

## **CHAPTER 4**

# **WAGON BODY**

### **401. INTRODUCTION**

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

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

### **402. GENERAL CONSTRUCTION OF OPEN WAGON**

#### **A. SIDES**

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

#### **B. ENDS**

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

#### **C. DOORS**

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

**403. GENERAL CONSTRUCTION OF COVERED WAGON****A. SIDES**

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

**B. ENDS**

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

**C. ROOF**

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

**D. DOOR**

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

**404. GENERAL CONSTRUCTION OF FLAT WAGON AND WELL WAGON****A. ENDS**

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

**B. SIDE STANCHION**

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

**405. GENERAL CONSTRUCTION OF HOPPER WAGON****A. SIDES**

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

**B. ENDS**

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

**C. DOOR AND DOOR OPERATING MECHANISM**

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

**406. NATURE OF REPAIRS REQUIRED IN WAGON BODY**

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

- i. Corrosion of panels, floor plates and roof sheets.
- ii. Puncturing of panels due to improper loading, inadequately secured consignments or deliberate tampering.
- iii. Bulging of ends due to shifting of loads.
- iv. Tearing of panels, fracture of stanchions and shearing of rivets due to severe impacts, and shifting of loads.
- v. Corrosion of end floor angles and crib angles.
- vi. Bulging of side usually occur after a prolonged period in service.
- vii. Slackening of rivets due to the combined effect of ageing, corrosion, wear and tear.
- viii. Weakening of welded joints due to loss of weld metal by corrosion, wear and tear.
- ix. Wearing out of door hinges.
- x. Damage to door fittings because of wear and tear or mishandling.
- xi. Distortion of doors mainly because of mishandling.
- xii. Failure of welded joints.
- xiii. Distortion or cracking of stanchions and other structural members because of abnormal loads, e.g., those due to defective clamping on tipplers.
- xiv. Wear and tear or breakage of miscellaneous fittings, such as ladders, cleats, label holders etc.

**407. CORROSION IN WAGON BODY**

The corrosion of wagon floor and roof plates results from:

- i. Water logging in crevices and overlaps. This is greatly accentuated if cleaning is neglected, since the accumulated dust and refuse retain moisture for a prolonged period.
- ii. Contact of panels with residues from corrosive consignments e.g., salt, fertilisers etc.
- iii. Spillage of corrosive fluids due to defective packing or rough handling.
- iv. Escape of corrosive vapours from the consignment.

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

#### **408. ANTICORROSIVE MEASURES**

- i. The most important anti corrosive measure to be taken in day to day working is to ensure that the wagon is kept thoroughly clean and receives special attention in this respect after it has transported a corrosive or hygroscopic commodity.
- ii. The second important step to prevent corrosion is to ensure that cleaning, surface preparation and painting are carried out with due thoroughness. The correct procedure to be followed in major maintenance schedules is given at the end of this chapter. The procedure to be adopted at the time of minor repairs should come as close to this as practicable.
- iii. While attending to miscellaneous repairs, panel patching or welding; it is important to ensure that surfaces in contact are well fitted to avoid water pockets. Due care is to be taken to clean and paint the affected surfaces to prevent corrosion by electrochemical action.

#### **409. REJECTABLE DEFECTS**

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

#### **410. REPAIRS IN SICKLINE & ROH DEPOT**

##### **410A PANEL PATCHING**

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

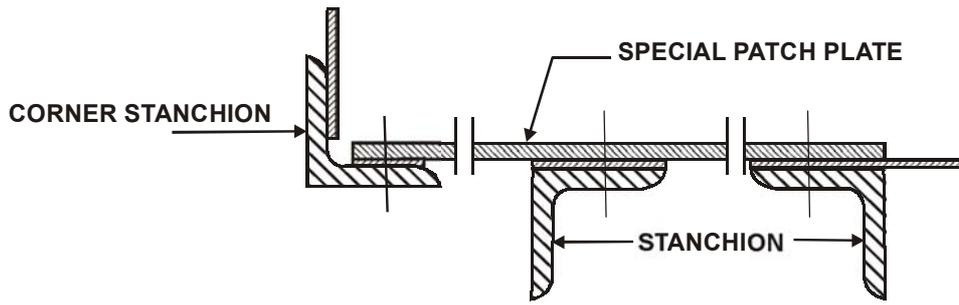


FIG 4.1

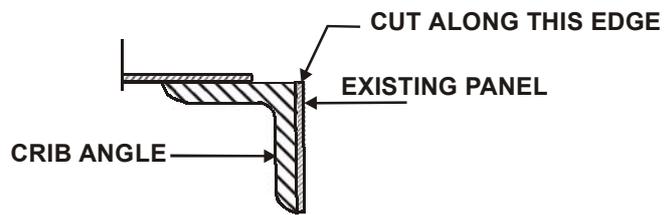


FIG 4.2

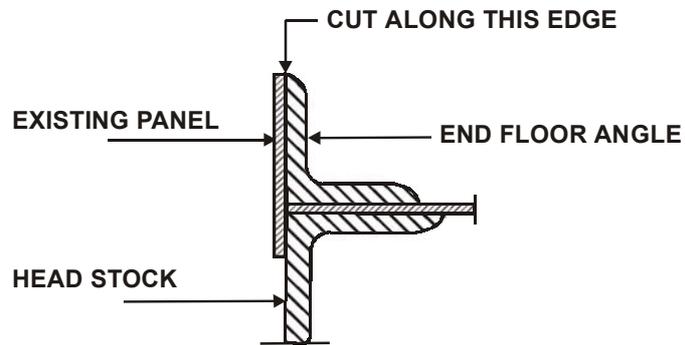


FIG 4.3

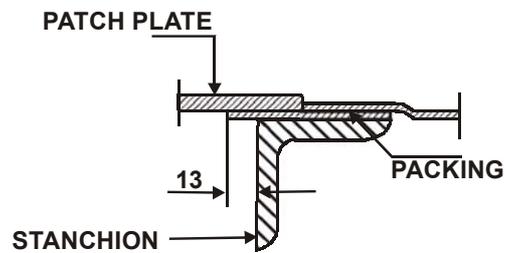


FIG 4.4

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

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

**TABLE- 4.2**  
**PANEL PATCHES FOR BOX WAGON**

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

**TABLE- 4.3**  
**PANEL PATCHES FOR BOXN WAGON**

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

**TABLE- 4.4**  
**THICKNESS OF PATCH PLATES**

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

**410A**

- i. For locations other than the skirting plates, damaged panels should be replaced by using standard patches. These patches should invariably be of the same thickness as the damaged panel. The thickness of panels at different locations on various wagons is given in Table 4.4.
- ii. Sick lines may weld or rivet smaller patches to take care of minor damages, but in no case, should a patch of less than 100mm on any one side be used. If the patch is attached by riveting there should not be less than 8 rivets securing the patch. The pitch of the rivets must also not exceed 90 mm.
- iii. Standard patch plates should, preferably be kept ready in stock in shops and sicklines after proper surface cleaning and painting with two coats of zinc chromate primer.

**410B. PROCEDURE FOR WELDED PATCHES**

- i. Examine and mark the area of patch to be cut. Cut the corroded panel along crib/end floor angle and up to a height suitable for standard patches, as shown in Fig. 4.2 and 4.3. The 2.5 mm thick old panel sheet at the stanchion should be retained as a packing piece if not badly corroded. Otherwise use fresh 5 mm thick packing(RDSO Drawing No. WD-94047-S-1). The packing should extend 13mm wherever lap welding of the new patch with packing piece is involved (See Fig. 4.4).
- ii. Cut rivets on stanchion as required and end floor angle horizontal leg by 10 mm when fitting patches at the corners as shown in Fig.4.5. Take a standard patch plate from stock or prepare the same from plate of requisite thickness.
- iii. Cut floor plates by 8mm (10mm for CRT wagons) for fitting new patch, as shown in Fig. 4.5. As an alternative, the patch plate may be made to rest over the floor plate, as shown in Fig. 4.6 & 4.7. In case, floor plates also require renewal, the width of the floor plates should be reduced to follow the arrangement shown in Fig. 4.8 & 4.9. Secure the standard patch on the wagon by means of tack welding. Weld all round.
- iv. Rivet 2.5mm packing piece in position as shown in Fig. 4.10.
- v. Overlapping portions should be welded on both sides as shown in Fig. 4.11 and 4.12.
- vi. Ensure continuous welding without any craters.
- vii. In case of bulged panels, the patch should be riveted to the panels, as shown in Fig. 4.13.
- viii. Clean and repaint the welded portion at locations where paint has been burnt off.

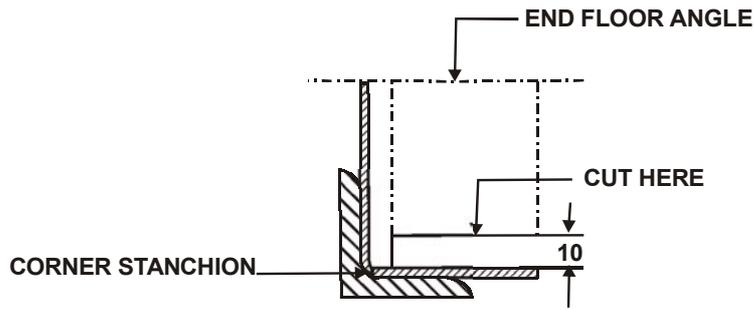


FIG. 4.5

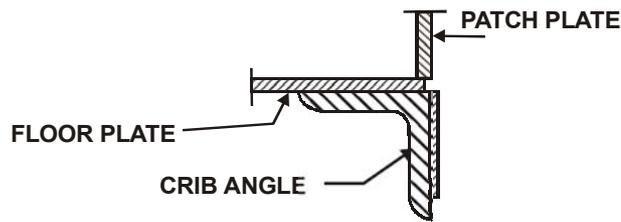


FIG. 4.6

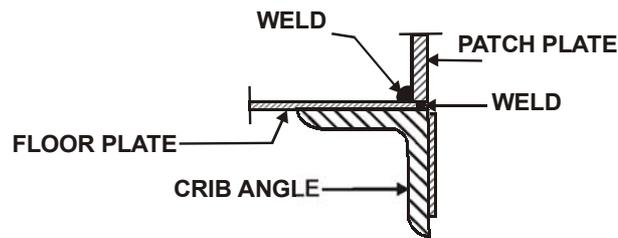


FIG. 4.7

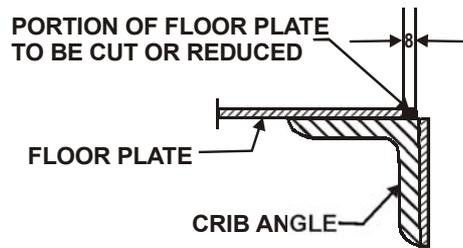


FIG. 4.8

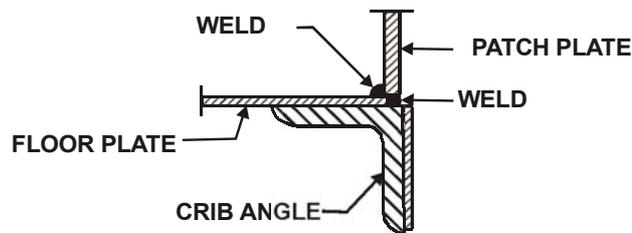


FIG. 4.9

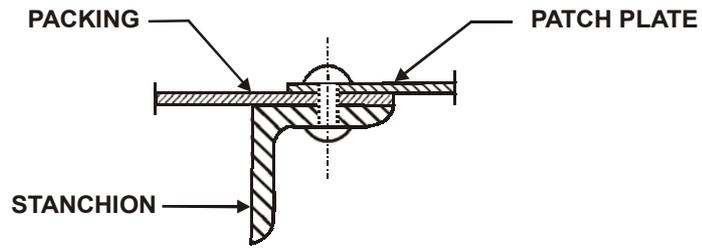


FIG 4.10

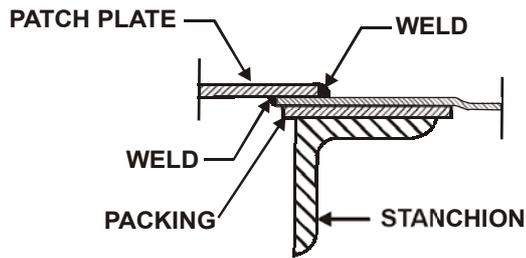


FIG 4.11

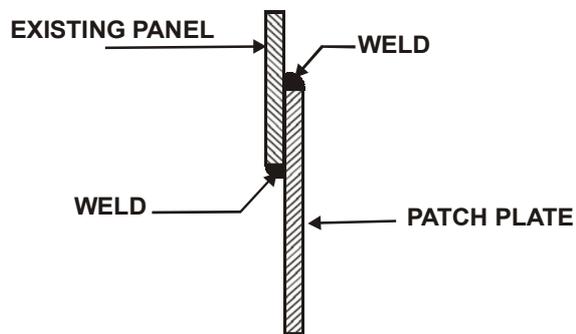


FIG 4.12

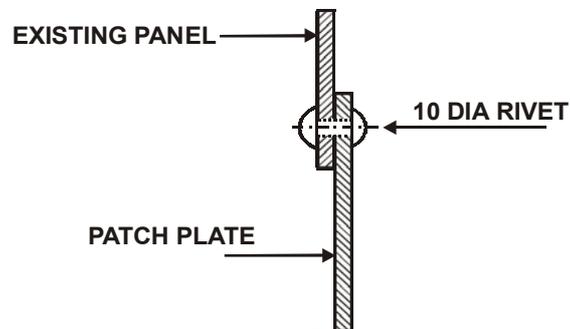


FIG 4.13

**410C. RIVETED PATCH**

- i. Examine and mark the area of the patch to be cut.
- ii. Take a standard patch plate from stock or prepare the same from plate of requisite thickness.
- iii. Position the patch on the wagon and mark the location of the rivet holes.
- iv. Drill/punch the holes on both the patch and the wagon panel and secure the latter in position by temporary bolts and nuts.
- v. Rivet the patch in position.
- vi. Ensure that riveting is sound and with concentric snap heads, and also that mating edges are set properly leaving no gap in between.

**410D. REPAIRS TO BULGED ENDS**

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

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

- a. Damages to these members are usually due to rough handling, heavy shunting impacts or shifting of loads due to improper packing/stacking of the consignments. At first these components bulge out, but later even the rivets holding them to the underframe/superstructure members break out. It should be ensured that the bulging of these components does not cause infringements with the maximum moving dimensions of 1929 mm. Bulging of these components by more than 25mm should be rectified. These components should be straightened without dismantling by pulling into correct position with the help of a chain and screw coupling or stripped and straightened either cold or by heating, as required and then riveted in position. Spot heating and cooling to straighten the stanchions can rectify bulging of all welded ends.
- b. In certain cases, these components may have developed cracks, or may have broken in pieces. Such of these components should be repaired by welding both the pieces and applying a stiffener angle prepared by bending a 6mm plate in the shape of an angle with its outer faces sitting flush in the inner profile of the member to be patched and welding it all round to the member. Elongated holes in these components should be filled up by welding and refilled.

**410F. WATER TIGHTENING OF WAGON**

Covered wagons must be kept watertight at all times. Covered wagons must be tested for water tightness at the time of leaving the workshop after POH or other repairs. All empty covered wagons attended to in sicklines, should also be tested for leaks, and made watertight by applying sealing compound. Before the onset of the monsoon

season, a special drive should be instituted and sealing compound must be applied at all points of covered wagon bodies, which are likely to leak particularly peripheries of riveted patches other overlaps and small holes.

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

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

#### **410G. REPAIRS TO DOORS AND DOOR FITTINGS**

The main defects arising in doors are:-

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

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

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

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

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

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

#### **410H. LOUVERS**

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

#### **410I. CLEANING, SURFACE PREPARATION AND PAINTING**

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

##### **a. Preparation of surface before painting**

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

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

- b. A coat of priming paint should be applied immediately after the surface has been cleaned and dried. A delay of more than 4 hours may result in development of fresh rust on the surface. A second coat of primer must be given when the first coat is dry. Painting must be done under cover in a shed or shop. The painted surfaces must remain under cover until the paint is dry.
- c. Panel patches and riveting strips must be cleaned, as prescribed above, and given two coats of primer before storage or fitment.
- d. After completion of all repairs a final coat of finishing paint should be given to all painted surfaces.
- e. When the paint film is only partially damaged, it should be touched up with one coat of primer and then given the finishing coat.
- f. Surfaces, which will become inaccessible after assembly must be given complete painting before assembly.

#### **411. REPAIRS AND MAINTENANCE IN WORKSHOPS DURING POH AND NPOH**

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

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

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

**b. Lettering**

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

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

#### **412. IMPORTANT PRECAUTIONS TO BE TAKEN WHILE CARRYING OUT WELDING**

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

**A. Loaded wagons**

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

Tank wagons should never be welded when loaded.

**B. Empty wagons**

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

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

**C. Wagons fitted with roller bearing**

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

### 413. IMPORTANT DO'S AND DON'TS

#### Do's

- i. Ensure that you have the proper tools required for the job. Use of improper tools can make matters worse.
- ii. Ensure that tools and equipment are in good condition.
- iii. See that rivet heads are properly formed with correctly profiled snaps.
- iv. While fitting patches to structural members, ensure that the pitch of rivets conforms to the original pitch in the structural members.
- v. See that doors are provided with all required fittings so as to ensure proper securing and prevent unauthorised opening.
- vi. Ensure that door hooks are intact and so placed that they will engage with the door eye in open position.
- vii. Ensure that all chains links and other attachments are in position and in working order.

#### Don'ts

- i. Do not use patches of less thickness than the original panel.
- ii. Do not patch existing patches.
- iii. Do not build up perforations in panel due to corrosion. Cut out and fit a new patch.
- iv. Do not permit empty wagons to run with open doors.
- v. Do not permit loaded wagons to run without properly secured doors.
- vi. Do not allow wagons with inadequately secured/lashed consignments.

### 414 IMPORTANT MODIFICATIONS

- a) Fitment of glass wool in place of wood dust bags on BVG brake van vide RDSO letter No. MW/CWSC/59 Dt. 10.2.95.
- b) Strengthening of fixed end of BRN wagon vide RDSO letter No. MW/BRN Dt. 7.1.99.

