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17 EEB 409

GI - 2134

GROUP - 07

Selection of conductor

→ The conductor is one of the important item in a Transmission Line & proper selection of conductor & its size is very important for economy & efficiency point of view

→ A conductor used for power evacuation & distribution must have the following qualities –

1). High quality conductivity
2) High tensile strength to withstand mechanical stress
3) Low cost so that it can be used for long distance power transmission
4) Low specific gravity so that weight per unit volume is less

If there are 'n' layers in a stranded conductor, then

Total number of individual wire in that conductor = $1 + 3n(n+1)$

ASCR conductor

ASCR → Aluminium conductor steel Reinforced

→ To increase the tensile strength of Al conductor, Galvanized steel is reinforced in Al conductor. The composite conductor thus obtained is properly known as ASCR

Calculation for conductor selection for double circuit line.

The Power transmitting capacity of a conductor can be given by

$$P = \sqrt{3} V_L I_L \cos\phi N_C$$

where, $P = 120 MW$, $V_L = 132 KV$

$N_C = 2$, $\cos\phi = 0.95$

Hence current carrying capacity of the conductor can be calculated as

$$I_L = \frac{P}{\sqrt{3} \times V_L \times N_C \times \cos\phi}$$

$$I_L = \frac{120 \times 10^3}{\sqrt{3} \times 132 \times 2 \times 0.95}$$

$$I_L = 276.24408 A$$

for future, expansion,

increasing the current by 20%.

$$I_L' = 1.2 \times I_L$$

$I_L' = 331.4929\ A$

corresponding to this value of current, The conductor from the the table of standard conductor is

LEOPARD

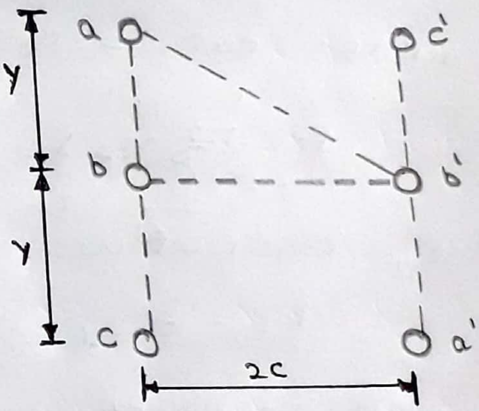
Diamter of conductor = 15.84 mm

$$\text{radius} = \frac{15.84}{2}\ mm$$

$$= 7.92\ mm$$

Calculation of D_m'

D_m = mutual distance between the conductor



Double circuit line

$D_m = (D_{AB}\ D_{BC}\ D_{CA})^{1/3}$

D_{AB} = Mutual distance between conductor A & B

$= (D_{ab}\ D_{ab'}\ D_{a'b}\ D_{a'b'})^{1/4}$

D_{BC} = Mutual distance between B & C

$= [D_{bc}\ D_{b'c}\ D_{bc'}\ D_{b'c'}]^{1/4}$

D_{CA} = Mutual conductor between C & A

$= (D_{ca}\ D_{ca'}\ D_{c'a}\ D_{c'a'})^{1/4}$

we known

$y = 357.997\ cm$

$2c = 746.608\ cm.$

$$D_{ab} = D_{a'b'} = D_{b'c'} = D_{bc} = y$$

$$D_{ca} = D_{c'a'} = 2y$$

$$D_{ca'} = D_{c'a} = 2c$$

$$D_{ab'} = D_{a'b} = D_{b'c} = D_{bc'} = \sqrt{y^2 + 4c^2}$$

$$D_{AB} = \left(y \times \sqrt{y^2+4c^2} \times \sqrt{y^2+4c^2} \times y\right)^{\frac{1}{4}}$$

$$\left[(357.9871)^2 \times \{(357.987)^2 + 4\times(373.31)^2\}\right]^{\frac{1}{4}}$$

$$= 544.439 cm$$

$$D_{BC} = \left(y \times \sqrt{y^2+4c^2} \times \sqrt{y^2+4c^2} \times y\right)^{\frac{1}{4}}$$

$$\left((357.987)^2 \times (827.997)^2\right]^{\frac{1}{4}}$$

$$= 544.439 cm$$

$$D_{CA} = (2y \times 2c \times 2c \times 2y)^{\frac{1}{4}}$$

$$= \left[(2\times357.987)^2 \times (2\times373.31)^2\right]^{\frac{1}{4}}$$

$$= 731.1365 cm$$

$$D_m = \left[D_{AB}\, D_{BC}\, D_{CA}\right]^{\frac{1}{3}}$$

$$= \left[(544.439)^2 \times 731.1365\right]^{\frac{1}{3}}$$

$$D_m = (216720537.7)^{\frac{1}{3}}$$

$$D_m = 600.664 cm$$

Disruptive Critical Voltage.

The minimum voltage at which the air at vicinity of conductor breakdown & corona occurs in fair weather is known as disruptive critical voltage & is given by

$$V_d = \sqrt{3} \times g_o \times r \times m_o \times \delta \times \ln \frac{D_{eq}}{r}$$

where,

V_d = line to line disruptive critical voltage in kV

g_o = potential gradient in kV/cm (rms value)

$= \frac{30}{\sqrt{2}}$ kV/cm $= 21.21$ kV/cm

$r = 7.92 \times 10^{-1}$ cm = radius of conductor

$m_o = 0.85$ for stranded conductor surface irregularity factor

δ = air density factor

$= \frac{0.392 \times P}{273 + t} = \frac{0.392 \times 760}{273 + 45}$

$= 0.94$

P = atm in mm of Hg

t = ambient temp in °C

$D_m = 600.664$ cm = mutual GMD

$$V_d = \sqrt{3} \times 21.21 \times 0.792 \times 0.85 \times 0.94 \times \ln \frac{600.664}{0.792}$$

$$= 23.247 \times \ln \frac{600.664}{0.792}$$

$$\boxed{V_d = 154.158 \text{ KV}}$$

calculated value of disruptive critical voltage is $V_d > V_L$

i.e $154.158 \text{ KV} > 132 \text{ KV}$

∴ selected conductor from the table is given by

next 3 conductor after LEOPARD

1) COYOTE
2) TIGER
3) WOLF

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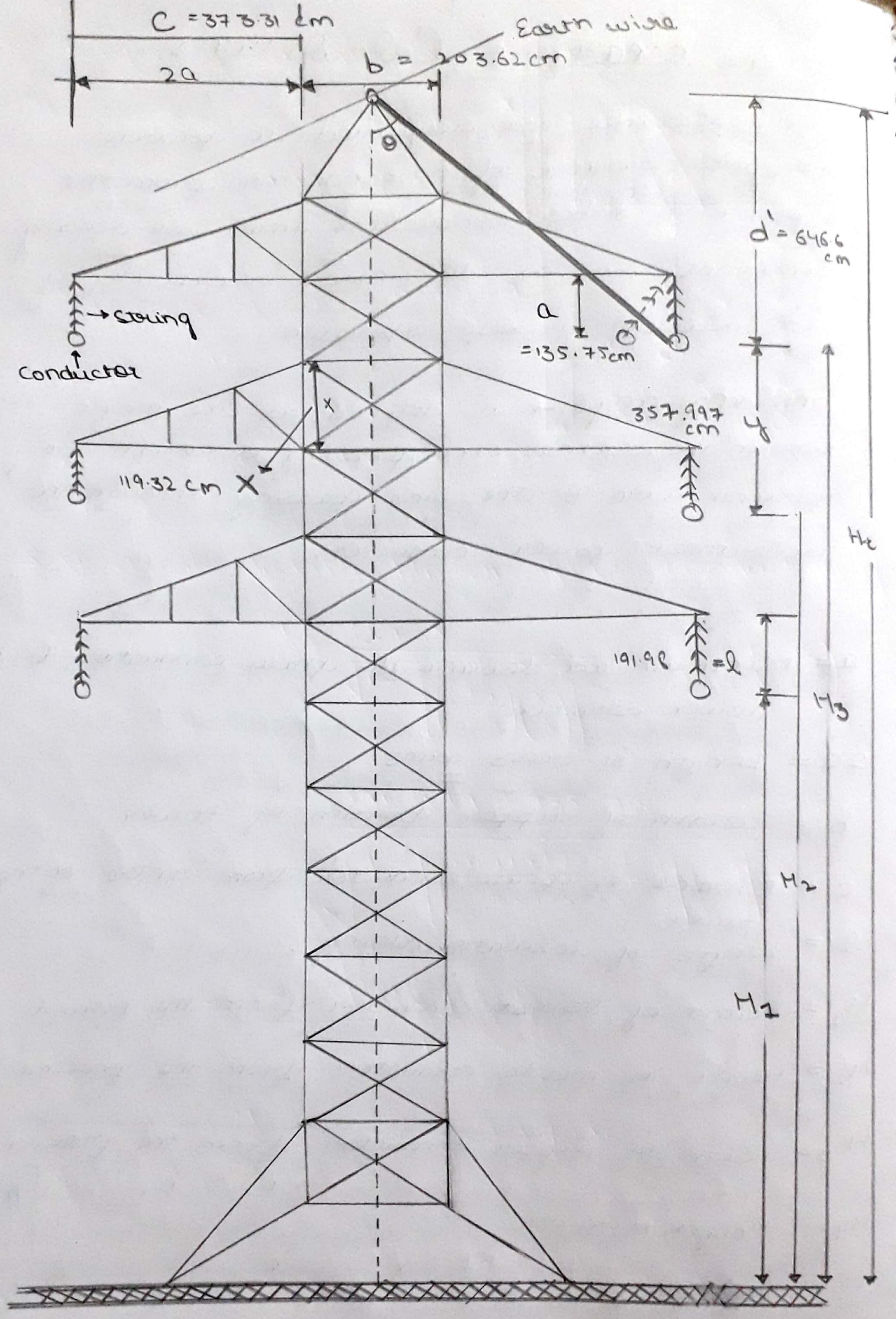
corresponding to the value of current the standard conductor at 45°C is choosen

TABLE OF STANDARD ACSR CONDUCTORS

Name	NOM. CU. Area mm2	Eq.Al Area mm2	Resistance Ohm/Km at 20 DC	C.C.C. Amp at 40°C	C.C.C. Amp at 45°C	C.Density AMP/mm2 at 40 DC	Strands Al	Strands St	Dia. in mm Al	Dia. in mm St	Dia. COND mm	Weight Al	Weight St	Kg/Km Total	UTS Kg	Y.M. Kg/Cm2 10**6	Alpha 10**-6	GMR1 mm	GMR2 mm
1.SQUIRREL	13	20.71	1.37400	115	107	8.84610	6	1	2.11	2.11	6.33	58	27	85	771	0.809	18.99	2.30	3.165
2.GOPHER	16	25.91	1.09800	133	129	8.31250	6	1	2.36	2.36	7.08	72	34	106	952	0.809	18.99	2.57	3.540
3.WEASEL	20	31.21	0.91160	150	139	7.50000	6	1	2.59	2.59	7.77	87	41	128	1136	0.809	18.99	2.60	3.885
4.SPARROW	20	33.16	0.85780	157	145	7.85000	6	1	2.67	2.67	8.01	92	43	135	1208	0.809	18.99	2.91	4.005
5.FOX	22	36.21	0.78570	165	153	7.50000	6	1	2.79	2.79	8.37	101	48	149	1313	0.809	18.99	3.04	4.185
6.FERRET	25	41.87	0.67950	181	168	7.24000	6	1	3.00	3.00	9.00	116	55	171	1503	0.809	18.99	3.23	4.500
7.RABBIT	30	52.21	0.54490	208	193	6.93340	6	1	3.35	3.35	10.05	145	69	214	1860	0.809	18.99	3.65	5.025
8.MINK	40	62.32	0.45650	234	217	5.85000	6	1	3.36	3.36	10.98	173	82	255	2207	0.809	18.99	3.99	5.490
9.BEAVER	45	74.07	0.38410	261	242	5.80000	6	1	3.99	3.99	11.97	205	98	303	2613	0.809	18.99	4.35	5.985
10.RACCOON	48	77.83	0.35560	270	250	5.62500	6	1	4.09	4.09	12.27	215	103	318	2746	0.809	18.99	4.45	6.135
11.OTTER	50	82.85	0.34340	281	260	5.[illegible]	6	1	4.22	4.22	12.66	229	110	339	2932	0.809	18.99	4.60	6.330
12.CAT	55	94.21	0.30200	305	283	5.55550	6	1	4.50	4.50	13.50	261	124	385	3324	0.809	18.99	4.90	6.750
13.DOG	65	103.60	0.27450	324	300	4.98460	6	7	4.72	1.57	14.16	288	106	394	3299	0.809	18.99	5.14	7.090
14.LEOPARD	80	129.70	0.21930	375	348	4.68750	6	7	5.28	1.76	15.84	360	133	493	4137	0.809	18.99	5.75	7.820
15.COYOTE	80	128.50	0.22140	375	348	4.68750	26	7	2.54	1.90	15.89	365	156	521	4638	0.787	17.73	6.56	7.945
16.TIGER	80	128.10	0.22210	382	354	4.77500	30	7	2.36	2.36	16.52	383	241	624	5758	0.787	17.73	6.82	8.260
17.WOLF	95	154.30	0.18440	430	398	4.52630	30	7	2.59	2.59	18.13	436	291	727	6880	0.787	17.73	7.49	9.065
18.LYNX	110	179.00	0.15890	475	440	4.31820	30	7	2.79	2.79	19.53	506	338	844	7950	0.787	17.73	8.07	9.765
19.PANTHER	130	207.00	0.13750	520	482	4.00000	30	7	3.00	3.00	21.00	586	390	976	9127	0.787	17.73	8.67	10.500
20.LION	140	232.50	0.12230	555	515	3.96400	30	7	3.18	3.18	22.25	659	439	1097	10210	0.787	17.73	9.20	11.130
21.DEER	160	258.10	0.11020	595	552	3.71875	30	7	3.35	3.35	23.45	738	491	1229	11310	0.787	17.73	9.68	11.725
22.GOAT	185	316.50	0.08982	680	630	3.67570	30	7	3.71	3.71	25.97	896	596	1492	13780	0.787	17.73	10.73	12.935
23.SHEEP	225	366.10	0.07771	750	690	3.33333	30	7	3.99	3.99	27.93	1036	693	1726	15910	0.787	17.73	11.55	13.965
24.ZEBRA	250	403.70	0.07442	790	728	3.16000	54	7	3.18	3.18	28.60	1185	789	1974	16000	0.686	19.35	11.59	14.300
25.BEAR	250	419.30	0.06786	810	747	3.11540	30	7	4.27	4.27	29.89	1188	789	1977	18230	0.787	17.73	12.35	14.945
26.CAMEL	250	438.00	0.06448	840	771	3.00000	30	7	4.31	4.31	30.17	1215	804	2019	18562	0.787	17.73	12.29	15.085
27.ELK	300	465.70	0.06110	870	796	2.90000	30	7	4.50	4.50	31.50	1320	876	2196	20240	0.787	17.73	13.00	15.750
28.MOOSE	325	515.70	0.05517	910	835	2.80000	54	7	3.53	3.53	31.77	1463	539	2002	16250	0.686	19.35	12.86	15.885



C = 378.31 cm
Earth wire
2a
b = 203.62 cm
θ
d' = 646.6 cm
string
Conductor
a
= 135.75cm
357.997 cm
y
x
119.32 cm
X
Ht
191.98
= l
H3
H2
H1