

Data sheet: E3.1

Angles

Hot rolled, weldable structural steel sections

General description

ArcelorMittal Steel South Africa, Newcastle Steel produces an extensive range of structural steel angles. Non-standard sizes and steel specifications not covered by this data sheet may be considered on an enquiry basis.

The geometry of angle (equal leg) and angle (unequal leg) sections complies with ISO R 657/1: 1968 and ISO R 657/11: 1968 respectively with the exception of toe radius which is not guaranteed.

Steel for structural sections is normally produced to SANS 50025/BS EN 10025 grade S355JR.

For improved atmospheric corrosion resistance, COR-TEN[®] A should be used.

See data sheet: COR-TEN[®] (file reference E6.1)

For applications where mechanical properties of the steel are not important, angles (equal leg) in the size range 25 x 25 x 3 mm to 80 x 80 x 12 mm can be ordered in the "mild steel" grade (commercial quality).

The "South African Steel Construction Handbook" published by the South African Institute of Steel Construction should be consulted for section properties.

Quality assurance

Quality assurance systems based on the requirements of SANS ISO 9001: 2000 are in operation.

Protective coatings

When choosing a rust prevention method for a steel component or structure, many technical factors including the environment, stress during transport, storage, fitting or erection must be considered. Adequate preparation of the substrate is of vital importance to the ultimate success of the coating, as is the method of application. Paint, hot-dip galvanizing or duplex coatings (zinc plus paint) can be specified for corrosion protection, depending on the aggressiveness of the environment. Choice of the protective mechanism is considered to be the responsibility of the specifier, fabricator or end user.

Applications

Angle sections can be used for a wide range of structural elements, including lightweight purlins for industrial and other structures.

For further information, contact:

ArcelorMittal South Africa Limited, Newcastle Works, PO Box 2, Newcastle 2940. Tel (034) 314-8629 Fax (034) 314-8211
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Surface quality

Surface defects up to a maximum depth of 3% of the nominal thickness shall not be considered as a reason for rejection. Larger surface defects may be removed, providing the nominal thickness is not reduced by more than 7%.

Steel specifications (mechanical properties)

Specification	Code	Tensile Strength (MPa)	Yield Strength (MPa)	Elongation	Impact Test
SANS 50025/EN 10025: 1993 S355JO	101 008	490 - 630	355 min ≤ 16 mm 345 min > 16 mm	22% min on $5,65\sqrt{S_o}^{1)}$	27J at 0°C
ASTM A 36 - 93A	371 002	402 - 550	250 min	20% min	-
DIN17100 RST 37/2	171 001	340–470>2,5mm 360–500 ≤2,5mm	235 min ≤ 16 mm 225 min > 16 mm	26% min on $L_o = 5D_o$	
DIN 17100 RST 44/2	554 002	410 - 540	275 min ≤ 16 mm 265min>16≤40mm 255min>40≤60mm	22% on 3 - 40mm 21% on 41-60mm	27J at 20°C
DIN17100 RRST 52/3	474 008	490 - 630	355 min ≤ 16 mm 345 min > 16 mm	22% min on $L_o = 5D_o$	27J at 20°C
⊗ COR-TEN® A	124 001	480 min ≤12,7mm 315min 12,8-38mm	345 min	22% min ≤12,7mm 21% min 12,8-38mm	-
SANS 50025/EN 10025 S275JR	064 002	410-560 3-100mm 430-580 ≤2,5mm	275 min ≤ 16 mm 265min>16≤40mm 255min>40≤63mm 245min>63≤100mm	22% on 3-40mm 21% on 41-63mm 20% on 64-100mm	27J at 20°C
SANS 50025/EN 10025 S235JR	016 001	340 - 470	235 min ≤ 16 mm 225 min > 16mm	26% min on $L_o = 5D_o$	27J at 20°C
SANS 50025/EN 10025 S355JR	078 002	490 - 630	355 min ≤ 16 mm 345 min > 16mm	22% min on $L_o = 5D_o$	27J at 20°C
Commercial Quality	250 555	C,30x	with CE = 0,51max $CE=C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15$		

1 S_o = original cross-sectional area.

⊗ Non-standard qualities: available on enquiry only.

Weldability

The above mentioned structural steel specifications may be welded using any of the standard metal arc and resistance welding processes, usually without any special precautions. However, when welding heavy sections, BS 5135:1984 "Metal-arc welding of carbon and carbon manganese steels" should be consulted to determine preheat requirements at low heat inputs.

Steel grades

Note: The tables of steel grades are not intended to be lists of equivalent grades. They are merely lists of generically similar steel grades available in each geographic region.

Certification

Test and analysis certificates are supplied for all steel ordered to international specifications. The mechanical and chemical laboratories of ArcelorMittal Steel S A, Newcastle Steel are SANAS accredited facilities.

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Americas	European Community	Pacific Rim
3.1 structural steel		
3.1.1 Standard grades Lower strength (for workability and weldability)		
	EN 10 025 S235JR	
	DIN 17100 RST 37-2	
Normal strength (for general use)		
ASTM A 36 - 93A	EN 10 025 S275JR	JIS G 3101 SS400
	DIN 17100 RST 44-2	
Higher strength micro-alloyed steel		
ASTM A 572 Gr 50	EN 10 025 S355JR/JO	
	DIN 17100 RRSt 52-3	
	BS 4360: 1986 Gr 50B/C	
3.1.2 Weathering steel - for improved atmospheric corrosion resistance		
Available on enquiry		

**Steel specifications to chemical analysis
(mechanical properties as per international specifications)**

Specification	Code	C	Mn	P	S	Si	Al
Commercial Quality *	250 555	0,30	-	-	-	-	-
BS 4360/1986 Gr 50B	475 002	0,20	1,50	0,04	0,045	0,4	-
BS 4360/1986 Gr 50C	859 008	0,18	1,50	0,035	0,035	0,50	0,02/0,06
SANS 50025/EN 10025/ 1993 S275JR	064 002	0,21	1,50	0,03	0,045-	-	-
SANS 50025/EN 10025/ 1993 S235JR	016 001	0,17	1,40	0,03	0,045-	-	-
SANS 50025/EN 10025/ 1993 S235JRG2	090 001	0,17	1,40	0,03	0,045-	-	-
SANS 50025/EN 10025/ 1993 S355JR	078 002	0,20	1,50	0,04	0,045	0,4	-
DIN 17100/1980 RST 37/2	171 001	0,17	1,40	0,03	0,045-	-	-
DIN 17100/1980 RST 44/2	554 002	0,21	1,50	0,03	0,045-	-	-
DIN 17100/1980 RRST 52/3	474 008	0,18	1,50	0,035	0,035	0,50	0,02/0,06
ASTM A36-93A	371 002	0,22	1,50	0,03	0,04	0,35	-
ASTM A572-93 Gr50	772 002	0,20	1,50	0,04	0,045	0,4	-

* Supplied to chemical analyses only.

Angles (equal leg)

Dimensions and properties									
Designation	Nominal mass	Typical radius	Sectional area	Distance of centre of gravity				Paint area	
				C _x	C _y	C _v	e _v	m ² /m length	m ² /ton
A x A x t Mm	kg/m	root mm	10 ³ mm ²	mm	mm	mm	mm		
25 x 25 x 2,0	0,775	3,5	0,099	6,9	6,9	9,7	9,2	0,097	125,2
25 x 25 x 2,5	0,953	3,5	0,124	7,0	7,0	9,9	8,7	0,097	103,2
25 x 25 x 3	1,114	3,5	0,142	7,2	7,2	10,2	8,8	0,097	87,4
25 x 25 x 4,5	1,614	3,5	0,205	7,4	7,4	11,0		0,097	59,9
25 x 25 x 5	1,773	3,5	0,226	8,0	8,0	11,3	9,1	0,097	54,8
30 x 30 x 2,0	0,953	3,5	0,121	8,1	8,1	11,5	10,5	0,116	121,7
30 x 30 x 2,5	1,171	3,5	0,146	8,1	8,1	11,5	10,5	0,116	100,9
30 x 30 x 3	1,363	3,5	0,174	8,4	8,4	11,8	10,5	0,116	85,3
30 x 30 x 5	2,180	3,5	0,278	9,2	9,2	13,0	10,7	0,116	53,2

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40 x 40 x 2,0	1,285	3,5	0,159	10,	10,6	15,0	14,7	0,155	124,4
40 x 40 x 2,5	1,582	3,5	0,988	10,5	10,5	14,9	14,1	0,155	98,7
40 x 40 x 3	1,845	3,5	0,235	10,7	10,7	15,2	14,0	0,155	84,2
40 x 40 x 4	2,417	3,5	0,308	11,2	11,2	15,8	-	0,155	64,3
40 x 40 x 5	2,974	3,5	0,379	11,6	11,6	16,4	14,1	0,155	52,2
40 x 40 x 6	3,516	3,5	0,448	12,0	12,0	17,0	14,3	0,155	44,0
45 x 45 x 3	2,131	3,5	0,266	11,8	11,8	16,7	15,7	0,174	83,3
45 x 45 x 4	2,742	3,5	0,349	12,3	12,3	17,5	-	0,174	63,5
45 x 45 x 5	3,378	3,5	0,430	12,8	12,8	18,1	15,8	0,174	51,5
50 x 50 x 3	2,367	7	0,296	13,1	13,1	18,5	17,5	0,194	85,1
50 x 50 x 4	3,056	7	0,389	13,6	13,6	19,2	17,6	0,194	63,0
50 x 50 x 5	3,770	7	0,480	14,0	14,0	19,9	17,6	0,194	51,5
50 x 50 x 6	4,469	7	0,569	14,4	14,4	20,4	17,7	0,194	43,4
50 x 50 x 8	5,819	7	0,741	15,2	15,2	21,6	18,0	0,194	33,3
60 x 60 x 4	3,696	7	0,471	16,0	16,0	22,6	21,0	0,233	63,7
60 x 60 x 5	4,568	7	0,582	16,4	16,4	23,2	21,1	0,233	51,0
60 x 60 x 6	5,423	7	0,691	16,9	16,9	23,9	21,1	0,233	43,0
60 x 60 x 8	7,088	7	0,903	17,7	17,7	25,0	21,4	0,233	32,9
65 x 65 x 5	4,974	7	0,634	17,7	17,7	25,0	22,9	0,253	50,95
65 x 65 x 6	5,908	7	0,753	18,0	18,0	25,6	22,6	0,253	42,90
70 x 70 x 6	6,380	9	0,813	19,3	19,3	27,3	24,6	0,272	42,6
70 x 70 x 8	8,358	9	1,065	20,1	20,1	28,5	24,8	0,272	32,5
70 x 70 x 10	10,273	9	1,309	20,9	20,9	29,6	24,1	0,272	26,4
80 x 80 x 6	7,338	10	0,935	21,7	21,7	30,7	28,1	0,311	42,4
80 x 80 x 8	9,630	10	1,227	22,6	22,6	31,9	28,3	0,311	32,3
80 x 80 x 10	11,859	10	1,511	23,4	23,4	33,0	28,5	0,311	26,1
90 x 90 x 6	8,297	11	1,060	24,1	24,1	34,0	31,5	0,350	42,2
90 x 90 x 7	9,608	11	1,224	24,5	24,5	34,7	31,6	0,350	36,8
90 x 90 x 8	10,904	11	1,389	25,0	25,0	35,3	31,7	0,350	32,1
90 x 90 x 10	13,447	11	1,713	25,8	25,8	36,5	31,9	0,350	26,1
100 x 100 x 6	9,259	12	1,180	26,4	26,4	37,4	35,1	0,390	42,19
100 x 100 x 7	10,727	12	1,367	26,9	26,9	38,1	35,1	0,390	36,42
100 x 100 x 8	12,179	12	1,551	27,4	27,4	38,7	35,2	0,390	31,99
100 x 100 x 10	15,036	12	1,915	28,2	28,2	39,9	35,4	0,390	25,91
100 x 100 x 12	17,831	12	2,271	29,0	29,0	41,1	35,7	0,390	21,85
110 x 110 x 8	13,477	13	1,717	29,8	29,8	42,2	38,8	0,429	31,88
110 x 110 x 10	16,648	13	2,121	30,7	30,7	43,4	39,0	0,429	25,81
120 x 120 x 8	14,712	13	1,870	32,3	32,3	45,6	42,0	0,469	31,90
120 x 120 x 10	18,197	13	2,318	33,1	33,1	46,9	42,4	0,469	25,76
120 x 120 x 12	21,620	13	2,754	34,0	34,0	48,0	42,6	0,469	21,68
120 x 120 x 15	26,636	13	3,393	35,1	35,1	49,7	43,1	0,469	17,60
150 x 150 x 10	22,981	16	2,930	40,3	40,3	57,1	52,5	0,586	25,48
150 x 150 x 12	27,345	16	3,483	41,2	41,2	58,3	52,9	0,586	21,43
150 x 150 x 15	33,774	16	4,302	42,5	42,5	60,1	53,3	0,586	17,35
150 x 150 x 18	40,062	16	5,103	43,7	43,7	61,7	53,7	0,586	14,63

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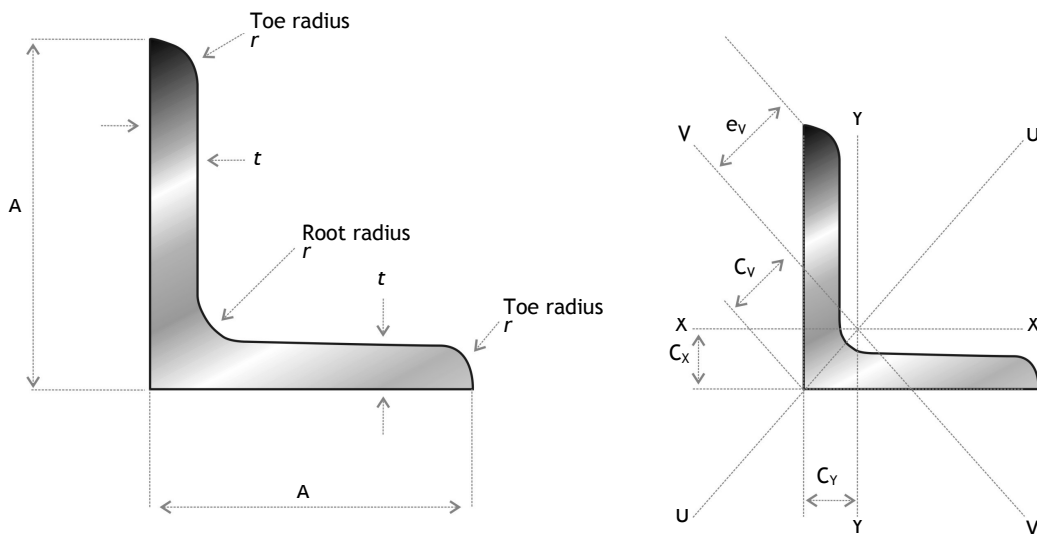
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Angles (equal leg) – non-standard

Note: available on enquiry only

Dimensions and properties									
Designation	Nominal mass	Typical radius	Sectional area	Distance of centre of gravity				Paint area	
				$A \times A \times t$ mm	kg/m	root mm	10^3 mm^2	C_x mm	C_y mm
25 x 25 x 4	1,452	3,5	0,185	7,6	7,6	10,8	9,3	0,097	65,5
25 x 25 x 6	2,080	3,5	0,2649	8,3	8,3	11,8	9,1	0,097	46,4
30 x 30 x 4	1,779	3,5	0,227	8,8	8,8	12,4	11,2	0,116	66,3
30 x 30 x 6	2,564	3,5	0,3267	9,6	9,6	13,5	10,9	0,116	45,7
45 x 45 x 6	3,998	3,5	0,509	13,2	13,2	18,7	16,9	0,174	43,5
50 x 50 x 10	7,106	7	0,9053	16,0	16,0	22,6	18,4	0,194	27,3
60 x 60 x 10	8,689	7	1,110	18,5	18,5	26,1	21,7	0,233	26,8
65 x 65 x 8	7,729	7	0,985	18,9	18,9	26,8	23,2	0,253	32,78
65 x 65 x 10	9,488	7	1,209	19,7	19,7	27,9	23,5	0,253	26,71
70 x 70 x 5	5,367	9	0,684	18,8	18,8	26,6	24,6	0,272	50,6
70 x 70 x 7	7,377	9	0,940	19,7	19,7	27,9	26,7	0,272	36,9
70 x 70 x 9	9,323	9	1,1877	20,5	20,5	29,0	25,0	0,272	29,4
80 x 80 x 7	8,492	10	1,0817	22,1	22,1	31,3	28,2	0,311	36,6
80 x 80 x 9	10,752	10	1,3697	23,0	23,0	32,5	28,4	0,311	28,9
80 x 80 x 12	14,026	10	1,790	24,1	24,1	34,1	30,0	0,311	22,2
90 x 90 x 9	12,183	11	1,552	25,4	25,4	35,9	31,8	0,350	28,7
90 x 90 x 12	15,928	11	2,030	26,6	26,6	37,6	34,0	0,350	22,01
100 x 100 x 9	13,615	12	1,9155	27,8	27,8	39,3	35,3	0,390	28,70
100 x 100 x 15	21,905	12	2,791	29,0	29,0	41,1	35,7	0,380	17,38
120 x 120 x 9	16,463	13	2,097	32,7	32,7	46,3	42,3	0,469	28,54
120 x 120 x 13	23,308	13	2,969	34,4	34,4	48,6	42,8	0,469	20,16
120 x 120 x 14	24,980	13	3,182	34,8	34,8	49,2	42,9	0,469	18,81
130 x 130 x 8	16,041	16	2,044	34,4	34,4	48,7	45,6	0,506	31,60
130 x 130 x 9	17,949	16	2,287	34,9	34,9	49,4	45,6	0,506	28,24
150 x 150 x 9	20,775	16	2,647	39,9	39,9	56,4	52,7	0,586	28,25
150 x 150 x 14	31,647	16	4,032	42,1	42,1	59,5	53,2	0,586	18,55
150 x 150 x 16	35,886	16	4,572	42,9	42,9	60,6	53,4	0,586	16,36
150 x 150 x 20	44,176	16	5,628	44,4	44,4	62,8	54,1	0,586	13,29

Figure 1: Equal leg angles



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Angles (unequal leg)

Dimensions and properties												
Designation	Nominal mass	Typical radius	Sectional area	Distance of centre of gravity						Inclination of V -V	Paint area	
A x B x t Mm	kg/m	root mm	10 ³ mm ²	C _x mm	C _y mm	C _v mm	e _v mm	e _u mm	C _u mm	axis tan _α	m ² /m length	m ² /ton
100 x 75 x 6	8,044	10	1,025	30,1	17,9	30,1	36,7	69,9	53,9	0,548	0,341	42,44
100 x 75 x 7	9,316	10	1,187	30,6	18,3	30,7	36,6	69,7	54,1	0,549	0,341	36,67
100 x 75 x 8	10,572	10	1,347	31,0	18,7	31,3	36,5	69,5	54,2	0,547	0,341	32,29
100 x 75 x 9	11,812	10	1,505	31,5	19,1	31,8	36,5	69,4	54,3	0,546	0,341	28,92
100 x 75 x 10	13,037	10	1,661	31,9	19,5	32,4	36,5	69,2	54,5	0,544	0,341	26,18
125 x 75 x 7	10,707	11	1,364	40,9	16,4	28,9	42,2	86,7	58,4	0,360	0,391	36,58
125 x 75 x 8	12,160	11	1,549	41,4	16,8	29,8	42,0	84,4	58,6	0,360	0,391	32,11
125 x 75 x 9	13,596	11	1,732	41,8	17,2	30,3	41,9	84,1	58,8	0,358	0,391	28,81
125 x 75 x 10	15,017	11	1,913	42,3	17,6	30,8	41,7	83,8	59,1	0,357	0,391	26,00
125 x 75 x 12	17,812	11	2,269	43,1	18,4	31,7	41,5	83,3	59,5	0,354	0,391	21,92
150 x 75 x 9	15,362	11	1,957	52,7	15,7	28,7	45,0	90,0	51,1	0,260	0,441	23,77
150 x 75 x 10	16,979	11	2,163	53,2	16,1	29,1	44,8	97,7	56,3	0,261	0,441	25,94
150 x 75 x 11	18,581	11	2,367	53,6	16,5	29,5	44,7	97,4	61,6	0,260	0,441	23,77
150 x 75 x 12	20,167	11	2,569	54,1	16,9	29,9	44,5	97,1	66,9	0,259	0,441	21,34
150 x 90 x 9	16,441	12	2,095	49,5	20,0	35,6	50,5	101,5	70,4	0,368	0,470	28,63
150 x 90 x 10	18,176	12	2,315	50,0	20,4	36,1	50,3	101,0	70,6	0,361	0,470	25,84
150 x 90 x 12	21,599	12	2,751	50,8	21,2	37,1	50,0	100,5	71,1	0,358	0,470	21,75
150 x 90 x 15	26,615	12	3,390	52,0	22,3	38,4	49,8	99,8	71,6	0,354	0,470	17,64

Angles (unequal leg) – non-standard *Note: available on enquiry only*

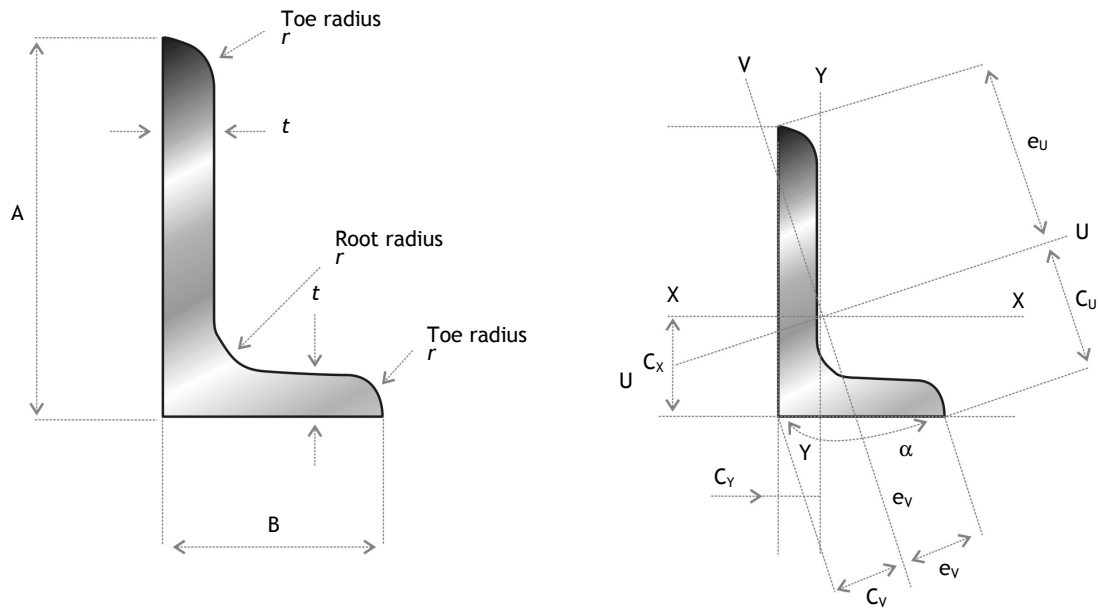
Dimensions and properties												
Designation	Nominal mass	Typical radius	Sectional area	Distance of centre of gravity						Inclination of V -V	Paint area	
A x B x t Mm	kg/m	root mm	10 ³ mm ²	C _x mm	C _y mm	C _v mm	e _v mm	e _u mm	C _u mm	axis tan _α	m ² /m length	m ² /ton
100 x 75 x 12	15,439	10	1,967	32,7	20,3	33,4	36,5	68,9	54,7	0,540	0,341	22,14
125 x 75 x 6	9,239	11	1,177	40,4	15,9	28,6	17,8	85,0	58,0	0,360	0,391	41,60
150 x 75 x 8	13,730	11	1,749	52,3	15,3	28,1	16,6	98,4	65,7	0,263	0,441	31,96
150 x 75 x 15	24,829	11	3,163	55,3	18,1	31,1	19,1	96,3	67,6	0,254	0,441	17,78

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Figure 2: Un-equal leg angles



Rolling tolerances to ISO R657: 1976

Leg Length ¹ (mm)	Length variation	Thickness variation	Camber (straightness)	Out-of-square
≤ 50	± 1,0 mm	± 0,5 mm	0,4% of length-	1,0 mm max
>50 to 100	± 1,5 mm	± 0,8 mm	0,4% of length	2,0 mm max
>100 to 150	± 2,0 mm	± 1,0 mm	0,25% of length	3,0 mm max

¹ For unequal-leg angles the longer leg length is the reference.

Standard lengths

Cutting tolerance: -0+50 mm

- Light profiles - Lengths from 6m up to 13 meters in increments of 100 mm can be ordered.
- Medium profiles – lengths from 6m up to 22 meters in increments of 100mm can be ordered.

Bundling

Bundle masses from 2 ton to 5 ton to be specified by customer.

Bundles are securely tied, normally containing a standard number of units per size and length. Bundles are secured with wire ties or steel straps depending on profile, two adjacent straps 150 - 250mm from each end and intermediate straps at approximately 1,5 meter intervals.

Mill	Minimum	Maximum	Deviation from gross mass
Medium Mill	3 ton	5 ton	-10% on ordered bundle mass
Bar Mill	1,5 ton	2,5 ton	-10% on ordered bundle mass

Basis for invoicing

Invoicing is based on theoretical mass.

For further information, contact:

ArcelorMittal South Africa Limited, Newcastle Works, PO Box 2, Newcastle 2940. Tel (034) 314-8629 Fax (034) 314-8211 e-mail address: enquiries.newcastle@arcelormittal.com

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Labels and marking

One polyester label on a metal backing will be tied to each end of the coil/bundle by means of wire ties or laced to bundle straps at the works' option.

Coloured metal backings are available in: white, blue, green, purple, grey, brown, orange, pink, black, beige, light green, light blue and red.

Where no metal backing colour is specified on orders, white labels will normally be used at the works' discretion.

Labels will bear information to a maximum of four lines with a maximum of forty-five characters per line.

The following standard information will normally be stated:

- ArcelorMittal Steel South Africa's order confirmation number
- Customer's order number/mark
- Port of destination (export)
- Cast number
- Steel specification, grade and size
- Bundle mass
- Bundle number (also printed on bar code)

Paint marking

Water based paint marking is available in single colours or up to three stripes in two colours or up to three stripes in three colour combinations for customers' identification purposes.

Colours available: red, green, blue, pink and white

Coloured lines/bands are approximately 50mm or 100mm wide and are applied through approximately 180 degrees. Colour splashes are approximately 100mm in diameter.

For further information, contact:

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