

# 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 400 KV D/C MADURAI - PUGALUR TRANSMISSION  
LINE AGAINST SPECIFICATION NO. C - 55808 -L195A-7 (PACKAGE-A1) DTD. 21.02.2006

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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	
		0 DEGREE		0-15 DEGREE		15-30 DEGREE		30-60 DEGREE	
		DOWNWARDS MAX	MIN	DOWNWARD MAX	UPWARD MIN	DOWNWARD MAX	UPWARD MIN	DOWNWARD MAX	UPWARD MIN
1	MAXIMUM ANGLE OF DEVIATION								
2	VERTICAL LOAD LIMITATION ON WEIGHT SPAN (FOR BOTH GW & CONDUCTOR)  (I) ON BOTH SPANS (m) (II) ONE SPAN (m)	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 0°	SPAN 800	DEVN ANGLE 15° 14° 13° 12° 11° 10° 9° 8° 7° & BELOW	SPAN 800 850 900 950 1000 1050 1100 1150 1200	DEVN ANGLE 30° 29° 28° 27° 26° 25° 24° 23° 22° & BELOW	SPAN 800 845 890 935 980 1025 1070 1115 1160	DEVN ANGLE 60° 59° 58° 57° 56° 55° 54° 53° 52° 51° 50° & BELOW	SPAN 800 840 880 920 960 1000 1040 1080 1120 1160 1200

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.	DEVN ANGLE	SPAN
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.	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. TELECOMMUNICATION 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)

Devaiiton 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)

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

## Sag-Tension Calculation of ACSR Moose

(Brajesh Kumar, Engg-T/L)

### 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
Temperature (deg C)	0	32	75	0
Pressure ( % of full wind)	0	0	0	36
Resultant Tension (Kg)	4144.81	3614.16	3114.26	4698.92
Resultant Sag (mts)	9.67	11.09	12.87	#
				#
				32
				100
				6333.22
				3022.04
				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 span greater than Normal Span i.e. 400m (For both conductor & Earthwire) – 32 ° C & Full Wind

L span.

## Sag-Tension Calculation of Earthwire

(Brahesh Kumar, Enag-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

Initial Sag, Ten at 0 deg C, 0% Wind		
#REF!	#REF!	#REF!
19.22	1339.91	8.70

	Standard Conditions				Any other condition
	75	0	36	100	
Temperature (deg C)	0	32	0	32	53
Pressure ( % of full wind)	0	0	36	100	0
Resultant Tension (Kg)	1339.91	1212.66	1677.96	2619.96	1143.24
Resultant Sag (mts)	8.70	9.62	#	#	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 <sub>1</sub> )	Tension as per sag template at 85 deg.c in kg.  (T <sub>2</sub> )	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	