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Short Line Formulas

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List of 30 Short Line Formulas

Short Line

Current

1) Receiving End Current using Impedance (STL)

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

[Open Calculator !\[\]\(de95854c7ee024cfadc48187bbb781b2_img.jpg\)](#)

$$\text{ex } 3.90625\text{A} = \frac{400\text{V} - 380\text{V}}{5.12\Omega}$$

2) Receiving End Current using Losses (STL)

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

[Open Calculator !\[\]\(6a9b39b98eb945faa14c645ec99e4eaa_img.jpg\)](#)

$$\text{ex } 3.901372\text{A} = \sqrt{\frac{3000\text{W}}{3 \cdot 65.7\Omega}}$$

3) Receiving End Current using Receiving End Power (STL)

$$\text{fx } I_r = \frac{P_r}{3 \cdot V_r \cdot \cos(\Phi_r)}$$

[Open Calculator !\[\]\(f1c5da15572e3e09d343161be98f508d_img.jpg\)](#)

$$\text{ex } 3.897595\text{A} = \frac{1150\text{W}}{3 \cdot 380\text{V} \cdot \cos(75^\circ)}$$

4) Receiving End Current using Sending End Angle (STL)

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

[Open Calculator !\[\]\(166772600a13ad0a433053f90fe45649_img.jpg\)](#)


$$\text{ex } 3.850612\text{A} = \frac{(3 \cdot 400\text{V} \cdot 3.98\text{A} \cdot \cos(30^\circ)) - 3000\text{W}}{3 \cdot 380\text{V} \cdot \cos(75^\circ)}$$



5) Receiving End Current using Transmission Efficiency (STL) [Open Calculator !\[\]\(4729e517bc6a7cd81c8025b9646574fb_img.jpg\)](#)


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

$$\text{ex } 3.897074A = 0.278 \cdot 400V \cdot 3.98A \cdot \frac{\cos(30^\circ)}{380V \cdot \cos(75^\circ)}$$

6) Sending End Current using Losses (STL) [Open Calculator !\[\]\(e474458956c9a37fbf9586ddb60a7fa1_img.jpg\)](#)

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

$$\text{ex } 3.994022A = \frac{3 \cdot 380V \cdot 3.9A \cdot \cos(75^\circ) + 3000W}{3 \cdot 400V \cdot \cos(30^\circ)}$$

7) Sending End Current using Sending End Power (STL) [Open Calculator !\[\]\(4fe57c3593bf1b21d272ae7ac8dfaf77_img.jpg\)](#)


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

$$\text{ex } 3.979868A = \frac{4136W}{3 \cdot 400V \cdot \cos(30^\circ)}$$

8) Sending End Current using Transmission Efficiency (STL) [Open Calculator !\[\]\(2bae76de5ebbd5c4d7d47162f1673734_img.jpg\)](#)

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

$$\text{ex } 3.982988A = \frac{380V \cdot 3.9A \cdot \cos(75^\circ)}{0.278 \cdot 400V \cdot \cos(30^\circ)}$$

9) Transmitted Current (SC Line) [Open Calculator !\[\]\(5d954b3e270654ad8ab0d5913161c03c_img.jpg\)](#)

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

$$\text{ex } 0.36036A = \frac{20V}{55.5\Omega}$$



Line Parameters

10) Impedance (STL)

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

[Open Calculator !\[\]\(23d9fc146e83b5c3013cfa32c784f8d5_img.jpg\)](#)

$$\text{ex } 5.128205\Omega = \frac{400\text{V} - 380\text{V}}{3.9\text{A}}$$

11) Losses using Transmission Efficiency (STL)

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

[Open Calculator !\[\]\(aa53ad6fea213b8b2226d3077e30533a_img.jpg\)](#)

$$\text{ex } 2988.533\text{W} = \left(\frac{3 \cdot 380\text{V} \cdot 3.9\text{A} \cdot \cos(75^\circ)}{0.278} \right) - (3 \cdot 380\text{V} \cdot 3.9\text{A} \cdot \cos(75^\circ))$$

12) Resistance using Losses (STL)

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

[Open Calculator !\[\]\(626ce8ac21792b9405bfddfea8e0c96a_img.jpg\)](#)

$$\text{ex } 65.74622\Omega = \frac{3000\text{W}}{3 \cdot (3.9\text{A})^2}$$


13) Transmission Efficiency (STL)

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

[Open Calculator !\[\]\(c1168d6a8b365d11e842ece304635fa7_img.jpg\)](#)


$$\text{ex } 0.278209 = \frac{380\text{V} \cdot 3.9\text{A} \cdot \cos(75^\circ)}{400\text{V} \cdot 3.98\text{A} \cdot \cos(30^\circ)}$$



14) Voltage Regulation in Transmission Line [Open Calculator !\[\]\(bd1a142de767a21e5362c595f844a4ff_img.jpg\)](#)

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

$$\text{ex } 5.263158 = \left(\frac{400V - 380V}{380V} \right) \cdot 100$$

Power & Phase Difference 15) Receiving End Angle using Losses (STL) [Open Calculator !\[\]\(0b5e7e25e8775f7e7e80906ada4f0021_img.jpg\)](#)

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

$$\text{ex } 75.19433^\circ = a \cos \left(\frac{(3 \cdot 400V \cdot 3.98A \cdot \cos(30^\circ)) - 3000W}{3 \cdot 380V \cdot 3.9A} \right)$$

16) Receiving End Angle using Receiving End Power (STL) [Open Calculator !\[\]\(bd3b31712ad9bab5a241210fa6925cdd_img.jpg\)](#)


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

$$\text{ex } 75.00947^\circ = a \cos \left(\frac{1150W}{3 \cdot 380V \cdot 3.9A} \right)$$

17) Receiving End Angle using Transmission Efficiency (STL) [Open Calculator !\[\]\(7bc43b319a082987e20f7bf78f4bab80_img.jpg\)](#)

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

$$\text{ex } 75.01152^\circ = a \cos \left(0.278 \cdot 400V \cdot 3.98A \cdot \frac{\cos(30^\circ)}{3.9A \cdot 380V} \right)$$

18) Receiving End Power (STL) [Open Calculator !\[\]\(4a7b4ce770af8456e11a71f9565c8c2b_img.jpg\)](#)

$$\text{fx } P_r = 3 \cdot V_r \cdot I_r \cdot \cos(\Phi_r)$$

$$\text{ex } 1150.709W = 3 \cdot 380V \cdot 3.9A \cdot \cos(75^\circ)$$




19) Sending End Angle using Receiving End Parameters (STL) 

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

Open Calculator 

$$\text{ex } 27.56913^\circ = a \cos\left(\frac{380V \cdot \cos(75^\circ) + (3.9A \cdot 65.7\Omega)}{400V}\right)$$

20) Sending End Angle using Sending End Power (STL) 

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

Open Calculator 


$$\text{ex } 30.00329^\circ = a \cos\left(\frac{4136W}{400V \cdot 3.98A \cdot 3}\right)$$

21) Sending End Power (STL) 

$$\text{fx } P_s = 3 \cdot I_s \cdot V_s \cdot \cos(\Phi_s)$$

Open Calculator 


$$\text{ex } 4136.137W = 3 \cdot 3.98A \cdot 400V \cdot \cos(30^\circ)$$

22) Transmitted Current (SC Line) 

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

Open Calculator 

$$\text{ex } 0.36036A = \frac{20V}{55.5\Omega}$$


Voltage 23) Receiving End Voltage using Impedance (STL) 

$$\text{fx } V_r = V_s - (I_r \cdot Z)$$

Open Calculator 

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



24) Receiving End Voltage using Receiving End Power (STL) 

$$fx \quad V_r = \frac{P_r}{3 \cdot I_r \cdot \cos(\Phi_r)}$$

Open Calculator 


$$ex \quad 379.7657V = \frac{1150W}{3 \cdot 3.9A \cdot \cos(75^\circ)}$$

25) Receiving End Voltage using Transmission Efficiency (STL) 

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

Open Calculator 


$$ex \quad 379.7149V = 0.278 \cdot 400V \cdot 3.98A \cdot \frac{\cos(30^\circ)}{3.9A \cdot \cos(75^\circ)}$$

26) Sending End Voltage in Transmission Line 

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

Open Calculator 

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

27) Sending End Voltage using Power Factor(STL) 


fx

Open Calculator 

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

ex

$$510.9091V = \sqrt{((380V \cdot \cos(75^\circ)) + (3.9A \cdot 65.7\Omega))^2 + ((380V \cdot \sin(75^\circ)) + (3.9A \cdot 0.2\Omega))^2}$$

28) Sending End Voltage using Sending End Power (STL) 

$$fx \quad V_s = \frac{P_s}{3 \cdot I_s \cdot \cos(\Phi_s)}$$

Open Calculator 


$$ex \quad 399.9867V = \frac{4136W}{3 \cdot 3.98A \cdot \cos(30^\circ)}$$



29) Sending End Voltage using Transmission Efficiency (STL) [Open Calculator](#) 

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

$$\text{ex } 400.3003\text{V} = 380\text{V} \cdot 3.9\text{A} \cdot \frac{\cos(75^\circ)}{0.278 \cdot 3.98\text{A} \cdot \cos(30^\circ)}$$

30) Transmitted Inductance (SC Line) [Open Calculator](#) 

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

$$\text{ex } 55.55556\Omega = \frac{20\text{V}}{0.36\text{A}}$$








Variables Used

- **%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*)
- **Z₀** Characteristic Impedance (*Ohm*)
- **η** Transmission Efficiency
- **Φ_r** Receiving End Phase Angle (*Degree*)
- **Φ_s** Sending End Phase Angle (*Degree*)







Constants, Functions, Measurements used

- **Function: acos** , $\text{acos}(\text{Number})$
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.
- **Function: cos** , $\text{cos}(\text{Angle})$
Cosine of an angle is the ratio of the side adjacent to the angle to the hypotenuse of the triangle.
- **Function: sin** , $\text{sin}(\text{Angle})$
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.
- **Function: sqrt** , $\text{sqrt}(\text{Number})$
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 ($^{\circ}$)
Angle Unit Conversion 
- **Measurement: Electric Resistance** in Ohm (Ω)
Electric Resistance Unit Conversion 
- **Measurement: Electric Potential** in Volt (V)
Electric Potential Unit Conversion 



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- [Long Transmission Line Formulas](#) 
- [Short Line Formulas](#) 
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