

**Annexures to**  
**Part 2- Supply Requirements**  
**Section VII-Schedule of Requirements**  
**No. of Annexures -4**

- 1. Annexure 1-**Indian Railway Standard Specification for Flat Bottom Rails, IRS T-12-2009
- 2. Annexure 2-** RDSO policy no. CT/Policy/01 (Revised March 2023), Policy on Domestic rail plants for symmetrical rails of different grades
- 3. Annexure 3-** RDSO letter no. CT/Rail handling dated 09.02.2023 regarding guidelines for handling and stacking of rails
- 4. Annexure 4-** Railway Board Letter No 2019/Track I(P)/1175HT rail/Vol.1 dated 18.08.2023 for R350HT grade rail

**ANNEXURE 1**  
**TO**  
**PART 2 SUPPLY REQUIREMENTS**  
  
**INDIAN RAILWAY STANDARD SPECIFICATION**  
**FOR FLAT BOTTOM RAILS**  
**IRST-12-2009**

**भारत सरकार  
Government of India  
रेल मंत्रालय  
MINISTRY OF RAILWAYS**



**भारतीय रेल मानक विशिष्टि  
INDIAN RAILWAY STANDARD SPECIFICATION**

**समतल आधार रेलों के लिये  
FOR FLAT BOTTOM RAILS**

**IRST-12-2009**



**अनुसंधान अभिकल्प एवं मानक संगठन लखनऊ- 11  
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## INDEX

<b>SNo.</b>	<b>Description</b>	<b>Page No.</b>
1.	Index	2
2.	Scope	3
3.	Rail Section	3
4.	Templates and Gauges	3
5.	Definitions	3
6.	Manufacture	4
7.	Information to be supplied by the Purchaser	5
8.	Grade, chemical composition and mechanical properties	5
9.	Marking	5
10.	Sections & dimensions	9
11.	Freedom from defects	15
12.	Finishing	17
13.	Testing facilities	17
14.	Qualifying criteria	17
15.	Nature of tests	18
16.	Test sample	19
17.	Chemical analysis	19
18.	Tensile test	20
19.	Sulphur print test	24
20.	Hardness Test and Microstructure	28
21.	Falling weight test	30
22.	Determination of hydrogen content	32
23.	Qualifying criteria tests	32
24.	Inspection	37
25.	Method of payment	38
26.	Shipment	38
27.	Warranty	38

## Appendix

I, II(Revised), IIA(Revised) & III	Rail Sections
IV	Colour Code
V	Gauge for checking asymmetry
VI/1, VI/2 & VI-A(REV.1)	Sketch showing details of standard test piece for ultrasonic testing.
VII	Proforma for ladle analysis of rails steel
VIII	Album of macrographic prints
IX	Proforma for mechanical properties
X	Proforma for details of rails offered for inspection
XI	Standard test method for the determination of the plane strain fracture toughness ( $K_{1c}$ ) of rails
XII	Recommended arrangement for stacking of rails
XIII	Method for the determination of rail foot surface longitudinal residual stresses

## SERIAL NO. T-12-09

This specification was initially adopted in 1934 and subsequently revised in 1939, 1950, 1953, 1955, 1958, 1960, 1964, 1988 and 1996.

The present version has been adopted in 2009 specifying the requirements of the Prime rail and IU rails.

## **1. SCOPE**

This specification applies to Flat bottom Railway Rails. It specifies quality of the steel, manufacturing process, chemical composition, acceptance tests/ retests, qualifying criteria and other technical conditions of supply.

## **2. Rail section**

The Section of the flat bottom rails shall be in accordance with the section profiles shown in Appendix-I, II(Revised), IIA (Revised), III, unless otherwise specified by the purchaser.

## **3. TEMPLATES AND GAUGES**

The manufacturer shall submit, at his own expenses, two sets of templates (internal and external) made of stainless steel for each section of rail ordered or contracted for as per approved drawings. Two sets of plus and minus limit gauges made of stainless steel, in accordance with the stipulated maximum and minimum tolerances, shall also be submitted for approval of the Purchaser or his Authorised Inspecting Agency. The approval of purchaser or his authorised inspecting agency shall be obtained before the rolling of rails is commenced. The templates and gauges shall be stamped by the Purchaser/Authorised Inspecting Agency as a token of approval.

One set of templates of plus and minus limit gauges (called hereinafter master gauges) shall remain in possession of the Purchaser/Authorised Inspecting Agency during the period of acceptance. Only gauge bearing the stamp of the Purchaser/Authorised Inspecting Agency shall be valid for checking purpose.

Each template/gauge shall be suitably engraved with the manufacturer's name and the number of the rail section together with such other marks as the Inspecting Agency or the purchaser may direct.

## **4. DEFINITIONS**

### **4.1 Sequence-continuous casting**

This term is used when a sequence of casts of the same grade of steel is poured through a continuous casting machine without interruption in flow of liquid steel into the moulds and strands. The pouring of the next cast from ladle into the tundish begins before the steel from the previous cast is completely poured off from tundish to the mould, leading to an inter-mixing of some liquid steel from the two successive casts.

**4.2 Cast /Heat**

Liquid steel melt tapped out of a converter or electric arc furnace which includes after continuous casting a given number of blooms relating to the weight of the heat and the extension of the mixing zone

**4.3 Changeover, Overlap or Intermediate Bloom**

Blooms that may contain steel from more than one cast i.e. material arising during the Changeover from one cast to the next in the sequence. Number of change over bloom will be mutually decided by manufacturer/Purchaser depending upon casting practice adopted by the manufacturer.

**4.4 Classification of rails**

52 kg/m, 60E1, 68 kg/m & 60E1A1 rails shall be classified as class 'A' and class 'B' based on tolerance in end straightness as specified in Clause 9.4.2.

**4.5 Heat treated rail**

Rail that has undergone accelerated cooling from austenitizing temperature during the metallurgical transformation period.

**4.6 Re-heated rail**

Rolled rail that has undergone re-austenitization for heat treatment purposes.

**4.7 Mill heat treated rail**

Heat treated rail that has not undergone re-austenitization after rolling.

**4.8 Rail Running Surface**

Curved surface of the rail head. Area between both gauge corners (transition points of the head inclination and the first head radius)

**5 MANUFACTURE**

**5.1** The steel used for the manufacture of rails shall be made by basic oxygen or electric arc furnace process and continuously cast. Any other method of casting shall have prior approval of the Purchaser. For molten steel secondary ladle refining is mandatory. The manufacturer in his offer shall furnish details of the steel making process including refining, vacuum degassing.

**5.2** The cross sectional area of the bloom shall not be less than ten times that of the rail section to be produced.

**5.3** The manufacturer shall apply the best accepted code of practice throughout manufacturing process to ensure that the rails meet the stipulations of this specification. The manufacturer shall, on request, inform the purchaser of the measures adopted for ensuring the above.

#### 5.4 Heat Treatment Process

The rails shall be suitably heat treated to meet the requirements of the specification.

### 6 INFORMATION TO BE SUPPLIED BY THE PURCHASER

The purchaser shall provide the following information to the supplier when inviting tender for supply of rails according to this specification:

- i) Rail steel grade (Table 1)
- ii) Rail Section profile {Appendix I, II(Revised), IIA(Revised) and III}
- iii) Class of rail
- iv) Length of rail.
- v) Undrilled or drilled rails ends.
- vi) Colour code requirements (Appendix IV)

### 7 Grade, Chemical Composition and Mechanical Properties

The steel for the rails shall be of fully killed quality and shall confirm to chemical composition and mechanical properties given in Table-1. The limits for chemical composition are applicable both for tests on ladle samples and for check analysis of finished rails. Ladle and check analysis of steel, will be carried out by the method specified in the relevant part of IS: 228 or by any other established instrumental/chemical method of testing with the approval of the purchaser. In case of any dispute, the procedure given in the relevant part of IS:228 shall be referred.

### 8 MARKING

#### 8.1 Brand Marks

With the prior approval of purchasers, brand marks of suitable size clearly legible, shall be rolled in relief on one side of web at least at every 4.0 meter interval. The brand mark shall include:

- a) The rail section.
- b) The grade of steel, i.e.
 

Grade 880	880
Grade 1080HH	1080HH
Grade 880Ni Cr Cu	880NC
Grade R260	R260
Grade 1175HT	1175HT
- c) Identification mark of the manufacturer
- d) Month (using roman numbers) and last two digits of year of manufacture.
- e) Process of Steel making
  - i) Basic Oxygen – O
  - ii) Electric – E

TABLE-1

TABLE-1																	
Grade	Chemical Composition (percentage)													Mechanical Properties			
	C	Mn	Si	S (max)	P (max)	Al (max)	Mo (max)	Cr	V (max)	Cu	Ni	10 <sup>-4</sup> % (ppm) max by mass O	Hydrogen content in liquid steel (max.)	UTS (MPa) (Min)	*** Yield Strength (MPa)(Min.)	Elongation % on gauge length – 5.65√So (min)	Running surface hardness (BHN)
880	0.60-0.80	0.80-1.30	0.10-0.50	0.030*	0.030*	0.015	-	0.30 (max)	0.01	-	-	-	1.6 ppm	880	460	10.0	Min 260**
1080 HH	0.60-0.80	0.80-1.30	0.10-0.50	0.030*	0.030*	0.015	-	0.30 (max)	0.01	-	-	-	1.6 ppm	1080	460	10.0	340-390
Nickel Chromium Copper (NC)	0.60-0.80	0.80-1.30	0.10-0.50	0.030*	0.030*	0.015	0.25	0.50-0.65	-	0.3-0.4	0.25-0.40	-	1.6 ppm	880	550	10.0	Min 260

So = Cross sectional area of tensile test piece in mm<sup>2</sup>

\*0.035 maximum for finished rail

The chemical compositions specified as above are applicable to Ladle analysis and Product Analysis. Manufacturer shall ensure that chemical composition at ladle analysis should be such that product analysis also satisfies the requirement of chemical composition as above.

\*\* Desirable Value.

\*\*\*Frequency to be mutually agreed by purchaser and manufacturer.

TABLE-1 contd.....																
Grade		Chemical Composition (percentage)										Mechanical Properties				
		C	Mn	Si	S (max)	P (max)	Al (max)	Cr	V (max)	N (max.)	# # 10 <sup>-4</sup> % (ppm) max by mass O	Hydrogen content in liquid steel (max.)	# UTS (MPa) (Min)	# * Yield Strength (MPa)(Min.)	# Elongation % on gauge length – 5.65√So (min)	Running surface hardness (BHN)
R260	Liquid	0.62-0.80	0.70-1.20	0.15-0.58	0.025	0.025	0.004	≤0.15	0.030	0.009	20	1.6 ppm	-	-	-	-
	Solid	0.60-0.82	0.65-1.25	0.13-0.60	0.030	0.025	0.004	≤0.15	0.030	0.010	20	1.6 ppm	880# #	550# #	10 # #	260-300

So = Cross sectional area of tensile test piece in mm<sup>2</sup>

The chemical compositions specified as above are applicable to Ladle analysis and Product Analysis. Manufacturer shall ensure that chemical composition at ladle analysis should be such that product analysis also satisfies the requirement of chemical composition as above.

\* After results of 1000 heats on rails supplied by manufacturer, frequency would be reviewed as mutually agreed by purchaser and manufacturer.

# The samples for R260 grade shall be taken from head as well as foot of the rail and location of sample as per fig 4 and 4 (a) of Para 17 respectively.

# # The limits of UTS, YS and Elongation would be applicable to sample taken from rail head. No limit has been specified for UTS, YS and Elongation of sample taken from rail foot, as these data would be for records purpose.

# # # Testing frequency of total oxygen content shall be as per Clause 18.5 i.e. 'one test per sequence'.

TABLE-1contd.....																
Grade		Chemical Composition (percentage)											Mechanical Properties			
		C	Mn	Si	S (max)	P (max)	Al (max)	Cr (max.)	V (max.)	N (max.)	***10 <sup>-4</sup> % ( ppm) max by mass O	Hydrogen content in liquid steel (max.)	*UTS (MPa) (Min)	*Yield Strength (MPa)(Min.)	*Elongation % on gauge length – 5.65\So (min)	Running surface hardness (BHN)
1175 HT	Liquid	0.72-0.80	0.70-1.20	0.15-0.58	0.025	0.020	0.004	0.15	0.030	0.009	20	1.6 ppm	-	-	-	-
	Solid	0.70-0.82	0.65-1.25	0.13-0.60	0.030	0.025	0.004	0.15	0.030	0.010	20	1.6 ppm	1175 (Head) **	560 (Head) 560 (foot)	9 (Head) **	350-390

So = Cross sectional area of tensile test piece in mm<sup>2</sup>

The chemical compositions specified as above are applicable to Ladle analysis and Product Analysis. Manufacturer shall ensure that chemical composition at ladle analysis should be such that product analysis also satisfies the requirement of chemical composition as above.

\* Testing frequency one test per 1000T. The samples for 1175 HT grade shall be taken from head as well as foot of the rail and location of sample, is shown in figure under clause 17.3

\*\*The minimum value of UTS and Elongation would be applicable to sample taken from rail head. No limit has been specified for UTS and Elongation of sample taken from rail foot as these data would be for records purpose.

\*\*\*Testing frequency of total oxygen content shall be as per Clause 18.5 i.e. 'one test per sequence'.

TABLE-1contd.....									
Maximum residual elements, % by mass									
Grade	Mo	Ni	Cu	Sn	Sb	Ti	Nb	Cu+10Sn	Others (Cr + Mo + Ni + Cu + V)
1175HT	0.02	0.10	0.15	0.030	0.020	0.025	0.04	0.35	0.25
R260	0.02	0.10	0.15	0.030	0.020	0.025	0.04	0.35	0.25

## 8.2 Hot Stamping

Each rail shall be identified by a numerical, alphabetical or combined alphabetical and numerical code which will be distinctly hot stamped at least once every 5.0m on the web in figures and letters of suitable size from which following information can be obtained:

- i) The number of the cast from which the rails has been rolled with letter 'C'
- ii) Number of the strand
- iii) For rails from change over bloom, cast number should be the preceding cast number with prefix letter 'B'.

Alternatively, the identification system employed shall be such as to enable the hot stamped marking to be collated with the:

- a) number of the heat from which the rail has been rolled;
- b) number of the strand and position of bloom within the strand;
- c) Position of the rail in the bloom (A, B ... Y).

Further, in the event of identification marks having been removed, omitted or requiring alteration, re-identification of such marks shall be made by rotary burr.

## 8.3 Cold Punching

8.3.1 Following should be cold punched on one of end face of each rail:

- a) Inspecting Agency ID and Group ID
- b) Shift No in which product inspected
- c) Date of Inspection

Alternatively, any other method of marking/identification of rail can be adopted containing above information on one of end face of each rail.

To avoid damage to the HH rails, instead of cold punching, any other method of marking/identification on one of end face of each rail containing above information can be adopted.

### 8.3.2 For IU rails

In addition to marking mentioned in this Specification, the letter "IU" (Industrial Use grade) as the case may be in 15 mm size shall be stamped on both end faces of rails.

## 8.4 Colour code

Rails shall be painted as per colour code given in Appendix-IV to distinguish grade, class, length and other special requirements. Paint of good quality should be used with the prior approval of the Inspecting Agency. Alternatively, different colour code may also be decided by the supplier with the prior approval of purchaser.

## 9 SECTIONS AND DIMENSIONS

Each section of rails shall be accurately rolled to its respective template within the tolerances specified in this clause.

### 9.1 Permissible Variations in Dimensions

The tolerances in sectional dimensions shown here under shall be allowed, provided,

For Prime quality rail the actual weight computed by weighing short pieces of rails, not less than 300mm each in length, shall fall within 0.5 percent below and 1.5 percent above the calculated weight shown in Appendix I, II(Revised), IIA (Revised) and III for each rail section.

For IU Rail the actual weight computed by weighing short pieces of rails not less than 300 mm each in length is not less than the calculated weight shown in Appendix I, II(Revised), IIA (Revised) and III of this specification for each section of rail by more than 1.5%.

The weight test shall be conducted for each rail section, grade and class at least once per 5000 MT quantity.

### 9.1.1 Tolerances in sectional dimensions (For Prime Quality rails)

#### For profile as per Appendix I, III

Dimension	Tolerance	Remarks
Overall Height of Rails	+0.8 mm -0.4 mm	
Width of Head	$\pm 0.5\text{mm}$	This will be measured 14mm below the rails top.
Width of flange	$\pm 1.0\text{mm}$	For section less than 60Kg/m
	+1.2 mm	For sections 60kg and above
	-1.0 mm	
Thickness of web	+1.0 mm	This will be measured at the point of minimum thickness
	-0.5 mm	
Verticality/Asymmetry	$\pm 1.2\text{mm}$	Measured by gauge shown in App. V)
Flange	The base of the rail shall be true and flat, but a slight concavity not exceeding 0.40mm shall be permissible.	
Fishing surface	The standard template for rail fishing surface shall not stand away from the contour of web by more than 1.20mm and the clearance at the fishing surfaces shall not exceed 0.2mm at any point.	

#### For profile as per Appendix II(Revised) (Prime Quality rails)

Sr. No.	*Reference Points(see figure A1)		Profile (tolerance in mm)	Gauge/figure number(see Annex A)
	Location /property	Symbol		
1	Height of Rail <sup>a</sup>	*H	+0.6	A3
2	Crown Profile -Class A straightness	*C	+0.6 -0.3	A4
	-Class B straightness		$\pm 0.6$	
3	Width of railhead	*WH	$\pm 0.5$	A5
4	Rail Assymetry	*As	$\pm 1.2$	A6,A7
5	Height of fishing	*HF	$\pm 0.6$	A8

6	Web thickness	*WT	+1.0 -0.5	A9
7	Width of Rail foot	*WF	$\pm 1.0$	A10
8	Foot toe thickness	*TF	+0.75 -0.5	A11
9	Foot base concavity	-	0.3 max.	-
<sup>a</sup> The total height variation over any rail length shall not be greater than 1.2 mm for rails $\geq 165$ mm.				

Measurement will be done as per inspection gauges at Annexure-A

### For profile as per Appendix IIA(Revised) (Prime Quality rails)

Sr. No.	*Reference Points (see Figure A1)		Profile (tolerance in mm)	Gauge/ figure number (see Annex B)
	Location /property	Symbol		
1	Height of Rail	<165mm *H	$\pm 0.7$	A3
2	Crown Profile	*C	$\pm 0.6$	A4
3	Width of railhead	*WH	$\pm 0.5$	A5
4	Height of fishing	<165mm *HF	$\pm 0.5$	A8 <sup>c</sup>
5	Web thickness	*WT	$\pm 0.7$	A9
6	Width of Rail foot	*WF	$\pm 1.0$	A10
7	Foot base concavity	-	0.3 max.	-
<sup>c</sup> Not applicable for full web rails; in the case of all other rails, pairs of gauges with agreed dimensions shall be used to consider the different dimensions on both rail sides.				

Measurement will be done as per inspection gauges at Annexure-B.

### 9.1.2 Tolerances in sectional dimensions (for IU rails)

#### For profile as per Appendix I, III

Dimension	Tolerance	Remarks
Overall Height of Rails	+2.0 mm -1.0 mm	
Width of Head	+2.0mm -2.0mm	This will be measured 14mm below the rails top
Thickness of web	+2.0 mm -1.0 mm	This will be measured at the point of minimum thickness
Width of flange	+1.5 mm -2.0mm	
Flange	The base of the rail shall be true and flat, but a slight concavity not exceeding 0.40mm shall be permissible.	

Fishing surface	The standard template for rail fishing surface shall not stand away from the contour of web by more than 1.20mm and the clearance at the fishing surfaces shall not exceed 0.2mm at any point.
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**For profile as per Appendix II(Revised) (IU rails)**

Sr. No	*Reference Points(see figure A1)		Profile (tolerance in mm)	Gauge/ figure number (see Annex A)
	Location/ property	Symbol		
1	Height of Rail <sup>a</sup>	*H	+0.6 -1.1	A3
2	Crown Profile	*C	±0.6	A4
3	Width of railhead	*WH	+0.6 -0.5	A5
4	Rail Asymmetry	*As	±1.2	A6,A7
5	Height of fishing	*HF	±0.6	A8
6	Web thickness	*WT	+1.0 -0.5	A9
7	Width of Rail foot	*WF	+1.5 -1.0	A10
8	Foot toe thickness	*TF	+0.75 -0.5	A11
9	Foot base concavity	-	0.3 max.	-
<sup>a</sup> The total height variation over any rail length shall not be greater than 1.2 mm for rails ≥ 165 mm.				

Measurement will be done as per inspection gauges at Annexure-A

## 9.2 Length of Rails

The standard length of rail shall be 13 meters or 18 meters or 25 meters or 26 meters. The manufacturer shall be entitled to supply in pairs of short lengths up to 10% by weight of the quantity contracted for or ordered. Shorter lengths shall not be less than 10.0m in length for 13.0M and shall not be less than 16M in lengths for 18M and shall not be less than 23M in lengths for 25M and 24 M in lengths of rail for 26M. Short lengths shall be in multiples of 1.0M. In case of 60E1A1 Rails, length shall be suitable for Turnout design offered/proposed.

Type of Rail	Tolerance in length	
Prime Quality Rail	+20mm	-10mm
IU Grade	+30mm	-30mm

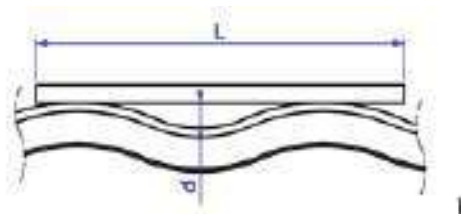
### 9.3 End Squareness

The deviation from square in both horizontal and vertical directions shall not exceed 0.60 mm on a length of 200mm.

### 9.4 Straightness

9.4.1 Flatness testing of the body shall be performed automatically.

Location/ Dimensional Properties		Class B		Class A	
		d	L	d	L
Body <sup>a</sup>	Vertical Flatness V	≤0.4mm	3m <sup>c</sup>	≤0.3mm	3m <sup>c</sup>
		And		and	
	Horizontal flatness H	≤0.3 mm	1m <sup>c</sup>	≤0.2mm	1m <sup>c</sup>
		≤0.6 mm	1.5 m <sup>c</sup>	≤0.45mm	1.5 m <sup>c</sup>



<sup>a</sup>Automatic measurement equipment shall measure as much of the rail as possible but, at least the body. If the whole rail satisfies the body specifications, then measurement of end and overlap is not mandatory.

<sup>b</sup>Automatic measurement techniques are complex and are therefore difficult to define but the finished rail flatness shall be capable of being verified by straight edge as shown in the above drawings.

<sup>c</sup>95 % of delivered rails shall be within limits specified, with 5% of rails allowed outside the tolerances by 0.1 mm.

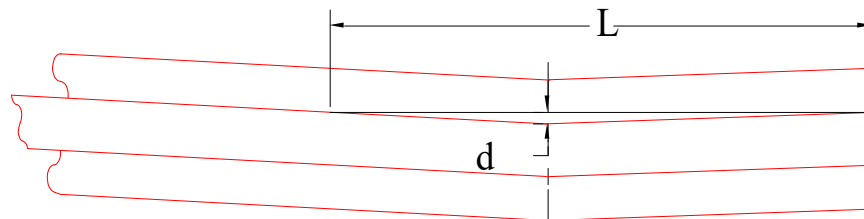
### 9.4.2 End Straightness

The tolerances for end straightness shall be as indicated in Table 2 and as illustrated in figure 1 and 2.

**Table –2**

Sl. No	Straightness	Tolerance		
		Class 'A' rails	Class 'B' rails	I U Grade rails
1.	Horizontal	Deviation of 0.5mm measured as maximum	Deviation of 0.7mm measured as maximum	Deviation of 1.5mm measured as maximum ordinate from the chord of 1.5

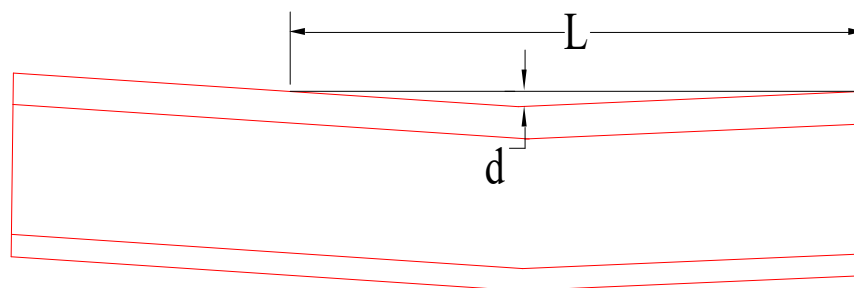
		ordinate from the chord of 2.0 meters standard straight edge.	ordinate from the chord of 1.5 meters standard straight edge	meters standard straight edge
2.	<b>Vertical</b> <b>a) Up sweep</b>	Deviation of 0.4mm measured as maximum ordinate from the chord of 2.0 meters standard straight edge.	Deviation of 0.5mm measured as maximum ordinate from the chord of 1.5 meters standard straight edge.	Deviation of 1.5mm measured as maximum ordinate from the chord of 1.5 meters standard straight edge.
	<b>b)Down Sweep</b>	NIL	NIL	NIL



L= Length of straight edge specified in Table 2

d= Maximum tolerance specified in Table 2.

**Fig.1 TOP VIEW OF HORIZONTAL TOLERANCE AT RAIL ENDS**



**Fig.2: SIDE VIEW OF VERTICAL TOLERANCE AT RAIL ENDS**

Any rail not complying with these requirements may be rectified once by the Manufacturer and offered for re-inspection.

## 10 FREEDOM FROM DEFECTS

**10.1** The rails shall be free from all detrimental defects such as cracks of all kinds, flaws, piping or lack of metal etc. having an unfavorable effect on the behavior of the rail in service.

**10.2** The absence of harmful internal defects shall be ensured by the continuous on-line ultrasonic examination. This examination shall be carried out for all rails under the responsibility of the manufacturer to the satisfaction of the Inspecting Agency.

**10.3** The manufacturer in his offer shall furnish the detailed method of on-line ultrasonic testing of rails to be followed by him. The limits of permissible defects for ultrasonic testing of rails shall be as follows and the standard test piece shall be as shown in drawing of Appendix-VI/1 and Appendix-VI/2 for symmetric rail

Head	: 1.5 mm dia FBH at two locations 1.5mm dia and 2.0mm dia through holes
Web	: 2.0 mm dia FBH at four locations
Web & foot junction	: 2.0 mm dia drilled hole
Foot	: 2.0 mm dia horizontal hole (both side)

The limits of permissible defects for ultrasonic testing and standard test piece of asymmetric rails shall be as shown in drawing of Appendix-VI-A (Rev. 1) Nov-2020.

All Flash Butt Welds executed by the manufacturer for welding of rails in to long panels shall be subjected to ultrasonic testing along with other acceptance criteria as per provisions of Manual for Flash Butt Welding of Rails, 2012 with latest amendment.

### 10.4 Eddy Current Testing

The manufacturer should have eddy current testing covering bottom area of the rail as also the top surface and sides of surface head. The ECT probes should cover complete area of rail bottom and at least 80% area of top surface and sides of the head.

The equipment used shall be able to detect artificial imperfections on the underside of the rail foot with sizes as shown in below table. For artificial imperfections, a tolerance of  $\pm 0.1$  mm shall apply:

Depth (mm)	Length (mm)	Width (mm)
1.0	20	0.5
1.5	10	0.5

### 10.5.1 SURFACE QUALITY

#### 10.5.1.1 Surface quality for Prime Quality Rail

##### 10.5.1.2 Hot marks

Depth of rolling guide marks anywhere on the rail should not exceed 0.5mm. A maximum of two guide marks are allowed per rail. The width of each rolling guide mark should not exceed 4.0mm.

Depth and width of guide marks must conform to the following:

Depth	Minimum width	Maximum width
mm	mm	mm
0.5	1.5	4.0
0.4	1.2	4.0
0.3	0.9	4.0

#### 10.5.1.3 Cold Marks

Depth of longitudinal or transverse cold formed scratches anywhere on the rail should not exceed 0.5mm.

#### 10.5.1.4 Seams

Rails with seams greater than 0.2 mm in depth are not acceptable and shall be ground. On the running surface of the rail, dressing shall be limited to 0.3mm deep and in other places; it shall be limited to 0.5 mm deep.

#### 10.5.2 Surface Quality for IU rail

The rails shall be of uniform section throughout and shall be generally sound and free from twists, cracks and major surface defects.

The following maxima of dimensions of surface defects in the rail shall, however, be acceptable:-

Type of defect	Location	Permissible dimensions of defects
Seams	(a) Table of rails, side of the head of rail, bottom and side of the foot of rail (excepting middle third of the foot).	Up to 3mm in depth
	(b) Middle third of the bottom surface of the foot of the rail.	Up to 2mm in depth
Scabs	Table of rail and side of the head of the rail.	75 mm x 25 mm not to exceed 3 mm in depth.

Number of scabs shall not be more than 3 in the standard rail lengths and shall be separated from each other by at least six times the length of the scab. There shall be no scab within 200mm from the end of the rail.

#### 10.5.3 Protrusions

All protrusions in the head or foot of the rail shall be ground to match the parent contour. Protrusions on web greater than 1.5mm high and 20mm square shall be ground. All protrusions affecting the fitment of the fishplate shall be ground.

**10.6** During examination on the inspection banks, any shrinkage cavity, inclusion & segregation visible to the naked eye shall result in rejection of such rail or cutting out of the defective portion and re-examination.

**10.7** Any operation carried out either in the hot or cold state with the object of hiding a defect is strictly forbidden.

## **11 Finishing**

**11.1** Cold straightening shall be effected by means of gradual pressure without impact. The rails may be roller straightened only once in each direction. The markings must be protected from the action of the straightening rolls.

**11.2** The rails must be cut to length when cold. Burrs shall be removed without any perceptible beveling of the section.

## **12 TESTING FACILITIES**

The manufacturer shall, at his own expense, supply all templates and gauges, prepare and supply test pieces and sample of steel, sample rails and drillings, and supply labour and apparatus/equipment, for testing which may be required by the Inspecting Agency for carrying out all the tests and render reasonable assistance in execution of such tests as desired by the Purchaser/Inspecting Agency.

## **13 QUALIFYING CRITERIA**

The following test shall be done for each rail section, grade and class after any change in the process of manufacture which may affect the results or annually for first three years for each contract. The first set of tests would be conducted prior to commencement of production for supply of rail under the contract and will be witnessed by purchaser or his nominated inspecting agency. If results of these three years are consecutively found satisfactory, this frequency may be relaxed to three years by Purchaser. The test shall be undertaken by the supplier to demonstrate compliance with the qualifying criteria. If so desired, the purchaser/Inspecting Agency should be provided all facilities to check the sample and witness the test.

- a) Residual stress measurement.
- b) Fracture toughness measurement
- c) Fatigue test
- d) Fatigue Crack Growth Rate Test
- e) Variation of Centre line running surface hardness (for 1175HT grade)

The samples for these tests shall be collected from finished rails. These samples shall not be subjected to any further mechanical or thermal treatment. The tests shall be carried out by an accredited/recognized laboratory approved by the purchaser and the test results shall be reported to the purchaser. The purchaser shall have access to all test records, calibrations and calculation which contribute to the final results.

In case any sample fails to meet the requirement laid in the qualifying criteria the manufacturer shall review its process of manufacturing within six months to eliminate any shortcomings and fresh qualifying criteria test shall be undertaken under intimation to the Purchaser.

## 14 NATURE OF TESTS

All tests shall be carried out as per latest version of reference specifications mentioned in this document.

### 14.1 ACCEPTANCE TESTS

**14.1.1** Following acceptance tests shall be conducted for Grade 880, 1080HH, 880NC, R260 and 1175HT Rails:

- a) Chemical Analysis
- b) Tensile Test
- c) Sulphur Print
- d) Hardness test
- e) Falling Weight Test
- f) Hydrogen content
- g) Inclusion Rating Level

**14.1.2** Following acceptance tests would be carried out in addition to the tests stipulated in 14.1.1.

**For R260 Grade**

1. Decarburisation Test
2. Determination of total oxygen content

**For 1175HT**

1. Decarburisation Test
2. Determination of total oxygen content
3. Microstructure

The following tests out of the Acceptance tests for 1175HT, would be necessarily carried out after heat treatment

- a. Tensile test
- b. Hardness test
- c. Microstructure test

For Grade 1080 Head Hardened (1080 HH) Rails all the tests stipulated in Para 14.1.1 above shall be conducted except tensile test and hardness test, prior to heat treatment. Following tests shall be carried out after heat treatment:

1. Tensile Test
2. Hardness Test
3. Macroscopic Test

**14.2** The choice of the test sample location within the cast and strand shall normally lie with the manufacturer. The test sample position within the bloom/rail shall be selected at the discretion of the Inspecting Agency.

**14.3** The initial test pieces and also the samples intended for retest must not be taken from the change over or intermediate blooms. Tests will only be carried out on these blooms when part or the whole of the adjacent cast has been withdrawn as not conforming to specification, or for supplying supplementary information, if required by the purchaser.

**14.4** The test methods and the conditions, under which the tests are carried out, shall conform to the standard in force in the country of manufacture, in so far as they are not defined in the present specification.

## **15 TEST SAMPLE**

**15.1** The samples drawn for preparation of the test pieces shall be marked and stamped under the supervision of the Inspecting Agency.

**15.2** If during the preparation of test pieces, any marks have been removed, they shall be replaced on the actual test pieces in the presence of the Inspecting Agency.

**15.3** The test pieces shall be machined in the cold state and must not be subjected to any cold or hot working or heat treatment except for stress relieving treatment at 100°C for two hours for tensile test pieces at the option of the manufacturer.

## **16 CHEMICAL ANALYSIS**

**16.1** The manufacturer shall, at his own expense, make a complete ladle sample analysis of each cast from which the rails are to be rolled and shall submit an authenticated copy of the results to the Inspecting Agency in the proforma at Appendix- VII. The percentage of each specified element shall conform to the limits specified in table-1 of clause 7.

### **16.2 Extent of test (Product)**

For casts  $\leq$  150t, one test per cast.

For casts  $>$  150t, two tests per cast, one sample taken from first half of the cast and the other from the second half and different strand.

**16.3** If chemical analysis of any cast fails to conform to the provisions of clause 7, the cast shall be subjected to the retest as per provisions of clause 16.4.

### **16.4 Retest**

Two additional chemical analyses shall be made. If both analyses pass, the casts shall be considered as complying with clause 7. If one or both of the analyses fail, the cast shall be rejected.

**16.4.1** If a cast does not satisfy the conditions of the specification, the intermediate metal belonging to preceding and succeeding cast shall be rejected or subjected to a retest.

**16.5** The chemical analysis for specified elements shall also be made either from drillings taken from a hole drilled in the rail, or by spectrography or any other approved method from the position shown (in fig.3), rolled from the same cast or from the tensile test piece or piece selected by the Inspecting Agency and the percentage of each specified element shall be within the range specified in table 1 of clause 7.

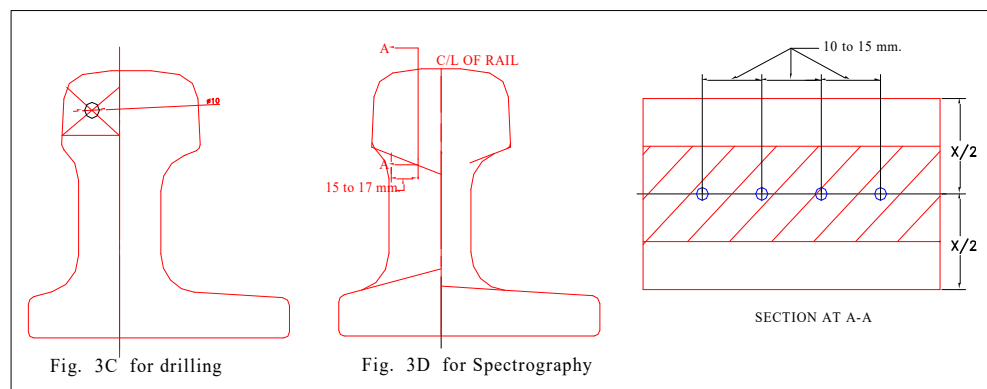
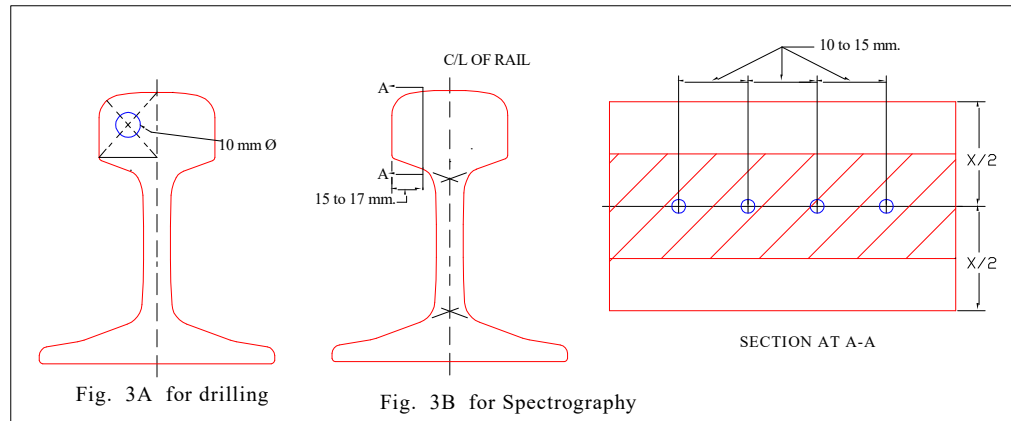


Fig. 3 Location of Sample for Chemical Analysis

## 17 TENSILE TEST

### 17.1 For 880, 880 NC and R260 grade Rails:

#### 17.1.1 Nature of Tests

The manufacturer shall determine the tensile properties of the steel in accordance with the requirements of IS: 1608. Such tests shall be made on standard test pieces taken from position shown in figure 4.

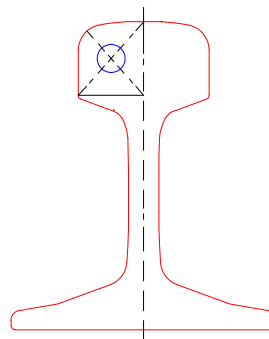


Fig .4 The location of sample for YS, UTS and Elongation in rail head for 880, 880NC and R260 grade rails

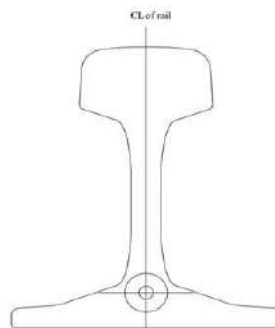
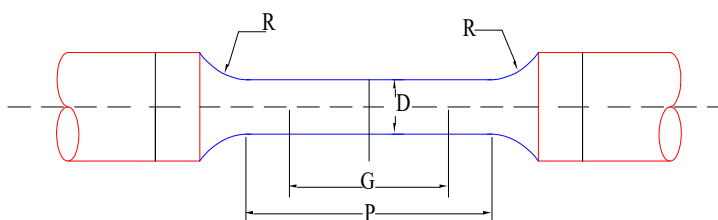


Fig.4(a) The location of sample for YS, UTS and Elongation in rail foot for R260 grade rails



**Fig . 5 STANDARD ROUND TENSILE TEST PIECE**

Three sizes of the standard test piece, as shown in fig.5 are given in table 3, any of which may be adopted.

**Table-3**

Diameter	Area of cross section	Gauge length	Parallel length	Radius at Shoulder
D mm	A mm <sup>2</sup>	G mm	P mm	R mm
20.64	333.33	100	120	18
14.56	166.67	75	90	13
10.00	78.50	50	55	10

#### 17.1.2 Extent of Tests

**(a) for 880 and 880NC grade Rails**

For casts ≤ 150t, one test per cast.

For casts > 150t, two tests per cast, one sample taken from first half of the cast and the other from the second half and different strand.

**(b) for R260 grade Rails**

The tensile test in rail head shall be carried out with the testing frequency of one test per heat/cast.

**(c) for R260 grade Rails foot sample**

The tensile test in rail foot shall be carried out with the testing frequency of one test per 2000T.

Note: After results of 1000 heats on rails supplied by manufacturer, frequency of Yield strength (YS) would be reviewed as mutually agreed by purchaser and manufacturer.

### **17.1.3 Results to be obtained**

The tensile strength obtained shall not be lower than the minimum value given in table 1, clause 7. Should the test piece break outside the middle half of the gauge length, it may be discarded and such breaks should not be considered as a failure of the test. A fresh test or fresh tests may be made by the manufacturer with a test piece or test pieces taken from rail from the same cast from which the discarded test piece was taken.

### **17.1.4 Retests**

When the first tensile test does not give satisfactory result, three retests shall be made. The two retests shall be made on any of the rails from the same strand and the third retest on any of the rails from another strand of the same cast.

The check tests must not be carried out on rails produced from intermediate blooms of a sequential continuous cast.

If all the three retests are satisfactory, all the rails of the cast shall be accepted.

If any of the two retests from original strand does not give satisfactory result and the third retest from the other strand gives satisfactory result, all the rails of the original strand shall stand rejected and rest of the rails of the cast shall be accepted.

If third retest does not give satisfactory result, further retest shall be made strand by strand as above up to 50% of strands.

For sequential continuously cast material, in the event of rejection or withdrawal of rails from one or more strands of a cast, the rails rolled from the changeover blooms between the ends of these strands of the previous and next cast in the sequence shall either be deemed not to comply with the requirements or shall be subjected to retest which shall be carried out, one on rail from the strand represented by the original test and the other from another strand. In the event of failure of either of these retests, rails rolled from change over blooms shall be rejected.

## **17.2 For 1080 HH (Head Hardened ) Grade Rails**

### **17.2.1 Nature of Test**

The manufacturer shall determine the tensile properties of the steel in accordance with the requirements of IS: 1608.

Such test shall be made on standard test pieces taken from position as shown in fig.6 given below.

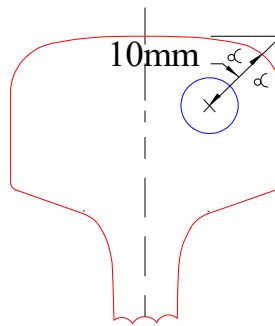


Figure -6

The diameter of the test piece shall be 6 mm with gauge length 3.54D or 21 mm.

### 17.2.2 Extent of Tests

One test per 1000 meter of heat treated rail from one heat.

### 17.2.3 Results to be Obtained

The minimum tensile strength after heat treatment shall not be less than 1080 MPa with a minimum elongation of 10% and 0.2% proof stress shall be measured and record maintained. If the test piece breaks outside the middle half of the gauge length, it may be discarded and such breaks shall not be considered as failure of the test. A fresh test or fresh tests may be made by the manufacturer with a test piece or test pieces taken from a rail from the same lot from which discarded test piece was taken. If the tests fail to meet the above requirements, the rails may be retreated at the option of the manufacturer and such rail may be retested as above.

### 17.3 For 1175HT grade Rails: General:

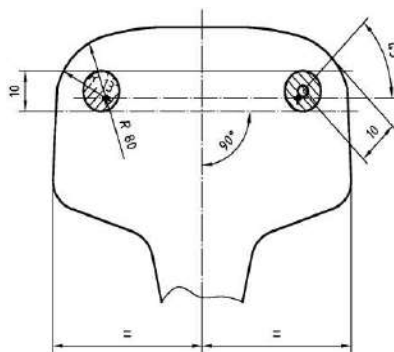
The tensile test shall be carried out with the testing frequency as given below:

One test per 1000 tonnes<sup>a, c</sup>

<sup>a</sup> Samples shall be taken at random but only rails from blooms outside the mixing zone between heats when continuously cast in sequence.

<sup>c</sup> Samples shall be cut from heat treated rails

Test samples from the rail shall be taken as given in figure given below. Results obtained shall comply with the values given in Table-1



### Key

- \* Intersecting point of the  $R13$  and  $R80$  radii (60E1 section)
- Location at the centre of the tensile test piece
- Area to be checked for microstructure

Figure- Location of tensile test piece and microstructure checks

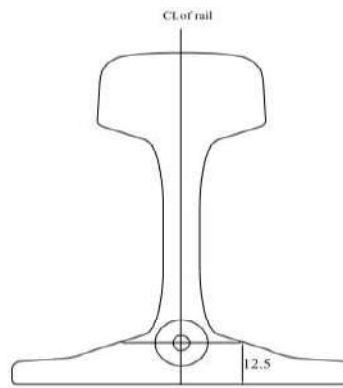


Figure-The location of sample for YS, UTS and Elongation in rail foot

#### **Method of test:**

The manufacturer shall determine the tensile properties in accordance with EN ISO 6892-1 using a proportional circular test piece of 10 mm diameter.

Before testing, the tensile test pieces should be maintained at a temperature of 200°C for up to 6 h. In the case of dispute, the tensile test pieces shall be maintained at a temperature of 200°C for 6 h before testing.

#### **Retest procedures:-**

If any test fails to meet the requirements then two tests shall be performed on samples from rails in close proximity to the original. Should either retest fail the failed material shall be re-treated and tested. The minimum values in Table-1 shall apply in such cases.

### **18 Sulphur Print Test**

#### **18.1 For Grade 880/1080 HH / 880 NC/ R260/1175 HT Rails**

##### **18.1.1 Nature of test**

A Baumann-type impression is obtained by the application of bromide paper, previously impregnated with a solution of Sulphuric acid, to the clean rail sections drawn from a location within the cast at the discretion of the Inspecting Agency.

The sections intended to be used for these tests are cold sawn and are then sufficiently cleaned on one surface in order to eliminate completely all machining marks and to obtain a sharp impression.

The initial samples and also those intended for the retests must not be taken from rails of changeover blooms. Tests will only be made on these rails when part or whole of the adjacent cast has been withdrawn as not conforming to specification.

##### **18.1.2 Extent of Tests**

Sulphur print tests shall be carried out at the rate of one each per cast for casts  $\leq 150$  t and two per cast for casts  $> 150$  tones.

### **18.1.3 Results to be Obtained**

The prints obtained must not reveal macrographic defects more marked than those of the limit prints shown in (or equivalent to those shown in) the album of macrographic prints given in Appendix-VIII.

### **18.1.4 Retests**

If Macrographic examination (Sulphur print) conducted according to 18.1.3 does not give satisfactory results, three further samples, two from the same strand and one from the other strand shall be tested.

If all the retests are satisfactory, all the rails of the cast shall be accepted.

If any of the two retests from the original strand does not give satisfactory result but the third retest from the other strand gives satisfactory result, all the rails of the original strand shall stand rejected and rest of the rails of the cast shall be accepted.

If the third retest from the other strand does not given satisfactory result, further retest shall be conducted strand by strand.

For rails from sequential continuously cast blooms, in the event of rejection or withdrawal of rails from one or more strands of a cast as a result of macrographic test, the rails rolled from the change over blooms at the end of these strands of the next cast in sequence shall either be deemed not to comply with requirements or shall be subjected to retest which shall be carried out one on the rails from the strand represented by the original test and the other from any other strand. In the event of failure of either of these retests, the rails rolled from change over blooms shall be rejected.

## **18.2 Inclusion Rating Level**

**18.2.1** The inclusion rating level, when examined as per IS: 4163, shall not be worse than 2.5 A, B, C, D thin or 2.0 A,B,C,D thick. Reporting for a parameter is to be in either thin series or thick series.

**18.2.3** This test shall be done once every day at random .The record of the test results shall be communicated to purchaser.

## **18.3 Macro-Structure Test (For 1080HH Grade Rails)**

One macro-structure test of hardened layer per 1000 meters of heat treated rails shall be performed. Macro structure of heat affected zone shall confirm to figure 7.

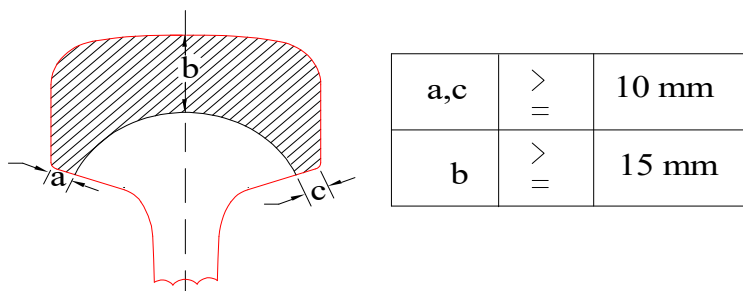


Figure -7

Due to specific process of heat treatment being adopted by the manufacturer e.g. inline air quenching method, Macro-structure of heat affected zone may not show distinct zones, as shown above in figure-7, supplier should advise about the same to the purchaser in advance.

#### 18.4 Decarburisation for R260 and 1175HT grade Rails:

The decarburisation depth shall be assessed by means of a hardness test at a frequency given below. After a minimum of preparation of the rail surface (polishing) a hardness test according to the method indicated in 19.0 shall be performed at three points. None of the results of hardness obtained shall be lower than the minimum value specified for the grade, reduced by 7 HBW. Alternatively to the hardness test, or if there are any doubts regarding the conformity with the requirements on decarburization, metallographic investigations shall be carried out according to the manufacturer's decision or upon request of the purchaser. Photomicrographs showing the depth of decarburisation allowed are shown in Figure (a). Figure (b) defines the rail head surface for decarburisation checks. No closed ferrite network shall be observed below 0,5 mm depth measured anywhere on the rail head surface.

##### Testing Frequency for 1175 HT grade rails-

One per 500 tonnes of re-heated and mill heat treated <sup>a, c</sup>

<sup>a-</sup> Samples shall be taken at random but only rails from blooms outside the mixing zone between heats when continuously cast in sequence.

<sup>c-</sup> Samples shall be cut from heat treated rails.

##### Testing Frequency for R260 grade rails

One per 1000 tonnes of part thereof

Samples shall be taken at random but only rails from blooms outside the mixing zone between heats when continuously cast in sequence. Samples shall be cut after rolling.

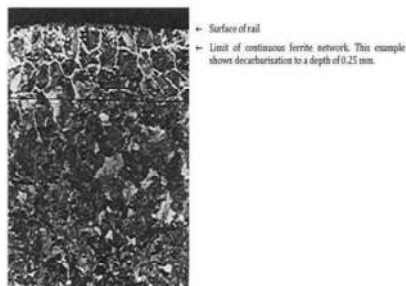
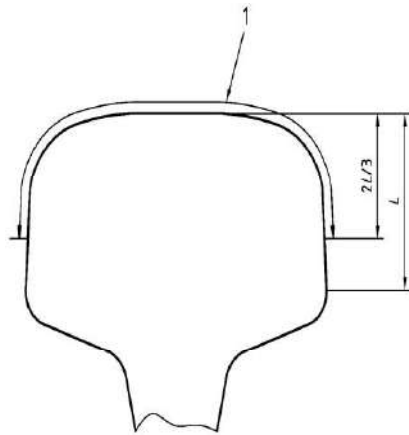


Figure (a) - Photomicrograph (x 100) showing depth of decarburisation allowed on the rail wear surface



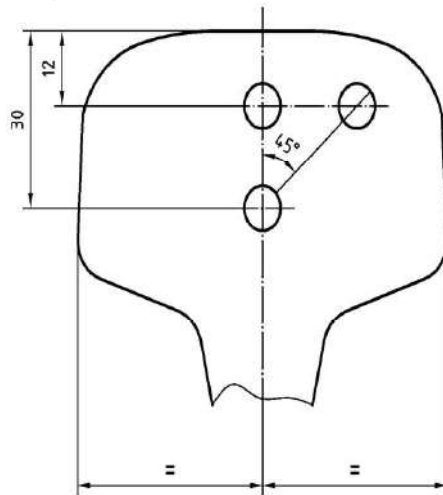
**Key** 1 decarburisation limits apply to this part of rail head.

Figure (b) - Range of extent of rail head surface for decarburisation checks

### 18.5 Determination of total oxygen content for R260 and 1175HT grade rails

#### General

Total oxygen content shall be determined in the liquid steel, following solidification of the sample, or from the solid rail head, in the positions as shown in Figure below,



#### Preparation of the sample

The thickness of the transverse rail slice shall be 4 mm. Samples shall be prepared in accordance with EN 10276-1.

#### Measurement:

The measurement of oxygen shall be made using an automatic machine

The testing frequency given below:-

One test per sequence

Note: Samples shall be taken at random but only rails from blooms outside the mixing zone between heats when continuously cast in sequence.

Total oxygen content shall be max. 20 ppm given in Table 1.

- i) If oxygen content is more than 20ppm, all heats of the sequence shall be checked.
- ii) Heats with a total oxygen content greater than 30ppm shall be rejected.

- iii) Atleast 95% of heats shall have a total oxygen content less than 20ppm. Otherwise all the heats of the sequence will be rejected. For sequence having number of heats less than 20, 95% heats would be interpreted as all the heat except for one.

## **19 Hardness Test and Microstructure**

### **19.1 For 880, 880 NC, R260 Grade Rails**

#### **19.1.1 Nature of Test**

For carrying out this test, impression shall be made on the running tread of a test piece drawn at the discretion of the manufacturer. The test shall be performed in accordance with IS: 1500.

#### **19.1.2 Extent of Test**

Test on 10% of the casts shall be carried for the purpose of records and for any corrective action as required.

Results of the test should be average of five observations on the same test piece.

The hardness values should be as per Table-1

Brinell hardness tests (HBW 2,5/187,5) shall be carried out in accordance with EN ISO 6506-1. Other measurement techniques, for example Rockwell or Vickers hardness testing, may be used, but in case of dispute Brinell hardness testing in accordance with EN ISO 6506- 1 shall be used. 0,5 mm shall be ground from the rail running surface before a hardness impression is made

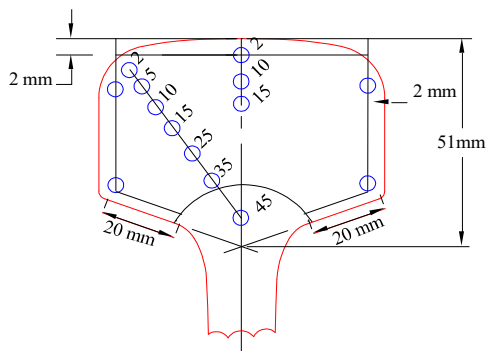
### **19.2 For 1080 Grade (Head Hardened) Rails**

#### **19.2.1 Nature of Test:**

The hardness test on the rail head surface shall be carried out for 10% of rails, at one end of the rail (after removing the decarburised surface), at regular interval of heat treatment and the hardness should be in the range of 340-390 BHN for 1080 HH Grade Rails. In case of non-conformance of any rail, 9 consecutive rails on either side of the rails having non- conformed value shall be checked for hardness in the sequence. Rails not meeting the hardness stipulations maybe retreated only once at the option of the manufacturer and such rails may be retested as above."

#### **19.2.2 Results to be obtained:**

Hardness of rail head surface after heat treatment shall be within Brinell Hardness No. 340 to 390.

Figure -8 Hardness Distribution

### 19.2.3: Hardness Distribution Test

The hardness distribution test shall be conducted on transversely cut rail section as shown in Figure-8. Hardness value at any point shall not exceed 390BHN. The cross sectional hardness distribution of heat treated rails shall slope towards the inside. No sharp drop in hardness should be present. The hardness at 10mm below the rail head shall be 340BHN minimum. The hardness at 15mm below the rail head table at center shall be minimum 315BHN.

### 19.2.4 Extent of Test:

One hardness distribution test per 1000 m length of heat treated Rail shall be performed.

### 19.2.5 Microstructure :

Test piece for microstructure should be taken from the top of rail head. Test piece should be polished, etched and viewed under microscope X100 and X500 magnification. The microstructure shall be fine pearlite without formation of any martensite and Bainite. One test per 1000m of heat treated rail from one heat to be carried out.

## 19.3 For 1175HT Grade (Heat Treated) Rails

Brinell hardness tests (HBW 2,5/187,5) shall be carried out in accordance with EN ISO 6506-1 at the frequency of one test per 100 tonnes of heat treated rails. Other measurement techniques, for example Rockwell or Vickers hardness testing, may be used, but in case of dispute Brinell hardness testing in accordance with EN ISO 6506-1 shall be used.

The hardness values measured shall meet the requirements given in Table below.

**Table - Hardness testing positions and requirements**

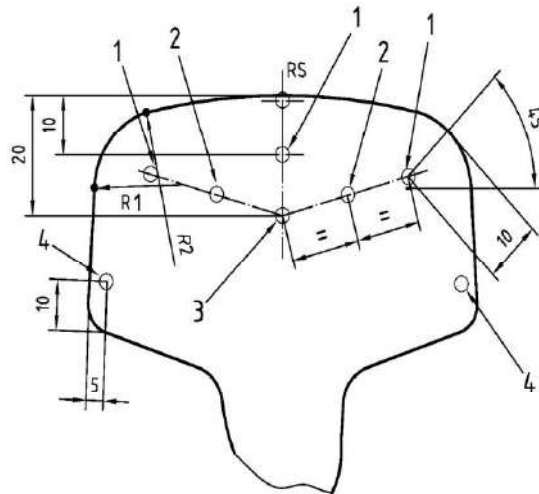
Position	Rail Steel Grade-1175HT
RS <sup>a</sup>	350 to 390 <sup>b</sup>
1	≥ 340 min
2	≥ 331 min
3	≥ 321 min
4	≥ 340 min

<sup>a</sup> RS = Point on the centre line rail running surface.

<sup>b</sup> If the hardness exceeds 390 HBW, the rail is acceptable provided the microstructure is confirmed to be pearlitic, and the hardness does not exceed 405 HBW.

The testing positions are shown in Figure below.

Dimensions in millimetres



**Key** 1, 2, 3 and 4 location of hardness testing exact intersecting points of the radii

For hardness distribution of the heat treated rails, the following shall apply:

$$HBW2 > HBW3 + 0,3 (HBW1 - HBW3),$$

Where HBW1, HBW2 and HBW3 are the mean hardness values at position 1, 2 or 3 respectively. Also the difference between any of the three positions shall be no more than 30 HBW.

The hardness on the centre line of the head crown shall not vary by more than 30 HBW on any individual rail.

0,5 mm shall be removed from the rail running surface before a hardness impression is made.

### 19.3.1 Microstructure

#### General

Microstructures shall be determined at a magnification of X500.

The microstructure shall be verified for 1175HT Grade rails at a frequency of one test per 100 tonnes of heat treated rails <sup>a, c</sup>. The testing position in the rail head shall be as shown in Figure at Para 17.3.

<sup>a</sup> Samples shall be taken at random but only rails from blooms outside the mixing zone between heats when continuously cast in sequence.

<sup>c</sup> Samples shall be cut from heat treated rails

The microstructure shall be fully pearlitic with no martensite, bainite or grain boundary cementite.

## 20 FALLING WEIGHT TEST

### 20.1 Nature of Test

20.1.1 The single guided falling weight test shall be carried out, the minimum height of the drop (in m) varying in relation of the mass per unit length of the

profile  $M_r$  (in Kg) and the mass of the falling weight selected  $M_m$  (in Kg) according to the formula-

$$H = 150 \frac{M_r}{M_m}$$

Falling weight test piece minimum 1.3 meters long shall be cut from a location as per choice of the Inspecting Agency. For heat treated rails, the sample shall be taken after heat treatment. The test piece shall be placed in horizontal position with the head up on two iron or steel supports resting on a solid metal anvil. The weight of the metal anvil block shall not be less than 10,000 kg and its supporting base would be sufficiently rigid. No timber or spring shall be permitted between the rail supports and the anvil or between the anvil and the foundation. Block guides shall be provided which shall permit free fall of the weight. The upper surface of the supports shall be curved to a radius of not more than 125 mm.

One blow shall be delivered midway between the supports, by means of a freely falling iron weight or 'TUP', the striking face of which shall be rounded to a radius of not more than 125mm. The weight of the "TUP", the distance between the centre of the bearings, the height between the surface of the rail and the bottom of the "TUP", before the latter is released shall be as specified in table-4.

Table - 4

Rail section	*Weight of TUP (Kg)	**Distance between centers of bearers(m)	Height of drop (m)
52kg	1000	1.00	Measured from the top of the rail head and variable according to the above formula.
60E1	1000	1.00	
68kg	1000	1.00	

\*1000Kg in principle but it may be vary according to the formula above

\*\*1.00 m in principle but may vary between 1.00 m and 0.85 m

Note-

- i) The value of the height should be rounded to the nearest first digit of decimal.
- ii) The height for 60E1A1 rail profile would be the same as that for 60E1 rail profile.

## 20.2 Extent of Tests

One Test per cast shall be carried out. Sample for 20% (minimum) of the fresh casts rolled per day shall be selected at random from straightened rails and the remaining samples shall be hot sawn. No retest shall be permitted on account of sample from straightened rails failed in Falling weight test. However, present provision of retests shall be applicable to rest 80% of samples taken from un-straightened rails. Choice of the test sample location within cast and strand shall normally lie with the manufacturer. The test sample position within bloom/ rail shall be selected at the discretion of the inspecting agency.

## 20.3 Results to be Obtained

**20.3.1** The blow shall be sustained without fracture or crack, and the permanent set resulting from the blow shall be measured after every test, over the specified distance between the centers of the bearer and recorded and advised to the purchaser.

**20.3.2** The Inspecting Agency shall be entitled to test to destruction any rail piece subjected to the falling weight test or carry out any other test/examination/analysis in order to confirm that the rails are sound.

## **20.4 Retest**

Test sample shall be selected at random from the finished rails at the discretion of the Inspecting Agency.

If a falling weight test piece gives unsatisfactory result, three retests shall be made on two rails from the same strand and one from any other strand. If all the three tests are satisfactory, all the rails of the cast shall be accepted.

If either of the two tests from original strand gives unsatisfactory result and the third test from the other strand gives satisfactory results, all the rails of the original strand shall be rejected and other rails of the cast shall be accepted.

If the third test from the other strand gives unsatisfactory result, further retest shall be conducted strand by strand. For sequential continuous cast, if rails are rejected or withdrawn from one or more stands of a cast, the rails rolled from the changeover bloom at the end of the same strands of the previous and next cast in the sequence shall either be withdrawn or subjected to two retests, failure of either of retest shall result in rejection of the rails rolled from the changeover blooms of the same strand.

## **21 Determination of Hydrogen Content**

Vacuum degassing of liquid steel shall be done to reduce the hydrogen content. For this purpose, RH degasser or REDA (Revolutional Degassing Activator) shall be used. All measurement of hydrogen shall be done for the liquid steel in tundish or mould.

21.1 The measurement of hydrogen shall be done by following method:

On-Line/Instantaneous Method-

HYDRIS is approved as method of on-line instantaneous measurement. The method of measurement as prescribed by the manufacturer of HYDRIS system shall be adopted.

21.2 The level of hydrogen measured by the method described under Para 21.1 above shall be 1.6 ppm maximum for acceptance of a heat for production of rail.

## **22 QUALIFYING CRITERIA TESTS**

### **22.1 Residual stress in rail foot**

#### **22.1.1 Test method**

The residual stresses in the rail foot shall be determined in accordance with APPENDIX-XIII.

#### **22.1.2 Test pieces**

For residual stress tests, there shall be 6 sample rails and the test pieces shall be taken at least 3m from each rail end. Each of the 6 test pieces from the rail section shall be 1 m in length.

NOTE- Only a small part of the test piece will be destroyed for the purpose of measuring residual stress; the remainder can be used for other qualifying approval tests.

### 22.1.3 Measurements

Longitudinal residual stress determinations shall be made on the rail foot of each of the 6 test pieces described in 22.1.2. The location of the measurements is shown in Figure 9(A) & 9(B).

'F' IS STRAIN GAUGE LOCATION

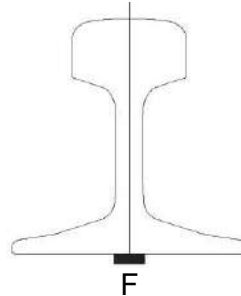


Fig. 9A

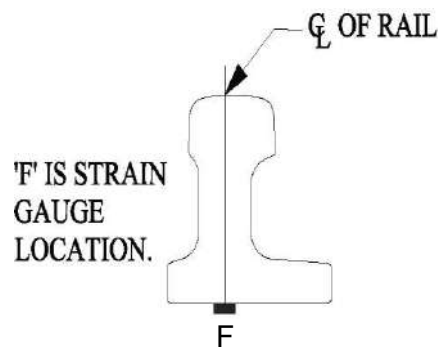
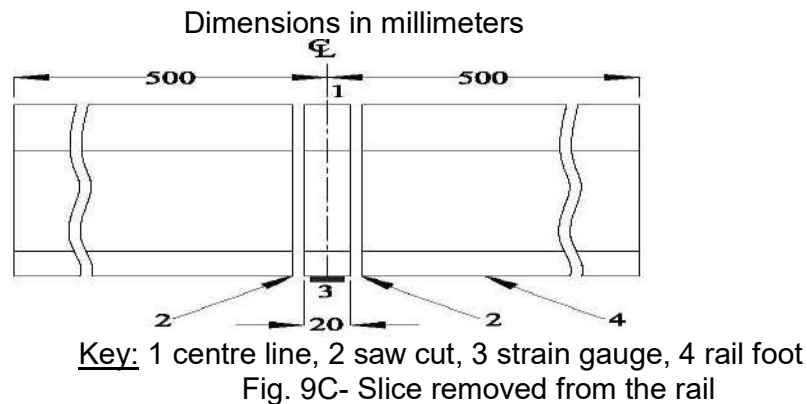


Fig. 9B



### 22.1.4 Qualifying criteria

The maximum longitudinal residual stress in the foot shall be 250 MPa for all steel grades.

## 22.2 Fracture Toughness $K_{1c}$

### 22.2.1 Test pieces and test methods

Tests shall be performed in accordance with **APPENDIX-XI**

### 22.2.2 Qualifying Criteria:

The values of  $K_{1c}$  shall comply with table given below:

Steel grade	Minimum single value $K_{1c}$ ( MPa m $^{1/2}$ )	Minimum Mean $K_{1c}$ ( MPa m $^{1/2}$ )
880, 880NC and R260	26	29
1175HT and 1080 HH	30	32

Note: In some circumstances  $K_Q$  values can be used for the purpose of qualification – see B.6 of appendix XI.

### 22.3 Fatigue Test: For 880 grade and 1080HH Grade

**22.3.1** The constant amplitude fatigue test shall be carried out in accordance with ASTM E606.

#### 22.3.2 Test Pieces

The test pieces shall be machined from the sample rail at a location at least 2m from the rail ends.

#### 22.3.3 Number of Tests and Test Conditions

A minimum of three tests shall be performed under the following conditions:-

Test temperature = Ambient

Control variable shall be axial strain amplitude.

**Note:-**Load control during the test is acceptable provided the requirements of ASTM E606, clause 10.2.1 are complied with.

The strain cycle shall be symmetrical about the initial zero load strain level.

**22.3.4** Each sample should endure 10 million cycles at strain of 0.00135 for 880grade rails. For rails of grade 1080 the each sample should endure 10million cycles at strain of 0.00166. Testing shall be done in such a way that peak strain shall be 0.00135 in tension and 0.00135 in compression for 880grade rails. For rails of grade 1080 the peak strain shall be 0.00166 in tension and 0.00166 in compression.

### 22.4 Fatigue test: For R260 and 1175HT Grade rail

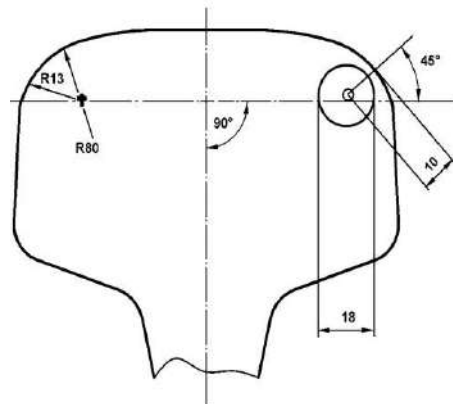
#### Test method:

Constant amplitude fatigue tests shall be carried out in accordance with ISO 1099.

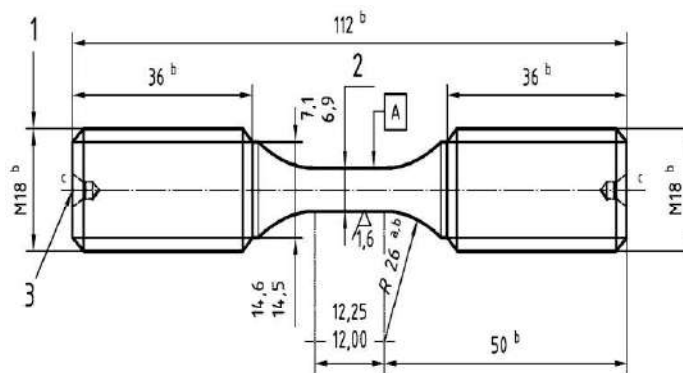
#### Test pieces:

The test pieces shall be machined from the sample rail as shown in figure given below.

Dimensions in millimeters



- ✦ intersecting point of the R13 and R80 radii (60 E1)
- location of the centre of the test piece



#### Key

- 1 screw threads (both ends) to be concentric with  $\varnothing A$  within 0,005 mm. Different forms (without threaded heads of test pieces) may also be used.
  - 2 cylindrical within 0,005 mm
  - 3 centre drill
    - a 26 mm radius shall run tangential with gauge diameter (datum dia 'A') without undercutting or leaving a shoulder
    - b general tolerance to be  $\pm 0,2$  mm unless otherwise stated
    - c specimen to be identified on each end
- Figure - Specimen for determining fatigue initiation life.

#### Number of tests and test conditions:

Test pieces for fatigue test shall be taken from 3 sample rails at least 3 m from the cut ends of the rail. Sample rails shall be from different heats and different strands.

A minimum of 3 test pieces shall be tested from each sample rail under the following conditions:

- test temperature shall be within the range  $+15$  °C to  $+25$  °C;
- control variable shall be axial strain amplitude;
- strain cycle shall be symmetrical about the initial, zero load.

**Qualifying criteria:**

For a total strain amplitude of 0.00135, testing shall be done in such a way that peak strain shall be 0.00135 in tension and 0.00135 in compression, the life of each specimen shall be greater than  $5 \times 10^6$  cycles.

**22.5 Fatigue Crack Growth Rate**

Test pieces for fatigue crack growth rate test shall be taken from 3 sample rails at least 3 m from the cut ends of the rail. Sample rails shall be from different heats and different strands.

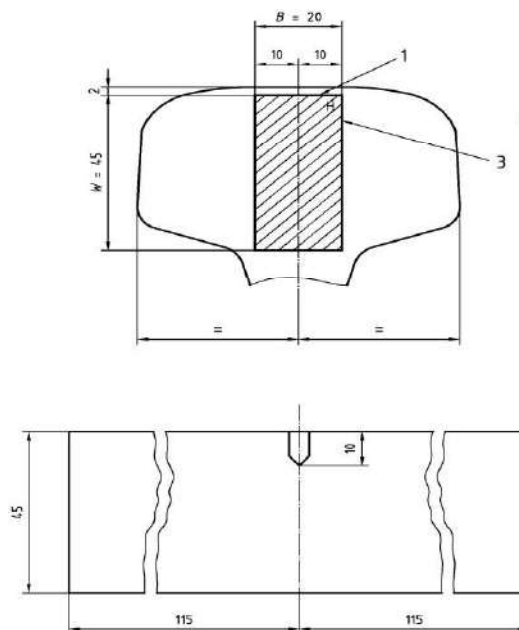
Test method:

Tests shall be carried out in accordance with the general requirements of ISO 12108.

Test pieces:

A three point bend, single edge notch test piece, of the dimensions and location within the rail shown in figure below shall be used.

Dimensions in millimetres



1 notch machined into this face

2 section through rail head

3 letter 'H' to be stamped on end face of test piece as shown

**Figure- Location and dimensions of fatigue crack growth test pieces**

Number of tests and test conditions:

A minimum of 3 tests from each sample rail shall be performed under the following conditions:

- Test temperature shall be within the range +15 °C to +25 °C;
- $R = 0.5$  ( $R$  = minimum cyclic load/maximum cyclic load);
- 3 point bend test piece loading span shall be  $4W$  (see figure above)
- Cyclic loading frequency shall be within the range 15 Hz to 40 Hz;
- Environment: laboratory air.

**Qualifying criteria:**

Fatigue crack growth rates (m/Gc) shall not exceed the values given in table below.

Table -Fatigue crack growth rates

Steel grades	$\Delta K = 10 \text{ MPa m}^{1/2}$	$\Delta K = 13.5 \text{ MPa m}^{1/2}$
880, 880NC, R260, 1080HH and 1175HT	17 m/Gc	55 m/Gc

**22.6 Variation of Centre Line Running Surface Hardness for 1175HT Grade Rail**

For the longest length of rail produced by the manufacturer, a one meter length of rail shall be taken from each end and at 20m intervals from one end of the rail. These shall be hardness tested (HBW) in accordance with EN ISO 6506-1 along their length at 25 mm intervals on the centerline of the running surface after 0,5 mm has been ground away. The hardness results shall be no more than  $\pm 15$  HBW from the mean result obtained.

**23 INSPECTION**

- 23.1** The purchaser/Inspecting Agency shall have free access to the works of the manufacturer at all reasonable times. The Inspecting Agency shall be at liberty to inspect at every stage the process of steel manufacture and rail production and cross check the results of the stipulated tests when so desired by it.
- 23.2** Rails rolled from passed heats only shall be inspected by the Inspecting Agency or as mutually agreed by purchaser and Inspecting Agency. The acceptance procedure should not interfere with the normal manufacturing process. When a cast is rolled in several batches, tests carried out on the first part of the cast may be considered valid for the remaining parts of the cast in agreement with the Inspecting Agency.
- 23.3** Before the rails are submitted to the Inspecting Agency, these rails shall be properly examined by the manufacturer's inspectors and all defective rails shall be conspicuously marked and segregated. Rails passed in internal inspection should only be offered for examination by the Inspecting Agency.
- 23.4** The analysis of all casts rolled together with a report on the manufacturer's rejections shall be submitted in proforma as appendix IX and X to the Inspecting Agency.
- 23.5** After inspection, every accepted rail shall be clearly stamped with the Inspecting Agency's stamp at one end in the presence of the Inspecting Agency and painted as per colour code specified in clause 8.4. Cast numbers shall be cold stamped on the faces of the rails at one end.
- 23.6** Passed rails should be properly stacked on leveled and well drained stacking area. Rails shall be stacked in head up position with 100 x 25 mm mild steel flats as spacers at a distance of 4.0 m between successive layers. Recommended

arrangement for stacking of rails shall be as per RDSO drawing no. RDSO/T-6219, as Appendix XII.

- 23.7** For lifting rails, single point slinging is not permitted. For 13m long rails, there should be two lifting point spaced at 6 to 7.5 m apart and the maximum rail end overhang beyond the lifting point should not be more than half of the distance between the lifting point. For lifting longer rails the spacing between lifting points shall not be more than 15 m. The system should be an automatic rail handling system of suitable capacity such that it avoids any damage to the rail during handling. For jerk free handling, movement of the rail should be controlled and synchronized, both, in horizontal direction or cross travel and in the vertical direction or hoist. Clamping system should be such that it avoids point load on the rail. To avoid any undesirable stresses during handling, manufacturer shall issue detailed instructions for operation of the automatic long rail handling system as well as issue Do's and Don'ts for the safe operation.
- 23.8** Sudden impact on rails during loading, unloading, stacking or transferring from one point to the other shall be avoided.

## **24 METHOD OF PAYMENT**

- 24.1** The calculated weights of rails given in appendix I, II (Revised), II-A(Revised) and III of this specification shall be regarded as actual weights and payment shall be made on these weights unless otherwise agreed to.

## **25 SHIPMENT**

- 25.1** No rail shall be loaded or dispatched until notification has been received from the Inspecting Agency that it has been inspected and has satisfactorily passed all specified tests.
- 25.2** Industrial Use (IU) rails should be loaded in one wagon and should not be mixed with other rails for dispatch.

### **25.3 Import Shipment**

The rails shall be loaded in bundles of three rails each bundle containing one rail upside down placed in between two rails snugly fitting and suitable tied by M.S. straps at four or more places along the length of rails so that they will not get loosened during their transportation from manufacturer's place to site of work. Alternatively, manufacturer may supply loose rails i.e. single rail without bundling. The manufacturer shall supply rail handling equipments free of charge in sufficient numbers to the satisfaction of purchaser so that unloading/ loading of rails is not delayed on this account.

### **25.4 Rail Transport Transportation within the country**

Rails shall be loaded in wagons in layers with wooden/steel spacer flats between them so that the rails do not get damaged during transportation. Any missing bolster in BFRs/BRHs/BRNs shall be replaced by the manufacturer at his expense. The rails shall be tied as per the extant instructions.

## **26.0 WARRANTY**

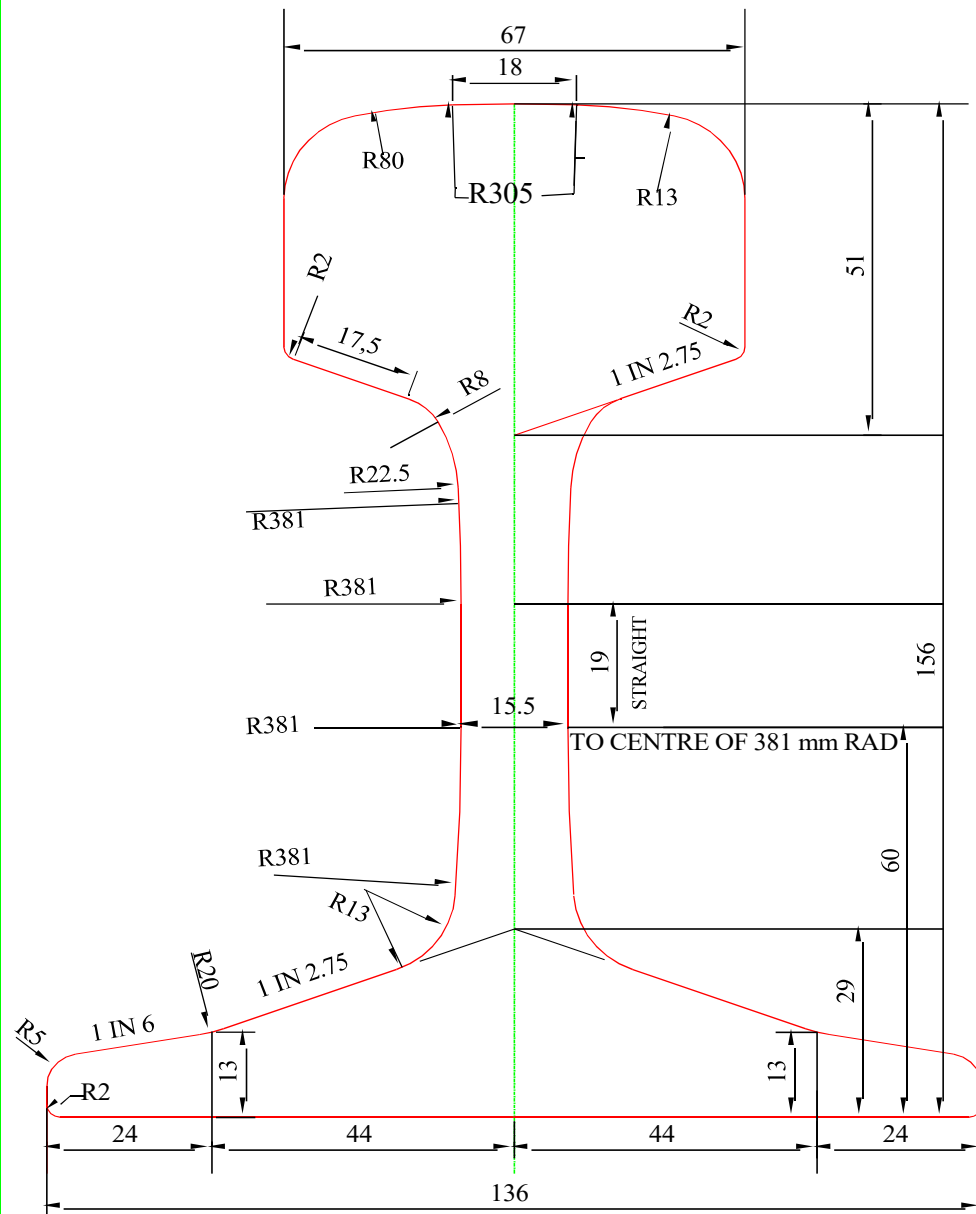
As a warranty for supply of rails free from manufacturing defects by rail suppliers, after initial USFD testing of new rails in rail manufacturing plants, a USFD test free period of 25% of service life of rails in terms of GMT as given below (Para 302 (1)(d) of IRPWM-2004 as amended from time to time) shall be applicable. This clause of test free period of 25% of service life of rails shall also be

applicable for all types of 90UTS (grade 880) and higher grade of rails of this specification. If any rail fracture due to suspected manufacturing defect is detected within a period of 25% service life of rail in terms of Gross Million Tonne, then investigation will be conducted jointly by purchaser and supplier to ascertain the cause of failure".

Rail Section	Assessed GMT service life for 90UTS rails
60Kg	800
52 Kg	525
90R	375

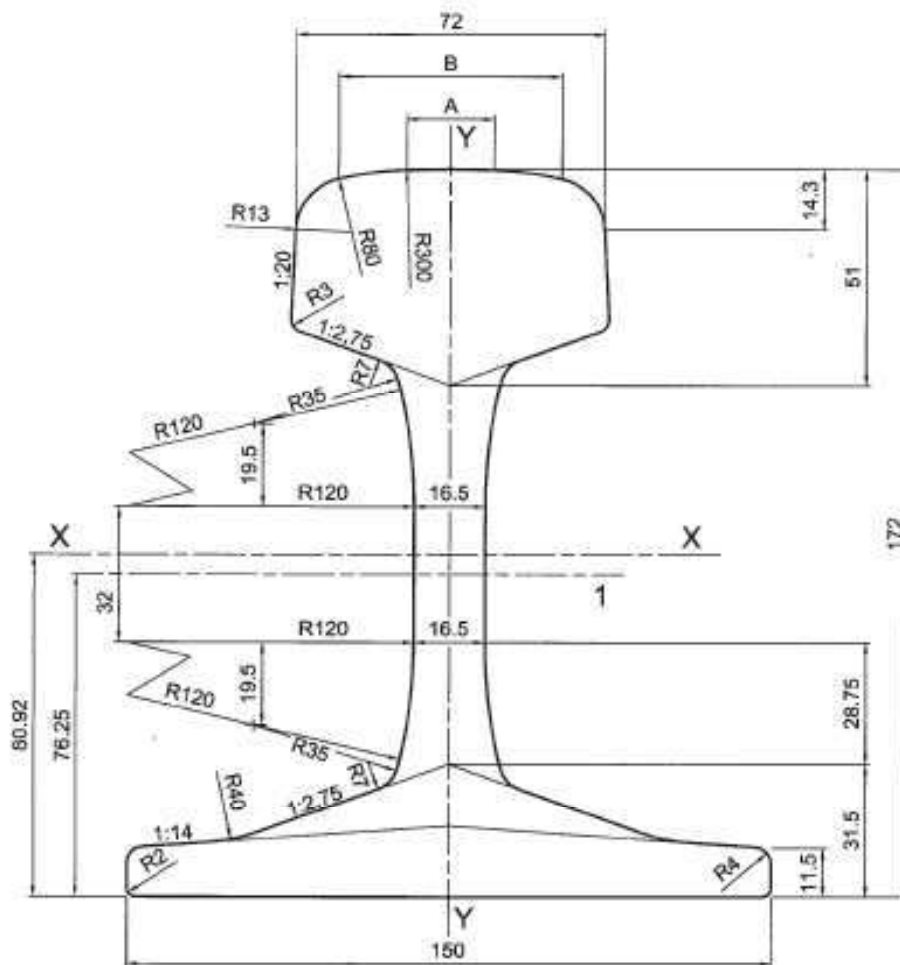
**IRS- 52 kg/m**

**APPENDIX-I**



**CALCULATED WEIGHT 51.89 kg per metre**  
**CROSS SECTION AREA 66.15 sqcm**

**Appendix II (Revised)**  
**60E1 (as per EN 13674-1:2011+A1:2017(E))**

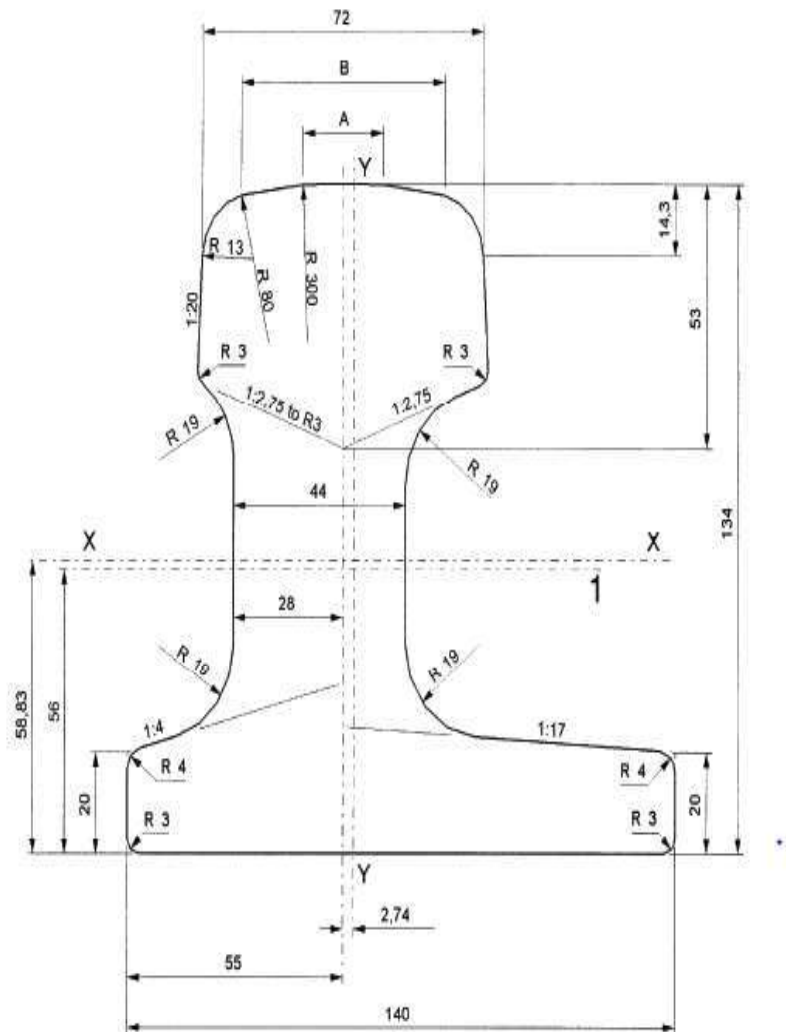
**Key**

1 centre line of branding

cross-sectional area	: 76,70	cm <sup>2</sup>
mass per metre	: 60,21	kg/m
moment of inertia x-x axis	: 3 038,3	cm <sup>4</sup>
section modulus - Head	: 333,6	cm <sup>3</sup>
section modulus - Base	: 375,5	cm <sup>3</sup>
moment of inertia y-y axis	: 512,3	cm <sup>4</sup>
section modulus y-y axis	: 68,3	cm <sup>3</sup>
indicative dimensions:	A = 20,456 mm	
	B = 52,053 mm	

**Appendix IIA(Revised)**  
**60E1A1(as per EN 13674-2:2006+A1:2010(E))**

Dimensions in millimeters

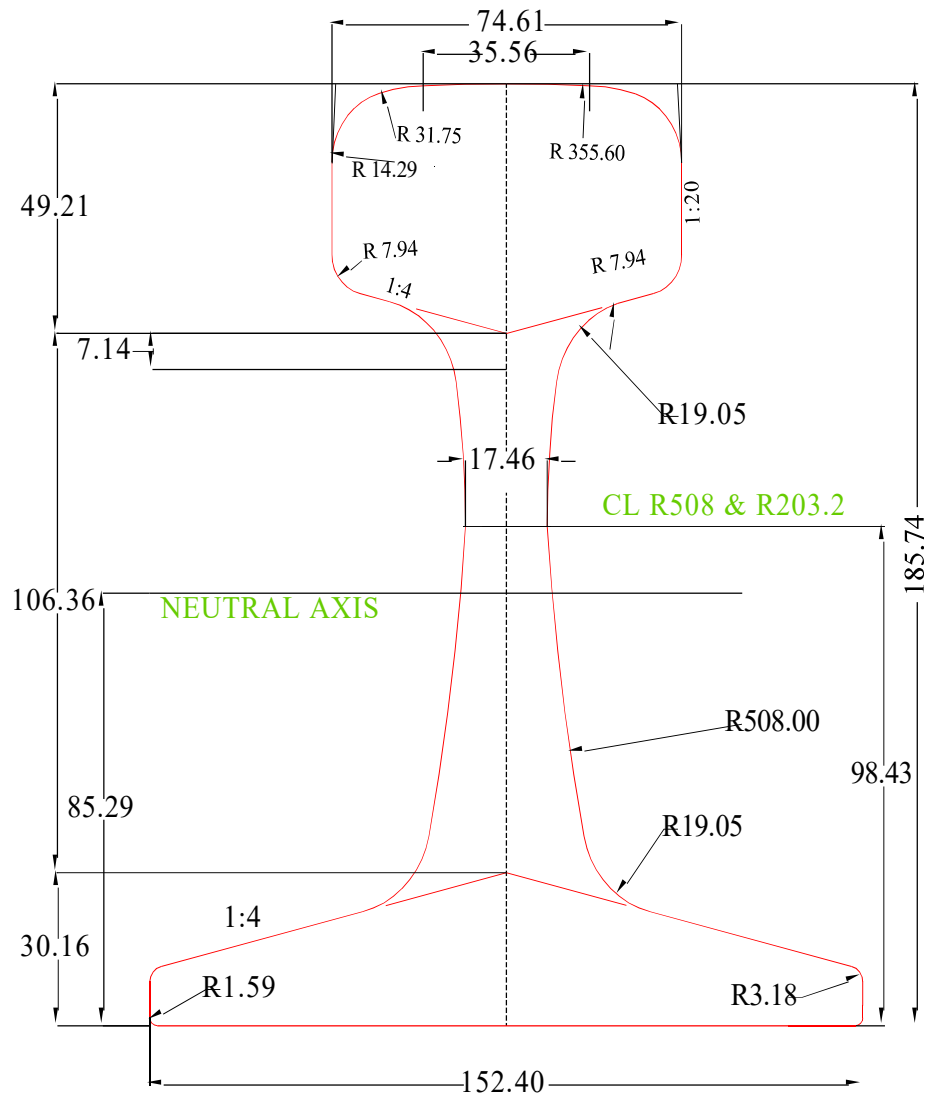


Key

1 Center line of branding


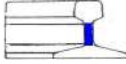
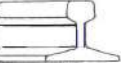
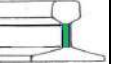
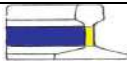
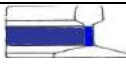
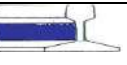
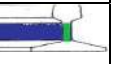
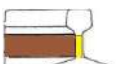
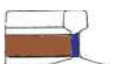
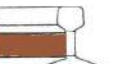
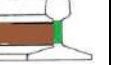
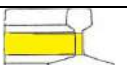
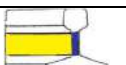
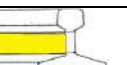
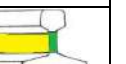
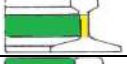



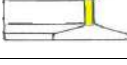
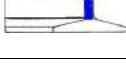

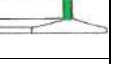
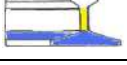
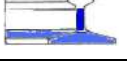
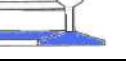
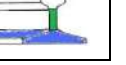
Cross-sectional area : 92.95 cm<sup>2</sup>  
 Mass per meter : 72.97 kg/m  
 Moment of inertia x-x axis : 1726.9 cm<sup>4</sup>  
 Section modulus-Head : 229.7 cm<sup>3</sup>  
 Section Modulus- Base : 293.5 cm<sup>3</sup>  
 Moment of inertia y-y axis : 741.2 cm<sup>4</sup>  
 Section modulus y-y axis left : 128.4 cm<sup>3</sup>  
 Section modulus y-y axis right : 90.1 cm<sup>3</sup>

Indicative dimensions A = 20.456mm  
 B = 52.053 mm

**136 RE 14 (68 kg/m)****APPENDIX -III****CALCULATED WEIGHT; 67.364 kg/m****SEC. AREA :86.131 sqcm**

**ALL DIMENSION ARE IN MILLIMETRES  
FOR INDIAN RAILWAYS, HEAD SLOPE HAS  
BEEN KEPT 1:20 IN PLACE OF 1:40 AS  
AREMA PROFILE**

**COLOUR CODE FOR RAILS****APPENDIX – IV**

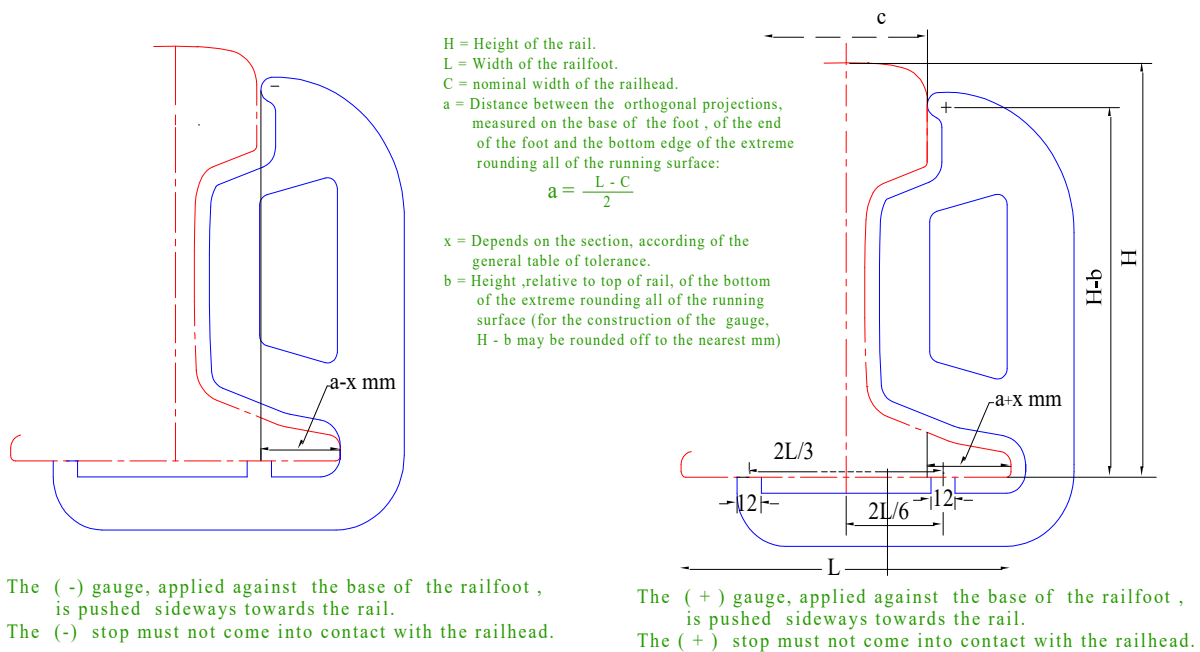
S. No.	Grade	Colour Code	13m, 18m, 26m, 130m, 260m	12m, 17m, 25m, 129m, 259m	11m, 16m, 24m	10m, 23m
1	GR. 880	Only common length wise colour code and no paint on web surface				
2	GR.1080 H.H.	In addition to common length wise colour code, <b>Blue</b> paint on both sides of web surface for a distance of 500 mm from each end.				
3	Nickel Chromium Copper 880NC	In addition to common length wise colour code, <b>Brown</b> paint on both sides of web surface for a distance of 500 mm from each end.				
4	GR. R260	In addition to common length wise colour code, <b>Yellow</b> paint on both sides of web surface for a distance of 500 mm from each end.				
5	1175HT	In addition to common length wise colour code, <b>Green</b> paint on both sides of web surface for a distance of 500 mm from each end.				
6	CLASS'A' RAIL	In addition to common length wise colour code, grade code as 1, 2, 3, 4 & 5 and Green paint on gauge/non gauge face for a distance of 500 mm from each end.				
7	IU	In addition to common length wise colour code, <b>Blue</b> paint on end face of flange and both sides of flange for a distance of 500mm from each end.				

**Common lengthwise colour code**

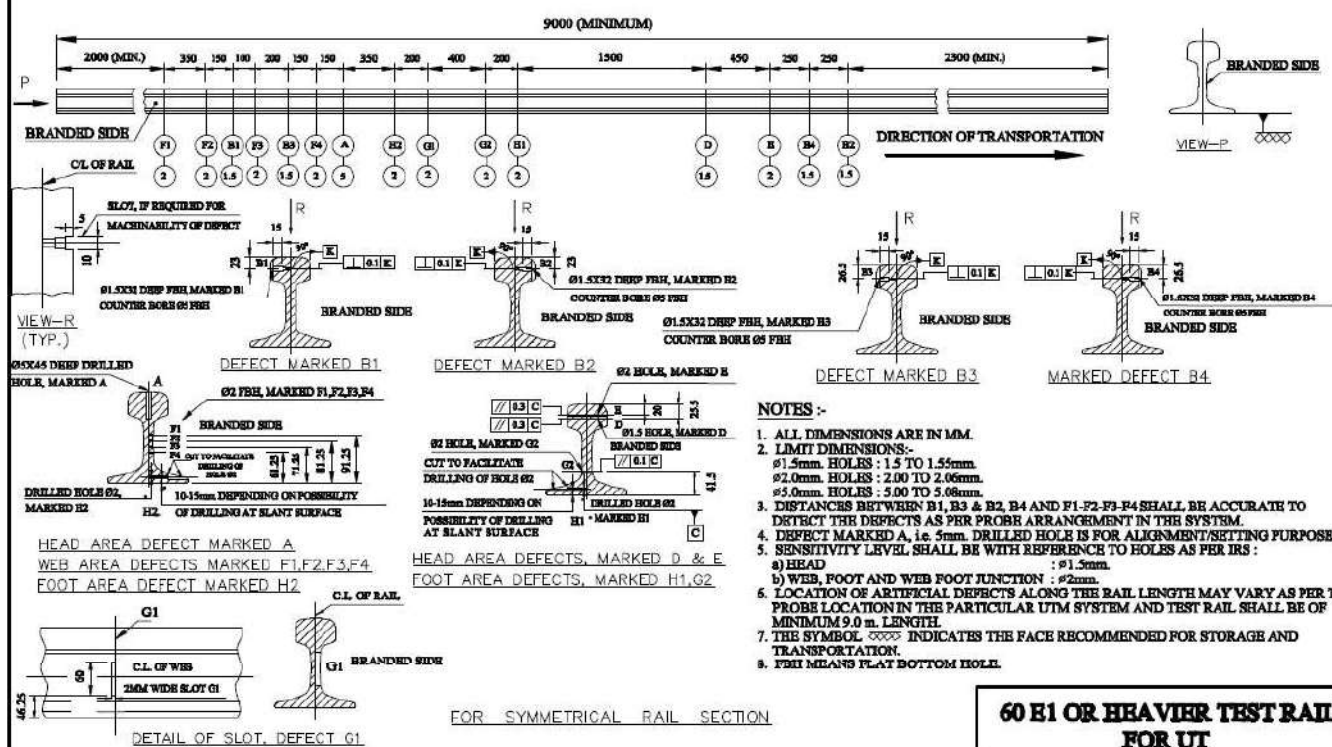
1. No paint on gauge/non-gauge face indicates class 'B' rails.
2. Yellow paint on each end face on web region indicates **13m, 18m, 26m, 130m, and 260m** length.
3. Blue paint on each end face on web region indicates **12m, 17m, 25m, 129m, and 259m** length.
4. White paint on each end face on web region indicates **11m, 16m, 24m** length.
5. Green paint on each end face on web region indicates **10m, 23m** length.

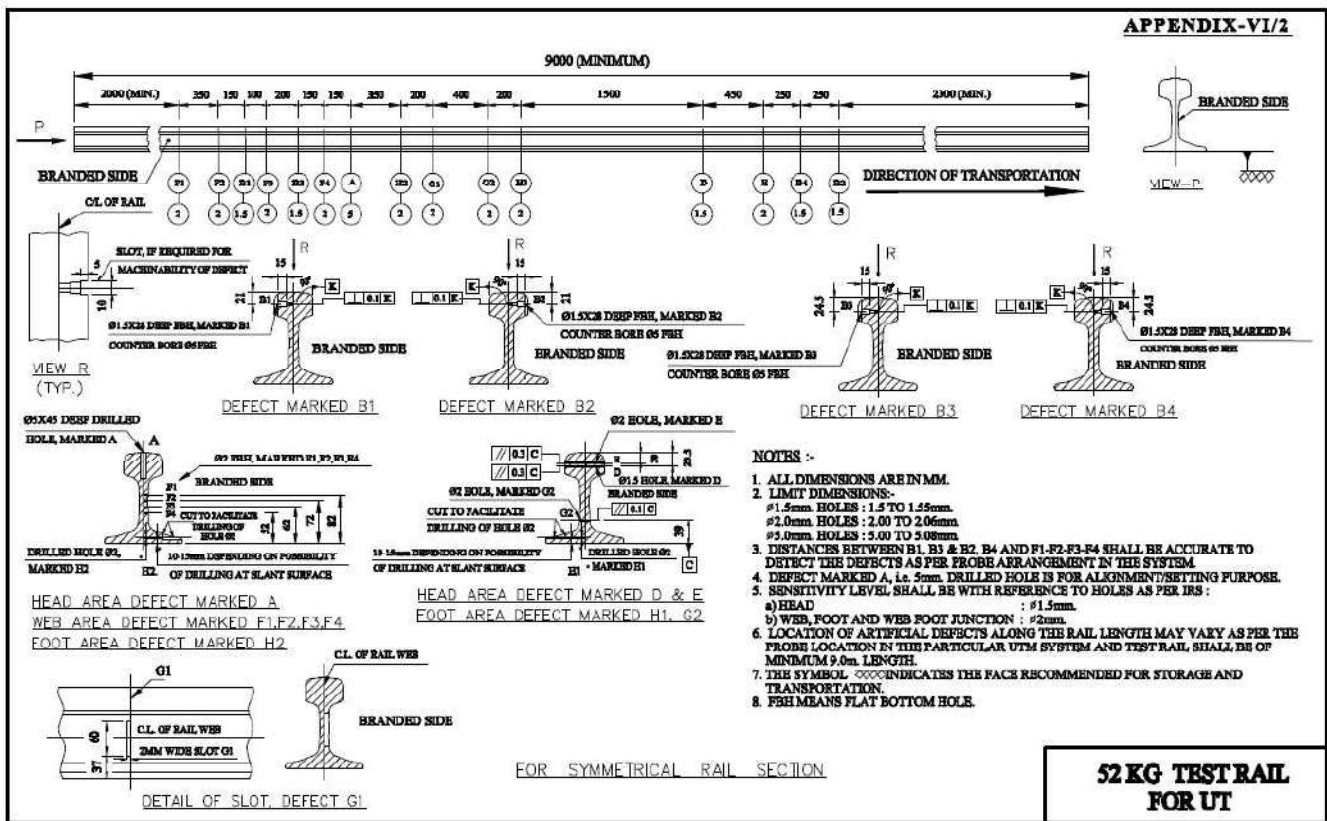
**Note:** - This colour code is for new rails, for second hand rails Para 722 of redrafted IRPWM-June/2020 may be referred to.

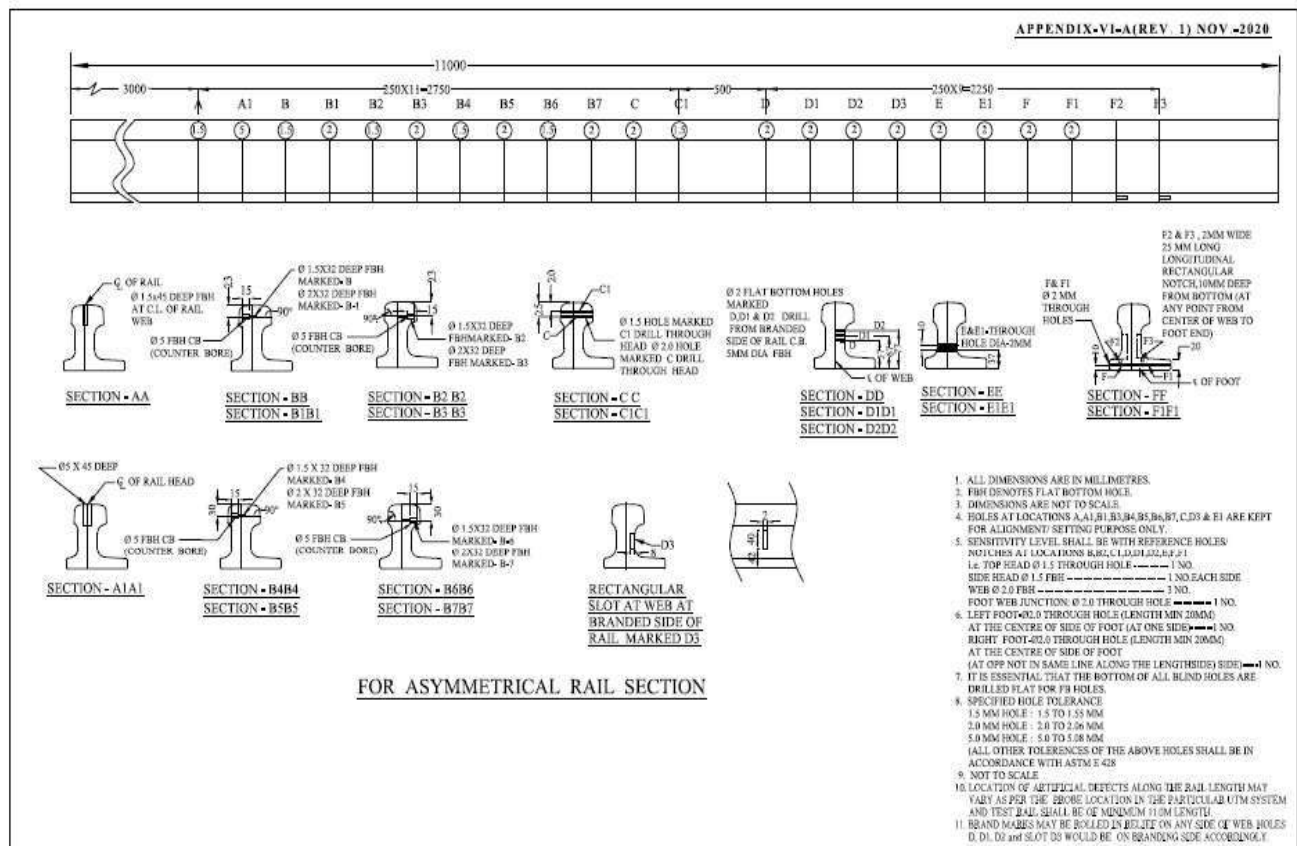
# GAUGE FOR CHECKING THE ASYMMETRY APPENDIX-V



**APPENDIX-VI/1**







## APPENDIX- VII

**LADLE ANALYSIS OF RAIL STEEL**

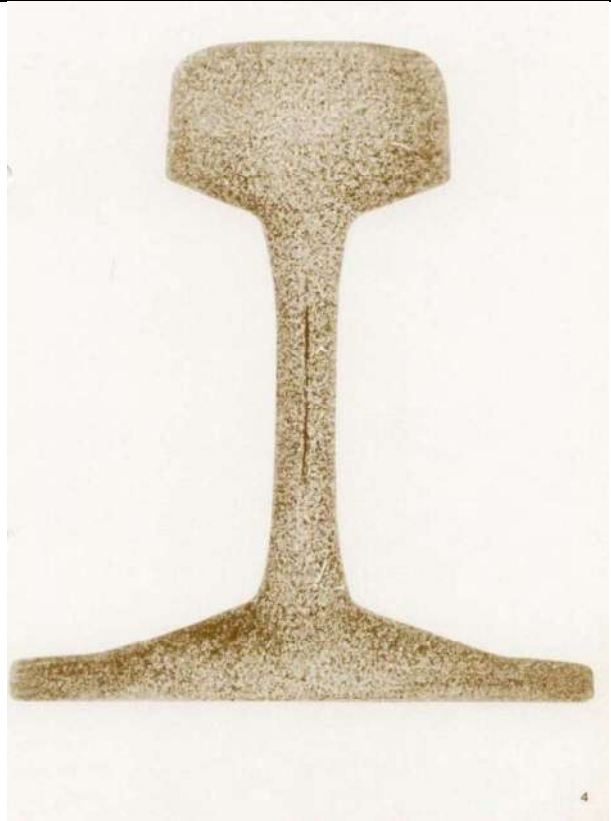
Date	HEAT NO	PERCENTAGE												H <sub>2</sub> PPM	O <sub>2</sub> PPM
		C	Mn	Si	S	P	Mo	Cr	V	Ni	Cu	Al	N		

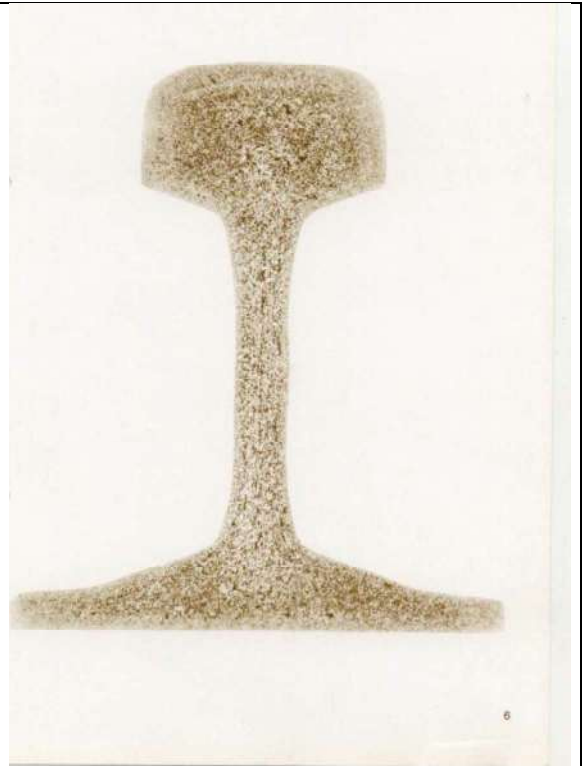
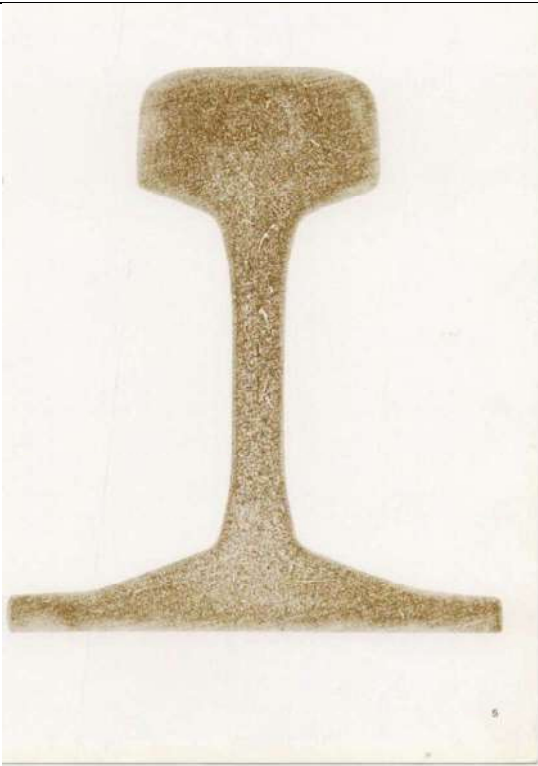
**Maximum residual elements, % by mass**

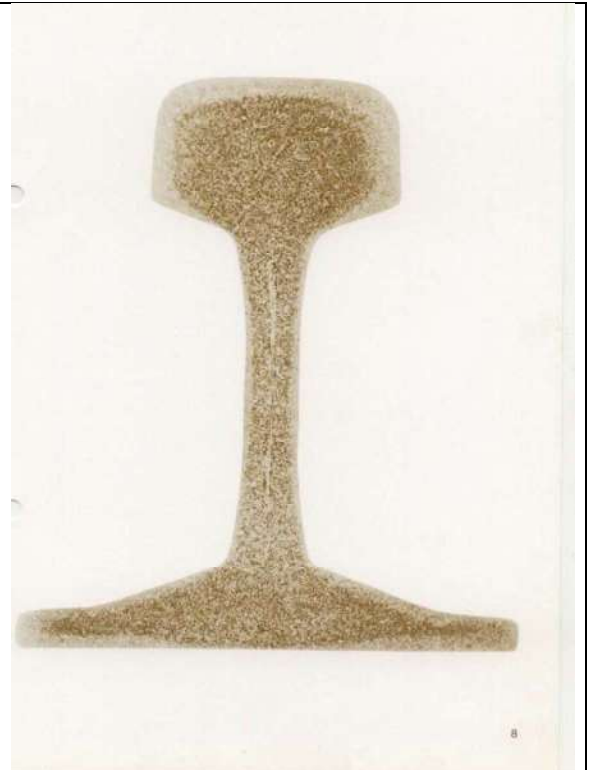
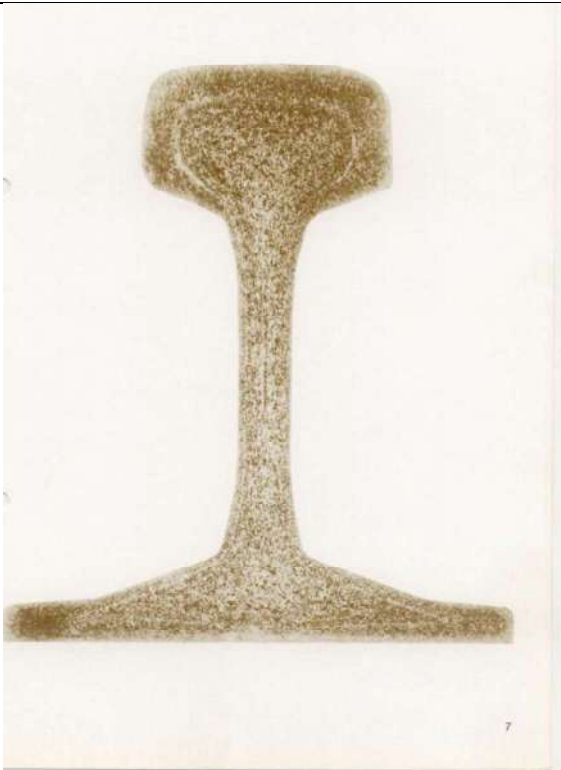
Date	Heat no	Grade	Mo	Ni	Cu	Sn	Sb	Ti	Nb	Cu+10Sn	Others

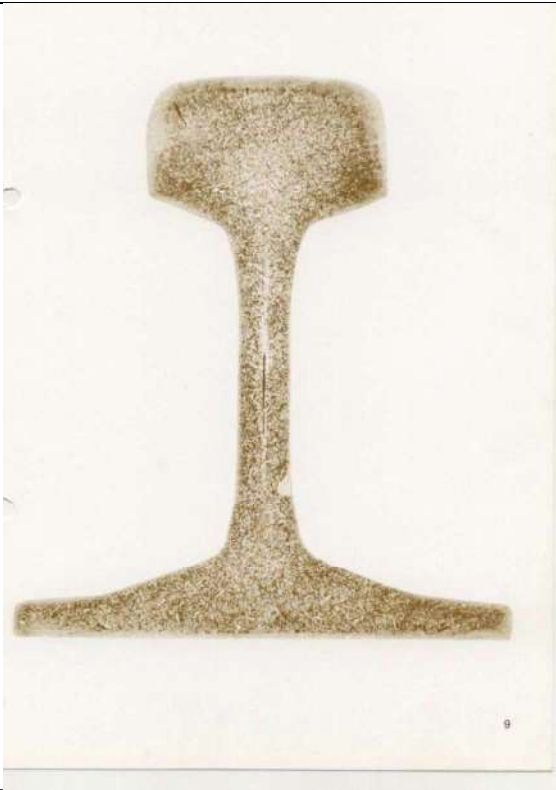
**ALBUM  
OF  
MACROGRAPHIC PRINTS**

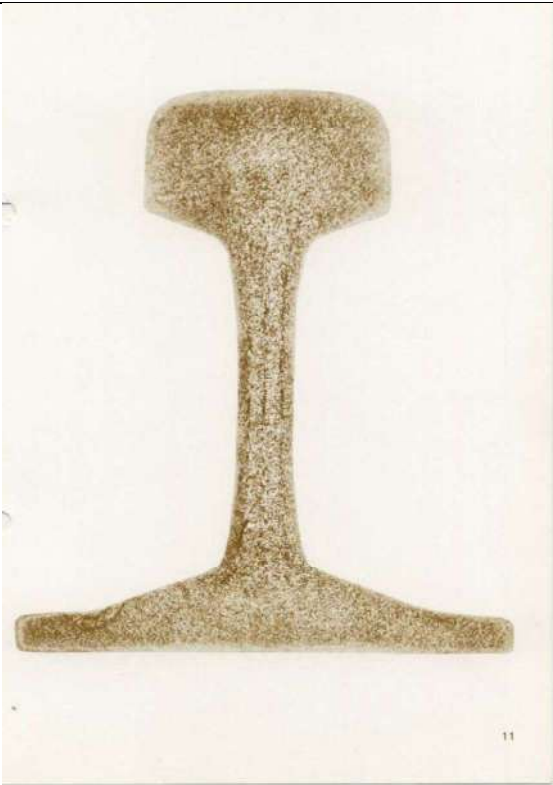












APPENDIX- IX

**MECHANICAL PROPERTIES**

DATE	HEAT NO	SPECIMEN		BEFORE FRACTURE	AFTER FRACTURE	% ELONGATION	BREAKING LOAD kg	YS MPa	UTS MPa	HARDNESS S (BHN)	FALLING WEIGHT TEST	
		DIA mm	AREA mm <sup>2</sup>	INITIAL GAUGE LENGTH mm	FINAL GAUGE LENGTH mm						BROKEN / NOT BROKEN	DEFLECTION mm
1	2	3	4	5	6	7	8	9	10	11	12	13

APPENDIX- X

DETAILS OF RAILS OFFERED FOR INSPECTION																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																							
Date		Heat no		No of blooms produced from the heat		Wt. Of blooms produced from the heat		No of rails of length										No of rails found o.k. after internal inspection										No of rails rejected during internal inspection																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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## **Standard test method for the determination of the plane strain fracture toughness ( $K_{Ic}$ ) of rails**

### **B.1 Test methods**

This test shall be performed in accordance with the requirements of ASTM E399 except where superseded by the requirements specified in this part of IRS T-12. The requirements specified in this part of the IRS T-12 apply only to the determination of plane strain fracture toughness of railway rail steels covered by the definitions and requirements of this standard.

### **B.2 Test pieces**

B.2.1 The location of the test piece in the rail's transverse section is shown in Figure B.1.

B.2.2. The thickness "B" of all test pieces shall be 25 mm. For any rail head transverse profile the test piece width "W" shall be the maximum achievable of the following dimensions:

40 mm;  
45 mm;  
50 mm.

### **B.3 Number of tests**

A minimum of 5 tests from each sample shall be performed.

### **B.4 Test conditions**

B.4.1 Fatigue pre-cracking shall be carried out in the temperature range + 15° C to + 25° C using a stress ratio in the range  $> 0 < +0.1$ . Fatigue pre-cracking shall be carried out at a cyclic frequency in the range 15 Hz to 120 Hz. The final crack length to test piece width ratio shall be in the range 0.45 to 0.55.

B.4.2 The single edge notched bend test piece shall be loaded under displacement control using three point bending with a loading span (S) equal to four times the test piece width (W)

B.4.3 Tests shall be performed at a test temperature of  $-20^{\circ}\text{C} \pm 2^{\circ}\text{C}$ . Test piece temperature shall be measured using a beadless thermocouple spot welded to the test piece at the location shown in figure B.2.

---

<sup>1)</sup> It is recommended that the chevron notch in ASTM E399 is used to avoid crack front curvature problems.

## B.5 Analysis of test data

B.5.1 The calculation of  $K_Q$  shall be in accordance with ASTM E399. The checks made to establish whether this value is a valid  $K_{1c}$  shall be in accordance with ASTM E399 except for the requirements of B.5.2 to B.5.6.

B.5.2  $P_{max}/P_Q$  shall be less than 1.10 for force-crack mouth opening curves where pop-in does not occur before the intersection of the curve with the 95 % secant. There shall be no  $P_{max} / P_Q$  criterion for other types of curve.

B.5.3 The linearity of force-crack mouth opening curves Ia, Ib, IIa and III (see figure B.3) shall be checked in the following manner.

Measure the distance ( $u_1$ ) between the tangent OA and the force-crack mouth opening curve at a constant force of  $0.8 P_Q$ . Measure the distance ( $u$ ) between the tangent OA and the force-crack mouth opening curve at a constant force of  $P_Q$ . for a test result to be valid...  $u_1 \leq 0.25u$

B.5.4 The linearity of force – crack mouth opening curves IIb and IIc (see Figure B.3) shall be checked in the following manner.

Measure the distance between the tangent OA and the force-crack mouth opening curve at constant forces of  $0.8 P_Q$  and  $P_Q$ , recording these values as  $u_1^*$  and  $u^*$ , respectively.

Measure the crack mouth opening values arising from all “pop-ins” that occur up to  $P_Q$ . this is done by measuring the horizontal distance travelled along the crack mouth opening axis between the start and finish of each “pop-in”. Sum the values for “pop-ins” occurring below  $0.8 P_Q$  and for those occurring between  $0.8 P_Q$  and  $P_Q$ , recording them as  $\sum u_{1p1}$  and  $\sum u_{p1}$ , respectively.

For a test result to be valid ...  $[u_1 - \sum u_{1p1}] \leq 0.25[u - (\sum u_{p1} + \sum u_{1p1})]$

B.5.5 The linearity criterion cannot be applied to force-crack mouth opening curve IV.

B.5.6 For all force-crack mouth opening curves the  $K_Q$  value shall be subjected to the validity check that the test piece thickness ( $B$ ) and crack length ( $a$ ) are equal to, or greater than, the value of  $2.5(K_Q / R_{p0.2})^2$ , where  $R_{p0.2}$  is the 0.2% proof stress at the fracture test temperature of  $-20^\circ\text{C}$ .

## B.6 Reporting of results

All measurements required to calculate the test result and to show that the test conditions were as specified in the test procedure shall be recorded.

All results shall be reported as either  $K_{1c}$  values  $K_{Q^*}$  values or  $K_Q$  values; where  $K_{Q^*}$  values are those  $K_Q$  values which failed the validity criteria due only to one or more of the following:

- i)  $P_{MAX} / P_Q > 1.1$ ;
- ii) Exceedence of the  $2.5(K_Q / R_{p0.2})^2$  criterion;
- iii) Crack mouth opening displacement-force relationship.

The mean and standard deviation of both  $K_{1c}$  and  $K_{Q^*}$  results shall be recorded. For each grade of rail tested these results shall be included in a table giving the following information.

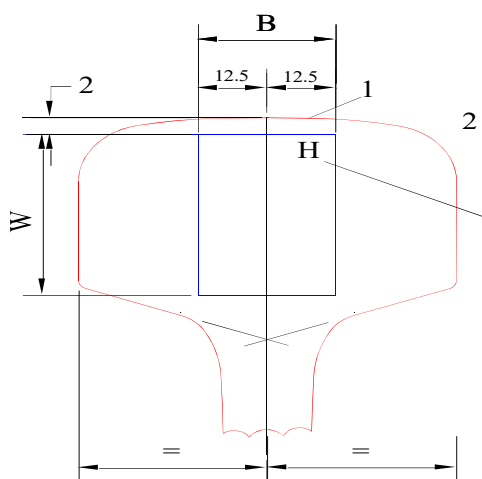
Steel Grade	0.2% proof stress at $-20^{\circ}\text{C}$ MPa	Mean $K_{1c}$ (MPa $\text{m}^{1/2}$ )	Number of $K_{1c}$ results	Samples standard deviation (MPa $\text{m}^{1/2}$ )	Mean ( $K_Q$ ) (MPa $\text{m}^{1/2}$ )	Number of $K_Q$ Results	Sample standard deviation (MPa $\text{m}^{1/2}$ )

The value to be used for the acceptance criteria is that of the mean  $K_{1c}$  and shall be based on a minimum of five  $K_{1c}$  values.

When five  $K_{1c}$  values have not been obtained any  $K_{Q^*}$  values shall be included with any  $K_{1c}$  values in the mean value to be used for the acceptance criteria. In this event the number of test results shall be at least ten.

All values of  $K_{1c}$  And  $K_{Q^*}$  shall be above the minimum value specified in Table 2.

Dimension in millimetre



Figure

Key

1. Notch machined in this face
2. Section through rail heat
3. Letter 'H' to be stamped on end face of test piece as shown

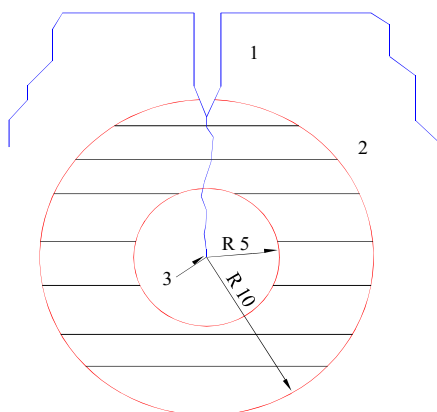
B = 25

W = see B.2.2

For all other test piece proportions See ASTM E399

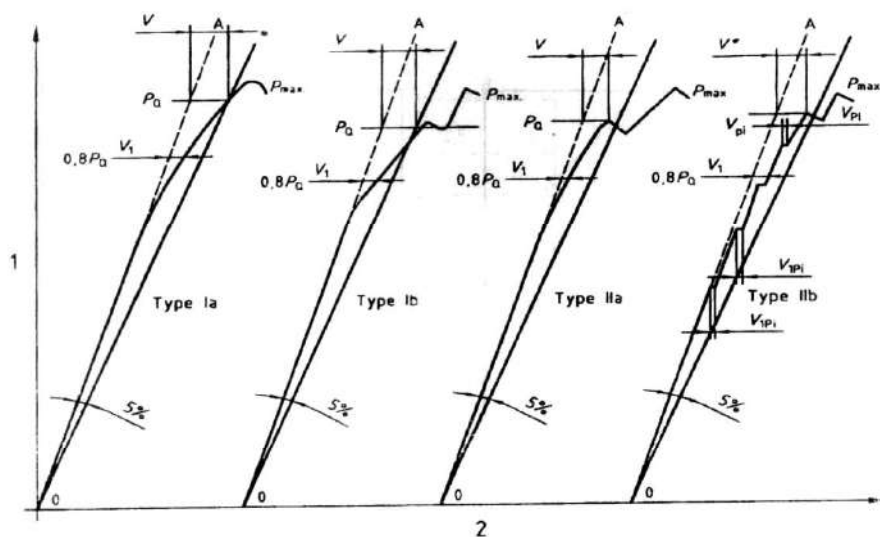
**Figure B.1- Location and section of fracture toughness test pieces**

Dimension in millimetres

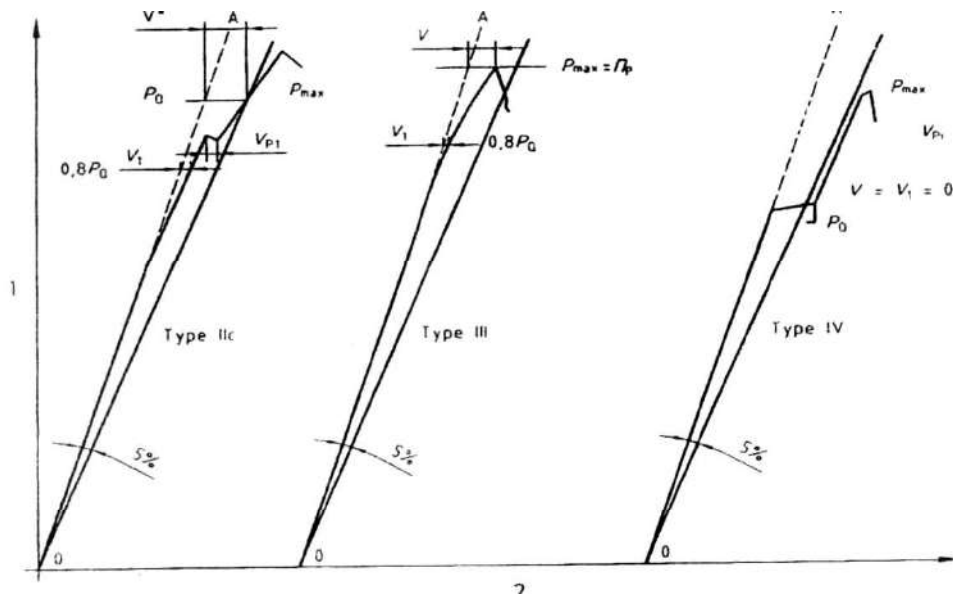
**Key**

1. Notch
2. Thermocouple to be placed in the shaded zone
3. Fatigue crack tip

**Figure B.2-Location of thermocouple on fracture toughness specimens**

**Key**

1. Force, P
2. Crack mouth opening displacement (v)

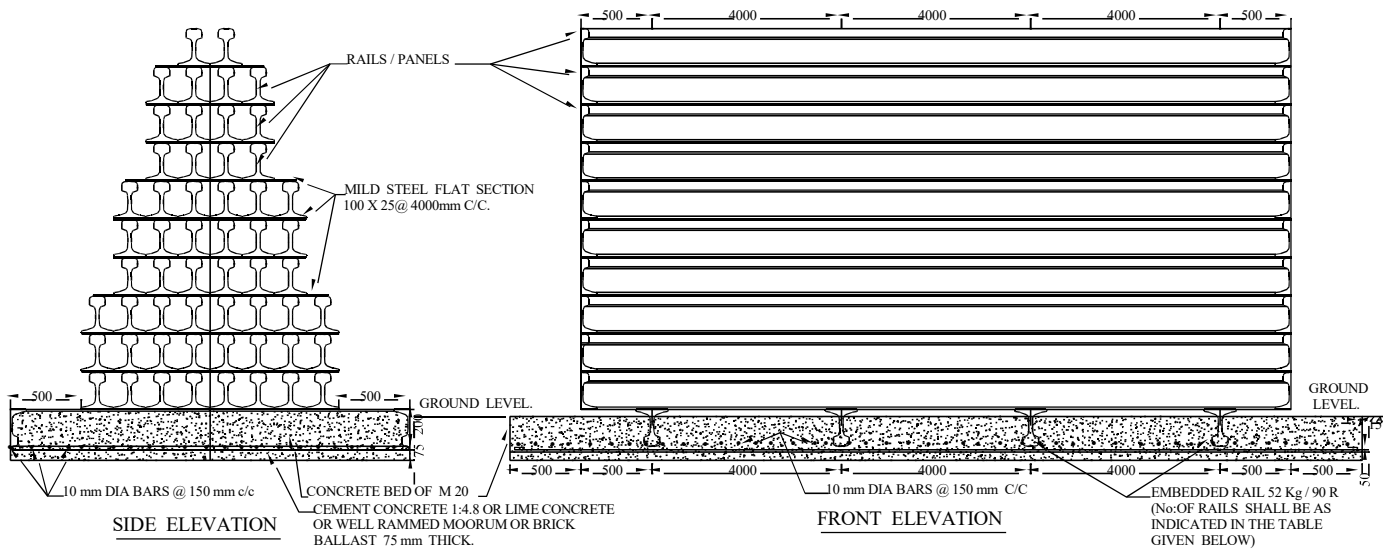


Key

1. Force,  $P$
2. Crack mouth opening displacement ( $v$ )

Figure B.3 – Force-Crack mouth opening curves

APPENDIX-XII



SCHEDULE OF DIMENSIONS

RAIL LENGTH / WELDED PANEL (METRES)	NUMBER OF EMBEDDED RAILS
12 / 13	4 @ 4000 mm C/C
26	7 @ 4000 mm C/C
39	10 @ 4000 mm C/C
130	33 @ 4000 mm C/C
260	66 @ 4000 mm C/C

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R. D. S. O.

ARRANGEMENT FOR STACKING FREE RAILS AND WELDED PANELS

STAND. ....	ADVANCE
CANCLD. ....	15.5.2002
REVSD. ....	( T )

R. D. S. O. / T- 6219

- THE DRAWING SUPERSEDES THE DRG.No. RDSO/T-4962.
- ONE RAIL/PANEL MAY BE REDUCED AFTER EVERY THIRD LAYER TO ACHIEVE PROPER STACKING FROM BOTH SIDES.
- BETWEEN TWO LAYERS OF RAILS M.S.FLAT OF SIZE 100X25 mm SHOULD BE PROVIDED AT 4000 mm C/C AND IT SHALL BE ENSURED THAT RAIL ENDS DO NOT OVERHANG BY MORE THAN 1500 mm.
- ONLY ONE TYPE OF FREE RAILS/ WELDED PANELS SHALL BE STACKED IN ONE STACK.
- MAX. NUMBER OF LAYERS IN WHICH FREE RAILS AS WELL AS WELDED PANELS CAN BE STACKED, SHALL BE LIMITED TO 10.
- 52 Kg.per.m. / 90 R RAIL SHALL BE EMBEDDED IN THE CONCRETE BED OF M-20 GRADE CONCRETE (TO IS:456-1978) AS SHOWN IN THE DRG. ABOVE.
- A SLOPE OF 1:400 MAY BE GIVEN IN CONCRETE BED ACROSS THE LENGTH OF RAIL.
- ALL DIMENSIONS ARE IN MILLIMETRES EXCEPT WHERE OTHER WISE SHOWN.

- M. S. FLAT TO IS: 226-1975.
- IS:456-1978 FOR CONCRETE BED.

NOTE

SPECIFICATION SCALE ALT: DESCRIPTION DATE

**Appendix- XIII****Method for the determination of rail foot surface longitudinal residual stresses****1. Procedure**

Residual stresses shall be estimated by first attaching an electrical strain gauge on the rail foot surface. The surface to which the gauge is attached shall be progressively isolated from the rail and the relaxed strains shall then be used to estimate the stresses which have been relieved whilst the original residual stresses are taken to be those values but with a change of sign.

**2. Strain gauges and their location**

Electrical strain gauges of the encapsulated type shall be used, 3 mm in length with gauge factor accuracy of better than  $\pm 1\%$ .

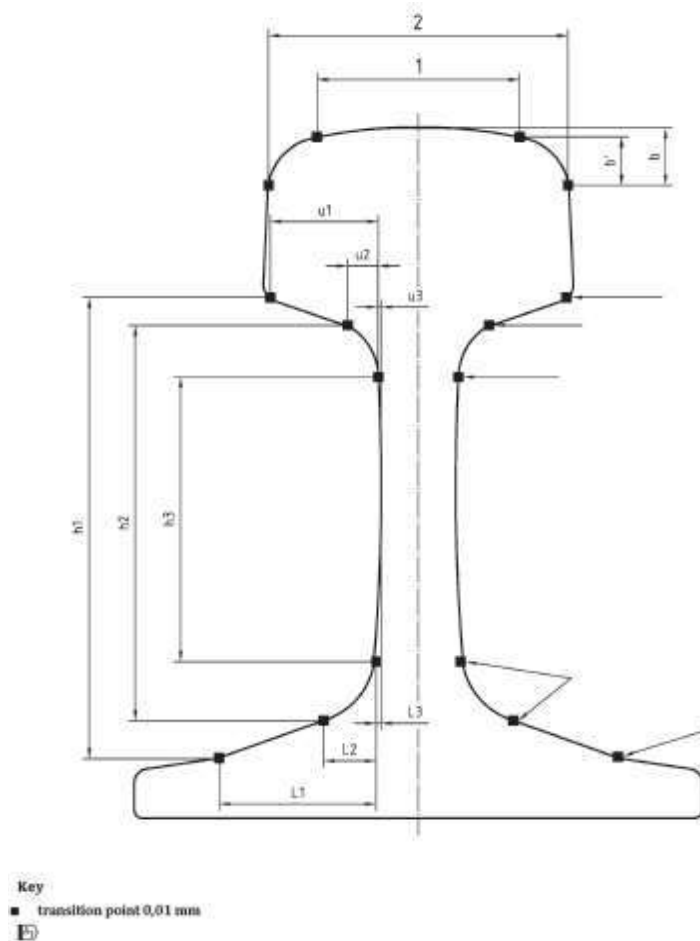
The strain gauge shall be attached to the surface of the rail foot in order to measure longitudinal strain at the positions as shown in Figure Fig. 9A & Fig. 9B. The surface of the rail foot shall be prepared and the strain gauge shall be attached, in accordance with the recommendations of the strain gauge manufacturer.

Any surface preparation shall not result in a change of the residual stresses in the rail foot.

NOTE- The strain gauge should be located at the center of the 1 m length of the sample rail set aside for this work.

Readings shall be taken from the strain gauges. While cooling the rail to maintain a constant temperature, two saw cuts shall be made to remove a 20 mm thick slice from the center of the rail length (Fig. 9C). A second set of measurements shall be taken.

The residual stresses shall be calculated from the differences between the first and second sets of measurements of relieved strains by multiplying with Young's modulus of elasticity for steel i.e.  $2.05 \times 10^6 \text{ kg/cm}^2$ .

**Annexure-A****Table A- Rail transition references (see Figure A)**

Rail profile	Dimension in mm												
	1	2	b	b'	h 1	h 2	h 3	L1	L2	L3	u 1	u 2	u 3
60E1	52.05	72.00	14.30	12.00	118.57	101.50	87.06	36.61	8.25	3.20	26.83	8.25	3.20

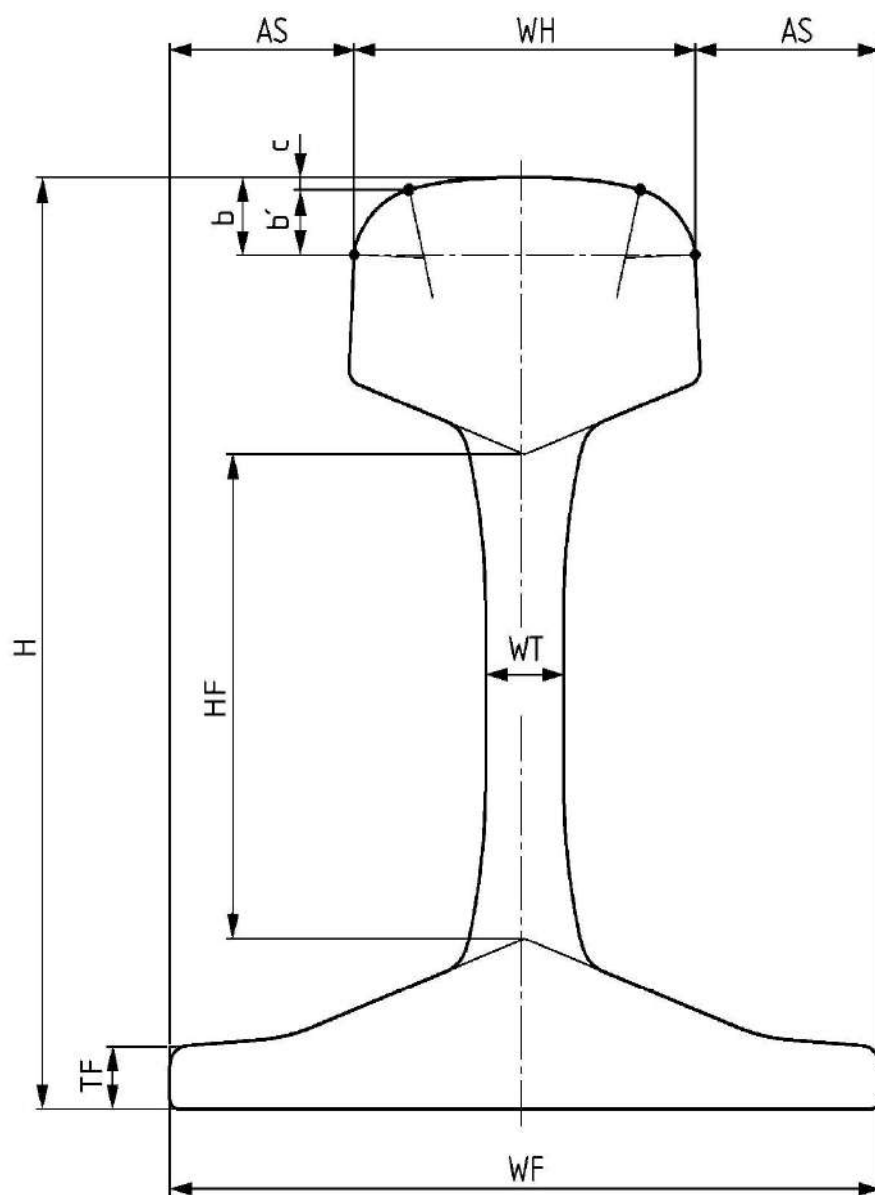
**Figure A — Principal rail transition references**

### Gauges for inspection

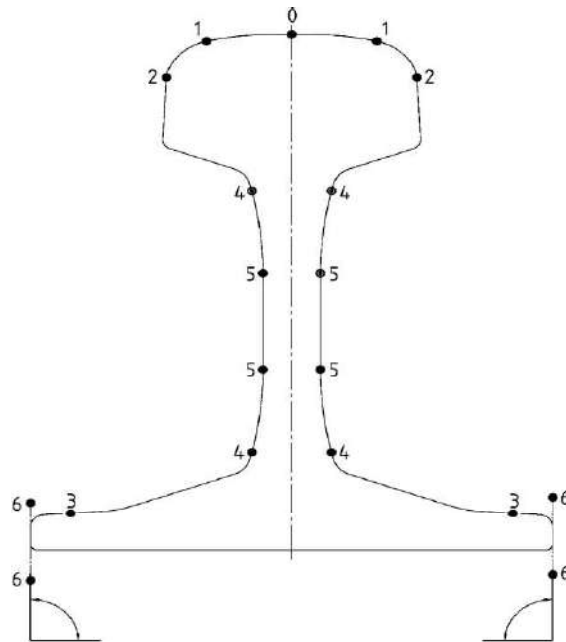
The gauges for manufacture as specified in clause 9.1.1 and 9.1.2 for 60E1 profile as per appendix II (Revised) are summarised In Table A1

**Table A1 — Summary of figures**

Figure A1	Datum references for tolerances
Figure A2	Datum references for decision
Figure A3	Height of rail
Figure A4	Crown profile
Figure A5	Width or rail head
Figure A6 and A7	Asymmetry
Figure A8	Fishing height HF
Figure A9	Web thickness
Figure A10	Width of rail foot
Figure A11	Foot toe thickness
Figure A12 and A13	Drilling gauges

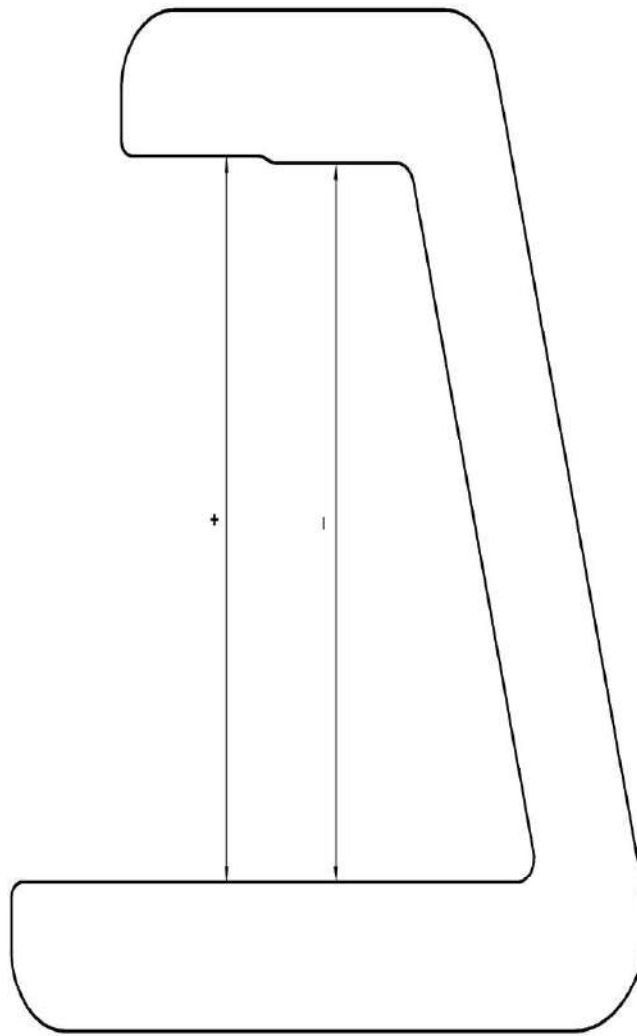


**Figure A1- Datum references for tolerances (See Para 9.1.1, 9.1.2, Figure-A and Table-A)**

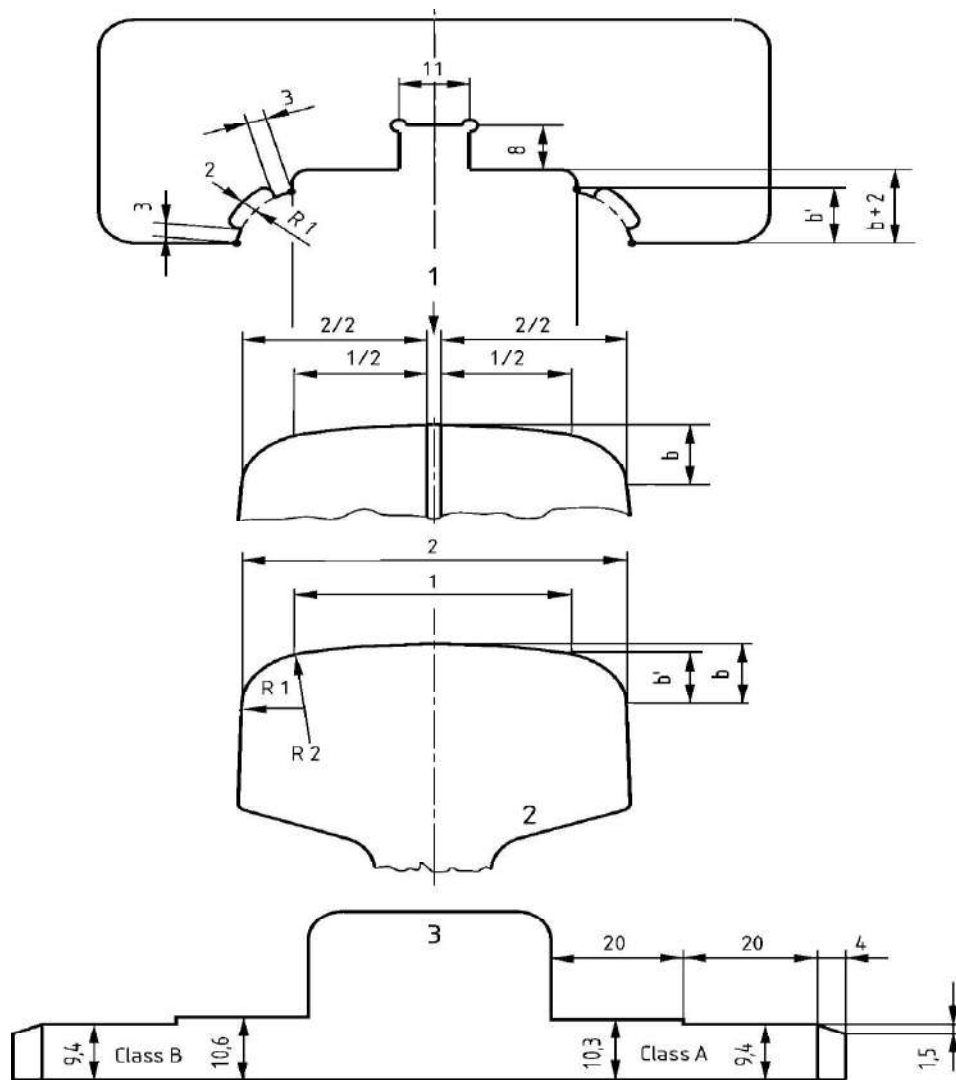


Datum	Reference	Figure No.
0	height - must not + must pass	A3
0	crown profile - must + must not pass the wedge	A4
1	width of rail head - must not + must touch	A5
2	rail asymmetry - must not + must touch	A6, A7
4,5	height of fishplating - must + must not touch	A8
5	web thickness - must not + must pass	A9
3,6	foot toe thickness - must be within $\pm$ limits	A11
6	width of rail foot - must not + must pass	A10

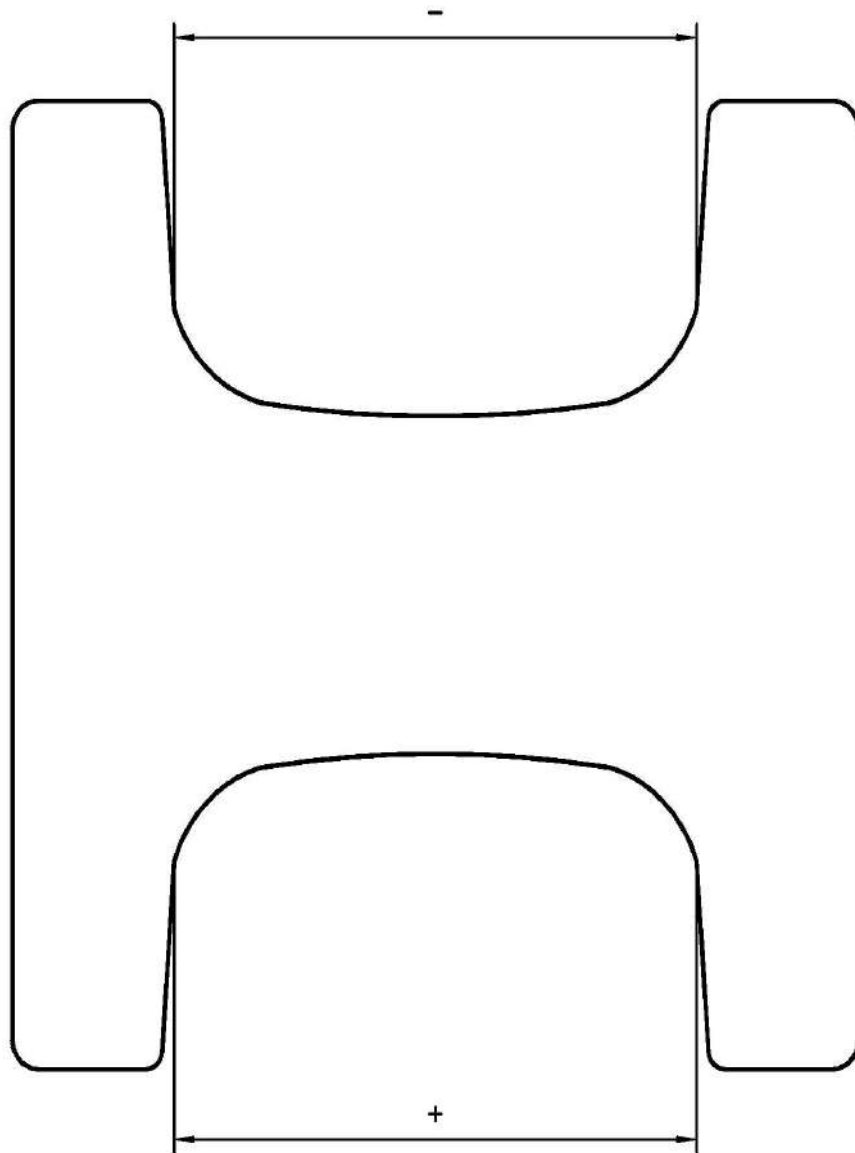
**Figure A2 — Datum references for decision**



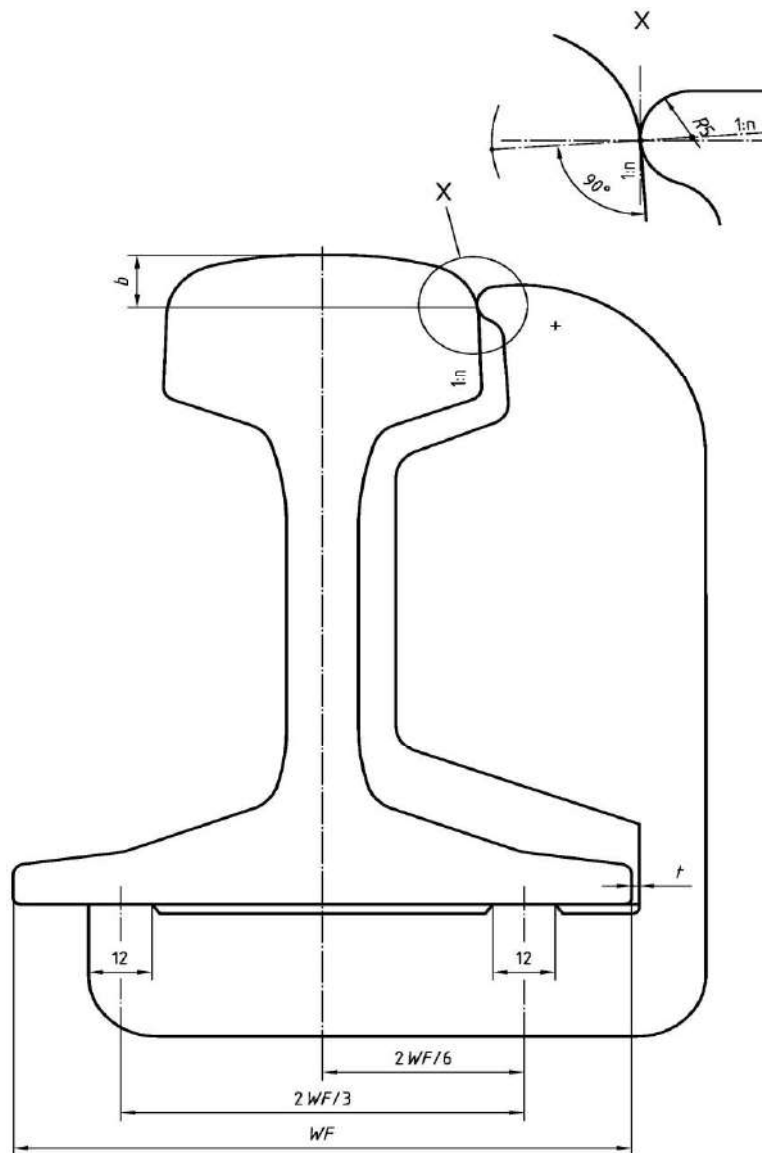
**Figure A3- Height of Rail**



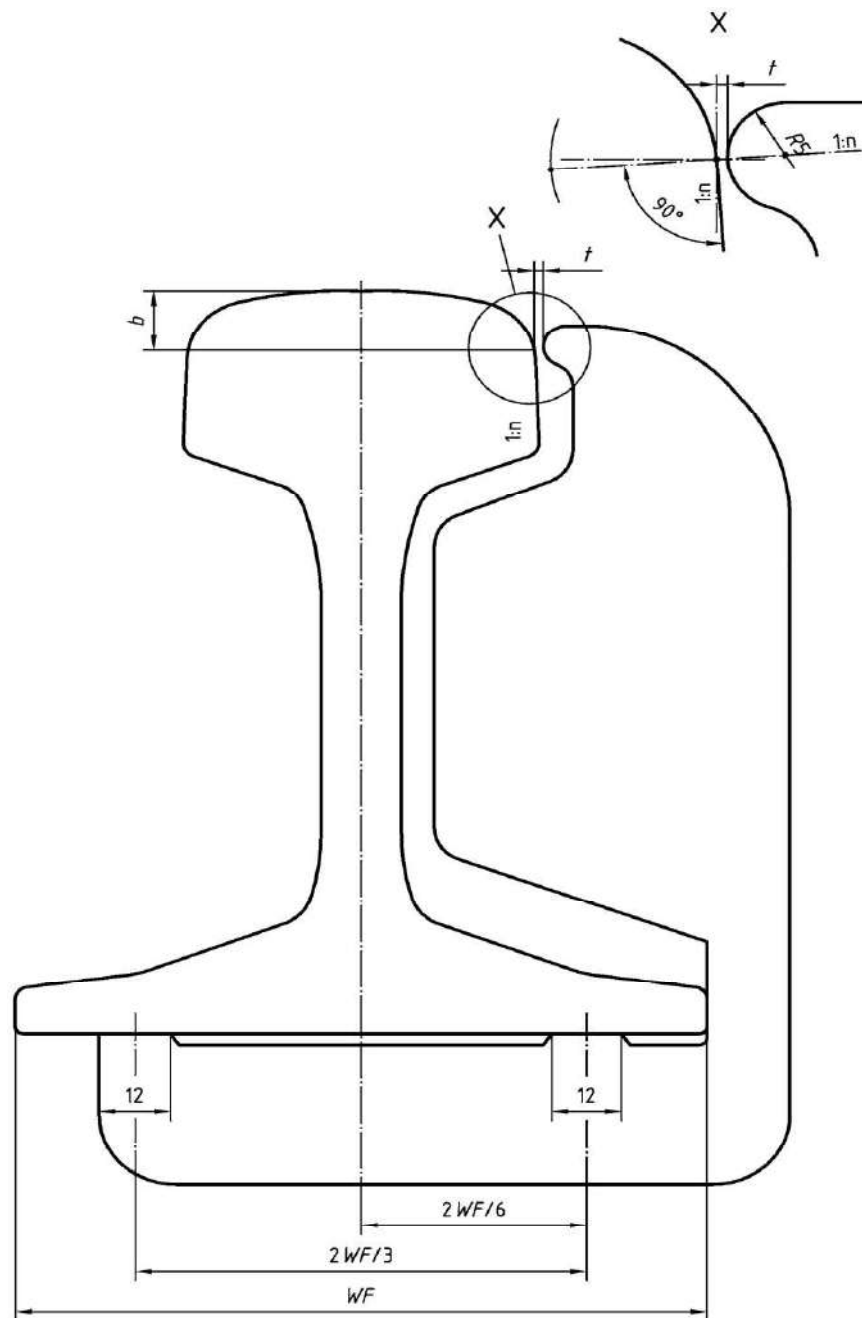
**Figure A4- Crown Profile**



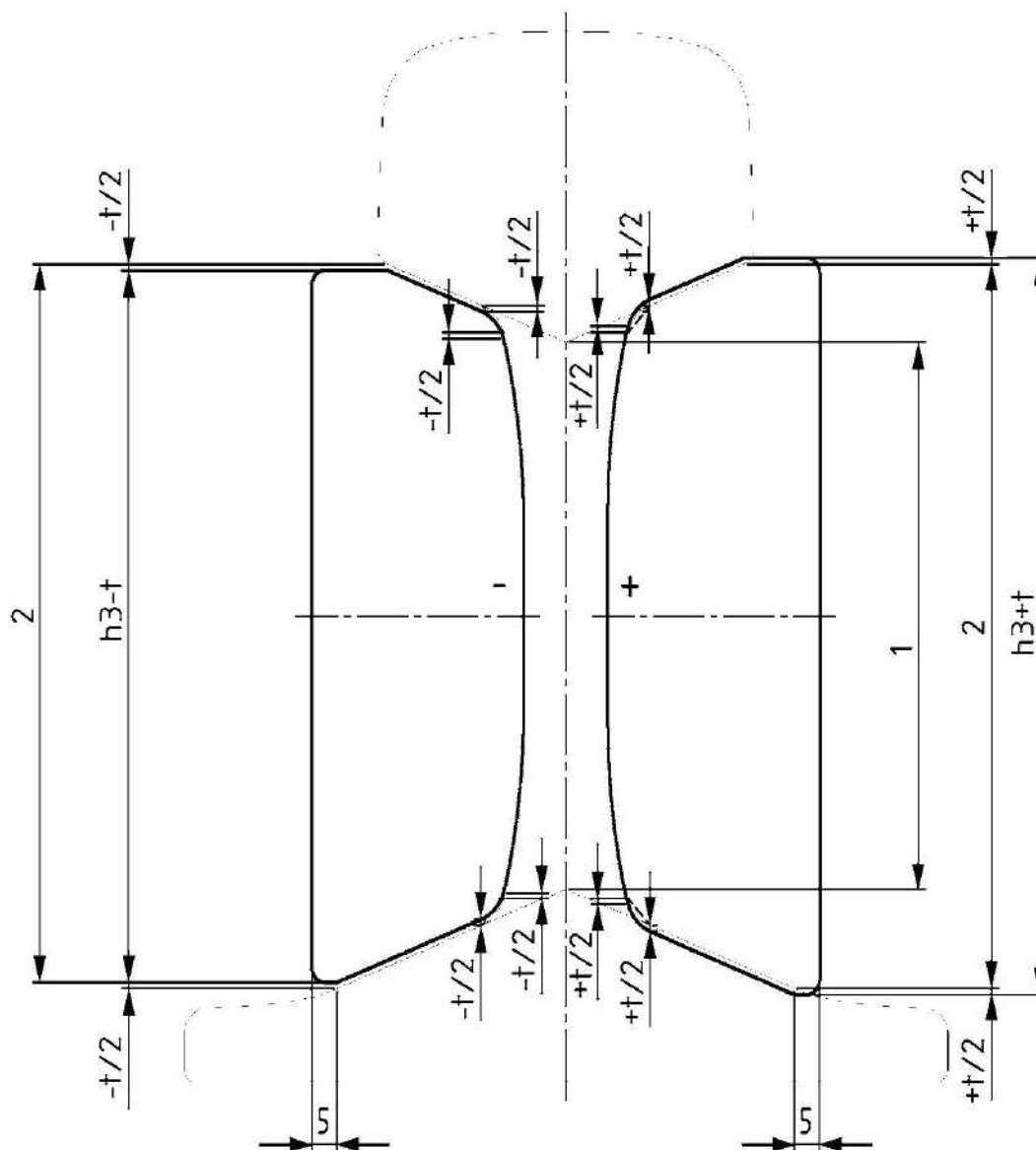
**Figure A5- Width of Rail Head**



**Figure A6 - Rail Asymmetry**

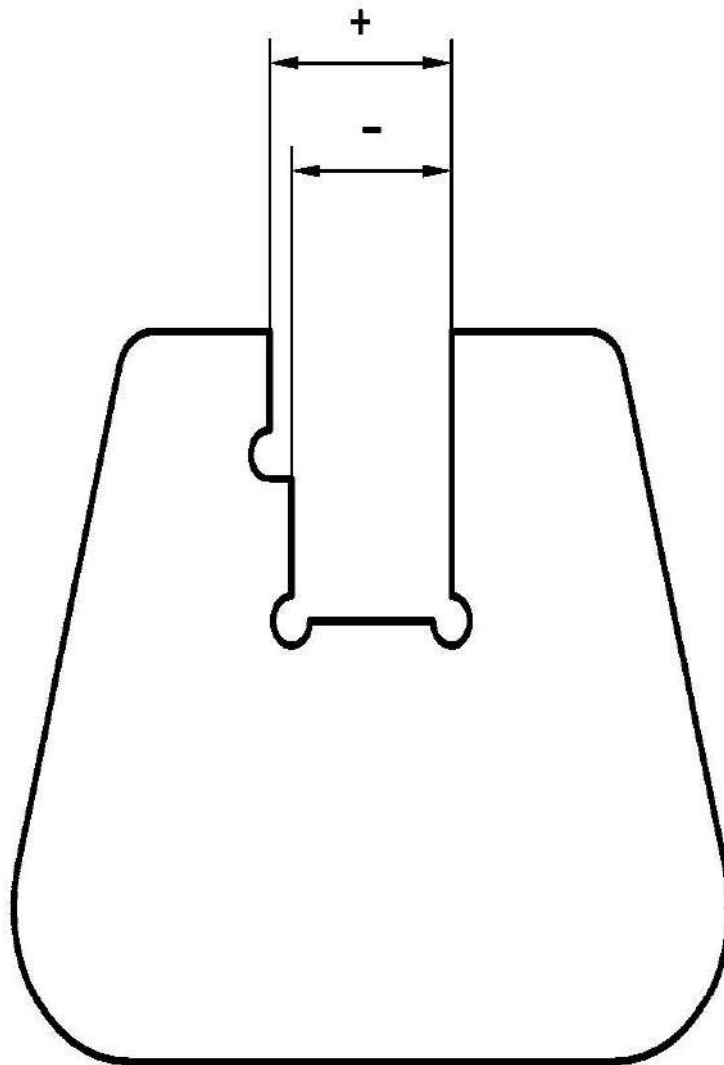


**Figure A7- Rail Asymmetry**

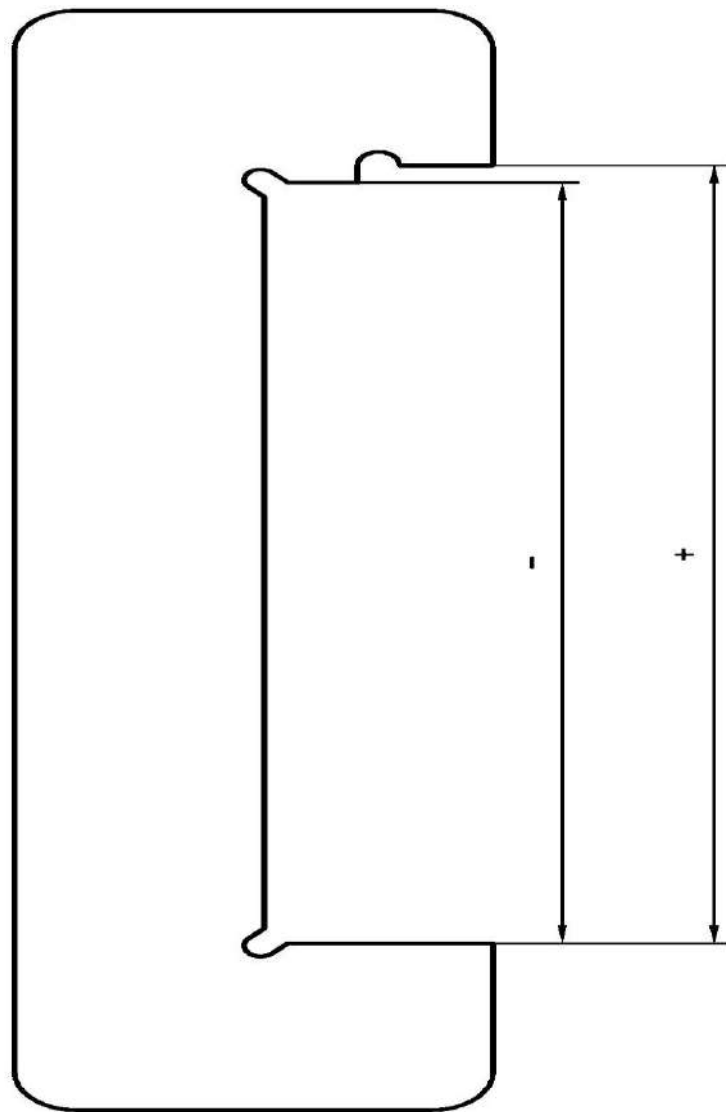


**Key-** 1 HF= Fishing height (see Figure A1) and  
2 h3= Theoretical

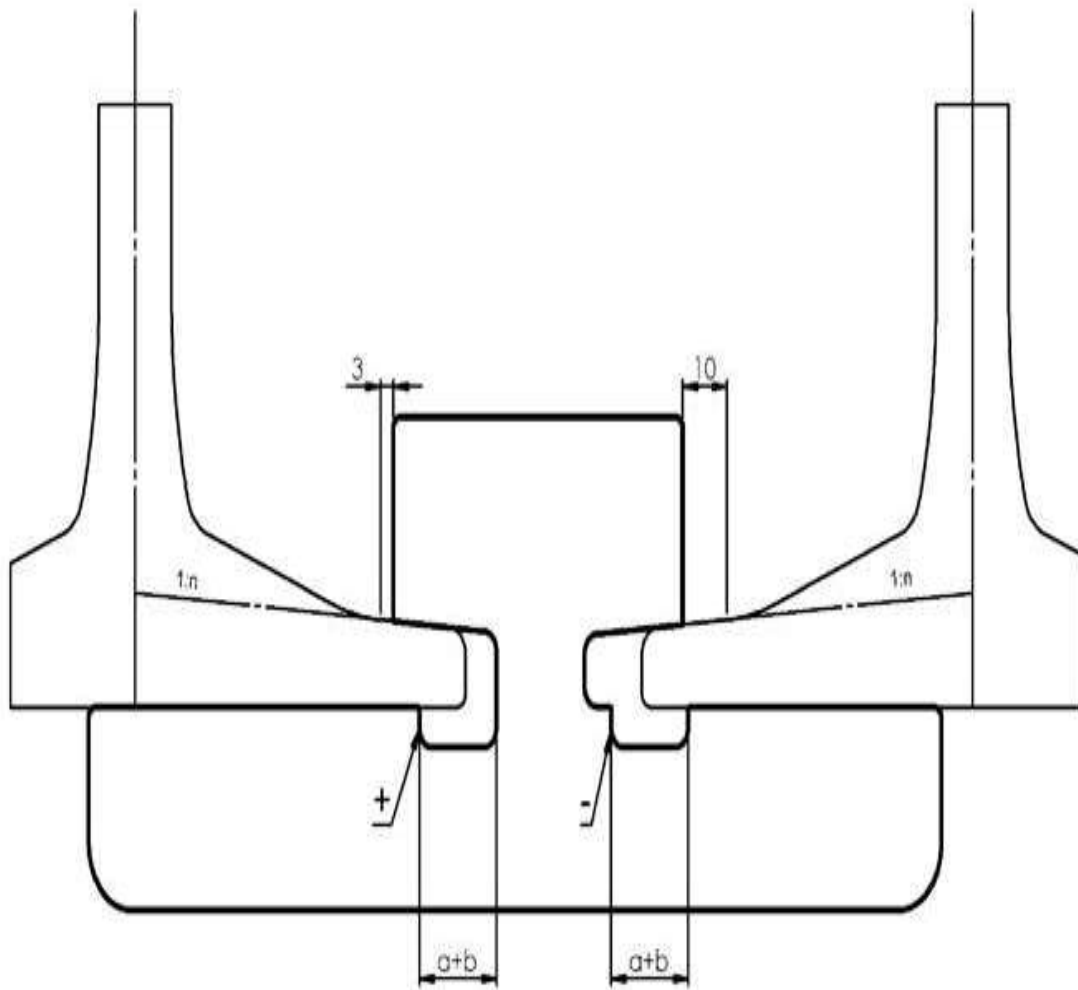
**Figure A8- Fishing Height**



**Figure A9- Web Thickness**

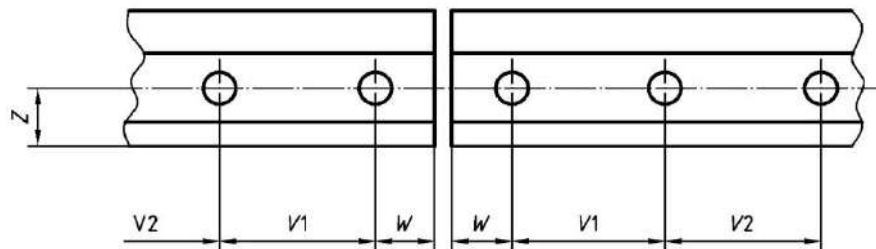
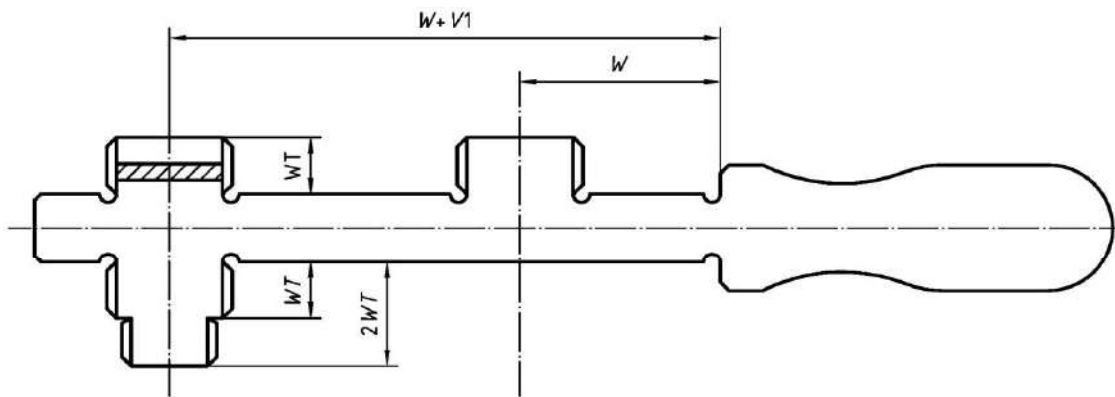


**Figure A10- Width of Rail foot**



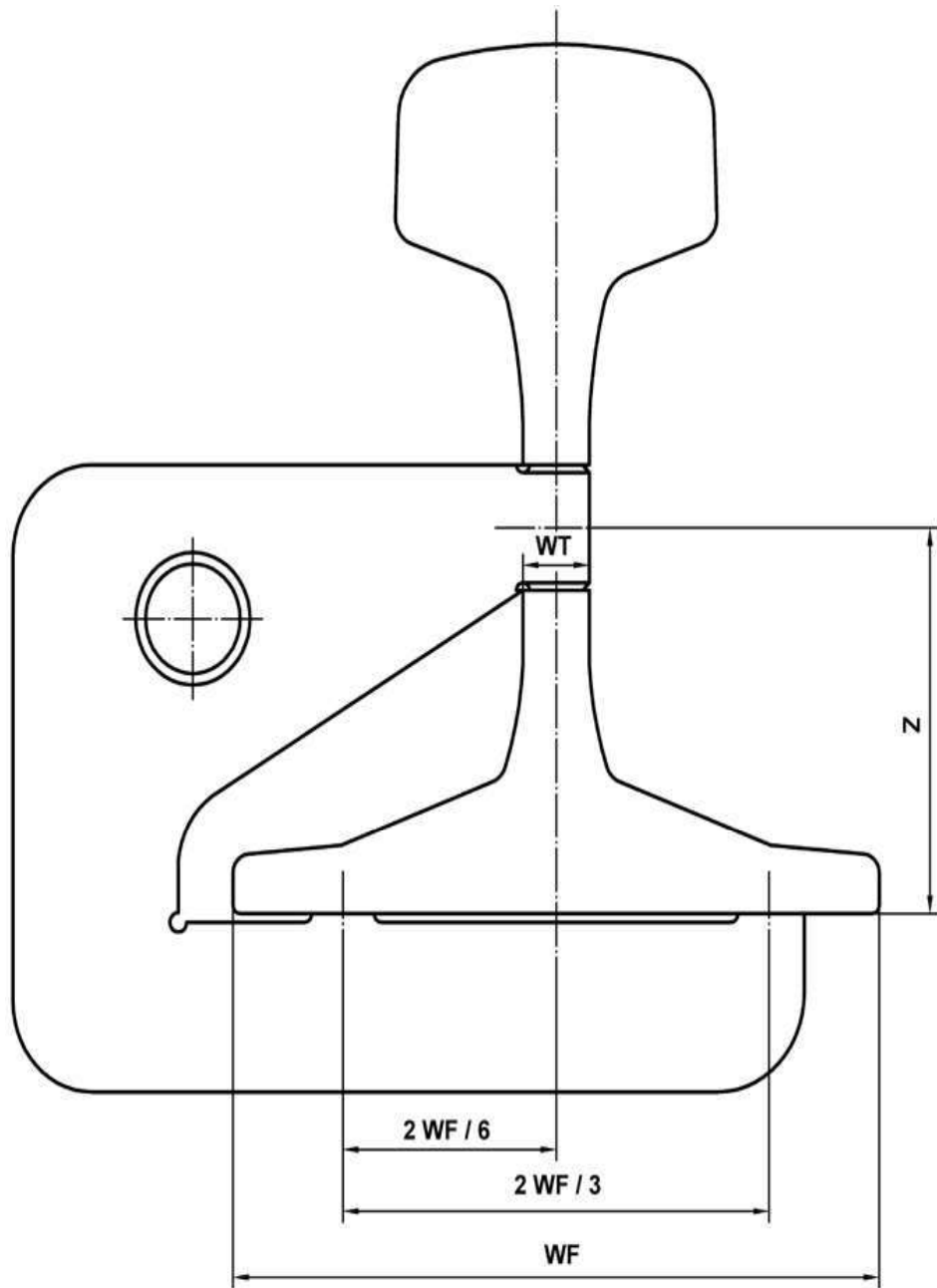
Key-  $a = +\text{Tolerance} \times n$   
 $b = -\text{Tolerance} \times n$

### **Figure A11- Foot Toe Thickness**



Key- WT= web thickness

**Figure A12- Gauge for checking distance between holes and rail end and hole diameter**

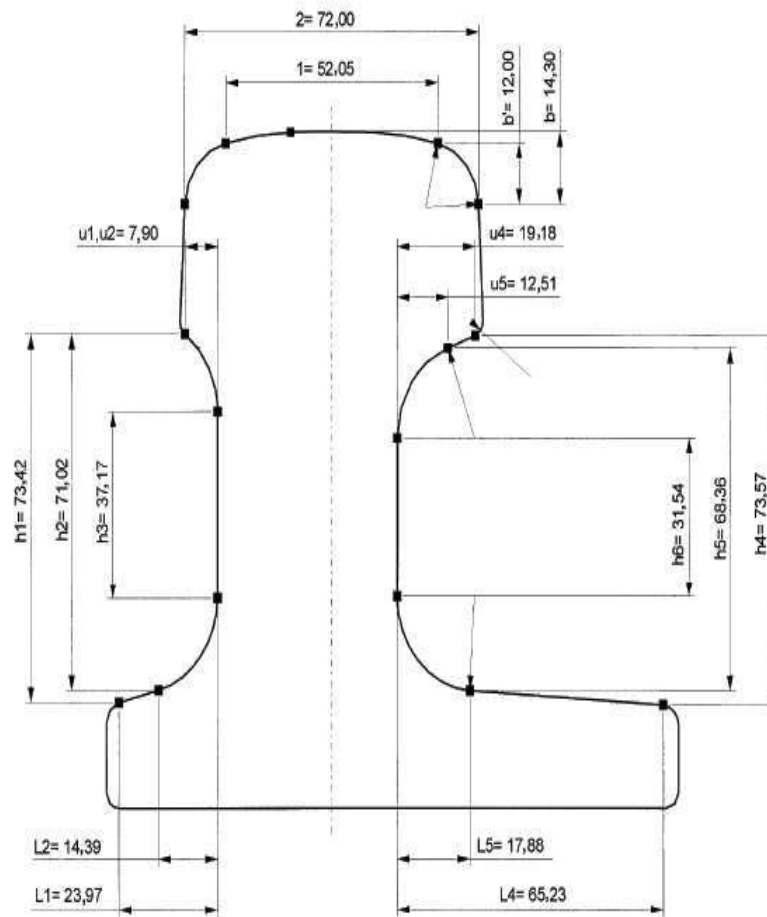


Key- WF= width of foot, WT= web thickness, Z= distance between center of the hole and base of the rail

**Figure A13- Gauge for checking distance between holes and base of rail**

**Annexure B**

Dimensions in millimetres

**Figure B1 – 60E1A1 Rail Transition Points**

**Gauges for inspection:** The gauges (Figure A3, A4, A5, A8, A9 and A10) for manufacture as specified in clause 9.1.1 for 60E1A1 profile as per Appendix IIA(Revised).

**ANNEXURE 2**  
**TO**  
**PART 2, SUPPLY REQUIREMENTS**  
  
**POLICY ON DOMESTIC RAIL PLANTS FOR**  
**SYMMETRICAL RAILS OF DIFFERENT GRADES**  
  
**No. CT/Policy/01**  
**(REVISED MARCH 2023)**



सत्यमेव जयते

भारत सरकार  
रेल मंत्रालय  
**GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS**

**POLICY ON DOMESTIC RAIL PLANTS FOR  
SYMMETRICAL RAILS OF DIFFERENT GRADES**

**No. CT/Policy/01  
(Revised March 2023)**

**Issued by  
TRACK DESIGN DIRECTORATE**

**अनुसंधान अभिकल्प एवं मानक संगठन लखनऊ- 11  
Research, Designs and Standards Organisation, Lucknow-11**



ADE/Track/RF	Joint Director/Track-I	Page 1 of 7
Digitally signed by RAJESH KUMAR SRIVASTAVA Date: 2023.03.21 13:30:18 +05'30'	MAHENDRA KUMAR GUPTA Digitally signed by MAHENDRA KUMAR GUPTA Date: 2023.03.21 14:51:12 +05'30'	

## **Policy on Domestic Rail Plants For Symmetrical Rails of different grades**

1. Grade of rails developed/ to be developed by different domestic manufacturers as per IRS-T-12-2009 can be divided into two categories as under:
  - i. **Category-I:** 880 grade, R260 grade, 1080HH grade & R350HT (previously known as 1175HT) grade as per IRS-T-12-2009 are considered in Category-I.
  - ii. **Category-II:** R260NC (previously known as 880NC) and any other grade rails as per IRS-T-12-2009 is considered in Category-II.
2. Policy to induct new grade of symmetrical profile of rails developed by domestic manufacturers to be used on IR and other rail networks in India is as under-

### **A. Category- I**

#### **a) New Rail Plant**

- i. Vendor of a domestic rail plant which is not yet approved for any of the rail grades would communicate with Railway Board for approval of a particular rail grade. On the direction of Railway Board, RDSO (Track & M&C Dte) would conduct Technical assessment of rail manufacturing capability for that rail grade as per extant RDSO Specifications/Manuals and Guidelines. Welding plant for FB welding of the rail grade would also be assessed as per extant RDSO Specifications/Manuals and Guidelines. Approval of QAP would also be done by RDSO at this stage.
- ii. Based on satisfactory Technical assessment by RDSO, the manufacturer would be considered as New Vendor, with the approval of Railway Board, for supply of the particular grade of rail on any domestic rail network in India.
- iii. A "New Vendor" with a "New Rail plant" is technically eligible for full Rail quantity for that particular grade Rails in a domestic Rail tender as a regular vendor. However, field performance of the initially supplied quantity of 25000T would be assessed for up-gradation of the status of the vendor as described hereunder. Supply would be halted during the above assessment.
- iv. Performance of initially supplied quantity of 25000T rails would be assessed in the field on any domestic rail network of IR for up-gradation of the status of the vendor as per protocol at Annexure-A. In case any adverse performance is reported, matter would be referred to Railway Board for decision on further supply. Based on the satisfactory performance, RDSO would draw a report for change of status of the vendor for that particular rail plant from New Vendor to Approved Vendor for that particular rail grade, for decision by Railway Board.
- v. Subsequent to the vendor getting Approved status for a New rail plant for one of the rail grades, approval for other rail grades would be done following the provisions for Existing rail plant, as stipulated below.

ADE/Track/RF	Joint Director/Track-I	Page 2 of 7
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## **b) Existing Rail Plant**

- i. Vendor of a domestic rail plant which is already approved for any of the rail grades with IR would communicate with Railway Board for approval of another rail grade. On the direction of Railway Board, RDSO (Track & M&C Dte) would conduct Technical assessment of rail manufacturing capability for that rail grade as per extant RDSO Specifications/Manuals and Guidelines. Welding plant for FB welding of the rail grade would be assessed as per extant RDSO Specifications/Manuals and Guidelines. Approval of QAP would also be done by RDSO at this stage.
- ii. Based on satisfactory Technical assessment by RDSO, the manufacturer would be considered as Provisionally Approved Vendor, with the approval of Railway Board, for supply of the particular grade of rail on any domestic rail network in India.
- iii. A "Provisionally Approved Vendor" with an "Existing Rail plant" is technically eligible for full Rail quantity in case of Category-I Rails in a domestic Rail tender.
- iv. Field performance of the initial supply of 10000T would be assessed for up-gradation of the status of the vendor and for any suggestion by RDSO. Supply would not be halted during the above assessment. Zonal Railways/other domestic rail network would closely monitor the field performance of rails as per Annexure-B. Based on the satisfactory field performance, RDSO would draw a report for change of status of the vendor for that particular rail plant from Provisionally Approved Vendor to Approved vendor for the particular grade of rail, for decision by Railway Board.

## **B. Category- II**

Vendor of a domestic rail plant would communicate with Railway Board for approval of a particular rail grade. On the direction of Railway Board, RDSO (Track & M&C Dte) would frame separate trial protocol for lab and field testing. FB and AT weldability is also to be ensured by the rail manufacturer. These rails are to be laid as per protocol to be approved by Railway Board. RDSO (Track & M&C Dte) and Zonal Railways would closely monitor the performance of rails as per the protocol.

Based on the performance of trial, RDSO would draw a report for further decision of Railway Board.

ADE/Track/RF	Joint Director/Track-I	Page 3 of 7
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#### **Annexure-A**

- i. Rails of a New rail plant shall be laid in identified long stretches having maximum permissible speed of 110KMPH or more to facilitate close monitoring of its performance for 25 GMT or one year, whichever is earlier.
- ii. Relaxation in frequency provided during test free/reduced frequency period will not be applicable for USFD Testing. USFD testing is to be carried out as per the normal frequency prescribed in USFD Manual, as applicable after test free/reduced frequency period.
- iii. No painting or any other such treatment shall be done as these rails are under performance monitoring.
- iv. Proper record of defects and performance of rail and weld shall be maintained as per the proforma attached i.e. Annexure-I, II.
- v. Details of measurement regarding wear and corrosion shall be recorded every quarter jointly with the firm's representative. Railways shall procure rail profile measuring device if not available.
- vi. All rail withdrawals (fracture pieces and IMR) of rail/ weld will be subjected to analysis in M&C lab of RDSO. For analysis, detailed proforma as per Annexure-III & IV of USFD Manual shall be submitted.
- vii. During the regular trolley/foot inspections, Sr.DEN/DEN, ADEN, SSE (P.Way) In-charge and sectional SSE/JE (P. Way) will carry out careful visual inspection of the rails supplied against the initial quantity of 25000T and shall record any significant observations.
- viii. Any unusual observation in performance of such rails shall be reported by the Railway to RDSO.
- ix. RDSO would analyse the defects noticed during monitoring of rails and suggest improvement in the process of rail manufacturing, if required. Rail manufacturer shall implement the suggestions accordingly which would be further verified by RDSO. Technical assessment of rail manufacturing capability done earlier by RDSO shall be valid subject to implementation of the suggestions by the rail manufacturer. RDSO would decide, with the approval of Railway Board, whether Technical assessment of rail manufacturing capability is to be repeated.
- x. Frequency of Feedback to RDSO - Quarterly
- xi. Joint inspection with RDSO - Every six month
- xii. Period of performance monitoring - 25 GMT or one year, whichever is earlier

(To be reckoned from the date when 80% rail of initially supplied quantity of 25000T is laid in track)

ADE/Track/RF	Joint Director/Track-I	Page 4 of 7
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## **Annexure-B**

- i. The rails shall be laid in identified long stretches to facilitate close monitoring of its performance for 25 GMT or one year, whichever is earlier.
- ii. Relaxation in frequency provided during test free/reduced frequency period will not be applicable for USFD Testing. USFD testing is to be carried out as per the normal frequency prescribed in USFD Manual, as applicable after test free/reduced frequency period.
- iii. Proper record of defects and performance of rail and weld shall be maintained as per the proforma attached i.e. Annexure-I, II.
- iv. All rail withdrawals (fracture pieces and IMR) of rail/ weld will be subjected to analysis in M&C lab of RDSO. For analysis, detailed proforma as per Annexure-III & IV of USFD Manual would be submitted.
- v. During the regular trolley/foot inspections, Sr.DEN/DEN, ADEN, SSE (P.Way) In-charge and sectional SSE/JE (P.Way) will carry out careful visual inspection of the rails and shall record any significant observations.
- vi. Any unusual observation in performance of such rails shall be reported by the Railway to RDSO.
- vii. RDSO would analyse the defects noticed during monitoring of rails and suggest improvement in the process of rail manufacturing, if required. Rail manufacturer shall implement the suggestions accordingly which would be further verified by RDSO. Technical assessment of rail manufacturing capability done earlier by RDSO shall be valid subject to implementation of the suggestions by the rail manufacturer. RDSO would decide, with the approval of Railway Board, whether Technical assessment of rail manufacturing capability is to be repeated.
- viii. Frequency of Feedback to RDSO - Quarterly
- ix. Period of performance monitoring - 25 GMT or one year, whichever is earlier

(To be reckoned from date when the 80% of initial supply of 10000T is laid in track)

ADE/Track/RF	Joint Director/Track-I	Page 5 of 7
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## Annexure-I

## WEAR AND CORROSION MEASUREMENT OF UIC 60/60E1 ..... GRADE RAILS

SSE (In charge)

ADEN:

Division:

Railway:

Date of inspection

Yard/Block Section

KM: From .... To .....

UP/DN/ Single Line

Annual GMT

Quarter 1<sup>st</sup>/2<sup>nd</sup>/3<sup>rd</sup>/4<sup>th</sup>

Name of manufacturer	Sl. No.	Measurement Location (Km/TP)	Laying date	GMT carried	Degree of curve/ Straight	Rolling mark	Observation								Remarks	
							Wear (mm)				Corrosion (mm)					
							Lateral wear		Vertical wear		Depth of corrosion at liner seat		General Corrosion			
							L	R	L	R	L	R	Foot	Web		
	1. 2. 3. .															

**Note:** 1. Measurement Locations to be paint marked and numbered on rail for subsequent periodic measurements.

2. Measurement shall be taken on 2 consecutive sleepers.

3. On Straight, measurements to be taken every 500m and on curve at the start, centre and end of curve.

Signature of ADEN

Signature of SSE (In charge)

ADE/Track/RF	Joint Director/Track-I	Page 6 of 7
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## Annexure-II

## USFD DEFECTS, GAUGE CORNER CRACKING DEFECTS AND SURFACE DEFECTS OF UIC 60/60E1 ..... GRADE RAILS

SSE (In charge)                      ADEN:                      Division:                      Railway:                      Date of inspection  
Yard/Block Section                      KM: From .... To .....                      UP/DN/ Single Line                      Annual GMT                      Quarter 1<sup>st</sup>/2<sup>nd</sup>/3<sup>rd</sup>/4<sup>th</sup>

USFD testing and defects							Details of Kidney Defect if any	Detail of fracture		Gauge Corner Cracking		Surface Defect		Remarks
Name of manufacturer	Date of testing	KM: From .... To	Location of USFD defect	Rolling mark	LH/RH	Defect position Head/Web/Foot		No. of Fracture	Fracture codes	No. of patches	Cumulative length	Location	Type of defect and remarks	

**Note:** 1. Data for USFD of rail and weld shall be given separately.  
2. Detailed proforma to be enclosed as per USFD Manual for rail/weld fracture.

Signature of ADEN

Signature of SSE (In charge)

ADE/Track/RF	Joint Director/Track-I	Page 7 of 7
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**ANNEXURE 3**  
**TO**  
**PART 2, SUPPLY REQUIREMENTS**

**RDSO LETTER NO. CT/RAIL HANDLING**  
**DATED 09.02.2023**

**GUIDELINES FOR *HANDLING AND STACKING OF RAILS***  
**February-2023**  
**(No. CT-35)**



No. CT/Rail Handling

Date:09.02.2023

**As per Mailing list**

**Sub: Guidelines for handling and stacking of rails**

**Ref:** (i) This office letter of even no. dated 05.11.2014 and 07.08.2020.

(ii) Railway Board's letter no. 2019/Track-I(P)/1175HT Rails/Vol-I dated 08.02.2023.

\*\*\*\*\*

1. Vide letter referred at (i) above, RDSO has issued guidelines for handling and stacking of Rails (CT-35) for 90 UTS and above grade rails including R260 grade rails.
2. Subsequently, due to the introduction of R350HT (earlier known as 1175HT) grade Rails on Indian Railways, above guidelines (CT-35) has been revised by RDSO. Railway Board has approved revised Guidelines vide letter referred at (ii) above.
3. Revised "Guidelines for handling and stacking of rails (CT-35), February, 2023", has been attached herewith for information and necessary action. The copy of the same is also uploaded on RDSO website.

**DA:** As above

MAHENDRA  
KUMAR GUPTA  
Digitally signed by  
MAHENDRA KUMAR  
GUPTA  
Date: 2023.02.10 09:52:31  
+05'30'

**(M. K. Gupta)**  
Jt. Director/Track-I

**GUIDELINES**  
**FOR**  
***HANDLING AND STACKING***  
***OF***  
***RAILS***

**February-2023**  
**(No. CT-35)**

**RESEARCH DESIGNS AND STANDARDS ORGANISATION**  
**LUCKNOW – 226011**

### **Amendment History**

<b>Sr. No.</b>	<b>Amendment Year</b>	<b>Version</b>	<b>Reason for amendment</b>
<b>1.</b>	13.11.2006	1.0	First Issued Guidelines
<b>2.</b>	05.11.2014	2.0	Revised
<b>3.</b>	February-2023	3.0	Revised

## **INSTRUCTIONS FOR HANDLING AND STACKING OF RAILS**

### **1.0 INTRODUCTION:**

**1.1** On Indian Railways, various grade and sections of Rails are in use depending upon the traffic requirements. Use of higher UTS Rails has been necessitated to meet the requirement of traffic. Now almost all the new rails being manufactured are of 90 UTS and above. The 72 UTS rails (also known as MM Rails) used earlier were more ductile, hence were not susceptible to sudden fractures. Newly developed R260 and R350HT (earlier known as 1175HT) grade rail has been included in IRS-T-12/2009 specifications. R350HT grade rails have higher UTS and higher hardness value as compared to 90UTS rails. Rails of higher UTS (90 and above including R260 and R350HT Grade rails), being brittle in nature, are susceptible to sudden fracture from locations of even minor dents. The presence of dent/deformation at the edge of the rail foot has been found as the main cause of premature fractures investigated by RDSO. The dent/deformation on the edge of the rail foot is formed mainly due to rubbing of rails during unloading and handling of rails at site. This is indicative of fact that due care is not being taken in field in handling of rails. Improper handling may cause bending, indentation or damage to surface, leading to premature failure of rails. As such, handling of rails with care and attention is important for achieving required servicelife of rails. It is essential that P. Way officials at all levels are sensitized regarding precautions to be taken during unloading and handling of rails to prevent development of defects leading to premature or sudden failures.

**1.2** The instructions regarding handling of rails are available in various guidelines/ Manuals of IR.

(a) Para 1.1.3 of Manual for Ultrasonic Testing of Rails and Welds (Revised-2022) states that incorrect handling of rails may cause plastic deformation, scoring and denting of rails.

(b) Para 610 of IRPWM contain the guidelines on handling and stacking of rails.

(c) Para 711 of IRPWM covers the guidelines on unloading of rails, Sleepers and Fastenings.

These guidelines shall be strictly adhered to minimize formation of dent/ deformation at the edge of the rail foot and other damages to rails.

- 1.3** The damage to rails including formation of dent/deformation at rail foot can be detected by inspecting rails before laying in track. Therefore, it becomes essential that Rails are thoroughly inspected at the level of SSE/P.Way for presence of damages to rails during transportation, unloading and handling, if any, before laying in the track. In case any damage including dent/deformation is noticed, such rails should not be used in track without removal of damaged portion of rails.
- 1.4** These comprehensive guidelines are being issued for sensitizing the field staff and other agencies involved in handling and laying of rails, so as to avoid damage to rails.

## **2.0 HANDLING AND STACKING OF RAILS:**

### **2.1 Stacking and Handling of rails in rail manufacturing plants, Flash Butt Welding plants and other Bulk Storage locations:**

#### **2.1.1 Stacking of Rails and welded Panels:**

- (i) The rails shall be stacked on level and well drained base platform. For stacking on the level ground, unserviceable 90R or 52 kg rails should be embedded in the concrete bed of M- 20 grade concrete keeping rail head embedded in concrete and rail flange projecting above concrete surface as shown in Drawing No. RDSO/T-6219 (Annexure-I). Intermediate distance between them should be 4.0 m. A slope of 1:400 may be given in the concrete bed across the length of rails for drainage of water as mentioned in the drawing.
- (ii) Mild steel flats of 100 x25 mm size should be used between two successive layers of rails and kept at a distance not more than 4.0 m center to center. Number of layers in a stack should not be more than 10.
- (iii) One rail panel should be reduced from both sides after every third layer to achieve proper stacking of rails.
- (iv) Drawing no. RDSO/T-6219 (Annexure-I) shall be followed for stacking of free rails and welded panels.

#### **2.1.2 Handling of Rails:**

- (i) Rail should be lifted preferably through magnetic chucks. In case magnetic lifting devices for rails cannot be provided, all handling of rails shall be done with synchronized electric hoists and spreader beams. This can be possible only when rails are stacked in layers properly.

**(ii) Slings Principle:**

The single point slinging increases risk of excessive bending and surface damage to the rails. The overhang portion of rail beyond the outer lifting point should not be greater than one-half the distance between two adjacent lifting points. Therefore, recommended locations of lifting points for various rail lengths shall be as per Table 1:

**Table 1**

<b>Rail length (m)</b>	<b>No. of lifting points</b>	<b>Distance between two adjacent lifting points (m)</b>	<b>Max. rail end overhang (m)</b>
12-13	2	6-6.5	3-3.25
26	4	6.5	3.25
39	6	6.5	3.25
130	20	6.5	3.25
260	40	6.5	3.25

**2.2 Handling of Single/Three Rail Panels:****2.2.1 Loading of single rails/three rail panels:**

- (i) Wagon should be fit for loading and transportation of rails. Minimum three bolsters/cross beams, one at center and others at maximum inter-distance of 5.0m should be available in wagon platform to give it a uniform base for rail placement. The rails should be loaded to obtain equal overhang at each end beyond the end bolsters. Availability of both end bulk heads in BFRs shall be ensured before loading of rails.
- (ii) All loaded rails should be tightened by suitably flexible but strong MS strip. While binding with MS strip, a card board or any other non-metallic material should be provided between rails and strip, so that abrasion/corrosion is avoided.
- (iii) Mild steel spacers made of flat of 100x25 mm size should be provided between two layers of rails at every 4.0 m distance interval.
- (iv) Shorter rails should be placed in upper layers so that each successive layer is of same or decreasing width to ensure centric and stable loading of wagons.

**2.2.2 Unloading of single rails and 3 rail panels:**

- (i) Rails shall be unloaded fairly opposite to the position where they are to be laid. Care shall be taken to avoid unloading of materials in excess of actual requirement so as to avoid double handling.

- (ii) Two or more ramps should be made in the middle of BFR using unserviceable rails, with a maximum distance of 6.5 m between them. Intermediate supports using pre-fabricated props etc. may also be given below the ramps to prevent excessive sagging. Proper greasing should be done on top surface of ramps for lubrication and easy sliding of rails downwards.
- (iii) At the bottom end of ramp, gunny bag should be provided so that rails do not get damaged while unloading.
- (iv) Rail should be held by 2 or 3 rail tongues in middle portion and placed on the ramp. Both ends of the rail should be tied by manila rope. After placing on ramp, rails should be slid slowly by gradually releasing manila rope to reach the rails to placement location.

## **2.3 Handling of Long Welded Rail Panels:**

### **2.3.1 Loading of long rail panels in EURs:**

- (i) Availability of proper end unloading rakes as per standard arrangement shall be ensured for loading of long rail panels. The speed certificate and sanction of competent authority for operation of rake must be available.
- (ii) The rake must be checked thoroughly before loading. All rollers should be available at their respective locations. Not even a single roller shall be missing or ineffective. It should also be checked that no roller is jammed i.e. it should be free to rotate.
- (iii) Rail panels should be lifted by multiple slinging arrangements keeping intermediate distance not exceeding 6.5 m center to center following slinging principle mentioned at Para 2.1.2 (ii) above.
- (iv) Shorter length panel should be loaded in pairs and placed on same tier keeping equal distance from center so that they can be unloaded at same location.
- (v) Dynamic and localized loading in EUR rake shall be avoided.

### **2.3.2 Unloading of long rail panels from EURs:**

For unloading of long rail panels from EUR, following general principles should be followed. In addition to these general guidelines, any of the specific instructions issued by OEMs should also be followed.

#### **a. With Conventional Rail unloading arrangements requiring hole at panel ends:**

- (i) Unloading of rails from the End Unloading Rake(EUR) shall be done in traffic block.
- (ii) The unloading shall be started from top layer panels. The protective rail and flap door of bulk head shall be opened during block only for the layer to be tackled. Once all the

rails of that layer are unloaded, next layer door shall be opened for unloading.

- (iii) Rail panels should be tied with manila rope/slings with the help of HTS bolts through the holes provided at the end of panels. Only tested slings shall be used for unloading of welded panels.
- (iv) Rope should be passed through the arrangement fixed in ramper and threader wagons attached at the end of EUR rake to prevent rails from bending while unloading.
- (v) Height of rampers should be adjusted/ maintained with respect to the layer of rails being unloaded and it should be decreasing towards end of wagon. The height of ramper to be so adjusted that a smooth slope can be provided to the panels to be unloaded.
- (vi) Other end of manila rope should be tied to any fixed structure capable of pulling rail load and allow the rake to move forward at very cautious speed not exceeding 15kmph so that in the event of any unusual/unsafe situation the rake can be stopped immediately.
- (vii) Rail panels at equal distances from center line shall be unloaded. Eccentric unloading or unloading from only one side of BFR is strictly prohibited.
- (viii) Just before complete unloading of first pair of rail panel, the rake should be stopped and next rail panel to be unloaded is tied with the near end of rail panel partially unloaded, with rope. Then, the rake should be moved forward to unload next rail panel. This process is to be continued for unloading of successive rail panels.
- (ix) The EUR rake shall never be moved backward during unloading.
- (x) The EUR rake shall not run either backward or forward with open door of bulk head in any circumstance except in block during unloading.
- (xi) In case, traffic block is to be cleared before complete unloading of rake, the clamps for layers, where rail panels are left shall be re-fixed properly before movement of rake to avoid any chance of movement of panel during run.
- (xii) Unloading shall not be undertaken at locations having vertical clearance less than 4500 mm from rail level to the fixed structure.
- (xiii) Unloading of rail panels shall not be undertaken in platform area and on ballast-less open web girder bridges.
- (xiv) Unloading of panels should be arranged in such a way that turnout and cross-overs are avoided.

**b. With modified rail unloading arrangements not requiring holes at panel ends:**

- (i) Unloading of rails from the End Unloading Rake shall be done in traffic block.
- (ii) The unloading shall be started from top layer panels. The protective rail and flap door of bulk head shall be opened during block only for the layer to be tackled. Once all the rails of that layer are unloaded, next layer door shall be opened for unloading.
- (iii) In order to mitigate the issue of damage such as dent/deformation as a consequence of impact and sudden jerk during unloading, use of improved end unloading system for long rail panel provisions of 'Technical Specification of Improved End Unloading System for long Rail Panels (RDSO's Specification no. TM/HM/29/EUR/450 of 2018)' attached as Annexure III shall be followed.
- (iv) For mechanized system for unloading and loading for long rail panels in field the provisions of 'Technical Specification of Improved In Field Unloading and Loading System for long Rail Panels for BG (1676mm) (RDSO's Specification no. TM/HM/29/449 of 2019) attached as Annexure IV shall be followed'.
- (v) As there is no provision of holes in rails in these rail unloading arrangements, clamps or magnetic chucks should be used for lifting and unloading of rails.
- (vi) In absence of holes at the ends of rail, while transportation of rails from manufacturing plant to unloading site, bulkhead or any other provision should be made in such a way so that loaded rails in BFR on rollers do not move and break/damage the bulkheads due to impact by acceleration/deceleration of rake or while moving on steep rising/falling gradient of track.
- (vii) When all clamps are fully unlocked, rails should be lifted with extreme care to prevent accidental lifting of the nearby rails by the edges of the feet.

**2.4 Placement of single rails and welded rail panels on cess:**

- (i) New single rails should be unloaded on one side of the track on the cess leaving the other side free for stacking released rails. Rails should be placed on cess away from toe of ballast profile to avoid any infringement and disturbance to ballast profile.
- (ii) As far as possible, rail should be kept straight otherwise a smooth curvature may be given to cross any obstruction. Care must be taken not to unload rails one over the other as this causes bending of rails.
- (iii) While carrying rails, they shall be supported by rail tongs or rail slings at locations mentioned in Para 2.1.2 (ii) above.

- (iv) Rails should be so spread as to rest evenly along their entire length on supports closely spaced to prevent formation of kinks. Rails should be placed with head in upward direction. Drawing no. RDSO/T-8413 (**Annexure- II**) shall be followed for the purpose. Free rails should be supported at least at four points, evenly along their length.
- (v) Kinky rails must be jim-crowed (except R350HT grade) and straightened before placing them in track.
- (vi) Rails must be inspected visually for any dent/rubbing marks on the edge of rail foot. Such rails shall be placed in the track only after removal of damaged portion.
- (vii) Punch marks on rails or marking by chisel should be prohibited as these cause incipient failures.
- (viii) On bridges, unloaded panels are to be supported on sleepers outside the track so as not to allow them to sag downwards.
- (ix) It shall be ensured that signaling bonds are not disturbed while placing the rails. In track circuited territory, the rails shall be handled in such a way that rail does not contact both rails of track together to prevent track circuit failures.

## **2.5 Precautions for handling of rails in Electrified areas:**

- (i) In Electrified territory, no work shall be done without obtaining “permit-to-work”. Working under OHE shall be careful.
- (ii) Touching of fallen wires should be avoided unless power is switched-off and the wire or wires are suitably earthed.
- (iii) Loading and unloading shall be done under the supervision of an Engineering Official not below the rank of a SSE/P. Way who shall personally ensure that no tool or any part of body of worker comes within the “danger zone” i.e. within 2m of the OHE.
- (iv) Rails should not touch each other to form a continuous metallic mast of length greater than 300m.

## **2.6 Handling of Rails at port:**

- (i) Availability of proper facilities for handling of rails at Ports as required by these guidelines should be ensured.
- (ii) Magnetic lifting devices with suitable spreader beams should preferably be used. In case, it is not possible to provide magnetic lifting device for lifting of rails, electric hoists or cranes with suitable spreader beams may also be used so as to lift the rails in accordance with laid down basic principles.
- (iii) Suitable enabling provisions in the contract for procurement of for rails shall be ensured for carrying out modifications in the existing facilities available at ports or to develop suitable method for unloading and handling of rails so as to avoid any

damage.

### **3.0 Precautions for preventing damage to rails:**

#### **3.1 Protection of straightness:**

Proper straightness of rails is essential for smooth riding and preventing unusual stress during operation. Even the small variation of straightness, which is barely visible, (for example, a deflection of 0.75 mm over 1.5m span) renders a rail unacceptable. Therefore, careful handling and stacking shall be ensured particularly on following:

- (i) Heavy static loading on rails should not be done. Also, sudden impact should not be imparted to rails while unloading and handling.
- (ii) While stacking in layers, localised point or line contact loading should not be allowed. It should also be checked that rails are not stacked in criss-cross manner in alternative layers at right angles to each other.
- (iii) Excessive rail end overhang should not be allowed while lifting and shifting of rails. Overhangs mentioned in Table 1 shall be followed.
- (iv) Rails should be kept as horizontal and straight as possible while lifting/moving.
- (v) Rail ends are to be protected against damage by any impact even after having been stacked.
- (vi) Overlapping of flange in unloaded rail should be avoided.
- (vii) It is important that any rail support, handling or clamping device and rail pinch rollers do not apply localized or point contact to the rail.
- (viii) Long duration storage of rails should be restricted on sites/depot.
- (ix) For R350HT grade rails, straightening or removal of small kinks in rail by application of reversible force with Jim-crowing shall be avoided, and if necessary, kinky rail portion shall be removed by cropping.

#### **3.2 Protection of rail surface:**

Rails are very sensitive to notches and dents/deformations at the edge of the rail foot. Surface notches of even less than 0.25 mm in depth are liable to cause rail fracture in service. Therefore, to prevent rail surface from any damage, following shall be strictly ensured:

- (i) Rails shall be protected against impact or abrasion against separators in wagons, vehicles, hatches, ships etc. and also shall be protected against brushing, notching or scoring of

rail surface.

- (ii) Electro-magnetic lifting devices shall be used for lifting of rails. In case of non-availability of such device, conventional slings made of flat link chains fitted with fabric sleeves can be used for lifting rails. Round link chain slings should not be used for securing the rails.
- (iii) Any rail support, handling or clamping devices and rail pinch rollers shall not apply localized or point contact to the rail and must not have sharp edges. Wherever possible, the profile of rail support, handling and clamping devices should be contoured to rail profile.
- (iv) Minor or light scoring or abrasion of rails can be extremely dangerous. Avoid impact or abrasion of rails and rail bundles against structures, buildings, wagons and vehicles.
- (v) Potentially prejudicial materials shall not be stowed near or above the rails.

### **3.3 Prevention of metallurgical damages:**

Rails, especially R350HT rails (due to heat treatment) are thermally very sensitive and are likely to develop metallurgical defects, if exposed to localized heating. The localized heating produces very hard and brittle metallurgical structures, which may lead to sudden failures. Therefore,

- (i) No work of heating, flame cutting, spot welding on or adjacent to rails should be done.
- (ii) Rails should not be in contact with (a) loose electric cables to produce arcs, and (b) molten metal splashes from adjacent welding operations.

### **3.4 Protection from contact with injurious substances:**

All rail in general and 90 UTS or higher grade rails in particular due to higher carbon content, are sensitive to localized corrosion and pitting, which may cause subsequent rail fractures. Therefore, contact of rails with injurious substances causing corrosion of steel, i.e. acids, alkalis, salts, fertilizers, sulphate, chlorides, nitrates etc. should be avoided.

## **4.0 Safety of Personnel:**

Safety of personnel involved in handling of rails is of utmost importance. Following precautions must be ensured for safety of personnel-

- (i) The staff deputed for unloading of EUR rakes must never

travel on BFRs. They shall travel only in tool van/ separate wagon provided in rake composition. No staff shall be allowed on ramper/threader during movement of rake from one station to another station where rake is moving for non- block activity.

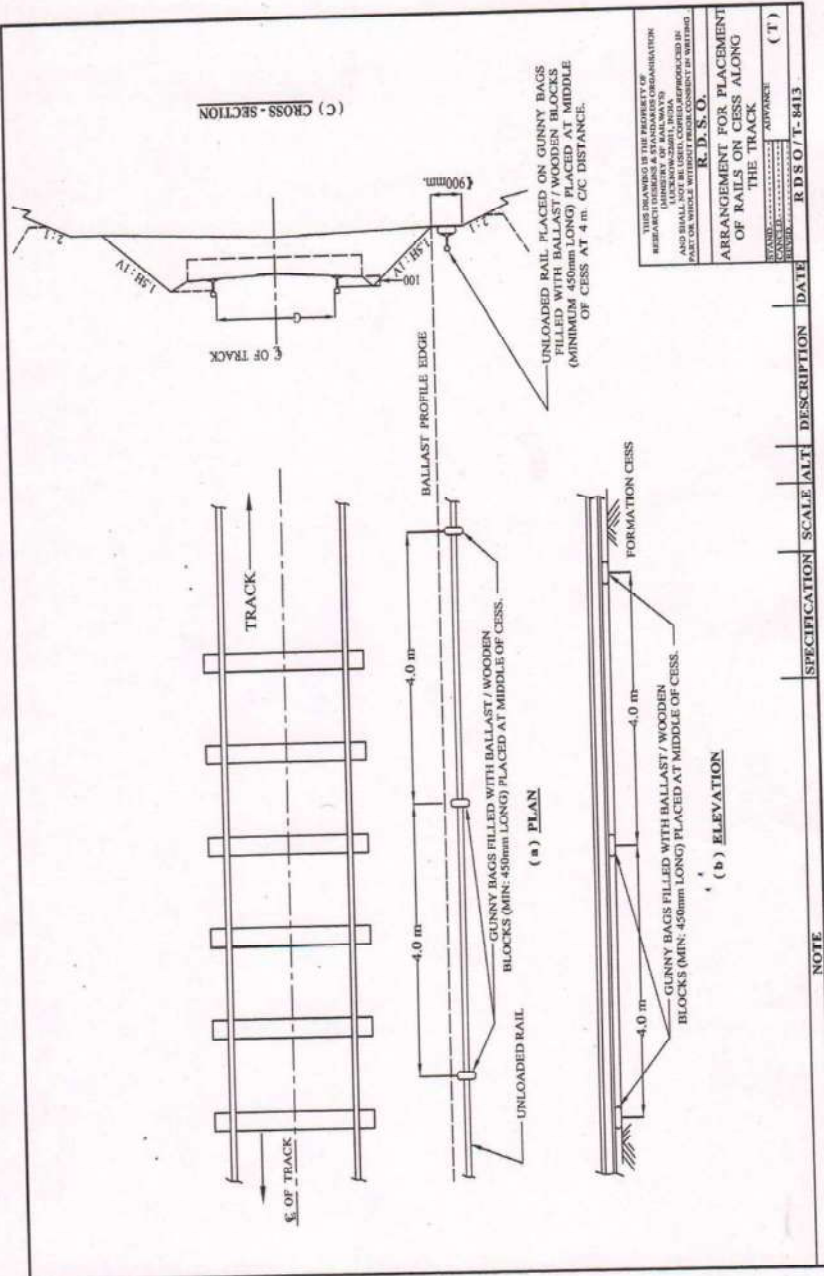
- (ii) Trackmen/staff shall not be allowed to stand between bulkhead doors and panels on either side of the formation while rake is on run.
- (iii) The staff must use protective gloves and clothing to minimize the risk of skin abrasion, lacerations and extremes of temperature.
- (iv) Handling of rails shall be done using proper tools and equipment approved by SSE (P. Way) in-charge. No locally made arrangements shall be used.
- (v) The staff must wear distinctive coloured helmet and clothing for easy identification by crane and other machine operators to avoid accidents.
- (vi) The staff shall use steel toe-capped protective footwear.
- (vii) The staff shall be properly trained and cautioned to avoid standing under suspended loads, sudden dropping and impact of rails.
- (viii) Safe working in the vicinity of electrical conductors and cables shall be ensured.
- (ix) The rails should never be carried by staff on the head or shoulder.
- (x) Necessary precaution for working at heights needs to be taken.

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RAIL LENGTH / WELDED PANEL (METERS)	NUMBER OF EMBEDDED RAILS
400	4000 mm C/C
350	4000 mm C/C
300	4000 mm C/C
250	4000 mm C/C
200	4000 mm C/C

Guidelines for Handling and Stacking of Rails (CT- 35), October-2014

ANNEXURE - II



THIS DRAWING IS THE PROPERTY OF  
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R.D. S. O.

ARRANGEMENT FOR PLACEMENT  
OF RAILS ON CESS ALONG  
THE TRACK

DATE: / / ADVANCE  
RDS O/T-8413

**GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS**



**Technical Specification  
Of  
Improved End Unloading System for Long Rail Panels  
(Specification no. TM/HM/29/EUR/450 of 2018)**

S. No.	Month & Year of approval	Revision/Amendment	Reason for Amendment
1.	March-2019	Nil	First Issue

Signature				
Name & Designation	(A.K. Chakraborty) SSE/TM Prepared By	(Muslim Ahmad) ARE/TM Checked By	(Om Prakash) DTM-III	S.C. Srivastava ED/TM Approved By

**Issued by:**

**RESEARCH DESIGNS AND STANDARDS ORGANISATION,  
MANAK NAGAR, LUCKNOW-226011**

Ref: QO-D-7.1-2 Ver. 7.0	Page 1 of 12	Date of Issue: 12 -March-2019	TM/HM/29/EUR/450 of 2019
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## Technical Specification for Improved End Unloading System for Long Rail Panels (Specification No. TM/HM/29/EUR/450 of 2018)

### 1.0 General

- 1.1 Long rail panels of 260m are being transported through End Unloading Roller (EUR) Rakes at present. In the present system, rails are tied to track by wire rope by drilling a hole in rail panels for unloading of long rail panels. Gap between two unloaded rail panels is large and requires extra effort for pairing and butting of all subsequently unloaded rail panels. Sometimes, the hook slips and causes injury to workmen involved and engaging the hooks to the clamps attached to the panel end requires human skills and correct timing. In the existing arrangement, end of the rail panels does not unload in a gradual manner and bears a sudden jerk, which may induce additional stresses in the rail panel. Damage such as dent marks/deformation as a consequence of this impact may occur, which may lead to rail fracture during service. To mitigate above issues, it becomes necessary to use such equipment for unloading of rail panels from available EUR rakes being used on Indian Railways which can overcome all the above mentioned hazards. This Specification has been prepared to cover service conditions and material, functional and other technical requirements of the "Improved End Unloading System for Long Rail Panel" hereinafter called "Unloading System".
- 1.2 The technical specification has been drafted to reflect the performance and quality requirements of the unloading system in a neutral manner without bias to any specific manufacturer. The unloading system comprises of dedicated wagons/BFRs fitted with suitable attachment like guide rollers, end unloading chutes, landing chute etc. The unloading system may include separate follower arrangements like guiding trolley at the rear of unloading wagon/BFR, connected with the rake by detachable arrangement like tie rod etc. Bidders are requested to study carefully the specification and assure that their unloading system fully comply therewith. If a bidder feels that his unloading system can substantially meet the performance and quality requirements of the machine but does not fully satisfy a particular system specification, he shall mention the same in the statement of deviation from the specifications, giving the details how the functional requirements are going to be met with.
- 1.3 The bidder shall specify the make/model of offered unloading system and furnish a detailed technical description of the same. System/ Subsystem of the working mechanism of the unloading system as per Para 3.0 in particular and all the items of the specifications in general shall be described in detail in the "technical description" along with sketches to show the manner in which the requirements of the specifications are accomplished by the unloading system (model) offered.
- 1.4 Photograph of the type of the unloading system offered, in working mode shall be enclosed with the offer. These shall also show the close-ups of various working assemblies/ systems and the full unloading system. The tenderer shall furnish a

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Ref: QO-D-7.1-2 Ver. 7.0	Page 2 of 12	Date of Issue: 12 -March-2019	TM/HM/29/EUR/450 of 2019
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compact disc or DVD or USB showing the working of unloading system in real time under field condition. Tenderer shall also submit the names of countries & Railways where the offered unloading systems are working and where their working at site can be visited by Indian Railway officials.

## 2.0 DIMENSIONAL AND OPERATING REQUIREMENTS

- 2.1 The design and dimensions of the unloading system and its components shall be to metric standards. Quality assurance during manufacturing of the machine shall be according to ISO 9001. The welding standard followed for manufacturing of the unloading system shall conform to ISO:3834, EN:15085 or any other equivalent standard for welding railway vehicle and components. The manufacturer shall specify the standard followed and certify that it meets the welding standard mentioned above.
- 2.2 The profile of the unloading system, including the additional fittings/components fitted on the wagons or their any part and supporting sub-system loaded on the wagon etc., longitudinally and in cross section, shall not infringe the Indian Railways schedule of dimensions-1676 mm (BG) revised 2004 print with the latest corrigendum and up to date correction slips issued during movement in train formation. The maximum moving dimensions are enclosed as Annexure-I. The tenderer shall provide sketches of the unloading system consist i.e. rail panel unloading unit/fittings fitted on the wagon, unloading supporting components/trolleys additionally tied/fitted with the wagons, in plan and shall give calculations to prove that the unloading system does not cause infringement while moving on a 10 degree curve at any cross section.
- 2.3 Adequate clearance shall be allowed so that no component /part infringe the minimum clearance of 102 mm from the rail level while travelling.
- 2.4 It shall be capable of negotiating curves up to 10 degree curvature (175 m radius), super elevation up to 185 mm and gradients up to 3% in travel mode in train formation.
- 2.5 The unloading system shall be capable of working continuously during the varying atmospheric and climatic conditions occurring throughout the year. The range of climatic conditions is as follows:

Ambient Temperature	: (-) 5 <sup>0</sup> to (+)55 <sup>0</sup> C
Altitude	: Up to 1750 m above mean sea level
Relative Humidity	: up to to 100%
Rail Temperature	: (-) 15 <sup>0</sup> C to (+) 76 <sup>0</sup> C
Rainfall	: Fairly heavy

## 2.6 Service Conditions:

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Ref: QO-D-7.1-2 Ver. 7.0	Page 3 of 12	Date of Issue: 12-March-2019	TM/HM/29/EUR/450 of 2019
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### 2.6.1 Operating Conditions:

- (i) 260 m rail panel to be transported through EUR rakes being used on Indian Railways.
- (ii) Maximum speed of EUR rake: 75 kmph on straight track, station yards and curves  $2^0$  &  $3^0$  and 60 kmph on  $5^0$  curves on Indian Railways.
- (iii) Electric Traction (Minimum): 2x25 KV or 25 KV AC or 1500 V DC
- (iv) Track Circuits: DC in AC traction and non-electrified areas and AC in DC traction areas. On Indian Railways network, electrified traction consists of over head electric system of either 2x25KV AC or 1500V DC with residual return current passing through one of the rails in the track. The voltage for track circuits for signaling purpose is up to 12 Volts and the corresponding current up to 1 Amp passes through the other rail apart from traction return current. Traction return current, for 25KV AC traction, is of the order of 13.3 KA for short duration (i.e. <1 sec) and 1545/600A for long duration and for 1500V DC traction it is of the order of 4000A.
- (v) In working mode, unloading speed shall not exceed as following:  
 Straight track: 10 kmph  
 Curve radius: 5 kmph  
 Last pair of rails: 3 kmph

### 2.6.2 Track Structure:

- (i) Rail: IRS 52Kg/m and UIC 60/60 E1
- (ii) Sleepers: Pre-stressed mono block concrete sleeper at 1540/1660 nos. per km.
- (iii) Gauge: Broad Gauge- 1676mm

## 3.0 Working Mechanism:

- 3.1 The unloading system shall be compatible with EUR rakes being used for transportation of long rail panels on Indian Railways for which the drawings of wagons shall be provided by the purchaser.
- 3.2 The unloading system shall be such that, bending stresses induced in rails during the course of unloading are minimum. The rail ends shall slide through the support blocks and then through the inclined chutes onto the track bed gently. Rail handling process shall be as per "Guidelines for Handling and Stacking of Rails"(CT-35, Oct. 2014).
- 3.3 Tracking and retaining rollers in the rail guide heads shall ensure that the rails are unloaded without tipping over. There shall be scope for adjustment of the rail guide heads in vertical and horizontal directions.

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Ref: QO-D-7.1-2 Ver. 7.0	Page 4 of 12	Date of Issue: 2 -March-2019	TM/HM/29/EUR/450 of 2019
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- 3.4 Minimal longitudinal gap between two unloaded rail panels shall be ensured for ease of welding/pairing and butting and to avoid extra efforts for pulling purpose. Overlapping of the unloaded rail panels shall not be permitted. For minimizing the gap between two unloaded panels, suitable rail clamp/universal type clamp may be used.
- 3.5 For the smooth unloading of rails and to minimize the overhang length of the rail panel, there shall be a trolley mounted rail positioning unit attached with existing EUR rakes at a maximum distance of 6.5 m on the running track. The trolley mounted rail positioning unit shall be detachable type and shall be connected with the rear of the wagon. During unloading of panels the rail positioning unit shall be used. There shall be suitable arrangement to load and unload the rail positioning unit on the wagon.
- 3.6 System shall be able to unload the panels at equal distances from the centre line of the track. Eccentric unloading or unloading from one side of BFR is strictly prohibited.
- 3.7 The unloading System shall be such that no damage/disturbance occur to the existing track or any component i.e. fittings, fastenings and sleepers etc. Further, any component or part of the unloading system shall not infringe any provision of Schedule of Dimensions (SOD) for Broad Gauge (1676mm).
- 3.8 The unloading system shall be able to unload the long rail panel without requirement of drilling hole in the rail. There shall be suitable rail clamping arrangement for fastening two rail ends together permitting maximum gap of 25-35 mm in between.
- 3.9 Unloading belts/rope/chain shall have adequate strength for pulling off the rail panels of 260 m length of UIC 60 Kg / 68 Kg rail sections. If chain/wire rope is used for fastening first pair of rail panel with running line at the time of commencement of rail panel unloading, the same shall be covered with suitable material so that running rails do not get scratch/dents on touching the rail surface by the rope/chain.
- 3.10 While working on double line section, it shall not infringe the adjoining track and it shall be possible to permit trains at full speed at adjoining track.
- 3.11 The required output of the machine shall be as follows:
  - a) Unloading of 260 m long rail panels (each pair) from roller wagons : 6-8 min.
  - b) Minimum radius when pulling off the rails : 175 m
  - c) Maximum track super elevation when pulling off the rails : 185 mm

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Ref: QO-D-7.1-2 Ver. 7.0	Page 5 of 12	Date of Issue: 12-March-2019	TM/HM/29/EUR/450 of 2019
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#### 4.0 End Unloading Arrangement/System:

- 4.1 End unloading arrangement shall be mounted at the end of EUR to facilitate the unloading of long rails.
- 4.2 End unloading arrangement of the system shall consist of end unloading chute fitted with suitable rollers assembly for guiding the rails at top, side and bottom positions, being unloaded from the EUR. The end unloading arrangement shall be for both the rails separately.
- 4.3 There shall be an arrangement of troughs (troughs at BFR level to receive long rail panel from roller chute, inclined along with horizontal troughs allowing long rail panels to descend gradually from BFR and to land on the ground smoothly) at both side (for left and right side respectively) after the roller arrangement which shall be operated hydraulically or by spring action to guide the long rails to descend from BFR smoothly or without any jerk.
- 4.4 The end unloading arrangement shall be laterally sliding type across the width of the BFR end and shall be fixed at required location as per site condition i.e., whether unloading will be made at the centre of the track or outside the track. Such arrangement shall be adequately designed to avoid tilting of the rails during course of unloading.
- 4.5 There shall also be an arrangement of long rail panel holder at the starting end of unloading long rail panel which shall be adjustable to keep equal distance of the long rails, being unloaded, between each other and from running rails, whether unloading is done inside or outside the track.
- 4.6 For smooth unloading of the panels and to minimize the stress on the rail panels being unloaded, there shall be a suitable arrangement to provide intermediate support to overhanging length of the unloaded portion (between end unloading chute and the point at which the panels touch the ground) of the rail panels continuously by placing a moving support/trolley.
- 4.7 The moving support/trolley shall have roller arrangement through which the long rail panels can move smoothly. The roller arrangement position shall be adjustable according to site requirement of unloading long rail panel inside the track or outside the track. The height of this intermediate supporting arrangement from rail level shall be approximately half the height of end supporting chute of the end unloading system/buffer height of the wagon.
- 4.8 The intermediate support/trolley shall be tied with the end unloading system end by suitable connector so that the intermediate support/trolley moves on the track at the same speed of that of EUR.

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Ref: QO-D-7.1-2 Ver. 7.0	Page 6 of 12	Date of Issue: 12-March-2019	TM/HM/29/EUR/450 of 2019
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- 4.9 The intermediate moving support/trolley shall have an arrangement of hinge type, spring loaded trough for both rails so that after passing through the support/trolley rollers, the rail ends will land on these inclined troughs which will gently lower the rail ends to the unloading ground level.
- 4.10 There shall be an arrangement of hydraulic / mechanical rail puller for connecting long rail panels to make a continuous strand with suitable /universal rail clamps without affecting the output efficiency of the system. The universal rail clamps shall be able to function without drilling holes in rail panels.
- 4.11 Sufficient numbers of suitable/universal rail clamps for unloading 60 long rail panels shall be supplied. The transportation arrangement of universal rail clamps by trolley shall also be provided.
- 4.12 One portable diesel operated DC. welding plant (with the provision of auxiliary output of minimum 2.5 KW, 230 V AC for lighting) of reputed make (preferably made in India) with a minimum 5 KVA capacity capable of welding up to 5 mm diameter electrode at 60% duty cycle shall be supplied for welding, operating assemblies/sub-assemblies of unloading arrangement system, if required.
- 4.13 The minimum height of lower most part of the intermediate support/trolley and/or the EUR shall be 102 mm from rail level.

## 5.0 TOOLS AND INSTRUCTION MANUALS

- 5.1 Each unloading system shall be supplied with a complete kit of tools required by operator in emergency and for normal working of the unloading system. The list of tools to be provided shall also include all tools necessary for maintenance and repair of the entire system including specialized equipment. All special tools shall be listed and catalogued illustrating the method of application. The tenderer shall along with his offer submit the list of tools to be supplied along with each machine.
- 5.2 Detailed operating and service manual shall be specifically prepared in English language and four hard copies & soft copies of each of the same shall be supplied with each machine.
- 5.3 One set of all the manuals in hard as well as soft copy shall also be sent to the Principal/Indian Railways Track Machine Training Centre, Allahabad, one set to ED/TMM, RDSO, Lucknow, one set to DTK (MC)/Railway Board and one set to Director/IRICEN/Pune along with supply of first machine. In case, there is any subsequent amendment in above documents based on field performance, the amendment/amended documents shall also be sent to above mentioned authorities.
- 5.4 A draft copy of all documents to be supplied with the unloading system shall be sent 3 months in advance of inspection of the first system to RDSO for their review regarding adequacy and manner of detailing. Necessary modifications and further

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Ref: QO-D-7.1-2 Ver. 7.0	Page 7 of 12	Date of Issue: 12-March-2019	TM/HM/29/EUR/450 of 2019
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detailing as per RDSO's comments shall be carried out and compliance shall be reported to RDSO as well as the Inspecting officer of the first machine.

## **6.0 SPARE PARTS**

- 6.1 The expected life of the components, used in the unloading system, shall be advised by the tenderer along with their condemning limits. The unloading system shall be supplied with necessary spare parts for the operation and maintenance of the system for a period of two years. The spare parts required shall be detailed in a separate list indicating description, part number and whether imported or indigenous.
- 6.2 The manufacturer shall be responsible for the subsequent availability of spare parts to ensure trouble free service for the life of the machine.

## **7.0 MAKER'S TEST CERTIFICATE**

- 7.1 Copies of the Maker's certificate guaranteeing the performance of the equipment shall be supplied in duplicate along with the delivery of the each machine.

## **8.0 OPERATORS**

- 8.1 The number of operators and allied staff for working of the system under normal condition shall be indicated, specifying their duties and minimum qualifications.

## **9.0 INSPECTION OF THE UNLOADING SYSTEM**

- 9.1 While inspecting the unloading system before dispatch from the supplier's premises, the inspecting officer shall verify the conformity of the system with respect to individual specification as above. The machine's conformity / non-conformity with respect to each item shall be jointly recorded before issue of the inspection certificate and approval for dispatch of the machine as per Annexure-II enclosed.
- 9.2 Following arrangements shall be made by the supplier/Manufacturer at the inspection premises for carrying out inspection of the unloading system by inspecting officials:
  - The system to be compatible with Indian Railways standard flat wagon intended to be used in the EUR and roller wagons. The system thus fitted on wagon shall be stabled on straight & level BG track. The length of the track shall be at least 10 m more than buffer to buffer length of wagon.
  - In order to check Maximum Moving Dimensions in cross section, a sturdy frame of Indian Railways Maximum Moving Dimensions shall be provided by the manufacturer and passed over the machine holding it perpendicular to track, centre aligned with track centre. Adequate arrangements shall be made to the satisfaction of inspecting official.

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9.3 The following documents shall be provided to the Inspecting Officer at least 30 days before the proposed date of inspection.

- i) One copy of complete technical literature mentioned in clause 5.0, in English language, including operation, service and field maintenance manuals/instructions and other relevant technical details as a reference documents in soft & hard copies for the inspecting officer.
- ii) Cross section of the system fitted on Indian Railways standard flat wagon intended to be used in the EUR and roller wagons super imposed on Indian Railways Maximum Moving Dimensions envelope shall be provided to IO in advance.
- iii) Clause by clause comments of the manufacturer to be sent to Inspecting Officer (IO) in advance for his review. Comments shall state manufacturer's conformity of compliance of each of the requirement stated in each clause, elaborating where necessary the details/manner in which the requirement has been complied. The pro-forma for the clause-wise comments is given below:

Clause no.	Clause	Comments of Supplier/ manufacturer	Comments of Inspecting Officer

- iv) Manufacturer's Internal Quality Inspection Report of the machine.
- v) Manufacturer's quality certificate and/or test reports for bought out assemblies/sub-assemblies to be provided to IO, containing serial number wherever applicable.
- vi) Draft Inspection Report to be prepared by the manufacturer, containing all annexure mentioned at para 9.4.
- vii) Details of arrangements made for checking Maximum Moving Dimensions for his approval.

Supplier will incorporate amendments/further clarification in the above documents to the satisfaction of the Inspecting Officer keeping in view the Inspecting Officer's comments, if any.

9.4 List of documents to be annexed in the draft Inspection Report shall include:

- i. Maker's Test Certificate.
- ii. Manufacturer's Internal Quality Inspection Report
- iii. Quality Certificates of Bought out assemblies/sub-assemblies
- iv. Cross section of the machine super imposed on the Indian Railways MMD
- v. Vogel's diagram for calculating centre and end throw of the unloading system on curved track.
- vi. List of spare parts to be dispatched along with the machine
- vii. List of tools to be dispatched along with the machine

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Ref: QO-D-7.1-2 Ver. 7.0	Page 9 of 12	Date of Issue: 2 -March-2019	TM/HM/29/EUR/450 of 2019
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- viii. List of Manuals, Drawings, Spare Parts Catalogues, etc. to be dispatched along with the machine, duly indicating the number of sets of each.

## **10.0 TRAINING OF INDIAN RAILWAYS OFFICIALS**

- 10.1 On the job, operation and maintenance training for 2 weeks for 3 supervisors per system shall be provided during and/or post commissioning to the satisfaction of purchaser.

## **11.0 COMMISSIONING OF THE UNLOADING SYSTEM**

Tenderer will arrange to commission the system within 60 days of its arrival at the ultimate consignee premises and will also arrange for tests to be conducted according to the contract as required by the purchaser or his nominee.

## **12.0 SERVICE ENGINEER**

- 11.1 The service engineers shall be available for the commissioning of the system for regular service. E-Learning courses module shall be arranged for imparting training to railway operators during commissioning. In addition, the service engineer shall provide hands on training to railway staff in calibration, operation, repairing and maintenance of the system in field to make them fully conversant with the system. The engineers shall also advise the Railways on appropriate maintenance, testing, operating, repair and staff training facilities that are necessary for the efficient performance of the system.

## **13.0 ACCEPTANCE TEST**

- 13.1 In addition to verification of the various items of specifications covered earlier, the following tests shall be carried out in India at the purchaser's premises by the purchaser's nominee at the time of the commissioning of the system.
- 13.2 Dimensional check of loading gauge, i.e. maximum moving dimensions, clearance and clearances on curves etc.
- 13.3 Testing for negotiability on 1 in 8.5 turnouts.
- 13.4 Construction and engineering of the system and its ability to perform all the functions as laid down in the specifications above.

**ACTUAL OUTPUT AND PERFORMANCE TESTS:** Actual output and performance tests to be conducted on first unloading system.

The general conditions of the tests shall be as follows:

- Machine crew shall be either trained personnel of Indian Railways or the staff of the supplier.
- Dry weather, ambient temperature between -5°C to +55°C.

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Ref: QO-D-7.1-2 Ver. 7.0	Page 10 of 12	Date of Issue: 12-March-2019	TM/HM/29/EUR/450 of 2019
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- c) Straight track or curve up to 1000 m radius.
- d) Straight track with gradients up to 1/200.
- e) Rails fastened to all the sleepers.
- f) Concrete sleepers.

The machine shall be required to achieve an output of 260 m rail panel unloading over a period of 6-8 minutes to cover all the items required as per para 3.11.

#### 14.0 WARRANTY

- 14.1 The unloading system shall be warranted for 1200 effective working hours or 18 months from date of commissioning and proving test of equipment or 24 months from date of delivery at ultimate destination in India whichever shall be earlier. Effective working hours for this purpose will be traffic block time during which the system is deployed for work of unloading of rail panel. Shall any design modification be made in any part of the equipment offered, the warranty period of 18 months would commence from the commissioning and proving test of the machine for the purpose of that part and those parts which may get damaged due to defects in the new replaced part. The cost of such modification shall be borne by the supplier.

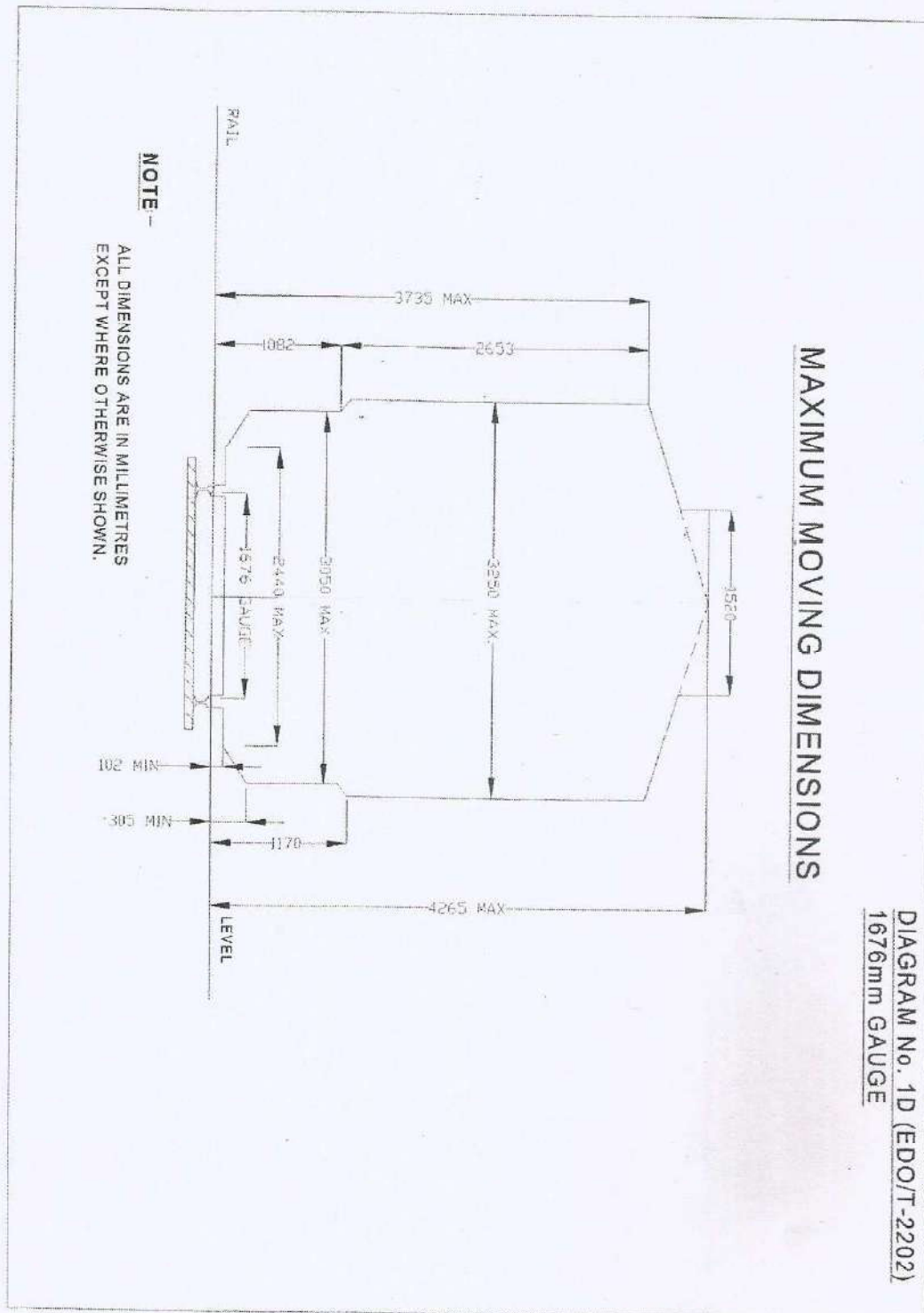
#### 15.0 MARKING & COLOUR OF MACHINE:

- 15.1 The wagon body and the fitted unloading components, sub system like following trolleys shall be painted in golden yellow colour of Indian Standard Colour code of 356 as per IS:5 The exterior painting shall be polyurethane binder based conforming to RDSO Specification No. M&C/PCN/100/2013 (Specification for Epoxy cum Polyurethane Painting System –Two packs for the Exterior Painting of Railway Coaches, Diesel and Electric Locomotives and other Industrial Applications) or ISO 12944.
- 15.2 Following shall be written in black on the wagon side at appropriate location in English & Hindi as per direction of Indian Railway official.
  - i) India Railways logo of height of optimum size.
  - ii) The text " INDIAN RAILWAYS" shall be written in bold and in black colour of size equal to or slightly smaller than the size of logo but of size not less than 150 mm on both side faces and below the Indian Railways logo.
  - iii) Machine model and manufacturing year shall be written in black colour and in letter of size less than the size in which Indian Railways is written but not less than 100 mm in any case below the text "INDIAN RAILWAYS" mentioned above.
  - iv) If required, the manufacturers name may be written in size not more than 150 mm and shall not be at more than four locations. Also the manufacturers logo may be provided at not more than two locations and shall be of size less than 100 mm.

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# Annexure-I



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Ref: QO-D-7.1-2 Ver. 7.0	Page 12 of 12	Date of Issue: -March-2019	TM/HM/29/EUR/450 of 2019
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**Annexure-II**

**INSPECTION CERTIFICATE**

**CERTIFICATE OF INSPECTION OF TRACK MACHINE (.....)  
BY INSPECTING OFFICIAL AND APPROVAL FOR DESPATCH OF MACHINES. (STRIKE OUT  
WHICHEVER NOT APPLICABLE)**

This is to certify that I have inspected the machine  
(type)\_\_\_\_\_ bearing Sr.No.\_\_\_\_\_ from  
(date) \_\_\_\_\_ to \_\_\_\_\_ at (Place) \_\_\_\_\_ for its  
conformity/non-conformity with respect to the laid down Technical Specifications in  
contract \_\_\_\_\_ Agreement \_\_\_\_\_ No. \_\_\_\_\_  
dated \_\_\_\_\_ between President of India through Director Track  
(Machines) and M/s. (Name of Supplier) \_\_\_\_\_

The detailed Inspection Note regarding its conformity/non-conformity to the laid  
specifications is enclosed along with this certificate. It is observed that (strike out  
whichever is not applicable):-

- The Machine conforms to all the laid down specifications.
- The machine conforms to all the laid down specifications except those at Sl.  
No. \_\_\_\_\_.
- The above deviations are minor/major affecting/not affecting the performance of the  
equipment in substantial way.

The following T and P/manuals/drawings are to be supplied along with the machine:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Based on the above, the Machine is certified/not certified to be conforming to the  
specifications.

The machine is approved/not approved for dispatch to \_\_\_\_\_  
\_\_\_\_\_(Consignee) Indian Railways.

For M/s. \_\_\_\_\_  
\_\_\_\_\_

SIGNATURE AND DATE  
INSPECTING OFFICIAL  
(NAME AND DESIGNATION)  
for and on Behalf of President of India





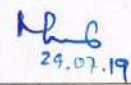
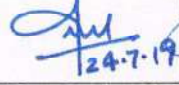

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INDIAN RAILWAY

## Technical Specification of Improved In Field Unloading and Loading System for Long rail Panels for BG (1676 mm)

(Specification No. TM/HM/29/449 of 2018)

S. No.	Month & Year of approval	Revision/Amendment	Reason for Amendment
1.	July-2019	Nil	First Issue

Signature					
Name & Designation	(Ravi Kumar) SSRE/TM	(A. K. Chakraborty) SSE/TM	(Muslim Ahmad) ARE/TM	(Om Prakash) DTM-III	(S. C. Srivastava) ED/TM
	Prepared By		Checked By		Approved By

Issued By:

Track Machine & Monitoring Directorate  
Research Designs and Standards Organization  
Manak Nagar, Lucknow-226011

ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 1 of 18	Date of issue: 25 July-2019	TM/HM/29/449 of 2018
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## Technical Specification of Improved In Field Unloading and Loading System for Long rail Panels for BG (1676 mm)

(Specification No. TM/HM/29/449 of 2019)

### 1.0 General

- 1.1 Unloading of long rail panels (130-260 m) in field is done through end unloading rakes (EUR) as per prevailing practice. The process of unloading of rail panels is partially mechanised and requires manual intervention which depends upon individual skill of workmen and also involves possibilities of accidents causing injuries to the workmen. Presently there is no system existing for loading of released rail on the empty rake. In view of this, mechanised improved system of unloading and loading of rail panels (130-260 m long) is required. This specification has been prepared to cover service conditions and material, functional and other technical requirements of the "in field unloading and loading system" for long rail panels hereinafter called "system". This system shall be equally capable for unloading of long rail panels from existing Indian Railways standard roller wagons without modifications and unloading of long rail panels from/loading of released rail panels to modified new built rail transport rake as mentioned in para 1.2. The system shall be capable of executing rail threading for relaying new rail panels and unloading of long rail panels independently.
- 1.2 The rail transport rake fitted with running rails for crane movement for unloading and loading of long rail panels shall be made by modifying the existing designs as per drg. Nos. RDSO/T 8403 to 8412. The new wagon (BRNA, BRNAHS) shall be supplied by Indian Railways for modified new built transport rake and in field unloading and loading system. The bidder shall submit the details and drawings of modified rail transport rake for unloading and loading of long rail panel with running rails for crane movement to Indian Railways. Detailed dimensional drawing of the in field unloading and loading system, shall also be submitted with the offer.
- 1.3 The technical specifications have been drafted to reflect the performance and quality requirements of the system in a neutral manner without bias to any specific manufacturer. Bidders are requested to carefully study the specification and assure that their system fully comply therewith. If a bidder feels that his system can substantially meet the performance and quality requirements of the system but does not fully satisfy a particular system specification, he should mention the same in the statement of deviation from the specifications, giving the details how the functional requirements are going to be met with.
- 1.4 The bidder shall specify the make/model offered system and furnish a detailed technical description of the same. System/ Subsystem of the working mechanism as per Para 3.0 in particular and all the items of the specifications in general shall be described in detail in the "technical description" along with sketches to show the manner in which the requirements of the specifications are accomplished by the system (model) offered.

*July*

ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 2 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
--------------	-----------------------------	--------------	-----------------------------	----------------------

- 1.5 Photograph of the type of the system offered, in working mode shall be enclosed with the offer. These shall also show the close-ups of various working assemblies/ systems and the full system. The tenderer shall furnish a compact disc or DVD or USB showing the working of system in real time under field condition. Tenderer shall also submit the names of countries & Railways where the offered systems are working and where their working at site can be visited by Indian Railways officials.
- 1.6 Since, the system under procurement comprises of a main unit/rail crane and several auxiliary smaller system/components, the tenderer must ensure that they are matching in capacity with respect to the targeted output mentioned in para. 3.16.
- 1.7 The bidder shall be entirely responsible for the execution of the contract strictly in accordance with the terms and conditions of the specification notwithstanding any approval, which RDSO or the Inspecting Officer may have given:
- Of the detailed drawings prepared by the bidder.
  - Of his sub- bidders for materials, components & sub-assemblies.
  - Of other parts of the work involved in the contract.
  - Of the tests carried out by the bidder/Sub- bidder or RDSO or the Inspecting Officer.

## 2.0 DIMENSIONAL AND OPERATING REQUIREMENTS

- 2.1 The design and dimensions of the system and its components shall be to metric standards. Quality assurance during manufacturing of the system shall be according to ISO-9001. The welding standard followed for manufacturing of system should conform to ISO: 3834, EN: 15085 or any other equivalent standard for welding railway vehicle and components. The manufacturer should specify the standard followed and certify that it meets the welding standard mentioned above.
- 2.2 The profile of the system consist i.e., rail panel unloading/loading unit fitted on the wagon, loading/unloading supporting components additionally fitted on the wagons or their any part, longitudinally and in cross section, shall not infringe the Indian Railways schedule of dimensions-1676 mm (BG) revised 2004 print with the latest corrigendum and up to date correction slips issued during movement in train formation. The maximum moving dimensions are enclosed as Annexure-I. The tenderer shall provide sketches of the system consist i.e. rail panel unloading/loading unit fitted on the wagon, loading/unloading supporting components additionally fitted on the wagons, in plan and shall give calculations to prove that the system does not cause infringement while moving on a 10 degree curve at any cross section.

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ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 3 of 18	Date of issue: 25 July-2019	TM/HM/29/449 of 2018
--------------	-----------------------------	--------------	-----------------------------	----------------------

- 2.3 Adequate clearance shall be allowed so that no component/part infringe the minimum clearance of 91 mm from the rail level while travelling up to condemnation limit of wheel.
- 2.4 It shall be capable of negotiating curves up to 10 degree curvature (175 m radius), super elevation up to 185 mm and gradients up to 3% in travel mode in train formation.
- 2.5 The system shall be capable of working continuously during the varying atmospheric and climatic conditions occurring throughout the year. The range of climatic conditions is as follows:

Ambient Temperature	: (-) 5 <sup>0</sup> to (+) 55 <sup>0</sup> C
Altitude	: Up to 1750 m to above mean sea level
Relative Humidity	: up to 100%
Maximum Rail Temperature	: (-)15 <sup>0</sup> to (+) 76 <sup>0</sup> C
Rainfall	: Fairly heavy

- 2.6 All the system components vulnerable to rain water and moisture shall be covered where reasonably possible by roof or other suitable sturdy covering so that the system & components are not adversely affected during rains and the system is able to work continuously even during rains.
- 2.7 The system fitted on IR wagon shall be capable of being hauled at a speed not less than 100 kmph.
- 2.8 It shall be capable of working without requiring power block in electrified section. 25 KV or 2x25 KV AC power supply is used for traction through an overhead wire at 5500 mm above rail level. On bridges and tunnels, the height of OHE is restricted to 4800 mm.
- 2.9 While working on double line section, it shall not infringe the adjoining track and it shall be possible to permit trains at full speed on that track. Minimum centre to centre spacing of track is 4265 mm.

### 3.0 WORKING MECHANISM

- 3.1 The system shall consist of modified IR wagons fitted with components for movement of gantry crane type rail panel manipulator/system, panel supporting fixtures, panel guiding roller assemblies system, rail end supporting arrangement etc and rail threading assembly. The system shall be compatible for unloading of long rail panels from EUR (End Unloading Rake, RDSO Drg. Nos. RDSO/T 8403 to 8412) which is being used for transportation of long rail panels on Indian Railways.

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ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 4 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
--------------	-----------------------------	--------------	-----------------------------	----------------------

- 3.2 The system shall be capable to unload long rail panels of 130 m to 260 m as well as load the released rail panels of 130 m to 260 m long at site on modified new built rail transport rake as mentioned in para 1.2.
- 3.3 The system shall have pulling system for pairing and butting of rail panels without drilling any holes in the rails. There shall be proper clamping arrangement for pairing and butting of rail panels without using rope/wire which shall not get loosened during unloading. Additional pairing and butting of rail panels, unloaded by the system, shall not be required. The pulling mechanism shall be capable of pulling the rail panels both in pairs and single rail panel.
- 3.4 There shall be a rail panel-positioning unit, following the unloading wagon for placing the long rail panels at required alignment. The positioning unit should move with the unloading rake by tying it with the rear wagon of the system. There shall be necessary arrangement to load and unload the rail panel positioning unit on the unloading wagon and in loaded condition adequate locking arrangement should be provided to secure the unit on the wagon floor against any movement during transportation of the system. The panel positioning unit, when loaded on wagon shall not infringe MMD of IRSOD (latest edition).
- 3.5 Whenever required, rail threading unit shall be used for relaying new rail panels along with the in-field unloading and loading system and the rail positioning unit shall move behind the unloading wagon on the existing rails and shall feed the new rail panels towards the rail threading unit for laying the rail on the track replacing existing rails. Sufficient distance between the rail positioning unit and rail threading unit shall be maintained so that the rail threading unit may get adequate length of newly laid track ahead of its movement as well as the rail positioning unit may move on the existing track before the rails of the track are removed by rail threading unit. The elastic rail clips of the existing track shall be removed simultaneously (done manually by a team of track men) ahead of rail threading unit for removing the existing rails from rail seats of the sleepers. After relaying, the elastic rail clips shall be inserted manually.
- 3.6 There shall be an arrangement of universal rail clamp for connecting long rail panels to make a continuous strand. The universal rail clamps shall be able to function without drilling holes in rail panels and shall be sufficient in numbers for unloading the rake loaded to full capacity of long rail panels. The transportation arrangement of universal rail clamps by trolley/wheelbarrow shall also be provided.
- 3.7 The system shall be able to unload the rail panels in the middle of the track and also on the ends of the sleepers up to 1.8 m away from the centre of the track on either side of the track requiring no manual intervention at ground level during normal unloading. Similarly, the system shall be able to load the released rail panels from the middle of the track and from the ends of the sleepers up to 1.8 m away from the centre of the track on either side of the track requiring no manual intervention.

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ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 5 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
--------------	-----------------------------	--------------	-----------------------------	----------------------

- 3.8 System shall be such that, bending stresses induced in rails during the course of unloading and loading are minimum. The unloading system shall be suitably designed for rail profiles IRS52, UIC60 and 60EI. The rail handling crane/manipulator shall have four arms, two at each end. The arms shall be operated hydraulically to grip and pull the rail panels towards the unloading end of the rake.
- 3.9 The rail handling crane/manipulators shall be self-propelled and able to run on the wagons of in field unloading and loading system/new built rail transport rake. Gripping points shall be as per "Guidelines for Handling and Stacking of Rails" (CT-35, Oct. 2014).
- 3.10 Design of the system shall be such that unloading and loading of rail panels can take place without any damage/disturbance to track components like rails, fittings & fastenings and sleepers etc.
- 3.11 There shall be a guiding system for unloading of the rail panels so that minimal force is transmitted to track and there is no damage either to track or to the guiding system during unloading of rail panels.
- 3.12 The system shall be able to unload the rail panels in upright position without tilting at equal distances from the centre line of the track on outside as well as inside the track. Eccentric unloading or unloading of pairs of rails from one side of wagon is strictly prohibited. No additional personnel and wagon shall be used for positioning the rails.
- 3.13 The system shall be so designed that during unloading, the rail panels shall move smoothly either on rollers or on any suitable arrangement fitted on wagon. The rail panel shall move without sudden lateral/toppling movement and not get damaged. Rail panels shall be lifted mechanically without leaving any dent/mark on rail and placed in position for unloading without applying any extra force to rail panel. Rail panels shall not rub on the floor of the wagon or any other component of the wagon so that damage to rail is minimised during this activity. Rail ends shall gradually fall on the track passing through landing plates/chute attached at the end of the last wagon/BFR of the in field unloading and loading system. The rail panel shall be unloaded without use of steel core wire rope/any type of rope/wire etc. and also without any safety hazard in such a manner that need of fixing of the end of panel with track does not require.
- 3.14 The system shall be such that maintenance can be done without the need of removal of the gantry crane/rail manipulator or any other components.
- 3.15 In order to avoid mechanical injuries while the rails are being pulled off, the rails shall be pulled off over roller-bearing rail guide heads.
- 3.16 The required minimum output of the system shall be as follows:

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ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 6 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
--------------	-----------------------------	--------------	-----------------------------	----------------------

- a) Unloading of 260 m long rail panels (each pair) from rail transport wagons sets with crane running rails new built for this purpose provided by Indian Railways where pairing is not required and butting of rail panels is done by the crane : 4-6 min
  - b) Unloading of 260 m long rail panels (each pair) from Indian Railways standard EUR including pairing and butting from roller wagons : 8-10 min
  - c) Loading of 260 m long rail (each pair) rail transport wagons sets with crane running rails new built for this purpose : 6-8 min
  - d) Minimum radius when pulling off the rails from rail transport wagons sets with crane running rails new built for this purpose : 175 m (10<sup>0</sup> curvature)
  - e) Minimum radius when pulling off the rails from Indian Railways standard EUR : 350 m (5<sup>0</sup> curvature)
  - f) Maximum track super elevation when pulling/unloading off the rails : 185 mm
- 3.17 The arrangement of unloading system and rail guide system shall be so provided that the safety of trackmen working around or on the unloading system shall be ensured all the time.
- 3.18 The design life of the system shall coincide with the codal life of the wagons of EUR over which it will be installed.
- 3.19 One portable diesel operated D.C. welding plant (with the provision of auxiliary output of minimum 2.5 KW, 230 V AC for lighting) of reputed make (preferably made in India) with a minimum 5 KVA capacity capable of welding up to 5 mm dia electrode at 60% duty cycle shall be supplied for welding as well as power pack for operating assemblies/sub-assemblies of unloading system, if required.
- 4.0 Crane:**
- 4.1 The crane shall be sturdy, hydraulically operated and can move on the unloading/loading wagon. It shall have four arms, two at each end for gripping the rail panels. The rail gripping system shall be so designed that there shall not be any point contact with rail section to avoid load/ stress concentration at point of grip.
- 4.2 The hydraulic system of the crane shall function for all the activities like travelling, gripping, lifting and pulling the rail panels simultaneously.
- 4.3 The crane shall be provided with suitable, ergonomically designed, AC, noise isolated cabin with comfortable seating arrangement for the operator. The cabin and engine shall be mounted on rubber buffer to minimise operational jerk in the cabin. The cabin shall have CC TV for proper rear viewing. The front view of working area shall not be obstructed during operation of crane for loading/unloading of long rail panels.

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ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 7 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
--------------	-----------------------------	--------------	-----------------------------	----------------------

- 4.4 The gauges, instruments and controls shall be suitably located in the operator's panel so that they can be observed without undue fatigue to the operator. To enter into the cabin, it shall have pneumatically/hydraulically operated collapsible/folding ladder.
- 4.5 The electric supply in the control panel for operation of electrical instruments, gauges etc. shall not be more than of 110 V.
- 4.6 To the extent possible hydraulic and pneumatic (if used) component/assembly should be fixed at suitable location preferably on the side frame of the system so as to avoid the need of going on top of the system/ gantry crane frame for day-to-day maintenance schedules.
- 4.7 Onboard system for online filtration and monitoring the quality of hydraulic oil in hydraulic circuit should be provided. The gauge should clearly indicate if the hydraulic oil is contaminated beyond the permissible limits and requires immediate replacement.

#### **5.0 Rail Threading Unit:**

- 5.1 The rail-positioning unit & rail threading unit shall work independently. However, both these units will be capable of being worked simultaneously. Positioning unit shall move on old track just following the rear wagon of loading/unloading system for receiving the rail panels from unloading chute and guiding the same to lay on sleepers at correct alignment of existing rail. The rail threading unit shall follow the positioning unit within suitable distance and remove the old rail panel from the track spreading them out side of the track and laying the new rail into the rail seat compartment of sleeper. The old rail lying outside of the track can be loaded later to new built Indian Railway standard wagons (BRNA, BRNAHS) with certain modifications as mentioned in para 1.2.
- 5.2 The rail threading unit shall work self-sufficiently and independently with suitable distance from unloading system of long rail panels.
- 5.3 The rail positioning unit, adjacent to unloading wagon shall have hydraulic system for lateral movement of the rail positioning components. Hydraulic power may be taken from the power pack of the unloading wagon. The rail positioning unit shall receive the rail panels from the unloading wagon and lay the panels at proper alignment so that no additional effort is required for alignment of the newly laid rails. The rail positioning unit shall be connected with the unloading wagon with suitable connector.
- 5.4 The rail threading unit shall be self-propelled and hydraulically operated for removing the old rail from track and treading new rail in. The rail threading unit shall move on its own power.
- 5.5 No components/members of the entire system shall infringe the traffic movement on adjacent track during unloading, relaying and loading of long rail panels.

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## 6.0 Roller Wagons and End Unloading Wagons:

- 6.1 New built Indian standard wagons/BFRs provided by IR shall be used for roller wagons on which the long rail panels shall be loaded in layers for new built rail transport rake as mentioned in para 1.2. There shall be provision of accommodating at least 40 long rail panels of length 130/260 m in the rake with sufficient numbers of wagons.

For unloading from existing IR standard Wagon to drawing nos. RDSO/T-8403 to 8412, there shall be provision of accommodating at least 60 long rail panels of length 130/260 m in the EUR rake.

- 6.2 The rake for carrying long rail panels shall have the suitably designed roller bunks (lever arm) for carrying rail panels. The roller bunks shall provide vertical support to the rail panels. Sufficient nos. of roller bunks shall be used and linear distance between two successive supports shall not be more than 6.5 m.
- 6.3 The roller bunks (lever arm) shall be fitted across the wagon width. The roller bunks shall be in two parts and splitted centrally, so that each half part may be slewed around the vertical pillar to rest on vertical support (end column) at edge of wagon/BFR and along the length of the wagon/BFR, whenever required. The roller bunks shall be attached to vertical pillars (end column) erected at side edge of the wagon/BFR. Other end of roller bunk (lever arm) shall rest on column erected at the centre as well as at the side of the wagon and with the alignment of the roller bunks (lever arm).
- 6.4 Each roller bunk shall have roller arrangement on which the rail panels shall move.
- 6.5 There shall be three ramper and threader wagons coupled at the end of rail panel loaded rake. There shall be suitable arrangement for moving of the crane/rail manipulator along these three wagons.
- 6.6 As the crane moves on its own power by double flanged wheels. Rail/steel beam matching the wheel profile, shall be fitted along the side wall of the wagons for crane movement. Fitting of such rails/steel beam shall not infringe MMD of IRSOD (latest version).
- 6.7 The joints of the rail/steel beam between wagons on which the crane is moving, shall be detachable type and flexible enough to negotiate 10° curves (175 m) while travelling and in working mode.

## 7.0 DIESEL ENGINE

*July*

ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 9 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
--------------	-----------------------------	--------------	-----------------------------	----------------------

- 7.1 The gantry crane/rail manipulator of the system and also rail threader (whenever supplied with the system) shall be powered by diesel engine preferably indigenous, with proven record of service in tropical countries. Robust construction and low maintenance cost are of particular importance. Adequate allowance shall be made for de-rating of diesel engine under the most adverse climatic conditions mentioned in this specification elsewhere.
- 7.2 High speed diesel oil to Indian Standard specification shall be normally used. A minimum fuel capacity sufficient for continuous operation for 16 hours will be desirable.
- 7.3 Sight glass type fuel measuring gauge preferably of full height shall be provided on the fuel tank.
- 7.4 The engine parameter monitoring gauges like temperature, rpm, lubricant oil pressure shall be direct reading type mounted on the engine, backed up by electrical / mechanical gauges in the operator's cabin console showing the absolute readings along-with safety limits suitably coloured. There shall be audio-visual warning (safety mechanism) to the operators in case of any of these parameters exceeding the safe limit and engine will shut down automatically.
- 7.5 In order to adhere to pollution Control norms, the diesel engine should be electronically controlled emissionized engine with minimum compliance of tier 2 stage.
- 7.6 The engine should be enclosed in a weather protective, sound and dust resistant enclosure to minimize engine noise and to prevent oozing out of oil spills etc. from engine area to the adjacent system components, hoses, electrical cables fittings as a protection against fire. All doors on the enclosure shall be strategically located in areas as to allow ease of maintenance of the engine and allow good access to and visibility of instruments, controls, engine gauges, etc. Sufficient louvers shall be provided to allow the total engine cooling air requirements used in this application.

## 8.0 DRIVING MECHANISM

- 8.1 The gantry crane/rail manipulator of the system should be provided with an efficient traction drive system for traction during movement on the unloading wagons.
- 8.2 The driving mechanism should be rugged to perform satisfactorily during the life cycle of the gantry crane/rail manipulator. The driving system shall be through hydro-statically coupled power transmission arrangement capable of achieving required speed in both directions. The system should be so designed that all the driving wheels work in synchronization and there is no slippage/skidding of the wheel during the movement.

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ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 10 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
--------------	-----------------------------	---------------	-----------------------------	----------------------

- 8.3 The system of the gantry crane/rail manipulator shall be such that whenever required the relative movement between the travelling wheels of the system and the rail/beam on which the system moves will be possible by disengaging/engaging the transmission power to the wheels.

## 9.0 COOLING SYSTEM

- 9.1 The cooling system for prime mover as well as hydraulic system oil shall be efficient and designed for a maximum ambient temperature of 55°C. Tenderer may note that the system shall be working under extreme dusty conditions and the cooling mechanism should be maintainable under these conditions.
- 9.2 Adequate heat transfer arrangement for hydraulic system shall be designed and provided so that under extreme heat conditions as mentioned in 2.5 above, the system oil temperature does not go beyond specified range.

## 10.0 BRAKES

- 10.1 The system of the gantry crane/rail manipulator shall have suitable brake system applying on all the wheels. The brake system may be hydraulically or pneumatically operated.

## 11.0 HORN, HOOTERS AND SAFETY SWITCHES

- 11.1 The system of the gantry crane/rail manipulator shall be provided with dual tone (low tone & high tone) electric/pneumatic horns facing outwards at each end of the system at suitable locations for use during rail panel unloading and loading operation to warn the workmen of any impending danger. Control shall be provided in close proximity to the operator permitting the driver to operate either horn individually or both horns simultaneously. The horns shall be distinctly audible from a distance of at-least 400 m from the system and shall produce sound of 120-125 dB at a distance of 5 meter from horn (source of sound). The higher tone horn shall have fundamental frequency of 370 ±15 hertz.
- 11.2 Adequate numbers of safety stop switches should be provided all around so that in case of any danger to workers as well as hitting of any obstructions by working unit like signalling cable, joggle fish plate etc. during working, so that the operator can be warned or the working can be stopped immediately.
- 11.3 System shall be provided with emergency backup system to wind up the system in the event of failure of prime mover or power transmission system of the system to clear the traffic block for safe passage of traffic. The emergency backup system should be able to be operated manually also.

## 12.0 LIGHTING ARRANGEMENTS

- 12.1 The electric equipment to be provided shall conform to relevant standard specifications and shall be suitable for Indian climatic conditions. The system shall

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ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 11 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
--------------	-----------------------------	---------------	-----------------------------	----------------------

be equipped with twin beam headlights conforming to RDSO's specification no. ELRS/SPEC/PR/0024 Rev-1, Sept 2004 with latest amendments ensuring a light intensity of 3.2 lux at ground level at track centre at a distance of 305 m. away on a clear dark night, at each end and with two front and rear parking lights at each end.

- 12.2 Powerful floodlights shall also be provided to illuminate the working area sufficiently bright for efficient working during night.

### 13.0 TOOLS AND INSTRUCTION MANUALS

- 13.1 Each system shall be supplied with a complete kit of tools required by operator in emergency and for normal working of the system. The list of tools to be provided shall also include all tools necessary for maintenance and repair of the entire system including specialized equipment. All special tools shall be listed and catalogued illustrating the method of application. The tenderer shall along with his offer submit the list of tools to be supplied along with each system.
- 13.2 Detailed operating manual, circuit diagrams of electrical, hydraulic, pneumatic and electronic circuits used on the system maintenance, trouble shooting manuals and service manuals shall be specifically prepared in English language and four hard copies & soft copies of each of the same shall be supplied with each system.
- 13.3 One set of all the manuals and diagrams in hard as well as soft copy should also be sent to the Principal/Indian Railways Track System Training Centre, Allahabad, one set to ED/TMM, RDSO, Lucknow, one set to DTK (MC)/Railway Board and one set to Director/IRICEN/Pune along with supply of first system. In case, there is any subsequent amendment in above documents based on field performance, the amendment/amended documents should also be sent to above mentioned authorities.
- 13.4 A draft copy of all documents to be supplied with the system should be sent 3 months in advance of inspection of the first system to RDSO for their review regarding adequacy and manner of detailing. Necessary modifications and further detailing as per RDSO's comments should be carried out and compliance should be reported to RDSO as well as the Inspecting officer of the first system.

### 14.0 SPARE PARTS

- 14.1 The expected life of the components, used in the system, shall be advised by the tenderer along with their condemning limits. The system shall be supplied with necessary spare parts for the operation and maintenance of the system for a period of two years. The spare parts required shall be detailed in a separate list indicating description, part number and whether imported or indigenous.
- 14.2 The manufacturer shall be responsible for the subsequent availability of spare parts to ensure trouble free service for the life of the system.

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ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 12 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
--------------	-----------------------------	---------------	-----------------------------	----------------------

- 14.3 For indigenous parts and bought out components and assemblies, the source (original equipment manufacturers reference and part no.) and other relevant technical details shall be supplied while offering the first system for inspection.

## **15.0 MAKER'S TEST CERTIFICATE**

- 15.1 Copies of the Maker's certificate guaranteeing the performance of the system shall be supplied in duplicate along with the delivery of the each system.

## **16.0 OPERATORS**

- 16.1 The number of operators and allied staff for working of the system under normal condition shall be indicated, specifying their duties and minimum qualifications. Manpower required for loading/unloading including operating the system should not be usually high.

## **17.0 OPTIONAL EQUIPMENTS**

- 17.1 Tenderer is expected to quote for optional equipment separately for each item giving the advantage/functions of such optional equipment. Tenderer shall also indicate whether such equipment is already in use on systems elsewhere indicating the user Railway system.

## **18.0 INSPECTION OF THE SYSTEM**

- 18.1 While inspecting the system before dispatch from the supplier's premises, the inspecting officer shall verify the conformity of the system with respect to individual specification as above. The system's conformity/non-conformity with respect to each item shall be jointly recorded before issue of the inspection certificate and approval for dispatch of the system as per Annexure-II enclosed.
- 18.2 Following arrangements shall be made by the supplier/Manufacturer at the inspection premises for carrying out inspection of the system by inspecting officials:
- The system of the gantry crane/rail manipulator to be placed on Indian Railways standard flat wagon intended to be used in the EUR and new built rail transport rake. The system thus loaded on wagon shall be stabled on straight & level BG track. The length of the track should be at least 10 m more than buffer to buffer length of wagon.
  - In order to check Maximum Moving dimensions in cross section, a Sturdy frame of Indian Railways Maximum Moving Dimensions shall be provided by the manufacturer and passed over the system holding it perpendicular to track, centre aligned with track centre. Adequate arrangements shall be made to the satisfaction of inspecting official.
- 18.3 The following documents shall be provided to the Inspecting Officer at least 30 days before the proposed date of inspection.

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- i) One copy of complete technical literature mentioned in clause 13, in English language, including operation, service and field maintenance manuals/instructions and complete electrical, hydraulic and pneumatic circuit diagrams, trouble shooting charts, component drawings/description and other relevant technical details as a reference documents in soft & hard copies for the inspecting officer.
- ii) Cross section of the system of the gantry crane/rail manipulator placed on Indian Railways standard flat wagon intended to be used in the EUR and new built transport rake super imposed on Indian Railways Maximum Moving dimensions envelope shall be provided to Inspecting Officer (IO) in advance.
- iii) Clause by clause comments of the manufacturer to be sent to Inspecting Officer (IO) in advance for his review. Comments should state manufacturer's conformity of compliance of each of the requirement stated in each clause, elaborating where necessary the details/manner in which the requirement has been complied. The pro-forma for the clause-wise comments is given below:

Clause no.	Clause	Comments of Supplier/ manufacturer	Comments of Inspecting Officer

- iv) Manufacturer's Internal Quality Inspection Report of the system.
- v) Manufacturer's quality certificate and/or test reports for bought out assemblies/sub-assemblies to be provided to IO, containing serial number wherever applicable.
- vi) Draft Inspection Report to be prepared by the manufacturer, containing all annexure mentioned at para 18.4.
- vii) Details of arrangements made for checking Maximum Moving Dimensions for his approval.

Supplier will incorporate amendments/further clarification in the above documents to the satisfaction of the Inspecting Officer keeping in view the Inspecting Officer's comments, if any.

#### 18.4 List of documents to be annexed in the draft Inspection Report shall include:

- i) Maker's Test Certificate.
- ii) Manufacturer's Internal Quality Inspection Report
- iii) Quality Certificates of Bought out assemblies/sub-assemblies
- iv) Cross section of the system super imposed on the Indian Railways MMD
- v) Vogel's diagram
- vi) List of spare parts to be dispatched along with the system

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ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 14 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
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- vii) List of tools to be dispatched along with the system
- viii) List of Manuals, Drawings, Spare Parts Catalogues, etc. to be dispatched along with the system, duly indicating the number of sets of each.
- ix) Details and drawings of modified rail transport rake and in field unloading and loading system for long rail panel.

## 19.0 TRAINING OF IR OFFICIALS

19.1 Two officials for each system from Zonal Railways and 4 officials from RDSO/Railway Board shall be trained as under:

(a) Training for a period of two weeks in the manufacturing plant and field operation abroad (for foreign manufacturing), shall be provided by the supplier/Manufacturer at manufacturing plant on the following key points:

- Key aspects of Operation and Maintenance of the system;
- Driving of the vehicle and crane operation.
- Assimilating various maintenance schedules of the system;
- Cost of boarding, lodging and travel of IR Officials will be borne by the purchaser.

19.2 In addition to the above, on the job operation and maintenance training for 2 weeks for 3 system supervisors per system, shall be provided during and/or post commissioning to the satisfaction of purchaser.

## 20.0 COMMISSIONING OF THE SYSTEM

20.1 Tenderer will arrange to commission the system within 60 days of its arrival at the ultimate consignee premises and will also arrange for tests to be conducted according to the contract as required by the purchaser or his nominee.

## 21.0 SERVICE ENGINEER

21.1 The service engineers shall be available for the commissioning of the system for regular service. E-Learning courses module should be arranged for imparting training to railway operators during commissioning. In addition, the service engineer shall provide hands on training to railway staff in calibration, operation, repairing and maintenance of the system in field to make them fully conversant with the system. The engineers shall also advise the Railways on appropriate maintenance, testing, operating, repair and staff training facilities that are necessary for the efficient performance of the systems.

## 22.0 ACCEPTANCE TEST

22.1 In addition to verification of the various items of specifications covered earlier, the following tests shall be carried out in India at the purchaser's premises by the purchaser's nominee at the time of the commissioning of the system.

*guy*

ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 15 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
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- 22.2 Dimensional check of loading gauge, i.e. maximum moving dimensions, clearance and clearances on curves etc.
- 22.3 Testing for negotiability on 1 in 8.5 turnouts.
- 22.4 Construction and engineering of the system and its ability to perform all the functions as laid down in the specifications above.
- 22.5 **ACTUAL OUTPUT AND PERFORMANCE TESTS:** Actual output and performance tests to be conducted on first system.

The general conditions of the tests shall be as follows:

- a) System crew shall be either trained personnel of Indian Railways or the staff of the supplier.
  - b) Dry weather, ambient temperature between  $-5^{\circ}\text{C}$  to  $+55^{\circ}\text{C}$ .
  - c) Straight track or curve as per para 3.16.
  - d) Straight track with gradients as per para 2.4.
  - e) Rails fastened to all the sleepers.
  - f) Concrete sleepers.
  - g) Fittings not seized.
  - h) The system shall be required to achieve an output of 260 m rail panel unloading and loading over period with performance data stipulated as per para 3.16 of working to cover all the items required as per para 3.0.
- 22.6 Should any modification be found necessary as a result of the tests, the same shall be carried out by the supplier at his own expenses.

## 23.0 WARRANTY

- 23.1 The system shall be warranted for 1200 effective working hours or 18 months from date of commissioning and proving test of equipment or 24 months from date of delivery at ultimate destination in India whichever shall be earlier. Effective working hours for this purpose will be traffic block time during which system is deployed for work of unloading/loading of rail panel. Should any design modification be made in any part of the equipment offered, the warranty period of 18 months would commence from the commissioning and proving test of the system for the purpose of that part and those parts which may get damaged due to defects in the new replaced part. The cost of such modification should be borne by the supplier.

## 24.0 MARKING & COLOUR OF SYSTEM:

- 24.1 The rail crane/manipulator and the rake shall be painted in golden yellow colour of Indian Standard Colour code of 356 as per IS:5 The exterior painting shall be

Any

ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 16 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
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polyurethane binder based conforming to RDSO Specification No. M&C/PCN/100/2013 (Specification for Epoxy cum Polyurethane Painting System –Two packs for the Exterior Painting of Railway Coaches, Diesel and Electric Locomotives and other Industrial Applications) or ISO 12944.

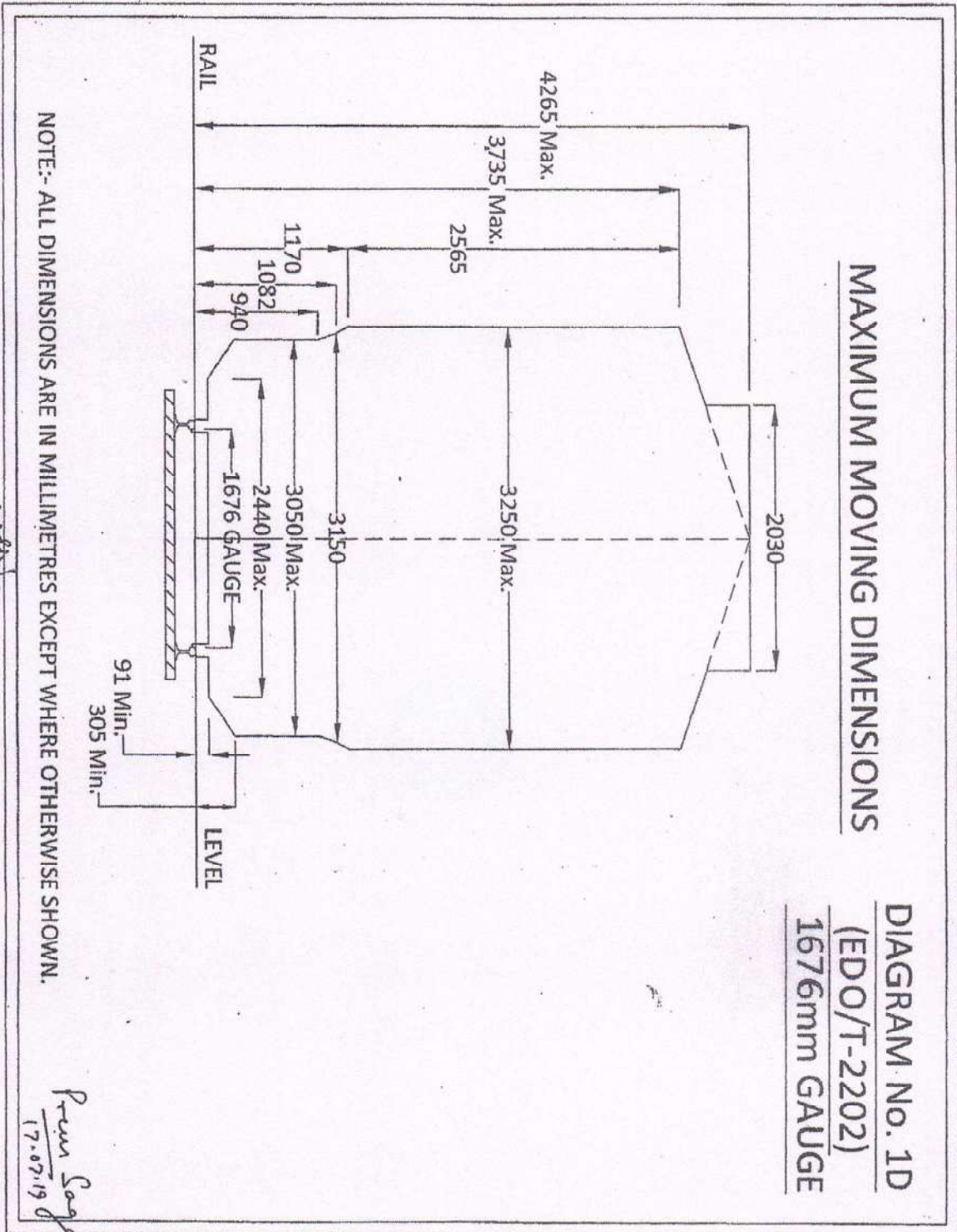
24.2 Following shall be written in black on the system at appropriate location in English & Hindi as per direction of Indian Railway official

- i) India Railways logo of height between 300 mm to 600 mm as suitable on all four faces of the system.
- ii) The text “ INDIAN RAILWAYS” shall be written in bold and in black colour of size equal to or slightly smaller than the size of logo but of size not less than 250 mm on both side faces and below the Indian Railways logo.
- iii) System model and manufacturing year shall be written in black colour and in letter of size less than the size in which Indian Railways is written but not less than 200 mm in any case below the text “INDIAN RAILWAYS” mentioned above.
- iv) If required, the manufacturers name may be written in size not more than 150 mm and shall not be at more than four locations. Also the manufacturer’s logo may be provided at not more than two locations and shall be of size less than 200 mm.

\*\*\*\*\*



# Annexure-I



*guy*

ISO9001:2015	Ref: QO-D-8.1-1 Ver. 1.1	Page 18 of 18	Date of issue: 25-July-2019	TM/HM/29/449 of 2018
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## Annexure-II

### INSPECTION CERTIFICATE

#### CERTIFICATE OF INSPECTION OF TRACK SYSTEM (.....)

BY INSPECTING OFFICIAL AND APPROVAL FOR DESPATCH OF SYSTEMS. (STRIKE OUT WHICHEVER NOT APPLICABLE)

This is to certify that I have inspected the system (type) \_\_\_\_\_ bearing Sl. No. \_\_\_\_\_ from (date) \_\_\_\_\_ to \_\_\_\_\_ at (Place) \_\_\_\_\_ for its conformity/non-conformity with respect to the laid down technical Specifications in contract agreement No. \_\_\_\_\_ dated \_\_\_\_\_ between President of India through Director Track (Systems) and M/s. (Name of Supplier) \_\_\_\_\_. The detailed inspection note regarding its conformity/non-conformity to the laid specifications is enclosed along with this certificate. It is observed that (strike out whichever is not applicable):-

- The System conforms to all the laid down specifications.
- The system conforms to all the laid down specifications except those at Sl. No. \_\_\_\_\_.
- The above deviations are minor/major affecting/not affecting the performance of the equipment in substantial way.

The following T and P/manuals/drawings are to be supplied along with the system:

1. \_\_\_\_\_
2. \_\_\_\_\_
3. \_\_\_\_\_

Based on the above, the System is certified/not certified to be conforming to the specification.

The system is approved/not approved for dispatch to \_\_\_\_\_ (Consignee) Indian Railways.

For M/s. \_\_\_\_\_  
\_\_\_\_\_

SIGNATURE AND DATE  
INSPECTING OFFICIAL  
(NAME AND DESIGNATION)  
for and on Behalf of President of India



**ANNEXURE 4**  
**TO**  
**PART 2, SUPPLY REQUIREMENTS**  
**Railway Board Letter No 2019/Track I(P)/1175HT rail/Vol.1**  
**dated 18.08.2023**

**GUIDELINES REGARDING ADOPTION OF R350HT GRADE**  
**RAILS ON IR.**



भारतसरकार/GOVERNMENT OF INDIA  
रेलमंत्रालय/MINISTRY OF RAILWAYS  
(रेलवेबोर्ड) (RAILWAY BOARD)



सं/No. 2019/Track-I(P)/1175HT Rails/Vol.I

दिनांक/Date: 14.08.2023

**As per mailing list**

**विषय/Sub: Guidelines regarding adoption of R350HT grade rails on IR.**

**संदर्भ/Ref:** RDSO's letter No. CT/Rail Handling dated 09.02.2023 (copy enclosed).

Indian Railway has taken a decision to improve the quality of rails and with significant indigenous efforts, R350HT grade rails have been developed. Their un-interrupted use is required on the Railways. Accordingly following Instructions are being issued regarding precaution to be taken during unloading, handling and advance preparation for laying of these rails for clarity and guidance of all concerned:


**1. Guidelines for R350HT Grade Rails:**

- i. 350HT rails having minimum Elongation is 9% are considered more brittle than R260 and 880 grade rails which needs more smooth and gentle handling, and unloading requirements in the field. Hence, handling and unloading of long rail panels of 350 HT rails requires more mechanised and improved system. Accordingly, Revised "Guideline for handling and stacking of rails (CT-35) February-2023" after incorporating R350HT grade rails has been issued vide RDSO's letter dated 09.02.2023.
- ii. R350HT grade rail of EN 13674-1, having UTS value of 1175MPa is already in extensive use over world Railways and considered as proven grade and hence no field trial is required. It is considered that separate trial of track components i.e. Turnouts, SEJs and Glued Joints manufactured with these rails would not be required (except Thick Web Switches (TWS) for which the provisions contained in "Policy on Domestic Rail Plants for Asymmetrical Rails of Different Grades, No. CT/Policy/02 dated 28.01.2022" shall be followed **Annexure-A**). Manufacture of these components would be done using R350 grade rails, following the same drawings and specifications as is being done for 880/R260 grade rails. Therefore, this grade rail is included in IRS-T-12:2009. However, since this grade rails will be manufactured by Domestic rail manufacturer and will be used for the first time on IR, therefore, rails shall be kept under close monitoring for any unusual behaviour, if any, for a stipulated period as per provisions of "Policy on Domestic Rail Plants for Symmetrical Rails of different grades (No. CT Policy/01, Revised March 2023)" issued vide RDSO's letter dated 21.03.2023 (**Annexure-B**).

**2. Development of Venders for AT welding and FB welding of 60 Kg/60E1 R350HT grade Rails**

**A. AT welding of R350HT grade Rails:**

1. AT welding technique for 60 Kg/60E1 R350HT grade rails has been developed and two vendors (M/s The India Thermit Corporation, Kanpur and M/s Chakradhar Industries LLP, Mumbai) have been provisionally approved and included in the vendor list of

  
14.8.23

RDSO vendors for developmental orders. Firms will carry out the field trial of above technique in their first order, after availability of rails in field.

2. In addition to above, two more firms (M/s ORA IPL, Kanpur and M/s Oberoi Thermit Pvt. Ltd., Haridwar) have also been conditionally approved and included in the vendor list of RDSO vendors for developmental orders. These two firms are also eligible for participation in the tenders.

**B. Combination AT welding of 60 Kg/60E1 R350HT & 60 Kg/60E1R260 grade Rails**

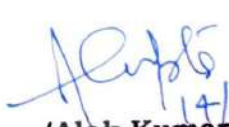
1. Combination A.T. welding technique for 60 Kg/60E1 R350HT grade rails with 60Kg/60E1 R260 is also developed and one vendor (M/s Chakradhar Industries LLP, Mumbai) has been provisionally approved and included in the vendor list of RDSO vendors for developmental orders.
  2. In addition to above, one more firm (M/s Oberoi Thermit Pvt. Ltd., Haridwar) have been conditionally approved and included in the vendor list of RDSO vendors for developmental orders.
- C.** Development of more vendors is in the pipeline and Railways may obtain latest details in this regard from RDSO website <https://rdso.indianrailways.gov.in> and may consult ED/Track-I RDSO.

**D. FB welding of R350HT grade Rails:**

1. In case of stationary FB welding plants, FB welding can be developed as per requirement by Zonal Railways. For this "Revised Protocol for Development of FB Welding for 1175HT Grade Rails (re-designated as R350HT) dated 28.07.2022" (**Annexure-C**) shall be adhered to.
2. For in-situ FB welding by MFBWPs, FB welding will be developed in due course after availability of Rails in field.

This issues with the approval of AM/CE, Railway Board.

DA: As Above

  
(Alok Kumar)  
Executive Director/Track (P&P)  
Railway Board  
Phone: 011-23304852  
E-mail: [alokkumar.g@gov.in](mailto:alokkumar.g@gov.in)  
2<sup>nd</sup> Floor, Room No. 256-D,  
Rail Bhawan, Raisina Road,  
New Delhi -110001.

**Mailing list:**

1. **General Managers, All Indian Railways & Production Units.**
2. **General Manager (CON.), N.F. Railway, Guwahati.**
3. **General Manager/CORE, Allahabad.**

**Principal Chief Engineer(s)**

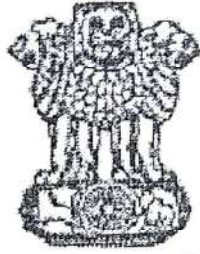
1. Central Railway, Mumbai CST-400 001
2. Eastern Railway, Fairlie Place, Kolkata-700 001
3. East Central Railway, Hajipur-844 101
4. East Coast Railway, Bhubaneswar - 751016
5. Northern Railway, Baroda House, New Delhi - 110 001
6. North Central Railway, Allahabad-211 001
7. N.E. Railway, Gorakhpur-273 012
8. N.F. Railway, Malegaon, Guwahati-781 011
9. North Western Railway, Jaipur-302 001
10. Southern Railway, Park Town, Chennai-600 003
11. South Central Railway, Rail Nilayam, Secunderabad-500 371
12. South Eastern Railway, Garden Reach, Kolkata - 700 043
13. South East Central Railway, Bilaspur - 495 004
14. South Western Railway, Hubli-589 020
15. Western Railway, Churchgate, Mumbai- 400 020
16. West Central Railway, Jabalpur - 482 001
17. Metro Railway, Metro Bhawan, Kolkata-700 071

**The Chief Administrative Officer (Construction)**

1. Central Railway, Mumbai CST-400 001
2. Eastern Railway, Fairlie Place, Kolkata-700 001
3. East Central Railway, Hajipur-844 101
4. East Coast Railway, Bhubaneswar - 751016
5. Northern Railway, Baroda House, New Delhi - 110 001
6. North Central Railway, Allahabad-211 001
7. N.E. Railway, Gorakhpur-273 012
8. N.F. Railway, Malegaon, Guwahati-781 011
9. North Western Railway, Jaipur-302 001
10. Southern Railway, Park Town, Chennai-600 003
11. South Central Railway, Rail Nilayam, Secunderabad-500 371
12. South Eastern Railway, Garden Reach, Kolkata - 700 043
13. South East Central Railway, Bilaspur - 495 004
14. South Western Railway, Hubli-589 020
15. Western Railway, Churchgate, Mumbai- 400 020
16. West Central Railway, Jabalpur - 482 001
17. CAO, COFMOW, Tilak Bridge, New Delh

**18. All CMDs/MDs of Indian Railway PSUs and SPVs****Copy to**

1. Director General, RDSO, Manak Nagar, Lucknow
2. Director General, NAIR, Vadodara
3. Director General, IRICEN, Pune-411 001
4. Director, IRIEN, PB No 233, Nasik Road -422101
5. Director, IRISSET, Taa Naka Road, Lalla Guda, Secunderabad-500017
6. Director, IRIMEE, Jamalpur-811214
7. Director, IRITM, Sarswati Residential Estate, IRITM Campus, Manak Nagar Lucknow



सत्यमेव जयते

भारत सरकार

रेल मंत्रालय

GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS

**POLICY ON DOMESTIC RAIL PLANTS FOR ASYMMETRICAL  
RAILS OF DIFFERENT GRADES**

No. CT/Policy/02  
(28.01.2022)

Issued by

**TRACK DESIGN DIRECTORATE**

अनुसंधान अभिकल्प एवं मानक संगठन लखनऊ- 11  
Research, Designs and Standards Organisation, Lucknow-11

**अअमा सं RDS**  
रेल अग्रदूत Transforming Railways  
[www.rdsso.gov.in](http://www.rdsso.gov.in)

**POLICY ON DOMESTIC RAIL PLANTS**  
**FOR ASYMMETRICAL RAILS OF DIFFERENT GRADES**

Policy for Asymmetrical rails of the following grades manufactured by domestic manufacturers to be used for manufacture of Thick Web Switches on IR and other rail networks in India is as under-

**I. Rail grade 880/ R260/1080HH/1175HT**

**A. New Rail Plant**

Vendor of a domestic rail plant which is not yet approved for any of these rail grades for symmetrical rail, would not be eligible for supply of asymmetrical rail. They have to first get approval for symmetrical rail of any of these grades as per Policy no. CT/Policy/01 (24.01.2022) for symmetrical rail for New Rail Plant. Subsequent to the vendor getting Approved status for symmetrical rail for a New Rail Plant for one of these rail grades, approval for asymmetrical rail would be considered following the provisions for Existing Rail Plant, as stipulated below.

**B. Existing Rail Plant**

- i. Rail grades for which the vendor has already got the Approved status for symmetrical rail- Following direction from Railway Board, Technical assessment of rail manufacturing capability for the same rail grade for asymmetrical rail would be carried out by RDSO (Track and M&C) as per extant RDSO Specifications and Guidelines. Consequent to satisfactory Technical assessment by RDSO, the vendor would be considered as Approved for manufacture of asymmetrical rail of the concerned grade, with approval of Railway Board.
- ii. Rail grades for which the vendor has already got the Provisionally Approved status for symmetrical rail- Following direction from Railway Board, Technical assessment of rail manufacturing capability for the same rail grade for asymmetrical rail would be carried out by RDSO (Track and M&C) as per extant RDSO Specifications and Guidelines. Consequent to satisfactory technical assessment by RDSO, the vendor would be considered as Provisionally Approved for manufacture of asymmetrical rail of the concerned grade, with approval of Railway Board.
- iii. Considering above, any vendor either having 'Approved status' or having 'Provisionally Approved status' for manufacturing and supply of Symmetrical rail through RDSO as stated above, shall be considered eligible (Approved or Provisionally Approved category as the case may be) to manufacture & supply Thick Web Asymmetrical (TWA) rail of the concerned grade subject to fulfilment of the following additional conditions:

ADE/Track/RF	Director/Track-I	Director/Track-III	Page 1 of 5
Digitally signed by RAJESH KUMAR SRIVASTAVA Date: 2022.01.27 11:56:45 +05'30'	ALOK KUMAR Digitally signed by ALOK KUMAR Date: 2022.01.27 10:47:19 +05'30'	Digitally signed by RITU RAJ Date: 2022.01.27 18:35:25 +05'30'	

1. Any such vendor would be considered as an approved vendor in any of the above category, only if he takes the responsibility of supplying end forged Thick Web Asymmetrical (TWA) rails of 60E1A1 profile into 60E1 rail profile. This would ensure that the onus of end forging quality lies with the manufacturer of Thick Web Asymmetrical rails only. TWA rail manufacturer may get the end Forging of TWA rails either in-house or through any agency having facilities of End Forging of TWA rails into 60E1 rail profile conforming to Indian Railway specification for supply of End Forged TWA rail. The inspection of TWA rails and its End Forging shall be done as stipulated in the Inspection Regime circulated by Railway Board vide letter dated 21.10.2016 and 25.05.2018.
2. The performance of end-forged thick web asymmetrical rails shall be required to be judged in the field conditions. For this purpose, 25 sets of Thick Web Switches manufactured from these end forged Thick Web Asymmetrical rails shall initially be laid on trial. Zonal Railways in association with RDSO would monitor the field performance of these thick web switches for a period of minimum 6 months on the standard proforma enclosed as Annexure.
3. Both type of vendors (whether an "Approved" or a "Provisionally approved") will be considered eligible for bulk order quantity. However, the supplies from a "Provisionally approved vendor" shall be regulated in such a manner that initial 25 sets of TWS are supplied first and their performance is certified and proven in the field as per RDSO instructions and annexure provided in this regard.
- iv. Field performance of Thick Web Switches manufactured from asymmetric rail of Provisionally Approved vendor would be assessed as per protocol at **Annexure**. Zonal Railways/other domestic rail network would closely monitor the field performance of Thick Web Switch. In case any adverse performance is reported relating to asymmetrical rail, matter would be referred to Railway Board for decision on further supply.
- v. Change in status of the vendor from Provisionally Approved to Approved for asymmetrical rail of the grade would be done based on a similar change of status for symmetrical rail of the grade and field performance report of thick web switches to be drawn by RDSO, with the approval of Railway Board.

## II. Special/ New grades

As Thick web switches of these rail grades are not envisaged at present, Policy would be framed as the need arises.

ADE/Track/RF	Director/Track-I	Director/Track-III	Page 2 of 5
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III. With the above, the policy for procurement of thick web asymmetrical rails described vide Railway Board's letter No. 2013/Track-I/16/2 dated 25.05.2018 shall stand modified and Para 3.0 of its Annexure-I, shall stand modified as under:-

"3.0 Asymmetrical rails of Zu-1-60 / 60E1A1 Rails profile shall be sourced from rail manufacturer(s):

(a) Who have supplied asymmetrical rails as per IRS:T-12/2009, during last 7 (seven) years and current year upto the date of tender opening, for use in Thick Web Switches on Indian Railways or KRCL or RVNL or any State/Central Government owned Metro Railways in India. Certificate from user Railway Network about satisfactory performance of asymmetrical rails supplied in this regard should be submitted by the tenderer.

OR

(b) If manufacturing facilities of Asymmetrical rails are not located in India, then rail manufacturer should have supplied 60 Kg rails in India as per IRS: T-12/2009 during last 7 (seven) years and current year upto the date of tender opening and these rails should have been used on Indian Railways or KRCL or RVNL or any State/Central Government owned Metro Railways in India; AND should have supplied asymmetrical rails, during last 7 (seven) years and current year upto the date of tender opening, for fabrication of thick web switches to/for passenger/mixed traffic carrying Railway networks in minimum 3 (three) countries and which should have been used on such railway networks. Certificates from the user Railway networks of these countries about satisfactory performance of Thick web Switches manufactured from these rails should be submitted by the tenderer.

OR

(c) Domestic asymmetric rail manufacturers qualified as eligible, (Provisionally approved vendor or Approved vendor both) in accordance with the policy as detailed in Para I. B. (iii) above."

The above generic policy pertains to approval of Domestic Rail Plants only. As far as the imports are concerned, the eligibility and all other norms shall continue to be governed by the extant policies in vogue.

ADE/Track/RF	Director/Track-I	Director/Track-III	Page 3 of 5
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Performance of Thick Web Switches (Using End Forged TWA rails manufactured by domestic manufacturer)

Location :- Section :- Point No. LH/RH T/O Initial Opening - Normal- Reverse -		GMT :- Straight/Curve :- Date of Installation :- Rail section :- Limit		Angle of crossing - 18.5/1 12 Type of sleepers -	
SN	Description	Left	Right	Remarks	
1.	Switch Assembly: (a) Condition of stock rail (b) Condition of tongue rail (c) Lateral & Vertical wear of stock rail (d) If SRJ is welded as per RDSO drg.	Good/Satisfactory/Poor Good/Satisfactory/Poor As per IRPWM Yes/No		As per IRPWM the limit of lateral and vertical wear is -8mm for 50kg	
2.	Condition of fittings of switch assembly (a) Slide chairs (b) Gauge tie plate (c) Nut bolts and spring washer	Good/Satisfactory/Poor Good/Satisfactory/Poor Good/Satisfactory/Poor			
3.	Tongue rail flange hole condition	Snug fit/Loose		To be tested by Std. Pin. If loose and creating problem, plan rail replacement	
4.	Indicate number of sleepers, up to which switch is housing properly.				
5.	Whether tongue rail resting on slide chairs, when set with stock rail?	Yes/No			
6.	Squareness of the a) Toe of switch b) Point machine sleeper	Within limit. (<10 mm.)			
7.	a) Gauge and cross level at the toe of switch in mm. at 150mm. from toe towards SRJ b) 5 <sup>th</sup> sleeper c) 9 <sup>th</sup> sleeper	As per IRPWM		As per Para 237 (1) (g) of IRPWM, the tolerances for gauge & cross level shall not be inferior to that applicable to the route. However, the cross level shall be as per Para 317 of IRPWM	

ADE/Track/RF		Director/Track-I		Director/Track-III	
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Page 4 of 5					

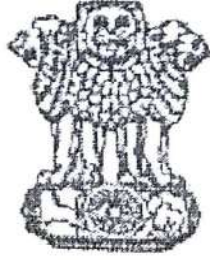
8.	<p><b>Switch setting device (SSD)</b></p> <p>a) Whether distance between gauge faces of stock rail at JOH is 1745±2mm for 60 Kg switch</p> <p>b) Whether open side clearance at JOH is 57mm or more?</p> <p>c) Insulation condition</p> <p>d) Squareness of arms, condition of base plate. Gap between bolt &amp; Stopper of SSD</p> <p>e) Tightness of nut bolts and other fittings</p> <p>f) Location &amp; position of SSD</p>	<p>Yes/No</p> <p>Yes/No</p> <p>Good/ Plan Rep/Imm. Rep</p> <p>Both arms shall be straight alignment</p> <p>Good/satisfactory/loose</p> <p>As per RDSO's drawing</p>	<p>The uncompressed spring length as per SSD drawing is 212.5mm. The compressed spring length should be such that it should create a gap of 60+2/60-3 mm on the open side at JOH location both in normal as well as reverse conditions.</p> <p>As per RDSO's drawing the location &amp; position of SSD is as follows:</p> <p><b>For 1:16</b> – Location of SSD is at sleeper number 14 and distance of hole for fixing of tongue mouth from centerline of sleeper no 14 is 192mm</p> <p><b>For 1:12</b> – Location of SSD is at sleeper number 13 and distance of hole for fixing of tongue mouth from center line of sleeper no 13 is 232mm</p> <p><b>For 1:8.5</b> – Location of SSD is at sleeper number 8 and distance of hole for fixing of tongue mouth from center line of sleeper no 8 is 213mm</p>		
9.	Other comments, if any				
10.	Overall performance				

Sign./ Name / date  
Railway official

NOTE:-1. The monitoring of trial shall be done for a period of minimum **six** months from the date of laying.  
2. The inspection of trial quantity shall be done initially at the time of laying TWS and then after three months interval.  
3. Prior to conducting trial, following shall be ensured by the trial conducting Zonal Railway at the trial locations:

- No missing/ displaced/ broken/ crushed fittings (Liners, ERC, Rubber Pad on sleepers, spring loaded key on slide chair, Cotter wedges of chair plates) are there for stock rail holding.
- Packing under the switch assembly is proper.
- Lubrication of slide chairs and assembly, beyond 3 sleepers from the toe of switch and of moving parts of SSD is proper.
- Point machine is free from any obstruction (dust, rust or any foreign material).

ADE/Track/RF	Director/Track-I	Director/Track-III	Page 5 of 5
Digitally signed by RAJESH KUMAR SRIVASTAVA Date: 2022.01.27 12:00:43 +05'30'	ALOK KUMAR Digitally signed by ALOK KUMAR Date: 2022.01.28 10:09:52 +05'30'	RITU RAJ Digitally signed by RITU RAJ Date: 2022.01.27 18:46:59 +05'30'	



सत्यमेव जयते

भारत सरकार  
रेल मंत्रालय  
GOVERNMENT OF INDIA  
MINISTRY OF RAILWAYS

**POLICY ON DOMESTIC RAIL PLANTS FOR  
SYMMETRICAL RAILS OF DIFFERENT GRADES**

No. CT/Policy/01  
(Revised March 2023)

Issued by  
TRACK DESIGN DIRECTORATE

अनुसंधान अभिकल्प एवं मानक संगठन लखनऊ. 11  
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**आ आमा सं RDS**  
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### Policy on Domestic Rail Plants For Symmetrical Rails of different grades

1. Grade of rails developed/ to be developed by different domestic manufacturers as per IRS-T-12-2009 can be divided into two categories as under:
  - i. **Category-I:** 880 grade, R260 grade, 1080HH grade & R350HT (previously known as 1175HT) grade as per IRS-T-12-2009 are considered in Category-I.
  - ii. **Category-II:** R260NC (previously known as 880NC) and any other grade rails as per IRS-T-12-2009 is considered in Category-II.
2. Policy to induct new grade of symmetrical profile of rails developed by domestic manufacturers to be used on IR and other rail networks in India is as under-

#### **A. Category- I**

##### **a) New Rail Plant**

- i. Vendor of a domestic rail plant which is not yet approved for any of the rail grades would communicate with Railway Board for approval of a particular rail grade. On the direction of Railway Board, RDSO (Track & M&C Dte) would conduct Technical assessment of rail manufacturing capability for that rail grade as per extant RDSO Specifications/Manuals and Guidelines. Welding plant for FB welding of the rail grade would also be assessed as per extant RDSO Specifications/Manuals and Guidelines. Approval of QAP would also be done by RDSO at this stage.
- ii. Based on satisfactory Technical assessment by RDSO, the manufacturer would be considered as New Vendor, with the approval of Railway Board, for supply of the particular grade of rail on any domestic rail network in India.
- iii. A "New Vendor" with a "New Rail plant" is technically eligible for full Rail quantity for that particular grade Rails in a domestic Rail tender as a regular vendor. However, field performance of the initially supplied quantity of 25000T would be assessed for up-gradation of the status of the vendor as described hereunder. Supply would be halted during the above assessment.
- iv. Performance of initially supplied quantity of 25000T rails would be assessed in the field on any domestic rail network of IR for up-gradation of the status of the vendor as per protocol at Annexure-A. In case any adverse performance is reported, matter would be referred to Railway Board for decision on further supply. Based on the satisfactory performance, RDSO would draw a report for change of status of the vendor for that particular rail plant from New Vendor to Approved Vendor for that particular rail grade, for decision by Railway Board.
- v. Subsequent to the vendor getting Approved status for a New rail plant for one of the rail grades, approval for other rail grades would be done following the provisions for Existing rail plant, as stipulated below.

**b) Existing Rail Plant**

- i. Vendor of a domestic rail plant which is already approved for any of the rail grades with IR would communicate with Railway Board for approval of another rail grade. On the direction of Railway Board, RDSO (Track & M&C Dte) would conduct Technical assessment of rail manufacturing capability for that rail grade as per extant RDSO Specifications/Manuals and Guidelines. Welding plant for FB welding of the rail grade would be assessed as per extant RDSO Specifications/Manuals and Guidelines. Approval of QAP would also be done by RDSO at this stage.
- ii. Based on satisfactory Technical assessment by RDSO, the manufacturer would be considered as Provisionally Approved Vendor, with the approval of Railway Board, for supply of the particular grade of rail on any domestic rail network in India.
- iii. A "Provisionally Approved Vendor" with an "Existing Rail plant" is technically eligible for full Rail quantity in case of Category-I Rails in a domestic Rail tender.
- iv. Field performance of the initial supply of 10000T would be assessed for up-gradation of the status of the vendor and for any suggestion by RDSO. Supply would not be halted during the above assessment. Zonal Railways/other domestic rail network would closely monitor the field performance of rails as per Annexure-B. Based on the satisfactory field performance, RDSO would draw a report for change of status of the vendor for that particular rail plant from Provisionally Approved Vendor to Approved vendor for the particular grade of rail, for decision by Railway Board.

**B. Category- II**

Vendor of a domestic rail plant would communicate with Railway Board for approval of a particular rail grade. On the direction of Railway Board, RDSO (Track & M&C Dte) would frame separate trial protocol for lab and field testing. FB and AT weldability is also to be ensured by the rail manufacturer. These rails are to be laid as per protocol to be approved by Railway Board. RDSO (Track & M&C Dte) and Zonal Railways would closely monitor the performance of rails as per the protocol.

Based on the performance of trial, RDSO would draw a report for further decision of Railway Board.

**Annexure-A**

- i. Rails of a New rail plant shall be laid in identified long stretches having maximum permissible speed of 110KMPH or more to facilitate close monitoring of its performance for 25 GMT or one year, whichever is earlier.
- ii. Relaxation in frequency provided during test free/reduced frequency period will not be applicable for USFD Testing. USFD testing is to be carried out as per the normal frequency prescribed in USFD Manual, as applicable after test free/reduced frequency period.
- iii. No painting or any other such treatment shall be done as these rails are under performance monitoring.
- iv. Proper record of defects and performance of rail and weld shall be maintained as per the proforma attached i.e. Annexure-I, II.
- v. Details of measurement regarding wear and corrosion shall be recorded every quarter jointly with the firm's representative. Railways shall procure rail profile measuring device if not available.
- vi. All rail withdrawals (fracture pieces and IMR) of rail/ weld will be subjected to analysis in M&C lab of RDSO. For analysis, detailed proforma as per Annexure-III & IV of USFD Manual shall be submitted.
- vii. During the regular trolley/foot inspections, Sr.DEN/DEN, ADEN, SSE (P.Way) In-charge and sectional SSE/JE (P. Way) will carry out careful visual inspection of the rails supplied against the initial quantity of 25000T and shall record any significant observations.
- viii. Any unusual observation in performance of such rails shall be reported by the Railway to RDSO.
- ix. RDSO would analyse the defects noticed during monitoring of rails and suggest improvement in the process of rail manufacturing, if required. Rail manufacturer shall implement the suggestions accordingly which would be further verified by RDSO. Technical assessment of rail manufacturing capability done earlier by RDSO shall be valid subject to implementation of the suggestions by the rail manufacturer. RDSO would decide, with the approval of Railway Board, whether Technical assessment of rail manufacturing capability is to be repeated.
- x. Frequency of Feedback to RDSO - Quarterly
- xi. Joint inspection with RDSO - Every six month
- xii. Period of performance monitoring - 25 GMT or one year, whichever is earlier

(To be reckoned from the date when 80% rail of initially supplied quantity of 25000T is laid in track)

**Annexure-B**

- i. The rails shall be laid in identified long stretches to facilitate close monitoring of its performance for 25 GMT or one year, whichever is earlier.
- ii. Relaxation in frequency provided during test free/reduced frequency period will not be applicable for USFD Testing. USFD testing is to be carried out as per the normal frequency prescribed in USFD Manual, as applicable after test free/reduced frequency period.
- iii. Proper record of defects and performance of rail and weld shall be maintained as per the proforma attached i.e. Annexure-I, II.
- iv. All rail withdrawals (fracture pieces and IMR) of rail/ weld will be subjected to analysis in M&C lab of RDSO. For analysis, detailed proforma as per Annexure-III & IV of USFD Manual would be submitted.
- v. During the regular trolley/foot inspections, Sr.DEN/DEN, ADEN, SSE (P.Way) In-charge and sectional SSE/JE (P.Way) will carry out careful visual inspection of the rails and shall record any significant observations.
- vi. Any unusual observation in performance of such rails shall be reported by the Railway to RDSO.
- vii. RDSO would analyse the defects noticed during monitoring of rails and suggest improvement in the process of rail manufacturing, if required. Rail manufacturer shall implement the suggestions accordingly which would be further verified by RDSO. Technical assessment of rail manufacturing capability done earlier by RDSO shall be valid subject to implementation of the suggestions by the rail manufacturer. RDSO would decide, with the approval of Railway Board, whether Technical assessment of rail manufacturing capability is to be repeated.
- viii. Frequency of Feedback to RDSO - Quarterly
- ix. Period of performance monitoring - 25 GMT or one year, whichever is earlier

(To be reckoned from date when the 80% of initial supply of 10000T is laid in track)

## WEAR AND CORROSION MEASUREMENT OF UIC 60/60E1 ..... GRADE RAILS

SSE (In charge)      ADEN:      Division:      Railway:      Date of inspection  
 Yard/Block Section      KM: From .... To .....      UP/DN/ Single Line      Annual GMT      Quarter 1<sup>st</sup> /2<sup>nd</sup> /3<sup>rd</sup> /4<sup>th</sup>

Name of manufacturer	Sl. No.	Measurement Location (Km/TP)	Laying date	GMT carried	Degree of curve/ Straight	Rolling mark	Observation						Remarks
							Wear (mm)		Corrosion (mm)				
							Lateral wear	Vertical wear	Depth of corrosion at liner seat	General Corrosion			
										Foot	Web		
												L	
	1												
	2												
	3												
	.												

**Note:** 1. Measurement Locations to be paint marked and numbered on rail for subsequent periodic measurements.

2. Measurement shall be taken on 2 consecutive sleepers.

3. On Straight, measurements to be taken every 500m and on curve at the start, centre and end of curve.

Signature of ADEN

Signature of SSE (In charge)

Annexure-II

USFD DEFECTS, GAUGE CORNER CRACKING DEFECTS AND SURFACE DEFECTS OF UIC 60/60E1 ..... GRADE RAILS

SSE (In charge)      ADEN:      Division:      Railway:      Date of inspection  
 Yard/Block Section      KM: From .... To .....      UP/DN/ Single Line      Annual GMT      Quarter 1<sup>st</sup>/2<sup>nd</sup>/3<sup>rd</sup>/4<sup>th</sup>

Name of manufacturer	USFD testing and defects						Details of Kidney Defect if any	Detail of fracture		Gauge Corner Cracking		Surface Defect		Remarks
	Date of testing	KM: From .... To	Location of USFD defect	Rolling mark	LH/RH	Defect position Head/Web/Foot		No. of Fracture	Fracture codes	No. of patches	Cumulative length	Location	Type of defect and remarks	

**Note:** 1. Data for USFD of rail and weld shall be given separately.  
 2. Detailed proforma to be enclosed as per USFD Manual for rail/weld fracture.

Signature of ADEN

Signature of SSE (In charge)

(Reference item 1 of MoM dated 18.07.2022  
and meeting dated 28.07.2022)

### Revised Protocol for Development of FB Welding for 1175HT Grade Rails

To decide the FB weldability of 1175HT grade rails, protocol as under shall be followed:

#### 1. Submission of ITR:

- 1.1. **Fixing of Welding Parameters:** Firm should decide provisional welding parameters for 1175HT grade rails by internal testing with the help of OEM.
- 1.2. By using provisionally fix welding parameters decided by the firm during internal test, 06 FB joints shall be made. All joints should meet the requirements of Para 5.6.4.1 to 5.6.4.6 of the Manual for Flash Butt Welding of Rails, Reprint 2022. Out of these, 3 joints shall be subjected for Transverse Testing as per Para 5.4.5 & 8.10.3 of BS EN 14587-1:2018 and remaining 3 joints for Macro Examination as mentioned in para 1.3 below. All joints shall pass the requirements. Provisions of Para 5.4.5 of BSEN (for TLT) are temporarily relaxed for expediting initial approval of stationary plant at rail manufacturing plant till installation/availability of higher capacity TLT machine is as under:

For initial procedure approval for a stationary welding plant, the test shall be continued until fracture occurs or be terminated when the force limit of the press is reached, provided that the bend test values have reached the values given in Table A.1 of BSEN 14587-1:2018. For the latter case, the weld shall be notched to ensure that fracture occurs in the welding zone, and the test weld shall be fractured. **This relaxation is only for six month from the date of initial approval of stationary plant at rail manufacturing plant i.e. BSP, Bhilai and JSPL, Raigarh.**

- 1.3. **Macro Examination:** Three welds in finished condition shall be sectioned for macro examination. For macro examinations a longitudinal vertical section shall be taken centrally down the vertical axis of full rail and extend 50mm each side of fusion line. Similar section shall be taken from both sides of the foot, 10mm in board of the foot tip. The sections shall be polished to a suitable finish using a minimum 220 grit paper. One full depth rail sample and associated rail foot samples shall be etched to show the weld boundary lines.

The etching agent shall be 5-10% Nitric Acid. Etching at room temperature shall be done for sufficient time, 20 minutes maximum, in order to show boundary lines clearly when examined. These welds shall conform to following requirements.

- a) The visible heat affected zone shall be of a nominally symmetrical shape about weld line and fall within the width of 40mm maximum and 20mm minimum. The permissible deviation between the maximum and minimum dimension of visible heat affected zone on any weld shall not exceed 10 mm. This requirement shall apply equally to vertical axis cut through full rail depth and those taken from each rail foot.
- b) There shall be no evidence of lack of bond, inclusion, cracks or shrinkage. Imperfections that cannot be positively identified by macro examination shall be inspected by micro examination.
- c) In case that flat spots are found, they shall be checked by micro examination at 100 X magnification. If any cracks are found, the process is rejected.

**1.4. Micro examination:** Following completion of macro examination, a micro examination shall be carried out on one of the three welds taken for macro examination having maximum HAZ. The micro sample 15mm high and 25mm wide (it includes 2mm on one side of fusion line and 23 mm on other side of fusion line) shall be drawn from the foot 3mm above rail foot bottom surface. The micro structure shall be free from martensite and bainite and grain size shall not be coarser than ASTM-4 at 100X magnification.

**1.5.** In case of failure of any joint on any test, welding parameters shall be re-fixed and process shall be repeated until result of all 06 joints found satisfactory.

**1.6. Fatigue test:** After satisfactory results of all 06 joints, 03 more FB joints shall be made on the same welding parameters and Fatigue test shall be conducted with the past-the-post test method on all three FB welds as per procedure mentioned at Para 5.4.9 of BS EN 14587-1:2018. All the three samples need to pass the Fatigue test. Frequency of Fatigue testing (not prescribed in EN code) shall be any frequency between 8.33 Hz to 12 Hz.

**Re-test:** If the result of Fatigue test of any sample failed to meet the requirements of the fatigue test, the process of re-setting of welding parameters and repetition of process shall be taken up.

**2. Standardization of welding parameters:** After development of FB weldability of 1175HT grade rails and before starting the commercial production, RDSO shall standardize the welding parameters by conducting the test as per procedure mentioned below:

- (i) Ten welds shall be made with the welding parameters given by the firm in ITR. All welds should pass in visual, dimensional & USFD test as per Para 5.6.4.1, 5.6.4.4 & 5.6.4.5 of FBW Manual-Reprint 2022.
- (ii) Out of ten welds, five welds shall be subjected to Transverse Load Test as per Para 5.4.5 & 8.10.3 of BSEN 14587-1:2018 and Para 1.2 of this protocol. Before conducting Transverse Load Test, Brinell hardness test shall be

conducted on the test weld samples as per Para 5.6.4.6 of FBW Manual, Reprint 2022.

- (iii) Remaining five welds shall be subjected to Macro examination as per procedure mentioned at Para 1.3 above. Following completion of macro examination, a micro examination shall be carried out on one of the five welds taken for macro examination having maximum HAZ as per procedure mentioned at Para 1.4 above.
- (iv) After passing all ten welds, Fatigue test on 03 FBW joints executed on the same welding parameters shall be carried out as per Para 5.4.9 of BS EN 14587-1:2018 at any frequency between 8.33 Hz to 12 Hz.
- (v) Welding parameters proposed by the firm in the ITR shall be standardized, if all three welds pass in Fatigue test. In case of failure of any joint on any test, welding parameters shall be re-fixed by the firm and process shall be repeated.

3. **Verification of Transverse Load Test of FB welds:** After installation/availability of higher capacity TLT machine verification of stationary plant at rail manufacturing plant for FB welding of 1175HT rails shall be done after conducting Transverse Load Test on five welds as per Para 5.4.5 of BSEN 14587-1:2018 on test welds executed with the same welding parameters. In case of any joint not meeting the requirements, FB welding of 1175HT rails will be stopped and corrective action shall be taken by the firm for re-standardization of welding parameters.

4. **Frequency of Sample Testing in production of FB welds of 1175HT Grade Rails:**

(a) **Hardness & Transverse Load Test:** 1 in 100 for first 1,000 joints welded by Flash Butt Welding Plant (both Stationary and Mobile plants) and subsequently at a frequency of 1 in 500 joints.

(b) **Macro & Micro Examination:** One test joint for every 1,000 joints welded by Flash Butt Welding Plant (both Stationary and Mobile plants) shall be subjected to Macro examination and micro examination.

5. Inspecting agency shall maintain the record of flash butt welding of 1175HT grade rails and shall share their test results with RDSO on monthly basis for further decision.

6. Any provisions not covered in this protocol shall be followed as per FBW Manual Reprint 2022.

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