# Important Short Line Formulas PDF

Formulas
Examples
with Units

**List of 30**
**Important Short Line Formulas**

## 1) Current Formulas

### 1.1) Receiving End Current using Impedance (STL) Formula

Evaluate Formula

Formula

$$I_r = \frac{V_s - V_r}{Z}$$

Example with Units

$$3.9062\,\text{A} = \frac{400\,\text{V} - 380\,\text{V}}{5.12\,\Omega}$$

### 1.2) Receiving End Current using Losses (STL) Formula

Evaluate Formula

Formula

$$I_r = \sqrt{\frac{P_{loss}}{3 \cdot R}}$$

Example with Units

$$3.9014\,\text{A} = \sqrt{\frac{3000\,\text{W}}{3 \cdot 65.7\,\Omega}}$$

### 1.3) Receiving End Current using Receiving End Power (STL) Formula

Evaluate Formula

Formula

$$I_r = \frac{P_r}{3 \cdot V_r \cdot \cos\left(\Phi_r\right)}$$

Example with Units

$$3.8976\,\text{A} = \frac{1150\,\text{W}}{3 \cdot 380\,\text{V} \cdot \cos\left(75°\right)}$$

### 1.4) Receiving End Current using Sending End Angle (STL) Formula

Evaluate Formula

Formula

$$I_r = \frac{\left(3 \cdot V_s \cdot I_s \cdot \cos\left(\Phi_s\right)\right) - P_{loss}}{3 \cdot V_r \cdot \cos\left(\Phi_r\right)}$$

Example with Units

$$3.8506\,\text{A} = \frac{\left(3 \cdot 400\,\text{V} \cdot 3.98\,\text{A} \cdot \cos\left(30°\right)\right) - 3000\,\text{W}}{3 \cdot 380\,\text{V} \cdot \cos\left(75°\right)}$$

### 1.5) Receiving End Current using Transmission Efficiency (STL) Formula

Evaluate Formula

Formula

$$I_r = \eta \cdot V_s \cdot I_s \cdot \frac{\cos\left(\Phi_s\right)}{V_r \cdot \cos\left(\Phi_r\right)}$$

Example with Units

$$3.8971\,\text{A} = 0.278 \cdot 400\,\text{V} \cdot 3.98\,\text{A} \cdot \frac{\cos\left(30°\right)}{380\,\text{V} \cdot \cos\left(75°\right)}$$

### 1.6) Sending End Current using Losses (STL) Formula

Evaluate Formula

Formula

$$I_s = \frac{3 \cdot V_r \cdot I_r \cdot \cos\left(\Phi_r\right) + P_{loss}}{3 \cdot V_s \cdot \cos\left(\Phi_s\right)}$$

Example with Units

$$3.994\,\text{A} = \frac{3 \cdot 380\,\text{V} \cdot 3.9\,\text{A} \cdot \cos\left(75°\right) + 3000\,\text{W}}{3 \cdot 400\,\text{V} \cdot \cos\left(30°\right)}$$

### 1.7) Sending End Current using Sending End Power (STL) Formula

Evaluate Formula

Formula

$$I_s = \frac{P_s}{3 \cdot V_s \cdot \cos\left(\Phi_s\right)}$$

Example with Units

$$3.9799\,\text{A} = \frac{4136\,\text{W}}{3 \cdot 400\,\text{V} \cdot \cos\left(30°\right)}$$

### 1.8) Sending End Current using Transmission Efficiency (STL) Formula

Evaluate Formula

Formula

$$I_s = \frac{V_r \cdot I_r \cdot \cos\left(\Phi_r\right)}{\eta \cdot V_s \cdot \cos\left(\Phi_s\right)}$$

Example with Units

$$3.983\,\text{A} = \frac{380\,\text{V} \cdot 3.9\,\text{A} \cdot \cos\left(75°\right)}{0.278 \cdot 400\,\text{V} \cdot \cos\left(30°\right)}$$

### 1.9) Transmitted Current (SC Line) Formula

Evaluate Formula

Formula

$$I_t = \frac{V_t}{Z_0}$$

Example with Units

$$0.3604\,\text{A} = \frac{20\,\text{V}}{55.5\,\Omega}$$

## 2) Line Parameters Formulas

### 2.1) Impedance (STL) Formula

Evaluate Formula

Formula

$$Z = \frac{V_s - V_r}{I_r}$$

Example with Units

$$5.1282\,\Omega = \frac{400\,\text{V} - 380\,\text{V}}{3.9\,\text{A}}$$

### 2.2) Losses using Transmission Efficiency (STL) Formula

Evaluate Formula

Formula

$$P_{loss} = \left(\frac{3 \cdot V_r \cdot I_r \cdot \cos\left(\Phi_r\right)}{\eta}\right) - \left(3 \cdot V_r \cdot I_r \cdot \cos\left(\Phi_r\right)\right)$$

Example with Units

$$2988.5332\,\text{W} = \left(\frac{3 \cdot 380\,\text{V} \cdot 3.9\,\text{A} \cdot \cos\left(75°\right)}{0.278}\right) - \left(3 \cdot 380\,\text{V} \cdot 3.9\,\text{A} \cdot \cos\left(75°\right)\right)$$

### 2.3) Resistance using Losses (STL) Formula

Evaluate Formula

Formula

$$R = \frac{P_{loss}}{3 \cdot I_r^2}$$

Example with Units

$$65.7462\,\Omega = \frac{3000\,W}{3 \cdot 3.9\,A^2}$$

### 2.4) Transmission Efficiency (STL) Formula

Evaluate Formula

Formula

$$\eta = \frac{V_r \cdot I_r \cdot \cos\left(\Phi_r\right)}{V_s \cdot I_s \cdot \cos\left(\Phi_s\right)}$$

Example with Units

$$0.2782 = \frac{380\,V \cdot 3.9\,A \cdot \cos\left(75°\right)}{400\,V \cdot 3.98\,A \cdot \cos\left(30°\right)}$$

### 2.5) Voltage Regulation in Transmission Line Formula

Evaluate Formula

Formula

$$\%V = \left(\frac{V_s - V_r}{V_r}\right) \cdot 100$$

Example with Units

$$5.2632 = \left(\frac{400\,V - 380\,V}{380\,V}\right) \cdot 100$$

## 3) Power & Phase Difference Formulas

### 3.1) Receiving End Angle using Losses (STL) Formula

Evaluate Formula

Formula

$$\Phi_r = acos\left(\frac{\left(3 \cdot V_s \cdot I_s \cdot \cos\left(\Phi_s\right)\right) - P_{loss}}{3 \cdot V_r \cdot I_r}\right)$$

Example with Units

$$75.1943° = acos\left(\frac{\left(3 \cdot 400\,V \cdot 3.98\,A \cdot \cos\left(30°\right)\right) - 3000\,W}{3 \cdot 380\,V \cdot 3.9\,A}\right)$$

### 3.2) Receiving End Angle using Receiving End Power (STL) Formula

Evaluate Formula

Formula

$$\Phi_r = acos\left(\frac{P_r}{3 \cdot V_r \cdot I_r}\right)$$

Example with Units

$$75.0095° = acos\left(\frac{1150\,W}{3 \cdot 380\,V \cdot 3.9\,A}\right)$$

## 3.3) Receiving End Angle using Transmission Efficiency (STL) Formula

Evaluate Formula

Formula

$$\Phi_r = acos\left(\eta \cdot V_s \cdot I_s \cdot \frac{\cos\left(\Phi_s\right)}{I_r \cdot V_r}\right)$$

Example with Units

$$75.0115° = acos\left(0.278 \cdot 400\,V \cdot 3.98\,A \cdot \frac{\cos\left(30°\right)}{3.9\,A \cdot 380\,V}\right)$$

## 3.4) Receiving End Power (STL) Formula

Evaluate Formula

Formula

$$P_r = 3 \cdot V_r \cdot I_r \cdot \cos\left(\Phi_r\right)$$

Example with Units

$$1150.7095\,W = 3 \cdot 380\,V \cdot 3.9\,A \cdot \cos\left(75°\right)$$

## 3.5) Sending End Angle using Receiving End Parameters (STL) Formula

Evaluate Formula

Formula

$$\Phi_s = acos\left(\frac{V_r \cdot \cos\left(\Phi_r\right) + \left(I_r \cdot R\right)}{V_s}\right)$$

Example with Units

$$27.5691° = acos\left(\frac{380\,V \cdot \cos\left(75°\right) + \left(3.9\,A \cdot 65.7\,\Omega\right)}{400\,V}\right)$$

## 3.6) Sending End Angle using Sending End Power (STL) Formula

Evaluate Formula

Formula

$$\Phi_s = acos\left(\frac{P_s}{V_s \cdot I_s \cdot 3}\right)$$

Example with Units

$$30.0033° = acos\left(\frac{4136\,W}{400\,V \cdot 3.98\,A \cdot 3}\right)$$

## 3.7) Sending End Power (STL) Formula

Evaluate Formula

Formula

$$P_s = 3 \cdot I_s \cdot V_s \cdot \cos\left(\Phi_s\right)$$

Example with Units

$$4136.1373\,W = 3 \cdot 3.98\,A \cdot 400\,V \cdot \cos\left(30°\right)$$

## 3.8) Transmitted Current (SC Line) Formula

Evaluate Formula

Formula

$$I_t = \frac{V_t}{Z_0}$$

Example with Units

$$0.3604\,A = \frac{20\,V}{55.5\,\Omega}$$

# 4) Voltage Formulas

## 4.1) Receiving End Voltage using Impedance (STL) Formula

Evaluate Formula

Formula

$$V_r = V_s - \left( I_r \cdot Z \right)$$

Example with Units

$$380.032\,\text{V} = 400\,\text{V} - \left( 3.9\,\text{A} \cdot 5.12\,\Omega \right)$$

## 4.2) Receiving End Voltage using Receiving End Power (STL) Formula

Evaluate Formula

Formula

$$V_r = \frac{P_r}{3 \cdot I_r \cdot \cos\left( \Phi_r \right)}$$

Example with Units

$$379.7657\,\text{V} = \frac{1150\,\text{W}}{3 \cdot 3.9\,\text{A} \cdot \cos\left( 75° \right)}$$

## 4.3) Receiving End Voltage using Transmission Efficiency (STL) Formula

Evaluate Formula

Formula

$$V_r = \eta \cdot V_s \cdot I_s \cdot \frac{\cos\left( \Phi_s \right)}{I_r \cdot \cos\left( \Phi_r \right)}$$

Example with Units

$$379.7149\,\text{V} = 0.278 \cdot 400\,\text{V} \cdot 3.98\,\text{A} \cdot \frac{\cos\left( 30° \right)}{3.9\,\text{A} \cdot \cos\left( 75° \right)}$$

## 4.4) Sending End Voltage in Transmission Line Formula

Evaluate Formula

Formula

$$V_s = \left( \frac{\%V \cdot V_r}{100} \right) + V_r$$

Example with Units

$$399.988\,\text{V} = \left( \frac{5.26 \cdot 380\,\text{V}}{100} \right) + 380\,\text{V}$$

## 4.5) Sending End Voltage using Power Factor(STL) Formula

Evaluate Formula

Formula

$$V_s = \sqrt{\left( \left( V_r \cdot \cos\left( \Phi_r \right) \right) + \left( I_r \cdot R \right) \right)^2 + \left( \left( V_r \cdot \sin\left( \Phi_r \right) \right) + \left( I_r \cdot X_c \right) \right)^2}$$

Example with Units

$$510.9091\,\text{V} = \sqrt{\left( \left( 380\,\text{V} \cdot \cos\left( 75° \right) \right) + \left( 3.9\,\text{A} \cdot 65.7\,\Omega \right) \right)^2 + \left( \left( 380\,\text{V} \cdot \sin\left( 75° \right) \right) + \left( 3.9\,\text{A} \cdot 0.2\,\Omega \right) \right)^2}$$

## 4.6) Sending End Voltage using Sending End Power (STL) Formula

Evaluate Formula

Formula

$$V_s = \frac{P_s}{3 \cdot I_s \cdot \cos\left( \Phi_s \right)}$$

Example with Units

$$399.9867\,\text{V} = \frac{4136\,\text{W}}{3 \cdot 3.98\,\text{A} \cdot \cos\left( 30° \right)}$$

## 4.7) Sending End Voltage using Transmission Efficiency (STL) Formula

Evaluate Formula

Formula

$$V_s = V_r \cdot I_r \cdot \frac{\cos\left(\Phi_r\right)}{\eta \cdot I_s \cdot \cos\left(\Phi_s\right)}$$

Example with Units

$$400.3003\,\text{V} = 380\,\text{V} \cdot 3.9\,\text{A} \cdot \frac{\cos\left(75°\right)}{0.278 \cdot 3.98\,\text{A} \cdot \cos\left(30°\right)}$$

## 4.8) Transmitted Inductance (SC Line) Formula

Evaluate Formula

Formula

$$Z_0 = \frac{V_t}{I_t}$$

Example with Units

$$55.5556\,\Omega = \frac{20\,\text{V}}{0.36\,\text{A}}$$

## Variables used in list of Short Line Formulas above

- **%V** Voltage Regulation
- $I_r$ Receiving End Current *(Ampere)*
- $I_s$ Sending End Current *(Ampere)*
- $I_t$ Transmitted Current *(Ampere)*
- $P_{loss}$ Power Loss *(Watt)*
- $P_r$ Receiving End Power *(Watt)*
- $P_s$ Sending End Power *(Watt)*
- **R** Resistance *(Ohm)*
- $V_r$ Receiving End Voltage *(Volt)*
- $V_s$ Sending End Voltage *(Volt)*
- $V_t$ Transmitted Voltage *(Volt)*
- $X_c$ Capacitive Reactance *(Ohm)*
- **Z** Impedance *(Ohm)*
- $Z_0$ Characteristic Impedance *(Ohm)*
- $\eta$ Transmission Efficiency
- $\Phi_r$ Receiving End Phase Angle *(Degree)*
- $\Phi_s$ Sending End Phase Angle *(Degree)*

## Constants, Functions, Measurements used in list of Short Line Formulas above

- Functions: **acos**, acos(Number)
  *The inverse cosine function, is the inverse function of the cosine function. It is the function that takes a ratio as an input and returns the angle whose cosine is equal to that ratio.*
- Functions: **cos**, cos(Angle)
  *Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.*
- Functions: **sin**, sin(Angle)
  *Sine is a trigonometric function that describes the ratio of the length of the opposite side of a right triangle to the length of the hypotenuse.*
- Functions: **sqrt**, sqrt(Number)
  *A square root function is a function that takes a non-negative number as an input and returns the square root of the given input number.*
- Measurement: **Electric Current** in Ampere (A)
  *Electric Current Unit Conversion*
- Measurement: **Power** in Watt (W)
  *Power Unit Conversion*
- Measurement: **Angle** in Degree (°)
  *Angle Unit Conversion*
- Measurement: **Electric Resistance** in Ohm (Ω)
  *Electric Resistance Unit Conversion*
- Measurement: **Electric Potential** in Volt (V)
  *Electric Potential Unit Conversion*

## Download other Important Transmission Lines PDFs

- Important Line Performance Characteristics Formulas
- Important Long Transmission Line Formulas
- Important Short Line Formulas
- Important Transient Formulas

## Try our Unique Visual Calculators

- Percentage growth
- LCM calculator
- Divide fraction

Please SHARE this PDF with someone who needs it!

## This PDF can be downloaded in these languages

English Spanish French German Russian Italian Portuguese Polish Dutch

*7/8/2024 | 7:46:32 AM UTC*