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### Operational lifetime of Helvar Lighting Control Equipment

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#### ***Background***

Operational lifetime is a key design parameter of all Helvar control products. Lighting control operates continuously for 24hours a day, every day of the year and product design must reflect this need. The design target is a minimum projected lifetime of 10 years continuous operation. Field experience has shown this target to be exceeded for all mature product ranges and Helvar is committed to applying this experience to all new product designs.

#### ***Lifetime influences***

Many factors can influence the operational lifetime of a product, but in particular electrical and thermal stresses. Electrical stresses are usually in the form of supply transients or over-voltages. Thermal stress is most common with high operating ambient temperatures. The following guidelines are offered as a guide to the effects of ambient temperature alone. As adverse influences are generally additive the accuracy of the guidelines can not be specified, but are based on field experience of best practice and are offered on that basis only.

#### ***Component stability***

The key weakness of all electronic and electrical components is the chemical stability of the materials used to make them. The operating temperature inherently influences the chemical stability of a material. Deviation outside the optimum range for a material will adversely affect useful lifetime, and a significant deviation can be catastrophic. The influence of temperature is generally logarithmic in nature, which explains the magnitude of possible effects with relatively modest deviations.

#### ***Electronic components***

Many manufacturers of electronic components offer a guaranteed minimum working life of only 2000hours or around 83days continuous operation at specification limits and generally will not guarantee the stability of published component parameters beyond 70,000hours or around 8years shelf life. The design process has to understand the ageing process and how the component parameters may change with time and build into the design appropriate operating tolerances. Here the value of field experience to validating design parameters is clearly demonstrated.

#### ***Product operating temperature***

The specified ambient working temperature range defines the range over which the full specification of the product is available. Operation outside this range may restrict the specification and this must be considered in any application. A specific example is that of dimmers. All Helvar dimmers incorporate thermal protection, generally in the form of load reduction (by dimming) to achieve the best load output whilst maintaining all control devices within their safe operating temperature regions. This can mean that operation above the specified maximum ambient will result in reduced load handling.

#### ***Lifetime projection***

From best practice calculations the projected operational lifetime of the equipment can be shown graphically by a lifetime multiplier chart. The chart gives a unity multiplier when the equipment is operated at its specified maximum ambient temperature.

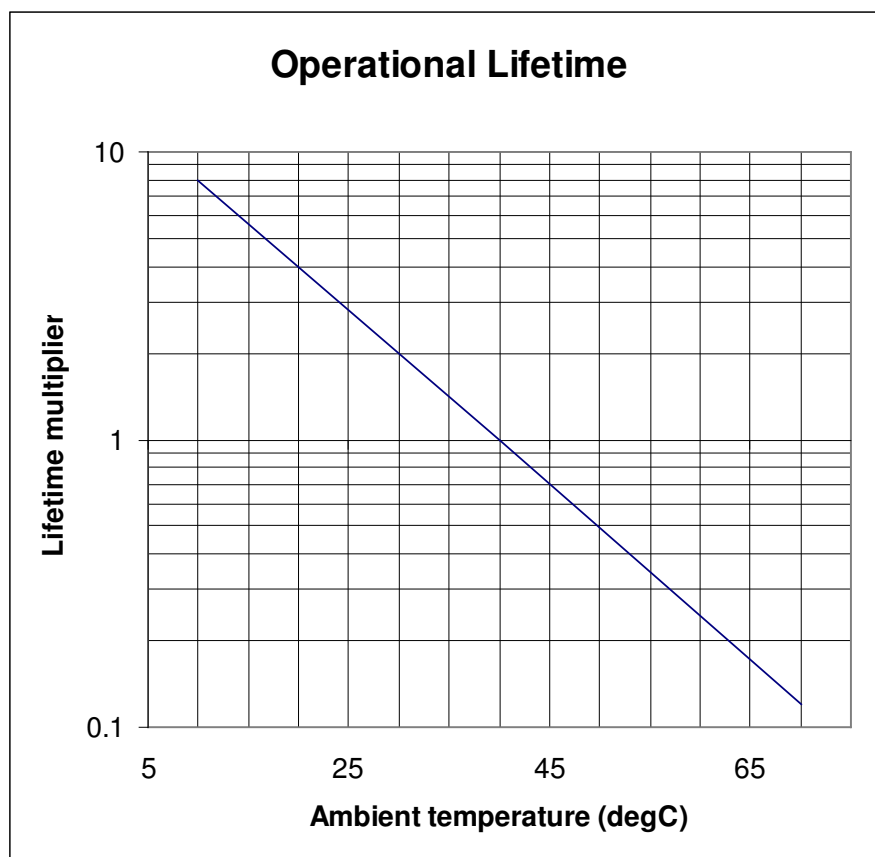


Fig. 1: Operational lifetime plotted against ambient temperature for a product specified to 40degC

### **Example use of the chart**

The normalised operational lifetime is 10years. For a product specified to 40degC ambient operated at 40degC we refer to the limit value which shows the unity multiplier to the normalised lifetime. Operating the same product at 15degC above the specification limit shows an expected multiplier of 0.35, which is 3.5years service.

In this example it is assumed the elevated operating temperature is constant. In practice temperature swings are common and this will influence lifetime calculations.