

# Temperature compensation, TORHEL 900



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## Temperature compensation when testing battery banks

A battery's capacity is dependent on the ambient temperature. If the ambient temperature is high the capacity increase, but it will at the same time shorten the battery life. In the opposite direction, when ambient temperature is low, the capacity of the battery is reduced. This must be considered when performing a capacity test.

Nominal temperature for battery specifications is normally 20°C/68F or 25°C/77F. In order to compare the test result from a discharge test with the battery specification, the temperature must be considered. There are international standards that describe the temperature compensation procedure, IEEE 1188 (VRLA), IEEE 450 (vented) and IEC 60896-11/21(vented/VRLA).

TORHEL 900 has implemented all these temperature compensation methods according to the standards.

To enable the temperature compensation, press the  button. Select "Settings" and set to ON for temperature compensation. The  button comes up where temperature can be set, and IEEE or IEC standard can be selected.

## 1. IEEE 450 and IEEE 1188

### Tests longer than 1 hour

The most commonly used temperature compensation method in these international standards is to apply the temperature correction to the capacity calculation after completion of the test.

$$C = (t_a / t_s \times K_t) \times 100$$

Where

C is the % capacity at 25°C

t<sub>a</sub> is the actual time of test to specified terminal or cell/unit voltage


t<sub>s</sub> is the rated time to specified terminal or cell/unit voltage

K<sub>t</sub> is the correction factor for the cell temperature before the start of the test


Simply run the test at rated current and time. When the desired voltage level has been reached the test is stopped. The temperature compensation is then performed according to the calculation above and the % Capacity is calculated.


In an earlier version of the IEEE standards there was a possibility to perform the temperature compensation prior to the test by adjusting the test time. This method is still valid and can be used.

## Temperature compensation after performed discharge test.


Start the test as a normal without temperature compensation\*. When the test is completed, press the  button and save the test.

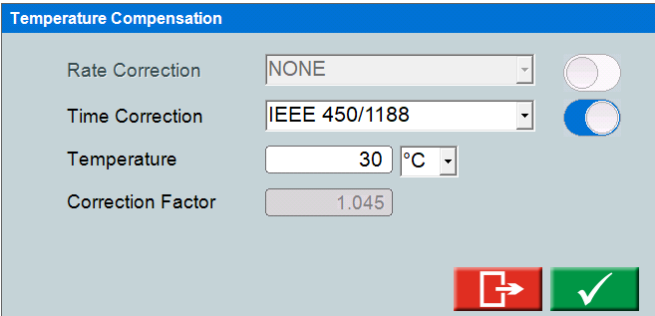
Enter "Rated time" and "Rated capacity".

At the "RESULT" tab, press the  button, enable the temp compensation. Enter the temperature. When returning to the "RESULT" tab, the "%Capacity" value is calculated.

\* Temperature compensation function should be enabled (  button available), but any temperature compensation should be disabled.

## Temperature compensation before start of discharge test

Click on the  button. Below menu comes up.



Enable "Time correction". And set temperature.

When rated time is set on the start menu, compensated time is calculated for the specified temperature. The "Rated Capacity" on the "RESULT" tab shall also be set. The "%Capacity" are then calculated.


## Tests shorter than 1 hour

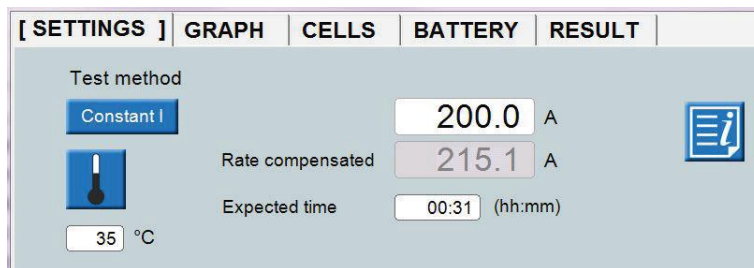
For these tests a different method is used, current rate compensation which is made prior to the test. The discharge current for the test will then be compensated relative to the nominal rate. If the temperature is higher than 25°C, the current discharge rate is increased. If lower than 25°C, the current discharge rate is decreased.

$$\% \text{ capacity at } 25 \text{ }^{\circ}\text{C} = X_a \times K_c / X_t \times 100$$

where

- X<sub>a</sub> actual rate for the used test
- X<sub>t</sub> published rating for time t
- t time of test to specified terminal voltage
- K<sub>c</sub> temperature correction factor

Click on the  button to open up the “Temperature Compensation” menu. Slide the switch for “Rate Correction” IEEE 450/1188. And set the temperature.



In the above example the rated current 200A now get's 215,1A for 35°C ( 95°F ). When the test has been started, the current discharge will now be 215,1A.

## 2. IEC 60896-11/21

In this international standard the temperature compensation is performed prior to the test. The measured capacity shall be corrected by means of the following equation to obtain the actual capacity  $C_a$  at the reference temperature 20°C.

$$C_a (20^{\circ}\text{C}) = C / [ 1 + \lambda (\Theta - 20) ] \text{ in Ah}$$

The coefficient  $\lambda$  is 0,006 for discharge tests that are 3 hours or longer. For tests shorter than 3 hours  $\lambda$  is 0,01.

When setting the rated time and the temperature, a compensated test time is calculated. This is how long the test shall proceed in order to be able to compare the tested capacity to the rated capacity.


If the test reaches the compensated time before reaching the voltage limit, the test shows that the battery has 100% capacity or higher. If the test reaches the voltage limit before reaching the compensated time, the test shows that the battery has lower than 100% capacity.

In the IEC standard there is no current rate compensation and no possibility to compensate after the test.

## Temperature compensation TORKEL 900

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Click on the  button to open up the “Temperature Compensation” menu. Slide the switch for “Time Correction” IEC 60896/11/21. Set the temperature. Start the test from the “SETTING” tab.

**Temperature Compensation**

Rate Correction	<input type="text" value="NONE"/>	<input type="checkbox"/>
Time Correction	<input type="text" value="IEC 60896-11/21"/>	<input checked="" type="checkbox"/>
Temperature	<input type="text" value="30"/> °C	
Correction Factor	<input type="text" value="1.100"/>	