

TRACK STRUCTURE

Lesson 3

RAIL FASTENINGS

Rail have to be properly fixed over sleeper to ensure following:

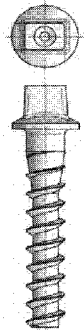
- (i) To maintain the gauge
- (ii) To transmit the loads
- (iii) To with stand lateral forces
- (iv) To reduce impact on the joints
- (v) To have least disturbance during movement of wheels over it.

Bearing the above facts the following fittings are in used for different rail sections.

1. PLATE SCREWS

- (1) This is not driven but screwed.
- (2) Screw size is thicker and screw thread makes the plate snug fit
- (3) Cannot be easily removed.
- (4) There is a cant of a 1 in 20 circular head where it comes in contact with rail which will ensure more area of contact.
- (5) Replacement will be easy.

Before fixing, this should be greased instead of coal taring so that fixing and extraction will be easy at later stage



2. Elastic Fasteners

In recent years some of new fixtures which are very sturdy and of fit and forget type have been developed. Fig.3.1.1 & Fig.3.1.2 show details of one such fastening, known as Elastic Rail Clip (ERC) for fixing the clip to rail. ERC was earlier known as PANDROL clip.

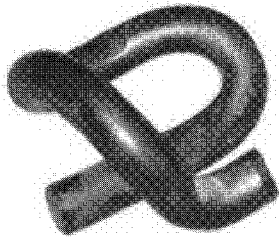


FIG. 3.1.1 PANDROL CLIP

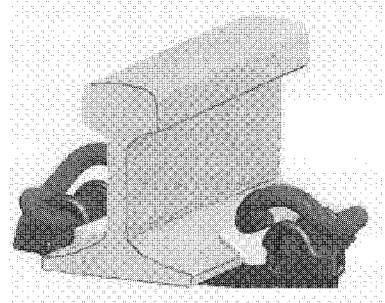


FIG. 3.1.2 PANDROL CLIP WITH ELASTIC FITTINGS

2.1 These clips (ERC) are made up of high silicon spring steel. These are manufactured to a special bent shape so that one leg of clip will press on foot of the rail and other leg is fixed in eye of insert. This will provide toe load on rail foot. It is necessary to provide grooved rubber pad at rail seat. Each sleeper requires four clips and these clips should be greased once in 2 years to avoid corrosion.

2.2 Fittings for concrete sleepers

2.2 (A) Spheroid Graphite Cast Iron (SGCI) Inserts

The SGCI Inserts are used in Pre-Stressed Concrete Sleepers on a Railway Track fitted with Elastic Rail Clips and Rubber Pads to hold the rails. Two Elastic Rail Clips are provided on both sides of the rail and hold the flange side of the rail with the SGCI Insert. The top part of the Insert resting on the Sleeper surface is a combination of the tapered part called the shoulder and semi cylindrical part with a cylindrical hole in it called the centre leg. The Elastic Liners are used between the rail flange and SGCI Inserts, and together with ERC they reduce the dynamic loads on the Inserts.

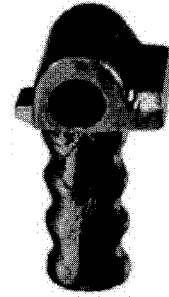


FIG 3.2 (a) SGCI INSERT

2.2 (B) Grooved Rubber Sole Plate (GRSP)

The rail seat is provided with the rubber pad which is of size 130 mm x 125mm x 6mm with grooves at 11 mm centre to centre and 3mm deep on either side alternatively at top and bottom. The placing of pad has to be done with grooves parallel to the rail.

The rubber pad is an integral part of an elastic fastening. The functions of the rubber pad are as under:

- (i) It absorbs the shocks.
- (ii) It dampens and absorbs vibration,
- (iii) It resists longitudinal movement of rail.
- (iv) It prevents abrasion of rail on the top of sleeper.
- (v) It acts as an insulator between rail and sleeper.

Now a days Composite Rubber Sole Plate (CGRSP) are being used in Indian Railways. Composite GRSP are developed with two layers of different types of rubber, which has the top layer having higher modulus of elasticity (harder) while bottom is of softer Material. The harder layer should be kept in contact of Rail, thus, the surface of CGRSP where the manufacturer's initials are embossed should be placed on rail seat, facing up.

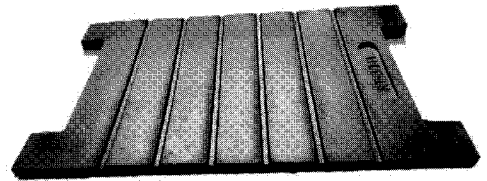


FIG 3.2 (b) GRSP

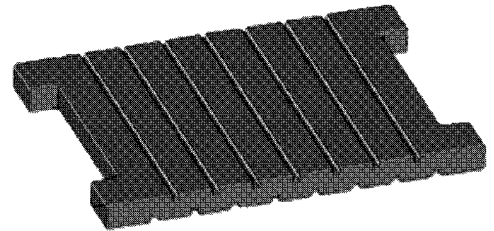


FIG 3.2 (c) CGRSP

2.2 (C) Liners

In track circuited portions, glass filled nylon (GFN) insulated liner are inserted between foot of the rail and pandrol clip. Metal liners are used in non-track circuited area.

RDSO has developed glass filled nylon liners (GFN-66) of 4 mm thickness particularly for track circuited areas and sections, subject to severe corrosion. These glass filled nylon liners are considered to be technically superior because these are in single piece, have longer life and are free from corrosion. These liners are on extensive use on Indian Railways particularly with ERC clip assembly on 60 kg and 52 kg rails and PRC sleepers. It has also been decided that in saline atmosphere of coastal belts and areas subjected to industrial fumes etc., where corrosion is prominent, only GFN-66 liners should be used.

2.2 (D) ERC (Elastic Rail Clip or Pandrol Clip)

The eye piece of insert is greased properly and then pandrol clip is driven in such a manner that leg of clip is flush with face of eye of insert.

When all four pandrol clips are provided with liners correctly, the gauge of track becomes uniform, It is not possible to adjust the gauge & cross level with above type elastic fastenings therefore, necessary care is to be taken to manufacture the concrete sleepers with tight tolerances.



FIG 3.2 (c) Liner

3. Rail Joints

To keep the continuity of rail, the rails are to be fastened by some means so that the rails are kept in position while withstand imposed loads. The location where it happens is called joint.

It is a well-known fact that joint is the weakest link in track due to following reasons:

- (1) Sudden impact
- (2) Extra stresses of bending.
- (3) The ballast get disturbed leaving voids.

Therefore, maintenance of joints is very important for P. Way engineers.

4. Fish Plates

4.1 Ordinary Fish Plate

These are used to connect two rails together with fish bolts. Since these are fishing the rails to provide continuity and rigidity to the joint, the name is given as fish plate. Standard IRS fishplates are provided with four holes. These Fish plates are now being replaced by 1 mtr long Fish Plate at all the locations.

To accommodate the bolts, it is quite necessary to drill holes in rails at pre-specified locations and spacing keeping in view the thermal movements of rails, i.e. expansion or contraction and to slide without disturbing the geometry of rail or track structure.

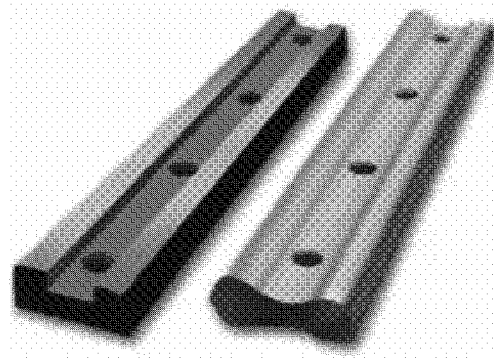
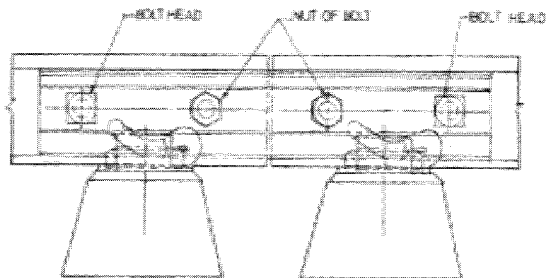


FIG 3.3 FISH PLATED JOINT & FISH PLATES

4.2 One meter long fish plates:

To reduce the number of joints in the track, the standard rails are welded into a longer length of around 1 km to form LWR. While doing the work of welding, 1 m special Fishplates are used temporarily as they provide larger bearing area for longer gaps encountered (Fig. 3.4). It is possible to avoid drilling of holes into the new rails with the use of 1 m long fishplates and special clamps. 1 m fish plates shall be used on Fish plated rail joints with normal spacing of sleepers.

There are two types of special Fishplates:

- (1) With predrilled holes which can be fixed with fish bolts.

- (2) Without holes having grooves in place of holes in the fishplate to accommodate the special clamps instead of bolts.

These special clamps are having two parts, one is male part, and the other is female part and these clamps are tightened using one bolt.

While tightening the clamp, it should be ensured that top portion of male and female part is fixed in groove of fish plate and bottom portion of male & female parts are fixed with each other, such clamp is shown in Fig. 3.5

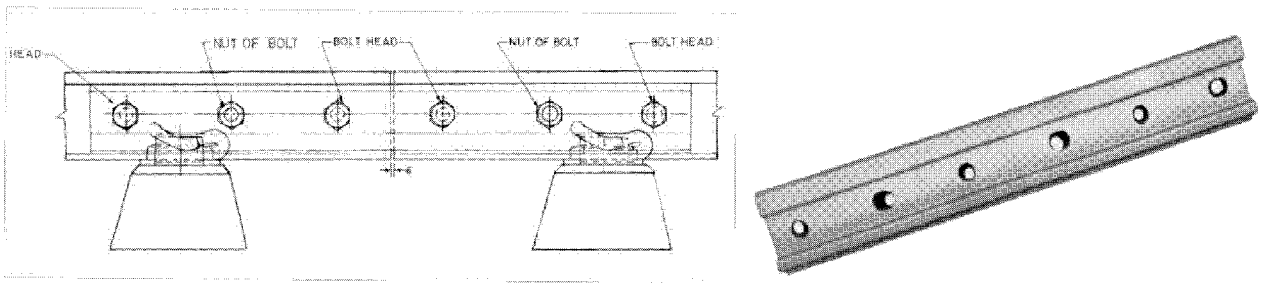


Fig. 3.4 1mtr LONG FISH PLATE

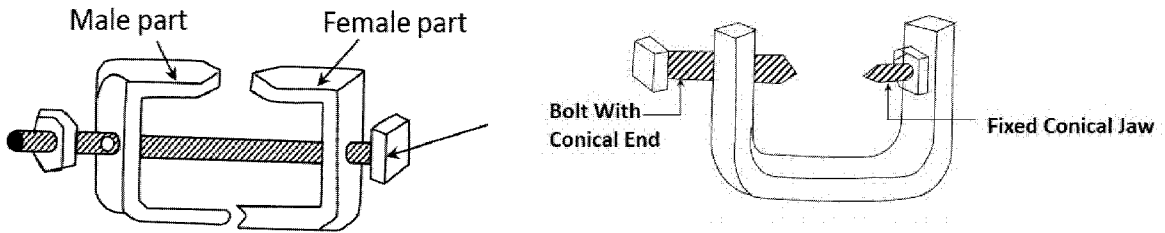


Fig. 3.5 UNIVERSAL SCREW CLAM

4.3 Junction or combination fish plates

When two different sections of rails are to be joined, junction or combination fish plate is used. Details shown in Fig 3.6

The construction features of combination fish plate are as under:

- (1) The thickness at centre is increased.
- (2) The clips of bigger and smaller section are either raised or lowered to make the top level of rail even.
- (3) The holes are drilled on either side corresponding to the rail section.
- (4) Pairs are made and inscribed on fish plate as outside right as OR, inside right as (IR), outside left as OL and inside left as IL.
- (5) Longer fish bolts are to be used near the joints and ordinary bolts on ends of fish plate.

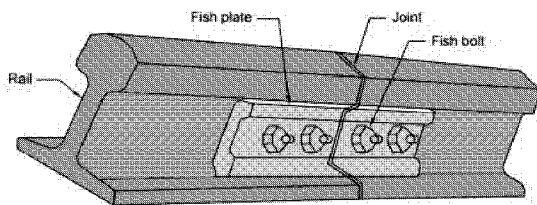


Fig. 10.1 Fish plate

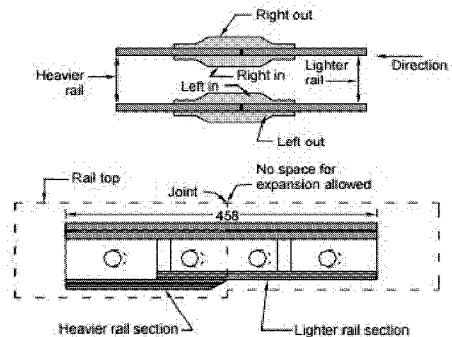


Fig. 3.6 COMBINATION FISH PLATE

While providing junction fish plates following care should be taken:

- (1) Higher section of rails to be faced while fishing these fish plate
- (2) There should not be any expansion gap and rails should butt each other (Gapless Joint)
- (3) Rail ends should be made perfectly vertical by saw cut.
- (4) When old rail sections are joined, their ends should be cropped and new holes drilled.
- (5) The spacing and pitch of holes should be such that a gapless joint is formed.
- (6) Proper size of bolts to be used. No washers are used on any side.

The above requirement is a must to avoid rails acting independently. Joint should be rigid and firm and act as one unit to withstand stresses of rails including the impact of wheels.

4.4 Joggled fishplates

These are the fishplates used for providing temporary security to defective welds. These fishplates are made out of hard steel or medium hard steel plates. The length of fishplates is not less than 450mm. The central portion of fishplates is having semi-circular projection of 3 inch radius to accommodate the protruding centre portion collar of welds. These fishplate have groves on either side, so that it can be tightened by the clamps. When these fishplates are used, minimum 4 clamps should be provided before passing any train. Joggled fish plates are exclusively used whenever Alumino Thermit weld is found to be defective/fractured. Till the time, weld are tested by USFD and found sound or defective weld exists, such welds should be protected with joggled fishplates and clamps. Recently joggled fish plates with elongated holes have been developed which can be fixed with fish bolt duly driving the holes in the rails.

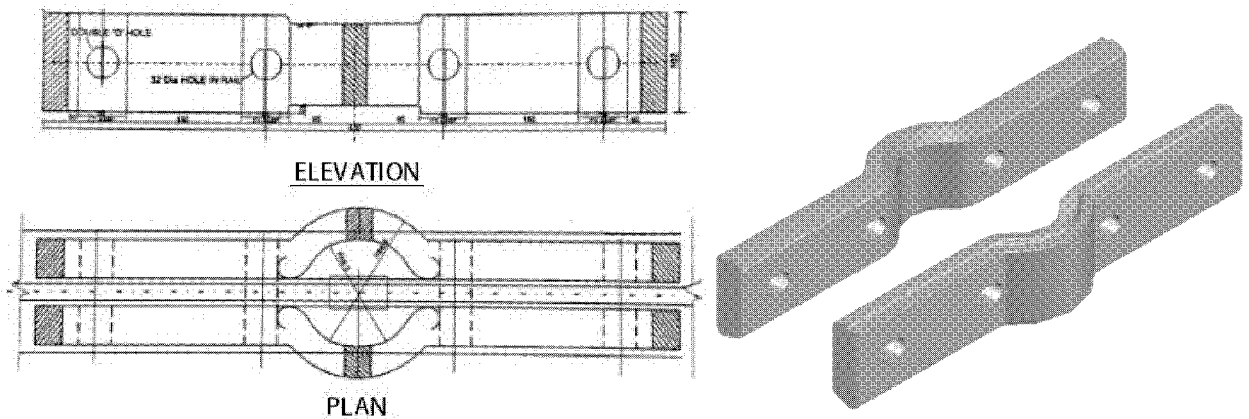


Fig. 3.7 JOGGLED FISH PLATE

5. Insulated Joints

These are used in track circuited area to provide electrical insulation between the two rails at a joint. Special insulation material in the form of ferrules, and post channel plates, etc. made up of fibre/nylon is used to make the joint electrically insulated.

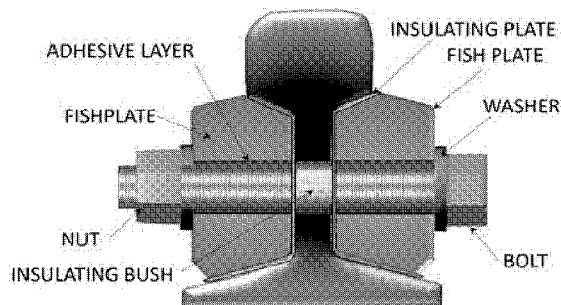


Fig. 3.8 INSULATED JOINT

6. Glued joint

Glued joints are commonly prefabricated in workshop, however on Indian Railways in situ fabrication of Glued Joints are also being done. Glued joints are fabricated with two rails of 3.25 m length on either side of joint so that there is no wastage since free rail is 13 m of length. These joints are normally fabricated in workshop, inserted into the track and welded to existing track at site. Insulation is provided by hard nylon liner with ferrules for fish plates and bolts. End post is provided between the two rails. G3 (L) type of Glued Joints are used in LWR track. Now glued joints are made at site also duly taking traffic block and making only one cut in the rail.

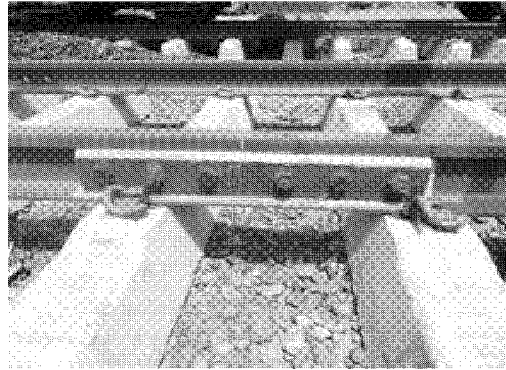
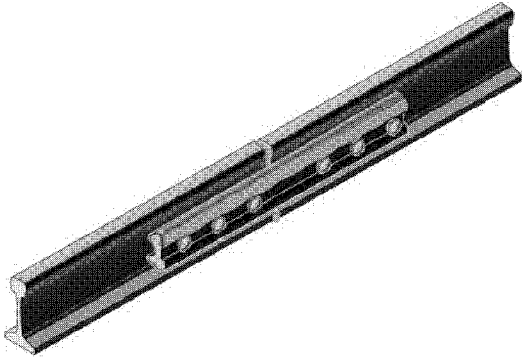


Fig. 3.9 GLUED JOINT

7. Lubrication of Rail Joints

The fish plates are to be examined periodically. This is carried out at the time of lubrication of rail joint. Wherein fishing planes are lubricated using PLUMBAGO (Graphite powder mixed with K-oil). In case any cracks are noticed the fishplate is be replaced. Lubrication of joints is done during the months of November to March of each year. The bolts are thoroughly cleaned, examined for cracks and wear and oiled. After this, fish plates are put back in their position. To check the cracks of fish plates, rails, etc., magnifying glasses are used by the maintenance staff, after cleaning the rail ends and fish plates.