



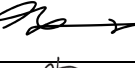

PRASA RAIL INFRASTRUCTURE: Perway Technical specification For Turnout/Crossings						 prasa <small>PASSENGER RAIL AGENCY OF SOUTH AFRICA</small>
File Ref	ENGINEERING_LIB#???-V1-Engineering_Services INFRASTRUCTURE PERWAY TECHNICAL SPECIFICATION FOR TURNOUTS/CROSSINGS			Last Edit Date	2023-05-03	
Creation Date	2022-08-02	Author		AM Vermeulen		PRASA Rail Engineering Services
Doc No. & Version	#160-V2	Chairperson of Technical Committee	Recommended	Vonani Rikhotso		
Volume & Edition	Vol. 1, 1st Addison	Executive Manager Engineering Services	Approver	Letsane Rathaba		

PRASA RAIL ENGINEERING SERVICES INFRASTRUCTURE


Technical Specification for Turnout (Switches and Crossings)

Last updated: 02 August 2022

Inter Business / Departmental Interphase Approvals of Procedure:


Name	Role	Responsibility (for this document)	Signature	Date of Approval
1. Fana Marutla	Chief Engineer Perway	Approved		04.05.2023
2. Lawrence Mthombeni	Principal engineer Perway	Recommended		03/05/2023
3. Vonani Rikhotso	Perway Specialist	Amendments		03/05/2023

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Standard Rail Specification

1 General

The standard rail sections will be 48 kg, 57kg, UIC 54 and UIC 60 in accordance with the South Africa Manual for Track Maintenance 2000, European Standard (EN 13674-1) and secondly UIC 860-0 / UIC 861-1, latest editions or equivalent standards.

All turnouts (Switches and crossings) will be in accordance with European Standard (EN 13232-1). The manual for track maintenance and the EN standard caters for existing and new turnouts respectively.

The South Africa Manual for Track Maintenance 2000, relevant UIC codes, equivalent EN standards, latest versions, must be applied for the inspection, acceptance, supply, delivery, storage, quality assurance and acceptance.

Turnout types:

- 60E1-173.6 -1:9(Single turnout)
- 60E1-300-1:12 (Single turnout)
- 60E1-600-1:20 (Single turnout)
- 60E1-904-1:20 (Single turnout)
- 60E1-2x1:9-4.8 (Scissors crossover)
- SAR48/51-178-1:9 (Single turnout)
- SAR48/51-320-1:12 (Single turnout)
- DS48/51-190-1:9 (Double slip)
- SS48/51-190-1:9 (Single slip)
- CR48/51-1:9 (Diamond crossing)
- CR60E1-2x1:9 (Diamond crossing)
- SCR48/51-2x1:9-4.8 (Scissors crossover)

Technical information

- Gauge: 1065 mm
- Radius: as per layout
- Turnout angel: as per layout
- Rail: UIC 60 E1 or SAR 48
- Rail inclination: 1 : 20 or 1 : 1 : ∞

Requirements and definitions of European standard EN 13232, part 1 to 7, Track – Switches and crossings-, must be fulfilled.

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PRASA Rail Engineering
Services

The life-time of turnouts based on gross tons passing along straight track, for SAR48 and 60E1 turnouts, shall be at least 600 MGT (million gross register tons).

2 Technical Description

2.1 Rail Grading

The standard rail must be manufactured in accordance with South Africa Manual for Track Maintenance 2000, EN 13674-1 or equivalent and to the following grade:-

<i>Type</i>	<i>Profile</i>	<i>Steel grade</i>	<i>Tensile Strength</i>	<i>Hardness Brinell</i>	<i>Trackwork Location</i>
48 kg	SAR 48	R350LHT	1175 N/mm ²	350 - 390	Cat. B and C Lines
57kg	SAR 57	R350LHT	1175 N/mm ²	350 - 390	Cat. B and C Lines
UIC 60	60 E 1	R350LHT	1175 N/mm ²	350 - 390	Main Lines
UIC 54	54 E 1	R350LHT	1175 N/mm ²	350 - 390	Transition zone from UIC 60E1 to SAR 48

The properties and chemical composition of the rail must be in accordance with EN 13674-1, latest edition or equivalent.

Stock rails and points blades used in turnouts shall be of R 350LHT quality in accordance with European or equivalent standards EN 13 674 -1 and EN 13 674-2 for Switch and crossing rails.

In different parts of the standard normal rails, point blades and stock rails are described. Turnouts shall be manufactured of 60E1 or 48/51kg/m rails in accordance with track diagrams and the drawings appended to these technical specifications. However, the cross section tolerance of 60E1 rail head is ± 0.5 mm.


Closure Rails and Rails of the crossing area of 60E1 1:9 turnouts shall be heat treated. The head hardness shall be in the range of 340...390 HB.

Brinell hardness test method for rails is specified in ISO 6506-1.

Closure Rails and Rails of the crossing area of longer 60 E1 turnouts and of 48/51 turnouts are not heat treated.

60E1A4 rails or alternatively 60E1A1 rails machined to 60E1A4 rails or alternatively 60E1A1 rails machined are used as a blade rail in 60E1 turnouts. 51kg/m rails shall be used as a blade rail in 48/51 turnouts.

The delivery must cover the entire rail material of the turnout; closure rails and rails of the crossing area have to be included in the delivery.

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2.2 Main Dimensions and Tolerances

The nominal dimensions of the section and ends must be within the following tolerances:

	<i>Dimension</i>				<i>Tolerances</i>
	<i>SAR 48</i>	<i>SAR 57</i>	<i>UIC 60 E1</i>	<i>UIC 54 E1</i>	
Height of Rail	150 mm	165 mm	172 mm	159 mm	± 0.5 mm ± 0.6 mm (UIC60)
Width of Rail Foot	127 mm	140 mm	150 mm	140 mm	± 1.0 mm
Nominal Width of Rail Head	68 mm	70 mm	72 mm	70 mm	± 0.5 mm
Asymmetry of Section					± 1.2 mm
Thickness of Web (at point of minimum thickness)					+ 1.0 mm - 0.5 mm
Inclination of fishing surface (on the basis of 14 mm parallel to the inclined theoretical fishing surface)					± 0.5 mm ± 0.6 mm (UIC60)


The rail ends must be cut to 90 degree of the rail longitudinal axis to permit welding without preparatory cuts.

The supply of rails to be accompanied by the provision of 3D models and editable drawings.

2.3 Existing Turnouts

Replacement of like for like existing turnouts should have the following characteristics:

- The turnouts are of secant design.
- The standard turnout designs are 1:9 and 1:12
- The weight of the rails can either be 48kg/m and 57kg/m are designed to carry a maximum axle load of 22t/xle.
- For 60 kg/m the axle load design is 26t.
- The entry and exit speed on the straight is 50km/hr.
- The entry and exist speed through the cross over is 30km/hr.
- The design should fit onto Universal concrete sleepers or are specially designed concrete sleepers.

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- No wooden sleepers are permitted.
- The turnout design must withstand a maximum lateral load of 8t.
- The turnouts are to be constructed to existing Transnet drawings. In absence of these drawings existing British standards or Arema standards shall apply.
- The frogs can either be rail manufactured, Rail bound Manganese Crossings, Manganese insert or Manganese monoblock .
- The fastening system can either be Infra bolts or e clip design
- The switches must be able to accommodate existing signalling systems.

2.4 New Type Turnouts

Replacement of old with new generation turnouts should have the following characteristics:

- The turnout is to be designed as per European Standards.
- The turnout is to be a Tangential design.
- The standard turnouts are 1:9, 1:12 and 1:20.
- The weight of the rail is to be 60kg/m.
- The maximum axle load to be carried is 32T.
- The entry and exit speed on the straight is 100km/hr
- The entry and exit speed on the turnout is to be 75km/hr.
- The turnout must be able to withstand a minimum lateral load of 8T.
- The turnout needs to be insulated.
- The minimum clamping force of the fastening system required is 25KN.
- Dedicated concrete sleepers are required. Hollow sleepers to accommodate signalling systems are preferable.
- The frog can be rail bound, rail manufactured or monoblock in design. Interchangeably is preferable.
- The switches must be able to accommodate existing signalling systems
- The design lifespan of the turnout should be B00MGT.
- Welding on the turnout should be kept to the minimum.
- Components for worn turnouts should be easily replaceable and readily available
- The tamping machine must be able to tamp this turnout.

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- The turnout designs must be able to be installed in exiting track layouts.
- The overall length for the turnouts are as follows
 - 1:9 total length 28,0 m max
 - 1:12 total length 33,9m max
 - 1:20 total length 46.0m max
- The turnout design should be flat. Alternate cant designs may be proposed.
- The turnout should be easy to maintain and worn components must be easily replaceable.

2.5 Layout and Design Process

The design of turnouts should be in accordance to EN 13 232-9 or equivalent standards.

At the end of the detailed component design of the Turnout layout, the contractor shall supply all the following information:

- Assembly documents;
- Detailed component plans
- Parts list for the layout.

The content of these documents is described at EN 13232-9, chapter 7.5.

Furthermore, the contractor shall deliver the following additional information:

- Maintenance documents;
- Handling documents;
- Detailed component plans;
- Part lists for component plans.

The results and all documents required by the above mentioned EN Standard of each design step will be subject of the engineer's approval.


The contractor shall submit to the engineer's approval a report indicating the specifications of the materials for use in switch manufacture, technical drawings and manufacturing project details pertaining to the switch designs. The engineer reserves the right of demanding modifications on the features provided in the said report. In such case, the contractor shall perform the said modifications on the project and resubmit it to the engineer for approval. The Contractor is not entitled to claim whatsoever resulting from such modifications.

2.6 Branding and Stamping

The rails will be marked in accordance with article 7.4 of EN 13674-1 and art. 1.3 of UIC Code 860 or equivalent.

Brandings must be provided on one side of the web and must include the following:

- ◆ The manufacturer's identification
- ◆ The last two digits of the year of manufacture

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- ◆ The symbol of the steel grade
- ◆ The symbol of the rail profile

In addition to the branding requirements each rail shall be identified by a numerical and/or alphabetical code system, at least every 10 m hot stamped on the non-branded side of the rail web.

3 Manufacture

The steel making process must comply with the procedure of the Manufacturer as accepted by major railway companies world wide.

The Manufacturer is required to substantiate the necessary details for submission. The process must be one of the following: liquid steel melt tapped out of converter (basic oxygen) or electric arc furnace and must comply with art. 7 of EN 13674-1 or equivalent.

The Manufacturer must describe in detail the process under which the rails are to be produced. The description must include:

- ◆ the source of rail steel,
- ◆ the steel making process,
- ◆ chemical composition of final rails,
- ◆ the procedure for straightening rails, and
- ◆ the quality control system for manufacture.

The manufacturer must provide a certificate of conformance to his specification.

4 Corrosion Protection Coating for Rails

Rails destined for the coastal areas will be induced to the highly corrosive costal environment. Therefore, it is required that corrosion resistant coating is applied to rails that are destined to be delivered at the coastal areas. This process will happen as part of the manufacturing process for rails.

5 Protection During Transport and Storage

Storage and transport must be arranged such that the rails are not mechanically damaged and not exposed to aggressive chemical influences.


Rails are not to be stored at port awaiting shipment.

Suitable commonly used protection methods against environmental damage must be proposed for approval.

The manufacturer has to present the Package and loading manual of turnouts and turnout parts prior to the start of the manufacturing process to the designed engineer for approval.

6 Acceptance Tests

The manufacturer must supply the necessary gauges of each rolling to be used for spot checks on site.

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Testing must be performed at the manufacturer's plant by independent qualified personnel which must be approved by the Purchaser. All major specification criteria must be tested and inspected to confirm compliance.

The frequency of testing must follow the respective standards of major railways, adjusted for smaller quantities. Test certificates must be delivered with the rails. No delivery may take place before acceptance by the Purchaser.

The testing and acceptance of the quality of the rails must include:

- ◆ chemical composition,
- ◆ tensile tests,
- ◆ hardness tests,
- ◆ ultrasonic testing for internal defects,
- ◆ surface tests, and
- ◆ dimension tests

in accordance with the South Africa Manual for Track Maintenance 2000 and art. 9 of European Standard Rails (EN 13 674-1) or equivalent.

The manufacturer shall produce an inspection report on all main parts of a turnout (switches, crossing and check rails) in accordance with the technical specifications and the relevant parts of the EN 13 232 or equivalent standards. A report of the required tests must be submitted to the PRASARAIL Quality Assurance Inspector prior to delivery. The report of the test results must be traceable to each batch manufactured.

Remark:

The manufacturer's quality assurance system has to be at least equivalent to the requirements of ISO 9001(latest edition). Qualifying tests must be carried out according to art. 8 of EN 13 674-1. The current certificate must be submitted.

7 Inspection and Dispatch

Representatives of PRASARAIL will be entitled to witness, at any time, the manufacturing process in all details; including all testing procedures (approval of the gauges of each rolling according Annexure "E" of EN 13674-1 or equivalent).


The manufacturer must give the inspector at least 15 days written notice of the date of rolling of the rails for this contract.

The inspector must stamp all rails accepted by him, at least 10% of each rolling out. No rails may be dispatched for use by PRASARAIL unless 10% of each lot carry his acceptance mark.

Final inspection will be performed at the delivery point.

8 Warranty

The manufacturer shall give a guarantee of three years on raw materials and work, starting at the beginning of the year following the delivery. Tongue rails and rails shall be guaranteed for five years according to UIC leaflet 860-V, 8th edition 1.7.1986, with amendments of 1.9.1988. Small parts (for example fastening devices) shall be guaranteed for five years.

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The manufacturer accepts the obligation to replace at own cost without delay faults due to raw material, work or manufacturing methods.

9 Turnout Drawings

19.1 Drawings to be used

Drawings to be used are presented as appendices to these technical specifications.

19.2 Drawings to be delivered

Before manufacture is started the contractor shall deliver to the purchaser two sets of complete **editable** drawings of the turnout parts designed, for inspection and approval. Scales: general layout 1:100, details: 1:50, 1:20 and 1:10, see also chapter two (2) of this specification.

After the approval the supplier shall deliver the drawings in electronic format and 3D Model (Micro CADAM Release 14/AutoCAD Release 13) and one set of plastic prints for files.

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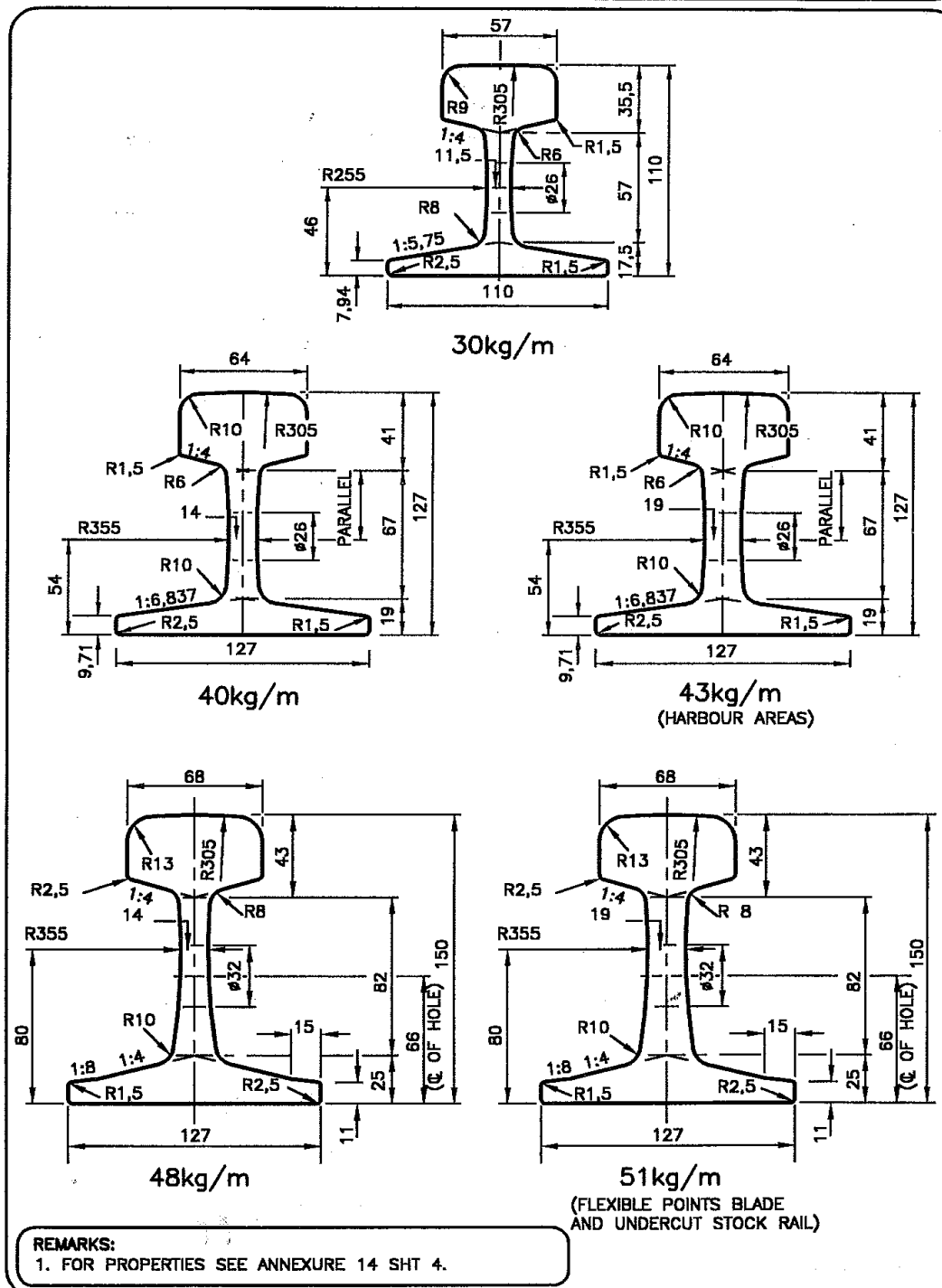


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10 Extract from the Track Manual

ANNEXURE 14
SHEET 1 of 4
AMENDMENT

RAIL PROFILES



BE 97-14 Sht 1 of 4. DATE : JUNE 2000

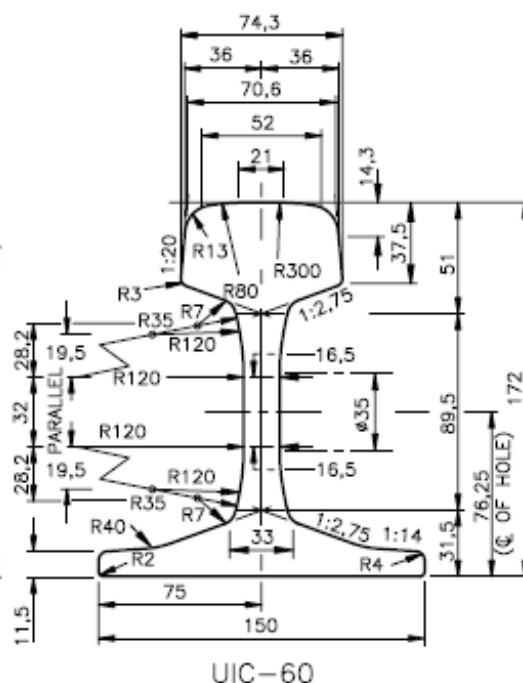
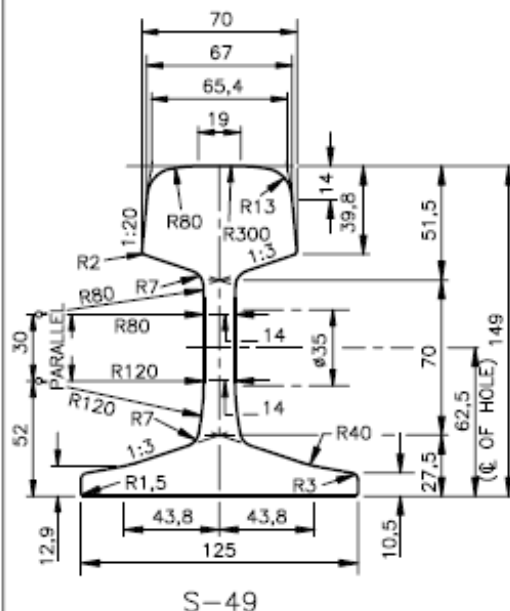
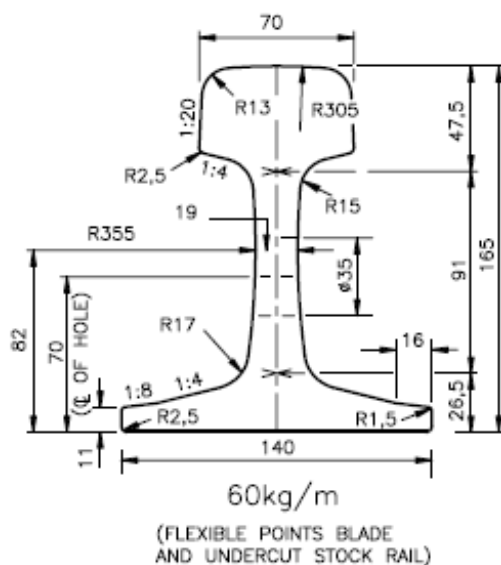
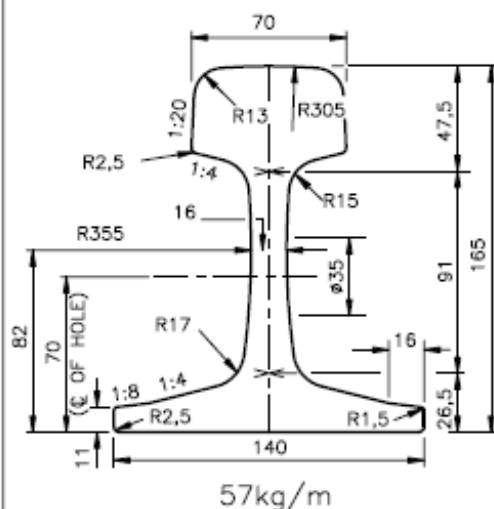
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ANNEXURE 14
SHEET 2 of 4
AMENDMENT

RAIL PROFILES



REMARKS:

1. FOR PROPERTIES SEE ANNEXURE 14 SHT 4.

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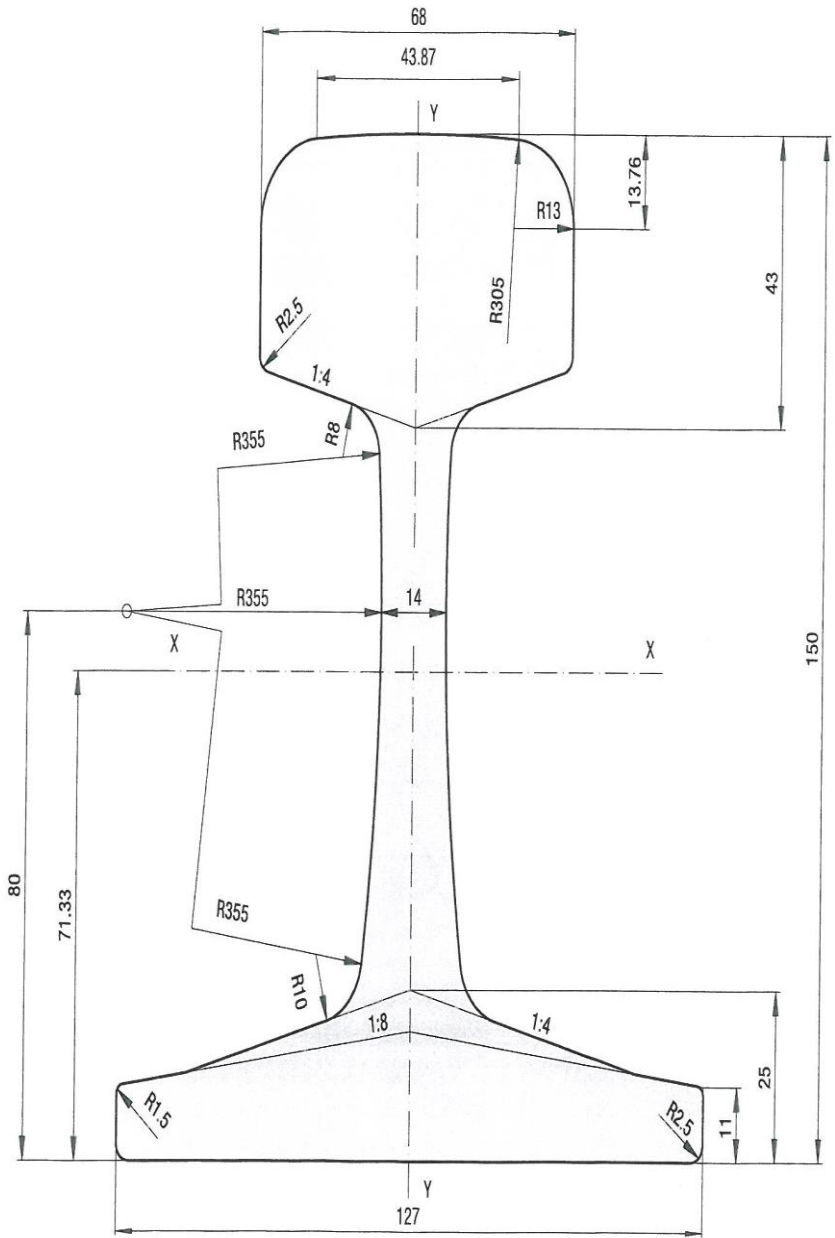
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11 Other Rail Profiles

SAR48

VIGNOLSCHIENEN, FLAT BOTTOM RAILS

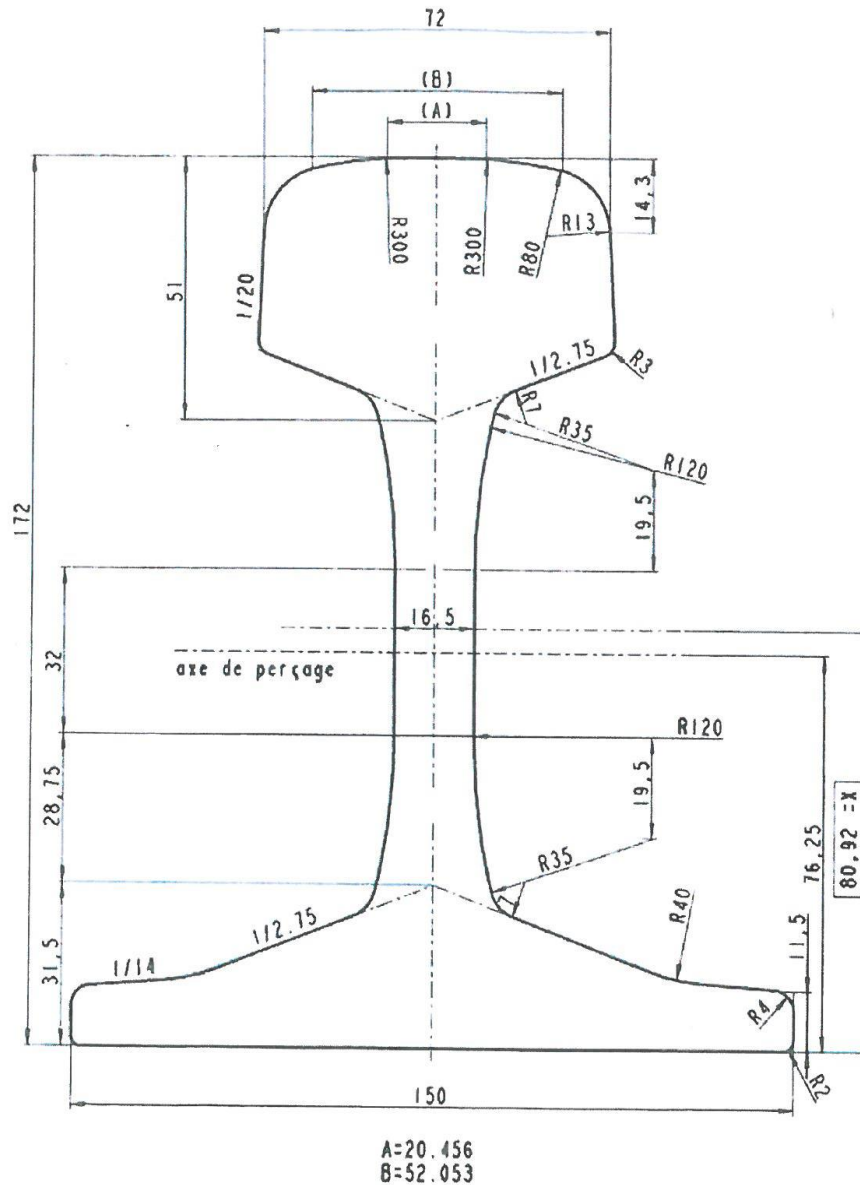


MASSE / MASS		48.07	kg/m	AUSGABE / EDITION	03.2004
FLÄCHE / AREA		61.24	cm ²	MASSSTAB / SCALE	1:1
TRÄGHEITSMOMENT / MOMENT OF INERTIA	X-X	1854.9	cm ⁴		
	Y-Y	322.5	cm ⁴		
WIDERSTANDSMOMENT / SECTION MODULUS	X-X Kopf / Head	260.0	cm ³		
	X-X Fuß / Base	235.8	cm ³		
	Y-Y Achse / Axis	50.8	cm ³		

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P = 60,21 kg/m	I _x = 3038 cm ⁴	I _x /v = 334 cm ³
S = 76,70 cm ²	I _y = 512 cm ⁴	I _y /u = 68 cm ³
EN: 60 EI	UC 60	6 420 201 5

