

Angles

- ◆ Equal Angles
- ◆ Unequal Angles

ANGLES

Angles

Rolling Tolerances - EN 10056-2 : 1993

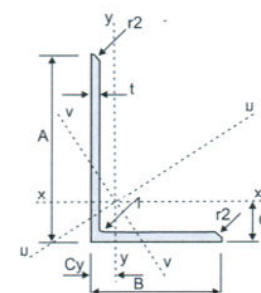
This European specifies tolerances on shapes dimensions and mass of hot rolled structural steel equal and unequal leg angles.

Tolerances On Shapes And Dimensions

Leg Length (a or b)

The deviation from nominal on length shall be within the tolerance given in the following table. For unequal leg angles, the longer leg length (a) shall be used to determine the tolerance band.

Leg Length a (mm)	Tolerance (mm)	
Up to and including 50	+1.0	-1.0
Greater than 50 up to and including 100	+2.0	-2.0
Greater than 100 up to and including 150	+3.0	-3.0
Greater than 150 up to and including 200	+4.0	-4.0
Greater than 200	+6.0	-4.0



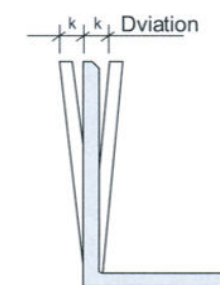
Section Thickness (t)

The deviation from nominal on thickness shall be within the tolerance given in the following table.

Leg Length a (mm)	Tolerance (mm)	
Up to and including 5	+0.5	-0.5
Greater than 5 up to and including 10	+0.75	-0.75
Greater than 10 up to and including 15	+1.0	-1.0
Greater than 15	+1.20	-1.20

Out Of Square (k)

Out-of-squareness of the section shall not exceed the maximum following table. For unequal leg angles, the longer leg length (a) shall be used to determine the tolerance band.



Out Of Square - Leg Length (mm)	Tolerance (mm)
Up to and including 100	1.0
Greater than 100 up to and including 150	1.5
Greater than 150 up to and including 200	2.0
Greater than 200	3.0

Straightness (q)

The deviation from straightness shall not exceed the tolerances given in the following table. For unequal leg angles, the longer leg length (a) shall be used to determine the tolerance band.

Leg Length a (mm)	Over Full Bar Length	Tolerance Over Any Part Bar Length (mm)	
	Deviation q (mm)	Length Considered	Deviation q (mm)
Up to and including 150	0.4% L	1,500	-0.5
Up to and including 200	0.2% L	2,000	-0.75
Greater than 200	0.1% L	+1.20	-1.20

Tolerance On Mass

The deviation from the nominal mass of any individual piece shall not exceed:

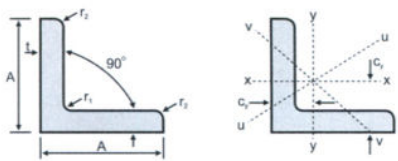
- $\pm 6\%$ for thickness for $t \leq 4\text{mm}$ or
- $\pm 4\%$ for thickness for $t > 4\text{mm}$

The deviation from the nominal mass is the difference between the actual mass of the piece and the calculated mass. The calculated mass shall be determined using a density of 7850 kg/m^3 .

Tolerance On Length

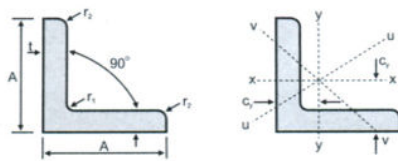
The tolerance on ordered length shall be either.

- $\pm 50\text{mm}$; or
- $-0 / +100\text{mm}$ where minimum lengths are requested



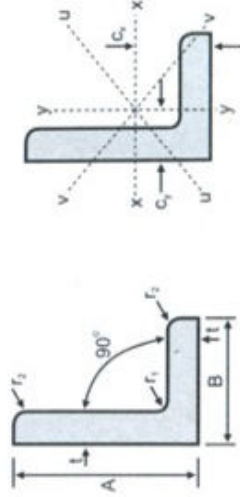
EQUAL

Designation Size	Thickness	Mass Per Metre	Radius		Area Of Section	Distance Centre Of Gravity	Secomd Moment Of Area			Radius Of Gyration			Elastic Modulus			
AxA	t		r ₁	r ₁		C _x and C _y	Axis x-x	Axis y-y	Axis u-u	Axis v-v	Axis x-x	Axis y-y	Axis u-u	Axis v-v	Axis x-x	Axis y-y
mm	mm	kg/m	mm	mm	cm ²	cm	cm ⁴	cm ⁴	cm ⁴	cm	cm	cm	cm	cm	cm ³	cm ³
20x20	3	0.885	3.5	2.4	1.11	0.593	0.381	0.601	0.160	0.585	0.735	0.380			0.271	
25x25	3	1.12	3.5	2.4	1.41	0.718	0.784	1.24	0.326	0.745	0.938	0.481			0.440	
	4	1.45	3.5	2.4	1.84	0.758	1.00	1.58	0.422	0.737	0.926	0.479			0.574	
	5	1.70	3.5	2.4	2.25	0.796	1.19	1.87	0.516	0.728	0.912	0.479			0.701	
30x30	3	1.36	5	2.4	1.74	0.836	1.41	2.23	0.590	0.901	1.13	0.582			0.652	
	4	1.76	5	2.4	2.27	0.879	1.81	2.86	0.758	0.893	1.12	0.578			0.853	
	5	2.16	5	2.4	2.78	0.919	2.17	3.42	0.921	0.884	1.11	0.576			1.04	
35x35	6	1.65	5	2.4	3.87	1.08	4.13	6.51	1.76	1.03	1.30	0.674			1.71	
38x38	3	1.72	6	2.4	2.24	1.03	2.99	4.72	1.25	1.15	1.45	0.748			1.08	
	4	2.36	6	2.4	2.93	1.07	3.85	6.10	1.61	1.15	1.44	0.741			1.41	
	5	2.79	6	2.4	3.60	1.12	4.66	7.36	1.95	1.14	1.43	0.736			1.73	
	6	3.33	6	2.4	4.25	1.15	5.40	8.51	2.29	1.13	1.41	0.733			2.04	
40x40	3	1.83	6	2.4	2.36	1.08	3.51	5.55	1.47	1.22	1.53	0.789			1.20	
	4	2.42	6	2.4	3.09	1.12	4.53	7.18	1.89	1.21	1.52	0.782			1.58	
	5	2.95	6	2.4	3.80	1.17	5.48	8.68	2.29	1.20	1.51	0.776			1.94	
	6	3.52	6	2.4	4.49	1.20	6.37	10.1	2.69	1.19	1.50	0.773			2.28	
45x45	4	2.74	7	2.4	3.52	1.24	6.59	10.4	2.75	1.37	1.72	0.884			2.02	
	5	3.38	7	2.4	4.33	1.29	7.99	12.6	3.34	1.36	1.71	0.878			2.49	
	6	3.99	7	2.4	5.12	1.33	9.31	14.7	3.90	1.35	1.69	0.873			2.93	
50x50	3	2.33	7	2.4	2.99	1.32	7.06	11.1	2.97	1.54	1.93	0.997			1.92	
	4	3.06	7	2.4	3.92	1.37	9.17	14.5	3.82	1.53	1.92	0.987			2.52	
	4.5	3.40	7	2.4	4.38	1.39	10.2	16.1	4.23	1.52	1.92	0.984			2.82	
	5	3.77	7	2.4	4.83	1.41	11.2	17.7	4.64	1.52	1.91	0.980			3.11	
	6	4.43	7	2.4	5.72	1.45	13.0	20.6	5.43	1.51	1.90	0.974			3.67	
	8	5.78	7	2.4	7.44	1.53	16.5	25.9	6.97	1.49	1.87	0.968			4.74	
60x60	5	4.55	8	2.4	5.86	1.65	19.8	31.4	8.24	1.84	2.31	1.19			4.56	
	6	5.42	8	2.4	6.95	1.70	23.2	36.8	9.65	1.83	2.30	1.18			5.40	
63x63	5	4.75	8	2.4	6.16	1.73	23.1	36.6	9.58	1.93	2.44	1.25			5.05	
	6	5.71	8	2.4	7.31	1.77	27.1	42.9	11.2	1.92	2.42	1.24			5.98	
	8	7.42	8	2.4	9.55	1.85	34.5	54.6	14.4	1.90	2.39	1.23			7.76	
65x65	5	5.00	9	2.4	6.40	1.77	25.5	40.3	10.6	2.00	2.51	1.29			5.39	
	6	5.91	9	2.4	7.59	1.82	29.9	47.4	12.4	1.98	2.50	1.28			6.38	
	8	7.66	9	2.4	9.91	1.90	38.2	60.4	15.9	1.96	2.47	1.27			8.29	
	9	8.55	9	2.4	11.0	1.94	42.0	66.4	17.6	1.95	2.45	1.26			9.21	
70x70	6	6.38	9	2.4	8.19	1.94	37.7	59.8	15.7	2.15	2.70	1.38			7.46	
	7	7.38	9	2.4	9.46	1.98	43.1	68.3	17.9	2.13	2.69	1.38			8.59	
	8	8.43	9	2.4	10.71	2.02	48.3	76.5	20.1	2.12	2.67	1.37			9.70	
75x75	5	5.69	10	4.8	7.37	2.00	38.7	61.2	16.2	2.29	2.88	1.48			7.02	
	6	6.85	10	4.8	8.76	2.04	45.7	72.4	19.0	2.28	2.88	1.47			8.38	
	8	9.03	10	4.8	11.5	2.13	59.0	93.5	24.5	2.27	2.85	1.46			11.0	
	9	9.96	10	4.8	12.8	2.17	65.3	103	27.2	2.26	2.84	1.46			12.3	
	10	10.99	10	4.8	14.1	2.21	71.3	113	29.8	2.25	2.83	1.45			13.5	
	12	13.00	10	4.8	16.7	2.29	82.7	130	35.0	2.23	2.80	1.45			15.9	
80x80	6	7.34	10	4.8	9.36	2.17	56.0	88.7	23.2	2.45	3.08	1.58			9.6	
	8	9.66	10	4.8	12.3	2.26	72.4	115	30.0	2.43	3.06	1.56			12.6	
	10	11.8	10	4.8	15.1	2.34	87.7	139	36.5	2.41	3.03	1.55			15.5	
90x90	6	8.30	11	4.8	10.6	2.41	81.0	128	33.7	2.76	3.48	1.78			12.3	
	7	9.61	11	4.8	12.3	2.46	93.2	148	38.7	2.76	3.47	1.77			14.3	
	8	10.90	11	4.8	13.9	2.50	105	167	43.5	2.75	3.46	1.77			16.2	
	9	12.20	11	4.8	15.6	2.54	117	185	48.2	2.74	3.45	1.76			18.0	
	10	13.40	11	4.8	17.2	2.58	128	202	52.9	2.73	3.43	1.76			19.9	
	12	15.90	11	4.8	20.3	2.66	149	235	62.1	2.70	3.40	1.75			23.5	
	13	17.00	11	4.8	21.9	2.70	159	251	66.6	2.69	3.39	1.74			25.2	



EQUAL

Designation Size	Thickness	Mass Per Metre	Radius		Area Of Section	Distance Centre Of Gravity	Secomd Moment Of Area			Radius Of Gyration			Elastic Modulus	
			Root	Toe			Axis x-x	Axis y-y	Axis u-u	Axis v-v	Axis x-x	Axis y-y	Axis u-u	Axis v-v
AxA	t		r ₁	r ₁		C _x and C _y								
mm	mm	kg/m	mm	mm	cm ²	cm	cm ⁴	cm ⁴	cm ⁴	cm	cm	cm		cm ³
100x100	6	9.20	12	4.8	11.9	2.65	113	178	47.0	3.08	3.88	1.99		15.3
	7	10.70	12	4.8	13.7	2.70	130	206	53.9	3.08	3.87	1.98		17.8
	8	12.20	12	4.8	15.6	2.75	146	232	60.6	3.07	3.86	1.97		20.2
	10	15.00	12	4.8	19.2	2.83	178	283	73.8	3.05	3.84	1.96		24.8
	12	17.80	12	4.8	22.8	2.91	208	330	86.5	3.02	3.81	1.95		29.4
	13	19.10	12	4.8	24.5	2.95	222	352	92.8	3.01	3.79	1.95		31.5
	15	21.90	12	4.8	28.0	3.02	250	395	105	2.99	3.76	1.94		35.8
120x120	8	14.70	13	4.8	18.8	3.24	259	411	107	3.71	4.67	2.38		29.5
	10	18.20	13	4.8	23.3	3.32	316	502	130	3.69	4.64	2.37		36.4
	12	21.60	13	4.8	27.6	3.41	371	588	153	3.66	4.62	2.36		43.1
	15	26.60	13	4.8	34.0	3.52	448	710	186	3.63	4.57	2.34		52.8
125x125	8	14.90	14	4.8	19.7	3.36	294	466	122	3.87	4.87	2.49		32.2
	10	19.09	14	4.8	24.3	3.44	360	570	149	3.84	4.84	2.47		39.7
	12	22.67	14	4.8	28.9	3.53	422	669	174	3.82	4.81	2.46		47.0
130x130	8	15.90	14	4.8	20.5	3.48	332	527	138	4.03	5.07	2.59		34.9
	9	17.90	14	4.8	22.9	3.43	370	586	153	4.02	5.06	2.58		39.0
	10	19.70	14	4.8	25.3	3.57	406	645	168	4.01	5.05	2.57		43.1
	12	23.50	14	4.8	30.1	3.65	477	758	197	3.98	5.02	2.56		51.1
	15	28.80	14	4.8	37.1	3.77	578	916	240	3.95	4.97	2.54		62.6
	16	30.70	14	4.8	39.4	3.81	610	966	253	3.94	4.95	2.54		66.3
150x150	8	18.00	16	4.8	23.8	3.97	518	820	215	4.66	5.87	3.01		46.9
	10	23.00	16	4.8	29.5	4.06	635	1008	263	4.64	5.85	2.99		58.0
	12	27.30	16	4.8	35.0	4.14	748	1187	309	4.62	5.82	2.97		68.9
	15	33.80	16	4.8	43.2	4.26	909	1442	375	4.59	5.78	2.95		84.6
	16	35.70	16	4.8	45.9	4.30	960	1523	397	4.57	5.76	2.94		89.8
	18	40.10	16	4.8	51.2	4.38	1060	1680	440	4.55	5.73	2.93		99.8
	19	41.90	16	4.8	53.8	4.42	1109	1756	462	4.54	5.71	2.93		105
175x175	12	31.80	16	4.8	41.0	4.77	1208	1920	497	5.43	6.84	3.48		94.9
	15	39.40	16	4.8	50.7	4.89	1474	2342	606	5.39	6.80	3.46		117
200x200	12	36.55	18	4.8	47.2	5.38	1829	2906	753	6.23	7.85	4.00		125
	13	39.49	18	4.8	50.9	5.42	1967	3126	809	6.22	7.84	3.99		135
	15	45.30	18	4.8	58.3	5.50	2237	3555	919	6.19	7.81	3.97		154
	16	48.50	18	4.8	62.0	5.54	2369	3765	973	6.18	7.79	3.96		164
	18	54.20	18	4.8	69.4	5.62	2627	4174	1080	6.15	7.76	3.95		183
	20	59.90	18	4.8	76.6	5.70	2877	4569	1185	6.13	7.72	3.93		201
	24	71.10	18	4.8	90.8	5.85	3357	5322	1391	6.08	7.65	3.91		237
	25	73.60	18	4.8	94.3	5.89	3472	5502	1442	6.07	7.64	3.91		246
	26	76.80	18	4.8	97.8	5.93	3586	5680	1492	6.05	7.62	3.91		255
250x250	25	93.70	20	4.8	120	7.14	7030	11170	2891	7.67	9.67	4.92		394
	28	104.00	20	4.8	133	7.25	7741	12290	3195	7.63	9.61	4.90		436
	32	118.00	20	4.8	151	7.40	8650	13710	3593	7.58	9.54	4.89		491
	35	128.00	20	4.8	164	7.51	9305	14720	3887	7.54	9.49	4.88		532
300x300	35	155.00	24	18	197	8.71	16300	25900	6690	9.09	11.50	5.82		766
350x350	35	182.00	24	18	232	9.96	26000	42300	10800	10.70	13.50	6.83		1060



UNEQUAL

ANGLES

Designation Size		Thickness	Mass Per Metre	Radius Root	Radius Toe	Area Of Section	Distance Centre Of Gravity		Secomd Moment Of Area				Radius Of Gyration				Elastic Modulus	Angle x-x Axis to u-u Axis
AxB	t	mm	kg/m	r ₁ mm	r ₁ mm	cm ²	C _x cm	C _y cm	Axis x-x cm ⁴	Axis y-y cm ⁴	Axis u-u cm ⁴	Axis v-v cm ⁴	Axis x-x cm	Axis y-y cm	Axis u-u cm	Axis v-v cm	Axis x-x cm ³	Axis y-y cm ³
63x38	4.5	6	3.45	6	2.4	4.4	2.10	0.870	18.0	4.90	20.0	3.00	2.01	1.06	2.12	0.820	4.20	1.68
	6	6	4.43	6	2.4	5.75	2.17	0.930	23.0	6.30	25.0	3.80	1.99	1.04	2.10	0.820	5.50	2.18
75x50	6	7	5.65	7	2.4	7.22	2.45	1.21	40.9	14.6	47.1	8.48	2.38	1.42	2.55	1.08	8.10	3.87
	8	7	7.39	7	2.4	9.44	2.53	1.29	52.4	18.6	60.1	10.9	2.36	1.40	2.52	1.07	10.5	5.01
100x65	7	8	8.8	10	4.8	11.2	3.23	1.52	113	37.7	128	22.1	3.18	1.84	3.39	1.41	16.7	7.56
	8	9	9.4	10	4.8	12.7	3.28	1.56	127	42.3	144	24.9	3.17	1.83	3.38	1.40	18.9	8.57
100x75	9	11	11.0	10	7.0	14.0	3.31	1.58	138	45.5	157	26.8	3.14	1.80	3.34	1.38	20.6	9.26
	10	12	12.3	10	4.8	15.6	3.36	1.64	154	51.1	175	30.2	3.14	1.81	3.35	1.39	23.2	10.5
100x75	12	14	14.4	10	7.0	18.4	3.43	1.70	177	58.0	201	34.7	3.11	1.78	3.30	1.37	27.0	12.1
	7	9	9.3	10	5.0	11.9	3.06	1.84	118	56.9	144	30.7	3.15	2.19	3.49	1.61	17.0	10.1
100x75	8	10	10.6	10	4.8	13.5	3.11	1.88	133	64.2	163	34.6	3.14	2.18	3.48	1.60	19.3	11.4
	9	11	11.8	10	4.8	15.1	3.15	1.92	148	71.1	181	38.4	3.13	2.17	3.46	1.60	21.6	12.7
125x75	10	13	13.0	10	4.8	16.6	3.19	1.96	162	77.7	198	42.2	3.12	2.16	3.45	1.59	23.8	14.0
	12	15	15.4	10	4.8	19.7	3.27	2.03	189	90.3	230	49.5	3.10	2.14	3.42	1.59	28.1	16.5
125x75	13	16	16.5	10	4.8	21.2	3.31	2.07	202	96.3	245	53.1	3.09	2.13	3.40	1.58	30.2	17.7
	6.5	10	10.0	11	4.8	12.7	4.07	1.62	206	56.6	228	34.4	4.02	2.11	4.23	1.64	24.4	9.63
150x75	7	10	10.7	11	4.8	13.7	4.10	1.64	220	60.5	244	36.7	4.01	2.10	4.22	1.64	26.2	10.3
	8	12	12.2	11	4.8	15.5	4.14	1.69	249	68.1	275	41.3	4.00	2.10	4.21	1.63	29.7	11.7
150x75	9	13	13.5	11	4.8	17.4	4.19	1.73	276	75.5	306	45.8	3.99	2.09	4.20	1.62	33.2	13.1
	10	15	15.0	11	4.8	19.2	4.23	1.77	303	82.6	336	50.2	3.98	2.08	4.18	1.62	36.7	14.4
150x75	12	17	17.8	11	4.8	22.7	4.32	1.84	355	96.0	392	58.8	3.95	2.06	4.16	1.61	43.4	17.0
	13	19	19.1	10	7.0	24.3	4.35	1.87	376	101	414	61.9	3.93	2.04	4.13	1.60	46.1	17.9
150x75	7	12	12.1	12	5.0	15.5	5.17	1.50	364	63.1	386	40.8	4.85	2.02	5.00	1.62	37.0	10.5
	8	13	13.8	11	4.8	17.5	5.23	1.54	411	71.2	436	45.8	4.84	2.02	4.99	1.62	42.1	11.9
150x75	9	15	15.3	12	8.5	19.4	5.25	1.55	447	75.3	473	48.7	4.79	1.97	4.93	1.58	45.8	12.7
	10	17	17.0	11	4.8	21.7	5.32	1.62	503	86.3	533	55.8	4.82	2.00	4.96	1.60	52.0	14.7
150x75	12	20	20.2	11	4.8	25.7	5.41	1.70	591	100	626	65.3	4.79	1.98	4.93	1.59	61.6	17.3
	15	24	24.8	11	4.8	31.7	5.53	1.81	715	120	756	79.2	4.75	1.95	4.89	1.58	75.5	21.1
150x90	8	14	14.3	10	5.0	18.7	4.93	1.97	436	121	484	72.7	4.83	2.54	5.09	1.97	43.3	17.2
	9	16	16.4	12	6.0	20.9	4.95	2.00	485	133	537	80.5	4.81	2.52	5.06	1.96	48.2	19.0
150x90	10	18	18.2	12	4.8	23.2	5.00	2.04	536	147	595	89.2	4.81	2.52	5.06	1.96	53.7	21.2
	12	21	21.6	12	4.8	27.6	5.09	2.12	630	172	698	105	4.78	2.50	5.03	1.95	63.6	25.0
150x90	15	26	26.6	12	4.8	34.0	5.21	2.24	764	207	844	127	4.74	2.47	4.99	1.93	78.1	30.6
	8	15	15.2	12	8.5	19.4	4.70	2.24	441	158	508	90.9	4.77	2.86	5.12	2.17	42.8	20.3
150x100	9	17	17.1	12	6.0	21.8	4.77	2.30	502	181	579	104	4.79	2.88	5.15	2.18	49.1	23.5
	10	19	19.0	13	6.5	24.2	4.80	2.34	552	198	635	114	4.78	2.86	5.13	2.17	54.1	25.8
150x100	12	22	22.4	12	8.5	28.6	4.88	2.41	642	228	738	132	4.74	2.83	5.08	2.15	63.4	30.1
	14	26	26.1	12	6.0	33.2	4.98	2.50	744	265	856	153	4.74	2.82	5.08	2.15	74.3	35.3
150x100	15	27	27.7	12	8.5	35.2	5.01	2.53	781	276	897	161	4.71	2.80	5.04	2.14	78.2	37.0
	10	23	23.0	15	4.8	29.4	6.95	2.03	1233	215	1309	138	6.48	2.70	6.68	2.17	94.5	27.0
200x100	12	27	27.3	15	4.8	34.9	7.04	2.11	1454	252	1544	162	6.45	2.68	6.65	2.16	112	31.9
	14	31	31.6	15	7.5	40.3	7.12	2.18	1654	282	1755	182	6.41	2.65	6.60	2.12	128	36.1
200x100	15	33	33.7	15	4.8	43.1	7.17	2.23	1772	303	1879	197	6.41	2.65	6.60	2.14	138	39.0
	12	32	32.0	15	4.8	40.9	6.10	3.63	1667	813	2046	434	6.38	4.45	7.07	3.26	120	71.5
200x150	15	39	39.6	15	4.8	50.6	6.22	3.75	2037	989	2496	530	6.34	4.42	7.02	3.23	148	87.9
	18	47	47.4	15	4.8	60.1	6.34	3.86	2390	1155	2923	622	6.30	4.38	6.97	3.22	175	104