

CHAPTER 2

SHELL

201 DESCRIPTION

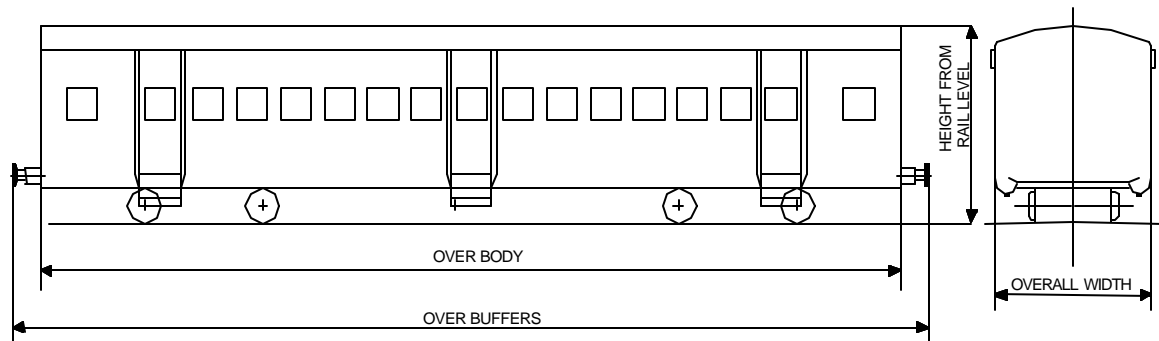
The concept of the lightweight integral design originated in the recognition of the properties of hollow girders from the point of view of strength and utilization of material. The reduction in tare weight of these coaches could be achieved by utilising "stressed skin" concept and by use of low alloy 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

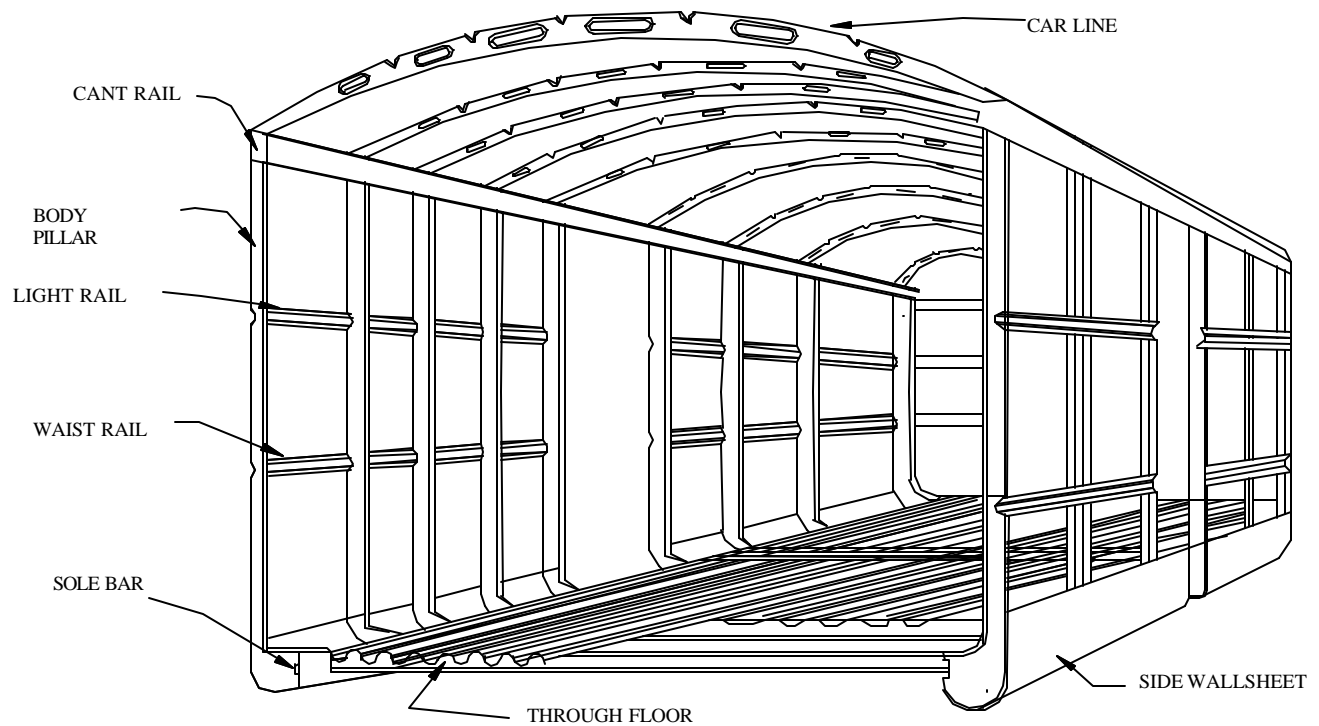


COACH SHELL

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

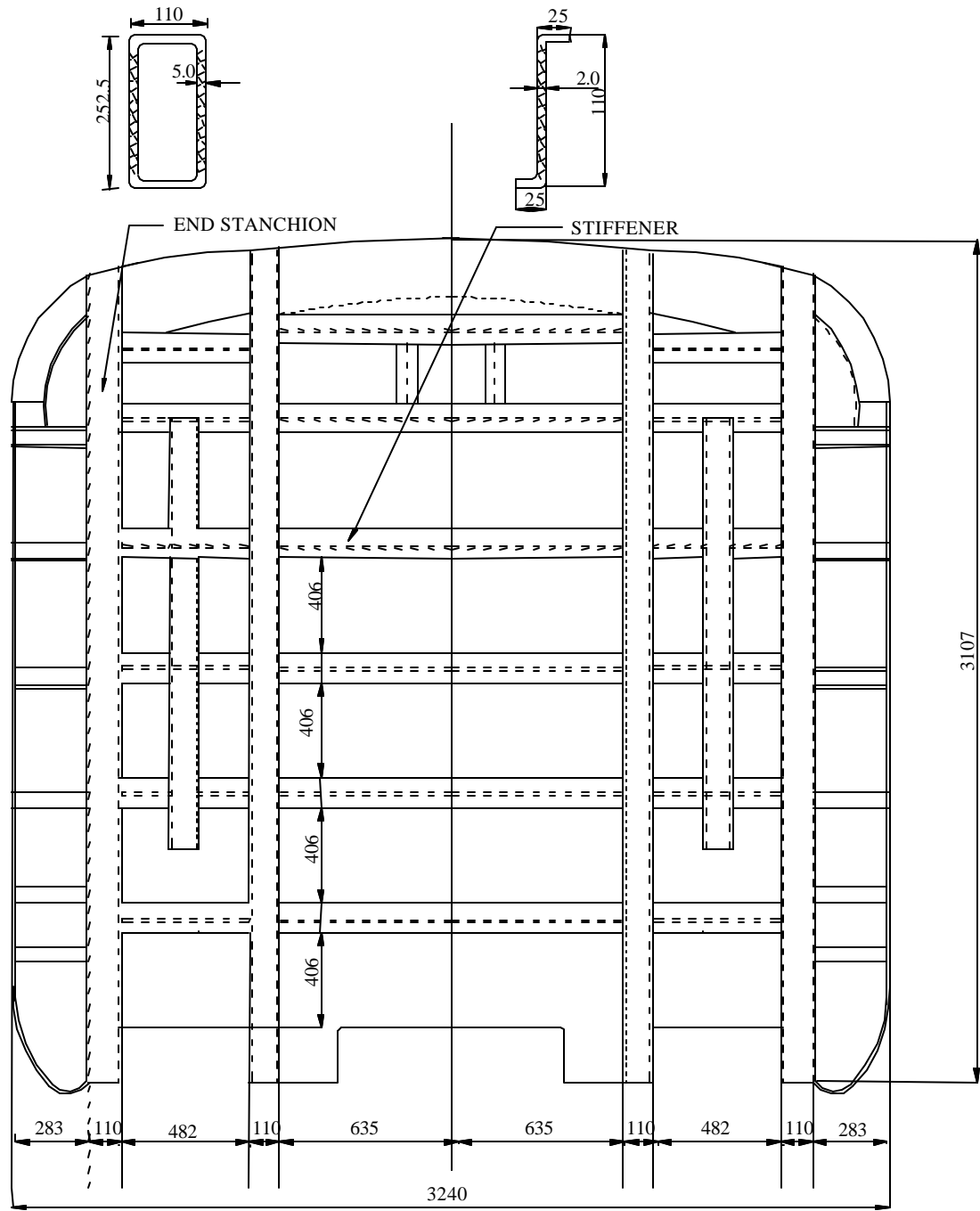
the length between the head stocks of underframe. The whole forms a tubular shell of integral construction in which the sides and roof panels also share the load. The corrugated trough floor with its corrugations running longitudinally from one head stock to the other takes up the buffing loads. Below 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. C-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, laminate paneling 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.

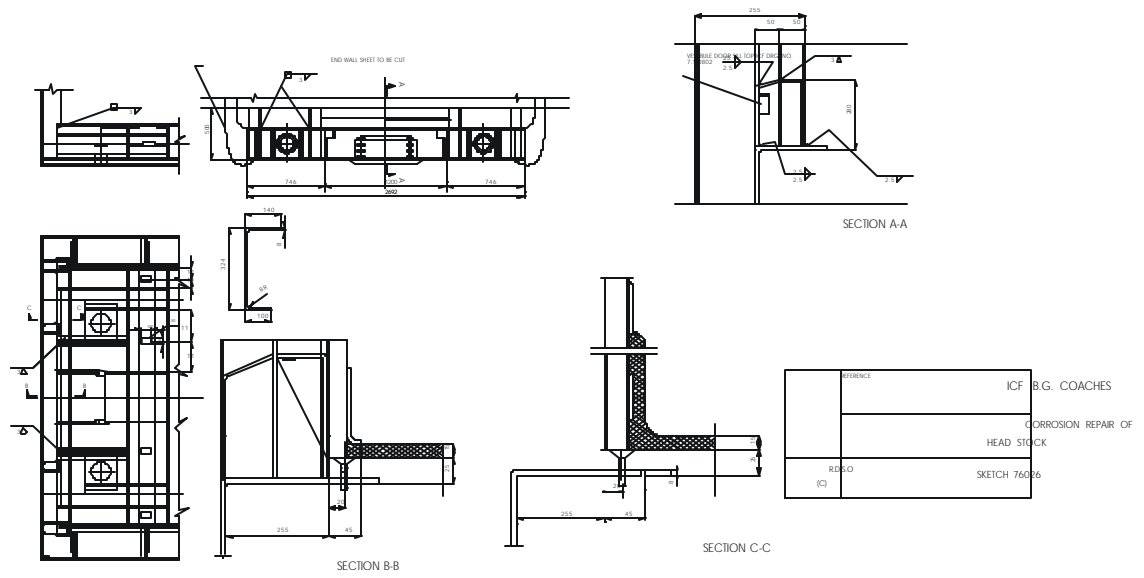


FIGURE 2.4

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	1. EOT cranes
2. Trestles for coach body	2. Trestles for coach body
3. Inspection torches	3. Gas cutting plants
4. Spiked hammers	4. Multi-operator welding plants
5. Ball peen hammers	5. CO ₂ Welding plant
6. Goggles for inspection staff	6. Electrical angle grinders
7. Measuring tape	7. Pneumatic hand grinders
8. Measuring scale	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.
