1-FAULT LEVEL CALCULATION – A

A1-1 Fault level on 66 KV side of Transformer at Alwaye substation = 1305 MVA

A1-2 Rating of 66KV/11KV Power Transformer = 10MVA

A1-3 Percentage Impedance of 66KV/11KV Transformer = 9.44%

A1-4 Equivalent percentage impedance of 1305 MVA (from 1.1) fault level on 10MVA base = \( \frac{100 \times 10}{1305} = 0.766\% \)

A1-5 Total percentage impedance on 11KV side of 66kv/11kV Transformer On 10MVA base (from A1.3 & A1.4) = 10.206%

A1-6 Fault level on 11kv side for percentage impedance = \( \frac{100 \times 10}{10.20} = 97.98\text{MVA} \)

A1-7 Length of 11KV overhead line from 66KV sub Station to factory site = 1.5KM

A1-8 Size of conductor = Mink

A1-9 Resistance of Mink conductor = 0.456 ohm/KM

A1-10 Total resistance for 1.5KM = 0.456 x 1.5 = 0.684 ohms.

A1-11 Total impedance of conductor (Taking the value of reactance as same as resistance) = \( \sqrt{R^2 + X^2} \)

= \( \sqrt{0.684^2 + 0.684^2} \)

= \( \sqrt{0.936} \approx 0.967\text{ohms} \)
A1-12  Equivalent percentage value of 0.967 ohms, Ohms impedance on 500KVA base.  
\[ = \frac{(KVA)_b \times X}{10KV^2} \]
\[ = \frac{500 \times 0.967}{10 \times 11^2} \]
\[ = \frac{483.5}{1210} \]
\[ = 0.4\% \]

A1-13  Equivalent percentage impedance Of 97.98MVA fault level (from A1.6) on 500KVA base. 
\[ = \frac{100 \times 500}{97.98 \times 1000} \]
\[ = \frac{50,000}{97,980} \]
\[ = 0.51\% \]

A1-14  Total percentage impedance on 11KV side in factory site on 5000KVA vase (from A1.12 and A1.13) 
\[ = 0.4 + 0.51 \]
\[ = 0.91\% \]

A1-15  Fault level on 11KV side at factory site for percentage impedance of 0.91 (from A1.14) on 500 KVA base.  
\[ = \frac{500 \times 100}{0.91} \]
\[ = 54945.1KVA \]
\[ = 54.95MVA \]

A1-16  Fault current on 11KV side of 500KVA Transformer at factory Premises 
\[ = \frac{54.95 \times 10^6}{\sqrt{3} \times 11 \times 10^3} \]
\[ = \frac{54950000}{19052} \]
\[ = 2884.21A \]
\[ = 2.88 KA \]

A1-17  Percentage impedance of 500KVA Transformer 
\[ = 4.6\% \]

\[ = 0.91 + 4.6 \]
\[ = 5.51\% \]

A1-19  Fault level on secondary side of Transformer for percentage impedance of 5.51 (from A1.18) on 500KVA base.  
\[ = \frac{500 \times 100}{5.51} \]
\[ = 9074.41KVA \]
A1-20 Fault current on MV side (433 Volt side) of 500KVA Transformer at factory site.

\[
= 9.07 \text{MVA} \\
= 9.07 \times 10^6 \\
\sqrt{3 \times 433} \\
= 9.07 \times 10^6 \\
749.956 \\
= 12094.04 \text{A} \\
= 12.094 \text{ KA} \\
\]

1 FAULT LEVEL LCALCULATION – B

B1-1 Fault level on 11KV side of 500KVA Transformer at factory premises.

\[
= 250 \text{MVA} \\
\]

B1-2 Fault current on 11KV side of 500KVA Transformer for 250 MVA fault level.

\[
= 250 \times 10^6 \\
3 \times 11 \times 10^3 \\
= 13121.981 \text{ A} \\
= 13.12 \text{ KA} \\
\]

B1-3 Equivalent percentage impedance of 250MVA fault level on 500KVA base

\[
= 100 \times 500 \\
250 \times 10^3 \\
= 0.2\% \\
\]

B1-4 Percentage impedance of 500KVA Transformer

\[
= 4.6\% \\
\]

B1-5 Total percentage impedance on MV side of 500KVA Transformer on 500KVA base (Form B1.3 & B1.4)

\[
= 0.2 + 4.6 \\
= 4.8\% \\
\]

B1-6 Fault level on secondary side of Transformer for percentage impedance of 4.8 (From B1.5) on 500KVA base.

\[
= 500 \times 100 \\
4.8 \\
= 10416.667 = 10.42 \text{MVA} \\
\]

B1-7 Fault current on MV side (433 Volt side) of 500KVA Transformer at factory site.

\[
= 1042 \times 10^6 \\
3 \times 433 \\
= 10.42 \times 10^6 \\
749.956 \\
= 13894.148 \\
\]

\[
= 13.89 \text{ KA} \\
\]
From B1-3 (Fault current on 11KV side as 13.12) and from B1.7 (fault current on MV side as 13.89)
The maximum fault current that can come on 11KV side is 13.12 KA and maximum fault current that can come on 433 Volt side is 13.89 KA for 500KVA Transformer at factory premises.

11 MEASUREMENT OF SOIL RESISTIVITY

Resistivity of soil in ohm meter = 2 SR.

Where S-Distance between successive earth electrodes in meters
R- megger reading in ohms on 4 pole earth megger.

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<th>Direction</th>
<th>Sl.No</th>
<th>S</th>
<th>R</th>
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2 - 2
A polar curve is plotted on standard graph sheet and its area \( R^2 \) (From polar curve)

2 - 3
Average resistance of the soil at the place of proposed sub station = \( \frac{36988}{3.14} \)

= 11779.6  = 108.53

2 - 4
For further calculation specific resistance = 109 ohm meter.

III  CALCULATION TO PROVE THE ADEQUACY OF NUMBER OF EARTH PITS ON HT SIDE OF 500KVA TRANSFORMER.

| 3 - 1 | On HV side we are providing 3 Nos. of 1.2M x 1.2 M x 0.125M Standard earth plates, one for Transformer neutral and 2 Nos. for H.T breaker and transformer body. |
| 3 - 2 | For 500KVA Generator we are proposing 3 Nos. Standard plate earthin, one for neutral and 2 Nos. for body. |
| 3 - 3 | On MV side we are proposing 5 Nos. interconnected, standard plate earth. |
| 3 - 4 | Therefore total No. of earth plates (from 3.1,3.2 AND 3.3) = 3 + 3 + 5 = 11Nos. |
| 3 - 5 | Total area of earth plate available = 12 x 1.2 x 2 x 11 = 31.68 |
| 3 - 6 | The maximum permissible current Density ID (From 2.4, and taking duration of fault as 3 seconds) = \( 7.57 \times 10^3 \) |