Polarity Test on a Transformer

1 Aim

To determine polarities of transformer windings

2 Theory

A transformer is used to transform voltage and pass on electrical energy from primary to secondary circuit. The primary and secondary of a transformer are not connected to each other i.e. they are "electrically" isolated.

If the terminals of transformer are not "marked" for polarities, as they are not accesible visually; there can be an error in connections at primary and secondary windings. This can lead to severe faults in certain cases. However, polarity test can be used to *identify* the terminals of the transformers. From Fig. 4, we observe that voltage across terminals $T1$ and $T2$ is

$$V_m = V_{T1T2} = V_{T1C1} + V_{T2C2}$$

3 Prelab Questions

1. See Fig. 1. Depending upon the polarities of windings,

   $V_m = V_{T1T2} = f(|V_{T1C1}|, |V_{T2C2}|) =$ .....; ... if $C1$ and $C2$ have same polarity (1)

   $V_m = V_{T1T2} =$ .....; ... if $C1$ and $C2$ have opposite polarity (2)

   Fill in the blanks above
2. Consider the circuit shown in Fig. 1. $T1 - C1$ is supplied with $v_{T1-C1}(t) = V_m \sin(314t)$. Draw the waveform of voltage across $T2 - C2$ i.e. v_{T2-C2}, if - (a) dot convention is as shown in the figure and (b) the dot convention is opposite.

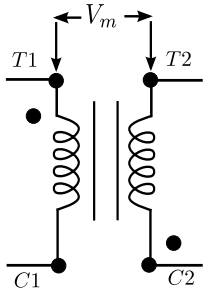


Figure 1: Single phase transformer

4 Procedure

Note to TAs/RAs: Open the cover of the transformer and show the students HV and LV terminals, conductors used for LV and HV winding. Also show them E & I laminations, and ferrite core.

- Connect the transformer terminals as shown in Fig. 4. The terminals $T1$, $T2$, $C1$, $C2$ are arbitrarily marked.
- Apply some voltage (lesser than rated) to $T1$-$C1$. In case rated voltage is unknown, increase applied voltage slowly beginning from 0 V.
- Using voltmeter, measure voltage across the other winding. This would give the transformation ratio.
- Using digital multimeter, measure the voltage across $T1$ and $T2$

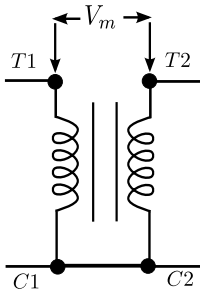


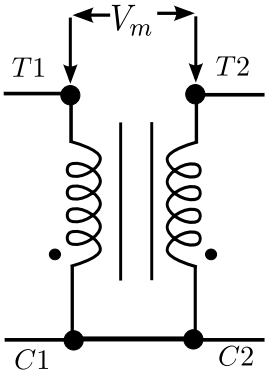
Figure 2: Connections for polarity test

5 Report

1. Note the voltage across the terminals $T1$ and $T2$.
2. Accordingly mark the polarity of transformer.

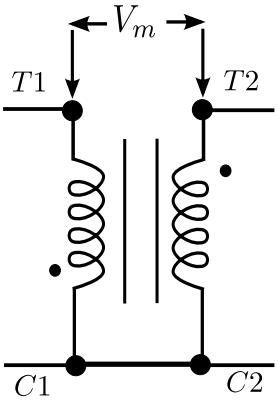
6 Questions to be answered

1. Could you think of situations where incorrect connections at transformer terminals would be harmful?
2. How will you perform the test if the transformer has a tertiary winding as well?
3. It is often said that transformer provides isolation. What does this mean?
4. Suppose that it is desired to have 200V DC wrt ground. We wish to achieve this using a bridge rectifier as shown below. A single phase AC supply (phase to neutral) is used. The neutral is also grounded. Will this circuit work as intended?



$V_m = V_{T1T2} = |V_{T1C1}| - |V_{T2C2}|$

(a) $C1$ and $C2$ have same polarity



$V_m = V_{T1T2} = |V_{T1C1}| + |V_{T2C2}|$

(b) $C1$ and $C2$ have opposite polarity

Figure 3: Expected outcome of polarity test

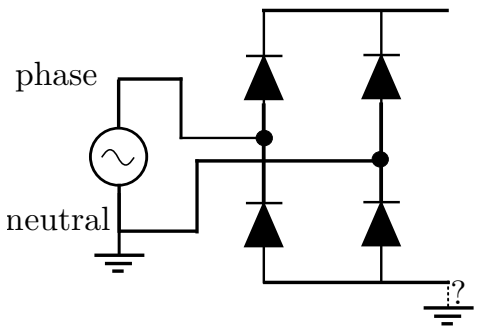


Figure 4: Proposed connections for single phase DC supply