

J STEEL
ENGINEERING OUTCOMES



ArcelorMittal

ArcelorMittal Rails & Special Sections



Transport rail

Brochure and technical manual

Introduction

ArcelorMittal is the world's leading steel and mining company, with over 158.000 employees in more than 60 countries, and annual steel capacity production of 82.7 million tonnes.

ArcelorMittal is the leader in all major global steel markets, including automotive, construction, household appliances, packaging and rails, with leading R&D and technology, as well as sizeable captive supplies of raw materials and outstanding distribution networks. With an industrial presence in Europe, Asia, Africa and America, the Company covers all of the key steel markets, from emerging to mature.

With production sites in Gijón (Spain), Dabrowa Górnicza and Chorzów (Poland), Rodange (Luxembourg), ArcelorMittal is part of a small group of rail manufacturers whose production has developed notably in the specialised high-speed and heavy transport sectors.

ArcelorMittal has implemented and keeps updated a quality assurance system that complies with the requirements of the international standard ISO 9001, and is certified by AENOR, the Spanish Association for Standardisation and Certification, a member of IQNet, the international network of organisations for the evaluation and certification of quality systems. ArcelorMittal Poland and ArcelorMittal Rodange are both ISO 9001 certified.

Leadership

Rails are a steel product of a high complexity, both as regards its technical design and manufacturing process, and the ever greater demands made on them in their service conditions. Rails must be capable of responding satisfactorily to the increase in the loads hauled, increases in speed, a higher train frequency, a higher level of comfort (on passenger lines) and, above all, to railroad safety requirements.

Today, only a very small group of rail manufacturers combine long experience with a dynamic of continuous improvement to their facilities and processes. The factor that differentiates this select group of manufacturers from their competitors is their high technological level, which allows them to supply a rail of excellent quality, capable of meeting the present and future needs of the most demanding users.



R&D

In ArcelorMittal we are permanently committed to improving rail steel quality, production and new developments. The development of new materials starts with a design of new material, which includes both chemical composition and heat treatment, continues with the fabrication and testing of the prototypes and ends with real test track. To carry out such process, ArcelorMittal Global R&D designs and builds different equipment, such as for advanced testing and in-use properties control (twin-disk and real size Rolling Contact Fatigue Bench).

In addition, there is a pilot welding plant with: aluminothermic welding equipment, heat treatment furnaces and specific repair welding equipment, among others. The rail welding research line has extensive experience in finite element simulation of rail joining processes, which allows us to advance on specific procedures adapted to the new rail grades.

Once the rail is installed on track, a monitoring of the most relevant parameters is carried out. This monitoring of the performance may include hardness, wear, rolling contact fatigue or corrosion evolution.



Laboratory

The mechanical test laboratory carries out the mechanical and metallographic tests required to guarantee the quality of the final product.

The following stand out among the number of tests performed in these facilities:

- Tensile test at ambient temperature
- Hardness test (Brinell, Vickers and Rockwell)
- Impact / crash test
- Heat treatments (specimen ageing)

Analyses are also made of the chemical composition (of heat and/or product) together with metallographic analyses.

- Bauman prints
- Micrographs
- Macroetching
- Inclusions rate
- Decarburisation

ArcelorMittal performs the suitability tests required in the European standard EN 13674-1. Moreover, ArcelorMittal issues certificates of all its products in accordance with EN 10204, AREMA and others.

Development of new products

ArcelorMittal to continuously improve rail steel by harmonising the set of characteristics that determine the rails' performance on the track, such as hardness, dry wear resistance or fatigue resistance and weldability.

In this area, ArcelorMittal research and carrying out tests, requirements of the European standard, particularly:

- Oligocyclic fatigue test
- Fatigue crack growth test
- Fracture toughness test
- Weldability test
- Residual stress test

ArcelorMittal produces rails to the following standards: Euronorm (EN), ASCE standard, American Standard (AREMA), Australian standard (AS), British standard (BS), Russian standard (GOST), Indian standard (IRST), and to the particular specifications of its customers. ArcelorMittal is homologated in the main Railway Administrations.

Applications

The rails and track fittings manufactured by ArcelorMittal are not only supplied to the European market, but exported throughout the world for high speed tracks, heavy haul tracks, urban transport systems, etc.

The quality of the products developed by ArcelorMittal has earned us the full confidence of our customers, to whom we are able to offer the highest level of reliability to be found today on the market.

This is why our rails are used on both railway and urban underground lines in Europe, Asia, Africa, Oceania and America.



The experience, technology and guaranteed quality of the rails manufactured by ArcelorMittal allow us to offer:

- A variety of sizes from 40 kg/m to 80 kg/m.
- A wide range of steel grades to international standards or to the customers' own technical specifications, both for the construction of new tracks and for revamping existing ones.
- Possibility to manufacture any new type of rail (4,000 tonnes minimum)
- Rails with very strict dimensional tolerances for high speed tracks.
- One-piece rails up to 120 metres long.
- Long welded rails (up to 288 metres)
- Asymmetric rails.

Public and urban transport lines

This market is expanding rapidly throughout the world, due to urban growth and the saturation that it originates, in order to provide transport services for the population living in the outskirts and peripheral towns.

Urban systems have a high service frequency and face a difficult topography, with sharp curves and steep gradients, as well as short braking and acceleration distances.

ArcelorMittal supplies rails for underground systems and intercity railways in cities such as Madrid, Barcelona, Bilbao, Seville, Paris, Buenos Aires, Rio de Janeiro, Fortaleza, Brasilia, Caracas, Medellin, etc.

Heavy haul lines

These lines carry great quantities of ores, containers and other products. The traffic is usually characterised by trains with a high number of wagons and high load per axle.

Rails with high wear resistance and high fatigue failure resistance are required for these tracks.

High speed lines

It is a continuously growing market in Europe and in most industrialised countries with speeds over 350 km/h.

ArcelorMittal supplies rails that combine excellent reliability, geometrical precision, strict flatness tolerance and the highest quality on the market, for high speed lines in Spain, France, Germany, Portugal, Saudi Arabia, Turkey, etc.

Mixed-traffic systems

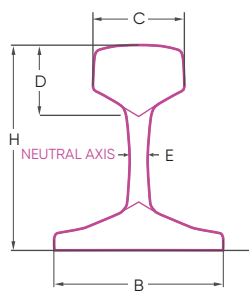
The operation of these systems involves a great variety of traffic conditions, different topographies and climates, frequently, in oneway routes and in a wide variety of densities.

Switches and crossovers

ArcelorMittal has joined the group of worldclass manufacturers of rails for switches through the production of switch bars of up to 108 m. (or 120 m.) from special asymmetric rails.

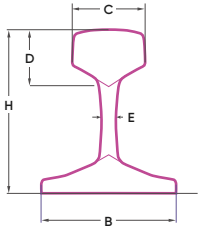


Flat Bottom Rails

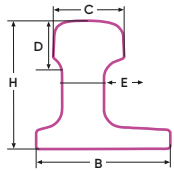


TYPE OF RAIL	STANDARD	DIMENSIONS (mm)					SECTION cm²	MASS /M kg/m
		H	B	C	D	E		
EUROPEAN STANDARDS								
39E1 (BS 80A)	EN 13674-4	133,35	117,47	63,50	42,47	13,10	50,66	39,77
45E1 (BS 90A)	EN 13674-4	142,88	127,00	66,67	46,04	13,89	57,46	45,11
45E3 (RN 45)	EN 13674-4	142,00	130,00	66,00	40,50	15,00	57,05	44,79
46E2 (U33)	EN 13674-1	145,00	134,00	62,00	47,00	15,00	58,94	46,27
MAV48	EN 13674-1	148,00	120,00	66,80	50,00	14,00	61,78	48,50
49E1 (S49)	EN 13674-1	149,00	125,00	67,00	51,50	14,00	62,92	49,39
49E5	EN 13674-1	149,00	125,00	67,00	51,50	14,00	62,59	49,13
50E2	EN 13674-1	151,00	140,00	72,00	44,00	15,00	63,65	49,97
50E3	EN 13674-1	155,00	133,00	70,00	48,00	14,00	63,71	50,02
50E6 (U50)	EN 13674-1	153,00	140,00	65,00	49,00	15,50	64,84	50,90
54E1 (UIC54)	EN 13674-1	159,00	140,00	70,00	49,40	16,00	69,77	54,77
54E2 (UIC54E)	EN 13674-1	161,00	125,00	67,00	51,40	16,00	68,56	53,82
54E3 (S54)	EN 13674-1	154,00	125,00	67,00	55,00	16,00	69,52	54,57
54E4	EN 13674-1	154,00	125,00	67,00	55,00	16,00	69,19	54,31
54E5	EN 13674-1	159,00	140,00	70,20	49,40	16,00	69,32	54,42
56E1	EN 13674-1	158,75	140,00	69,85	49,21	20,00	71,69	56,30
60E1 (UIC60)	EN 13674-1	172,00	150,00	72,00	51,00	16,50	76,70	60,21
60E2	EN 13674-1	172,00	150,00	72,00	51,00	16,50	76,48	60,03
AUSTRALIAN STANDARD								
AS60	AS 1085. 1	170,00	146,00	70,00	49,00	16,50	77,25	60,60
AS68	AS 1085. 1	185,70	152,40	74,60	49,20	17,50	86,02	67,50
RUSSIAN STANDARD								
R50 (P50)	GOST	152,00	132,00	72,00	42,00	16,00	65,99	51,80
R65 (P65)	GOST	180,00	150,00	75,00	45,00	18,00	82,65	64,88
AMERICAN STANDARD								
90ARA-A (TR45)	AREMA	142,90	130,20	65,10	37,30	14,30	56,90	44,65
100RE	AREMA	152,40	136,52	68,26	42,07	14,29	64,19	50,35
115RE (TR57)	AREMA	168,30	139,70	69,10	42,90	15,90	72,32	56,73
136RE (TR68)	AREMA	185,70	152,40	74,60	49,20	17,50	85,93	67,40

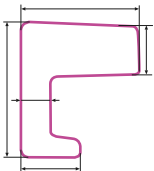
Switches and Crossing



TYPE OF RAIL	STANDARD	DIMENSIONS (mm)					SECTION cm ²	MASS /M kg/m
		H	B	C	D	E		
60 E1T2 (A74, UIC60A)	EN 13674-2	172,00	150,00	72,00	54,00	30,00	94,57	74,24

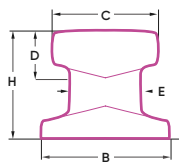


49E1A3 (I49)	EN 13674-2	116,00	145,00	66,80	53,50	40,00	80,49	63,18
54 E1A1 (A69, UIC54B, ZuUIC54B)	EN 13674-2	129,00	147,00	70,00	49,40	40,00	87,83	68,95
60 E1A1 (A73, UIC60B, Zu 1 60)	EN 13674-2	134,00	140,00	72,00	53,00	44,00	92,95	72,97
60 E1A4 (60D)	EN 13674-2	142,00	150,00	72,00	51,15	32,50	88,95	69,83
60 E1A6 (I60)	EN 13674-2	139,00	160,00	72,00	53,00	40,00	97,08	76,21



33 C1 (A69, UIC33, RL 1-60)	EN 13674-3	93,00	40,00	80,00	33,00	20,00	42,02	32,99
SBB Radlenker	EN 13674-3	104,00	40,00	80,00	45,00	20,00	51,66	40,56

Conductor rail



TYPE OF RAIL	STANDARD	DIMENSIONS (mm)					SECTION cm ²	MASS /M kg/m
		H	B	C	D	E		
STR	-	105,20	80,00	80,00	43,00	18,00	51,00	40,00
STR 74 (150 LBS MMC)	-	103,20	123,80	104,80	44,50	69,80	94,26	74,05

Chemical composition

STANDARD	STEEL GRADE	MECHANICAL PROPERTIES														MAX H ppm	MAX O ppm
		%C	%Mn	%Si	%P	%S	%Ni	%Mo	%Al	%Cr	%V	%N	%Cu	%Nb			
UIC 860-R	700	0,40 0,60	0,8 1,25	0,05 0,35	MAX 0,05	MAX 0,05	-	-	-	-	-	-	-	-	-	-	
	900A	0,60 0,80	0,8 1,3	0,1 0,5	MAX 0,04	MAX 0,04	-	-	-	-	-	-	-	-	-	-	
	900B	0,55 0,75	1,3 1,7	0,1 0,5	MAX 0,04	MAX 0,04	-	-	-	-	-	-	-	-	-	-	
EN 13674-1	R200	0,40 0,60	0,70 1,20	0,15 0,58	MAX 0,035	MAX 0,035	MAX 0,10	MAX 0,02	MAX 0,004	≤ 0,15	MAX 0,03	MAX 0,009	MAX 0,15	MAX 0,01	3,0	20	
	R260	0,62 0,80	0,70 1,20	0,15 0,58	MAX 0,025	MAX 0,025	MAX 0,10	MAX 0,02	MAX 0,004	≤ 0,15	MAX 0,03	MAX 0,009	MAX 0,15	MAX 0,01	2,5	20	
	R260 MN	0,55 0,75	1,30 1,70	0,15 0,60	MAX 0,025	MAX 0,025	MAX 0,10	MAX 0,02	MAX 0,004	≤ 0,15	MAX 0,03	MAX 0,009	MAX 0,15	MAX 0,01	2,5	20	
	R350 HT	0,72 0,80	0,70 1,20	0,15 0,58	MAX 0,02	MAX 0,025	MAX 0,10	MAX 0,02	MAX 0,004	≤ 0,15	MAX 0,03	MAX 0,009	MAX 0,15	MAX 0,04	2,5	20	
	R350 LHT	0,72 0,80	0,70 1,20	0,15 0,58	MAX 0,02	MAX 0,025	MAX 0,10	MAX 0,02	MAX 0,004	≤ 0,30	MAX 0,03	MAX 0,009	MAX 0,15	MAX 0,04	2,5	20	
EN 13674-2	R260	0,62 0,80	0,70 1,20	0,15 0,58	MAX 0,025	MAX 0,025	MAX 0,10	MAX 0,02	MAX 0,004	MAX 0,15	MAX 0,03	MAX 0,009	MAX 0,15	MAX 0,01	2,5	20	
	R350 HT	0,72 0,80	0,70 1,20	0,15 0,58	MAX 0,020	MAX 0,025	MAX 0,10	MAX 0,02	MAX 0,004	MAX 0,15	MAX 0,03	MAX 0,009	MAX 0,15	MAX 0,04	2,5	20	
	R350 LHT	0,72 0,80	0,70 1,20	0,15 0,58	MAX 0,020	MAX 0,025	MAX 0,10	MAX 0,02	MAX 0,004	MAX 0,30	MAX 0,03	MAX 0,009	MAX 0,15	MAX 0,04	2,5	20	
BS 11 1965	A	0,65 0,80	0,80 1,30	0,10 0,50	MAX 0,040	MAX 0,040	-	-	-	-	-	-	-	-	-	-	
	B	0,55 0,75	1,30 1,70	0,10 0,50	MAX 0,040	MAX 0,040	-	-	-	-	-	-	-	-	-	-	
AREMA	CARBON STANDARD	0,74	0,75	0,10	MAX	MAX	MAX	MAX	MAX	MAX	MAX	-	-	-	-	-	
	CARBON HIGH STRENGTH	0,86	1,25	0,60	0,020	0,020	0,25	0,06	0,01	0,30	0,01	-	-	-	-	-	
	LOW ALLOY INT. STRENGTH	0,72	0,70	0,10	MAX	MAX	MAX	MAX	MAX	0,40	MAX	-	-	-	-	-	
	LOW ALLOY HIGH STRENGTH	0,82	1,25	1,00	0,020	0,020	0,15	0,05	0,005	0,70	0,01	-	-	-	-	-	
AS 1085.1	ALL RAIL	0,65 0,82	0,70 1,25	0,15 0,58	MAX 0,025	MAX 0,025	MAX 0,10	MAX 0,02	MAX 0,005	MAX 0,15	MAX 0,03	MAX 0,01	MAX 0,15	MAX 0,010	2,5	35	
AM	MICROALLOYED	0,74 0,82	0,80 1,30	MAX 0,50	MAX 0,025	0,01 0,025	-	-	-	MAX 0,30	MAX 0,08	-	-	MAX 0,035	2,0	-	
	900ACRV	0,74 0,84	0,80 1,25	0,10 0,60	MAX 0,025	0,008 0,025	MAX 0,10	MAX 0,02	MAX 0,02	MAX 0,35	MAX 0,07	MAX 0,009	MAX 0,15	MAX 0,010	2,0	20	
	B1000	0,62 0,82	0,70 1,20	0,15 1,0	MAX 0,025	MAX 0,025	MAX 0,10	MAX 0,02	MAX 0,02	0,40 0,80	0,04 0,20	MAX 0,009	MAX 0,15	MAX 0,010	2,0	20	

Mechanical properties

STANDARD	STEEL GRADE	MECHANICAL PROPERTIES		
		RM M PA	MIN A5%	HB
UIC 860-R	700	680 830	14	-
	900A	880 1030	10	-
	900B	880 1030	10	-
EN 13674-1	R200	MIN 680	14	200-240
	R260	MIN 880	10	260-300
	R260 MN	MIN 880	10	260-300
	R350 HT	MIN 1175	9	350-390
	R350 LHT	MIN 1175	9	350-390
EN 13674-2	R260	MIN 880	10	260-300
	R350 HT	MIN 1175	9	350-390
	R350 LHT	MIN 1175	9	350-390
BS 11 1965	A	MIN 880	8	-
	B	MIN 880	8	-
AREMA	CARBON STANDARD CARBON HIGH STRENGTH	MIN 983 MIN 1179	10 10	MIN 310 STANDARD S. RAIL MIN 370 HIGH S. RAIL
	LOW ALLOY INT. STRENGTH LOW ALLOY HIGH STRENGTH	MIN 1014 MIN 1179	8 10	MIN 325 INTERMEDIATE S. RAIL MIN 370 HIGH S. RAIL
AS 1085.1	ALL RAIL	MIN 880	8	MIN 260
	MICROALLOYED	780 1130	9	MIN 340
AM	900ACRV	MIN 1040	9	320-360
	B1000	MIN 966	9	MIN 315
	900ACRV	MIN 1080	9	320-360

Achieving carbon neutral steel

ArcelorMittal Europe has committed to reduce CO2 emissions by 35 % by 2030, with a further ambition to be carbon neutral by 2050, in line with the EU's Green Deal and the Paris Agreement.

As the leading global steel company, we are engaged in the most important challenge faced by the industry: producing all the steel the world needs in an environmentally sustainable way.

XCarb™ is the new brand name for ArcelorMittal's ongoing global programme of steelmaking innovation targeted at carbon-neutral steel by 2050. The initiatives that are part of XCarb™ aim to reduce the carbon footprint of ArcelorMittal and of our customers.

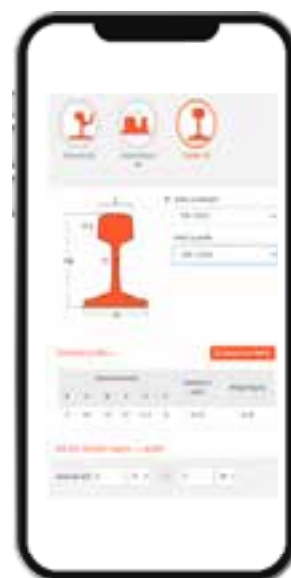
Our first XCarb™ products are now ready for market: XCarb™ green steel certificates and XCarb™ recycled and renewably produced for steel products made via the electric arc furnace route using scrap steel and 100% renewable energy.

Rail Tool app

Rail Tool App allows rail key players to:

- Get interactive information regarding standards and profiles for different rail product typology.
- Calculate rail length or tonnage for different types of railway projects (rail calculator available online and offline).
- Download the dimensional profile drawing.
- Search by category or profile name, enter one or more profile dimensions, such as height or rail foot and get the best results and difference with the search.
- Possibility of compare several profiles and their results.

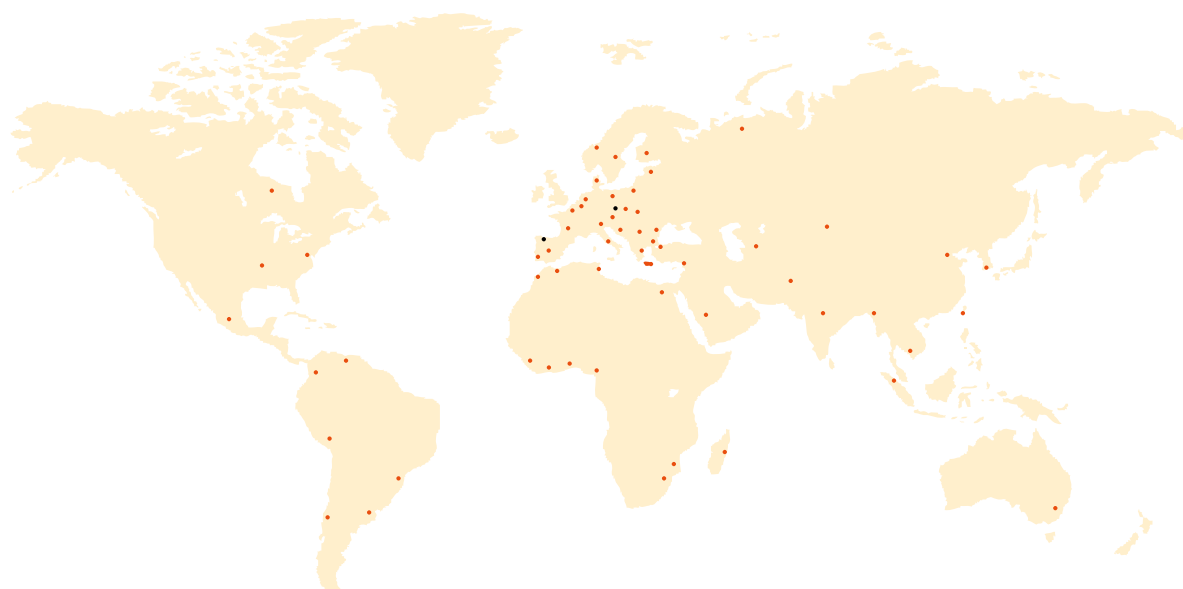
In addition, the tool is more intuitive and allows to visualize the dimensions over the desired profile.



rails.arcelormittal.com/rail-tool



References and global presence



Rails manufactured by ArcelorMittal are used worldwide, for high speed railways as well as for heavy hauls, urban transport, etc.

The quality of our products allows us to enjoy total trust from our customers, to whom we can offer the highest possible reliability in the present market.

This is the reason why our rails are present in railways as well as underground lines in Europe, Asia, Africa, Oceania and America.

AMERICA

Canada
USA
Chile
Colombia
Venezuela
Brazil
Mexico
Argentina
Peru
Uruguay
Bolivia
Ecuador
Dominican Republic

EUROPE

Spain
Belgium
Netherlands
Turkey
Denmark
France
Germany
Portugal
Greece
Finland
Serbia
Poland
Croatia
Latvia
Estonia
Lithuania

Czech Republic
Romania
Luxembourg
Sweden
Italy
Hungary
Slovakia
Bulgaria
Bosnia and Herzegovina
Belarus
Switzerland
Russia
Slovenia
Montenegro
United Kingdom

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Morocco
Tunisia
Egypt
Senegal
Madagascar
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Liberia
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Guinea

ASIA

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