

INDIAN RAILWAYS



WELDING PROCEDURE SPECIFICATION FOR BOGIE OPEN WAGON (91.6 Tonnes) TYPE – BOXNRM2/ BOXNRHS

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SECTION A

1. GENERAL

1.1 Scope:

This welding procedure is intended to cover the general requirement for the arc welding of steels to specification IS: 2062 E250 A with Cu, IS: 2062 E450 BR with Cu, IRS: M44 and others as mentioned and specified in related drawings and applicable to the fabrication of bogie open wagon BOXNRM2/ BOXNRHS as per Guideline and STR no. WD-16-BOXNR-2010, Rev.2 (latest version). It covers welding procedure, like consumable details, welding process, fitment procedure, type of weld, position of weld, etc.

This procedure is for shop guidance and should be used in conjunction with the relevant drawings.

1.2 Welding Symbols:

The welding symbols are as specified in specification IS:813:1986 (latest), scheme of symbols for welding. The terms used in this WPS shall have their meaning as defined in IS: 812:1957 (latest version), glossary of terms related to welding and cutting of metals.

1.3 Welders Qualification:

Welders qualification test shall be conducted as per IS: 7310 (Part-1) – 1974 (latest version).

1.4 Welding Processes:

GMAW [gas metal arc welding (MIG/MAG)] processes or as specified in this WPS will be adopted considering technical suitability, operational flexibility and application.

2. MATERIALS

2.1 Parent Metals:

S.No.	Description	Specification
1	Under frame	IS: 2062 E250A with Cu
2	CRF Section	IS: 2062 E450 BR with Cu & IRS :M44
3	Plate/ Sheet	IRS :M44

All raw materials as specified in drawing should be procured & tested chemically as mentioned in para no. 6(xiii) and 5.0 of Section-B of Guideline and STR no. WD-16-BOXNR-2010, Rev.2 (latest version). All raw materials checked and documented and shall be verified by RDSO/ Inspecting agency as mentioned in para no. 6(xiii) of Section-B of Guideline and STR no. WD-16-BOXNR-2010, Rev.2 (latest version).

2.2 Welding Consumables:

Sl. No.	Material to be joined	Welding Consumables to be Used			
		MIG/MAG welding filler wires as per IRS M-46-03(Latest version)			
		IRS class	AWS code	Type of Wire	Shielding Gas
01.	IRS:M44 to IRS:M44	Class-VI	ER 308L	Solid wire	Argon + (1-5%) O ₂
		Class-VI	E308LT1-1	Flux cored wire	CO ₂
02.	IRS:M44 to IS: 2062 E450 BR with Cu or to IS: 2062 E250A with Cu	Class-VII	ER 309L	Solid wire	Argon + (1-5%) O ₂
		Class-VII	E309T1-1	Flux cored wire	CO ₂
03.	IS: 2062 E450 BR with Cu to IS: 2062 E450 BR with Cu or to IS: 2062 E250A with Cu	Class-III	ER 90SD2	Solid wire with Cu coating	CO ₂ or 75-80% Argon rest CO ₂ mixture
		Class-III	E91T1-D1C	Flux cored wire	CO ₂
04	IS: 2062 E250A with Cu to IS: 2062 E250A with Cu	Class-I	S3X503*	Solid wire with Cu coating	CO ₂ or 75-80% Argon rest CO ₂ mixture
		Class-I	E71T-12	Flux cored wire	CO ₂

* X-stands for C or M only as per IS: 6419-04(latest)

All welding consumables shall be purchased from RDSO approved sources or as mentioned in para no. 6(xiii) of Section-B of Guideline and STR no. WD-16-BOXNR-2010, Rev.2 (latest version).

2.3 Care of Electrodes and Fluxes:

All welding consumables shall be stored and handled with care and in accordance with manufacturer's recommendation. All electrodes / filler wires shall be stored properly in their original moisture resisting packets / cartons / spools / bundle and containers in a dry & well-ventilated storeroom. Use of racks or other suitable means to store electrode off the floor shall be done. Electrodes having part of their coating damaged (cracked or flaked coating) & rusty wires shall be discarded.

2.4 Drying of Electrodes:

Low hydrogen electrodes shall be redried / baked at 250° C in electrode drying oven for one hour before use or to be baked to a temperature as per recommendation of the manufacturer. Agglomerated fluxes shall be pre – heated to the temperature of 250° C for one hour in the drying oven, immediately before use and maintained during weld.

3. WELDING TECHNIQUES

3.1 Edge Preparation:

Edge preparation of all butt and fillet joint shall be carried out as per IS:9595(latest version). Edges shall be prepared for welding by edge planing machine or by any other suitable mechanical means (use of oxy-cutting for IRS: M44 is prohibited). Joint configuration shall comply with the requirement of design shown in the drawing.

Any gouges or nicks deeper than 1/8 thickness of the plate, that cannot be fused during welding, shall be ground prior to welding. All grinding shall be done in the direction of the length of the member and not transversely. Brief detail of machine used for edge preparation shall be given.

3.2 Weld Zone Cleaning:

Weld zone shall be absolutely free from grease, oil, paint, rust, scales, and oxides, to about 50 mm on either side of weld, before welding. Each run of weld layer shall be thoroughly cleaned to remove particles of slag, flux, spatters etc., before the subsequent layer of weld. Visible defects such as cracks, cavities, blow holes, pin holes and other deposition faults, if any, shall be removed by gouging / grinding to sound metal before depositing subsequent layer of weld.

3.3 Alignment:

The root edges or root faces of butt joints shall not be out of alignment by more than 25% of the thickness of the thinner material for material upto and including 12 thick or by more than 3 mm for thicker material, as prescribed in IS 9595(latest version). Welding stresses in different segment must be separated by least combined stresses. The tolerance on limits of root gap & root face should be $\pm 1\text{mm}$ on the specified dimension for material upto & including 12mm thick & $\pm 2\text{mm}$ for material over 12mm thick, for manual welding .

3.4 Current & OCV:

D.C current machine shall be used. Current, voltage and other welding parameters shall be fixed for each weld joint as per requirement of weld size and quality of weld. O.C.V, polarity, welding voltage & current shall be as per recommendation of electrode manufacturers and to suit thickness/ composition of parent materials. Recommendation of electrode manufacturer shall prevail, in case of difference in specified voltage & current for welding between electrode manufacturer & WPS.

3.5 Welding Position:

All welding shall be done in the down hand position as far as practicable and the welders should weld in a comfortable position. Overhead, vertical and horizontal position shall be used only if unavoidable and with the prior qualification of the welders in that position. For details of welding position refer IS: 812:1957(latest version)

3.6 Tack Welding:

The throat thickness or leg length of tack welds shall not be less than the throat thickness or leg length of the root run to be used in the joint and shall be subjected to the same welding condition as those specified for the root run. Any defect in the tack weld must be removed prior to depositing the first layer. The length of tack welding shall not be less than 4 times the thickness of the thicker plate or 50 mm whichever is smaller. Distance between the tack weld will be between 300 to 400 mm approximately. Tack weld shall not be made at the extreme ends of the joint. The tack weld must be free from all cracks and other welding defects. Tack weld having cracks, shall be cut out and re-welded.

3.7 Butt Welds:

Details of all butt welds shall be arranged to permit use of a satisfactory welding procedure and shall be such that the resultant joint comply with the requirement of design and as per IS: 9595(latest version) .

3.8 Miscellaneous:

a) Use of Run-on & Run-off plates

b) Run-on & run-off plates shall be used for all butt welds, wherever possible, to avoid end craters and defects. Locking or lashing of ends shall be done with care after the Run-on & Run-off plates are removed. Removal of end pieces shall be done as per recommendation.

c) Fillet Weld Contour

Fillet weld contour shall be convex. Excessive convexity shall be avoided. Tolerance on fillet weld size shall be +1.5mm max and 0 min on the specified weld size. For fillet welds the actual throat thickness shall not be more than 0.9 times the specified leg length.

d) Weld Contour

Weld toe should have slight concavity & should merge with parent plate gradually & to smooth profile.

e) Sealing Run

All butt welds shall be back gouged by chipping/ grindings up to sound metal and a sealing run deposited, except where otherwise stated, or where accessibility on the reverse side is not possible or where backing plate is used.

f) Weld Bead

Whip Back technique should be used for starting and finishing of welds to ensure proper fusion and avoidance of starting & finishing porosity. The travel speed should be reduced and the arc length gradually increased to fill up the crater before the arc is extinguished.

g) Stray Arc and Crater

Stray arcing / striking of arc must be avoided on parent plate/ job as this can leave local hard spots or cracking. Extra plates should be used for this purpose. All craters shall be carefully filled up. Crater crack, if any, must be gouged out till crack free sound metal is observed, then the crater should be filled up with fresh welding.

3.9 During Welding:

a) Necessary steps will be taken to ensure that all welded joints are smooth, regular and strong, as required. Steps shall be taken during welding to arrest cracks, blow-holes, porosity & undercut.

b) Welding shall not be done on wet surface, at high wind areas. Wind breakers shall be used.

c) Welding current shall be in accordance with the recommendation of the manufacturer of welding consumables. Electrode manipulation shall be restricted. It should ensure proper fusion of filler metal and parent plates. Over lapping must be avoided. Under cutting should not occur, avoid slag inclusion and give ample scope to remove gas pockets etc., resulting in a smooth and uniform weld. The electrode angle should be such as to obtain proper slag control, avoidance of undercuts and proper fusion of both members and uniform arc length.

3.10 General:

- a) Atmosphere lighting condition, moisture and general conditions shall be made favorable to achieve better welds.
- b) Gauges shall be provided to measure proper gaps (edge preparation) and weld profile, as per drawings.

4. INSPECTION & DEFECT RECTIFICATION

4.1 Inspection of Weld Joint:

Welding zone should be absolutely free from grease, oil, paint, rust, scales, and oxides before welding. Weld joint configuration, edge preparation, alignments and fitup should be proper and as shown in the approved drawing and also as per IS: 9595(latest version) & other relevant codes . All welding joints should be free from defects such as slag inclusion, blow holes, porosity, any type & any size of crack, lack of penetration, lack of fusion, irregular weld shape, undercut, spatter etc. Excess convexity and excess reinforcement must be avoided. All weld surfaces should be reasonably smooth and regular and shall satisfy strength requirement. NDT or other tests shall be as specified. Dye penetrant test shall be used to detect invisible surface defects.

4.2 Rectification of Defects:

Rectification of weld defects shall be done in compliance to IS: 823-04,15.2.7 or relevant IS specification. Defects, if any, shall be chipped out and / or ground. After complete removal of defect, fresh welding is to be done using the same sequence and procedure as required for original welding. In case of fillet welds the electrode angle should be such as to obtain uniform required leg length , a proper slag control to eliminate any slag inclusion and an undercut free welding. In case of butt welds proper root penetration and fusion, proper fusion of both the parent plates, total elimination of slag entrapment and the weld metal free from any other defect is to be ensured.

4.3 Steps to Control Distortion and Residual Stress:

- (i) Do not over weld.
- (ii) Use the smallest leg size permissible when fillet welding.
- (iii) Use minimum root opening, included angle and reinforcement.
- (iv) Weld alternately on either side of the joint when possible with multiple pass welds (balancing method - to balance stresses).
- (v) Use fewer weld passes.
- (vi) Long parallel runs to be deposited concurrently as far as practicable
- (vii) Use higher deposition rate processes.
- (viii) Use higher welding method - mechanical welding.
- (ix) Use welding methods that give accurate penetration and thus reduce the amount of weld metal needed for the same strength and amount of heat input.
- (x) Use welding positioners to achieve max. amount of down hand welding allowing the use of large diameter electrodes or higher deposition rate welding procedures with faster welding speed.
- (xi) Balance weight about neutral axis of the member.
- (xii) Distribute the welding heats evenly as possible through planned welding sequence and welding position (skip or staggered welding)
- (xiii) Weld towards the unstrained part of the member.
- (xiv) Use clamps, fixtures and strong backs to maintain fit up and alignment.
- (xv) Pre-set the members or pre - set the joints to let shrinkage pull them back into alignment.
- (xvi) Weld those joints that cause most contraction first.
- (xvii) On multipass double 'V' welds, balance welds on both sides
- (xviii) Start welding from the middle and progress both sides towards the free ends.
- (xix) While welding thin section to very thick sections, use a copper backing material that may be effective in minimising distortion.
- (xx) Clamping may not completely eliminate warping but is likely to be more effective if clamps are kept in position until the balancing weld sequence are completed.
- (xxi) Avoid excessive pressing of members by forcing alignment to get better fittings of parts.

4.4 Control of Shrinkage:

- (i) Ensure proper fit-up and alignment.
- (ii) Over welding shall be avoided
- (iii) Intermittent welding shall be used
- (iv) Use as few weld passes as possible
- (v) Use back step welding
- (vi) Anticipate the shrinkage process
- (vii) Use minimum root opening, included angle and reinforcement.
- (viii) Weld those joints that cause most contraction first.
- (ix) Weld the more flexible section first so they can be straightened, if necessary in final assembly.
- (x) Sequence sub-assemblies so that the welds being made continually balance each other around the neutral axis of the section.

4.5 Correction of Distortion:

Any distortion, which is unavoidable, may be corrected by:-

- (i) Cold (Mechanical process)
- (ii) Peening (excess peening not recommended)
- (iii) Heating and cooling techniques (sudden cooling not permitted)
- (iv) Care should be taken to prevent build up of residual stresses
- (v) Combination of heating and mechanical working
- (vi) Remove shrinkage forces after welding by peening or stress relieving
- (vii) Welding time shall be minimized as far as practicable
- (viii) Maximum utilization of fixtures/clamps/strong back etc.

5. MISCELLANEOUS

5.1 No. of Welders (to be filled up by the manufacturer)

Welding Process	GMAW	SMAW (if used)	Radiography quality weld
No of Welders			

5.2 Training Facilities and Evaluation:

Manufacturer should have either in- house training facilities for welders or he should arrange training at reputed training institutes. **IS: 817 (PART 1):1992(latest version).**

5.3 Information about Work Set Up (to be filled up by the manufacturer):

Welding Process	GMAW	SMAW (if used)	Edge preparation machines	Plasma cutting
Machine type				
No. of machines				

Set-up for inspection of welding machine, earthing, clamping devices, edge preparation and other machines/devices shall be attached by manufacturer with this WPS.

5.4 Calibration of Equipments/Machines/Devices:

All the equipments/machines must be calibrated periodically, including voltmeters, ammeters etc. Manufacturer should ensure it. Calibrated tong tester for measuring of welding current must be used.

5.5 Availability of Latest Specifications:

Manufacturer should have latest issue of IS/IRS specifications / recommendations (latest) available in works. Latest recommendations shall be rigorously followed. Authority has to guide the workers regarding these recommendations/ guidelines.

5.6 Inspection Facilities:

Facility shall be available to check the quality of electrodes, fluxes for welding and having testing facility as prescribed in IS/IRS specification(as per latest version). Facility of mechanical testing (such as tensile strength and other physical properties) and chemical testing (such as chemical composition of weld metal etc.) should be available as per Guideline and STR no. WD-16-BOXNR-2010, Rev.2 (latest version).

6. PRECAUTIONS FOR WELDING OF STAINLESS STEEL

Since stainless steel has high coefficient of thermal expansion and less heat conductivity, it is advised to use low welding current with the recommended range and smaller gauge electrode to minimize the heat input and reduce distortions.

- (i) Always maintain short Arc to minimize the loss of alloying elements
- (ii) After finishing welding, lift electrodes slowly and fill the crater before breaking the arc. This will avoid crater cracks
- (iii) Any defect like crack, blow hole etc. must be properly gouged out and re-welded.
- (iv) Tack the welded area correctly to ensure proper gap
- (v) Proper welding sequence must be followed to reduce internal stresses and hence reduce warpage of structure
- (vi) Always weld towards the free ends
- (vii) Surfaces to be welded and surfaces adjacent to a weld must be free from loose or thick scale, slag, rust, moisture, grease and other foreign materials that would prevent production of acceptable quality welds. This can be achieved in part by thorough degreasing of the weld joint.
- (viii) Surfaces and edges to be joined must be smooth, uniform and free from fins, tears, cracks and other discontinuities which would adversely affect the quality or strength of the weld.
- (ix) Good welding practice to avoid craters, burn through and excess penetration will ensure that premature failures do not occur in service.
- (x) The work must be positioned for flat position welding whenever possible.
- (xi) Before tack welding, ensure that the joint geometry is correct e.g. fit up, root opening, edge preparation etc.
- (xii) The classification and size of electrode, voltage, amperage and weld speed must be adjusted to suit the thickness of material, type of weld joint, welding position and other circumstances at the time of welding.
- (xiii) Current settings should be minimum as required but within the range recommended by the electrode/filler wire manufacturer.
- (xiv) Where basic coated electrodes are used they should be baked in an oven at a temperature of 150-200 deg. C for one hour or as recommended by the manufacturer. These electrodes should be used within 30 minutes of their removal from the oven.
- (xv) Striking the arc must be performed with caution to prevent arc strikes outside of the weld joint. Arc strikes are hard spots which can affect both the mechanical properties and corrosion resistance of the steel.
- (xvi) Avoid weaving and back stepping to reduce heat input. A stringer bead method is preferred.
- (xvii) Back grinding or gouging to sound metal on the reverse side of the weld will be necessary for full penetration welds on plate thicker than 3 mm.
- (xviii) When doing multi-pass runs, interpass temperatures should not exceed 150 deg. C.
- (xix) Before welding over previously deposited metal, all slag should be removed and the weld and adjacent base metal should be brushed clean using a stainless steel wire brush. This requirement applies not only to successive layers but also to successive beads and to the crater area when welding is resumed after any interruptions.

7. RESPONSIBILITY OF CONTRACTOR

This WPS, however, will not, in any way, reduce the contractor's responsibility for satisfactory execution of the contract in all respects as stipulated in clause 4 of General Standard Specification No. G-72 (Revision-3 or latest Revisions, Amendments), as mentioned in particular Guideline and STR WD-16-BOXNR-2010, Rev.2 (latest Revisions, Amendments).

Annexure “A”

Details of Jigs, fixtures, Edge planing machine, Distortion correction machine, etc. as given below:-

MAIN ASSEMBLY FIXTURES

SL. No.	DESCRIPTION	Drawing No. with Alt. No. (to be filled up by manufacturer)	CH.DT.	SIG.	CH. DT.	SIG.
01	BODY SIDE					
02.	BODY END					
03	FLAP DOOR					
04	CAMBER FIXTURE					

SUB-ASSEMBLY FIXTURE

Sl. No.	DESCRIPTION	Drawing No. with Alt. No. (to be filled up by manufacturer)	CH.DT.	SIG.	CH. DT.	SIG.
05	SIDE STANCHION					
06	END STANCHION					
07	SIDE TOP COPING					
08	END TOP COPING					

BODY SIDE TEMPLATES

Sl. No.	DESCRIPTION	Drawing No. with Alt. No. (to be filled up by manufacturer)	CH.DT.	SIG.	CH. DT.	SIG.
09	BODY SIDE STANCHION					
10	STRINGER (2 NO.)					
11	DOOR WAY CROSS BAR					

BODY SIDE DRILLING JIGS

Sl. No.	DESCRIPTION	Drawing No. with Alt. No. (to be filled up by manufacturer)	CH.DT.	SIG.	CH. DT.	SIG.
12	SIDE STANCHION					
13	DOOR WAY CROSS BAR					
14	DOOR WAY PLATE					

BODY END TEMPLATES

Sl. No.	DESCRIPTION	Drawing No. with Alt. No. (to be filled up by manufacturer)	CH.DT.	SIG.	CH. DT.	SIG.
15	END STANCHION (L H & RH)					
16	END STANCHION (L H & RH)					
17	CORNER STANCHION (L H & RH)					

DOOR TEMPLATES

SL NO.	DESCRIPTION	Drawing No. with Alt. No. (to be filled up by manufacturer)	CH.DT.	SIG.	CH. DT.	SIG.
18	DOOR CHANNEL TOP					
19	DOOR CHANNEL CEN.					
20	DOOR CHANNEL SIDE					
21	DOOR CHANNEL AT HINGE SIDE.					
22	BODY SIDE SETTING GAUGES					

Annexure-B

WELDER TRACEABILITY CHART

TYPE:

WAGON NO. (Side Wall, End Wall & Flap Door no.):

ITEM	DATE	STARTED	COMPLETED	NAME OF WELDERS	SIGN.OF SUPERVISOR	REMARKS (Defect, if any)

Annexure-C

SEQUENCE OF WELDING OF WAGON

1. Welding Sequence

Welding should be carried out following the suitable weld sequence. The main aim is to provide uniform heat input at different locations so as to reduce the formation of residual stresses and distortion.

2. Welding Technique

Welding shall not be done on wet surface and in high wind area, specially for GMAW process of welding. Welding current shall be with accordance to recommendation of the manufacturer of welding consumables or $\text{amps} = (40-50) \times \text{dia of electrode}$. It is better to use iron powder type electrode for higher deposition. Electrode manipulation shall be restricted to ensure proper fusion of filler metal and parent plates. Overlapping is to be avoided. The weaving of electrodes should not be more than 3 times of its core wire diameter.

3. Welding Sequence

a) Body Side :

Assembly of bodyside components are done on a fixture. Plates, side stanchion, doorway stiffening crossbar, side middle coping and side top coping are to be fitted on body side fixture, tacked and clamped properly to minimise distortion. Final welding is to be started simultaneously from centre to end. Back side welding is done after necessary back gouging.

b) Body End:

Assemblies of body end components are done on a fixture. Plates end stanchion, and top coping are to be fitted on bodyend fixture, tacked and clamped properly to minimise distortion. Final welding is to be started simultaneously from centre to end. Back side welding is done after necessary back gouging.

c) Flap Door

Assemblies of door components are done on a fixture. Door Frame, Door sheet and Hinge are to be fitted on door fixture, tacked and clamped properly to minimise distortion. Final welding is to be started simultaneously from centre to end. Back side welding is done after necessary back gouging, if required.

4. Manipulator

After completion of boxing, wagon is placed on manipulator to weld the superstructure in down hand position to achieve required welding.

Annexure-D

Welding Consumables proposed to be used
(to be filled up by the manufacturer)

1. WELDING CONSUMABLES

All welding consumables proposed to be used shall have the approval of RDSO.

a) **Electrodes**

- **GMAW** - MIG / MAG WELDING FILLER WIRE – DIA 1.2 mm or as used in welding

AS PER IRS M: 46 (latest)

BRAND NAME	MANUFACTURER	IRS CLASS	AWS CODE (IS 814 :1991 or Latest)

- **SMAW (if used)** – Size of electrode:-
As per IRS M: 28 (latest)

BRAND NAME	MANUFACTURER	IRS CLASS	AWS CODE (IS 814 :1991 or Latest)

Annexure-E

Certificate/letter of approval from local I&L, RDSO regarding facilities, process, methodology and other information submitted vide this WPS

(To be arranged and attached by the Manufacturer)

WELDING PROCEDURE FOR BOXNRM2/ BOXNRHS WAGONS

WD-WPS-BOXNRM2/BOXNRHS-2024
(Superseded WD-WPS-BOXNR-2010, Rev.1)

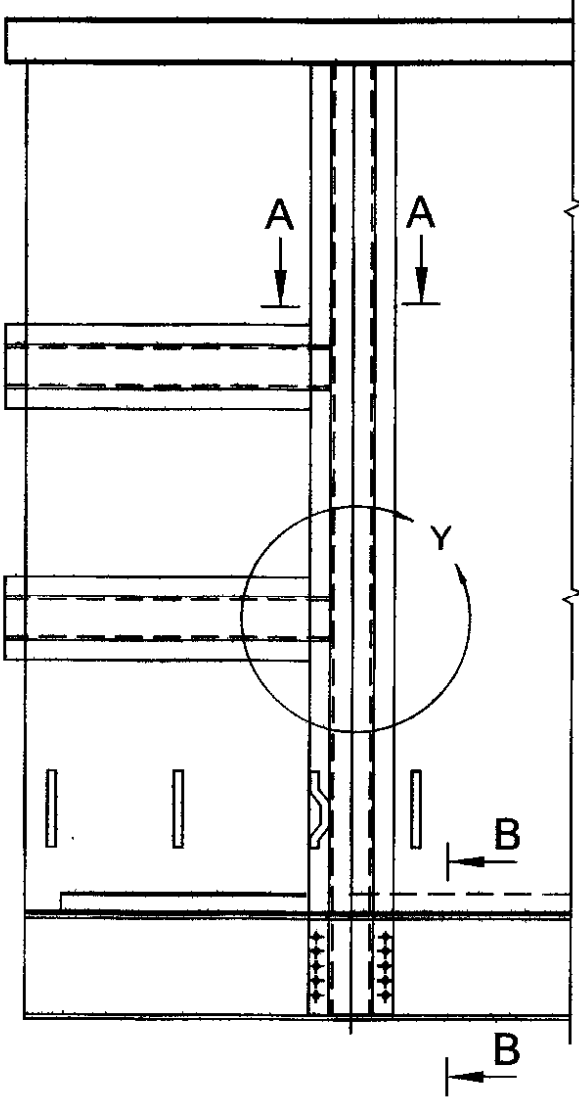
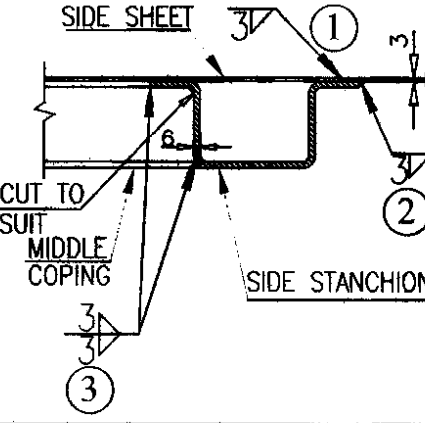
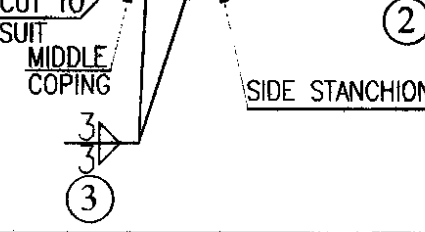

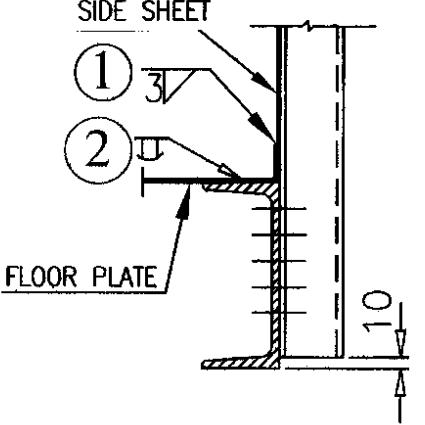
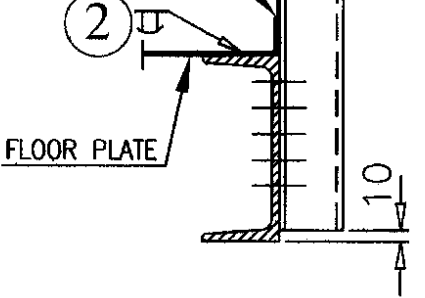
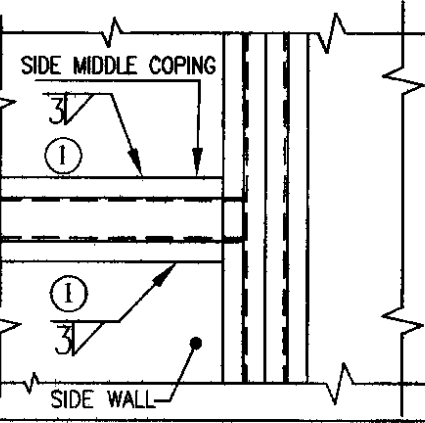
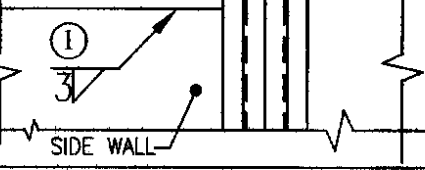
SHEET NO. 1 OF 8

DIAGRAM	JOINT REFERENCE	SKETCH OF JOINTS	WELD PROCESS	WELD TYPE	WELD SIZE (M M)	ELECTRODE/ WIRE SIZE (M M) *	ELECTRODE/ WIRE/FLUX SPECIFICATION	No. OF PASS	CURRENT/ VOLTAGE	POLARITY	WELD POSITION	WELD SEQUENCE & REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
<p>RDSO. DRG. NO. WD-07001-S-04 & WD-07001-S-07 (UNDERFRAME ARRANGEMENT & DETAIL SHEET-3)</p> <p>ENLARGED VIEW-M</p>	SECTION-AA STRINGER TO CROSS TIE (IS:2062 E250A Cu TO IS:2062 E250A Cu)		① GMAW	SINGLE BEVEL BUTT	---	1.2	Welding consumable should be used as per clause no. 2.2 of Section 'A'	2	As indicated by the Welding consumable manufacturer	DC(+)	FLAT,	THE SHIELDING GASES SHALL BE AS GIVEN IN TABLE-1, OF IRSM:46-03 FOR SOLID & FLUX CORED MIG/MAG WELDING FILLER WIRES OF DIFFERENT CLASSES.
			② GMAW	SINGLE BEVEL BUTT	---	1.2		2		DC(+)	FLAT, H/V	
			③ GMAW	FILLET	4	1.2		1		DC(+)	FLAT, H/V	
	DETAIL-BB CENTRE SILL TO CROSS TIE (IS:2062 E250A Cu TO IS:2062 E250A Cu)		① GMAW	SINGLE BEVEL FILLET	5	1.2		2		DC(+)	FLAT,	
			② GMAW	FILLET	4	1.2		1		DC(+)	FLAT, H/V	
	DETAIL-CC SOLE BAR TO CROSS TIE SOLE BAR TO STEPPING PLATE (IS:2062 E250A Cu TO IS:2062 E250A Cu)		① GMAW	SINGLE BEVEL BUTT	--	1.2		2		DC(+)	FLAT,	
			② GMAW	FILLET	5	1.2		1		DC(+)	FLAT, H/V	
	① DETAIL-DD SUPPORT ANGLE FOR A.R. SUPPORT BKT. TO STRINGER (ISM-100)		① GMAW	FILLET	4	1.2		1		DC(+)	FLAT, H/V	
	② SUPPORT ANGLE FOR A.R. SUPPORT BKT. AND STRINGER (ISM-100) TO A.R. TOP PLATE (10 TH.)		②									
	③ A.R. SUPPORT TOP STRAP TO A.R. TOP PLATE (10 TH.)		③ GMAW	FILLET	3	1.2		1		DC(+)	FLAT,	
	④ A.R. SUPPORT TOP STRAP (5 TH.) & A.R. TOP PLATE (10 TH.) TO A.R. WEB PLATE (5 TH.) (IS:2062 E250A Cu TO IS:2062 E250A Cu)		③ GMAW	FILLET	3	1.2		1		DC(+)	FLAT, H/V	
*FOR WELDING DIFFERENT MATERIAL, WELDING ELECTRODE/WIRE/ FLUX ETC. OTHER THAN SPECIFIED IN CLAUSE NO. 2.2 OF SECTION-A, REFER RDSO SPECIFICATION NO. G-72, REV. 3 (LATEST).			PREPARED BY A.K.KUSHVAHA	APPROVED BY 	DATE 03-2024	REV.NO. NIL	PAGE NO. PAGE NO. 14 OF 21					

WELDING PROCEDURE FOR BOXNRM2/ BOXNRHS WAGONS

WD-WPS-BOXNRM2/BOXNRHS-2024
(Superseded WD-WPS-BOXNR-2010, Rev.1)

SHEET NO. 2 OF 8

DIAGRAM	JOINT REFERENCE	SKETCH OF JOINTS	WELD PROCESS	WELD TYPE	WELD SIZE (M M)	ELECTRODE/ WIRE SIZE (M M) *	ELECTRODE/ WIRE/FLUX SPECIFICATION	No. OF PASS	CURRENT/ VOLTAGE	POLARITY	WELD POSITION	WELD SEQUENCE & REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	
<p>RDSO. DRG. NO. WD - 07001-S-08 (BODY SIDE ARRANGEMENT)</p> 	<p>SECTION-AA</p> <p>① ② SIDE WALL TO SIDE STANCHION IRS:M44 TO IS:2062 E450 BR Cu</p> <p>③ SIDE WALL END MIDDLE COPING TO SIDE STANCHION IS:2062 E450 BR Cu TO IS:2062 E450 BR Cu</p>		① GMAW	FILLET	3	1.2	Welding consumable should be used as per clause no. 2.2 of Section 'A'	1	As indicated by the Welding consumable manufacturer	DC(+)	H.V FLAT	THE SHIELDING GASES SHALL BE AS GIVEN IN TABLE-1, OF IRSM:46-03 FOR SOLID & FLUX CORED MIG/MAG WELDING FILLER WIRES OF DIFFERENT CLASSES.
			② GMAW	FILLET	3	1.2		1		DC(+)	FLAT	
			③ GMAW	DOUBLE FILLET	3	1.2		2		DC(+)	H.V	
	<p>SECTION-BB</p> <p>① SIDE CRIB ANGLE TO SIDE WALL (IRS:M44 TO IRS:M-44)</p> <p>② SIDE CRIB ANGLE TO FLOOR PLATE (IRS:M44 TO IRS:M-44)</p>		① GMAW	FILLET	3	1.2		1		DC(+)	H.V	
			② GMAW	SQUARE BUTT	--	1.2		2		DC(+)	FLAT	
	<p>DETAIL AT-Y</p> <p>① SIDE SHEET TO SIDE MIDDLE COPING IRS:M44 TO IS:2062 E450 BR Cu</p>		① GMAW	FILLET	3	1.2		1		DC(+)	FLAT	
			① GMAW	FILLET	3	1.2		1		DC(+)	FLAT	

*FOR WELDING DIFFERENT MATERIAL, WELDING ELECTRODE/WIRE/ FLUX ETC. OTHER THAN SPECIFIED IN CLAUSE NO. 2.2 OF SECTION-A, REFER RDSO SPECIFICATION NO. G-72, REV. 3 (LATEST).

PREPARED BY

Anil
A.K.KUSHVAHA

APPROVED BY

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DATE

03-2024

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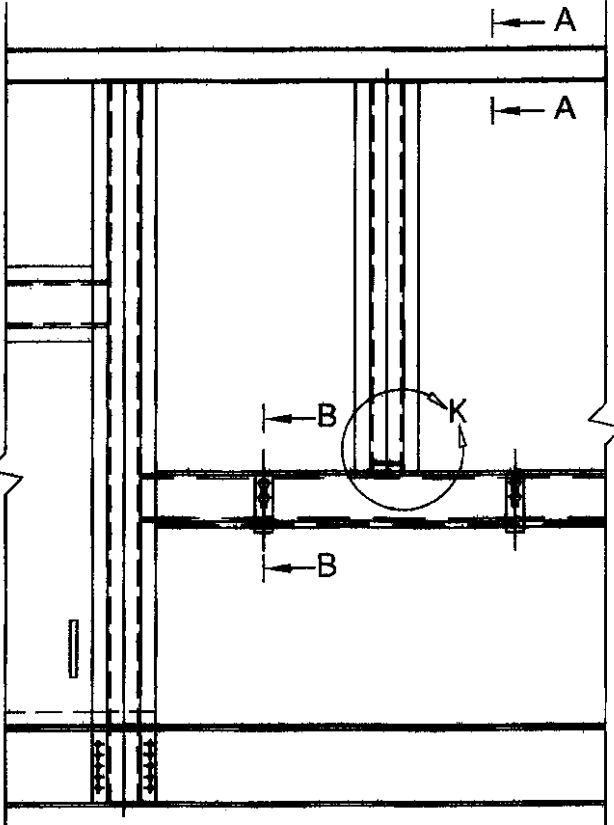
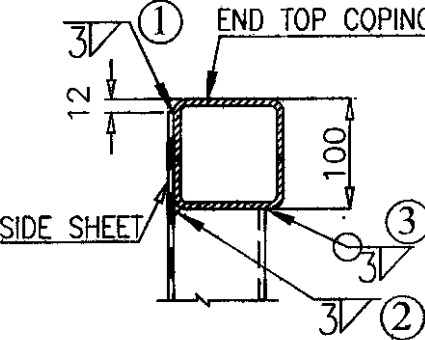
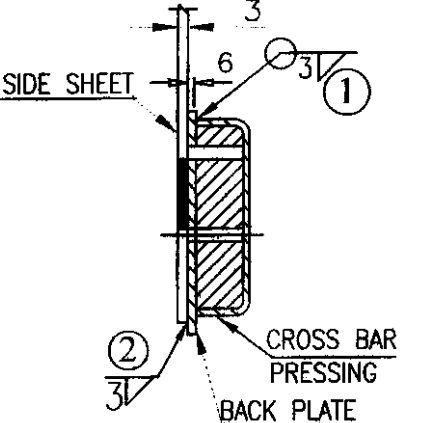
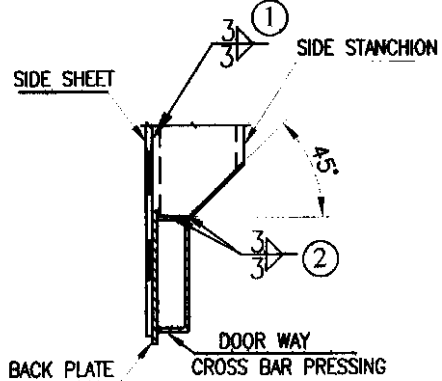
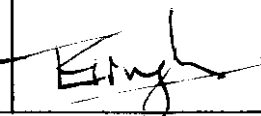
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WELDING PROCEDURE FOR BOXNRM2/ BOXNRHS WAGONS

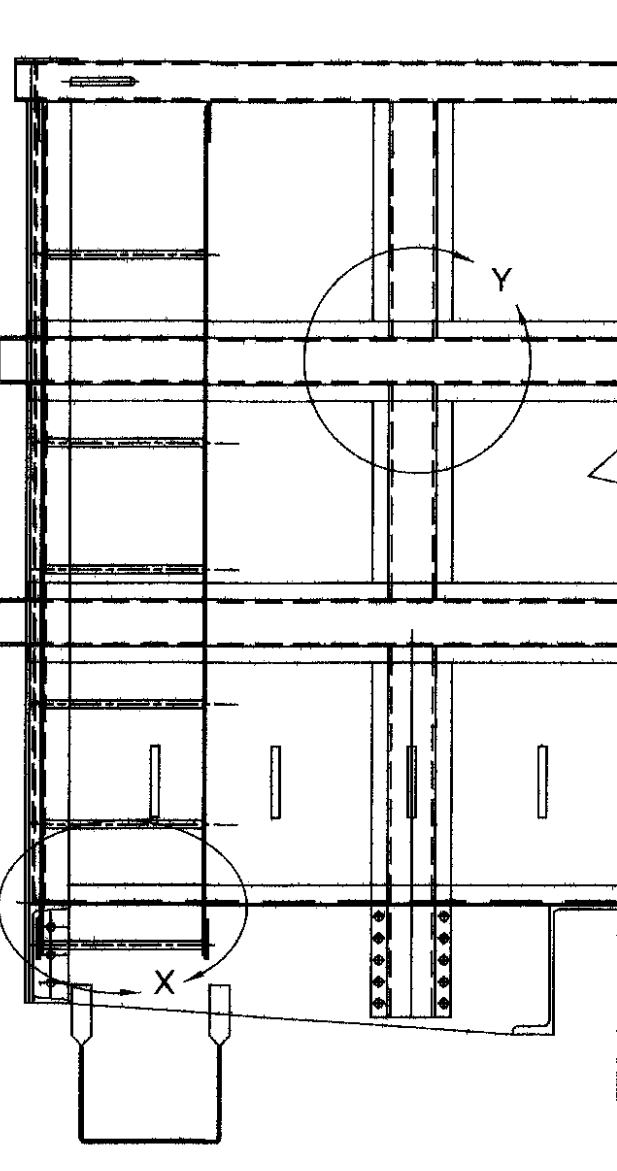
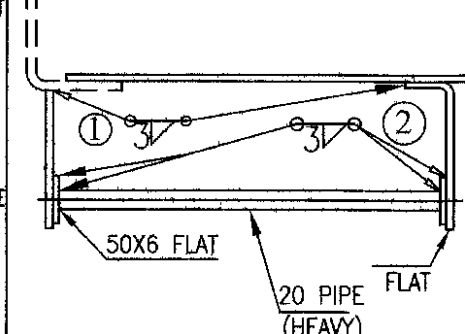
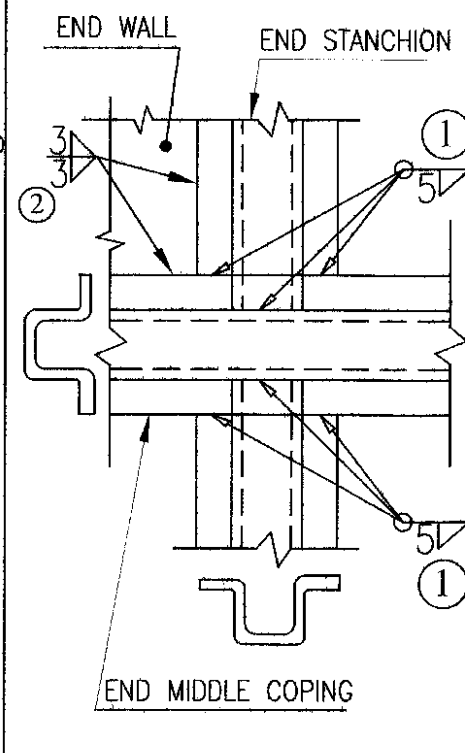
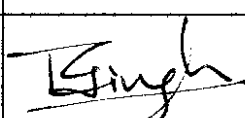
WD-WPS-BOXNRM2/BOXNRHS-2024
(Superseded WD-WPS-BOXNR-2010, Rev.1)

SHEET NO. 3 OF 8

DIAGRAM	JOINT REFERENCE	SKETCH OF JOINTS	WELD PROCESS	WELD TYPE	WELD SIZE (M M)	ELECTRODE/ WIRE SIZE (M M) *	ELECTRODE/ WIRE/FLUX SPECIFICATION	No. OF PASS	CURRENT/ VOLTAGE	POLARITY	WELD POSITION	WELD SEQUENCE & REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
RDSO. DRG. NO. WD - 07001-S-08 (BODY SIDE ARRANGEMENT) 	① SECTION-AA SIDE TOP COPING TO SIDE SHEET IS:2062 E450 BR Cu TO IRS:M44		① GMAW	FILLET	3	1.2	Welding consumable should be used as per clause no. 2.2 of Section 'A'	1	As indicated by the Welding consumable manufacturer	DC(+)	H.V	THE SHIELDING GASES SHALL BE AS GIVEN IN TABLE-1, OF IRSM:46-03 FOR SOLID & FLUX CORED MIG/MAG WELDING FILLER WIRES OF DIFFERENT CLASSES.
	② SIDE SHEET TO SIDE STANCHION IRS:M44 TO IS:2062 E450 BR Cu		② GMAW	FILLET	3	1.2		1		DC(+)	FLAT	
	③ SIDE TOP COPING TO SIDE STANCHION IS:2062 E450 BR Cu TO IS:2062 E450 BR Cu		③ GMAW	FILLET	3	1.2		1		DC(+)	FLAT	
	SECTION-BB ① DOOR WAY CROSS BAR PRESSING TO DOOR WAY BACK PLATE IS:2062 E450 BR Cu TO IRS:M44		① GMAW	FILLET	3	1.2		2		DC(+)	H.V	
	② DOOR WAY BACK PLATE TO SIDE SHEET IRS:M44 TO IRS:M44		② GMAW	FILLET	3	1.2		1		DC(+)	FLAT	
	DETAIL AT-K ① SIDE STANCHION TO SIDE SHEET IS:2062 E450 BR Cu TO IRS:M44		① GMAW	DOUBLE FILLET	3	1.2		2		DC(+)	H.V	
	② DOOR WAY CROSS BAR PRESSING TO SIDE STANCHION IS:2062 E450 BR Cu TO IS:2062 E450 BR Cu		② GMAW	DOUBLE FILLET	3	1.2		2		DC(+)	H.V	
*FOR WELDING DIFFERENT MATERIAL, WELDING ELECTRODE/WIRE/ FLUX ETC. OTHER THAN SPECIFIED IN CLAUSE NO. 2.2 OF SECTION-A, REFER RDSO SPECIFICATION NO. G-72, REV. 3 (LATEST).			PREPARED BY	APPROVED BY	DATE	REV.NO.	PAGE NO.					
			A.K.KUSHVAHA		03-2024	NIL	PAGE NO. 16 OF 21					

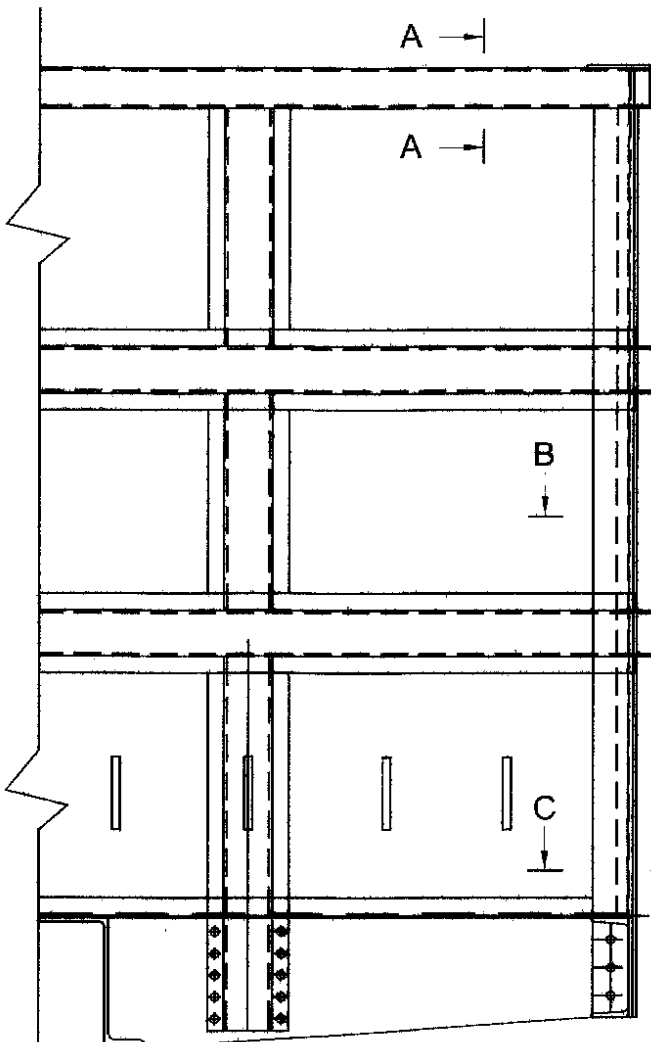
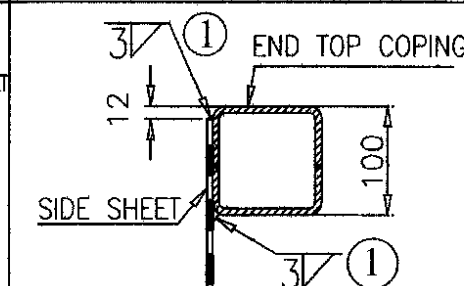
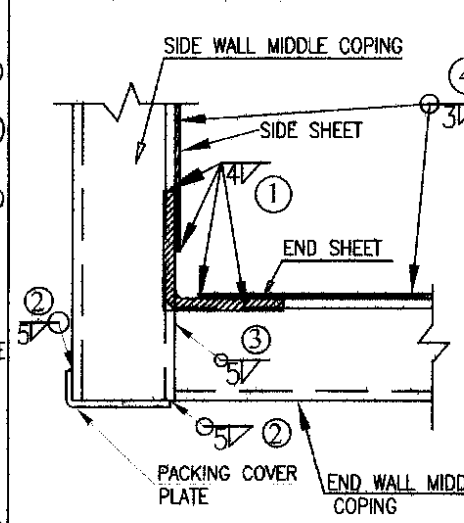
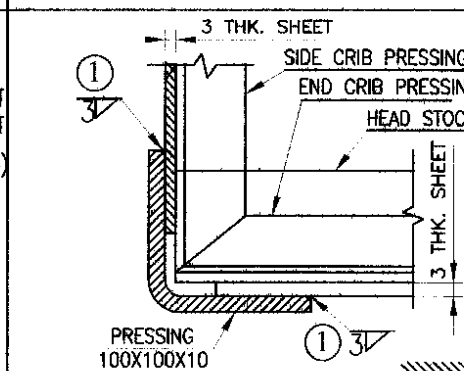
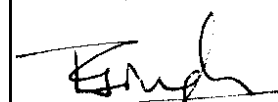
WD-WPS-BOXNRM2/BOXNRHS-2024
(Superseded WD-WPS-BOXNR-2010, Rev.1)

WELD POSITION	WELD SEQUENCE & REMARKS
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DIAGRAM	JOINT REFERENCE	SKETCH OF JOINTS	WELD PROCESS	WELD TYPE	WELD SIZE (M M)	ELECTRODE/ WIRE SIZE (M M) *	ELECTRODE/ WIRE/FLUX SPECIFICATION	No. OF PASS	CURRENT/ VOLTAGE	POLARITY	WELD POSITION	WELD SEQUENCE & REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
<div>RDSO. DRG. NO. WD - 07001-S-10 (BODY END ARRANGEMENT)</div> 	<div>DETAIL AT-X</div> <div>① HEAD STOCK TO LADDER BRACKET IS:2062 E250A Cu TO IS:2062 E250A Cu</div> <div>② LADDER BRACKET TO LADDER PIPE IS:2062 E250A Cu TO IS:1239 Pt1</div>		① GMAW	FILLET	3	1.2	Welding consumable should be used as per clause no. 2.2 of Section 'A'	1	As indicated by the Welding consumable manufacturer	DC(+)	H.V	THE SHIELDING GASES SHALL BE AS GIVEN IN TABLE-1, OF IRSM:46-03 FOR SOLID & FLUX CORED MIG/MAG WELDING FILLER WIRES OF DIFFERENT CLASSES.
		② GMAW	FILLET	3	1.2	1		DC(+)		H.V		
	<div>DETAIL AT-Y</div> <div>① MIDDLE TOP COPING TO END STANCHION IS:2062 E450 BR Cu TO IS:2062 E450 BR Cu</div> <div>② END SHEET TO END MIDDLE COPING & END STANCHION IRS:M44 TO IS:2062 E450 BR Cu</div>		① GMAW	FILLET	5	1.2		1		DC(+)	H.V	
		② GMAW	FILLET	3	1.2	1		DC(+)		FLAT		
	*FOR WELDING DIFFERENT MATERIAL, WELDING ELECTRODE/WIRE/ FLUX ETC. OTHER THAN SPECIFIED IN CLAUSE NO. 2.2 OF SECTION-A, REFER RDSO SPECIFICATION NO. G-72, REV. 3 (LATEST).			PREPARED BY	APPROVED BY	DATE		REV.NO.		PAGE NO.		
				A.K.KUSHVAHA		03-2024		NIL		PAGE NO. 18 OF 21		

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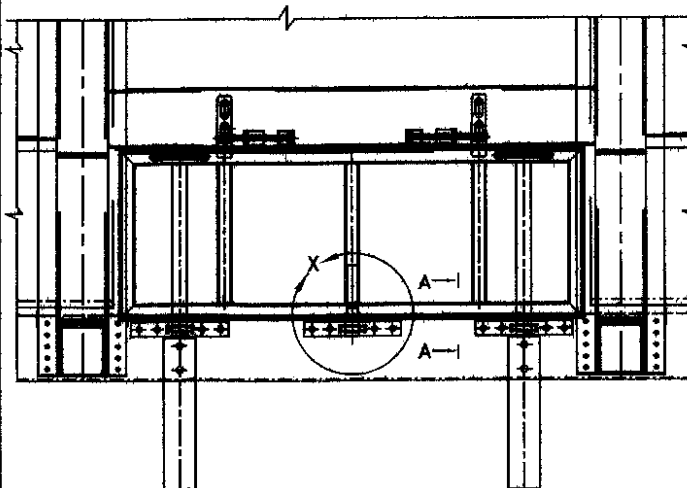
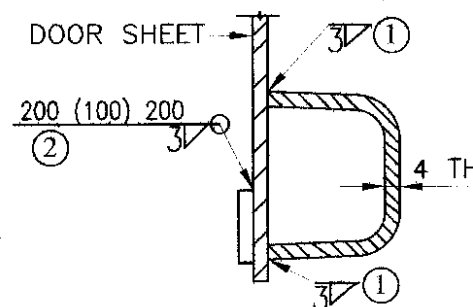
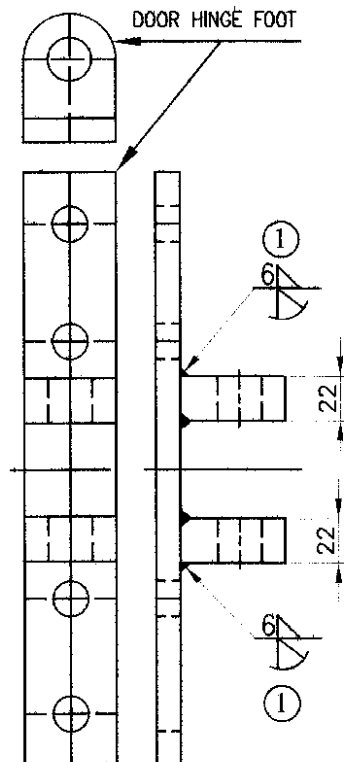
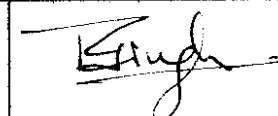
WELD POSITION	WELD SEQUENCE & REMARKS
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DIAGRAM	JOINT REFERENCE	SKETCH OF JOINTS	WELD PROCESS	WELD TYPE	WELD SIZE (M M)	ELECTRODE/ WIRE SIZE (M M) *	ELECTRODE/ WIRE/FLUX SPECIFICATION	No. OF PASS	CURRENT/ VOLTAGE	POLARITY	WELD POSITION	WELD SEQUENCE & REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
<p>RDSO. DRG. NO. WD - 07001-S-10 (BODY END ARRANGEMENT)</p> 	<p>SECTION-AA</p> <p>① END TOP COPING TO END SHEET IS:2062 E450 BR Cu TO IRS:M44</p>		① GMAW	FILLET	3	1.2	Welding consumable should be used as per clause no. 2.2 of Section 'A'	1	As indicated by the Welding consumable manufacturer	DC(+)	H.V	THE SHIELDING GASES SHALL BE AS GIVEN IN TABLE-1, OF IRSM-46-03 FOR SOLID & FLUX CORED MIG/MAG WELDING FILLER WIRES OF DIFFERENT CLASSES.
	<p>DETAIL-BB</p> <p>① CORNER STANCHION TO END SHEET AND SIDE SHEET (IRS:M44 TO IRS:M-44)</p> <p>② PACKING COVER PLATE TO SIDE & MIDDLE COPING IS:2062 E450 BR Cu TO IS:2062 E450 BR Cu</p> <p>③ SIDE MIDDLE COPING TO END MIDDLE COPING IS:2062 E450 BR Cu TO IS:2062 E450 BR Cu</p> <p>④ CORNER STANCHION TO END SHEET AND SIDE SHEET (IRS:M44 TO IRS:M-44)</p>		① GMAW	FILLET	4	1.2		1		DC(+)	H.V	
			② GMAW	FILLET	5	1.2		1		DC(+)	H.V	
			③ GMAW	FILLET	5	1.2		1		DC(+)	FLAT	
			④ GMAW	FILLET	3	1.2		1		DC(+)	H.V.	
	<p>DETAIL-CC</p> <p>① CORNER STANCHION TO END SHEET CORNER STANCHION TO SIDE SHEET (IRS:M44 TO IRS:M-44)</p>		① GMAW	FILLET	3	1.2		1		DC(+)	H.V	
<p>*FOR WELDING DIFFERENT MATERIAL, WELDING ELECTRODE/WIRE/ FLUX ETC. OTHER THAN SPECIFIED IN CLAUSE NO. 2.2 OF SECTION-A, REFER RDSO SPECIFICATION NO. G-72, REV. 3 (LATEST).</p>			PREPARED BY	APPROVED BY	DATE	REV.NO.	PAGE NO.					
			A.K.KUSHVAHA		03-2024	NIL	PAGE NO. 19 OF 21					

WELDING PROCEDURE FOR BOXNRM2/ BOXNRHS WAGONS

WD-WPS-BOXNRM2/BOXNRHS-2024
(Superseded WD-WPS-BOXNR-2010, Rev.1)

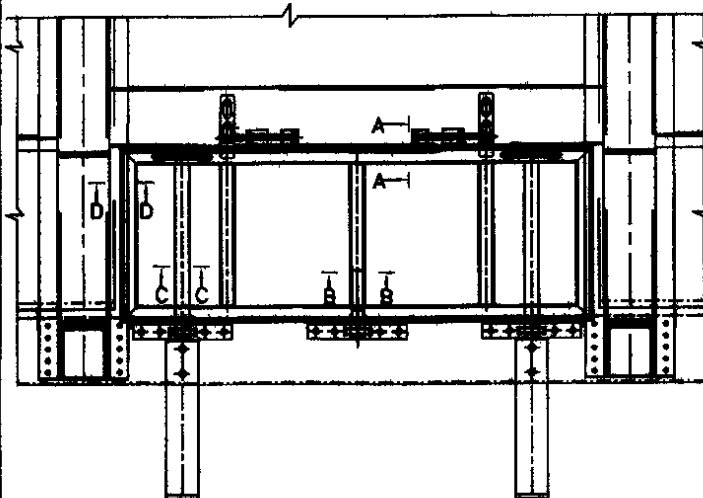
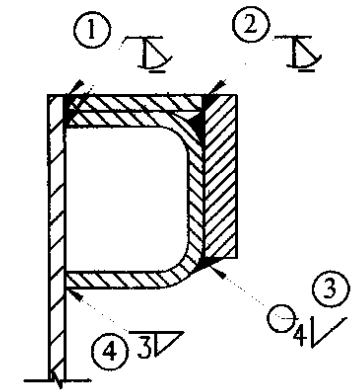
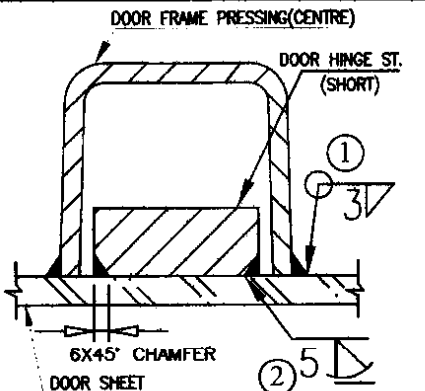
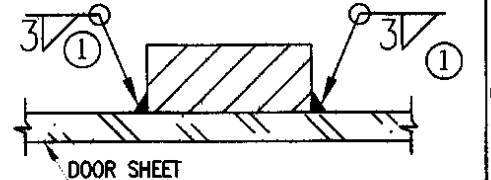
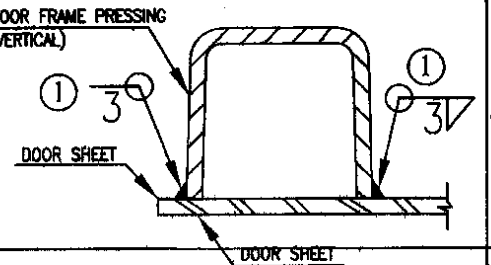
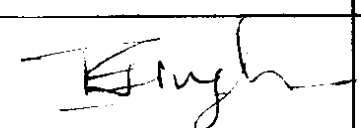
SHEET NO. 7 OF 8

DIAGRAM	JOINT REFERENCE	SKETCH OF JOINTS	WELD PROCESS	WELD TYPE	WELD SIZE (M M)	ELECTRODE/ WIRE SIZE (M M) *	ELECTRODE/ WIRE/FLUX SPECIFICATION *	No. OF PASS	CURRENT/ VOLTAGE	POLARITY	WELD POSITION	WELD SEQUENCE & REMARKS
1	2	3	4	5	6	7	8	9	10	11	12	13
RDSO. DRG. NO. WD-23027-S-01 (FLAP DOOR ARRANGEMENT) 	① SECTION-AA DOOR FRAME HORIZONTAL TO DOOR SHEET (IRS:M44 TO IRS:M-44)		① GMAW	FILLET	3	1.2	Welding consumable should be used as per clause no. 2.2 of Section 'A'	1	As indicated by the welding consumable manufacturer	DC(+)	H.V	THE SHIELDING GASES SHALL BE AS GIVEN IN TABLE-1, OF IRSM:46-03 FOR SOLID & FLUX CORED MIG/MAG WELDING FILLER WIRES OF DIFFERENT CLASSES.
	② PACKING PLATE TO DOOR SHEET (IRS:M44 TO IRS:M-44)		② GMAW	INTERMITTENT	3	1.2		1		DC(+)	H.V	
	DETAIL AT 'X' DOOR HINGE FOOT (IRS:M44 TO IRS:M-44)		① GMAW	SINGLE BEVEL FILLET	6	1.2		2		DC(+)	H.V	
*FOR WELDING DIFFERENT MATERIAL, WELDING ELECTRODE/WIRE/ FLUX ETC. OTHER THAN SPECIFIED IN CLAUSE NO. 2.2 OF SECTION-A, REFER RDSO SPECIFICATION NO. G-72, REV. 3 (LATEST).			PREPARED BY	APPROVED BY	DATE	REV.NO.	PAGE NO.					
			A.K.KUSHVAHA		03-2024	NIL	PAGE NO. 20 OF 21					

WELDING PROCEDURE FOR BOXNRM2/ BOXNRHS WAGONS

WD-WPS-BOXNRM2/BOXNRHS-2024
(Superseded WD-WPS-BOXNR-2010, Rev.1)

SHEET NO. 8 OF 8

DIAGRAM	JOINT REFERENCE	SKETCH OF JOINTS	WELD PROCESS	WELD TYPE	WELD SIZE (M M)	ELECTRODE/ WIRE SIZE (M M) *	ELECTRODE/ WIRE/FLUX+ SPECIFICATION	No. OF PASS	CURRENT/ VOLTAGE	POLARITY	WELD POSITION	WELD SEQUENCE & REMARKS			
1	2	3	4	5	6	7	8	9	10	11	12	13			
<div>RDSO. DRG. NO. WD-23027-S-01 (FLAP DOOR ARRANGEMENT)</div> 	① SECTION-AA DOOR FRAME HORIZONTAL TO DOOR SHEET & FLAT TO DOOR SHEET (IRS:M44 TO IRS:M-44)		①&② GMAW	SINGLE BEVEL BUTT	---	1.2	Welding consumable should be used as per clause no. 2.2 of Section 'A'	2	As indicated by the Welding consumable manufacturer	DC(+)	H.V	THE SHIELDING GASES SHALL BE AS GIVEN IN TABLE-1, OF IRSM:46-03 FOR SOLID & FLUX CORED MIG/MAG WELDING FILLER WIRES OF DIFFERENT CLASSES.			
	② PACKING PLATE TO FLAT (IRS:M44 TO IRS:M-44)		③ GMAW	FILLET	4	1.2		1		DC(+)	H.V				
	③ DOOR FRAME HORIZONTAL TO PACKING PLATE (IRS:M44 TO IRS:M-44)		④ GMAW	FILLET	3	1.2		1		DC(+)	H.V				
	④ DOOR FRAME PRESSING HORIZONTAL TO DOOR SHEET (IRS:M44 TO IRS:M-44)		① GMAW	FILLET	3	1.2		1		DC(+)	FLAT				
	① SECTION-BB DOOR FRAME PRESSING (CENTRE) TO DOOR SHEET (IRS:M44 TO IRS:M-44)		② GMAW	SINGLE BEVEL BUTT	5	1.2		2		DC(+)	H.V				
	② DOOR HINGE STRAIGHT (SHORT) TO DOOR SHEET (IS:2062 E250A Cu TO IRS:M-44)		① GMAW	FILLET	3	1.2		1		DC(+)	FLAT				
	① SECTION-CC DOOR HINGE STRAIGHT (LONG) TO DOOR SHEET (IS:2062 E250A Cu TO IRS:M-44)		① GMAW	FILLET	3	1.2		1		DC(+)	FLAT				
	① SECTION-DD DOOR FRAME PRESSING (VERT.) TO DOOR SHEET (IRS:M44 TO IRS:M-44)		① GMAW	FILLET	3	1.2		1		DC(+)	FLAT				
*FOR WELDING DIFFERENT MATERIAL, WELDING ELECTRODE/WIRE/ FLUX ETC. OTHER THAN SPECIFIED IN CLAUSE NO. 2.2 OF SECTION-A, REFER RDSO SPECIFICATION NO. G-72, REV. 3 (LATEST).			PREPARED BY		APPROVED BY	DATE	REV.NO.	PAGE NO.							
			A.K.KUSHVAHA			03-2024	NIL	PAGE NO. 21 OF 21							