VOLAGE DROP BY EXACT FORMULA METHOD (Special Formulas)

The method outlined in the National Electrical code for calculating voltage drop is an approximate method, due to the assumption of a power factor of 100% or 85%. The formula for this program accounts for the actual power factor in the equation, and is therefore a more exact method. You may be expected to calculate the voltage drop by taking account of power factor in this exam. Typically a circuit is given for which the voltage drop due to the impedance of the conductors must be calculated.

Program text:

VOLTDROP-EXACT

1. D=(2*(W-1)^-1*(R*F/100+X*SIN(ACOS(F/100)))*L*S)/(10*V^2)
2. D=(2*(W-1)^-0.2075*(R*F/100+X*SIN(ACOS(F/100)))*L*I)/(10*V)

Variables:

D = Voltage drop as a percentage of the circuit voltage (V)

W= Number of wires in the circuit (W=2 for single phase, W=3 for three-phase)

R = Resistance of conductor per 1,000ft (Ω) – See NEC Table 9

X = Reactance of conductor per 1,000ft (Ω) – See NEC Table 9

F = Power factor of load (%)

L = Length of conductor (ft)

S = Apparent power of load (VA)

V = circuit voltage (V)

I = Line current (A)

Notes:

1. Questions may give the circuit load in either volt-amperes (VA) or current (A). If the volt-amperes are given, use equation 1. If the current is given, use equation 2.
2. Both equations can be used for both single and three-phase circuits. If a single phase circuit is given, use W=2 (two wires). If a three phase circuit is given, use W=3 (three wires).
3. Enter power factor, F as a percentage value. For fully resistive loads (zero reactance), F = 100%.

Test – equation 1:

W = 3, R = 2.0, F = 90, X = 0.068, L = 600, S = 1,500, V = 480

Answer: D = 0.71%

Test – equation 2:

W = 2, R = 2.0, F = 90, X = 0.068, L = 200, I = 8, V = 120

Answer: D = 4.88%