GOVERNMENT OF INDIA

MINISTRY OF RAILWAYS

GUIDELINES FOR FABRICATION INSPECTION OF RDSO STANDARD SPANS- COMPOSITE I-SECTION STEEL GIRDERS FOR ROAD OVER BRIDGES (ROBs)

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ISSUED BY

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Guidelines for Fabrication Inspection of RDSO Standard spans- Composite I-Section Steel Girders for Road Over Bridges (ROBs)

1.0 Introduction:

1.1 The fabrication of composite I-section steel girder of RDSO standard spans for Road Over Bridges (ROBs) is being done by various Railway Workshops as well as through trade. The fabrication is governed by the provisions of:

(1) Indian Railway Standard specification for Fabrication and Erection of Steel Girder Bridges and Locomotive Turn-tables. (B1-2001) as corrected from time to time.

(2) Indian Railway Standard Code of Practices for Metal Arc Welding for Structural Steel Bridges carrying rail, rail cum road or pedestrian traffic i.e. Welded Bridge Code (Adopted 1972 Revised 2001) as corrected from time to time.

1.2 The officials associated with fabrication work should have thorough understanding of the codes (1) & (2). However, these guidelines have been mainly prepared for helping the field engineers associated with execution of the fabrication work of composite I-section steel girder of RDSO standard spans for Road Over Bridges (ROBs). It has been tried to cover various aspects which require close attention of the field engineers for ensuring quality of the fabrication work. These guidelines are just to facilitate and not to supersede the two codes or any other specification referred therein. All engineers associated with fabrication are advised to understand the provisions of IRS B1 and Welded Bridge Code and take help from these guidelines. Book published by RETS IRICEN “Steel Structure Fabrication for Railways” is also a very good guide for the Engineer in-charge of fabrication. The workshop engineer or contractors should also have good understanding of various provisions of above Railway codes and other related codes.

2.0 Scope:

2.1 These guidelines are for fabrication inspection of composite I-section steel Road Over Bridge (ROB) girders of RDSO standard spans only. For non-standard spans it is not applicable and inspection of non-standard composite I-section steel bridge girders will be dealt as per extant instructions prevailing.

3.0. Approved Drawing to be used for fabrication:

Field/Workshop Engineer associated with fabrication should have all the relevant drawings, Codes & Specifications with latest Correction Slips prior to the start of work. On the basis of RDSO standard structural drawings of Road Over Bridge (ROB), fabrication drawings should be prepared by fabricator and approved by the Engineer-in-charge of project executing organization before starting fabrication work.

4.0 Selection of Fabrication Inspection Agency

Under present Railway Board's directives (RB letter no. 2016/54/CE-III/BR/RDSO Misc. dated 15.07.2019) inspection of RDSO standard span composite I-section steel ROB girders can either be done by fabrication inspection unit (FIU) headed by minimum JAG rank officer working under CBE of Zonal Railway or by a specialized third party (RITES, WRI or any other expert public sector undertaking e.g. CEIL etc.).

5.0. Quality Assurance Program (QAP)

5.1 To ensure the proper quality of fabrication, standard Quality Assurance Plan (QAP) has been prepared by RDSO and is annexed as Annexure-1. This standard QAP covers stage-wise fabrication process covering various steps, tests, checks & their frequency, sampling plan, authority for grant of clearance etc. for all activities involved in girder fabrication process. The QAP must cover following aspects-

a. Brief Details of project

b. Contract Agreement No.

c. Loading Standard

d. Governing Specifications

e. Drawing references

f. Roles and responsibilities of various agencies involved in fabrication, erection & inspection.

5.2 A standard QAP for composite I-section ROB girders is given as Annexure-1. This standard QAP is being provided for standardizing the repetitive work of developing QAP afresh in each new case of composite I-section ROB girder. This standard QAP can be used as it is, thus only changing the particulars related to each project. Each page of QAP shall be signed by fabricator, contractor, an officer of project executing organization being minimum Railway JAG or equivalent rank.

5.3 QAP preparation shall be done according to item no. 1 & 2 of the Annexure -2 based upon the applicable use case. However, QAP approval shall be done invariably by minimum JAG officer working under CBE who is heading Fabrication Inspection Unit (FIU). These instructions should be read along with Note no. 4 of Annexure – 2.

5.4 Field Engineers of executing agency should ensure that work is carried out strictly as per the approved QAP and no deviation takes place from QAP. All the stages should be studied in detail, prior to start of work.

5.5 Any change in model QAP attached as Annexure-1, if unavoidable can be done on case to case basis only and with the approval of Chief Bridge Engineer only.

6.0 Preparation & Approval of Welding Procedure Specifications Sheet (WPSS):

6.1 WPSS is a process sheet indicating plate/section used, welding process, type of joint, welding consumables, quality, welding parameters, acceptance standard, tests applicable etc. Field Engineers of executing agency should ensure that welding is carried out as per approved WPSS.

6.2 Performa for WPSS is given in Appendix-V of IRS B1-2001. The same has been reproduced as Annexure- 3.

6.3 WPSS preparation and approval shall be done according to item no. 3 & 4 of the Annexure -2 based upon the applicable use case. These instructions should be read along with Note no. 4 of Annexure – 2.

6.4 A separate record shall be maintained for consumables. A sample Performa for record keeping of consumables is enclosed as Annexure–5.

7.0 Welding Procedure Qualification Records (WPQR):

7.1 WPQR is the document indicating approval of various welders who are to be deployed for carrying out welding work for fabrication. It contains Name of the welder with photograph, qualification, experience, qualification tests and records for each welding process and joint, welding parameter etc. Tests are to be conducted by the inspecting agency before qualifying the welders and then approval is granted through WPQR by the inspecting agency.

7.2 For Welder Qualification Test procedure and its validity etc., IS: 7310 Part 1 and instructions issued from Railway Board are to be followed.

7.3 WPQR sheets should be signed by fabricator and concerned officials (not below JA grade) of executing agency e. g. concerned Railway officials (open line/ construction), and equivalent in case of PSU.

7.4 WPQR preparation and approval shall be done according to the Annexure -2 based upon the applicable use case. Item no. 6 and 7 cover such fabrication cases where girder is being fabricated for the first time by a fabricator. Item no. 8 and 9 cover the fabrication cases where the welder was at least once approved by the same fabricator for the fabrication of same RDSO standard span. These instructions should be read along with Note no. 4 of Annexure – 2.

7.5 Performa for WPQR is given in Appendix-V of IRS B1-2001. The same has been reproduced as Annexure 4. Field engineer of executing agency should ensure that welding is done only by approved welders and no deviation takes place.

8.0 Inspection of Raw Materials

8.1 Passing of raw material is done on the basis of visual inspection and lab test reports for mechanical properties, chemical composition, ultrasonic examination, Charpy Impact Test etc. Studs, HSFG bolt assemblies and other consumables like paint etc. should also be got tested from NABL/NABCB accredited Lab as mentioned in standard QAP attached (Ref: ED/B&S/RDSO letter no. CBS/PBEJ/Reg dated 10.07.2017, ACS no.1 of BS 110(R)).

8.2 All the required test should be got done through independent NABL approved Labs and compared with the mill test certificate results given by the supplier before passing the material for use.

8.3 Material test certificate register must be maintained by fabricator as per Annexure available in IRS: B1-2001(Appendix-I, Performa-7) and signed by the representative of project executing agency as well as fabricator.

8.4 All angle/channel rolled section to be used for fabrication shall be checked for rolling tolerance as stipulated in IS:1852.

8.5 In addition to above, visual inspection shall be done to ensure that steel is free from surface defects like pitting, laminations, imperfect edges, twist, other harmful defects etc. and recorded in the register.

8.6 Final approval of raw materials shall be done by Junior scale/Senior scale officer or an officer of equivalent rank or above of executing agency involved in direct execution of that project.

9.0 Trial Assembly of ROB Steel Girder (I-section):

9.1 For a particular fabrication workshop, the very first span (including all leaves in assembled position) of certain RDSO standard span being fabricated for the first time by this fabricator, will be invariably be trial assembled in the premises of RDSO approved fabrication workshop. First span (including all leaves in assembled position) is always trial assembled to check whether fabrication process is proper or require any correction in workmanship or procedures to ensure regular quality output.

9.2 All the leaves of first span shall be checked in assembled position for following parameters:

a) Overall length
b) Bearing centers
c) Height
d) Girder center
e) Squareness
f) Fairing of holes
g) Verticality
h) Infringement, if any
i) Butting of compression flange.
j) Camber provided if any.

9.3 Trial Assembly of the girder (when it is being done by a fabricator for the first time for a particular RDSO standard span) shall be inspected by zonal Fabrication Inspection Unit (FIU) and approval of successful trial assembly shall be given by minimum JAG level officer working under CBE heading FIU as per item no. 10 of Annexure – 2.

9.4 Trial Assembly can be exempted for subsequent girders according to Note no. 3 of Annexure-2 – “If agency has fabricated same span which has been commissioned within previous 2 years, then exemption from trial assembly can be granted.”

9.5 Exemption from trial assembly for subsequent girders of a particular span shall be dealt as per item no. 11 of Annexure – 2.

10.0 Certificates to be furnished by Railway/ PSUs for inspection calls: -

10.1 During fabrication, internal inspection to be done by Railways/PSU to ensure that only approved welders carry out welding as per approved WPSS, work is as per dimensional tolerances and other quality aspects and should satisfy itself before sending inspection call to inspecting agency for Trial Assembly or Component Inspection. Railway/PSU has to give following four-point certificate at the time of sending Inspection Call-

(i) *Steel used for welded Bridge Girders components is of weldable quality is IS: 2062 Gr. B0 fully killed and fully normalized, which has been inspected & approved by the Railways.*

(ii) *Fabrication has been done with the help of approved Jigs (applicable to Railway workshops only) / CNC machines.*

(iii) *Entire welding was done by approved welders using approved welding procedures (WPSS) and welding consumables.*

(iv) *Fabrication work has been inspected by our internal quality control/ inspection organization including the welding. All significant defects have been rectified and final dimensions are within tolerances.*

10.2 Above inspection call containing the four points can only be placed by an officer as defined under item no. 9 of Annexure-2.

11.0 Inspection of Components and its approval

11.1 Inspection of girder components and report preparation shall be dealt according to item no. 12 of the Annexure -2 based upon the applicable use case. Approval shall be done as per item no. 13 of Annexure- 2.

12.0 Test check of assembly/ camber at site before and after launching

12.1 The test checking of trial assembly / camber at site before and after launching is mandatory in each case. This check will be performed by Fabrication Inspection Unit (FIU) working under CBE.

13.0. Some important DOs & DON'Ts for guidance: -

13.1 DOs-

a) Use proper fixtures and clamps to hold the members firmly at desired location while welding. The clamps and fixtures must be strong enough to prevent any distortion of the member while cooling of the welding joint. The clamps and fixtures are only to be removed when the joint is cooled to ambient temperature.

b) Do the welding work in a warm, dry and covered place so that rain water or other atmospheric elements may not come in contact while welding is in progress.

c) While welding in very cold weather pre-heat the material before welding and apply post heating to prevent the weld joint from rapid cooling and develop stress raiser due to sudden contraction.

d) Cross level of bearing plates in the welded plate girders should be checked properly for proper sitting over bed plate.

e) To co-relate use of steel and welders in different members proper records should be maintained.

f) Drilling of holes through CNC machines should be ensured. No fabrication should be done without CNC.

g) Fairing of holes and removal of drill burrs should be ensured.

h) Proper edge finishing with grinding/ special attention in top chord compression members butting by end milling should be carried out

i) Application of paint on permanent contact surface should be ensured after proper surface preparation.

j) The plates should be perfectly horizontal while drilling the holes to ensure horizontal verticality of holes.

k) Steel with proper test certificate/ reports should be used.

l) Steel received from the rolling mills has generally punch heat mark numbers. These numbers should be legibly marked again with paint for easy identification. Heat mark numbers should be transferred to cut members with paints.

m) Consistency of weld quality is higher in Submerged Arc Welding Process and chances of human errors are also eliminated. Therefore, welding of the ROB steel girders should be done by SAW process. Wherever not possible then GMAW welding can be done in such places if provided in approved WPSS.

~~n)~~ Skilled and qualified welders, drillers, fitter should be deployed for welding, drilling and marking works. The welder should be individually approved by authorized agency as mentioned in QAP/WPSS.

o) For tack welding GMAW/MMAW welding to be used.

13.2 DON'T's-

a) Use of pitted/ corroded material should not be done because it gives rise to concentration of stresses and results in poor fatigue strength.
b) Do not hammer the distorted joints for rectification. It may lead to the development of cracks and failure of the joints.
c) Do not do the welding in chilled weather, as due to sudden cooling of welded joints they are liable to be brittle and develop cracks. The joints may also suddenly fail under dynamic loading without any prior warning.
d) Do not weld with un-controlled welding parameters, this will affect the quality of welding and make the joints weak and may yield in dynamic loading on the structure.
e) Do not weld the joint haphazardly without following the proper welding sequence. This will lead to uncontrolled and irreparable distortion of the proper geometry of the joint.
f) Sharp notches in the member should be avoided.

14.0 Items requiring attention during & after fabrication

14.1 Items requiring attention during fabrication

a) Ensuring Use of Approved Raw Material –Only raw material cleared originally to be used during fabrication. Proper record for the same to be maintained.

b) Ensuring use of RDSO Approved Welding Consumables-Type of consumables, source, quality, approval status, grade, suitability for fabrication as per WPSS etc. to be frequently checked and recorded.

c) Ensuring use of Approved Welders-Checking of welder's certificate, records, skill and procedure adopted for welding as per WPSS etc.

d) Ensuring use of Approved WPSS & Welding Parameters-Checking welding parameters and equipment used for correctness of joint preparation etc.

e) Good Working practice for prevention of distortion in welded ROB girders are to be followed by pre-bending of flange plate of welded ROB girder using appropriate fixture and by clamping the flange plate to fixture.

f) Important Checks for Tack Welding:

   (i) Ensure that top & bottom flange plate are perfectly perpendicular with reference to web throughout the length of I-Section.

   (ii) Ensure the squareness i.e. 90^0 angle between flange & web of top and bottom flange plate to avoid out of squares flanges.

   (iii) Checking with filler gauge throughout the length of top & bottom flange connection for uniform contact throughout the web plate.

   (iv) Outside to outside distance of top flange and bottom flange at regular interval to be checked to ensure that depth of ROB steel girder at ends and at center is same.

g) Points requiring attention during full SAW welding:

   (i) Thorough cleaning of tack welded member should be done with appropriate tool like wire brush, before shifting for full welding. Minimum width of 75mm throughout the length shall be cleaned to ensure that the surface is free from dust, mill scale, grease, oil and paint to ensure sound quality of weld.

   (ii) Full welding shall be carried out in appropriate position with SAW process as per sequence mentioned in WPSS/WPQR using manipulator/special welding fixture.

   (iii) The sequence of welding shall be shown in WPSS/WPQR marked as 1, 2, 3 & 4 in the order of welding.

   (iv) The welding should be done in proper sequence.

   (v) Minor welds/ Inaccessible location welds shall be made by CO_2 welding or other type of welding as per approved WPSS.

14.2 Items requiring attention after fabrication

a) Stacking of component should be proper and shipping mark should be properly stenciled on component for identification.
b) Quality of weld, uniformity of weld bead, size of the weld, weld defects e.g. under cut, blow hole, porosity, spatter, crack etc. should satisfy para 31 and Appendix C of Welded Bridge Code.
c) Macro etching on ROB steel girder, run-on, run-off tabs for ensuring proper weld quality, Dye penetrant examination etc. should be arranged by fabricator, for independent inspection.
d) Surface preparation, metalizing and or painting as per applicable painting schedule should be done as mentioned in relevant RDSO drawing and standard QAP.

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Standard QAP

MODEL QUALITY ASSURANCE PLAN (QAP) FOR FABRICATION OF COMPOSITE I-GIRDER TYPE ROB OF RDSO STANDARD DRAWINGS

PART-A (DETAILS OF WORK)

S.No.	Item	Details
1	Name of Project	
2	Project falls into Zonal Railway jurisdiction of	
3	Executing organization of the agreement (i.e. Zonal Railway/ Railway PSU/NHAI or any other government agency)	
4	Contractor Agency (Name and address)	
5	Fabricating Agency (Name and address)	
6	Inspecting Agency	
7	QAP No.	
8	Agreement No./LOA No.	
9	Date of Agreement/LOA	
10	Completion date as per Agreement/LOA	
11	Scope of fabrication (in no. of spans and tonnage)	
12	Applicable RDSO Drawing No.	
13	Any other relevant detail	

PART B - MODEL QAP

Sl. No.	Component / Operations	Characteristic to be checked	Frequency & type of check	Reference Document	Fabricators Quality Control	Inspection Details		Type of record	Acceptance Criteria	Remarks
						Inspecting agency	Extent of Inspec-tion			
1	2	3	4	5	6	7	8	9	10	11
1.0	RAW MATERIAL									
1.1	Steel Plates and other Structural Steel Section	Identification and Co- relation with Mill Test Certificate from Supplier. Source / Brand of steel to be decided as per prevailing instructions issued from Railway Board.	As per Mill Test Certificate & test required by Inspection Agency from approved Laboratory**.	Challan, Mill T.C.	Verification of reference documents	As per clause 8.6 of guidelines	100%	Fabricator's Record	1) Steel Plates: IS 2062:2011 Grade E250 or E350, Quality B0 as mentioned in the respective approved drawing. 2) Plates 12mm and above thick, Plates are fully killed/normalized or control cooled. 3) Rolled Sections or any other structural steel member: IS 2062:2011 Grade E250 or E350, Quality B0 as mentioned in the respective approved drawing.	1. Grade and Quality of Steel Plates, structural section to be same as mentioned in the respective approved drawings 2. For other details of structural steel plates and structural section A&C no. 5 of IRS-B1: 2001, IS 2062-2011 and codes referred in these shall be complied as applicable. 3. Raw Matererial clearance shall be done by an authority as mentioned under clause 8.6 of these guidelines. 4. Material

										produced by re-rolling finished products (virgin or used or scrap), or by rolling material for which the metallurgical history is not fully documented or not known, are not acceptable. Since the starting material for re-rollers is mostly billets, ingots, it has to be ISI marked as per IS 2830.
		Physical Condition i.e.- Pitting,rusting, straightness ,rolling defects etc.	Visual	--	Complete Visual inspection		100%	Fabricator's Record	A&C no. 5 of IRS-B1: 2001, IS 2062-2011 and codes referred in these shall be complied as applicable	
		Mechanical Test as per IS-2062:2011 UTS,YS,%EL,Bend Test	Lab test at approved laboratory**	-	Lab Test Report		-	-	Table 2 along with notes below and other relevant clauses of IS- 2062-2011 and codes referred in it, for quality and grade of steel as mentioned in respective drawings as applicable.	
		Charpy Test at 0 ° C for plates 12 mm thick and above	Lab test at approved laboratory**	-	Lab Test Report		Heat / Cast no section wise as per IS	-		

							2062-2011			
		Chemical Analysis as per IS 2062-2011	Lab test at approved laboratory**	-	Lab Test Report		Heat / Cast no section wise as per IS 2062-2011	-	Table 1 along with notes below and other relevant clauses of IS- 2062-2011 and codes referred in it, for quality and grade of steel as mentioned in respective drawings as applicable.	
		Ultra sonic test for 12mm and above thick plates as per IS-4225/ASTM SA-435/435M	By ASN level-II operator	-	Lab Test Report		100%	-	IS-4225 or ASTM SA-435/435M and codes referred in it as per applicability	
		Dimension	Measurement	Challan	Measurement of dimension		100%	Fabricator's Record & Inspection Agency record	IS 2062: 2011 or other relevant codes referred in it as applicable	

1.2	**HSFG Bolting Assemblies with DTI washers**	Dimensions	Visual / Measurement	Challan and Manufacturer's Test Certificate	Verification of reference Documents	As per clause 8.6 of guidelines	As per A&C no. 11 of IRS B1-2001 and relevant EN 14399 series codes referred in it	Fabricator's Record	1. HSFG bolting assemblies shall meet the criterion not only for individual components such as bolts, nut, washers and DTI washers as mentioned in relevant EN 14399 codes but also meet the criterion for full HSFG bolting assembly along with DTI washers so that designed preload is achieved in HSFG bolting assembly when tightened properly.	1. Only HSFG Bolting assemblies with DTI washers as per the A&C no. 11 of IRS B1-2001 and BS Report no. 111 (Rev. 6) and relevant EN 14399 series codes reffered in these are to be used. 2.HSFG Bolting assemblies is to be procured from RDSO approved vendors only 3. Test at the approved laboratory suitable for the purpose shall be done as per the instruction of the inspecting agency which is responsible for passing of the material
		Mechanical & Chemical properties	Lab Test at approved laboratory**.	Manufacturer Test Certificate	Verification of reference Documents					
1.3	**Paints and Primers**	Verification of Manufacturer's Test Certificate, Inspection Certificate, Challan	Visual	Challan , Manufacture's Test Certificate	Verification of Reference Documents	As per clause 8.6 of guidelines	Each Batch	Manufacture's Test Certificate	IRS B1-2001, IS:51, IS:104, IS:2339, IS:5666 and applicable codes referred in these codes	1. Paints to be procured from venors approved by RDSO. 2.Test at the approved

		Tests as per specification	Lab Test at approved laboratory**.	Challan , Manufacture's Test Certificate	Verification of Reference Documents		Rando m	Lab Test Report		laboratory suitable for the purpose shall be done as per the instruction of the inspecting agency which is responsible for passing of the material
1.4	**Aluminium wire**	Properties of Aluminium wire such as Dia, class and purity as mentioned in appendix-VII of IRS B1-2001	Review of reference documents with material	Challan , Manufacture's Test Certificate	Verification of Reference Documents	As per clause 8.6 of guidelines	Each Batch	Manufacture's Test Certificate	IRS B1-2001, IS:2590 and applicable codes referred in these codes	Test at the approved laboratory suitable for the purpose shall be done as per the instruction of the inspecting agency which is responsible for passing of the material
		Tests as per specification	Lab Test at approved laboratory**.	Challan , Manufacture's Test Certificate	Verification of Reference Documents		Rando m	Lab Test Report		
1.5	**Welding Consumables**	As Per Specification and as approved by RDSO	Any Test as required	Challan & Manufacturer' s Test Certificate	Verification of reference Documents	As per clause 8.6 of guidelines	As per require ment	Fabricator's record	IRS Welded Bridge Code 2001, IRS M28, IRS M39, IRS M46 and other applicable codes referred in these codes and specifications	Consumable should be of RDSO approved Brand/Vendors

1.6	**Stud**	1. Identification and co-relation with Manufacturer's test certificate 2. Physical Condition of material- Pitting, Rusting, Straightness, dimensions or any defect and cracks 3. Dimensions of Stud	Visual and dimension verification	Challan & Manufacturer's Test Certificate	Verification of reference Documents	As per clause 8.6 of guidelines	Random	Fabricator's record	BS Report no. BS-115 (Revision 1), ISO 13918 and applicable codes referred in these codes and guidelines.	1. Material should be as per SD1 of ISO 13918 2. Manufacture's ID should be embossed in every piece 3. Test at the approved laboratory suitable for the purpose shall be done as per the instruction of the inspecting agency which is responsible for passing of the material
		Chemical and Mechanical properties	Lab Test at approved laboratory**	Challan & Manufacturer's Test Certificate	Verification of reference Documents		Random	Lab Test Report		

Sl. No.	Component / Operations	Characteristic to be checked	Frequency & type of check	Reference Document	Fabricators Quality Control	Inspection Details		Type of record	Acceptance Criteria	Remarks
						Inspecting agency	Extent of Inspection			
1	2	3	4	5	6	7	8	9	10	11
2.0	**Manufacturing Process**									
2.1	**Layout of Components, Joints, Cross frame, diaphragm and any other member as applicable**	Dimension	Measurement with calibrated steel Tape.	Approved Drawings	Measurement of dimensions	Inspecting Agency*	100%	Inspection Report of Inspection officials	Approved fabrication Drawings# and relevant IS/IRS/IRC codes.	Clearance by Inspecting agency with the help of Master Plates if required.
2.2	**Preparatory work such as Cutting, Straightening, Edge Preparation, Marking, Drilling, Fit up, Pre-assembly, End finishing**	Dimension , freedom from defects	Visual / Measurement with calibrated steel tape, gauges, templates etc.	Inspection Report of Inspection officials & fabricator's record	Visual & Measurement of dimensions	Inspecting Agency*	100%	Inspection Report of Inspection officials & fabricator's record	Approved fabrication drawings#, IRS B1-2001, IS-1852-85 and codes reffered in these codes as applicable	--

Sl. No.	Component / Operations	Characteristic checked	Frequency & type of check	Reference Document	Fabricators Quality Control	Inspection Details		Type of record	Acceptance Criteria	Remarks
						Inspecting agency	Extent of Inspection			
1	2	3	4	5	6	7	8	9	10	11
3.0	**Welding**									
3.1	**WPSS**	Review of WPSS	Verification	IS 9595-96, IRS B1-2001, IRS WBC-2001 and codes referred in these codes as applicable	Verification Reference Documents	Inspecting Agency*	100%	Fabricator's Record	Approved fabrication Drawings#, IS 9595-96, IRS B1-2001, IRS WBC-2001 and codes reffered in these codes as applicable. Instructions issued by Railway Board also to be followed.	1. Welding to be performed following the different specification and parameters mentionrd in WPSS approved by Inspecting Agency 2. For details of Stud Welding refer BS 115 (Revision 1)

3.2	**WPQR**	1. Witnessing of established WPSS. 2. Witnessing of Welder Qualification test	Visual ,DT and NDT at approved laboratory**	As per Codal Requirement	Verification of Reference Documents	Inspecting Agency*	100%	WPQR Sheet to be recorded in presence of Inspecting agency	IS 7307 (Part-1), IS 7310 (Part-1), IRS B1-2001, IRS WBC-2001 and codes reffered in these codes as applicable	1. Only Inspecting Agency certified welders to be engaged in the job 2. For Details of Stud Welding refer BS 115 (Revision 1)
3.3	**Preheating**	Measurement of Temperature	Visual with thermal Chalk or Infrared Thermometer	Approved WPSS	Verification of Reference Documents	Inspecting Agency*	Random	Inspection Report of Inspection officials & fabricator's record	IS 9595-96, IRS B1-2001, IRS WBC-2001 and codes reffered in these codes as applicable	--
3.4	**Baking of Electrode , flux**	To have moisture free electrode and flux	Visual check of Electrodes and heating	As per Manufacture's Recommendation	Verification of Reference Documents	Inspecting Agency*	100%	Inspection Report of Inspection officials & fabricator's record	IRS B1-2001	--

3.5	**Selection of Correct Electrodes & flux**	Reference to WPSS IRS class etc.	Visual	As per Approved WPSS	Verification of Reference Documents	Inspecting Agency*	100%	Inspection Report of Inspection officials & fabricator's record	IRS Welded Bridge Code 2001, IRS M28, IRS M39, IRS M46 and other applicable codes referred in these codes and specifications	Refer Para 1.5 of this QAP
3.7	**Current Condition**	Measurement of Amp./Voltage	Visual with Ammeter and Voltmeter	As per Approved WPSS	Verification of Reference Documents	Inspecting Agency*	Random	Inspection Report of Inspection officials & fabricator's record	IS 9595-96, IRS B1-2001, IRS WBC-2001 and codes reffered in these codes as applicable	--
3.8	**Sequence of Welding**	Controlling Distortion	Visual	As per Approved WPSS	Verification Reference Documents	Inspecting Agency*	Random	Inspection Report of Inspection officials & fabricator's record	IS 9595-96, IRS B1-2001, IRS WBC-2001 and codes reffered in these codes as applicable	--
3.9	**Provision of Run-on and Run-off Plates**	To avoid crater defects	Visual	As per Approved WPSS	Verification Reference Documents	Inspecting Agency*	100%	Inspection Report of Inspection officials & fabricator's record	IS 9595-96, IRS B1-2001, IRS WBC-2001 and codes reffered in these codes as applicable	--

Sl. No.	Component / Operations	Characteristic to be checked	Frequency & type of check	Reference Document	Fabricators Quality Control	Inspection Details		Type of record	Acceptance Criteria	Remarks
						Inspecting agency	Extent of Inspection			
1	2	3	4	5	6	7	8	9	10	11
4.0	**Inspection of Welding**	**For Fillet Welds-** Visual, D.P. Test,Fillet Size, Penetration, Leg length, Throat thickness etc.	Visual, Gauge and Macro etching	Approved fabrication Drawings# & WPSS	Visual Inspection & Verification of Dimension by Gauge	Inspecting Agency*	100%	Fabricator's Record	Approved fabrication Drawings#, IRS B1-2001, IRS WBC-2001 and codes reffered in these codes as applicable	1. Clerance by Inspecting agency 2. It is to be ensured during fabrication process that fabrication has been done as per the WPSS approved by Inspecting agency and Welders approved by inspecting agency.
5.0	**Stud welding**	Visual Inspection, Dimension Inspection, Ring Test and Bend Test etc. as applicable, for good penetration & crack free weld.	Test as mentioned in BS 115 (Revision 1)	Approved Fabrication Drawing# and WPSS	100% Visual Inspection & Verification of Dimension by gauge and Test record	Inspecting Agency*	100%	Test Reports & Fabricator's Report	Approved Fabrication Drawing#, WPSS, WPQR, BS 115 (Revision 1) and other relevant codes referred in it and in approved drawings	1. Details of inspection of automatic stud welding shall be maintained as per annexure I of BS-115 (Revision 01) 2. Clearance to be given by Inspecting agency
6.0	**First span Inspection**									

6.1	**Trial Assembly**	a) Overall length b) Bearing centres c) Height d) Girder Centres e) Squareness f) Verticality g) Camber on Jack h) Dead Load deflection (Camber without Jack) i) Dimension j) Fairness of Holes k) Temporary fasteners l) Any Infringement m) Butting of compression flanges	Visual & Dimensional	Approved Drawings	Complete Dimensional Check of Trial Assembly	Inspecting Agency*	First span	Inspection Report of Inspection officials & fabricator's record	IRS B1-2001, IRS WBC-2001 and applicable codes referred in these codes.	1. Clerance by Inspecting agency 2. Trial assembly shall be done in Workshop of fabricator only. Fabricator shall ensure that sufficient space is available in workshop for trial assembly before finalizing the order of fabrication for a particular span.
6.2	**Dismantled component inspection**	1. Component completeness after dismantling, 2. To find out that dismantled components are free from Elongation of holes, Tearing of edges or other defects.	Visual, Dimensional & Structural	Stage clearance Record	Verification of Stage clearance Record	Inspecting Agency*	100%	Inspection Report of Inspection officials & fabricator's record	IRS B1-2001, IRS WBC-2001 and applicable codes referred in these codes.	Clearance to be given by inspecting agency including the clearance for welding as per Annexure 2.

7.0	**Inspection of Components- 2nd span and onwards**	a) Component completeness b) Dimensions c) Fairness of holes d) Verticality e) Butting of compression flange f) Squareness g) Overall length h) Height	Visual, Dimensional & Structural	Stage clearance Record	Verification of Stage clearance Record	Inspecting Agency*	100%	Inspection Report of Inspection officials & fabricator's record	IRS B1-2001, IRS WBC-2001 and applicable codes referred in these codes.	1. Clearance to be given as per Annexure -2. 2. 2nd span and onwards, each girder to be offered in leaf assembled condition. 3. Full Components of one span or more than one span shall be offered for inspection of inspecting agency. Part spans should not be offered for inspection of inspecting agency.
8.0	**Surface Preparation by Shot Blasting & Metalizing**	Surface condition after blasting	Visual checking with reference to surface preparation	Approved Fabrication Drawing# & IRS - B1-2001 and codes referred in these	Verification of Stage clearance Record	Inspecting Agency*	100% by fabricator & Random by Zonal Railway *	Fabricator's Record	IRS B1-2001 Appendix- VII IS: 6586, IS:5905 , IS:2590 and codes referred in these codes	1. Clerance shall be given as per Annexure-2. 2. No need for metalizing and painting on top side of I-Beam before welding of Stud Shear Connector 3. If required for corrosion protection, the steel surface duly fitted with studs shall be aluminium metallised after welding of studs and their inspection is over. However, the same shall not be
		Surface finish after metalizing	Visual checking	Approved Fabrication Drawing# & IRS - B1-2001 and codes referred in these	Verification of Stage clearance Record	Inspecting Agency*	100% by fabricator & Random by Zonal Railway *	Fabricator's Record		

		DFT checking	Measurement	Approved Fabrication Drawing# & IRS - B1-2001 and codes referred in these	Verification of Stage clearance Record	Inspecting Agency*	Minimum one reading per square meter	Measurement Record		painted (Please refer BS 115 Rev. 1)
9.0	**Cleaning & Painting**	Surface condition before painting	Visual checking with reference to surface preparation	Approved Fabrication Drawing# & IRS - B1-2001 and codes referred in these	Verification of stage clearance records	Inspecting Agency*	100% by fabricator & Random by Zonal Railway *	Fabricator's Record	Clause 39.2.1 and appendix VII of IRS B1-2001, IS: 104, IS:51, IS: 2339, IS: 5666, BS-111 and applicable codes referred in these codes	
		Surface finish after painting	Visual checking	Approved Fabrication Drawing# & IRS - B1-2001 and codes referred in these	Verification of stage clearance records	Inspecting Agency*	100% by fabricator & Random by Zonal Railway *	Fabricator's Record		
		DFT checking	Measurement	Approved Fabrication Drawing# & IRS - B1-2001 and codes referred in these	Verification of stage clearance records	Inspecting Agency*	Minimum one reading per square meter	Measurement Record		

	Final Dispatch including packing, Shipping mark and loading etc.	1. Shipping Mark on all Components as per Approved Fabrication drawings# 2. Fixing of Inscription Plate 3. Packing 4. Loading	Visual	Fabricator's Record		Inspecting Agency*	Rando m	Approved Fabrication Drawing# & Fabricator's record	Approved Fabrication Drawing# & Clause 42, 43 and 44 of IRS - B1-2001 and codes referred in these	Site Painting is to be done after assembly and erection of girder on site as per IRS B1-2001

Notes:

1 * Inspection Agency as decided vide guidelines and Aneexure -2.

2 ** Approved laboratory in this QAP means NABL/NABCB Accredited Lab. (Ref: ED/B&S/RDSO letter CBS/PBEJ/Reg dated 10.07.2017.)

3 # "Fabrication drawings" shall be made on the basis of approved structural drawing if required as per the provisions of para 1.2 of IRS B1-2001. Fabrication work is to be undertaken on the basis of these fabrication drawings only after approval of Engineer in charge of project. Also on the completion of work, contractor should supply the "Completion Drawing" along with alteration if any.

Annexure-2

Schedule for the Inspection and Approvals for RDSO Standard I-Section Composite Girders for ROBs

Executing Agency →		Zonal Railway		Construction Org. of Zonal Railway		Railway PSU like RVNL, DFCCIL etc.		Non-Railway PSU like NHAI, CPWD etc.	
Inspecting Agency →		FIU of zonal railway	Outsourced to third party Insp. Agency	FIU of zonal railway	Outsourced to third party Insp. Agency	FIU of zonal railway	Outsourced to third party Insp. Agency	FIU of zonal railway	Outsourced to third party Insp. Agency
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
1.	**QAP preparation**	FIU team	T/Party team	DyCE/Con. (Also see Note-4)	Dy.CE/Con with assistance of T/Party team	PSU Officer i/c of the project	PSU officer i/c of the project	PSU Officer i/c of the project	PSU officer i/c of the project
2.	**QAP Approval**	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU
3.	**WPSS preparation**	FIU team	T/Party team	DyCE/Con. (Also see Note-4)	Dy.CE/Con with assistance of T/Party team	PSU Officer i/c of the project	PSU officer i/c of the project	PSU Officer i/c of the project	PSU officer i/c of the project
4.	**WPSS Approval**	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Dy.CE/Con/Br. if available else CE(Con)	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU
5.	**WPQR preparation 1st span**	FIU team	T/Party team	DyCE/Con. (Also see Note-4)	Dy.CE/Con with assistance of T/Party team	PSU Officer i/c of the project	PSU officer i/c of the project	PSU Officer i/c of the project	PSU officer i/c of the project
6.	**WPQR Approval 1st span**	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Dy.CE/Con/Br. if available else CE(Con)	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU

Executing Agency →		Zonal Railway		Construction Org. of Zonal Railway		Railway PSU like RVNL, DFCCIL etc.		Non-Railway PSU like NHAI, CPWD etc.	
Inspecting Agency →		FIU of zonal railway	Outsourced to third party Insp. Agency	FIU of zonal railway	Outsourced to third party Insp. Agency	FIU of zonal railway	Outsourced to third party Insp. Agency	FIU of zonal railway	Outsourced to third party Insp. Agency
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
7.	**WPQR preparation Subs. Span**	FIU team	T/Party team	DyCE/Con. (Also see Note-4)	Dy.CE/Con with assistance of T/Party team	PSU Officer i/c of the project	PSU officer i/c of the project	PSU Officer i/c of the project	PSU officer i/c of the project
8.	**WPQR Approval Subs. span**	Min. JAG officer working under CBE, heading FIU without fresh WPQR	Min. JAG officer working under CBE, heading FIU without fresh WPQR	Min. JAG officer working under CBE, heading FIU without fresh WPQR	Dy.CE/Con/Br. if available else CE(Con)	Min. JAG officer working under CBE, heading FIU without fresh WPQR	Min. JAG officer working under CBE, heading FIU without fresh WPQR	Min. JAG officer working under CBE, heading FIU without fresh WPQR	Min. JAG officer working under CBE, heading FIU without fresh WPQR
9.	**Signing 4 point certificate**	JAG officer in charge of the project	JAG officer in charge of the project	JAG officer in charge of the project	Dy.CE/Con in charge of the project	JAG equivalent officer in charge of executing agency	JAG equivalent officer in charge of executing agency	JAG equivalent officer in charge of the project	JAG equivalent officer in charge of the project
10.	**Trial Assembly Approval of 1st span**	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU
11.	**Trial Assembly exemption for subsequent span**	To be decided at the stage of QAP approval itself, by the authority giving approval of QAP subject to the condition that same set of welders shall be deployed in the fabrication of subsequent girder of same RDSO standard span.							
12.	**Component inspection & report preparation**	FIU team	T/Party team	FIU team (Also see Note-4)	T/Party team	FIU team	T/Party team, f/b PSU officer i/c of the project	FIU team	T/Party team, f/b PSU officer i/c of the project

Executing Agency →		Zonal Railway		Construction Org. of Zonal Railway		Railway PSU like RVNL, DFCCIL etc.		Non-Railway PSU like NHAI, CPWD etc.	
Inspecting Agency →		FIU of zonal railway	Outsourced to third party Insp. Agency	FIU of zonal railway	Outsourced to third party Insp. Agency	FIU of zonal railway	Outsourced to third party Insp. Agency	FIU of zonal railway	Outsourced to third party Insp. Agency
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
13.	**Component Approval**	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Dy.CE/Con/ Br. if available else Dy.CE/Con. i/c.	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU	Min. JAG officer working under CBE, heading FIU
14.	**Test-check of assembly/ camber at site before & after launching**	Mandatory by Zonal Railway FIU working under CBE							

NOTES:

1. In case of Construction Organisation, Railway PSU and Non-Railway PSU the permission for outsourcing to third party will have to be taken from CBE.
2. WPQR approval for subsequent span based upon previous approved WPQR tests can be done/dispensed with as per relevant BIS code. However, WPQR are to be prepared and got approved.
3. If agency has fabricated same span which has been commissioned within previous 2 years then exemption from trial assembly can be granted.
4. If any Construction Organisation (CAO/Con. Unit) of any Zonal Railway has a bridge unit then it will assist Dy. CE/CONs in preparation of QAP, WPSS & WPQR. It can also carryout component inspection and report preparation (SNo.-12). However, for all these the competent authority for approval will be minimum JAG officer heading FIU unit working under CBE.

Annexure-3

APPENDIX – V (1)

(Ref. clause 26 of IRS B1-2001)

Proforma for Welding Procedure Specification Sheet

Name and address of Fabricator:

Welding procedure specification No

1. Weld joint description :

2. Base Metal :

3. Welding Process :

4. Welding position :

5. Welding consumables :

5.1 Electrode/wire Class :

Dia. :

Drying method :

5.2 Flux Class :

Type :

Drying method :

5.3.1 Shielding gas:

6.0 Base Metal preparation:

6.1 Joint design details:

(Give sketch showing arrangement

of parts, welding groove details,

weld passes & their sequence etc.)

6.2 Joint preparation:

7. Welding current: Type:

Polarity:

8. Welder qualification:

9 Welding parameters and technique:

9.1 Welding Parameters:

Weld Pass No.	**Electrodes/ wire dia.(mm)**	**Current (amp)**	**Arc Voltage (volt)**	**Wire feed speed (m/min)**	**Travel speed (m/min)**	**Electrical stickout (mm)**	**Gas flow rate (litre/min.)**
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

9.2 Welding sequence and technique:

(Give sketch showing sequence and direction of welding).

10. Provision of run in and run-off tabs:

11. Cleaning of weld bead before laying next weld bead:

12. Root preparation before welding other side of groove weld:

13 Preheating and inter pass temperature:

14 Peening

15 Post weld treatment:

16 Rectification of weld defects:

17 Inspection of weld.

18. Any other relevant details

Prepared by

Signature_____

Designation _____

Date _____

(for & on behalf of Fabricator).

Annexure-4

APPENDIX – V (2)

(Ref. clause 26 of IRS B1-2001)

Performa for Welding Procedure Qualification Record

NAME AND ADDRESS OF FABRICATOR

1. Description of weld joint:
2. Welding procedure specification no.:
3. Name of welder:
4. Date of preparation of test piece:
5. Dimensions of test piece:
6. Base Metal:
7. Welding Process:
8. Welding position:
9. Welding Current: Type:
   Polarity:
10. Weld joint design details:
11. Welding consumables:

11.1 Electrode/wire Class:
   Dia:
   Brand:

11.2 Flux Class:
   Type:
   Brand:

11.3 Shielding gas:

12. Welding parameters:

Weld pass No.	Electrode wire dia (mm)	Current (amp)	Arc voltage (volt)	Wire feed speed (m/min.)	Travel speed (m/min.)	Electrical stick out (mm)	Shielding gas flow rate (lit/min.)
1	**2**	**3**	**4**	**5**	**6**	**7**	**8**

13. Preheating and interpass temperature:

14. Results of Qualification Tests:

Test	Specimen No.	Result.
1	2	3
Non-destructive tests: i) Visual examination: ii) Dye penetrant test: iii) Magnetic particle test: iv) Radiographic/Ultrasonic test: Destructive tests: i) Macro-examination: ii) Hardness survey: iii) Fillet weld fracture test: iv) Transverse tensile test: Tensile strength Yield Stress Location of fracture v) All-weld tensile test: Tensile strength		

	Yield Stress		
	Elongation %		
vi)	Guided bend test:		
	Root bend test		
	Face bend test		
	Side bend test		
vii)	Any other tests:		

Signature _____

Designation _____

Date _____

(for & on behalf of Fabricator).

Annexure-5

Performa for maintaining Register for consumables:

Date	Detail of Item with manufacturer name	Whether item is approved by RDSO (Yes/No)	Manufacturer test certificate detail.	Quantity received	Quantity consumed	Quantity balance	Sign of site supervisor