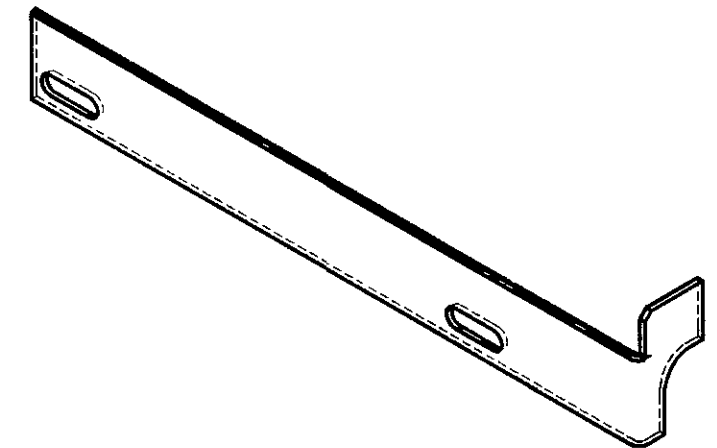
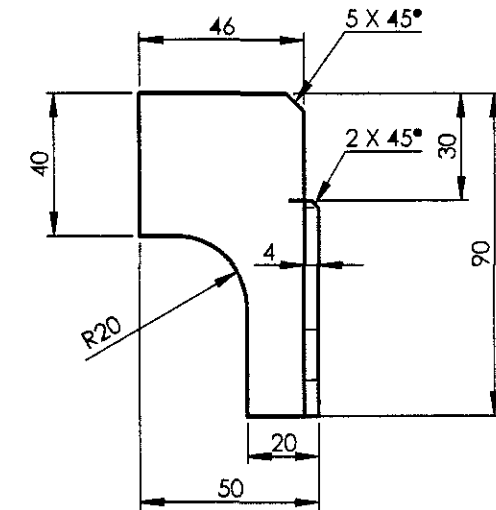


ANY MANUAL ALTERATION SHALL AUTOMATICALLY RENDER THIS DRAWING INVALID. WELDING SYMBOLS ARE AS PER EN ISO 2553.  
WEIGHT GIVEN IN DRAWING IS FOR INDICATIVE PURPOSE ONLY

REVISIONS			
ALT.	ZONE	DESCRIPTION	APPROVED & DATE

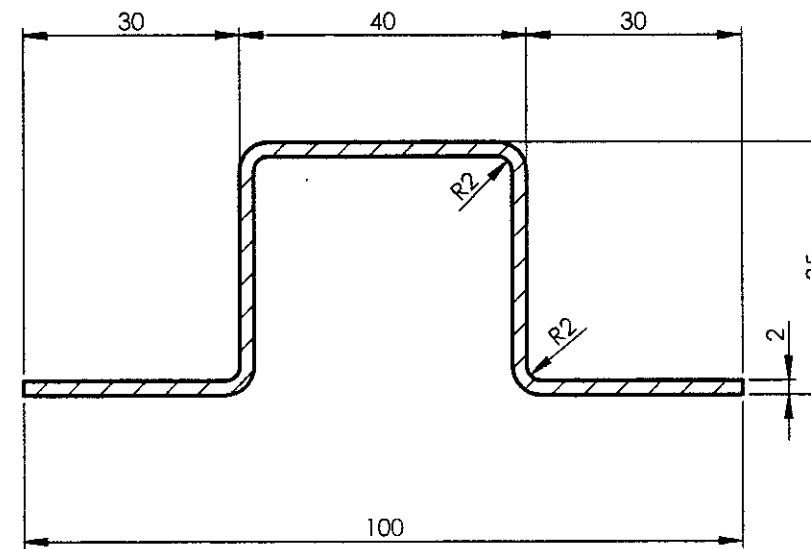
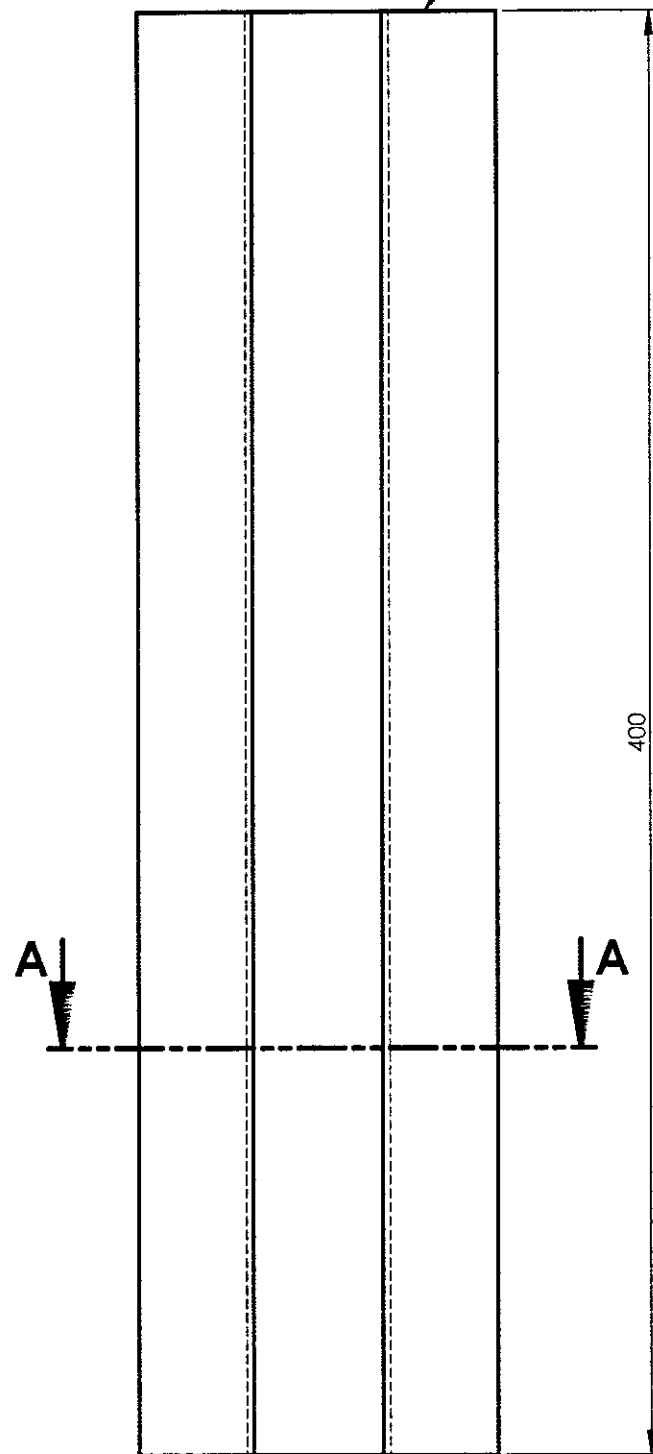


	07-12-2022	
DATE OF LATEST ALT.	DATE OF FIRST ISSUE	AME/SME

AAJ14077

▽ ROUGH MACHINED	①1 ROUGH CLEANED
▽▽ FINISH MACHINED	①1b BURRS REMOVED
▽▽▽ FINE FINISH MACHINED	①8 CHAMFERED

REVISIONS			
ALT.	ZONE	DESCRIPTION	APPROVED & DATE

SECTION A-A  
SCALE 1 : 1

1	HAT SUPPORT	2x154x400	1		RDSO SPEC C- K201 X2 Cr Ni 12	1.03	
QTY	DESCRIPTION	DIMENSIONS	ITEM NO.	REF. DRGS	MATL.SPEC.	WT/UNIT IN KGS	REMARKS
GROUP: 1-4		SURFACE AREA IN Sq.m.:			WT/ASSY IN Kgs:		
HAT SUPPORT					SCALE 1:5	SSE/D	
						CHD	
					ALT.	ALTD	
						DRN	ARUN S
INDIAN RAILWAY STANDARDS  INTEGRAL COACH FACTORY, CHENNAI - 600038				SHEET 1 OF 1			
					AAJ14077		A3

ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED. FOR UNTOLERANCED DIMENSIONS AND ROUGHNESS VALUES, REFER DRAWING NO ICF/STD-9-0-001.  
ANY MANUAL ALTERATION SHALL AUTOMATICALLY RENDER THIS DRAWING INVALID. WELDING SYMBOLS ARE AS PER EN ISO 2553.  
WEIGHT GIVEN IN DRAWING IS FOR INDICATIVE PURPOSE ONLY

REF.DRG.NO.-

-	01-11-23	
DATE OF LATEST ALT	DATE OF FIRST ISSUE	AME/SME

AAJ14078

▽ ROUGH MACHINED

① ROUGH CLEANED

▽▽ FINISH MACHINED

①b BURRS REMOVED

▽▽▽ FINE FINISH MACHINED

①8 CHAMFERED

REVISIONS

ALT.

ZONE

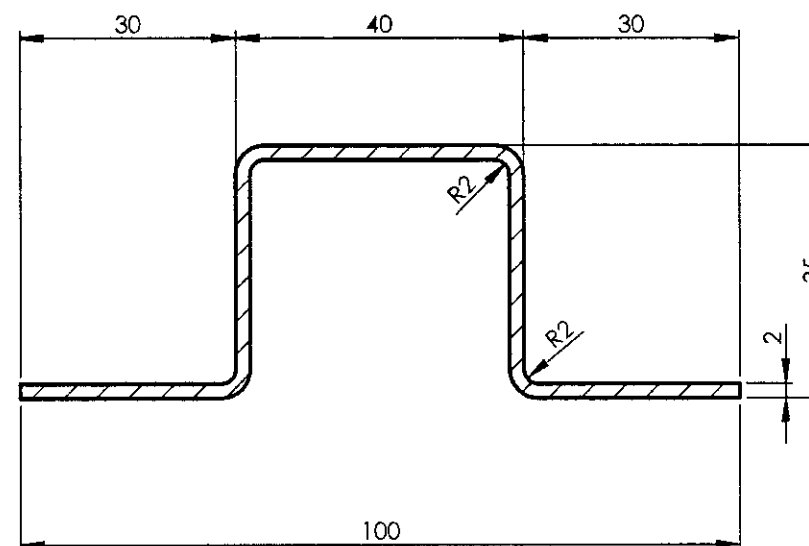
DESCRIPTION

APPROVED &  
DATE

1

365

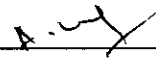
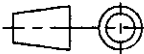
A | A

SECTION A-A  
SCALE 1 : 1

ALL DIMENSIONS ARE IN mm UNLESS OTHERWISE SPECIFIED. FOR UNTOLERANCED DIMENSIONS AND ROUGHNESS VALUES, REFER DRAWING NO ICF/STD-9-0001.  
ANY MANUAL ALTERATION SHALL AUTOMATICALLY RENDER THIS DRAWING INVALID. WELDING SYMBOLS ARE AS PER EN ISO 2553.  
WEIGHT GIVEN IN DRAWING IS FOR INDICATIVE PURPOSE ONLY

REF.DRG.NO.-

	01-11-23	
DATE OF LATEST ALT	DATE OF FIRST ISSUE	A.M.E./S.M.E.

1	HAT SUPPORT	2x154x365	1		RDSO SPEC C- K201 X2 Cr Ni 12	0.94	
QTY	DESCRIPTION	DIMENSIONS	ITEM NO.	REF. DRGS	MATL.SPEC.	WT/UNIT IN KGS	REMARKS
GROUP: 1-4		SURFACE AREA IN Sq.m.:			WT/ASSY IN Kgs:		
HAT SUPPORT					SCALE	SSE/D	
					1:5	CHD	
					ALT.	ALTD	
						DRN	ARUN S
INDIAN RAILWAY STANDARDS  INTEGRAL COACH FACTORY, CHENNAI - 600038				SHEET 1 OF 1			
					AAJ14078		A3

फैक्स/Fax : 91-0522-458500  
तार : 'रेलमानक' लखनऊ  
टेलीग्राम : 'RAILMANAK', Lucknow  
टेलीफोन/Tele : 451200 (PBX)  
450567 (DID)



14  
भारत सरकार - रेल मंत्रालय  
अनुसंधान अभिकल्प और मानक संगठन  
लखनऊ - 226011  
Government of India-Ministry of Railways  
Research Designs & Standards Organisation  
Office of the CDE / Mech.



Note No. MC/STN/STL

14 FEB 2002

23/1  
Date : 21.01.2002

The General Manager (Mech)

स. डि. का. चेन्नै-600 038  
C F. CHENNAI-600 038

1. Central Railway, Mumbai CST, Mumbai - 400 001.
2. Eastern Railway, Fairlie Place, Kolkata- 700 001.
3. Northern Railway, Baroda House, New Delhi- 110 001.
4. North Eastern Railway, Gorakhpur - 273 011.
5. Northeast Frontier Railway, Maligaon, Guwahati- 11.
6. Southern Railway, Park Town, Chennai- 600 003.
7. South Central Railway, Rail Nilayam, Secundrabad- 500 371.
8. South Eastern Railway, Garden Reach, Kolkata - 700 043.
9. Western Railway, Churchgate, Mumbai- 400 020.
10. Integral Coach Factory, Chennai - 600 038
11. Rail Coach Factory, Kapoorthala -144 602
12. M/s BEML, Bangalore Complex, New Thippasandra, P.B.No.7501, Bangalore - 560 075.

Sub : Specification for Stainless steel sheets/plates for coaches of Indian Railways.

Please find enclosed on copy of the specification C-K201 for stainless steel sheets / plates for coaches of Indian Railways for your information and necessary action.

DA : As above

(Amitabh Sinha)  
For Director General/Carriage

Copy to :-

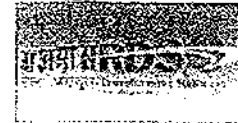
- 1) M/s Essar Steel Ltd., 27<sup>th</sup> KM Surat Hazira Road, Hazira-394 2/0 Distt. Surat
- 2) M/s.Lloyds Steel Industries (Steel Division), Wardha-422001(Maharashtra).
- 3) M/s.Ispat Industries Ltd., Geetpuram, Dolvi Taluka-Pen, Distt. Raigarh 402107(Maharashtra).
- 4) M/s.Tata Iron & Steel Company Ltd., Jamshedpur-831001(Jharkhand).
- 5) M/s.Steel Authority of India, Bokaro Steel Plant, Bokaro (Jharkhand).
- 6) M/s. Salem Steel Plant, Regional Marketing Office, Antriksh Bhawan, 11<sup>th</sup> Floor, 22- Kasturba Gandhi Marg, New Delhi-110 001

(Amitabh Sinha)  
For Director General/Carriage

Reg. no 2  
1280  
24/2

सु.अ.इ./यांत्रिक का क.क.  
Office of the CDE/

Government of India Ministry of Railways  
Research Designs & Standards Organisation  
Lucknow - 226 011  
DBO (0522) 2453115  
DBS (0522) 2465310



Date: 07.10.2015

MC/STL

Chief Mechanical Engineer,

1. Central Railway, Chhatrapati Shivaji Terminus, Mumbai - 400 001
2. Eastern Railway, Fairlie Place, Kolkata - 700 001
3. Northern Railway, Baroda House, New Delhi - 110 001
4. North Eastern Railway, Gorakhpur - 273 001
5. Northeast Frontier Railway, Maligaon, Guwahati - 781 011
6. Southern Railway, Park Town, Chennai - 600 003
7. South Central Railway, Rail Nilayam, Secunderabad - 500 071
8. South Eastern Railway, Garden Reach, Kolkata - 700 043
9. Western Railway, Churchgate, Mumbai - 400 020
10. East Central Railway, Hajipur - 844 101
11. East Coast Railway, Chandrasekharpur, Bhubaneswar - 751 016
12. North Central Railway, Allahabad - 211 001
13. North Western Railway, Jaipur - 302 006
14. South East Central Railway, Bilaspur - 495 004
15. South Western Railway, Hubli - 580 023
16. West Central Railway, Jabalpur - 482 008
17. Konkan Railway Corp. Ltd., Corporate Office, Belapur, New Mumbai-400 614
18. Rail Coach Factory, Hussainpura, Kapurthala-144 602
19. Integral Coach Factory, Chennai- 600 038.

Sub: Corrigendum No.1 of October, 2015 to RDSO Specification No. C-K 201 with Amendment No.-1 for 'Stainless Steel Sheets /Plates for Coaches of Indian Railways'.

Ref: CDE/ICF letter no. MD/SS/Fur./103B dated 05.10.2015.

CDE/ICF vide letter under reference raised issue that in Table-1 (Steel grades and their chemical composition as determined by ladle analysis), Table-2 (Mechanical properties of cold rolled products (6 mm thickness maximum)) and Table-3 (Guideline information on filler metals for arc welding) of RDSO specification no. C-K201 with Amendment no. 1, X2CrNi12(409M)(IRSM 44) has been specified which gives an impression that chemical composition and mechanical properties of specified designation/grade given in brackets are same to X2CrNi12. This creates confusion to inspecting agencies and suppliers whether they can be treated as equivalent or not. The matter has been examined and accordingly a Corrigendum No.1 of October, 2015 to RDSO Specification No. C-K 201 with Amendment No.-1 for 'Stainless Steel Sheets /Plates for Coaches of Indian Railways' has been issued as an extreme measure.

Please find enclosed herewith a copy of Corrigendum No.1 of October, 2015 to RDSO Specification No. C-K201 for 'Stainless Steel Sheets/Plates for Coaches of Indian Railways' for information and necessary action.

DA: As above

(Deependra Kumar)  
Director/Std./ Carriage  
For Director General (Carriage)

Copy to:

1. EDME (Coaching), Rail Bhawan, Railway Board, New Delhi-110 001.
2. EDME (Workshop), Rail Bhawan, Railway Board, New Delhi-110 001.
3. NCO/IRCA General Secretary office, Accounts Building, DRM Office Complex, State Entry Road, New Delhi-110 055.
4. Director, IRIMEE, Jamaipur, Munger, Bihar- 811 214.
5. ED, CAMTECH, Maharajpur, Gwalior, Madhya Pradesh-474 005.

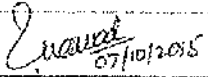
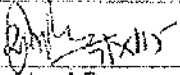
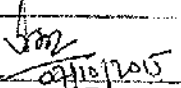
SSE/mg

For nia pl

27/10/15

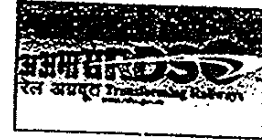
**Corrigendum No.1 of October, 2015 to RDSO Specification No. C-K 201,  
Amendment No.-1 for Stainless Steel Sheets /Plates for Coaches  
of Indian Railways.**

1. In Table-1 (STEEL GRADES AND THEIR CHEMICAL COMPOSITION AS DETERMINED BY LADLE ANALYSIS), X2 Cr Ni 12 (409M) (IRSM 44) shall be read as X2 Cr Ni 12.
2. In Table-2-(MECHANICAL PROPERTIES OF COLD ROLLED PRODUCTS (6 MM THICKNESS MAXIMUM)), X2 Cr Ni 12 (409M) shall be read as X2 Cr Ni 12.
3. In Table-3 (GUIDELINE INFORMATION ON FILLER METALS FOR ARC WELDING), X2 Cr Ni 12 (409M) (IRSM 44) shall be read as X2 Cr Ni 12.
4. In Table-3 (GUIDELINE INFORMATION ON FILLER METALS FOR ARC WELDING), X2 Cr Ni 12 (409M) shall be read as X2 Cr Ni 12.
5. In Annexure-II, "Laboratory Weld Corrosion Resistance Test For Ferritic Stainless Steel – Electric Arc Welded Samples only (409, 409 M)" shall be read as "Laboratory Weld Corrosion Resistance Test For Ferritic Stainless Steel – Electric Arc Welded Samples only (X2 Cr Ti 12 (409) and X 2 Cr Ni 12)".

Signature			
Name & Designation	Prepared By:- Waseem Ahmad JE/Std./Carriage	Checked By:- S. C. Meena Jt. Director/Std./Carriage	Approved By:- Deependra Kumar Director/Std./Carriage



Government of India Ministry of Railways  
Research Designs & Standards Organisation  
Lucknow - 226 011  
DID (0522) 2450115  
DID (0522) 2465310



## MC/STEEL

Date: 18.11.2013

Chief Mechanical Engineer,

1. Central Railway, Chhatrapati Shivaji Terminus, Mumbai - 400 001
2. Eastern Railway, Fairlie Place, Kolkata - 700 001
3. Northern Railway, Baroda House, New Delhi - 110 001
4. North Eastern Railway, Gorakhpur - 273 001
5. Northeast Frontier Railway, Maligaon, Guwahati - 781 011
6. Southern Railway, Park Town, Chennai - 600 003
7. South Central Railway, Rail Nilayam, Secunderabad - 500 071
8. South Eastern Railway, Garden Reach, Kolkata - 700 043
9. Western Railway, Churchgate, Mumbai - 400 020
10. East Central Railway, Hajipur - 844 101
11. East Coast Railway, Chandrasekharpur, Bhubaneswar - 751 016
12. North Central Railway, Allahabad - 211 001
13. North Western Railway, Jaipur - 302 006
14. South East Central Railway, Bilaspur - 495 004
15. South Western Railway, Hubli - 580 023
16. West Central Railway, Jabalpur - 482 008
17. Rail Coach Factory, Hussainpura, Kapurthala-144 602
18. Integral Coach Factory, Chennai - 600 038.

Sub: Amendment No. 1 of November 2013 to RDSO specification No. C-K201 for stainless steel sheets/plates for coaches of Indian Railways.

Ref: CDE's meeting held at ICF-Chennai on 15.12.2012

Railways and PUs are regularly procuring 1.7 mm thick stainless steel sheets to RDSO specification No. C-K 201. The permissible thickness deviation for 1.7mm stainless steel sheet was not specified in the table of clause no. 1.1 of Annexure-1 of RDSO specification No. C-K 201 mentioned under as Table-A. To include the permissible thickness deviation of 1.7 mm stainless steel sheet in the table of clause no. 1.1 of Annexure-1 of RDSO specification No. C-K 201 it has been decided to amend the RDSO specification No. C-K 201.

Table-A

Nominal thickness (mm)	Permissible thickness deviation (+/-mm)	Upper deviation in the normal width	Upper deviation in normal length.
1 & 1.25mm	0.06	1.5 mm	10 mm
2.00 mm	0.075	2 mm	10 mm
2.50 & 3 mm	0.10	2 mm	10 mm
4.00 mm	0.13	2 mm	10 mm
5 & 6 MM	0.20	5 MM	15 MM

As per Note (3) of table A 3.5 of ASTM A480/A480M-13 "For specified thickness other than those shown, the tolerances for the next higher thickness shall apply". Based on this, permissible thickness deviation of 1.7 mm stainless steel sheet has been clubbed with 2.00 mm in RDSO specification No. C-K 201.

C2

The above table amended as below and nominal thickness of 1.7mm stainless steel sheet has been clubbed with the dimensional tolerances of 2.00 mm thick stainless steel sheet.


Table-B

Nominal thickness (mm)	Permissible deviation (+/-mm)	thickness	Upper deviation in the normal width	Upper deviation in normal length.
1 & 1.25mm	0.06		1.5 mm	10 mm
1.7 & 2.00 mm	0.075		2 mm	10 mm
2.50 & 3 mm	0.10		2 mm	10 mm
4.00 mm	0.13		2 mm	10 mm
5 & 6 MM	0.20		5 MM	15 MM

The Amendment No. 1 of November 2013 to RDSO specification No. C-K 201 can also be browsed at RDSO website through following link.  
<http://www.rdsso.indianrailways.gov.in> → Carriage Directorate → Specification → Draft specification for comments

It is requested to send your valuable comments on draft amendment No. 1 of November 2013 to RDSO specification No. C-K 201 enclosed as Annexure-A at the earliest.

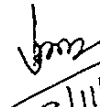
DA: As above

  
18/11/2013  
(Deependra Kumar)  
Director/Std./ Carriage  
For Director General (Carriage)

Copy to:

EDME (Coaching),  
Rail Bhawan,  
Railway Board, New Delhi- For kind comments on draft amendment No. 1 of November 2013 to RDSO specification No. C-K 201.

DA: As above

  
18/11/2013  
(Deependra Kumar)  
Director/Std./ Carriage  
For Director General (Carriage)

S/c



Annexure-A

Amendment No. 1 of November 2013 to RDSO Specification No. C-K 201 for  
Stainless Steel Sheets /Plates for Coaches of Indian Railways.

Table of the clause No. 1.1 of Annexure-1 of the specification to be read as follows:

Nominal thickness (mm)	Permissible thickness deviation (+/-mm)	Upper deviation in the normal width	Upper deviation in normal length.
1 & 1.25mm	0.06	1.5 mm	10 mm
1.7 & 2.00 mm	0.075	2 mm	10 mm
2.50 & 3 mm	0.10	2 mm	10 mm
4.00 mm	0.13	2 mm	10 mm
5 & 6 MM	0.20	5 MM	15 MM

Annexure-B

Comments of manufacturers of steel on Amendment No. 1 of November 2013 to RDSO Specification No. C-K 201 for Stainless Steel Sheets /Plates for Coaches of Indian Railways.

S. No.	Amendment No. 1 of November 2013 to RDSO Specification No. C-K 201 for Stainless Steel Sheets /Plates for Coaches of Indian Railways.	Comments of M/s Salem Steel Plant.	Comments of M/s Jindal Stainless Limited, Hisar.	RDSO's Remarks																												
1.	<table><tr><td colspan="4">Table of the clause 1.1 of Annexure-1 of the specification to be read as follows:</td></tr><tr><th>Nominal thickness (mm)</th><th>Permissible thickness deviation (+/-mm)</th><th>Upper deviation in the normal width</th><th>Upper deviation in normal length.</th></tr><tr><td>1.8 &amp; 1.25mm</td><td>0.06</td><td>1.5 mm</td><td>10 mm</td></tr><tr><td>1.7 &amp; 2.00 mm</td><td>0.075</td><td>2 mm</td><td>10 mm</td></tr><tr><td>2.50 &amp; 3 mm</td><td>0.10</td><td>2 mm</td><td>10 mm</td></tr><tr><td>4.00 mm</td><td>0.13</td><td>2 mm</td><td>10 mm</td></tr><tr><td>5 &amp; 6 mm</td><td>0.20</td><td>5 mm</td><td>15 mm</td></tr></table>	Table of the clause 1.1 of Annexure-1 of the specification to be read as follows:				Nominal thickness (mm)	Permissible thickness deviation (+/-mm)	Upper deviation in the normal width	Upper deviation in normal length.	1.8 & 1.25mm	0.06	1.5 mm	10 mm	1.7 & 2.00 mm	0.075	2 mm	10 mm	2.50 & 3 mm	0.10	2 mm	10 mm	4.00 mm	0.13	2 mm	10 mm	5 & 6 mm	0.20	5 mm	15 mm	This has reference to your email dated 18.11.2013 on the above subject. It is possible to implement the amendment No. 1 as proposed in your message	Noted the point 1. M/s Salem steel plant indicated by you. This is also OK with us if 1.7mm thick is included with 2.0 mm.	1. M/s Salem steel plant comments are in line to the proposed amendment No.1 hence is acceptable.  2. M/s Jindal stainless Limited comments are in line to the proposed amendment No 1 hence is acceptable.
Table of the clause 1.1 of Annexure-1 of the specification to be read as follows:																																
Nominal thickness (mm)	Permissible thickness deviation (+/-mm)	Upper deviation in the normal width	Upper deviation in normal length.																													
1.8 & 1.25mm	0.06	1.5 mm	10 mm																													
1.7 & 2.00 mm	0.075	2 mm	10 mm																													
2.50 & 3 mm	0.10	2 mm	10 mm																													
4.00 mm	0.13	2 mm	10 mm																													
5 & 6 mm	0.20	5 mm	15 mm																													

Annexure-C

Amendment No. 1 of December 2013 to RDSO Specification No. C-K 201 for  
Stainless Steel Sheets /Plates for Coaches of Indian Railways.

Table of the clause No. 1.1 of Annexure-1 of the specification to be read as follows:

Nominal thickness (mm)	Permissible thickness deviation (+/-mm)	Upper deviation in the normal width	Upper deviation in normal length.
1 & 1.25mm	0.06	1.5 mm	10 mm
1.7 & 2.00 mm	0.075	2 mm	10 mm
2.50 & 3 mm	0.10	2 mm	10 mm
4.00 mm	0.13	2 mm	10 mm
5 & 6 MM	0.20	5 MM	15 MM

SD/W/02/569  
28/04/2014

C-K201

**SPECIFICATION FOR STAINLESS STEEL  
SHEETS / PLATES FOR COACHES  
OF INDIAN RAILWAYS**

**JANUARY, 2002**

*Rec'd with 2050 ltr  
MC/STN/STL'dt  
23/1/02*

*22.1.02*

**ISSUED BY**

**RESEARCH DESIGNS AND STANDARDS ORGANISATION  
MINISTRY OF RAILWAYS  
MANAK NAGAR  
LUCKNOW - 226011**

*Reg no: 002  
Sl no: 1280  
22/2*

Price : \_\_\_\_\_

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**SPECIFICATION FOR STAINLESS STEEL**  
**SHEETS/PLATES FOR COACHES OF INDIAN RAILWAYS**

**1. FOREWORD**

This specification has been adopted for stainless steel sheets/plates to be used in the manufacture of passenger coaches. These are expected to provide desired mechanical properties and formability, ease of fabrication, adequate corrosion resistance against varying temperature, humidity and exposure to environmental conditions experienced during service and, therefore, required to be produced through established manufacturing process and quality assurance procedures.

This specification is issued under the fixed serial number IRS M-XXX-2001, the final number indicating the year of original adoption as specification or the year of last revision. This specification also draws reference to other specifications, wherever applicable.

**2. SCOPE**

This specification specifies the technical requirements and conditions of supply for the stainless steel sheets/plates having nominal thickness varying from 1.00 mm to 6.0 mm. The sheets/plates shall be supplied in width of 1250 mm max. in cut to length or in continuous coil form in trimmed conditions, unless otherwise specified in the order.

**3. MANUFACTURE**

Steel shall be produced in Electric furnace and refined by AOD/VOD secondary refining process to ensure freedom from harmful gases, inclusions and other undesirable constituents. Any other process adopted shall have the prior approval of the Purchaser.

**4. FREEDOM FROM DEFECTS**

Steel sheets/plates shall be cleanly rolled to the dimensions, weights and tolerances specified. Finished product shall be free from cracks, surface flaws, laminations, rough, jagged and imperfect edges, unevenness and other harmful defects detrimental to the end use. The sheets/plates shall be reasonably flat, cleanly sheared and truly squared to the specified dimensions. The Inspecting Officer or the Purchaser's representative shall be free to decide the method of detecting these defects. (The defects, its classification and detection method will be included in the approved QAP to be finalised at the time of order)

**5. CONDITIONS OF SUPPLY**

The material supplied shall be of guaranteed mechanical properties, formability, weldability and corrosion resistance.

While ordering, the specification designation, shall include material grade, designation, heat treatment condition, work hardening category, surface quality, surface treatment, etc. Unless otherwise specified, the austenitic stainless steel shall be supplied in solution annealed and descaled condition while ferritic stainless steel shall be supplied in annealed and descaled condition.

Optionally, only for specific areas of usage where surface protection is important, cold rolled sheets/coils may be procured with LDPE tape used as surface protection film ( $90 \pm 10$  microns).

The steel sheets/plates shall be manufactured, by hot rolling and subsequent cold rolling process, according to the requirements specified and shall be to the specified dimensions.

## 6 CHEMICAL COMPOSITION

### 6.1 Ladle Analysis

The ladle analysis of steel when carried out by the methods specified in IS:228/ASTM or by any other instrumental/chemical method approved by the Purchaser shall be as indicated in Table -1. In case of dispute, the method specified by the Purchaser shall be the reference method.

### 6.2 Product Analysis

Analysis of product composition from each cast shall be carried out by methods specified in IS:228/ASTM and the chemical variation from the ladle analysis shall be within the limits of permissible variation indicated in Table - 1a.

## 7. MECHANICAL PROPERTIES

### a. Tensile Test

- 7.11 Tensile test shall be carried out from each lot of 15 tonnes coil weight or part thereof belonging to the same cast.
- 7.12 Where sheets/plates or more than one thickness are rolled from the same cast, one tensile test shall be carried out from the material representing each thickness.
- 7.13 Tensile test shall be carried out both in longitudinal and transverse direction of rolling.
- 7.14 When tested in accordance with method of tensile testing specified in ASTM A240/370, the UTS, 0.2 % proof stress, and elongation percentage at fracture shall be according to stipulation in Table - 2.
- 7.15 If the fracture of the tensile test piece is outside the gauge length, the test shall be discarded and retest conducted. To facilitate this, sufficient numbers of test pieces shall be prepared in advance.



**b. Bend Test**

- i. Bend test shall be conducted from each lot of 15 tonnes of coil weight or part thereof of the same cast.
- ii. One test piece each shall be selected in longitudinal and transverse direction of rolling.
- iii. The rough edges or burrs arising from shearing may be removed by filing or grinding and machining. No other preparation shall be received by the test pieces.
- iv. Bend test shall be conducted in accordance with the method specified in ASTM A 370.
- v. The bend test specimens shall withstand being bent at ambient temperature in any direction through 180° around a mandrel or former of diameter equal to the material thickness without cracking on the outside convex surface of the bent portion.

**8. LOCATION OF TEST PIECES**

Samples for chemical analysis and test pieces for tensile and bend test shall be selected from the product so as to be representative of the lots.

**9. RETEST**

Should any of the test pieces first selected not pass any of the tests specified in this specification, two further samples shall be selected from the same lot in the same manner. Should the test pieces from both these additional samples pass, the material represented by the test samples shall be deemed to comply with the requirements of that particular test. Should the test pieces from either of these additional samples not pass, the material represented by the test samples shall be deemed to be not conforming to this specification.

## **10. DIMENSIONAL TOLERANCES**

Stainless steel sheets/plates shall be supplied to dimensions ordered. Permissible variation from size ordered have been listed in Annexure - 1.

## **11. SURFACE FINISH**

- 11.1 The sheets/plates supplied shall be well and cleanly rolled. Minor surface defects may be removed by grinding, provided the thickness is not reduced locally by more than 4% and the final thickness remains within the tolerance.
- 11.2 The surface finish(Ra Value) of the products shall not exceed 1.6 microns upto and including 2 mm thickness and 8 microns for thickness above 2 mm upto and including 6 mm.

## **12. WELDABILITY**

The sheets/plates in 2D & 2B finishes shall be suitable for metal arc welding using appropriate electrodes approved by RDSO or electrodes recommended by the Manufacturer. When butt welded with these electrodes, the weld and adjacent area shall not show any sign of cracking on macro examination (5X). Guidelines in respect of filler metals of arc welding is indicated in Table - 3. (Butt weld test shall be conducted for every 100 MT or part thereof in each thickness and grade). 3 specimens of 30 mm minimum width will be cut from the welded samples (100 to 150 mm each side) and ground flush on both sides for macro examination. If 2 out of 3 specimens pass, the lot is acceptable. In case all three specimens fail, the test will be repeated where if all 3 pass the lot is acceptable.

### 13. CORROSION RESISTANCE

The austenitic stainless steel sheet/coil/plate covered in this specification shall be subjected to corrosion resistance test in accordance with IS:10461 Part 2/ASTM A 262 Practice E for resistance against intergranular and intercrystalline corrosion and the results shall comply to Table -4.

- 13.1 The austenitic and ferritic stainless steel butt welded samples (as in para 12) will be subjected to corrosion resistance tests as in Annexure -2.

### 14. INSPECTION

- 14.1 The purchaser or his Inspecting Officer shall have free access to the works of the Manufacturer at all reasonable times and he shall be at liberty to inspect the manufacture at any stage and to reject material that does not conform to the stipulations of this specification.

#### 14.2 Testing facilities.

- 14.2.1.1 The Manufacturer shall supply the material required for testing free of charge and shall, at his own cost, furnish and prepare the necessary test pieces and supply labour and appliances for such testing as may be carried out on his premises in accordance with this specification. Failing to provide the facilities at his own works for making the prescribed test, the Manufacturer shall bear the cost of carrying out the tests in a laboratory/test house selected by the Inspecting Officer or the Purchaser.

- 14.2.1.2 All supplies of plate/sheet shall be furnished with a test certificate indicating chemical composition, mechanical properties, bend test, and corrosion tests results.

**15. MARKING**

Each product (Sheet/plate) shall be continuously marked with material specification, code of surface finish, cast number, the Manufacturer's name or trade mark and size of the product.

**16. PROTECTION AND PACKING**

- 16.1 Plates supplied shall be provided with reasonable packing, with metal strapping for handling during transit and storage.
- 16.2 Due care shall also be taken, to avoid mechanical damage and corrosion during transit.

**17. HEAT TREATMENT**

Stainless steel sheets covered in this specification shall be supplied in one of the heat treatment conditions mentioned in the order. Various heat treatment conditions for the sheets/plates are indicated in Table -5.

**ANNEXURE - I****TOLERANCES FOR STAINLESS STEEL SHEETS/PLATES****1.0 PERMISSIBLE DEVIATIONS :**

- 1.1 Standard size of cut sheet/plate will be 1250 mm width max. Permissible deviation of thickness, width and length shall be as per the table given below for various nominal thicknesses.

Nominal thickness(mm)	Permissible thickness deviation(+/- mm)	Upper deviation in the normal width	Upper deviation in normal length
1 & 1.25 mm	0.06	1.5 mm	10 mm
2.00 mm	0.075	2 mm	10 mm
2.50 & 3 mm	0.10	2 mm	10 mm
4.00 mm	0.13	2 mm	10 mm
5 & 6 mm	0.20	5 mm	15 mm

- 1.2 The maximum permissible deviation of straightness of the length edge (camber) is 5 mm on a length of 2500 mm.
- 1.3 The maximum permissible deviation of flatness is 12.7 mm in a length of 2500 mm.
- 1.4 The maximum permissible deviation of squareness is 1% of the sheet width.

**2 Measurement of Parameters :**

- 2.1 Thickness is to be checked on any point along the length of the sheet/plate at a distance of 20 mm from the edge.

**ANNEXURE -II**

**Laboratory Weld Corrosion Resistance Test For**  
**Ferritic Stainless Steel - Electric Arc Welded Samples only**  
**(409, 409M)**

- 1.0 One sample from each ordered quantity lot of 100MT or part there of in each thickness and grade is subjected to testing in a boiling mixture of 50% reagent grade hydrochloric acid and 50% water. Prepare the Hydrochloric acid solution by slowly adding reagent grade(approx. 37%) hydrochloric acid to an equal volume of distilled water.
  
- 2.0 Approximately 40-65mm long samples (3 numbers) in the direction of rolling with weld in centre across the direction of rolling and of 25 mm width shall be prepared from the welds. The sample may be one piece, which contains the weld and part of base metal to one side / both side of the weld. Alternatively, the sample may be two separate pieces with one containing the weld and a similar size section from the base metal. Remove all burrs and sharp edges by lightly grinding. Remove dust and grease by cleaning with soap and water or other suitable solvents. Then, place samples in the flask. It is not recommended to test more than four samples together, or to mix alloy types.  
  
The test container shall be 1L Erlenmeyer flask equipped with ground glass joints and an Allihncondenser. The volume of solution shall be approx. 700 ML.

- 3.0 Measure the thickness of the sample at five locations along the weld area and at five locations along the base-metal section. In both cases, take measurements at approximately equal intervals along the section lengths. Make these measurements with a sharp pointed micrometer having a least count of 0.01 mm.
- 4.0 Immerse the samples into the solution. Add boiling chips and bring to a boil. Allow the chips to remain boiling throughout the test. The time of testing shall be 45 minutes.
- 5.0 At the end of the test period, remove the samples from the solution, rinse with distilled water, and dry.
- 6.0 After exposure to the test solution, repeat the thickness measurement as in 3.0. If the thinning is not uniform across the width of the weld, then two sets of weld-metal measurement are required. One set of measurements is to be taken along the centerline of the weld. The second set of measurements is to be taken in the thinnest area of the weld.
- 7.0 Calculate the corrosion ratio, R, for both sections of the weld as follows :

$$R = \frac{W_o - W}{B_o - B}$$

Where :

W<sub>o</sub> = Average weld-metal thickness before the test

W = Average weld-metal thickness after the test

B<sub>o</sub> = Average base-metal thickness before the test.

B = Average base-metal thickness after the test.

8.0 An average corrosion ratio of 3 samples shall be 1.25 or less for the thinnest section of the weld is acceptable.

9.0 In case of Failure of the first set of 3 samples, duplicate set of 3 samples shall be tested, and if it passes the test, the material is acceptable.

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**ANNEXURE - III**

**LABORATORY WELD CORROSION RESISTANCE TEST FOR**  
**AUSTENITIC STAINLESS STEELS - ELECTRIC ARC WELDED**  
**SAMPLES ONLY**  
**(301, 304, 316, 321)**

- 1.0 One sample from each ordered quantity lot of 100 MT or part thereof in each thickness and grade is subjected to the copper - copper sulfate - 16% sulfuric acid test to determine the intergranular corrosion resistance of the welds.
- 2.0 Approximately 75 to 100 mm long samples or as required for the test, longitudinal to the direction of rolling with weld in centre across the direction of rolling of width about 25 mm shall be tested.

A suitable sample of an austenitic stainless steel weld embedded in copper shot or grindings, is exposed to boiling acidified copper sulfate solution for 24 hours. After exposure in the boiling solution, the specimen is bent and samples shall be observed with naked eye on the outer bend area for cracks.

- 3.0 A 1-L glass Erlenmeyer flask with a ground 45/50 glass joint and four-bulb (minimum) Allihn condenser with 45/50 ground glass joint are required.

- 4.0 Specimen supports - An open glass cradle capable of supporting the specimens and copper shot or grindings in the flask is recommended.
- 5.0 Heat Source - Any gas or electrically heated hot plate may be utilized for heating the test solution and keeping it boiling throughout the test period.
- 6.0 Dissolve 100 g of copper sulfate ( $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ ) in 700 ml of distilled water, add 100 ml of sulfuric acid ( $\text{H}_2\text{SO}_4$ , cp, sp gr 1.84), and dilute to 1000 ml with distilled water.
- 7.0 Electrolytic grade copper shot or grindings is to be used to cover all surfaces of the specimen whether it is in a vented glass cradle or embedded in a layer of copper shot on the bottom of the test flask.
- 8.0 The amount of copper used, assuming an excess of metallic copper is present, is not critical.
- 9.0 The copper shot or grindings may be reused if they are cleaned in warm tap water after each test.
- 10.0 Specimens obtained by shearing should have the sheared edges machined or ground off prior to testing. Care should be taken when grinding to avoid overheating or "burning".

- 11.0 Any scale on the specimens should be removed mechanically or chemically.
- 12.0 Each specimen should be degreased using a cleaning solvent such as acetone, alcohol, ether, or a vapor degreaser prior to being tested.
- 13.0 The volume of acidified copper sulfate test solution used should be sufficient to completely immerse the specimens.
- 14.0 As many as three specimens can be tested in the same container. It is ideal to have all the specimens in one flask to be of the same grade.
- 15.0 The test specimen(s) should be immersed in ambient test solution which is then brought to a boil and maintained boiling throughout the test period. Begin timing the test period when the solution reaches the boiling point.
- 16.0 The time of the test shall be 24 hours.
- 17.0 The test specimen with weld at centre shall be bent through  $180^\circ$  and over a diameter equal to the 4 times thickness of the specimen being bent. In no case shall the specimen be bent over a smaller radius or through a greater angle. The bending shall be such that the face side of the weld is seen outside.

18.0 The bent specimen shall be examined with naked eye on the outer side at welds. The appearances of cracks on the weld area indicate the presence of intergranular corrosion attack and are rejected.

Cracking that originates at the edge of the specimen and the appearance of deformation lines, wrinkles, or "orange peel" on the surface, without accompanying cracks, are not a cause of rejection.

19.0 In case the first sample tested fails, a duplicate sample shall be tested and if it passes, the material is acceptable.

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TABLE - 1, STEEL GRADES AND THEIR CHEMICAL COMPOSITION AS DETERMINED BY LADLE ANALYSIS

Material	C %	Mn%	Si %	S %	P %	Cr %	Mo %	Ni %	Others
Designation/ Grade									
<b>FERRITIC STEELS</b>									
X2 Cr Ti 12 (409)	≤ 0.03	1.0 max	1.0 max	0.030 max	0.040 max	10.5 to 12.5	-	-	Ti 6 x % C min upto 1.0 max
X2 Cr Ni 12(409M) (IRSM 44)	≤ 0.03	0.5 to 1.5	1.0 max	0.030 max	0.040 max	10.5 to 12.5	-	0.3 to 1.0	N-0.03 max
X6 Cr 17 (430)	≤ 0.08	1.0 max	1.0 max	0.030 max	0.040 max	16 to 18	-	-	-
<b>AUSTENITIC STEELS</b>									
X5 Cr Ni 18 10 (304)	≤ 0.07	2.0 max	1.0 max	0.030 max	0.045 max	17 to 19	-	8.5 to 10.5	-
X2 Cr Ni N 18 7 (301)	≤ 0.08	2.0 max	1.0 max	0.030 max	0.045 max	16 to 18	-	6 to 8	-
X6 Cr Ni Ti 18 10 (321)	≤ 0.08	2.0 max	1.0 max	0.030 max	0.045 max	17 to 19	-	9 to 12	Ti 5 x C% min upto 0.80 max
X5 Cr Ni Mo 17 12 2 (316)	≤ 0.07	2.0 max	1.0 max	0.030 max	0.045 max	16 to 18	2.0 to 2.5	10.5 to 13.5	-

**TABLE - 1a****CHEMICAL COMPOSITION VARIATION FROM LADLE  
ANALYSIS**

Element	Limits of ladle analysis Percent		Permissible Deviation Percent
	Over	Up to and including	
C	-	0.030	+ 0.005
	0.030	0.200	± 0.010
	0.200	0.600	± 0.020
	0.600	1.200	± 0.030
Cr	10.0	15	± 0.150
	15.0	20	± 0.200
	20.0	30	± 0.250
Mo	-	0.60	± 0.030
	0.60	1.75	± 0.050
	1.75	3.00	± 0.100
Ni	-	1.00	± 0.030
	1.00	5.00	± 0.070
	5.00	10.0	± 0.100
	10.0	20.0	± 0.150
	20.0	30.0	± 0.200