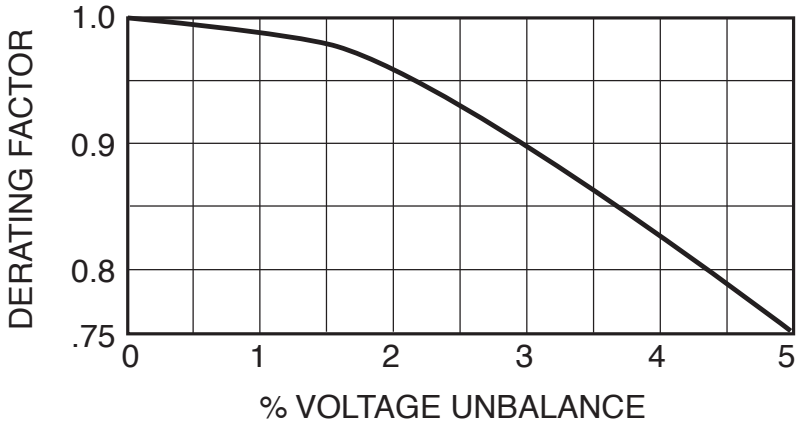
EFFECT OF VOLTAGE UNBALANCE ON MOTOR PERFORMANCE

When the line voltages applied to a polyphase induction motor are not equal, unbalanced currents in the stator windings will result. A small percentage voltage unbalance will result in a much larger percentage current unbalance. Consequently, the temperature rise of the motor operating at a particular load and percentage voltage unbalance will be greater than for the motor operating under the same conditions with balanced voltages.

Should voltages be unbalanced, the rated horsepower of the motor should be multiplied by the factor shown in the graph below to reduce the possibility of damage to the motor. Operation of the motor at above a 5% voltage unbalance condition is not recommended.

Alternating current, three-phase motors normally are designed to operate successfully under running conditions at rated load when the voltage unbalance at the motor terminals does not exceed 1%. NEMA MG1-2006, 12.45 states that if voltage unbalance exceeds 1% performance will not necessarily be the same as when the motor is operating with a balanced voltage at the motor terminals. This may increase operating temperature, vibration, nuisance trips and failures.

MEDIUM MOTOR DERATING FACTOR DUE TO UNBALANCED VOLTAGE



$$\text{Percent voltage unbalance} = 100 \times \frac{\text{Max. volt. deviation from avg. volt.}}{\text{Average volt.}}$$

Example: With voltages of 460, 467, and 450, the average is 459, the maximum deviation from the average is 9, and the

$$\text{Percent unbalance} = 100 \times \frac{9}{459} = 1.96\%$$

Reference: NEMA MG 1-2006, 14.36.

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