Table 2-8

Effective resistances per unit length of PVC-insulated cables with copper conductors as per DIN VDE 0271 for 0.6/1 kV

Number of conductors and cross-section	D. C. resistance at 70 °C	Ohmic resistance at 70 °C	Inductive reactance	Effective resistance per unit length $R'_L \cdot \cos\varphi + X'_L \cdot \sin\varphi$ at $\cos\varphi$				
				0.95	0.9	0.8	0.7	0.6
mm²	R'_L– Ω/km	R'_L~ Ω/km	X'_L Ω/km	Ω/km	Ω/km	Ω/km	Ω/km	Ω/km
4 × 1.5	14.47	14.47	0.115	13.8	13.1	11.65	10.2	8.77
4 × 2.5	8.71	8.71	0.110	8.31	7.89	7.03	6.18	5.31
4 × 4	5.45	5.45	0.107	5.21	4.95	4.42	3.89	3.36
4 × 6	3.62	3.62	0.100	3.47	3.30	2.96	2.61	2.25
4 × 10	2.16	2.16	0.094	2.08	1.99	1.78	1.58	1.37
4 × 16	1.36	1.36	0.090	1.32	1.26	1.14	1.020	0.888
4 × 25	0.863	0.863	0.086	0.847	0.814	0.742	0.666	0.587
4 × 35	0.627	0.627	0.083	0.622	0.60	0.55	0.498	0.443
4 × 50	0.463	0.463	0.083	0.466	0.453	0.42	0.38	0.344
4 × 70	0.321	0.321	0.082	0.331	0.326	0.306	0.283	0.258
4 × 95	0.231	0.232	0.082	0.246	0.245	0.235	0.221	0.205
4 × 120	0.183	0.184	0.080	0.2	0.2	0.195	0.186	0.174
4 × 150	0.149	0.150	0.080	0.168	0.17	0.168	0.162	0.154
4 × 185	0.118	0.1202	0.080	0.139	0.143	0.144	0.141	0.136
4 × 240	0.0901	0.0922	0.079	0.112	0.117	0.121	0.121	0.119
4 × 300	0.0718	0.0745	0.079	0.0954	0.101	0.107	0.109	0.108

Example:

A three-phase power of 50 kW with $\cos\varphi = 0.8$ is to be transmitted at 400 V over a line 100 m long. The voltage drop must not exceed 2 %. What is the required cross section of the line?

The percentage voltage drop of 2 % is equivalent to

$$\Delta U = \frac{\Delta u}{100\ \%} U_n = \frac{2\ \%}{100\ \%} 400\ \text{V} = 8.0\ \text{V}.$$

The current is

$$I = \frac{P}{\sqrt{3} \cdot U \cdot \cos\varphi} = \frac{50\ \text{kW}}{\sqrt{3} \cdot 400\ \text{V} \cdot 0.8} = 90\ \text{A}.$$

Calculation is made easier by Table 2-8, which lists the effective resistance per unit length $R'_L \cdot \cos\varphi + X'_L \cdot \sin\varphi$ for the most common cables and conductors. Rearranging the formula for the voltage drop yields

$$R'_L \cdot \cos\varphi + X'_L \cdot \sin\varphi = \frac{\Delta U}{\sqrt{3} \cdot I \cdot l} = \frac{8.0}{\sqrt{3} \cdot 90\ \text{A} \cdot 0.1\ \text{km}} = 0.513\ \Omega/\text{km}.$$