

10kV bus surge impedance



Article Overview

The surge impedance of a 10kV bus is typically determined by the bus's characteristic impedance, which depends on its inductance and capacitance, and is used to calculate the Surge Impedance Loading (SIL) for voltage stability and reactive power balance.

Understanding Surge Impedance

Surge impedance (Z_0), also called characteristic impedance, is the ratio of voltage to current for a traveling wave along a lossless line or bus, where the reactive power generated by the line's capacitance is exactly absorbed by its inductance. It can be expressed as: $Z_0 = \sqrt{L/C}$ where L is the distributed inductance per unit length and C is the distributed capacitance per unit length. For overhead lines, Z_0 typically ranges from 300 to 600 ohms, while underground cables may have lower values around 40 ohms.

Surge Impedance Loading (SIL)

SIL is the real power at which a line or bus naturally operates with a flat voltage profile, meaning the voltage at the sending and receiving ends is equal. It is calculated using: $SIL = (V_{LL}^2) / Z_0$ where V_{LL} is the line-to-line RMS voltage of the bus and Z_0 is the surge impedance. For a 10kV bus:

- $V_{LL} = 10 \text{ kV}$
- Assuming a typical Z_0 for a short 10kV bus (e.g., 10-50 ohms for cables or busbars), SIL can be estimated as: $SIL \approx (10,000^2) / 50 \approx 2 \text{ MW}$ This is a rough estimate; the...

Article Content

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(PDF) The Measurement and Analysis of Surge ...

This paper describes a new approach of the lightning surge analysis for an air-insulated substation (AIS). The lightning

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SURGE IMPEDANCE LOADING OF TRANSMISSION LINE

Finally, the table provides the surge impedance loading (SIL) of the transmission lines at the four different voltage

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Design of low impedance busbar for 10 kV, 100A 4H-SiC MOSFET

This paper discusses the design of a setup for short-circuit (SC) testing of 10 kV 10A 4H-SiC MOSFETs. The setup can achieve

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Demystifying surge protection

High impedance occurs when the surge originates near the system, such as in a neighboring cable, rather than directly on it. In this

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What is Surge Impedance Loading? Definition and Meaning

The load at which the inductive and capacitive reactive volt-amperes are equal and opposite, such load is called surge impedance

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Surge Impedance Loading

The Surge Impedance Loading calculator computes the power loading of a transmission line based on the line to line

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Surge Impedance Interactive Calculator | FIRGELLI

Use this Surge Impedance Calculator to calculate characteristic impedance, wave velocity, surge impedance loading

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Surge Impedance Calculator How to Use This Calculator Select your calculation mode from the dropdown — options

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Characteristic impedance

The characteristic impedance or surge impedance (usually written Z_0) of a uniform transmission line is the ratio of the amplitudes of

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Cheatsheet for calculating lightning surge arrester ratings

Are you sizing a lightning surge arrester for installation inside a substation? Electrical parameters: MCOV, TOV, and

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Calculation of Cable Data

MEDIUM VOLTAGE SHIELDED CABLE PARAMETER CALCULATOR The following calculator computes the resistance,

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CALCULATION OF SURGE IMPEDANCE OF TRANSMISSION LINE TOWERS

The aim of this work is to compare methods for the computation of transmission line tower surge impedance, that are:

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Surge Impedance Loading or SIL

Surge Impedance Loading is a key parameter for analyzing power systems because it predicts the maximum capacity

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Medium-voltage surge arresters

Siemens 3ES surge arresters are ideally suited for the reliable protection of gas-insulated switchgear (GIS), gas-insulated

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9781133386681.pdf

The concepts of surge impedance loading and transmission-line wavelength are also presented. An important issue discussed in this

Oct 10, 2025

Can I load a transmission line to more than 10x surge impedance

Assuming that I use a high temperature low sag line that can withstand 210°C CIGRE. These lines have a thermal

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An Introduction to Surge Impedance in Long-Distance Power

The surge impedance, also known as the characteristic impedance Z_0 , is a fundamental property of long transmission

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Substation Surge Voltage Estimation Tool | True Geometry's Blog

Substation Surge Voltage Estimation Tool 07 Mar 2025 Tags: Electrical Engineering Power Systems Power System

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Surge Impedance

Surge Impedance In power system work, the characteristic impedance is sometimes referred as surge impedance. It is defined as

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Eaton's Guide to Surge Suppression

Eaton has an extensive family of surge protective devices (SPD) for any facility or application. Using our Powerware and Innovative

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Surge Impedance and Surge Impedance Loading

Surge Impedance is the characteristic impedance of a lossless transmission line. It is also called Natural Impedance

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Impedance-frequency characteristic curve of 10kV bus

Phase angle -frequency characteristic curve of 10kV bus. From Figures 13 to 15, it can be seen that the zero points in the phase

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Surge Impedance

These values (L and C) help to determine the likely surge voltages that may develop during a switching operation while using

Mar 24, 2026

FAQs | NEMA Surge protection Institute

What are surges, transients, and temporary over-voltages, and what are their typical characteristics? Although often used as

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line_flow_approximation.dvi

1 Surge Impedance Loading We first calculate the surge impedance loading (SIL) for the transmission line. If there is a non-zero

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Basic Insulation Level (BIL): Definition, Table, Formula

Understanding Basic Insulation Level (BIL): BIL represents the maximum surge voltage that electrical insulation can

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IEC 61000-4-5

With a short circuit output, the surge current waveform is a damped sine wave. The ratio between the peak open-circuit voltage and

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Surge Impedance Loading (SIL) by Doug Millner

Surge Impedance Loading (SIL) Explained Surge Impedance Loading (SIL) is a key concept in high-voltage transmission line

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