



**INDEPENDENT POWER TRANSMISSION OPERATOR S.A.
TRANSMISSION NEW PROJECTS DEPARTMENT
SECTION OF TRANSMISSION LINES SPECIFICATIONS**

**TECHNICAL DESCRIPTION TD-211
STEEL LATTICE TOWERS
FOR SINGLE & DOUBLE CIRCUIT 400 KV O.H.T.L.
WITH TWIN CONDUCTORS**

MAY 2018



A. GENERAL DATA

1. There are the following tower types for each one of the following two categories of lines.

Tower type	Single circuit	Double circuit
Straight line	S₆	S₁₅
Straight line, big span	-	G₅
Small angle	R₆	R₅
45° angle	T₆	T₅
75° angle or Terminal Dead End	Z₆	Z₅

2. The general characteristics of the transmission lines of each category are :

	Single circuit	Double circuit
- Line Voltage	400 KV	400 KV
- Line circuits	One three phase circuit with two conductors per phase	Two three phase circuits with two conductors per phase.
- Circuit arrangement	The three phases are arranged in a horizontal configuration For tower S ₆ and R ₆ the middle phase is suspended through a V-string.	The three phases of each circuit are arranged in an approximate vertical configuration at each side of the tower.
- Shield wires arrangement	Each tower is equipped with two shield wires installed above the conductors symmetrically to the tower axis.	Each tower is equipped with two shield wires installed above the conductors symmetrically to the tower axis
- Phase conductor data :	Two CARDINAL ACSR sub conductors of 954000 CM each, per phase conductor	
- Shield wire data :	Seven strand galvanized steel wire , overall diameter 12,6 mm	
- Insulators data :	Disc type insulators of 11 IN diameter and 6 3/4 IN spacing of Normal type (or Fog type where needed).	



3. The towers shall be manufactured from structural steel angle profiles, of Open Hearth (Siemens-Martin), Electric Furnace or LD process. S235 J_R/J₀ and S355 J_R/J₀ steel qualities, as defined in EN10025 Standard for Structural Members, must be used. The ratio between width and thickness shall be not greater than 17.

A minimum ungalvanized thickness of 6 mm material shall be used for members forming the shape of the tower and 4 mm for all other members.

Each member of the tower shall be marked before galvanizing, to facilitate erection. The marking must specify the tower type and the member number shown at the corresponding drawings.

The maximum allowable ratio of unsupported length to the radius of gyration shall be as follows; 150 for corner legs, 200 for diagonals and 250 for redundants.

4. Metric thread bolts from high tensile steel quality shall be used, having a diameter not smaller than 12 mm. Not more than 4 sizes of bolt diameter shall be used for each tower type.

All bolts shall be of sufficient unthreaded part length, to secure that no shearing forces will be developed in the threaded part and shall be furnished with suitable washers and spring washers according to ISO 7089 (or DIN 126) and DIN 127B correspondingly. The mechanical properties of bolts and nuts shall be in accordance with ISO 898-1 and 898-2 correspondingly while their geometric properties shall be in accordance with DIN 7990 and DIN 934 respectively. Only bolts of proper class 6.6 or 6.8 shall be used. The tolerance between hole and bolt diameter shall be in accordance with the corresponding EN 1090-2 Standard.

The fabrication of towers shall be in accordance with EN 1090-1 and 1090-2 for execution class EXC3.

All holes have to be done by drilling or punching. Punching of holes on steel members must be made in accordance with EN 1090-2. The opening of holes by drilling is mandatory only regarding the following tower elements:

- Corner legs
- Main elements of cross arms (internal bracing not included)
- Holes locate nearby the bending zone of corner members and gusset plates
- Other elements the thickness of which exceeds 10mm and 14mm for S355 and S235 steel qualities respectively, according to EN-10025 Standard.

An extra three per cent (3%) of the necessary quantity of bolts, nuts, washers and spring washers must be delivered to IPTO S.A. All tower members and connecting material shall be hot dip galvanized in accordance with EN ISO 1461 specifications.

The nuts must be delivered bolted on the corresponding bolts.

5. Each tower shall be provided with the necessary tower fittings i.e. shackles, hangers and U-bolts, required for the attachment of the line fittings to the tower. Tower fittings shall be made of high tensile steel and shall have an opening with ample radius of curvature in order to avoid undesirable friction effects. Their axis of rotation on the tower shall be horizontal. Cotter pins of all tower fittings shall be made of brass or phosphorus bronze.

Anticlimbing guards shall be furnished where needed, to prevent climbing in tower of unauthorized persons. Enameled danger plates shall be also furnished to be installed on every tower.



Two diagonally placed other legs of every tower shall be equipped with step bolts starting about 3 m above ground for all extensions and located every 40 cm.

B. TOWER CHARACTERISTICS

The height of the conductor attachment from theoretical ground level is 20,0 m for a normal tower with normal legs.

The towers are furnished with individual leg extensions for use on irregular ground and/or for increasing the height of the conductor attachment, from the ground level.

For all types of towers the following legs and body extensions have been designed :

(a) Body extension increasing +8,0 m the height of tower.

(b) Normal (zero) leg extensions.

(c) Leg extensions 4,0 m shorter than normal

(d) " 3,0 m "

(e) " 2,0 m "

(f) " 1,0 m longer "

(g) " 2,0 m "

(h) " 3,0 m "

(i) " 4,0 m "

Similar leg extensions have been designed for towers with body extension (a).

Extra extended bodies which increase +18,0 m the height of tower have been designed for tower types T6, R5 and T5.

All legs of the same type and the same body extension are interchangeable and suitable for connection on the left or right side of the tower face.

For type "6" towers there is only one group of legs for normal or extended towers.

Any horizontal section of the whole tower below waist is square and the webs of every tower face are symmetrically placed.

The use of tensioned web members has not been allowed.

All types of towers are equipped with horizontal panels located at:

- The lower surfaces of the crossarms
- The upper part of the body extensions
- The upper part of the leg extensions
- Any change in inclination of leg members

C. CONNECTIONS

Generally welding is not allowed. The connections of members shall be detailed in such a manner, as to avoid eccentricities. Empty spaces at connections between members must be filled with suitable fillers.

All connections shall meet the following minimum requirements.

1. Splices between leg members

Lap splices are not allowed

Butt splices between leg members have to be made with an inside splice angle having a thickness of at least the same with that of the thicker member and two outside straps having a thickness of at least 6 mm.



2. Splices between other members

Lap splices may be used where the larger sized member is at least 15% overstrength.

Butt splices may be used with an inside splice angle, having a thickness at least equal to the thicker member, or with outside butt straps having a thickness of at least 1 mm greater than of the thicker member.

Splices in web members are not allowed.

3. Connection at joints

When two or more members are jointed on another stronger member, the intersection of their bolt axes must lie within the limits of this other member. In case this cannot be effected, gusset plates should be used, having a thickness of at least 1 mm greater than that of the thicker of these jointed members.

When more than two members are jointed together through a gusset plate, this should have a thickness of at least 1 mm greater than of the thicker jointed member.

4. Quality of splice angles, straps and plates.

The quality (ultimate strength) of the splice angles, butt straps and gusset plates, shall be at least equal to the higher quality of the members involved in the connection.

5. Minimum distances from bolts

The following minimum distances from the center of the bolt hole, must be kept (d=nominal diameter of bolt):

- For all members and straps of splice connections :

Distance from sheared edge	= 2,00 D
Distance from rolled edge	= 1,35 D
Distance from the center of the nearest bolt	= 3,50 D

- For all members and plates of connections at joints :

Distance from sheared edge	= 1,50 D
Distance from rolled edge	= 1,25 D
Distance from the center of the nearest bolt	= 2,50 D

D. FOUNDATIONS

Each tower will be based on four separate concrete footings.

The steel stubs shall be cast into concrete blocks, suitably reinforced if necessary.

The lengths of foundation stubs depend on the type of foundation used for each kind of soil. The lengths of stubs and the corresponding theoretical weights are determined by IPTO S.A.

The types of foundations that are mainly used are Rock Anchor, Auger and Pad and Chimney. For soils with low allowable bearing pressure Special Type foundations are used.

For each type of foundation a standard length of stubs is used.

Each footing shall be provided with one galvanized steel grounding rod of 2 cm diameter and 2,0 m length. The grounding rod shall be attached with good electrical connection to the tower at the bottom



of the footing, through a length of 1 cm diameter galvanized steel solid wire. For every tower 4 such grounding rods are required, one for each leg.

Counterpoise will be used for additional tower grounding, where needed, and shall be connected at the tower on an individual bolt of suitable diameter above ground, long enough to take this connection. For every tower 4 such bolts are required, one for each leg.

E. REQUIREMENTS FOR BIDDER AND CONTRACTOR

1. The Bidder has to submit with his offer the guaranteed characteristics of steel to be used, which must be in accordance with EN 10025 Standard.
2. After the award of the contract the CONTRACTOR has to submit the following for approval.
 - Table of characteristics and dimensions of the steel sections to be used if there are changes in the construction drawings.
 - Construction drawings of any changes that may be required by IPTO S.A. (and CONTRACTOR is obliged to accept) and also the resultant difference of unit weight. These drawings are property of IPTO S.A. hereafter.
 - Detailed drawings of any proposed modifications to tower fittings. Any changes will be done under IPTO S.A. approval and without any extra charge of IPTO S.A.

F. ROUTINE TESTS AND SAMPLING

For each tower type an assembly test of tower body and body extensions will be made and, after IPTO S.A. representative request, assembly of leg extensions.

The following routine tests shall be made on every lot of tower elements for shipment, but in no way shall restrict the IPTO S.A. representative to request any other additional or supplementary tests.

1. Material control: Tension test, Elongation measurement Bending test, Shear test.
2. Galvanizing tests: Visual control, Adherence test, Uniformity of coating test, Thickness and Weight of coating test.
3. Dimension control: General dimensions control, Profile measurement, Interchangeability control.
4. All tests required by EN 1090-1 and EN 1090-2 for execution class EXC3.

All the above tests shall be made on all qualities of steel and connecting material used in the manufacture of the lot to be delivered.

The number of test specimens will be sufficient to secure that the delivered lot is suitable for its intended use and is in conformity with the specifications.



G. ATTACHMENTS

For bidder's information are attached

- Table of unit weights of tower's parts (ΤΣΠΕΓΜ 911Α, 912Α)
- Tower outlines of line categories 5 and 6 (ΤΜΓΜ 640,641,642,643 and ΤΜΓΜ 555Α, 908, 556, 557, 558)
- Table of steel sections used and their geometrical characteristics (3 pages).
- Table of construction drawings that IPTO S.A. will give to CONTRACTOR after the award of the contract.



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TABLE OF WEIGHTS OF TOWER PARTS FOR 400 KV T.L.
SINGLE CIRCUIT WITH TWIN CONDUCTORS

TOWER TYPE	TOWER BODY	B A S E S		BODY EXT. +8 or +18	L E G E X T E N S I O N S										FOUNDATION STUBS	
		LIGHT	HEAVY		- 4	- 3	- 2	-1	OL	OH	+ 1	+ 2	+ 3	+ 4	P	A
S6	4.911	---	244	---	---	119	161	203	---	249	328	378	433	485	85	42
S6 + 8	---	---	1.309	1.518	---	122	165	209	---	256	328	378	433	485	85	42
R6	6.793	---	278	---	---	147	208	251	---	304	382	455	503	568	129	58
R6 + 8	---	---	1.572	1.718	---	147	208	251	---	319	382	455	503	568	129	58
T6	10.103	---	392	---	---	174	258	356	---	415	503	582	668	756	312	186
T6 + 8	---	---	2.248	2.357	---	174	258	356	---	415	503	582	668	756	312	186
T6 + 18	---	---	3.220	7.218	---	---	258	---	---	415	---	582	---	756	312	186
Z6	12.325	---	517	---	---	262	371	485	---	565	654	768	860	1.014	461	263
Z6 + 8	---	---	2.726	3.077	---	262	371	485	---	565	654	768	860	1.014	461	263

T.Σ.Π.Ε.Γ.Μ. 912A

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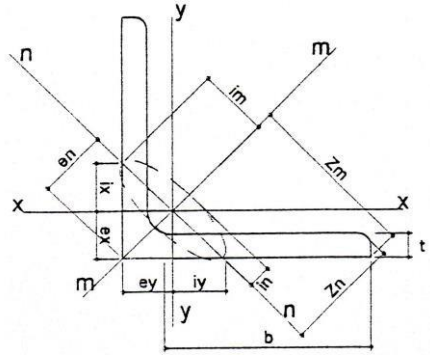


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TABLE OF WEIGHTS OF TOWER PARTS FOR 400 KV T.L.
DOUBLE CIRCUIT WITH TWIN CONDUCTORS

TOWER TYPE	TOWER BODY	B A S E S		BODY EXT. +8 or +18	L E G E X T E N S I O N S										FOUNDATION STUBS	
		LIGHT	HEAVY		- 4	- 3	- 2	-1	OL	OH	+ 1	+ 2	+ 3	+ 4	P	A
S15	10.274	(330)	339	---	---	143	192	262	302	310	409	473	552	731	148	66
S15 + 8	---	---	564	3.208	---	229	264	325	---	405	460	559	710	780	161	75
G5	11.241	(330)	339	---	---	156	230	296	318	335	447	503	636	774	183	79
G5 + 8	---	---	564	3.273	---	238	275	338	---	419	477	580	733	806	206	105
R5	12.245	(1.040)	1.188	---	220	268	345	422	446	464	556	650	749	804	238	112
R5 + 8	---	---	1.978	3.818	257	347	423	508	---	574	686	761	895	1.001	254	120
R5 + 18	---	---	---	12.075	---	---	568	---	---	789	---	1.026	---	1.336	---	176
T5	19.693	(1.820)	1.900	---	470	566	674	779	858	868	986	1.136	1.276	1.438	494	276
T5 + 8	---	---	4.243	6.381	550	681	794	892	---	1.054	1.190	1.321	1.464	1.746	531	314
T5 + 18	---	---	5.704	15.106	---	---	886	---	---	1.170	---	1.458	---	1.914	592	345
Z5	24.376	(2.680)	3.652	---	572	639	772	921	(955)	1.093	1.181	1.382	1.620	1.834	694	428
Z5 + 8	---	---	7.057	8.228	793	923	1.090	1.241	---	1.434	1.569	1.777	2.077	2.315	867	530

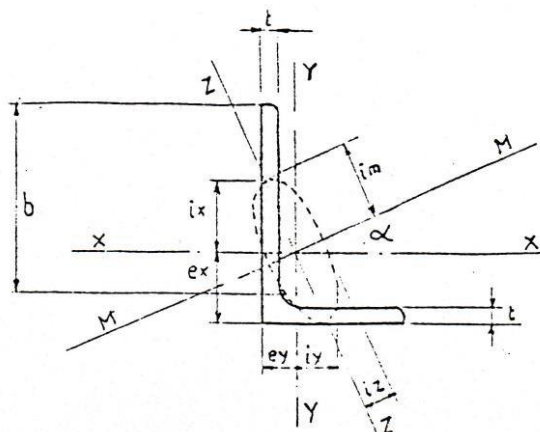
T.Σ.Π.Ε.Γ.Μ. 911A
Rev. Nov. 2015

**L (EQUAL LEGS)**

Designation	Thick.		Cross section	Weight	Distance of axes				Moment of inertia			Section Modulus			Radius of gyration		
L	t	b/t	F	G	ex=ey	en	Zn	Zm	Jx=Jy	Jm	Jn	Wx=Wy	Wm	Wn	ix=iy	im	in
(mm)x(mm)	(mm)		(cm ²)	(kg/m)	(cm)	(cm)	(cm)	(cm)	(cm ⁴)	(cm ⁴)	(cm ⁴)	(cm ³)	(cm ³)	(cm ³)	(cm)	(cm)	(cm)
35x35	3	9,00	2,04	1,60	0,96	1,36	1,23	2,47	2,29	3,72	0,97	0,90	1,51	0,77	1,06	1,35	0,68
	4	6,50	2,67	2,09	1,00	1,41	1,24	2,47	2,96	4,68	1,24	1,18	1,89	0,88	1,05	1,32	0,68
	5	5,00	3,28	2,57	1,04	1,47	1,25	2,47	3,56	5,63	1,49	1,45	2,28	1,10	1,04	1,31	0,67
	6	4,00	3,87	3,04	1,08	1,53	1,27	2,47	4,14	6,50	1,77	1,71	2,63	1,16	1,03	1,30	0,67
38x38 1½"x 1½"	3,2	9,98	2,32	1,83	1,07	1,51	1,26	2,69	3,32	5,06	1,36	1,22	1,88	0,90	1,19	1,47	0,76
	4,8	6,34	3,42	2,68	1,12	1,58	1,30	2,69	4,56	7,18	1,87	1,70	2,67	1,18	1,17	1,45	0,74
	6,4	4,50	4,45	3,48	1,19	1,69	1,31	2,69	5,83	9,01	2,43	2,16	3,36	1,44	1,15	1,42	0,74
40x40	3	10,33	2,35	1,84	1,07	1,52	1,40	2,83	3,45	5,45	1,44	1,18	1,95	0,95	1,21	1,52	0,78
	4	7,50	3,08	2,42	1,12	1,58	1,40	2,83	4,48	7,09	1,86	1,55	2,51	1,18	1,21	1,52	0,77
	5	5,80	3,79	2,97	1,16	1,64	1,42	2,83	5,43	8,64	2,22	1,91	3,04	1,35	1,20	1,51	0,77
	6	4,67	4,48	3,52	1,20	1,70	1,43	2,83	6,33	9,98	2,67	2,26	3,53	1,57	1,19	1,49	0,77
44x44 1¾"x 1¾"	3,2	11,48	2,72	2,15	1,22	1,73	1,49	3,15	5,25	8,10	2,14	1,62	2,68	1,24	1,39	1,73	0,88
	4,8	7,34	4,00	3,16	1,29	1,83	1,51	3,15	7,45	11,28	2,99	2,36	3,72	1,64	1,37	1,68	0,87
	6,4	5,25	5,24	4,13	1,35	1,90	1,55	3,15	9,45	14,70	3,90	3,05	4,85	2,05	1,35	1,68	0,86
45x45	4	8,50	3,49	2,74	1,23	1,75	1,57	3,18	6,43	10,20	2,68	1,97	3,24	1,53	1,36	1,71	0,88
	5	6,60	4,30	3,38	1,28	1,81	1,58	3,18	7,84	12,40	3,26	2,43	3,90	1,80	1,35	1,70	0,87
50x50	4	9,75	3,89	3,06	1,36	1,92	1,75	3,54	8,97	14,20	3,73	2,46	4,06	1,94	1,52	1,91	0,98
	5	7,60	4,80	3,77	1,40	1,99	1,76	3,54	11,00	17,40	4,55	3,05	4,92	2,29	1,51	1,90	0,97
51x51 2"x 2"	3,2	13,48	3,12	2,43	1,39	1,89	1,71	3,61	7,90	12,00	3,18	2,15	3,32	1,61	1,59	1,97	1,01
	4,8	8,67	4,61	3,63	1,45	2,05	1,75	3,61	11,32	16,90	4,49	3,11	4,68	2,19	1,57	1,92	1,00
	6,4	6,25	6,06	4,75	1,50	2,12	1,79	3,61	14,48	22,35	5,95	4,05	6,19	2,81	1,55	1,92	0,99
	7,9	4,80	7,41	5,84	1,56	2,19	1,83	3,61	17,32	27,30	7,26	4,92	7,57	3,32	1,53	1,92	0,90
55x55	4	11,00	4,26	3,35	1,48	2,09	1,90	3,89	11,90	18,80	4,97	2,96	4,83	2,38	1,67	2,10	1,08
	5	8,60	5,32	4,17	1,52	2,15	1,93	3,89	14,70	23,30	6,11	3,70	5,99	2,84	1,66	2,09	1,07
	6	7,00	6,31	4,96	1,56	2,21	1,94	3,89	17,30	27,40	7,24	4,40	7,04	3,28	1,66	2,08	1,07
	7	5,71	7,25	5,69	1,60	2,27	1,95	3,89	19,80	31,20	8,22	5,06	8,03	3,62	1,65	2,07	1,07
60x60	8	4,23	8,23	6,46	1,64	2,32	1,97	3,89	22,10	34,80	9,35	5,72	8,96	4,03	1,64	2,06	1,06
	4	12,00	4,71	3,70	1,60	2,28	2,07	4,24	15,77	24,92	6,56	3,58	5,88	2,88	1,83	2,30	1,18
	5	9,40	5,82	4,56	1,64	2,32	2,11	4,24	19,40	30,70	8,03	4,45	7,26	3,46	1,82	2,30	1,17
	6	7,66	6,91	5,42	1,69	2,39	2,11	4,24	22,80	36,10	9,43	5,29	8,52	3,95	1,82	2,29	1,17
64x64 2½"x 2½"	7	6,43	7,95	6,26	1,73	2,45	2,13	4,24	25,90	41,30	10,80	6,04	9,74	4,42	1,81	2,27	1,16
	8	5,37	9,63	7,09	1,77	2,50	2,14	4,24	29,20	46,10	12,20	6,89	10,90	4,86	1,80	2,26	1,16
	4,8	11,00	5,94	4,66	1,76	2,49	2,12	4,45	22,77	33,61	8,92	4,96	7,56	3,60	1,98	2,41	1,25
	6,4	8,00	7,68	6,10	1,82	2,58	2,13	4,45	29,26	44,50	11,80	6,46	10,00	4,56	1,95	2,41	1,24
65x65	7,9	6,20	9,42	7,39	1,88	2,66	2,16	4,45	35,35	55,00	14,60	7,90	12,38	5,48	1,93	2,41	1,24
	4	13,25	5,13	4,02	1,72	2,44	2,26	4,60	20,30	32,00	8,53	4,24	6,96	3,50	1,99	2,50	1,29
70x70	5	10,40	6,31	4,95	1,77	2,49	2,27	4,59	24,70	40,60	10,50	5,09	8,85	4,21	1,98	2,53	1,29
	4	14,25	5,47	4,29											2,18	2,96	1,39
75x75	4,5	12,56	6,18	4,85	1,86	2,63	2,45	4,95	28,50	45,70	11,80	5,55	9,23	4,43	2,15	2,72	1,38
	5	11,20	6,84	5,37	1,88	2,68	2,45	4,95	31,20	49,80	13,00	6,10	10,00	4,85	2,14	2,70	1,38
	6	9,16	8,13	6,36	1,93	2,73	2,46	4,95	36,90	58,40	15,30	7,27	11,80	5,60	2,13	2,68	1,37
	7	7,71	9,40	7,38	1,97	2,79	2,47	4,95	42,30	67,10	17,50	8,42	13,60	6,28	2,12	2,67	1,36
	8	6,62	10,60	8,32	2,03	2,88	2,48	4,95	47,50	74,70	19,75	9,55	15,10	6,85	2,11	2,65	1,36
	4	15,50	5,89	4,62											2,33	2,96	1,50
76x76 3"x 3"	4,5	13,50	6,68	5,25	1,97	2,78	2,63	5,30	35,30	56,90	14,60	6,38	10,73	5,25	2,30	2,92	1,48
	5	12,20	7,36	5,78	1,95	2,76	2,62	5,30	39,20	62,70	16,30	7,06	11,80	5,93	2,31	2,92	1,49
	7	8,43	10,10	7,93	2,09	2,95	2,63	5,30	52,40	83,60	21,10	9,67	15,70	7,15	2,28	2,87	1,46
	4,8	13,34	7,03	5,52	2,09	2,94	2,58	5,38	40,04	60,00	15,80	7,23	11,17	5,37	2,39	2,92	1,50
80x80	6,4	9,75	9,29	7,30	2,14	3,02	2,60	5,38	51,61	79,10	20,90	9,45	14,70	6,92	2,36	2,92	1,50
	7,9	7,60	11,48	9,01	2,21	3,12	2,62	5,38	62,85	98,00	25,99	11,59	18,20	8,32	2,34	2,92	1,50
	4	16,50	6,25	4,95											2,50	3,22	1,60
	4,5	14,56	7,12	5,59	2,10	2,97	2,80	5,66	43,10	68,40	17,80	7,30	12,08	5,95	2,46	3,10	1,58
	5	13,00	7,80	6,20	2,14	3,03	2,80	5,66	47,20	74,00	19,50	8,10	13,00	6,40	2,45	3,08	1,58
	6	10,66	9,35	7,34	2,17	3,08	2,81	5,66	55,80	88,70	23,00	9,57	15,60	7,48	2,44	3,08	1,57
80x80	7	9,00	10,80	8,48	2,21	3,13	2,82	5,66	64,20	102,00	26,50	11,10	18,00	8,44	2,44	3,07	1,57
	8	7,75	12,30	9,66	2,26	3,20	2,82	5,66	72,30	115,00	29,60	12,60	20,30	9,25	2,42	3,06	1,56

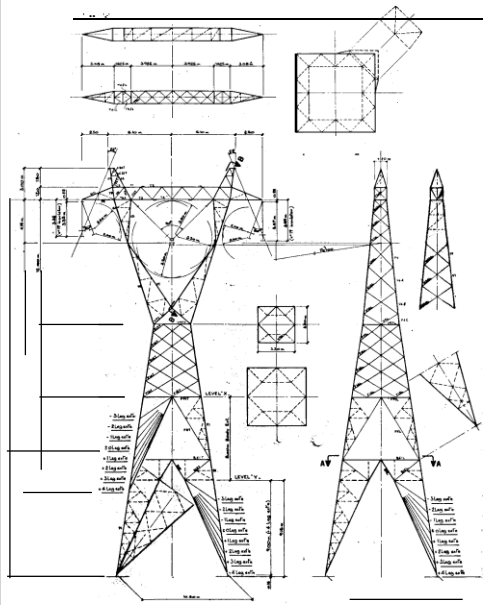
Designation	Thick.		Cross section	Weight	Distance of axes				Moment of inertia			Section Modulus			Radius of gyration		
L	t	b/t	F	G	ex=ey	en	Zn	Zm	Jx=Jy	Jm	Jn	Wx=Wy	Wm	Wn	ix=iy	im	in
(mm)x(mm)	(mm)		(cm ²)	(kg/m)	(cm)	(cm)	(cm)	(cm)	(cm ⁴)	(cm ⁴)	(cm ⁴)	(cm ³)	(cm ³)	(cm ³)	(cm)	(cm)	(cm)
89x89 3½"x 3½"	4,8	15,67	8,18	6,47	2,42	3,42	2,99	6,30	64,58	95,56	25,35	9,98	15,20	7,40	2,79	3,41	1,76
	6,4	11,50	10,90	8,63	2,46	3,47	3,00	6,30	83,66	127,70	33,40	13,01	20,22	9,57	2,77	3,40	1,75
	7,9	8,99	13,49	10,71	2,52	3,56	3,01	6,30	101,98	158,00	41,30	16,00	25,10	11,40	2,74	3,40	1,75
	9,5	7,34	16,00	12,65	2,57	3,63	3,02	6,30	119,45	187,10	49,00	18,85	29,75	13,15	2,72	3,39	1,75
90x90	5	14,80	8,75	6,87	2,38	3,37	3,14	6,36	67,20	106,00	27,70	10,15	16,60	8,22	2,77	3,48	1,78
	7	10,28	12,20	9,58	2,46	3,48	3,16	6,36	92,40	146,00	38,20	14,10	22,90	11,00	2,75	3,46	1,77
100x100	5	16,60	9,75	7,65	2,62	3,72	3,49	7,07	92,50	147,50	38,20	12,50	20,80	10,20	3,08	3,89	1,98
	7	11,57	13,70	10,80	2,70	3,82	3,51	7,07	128,30	204,10	53,10	17,60	28,80	13,90	3,06	3,86	1,97
102x102 4"x 4"	6,4	13,50	12,51	9,82	2,77	3,91	3,44	7,15	126,53	194,00	51,50	17,81	27,15	13,17	3,17	3,94	2,02
	7,9	10,59	15,48	12,20	2,84	4,02	3,45	7,15	159,42	235,00	62,50	21,13	32,90	15,55	3,15	3,92	2,01
	9,5	8,67	18,44	14,60	2,90	4,09	3,48	7,15	181,48	281,00	74,50	24,91	39,40	18,25	3,12	3,90	2,01
110x110	6	15,33	12,85	10,05	2,91	4,12	3,85	7,78	152,00	241,00	62,20	18,80	31,00	15,10	3,44	4,33	2,20
	7	13,00	14,95	11,70	2,95	4,17	3,86	7,78	175,00	276,00	71,70	21,75	35,50	17,20	3,42	4,30	2,19
	8	11,25	17,10	13,40	2,99	4,23	3,87	7,78	197,00	314,00	81,30	24,60	40,40	19,20	3,40	4,28	2,18
	9	9,88	19,10	15,00	3,03	4,28	3,88	7,78	219,00	347,00	90,00	27,40	44,60	21,00	3,38	4,26	2,17
	10	8,80	21,20	16,60	3,07	4,34	3,89	7,78	239,00	379,00	98,60	30,10	48,70	22,70	3,36	4,23	2,16
120x120	6	16,83	14,25	11,20	3,16	4,47	4,20	8,49	201,00	324,00	82,20	22,80	38,20	18,40	3,76	4,77	2,40
	7	14,28	16,52	13,00	3,20	4,53	4,21	8,49	231,00	372,00	94,50	26,30	43,80	20,90	3,74	4,74	2,39
	8	12,37	18,77	14,75	3,24	4,59	4,22	8,49	260,00	416,00	106,20	29,70	49,00	23,20	3,72	4,71	2,38
127x127 5"x 5"	9	10,88	21,00	16,50	3,28	4,64	4,23	8,49	287,00	461,00	118,00	32,90	54,40	25,50	3,70	4,68	2,37
	6,4	17,00	15,62	12,27	3,43	4,85	4,30	9,00	253,70	396,70	99,50	27,40	44,08	20,52	4,03	5,04	2,52
	7,9	13,39	19,52	15,32	3,48	4,92	4,35	9,00	308,84	496,00	123,00	33,42	54,90	25,00	3,99	5,03	2,52
	9,5	11,00	23,25	18,30	3,53	5,00	4,38	9,00	363,79	580,00	146,20	39,66	64,50	29,20	3,96	4,99	2,51
130x130	11,1	9,28	27,00	21,28	3,58	5,05	4,44	9,00	416,23	665,00	167,40	45,72	73,90	36,00	3,94	4,97	2,50
	12,7	8,00	30,61	24,10	3,63	5,14	4,47	9,00	470,34	745,00	190,00	51,78	82,90	37,00	3,91	4,93	2,49
	7	15,57	17,65	13,90	3,44	4,86	4,64	9,19	293,00	468,00	120,00	30,60	50,90	24,70	4,07	5,15	2,60
140x140	12	9,41	32,40	25,40	3,88	5,49	4,94	9,90	596,00	951,00	245,00	59,00	96,00	44,60	4,29	5,42	2,75
	13	8,61	35,00	27,50	3,92	5,54	4,96	9,90	638,00	1010,00	262,00	63,30	102,00	47,30	4,27	5,39	2,74
152x152 6"x 6"	7,9	16,59	23,54	18,45	4,11	5,81	5,16	10,78	541,00	865,00	215,20	48,57	79,50	37,20	4,80	6,05	3,05
	9,5	13,67	28,10	22,19	4,17	5,90	5,22	10,78	641,00	1037,00	256,00	57,85	95,30	43,40	4,77	6,02	3,02
	11,1	11,57	32,61	25,60	4,21	5,95	5,28	10,78	736,72	1169,00	298,00	66,85	107,40	50,10	4,75	5,99	3,02
	12,7	10,00	37,10	29,18	4,26	6,02	5,33	10,78	828,30	1314,00	334,00	75,54	121,00	55,50	4,72	5,95	3,00
	14,3	8,77	41,50	32,60	4,34	6,13	5,34	10,78	919,90	1460,00	373,00	84,23	134,30	60,80	4,70	5,93	3,00
	15,9	7,80	45,85	36,00	4,39	6,20	5,37	10,78	1007,00	1591,00	412,00	92,75	146,50	66,50	4,67	5,90	3,00
	19,1	6,33	54,40	42,75	4,51	6,38	5,42	10,78	1173,80	1870,00	480,00	109,13	172,00	75,20	4,65	5,87	2,97
180x180	14	10,57	48,50	38,10	4,94	7,02	6,34	12,70	1515,00	2370,00	594,00	116,00	186,00	84,60	5,53	6,99	3,50
	16	9,12	55,40	43,50	5,02	7,11	6,38	12,70	1680,00	2690,00	679,00	130,00	210,00	95,50	5,51	6,96	3,50
	18	8,00	61,90	48,60	5,10	7,22	6,41	12,70	1870,00	2970,00	757,00	145,00	233,00	105,00	5,49	6,93	3,49
	20	7,10	68,40	53,70	5,18	7,33	6,44	12,70	2040,00	3260,00	830,00	160,00	255,00	113,00	5,47	6,90	3,49
203x203 8"x 8"	12,7	13,75	50,00	39,30	5,55	7,85	7,06	14,39	2023,00	3085,00	820,00	137,00	215,00	104,50	6,35	7,86	4,04
	14,3	12,10	56,00	44,10	5,61	7,94	7,09	14,39	2252,00	3420,00	901,00	153,10	238,00	113,80	6,35	7,85	4,04
	15,9	10,80	62,00	48,70	5,65	8,00	7,14	14,39	2472,00	3785,00	999,00	168,80	264,00	124,90	6,33	7,82	4,02
	19,1	8,83	73,54	57,90	5,79	8,19	7,17	14,39	2900,00	4420,00	1172,00	200,00	308,00	143,40	6,28	7,77	4,02
	22,2	7,43	85,16	67,00	5,89	8,32	7,27	14,39	3313,00	5115,00	1359,00	229,50	356,00	163,00	6,22	7,75	3,99
	25,4	6,38	96,78	75,90	6,03	8,53	7,29	14,39	3704,00	5730,00	1518,00	259,00	399,00	178,00	6,20	7,72	3,96
	28,5	5,75	107,74	84,60	6,13	8,66	7,37	14,39	4079,00	6370,00	1690,00	286,80	444,00	195,10	6,15	7,70	3,96

IPTO S.A. / TNPD / OVERHEAD T.L. DESIGN & SPECIFICATIONS SECTION



L (UNEQUAL LEGS)

Designation	Thick.	b/t	Cross section	Weight	tg a	Distance of axes		Moment of inertia	
L	t		F	G		ex	ey	Jx	Jy
(mm)x(mm)	(mm)		(cm ²)	(kg/m)		(cm)	(cm)	(cm ⁴)	(cm ⁴)
40x25	4,0	8,00	2,45	1,92	0,382	1,37	0,62	3,88	1,17
	5,0	6,20	3,01	2,36	0,375	1,40	0,66	4,68	1,39
44x32 1 3/4" x 1 1/4"	3,2	11,49	2,32	1,83	0,506	1,42	0,78	4,70	2,04
	4,8	7,34	3,40	2,68	0,496	1,47	0,84	6,66	2,83
	6,4	5,25	4,44	3,48	0,486	1,53	0,89	8,41	3,54
45x30	4,0	9,25	2,87	2,25	0,433	1,48	0,74	5,78	2,05
64x51 2 1/2" x 2"	4,8	11,00	5,22	4,09	0,631	1,94	1,31	21,19	12,11
	6,4	8,00	6,84	5,38	0,626	2,00	1,37	27,22	15,48
76x51 3" x 2"	4,8	13,34	5,82	4,57	0,446	2,46	1,19	35,05	12,78
	6,4	9,74	7,68	6,10	0,440	2,52	1,25	45,37	16,32
	7,9	7,59	9,42	7,44	0,435	2,59	1,31	54,94	19,56
76x64 3" x 2 1/2"	4,8	13,34	6,43	5,05	0,688	2,25	1,62	37,75	24,02
	6,4	9,00	8,45	6,70	0,684	2,31	1,67	48,70	30,93
	7,9	7,59	10,45	8,33	0,680	2,36	1,73	59,10	37,40
89x64 3 1/2" x 2 1/2"	4,8	15,00	7,03	5,52	0,511	2,74	1,50	57,91	25,09
	6,4	11,74	9,29	7,30	0,506	2,82	1,56	74,92	32,34
	7,9	9,19	11,48	9,08	0,501	2,89	1,62	91,15	39,10
	9,5	7,50	13,61	10,72	0,496	2,94	1,68	106,55	45,37
89x76 3 1/2" x 3"	4,8	15,65	7,65	6,01	0,730	2,59	1,94	60,77	42,05
	6,4	11,50	10,05	8,04	0,727	2,64	2,00	79,50	54,11
	7,9	8,99	12,45	9,83	0,724	2,69	2,06	96,98	65,76
	9,5	7,33	14,83	11,76	0,721	2,74	2,11	113,21	77,00



SECTION A-A

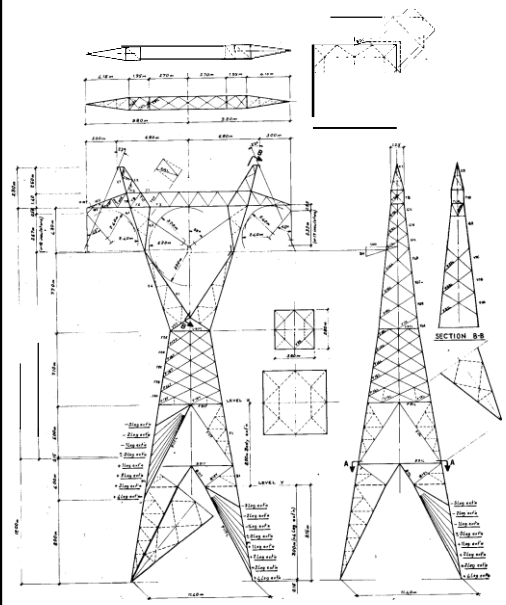
SECTION B-B

Revision May 1980.
Approximate weight of normal tower

WEIGHT OF NORMAL
TOWER: 6.8 tons

PUBLIC POWER CORPORATION -GREECE
TOWER S6 400 KV
DATE NOV. 78 SCALE 1:100
T.M.F.M 640

SECTION A-A



11

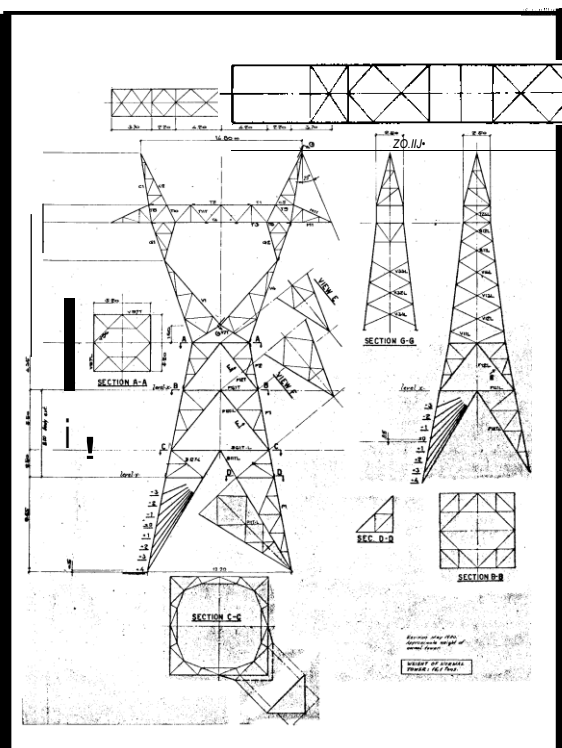
li
2

Revision May 1980.
Approximate weight of normal tower

WEIGHT OF NORMAL
TOWER: 6.5 tons

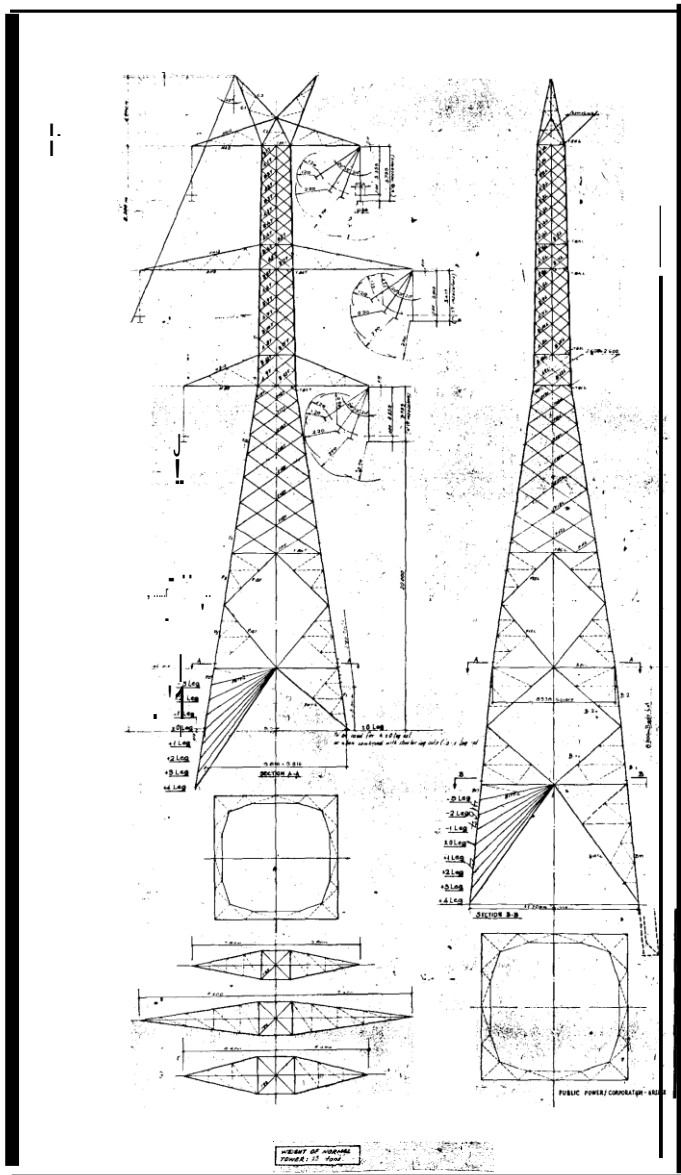
PUBLIC POWER CORPORATION - GREECE
TOWER R6 400 KV
DATE NOV. 78
T.M.F.M 641

SCALE 1:100



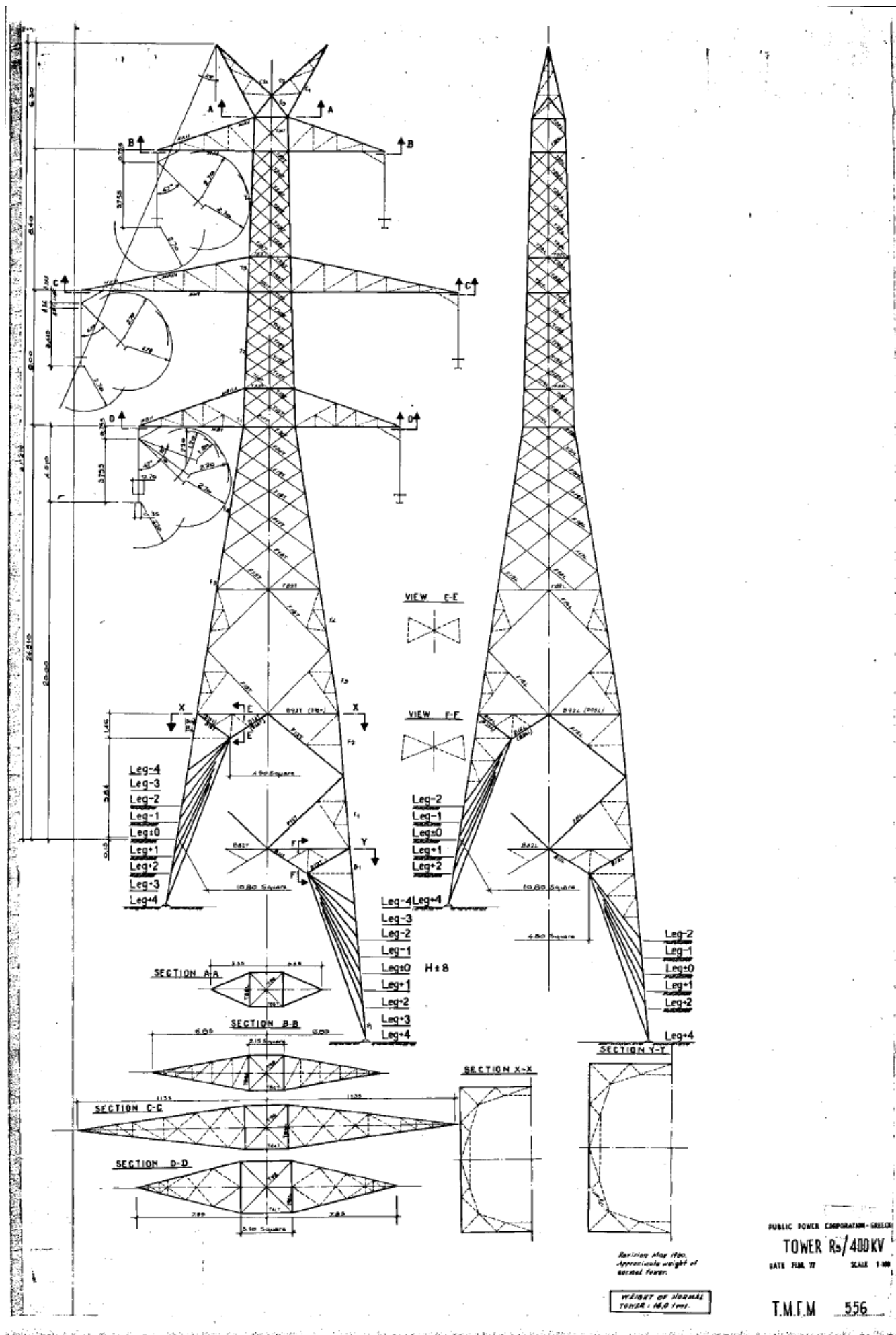
PUBLIC POWER CORPORATION - GREECE
TOWER Z6 400 KV

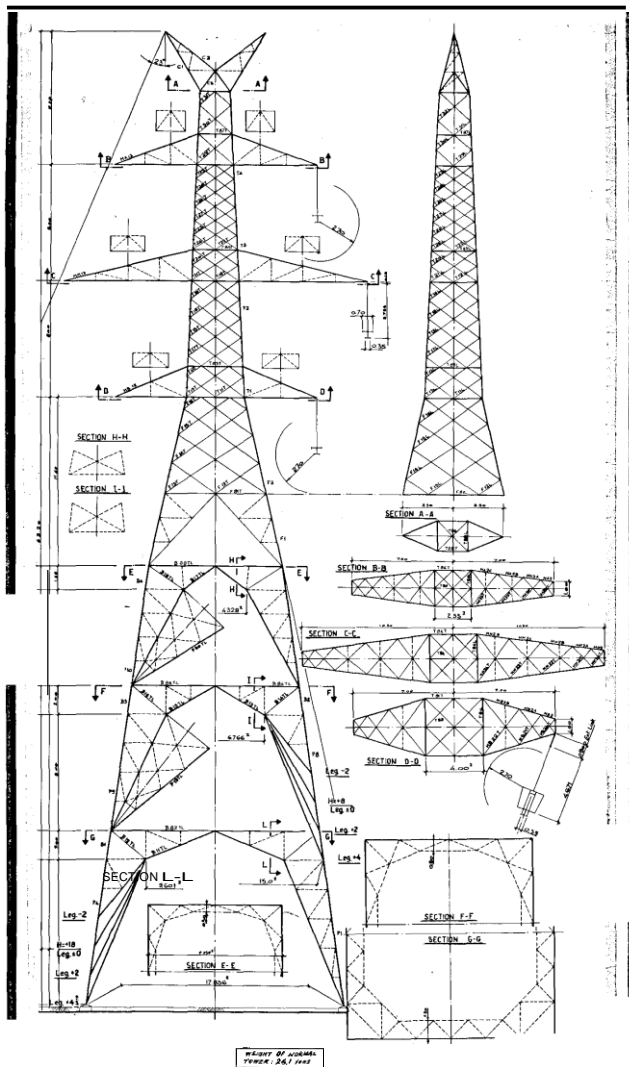
TMΓM 643



TOWER G5 / 400 KV

TMГМ 908





PUBLIC POWER CORPORATION-GREECE
 TOWER T5/400 KV
 DATE FEBR 77
 T.M.G.M. 557



**DRAWINGS OF TOWERS OF 400 KV
SINGLE CIRCUIT TRANSMISSION LINES**

SUSPENSION TOWER TYPE S6

1. TOWER S6 (21 Drawings)	OLD Drawings S6
P 69503 e Stubs for Foundations AD2 (Bended stubs for other two foundations are not approved)	
P 69504 d Stubs for Foundations RA-ADO8	
P 69505 c Setting Dimenstions for type AD2-ADO8-RA Foundations	
P 69506 d Stubs for Special Concrete Foundations SD2-SDO8	
P 69507 c Ground wire Peak	
P 69508 b Cross - arm	
P 69509 b Bridge	
P 69510 b Top part K Frame	
P 69511 b Bottom Part K Frame	
P 69512 b View "E" for Bottom K Frame	
P 69513 a View "F" for Bottom K Frame	
P 69514 a Common Part & Base ± 0	
P 69515 b Sections M-M & N-N	
P 69516 b +8m. Body Extension	
P 69517 a Sections R-R & S-S	
P 69518 c Leg Ext. -3 & ± 0	
P 69519 b Leg Ext. -2 & -1	
P 69520 a Leg Ext. +1	
P 69521 a Leg Ext. +2	
P 69522 a Leg Ext. +3	
P 69523 a Leg Ext. +4	



**DRAWINGS OF TOWERS OF 400 KV
SINGLE CIRCUIT TRANSMISSION LINES**

SUSPENSION TOWER TYPE R6

1. TOWER R6 (22 Drawings)	OLD Drawings R6
P 69540 b Ground Wire Peak	
P 69541 b Cross - arm and Lateral Hanger	
P 69542 d Girder	
P 69543 c Top Part K Frame	
P 69544 b Bottom Part K Frame	
P 69545 a External View - A - (K Frame)	
P 69546 a External View - B - (K Frame)	
P 69547 a Common Part & Base ± 0	
P 69548 a Sections A-A & B-B	
P 69549 b Body Extension +8	
P 69550 b Sections C-C & D-D	
P 69551 a Leg Ext. -2 & -3	
P 69552 a Leg Ext. -1	
P 69553 a Leg Ext. ± 0	
P 69554 a Leg Ext. +1	
P 69555 a Leg Ext. +2	
P 69556 a Leg Ext. +3	
P 69557 a Leg Ext. +4	
P 69558 c Stubs for Foundations RA-AD2-ADO8	
P 69560 c Stubs for Special Concrete Foundations SD2-SD08	
P 69561 c Setting Dimensions for AD2-ADO8-RA Foundations	
P 72509 Special Concrete Foundations type SD2-SD08	



**DRAWINGS OF TOWERS OF 400 KV
SINGLE CIRCUIT TRANSMISSION LINES**

TENSION TOWER TYPE T6

1. TOWER T6 (23 Drawings)	OLD Drawings T6
P 70276 e Ground Wire	
P 70277 d Girder	
P 70278 b Upper & Lower Plan of Girder	
P 70279 c Gross - arms	
P 70280 f K Frame	
P 70281 b View "O" of K Frame	
P 70282 b View "P" of K Frame	
P 70283 c Tower Body & Base ÷0	
P 70284 Diaphragm at waist	
P 70285 c Body Extension for Base +8 & other Base + 8	
P 70286 b Sections A-A, B-B, C-C for Body Extension & Base +8	
P 70287 c Body Extension for Base ÷18	
P 70288 a Base +18	
P 70289 Section E-E	
P 70290 a Leg Extensions -3, -2 and -1	
P 70291 a Leg Extensions ±0, and +1	
P 70292 b Leg Extension +2	
P 70293 b Leg Extension +3	
P 70294 a Leg Extension +4	
P 70325 a Stubs for Auger Foundations ADO8, RA & AD2	
P 70327 a Setting Dimensions for type AD2, ADO8 and RA Foundations	
P 70377 a Stub for Special Concrete Foundations SD2	
P 70378 a Stub for special Concrete Foundations SD08	



**DRAWINGS OF TOWERS OF 400 KV
SINGLE CIRCUIT TRANSMISSION LINES**

TENSION TOWER TYPE Z6

1. TOWER Z6 (23 Drawings)	OLD Drawings Z6
P 70265 c Tower Body and Base ± 0	
P 70266 b Section A-A	
P 70267 c Body Extension for Base $\div 8$	
P 70268 Base +8	
P 70269 Section D-D	
P 70270 a Leg Extension, -3, -2 and -1	
P 70271 a Leg Extension ± 0	
P 70272 a Leg extension +1	
P 70273 a Leg extension +2	
P 70274 a Leg extension +3	
P 70275 a Leg extension +4	
P 70356 c Ground Wire Peak	
P 70357 d Girder	
P 70358 b Upper & Lower Plan of Girder	
P 70359 c Cross-arm	
P 70360 d Transverse Face of K Frame	
P 70361 c Longitudinal External Face of K Frame	
P 70362 b Longitudinal Internal Face of K Frame	
P 70328 a Stubs for Auger Foundations ADO8, RA & AD2	
P 70330 a Setting Dimensions for type AD2, ADO8 and RA Foundations	
P 70375 a Stub for special Concrete Foundations SD08	
P 70376 a Stub for special Concrete Foundations SD2	
P 72515 Setting Dimensions type SD2-SD08 for special Concrete Foundations	



IPTO S.A / TNPD / OVERHEAD T.L. DESIGN & SPECIFICATIONS SECTION / NOV. 2015

**DRAWINGS OF TOWERS OF 400 KV
SINGLE CIRCUIT TRANSMISSION LINES**

TOWERS FITTINGS (7 Drawings)		
OA	2101	Typical grounding
OA	2102	Extension link for tower S6
U	501	Step bolt
	5a	Shackle
U	102	U bolt
U	14a	Shackle
P	69501	Danger plate and anticleimbing guard



IPTO S.A. / TNPD / OVERHEAD T.L. DESIGN & SPECIFICATIONS SECTION / NOV. 2015

**DRAWINGS OF TOWERS OF 400 KV
DOUBLE CIRCUIT TRANSMISSION LINES**

SUSPENSION TOWER TYPE S15

1. TOWER S15 (17 Drawings)	OLD Drawings S5
52398 c Superstructure	(ref. P. 41704 hil)
52399 Ground Wire Peaks and Top Cross - arms	(ref. P. 41705 m)
52400 a Middle Cross-arms	(ref. P. 41706 e)
52401 Bottom Cross-arm	(ref. P. 41707 e)
52396 Upper Tower Body, Transverse	(ref. P. 41708 g)
52397 a Upper Tower Body, Longitudinal	(ref. P. 41709 e)
52395 a Lower Tower Body	(ref. P. 41710 f)
52390 b Leg ± 0 and Stubs for ± 0	(ref. P. 41711 o)
52402 a Body extension +8	(ref. P. 43170 h)
52406 Horiz. Frame & Legs -1 and -2 for + 8	(ref. P. 43171 e)
52405 Legs ± 0 and +1 for + 8	(ref. P. 43172 d)
52404 Legs +2 and +3 for + 8	(ref. P. 43173 d)
52403 b Legs +4 and Stubs for + 8	(ref. P. 43174 h)
52393 Legs -1 and -2 for ± 0	(ref. P. 43359 a)
52391 Legs +1 and +2 for ± 0	(ref. P. 43360 a)
52392 a Legs +3 and +4 for ± 0	(ref. P. 43361 a)
52394 a Legs -3 for ± 0 and +8	(ref. P. 43227 d)



IPTO S.A. / TNPD / OVERHEAD T.L. DESIGN & SPECIFICATIONS SECTION / NOV. 2015

**DRAWINGS OF TOWERS OF 400 KV
DOUBLE CIRCUIT TRANSMISSION LINES**

SUSPENSION TOWER TYPE G5

2. TOWER G5 (17 Drawings)	OLD Drawings G5
52813 a Superstructure	(ref. P. 41704 i)
52814 a Ground Wire Peaks and Top Cross - arms	(ref. P. 41705 m)
52815 a Middle Cross-arms	(ref. P. 41706 e)
52816 a Bottom Cross-arm	(ref. P. 41707 e)
52817 a Upper Tower Body, Transverse	(ref. P. 41708 s)
52818 a Upper Tower Body, Longitudinal	(ref. P. 41709 e)
52819 a Lower Tower Body	(ref. P. 41710 f)
52820 Leg ± 0 and Stubs for ± 0	(ref. P. 41711 o)
52821 a Body extension +8	(ref. P. 43170 h)
52822 Horiz. Frame & Legs -1 and -2 for + 8	(ref. P. 43171 c)
52823 Legs ± 0 and +1 for + 8	(ref. P. 43172 d)
52824 Legs +2 and +3 for + 8	(ref. P. 43173 d)
52825 Legs +4 and Stubs for + 8	(ref. P. 43174 h)
52826 Legs -1 and -2 for ± 0	(ref. P. 43559 a)
52827 Legs +1 and +2 for ± 0	(ref. P. 43360 a)
52828 Legs +3 and +4 for ± 0	(ref. P. 43361 a)
52829 Legs -3 for ± 0 and +8	(ref. P. 43227 d)



IPTO S.A. / TNPD / OVERHEAD T.L. DESIGN & SPECIFICATIONS SECTION / NOV. 2015

**DRAWINGS OF TOWERS OF 400 KV
DOUBLE CIRCUIT TRANSMISSION LINES**

SUSPENSION TOWER TYPE R5

3. TOWER R5 (28 Drawings)	OLD Drawings R5
P. 42777 e Legs-2 and -1 for ± 0	
P. 42778 d Legs +1 for ± 0	
P. 42779 e Legs +2 for ± 0	
P. 42780 e Legs +4 for ± 0	
P. 42781 f Body Extension for + 8	
P. 42782 a Horiz . Frame for + 8	
P. 42783 g Base and Leg for ± 0 for + 8	
P. 43281 d Legs -1 and -2 for + 8	
P. 43282 c Leg +1 for +8	
P. 43283 e Leg +2 for +8	
P. 43284 d Leg +4 for +8	
P. 43586 g Upper Part of superstructure	
P. 43587 f Lower Part of superstructure	
P. 43588 d Ground Wire Peaks	
52407 Top cross- arm	(ref. P. 43589 g)
52408 Middle Cross-arm	(ref. P. 43591 h)
52409 Bottom Cross-arm	(ref. P. 43594 d)
52410 Hanger	(ref. P. 43595 c)
P. 43596 d Tower Body, Upper Part	
P. 43597 d Tower Body, Middle Part	
P. 43598 g Tower Body, Lower Part	
P. 43599 d Base and Leg ± 0	



IPTO S.A. / TNPB / OVERHEAD T.L. DESIGN & SPECIFICATIONS SECTION / NOV. 2015

**DRAWINGS OF TOWERS OF 400 KV
DOUBLE CIRCUIT TRANSMISSION LINES**

SUSPENSION TOWER TYPE R5

P. 43600 h	Stubs ± 0 and +8	(ref. P. 43600 g)
P. 44305 b	Stub Extension for special footings : Bases ± 0 and +8	(ref. P. 44305 a)
P. 44274 a	Legs -3 and -4 for ± 0	
P. 44275 a	Legs +3 for ± 0	
P. 44276 a	Legs -3 and -4 for +8	
P. 44277 b	Legs +3 for +8	



**DRAWINGS OF TOWERS OF 400 KV
DOUBLE CIRCUIT TRANSMISSION LINES**

TENSION TOWER TYPE T5

4. TOWER T5 (41 Drawings)		OLD Drawings T5
P. 44105 f	Ground Wire Peaks	
52412	Top Cross - arms	(ref. P. 44106 c)
52411	Middle Cross-arms	(ref. P. 41706 a)
52413	Bottom Cross-arm	(ref. P. 44108 a)
P. 44109 i	Upper Superstructure , Transverse	
P. 44110 f	Upper Superstructure , Longitudinal	
P. 44111 m	Lower Superstructure , Transverse	
P. 44112 f	Lower Superstructure , Longitudinal	
P. 44113 d	Cross-arm Horiz. Frames	
P. 44114 h	Tower body, Transverse	
P. 44115 i	Tower body, Longitudinal	
P. 44116 h	Horiz. Frame for ± 0	
P. 44117 e	Base and Leg ± 0 for ± 0 (light)	
P. 44118 q	Stubs ± 0 and Special footing for ± 0	(ref. P. 44118 p)
P. 44313 f	Base and Leg ± 0 for ± 0 (Heavy)	
P. 44314 d	Horiz. Frame for + 8	
P. 44315 i	Body extension + 8 (and +18)	
P. 44316 e	Horiz. Frame for + 8 (and +18)	
P. 44317 e	Bases + 8 and leg -2	
P. 44318 h	Body extension for +18	
P. 44319 e	Horiz. frame for +18	
P. 44320 e	Base + 18 and Leg -2	
P. 44321 c	Legs -3 and -4 for ± 0	



**DRAWINGS OF TOWERS OF 400 KV
DOUBLE CIRCUIT TRANSMISSION LINES**

TENSION TOWER TYPE T5

P. 44322 b	Leg -2 for ± 0	
P. 44323 d	Leg -1 for ± 0	
P. 44324 b	Leg +1 for ± 0	
P. 44325 c	Leg +2 for ± 0	
P. 44326 b	Leg +3 for ± 0	
P. 44327 c	Leg +4 for ± 0	
P. 44328 c	Legs -3 and -4 for +8	
P. 44329 c	Leg -1 for +8	
P. 44330 b	Leg ± 0 for +8	
P. 44331 c	Leg + 1 for +8	
P. 44332 d	Leg + 2 for +8	
P. 44333 c	Leg + 3 for +8	
P. 44334 c	Leg + 4 for +8	
P. 44335 d	Leg ± 0 for +18	
P. 44336 d	Leg +2 for +18	
P. 44337 e	Leg +4 for +18	
P. 44338 k	Stubs for +8 and Stub Extension for special Footing +8	(ref. P. 44338 j)
P. 44339 i	Stubs for +18 and Stub Extension for special Footing +18	(ref. P. 44339 h)



**DRAWINGS OF TOWERS OF 400 KV
DOUBLE CIRCUIT TRANSMISSION LINES**

TENSION TOWER TYPE Z5

5. TOWERS Z5 (35 Drawings)	
P. 44125 f	Ground Wire Peaks
P. 44126 e	Top Part of Superstructure
P. 44127 f	Middle Superstructure , Transverse
P. 44128 e	Middle Superstructure , Longitudinal
P. 44129 e	Lower Portion of Superstructure, Transverse
P. 44130 e	Lower Portion of Superstructure, Long. Face
P. 44134 g	Top Cross-arm
P. 44135 g	Middle Cross-arm
P. 44136 f	Bottom Cross-arm
P. 44140 d	Sections D-D, E-E, F-F
P. 44141 g	Upper Tower Body
P. 44142 e	Lower Tower Body
P. 44143 d	Base ± 0 for Standard Tower
P. 44144 b	Legs ± 0 Light for ± 0
P. 44555 i	Base ± 0
P. 44556 b	Legs -3 and +1 for ± 0
P. 44557 b	Legs -1 and -2 for ± 0
P. 44558 b	Legs ± 0 for ± 0
P. 44559 b	Legs +2 for ± 0
P. 44560 b	Legs +3 for ± 0
P. 44561 b	Legs +4 for ± 0
P. 44562 e	Upper Part of Ext. +8
P. 44563 f	Lower Part of Body Ext. + 8



IPTO S.A. / TNPD / OVERHEAD T.L. DESIGN & SPECIFICATIONS SECTION / NOV. 2015

**DRAWINGS OF TOWERS OF 400 KV
DOUBLE CIRCUIT TRANSMISSION LINES**

TENSION TOWER TYPE Z5

P. 44564 g	Base +8
P. 44565 c	Legs -4 and -1 for +8
P. 44566 d	Legs -3 and -2 for +8
P. 44567 c	Legs ± 0 for +8
P. 44568 c	Leg +1 for +8
P. 44569 c	Leg +2 for +8
P. 44570 b	Leg +3 for +8
P. 44571 b	Leg +4 for +8
P. 45352 b	Leg -3, 80 for ± 0
P. 43285 k	Stubs for ± 0
P. 43286 h	Stubs for +8
P. 54596 d	Bottom Square Cross-arm



**DRAWINGS OF TOWERS OF 400 KV
DOUBLE CIRCUIT TRANSMISSION LINES**

6. TOWERS FITTINGS (9 Drawings)	
OA. 1796 c	Caution Plate
OA. 1797 e	Anticlimbing Guard
OA. 1827 b	Grounding Unit
OA. 1840 d	Extension Links for T5 & Z5 Towers
TMFM 1016	Extension Links for T5 & Z5 Towers
U5	Conductor shackle for T5 & Z5 Towers
U 104/100	U-Bolt for S15, R5, Towers and Jumpers
U 112/90	U-Bolt for S15, R5, Towers (Shield Wire)
U 501 a	Step Bolt