

Application Note

Earth Leakage Toroids

1. Introduction

Toroids (current transformers) are not ideal devices and if correct procedures are not followed during installation nuisance tripping can result. If, for example, we consider a single-phase earth leakage system where active and neutral pass through a toroid then at all times currents in the two wires are equal and opposite so that the net current through the toroid is zero. An ideal current transformer would have all of the flux from each wire contained in the core and so would accurately add the opposing fluxes to get a net result of zero. A real current transformer has “leakage fluxes”. That is, a very small proportion of the total flux from each cable is not contained in the core but in the space outside it and as a result it may link some turns but not others, depending on the positioning of the cables. The effect of this is that a small output may be obtained from the toroid where none would arise if the device were ideal.

The size of the error may vary from toroids of the same type because of slight differences in the core and the symmetry of the winding. Problems caused in this way increase as the toroid size increases, as currents increase and symmetry decreases. Nuisance tripping tends to occur when the total current rises, such as when a large motor is started. The following guidelines would help to avoid such problems.

2. Selection Guidelines

1. Select the smallest internal diameter toroid, which will allow the cables to fit through. Avoid very large toroids (200m) or toroids with square apertures.
2. Only use approved toroids specified by Ampcontrol as these have been designed to minimise the problem.

3. Installation Guidelines

1. Keep cables as close to the centre of the toroid as possible. Do not tie them to one side of the toroid. Remember to aim at symmetry

2. Do not bring the cables back past the toroid within one diameter of the toroid. Trying to cram cables into a small space reduces symmetry and may lead to problems, which are difficult to solve.
3. Avoid placing the toroid near any device, which produces magnetic fields. This includes bus bars, transformers or other cables. Try to maintain several toroid diameters clearance.
4. Many small cables tend to be worse than say three large ones. Try to position the toroid in the circuit with this in mind.
5. Toroids used for core balance earth leakage protection cannot have bus bars passed through the toroid.
6. Where high currents are experienced during start up an Ampcontrol High Performance Toroid must be used to prevent nuisance tripping.
7. When the toroid is used on non-earth fault limited systems an Ampcontrol Snubber should be connected across the toroid terminals to prevent damage to the relay. See Application Note ELCB006 for further information and part numbers.
8. To prevent possible nuisance tripping it is suggested that the conductor screen of the earth leakage toroid should be earthed one end only, the relay end. If both ends are earthed the possibility exists for the shield to become an earth loop, having finite resistance and injecting noise into the toroid leads.

4. Toroid Installation on Armoured Cable

It is important that correct installation procedures are followed when installing a toroid over an armoured cable. The cone and mounting bolts must be insulated from any earthed metal enclosures. The lead is earthed to the cone and then passed through the toroid and connected to earth. If this procedure is not followed an earth fault may not be detected. See Figure 1, Page 2.



Toroid Installation on Armoured Cable

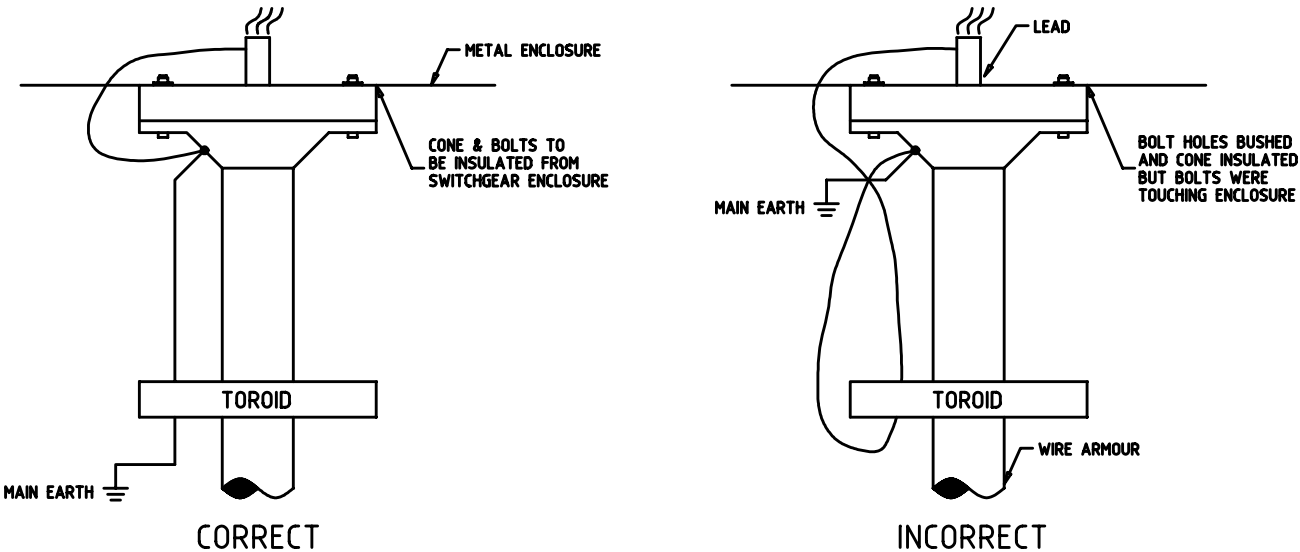


Figure 1