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Introduction

NOTICE

The measuring methods described here, are only applicable if Tridonic batteries or accupacks are used in combination with Tridonic emergency lighting LED Drivers.
They do not replace the measurements of the IEC 60598-2-22.

The batteries or accupacks of self-contained emergency luminaires are thermically critical components.

Excessive heat causes batteries and accupacks to age faster. As a result, they do not reach the specified lifetime.
In order to protect batteries and accupacks from heat, during the luminaire design their temperature must be monitored and reduced if the specified values are exceeded.

Thermal measurement of batteries and accupacks includes the following steps:

1. Determine a suitable temperature measuring point
2. Measure the temperature at this measuring point
3. Compare the results with the permitted maximum values given in the emergency LED Driver data sheet for the corresponding battery
4. If the permitted values are exceeded:
    a. Take measures to reduce the temperature
    b. Repeat steps 1-4

Determine a measuring point

Determining the measuring point differs for batteries and accupacks.

2.1. Determine a measuring point for batteries

- Place all components inside the luminaire.
- Wire all components according to the wiring diagram (see respective data sheet).
- Connect mains.
- Check after 2-3 hours with a thermal camera where the hottest spot of the battery is.
  -> This hottest spot is determined as the measuring point for the battery
- Disconnect the mains and battery.

2.2. Determine a measuring point for accupacks

The measuring point for an accupack is given by the t_c point. A marking on the label shows the exact position of the t_c point.

Different charging methods

3.1. Constant current charge (CC)

The battery/accupack is charged continuously with the same current as long as mains is connected.

3.2. Multi-level constant current charge (MLCC)

The battery/accupack is charged with three different current ratings.

- Initial Charge: The Initial Charge takes place when mains is connected for the first time to charge the battery to 100 percent.
- Fast Charge: After a discharge event the battery will be charged by a high Fast Charge current for 15 hours.
- Trickle Charge: After both initial charge and Fast Charge the device switches to Trickle Charge to maintain the state of charge. With the lower current of Trickle Charge the heating of the battery is more moderate.

3.3. Intermittent charge (IC)

Intermittent charge uses the same three current settings as multi-level constant current charge. The difference to multi-level constant current charge is that in Trickle Charge the current is pulsed.

3.4. Voltage dependent constant current charge (VDCC)

Voltage dependent charging measures the voltage level and switches the charging on and off depending on whether or not a certain charge state is reached. With this, the charging time can be minimised which makes time-based charging the most energy efficient charging method. Unlike MLCC and IC there are no different charging modes. The two possible states are charging and not charging.

In the beginning, when batteries are connected, they are charged until the nominal voltage (3.6 V) is reached. Then the charging stops. Because of self-discharge, batteries will slowly lose voltage if they are not charged. If the voltage falls beneath a certain level (depending on the manufacturer between 3.2 and 3.5 V), the charging starts again. This process repeats itself.

Voltage dependent charging is only suitable for $LiFePO_4$ batteries. $LiFePO_4$ batteries from TRIDONIC have an inbuilt protection against overcharging to ensure safe operation.

Measure the temperature

The temperature measurement is identical for batteries and accupacks but differs for different charging methods of the emergency lighting LED driver.

4.1. Measure the temperature for constant current charge

- Make sure that all components are wired according to the wiring diagram (see respective data sheet).
- Place the thermocouple on the measuring point of the battery/accupack.
- Measure the temperature after min. 24 hours charge when the battery reaches a stable temperature.

4.2. Measure the temperature for multi level charge

- Make sure that all components are wired according to the wiring diagram (see respective data sheet).
- Place the thermocouple on the measuring point of the battery/accupack.
- Charge min. 24 hours (Initial Charge).
- Discharge the battery until the emergency lighting LED Driver switches off.
- Recharge the battery (Fast Charge).
- Measure the temperature continuously during Fast Charge until it drops (emergency lighting LED Driver switches to Trickle Charge).
- Operate the emergency lighting LED Driver in Trickle Charge mode until the temperature stabilises.

4.3. Measure the temperature for intermittent charge

- Make sure that all components are wired according to the wiring diagram (see respective data sheet).
- Place the thermocouple on the measuring point of the battery/accupack.
- Charge min. 24 hours (Initial Charge).
- Discharge the battery until the emergency lighting LED Driver switches off.
- Recharge the battery (Fast Charge).
- Measure the temperature continuously during Fast Charge until it drops (emergency lighting LED Driver switches to Trickle Charge).
- Operate the emergency lighting LED Driver in Trickle Charge mode for a few hours.
- Afterwards measure the temperature of the battery for one hour and calculate the average.

Measure the temperature

4.4. Measure the temperature for Voltage dependent constant current charge

- Make sure that all components are wired according to the wiring diagram (see respective data sheet).
- Place the thermocouple on the measuring point of the battery/accupack.
- Charge min. 24 hours.
- Measure the temperature when the battery reaches a stable temperature.

Compare measuring results with permitted values

5.1. Compare measuring results for constant current charge

- The average temperature in constant current charge has to be within the limits of the max. battery casing temperature stated in the emergency lighting LED Driver data sheet.

5.2. Compare measuring results for multi level charge

- The average temperature in Trickle Charge has to be within the limits of the max. battery casing temperature stated in the emergency lighting LED Driver data sheet.
- The maximum temperature which occurred during the Fast Charge measurement has to be within the limits of the max. short term temperature stated in the emergency lighting LED Driver data sheet.

5.3. Compare measuring results for intermittent charge

- The average temperature in Trickle Charge has to be within the limits of the max. battery casing temperature stated in the emergency lighting LED Driver data sheet.
- The maximum temperature which occurred during the Fast Charge measurement has to be within the limits of the max. short term temperature stated in the emergency lighting LED Driver data sheet.

5.4. Compare measuring results for Voltage dependent constant current charge

- The average temperature in constant current charge has to be within the limits of the max. battery casing temperature stated in the emergency lighting LED Driver data sheet.

Measures to reduce the temperature

- If the measured temperatures are within the given limits, no further steps are needed.
- If the measured temperatures exceed the limits stated in the emergency lighting LED Driver data sheet, measures to reduce the temperature have to be taken.

The measures to reduce the temperature differ for batteries and accupacks.

6.1. Reduce the temperature by changing the position of batteries

- Change the position of the battery within the luminaire.
- Make sure that the battery is as far away from any heat radiating components as possible. The most critical components for heat radiation are LED Driver, LED and emergency LED Driver.
- Repeat all the steps from above.

6.2. Reduce the temperature by changing the position of accupacks

Accupacks are designed to be placed outside of a luminaire. Therefore, there is no possibility of reducing the temperature by changing the position of the accupack.

6.3. More advanced measures to reduce the temperature

If the above measures do not effectively reduce the temperature of the batteries, more advanced measures have to be taken.

- Check if changing the device from one with constant current charge to another one with a more advanced charging method (multi-level charge or intermittent charge) will reduce the temperature of the batteries.
- Check if it is possible to use a different battery type, e.g. changing from NiMH to NiCd.