Ongoing development
2nd gen. samples

High Voltage Breaker - HVB10

HV protection and switching device

Performance data at a glance



HYPOTHESIS

- The e-trucks of the near future will be able to charge so quickly that the mandatory 30-minute break for the driver will be enough to continue driving for the next 4.5 hours
- To achieve this high charging capacity, the battery pack or battery junction box is equipped with a powerful air conditioning system to cool the switchgear
- One of the biggest challenges of this high-power charging is Thermal Control. The HVB10 design is built to manage heat dissipation better than any other contactor

CORE SPECIFICATION

- Two HV main contacts (NO) that switch simultaneously
- Rated voltage 850 V
- Continuous current approx. 340 A
- Sustained maximum charging current of 650A for at least 18 minutes
- Breaking capacity at least 24 kA
- Bidirectional - No preferred direction
- Mech. Lifetime 500,000 operations
- Electromechanical overcurrent protection (no electronic sensor, microcontroller or software needed) that also works without LV supply voltage
- Condition monitoring via mirror contact
  1 kOhm = open
  11 kOhm = closed
  > 12 kOhm = probably broken wire
- Protection class tbd (Protected against external environmental influences by the battery housing)
- Installation space
  approx. (172 x 75 x 126) mm
- Weight approx. 2 kg
- Insulation coordination (according to IEC60664-1 (pollution degree 2, insulation material group 1):
  Air gap > 11.25 mm
  Creepage distance > 10.00 mm

YOUR BENEFITS

- **Increased uptime**, as the HVB10 circuit breaker can be switched on again. If a pyrofuse is accidentally triggered, the vehicle will no longer drive anywhere!
- Less complexity means more efficiency. The **HVB10's all-in-one design** combines switching and protection, replacing more than 10 components in every HV battery pack
- The HVB10's electromechanical overcurrent and short-circuit protection qualifies as a reliable **"other technology" according to ISO 26262**
- **Space-saving at system level** if all replaced components are taken into account
- **Optimum protection,** a gap between HV contactor and fuse is not possible
- **Very fast and safe switch-off** in the event of a short circuit without pyrotechnics

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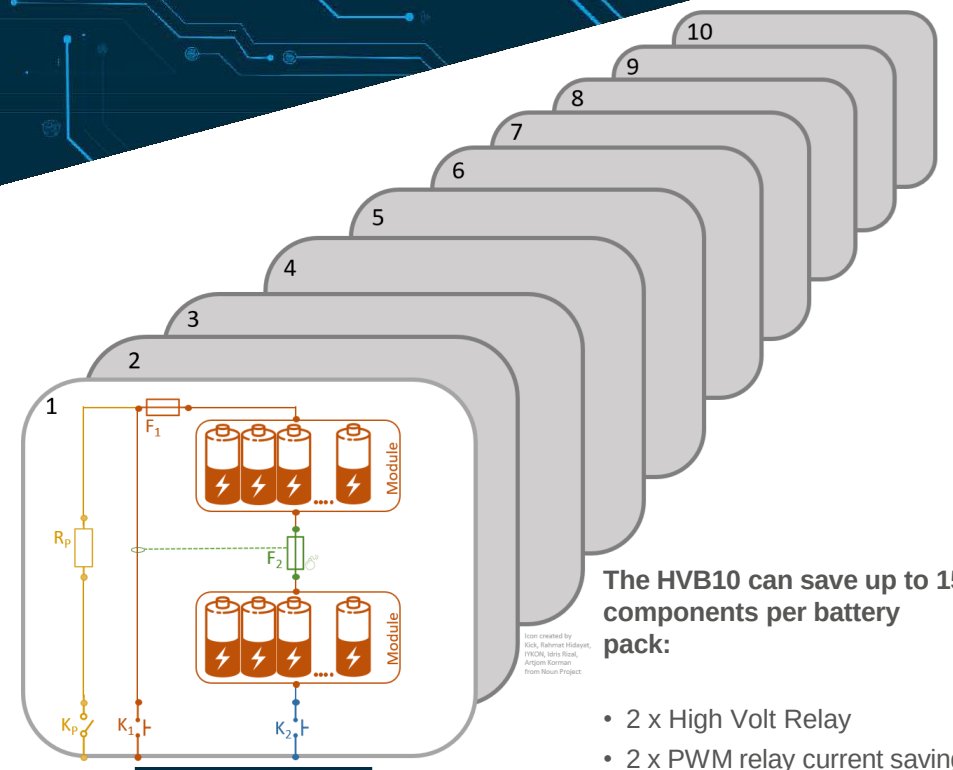
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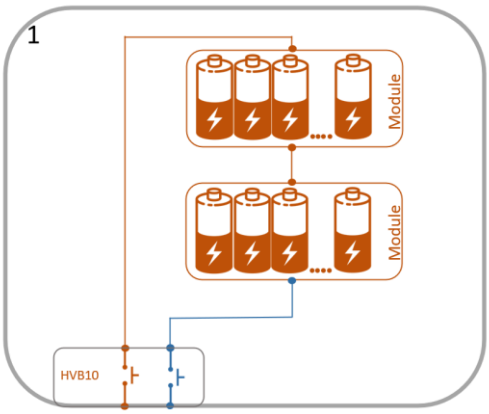
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On-board network architectures in comparison



The HVB10
Replaces up to
15 components
Per battery pack



The HVB10 can save up to 15 components per battery pack:

- 2 x High Volt Relay
- 2 x PWM relay current saving modules
- 1 x Fuse
- 1 x Pyrofuse
- 2 x control lines (relay and pyrofuse)
- 2 x HV busbars
- 5 x connections between individual components

For a long-haul truck with 9 battery packs**, 135 components can be replaced by 9** HVB10s.

If the vehicle is precharged with a **DC/DC converter** (24V to 850V), another **18 components** can be **saved**. One precharging relay and resistor per battery.

FUNCTION

- **Pre-charging** should be done **with a** DC/DC converter **outside the battery**, because plus and minus are separated at the same time
- The two simultaneously switching poles **together** handle **850 V and** require less installation space for this
- Both switching chambers are switched by **one drive**
- When switched off, the HVB10 galvanically **isolates** the **PLUS and MINUS** poles **simultaneously**
- **Switching position of** the contacts can be evaluated by means of a **mirror contact**

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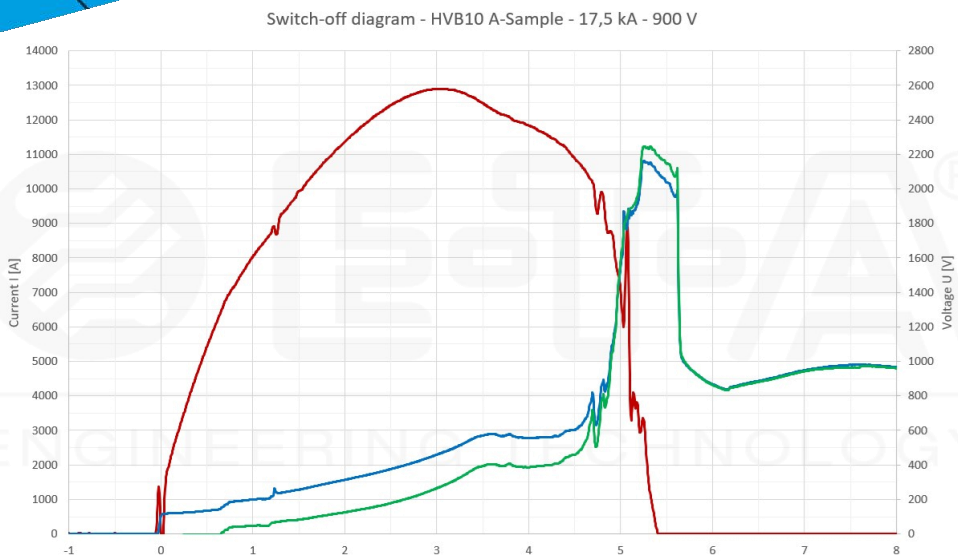
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High Voltage Breaker - HVB10

HV protection and switching device

Short circuit switching tests 1st gen. sample



TEST PARAMETERS

- DUT is a 1st gen. HVB10 sample
- Open circuit voltage 918 V
- Prospective load current 17.5 kA
- Tau 1,44 ms
- Max current 12.9 kA
- Max arc voltage 2.24 kV
- Switch off time 5.45 ms
- I^2t 556326 A^2s

- Current [A]
- Source [V]
- Arc [V]



One of the 4 splitting blade packs used in the HVB10.

The HVB10 uses a well-proven method to extinguish the arc. As early as 1907, a patent described how a counter voltage is generated by splitting the arc. If the arc is divided several times at the same time, the chained counter voltage increases. As soon as the chained counter-voltage is higher than the driving voltage of the battery, the arc is extinguished.

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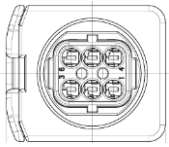
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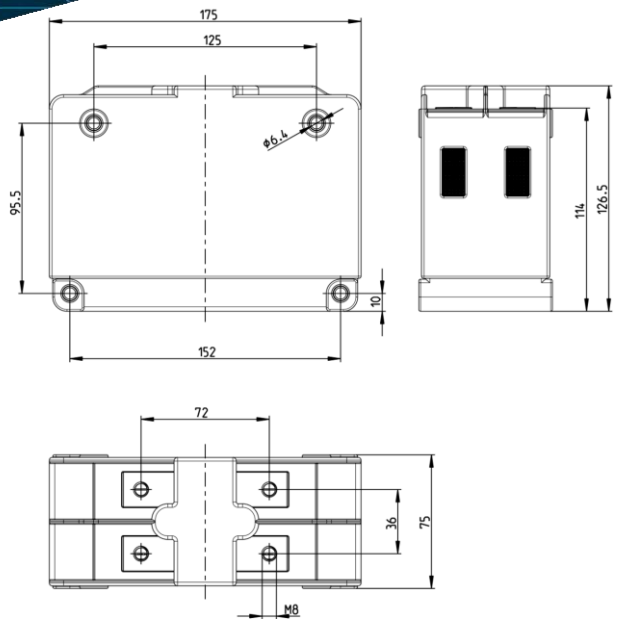
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Dimension drawing



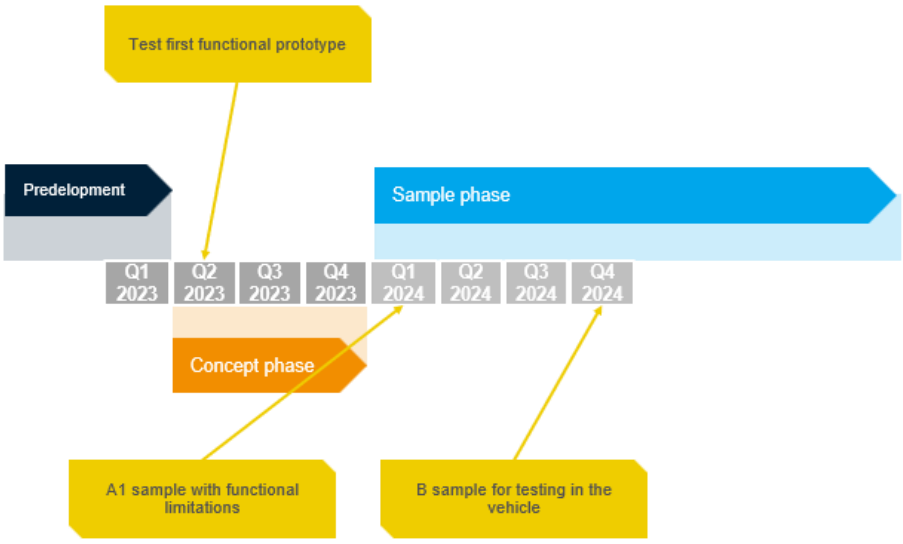


TEST PARAMETERS

- Compression limiters allow fastening by means of threaded bolts.
- A TE HDSCS connector is used for the control line.

Schedule

- **B samples**
  (functional limitations compared to series product).
- Available from Q4 2024



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