CHAPTER 5

UNDERFRAME

501. GENERAL

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

502. GENERAL CONSTRUCTION OF BG WAGON UNDERFRAME

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

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

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

Various rolled sections are used for the underframe members. Channel sections are generally used for headstock and sole bars for facilitating fitment of axle guards and buffers and Z-Sections are used for centre sills. Welding is generally used for joining the underframe members. But in earlier wagons,

riveting had been used for joining these members. In the case of bogie wagons, the underframe has comparatively stronger cross members, known as bolsters, for fitting the upper centre pivot casting, which rests on the bogie pivot.

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

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

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

i)	Inside length	+ 5 mm (riveted) - 5 mm + 7 mm (welded) - 3 mm
ii)	Inside width	+ 3 mm - 3 mm
iii)	Inside height	+ 3 mm - 3 mm
iv)	Difference between diagonals	
	a. Under frame	5 mm
	b. Body side	5 mm
	c. Body end	5 mm
	d. Door opening	4 mm
	e. Door	3 mm
v)	Distance between bogie pivot centres	+ 3 mm (riveted) - 3 mm + 5 mm (welded) - 2 mm
vi)	Distance between bogie pivot centre and adjacent headstock	+2 mm - 2 mm
vii)	Distance between stanchions:	
	(a) Body side	+ 3 mm - 3 mm
	(b) Body end	+1.5 mm - 1.5 mm
viii)	Door opening (vertical or horizontal)	+ 0 mm - 3 mm
ix)	Door length	+ 5 mm - 0 mm
x)	Door width	+ 3 mm - 0 mm

xi)	Distance between door centre line to centre line of door hinge	+ 1.5 mm - 1.5 mm
xii)	Coupler height from rail level in case the bogies are fabricated by the wagon builder himself.	+ 0 mm - 5 mm
xiii)	Coupler height from bogie top pivot in case bogies are provided as free supply items.	+ 0 mm - 3 mm

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

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

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

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

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

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

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

503. BG FOUR WHEELER UNDERFRAME

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

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

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

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

504. REPAIR PROCEDURE

A. Inspection of underframe

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

a) Rivets

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

b) Cracks

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

B. Alignment

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

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

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

i. Longitudinal check measurement of the wheel base.

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

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

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

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

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

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

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

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

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

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

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

505. CLEANING AND DE-RUSTING OF THE UNDERFRAME

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

506. REPAIRS TO HEAD STOCK

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

ii. Stripping the heavily bent/damaged members and getting them straightened and aligned in the smith shop.

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

507. REPAIRS TO DIAGONALS AND CROSS BARS

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

508. REPAIRS TO SOLE BARS

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

xv. Generally pitting/ corrosion on sole bar occur at door ways on open wagons. The provision of protection plates to sole bars at these locations as may be seen at Fig. 5.20. In this sketch, 3.15 mm thick copper bearing mild

steel protection sheet is to be welded around the web below the door opening area if the thickness of the web has not been reduced by more than 2mm where as by 5mm copper bearing mild steel plate if the reduction in the web thickness is more than 2mm but less than 5mm. As the web thickness of the sole bar of ISMC 250x82 is 9mm, it concludes that any sole bar web found to be less than 4mm should be replaced.

509. REPAIRS TO FLOOR PLATE

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

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

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

510. UNDERFRAME OF BRAKE VAN

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

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

511. BOGIE WAGON UNDERFRAME

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

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

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

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

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

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

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

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

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

h. The BFRs were primarily designed for loading of rails. However in actual practice, other commodities are also loaded in these wagons. Particularly where heavy machinery items like steel coils are loaded on these wagons and due care is not exercised in lowering these on the BFR, heavy impact of the load can cause damage to the underframe of the BFR with the result that these sag in the middle. Sometimes, these sag only one side, the repair of these underframe posses serious difficulties. If the underframe sags uniformly on both sides, the ends are anchored and the middle portion is raised by the application of screw jacks to make straight. In case of BRN wagons, the problem of breakage/detachment of fixed ends/ headstock and sagging of sole bar/centre

girder was noticed within first POH period. RDSO vide letter no.MW/BRN Dt. 7.1.99 asked Railways to modify the wagon to arrest such failures. These modifications are shown in RDSO Drg.No.WD-95010-S-1,S-2 and S-3.

512. MG FOUR WHEELER WAGON UNDERFRAME

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

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

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

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

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

513. MG BOGIE WAGON UNDERFRAME

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

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

B. MBTPX (IRS underframe)

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

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

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

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

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

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

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

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

D. MBTPZ wagons

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

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

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

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

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

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

514. LIST OF MODIFICATIONS

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

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

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

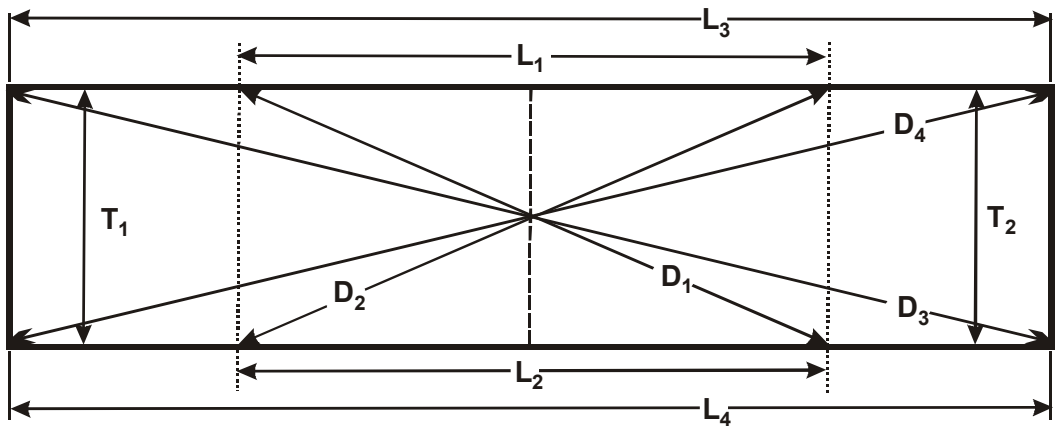


FIG. : 5.1 - DIMENSIONAL CHECKS ON UNDERFRAME

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

1. The difference between dimension L1 and L2, longitudinal axle guard centres, should not exceed 3 mm. (1/8"). The tolerance permitted in the length L3 and L4 is + 3.0 mm. (+1/8") and - 1.5 mm. (-1/16")
2. The difference between dimension T1 and T2, transverse axle guard centres, should not exceed 1.6 mm.(1/16")
3 The difference between max. dimension D1 and D2 diagonals of axle guard centres should not exceed 1.5 mm.(1/16"). The difference in the diagonals of the underframe, D3 and D4 should be within 2.5 mm.(3/32")

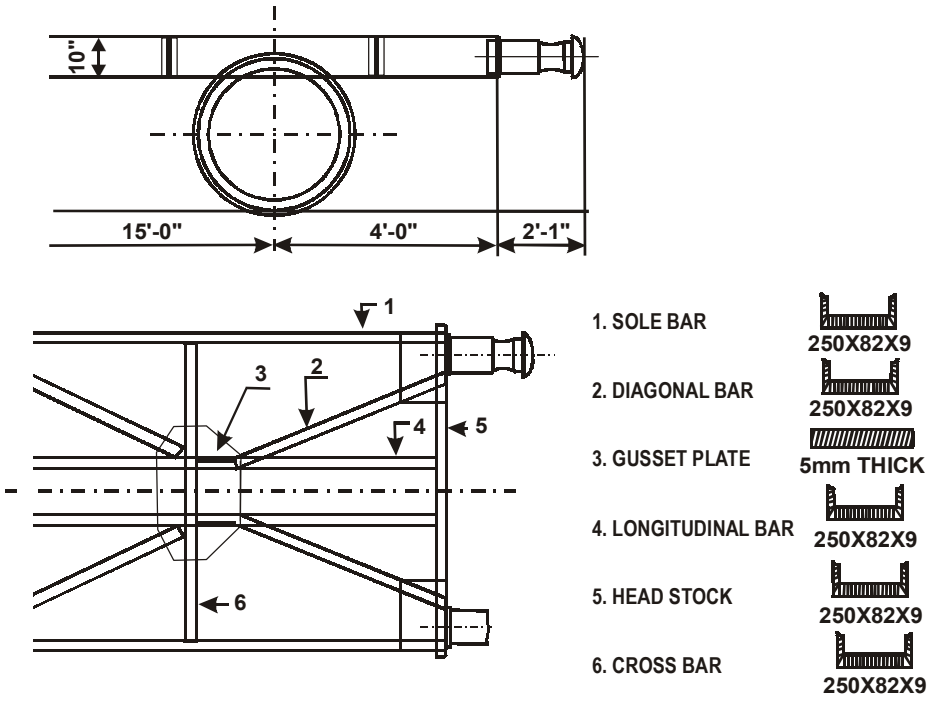
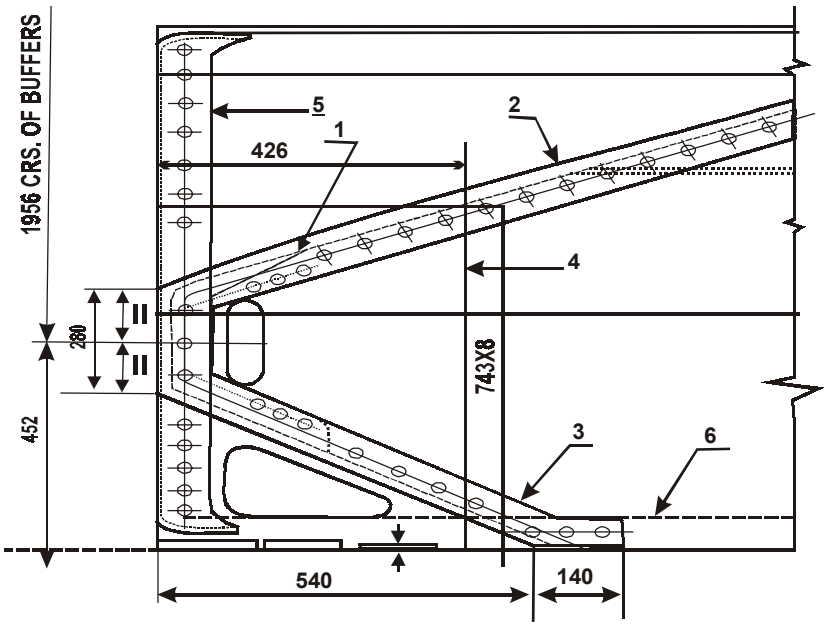


FIG 5.2 TYPICAL FOUR WHEELER UNDERFRAME
टिपिकल चार पहियों वाला अंडरफ्रेम



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

FIG : 5.3 MODIFICATION TO HEAD STOCK DIAGONAL & KNEE JOINT (FOR BOGIE OPEN WAGON TYPE BOX MK)
हेड स्टॉक डायगोनल एवं नी जोड़ का मॉडीफिकेशन (बाक्स प्रकार के ओपन बोगी वैगन हेतु)

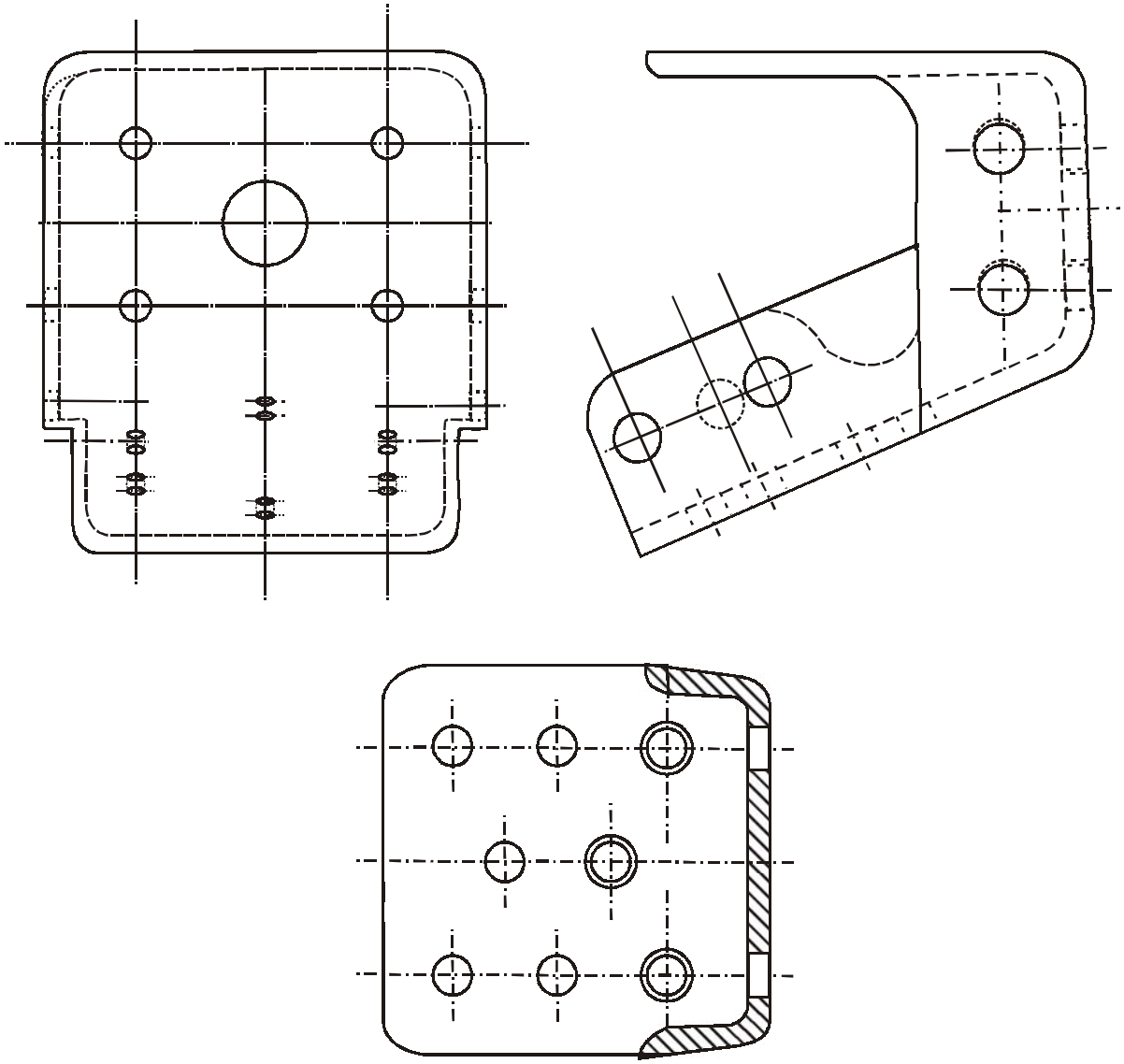


FIG 5.4 CAST STEEL BRACKET
(FOR GOODS BRAKE VAN TYPE BVGT)

कास्ट स्टील ब्रेकिट
(बी वी जी टी प्रकार के मालगाड़ी ब्रेक वान हेतु)

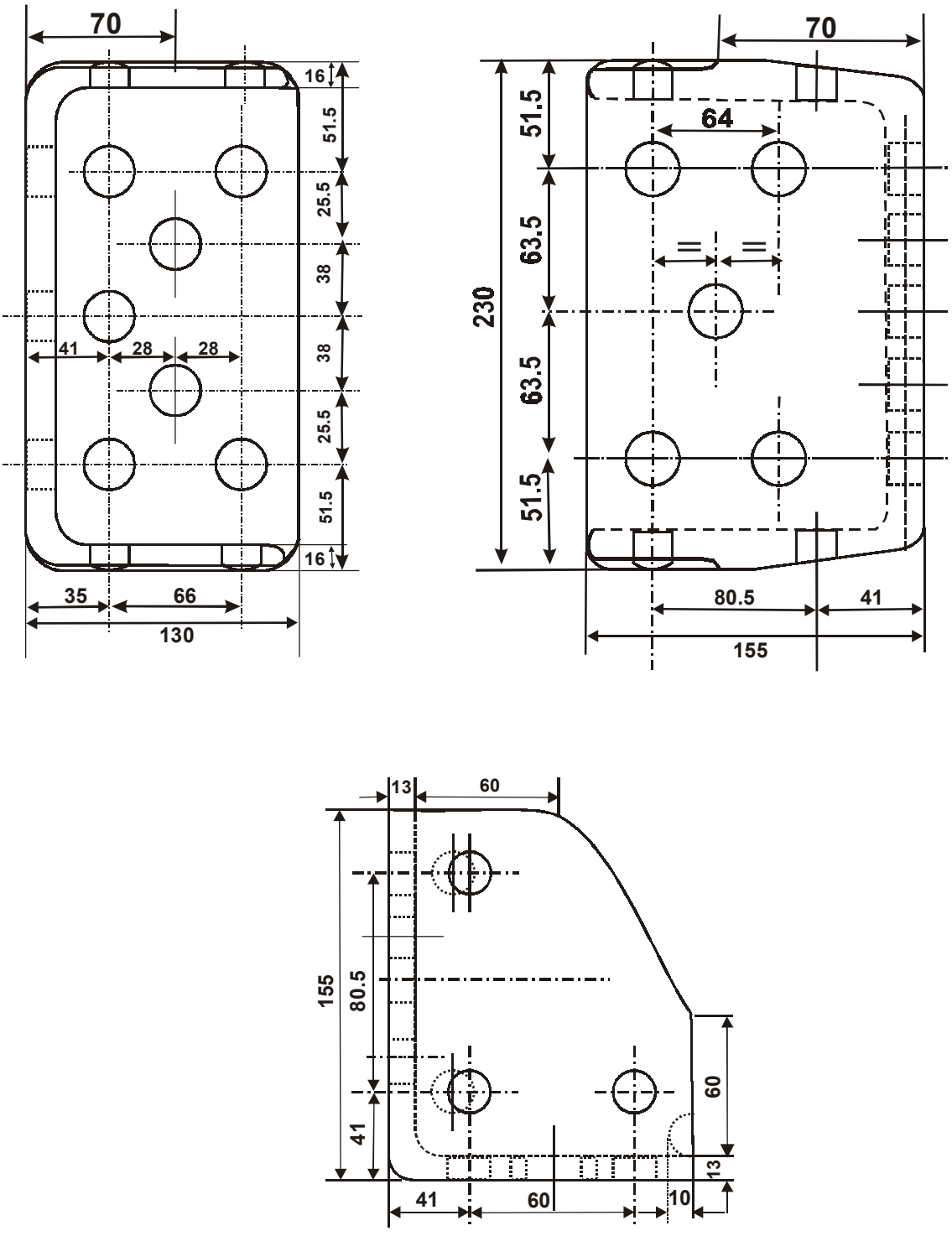


FIG. 5.5
CAST STEEL KNEE FOR FOUR WHEELER
BG WAGON TYPE "BVGT"

कास्ट स्टील नी चार पहिया बी जी वैगन प्रकार (बी वी जी टी हेतु)

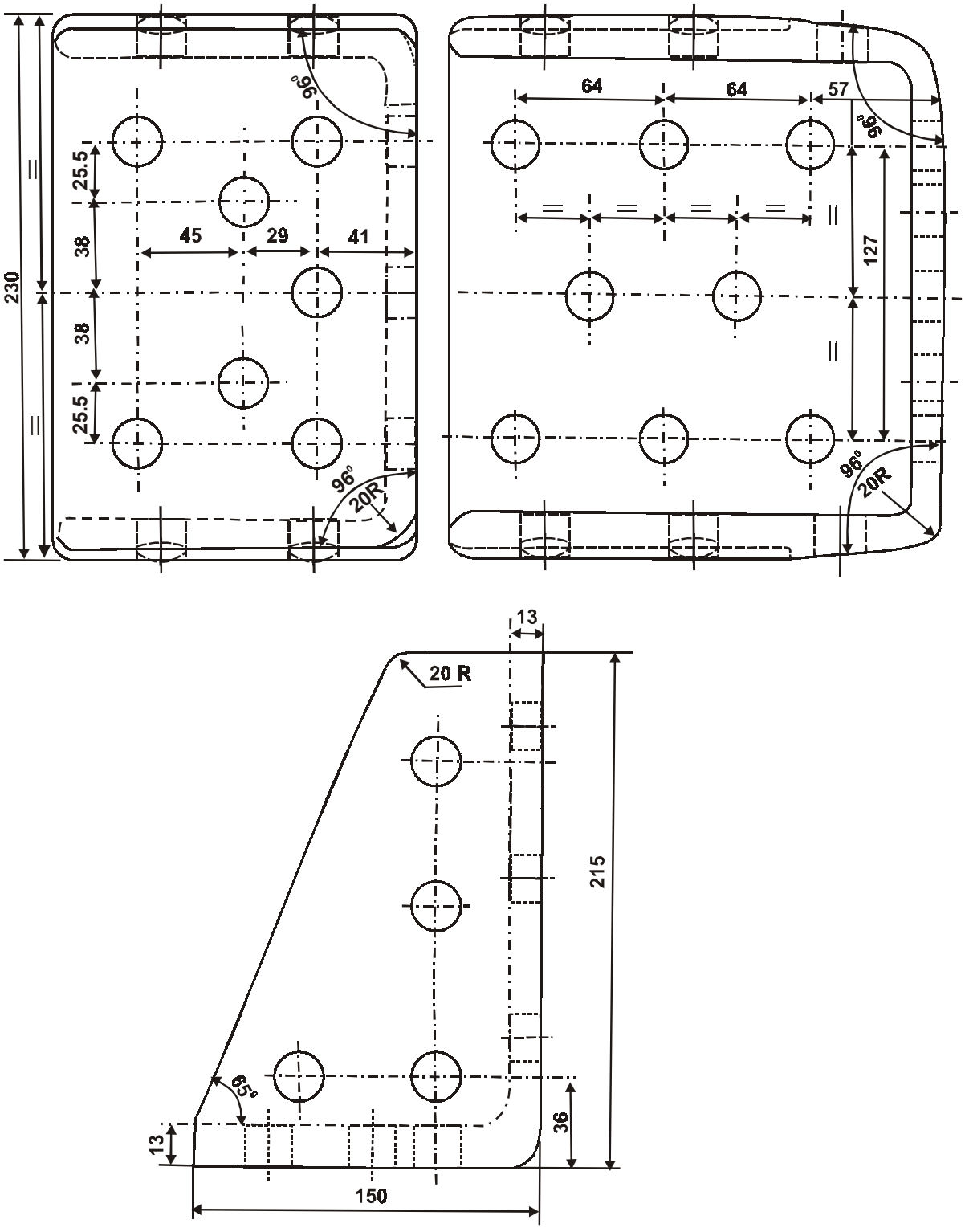


Fig. No. 5.6
CAST STEEL KNEE FOR FOUR WHEELER WAGON
कास्ट स्टील नी चार पहिया वैगन हेतु ।

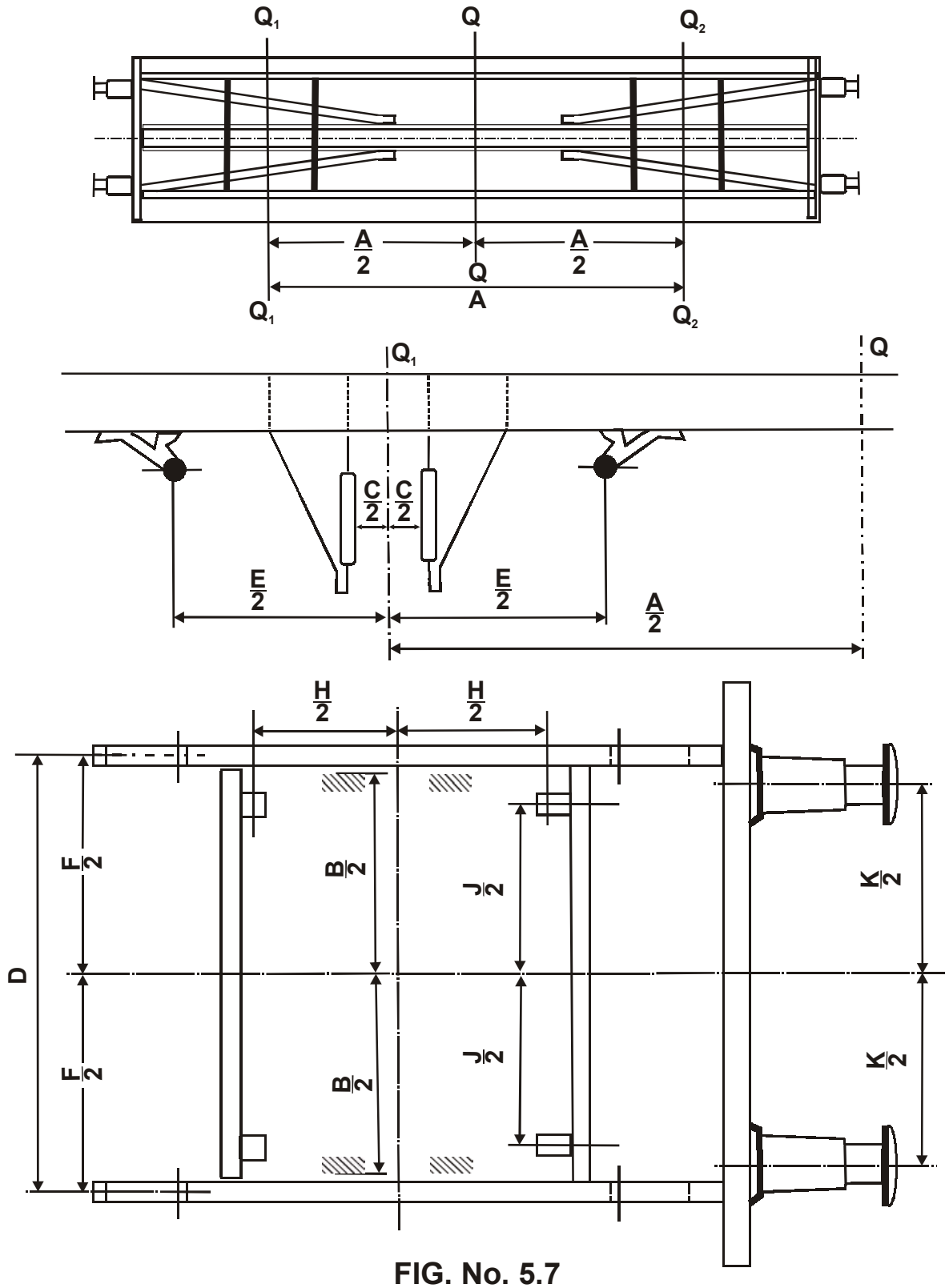


FIG. No. 5.7
POSTIONING OF SCROLL IRON, HORN CHEEK AND BUFFERS

स्क्राल आयरन, हार्न चीक एवं बफर की पोजीशन ।

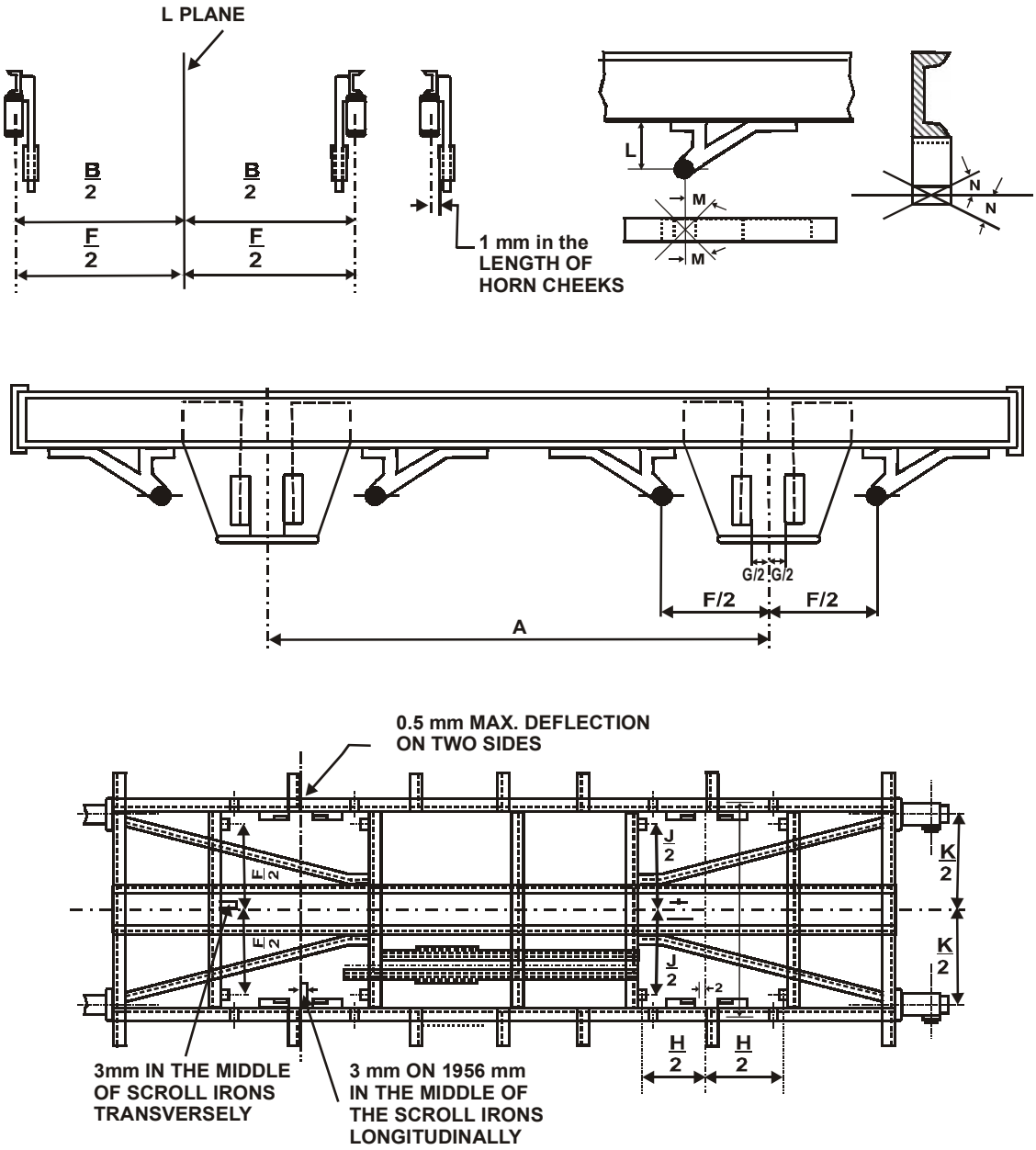


Fig. No. 5.8
POSITIONING OF SCROLL IRONS, HORN CHEEKS BUFFERS etc. ON A FOUR WHEELER WAGON

चार पहिया वैगन पर स्क्राल आयरनों, हार्न चीक बफर इत्यादि की स्थिति

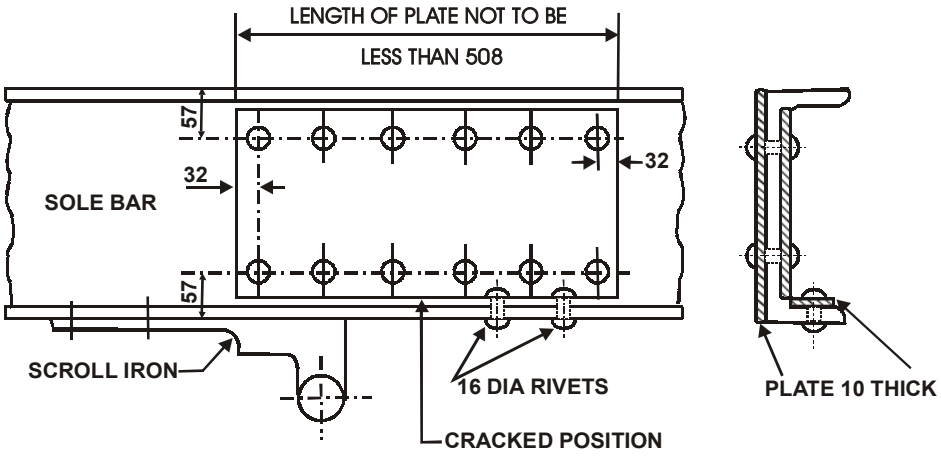


FIG. 5.9 PATCHING OF SOLE BAR

सोल बार की पैचिंग

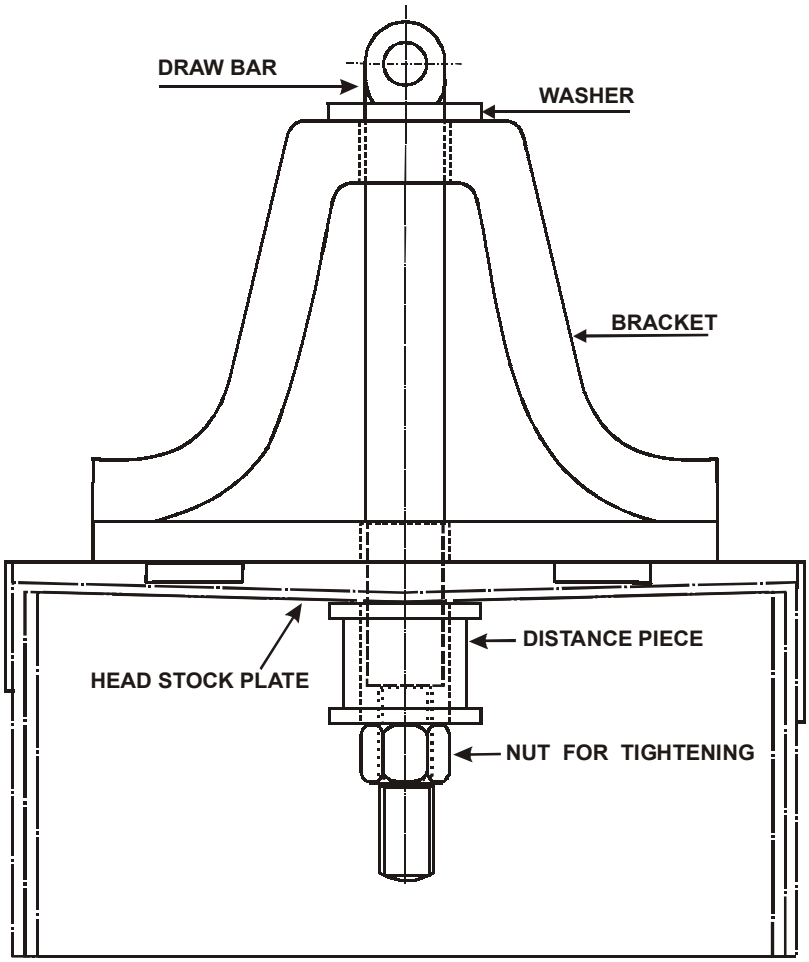


FIG. 5.10
HEAD STOCK STRAIGHTENING DEVICE

हेड स्टाक को सीधा करने वाला उपकरण

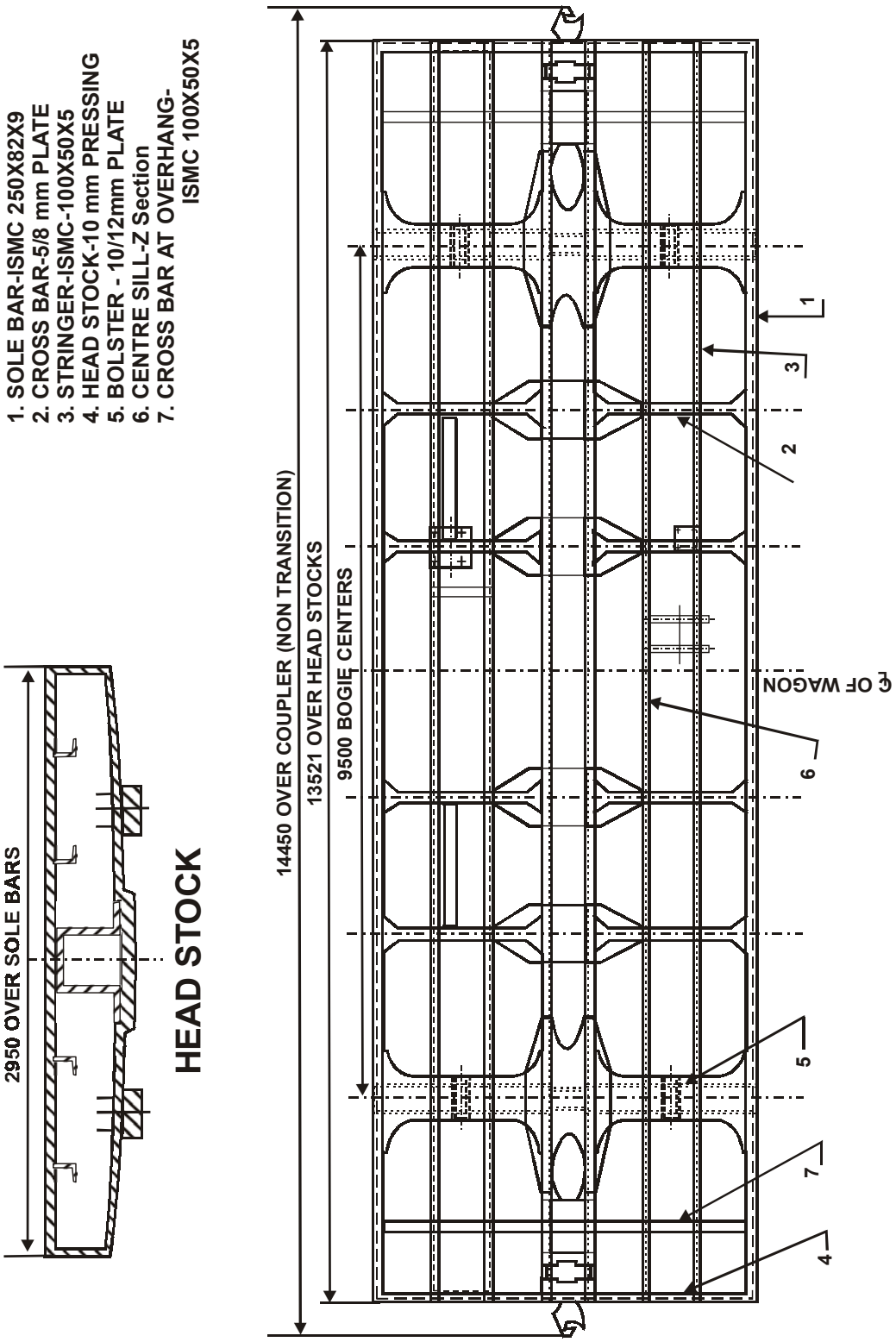


FIG. 5.11 BG WAGON TYPE "BCNA"

"बी सी एन ए" प्रकार का बी जी वैगन

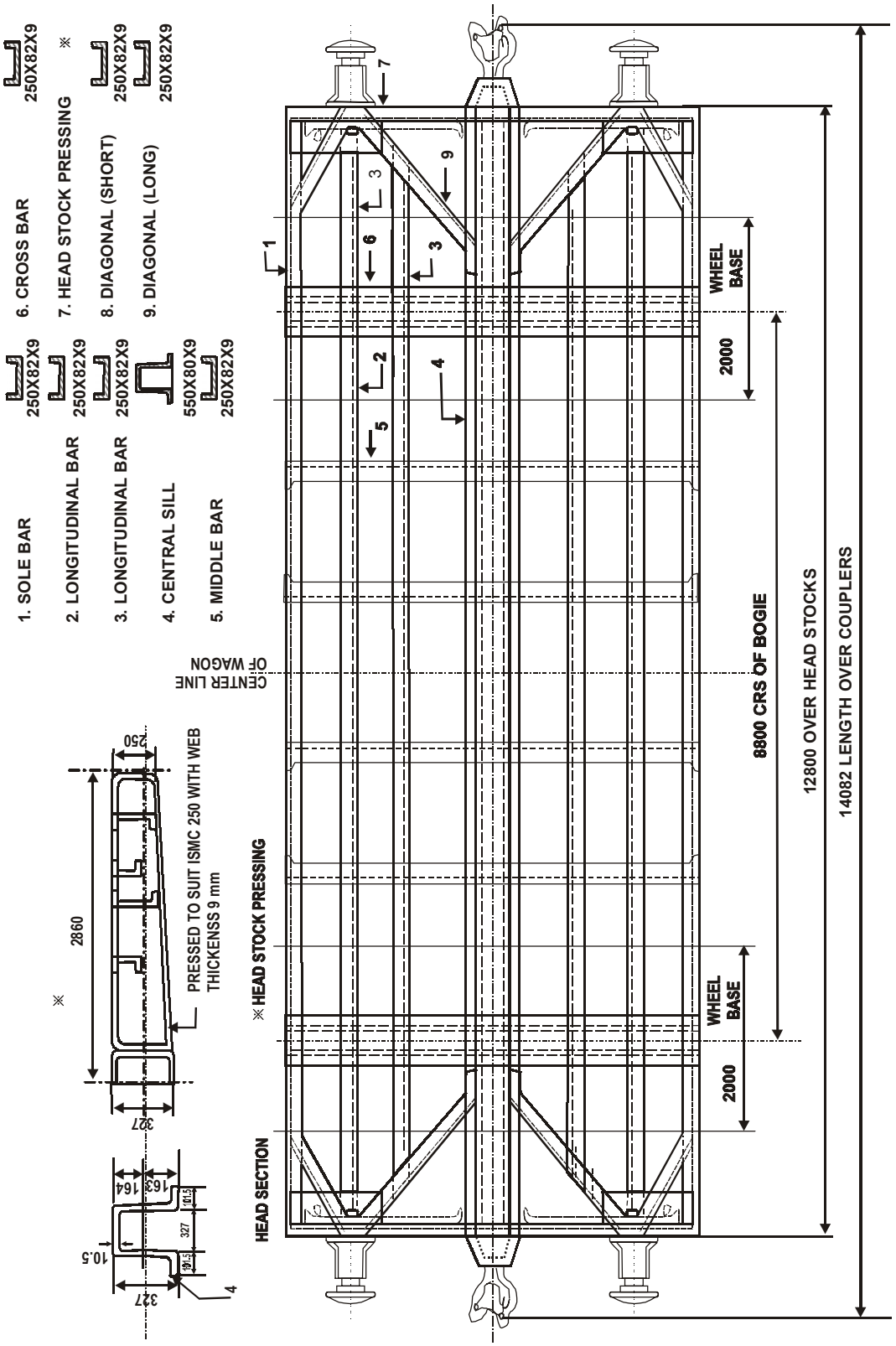


Fig. 5.12 UNDERFRAME FOR BOGIE OPEN WAGON (TYPE BOX)

ओपन वैगन बोगी की अंडरफ्रेम (बाक्स प्रकार)

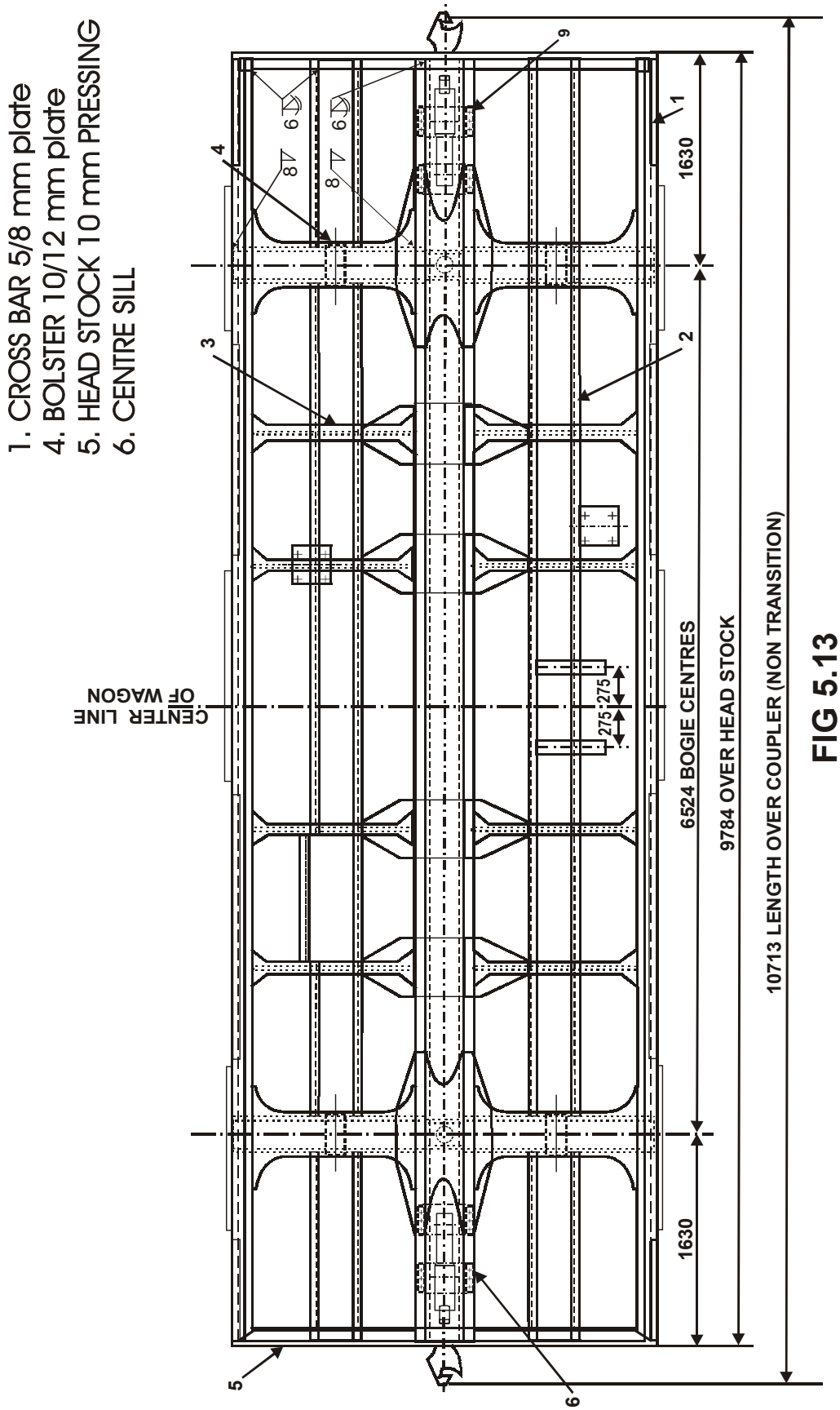


FIG 5.13

UNDERFRAME OF BOGIE OPEN WAGON (TYPE BOXN)

ओपन वैगन बोगी की अंडरफ्रेम (बाक्स एन प्रकार)

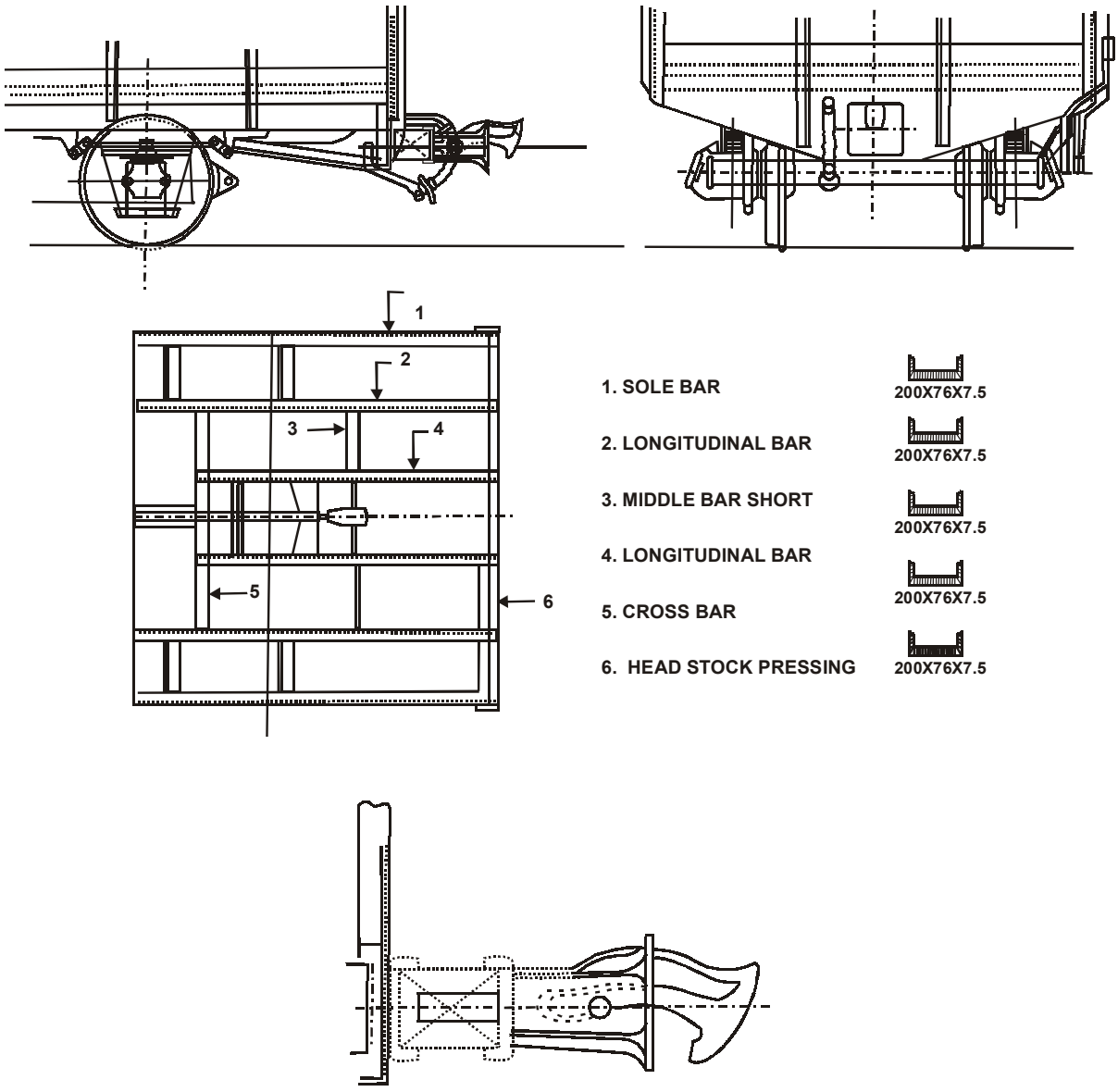


Fig. 5.14 IRS COVERED WAGON UNDERFRAME (MG FOUR WHEELER)

आई आर एस कवर्ड वैगन अंडरफ्रेम (एम जी चार पहियों वाला)

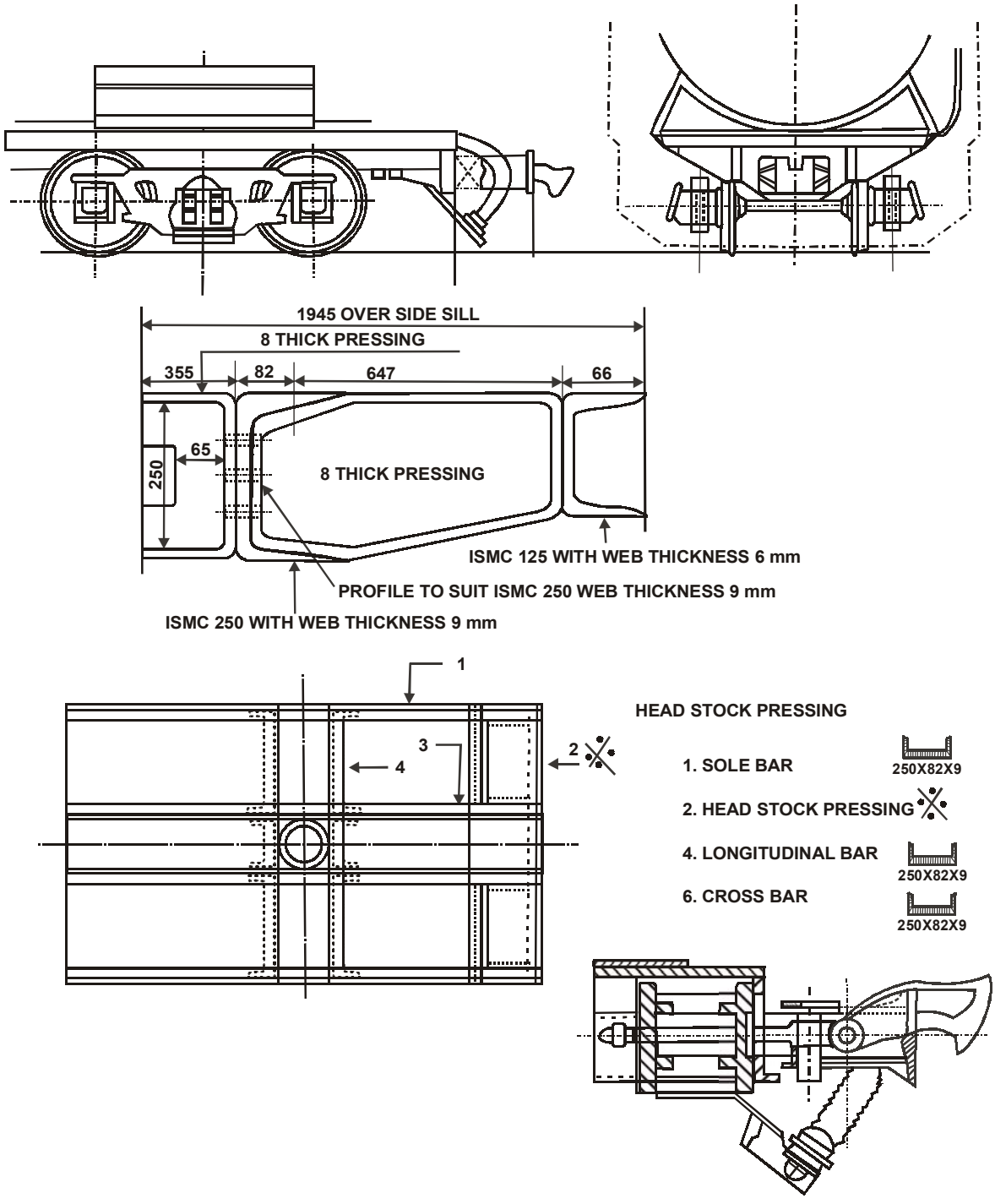


FIG. 5.15
UNDERFRAME BOGIE WAGON (TYPE MBTPX)

अंडरफ्रेम बोगी वैगन प्रकार एम बी टी पी एक्स

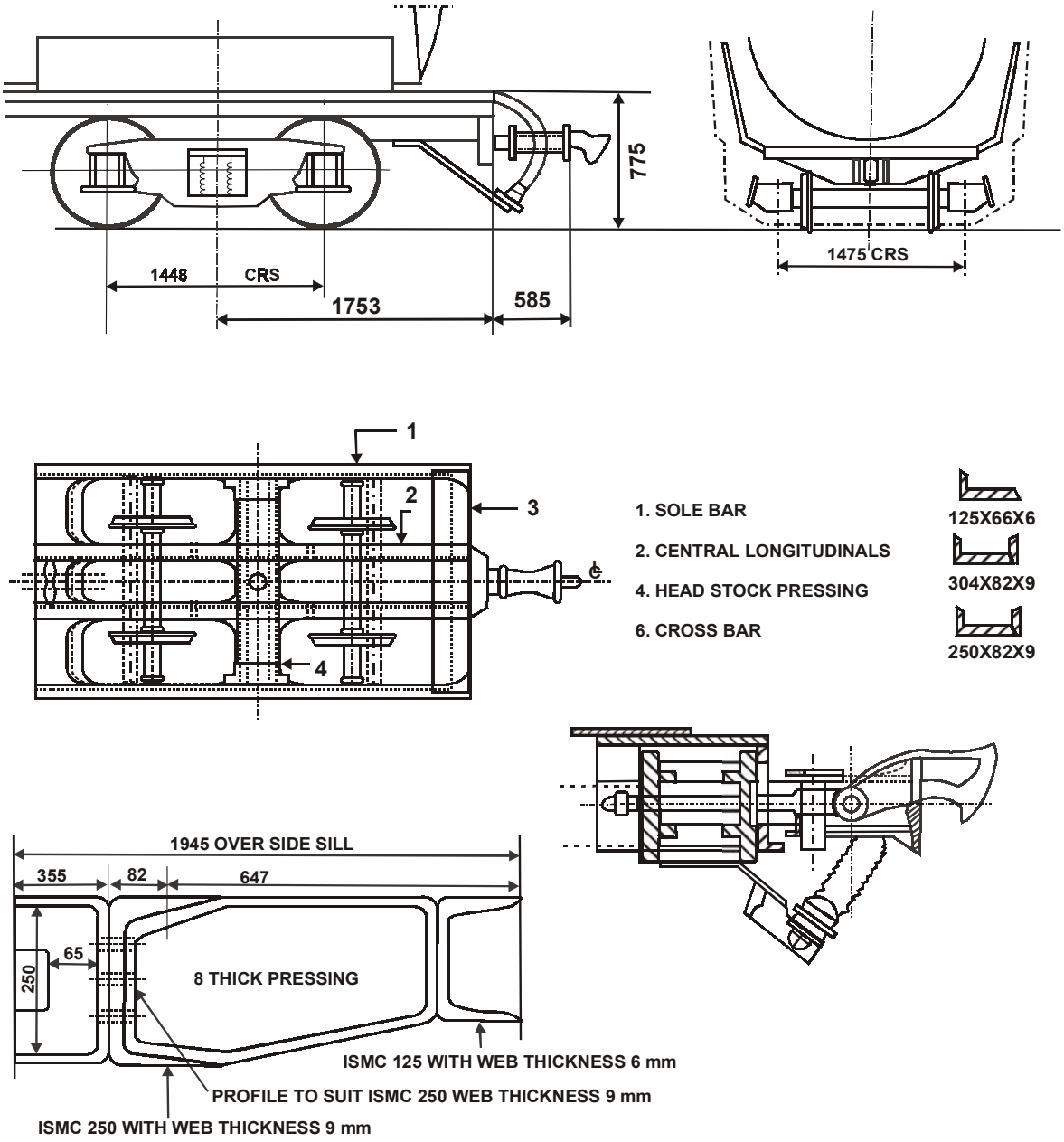


FIG 5.16
IRS EIGHT WHEELER UNDERFRAME MBTPZ TANK WAGON
आई आर एस आठ पहियों वाला अंडरफ्रेम (एम बी टी पी जेड टैंक वैगन)

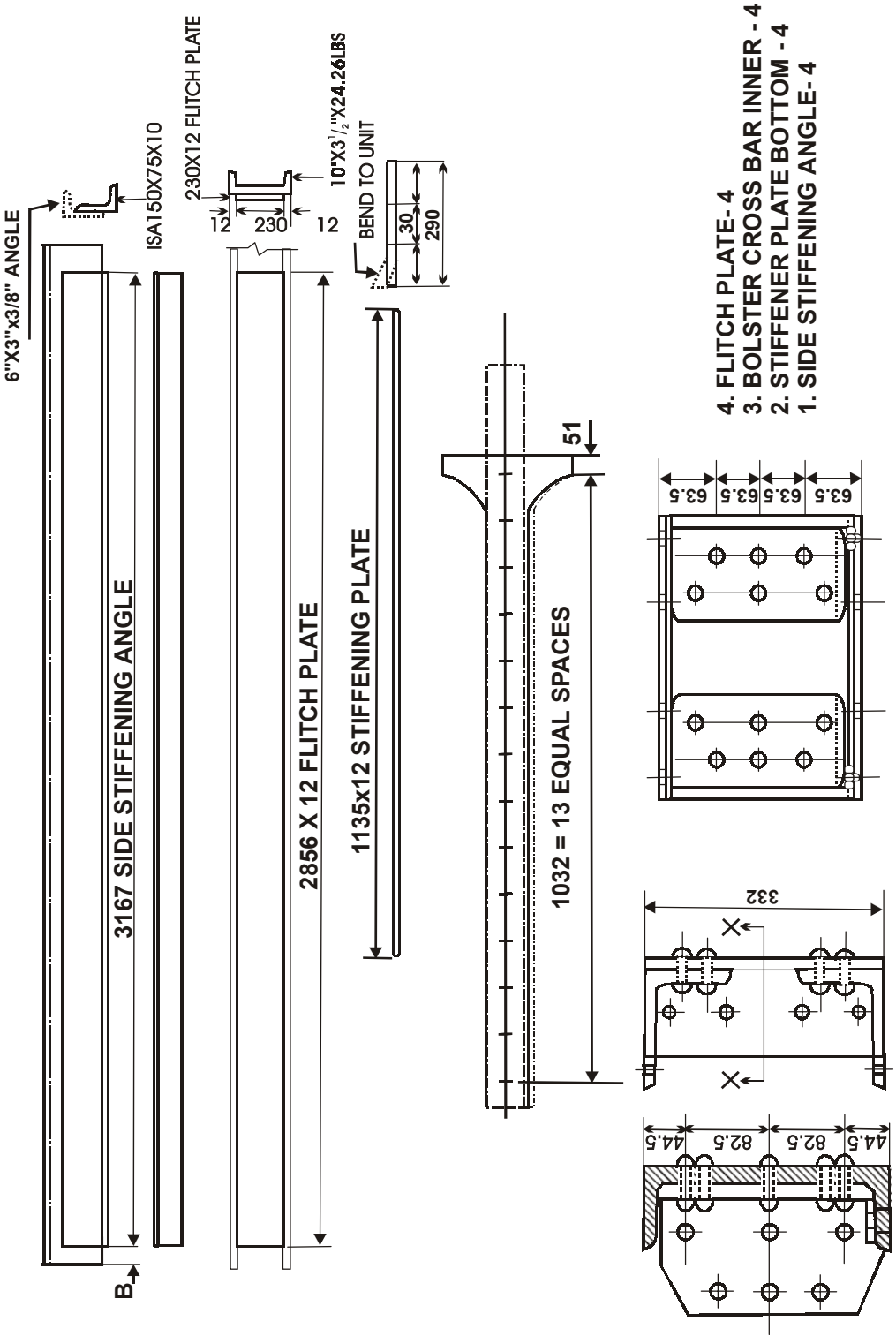


FIG. 5.17

DETAILS OF STIFFENING OF UNDERFRAME IN EXISTING "MBTPX" WAGON

एम बी टी पी एक्स वैगन में लगी अंडर फ्रेम स्टिफनिंग का वर्णन

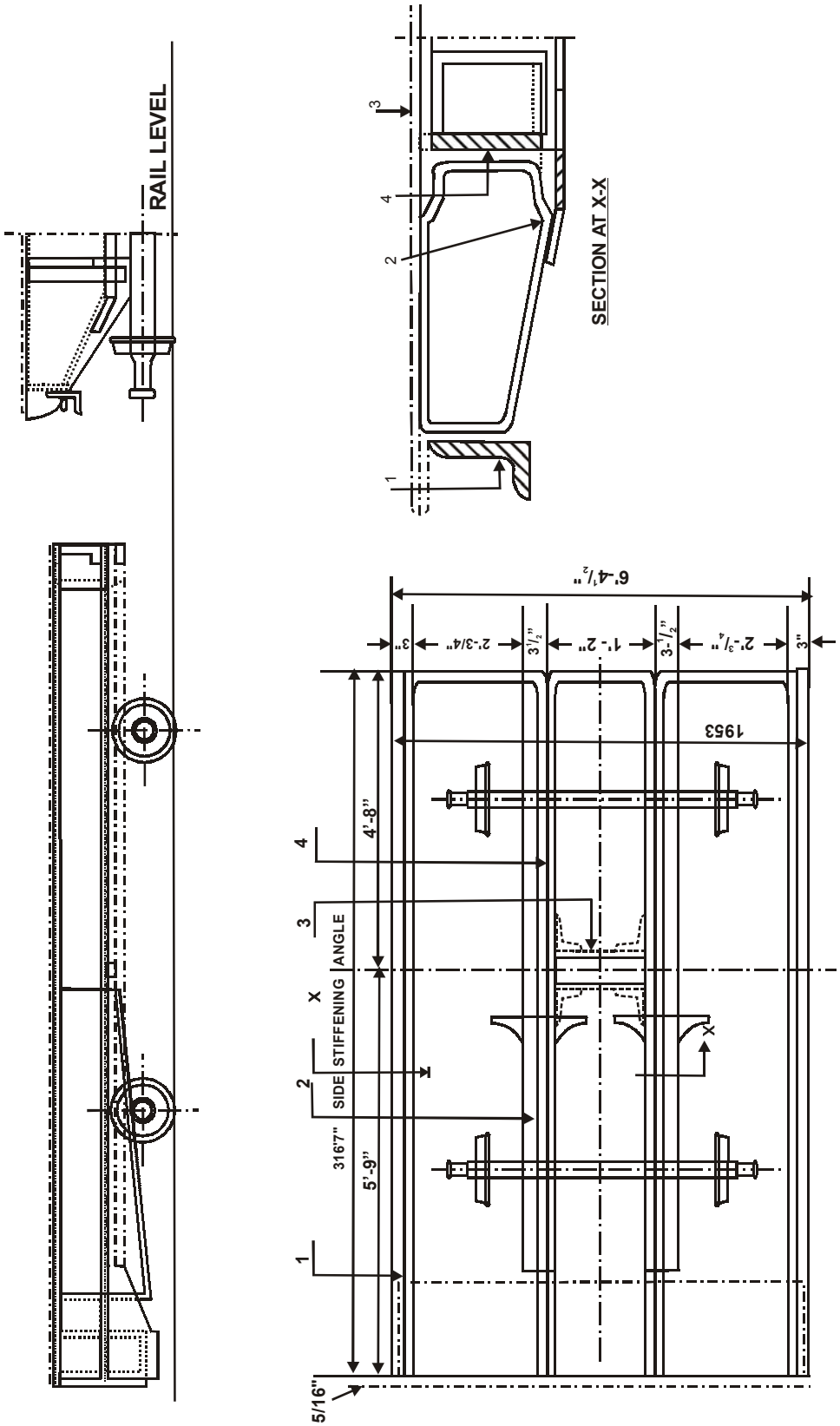


FIG : 5.18 ARRANGEMENT OF STIFFENING OF UNDERFRAME IN EXISTING "MBTPX" WAGON

एम बी टी पी एक्स वैगनों में लगी अंडरफ्रेम स्टिफनिंग का प्रबंध

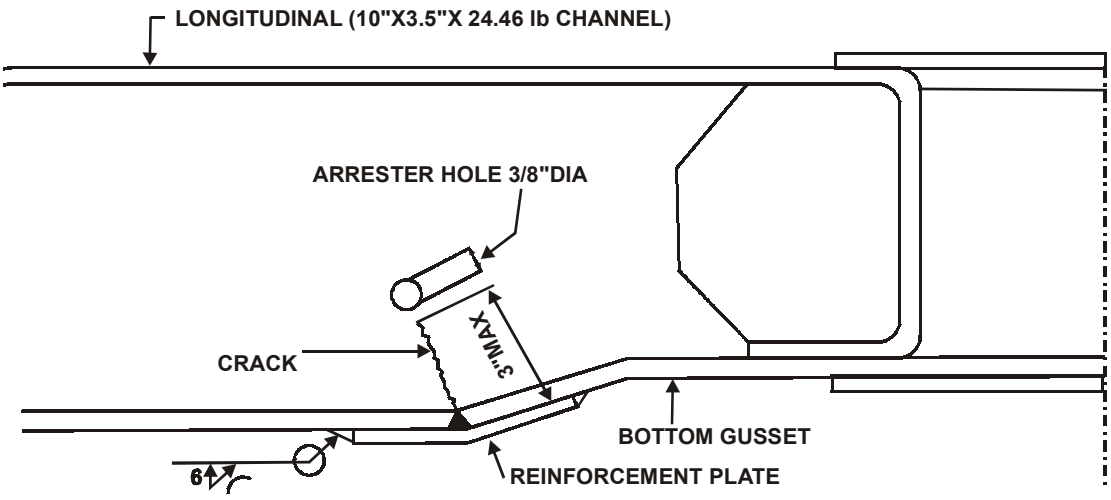


FIG. 5.19.1 CRACK IN LONGITUDINAL CHANNEL WEB AT WELDED JOINT OF BOTTOM GUSSET PLATE

ckVe x tV IyV d ofYMx TokbUV ij YkkxhV;Muy puy oc e Ød

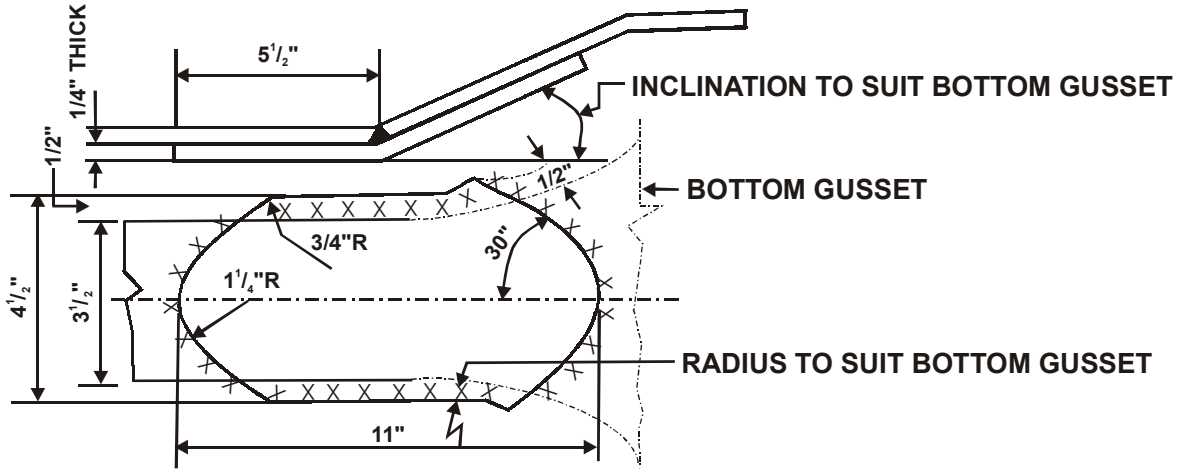
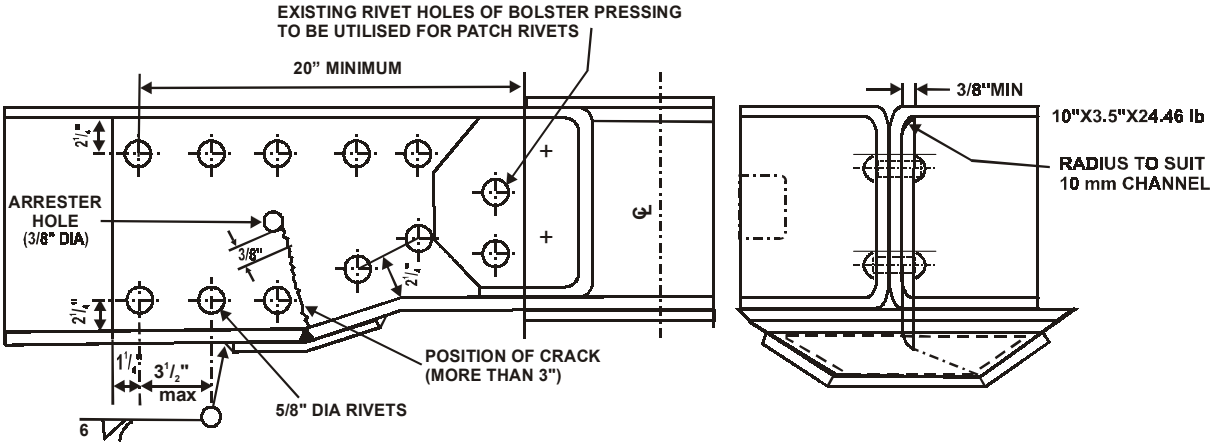


FIG 5.19.2 REINFORCEMENT PLATE

रीन्फोर्समेंट प्लेट



REPAIR PROCEDURE

1. Lift wagon and run out bogie
2. Drill arrester hole as shown in fig 19.1
3. Gouge crack to "U" or "V" groove (included angle for "V" groove should be 60^0-70^0) up to arrester hole
4. If gusset plate butt weld is cracked or defective, gouge weld to expose sound metal and reweld. Weld reinforcement to exceed 1/16".

FIG 5.19.3 PATCHING OF LONGITUDINAL

515. REPAIR AND MAINTENANCE IN SICKLINE & ROH DEPOT

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

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

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

516. REPAIR & MAINTENANCE IN WORKSHOP DURING POH/NPOH

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

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

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

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

