MANUAL
FOR
GLUED INSULATED RAIL JOINTS
(1998)

Included Up to C.S. No. 06
Correction Shown as

RESEARCH DESIGNS AND STANDARDS ORGANISATION
LUCKNOW - 226 011
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FOREWORD

0.1 The Manual of instructions for fabrication, installation and maintenance of Glued Insulated Rail Joints was first issued in 1982. The manual was revised in 1989. This manual is issued under the title "MANUAL FOR GLUED INSULATED RAIL JOINTS" in consultation with Signal Directorate of RDSO (reference Signal Engg. Dte. letter No.STS/E/IRJ/PIJ dated: 20.6.97).

0.2 The Manual has been further revised in its present form in view of use of rails of different grades of steel such as GR 880, GR 1000 and GR 1080 and experience gained in the intervening period. The procedure for approval of new units for Glued insulated rail joints has also been included as annexure A.

0.3 For convenience GLUED INSULATED RAIL JOINTS" have been referred to as "Glued Joints"

0.4 There are two types of glued joints namely G3(L) type having six bolts and G3(S) type having four bolt. G3 (L) type and G3(S) type of glued joints can be manufactured from different rail sections as per drawing numbers given below:

<table>
<thead>
<tr>
<th>End post Thickness</th>
<th>Rail Section</th>
<th>Drawing No.</th>
</tr>
</thead>
<tbody>
<tr>
<td>6mm</td>
<td>75 R</td>
<td>RDSO/T - 1283</td>
</tr>
<tr>
<td></td>
<td>90R</td>
<td>RDSO/T - 1276</td>
</tr>
<tr>
<td></td>
<td>52 kg</td>
<td>RDSO/T - 671</td>
</tr>
<tr>
<td></td>
<td>60 kg (UIC)</td>
<td>RDSO/T - 2572</td>
</tr>
<tr>
<td>10mm</td>
<td>52 kg</td>
<td>RDSO/T - 5361</td>
</tr>
<tr>
<td></td>
<td>60 kg (UIC)</td>
<td>RDSO/T - 5843</td>
</tr>
</tbody>
</table>

Typical features of G3 Type Glued joints using 6 mm thick end post are as shown in Annexure 'H'.

0.5 G3(L) type glued joints are for use in LWR/CWR track in all the temperature zones and G3(S) type joints are for use in fishplated track as well as in SWR track.

0.6 "All the provisions contained in RDSO's ISO procedures laid down in Document No. QO-D-7.1-11 dated 19.07.2016 (titled "Vendor-Changes in approved status") and subsequent versions/amendments thereof, shall be binding and applicable on the successful vendor/vendors in the contracts floated by Railways to maintain quality of products supplied to Railways."  

C.S. No. 6
0. FOR EWR

0.1 The Manual of instructions for fabrication, installation and maintenance of Glued Insulated Rail Joints was first issued in 1982. The manual was revised in 1989. This manual is issued under the title "MANUAL FOR GLUED INSULATED RAIL JOINTS" in consultation with Signal Directorate of ROSO (reference Signal Engg. Dte. letter No.STS/E/IRJ/PIJ dated: 20.6.97).

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<table>
<thead>
<tr>
<th>End post Thickness</th>
<th>Rail Section</th>
<th>G3 (L) Type</th>
<th>G3 (S) Type</th>
</tr>
</thead>
<tbody>
<tr>
<td>6mm</td>
<td>75 R</td>
<td>RDSO/T - 1283</td>
<td>RDSO/T - 3008</td>
</tr>
<tr>
<td></td>
<td>90 R</td>
<td>RDSO/T - 1276</td>
<td>RDSO/T - 1278</td>
</tr>
<tr>
<td></td>
<td>52 kg (UIC)</td>
<td>RDSO/T - 2572</td>
<td>RDSO/T - 2576</td>
</tr>
<tr>
<td>10mm</td>
<td>52 kg (UIC)</td>
<td>RDSO/T - 5361</td>
<td>-</td>
</tr>
</tbody>
</table>

Typical features of G3 Type Glued joints using 6 mm thick end post are as shown in Annexure ‘H’.

0.5 G3(L) type glued joints are for use in LWR/CWR track in all the temperature zones and G3(S) type joints are for use in fishplated track as well as in SWR track.
CHAPTER - 1

MATERIAL, MATERIAL SPECIFICATIONS AND EQUIPMENT FOR FABRICATION OF GLUED JOINTS

1.1 MATERIAL:

The requirement of material for fabrication of one glued joint is given in Annexure B. The input materials shall be procured from RDSO approved suppliers only. The list of approved suppliers of input materials is available in Master list of Approved Vendors issued by Quality Assurance (Civil) directorate of RDSO which is updated from time to time.

1.2 SPECIFICATIONS:

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The material shall be as per specifications given in Annexure C.

1.3 EQUIPMENT:

List of equipment required for fabrication of glued joints is given in Annexure E.

1.3.1 A special jig for assembly (item f of Annexure E) and a testing frame

1.3.2 (item g of Annexure E) for conducting pull-out test on glued joints shall be manufactured as per guide lines shown in fig. 2 & 3 respectively
CHAPTER - 2

FABRICATION/ASSEMBLY OF GLUED JOINTS

2.1 PRE-FABRICATION WORK

2.1.1 The glued joints shall be fabricated/assembled in a covered shed having clean dust free and well lit area, so that there is no possibility of extraneous particle mixing with the glue.

2.1.2 The assembly jig shall be thoroughly cleaned of any dust using a brush before taking up assembly.

2.1.3 One rail piece of minimum 6 m length shall be used for fabricating one glued joint.

2.1.4 Rails required for fabrication of glued joints shall be straight and USFD tested. These rails shall be issued by the consignee Zonal Railways to the manufacturer. Old/Service rails shall not be used for fabrication of glued joints. New rails need not to be USFD tested again by consignee Zonal Railways if they have received the same from rail manufacturing plant duly USFD tested.

2.1.5 The rail piece shall be cut in the middle with a rail cutting machine. It shall be ensured that the cut is square and the rail ends are square, plane and smooth. Since rail pieces taken from two separate rails are likely to have variations in profile, it is, therefore, necessary that rail pieces cut from the same rail are jointed together at the cut-end for fabrication of the joint. For this purpose, just before cutting a rail-piece, necessary marking (such as A-A' or 1-1' etc.) shall be put on the adjoining cut-ends with indelible paint and it shall be ensured that the ends with corresponding mark only are jointed together.

2.1.6 The edges of the rail-ends of the two pieces at the cut shall be finished smooth with a flat file. All burrs shall be removed.

2.1.7 Holes in rail pieces shall be drilled at locations following the relevant drawing with a precision drill using jigs to ensure accuracy. It shall be ensured that the holes drilled are not skew.

2.1.8 The burrs around holes shall be removed. The edges of the drilled holes shall be chamfered using the chamfering tools of the type shown in Figure-1.

2.1.9 The fish-plates shall have correct profile as per drawing so that contact with rail on the fishing surfaces and web is proper. Drilling of holes in fishplates shall be done by a precision drill using jigs. The edges of drilled holes shall be cleaned of burrs.

2.1.10 The markings of rail designation, rolling details etc., occurring in the zone of contact of rail and fishplates, shall be ground with a grinder so as to merge with the parent profile/contour.
2.1.11 The matching surfaces of the rail and that of fishplate shall be sand blasted. Sand blasted rail and fishplate surfaces shall be cleaned with the help of a high speed revolving wire-brush (of about 500 revolutions per minute) and with a blower to dislodge the metallic dust, caused during sand blasting, from the cavities. Alternatively, the surfaces may be cleaned with the help of a brush with hard nylon bristles.

2.1.12 The surfaces of rail, fishplates, insulating components, bolts, nuts & washers shall then be finally cleaned using a suitable chemical such as Trichloroethylene, Acetone, Carbon tetrachloride or Benzene. It shall be ensured that the surfaces, after cleaning, are free from traces of oily substances.

2.1.13 The end-post, bushes/sleeves and insulating liners shall be roughened by Emery Cloth No.2.

2.1.14 The assembly work shall be commenced as soon as possible and in any case within four hours of sand-blasting. If due to some reasons, the rails and the fishplates could not be used within four hours of sand blasting, the sand blasting operation should be repeated.

2.2 PRECAUTIONS DURING FABRICATION

The following precautions shall be taken during fabrication of glued joints:

2.2.1 The mating surfaces of rails & fishplates shall be kept clean and free from oily traces and shall not be touched after cleaning.

2.2.2 The jig shall always be kept covered by polythene sheet to prevent accumulation of dust. A newly fabricated glued joint should also be kept covered by polythene sheet for a minimum period of 24 hours.

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

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

2.2.5 Smoking within the fabrication area should be strictly prohibited.

2.2.6 At least one set of portable fire extinguisher should be kept in the fabrication area.

2.2.7 The matching of the cut ends A-A' or 1-1' (as the case be) of rails shall be ensured.

2.2.8 Grinding of marking of rail designation, rolling details etc. shall be ensured.

2.3 FABRICATION / ASSEMBLY

2.3.1 For fabrication/assembly of joints, the two cleaned rail pieces with matching ends shall be placed on the jig as per drg. No. EDO/T-1473 (figure 4). The rail ends shall
be perfectly aligned both laterally and vertically. The two rails shall then be held firmly in position by clamps. The distance between two rail ends shall be marginally more than the thickness of the end-post to be used to enable insertion of the end-post.

2.3.2 The application of glue shall be commenced only when the finished rails and fishplates have been properly cleaned & have dried completely.

2.3.3 The resin and the hardener shall be mixed as per supplier’s instructions in a suitable container. The constituents shall be thoroughly mixed to get a homogenous mixture (hereafter called as ‘glue’). The glue shall be used within its pot life as prescribed by the supplier.

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

2.3.5 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 fishplates.

2.3.6 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.

2.3.7 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 by using screw clamps at the rail ends so that no gap is left between the end-post and the rails.

2.3.8 In case of glued joint with 6 mm thick end post, the insulating bushes duly dipped in glue shall be placed in the rail holes. The bonding surfaces of the rails shall then be coated with a layer of glue and the fishplates made ready as described in paras 2.3.4 to 2.3.6 shall be placed in position in contact with the rail web. In case of glued joint with 10 mm thick end post, the bonding surfaces of the rails shall be coated with a layer of glue and the fish plates made ready as per para 2.3.4 to 2.3.6 are to be placed in position in contact with the rail web. The insulating sleeves duly dipped in glue shall then be inserted in the joint holes and subsequently bolts to be inserted for tightening to the required bolt tension.

2.3.9 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 35 kg-m per bolt. Care shall be taken to tight inner bolts first and the outer bolts. Finally, all the bolts shall be tightened with a torque of 105 kg-m.

2.3.10 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.
The joints shall be finished by covering all visible edges of glass-cloth carrier with glue. Fillet shall then be formed around the fishplate by utilising the oozed out glue. Excess glue shall be removed.

2.4 MARKING

2.4.1 (A) Marking of Glued Joints (by manufacturer)- Every glued joint shall have distinctive mark indicating the glued joint number, month and year of manufacturing and the code of the manufacturer 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 fish plate 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, as indicated in figure 5.

XXXX · MM YY AAA

The first four digits indicate the glued joint number starting from 0001 for first joint of every month, the next two digits month of manufacturing followed by last two digits of the year of manufacturing. The end letters shall be code of the manufacturer, assigned by the Quality Assurance (Civil) directorate of RDSO.

(B) Marking of Glued Joints (by insps authority)- Every glued joint shall have distinctive inspection mark of inspecting agency. 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 another end of fish plate 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, as indicated in figure 5.

2.4.2 In order to indicate the UTS of the rail, coding as shown in figure 5 shall be done by approved enamel paint.

2.5 POST FABRICATION WORKS

2.5.1 Assembly jig should be covered with polythene sheet after fabrication of joint.

2.5.2 CURING

The assembled joint shall then be allowed to cure on the jig for at least 24 hours at room temperature without disturbance. It shall be ensured that no moisture, oil or other deleterious material come in contact with the assembled joint till it is cured.

2.5.3 CLEANING OF TOOLS:

All tools and equipments used to be cleaned of glue after the assembly of the joint.
CHAPTER - 3

TESTING AND INSPECTION OF GLUED JOINTS

3.0 All the facilities for carrying out stipulated tests on the glued joints should be available at the manufacturing site.

3.1 Lot size:

50 joints or part thereof shall form the lot for the purpose of testing and inspection of the joints.

3.2 Dimensional check

3.2.1 Every fabricated/assembled joint shall be checked for vertical and lateral alignment with 1 m long straight edge. The tolerances permitted shall be as under:

(i) Vertical alignment- Variation at the joint shall be within +1 mm and -0 mm measured at the end of 1 m straight edge placed at the top of rail head.

(ii) Lateral alignment- Variation at the joint shall not be more than ± 0.5 mm measured at the centre of 1 m straight edge placed along the gauge face.

3.2.2 All the other tests shall be carried out only if the joints are dimensionally satisfactory.

3.3 INSULATION RESISTANCE TEST IN DRY CONDITION

Each joint shall be subjected to insulation resistance test in dry condition. A meggering voltage of 100 V DC shall be applied across the joint. The value of the insulation resistance shall not be less than 25 megaohms.

3.4 PULL-OUT TEST

3.4.1 Only if the joints are found satisfactory in dimensional check (para 3.2) and insulation resistance test in dry condition (para 3.3), the pull-out test shall be conducted.

The pull out test shall be conducted by suitably gripping the two rail pieces of the joint and subjecting the joint to axial tension. One method of conducting the test is to hold one end of the glued joint with the help of fishplates as fixed end. The other end of the glued joint is held to a moving frame with the help of a wedge inserted in slots cut in the glued joint through the moving frame brackets. The arrangement is shown in figure 2. The other method of conducting the test is to hold the glued joint with the help of fish plates at both ends of the testing frame. One end of the testing frame remains fixed and the other is moved with the help of two hydraulic jacks operated simultaneously, the arrangement is shown in figure 3. Manufacturer can adopt any other method also with prior approval of RDSO.
3.4.3 Acceptance values:

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 in the table below:

<table>
<thead>
<tr>
<th>S No.</th>
<th>Rail Section</th>
<th>Minimum pull out load in tonnes</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>75R</td>
<td>G3 (L) type joint 110</td>
</tr>
<tr>
<td>2.</td>
<td>90R</td>
<td>G3 (S) type joint 125</td>
</tr>
<tr>
<td>3.</td>
<td>52 kg</td>
<td>G3 (L) type joint 150</td>
</tr>
<tr>
<td>4.</td>
<td>60 kg (UIC)</td>
<td>G3 (S) type joint 170</td>
</tr>
</tbody>
</table>

3.4.4 The basis for acceptance/rejection of the lot with respect to pull-out test shall be as follows:

Four joints should be randomly selected. Out of these four, two joints are to be subjected to pull-out test. If

(i) both joints pass, lot is cleared for insulation resistance test in wet condition;

(ii) both joints fail, lot is rejected;

(iii) one joint fails, remaining two joints should be tested and if both pass, the lot is cleared for insulation resistance test in wet condition otherwise entire lot is rejected.

3.5 INSULATION RESISTANCE TEST IN WET CONDITION

Only two joints out of those joints which have successfully withstood insulation resistance test in dry condition (para 3.3) and pull-out test (para 3.4) shall be tested for insulation resistance in wet condition. The joints shall be immersed in water for 48 hours in suitable clean water tank; and resistance shall be measured immediately after taking out the joint from the water by applying meggering voltage of 100 V DC across the joint and measuring current by an ammeter capable of measuring current up to micro-amperes. 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 joint. If both the joint pass this test, the lot will be accepted.

3.6.3 Pieces of the rail of tested joints shall be returned by the manufacturer to the railway/purchaser.

3.7 DISPOSAL OF PULL-OUT TESTED JOINTS:

3.7.1 The pull-out tested joints shall not be repaired or welded and shall be distinctly marked 'NOT TO BE PUT IN TRACK' on both the surfaces of the web of the rail on either side of the joint with approved enamel RED PAINT immediately after the pull out test.
3.7.2 The pull out tested joints shall be dismantled soon after the inspection. Fishplates may be re-used in subsequent fabrications if their condition is satisfactory.

3.8 DISPOSAL OF REJECTED LOT

Each joint of the rejected lot shall be marked with red paint over at least 30 cm length at both ends.

3.9 MAINTENANCE OF RECORDS

Records in respect of fabrication of glued joints should be maintained in the performae as given in Annexure G.
CHAPTER - 4

INSTALLATION AND MAINTENANCE OF GLUED JOINTS

4.1 PRELIMINARY WORKS

4.1.1 Sleeper spacing: The sleeper spacing under glued joint shall be the same as that of intermediate sleepers.

4.1.2 Before laying of the glued joint, it shall be ensured that at least ten sleepers on either side of the joint are properly packed to the correct level.

4.1.3 Proper care shall be taken in transporting the joints to site of laying so that no damage is caused during loading, unloading and transportation.

4.2 INSTALLATION OF GLUED JOINTS

For installation of joint, the following procedure should be adopted:

a) suitable length of rail, depending on length of the joint to be inserted, shall be cut and removed. The glued joint shall be placed in position and shall be welded at the two ends by an approved method.

b) For installation of a glued joint in an existing LWR, the method used for rectification of the rail fractures, as outlined in the Manual of instructions for LWR shall be adopted.

4.2.2 For the replacement of a defective joint, similar procedure as mentioned above shall be followed.

4.2.3 Insulation resistance of the Glued Joint shall be checked in association with concerned Signalling Staff before insertion in Track.

4.3 MAINTENANCE OF GLUED JOINTS

4.3.1 BALLAST:

The ballast in track in the vicinity of the glued joints shall be clean to ensure proper packing and efficient drainage. It shall be ensured that the ballast is clear of rails and rail-fastenings. The clearance from the underside of rail to ballast shall normally not be less than 50mm.

4.3.2 MAINTENANCE:

"Between two successive tamping of glued joints by track machine, proper maintenance attentions and inputs should be given to glued joints for their upkeep and proper function."

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4.3.3 For the upkeep of the insulating properties of the Glued Joint, assistance should be provided by Engineering staff as and when required by Signalling staff.
4.3.4 As in the case of ordinary insulated joints, the metal burrs/flow at the ends of the rails shall be removed from time to time to avoid short-circuiting. The burrs/flow shall be removed skillfully avoiding damage to the end-post.

4.3.5 It shall be ensured that live cinders, which may damage glued joints, are not dropped in the vicinity of such joints.

4.3.6 FAILED JOINTS:

Normally no relative movement shall occur between rails and fishplates at the glued joint. In case, failure of the joint occurs by separation of the rail/fishplates surfaces with consequent relative movement, the damaged glued joint may be replaced as early as possible by a new joint.

4.4 RECLAMATION OF DAMAGED GLUED JOINTS:

4.4.1 The damaged glued joint removed from the track shall be stripped off the glue to reclaim fishplates to the extent possible. This work is best done in a Workshop. For this purpose, the glued joint shall be heated by a blow lamp to a temperature of over 200 deg. C. As soon as the glue clinging to the threads of fishbolts becomes thin, the nuts shall be loosened and fishbolts shall be pushed out. A chisel shall be inserted between the rail and the fishplate and with the help of gentle and careful blows of a hammer, the fishplates shall be removed.

4.4.2 The fishplates shall be cleaned of glue, dried and kept in stock for reuse if required after ascertaining that there is no physical damage.

4.4.3 Released rails, if worn out, may be disposed off as scrap as per extant practice.

4.5 Life cycle of Glued insulated Rail Joints is tentatively fixed at 200 Gross Million Tonnes of traffic

C.S. No. 5
Guidelines regarding developmental inspection of firms by RDSO.

A.1 Development inspection of glued joint will be undertaken by RDSO after initial development of firm in normal course as per extant instruction or against developmental/educational order placed by Zonal Railway on any firm/or as per decision of competent authority. Separate approval shall be required for each drawing of the glued joints.

A.1.1 The development of firm against developmental order by Zonal Railway shall be dealt as per extant instructions of Railway Board.

A.2 After administrative clearance for development of firm, a technical capability assessment proforma will have to be downloaded by the firm/obtained from vendor registration system of RDSO. Firm shall be required to fill in the proforma in duplicate and submit the same to concerned directorate of RDSO for scrutiny along with the necessary charges.

A.2.1 All the information in the proforma should be clear and to the point and no para should be left blank.

A.3 The filled in proforma will be scrutinized in RDSO duly calling for any additional information if required.

A.4 If the proforma details and clarifications given by the firm are acceptable, the works of the firm shall be inspected by RDSO officials for verification of the facilities. The date of inspection of firm's works shall be advised to the firm in advance.

A.5 During the inspection, the inspecting officer shall have free access to all the sections of the firm's works. Firms shall be required to offer, to the inspecting officer, all necessary facilities to undertake the assessment inspection.

A.6 After the assessment, if the firm's manufacturing capacity/facilities are found acceptable, the firm will be required to furnish two sets of templates/gauges (item 't' Annexure 'E') for approval by RDSO along with the templates/gauge approval charges.

A.7 After approval of templates/gauges, the firm will undertake internal development and submit internal test report (ITR) for scrutiny to RDSO. For internal development, firm will procure rails from authorized source and preserve record for the same.

In case, ITR submitted by the firm is found satisfactory, the firm shall be advised to deposit sample draw & testing charges.

A.8 After submission of charges, the firm will undertake manufacture of Glued joints in presence of RDSO representative and sample shall be drawn at random from the production undertaken and will be tested as per specified testing scheme given in chapter-3.
A.9 The firm shall bear the entire cost of preparation of samples and testing. The firm shall be required to pay the due charges in advance for development of their firm. The amount of charge shall be advised to the firm by RDSO.

A.10 After the samples are found satisfactory and other conditions fulfilled, the vendor shall be considered for approval. If the development is undertaken against developmental order, the firm will be given permission to undertake manufacture of ordered quantity. After satisfactory supply, it will be considered for approval.

A.11 General Instructions

A.11.1 The firm shall be required to procure all components of assembly of the joints from the firms approved by RDSO and should maintain the copies of test certificates wherever applicable.

A.11.2 Drawings and specification of the glued joints are priced documents and may be obtained either by downloading from RDSO website through RTGS/NEFT payment or from Director General (Track Design) RDSO, Lucknow on payment.

A.11.3 If the results of testing are not found satisfactory as per specifications, the firm will be required to improve upon the technique of production.

A.11.4 The firm is required to establish Quality Assurance Programme as per the proforma given in Annexure-F, and its satisfactory implementation in addition to manufacture of a minimum number of Glued joints as specified by RDSO.

A.11.5 After approval of test samples (after supply of ordered quantity in case of developmental order), the firm shall be brought as Part-II source in approved list of manufacture of Glued Joints for the particular rail section and all concerned shall be advised.

A.11.6 Based on the satisfactory and consistent quality of the firm's product, proven performance and successful implementation of QAP, the firm will be considered for upgradation in Part-I in the approved list of manufacturer after fulfilling the criteria for upgradation as mentioned in General Guidelines for Vendor Development.

A.11.7 The approval shall be required to be renewed after a particular period as per the terms of the letter of approval and it shall be firm's responsibility to approach RDSO at least three months in advance for renewal of approval otherwise the approval is liable to lapse.

C.S. No. 5
### MATERIALS REQUIRED FOR FABRICATION OF GLUED JOINT

Materials required for fabrication of one glued joint is as under:

<table>
<thead>
<tr>
<th>No.</th>
<th>Description</th>
<th>Quantity G3(L)</th>
<th>Quantity G3(S)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Rail piece of required length</td>
<td>1 No.</td>
<td>1 No.</td>
</tr>
<tr>
<td>2.</td>
<td>Fishplates</td>
<td>2 Nos.</td>
<td>2 Nos.</td>
</tr>
<tr>
<td>3.</td>
<td>HTS bolts with nuts</td>
<td>6 &quot;</td>
<td>4 &quot;</td>
</tr>
<tr>
<td>4.</td>
<td>Punched Washers</td>
<td>12 &quot;</td>
<td>8 &quot;</td>
</tr>
<tr>
<td>5.</td>
<td>Insulating Bushes/Sleeves**</td>
<td>6 &quot;</td>
<td>4 &quot;</td>
</tr>
<tr>
<td>6.</td>
<td>Insulating Liners**</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>7.</td>
<td>Insulating End Post**</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>8.</td>
<td>Glue</td>
<td></td>
<td>(As indicated in para C.5.1.2)</td>
</tr>
<tr>
<td>9.</td>
<td>Glass cloth carrier/(Woven rovings)</td>
<td>4 pieces</td>
<td>4 pieces</td>
</tr>
<tr>
<td></td>
<td></td>
<td>(15 x 100 cm)</td>
<td>(15 x 66 cm)</td>
</tr>
<tr>
<td>10.</td>
<td>Acetone or Trichloroethylene Or Carbon Tetrachloride or benzene (for cleaning tools, rails etc.)</td>
<td>Half lit. approx.</td>
<td>Half lit. approx.</td>
</tr>
<tr>
<td>11.</td>
<td>Kerocleanse Chemical for cleaning hands</td>
<td></td>
<td></td>
</tr>
<tr>
<td>13.</td>
<td>Sand (For sand blasting)</td>
<td>0.2 cu.m</td>
<td>0.2 cu.m</td>
</tr>
<tr>
<td>14.</td>
<td>Cotton waste or liner rags.</td>
<td>0.5 kg approx.</td>
<td></td>
</tr>
<tr>
<td>15.</td>
<td>Emery Cloth No. 2</td>
<td>2 sheets</td>
<td>2 sheet</td>
</tr>
<tr>
<td>16.</td>
<td>Approved paints i.e. red, yellow and blue as per requirement.</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**The insulating components shall be made at the manufacturing site and shall not be procured from outside agencies.**
SPECIFICATION FOR FISHPLATES

i) "Material and manufacturing process of fish plate shall conform to IRST-1 as amended from time to time."

ii) The dimensions of fish plate shall conform to relevant drawing of the glued joints.

iii) Special fish plates to be used in fabrication of Glued Insulated Rail Joints shall be inspected by purchaser Railway or its nominated inspecting agency (M/s RITES) at the premises of fish plate in Manufacturer firm. Inspection shall be done as per Para 19 of IRST-1 as amended from time to time. After inspection every accepted fish plate shall be plainly stamped with the inspecting officers stamp at one end of each fish plate on its outer side in the presence of Inspecting officer. The inspection certificate of inspecting agency shall be sent by manufacturer of special fish plate along with the supply to glued joint manufacturer. The glued joint manufacturer will check the supply with respect to the details mentioned in Inspection Certificate of inspecting agency and then only put these in use.

SPECIFICATION FOR HTS BOLTS & UTS

HTS bolts and nuts shall comply with the following specifications:

1) "HTS Bolts - Material and manufacturing process of Hex bolts shall be as per IS: 1363 confirming to property clause 10.9 of IS: 1367."

2) "HTS Nuts - Material and manufacturing process of Hex nuts shall be as per IS: 1363 confirming to property clause 12.0 of IS: 1367."

SPECIFICATION FOR PUNCHED WASHER

Steel of Punched Washers shall conform to IS:2062.

SPECIFICATION OF INSULATING BUSIES/SLEEVES, LINERS & END-POSTS

The insulating components viz. bushes/sleeves, liners and end-posts shall be made with the following materials in the premises of manufacturer as per the procedure indicated under para C.5.2

MATERIALS
d) Binder: The glass rovings shall contain a sizing agent to facilitate weaving and to impart high wet strength to liners, bushes/sleeves and end-posts. The sizing agent used shall be compatible with epoxide resins. Approximate size of glass-cloth pieces are given below for guidance:

i) For G3(L): 15 X 100 cm for 60kg, 52kg and 90R joints 15 X 65 cm for 75R joints

ii) For G3(S): 15 X 66 cm for 60kg, 52kg and 90R joints 15 X 48 cm for 75R joints.

5.1.2 GLUE: (for making insulating components)

Glue consists of resin and hardener. The nomenclature of resin & hardener manufactured by firms approved at present are as under:

<table>
<thead>
<tr>
<th>Firm’s name</th>
<th>Resin</th>
<th>Hardener</th>
</tr>
</thead>
<tbody>
<tr>
<td>M/s ATUL Ltd</td>
<td>Epoxy Resin Lapox L-12</td>
<td>Epoxy Hardener Lapox K-6</td>
</tr>
<tr>
<td>M/S HUNTSMAN Advanced Materials INDIA PVT. LTD.</td>
<td>ARALDITE LY-556</td>
<td>ARADURE HY-951 IN</td>
</tr>
</tbody>
</table>

Resin and hardener shall be mixed in the ratio of 10:1.

C.5.2 FABRICATION TECHNIQUE

C.5.2.1 The liners, end-posts and bushes/sleeves shall be fabricated either by the hand lay-up process or by pressure-moulding technique or by any other standard method.

C.5.2.2 The hand lay-up process is similar to the method described earlier in para 2.3.6. 2.3.7 The components are to be fabricated by building-up layer after layer till sufficient thickness is achieved. Generally 20 layers of cloth would be needed for end-posts of 6mm thickness and 5 layers for liners, bushes/sleeves for obtaining the stipulated thickness.

C.5.2.3 The end-post may be built-up by using suitable sized rectangular pieces of glass-cloth. Nominal pressure shall be maintained till the piece is cured. The rectangular piece shall then be cut and profiled to the shape of the end-post.

C.5.2.4 The liner may be fabricated in the hollow of a rail-web by placing a rail piece with its web horizontal and by building up layer after layer. Nominal pressure shall be maintained in this case also till the piece is cured.

C.5.2.5 The bushes/sleeves are to be fabricated by winding a wide piece of glass-cloth on a bolt-shank and then cutting up the finished tubing into suitable size after curing.

C.5.2.6 In all the above cases, a coat of a release agent “Releasil-7” or a similar product shall be applied on the surface on which the component is fabricated to enable easy separation of the same after curing.
C.5.3 DIMENSIONS OF FINISHED PRODUCT:

The liners, end-posts and bushes/sleeves shall be given final finish conforming to the dimensions shown in the relevant drawings.

C.5.4 QUANTITY PER JOINT

C.5.4.1 Quantity of raw material required for insulating components for 52kg G3 (L) and 60kg G3 (L) glued joint, with 10mm thick end-post drawing, shall be approximately as under:

<table>
<thead>
<tr>
<th>S No.</th>
<th>Insulating components</th>
<th>Qty. Req'd per joint</th>
<th>Fibre Glass cloth (gm)</th>
<th>LY-556 (gm)</th>
<th>HY-951 (gm)</th>
<th>L-12 (gm)</th>
<th>K-6 (gm)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Insulating Liners</td>
<td>2</td>
<td>500 500 450 450 180 180</td>
<td>560 560 500 500 190 190</td>
<td>60 60 60 60 60 60</td>
<td>60 60 60 60 60 60</td>
<td>50 50 50 50 50 50</td>
</tr>
<tr>
<td>2</td>
<td>End post</td>
<td>1</td>
<td>210 210 180 180 180 180</td>
<td>225 225 180 180 180 180</td>
<td>60 60 60 60 60 60</td>
<td>60 60 60 60 60 60</td>
<td>18 18 18 18 18 18</td>
</tr>
<tr>
<td>3</td>
<td>Bushes/Sleeves</td>
<td>6</td>
<td>180 180 150 150 150 150</td>
<td>190 190 150 150 150 150</td>
<td>60 60 60 60 60 60</td>
<td>60 60 60 60 60 60</td>
<td>15 15 15 15 15 15</td>
</tr>
</tbody>
</table>

C.5.4.2 Quantity of raw material required for G3(S) type joints can be obtained by reducing proportionately.

C.5.5 Other components 8111 input materials such as glue, glass cloth carrier reinforcement as mentioned at Para C.5.1, C.5.1.2, C.5.4.1 and C.6 of this manual to be used in fabrication of glued insulated rail joint shall be procured by the manufacturer of glued insulated rail joint from their approved sources i.e. listed in the current Master List of Approved Vendors issued by Quality Assurance (Civil) Directorate of RQSO which is updated from time to time. While procuring these materials from their respective approved sources, glued joint manufacturer must ensure that these input materials used in fabrication of glued joints have been procured from their respective approved sources by verifying the related inspection certificate/documents and records maintained by glued joint manufacturer.

C.6 SPECIFICATION AND QUANTITY REQUIRED OF GLUE

The tangential shear strength of glue is claimed to be about 120 kg/sq.cm by the manufacturer.

i) The Glue as developed by nis Huntsman Advanced nsaterials (INDIA) Pvt Ltd for prefabricated type Glued 3 joints consists of ARALDITE XY 27 and hardener XY 28 IN to be mixed in proportion of 100:40. The approximate quantity of combined adhesive required for 52 Kg rail joint is 14 kg for 03 (L) and for 60Kg rail joint is 16.8 kg for G3 (L). The quantity may be estimated proportionately in case of 03 (S) type joints.

ii) Similarly, the Glue as developed by nIS A TUL Ltd for Prefabricated type Glued 3 joints consists of Epoxy resin Lapox A-83 and Hardener Lapox K-83 to be mixed in proportion of 100:40. The approximate quantity of combined adhesive required for 52 Kg rail joint is 1.4 kg for 03 (L) and for 60 kg rail joint is 1.68 kg for 03 (L). The quantity may be estimated proportionately in case of 03 (S) type joints.
NOTE:

(i) The weight of raw material indicated above is approximate and includes allowance for wastage and is based on experience gained at the time of development of these joints in RDSO.

(ii) Detailed instructions regarding the method of storage, mixing, pot-life and minimum period of curing of adhesive at various temperature shall be obtained by purchaser from the suppliers and shall be scrupulously followed.

(iii) The resin and hardener should be of same firm as approved i.e. resin of one firm and hardener of another firm can not be used.
LIST OF ESSENTIAL EQUIPMENTS REQUIRED FOR FABRICATION AND TESTING OF GLUED JOINT

a) Rail cutting machine
b) Drilling machine with required drill bits
c) Electric grinder
d) Protective goggles
e) Sand blasting equipment with 10 hp compressor
f) Jigs for assembly of joints.
g) Pull-out strength testing frame complete with 200 t capacity hydraulic jack and pressure gauge duly calibrated.
h) Straight edge 1 m long with 15 mm notch at centre
i) Steel brushes (stiff)
j) Steel brush (round) attachment of eccr grinder
k) Steel pans about 30 cm dia. For mixing glue
l) Split washer rollers
m) Receptacle (to clean tools etc.)
n) Torque wrench 105 kg m capacity
o) Pair of scissors for cutting of glass cloth
p) Files (round and flat)
q) Spanners/adjustable spanners suitable for tightening of HTS bolts & nuts
r) Weighing balance with set of suitable weights
s) Chamfering tool with bolts & nuts as per figure 1.
t) Templates of fishplates duly appd. by RDSO
u) Vernier calipers, steel scales, steel tapes of various sizes, inner & outer caliper and filler gauges in mm.
v) Megger 100 v DC for testing insulation resistance in dry condition.
w) An Ammeter capable of measuring current upto 1 micron ampere for insulation resistance in wet condition.
x) Electric heaters in winters to maintain temperature above 20 °C in the shed required for hardening of glue in 24 hrs.
y) 200 Tonnes Capacity Proving Ring

C. S. No. 4
# PRO FORMA FOR QUALITY ASSURANCE PROGRAMME

<table>
<thead>
<tr>
<th>S.NO</th>
<th>ITEM</th>
<th>OBSERVATION</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>MATERIAL</td>
<td>(To be recorded for each section of rail for each supply)</td>
</tr>
<tr>
<td>a)</td>
<td>RAILS</td>
<td></td>
</tr>
<tr>
<td>i)</td>
<td>Rail Section</td>
<td></td>
</tr>
<tr>
<td>ii)</td>
<td>Condition of Storage</td>
<td></td>
</tr>
<tr>
<td>iii)</td>
<td>Ultrasonically tested</td>
<td></td>
</tr>
<tr>
<td>iv)</td>
<td>Availability of Test Certificate</td>
<td></td>
</tr>
<tr>
<td>v)</td>
<td>Straightness</td>
<td></td>
</tr>
<tr>
<td>vi)</td>
<td>Quantity in hand</td>
<td></td>
</tr>
<tr>
<td>b)</td>
<td>FISHPLATES</td>
<td>(To be recorded for each drg. of fish plate for each supply)</td>
</tr>
<tr>
<td>i)</td>
<td>For which rail section and drg. No.</td>
<td></td>
</tr>
<tr>
<td>ii)</td>
<td>Condition of storage</td>
<td></td>
</tr>
<tr>
<td>iii)</td>
<td>Source of supply</td>
<td></td>
</tr>
<tr>
<td>iv)</td>
<td>Availability of Certificate if material conforming to IRS T-1</td>
<td></td>
</tr>
<tr>
<td>v)</td>
<td>If conforming to template approved by RDSO</td>
<td></td>
</tr>
<tr>
<td>vi)</td>
<td>Holes position w.r.t. centre line of rail hole (measured with the help of template)</td>
<td></td>
</tr>
<tr>
<td>vii)</td>
<td>Straightness</td>
<td></td>
</tr>
<tr>
<td>viii)</td>
<td>Twist</td>
<td></td>
</tr>
<tr>
<td>ix)</td>
<td>Quantity in hand</td>
<td></td>
</tr>
<tr>
<td>c)</td>
<td>HTS BOLTS AND NUTS</td>
<td>(To be recorded for each supply)</td>
</tr>
<tr>
<td>i)</td>
<td>Source of supply</td>
<td></td>
</tr>
<tr>
<td>ii)</td>
<td>Availability of certificate for material conforming to specifications.</td>
<td></td>
</tr>
<tr>
<td>iii)</td>
<td>Marking on bolts &amp; nuts</td>
<td></td>
</tr>
<tr>
<td>iv)</td>
<td>Storage facility</td>
<td></td>
</tr>
<tr>
<td>v)</td>
<td>Quantity in hand</td>
<td></td>
</tr>
<tr>
<td>d)</td>
<td>FIBRE GLASS (WOVEN ROVINGS)</td>
<td>(To be recorded for each supply)</td>
</tr>
<tr>
<td>i)</td>
<td>Source of supply</td>
<td></td>
</tr>
<tr>
<td>ii)</td>
<td>Condition of Storage</td>
<td></td>
</tr>
<tr>
<td>iii)</td>
<td>Quantity in hand</td>
<td></td>
</tr>
<tr>
<td>e)</td>
<td>INSULATING COMPONENTS END POST</td>
<td>(To be recorded per 100 Nos.)</td>
</tr>
<tr>
<td>i)</td>
<td>Size and shape variation, if any</td>
<td></td>
</tr>
<tr>
<td>ii)</td>
<td>Thickness variation, if any</td>
<td></td>
</tr>
<tr>
<td>iii)</td>
<td>Glue used for making and ratio</td>
<td></td>
</tr>
<tr>
<td>iv)</td>
<td>Whether Roughened properly before use</td>
<td></td>
</tr>
<tr>
<td>v)</td>
<td>Quantity in hand</td>
<td></td>
</tr>
</tbody>
</table>
I) LINERS
   i) Size and shape variation, if any
   ii) Thickness variation, if any
   iii) Glue used and its ratio
   iv) Position of holes w.r.t. centre line of fishplate
   v) Dia and distance of holes
   vi) Whether roughened properly before use
   vii) Quantity in hand

II) BUSHES/SLEEVES
   i) Size, dia and shape variation, if any
   ii) Thickness variation, if any
   iii) Glue used and its ratio
   iv) Whether roughened properly before use
   v) Quantity in hand

II) ASSEMBLY AND TESTING EQUIPMENTS
   - Availability and condition of the following:
     a) Sand blasting equipment and compressor
     b) Assembly jigs with facility for alignment for vertical and lateral adjustment
     c) Provision for end-pressure arrangement
     d) Spirit level
     e) Torque wrench and other wrenches
     f) Calibration of Torque wrench to be done every six month
     g) Chamfering tools as per drawing (fig. 1)
     h) Pull Out testing frame having 200 t capacity
     i) Hydraulic jack with pressure gauge
     j) Calibration of Pressure gauge to be done every six month
     k) Megger for measuring dry insulation resistance
     l) Separate meter or arrangement for measuring insulation resistance in wet condition capable of measuring from 0 to 100 Kilo ohms

III) GENERAL OBSERVATIONS AT THE TIME OF ASSEMBLY OF JOINTS
   (To be recorded for assembly of each joint)
   a) Rolling marks on rail are ground before assembly of joint.
   b) Position of holes w.r.t. dimensions shown in drg. vertical and horizontal.
   c) Rail holes are chamfered with proper chamfering tool and with proper torque.
   d) Rail is placed properly on assembly jig, aligned properly and checked with the help of straight edge and spirit level.
e) Rails and fishplates are first cleaned with wire-brush and then rail, fishplates and bolts & nuts are cleaned with Acetone or Benzene.
f) Resin and Hardener weighed separately in the ratio prescribed by the firm and stirred properly before use.
g) Method of application of glue and putting the insulating components and fibre glass cloth are according to Manual of Instructions.
h) End pressure is given at the joint after insertion of end-post in position duly soaked in glue.
i) Bushes are inserted in rail-holes duly dipped in glue. Sleeves are inserted around bolts.
j) Bolts are inserted without difficulty and tightened in stage of 35 kg-m torque upto 105 kg-m torque initially (Central bolts are to be tightened first).
k) Final tightening is checked after 20 min. with 105 kg-m torque.
l) Oozed out glue is applied around the fishplates to fill the fillets.
m) Insulation resistance is checked immediately after making the joints.
n) Joints are not disturbed before 24 hrs. at room temperature.

IV OBSERVATIONS AT THE TIME OF TESTING THE JOINTS

a) The slots are cut properly and rounded.
b) Eccentric loading is not applied.
c) Load is applied without jerks.
d) Loading is stopped when crack appears at the joints.
e) Value of load applied at appearance of crack or completion of testing.
f) Insulation resistance is recorded after pull-out test and then the joint is immersed in water for 48 hours for wet insulation resistance test.
g) Insulation value obtained.

V GENERAL

a) Availability of Required drawing, specification, literature etc.
b) Display of Board for identification of resin and Hardener with their prescribed ratios.
for use

c) Display of boards for calibration of pressure gauge and torque wrench.

d) General Working conditions e.g. proper lighting, ventilation, cleanliness etc.

Signature and Name of Inspecting Engineer with date of inspection

Date:
### A. PRO FORMA FOR MAINTAINING RECORD OF PRODUCTION

**Page No. 1**

<table>
<thead>
<tr>
<th>S. NO.</th>
<th>DATE OF MANUFACTURE</th>
<th>JOINT NO.</th>
<th>DRG. NO.</th>
</tr>
</thead>
</table>

**Page No. 2**

<table>
<thead>
<tr>
<th>DATE OF INSPECTION</th>
<th>TOTAL NOS. OFFERED</th>
<th>NO. OF JOINTS FAILED</th>
<th>REMARKS AGAINST FAILURE</th>
</tr>
</thead>
</table>

**Page No. 3**

<table>
<thead>
<tr>
<th>DATE OF DESPATCH</th>
<th>CONSIGNEE</th>
<th>JOINT NOS. DESPATCHED</th>
</tr>
</thead>
</table>

### B. PRO FORMA FOR MAINTAINING RECORD FOR GLUE & FIBRE GLASS

**Opening balance as on 1st of last month (kg)**

<table>
<thead>
<tr>
<th>Glue for making joints (kg)</th>
<th>Glue for making insulating components (kg)</th>
<th>Fibre Glass (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>B</td>
<td>C</td>
</tr>
</tbody>
</table>

**Receipt of material during the month (kg)**

<table>
<thead>
<tr>
<th>No. of joints fabricated during the month (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
</tbody>
</table>

**Consumption during the month (kg)**

<table>
<thead>
<tr>
<th>Opening balance on 1st day of the current month (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
</tbody>
</table>

**Opening balance on 1st day of the current month (kg)**

<table>
<thead>
<tr>
<th>Opening balance on 1st day of the current month (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Opening balance on 1st day of the current month (kg)</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
</tr>
</tbody>
</table>
TYPICAL FEATURES OF G3 TYPE GLUED INSULATED JOINTS

END POST
G3 (L) FOR LWR/CHR

H.T.S. BOLT: 24 x 9 x 4.0
PLAIN WASHER

ADHESIVE LAYER
INSULATING LINER
STEEL FISHPLATE
INSULATING BUSH

END POST
PLAIN WASHER

NOTE: SLEEVE SHALL BE USED IN PLACE OF INSULATING BUSH WHEN GLUED JOINTS ARE FABRICATED WITH 10 mm END POST.
CHAMFERING OF RAIL HOLE

ASSEMBLY FOR CHAMFERING OPERATION

1. INDIAN STANDARD SCREW THREAD
2. PACKING PIECE
3. CHAMFERING TOOL
4. H.T.S. BOLT
5. PACKING PIECE
6. H.T.S. NUT

NOTE:

6. 52 ± 1° TANGENT TORQUE SHALL BE APPLIED ON THE NUT TO DEVELOP A BOLT TENSION OF 12.5 K DURING CHAMFERING WORK.
4. PACKING PIECE SHALL BE OF M.S. TO IS: 226.
1. ALL DIMENSIONS ARE IN MILLIMETERS.

EDO/T-1760
METHOD OF CONDUCTING PULL OUT TEST ON GLUED JOINT

HAN D OPERATED HYDRAULIC PUMP

DETAIL OF FRAME

THE ABOVE METHOD IS ONLY SECTIONS. THE MANUFACTURER IS FREE TO ADOPT ANY OTHER EXISTING ARRANGEMENT AND OBTAIN APPROVAL OF THE FURTHER SIZING AND DIMENSIONS. ALL DIMENSIONS ARE IN MILLIMETRES.

THE DETAIL DIMENSIONS OF STEEL BAR, SLOT, STEEL FRAME, WEDGE ETC. MAY BE MODIFIED/ADJUSTED BY MANUFACTURER TO SUIT THE PULL-OUT LOAD TO BE APPLIED.
NOTE:
This drawing has been prepared for making a glued joint with 6 in. long rails. In case joints are to be made with longer rails, end arrangements will be suitably modified so as to apply horizontal pressure during production. External support shall be arranged at least at 2 locations on either side of the joint. A vertical support shall be arranged at the centre of the joint.
PAINT MARKING AS PER IRS-T-12-2009 APPENDIX-IV

SIMILAR MARKING AT OPPOSITE FACE

GLUED INSULATED RAIL JOINT

MARKING ON GLUED JOINT AS PER PARA 2.4.1 (A)

MARKING ON GLUED JOINT AS PER PARA 2.4.1 (B)

LOCATION OF MARKING ON GLUED INSULATED RAIL JOINT