type II of RDSO's STR No. C- 9503.	Same as above
Sleeper class, Second class day coach	Solid layer vinyl coated fabric to type II of RDSO's STR No. C- 9503.	Same as above

For stitching the furnishing cloth, cotton sewing thread no. 30 is used, thread no. 40 for curtains. Cotton padding to Specification no. G/TEX/C - 1813 is used to give even shape to the cushion.

1106b **Maintenance in workshops**

i) The berths and seats found defective due to opening of stitches, cracked / torn/ faded rexine, or sagged cushion should be removed from coach and sent to Trimming shop for repairs. Otherwise they should be cleaned in position with a suitable detergent or interior cleaning agent which does not damage/discolour and does not require water for rinsing.

ii) After stripping the seats, backrests, berths, arm rests, etc., completely, the frame should be examined for distortion/crack. These should be first got repaired in fitting section or carpentry section as the case may be. The wooden battens of the frame for fixing the rexine should be examined and replaced if damaged / broken. The steel members should be painted and the wooden members varnished after repairs before doing upholstery repair work.

iii) Following measures may be taken to improve the quality of upholstery work:

- *Rounding of corners of berths and seats:* This eliminates corner folds where the rexine gets torn often for old design of berth.
- *Use of nylon sewing thread:* Nylon thread has higher strength than cotton threads and hence reduces incidence of opening of stitches.
- *Use of straight edge rexine cutting machine:* This helps in cutting rexine in a batch for improved repair work productivity
- *Use of pneumatic staplers:*

Pneumatic staplers can be used instead of nailing.

Reclining Seats of Chair Cars

- The reclining chairs should be removed from the chair cars in every POH and sent to Fitting and Trimming shops for overhaul.

- Strip the chairs with adjustable backrests and replace worn out gear wheels and other components including bottom rail. The moving parts should be oiled and the assembly checked for even sliding before it is refitted. The upholstery portion should be repaired as given in section 1105c. The chrome plated legs, where provided, should be examined and re-chrome plated, if necessary. After the chairs are repaired and assembled, they should be tested for easy movement and firm securing in all reclining positions.
- Strip the reclining mechanism gear, and replace worn / defective parts. The components should be painted all over except sliding and rotating surfaces, which should be well greased. After assembly the chair should be tested for ease of rotation and proper locking.
- The folding table, if provided, on the base of the back- rest should be examined for loose or damaged hinges, broken of cracked moldings or damage to table top. Replace table if found damaged. Hinges and locking catch should be lightly oiled and examined and attended for proper operation

1106c **Examination and Repair Practice in Carriage Maintenance Depot**

i) Primary/Secondary examination

- Examine visually curtain cloth in AC coaches attend if necessary.
- Examine middle and upper berth chains.
- Examine the holding / securing brackets for seat and berths and attend if necessary.
- Examine snack table in upper class coaches for damages and rectify if necessary.
- Examine and repair damaged upholstery cushions and curtains.
- Wooden seats and frame should be cleaned

ii) Schedule A and B examination

- Examine as per (i) above.
- Wooden seats and frames should be disinfected.

iii) Schedule C examination

- Examine as per (ii) above.
- Examine reclining mechanism on chair cars for proper functioning and attend if necessary.

1107 **DOORS**

1107a **Examination in Workshop**

i) **Body side Doors**

- Doors should be checked for ease of working and corrosion, especially on the bottom side of the panels. If found heavily corroded, they should be removed and repaired as per RDSO Technical pamphlet C-7602 (Rev.1).
- The top and the bottom bearing pivots should be checked for worn ridges. If ridges are found they should be removed and if the condition warrants, the pivots should be replaced.
- The door handles, guard key locks and safety latches on the doors should be checked for smooth and easy working. The bent parts should be straightened or renewed as required. Pad locking plates on the doors.
- Dust excluding device in the form of a rubber tube is fitted all around on the door. This should be checked and if perished, or torn or decayed, should be renewed.
- If door safety latches are found bent or jammed, they should be repaired ensuring proper working.

ii) **Sliding Doors**

Sliding doors of upper class compartments

- Sliding doors should be removed in every POH. Top roller race and top guide rails should be checked for smooth working and replaced when worn more than **1 mm** on each part. The door stops at the top and bottom should be checked and adjusted. The ball bearings in the top guide rollers should be checked, greased and refitted or replaced as necessary. The ridges from the roller `V' surfaces should be removed or, if worn too small the rollers should be replaced.
- The automatic lock, specially its lock casing, should be checked for cracks at its flanges. If cracked, it should be replaced.
- If the door operating rod is broken, it should be replaced.
- The coach door should be checked for wear. If worn more than **1 mm**, it should be replaced.
- The pins of the lock should be cleaned, oiled and refitted.
- The internal door locking latches (parrot latches) and the tower bolts should be checked for ease of working and replaced if required.
- While fitting the door, it should be ensured that the gap between the door and the panel does not exceed **4.5 mm**.
- Broken glass in the observation windows provided in sliding doors of AC First class coaches should be replaced.

Sliding doors of luggage vans - ICF/ BEML design (TLR-5-8-001)

- Sliding doors should be removed at every POH. All corroded and damaged panels, louvres and members should be cut out and replaced.
- Roller assembly should be removed and stripped. Replace rollers if found worn beyond **3 mm**, otherwise they should be reused after smoothening ridges or dents formed at the rolling surface. Similarly, other components should be examined and repaired or replaced as required. Perished / torn rubber sealing shall be replaced. After assembling the components, the moving parts of the assembly should be greased before fitting them in position on the door.
- The bottom guide, door handle and door locking arrangements should be examined and repaired or replaced to ensure smooth working in operation and effective locking from inside and outside. The inside and outside locking arrangement shall be to sketch 75118 and 75210 respectively.
- The door assembly, after repairs should be checked, preferably in a fixture, for its alignment of the top rollers and the bottom guide. The alignment should be corrected as required before the door assembly is passed for fitting on the coach.
- Inspection door & pocket in partition for sliding door shall be provided as per ICF drawing TLR-4-2-717, SLR-4-2-002 & WLLRM-4-2-605 in respective coaches.

iii) **Vestibule doors**

a) *Sliding doors* - These should be attended as per instructions contained in section (ii) above. Semi-permanent locking arrangement shall be as per RDSO sketch 84154.

b) *Flap doors* - They should be checked for ease of working, damages to their panels, hinges, locking bolts and other parts, and necessary repairs carried out.

c) *Rolling shutters* - They should be checked for ease of working and damages and necessary repairs carried out.

It should be ensured that the locking arrangements for the sliding doors / flap doors / rolling shutters are provided and are in working order.

iv) **Corridor inter communication doors of air conditioned coaches**

Replace all damaged or perished lining to ensure proper sealing. Remo ve door closer and test for proper functioning. Defective door closer should be overhauled before fitting.

1107b **Examination and Repair Practice in Carriage Maintenance Depot**

i) Primary/Secondary examination, Schedule A, B and C Examination

- Examine body side doors for working/ damages.
- Inspect door handles for damages/missing.
- Examine door for proper functioning. Also check that door is properly secured with hinges and pivots and should not be grazing with floor or door sill plates.
- Examine that the door locks and latches are firmly secured with correct sized screws and are properly engaging in their slot. The tongue of gravity type latch should be in proper alignment with its slot plate.
- Examine compartment sliding doors in AC first and ordinary first clas s coaches for smooth functioning.
- Thorough inspection and repair of sliding doors in SLR coaches should be undertaken.
- Examine door closer in AC coaches for proper functioning.
- Check lavatory hinge door for proper functioning.
- Examine lavatory door latches / tower bolts for proper function.

1108 **VESTIBULE**

1108a **UIC type rubber vestibule (RDSO sketch - 99056) and Foot Plate arrangement**

i) **Conversion to UIC type vestibule**

The existing stock can be provided with UIC type vestibule as per RDSO SK-99056. The following items/components are required for conversion.

Sr. No.	Description of item/ component	No. off / assly.	Drawing No.
1	Steel frame complete	1	RDSO SK-99057
2	Upper flange	1	RDSO SK-85248
3	Lateral side flange	2	
4	Rubber packing 6x75x1900	2	RDSO SK-99060
5	Rubber packing 6x75x1500	1	
6	Locking plate	2	RDSO SK-99058
7	Locking plate	2	
8	Locking plate	1	
9	Locking plate	1	
10	Special screw	17	RDSO SK-99059
11	Spring washer M10	53	IS:3063-65 tab-1 type B
12	Hex nuts M10 (D.C.)	70	IS:1363-92 Pt.3. Tab-1
13	CSK head screw AM 10x25	36	IS:1365-68, 4-6 Tab, 2 & 3
14	Snap head rivet dia. 5x10	10	IS:2998-82, Gr.1, Tab-1

Sr. No.	Description of item/ component	No. off / assly.	Drawing No.
15	Foot plate arrangement	1	RDSO SK-99057
16	Support bracket for foot plate	2	
17	Vestibule door sill arrangement	1	
18	Holding device for foot plate	2	T-2-5-699
19	Pin	2	RDSO SK-99059
20	Washer M20	2	
21	Split pin dia. 4X36	2	IS:549
22	Connecting component	2	ICF/SK-2-5-078
23	Foot plate holding bracket	2	RDSO SK-99057
24	LP sheet	2	
25	Spring plate	2	RDSO SK-99058

1108b **Maintenance during POH**

- Examine the steel frame complete for deformation, corrosion, welding crack. Repair the defective components. Straighten the deformed vertical channels by heating and pulling inwards by suitable chain & screw tensioning mechanism.
- Examine the LP sheet on the inside of frame. Wash and clean if found stained and dirty. Replace if found broken or cracked. For vestibules without LP sheet, painting may be done.
- Examine the condition of upper and lateral rubber flanges (bellows) for wear or cuts. The cracked portion up to **300 mm** on lateral side flange may be repaired by rubber patch and rubber solution. Replace if found beyond repair.
- Examine the fixing screws and nuts for rubber flanges. Tighten if found loose or replace if found missing.
- Examine the support brackets for foot plate. The deformed or corroded brackets which are beyond repair, should be replaced in position. See that the foot plate rests evenly on both the brackets. Replace the perished or missing rubber sheet on the support brackets with rubber adhesive.
- Clean the foot plate with wire brush to remove muck, dirt, etc. accumulated on the foot plate surfaces. Examine the foot plate arrangement for wear, deformation or corrosion. Replace the foot plate if found beyond repair. Remove the sharp corners of the foot plate. Replace the worn out or broken wearing piece. Examine the condition of holding brackets and pins for wear, broken or welding crack. Replace if foot plate brackets and pins are found beyond repair. Paint foot plate with anti-corrosive paint.
- Examine the holding device for foot plate. Replace or repair if found defective. examine the hand rail for breakage, etc.
- Examine the bracket assembly and connecting components (if provided) for coupling the UIC vestibule with conventional vestibule. Replace the deformed or missing components.
- After completion of the repairs, all components should be painted with one coat of red oxide zinc chromate primer.

1108c **Examination and repair practice in Carriage Maintenance Depot**

i) Primary/Secondary examination, Schedule A, B & C examination'

- Examine visually rolling shutters/sliding doors of vestibule for smooth working.
- Inspect vestibule and its Rubber fittings for damages /missing components. Repair if necessary.
- Visually check vestibule fall plate, mounting brackets, pins and lock lever for ease of operation, damages/ deficiency.

****

CHAPTER 12

PAINTING

1201 **GENERAL**

1201a After the coach body is fully repaired and the flooring work completed, it should be swept and cleaned of all dust, shavings, etc., before the coach is placed in the Paint shop for painting and polishing.

1201b The condition of the paint on the inside and outside surfaces should be examined to decide whether the old paint should be removed to the bare metal. Usually, extensive corrosion repair work necessitates removal of old paint to bare metal and complete repainting of the coach.

1201c If the condition of the paint so warrants or at every 5th POH of a coach, the paint should be completely removed to the bare metal and the coach repainted as per paint schedule `A'. If the general condition of the paint is good, follow paint schedule `C'. These paint schedules cover the exterior painting of coaches with synthetic enamel paint system. RDSO Sketch No :CSC - 1723 gives the exterior colour scheme of the coaches (Sketch no. CSC - 1723 has been made into two parts i.e. **figure 12.1a & figure 12.1b** and attached at pages 2 and 3).

1202 **PAINT SCHEDULE `A' (Refer Annexure 12.1)**

1202a The entire surface should be applied with a suitable paint remover and the old paint scraped off. Thereafter, the coach surface shall be swabbed with petroleum hydrocarbon solvent to IS:1745 to remove all traces of paint remover.

1202b After the surface dries up completely, it should be sand papered to make it slightly rough and a coat of red oxide zinc chromate primer to IS 2074-92 to a **DFT of 25 microns minimum** should be applied by spray/brush immediately. Where facilities exist, the entire coach body should be sand blasted and the primer coat of red oxide zinc chromate should be applied by spray/brush immediately thereafter.

1202c After allowing adequate drying time for primer, the entire coach should be applied with the first coat of brushing filler to IS 110-83 by spray/brush to a **DFT of 30 micron minimum**.

1202d (i) After hard drying of filler, apply the first coat of knifing stopper putty to IS:5083-88 followed by spot putty application and wet rubbing.

(ii) After ensuring drying of water, apply necessary putty to get a uniform surface followed by wet rubbing.

(iii) After drying of water, apply second coat of filler to IS:110-83 to a **DFT of 30 microns minimum**.

1202e The dry surface should be wet rubbed down with bone cuttle and silicon carbide water proof **paper grade 120 and 220**. It should then be allowed to dry.

1202f After ensuring that there is no trace of water on the surface, a coat of under-coating to IS 8662-93 should be sprayed or applied by brush to a DFT of 25 microns minimum.

1202g The entire surface should again be rubbed down smooth with silicon carbide water proof **paper grade 320** and after drying, a coat of enamel finishing to IS 8662-93 should be applied to a **DFT of 20 microns minimum**.

1202h After the first coat of finish enamel has dried completely, it should again be flattened with silicon carbide water proof **paper grade 400** and apply a second coat of synthetic finish enamel to IS 8662-93 to a **DFT of 20 microns minimum**.

1202i The door handles, if not chrome plated, should be painted with golden yellow to IS 8662-93. The foot steps, roof, etc., should be painted as per prescribed colour scheme.

1202j Standard lettering, as specified, should be done with golden yellow to IS 8662-93. Similarly, all standard schedule charts, signs, etc., should be stenciled/painted as prescribed.

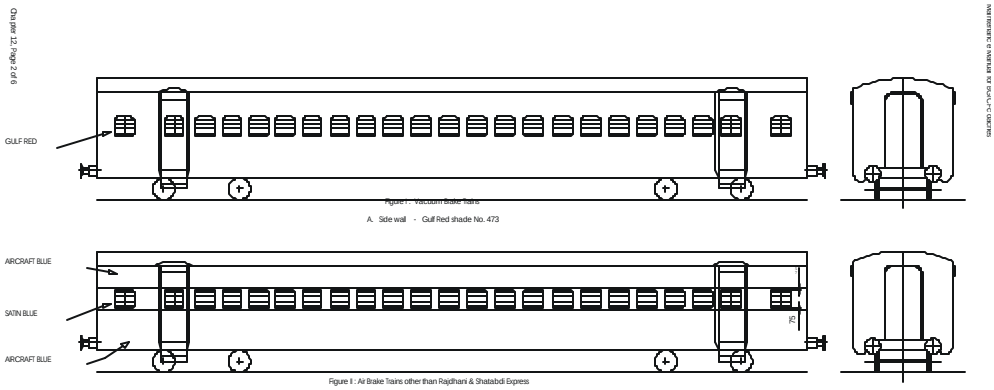


Figure I - Vacuum Brake Trains

A. Side wall - Gulf Red shade No. 473

Figure II : Air Brake Trains other than Rajdhani & Shatabdi Express

A. Side wall upto 75 mm below window and from 75 mm above window - Air Craft blue shade No. 108
B. Side wall window area 75 mm above and below windows - Satin blue shade No. 177

NOTE:
1. For special rakes, instructions as per Rly. Board's letter No. 76/M (C)/137 / 31 dated 5.6.1986 shall be followed.
2. Postal portion of partial postal vans shall be painted with postal red.
3. Existing procedures for roof and end wall painting, lettering and exterior markings continue unchanged.
4. All finishing paints should be to specification No. IS:8662-93 and colours to specification No. IS:5-94

EXTERIOR COLOUR SCHEME FOR MAIN LINE COACHES

RDSO Sketch No. CSC-1723. Approved vide Railway Board's letter No. 97/M (C)/ 137 / 20 dated 23.6.98

FIGURE 12.1a

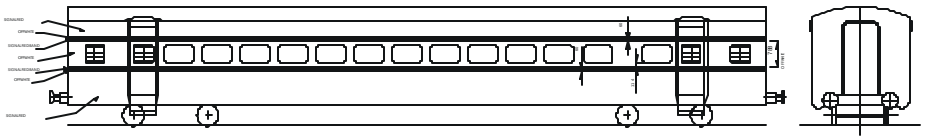


Figure II : Rajdhani Express

A. Side walls upto 234 mm below window and from 234 mm above window - Signal Red shade No. 537
B. Band of 60 mm above and below windows at a distance of 114 mm from window - Signal Red shade No. 537.
C. Side wall window area 234 mm above and below window - Off white ICI shade No. 28-1004

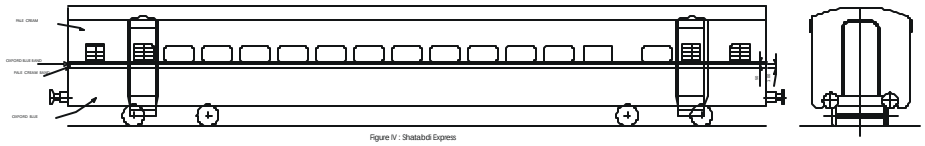


Figure IV : Shatabdi Express

A. Side walls upto lower window sill - Oxford Blue shade No. 105
B. Side wall above lower window sill - Pale cream shade No. 352
C. Band of 100 mm at a distance of 50 mm below lower window sil - Pale cream shade No. 352

EXTERIOR COLOUR SCHEME FOR MAIN LINE COACHES

RDSO Sketch No. CSC-1723. Approved vide Railway Board's letter No. 97/M (C)/ 137 / 20 dated 23.6.98

FIGURE 12.1b

1202k Finally, the window glasses, etc., should be cleaned well and all paint marks removed. Any damage to the paint should be touched up before the coach is turned out after POH.

1203 **PAINT SCHEDULE `C'**

- The portions where paint has flaked or is damaged, should be scraped off of all the loose and damaged paint. The coach should then be washed thoroughly with soap and water and allowed to dry. Then a coat of red oxide zinc chromate primer to IS 2074-92 should be applied by brush at the places where metal surface is visible.
- After the primer dries up completely, it should be puttied and a coat of under-coating to IS 8662-93 should be applied at these portions.
- The complete coach shall thereafter be painted in the manner described in paragraphs 1202g to 1202k above.

1204 **INTERIOR PAINTING**

- Newly built coaches with laminated plastic panels require painting only on the steel mouldings. The mouldings should be cleaned in every POH and repainted with one coat of synthetic enamel to IS:133-93 of appropriate colour. Sketch 90068 gives the interior colour scheme of coaches.
- If the condition of the paint on the mouldings has deteriorated or become thick, the complete paint should be removed by the paint remover. The moulding should then be washed thoroughly, allowed to dry and repainted with one coat Red-oxide zinc chromate primer to IS:2074 -92 followed by synthetic enamel to IS 133-93 of appropriate colour.
- Aluminum window frames should not be painted, but should be thoroughly cleaned of all stains in position. If they are very dirty, they should be removed and cleaned with oxalic acid. FRP windows should be painted with polyurethane paints to RDSO specification No. M&C/ PCN/100/ 96 (Chapter IV).
- Laminated panels should be polished with silicon paste or similar suitable polish to restore luster and also to provide a protective coating.
- Coaches other than those fitted with laminated plastic panels should be cleaned with soap solution or suitable detergent and thereafter cleaned thoroughly with wet cloth so that all head stains, oily marks, etc., are completely removed. Then a single coat or, if required, a double coat of synthetic enamel to IS:133-93 should be applied by brush/spray.
- In case where the old paint has become thick due to repeated painting or where the paint has deteriorated or cracked, the wooden panel should be removed and replaced or reused after completely removing the old paint and repainting it.

1205 **PAINTING OF PARTS**

- The laminated plastic seats or moulded seats of synthetic materials require no painting. They should only be thoroughly cleaned with soap solution or suitable detergent.
- In case of seats made of wooden battens, the battens which have been replaced should be sand papered smooth and a coat of filler should be applied. Then, entire surface including old painted surface should be sand papered smooth and the seats should be repainted with a coat of enamel finishing of the prescribed colour to IS 133-93.

1206 **MARKING OF COACHES TOGETHER WITH EXTERIOR**

All lettering on coaches should be according to the sizes prescribed in the marking diagrams for the type of coach to which they pertain (refer RDSO drawing number CSC-970). Anti telescopic coach end walls should be marked with yellow stripes as sketch no. 77356. Each should be marked with following details:

i) Coach No., Owning Railway, and Mechanical code if any.

ii) Name of base station for primary maintenance

iii) No. of compartments and seating capacity as prescribed for the type of coach

iv) Notices for use of alarm signal, safety precautions etc. if separate notice plates for these are not placed.

v) Transportation code applicable to the type of coach as per appendix 'B' of IRCA Conference Rule part IV.

vi) Carrying capacity of OCV's to the nearest tonnes up to one decimal place above actual capacity.

vii) Tare weights as recorded at the time of initial building or subsequent major modifications.

viii) A woman's figure head painted on illuminated panel of compartments permanently reserved for ladies.

ix) Return date showing the month and year in which the coach is required to be returned to the owning railway workshop for POH.

x) A block as shown below to be stenciled on the left side of end panel

Table 12.1

Schedules	**Station code**	**Date**
Disinfected		
Alarm chain periodical examination done		
Dash pot oil checked		
Side bearer oil level checked		
Over head tank flushed		
Intermediate lifting		
DA valve examined		

Note: Size of letters should be 10 mm and the block 350x250mm.

xi) The capacity of the dynamo and light/fan loads to be stenciled on the end panels.

xii) The following legends should be stenciled on battery box covers to enable stenciling of necessary particulars against each.

- Make
- Type
- Specific gravity (at full charge)
- Corrected to temperature
- Cell watered on
- Cell examined on

1207 **TOOLS AND PLANTS FOR PAINTING**

1207a **Types of brushes**

i) Round brushes nos. 1/0, 2/0, 3/0 & 4/0.

ii) Flat brushes nos. 25 mm, 38 mm, 50 mm, 63 mm, 75 mm, 100 mm

iii) Lettering brushes:

- **Flat brushes nos. 1 to 12**
- **Round brushes nos. 1 to 12**

iv) Stencil brushes

v) Cleaning brushes for LP sheets with soda ash

1207b **Putty knife**

i) Pallet knife

ii) Falling knife

iii) Haking knife

1207c **Scrapers**

i) Shave tukes

ii) Triangular

iii) Semi circular

iv) Diagonal

1207d **Abrasive papers**

i) Silicon carbide **water proof paper grade nos. 120, 220, 320 & 400**.

1207e **Safety apparels**

i) Goggles

ii) Helmet

iii) Gum boots

1207f Painting spray gun with air compressor plant for painting.

Annexure 12.1

A SCHEDULE (NINE DAYS)

1st Day	**:**	Remove old paint
2nd Day	**:**	One coat of Red Oxide Zinc chromate primer.
3rd Day	**:**	One coat of brush filler followed by spot putty to fill up holes/dents where required.
4th Day	**:**	Filler second coat (including spot putty where necessary)
5th Day	**:**	Rub down with **silicon carbide water proof paper Gr. 120 & 220**
6thDay	**:**	One coat of under coat
7th Day	**:**	Flat with **silicon Carbide water proof Paper Gr. 320**. One coat of enamel finishing.
8th Day	**:**	Flat with **silicon Carbide water proof Paper Gr. 400** and apply a second coat of synthetic enamel finishing.
9th Day	**:**	Lettering with Golden yellow and miscellaneous work (cleaning window glasses etc.)

Annexure 12.2

POH PAINTING PROCEDURE "C" SCHEDULE

1st Day	**:**	Cleaning with soap solution or any other cleaning solution and wash thoroughly with water touch up damaged portion with primer recommended under A schedule .
2nd Day	**:**	Spot putty if necessary and one coat of under coat.
3rd Day	**:**	Flat with **silicon carbide water proof paper Gr. 120 & 220**, and apply one coat of finishing enamel.
4th Day	**:**	Flat with **silicon carbide water proof Gr. 400** and apply a second coat of synthetic enamel finishing.
5th Day	**:**	Lettering with golden yellow and miscellaneous work.

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APPENDIX- A

TRANSPORTATION CODES FOR COACHES

S. No.	TRANSPORTATION CODE	DETAILS
1	ART	ACCIDENT AND TOOL VAN OR RELIEF VAN
2	CT	TOURIST CAR
3	CTS	TOURIST CAR FOR 2ND CLASS PASSENGERS
4	CZACEN	AIR CONDITIONED CHAIR CAR WITH END ON GENERATION
5	ERR	FOUR / SIX WHEELER
6	ERU	FOUR / SIX WHEELER SELF PROPELLED TOWER VAN
7	FCS	FIRST CLASS COUPE AND SECOND CLASS
8	FSCN	FIRST CUM II CLASS 3-TIER SLEEPER
9	GS	SECOND CLASS FITTED WITH SELF GENERATING EQUIPMENT
10	LR	LUGGAGE WITH BRAKE VAN
11	NMG	NEW MODIFIED GOODS
12	OHE	OVER HEAD EQUIPEMNT INSPECTION CAR
13	PPS	FULL BOGIE POSTAL VAN
14	RA	INSPECTION CARRIAGE (ADMINISTRATIVE)
15	RAAC	AIR CONDITIONED INSPECTION CAR
16	RD	INSPECTION CARRIAGE (SUBORDINATE)
17	RE	INSTRUCTION VAN (MOBILE TRAINING CAR)
18	RH	MEDICAL VAN
19	RHV	AUXILIARY MEDICAL VAN
20	RK	DYNAMOMETER CAR
21	RN	GENERATING VAN
22	RS	STORES VAN
23	RT	ACCIDENT AND TOOL VAN OR RELIEF VAN
24	RZ	TRACK RECORDING CAR
25	SLR	SECOND CLASS LUGGAGE AND BRAKE VAN
26	SMN	POWER CAR WITH MID ON GENERATION
27	VP	PARCEL VAN
28	VPC	PARCEL VAN CONVERTED
29	WACCNEN	VESTIBULED AC 3-TIER WITH END-ON–GENERATION
30	WCB	VESTIBULED PANTRY CAR
31	WSCZACEN	VESTIBULED AC CHAIR CAR WITH END-ON-GENERATION
32	WCD	VESTIBULED DINING CAR
33	WCRAC	VESTIBULED AIR CONDTIONED TWIN CAR
34	WCTAC	VESTIBULED AIR CONDITIONED TOURIST CAR
35	WFACEN	VESTIBULED AIR CONDITIONED FIRST CLASS WITH END ON GENERATION
36	WFC	VESTIBULED FIRST CLASS
37	WGACCN	VESTIBULED AIR CONDITIONED THREE TIER WITH SELF GENERATING ELECTRICAL EQUIPMENT
38	WGACCW	VESTIBULED AIR CONDITIONED TWO TIER WITH SELF GENERATING ELECTRICAL EQUIPMENT
39	WACCWEN	VESTIBULED AIR CONDITIONED TWO TIER SLEEPER WITH END ON GENERATION
40	WGFAC	VESTIBULED AIR CONDITIONED FIRST CLASS WITH SELF GENERATING ELECTRICAL EQUIPMENT
41	WGFACCW	VESTIBULED FIRST CUM AC 2-TIER SLEEPER

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S. No.	TRANSPORTATION CODE	DETAILS
42	WGSCN	VESTIBULED SECOND CLASS THREE TIER SLEEPER WITH SELF GENERATING EQUIPMENT
43	WGSCNLR	VESTIBULED SECOND CLASS THREE TIER SLEEPER WITH LUGGAGE AND BRAKE VAN
44	WGSCZ	VESTIBULED SECOND CLASS CHAIR CAR WITH SELF GENERATING ELECTRICAL EQUIPENT
45	WGSCZAC	VESTIBULED SELF GENERATING SECOND AC CHAIR CAR
46	WGSD	VESTIBULED SECOND CLASS DOUBLE DECKER WITH SELF GENERATING ELECTRICAL EQUIPMENT
47	WLRRM	POWER CAR END-ON-GENERATION
48	WSCZACEN	VESTIBULED AIR CONDITIONED SECOND CLASS CHAIR CAR WITH END ON GENERATION
49	WSLRN	VESTIBULED SECOND CLASS, BRAKE CUM LUGGAGE AND POWER CAR

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APPENDIX – B

ITEMS WHICH MUST BE CHANGED DURING POH OF HIGH SPEED COACHES (RDSO letter no. MC/CB/MARS dtd. 9.8.99)

1.	Roller bearing grease	(when opened)
2.	Locking plates (T-0-2-637)	(when opened)
3.	Rubber sealing ring of axle box front & rear cover (T-0-2-625)	(when opened)
4.	Rubber packing ring (T-0-1-632)	
5.	Guide ring (T-0-1-635)	
6.	Guide bush (T-0-1-634)	
7.	Circlip for dash pot guide bush (if used) (ICF Sk-0-1-182, item 3)	
8.	Wearing piece (T-0-5-649)	
9.	Wearing plate (T-0-5-648)	
10.	Side bearer oil	
11.	Dashpot oil	
12.	Brake gear bushes (as a set) (RDSO Sk. 81039)	
13.	Brake shoe key (T-3-1-618)	
14.	Shoe adjuster assembly (T-3-1-612, T-3-1-607, T-3-1-609) & M16 nut & bolt with split pin	
15.	Brake beam bush collared (T-3-2-644)	
16.	All bulb type cotters (T-3-2-632)	(when opened)
17.	Sealing washer for air vent screw (T-0-1-629)	
18.	Rubber stopper & crown bolt (RDSO Sk.-97068)	
19.	Rolling ring (VB-79/M)	

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20. Joint ring (VB-87/M)

21. Gland packing ring (VB-87/M)

22. DA valve diaphragm

23. Vacuum hose pipe – 50 mm dia (VB-504/M)

24. Vacuum brake syphon pipe – 20 mm dia (VB-510/M)

25. All rubber item of air brake equipment (if overhauled)

26. Centre pivot locking plate (T-0-6-612)

27. Bush for equalising stay (RDSO SK 88018 item 5 & 6, RDSO SK 88105 item 5)

28. Bush for 18 kw alternator (MG/T-3-2-009)

29. Bush for 4.5 kw alternator (T-0-3-659 item 5)

30. Silent block for anchor link (T-0-7-601)

31. Centre pivot bushing sleeve (T-0-6-603)

32. Dirt collector filters

33. Buffer bolts (T-2-2-503)

34. Centre pivot bolts

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APPENDIX - C

MODIFCATIONS IN BG COACHING STOCK
(RDSO's Letter No. MC/CB/MARS Dtd. 24.06.98)

Sr. No.	Description of Modifications	Sketch / Drg. No.	Applicability	Category
1	Adoption of worn and intermediate profile of wheels	RDSO SK - 92082 & 91146	Railways and Production Units	A
2	Standardisation of 16t. Equalising Stay on all new coaches	RDSO SK - 88105 & 93236	Production Units only	A
3	Provision of locking arrangement for guide caps of a) Existing Bogies, b) New Bogies	RDSO SK - 85070 alt. 3 ICF / SK-0-1-182	Railways and Production Units	A
4	Axle end locking arrangement for direct mounted spherical roller bearings	ICF Drg. No. T-0-2-637 alt. a	Railways and Production Units	A
5	Procedure for manufacture and inspection of bolster suspension hangers	Drg. No. C/BE-4501 alt 7	Railways and Production Units	A
6	Schedule of technical requirement of silent block for anchor link	Spec. C-9406 (Rev.1)	Railways and Production Units	Spec.
07	Lowering of attendant berth to approx. 600 mm. from floor level in AC coaches	RCF Drg. No. M1000517	Railways and Production Units	A
08	Earmarking of one seat in GS coaches for physically handicap person	RDSO SK - 96078	Railways and Production Units	A
09	STR No. C - 9503 for upholstery cloth for coaching	Spec. No. C-9503 amendment slip 1	Railways and Production Units	Spec.
10	Schedule of requirement for LP sheet	Spec. C- 9602 with amend slip 1	Railways and Production Units	Spec.
11	Provision of APD for foot plate of vestibule by welding of washer with securing pin	RDSO SK – 95199	Completed, may be treated as standard	A
12	Provision of compression spring to support canvas vestibule frame	RDSO SK – 96006	Railways only	A
13	Modified pin for 'Z' lever hanger to avoid working out of bushes in the brackets	RDSO SK – 98127	Railways and Production Units	A
14	Color coding of SAB spindles for different length	ICF Drg. No. T-3-3-704	Railways and Production Units	A
15	Revised locations for fixing holes in buffer case to minimize cracking of head stock	RDSO SK – 94043 94044	Production Units only. Railways to make new purchase as per revised drawing.	A
16	Provision of PVC flooring and aluminium chequered plate in doorways and gangways		Railways and Production Units	A
17	Use of high performance grease viz Servogem - RR3 and Balmerol Multi-grease in roller bearing axle boxes	-	Railways and Production Units	-
18	Use of plastic axle guide bushes to STR - C-8215 (Rev.II)	RDSO SK - 84102	Railways and Production Units	Spec.
19	Elimination of roof filling arrangement and provision of foot step and handle in lieu of ladder	RDSO SK - 90088	Railways only	A
20	Interior colour scheme	RDSO SK - 90068	Railways and Production Units	A

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Sr. No.	Description of Modifications	Sketch / Drg. No.	Applicability	Category
21	Provision of FRP tissue on trough floor, sole bar, turn under and side wall	ICF Drg. No. ICF SK- 9-0-890	Railways and Production Units	A
22	Modification to increase linen room capacity in 2tier AC coaches	RDSO SK - 88103 Alt.2	Railways only	A
23	Modification of suspension of under slung water tank provided under AC Coaches	ICF Drg. No. WGFAC - 6- 3-208 (col II) WGFAC3 - 6- 3- 305 alt.'d'	Railways and Production Units	A
24	Strengthening of bogies frame for transom mounting of 4.5 KW alternator for 110 V. dc system	RDSO SK – 88062	Railways and Production Units	A
25	Provision of wall type fans in the lavatories of AC coaches	-	Railways and Production Units	A
26	Modification for pad locking of body side door from inside of a coach	RDSO SK –87020	Railways and Production Units	A
27	Provision of TRA type roof ventilators	ICF Drg. No. WLRRM4-7-3-402 alt. 'n' & WLRRM4-7-3-401 alt. 'g'	Railways and Production Units	A
28	Strengthening of partition wall between guard's lobby and luggage / brake van	ICF Drg. No. SLR - 9-0-001	Railways and Production Units	A
29	Provision of wire rope arrangement below seats for luggage securing	ICF Drg. No. ICF/SK-6-1-234	Railways and Production Units	A
30	Provision of aluminium chequered flooring in pantry portion, washing room and door ways of PCs.	RDSO SK – 85121 (existing), 85120 (new)	Railways and Production Units	A
31	Provision of safety partition on flaps on end berths at either end of AC Sleeper coaches	RDSO SK – 83014 alt. 1	Completed, may be treated as standard	A
32	Provision of nylon wire net magazine pouches.	-	Railways and Production Units	A
33	Marking of 125 mm diagonal cross in fluorescent yellow paint and fitment of acrylic reflector in addition to existing tail lamp / board	RDSO SK – 85020	Railways and Production Units	A
34	Provision of five additional safety bars on body side door windows	RDSO SK – 84162	Railways and Production Units	A
35	Modification of body pillars for corrosion repair	RDSO SK – 76020 alt. 7	Railways only	A
36	Provision of M24 bolt and nuts for fitment of bottom cover to the centre pivot flange with bent plate anti rotation of bolts	ICF Drg. No. ICF/ SK-1-1-135 and RDSO SK- 75108 alt. 1	Railways and Production Units	A
37	Provision of four bars on window of body side wall of guard's portion of brake van	-	Railways and Production Units	A
38	Use of seamless pipe in air brake system	Spec. No. 04 ABR – 94, amendment Slip 4	Railways and Production Units	Spec.
39	Modification in design of existing 13t. equalising stay & safety strap	RDSO SK – 88018 alt. 6 and SK – 97022	Railways only	B
40	Provision of rubber stopper to maintain axle box crown clearance	RDSO SK – 97068	Railways and Production Units	B
41	Provision of FRP frame glass shutter as alternative to aluminium shutter	ICF /SK- 5-4-094 and spec. C-9403	Railways only	B

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Sr. No.	Description of Modifications	Sketch / Drg. No.	Applicability	Category
42	Provision of FRP banjo shutter as alternative to aluminium shutter	ICF / SK-5-5-020 & Spec. C-9403 with amend. slip no. 1 &2	Railways only	B
43	Provision of UHMWPE/NFTC axle box packing	RDSO SK- 97072 & STR No. C-9703	Railways only	B
44	Standardisation of seats and berths	RDSO SK- 97051, 97052, 97053, 97054 & 97055	Production units only	B
45	Use of single piece FRP louvre shutter	RDSO SK- 97020 & STR C- 9403 with amend slip 1 & 2	Railways and Production Units	B
46	Semi-permanent locking arrangement for unused vestibule doors	RDSO SK- 84179 & 84154	Railways and Production Units (in vestibule with sliding doors)	B
47	Slack adjuster articulation arrangement in vacuum braked coaches	RDSO SK – 96102 alt. 1	Railways only	B
48	Brake beam for air braked coaches & brake beam test procedure	RDSO SK - 82010 alt. 5	Railways and Production Units	B
49	Modified design of brake head and brake shoe key for snug fitting of brake block.	RDSO SK - 94026 & 94027	Railways and Production Units	B
50	Increased length of 30 mm of brake block hanger	RDSO SK- 93286	Railways and Production Units	B
51	Modification to passenger alarm system in vacuum brake system	RDSO SK - 96040	Railways only	B
52	Use of ventury type chute for lavatories	ICF / SK-6-3-324	Railways and Production Units	B
53	Modification to safety strap for axle guide arrangement and axle box lug	RDSO SK - 90005 alt. 2	Railways and Production Units	B
54	Provision of emergency openable window in non AC coaches	ICF Drg. No. DMU/DPC-5-4-002	Production Units	B
55	Provision of closing piece and inspection door on sliding door pocket in luggage compartment of SLR / WLRRM coaches	ICF Drg. No. TLR-4 -2-717, SLR - 4-2-002, WLRRM -4-2-604 , WLRRM-4 -2-605	Railways and Production Units	B
56	Provision of complete FRP window including window sill & guides	RDSO Spec. No. C-9502	Railways and Production Units	C
57	Use of 12 mm. compreg flooring in place of 19 mm. plywood	STR C- 9407 type II	Railways and Production Units	C
58	Standardized stainless steel inlays for lavatories	ICF/STD-4 -1-002	Production Units only. Railways in corrosion repair coaches	C
59	Fitment of UIC vestibule on coaches	Spec C-8812 rev. I RDSO Sk-88058, alt.5 & Sk -88059, alt. 5	Railways and Production Units	C
60	Use of Nylon 66 bushes in brake gear with N5 finished Electro plated pins	RDSO SK-81039, 82023, 84018, 84116, 84132 and 93186 alt. 2	Railways and Production Units	C
61	Safety wire rope arrangement for brake beam	RDSO SK- 93289, 93340 & 82010	Railways and Production Units	C

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Sr. No.	Description of Modifications	Sketch / Drg. No.	Applicability	Category
62	Use of high capacity buffer packs inside buffers of coaches	Spec. C- 9501 (Rev. I), SK- 96002 alt. 3	Railways and Production Units	C
63	Fitment of enhanced screw coupling and draft gear	RDSO Sk- 79061 & Sk- 79067	Railways and Production Units	C
64	Fitment of Emergency window in AC and Non AC coaches	RDSO-SK. 98161 (Alt.1), ICF/STD 3 -4-005, ICF/SK. 5-4-168	Railways and Production Units	C

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APPENDIX D

LIST OF RDSO TECHNICAL PAMPHLETS

S.No.	RDSO No.	Description
01	C-6803	Maintenance and repair procedure for hydraulic shock absorbers used on coaching stock.
02	C-6904	Instructions for repair of corroded ICF coaches BG
03	C-7103	Instructions for examination and maintenance of bogies and undergear of coach nominated to run at sanctioned speed of 110 kmph (BG).
04	C-7301	Direct admission valve for passenger coaches maintenance instructions.
05	C-7511	Instructions for adjustment of buffer height of ICF built BG coaches in workshops and depots.
06	C-7512	Hindi version of C-7511, adjustment of buffer height of ICF BG coaches.
07	C-7601	Description of water raising apparatus and instructions for filling water in coaches fitted with under slung water tanks.
08	C-7602	Instructions for corrosion repairs ICF built BG coaches.
09	C-7607	Instructions for inspection, repair and manufacturing procedure for helical springs of ICF & BEML built coaches.
10	C-7703	Instructions for inspection and maintenance of roller bearing axle boxes of BG/ICF bogies..
11	C-7717	Instructions for maintenance of axle box guide arrangement for mainline ICF built coaches (BG/MG)
12	C-7807	Instruction for maintenance of bogie and under gear of Rajdhani express coaches (BG) (for shops and maintenance depots)
13	C-7808	Hindi version of C-7807, maintenance of bogie and undergear of Rajdhani coaches.
14	C-7809	Instruction for inspection, repair and manufacturing procedure for helical springs of ICF & Jessop's EMU stock.
15	C-7817	Instructions for inspection and maintenance of direct mounted roller bearing axle boxes of BG/ICF bogies.
16	C-7901	Maintenance and repair procedure of Gabriel vertical hydraulic shock absorber.
17	C-7902	Hindi version of C-7901, maintenance and repair procedure Gabriel shock absorber.
18	C-7907	Wheel and axle manual
19	C-8105	Schedule of requirements for asbestos sheets roof ceiling of railway passenger coaches.
20	C-8107	Schedule of requirements for nylon bush for brake gear for mainline coach.
21	C-8108	Hindi version of C-8107, nylon bushes for coaches
22	C-8207	Schedule of requirement for FRP Battery Box.

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S.No.	RDSO No.	Description
23	C-8211	Schedule of requirements for rubberised coir cushion
24	C-8215	Schedule of requirements for plastic guide bush for axle box guide of ICF/BG bogie (tentative)
25	C-8217	Schedule and requirements for aluminum chequered sheets for use as flooring material on coaching stock.
26	C-8219	Fibre glass reinforced plastic in railway coaches
27	C-8303 Rev. I	Technical specification for hot coiled helical springs used on main line coaches and EMU stock.
28	C-8305	Anti-pilferage measures for compartment, lavatory and other coaching stock fittings.
29	C-8409	Tentative schedule of requirements for sheet moulding compound to be used for manufacture of FRP products for passenger coaches.
30	C-8415	Tentative schedule of requirements for FRP seat cum back tests of Indian railway coaches.
31	C-8419 Rev. I	Technical specification for hot coiled helical springs used on maintenance coaches & EMU stock.
32	C-8421	Tentative schedule of requirements for FRP wall protector for bath room of coaching stock of IR (Sk.-83114)
33	C-8515	Schedule of requirements for flexible PVC flooring for passenger coaches (tentative)
34	C-8517	Schedule of requirements for anaerobic adhesive for use on coaching stock (tentative).
35	C-8518	Hindi version of C-8517, anaerobic adhesive for use in coaches.
36	C-8519	STR for air brake equipment for coaching stock.
37	C-8527	Roller bearing specification
38	C-8531	Particular specification for BG (1676 mm) all metal integral light weight self-generating Ist class air conditioned coaches.
39	C-8533	Particular specification for BG all metal light weight coaches.
40	C-8605	STR for nylon guide roller/wearing piece for retractable footplate
41	C-8606	Hindi version of C-8605, nylon guide roller/wear piece for retractable foot plate.
42	C-8623	STR for decorative thermosetting synthetic resin bonded laminated sheets.
43	C-8625	Note on cleaning media for use in bearing cleaning plants.
44	C-8626	Procedure for manual ARC welding of wear plates (IRS: R-65-78)
45	C-8629	Report of committee on reduction of weight of coaches.
46	C-8703	Specification for shock absorber.
47	C-8805	Instructions for inspection/maintenance of air brake equipment on passenger coaches.

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S.No.	RDSO No.	Description
48	C-8812	Schedule of requirements for UIC type elastomer flange connections for intercommunication between passenger coaches.
49	C-8903	Schedule of requirement for hot cases operated by liquefied petroleum gas for installation in Rly. pantry cars.
50	C-8906	Schedule of technical requirements for vestibule canvas cloth to be used in passenger coaches.
51	C-8910	Schedule of technical requirements for direct admission valve.
52	C-8914	Schedule of requirements for flexible load bearing polyurethane foam to be used in berth and seats of passenger coaches.
53	C-9001	Procedure for laying PVC flooring in passenger coaches.
54	C-9005	Water raising system and instruction for filling water for air braked coaches
55	C-9009	Description of water raising system to SK-86209 and instructions for filling water for air braked coaches.
56	C-9011	Quality assurance specification for 'L' type Ferrodo quality 89/24 composition brake blocks for passenger trains.
57	C-9019	Schedule of technical requirement for water purifier.
58	C-9101	Specification for electric train set.
59	C-9103	Schedule of technical requirements for plastic sheets (filled PVC) for use in interior roof ceiling of passenger coaches.
60	C-9105	Schedule of technical requirements for FRP axle box front covers for all coil ICF type bogies for passenger coaches (BG)
61	C-9121	Schedule of requirements for push cock (tentative)
62	C-9123	Schedule of requirements for plastic lavatory chute (tentative).
63	C-9125	Schedule of requirements for plastic packing ring (tentative).
64	C-9202	Technical specification for fabricated bogie frame/bolster for coaching stock.
65	C-9203	Schedule of requirements for plastic brake gear bushes for passenger coaches (ACETAL)
66	C-9206	Instructions for operation of air brake main line passenger trains (BG)
67	C-9210	Specification for pipes and joints for Air braked coaches
68	C-9212	Guide for approval of manufacturers for supply of bolster suspension hangers for main line coaches and EMU stock.
69	C-9213	Guide for approval of manufactures for supply of screw couplings for main line coaches and wagon stock.
70	C-9303	Schedule of technical requirements for air brake system for loco hauled main line passenger stock for operational speed of 160 kmph (tentative).

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S.No.	RDSO No.	Description
71	C-9307	Schedule of technical requirements of axle end locking screw used in roller bearing axle box arrangement of ICF coaches.
72	C-9309-U	Specification for sliding plug doors for mainline coaching stock.
73	C-9313-U	Specification for side-buffer.
74	C-9314-U	Plywood specification for new Ac chair car
75	C-9318-U	Specification for test scheme for stress investigation in prototype new design of BG AC coach shell.
76	C-9319	Schedule of technical requirements for development of interior roof ceiling sheet for passenger coaches.
77	C-9321	Schedule of technical requirements for development of light weight transverse upper sleeping berth to be used in AC coaches.
78	C-9322	Schedule of technical requirements for development of light weight partition walls to be used in AC coaches.
79	C-9403	Schedule of technical requirements for fibre glass reinforced (SMC) glass window frames, lavatory banzo frames and louvre sheets for use in coaches.
80	C-9406	Schedule of technical requirements for silent block for anchor link.
81	C-9407	Schedule of technical requirements for compreg laminate.
82	C-9408	Instructions for operation of air braked main line passenger trains (BG) Dec,94.
83	C-9501	Rubber buffer spring of 1030 kg. m. capacity for side buffers of BG coaches.
84	C-9502	Schedule of technical requirements for fibre glass reinforced (SMC) window guides and sills for use in coaches.
85	C-9503	Schedule of requirements for upholstery cloth for coaching stock.
86	C-9505	STR for high tensile steel screw coupling.
87	C-9509	STR for alloy steel draw hook on Railway coaches.
88	C-9511	Schedule of technical requirements for Natural Fibre Thermo-Set Composite (NFTC) sheets for roof ceiling of passenger coaches (tentative)
89	C-9601	Tentative specification for Natural Fibre composite board for use in flooring in passenger.

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S.No.	RDSO No.	Description
90	C-9602	Schedule of technical requirements for decorative thermo setting synthetic resin bonded laminated sheets for use in coaching stock.
91	C-9702	Instructions for maintenance of brake system of air braked coaches fitted with bogie mounted brake cylinders and 'K' type composition blocks.
92	C-9703	Schedule of technical requirements of packing ring for axle box guide arrangement.
93	C-9704	Schedule of technical requirements for polymerised floor topping compound for flooring of coaches.
94	C-9705	Schedule of technical requirements for Ultra High Molecular Weight Polyethylene (UHMWPE) for use in Railway coaches.
95	C-9802	Overhauling and testing of hose coupling of air brake system.
96	C-9803	Schedule of technical requirements for rubber items used in air brake components for coaching stock.
97	C-9805	Specification for flasher light for SLR (Brakes, luggage-cum-2nd class).
98	C-9807	STR for friction snubber for primary suspension of Broad Gauge mainline ICF all coil bogie for operation at max. speed of 105 kmph.
99	C-9808	Schedule of technical requirements for manufacture of brake block hanger.
100	C-9809	Specification for non-asbestos based 'K' type high friction composition brake blocks for bogie mounted mainline coaches (both AC & Non-AC coaches)
101	C-9810	Specification for asbestos based 'K' type high friction composition brake blocks for bogie mounted mainline coaches (both AC & non-AC)
102	C-9901	STR for upholstery for Ist class AC coaches and executive class chair car of Satabdi express
103	C-9903	Inspection and test scheme for primary suspension of BG (1676 mm) main line ICF all coil bogie (13 t axle) for operation of maximum speed of 150 kmph.
104	C-9904	STR for insecticide paint for coach interiors (tentative)
105	C-9905	STR for specially Treated Brake Pins (Alternative to Electroplating)

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S.No.	RDSO No.	Description
106	C-9906	STR for controlled Discharge Toilets for Indian Railway coaches (BG)
107	C-9907	Specification for L-type composition Brake block for main line coaches.
108	C-9908	STR for Biological Toilets in Indian Railway coaches.
109	C-9911	STR for fire retardant curtain fabric
110	C-9912	Tentative specification Natural Fibre Reinforced Panels (NFRP) for use in Railway coaches.
111	C-K013	Specification for Bogie mounted brake cylinder with inbuilt Slack adjuster for EMU and mainline passenger coaches.
112	CMI 9801	Maintenance instructions for IRY coaches fitted with IR-20 bogies.
113	CMI 9901	Maintenance Instructions for enhanced draw gear & screw coupling (BG) of mainline coaches.
114	CMI-K003	Guidelines for interpretation of wheel defects in solid/tyred coaching/EMU wheels in open line and workshops.
115	G-92	Maintenance manual for IRSA-600 slack adjuster.
116	G-97, Amnd. Slip 2, July, 2001	Maintenance manual of Air brake System for freight stock.
117	M&C/PCN/ 101/2001	Specification for cleaning solution.
118	02-ABR-94	Specification for Air Brake for freight & passenger stock of Indian Railways.
119	R-64/98 (Revised)	STR for upper and lower rubber washers for mail line coaches.
120	R-19/93	Wheels
121	IRS – M-41	Corrosion resistant high tensile strength steel (corton)

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APPENDIX E

STANDARD INTEGRATED MODULAR PITLINE FOR UNIFIED MAINTENANCE

This has been separately issued as CAMTECH's document no. CAMTECH/M/99/INFRA-WASHING LINE/1.1

(Please refer latest version)

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APPENDIX F

MAINTENANCE SCHEDULES

Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
1.0	**Coach**				
1.1	Coach should be washed both from out side & inside.				
1.2	Disinfect and spray insecticide at corner and crevices of coaches after washing all coaches	-			
1.3	Intensive cleaning of coach	-			
2.0	**Shell**				
2.1	Visually check body panels/end walls for damages				
2.2	Visually inspect destination boards brackets.				
2.3	Visually inspect window bars for damage/missing				
2.4	Examine body side doors for working/ damages				
2.5	Inspect door handles for damages/missing				
2.6	Inspect vestibule and its Rubber fittings for damages/missing, repair if necessary				

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
2.7	Visually check vestibule fall plate, mounting brackets, pins and lock lever for ease of operation, damages/ deficiency				
2.8	Thoroughly clean and remove dust, rust accumulated at pillars through turn under holes with coir brush and compress air	-	-	-	
2.9	Examine for corrosion of sole bar and other under frame members with torch light or inspection lamp	-	-	-	
2.10	Touch up damaged paint both inside & outside	-	-	-	
2.11	Check roof ventilator for damages	-	-	-	
3.0	**Under frame**				
3.1	Visually examine centre pivot mounting bolts and attend if needed				
3.2	Check condition of head stock/sole bar				
3.3	Examine trough floor, turn under and other under frame members from underneath for corrosion	-	-		
3.4	Visually inspect centre pivot cover				

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
4.0	**Bogie**				
4.1	***Bogie frame***				
4.1.1	Examine visually the condition of bogie side frame, transom, longitudinals and all welded locations				
4.1.2	Examine rubber stopper/stop screw of axle box crown for damage/missing/loose				
4.1.3	Inspect axle box safety straps/loops for damage/broken/missing				
4.1.4	Bolster safety straps/loops for damage/broken/missing				
4.1.5	Brake hanger brackets for damages				
4.1.6	Inspect safety brackets for brake hanger pins				
4.1.7	Examine oil level in side bearer oil-bath and oil filling cap, replenish oil if needed	-			
4.1.8	Check visually BSS hanger brackets				
4.1.9	Examine visually anchor link brackets				
4.1.10	Examine condition of wearing piece and wearing plate	-	-	-	

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
4.2	***Primary suspension***				
4.2.1	Visually examine axle box springs for breakage				
4.2.2	Visually examine dash pot oil filling special screw for deficiency				
4.2.3a	Check oil leakages in dash pot through defective seals/vent screws				
4.2.3b	Add specified grade of oil in dash pot	-			
4.2.4	Visually examine axle box clearance				
4.2.5	Check and attend axle guide assembly if necessary	-	-	-	
4.2.6	Check axle box clearance with gauge	-	-	-	
4.3	***Secondary suspension***				
4.3.1 4.3.2	Visually examine bolster springs breakages/damages Visually examine Bolster lower spring beam				
4.3.3	Visually examine BSS hangers, hanger blocks, BSS pins				
4.3.4	Check bolster clearance				
4.3.5	Visually examine equalising stay rods and pins (small and big)				
4.3.6	Visually check anchor links				

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
4.3.7	Examine visually the anchor link securing bolts and attend if needed				
4.3.8	Visually examine Equalising stay brackets				
4.3.9	Examine and attend safety loops of bolster				
4.3.10	Check and attend safety loops of Equalising stay rod				
4.3.11	Examine vertical shock absorbers for damages				
4.4	***Brake rigging***				
4.4.1	Check brake gear and adjust so that the piston stroke is within the limit.				
4.4.2	Examine brake beams breakages/damages				
4.4.3	Check and attend brake beam safety wire ropes/safety straps				
4.4.4	Check and attend brake shoe head and key & replace if necessary				
4.4.5	Check and replace worn brake blocks				
4.4.6	Visually inspect brake hangers, brake gear pins and cotters/split pins and replace if necessary				

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
4.4.7	Visually inspected damaged/missing brake gear bushes and replace if necessary				
4.4.8	Check and attend brake block adjuster	-			
4.4.9	Examine and attend brake levers	-			
4.4.10	Examine and attend floating lever suspension brackets	-			
4.4.11	Examine lever hanger pins.				
4.5	***Bogie to be run out if found necessary during IOH and following should be done:***				
4.5.1	Examine and replace all the brake gear components found deficient / worn out	-	-	-	
4.5.2	Examine and replace primary and secondary suspension components as required	-	-	-	
4.5.3	Examine wheel profile and thickness and gauge if in case they appear to be near condemning limit	-	-	-	
5.0 5.1	**Brake System** ***Air brake system***				
5.1.1	Conduct brake test as per rake test and attend leakages and defective components if any.				

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
5.1.2	Visually inspect for damage on brake pipe, feed pipe and hose coupling.				
5.1.3	Visually inspect suspension bracket for air brake equipement and anti pilferage device for any defect and rectify				
5.1.4	Check passenger alarm by pulling the chain with spring balance with 6.4 kg to 10 kg force	Minimum 3 coaches			
5.1.5	Carry out manual brake release test to ensure proper function of release lever				
5.1.6	Check and adjust brake gear to achieve correct piston stroke				
5.1.7	Service application, release test of every coach of the rake to ensure full brake power				
5.1.8	Carry out guard van valve test to ensure proper functioning of guard van valve.				
5.1.9	Examine slack adjuster for damage and mal functioning and subsequent replacement				

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
5.2	***Vacuum brake System***				
5.2.1	Clean, grease and test alarm chain apparatus under full vacuum with spring balance and cleaning/checking of clappet valve for leakage	minimum 3 coaches			
5.2.2	Test entire vacuum bake system including slack adjuster and DA valve in a prescribed manner for leakage and proper functioning to ensure full brake power.				
5.2.3	Conduct balance vacuum test for whole rake.	-			
5.2.4	Inspect train pipe and hose pipe including their cages, vacuum cylinders, siphon pipes for leakage				
5.2.5	Attention to DA valve	-			
5.2.6	a) Testing of alarm chain apparatus				
	b) Overhauling of alarm chain apparatus	-	-		
5.2.7	Overhaul release valve, replace its diaphragm and sealing washer if necessary	-	-		
5.2.8	Examine neck ring and replace if necessary	-	-		
5.2.9	Test vacuum gauges with master gauges	-	-	-	

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
5.2.10	Testing of cylinder and train pipe joints with exhauster under 510 mm of vacuum	-			
6.0	**Draw gear**				
6.1	Check and replace damage/missing split pins/cotters/rivets				
6.2	Examine draw hook, draw bars, rubber pads for damages				
6.3	Check condition of the screw coupling and its components and replace if required.				
6.4	Ensure that wear on screw coupling shackle pins, trunion pins, shackle/link holes and draw hook holes should not exceed 3mm.	-	-	-	
6.5	Ensure that wear at any section on draw hook should not exceed 10 mm.	-	-	-	
6.6	Check condition of draw beam and locating pins on it				
6.7	Examine visually draft key locking pins				
7.0	**Buffing gear**				
7.1a	Visually examine buffer plungers for damage/drooping/stroke length.				

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
7.1b	Ensure the length is within 584-635 mm	-	-	-	
7.2	Inspect buffer plunger false plate for wear and profile	-	-	-	
7.3	Examine buffer mounting bolts and attend if necessary				
7.4	Examine visually buffer casing for cracks/damages				
8.0	**Running gear**				
8.1	Examine visually axle box for grease oozing out, warm box if any				
8.2	Visually examine wheel tyre profile and thickness of tyre and check with tyre profile gauge if they appear to be near condemning limit				
8.3	Visually inspect axle box covers.				
8.4	Check with wheel distance gauge for loose or tight wheel (IOH)	-	-	-	
8.5	Inspect wheel tread for shattered rim, spread rim, shelled tread, thermal cracks, heat checks				
8.6	Examine axle pulleys on the wheels	-	-	-	

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
9.0	**Seats and berths**				
9.1	Examine middle and upper berth chains				
9.2	Examine the holding/securing brackets for seats and berths and attend if necessary				
9.3	Examine snack tables for damages and rectify if necessary				
9.4	Examine and repair damaged upholstery cushions and curtains				
9.5	Examine reclining mechanism on chair cars for proper functioning and attend if necessary	-			
9.6a	Wooden seats and frames should be cleaned				
9.6b	Disinfect the seats and frames.	-			
9.7	Cushion should be cleaned with duster. Oil or head stain and dirty spots if any should be cleaned with mild soap solutions and wipe dry				
10.0	**Doors**				
10.1	Examine doors for proper functioning and securing with hinge pivots. Doors should not graze with floor or door sill plates				

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
10.2	Examine door locks, latches firmly secured with correct sized screws and properly/smoothly engaging in their slot. The tongue of gravity type latch should be in proper alignment with its slot plate.				
10.3	Visually examine window shutters for smooth working and proper locking				
10.4	Examine visually rolling shutters/sliding doors of vestibule for smooth working				
10.5	Examine compartment sliding doors in AC first and ordinary first class coaches for smooth function				
10.6	Thorough inspection and repair sliding doors in SLR coaches for easy and smooth operation.				
11.0	**Windows**				
11.1	Examine window shutters of non AC coaches for smooth movement in railing to prevent rattling and disengaging of catches on run				
11.2	Window frame on non AC coaches should not be broken and its glass, gauze wire and venetian louver should be in proper condition				

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
11.3	Check window balancing mechanism on non AC coaches for proper function				
11.4	Examine window safety catches for proper engagement in their slots				
11.5	Check lavatory banjo shutters for damage/missing				
11.6	Examine window frame and rubber profile of sealed windows in AC coaches for damages and attend if needed				
11.7	Window bars should be provided and fixed in prescribed manner and replaced if damaged				
11.8	Examine sealed windows of AC coaches, replace broken/damaged glasses				
11.9	Check the availability of emergency exits in AC and Non AC coaches. Examine and attend if necessary.				
12.0	**Flooring**				
12.1	Inspect and attend torn/damaged/cracked PVC flooring	-	-	-	
12.2	Examine and attend opened PVC joints	-	-	-	

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
12.3	Examine Drain holes in trough floor for accumulation of water due to clogging if noticed, inspect affected area for corrosion.	-	-	-	
13.0	**Interior fittings**				
13.1	Examine laminated panels and mouldings for damage /cracks.				
13.2	Visually inspect passenger amenity fittings, replace if found damaged/deficient				
13.3	Examine door closer in AC coaches for proper function				
13.4	Examine tower bolts of back rests in sleeper coaches for proper working				
13.5	Examine visually curtain clothes in AC coaches attend if necessary				
13.6	Examine ventilation grills for damages				
13.7	Examine luggage racks/bunks for breakage				

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Sr. No.	Particulars		Schedule		
		Primary / Secondary examination	**'A'**	**'B'**	**'C'**
	Frequency of Examination	Primary / Secondary Maintenance	1 month ± 3 days	3 months ± 7 days	6 months ± 15 days
	Maintenance to be done at:	On rake	On rake at nominated primary depot	On rake at nominated primary depot	Sick line at nominated primary depot
14.0	**Lavatory and lavatory fittings**				
14.1	Check lavatory hinge door for proper function				
14.2	Examine lavatory door latches/ tower bolts for proper function				
14.3	Examine push cock, flush valve for proper functioning.				
14.4	Check and attend leakage in pipes, fittings and shower roses in lavatory				
14.5	Clean drain grills and drain holes in bath room and wash basin if found choked.				
14.6	Check and replace damaged/ missing mirrors/shelves/ soap dishes				
14.7	Examine squatting pans and foot rest for damages				
14.8	Intensive cleaning of lavatory pans and commode with cleaning agent.	-			
14.9	Thorough flushing of water tanks	-	-		

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Appendix G

IOH FORMAT

COACH NUMBER BASE STATION

TYPE SERVICE

YEAR BUILT MANUFACTURED BY

LAST POH SCHEDULE-A

RETURN DATE SCHEDULE-B

BOGIE DETAILS

	ICV end	NICV end
Bogie No:		
Year Built:		
Manufactured By:		

DATE OF IOH

DATE OF RELEASE

SSE/IOH SE/ JE/ IOH

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BOGIE DETAILS

DESCRIPTION	ICV END	NICV END	REMARKS
Bogie frame condition	Cracked/ Worn out/ good	Cracked/ worn out / good	
Bolster	Cracked/ bent/ good/ renewed	Cracked/ bent/ good/ renewed	
Bolster suspension bracket	Cracked/corroded/good/renewed	Cracked/ corroded/good/renewed	
Lower spring seat	Cracked/ worn out/good/renewed	Cracked/ worn out/good/renewed	
Axle guide	Worn/misalign/good	Worn/misalign/good	
Axle guide cap/ modified/unmodified	Dropped /good/replaced/modified	Dropped/good/replaced/modified	
Axle guide assembly	Worn out/damaged/good/renewed	Worn out/damaged/good/renewed	
Guide bush	Worn out/good/renewed	Worn out/ good/renewed	
Packing rings rubber	Damaged/good/renewed	Damaged/good/renewed	
Protective tubes	Cracked/good/renewed	Cracked/good/renewed	
Equalizing stay	Bent/corooded/good/renewed/13/16 tonnes	Bent/corooded/good/renewed/13/16 tonnes	
Anchor links	Damaged/good/renewed	Damaged/good/renewed	
Bolster suspension hanger block	Gauged/good/renewed	Gauged/good/renewed	
Bolster suspension hanger pin	Gauged/good/renewed	Gauged/good/renewed	
Center pivot	Bolt loose/worn/good/renewed	Bolt loose/worn/good/renewed	
Center pivot silent block	Silent block damaged/renewed/good	Silent block damaged/renewed/good	
Side bearer	Damaged/good	Damaged/good	
Side wearing piece	Gauged/good/worn out/renewed	Gauged/good/worn out/renewed	
Side wearing plate	Gauged/good/worn out/renewed	Gauged/good/worn out/renewed	
Side bearer oil cup	Leaking/good/oil topped up	Leaking/good/oil topped up	
Vertical shock absorber	Damaged/good/renewed	Damaged/good/renewed	
Axle box safety strap	Missing/good/renewed	Missing /good/renewed	
Bolster safety strap	Missing /good/renewed	Missing /good/renewed	
Brake beam safety slings/wire ropes	Missing/worn out/good/renewed	Missing worn out/good/renewed	
Equalising stay safety bracket	Missing/bent/good/renewed	Missing/bent/good/ renewed	

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BOGIE ASSEMBLY-BRAKE GEAR

DESCRIPTION	ICV END BOGIE	NICV END BOGIE	REMARKS
Brake beam	Damaged / bent / good / renewed / 13 tonnes / 16 tonnes	Damaged / bent / good / renewed / 13 tonnes / 16 tonnes	
Brake head	Damaged / good / renewed	Damaged / good / renewed	
Brake hanger	Damaged / good / renewed	Damaged / good / renewed	
Brake blocks	Good / Renewed / Ordinary / composite	Good / Renewed / Ordinary / composite	
Equalizing lever long	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Equalizing lever short	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Equalizing leve r hanger	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Connecting rod	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Actuating rod	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Adjusting link	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Hanger bracket bushes	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Hanger bush	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Brake head bushes	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Collar bushes	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Sleeve bushes	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Equalizing lever bushes	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Pin No: 1	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Pin No: 2	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Pin No: 3	Good / Damaged / worn out / renewed	Good / Damaged / worn out / renewed	
Hand brake	Good / Jammed / Eased	Good / Jammed / Eased	

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VACUUM BRAKE

VACUUM CYLINDER

Position	**Barrel serrations**	**Piston head serrations**	**Piston rod**	**Piston rod guide bush**	**Rolling ring**	**Neck ring**	**Joint ring**	**Balance vac. Brake test**
ICV end	Good/worn out/renewed	Good/worn out/renewed	Good/bent/ renewed	Good/worn out/renewed	Damaged/Good /renewed	Damaged/Good /renewed	Damaged/Good /renewed	Done/ Not done
NICV end	Good/worn out/renewed	Good/worn out/renewed	Good/bent/ renewed	Good/worn out/renewed	Damaged/Good /renewed	Damaged/Good /renewed	Damaged/Good /renewed	Done / Not done

DA VALVES

Position	**O.Ring**	**K.Ring**	**Diaphragm**	**Air admission valve**	**Non return valve**	**Filter**	**Body**	**Bench testing**
ICV end	Good / Renewed	Good / Renewed	Good / Renewed	Good / Renewed	Good / Renewed	Cleaned / Renewed	Damaged / Renewed	Done / Not done
NICV end	Good / Renewed	Good / Renewed	Good / Renewed	Good / Renewed	Good / Renewed	Cleaned / Renewed	Damaged / Renewed	Done / Not done

RELEASE VALVE

Position	**R/Valve diaphragm**	**Seating washer**	**Release valve body**	**Release valve lever & pin**	**Triangular washer**	**Vacuum testing**
ICV end	Good / Reused / Renewed	Good / Reused / Renewed	Good / Reused / Renewed	Good / Reused / Renewed	Good / Reused / Renewed	Done / Not done
NICV end	Good / Reused / Renewed	Good / Reused / Renewed	Good / Reused / Renewed	Good / Reused / Renewed	Good / Reused / Renewed	Done / Not done

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IC VALVE

Spring	Broken / Weak / Good / Renewed
Lid	Missing / Good / Renewed
Washer	Damaged/ Good / Renewed
Step screw	Bent/ Weak / Good / Renewed
Bronze bush	Good / Renewed

BRAKE FITTINGS	**ICV END**	**NICV END**
SAB	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Hose pipes & clips	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Siphon Pipes & clips	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Vacuum reservoir	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Train pipes	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Van Valves	Defective / good / Renewed / tested	Defective / good / Renewed / tested
SAB antivibration bracket	Missing / good / defective / renewed	Missing / good / defective / renewed

AIR BRAKE FITTINGS :

END	ICV END	NICV END
Angle cocks	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Isolating cocks	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Dirt collectors	Defective / good / Renewed / tested	Defective / good / Renewed / tested
P.E.A.V.	Defective / good / Renewed / tested	Defective / good / Renewed / tested
P.E.A.S.D.	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Guard emergency valve	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Drain cocks	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Brake cylinders	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Bogie mounted brake cylinder	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Flexible hoses of BMBC	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Air reservoir	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Distributor valves	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Hose B.P. with palm end	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Hose F.P. with palm end	Defective / good / Renewed / tested	Defective / good / Renewed / tested
Train pipes – B.P. & F.P.	Defective / good / Renewed / tested	Defective / good / Renewed / tested

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BUFFING GEAR / DRAW GEAR

Description	ICV END	**NICV END**
Buffer assembly	Examined / good / renewed	Examined / good / renewed
Buffer bolts	Examined / good / renewed	Examined / good / renewed
Buffer plunger	Examined / good / renewed	Examined / good / renewed
Buffer casing	Examined / good / renewed	Examined / good / renewed
Buffer spindle plug	Missing / good / renewed	Missing / good / renewed
Destruction tube	Damaged / corroded / good	Damaged / good
Draw bar assembly	Examined / good / renewed	Examined / good / renewed
Screw coupling	Damaged / missing / good / renewed	Damaged / missing / good / renewed
Screw coupling suspension hook	Examined / good / renewed	Examined / good / renewed
Draw bar guide	Worn out / good / renewed	Worn out / good / renewed

UNDER FRAME

Head stock	Corroded / cracked / good	Corroded / cracked / good
Trough floor	Corroded / good	Corroded / good
Sole bar	Corroded / good	Corroded / good
Cross members	Corroded / good	Corroded / good
Diagonals	Corroded / good	Corroded / good
Main transom	Corroded / good	Corroded / good
Inner headstock	Corroded / good	Corroded / good
Train pipe and joints	Corroded / good	Corroded / good
Dummy carrier & dummy plug	Missing / good / Renewed	Missing / good / renewed

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CONDITION OF WHEEL & AXLE – ON ARRIVAL

Location	Diameter		Wheel distance	Axle number	Tyre profile	Condition of flange & thickness	
L-1/R-1							
L-2/R-2							
L-3/R-3							
L-4/R-4							

CONDITION OF WHEEL & AXLE ON DESPATCH

Location	Tyre turned / not turned	Wheel dia		Wheel distance	Axle number	UST number	Axle pulley condition	If shop wheel, SL number
L-1/R-1								
L-2/R-2								
L-3/R-3								
L-4/R-4								

ROLLER BEARING PARTICULARS

Axle box Nos.	L1	R1	L2	R2	L3	R3	L4	R4
Make								
Shop code / etching								
Cage open / closed								
Number of rollers								
Condition of locking plate								
Condition of grease								
Axle Box sealing ring								
Torque value applied								
Type of grease topped up								
Quantity of grease used								

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DIMENSION – ON ARRIVAL

Description	L-1		**R-1**		**L-2**		**R-2**	
Buffer height								
"A" dimension								
'B" dimension								
Table height								

DIMENSION - AFTER IOH

Description	**L-1**		**R-1**		**L-2**		**R-2**	
Buffer height								
"A" dimension								
"B" dimension								
Table height								

CONDITION OF AXLE SPRINGS – ARRIVAL

Axle springs	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Left	Broken / good	Broken / good	Broken / good	Broken / good	Broken / good	Broken / good	Broken / good	Broken / good
Right	Broken / good	Broken / good	Broken / good	Broken / good	Broken / good	Broken / good	Broken / good	Broken / good

CONDITION OF AXLE SPRINGS – AFTER IOH

Axle spring height	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**
Left								
Right								

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CONDITION OF BOLSTER SPRINGS - ARRIVAL

Bolster springs	**1**	**2**	**3**	**4**
Left	Broken / good	Broken / good	Broken / good	Broken / good
Right	Broken / good	Broken / good	Broken / good	Broken / good

CONDITION OF BOLSTER SPRINGS – AFTER IOH

Bolster spring height	**1**	**2**	**3**	**4**
Left				
Right				

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AMENITY FITTINGS

Items		Remarks
Mirrors	Missing / damaged / good / renewed	
Mirror shelves	Missing / damaged / good / renewed	
Commodes	Missing / damaged / good / renewed	
Squatting pans	Missing / damaged / good / renewed	
Commode seat & lid	Missing / damaged / good / renewed	
Commode chute	Missing / damaged / good / renewed	
Push cocks	Missing / damaged / good / renewed	
Flushing valves	Missing / damaged / good / renewed	
Turn over latches	Missing / damaged / good / renewed	
Tower bolts	Missing / damaged / good / renewed	
Shower rose	Missing / damaged / good / renewed	
Coat hooks	Missing / damaged / good / renewed	
Glass shutters	Missing / damaged / good / renewed	
Louver shutters	Missing / damaged / good / renewed	
Banjo shutter	Missing / damaged / good / renewed	
Safety latches	Missing / damaged / good / renewed	
Window bars	Missing / damaged / good / renewed	
Main door handles & latches	Missing / damaged / good / renewed	
Berths / back rest / seats	Missing / damaged / good / renewed	
Cushions	Missing / damaged / good / renewed	
Rexene	Missing / damaged / good / renewed	
Vestibules-UIC / conventional	Missing / damaged / good / renewed	
Vestibule fall plates	Missing / damaged / good / renewed	
Vestibule Door locking / latches	Missing / damaged / good / renewed	
Condition of exterior paint	Good / Shabby / Washed / Repainted	
Condition of interior painting	Good / Shabby / Washed / Repainted	
End body & roof painting	Good / Shabby / Washed / Repainted	
Emergency exit window	Not available/Available/Good	

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PROFORMA FOR SINGLE CAR TEST

COACH NO. TYPE OF DV AND SL.NO: BP PRESSURE: FP PRESSURE:

S.No.	Check	Specified	Actual
1.	Leakage rate		
	a) Brake pipe	0.2 Kg/cm^2 per minute (max.)	
	b) Feed pipe	0.2 Kg/cm^2 per minute (max.)	
2.	a) Brake cylinder filling time (from 0 to 3.6 kg/cm^2)	3 to 5 seconds	
	b) Maximum Brake cylinder pressure	3.8 $\pm$ 0.1 Kg/cm^2	
3.	Brake cylinder release time (3.8 to 0.4 Kg/cm^2)	15 to 20 seconds	
4.	Sensitivity & Insensitivity		
	a) Brake application when brake pressure is reduced at the rate of 0.6 Kg/cm^2 in 6 seconds	Brake should apply	
	b) Brake application when brake pressure is reduced at the rate of 0.3 Kg/cm^2 in 60 seconds	Brake should not apply	
5.	Emergency brake application and release		
	a) Maximum brake cylinder pressure	3.8 $\pm$ 0.1Kg/cm^2	
	b) Manual release of brake cylinder after emergency application	Brake cylinder should get fully released	
6.	Graduated application and release		
	a) Application	Brake pipe pressure decreases in steps and Brake cylinder pressure builds up in steps	
	b) Leakage in Brake cylinder pressure in 5 minutes after emergency application	0.1 Kg/cm^2 within 5 minutes	
	c) Release	Brake pipe pressure increases in steps and Brake cylinder pressure reduces in steps	
7.	Piston stroke	90$\pm$10mm	

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S.No.	Check	Specified	Actual
8.	Passenger alarm system		
	a) Pull handle	(1) Air to exhaust from PEAV. (2) Brake should apply (3) Coach indication light should glow	
	b) Reset PEASD	Exhaust of air should stop and indication light should extinguish	
9.	Guard's emergency valve test		
	a) Pull valve handle	(1) Brake pipe air to exhaust. (2) Brake should apply	
	b) Normalise the handle	Air exhaust to stop	
	c) Testing of Brake pipe and Feed pipe in guard's compartment	Gauges should register variation in Brake pipe and Feed pipe.	
10.	Dirt collector	Cleaned / Renewed	

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सत्यमेव जयते

(Govt. of India)
(Ministry of Railways)

1st to 10th correction slip for Maintenance manual for BG coaches of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/cs-1to cs-10/2014

2014

C*entre*
for
A*dvanced*
M*aintenance*
TECH*nology*

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Excellence in Maintenance

MAHARAJPUR, GWALIOR--474020

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सत्यमेव जयते

(Govt. of India)
(Ministry of Railways)

1st correction slip for Maintenance manual for BG coaches of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/1.0/CS-01(07/2006)

July – 2006

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Maintenance manual for B.G. coaches of ICF design (Ist Correction slip)

The Ist correction slip for Maintenance Manual for B.G. Coaches of ICF design is being issued. The corrections/modifications are based on the following:-

1. Report of the Manual Review Committee for Coach Manual March -05 (Approved by Railway Board vide letter No. 2001/M(safety)/7/6/RSRC/Pt II Dt: 06.09.2005

2. RDSO's letter No. MC/CB/MM/Dt: 28/29.12.2005

3. RDSO's letter No. MC/CB/correction Dt: 19.07.2006

4. RDSO's letter No. MC/CB/general Dt: 19.07.2006

Kundan Kumar
Director (Mech)/CAMTECH

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Maintenance manual for Wagon (Ist Correction slip)

The Ist correction slip for Maintenance Manual for Wagon is being issued. The corrections/modifications are based on the following:-

1. Report of the Manual Review Committee for Wagon Manual March -05 (Approved by Railway Board vide letter No. 2001/M(safety)/7/6/RSRC/Pt II Dt: 06.09.2005

Kundan Kumar
Director (Mech)/CAMTECH

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(144)

INDIAN RAILWAYS

CENTRE FOR ADVANCED MAINTENANCE TECHNOLOGY

MAHARAJPUR, GWALIOR, M.P. 474 020

Ph 0751-2470803, Fax – 0751 – 2470841

No.CAMTECH.M.WMM.Rev. Dt.07-08-06

All CMEs
Indian Railway

Kind Attention- Mr. Adarsh Khare.

Sub.: 1st correction slip to CAMTECH, Coaching and Wagon manual
Ref.: Rly.Bd.'s letter no.2001/M(safety)7/6/RSRC/Pt.-II dated 6-9-2005

As a follow up action to the recommendations of Railway Safety Review Committee, Railway Board vide letter no.2001/M(safety)/7/6/Pt.II dtd.03-11-03 and 19-02-04 nominated a committee to review the Mechanical manuals. The committee consisting of members from IRIMEE, RDSO, N.Rly. and IRCA reviewed the following Mechanical manuals:

1. CAMTECH Coaching manual
2. CAMTECH Wagon manual
3. IRCA –Part III
4. IRCA- Part IV

In March 05, the manual review committee submitted its report to Railway Board.

Based on the report of the manual review committee and its approval by Railway Board vide letter no. 2001/M(safety)7/6/RSRC/Pt.-II dated 6-9-05, the first correction slip to CAMTECH Coaching and Wagon Manuals has been prepared. 05 copies each of the same are being sent to you.

ED/CAMTECH

Copy : EDME | Coaching
Rly board

Rajiv Maruf
11/08/06

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Correction/Modification in CAMTECH Coaching Manual

<table>
<tr><th>Sr. No</th><th>CAMTECH MANUAL REF.</th><th>EXISTING INSTUCTIONS</th><th>MODIFIED/CORRECTED INSTRUCTIONS</th><th>REMARKS</th></tr>
<tr><td>1.</td><td>Ch 1 Pg 1
Para 103
(Hindi)</td><td>2 lakhs kms</td><td>2.5 lakhs kms</td><td>In English version is 2.5 lakhs kms</td></tr>
<tr><td>2</td><td>Ch 1 Pg 2
Para 105 b (iii)</td><td>Brake pull rod from bogie brake rigging</td><td>Brake pull rod from bogie brake rigging in case of under frame mounted cylinder AB system</td><td>To add</td></tr>
<tr><td>3.</td><td>Ch 1 Pg 5
Para 106 (d)
Note (i)</td><td>minimum shop issue size of solid wheel is 836 mm</td><td>minimum shop issue size of solid wheel is 837 mm</td><td>(1) Ch 10 Pg 3 Table 10.1 is also modified
(2) RB L no. 92/M (c)/137/2 (part iii) Dt: 03.03</td></tr>
<tr><td>4.</td><td>Ch 1 Pg 5</td><td>Table No. 1.7 (Existing)</td><td>Revised Table 1.7
<table>
<tr><th>Type of Coach</th><th>Crown Clearance mm</th></tr>
<tr><td>GS, SCN, WCB, WGSRJ, WGSCZJ</td><td>45 ± 3</td></tr>
<tr><td>SLR, SDC</td><td>48 ± 3</td></tr>
<tr><td>WFAC, WACCW, WCBAC</td><td>25 ± 3</td></tr>
<tr><td>WACCN</td><td>34 ± 3</td></tr>
<tr><td>WGFAC, WGACCW, WGACCN, WGSCZAC, WGFSCZAC, WGFACCW, WGSCZACJ</td><td>36 ± 3</td></tr>
</table></td><td></td></tr>
<tr><td>5.</td><td>Ch 1 Pg 13
Table No. 1.6
column 1</td><td>Type of coaches – AC/GS/SOC/SCN</td><td>Type of coaches – Non AC/GS/SDC/SCN</td><td>Printing error</td></tr>
</table>

Sr. No	CAMTECH MANUAL REF.	EXISTING INSTUCTIONS	MODIFIED/CORRECTED INSTRUCTIONS	REMARKS
6.	Ch 1 Pg 16 Fig 1.6	598 mm, 286 mm & 96R	125 mm, 60 mm & 20R	**Ref:** WR/Drg.C/SK
7.	Ch 1 Pg 17 Table no.1.8 Sr no. 3 (a) Column no. 4	'At both the ends'	'At primary end'	**Ref:** RPC 4 RB letter No. 95/MC/141/1 Dt. 29.10.01
8.	Ch 1 Pg 18 Sr no. 4 Column no.4	7 days	4 days	**Ref:** RPC 4 RB letter No. 95/MC/141/1 Dt. 29.10.01
9.	Ch 1 Pg 18 Sr no. 4 Column no.8	Last column is blank	To add:- 'only continuity check if stabled at platform, otherwise brake power check with endorsement on original BPC'	**Ref:-** RPC- 4
10.	Ch 1 Pg 20 Para no. 109 d (ix)	In AC Coaches	In 1ST AC Coaches	
11.	Ch 1 Pg 21 Para no. 110 b (ii)	Only enhanced capacity draw gear and screw coupling to RDSO sketch No. 79061 and 79067 are to be provided on the rake	Material for the draw gear and screw coupling components upgraded to IS 5517-93 Grade 35 Mn 6M03 to enhance the proof load to 75 t (both) and a breaking load of 130 t (both). Relevant/revised drawings shown in table on Ch 9 Pg no 1 Para no 901 a (i)	This correction is as per para 901 (a) (i) Ch 9 page 1
12.	Ch 1 Pg 22 Para no. 111a (vi)	IRCA rule 2.2.4 should be followed	IRCA rule 2.3.4 should be followed	
13.	Ch 1 Pg 27 table no. 1.9 Sr. no. 5	Warranty period for shock absorber is 15 months from the date of delivery or 12 months from date of fitment which ever is earlier	Warranty period is 4 Lakhs Km or 2 Years from the date of fitment which ever is earlier	RDSO specn. C- 8703 Rev. 1 para 8.1
14.	Ch 1 Pg 29 Table no 1.10 row no 2 column no 3	Max - 95 mm (For BMBC)	Max - 32 mm (For BMBC)	**Ref:** STR for BMBC C-K013Nov. 2000 pg no. 8
15.	Ch 1 Pg 31 Para no 115 b Sub Para 3 (iii)	Other assembly maintenance 'Painting of lavatories from inside'	Deleted	Since LP Sheet is provided in lavatories painting is not required

Sr. No	CAMTECH MANUAL REF.	EXISTING INSTUCTIONS	MODIFIED/CORRECTED INSTRUCTIONS	REMARKS
16.	Ch 1 Pg 35 9 A (i)	Total no of brake/Vac/ Cylinder	Total no of brake/Vac. Cylinder	Printing error
17.	Ch 1 Pg 35 9 A (i)	No. of operative brake Vac. Cylinder	No. of operative brake / Vac.Cylinder	Printing error
18.	Ch 1 Pg 37 Annexure 1.2 column 3	Ash tray	Deleted.	Since ash trays are not being provided now
19.	Ch 2 Pg 5 Para no 202 d (vi) sub Para 3	"magnesium oxy chloride or"	Deleted.	obsolete
20.	Ch 3 Pg 9 table no. 3.3 Sr no 7 & 10	HIG AC3-3-2-302 (Sr. no. 7) T3-2-048 (Sr. no. 10)	WTAC3-3-2-302 (Sr. no. 7) T3-2-648 (Sr. no. 10)	
21.	Ch 3 Pg 9 Table no. 3.4 Sr. no. 11& 12	T3-2-048 T3-2-048	T3-2-648 T3-2-648	
22.	Ch 3 Pg 9 Table no.3.3 & 3.4	Quantity of bogie components shown per bogie	Table No. 3.3 & 3.4 shown quantity of bogie component per coach	**Ref:** Drg: no. T-3-2-801
23.	Ch 3 Pg 12 Table no.3.5 & 3.6	Quantity of bogie components shown per bogie	Table No. 3.5 & 3.6 shown quantity of bogie component per coach	**Ref:** Drg: no. T-3-2-801
24.	Ch 3 Pg 12 Table no. 3.5	Quantity of Long lever mentioned as 8 Nos. per coach	Actual Quantity of Long lever is only 4	
25.	Ch 3 Pg 12 Table No. 3.5 Sr. no. 11	ICF/ISD 3 -2-003	ICF/**STD** 3-2-003	
26.	Ch 3 Pg 12 Table No. 3.6 Sr. no. 16	WFT AC3/3-2-307	WTAC3 -3-2-302	
27.	Ch 3 Pg 16 Fig. No. 3.13	RDSO Sketch SK-88105	RDSO Sketch SK-88105 Alt. 3	Revised as per latest drg.
28.	Ch 3 Pg 17 Fig no 3.14 Column 1 Row no 4	38.4	38	

Sr. No	CAMTECH MANUAL REF.	EXISTING INSTUCTIONS	MODIFIED/CORRECTED INSTRUCTIONS	REMARKS
29.	Ch 3 Pg 18 Table no 3.7 Row 9 Column 2&3	870±1.0 mm	876±1.0 mm	**Ref:** Drg: no. T-0-3-601
30.	Ch 3 Pg 24 Para 316 e (ii)	----------	**To add**:- the silent block in anchor link is a must change item during the POH	
31.	Ch 3 Pg 26 Para 316 I (i)	2B electrodes	B2 electrodes	**Ref:** RDSO M&C/W/V Dt. 24.05.04
32.	Ch 3 Pg 26 Para 317 (iii)	2 minutes	½ minutes	**Ref:** RDSO tech pamphlet C 8419 Rev. 1 para 3.2
33.	Ch 3 Pg 26 Para 317 (vi)	"Each spring may be tested for other deflection/loads indicated in drg. And the spring characteristics plotted. The spring should be replaced if its characteristics are not within specified limits"	deleted	To be deleted As for manufacturer only
34.	Ch 3 Pg 28 Para 317 v & vi	v & vi	vii & viii	Printing error
35.	Ch 3 Pg 29 Para 319 c (i)	Ensure that bolster springs with height (under test load) variation within 2 mm are selected in the same group of springs for each bogie assembly.	For pairing spring should be selected from the same group as per table 3.17	Para 319 c (i) to be corrected as per para 317 (viii)
36.	Ch 4 Pg 9 Para 409 i (iv) Sub Para 6	0.1 Kg/cm^2 in **10** minutes.	0.1 Kg/cm^2 in **5.0** minutes.	
37.	Ch 4 Pg 33 Fig 4.20	Φ 4	Φ 8	RDSO instruction March 2003 10th CMG, item A3
38.	Ch 4 Pg 33 Para 420	BP pressure to exhaust through the **4** mm choke in the PEAV.	BP pressure to exhaust through the **8** mm choke in the PEAV	

Sr. No	CAMTECH MANUAL REF.	EXISTING INSTUCTIONS	MODIFIED/CORRECTED INSTRUCTIONS	REMARKS
39.	Ch 4 Pg 47 Annexure 4.4 Para 5 Sr. no. 7	80 to 130 mm	85±10 mm	Brake cylinder piston stroke 85±10 mm is correct. As per RDSO letter Jan 05 brake rigging ratio modified to 1.13.1 piston stroke for modified ratio is 60±10 mm 2. Appendix G Sr. no. 7 also modified
40.	Ch 5 Pg 4 Para 503j (ii)	6.4 Kgs	7.0 Kgs	IRCA rule 2.12.1.6. para 26 C 4 (e) page no. 104
41.	Ch 9 Pg 4 Table no. 9.6 Row 2 Column 3	12 mm	6 mm	**Ref:-** Drg: no T-2-1-602, thickness of new wearing piece is 12 mm and permissible wear is 6 mm
42.	Ch 9 Pg 4 Table no. 9.7 row no. 6 column 4	49 mm flat	Use of 2 mm hard, chrome plated rod for checking wear between trunnion and bent link hole in assembled condition	Since trunnion and bent link cannot be dismantled during POH 2 mm chrome plated wire is suggested
43.	Ch 9 Pg 5 Para 901 Sub Para 4	**196** mm length of pack	**193** mm length of pack	RDSO CMI 9901(Rev. 1)
44.	Ch 9 Pg 5 Table no 9.8 row 5 column 2	Drawing no. for rubber pads mentioned as SK 96002 and STR No. C-9501 (Rev.-2)	Drawing no. for rubber pads is changed to SK- K2048 and STR No.C-K210 (Rev.-3)	Also corrected the Appendix C Sr .no. 62

Sr. No	CAMTECH MANUAL REF.	EXISTING INSTUCTIONS	MODIFIED/CORRECTED INSTRUCTIONS	REMARKS
45.	Ch 9 Pg 7 Para 902 b (viii)	Projection of buffer from head should be 600 to 635 mm	Buffer stroke given as 127+0/-5 mm	Projection of buffer may be checked in terms of buffer stroke length instead of overall length of buffer assembly. Further the stroke length 127+0/-5 given in RDSO Drg: no. SK 98145 is for new assembly. Hence for POH suitable buffer stroke length may be mentioned instead of maintaining overall length of 600 to 635 mm.
46.	Ch 10 Pg. 10 Fig 10.4 Note no. 1.	The coaches to run at max.----- Kmph and above.	The coaches to run at max. **110** Kmph and above.	Max. operating speed was missing.
47.	Ch 11 Pg 1 to 5 Table 11.1 & 11.2 (Both Hindi & English)	----------	Existing table is deleted, Modified table is given at Annexure-II (English) Annexure-III (Hindi)	
48.	Ch 11 Pg 13 Para 1106 a row 2 column 3	Foam rubber cushion to IS: 1741/60 Gr. "B"	PU foam to RDSO spec. No. C-8914 (Rev.1)/ Densified thermal bonded polyester blocks to RDSO spec. No. C-K607	
49.	Appendix (A to D)	----------	Existing Appendix (A to D) deleted, Modified Appendix is given at Annexure V	

Sr. No	CAMTECH MANUAL REF.	EXISTING INSTUCTIONS	MODIFIED/CORRECTED INSTRUCTIONS	REMARKS
50.	Appendix G Sr. No. 7	Piston Stroke - 90±10 mm	Piston Stroke - 85±10 mm	Brake cylinder piston stroke 85±10 mm is correct. As per RDSO letter Jan 05 brake rigging ratio modified to 1.13.1 piston stroke for modified ratio is 60±10 mm
51.	**New Addition** (i) Repair of water tanks (ii) Depot facilities required in coaching depots		(i) Annexure – I (ii) Annexure - IV	

Annexure-I

Write up on repairs of water tanks. This may be added to CAMTECH manual

Overhead tanks

1. All overhead tanks should be removed in every third POH for testing and repairs. The inspection joint should be opened, the tanks de-scaled, thoroughly cleaned and all rubber and flexible pipes renewed. The tank and joints should be given pressure test at 0.35 Kg/cm^2gauge pressure. Corroded and bulged panels should be cut out and replaced. If this is not workable, the tank should be condemned and replaced. After the hydraulic test, the inside of the tank should be painted with bituminous black lead-free acid, alkali, water and heat resistant paint, free from CNSL and BNSL, to IS 158/1968 Type 2 and properly dried before fitment.

2. During other POH, panels under the tanks and the top panels of the partition should be removed for inspection of tanks, joints and holding bolts in position. Tanks should be filled with water and all joints checked for leaks. The holding bolts of the roof tanks should be checked for tightness and corrosion. Bolts with worn out, damaged or corroded threads should be replaced. The flexible hose couplings between the water pipes and the tanks should be replaced in every POH.

3. The tank foundation frames should be painted with anti-corrosive paint after cleaning it free of dust and corrosion.

4. The repaired tanks should then be fitted back in position using new holding bolts and nuts, which should be galvanized before use.

5. All distorted, deficient or broken covers of roof and side water filling caps should be replaced. Wherever not available, side water filling arrangement should be provided. The tank should be flushed and all loose scales, dirt, etc cleaned before plumbing work in taken in hand.

Annexure-II

Table No. 11.1

This existing table should be treated as cancelled and the corrected/modified table is given below:

SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES									
Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	Sleeper	Day coach	General	Double Decker
1) Depth of faces of partition to the edge of:									
I. Seat (for seating purpose)	785	616 Long 665 Trans	635	680	785	618 Long 610 Trans	592	607 T 495 L	505
II. Berth (for sleeping purpose)	785	616 Long 665 Trans	600 Long 635 Trans	NA	785	618 Long 610 Trans	NA	NA	NA
2) Length									
I. Berth	2010	1831	1810	NA	2010	1833	NA	1800	NA
3) Hip width for passenger	610	550	550	450	610	490	415	504	450
4**) Height clearance for seat / berth**									
I. Clear space below seats	265	340	305	--	340	340	340	340	--
II. Height of top of seat from floor	405	420	420	405	405	420	405	405	405
III. Clear space between top of seat and bottom of upper berth bunk	900	957	675	NA	900	675	NA	900	NA

SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES									
Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	Sleeper	Day coach	General	Double Decker
5) Corridor width	700	590	600	435	700	590	550	565	570
6) Bay width									
I. Four berths/ general component	2312	1896	1836	NA	2312	1800	1702	1702	1575
II. Coupe single row	1600	-	-	NA	1500	-	-	-	-
III. Pitching of chairs	NA	NA	-	1020	NA	NA	NA	NA	NA
7) Knee room									
I. Four berther	710	540	540	NA	710	554	518	488	535
II. Coupe	710	-	NA	NA	710	-	-	-	-
8) Lavatory									
I. In side area in Sq. metre	1.6	1.56	1.1	1.1	1.6	1.1	1.4	1.5	1.59
II. Max. No. of passengers per lavatory	6	12	16	18	09	18	27	23	36
9) Body side door									
I. Max. No. of passengers per door a side	12	23	32	36	18	36	36	30	72

SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES									
Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	Sleeper	Day coach	General	Double Decker
10) Electrical requirement									
A- Lighting									
i) Minimum lux at horizontal plane 840 mm above floor level									
a) Compartment	40	40	40	40	40	30	30	30	30
b) Lavatory	16	16	16	16	16	11	11	11	11
c) Corridor	16	16	16	16	16	11	11	11	11
ii) Individual switches for ceiling light	Yes	Yes	Yes	No	Yes	Yes	No	No	No
iii) Berth reading light with switches	Yes	Yes	No	No	Yes	No	No	No	No
iv) Night light	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
v) Individual switch for night light	Yes	Yes	Yes	No	Yes	Yes	No	No	No
vi) Toilet engage light	Yes	Yes	Yes	Yes	No	No	No	No	No
vii) Toilet engage sign	No	No	No	No	No	No	No	No	No
viii) Socket out let 110V	No	No	No	No	No	No	No	No	No
ix) Call bell push button	Yes	No	No	No	No	No	No	No	No
x) Plug point & switch for 110V for Lap top & mobile	Yes	Yes	Yes	Yes	Yes	No	No	No	No

SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES									
Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	sleeper	Day coach	General	Double Decker
B. Fannage									
i) No of fans									
a) Compartment	One for two berths	One per bay	One per bay	One for two row	One per bert h	3 per bay	3 per bay	3 per bay	3 per bay
b) Lavatory	One per lav.	One per lav.	One per lav.	One per lav.	No	No	No	No	No
ii) Size/type of fan									
a) Compartment (Swivelling = S) (Fixed = F)	400 mm (S)	300 mm (F)	300 mm (F)	400 mm (F)	400 mm (S)	400 mm (F)	400 mm (F)	400 mm (F)	400 mm (S)
b) lavatory	200 mm (F)	200 mm (F)	200 mm (F)	200 mm (F)	No	No	No	No	No
c) Regulator for fans	Yes	No	No	No	Yes	No	No	No	No
d) On/Off switch for fans	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes
11) Compartment and doorway fittings									
a) Cushioned seats and back rests	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
b) Cushioned berths	Yes	Yes	Yes	NA	Yes	Yes	NA	NA	NA
c) Longitudinal luggage racks i) Light (L) ii) Sturdy (S)	L	L	L	S	L	No	S	S	L
d) Folding or fixed table	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
e) Roof ventilators									
i) Compartment	No	No	No	No	Yes	Yes	Yes	Yes	Yes
ii) Doorway	No	No	No	No	Yes	Yes	Yes	Yes	Yes
f) Bottle holder	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No

SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES									
Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	sleeper	Day coach	General	Double Decker
g) Waste paper basket dust bin									
i)Compartment	Yes	No	No	No	No	No	No	No	No
ii) Door way	Yes	Yes	Yes	Yes	No	No	No	No	No
h) Foot rest	No	No	No	Yes	No	No	No	No	No
i) Notices	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
j) Mirror with shelf									
i) Compartment	Yes	Yes	Yes	No	Yes	Yes	No	No	No
ii) Doorway	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
k) Coat hook	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
l) Foot steps	Yes	Yes	Yes	NA	Yes	Yes	No	NA	No
m) Magazine pouch	Yes	Yes	Yes	Yes	Yes	Yes	No	No	No
n) Wash basin									
i) Compartment	Yes	No	No	No	No	No	No	No	No
ii) Door way	No	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes
o) Ward robe with fixed hangers	Yes	No	No	No	No	No	No	No	No
p) Water cooler	Yes	No	No	Yes	No	No	No	No	No
q) Drinking water with container	Yes	No	No	No	No	No	No	No	No
r) Thali rack	No.	Yes	No.	No.	No.	No.	No.	No.	No.
s) Linen room	Yes	Yes	Yes	No	No	No	No	No	No
t) Rings below berths for securing luggage	No	Yes	Yes	No	Yes	Yes	No	No	No
12) Lavatory fittings									
a) Shower bath	Yes	No	No	No	Yes	No	No	No	No
b) Wash basin	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES									
Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	sleeper	Day coach	General	Double Decker
c) Towel rail	Yes	Yes	Yes	Yes	No	No	No	No	No
d)Flushing commode	Three	One	One	One	One	One	Nil	Nil	Nil
e) Flushing pan	One	Three	Three	Three	Three	Three	all	all	all
f) Push cock for lotah filler	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
g) Commode rail	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
h) Mirror shelf	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
i) Bottle opener	Yes	No	No	No	No	No	No	No	No
j) Coat hook	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
k) Soap dish (SD), Liquid soap container (LC)	Both	LC	LC	LC	SD	SD	SD	SD	SD
l) Lavatory chutes should be slanting so that ground is not visible from inside and lavatory discharge does not fall on rails and track fasteners.									
m) Inter communication Inter communication doors shall be provided between the two classes of accommodation in a composite coach.									
13) External fittings									
a) Reservation display plates	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
b) Destination board	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
c) No. plates on mail & express trains only	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	yes

Table 11.2

This existing table should be treated as cancelled and the corrected/modified table is given below:

Safety requirements SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES									
Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	sleeper	Day coach	General	Double Decker
a) Alarm pull No. of per	-	-	-	-	-	-	-	-	-
i) Compartment	1 Per 2 berth 2 per 4 Berth	1 Per Bay	1 Per Bay	6 Total	1 Per 2 berth 2 per 4 Berth	1 per Bay	6 Total	6 Total	One
ii)Lavatory									
iii) Corridor	2				2				
b) Internal latches at top and bottom on body side doors	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
c) Provision of pad locking arrangement from outside on one body side door	Yes	Yes	Yes	Yes	Yes	Yes	NA	NA	NA
d) Internal latch and shout bolts with notched stopper and outside pad locking arrangement for compartment sliding door	Yes	NA	NA	NA	Yes	NA	NA	NA	NA

Safety requirements									
SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES									
Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	sleeper	Day coach	General	Double Decker
e) Throw over latch and Pad Locking arrangement for sliding of vestibule	NA	Yes	Yes	NA	Yes	Yes	No	No	No
f) Shout bolts and sliding door bolts for swing doors and pad locking for rolling shutters of vestibules	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	No
g) Latches for windows shutters of body side doors and partition walls	No	No	No	No	Yes	Yes	Yes	Yes	Yes
h) Fire extinguishers	2	2	2	2	No	No	No	No	No
i) Safety bars on all window opening	No	No	No	No	Except four	Except four	Except four	Except four	Yes
j) Windows shutters									
i) Glass shutters	No	No	No	No	Yes	Yes	Yes	Yes	Yes

Safety requirements									
SCHEDULE OF PASSENGER AMENITY FITTINGS FOR BG COACHES									
Description	Air conditioned coaches				Non Air conditioned coaches				
	First class	2Tier sleeper	3Tier sleeper	Chair car	First class	sleeper	Day coach	General	Double Decker
ii) Louvre shutters	No	No	No	No	Yes	Yes	Yes	Yes	No
iii) Louvre cum gauge shutters	No	No	No	No	Yes	No	No	No	No
iv) Frosted single glass sealed window	Yes	Yes	Yes	Yes	No	No	No	No	No
v) Louvre cum Frosted glass liftable type shutters	No	No	No	No	Yes	Yes	Yes	Yes	Yes
vi) provision of emergency openable window	yes	yes	yes	yes	yes	yes	yes	yes	yes

Annexure III

टेबुल–11.1

वर्तमान टेबुल निरस्त की जाती है संशोधित टेबुल निम्नलिखित है।

बीजी कोच में यात्री सुविधाओं के लिये की गई फिटिंग की अनुसूची									
विवरण	वातानुकूलित कोच				वातानुकूलन रहित कोच				
	प्रथम श्रेणी	2 टीयर स्लीपर	3 टीयर स्लीपर	चेयर कार	प्रथम श्रेणी	स्लीपर	डे कोच	सामान्य	डबल डेकर
1. किनारे से पार्टीसन के फेस की गहराई									
I. सीट (बैठने के लिये)	785	616 लम्बाई 665 विकर्ण	635	680	785	618 लम्बाई 610 विकर्ण	592	607	505
II. वर्थ (सोने के लिये)	785	616 लम्बाई 665 विकर्ण	600 लम्बाई 635 विकर्ण	नहीं	785	618 लम्बाई 610 विकर्ण	नहीं	नहीं	नहीं
2. लम्बाई									
I. बर्थ	2010	1831	1810	नहीं	2010	1833	नहीं	1800	नहीं
3. सवारी बैठने के लिये आवश्यक स्थान	610	550	550	450	610	490	415	504	450
4. स्पष्ट ऊचाई सीट/वर्थ के लिये									
I.सीट के नीचे निश्चित स्थान	265	340	305	–	340	340	340	340	–
II. फर्स से सीट के ऊपरी तल की ऊंचाई	405	420	420	405	405	420	405	405	405
III. सीट के ऊपरी तल से ऊपर की बर्थ के बेक तक का स्थान	900	957	675	नहीं	900	675	नहीं	–	नहीं
5. कोरीडोर की चौड़ाई	700	590	600	435	700	590	550	565	570
6. रास्ते की चौड़ाई									
I.चार बर्थ/सामान्य कम्पार्टमेण्ट	2312	1896	1836	एन ए	2312	1800	1702	1702	1575

बीजी कोच में यात्री सुविधाओं के लिये की गई फिटिंग की अनुसूची									
विवरण	वातानुकूलित कोच				वातानुकूलन रहित कोच				
	प्रथम श्रेणी	2 टीयर स्लीपर	3 टीयर स्लीपर	चेयर कार	प्रथम श्रेणी	स्लीपर	डे कोच	सामान्य	डबल डेकर
II. कूप एकल पंक्ति	1600	–	–	एन ए	1500	एन ए	–	–	–

III. चेयर्स की पिचिंग	एन.ए	एन.ए	–	1020	एन ए	एन ए	एन ए	एन ए	एन ए
7. घुटनों के लिये स्थान									
I- चार बर्थ वाला कूपा	710	540	540	एन ए	710	554	518	488	535
II. कूपा	710	एन ए	एन ए	एन ए	710	एन ए	एन ए	एन ए	एन ए
8. शौचालय									
I. अन्दर का क्षेत्रफल वर्ग मीटर में	1.6	1.56	1.1	1.1	1.6	1.1	1.4	1.5	1.59
II.- प्रति शौचालय यात्रियों की अधिकतम संख्या	6	12	16	18	9	18	27	23	36
9. बोडी साइड डोर									
I. प्रति दरवाजा यात्रियों की अधिकतम संख्या	12	23	32	36	18	36	36	30	72
10.बिजली की आवष्यकता									
ए– प्रकाश संबंधी									
i) फर्स तल से 840 एमएम ऊंचाई पर क्षैतिज तल पर न्यनतम लक्स									
a) कम्पार्टमेण्ट	40	40	40	40	40	30	30	30	30
b) शौचालय	16	16	16	16	16	11	11	11	11
c) कोरीडोर	16	16	16	16	16	11	.	.	.
ii) छत की लाइट के लिये प्रथक स्विच	हॉ	हॉ	हॉ	नहीं	हॉ	हॉ	नहीं	नहीं	नही

बीजी कोच में यात्री सुविधाओं के लिये की गई फिटिंग की अनुसूची

विवरण	वातानुकूलित कोच				वातानुकूलन रहित कोच				
	प्रथम श्रेणी	2 टीयर स्लीपर	3 टीयर स्लीपर	चेयर कार	प्रथम श्रेणी	स्लीपर	डे कोच	सामान्य	डबल डेकर
iii) स्विच सहित बर्थ रीडिंग लाइट	हॉ	हॉ	नही	नहीं	हॉ	नहीं	नहीं	नहीं	नहीं
iv) नाइट लाइट	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	न्हीं
v) नाइट लाइट के लिये प्रथक स्विच	हॉ	हॉ	हॉ	नहीं	हॉ	हॉ	नहीं	नहीं	नहीं
vi) शौचालय भरे होने की लाइट	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं	नहीं	नहीं

vii) शौचालय भरे होने का संकेत	नहीं	नहीं	नही	नहीं	नहीं	नहीं	नहीं	नहीं	नहीं
viii) आउटलेट का 110 वोल्ट का सॉकेट	नहीं	नहीं	न्हीं	नहीं	नहीं	नहीं	नहीं	नहीं	नहीं
ix) काल वैल पुश बटन	हॉ	नहीं	न्हीं	नहीं	नहीं	नहीं	नहीं	नहीं	नहीं
x) लेपटाप 110 वोल्ट प्वांट	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं	नहीं
i) पंखों की संख्या									
ए. कम्पार्टमेंट	दो बर्थ के लिये एक	एक प्रति गली	एक प्रति गली	दो में एक	एक प्रति बर्थ	3 प्रति गली	3 प्रति गली	3 प्रति गली	3 प्रति गली
बी. शौचालय	एक प्रति शौचालय	एक प्रति शौचालय	एक प्रति शौचालय	एक प्रति शौचालय	एक प्रति शौचालय	नहीं	नहीं	नहीं	नहीं
ii) पंखों का आकार/प्रकार									

बीजी कोच में यात्री सुविधाओं के लिये की गई फिटिंग की अनुसूची									
विवरण	**वातानुकूलित कोच**				**वातानुकूलन रहित कोच**				
	प्रथम श्रेणी	**2 टीयर स्लीपर**	**3 टीयर स्लीपर**	**चेयर कार**	**प्रथम श्रेणी**	**स्लीपर**	**डे कोच**	**सामान्य**	**डबल डेकर**
a) कम्पार्टमेंट (घूमने वाले –एस) (स्थिर–एफ)	400 एमएम–एस	300 एमएम एफ	300 एम एम (एफ)	400 एम एम (एफ)	400 एम एम (एफ)	400 एम एम (एफ)	400 एम एम (एफ)	400 एम एम (एफ)	400 एम एम (एफ)
b) शौचालय	100 एम एम (एफ)	200 एम एम (एफ)	200 एम एम (एफ)	200 एम एम (एफ)	नहीं	नहीं	नहीं	नहीं	नहीं
c) पंखों के लिये रेगुलेटर	हॉ	नहीं	नहीं	नहीं	हॉ	नहीं	नहीं	नहीं	नहीं
d) ऑन आफ स्विच पंखों के लिये	हॉ	हॉ	हॉ	नहीं	हॉ	हॉ	हॉ	हॉ	हॉ
11. कम्पार्टमेंट एवं डोर वे की फिटिंग									

ए) गद्दे दार सीट तथा बेक रेस्ट	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	नही	हॉ
बी) गद्दे दार बर्थ	हॉ	हॉ	हॉ	नहीं	हॉ	हॉ	नहीं	नहीं	नहीं
सी) लोगीट्यूडनल लगेज रेल 1- हल्की (लाइट) 2- सख्त लाइट(स्टडी)	एल	एल	एल	एस	एल	नहीं	एस	एस	एल
डी) बन्द होने वाली या स्थिर टेबल	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं
ई) रूफ वेन्टीलेटर									
i) कम्पार्टमेंट	नहीं	नहीं	नहीं	नहीं	हॉ	हॉ	हॉ	हॉ	हॉ
ii) डोर वे	नहीं	नहीं	नहीं	नहीं	हॉ	हॉ	नहीं	नहीं	नहीं
एफ) टम्बलर होल्डर	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं
जी) ऐश ट्रे									

बीजी कोच में यात्री सुविधाओं के लिये की गई फिटिंग की अनुसूची									
विवरण	वातानुकूलित कोच				वातानुकूलन रहित कोच				
	प्रथम श्रेणी	2 टीयर स्लीपर	3 टीयर स्लीपर	चेयर कार	प्रथम श्रेणी	स्लीपर	डे कोच	सामान्य	डबल डेकर
एच) वेस्ट पेपर बास्केट डस्टविन	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं	नहीं
1. कम्पार्टमेंट	हां	नहीं	नही	नहीं	नहीं	नहीं	नहीं	नहीं	नहीं
2. डोर वे	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं	न्ही
आई) फुट रेस्ट	नहीं	नहीं	नही	हॉ	नहीं	नहीं	नहीं	नहीं	नहीं
जे) नोटिस	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ
के) मिरर									
1. कम्पार्टमेंट	हॉ	हॉ	हॉ	नहीं	हॉ	हॉ	नहीं	नहीं	नहीं
2. डोर वे	नही	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं
एल) कोट हुक	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ
एम) फुट स्टेप	हॉ	हॉ	हॉ	उपलब्ध नहीं	हॉ	हॉ	नहीं	उपलब्ध नहीं	नहीं
एन) मैग्जीन पाउच	हॉ	हॉ	नही	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं
ओ) वाशवेसिन									
1. कम्पार्टमेंट	हां	नहीं	नही	नहीं	नहीं	नहीं	नहीं	नहीं	नहीं

2. डोर वे	नही	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ
पी) फिक्स हैंगर के साथ बार्ड रोव	हॉ	नहीं	नही	नहीं	नहीं	नहीं	नहीं	नहीं	नहीं
क्यू) वाटर कूलर	हॉ	नहीं	नही	हा	नहीं	नहीं	नहीं	नहीं	नहीं
आर) पीने का पानी कन्टेनर में	हॉ	नहीं	नही	नहीं	नहीं	नहीं	नहीं	नहीं	नहीं
एस) थाली रेक	नहीं	हा	नही	हां	नहीं	नहीं	नहीं	नहीं	नहीं
टी) लिनिन रेक	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं	नहीं	नहीं	नहीं
यू) बर्थ के नीचे सामान की सूरक्षा के लिय रिंग	हॉ	हॉ	हॉ	नही	हॉ	हॉ	नहीं	नहीं	नहीं
12) शौचालय की फिटिंग									

बीजी कोच में यात्री सुविधाओं के लिये की गई फिटिंग की अनुसूची

विवरण	वातानुकूलित कोच				वातानुकूलन रहित कोच				
	प्रथम श्रेणी	2 टीयर स्लीपर	3 टीयर स्लीपर	चेयर कार	प्रथम श्रेणी	स्लीपर	डे कोच	सामान्य	डबल डेकर
ए) शावर बाथ	हॉ	नहीं	नही	नहीं	नहीं	नहीं	नहीं	नहीं	नहीं
बी) वाश वेसिन	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ
सी) टावल रेल	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं	नहीं
डी) फ्लेशिंग कमोड	तीन	एक	एक	एक	एक	एक	नहीं	नहीं	नहीं
इ) फ्लेशिंग पेन	एक	तीन	तीन	तीन	तीन	तीन	समस्त	समस्त	समस्त
एफ) लोटा भरने के लिए पुश काक	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ
जी) कमोड रेल	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं
एच) मिरर शैल्फ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	हॉ
आई) बोतल ओपनर	हॉ	नहीं	न्हीं	नहीं	नहीं	नहीं	नहीं	नहीं	नहीं
जे) कोट हुक	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ
के) सोप डिस (एस डी) लिक्यूड सोप कण्टेनर (एल सी)	दोनो	एल सी	एल सी	एल सी	एस डी	एस डी	एस डी	एस डी	एस डी

एल) शौचालय के च्यूट ढलवा होना चाहिये जिस से अन्दर से जमीन नहीं दिखाई दे तथा शौचालय गिरने वाला पदार्थ रेलों कम ऊपर तथा ट्रेक फास्टनरों पर न गिरे।

एम) अन्तर आवागमन अन्तर आवागमन के लिए दो श्रेणी के कोच के बीच दरवाजा कम्पोजिट में दिया जायेगा।									
13) बाहरी फिटिंग									
ए) रिजर्वेशन सूचना पट	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं
बी) डेस्टिनेशन बोर्ड (गंतव्य पटट)	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ
सी) नम्बर प्लेट केवन मेल/ऐक्सप्रेस ट्रेन पर	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ

टेबुल–11.2

<u>वर्तमान टेबुल निरस्त की जाती है संशोधित टेबुल निम्नलिखित है।</u>

सुरक्षा संबंधी आवश्यकतायें									
बीजी कोच में यात्री सुविधाओं के लिये की गई फिटिंग की अनुसूची									
विवरण	वातानुकूलित कोच				वातानुकूलन रहित कोच				
	प्रथम श्रेणी	2 टीयर स्लीपर	3 टीयर स्लीपर	चेयर कार	प्रथम श्रेणी	स्लीपर	डे कोच	सामान्य	डबल डेकर
ए) अलार्म पुल की संख्या प्रति									
1) कम्पार्टमेंट	1 प्रति 2 बर्थ 2 प्रति 4 बर्थ	1 प्रति वे	1 प्रति वे	6 कुल	1 प्रति 2 बर्थ 2 प्रति 4 बर्थ	1 प्रति वे	6 कुल	6 कुल	1
2) लेबोटरी									
3) कोरीडोर	2				2				
बी) बाडी साइड डोर के ऊपर नीचे के अन्दरूनी चटकनी (लैच)	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ
सी) एक बाडी साइड डोर में पैंड लाक लगाने की व्यवस्था बाहर की ओर से	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	एन.ए.	एन.ए.	एन.ए.

डी) कम्पार्टमेंट के स्लाइडिंग डोर के लिये अन्दरूनी लैच तथा शाउट वोल्ट के साथ लेच स्टोपर तथा बाहर से पैड लाक की व्यवस्था।	हॉ	एन.ए.	एन.ए.	एन.ए.	हॉ	एन.ए.	एन.ए.	एन.ए.	एन.ए.
ई) थ्रो ओवर लैच तथा पैड लाक की व्यवस्था वेस्टव्यूल के स्लाइडिंग डोर के लिये	एन.ए.	एन.ए.	एन.ए.	एन.ए.	हॉ	हॉ	नहीं	नहीं	नहीं

सुरक्षा संबंधी आवष्यकतायें									
बीजी कोच में यात्री सुविधाओं के लिये की गई फिटिंग की अनुसूची									
विवरण	वातानुकूलित कोच				वातानुकूलन रहित कोच				
	प्रथम श्रेणी	2 टीयर स्लीपर	3 टीयर स्लीपर	चेयर कार	प्रथम श्रेणी	स्लीपर	डे कोच	सामान्य	डबल डेकर
एफ) वेस्टव्यूल के रोलिंग शटर के पैड लाक स्वईंग दरवाल के लिये आउट बोल्ट तथा स्लाअडिंग डोर बोल्ट की वयवस्था	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	नहीं	हॉ
जी) बाडी साइड डोर के विण्डो शटर तथा पार्टीशन वाल के लिये लेचिस	नहीं	नहीं	नहीं	नहीं	हॉ	हॉ	हॉ	हॉ	हॉ
एच) अग्निशामन यंत्र	2	2	2	2	नहीं	नहीं	नहीं	नहीं	नहीं
आई) समस्त खिड़कियों पर सेफ्टी बार	नहीं	नहीं	नहीं	नहीं	–चार के अतिरिक्त–				
जे) विण्डो शटर									
1) ग्लास शटर	नहीं	नहीं	नहीं	नहीं	हॉ	हॉ	हॉ	हॉ	हॉ
2) लुअर शटर	नहीं	नहीं	नहीं	नहीं	हॉ	हॉ	हॉ	हॉ	हॉ
3) लुअर कम गेज शटर	नहीं	नहीं	नहीं	नहीं	हॉ	नहीं	नहीं	नहीं	नहीं
4) फ्रोस्टिड सिगिल ग्लास सील्ड विडों	हॉ	हॉ	हॉ	हॉ	नहीं	नहीं	नहीं	नहीं	नहीं
5) लुअर कम फ्रोस्टिड ग्लास लिफ्टेबल शटर	नहीं	नहीं	नहीं	नहीं	हॉ	हॉ	हॉ	हॉ	हॉ
6) आपात निकास खिड़की	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ	हॉ

Annexure IV

Write up on Depot facilities required in Coaching depots. This may be added to CAMTECH manual

STANDARD FACILITIES IN CARRIAGE MAINTENANCE DEPOTS

1. Classification of depots

For the purpose of providing standard facilities, carriage depots have been classified into the following three categories:

Classification	No. of Coaches Based
Minor Depot	Below 100
Medium Depot	100 to 250
Major Depot	Above 250

2. Covered accommodation over a sick line

(i) Every depot should have a heavy repair and schedule bay (sick line) with a covered accommodation capable of accommodating a minimum of 4% of the base stock at the depot. For this purpose, each coach should be provided with a minimum of 35 meters of track length to leave adequate space on either side of the coach for running out its bogies and wheels and still leave some room for staff to move around the coach.

(ii) For easy placement and removal as well as adjusting coaches at the work plce in sick line, where possible, the length of one line under covered accommodation should not be more than 4 coach lengths.

(iii) The covered accommodation should normally consist of 15 meter wide bays, each bay covering 2 tracks under it. The track should thus be 7.5 Meters apart to permit free movement of material transport vehicles, at the same time providing working and spare parts storage space.

(iv) To attend to the under gear, a minimum of 50% of the covered lines should have examination pits. Arrangement to provide pits over the entire length of half the number of lines under the covered accommodation is preferable. The examination pits should have efficient and effective drainage. Where low places are not available nearby for draining out the pits, a minimum of two drain wells of adequate depth and size should be provided along with proper pumping arrangements to ensure the examination pits remaining dry all the time.

(v) Covered accommodation should also have monorail girders covering the entire track and wheel park tracks suitable for power operated 2 tonne hoists.

(vi) For lifting of bogies and movement of heavy material, one 3 tonne hoist should be provided for every two lines under covered accommodation. Major depots should preferably be provided with a 20 tonne EOT crane.

(vii) Entire covered accommodation should have proper industrial lighting arrangements for work during day and night.

3. Flooring

(i) The entire covered area and pathways should be paved with a minimum of 150 mm reinforced concrete so that the floor can withstand heavy stresses.

(ii) The store room, vacuum cylinder overhauling section, machine section and similar areas should also be laid with 150 mm thick reinforced concrete floor. The rest of the areas should have 40mm thick concrete flooring.

(iii) For whiting jacks to be used for lifting coaches, on either side of the tracks, a reinforced concrete slab of 1.25m wide and 300mm thick and properly levelled, should be provided at a suitable distance away from the rail.

4. Washing Line

(i) The number of washing lines should be adequate to provide a minimum 6 hours maintenance slot on the washing line for every rake scheduled for primary or secondary maintenance at the depot.

(ii) The washing line design and facilities should be as standardised by the Railway. Pit for examination of under gear, running supplies of air, vacuum and water (both for coach washing and tank filling), electrical outlets for hand tools, coach battery charging and precooling of air-conditioned coaches, drainage for pit and surroundings, paved pathways for movement of material trollies, trucks, etc., and good illumination for attending to the rakes at night, are some of the essential requirements of the washing line.

(iii) It is desirable to have the facilities for placement and withdrawal of rakes from both ends of the washing line.

(iv) A well designed and constructed drainage system should be provided to the washing line and its surrounding area. Collection pits and drain pumps should be provided at places where seasonal water logging occurs. A clean, dry and well lighted environment is required to ensure proper quality attention to the rakes at the washing line.

5. Sick line yard

The number and length of yard lines should be sufficient to hold coaches equal to 3 times the number for which covered accommodation is required to be provided.

6. Machinery and plant

The following list gives the minimum requirement of M&P for the 3 Classes of depots. Additional machinery may be provided considering the special requirement of a depot:

Description	**Minor Depot**	**Medium Depot**	**Major Depot**
Machinery & Plant			
U/floor wheel Lathe	-	-	1
Whiting Jacks (5 Nos)	-	1 Set	1 Set
EOT Crane 20t	-	-	1
Coach Shunter	-	1	2
Welding Plant	1	2	4
Gas cutting equipment	1	2	2
Vacuum Exhauster	1	2	2
Air Compressor 30 cfm	1	2	2
Portable Vacuum Testing Equipment	-	1	1
Portable Air Compressor	-	-	1
2t Tram beam hoist	1	1	2
Sewing machine	-	1	1
Truck 10t	-	-	1
Light Coml.Vehicle	1	1	1
Fork lift truck	-	-	1
Lister truck	1	1	2
Car Washer	-	1	1
Portable Trolley Light	2	4	
Cotton waste soaking plant	1	1	1
Wood cutting saw machine	-	1	1
Hand shearing m/c	-	1	1
Portable furnace	1	1	2
Centre lathe	-	-	1
Bogie manipulator	-	-	1
Description	**Minor Depot**	**Medium Depot**	**Major Depot**
Ultrasonic testing apparatus	1	1	1
Tool post grinder	-	1	1

Vacuum Cleaner	1	2	3
Pressure jet cleaner	1	2	4
Tools			
Pneumatic handtools			
a) Grinder	1	1	2
b) Drill	1	1	2
c) Chipper/buster	-	1	2
d) Riveter	-	-	1
Electric power tools			
a) Pop riveting gun	-	1	1
b) Drill	-	1	1
c) Bolt tightener	-	-	1
Hand tools	As required		
Test Benches			
Water Tank Test Rig	-	1	1
D.A.Valve Test Bench	-	1	1
Vac.Cyl.test bench	-	1	1
Slack adjuster test bench	-	1	1
DV Test Bench	-	1	1
Air brake single coach test rig	-	1	1
Office Equipment			
Computer system	1	1	1
Plain Paper Copier	1	1	2
Telefax		1	1

7. Work and office accommodation

(i) Double storied building is preferable on space and economic considerations. It should provide accommodation for the following:

(ii) **On ground floor**:

- Store room with adjoining fenced yard and a siding with loading/unloading platform.
- Tool room
- Decolite room
- Fitting and carpentry room
- Painters' room
- Trimming room
- Machine Maintenance Room
- Welding booth
- Machine shop
- Garage for material handling vehicles
- Vacuum exhauster and air compressor room

- Vacuum cylinder overhauling section
- Black smithy
- Roll packing room
- ETL and AC repair room
- Workers' lockers with washing facilities
- Water Cooler
- Time office

(iii) On first floor

- CWS' room with attached bath
- Supervisors' rooms
- Sick line TXR's room
- Office
- Computer room
- Model room
- Training cum conference room
- Record room
- Stationery store
- Canteen with separate staircase
- Toilet facilities should be provided on both floors depending on number of staff working on each floor.

(iv) All coach maintenance facilities should preferably be located in one complex. It is desirable that such complexes at all central depots basing more than 500 coaches are protected by a boundary wall.

8. Communication facilities

Minimum 5 numbers divisional railway telephone connections and 2 public (DOT) telephone lines should be provided for the depot. These should be in addition to the telephone lines required by the officers stationed at the depot. Also all sections of the depot should be connected through an intercom. Walkie talkie sets with talk back facility should be provided if the depot facilities are spread out over a large area.

9. Coach depot information system

A computer based information system tailored for coach depots can assist the planning and execution of maintenance work. A software package developed CAMTECH, Gwalior, is available for implementation in the depots.

Annexure V

The existing Appendix A to D should be treated as cancelled and the corrected/modified Appendix is given below:

APPENDIX- A

TRANSPORTATION CODES FOR COACHES

S. No.	TRANSPORTATION CODE	DETAILS
1	ART	ACCIDENT AND TOOL VAN OR RELIEF VAN
2	CT	TOURIST CAR
3	CTS	TOURIST CAR FOR 2ND CLASS PASSENGERS
4	CZACEN	AIR CONDITIONED CHAIR CAR WITH END ON GENERATION
5	ERR	FOUR / SIX WHEELER
6	ERU	FOUR / SIX WHEELER SELF PROPELLED TOWER VAN
7	FCS	FIRST CLASS COUPE AND SECOND CLASS
8	GS	SECOND CLASS FITTED WITH SELF GENERATING EQUIPMENT
9	LR	LUGGAGE WITH BRAKE VAN
10	NMG	NEW MODIFIED GOODS
11	OHE	OVER HEAD EQUIPEMNT INSPECTION CAR
12	PPS	FULL BOGIE POSTAL VAN
13	RA	INSPECTION CARRIAGE (ADMINISTRATIVE)
14	RAAC	AIR CONDITIONED INSPECTION CAR
15	RD	INSPECTION CARRIAGE (SUBORDINATE)
16	RE	INSTRUCTION VAN (MOBILE TRAINING CAR)
17	RH	MEDICAL VAN
18	RHV	AUXILIARY MEDICAL VAN
19	RK	DYNAMOMETER CAR
20	RN	GENERATING VAN
21	RS	STORES VAN
22	RT	ACCIDENT AND TOOL VAN OR RELIEF VAN
23	RZ	TRACK RECORDING CAR
24	SLR	SECOND CLASS LUGGAGE AND BRAKE VAN
25	SMN	POWER CAR WITH MID ON GENERATION
26	VP	PARCEL VAN
27	VPC	PARCEL VAN CONVERTED
28	WACCNEN	VESTIBULED AC 3-TIER WITH END-ON–GENERATION
29	WCB	VESTIBULED PANTRY CAR
30	WSCZACEN	VESTIBULED AC CHAIR CAR WITH END-ON-GENERATION

S. No.	TRANSPORTATION CODE	DETAILS
31	WCTAC	VESTIBULED AIR CONDITIONED TOURIST CAR
32	WFACEN	VESTIBULED AIR CONDITIONED FIRST CLASS WITH END ON GENERATION
33	WFC	VESTIBULED FIRST CLASS
34	WGACCN	VESTIBULED AIR CONDITIONED THREE TIER WITH SELF GENERATING ELECTRICAL EQUIPMENT
35	WGACCW	VESTIBULED AIR CONDITIONED TWO TIER WITH SELF GENERATING ELECTRICAL EQUIPMENT
36	WACCWEN	VESTIBULED AIR CONDITIONED TWO TIER SLEEPER WITH END ON GENERATION
37	WGFAC	VESTIBULED AIR CONDITIONED FIRST CLASS WITH SELF GENERATING ELECTRICAL EQUIPMENT
38	WGFACCW	VESTIBULED FIRST CUM AC 2-TIER SLEEPER
39	WGSCN	VESTIBULED SECOND CLASS THREE TIER SLEEPER WITH SELF GENERATING EQUIPMENT
40	WGSCNLR	VESTIBULED SECOND CLASS THREE TIER SLEEPER WITH LUGGAGE AND BRAKE VAN
41	WGSCZ	VESTIBULED SECOND CLASS CHAIR CAR WITH SELF GENERATING ELECTRICAL EQUIPENT
42	WGSCZAC	VESTIBULED SELF GENERATING SECOND AC CHAIR CAR
43	WGSD	VESTIBULED SECOND CLASS DOUBLE DECKER WITH SELF GENERATING ELECTRICAL EQUIPMENT
44	WLRRM	POWER CAR END-ON-GENERATION
45	WSCZACEN	VESTIBULED AIR CONDITIONED SECOND CLASS CHAIR CAR WITH END ON GENERATION
46	WSLRN	VESTIBULED SECOND CLASS, BRAKE CUM LUGGAGE AND POWER CAR
47	WGSCZJ	VESTIBULED SECOND CLASS CHAIR CAR FOR JAN SHATABDI COACHES.
48	WGSRJ	VESTIBULED SECOND CLASS CHAIR CUM BRAKE VAN FOR JAN SHATABDI COACHES.
49	WGSCZACJ	VESTIBULED SECOND CLASS AC CHAIR CAR FOR JAN SHATABDI COACHES.

APPENDIX – B

ITEMS WHICH MUST BE CHANGED DURING POH OF BG COACHES

1.	Locking plates (T-0-2-637)	(when opened)
2.	Rubber sealing ring of axle box front & rear cover (T-0-2-625)	(when opened)
3.	Rubber packing ring (T-0-1-632)	
4.	Guide ring (T-0-1-640)	
5.	Guide bush (T-0-1-634)	
6.	Circlip for dash pot guide bush (if used) (T-0-1-638, item 3)	
7.	Brake gear bushes of Nylon-66 (RDSO Sk. 81039)	
8.	Shoe adjuster assembly (T-3-1-612, T-3-1-607, T-3-1-609) & M16 nut & bolt with split pin	
9.	Acetal Resign Bushes for bogies (T-3-2-644)	
10.	All bulb type cotters (T-3-2-632)	(when opened)
11.	Sealing washer for air vent screw (T-0-1-629)	
12.	Rubber stopper & crown bolt (RDSO Sk.-97068)	
13.	Rolling ring (VB-79/M)	
14.	Joint ring (VB-84/M)	
15.	Gland packing ring (VB-87/M)	
16.	DA valve diaphragm	
17.	Vacuum brake hose pipe – 50 mm dia (VB-504/M)	
18.	Vacuum brake siphon pipe – 20 mm dia (VB-510/M)	
19.	All rubber item of air brake equipment (if overhauled)	
20.	Centre pivot locking plate (T-0-6-612)	
21.	Bush for equalising stay (RDSO SK 88018 item 5 & 6, RDSO SK 88105 item 5)	
22.	Bush for 18 kw alternator (MG/T-3-2-009)	
23.	Bush for 4.5 Kw alternator (T-0-3-659 item 5)	
24.	Silent block for anchor link (T-0-7-601)	
25.	Dirt collector filters	
26.	Felt Ring	
27.	NB: Consumable, viz Roller bearing grease, dashpot oil and side bearer oil should be changed during POH.	

APPENDIX - C

MODIFCATIONS IN BG COACHING STOCK
(RDSO's Letter No. MC/CB/MARS Dtd. 24.06.98)

Sr. No.	Description of Modifications	Sketch / Drg. No.	Applicability
1	Adoption of worn and intermediate profile of wheels	RDSO SK - 92082 & 91146	Railways and Production Units
2	Standardisation of 16t. Equalising Stay on all new coaches	RDSO SK - 88105 & 93236	Production Units only
3	Provision of locking arrangement for guide caps of a) Existing Bogies, b) New Bogies	RDSO SK - 85070 alt. 3 T-0-1-638	Railways and Production Units
4	Axle end locking arrangement for direct mounted spherical roller bearings	ICF Drg. No. T-0-2-637 alt. a	Railways and Production Units
5	Procedure for manufacture and inspection of bolster suspension hangers	ICF Drg: no. 1-0-5-639	Railways and Production Units
6	Schedule of technical requirement of silent block for anchor link	Spec. C-9406 (Rev.1)	Railways and Production Units
07	Lowering of attendant berth to approx. 600 mm. from floor level in AC coaches	RCF Drg. No. M1000517	Railways and Production Units
08	Earmarking of one seat in GS coaches for physically handicap person	RDSO SK - 96078	Railways and Production Units
09	STR No. C - 9503 for upholstery cloth for coaching	Spec. No. C-9503 amendment slip 1	Railways and Production Units
10	Schedule of requirement for LP sheet	Spec. C- 9602 with amend slip 1	Railways and Production Units
11	Provision of APD for foot plate of vestibule by welding of washer with securing pin	RDSO SK – 95199	Completed, may be treated as standard
12	Provision of compression spring to support canvas vestibule frame	RDSO SK – 96006	Railways only

Sr. No.	Description of Modifications	Sketch / Drg. No.	Applicability
13	Modified pin for 'Z' lever hanger to avoid working out of bushes in the brackets	RDSO SK – 98127	Railways and Production Units
14	Color coding of SAB spindles for different length	ICF Drg. No. T-3-3-704	Railways and Production Units
15	Revised locations for fixing holes in buffer case to minimize cracking of head stock	RDSO SK – 94043 94044	Production Units only. Railways to make new purchase as per revised drawing.
16	Provision of PVC flooring and aluminium chequered plate in doorways and gangways		Railways and Production Units
17	Use of high performance grease viz Servogem - RR3 and Balmerol Multi-grease in roller bearing axle boxes	-	Railways and Production Units
18	Use of plastic axle guide bushes to STR - C-8215 (Rev.II)	RDSO SK - 84102	Railways and Production Units
19	Elimination of roof filling arrangement and provision of foot step and handle in lieu of ladder	RDSO SK - 90088	Railways only
20	Interior colour scheme	RDSO SK - 90068	Railways and Production Units
21	Provision of FRP tissue on trough floor, sole bar, turn under and side wall	ICF Drg. No. ICF SK- 9-0-890	Railways and Production Units
22	Modification to increase linen room capacity in 2tier AC coaches	RDSO SK - 88103 Alt.2	Railways only
23	Modification of suspension of under slung water tank provided under AC Coaches	ICF Drg. No. WGFAC - 6- 3-208 (col II) WGFAC3 - 6-3- 305 alt.'d'	Railways and Production Units
24	Strengthening of bogies frame for transom mounting of 4.5 KW alternator for 110 V. dc system	RDSO SK – 88062	Railways and Production Units

Sr. No.	Description of Modifications	Sketch / Drg. No.	Applicability
25	Provision of wall type fans in the lavatories of AC coaches	-	Railways and Production Units
26	Modification for pad locking of body side door from inside of a coach	RDSO SK – 87020	Railways and Production Units
27	Provision of TRA type roof ventilators	ICF Drg. No. WLRRM4-7-3-402 alt. 'n' & WLRRM4-7-3-401 alt. 'g'	Railways and Production Units
28	Strengthening of partition wall between guard's lobby and luggage / brake van	ICF Drg. No. SLR - 9-0-001	Railways and Production Units
29	Provision of foldable pull-up handle (ring)	Drg: no. SCN 5-6-1-519	Railways and Production Units
30	Provision of aluminium chequered flooring in pantry portion, washing room and door ways of PCs.	RDSO SK – 85121 (existing), 85120 (new)	Railways and Production Units
31	Provision of safety partition on flaps on end berths at either end of AC Sleeper coaches	RDSO SK – 83014 alt. 1	Completed, may be treated as standard
32	Provision of nylon wire net magazine pouches.	-	Railways and Production Units
33	Marking of 125 mm diagonal cross in fluorescent yellow paint and fitment of acrylic reflector in addition to existing tail lamp / board	RDSO SK – 85020	Railways and Production Units
34	Provision of five additional safety bars on body side door windows	RDSO SK – 84162	Railways and Production Units
35	Modification of body pillars for corrosion repair	RDSO SK – 76020 alt. 7	Railways only

Sr. No.	Description of Modifications	Sketch / Drg. No.	Applicability
36	Provision of M24 bolt and nuts for fitment of bottom cover to the centre pivot flange with bent plate anti rotation of bolts	ICF Drg. No. ICF/ SK-1-1-135 and RDSO SK-75108 alt. 1	Railways and Production Units
37	Provision of four bars on window of body side wall of guard's portion of brake van	-	Railways and Production Units
38	Use of seamless pipe in air brake system	Spec. No. 04 ABR – 94, amendment Slip 4	Railways and Production Units
39	Modification in design of existing 13t. equalising stay & safety strap	RDSO SK – 88018 alt. 6 and SK – 97022	Railways only
40	Provision of rubber stopper to maintain axle box crown clearance	RDSO SK – 97068	Railways and Production Units
41	Provision of FRP frame glass shutter as alternative to aluminium shutter	ICF /SK- 5-4-094 and spec. C-9403	Railways only
42	Provision of FRP banjo shutter as alternative to aluminium shutter	ICF / SK-5-5-020 & Spec. C-9403 with amend. slip no. 1 &2	Railways only
43	Provision of UHMWPE/NFTC axle box packing	RDSO SK-97072 & STR No. C-9703	Railways only
44	Standardisation of seats and berths	RDSO SK-97051, 97052, 97053, 97054 & 97055	Production units only
45	Use of single piece FRP louvre shutter	RDSO SK-97020 & STR C- 9403 with amend slip 1 & 2	Railways and Production Units

Sr. No.	Description of Modifications	Sketch / Drg. No.	Applicability
46	Semi-permanent locking arrangement for unused vestibule doors	RDSO SK-84179 & 84154	Railways and Production Units (in vestibule with sliding doors)
47	Slack adjuster articulation arrangement in vacuum braked coaches	RDSO SK – 96102 alt. 1	Railways only
48	Brake beam for air braked coaches & brake beam test procedure	RDSO SK - 82010 alt. 5	Railways and Production Units
49	Modified design of brake head and brake shoe key for snug fitting of brake block.	RDSO SK - 94026 & 94027	Railways and Production Units
50	Increased length of 30 mm of brake block hanger	RDSO SK-93286	Railways and Production Units
51	Modification to passenger alarm system in vacuum brake system	RDSO SK - 96040	Railways only
52	Use of ventury type chute for lavatories	ICF / SK-6-3-324	Railways and Production Units
53	Modification to safety strap for axle guide arrangement and axle box lug	RDSO SK - 90005 alt. 2	Railways and Production Units
54	Provision of emergency openable window in non AC coaches	ICF Drg. No. DMU/DPC-5-4-002	Production Units
55	Provision of closing piece and inspection door on sliding door pocket in luggage compartment of SLR / WLRRM coaches	ICF Drg. No. TLR-4 -2-717, SLR - 4-2-002, WLRRM-4-2-604 , WLRRM-4 -2-605	Railways and Production Units
56	Provision of complete FRP window including window sill & guides	RDSO Spec. No. C-9502	Railways and Production Units
57	Use of 12 mm. compreg flooring in place of 19 mm. plywood	STR C- 9407 type II	Railways and Production Units
58	Standardized stainless steel inlays for lavatories	ICF/STD-4 -1-002	Production Units only. Railways in corrosion repair coaches

Sr. No.	Description of Modifications	Sketch / Drg. No.	Applicability
59	Fitment of UIC vestibule on coaches	Spec C-8812 rev. I RDSO Sk-88058, alt.5 & Sk-88059, alt. 5	Railways and Production Units
60	Use of Nylon 66 bushes in brake gear with N5 finished Electro plated pins	RDSO SK-81039, 82023, 84018, 84116, 84132 and 93186 alt. 2	Railways and Production Units
61	Safety wire rope arrangement for brake beam	RDSO SK-93289, 93340 & 82010	Railways and Production Units
62	Use of high capacity buffer packs inside buffers of coaches	Spec. C- K-210 (Rev. 3), SK- K 2048	Railways and Production Units
63	Fitment of enhanced screw coupling and draft gear	RDSO Sk-79061 & Sk-79067	Railways and Production Units
64	Fitment of Emergency window in AC and Non AC coaches	RDSO-SK. 98161 (Alt.1), ICF/STD 5 - 4-005, ICF/SK. 5-4-168	Railways and Production Units

APPENDIX D

LIST OF RDSO TECHNICAL PAMPHLETS

S. No.	SPEC No.	REV	AMEND	DESCRIPTION
1	C-6803			Maintenance & repair procedure for hydraulic shockabsorbers used on coaching stock.
2	C-7103			Instructions for examination and maintenance of bogies and undergear of coach nominated to run at sanctioned speed of 110 Kmph (BG)
3	C-73011			Direct admission valve for passenger coaches-maintenance instructions.
4	C-7511			Instructions for adjustment of buffer height of ICF built BG coaches in W/shops and depots.
5	C-7512			Hindi version of C-7511, Adjustment of buffer height of ICF BG coaches
6	C-7601			Description of water raising apparatus and instructions for filling water in coaches fitted with underslung water tanks.
7	C-7602	1		Instructions for corrosion repairs ICF built BG coaches.
8	C-7703			Instructions for inspection and maintenance of roller bearing axle boxes of BG ICF bogies.
9	C-7801			Instructions for maintenance of ICF built MG All coil bogie and undergear (max. speed 75 Kmph)
10	C-7807	1		Instruction for maintenance of bogie and u/gear of Rajdhani Express coaches(BG)(for shops & maint.depots)
11	C-7808			Hindi version of C-7807, maintenance of bogie and undergear of Rajdhani coaches
12	C-7809			Instruction for inspection, repair & manufacturing procedure for helical springs of ICF & Jessop's EMU stock
13	C-7817			Instructions for inspection and maintenance of roller bearing axle boxes of BG ICF bogies.
14	C-7901			Maintenance and repair procedure for Gabriel, vertical hydraulic shock absorbers
15	C-7902			Hindi version of C-7901, maintenance and repair procedure of Gabriel shock absorber
16	C-7903			Instructions for inspection and maintenance of roller bearing axle boxes of BG ICF bogies.
17	C-7907			Wheel & axle manual.

S. No.	SPEC No.	REV	AMEND	DESCRIPTION
18	C-8005			Quality assurance specification for K-Type composition brake block supplied by M/s Rane
19	C-8215	2		Schedule of Requirements for plastic guide bush for axle box guide of ICF/BG bogie (tentative).
20	C-8217	1		Schedule of Requirements for aluminium chequered sheets for use as flooring material on coaching stock.
21	C-8219			Fibre glass reinforced plastic in railway coaches
22	C-8305			Antipilferage measures for compartment, lavotory and other coaching stock fittings
23	C-8409	1		Tentative Schedule of requirements for sheet moulding compound to be used for manufacture of FRP products for passenger coaches
24	C-8415			Tentative Schedule of Requirements for FRP seat cum back rests of Indian railway coaches
25	C-8419	1		Maintenance procedure for Helical springs coaching stock (BG & MG)
26	C-8421	1		Tentative Schedule of Requirements for FRP Wall protector for bath room of coaching stock of IR (SK-83114)
27	C-8515	2		Schedule of Requirements for flexible PVC flooring for passenger coaches (tentative).
28	C-8517	1		Schedule of requirements for anerobic adhesive for use on coaching stock (tentative).
29	C-8518	1		Hindi version of C-8517, anarobic adhesive for use in coaches
30	C-8521			Specification for tight lock centre buffer coupler for coaching stock.
31	C-8522			Hindi version of C-8521, tight lock centre buffer coupler for coaching stock
32	C-8523			STR for CBC coupler for coaching stock.
33	C-8525			STR for UIC flange type vestibule for BG coaches with CBC only (for screw coupling arrangement Ref. C-8812).
34	C-8526	1		Procedure for Manual Arc Welding of wear plates(IRS: R-65-78)
35	C-8527			Roller bearing specification.
36	C-8531			Particular specification for BG(1676 MM) all metal integral light weight self-generating 1st class air conditioned coaches.
37	C-8533			Particular specification for BG all metal light weight coaches.

S. No.	SPEC No.	REV	AMEND	DESCRIPTION
38	C-8605			STR for nylon guide roller/wearing piece for retractable footplate.
39	C-8606			Hindi version of C-8605, nylon guide roller / wear piece for retractable foot plate
40	C-8625			Note on cleaning media for use in bearing cleaning plants.
41	C-8629			Report of committee on reduction of weight of coaches
42	C-8703	1		Specification for shock absorber.
43	C-8805			Instructions for inspection/maintenance of air brake equipment on passenger coaches.
44	C-8810	3		Specification for disc brake equipment for passenger coaches of IR (BG)
45	C-8812	1		Schedule of Requirements for UIC type elastomer flange connections for intercommunication between passenger coaches.
46	C-8903			Schedule of requirement for hot cases operated by liquified petroleum gas for installation in Rly. pantry cars.
47	C-8904			Procedure for recambering of MG ICF coaches
48	C-8910	1		Schedule of technical requirements for direct admission valve.
49	C-8914	1		Schedule of requirements for flexible load bearing polyurethene foam to be used in berth and seats of passenger coaches.
50	C-9001			Procedure for laying PVC flooring in passenger coaches
51	C-9009			Description of water raising system to SK-86209 and Instructions for filling water for air braked coaches
52	C-9011			Quality assurance specification for `L' type Ferrodo quality 89/24 composition brake blocks for passenger trains
53	C-9019	1		Schedule of technical requirement for water purifier
54	C-9101			Specification for electric train set.
55	C-9103			Schedule of Technical requirements for plastic sheets (filled PVC) for use in interior roof ceiling of passenger coaches
56	C-9105			Schedule of Technical Requirements for FRP axle box front covers for all coil ICF type bogies for passenger coaches (BG)
57	C-9121			Schedule of Requirements for push cock (tentative)
58	C-9123	1		Schedule of Requirements for plastic lavatory chute (tentative)
59	C-9125			Schedule of Requirement for plastic packing ring (tentative)

S. No.	SPEC No.	REV	AMEND	DESCRIPTION
60	C-9202			Technical specification for fabricated bogie frame /bolsters for coaching stock
61	C-9203			Schedule of Requirements for plastic brake gear bushes for passenger coaches (acetal)
62	C-9212			Guide for approval of manufacturers for supply of bolster suspension hangers for main line coaches and EMU stock
63	C-9213			Guide for Approval of manufactures for supply of screw couplings for main line coaches and wagon stock
64	C-9301-U			Specification for swing sliding plug automatic door(Revised)
65	C-9302-U			Specification for vacuum toilet system
66	C-9303	1		Schedule of Technical Requirements for Air Brake system for Loco hauled main line passenger stock for operational speed of 160 kmph (Tentative)
67	C-9306-U			Buffer gear for coaches
68	C-9307	1		Schedule of Technical Requirements of axle end locking screw used in roller bearing axle box arrangement of ICF coaches
69	C-9309-U	1		Specification for sliding plug doors for mainline coaching stock
70	C-9313-U	1		Specification for side-buffer
71	C-9314-U			Plywood specification for new AC Chair Car
72	C-9318-U			Specification for Test Scheme for stress investigation in prototype new design of BG AC coach shell
73	C-9321			Schedule of Technical requirements for development
74	C-9322			Schedule of Technical Requirements for development of light weight partition walls to be used in A/C coaches
75	C-9403	1		Schedule of Technical Requirements for Fibre Glass Reinforced(SMC) glass window frames , lavatory banzo frames and louvre sheets for use in coaches
76	C-9406	2		Schedule of Technical Requirements for silent block for anchor link
77	C-9407	2		Schedule of Technical Requirements for compreg laminate
78	C-9408			Instructions for operation of air braked main line passenger trains (BG) Dec.'94
79	C-9501	3		Rubber Buffer Springs of 1030 kg.m. capacity for side buffers of BG coaches

S. No.	SPEC No.	REV	AMEND	DESCRIPTION
80	C-9502			Schedule of Technical Requirements for fibre glass reinforced (SMC) window guides and sills for use in coaches
81	C-9503			Schedule of Requirements for upholstery cloth for coaching stock
82	C-9505	Revised		STR for high tensile steel screw coupling
83	C-9509	1		STR for alloy steel draw hooks on railway coaches
84	C-K-511			Schedule of Requirements for Natural Fibre Thermo-set Composite (NFTC) Sheets for roof ceiling of passenger coaches (tentative)
85	C-9601			Tentative Specification for Natural Fibre Com-posite board for use in flooring in passenger coaches.
86	C-9602			Schedule of technical requirements for decorative Thermo Setting Synthetic Resin bonded laminated sheets for use in coaching stock
87	C-9702	1		Instructions for maintenance of brake system of air braked coaches fitted with bogie mounted brake cylinders and K' type composition blocks
88	C-9703			Schedule of Tech. Requirements of packing ring for axle box guide arrangement
89	C-9704			Schedule of Tech. Requirements for polymerised floor topping compound for flooring of coaches.
90	C-9705			Schedule of Tech. Requirements for Ultra High Molecular Weight Polyethylene (UHMWPE) for use in Railway coaches
91	C-9802			Overhauling and testing of hose coupling of air brake system
92	C-9803			Schedule of technical requirements for rubber items used in air brake components for coaching stock
93	C-9805			Specification for flasher light for SLR (Brakes, Luggage-cum-2nd class)
94	C-9808			Schedule of technical requirements for manufacture of brake block hanger
95	C-9809	2		Specification for non-asbestos based `K' type high friction composition brake blocks for bogie mounted mainline coaches (Both AC & Non-AC coaches)
96	C-9810	1	2	Specification for asbestos based `K' type high friction composition brake blocks for bogie mounted mainline coaches (Both AC & Non-AC)
97	C-9901	2		STR for Upholstry for Ist Class AC Coach & Executive Class Chair Car of Satabdi Express.

S. No.	SPEC No.	REV	AMEND	DESCRIPTION
98	C-9904	1		STR for Insecticidal Paint for Coach Interiors.(Tentative)
99	C-9905			STR for Specially Treated Brake Pins (Alternative to Electroplating.)
100	C-9906			STR for Controlled Discharge Toilets for Indian Rly. Coaches.(BG)
101	C-9907	2		Specification for L-Type Composition Brake Block for Mainline Coaches.
102	C-9908			STR for Boilogical Toilets in Indian Rly. Coaches.
103	C-9911	3		STR for Fire Retardent Curtain Fabric.
104	C-9912			Tentative Specification Natural Fibre Reinforced Pannels (NFRP) for use in Raiway Coaches
105	C-K013			Specification for Bogie Mounted Bracke Cylinder with in Slack Aduster for EMU & Mainline Panssenger Coaches.
106	C-K102			STR for Silent block for Centr Pivot of mainline coaches
107	C-K105		2	STR for boster suspension Hanger of mainline & EMU Coaches
108	C-K106			STR of Air Suspension Systemfor EMU / DMU Coaches and Coaching Container Flat Bogies (Part A & B)
109	C-K201			Specification for Stainless Steel / Plates for Coaches of Indian Railways.
110	C-K202		1	Schedule of Requirement for Hanger Block of Mainline & EMU Coaches.
111	C-K207	4		Schedule of technical requirement of modular toilets for Indian Railways Coaches (BG).
112	C-K208		1	STR for Prelaminated Shaded Compreg for use in Rly. Coaches.
113	C-K209			Specification for distribution valve with relay valve for air brake system of passenger stock of I. Rly.
114	C-K210	2	1	STR for high capacity buffer springs for side buffers of BG coaches.
115	C-K211	1		Specification for non-asbestos based low friction composite brake blocks for application on MG Coaching Stock of I. Rlys.
116	C-K213	1		Schedule of Technical Requirement for manufacturing of FRP main doors for passenger coaches (BG) and EMU's.
117	C-K214	1		Requirements of infrastructure facilities of manufacture Dashpot Rubber packing ring.
118	C-K307			STR for Rhenolic Bushes to be used in the brake gear of ICF BG coaches.
119	C-K308			STR for Thermoplastic Polyurethane wearing piece for side bracket of BG coaches

S. No.	SPEC No.	REV	AMEND	DESCRIPTION
120	C-K309			STR for Deurified Thermal Bonded Polyester Blocks for use in Railway coaches.
121	C-K401			STR for friction snubber for prymary suspension of BG main line all coil bogies for operation at max. speed of 105Kmph .
122	C-K404			Specification for double sealed unit(DSU) for AC coaches.
123	C-K405			STR for capsule type sock absorber for primary suspension for B.G.(1676 mm) main line ICF all coil bogies.
124	C-K406			STR for Air spring assbly.for higher capacity loads used on MEMU/DMU&EMU coaches.
125	C-K407			STR for Air suspension control equipments for air spring assbly.system with ICF/LHB type bogie.
126	C-K409			STR for high capacity HYTREL upper and lower washers used in the primary suspension for B.G. mainline coaches.
127	CMI-9801			Maintenance Instructions for IRY coaches fitted with IR-20 Bogie
128	CMI-9802	1		Maintenance Instructions for Retrofitted Air Suspension Bogie for DC EMU.
129	CMI-9901	2		Maintenance Instructions for Enhanced Draw Gear And Screw Couplings of BG Main line Coaches
130	CMI-9903			Procedure of IOH on Broad Gauge (1676) IRY Coaches having IR-20 Bogies
131	CMI-K001			Maintenance Manual for EMU AC/DC and Mainline EMU Stock Bogie & Undergear of AC EMU DC EMU &MEMU Fitted with Steel Spring Suspension Arrangement.
132	CMI-K003			Inspection of wheels on openline and Workshops
133	CMI-K301			Instructions for maintenance of bogie and undergear of Jan Shatabdi coaches (BG) (For shops and maintenance depot).
134	CMI-K302		1	Instructions for corrosion repairs of ICF/RCF built MG coaches.
135	CMI-K303			Instructions for maintenance of axle box guide arrangement for main line ICF/RCF type bogies (BG/MG). (Supersedes C - 7715)
136	CMI-K401			Maintenance manual of bogie, brake, brake gear and coupler for HHPDMU stock (1400 hp) fitted with air suspension (BG - 1676 mm)
137	CMI-K402			Code of practice for prevension of fires on DMUs.

S. No.	SPEC No.	REV	AMEND	DESCRIPTION
138	WD-04-Nylon bushes-2002			Schedule of requirements for Nylon bush for brake gear for mainline coaches.
139	G-92			Maintenance Manual for IRSA - 600 slack adjuster.
140	G-97		2	Maintenance Manual of Air brake system for frieght stock.
141	M&C/PCN/ 101/2001			Specification for cleaning solution.
142	02-ABR-2002			Specification for Air brake system for frieght & passenger stock for I. Rlys.
143	R-64/98	Revised		STR for upper & lower rubber washerfor mailine coaches.
144	R-19/93			Wheels.
145	R-35/			
146	IRS-M-41			Corrosion resistance high tensile strength steel (corton steel)

सत्यमेव जयते

(Govt. of India)
(Ministry of Railways)

2nd correction slip
for
Maintenance manual
for
BG coaches
of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/1.0/CS-02 (09/2006)

September–2006

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INDIAN RAILWAYS

CENTRE FOR ADVANCED MAINTENANCE TECHNOLOGY

MAHARAJPUR, GWALIOR, M.P. 474 020

✆ 0751-2470890, Fax – 0751 – 2470841

Email -

NO.IRCAMTECH/M/GWL/MR
Dated: 29.09.06

All CMEs
Indian Railway.

Sub: 2nd correction slip to CAMTECH. Coach Manual

Ref: i. Rly Board's letter No 98/m(c)/137/19 pt 1 Dated 25.08.2006

ii. Rly Board's letter No. 87/m (c)/202/10 vol. II dated 3.08.2006

2nd correction slip to Coach Maintenance Manual is being issued. The corrections are as per the letter of Railway Board referred above. 05 copies of the same are being sent you.

For Executive Director

Copy: -

EDME/Coaching/ Rly Board
ED/ Carriage/ RDSO
DME/Coaching/ Rly Board

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Correction/Modification in CAMTECH Coaching Manual

Sr. No	CAMTECH MANUAL REF.	EXISTING INSTUCTIONS	MODIFIED/CORRECTED INSTRUCTIONS	REMARKS
1.	Ch 1 Pg 35 Sr. No. 10 annexure1 .1 brake power certificate (Both Hindi & English) Hindi version	The footnote of the brake power certificate is ---- "THIS CERTIFICATE IS VILID UPTO DESTINATION PROVIDED THE RAKE INTEGRITY IS NOT BROKEN OR CHANGED BY MORE THAN TWO VEHICLE UNITS OR THE TRAIN ENGINE IS NOT CHANGED IF RAKE INTEGRITY IS BROKEN BY MORE THAN TWO VEHICLE UNITS, A FRESH CERTIFIATE IS REQUIRED. IF THE TRAIN ENGINE IS CHANGED. THE CERTIFICATE SHOULD BE VALIDATED BY ENGINEER (C&W) THROUGH ENDORSEMENT IN THE COLUMN ON THE REVERSE" "यह प्रमाण पत्र पूरे रैक के गंतव्य स्थान तक यदि खंडित न हुई हो जारी किया जायेगा या दो कोच से अधिक इकाई में परिवर्तित हुई हो या ट्रेन इंजन को न बदला गया हो। यदि रैक की अखंडता दो कोच से अधिक इकाई में परिवर्तित हुई हो तो प्रमाण पत्र की आवष्यकता होती है। प्रमाण पत्र की वैधता अभियंता (कै एवं वै.) द्वारा पिछली तरफ लिखे कॉलम द्वारा किया जायेगा।"	The footnote is amended as -- "THIS CERTIFICATE IS VALID PROVIDED THE RAKE INTEGRITY IS NOT BROKEN OR CHANGED, OR THE TRAIN ENGINE IS NOT CHANGED. IF RAKE INTEGRITY IS BROKEN OR THE TRAIN ENGINE IS CHANGED, THIS CERTIFICATE SHOULD BE REVALIDATED BY ENGINEER (C&W) THROUGH ENDORSEMENT IN THE COLUMN PROVIDED ON REVERSE AFTER ENSURING BRAKE CONTINUITY, PROVIDED THE COACH (ES) BEING ATTACHED, IF ANY, HAVE BEEN MAINTAINED AS PER EXTANT INSTRUCTIONS"	As per RB letter no.98/M(C /137/19/Pt. I/Dt:25.08. 06

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Sr. No	CAMTECH MANUAL REF.	EXISTING INSTUCTIONS	MODIFIED/CORRECTED INSTRUCTIONS	REMARKS
2.	Appendix A	----------	To include appendix A-1 [Transportation codes for BG coaches (LHB type)]	List enclosed. As per RB letter No. 87/M(C/202/10 Vol.II
3.	Appendix A	----------	To include appendix A-2 [Transportation codes for BG coaches (ICF type)]	List enclosed. As per RB letter No. 87/M(C/202/10 Vol.II

APPENDIX- A-1

TRANSPORTATION CODES FOR BG COACHES (LHB TYPE)

S. No.	TRANSPORTATION CODE	DETAILS
1.	LWFAC	A/C FIRST CLASS COACH (EOG)
2.	LWGFAC	A/C FIRST CLASS COACH (SG)
3.	LWACCW	A/C 2 – TIER SLEEPER COACH (EOG)
4.	LWGACCW	A/C 2 – TIER SLEEPER COACH (SG)
5.	LWACCN	A/C 3 – TIER SLEEPER COACH (EOG)
6.	LWGACCN	A/C 3 – TIER SLEEPER COACH (SG)
7.	LWCBAC	A/C HOT BUFFET CAR (EOG)
8.	LWLRRM	BRAKE,LUGGAGE CUM GENERATOR CAR
9.	LGS	SECOND CLASS COACH (SG)
10.	LWGSCN	3 – TIER SLEEPER COACH (SG)
11.	LGSLR	SECOND CLASS CUM LUGGAGE & BRAKE VAN (SG)
12.	LWFCZAC	A/C EXECUTIVE CHAIR CAR (EOG)
13.	LWSCZAC	A/C CHAIR CAR (EOG)

APPENDIX- A-2

TRANSPORTATION CODES FOR BG COACHES ICF TYPE

S. No.	TRANSPORTATION CODE	DETAILS
1.	WGFAC	A/C FIRST CLASS COACH (SG)
2.	WFAC	A/C FIRST CLASS COACH (EOG)
3.	WGACCW	A/C 2 – TIER SLEEPER COACH (SG)
4.	WACCW	A/C 2 – TIER SLEEPER COACH (EOG)
5.	WGACCN	A/C 3 – TIER SLEEPER COACH (SG)
6.	WACCN	A/C 3 – TIER SLEEPER COACH (EOG)
7.	WGFCWAC	A/C FIRST CLASS CUM A/C 2 – TIER SLEEPER COACH (SG)
8.	WFCWAC	A/C FIRST CLASS CUM A/C 2 – TIER SLEEPER COACH (EOG)
9.	WCCWNAC	A/C 2 – TIER CUM A/C -3 TIER SLEEPER COACH
10.	WGSCZAC	A/C CHAIR CAR (SG)
11.	WFCZAC	A/C EXECUTIVE CHAIR CAR (EOG)
12.	WSCZAC	A/C CHAIR CAR (EOG)
13.	WGFC	FIRST CLASS COACH (SG)
14.	WGSCN	3 – TIER SLEEPER COACH (SG)
15	GS	SEOND CLASS COACH (SG)
16.	WGSCZ	SECOND CLASS DAY COACH WITH SITTING ACCOMODATION (SG)
17.	GSD	SECOND CLASS DOUBLE DECKER COACH (SG)
18.	GSLR	SECOND CLASS CUM LUGGAGE & BRAKE (SG)

S. No.	TRANSPORTATION CODE	DETAILS
19.	GSLRD	SECOND CLASS CUM LUGGAGE & BRAKE VEN WITH DISBLED FRIENDLY COMPARTMENT (SG)
20.	GSLRDAC	SEOND CLASS CUM LUGGAGE & BRAKE WITH A/C DISABLED FRIENDLY COMPARTMENT (SG)
21.	GSRD	SECOND CLASS COACH WITH BRAKE VAN AND DISABLED FRIENDLY COMPARTMENT (SG)
22.	WLRRM	BRAKE LUGGAGE AND GENERATOR CAR
23.	WGCB	PANTRYCAR (SG)
24.	WCBAC	A/ PANTRY CAR (EOG)
25.	WGSZAJ	A/C CHAIR CAR FOR JAN SHATABDI (SG)
26.	WGSCZJ	SECOND CLASS CHAIR CAR FOR JAN SHATABDI (SG)
27.	WGSCZRJ	SECOND CLASS CHAIR CAR CUM BRAKE VAN FOR JAN SHATABDI (SG)
28.	WACCNH	A/C 3 – TIER SLEEPER COACH FOR GARIB RATH (EOG)
29.	WSCZACH	A/C COACH WITH SITTING ACCOMODATION FOR GARIB RATH (EOG)
30.	WRRMDAC	BRAKE,GENERATOR CAR WITH A/C DISABLED FRIENDLY COMPARTMENT FOR GAIRB RATH
31.	RA	INSPECTION CARRIAGE (ADMINISTRATIVE)
32.	RAAC	A/C INSPECTION ARRIAGE (ADMINISTRATIVE)
33.	NMG	MOTOR CAR CARRIER COACH
34.	PP	POSTAL VAN
35.	VP	PAREL VAN
36.	VPH	HIGH CAPACITY PARCEL VEN

S. No.	TRANSPORTATION CODE	DETAILS
37.	VPU	MOTOR CUM PARCEL VAN
38.	VR	REFRIGERATED PARCEL VAN
39.	RT	ACCIDENT RELIEF AND TOOL VAN
40.	RH	MEDICAL VAN
41.	RE	TRAINING/INSPECTION VAN
42.	RU	SELF PROPELLED TOWER CAR

SG – DENOTESSELF GENERRATING COACH
EOG – DENOTES END ON GENERATION COACH

NOTE:-CODES FOR MILITARY OWNED COACHES TO BE PREFIXED BY ‘M’ FOR RESPECTIVE COACH TYPES.

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(Govt. of India)
(Ministry of Railways)

3rd correction slip for Maintenance manual for BG coaches of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/1.0/CS-03 (12 /2007)

December–2007

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INDIAN RAILWAYS
CENTRE FOR ADVANCED MAINTENANCE TECHNOLOGY
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No.M.CAMTECH/M/GWL/MR
Dt. 03-12-07

All CME
Indian Railways

Sub: 3rd Correction slip to CAMTECH Coaching Manual.
Ref: (I) RDSO letter No. 2004/m(C)/ 137/8 Dated 1/09/05
(II) RDSO letter No. MC/RB/General. Dated 14/11/07
(III)CAMTECH letter No. IRCAMTECH/M/GWL/M&C Dated 09/06/07

3rd correction slip to coach maintenance manual is being issued. The corrections are as per the RDSO's letter referred above. 05 copies of the same are being sent to you.

03/12/07

For Executive Director

C/-

EDME/Coaching/Rly.Bd
ED/Carriage/RDSO

246

Correction/ Modification in CAMTECH Coaching Manual

1. Vide RDSO's letter referred at (I) above.

   Periodicity of inspection of Roller bearing of coaching application.

CAMTECH manual Ref.	Existing Instruction.	Modified/corrected instruction.
Ch.10, page no 8, Para 1005 ROLLER BEARINGS	• All roller bearings should be cleaned, inspected and fitted with fresh grease at every POH. • All bearings should be dismounted every alternate POH or 2 lakh Km whichever is earlier in the workshop for renewal of felt sealing ring and overhaul of the roller bearings.	• All roller bearings must be cleaned, inspected and re-lubricated with fresh grease at every POH (Periodic over haul) and for Rajdhani and Shatabdi wheel sets at every IOH. • Dismount roller bearings at every alternate inspection in the workshops for renewal of felt sealing ring. If any defect in roller bearing or its component is suspected and/or the rear cover is damaged, bearing should be dismounted and sent for inspection.

2. **Value of radial clearance specified in Chapter 10, Page 12 , table No. 10.4 and page 15, table no. 10.5**

Existing instructions: -

Bearing makes	Radial clearance in mm
SKF	0.105 to 0.295 mm
FAG/NORMA	0.080 to 0.185 mm
NEI/NBC	0.080 to 0.190 mm

New bearing	0.145 to 0.190 mm
Maximum permissible clearance for bearing in service	
SKF make	0.33 mm
FAG/NORMA make	0.270 mm
NBC makes	0.295 mm

Modified/ Corrected Instructions: - (Based on RDSO's letter referred at II above)

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

(21)

Correction/ Modification in CAMTECH Coaching Manual

1. Vide RDSO's letter referred at (I) above.

   Periodicity of inspection of Roller bearing of coaching application.

CAMTECH manual Ref.	Existing Instruction.	Modified/corrected instruction.
Ch.10, page no 8, Para 1005 ROLLER BEARINGS	• All roller bearings should be cleaned, inspected and fitted with fresh grease at every POH. • All bearings should be dismounted every alternate POH or 2 lakh Km whichever is earlier in the workshop for renewal of felt sealing ring and overhaul of the roller bearings.	• All roller bearings must be cleaned, inspected and re-lubricated with fresh grease at every POH (Periodic over haul) and for Rajdhani and Shatabdi wheel sets at every IOH. • Dismount roller bearings at every alternate inspection in the workshops for renewal of felt sealing ring. If any defect in roller bearing or its component is suspected and/or the rear cover is damaged, bearing should be dismounted and sent for inspection.

2. **Value of radial clearance specified in Chapter 10, Page 12 , table No. 10.4 and page 15, table no. 10.5**

   Existing instructions: -

Bearing makes	Radial clearance in mm
SKF	0.105 to 0.295 mm
FAG/NORMA	0.080 to 0.185 mm
NEI/NBC	0.080 to 0.190 mm

New bearing	0.145 to 0.190 mm
Maximum permissible clearance for bearing in service	
SKF make	0.33 mm
FAG/NORMA make	0.270 mm
NBC makes	0.295 mm

Modified/ Corrected Instructions: - (Based on RDSO's letter referred at II above)

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

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सत्यमेव जयते

(Govt. of India)
(Ministry of Railways)

4th correction slip for Maintenance manual for BG coaches of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/1.0/CS-04 (09 /2008)

September–2008

Centre for Advanced Maintenance TECHnology

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CENTRE FOR ADVANCED MAINTENANCE TECHNOLOGY
MAHARAJPUR, GWALIOR, M.P. 474 020
✆ 0751-2470803, Fax – 0751 – 2470841

No.M.CAMTECH/M/GWL/MR
Dt. 18-09-08

The CMEs
All Indian Railways

Sub: 4th Correction slip to Maintenance Manual for BG Coaches of ICF design.

Please find enclosed herewith the 4th correction slip to Coaching Maintenance Manual for BG coaches of ICF design. 05 copies of the same are being sent to you for necessary action please.

18/9/2008

For Executive Director

C/-

EDME/Coaching/Rly.Bd
ED/Carriage/RDSO

Correctio slip no.4 for Coaching Maintenance Manual for BG coaches of ICF design

Ref: (I) Coach maintenance manual no. CAMTECH/2002/M/C/CMM/1.0
(II)Correction slip no. CAMTECH/2002/M/C/CMM/1.0/CS-03 (12-2007)
(III) Railway Board's letter No. 2004/M(C)/137/8 dated 29/08/08

1. Reference above, the following modifications/amendments are being issued to Maintenance Manual for BG Coaches of ICF design.

Periodicity of inspection of Roller bearing of ICF design Coaching Stock :

CAMTECH manual Ref.	Existing Instruction.	Modified/corrected instruction.
Clause No.1005(a) of chapter 10 & Correction slip CAMTECH/2002/M/C/CMM/1.0/CS-03 (12-2007)	• All roller bearings must be cleaned, inspected and re-lubricated with fresh grease at every POH (Periodic over haul) and for Rajdhani and Shatabdi wheel sets at every IOH. • Dismount roller bearings at every alternate inspection in the workshops for renewal of felt sealing ring. If any defect in roller bearing or its component is suspected and/or the rear cover is damaged, bearing should be dismounted and sent for inspection.	• All Roller Bearings must be cleaned, inspected and re-lubricated with fresh grease during each attention to the wheel set/ bearings in the workshops. • **The roller bearings must be dismounted from the wheel set during every alternate attention in the workshop for thorough inspection of the components, rear cover and renewal of the felt sealing ring.** The wheel bearing must however necessarily be dismounted and overhauled in case of any warranted out of course attention in the workshop **Note : (i)** It may be noted that the inspection/overhaul of the bearings in the workshops is no more linked to the coach POH as the 'Bogie' and 'Coach Body' are to be taken as distinct identities for the purpose of periodicity of overhaul. The replacement of felt sealing ring would be required to be carried out in line with the instructions as above. **(ii)** The must change periodicity of Rubber Sealing Ring for Axle Box rear cover shall be 'during every alternate wheel attention in the workshops.'

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(Govt. of India)
(Ministry of Railways)

5th correction slip for Maintenance manual for BG coaches of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/1.0/CS-05 (11 /2008)

November–2008

Centre for Advanced Maintenance TECHnology

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MAHARAJPUR, GWALIOR, M.P. 474 020
✆ 0751-2470803, Fax – 0751 – 2470841

No: CAMTECH/M/GWL/MR
Dt. 06-11-08

The Chief Mechanical Engineer
All Indian Railways

Sub: 5th Correction slip to Maintenance Manual for BG Coaches of ICF design.

Please find enclosed herewith the 5th correction slip to Coaching Maintenance Manual for BG coaches of ICF design 02 copies of the same are being sent to you for necessary action please.

06/11/08

For Executive Director
O/C

C/-

EDME/Coaching/Rly.Bd
ED/Carriage/RDSO

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Correction slip no.5 for Coaching Maintenance Manual for BG coaches of ICF design

Ref.: (I) Railway Board's letter No. 2007/M(C)/ 141/1 Dated 26/09/08

1. Reference above, the following modifications/amendments are being issued to Maintenance Manual for BG coaches of ICF design.

IOH/POH periodicity of ICF design coaches.

CAMTECH manual Ref.	**Modified/corrected instruction.**			
Ch.1, page no 1, Para 103	**Coach category**	**Periodicity (Months)**		
		IOH (In depot)	**IOH (In workshops)**	**POH (In workshops)**
	New coach turned out by PU or a coach turned out after MLR.	12#	-	24
	Rajdhani/ Shatabdi	-	9	18
	Mail/ Express, Garib Rath, Jan Shatabdi & OCVS forming part of standard rake composition of M/E Trains.	9^	-	18
	Passenger	9 @	-	18
	Other OCVS	12 @	-	24

Note: The concept of a **'C' schedule** in the depots, hitherto being followed on the railways, may be done away with & **replaced by an IOH** as under:

^ Unit exchange of overhauled bogie supplied by the workshops must be ensured. In case of logistical issued involved in transporting assembled bogies because of the workshop being far away from the base depots, the bogie may be attended for IOH in the depots with mandatory replacement of overhauled wheel sets supplied by workshops.

@ The bogies must be rolled out and the IOH schedule carried out on the bogies in the depot itself retaining the wheel sets, unless specific attention or change is warranted on the wheel set(s). The attended bogies must then be provided in the same coach.

The scope of work to be carried out during IOH in the depot will depend on the train category being serviced by the coach turned out by PU/ after MLR as marked at ^ and @ respectively.

The tolerance for IOH may be kept as +30/-0 days as in the extant instructions. Periodicity and tolerance for other coach schedules viz, 'A' & 'B' shall also remain unaltered.

The periodicity of inspection/ complete overhaul of roller bearings and wheel set of ICF design coaching stock shall however be governed by Board's letter No. 2004/M(C)/137/8 dated 29.11 .07.

Marking the return date on off- POH coaches may be continued to be governed by the provisions of Board's letter No. 85/M (W)/814/64 dated 11.08.85. The tolerance for retaining the coach in service beyond the return date shall also continue to be governed by the provision under Para 2.3.4 of Chapter II of I.R.C.A. rules Pt. IV with partial amendment of replacing 'C' Schedule with IOH in the depots as per @ above.

The revised IOH/POH periodicity for all ICF coaches as above shall be reckoned for all new coaches being turned out of the Production units/ MLR and after POH as per the existing return dates.

This is issued in reference to Railway Board's letter under reference above.

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(Govt. of India)
(Ministry of Railways)

6th correction slip for Maintenance manual for BG coaches of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/1.0/CS-06 (06 /2009)

June–2009

Centre for Advanced Maintenance TECHnology

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MAHARAJPUR, GWALIOR, M.P. 474 020
✆ 0751-2470803, Fax – 0751 – 2470841

No: CAMTECH/M/GWL/MR
Dt. 23-06-09

The Chief Mechanical Engineer
All Indian Railways

Sub: 6th Correction slip to Maintenance Manual for BG Coaches of ICF design.

Please find enclosed herewith the 6th correction slip to Coaching Maintenance Manual for BG coaches of ICF design. 01 copy of the same is being sent to you for necessary action please.

23/06/2009.

For Executive Director

C/- EDME/Coaching /Rly. Board
ED/Carriage/RDSO

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Correction slip No. 6 for Maintenance Manual for BG coaches of ICF design

Sub.: Inspection of Brake Block Hangers during IOH/POH.

Ref.: RDSO spec. No. C- 9808 (Rev. –2)

Reference above, the following modification/ amendment is being issued to Maintenance Manual for BG coaches of ICF design.

Para	Existing	Revised to
Para 318 BOGIE BRAKE GEAR	**Nil** (Add new point, viii under this para)	viii. Brake block hangers should be removed during every IOH/POH. They should be cleaned, and checked visually for cracks, distortion or excessive corrosion. Hangers found serviceable should be • Checked for wear on the bores of the hole (Ø 42 H7) with the help of a plug gauge. • Magnaflux tested for any cracks during POH. • Bushes and split cotter must be replaced during POH.

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(Govt. of India)
(Ministry of Railways)

7th correction slip for Maintenance manual for BG coaches of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/1.0/CS-07 (07 /2009)

July–2009

Centre for Advanced Maintenance TECHnology

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✆ 0751-2470803, Fax – 0751 – 2470841

No: CAMTECH/M/GWL/MR
Date. 04-08-09

The Chief Mechanical Engineer
All Indian Railways

Sub: 7th Correction slip to Maintenance Manual for BG Coaches of ICF design.

Please find enclosed herewith the 7th correction slip to Coaching Maintenance Manual for BG coaches of ICF design. 01 copy of the same is being sent to you for necessary action please.

04/08/2009.

For Executive Director

C/- EDME/Coaching /Rly. Board
ED/Carriage/RDSO

GO TO CONTENTS

Correction slip No. 7 for Maintenance Manual for BG coaches of ICF design

Sub.: (1) Springs for ICF BG (VPU & VPH) coaches.
(2) Procurement of Brake Block Hangers & Maintenance of Brake Gear Rigging.

Ref.: (1) RDSO letter No. MC/MV dtd 05.06.2009
(2) RDSO letter No. MC/ICF/B/D dtd 03.07.2009

1. Chapter 3, Table 3.15

Reference (1), the following entries may be added in Table 3.15 of Maintenance Manual for BG coaches of ICF design.

Type of springs	Type of stock	Drawing Number
Axle Box	VPU (18t Pay load)	RDSO SK- 84262
	VPH (23t Pay load)	RDSO SK- 98017
Bolster	VPU (18t Pay load)	RDSO SK- 84263
	VPH (23t Pay load)	RDSO SK- 98018

2. Chapter 3, Para 318- The following note may be added under this para-

Note: RDSO has issued instructions regarding procurement of Brake Block Hangers and Maintenance of Brake Gear Rigging vide letter no. MC/ICF/B/D dtd 03.07.2009. The Brake Gear Rigging should be maintained as per instructions given by RDSO.

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(Govt. of India)
(Ministry of Railways)

8th correction slip for Maintenance manual for BG coaches of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/1.0/CS-08 (08 /2009)

August–2009

Centre for Advanced Maintenance TECHnology

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✆ 0751-2470803, Fax – 0751 – 2470841

No.M.CAMTECH/M/GWL/MR
Dt. 26-08-09

CMEs
All Indian Railways

Sub: 8th Correction slip to CAMTECH Coaching Manual.
Ref: (I) Coach Maintenance Manual no. CAMTECH/2002/M/C/CMM/1.0
(II) Correction slip no.CAMTECH/2002/M/C/CMM/1.0/CS-5.0 (Nov-2008)
(III) Railway Board letter no. 2007/M(C)/141/1 dated 06.08.2009 — placed at 3rd side

8rd correction slip to coach maintenance manual is enclosed. The corrections are as per the Railway Board's letter referred above. 02 copies of the same are being sent to you for kind information and necessary action please.

26/8/09
For Executive Director

C/-

EDME/Coaching/Rly.Bd
ED/Carriage/RDSO

GO TO CONTENTS

Correction slip no.8 for Coaching Maintenance Manual

Ref.: Railway Board's letter no. 2007/M(C)/141/1 dated 06.08.2009

IOH/POH periodicity of ICF design coaches.

CAMTECH manual Ref.	Existing Instruction.	Modified/corrected instruction.
Ch.1, page no.1, Para 103 and 5th Correction slip no. CAMTECH/2002/M/C/CMM/1.0/CS-5.0 (Nov-2008) issued on 06.11.08	**@** The bogies must be rolled out and the IOH schedule carried out on the bogies in the depot itself retaining the wheels sets, unless specific attention or change is warranted on the wheel set(s). The attended bogies must then be provided in the same coach.	With specific reference to the IOH of **new built coaches**, the instructions contained in 5th correction slip may be amended as under: • The bogies must be rolled out and the IOH schedule carried out on the bogies in the coaching depot itself with a mandatory replacement of overhauled wheels sets supplied by the workshops. The attended bogies must then be provided in the same coach. Further, the IOH schedule shall be carried out after 12 months of the manufacturing by the PUs and shall be applicable to all new ICF design coaches irrespective of the train category being serviced by them.

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(Govt. of India)
(Ministry of Railways)

9th correction slip for Maintenance manual for BG coaches of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/1.0/CS-09 (10 /2009)

October –2009

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TECH*nology*

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INDIAN RAILWAYS
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MAHARAJPUR, GWALIOR, M.P. 474 020
✆ 0751-2470803, Fax – 0751 – 2470841

No: CAMTECH/M/GWL/MR
Date: 22-10-2009

The Chief Mechanical Engineer,
All Indian Railways

Sub: 9th Correction slip to Maintenance Manual for BG Coaches of ICF design.

Please find enclosed herewith the 9th correction slip to Coaching Maintenance Manual for BG coaches of ICF design. 02 copies of the same are being sent to you for information and necessary action please.

22/10/09.
For Executive Director

C/- EDME/Coaching /Rly. Board
ED/Carriage/RDSO

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Correction slip No. 9 for Maintenance Manual for BG coaches of ICF design

Sub.: Introduction of air spring at secondary stage in ICF bogie coaches.

Ref.: i) RDSO letter no. MC/CB/MM dated 09.09.2009.
ii) Rly Bd. Letter no. 2007/M(C)/137/7 dated 08.10.2009

Reference above, the following modification/ amendment is being issued to Maintenance Manual for BG coaches of ICF design.

Para	Existing	Revised to
Para 107b. Enroute/ Terminating Examination of Passenger Trains (Point iv)	iv). As the train passes the nominated point, C&W staff should watch out vigilantly for loose/Hanging/broken undergear parts of the coaches, any unusual sound coming from the coaches or any other abnormality in the coaches.	iv). As the train passes the nominated point C&W staff should watch out vigilantly for loose/hanging/ broken undergear parts of the coaches, any unusual sound coming from the coach or any other abnormality in the coaches. **Special attention should be paid to air springs in case of coaches provided with air springs at secondary suspension stage. It should be ensured that all the air springs are in inflated condition by noting that the leveling valve lever is in horizontal position. In case it is not possible to inflate the air springs of any particular coach, these should be isolated by air spring isolating cock and speed of train should be reduced to 60 kmph, or the coach should be detached.** ***Note:*** a). *A detailed Maintenance Manual of air springs applicable for mainline ICF bogie coaches (No. RDSO/2009/CG/CMI-01 of September 2009) has been prepared by RDSO. Instructions contained in the maintenance manual should be strictly followed.* b). *Necessary infrastructure required for testing and inspection of air spring should be provided at the nominated maintenance points.* *c). Stocking of maintenance spares should be ensured especially for few air springs, control equipments, leveling valves at primary/secondary depots for use as unit exchange spares. Leveling valves may also be kept enroute at major depots for trouble shooting maintenance depots.* *d). Modified Brake Power Certificate issued vide RDSO letter no. AV.AS.ML dated 18.09.2009 should be used by C&W staff with immediate effect.*

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MAHARAJPUR, GWALIOR, M.P. 474 020
✆ 0751-2470803, Fax – 0751 – 2470841

No.M.CAMTECH/M/GWL/MR
Dt. 01-04-2011

CMEs
All Indian Railways

Sub: Correction in 9th Correction slip issued by CAMTECH for Coaching Manual.

Ref: (I) Correction slip no.CAMTECH/2002/M/C/CMM/1.0/CS-09 (Oct-2009)
(II) Railway Board letter no. 2007/M(C)/137/7 dated 08.10.2009
(III) RDSO letter no. MC/CB/MM dated 18.09.2009.

In reference to above, the 9th correction slip para 107b. Enroute /Terminating Examination of passenger trains (Point iv) Note-d) issued by CAMTECH should be revised and read as under;

Old

d) Modified Brake Power Certificate issued vide **RDSO letter no. AV/AS/ML** dated 18.09.2009 should be used by C&W staff with immediate effect.

Revised

d) Modified Brake Power Certificate issued vide ***RDSO letter no. MC/CB/MM*** dated 18.09.2009 should be used by C&W staff with immediate effect.

Executive Director
CAMTECH/GWL

C/-
EDME/Coaching/Rly.Bd
ED/Carriage/RDSO

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(Govt. of India)
(Ministry of Railways)

10th correction slip for Maintenance manual for BG coaches of ICF design

(For official use only)

IRCAMTECH/2002/M/C/CMM/1.0/CS-02 (05/2014)

May - 2014

Centre for Advanced Maintenance TECHnology

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✆ 0751-2470803, Fax – 0751 – 2470841

No: CAMTECH/2002/M/GWL/CCM/1.0/CS-10 **Date: 05.05.2014**

The Chief Mechanical Engineer
All Indian Railways

Sub: 10th Correction slip to Maintenance Manual for BG Coaches of ICF design.
Ref: RDSO letter No. MC/WA/General dated 14.08.2012

Please find enclosed herewith the 10th correction slip to Coaching Maintenance Manual for BG coaches of ICF design. 01 copy of the same is being sent to you for necessary action please.

(K.P.Yadav)
Director (Mech)
CAMTECH/GWL

C/- EDME/Coaching /Rly. Board
ED/Carriage/RDSO

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Correction Slip No. 10 for Maintenance Manual for BG coaches of ICF design

Ref.: RDSO letter No. MC/WA/General dated 14.08.2012.

Reference above, the following modification/ amendment is being issued to Maintenance Manual for BG coaches of ICF design.

Para	Existing	Revised to
Clause No. 1003 c of Chapter 10.0 **"Pressing on Wheel Discs on Axle"**	▪ The wheel seat should be lubricated with a mixture of basic carbonate white lead and boiled linseed oil, in the proportion of **1.2 kg.** of white lead paste to **1 litre** of boiled linseed oil. The wheel and axle should be properly aligned on the wheel press.	• Since the white lead is withdrawn due to environmental pollution, the castor oil confirming to IS-435/1973 of special grade as mentioned in table 1 of the specification, having the viscosity 6.3-9.0 stokes, is allowed to be used in place of Mixture of "Basic carbonate white lead paste & boiled linseed oil", for application on wheel set and wheel bore during pressing of wheel on to the axle. In this regard, RDSO letter No. MW/WA/WAP dated 08.02.1993 may be connected for further details.
	• The axle end should be stamped with the shop code, date of mounting, pressing in pressure, axle no., cast no., cons. no. to enable identification of wheels. Care should be taken to ensure that wheel disc number is preserved	• Marking of assembly details such as manufacture's/workshop's code, month & year of assembly, and pressing on pressure in tones, is allowed to be stamped on outer face of wheel rim, as the space on journal face is inadequate for stamping.

This is issued in reference to RDSO/LKO letter under reference.

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