

CALCULATION OF LOADS FOR 220 KV D/C Monopole of type - 2P3

INPUT DATA:

1. Wind pressure on Conductors in Kg/Sq.m .	[Pc] =	106.5
2. Wind pressure on Ground wire in Kg/Sq.m	[Pgw] =	133
3. Wind pressure on Insulator Kg/Sq.m	[Pi] =	133.5
4. Wind span in mtrs for NC	[WSNC] =	150
5. Wind span in mtrs for BWC	[WSBWC] =	90
6. Weight Span in mtrs for NC (max).	[W1] =	225
7. Weight Span in mtrs for NC (min).	[W2] =	-225
8. Weight Span in mtrs for BWC (max).	[W3] =	135
9. Weight Span in mtrs for BWC (min) .	[W4] =	-135
10. Power Conductor Used.	<u>AAAC MOOSE</u>	
11. Diameter of Conductor in mtrs.	[Dc] =	0.03195
12. Weight of Conductor in Kg/m .	[Wc] =	1.666
13. Number of Conductor.	[Nc] =	1
14. Tension of Coductor at 32 deg.C & FW .	[CT1] =	5213
15. Tension of Coductor at 32 deg.C & NW .	[CT2] =	4074
16. Ground Wire Used.	<u>48F OPGW</u>	
17. Diameter of Ground Wire in mtrs.	[Dgw] =	0.0122
18. Weight of Ground wire in Kg/m.	[Wgw] =	0.451
19. Tension of Ground Wirer at 32 deg.C & FW .	[GT1] =	1263
20. Tension of Ground Wirer at 32 deg.C & NW .	[GT2] =	456
21. No.of Insulator Strings.	[NI] =	2
22. Length of Insulator String in Mtrs.	[LI] =	3.35
22. Diameter of the Insulator in Mtrs.	[DI] =	0.255
23. Weight of Insulator String in Kg. (Max).	[Wimax] =	300
25. Weight of Insulator String in Kg. (Min).	[Wimin] =	150
26. Angle of Deviation in degrees.	[THETA] =	30
27. Angle of Deviation in Radians.	[THETA] =	0.523598783
28. Angle of Wind Direction (θ) in deg	[THEETA]=	0
29. Angle of Wind Direction (θ) in radians	[THEETA]=	0

I. RELIABILITY REQUIREMENT

A. TRANSEVERSE LOADS.

POWER CONDUCTOR

a) Wind on conductor $[P_c \cdot \sin^2 \Omega \cdot W_{SNC} \cdot DC] \cdot N_c$	=	510
b) Wind on Insulators $[P_i \cdot L_i \cdot D_i \cdot N_i \cdot 0.5] \cdot \cos(\theta)$	=	114
c) Due to Deviation $[2 \cdot CT_1 \cdot \sin(\theta/2)] \cdot N_c$	=	2698
		<hr/>
		3323
		<hr/>

GROUND WIRE.

a) Wind on Ground wirer $[P_{gw} \cdot \sin^2 \Omega \cdot W_{SNC} \cdot D_{gw}]$	=	243
c) Due to Deviation $[2 \cdot GT_1 \cdot \sin(\theta/2)]$	=	654
		<hr/>
		897
		<hr/>

B. LONGITUDINAL LOADS

a) CONDUCTOR	=	0
b) Wind on Insulators $[P_i \cdot L_i \cdot D_i \cdot N_i \cdot 0.5] \cdot \sin(\theta)$	=	0
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		0
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a) GROUND WIRE.	=	0
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C. VERTICAL LOADS.

CONDUCTOR

		<u>Max.</u>	<u>Min.</u>
a) Weight of Conductor $[W_c \cdot W_1, W_c \cdot W_2] \cdot N_c$	=	375	-375
b) Weight of Inulator string $[W_{lmax}, W_{lmin}] \cdot N_i$	=	600	300
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		975	-75
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GROUND WIRE

a) Wght. of Ground Wire $[W_{gw} \cdot W_1, W_{gw} \cdot W_2]$	=	101	-101
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II SECURITY REQUIREMENTS

A. TRANSEVERSE LOADS.

CONDUCTOR

a) Wind on conductor [$P_c \cdot W_{SNC}/W_{SBWC} \cdot DC$] $\cdot N_c$	=	306	510
b) Wind on Insulators [$P_i \cdot L_i \cdot DI \cdot NI \cdot 0.5$]	=	114	114
c) Due to Deviation [$1 \cdot CT1 \cdot \sin(\theta/2) \cdot N_c$, [$2 \cdot CT1 \cdot \sin(\theta/2) \cdot N_c$	=	1349	2698
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		1770	3323
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GROUND WIRE

a) Wind on Ground wire [$P_{gw} \cdot W_{SNC}/W_{SBWC} \cdot D_{gw}$]	=	146	243
b) Due to Deviation [$1 \cdot GT1 \cdot \sin(\theta/2) \cdot N_c$, [$2 \cdot GT1 \cdot \sin(\theta/2) \cdot N_c$	=	327	654
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		473	897
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B. LONGITUDINAL LOADS

a) <u>CONDUCTOR</u>	=	5035	0
b) <u>GROUND WIRE</u>	=	1220	0

C. VERTICAL LOADS.

CONDUCTOR.

		<u>BROKEN</u>	
		<u>MAX.</u>	<u>MIN.</u>
a) Weight of Conductor [$W_c \cdot W3/W1$, $W_c \cdot W4/W2$] $\cdot N_c$	=	225	-225
b) Weight of Inulator string [W_{lmax} , W_{lmin}] $\cdot NI$	=	600	300
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		825	75
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GROUND WIRE

a) Weight of Ground wire [$W_{gw} \cdot W3$, $W_{gw} \cdot W4$]	=	61	-61
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III. SAFETY REQUIREMENT (NORMAL CONDITION)

A. TRANSEVERSE LOADS.

POWER CONDUCTOR

a) Wind on conductor $[0 * WSNC * DC] * Nc$	=	0	
b) Wind on Insulators $[0 * LI * DI * NI * 0.5] * COS(\theta)$	=	0	
c) Due to Deviation $[2 * CT2 * SIN(THETA/2)] * Nc$	=	2109	

		2109	-----

GROUND WIRE.

a) Wind on Ground wiler $[Pgw * SIN^2\Omega * WSNC * Dgw]$	=	0	
c) Due to Deviation $[2 * GT2 * SIN(THETA / 2)]$	=	236	

		236	-----

B. LONGITUDINAL LOADS

a) CONDUCTOR	=	0	
a) GROUND WIRE.	=	0	

C. VERTICAL LOADS.

CONDUCTOR.

		<u>MAX.</u>	<u>MIN.</u>
I) Weight of Conductor $[2 * Wc * W1, 2 * Wc * W2] * Nc$	=	750	-750
ii) Weight of Insulator $[Wimax * NI * 2]$	=	1200	1200
iii) Weight of line man with tools.	=	150	0
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		2100	450
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GROUND WIRE.

ii) Weight of Ground Wire $[Wgw * W3 * 2, Wgw * W1 * 2]$	=	203	-203
iii) Weight of line man with tools.	=	150	0
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		353	-203
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IV. SAFETY REQUIREMENT (BROKEN CONDITION)

A. TRANSEVERSE LOADS

POWER CONDUCTOR

		<u>BRKN</u>	<u>INTACT</u>
a) Wind on conductor $[0 * WSNC * DC] * Nc$	=	0	0
b) Wind on Insulators $[0 * LI * DI * NI * 0.5] * COS(\theta)$	=	0	0
c) Due to Deviation $[1 * CT2 * SIN(THETA/2)] * Nc$	=	1054	2109
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		1054	2109
		-----	-----

GROUND WIRE.

a) Wind on Ground wirer $[Pgw * SIN^2\Omega * WSNC * Dgw]$	=	0	0
c) Due to Deviation $[2 * GT2 * SIN(THETA / 2)]$	=	118	236
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		118	236
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B. LONGITUDINAL LOADS

		<u>BRKN</u>	<u>INTACT</u>
CONDUCTOR @ INTACT POINTS $(1.5 * 0.5 * CT2)$:	=		3056
CONDUCTOR @ STRINGING POINTS $(2.0 * 0.5 * CT2)$:	=	4074	
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		4074	3056
		-----	-----

GROUND WIRE @ INTACT POINTS $(1.5 * 0.5 * GT2)$:	=		342
GROUND WIRE @ STRINGING POINTS $(2.0 * 0.5 * GT2)$:	=	456	

C. VERTICAL LOADS

CONDUCTOR.

		<u>BROKEN</u>	
		<u>MAX.</u>	<u>MIN.</u>
i) Weight of Conductor $[2 * Wc * W3, 2 * Wc * W4] * Nc$	=	450	-450
ii) Weight of Insulator $[Wimax * NI * 2]$	=	1200	1200
iii) Weight of line man with tools.	=	150	0
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		1800	750
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GROUND WIRE.

ii) Weight of Ground Wire $[Wgw * W3 * 2, Wgw * W4 * 2]$	=	122	-122
iii) Weight of line man with tools.	=	150	0
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		272	-122
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V. ANTI - CASCADING REQUIREMENTS.

A. TRANSEVERSE LOADS (Only deviation loads)

a. Conductor ($1 \cdot CT2 \cdot \sin(\theta/2)$)	=	1054
b. Ground Wire ($1 \cdot GT2 \cdot \sin(\theta/2)$)	=	118

B. VERTICAL LOADS.

		<u>MAX.</u>	<u>MIN.</u>
a) Weight of Conductor [$Wc \cdot W1/W2 \cdot 0.5$] $\cdot Nc$	=	187	-187
a) Weight of Insulators. [$Wimax \cdot NI$]	=	600	600
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		787	413
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a) Weight of Ground wire [$Wgw \cdot W1 \cdot 0.5$]	=	51	-51

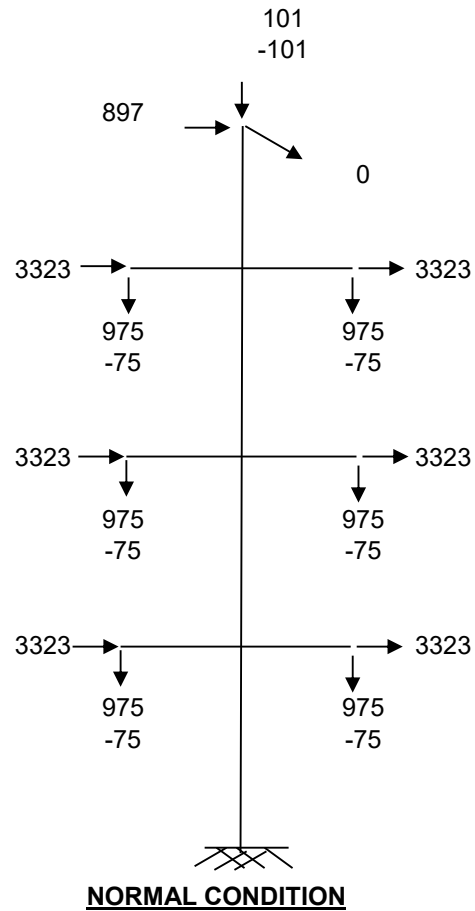
C. LOGITUDINAL LOADS

a) Conductor [$CT2$] $\cdot Nc$	=	4074
b) Ground Wire [$GT2$]	=	456

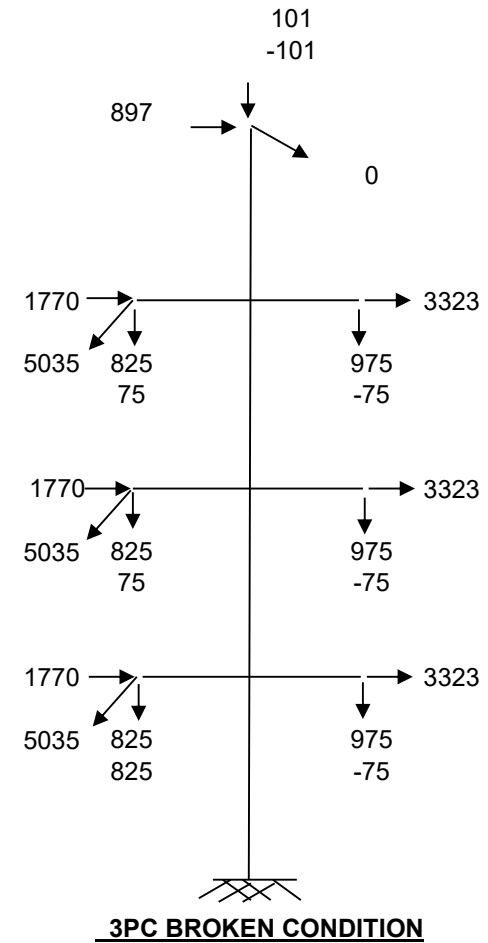
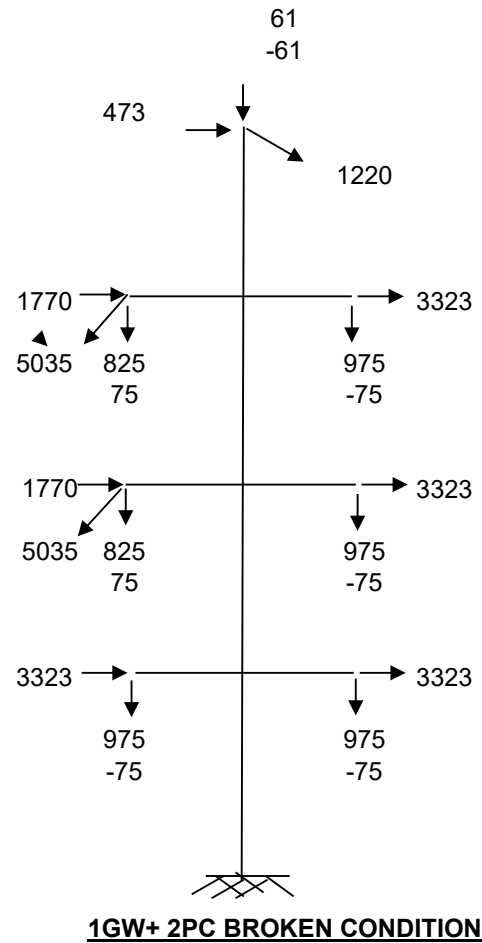
LOADING TREES FOR 220kV D/C MONOPOLE OF TYPE 2P3(30° - 60°)"

(ANGLE OF DEVIATION: 30 Deg & WIND ANGLE: 0 Deg)

1 - RELIABILITY CONDITION



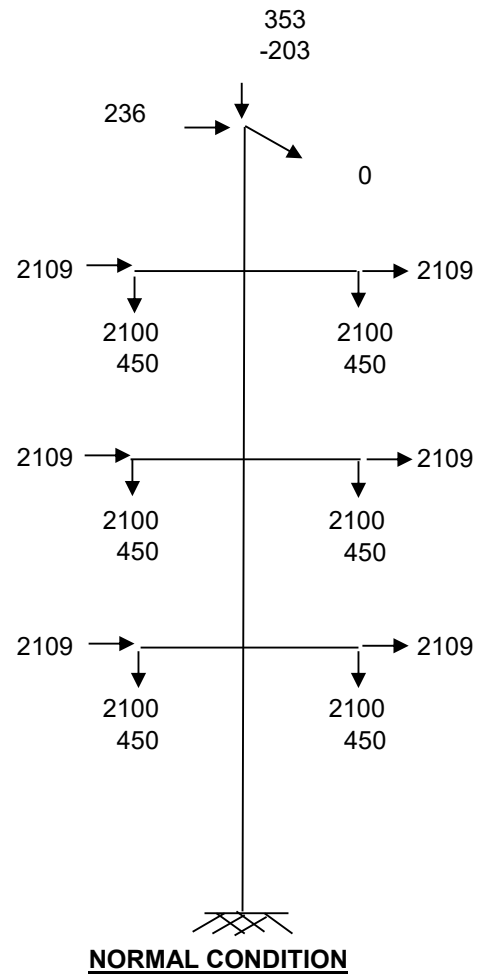
2 - SECURITY CONDITION



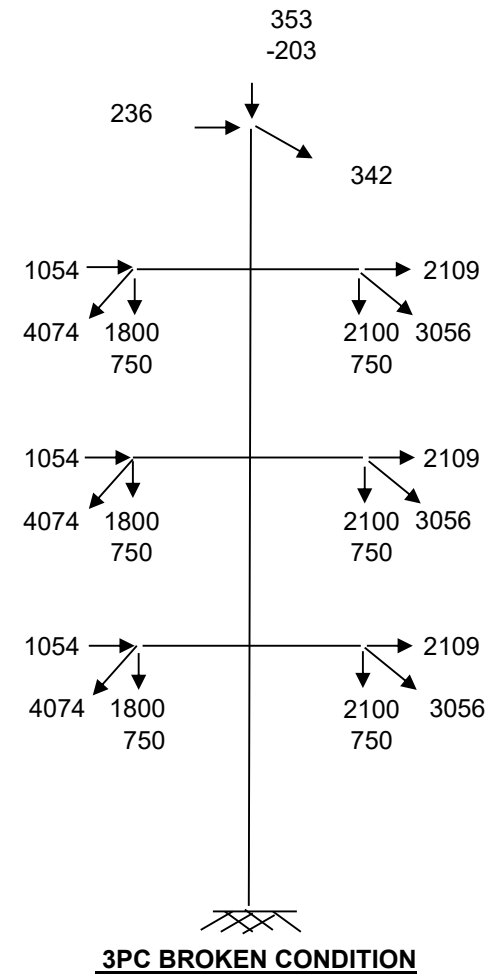
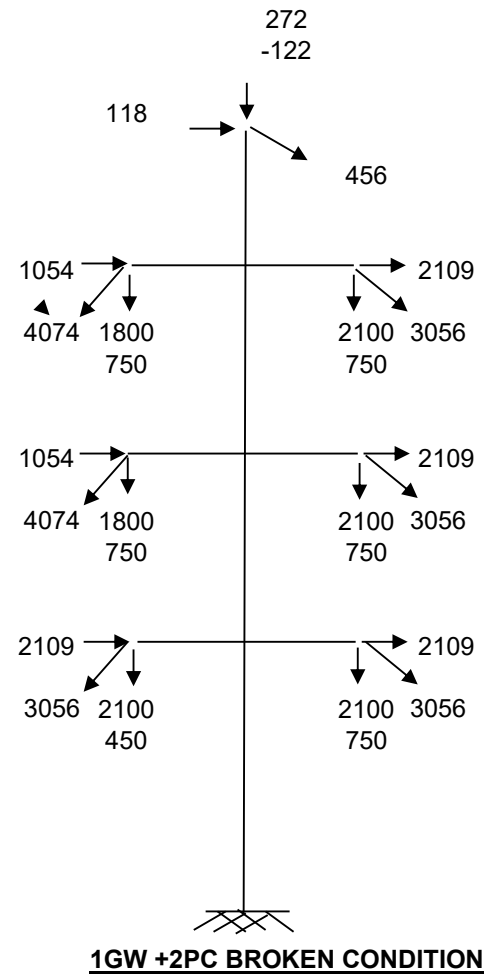
LOADING TREES FOR 220kV D/C MONOPOLE OF TYPE 2P3(30° - 60°)"

(ANGLE OF DEVIATION: 30 Deg & WIND ANGLE: 0 Deg)

3 - SAFETY CONDITION



4 - SAFETY BROKEN CONDITION



LOADING TREES FOR 220kV D/C MONOPOLE OF TYPE 2P3(30° - 60°)"

(ANGLE OF DEVIATION: 30 Deg & WIND ANGLE: 0 Deg)

5 - ANTI-CASCADING

