

Data sheet: E3.1

## Angles (Equal & Unequal leg)

### Hot rolled, weldable structural steel sections

#### General description

ArcelorMittal Steel South Africa, Newcastle Works 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.

Steel for structural sections is normally produced to EN 10025-2:2019 standard, S235, S275, S355 & S460. The heavy sections from Highveld are only available in S355JR and lower strengths at present

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 ISO 9001:2015.

#### Applications

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

Other sections, lengths, and tolerances may be available on enquiry.

#### Weldability

The above-mentioned structural steel grades 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.

#### 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%.

Rust: The material will be inspected and handled according to the American Rust Standard Guide and all material up to a high B in the guide will not be considered a reason for rejection.

- Definition of High B: - GOOD - Mostly blue with some concentrations of rust

Exceptions: Products that will be handled according to the American Rust Standard Guide up to a high C in the guide will not be considered a reason for rejection:

- Medium mill sections that were straightened & cut to length was exposed to water during cutting & the protective scale layer was removed during straightening

- Definition of High C: - FAIR – More than half or completely covered with a light surface rust

#### Certification

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

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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## Steel specifications (mechanical properties)

Specification	Standard	Tensile Strength (MPa) (Nominal Thickness: 3-100mm)	Minimum Yield Strength (MPa)	Elongation (5,65√So <sup>1</sup> ) (Nominal Thickness: 3-40mm)	Impact Test
EN 10025-2 - S235JR (Thickness: ≤25 mm)	Standard	340 - 470	235 (Thickness ≤ 16 mm)	26%	27J at 20°C
			225 (Thickness: >16mm≤40mm)		
EN 10025-2 - S275J0	Standard	410 – 560	275 (Thickness: ≤ 16mm)	23%	27J at 0°C
			265 (Thickness: >16mm ≤ 40mm)		
EN 10025-2 - S275JR	Standard	410 – 560	275 (Thickness: ≤ 16mm)	23%	27J at 20°C
			265 (Thickness: >16mm ≤ 40mm)		
EN 10025-2 - S355JR	Standard	490 - 630	355 (Thickness ≤ 16 mm)	22%	27J at 20°C
			345 (Thickness: >16mm ≤ 40mm)		
EN 10025-2 - S355J0	Standard	490 - 630	355 (Thickness: ≤ 16mm)	22%	27J at 0°C
			min 345 (Thickness: >16mm ≤ 40mm)		
EN 10025-2 – S460J0	Non-Standard	550 - 720	460 (Thickness ≤ 16 mm)	17%	27J at 0°C
			min 440 (Thickness ≤ 16 mm)		
Commercial Quality	Standard	C,30x	with CE = 0,51max CE = C + Mn/6 + (Cr+Mo+V)/5 + (Ni+Cu)/15		

### Notes:

- 1  $S_o$  = original cross-sectional area.
- 2 **The heavy sections from Highveld are only available in S355JR and lower strengths at present**

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**Steel specifications to chemical analysis (mechanical properties as per international specifications - All values in this table are maximum unless otherwise stated)**

Specification	Code	C	Mn	P	S	Si
EN 10025-2 - S235JR	C51 001	0,17	1,40	0,035	0,035	-
EN 10025-2 - S275J0	C50 957	0,18	1,50	0,030	0,030	-
EN 10025-2 - S275JR	C49 030	0,21	1,50	0,035	0,035	-
EN 10025-2 - S355J0	C53 008	0,20	1,60	0,030	0,030	0,55
EN 10025-2 - S355JR	C46 333 (Thickness: ≤8mm)	0,24	1,60	0,035	0,035	0,55
	C46 678 (Thickness: >8mm)					
EN 10025-2 – S460J0	C44	0,20	1,70	0,030	0,030	0,55
*Commercial quality	250 555	0,30	-	-	-	-

\* Supplied to chemical analyses only with CE = 0,51max

<b>Lower strength (for workability and weldability)</b>
EN 10025 S235JR
<b>Normal strength (for general use)</b>
EN 10025 S275JR/J0
<b>Higher strength micro-alloyed steel</b>
EN 10025 S355JR/J0
EN 10025 S460J0

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## Angles (Equal leg)

The geometry of equal leg angle sections complies with ISO R657/1:1968, except for the toe radius which is not guaranteed

Dimensions and properties									
Designation	Nominal mass	Typical radius	Sectional area	Distance of centre of gravity				Paint area	
				Cx	Cy	Cv	ev	m <sup>2</sup> /m length	m <sup>2</sup> /ton
A x A x t (mm)	kg/m	root (mm)	10 <sup>3</sup> mm <sup>2</sup>	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	1,452	3,5	0,185	7,6	7,6	10,8	9,3	0,097	65,5
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
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 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 4	1,779	3,5	0,227	8,8	8,8	12,4	11,2	0,116	66,3
30 x 30 x 5	2,180	3,5	0,278	9,2	9,2	13,0	10,7	0,116	53,2
30 x 30 x 6	2,564	3,5	0,3267	9,6	9,6	13,5	10,9	0,116	45,7
40 x 40 x 2,0	1,246	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
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 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
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 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
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 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
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 6	6,380	9	0,813	19,3	19,3	27,3	24,6	0,272	42,6
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 8	8,358	9	1,065	20,1	20,1	28,5	24,8	0,272	32,5
70 x 70 x 9	9,323	9	1,1877	20,5	20,5	29,0	25,0	0,272	29,4
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 7	8,492	10	1,0817	22,1	22,1	31,3	28,2	0,311	36,6
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 9	10,752	10	1,3697	23,0	23,0	32,5	28,4	0,311	28,9
80 x 80 x 10	11,859	10	1,511	23,4	23,4	33,0	28,5	0,311	26,1
80 x 80 x 12	14,026	10	1,790	24,1	24,1	34,1	30,0	0,311	22,2

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## Angles (Equal leg) – continued

Dimensions and properties									
Designation	Nominal mass	Typical radius	Sectional area	Distance of centre of gravity				Paint area	
A x A x t mm	kg/m	root mm	10 <sup>3</sup> mm <sup>2</sup>	C <sub>x</sub> mm	C <sub>y</sub> mm	C <sub>v</sub> mm	e <sub>v</sub> mm	m <sup>2</sup> /m length	m <sup>2</sup> /ton
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 9	12,183	11	1,552	25,4	25,4	35,9	31,8	0,350	28,7
90 x 90 x 10	13,447	11	1,713	25,8	25,8	36,5	31,9	0,350	26,1
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 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 9	13,615	12	1,9155	27,8	27,8	39,3	35,3	0,390	28,70
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
100 x 100 x 15	21,905	12	2,791	29,0	29,0	41,1	35,7	0,380	17,38
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 9	16,463	13	2,097	32,7	32,7	46,3	42,3	0,469	28,54
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 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
120 x 120 x 15	26,636	13	3,393	35,1	35,1	49,7	43,1	0,469	17,60
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 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 14	31,647	16	4,032	42,1	42,1	59,5	53,2	0,586	18,55
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 16	35,886	16	4,572	42,9	42,9	60,6	53,4	0,586	16,36
150 x 150 x 18	40,062	16	5,103	43,7	43,7	61,7	53,7	0,586	14,63
150 x 150 x 20	44,176	16	5,628	44,4	44,4	62,8	54,1	0,586	13,29

### Equal leg angles: Rolling tolerances to ISO R657: 1976

Leg Length (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

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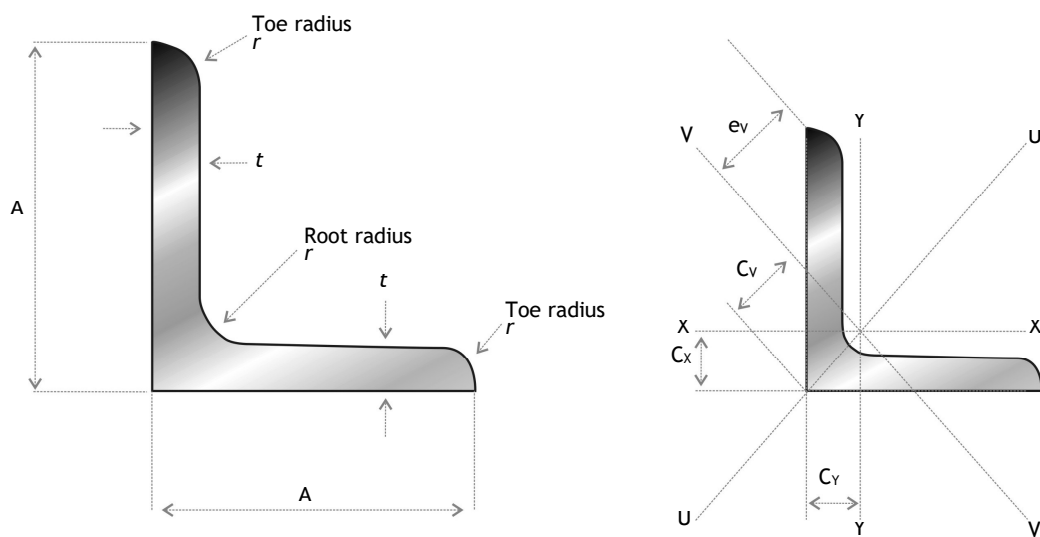
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### Angles (Equal leg) – continued: Heavy Section Mill – Highveld

The geometry of heavy equal leg angle sections complies with Dimensions: EN10056-1:2017.  
Tolerances comply with EN 10056-2:1994

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		
200 x 200 x 24	71.1	18	9.06	58.4	58.4	82.6	72.1	0.785	11.03
200 x 200 x 20	59.9	18	7.63	56.8	56.8	80.4	71.5	0.785	13.09
200 x 200 x 18	54.2	18	6.91	56.0	56.0	79.3	71.2	0.785	14.46
200 x 200 x 16	48.5	18	6.18	55.2	55.2	78.1	70.9	0.785	16.18

Figure 1: Equal leg angles



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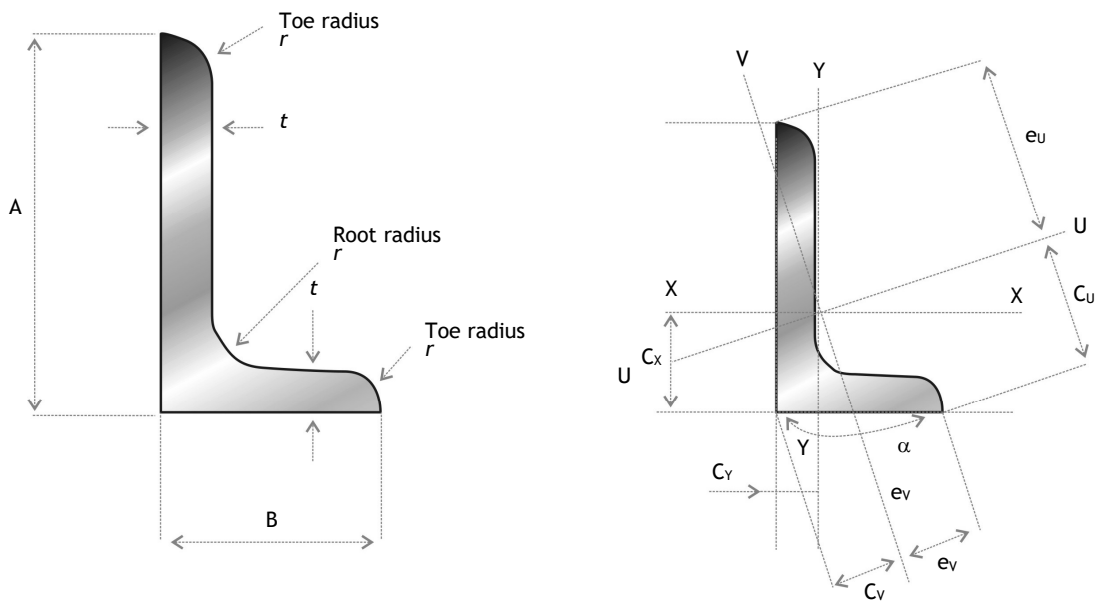
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## Angles (unequal leg)

The geometry of unequal leg angle sections complies with ISO R657/11:1968, except for the toe radius which is not guaranteed.

Designation	Nominal mass	Typical radius	Sectional area	Distance of centre of gravity						Inclination of V-V	Paint area	
				$C_x$	$C_y$	$C_v$	$e_v$	$e_u$	$C_u$		axis $\tan \alpha$	m <sup>2</sup> /m length
A x B x t (mm)	kg/m	root (mm)	10 <sup>3</sup> mm <sup>2</sup>	mm	mm	mm	mm	mm	mm	mm		
65 x 50 x 6	5,16	6	0,658	20,4	12,9	21,4	23,9	45,2	36,1	0,575	0,224	
65 x 50 x 8	6,75	6	0,860	21,1	13,7	22,4	23,9	44,9	36,3	0,569	0,224	
75 x 50 x 6	5,631	7	0,719	24,4	12,1	20,8	26,4	51,2	37,5	0,435	0,241	
75 x 50 x 8	7,375	7	0,941	25,2	12,9	21,8	26,2	50,8	37,8	0,430	0,241	
80 x 60 x 6	6,37	8	0,811	24,7	14,8	24,7	29,2	55,7	43,3	0,547	0,273	
80 x 60 x 8	8,34	8	1,063	25,5	15,6	25,9	29,2	55,3	43,6	0,544	0,273	
90 x 65 x 6	7,07	8	0,901	27,9	15,6	26,6	32,7	62,4	47,3	0,510	0,303	
90 x 65 x 8	9,29	8	1,183	28,8	16,4	27,7	32,6	62,0	47,6	0,507	0,303	
90 x 65 x 10	11,4	8	1,457	29,6	17,2	28,6	32,6	61,7	47,9	0,503	0,303	
100 x 65 x 8	9,94	10	1,267	32,7	15,5	26,9	34,7	68,1	49,2	0,413	0,321	
100 x 65 x 10	12,3	10	1,561	33,6	16,3	27,9	34,5	67,6	49,5	0,410	0,321	
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
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
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 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 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 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
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

Figure 2: Un-equal leg angles



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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### Unequal leg angles: Rolling tolerances to ISO R657: 1976

Leg Length <sup>1</sup> (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

- Light sections: Standard lengths are available in steps of 100 mm in the range of 6 to 13 meters.
- Medium sections: 6, 9, 11, 12 & 13m
- Heavy sections: 9, 11, 12 & 13m

### Non-Standard lengths

- Medium profiles: Lengths from 6m up to 22 meters in increments of 100mm can be ordered.
- Heavy profiles: Lengths are available from 6m to 22m maximum. Lengths in increments of 50mm available

### Cutting tolerance

Light & Medium sections: -0+50 mm

Heavy sections: -0+100 mm

### 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.

### 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: 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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