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1. Introduction

For compliance with the requirements of the luminaire standard IEC/EN 60598, no part of the luminaire shall attain a temperature which would impair safety when the luminaire is operated at its rated ambient temperature t_a.

For the controlgear the temperature limit is defined as the rated maximum temperature of the case of the controlgear (t_c) measured at the given reference point marked by the device manufacturer.

This technical information explains

_ the meaning of the t_a and t_c temperature

_ when and how to use t_a and t_c

_ the relevance of t_a and t_c for the thermal performance and lifetime of the controlgear

2. Definitions for t_a and t_c

Rated maximum ambient temperature t_a:

The controlgear standard IEC/EN 61347 contains no definition of t_a and its measurement for luminaire inbuilt controlgear.
For independent controlgear the luminaire standard applies.
The luminaire standard requires the marking of the rated maximum ambient temperature t_a, if other than 25 °C.

Rated maximum case temperature t_c:

The definition according to the lamp controlgear standard IEC/EN 61347 is:
"highest permissible temperature which may occur on the outer surface (at the indicated place, if marked) under normal conditions and at the rated voltage or the maximum of the rated voltage range"

3. Difference between t_a and t_c

_ t_a = ambient temperature:
The temperature range of the air surrounding the electronic controlgear declared by the manufacturer.

_ t_c= case temperature:
The temperature of a reference point on thecontrolgear housing.

4. Importance of t_a and t_c

The ambient temperature t_a has direct influence on the lifetime of electronic components.
If the ambient temperature t_a is too high, the device cannot emit enough heat to the environment. This can result in so-called hotspots (points where the temperature concentrates). Hotspots in the air close to the components can lead to premature aging and failure of the devices.

The lifetime of a controlgear is based on its ambient temperature.
The case temperature t_c is the highest permissible temperature which may occur at the t_c point on the controlgear housing for safe operation.

5. Need for two different temperature values

The ambient temperature t_a of a controlgear inside a luminaire is very difficult to measure. The measurement of the t_c temperature is easier and more reliable.

As part of the design process, Tridonic conducts measurements for both t_a and t_c and makes sure that both measurements meet the highest requirements. Having a reliable result for t_c and t_a, it is possible to provide exact correlations between these two parameters in the product datasheet.

This allows the luminaire manufacturer to determine the expected lifetime of the controlgear based on the t_c temperature which is easier to measure.

6. Position of the t_c point

Typically, the t_c point is placed directly above temperature and lifetime critical components (e.g. capacitor, coil, etc.). But there is no binding rule for that. The t_c point is defined by the manufacturer and can be freely chosen. Due to this fact, the t_c temperature is not suitable to compare different controlgear in terms of their thermal performance.

7. Practical use of t_a and t_c

For comparison of different controlgear and to get reliable information about their lifetime, the ambient temperature t_a has to be taken into consideration.

The t_c temperature is highly dependent on the exact position of the t_c point and since the manufacturer can define this position, it makes no sense to compare the t_c temperatures from different manufacturers.
A lower or higher t_c temperature does not guarantee a better quality or longer lifetime. It could be the result of different manufacturers using different, more or less favourable t_c points.

Additionally, controlgear from the same manufacturer can have different t_c temperatures but the same t_a temperature. Also in that case the t_a temperature is relevant for the lifetime.

Only the t_a temperature can provide reliable information about the lifetime of a controlgear.

8. Practical examples for t_a and t_c temperatures and their calculation

The following table shows two different Tridonic devices.
Although the t_c temperatures are different (55 °C and 60 °C), the t_a temperatures (40 °C) and the lifetime (50.000 hours) are the same.

Expected life-time:

Type	t_a	40 °C	50 °C	60 °
LED Driver type 1	t_c	55 °C	65 °C	x
	Life-time	50,000 h	30,000 h	x
LED Driver type 2	t_c	60 °C	70 °C	x
	Life-time	50,000 h	30,000 h	x

The LED Driver type 1 has the following data for 50,000 hours lifetime:

_ t_a: 40 °C
_ t_c: 55 °C

In the following example the LED Driver type 1 is compared to a device from a different manufacturer which uses a different wording (see following table).

Operational temperature:

Specification item	Value	Unit	Condition
T_a-max	50	°C	
T_c-max	90	°C	Maximum temperature measured at T_c-point
T_c-life	80	°C	Measured at T_c-point
Driver lifetime	50,000	h	Measured temperature at T_c-point is T_c-life

The information says:

_ t_a (max): +50 °C
_ t_c (max): +90 °C

But the t_c temperature for a lifetime of 50,000 hours is 80 °C which means that for this lifetime the t_a is not 50 °C but 40 °C.

This means that the comparable values for a lifetime of 50,000 hours are:

_ t_a: +40 °C
_ t_c: +80 °C

The result shows that the two controlgear types (LED Driver type 1 from Tridonic and the LED Driver from another manufacturer) have different t_c temperatures (80 °C and 55 °C) but the t_a temperature (40 °C) and the lifetime (50.000 h) is the same.

So in this case both have the same thermal performance.