COMPACT EMERGENCY LUMINAIRES - BEWARE!

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Compact fluorescent lamp luminaires are often crammed with emergency gear in order to provide a low cost emergency lighting solution. This “solution” is often false economy because the elevated temperatures inside the enclosure cause premature battery ageing. The service life of all nickel cadmium cells (including high temperature types) is adversely affected by high temperature. Lead acid batteries will not be discussed because they should not be used in maintained luminaires[1]. This paper provides an insight into the temperature rise in a typical maintained emergency bulkhead luminaire and its predicted effect on battery life.

A compact fluorescent lamp bulkhead with either one or two Osram Dulux S 9 Watt compact fluorescent lamps (with Helvar L11D or L13D ballasts) were used for the tests. The particular bulkhead was chosen because it has a metal reflector onto which the emergency gear can be neatly mounted. The bulkheads were mounted in a draught free environment in both the vertical (against a wall) and horizontal (base up against a ceiling board) positions. The internal temperature was monitored as far away as possible from the ballast.

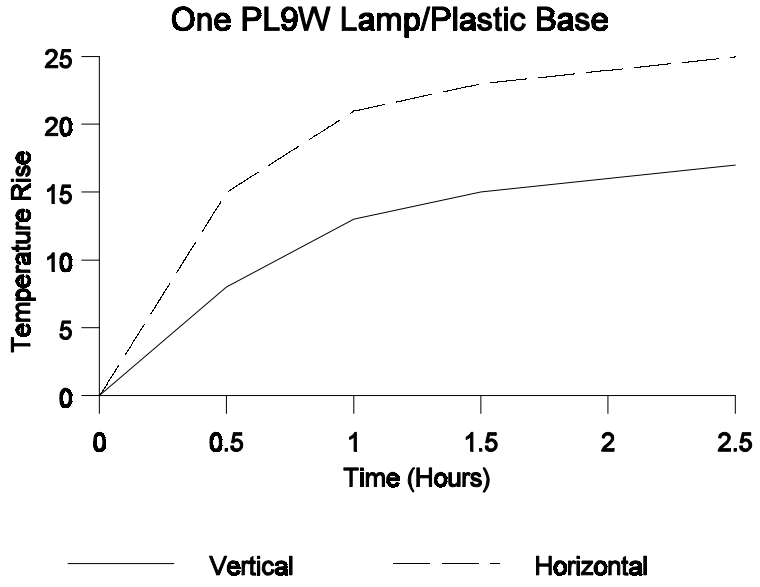

Figure 1

Figure 1 shows the temperature rise inside the bulkhead fitted with a single PL9W lamp. Note the difference between the steady state temperature in the vertical and horizontal positions. This is due to convection currents within the luminaire which suggests that steady state temperature will depend considerably upon where the batteries are positioned within the luminaire. The effects of lens opacity and shape seem to be negligible: a mere 1 ^{0}C improvement was measured by substituting the shallow opal with a deep prismatic lens. This makes sense because only about 19% of lamp input power is converted to light. An improvement of 6 ^{0}C was recorded when the plastic base was substituted with an aluminium one.

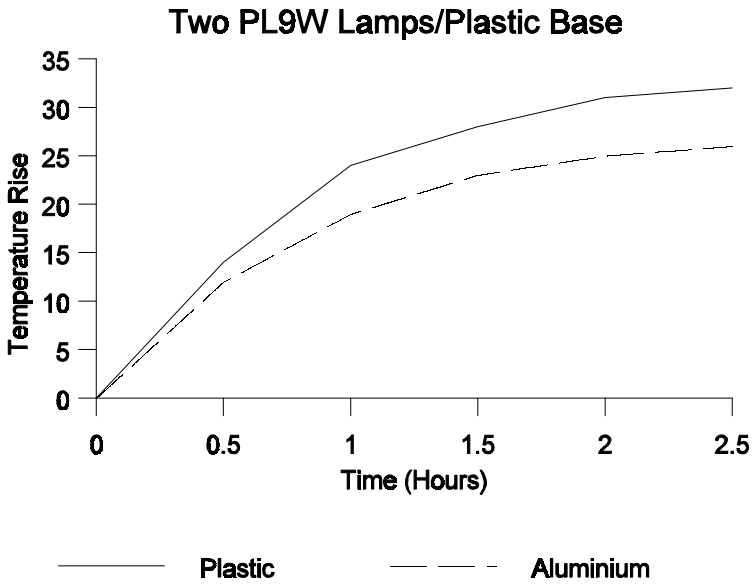

Figure 2

Figure 2 shows the internal temperature rise with two PL9W lamps with the luminaire mounted base up. The difference between the aluminium and plastic bases is again approximately 6 ^{0}C. Note that the temperature inside the luminaire may be greater than 30 ^{0}C above ambient.

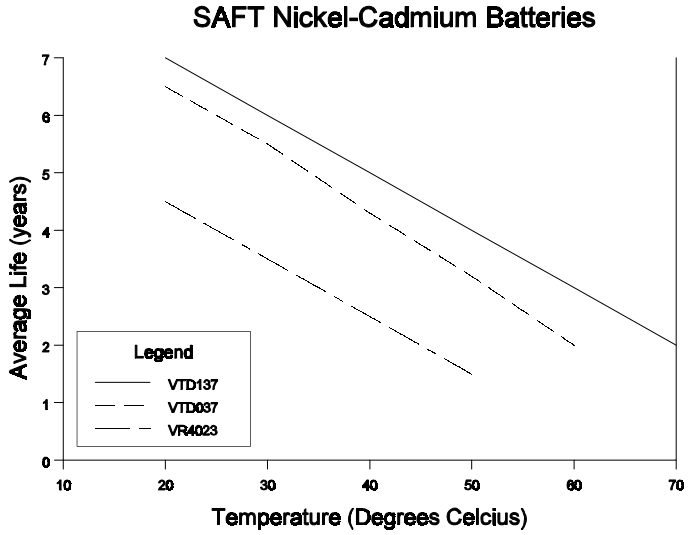

Figure 3: Averaged predicted service life of nickel-cadmium batteries. (Courtesy SAFT)

Figure 3 shows the averaged expected service life of various SAFT^{TM} nickel cadmium cells[2]. Note the large difference in expected life between the various cell types. There is roughly a one year gain in cell life for every 10 ^{0}C reduction in cell temperature. High temperature types are more expensive and are therefore seldom

used in the fiercely competitive emergency lighting market in South Africa. As the effect of temperature on cell life is fairly linear it follows that averaged room temperature can be used to predict cell life in a given emergency luminaire. The 20 year averaged ambient temperature for Durban is 20.8 ^{0}C [3]. The average cell temperature of the sample maintained bulkhead using two PL9W lamps would therefore be approximately 54 ^{0}C (in Durban). Using the manufacturer's data the predicted service life of the VR4 type cell would be about one year, the VTD037 would last 2.5 years and the VTD137 cell would last 3.5 years.

SUMMARY

Unless extensive tests prove to the contrary or if only non-maintained operation is required emergency gear should not be fitted inside compact fluorescent bulkheads. Battery life considerations aside, the resulting crammed emergency luminaire may be dangerous and therefore illegal anyway (contravening SABS/IEC 598-1 or SABS 1464 Part 22). A remote box housing both the batteries and control gear should be used. The cell temperature inside the remote box could therefore be 30 ^{0}C lower and so provide another 3 years of service life.

The bulkhead used in these tests is typical of those converted in emergency units. It should, however, be emphasised that the temperature inside less suitable bulkheads can significantly exceed these measurements. In the author's experience the battery service life inside crammed bulkheads can be limited to a few months. Although compact fluorescent luminaires have been singled out here as culprits the exercise serves to highlight the potential problems with any emergency luminaire.

REFERENCES

[1] "Standby lighting: a state of emergency?" Elektron Journal, June 1998.
[2] SAFT Technical Publication CB AJ 02.97
[3] Durban Weather Bureau