Current Transformers

A current transformer (CT) is a passive device that will provide a current flow that is in a secondary circuit that is a much smaller exact ratio of the current flow in a circuit conductor. It is a special version of a typical transformer. When a current flows through a wire a magnetic field builds up around the wire where the magnetic field has a strength or density that is proportional to the current flow. Another principal of "ac" electricity is that the magnetic field that is produced by the primary circuit current can cause an "ac" current to flow in a secondary circuit. The secondary circuit is intended to operate as a shot circuit as shown in *Figure 214c*.1. It can be designed so that the current flowing in the secondary circuit is an exact ratio of the primary circuit current. Assume the CT ratio is 40 to 1. This means it takes 40 amperes flowing in the primary circuit to cause one ampere to flow in the secondary circuit. When built to exact specifications a current transformer can be used to measure very large currents and power use. Current transformers are built in as a component of all types of equipment and devices. A diagram of a current transformer is shown in *Figure 214c.1*

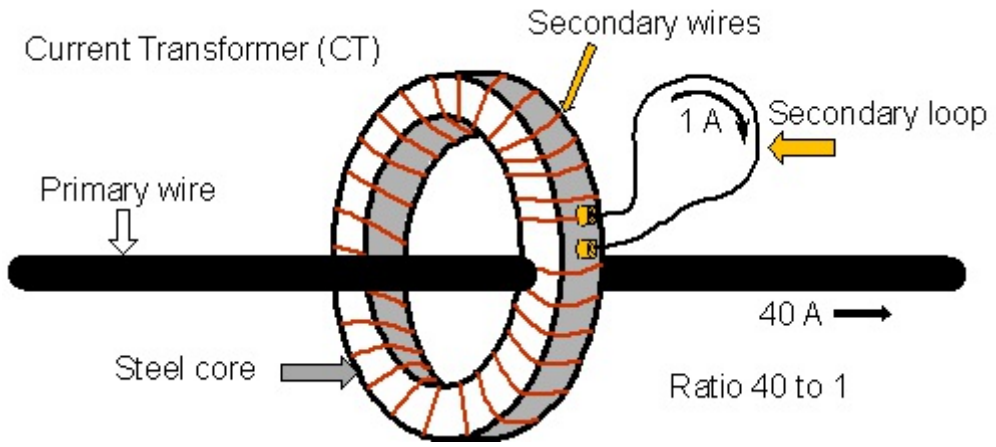

Figure 214c.1 *The basic construction of a current transformer has a primary circuit conductor passing through the center of the steel core that has secondary circuit wires wrapped around the core. The purpose is for a small current flow in the secondary that is an accurate ratio of the current in the primary circuit.*

By wrapping a wire around the steel core the magnetic field in the steel core will create a current flow in the wire *(see Figure 214c.1)*. The device is constructed so that there is an exact ratio between the current flow in the primary wire and the current in the secondary wire. By measuring the strength or density of the magnetic field around a conductor carrying "ac" current, the amperes of current flowing in the primary conductor can be determined. The steel core is a toroid shape (donut shape) and the secondary wire is wrapped around the toroid as shown in *(Figure 214c.1)* and the primary simply passes through the hole of the toroid core.

A clamp-around ammeter uses a current transformer to measure the current in a conductor. In the case of an ammeter the secondary wire is inside the meter at one end of the toroid coil as shown in *Figure 214c.2.* The steel core is hinged so that it will open so it can be wrapped around the primary circuit wire. There is a push trigger on the meter that will open the core. The point where the core opens must be kept clean so the two parts of the core will make good contact when closed.

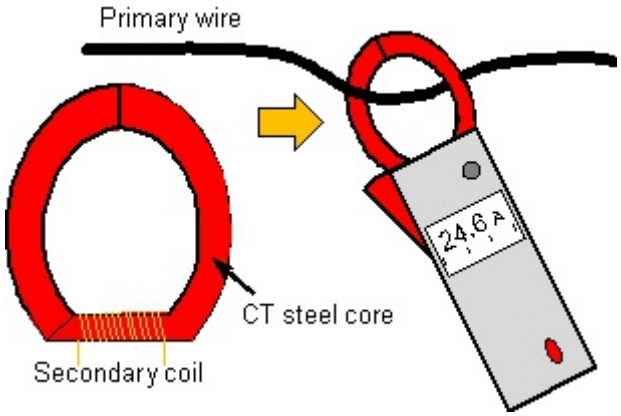

Figure 214.2c. In the case of a clamp-around ammeter the steel core opens so the wire can be inserted into the "hole." The secondary circuit wires are at one end of the core inside the meter case.

The steel core will eventually reach magnetic saturation as primary current increases. The ratio label on the current transformer *(200 in Figure 214c.3)* will give the maximum primary current it can handle. If this maximum value is exceeded the current transformer ratio will begin to change. The current transformer ratio is determined by dividing the maximum primary current by the maximum secondary current. For the example in *Figure 214c.3* divide 200 by 5 to obtain the ratio which for this CT is 40 to 1.

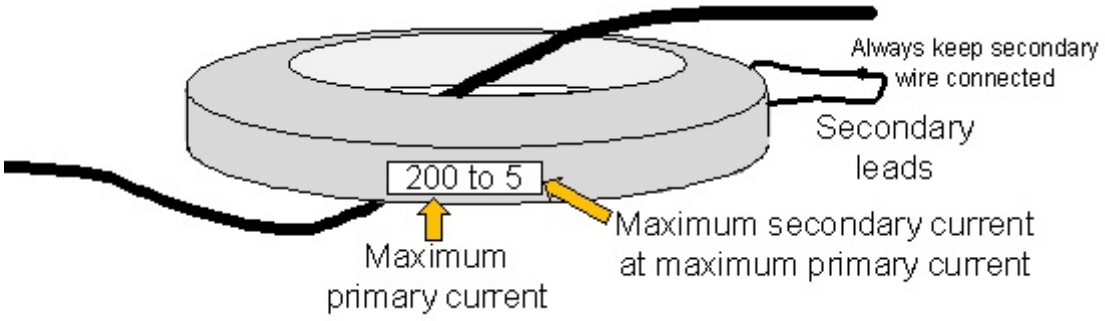

Figure 214.3c. A current transformer will have a label that gives the maximum primary current permitted to maintain the ratio. For this CT the maximum is 200 amperes and the ratio is 40 to 1.

Safety Note: Current transformer secondary wires or terminals must always be shorted together when live primary wires are installed through the CT hole. A dangerous voltage may develop across the two secondary terminals or wires.

For more information about transformers see *Tech Note 218*