QUESTIONS ABOUT FUSES

THIS is where I stand up and show my ignorance about fuses, perhaps to the amusement of the more knowledgeable ones. I was most interested to read Mr Connor's article in the January issue because, in my work mainly as a designer of electronic circuits and during my university training, I have not had to learn nor have been taught much about these humble components. I sometimes idly wondered how they behaved apart from the fact that they are likely to fuse

if the rated current is exceeded. I have even been confused enough to believe that transient or anti-surge fuses, which I infer are better described as time-lag fuses, were designed to guard against transients. In future I shall try to remember that the obvious assumption that occurs to me because of the names is the wrong one.

I get the impression that, out of the various types, only a limited range (generally unmarked as to their speed of operation) is available to the general public or amateur constructor, presumably due to lack of demand. Perhaps a little technical advertising on behalf of the manufacturers might stimulate designers like myself to use fuses in less conventional applications, especially if they are now being developed successfully to protect semiconductor devices.

I would like to ask two questions of Mr Connor (or of his obliging expert Mr Newbury of Brush Fusegear) which other readers might also be interested in.

First, can he give me some typical examples of the range of speed characteristics available and how these speeds are defined when considering different types of I/t fusing characteristics?

Secondly, is it safe to use fuses in normally pulsed conditions (e.g. without premature ageing and failure) as long as the average power dissipation ($\propto I^2 t/T$) is below the rated value and the pulse width t is somewhat shorter than the pre-arcing time for current I? I suppose that in this case the speed of operation on a fault current could be limited by either average or pulsed power considerations assuming one effect to be dominant.

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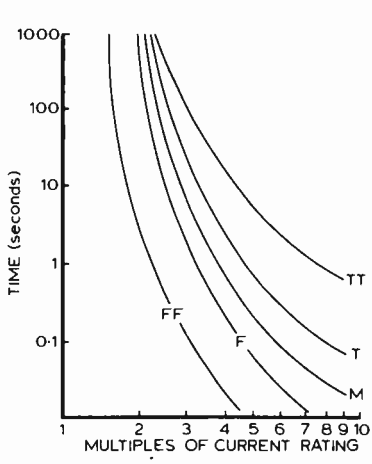
Mr Connor replies:

I would like to thank Mr Cockings for his letter, but would point out that it was not possible in a short article to cover the points he has raised. I assume his questions refer to miniature fuses of current ratings 32mA to 10A. These are covered by British Standard 4265 and IEC Specification No. 127 which give maximum and minimum pre-arcing times for class F and T types only. The accompanying figure, showing operating speeds of miniature fuses, is reproduced from a recent paper by P. G. Newbery and Prof. A. Wright ("Electric fuses," *Proc. IEE*, 124, 11R, Nov. 1977) which gives a review of all types of fuse at present in use and also refers to future developments. It will be seen that there is a wide difference in operating speed between the super-quick acting (FF) and the



super time-lag (TT) fuse. Intermediate speeds are obtained with the other classes which were referred to in the penultimate paragraph of my article. These differences are achieved by specially designed fuse elements and the wide choice in operating speeds should cover the requirements of most users.

Regarding pulsed loading, manufacturers would, I feel sure, be most reluctant to publish withstand curves for their fuses under pulsed loading conditions. I suggest, however, that most industrial and miniature fuses will withstand indefinitely pulses of 75% of the currents for the corresponding times shown on their t/I characteristic curves. For semiconductor fuses this factor may have to be reduced to 50%; manufacturers should be consulted in cases of difficulty.

I entirely agree with Mr Cockings's remarks regarding technical advertising and hope that his letter will provide the stimulus.

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