



VD-100
REV. NO.: 1

VOLTAGE DROP

WHEN SELECTING A TYPE AND SIZE OF A CABLE FOR A PARTICULAR CIRCUIT, AMPACITY IS THE FIRST CRITERIA USED TO DETERMINE THE CABLE TYPE AND SIZE. HOWEVER, IN SOME CASES, PARTICULARLY IN LONG RUNS, IT WILL BE NECESSARY TO SELECT A CONDUCTOR SIZE LARGER THAN THAT REQUIRED TO CARRY THE AVAILABLE CURRENT DUE TO VOLTAGE DROP. IT IS THEREFORE PRUDENT TO CALCULATE VOLTAGE DROP ON ALL BUT THE SHORTEST CIRCUITS SINCE THE PENALTIES OF LOW VOLTAGE ARE MANY: DIM LIGHTS, REDUCED MOTOR SPEEDS AND LIFE, INEFFICIENT PERFORMANCE, AND WASTED ENERGY.

THE CALCULATION OF THE EXACT VOLTAGE DROP FOR A PARTICULAR A.C. CIRCUIT IS TIME-CONSUMING AND COMPLICATED SINCE SUCH FACTORS AS CIRCUIT LENGTH, POWER FREQUENCY, POWER FACTOR, OPERATING TEMPERATURE, CONDUCTOR SPACING, AND RACEWAY OR CONDUIT TYPE ARE INVOLVED.

TABLE I PROVIDES A SHORT-CUT METHOD OF DETERMINING VOLTAGE DROP WHICH IS SUFFICIENTLY ACCURATE FOR MOST PURPOSES. IN ORDER TO OBTAIN THE VOLTAGE DROP, MULTIPLY THE LENGTH (IN FEET) OF ONE CONDUCTOR BY THE CURRENT (IN AMPERES) AND BY THE FIGURE SHOWN IN THE TABLE FOR THE CONDUCTOR SIZE, CIRCUIT TYPE, AND POWER FACTOR. DIVIDE BY 1,000,000 (OR MOVE THE DECIMAL POINT 6 PLACES TO THE LEFT) AND THE RESULT IS THE VOLTAGE LOSS TO BE EXPECTED. IF THE VOLTAGE DROP EXCEEDS 3% A LARGER SIZE MUST BE CHOSEN.

EXAMPLE: 500 FOOT LENGTH OF RUN, 3-75°C RATED CONDUCTORS IN METALLIC CONDUIT IN AIR, 50 AMP LOAD, 240V., THREE PHASE CIRCUIT AT 80% POWER FACTOR.

PER TABLE 310-16 OF THE NEC, 8 AWG CABLE WILL BE SUFFICIENT TO CARRY 50 AMPS UNDER THE STATED CONDITIONS. THE VOLTAGE DROP WOULD BE 28.0 VOLTS (500 X 50 X 1120 DIVIDED BY 1,000,000) OR 11.7%. SELECTING #1 AWG CABLES RESULTS IN A VOLTAGE DROP OF 6.75 VOLTS OR 2.81 % (500 X 50 X 270 DIVIDED BY 1,000,000).