Insulator String Voltage Distribution and Efficiency

Voltage across each disc of a suspension insulator string and the string efficiency from the number of discs and the ratio of pin-to-earth to self capacitance.

Method: Suspension insulator string theory (self and shunt capacitances); as in Kothari–Nagrath and V. K. Mehta

Input parameters

Unit system: SI

Parameter	Value	Unit
Number of discs	4.0000	
Shunt-to-self capacitance ratio C_1/C	0.10000	
Phase voltage across the string	38.105	kV

Calculated results

Parameter	Value	Unit
Voltage across the top disc (furthest from the line)	7.5292	kV
Voltage across the disc nearest the line	12.431	kV
String efficiency	76.635	%

Notes for this case

- Classic model: equal self capacitance C per disc and shunt capacitance kC from each link pin to earth, none to the line. Guard rings reduce the unevenness.

Formula and method

$$I_j = I_{j-1} + k\sum_{i<j} V_i \ \text{(per unit)}, \quad \eta = \frac{V}{nV_n}$$

Variables

n	Number of discs	-
k	Shunt-to-self capacitance ratio C_1/C	-
V	Phase voltage across the string	V
V_1	Voltage across the top disc (furthest from the line)	V
V_n	Voltage across the disc nearest the line	V
η	String efficiency	-

Method and standards

Capacitance ladder.

Assumptions and limits

- Uniform discs; capacitance to earth only.

References

- Suspension insulator string theory (self and shunt capacitances)
- as in Kothari–Nagrath and V. K. Mehta

Report details

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Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/electrical/power/string-insulator-efficiency

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.