Cable Design Equations—Coaxial Cable

COAXIAL CABLE CAPACITANCE:

$$C = \frac{7.36\varepsilon}{LOG\left(\frac{D}{fd}\right)}, \text{ pF/ft}$$

COAXIAL CABLE VELOCITY OF PROPAGATION:

$$V_p = \frac{100}{\varepsilon^{1/2}}, \%$$

COAXIAL CABLE INDUCTANCE:

$$L = 0.140 \text{ LOG } \left(\frac{D}{fd}\right), \mu H/ft$$

COAXIAL CABLE TIME DELAY:

$$t_d = 1.016\ \varepsilon^{1/2}, \text{ nsec/ft}$$

COAXIAL CABLE IMPEDANCE:

$$Z_o = \frac{138}{\varepsilon^{1/2}} \text{ LOG } \left(\frac{D}{fd}\right), \Omega$$

COAXIAL CABLE CUTOFF FREQUENCY:

$$f_{co} = \frac{7.50}{\varepsilon^{1/2}(D + fd)}, \text{ GHz}$$

where:

- C = capacitance, pF/ft
- ε = insulation dielectric constant (see table below)
- D = diameter under the shield, inches
- d = diameter of the center conductor, inches
- L = inductance, μH/ft
- f = strand factor (see Table II, page 196)
- Z_o = characteristic impedance, Ω
- V_p = velocity of propagation, %
- t_d = time delay, nsec/ft
- f_{co} = cutoff frequency, GHz

MATERIAL	ε	POWER FACTOR, PF
FEP Teflon® (Cellular)	1.40	0.0002
FEP Teflon® (Solid)	2.10	0.0003
PE (Cellular)	1.56	0.0003
PE (Solid)	2.26	0.0003
PE (Semi-Solid)	1.29	0.0003