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**LOAD DIVISION AND CIRCULATING
CURRENT IN PARALLEL OPERATED
TRANSFORMERS**

LOAD DIVISION AND CIRCULATING CURRENT IN PARALLEL-OPERATED TRANSFORMERS

1.-DIVISION OF LOAD BETWEEN PARALLELED TRANSFORMERS OF DIFFERENT IMPEDANCES, BUT OF THE SAME TURN RATIO

The load, amperes (I) or kVA, is inversely proportional to the transformer impedances. When the turn ratios and voltages are equal (fig. 1), there will be no circulating current. This method is not exact if the transformer resistance (R) and impedance (X) values are not in the same ratio, but is accurate enough for practical purposes.

The following is true if both Z_1 and Z_2 are on the same load kVA base:

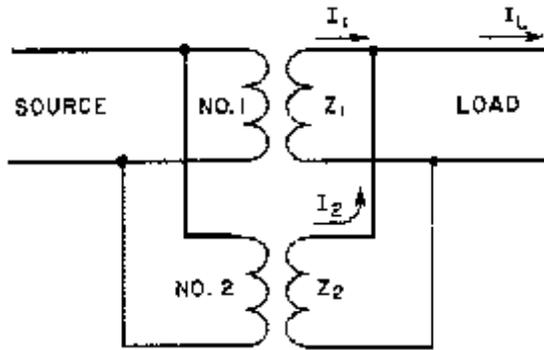


Figure 1. - Parallel transformers with the same load kVA base.

$$I_1 = \frac{Z_2}{Z_2 + Z_1} \times I_L \quad (1)$$

$$I_2 = \frac{Z_1}{Z_1 + Z_2} \times I_L \quad (2)$$

- Where I_1 = load current from transformer No. 1
 I_2 = load current from transformer No.2
 I_L = $I_1 + I_2$ = load current
 Z_1 = Impedance of transformer No. 1 (percent)
 Z_2 = Impedance of transformer No. 2 (percent)

If the two transformers do not have the same Kva

rating, the actual Z_2 should be converted to a new theoretical impedance, Z'_2 , with the same load kVA base as transformer No. 1 by the formula:

$$Z'_2 = \frac{Z_2 \times \text{kVA}_1}{\text{kVA}_2} \quad (3)$$

Where Z'_2 may be substituted for Z_2 in equations (1) and (2)

kVA_1 = rated load kVA of transformer No.1

kVA_2 = rated load kVA of transformer No.2

2.-CIRCULATING CURRENT IN PARALLELED TRANSFORMERS HAVING DIFFERENT TURN RATIOS AND THE SAME OR DIFFERENT IMPEDANCES

If the two paralleled transformers have different turn ratios there will be circulating current between the two, due to the difference in terminal voltage. This I_c (circulating current) lags the primary current due to the terminal voltage E_1 and E_2 and the 100-percent power factor load current, by about 90 degrees, and must be added vectorially to the load current of the transformers will be influenced by the power factor of the load being supplied. The circulating current is independent of loading conditions.

If the two units have different impedances in addition to different turn ratios, this will further affect the distribution of current between the units: