



# PPC Tool v2: more sizing & selection functions for OEM & application engineers

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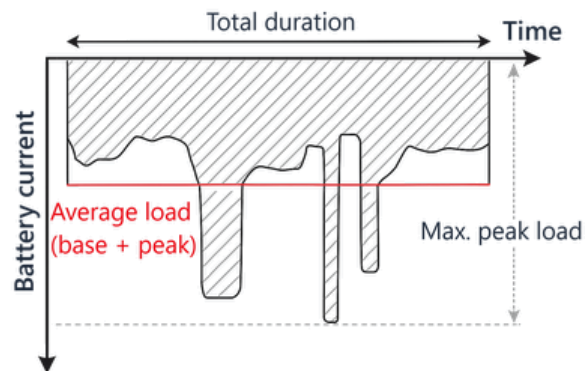
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- Battery sizing tool based on PPC requirements of IEC 60095-8
  - Linearized model based on global fit for one 35 Ah AGM battery
  - Scaled to a battery that just meets the IEC requirements
  - Typical batteries with specified  $I_{cc}$  current will match the tool results
- Improvements in v2
  - New default views for begin-of-life and end-of-life comparison
  - Input of generalized, more complex profiles via equivalent one-step profile
  - Extension to shorter and longer pulse durations
  - Rewrite with reactive framework for improved interactivity and user experience (immediate input validation and update of graphs)

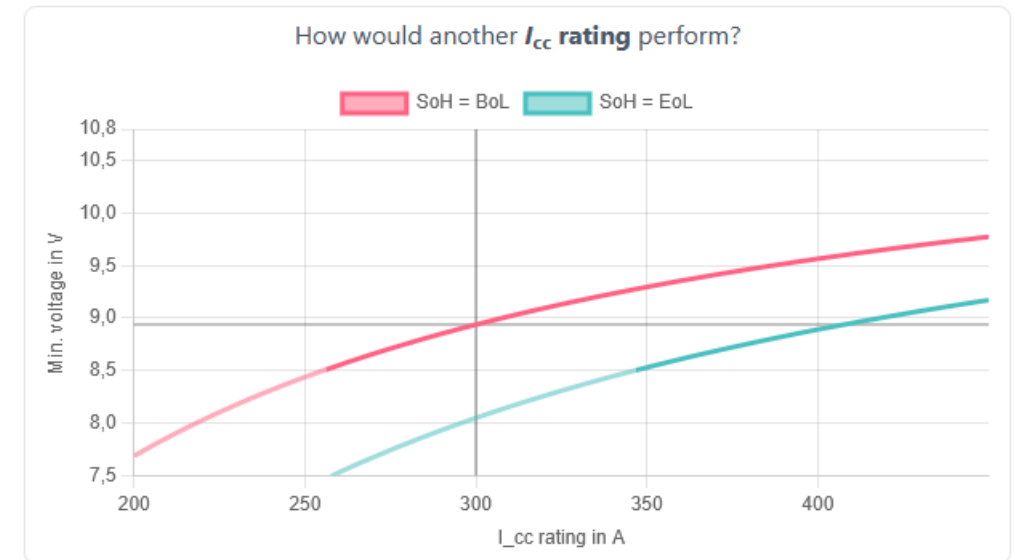


Temperature in °C  
-50  
Must be -40...40

## Result

With the given parameters, the battery would sustain a minimum voltage of  $U_{min} \approx 8.94 \text{ V}$  (good accuracy).

Select diagram type: BoL/EoL diagrams



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- Case  $U_{\min}$ : Voltage that the battery can sustain

## Load scenario

|                                 |                                 |                                  |
|---------------------------------|---------------------------------|----------------------------------|
| Total duration in s             | Avg. current in A               | Max. current in A                |
| <input type="text" value="30"/> | <input type="text" value="40"/> | <input type="text" value="150"/> |
| 1...120 s                       | 1...500 A                       | 15...1000 A                      |

Equivalent profile:  $I_{\max} = 150 \text{ A}$  for  $t_{\text{eff}} = 8.00 \text{ s} \rightarrow U_{\min,5\text{s}} = 9.00 \text{ V}$ ,  $U_{\min,8.00\text{s}} = 8.94 \text{ V}$

## Battery condition

|                                  |                                            |                                  |                                 |
|----------------------------------|--------------------------------------------|----------------------------------|---------------------------------|
| $I_{\text{cc}}$ rating in A      | Ageing condition                           | Temperature in °C                | State of Charge in %Cn          |
| <input type="text" value="300"/> | <input type="text" value="Begin of Life"/> | <input type="text" value="-25"/> | <input type="text" value="80"/> |
| 100...1000 A                     | BoL / EoL                                  | -40...40 °C                      | 30...100 %Cn                    |

- Equivalent one-step profile is calculated
  - Load throughput calculated based on total duration and avg. current
  - Max. current for a duration leading to same load throughput
  - Min. voltage adjusted by fitted voltage slope for this working point
  - Output of equivalent representation for development version only

- Case  $I_{\text{cc}}$ : Rating for a specified load profile

## Load scenario

|                                 |                                 |                                  |                                  |
|---------------------------------|---------------------------------|----------------------------------|----------------------------------|
| Total duration in s             | Avg. current in A               | Min. voltage in V                | Max. current in A                |
| <input type="text" value="15"/> | <input type="text" value="50"/> | <input type="text" value="8.5"/> | <input type="text" value="200"/> |
| 1...120 s                       | 1...500 A                       | 7.5...10.8 V                     | 15...1000 A                      |

Equivalent profile:  $I_{\max} = 200 \text{ A}$  for  $t_{\text{eff}} = 3.75 \text{ s} \rightarrow U_{\min,5\text{s}} = 8.50 \text{ V}$ ,  $U_{\min,3.75\text{s}} = 8.46 \text{ V}$

## Battery condition

|                                            |                                  |                                 |
|--------------------------------------------|----------------------------------|---------------------------------|
| Ageing condition                           | Temperature in °C                | State of Charge in %Cn          |
| <input type="text" value="Begin of Life"/> | <input type="text" value="-18"/> | <input type="text" value="70"/> |
| BoL / EoL                                  | -40...40 °C                      | 30...100 %Cn                    |

- Adjusted inputs for each use case
  - Ageing condition still relevant for numeric result output or v1 style plots
  - Input for case  $I_{\max}$  will follow soon
- Feedback to usability and possible improvements welcome!