High-Voltage Contactors
Gas-Filled Contactor for High-Voltage DC Disconnection Applications

The HVC series by TDK has been designed to meet the requirements of high voltage DC disconnection applications. The hermetically sealed design based on our gas filled technology experience exhibits excellent reliability in harsh environments. The HVC series are made for fast and reliable switchings.

Features
- Up to 1200 V DC
- Up to 500 A DC
- Up to one million nominal switching cycles
- Unipolar and bipolar design
- UL, CE, CCC
- Contactless stuck detection available

Applications
- DC fast charging stations
- Battery disconnect units and battery junction boxes in electrical vehicles
- Energy storage systems
High-Voltage Contactors for High-Voltage DC Disconnection

Operating principle

The HVC series are specially designed to disconnect DC circuits. A major challenge is the electric arc occurring between the stationary contacts and the moveable contact bridge, whenever the contacts separate. An uncontrolled electric arc would burn the contacts. This would lead to a decrease of life-time or in worst case to the contacts being stucked. Especially at high voltages extinguishing the arc needs to be taken care by design. Our decade-long experiences with electric arc, gas and ceramic made it easy for us to address the challenge.

HVC series features two magnets along the side of the stationary contacts and the contactors bridge, letting the arc run along the side to move it away from the contact points to avoid direct contact and therewith higher abrasion. In addition, the arc must cover a longer distance and over the distance the arc looses energy, which supports extinguishing.

Contact arrangement

Example circuit

Form “A” NO, SPST
NO: Normally open
SPST: Single pole, single throw
# High Voltage Contactors for High-Voltage DC Disconnection

## Single coil

**Diagram:**

- A1
- A2
- Coil (+)
- Coil (-)

**Single coil**

- No coil inrush during switch-on
- Only 6 W energy consumption
- Bipolar design without any preferred polarity of the main contact
- No economizer required
- Coil termination included

## Bipolar design

**Diagram:**

- RA30494-V
- RA30495-W

- The polarity of the HVC series can be reversed.

## Dual coil

**Diagram:**

- A1
- A2
- Coil (+)
- Coil (-)

**Dual coil**

- Dual coil design for highest switch-on performance and highest inrush capability
- 3000 times switch-on and off of 300 A at 450 V (unipolar design)
- 1000 times switch-on and off of 300 A at 750 V
- Only 4 W energy consumption in steady state after start-up phase
- Coil termination included
- Available as unipolar (E) and bipolar (E2) design
# High-Voltage Contactors for High-Voltage DC Disconnection

## Specification single coil version

<table>
<thead>
<tr>
<th></th>
<th>Type</th>
<th>HVC200A</th>
<th>HVC300A</th>
<th>HVC500B</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Contact</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. operating current</td>
<td></td>
<td>200 A</td>
<td>300 A</td>
<td>500 A</td>
</tr>
<tr>
<td>Max. operating voltage</td>
<td>1000 V</td>
<td>1000 V</td>
<td>1000 V</td>
<td></td>
</tr>
<tr>
<td>Contact resistance (typ.)</td>
<td>0.125 mΩ</td>
<td>0.125 mΩ</td>
<td>0.125 mΩ</td>
<td></td>
</tr>
<tr>
<td>Contact resistance (max.)</td>
<td>0.25 mΩ</td>
<td>0.25 mΩ</td>
<td>0.25 mΩ</td>
<td></td>
</tr>
<tr>
<td><strong>Coil</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Coil voltage</td>
<td></td>
<td>12 V</td>
<td>24 V</td>
<td>12 V</td>
</tr>
<tr>
<td>Coil voltage range</td>
<td>9 ... 16 V</td>
<td>18 ... 32 V</td>
<td>9 ... 16 V</td>
<td>18 ... 32 V</td>
</tr>
<tr>
<td>Coil pick-up voltage range (max.)</td>
<td>9 V</td>
<td>18 V</td>
<td>9 V</td>
<td>18 V</td>
</tr>
<tr>
<td>Coil drop-out voltage range (min.)</td>
<td>1 V</td>
<td>2 V</td>
<td>1 V</td>
<td>2 V</td>
</tr>
<tr>
<td>Coil power</td>
<td>6 W</td>
<td>6 W</td>
<td>6 W</td>
<td>6 W</td>
</tr>
<tr>
<td><strong>Electrical characteristics</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Operating time switch on</td>
<td>&lt; 35 ms</td>
<td>&lt; 35 ms</td>
<td>&lt; 35 ms</td>
<td></td>
</tr>
<tr>
<td>Operating time switch off</td>
<td>&lt; 15 ms</td>
<td>&lt; 15 ms</td>
<td>&lt; 15 ms</td>
<td></td>
</tr>
<tr>
<td>Insulation resistance at 500 V (initial) contact to contact / contact to coil</td>
<td>1 GΩ</td>
<td>1 GΩ</td>
<td>1 GΩ</td>
<td></td>
</tr>
<tr>
<td>Dielectric strength contact to contact / contact to coil</td>
<td>&gt; 4400 V AC</td>
<td>&gt; 4400 V AC</td>
<td>&gt; 4400 V AC</td>
<td></td>
</tr>
<tr>
<td><strong>Auxiliary contact REED (optional)</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. voltage</td>
<td>36 V</td>
<td>36 V</td>
<td>36 V</td>
<td></td>
</tr>
<tr>
<td>Max. current</td>
<td>250 mA</td>
<td>250 mA</td>
<td>250 mA</td>
<td></td>
</tr>
<tr>
<td>Max. switching power</td>
<td>3 W</td>
<td>3 W</td>
<td>3 W</td>
<td></td>
</tr>
</tbody>
</table>

1) Higher operating voltage, different coil voltage, auxiliary contact, voltage sensor and temperature sensor upon request.
## High-Voltage Contactors for High-Voltage DC Disconnection

### Specification dual coil version

<table>
<thead>
<tr>
<th>Type</th>
<th>HVC200A-…E</th>
<th>HVC300A-…E</th>
<th>HVC500B-…E</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Max. operating current</strong></td>
<td>200 A</td>
<td>300 A</td>
<td>500 A</td>
</tr>
<tr>
<td><strong>Max. operating voltage</strong></td>
<td>1000 V</td>
<td>1000 V</td>
<td>1000 V</td>
</tr>
<tr>
<td><strong>Contact resistance (typ.)</strong></td>
<td>0.2 mΩ</td>
<td>0.2 mΩ</td>
<td>0.2 mΩ</td>
</tr>
<tr>
<td><strong>Contact resistance (max.)</strong></td>
<td>0.3 mΩ</td>
<td>0.3 mΩ</td>
<td>0.3 mΩ</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>Coil</strong></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Coil voltage</strong></td>
<td>12 V</td>
<td>24 V</td>
<td>12 V</td>
</tr>
<tr>
<td><strong>Coil voltage range</strong></td>
<td>9…16 V</td>
<td>18…32 V</td>
<td>9…16 V</td>
</tr>
<tr>
<td><strong>Coil pick-up voltage range (max.)</strong></td>
<td>9 V</td>
<td>18 V</td>
<td>9 V</td>
</tr>
<tr>
<td><strong>Coil drop-out voltage range (min.)</strong></td>
<td>1 V</td>
<td>2 V</td>
<td>1 V</td>
</tr>
<tr>
<td><strong>Coil power after 120 ms (pick-up phase)</strong></td>
<td>4 W</td>
<td>4 W</td>
<td>4 W</td>
</tr>
</tbody>
</table>

### Electrical characteristics

<p>| | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Operating time switch on</strong></td>
<td>&lt; 30 ms</td>
<td>&lt; 30 ms</td>
<td>&lt; 30 ms</td>
</tr>
<tr>
<td><strong>Operating time switch off</strong></td>
<td>&lt; 20 ms</td>
<td>&lt; 20 ms</td>
<td>&lt; 20 ms</td>
</tr>
<tr>
<td><strong>Insulation resistance at 500 V (initial)</strong></td>
<td>1 GΩ</td>
<td>1 GΩ</td>
<td>1 GΩ</td>
</tr>
<tr>
<td><strong>Dielectric strength</strong></td>
<td>&gt; 4400 V AC</td>
<td>&gt; 4400 V AC</td>
<td>&gt; 4400 V AC</td>
</tr>
<tr>
<td><strong>Auxiliary contact REED (optional)</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Max. voltage</td>
<td>36 V</td>
<td>36 V</td>
<td>36 V</td>
</tr>
<tr>
<td>Max. current</td>
<td>250 mA</td>
<td>250 mA</td>
<td>250 mA</td>
</tr>
<tr>
<td>Max. switching power</td>
<td>3 W</td>
<td>3 W</td>
<td>3 W</td>
</tr>
</tbody>
</table>

### Characteristics single and dual coil

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Shock 11 ms 1/2 sine, peak</strong></td>
<td>196 m/s²</td>
</tr>
<tr>
<td><strong>Vibration sine 100 … 2000 Hz, peak</strong></td>
<td>196 m/s²</td>
</tr>
<tr>
<td><strong>Wideband random vibration, eff.</strong></td>
<td>196 m/s² RMS</td>
</tr>
<tr>
<td><strong>Temperature</strong></td>
<td>−40 … +85 °C</td>
</tr>
<tr>
<td><strong>Weight</strong></td>
<td>approx. 500 g</td>
</tr>
<tr>
<td><strong>Certifications</strong></td>
<td>CE, UL 60947-4-1 (E491412), CCC</td>
</tr>
</tbody>
</table>
High-Voltage Contactors for High-Voltage DC Disconnection

Operating voltage of coil over temperature

<table>
<thead>
<tr>
<th>12 V single coil</th>
<th>24 V single coil</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Characteristics for 300 A single coil

Current handling capability at 85 °C

Estimated service life for resistive loads

For other types and specifications, please refer to the data sheets.
High-Voltage Contactors
for High-Voltage DC Disconnection

Dimensional drawings

**HVC***B with M8 outside thread**

Nuts and washers

- M8 nut
- Spring washer
- Flat washer

Load input terminals

**HVC***A with M6 inside thread**

Nuts and washers are already included in the packaging unit.

Cover shield to order if required:

B88269X2200C101 = 10 pcs. cover shields in a box
High-Voltage Contactors 
for High-Voltage DC Disconnection

**Stuck detection**

Stuck detection is an auxiliary contact indicating the switching status of the main contacts.

**Design advantages**

- Contactless
- No impact on breaking capability
- No impact on dielectric strength

### Main contact OFF

![Diagram of Main contact OFF](RA04464-J-E)

1. Main 1
2. Main 2
3. Coil 1
4. Coil 2
5. Aux COM
6. Aux NO
7. LED off

### Main contact ON

![Diagram of Main contact ON](RA04465-J-E)

1. Main 1
2. Main 2
3. Coil 1
4. Coil 2
5. Aux COM
6. Aux NO
7. LED on

**Integrated sensors**

- Voltage sensor
- Temperature sensor

For further information please contact your local sales office.
# High-Voltage Contactors for High-Voltage DC Disconnection

## HVC by TDK

![Graph showing HVC part extinguishing in 1.2 ms with a clear break of current.](image)

- Longer life-time
- Highest reliability

## Typical Contactor

![Graph showing typical contactor part extinguishing in 4.6 ms with lots of fluctuations.](image)

## Coil Terminations

### Integrated coil termination (varistor in single coil / diode in dual coil)

![Diagram of integrated coil termination.](image)

## Reliability

<table>
<thead>
<tr>
<th>Icon</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>&gt; One million mechanical switching cycles</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>CE marking, complies with EC Low Voltage Directive 2014/35/EC</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>All sites are certified according the following standards: ISO 9001, IATF 16949, ISO 14001</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>UL 60947-4-1 certified File No: E491412</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Tested in accordance with AEC Q-200, Rev. D</td>
</tr>
<tr>
<td><img src="image" alt="Icon" /></td>
<td>Up to 1200 V DC operating voltage and 500 A DC continuous current capability</td>
</tr>
</tbody>
</table>
High-Voltage Contactors for High-Voltage DC Disconnection

Applications

Battery disconnect unit

- Charger relay
- Main relay 1
- Pre-charge relay
- Main relay 2
- DC charger
- Fuse
- Inverter
- Load
- Battery

DC charger

- DC outlet to charge EV
- Control electronics
- Main relay 1
- Main relay 2
- Fuse
- AC
- DC
- Grid

Battery Management System (BMS)
- Manages the charging of the battery.
- Controls the battery and the HVC.
- In an emergency the battery has to be disconnected from the load. Therefore the Battery Disconnect Unit (BDU) belongs or is part of the BMS.
- The bipolar HVC allows charging (regenerative break) and discharging using the same contactor.

DC charger
- HVC is only connected during charging.
- HVC is used to disconnect charger from the battery in case of an emergency.
High-Voltage Contactors for High-Voltage DC Disconnection

New compact HVC43 series

![Image of HVC43 series](image_url)

**Features**
- Up to 250 A operating current
- 30% smaller as standard types
- 40% lighter as standard types

**More information**

More information on our high-voltage series, data sheets and 3D data can be found on [https://www.tdk-electronics.tdk.com/en/hvc_presentation](https://www.tdk-electronics.tdk.com/en/hvc_presentation)
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