CALCULATING PERCENT IMPEDANCE FOR AN AC LINE REACTOR

Description:

The concept of *Percent Impedance* is a method for stating the inductance value of a line reactor. The rated percent impedance value for a given inductor is based on the percent of nominal voltage that would be dropped across the reactor with the rated current flowing and at rated fundamental frequency. A question that comes up is: How do I calculate the percent impedance if I know the value of the inductance?

Calculating Percent Impedance:

From Ohm's Law the voltage drop across the inductor would be:

$E = I X_L$

($X_L = 2 \pi F L$)

Where: X_L Inductive Impedance

E Voltage (Volts)

I Fundamental Current (Amps)

F Fundamental Frequency (Hertz)

L Inductance (Henries)

The percent impedance is defined as the voltage drop across the reactor as a percentage of nominal voltage. To calculate percent impedance you would need the inductance per phase value of the reactor (given) and the line to neutral value of the voltage. The Line to Neutral Voltage can be found by dividing the Line to Line Voltage by 1.73. ($V_{L-N} = V_{L-L} / 1.732$)

So the formula for *Percent Impedance* would be as follows:

$\%Z = L \text{ (in Henries)} / [(V_{L-L} / 1.732) / (I \times 2\pi \times F)] \times 100\%$

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External	Industry – Industrial, HVAC or PLC	Document #: LVD-EOTN57U-EN Revision: C
All		

Example:

Calculate the percent impedance for a reactor that has a per phase inductance of .001475 Henries that is used on a drive with 16 A of input current flowing at 480 V and at a 60 Hz fundamental frequency.

%Z = .001475 / [(480 / 1.732) / (16 x 2 x 3.14 x60)] x 100%

.001475 / (277.14 / 6031.86) x 100%

.001475 / .04595 x 100%

3.2 %

Note also that the percent impedance is directly proportional to the current flow and inversely proportional to the voltage. This means for example that if only half of the current was flowing, the effective impedance value would be one half of the full load value and that the percent impedance would double if the voltage was halved.