POWERGRID CORPORATION OF INDIA LTD.

TOWER SPOTTING DATA

FOR

400 KV D/C TRANSMISSION LINE.
ACSR CONSUCTOR-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

Revision	Date	Description	Prepared By	Reviewed By	Approved By

20/08/04
PREPARED BY
S. GUPTA
Sr. Engr.(ENGG-TL)

23.8.04
REVIEWED BY
A.K.VYAS
CDE(ENGG-TL) /

RAJESH KUMAR
DGM(ENGG-T/L)

APPROVED BY
D.CHOWDHURY
GENERAL MANAGER (Engg.)
25/8/04

POWER GRID CORPOARTION 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	
		DOWNWARDS		DOWNWARD	UPWARD	DOWNWARD	UPWARD	DOWNWARD	UPWARD
		MAX	MIN	MAX	MIN	MAX	MIN	MAX	MIN
2	VERTICAL LOAD LIMITATION ON WEIGHT SPAN (FOR BOTH GW & CONDUCTOR)								
	(I) ON BOTH SPANS (m)	600	200	600	0	600	0	600	0
	(II) ONE SPAN (m)	360	100	360	-200	360	-200	360	-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		51°	1160
								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).	DEVN ANGLE	SPAN
Permissible one span for various deviation angles should not exceed 50% of the value shown for sum of adjacent spans.	50°	720
	49°	762
	48°	804
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.	47°	846
	46°	888
	45° & below	930

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 :

SuspensionTower (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)

Deviaiton 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)

Deviaton 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
Intial 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

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	32	85
Pressure (% of full wind)	0	0	0	36	100	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.

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.	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	$(2.004 / 8) \times (SPAN)^2 \times (1/T_1 - 1/T_2)$
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	