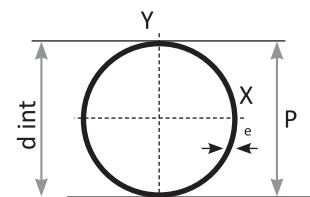


4.1 TUBERÍAS DE ACERO ESTRUCTURAL REDONDA



NOTA: Propiedades geométricas calculadas con espesor de diseño = 0.93 t (NSR-10 F.2.2.4.2)

REFERENCIA		Dimensiones Nominales		t _{diseño}	D/t	Área de diseño de la sección	EJE DE SIMETRÍA				Saint Venant	Area superficial	Peso Nominal
Diámetro Nominal (pulg)	Diámetro externo (pulg)	Diámetro Exterior	Espesor				I _x	S _x	r _x	Z _x			
		D [mm]	t [mm]	[mm]		[mm ²]	[mm ⁴]	[mm ³]	[mm]	[mm ³]	J [mm ⁴]	[m ² / m]	[kg / m]
1-1/2"	1.89"	48,0	1,5	1,40	34,41	204	55.504	2.313	16,48	3.031	111.007	0,151	1,78
		48,0	2,0	1,86	25,81	270	71.864	2.994	16,33	3.962	143.728	0,151	2,35
		48,0	2,5	2,33	20,65	334	87.225	3.634	16,17	4.855	174.451	0,151	2,92
		48,0	3,0	2,79	17,20	396	101.629	4.235	16,01	5.710	203.258	0,151	3,45
2"	2.36"	60,0	2,0	1,86	32,26	340	143.695	4.790	20,57	6.289	287.390	0,188	2,94
		60,0	2,5	2,33	25,81	421	175.449	5.848	20,41	7.738	350.898	0,188	3,64
		60,0	3,0	2,79	21,51	501	205.642	6.855	20,25	9.139	411.284	0,188	4,33
		60,0	4,0	3,72	16,13	658	261.552	8.718	19,94	11.800	523.104	0,188	5,67
2-1/2"	2.87"	73,0	2,0	1,86	39,25	416	263.155	7.210	25,16	9.415	526.309	0,229	3,58
		73,0	2,5	2,33	31,40	516	322.664	8.840	25,00	11.617	645.327	0,229	4,44
		73,0	3,0	2,79	26,16	615	379.792	10.405	24,84	13.760	759.585	0,229	5,30
		73,0	4,0	3,72	19,62	810	487.166	13.347	24,53	17.872	974.332	0,229	6,97
3"	3-1/2"	89,0	2,0	1,86	47,85	509	483.530	10.866	30,82	14.126	967.060	0,280	4,37
		89,0	2,5	2,33	38,28	633	594.945	13.370	30,66	17.471	1.189.890	0,280	5,43
		89,0	3,0	2,79	31,90	756	702.735	15.792	30,50	20.743	1.405.470	0,280	6,48
		89,0	4,0	3,72	23,92	997	907.758	20.399	30,18	27.072	1.815.516	0,280	8,54
4"	4-1/2"	114,3	2,5	2,33	49,16	818	1.282.429	22.440	39,60	29.156	2.564.858	0,359	6,99
		114,3	3,0	2,79	40,97	977	1.520.118	26.599	39,44	34.699	3.040.236	0,359	8,35
		114,3	4,0	3,72	30,73	1.292	1.977.533	34.603	39,12	45.505	3.955.067	0,359	11,04
		114,3	6,0	5,58	20,48	1.906	2.823.351	49.402	38,49	66.014	5.646.703	0,359	16,26
6"	6"	152,4	4,0	3,72	40,97	1.738	4.804.324	63.049	52,58	82.251	9.608.648	0,479	14,92
		152,4	6,0	5,58	27,31	2.574	6.945.070	91.143	51,95	120.341	13.890.139	0,479	22,09
		152,4	8,0	7,44	20,48	3.388	8.923.185	117.102	51,32	156.477	17.846.369	0,479	29,05
6"	6-1/4"	159	4,0	3,72	42,74	1.815	5.472.661	68.839	54,92	89.713	10.945.323	0,500	15,66
		159	6,0	5,58	28,49	2.689	7.923.447	99.666	54,28	131.398	15.846.893	0,500	22,60
8"	8-5/8"	219,1	5,0	4,65	47,11	3.132	18.011.226	164.430	75,83	213.832	36.022.453	0,688	26,75
		219,1	8,0	7,44	29,45	4.947	27.728.840	253.145	74,87	333.370	55.457.679	0,688	42,21
		219,1	10,0	9,30	23,56	6.129	33.779.776	308.385	74,24	409.520	67.559.552	0,688	52,27
8"	8-7/8"	225,0	5,0	4,65	48,39	3.219	19.545.436	173.737	77,92	225.810	39.090.872	0,707	27,79
		225,0	7,0	6,51	34,56	4.469	26.688.302	237.229	77,28	310.866	53.376.605	0,707	37,71
10"	10-3/4"	273,1	7,0	6,51	41,94	5.451	48.438.094	354.793	94,26	462.586	96.876.189	0,858	46,43
		273,1	9,0	8,37	32,62	6.960	61.007.441	446.859	93,63	586.560	122.014.882	0,858	59,25
12"	12-3/4"	323,9	8,0	7,44	43,53	7.396	92.602.663	571.886	111,90	744.995	185.205.327	1,017	62,89
		323,9	10,0	9,30	34,82	9.190	113.760.470	702.550	111,26	920.426	227.520.939	1,017	78,12
		323,9	12,0	11,16	29,02	10.963	134.158.721	828.524	110,62	1.091.633	268.317.442	1,017	93,15
16"	16"	406,4	12,7	11,81	34,41	14.641	285.213.718	1.403.611	139,57	1.839.528	570.427.435	1,277	123,31
20"	20"	508,0	12,7	11,81	43,01	18.411	566.935.895	2.232.031	175,48	2.908.459	1.133.871.790	1,596	155,13
24"	24"	609,6	12,7	11,81	51,61	22.181	991.196.628	3.251.957	211,39	4.221.230	1.982.393.256	1,915	186,95

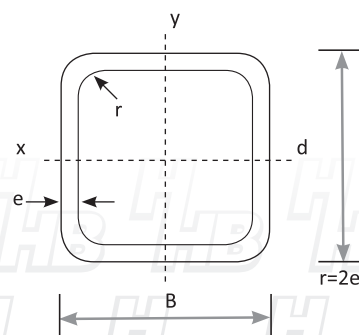
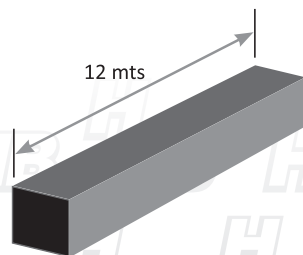
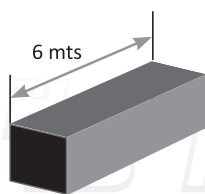
NORMA DE FABRICACIÓN		Fy (MPa)	Fu (MPa)
Para espesores menores y 12,7 mm	ASTM A500 Grado C	315	425
Para espesores iguales a 12mm	ASTM A500 Grado A	230	310

Norma ASTM A 500 Grado del Acero	Propiedades Mecánicas (Mínimas)		
	Límite de Faluencia	Resistencia a la Tracción (psi)	% Elongación
Grado A	39.000	45.000	25,00
Grado B	46.000	58.000	23,00
Grado C	50.000	62.000	21,00

4.2 TUBERÍAS DE ACERO ESTRUCTURAL CUADRADO

REF.	Dimensiones Nominales			Dimensión de Diseño	tdiseño	b/t	Área de diseño de la sección transversal	EJE DE SIMETRÍA				Saint Venant	Area superficial	Peso Nominal
								IC	SC	rC	ZP			
Tubería Cuadrada	A [mm]	B [mm]	t [mm]	b [mm]	[mm]		[mm ²]	[mm ⁴]	[mm ³]	[mm]	[mm ³]	J [mm ⁴]	[m ² / m]	[kg / m]
25 x 25	25	25	1,5	16,00	1,40	11,47	123	10.907	873	9,42	1.057	18.348	0,092	1,16
	25	25	2,0	13,00	1,86	6,99	156	13.049	1.044	9,13	1.301	23.046	0,090	1,51
	25	25	2,5	10,00	2,33	4,30	186	14.517	1.161	8,83	1.493	27.106	0,087	1,84
30 x 30	30	30	2,0	18,00	1,86	9,68	194	24.258	1.617	11,19	1.977	41.446	0,110	1,82
	30	30	2,5	15,00	2,33	6,45	233	27.660	1.844	10,90	2.310	49.282	0,107	2,26
	30	30	3,0	12,00	2,79	4,30	268	30.103	2.007	10,59	2.581	56.207	0,105	2,66
40 x 40	40	40	1,5	31,00	1,40	22,22	207	50.056	2.503	15,57	2.943	80.261	0,152	1,87
	40	40	2,0	28,00	1,86	15,05	268	62.719	3.136	15,30	3.748	103.194	0,150	2,45
	40	40	2,5	25,00	2,33	10,75	326	73.487	3.674	15,02	4.466	124.332	0,147	3,02
50 x 50	40	40	3,0	22,00	2,79	7,89	380	82.432	4.122	14,73	5.100	143.742	0,145	3,57
	50	50	1,5	41,00	1,40	29,39	262	101.367	4.055	19,66	4.724	160.183	0,192	2,24
	50	50	2,0	38,00	1,86	20,43	342	128.769	5.151	19,39	6.076	207.506	0,190	3,08
60 x 60	50	50	2,5	35,00	2,33	15,05	419	153.123	6.125	19,12	7.320	251.939	0,187	3,81
	50	50	3,0	32,00	2,79	11,47	491	174.516	6.981	18,84	8.455	293.566	0,185	4,51
	60	60	1,5	51,00	1,40	36,56	318	179.356	5.979	23,74	6.923	280.788	0,232	2,81
70 x 70	60	60	2,0	48,00	1,86	25,81	417	229.848	7.662	23,48	8.963	365.543	0,230	3,71
	60	60	2,5	45,00	2,33	19,35	512	275.866	9.196	23,22	10.871	446.052	0,227	4,59
	60	60	3,0	42,00	2,79	15,05	603	317.515	10.584	22,95	12.648	522.420	0,225	5,45
90 x 90	70	70	2,0	58,00	1,86	31,18	491	373.396	10.668	27,57	12.407	588.463	0,270	4,34
	70	70	2,5	55,00	2,33	23,66	605	451.017	12.886	27,31	15.119	720.622	0,267	5,38
	70	70	3,0	52,00	2,79	18,64	715	522.589	14.931	27,04	17.678	847.044	0,265	6,39
100 x 100	90	90	2,0	78,00	1,86	41,94	640	817.658	18.170	35,74	20.970	1.273.597	0,350	5,59
	90	90	2,5	75,00	2,33	32,26	791	995.743	22.128	35,49	25.709	1.566.932	0,347	6,95
	90	90	3,0	72,00	2,79	25,81	938	1.163.604	25.858	35,22	30.249	1.850.560	0,345	8,28
120 x 120	100	100	2,0	88,00	1,86	47,31	714	1.133.253	22.665	39,83	26.089	1.758.130	0,390	6,22
	100	100	2,5	85,00	2,33	36,56	884	1.383.917	27.678	39,57	32.050	2.166.572	0,387	7,73
	100	100	3,0	82,00	2,79	29,39	1.049	1.621.864	32.437	39,31	37.790	2.562.932	0,385	9,22
135 x 135	100	100	4,0	76,00	3,72	20,43	1.370	2.060.301	41.206	38,78	48.609	3.320.100	0,379	12,14
	100	100	6,0	64,00	5,58	11,47	1.966	2.792.252	55.845	37,69	67.643	4.697.061	0,369	17,75
	120	120	4,0	96,00	3,72	25,81	1.667	3.677.563	61.293	46,97	71.701	5.848.682	0,459	14,81
150 x 150	135	135	4,0	111,00	3,72	29,84	1.890	5.329.924	78.962	53,10	91.949	8.416.638	0,519	16,69
	135	135	6,0	99,00	5,58	17,74	2.747	7.438.253	110.196	52,04	130.737	12.095.906	0,509	24,58
	150	150	4,0	126,00	3,72	33,87	2.114	7.414.726	98.863	59,23	114.709	11.643.882	0,579	18,57
200 x 200	150	150	6,0	114,00	5,58	20,43	3.082	10.430.275	139.070	58,18	164.055	16.808.007	0,569	27,41
	150	150	9,0	96,00	8,37	11,47	4.423	14.135.777	188.477	56,53	228.295	23.778.871	0,554	40,08
	200	200	5,0	170,00	4,65	36,56	3.535	22.142.674	221.427	79,14	256.400	34.665.159	0,774	30,88
220 x 220	200	200	7,0	158,00	6,51	24,27	4.846	29.556.280	295.563	78,10	346.472	47.158.129	0,764	42,70
	200	200	9,0	146,00	8,37	17,44	6.097	36.178.243	361.782	77,03	429.529	58.900.090	0,754	54,21
	220	220	7,0	178,00	6,51	27,34	5.366	39.947.001	363.155	86,28	424.026	63.345.184	0,844	47,09
250 x 250	220	220	9,0	166,00	8,37	19,83	6.767	49.140.333	446.730	85,22	527.600	79.333.598	0,834	59,86
	250	250	9,0	196,00	8,37	23,42	7.771	73.861.649	590.893	97,49	693.538	118.080.455	0,954	68,34
	300	300	10,0	240,00	9,30	25,81	10.420	143.654.801	957.699	117,41	1.120.328	228.464.141	1,148	91,25
300 x 300	300	300	12,0	228,00	11,16	20,43	12.327	166.884.397	1.112.563	116,35	1.312.443	268.928.112	1,138	108,60

Largo de tubos más comerciales



4.3 TUBERÍAS DE ACERO ESTRUCTURAL RECTANGULAR

REF.	Dimensiones Nominales			Dimensiones de Diseño		tdiseño	h/t	b/t	Área de diseño de la sección transversal	EJE X-X				EJE Y-Y				Saint Venant	Area superf.	Peso Nominal
	A [mm]	B [mm]	t [mm]	h [mm]	b [mm]					[mm]	Ix [mm4]	Sx [mm3]	rx [mm]	Zx [mm3]	Iy [mm4]	Sy [mm3]	ry [mm]			
Tubería Rectangular	A [mm]	B [mm]	t [mm]	h [mm]	b [mm]	[mm]			[mm2]	[mm4]	[mm3]	[mm]	[mm3]	[mm4]	[mm3]	[mm]	[mm3]	J [mm4]	[m2 / m]	[kg / m]
50 x 30	50	30	1,5	41	21	1,40	29,39	15,05	207	68.401	2.736	18,20	3.368	31.268	2.085	12,30	2.379	69.852	0,152	1,87
	50	30	2,0	38	18	1,86	20,43	9,68	268	85.643	3.426	17,88	4.285	39.008	2.601	12,06	3.024	89.494	0,150	2,45
	50	30	2,5	35	15	2,33	15,05	6,45	326	100.236	4.009	17,54	5.103	45.509	3.034	11,82	3.597	107.430	0,147	3,02
60 x 40	60	40	1,5	51	31	1,40	36,56	22,22	262	131.435	4.381	22,38	5.288	70.856	3.543	16,43	4.020	146.909	0,192	2,34
	60	40	2,0	48	28	1,86	25,81	15,05	342	166.953	5.565	22,08	6.800	89.797	4.490	16,19	5.166	189.985	0,190	3,08
	60	40	2,5	45	25	2,33	19,35	10,75	419	198.485	6.616	21,77	8.189	106.530	5.327	15,95	6.218	230.258	0,187	3,81
76 x 38	60	40	3,0	42	22	2,79	15,05	7,89	491	226.126	7.538	21,45	9.456	121.134	6.057	15,70	7.176	267.814	0,185	4,51
	76	38	1,5	67	29	1,40	48,03	20,79	301	226.016	5.948	27,38	7.357	78.036	4.107	16,09	4.578	187.101	0,220	2,67
	76	38	2,0	64	26	1,86	34,41	13,98	394	288.709	7.598	27,05	9.501	99.256	5.224	15,86	5.903	242.174	0,218	3,52
80 x 40	76	38	2,5	61	23	2,33	26,24	9,89	484	345.270	9.086	26,71	11.494	118.216	6.222	15,63	7.131	293.767	0,215	4,35
	76	38	3,0	58	20	2,79	20,79	7,17	570	395.817	10.416	26,36	13.336	134.999	7.105	15,40	8.262	341.978	0,213	5,17
	80	40	1,5	71	31	1,40	50,90	22,22	318	265.285	6.632	28,88	8.190	91.655	4.583	16,97	5.097	219.193	0,232	2,81
90 x 50	80	40	2,0	68	28	1,86	36,56	15,05	417	339.672	8.492	28,55	10.596	116.875	5.844	16,75	6.585	284.149	0,230	3,71
	80	40	2,5	65	25	2,33	27,96	10,75	512	407.239	10.181	28,21	12.842	139.573	6.979	16,51	7.970	345.227	0,227	4,59
	80	40	3,0	62	22	2,79	22,22	7,89	603	468.109	11.703	27,86	14.928	159.837	7.992	16,28	9.252	402.530	0,225	5,45
100 x 40	90	50	2,0	78	38	1,86	41,94	20,43	491	528.621	11.747	32,80	14.412	215.021	8.601	20,92	9.658	491.438	0,270	4,34
	90	50	2,5	75	35	2,33	32,26	15,05	605	638.218	14.183	32,49	17.555	258.896	10.356	20,69	11.753	600.244	0,267	5,38
	90	50	3,0	72	32	2,79	25,81	11,47	715	739.068	16.424	32,16	20.516	299.027	11.961	20,46	13.724	703.673	0,265	6,39
100 x 50	100	40	1,5	91	31	1,40	65,23	22,22	374	462.768	9.255	35,18	11.651	112.454	5.623	17,34	6.174	294.648	0,272	3,28
	100	40	2,0	88	28	1,86	47,31	15,05	491	595.753	11.915	34,83	15.136	143.953	7.198	17,12	8.004	382.441	0,270	4,34
	100	40	2,5	85	25	2,33	36,56	10,75	605	718.348	14.367	34,46	18.424	172.616	8.631	16,89	9.722	465.230	0,267	5,38
100 x 50	100	40	3,0	82	22	2,79	29,39	7,89	715	830.700	16.614	34,09	21.517	198.539	9.927	16,67	11.328	543.140	0,265	6,39
	100	50	1,5	91	41	1,40	65,23	29,39	402	530.590	10.612	36,34	13.026	183.779	7.351	21,39	8.114	435.338	0,292	3,52
	100	50	2,0	88	38	1,86	47,31	20,43	528	685.337	13.707	36,01	16.962	236.584	9.463	21,16	10.553	567.626	0,290	4,65
120 x 60	100	50	2,5	85	35	2,33	36,56	15,05	651	829.276	16.586	35,68	20.695	285.340	11.414	20,93	12.862	693.723	0,287	5,77
	100	50	3,0	82	32	2,79	29,39	11,47	770	962.561	19.251	35,35	24.229	330.154	13.206	20,70	15.041	813.761	0,285	6,86
	100	50	4,0	76	26	3,72	20,43	6,99	998	1.197.777	23.956	34,65	30.701	408.398	16.336	20,23	19.017	1.036.177	0,279	9,00
150 x 50	120	60	2,0	108	48	1,86	58,06	25,81	640	1.209.702	20.162	43,48	24.815	418.531	13.951	25,57	15.451	995.598	0,350	5,59
	120	60	2,5	105	45	2,33	45,16	19,35	791	1.472.408	24.540	43,15	30.409	508.008	16.934	25,35	18.916	1.221.492	0,347	6,95
	120	60	3,0	102	42	2,79	36,56	15,05	938	1.719.587	28.660	42,82	35.762	591.681	19.723	25,12	22.225	1.438.504	0,345	8,28
150 x 100	150	50	2,0	138	38	1,86	74,19	20,43	714	1.902.428	25.366	51,60	32.497	344.400	13.776	21,96	15.030	963.882	0,390	6,22
	150	50	2,5	135	35	2,33	58,06	15,05	884	2.319.529	30.927	51,23	39.884	417.557	16.702	21,74	18.404	1.179.872	0,387	7,73
	150	50	3,0	132	32	2,79	47,31	11,47	1.049	2.713.658	36.182	50,85	46.977	485.793	19.432	21,52	21.627	1.386.232	0,385	9,22
200 x 70	150	50	4,0	126	26	3,72	33,87	6,99	1.370	3.433.870	45.785	50,07	60.293	608.018	24.321	21,07	27.625	1.770.775	0,379	12,40
	150	100	3,0	132	82	2,79	47,31	29,39	1.328	4.225.377	56.338	56,40	67.513	2.281.168	45.623	41,44	51.351	4.675.133	0,485	11,69
	150	100	4,0	126	76	3,72	33,87	20,43	1.742	5.424.298	72.324	55,81	87.501	2.922.825	58.457	40,97	66.517	6.084.093	0,479	15,43
200 x 100	150	100	6,0	114	64	5,58	20,43	11,47	2.524	7.519.256	100.257	54,58	123.762	4.037.362	80.747	40,00	93.986	8.688.400	0,469	22,70
	200	70	3,0	182	52	2,79	65,23	18,64	1.440	6.861.712	68.617	69,03	87.705	1.342.251	38.350	30,53	42.055	3.707.367	0,525	12,63
	200	70	4,0	176	46	3,72	47,31	12,37	1.890	8.815.389	88.154	68,29	113.788	1.711.431	48.898	30,09	54.394	4.795.804	0,519	16,69
250 x 100	200	70	6,0	164	34	5,58	29,39	6,09	2.747	12.236.315	122.363	66,74	161.286	2.340.879	66.882	29,19	76.614	6.763.261	0,509	24,58
	200	100	3,0	182	82	2,79	65,23	29,39	1.607	8.489.442	84.894	72,67	104.212	2.940.471	58.809	42,77	64.911	6.965.409	0,585	14,05
	200	100	4,0	176	76	3,72	47,31	20,43	2.114	10.965.389	109.654	72,03	135.693	3.785.349	75.707	42,32	84.425	9.082.016	0,579	18,58
300 x 100	200	100	6,0	164	64	5,58	29,39	11,47	3.082	15.400.972	154.010	70,69	193.831	5.282.471	105.649	41,40	120.329	13.020.172	0,569	27,41
	250	100	3,0	232	82	2,79	83,15	29,39	1.886	14.762.810	118.102	88,46	147.885	3.599.774	71.995	43,68	78.472	9.356.206	0,685	16,40
	250	100	5,0	220	70	4,65	47,31	15,05	3.070	23.271.621	186.173	87,06	236.503	5.623.177	112.464	42,80	125.063	14.939.097	0,674	26,95
300 x 150	250	150	5,0	220	120	4,65	47,31	25,81	3.535	30.270.316	242.163	92,54	293.547	13.892.041	185.227	62,69	207.629	30.272.043	0,774	30,88
	300	100	3,0	282	82	2,79	101,08	29,39	2.165	23.394.230	155.962	103,94	198.534	4.259.078	85.182	44,35	92.033	11.809.296	0,785	18,76
	300	100	5,0	270	70	4,65	58,06	15,05	3.535	37.112.467	247.416	102,46	319.068	6.680.916	133.618	43,47	147.232	18.877.952	0,774	30,88
400 x 200	300	100	7,0	258	58	6,51	39,63	8,91	4.846	49.360.524	329.070	100,93	430.241	8.787.786	175.756	42,59	197.602	25.330.246	0,764	42,70
	300	100	9,0	246	46	8,37	29,39	5,50	6.097	60.166.226	401.108	99,34	532.134	10.596.297	211.926	41,69	243.225	31.189.020	0,754	54,21
	300	150	8,0	252	102	7,44	33,87	13,71	6.223	70.865.345	472.436	106,72	591.175	24.357.558	324.767	62,56	367.269	59.486.601	0,859	54,77
400 x 200	300	150	10,0	240	90	9,30	25,81	9,68	7.630	84.691.415	564.609	105,35	714.801	28.989.513	386.527	61,64	443.418	72.129.1		

Largo de tubos más comerciales

