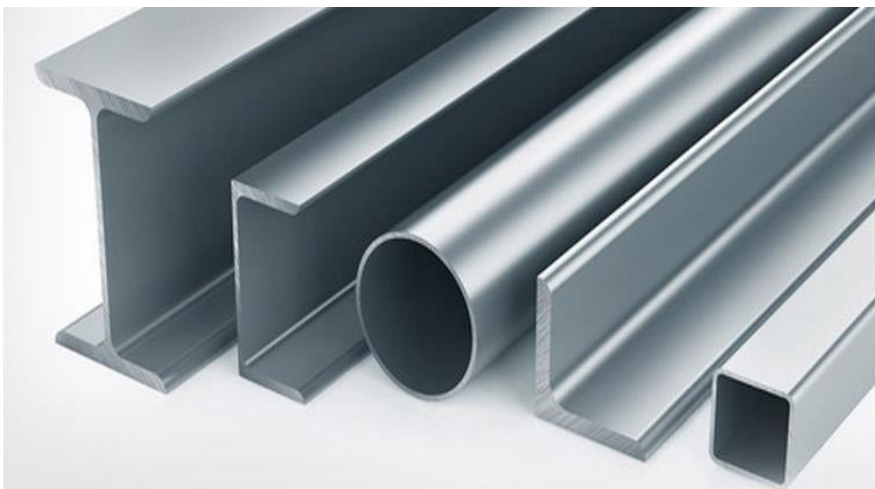




جدول اشتال کاربردی برای آزمون نظام مهندسی

گردآورنده:

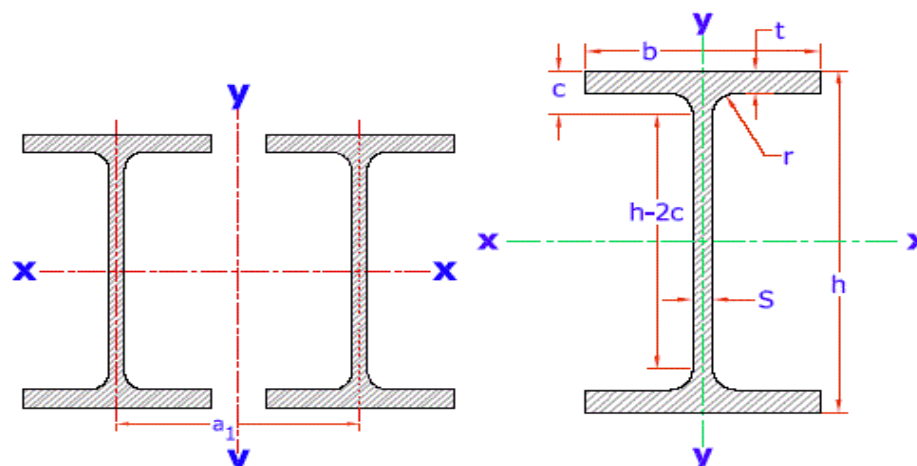
دکتر علی گوهررخي

goharrokhi.ali@gmail.com

Telegram: @ali_goharr

IPE

IPE	h mm	b mm	s mm	t mm	r mm	c mm	h-2c mm	A cm ²	G kg/m	I_x cm ⁴	S_x cm ³	r_x cm	Z_x cm ³	I_y cm ⁴	S_y cm ³	r_y cm	Z_y cm ³	a₁ mm	r_{ts} mm
80	80	46	3.8	5.2	5	10.2	59	7.64	6	80.1	20	3.24	23.2	8.49	3.69	1.05	5.82	63	12.6
100	100	55	4.1	5.7	7	12.7	74	10.3	8.1	171	34.2	4.07	39.4	15.9	5.79	1.24	9.15	79	14.8
120	120	64	4.4	6.3	7	13.3	93	13.2	10.4	318	53	4.9	60.7	27.7	8.65	1.45	13.6	96	17.2
140	140	73	4.7	6.9	7	13.9	112	16.4	12.9	541	77.3	5.74	88.3	44.9	12.3	1.65	19.2	112	19.7
160	160	82	5	7.4	9	16.4	127	20.1	15.8	869	109	6.58	124	68.3	16.7	1.84	26.1	129	21.9
180	180	91	5.3	8	9	17	146	23.9	18.8	1320	146	7.42	166	101	22.2	2.06	34.6	145	24.4
200	200	100	5.6	8.5	12	20.5	159	28.5	22.4	1940	194	8.26	221	142	28.5	2.24	44.6	162	26.5
220	220	110	5.9	9.2	12	21.2	177	33.4	26.2	2770	252	9.11	285	205	37.3	2.48	58.1	179	29.3
240	240	120	6.2	9.8	15	24.8	190	39.1	30.7	3890	324	9.97	367	284	47.3	2.6	73.9	196	31.8
270	270	135	6.6	10.2	15	25.2	219	45.9	36.1	5790	429	11.2	484	420	62.2	3.02	96.9	220	35.7
300	300	150	7.1	10.7	15	25.7	248	53.8	42.2	8360	557	12.5	628	604	80.5	3.35	125	245	39.6
330	330	160	7.5	11.5	18	29.5	271	62.6	49.1	11770	713	13.7	804	788	98.5	3.55	154	270	42.0
360	360	170	8	12.7	18	30.7	298	72.7	57.1	16270	904	15	1019	1040	123	3.79	191	294	44.7
400	400	180	8.6	13.5	21	34.5	331	84.5	66.3	23130	1160	16.5	1307	1320	146	3.95	229	326	46.9
450	450	190	9.4	14.6	21	35.6	378	98.8	77.6	33740	1500	18.5	1702	1680	176	4.12	276	365	49.4
500	500	200	10.2	16	21	37	426	116	90.7	48200	1930	20.4	2194	2140	214	4.31	336	404	51.8
550	550	210	11.1	17.2	24	41.2	467	134	106	67120	2440	22.3	2787	2670	254	4.45	400	442	54.0
600	600	220	12	19	24	43	514	156	122	92080	3070	24.3	3512	3390	308	4.66	486	481	56.6

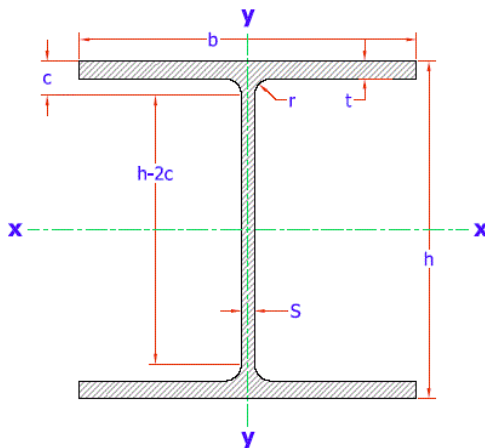


IPE

<i>IPE</i>	C_w <u>cm⁴</u>	J <u>cm⁴</u>	L_p (ST37) <u>cm</u>	L_p (ST52) <u>cm</u>	L_r (ST37) <u>cm</u>	L_r (ST52) <u>cm</u>
80	118.75	0.57	53.35	43.55	265.32	183.61
100	353.48	0.90	63.00	51.44	273.87	193.28
120	895.24	1.39	73.67	60.15	297.19	212.60
140	1988.58	2.06	83.84	68.44	322.56	233.26
160	3976.21	2.85	93.49	76.32	341.18	249.70
180	7469.96	3.96	104.67	85.45	371.16	273.37
200	13018.65	5.22	113.81	92.92	389.88	289.67
220	22773.78	7.15	126.01	102.87	426.49	317.82
240	37624.35	9.36	132.11	107.85	454.34	340.29
270	70870.84	12.04	153.45	125.27	492.46	372.60
300	126378.68	15.70	170.21	138.96	535.05	407.47
330	199841.23	20.70	180.38	147.25	559.33	427.66
360	313604.95	29.14	192.57	157.21	598.00	456.74
400	492961.43	37.72	200.70	163.85	615.94	473.11
450	796207.27	51.47	209.34	170.90	641.22	494.27
500	1253269.60	71.73	218.99	178.78	669.75	516.96
550	1894871.23	95.53	226.10	184.59	693.09	536.17
600	2860829.48	134.06	236.77	193.30	729.71	563.86

IPB

IPB	h mm	b mm	s mm	t mm	r mm	c mm	h-2c mm	A cm ²	G kg/m	I _x cm ⁴	S _x cm ³	r _x cm	Z _x cm ³	I _y cm ⁴	S _y cm ³	r _y cm	Z _y cm ³	r _{ts} mm
100	100	100	6	10	12	22	56	26	20.4	450	89.9	4.16	104	167	33.5	2.53	51.4	27.8
120	120	120	6.5	11	12	23	74	34	26.7	864	144	5.04	165	318	52.9	3.06	81	33.4
140	140	140	7	12	12	24	92	43	33.7	1510	216	5.93	245	550	78.5	3.58	120	38.9
160	160	160	8	13	15	28	104	54.3	42.6	2490	311	6.78	354	889	111	4.05	170	44.4
180	180	180	8.5	14	15	29	122	65.3	51.2	3830	426	7.66	481	1360	151	4.57	231	49.9
200	200	200	9	15	18	33	134	78.1	61.3	5700	570	8.54	643	2000	200	5.07	306	55.5
220	220	220	9.5	16	18	34	152	91	71.5	8090	736	9.43	827	2840	258	5.59	394	61
240	240	240	10	17	21	38	164	106	83.2	11260	938	10.3	1053	3920	327	6.08	498	66.6
260	260	260	10	17.5	24	41.5	177	118	93	14920	1150	11.2	1283	5130	395	6.58	602	72.2
280	280	280	10.5	18	24	42	196	131	103	19270	1380	12.1	1534	6590	471	7.09	718	77.6
300	300	300	11	19	27	46	208	149	117	25170	1680	13	1869	8560	571	7.58	870	83.2
320	320	300	11.5	20.5	27	47.5	225	161	127	30820	1930	13.8	2149	9240	616	7.57	939	83.1
340	340	300	12	21.5	27	48.5	243	171	134	36660	2160	14.6	2408	9690	646	7.53	986	82.9
360	360	300	12.5	22.5	27	49.5	261	181	142	43190	2400	15.5	2683	10140	676	7.49	1032	82.7
400	400	300	13.5	24	27	51	298	198	155	57680	2880	17.1	3232	10820	721	7.4	1104	82.3
450	450	300	14	26	27	53	344	218	171	79890	3550	19.1	3982	11720	781	7.33	1198	81.9
500	500	300	14.5	28	27	55	390	239	187	107200	4290	21.2	4815	12620	842	7.27	1292	81.6
550	550	300	15	29	27	56	438	254	199	136700	4970	23.2	5591	13080	872	7.17	1341	81.1
600	600	300	15.5	30	27	57	486	270	212	171000	5700	25.2	6425	13530	902	7.08	1391	80.7

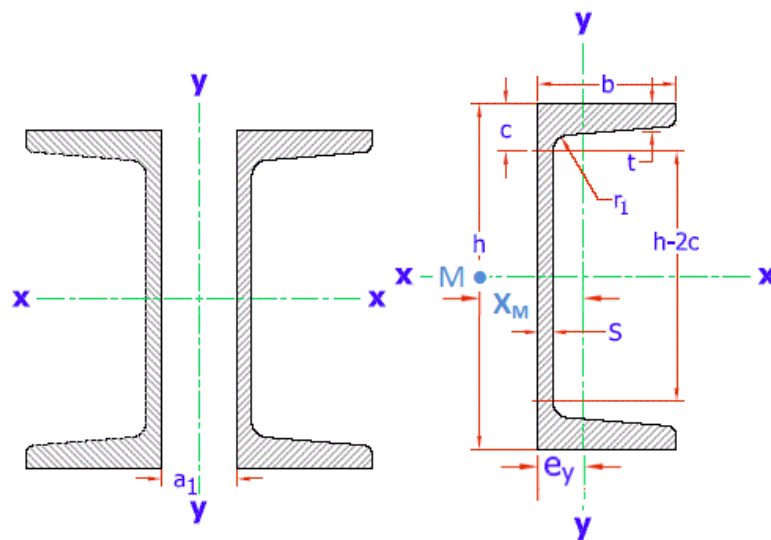


IPB

IPB	C_w <u>cm⁴</u>	J <u>cm⁴</u>	L_p (ST37) <u>cm</u>	L_p (ST52) <u>cm</u>	L_r (ST37) <u>cm</u>	L_r (ST52) <u>cm</u>
100	3381.75	7.31	128.55	104.94	911.77	930.99
120	9445.40	11.65	155.48	126.93	994.45	1090.61
140	22528.00	17.59	181.90	148.50	1075.47	1249.19
160	48026.00	25.94	205.78	167.99	1157.24	1403.83
180	93690.40	36.33	232.20	189.56	1240.99	1563.82
200	171125.00	49.50	257.61	210.30	1317.99	1719.20
220	295473.60	65.90	284.03	231.87	1408.22	1884.51
240	487344.20	86.04	308.92	252.20	1488.62	2041.94
260	754190.16	100.98	334.33	272.94	1517.27	2183.60
280	1130909.90	118.97	360.24	294.09	1567.10	2336.60
300	1689765.40	149.65	385.14	314.42	1650.67	2495.00
320	2072075.78	187.49	384.63	314.00	1667.62	2499.63
340	2457438.51	217.11	382.60	312.34	1645.97	2491.90
360	2887523.44	249.79	380.57	310.69	1628.80	2486.66
400	3824220.80	307.32	375.99	306.95	1567.90	2465.78
450	5267436.80	390.30	372.44	304.05	1506.87	2445.44
500	7028835.20	487.01	369.39	301.56	1458.88	2428.59
550	8876120.70	546.39	364.31	297.41	1383.24	2402.58
600	10989742.50	610.75	359.73	293.68	1321.57	2378.25

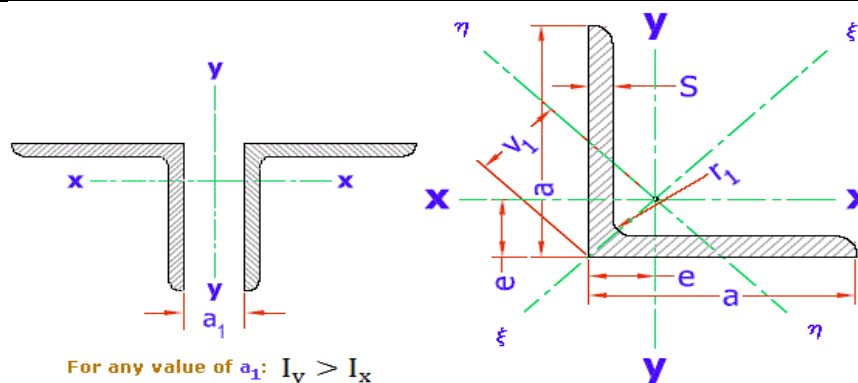
UNP

UNP	h mm	b mm	s mm	t=r ₁ mm	c mm	h-2c mm	A cm ²	G kg/m	I _x cm ⁴	S _x cm ³	r _x cm	Z _x cm ³	I _y cm ⁴	S _y cm ³	r _y cm	Z _y cm ³	e _y cm	x _M cm	a ₁ mm
80	80	45	6	8	17	47	11	8.64	106	26.5	3.1	29.6	19.4	6.36	1.33	12	1.45	2.67	28
100	100	50	6	8.5	18	64	13.5	10.6	206	41.2	3.91	45.2	29.3	8.49	1.47	16.1	1.55	2.93	42
120	120	55	7	9	19	82	17	13.4	364	60.7	4.62	66.3	43.2	11.1	1.59	21.2	1.6	3.03	56
140	140	60	7	10	21	97	20.4	16	605	86.4	5.45	93.9	62.7	14.8	1.75	28.2	1.75	3.37	70
160	160	65	7.5	10.5	22.5	116	24	18.8	925	116	6.21	125	85.3	18.3	1.89	35	1.84	3.56	82
180	180	70	8	11	23.5	133	28	22	1350	150	6.95	162	114	22.4	2.02	42.9	1.92	3.75	96
200	200	75	8.5	11.5	24.5	151	32.2	25.3	1910	191	7.7	205	148	27	2.14	51.7	2.01	3.94	108
220	220	80	9	12.5	26.5	166	37.4	29.4	26900	245	8.48	262	197	33.6	2.3	64.2	2.14	4.2	122
240	240	85	9.5	13	28	185	42.3	33.2	3600	300	9.22	320	248	39.6	2.42	75.7	2.23	4.39	134
260	260	90	10	14	30	201	48.3	37.9	4820	371	9.99	396	317	47.7	2.56	91.6	2.36	4.66	146
280	280	95	10	15	32	216	53.3	41.8	6280	448	10.9	478	399	57.2	2.74	110	2.53	5.02	160
300	300	100	10	16	34	232	58.8	46.2	8030	535	11.7	571	495	67.8	2.9	130	2.7	5.41	174
320	320	100	14	17.5	37	247	75.8	59.5	10870	679	12.1	730	597	80.6	2.81	152	2.6	4.82	182
350	350	100	14	16	34	283	77.3	60.6	12840	734	12.9	781	570	75	2.72	142	2.4	4.45	204
380	380	102	13.5	16	33.5	313	80.4	63.1	15760	829	14	879	615	78.7	2.77	149	2.38	4.58	227
400	400	110	14	18	38	325	91.5	71.8	20350	1020	14.9	1081	846	102	3.04	192	2.65	5.11	240



نیشی با ساق های مساوی

a X s mm	r ₁ mm	V ₁ cm	A cm ²	G kg/m	I _x =I _y cm ⁴	S _x =S _y cm ³	i _x =i _y cm	I _ξ cm ⁴	r _ξ cm	I _η cm ⁴	S _η cm ³	r _η cm	e cm
40 X 4	6	1.58	3.08	2.42	4.48	1.56	1.21	7.09	1.52	1.86	1.18	0.78	1.12
50 X 5	7	1.98	4.8	3.77	11	3.05	1.51	17.4	1.9	4.59	2.32	0.98	1.4
55 X 5	8	2.15	5.32	4.18	14.7	3.7	1.66	23.3	2.09	6.11	2.84	1.07	1.52
55 X 6	8	2.21	6.31	4.95	17.3	4.4	1.66	27.4	2.08	7.24	3.28	1.07	1.56
60 X 6	8	2.39	6.91	5.42	22.8	5.29	1.82	36.1	2.29	9.43	3.95	1.17	1.69
70 X 7	9	2.79	9.4	7.38	42.4	8.43	2.12	67.1	2.67	17.6	6.31	1.37	1.97
75 X 6	10	2.89	8.75	6.87	45.6	8.35	2.28	72.2	2.87	18.9	6.54	1.47	2.04
75 X 7	10	2.95	10.1	7.94	52.4	9.67	2.28	83.6	2.88	21.1	7.15	1.45	2.09
75 X 8	10	3.01	11.5	9.03	58.9	11	2.26	93.3	2.85	24.4	8.11	1.46	2.13
80 X 7	10	3.13	10.8	8.49	64.2	11.1	2.44	102	3.07	26.5	8.48	1.57	2.21
80 X 8	10	3.2	12.3	9.66	72.3	12.6	2.42	115	3.06	29.6	9.25	1.55	2.26
90 X 8	11	3.53	13.9	10.9	104	16.1	2.74	165	3.45	43.5	12.3	1.77	2.5
90 X 9	11	3.59	15.5	12.2	116	18	2.74	184	3.45	47.8	13.3	1.76	2.54
100 X 8	12	3.87	15.5	12.2	145	19.9	3.06	230	3.85	59.9	15.5	1.96	2.74
100 X 10	12	3.99	19.2	15.1	177	24.7	3.04	280	3.82	73.3	18.4	1.95	2.82
100 X 12	12	4.1	22.7	17.8	207	29.2	3.02	328	3.8	86.2	21	1.95	2.9
110 X 10	12	4.34	21.2	16.6	239	30.1	3.36	379	4.23	98.6	22.7	2.16	3.07
110 X 12	12	4.45	25.1	19.7	280	35.7	3.34	444	4.21	116	26.1	2.15	3.15
120 X 12	13	4.8	27.5	21.6	368	42.7	3.65	584	4.6	152	31.6	2.35	3.4
150 X 15	16	6.01	43	33.8	898	83.5	4.57	1430	5.76	370	61.6	2.93	4.25



نیشی با ساق های نامساوی

a X b X s mm	r ₁ mm	A cm ²	G kg/m	e _x cm	e _y cm	I _x cm ⁴	S _x cm ³	r _x cm	I _y cm ⁴	S _y cm ³	r _y cm	I _ξ cm ⁴	r _ξ cm	I _η cm ⁴	r _η cm	a ₁ mm
40 X 20 X 4	3.5	2.25	1.77	1.47	0.48	3.59	1.42	1.26	0.6	0.39	0.52	3.79	1.3	0.39	0.42	13.8
50 X 30 X 5	4.5	3.78	2.96	1.73	0.74	9.41	2.88	1.58	2.54	1.12	0.82	10.4	1.66	1.56	0.64	12.2
50 X 40 X 5	4	4.27	3.35	1.56	1.07	10.4	3.02	1.56	5.89	2.01	1.18	13.3	1.76	3.02	0.84	—
60 X 30 X 5	6	4.29	3.37	2.15	0.68	15.6	4.04	1.9	2.6	1.12	0.78	16.5	1.96	1.69	0.63	21.4
80 X 40 X 6	7	6.89	5.41	2.85	0.88	44.9	8.73	2.55	7.59	2.44	1.05	47.6	2.63	4.9	0.84	29
80 X 40 X 8	7	9.01	7.07	2.94	0.95	57.6	11.4	2.53	9.68	3.18	1.04	60.9	2.6	6.41	0.84	27.2
90 X 60 X 6	7	8.69	6.82	2.89	1.41	71.7	11.7	2.87	25.8	5.61	1.72	82.8	3.09	14.6	1.3	17.8
100 X 50 X 8	9	11.5	8.99	3.59	1.13	116	18	3.18	19.5	5.04	1.31	123	3.28	12.6	1.05	35.4
100 X 50 X 10	9	14.1	11.1	3.67	1.2	141	22.2	3.16	23.4	6.17	1.29	149	3.25	15.5	1.04	33.8
120 X 80 X 12	11	22.7	17.8	4	2.03	323	40.4	3.77	114	19.1	2.25	371	4.04	66.1	1.71	20.2
130 X 65 X 10	11	18.6	14.6	4.65	1.45	321	38.4	4.15	54.2	10.7	1.71	340	4.27	35	1.37	46.8
130 X 65 X 12	11	22.1	17.3	4.74	1.53	376	45.5	4.12	63	12.7	1.69	397	4.24	41.2	1.37	44.6
150 X 75 X 11	10.5	23.6	18.6	5.37	1.65	545	56.6	4.8	93	15.9	1.98	578	4.95	59.8	1.59	54.4
150 X 100 X 12	13	28.7	22.6	4.89	2.42	650	64.2	4.76	232	30.6	2.84	749	5.1	132	2.15	28
150 X 100 X 14	13	33.2	26.1	4.97	2.5	744	74.1	4.73	264	35.2	2.82	856	5.07	152	2.14	26.2
160 X 80 X 12	13	27.5	21.6	5.72	1.77	720	70	5.11	122	19.6	2.1	763	5.26	78.9	1.69	57.9
160 X 80 X 14	13	31.8	25	5.81	1.85	823	80.7	5.09	139	22.5	2.09	871	5.23	90.5	1.69	55.8
180 X 90 X 10	14	26.2	20.6	6.28	1.85	880	75.1	5.8	151	21.2	2.4	934	5.97	97.4	1.93	69
180 X 90 X 12	14	31.2	24.5	6.37	1.93	1040	89.3	5.77	177	25.1	2.38	1100	5.94	114	1.92	67
200 X 100 X 10	15	29.2	23	6.93	2.01	1220	93.2	6.46	210	26.3	2.68	1300	6.66	133	2.14	77.4
200 X 100 X 12	15	34.8	27.3	7.03	2.1	1440	111	6.43	247	31.3	2.67	1530	6.63	158	2.13	75.2

