

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 ± 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 :

Wo = Average weld-metal thickness before the test
W = Average weld-metal thickness after the test
Bo = 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.

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 (H_2SO_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° 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.

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									
FERRITIC STEELS									
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	-	-	-
AUSTENITIC STEELS									
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

TABLE - 2**MECHANICAL PROPERTIES OF COLD ROLLED PRODUCTS
(6 MM THICKNESS MAXIMUM)**

Designation/ Grade	Condition	Min. Yield Stress or 0.2% proof stress (N/mm ²) transverse	Tensile Strength (N/mm ²) Transverse	Min. Elongation at fracture (%) at 50 mm gauge length
FERRITIC STEELS				
X2 Cr Ti 12(409)	2D/2B	220	390 to 560	20
X2 Cr Ni 12(409M)	2D/2B	320	450 to 650	20
X6 Cr 17(430)	2D/2B	270	450 to 600	20
AUSTENITIC STEELS				
X5 Cr Ni 18 10(304)	2D/2B	235	550 to 750	40
	Work-hardened	350	700 min.	25
X2 Cr Ni N 18 7 (301)	2D/2B	350	600 to 900	40
	Work hardened	500	800 min.	20
X6 Cr Ni Ti 18 10 (321)	2D/2B	245	540 to 740	40
X5 Cr Ni Mo 17 12 2 (316)	2D/2B	255	550 to 700	40
Note : if the fracture of the tensile test piece is outside gauge length, the test shall be discarded and retest conducted. To facilitate this, sufficient number of test pieces shall be prepared.				

TABLE - 3

GUIDELINE INFORMATION ON FILLER METALS FOR ARC WELDING

Parent Metal A	Suitable filler metal (material No.) as specified in AWS	Parent Metal B					
		X2 Cr Ti 12 (409)	X2 Cr Ni 12 (409M)	X5 Cr Ni 18 10 (304)	X2 Cr Ni 18 7 (301)	X6 Cr Ni Ti 18 10 - (321)	X5 Cr Ni Mo 17 12 2 (316)
X2 Cr Ti 12 (409)	E 308L - 15	X	-	-	-	-	-
X2 Cr Ni 12 (409M)	E-308L-15	X	X	-	-	-	-
IRSM - 44							
X5 Cr Ni 18 10 (304)	E 308L - 15	X	X	X	-	-	-
X2 Cr Ni 18 7 (301)	E 308L - 15	X	X	X	X	-	-
X6 Cr Ni Ti 18 10 (321)	E 347 - 15	X	X	X	X	X	-
X5 Cr Ni Mo 17 12 2 (316)	E 316L - 15	X	X	X	X	X	X

Note that where grade x6 Cr 17 is to be welded, only the resistance welding process should be used. For welding any SS with M-41, use the corresponding SS electrode only as per table.

TABLE - 4

**RESISTANCE TO INTER CRYSTALLINE CORROSION
(FOR 2D & 2B FINISH MATERIAL)**

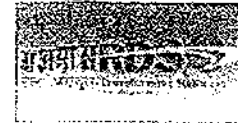
Material		Resistance to inter crystalline corrosion (tested as per ASTM A262 Practice E)	Smallest inside bending (180°) radius for a thickness, 't' not exceeding 6 mm
Designation	Grade	In the condition of supply	
X5 Cr Ni 18 10	304	Yes	1 t
X2 Cr Ni N 18 7	301	Yes	1 t
X6 Cr Ni Ti 18 10	321	Yes	1 t
X5 Cr Ni Mo 17 12 2	316	Yes	1 t

TABLE -5**HEAT TREATMENT CONDITION**

COLD ROLLED PRODUCTS		
2D	Cold rolled annealed and pickled.	Uniform Dull finish for thickness of 5 and 6 mm.
2B	Cold rolled annealed, pickled and skin passed.	Smoother finish and thickness upto and including 4 mm.
No.4	Cold rolled, annealed, pickled, and polished with 120-150 grit abrasive.	Decorative finish. For thickness of 1.00 to 2.5 mm.

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Office of the CDE/

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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.

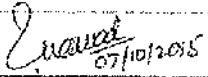
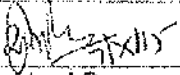
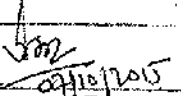
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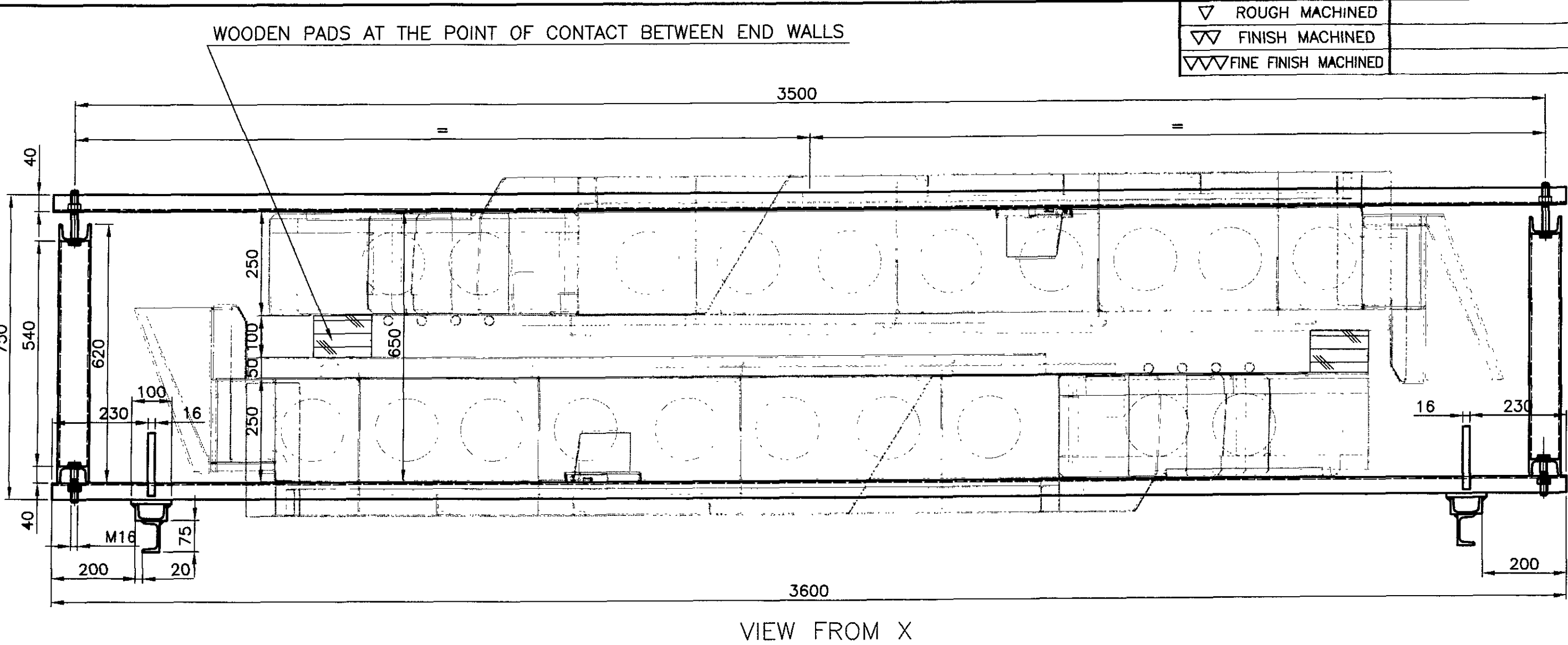
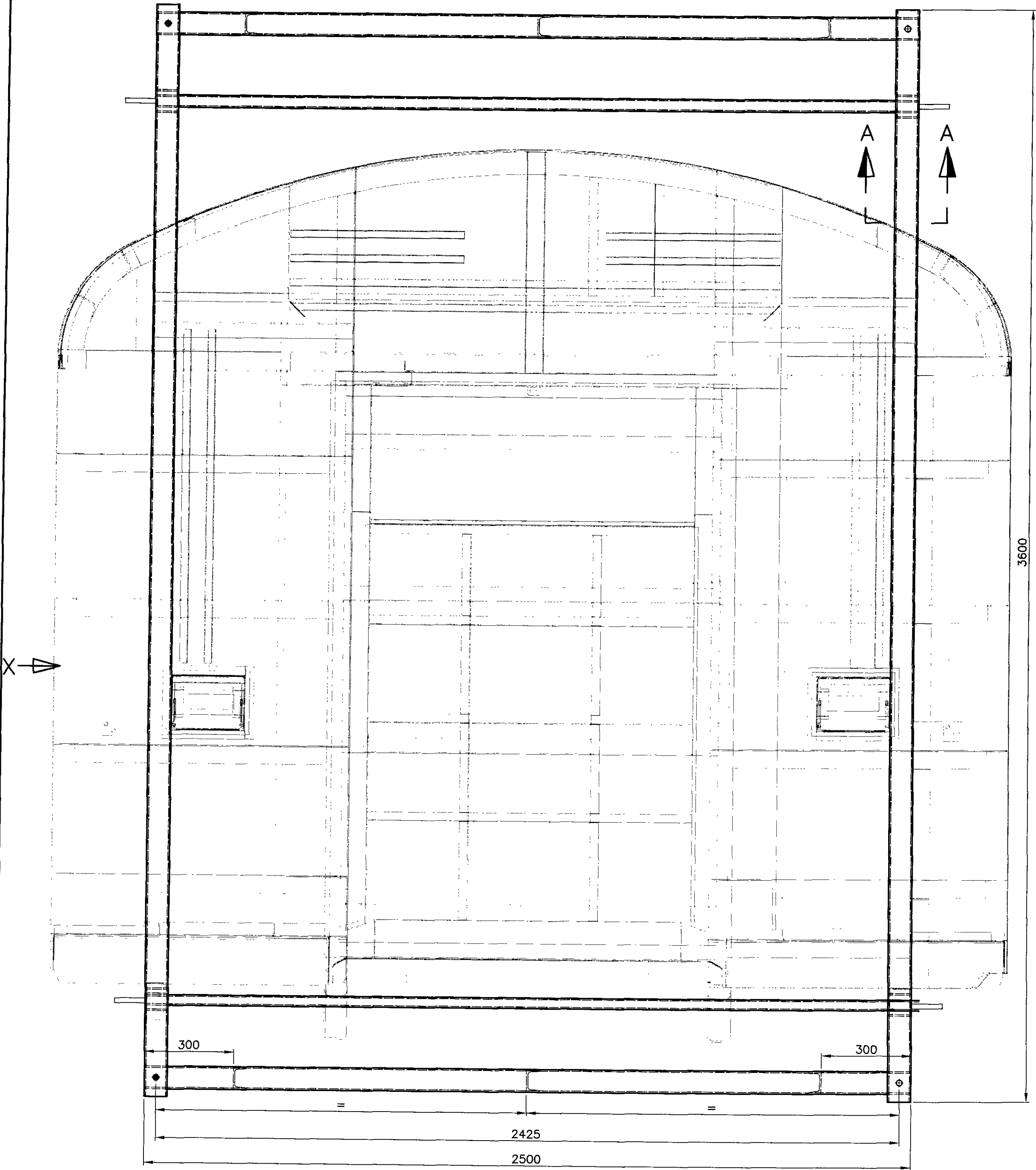
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27/10/15

**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



ALTERATIONS

Ⓢ

DATE:04-03-22

JOB NO.680/21-22

1.NOTE 12 ADDED.

Signature

KP

SSE/J&T

250

40

75

75

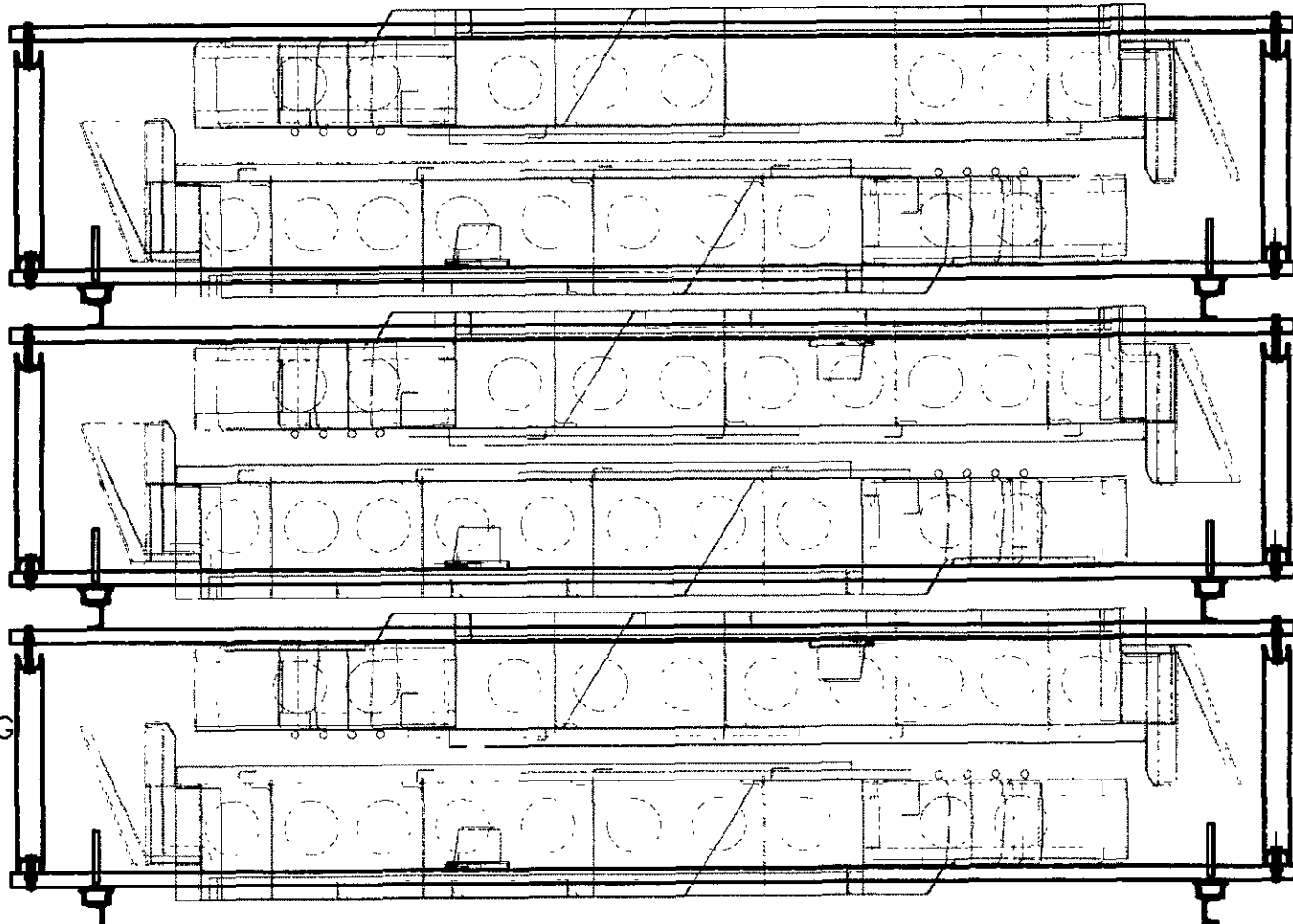
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SECTION AA

- NOTE:
1. FRAME TO BE FABRICATED FROM SUITABLE MS CHANNELS.
 2. FRAME SHOULD BE OF ADEQUATE STRENGTH FOR TRANSPORTING & LIFTING.
 3. DIMENSIONS SHOWN ARE INDICATIVE ONLY.
 4. PACKING SHALL BE SUCH THAT END WALL SHALL NOT GET DAMAGED DURING TRANSPORTING AND LIFTING.
 5. END WALL TO BE HELD TIGHT WITH THE FRAME WITH STEEL OR POLYESTER BANDS.
 6. PACKING CONDITION SHOWN IS FOR GUIDANCE ONLY.
 7. SUITABLE NAME PLATE INDICATING SUPPLIER NAME, MONTH & YEAR OF MANUFACTURE TO BE FIXED ON THE FRAME.
 8. PACKING SHOULD BE OPENED AT THE TIME OF ASSEMBLY.
 9. THE COMPONENT SHOULD REMAIN IN PACKED CONDITION DURING THE STORAGE.
 10. SUITABLE RIBS TO BE WELDED TO THE CHANNELS TO WITHSTAND THE LOAD.
 11. END WALL FOR ONE COACH SET TO BE PACKED IN ONE FRAME & NECESSARY WOODEN PACKING TO BE PROVIDED IN BETWEEN TWO END WALLS.
 12. ALL THREADED HOLES OF ENDWALL TO BE PLUGGED WITH PLASTIC DUMMY SCREWS TO AVOID DAMAGE OF THREADS.



SCHEMATIC VIEW SHOWING END WALL IN STACKED CONDITION

THE PACKING FRAMES/STRUCTURES ARE TO BE TAKEN BACK BY THE SUPPLIER FROM ICF PREMISES AFTER THE COMPONENTS ARE TAKEN FOR PRODUCTION

ASSEMBLY DRAWINGS		
DATE	SME/D	AME/J&T

NO.	OFF	DESCRIPTION & DIMENSIONS	ITEM	REF. DRGS.	MAT.& SPEC	REMARKS
		CADFILE:-\\10.53.12.205\JIG&TOOL\J&T-CAD\SKT\SKT_1809_a.DWG			SUPERSEDED BY:	
PACKING CONDITION FOR LHB END WALL						SUPERSEDES:
SCALE		SSE/D	CHD	Signature		
1:20		DRN		T.Rajashkar		
1:10		CAD				
ALT		g				
INTEGRAL COACH FACTORY CHENNAI-38						
ICF/J&T/SK-1809						

UNLESS OTHERWISE STATED IN THE DRAWINGS, DIMENSIONS OVER TO OR BETWEEN SURFACES FOR WHICH NO LIMITS ARE GIVEN SHALL BE WITHIN THE TOLERANCES GIVEN BELOW.													
DEVIATIONS FOR LINEAR DIMENSIONS ALL DIMENSIONS IN MILLIMETRES													
CLASS OF DEVIATION		RANGE OF NOMINAL DIMENSIONS											
	ABOVE	0.5	3	6	30	120	315	1000	2000	4000	8000	12000	16000
	UPTO AND INCLUDING	3	6	30	120	315	1000	2000	4000	8000	12000	16000	20000
MACHINED		±0.1	±0.1	±0.2	±0.3	±0.5	±0.8	±1.2	±2	±3	±4	±5	±6
FABRICATED		-	±0.2	±0.5	±0.8	±1.2	±2	±3	±4	±5	±6	±7	±8

ROUGHNESS VALUE												
SYMBOL	▽▽▽▽			▽▽▽			▽▽			▽	~	
Ra IN MICRONS	0.025	0.05	0.1	0.2	0.4	0.8	1.6	3.2	6.3	12.5	25	50
ROUGHNESS GRADE	N1	N2	N3	N4	N5	N6	N7	N8	N9	N10	N11	N12

DEVIATIONS FOR ANGULAR DIMENSIONS ALL DIMENSIONS IN MILLIMETRES								
CLASS OF DEVIATION	PERMISSIBLE VARIATIONS ON LENGTH OF SHORTER SIDE OF ANGLE							
	UPTO 10		OVER 10 TO 50		OVER 50 TO 120		OVER 120	
	DEGREE	mm PER 100 mm	DEGREE	mm PER 100 mm	DEGREE	mm PER 100 mm	DEGREE	mm PER 100 mm
MACHINED	±1°	±1.8	±30'	±0.9	±20'	±0.6	±10'	±0.3
PRESSED/ FABRICATED	±1°30'	±2.6	±50'	±1.5	±25'	±0.7	±15'	±0.4

ALTERATIONS		
①	2/99	
TITLE OF DRG. AND NOTE REVISED.		
SD	-Sd-	SME/DSS
②	01/2001	
DEVIATIONS FOR ANGULAR DIMENSIONS TABLE ADDED. DRG. REDRAWN IN CAD.		
-Sd-	31-01-2001	
SSE/D		SME/BD
③	10/2020	
NOTE-2 ADDED.		
SSE/D		SME/DI

- NOTE:**
1. TOLERANCE MENTIONED HERE ARE APPLICABLE WHEREVER SPECIFIC TOLERANCES ARE NOT INDICATED IN THE DRAWINGS.
2. THIS DRAWING COVERS THE GENERAL TOLERANCES REQUIREMENTS OF EN 15085.

QTY		DESCRIPTION & DIMENSION	ITEM	REF.DRGS	MAT.SPEC	WEIGHT/UNIT	REMARKS
1	GROUP:	OPEN TOLERANCES AND SURFACE FINISH				SUPERSEDED BY:	
						SUPERSEDES: ICF/STD-9-0-001 Alt.a/-	
						SCALE	SSE/D
						CHD	H. K. M. R. M.
						ALTD	10/20
						DRN	R. Muralidar
						Alpha Alt:- c	
						INTEGRAL COACH FACTORY CHENNAI-38	
						ICF/STD-9-0-001	

ASSEMBLY DRAWINGS		28-10-2020			
		0 Num. Alt.	DATE OF LATEST ALT	DATE OF FIRST ISSUE	AME/SME

DATA CODE NO.	INDIAN RAILWAY STANDARDS	SHEET
140		1 OF 1

PART LIST FOR CLASSIFICATION LEVELS (CL) AS PER EN 15085-2

CL1 PARTS	CL2 PARTS	CL3 PARTS
<u>Bogies</u> Bogie frames, Bogie bolsters, headstock, transoms, nose suspension brackets) Wheel set mountings, axle boxes, spring supports, shock absorbers, vibration dampers. Brake equipment (eg.magnetic track brake, brake rods, brake triangles, brake cylinders, brake cross beams, levers)	Payload container for non-dangerous materials	Cranks and levers for various operations
	other transport containers	striking plates
	Internal parts of passenger coaches(partitions, walls, doors, panelling)	Equipment boxes and switch cabinets in rail vehicles(including gear boxes and consoles for hand brake operation, without supporting frame)
	supporting frame for internal parts (electrical, air-conditioning and compressed air installations)	holders for index plates
<u>Bodyshell components(eg. underframes, structures)</u> underframes(solebars, cross bearers, modular frames, Body Bolster, headstock) vehicle body (front walls/Nose cone, side walls, roof, end walls) Buffers & drawgear	Driving cab equipment	wheel scotches
	Lavatory parts and water containers with installations	covers for freight wagons(heat protection on tank wagons)
	Sliding doors in vehicles including runways	steps, handrails, railings on rail vehicles (Inside the Coach)
	Fastenings for brake pipes	seating frames
Supporting frames for heavy components (eg. traction units, pantographs) Supporting frames for external equipment parts (eg. tanks, electrical, air-conditioning and air containers) Supporting frames for heavy duty vehicles including road/rail vehicles Welded components for drag transmission from bogie to vehicle (bolster)	Non-self supporting equipment boxes underneath the base frame(without supporting frame)	window frames
	Gear boxes and consoles for hand brake operation	ventilation grills
	Steps, hand rails (including handrails in entry areas) and railings external to the vehicle	
	Machine room equipment(transformer casing, transformer suspension, engine suspension, transmission suspension, attachment for traction motor, instrument racks); if they are assembled outside of the carbody	
finishing welding of castings within components indicated above external fuel tanks pressure gas tanks, tanks and containers of rail vehicles with test pressure containers for dangerous materials	Exhaust pipes	
	Entrance doors, end doors, foot step	
	self-supporting equipment boxes and underfloor containers(fresh water and waste-water containers)	
	External machine equipement parts(transformer, engine, transmission suspension)	
	Roof construction(pantograph, panelling)	
	Power transmission parts (traction coupling, cardan shafts)	
	Traversers(ie. car wagon)	
	Turning and tipping equipment	
	Obstacle deflectors	
	Stanchions and lashing rings	
	Compressed-air reservoirs for rail vehicles	
	Pressurised pipes	
	Seat frame, hand holds and luggage racks	

GENERAL GUIDELINES FOR WELDING ELECTRODES/FILLER WIRES AND SHIELDING GASES
IN COACH FABRICATION (SEE NOTE-5)

Sl. No	Parent Material Used for fabrication	Welding Process	Electrode / Filler wire (Specification & Grade)	Shielding Gas designation & Composition	Fabrication component description
1	Mild steel (IS:2062 grade E250A, E250B0 & E250BR, E250C) with Mild steel	MMAW (111)	IRS M 28 – ‘A2’ Class (Eq – ER4211X of IS:814)	N.A.	Non critical mild steel components. Also for tack welding
2	Mild steel (IS:2062 grade E250C) with Mild steel		IRS M 28 – ‘A3 or A4’ Class (Eq – EB5326H2JX of IS:814)	N.A.	Bogie frames & bolsters
3	HSLA Steels & weathering steels like Corten steel (IRS M41) & EN 10025-5 steels with same material and with mild steels (IS: 2062)		IRS M 28 – ‘D’ Class (Eq – E8018 of AWS A 5.5)	N.A.	Sub-assembly parts of underframe, Bogie frame components
4	Stainless steel (SS 301, SS 301L, SS304, SS409M) with stainless steel (similar welding)		IRS M 28 – ‘M2’ Class (Eq – E308L of AWS A 5.4)	N.A.	SS partition frames,
5	Stainless steel (SS 316/SS 316L) with similar steel		IRS M 28 – ‘M3’ Class (Eq – E316 of AWS A 5.4)	N.A.	Water tank, Bio toilet parts and lavatory parts
6	Stainless steel (all grades) with stainless steel. Also dissimilar welding of SS with Mild Steel / Corten steel & EN10025-5 steel		IRS M 28 – ‘M4’ Class (Eq – E309L of AWS A 5.4)	N.A	Body jig assembly fabrication of side wall, End wall with roof and door corner sheets
7	Manganese steel liner with mild steel / corten steel		IRS M 28 – ‘M5’ Class (Eq – E18.8MnR26 of IS:5206)	N.A	Wear plate (Rubbing pad) fabrication in bogie frames.
8	Mild steel (Grade E250C of IS 2062) with mild steel	GMAW (135)	IRS M 46 – Class I (Eq – ER70S6 of AWS A 5.18)	ISO: 14175 C1 100% CO ₂ (Or) M21 80%Ar + 20%CO ₂ (ACM)	Bogie frames, Bolsters & Under Frame assembly.
9	Corten steel to IRSM – 41& Weathering Steel to EN10025-5 with same material and with mild steel (IS: 2062)		IRS M 46 – Class IV (Eq – ER80SG of AWS A 5.28)		Subassembly Components of bogie & under frame
10	Stainless Steel (SS 301, SS 301L, SS304, SS409M) with same grade of stainless steels		IRS M 46 – Class VI (Eq – ER308L of AWS A 5.9)	ISO: 14175 M13 98% Ar + 2% O ₂ (Or) M12 98% Ar + 2% CO ₂	Side Wall Assembly & endwall assembly
11	SS grades (SS 301, SS 301L, SS304, SS409M) with SS and dissimilar welding of SS with Mild Steel / Corten steel		IRS M 46 – Class VII (Eq – ER309L of AWS A 5.9)		Trough floor sheet with underframe assembly, body shell assembly and side wall with sole bar(u/f)

NOTE:

- THE CLASSIFICATION LEVEL TABLE PREPARED BASED ON EN15085-2 AND IS NOT EXHAUSTIVE AND INDICATIVE ONLY.
- FOR ITEMS WHICH ARE NOT CATEGORIZED IN THE LIST, ICF SHALL ALLOT SUITABLE CLASSIFICATION LEVELS.
- ICF RESERVES THE RIGHT TO CHANGE CLASSIFICATION LEVEL BASED ON CUSTOMER FEEDBACK/DESIGN CHANGE/FEEDBACK FROM PRODUCTION SHOPS ETC.
- CLASSIFICATION LEVEL FOR EACH COMPONENT SHALL BE INDICATED IN LIST OF PARTS (LOP)/BILL OF MATERIALS (BOM) BY PLANNING DEPT.
- THIS IS FOR REFERENCE ONLY. SHIELDING GASES SHALL BE USED AS PER RELEVANT WPS OF PARTICULAR WELD JOINT AND AS RECOMMENDED BY THE ELECTRODE MANUFACTURERS. FOR FURTHER INFORMATION, REFER IRS M28 & IRS M46.

12	Aluminium alloys IS: 737:2008 Grade 31000-H2 and similar	GMAW (131)	ER 4043 of AWS A 5.10	ISO: 14175 I1 100% Argon	AC duct fabrication
13	Mild steel (Grade E250C of IS 2062) with mild steel	FCAW (136)	IRS M 46 – Class I (Eq – E71T12 of AWS A 5.20)	ISO: 14175 C1 100% CO ₂	Bogie frames, Bolsters & Under Frame assembly.
14	Corten steel to IRSM – 41& Weathering Steel to EN10025-5 with same material and with mild steel (IS: 2062)		IRS M 46 – Class IV (Eq – E81T1W2C of AWS A 5.29)		Subassembly Components of bogie & under frame
15	Stainless Steel (SS 301, SS 301L, SS304, SS409M) with same grade of stainless steels		IRS M 46 – Class VI (Eq – E308LT1-1 of AWS A 5.22)		SS+SS in Side wall Assembly & endwall assembly
16	SS grades (SS 301, SS 301L, SS304, SS409M) with SS and dissimilar welding of SS with Mild Steel / Corten steel		IRS M 46 – Class VII (Eq - E309LT1-1 of AWS A 5.22)		Trough floor sheet with underframe assembly, body shell assembly and side wall with sole bar(u/f)
17	SS 316 with SS 316 and SS 316 with corten steel / Mild steel	GTAW/ TIG (141)	E309LMoT1-1 of AWS A 5.22	ISO: 14175 I1 100% Argon	Bio toilet , Biotoilet J bracket with underframe
18	Stainless Steel (SS 301, SS 301L, SS304, SS409M) with same grade of stainless steels		Electrode: EWLa2 / EWTh2 (AWS A 5.12) Filler wire: ER308L of AWS A 5.9		Roof & Side wall Assembly & Body Shell Assembly
19	SS grades (SS 301, SS 301L, SS304, SS409M) with SS and dissimilar welding of SS with Mild Steel / Corten steel		Electrode: EWLa2 / EWTh2 (AWS A 5.12) Filler wire : ER309L of AWS A 5.9		Side wall with sole bar dissimilar joints
20	Stainless Steel (SS 409M, SS304)	MIG brazing (983)	DIN 1733-SG-Cu A18	ISO: 14175 I1 100% Argon	Side Wall Assembly

DESCRIPTION & DIMENSION		ITEM	REF.DRGS	MAT.SPEC	WEIGHT/UNIT	REMARKS
GROUP: 9-0		SUPERSEDED BY:				
SCALE		SUPERSEDES: ICF/STD-9-0-998 ALT 1/-				
NTS		SSE/D	SABAPATHY NATHAN M			
		CHD	J. RAMESH			
		ALTD	J. RAMESH			
		DRN	J. RAMESH			
Alpha Alt:- 9						
DATA CODE NO.		INDIAN RAILWAY STANDARDS			SHEET	INTEGRAL COACH FACTORY CHENNAI-38
140					1 OF 2	ICF/STD-9-0-998

TABLE-1 FOR BOGIE & ITS COMPONENTS

WELD TESTING PREFERENCES AS PER EN 15085-3: 2022 (FUSION WELDING)

WELD PERFORMANCE CLASS	QUALITY LEVEL FOR IMPERFECTIONS EN ISO 5817	INSPECTION CLASS	VOLUMETRIC TEST RT	SURFACE TEST MPT or DPT	VISUAL EXAMINATION VT
CP B1	B	CT2	100 %	10 %	100 %
CP C2	B	CT2	NOT REQUIRED	10 %	100 %
CP C2	C	CT3	NOT REQUIRED	NOT REQUIRED	100 %

CONTENTS OF THE TABLE IS SIMILAR TO TABLE-3 OF EN 15085-3, BUT CUSTOMIZED TO ICF REQUIREMENTS.

TABLE-2 FOR SHELL & ITS COMPONENTS

WELD TESTING PREFERENCES AS PER EN 15085-3: 2022 (FUSION WELDING)

WELD PERFORMANCE CLASS	QUALITY LEVEL FOR IMPERFECTIONS EN ISO 5817	INSPECTION CLASS	VOLUMETRIC TEST RT	SURFACE TEST MPT or DPT	VISUAL EXAMINATION VT
CP C2	C	CT3	NOT REQUIRED	NOT REQUIRED	100 %

CONTENTS OF THE TABLE IS SIMILAR TO TABLE-3 OF EN 15085-3, BUT CUSTOMIZED TO ICF REQUIREMENTS.

NOTE: (FOR FUSION WELDING)

- THE VENDOR/SUPPLIER SHOULD POSSESS VALID ISO:3834-2 OR EN 15085-2 CERTIFICATION AND SHALL FULLY COMPLY WITH THE REQUIREMENTS OF THE SPECIFICATION.
- 'UT' IS NOT PERMITTED IN VOLUMETRIC TEST OF BUTT WELDS.
- ISO: 5817 SHALL BE FOLLOWED FOR QUALITY LEVELS FOR IMPERFECTIONS OF FUSION WELDED JOINT. ISO-13919-1 FOR LASER WELD TABLE AND EN15085-3 FOR SPOT WELDING TABLE.
- ISO: 17636 SHALL BE FOLLOWED FOR 'RT' AND SHALL ENSURE UNAMBIGUOUS IDENTIFICATION OF EACH SECTION AND EACH ITEM.
- ACCEPTANCE LEVEL FOR 'RT' SHALL BE AS PER ISO: 10675-1, LEVEL-1.
- ISO: 17637 SHALL BE FOLLOWED FOR VISUAL TESTING OF FUSION WELDED JOINTS.
- ACCEPTANCE LEVEL FOR 'VT' SHALL BE AS PER COL-2 OF ABOVE TABLE.
- ISO: 17638 SHALL BE FOLLOWED FOR MAGNETIC PARTICLE TEST OF FUSION WELDED JOINTS.
- ACCEPTANCE LEVEL FOR 'MPT' SHALL BE AS PER ISO: 23278, LEVEL-2X.
- ISO: 3452-1 SHALL BE FOLLOWED FOR PENETRANT TESTING OF FUSION WELDED JOINTS.
- ACCEPTANCE LEVEL FOR 'DPT' SHALL BE AS PER ISO: 23277, LEVEL-2X.
- ALL NDT (RT/MPT/DPT) SHALL BE PERFORMED BY PERSONNEL CERTIFIED ACCORDING TO ISO 9712 LEVEL-II AND SHALL BE DOCUMENTED.
- FOR INSPECTION CLASS CT2, THE VISUAL EXAMINATION SHALL BE PERFORMED BY PERSONNEL CERTIFIED ACCORDING TO ISO 9712 LEVEL-II AND SHALL BE DOCUMENTED. FOR CT3 SUITABLY TRAINED PERSONNEL BY RESPONSIBLE WELDING COORINATOR.
- THE TEST METHODS INDICATED SHALL BE THE MINIMUM CAPABLE OF ENSURING COMPLIANCE OF THE WELDED JOINTS. ADDITIONAL TESTS DEPENDING ON THE MATERIAL AND DESIGN MAY BE INSISTED BY THE PURCHASER.
- THE PERCENTAGES EXPRESSED, REFER TO THE TOTAL LENGTH TO BE EXAMINED FOR ONE GIVEN WELD.
 - 10% MEANS: TESTING OF 10% OF THE ENTIRE LENGTH OF THE WELD ON ALL THE PIECES BUILT OR 100% TESTING ON 1 OF EVERY 10 ITEMS BUILT.
 - 100% MEANS: TESTING OF THE ENTIRE LENGTH OF THE WELD AND ON ALL THE PIECES BUILT.
- MACRO EXAMINATION SHALL BE CARRIED OUT AS PER ISO: 17639 ON ATLEAST ONE REPRESENTATIVE TEST PIECE FOR EACH WPS USED IN THE WELDED COMPONENT. THE TEST PIECE SHOULD MEET THE REQUIREMENTS OF COL-2 OF ABOVE TABLE FOR ALL INTERNAL IMPERFECTIONS.
- PRODUCTION WELD TESTS SHALL BE CONDUCTED AS PER CLAUSE 4.2 OF EN 15085-4.
- PRODUCTION WELD TESTS SHOULD BE CHECKED IN ACCORDANCE WITH EN ISO 15613 AND TESTS SHALL BE DOCUMENTED.
- IN ADDITION TO THE ABOVE REQUIREMENTS, ANY SPECIFIC REQUIREMENTS MENTIONED IN RESPECTIVE DRAWINGS SHALL BE ADHERED TO.

TABLE-3 FOR SPOT AND SEAM WELDING

WELD TESTING PREFERENCES AS PER EN 15085-3: 2022

WELD PERFORMANCE CLASS	QUALITY LEVEL FOR IMPERFECTIONS EN-15085-3	INSPECTION CLASS	VOLUMETRIC TEST RT	SURFACE TEST MPT or DPT	VISUAL EXAMINATION VT
CP C2	TABLE-F2 OF EN15085-3	CT3	NOT REQUIRED	NOT REQUIRED	100 %

CONTENTS OF THE TABLE IS SIMILAR TO TABLE-3 OF EN 15085-3, BUT CUSTOMIZED TO ICF REQUIREMENTS.

NOTE: (FOR SPOT & SEAM WELDING)

- FOR WELD QUALITY, SURFACE QUALITY AND SHEAR STRENGTH REQUIREMENTS EN15085-3 TABLE F-2, F-3 AND TABLE F-4 SHALL BE FOLLOWED.
- WELDING OPERATORS NEED TO BE QUALIFIED AS PER ISO: 14732.
- WELDING PROCEDURE SPECIFICATION SHALL BE QUALIFIED AS PER ISO 15609-5/ISO, 15614-12/ISO & 15613.
- FOR INSPECTION CLASS CT3, SUITABLY TRAINED PERSONNEL BY RESPONSIBLE WELDING COORDINATOR/COMPETENT PERSON OF MANUFACTURER SHALL BE DEPLOYED AND SHOULD BE DOCUMENTED.
- SWPT (SIMPLIFIED WELD PRODUCTION TEST) TO BE DONE DAILY AND NWPT(NORMAL WELD PRODUCTION TEST) TO BE DONE ONCE IN SIX MONTHS AS PER EN15085-3 TABLE F-2 REQUIREMENTS AND SHALL BE DOCUMENTED.

TABLE-4 FOR SURFACE QUALITY OF SPOT WELDS (REF. EN15085-3 TABLE F-3)

SURFACE QUALITY AS PER EN15085-3	REQUIREMENTS	APPLICATION
2	SURFACES WHERE WELDING MARKS (ELECTRODE IMPRESSIONS,RING SHAPED REINFORCEMENT-FORMATION,IMPERFECTIONS, THROUGH HEAT DISTORTION ETC.) DO NOT AMOUNT TO MORE THAN 10% OF THE PARTICULAR SINGLE SHEET METAL THICKNESS. NOTE: IF REQUIRED THE INDENTATION CAN BE FILLED IN.	AESTHETIC SIDE OF PASSENGER COACH SIDE WALLS, NOSE CONE AND ROOFS.
3	SURFACES WHERE WELDING MARKS DO NOT AMOUNT TO MORE THAN 25% OF THE PARTICULAR METAL THICKNESS. IN THIS AREA ARE ALSO FIRMLY ADHERING WELDING SPATTER PERMITTED AS LONG AS THE DRAWING DOES NOT DEMAND THAT IT SHALL BE FREE OF BURRS AND SPATTERS.	SURFACES FOR NON-AESTHETIC REQUIREMENT.

TABLE-5 FOR LASER WELDING

WELD TESTING PREFERENCES AS PER EN 15085-3: 2022

WELD PERFORMANCE CLASS	QUALITY LEVEL FOR IMPERFECTIONS ISO-13919-1	INSPECTION CLASS	VOLUMETRIC TEST RT	SURFACE TEST MPT or DPT	VISUAL EXAMINATION VT
CP C2	C	CT3	NOT REQUIRED	NOT REQUIRED	100 %

CONTENTS OF THE TABLE IS SIMILAR TO TABLE-3 OF EN 15085-3, BUT CUSTOMIZED TO ICF REQUIREMENTS.

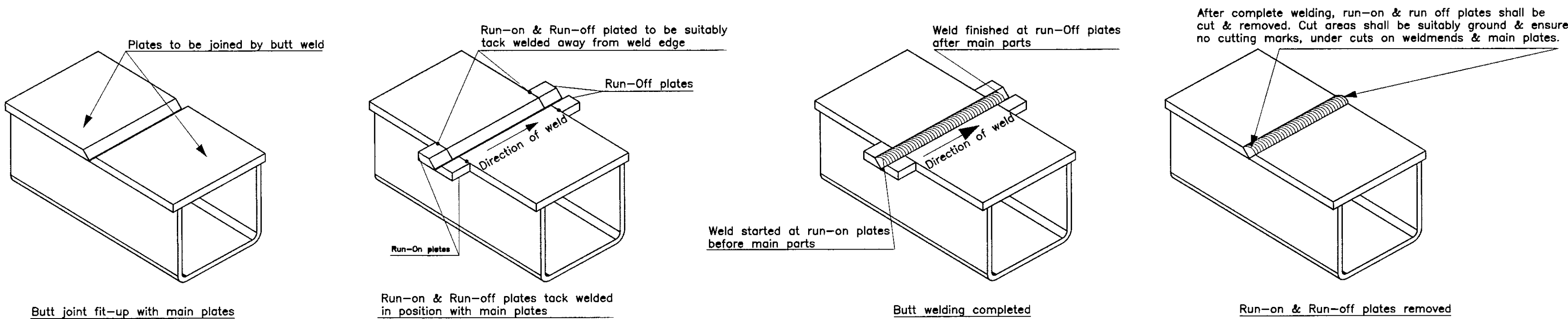
NOTE: (FOR LASER WELDING)

- FOR VISUAL EXAMINATION (VT) AND OTHER ROUTINE TESTS ISO 13919-1 SHALL BE USED. .
- WELDING OPERATORS NEED TO BE QUALIFIED AS PER ISO 14732.
- WELDING PROCEDURE SPECIFICATION SHALL BE QUALIFIED AS PER ISO 15609-4/ISO, 15614-11/ISO & 15613.
- FOR INSPECTION CLASS CT3 SUITABLY TRAINED PERSONNEL BY RESPONSIBLE WELDING COORDINATOR/COMPENT PERSON/MANUFACTURER SHALL BE DEPLOYED AND SHOULD BE DOCUMENTED.
- LASER WELDING TESTING REQUIREMENTS AS PER TABLE GIVEN BELOW SHALL BE FOLLOWED.
- SWPT (SIMPLIFIED WELD PRODUCTION TEST) TO BE DONE IN ONCE IN EVERY WEEK AND NWPT(NORMAL WELD PRODUCTION TEST) TO BE DONE ONCE IN SIX MONTHS AS PER ISO 15614-11 & ISO 13919-1 AND SHALL BE DOCUMENTED.

TABLE-6 LASER WELDING TESTING STANDARDS - FOR INFORMATION

TEST METHOD	TESTING STANDARD	ACCEPTANCE CRITERIA STANDARD
VISUAL TESTING (VT)	ISO 17637	ISO 13919-1
MAGNETIC PARTICLE TESTING (MPT)	ISO 17638	ISO 23278 LEVEL-2X
DYE PENETRANT TESTING (DPT)	ISO 3452-1	ISO 23277, LEVEL-2X
RADIO GRAPHIC TESTING	ISO 17636	ISO 10675-1, LEVEL-1

TABLE-7 Use of Run-on & Run-off plates in butt joints with CP B1 weld performance class



Note:

- Thickness, material & edge preparation of Run-on & Run-off plates shall be the same as of parent materials.
- After welding, 1% of the removed run-on & run-off plates may be used for sample testing (macro etch testing).

GENERAL INSTRUCTIONS:

- TRIAXIAL WELDS AND USE OF BACKINGS OR BACK STRIPS SHALL BE AVOIDED.
- WELDING GAPS SHALL BE SEALED WITH APPROVED QUALITY OF SEALING COMPOUND TO IS:1580 TO AVOID MOISTURE CREEP.
- CREVICE IN WELDMENT TIP IF ANY, SHALL BE WELDED AND GROUND SMOOTHLY.
- STAGE INSPECTION SHOULD BE DONE AND DOCUMENTED AS PER CLAUSE-6 OF EN 15085-5 AND REPORTS SHOULD BE SUBMITTED TO INSPECTION AGENCY.
- INSPECTION AND TESTING BEFORE/DURING/AFTER WELDING SHALL BE DONE AS PER CLAUSE-14 OF ISO 3834-2 AND REPORTS SHALL BE SUBMITTED TO THE INSPECTION AGENCY.
- THIRD PARTY INSPECTION AGENCY LIKE RITES/RDSO SHALL COLLECT ALL THE WELD TEST REPORTS FROM THE VENDORS AND SUBMIT THE SAME TO ICF.
- WELDING OF REPLACED MATERIAL AFTER SAMPLE COLLECTION AND SUBSEQUENT WELD TEST(DPT) BY INSPECTION AGENCIES ALSO TO BE CARRIED OUT AS PER THIS DRAWING. FOR WPS DETAILS, REFER DRAWING No.140-9-0-999 (LATEST ALTERATION).

ALTERATION	
09/2018	NOTES-4 TO 7 MODIFIED. AND NOTE-12 ADDED.
-Sd/-SSE/D	-Sd/-SME/BD
11/2020	WELDING TABLE, NOTES & TITLE BLOCK REVISED. SHEET-2 ADDED.
-Sd/-SSE/D	3.11.20 SME/AME
12/2020	'GENERAL INSTRUCTIONS' ADDED IN SHEET-2.
-Sd/-SSE/D	-Sd/-SME
02/2021	TITLE REVISED. CLASSIFICATION TABLE REVISED AS PER EN 15085-2.
-Sd/-SSE/D	6.2.21 SME
10/2022	GENERAL GUIDELINES FOR WELDING ELECTRODES/FILLER WIRES AND SHIELDING GASES ADDED IN SHEET-1.
-Sd/-SSE/D	31.10.22 AME
9/2023	ALL DATA UPDATED BASED ON EN15085-3:2022 AND AWTI LR.No.AWTI/79 DT.31-8-2023.
-Sd/-SSE/D	8.9.23 AME
12/2024	GENERAL INSTRUCTION No. 7 ADDED AS PER WQMS EXTERNAL AUDIT INSTRUCTIONS.
SSE/D	AME

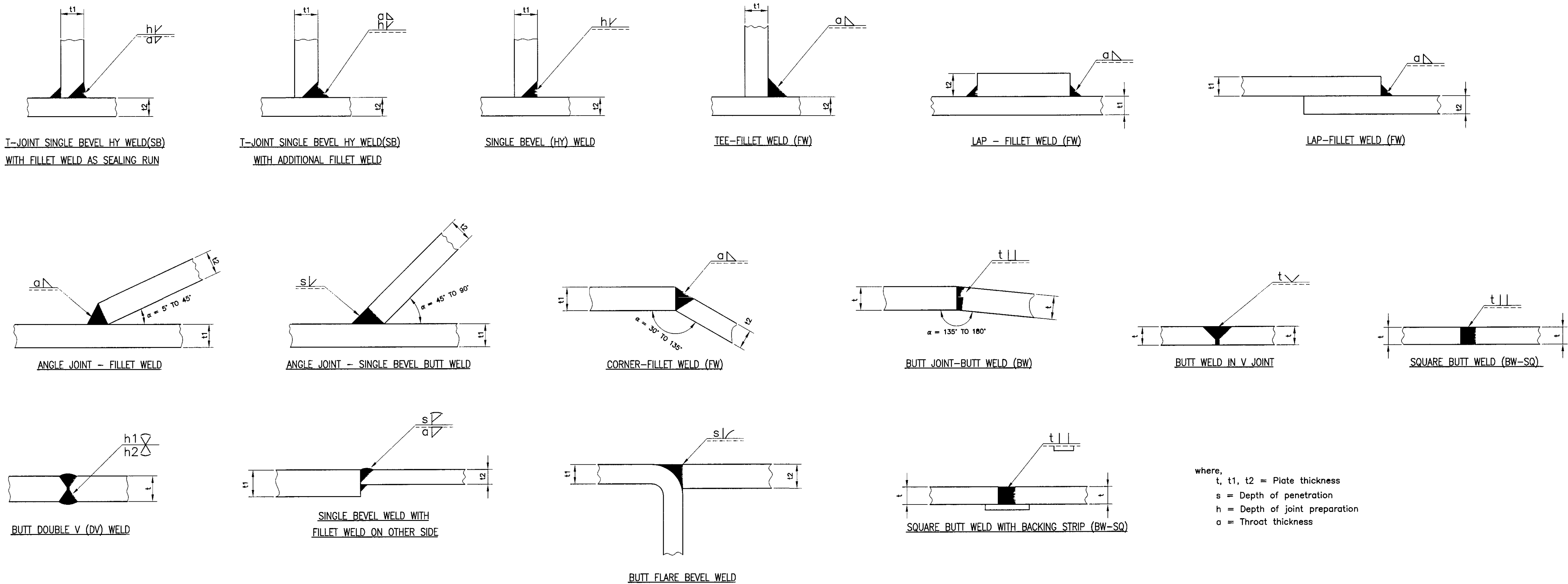
QTY	DESCRIPTION & DIMENSION	ITEM	REF.DRGS	MAT.SPEC	WEIGHT/UNIT	REMARKS
1	GROUP: 9-0					SUPERSEDED BY:
						SUPERSEDES: ICF/STD-9-0-998 ALT 1/-
						SCALE SSE/D SABAPATHY NATHAN M
						NTS CHD
						ALTD J. RAMESH
						DRN J. RAMESH
						Alpha Alt:- g
						INTEGRAL COACH FACTORY CHENNAI-38
						ICF/STD-9-0-998

S.No.	MATERIAL	THICKNESS	JOINT	TYPE OF WELD	POSITION	GAS	PROCESS	WPS No.	REMARKS
GMAW									
1	IRS M41 + IRS M41	6 mm + 8 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/6N8/FW/PB/315	
2	IRS M41 + IS 2062	6 mm + 16 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/6N16/FW/PB/317	
3	IRS M41 + IS 2062	6 mm + 12 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/6N12/FW/PB/316	
4	IRS M41 + IRS M41	10 mm + 10 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/10N10/FW/PB/325	
5	IRS M41 + IS 2062	10 mm + 16 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/10N16/FW/PB/324	
6	IRS M41 + IRS M41	5 mm + 10 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/5N10/FW/PB/318	
7	IS 2062 + IS 2062	12 mm + 16 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/12N16/FW/PB/326	
8	IRS M41 + IRS M41	8 mm + 8 mm	T	FW	PA	CO ₂	GMAW	ICF/WPS/GMAW/CS/8N8/FW/PA/012	
9	IRS M41 + IS 2062	8 mm + 16 mm	T	FW	PA	CO ₂	GMAW	ICF/WPS/GMAW/CS/8N16/FW/PA/004	
10	IS 2062 + IS 2062	12 mm + 10 mm	T	FW	PA	CO ₂	GMAW	ICF/WPS/GMAW/CS/12N10/FW/PA/002	
11	IRS M41 + IRS M41	10 mm + 10 mm	T	FW	PA	CO ₂	GMAW	ICF/WPS/GMAW/CS/10N10/FW/PA/001	
12	DIN1630(st 52.4) + DIN17182(GS20Mn5V)	14 mm + 10 mm	T-PIPE	FW	PB	ACM	GMAW	ICF/WPS/GMAW/DIS/14N10/FW/PB/701-PIPE	
13	IRS M41 + IRS M41	10 mm + 8 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/10N8/FW/PB/502	
14	IRS M41 + IRS M41	8 mm + 5 mm	LAP	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/8N5/LAP/PB/503	
15	IRS M41 + IRS M41	10 mm + 5 mm	T	FW	PG	CO ₂	GMAW	ICF/WPS/GMAW/CS/10N5/FW/PG/505	
16	IRS M41 + IRS M41	1.6 mm + 1.6 mm	LAP	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/1.6N1.6/LAP/PB/510	
17	IRS M41 + IRS M41	2 mm + 2 mm	T	FW	PG	CO ₂	GMAW	ICF/WPS/GMAW/CS/2N2/FW/PG/511	
18	IRS M41 + IRS M41	2 mm + 3.15 mm	T	FW	PG	CO ₂	GMAW	ICF/WPS/GMAW/CS/2N3.15/FW/PG/512	
19	IRS M41 + IRS M41	10 mm + 10 mm	T	FW	PG	CO ₂	GMAW	ICF/WPS/GMAW/CS/10N10/FW/PG/301	
20	IRS M41 + IS 2062	8 mm + 12 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/8N12/FW/PB/287	
21	IRS M41 + IS 2062	8 mm + 16 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/8N16/FW/PB/286	
22	IRS M41 + IS 2062	10 mm + 12 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/10N12/FW/PB/285	
23	IS 2062 + IRS M41	8 mm + 10 mm	T	FW	PG	CO ₂	GMAW	ICF/WPS/GMAW/CS/8N10/FW/PG/302	
24	IRS M41 + IRS M41	5 mm + 5 mm	T	FW	PG	CO ₂	GMAW	ICF/WPS/GMAW/CS/5N5/FW/PG/342	
25	IRS M41 + IRS M41	2 mm + 2 mm	T	FW	PG	CO ₂	GMAW	ICF/WPS/GMAW/CS/2N2/FW/PG/341	
26	IRS M41 + IRS M41	2 mm + 5 mm	LAP	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/2N5/LAP/PB/321	
27	IRS M41 + IRS M41	2 mm + 2 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/2N2/FW/PB/323	
28	IRS M41 + IRS M41	4 mm + 8 mm	T	FW	PF	CO ₂	GMAW	ICF/WPS/GMAW/CS/4N8/FW/PF/010	
29	IRS M41 + IRS M41	4 mm + 6 mm	T	FW	PF	CO ₂	GMAW	ICF/WPS/GMAW/CS/4N6/FW/PF/09	
30	IRS M41 + EN 10025	8 mm + 15 mm	LAP	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/DIS/8N15/LAP/PB/06	
31	EN 10393 + IRS M41	10 mm + 6 mm	T	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/DIS/10N6/FW/PB/01	
32	IS 2062 + IS 2062	22 mm + 22 mm	BUTT	BW-DV	PA	CO ₂	GMAW	ICF/WPS/GMAW/CS/22N22/BW/PA/309	
33	IS 2062 + IS 2062	16 mm + 20 mm	T	BW-HV	PA	CO ₂	GMAW	ICF/WPS/GMAW/CS/16N20/BW/PA/006	
34	IS 2062 + IS 2062	16 mm + 16 mm	BUTT	BW-HV	PA	CO ₂	GMAW	ICF/WPS/GMAW/CS/16N16/BW/PA/001	
35	EN 10025:2004 S355 J2 + EN 10025:2004 S355 J2	10 mm + 10 mm	T	BW-HV	PA	ACM	GMAW	ICF/WPS/GMAW/CS/10N10/BW/PA/705	
36	EN 10025:2004 S355 J2 + EN 10025:2004 S355 J2	18 mm + 12 mm	T	BW-HV	PA	ACM	GMAW	ICF/WPS/GMAW/CS/18N12/BW/PA/704	
37	EN 10025:2004 S355 J2 + EN 10025:2004 S355 J2	12 mm + 12 mm	T	BW-HV	PA	ACM	GMAW	ICF/WPS/GMAW/CS/12N12/BW/PA/703	
38	EN 10025:2004 S355 J2 + EN 10025:2004 S355 J2	8 mm + 10 mm	T	BW-HV	PA	ACM	GMAW	ICF/WPS/GMAW/CS/8N10/BW/PA/702	
39	DIN 1630(st.52.4) + EN 10025:2004 S355 J2	10 mm + 12 mm	T-PIPE	BW-HV	PA	ACM	GMAW	ICF/WPS/GMAW/DIS/10N12/BW/PA/706 PIPE	
40	IS 2062 + IS 2062	16 mm + 16 mm	BUTT	BW-HV	PE	CO ₂	GMAW	ICF/WPS/GMAW/CS/16N16/BW/PE/508	
41	IRS M41 + IRS M41	2 mm + 2 mm	BUTT	BW-SQ	PA	CO ₂	GMAW	ICF/WPS/GMAW/CS/2N2/BW/PA/322	
42	IRS M41 + IRS M41	8 mm + 8 mm	BUTT	BW-HV	PF	CO ₂	GMAW	ICF/WPS/GMAW/CS/8N8/BW/PF/08	
43	IRS M41 + EN 10293	6 mm + 15 mm	T	BW-HV	PB	CO ₂	GMAW	ICF/WPS/GMAW/DIS/6N15/BW/PB/07	
44	IRS M41 + EN 10293	8 mm + 10 mm	T	BW-HV	PB	CO ₂	GMAW	ICF/WPS/GMAW/DIS/8N10/BW/PB/03	
45	IRS M41 + IRS M41	5 mm + 5 mm	TEE	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/5N5/FW/PB/526	
46	IRS M41 + IRS M41	8 mm + 8 mm	TEE	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/8N8/FW/PB/531	
47	IRS M41 + IRS M41	6 mm + 6 mm	TEE	FW	PB	CO ₂	GMAW	ICF/WPS/GMAW/CS/6N6/FW/PB/530 Rev 01	
48	IRS M41 + IRS M41	5 mm + 5 mm	TEE	FW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/5N5/FW/PB/550	
49	IRS M41 + IRS M41	5 mm + 5 mm	BUTT	BW-SV	PA	ACM	GMAW	ICF/WPS/GMAW/CS/5N5/FW/PA/551	
50	IRS M41 + IRS M41	4 mm + 6 mm	TEE	FW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/4N6/FW/PB/552	
51	DIN EN 10293 G20Mn+QT + IRS M41	15 mm + 6 mm	SPL	BW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/15N6/BW/PB/553	
52	DIN EN 10025 355J10 + IRS M41	12 mm + 6 mm	LAP	FW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/12N6/LAP/PB/554	
53	IRS M41 + IRS M41	5 mm + 5 mm	TEE	FW	PF	CO ₂	GMAW	ICF/WPS/GMAW/CS/5N5/FW/PF/538	
54	IRS M41 + IRS M41	8 mm + 8 mm	TEE	FW	PG	ACM	GMAW	ICF/WPS/GMAW/CS/8N8/FW/PG/557	
55	IRS M41 + IS 2062	8 mm + 12 mm	TEE	FW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/8N12/FW/PB/558	
56	IRS M41 + IS 2062	8 mm + 20 mm	TEE	FW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/8N20/FW/PB/559	
57	IRS M41 + IS 2062	8 mm + 16 mm	TEE	FW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/8N16/FW/PB/561	
58	IRS M41 + IRS M41	5 mm + 5 mm	TEE	FW	PF	ACM	GMAW	ICF/WPS/GMAW/CS/5N5/FW/PF/564	
59	IRS M41 + IRS M41	6 mm + 6 mm	BUTT	BW-SQ	PF	CO ₂	GMAW	ICF/WPS/GMAW/CS/6N6/BW/PF/566	
60	IRS M41 + IRS M41	5 mm + 5 mm	BUTT	BW-SQ	PF+PG	CO ₂	GMAW	ICF/WPS/GMAW/CS/5N5/BW/PF+PG/567	
61	EN10025-5 S355 J2 W+N + EN10025-5 S355 J2 W+N	10 mm + 10 mm	TEE	BW-FW	PA	ACM	GMAW	ICF/WPS/GMAW/CS/10N10/BW+FW/PA/574	
62	DIN 1630 st52.4 + DIN 17182(GSMn5V)	14 mm + 10 mm	TEE-PIPE	FW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/14N10/FW/PB/570	
63	IS 2062 + IS 2062	16 mm + 16 mm	BUTT	BW-SV	PA	ACM	GMAW	ICF/WPS/GMAW/CS/16N16/BW/PA/562	
64	EN10025-5 S355 J2 W+N + EN10025-5 S355 J2 W+N	8 mm + 10 mm	TEE	BW	PA	ACM	GMAW	ICF/WPS/GMAW/CS/BW/8N10/PA/571	
65	DIN 1630 st52.4 + EN10025-5 S355 J2 W+N	10 mm + 12 mm	TEE	BW-FW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/10N12/BW+FW/PB/575	
66	EN10025-5 S355 J2 W+N + EN10025-5 S355 J2 W+N	12 mm + 12 mm	TEE	BW-FW	PA	ACM	GMAW	ICF/WPS/GMAW/CS/12N12/BW+FW/PB/572	
67	EN10025-5 S355 J2 W+N + EN10025-5 S355 J2 W+N	18 mm + 12 mm	TEE	BW	PA	ACM	GMAW	ICF/WPS/GMAW/CS/18N12/BW/PA/573	
68	IS 2062 + IS 1875	16 mm + 12 mm	LAP	FW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/16N12/FW/PB/587	
69	IRS M41 + IRS M41	6 mm + 6 mm	TEE	FW	PG	CO ₂	GMAW	ICF/WPS/GMAW/CS/6N6/FW/PG/632	
70	IRS M41 + IRS M41	2 mm + 2 mm	LAP	FW	PD	CO ₂	GMAW	ICF/WPS/GMAW/CS/2N2/LAP/PD/612	
71	IRS M41 + IRS M41	3.15 mm + 3.15 mm	BUTT	BW-SQ	PA	CO ₂	GMAW	ICF/WPS/GMAW/CS/3.15N3.15/BW/PA/619	
72	IS737:2008Gr.31000-H2 + IS737:2008Gr.31000-H2	2.5 mm +2.5 mm	TEE	FW	PB	Ar	GMAW	ICF/WPS/GMAW/ALU/2.5N2.5/FW/PB/583	
73	EN10025-5 S355 J2 W+N + DIN 17182(GSMn5V)	10 mm + 16 mm	TEE	FW	PB	ACM	GMAW	ICF/WPS/GMAW/CS/10N16/FW/PB/636	
74	EN10025+DIN 1630	14mm+12 mm	T	BW+FW	PB	ACM	GMAW	ICF-WPS-GMAW-CS-12N12-BW+FW-PB-634	
75	EN10025+EN 10025	10mm+10 mm	T	FW	PB	ACM	GMAW	AWTI-WPS-GMAW-CS-10N10-FW-PB-592	
76	EN10025+EN 10025	12mm+22 mm	T	FW	PA	ACM	GMAW	AWTI-WPS-GMAW-CS-12N22-FW-PA-594	
77	IS 2062+ IS 2062	16mm+16 mm	T	FW	PA	ACM	GMAW	AWTI-WPS-GMAW-CS-16N16-FW-PA-588	
78	EN10025+EN 10025	22mm+22 mm	BUTT	BW	PA	ACM	GMAW	AWTI-WPS-GMAW-CS-22N22-BW-PA-602	
79	EN10025+EN 10025	10mm+10mm	T	FW	PA	ACM	GMAW	AWTI-WPS-GMAW-CS-10N10-BW+FW-PA-584	
80	EN10025+EN 10025	10mm+12 mm	T	FW	PB	ACM	GMAW	AWTI-WPS-GMAW-CS-10N12-FW-PB-593	
81	IRSM 41+DIN EN 10293	8mm+15 mm	SINGLE BEVEL TEE	BW	PB	CO2	GMAW	ICF-WPS-GMAW-CS-15N8-BW-PB-03	CONSOLE WITH SOLE BAR
82	SS409M+SS 409M	2mm+3 mm	BUTT	BW	PA	ARGON	GMAW	ICF-WPS-GMAW BRAZING-SS-2n3-BW-PA-306	MIG BRAZING
83	EN10025+EN 10025	12mm+12 mm	BUTT	BW	PA	ACM	GMAW	ICF-WPS-GMAW-CS-12+12-BW-PA-607	
84	IRS M41 + IRS M41	3.15 mm +3.15 mm	BUTT	SQ BUTT	PG	CO ₂	GMAW	ICF/WPS/GMAW/CS/3.15N3.15/BW/PG/616	
85	IRS M41 + IRS M41	3.15 mm +3.15 mm	BUTT	SQ BUTT	PA	CO ₂	GMAW	AWTI-WPS-GMAW-CS-3.15N3.15-BW-PA-622	

S.No.	MATERIAL	THICKNESS	JOINT	TYPE OF WELD	POSITION	GAS	PROCESS	WPS No.	REMARKS
FCAW									
1	IRS M41 + AISI301	10 mm + 1.7 mm	LAP	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/DIS/10N1.7/LAP/PB/504	
2	IRS M41 + AISI 304	6 mm + 2 mm	CORNER	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/DIS/6N2/CORNER/PB/05	
3	AISI 304 + AISI 304	2 mm + 1.25 mm	LAP	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/AISI304/2N1.25/LAP/PB/02	
4	SS 409M + SS 409M	2.5 mm + 3 mm	T	FW	PA	CO ₂	FCAW	ICF/WPS/FCAW/SS409M/2.5N3/FW/PA/003	
5	SS 409M + SS 409M	2.5 mm + 2 mm	FLARE	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/SS409M/2.5N2/FW/PB/002	
6	SS 409M + SS 409M	2.5 mm + 4 mm	T	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/SS409M/2.5N4/FW/PB/001	
7	AISI 304 + AISI 304	1.25 mm + 1.25 mm	LAP	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/AISI304/1.25N1.25/LAP/PB/04	
8	SS 409M + SS 409M	3 mm + 3 mm	TEE	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/SS409M/3N3/FW/PB/519	
9	SS 409M + SS 409M	2 mm + 2 mm	TEE	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/SS409M/2N2/FW/PB/598	
10	SS 409M + SS 409M	3 mm + 3 mm	TEE	FW	PB	ACM	FCAW	ICF/WPS/FCAW/SS409M/3N3/FW/PB/585	
11	AISI 316 + AISI 316	6 mm + 6 mm	TEE	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/AISI316/6N6/FW/PB/581	
12	AISI 304 + AISI 304	2 mm + 2 mm	TEE	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/SS/2N2/FW/PB/579	
13	AISI 304 + AISI 304	1.25 mm + 1.25 mm	LAP	FW	PB	ACM	FCAW	ICF/WPS/FCAW/SS/1.25N1.25/PB/611	
14	AISI 304 + SS 409M	1.7 mm + 2 mm	TEE	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/SS/1.7N2/FW/PB/578	
15	AISI 304 + SS 409M	2 mm + 2 mm	TEE	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/SS/2N2/FW/PB/576	
16	AISI 304 + SS 409M	1.2 mm + 2 mm	TEE	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/SS/1.2N2/FW/PB/580	
17	IRS M41 + SS 409M	2 mm + 2 mm	TEE	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/SS/2N2/FW/PB/599	
18	AISI 316 + IRS M41	6 mm + 5 mm	TEE	FW	PB	CO ₂	FCAW	ICF/WPS/FCAW/DIS/6N5/FW/PB/582	

GTAW									
1	AISI 304 + SS 409M	Ø12 mm + 2 mm	Spl	FW	PJ	Ar	GTAW	ICF/WPS/GTAW/DIS/DIA12N2/FW/PJ/001-PIPE	Window bar+Sheet
2	AISI 304 + AISI 304	1.25 mm + 1.25 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/AISI304/1.25N1.25/LAP/PB/619	
3	SS 409M + SS 409M	3 mm + 2.5 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS409M/3N2.5/LAP/PB/311	
4	SS 409M + SS 409M	2.5 mm + 8 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS409M/2.5N8/LAP/PB/308	
5	SS 409M + SS 409M	2.5 mm + 3 mm	T	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS409M/2.5N3/FW/PB/305	
6	SS 409M + SS 409M	2.5 mm + 2 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS409M/2.5N2/LAP/PB/304	
7	SS 409M + SS 409M	4 mm + 2.5 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS409M/4N2.5/LAP/PB/302	
8	SS 409M + SS 409M	5 mm + 2.5 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS409M/5N2.5/LAP/PB/301	
9	SS 409M + SS 409M	2 mm + 4 mm	T	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS409M/2N4/FW/PB/611	
10	SS 409M + SS 409M	2 mm + 4 mm	T	FW	PD	Ar	GTAW	ICF/WPS/GTAW/SS409M/2N4/FW/PD/607	
11	AISI 304 + SS 409M	1.25 mm + 2 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/DIS/1.25N2/LAP/PB/606	
12	SS 409M + AISI 304	2 mm + 1.7 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/DIS/2N1.7/LAP/PB/605	
13	SS 409M + SS 409M	2 mm + 2.5 mm	T	FW	PG	Ar	GTAW	ICF/WPS/GTAW/SS409M/2N2.5/FW/PG/604	
14	AISI 304 + AISI 304	1.7 mm + 1.7 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/AISI304/1.7N1.7/LAP/PB/603	
15	AISI 304 + AISI 304	1.25 mm + 1.7 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/AISI304/1.25N1.7/LAP/PB/602	
16	IRS M41 + SS 409M	6 mm + 2 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/DIS/6N2/LAP/PB/200	
17	SS 409M + SS 409M	2 mm + 2 mm	LAP	FW	PG	Ar	GTAW	ICF/WPS/GTAW/SS409M/2N2/LAP/PG/196	
18	SS 409M + SS 409M	8 mm + 2.5 mm	Sq. BUTT	BW	PA	Ar	GTAW	ICF/WPS/GTAW/SS409M/8N2.5/BW/PA/312	Sidewall+Backpieces
19	SS 409M + SS 409M	4 mm + 2.5 mm	Single V	BW	PA	Ar	GTAW	ICF/WPS/GTAW/SS409M/4N2.5/BW/PA/303	
20	SS 409M + SS 409M	3 mm + 2.5 mm	FLARE	FW	PA	Ar	GTAW	ICF/WPS/GTAW/SS409M/3N2.5/FLARE/PA/310	Sidewall+Backpieces
21	SS 409M + SS 409M	2.5 mm + 2.5 mm	FLARE	FW	PA	Ar	GTAW	ICF/WPS/GTAW/SS409M/2.5N2.5/FLARE/PA/309	
22	SS 409M + SS 409M	3 mm + 3 mm	TEE	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS409M/3N3/FW/PB/524	
23	SS 409M + SS 409M	3 mm + 3 mm	TEE	FW	PD	Ar	GTAW	ICF/WPS/GTAW/SS409M/3N3/FW/PD/543*Wla	Lanthanum electrode
24	Duplex 2101 + Duplex 2101	2 mm + 2 mm	TEE	FW	PD	Ar	GTAW	ICF/WPS/GTAW/DUP2101/2N2/FW/PD/539*Duplex	Duplex stainless steel
25	SS 409M + SS 409M	3 mm + 3 mm	TEE	FW	PD	Ar	GTAW	ICF/WPS/GTAW/SS409M/3N3/FW/PD/536	
26	SS 409M + SS 409M	3 mm + 3 mm	Sq.BUTT	BW	PA	Ar	GTAW	ICF/WPS/GTAW/SS409M/3N3/BW/PA/590	Two passes
27	AISI 304 + AISI 304	1.7 mm + 2 mm	TEE	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS/1.7N2/FW/PB/621	08.07.2021
28	IRS M41 + SS 409M	8 mm + 3 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/DIS/8N3/LAP/PB/517	
29	SS409M + AISI 304	1.7 mm + 1.25 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS/1.7N1.25/FW/LAP/PB/620	08.07.2021
30	AISI 304 + AISI 304	1.2 mm + 1.2 mm	LAP	FW	PB	Ar	GTAW	ICF/WPS/GTAW/SS/1.2N1.2/FW/LAP/PB/644	
31	SS 409M + SS 409M	3 mm + 3 mm	LAP	FW	PG	Ar	GTAW	ICF/WPS/GTAW/SS/3N3/FW/LAP/PG/640	
32	IRS M41 + SS 409M	5 mm + 3 mm	LAP	FW	PD	Ar	GTAW	ICF/WPS/GTAW/DIS/5N3/FW/LAP/PD/646	
33	SS409M+SS304	3mm+1.2mm	LAP	FW	PB	Ar	GTAW	ICF-WPS-GTAW-SS-3N1.2-FW-PB-642	
34	SS409M+SS409M	2.5mm+8mm	LAP	FW	PB	Ar	GTAW	ICF-WPS-GTAW-SS-2.5N8-LAP-PB-308	

ALTERATIONS	
①	9/2023
ALL DATA UPDATED BASED ON EN15085-3:2022 AND AWTI LR.No.AWTI/79 DT.31-8-2023.	
-Sd-	8.9.23
SSE/D	AME
②	12/2024
NOTE-4 ADDED W.R.T AWTI LR.AWTI/79 DT.19-11-2024	
③	
SSE/D	AME



where,
t, t1, t2 = Plate thickness
s = Depth of penetration
h = Depth of joint preparation
a = Throat thickness

TABLE-1

RANGE OF QUALIFICATION FOR BUTT WELDS MATERIAL THICKNESS AND DEPOSITED METAL THICKNESS AS PER EN ISO 15614-1:2017 TABLE-7				
THICKNESS OF TEST PIECE 't' IN mm	RANGE OF QUALIFICATION			DEPOSITED WELD METAL THICKNESS FOR EACH PROCESS 's' IN mm
	PARENT MATERIAL THICKNESS			
	LEVEL 1	LEVEL 2		
		SINGLE RUN	MULTI-RUN	
t≤3		0.5t to 2t		MAX 2 s
3<t≤12	1.5 to 2t	0.5t(3MIN) to 1.3t	3 to 2t °	MAX 2 s °
12<t≤20	5 to 2t	0.5t to 1.1t	0.5t to 2t	MAX 2 s
20<t≤40	5 to 2t	0.5t to 1.1t	0.5t to 2t	MAX 2 s when s < 20 MAX 2 t when s ≥ 20
40<t≤100	5 to 200t	–	0.5t to 2t	MAX 2 s when s < 20 MAX 200 t when s ≥ 20
100<t≤150	5 to 200t	–	50 to 2t	MAX 2 s when s < 20 MAX 300 t when s ≥ 20
t>150	5 to 1.33t	–	50 to 2t	MAX 2 s when s < 20 MAX 1.33 t when s ≥ 20

° FOR LEVEL-1, WHEN IMPACT REQUIREMENTS ARE SPECIFIED BUT IMPACT TESTS HAVE NOT BEEN PERFORMED, THE MAXIMUM THICKNESS OF QUALIFICATION IS LIMITED TO 12mm.

TABLE-2

FOR LEVEL-2: RANGE OF QUALIFICATION FOR MATERIAL THICKNESS AND THROAT THICKNESS OF FILLET WELDS AS PER EN ISO 15614-1:2017 TABLE-8			
THICKNESS OF TEST PIECE 't' IN mm	RANGE OF QUALIFICATION		
	MATERIAL THICKNESS IN mm	THROAT THICKNESS	
		SINGLE RUN	MULTI-RUN
t ≤ 3	0.7t TO 2t		
3 < t < 30	3t TO 2t	0.75a TO 1.5a	NO RESTRICTION
t ≥ 30	≥ 5		

WHERE A FILLET WELD IS QUALIFIED BY MEANS OF A BUTT WELD TEST, THE THROAT THICKNESS RANGE SHALL BE BASED ON THE THICKNESS OF THE DEPOSITED WELD METAL. NOTE: 'a' IS THE NOMINAL THROAT THICKNESS AS SPECIFIED IN PWPS FOR THE TEST PIECE.

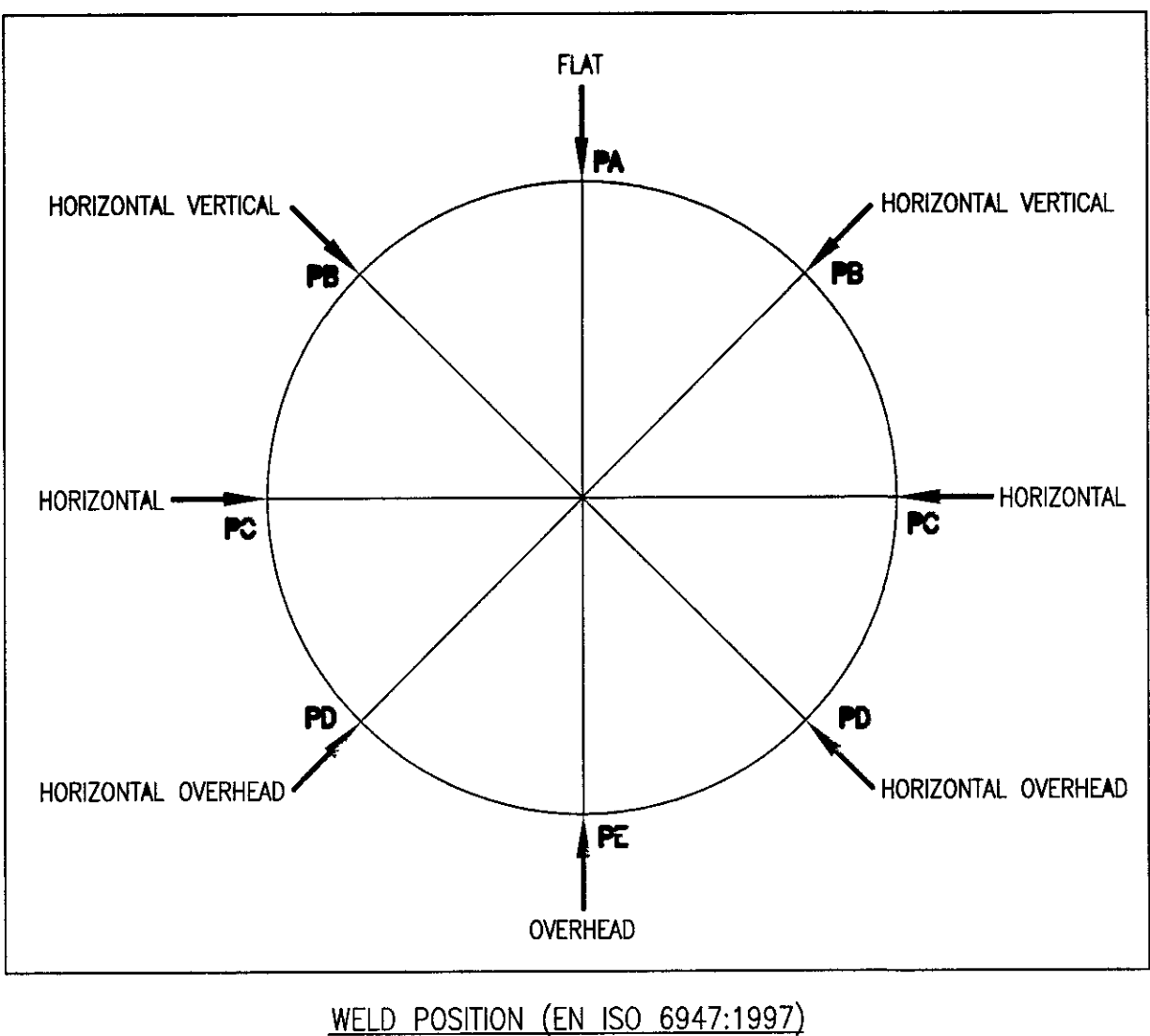
° - IN CASE OF DIFFERENT MATERIAL THICKNESSES, THE RANGE OF QUALIFICATION OF BOTH THICKNESSES OF THE TEST PIECES SHALL BE CALCULATED SEPARATELY.

TABLE-3

TERMS	DESCRIPTION	SYMBOL
FLAT POSITION	HORIZONTAL WORKING, CENTERLINE OF WELD VERTICAL, CAPPING LAYER ON CAPPING	PA
HORIZONTAL VERTICAL POSITION	HORIZONTAL WORKING, CAPPING LAYER TOWARDS THE CAPPING	PB
HORIZONTAL POSITION	HORIZONTAL WORKING, CENTERLINE OF WELD HORIZONTAL	PC
HORIZONTAL OVERHEAD POSITION	HORIZONTAL WORKING, OVERHEAD CAPPING LAYER TOWARDS THE BOTTOM	PD
OVERHEAD POSITION	HORIZONTAL WORKING, OVERHEAD CENTERLINE OF WELD VERTICAL, CAPPING LAYER UNDERNEATH	PE
VERTICAL UP POSITION	WORKING UPWARDS	PF
VERTICAL DOWN POSITION	WORKING DOWNWARDS	PG

TABLE-4

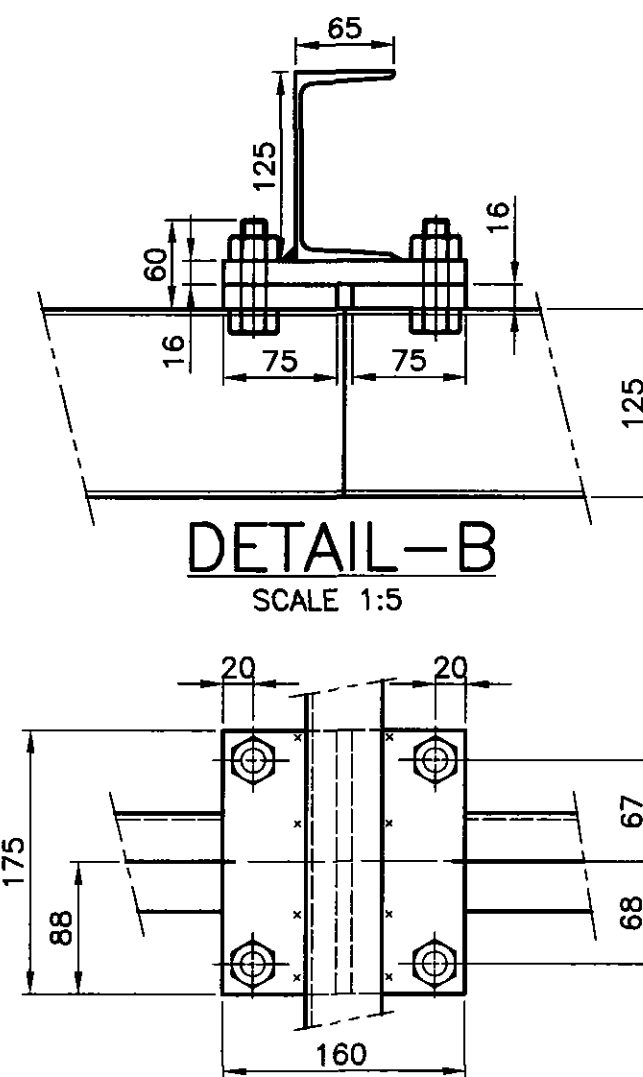
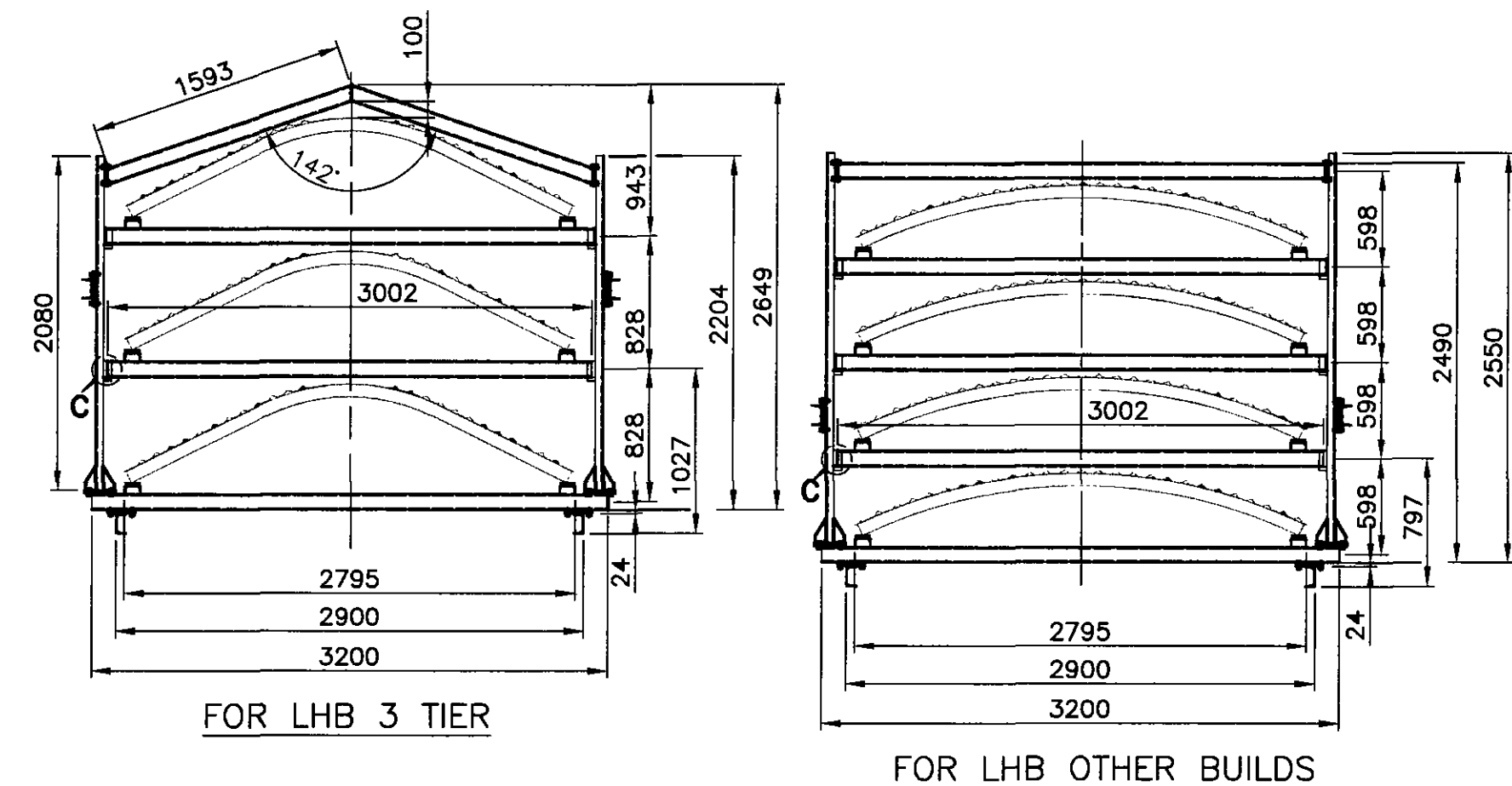
WELD PROCESS (EN ISO 4063)	CODE
MAW - MANUAL METAL ARC WELDING	111
MAW - METAL ACTIVE GAS ARC WELDING (MAG)	135
MAW - METAL ARC WELDING (ACTIVE GAS SHIELD)	136
TIG - TUNGSTEN INERT GAS ARC WELDING (TIG)	141
SELF SHIELDED ARC WELDING	114
SUBMERGED ARC WELDING	12
MIG - METAL INERT GAS WELDING (MIG)	131
MIG - METAL ARC WELDING (INERT GAS SHIELD)	137
PLASMA ARC WELDING	15
OXY-ACETYLENE WELDING	311
LBM - LASER BEAM WELDING WITH GAS	522
RSW - RESISTANCE SPOT WELDING (DIRECT)	212
RSW - RESISTANCE SPOT WELDING (INDIRECT)	211



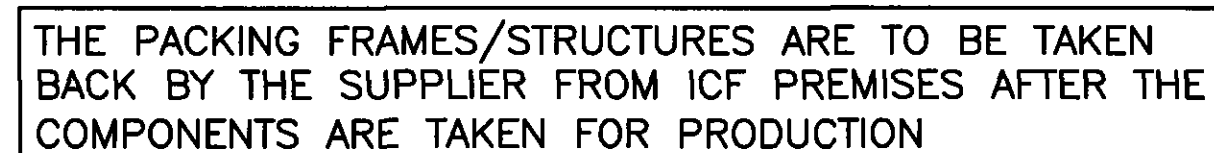
WELD POSITION (EN ISO 6947:1997)

- NOTE:**
- 1.1 RANGE OF QUALIFICATION FOR INFORMATION ONLY.
 - 1.2 FOR RANGE OF QUALIFICATION REFER EN ISO: 15614-1(LATEST REVISION)
 2. FOR DETAIL SPECIFICATIONS REFER THE APPLICABLE WELD PROCEDURE SPECIFICATION (WPS).
 3. IF ANY JOINT IS NOT COVERED IN THIS DRAWING, THE ASSEMBLY SHOP/VENDOR MAY DEVELOP WPS FOR THE SAME AND SUBMIT TO AWTI/ICF AND GET IT APPROVED.
 4. FOR LATEST WPS, ICF WORKSHOPS MAY REFER ICF WEBSITE LINK AS FOLLOWS: DEPARTMENT/MECHANICAL/DEPT.SUB SECTIONS/IMS/WQMS/WPS

QTY	DESCRIPTION & DIMENSION	ITEM	REF.DRGS	MAT.SPEC	WEIGHT/UNIT	REMARKS
	GROUP: 9-0					
WELD PROCEDURE SPECIFICATION DETAILS						SUPERSEDED BY:
						SUPERSEDES:
						SCALE: SSE/D 12/24
						NTS: CHD J.RAMESH, DRN UKKAPANDIAN T/NAZARUL HAQUE
Alpha Alt:- b						INTEGRAL COACH FACTORY CHENNAI-38
DATA CODE NO. 140						INDIAN RAILWAY STANDARDS
2-12-2024 16-09-2017						SHEET 2 OF 2
0 Num. Alt. DATE OF LATEST ALT DATE OF FIRST ISSUE AME/SME						ICF/STD-9-0-999



1. DIMENSIONS SHOWN ARE INDICATIVE ONLY.
2. FRAME TO BE FABRICATED FROM MS CHANNELS AND I-BEAM WITH BOLTS AND NUTS FOR EASY DISMANTLING.
3. FRAME TO BE OF ADEQUATE STRENGTH FOR TRANSPORTING AND LIFTING.
4. PACKING SHALL BE SUCH THAT, ROOF SHALL NOT GET DAMAGED DURING TRANSPORTING AND LIFTING.
5. IN ADDITION TO THE CLAMPING ARRGT. PROVIDED, SUITABLE BANDS ARE TO BE USED FOR CLAMPING THE ROOF WITH THE FRAME STRUCTURE AT VARIOUS LOCATIONS.
6. RUBBER OR WOOD TO BE PROVIDED AT THE CONTACT SURFACES AND ARE TO BE GLUED OR SCREWED.
7. SUITABLE NAME PLATE WITH MANUFACTURER'S NAME, MONTH AND YEAR OF MANUFACTURE TO BE FIXED ON THE FRAME.
8. PACKING TO BE OPENED AT THE TIME OF ASSEMBLY AND THE FRAME STRUCTURE IS TO BE TAKEN AWAY BY THE SUPPLIER, AFTER THE ASSEMBLIES ARE TAKEN FOR PRODUCTION.
9. ALL THREADED HOLES OF ROOF TO BE PLUGGED WITH PLASTIC DUMMY SCREWS TO AVOID DAMAGE OF THREADS.

[illegible]