Lepr Rev (1987) **58,** 189–190

Letter to the Editor

SOME PROBLEMS ARISING FROM UNCERTAIN ELECTRICITY SUPPLY

Sir,

In this country, and indeed in most countries in the West, the public give little thought, if any, to problems which could arise from an unreliable electricity supply. It is usually required that electricity supply be maintained within the statutory limits of a very small percentage of the declared voltage and frequency. Alas, this is not so in most of the Third World and developing countries. The only problem we meet is when the supply is cut off, temporarily, due to overloading in severe winters, when some load sharing may be necessary at times of major breakdown of plant.

I met some of the problems first in Africa and later in India where failure of the supply is a daily expectation and it is surprising how the communities in these countries have learned to live with these conditions, to accept them as normal and so often without a word of complaint. It is now over 10 years ago that I met in India what was quite a new problem to me, namely, dangers arising not from cuts but from sustained periods of low voltage. I was staying with the Medical Superintendent of a large leprosy hospital in South India, when he, realizing that I was an electrical engineer, appealed to me for help, not in overcoming the problem of the supply but in protecting his equipment from damage. The first and obvious answer was to tackle the problem of the supply and that could be done by installing generating plant, preferably with automatic starting and switching so that when the mains electricity dropped in voltage (or rose) below (or above) pre-determined safe values, the auxiliary generator cut in. He accepted this but still wanted to know what protection could be given in situations where there was no auxiliary generator. First he explained what happened in low voltage and two main items seemed to be affected. First, all single-phase motor driven equipment including refrigerators, air conditioners and the like, suffered burn out of their motors resulting in total loss, long delays and high cost. He was concerned particularly about the problems in hospital laboratories where cultures, etc. were used in experiments and medicines kept cool and preserved for treatment. The other problem was minor in comparison, namely the rapid reduction in the life of fluorescent lighting tubes. The cause of failure was the same in both cases, and fluorescent tubes revert to starting conditions when the voltage drops, starting currents are much heavier than full normal running currents and hence burn out results. I made certain suggestions to him on the installation of simple overload current trips.

Electrically, the problem is very simple, all that is required is to insert in the circuit a device which either will cut off the supply when the current exceeds a safe value, or apply to the circuit an under or over voltage relay which will cut off the supply before the current rises dangerously. Three devices are listed below:

A OVERCURRENT TRIPS

1 *Thermal trips*

These consist simply of a bi-metallic strip with heater. They can be given a variety of characteristics from slow to quick operation, automatic or manual resetting. They are marketed as subminiature

circuit breakers at ratings from 0·5 to 5 amps, single hole mounting, dimensions (body) 28L, 19H, 11W (in mm). They cost £2 each and one would be needed for each piece of equipment to be protected.

2 *Thermal/Magnetic trips*

These are largely as above but with added advantages, including more rapid action on dangerous surges and auxiliary terminals for battery operated warning devices such as tell-tale light (showing on or off, or both) audible warning and timing. The medical superintendent insisted he would want to be warned that the equipment had been cut off, and if it occurred at night, for how many hours it had been off. These are rated from 0·5 to 10 amps, they measure L59, H40, W19 (mm) and cost £7 each. Again, one would be needed for each piece of apparatus to be protected. They have manual resetting only.

B UNDER OR OVER VOLTAGE RELAYS

Before describing them, may I point out that serious over-voltage does occur. Again the above medical superintendent told me they had often experienced the 230 voltage rising to 400 and staying there for a day!

These relays are electronic costing approximately £30 each, and are designed to measure the supply voltage and to interrupt the supply under, for example, the following conditions. (i) Trip out of the voltage falls from a normal 240 volts to 170 volts and stay out until it rises again to 185 volts and stays there, or above for a pre-determined safe period of say 2–3 minutes. The circuit would then close. (ii) Trip out of the voltage rises above 285 volts and stay out until the voltage falls to 270 volts or below and then close the circuit after 2 or 3 minutes. (iii) If required, automatic closure can be replaced by manual setting. (iv) Auxiliary contacts can be supplied as in A 2 above. (v) These are rated up to 30 amperes and can protect any number of devices on the same circuit up to the normal rating of 30 amperes. (vi) They come in plastic boxes, roughly $150 \times 90 \times 50$ mm.

So far, these comments have related to single phase AC circuits but 3-phase electron motor protection relays are available. The manufacturer's information sheet states that 'these relays make up a system of overload stalled current and phase failure protection that offer benefits over the conventional bi-metallic (thermal) or solenoid overload devices. These are too complicated for further details here but information is available.

The name of the young man who supplied me with the goods and most of this information is: Mr Derek Huff, Integrated Design Ltd, 201 Fulwell Park Avenue, Twickenham, Middx TW2 5HD. He will, I know, be happy to give any help needed and to supply equipment or name the suppliers as may be required.

73 Delamere Road
Ealing, London W5 3JP

J E RICHARDSON