

NOR EASTERN RAILWAY
[CONSTRUCTION ORGANISATION]
ADDITIONAL SPECIAL CONDITIONS OF CONTRACT i.e. [Technical conditions]

1. ARRANGEMENT OF MATERIALS BY THE CONTRACTOR

- (i) Rolled steel sections conforming to IS:2062 (Gr. B0) and manufactured by M/s SAIL, TISCO, Jindal, RINL, IISCO, or any other source approved by RDSO are only to be used for girder fabrication. Relaxation has been given for using Grade "A" for other than plate sections till manufacturing of Gr. B0 starts. For grade A steel if permitted by Railway for structural section, 2% less payment per MT of fabrication shall be made for items of fabrication mentioned in the schedule.
- (ii) Normally steel is procured from Integrated Steel Plants. In cases Integrated Steel Plants are also not rolling and not available in their stock yard, supply is to be taken from the BIS approved Mini Steel plants/Re-rollers steel plants. In this connection guide lines of Railway Board/RDSO, issued from time to time shall be adhered to for ensuring quality of raw steel.
- (iii) Accordingly it should be ensured that supply of steel is taken only from the BIS approved sources and all certificates & identification, marks of traceability shall be ensured beforehand by the Railway as per latest guidelines of Railway Board/RDSO.
- (iv) Railway reserves the right to get the steel tested from Government/ NABL approved laboratories at the cost of contractor.
- (v) The agency shall first submit the quality assurance plan (QAP) for inspection procedure of raw material steel, rivet drift, nut, bolt, paint electrode etc & methodology of fabrication & erection. Agency shall also submit the welding procedure specification sheet (WPSS) and welding procedure quality record (WPQR) for the fabrication erection work, for approval by Railway.

Procurement of measuring equipment

Contractor shall hand over free of cost following measuring equipment along with calibration certificate to engineer in charge before the start of the work for calibration & cross checking of contractors work. These measuring equipments shall be retained by Railway after the completion of work. Measuring equipments to be supplied are (i) standard gauge cum level of PIE or similar make, (ii) Weld fillet gauge, (iii) Bridge CAM type weld gauge, (iv) automatic weld gauge, (v) leaf type weld fillet gauge, (vi) Vernier Callipers, (vii) Digital paint thickness gauge of make Elcometer or similar with extended probe attachment along with calibration test certificate capable of measuring galvanization & subsequent painting upto 1000 micron thickness over steel, (viii) calibrated measuring tape.

2. CODES & SPECIFICATIONS.

The materials as well as execution of works shall be to the following specifications and codes of practice (Latest Version of the Specification/Codes to be used).

I. Indian Railway Standard Codes and Specifications.

- (i) IRS welded Bridge Code(1972).
- (ii) IRS Steel Bridge Code (1962).
- (iii) IRSB-I Fabrication and erection of steel bridge girders.
- (iv) IRSM-28 Specifications for electrodes.
- (v) IRSM-19 Specification for wire flux Combination for SAW.
- (vi) IRBM- Indian Railway Bridge Manual
- (vii) IRS - Bridge Rule
- (viii) BS-110 (R) Guidelines On Fabrication Of Steel Girders For Construction/Field Engineers
- (ix) BS-111- Guidelines for Use of High Strength Friction Grip (HSFG) Bolting assemblies on Bridges on Indian Railways (**Revision - 7**)

II. Indian standard Codes and Specifications.

Signature of the Tenderer(s)

For Chief Administrative Officer/Con

- (i) IS:2062-2012 Hot rolled low ,medium and high tensile structural steel
- (ii) IS:813-1961 Scheme of symbols for welding.
- (iii) IS:9595-1980 Manual for metal arc welding.
- (iv) IS:4353-1967 Submerged arc welding.
- (v) IS:817-1966 Code of practice for training and testing of metal arc welders.
- (vi) IS:818-1968 Code of practice for safety and health requirements in electric and gas welding operations.
- (vi) IS:1181-1967 Qualifying tests for metal arc welders
- (vii) IS:123-1962 Specifications for ready mixed paints red oxide
- (viii) IS:2339 Specifications for paint Aluminium.
- (ix) IS:808 Hot Rolled Steel Beam ,Column, Channel and Angle Sections — Dimensions and Properties
- (x) IRC:83-2014 (Part I – IV) Code for Bearings (Latest Revision)

3. METHOD FOR FABRICATION OF GIRDER

A. SHOP ERECTION:

As the spans will be fabricated by the contractor with well knowing method, the contractor would undertake trial assembly in any of his works of girder of one span, as directed by the Engineer or authorized inspecting agency to prove templates and jigs. However, if the contractor does not envisage necessity of trial assembly for the entire span, assembly of each joint at the workshop shall be done by the contractor and get it inspected and certified by the inspecting agency. In that case any modification required afterwards, for achieving the desired profile, will be done by the contractor at his own cost.

B. METALISING

TECHNICAL SPECIFICATIONS

(i) SURFACE PREPARATIONS:

Cleaning prior to Blasting: Grease paint and any other foreign matters should be removed from the area to be sprayed as well as adjoining areas, for which petroleum hydrocarbon solvent to IS:1745-1978 shall be used.

(ii) BLASTING:

(a) Abrasive for blasting: Grit grade G-C100 to G -C42 as specified in IS-4683-1968(Appendix 'A' in IS-5905-1970) and as per Clause 3 of IS-6586-1972/IRS-B-1-2001(Revised).

(b) Standard of cleanliness and surface:

Roughness : Surface should be thoroughly cleaned and roughened by compressed air blasting or centrifugal blasting with grit as specified in clause 49 (i) (a) above immediately before spraying, it shall be ensured that the surface is free from grease, scale, rust, moisture or any other foreign matter. It shall then have a uniform metallic colour and corresponding appearance to prints designated Sa2.1/2 (Sa two and half) in IS 9954-1981/IRS-B-1-2001(Revised) i.e. near white metallic surface. It shall be comparable in roughness with a reference surface produced in accordance with Appendix 'A' of IS5905-1970/IRS-B-1-2001(Revised) and shall provide an adequate key for the subsequently sprayed metal coating.

(c) Blasting Method: Blasting method shall be in accordance with IS :6586/1972/IRS/B-1- 2001(Revised).

(iii) SPRAYING PROCEDURE:-

(a) Purity of Aluminium: The chemical composition of aluminium to be sprayed shall be 99.5% aluminium conforming to IS:2590- 1987 grade-3/IRS-B-1-2001(Revised).

(b) Spraying procedure: Procedure followed should be strictly in accordance to as specified in IS-6586-1989, following all the safety precautions. The metal spraying should be carried out without delay after the surface has been prepared by grit blasting, but in any case within such a period that the metal is sprayed on surface which is still completely clean and dry, without visible oxidation. If deterioration in the surface to be coated is observed by comparison with a freshly prepared metal surface of similar quality, which has undergone the same preparation, the preparation treatment shall be repeated on surface to be coated. The wire method shall be used for the purpose of metalizing, the diameter of the wire being 3 mm or 5 mm. Specified thickness of coating shall be applied in multiple layers and in no case less than 2 passes of the metal spraying unit shall be made over every part of the surface. At least one layer of the coating must be applied within 4 hours of blasting and the surface must be completely coating to be specified thickness within 8 hours of blasting.

(c) Appearance: The surface of the sprayed coating should be of uniform texture and free from lumps, coarse areas and loosely adhered particle.

(d) Thickness of coating:- The nominal thickness of the coating shall be 150 microns(0.006inch) the minimum local thickness shall not be less than 110 microns.

- (e) **Adhesion:** The sprayed metal coating shall be subjected to an adhesion test given in clause(iv)(b) below.
- (iv) **INSPECTION:-**
- (a) **Determination of thickness of Coating:** Thickness shall be measured by commercially available Elcometer. Method adopted shall be in accordance to IS:3203-1982/IRS Specification B1-2001. Equipment/ Elcometer which is to be used should be “any magnetic or electro-magnetic thickness meter that will measure local thickness of known standard with an accuracy of ± 10 percent.
- (b) **Calibration of Instrument: Calibration and checked the meter on one of the following standard (As appropriate).**
- I. (Applicable to magnetic and electro-magnetic meters other than the pull-off type). A soft brass shim, free from burrs in contact with the grit blasted surface of the base metal prior to its being sprayed. The thickness of the shim shall be measured by micrometer and shall be approximately the same as the thickness of coating.
- II. A sprayed metal coating of uniform known thickness approximately the same as the thickness of the sprayed coating to be tested, applied to a base of similar composition and thickness to the article being sprayed, grit blasting in accordance with clause (ii)(b).

Procedure of Testing:- For each measurement of local thickness, make an appropriate number of determinations, according to the type of instrument used.

- With instrument measuring the above thickness over an area of not less than 0.645 cm². The local thickness shall be the result of the one reading.
- With instrument having one or more pointed or rounded probes, the local thickness shall be the mean of 3 readings within a circle of 0.645 cm² area.
- With meters having two such probes, each reading shall be the average of two determinations with the probes reversed position.

The above mentioned method/procedure of testing and taking measurement of thickness and frequency depending in area i.e. 0.645 sqcm. Is to be included in a separate register and accordingly measurement reading readings are to be entered in it.

NOTE:For each measurement of local thickness, total 10nos. of determinations are to be made in 1.00sqm.area and it will be initially recorded in a separate register by the Engineer-in-charge and contractor duly signed.

- (c) **Method for adhesion test:** Using a straight edge and as hardened steel scribe which has been ground to a sharp 30 degree point. Scribed to parallel lines at a distance apart equal to approximately 10 times the average coating thickness. In scribbling the two lines, applying enough pressure on each occasion to cut through the coating to the base metal, in a single stroke.

The sprayed metal coating subjected to an adhesion test using the method of described above. If any part of the coating between the line breaks away from the base metal, it shall be deemed to have failed the test.

Articles, which have been rejected shall have the defective sections blasted clean of all sprayed metal prior to re-spraying. Where the rejection has been solely due to tooth in a coating sprayed metal of the same quality may be added that the surface has been kept dry and is free from visible contamination.

- (d) **Stage Inspection:**All components/fabricated girder undergoing surface preparation and metalizing shall be checked in the following stages and joint record will be maintained for every item, signed by Engineer's representatives and contractor or their authorized representatives.

I Stage-After grit blasting for ensuring surface finished to Sa2½ (Sa two and half) to IS:9954-1981 i.e. near white metallic surface & ensure proper removed of oil and grease.

II Stage-After metalizing—nominal thickness of the coating shall be 150 microns and local thickness shall be not less than 110 microns as per IRS-B-1-2001.

III Stage- Applied etch primer application IS-5666.

IV Stage- After etch primer applied Zinc chromate IS 104

V Stage-After application of aluminum paint to IS: 2339—Total thickness of coating including metalizing should not be less than 175 microns.

V. Re-treatment of Defective Areas:

Any defective area shall be cleaned of all sprayed metal by blasting and re-prepared to confirm the requirement of clause 1 prior to re-spraying. Where the defect has been solely due to, tooth in a coating, sprayed metal of same quality may be added, provided that the surface has been kept dry and is free visible contamination.

VI. Additional protective Coating of Paints:

After Metallizing, the components are to be painted, as described below:-

- (a) **First Coat:-**One coat of etch/wash primer conforming to IS:5666 of 1970 (or Latest).

Etch primer should be applied immediately after metal spraying to minimize the chances of contamination of the sprayed metal by moisture or pollutant.

- (b) One coat of Zinc Chromate primer to IS:104-1979 with additional provision that Zinc Chromate to be used in manufacturing of primer shall conform to type 2 of IS:51.
- (c) Two coats of aluminium paint to IS:2339-1963.
- (d) 2nd, 3rd and 4th coating shall be applied either by brushing or spraying (as required) after the hard drying of first, second and third coat respectively.
- (e) Total thickness of coating after painting (including Metallizing) should not be less than 175 microns.
- (f) Corrosion pits and gaps between members connected together should be filled with putty conforming to IS:419-1967, before applying final coat.
- (g) Linseed oil, raw or boiled used for mixing paints shall correspond to IS:77-1976. Manufacturer's test certificates for each lot of primers/paints/purity of aluminium wire shall be submitted to the Engineer-in-charge for verification.
- (h) Testing of Aluminium wire, Etch primer, Zinc chrome primer, Aluminium paint should be done by contractor's expenses and it is a responsibility of contractor.

(VII) Other Specification. In case of any doubt regarding specification, stipulation of IRS-B-1-2001 (Latest correction) will be final and binding on the Contractor.

VIII. Safety precautions:

The normal precautions against fume and dust hazards, such as wearing of mask and proper ventilation should be observed.

- (a) Any warning printed on containers by the paint manufacturer should be strictly observed and the user should consult him in all cases of doubt regarding health and fire hazards arising from the use of product.
- (b) Grit Blasting Metallizing and paint operations should be carried out in dry weather conditions, painting should not be done during damp or rainy weather.
- (c) Painting or sprayed coating should be applied without undue delay and contamination of sprayed surface with oil, grease dirt should be removed before application of first coat of paint i.e. primer.
- (d) The painting surface shall be free from flaking, peeling, cracking and blasting or any other form of paint film failure.
- (e) Adequate precautions should be taken for operator safety particularly during grit blasting and aluminium spraying.

Note - Metallizing (Aluminum spraying), painting and their checking tests all will be covered under appendix VII (Ref. clause 39 of B1-2001 Reprinted 2008 and correction up to date).

(i) INSPECTION FOR SURFACE COATING:

Inspection after grit blasting to confirm surface finish to Sa2-1/2 of Appendix 'A' of IS:5909.

(ii) DETERMINATION OF LOCAL THICKNESS OF PAINT/Metallizing

The minimum local thickness of paint shall be determined by the following method:

The equipment used for measurement shall be any magnetic or Electro-magnetic thickness meter that will measure local thickness of a known standard with an accuracy of +/- 10 percent.

(iii) CALIBRATION OF INSTRUMENT:

- (a) Calibrate and check the elcometer on one of the following standards (as appropriate):- (Applicable to magnetic and Electro-magnetic meters other than the pull-off type). A soft brass shim, free from burrs, in contact with the grit-blasted surface of the base metal prior to its being sprayed. The thickness of the shim shall be measured by micrometer and shall be approximately the same as the thickness of the coating.
- (b) A sprayed metal coating of uniform known thickness approximately the same as the thickness of the sprayed coating to be tested, applied to a base of similar composition and thickness to the article being sprayed, grit-blasted in accordance with Clause 1.

(c) PROCEDURE:

For each measurement of local thickness, make prescribed number of determination, according to the type of instrument used to get the average value. With instrument measuring the average thickness over an area of not less than 0.645 cm², the local thickness shall be the result of the one reading. With instruments having one or more pointed or rounded probes, the local thickness shall be the mean of three readings with

in a circle of 0.645cm² area. With meters having two such probes, each reading shall be the average of two determinations with the probes reversed in position.

- (d) **ADHESION Test** :The sprayed metal coating shall be subject to an adhesion test using the following method:- “Using a straight edge and hardened steel scribe which has been ground to a sharp 30 degree point, scribe two paralleled lines at a distance apart equal to approximately 10 times the average coating thickness. In scribing the two lines, apply enough pressure on each occasion to cut through the coating to the vase metal in a single stroke.” If any part of the coating between the lines breaks away from the base metal, it shall be deemed to have failed the test. Components, which have been rejected, shall have the defective sections blasted clean of all sprayed metal prior to re-spraying sections blasted clean of all sprayed metal prior to re-spraying. Where the rejection has been solely due to thin coating, sprayed metal of the same quality may be added if the surface has been kept dry and is free from visible contamination.

Painting contact surfaces before riveting/Bolting:

- (a) All parts shall be thoroughly cleaned and dried before they are painted and when so specified all mill scale shall also be removed before painting.
- (b) Surfaces which will have permanent contact shall be removed of paints and mill scale down to bare metal, clean and dried and immediately a coating of zinc chrome red oxide priming to IS: 2074 shall be applied. Care should be taken to see that all burrs are removed and no surface defects exist before the parts are assembled.

PAINTING

PLATE/COMPOSITE GIRDER.

- (i) **SURFACE TREATMENT**
No component to be given any surface treatment without component being passed and embossed by Railway’s Authorized Inspecting Agency.
- (ii) **SURFACE TREATMENT/PREPARATION OF SURFACE FOR PAINTING:** Surface cleaning, will be done by using wire brush or shot blasting and the application of the paint can be done either manually with brushes or by mechanical means to the satisfaction of the Engineer. Painting work will be permitted only with controlled condition similar to dry weather to the satisfaction of Engineer in charge .
- (iii) **PROTECTIVE PAINTING:** Protective coating by painting as per following painting schedule shall be applied with the approval of the Engineer- In-charge.
- (a) **PRIMER COAT:** One primer coat of ready mixed paint zinc chromate priming to IS:104, followed by one coat of ready mixed paint red oxide zinc chrome priming paint to IS:2074 over the structural member.

OR

Two coat of Zinc chromate red oxide primer to IRS:P-31.

Finishing coat Two Finishing coats of Aluminium paint to IS: 2339 shall be applied over the primer coats. One coat shall be applied before the fabricated steel work leaves the shop. After the steel work is erected at site, the second coat shall be applied after touching up the primer and the finishing coat if damaged in transit.

PAINTING OF OWG (Through Girder):

- (i) **SURFACE TREATMENT GENERAL:** No component to be given any surface treatment without component being passed and embossed by Railway’s Authorized Inspecting Agency.
- (ii) **SURFACE TREATMENT/PREPARATION OF SURFACE FOR PAINTING:** Surface cleaning, will be done by using wire brush or shot blasting and the application of the paint can be done either manually with brushes or by mechanical means to the satisfaction of the Engineer. Painting work will be permitted only with controlled condition similar to dry weather to the satisfaction of Engineer in charge .
- (iii) **PROTECTIVE PAINTING:** Protective coating by painting as per following painting schedule shall be applied with the approval of the Engineer- In-charge.
- (a) **PRIMER COAT:** One primer coat of ready mixed paint zinc chromate priming to IS:104, followed by one coat of ready mixed paint red oxide zinc chrome priming paint to IS:2074 over the structural member.
- (b) Finishing coat Two coats of aluminum paint to IS:2339 shall be applied over the primer coats. One coat shall be applied before the fabricated steel work leaves the workshop. After the steel work is erected at site, the second coat shall be applied after touching up the primer and the finishing coat if damaged in transit.
- (iv) Surface which are inaccessible after riveting/welding shall be applied thick coat of ready mixed paint red oxide zinc chrome priming paint to IS:2074. The work shall be kept tightly bolted together while it is being riveted/ welded. All rivets, bolts, nuts, washers etc. are to be thoroughly cleaned and dipped into boiled

linseed oil to IS:77. All machined surface are to be well coated with a mixture of white lead to IS:34 and Mutton tallow to IS:887.

Painting contact surfaces before riveting:

- (a) All parts shall be thoroughly cleaned and dried before they are painted and when so specified all mill scale shall also be removed before painting.
- (b) Surfaces which will have permanent contact shall be removed of paints and mill scale down to bare metal, clean and dried and immediately a coating of zinc chrome red oxide priming to IS:2074 shall be applied. Care should be taken to see that all burrs are removed and no surface defects exist before the parts are assembled.

TEMPLATES: The contractor shall make his own arrangement at his cost for the templates. The Railway will supply no steel in this connection. The templates used throughout the work shall be of steel of similar category as for the member and have tested quality.

PARTS IN CONTACT: All steel elements intended to be riveted on bolted together shall be in contact over the whole surface.

PAINTING RIVETS BOLTS ETC: All rivets, bolts, nuts washers will have to be thoroughly cleaned and dipped in boiled linseed oil to be arranged by the contractor at his own costs before dispatch. No extra payment will be made on there account.

DEFECTIVE RIVETS/BOLTS: All loose and burnt rivets and rivets with cracked badly formed eccentric or deficient heads shall be cut out and rivets shall also be cut out when required for the examination of the work. The actual method of cutting outs shall be approved by the Engineer or the inspecting agency. Recouping & caulking shall in no circumstances be resorted to. All defective BOLTS are to be removed at the cost of the Contractor.

RIVETS AND RIVETING: The dimensions on the drawings refer to the diameter of the rivets holes and their finished rivets. Rivets shall completely fill the holes and shall be machine driven wherever, possible by means of pressure or percussion riveters of approved design. The rivets shall be made to relevant IS: specification. The rivet holes shall be 1.5mm (1/16 inch) greater than the diameter of the rivet bars used. The clearance i.e. the difference in diameter between the rivet measured under head before being heated and rivet holes shall not be less than 0.7 mm (1/32 inch). The shanks shall be made of a length sufficient to fill the holes thoroughly and to form the head.

The rivets shall be at the proper heat and in no case shall the tip be hotter than the head. Rivets less than 10 mm (3/8 inch) diameter may be driven cold. Flattened rivet heads may be used in certain places where clearance requires them. Gauges for rivet dimensions and contours shall be provided by the contractor for the use of the inspecting officer. Before riveting is commenced, on works shall be properly bolted up so that the section riveted are in close contact throughout. Driven rivets when struck sharply on the head, with 110 grams riveting test hammers shall be free from movement and vibration. Drifts may be used for drawing light members into position but their use on heavy members should be restricted to securing them in their correct position. In no case shall drifting be allowed to such an extent that holes are destroyed. Drift steel shall be in accordance with relevant IS specification.

4. TEST CERTIFICATES:

- (i) All materials for the works should pass tests or analysis prescribed by the specifications mentioned above or such other recommended specifications as the railway shall have authorized as equivalent there to or in the absence of such authorized specifications such tests and analysis as Railway shall specify.
- (ii) For raw materials like electrodes, rivets, paints etc. the contractor shall furnish copies of test certificates from the manufactures. If any testing of materials is required by the Railway in respect of any of the material, this shall be arranged by the railway and its cost shall be fully borne by the agency free of cost. Any approval given by the Railway in consequence of such tests or analysis shall in no way limit or interfere with the absolute right of the Railway to reject the whole or portion of such materials supplied. Which in the judgment of the Railway do not comply with the conditions of the contract. The decision of the Railway in this regard shall be final and conclusive for all purposes.

Signature of the Tenderer(s)

For Chief Administrative Officer/Con

5. WELDING TESTS & PROCEDURES:

Radiographic testing of welds: Radiographic or other non-destructive testing (Die penetration, Ultrasonic etc.) is to be carried out on all Main welds carrying tension. On other welds, such testing shall be carried out as per the directions of the engineer or the inspecting agency to satisfy relevant specifications.

Close Butted Joints

Where close butted joints are required they will be indicated on the drawings and the butting ends of the parts shall be machined to ensure close contact when the joint is made. Close contact shall be deemed to have been achieved when 90% of the area is in close contact and the remaining 10% has clearance not exceeding 0.2 mm.

Shearing of plates

Shearing and grinding of steel plates shall not be carried out without the permission of the Engineer/Inspecting official (IO).

Notches The roots of all notches shall be smoothly radiused.

Procedure Trials:

Where required by the Engineer / I.O. welding and flame cutting trials shall be carried out and completed before fabrication on representative samples of materials to be used in the work, as follows:

- (a) The samples of materials shall be selected and marked by the Engineer when the materials for the work are inspected at the mills.
- (b) Trials on material 19mm thick may be taken to include all material under 19mm thick and on material 38 mm thick to include material between 19 mm and 38 mm thick. Over 38 mm thickness materials shall be tested for every thickness increment of 6mm. The trials of flame cutting shall be carried out in material representative of all thicknesses to be used in the work.
- (c) The welding and flame cutting trials shall commensurate to the satisfaction of the Engineer / I.O. The procedures to be adopted in the fabrication of the shall include:
 - I) Welding procedure in accordance with relevant specification.
 - II) The heat control technique required ensuring that the flame cut surfaces of steel to IS specification is suitable for inclusion in welds.
- (d) The trials shall include specimen weld details from the actual construction, which shall be welded in a manner simulating to the most unfavourable instances of fit-up and preparation which it is expected will occur in the particular fabrication. After welding the specimens shall be held as long as possible at room temperature but in any case not less than 72 hours and shall then be sectioned and examined for cracking.
- (e) Procedure trials & testing to relevant specification.

Qualification and testing of welders:

No welding operator shall be employed on the work until he has in the presence of the Engineer/I.O. passed the appropriate tests laid down in relevant specification.

Where plates of 12mm thick and over are to be but welded the tests set-out in relevant specification is to be followed.

Routine re-testing of welding operators may be required every six months if deemed necessary by the Engineer/I.O. The Engineer/I.O. reserve the right to require any welding operator to be retested at any time during the contract.

Supervision of Welding:

The contractor shall appoint welding supervisors whose competence and qualifications shall be subject to approval of the Engineer/I.O. All welds shall be carried out under their direction.

Except where agreed by the Engineer/I.O. a record shall be kept to enable butt welds to be identified with the welders responsible for the work but material shall not be marked by hard stamping for this purpose.

Welding Plant: The welding plant shall be capable of maintaining at the weld the voltage and current specified by the manufacturer of the electrodes used. The contractor shall supply instruments for verifying voltage and current as and when required by the Engineer/I.O.

Signature of the Tenderer(s)

For Chief Administrative Officer/Con

Welding:

Welding shall be carried out in accordance with relevant approved specification (WPSS) with the following additional requirements.

- (a) The welding procedure specification sheet (WPSS) and welding procedure quality record (WPQR) shall be submitted in writing to Engineer/ I.O. for approval before the work is put in hand.

No departure from the welding program or from the details shown on the drawings shall be made without the prior approval of the Engineer/I.O.

- (b) Approval of the welding procedure shall not relieve the contractor of his responsibility for correct Welding and for the minimizing of distortion in the finished structure.

- (c) The procedure for welding and flame-cutting established by the procedure trials under clause 27.5 shall be strictly followed.

- (d) All main butt welds shall have complete penetration and shall comply with the requirements of relevant specification. They shall be made between prepared fusion faces. Where possible they shall be welded from both sides. The ends of the welds shall have full throat thickness. This shall be obtained in all main welds by the use of extension pieces adequately secured on either side of the main plates. Additional metal remaining after the removal of the extension pieces shall be removed by machining or by other approved means, and the ends and surfaces of the welds shall be smoothly finished.

- (e) In the fabrication of built-up assemblies all butt welds in each component part shall be completed before the final assembly.

- (f) Preheating and temperature conditions, electrodes and size of single runs shall follow conforming to relevant approved specification.

- (g) Controlled hydrogen electrodes shall be dried out and used in strict accordance with the manufacturer's instructions.

- (h) Loose flux used for automatic and semi-automatic welding shall be kept free from contamination and used in accordance with the manufacturer's instruction.

- (i) All tack welds shall be of the same quality and size as the first run of the main weld. The main weld shall fuse completely with the ends of tack welds to form a regular profile. Where pre-heat is required for the main welds the tack welds shall be made under the same heat conditions. The length of the tack welds shall not be less than four times the thickness of the thicker part of 50mm, wherever is the smaller.

- (j) The position of welds required for temporary attachments shall be approved by the Engineer/ I.O. before the work starts.

- (k) Temporary attachments shall be removed without damage to the parent metal, which shall be finished smooth by grinding in the direction of the applied stress in the finished structure.

All cracked welds shall be cut out to the satisfaction of the Engineer/I.O. for re-welding.

- (l) Where automatic or semi-automatic welding processes are used, backgouging will not be required When it is demonstrated to the Engineer/I.O. that satisfactory welds are produced.

- (m) Where butt welds is to be ground flush there shall be no loss of parent metal. The final grinding shall be in the direction of the applied stress.

(n) Run-off plates and run-on plates:-

- (i) One pair of "run-on" plates and one pair of "run-off" plates all prepared to the same thickness and profile as the parent metal shall be attached by clamps to the start and finish respectively of all butt welds so that the direction of rolling of the added plates is parallel to that of the parent metal.

- (ii) Except as directed by the Engineer/I.O. the plates in approximately 1 in 5 pairs of run-off plates shall each be 150mm wide by 200mm long and the length being measured in the rolling direction of the metal and at right angles to the weld.

- (iii) The welds shall run the full length of the joint and extend at full section for a minimum distance of 25 mm into the run-off plates.

- (iv) On completion of the welds the 150x200 mm run-off plates shall not be removed until they have been marked by the Engineer/ I.O. to identify them with the joints to which they are attached.

- (v) When there moving the run-off and run-on plates by flame cutting the cuts shall not be nearer than 6 mm to the sides to the parent metal and remaining metal shall be removed by grinding in the direction of the applied stress or by other method approved by the Engineer/I.O. specimens for test shall be selected from the run-off plates as required by the Engineer/I.O.

Welding Inspection:

Signature of the Tenderer(s)

For Chief Administrative Officer/Con

The Engineer/I.O. will require radiographic or other non-destructive examinations to be carried out on all main welds carrying tension and on other welds to his discretion. If required, samples of the welds in permanent or temporary works shall be cut out for examination by the Engineer/I.O.

Stress Relieving:-If required by the Engineer/ I.O. elsewhere herein or on the drawings, welds shall be stress relieved and special units may require to be normalized.

Flame cutting:-Where the flame cut surface is not subsequently incorporated in a weld machine flame cutting may be used subject to the requirements of removing all irregularities.

6. INSPECTION AND PROGRESS REPORTS:

Railways authorized inspecting agency in this case. However the inspection charges of RDSO will be paid by Railway. All raw materials should be got certified by Railways. The work of fabrication in contractor's fabrication shop will at all times be opened for inspection by the Railway or their authorized inspecting agency. Before dispatch of fabricated steel work from the shop, they will be inspected in the contractor's workshop by the Railway or their authorized inspecting agency who will thereafter issue inspection certificates. The tests will be carried out at contractor's cost. All facilities as required for carrying out the inspection will be provided free of cost by the contractor including those requiring the services of outside agencies.

Any defects noticed during inspection in the execution of the work shall be rectified or replaced by the contractor at his own cost. The decision of the railways or its inspecting agency as to the existence of defect, the manner in which the defective work to be rectified or replaced shall be final, exclusive and binding on the contractor. No extra claim whatsoever shall be entertained for the cost of such rectification or replacement.

The progress of fabrication of steel work as well as execution of all works shall be subject to periodic review by the Railway Administration. The contractor shall provide all facilities to then Railway's representative to make periodical detailed assessment of the progress of the works. Such information and progress reports as may be called for by the Railway and at such intervals as specified shall also be made available.

The tenderer should provide suitable accommodation for the Inspecting official and a conveyance for going to the workshop for inspection and returning back to the place of accommodation. No extra payment shall be made for such arrangement.