http://waterheatertimer.org/Names-of-parts-on-electric-pole.html

The Basics of Voltage Imbalance

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Electrical equipment; especially motors and their controllers; will not operate reliably on unbalanced voltages in a 3-phase system. Generally, the difference between the highest and the lowest voltages should not exceed 4% of the lowest voltage. Greater imbalances may cause overheating of components; especially motors; and intermittent shutdown of motor controllers. Motors operated on unbalanced

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How much imbalance is too much? Let's look at an example. Suppose the lowest voltage on a 3-phase circuit is 230V, while another phase is 235V, and the third phase is 240V. Is this a significant voltage imbalance? Let's use the 4% rule to see.

Four percent of the lowest voltage (230V) is 9.2V (230V24%49.2V). The difference between the highest voltage (240V) and the lowest voltage (230V) is 10V. Therefore, these voltages have too great an imbalance. Why? Because the 10V difference is greater than four percent of the lowest voltage (9.2V).

You can use a more precise procedure for calculating voltage imbalance. The first step is to calculate the average voltage by adding all three phases and dividing by 3. In our example, the average is 235V: You add the voltages to get your total. 230V`235V`240V 4705V. Then you divide by the number of phases. 705V / 34235V.

Next, add up the absolute differences between each phase voltage and the average voltage. In this case, the difference between the average voltage and 230V is 5V. The difference between the average and itself is 0V; and the difference between the average and 240V is 5V. Adding up the differences, we get 10V. And that 10V is what we call the total imbalance.

Now divide the total imbalance in half to get an adjusted imbalance. Half of 10V is 5V. Finally, divide the adjusted imbalance into the average voltage to get a percentage imbalance. In this case, 5V / 235V40.021. That is 2.1% imbalance.

Reliable, long-term operation of most electrical equipment requires a voltage imbalance of less than two percent; which means your system has too much imbalance.

If you find voltage imbalances in your facility, the first place to look is not the power company. Instead, look for electrical distribution systems in which one leg of a 3-phase supply powers both single-phase and 3-phase loads. You may find single phase loads not evenly balanced across the phases. Or, look for in-line reactors installed to correct imbalances. These reactors usually have taps for adjustment, and somebody may have adjusted them. Or, the imbalance they originally corrected may have shifted over time. Circuits with tapped reactors rarely stay in balance indefinitely.

Now, here's a practice question. You go out onto the floor and find a 460V motor with phase voltages of 458V, 465V, and 480V. Is there a problem or not? There sure is.

Lowest voltage is 458V. First, calculate your four percent. 0.042458V 418.32V. The difference between the highest voltage (480V) and the lowest voltage (458V) is 22V (480-458). Since the difference (22V) is greater than 4% of the lowest voltage (18.32V), the phases are too far out of balance to ensure continued, reliable operation of electrical equipment.