



SNS COLLEGE OF ENGINEERING

Kurumbapalayam (Po), Coimbatore – 641 107

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME : 23EEB201 THEORY OF DC MACHINES AND TRANSFORMERS

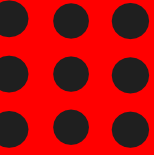
II YEAR / 03 SEMESTER EEE

Unit 5 – Testing and Applications of Transformers



INTRODUCTION

- An Auto Transformer refers to a transformer that features a single winding wound around a laminated core.
- An autotransformer is like a two-winding transformer however contrast in the manner the primary winding and secondary winding are interrelated.
- A piece of the winding is common to both the primary side and secondary sides.



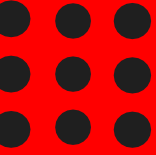


What is an AutoTransformer?

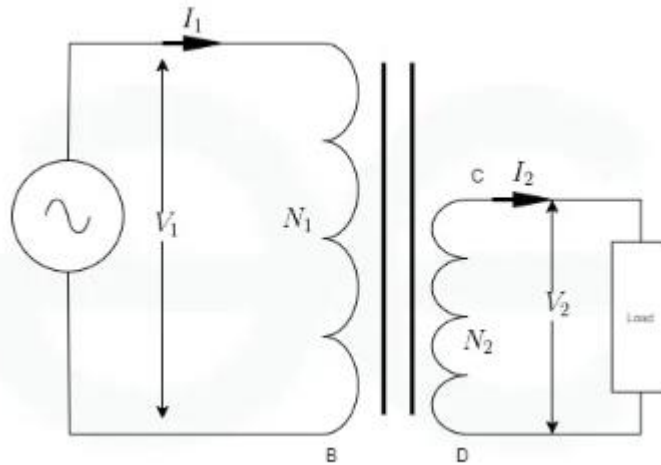
- It is an electrical transformer characterized by having a solitary winding. The "auto" prefix refers to the single coil acting alone (In Greek "self") - not to any programmed instrument.
- It is like a two-winding transformer yet changes in the manner the primary winding and secondary winding of the transformer are interrelated.
- It has a single consistent winding with a tap point between the primary winding and secondary windings.
- It has a clear advantage because the tap point can be changed to get the voltage you want at the output.
- The fact that the secondary winding is not electrically isolated from the primary is the autotransformer's primary drawback.
- On load condition, a piece of the load current is applied directly from the supply, and the remaining part is acquired by transformer action.
- It functions as a voltage regulator.



Construction and Working of AutoTransformer

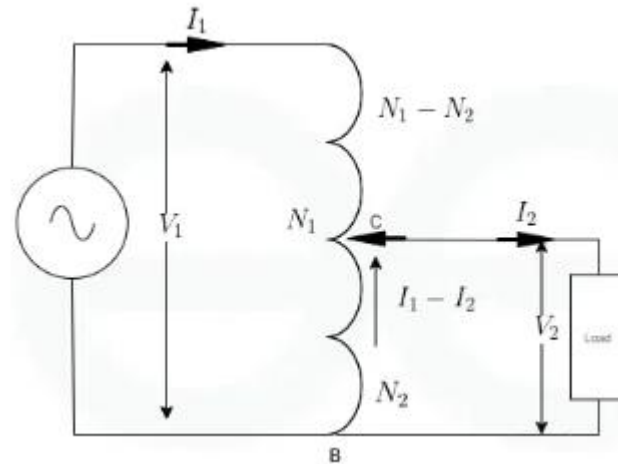


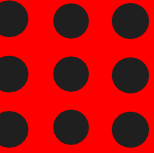
- In a conventional transformer, the primary and the secondary windings are electrically insulated from one another but connected magnetically as shown in the figure below.
- In an auto Transformer, the primary and secondary windings are linked both magnetically and electrically.





- Auto transformers can be categorized into two types based on their construction.
- In the first type, a continuous winding is employed with taps strategically positioned to achieve the desired secondary voltage.
- Conversely, the second type features at least two distinct coils that are electrically interconnected to create a seamless winding.
- The schematic representation of the auto transformer construction is depicted in the figure below.





- The primary winding AB from which a tapping at C is taken, that CB goes about as an optional winding.
- The supply voltage is applied across the AB, and the load is connected across the CB.
- The tapping could be constant or fluctuating.
- When AC voltage V_1 is applied across AB, an alternating flux is set up in the core, thus, an emf E_1 is induced in the winding AB.
- A part of this induced emf is taken in the secondary side circuit.

Let,

V_1 is Primary applied voltage

V_2 is Secondary voltage across the load

I_1 is Primary current

I_2 is load current

N_1 is number of turns among A and B

N_2 is number of turns among C and B

Neglecting no-load current, leakage reactance and losses,





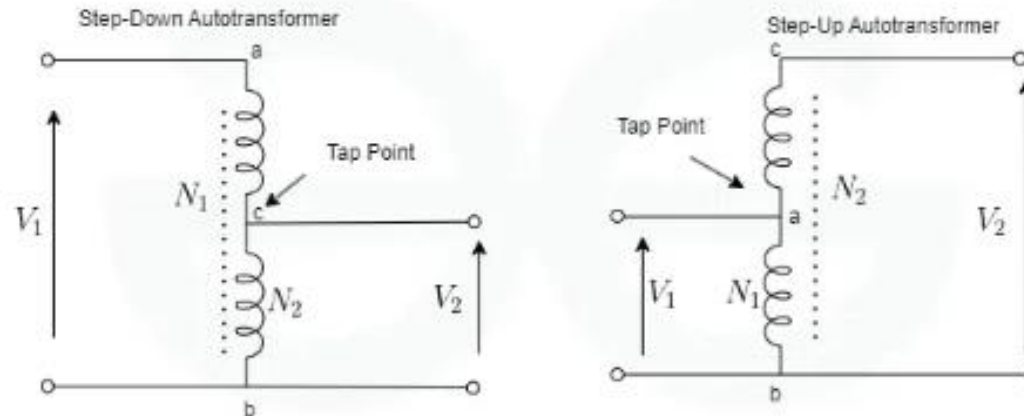
$$V_1 = E_1 \text{ and } V_2 = E_2$$

Therefore, the transformation ratio:

$$K = V_2 / V_1 = N_2 / N_1 = I_1 / I_2$$

Case 1 : Autotransformer on No-Load

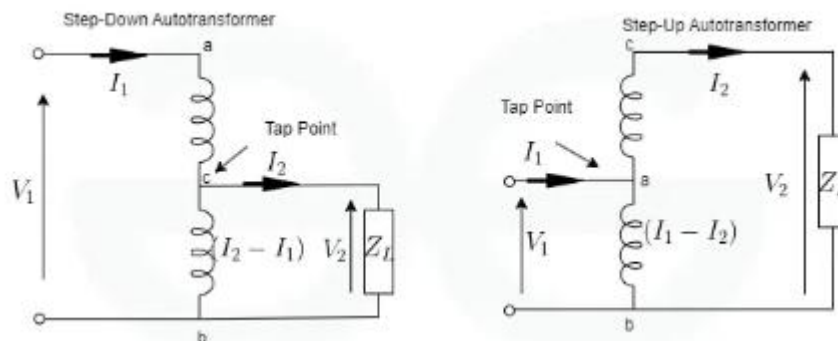
The connection diagram of a unloaded autotransformer (step-down and step-up) is shown in the figure. In this, the winding 'AB' is called primary winding having N_1 turns and the winding 'bc' is called secondary winding having N_2 turns.





Case 2: Autotransformer on Load

A load is connected to be loaded if it is connected to an autotransformer's secondary. The figure shows the circuit diagram of a autotransformer (step-down and step-up)





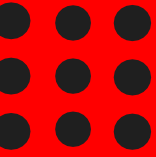
Advantages of Autotransformer

- An autotransformer has smaller core and copper losses and thus higher efficiency when compared with a conventional 2-winding transformer.
- Autotransformer requires less conductor material when contrasted with the 2-winding transformer.
- Reduced voltage drops in resistance and leakage reactance result in improved voltage regulation.
- It has more smaller size and cheaper in cost than a 2-winding transformer.
- It requires more modest excitation current.
- Variable voltages can be produced by an autotransformer.



Disadvantages of Autotransformer

- There is a direct connection between the primary and secondary sides. The load on the secondary side would receive the full primary voltage in the event of an open circuit in the common portion because of the windings. This might harm the hardware connected with the secondary side.
- An autotransformer has reduced inside impedance when compared with a 2-winding transformer which brings about a larger short circuit current.
- The autotransformer isn't electrically isolated, in this manner can't be used to electrically disconnect two circuits





Applications of Autotransformer

- Power systems with varying voltage levels can be connected to one another through the use of autotransformers.
- The autotransformers with recordings are utilized for turning over enlistment engines and coordinated engines.
- When a continuous variable voltage over a wide range is required, autotransformers are used as variac (variable AC).
- It is used as a starter to surrender to 50 to 60% of full voltage to the stator of a squirrel confine enlistment engine during turning over.



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