4.4 Sumpner Test

Sumpner's test or back to back test can be employed only when two Identical transformers are available. Both transformers are connected to supply such that one transformer is loaded on another. Primaries of the two identical transformers are connected in parallel across a supply. Secondaries are connected in series such that emf's of them are opposite to each other. Another low voltage supply is connected in series with secondary's to get the readings, as shown in the circuit diagram shown below.

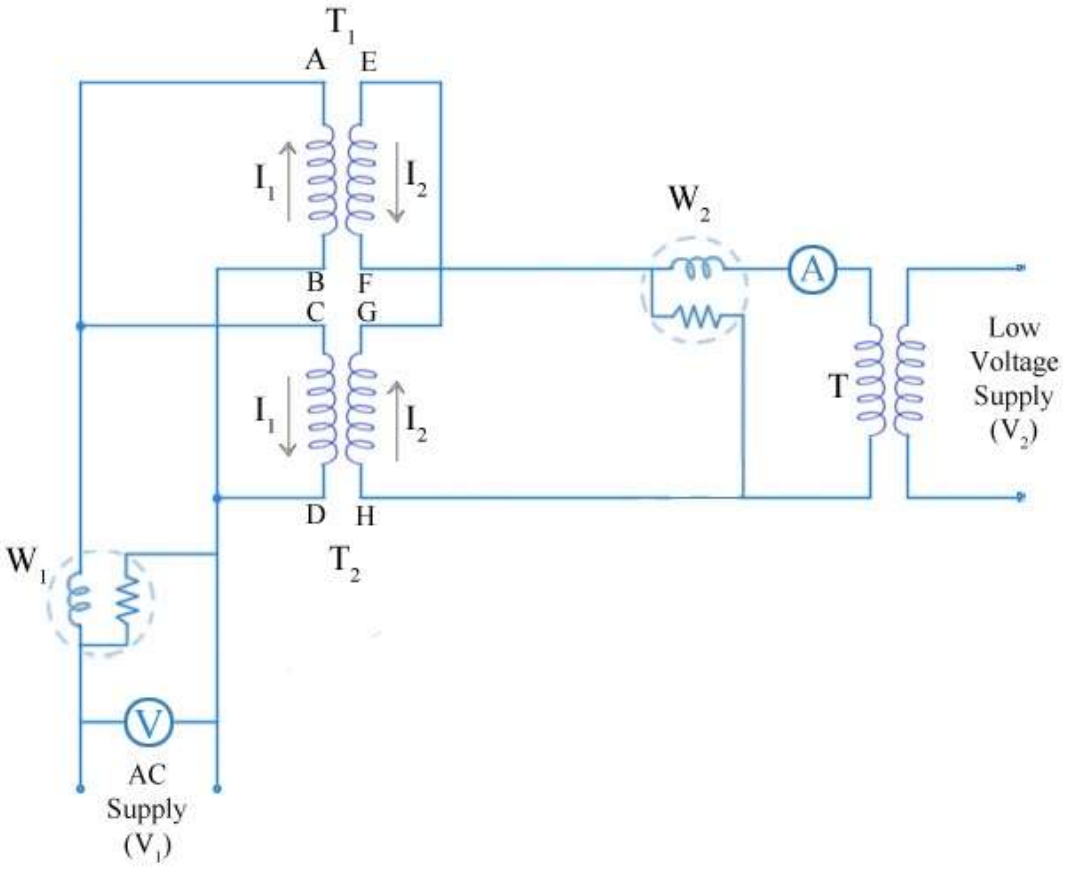

Figure 4.4.1 Sumpner Test

[Source: "'Electric Machinery Fundamentals" by Stephen J. Chapman*, Page: 135]*

In above diagram, T_1 and T_2 are identical transformers. Secondary of them are connected in voltage opposition, i.e. E_{EF} and E_{GH}. Both the emf's cancel each other, as transformers are identical. In this case, as per superposition theorem, no current flows through secondary. And thus the no load test is simulated. The current drawn from V_1 is

$2I_0$, where I_0 is equal to no load current of each transformer. Thus input power measured by wattmeter W_1 is equal to iron losses of both transformers.
i.e. iron loss per transformer $Pi = W_1/2$.

Now, a small voltage V_2 is injected into secondary with the help of a low voltage transformer. The voltage V_2 is adjusted so that, the rated current I_2 flows through the secondary. In this case, both primaries and secondary carry rated current. Thus short circuit test is simulated and wattmeter W_2 shows total full load copper losses of both transformers.

i.e. copper loss per transformer $P_{Cu} = W_2/2$.

From above test results, the full load efficiency of each transformer can be given as -

$$\%\ \text{full load efficiency of each transformer} = \frac{\text{output}}{\text{output} + \frac{W_1}{2} + \frac{W_2}{2}} \times 100$$