INTER PLANT STANDARD IN STEEL INDUSTRY		
IPSS	**METHOD OF PERMANENT WAY INSPECTION AND MAINTENANCE PRACTICES 0F RAIL TRACK**	**IPSS:3-02-013B-18 (Part – B)**
	Corresponding IS does not exist	Formally : IPSS:3-02-013-03(Part–B)

0. FOREWORD

0.1 Interplant standardization in steel industry was initiated under the aegis of the Indian Standards Institution (ISI) and the Steel Authority of India Limited (SAIL). This IPSS was prepared by the standard committee on Operation and Maintenance, IPSS 3:2 and firstly published in 2003. Lastly, this has been revised by the standard committee in July 2018 with the active participation of the representatives from major Indian steel plants and leading consultants.

0.2 Part-A of this standard which deals with “Inspection” has been published separately in March 2003 for use by steel plants. Thereafter, this has been revised in July 2018.

1. SCOPE

1.1 This Inter Plant Standard enumerates the method of permanent way inspection schedule for preventive maintenance and maintenance practice of all the rail tracks inside steel plant. This standard shall involve two parts (A) & (B). Part-A shall deal with inspection and part-B shall deal with maintenance practice.

2. PART – B MAINTENANCE

2.1 TIGHTENING OF JOINTS

Tighten all the bolts of joints where the play between fish plate & rail is more than 3 mm.

Note: If bolt cannot be tightened, open the nut, insert a coarse washer & retighten the nut.

2.2 GAUGING

2.2.1 Check the gauge of the track and mark with a chalk all the areas outside the standard norms. See Annexure-1A of Part-A : Check list for track inspection.

2.2.2 Clean the track up to sleeper top level.

2.2.3 Check the condition of sleepers and change if unserviceable (Para 8 of Annexure-1A). See step 8.0 below for sleeper changing.

2.3 GUAGING ON STEEL SLEEPERS

2.3.1 If sleeper does not touch the rail, lever it up with the help of crow bars, fix the loose jaws in the sleeper hole and drive in the steel keys crosswise on both side of the rail (if sleeper hole diameter is more than 38 mm, use a liner).

2.3.2 On straight track both side keys shall be driven equally, but on curves inside keys must be driven more than outside keys.

2.4 GAUGING ON WOODEN SLEEPERS

2.4.1 Remove all inner side spikes and half of outer side spikes with the help of clawed bar. Loosen the remaining outer side spikes.

2.4.2 Plug old spike holes by hammering in a tapered wooden plug.

2.4.3 Plant one or more crow bars, vertically, near the foot of the rail and push till the gauge is correct and hold in this position till boring and spiking is done (Apply the clawed bar from outside on the remaining outer side spikes, it also helps in pushing the rail).

2.4.4 Position the bearing plates, if any, properly between rail and sleeper and bore new holes by using 5/8” dia auger in correct position on both sides of the rail. (If sleeper does not touch the rail, lift it up by crow bars).

2.4.5 Drive in the dogspikes using 3 to 5 kg hammers. In case of screws spikes driving in partially using 3 to 5 kg hammers and then tighten by using box spanners. See para 5 of Annexure1A for number of spikes per rail. However if the sleeper conditions is not very good one or two extra spikes can be driven in behind the bearing plate also.

2.5 GAUGING ON CONCRETE SLEEPERS

2.5.1 Remove all rail elastic clips (Pandrol clips) and liners.

2.5.1 Lever up the rail using a clawed bar and check that the rubber pads are in good condition. Replace damaged pads and put additional pads wherever a groove has been cut in the rail seat & then lower the rail.

2.5.2 Lever the rail to the centre of the seat of the concrete sleeper and put one liner each on both sides of the rail foot and drive the pandrol clips into position with a hammer. (Lever up the sleeper, if necessary).

2.5.3 Continue the above steps for the subsequent sleepers till the end.

2.5.4 Check the rail joints and if the fish plate is loose, tighten the fish bolts with a 42 mm spanner. (Replace jammed bolts and fish plates worn out more than 3 mm).

2.5.5 All the sleepers, which have been lifted or changed, must be packed as per steps 6.5 to 6.6 below and the area shall be dressed after that.

3. OILING OF POINTS

3.1 Clean the foot of the stock rail and the slide chair using a long metallic strip (about 60 cm x 3 cm x .2cm) (Care must be taken to insert a wedge between stock rail and tongue rail in CTC areas). Also clean the area between the slide chairs.

3.2 Smear black-oil on the cleaned metallic surfaces with oil soaked swab.

3.3 Set the point in the other side and repeat the above steps for that side too.

3.4 If a gap is noticed between the tongue rail and stock rail or the point is not functioning well, report to PWI for further checking.

4. PACKING OF STRAIGHT AND CURVED TRACKS

4.1 Sight along both rails. The lower rail on straight track and inner rail on curved track is the sighting rail and the other is the leveling rail.

4.2 PWI/Technician shall sit 30 m away from the work spot and sight along the sighting rail. Mark the slack spots by chalk.

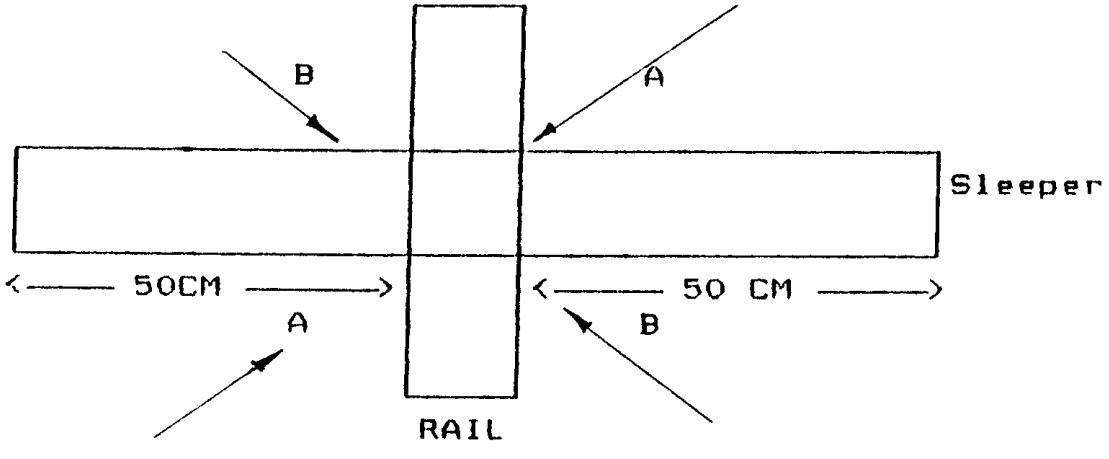
4.3 Clean upto 5 cm below sleeper bottom, at the same time check that the rail/sleeper fasteners are tightly in position. (Replace missing or loose fasteners and tighten the remaining fasteners).

4.4 Make place for jack at the centre of the dip and lift the track to correct level (The PWI/Technician shall be sighting along the rail while the jack is lifting the track).

4.5 Break the cores under the sleepers, affected by lifting, with the pick ends (sharp ends) of the beater.

4.6 Work in more ballast using the flat end of the beater, packing diagonally.

Note: Packing diagonally under the sleepers is called scissors packing. Two gang men shall take their position and pack one corner with their beaters in direction A-A. After several blows when no more ballast can go in, they take the position at the other corner and pack in the direction B-B as shown in the figure. For quick and sound packing, the blows must be simultaneous.



SCISSOR PACKING

4.7 Repeat steps 4.2 to 4.6 for all slack spots along the sighting rail.

4.8 Starting again from the first work spot, check level of the track by placing level board on the rails with the spirit level at the centre. The leveling rail shall be

level on straight track and higher (as per the degree at that spot) on curves. The required cant shall be given by placing a wooden cant on the sighting rail and then the spirit level shall be checked. See chart for super elevation in this part and Appendix-B for unevenness, twist, cant gradient in Part-A.

4.9 If level is OK at steps 4.8 go the next spot. If level is low then repeat steps 4.3 to 4.6 however this time using the spirit level to guide the track lifting instead of sighting.

4.10 If the level is high (excess super elevation) lift the inner track again to the required level and pack as before.

4.11 Continue till the end of the work area.

4.12 Finally sight along the sighting rail and smoothen the dips by lifting and packing.

4.13 Recheck the super elevation and repeat steps 4.9 and 4.10, if necessary.

4.14 Neatly dress up the area.

5. ALIGNMENT OF TRACK

5.1 PWI/Technician shall stand 100 m away on both sides of the working area and check the alignment visually or with the help of electronic instruments.

5.2 Roughly align by pushing in the large kinks as per steps 5.5 to 5.8 below.

5.3 After rough alignment, mark stations at 30 m intervals on side/foot of the rail.

5.4 Stretch a chord on the rail head between two subsequent stations and mark all spots more than the norm of 10 mm away from the chord with chalk on the head of the rail, indicating the direction of slew with an arrow.

5.5 Remove ballast from sleeper ends in the direction of slewing.

5.6 While PWI/Technician stands on the rail 50 to 60 mtr. away from the gang looking along the rail, slew the rail in the desired direction by using crow bars placed at an angle of 30 degree to the vertical. All staff must push in unison with one man calling out the pushing time.

5.7 If at first track is not moving, lift it up by about 5 cm by jack.

Note: In case some rigid spot is located near the rail where the alignment is to be corrected then it is easier to move the rail by jack. A sleeper or wooden block of appropriate size is placed horizontally against the spot and then the jack is placed horizontally between the sleeper so placed and the rail on which the alignment is to be taken. The jack is then operated with a crowbar to push the track up to the desired position.

In case a fixed spot is not available, then an alternative is to use a rail piece of about 7 mtrs. length & use it as a battering ram to bring the rail to the correct position.

5.8 Repeat steps 5.5 to 5.7 for other spots till track alignment is correct.

Note: In case of curved tracks first measure the degree of curved track. The degree shall increase gradually at the ends of the curve and remain the same over the rest of the curve. If that is not so, then the alignment can be corrected as above. Pushing the track out at a spot increases the degree at that spot while pulling it in reduces the degree. By trial and error method the alignment is corrected.

5.9 Pack all loose sleepers as per the steps 4.5 and 4.6.

5.10 Box the sleepers with ballast and dress up the area neatly.

6. CHANGING OF SLEEPERS

6.1 Mark the sleepers to be changed by chalk on the rail and sleeper (see para 8 of Annexure-1A of Part-A – check list for track inspection).

6.2 Transport new sleepers and distribute them opposite the sleepers to be changed.

6.3 Remove ballast all around the sleepers to a depth at least 10 cm below the bottom of the sleeper and break the core.

6.4 If the sides are jammed cut a groove 3 mt long upto sleeper bottom for its removal.

6.5 Remove the fittings (steel sleepers – loose jaws and keys, wooden sleepers – dog spikes/screw spikes and bearing plates, concrete sleepers – pandral clips, metal or insulating liners, grooved rubber pads) and pull out the old sleeper from under the rail using crow bars.

6.6 Further dress the area by shovel and wire claw after the old sleeper is removed.

6.7 Insert new sleeper by levering and pushing with crow bars.

6.8 Lever up the sleeper and square it with the rail using a tri-square.

6.9 Replace the rail-sleeper fasteners (see steps 2.3 to 2.5 for steel, wooden and concrete sleepers).

6.10 Put back the ballast and pack the new sleepers by beaters (see steps 4.5 and 4.6 above). Take care to fill the centre portion of the slippers loosely, not packing tight.

6.11 Continue the above steps for changing all subsequent damaged sleepers.

6.12 Neatly dress the area and box the sleepers 30 cm beyond the sleepers. Beyond that the ballast shall slope down at an angle of 1.5:1.

6.13 Transport all old, unserviceable materials to disposal area.

Note: For complete removal sleepers on a section it is easier to remove the rails to change the sleepers. However in this case the track must be blocked as per prevalent practice.

7. RAIL CHANGING

7.1 Mark the rails to be changed with chalk (see para 8 of Annexure-IA of Part-A – check list for track inspection) and measure the length and type of rail (90R, 52 Kg or 60 Kg) leaving 6 mm expansion gap.

7.2 Load new rails on trolley centrally and transport them to the work spot.

Note: The rails shall be loaded centrally on the trolley by crane or manually. In controlled areas proper permission must be taken from the yard master before moving trolley. In other areas one man shall move at least three rails ahead with a Red Banner.

7.3 Cut rail to the desired length using oxy-acetylene flame or Jim Crow.

7.4 Make holes at both ends of the rail, as per the holes in the fish plate, by ratchet. The gas cutting is permitted in only emergency cases.

7.5 Expose the rail to be changed upto sleeper top.

7.6 Open up the fish plate joints at both ends of the rail (or cut the old rail).

7.7 Remove the rail/sleeper fastenings.

In steel sleepers - loose jaws and keys

In wooden sleepers - one side dog spikes or screw spikes

In concrete sleepers - rail elastic clips and liners.

7.8 Remove the old rails to one side.

7.9 Clean on top of the sleeper and the area in between the sleepers along the alignment of the rail.

7.10 Place new rail on the sleepers.

7.11 Join both ends of the rail by fish plates and bolts (lifting up the new or the old rail to bring them to the same level or within 3 mm) or replace fish plate with thermite welding wherever possible.

7.12 Refit the rail sleeper fastening (Removed as per the step 7.7 above) levering up the sleepers if they do not touch the new rail.

7.13 Pack all loose sleepers as per steps 4.5 and 4.6.

7.14 Transport all old rails, cut pieces, old fittings etc to disposal area and dress up the area neatly (The old rails may be gas cut in convenient length for further disposal).

8. GAP ADJUSTMENT OR PULLING BACK OF RAILS

8.1 Locate the joint where the gap is excessive while other joints are pressed together tightly. In this particular joint two of the four bolts must have been sheared off.

8.2 Loosen the fittings of that rail and remove two of the bolts holding the other end of the rail.

8.3 Pull back the rail by hitting the fish plate with heavy crow bars till the rail just touches the liner of 6 mm thickness. Now the gap of this joint is correct but is more at the joint at the other end of the rail.

8.4 Fix all the four bolts at this joint and tighten back the rail sleeper fastenings.

8.5 Continue the above steps for the subsequent rails till all the gaps are adjusted.

Note: If this job is carried out in the hot season, care must be taken to see that rail does not spring up due to high tension in tight joint areas.

9. WORKING INSIDE SHOPS/MILLS

9.1 The above maintenance jobs may have to be done inside shops or mills. In such cases the shop shift in-charge must be informed before starting the work & proper banners/barricades must be provided.

9.2 In case overhead cranes are carrying loads, everyone must move away from below the moving loads to a safe distance. The load should not be carried over the working area wherever possible.

10. WORKING ON GRADIENTS, CURVES

10.1 Since the trains move at speed on gradients, track must be blocked by giving proper memo to concerned Yard Master. Also a sharp look out is to be kept for unforeseen movements like rolling down of trains etc. Red flag shall be put at a distance so that loco operator of the approaching trains can notice in advance.

11. UNLOADING OF BALLAST WAGONS

11.1 Take the ballast wagon to the work site, giving information/memo to the concerned Yard Master.

11.2 Open the discharge doors of one side of the wagon & slowly pull the wagon to clear the area where ballast has covered the rail.

11.3 Open the discharge doors of the other side of the wagon & again pull it out to a clear area.

11.4 Close the doors & spread the ballast up to rail top manually or by using a tyre mounted loaded/dozer.

11.5 After ensuring that the gauge is correct, inform the Yard Master of completion of job.

12. WORKING ON BRIDGES

12.1 When the aforesaid maintenance jobs are done on bridges, the track must be blocked as per prevalent practice, besides keeping a staff as look out.

12.2 The foundation bolts of bridge to the pier must also be tightened if they are loose.

13. WORKING ON MOTORISED POINTS

13.1 The setting of tongue rail to the stock rail must be checked in the presence of the signaling staff.

13.2 In case of failure of motor system the point must be clamped physically before permitting movements in facing direction over that point.

14. WORKING ON EMBANKMENTS

14.1 The track must be blocked as per prevalent practice at the beginning of the shift.

14.2 The slag bank must be leveled with the help of plough car/porcelain machine.

14.3 The track shall be opened up at one end & slewed to the edge of the bank using slewing machine/manually.

14.4 The slewed track shall be linked to the original track back again using rail closers/cut piece rails & the track packed.

14.5 The track shall be tested by passing a light engine over it and if no major sinkage is observed, it shall be handed over for movement.

15. JIM CROWING RAILS/TONGUE RAILS FOR STRAIGHTENING

15.1 Place the Jim crow on the rail/tongue rail so that it grips the rail head properly.

15.2 Insert the crow bar properly in the holes provided in the Jim crow & gradually start tightening. If necessary insert two crow bars at right angles to each other & then rotate the screw of the Jim crow.

15.3 When the desired bending is achieved, leave the Jim crow in position for about 5 minutes & then unscrew it back.

16. GAS CUTTING AND WELDING

16.1 These are extensively used in day to day maintenance & so all safety precautions associated with the job must be taken.

16.2 DA / Propane cylinders must be used in vertical position, well away from tracks & also well away from hot splashes of slag or molten metal.

16.3 Proper holder, screen & insulated cables must be used while welding.

16.4 Flashback arresters must be used in both ends for gas cutting in both oxygen and gas cylinders.

CHART FOR SUPER ELEVATION FOR VARIOUS CURVES

DEGREE OF CURVE	RADIUS OF CURVE (M)	SUPER ELEVIATION WITH At. SPEED 15 kmph (cm)	
1	1720	0.15	
2	660	0.34	
3	573.3	0.51	¼”
4	430	0.68	
5	344	0.85	
6	286.7	1.02	½”
7	245.7	1.20	
8	215	1.36	
9	191	1.53	
10	172	1.70	¾”
11	156	1.87	
12	143.3	2.04	
13	132.3	2.21	
14	122.9	2.38	1”
15	114.7	2.55	
16	107.5	2.72	
17	101.2	2.90	
18	95.6	3.10	
19	90.5	3.20	
20	86	3.40	1 ½”
21	81.9	3.56	
22	78.2	3.73	
23	74.8	3.90	
24	71.7	4.14	
25	68.8	4.32	
26	66.2	4.48	2”
27	63.7	4.66	
28	61.4	4.84	
29	59.3	4.99	
30	57.3	5.18	

STANDARD PROCEDURE TO MEASURE DEGREE OF CURVE AND ITS SUPER ELEVATION

- Establish tangent point roughly by standing on the straight on the straight portion of the track about 30 m away from start of the curve. The junction of straight and curve is the tangent point. Mark that point on the side of the rail.
- Mark stations by chalk, 0, 1, 2, 4 …… on the side or the foot of the outer rail with station 1 being the tangent point and O station before the tangent point at interval of 5.9 m.
- Stretch a cord from gauge face of the outer rail between stations O and 2.
- Measure the distance between the rail and cord at station 1. This distance in cm is the versine at that point and gives the degree of curve at that spot. Mark the degree on the side or foot of the rail by chalk.
- Continue as above with other stations (1-3, 2-4, 3-5…….) till the end of the curve.
- Place the level board on the heads of the two rails.
- Place the wooden cant on the inner rail under the level board.
- Keep the spirit level on level board at centre.
- Take super elevation reading by adjusting wooden cant board so that the spirit level bubble comes to the centre.
- Calculate super elevation theoretically using the formula

$$e = GV^2 / 1.27\ R$$

Where e = super elevation in cm

G = Gauge in m (1.676 m)

V = Velocity in Kmph.

R = Radius of curve in metres.

Whereas D = 1720/R

See chart for quick reference for V = 15 Kmph.

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