



Transformer Review

Bulletin #P-1

Transformers

- Transformers are electromagnetic devices that transfer electrical energy from one circuit to another by mutual induction. Mutual induction is the coupling of inductances by their mutual magnetic fields. In a single-phase transformer there are two coils, a primary and a secondary coil. The AC generator provides electrical power to the primary coil. The magnetic field produced by the primary induces a voltage into the secondary coil, which supplies power to a load.
- Transformers are used to step a voltage up to a higher level, or down to a lower level. Transformers are used extensively in power distribution systems, allowing power companies to transfer electrical energy many miles. Power generators typically generate high voltages. This voltage varies, depending on the generator. The voltage is stepped up through a transformer to higher levels for transmission to substations. The electrical power is received at substation transformers many miles away where, it is stepped down. From here, electrical power is fed to a distribution substation. It can also be fed directly to factory locations. If the power is fed to a factory, transformers at the factory site reduce the voltage to useable levels. Transformers at the substation for factory and home use reduce the power fed to a distribution substation.
- There is direct relationship between voltage, impedance, current, and the number of coil turns in a transformer. This relationship can be used to find primary or secondary voltage, current, and/ or the number of turns in each coil. It is the number of turns which determine if a transformer is a step up or step down transformer. The following “rules-of-thumb” apply to transformers:
 - a) If the primary coil has fewer turns than the secondary coil, it is step-up transformer.
 - b) If the primary coil has more turns than the secondary coil, it is a step-down transformer.

When the number of turns on the primary and secondary coils of a transformer are equal, input voltage, impedance, and current are equal to output voltage, impedance, and current.

- A step-up transformer is used when it is desirable to step voltage up in value. The primary coil has fewer turns than the secondary coil. The number of turns in a transformer is given as a ratio. When the primary has fewer turns than the secondary, voltage and impedance are stepped up. Because impedance is also stepped up, current is stepped down.
- A step-down transformer is used when it is desirable to step voltage down in value. The primary coil has more turns than the secondary coil. Voltage and impedance are stepped down, current is stepped up.

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