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GOVERNMENT OF INDIA

रेल मंत्रालय

Ministry of Railways

सत्यमेव जयते

Technical Specification for Re-Furbishing of Existing Glued Insulated Rail Joints and In-situ Fabrication of Glued Insulated Rail Joints (Provisional)

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TECHNICAL SPECIFICATION FOR RE-FURBISHING OF EXISTING GLUED INSULATED RAIL JOINTS AND IN-SITU FABRICATION OF GLUED INSULATED RAIL JOINTS

1.0 SCOPE

1.1 Insulation of track is required for track circuiting purposes. Previously, when most of the track had single and short welded rails, block joints were being used. These block joints were not able to bear thermal forces in LWR/CWR track, raising the need for glued insulated rail joints. Block joints are now obsolete and only Glued Insulated Rail Joints as per Manual for Glued Insulated Rail Joints, 1998 are in use on Indian Railways for track-circuiting purposes. Glued joints are fabricated either at the Railway's Engineering/Bridge Workshops or by approved Private manufacturers. This specification is prepared to have a uniform working procedure in the refurbishing of existing and in-situ fabrication of glued insulated joints on Indian Railways.

1.2 Those existing glued joints which are not performing satisfactorily may be repaired by in-situ refurbished to minimize the requirement of new insulated rail joints and optimize utilization of materials in-service. Re-furbished glued joints shall be allowed on track for an extended service period without generating any additional joints.

1.3 This specification covers the working methodology, performance parameters and testing regime for in-situ re-furbished glued insulated rail joints & in-situ fabricated glued insulated rail joints.

1.4 Refurbishment of existing glued joints and in-situ fabrication of glued joints shall be done by the RDSO approved firms appearing in the latest updated vendor directory of Q&A/Civil Directorate of RDSO.

2.0 DEVIATIONS

If any, the manufacturer/supplier shall furnish compliance or deviations, if any, for each clause and sub-clause of the specifications along with technical explanations/details. The manufacturer/supplier shall also furnish the technical and financial implications of the deviations.

3.0 SERVICE CONDITIONS

3.1 Operating Conditions:

i) Maximum Axle load: 25 T

ii) Maximum Speed: upto 100 Kmph for goods trains and 160 Kmph for passenger trains

iii) Electric Traction (Minimum): 25 KV AC or 1500 V DC

iv) Track Circuits: DC in AC traction and non-electrified areas and AC in DC traction areas.

v) Rail Temperature: (-) 15^0C to (+) 76^0C

vi) Humidity: Dry to Humid (0% to 100%)

vii) Rainfall: Fairly heavy

3.2 Track Structure:

(i) Rail: 52 Kg and 60 Kg

(ii) Sleepers: Pre-stressed mono block concrete sleeper at 1540/1660 nos. per Km.

(iii) Fastening system: Elastic fastening i.e. Elastic Rail Clip (ERC), Rubber Pad and Metal/GFN liners.

(iv) Continuous Welded Rail/Long Welded Rail /Short Welded Rail/Single Rail

(v) Ballast cushion: 250-350 mm

(vi) End post thickness: 6mm

4.0 Material and equipment:

4.1 Specification of Materials

Specification of material as contain in Annexure-C of "Manual for Glued Insulated Rail Joints, 1998" amended from time to time shall be followed. Material shall be procured from approved suppliers only. List of approved suppliers, updated by RDSO from time to time, shall be referred for the purpose.

4.2 Equipment:

Essential equipment as per requirement for re-furbishing/in-situ fabrication of glued insulated rail joints shall be as under:

i. Rail cutting machine
ii. Drilling machine with required drill bits
iii. Portable power pack 3KW
iv. Grinding machine
v. Mechanical/ Hydraulic tensor
vi. Torque spanner 105 kg m capacity
vii. Chamfering kit
viii. Spring balance
ix. Scissors
x. Straight edge 1 m long with 15mm notch at the center
xi. Rubber hand gloves
xii. Half-round and round files
xiii. Brushes for glue application
xiv. Rail jumpers

xv. Megger 100V DC for testing insulation resistance in dry condition

Note: - Any additional equipment as directed by Engineer-in-Charge shall also be provided.

5.0 In-situ re-furbishing of Glued Insulated Rail Joints:

5.1 General:

Presently, glued insulated rail joints existing in track have failed due to insulation/fishplate failure and are required to be replaced with another new glued insulated rail joints. To avoid one additional thermit weld failed glued insulated rail joints can be re-furbished in-situ provided the joints is free from burrs, excessive side/vertical wear, kinks, corrosion, scabbing, battering, etc.

5.2 Pre-refurbishing Activities:

Following activities shall be ensured before taking up re-furbishing of existing glued insulated rail joints:

(i) Glued Insulated Rail Joints requiring refurbishment should be jointly inspected with S&T department and certified as failed for track circuiting.

(ii) All required materials & equipment and manpower shall be arranged before commencing the re-furbishing work.

5.3 Repair of End Post:

If only end post at the top is broken and electrical resistance is more than 1 megaohm, the repair of the end post will be carried out as under:

(i) A traffic block of minimum of 90 minutes shall be taken.

(ii) The joint shall be properly levelled on sleepers and approach sleepers packed.

(iii) The gap between two rails from all sides shall be sealed with the help of an insulated tape.

(iv) Two components of glue (Hardener and Resin) should be mixed and fiberglass powder is added in the ratio prescribed by the manufacturer. This slurry is poured in the gap from the top of the rail head and tapped so that slurry fills all voids inside the joint.

(v) It should be ensured that a minimum of one hour is passed before permitting any traffic so that the filled up material dries up properly.

(vi) After repair of the end post, the electrical resistance shall be jointly measured by JE/SSE (P. Way) and JE/SSE (Signal), and shall not be less than 1 mega ohm.

(vii) Pull out test & Wet test are not required in case of end post repairs.

5.4 Thorough re-furbishing of Glued Joints:

Thorough re-furbishing of existing glued joints is necessitated if there is a loss of resistance due to failure of insulating material, fracture of fishplate or complete working out of end post. Procedure for the through refurbishing of existing failed glued joints is as under:

(i) Speed restriction of 30 Kmph shall be imposed at the location of refurbishment.

(ii) A minimum of 3 hours of traffic block shall be ensured. In case, traffic block available is less than 3 hours, thorough re-furbishing of glued joints should not be done. Track shall be protected with the help of banner flag and detonators as per provisions of IRPWM, amended from time to time.

(iii) During the traffic block, the glued joint should be heated by a blowlamp to a temperature of over 200^0C.

(iv) Nuts shall then be loosened and taken out.

(v) A chisel shall be inserted between rail and the fishplate with gentle blows of hammer and fishplates shall be removed. Care should be taken so that no dent mark is formed on the rail.

(vi) New fishplates with bolts & nuts shall be used. Released fish plates, bolts and nuts shall be discarded.

(vii) Rail should be made free of fittings over a length of 2.0 m on either side of the end post of failed glued joint.

(viii) The gap shall be maintained marginally more than the thickness of the end post to be used to enable the insertion of the end-post. Tensor may be applied if required for this purpose.

(ix) The rail ends shall be properly aligned both laterally and vertically with a straight edge using suitable wedges. The two rails shall then be held firmly in position by clamps and no hammering/disturbance to ends should be done after aligning the rails.

(x) The rail ends and fishplate surfaces shall be cleaned with acetone and dried completely. The application of glue shall be commenced only when the finished rails and fishplates have been properly cleaned and have dried completely.

(xi) The resin and hardener shall be mixed as per supplier’s instructions in a suitable container. The constituents shall be thoroughly mixed to get a homogeneous mixture (hereafter called ‘glue').

(xii) A thick layer of the glue shall be applied on the mating surfaces of the

fishplates simultaneously by two teams of workmen.

(xiii) One piece of clean glass cloth carrier shall be placed on the fishplates and evenly pressed so that the glue squeezes out through the glass cloth. The oozing glue shall be uniformly spread over. A layer of glue shall then be applied on the inside of the insulating liners followed by their placement on the glued glass-cloth carrier on the two fish plates.

(xiv) A layer of glue shall then be applied on the outside of the insulating liners and a clean piece of glass cloth carrier shall be laid. The oozing glue shall be uniformly spread over.

(xv) Glue shall be applied to both the faces of the end-post, before placing it between the two rail ends. Adequate pressure shall then be applied using tensor at the rail ends so that no gap is left between the end post and the rails. Alignment shall be checked again at this stage with a straight edge.

(xvi) The insulating bushes duly dipped in glue shall be placed in the rail holes.

(xvii) The bonding surfaces of the rail shall then be coated with a layer of glue and fishplates made ready as described in Para (viii) to (x) above shall be placed in a position in contact with the rail web.

(xviii) HTS bolts, washers and nuts shall then be placed in position and tightened with a torque wrench. The torque shall be increased gradually on all the bolts in stages of 25 kg-m per bolt. Care shall be taken to tight inner bolts first and then outer bolts. Finally, all the bolts shall be tightened with a torque of 105 kg-m.

(xix) The sequence of the above operation shall be completed within 45-60 minutes so that a minimum 120 minutes setting time is achieved.

(xx) About 20 minutes after the initial tightening of bolts, the bolts shall be re-tightened with a torque wrench until a torque of 105 kg-m is attained.

(xxi) The joints shall be finished by covering all visible edges of the glass-cloth carrier with glue. Fillet shall then be formed around the fishplate by utilizing the oozed out glue. Excess glue shall be removed.

(xxii) After re-tightening the bolts, the joint shall be left for setting with tensor in the clamped condition.

(xxiii) Electrical resistance shall be checked with insulation tester duly calibrated by appropriate Test House and ensured a minimum 10 Mega Ohm for the proper functioning of Glued Insulated Rail Joint before permitting the traffic movement.

(xxiv) Traffic block shall be cancelled after fastening the removed rail fittings in their positions. Before, passing the traffic, it shall be ensured that no extra materials i.e. settled glue etc. remain on the top of the head and gauge face side of the rail.

(xxv) Re-furbished glued joints shall be supported on wooden blocks for a minimum of 24 hours.

(xxvi) Speed restriction of 30Kmph should be continued for 24 hours after refurbishing work for proper curing of refurbishment glued joint with the least disturbance.

5.4.1 Post Re-furbishing Work:

(i) All tools and equipment used should be cleaned off to remove glue immediately after the re-furbishing.

(ii) Megger test to check the insulation of re-furbished glued joints must be done jointly with JE/SSE (P.Way) and JE/SSE (Signal).

(iii) Record of the refurbishment of glued joints should be maintained in a register for monitoring their performance. The record must indicate month/year of refurbishment, name of the agency and results of the Megger test.

5.4.2 Precaution During Re-furbishing of Existing Glued Insulated Rail Joints:

The following precautions shall be taken during re-furbishing of glued Joints:

(i) The mating surfaces of rail & fishplates shall be kept clean and free from oily traces and shall not be touched after cleaning.

(ii) The workers shall wear hand gloves and apron while working. Contact of adhesive and cleaning chemicals with any part of the body/skin can be injurious and, therefore, shall be avoided.

(iii) Any splash of resin on the body should be immediately removed with tepid soapy water. The use of solvents in such cases is not warranted.

(iv) Smoking within the fabrication area should be strictly prohibited.

(v) The first aid box shall be made available at the site.

(vi) Rail jumpers must be used in electrified areas for return current.

(vii) A set of fire extinguishers should be ready for use.

6.0 In-situ Fabrication of Glued Insulated Rail Joints:

6.1 General:

Glued joints are fabricated in the shop floor and transported to the site for insertion in running track which will result in the introduction of minimum 02 SKV welds. Glued joints can also be fabricated at the site to save effort needed in transportation and also avoid at least 02 SKV welds. In-situ fabrication of glued joint would preferably be carried out outside the running track i.e. on cess. In case it is required to be inserted in the running track, adequate traffic block (Minimum 3 hours) should be ensured. In case, the traffic block available is less than 3 hours, in-situ fabrication of glued joints should not be done.

6.2 Pre-fabrication Activities:

Following activities shall be ensured before taking up fabrication of glued insulated rail joints:

(i) The exact location of glued joints shall be identified and marked in advance.

(ii) All required materials & equipment and manpower shall be arranged before commencing the in-situ fabrication work.

6.3 Selection of Rails:

During the selection of rails for in-situ fabrication of glued insulated rail joints following shall be ensured:

(i) The rail to be converted into Insulated Joint should be free from burrs, excessive side/vertical wear, kinks, corrosion and scabbing etc.

(ii) The rails shall be straight and USFD tested.

(iii) Old free rail joints having battering etc. should be avoided for fabricating insulated joints.

(iv) Flash butt/thermit welds should be avoided within 4.0m from the insulated Joints.

6.4 Methodology for in-situ Fabrication of Glued Joint:

Methodology for in-situ fabrication of glued insulated rail joints is as under:

(i) In case, the fabrication is done in running track:

a. Speed restriction of 30 kmph shall be imposed at the location of in-situ fabrication of glued joints.

b. A minimum of 3 hours traffic block shall be taken and track shall be protected with the help of banner flag and detonators as per stipulated provisions in IRPWM, amended from time to time.

c. Rail should be made free of fittings over a length of 2.0 m on either side of the centerline of glued joints.

d. The gap shall be maintained marginally more than the thickness of the

end post to be used to enable the insertion of the end-post. Tensor may be applied if required for this purpose.

(ii) The rail ends shall be properly aligned both laterally and vertically with a straight edge using suitable wedges. The two rails shall then be held firmly in position by clamps and no hammering/disturbance to ends should be done after aligning the rails.

(iii) The rail ends and fishplate surfaces shall be cleaned with acetone and dried completely. The application of glue shall be commenced only when the finished rails and fishplates have been properly cleaned and have dried completely.

(iv) The resin and hardener shall be mixed as per supplier's instructions in a suitable container. The constituents shall be thoroughly mixed to get a homogeneous mixture (hereafter called 'glue').

(v) A thick layer of the glue shall be applied on the mating surfaces of the fishplates simultaneously by two teams of workmen.

(vi) One piece of clean glass cloth carrier shall be placed on the fishplates and evenly pressed so that the glue squeezes out through the glass cloth. The oozing glue shall be uniformly spread over. A layer of glue shall then be applied on the inside of the insulating liners followed by their placement on the glued glass-cloth carrier on the two fish plates.

(vii) A layer of glue shall then be applied on the outside of the insulating liners and a clean piece of glass cloth carrier shall be laid. The oozing glue shall be uniformly spread over.

(viii) Glue shall be applied to both the faces of the end-post, before placing it between the two rail ends. Adequate pressure shall then be applied using tensor at the rail ends so that no gap is left between the end post and the rails. Alignment shall be checked again at this stage with a straight edge.

(ix) The insulating bushes duly dipped in glue shall be placed in the rail holes.

(x) The bonding surfaces of the rail shall then be coated with a layer of glue and fishplates made ready as described above shall be placed in a position in contact with the rail web.

(xi) HTS bolts, washers and nuts shall then be placed in position and tightened with a torque wrench. The torque shall be increased gradually on all the bolts in stages of 25 kg-m per bolt. Care shall be taken to tight inner bolts first and then outer bolts. Finally, all the bolts shall be tightened with a torque of 105 kg-m.

(xii) The sequence of the above operation shall be completed within 45-60 minutes so that a minimum of 120 minutes setting time is achieved in case the execution is done under traffic block.

(xiii) About 20 minutes after the initial tightening of bolts, the bolts shall be re-tightened with a torque wrench until a torque of 105 kg-m is attained.

(xiv) The joints shall be finished by covering all visible edges of the glass-cloth carrier with glue. Fillet shall then be formed around the fishplate by utilizing the oozed out glue. Excess glue shall be removed.

(xv) After re-tightening the bolts, the joint shall be left for setting with tensor in the clamped condition. Tensor shall be used whether fabrication is done on cess or in-situ.

(xvi) Electrical resistance shall be checked with insulation tester duly calibrated by appropriate Test House and ensured a minimum 10 Mega Ohm for the proper functioning of Glued Insulated Rail Joint before put in track/permitting the traffic movement.

(xvii) In-Situ fabricated glued joints shall be supported on wooden blocks for a minimum of 24 hours.

(xviii) If fabrication is done in running track, the traffic block shall be cancelled after re-fastening the removed rail fittings in their positions. Before, passing the traffic, it shall be ensured that no extra materials i.e. settled glue etc. remain on the top of the head and gauge face side of the rail.

(xix) If fabrication is done in running track, speed restriction of 30 Kmph shall be imposed for 24 hours after completion of work for proper curing of in-situ fabricated glued joint with the least disturbance.

6.5 Post-fabrication Work:

(i) All tools and equipment used should be cleaned off glue immediately after the fabrication of the In-situ glued joints.

(ii) Megger test to check the insulation of In-situ fabricated glued joints must be done jointly with JE/SSE (P.Way) and JE/SSE (Signal).

(iii) Record of In-situ fabricated glued joints should be maintained in a register for monitoring their performance. The record must indicate month/year of In-situ fabrication, name of the agency and results of the Megger test.

6.6 Precautions during Fabrication of In-situ Fabricated Glued Insulated Rail Joints:

The following precautions shall be taken during fabrication of in-situ fabricated glued insulated rail joints:

(i) The mating surfaces of rail & fishplates shall be kept clean and free from oily traces and shall not be touched after cleaning.

(ii) The workers shall wear hand gloves and apron while working. Contact of adhesive and cleaning chemicals with any part of the body/skin can be injurious and, therefore, shall be avoided.

(iii) Any splash of resin on the body should be immediately removed with tepid soapy water. The use of solvents in such cases is not warranted.

(iv) Smoking within the fabrication area should be strictly prohibited. The first aid box shall be made available at the site.

(v) Rail jumpers must be used in electrified areas for return current.

(vi) A set of fire extinguishers should be ready for use.

7.0 Test Requirements and Performance Parameters:

7.1 For In-situ Re-furbished & In-situ Glued Insulated Rail Joints: All facilities for carrying out stipulated tests on re-furbished and in-situ fabricated glued insulated rail joints shall be available in the laboratory of the manufacturer/supplier of the joint.

7.2 Lot Size:

50 joints or part thereof, including 02 joints prepared with the same material and in the same environmental conditions on cess shall form a lot for testing and inspection of re-furbished & in-situ glued insulated joints.

7.3 Following tests shall be conducted on re-furbished & in-situ glued insulated rail joints:-

7.3.1 Dimensional Check

(i) Every Re-furbished/In-situ fabricated glued insulated joints shall be checked for vertical and lateral alignment with a 1m long straight edge. The tolerances permitted shall be as under:

(ii) Vertical Alignment:- Variation at the joint shall be within +1mm and -0mm measured at the end of a 1m straight edge placed at the top of the railhead.

(iii) Lateral Alignment:- Variation at the joint shall not be more than $\pm$ 0.5mm measured at the center of a 1m straight edge placed along the gauge face.

Note: Dry test, Pull out test and wet test shall be carried out only if the Re-furbished/In-situ fabricated glued insulated joints are dimensionally satisfactory.

7.3.2 Insulation Resistance Test in dry condition

Each insulated joint shall be subjected to an insulation resistance test in dry condition. A megger voltage of 100V DC shall be applied across the joint. The value of the insulation resistance shall not be less than 10 megaohms.

7.3.3 Pull Out Test

(i) If the joints are found satisfactory in the dimensional check and insulation resistance test in dry condition, the pull-out test shall be conducted. Pull out test shall be carried out as per Para 3.4 of Manual for Glued Insulated Rail Joints,1998 amended from time to time.

(ii) Pull out test shall be conducted on two Glued Insulated Joints prepared on cess with the same material & under the same environmental conditions representing a lot of 50 joints or part thereof.

(iii) If both joints pass, further wet resistance test shall be conducted on the samples.

(iv) If anyone of the two joints fails, two additional glued insulated joints should be randomly taken from the lot. If required, the glued joints for this purpose would be taken out from the track in case these have already been put in track. If anyone of these two joints fails, suitable penalty should be imposed on the firm by the zonal railways with no further payment for that particular lot of glued joint. The glued insulated joints which are already installed will continue to be used in track with regular monitoring.

(v) Each joint of the rejected lot shall be marked "O" marks with yellow paint on the web of rail both side. So that SSE/JE maintenance can keep them under observation.

7.3.3.1 Acceptance Value:

The test joint shall be considered acceptable if there is no indication of separation between end posts and rail end(s) visible to the naked eye, at the pull out load values given below:

(a) 60 Kg Rail- 1700KN (Minimum)

(b) 52 Kg Rail – 1500KN (Minimum)

7.3.4 Resistance Test in Wet Condition:

This test shall be conducted on up to two joints out of those joints which have successfully withstood insulation resistance test in dry condition and pull out test. This test shall be carried out as per procedure mentioned in Para 3.5 of Manual of Glued Insulated Rail Joints, amended from time to time.The insulation resistance determined by the ratio of voltage to current in amperes shall not be less than 3 kilo-ohms for each of the joints. If both the joints pass this test, the set of joints will be considered passed in this test, otherwise suitable penalty shall be imposed on the firm by the concerned Zonal Railway for the represented lot of joints.

7.4 Pieces of the rail and other components of tested joints shall be returned by the manufacturer/ supplier to the railway.

7.5 Pull out test joints shall be distinctly marked "NOT TO BE PUT ON TRACK" on both sides of the joint with approved enamel RED PAINT immediately after the pull-out test.

7.6 The pull out tested joints shall be dismantled soon after the inspection. Fish plates may be reused in subsequent fabrications if their condition is satisfactory.

8.0 Field Performance Parameters

Service Life (Minimum):

a) 150 GMT for re-furbished glued insulated rail joints

b) 200 GMT for in-situ fabricated glued insulated rail joints

9.0 Warranty:

9.1 The manufacturer shall ensure that in-situ refurbished glued joints, in-situ fabricated glued joints shall give a minimum 50% service life in terms of GMT as stipulated in Para7.0 above.

9.2 Any component of in-situ refurbished/in-situ fabricated glued joints (except rails) failing or proving unsatisfactory during the warranty period shall be replaced by the manufacturer. All associated expenses shall be borne by the manufacturer.

10.0 Inspection:

The inspection of in-situ refurbished glued joints/in-situ fabricated glued joints shall be done by the purchaser. The purchaser's authorized representative shall have free access to the manufacturer's plants/labs at all reasonable times to inspect the processing and testing of all the joints and/or their components. All the tests (Lab & Field) shall be conducted in the presence of the purchaser's authorized representative. All the expenses occurred towards the above testing shall be borne by the manufacturer.

11.0 Quality control:

The quality control in refurbishing/fabrication of in-situ glued joints shall be ensured by a QAP approved by Engineer in-charge of the work on the similar lines of QAP approved by QAC Directorate of RDSO.

12.0 Maintenance of records:

(i) Marking of Glued Joints: Every in-situ fabricated/ refurbished glued insulated rail joints shall be marked indicating the type of glued joint, serial number of glued joint, code of the manufacturer & its branch/workshop team number as allotted to vendor/workshop/team by Quality Assurance (Civil) Directorate of RDSO, month and year of fabrication as shown below. This marking should be embossed on the gauge and non-gauge face sides of the head of the rail of

glued joint at 300 mm away from the one end of fishplate by punching without causing any damage to rail, in letters/digits of 6 mm height at a depth of 10mm from top of vertical face of rail.

IS/RF-XXXX-AAA-BB- MM-YY

IS = Stands for In-situ

RF = Stands for refurbished glued insulated rail joints

XXXX in four digits = Serial number of glued joints starting from 0001 for each contract separately. The same procedure of numbering shall be followed by departmental workshops also

AAA in three digits =Code of firm/workshop

BB in two digits = Branch/workshop team no. as assigned by Quality Assurance (Civil) Directorate of RDSO for in-situ/refurbished glued joint

MM & YY in two digits each = Month and year of fabrication of glued joint

In case of refurbishing, new marking shall be done separately while old marking shall be painted in black color.

(ii) A detailed record for the traceability of each in-situ refurbished/ in-situ fabricated glued Joint shall be kept as per the format is given below:

S N	Date of fabrication	Location as per TMS guidelines	Line UP/DN/ SL	Block time/ On cess	The resistance of Glued Joint in dry condition (In mega ohms)	Name of Agency	Name of an agency Supervisor	Name of Railway Supervisor	Sign of Railway Supervisor

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