

WO.254

THIS DOCUMENT SHALL ALSO BE APPLICABLE FOR 400 KV D/C (TWIN ACSR MOOSE) KAKRAPAR NPP-NAVSARI AND KAKRAPAR NPP -VAPI TRANSMISSION LINE ASSOCIATED WITH KAKRAPAR ATOMIC POWER PROJECT 3 & 4 IN TOWER PACKAGE-TW01 NOA NO: CC-CS/277-WR2/TW-2046/3/G1/NOA-II/4933 & NOA-II/4934 DATED: 19/05/14

POWERGRID CORPORATION OF INDIA LTD.

THIS DRAWING IS ALSO TO BE USED FOR 400 KV D/C SIPAT-RAIPUR AND 400 KV D/C BHADRAWATI-CHANDRAPUR TRANS. LINE AGAINST SPECN. NO. C-33102-L195A-3.

TOWER SPOTTING DATA

FOR

400 KV D/C RAMAGUNDAM - HYDERABAD T.L

FOR WIND ZONE-3 (44 M/Sec)

DRG.No. TSD/RH/1

REV: ³/₂ No. OF PAGES : ³/₄ = ⁷/₈

THIS DRAWING IS ALSO TO BE USED FOR 400 KV D/C RAIPUR-PALANDUR-CHANDRAPUR TRANS. LINE AGAINST SPECN. NO. C-32104-L195A-3 (PACKAGE-A) & C-33105-L195A-3 (PACKAGE-A2)

Revision	Date	Description	By	Checked By	Approved By
3	10.06.2014	LEG. SCHEME ADDED	[Signature]	[Signature]	[Signature]
2	10.08.2003	Self-consistency calculation enclosed	[Signature]	[Signature]	[Signature]
1	07.02.2002	Extra ground clearance for Eq. Span between 350 to 400 deleted in Sh. No. 1 of 1	[Signature]	[Signature]	[Signature]

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WO.275 (PGCIL)
THIS DOCUMENT SHALL ALSO BE APPLICABLE FOR TOWER PACKAGE-TW03 FOR (i) 400KV D/C NIZAMABAD-DICHPALLI TRANS LINE (ii) LILO OF 400KV S/C HYDERABAD-KURNOOL TRANS LINE AT (MAHESWARAM) (PG) SUBSTATION (iii) LILO OF 400KV S/C VIJAYAWADA-GUJUWAKA TRANS LINE AT VEMAGIRI ASSOCIATED WITH WARDHA-HYDERABAD 765KV LINE, SPEC.NO. CC-CS/465-SR1/TW-2635/3/G7 NOA.NO. CC-CS/465-SR1/TW-2635/3/G7/NOA I/5311 & NPA-II/5312 DATED 31.03.2015

13/11/15
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POWER GRID CORPORATION OF INDIA LTD
TOWER SPOTTING DATA FOR

400KV D/C RAMAGUDAM-HYDERABAD TRANS. LINE FOR WIND ZONE (44m/sec)

SL NO	DESCRIPTION	DA		DB		DC		DD	
		2 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
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	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN	DEVN ANGLE	SPAN
		0°	800	15°	800	30°	800	60°	800
				14°	846	29°	845	59°	840
				13°	892	28°	890	58°	880
				12°	938	27°	935	57°	920
				11°	984	26°	980	56°	960
				10°	1030	25°	1025	55°	1000
				9°	1076	24°	1070	54°	1040
				8°	1122	23°	1115	53°	1080
				7°	1168	22°	1160	52°	1120
				& BELOW	& BELOW	& BELOW	& BELOW	& BELOW	& BELOW

NOTE: Max. conductor temperature has been considered 85 deg.C for 400 KV D/C Ramagudam-Hyderabad line .As 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
		50°
	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/B type or DC/C type or DD/D 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 : 1212.68 kgs (32° & NW) (For TT "DA")
 3063.72 kgs (32° & FW)

Deviation Angle	0°	2°	15°	30°	60°
Tension (kgs)	3063	3063	3036	2959	2652

For Conductor : 3614.16 kgs (32° & NW) (For TT "DA")
 7341.62 kgs (32° & FW)

Deviation Angle	0°	2°	15°	30°	60°
Tension (kgs)	7341	7341	7278	7091	6357

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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	

Sag-Tension Calculation of ACSR MOOSE

(Bhalesh Kumar, Engrg-7A)

Conductor Properties

Conductor Name
UTS (Kg)
Area of Conductor (sqmm)
Wt. Of Conductor (Kg/m)
Dia. Of Conductor (mm)
Modulus of Elasticity (Kg/sqmm)
Coeff. Of linear Expansion (per deg C)

ACSR MOOSE
 16428
 597
 2.004
 31.77
 7034
 0.0000193

Applicable for - ACSR MOOSE

1. 400KV D/C Part portion Tarapur - Padghe
2. LLO of 400KV S/C Gandhar - Padghe at Bolar
3. LLO of 400KV S/C Gandhar - Padghe at Vapi.

Note: The tension should be below 22% of UTS in day to day condition and should not exceed 70% of UTS in any condition.	70% of UTS = 11499.6 Kg
22% of UTS = 3614.16 Kg	

Initial Sag, Ten at 32 deg C, 0% Wind	
Ten (% of UTS)	Ten (kg)
22.00	3614.16
	Sag (mts)
	11.09

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

400
 139.82
 32
 0
 22

Standard Conditions					Any other condition
Temperature (deg C)	0	32	75	0	32
Pressure (% of full wind)	0	0	0	36	100
Resultant Tension (Kg)	4144.81	3614.16	3114.26	4990.19	7341.62
Resultant Sag (mts)	9.67	11.09	12.87	#	#
					3022.04
					13.26

PRINT

- Tension WITHIN Indian Standard limits

Stringing Chart shall be prepared considering following Starting condition

1. Equivalent Span less than the 400m (normal Span)	: 32Deg C, No Wind Condition
2. Equivalent Span more than the 400m (normal Span)	: 32Deg C, Full Wind Condition

Sag-Tension Calculation of Earthwire

(Ballesh Kumar, Engrg-174)

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

Applicable for

1. 400KV D/C Tarapur - Padghe
2. LILO of 400KV S/C Gandhar - Padghe at Boisar
3. LILO of 400KV S/C Gandhar - Padghe at Vapi
4. 400KV D/C Tarapur - Boisar

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

<u>Initial Condition</u>	
Normal Span (m)	400
Wind Pressure on Cond.(Kg/sqm)	174.17
Initial Cond. temp.(deg C)	0
Initial Wind %	0
Initial Cond. tension at above temp.and wind condition (% of UTS OR value in Kg)	1339.4

Initial Sag, Ten at 0 deg C, 0% Wind		
Ten (% of UTS)	Ten (kg)	Sag (mts)
19.21	1339.40	8.71

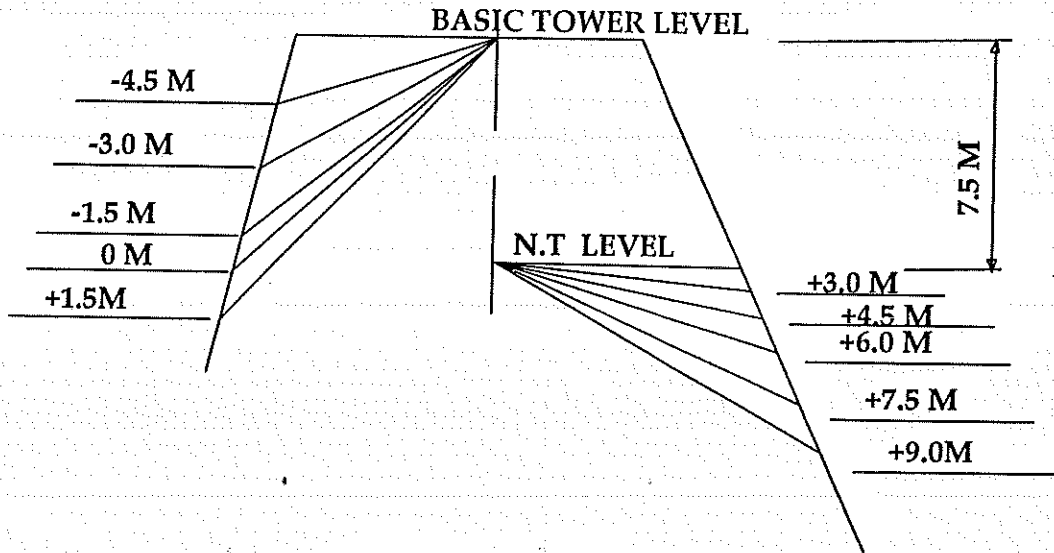
Standard Conditions				Any other condition
Temperature (deg C)	32	75	0	53
Pressure (% of full wind)	0	0	36	100
Resultant Tension (Kg)	1212.26	1079.77	1835.29	3063.18
Resultant Sag (mts)	8.71	10.80	#	1142.89
			#	10.20

- Tension WITHIN Indian Standard limits

Stringing Chart shall be prepared considering following Stringing condition

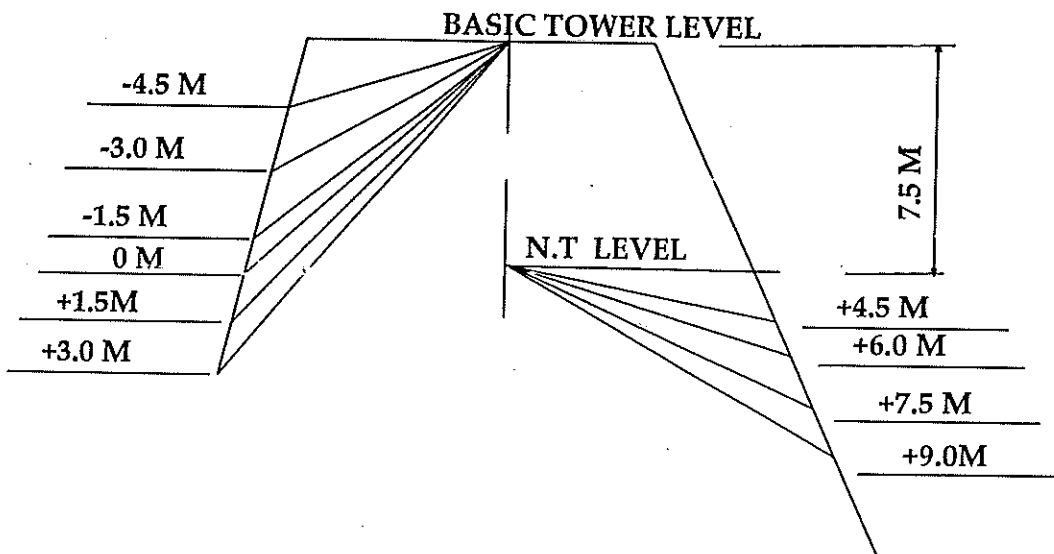
1. Equivalent Span less than the 400m (normal Span)	: 32Deg C, No Wind Condition
	: 32Deg C, Full Wind Condition

LEG Scheme for Towers



LEG SCHEME FOR
FOR TOWER TYPE-DA
WIND ZONE- 3 TWIN MOOSE
400 KV D/C

SCALE- NTS



LEG SCHEME FOR
FOR TOWER TYPE-DB,DC,DD
WIND ZONE- 3 TWIN MOOSE
400 KV D/C

SCALE- NTS