



**PHOENIX**  
Manufacturing Ltd.

email: sales@phnxfmfg.com  
tel: (905) 878-2818  
fax: (905) 878-0051

**Protecting transmission and distribution equipment  
against animal invasion**

By Bernard Summerville

The transmission and distribution of electrical energy is a vital service supplied on a system that is inherently vulnerable to interruption and breakdown. As the networks have become more complex and extensive, more hardware has been installed and particularly in overhead configurations. This can translate into an increased risk of animal related outages unless appropriate precautions are put into place. Animal induced faults on transmission and distribution systems are not new and records show how they have plagued engineers both in frequency and severity. The problems are not going to disappear and indeed studies show that animal related faults are becoming more and more prevalent. Aside from the systems reliability concerns, such faults escalate significantly the maintenance and equipment costs associated with unplanned outages.

Outdoor terminations, conductors and busbars in electrical transmissions and distribution systems provide excellent climbing apparatus for any invading animals and wild life, the consequences of which can be supply interruption and extensive damage to equipment. These problems are not confined to remote country stations but are equally prevalent in suburban and urban locations. The majority of animal related outages occur primarily at insulators associated with buswork, the bushings of transformers, circuit breakers and capacitors. The studies show that equipment in the voltage range 5kv to 38kv is the most susceptible to such animal invasion. This is where the electrical clearances can be easily spanned by animals such as squirrels, raccoons and the like, with the resulting damage to equipment becoming extensive and costly. A badly damaged transformer bushing requiring replacement is a typical example of serious damage. Similarly a damaged pothead, which needs to be replaced, creates an expensive supply outage requiring the rejoining of the cable. Consider an animal initiated flashover on, say, the 15kv secondary side of a main transformer. The porcelain skirts of the bushing could be damaged to the extent that the complete bushing has to be disconnected and replaced. This necessitates the dropping of the oil level in the transformer for removal of the bushing and the material; labour and downtime costs associated with such an occurrence can be extremely expensive.



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### Dealing With Animal Related Outage Problems

Having recognized that it is impossible to keep animals and any type of wildlife off outdoor electrical equipment, the installation of insulated cover up is the logical step to combat this invasion of the system. Available today are form fitting reusable insulating boots in an extensive range of configurations to cover every conceivable type or termination and connector associated with transformers, circuit breakers, capacitors and bus bar systems. This comprehensive range of boots provides the means for totally encapsulating any complex arrangement of bus bars and terminations. Throughout the distribution network, there is and increasing use of automatic reclosers. These are installed in strategic positions to enhance the network reliability by reducing transient electricity supply interruptions caused by lightning and storms. These devices are typically pole mounted and their principle function is to maintain continuity of supply. They are compact in design and are constructed with their bushings in close proximity to each other. This makes the device particularly vulnerable to animal invasion and here again insulated cover boots are necessary on the terminations to maintain the complete integrity of the installation.

The insulating boots used in transmission and distribution systems must retain their electrical integrity throughout their lifetime and from a practical point of view must be easily fitted and removed for maintenance procedures. They need to be form fitting manufactured from high-grade flexible insulating material to match the system voltage requirements. The material must be formulated to withstand a wide range of climate conditions including exposure to strong ultraviolet light and be inherently flame retardant.

The tolerance for loss of power supply has become less over recent years with consumers insisting upon zero interruption of supply and calling for appropriate guarantees. Investigations show that the supply authorities who have invested in animal control programs by encapsulating the vulnerable areas of their systems can meet the demands of their customers. Additionally they are enjoying the benefit in the reduction of animal induced outages and equipment failures.

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Bernard Summerville is the President of Phoenix Manufacturing Ltd., manufacturers of reusable boots for indoor and outdoor applications.  
Email: [sales@phnxfmg.com](mailto:sales@phnxfmg.com)