IS 12778 (2004): Hot Rolled Parallel Flange Steel Sections for Beams, Columns and Bearing Piles - Dimensions and Section Properties [CED 7: Structural Engineering and structural sections]

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भारतीय मानक

इस्पात के तप्त वेल्लित समान्तर फ्लेंज सैक्शन से बने बीम स्तम्भ एवं बेयरिंग पाइल सैक्शन — आयाम और सैक्शन के गुणधर्म

(पहला पुनरीक्षण)

Indian Standard

HOT ROLLED PARALLEL FLANGE STEEL SECTIONS FOR BEAMS, COLUMNS AND BEARING PILES — DIMENSIONS AND SECTION PROPERTIES

(First Revision)

ICS 77.140.70

BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

September 2004

Price Group 7

FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Structural Engineering and Structural Sections Sectional Committee had been approved by the Civil Engineering Division Council.

Parallel flange sections are hot rolled steel sections, with parallel or nearly parallel flange with square toes and curves at the root of flange and web. Structurally these beams are more efficient than the conventional I beams with taper flanges. Further these beams proved to be very popular with the construction industry for reasons of considerably reducing the cost of fabrication.

Whereas these beams are being widely used in most of the developed countries, their use is not very common in India; because of non-availability of the same in medium and large sizes; although a few sections of smaller depth are being rolled in very small quantities. A new versatile Universal Rolling Mill is being installed in India to produce various sizes of medium and large parallel flange beam and column sections and it is expected that the use of these efficient sections will increase and this Code will help the designers with additional dimensions, mass and section properties like area, moment of inertia, section modulus and radius of gyration, etc.

The present revision had been done based on the following considerations:

a) Larger sized parallel flange beams and columns will be available beyond the size range covered in existing code;

b) For the nominal size a variety of sections will be available with different thicknesses of web and flange and flange widths; and

c) Bearing pile sections have been incorporated, which were not covered in earlier Code.

This Code involves overcoming the above-mentioned shortcomings; specifically the following additions and modifications have been made:

a) Title of the Code has been modified to include bearing piles;

b) Narrow and wide flange beams have been clearly defined;

c) Column sections have been merged with wide flange beam sections since these sections can be used as beams or columns based on application;

d) Designation of sections has been modified from IPN to ISNPB for narrow parallel flange beams, IPW to ISWPB for wide parallel flange beams to keep parity with IS 808 : 1989 'Parallel flange bearing piles are designated as ISPBP';

e) Table 3 for the sectional properties of columns has been removed and the data has been merged with that of wide flange beam sections (*see* Table 2);

f) Bearing pile sections have been included in Table 3;

g) Some nominal sections from Table 2 have been brought to Table 1 in line with the definition of the sections;

h) Certain nominal sections have been removed from Tables 1 and 2 of earlier Code since these are not being/ going to be produced in the country;

j) Fillet radius of the sections has been modified to suit the latest production technology; and

k) Plastic section modulus values Z_{px} about X-X axis and Z_{py} about Y-Y axis have been included.

Institute for Steel Development and Growth (INSDAG), Kolkata has contributed considerably in the preparation of this standard.

The composition of the Committee responsible for the formulation of this standard is given at Annex A.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

HOT ROLLED PARALLEL FLANGE STEEL SECTIONS FOR BEAMS, COLUMNS AND BEARING PILES — DIMENSIONS AND SECTION PROPERTIES

(First Revision)

1 SCOPE

This standard covers the nominal dimensions; mass and sectional properties of hot rolled parallel flange beams, columns and bearing piles.

2 REFERENCES

The standards given below contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the following standards :

IS No.	*Title*
2062 : 1999	Steel for general structural purposes — Specification (*fifth revision*)
8500 : 1991	Structural steel — Microalloyed (medium and high strength qualities) — Specification (*first revision*)
12779 : 1989	Rolling and cutting tolerances for hot rolled parallel flange beam and cutting sections

3 DEFINITIONS

3.1 ***Y-Y* Axis** — A line parallel to the vertical axis of the web of the section and passing through the centre of gravity of the section profile.

3.2 ***X-X* Axis** — A line passing through the centre of gravity of the section profile and is at right angles to the *Y-Y* axis.

4 SYMBOLS

4.1 Symbols used in this standard have been indicated appropriately in Tables 1 to 3. Definitions of symbols used in Fig. 1 are given in **4.1.1**. Symbols for sectional properties and mass are given in **4.1.2** .

4.1.1 *Symbols for Dimensions*

B = flange width, mm;

D = depth of section, mm;

R = fillet radius, mm;

t = thickness of web, mm; and

T = thickness of flange, mm.

4.1.2 *Symbols for Sectional Properties and Mass*

a = sectional area, mm²;

I_x = moment of inertia about *X-X* axis, kg.mm²;

I_y = moment of inertia about *Y-Y* axis, kg.mm²;

M = mass of the section per metre length, kg/m;

e_x = distance of extreme fibre from *X-X* axis, mm;

e_y = distance of extreme fibre from *Y-Y* axis, mm;

$Z_x = \frac{I_x}{e_x}$ modulus of section about *X-X* axis, mm³;

$Z_y = \frac{I_y}{e_y}$ modulus of section about *Y-Y* axis, mm³;

Z_{px} = plastic section modulus about *X-X* axis, mm³;

Z_{py} = plastic section modulus about *Y-Y* axis, mm³;

$r_x = \sqrt{\frac{I_x}{a}}$ radius of gyration about *X-X* axis, mm; and

$r_y = \sqrt{\frac{I_y}{a}}$ radius of gyration about *Y-Y* axis, mm.

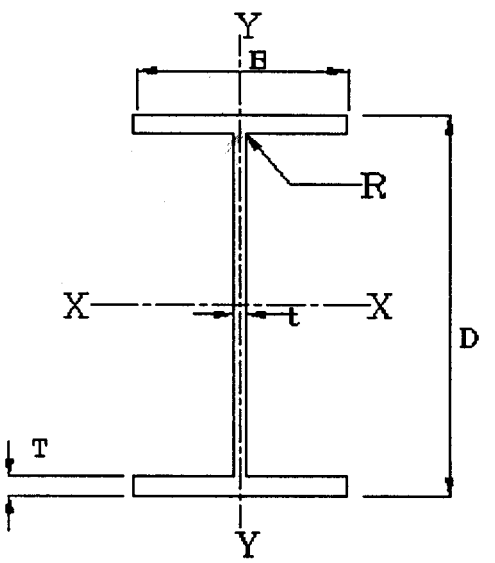

FIG. 1 PARALLEL FLANGE SECTION

5 CLASSIFICATION

5.1 Beams, column and pile sections are classified as follows:

a) Indian Standard Narrow Parallel Flange Beams, NPB.

b) Indian Standard Wide Parallel Flange Beams, WPB.

c) Indian Standard Parallel Flange Bearing Piles, PBP.

5.2 The following abbreviated reference symbols have been used in designating the Indian Standard sections mentioned in **5.1**:

Sl No.	*Section*	*Classification*	*Abbreviated Reference Symbol*
(1)	(2)	(3)	(4)
i)	Beams	ISNPB	NPB
ii)	Beams/ Columns	ISWPB	WPB
iii)	Pile Sections	ISPBP	PBP

6 DESIGNATION

6.1 Narrow Parallel Flange Beams, NPB

These are doubly symmetric shapes, generally used as beams whose inside flange surfaces are substantially parallel. Beams under this standard have flange widths generally lower than the depth. Beams are manufactured with heavy, medium and light flange and web thickness. Beams shall be designated by nominal depth and nominal flange width and mass of the section in kg/m. For example, NPB 300 × 150 × 36.52 would mean narrow parallel flange beam having nominal beam depth of 300 mm, nominal flange width of 150 mm and beam mass of 36.52 kg/m.

6.2 Wide Parallel Flange Beams, WPB

These are doubly symmetric shapes, generally used as beams or columns whose inside flange surfaces are substantially parallel. Beams or columns under the standard have nominal flange width same as depth up to nominal beam depth 300 mm. Beam depth larger than 300 mm have nominal flange width 300 to 400 mm. Columns may have flange widths more than the depths. Beams and column section are manufactured with heavy, medium and light flange and web thickness. Beams and columns are designated by nominal depth and nominal flange width and mass in kg/m. For example, WPB 600 × 300 × 128.79 would mean wide parallel flange beam having nominal depth 600 mm nominal flange width of 300 mm and beam mass of 128.79 kg/m; WPB 360 × 370 × 136.20 would mean wide parallel flange columns having nominal depth of 360 mm and nominal flange width of 370 mm and a mass of 136.20 kg/m.

6.3 Parallel Flange Bearing Pile Sections, PBP

These are doubly symmetric wide flange shapes generally used as bearing piles whose flanges and webs are of same nominal thickness and whose depth and width are essentially the same. Bearing piles are generally designated by nominal depth of the section and mass in kg/m. For example, PBP 360 × 174.02 would mean bearing pile section having nominal depth of 360 mm and nominal flange width of 360 mm and mass of 174.02 kg/m.

7 DIMENSIONS, MASS AND TOLERANCES

7.1 Nominal dimensions and mass of narrow and wide parallel flange beams and bearing piles shall conform to the values given in Tables 1 to 3, respectively of the standard.

7.2 Dimensional and mass tolerances of the various sections shall conform to the appropriate values stipulated in IS 12779.

8 SECTIONAL PROPERTIES

Sectional properties of the beam, column and pile sections are given in Tables 1 to 3, for information.

9 STEEL GRADES

9.1 Material strength of steel sections shall be conforming to IS 2062 for mild steel and IS 8500 for medium and high strength steel.

9.2 Bearing piles shall conform to the values given in Tables 1 to 3, respectively of the standard.

9.3 Dimensional and mass tolerances of the various sections shall conform to the appropriate values stipulated in IS 12779.

Table 1 Indian Standard Narrow Flange Beams

(*Foreword, Clauses* 4.1, 7.1, 8 *and* 9.2)

Sl No.	Designation					Mass	Area	Depth	Width	Web Thickness	Flange	Root Radius	Moment of Inertia		Radius of Gyration		Section Modulus		Plastic Section Modulus	
						M	a	D	B	t	T	R	I_x	I_y	r_x	r_y	Z_x	Z_y	Z_{px}	Z_{py}
						kg/m	cm^2	mm	mm	mm	mm	mm	cm^2	cm^2	cm	cm	cm^3	cm^3	cm^3	cm^3
(1)		(2)				(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1	NPB	100	×	55	×	8.10	10.3	100	55	4.1	5.7	7	171	15.9	4.07	1.24	34.2	5.8	39.41	9.15
2	NPB	120	×	60	×	10.37	13.2	120	64	4.4	6.3	7	318	27.7	4.90	1.45	53.0	8.6	60.73	13.58
3	NPB	140	×	70	×	12.89	16.4	140	73	4.7	6.9	7	541	44.9	5.74	1.65	77.3	12.3	88.35	19.25
4	NPB	160	×	80	×	15.77	20.1	160	82	5.0	7.4	9	869	68.3	6.58	1.84	108.7	16.7	123.87	26.10
5	NPB	180	×	90	×	15.37	19.6	177	91	4.3	6.5	9	1 063	81.9	7.37	2.05	120.1	18.0	135.34	27.96
6	NPB	180	×	90	×	18.80	23.9	180	91	5.3	8.0	9	1 317	100.9	7.42	2.05	146.3	22.2	166.42	34.60
7	NPB	180	×	90	×	21.27	27.1	182	92	6.0	9.0	9	1 505	117.3	7.45	2.08	165.4	25.5	189.16	39.91
8	NPB	200	×	100	×	18.42	23.5	197	100	4.5	7.0	12	1 591	117.2	8.23	2.23	161.6	23.4	181.67	36.54
9	NPB	200	×	100	×	22.36	28.5	200	100	5.6	8.5	12	1 943	142.4	8.26	2.24	194.3	28.5	220.66	44.62
10	NPB	200	×	100	×	25.09	32.0	202	102	6.2	9.5	12	2 211	168.9	8.32	2.30	218.9	33.1	249.44	51.90
11	NPB	200	×	130	×	27.37	34.9	207	133	5.8	8.5	12	2 666	334.0	8.74	3.10	257.5	50.2	288.18	77.47
12	NPB	200	×	130	×	31.55	40.2	210	134	6.4	10.0	12	3 153	401.9	8.86	3.16	300.3	60.0	337.19	92.46
13	NPB	200	×	150	×	30.45	38.8	194	150	6.0	9.0	12	2 675	507.0	8.30	3.62	275.7	67.6	306.78	103.54
14	NPB	200	×	165	×	35.68	45.5	201	165	6.2	10.0	12	3 414	749.5	8.67	4.06	339.7	90.9	376.80	138.58
15	NPB	200	×	165	×	42.47	54.1	205	166	7.2	12.0	12	4 166	916.0	8.77	4.11	406.4	110.4	454.30	168.46
16	NPB	200	×	165	×	48.00	61.1	210	166	6.5	14.5	12	5 025	1106.4	9.07	4.25	478.6	133.3	534.68	202.43
17	NPB	220	×	110	×	22.18	28.3	217	110	5.0	7.7	12	2 317	171.4	9.05	2.46	213.5	31.2	240.23	48.49
18	NPB	220	×	110	×	26.20	33.4	220	110	5.9	9.2	12	2 772	204.9	9.11	2.48	252.0	37.3	285.43	58.11
19	NPB	220	×	110	×	29.35	37.4	222	112	6.6	10.2	12	3 134	239.8	9.16	2.53	282.3	42.8	321.17	66.91
20	NPB	240	×	120	×	26.15	33.3	237	120	5.2	8.3	15	3 290	240.1	9.94	2.68	277.7	40.0	311.61	62.41
21	NPB	240	×	120	×	30.71	39.1	240	120	6.2	9.8	15	3 892	283.6	9.97	2.69	324.3	47.3	366.68	73.93
22	NPB	240	×	120	×	34.31	43.7	242	122	7.0	10.8	15	4 369	328.5	10.00	2.74	361.1	53.9	410.31	84.40
23	NPB	250	×	125	×	30.11	38.4	250	125	6.0	9.0	15	4 138	294.3	10.39	2.77	331.1	47.1	373.65	73.63

Table 1 (*Continued*)

Sl No.	Designation	Mass	Area	Depth	Width	Web Thickness	Flange	Root Radius	Moment of Inertia		Radius of Gyration		Section Modulus		Plastic Section Modulus	
		M	a	D	B	t	T	R	I_x	I_y	r_x	r_y	Z_x	Z_y	Z_{px}	Z_{py}
		kg/m	cm²	mm	mm	mm	mm	mm	cm²	cm²	cm	cm	cm³	cm³	cm³	cm³
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
24	NPB 250 × 150 ×	34.08	43.4	258	146	6.1	9.2	15	5 120	478.6	10.86	3.32	396.9	65.6	444.26	101.53
25	NPB 250 × 150 ×	39.78	50.7	262	147	6.6	11.2	15	6 200	594.5	11.06	3.43	473.3	80.9	530.17	124.91
26	NPB 250 × 150 ×	46.48	59.2	266	148	7.6	13.2	15	7 381	715.2	11.17	3.48	555.0	96.7	625.47	149.41
27	NPB 250 × 175 ×	43.94	56.0	244	175	7.0	11.0	15	6 091	984.2	10.43	4.19	499.3	112.5	555.60	172.49
28	NPB 270 × 135 ×	30.73	39.1	267	135	5.5	8.7	15	4 917	358.0	11.21	3.02	368.3	53.0	412.53	82.35
29	NPB 270 × 135 ×	36.07	45.9	270	135	6.6	10.2	15	5 790	419.9	11.23	3.02	428.9	62.2	484.04	96.96
30	NPB 270 × 135 ×	42.26	53.8	274	136	7.5	12.2	15	6 947	513.5	11.36	3.09	507.1	75.5	574.69	117.71
31	NPB 300 × 150 ×	36.52	46.5	297	150	6.1	9.2	15	7 173	519.0	12.42	3.34	483.1	69.2	541.83	107.33
32	NPB 300 × 150 ×	42.24	53.8	300	150	7.1	10.7	15	8 356	603.8	12.46	3.35	557.1	80.5	628.40	125.23
33	NPB 300 × 150 ×	49.32	62.8	304	152	8.0	12.7	15	9 994	745.7	12.61	3.45	657.5	98.1	743.86	152.59
34	NPB 300 × 165 ×	39.88	50.8	310	165	5.8	9.7	15	8 795	727.6	13.16	3.78	567.4	88.2	630.54	135.70
35	NPB 300 × 165 ×	45.76	58.3	313	166	6.6	11.2	15	10 210	855.6	13.23	3.83	652.4	103.1	727.91	158.77
36	NPB 300 × 165 ×	53.46	68.1	317	167	7.6	13.2	15	12 123	1026.8	13.34	3.88	764.8	123.0	857.61	189.65
37	NPB 300 × 200 ×	59.56	75.9	303	203	7.5	13.1	15	12 860	1828.6	13.02	4.91	848.9	180.2	940.72	275.19
38	NPB 300 × 200 ×	66.75	85.0	306	204	8.5	14.6	15	14 511	2068.5	13.06	4.93	948.4	202.8	1056.85	310.27
39	NPB 300 × 200 ×	75.37	96.0	310	205	9.4	16.6	15	16 676	2386.8	13.18	4.99	1075.9	232.9	1204.62	356.48
40	NPB 330 × 160 ×	42.97	54.7	327	160	6.5	10.0	18	10 231	685.2	13.67	3.54	625.7	85.6	702.00	133.28
41	NPB 330 × 160 ×	49.15	62.6	330	160	7.5	11.5	18	11 767	788.1	13.71	3.55	713.1	98.5	804.40	153.69
42	NPB 330 × 160 ×	57.00	72.6	334	162	8.5	13.5	18	13 910	960.4	13.84	3.64	833.0	118.6	942.86	185.00
43	NPB 350 × 170 ×	50.21	64.0	357.6	170	6.6	11.5	18	14 515	944.3	15.06	3.84	811.8	111.1	906.84	171.87
44	NPB 350 × 170 ×	57.09	72.7	360	170	8.0	12.7	18	16 266	1043.5	14.95	3.79	903.6	122.8	1019.22	191.11
45	NPB 350 × 170 ×	66.04	84.1	364	172	9.2	14.7	18	19 047	1251.2	15.05	3.86	1046.6	145.5	1186.16	226.93
46	NPB 350 × 250 ×	79.18	100.9	340	250	9.0	14.0	18	21 530	3650.1	14.61	6.02	1266.5	292.0	1402.36	446.20
47	NPB 400 × 180 ×	57.38	73.1	397	180	7.0	12.0	21	20 293	1170.6	16.66	4.00	1022.3	130.1	1144.02	202.09
48	NPB 400 × 180 ×	66.30	84.5	400	180	8.6	13.5	21	23 128	1317.8	16.55	3.95	1156.4	146.4	1307.26	229.02
49	NPB 400 × 180 ×	75.66	96.4	404	182	9.7	15.5	21	26 747	1564.2	16.66	4.03	1324.1	171.9	1502.29	269.11
50	NPB 400 × 200 ×	67.28	85.7	400	200	8.0	13.0	21	24 224	1738.4	16.81	4.50	1211.2	173.8	1355.08	269.29

Table 1 (*Concluded*)

Sl No.	Designation					Mass	Area	Depth	Width	Web Thickness	Flange	Root Radius	Moment of Inertia		Radius of Gyration		Section Modulus		Plastic Section Modulus	
						M	a	D	B	t	T	R	I_x	I_y	r_x	r_y	Z_x	Z_y	Z_{px}	Z_{py}
						kg/m	cm²	mm	mm	mm	mm	mm	cm²	cm²	cm	cm	cm³	cm³	cm³	cm³
(1)	(2)					(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
51	NPB	450	×	190	×	67.15	85.5	447	190	7.6	13.1	21	29 759	1 502.4	18.65	4.19	1 331.5	158.1	1 494.42	245.76
52	NPB	450	×	190	×	77.57	98.8	450	190	9.4	14.6	21	33 743	1 675.9	18.48	4.12	1 499.7	176.4	1 701.93	276.40
53	NPB	450	×	190	×	92.36	117.7	456	192	11.0	17.6	21	40 923	2 085.4	18.65	4.21	1 794.9	217.2	2 046.40	341.01
54	NPB	500	×	200	×	79.36	101.1	497	200	8.4	14.5	21	42 933	1 939.2	20.61	4.38	1 727.7	193.9	1 946.16	301.64
55	NPB	500	×	200	×	90.68	115.5	500	200	10.2	16.0	21	48 199	2 141.7	20.43	4.31	1 927.9	214.2	2 194.27	335.90
56	NPB	500	×	200	×	107.31	136.7	506	202	12.0	19.0	21	57 777	2 621.7	20.56	4.38	2 283.7	259.6	2 613.13	408.55
57	NPB	550	×	210	×	92.07	117.3	547	210	9.0	15.7	24	59 979	2 432.2	22.61	4.55	2 193.0	231.6	2 474.87	361.53
58	NPB	550	×	210	×	105.52	134.4	550	210	11.1	17.2	24	67 116	2 667.6	22.35	4.45	2 440.6	254.1	2 787.22	400.56
59	NPB	550	×	210	×	122.52	156.1	556	212	12.7	20.2	24	79 157	3 224.4	22.52	4.55	2 847.4	304.2	3 263.59	480.54
60	NPB	600	×	220	×	107.56	137.0	597	220	9.8	17.5	24	82 919	3 116.3	24.60	4.77	2 777.8	283.3	3 141.42	442.09
61	NPB	600	×	220	×	122.45	156.0	600	220	12.0	19.0	24	92 083	3 387.3	24.30	4.66	3 069.4	307.9	3 512.64	485.68
62	NPB	600	×	220	×	154.46	196.8	610	224	15.0	24.0	24	118 302	4 520.8	24.52	4.79	3 878.8	403.6	4 471.27	640.11
63	NPB	700	×	250	×	113.45	144.5	694	250	9.0	16.0	24	118 957	4 176.5	28.69	5.38	3 428.1	334.1	3 859.34	518.31
64	NPB	700	×	250	×	128.41	163.6	695	250	11.5	16.5	24	128 015	4 312.4	27.98	5.13	3 683.9	345.0	4 220.06	543.03
65	NPB	700	×	250	×	143.42	182.7	700	250	12.5	19.0	24	145 636	4 966.4	28.23	5.21	4 161.0	397.3	4 765.55	625.38
66	NPB	700	×	250	×	153.86	196.0	704	250	13.0	21.0	24	159 165	5 488.8	28.50	5.29	4 521.7	439.1	5 171.33	690.11
67	NPB	700	×	250	×	171.47	218.4	709	250	14.5	23.5	24	178 390	6 145.5	28.58	5.30	5 032.2	491.6	5 777.24	775.44
68	NPB	750	×	270	×	145.29	185.1	750	265	13.2	16.6	17	161 958	5 165.3	29.58	5.28	4 318.9	389.8	5 009.90	616.68
69	NPB	750	×	270	×	174.54	222.3	760	270	14.4	21.6	17	206 351	7 107.0	30.46	5.65	5 430.3	526.4	6 244.16	827.22
70	NPB	750	×	270	×	202.48	257.9	770	270	15.6	26.6	17	249 537	8 752.4	31.10	5.83	6 481.5	648.3	7 431.05	1 016.07

Table 2 Indian Standard Wide Flange Beams

(*Foreword, Clauses* 4.1, 7.1, 8 *and* 9.2)

Sl No.	Designation					Mass	Area	Depth	Width	Web Thickness	Flange	Root Radius	Moment of Inertia		Radius of Gyration		Section Modulus		Plastic Section Modulus	
						M kg/m	a cm^2	D mm	B mm	t mm	T mm	R mm	I_x cm^2	I_y cm^2	r_x cm	r_y cm	Z_x cm^3	Z_y cm^3	Z_{px} cm^3	Z_{py} cm^3
(1)	(2)					(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1	WPB	100	×	100	×	12.24	15.6	91	100	4.2	5.5	12	237	92.1	3.89	2.43	52.0	18.4	58.36	28.45
2	WPB	100	×	100	×	16.67	21.2	96	100	5.0	8.0	12	349	133.8	4.06	2.51	72.8	26.8	83.02	41.14
3	WPB	100	×	100	×	20.44	26.0	100	100	6.0	10.0	12	450	167.3	4.16	2.53	89.9	33.5	104.22	51.43
4	WPB	100	×	100	×	41.79	53.2	120	106	12.0	20.0	12	1 143	399.2	4.63	2.74	190.4	75.3	235.82	116.32
5	WPB	120	×	120	×	14.56	18.6	109	120	4.2	5.5	12	413	158.8	4.72	2.93	75.8	26.5	84.13	40.63
6	WPB	120	×	120	×	19.89	25.3	114	120	5.0	8.0	12	606	230.9	4.89	3.02	106.3	38.5	119.50	58.86
7	WPB	120	×	120	×	26.69	34.0	120	120	6.5	11.0	12	864	317.5	5.04	3.06	144.1	52.9	165.22	80.97
8	WPB	120	×	120	×	52.13	66.4	140	126	12.5	21.0	12	2 018	702.8	5.51	3.25	288.2	111.6	350.62	171.63
9	WPB	140	×	140	×	18.07	23.0	128	140	4.3	6.0	12	719	274.8	5.59	3.45	112.4	39.3	123.79	59.94
10	WPB	140	×	140	×	24.66	31.4	133	140	5.5	8.5	12	1 033	389.3	5.73	3.52	155.4	55.6	173.51	84.85
11	WPB	140	×	140	×	33.72	43.0	140	140	7.0	12.0	12	1 509	549.7	5.93	3.58	215.6	78.5	245.44	119.79
12	WPB	140	×	140	×	63.24	80.6	160	146	13.0	22.0	12	3 291	1 144.3	6.39	3.77	411.4	156.8	493.84	240.52
13	WPB	150	×	150	×	22.96	29.2	152	152	5.8	6.8	8	1 250	399.9	6.54	3.70	164.0	52.6	181.99	80.16
14	WPB	150	×	150	×	30.04	38.3	158	153	6.5	9.4	8	1 748	560.5	6.76	3.83	221.8	73.3	247.67	111.59
15	WPB	150	×	150	×	36.98	47.1	162	154	8.0	11.5	8	2 210	706.2	6.85	3.87	273.2	91.5	308.77	139.58
16	WPB	160	×	160	×	23.83	30.4	148	160	4.5	7.0	15	1 283	478.7	6.50	3.97	173.4	59.8	190.43	91.37
17	WPB	160	×	160	×	30.44	38.8	152	160	6.0	9.0	15	1 673	615.6	6.57	3.98	220.1	76.9	245.17	117.64
18	WPB	160	×	160	×	42.59	54.3	160	160	8.0	13.0	15	2 492	889.2	6.78	4.05	311.5	111.2	353.98	169.97
19	WPB	160	×	160	×	76.19	97.1	180	166	14.0	23.0	15	5 098	1 758.8	7.25	4.26	566.5	211.9	674.58	325.47
20	WPB	180	×	180	×	28.68	36.5	167	180	5.0	7.5	15	1 967	730.0	7.34	4.47	235.6	81.1	258.26	123.59
21	WPB	180	×	180	×	35.52	45.3	171	180	6.0	9.5	15	2 510	924.6	7.45	4.52	293.6	102.7	324.87	156.50
22	WPB	180	×	180	×	51.22	65.3	180	180	8.5	14.0	15	3 831	1 362.8	7.66	4.57	425.7	151.4	481.47	231.02
23	WPB	180	×	180	×	88.90	113.3	200	186	14.5	24.0	15	7 483	2 580.1	8.13	4.77	748.3	277.4	883.47	425.20

Table 2 (*Continued*)

Sl No.	Designation					Mass	Area	Depth	Width	Web Thickness	Flange	Root Radius	Moment of Inertia		Radius of Gyration		Section Modulus		Plastic Section Modulus	
						M	a	D	B	t	T	R	I_x	I_y	r_x	r_y	Z_x	Z_y	Z_{px}	Z_{py}
						kg/m	cm^2	mm	mm	mm	mm	mm	cm^2	cm^2	cm	cm	cm^3	cm^3	cm^3	cm^3
(1)		(2)				(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
24	WPB	200	×	200	×	34.64	44.1	186	200	5.5	8.0	18	2 944	1 068.5	8.17	4.92	316.6	106.8	347.09	163.18
25	WPB	200	×	200	×	42.26	53.8	190	200	6.5	10.0	18	3 692	1 335.5	8.28	4.98	388.6	133.6	429.52	203.83
26	WPB	200	×	200	×	50.92	64.9	194	202	8.0	12.0	18	4 531	1 651.3	8.36	5.05	467.1	163.5	521.52	249.79
27	WPB	200	×	200	×	61.29	78.1	200	200	9.0	15.0	18	5 696	2 003.4	8.54	5.07	569.6	200.3	642.58	305.82
28	WPB	200	×	200	×	74.01	94.3	206	206	10.2	18.0	18	7 173	2 626.7	8.72	5.28	696.4	255.0	793.36	388.89
29	WPB	200	×	200	×	83.52	106.4	209	209	13.0	19.5	18	8 058	2 973.5	8.70	5.29	771.1	284.5	888.79	436.01
30	WPB	200	×	200	×	103.06	131.3	220	206	15.0	25.0	18	10 642	3 651.2	9.00	5.27	967.4	354.5	1 135.18	543.23
31	WPB	220	×	220	×	40.40	51.5	205	220	6.0	8.5	18	4 170	1510.5	9.00	5.42	406.9	137.3	445.54	209.36
32	WPB	220	×	220	×	50.51	64.3	210	220	7.0	11.0	18	5 410	1 954.6	9.17	5.51	515.2	177.7	568.50	270.61
33	WPB	220	×	220	×	71.47	91.0	220	220	9.5	16.0	18	8 091	2 843.3	9.43	5.59	735.5	258.5	827.09	393.89
34	WPB	220	×	220	×	117.31	149.4	240	226	15.5	26.0	18	14 605	5 012.0	9.89	5.79	1 217.1	443.5	1 419.49	678.57
35	WPB	240	×	240	×	47.39	60.4	224	240	6.5	9.0	21	5 835	2 077.0	9.83	5.87	521.0	173.1	570.63	264.40
36	WPB	240	×	240	×	60.32	76.8	230	240	7.5	12.0	21	7 763	2 768.8	10.05	6.00	675.1	230.7	744.68	351.71
37	WPB	240	×	240	×	83.20	106.0	240	240	10.0	17.0	21	11 259	3 922.7	10.31	6.08	938.3	326.9	1 053.20	498.44
38	WPB	240	×	240	×	156.67	199.6	270	248	18.0	32.0	21	24 289	8 152.6	11.03	6.39	1 799.2	657.5	2 117.00	1 005.95
39	WPB	250	×	250	×	67.21	85.6	247	252	11.0	11.1	24	9 398	2 969.9	10.48	5.89	760.9	235.7	851.84	364.64
40	WPB	250	×	250	×	73.14	93.2	252	250	9.0	13.6	24	11 092	3 548.8	10.91	6.17	880.3	283.9	977.27	434.45
41	WPB	250	×	250	×	85.04	108.3	253	255	14.0	14.1	24	12 165	3 910.3	10.60	6.01	961.7	306.7	1 088.84	475.58
42	WPB	250	×	250	×	97.03	123.6	260	256	12.7	17.6	24	15 030	4 932.9	11.03	6.32	1 156.2	385.4	1 305.61	591.60
43	WPB	250	×	250	×	103.97	132.4	264	257	11.9	19.6	24	16 770	5 555.5	11.25	6.48	1 270.5	432.3	1 434.44	660.86
44	WPB	250	×	250	×	117.57	149.8	269	259	13.5	22.1	24	19 338	6 412.3	11.36	6.54	1 437.8	495.2	1 636.79	757.50
45	WPB	250	×	250	×	133.91	170.6	275	261	15.4	25.1	24	22 550	7 454.1	11.50	6.61	1 640.0	571.2	1 884.69	874.73
46	WPB	250	×	250	×	148.37	189.0	280	263	17.3	27.6	24	25 419	8 388.5	11.60	6.66	1 815.6	637.9	2 103.69	978.31

Table 2 (*Continued*)

Sl No.	Designation					Mass	Area	Depth	Width	Web Thickness	Flange	Root Radius	Moment of Inertia		Radius of Gyration		Section Modulus		Plastic Section Modulus	
						M kg/m	a cm^2	D mm	B mm	t mm	T mm	R mm	I_x cm^2	I_y cm^2	r_x cm	r_y cm	Z_x cm^3	Z_y cm^3	Z_{px} cm^3	Z_{py} cm^3
(1)	(2)					(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
47	WPB	260	×	260	×	54.14	69.0	244	260	6.5	9.5	24	7 981	2 788.0	10.76	6.36	654.1	214.5	714.54	327.76
48	WPB	260	×	260	×	68.15	86.8	250	260	7.5	12.5	24	10 455	3 667.6	10.97	6.50	836.4	282.1	919.85	430.19
49	WPB	260	×	260	×	92.98	118.4	260	260	10.0	17.5	24	14 919	5 134.5	11.22	6.58	1 147.6	395.0	1 282.99	602.27
50	WPB	260	×	260	×	114.40	145.7	268	262	12.5	21.5	24	18 912	6 455.9	11.39	6.66	1 411.4	492.8	1 599.79	752.48
51	WPB	260	×	260	×	141.51	180.3	278	265	15.5	26.5	24	24 331	8 235.7	11.62	6.76	1 750.5	621.6	2 015.39	950.51
52	WPB	260	×	260	×	172.42	219.6	290	268	18.0	32.5	24	31 307	10 448.6	11.94	6.90	2 159.1	779.7	2 523.69	1 192.50
53	WPB	280	×	280	×	61.25	78.0	264	280	7.0	10.0	24	10 558	3 664.2	11.63	6.85	799.8	261.7	873.15	399.40
54	WPB	280	×	280	×	76.35	97.3	270	280	8.0	13.0	24	13 673	4 762.6	11.86	7.00	1 012.8	340.2	1 112.31	518.16
55	WPB	280	×	280	×	188.53	240.2	310	288	18.5	33.0	24	39 547	13 162.8	12.83	7.40	2 551.4	914.1	2 965.72	1 396.71
56	WPB	280	×	280	×	284.13	361.9	280	280	105.0	18.0	24	30 710	9 106.0	9.21	5.02	2 193.6	650.4	2 941.06	1 406.80
57	WPB	300	×	300	×	69.79	88.9	283	300	7.5	10.5	27	13 804	4 733.5	12.46	7.30	975.6	315.6	1 065.41	482.34
58	WPB	300	×	300	×	88.33	112.5	290	300	8.5	14.0	27	18 263	6 309.6	12.74	7.49	1 259.5	420.6	1 383.39	641.20
59	WPB	300	×	300	×	100.84	128.5	294	300	10.0	16.0	27	21 046	7 211.4	12.80	7.49	1 431.7	480.8	1 584.33	733.49
60	WPB	300	×	300	×	117.03	149.1	300	300	11.0	19.0	27	25 166	8 562.8	12.99	7.58	1 677.7	570.9	1 868.79	870.18
61	WPB	300	×	300	×	237.92	303.1	340	310	21.0	39.0	27	59 201	19 403.1	13.98	8.00	3 482.4	1 251.8	4 077.79	1 913.22
62	WPB	320	×	300	×	74.24	94.6	301	300	8.0	11.0	27	16 447	4 959.1	13.19	7.24	1 092.8	330.6	1 196.33	505.78
63	WPB	320	×	300	×	97.63	124.4	310	300	9.0	15.5	27	22 929	6 985.2	13.58	7.49	1 479.3	465.7	1 628.22	709.78
64	WPB	320	×	300	×	126.65	161.3	320	300	11.5	20.5	27	30 824	9 238.8	13.82	7.57	1 926.5	615.9	2 149.37	939.13
65	WPB	320	×	300	×	244.96	312.0	359	309	21.0	40.0	27	68 135	19 709.3	14.78	7.95	3 795.8	1 275.7	4 435.16	1 950.77
66	WPB	340	×	300	×	78.89	100.5	320	300	8.5	11.5	27	19 552	5 184.7	13.95	7.18	1 222.0	345.6	1 341.06	529.33
67	WPB	340	×	300	×	104.78	133.5	330	300	9.5	16.5	27	27 693	7 436.0	14.40	7.46	1 678.4	495.7	1 850.62	755.98
68	WPB	340	×	300	×	134.15	170.9	340	300	12.0	21.5	27	36 656	9 689.9	14.65	7.53	2 156.3	646.0	2 408.25	985.76
69	WPB	340	×	300	×	247.92	315.8	377	309	21.0	40.0	27	76 372	19 710.7	15.55	7.90	4 051.5	1 275.8	4 717.71	1 952.75
70	WPB	360	×	300	×	83.69	106.6	339	300	9.0	12.0	27	23 037	5 410.4	14.70	7.12	1 359.1	360.7	1 495.39	553.01
71	WPB	360	×	300	×	112.06	142.8	350	300	10.0	17.5	27	33 090	7 886.8	15.22	7.43	1 890.8	525.8	2 088.63	802.32
72	WPB	360	×	300	×	141.80	180.6	360	300	12.5	22.5	27	43 193	10 141.2	15.46	7.49	2 399.6	676.1	2 683.14	1 032.53
73	WPB	360	×	300	×	250.26	318.8	395	308	21.0	40.0	27	84 867	19 521.7	16.32	7.83	4 297.1	1 267.6	4 989.47	1 942.40

Table 2 (*Continued*)

Sl No.	Designation					Mass	Area	Depth	Width	Web Thickness	Flange	Root Radius	Moment of Inertia		Radius of Gyration		Section Modulus		Plastic Section Modulus	
						M kg/m	a cm^2	D mm	B mm	t mm	T mm	R mm	I_x cm^2	I_y cm^2	r_x cm	r_y cm	Z_x cm^3	Z_y cm^3	Z_{px} cm^3	Z_{py} cm^3
(1)	(2)					(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
74	WPB	360	×	370	×	136.20	173.5	356	369	11.2	17.8	27	42 157	14 919.4	15.59	9.27	2 368.4	808.6	2 605.43	1 229.20
75	WPB	360	×	370	×	150.87	192.2	360	370	12.3	19.8	27	47 302	16 731.3	15.69	9.33	2 627.9	904.4	2 904.60	1 375.09
76	WPB	360	×	370	×	165.34	210.6	364	371	13.3	21.8	27	52 553	18 571.5	15.80	9.39	2 887.5	1 001.2	3 205.61	1 522.43
77	WPB	360	×	370	×	182.01	231.9	368	373	15.0	23.8	27	58 271	20 607.1	15.85	9.43	3 166.9	1 104.9	3 537.19	1 682.17
78	WPB	360	×	370	×	197.65	251.8	372	374	16.4	25.8	27	63 916	22 520.9	15.93	9.46	3 436.3	1 204.3	3 858.07	1 834.89
79	WPB	400	×	300	×	92.39	117.7	378	300	9.5	13.0	27	31 252	5 861.4	16.30	7.06	1 653.5	390.8	1 824.31	599.73
80	WPB	400	×	300	×	124.80	159.0	390	300	11.0	19.0	27	45 069	8 563.8	16.84	7.34	2 311.2	570.9	2 561.97	872.90
81	WPB	400	×	300	×	155.26	197.8	400	300	13.5	24.0	27	57 680	10 819.0	17.08	7.40	2 884.0	721.3	3 231.91	1 104.08
82	WPB	400	×	300	×	255.74	325.8	432	307	21.0	40.0	27	104 119	19 335.5	17.88	7.70	4 820.3	1 259.6	5 570.79	1 934.18
83	WPB	400	×	400	×	191.10	243.4	368	391	15.0	24.2	27	61 575	24 131.9	15.90	9.96	3 346.5	1 234.4	3 732.52	1 876.35
84	WPB	400	×	400	×	219.66	279.8	375	394	17.3	27.7	27	72 147	28 265.8	16.06	10.05	3 847.8	1 434.8	4 328.52	2 183.16
85	WPB	400	×	400	×	239.62	305.2	380	395	18.9	30.2	27	79 786	31 054.9	16.17	10.09	4 199.3	1 572.4	4 751.77	2 394.25
86	WPB	450	×	300	×	99.74	127.1	425	300	10.0	13.5	27	41 888	6 087.5	18.16	6.92	1 971.2	405.8	2 183.54	624.39
87	WPB	450	×	300	×	139.75	178.0	440	300	11.5	21.0	27	63 722	9 465.3	18.92	7.29	2 896.4	631.0	3 216.07	965.57
88	WPB	450	×	300	×	171.11	218.0	450	300	14.0	26.0	27	79 888	11 721.3	19.14	7.33	3 550.6	781.4	3 982.57	1 197.70
89	WPB	450	×	300	×	263.32	335.4	478	307	21.0	40.0	27	131 484	19 339.0	19.80	7.59	5 501.4	1 259.9	6 331.22	1 939.25
90	WPB	500	×	300	×	107.45	136.9	472	300	10.5	14.0	27	54 643	6 313.8	19.98	6.79	2 315.4	420.9	2 576.46	649.33
91	WPB	500	×	300	×	129.77	165.3	480	300	11.5	18.0	27	68 968	8 115.9	20.43	7.01	2 873.6	541.1	3 196.94	832.09
92	WPB	500	×	300	×	155.07	197.5	490	300	12.0	23.0	27	86 975	10 367.0	20.98	7.24	3 550.0	691.1	3 949.08	1 058.55
93	WPB	500	×	300	×	187.33	238.6	500	300	14.5	28.0	27	107 176	12 623.9	21.19	7.27	4 287.0	841.6	4 814.79	1 291.69
94	WPB	500	×	300	×	270.27	344.3	524	306	21.0	40.0	27	161 929	19 154.7	21.69	7.46	6 180.5	1 251.9	7 094.50	1 932.06
95	WPB	550	×	300	×	119.98	152.8	522	300	11.5	15.0	27	72 871	6 766.5	21.84	6.65	2 792.0	451.1	3 127.86	698.68
96	WPB	550	×	300	×	166.23	211.8	540	300	12.5	24.0	27	111 932	10 819.0	22.99	7.15	4 145.6	721.3	4 622.07	1 106.94
97	WPB	550	×	300	×	199.44	254.1	550	300	15.0	29.0	27	136 691	13 076.9	23.20	7.17	4 970.6	871.8	5 590.86	1 341.18
98	WPB	550	×	300	×	278.19	354.4	572	306	21.0	40.0	27	197 984	19 158.4	23.64	7.35	6 922.5	1 252.2	7 932.94	1 937.35

Table 2 (*Concluded*)

Sl No.	Designation	Mass	Area	Depth	Width	Web Thickness	Flange	Root Radius	Moment of Inertia		Radius of Gyration		Section Modulus		Plastic Section Modulus	
		M kg/m	a cm^2	D mm	B mm	t mm	T mm	R mm	I_x cm^2	I_y cm^2	r_x cm	r_y cm	Z_x cm^3	Z_y cm^3	Z_{px} cm^3	Z_{py} cm^3
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
99	WPB 600 × 300 ×	128.79	164.1	571	300	12.0	15.5	27	91 872	6 993.4	23.66	6.53	3 217.9	466.2	3 623.34	724.51
100	WPB 600 × 300 ×	177.77	226.5	590	300	13.0	25.0	27	141 208	11 271.3	24.97	7.05	4 786.7	751.4	5 350.67	1 155.70
101	WPB 600 × 300 ×	211.92	270.0	600	300	15.5	30.0	27	171 041	13 530.2	25.17	7.08	5 701.4	902.0	6 425.42	1 391.10
102	WPB 600 × 300 ×	285.47	363.7	620	305	21.0	40.0	27	237 447	18 975.5	25.55	7.22	7 659.6	1 244.3	8 772.37	1 930.42
103	WPB 650 × 300 ×	137.97	175.8	620	300	12.5	16.0	27	113 944	7 220.6	25.46	6.41	3 675.6	481.4	4 160.16	750.69
104	WPB 650 × 300 ×	189.69	241.6	640	300	13.5	26.0	27	175 178	11 723.9	26.93	6.97	5 474.3	781.6	6 136.60	1 204.83
105	WPB 650 × 300 ×	224.78	286.3	650	300	16.0	31.0	27	210 616	13 984.0	27.12	6.99	6 480.5	932.3	7 320.19	1 441.45
106	WPB 650 × 300 ×	293.38	373.7	668	305	21.0	40.0	27	281 667	18 979.2	27.45	7.13	8 433.2	1 244.5	9 657.27	1 935.72
107	WPB 700 × 300 ×	149.89	190.9	670	300	13.0	17.0	27	142 721	7 673.1	27.34	6.34	4 260.3	511.5	4 840.47	799.75
108	WPB 700 × 300 ×	204.48	260.5	690	300	14.5	27.0	27	215 301	12 178.8	28.75	6.84	6 240.6	811.9	7 032.16	1 256.78
109	WPB 700 × 300 ×	240.51	306.4	700	300	17.0	32.0	27	256 888	14 440.8	28.96	6.87	7 339.7	962.7	8 327.47	1 495.09
110	WPB 700 × 300 ×	300.67	383.0	716	304	21.0	40.0	27	329 278	18 797.4	29.32	7.01	9 197.7	1 236.7	10 539.23	1 928.83
111	WPB 800 × 300 ×	171.51	218.5	770	300	14.0	18.0	30	208 882	8 133.7	30.92	6.10	5 425.5	542.2	6 225.28	856.60
112	WPB 800 × 300 ×	224.37	285.8	790	300	15.0	28.0	30	303 442	12 638.7	32.58	6.65	7 682.1	842.6	8 699.97	1 312.31
113	WPB 800 × 300 ×	262.33	334.2	800	300	17.5	33.0	30	359 083	14 903.7	32.78	6.68	8 977.1	993.6	10 229.20	1 553.19
114	WPB 800 × 300 ×	317.35	404.3	814	303	21.0	40.0	30	442 598	18 627.4	33.09	6.79	10 874.6	1 229.5	12 488.19	1 930.45
115	WPB 850 × 300 ×	179.89	229.2	835	292	14.0	18.8	30	253 913	7 836.3	33.29	5.85	6 081.7	536.7	7 009.45	851.19
116	WPB 850 × 300 ×	195.73	249.3	840	292	14.7	21.3	30	282 472	8 877.3	33.66	5.97	6 725.5	608.0	7 732.10	962.05
117	WPB 850 × 300 ×	214.24	272.9	846	293	15.4	24.3	30	317 377	10 230.0	34.10	6.12	7 503.0	698.3	8 601.81	1 101.52
118	WPB 850 × 300 ×	230.55	293.7	851	294	16.1	26.8	30	347 613	11 397.7	34.40	6.23	8 169.5	775.4	9 356.69	1 221.37
119	WPB 850 × 300 ×	253.68	323.2	859	292	17.0	30.8	30	392 287	12 833.4	34.84	6.30	9 133.6	879.0	10 454.22	1 382.48
120	WPB 900 × 300 ×	198.00	252.2	870	300	15.0	20.0	30	301 145	9 041.4	34.55	5.99	6 922.9	602.8	7 999.37	957.71
121	WPB 900 × 300 ×	251.61	320.5	890	300	16.0	30.0	30	422 075	13 547.5	36.29	6.50	9 484.8	903.2	10 811.59	1 414.53
122	WPB 900 × 300 ×	291.45	371.3	900	300	18.5	35.0	30	494 065	15 815.9	36.48	6.53	10 979.2	1 054.4	12 584.65	1 658.40

Table 3 Indian Standard Parallel Flange Bearing Piles

(*Foreword, Clauses* 4.1, 7.1, 8 *and* 9.2)

Sl No.	Designation			Mass	Area	Depth	Width	Web Thickness	Flange	Root Radius	Moment of Inertia		Radius of Gyration		Section Modulus		Plastic Section Modulus	
				M kg/m	a cm^2	D mm	B mm	t mm	T mm	R mm	I_x cm^2	I_y cm^2	r_x cm	r_y cm	Z_x cm^3	Z_y cm^3	Z_{px} cm^3	Z_{py} cm^3
(1)	(2)			(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
1	PBP	200	×	43.85	55.9	200	205	9.3	9.3	10	3 999	1 337.0	8.46	4.89	399.9	130.4	447.68	199.93
2	PBP	200	×	53.49	68.1	204	207	11.3	11.3	10	4 977	1 673.2	8.55	4.96	488.0	161.7	551.31	248.57
3	PBP	220	×	57.19	72.9	210	225	11.0	11.0	18	5 729	2 079.3	8.87	5.34	545.6	185.2	613.69	285.55
4	PBP	260	×	75.00	95.5	249	265	12.0	12.0	24	10 646	3 732.5	10.56	6.25	855.1	281.7	958.59	435.09
5	PBP	260	×	87.30	111.2	253	267	14.0	14.0	24	12 586	4 455.0	10.64	6.33	994.9	333.7	1 123.62	516.19
6	PBP	300	×	76.92	98.0	299	306	10.8	10.8	15	16 006	5 162.0	12.78	7.26	1 070.7	337.4	1 186.40	515.42
7	PBP	300	×	88.00	112.1	302	308	12.4	12.4	15	18 467	5 996.0	12.84	7.31	1 223.0	389.4	1 362.23	595.93
8	PBP	300	×	95.00	121.0	304	309	13.3	13.3	15	20 097	6 547.5	12.89	7.36	1 322.2	423.8	1 476.74	649.16
9	PBP	300	×	109.54	139.5	308	311	15.3	15.3	15	23 477	7 681.2	12.97	7.42	1 524.5	494.0	1 713.28	758.28
10	PBP	300	×	124.20	158.2	312	313	17.3	17.3	15	26 972	8 856.4	13.06	7.48	1 729.0	565.9	1 954.77	870.51
11	PBP	300	×	150.00	191.1	319	316	20.8	20.8	15	33 325	10 963.5	13.21	7.57	2 089.3	693.9	2 386.34	1 071.17
12	PBP	300	×	180.12	229.4	327	320	24.8	24.8	15	41 085	13 584.3	13.38	7.69	2 512.8	849.0	2 901.54	1 315.46
13	PBP	300	×	184.11	234.5	328	321	25.3	25.3	15	42 148	13 989.6	13.41	7.72	2 570.0	871.6	2 971.22	1 350.96
14	PBP	300	×	222.58	283.5	338	326	30.3	30.3	15	52 656	17 567.3	13.63	7.87	3 115.7	1 077.7	3 648.49	1 677.33
15	PBP	320	×	88.47	112.7	303	304	12.0	12.0	27	18 743	5 633.6	12.90	7.07	1 237.1	370.6	1 378.74	572.11
16	PBP	320	×	102.83	131.0	307	306	14.0	14.0	27	22 053	6 704.2	12.97	7.15	1 436.7	438.2	1 611.31	677.32
17	PBP	320	×	117.32	149.5	311	308	16.0	16.0	27	25 476	7 814.9	13.06	7.23	1 638.3	507.5	1 848.78	785.59
18	PBP	320	×	146.68	186.9	319	312	20.0	20.0	27	32 671	10 160.1	13.22	7.37	2 048.3	651.3	2 338.62	1 011.41
19	PBP	320	×	184.09	234.5	329	317	25.0	25.0	27	42 343	13 332.3	13.44	7.54	2 574.1	841.2	2 979.36	1 311.35

Table 3 (*Concluded*)

Sl No.	Designation			Mass	Area	Depth	Width	Web Thickness	Flange	Root Radius	Moment of Inertia		Radius of Gyration		Section Modulus		Plastic Section Modulus	
				M kg/m	a cm^2	D mm	B mm	t mm	T mm	R mm	I_x cm^2	I_y cm^2	r_x cm	r_y cm	Z_x cm^3	Z_y cm^3	Z_{px} cm^3	Z_{py} cm^3
(1)	(2)			(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
20	PBP	360	×	83.44	106.3	340	367	9.9	9.9	15	22 984	8 160.2	14.70	8.76	1 352.0	444.7	1 483.44	676.17
21	PBP	360	×	109.08	139.0	346	371	12.9	12.9	15	30 568	10 986.7	14.83	8.89	1 767.0	592.3	1 955.16	903.01
22	PBP	360	×	134.84	171.8	352	374	15.9	15.9	15	38 437	13 876.5	14.96	8.99	2 183.9	742.1	2 436.53	1 134.44
23	PBP	360	×	152.18	193.9	356	376	17.9	17.9	15	43 876	15 877.0	15.04	9.05	2 464.9	844.5	2 764.69	1 293.35
24	PBP	360	×	174.02	221.7	361	379	20.4	20.4	15	50 897	18 462.8	15.15	9.13	2 819.8	975.6	3 183.13	1 497.21
25	PBP	360	×	178.41	227.3	362	379	20.9	20.9	15	52 331	18 991.4	15.17	9.14	2 891.2	1 002.2	3 267.92	1 538.69
26	PBP	400	×	122.41	155.9	348	390	14.0	14.0	15	34 770	13 850.6	14.93	9.42	1 998.3	710.3	2 212.35	1 082.39
27	PBP	400	×	140.18	178.6	352	392	16.0	16.0	15	40 274	16 076.6	15.02	9.49	2 288.3	820.2	2 547.30	1 251.99
28	PBP	400	×	158.08	201.4	356	394	18.0	18.0	15	45 939	18 367.5	15.10	9.55	2 580.8	932.4	2 888.20	1 425.44
29	PBP	400	×	176.10	224.3	360	396	20.0	20.0	15	51 766	20 724.6	15.19	9.61	2 875.9	1 046.7	3 235.11	1 602.75
30	PBP	400	×	194.25	247.5	364	398	22.0	22.0	15	57 759	23 148.9	15.28	9.67	3 173.6	1 163.3	3 588.06	1 783.95
31	PBP	400	×	212.52	270.7	368	400	24.0	24.0	15	63 921	25 641.6	15.37	9.73	3 474.0	1 282.1	3 947.11	1 969.05
32	PBP	400	×	230.92	294.2	372	402	26.0	26.0	15	70 255	28 203.6	15.45	9.79	3 777.2	1 403.2	4 312.30	2 158.10

ANNEX A

(Foreword)

COMMITTEE COMPOSITION

Structural Engineering and Structural Sections Sectional Committee, CED 7

Organization	*Representative(s)*
MECON Ltd, Ranchi	SHRI A. BASU (*Chairman*)
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Joint Director (Civ Engg), BIS

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This Indian Standard has been developed from Doc: No. **CED 7 (7143).**

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed at Simco Printing Press, Delhi