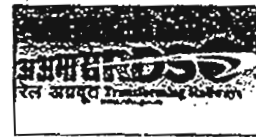




भारतीय रेलवे
Research Designs & Standards Organisation
Lucknow - 226 011
DID (0522) 2450115
DID (0522) 2465310

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, Chandrasekharapur, 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.

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.

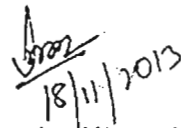
Table-B

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.

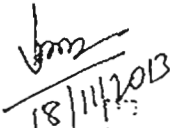
DA: As above


(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


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

S/c

Where :

W_o = Average weld-metal thickness before the test

W = Average weld-metal thickness after the test

B_o = 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 there of 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.

स.अ.इ.यांत्रिक का क.क.
Office of the CDE/ICF

Department of India Ministry of Railways
Research Designs & Standards Organisation
Lucknow - 226 011
DDO (527) 2465118
DDO (522) 2465119



Date: 07.10.2015

19

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, Jamalpur, Munger, Bihar- 811 214.
5. ED, CAMTECH, Maharajpur, Gwalior, Madhya Pradesh-474 005.

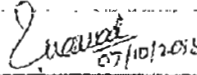
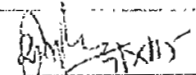
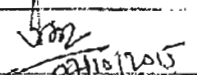
SSC/mag

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 Ni 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

C/LF-1880

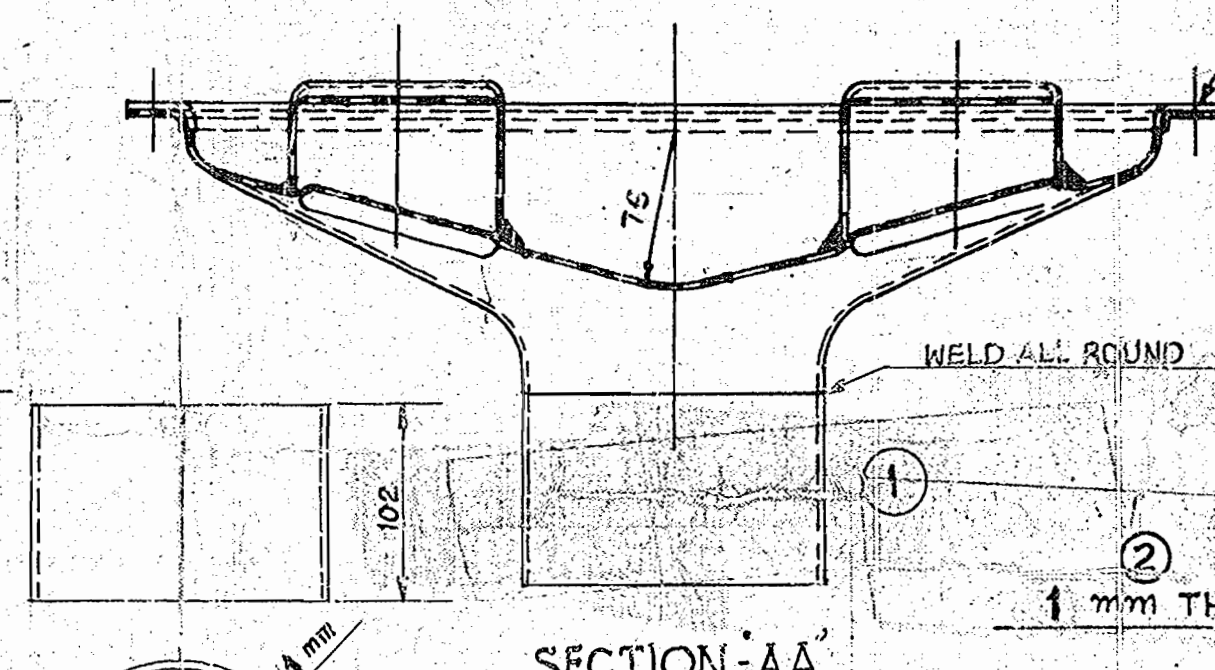
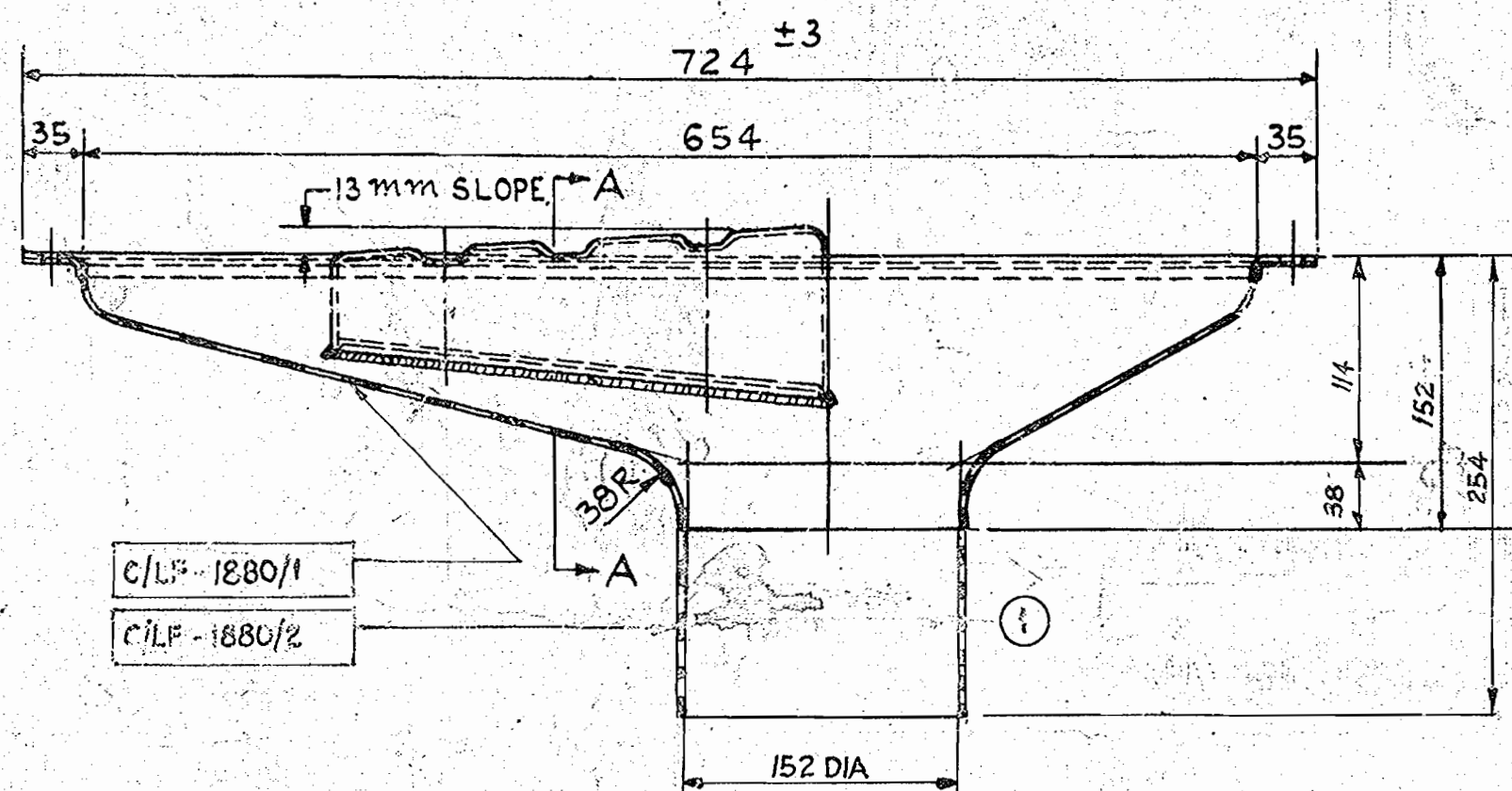
I.R. PART NO:

I.R. PART NO.	DESCRIPTION	NO.	REMARKS
C/LF-1880/1	PAN	1	
C/LF-1880/2	RING	1	

STAMP 5 mm TYPE "IRS C/LF-1880"

FREELY INTERCHANGEABLE
WITH IRS C-1880

②



48-6 DIA: SPOT WELDS EQUALLY SPACED.

2-MIO STAINLESS STEEL STUDS
PER PAD

WELD ALL ROUND

1 mm THICK

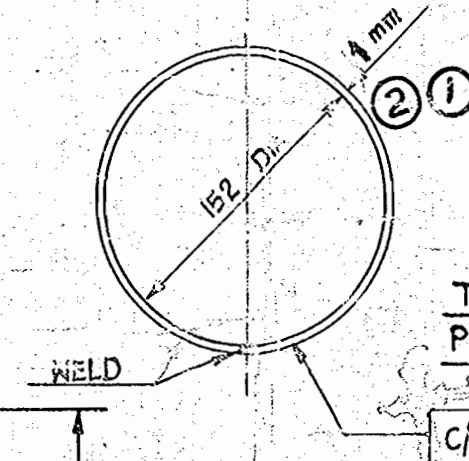
STANDARD WASHER

SPRING WASHER

SPLIT PIN

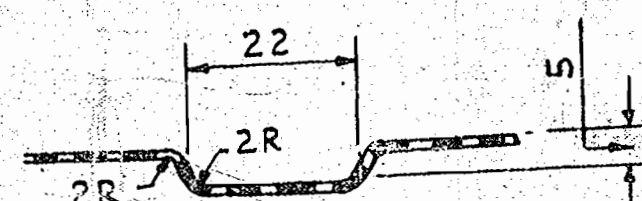
6 mm PRESSED IN

ALTERNATIVE ARRANGEMENT OF FIXING PAD

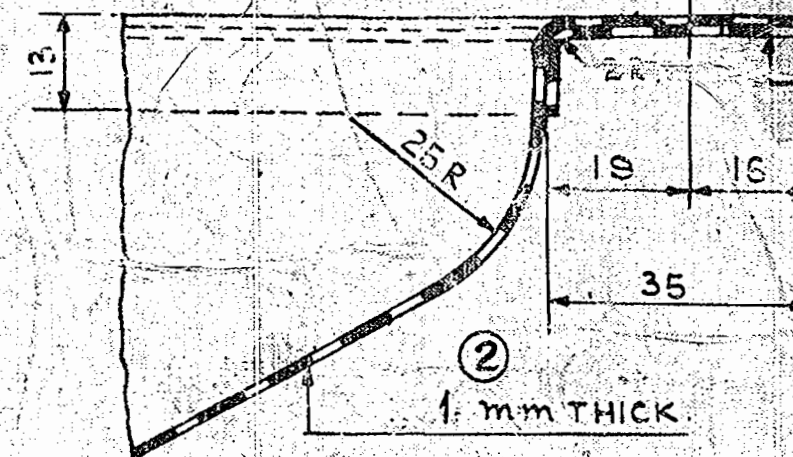


TO BE SOLDERED ALLROUND AFTER
PADS ARE BOLTED IN POSITION.

C/LF-1880/2



SECTION 'BB'



SECTION 'CC'

NOTE:-

1. PADS PRESSED SEPARATELY & WELDED OR BOLTED TO PAN.
2. SPACING & SIZE OF HOLES AS SHOWN UNLESS OTHERWISE SPECIFIED BY THE PURCHASER.

* STAINLESS STEEL (18/8 NICKEL CHROME)
IRS R-28.

6 DIA: CSK: HOLES.

FILED OR ROUGH GROUND	ROUGH MACHD:	FINISH MACHD:	FINE FINISH MACHD:	GROUND	HARDENED & GROUND
* > 80	* 4 TO 80	* 16 TO 40	* < 16	* < 10	* < 10

* ROUGHNESS NOS: IN MICRONS.

TYPE	MTL:	SPEC. NO:	TREAT	WEIGHT	SCALE
SIZE				5.6 Kg	- DO NOT SCALE
FORM					
RLY. PAT:					
RAILWAYS CONCERNED TO FILL					

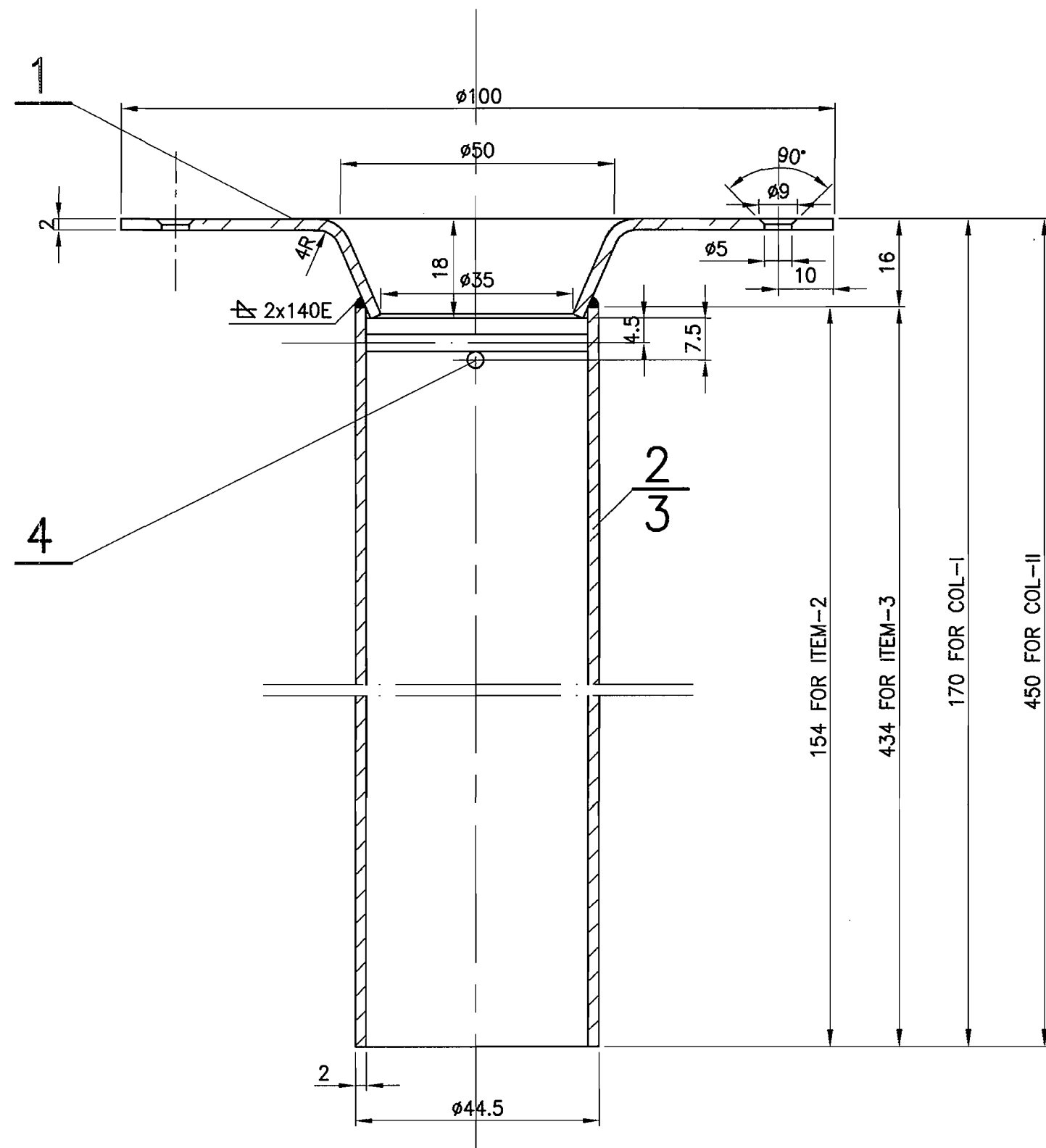
DATE	AUTHY	DESCRIP
4.3.82	(3) CPD/82/1	WEIGHT WAS 6.8 KG.
5.11.76	(2) CPD/76/21	THICKNESS OF SHEET ALTD FROM 1.20 mm TO 1 mm
3.5.66	(1) CEN/METRIC/POD/1880	FREELY INTERCH. IRS C-1880 DE
		DRG. MODIFIED U

LAVATORY PAN

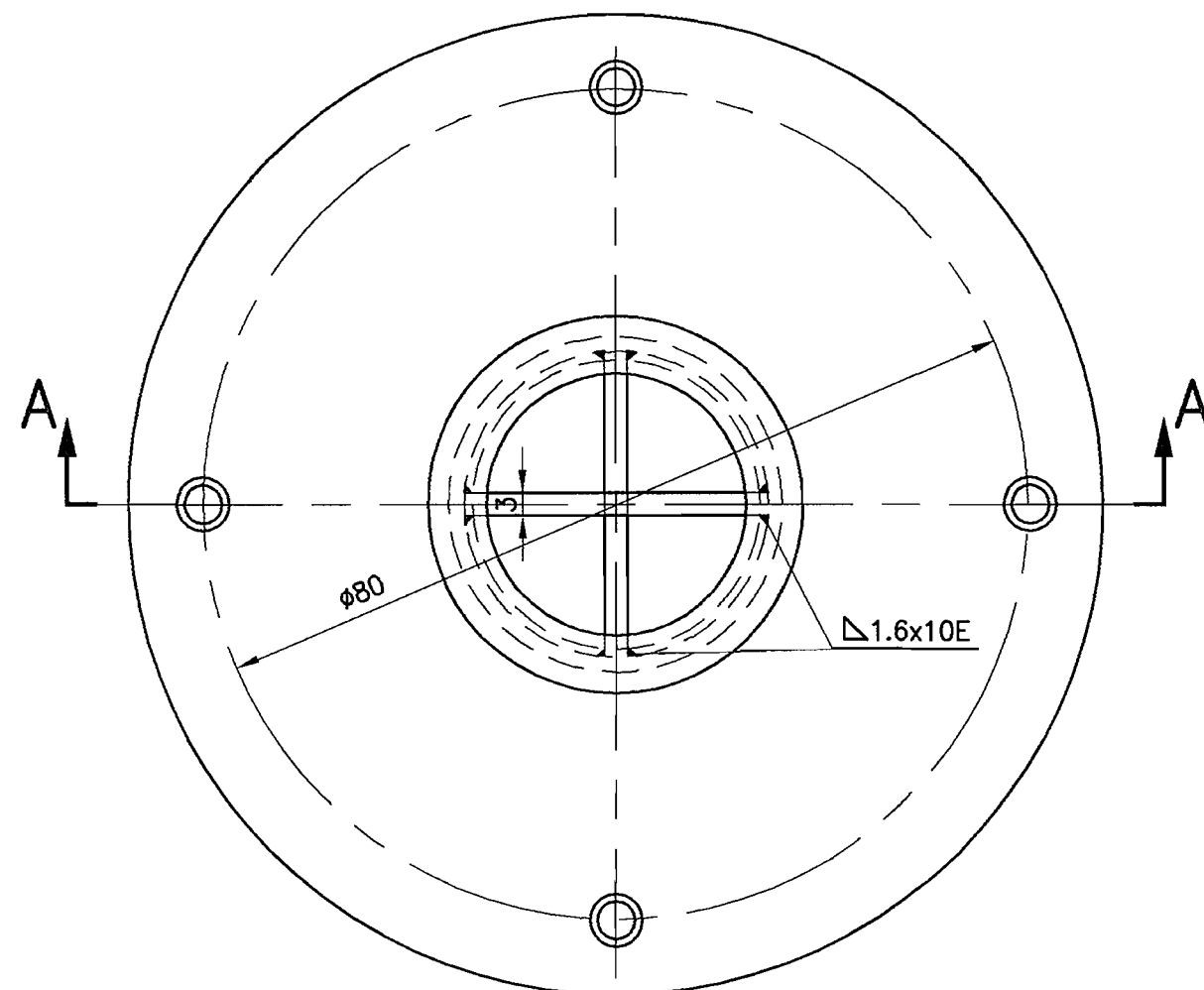
WHERE USED FOR	NO.
IRS	
C/LF-1880	
I.R. PART NO:	

DATE	ALLIED ENGINEERS
91-7-53	
DS(M)	

DESCRIPTION OF JIG OR TOOL	JIG OR TOOL No.	▽ ROUGH MACHINED	① ROUGH CLEANED	ALTERATIONS
		▽▽ FINISH MACHINED	⑱ CHAMFERED	④ 4/2001
		▽▽ FINE FINISH MACHINED	⑳ BURRS REMOVED	ASSEMBLY DRAWING NO. WGSCZAC3-4-1-301 DELETED.



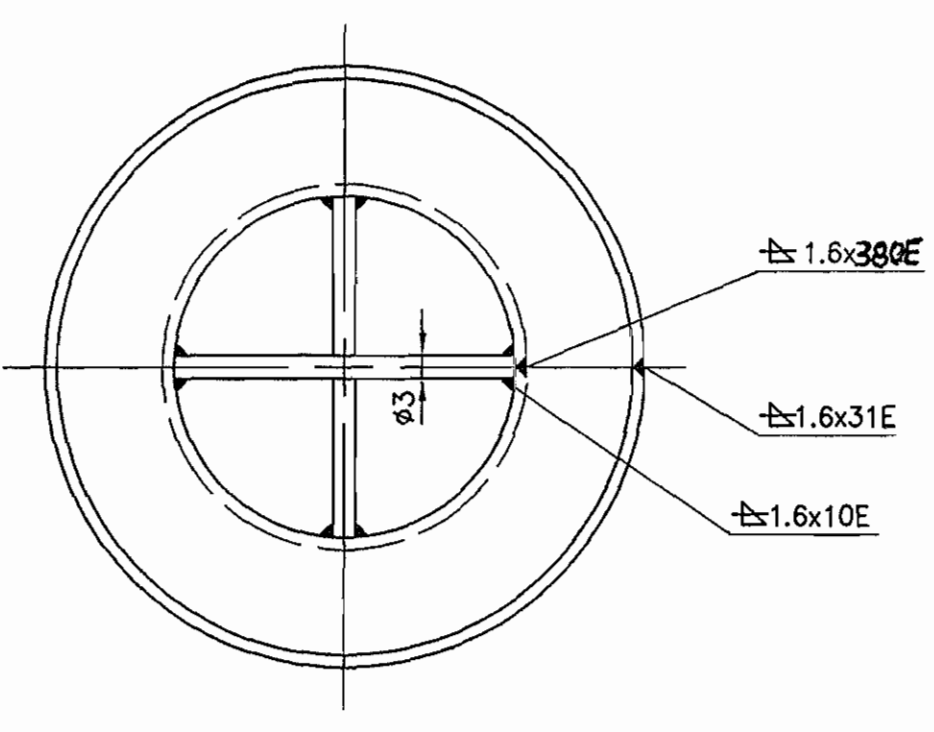
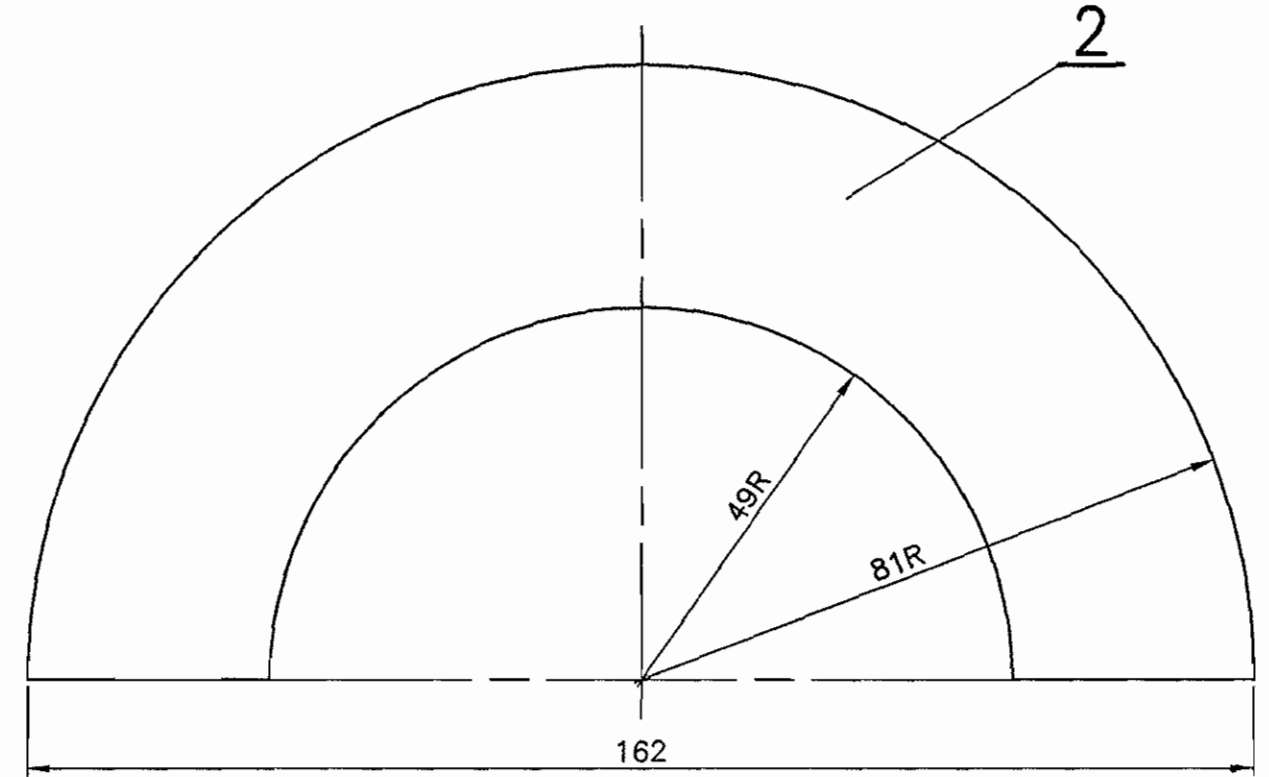
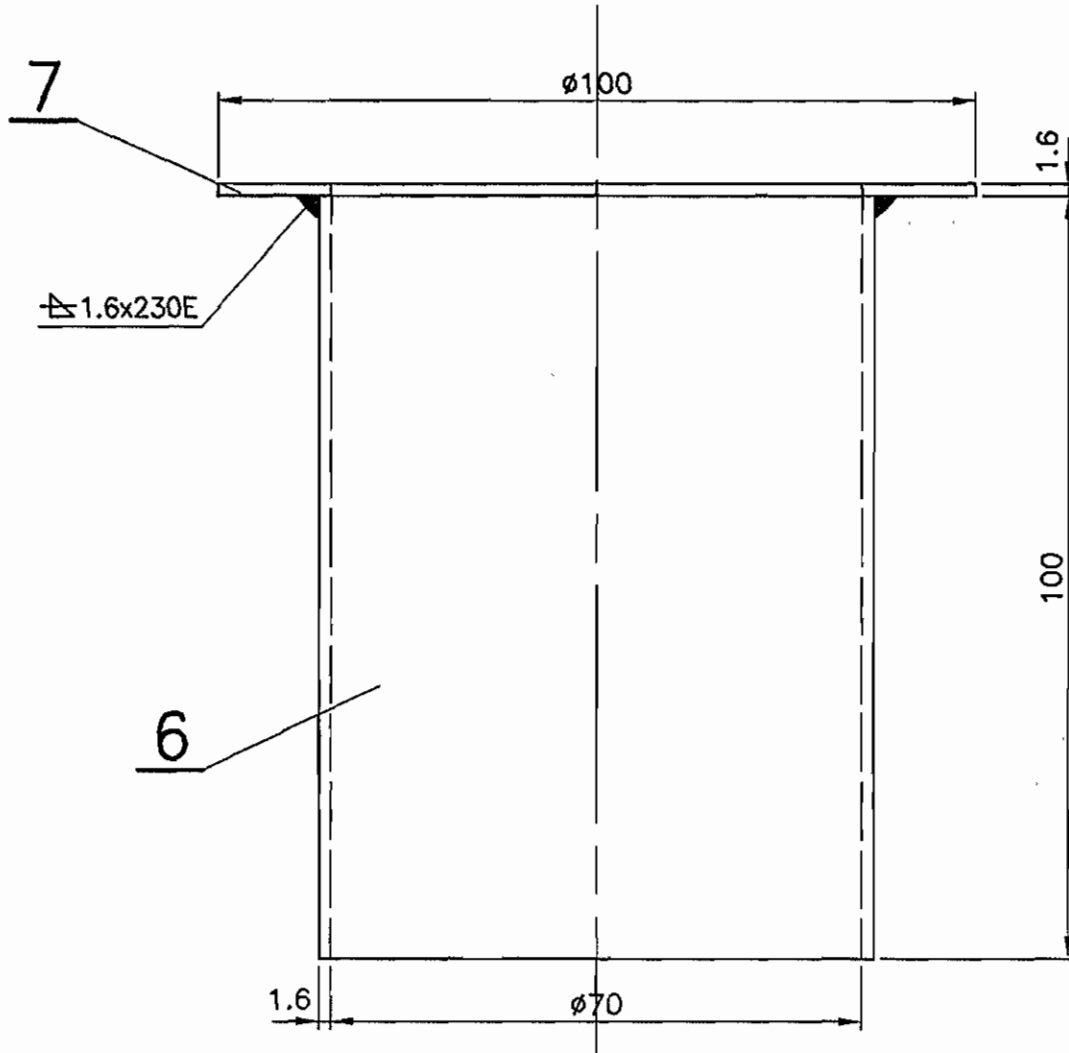
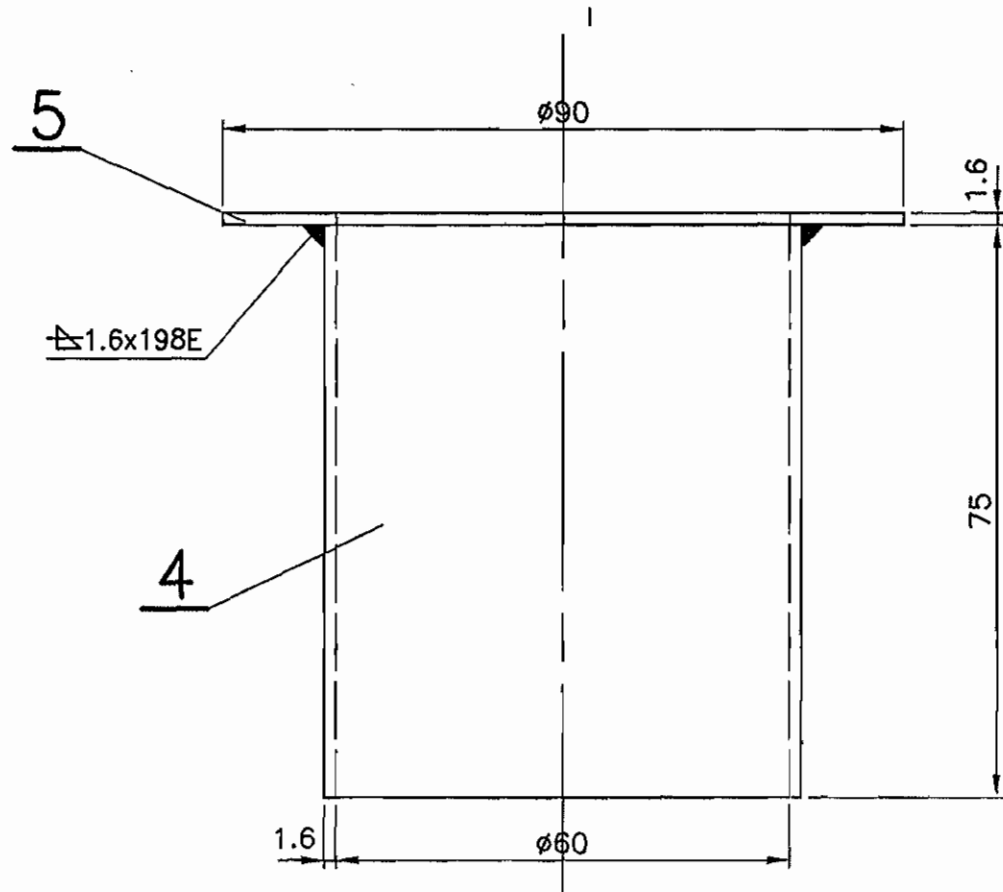
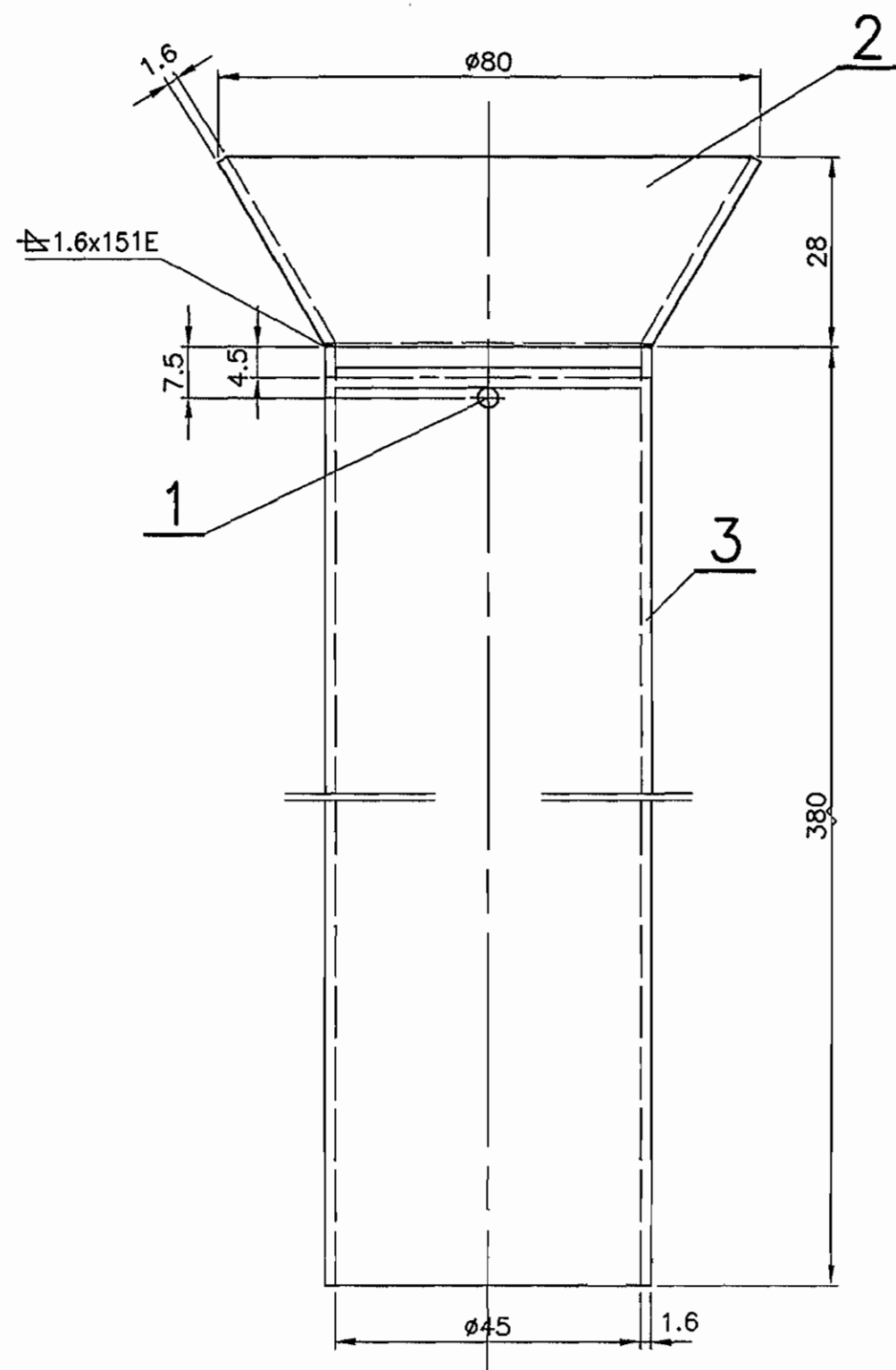
SECTION -AA



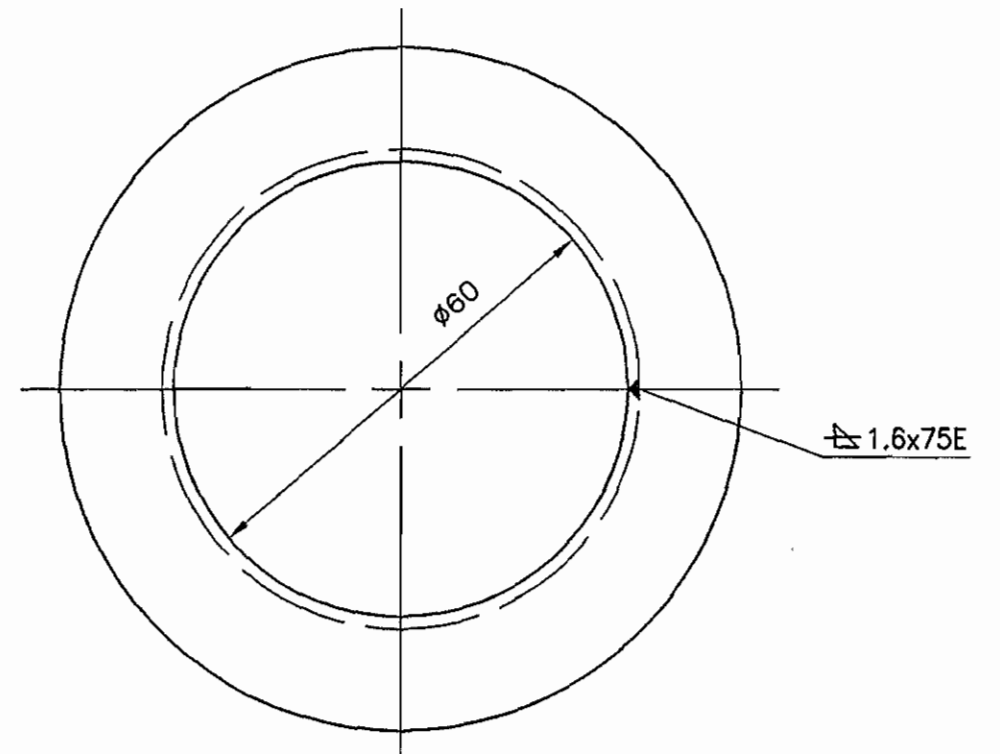
NO. OF ASSY REQUIRED PER COACH		
TYPE OF COACH	COL-I	COL-II
GS, SDC2	6	-
SCN5	4	-
WCB4	11	-
WLRRM8	-	5
ARTV	1	-
WGMWAC, DHTC, WGSCZAC3	-	1
MEMU/TC2	16	-
DMU/DPC	4	-
DC/EMU/2C & CH	46	-
DC/EMU/2D & DH	38	-
DC/EMU/2D & DH (MIDDLE TRAILER)	40	-
MEMU/DMC2 & DMC3	5	-
EMU/2A (E & SE)	45	-
EMU/2C, EMU/2C (E & SE)	45	-
EMU/2D (E & SE), EMU/2D	25	-
DMU/TC	6	4
DMU/DTC	6	2
EMU/M2	5	-
EMU/M2 (MODULAR)	3	-
DMU/DPC5	2	-

DC/EMU2/D-4-1-501			2	2	S. S. WIRE	ø3 X 40	4			FINISH-2D
DC/EMU2/C-4-1-501			1	-	DRAIN PIPE	OD 44.5x434	3			WELDED TUBE FINISH-2D
MEMU/TC2-4-1-201			-	1	DRAIN PIPE	OD 44.5x154	2		AISI-304	WELDED TUBE FINISH-2D
DMU/TC-4-1-001			1	1	FLANGE	2 x ø100	1			FINISH-2D
DHTC-4-1-001										
WGMWAC-4-1-001										
DMU/DPC5-4-1-501	WLRRM8-4-1-801	NO. OFF	DESCRIPTION & DIMENSIONS			ITEM	REF. DRGS.	MATL. & SPECN.	REMARKS	
EMU/M2-4-1-501	ARTV-4-1-001	IV	III	II	I	GROUP: 4-1 FLOORING				SUPERSEDED BY:
EMU2/D-4-1-501	WGSCZAC3-4-1-301					DRAIN PIPE STAINLESS STEEL				SUPERSEDES: ICF/STD-4-1-007/f
DMU/DPC-4-1-001	WCB4-4-1-401									SCALE 1:1
MEMU/DMC2-4-1-201	SCN5-4-1-501									SSE/D
EMU2/C-4-1-501	SDC2-4-1-202									CHD
EMU2/A-4-1-502	GS-4-1-003									TRD
ASSEMBLY DRAWINGS										DRN
						CAD FILE: C:\MD-CAD\140\4-1\007-SG00.DWG				ALT.
						DATA CODE 140	INDIAN RAILWAY STANDARDS	SHEET 1 OF 1	INTEGRAL COACH FACTORY MADRAS - 38.	
									ICF/STD-4-1-007	

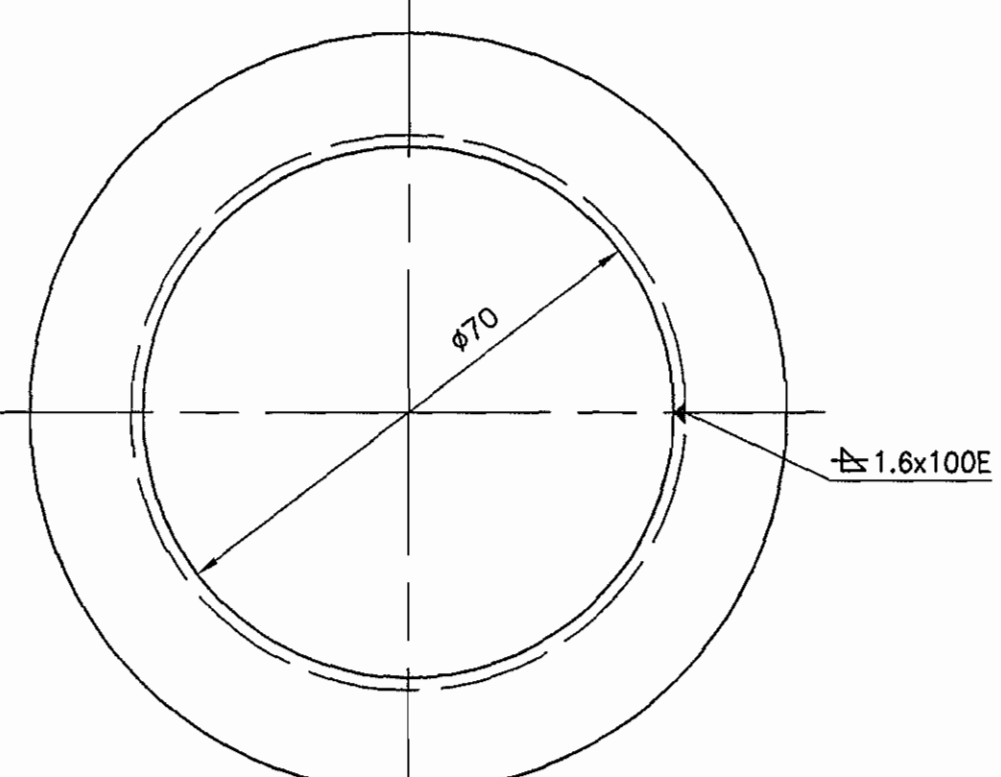
▽	ROUGH MACHINED	Ⓒ	ROUGH CLEANING	ALTERATIONS
▽▽	FINISH MACHINED			① 04/2007
▽▽▽	FINE FINISH MACHINED			MAT. SPEC. FOR ITEMS-1 TO 7 UPDATED.
		sd/-	sd/-	
		SSE/D	SME/DSD	
		②	12/2013	R.M. SIZE OF ITEM-3 ALTD. FROM 1.6x147x422 TO 1.6x147x380.
		SSE/D	SME/DSD	



COL-I



COL-II



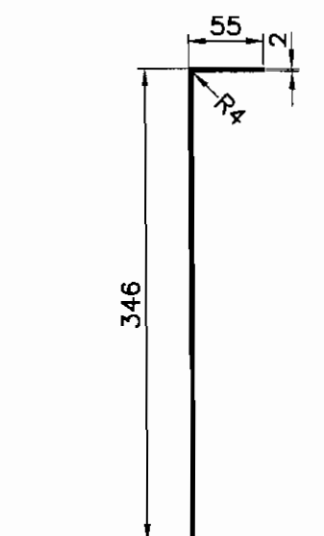
COL-III

© ITEM-2 MAY BE OBTAINED FROM THE SUITABLE CUTTING DIAGRAM FOR OPTIMISATION.

NO.	OFF.	DESCRIPTION & DIMENSIONS	ITEM	REF. DRGS.	MAT.& SPEC.	REMARKS
-	1	S.S. FLANGE FOR WASH BASIN OUTLET	7			
-	1	S.S. TUBE FOR WASH BASIN OUTLET	6			
-	1	S.S. FLANGE FOR SIDE FILLING PIPE	5			
-	1	S.S. TUBE FOR SIDE FILLING PIPE	4		AISI-304	FINISH-20
-	1	S.S. TUBE	3			
-	1	S.S. COVER	2			②
-	2	S.S. WIRE	1			
GROUP: FLOORING						
SUPERSEDED BY: ICF/STD-4-1-008 ALT 'a'						
PER ASSY	PER ASSY	PER ASSY	HOUSINGS AND DRAIN OUTLET FOR S.S. TOILET INLAY			
SCALE	SSE/D	CHD	TRD	CAD	ALT	
1:1						
INTEGRAL COACH FACTORY CHENNAI - 38.						
ICF/STD-4-1-008						

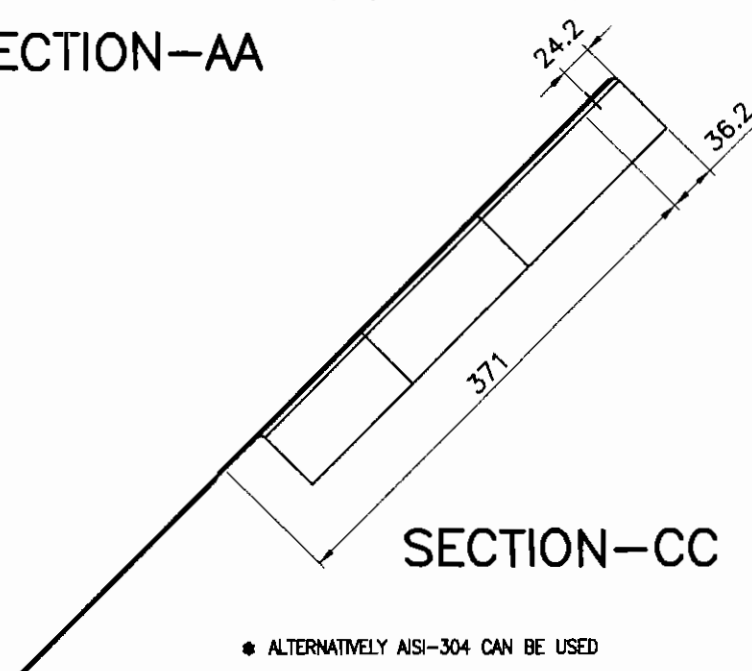
ASSEMBLY DRAWINGS			
11-12-2013	25-06-02		
ALT.	DATE OF LATEST ALTN	DATE OF FIRST ISSUE	AME/SME.

▽ ROUGH MACHINED	① ROUGH CLEANED	ALTERATIONS
▽▽ FINISH MACHINED		
▽▽▽ FINE FINISH MACHINED		



Technical drawing of a rectangular plate. The overall width is 288 mm. The overall height is 266 mm. The width of the top flange is 242 mm. The width of the bottom flange is 242 mm. The thickness of the plate is 55 mm. The top flange has a fillet radius of 8R. The bottom flange has a fillet radius of 4R. The drawing includes dimension lines and arrows indicating the measurements.

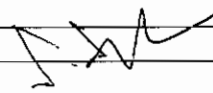
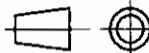
SECTION-BB





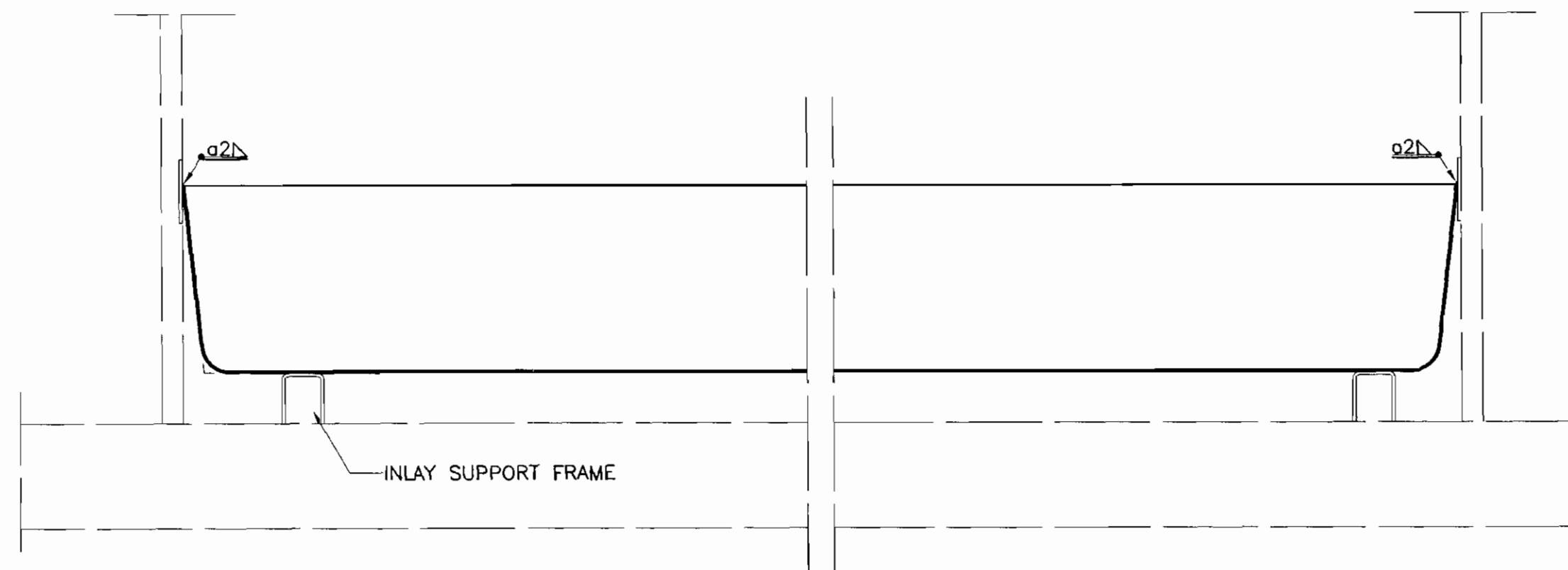
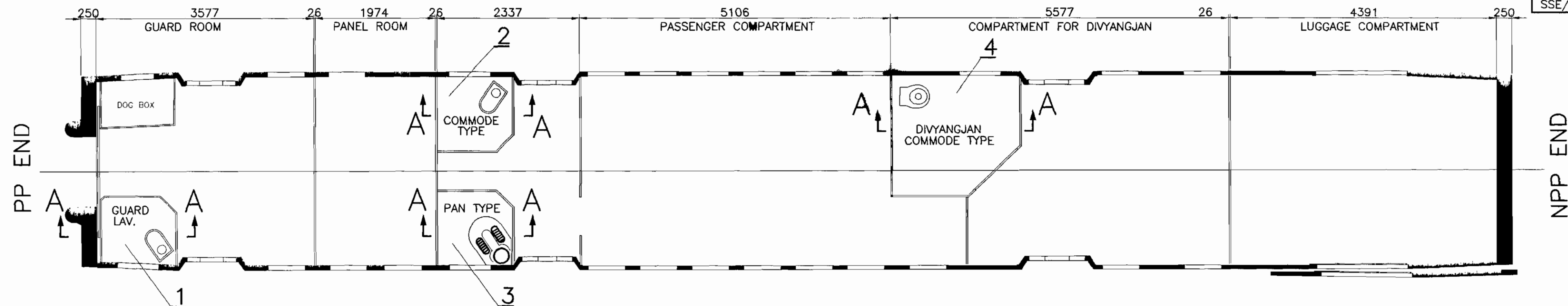
SECTION-CC

* ALTERNATIVELY AISI-304 CAN BE USED

		LSLRD-4-1-002	
		ASSEMBLY DRAWINGS	
		26/10/2019	N.K. 26/10/19
ALT	DATE OF LATEST ALTN.	DATE OF FIRST ISSUE	AME/SME

		-	-	-	-	1	PAN SEAT 2x524x524	1		RDSO/SPEC C-K 201 (X5CrNi1810)		*		
NO.OFF							DESCRIPTION AND DIMENSIONS	ITEM	REF.DRG	MAT & SPEC.	WEIGHT/UNIT	REMARKS		
	V	IV	III	II	I	GROUP: 4-1 FLOORING					SUPERSEDED BY:			
	PER ASSY	PER ASSY	PER ASSY	PER ASSY	PER ASSY	PAN SEAT.					SUPERSEDES:			
											SCALE	SSE/D		
											1:2.5	CHD		
											1:1	ALT		
							DRN	P. Thulasidas						
							ALT							
							CAD FILE:- C:\MD-CAD\741\4-1\741-4-1-004.dwg					 INTEGRAL COACH FACTORY CHENNAI - 38.		
						DATA CODE 741	INDIAN RAILWAY STANDARDS			SHEET 1 OF 1				
							LSLRD-4-1-004							

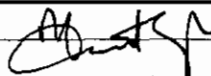
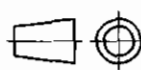
▽ -- ROUGH MACHINED	① ROUGH CLEANING	ALTERATIONS
▽▽ -- FINISH MACHINED		② 11/2023
▽▽▽ -- FINE FINISH MACHINED		NOTE-4 TO 6 ADDED
		 SSE/D
		 AME/D



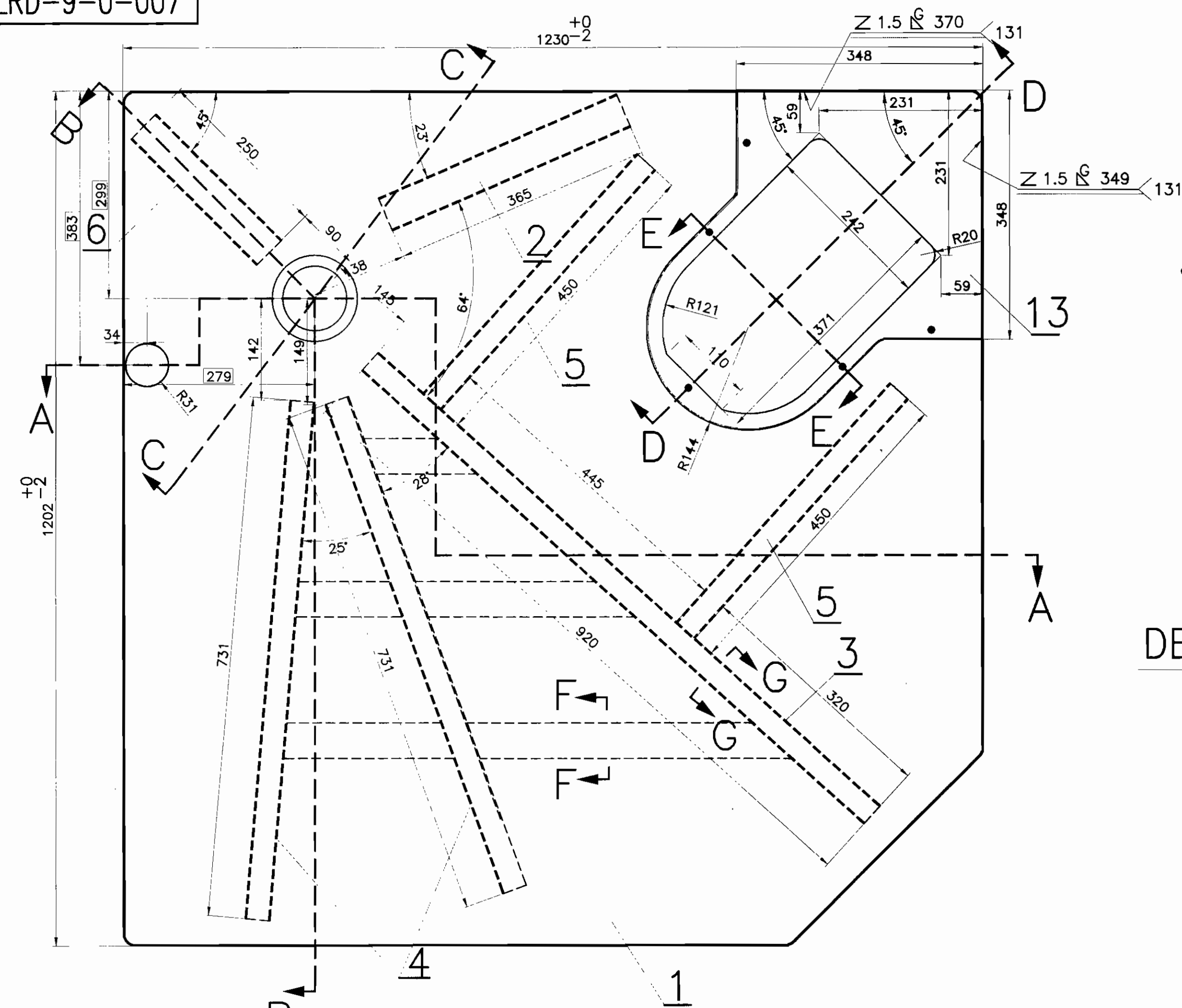
SECTION-AA

NOTE:-

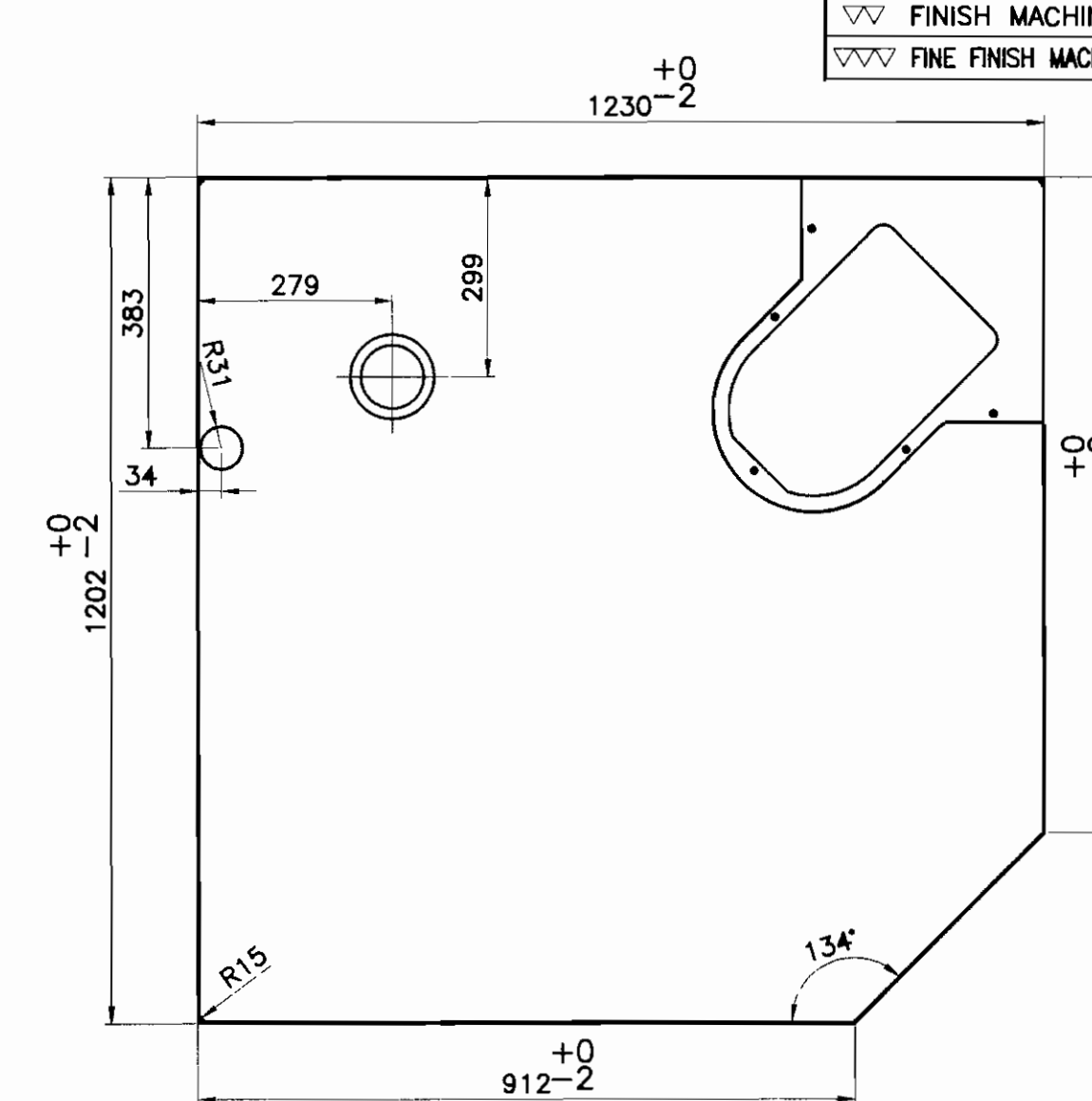
1. SS LAVATORY INLAY SHALL BE PLACED ON INLAY SUPPORT FRAME, SIDE FLANGES TO BE OPENED AND ALLIGNED TO PARTITION, SIDEWALL AND ENDWALL AND CONTINUOUS WELDING SHALL BE CARRIED OUT AS SHOWN.
2. SUITABLE WELDING ELECTRODE SHALL BE USED FOR WELDING STAINLESS STEEL INLAY TO CORTEN STEEL/MILD STEEL MEMBERS TO AVOID BIMETALLIC CORROSION.
3. WELDING OF DRAIN OUTLET PIPE/ WASHBASIN OUTLET PIPE TO INLAY ASSY. SHALL BE ENSURED.
4. INLAYS TO BE INSTALLED & WELDED IN SUCH A WAY THAT WATER IS NOT STAGNATED ON THE INLAY SURFACE
5. TEST TO BE CARRIED OUT TO CHECK, THE COMPLETE DRAIN OF WATER THROUGH DRAIN HOLE
6. CARE TO BE TAKEN IN ORDER TO AVOID DRUMMING EFFECT OF INLAY

			1	LAV. FLOOR COMPLETE (DIYANGJAN-COM.)	4	LSLRD 9-0-009									
			1	LAV. FLOOR COMPLETE (PAN TYPE)	3	LSLRD 9-0-008									
			1	LAV. FLOOR COMPLETE (COMMODE TYPE)	2	LSLRD 9-0-007									
			1	LAV. FLOOR COMPLETE (GUARD-COMMODE)	1	LR63245									
NO OFF				DESCRIPTION & DIMENSIONS		ITEM	REF. DRG.	MAT. & SPEC.	WEIGHT/UNIT	REMARKS					
IV	III	II	I	GROUP: 9-0						SUPERSEDED BY:					
				LAVATORY INLAY ASSEMBLY						SUPERSEDES: LSLRD-9-0-006, Alt.-/-					
										SCALE 1:50 1:5		SSE/D CHD ALTD DRN		 P. Thulasidas P. Thulasidas	
										ALT		a			
										PER ASSY					
				CAD FILE: C:\MD-CAD\741\9-0\00615400.DWG											
				DATA CODE No.		INDIAN RAILWAY STANDARDS			SHEET 1 OF 1						
				741					LSLRD-9-0-006						
										INTEGRAL COACH FACTORY CHENNAI-38					

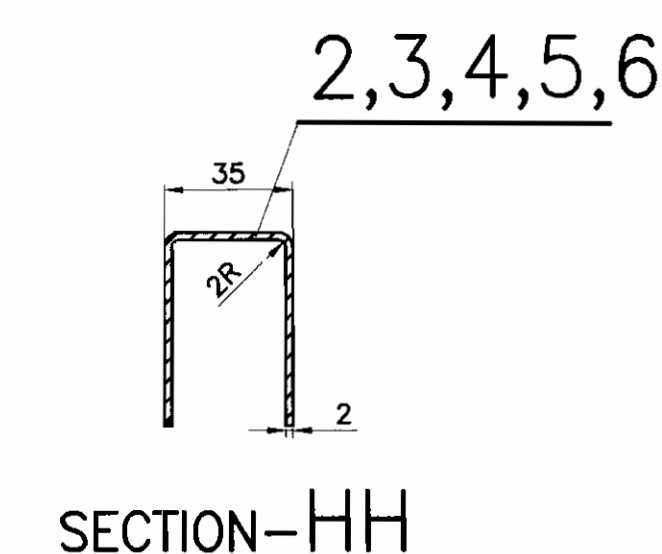
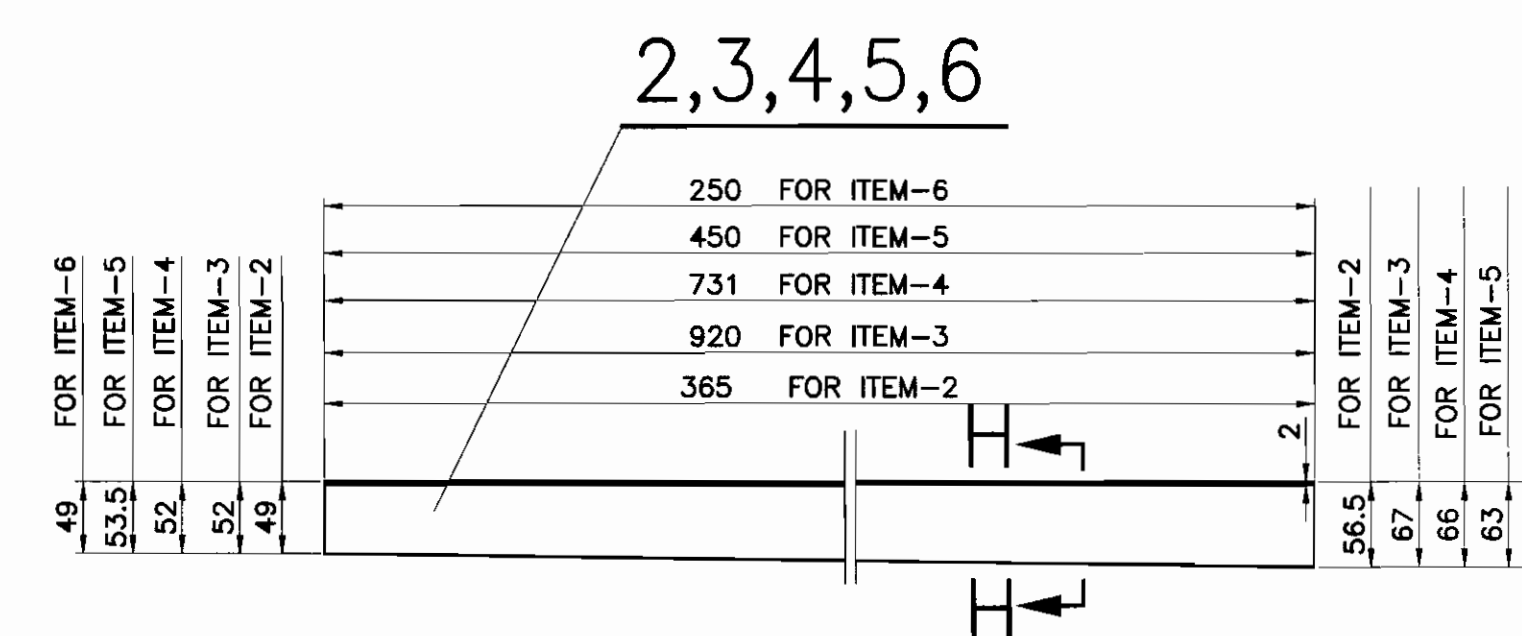
▽ ROUGH MACHINED	① ROUGH CLEANED	ALTERATIONS
▽ FINISH MACHINED		② 07/2021
▽ FINE FINISH MACHINED		LENGTH OF ITEM-3 & LOCATING DIM ALTD FROM 352 TO 320
		-Sd/- SSE/D
		-Sd/- SME/D
		③ 08/2022
		LOCATING DIM OF R31 HOLE REVISED
		SSE/D
		SME/D



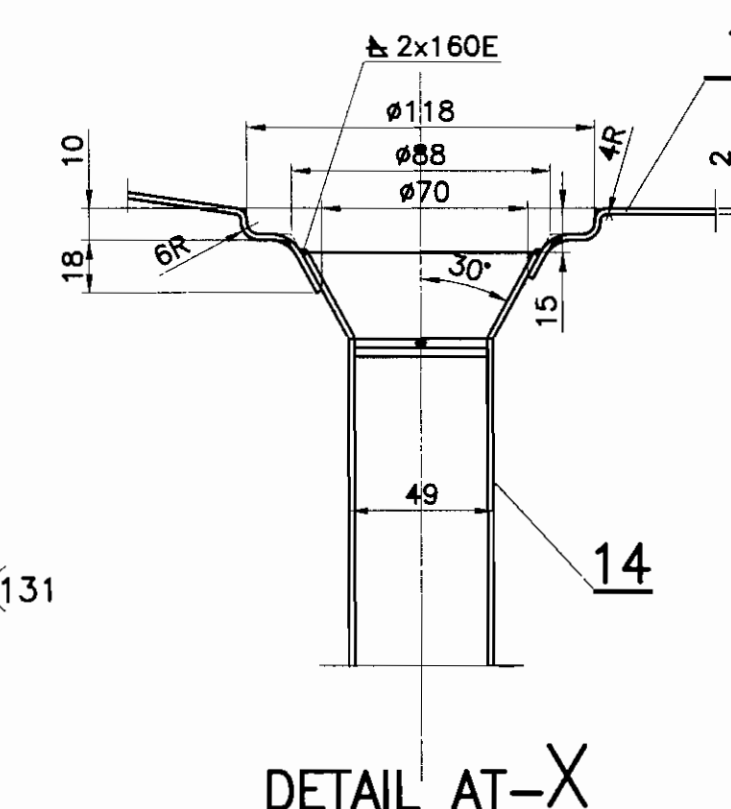
DETAILS OF LOCATION OF STIFFENERS



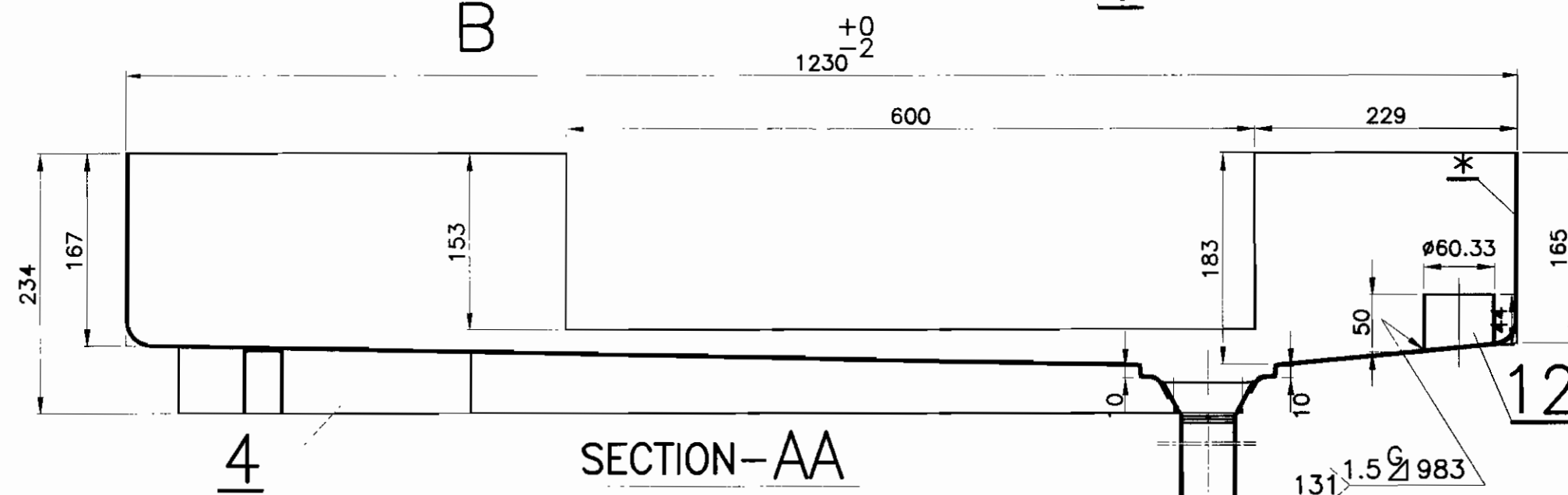
PAN FLOOR



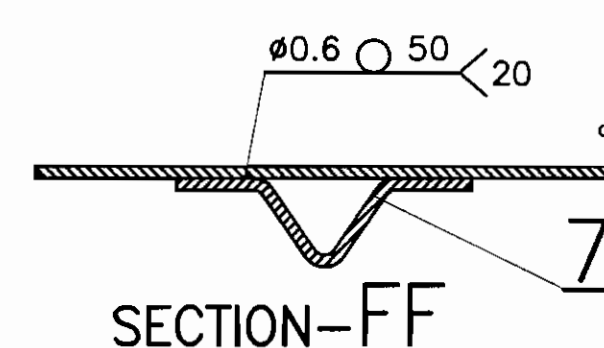
SECTION-HH



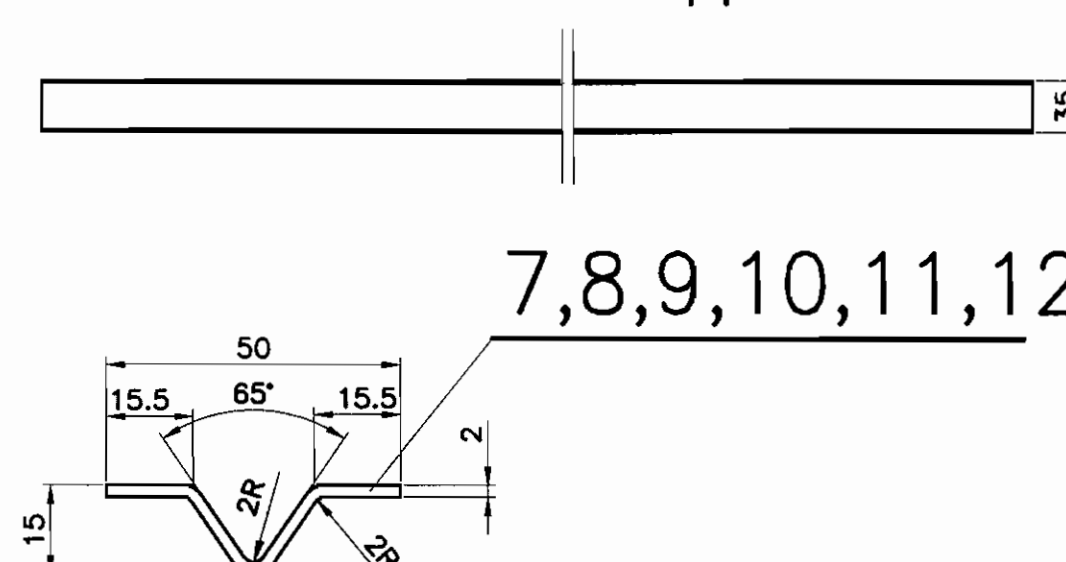
DETAIL AT-X



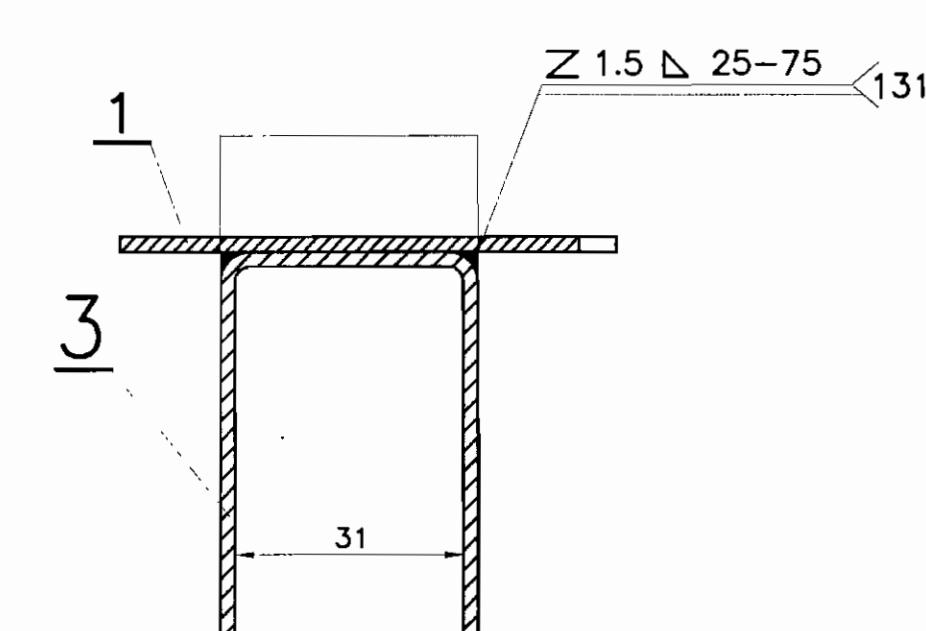
SECTION-AA



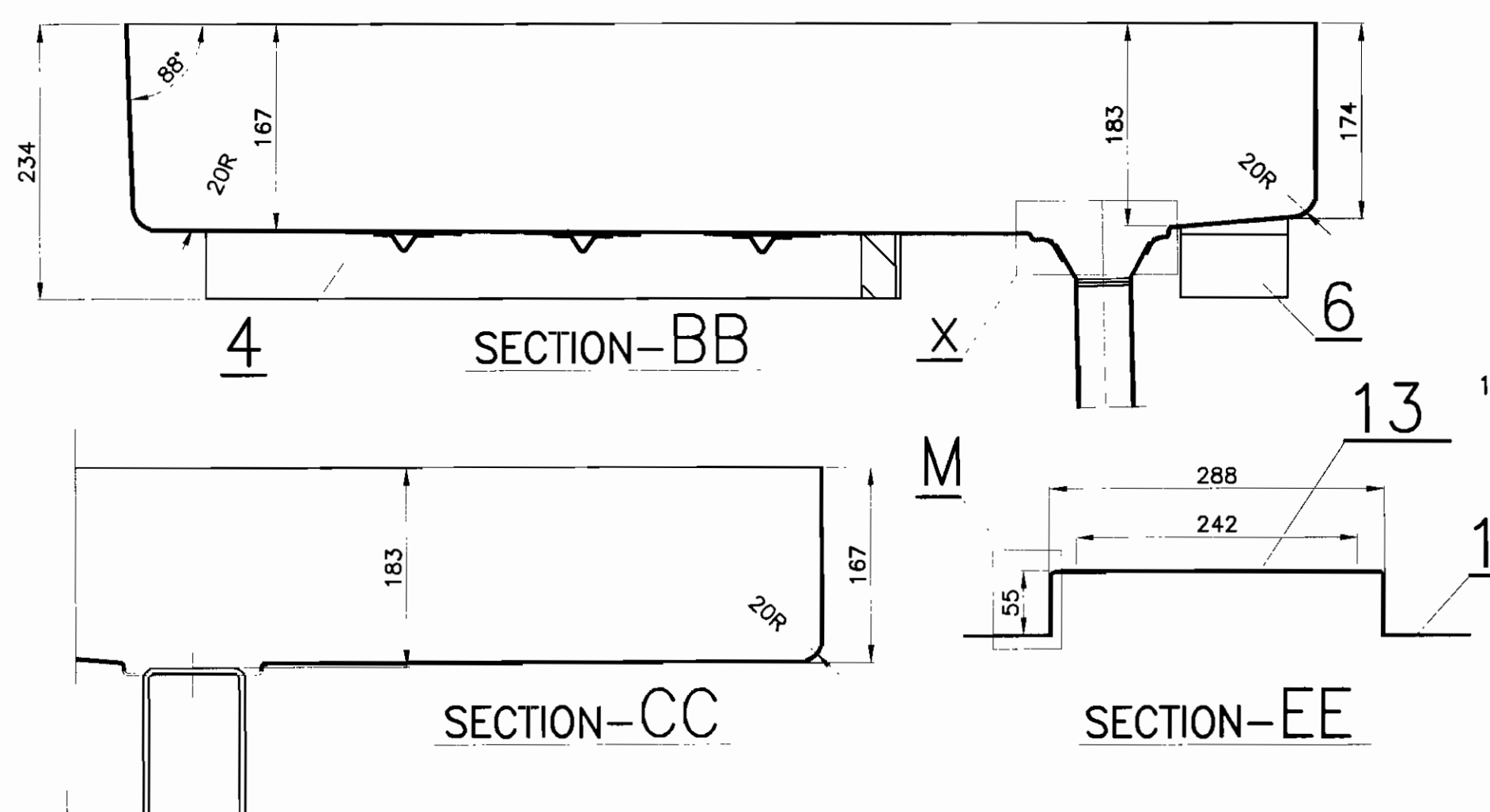
SECTION-FF



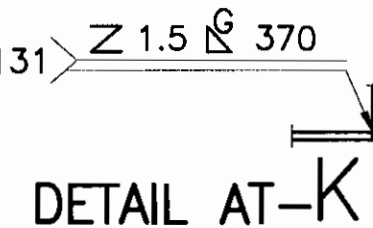
DETAILS OF STIFFENERS



SECTION-GG



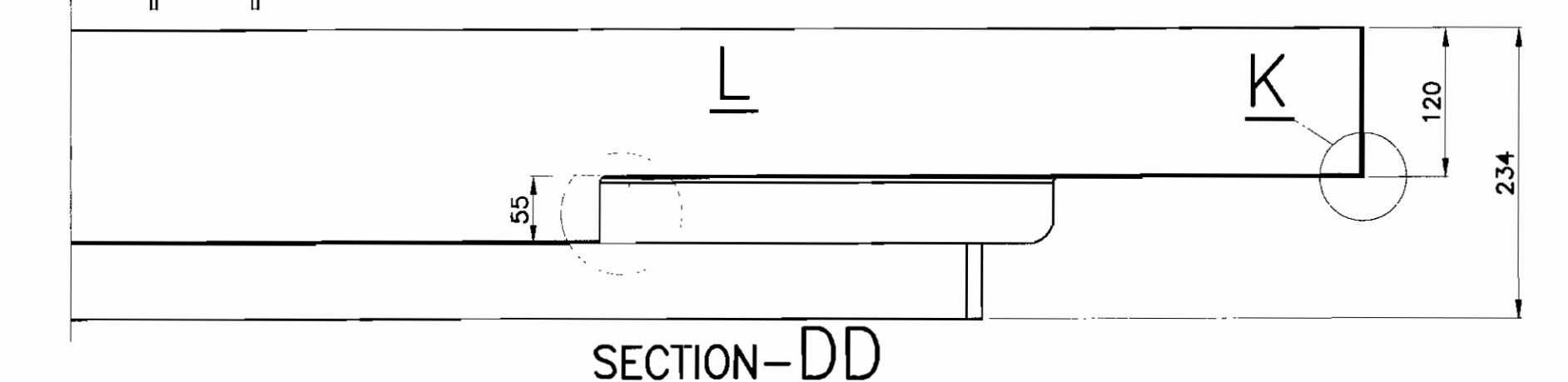
SECTION-BB



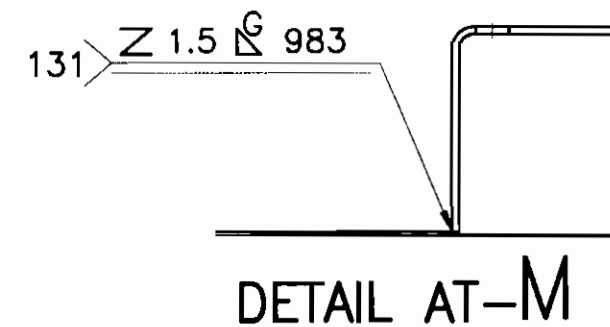
DETAIL AT-K



DETAIL AT-L



SECTION-DD



DETAIL AT-M

NOTE:-

- THE FOLLOWING DETAILS SHALL BE PUNCHED WITH 10MM HIGH LETTERS TO A DEPTH OF 0.5mm ON SKIRTING AT THE LOCATION MARKED THUS. *
(i) NAME OF THE MANUFACTURER.....
(ii) DATE OF MANUFACTURE.....
(iii) DRG.No. WITH COLOUMN.....
- WELDING ELECTRODE SHALL BE CONFIRM TO IRS-M-28-86,TAB.-8, CLAUSE-M1 E 19.9' OR EQUIVALENT.
- DIMENSION MARKED □ THUS SHALL BE MAINTAINED STRICTLY.
- ALTERNATIVELY STAINLESS STEEL TO IS:8911-92 Gr.-304S1 MAY ALSO BE PERMITTED IN LIEU OF RDSO/SPEC. C-K201 X5CrNi1810(304).
- SLOPE TOWARDS DRAIN OUTLET FOR INLAY SHALL BE PROVIDED TO SUIT ASSY. AS SHOWN.
- THE WELDED PORTION HAS TO BE GROUND & FINISHED.
- SUITABLE SURFACE PREPARATION SHALL BE DONE AFTER MASKING THE LAVATORY COMMODE AREA FOR PASTING OF P.V.C SHEET ON S.S.INLAY WITH A Rq VALVE [IN MICRONS] 0.5 TO 1.5
- A PROTOTYPE SAMPLE SHALL BE APPROVED BY ICF/DESIGN BEFORE BULK SUPPLY.
- ITEMS-14 SHALL BE SUPPLIED AS LOOSE PIECE, WELDED AT ASSEMBLY STAGE

NO.OFF	DESCRIPTION AND DIMENSIONS	ITEM	REF.DRG	MAT & SPEC.	WEIGHT/UNIT	REMARKS
1	DRAIN PIPE	14	ICF/STD 4-1-008			COL-1 #
1	PAN SEAT	13	LSLRD-4-1-004			
1	PIPE OD 60.33x2.77x50	12	ASTM A312/A312M Gr.TP304			
1	STIFFENER 2x55x149	11	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
1	STIFFENER 2x55x241	10	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
1	STIFFENER 2x55x140	9	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
1	STIFFENER 2x55x290	8	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
1	STIFFENER 2x55x438	7	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
1	SUPPORTING CHANNEL 2x147x250	6	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
2	SUPPORTING CHANNEL 2x155x450	5	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
2	SUPPORTING CHANNEL 2x159x731	4	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
1	SUPPORTING CHANNEL 2x161x920	3	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
1	SUPPORTING CHANNEL 2x146x365	2	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
1	PAN FLOOR	1	RDSO/SPEC C-K 201 X5CrNi1810			GRADE-304 \$
SUPERSEDED BY:						
SCALE 1:2.5						
SSE/D						
CHD						
ALT						
DRN						
ALT						
a						
b						
INTEGRAL COACH FACTORY CHENNAI - 38.						
LSLRD-9-0-007						

LSLRD-9-0-006	ASSEMBLY DRAWINGS
10/08/2022	24/12/2020
ALT	AME/SME

LAVATORY FLOOR COMPLETE (EURO TYPE)

CAD FILE: C:\WD-CAD\741\9-0-007-SB00.DWG

INDIAN RAILWAY STANDARDS

SHEET 1 OF 1

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

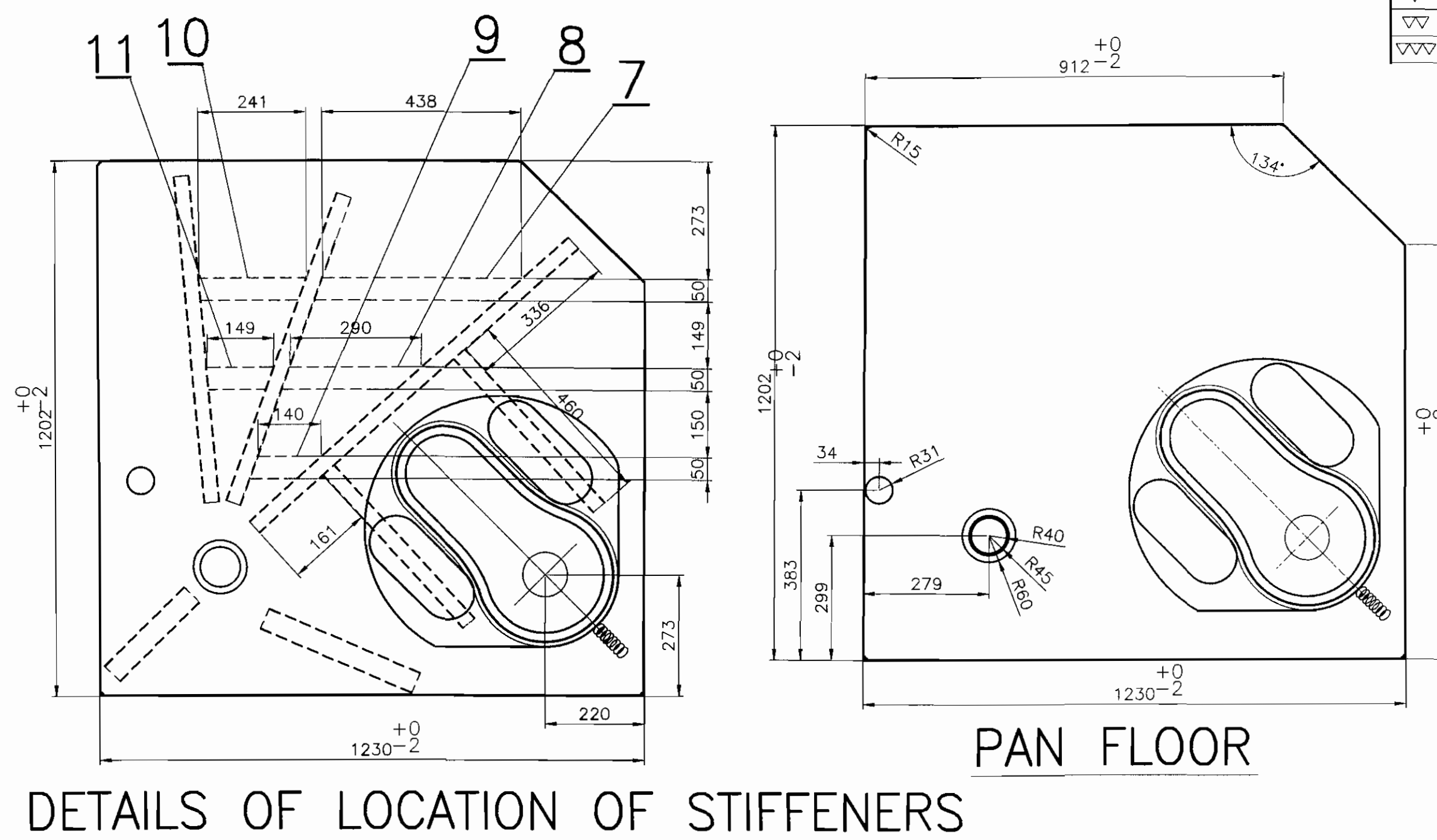
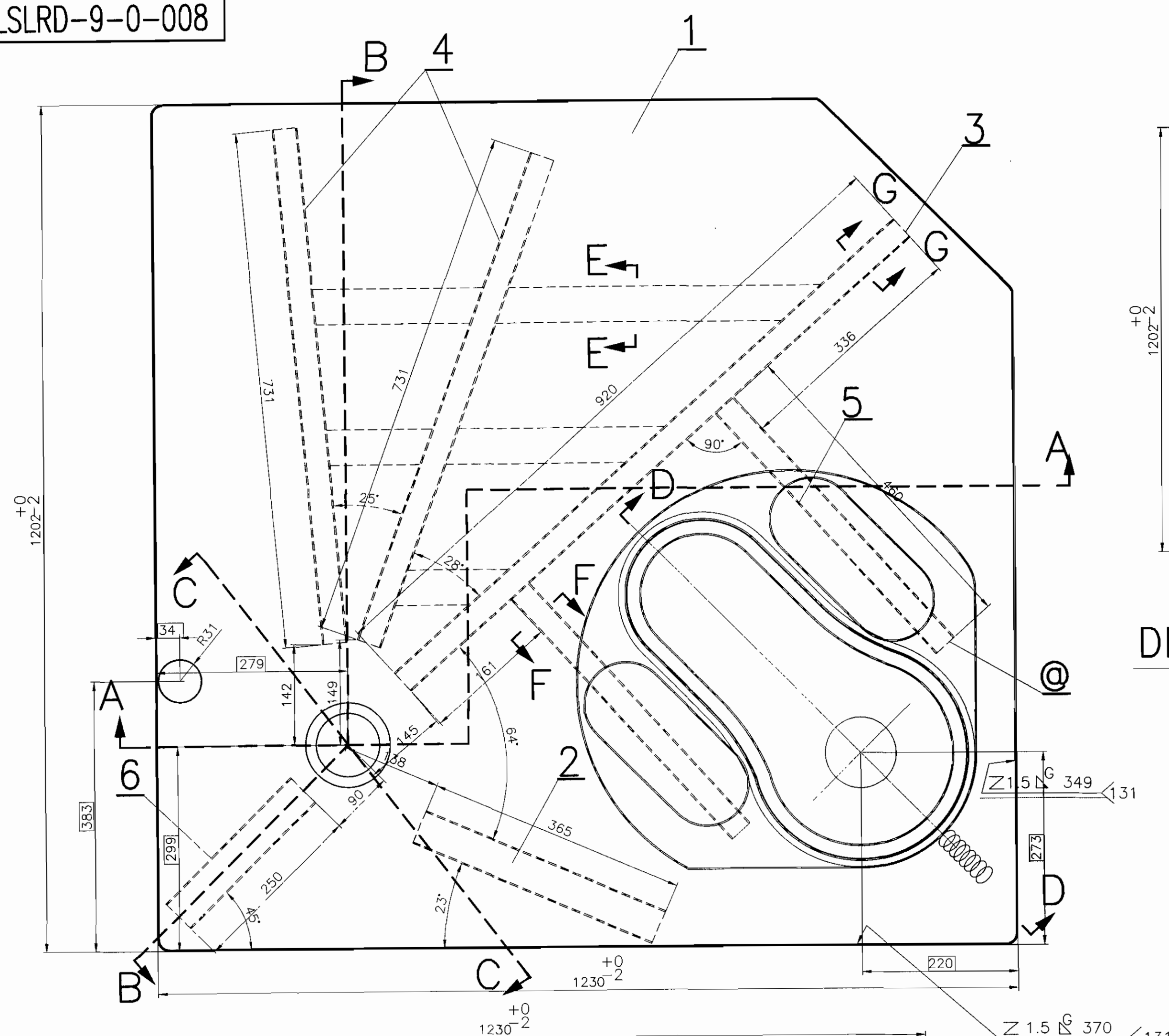
Comments of manufacturers of steel on Amendment No. 1 of November 2013 to RDSO Specification No. C-K 201 for Stainless Steel Sheets /Plates for Coaches of Indian Railways.

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 of the clause 1.1 of Annexure-1 of the specification to be read as follows: <table><thead><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></thead><tbody><tr><td>1 & 1.25mm</td><td>0.06</td><td>1.5 mm</td><td>10 mm</td></tr><tr><td>1.7 & 2.00 mm</td><td>0.075</td><td>2 mm</td><td>10 mm</td></tr><tr><td>2.50 & 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 & 6 mm</td><td>0.20</td><td>5 mm</td><td>15 mm</td></tr></tbody></table>	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	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.
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																									



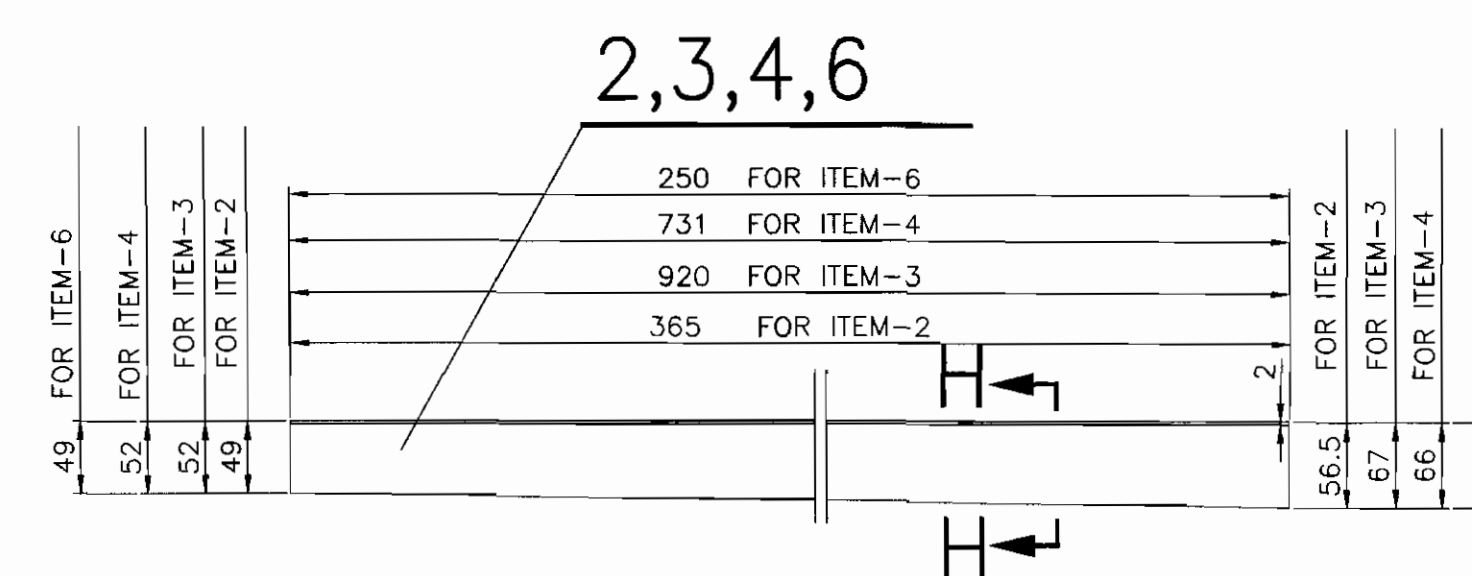
LSLRD-9-0-008

▽ ROUGH MACHINED	③ ROUGH CLEANED	ALTERATIONS
▽▽ FINISH MACHINED		① 07/2021
▽▽▽ FINE FINISH MACHINED		LENGTH OF ITEM-3 & LOCATING DIM ALTD FROM 191 TO 161
		-Sd/-SSE/D
		-Sd/-SME/D
		② 08/2022
		LOCATING DIM OF R31 HOLE REVISED
		SSE/D
		SME/D



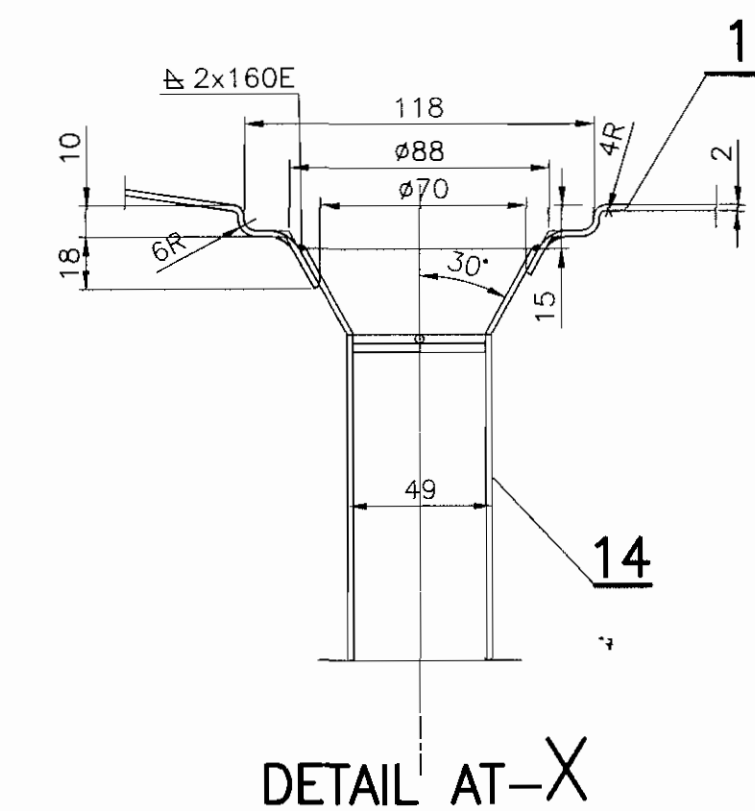
PAN FLOOR

DETAILS OF LOCATION OF STIFFENERS

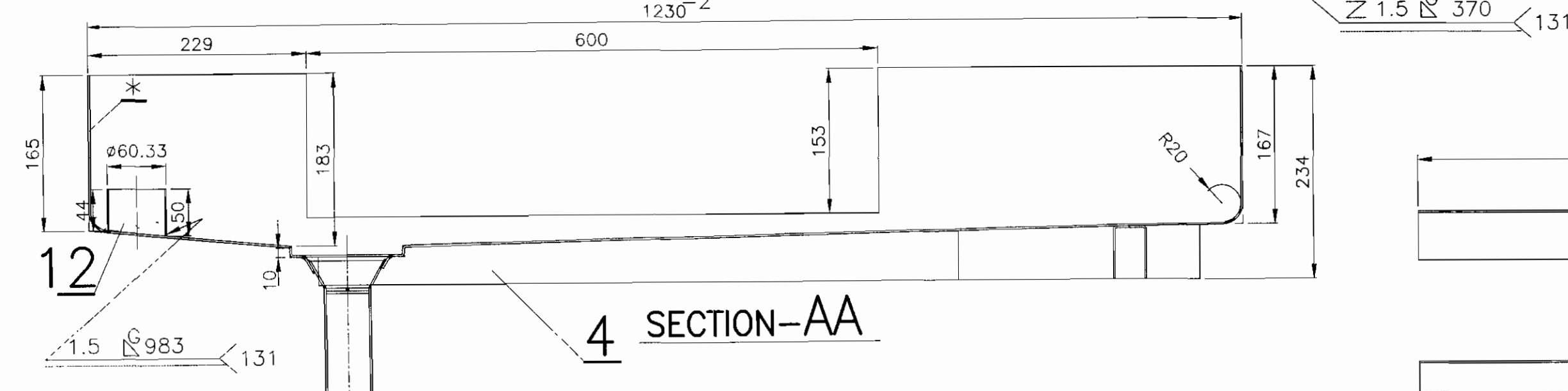


SECTION-HH

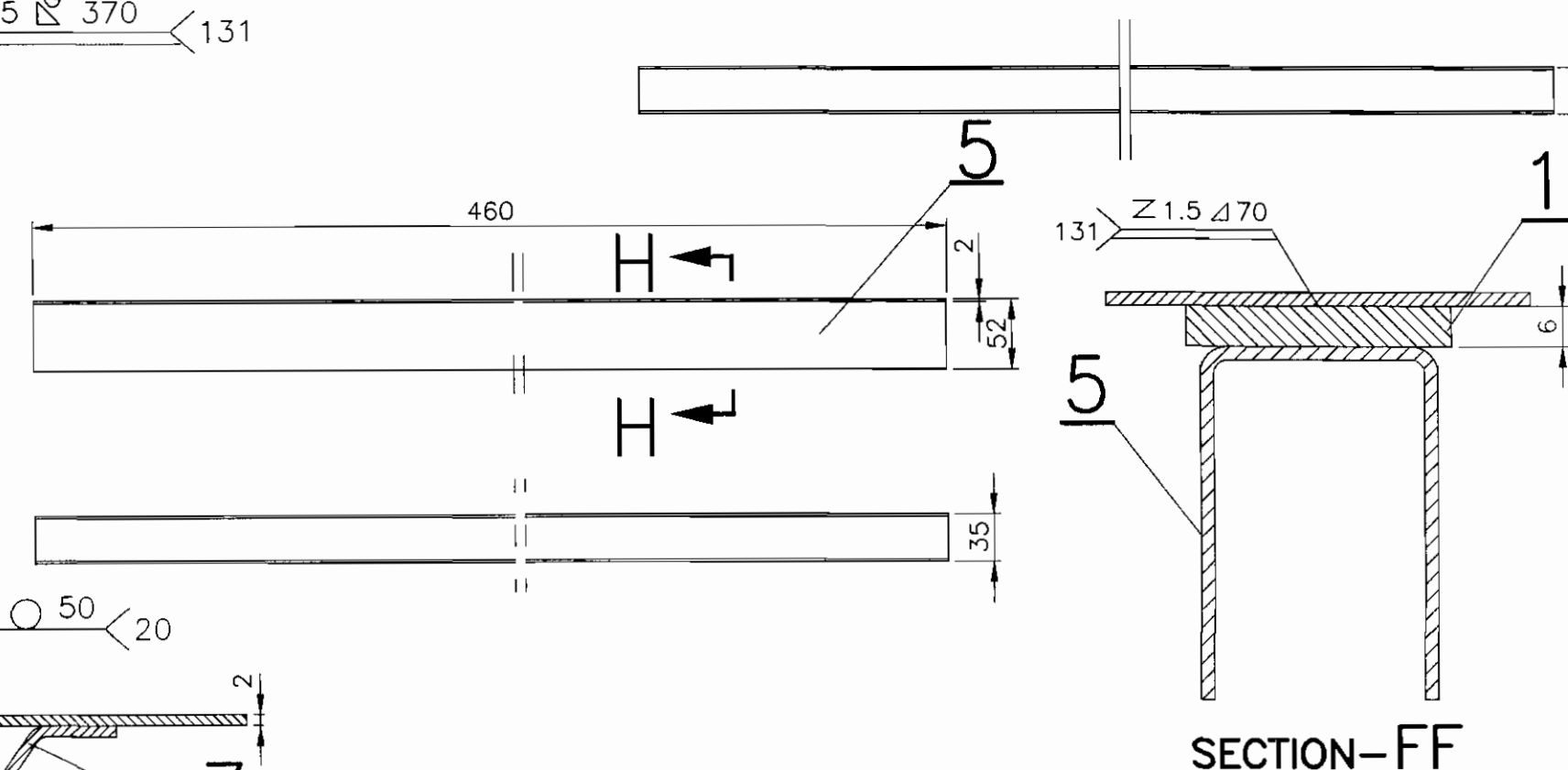
2,3,4,6



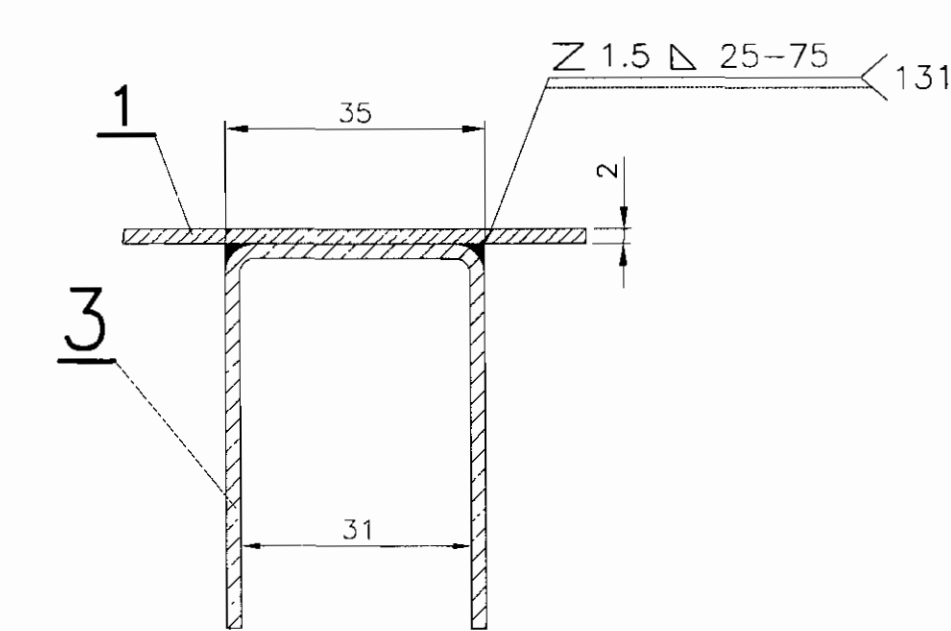
DETAIL AT-X



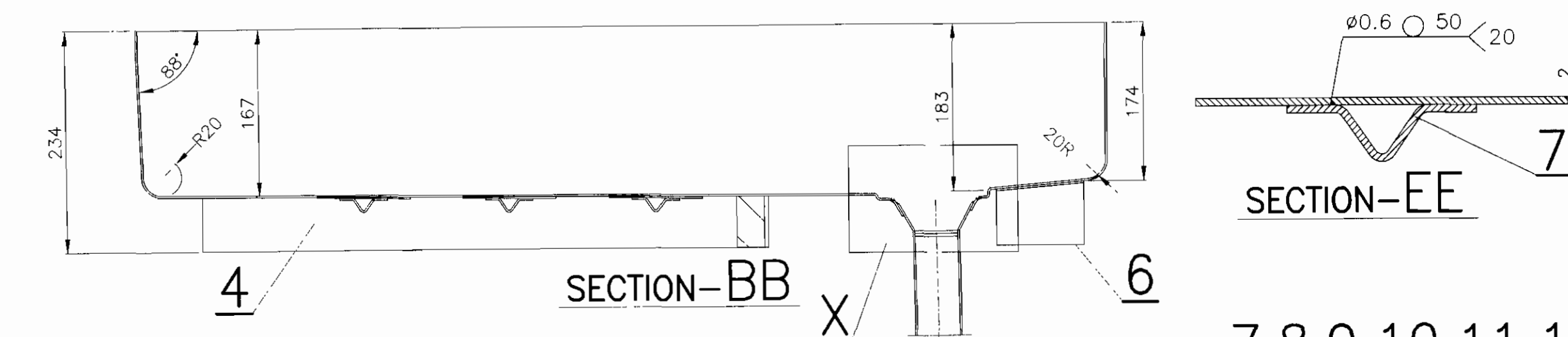
SECTION-AA



SECTION-FF



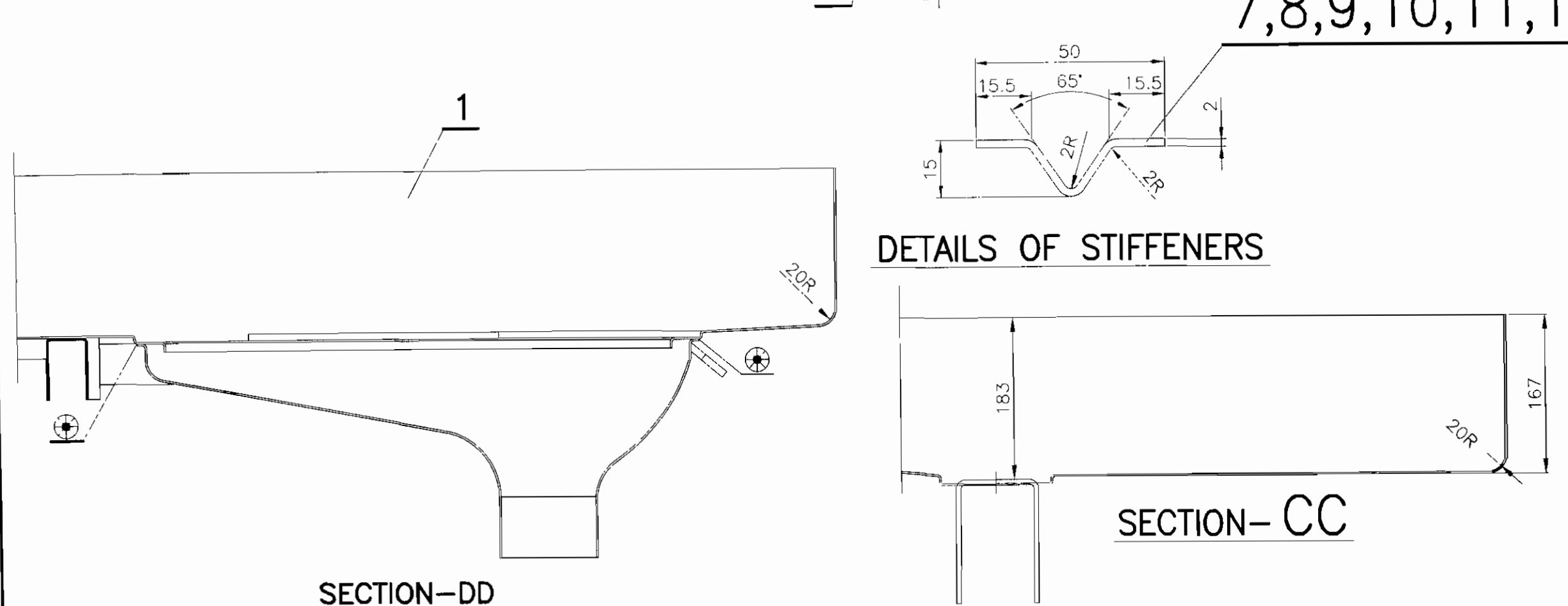
SECTION-GG



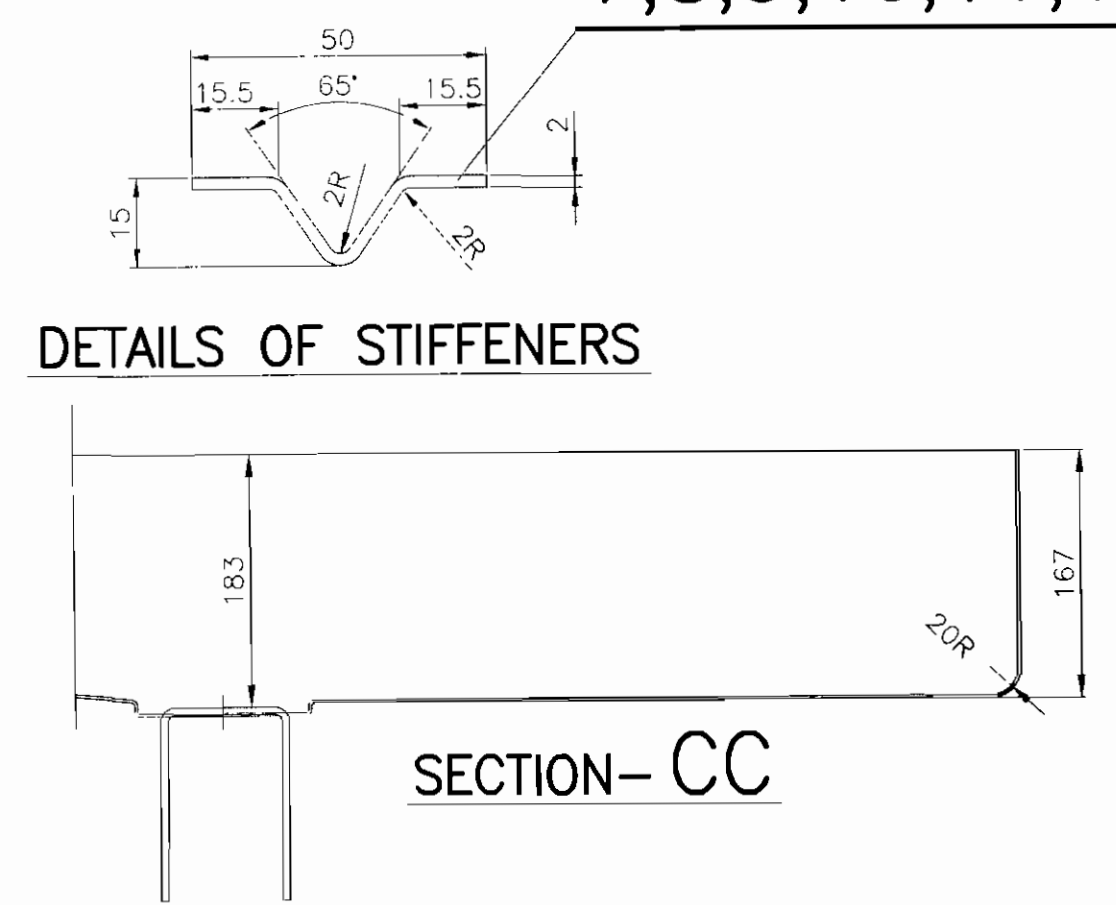
SECTION-BB

SECTION-EE

7,8,9,10,11,12



SECTION-DD



SECTION-CC

DETAILS OF STIFFENERS

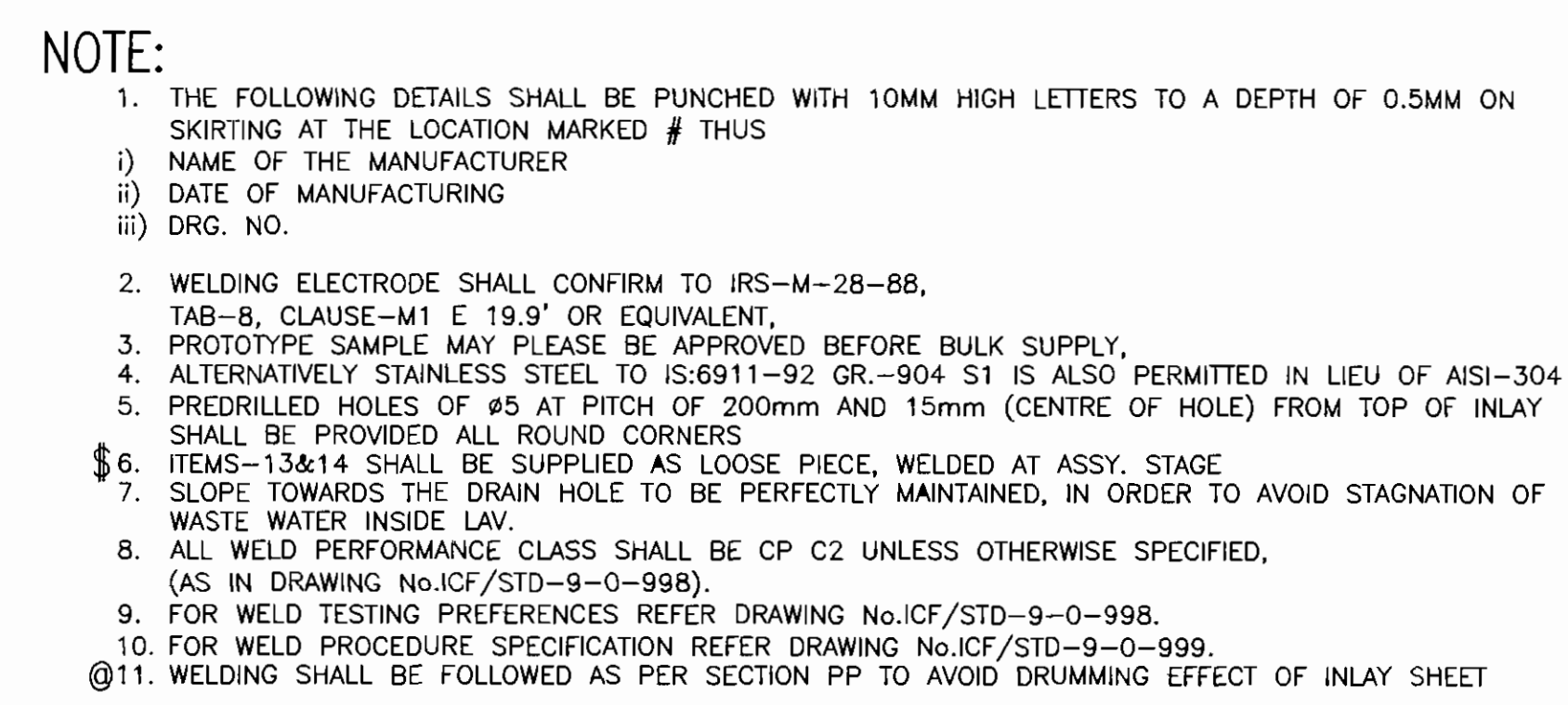
NOTE:-


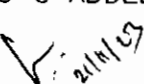
- THE FOLLOWING DETAILS SHALL BE PUNCHED WITH 10mm HIGH LETTERS, TO A DEPTH OF 0.5mm ON SKIRTING AT THE LOCATION MARKED * THUS.
 - NAME OF THE MANUFACTURER.....
 - DATE OF MANUFACTURE.....
 - DRG.No. WITH COLOUMN.....
- COVER SHEET & FOOT STEPS SHALL BE MADE INTEGRATED WITH INLAY. FOR THIS DIMENSIONS GIVEN IN LSLRD-4-1-005 SHALL BE FOLLOWED.
- WELDING ELECTRODE SHALL BE CONFIRM TO IRS-M-28-B6,TAB.-8, CLAUSE-M1 E 19.9' OR EQUIVALENT.
- DIMENSION MARKED □ THUS SHALL BE MAINTAINED STRICTLY.
- BOWL TO BE WELDED AS MENTIONED IN LSCN/EOG-4-1-007.
- PAN PORTION FINISH SHALL CONFIRM TO MIRROR FINISH NO.-8 OF IS:6911-92, TAB.-8.
- ALTERNATIVELY STAINLESS STEEL TO IS:6911-92 Gr.-304S1 MAY ALSO BE PERMITTED IN LIEU OF RD50/SPEC. CK-201 X5CrNi1810(304).
- SLOPE TOWARDS DRAIN OUTLET FOR INLAY SHALL BE PROVIDED TO SUIT ASSY. AS SHOWN.
- THE WELDED PORTION HAS TO BE GROUND & FINISHED.
- SUITABLE SURFACE PREPARATION SHALL BE DONE AFTER MASKING THE LAVATORY PAN AREA FOR PASTING OF P.V.C SHEET ON S.S.INLAY WITH A Rg VALVE [IN MICRONS] 0.5 TO 1.5
- A PROTOTYPE SAMPLE SHALL BE APPROVED BY ICF/DESIGN BEFORE BULK SUPPLY.
- ITEM-14 SHALL BE SUPPLIED AS LOOSE PIECE, WELDED AT ASSEMBLY STAGE

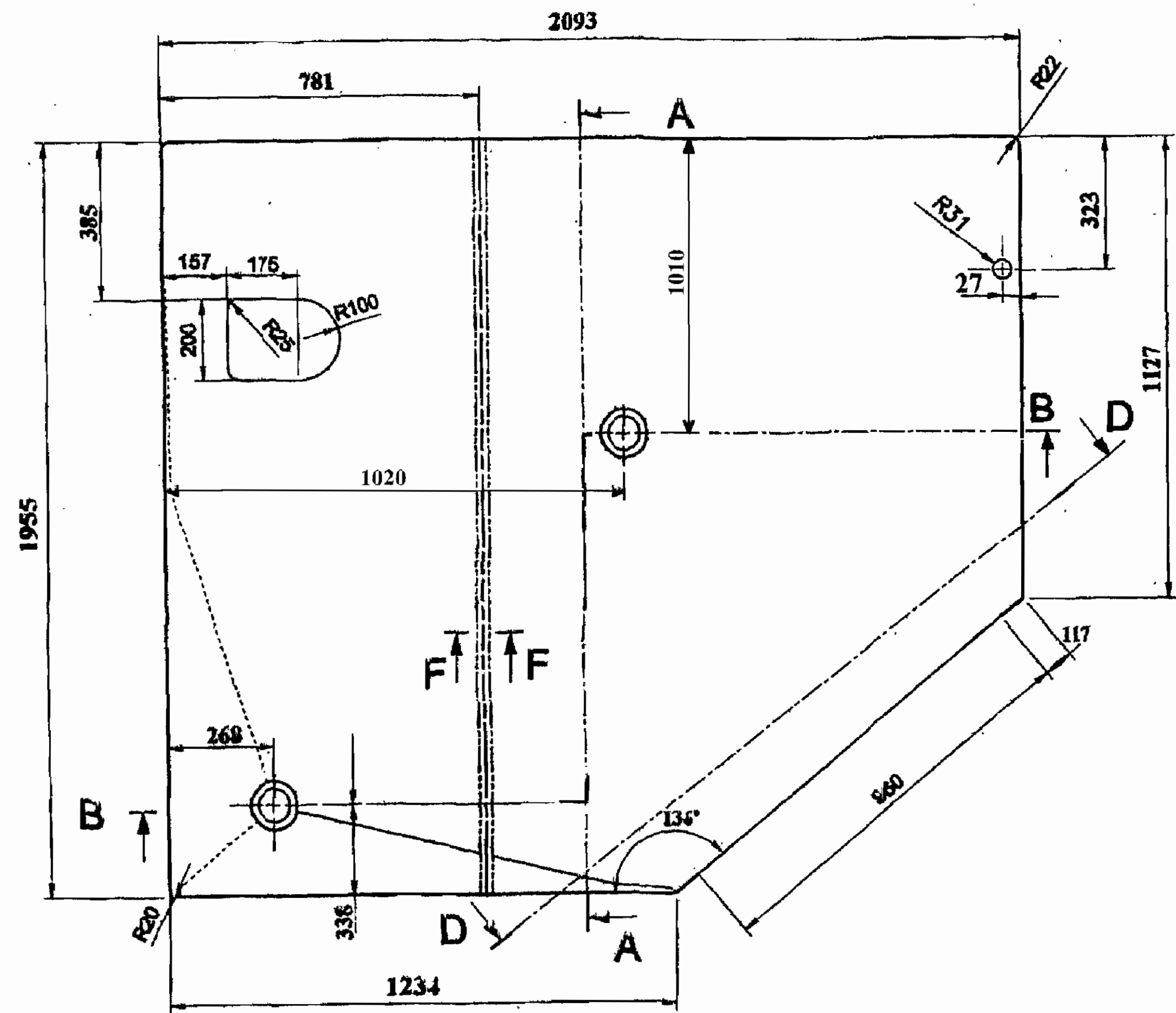
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1	DRAIN PIPE	14	ICF/STD 4-1-008			COL-I #
2	BACK PIECE 6x35x70	13		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
3	PIPE OD 60.33x2.77x50	12		ASTM A312/A312M Gr.TP304		
4	STIFFENER 2x55x149	11		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
5	STIFFENER 2x55x241	10		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
6	STIFFENER 2x55x140	9		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
7	STIFFENER 2x55x290	8		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
8	STIFFENER 2x55x438	7		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
9	SUPPORTING CHANNEL 2x145x250	6		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
10	SUPPORTING CHANNEL 2x131x460	5		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
11	SUPPORTING CHANNEL 2x159x731	4		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
12	SUPPORTING CHANNEL 2x161x920	3		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
13	SUPPORTING CHANNEL 2x146x365	2		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
14	PAN FLOOR	1		RD50/SPEC C-K 201 X5CrNi1810		GRADE-304 \$
SUPERSEDED BY:						
SUPERSEDES: LSLRD-9-0-008, Alt.a/-						
SCALE: 1:2.5						
SSE/D						
CHD						
ALT						
DRN						
ALT						
INTEGRAL COACH FACTORY CHENNAI - 38.						
LSLRD-9-0-008						

LAVATORY FLOOR COMPLETE

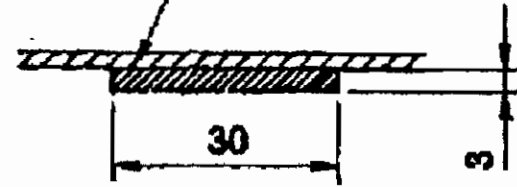
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 INDIAN RAILWAY STANDARDS
 SHEET 1 OF 1

[illegible]

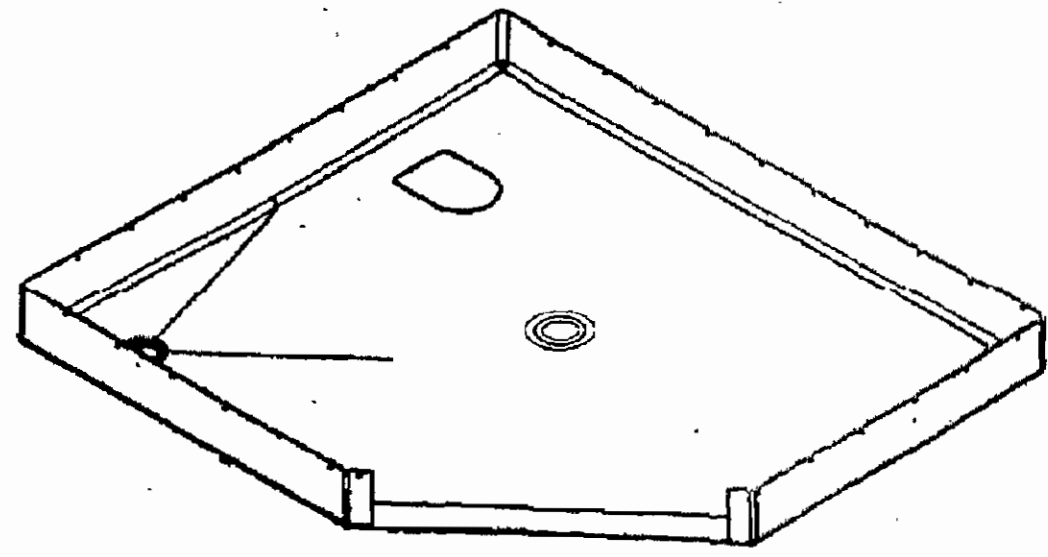
▽	ROUGH MACHINED	①	ROUGH CLEANED	ALTERATIONS	
▽▽	FINISH MACHINED			a) 03/2021	
▽▽▽	FINE FINISH MACHINED			WASH BASIN HOLE LOCATION REVISED	
				-Sd/- SSE/D	-Sd/- SME/D
				b) 07/2021	
				DOOR WAY CUTOUT DIMN ALTD FROM 148 TO 180	
				-Sd/- SSE/D	-Sd/- SME/D
				c) 07/2022	
				DOOR WAY CUTOUT DIMN ALTD FROM 180 TO 148	
				-Sd/- SSE/D	-Sd/- SME/D
				d) 11/2023	
				ADDITIONAL DRAIN HOLE & NOTE-4 TO 6 ADDED	
				 SSE/D	 AME/D



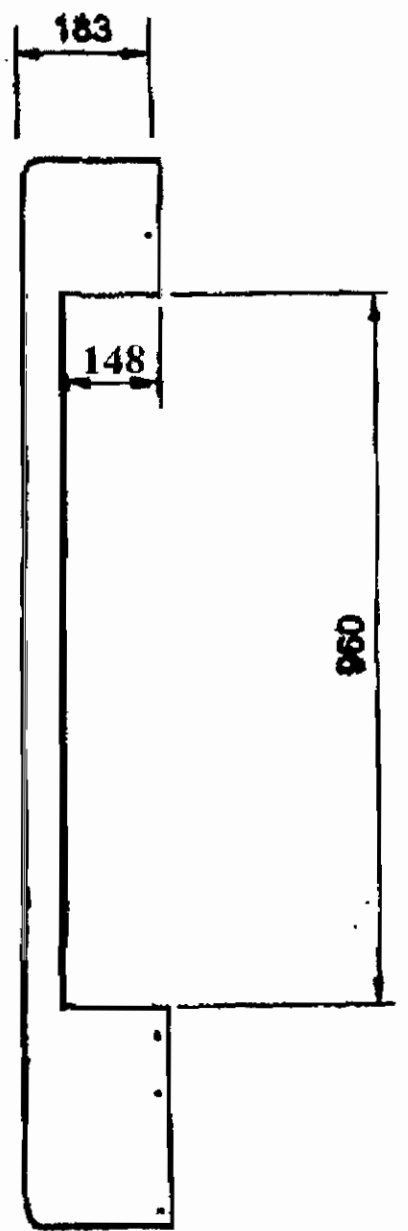
③ THIS WELDING SHALL PROPERLY BE MADE WITH PROVISION OF A SEALING RUN AND UPPER SURFACE GROUND & FINISHED



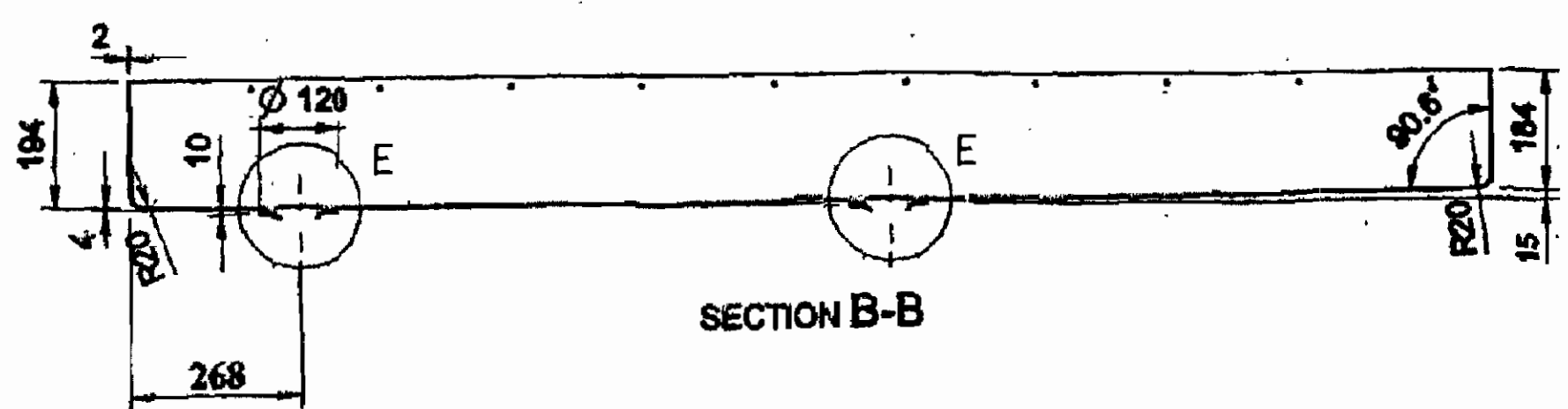
SECTION F-F
SCALE 1:2



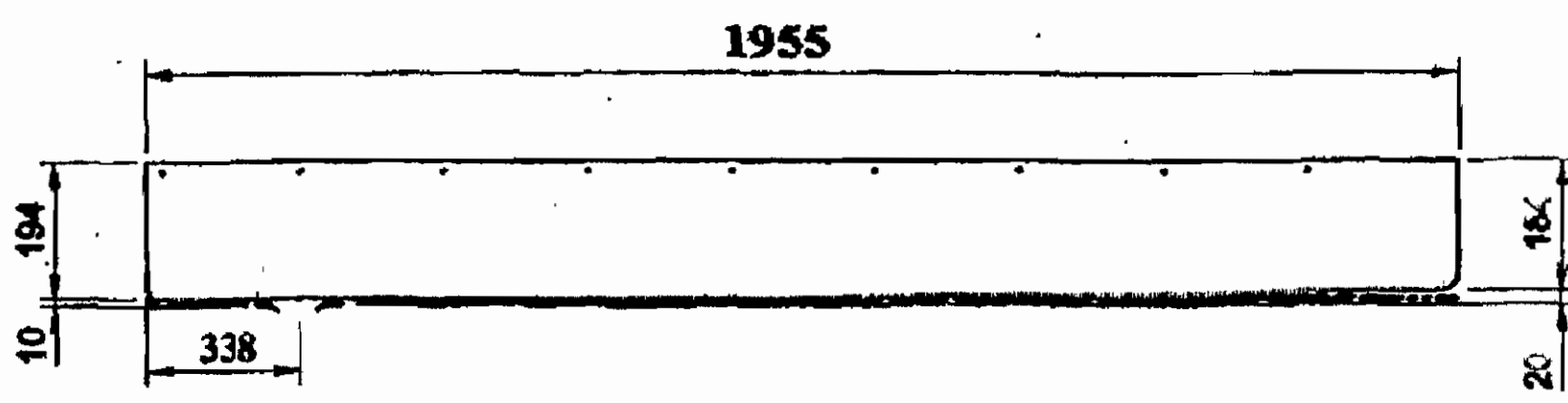
ISO-VIEW
(FOR REFERENCE ONLY)



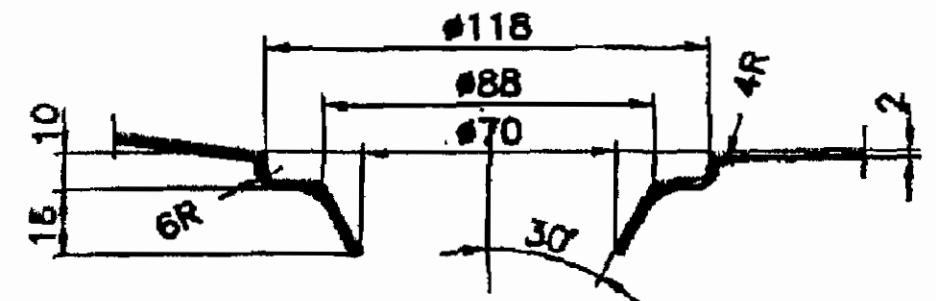
SECTION D-D



SECTION B-B



SECTION A-A



DETAIL E
SCALE 1:2

NOTE:

1. ALTERNATIVELY STAINLESS STEEL TO IS:6911-92 GR.-304 S1 IS ALSO PERMITTED IN LIEU OF AISI-304.
2. ONE SUITABLE WELD JOINT IS ALLOWED AT ONE SIDE MARKED THUS
③ SO AS TO OBTAIN THE REQUIRED SIZE OF THE INLAY BASED ON THE NORMAL SIZE OF THE RAW MATERIAL.
3. PREDRILLED HOLES OF Ø5 AT PITCH OF 200mm AND 15mm (CENTRE OF HOLE) FROM TOP OF INLAY SHALL BE PROVIDED ALL AROUND CORNERS.
4. ALL WELD PERFORMANCE CLASS SHALL BE CP C2 UNLESS OTHERWISE SPECIFIED, (AS IN DRAWING No.ICF/STD-9-0-998).
5. FOR WELD TESTING PREFERENCES REFER DRAWING No.ICF/STD-9-0-998.
6. FOR WELD PROCEDURE SPECIFICATION REFER DRAWING No.ICF/STD-9-0-999.

			1		SS LAVATORY INLAY		1		RDSO/SPEC C-K 201 (XSCN1810)		FINISH 2D			
NO.OFF			DESCRIPTION AND DIMENSIONS				ITEM	REF.DRG	MAT & SPEC.		WEIGHT/UNIT	REMARKS		
IV			III		II		I	GROUP: 9-0					SUPERSEDED BY:	
							PER ASSY	SS INLAY FOR DIVYANGJAN LAV. (LSLRD COACHES-EURO TYPE)					SUPERSEDES: LSLRD-9-0-010, Alt.c/-	
													SCALE: 1:2.5 1:1	
													SSE/D CHD ALT DRN ALT	
													P. Thiruvaidyan P. J. Rajan	
													INTEGRAL COACH FACTORY CHENNAI - 38.	
							LSLRD	CAD FILE: C:\MD-CAD\741\9-0\0101SD00.DWG					ALT d	
								DATA CODE 741					INDIAN RAILWAY STANDARDS	
													SHEET 1 OF 1	
													LSLRD-9-0-010	

ANNEXURE-A Dt.13.09.2023

- 1) Only ITI (or) equivalent qualified Welders/Fitters/Technicians should be employed by the contractor and necessary certificates viz. ITI or equivalent should be produced before taking up the work.
- 2) The Supervisors employed by Firm should be minimum Diploma holder.
- 3) The tools/equipments/consumables required for work shall be in the scope of contractor.
- 4) Water, compressed air and Electricity will be provided by ICF.
- 5) The contract employees should use all safety gadgets required for the work and should wear distinct uniform.



SSE/MS



AME/D-II

IRS M:28-2017

भारत सरकार
GOVERNMENT OF INDIA
रेल मंत्रालय
MINISTRY OF RAILWAYS
रेलवे बोर्ड
(RAILWAY BOARD)



**INDIAN RAILWAY STANDARD SPECIFICATION FOR CLASSIFICATION,
TESTING AND ACCEPTANCE CRITERIA OF MANUAL METAL ARC
WELDING ELECTRODES AND GAS WELDING RODS**

IRS M:28-2017**GOVERNMENT OF INDIA
MINISTRY OF RAILWAYS****(RAILWAY BOARD)****Indian Railway Standard Specification For Classification, Testing
And Acceptance Criteria of Manual Metal Arc Welding
Electrodes And Gas Welding Rods****0. FOREWORD**

- 0.1 This specification is issued under the fixed serial No. M- 28, the final number indicates the year of original adoption as standard or in the case of revision, the year of last revision.

ADOPTED 1976; REVISED 1986 , 2002, 2012 & 2017

- 0.2 This specification is issued to facilitate selection and procurement of manual metal arc welding electrodes and gas welding rods by Indian Railways for welding of structural steels, non-ferrous metals & alloys and other components in place of existing IRS M: 28-2012. It also covers various cutting, gouging, repair and reclamation electrodes used by Indian Railways.

0.3 The selection of a correct type of electrode or gas welding rod for specific application is a very important consideration in Metal Arc/Gas Welding. In this regard, the Bureau of Indian Standards has issued the following specifications: -

IS: 814-2011 : Covered electrodes for manual metal arc welding of Carbon and Carbon Manganese Steel

IS: 1395-2013: For low and medium alloy steel covered electrodes for manual metal arc welding

IS: 8666-2013: Copper and copper alloy covered electrodes for manual metal arc welding.

IS: 5206-2013: Covered electrodes for manual metal arc welding of stainless Steel & other similar high alloy steels.

IS: 5511-2013: Covered electrodes for manual metal arc welding of cast iron.

IS: 7303-2013: Covered electrodes for surfacing of metal by manual metal arc welding.

IS: 1278-2013: Filler rods for gas welding.

0.4 Considering that the above specifications do not fully cover the requirements of Manual Metal Arc Welding Electrodes/Gas Welding Rods used for various applications on the Indian Railway such as in the construction and repairs of Rolling Stock, Structures, Bridges, Permanent Way etc., it was considered necessary to lay down classification of Manual Metal Arc Welding Electrodes/Gas Welding Rods, their testing and acceptance criteria for specific requirements of Railways.

0.5 Considering the need of IR for electrodes suitable for joining many new types of metals which has progressively come into the market, some basic changes have been done in classification of electrode for welding of structural steels.

Basically, all the structural steels and cast steels covered by IS: 2062, IS: 1875, IS:1030 & IS:2002 latest versions have been divided in three categories based on their UTS and Y.S. Again in these classes, different uses have been identified i.e. static, moderately dynamic, highly dynamic and low temperature application. For each type of material & end use, a specific electrode class has been allotted. Separate class has been made for joining corten steel conforming to IRS M-41 & M-42, Stainless steels to IRS M-44, AISI grades 301,304, 310, 312,316 etc.

Parent Material	Use	Class of electrode
Low tensile steel	Static	A1
-do-	Mod. Dynamic	A2
-do-	Highly Dynamic/low temp	A3, A4
Pipe welding	All applications	A5
Medium Tensile steel	All standard applications	B1, B2
-do-	Low temperature application below -20	B3, B4
High Tensile steel	All applications	C1, C2
Corten to IRS M-41 & IRS M-42	All applications	D
Low & medium tensile steel	Low heat input welding	E1 & E2
Cast irons	For reclamation & repair	F&G
Ferrous components	Hard facing of ferrous components	H series
Non ferrous metal & alloys (Cu & Al)	All applications	K & L
Stainless Steels of various grades	All applications	M series
All ferrous & non ferrous metal & alloys	For cutting & gouging	N1,N2&N3

0.6 Based on experience and feed back from user Railways & manufacturer, some changes have been made in packaging system in MMAW electrodes. And alternate method for radiography test ASTM E 390 has been introduced with existing IIW Blue standard for some types of welding defects.

0.7 In framing this specification, necessary assistance has been derived from the specification as mentioned in clause 0.3 and also the following AWS specifications :-

AWS A5.5	Low Alloy Steel Covered Arc Welding Electrodes.
AWS A5.3	Aluminium and Aluminium Alloy Arc Welding Electrodes.

0.8 Packing conditions for both MMAW electrodes and Gas welding rods have been incorporated in Clause 5. The same has been kept as requirement of acceptance also.

0.9 Wherever a reference to any other standard appears in this specification, the latest version of the same shall be referred to.

0.10 For the purpose of deciding whether a particular requirement of this standard is complied with the final value, observed or calculated, expressing the result of a test or analysis shall be rounded off in accordance with IS: 2-2006 "Rules for rounding off numerical values (revised)". The number of significant places retained in the rounded off values shall be the same as that of the specified value in this standard.

1. Scope:

This standard lays down the classification, acceptance requirements and procedure for selection, testing and grading of different classes of manual metal arc welding electrodes/gas welding rods for use on Indian Railways.

2. Definition:

2.1 **Manufacturer:** Manufacturer means the indigenous unit manufacturing Manual Metal Arc Welding Electrodes/Gas Welding Rods. A manufacturer must have complete infrastructure required for production along with testing & quality control facilities. All the facilities must be located in single premises under its ownership dedicated to the production of subject items.

2.2 **Sister Concern:** Sister Concern means a separate production unit of the same concern or separate production unit under same administrative control. For the purpose of this specification, each such production units located in different premises will be treated as different firm.

3. Classification:

3.1 The electrodes have been classified into 34 different classes i.e. A1, A2, A3, A4, A5, B1, B2, B3, B4, C1, C2, D, E1, E2, F, G, H3, H3A, H3B, H3C, H4A, H4B, K, L, M1, M2, M3, M4, M5, M6, M7, N1, N2 & N3.

The purpose for which each class of electrode is to be used, together with the IS/AWS code and type of coating, is given in **Table 1**.

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(Cl. 3.1)

TABLE -1

**CLASSIFICATION OF ELECTRODES AS PER THEIR APPLICATION
ALONG WITH IS/AWS SPECIFICATION AND CODING THEREOF**

Sl. No	IRS Class	Purpose of use	IS/AWS Specification	IS/AWS Code*
1.	A1	Fabrication of component meant for static application made of steels to IS: 2062-2016 Gr.E250 Quality A, IS:1875-2014 Class 1 & 1A or equivalent. Suitable for joining steel sheets to IS: 513-2013, IS: 1079-2017 & Gr. Fe 330 to IS: 5986-2017 or equivalent and for repair welding of cast steels to IS: 1030-2012 Gr. 200-400W. This electrode can also be used for welding where strength requirement is not specified.	IS: 814-2011	ER4112 (Medium coated)
2.	A2	Fabrication of component meant for semi-dynamic application such as bridges etc., made of steel to IS: 2062-2016 Gr.E250 Quality BR&B0, IS: 1875-2014 Class 1 & 1A or similar. The weld deposit shall be of radiographic quality.	IS: 814-2011	ER4211X (Medium coated)
3.	A3	Fabrication of component meant for highly dynamic application made of steels to IS: 2062-2016 Gr.E250 quality C or for other applications where low temperature impact property is required. The weld deposit shall be of radiographic quality.	IS: 814-2011	EB5326H2X (Heavy coated)
4.	A4	Application same as A3 above with high deposition efficiency	IS: 814-2011	EB5326H2JX (Heavy coated)
5.	A5	For pipe welding or other applications where high penetration of arc is needed.	IS: 814-2011	EC4316X (Medium coated)

Sl. No	IRS Class	Purpose of use	IS /AWS specification	IS/AWS Code *
6	B1	Fabrication of component made of steels to IS: 2062-2016 Gr.E300 & E350 all quality, IS: 2002-2009 Gr. 1 & 2, IS: 1875-2014 Class 2, 2A and 3 or similar. Also suitable for repair welding of cast steels to IS: 1030-2012 Gr. 230-450W. The weld deposit shall be of radiographic quality. Also for joining of stainless steels type 3Cr12, IRS M-44 or its equivalent with mild steel/ low alloyed steel/ Corten steel.	IS: 814-2011	EB5426H3X (Heavy Coated)
7	B2	Application same as B1 above with high deposition efficiency.	IS: 814-2011	EB5426H3JX (Heavy coated)
8	B3	Fabrication of components made of steels to ASTM 516 Gr.70 or equivalent where low temperature (at - 46° C) impact properties are required. The weld deposit shall be of radiographic quality.	IS:1395-2013	E55BC126 (Heavy coated)
9	B4	Application same as B3 above with high deposition efficiency	IS:1395-2013	E55BC126J (Heavy coated)
10	C1	Fabrication of component made of steels to IS: 2062-16, Gr.E410, E450, IS: 2002-2009 Gr. 3, IS: 1875-2014 Class 3A or similar. The weld deposit shall be of radiographic quality.	IS:1395-2013	E63BD126 (Heavy coated)
11	C2	Application same as C1 above with high deposition efficiency	IS:1395-2013	E63BD126J (Heavy coated)
12	D	For joining weathering steels conforming to IRS M-41 or M-42 with same steel or steels to IS: 2062-2016, IS: 2002-2009& IS: 1875-2014 as mentioned above.This can also be used for combination joint of IRS M-44 &IRS M-41 and IRS M-41 & M-42. The weld deposit shall be of radiographic quality.	AWS A5.5	E8018W2 (Heavy coated)

Sl. No	IRS Class	Purpose of use	IS /AWS specification	IS/AWS Code *
13.	E1	For fabrication & repairing of Buckles, Gear cases, Protector Tubes, Door Patches, Side panels, End wall patches etc. of Rolling stock & locomotives. The electrode shall be low heat input type ** with 350 mm length.	IS:814-2011	ER4211X (Medium coated)
14.	E2	For repair welding of bogies, both cast and fabricated. The electrode shall be low heat input type ** with 350 mm length.	IS:1395-2013	E55BG1Ni26 (Heavy coated)
15	F	For reclamation of cast iron with non-machinable deposit.	IS: 5511-2013	EFe B26 (Medium coated)
16	G	For welding of cast iron with machinable deposit (Ni-Fe type core wire). Also suitable for joining of cast iron to other ferrous and non-ferrous materials.	IS:5511-2013	ENiFeG16 (Medium coated)
17	H3 ^s	For resurfacing of fabricated Medium-Mn steel or Cast Mn. Steel crossings to withstand traffic density of 15 GMT minimum.	-	-
18.	H3A ^s	Application same as H3 above to withstand traffic density of 25 GMT minimum.	-	-
19	H3B ^s	Application same as H3 above to withstand traffic density of 35 GMT minimum.	-	-
20	H3C ^s	Application same as H3 above to withstand traffic density of 50 GMT minimum.	-	-
21	H4A	For non-machinable hard facing of ferrous items with hardness range of 55-62Rc.	IS:7303-2013 [*]	EFe-1C314 (Heavy coated)
22	H4B	For machinable hard facing of ferrous items like reclamation of Equalising beam etc. with hardness range of 30-40 HRc.	IS:7303-2013	EFe-B314 (Heavy coated)
23	K	For welding of copper, bronze and other copper alloys including Gun-metal.	IS:8666-2013	ECuSn-A (Medium coated)

Sl. No	IRS Class	Purpose of use	IS /AWS specification	IS/AWS Code *
24	L	For welding of aluminium & aluminium alloys.	AWS A5.3	AL-43 (Medium coated)
25	[@] M1	For fabrication of stainless steels type 18%Cr 8%Ni type or its equivalent	IS:5206-2013	E19.9R26 (Heavy coated)
26	[@] ² M2	For fabrication of stainless steels type 3 Cr12, IRS M-44 or its equivalent. Also suitable for fabrication of 18%Cr 8%Ni stainless steel with low carbon.	IS:5206-2013	E19.9LR26 (Heavy coated)
27	[@] M3	For fabrication of stainless steels type 316 or its equivalent.	IS: 5206-2013	E19.12.2R26 (Heavy coated)
28	[@] M4	For fabrication of ferritic stainless steels type 3Cr12, IRS M-44 or its equivalent. Also suitable for joining dissimilar stainless steels as mentioned in M1, M2 and M3 or their equivalent. This is also suitable for joining M1, M2 and M3 type of stainless steels as mentioned above or their equivalent with mild steel or low alloyed steel. This can also be used for welding of heat resisting stainless steels 22%Cr 12%Ni type or its equivalent.	IS: 5206-2013	E23.12LR26 (Heavy coated)
29	[@] M5	For joining of manganese steel liners and other austenitic manganese steel components with steel casting to IS: 1030-2012 Gr. 230-450W/280-520W or to IS: 2062-2016.	IS: 5206-2013	E18.8MnR26 (Heavy coated)
30	[@] M6	For repair welding of cracked gas inlet casing of diesel locomotives. These can also be used for other repair welding of stainless steel castings having higher percentage of carbon and for welding of high heat resisting stainless steels 25%Cr 20%Ni type or its equivalent.	IS: 5206-2013	E25.20R26 (Heavy coated)
31	M7	For joining of cast ferrous alloy of similar composition, dissimilar metals such as carbon steels to stainless steels & welding of steels of unknown compositions.	IS: 5206-2013	E29.9R26 (Heavy coated)
32.	[#] N1	For cutting mild steels, low alloy steels, stainless steels, austenitic manganese steels, cast iron, cast steel & non-ferrous alloys such as Nickel alloys, Al, Cu, Bronzes etc.	-	-

Sl. No	IRS Class	Purpose of use	IS /AWS specification	IS/AWS Code *
33.	N2	For gouging & piercing of steels and non-ferrous alloys as described above in class N1.	-	-
34.	N3	For gouging of mild steels, low alloy steels, stainless steels, austenitic manganese steels and cast iron & cast steel. The electrode shall be of copper-coated graphitic type.	-	-

* IS/AWS code is for the purposes as explained in Cl. 3.2.

** An electrode shall be called "Low Heat Input Type" provided it runs with Max.70V OCV at the current ranges mentioned below:

Electrode Diameter	Current Range(Amps)
2.5 mm X 350mm	60-90
3.15mm X 350mm	90-120
4.00mm X 350mm	120-150
5.00mm X 350mm	150-200

\$ Different electrodes of H3 series are under development. Proper IS code will be allotted after finalisation.

@ All stainless steel electrodes must have stainless steel core wire.

Current range of N series of electrodes shall be as given below:

Dia. of electrode in mm	Current range in Amp. AC(OCV 50)/DC(-)	
	N1	N2 & N3
2.5	130 – 180	150 - 200
3.15	150 – 230	200 - 250
4.0	200 – 300	250 – 350
5.0	250 – 350	350 - 400

Coating factors: For Medium - 1.36 to 1.50 and for Heavy - 1.51 to 2.20

For any IRS class, no tender shall be published without mentioning its Code except in case of H3 & N series of electrodes.

3.2 Standard code as per IS or AWS has been shown against each class of electrode except N Class for type of covering, welding position and current condition only. For Mechanical properties and Chemical requirement, values stipulated in appropriate tables of this standard shall be followed. In areas not covered by this Standard, the views and conditions stipulated in the respective IS/AWS standard shall be followed.

3.3 The Gas Welding Rods have been classified into 4 different classes i.e. Class I to Class IV. The purpose for which each class of the Gas Welding Rod is to be used together with corresponding IS specification is given in **Table -2**.

(Cl. 3.3)

TABLE – 2

**CLASSIFICATION OF GAS WELDING RODS AND PURPOSE OF USE
ALONGWITH EQUIVALENT TYPES IN IS:1278-2013**

IRS Class	Purpose of use	Equivalent type in IS:1278-2013
Class I	General purpose low carbon mild steel rods meant for application where a minimum butt-weld strength of 35.0 kgf/ mm ² is required.	S-FS1
Class II	Mild steel rod intended for application in which minimum butt weld tensile strength 44 kgf/mm ² is required. It is not intended for general welding purpose.	S-FS2
Class III	Medium tensile steel rod intended for application where a minimum butt weld tensile strength of 50.0 kgf/mm ² is required.	S-FS3
Class IV	Silicon-Bronze /Brass rods intended for Bronze Welding/Brass welding of copper & mild steel and fusion welding of materials of same or closely similar composition.	S-C6

4. Size of MMAW electrode/Gas Welding Rod:

- 4.1 For electrode classes A3 - D, F and H4 series, the standard length shall be 450mm for all the diameters except 2.5mm. For 2.5mm dia, the length shall be 350mm. For classes A1 & A2, the standard length shall be 450mm for diameter 4.0mm & above, for diameter 2.5mm & 3.15mm, the length shall be 350mm.
- 4.2 For all other classes, the standard length shall be 350mm only.
- 4.3 Electrode shall be manufactured in the dia. of 1.6mm, 2.5mm, 3.15mm, 4mm, 5mm and 6.3 mm, covering the range of lower size and higher size.
- 4.4 Gas welding rods shall be manufactured in the diameters as given in IS: 1278-2013.
- 4.5 For gas welding rods, the standard length shall be 500mm for rod diameter less than 2.5 mm and 1000 mm for rod diameter 2.5 mm and above with a tolerance of ± 5 mm.

5. Packaging:

- 5.1 **Standard Packing:** To guard against ingress of moisture and accidental damage during transportation and storage till its consumption, the packaging system of electrode shall be as detailed below:

- 5.1.1 **For electrodes of Classes A1, A2, A5, E1, G, H4A, K, L, N1, N2 & N3:**

- 5.1.1.1 Counted and weighed electrodes shall be kept in moisture proof polythene bag and sealed.
- 5.1.1.2 The sealed bag shall further be kept in cardboard cartons. Cartons shall have printed on it the name & address of the manufacturer, electrode brand name, IRS class with IS and/or AWS code, coating factor, batch no., date of manufacture, date of expiry, size, current condition & welding parameters, quantity, cautionary note on safety during welding and any other special recommendation.
If the quantity of electrodes are supplied in Kg, the corresponding numbers of electrodes shall be indicated in the packet. The unit of quantity of electrodes to be supplied normally be expressed in running meter. The number of electrodes shall be mentioned in inspection certificate.
- 5.1.1.3 Total weight of the carton shall not exceed 7 kg.
- 5.1.1.4 This carton shall be sealed and put in a polythene bag and sealed/shrink sealed.
- 5.1.1.5 Counted number of sealed carton shall be kept in suitable wooden or cardboard box and stripped tightly to avoid damage during transportation.
- 5.1.1.6 The details of packing may vary from one manufacturer to other, but in essence, it must have two moisture proof polythene layers with two cardboard boxes. At least one packing must be of shrink packed type however; the preheating of low hydrogen electrodes should be done as per technological development & the recommendation of the electrode manufacturer to avoid moisture pickup during use. The preheated electrodes should be kept at welding site in the Holding Oven at a temperature around 170 °C for better quality of weld.
- 5.1.2 **For electrodes of Class H3 series and M series**
- 5.1.2.1 As given in clause 5.1.1.1.

- 5.1.2.2 The sealed bag shall be further kept in plastic box with single opening at end. The box shall contain all the information as given in clause 5.1.1.2.
- 5.1.2.3 As given in Clause 5.1.1.3.
- 5.1.2.4 As given in Clause 5.1.1.4.
- 5.1.2.5 As given in Clause 5.1.1.5.
- 5.2 Vacuum packing:** For Basic coated electrodes of classes **A3, A4, B1, B2, B3, B4, C1, C2, D, E2, F & H4B** which can be used without preheating if supply is given in vacuum packing, the vacuum packaging as follows:
- 5.2.1 If supplied in a vacuum packing maximum 4 Kg. of electrodes shall be packed in a pouch made of metal foil and hermetically sealed.
N.B. - Option for vacuum packing (Clause 5.2) or standard packing (Clause 5.1) are to be decided by the consignee.
- 5.2.2 The pouch must contain the relevant informations as given in Clause 5.1.1.2.
- 5.2.3 These pouches shall be kept in hard cardboard or wooden box and stripped tightly to prevent mechanical injury or accidental perforation of pouches during transportation, storage or handling.
- 5.2.4 Maximum weight of the box shall be limited to 7 kg.
- 5.3 Gas Welding Rods:** For Gas Welding Rods, the packaging shall be as detailed below:
- 5.3.1 As given in Clause 5.1.1.1
- 5.3.2 The sealed bag shall further be kept in hard cardboard cartons. All the relevant information as given in clause 5.1.1.2 shall be printed on the carton except current condition.
- 5.3.3 As given in Clause 5.1.1.3
- 5.3.4 As given in Clause 5.1.1.4
- 5.3.5 As given in Clause 5.1.1.5
- 6. Requirements:**
- 6.1 Electrodes/Gas welding rods must meet the relevant sub-clause of clause 4 & 5.
- 6.2 The requirements against each class of electrode have been indicated in **Table 3 & 4**. The minimum value requirement of each criteria is either given in the table or reference of appropriate Appendix and table has been made wherein the details of testing and minimum value requirement has been described.

TABLE 3 (Cl. 6.2)
REQUIREMENTS FOR 'A' to 'E' CLASS OF ELECTRODES

IRS Class	Performance Test *	Mechanical Properties	Chemical Composition	Radiography on All weld Assembly**	Hydrogen content ***	Deposition Efficiency #	Fillet weld test	Corr. Resistance
A1	App.-A	Table-5	-	-	-	-	-	-
A2	-do-	-do-	-	IIW Blue/ ASTM E 390	-	-	-	-
A3	-do-	-do-	Table-8/ App- B	-do-	H2	-	-	-
A4	-do-	-do-	- do-	-do-	-do-	110% - 130%	-	-
A5	-do-	-do-	-	-do-	-	-	-	-
B1	-do-	-do-	Table-8/ App- B	-do-	H3	-	-	-
B2	-do-	-do-	-do-	-do-	-do-	110% - 130%	-	-
B3	-do-	-do-	-do-	-do-	-do-	-	-	-
B4	-do-	-do-	-do-	-do-	-do-	110% - 130%	-	-
C1	-do-	-do-	-do-	-do-	-do-	-	-	-
C2	-do-	-do-	-do-	-do-	-do-	110% - 130%	-	-
D	-do-	-do-	-do-	-do-	-do-	110% - 130%	Table- 7	App-D
E1	-do-	-do-	-	-do-	-	-	-	-
E2	-do-	-do-	Table-8/ App- B	-do-	H3	-	-	-

* Further tests shall be carried out only if the electrode is found satisfactory in this test.

** IIW stands for International Institute of Welding/ ASTM stands for American Society for Testing & Materials.

*** H1, H2 and H3 stand for 15 ml, 10ml and 5ml of diffusible hydrogen per 100 gm of weld respectively.

A tolerance in limiting values as given in respective IS/AWS are applicable.

TABLE 4

(Cl. 6.2)

REQUIREMENTS FOR 'F' to 'N' CLASS OF ELECTRODES
AND G. W. RODS

IRS Class	Performance Test *	Usability Test	Mechanical Properties	Hardness	Chemical Composition	Fillet weld Test	Macro Examn.
F	App.- A	App.-C	-	-	-	-	-
G	-do-	-do-	-	175 - 200 HB /App.-C	Table-10	-	-
H4A	-do-	-	-	55 - 62 Rc/App.- F	Table- 9/ App.-F	-	App.- F
H4B	-do-	-	-	30 – 40 Rc/App.- F	-do-	-	-do-
K	-do-	-	Table- 6	-	Table- 10	-	-
L	-do-	-	-do-	-	-do-	-	-
M1	-do-	-	-	-	Table- 9/ App.-B	Table - 7	-
M2	-do-	-	-	-	-do-	-do-	-
M3	-do-	-	-	-	-do-	-do-	-
M4	-do-	-	-	-	-do-	-do-	-
M5	-do-	-	-	-	-do-	-do-	-
M6	-do-	-	-	-	-do-	-do-	-
M7	-do-	-	-	-	-do-	-do-	-
N1	-do-	-	-	-	-	-	-
N2	-do-	-	-	-	-	-	-
N3	-do-	-	-	-	-	-	-
G. W. Rods	-	-	-	-	Table- 10	-	-

* Further tests shall be carried out only if the electrode is found satisfactory in this test.

6.2.1 Performance test: Performance Test includes Running Performance and Accelerated Storage Stability Test. There shall not be any adverse remark in Running Performance. In Accelerated Storage Stability test, there shall not be any cracking, blistering or peeling off of flux. The core wire inside flux coating shall not have gross corrosion. The Deposition Efficiency of a high deposition type of electrode, when determined after subjecting it to above test, shall not fall below the minimum acceptable limit of 110%. The details of test procedure are given in **Appendix- A**.

6.2.2 Mech. Properties: Mechanical properties required for electrode classes **A to E , K & L** have been given in **Table 5 and 6** respectively. The base material requirement has also been specified for class K.

TABLE – 5 (Cl. 6.2.2)
MINIMUM REQUIREMENTS OF MECHANICAL PROPERTIES
FOR IRS CLASS ‘A’ to ‘E’

IRS Class	All Weld properties					Transverse Bend Test with 3T mandrel dia. at 180° (both face & root)
	UTS in N/mm ²	YS in N/mm ²	% Elongation on 5d G. L.	% Reduction in area	Impact in Joule	
A1	410	330	24	50	47 at +27 °C	Satisfactory
A2	410	330	26	50	47 at 0 °C	Satisfactory
A3	510	350	26	50	47 at –20 °C	Satisfactory
A4	510	350	26	50	47 at –20 °C	Satisfactory
A5	410	330	26	50	47 at –20 °C	Satisfactory
B1	510	350	26	50	47 at –20 °C	Satisfactory
B2	510	350	26	50	47 at –20 °C	Satisfactory
B3	540	390	24	45	25 at –46 °C	-
B4	540	390	24	45	25 at –46 °C	-
C1	590	450	20	40	27 at –20 °C	-
C2	590	450	20	40	27 at –20 °C	-
D	490	350	22	40	50 at –20 °C	-
E1	410	330	26	50	47 at 0 °C	-
E2	550	460	24	45	27 at –20 °C	-

Note: Tolerances in limiting values as given in respective IS/AWS are applicable.

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/WS/02/569
28/04/2014

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
Lucknow-226011
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., 27th 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 Piani, Bokaro (Jharkhand).
- 6) M/s. Salem Steel Plant, Regional Marketing Office, Antriksh Bhawan, 11th Floor, 22- Kasturba Gandhi Marg, New Delhi -110 001

(Amitabh Sinha)
For Director General/Carriage

Reg. no 2
1280
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Table-6

(Cl.6.2.2)

**TABLE OF BASE MATERIAL REQUIREMENT AND MINIMUM
VALUES OF DIFFERENT MECHANICAL PROPERTIES FOR
ELECTRODES OF IRS CLASS 'K' AND 'L'**

IRS Class	IS/AWS Specification	Electrode Classification	Base material specification	UTS in kgf/mm ²	Bend test at angle of bend
K	IS: 8666-2013	E-Cu Sn-A	IS 7814 -2015 Gr.I	24.61	Satisfactory at 90 ⁰
L	AWS A5.3	Al-43	ASTM B 209 Gr. 3003	9.80	Satisfactory at 180 ⁰

Note: Tolerances in limiting values as given in respective IS/AWS are not applicable.

6.2.3 **Usability Test:** Usability test shall be carried out for F and G class of electrodes. The procedure of testing and acceptance criteria has been given in **Appendix- C**.

6.2.4 **Radiography Test :-** Radiograph of all weld assembly test piece shall be at least equal to or better than IIW / ASTM E 390 standard radiograph as per given below:-

SN	Type of welding defects	Radiograph standard	
		IIW Standard	ASTM Standard (ASTM E 390)
1.	Coarse scattered porosity	Blue	Grade - II
2.	Scattered porosity	Blue	Grade - II
3.	Cluster porosity	Blue	Grade - I
4.	Linear porosity or Globlur Indication	Blue	Grade - I
5.	Slag Inclusion	Blue	Grade - I
6.	Tungsten Inclusion	Not allowed in IIW blue standard	Not allowed of any grade of ASTM E390
7.	Incomplete Penetration	--do---	--do---
8.	Lack of fusion	--do---	--do---
9.	Any type of crack & other defects	--do---	--do---

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6.2.5 Hydrogen Content: Hydrogen content shall be determined by Mercury apparatus Method as per IS:11802:2013.

6.2.6 Deposition Efficiency: Deposition efficiency of an electrode shall be determined by Core wire method.

$$\text{Deposition Efficiency \%} = \left\{ \frac{\text{Wt. of weld deposit of 3 electrodes}}{\text{Wt. of 3 core wires} - \text{Wt. of 3 stub ends}} \right\} \times 100$$

6.2.7 Corrosion Resistance: Corrosion resistance test shall be carried out for D class of electrodes. Procedure of testing and acceptance criteria has been given in **Appendix- D**.

6.2.8 Hardness Survey: Hardness survey shall be carried out for H3 and H4 classes of electrodes. Procedure of weld pad preparation, testing and acceptance criteria have been given in **Appendix - B for H3 and Appendix - F for H4**.

6.2.9 Macro Examination: Macro examination test shall be carried out for H3 and H4 classes of electrodes. Procedure of weld pad preparation, testing and acceptance criteria have been given in **Appendix - B for H3 and Appendix - F for H4**.

6.2.10 Fillet Weld Test: Fillet weld test shall be carried out for D class and M series of electrodes. The completed fillet weld test specimen shall be examined visually and the weld shall be free of cracks. The specimen shall be reasonably free of undercut, overlap, slag inclusion and surface porosity. Dimensional measurements and Macro examination shall be carried out on polished and etched transverse section. The transverse section shall have adequate penetration without any crack and shall reasonably be free from other welding defects. The dimensional requirement of fillet weld test is given in **Table –7**.

6.2.11 Chemical composition - The chemical composition requirement of low & medium alloy ferrous electrodes, high alloy ferrous electrodes and non-ferrous electrodes & Gas Welding Rods have been given in **Table 8, 9 & 10** respectively. Procedure of weld pad preparation and sample collection for chemical analysis has been given in **Appendix - B**.

TABLE 7 (Cl. 6.2.10)
DIMENSIONAL REQUIREMENTS FOR FILLET WELDS

Size of Fillet Weld (mm)	For IRS class D		For IRS M series	
	Maximum convexity (mm)	Maximum diff. Between leg lengths (mm)	Maximum convexity (mm)	Maximum diff. Between leg lengths (mm)
3.15	1.1	1.0	1.2	1.5
4.0	1.2	1.2	1.3	1.5
5.0	1.5	1.5	1.4	1.5
5.6	1.6	2.0	1.5	1.5
6.3	1.8	2.5	1.6	1.5
7.0	1.8	2.8	1.7	1.5
8.0	2.0	3.15	1.8	1.5
9.0	2.0	3.6	1.9	1.5
10.0	2.0	4.0	2.0	1.5

TABLE –8 (Cl. 6.2.11)

CHEMICAL COMPOSITION REQUIREMENTS FOR WELD DEPOSIT
OF LOW & MEDIUM ALLOY FERROUS ELECTRODES

IRS Class	C	Mn	Si	Ni	Cr	Mo	S	P	Cu	V
*(A3,A4, B1, B2)	0.12	1.6	0.75	0.30	0.20	0.30	0.035	0.035	-	0.08
B3	0.10	1.20	0.80	2.0 - 2.75	-	-	0.030	0.030	-	-
B4	-do-	-do-	-do-	-do-	-	-	-do-	-do-	-	-
C1	-do-	1.25 - 1.75	-do-	-	-	0.25 - 0.45	-do-	-do-	-	-
C2	-do-	-do-	-do-	-	-	-do-	-do-	-do-	-	-
D	0.12	0.50-1.30	0.35-0.80	0.40-0.80	0.45-0.70	-	0.040	-do-	0.30-0.75	-
E2	0.10	-	-	0.50(Min)	-	-	0.030	-do-	-	-
H4A	0.30-0.60	0.60-1.00	0.50	-	5.0-9.0	0.50	-do-	-do-	-	0.50
H4B	0.20	3.00	1.50	-	5.0	1.50	-do-	-do-	-	-

Note: 1) Single values are maximum except otherwise stated.

2) Tolerances in limiting values as given in respective IS/AWS are applicable.

3) The space where – mark is given against a particular element, the same may be present in small quantity in the core wire/weld metal if felt necessary by the manufacturer. But presence of the element should not adversely affect the end property of the weld.

* Combined limit for Mn+Ni+Cr+Mo+V = 1.75 Max

TABLE-9
(Cl. 6.2.11)
CHEMICAL COMPOSITION REQUIREMENTS FOR WELD DEPOSIT OF
HIGH ALLOY FERROUS ELECTRODES

IRS Class	%Chemical Composition							
	C	Cr	Ni	Mn	Mo	Si	S	P
M1	0.08	18.0 – 21.0	8.0 – 11.0	2.50	0.50	0.90	0.030	0.040
M2	0.04	18.0 – 21.0	8.0 – 11.0	2.50	0.50	0.90	0.030	0.040
M3	0.08	17.0 – 20.0	11.0 – 14.0	2.50	2.0 – 2.5	0.90	0.030	0.040
M4	0.04	22.0 – 26.0	11.0 – 15.0	2.50	0.50	0.90	0.030	0.040
M5	0.20	17.0 – 20.0	7.0 – 10.0	5.0 – 8.0	0.50	0.90	0.030	0.040
M6	0.20	24.0 – 28.0	18.0 – 22.0	2.50	0.50	0.75	0.030	0.030
M7	0.15	28.0 – 32.0	8.0 – 12.0	2.50	0.50	0.90	0.030	0.040

Note: 1) Single values are maximum except otherwise stated.
2) Tolerances in limiting values as given in respective IS/AWS are applicable.

7. **Storage:**

The electrode shall be stored in a dry room to minimise ingress of moisture. The roof, floor and walls shall be made of damp proof concrete/brick. The storeroom shall not be used as storage place for grease, oil or other chemicals, which may affect the performance of electrodes adversely. Preferably a separate room should be allotted. The storing system shall be **First in First out (FIFO)** to prevent undue storage.

8. **Shelf Life:**

The shelf life of the electrodes shall be 12 months from the date of receipt in Stores or 18 months from the date of manufacture whichever is more.

9. **Sampling plan for inspection of lot/s**

No. of packets (size wise) as lot size	No. of packets to be sampled
Up to 200	02
201-500	03
501-1000	05
1001-2000	07
2001 and above	10

10. **Test:**

Preparation of test pieces and testing shall be done as per relevant IS/AWS specification unless otherwise stated.

11. **Test for Bulk inspection:**

All the requirements as given in Clause 6 shall be applicable, only the tests are to be conducted on the size/s given in the Purchase Order.

12. **Retest:**

Where any test specimen fails to satisfy the requirement of a particular test, twice the no. of test specimens for that test shall be prepared using consumable from the same batch wherever possible and subjected to the test in which failure occurred. The consumable shall not be accepted as having passed that test unless all the test results on the additional specimens are satisfactory.

List of Appendices and Tables of IRS M:28-2017

Appendix - A (Clause 6.2.1)	Guideline for Running Performance Test and Storage Stability Test.
Appendix - B (Clause 6.2.8, 6.2.9 & 6.2.11)	Method of preparation of test pads for Hardness Survey, Macro test, Chemical analysis and acceptance criteria.
Appendix - C (Clause 6.2.3)	Method of Usability Test.
Appendix - D (Clause 6.2.7)	Method of preparation of test piece for corrosion resistance test and acceptance criteria (For D class of electrode).
Appendix - E	Safety considerations in welding
Appendix - F (Clause 6.2)	Method of preparation of test pads for Hardness Survey, Macro test, Chemical analysis and acceptance criteria (for H4 series of electrodes)

- Table - 1 (Cl. 3.1) - Classification of Electrodes as per their purpose of use along with IS Specification and coding thereof.
- Table - 2 (Cl. 3.3) - Classification of Gas Welding Rods as per their purpose of use along with equivalent type in IS: 1278-2013.
- Table - 3 (Cl. 6.2) - Acceptance criteria for A to E class of electrodes.
- Table - 4 (Cl. 6.2) - Acceptance criteria for F to N class of electrodes & G.W. rods.
- Table - 5 (Cl. 6.2.2) - Minimum acceptable values of different mechanical properties for A to E class of electrodes.
- Table - 6 (Cl. 6.2.2) - Base material requirement and acceptable values of mechanical properties of K and L Class of electrodes.
- Table - 7 (Cl. 6.2.10) - Dimensional requirements for fillet welds.
- Table - 8 (Cl. 6.2.11) - Chemical composition requirements for weld deposit of low & medium alloy ferrous electrodes.
- Table - 9 (Cl. 6.2.11) - Chemical composition requirements for weld deposit of high alloy ferrous electrodes.
- Table - 10 (Cl. 6.2.11) - Chemical composition requirements for core wire of non-ferrous electrodes and gas welding rods.
- Table - 11 (App - C) - Minimum dimension of test piece and electrode for usability test.

APPENDIX 'A'

(Cl. 6.2.1)

REQUIREMENTS FOR RUNNING PERFORMANCE TEST AND ACCELERATED STORAGE STABILITY TEST.

- A1 Running Performance:** Running performance test shall be done by deploying the welder approved as per IS: 7310 Part 1 and IS: 7318 Part 1 and performance test shall be applicable for all class of electrodes. Following criteria shall be checked
- A 1.1 General:**
- a) Packing condition: Shall be as per clause 5.
 - b) Physical condition of electrode (core wire and flux): Coating shall not be damaged / cracked. Core wire shall not be rusted.
 - c) Size and number of electrode in a packet shall be indicated: Diameter of core wire & length shall be within permissible limits.
 - d) Coating factor (Ratio of dia. of core wire and dia. of electrode in flux coated area): shall be as stipulated in respective IRS class.
 - e) Size of stub end and quality of end brushing: as per related IS/AWS.
- A 1.2 Current condition:** Electrodes (except N series) for all sizes offered shall be operated in the current range (both minimum and maximum) as recommended by the manufacturer. The minimum voltage as recommended by respective IS/AWS code shall be taken. In case IS/AWS code is not applicable, minimum voltage as recommended by the manufacturer shall be considered. In lower current range, the electrode shall run smoothly without any arc breaking and in higher current range, the electrode shall not become red hot upto minimum 50 mm beyond stub end.
- A 1.3 Performance test:** Electrode (except N series) shall be operated at ± 20 Amp of the middle of the current range given. Following parameters shall be checked:
- a) Ease of arc striking : The electrode should produce arc easily.
 - b) Arc stability : The arc must be stable & should not break during arcing.
 - c) Arc length : Short/Touch type/Medium/Long.
 - d) Spatter quality & quantity: The spatter shall be soft & less.
 - e) Smoke quality & quantity: The arc should be visible & smoke shall be normal.
 - f) Viscosity & controllability of slag: The slag should properly covered the weld beads.
 - g) Colour of slag: Black/Brown/Grey/Other.

- h) Slag detachability: The slag should be easily removed by chiselling.
- i) Ripple of weld bead: Smooth & evenly rippled.
- j) Convexity of weld bead : Flat to convex/concave.
- k) Tendency to undercut: No tendency to undercut.
- l) Crack, porosity etc.: Free from cracks, porosity & other defects.

There shall not be any adverse remark in any of the items indicated above.

- A 1.4 **Positional welding:** Upto 4.00 mm dia. electrode shall be operated at all the welding positions as per IS/AWS code. The appearance and quality of weld shall be satisfactory.
- A 1.5 **Cutting & Gouging:** This shall be applicable for N series of electrodes only. A cutting electrode shall be able to cut through smoothly using the welding parameters recommended by the manufacturer. The plate can be mild steels, low alloy steels, stainless steels, austenitic manganese steels, cast iron, cast steel & non-ferrous alloys such as Nickel alloys, Al, Cu, Bronzes etc. A gouging electrode shall be able to gouge easily the plates of material as mentioned above. However, testing of N3 class of electrode shall be limited to ferrous items only.
- A 1.6 **Any other adversity:** There shall not be any other adverse remark on the performance of the electrode.
- A1.7 The precautions to be taken during welding are given in **Appendix-E**. These precautions must be followed during welding operation.
- A2 **Accelerated Storage Stability Test:** This test is applicable for all classes of electrodes.
 - A 2.1 **Test:** Ten numbers of electrode shall be kept in a humidity chamber maintained at 48°C with Relative Humidity(RH) 90% min. for eight hours. After putting off the system, the electrodes shall be left in the humidity chamber for another 16 hours. After this period, the electrodes shall be taken out from the chamber and examined visually.
 - A 2.2 **Acceptance criteria:** At least eight electrodes out of ten shall not exhibit any:
 - a) Peeling off of flux coating.
 - b) Cracking of flux coating.
 - c) Loss of texture of flux.
 - d) Rusting of core wire inside flux coating.

For high deposition electrodes, deposition efficiency shall not fall below the minimum stipulated value of 110% when tested with the electrode found acceptable as per criteria given above.

APPENDIX 'B'

(Cl. 6.2)

METHOD OF PREPARATION OF TEST PAD FOR MACRO TEST, HARDNESS SURVEY AND CHEMICAL ANALYSIS AND ACCEPTANCE CRITERIA (For A3, A4, B1, B2, B3, B4, C1, C2, D, E2, G class and H3 & M series classes of Electrodes)

B .1 Preparation of Test weld Pad:

- B 1.1 **Material:** The parent metal for plates used in preparing test pieces shall be any grade of IS: 2062-2016.
- B 1.2 **Welding:** Test pad shall be prepared as shown in fig.1 using the welding parameters as specified by the manufacturers. The weld metal shall be deposited in flat position, using 3.15 mm dia and either 4.0 or 5.0 mm dia electrodes at the discretion of the approving authority. The deposit shall be at least 25mm thick.

B 2 Macro and Micro examination:

- B2.1 **Macro examination:** The surface of pad shall show no crack or other welding defects on macro examination with suitable magnification /DPT/MPT. The pad shall be sectioned and etched suitably to examine the cross section and interface. The cross section shall be free of any welding defect with proper fusion and bonding at interface.
- B2.2 **Micro examinations:** The micro examination test shall be carried out for H3 series of electrodes on separate parent metal by depositing around 10 mm layers.

B 3 Hardness survey:

- B 3.1 Hardness test shall be conducted at five places, one at the centre and four corners at a distance of $D/4$, D being the diagonal of the pad as shown in **Fig. 1**. Hardness number obtained shall be recorded.
- B 3.2 The hardness requirement of different hard facing electrodes shall be as given in **Table-4**.

B4 Sampling for Chemical analysis:

- B 4.1 Sufficient sample shall be taken from the test weld pad by an appropriate means (by drilling or shaping). Post heat treatment may be carried out to soften the test pad for easy removal of metal. Metal for the analysis purpose shall not be taken closer than 5 mm from the base metal. No oil or other lubricant shall be used while removing the sample.

- B 4.2 Wet analysis for different elements shall be carried out in accordance with IS: 228.
- B 4.3 Spectrometric analysis may also be carried out on solid and smooth surface of the pad after removing about 5 mm from top on at least 3 spots. The average of 3 readings shall be taken as the value for a particular element.
- B 4.4 In case of any controversy in the spectrometric analysis, wet analysis shall be considered as referee method.
- B 4.5 The chemical composition of the weldment shall conform to the range given in Table - 8, 9 & 10.

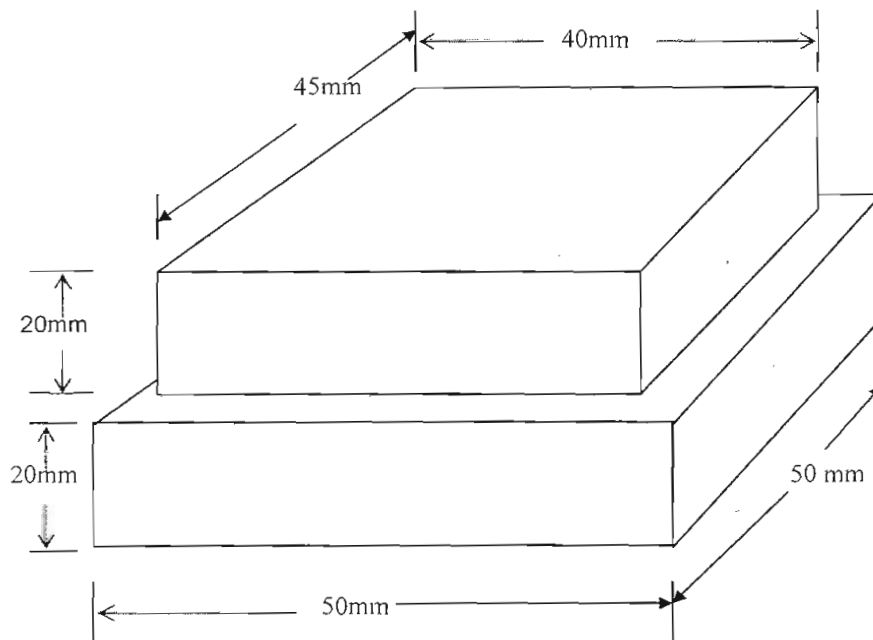


Fig: 1. Dimension of Weld Pad

C-K201

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

JANUARY, 2002

*Rec'd n/s 2050 lth
m C/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 ± 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 there of 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 specimen 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 :

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