

POWERGRID CORPORATION OF INDIA LTD.

TOWER SPOTTING DATA

FOR

**400 KV D/C TRANSMISSION LINE.
ACSR CONDUCTOR-MAX TEMP-85 DEG C**

FOR WIND ZONE-2 (39 M/Sec)

DRG.No. TSD/WZ2

REV:0

**No of Pages: 6
(excluding this page)**

Base Document:

**400KV KOHLAPUR – PONDA (MAPUSA) TRANS. SYSTEM
for wind zone-2, 39m/s**

THIS DRAWING IS ALSO TO BE USED FOR
400KV D/C TIRUNELVELI - UDUMALPET TRANSMISSION LINE (PART - I)
ASSOCIATED WITH KUDANKULAM TRANSMISSION SYSTEM
(GRID STRENGTHENING IN TAMILNADU - I)
SPECIFICATION NO. : C-52706-L195A-7 (PACKAGE-A1)

Revision	Date	Description	Prepared By	Reviewed By	Approved By

21/2/04
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POWER GRID CORPORATION OF INDIA LTD
TOWER SPOTTING DATA FOR
400kV D/C TRANSMISSION LINE FOR WIND ZONE (39m/sec)

SL NO	DESCRIPTION	DA		DB		DC		DD	
1	MAXIMUM ANGLE OF DEVIATION	0 DEGREE		0-15 DEGREE		15-30 DEGREE		30-60 DEGREE	
2	VERTICAL LOAD LIMITATION ON WEIGHT SPAN (FOR BOTH GW & CONDUCTOR) (I) ON BOTH SPANS (m) (II) ONE SPAN (m)	DOWNWARDS		DOWNWARD	UPWARD	DOWNWARD	UPWARD	DOWNWARD	UPWARD
		MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
		600 360	200 100	600 360	0 -200	600 360	0 -200	600 360	0 -300
3	PERMISSIBLE SUM OF ADJACENT SPANS IN METERS FOR VARIOUS DEVIATION ANGLES (SUBJECT TO AVAILABILITY OF MINIMUM SPECIFIED LIVE METAL CLEARANCES). PERMISSIBLE ONE SPAN FOR VARIOUS DEVIATION ANGLES SHOULD NOT EXCEED 50% OF THE VALUE SHOWN FOR SUM OF ADJACENT SPANS.	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN
		0°	800	15°	800	30°	800	60°	800
				14°	850	29°	845	59°	840
				13°	900	28°	890	58°	880
				12°	950	27°	935	57°	920
				11°	1000	26°	980	56°	960
				10°	1050	25°	1025	55°	1000
				9°	1100	24°	1070	54°	1040
				8°	1150	23°	1115	53°	1080
				7°	1200	22°	1160	52°	1120
				& BELOW		& BELOW		& BELOW	51°
							50°	1200	
							& BELOW		

NOTE: Max. conductor temperature has been considered 85 deg.C for 400 KV D/C line. The tower has been designed considering Max. temperature of conductor 75 deg.C. Therefore tower can be spotted at normal span if required ground clearance is available, other wise span shall be reduced accordingly.

4. +18/+25m Extn. For Tower type DA.

- a. Max. wind span =300 M
- b. Deviation angle =0 deg.

5. +18/+25m Extn. For Tower type DD.

Permissible sum of adjacent spans in meters for various deviation angles (subject to availability of minimum specified live metal clearances). Permissible one span for various deviation angles should not exceed 50% of the value shown for sum of adjacent spans. Note: The span may however be increased than the value indicated in table for reduced angle of line deviation. The detail proposal alongwith the profile shall be forwarded to CC Engg for their review / approval.	DEVN ANGLE	SPAN
	50°	720
	49°	762
	48°	804
	47°	846
	46°	888
	45°	930
	& below	

I. General Details

Normal Span : 400

Design Wind Span (m)

	DA	DB	DC	DD
NC	400	400	400	400
BWC	240	240	240	240

II. ELECTRICAL CLEARANCE FOR RAILWAY CROSSING:

- Prior approval of Railway Authority is to be obtained.
- Minimum Clearance between lowest point of 400kV line Conductor and Rail level shall be 17.9m. However approval of railway crossing from railway authority has to be obtained in each case.
- The crossing span shall be limited to 300 M.
- The crossing shall normally be at right angle to the railway track.
- Crossing should be done with DD type tower.

III. Minimum Clearance for Power line crossing

- For 400kV : 5490 mm
- For 220kV : 5490 mm
- For 132kV : 5490 mm

IV. TELECOMMUCATION LINE CROSSING:

The angle of crossing shall be as near to 90 deg. as possible. However, deviation to the extent of 30 deg. May be permitted under exceptionally difficult situations.

- v. The number of consecutive spans between the section points shall not exceed 15 or 5 Km. In plain terrain, and 10 spans or 3 Km. in hilly terrain. A section point shall comprise of tension point with DB type or DC type or DD type towers as applicable.
- vi. Minimum ground clearance required : 8840mm
- vii. For all National Highway crossing, tension tower is to be used and the crossing span is not to exceed 250meters.
- viii. Way leave clearance : 23 M either side from the C.L. of the tower.
- ix. Maximum Span of Adjacent Spans for various Angles of deviation are subject to the condition that Minimum specified Live Metal Clearance & Minimum Ground Clearance are available.
- x. Tower type "DC" shall be used for transposition with 0 deg. Deviation with modification of cross arms.
- xi. Maximum deviation of line for dead end tower shall be 15 deg. both side i.e. line side and substation side (slack span side).
- xii. Vertical load of individual spans are acting downwards for suspension towers.
- xiii. Broken wire Conditions :

Suspension Tower (DA)	Any ground wire broken or both sub-conductors of a bundle in one phase only.
Small/Medium Angle Towers (DB,DC)	Breakage of two phases on same side and on same span or breakage of any one phase and any one earthwire on same span.
Large angle/Dead End towers (DD/DE)	Breakage of all three phases on same side and on same span or breakage of any two phases and any one earthwire on same span.

xiv. Design Load Tensions :

For Ground Wire : 1212.69 kgs (32° & NW) (For T.T."DA")
2619.96 kgs (32° & FW)

Deviation Angle	0°	15°	30°	60°
Tension (kgs)	2619.96	2597.54	2530.68	2268.95

For Conductor : 3614.16kgs (32° & NW) (For T.T."DA")
6333.2 kgs (32° & FW)

Deviation Angle	0°	15°	30°	60°
Tension (kgs)	6333.2	6279.01	6117.40	5484.71

Sag-Tension Calculation of ACSR Moose
(Bhalesh Kumar, Engg-T/A)

Conductor Properties

Conductor Name	ACSR Moose
UTS (kg)	16428 ✓
Area of Conductor (sqmm)	597
Wt. Of Conductor (kg/m)	2.004
Dia of Conductor (mm)	31.77
Modulus of Elasticity (kg/sqmm)	7034
Coeff of linear Expansion (per deg C)	0.0000193

Initial Condition

Normal Span (m)	400
Wind Pressure on Cond.(Kg/sqm)	109.9937
Initial Cond. temp.(deg C)	32
Initial Wind %	0
Initial Cond. tension at above temp,and wind condition (% of UTS OR value in Kg)	22

Note: The tension should be below 22% of UTS in day to day condition and should not exceed 70% of UTS in any condition.

22% of UTS = 3614.16 Kg	70% of UTS = 11499.6 Kg
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Initial Sag, Ten at 32 deg C, 0% Wind		
Tension (%)	Tension (kg)	Sag (mts)
22.00	3614.16	11.09

	Standard Conditions					Any other condition
	0	32	75	0	32	
Temperature (deg C)	0	32	75	0	32	85
Pressure (% of full wind)	0	0	0 37.597 → 36		100 109.9937 37	0
Resultant Tension (Kg)	4144.81	3614.16	3114.26	4698.92	6333.22	3022.04
Resultant Sag (mts)	9.67	11.09	12.87	#	#	13.26

Starting Condition:

- a) For equivalent span less than or equal to Normal Span i.e. 400m (For both conductor & Earthwire) – 32 °C & No Wind
- b) For equivalent greater than Normal Span i.e. 400m (For both conductor & Earthwire) – 32 °C & Full Wind

L span

Sag-Tension Calculation of Earthwire

(Brajesh Kumar, Engrg-T/L)

Conductor Properties

Conductor Name	Earthwire
UTS (Kg)	6972
Area of Conductor (sqmm)	73.65
Wt. of Cond (Kg/m)	0.583
Dia of Cond. (mm)	10.98
Mod. of Elasticity (Kg/sqmm)	19361
Coeff. of linear expansion (per deg C)	0.0000115

Initial Condition

Normal Span (m)	400
Wind Pressure on Cond.(Kg/sqm)	137
Initial Cond. temp.(deg C)	0
Initial Wind %	0
Initial Cond. tension at above temp.and wind condition (% of UTS OR value in Kg)	1339.91

Note: The tension should be below 20% of UTS in day to day condition and should not exceed 70% of UTS in any condition.

20% of UTS = 1394.4 Kg	70% of UTS = 4880.4 Kg
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Initial Sag, Ten at 0 deg C, 0% Wind

#REF!	#REF!	#REF!
19.22	1339.91	8.70

	Standard Conditions					Any other condition
Temperature (deg C)	0	32	75	0	32	53
Pressure (% of full wind)	0	0	0	36 ^{49.77}	100 ¹³⁷	0
Resultant Tension (Kg)	1339.91	1212.66	1080.08	1677.96	2619.96	1143.24
Resultant Sag (mts)	8.70	9.62	10.80	#	#	10.20

- Tension WITHIN Indian Standard limits

TABLE FOR EXTRA GROUND CLEARANCE TO BE PROVIDED FOR EQUIVALENT SPAN IS LESS THAN THE NORMAL SPAN (i.e. 400 M)

Sl.No.	Equivalent span	Tension as per string chart 85 deg.c in kg. (T ₁)	Tension as per sag template at 85 deg.c in kg. (T ₂)	Formula for calculating extra ground clearance for all individual span in meter
1.	400	3022.04	3022.04	$(2.004 / 8) \times (\text{SPAN})^2 \times (1/T_1 - 1/T_2)$
2.	390	3001	3022.04	
3.	380	2979	3022.04	
4.	370	2956	3022.04	
5.	360	2933	3022.04	
6.	350	2907	3022.04	
7.	340	2881	3022.04	
8.	330	2854	3022.04	
9.	320	2825	3022.04	
10.	310	2794	3022.04	
11.	300	2762	3022.04	
12.	290	2729	3022.04	
13.	280	2693	3022.04	
14.	270	2656	3022.04	
15.	260	2617	3022.04	
16.	250	2575	3022.04	
17.	240	2532	3022.04	
18.	230	2486	3022.04	
19.	220	2437	3022.04	
20.	210	2386	3022.04	
21.	200	2332	3022.04	